

CSE 1001

# **Problem Solving and Programming**

# Course Objective

## •Course Objective

- **Introduce** the essential skills for a logical thinking to problem solving
- Introduce the essential skills in programming for problem solving using computer

## •Outcomes

- On completion of the course, students will have the
- -ability to identify an appropriate approach to solve the problem
- -ability to write a pseudo code for the identified strategy
- -ability to translate the pseudocode into an executable program
- -ability to validate the program for all the possible inputs.

# Course Details

- λ Minimum Credits for B. Tech - 180
- λ University Core Course
- λ Credits for the course 3
- λ Practical's 6 hours per week (~90 hours)

# Text Books and References

## Text Books

- 1) Prelude to Programming, 6/E, Stewart Venit Elizabeth Drake, Santa Fe College ISBN-10: 013374163X • ISBN-13: 9780133741636 2015
- 2) Problem Solving and Programming Concepts, 9/E Maureen Sprankle Jim Hubbard ISBN-10: 0132492644 • ISBN-13: 9780132492645 2012
- 3) Think like a programmer: An introduction to creative problem solving, Anton Spraul, 2012, No Starch Press, ISBN-10: 1593274246
- 4) Introduction to Computer Science Using Python:A Computational Problem-Solving Focus,Charles Dierbach, Wiley Publications

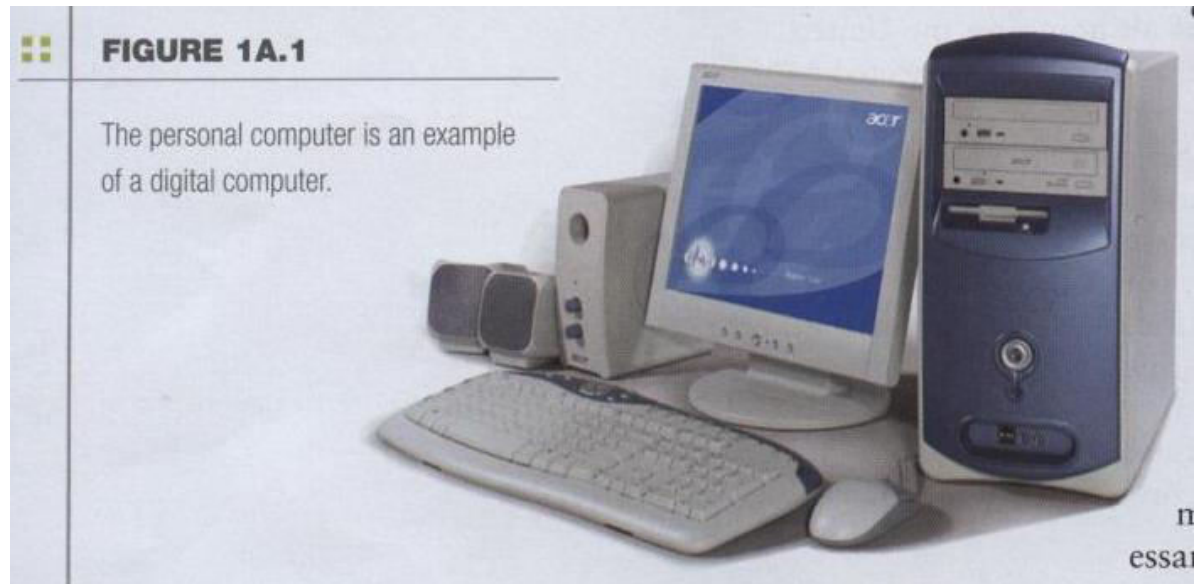
## Reference Books

- 1) How to Solve It: A New Aspect of Mathematical Method, G. Polya, Princeton University Press, 2014, ISBN-13: 9780691164076
- 2) How to Solve it By Computer, R.G.Dromey, Pearson Education, 2014, ISBN-13: 9788131705629
- 3) Introduction to Algorithms, 3<sup>rd</sup> Edition, T.H.Cormen, C.E.Leiserson, R.L.Rivest and C.Stein,MIT Press, 2009, ISBN-13: 9780262533058,

# Introducing Computer Systems

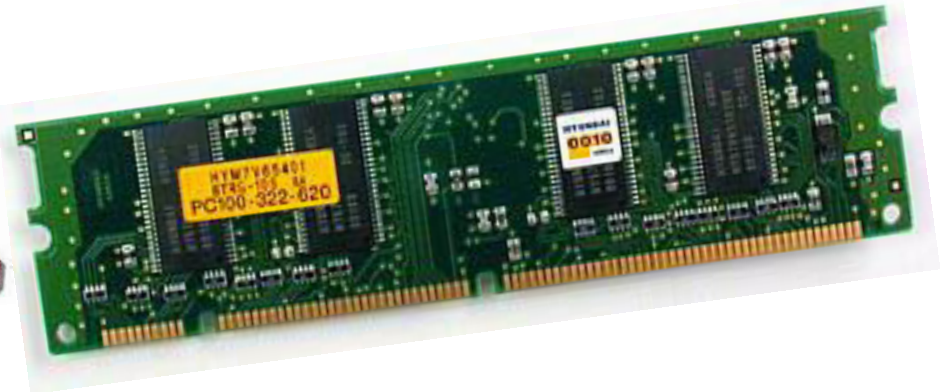
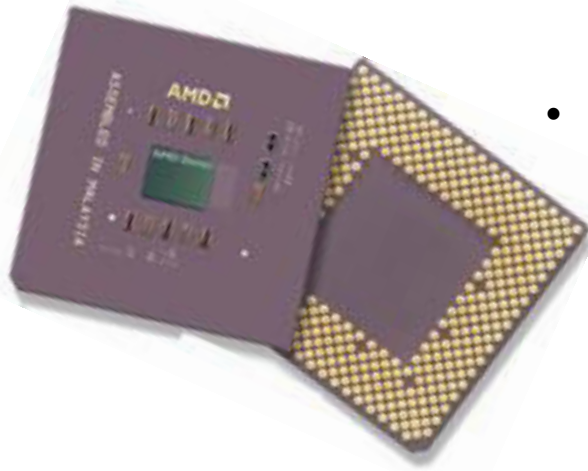
# The Computer Defined

- Electronic device
- Converts data into information
- Modern computers are digital
  - Two digits combine to make data (0, 1)



# A computer is:

- An electronic machine that can be programmed to accept data (*input*), and process it into useful information (*output*). Data is put in secondary storage (*storage*) for safekeeping or later use.
- The *processing* of input into output is directed by the software, but performed by the hardware.
- GI/GO



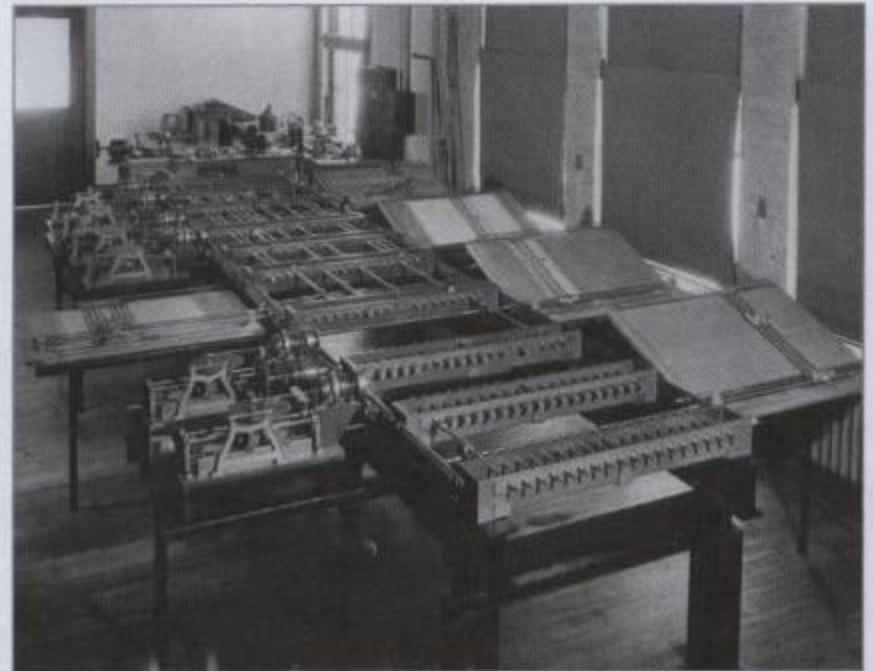
# The Computer Defined

- Older computers were analog
  - A range of values made data



**FIGURE 1A.2**

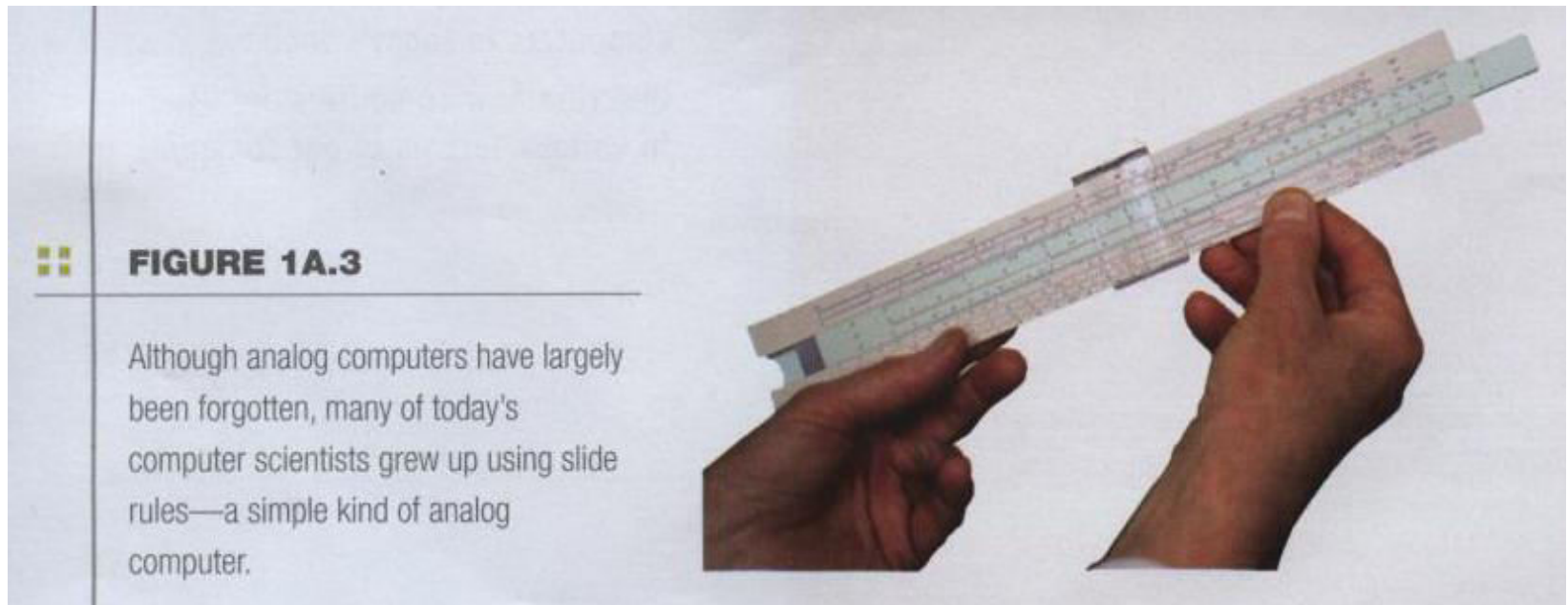
This early analog computer, created by Vannevar Bush in the late 1920s, was called a "differential analyzer." It used electric motors, gears, and other moving parts to solve equations.





# The Computer Defined

- Older computers were analog
  - A more manageable type -- the old-fashioned slide rule



# Computers for Individual Use

- Desktop computers
  - Different design types

**FIGURE 1A.7**  
This desktop PC follows the traditional design, with the monitor stacked on top of the system unit.



**FIGURE 1A.8**

This desktop PC has a "tower" design, with a system unit that sits upright and can be placed on either the desk or the floor.

**Norton ONLINE**

For more information on workstations, visit

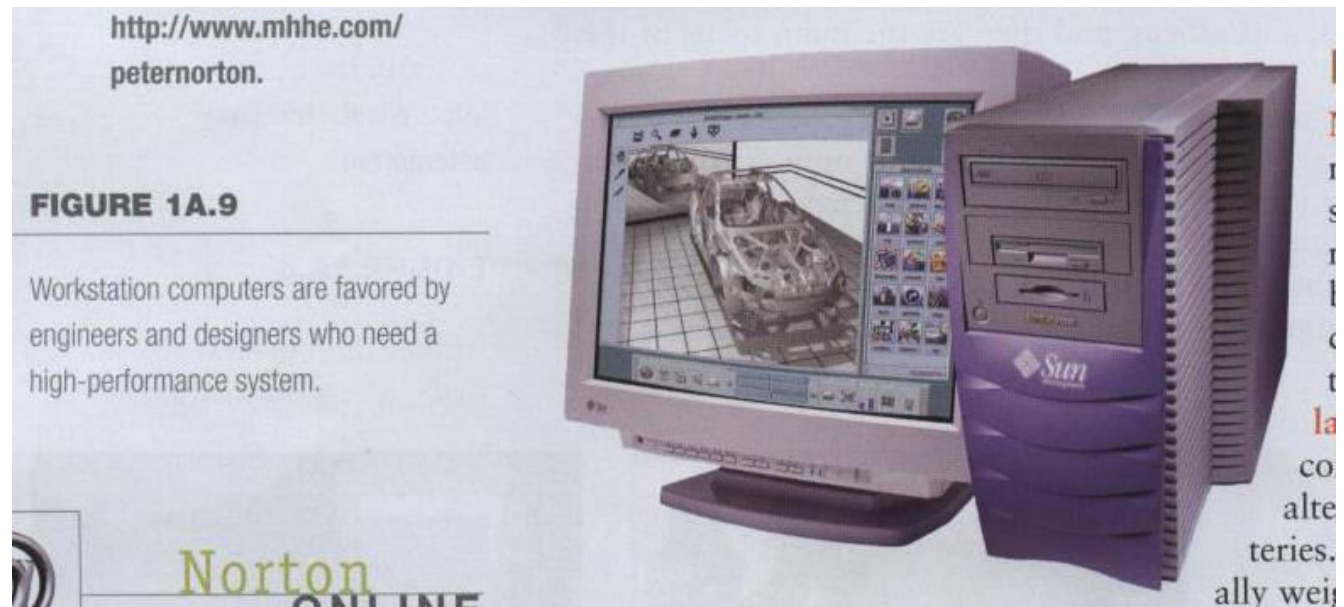
**Workst**  
A workst  
compute  
and feat  
(see Fig  
ula

tasks.  
high-resolution r  
handling capabilities, makin  
tectural or engineering design, mode

A photograph of a desktop PC with a tower system unit. The monitor is placed to the left of the tower. A keyboard and mouse are connected to the tower.

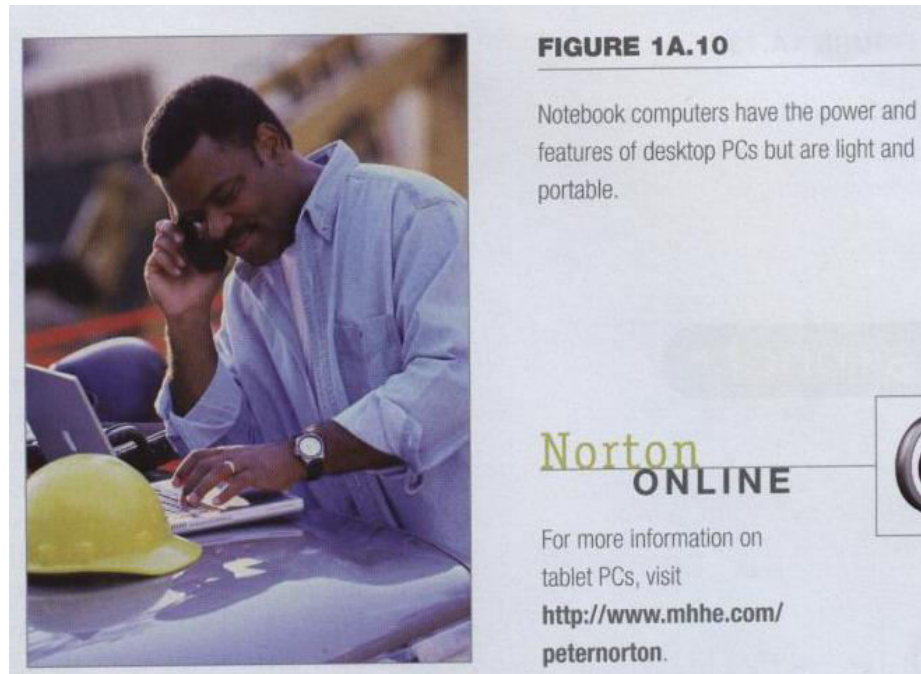
# Computers for Individual Use

- Workstations
  - Specialized computers
  - Optimized for science or graphics
  - More powerful than a desktop



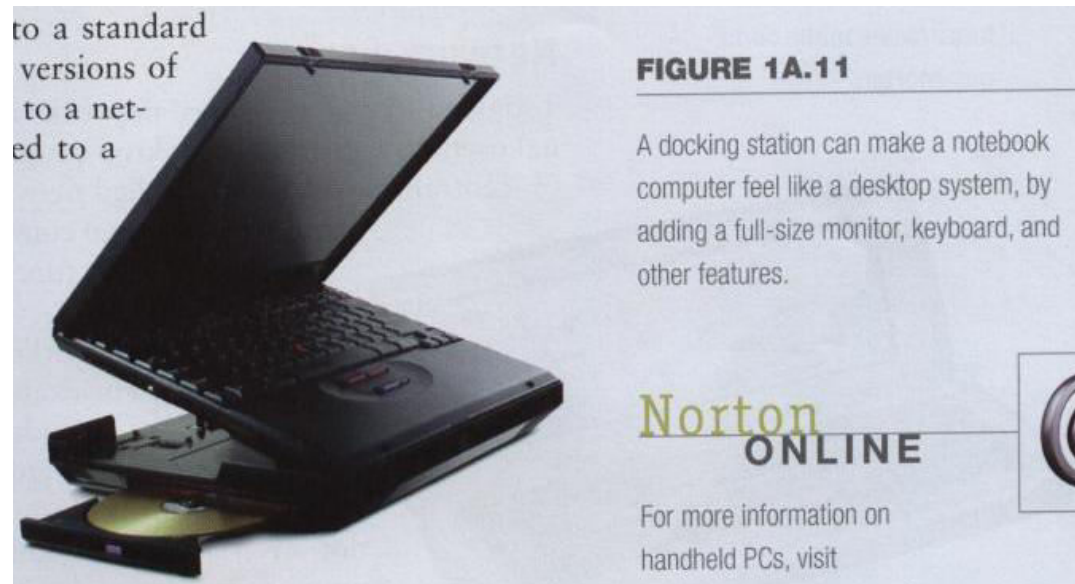
# Computers for Individual Use

- Notebook computers
  - Small portable computers
  - Weighs between 3 and 8 pounds



# Computers for Individual Use

- Notebook computers
  - About 8 ½ by 11 inches
  - Typically as powerful as a desktop
  - Can include a docking station



# Computers for Individual Use

- Tablet computers
  - Newest development in portable computers
  - Input is through a pen
  - Run specialized versions of office products





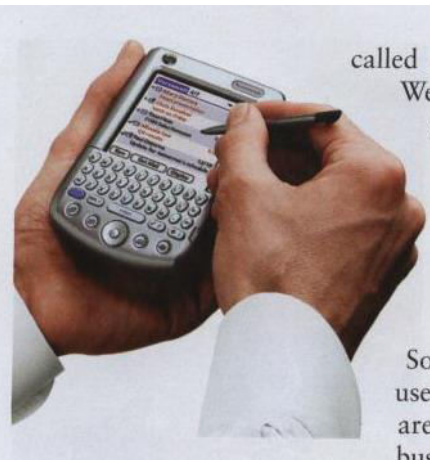
# Computers for Individual Use

- Handheld computers, palm computer
  - Very small computers
  - Personal Digital Assistants (PDA)
  - Note taking or contact management
  - Data can synchronize with a desktop

**FIGURE 1A.13**

Devices such as PDAs put a computer in your pocket and can be used in many different ways.

simnet™

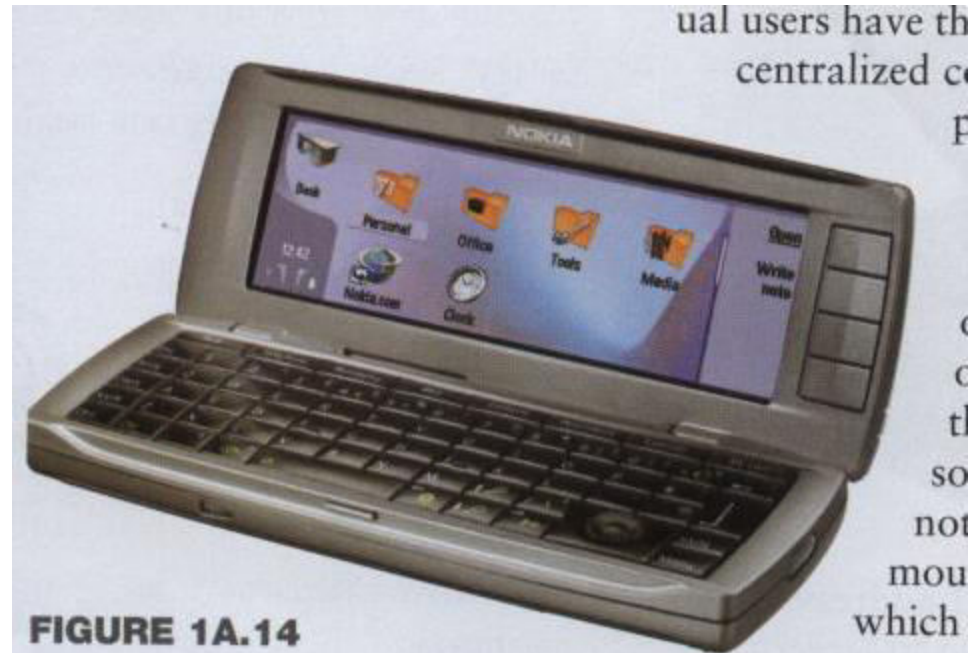


called s  
Wel  
P

So  
user  
are  
busi

# Computers for Individual Use

- Smart phones
  - Hybrid of cell phone and PDA
  - Web surfing, e-mail access



New cellular phones, like the Nokia 9500 Communicator, double as tiny computers, offering many of the features of PDAs.





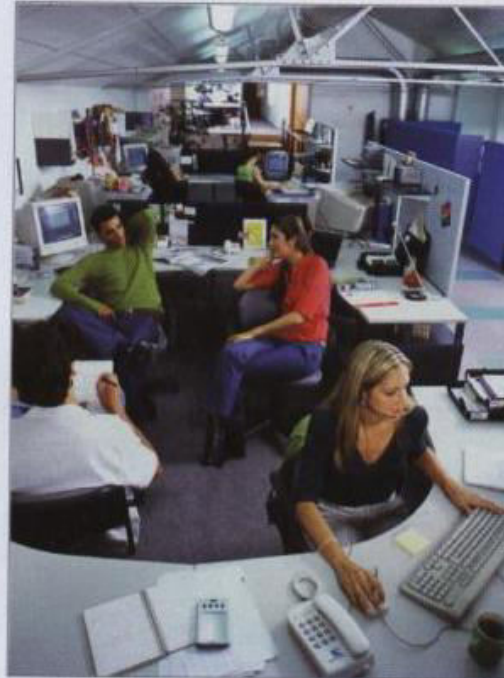
# Computers for Organizations

- Network servers
  - Centralized computer
  - All other computers connect

New cellular phones, like the Nokia 9500 Communicator, double as tiny computers, offering many of the features of PDAs.

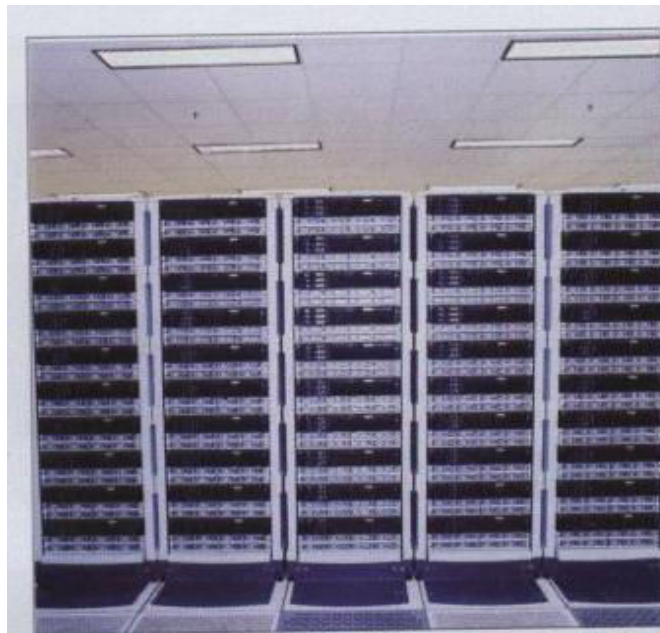
**FIGURE 1A.15**

In many companies, workers use their desktop systems to access a central, shared computer.



# Computers for Organizations

- Network servers
  - Provides access to network resources
  - Multiple servers are called server farms
  - Often simply a powerful desktop: Google

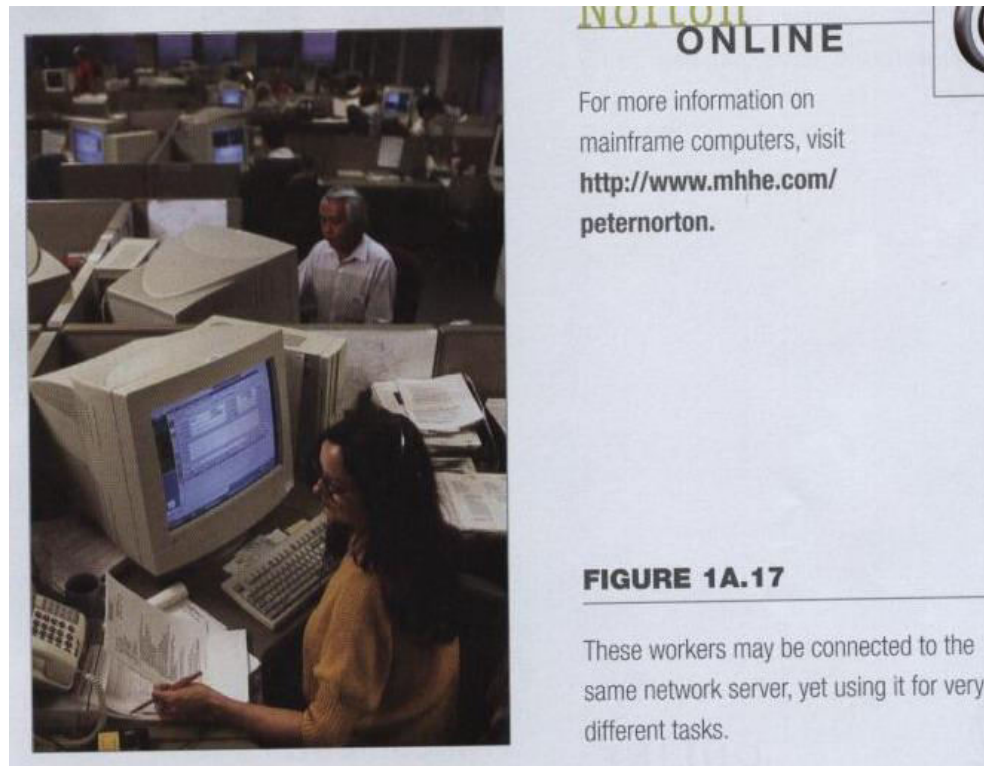


**FIGURE 1A.16**

Large corporate networks can use hundreds of servers.

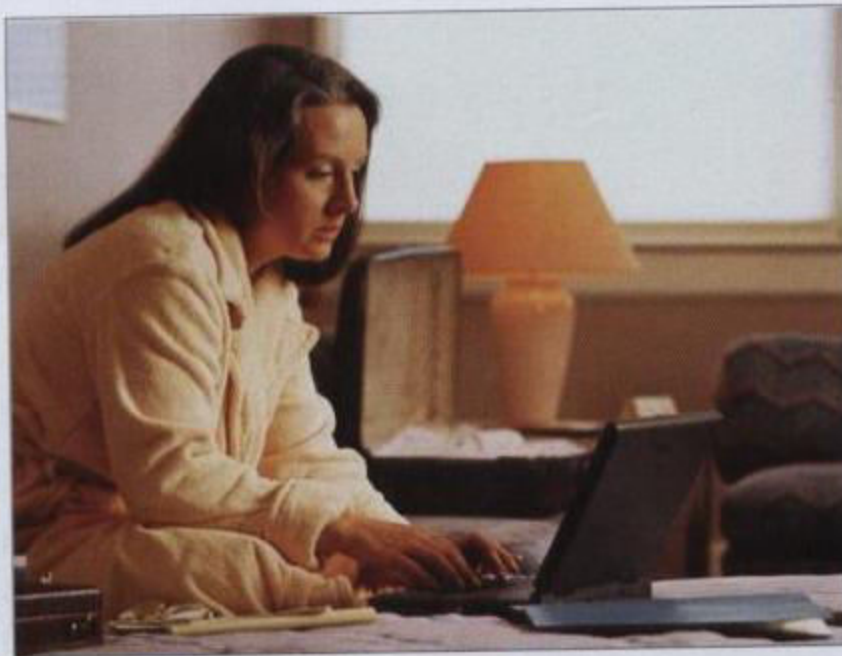
# Computers for Organizations

- Network servers
  - Flexibility to different kinds of tasks



# Computers for Organizations

- Network servers
  - Users use the Internet as a means of connecting even if away from the offices.



**FIGURE 1A.18**

Many users can access their organization's network no matter where they go.

# Computers for Organizations

- Mainframes
  - Used in large organizations
  - Handle thousands of users
  - Users access through a terminal

**FIGURE 1A.19**

Hundreds, even thousands, of mainframe users may use terminals to work with the central computer.





# Computers for Organizations

- Mainframes
  - Large and powerful systems



# Computers for Organizations

- Minicomputers
  - Called midrange computers
  - Power between mainframe and desktop
  - Handle hundreds of users
  - Used in smaller organizations
  - Users access through a terminal

# Computers for Organizations

- Supercomputers
  - The most powerful computers made
  - Handle large and complex calculations
  - Process trillions of operations per second
  - Found in research organizations





# Review Questions

1. What is a computer?
2. Explain a few of the different ways in which computers can be categorized.
3. List six types of computers that are designed for use by a single person.
4. Describe the two common designs for desktop computers.
5. How much do notebook computers typically weigh?
6. List four types of computers that are designed for use by organizations, and are commonly used by multiple people at the same time.

# Review Questions

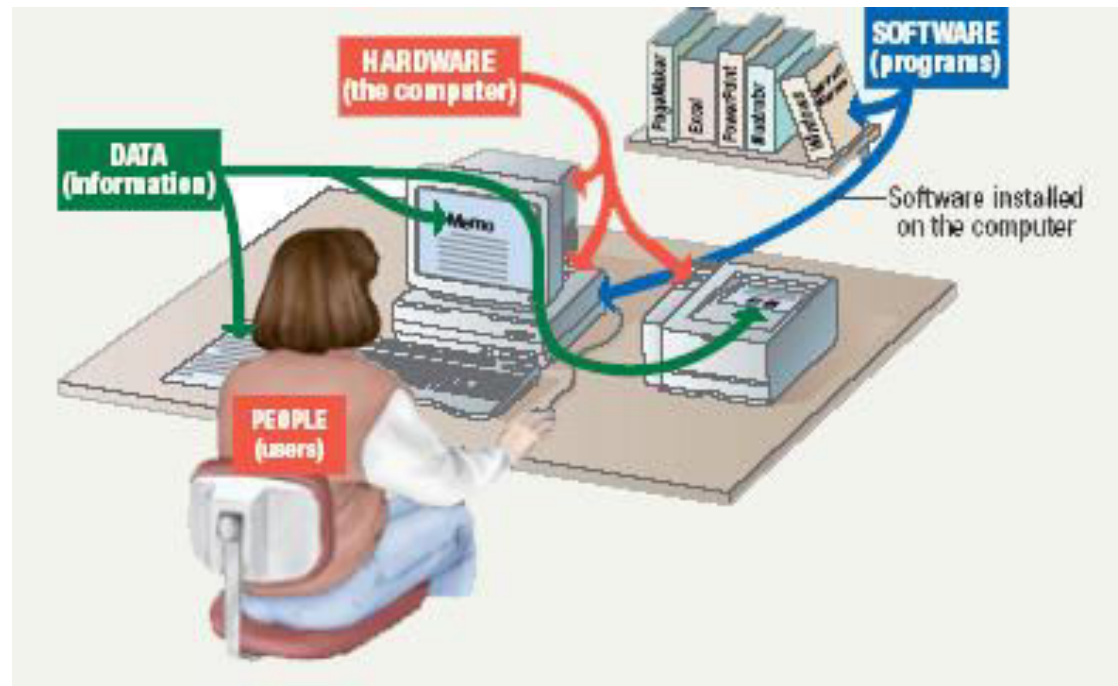
7. Why are mainframe systems usually limited in the number of tasks they perform?
8. What is the most popular use for home computers?
9. How are computer technologies used by the military?
10. How are computer technologies being used to train surgeons?

# Project

- Open your personal computer at home and list the hardware specification as detailed as possible, including the manufacturer, product type, and serial number. List every software installed on your personal computer. For example:
- PC: 友鄰
- CPU: Intel Pentium 4 1.8G Hz
- Motherboard: S45GMAX
- SDRAM: 1GB DDR
- AGP 3D/64MB SGRAM
- hard disk: 260GB
- flash disk drive: 1GB
- monitor: Lemel 17 inch TFT-LCD, Model: LC-AE
- power supply: 250W, ATX compatible
- keyboard: 104 keys Chinese-English
- CD-ROM drive: 52 times speed
- DVD-RW drive: 6 times speed
- sound blaster card:
- speakers: Trois DS 621G
- mouse: Logitech Optical Mouse
- anti-virus software: Norton AntiVirus
- anti-virus software: Trend Micro/Internet Phone
- OS: Microsoft Windows XP
- productivity software: Microsoft Office XP
- X-Stop: pornography prevention software
- ...

# Parts of the Computer System

- Computer systems have four parts
  - Hardware
  - Software
  - Data
  - User



# Parts of the Computer System

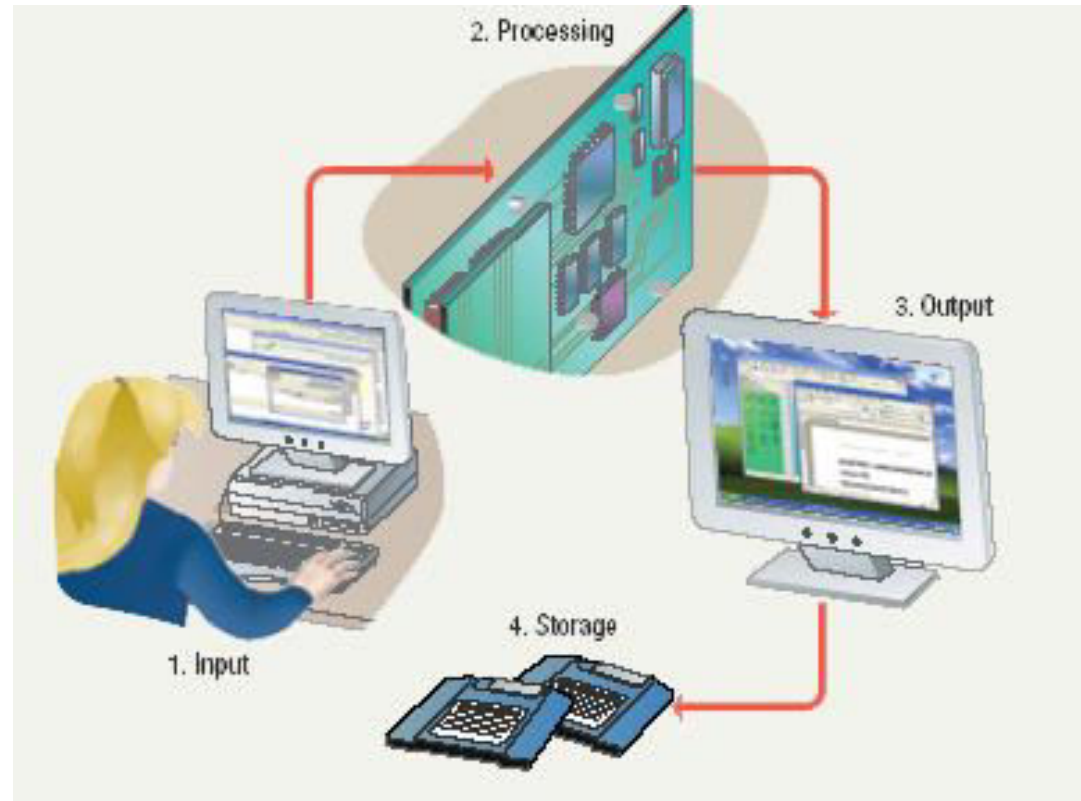
- Hardware
  - Mechanical devices in the computer
  - Anything that can be touched
- Software
  - Tell the computer what to do
  - Also called a program
  - Thousands of programs exist

# Parts of the Computer System

- Data
  - Pieces of information
  - Computers organize and present data
- Users
  - People operating the computer
  - Most important part
  - Tell the computer what to do

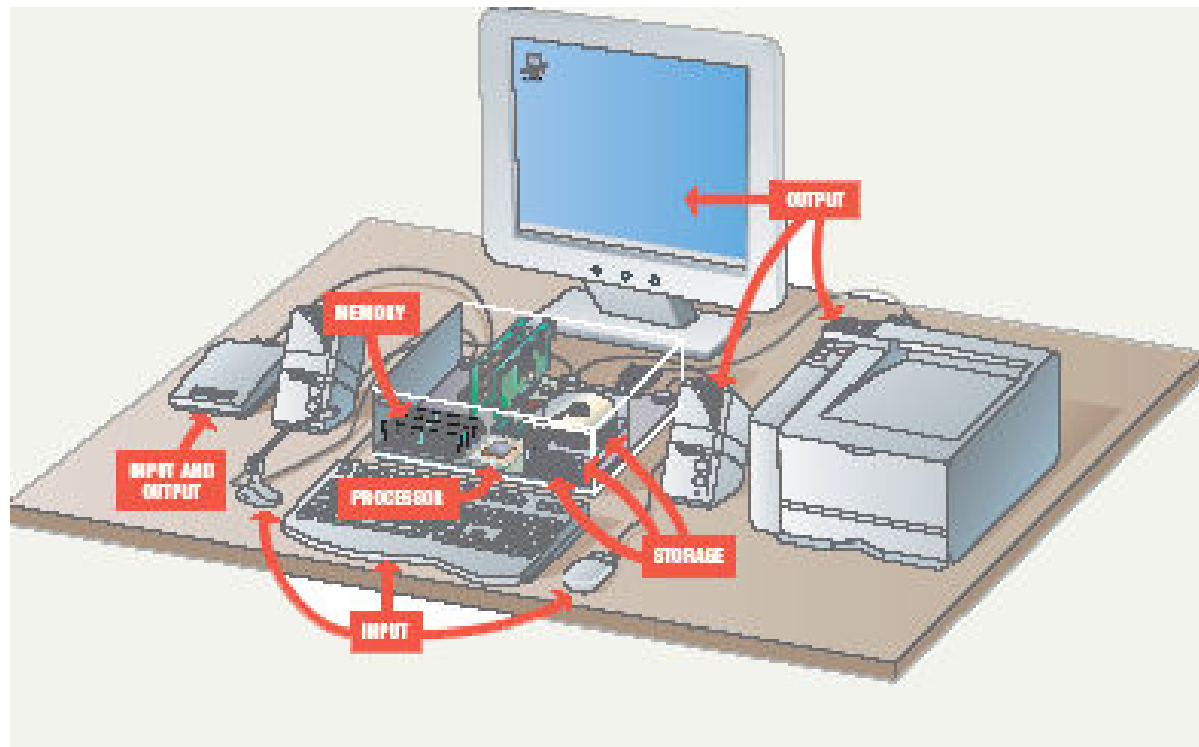
# Information Processing Cycle

- Steps followed to process data
- Input
- Processing
- Output
- Storage



# Essential Computer Hardware

- Computers use the same basic hardware
- Hardware categorized into four types





# The System Unit

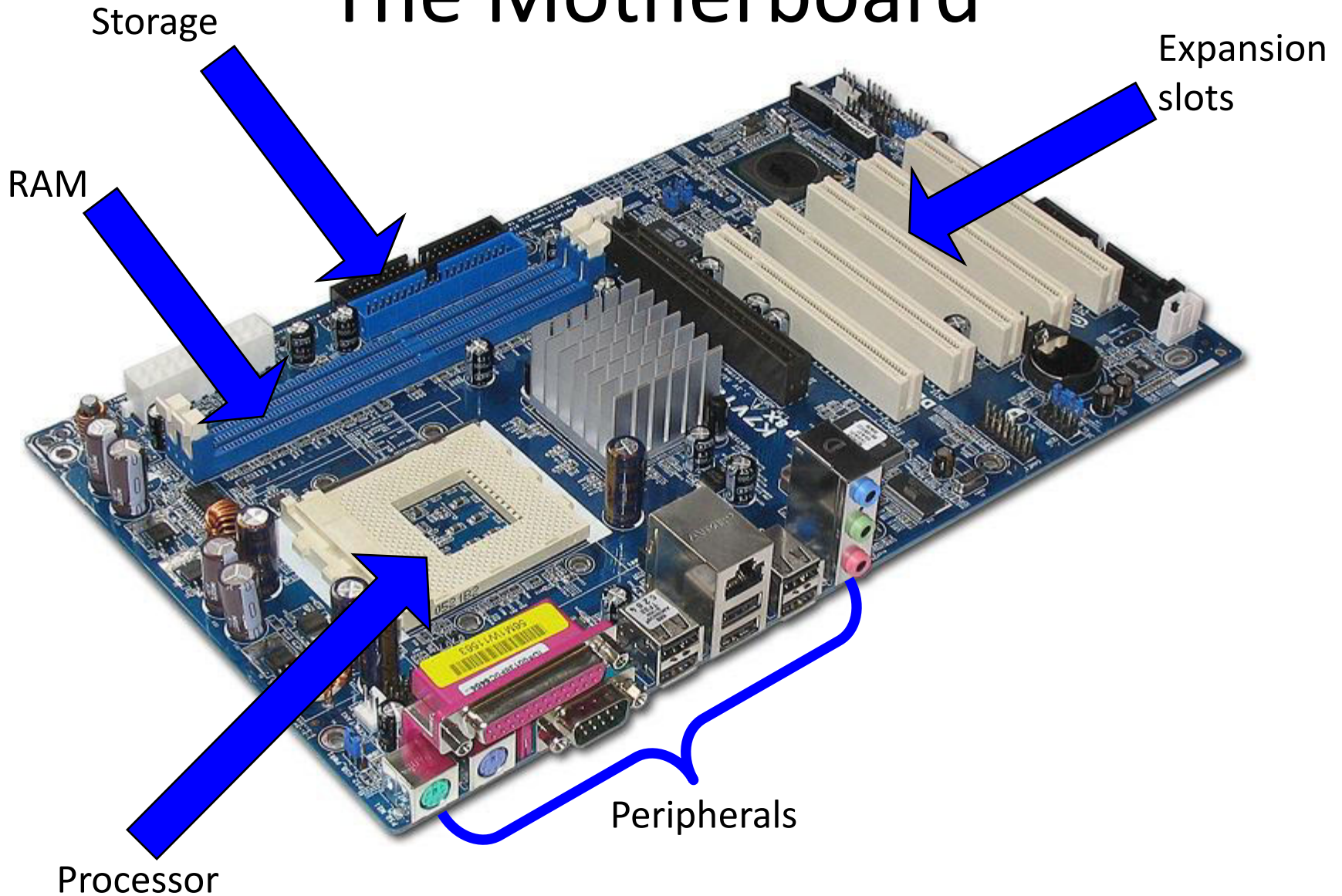
❖ The System Unit houses the central processing unit, memory modules, expansion slots, and electronic circuitry as well as expansion cards that are all attached to the motherboard; along with disk drives, a fan or fans to keep it cool, and the power supply.

❖ All other devices (monitor, keyboard, mouse, etc.), are linked either directly or indirectly into the system unit.



Sources: **Tom's Hardware site:** <http://www.tomshardware.com>

# The Motherboard



# Essential Computer Hardware

- Processing devices
  - Brains of the computer
  - Carries out instructions from the program
  - Manipulate the data
  - Most computers have several processors
  - Central Processing Unit (CPU)
  - Secondary processors
  - Processors made of silicon and copper

# Essential Computer Hardware

- Memory devices
  - Stores data or programs
  - Random Access Memory (RAM)
    - Volatile
    - Stores current data and programs
    - More RAM results in a faster system
  - Read Only Memory (ROM)
    - Permanent storage of programs
    - Holds the computer boot directions

# Essential Computer Hardware

- Input and output devices
  - Allows the user to interact
  - Input devices accept data
    - Keyboard, mouse
  - Output devices deliver data
    - Monitor, printer, speaker
  - Some devices are input and output
    - Touch screens

# Input Devices

Any peripheral used to provide data and input signals to the computer

Keyboard



Mouse



Joystick



Digital tablet



Mic. & Earphone



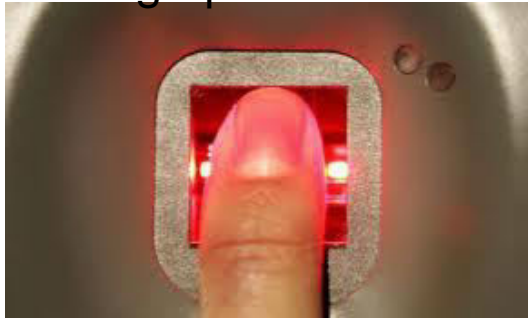
WebCamera





# Input Devices

Fingerprint scanner



Joystick



Wearable input gloves



Digital Camera



3-D scanner



Scanner



Racing Wheel



Barcode Scanner



Tablet

# Output Devices

A Place to present processed data

Monitor



Projector

Speakers



Plotter



Laser Printer



# Storage Vs. Memory

## Memory (e.g., RAM)

- The information stored is needed now
- Keep the information for a shorter period of time (usually volatile)
- Faster
- More expensive
- Low storage capacity (~1/4 of a DVD for 1 GB)



## Storage (e.g., Hard disk)

- The information stored is not needed immediately
- The information is retained longer (non-volatile)
- Slower
- Cheaper
- Higher storage capacity (~50 DVD's for 200 GB)



# Essential Computer Hardware

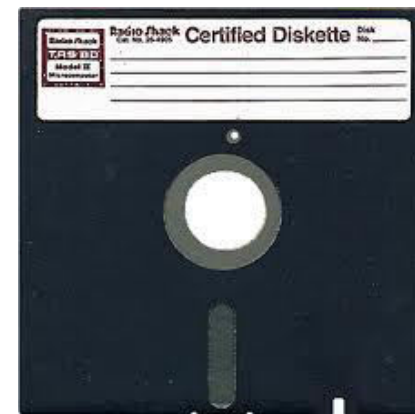
- Storage devices
  - Hold data and programs permanently
  - Different from RAM
  - Magnetic storage
    - Floppy and hard drive
    - Uses a magnet to access data
  - Optical storage
    - CD and DVD drives
    - Uses a laser to access data

# Storage Devices

Tape drives



5 1/2" Floppy drive



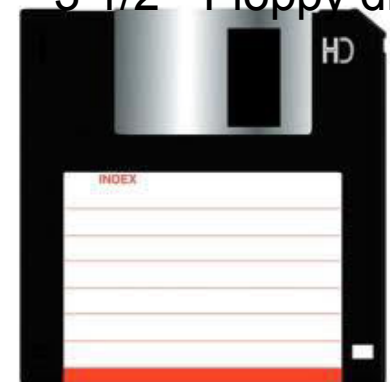
Flash memory card



USB flash drive



3 1/2 " Floppy drive



# Storage Devices

Zip drives



CD/DVD/Bluera  
y



Hard disk



Magento Optic

# Software Runs the Machine

- Tells the computer what to do
- Reason people purchase computers
- Two types
  - System software
  - Application software

# Software Runs the Machine

- System software
  - Most important software
  - Operating system
    - Windows XP
  - Network operating system (OS)
    - Windows Server 2003
  - Utility
    - Symantec AntiVirus

# Software Runs the Machine

- Application software
  - Accomplishes a specific task
  - Most common type of software
    - MS Word
  - Covers most common uses of computers

# Computer Data

- Fact with no meaning on its own
- Stored using the binary number system
- Data can be organized into files



# Computer Users

- Role depends on ability
  - Setup the system
  - Install software
  - Manage files
  - Maintain the system
- “Userless” computers
  - Run with no user input
  - Automated systems

# Inputting Data In Other Ways

# Devices for the Hand

- Pen based input
  - Tablet PCs, PDA
  - Pen used to write data
  - Pen used as a pointer
  - Handwriting recognition
  - On screen keyboard



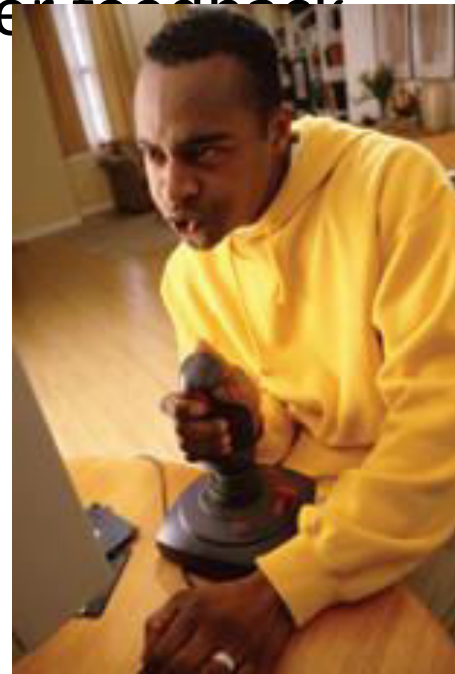
# Devices for the hand

- Touch screens
  - Sensors determine where finger points
  - Sensors create an X,Y coordinate
  - Usually presents a menu to users
  - Found in cramped or dirty environments



# Devices for the hand

- Game controllers
  - Enhances gaming experience
  - Provide custom input to the game
  - Modern controllers offer feedback
  - Joystick
  - Game pad



# Optical Input Devices

- Allows the computer to see input
- Bar code readers
  - Converts bar codes to numbers
    - UPC code
  - Computer find number in a database
  - Works by reflecting light
    - Amount of reflected light indicates number

# Optical Input Devices

- Image scanners
  - Converts printed media into electronic
  - Reflects light off of the image
  - Sensors read the intensity
  - Filters determine color depths

# Optical input devices

- Optical character recognition (OCR)
  - Converts scanned text into editable text
  - Each letter is scanned
  - Letters are compared to known letters
  - Best match is entered into document
  - Rarely 100% accurate



# Audiovisual Input Devices

- Microphones
  - Used to record speech
  - Speech recognition
    - “Understands” human speech
    - Allows dictation or control of computer
    - Matches spoken sound to known phonemes
    - Enters best match into document

# Audiovisual Input Devices

- Musical Instrument Digital Interface
  - MIDI
  - Connects musical instruments to computer
  - Digital recording or playback of music
  - Musicians can produce professional results



# Audiovisual Input Devices

- Digital cameras
  - Captures images electronically
  - No film is needed
  - Image is stored as a JPG file
  - Memory cards store the images
  - Used in a variety of professions



# Transforming Data Into Information

# How Computers Represent Data

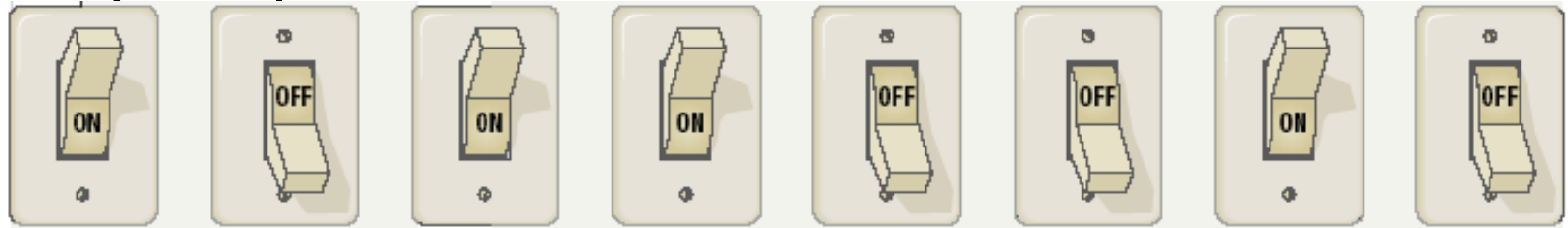
- Number systems
  - A manner of counting
  - Several different number systems exist
- Decimal number system
  - Used by humans to count
  - Contains ten distinct digits
  - Digits combine to make larger numbers

# How Computers Represent Data

- Binary number system
  - Used by computers to count
  - Two distinct digits, 0 and 1
  - 0 and 1 combine to make numbers

# How Computers Represent Data

- Bits and bytes
  - Binary numbers are made of bits
  - Bit represents a switch
  - A byte is 8 bits
  - Byte represents one character



# How Computers Represent Data

- Text codes
  - Converts letters into binary
  - Standard codes necessary for data transfer
  - ASCII
    - American English symbols
  - Extended ASCII
    - Graphics and other symbols
  - Unicode
    - All languages on the planet



# How Computers Process Data

- The CPU
  - Central Processing Unit
  - Brain of the computer
  - Control unit
    - Controls resources in computer
    - Instruction set
  - Arithmetic logic unit
    - Simple math operations
    - Registers

# How Computers Process Data

- Machine cycles
  - Steps by CPU to process data
  - Instruction cycle
    - CPU gets the instruction
  - Execution cycle
    - CPU performs the instruction
  - Billions of cycles per second
  - Pipelining processes more data
  - Multitasking allows multiple instructions

# How Computers Process Data

- Memory
  - Stores open programs and data
  - Small chips on the motherboard
  - More memory makes a computer faster



# How Computers Process Data

- Nonvolatile memory
  - Holds data when power is off
  - Read Only Memory (ROM)
  - Basic Input Output System (BIOS)
  - Power On Self Test (POST)

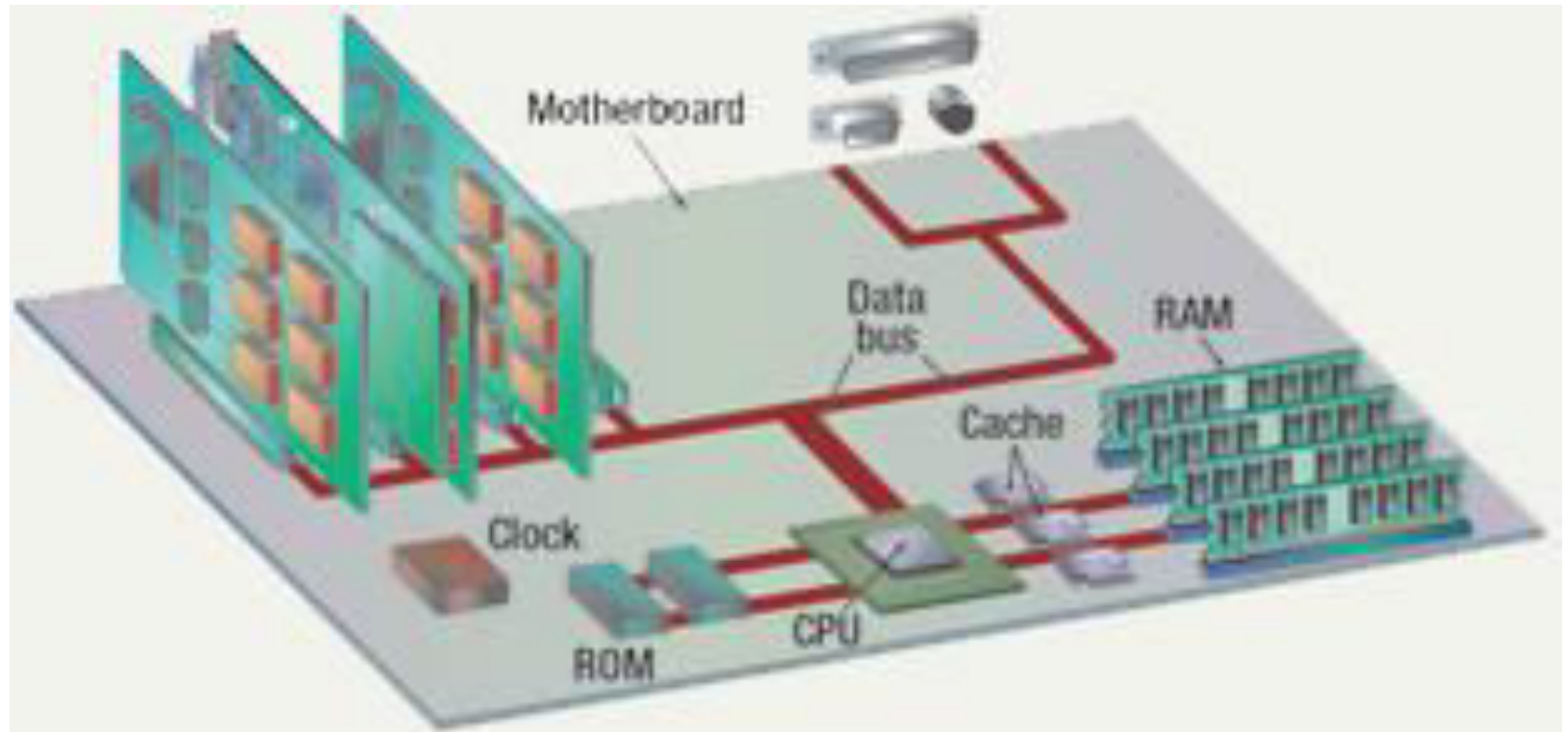
# How Computers Process Data

- Flash memory
  - Data is stored using physical switches
  - Special form of nonvolatile memory
  - Camera cards, USB key chains

# How Computers Process Data

- Volatile memory
  - Requires power to hold data
  - Random Access Memory (RAM)
  - Data in RAM has an address
  - CPU reads data using the address
  - CPU can read any address

# Components affecting Speed



# Affecting Processing Speed

- Registers
  - Number of bits processor can handle
  - Word size
  - Larger indicates more powerful computer
  - Increase by purchasing new CPU



# Affecting Processing Speed

- Virtual RAM
  - Computer is out of actual RAM
  - File that emulates RAM
  - Computer swaps data to virtual RAM
    - Least recently used data is moved

# Affecting Processing Speed

- The computer's internal clock
  - Quartz crystal
  - Every tick causes a cycle
  - Speeds measured in Hertz (Hz)
    - Modern machines use Giga Hertz (GHz)

# Affecting Processing Speed

- The bus
  - Electronic pathway between components
  - Expansion bus connects to peripherals
  - System bus connects CPU and RAM
  - Bus width is measured in bits
  - Speed is tied to the clock

# Affecting Processing Speed

- External bus standards
  - Industry Standard Architecture (ISA)
  - Local bus
  - Peripheral control interface
  - Accelerated graphics port
  - Universal serial bus
  - IEEE 1394 (FireWire)
  - PC Card

# Affecting Processing Speed

- Peripheral control interface (PCI)
  - Connects modems and sound cards
  - Found in most modern computers

# Affecting Processing Speed

- Accelerated Graphics Port (AGP)
  - Connects video card to motherboard
  - Extremely fast bus
  - Found in all modern computers

# Affecting Processing Speed

- Universal Serial Bus (USB)
  - Connects external devices
  - Hot swappable
  - Allows up to 127 devices
  - Cameras, printers, and scanners

# Affecting Processing Speed

- PC Card
  - Used on laptops
  - Hot swappable
  - Devices are the size of a credit card





# Affecting Processing Speed

- Cache memory
  - Very fast memory
  - Holds common or recently used data
  - Speeds up computer processing
  - Most computers have several caches
  - L1 holds recently used data
  - L2 holds upcoming data
  - L3 holds possible upcoming data

# Modern CPUs

# A Look Inside The Processor

- Architecture
  - Determines
    - Location of CPU parts
    - Bit size
    - Number of registers
    - Pipelines
  - Main difference between CPUs

# Microcomputer Processors

- Intel
  - Leading manufacturer of processors
  - Intel 4004 was worlds first microprocessor
  - IBM PC powered by Intel 8086
  - Current processors
    - Centrino
    - Itanium
    - Pentium IV
    - Xeon



# Microcomputer Processors

- Advanced Micro Devices (AMD)
  - Main competitor to Intel
  - Originally produced budget products
  - Current products outperform Intel
  - Current processors
    - Sempron
    - Athlon FX 64
    - Athlon XP



# Microcomputer Processors

- Freescale
  - A subsidiary of Motorola
  - Co-developed the Apple G4 PowerPC
  - Currently focuses on the Linux market

# Microcomputer Processors

- IBM
  - Historically manufactured mainframes
  - Partnered with Apple to develop G5
    - First consumer 64 bit chip

# Comparing Processors

- Speed of processor
- Size of cache
- Number of registers
- Bit size
- Speed of Front side bus



# Advanced Processor Topics

- RISC processors
  - Reduced Instruction Set Computing
  - Smaller instruction sets
  - May process data faster
  - PowerPC and G5

# Advanced Processor Topics

- Parallel Processing
  - Multiple processors in a system
  - Symmetric Multiple Processing
    - Number of processors is a power of 2
  - Massively Parallel Processing
    - Thousands of processors
    - Mainframes and super computers

# Extending The Processors Power

- Standard computer ports
  - Keyboard and mouse ports
  - USB ports
  - Parallel
  - Network
  - Modem
  - Audio
  - Serial
  - Video

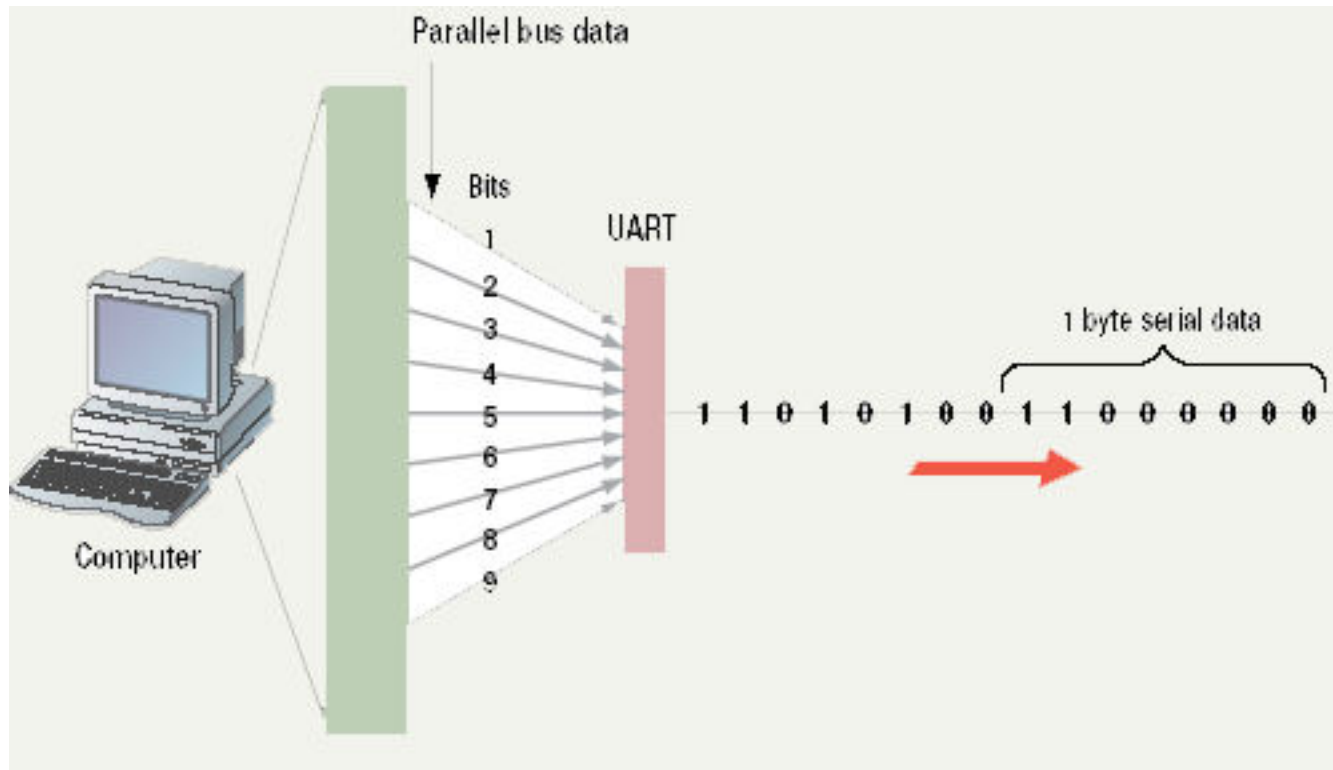
# Standard Computer Ports



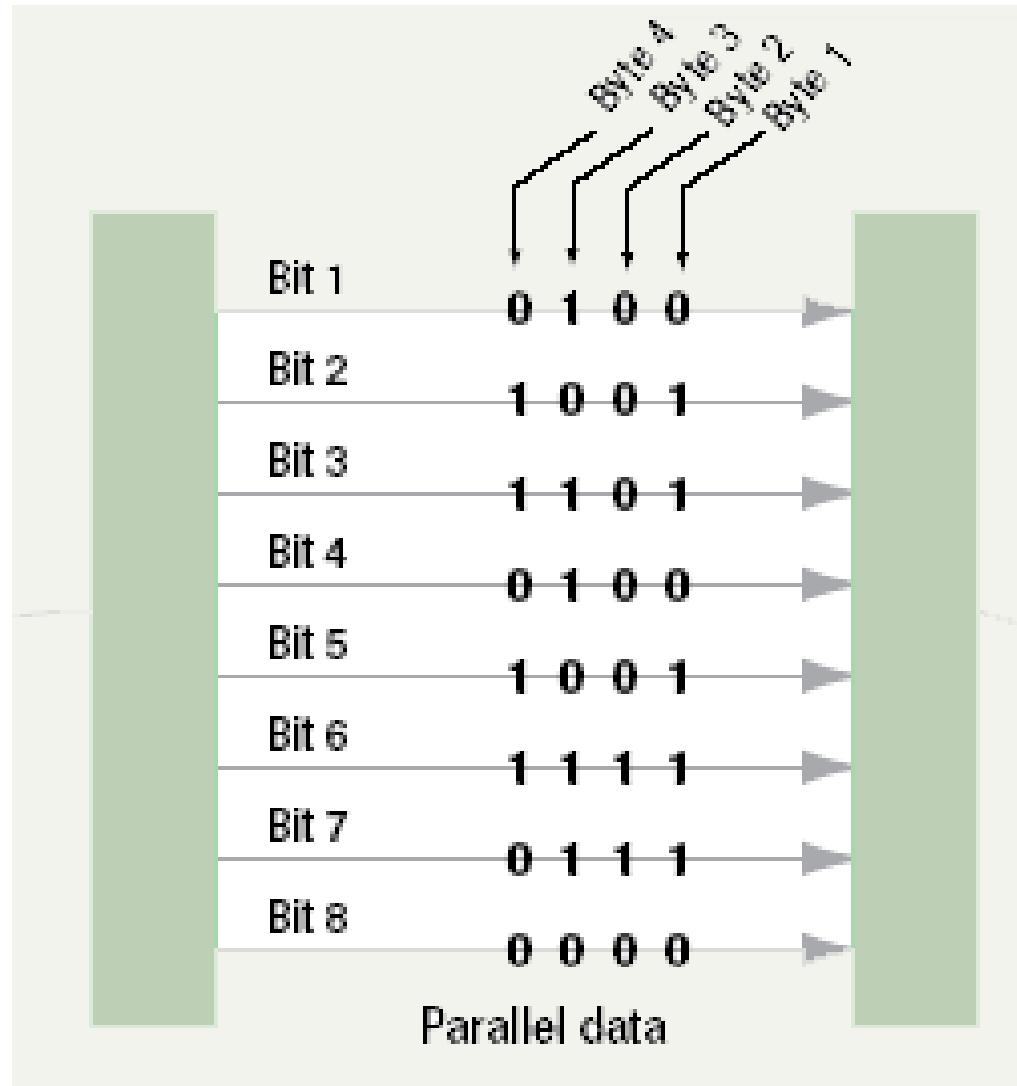
# Extending The Processors Power

- Serial and parallel ports
  - Connect to printers or modems
  - Parallel ports move bits simultaneously
    - Made of 8 – 32 wires
    - Internal busses are parallel
  - Serial ports move one bit
    - Lower data flow than parallel
    - Requires control wires
    - UART converts from serial to parallel

# Serial Communications



# Parallel Communications



# Extending The Processors Power

- SCSI
  - Small Computer System Interface
  - Supports dozens of devices
  - External devices daisy chain
  - Fast hard drives and CD-ROMs



# Extending The Processors Power

- USB
  - Universal Serial Bus
  - Most popular external bus
  - Supports up to 127 devices
  - Hot swappable

# Extending the Processors Power

- FireWire
  - IEEE 1384
  - Cameras and video equipment
  - Hot swappable
  - Port is very expensive

# Extending the Processors Power

- Expansion slots and boards
  - Allows users to configure the machine
  - Slots allow the addition of new devices
  - Devices are stored on cards
  - Computer must be off before inserting



# Extending the Processors Power

- PC Cards
  - Expansion bus for laptops
  - PCMCIA
  - Hot swappable
  - Small card size
  - Three types, I, II and III
  - Type II is most common

# Extending the Processors Power

- Plug and play
  - New hardware detected automatically
  - Prompts to install drivers
  - Non-technical users can install devices

# Operating System Basics

# Operating System

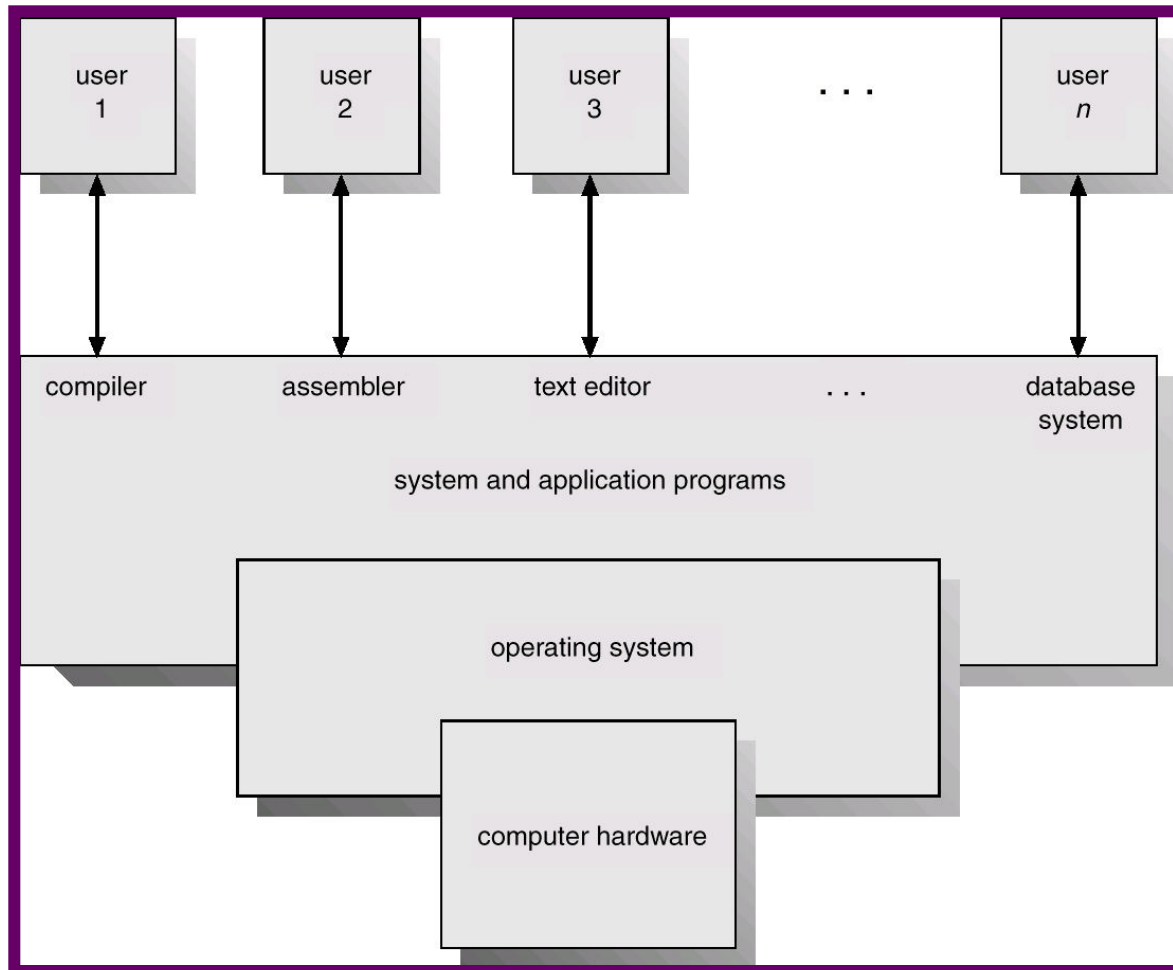
- λ Like the brain the OS manages the computer
- λ A program that manages the computer hardware
- λ Provides services for application software
- λ Acts as an intermediary between a user and the computer hardware
- λ Without OS, no application program will run

# Other Operating System Definitions

- λ Resource allocator – manages and allocates resources.
- λ Control program – controls the execution of user programs and operations of I/O devices  
•
- λ Kernel – the one program running at all times (all else being application programs).



# Abstract View of a Comp. System



Silberschatz

# Operating System ...

- λ Provides the means for proper use of the resources available
- λ Like a government, it performs no useful function by itself. It provides an environment within which other programs can do useful work

# Functions of Operating Systems

- Provide a user interface
- Run programs
- Manage hardware devices
- Organized file storage

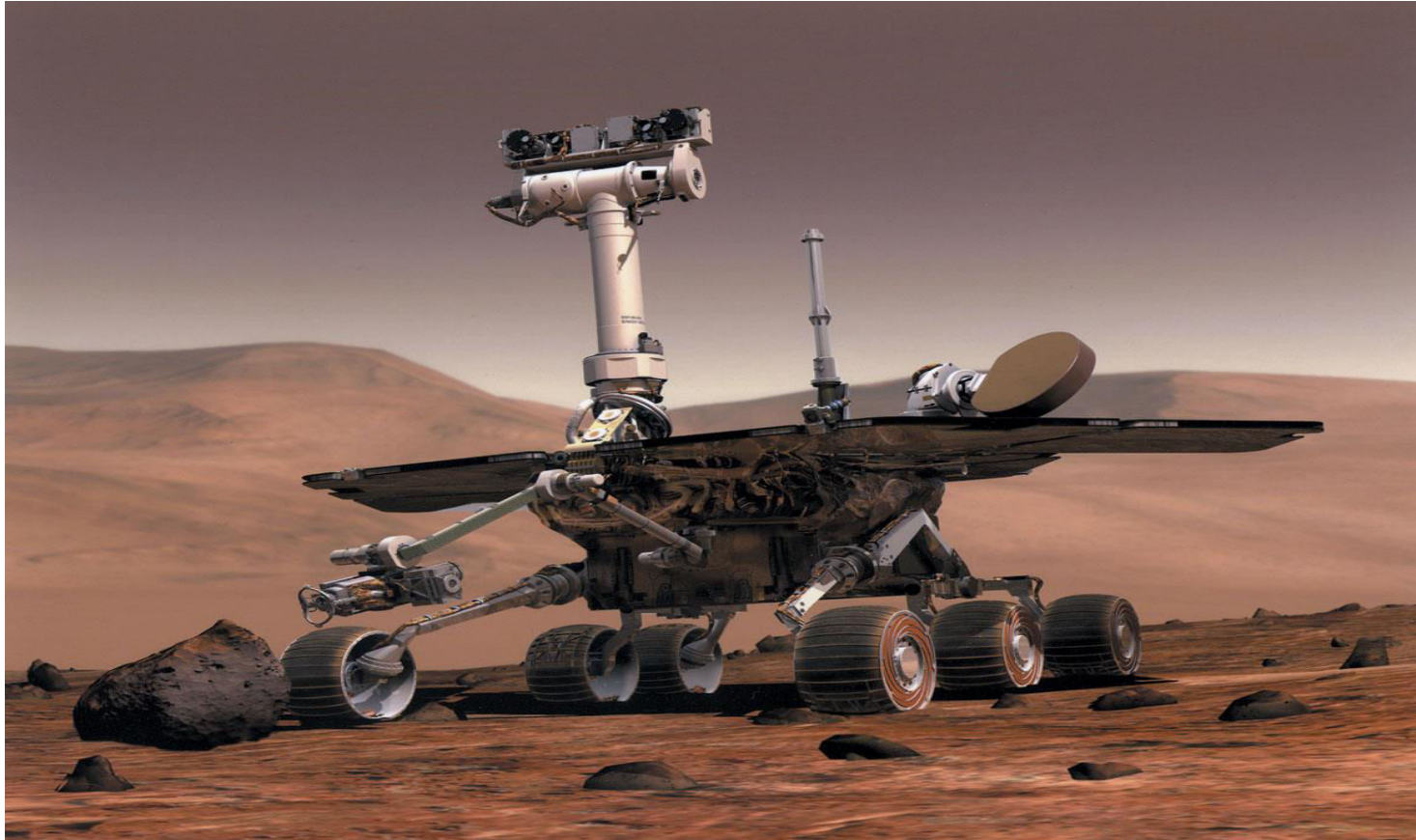
# One OS for all Systems ?

- Different systems exist

# Types of Operating Systems

- Real-time operating system
  - Very fast small OS
  - Built into a device
  - Respond quickly to user input
  - MP3 players, Medical devices

# Real Time Systems



# Types of Operating Systems

- Single user/Single tasking OS
  - One user works on the system
  - Performs one task at a time
  - MS-DOS and Palm OS
  - Take up little space on disk
  - Run on inexpensive computers

# Types of Operating Systems

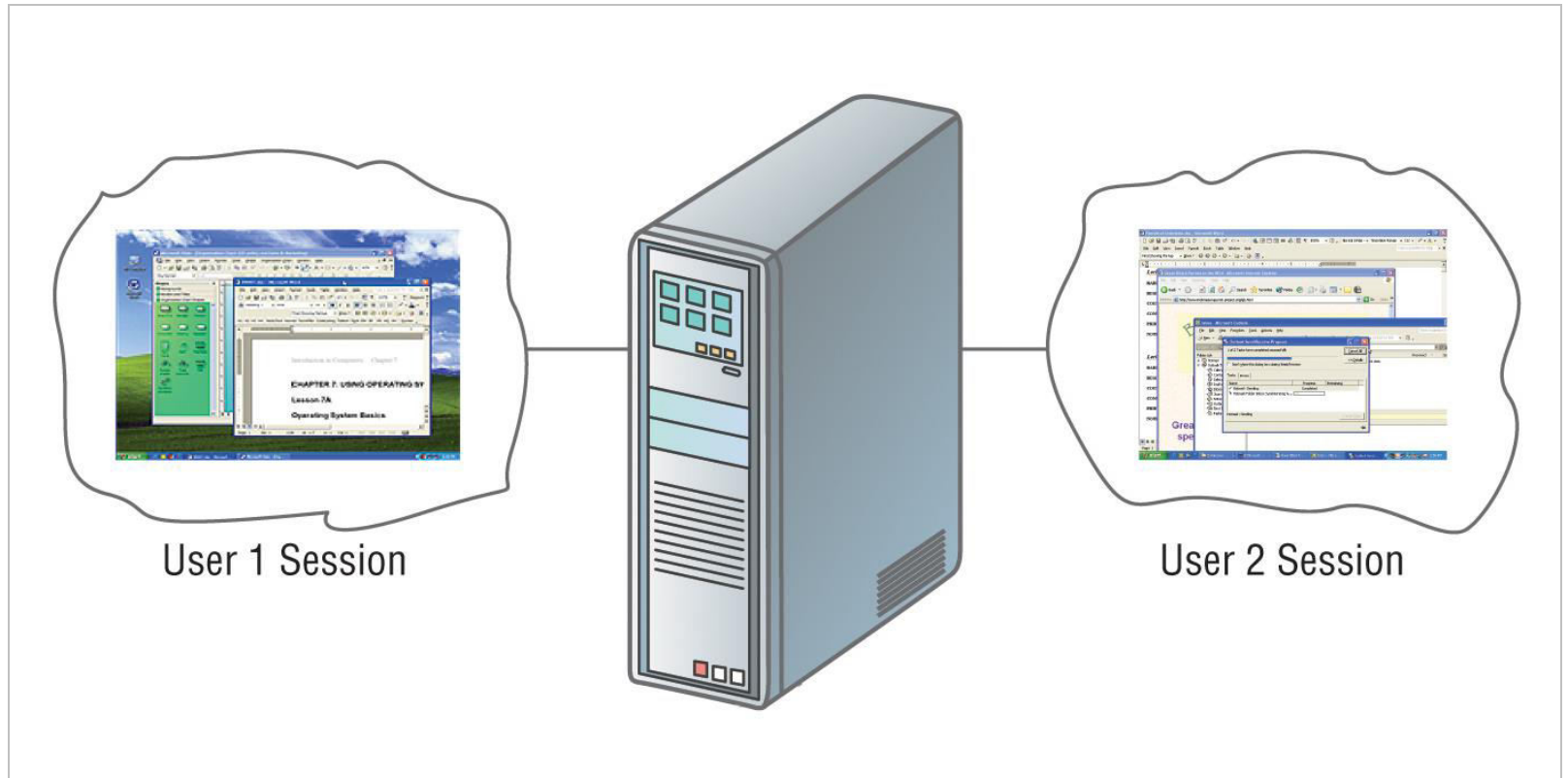
- Single user/Multitasking OS
  - User performs many tasks at once
  - Most common form of OS
  - Windows XP and OS X
  - Require expensive computers
  - Tend to be complex



# Types of Operating Systems

- Multi user/Multitasking OS
  - Many users connect to one computer
  - Each user has a unique session
  - UNIX, Linux, and VMS
  - Maintenance can be easy
  - Requires a powerful computer

# Multi user/Multi tasking OS



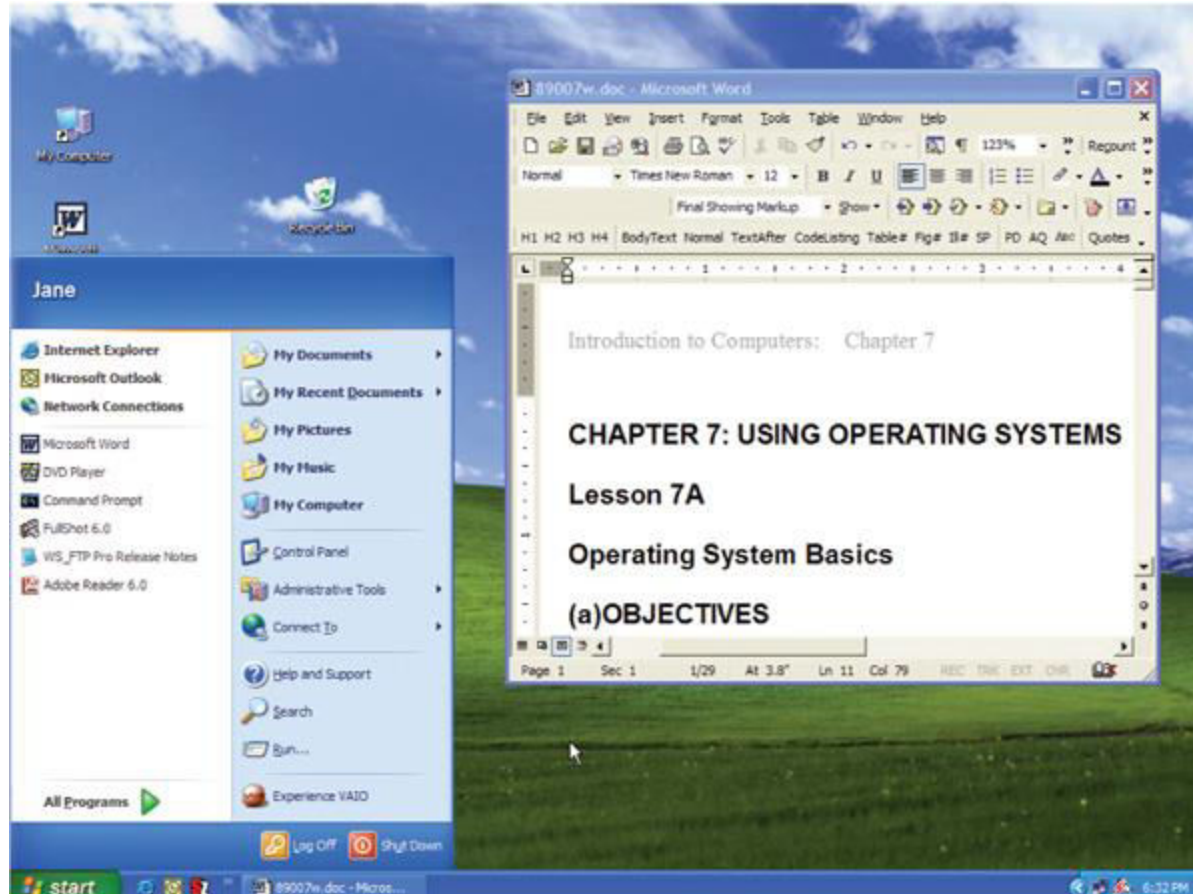
# Providing a User Interface

- User interface
  - How a user interacts with a computer
  - Require different skill sets

# Providing a User Interface

- Graphical user interface (GUI)
  - Most common interface
    - Windows, OS X, Gnome, KDE
  - Uses a mouse to control objects
  - Uses a desktop metaphor
  - Shortcuts open programs or documents
  - Open documents have additional objects
  - Task switching
  - Dialog boxes allow directed input

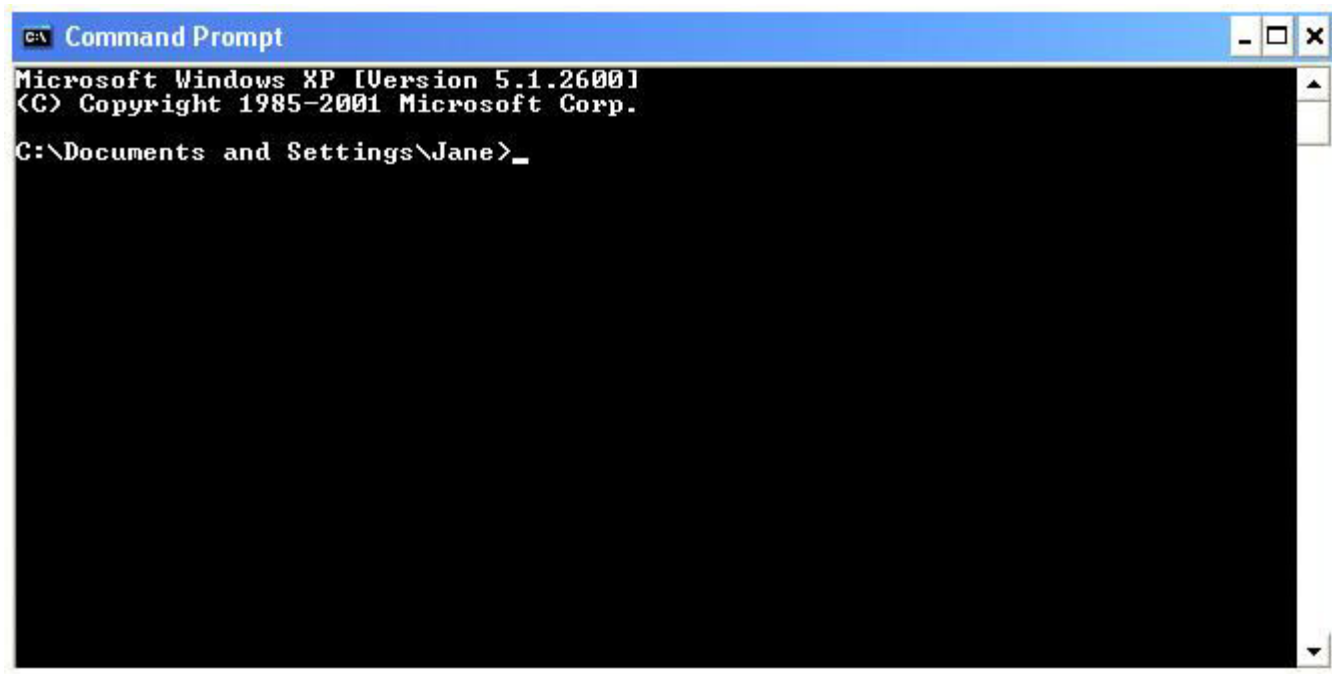
# Graphical User Interface



# Providing a User Interface

- Command line interfaces
  - Older interface
    - DOS, Linux, UNIX
  - User types commands at a prompt
  - User must remember all commands
  - Included in all GUIs

# Command Line Interface

A screenshot of a Windows XP Command Prompt window. The title bar is blue and contains the text "c:\ Command Prompt" and standard window control buttons (minimize, maximize, close). The main area is black with white text. The text displayed is: "Microsoft Windows XP [Version 5.1.2600]  
(C) Copyright 1985-2001 Microsoft Corp.  
C:\Documents and Settings\Jane>\_".

```
c:\ Command Prompt
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.
C:\Documents and Settings\Jane>_
```

# Running Programs

- Many different applications supported
- System call
  - Provides consistent access to OS features
- Share information between programs
  - Copy and paste
  - Object Linking and Embedding



# Managing Hardware

- Programs need to access hardware
- Interrupts
  - CPU is stopped
  - Hardware device is accessed
- Device drivers control the hardware

# Organizing Files and Folders

- Organized storage
- Long file names
- Folders can be created and nested
- All storage devices work consistently

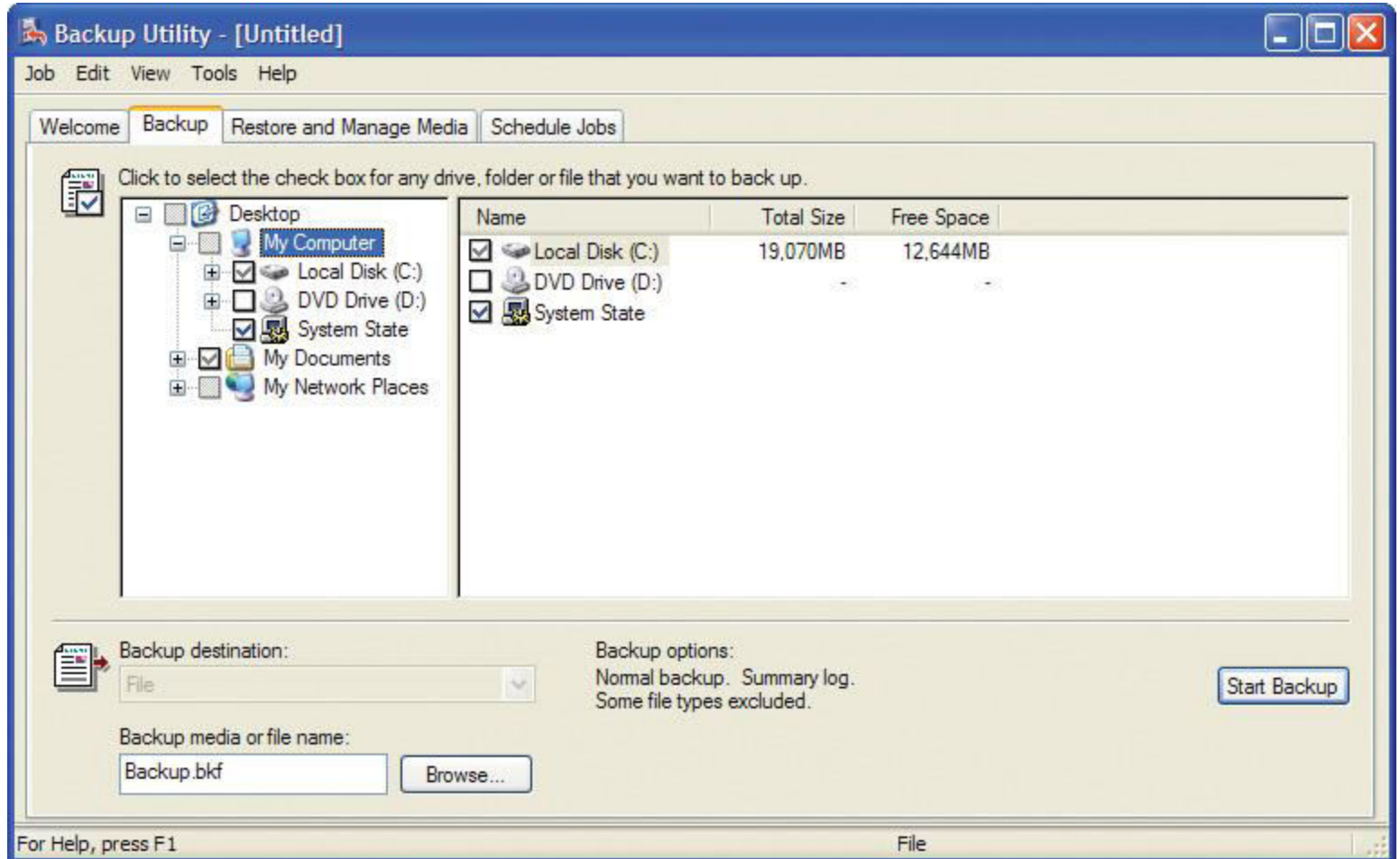
# Enhancing an OS

- Utilities
  - Provide services not included with OS
  - Goes beyond the four functions
  - Firewall, anti-virus and compression
  - Prices vary

# Enhancing an OS

- Backup software
  - Archives files onto removable media
  - Ensures data integrity
  - Most OS include a backup package
  - Many third party packages exist

# Backup Software



# Enhancing an OS

- Anti-virus software
  - Crucial utility
  - Finds, blocks and removes viruses
  - Must be updated regularly
  - McAfee and Norton Anti-Virus

# Enhancing an OS

- Firewall
  - Crucial utility
  - Protects your computer from intruders
  - Makes computer invisible to hackers
  - Zone Labs is a home firewall
  - Cisco sells hardware firewalls

# Enhancing an OS

- Intrusion detection
  - Often part of a firewall package
  - Announces attempts to breach security
  - Snort is a Linux based package



# Enhancing an OS

- Screen savers
  - Crucial utility for command line systems
    - Prevents burn in
  - Merely fun for GUI systems
  - Screen saver decorates idle screens



# Project

- Login to Unix or Linux workstation and run latex.
- `script t`
- `whoami`
- `man passwd`
- `passwd`
- `w`
- `finger fuh`
- `finger @linux3`
- `vi chapter1.tex`
- `textwidth` → 7.2 in
- `textheight` → 9.75 in
- `LARGE` → `normalsize`
- `Huge` → `normalsize`
- `latex chapter5.tex`
- `dvips -f chapter5 >! t.ps`
- `ghostview t.ps`
- `lpr t.ps`
- `df`
- `du`
- `ls`
- `date`
- `ps`
- `exit`
- `more t`

# Survey of PC and Network Operating Systems

# PC Operating Systems

- Microsoft Windows is the most popular
  - Installed more than other OS combined
  - Installed on about 95% of computers
  - Apple and Linux represent the other 5%

# PC Operating Systems

- DOS
  - Disk Operating System
  - Single user single-tasking OS
  - Command line interface
  - 16-bit OS
  - Powerful
  - Fast
  - Supports legacy applications

# DOS Application

Employee Maintenance		Change View	Load new Location	Options	Help	Quit		
View Screen		Funburgers						
Employee Name		Mon	Tue	Wed	Thr	Fri	Sat	Sun
Cashier		Off	11:00a	11:00a	11:00a	11:00a	Off	Off
Jeff	Howister	Off	07:00p	07:00p	07:00p	07:00p	Off	Off
Beer Server		Off	Off	09:30a	Off	09:30a	Off	Off
Jody	Loveless	Off	Off	09:30p	Off	09:30p	Off	Off
Grill Attendant		10:00a	10:00a	Off	10:00a	10:00a	Off	Off
Eva	Perone	09:00p	09:00p	Off	09:00p	09:00p	Off	Off
Runner		09:00a	09:00a	09:00a	09:00a	Off	Off	09:00a
Todd	Jones	10:00p	10:00p	10:00p	10:00p	Off	Off	10:00p
Sweeper		Off	09:00a	09:00a	09:00a	09:00a	Off	Off
Andy	Kaufmann	Off	10:00p	10:00p	10:00p	10:00p	Off	Off
Cashier		11:00a	Off	Off	Off	Off	Off	11:00a
Mandy	Williams	07:00p	Off	Off	Off	Off	Off	07:00p
Beer Server		09:30a	09:30a	Off	Off	Off	Off	Off
Gloria	A Reimann	09:30p	09:30p	Off	Off	Off	Off	Off
Beer Server		Off	Off	Off	09:30a	Off	Off	Off
Mandy	Williams	Off	Off	Off	09:30p	Off	Off	Off

Enter new employees or Edit/Delete employees. Alt-F1 for Help Index

# PC Operating Systems

- Windows NT
  - Designed for a powerful system
  - 32-bit OS
  - Very stable
  - Windows NT Workstation
    - Single user multi tasking OS
  - Windows NT Server
    - Multi user multi tasking OS
    - Network operating system

# PC Operating Systems

- Windows 9x
  - 95, 98, and Millennium Edition (Me)
  - 32-bit OS
    - Supported 16-bit programs well
  - Very pretty not stable OS
  - Still found in large corporations
  - 95 introduced the Start button
  - 98 introduced active desktop
  - Me improved multimedia software



# PC Operating Systems

- Windows 2000
  - Look of 9x with NT stability
  - Optimized for office and developers
  - Application software ran very well
  - Entertainment software ran very poorly

# PC Operating Systems

- Windows XP
  - Microsoft's newest desktop product
  - Different look from 2000
  - Many different versions
  - Digital multimedia support was enhanced
  - Communications was enhanced
  - Mobile computing became a priority

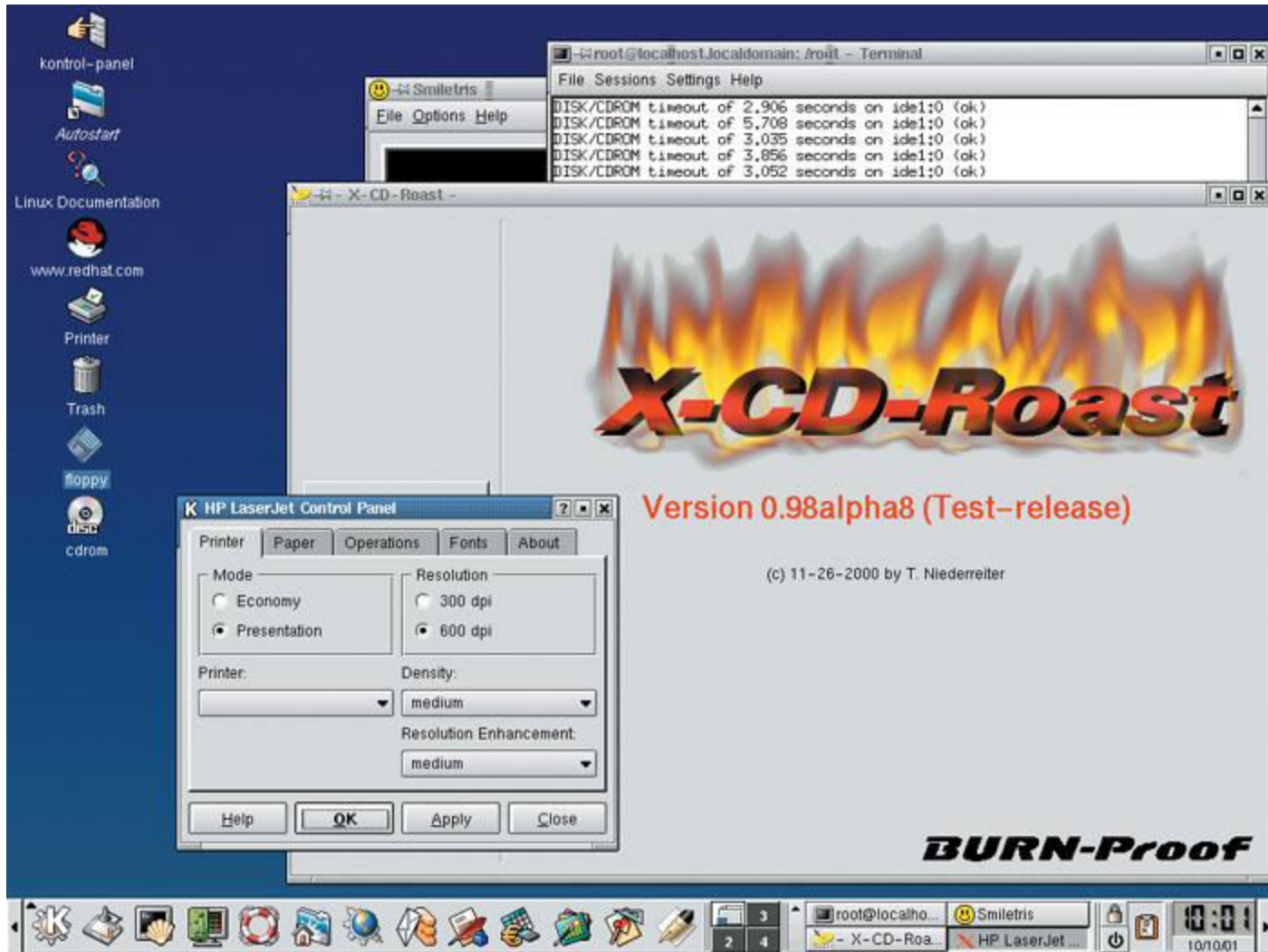
# PC Operating Systems

- UNIX
  - Runs on all computer types
  - 32- or 64-bit
  - Very stable and fast
  - Command-line interface
  - Can cost thousands of dollars

# PC Operating Systems

- Linux
  - Free or inexpensive version of UNIX
  - 32-bit OS
  - Very stable and fast
  - Most flavors are open source
  - X Windows GUI
    - Command line interface is available

# Linux Desktop



# PC Operating Systems

- Macintosh operating systems
  - OS X
  - Based on FreeBSD Linux
  - Very stable and easy to configure
  - Only runs on Mac hardware

# OS X Desktop



# NOS Features

- Network operating system
- Fast and stable
- Runs on servers
- Multi-user and multitasking OS
- 32- or 64-bit



# NOS Features

- File and print sharing
  - Users access the same files
  - Hundreds of users use a printer
  - Different OS can interact

# NOS Features

- Data integrity
  - Backups copies data onto tape
  - RAID copies data onto other drives
    - Redundant Array of Inexpensive Disks
    - Relies on two or more hard drives
    - May speed access to data

# NOS Features

- Data security
  - Access to data can be restricted
  - Access to server resources is controlled
  - Audits can be kept

# Networking Operating Systems

- NT Server
  - Same core as NT Workstation
  - Security added
  - Multi user capability added
  - RAID support included

# Networking Operating Systems

- Windows 2000 Server
  - Same technology as 2000 workstation
  - Active Directory (AD)
    - Central database of server resources
    - Simplifies network management
  - Distributed programs supported
  - Server Standard Edition
  - Advanced Server Edition
  - Data Center Edition

# Networking Operating Systems

- Windows 2003 Server
  - Designed to compete with UNIX
  - XP like interface
  - Better support for XP computers
  - MS .NET framework supported
  - Distributed programs are supported
  - Server Standard Edition
  - Data Center Edition

# Networking Operating Systems

- UNIX for servers
  - Oldest NOS in widespread use
  - Stable secure and fast
  - Main OS for Internet and Web
  - Large organizations depend on UNIX

# Networking Operating Systems

- Linux for servers
  - Popular in small businesses
  - Stable, fast and inexpensive
  - Linux's popularity is growing



# Embedded Operating Systems

- Devices have EOS built in
- Cell phones, PDAs, medical equipment
- Stable and fast

# Embedded Operating Systems

- Windows XP embedded
  - Based on Windows XP
  - Customized for each device

# Embedded Operating Systems

- Windows CE
  - Not based on a desktop OS
  - Customized for each device
  - PDA and cell phones
  - Microsoft Automotive will run in cars

# Embedded Operating Systems

- Palm OS
  - Standard on Palm PDA
  - First PDA OS for consumers
  - Can be found on cell phones



# Embedded Operating Systems

- Pocket PC
  - Developed to compete with Palm
  - Not customizable
  - Interacts securely with business networks
  - Can control PCs through PC

# Embedded Operating Systems

- Symbian
  - Found in smart cell phones
  - Games, Instant Messaging, Internet
  - Full color display

# Programming Languages and the Programming Process

# Programming Languages

- λ Communicate with the computer
- λ Understood by human and machine
- λ Languages
  - Lower level language (closer to machine)
  - Higher level language (closer to humans)



# Programming Languages ...

- λ Machine Languages (1<sup>st</sup> Generation)
- λ Assembly Languages (2<sup>nd</sup> Generation)
- λ Procedural Languages (3<sup>rd</sup> Generation)
- λ Problem Oriented Languages (4<sup>th</sup> Generation)
- λ Natural Languages (5<sup>th</sup> Generation)

# Machine Languages

- λ Machine knows two things, 1 & 0
- λ All instructions in terms of ones and zeros
- λ  $5 \times 4 = 00110101 \ 00101010 \ 00110100$

a=5  
b=10  
c=a\*b

```
01100001 00111101 00110101 00001101 00001010 01100010
00111101 00110001 00110000 00001101 00001010 01100011
00111101 01100001 00101010 01100010
```

# Machine Language

## λ Advantages

- Execution very fast and efficient

## λ Disadvantages

- Not easy to encode programs
- No one standard machine language
- Machine dependent - will not easily run on another machine

# Language Categories

- Second generation languages
  - Assembly languages
  - Statements that represent machine code
  - Code converted by an assembler
  - Still used to optimize video games

```
;CLEAR SCREEN USING BIOS
CLR: MOV AX,0600H      ;SCROLL SCREEN
      MOV BH,30        ;COLOUR
      MOV CX,0000      ;FROM
      MOV DX,184FH     ;TO 24,79
      INT 10H          ;CALL BIOS;
;INPUTTING OF A STRING
KEY:  MOV AH,0AH       ;INPUT REQUEST
      LEA DX,BUFFER    ;POINT TO BUFFER WHERE STRING STORED
      INT 21H          ;CALL DOS
      RET              ;RETURN FROM SUBROUTINE TO MAIN PROGRAM;
; DISPLAY STRING TO SCREEN
SCR:  MOV AH,09        ;DISPLAY REQUEST
      LEA DX,STRING    ;POINT TO STRING
      INT 21H          ;CALL DOS
      RET              ;RETURN FROM THIS SUBROUTINE;
```

# Assembly Language

- λ Reduce program complexity
- λ Symbolic language using mnemonic codes
- λ Codes replacing ones and zeros
- λ Does not replace machine language
- λ Assembly code converted into machine lang.
- λ One line of assembly code converted to one/many lines of machine code

# Assembly Language

## λ Advantages

- More standardized & easier to use
- Operates efficiently (not as efficient as machine language code)
- Easier to debug

## λ Disadvantages

- Very lengthy programs
- Complex
- Machine dependent

```
Start  Move N, R1
      Move N2,
      R2
      CLR R0
Loop   Add (R2), R0
      Inc R2
      Dec R1
      BGTZ
      loop
      Move R0,
```

# High Level Languages

- λ All languages above assembly language
- λ Procedure oriented Languages (3<sup>rd</sup> Gen.)
  - General purpose language
  - Express a logic
  - Solve a variety of problems

e.g. Pascal, BASIC, FORTRAN, COBOL

Advantages	Disadvantages
λ English like statements	Executes more slowly
λ Easy to understand and modify	
λ Machine independent	

# Language Categories

- Third generation languages (3GL)
  - First higher level language
  - Supports structured and OOP
    - Code is reusable
    - Code is portable
  - Typically written in an IDE
  - C/C++ creates games and applications
  - Java creates web applets
  - ActiveX creates Web and Windows applets



# High Level Languages ...

- λ Problem oriented languages (4<sup>th</sup> Gen.)
- λ Solve specific problems or develop specific applications
- λ PC Application software
- λ Query languages & report generators
- λ Application generators

# Language Categories

- Fourth generation languages (4GL)
  - Easier to use than 3GL
  - Coded in a visual IDE
  - Tools reduce the amount of code
  - Object oriented programming
  - Microsoft .Net is a language
  - Dream Weaver is an 4GL IDE

# High Level Languages ...

- λ Natural language (5<sup>th</sup> Gen.)
- λ Make man-machine interface humanlike
- λ Simulate learning process
- λ LISP and PROLOG

# Programming Languages

- Used to generate source code
- Avoids using machine code
- Have strict rules of syntax
  - Symbols and punctuation have meaning
  - Spelling must be exact
- Code is converted into machine language

# Interpreter

- λ Spanish PM talking to Japanese PM
- λ Dumb machine, knows only 1 & 0
- λ Interprets the high level language
- λ Interprets line by line
- λ Converts each line of code just before execution
- λ Executes program line immediately

# Interpreter ...

- λ Converts to intermediate level language machine can understand and executes
- λ No object code is stored
- λ One line executed several times, then converted to machine language each time
- λ Delay
- λ Example BASIC, Perl, MATLAB, Python, etc..

# UN Assembly ...



# Compiler

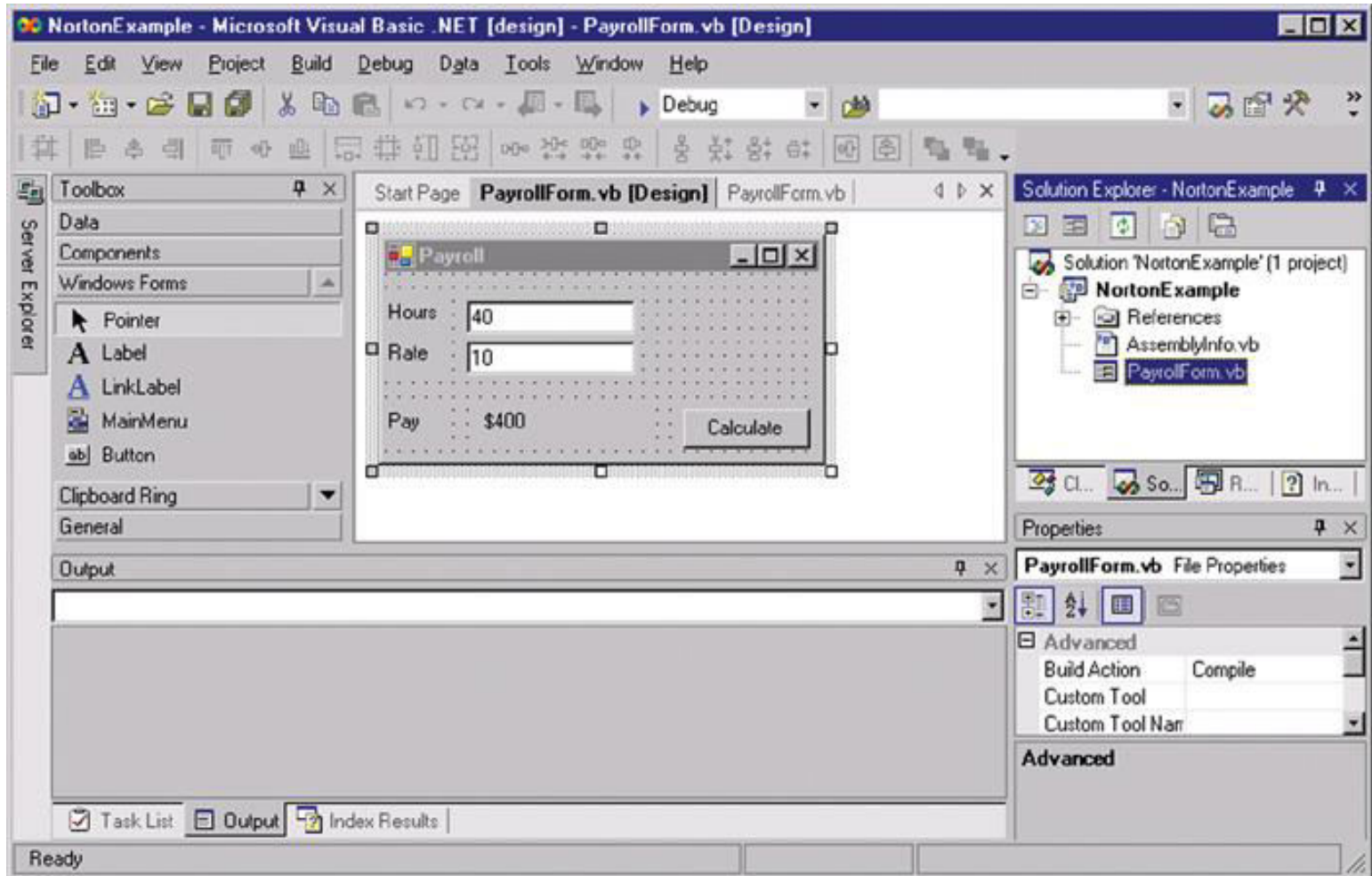
- λ UN General Assembly
- λ Predefined text, pretranslated, audio and printed text available during live address in own language
- λ Compiled text
- λ Compile program in machine language
- λ Compiler program's job



# Compiler ...

- λ Translate source code into object code/machine language
- λ Look at entire source code, collect and reorganise instructions
- λ Fast
- λ Better than interpreted languages
- λ Executed faster and more efficiently once object code is obtained
- λ Many compilers exist for same language
- λ Example C, FORTRAN, COBOL

# Microsoft.NET



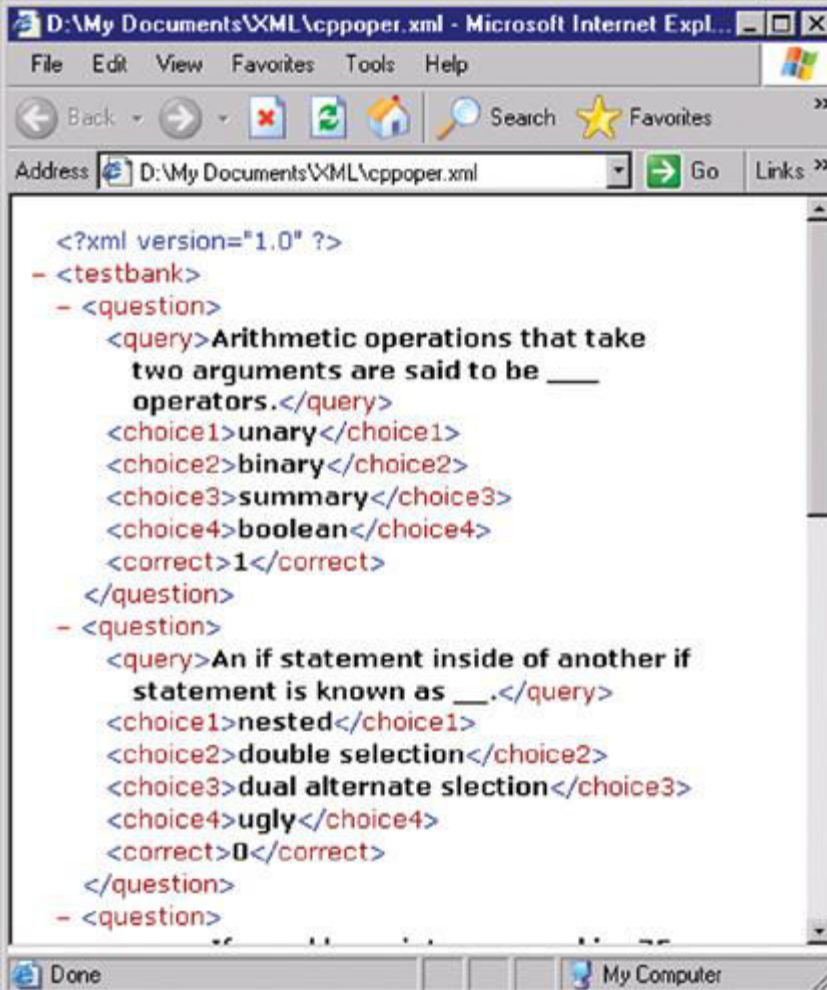
# WWW Development Languages

- Markup languages
  - Describe how the text is formatted
- Hyper Text Markup Language (HTML)
  - Basis of all web pages
  - Defines web structure using tags
  - Easy to learn and use
  - Created with a text editor

# WWW Development Languages

- Extensible Markup Language (XML)
  - Stores data in a readable format
  - Looks like HTML
  - Allows developers to create tags
  - Depends on HTML for formatting

# XML



```
<?xml version="1.0" ?>
- <testbank>
  - <question>
    <query>Arithmetic operations that take
      two arguments are said to be ____
      operators.</query>
    <choice1>unary</choice1>
    <choice2>binary</choice2>
    <choice3>summary</choice3>
    <choice4>boolean</choice4>
    <correct>1</correct>
  </question>
  - <question>
    <query>An if statement inside of another if
      statement is known as __.</query>
    <choice1>nested</choice1>
    <choice2>double selection</choice2>
    <choice3>dual alternate slection</choice3>
    <choice4>ugly</choice4>
    <correct>0</correct>
  </question>
  - <question>
```

# WWW Development Languages

- Extensible HTML (XHTML)
  - Newer version of HTML
  - Stricter rules
  - Based on XML rules

# WWW Development Languages

- Extensible Style Sheet Language (XSL)
  - Format and displays XML documents
  - Rules that dictate formatting
  - Create a standard web page

# WWW Development Languages

- Extensible HTML Mobile Profile
  - XHTML MP
  - Initially Wireless Markup Language (WML)
  - Creates pages viewable on a handheld



# WWW Development Languages

- Cascading Style Sheets (CSS)
  - Format HTML, XHTML and XSL
  - Applies consistent formatting to all pages

# WWW Development Languages

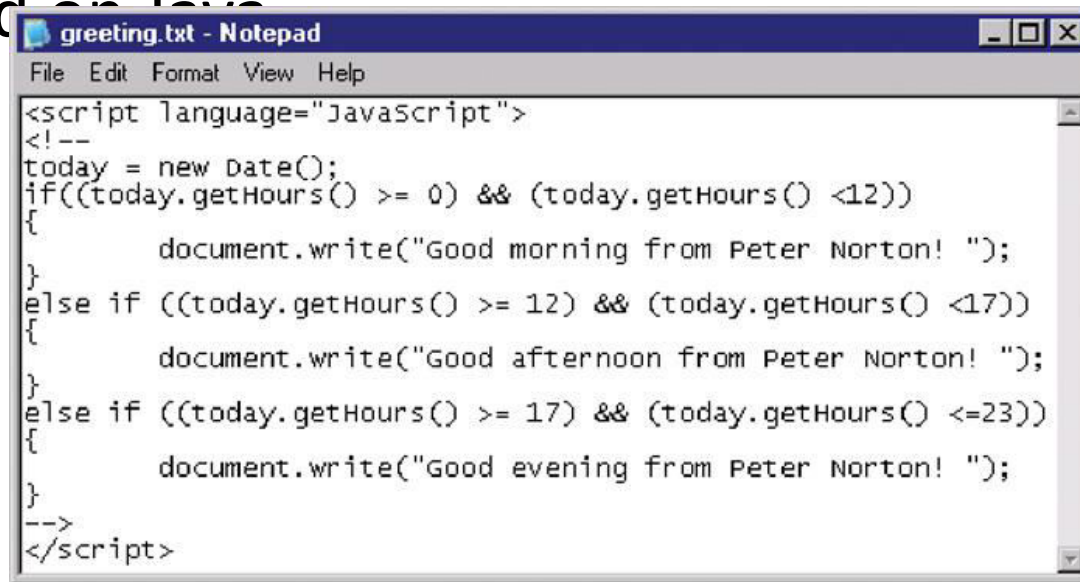
- Web authoring environments
  - Reduces tedium for creating pages
  - Tools that simplify web site creation
  - Macromedia Dream weaver
    - Simplifies large sites
    - CSS support is exceptional
  - Microsoft FrontPage simplifies large sites
  - Macromedia Flash creates web animations

# WWW Development Languages

- Scripting languages
  - Create dynamic web pages
    - Change based on user input
  - HTML can create static pages
  - Page is generated as needed

# WWW Development Languages

- JavaScript
  - Developed by Netscape
  - Works inside of HTML
  - Page verification and simple animation
  - Based on Java

A screenshot of a Notepad window titled "greeting.txt - Notepad". The window has a menu bar with "File", "Edit", "Format", "View", and "Help". The text area contains the following JavaScript code:

```
<script language="JavaScript">
<!--
today = new Date();
if((today.getHours() >= 0) && (today.getHours() <12))
{
    document.write("Good morning from Peter Norton! ");
}
else if ((today.getHours() >= 12) && (today.getHours() <17))
{
    document.write("Good afternoon from Peter Norton! ");
}
else if ((today.getHours() >= 17) && (today.getHours() <=23))
{
    document.write("Good evening from Peter Norton! ");
}
-->
</script>
```

# WWW Development Languages

- Active Server Pages (ASP)
  - Developed by Microsoft
  - Based on Visual Basic
  - Good at connecting to Microsoft databases
  - Runs only on Microsoft servers

# WWW Development Languages

- Perl
  - Old UNIX language
  - Found on all Windows and Linux servers
  - Excellent web scripting language

# WWW Development Languages

- Hypertext Pre-Processor (PHP)
  - Especially good at connecting to MySQL
  - Very popular language
  - Runs on UNIX and Windows