Chapter 4
Software Basics: The Ghost in the Machine

- The three major categories of software:
  - Software development tools
  - Applications
  - Systems software




- Software development tools:
  - compilers,
  - translators,
  - programs that enable programmers to create other software
- Examples: **Java** compiler, Visual Basic compiler, IDE (e.g., NetBeans).




- Applications:
  - end-user programs
  - serve as productivity tools to help computer users solve problems
- Examples: Editors, spreadsheets, databases, graphics programs, …
  - and the programs you wrote



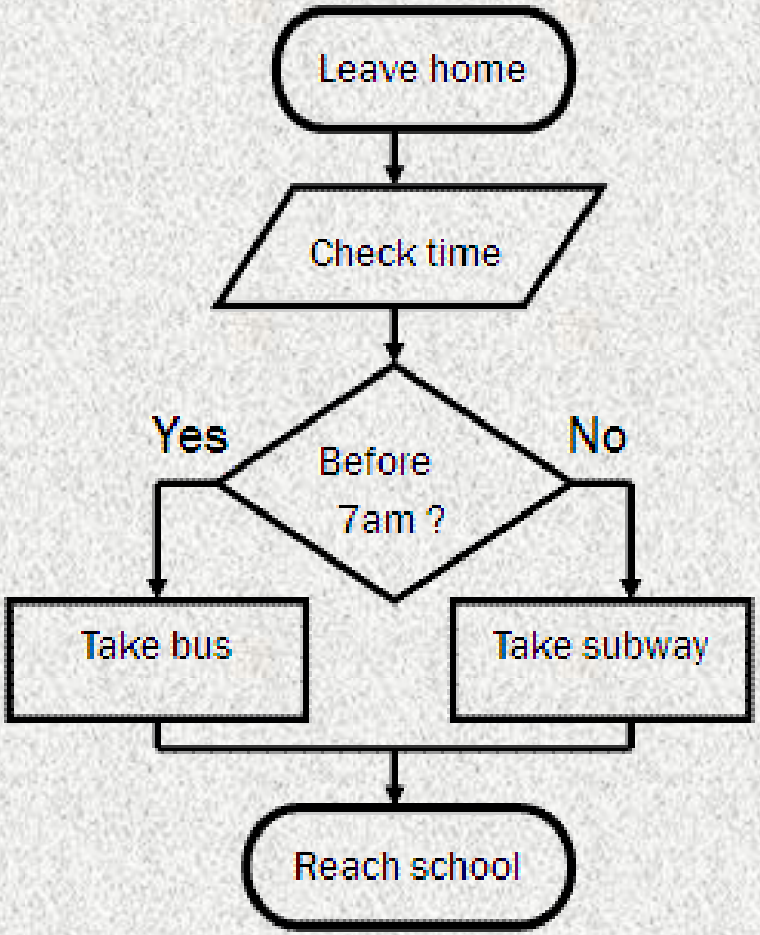

- Systems software:
  - operating system,
  - file management tools,
  - and other utilities (Internet browsers, e-mail, etc.);
- coordinates hardware/network operations and does behind-the-scenes work




Processing with Programs

- A Fast, Stupid Machine
  - An algorithm: a set of step-by-step instructions written in some language, e.g., English.
  - The steps may be ambiguous and not specific enough for a computer to execute.
  - Programmer translates these steps into a programming language.
  - Hence: a program

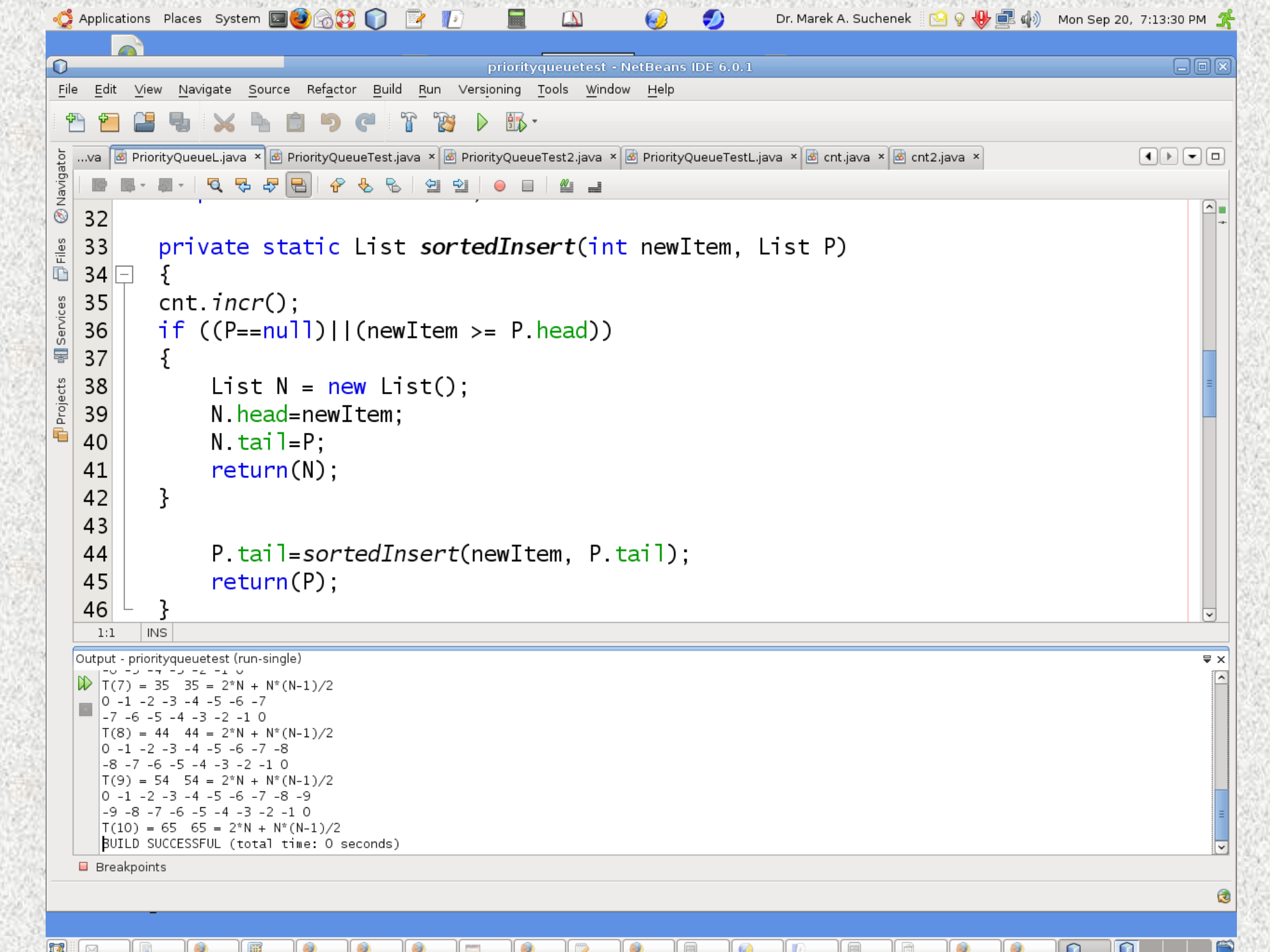




Leave home
Check time
Yes
Before
7am ?
No
Take bus
Take subway
Reach school

- The Languages of Computers
  - Machine Language: numeric codes that represent instructions and data
  - High-level language: a machine-independent language that uses math-like syntax and key words form natural language.
    - Compilers are most popular translators. They translate high-level language into machine language.

```
start:
8272:   bmi     82B6

8296:   jsr     r4,@#82B0
829A:   .asciz  "HELLO=WORLD!="
82A8:   jsr     r5,@#82AE
82AC:   sob     r0,8296
82AE:   rts     r5
82B0:   jsr     pc,@#1248
82B4:   rts     r4
82B6:   mov     #8041,@#8264
82BC:   sob     r0,8296
```


Applications Places System
Dr. Marek A. Suchenek
Mon Sep 20, 7:13:30 PM
priorityqueuetest - NetBeans IDE 6.0.1
File Edit View Navigate Source Refactor Build Run Versioning Tools Window Help
...va
PriorityQueueL.java
PriorityQueueTest.java
PriorityQueueTest2.java
PriorityQueueTestL.java
cnt.java
cnt2.java
Navigator
Files
Services
Projects
32
33 private static List sortedInsert(int newItem, List P)
34 {
35 cnt.incr();
36 if ((P==null)||(newItem >= P.head))
37 {
38 List N = new List();
39 N.head=newItem;
40 N.tail=P;
41 return(N);
42 }
43
44 P.tail=sortedInsert(newItem, P.tail);
45 return(P);
46 }
1:1
INS
Output - priorityqueuetest (run-single)
T(7) = 35 35 = 2*N + N*(N-1)/2
0 -1 -2 -3 -4 -5 -6 -7
-7 -6 -5 -4 -3 -2 -1 0
T(8) = 44 44 = 2*N + N*(N-1)/2
0 -1 -2 -3 -4 -5 -6 -7 -8
-8 -7 -6 -5 -4 -3 -2 -1 0
T(9) = 54 54 = 2*N + N*(N-1)/2
0 -1 -2 -3 -4 -5 -6 -7 -8 -9
-9 -8 -7 -6 -5 -4 -3 -2 -1 0
T(10) = 65 65 = 2*N + N*(N-1)/2
BUILD SUCCESSFUL (total time: 0 seconds)
Breakpoints

- Compatibility
  - It allows software to function properly with the hardware, operating system, and peripherals.
  - Programs written for one type of computer system may or may not work on another.




- Licensing: Commercial software is copyrighted so it can't be legally duplicated for distribution to others.
- Other software may be copyrighted, too.
  - Software license

Not all software is copyrighted.

- Public domain software
- Shareware

- Public domain software to avoid:

- LibreOffice




The Hardware-Software Connection

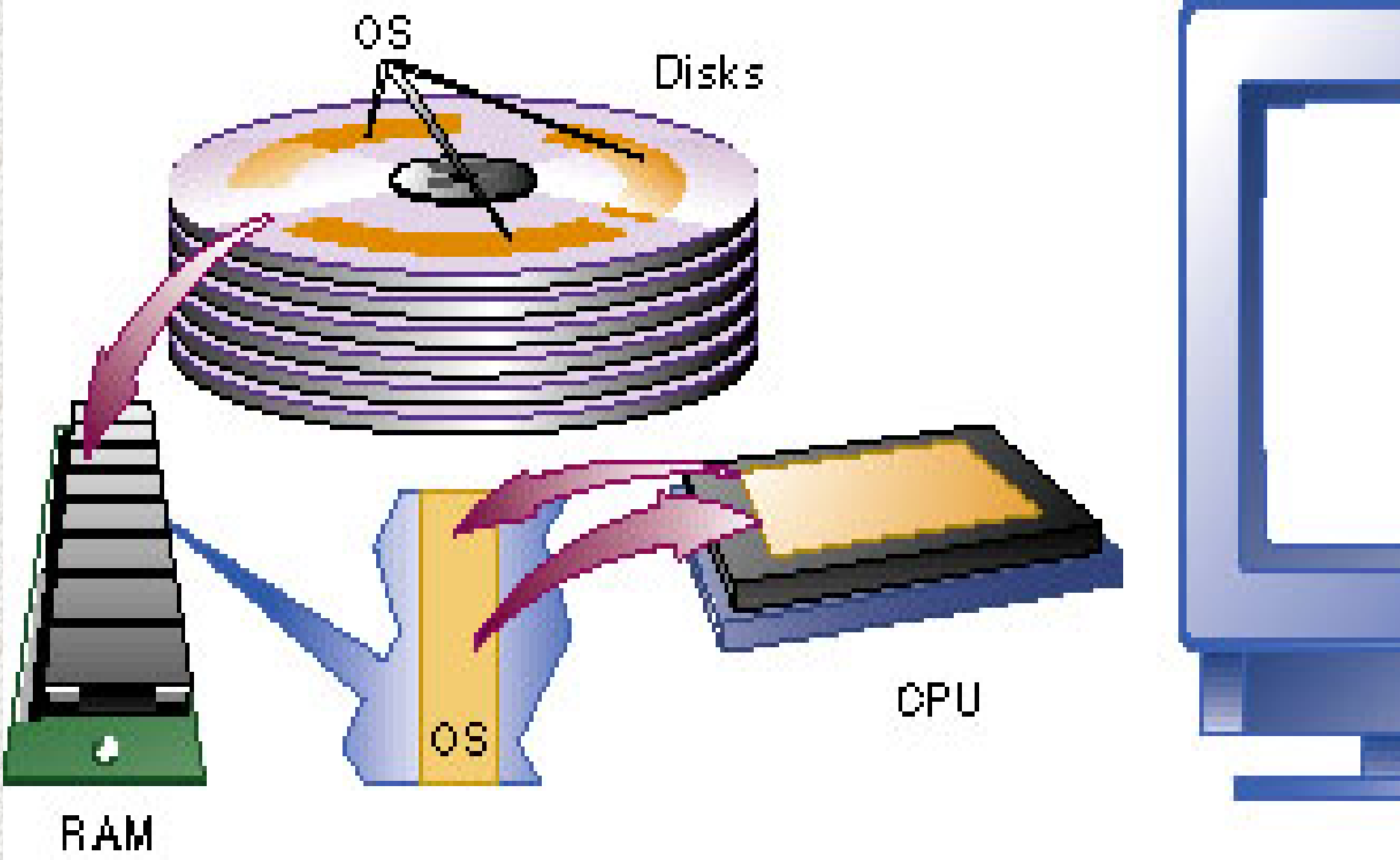
What the Operating System Does

- Systems software
  - A class of software that includes
    - the *operating system*,
    - *file management tools*, and
    - *utility programs*,




- Operating system functions:
  - Supervises execution of application programs (processes)
    - Manages **multitasking**
  - Allocates and manages memory and devices to processes
    - Maintains file system
  - Is responsible for security and protection



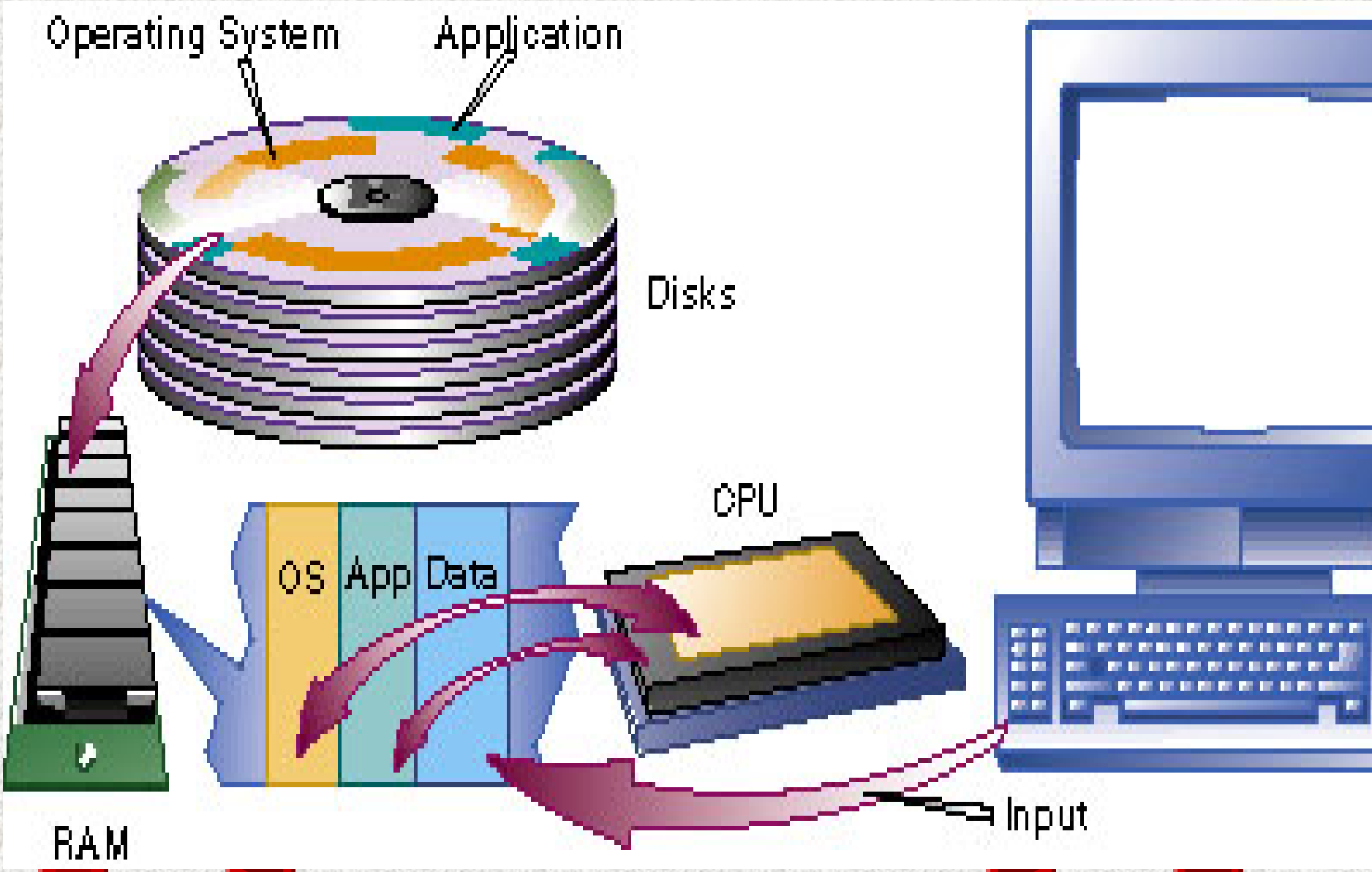
Device drivers

- Small programs that enable I/O devices—e.g., keyboard, mouse, printer, and others—to communicate with the computer
- Included with the operating system or bundled with peripherals
- Can be downloaded from the Internet.



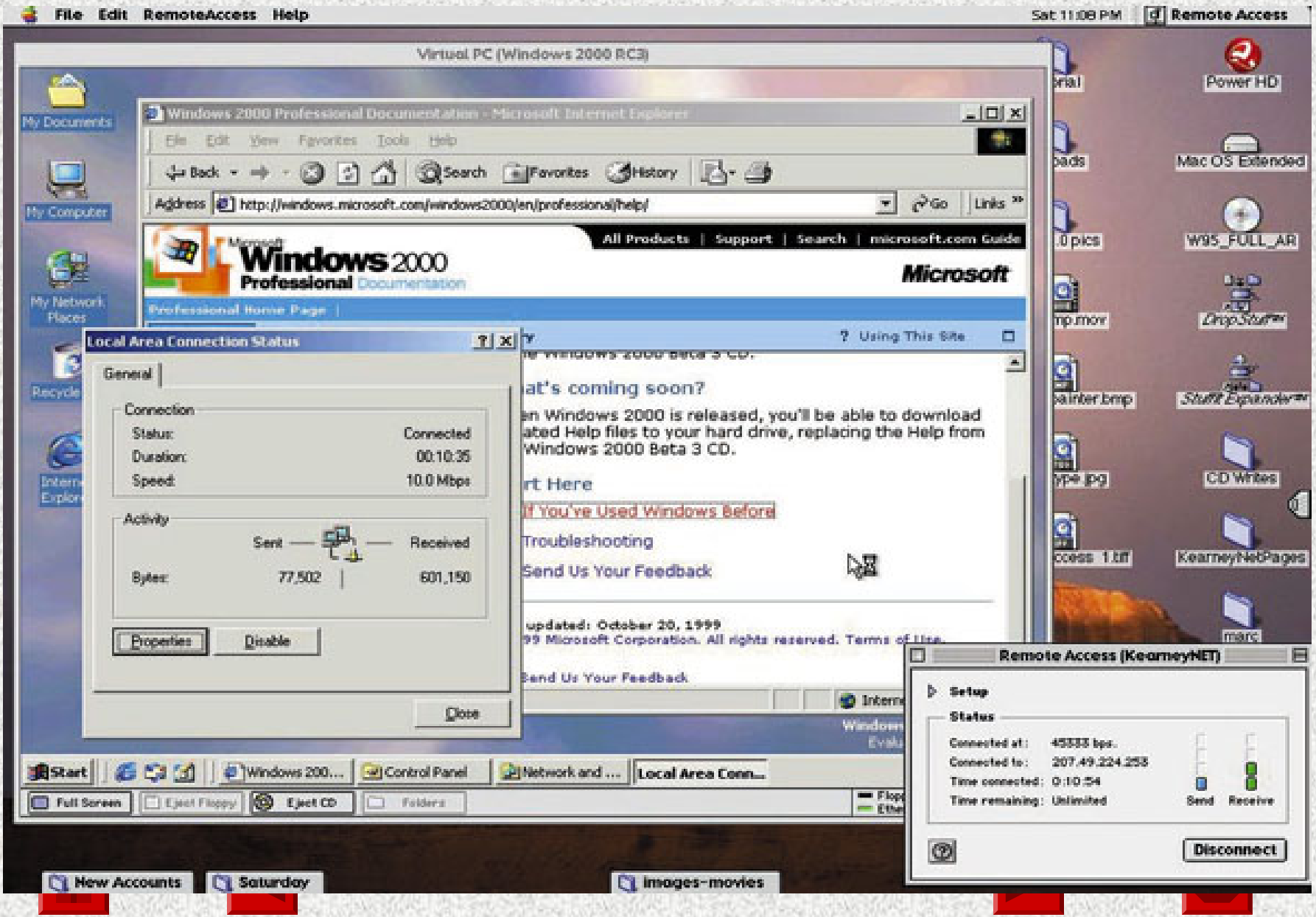

- Where the Operating System Lives
  - Some computers store their operating system in ROM.
  - Most include only the start-up part of OS in ROM.
    - The kernel of the OS is loaded into RAM from the disk in a process called **booting**, which occurs when you turn on the computer.



- Most of the time the operating system is dormant.
- It “takes over” the computer for relatively short times and performs its functions.
- Interacting with the operating system is done via the ***user interface.***



The User Interface: The Human–Machine Connection

- The interface defines the look and feel of the operating system from a human point of view.
- Desktop Operating Systems
  - MS-DOS is a **disk** operating system in which the user interacts using characters:
    - Letters
    - Numbers
    - Symbols




- Features may include:
  - Command-line interface (commands are typed); examples: DOS, “vanilla” UNIX, or
  - Menu-driven interface (commands are chosen from on-screen lists with pointing device)




- Graphical User Interfaces (GUI)
  - Mac OS (for Mac)
  - MS Windows (for MS OS)
  - OpenWindows (for Unix, Linux, Solaris, ...)
  - X Windows System (same as above)




- Multiple User Operating Systems: UNIX, Solaris, Linux, ..
  - **UNIX** was developed at Bell Labs before personal computers were available.
  - **Solaris** – a popular version of Unix, is the OS for Sun workstations
  - **Linux** (its kernel was first written by Linus Torvalds) – a collaborative effort, available as cost-free license.

- **Linux**

  A version to avoid:

- Mint

- The source code of Linux is free for anyone to use or improve, as long as they obey the license conditions.
- Some versions of Linux can also be purchased/ licensed (with maintenance and service agreement), e.g. Red Hat Enterprise Linux.
- There are many other operating systems!




Tomorrow's User Interfaces

- Current and future user interfaces are/are going to be built around emerging technologies such as:
  - Natural-language interfaces
  - Computer Vision
  - Intelligent Agents
  - Virtual Reality

File Management: Where's My Stuff?

- Files' management is difficult due to their huge number.
  - One solution to this problem is to organize data files logically in directories (a.k.a. folders)
  - Both Windows and the Mac support some common system folders with self-explanatory names:
    - My Documents (Documents)
    - My Pictures (Pictures)
    - My Music (Music)

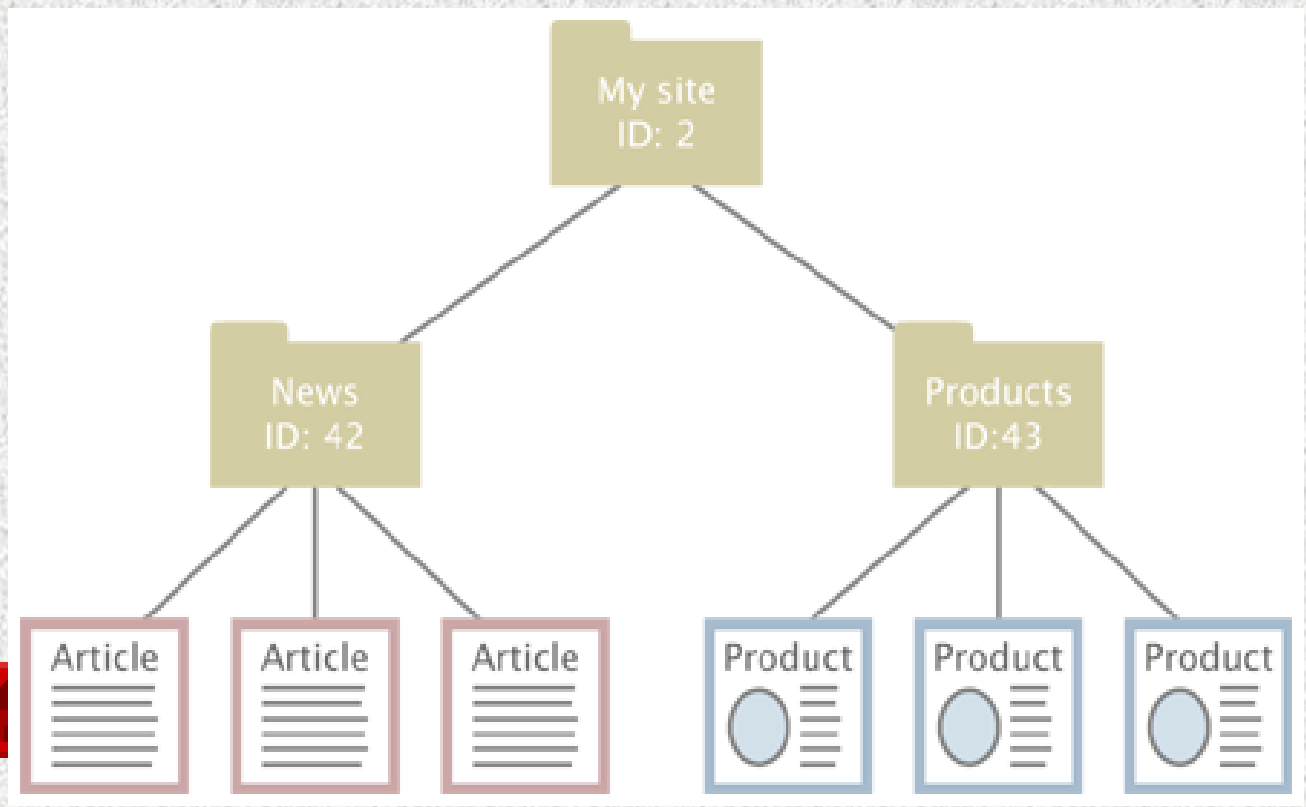



- File-Management Utilities
  - View, rename, copy, move, and delete files and folders
  - Tree-like hierarchies help with organization
  - Searching for a file
  - Get size, file type, and last modification date
- Managing Files from Applications
  - Example operations: Open, Save As, Save, Close, etc.
- Disk Fragmentation/Defragmentation




File-Management Utilities

- Tree-like hierarchies



Software Piracy and Intellectual Property Laws

- Software Piracy—illegal duplication of copyrighted software
  - Billions of dollars are lost each year to software pirates.
  - **One-third of all software is illegally copied.**




Software Piracy and Intellectual Property Laws

- Intellectual Property and the Law
  - Intellectual property is an intangible result of creative activities in science, arts, business, and industry.
  - Laws ensure that intangible creative work is justly rewarded and **encourage innovation.**
  - Copyrights, patents, trademarks, ...




Software Piracy and Intellectual Property Laws

- Copyrights, patents, trademarks, …

Software Piracy and Intellectual Property Laws

- Copyrights, patents, trademarks, …

U.S. Constitution, Article I, Section 8 (excerpts):

"The Congress shall have Power [...] To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries;"

Software Piracy and Intellectual Property Laws

- You will -most likely – make a living of your intellectual work.
- **So, you should be a strong advocate of protection of intellectual property.**




Tomorrow's Technology and You 8/e
Chapter 4
Lesson Summary

- This chapter provides some general answers to the "What is software" question, along with details about each of the three major categories of software:
  - Compilers and other translator programs, which enable programmers to create other software
  - Software applications, which serve as productivity tools to help computer users solve problems
  - System software, which coordinates hardware operations and does behind the scenes work the user seldom sees.




Tomorrow's Technology and You 8/e
Chapter 4
Lesson Summary (continued)

- ✓ Popular operating systems include Windows, Mac OS X, UNIX, and Linux.
- ✓ The user interface is a critical communication component in operating systems, applications, programming languages, and utilities.
- ✓ Tomorrow's interfaces are likely to rely on three-dimensional graphics and animation to create virtual realities.
- ✓ Software piracy is a major concern in the computer industry.