Software:
Systems and Application Software

PARDEEP MEHTA
COMPUTER SCIENCE

Principles and Learning Objectives

1. Identify and briefly describe the functions of the two basic kinds of software
2. Outline the role of the operating system and identify the features of several popular operating systems
3. Discuss how application software can support personal, workgroup, and enterprise business objectives
4. Identify three basic approaches to developing application software and discuss the pros and cons of each
5. Outline the overall evolution and importance of programming languages and clearly differentiate among the generations of programming languages
6. Identify several key software issues and trends that have an impact on organizations and individuals

Why Learn About Software?

- Software is indispensable for any computer system
- Systems software needed for input, calculations, and output
- Application software aids in productivity
- Personal tasks using software
  - Income tax preparation
  - Keeping a budget
  - Internet research
  - Games

An Overview of Software

- **Computer programs:** sequences of instructions for the computer
- **Documentation:** describes program functions
- Software – system software and application software

Systems Software

- **Systems software:** coordinates the activities and functions of hardware and programs
- **Computer system platform:** combination of a hardware configuration and systems software

Application Software

- **Application software:** helps users solve particular problems
- In most cases, application software resides on the computer's hard disk
- Application software can also be stored on CDs, DVDs, and flash or keychain storage devices

Supporting Individual, Group, and Organizational Goals

- Organisation – people, workgroup, enterprise – supported with software and IS
- Organisation needs to classify the software and IS uses to increase productivity – need to identify the scope of problems and opportunities
- **Sphere of influence:** the scope of problems and opportunities addressed by a particular organisation
- For most companies, the spheres of influence are personal, workgroup, and enterprise

Supporting Individual, Group, and Organizational Goals (continued)

Software	Personal	Workgroup	Enterprise
Systems software	Personal computer and workstation operating systems	Network operating systems	Midrange computer and mainframe operating systems
Application software	Word processing, spreadsheet, database, graphics	Electronic mail, group scheduling, shared work	General ledger, order entry, payroll, human resources

Table 4.1: Software Supporting Individuals, Workgroups, and Enterprises

Installing and Removing Software for PCs

- Before you can use software, it must be installed on a computer
- Software for personal computers typically comes on CDs or is downloaded from the Web
- Most operating systems have an add/remove program feature for removing software
  - Does not work with all software
  - Does not always remove all elements of the software

Systems Software

- Systems software
  - Controls operations of computer hardware
  - Supports application programs' problem-solving capabilities
- Types of systems software
  - Operating systems
  - Utility programs
  - Middleware

Operating Systems

- **Operating system (OS):** set of programs that controls the computer hardware and acts as an interface with application programs
- **Kernel:** ties all components of the OS together and regulates other programs

Operating Systems (continued)

- Various combinations of OSs, computers, and users
  - Single computer with a single user
  - Single computer with multiple users
  - Multiple computers
  - Special-purpose computers

Operating Systems (continued)

- Activities performed by the operating system
  - Perform common computer hardware functions
  - Provide a user interface and input/output management
  - Provide a degree of hardware independence
  - Manage system memory
  - Manage processing tasks
  - Provide networking capability
  - Control access to system resources
  - Manage files

Operating Systems (continued)

The role of Systems Software –interface between users, application software and hardware

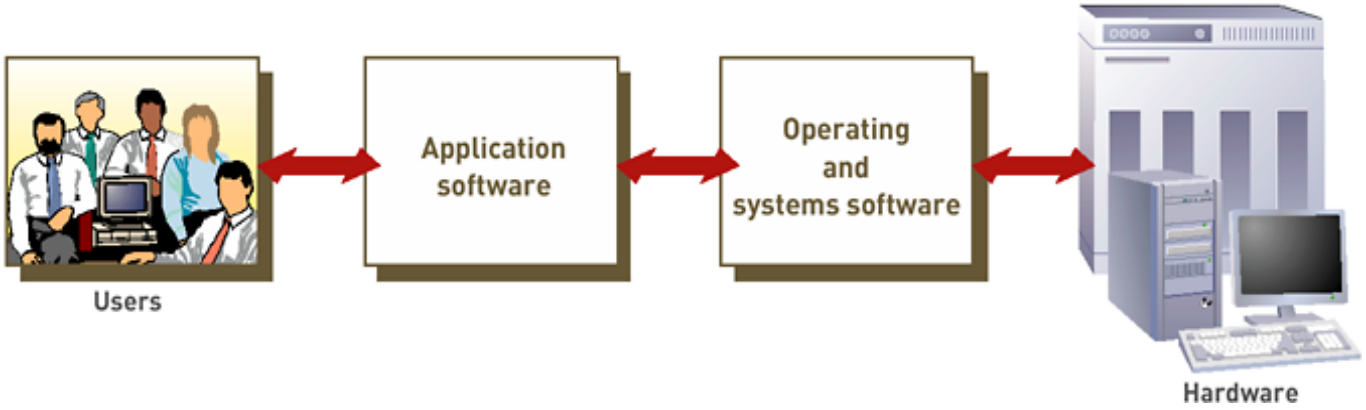

Figure 4.4: The Role of Systems Software

Operating Systems (continued)

- OS acts as an intermediary between application and hardware
- OS converts basic request into a set of details instruction that the hardware requires
- Common hardware functions (e.g.)
  - Get input from keyboard or some other input device
  - Retrieve data from disks
  - Store data on disks
  - Display information on a monitor or printer

Operating Systems Functions

1. User interface and input/output management
   - **User interface:** allows individuals to access and command the computer system
   - **Command-based user interface:** requires that text commands be given to the computer to perform basic activities
   - **Graphical user interface (GUI):** uses icons and menus displayed on screen to send commands to the computer system

Operating Systems Functions (continued)

2. Hardware independence
   - **Application program interface (API):** allows applications to make use of the operating system
3. Memory management
   - Control how memory is accessed and maximize available memory and storage

Operating Systems Functions (continued)

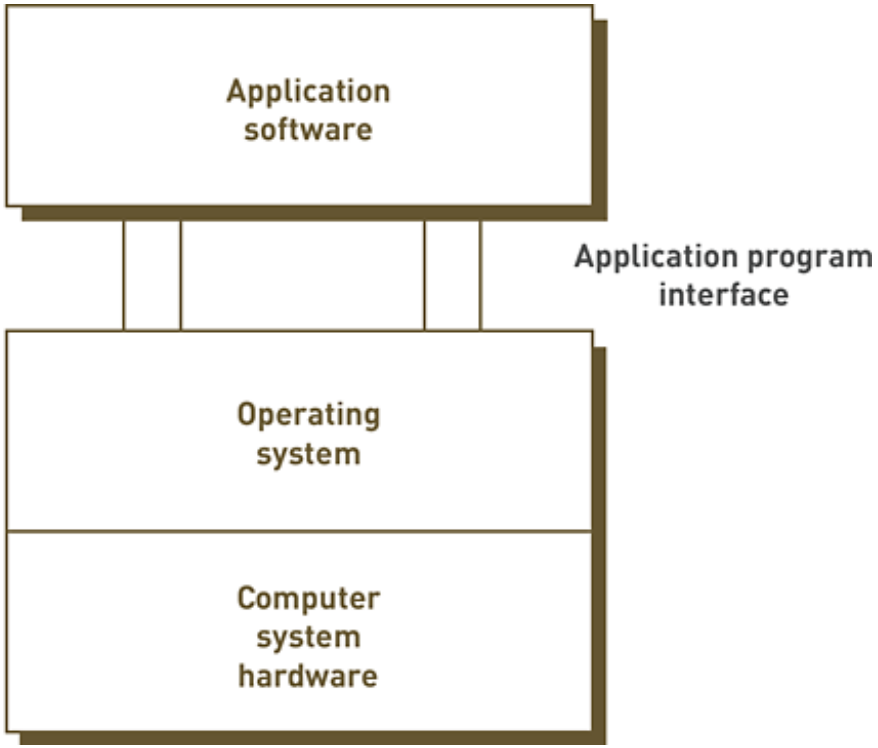

Figure 4.6: Application Program Interface Links Application Software to the Operating System

Operating Systems (continued)

4. Processing tasks
   - **Multitasking:** more than one program can run at the same time
   - **Time-sharing:** allows more than one person to use a computer system at the same time
   - **Scalability:** ability of the computer to handle an increasing number of concurrent users smoothly
5. Networking capability
   - Features and capabilities of the OS that aid users in connecting to a computer network

Operating Systems (continued)

6. Access to system resources and security
   - Protection against unauthorized access
   - Logins and passwords
7. File management
   - Ensures that files in secondary storage are available when needed and that they are protected from access by unauthorized users

Current Operating Systems

Personal	Workgroup	Enterprise
Windows Vista, Windows XP, Windows Mobile, and Windows Embedded	Windows NT Server	Windows NT Server
Mac OS	Windows 2003 Server	Windows 2003 Server
Mac OS X	Mac OS Server	Windows Advanced Server, Limited Edition
UNIX	UNIX	UNIX
Solaris	Solaris	Solaris
Linux	Linux	Linux
Red Hat Linux	Red Hat Linux	Red Hat Linux
Palm OS	Netware	
	IBM OS/390	IBM OS/390
	IBM z/OS	IBM z/OS
	HP MPE/iX	HP MPE/iX

Table 4.2: Popular Operating Systems Cross All Three Spheres of Influence

Current Operating Systems (continued)

- Microsoft PC operating systems
  - PC-DOS and MS-DOS: early, command-driven OSs
  - Windows XP: greatly improved stability and security over previous versions of Windows
  - Windows XP N: for European market
  - Windows XP Professional X64: for computers with newer 64-bit capabilities
  - Windows XP Media Center Edition: incorporates additional multimedia features
  - Vista: latest version of Windows

Current Operating Systems (continued)

- Apple operating systems
  - Often provide cutting edge tools in graphics and music not available from Microsoft
  - Mac OS X
    - Jaguar (OS X.2)
    - Panther (OS X.3)
    - Tiger (OS X.4): support for 64-bit computing, Dashboard, Spotlight, etc.

Current Operating Systems (continued)

- Linux
  - Developed by Linus Torvalds in 1991
  - Open-source product
  - Only the kernel of an OS
  - Several distributions available with capabilities/applications that form a complete OS
    - Examples: Red Hat Linux, Caldera OpenLinux

Workgroup Operating Systems

- Windows Server
- UNIX
- NetWare
- Red Hat Linux
- Mac OS X Server

Enterprise Operating Systems

- z/OS
- MPE/iX
- HP-UX
- Linux

Operating Systems for Small Computers, Embedded Computers, and Special-Purpose Devices

- Palm OS
- Windows Embedded
- Windows Mobile

Utility Programs

- Help to perform maintenance or correct problems with a computer sistem
- Common types of utility programs:
  - Hardware utilities
  - Virus-detection and recovery utilities
  - File-compression utilities
  - Spam and pop-up blocker utilities

Utility Programs (continued)

- Network and Internet utilities
- Server and mainframe utilities
- Other utilities
  - Manages and protects corporate documents
  - Helps people with visual disabilities use the Internet
  - Monitors employees
  - Searches for files and documents

Middleware

- **Middleware:** software that allows different systems to communicate and exchange data
- Middleware can also be used as an interface between the Internet and older legacy systems
- e.g. ?

Application Software

- Primary function is to apply the power of the computer to give individuals, workgroups, and the entire enterprise the ability to solve problems and perform specific tasks
- Application programs interact with systems software; systems software then directs computer hardware to perform the necessary tasks

Overview of Application Software

- **Proprietary software:** one-of-a-kind program for a specific application, usually developed and owned by a single company
- **Off-the-shelf software:** existing software program that is purchased

Overview of Application Software (continued)

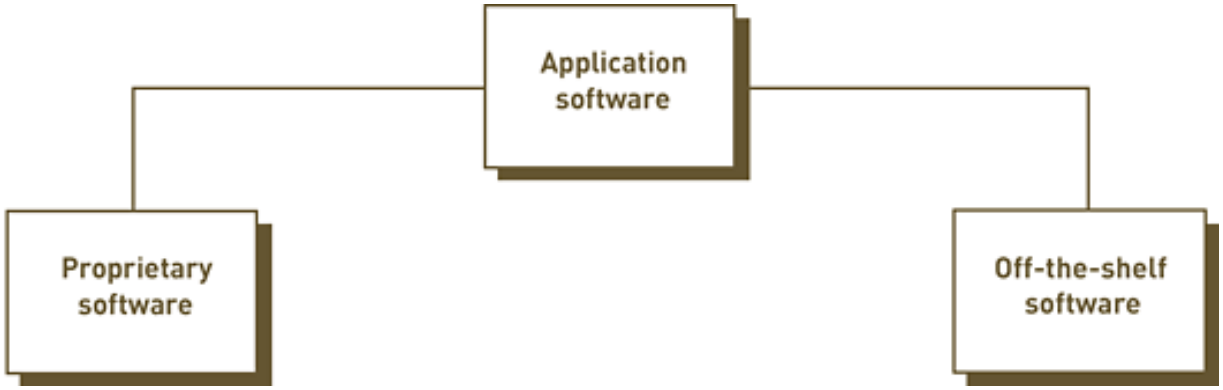

Figure 4.13: Types of Application Software

Overview of Application Software (continued)

Proprietary Software		Off-the-Shelf Software	
Advantages	**Disadvantages**	**Advantages**	**Disadvantages**
You can get exactly what you need in terms of features, reports, and so on.	It can take a long time and significant resources to develop required features.	The initial cost is lower because the software firm can spread the development costs over many customers.	An organization might have to pay for features that are not required and never used.
Being involved in the development offers control over the results.	In-house system development staff may become hard pressed to provide the required level of ongoing support and maintenance because of pressure to move on to other new projects.	The software is likely to meet the basic business needs—you can analyze existing features and the performance of the package.	The software might lack important features, thus requiring future modification or customization. This can be very expensive because users must adopt future releases of the software as well.

Table 4.4: A Comparison of Proprietary and Off-the-Shelf Software

Overview of Application Software (continued)

You can modify features that you might need to counteract an initiative by competitors or to meet new supplier or customer demands. A merger with or acquisition of another firm also requires software changes to meet new business needs.	There is more risk concerning the features and performance of the software that has yet to be developed.	The package is likely to be of high quality because many customer firms have tested the software and helped identify its bugs.	The software might not match current work processes and data standards.

Table 4.4: A Comparison of Proprietary and Off-the-Shelf Software (continued)

Personal Application Software

- Serves the needs of an individual user
- Includes personal productivity software
  - Enables users to improve their personal effectiveness

Personal Application Software (continued)

Type of Software	Explanation	Example	Vendor
Word processing	Create, edit, and print text documents	Word WordPerfect	Microsoft Corel
Spreadsheet	Provide a wide range of built-in functions for statistical, financial, logical, database, graphics, and date and time calculations	Excel Lotus 1-2-3	Microsoft Lotus/IBM
Database	Store, manipulate, and retrieve data	Access Approach dBASE	Microsoft Lotus/IBM Borland
Online information services	Obtain a broad range of information from commercial services	America Online MSN	America Online Microsoft
Graphics	Develop graphs, illustrations, and drawings	Illustrator FreeHand	Adobe Macromedia

Table 4.5: Examples of Personal Productivity Software

Personal Application Software (continued)

Project management	Plan, schedule, allocate, and control people and resources (money, time, and technology) needed to complete a project according to schedule	Project for Windows On Target Project Schedule Time Line	Microsoft Symantec Scitor Symantec
Financial management	Provide income and expense tracking and reporting to monitor and plan budgets (some programs have investment portfolio management features)	Managing Your Money Quicken	Meca Software Intuit
Desktop publishing (DTP)	Use with personal computers and high-resolution printers to create high-quality printed output, including text and graphics; various styles of pages can be laid out; art and text files from other programs can also be integrated into "published" pages	QuarkXPress Publisher PageMaker Ventura Publisher	Quark Microsoft Adobe Corel
Creativity	Generate innovative and creative ideas and problem solutions. The software does not propose solutions, but provides a framework conducive to creative thought. The software takes users through a routine, first naming a problem, then organizing ideas and "wishes," and offering new information to suggest different ideas or solutions	Organizer Notes	Macromedia Lotus

Table 4.5: Examples of Personal Productivity Software (continued)

Personal Application Software (continued)

- **Software suite:** collection of single application programs packaged in a bundle
  - Microsoft Office: most popular general-purpose software suite
  - Other general-purpose software suites: Corel's WordPerfect Office, Lotus SmartSuite, Sun Microsystems's StarOffice
- **Integrated application packages:** offer a range of capabilities for less money than software suites
  - Example: Microsoft Works

Personal Application Software (continued)

Personal Productivity Function	Microsoft Office	Lotus SmartSuite Millennium Edition	Corel WordPerfect Office	Sun Microsystems
Word Processing	Word	WordPro	WordPerfect	Writer
Spreadsheet	Excel	Lotus 1-2-3	Quattro Pro	Calc
Presentation Graphics	PowerPoint	Freelance Graphics	Presentations	Impress
Database	Access	Lotus Approach	Paradox	

Table 4.6: Major Components of Leading Software Suites

Workgroup Application Software

- **Workgroup application software:** support teamwork, whether people are in the same location or dispersed around the world
- **Groupware:** software that helps groups of people work together more efficiently and effectively

Workgroup Application Software (continued)

Quality	Description
Convenient	If it's too hard to use, it's not used; it should be as easy to use as the telephone.
Content	It must provide a constant stream of rich, relevant, and personalized content.
Coverage	If it isn't close to everything you need, it might never be used.

Table 4.7: Ernst & Young's "Three Cs" Rule for Groupware

Enterprise Application Software

- Software that benefits an entire organization
- **Enterprise resource planning (ERP) software:** set of integrated programs that manage a company's vital business operations for an entire multisite, global organization

Enterprise Application Software (continued)

Accounts receivable	Sales ordering
Accounts payable	Order entry
Airline industry operations	Payroll
Automatic teller systems	Human resource management
Cash-flow analysis	Check processing
Credit and charge card administration	Tax planning and preparation
Manufacturing control	Receiving
Distribution control	Restaurant management
General ledger	Retail operations
Stock and bond management	Invoicing
Savings and time deposits	Shipping
Inventory control	Fixed asset accounting

Table 4.8: Examples of Enterprise Application Software

Application Software for Information, Decision Support, and Specialized Purposes

- Specialized application software for information, decision support, and other purposes is available in every industry
- Examples
  - Genetic researchers use software to visualize and analyze the human genome
  - Music executives use decision support software to help pick the next hit
  - Decision support software is used to increase the cure rate for cancer

Programming Languages

- Sets of keywords, symbols, and a system of rules for constructing statements by which humans can communicate instructions to be executed by a computer
- Different languages have different characteristics
- **Syntax:** a set of rules associated with a programming language

The Evolution of Programming Languages

Generation	Language	Approximate Development Date	Sample Statement or Action
First	Machine language	1940s	00010101
Second	Assembly language	1950s	MVC
Third	High-level language	1960s	READ SALES
Fourth	Query and database languages	1970s	PRINT EMPLOYEE NUMBER IF GROSS PAY>1000
Beyond Fourth	Natural and intelligent languages	1980s	IF gross pay is greater than 40, THEN pay the employee overtime pay.

Table 4.9: The Evolution of Programming Languages

The Evolution of Programming Languages (continued)

- Visual, object-oriented, and artificial intelligence languages are easier for nonprogrammers to use than older generation languages
- Visual languages use a graphical or visual interface for program development
- Object-oriented programming languages are based on objects
- **Compiler:** a special software program that converts programmer's source code into machine-language instructions consisting of binary digits

The Evolution of Programming Languages (continued)

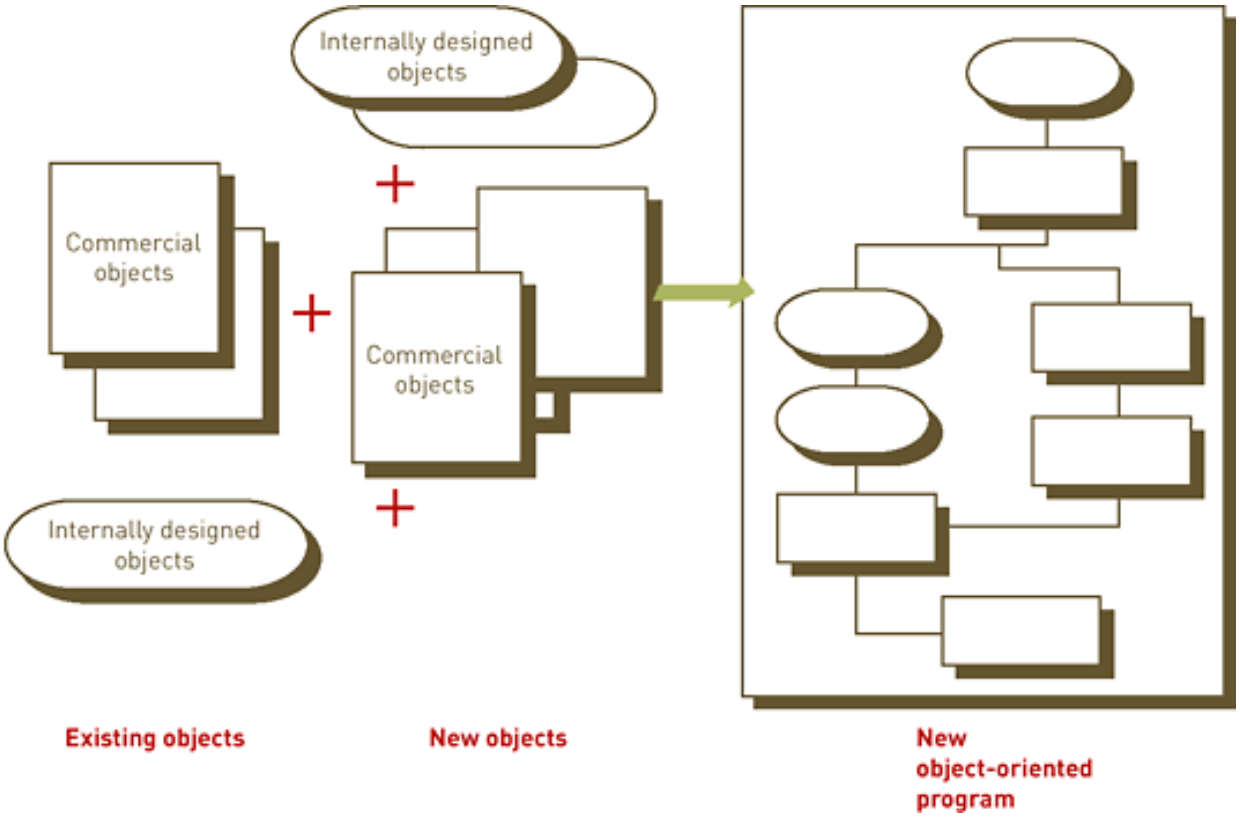

Figure 4.21: Reusable Code in Object-Oriented Programming

The Evolution of Programming Languages (continued)

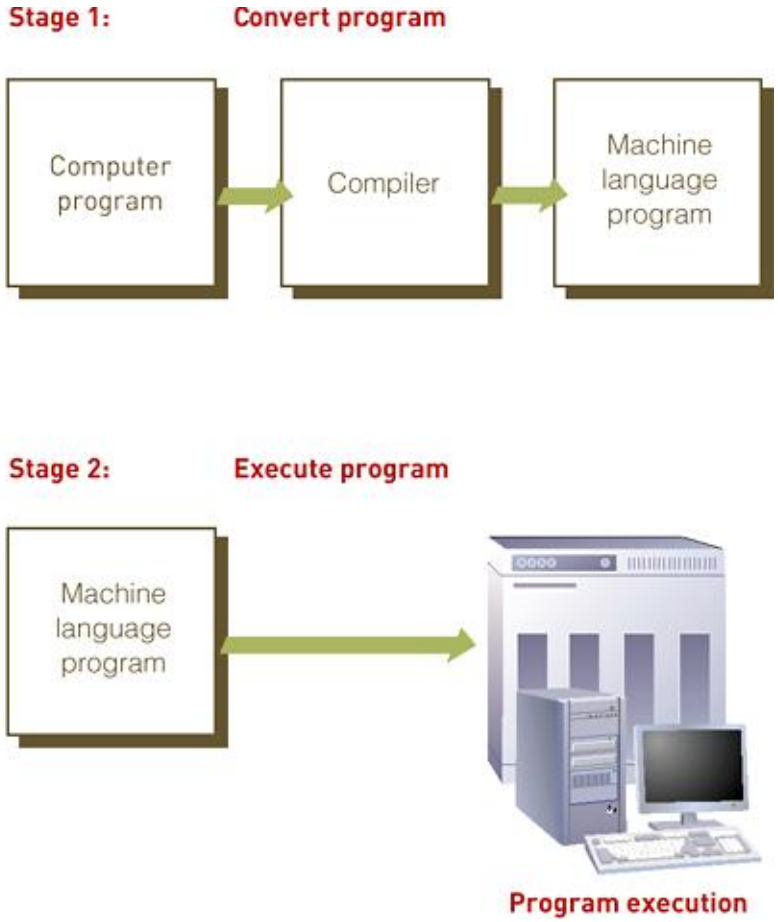

Figure 4.23: How a Compiler Works

Software Issues and Trends

- Because software is such an important part of today's computer systems, software issues have received increased attention
- Major software issues and trends discussed in the text
  - Software bugs, copyright, software licensing, open-source software, shareware and public domain software, multiorganizational software development, software upgrades, and global software support

Software Bugs

- **Software bug:** defect in a computer program that keeps it from performing as it is designed to perform
- Tips for reducing impact of software bugs
  - Register all software so that you can receive bug alerts, fixes, and patches
  - Check the manual or read-me files for work-arounds
  - Access support area of the manufacturer's Web site for patches
  - Install the latest software updates

Copyrights and Licenses

- Most software products are protected by law using copyright or licensing provisions
  - In some cases, you are given unlimited use of software on one or two computers
  - In other cases, you pay for your usage—if you use the software more, you pay more
- Some software now requires that you *register* or *activate* it before it can be fully used

Open-Source Software

- **Open-source software:** software freely available to anyone in a form that can be easily modified
- Some widely used open-source software packages: Linux OS, Free BSD, Apache, Sendmail, Perl
- Open-source software is often *more* reliable and secure than commercial software
- Open-source systems can contain hidden costs, particularly for user support or solving problems with the software

Open-Source Software (continued)

Software Type	Example
Operating system	Linux
Application software	Open Office
Database software	MySQL
Internet browser	Firefox
Internet messaging	Jabber

Table 4.10: Examples of Open-Source Software

Shareware, Freeware, and Public Domain Software

- **Shareware and freeware:** software that is very inexpensive or free, but whose source code cannot be modified
- **Public domain software:** shareware and freeware that is in the public domain

Software Upgrades

- Software companies revise their programs and sell new versions periodically
- Revised software may or may not offer any major additional capabilities
- Revised software can contain bugs or errors
- Software upgrades usually cost much less than the original purchase price

Global Software Support

- Vendors face the challenge of providing adequate support for their software customers in all locations of the world
- Trend of outsourcing global support to one or more third-party distributors

Summary

- Computer programs: sequences of instructions for the computer
- Systems software: coordinates the activities of hardware and programs
- Applications software: helps users solve particular problems
- Operating system (OS): set of computer programs that controls the computer hardware and acts as an interface with application programs

Summary (continued)

- Graphical user interface (GUI): user interface that uses icons and menus displayed on screen to send commands to the computer system
- Time-sharing: allows more than one person to use a computer system at the same time
- Proprietary software: one-of-a-kind program for a specific application, usually developed and owned by a single company
- Off-the-shelf software: existing software program that is purchased

Summary (continued)

- Enterprise resource planning (ERP) software: manages a company's vital business operations for an entire multisite, global organization
- Programming languages: allow humans to communicate instructions to be executed by a computer
- Most software products are protected by law using copyright or licensing provisions
- Open-source software is freely available to anyone in a form that can be easily modified

THANK YOU