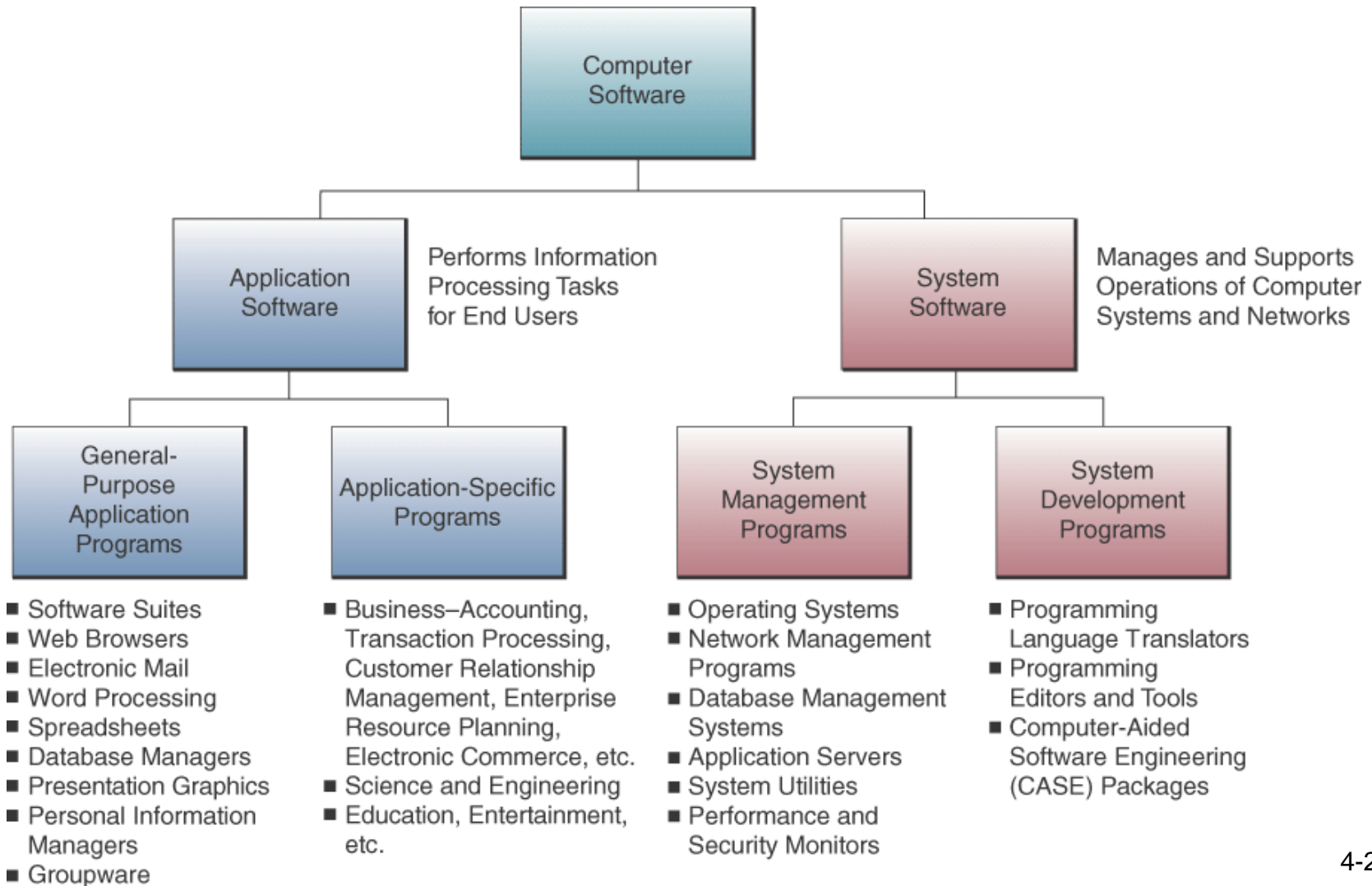# Chapter 4

- Computer Software

Types of Application & System Software

4-2

Application Software

- General Purpose
  - Programs that perform common information processing jobs for end users

  - E.g., word processing, spreadsheet

  - Also call productivity packages

- Custom Software
  - Software applications developed within an organization for use by that organization

Application Software

- Commercial Off-the-Shelf (COTS)

  – Many copies sold

  – Minimal changes beyond scheduled upgrades

  – Purchasers have no control over specifications, schedule, or evolution, and no access to source code or internal documentation

  – Product vendor retains the intellectual property rights of the software

Application Software

- Open-source Software

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

  - As each developer completes a project, the application code becomes available and free to anyone who wants it

Business Application Software

- Function-Specific Application Software

  – Thousands of these packages support specific applications of end users

  – **Examples**: customer relationship management, enterprise resource planning, supply chain management, Web-enabled electronic commerce

Software Suites, Integrated Packages

- Most widely used productivity packages are bundled together as software suites

- Advantages
  - Cost less than buying individual packages
  - All have similar GUI
  - Work well together

- Disadvantages
  - All features not used
  - Takes a lot of disk space (bloatware)

Components of Top Software Suites

Programs	Microsoft Office	Lotus SmartSuite	Corel WordPerfect Office	Sun StarOffice
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

Integrated Packages

- Integrated packages combine the functions of several programs into one package

  – E.g., Microsoft Works, AppleWorks

- Advantages

  – Many functions for lower price

  – Uses less disk space

  – Frequently pre-installed on microcomputers

- Disadvantages

  – Limited functionality

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Web Browsers

- Software applications that support navigation through the point-and-click hyper-linked resources of the Web

- Becoming the universal platform from which end users launch...
  - Information searches
  - E-mail
  - Multimedia file transfer
  - Discussion groups
  - Other Internet-based applications

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Search Engines

- Browsers are used to gain access to Internet search engines

  - Google, Ask Jeeves, Look Smart, Lycos, Overture, Yahoo!

- Using search engines to find information has become an indispensable part of Internet, intranet, and extranet applications

E-mail, Instant Messaging, and Weblogs

- E-mail
  - Software to communicate by sending and receiving messages and attachments via the Internet, intranet, or extranet

- Instant messaging (IM)
  - Receive electronic messages instantly

- Weblog or blog
  - A personal website in dated log format
  - Updated with new information about a subject or range of subjects

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Word Processing/Desktop Publishing

- Word Processing
  - Create, edit, revise, and print documents
  - E.g., Microsoft Word, Lotus WordPro, Corel WordPerfect

- Desktop Publishing
  - Produce printed materials that look professionally published
  - E.g., Adobe PageMaker, Microsoft Publisher, QuarkXPress

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Electronic Spreadsheets

- Used by virtually every business for...

  - Analysis, planning, modeling

- Electronic Spreadsheet

  - Worksheet of rows and columns

  - Can be stored on local computer or on network

  - Requires designing format and developing the relationships (formulas)

  - Most help you develop charts and graphic displays of spreadsheet results

  - Supports what-if questions

Presentation Graphics

- Common presentation graphics packages...
  - Converts numeric data into graphics displays
  - Used to create multimedia presentations of graphics, photos, animation, and video clips
  - E.g., Microsoft PowerPoint, Lotus Freelance, Corel Presentations
  - Top packages can tailor files for transfer in HTML format to websites

Personal Information Managers

- Software for end user productivity and collaboration

  – Stores information about clients

  – Manages schedules, appointments, tasks

  – Most include ability to access the Web and provide e-mail capabilities

  – Some support team collaboration by sharing information with other PIM users

  – E.g., Lotus Organizer, Microsoft Outlook

Groupware

- Software that helps workgroups collaborate on group assignments

  - E-mail, discussion groups, databases, video conferencing

  - E.g., Lotus Notes, Novell GroupWise, Microsoft Exchange

  - Windows SharePoint Services and WebSphere both allow teams to create websites for information sharing and document collaboration
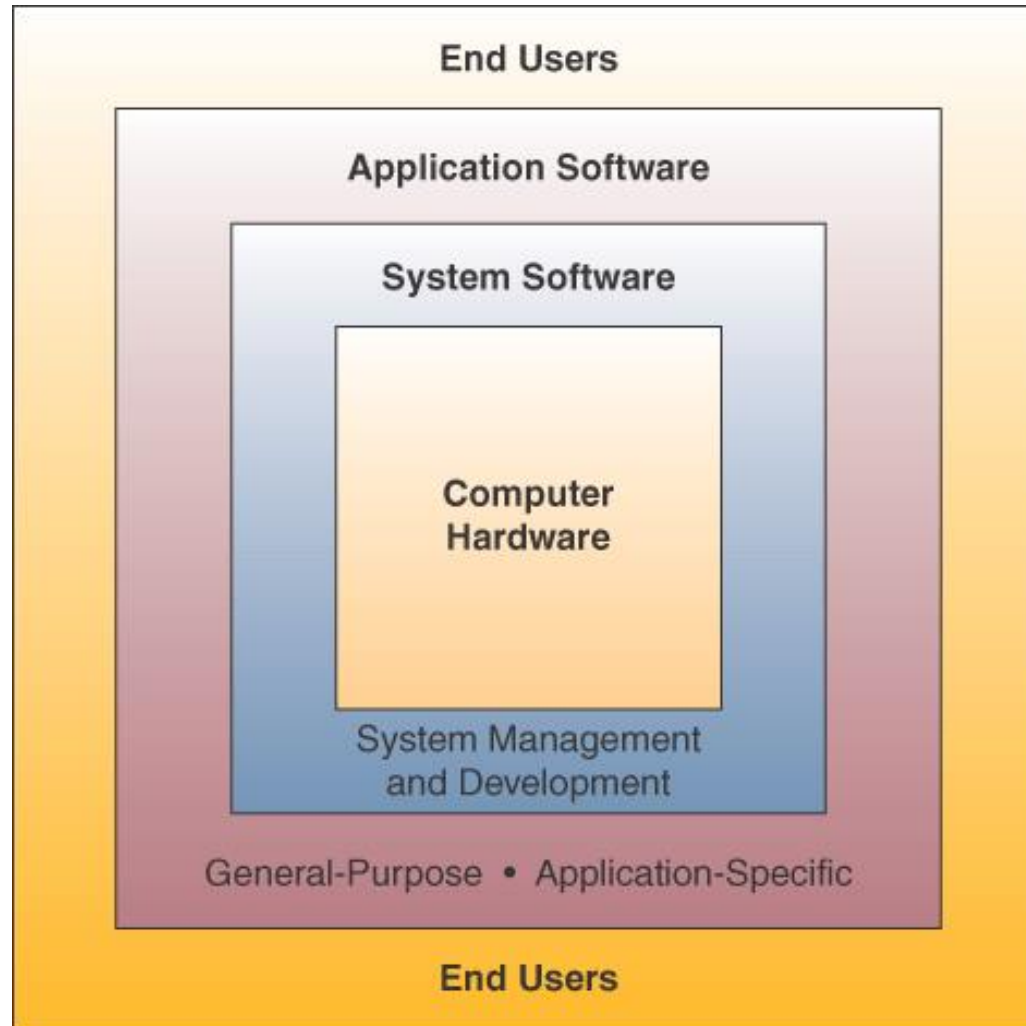
Software Alternatives

- Outsourcing development and maintenance of software

- Application service providers (ASPs)
  - Companies that own, operate, and maintain application software and computer system resources
  - Use the application for a fee over the Internet
  - Pay-as-you-go
  - Use expected to accelerate in the coming years

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Software Licensing

- All COTS and ASP software is licensed
  - Involves the underlying..
    - Intellectual property rights
    - Copyright
    - Trademark
    - Trade secrets
  - Also involves traditional contract law, including Uniform Commercial Code (UCC)
- You don't buy software
  - You buy a license to use the software
 - Licensed to protect the vendor's property rights

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Interface Between End Users and Computer

End Users

Application Software

System Software

Computer Hardware

System Management and Development

General-Purpose • Application-Specific

End Users

Operating Systems

- Integrated system of programs that…

    – Manages the operations of the CPU

    – Controls the input/output, storage resources, and activities of the computer system

    – Provides support services as the computer executes application programs

- The operating system must be loaded and activated before other tasks can be accomplished

Operating System Basic Functions
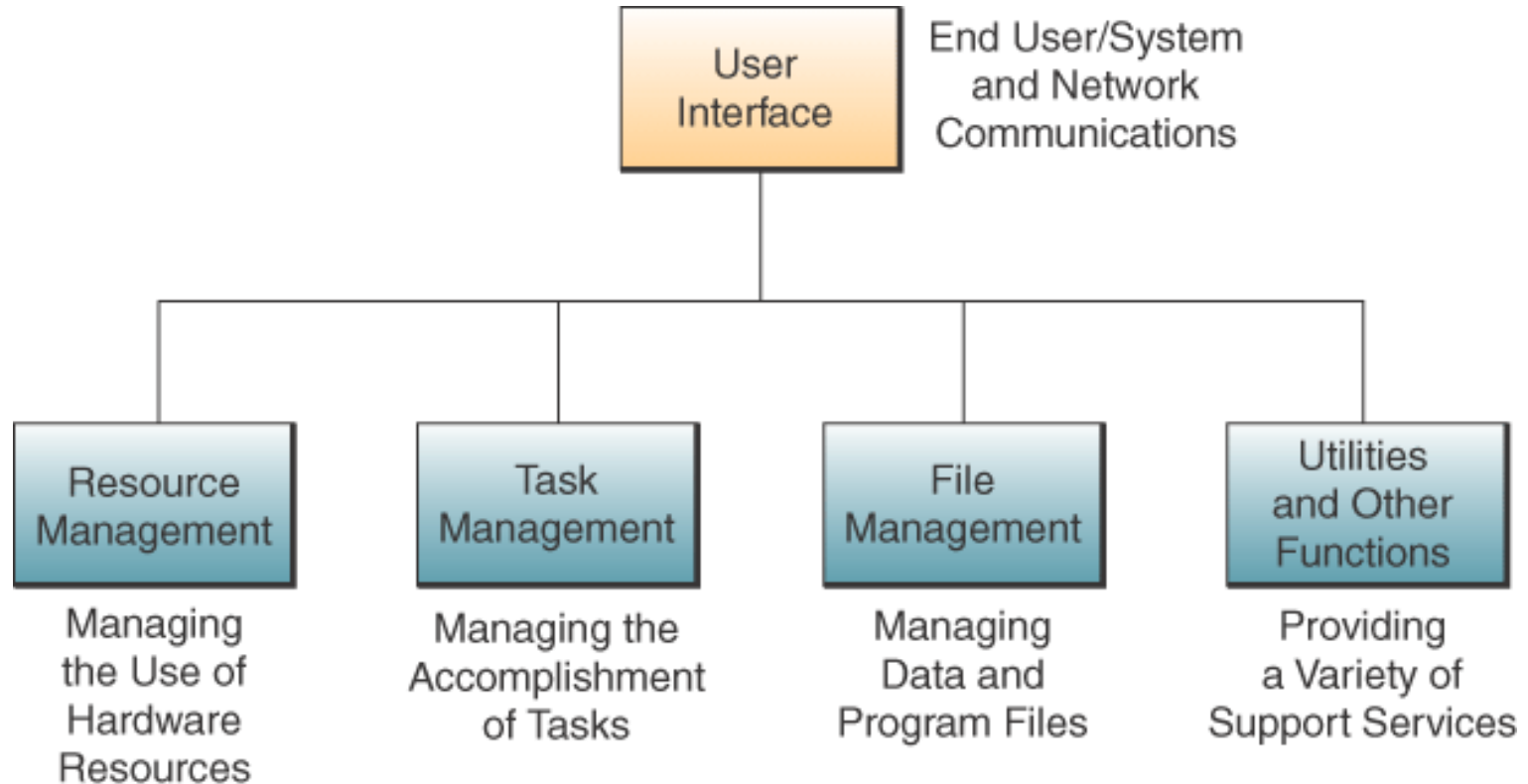
User Interface

- The part of the operating system that allows you to communicate with it

- Three main types…
  - Command-driven
  - Menu-driven
  - Graphical user interfaces (GUI)

Resource Management

- Part of the operating system that manages the hardware and networking resources of a computer system

  - Includes CPU, memory, secondary storage devices, telecommunications, and input/output peripherals

- Common functions

  - Keeping track of where data and programs are stored

  - Subdividing memory; providing virtual memory capability

File Management

- Part of the operating system that controls the creation, deletion, and access of files and programs

  - Keeps track of physical location on storage devices

  - Maintains directories of information about the location and characteristics of stored files

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Task Management

- Part of the operating system that manages the accomplishment of end user computing tasks

  – Controls which task gets access to the CPU, and for how long

  – Can interrupt the CPU at any time to substitute a higher priority task

  – Supports preemptive and cooperative multi-tasking and multi-processing

Popular Operating Systems

- Windows
  - GUI, multitasking, networking, multimedia
  - Microsoft's operating system
  - NT, XP, 2003
  - Different versions manage servers

- Unix
  - Multitasking, multi-user, network-managing
  - Portable - can run on mainframes, midrange, and PCs

Popular Operating Systems

- Linux
  - Low-cost, powerful reliable Unix-like operating system
  - Open-source

- MAC OS X
  - Apple operating system for the iMac
  - GUI
  - Multitasking
  - Multimedia

Open-Source Licensing Characteristics

- The Program
  - Must include source code and allow distribution in source code as well as compiled form

- The License
  - Shall not restrict any party from selling or giving away the software as a component of an aggregate software distribution containing programs from several sources

  - Must allow modifications and derived works, and must allow them to be distributed under the same terms as the license of the original software

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Open-Source Licensing Characteristics

- The License (continued)

  - Must allow modifications and derived works and allow them to be distributed under the same terms as the license of the original software

  - May restrict source code from being distributed in modified form only if the license allows the distribution of patch files with the source code for the purpose of modifying the program at build time

  - Must not discriminate against any person or any group of persons

Open-Source Licensing Characteristics

- The License (continued)

  - Must not restrict anyone from making use of the program in a specific field of endeavor

  - The rights attached to the program must apply to all to whom the program is redistributed, without the need for execution of an additional license

  - Must not be specific to a product

  - Must not contaminate other software by placing restrictions on any software distributed along with the licensed software

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Other System Management Programs

Software Category	What It Does	IBM Product	Customers	Main Competitor	Customers
Network management	Monitors networks to keep them up and running.	Tivoli	T. Rowe Price uses it to safeguard customer records.	HP OpenView	Amazon.com uses it to monitor its servers.
Application server	Shuttles data between business apps and the Web.	WebSphere	REI uses it to serve up its website and distribute data.	BEA WebLogic	Washingtonpost.com builds news pages with it.
Database manager	Provides digital storehouses for business data.	DB2	Mikasa uses it to help customers find its products online.	Oracle 9i	It runs Southwest Airlines' frequent-flyer program.
Collaboration tools	Powers everything from e-mail to electronic calendars.	Lotus	Retailer Sephora uses it to coordinate store maintenance.	Microsoft Exchange	Time Inc. uses it to provide e-mail to its employees.
Development tools	Allows programmers to craft software code quickly.	Rational	Merrill Lynch used it to build code for online trading.	Microsoft Visual Studio .NET	Used to develop Allstate's policy management system.

Source: Adapted from Susan Orenstein, Erik Schonfeld, and Scott Herhold, "The Toughest Guy in Software," *Business 2.0*, April 2003, p. 82.

Other System Software

- Utilities
  - Miscellaneous housekeeping functions
  - Example: Norton utilities includes data backup, virus protection, data compression, etc.

- Performance Monitors
  - Programs that monitor and adjust computer system to keep them running efficiently

- Security Monitors
  - Monitor and control use of computer systems to prevent unauthorized use of resources

Application Servers

- Provide an interface between an operating system and the application programs of users

- Middleware
  - Software that helps diverse software applications exchange data and work together more efficiently

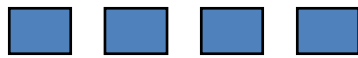# Multitasking & Components

- Components operate at different speeds
  - Processor   nanoseconds
  - Input   seconds or milliseconds
  - Output   seconds or milliseconds
  - Secondary Storage   milliseconds
- Time comparison
  - 1 ns / 1 sec   ==   31.7 years
  - 1 micro / 1 sec ==   11.6 days
  - 1 ms / 1 sec   ==   16:40 min:sec
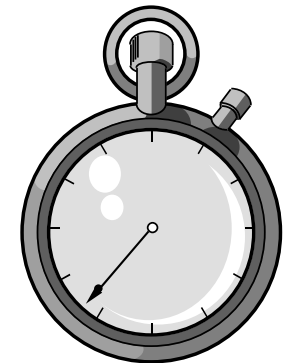
Multitasking

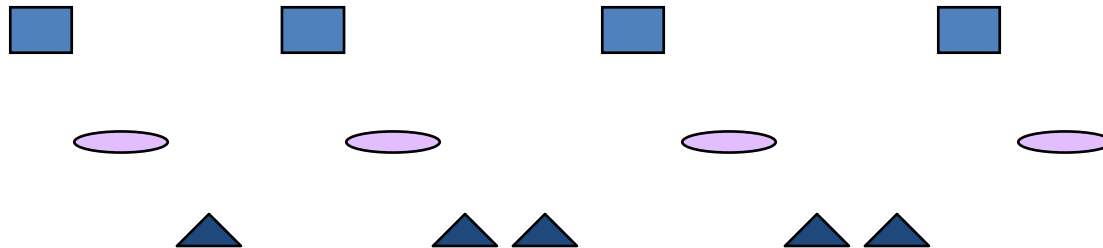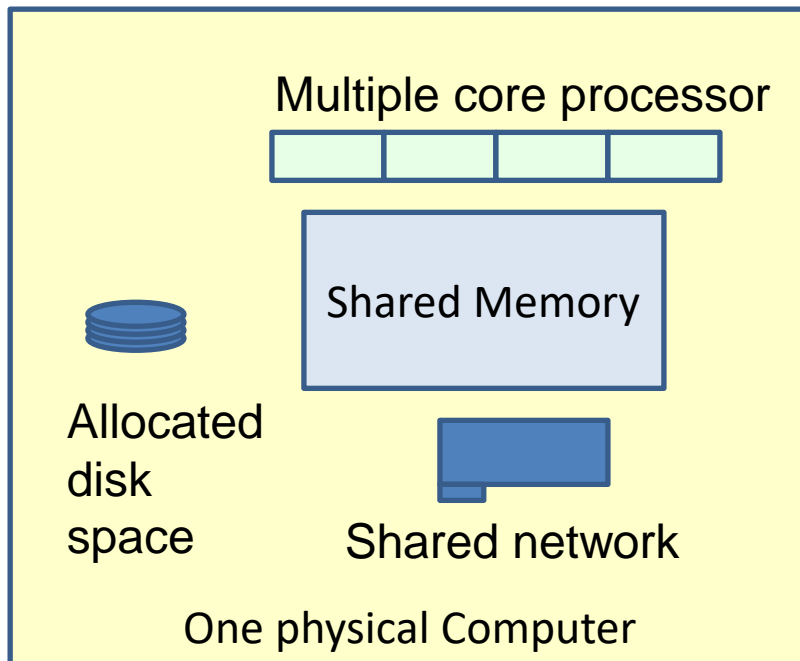Single Tasking

Task 1   Task 2   Task 3

Multitasking

Virtual Machine (VM)

One set of computer hardware configured to run multiple, independent operating systems.

VM1: Windows Server
   1 processor, 4 GB RAM

VM2: Linux Database Server
   2 processors, 8 GB RAM

VM3: Windows PC
   1 processor, 2 GB RAM

You have to purchase operating systems and software for each VM, but only one set of hardware.

Programming Languages

- Examples of programming in each language

Four Levels of Programming Languages	
• **Machine Languages:** Use binary coded instructions 1010 11001 1011 11010 1100 11011	• **High-Level Languages:** Use brief statements or arithmetic notations BASIC: X = Y + Z COBOL: COMPUTE X = Y + Z
• **Assembler Languages:** Use symbolic coded instructions LOD Y ADD Z STR X	• **Fourth-Generation Languages:** Use natural and nonprocedural statements SUM THE FOLLOWING NUMBERS

Machine Languages

- First generation languages

  – The most basic of programming languages

  – Strings of binary codes unique to each computer

  – Requires specific knowledge of the internal operations of the CPU being used

  – Must specify the storage locations for every instruction and item of data used

  – Difficult to work with, and error prone

Assembler Languages

- Second generation languages

  – Developed to reduce difficulties in writing machine language programs

  – Uses assemblers to convert the programs into machine instructions

  – Symbols are used to represent operation codes and storage locations

  – Alphabetic abbreviations call mnemonics and other symbols represent operation codes, storage locations, and data elements

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High-Level Languages

- Third generation languages

  – Uses brief statements or arithmetic expressions

  – Statements translated into machine language by compilers or interpreters

  – Less efficient than assembler languages and requires greater translation time

  – Machine independent

  – Examples: BASIC, COBOL, and FORTRAN

Fourth-Generation Languages

- Variety of programming languages that are nonprocedural and conversational
  - Encourages programmers to specify the results wanted; the computer determines the sequence of instructions that accomplishes the results
  - Simplified the programming process
- Natural languages
  - Very close to English or other human language
  - Sometimes called fifth-generation (5GLs)
  - No longer a trade-off between ease of use and

Object-Oriented Languages

- Combines data elements and the procedures that will be performed upon them into objects

  - E.g., data about a bank account and the procedures performed on it, such as interest calculations

Savings Account Object
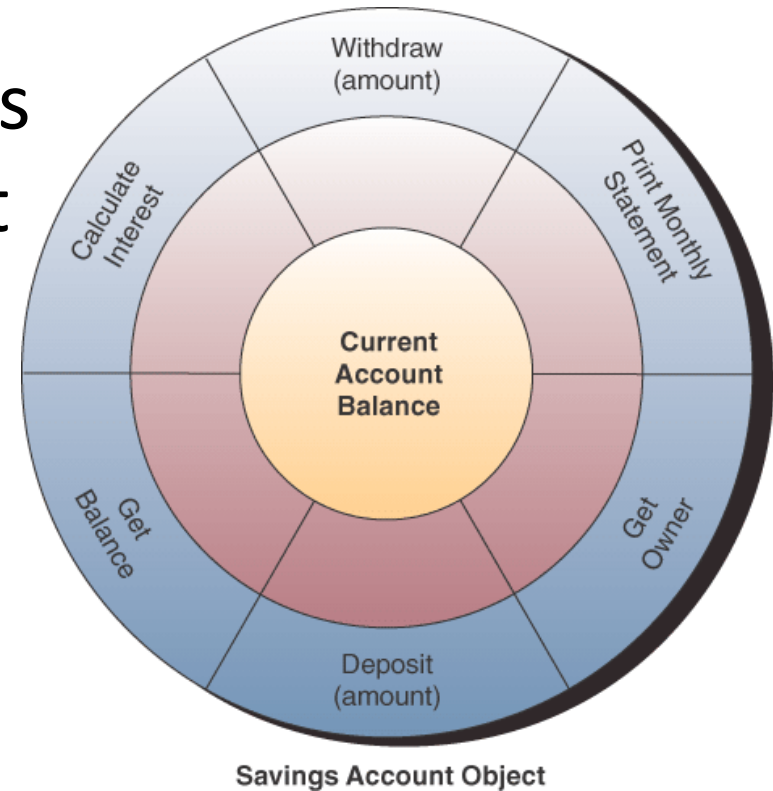
Object-Oriented Languages

- Most widely used software development languages

  - Easier to use and more efficient for graphics-oriented user interfaces

  - Reusable: can use an object from one application in another application

  - Examples: Visual Basic, C++, Java

  - Most object-oriented languages provide a GUI that supports visual programming

Language Translator Programs

- Translate instructions written in programming languages into machine language

- **Assembler**

  – Translates assembler language statement

- **Compiler**

  – Translates high-level language statements

- **Interpreter**

  – A compiler that translates and executes each statement in a program, one at a time
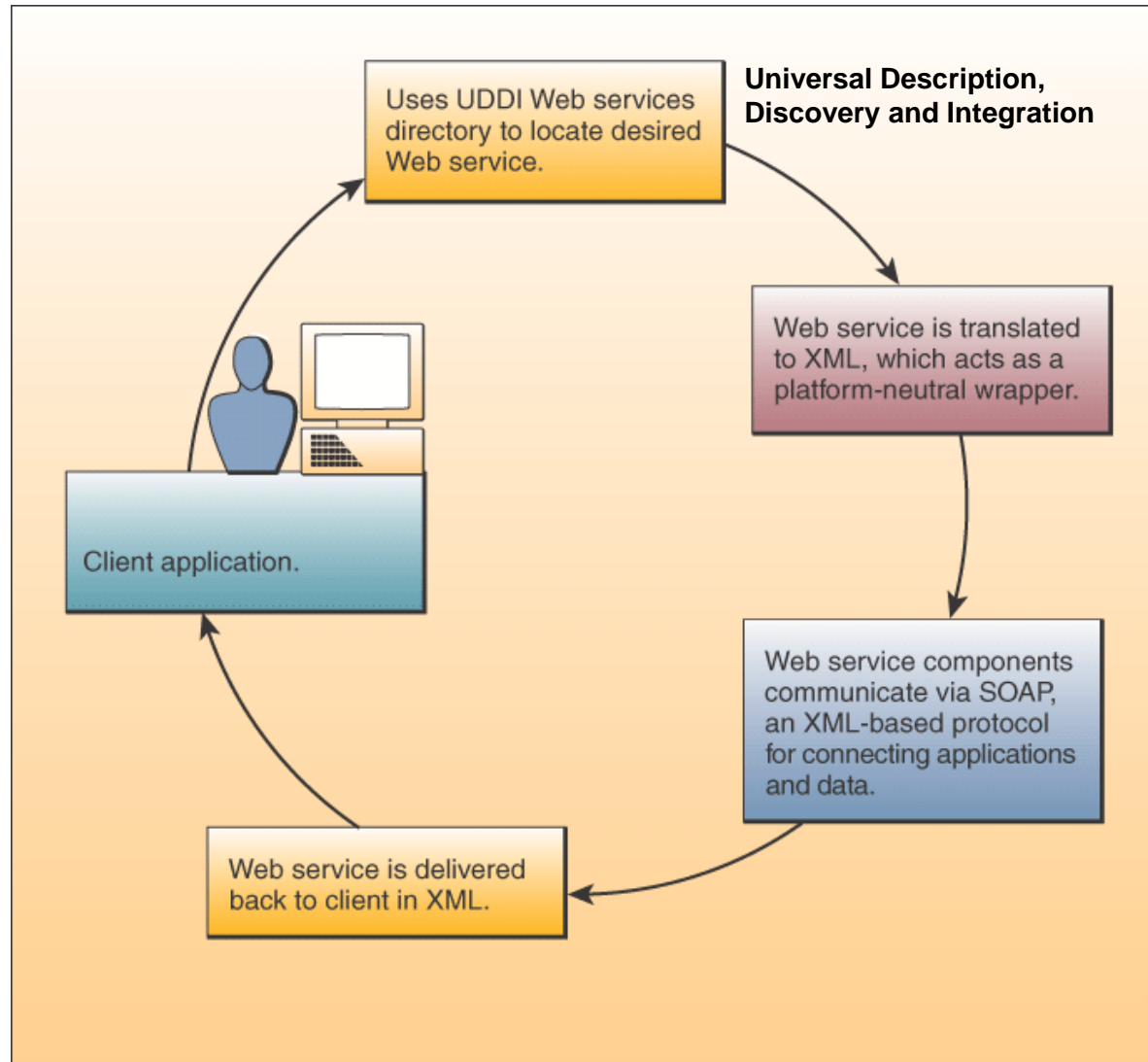
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Web Languages

- HTML
  - A page description language that creates hypertext documents for the Web

- XML
  - Describes Web page content by applying identifying tags or contextual labels to the data

- Java
  - Object-oriented programming language that is simple, secure, and platform independent
  - Java applets can be executed on any computer

Web Services

- Web services are software components that are

  - Based on framework of Web and object-oriented standards and technology

  - Used to link the applications of different users and computing platforms via the Web

How Web Services Work

Uses UDDI Web services directory to locate desired Web service.

Universal Description, Discovery and Integration

Web service is translated to XML, which acts as a platform-neutral wrapper.

Web service components communicate via SOAP, an XML-based protocol for connecting applications and data.

Web service is delivered back to client in XML.

Client application.

Programming Tools

- Help programmers identify and minimize errors while they are programming
  - Graphical programming interfaces
  - Programming editors
  - Debuggers
- CASE Tools
  - A combination of many programming tools into a single application with a common interface
  - Used in different stages of the systems development process