Chapter Four

Software Basics: The Ghost in the Machine

After reading this chapter, you should be able to:

- Describe three fundamental categories of software and their relationship
- Explain the relationship of algorithms to software
- Discuss the factors that make a computer application a useful tool
- Describe the role of the operating system in a modern computer system

After reading this chapter, you should be able to:

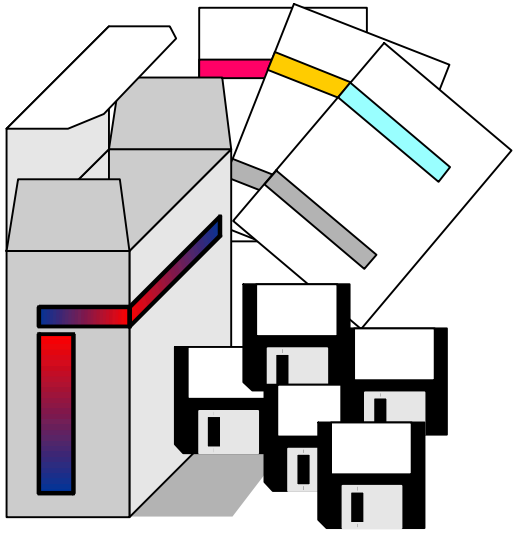
- Outline the evolution of user interfaces from early machine-language programming to futuristic virtual reality interfaces
- Compare character-based user interfaces with graphical user interfaces, and explain the tradeoffs involved in choosing a user interface

Chapter Outline

- Processing with Programs
- Software Applications: Tools for Users
- System Software: The Hardware-Software Connection
- The User Interface: The Human-Machine Connection

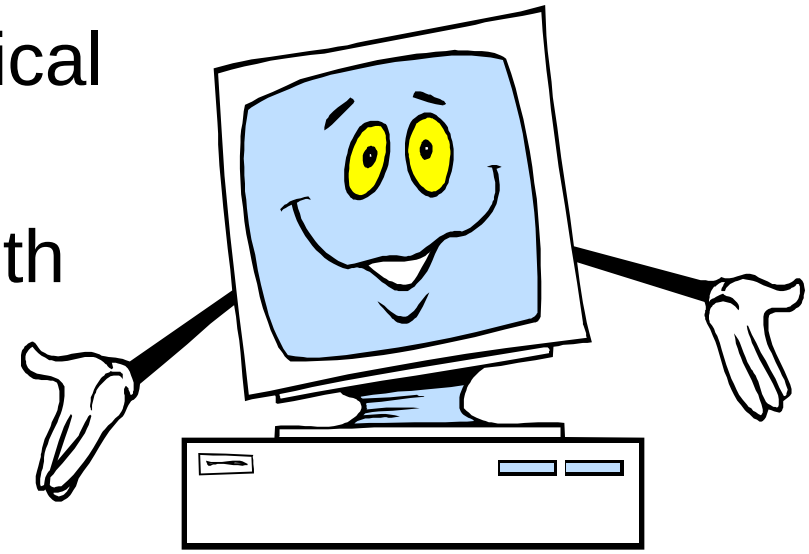
Processing with Programs

- Software programs:
  - Are invisible and complex
  - Must be clear
  - Must be free of errors
  - Are a set of instructions that tell a computer what to do



A Fast, Stupid Machine

- Computers:
  - Have limited capabilities
  - Can only do basic mathematics and logical comparisons
  - Must be instructed with programs what to do



The Language of Computers

- Programmers begin with an algorithm, which is:
  - A set of step-by-step instructions (written in a natural language, e.g., English)
- Algorithms are ambiguous, error-prone generalities
- Algorithms are translated into the vocabulary of a programming language

Programming Languages

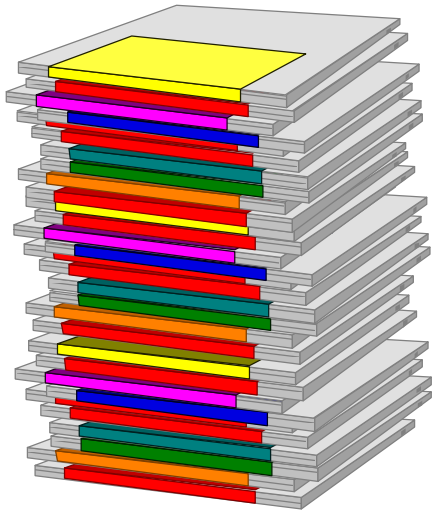
- Programming languages bridge the gap between the natural language of the human and the numeric codes (zeros and ones) understood by the computer
- Examples include:
  - COBOL, BASIC, and C++

Software Applications: Tools for Users

- Software applications include:
  - Consumer software
  - Integrated software
  - Vertical-market and custom software

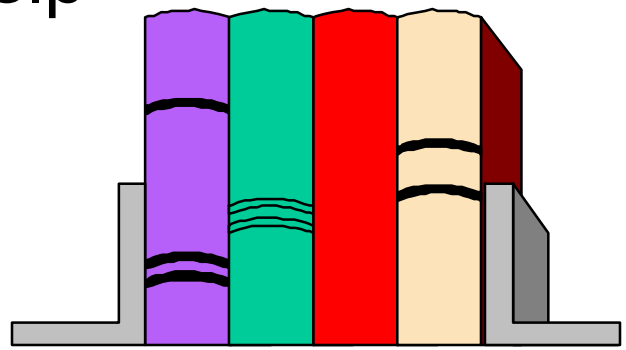
Consumer Applications

- There are thousands of different consumer software titles
- Consumer software differs based on:
  - Documentation
  - Upgradability
  - Compatibility
  - Warranty
  - Extent of ownership/license



Documentation

- Documentation includes:
  - Printed tutorial and reference manuals that explain how to use the software
  - On-line manuals and help screens which offer immediate help to the user

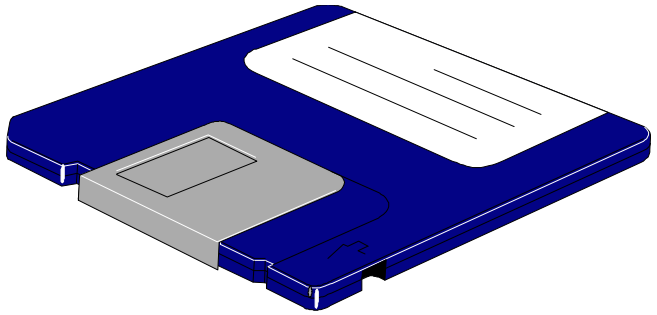


Upgrades

- Rather than buy the latest version and discard your old one, often you can pay a fee to the software maker and upgrade the old version to the new one
- Newer versions of a software company's product usually have additional features and fewer bugs

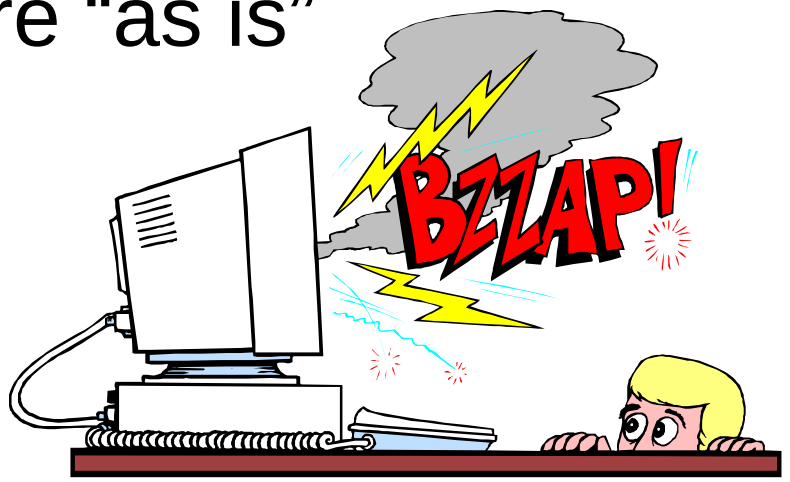
Compatibility

- Compatibility means the software will function properly with the hardware, operating system, and any peripherals
- To date, there is no industry standard that software must follow



Warranty

- Buyer beware!
- Software manufacturers limit their liability for software problems by selling their software “as is”
- Error-free software does not exist

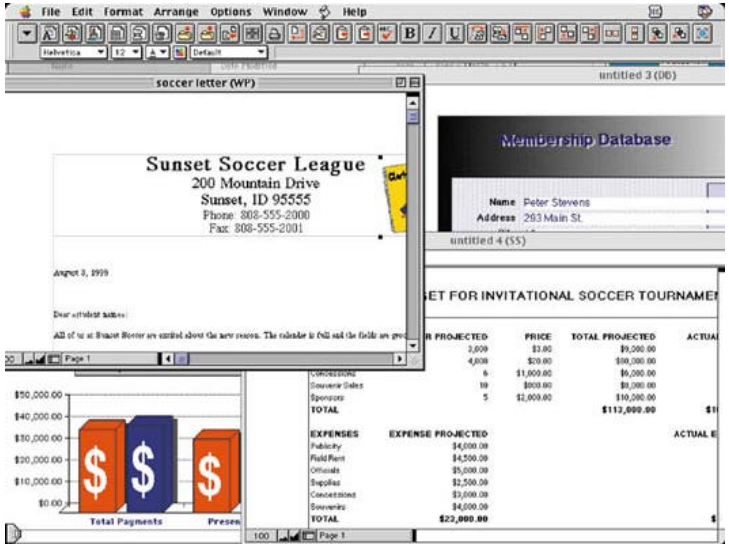


Ownership/Licensing

- Three categories:
  - Purchased software grants you a license to use the software as the software company tells you
  - Shareware software is free for the trying, but a nominal fee is to be paid to the programmer if you continue to use it
  - Public domain software is legally free and cannot be owned or licensed

Integrated Applications and Suites: Multipurpose Software

- Multipurpose software that includes most of these modules:
  - Word processing
  - Database
  - Spreadsheet
  - Graphics
  - Telecommunications



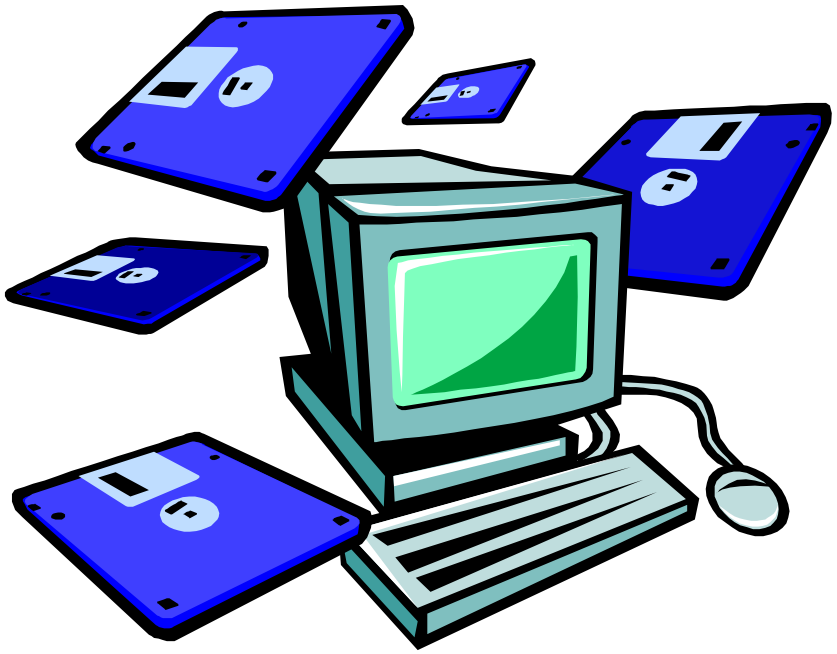
Integrated Software: Advantages

- Costs less than buying the applications individually
- Data is easily transferred between modules
- Commands used in each module are usually the same
- Usually there is a seamless integration of the modules

Vertical-Market and Custom Software

- Job-specific software:
  - Medical billings
  - Library cataloging
  - Restaurant management
  - Single-client software needs

System Software: The Hardware-Software Connection



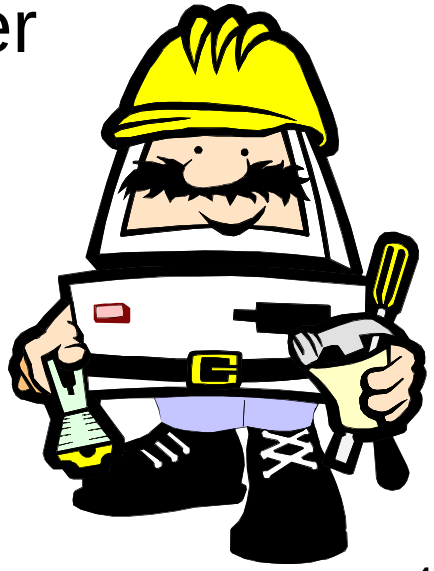
- Operating Systems
- Utility Programs

What the Operating System Does

- The operating system controls:
  - Communication with peripherals
  - Coordination of concurrent processing
  - Memory management
  - Monitoring of resources and security
  - Management of programs and data
  - Coordinating network communications

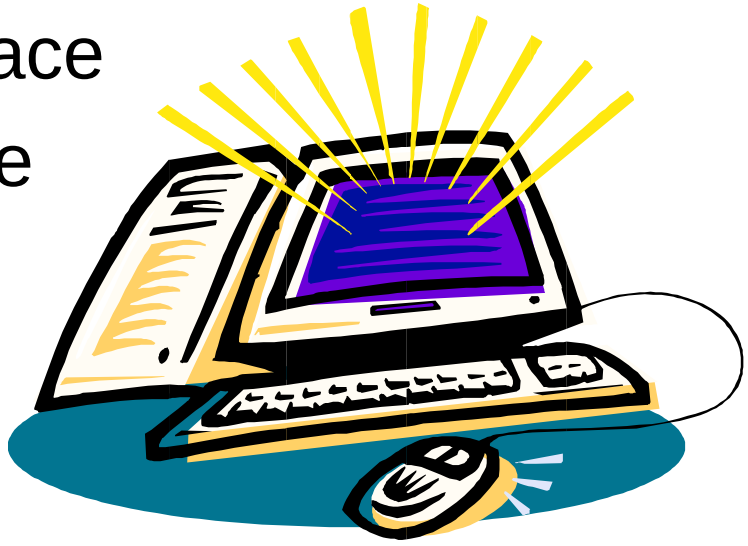
Utility Programs

- Utility software controls tasks such as:
  - repairing damaged files
  - making it easy for users to copy files from one storage device to another
  - translating files so different software can read them
  - guarding against viruses



The User Interface: The Human-Machine Connection

- The user interface is what the user sees on the screen and interacts with
- Two major user interface types:
  - Character-based interface
  - Graphical user interface



A Character-Based User Interface: MS-DOS

- This is a disk operating system in which the user interacts with characters
  - letters
  - numbers
  - symbols

```
C:\>dir /w

 Volume in drive C is WIN95
 Volume Serial Number is 6207-9FC6
 Directory of C:\

COMMAND.COM      [CIRRUS]         WIN386.SWP
[PROGRAMF]       [TEMP]           [WINDOWS]
[CDD]            [WP61]           WINZIP.LOG
[PERSONAL]       [PROJECT]        [WPDOCS]
          5 file(s)          93,640 bytes
         13 dir(s)      32,391,168 bytes free
```

A Character-Based User Interface: MS-DOS

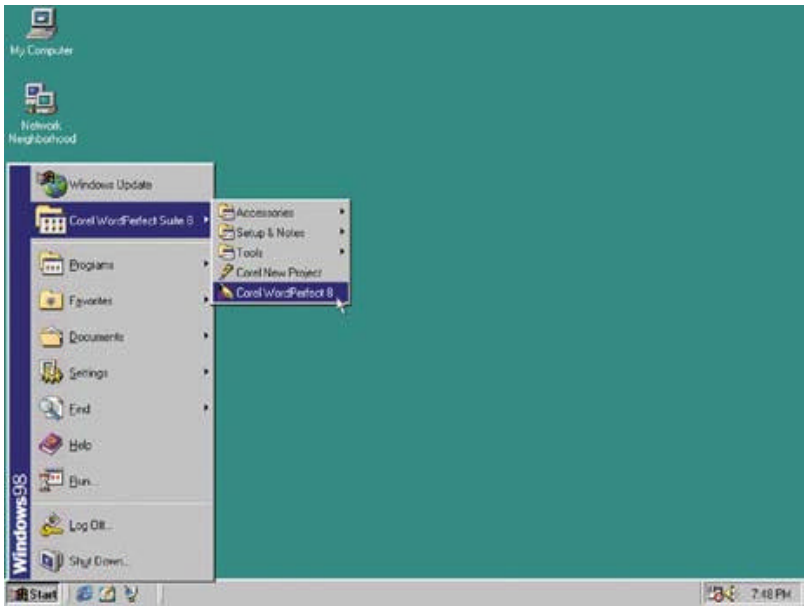
- MS-DOS™ is the most widely used general-purpose operating system
- Features include:
  - Command-line interface (commands are typed)
  - Menu-driven interface (commands are chosen from on-screen lists)

Graphical User Interfaces: Macintosh

- This is a disk operating system in which the user interacts with the computer by using a pointing device (e.g. a mouse)
- As early as 1984, the Macintosh™ computer was designed with this interface in mind

Graphical User Interfaces: Windows

- In 1995, Windows 95™ was released as a graphical user interface for IBM™ computers and their compatibles

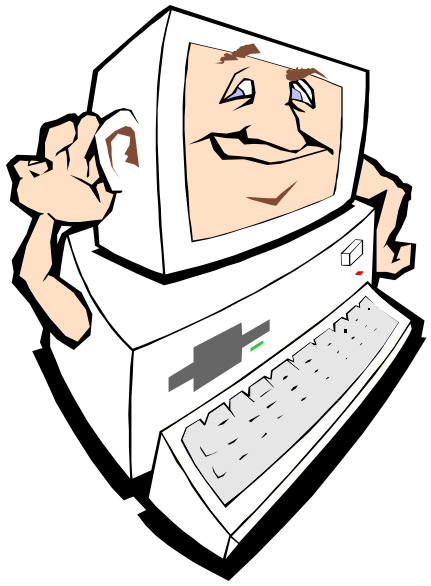


Why WIMP Won

- Windows, Icons, Menus, and Pointing devices
- In this graphical user interface, the cursor of the pointing device (mouse) appears on the screen and can be used to point to icons, work within windows, and select from menus

Tomorrow's User Interfaces

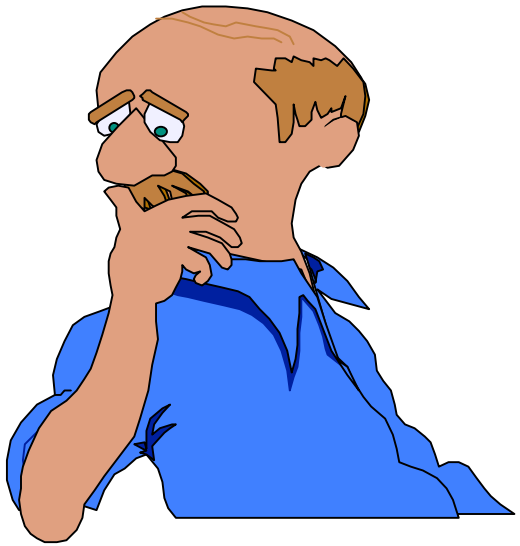
- Future interfaces will probably:
  - Make individual applications obsolete
  - Support natural languages (talk to the machine and it talks back)
  - Include artificial intelligence and agents that fit our needs
  - Be based on virtual reality (data in three-dimensional physical space)



Rules of Thumb: Computer Consumer Concepts

Before you buy, you should consider:

- Cost
- Compatibility
- Capacity
- Customizability
- Capability
- Connectivity
- Convenience
- Company
- Purchasing Curve



Cost

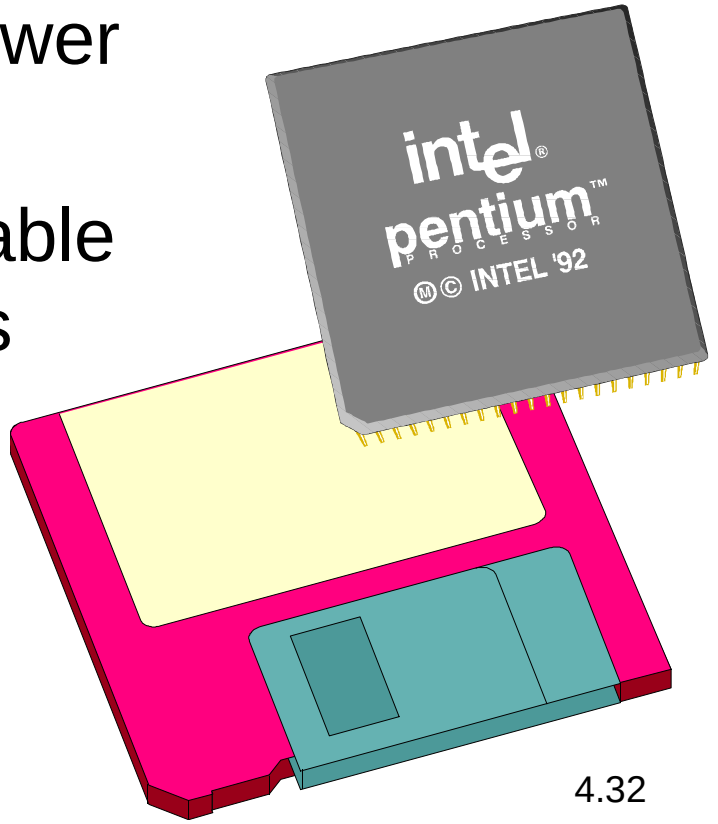
- Before you buy:
  - Determine what you can afford
  - Allow for “extras”
  - Join a user group or talk with other computer and software owners

Compatibility

- Before you buy, make sure you know:
  - What is the right computer and software for what you want to do
  - If the computer and software you will need work well together

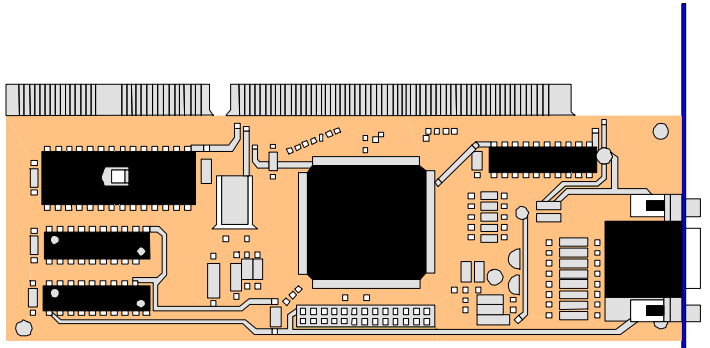
Capacity

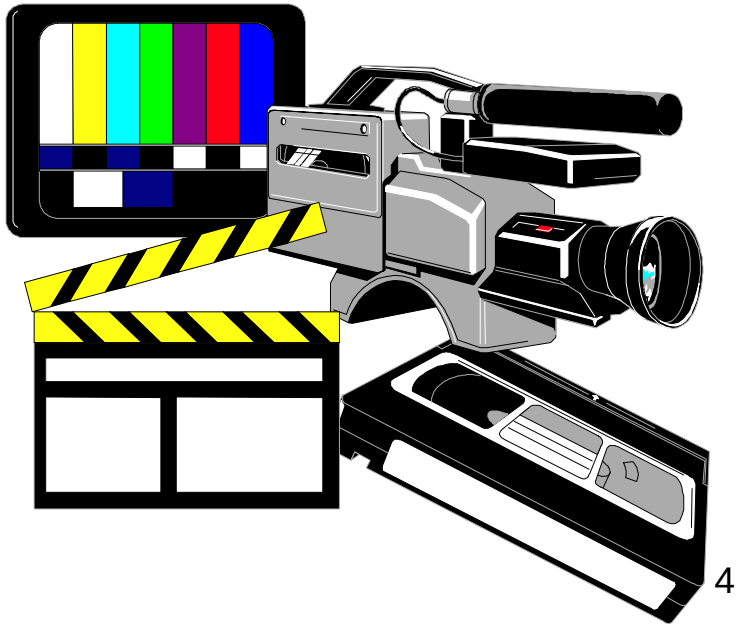
- Before you buy, make sure you know:
  - How much computer power you are going to need
  - If the processor will be able to handle your demands
  - If you will be able to upgrade later on



Customizability

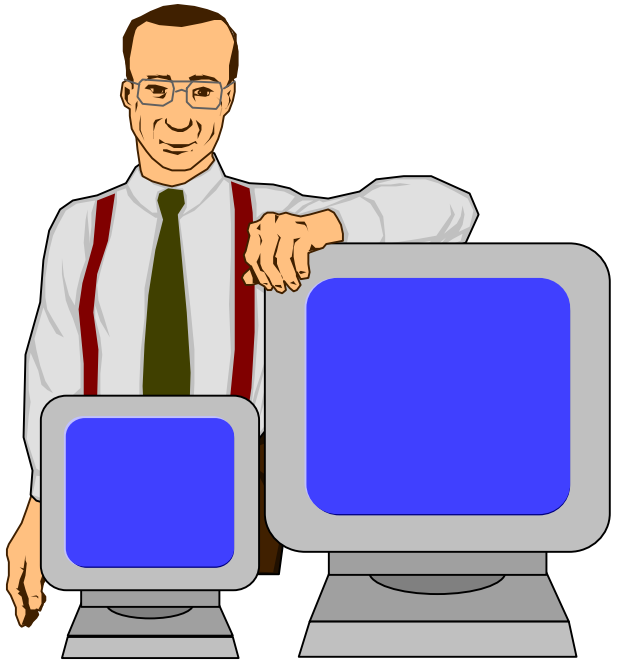
- Before you buy, make sure you know:
  - If your computer can be customized to fit your needs (such as video editing)





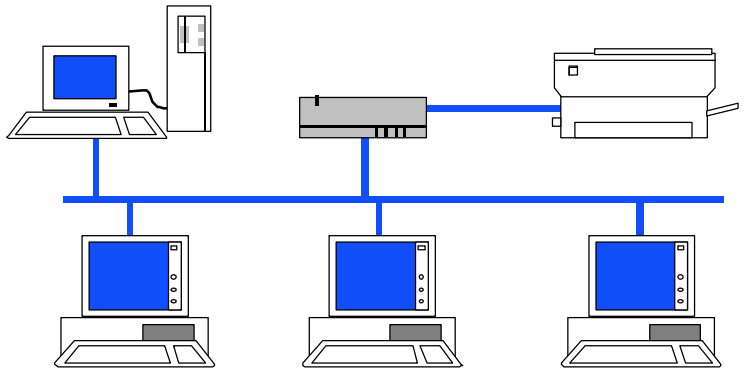
Capability

- Before you buy, make sure you know:
  - Which computer is the right tool for you
  - If the computer and software will be able to meet your demands today and years from now



Connectivity

- Before you buy, make sure you:
  - Have included a high-speed modem or some other network connection
  - Can take full advantage of the communication capabilities of your computer

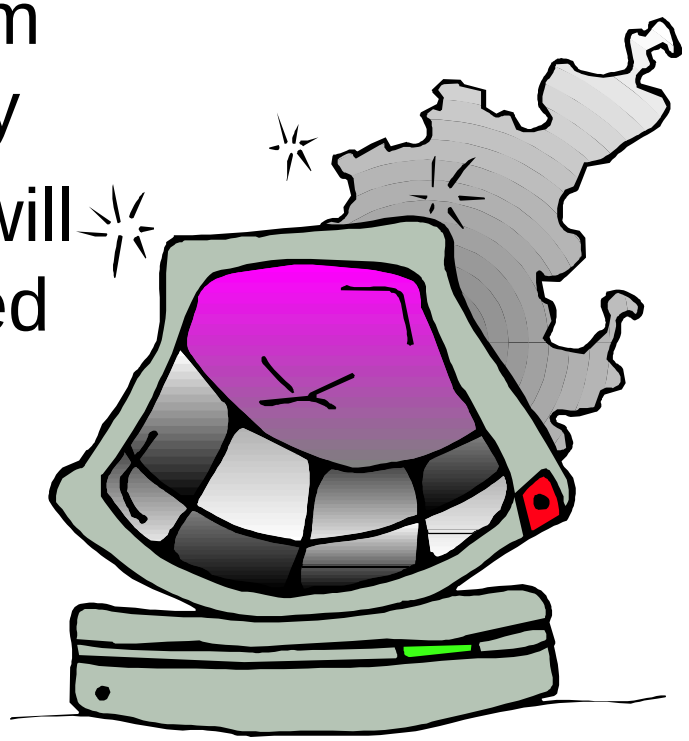


Convenience

- Before you buy, make sure you determine:
  - Whether portability or permanent connection of peripherals is important
  - Which kind of user interface will help you do your work easier
  - If you should have the same machine as people around you

Company

- Before you buy, make sure you know:
  - if you are buying from a reputable company
  - if parts and service will be available if needed



Purchasing Curve

- Most models of personal computers seem to have a useful lifespan of just a few years
- Before you buy, make sure you know:
  - how new or old the computer is that you want to buy
  - not to buy a brand new computer model
  - not to buy an “obsolete” computer model