



Chapter 4 Computer Software

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Learning Objectives

- Describe several important trends occurring in computer software
- Give examples of several major types of application and system software
- Explain the purpose of several popular software packages for end user productivity and collaborative computing
- Define and describe the functions of an operating system
- Describe the main uses of computer programming software, tools, and languages

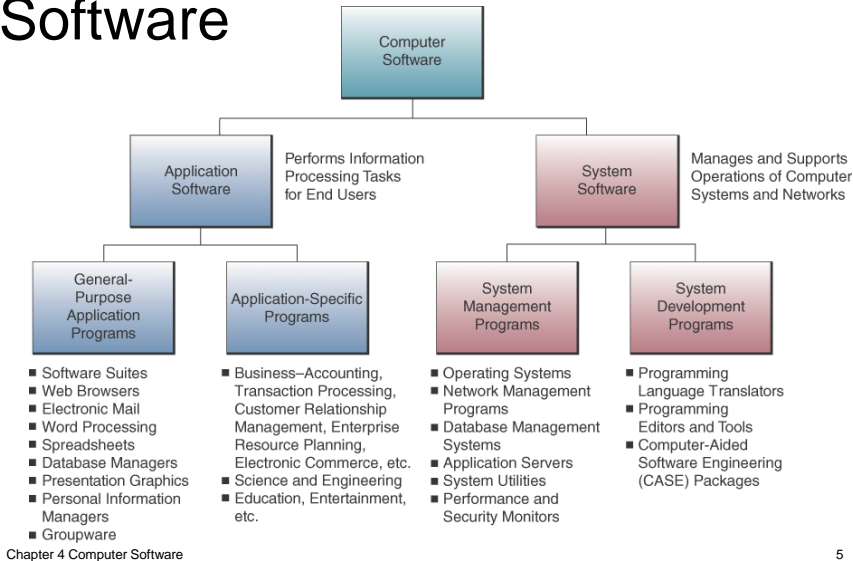
Case 1 Microsoft Supports Processes

- Microsoft is focusing on different industries and writing software products to support them
 - **Examples:** financial services, communications, government, education, automotive, retail
 - **Vertical segments:** a specific industry
 - **Accelerators:** software add-ons aimed at business processes common to a given industry
 - **Software layers:** serves the needs of a broad base of companies in a particular sector, inserted into enterprise applications

Case Study Questions

- A common phrase among IT professionals is “The world views its data through Windows.” Why does Microsoft dominate the desktop and networked software market?
- How successful will Microsoft be in competing with software vendors who specialize in specific market applications, like health care, retail, and other specialty services?
- Do you agree with Microsoft’s strategy to develop industry-specific partners to capitalize on opportunities in both large and small sectors?
 - Is there an advantage or a disadvantage to being one of Microsoft’s partners in this type of relationship?

Types of Application & System Software



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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
- **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

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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

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

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

Word Processing/Desktop Publishing

- Word Processing
 - Create, edit, revise, and print documents
 - Example: Microsoft Word, Lotus WordPro, Corel WordPerfect
- Desktop Publishing
 - Produce printed materials that look professionally published
 - Example: Adobe PageMaker, Microsoft Publisher, QuarkXPress

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
 - Example: Lotus Organizer, Microsoft Outlook

Groupware

- Software that helps workgroups collaborate on group assignments
 - E-mail, discussion groups, databases, video conferencing
 - Example: 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

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

Case 2 Webtop Software

- Web-based applications can run almost as seamlessly as programs used on the desktop
 - Webtop applications may replace the current suite of desktop applications
- Web applications link to myriad open APIs
 - Serves as building blocks for new applications and data
 - Information on the desktop can be fused with the Web through a powerful but invisible bridge between the two

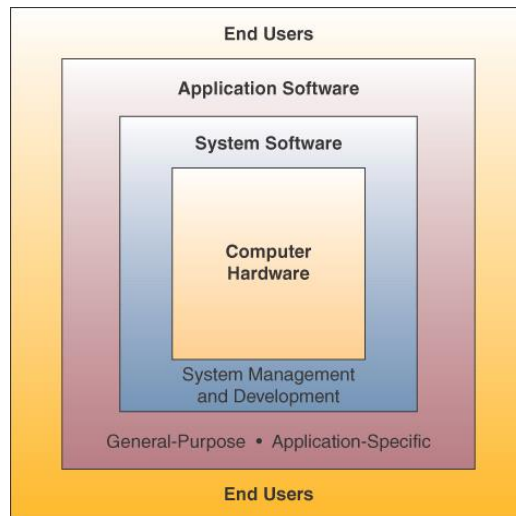
Case Study Questions

- Do you agree that webtop software will one day replace suites of desktop applications?
- Will Microsoft succeed in dominating the webtop?
- Should you invest your time and money in acquiring and learning how to use some of the webtop applications mentioned in this case?

Categories of Group Software

- System Management Programs
 - Manages the hardware, software, network, and data resources of computer systems
 - Example: operating systems, network management programs, database management systems, system utilities
- System Development Programs
 - Helps users develop IS programs and procedures and then prepare them for processing
 - Includes language translators and editors, CASE and programming tools

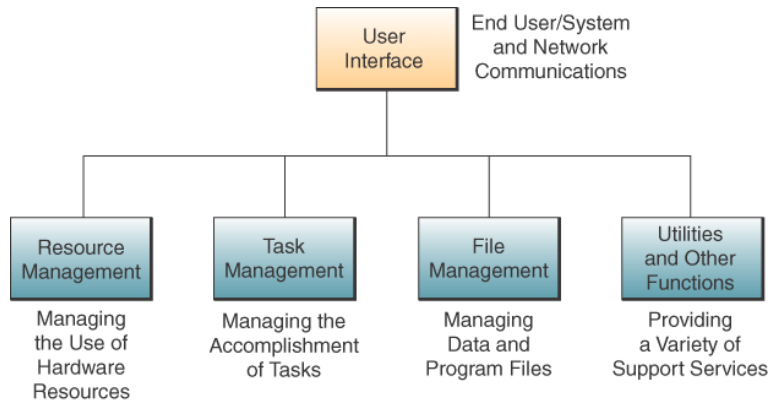
Interface Between End Users and Computer



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

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
- 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

Open-Source Licensing Characteristics

- The License (cont'd)
 - 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 (cont'd)
 - 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

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

Programming Languages

- Examples of programming in each language

Four Levels of Programming Languages	
<ul style="list-style-type: none">• Machine Languages: Use binary coded instructions 1010 11001 1011 11010 1100 11011	<ul style="list-style-type: none">• High-Level Languages: Use brief statements or arithmetic notations BASIC: $X = Y + Z$ COBOL: COMPUTE $X = Y + Z$
<ul style="list-style-type: none">• Assembler Languages: Use symbolic coded instructions LOD Y ADD Z STR X	<ul style="list-style-type: none">• 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

High-Level Languages

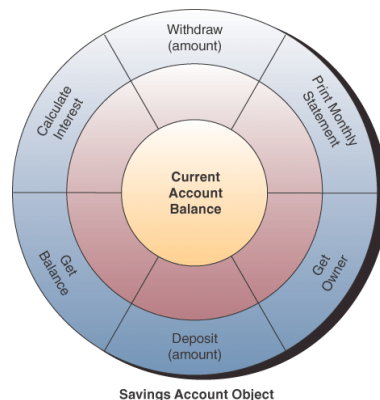
- Third generation languages
 - Uses brief statements or arithmetic expressions
 - Statements translated into machine language by compilers or interpreters
 - Less efficient than assembler languages and requires greater translation time
 - Machine independent
 - Example: BASIC, COBOL, and FORTRAN

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 flexibility

Object-Oriented Languages

- Combines data elements and the procedures that will be performed upon them into objects
 - Example: data about a bank account and the procedures performed on it, such as interest calculations



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
 - Example: Visual Basic, C++, Java
 - Most object-oriented languages provide a GUI that supports visual programming

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

J2EE versus .Net

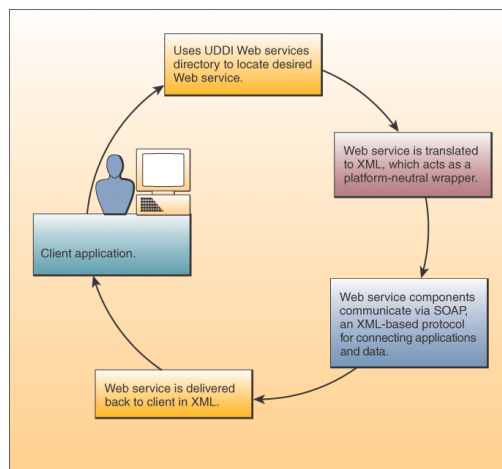
J2EE		.NET	
PROS	CONS	PROS	CONS
<ul style="list-style-type: none"> • Runs on any operating system and application server (may need adjustments). • Handles complex, high-volume, high-transaction applications. • Has more enterprise features for session management, fail-over, load balancing, and application integration. • Is favored by experienced enterprise vendors such as IBM, BEA, SAP, and Oracle. • Offers a wide range of vendor choices for tools and application servers. • Has a proven track record. 	<ul style="list-style-type: none"> • Has a complex application development environment. • Tools can be difficult to use. • Java Swing environment's ability to build graphical user interfaces has limitations. • May cost more to build, deploy, and manage applications. • Lacks built-in support for Web services standards. • Is difficult to use for quick-turnaround, low-cost, and mass-market projects. 	<ul style="list-style-type: none"> • Easy-to-use tools may increase programmer productivity. • Has a strong framework for building rich graphical user interfaces. • Gives developers choice of working in more than 20 programming languages. • Is tightly integrated with Microsoft's operating system and enterprise server software. • May cost less, due in part to built-in application server in Windows, unified management, less expensive tools. • Has built-in support for Web service standards. 	<ul style="list-style-type: none"> • Framework runs only on Windows, restricting vendor choice. • Users of prior Microsoft tools and technology face a potentially steep learning curve. • New runtime infrastructure lacks maturity. • Questions persist about the scalability and transaction capability of the Windows platform. • Choice of integrated development environments is limited. • Getting older applications to run in new .NET environment may require effort.

Source: Carol Sliwa, "Net vs. Java," *Computerworld*, May 20, 2002, p. 31.

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



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

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

Case 3 Amazon and eBay

- Amazon provides access to some of its data and website functionality
 - It still protects underlying infrastructure
- eBay opened up e-commerce software
 - Open to programmers of any company that is interested in e-commerce

Case Study Questions

- What are the purpose and business value of Web services?
- What are the benefits of Web services to Amazon, eBay, and their developer partners?
- What are the business challenges of Web services?

Case 4 Linux and Open-Source Software

- Open-source software
 - Also called “free” software
 - Can be modified
 - Typically acquired with a license
- Open-source licenses typically allow you to
 - Run the software
 - Own the source code
 - Modify the source code
 - Distribute copies of the software
 - Training, support, and documentation typically must be paid for
- Examples of open-source software...
 - Linux
 - Apache Web Server
 - Sendmail
 - Perl scripting language

Case Study Questions

- What are the business benefits of adopting open-source software?
- What are the risks associated with open-source software?
 - How can these risks be addressed?
- Do you see open-source software eventually replacing the current proprietary software model?