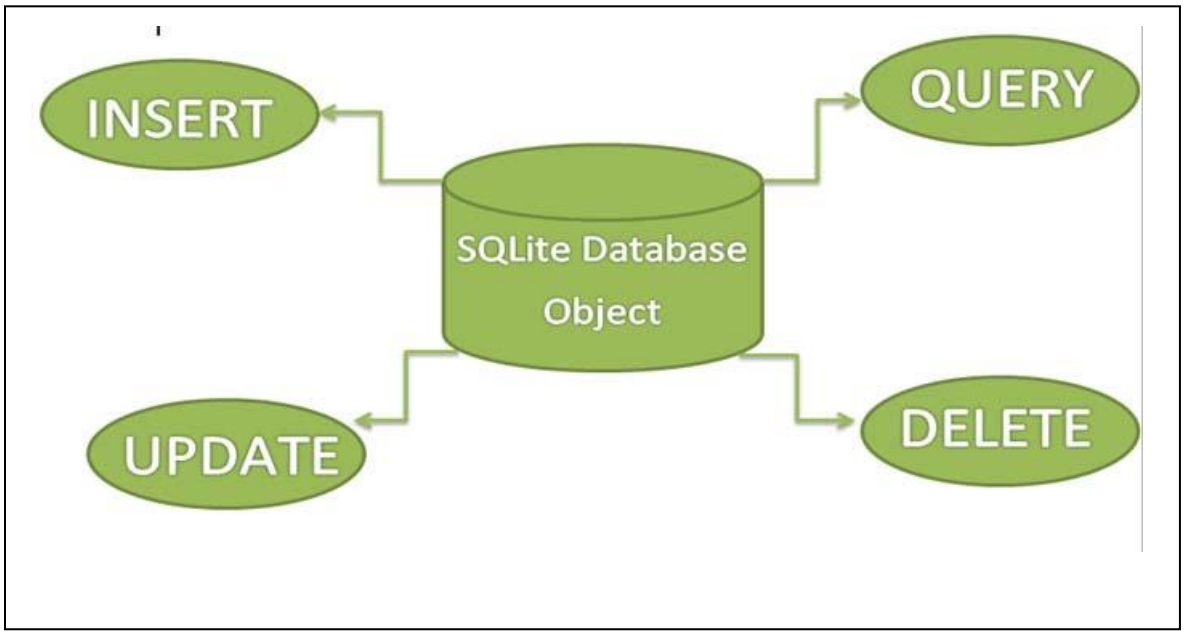
Lecture 3 – Databases / Computer Networks

Database Management Systems

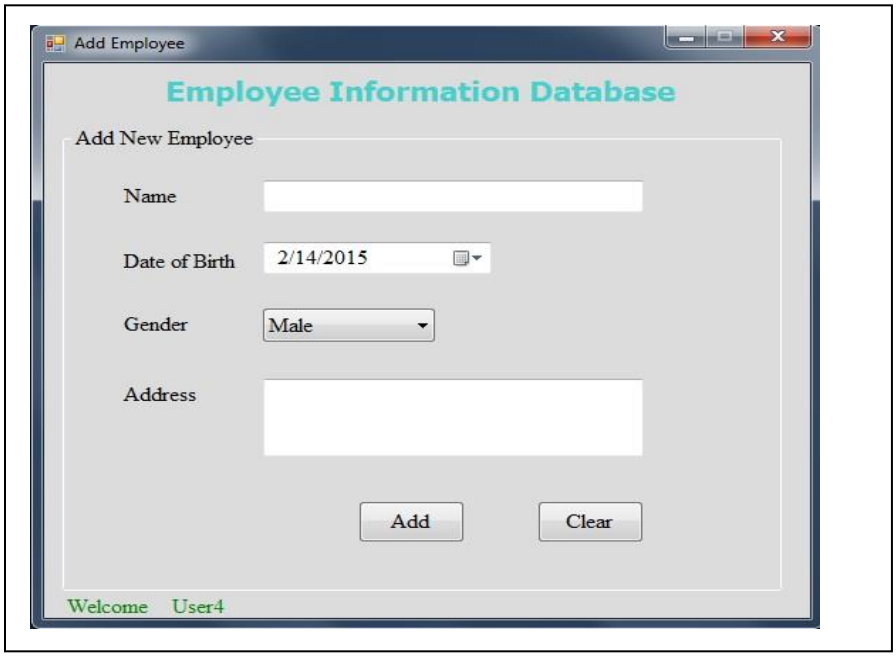
- **Database** A structured set of related data
- **Database** **Comprised of tables, queries, forms, and reports**
- **Microsoft Access** **is the most popular desktop database management software**

Database Features

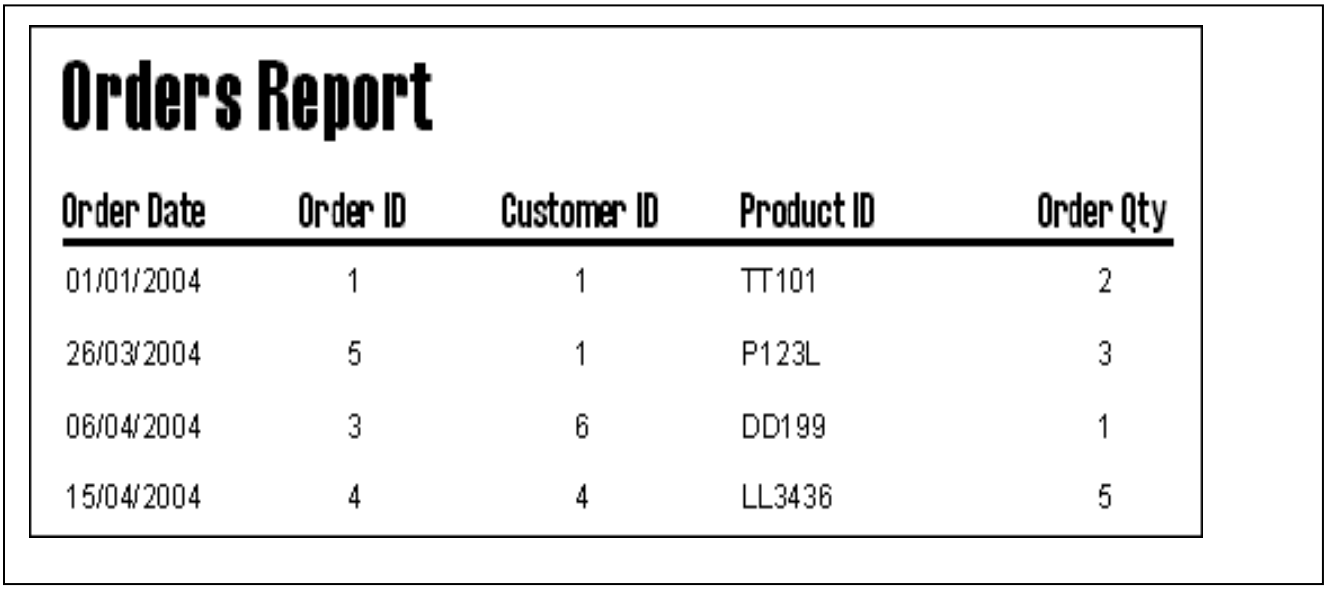
- Relational
- Tables
  - Records
  - Fields
- Record sorting
- Queries
- Forms
- Reports



Form :



Report :



Orders Report

Order Date	Order ID	Customer ID	Product ID	Order Qty
01/01/2004	1	1	TT101	2
26/03/2004	5	1	P123L	3
06/04/2004	3	6	DD199	1
15/04/2004	4	4	LL3436	5

The Relational Model

- In a relational DBMS, the data items and the relationships among them are organized into **tables**
  - A table is a collection of **records**
  - A record is a collection of related **fields**
  - Each field of a database table contains a single data value
  - Each record in a table contains the same fields

Movie

MovieId	Title	Genre	Rating
101	Sixth Sense, The	thriller horror	PG-13
102	Back to the Future	comedy adventure	PG
103	Monsters, Inc.	animation comedy	G
104	Field of Dreams	fantasy drama	PG
105	Alien	sci-fi horror	R
106	Unbreakable	thriller	PG-13
107	X-Men	action sci-fi	PG-13
5022	Elizabeth	drama period	R
5793	Independence Day	action sci-fi	PG-13
7442	Platoon	action drama war	R

We can express the schema for this part of the database as follows:

Movie (MovieId:key, Title, Genre, Rating)

Relationships

- We can use a table to represent a collection of relationships between objects

Rents

CustomerId	MovieId	DateRented	DateDue
103	104	3-12-2002	3-13-2002
103	5022	3-12-2002	3-13-2002
105	107	3-12-2002	3-15-2002

Structured Query Language

- **Structured Query Language (SQL)** A comprehensive database language for managing relational databases

Queries in SQL

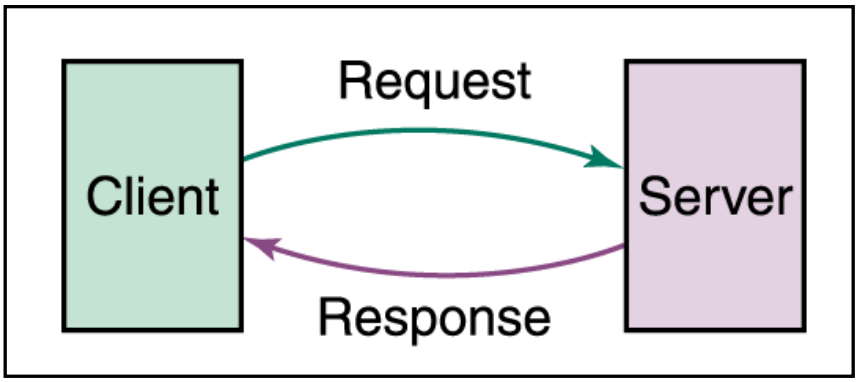
- select attribute-list from table-list where condition
- select Title from Movie where Rating = 'PG'
- select Name, Address from Customer
- select * from Movie where Genre like '%action%'
- select * from Movie where Rating = 'R' order by Title

Modifying Database Content

- insert into Customer values (9876, 'John Smith', '602 Greenbriar Court', '2938 3212 3402 0299')
- update Movie set Genre = 'thriller drama' where title = 'Unbreakable'
- delete from Movie where Rating = 'R'

Computer Network and The World Wide Web:

- A collection of computing devices that are connected in various ways in order to communicate and share resources.
- Usually, the connections between computers in a network are made using physical wires or cables
- Some connections are wireless, using radio waves or infrared signals
- The generic term node or host refers to any device on a network
- Data transfer rate The speed with which data is moved from one place on a network to another
- Data transfer rate is a key issue in computer networks
- Computer networks have opened up an entire frontier in the world of computing called the client/server model



- File server A computer that stores and manages files for multiple users on a network
- Web server A computer dedicated to responding to requests (from the browser client) for web pages

Types of Networks

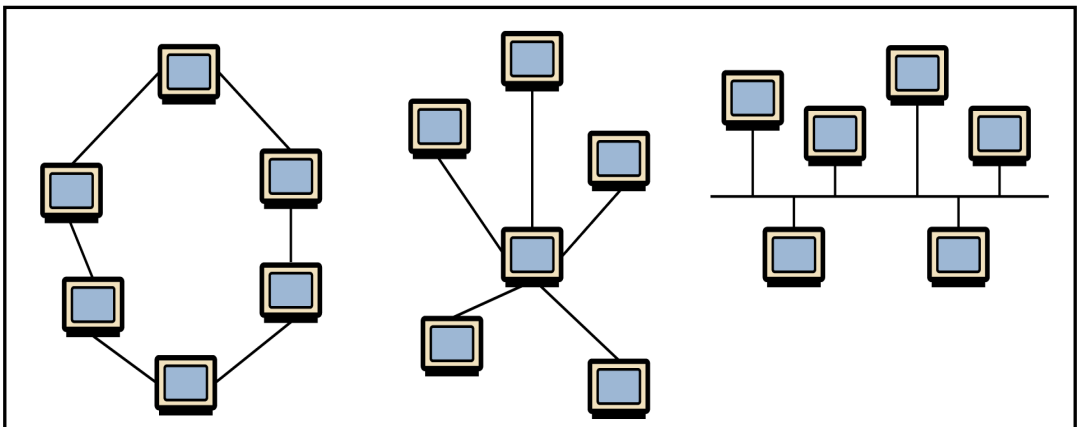
- Local-area network (LAN) A network that connects a relatively small number of machines in a relatively close geographical area

- Various configurations, called topologies, have been used to administer LANs

  - Ring topology A configuration that connects all nodes in a closed loop on which messages travel in one direction

  - Star topology A configuration that centers around one node to which all others are connected and through which all messages are sent

  - Bus topology All nodes are connected to a single communication line that carries messages in both directions



Various network topologies

- A bus technology called Ethernet has become the industry standard for local-area networks

- Wide-area network (WAN) A network that connects two or more local-area networks over a potentially large geographical distance

  - Often one particular node on a LAN is set up to serve as a gateway to handle all communication going between that LAN and other networks

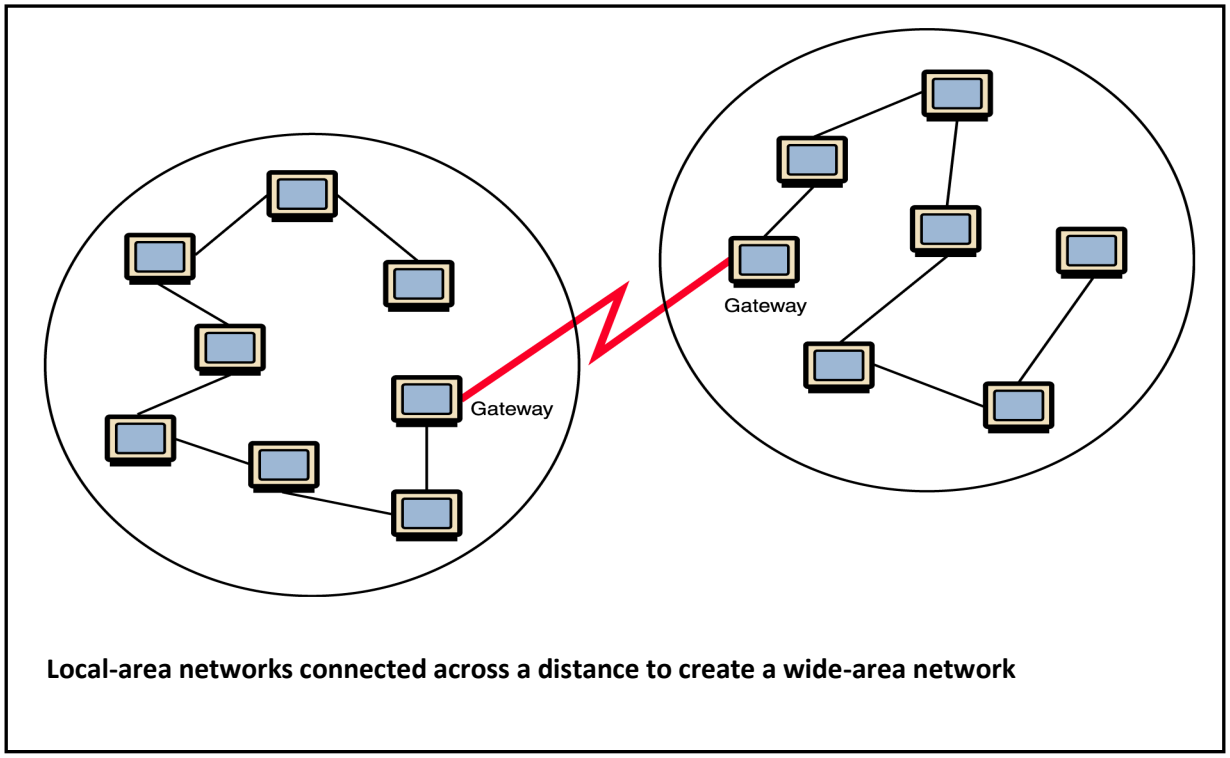
- Communication between networks is called internetworking

  - The Internet, as we know it today, is essentially the ultimate wide-area network, spanning the entire globe

- Metropolitan-area network (MAN) The communication infrastructures that have been developed in and around large cities

So, who owns the Internet?

Well, nobody does. No single person or company owns the Internet or even controls it entirely. As a wide-area network, it is made up of many smaller networks. These smaller networks are often owned and managed by a person or organization. The Internet, then, is really defined by how connections can be made between these networks.



Local-area networks connected across a distance to create a wide-area network

Internet Connections

- Internet backbone A set of high-speed networks that carry Internet traffic.

  These networks are provided by companies such as AT&T, GTE, and IBM

- Internet service provider (ISP) A company that provides other companies or individuals with access to the Internet

- There are various technologies available that you can use to connect a home computer to the Internet

  - A phone modem converts computer data into an analog audio signal for transfer over a telephone line, and then a modem at the destination converts it back again into data

  - A digital subscriber **line (DSL)** uses regular copper phone lines to transfer digital data to and from the phone company's central office

  - A cable modem uses the same line that your cable TV signals come in on to transfer the data back and forth

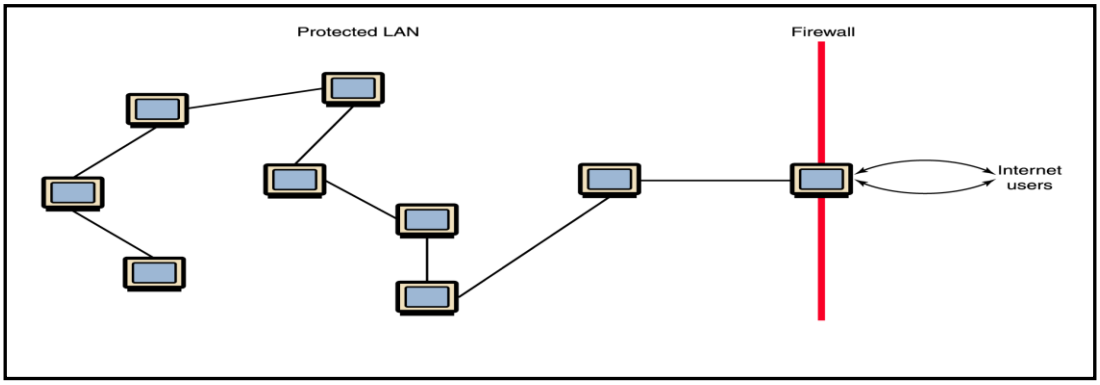
- Broadband A connection in which transfer speeds are faster than 128 bits per second

  - DSL connections and cable modems are broadband connections

  - The speed for **downloads** (getting data from the Internet to your home computer) may not be the same as **uploads** (sending data from your home computer to the Internet)

Firewalls

- Firewall A machine and its software that serve as a special gateway to a network, protecting it from inappropriate access
  - Filters the network traffic that comes in, checking the validity of the messages as much as possible and perhaps denying some messages altogether
  - Enforces an organization's access control policy



A firewall protecting a LAN

Network Addresses

- Hostname A unique identification that specifies a particular computer on the Internet

  For example

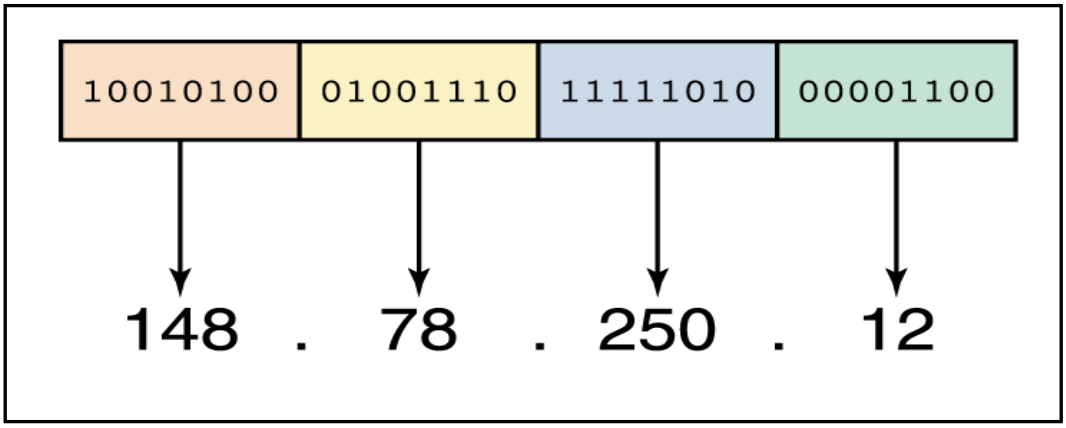
  matisse.csc.villanova.edu
  condor.develocorp.com

- Network software translates a hostname into its corresponding IP address

  For example

  205.39.145.18

- An IP address can be split into
  - network address, which specifies a specific network
  - host number, which specifies a particular machine in that network



An IP address is stored in four bytes

Domain Name System

- A hostname consists of the computer name followed by **the domain name**
- csc.villanova.edu is the domain name
  - A domain name is separated into two or more sections that specify the organization, and possibly a subset of an organization, of which the computer is a part
  - Two organizations can have a computer named the same thing because the domain name makes it clear which one is being referred to
- The very last section of the domain is called its top-level domain (TLD) name

Top-Level Domain	General Purpose	New TLDs	General Purpose
.com	U.S. Commercial	.biz	Business
.net	Network	.info	Information
.org	Nonprofit organization	.pro	Professional
.edu	U.S. Educational	.museum	Museums
.int	International	.aero	Aerospace industry
.mil	U.S. Military	.coop	Cooperative
.gov	U.S. Government		

Top-level domains, including some relatively new ones

- Organizations based in countries other than the United States use a top-level domain that corresponds to their two-letter country codes

Country Code TLD	Country
.au	Australia
.br	Brazil
.ca	Canada
.gr	Greece
.in	India
.ru	Russian Federation
.uk	United Kingdom

Some of the top-level domain names based on country codes

- The domain name system (DNS) is chiefly used to translate hostnames into numeric IP addresses
  - DNS is an example of a distributed database
  - If that server can resolve the hostname, it does so
  - If not, that server asks another domain name server

The World Wide Web

- The Web An infrastructure of distributed information combined with software that uses networks as a vehicle to exchange that information
- Web page A document that contains or references various kinds of data, such as text, images, graphics, and programs
- Links A connection between one web page and another that can be used "move around" as desired
- Website A collection of related web pages
  - The Internet makes the communication possible, but the Web makes that communication easy, more productive, and more enjoyable

Search Engines :

- Search Engine is a website that helps you find other websites
  - For example, Yahoo and Google are search engines
  - You enter keywords and the search engine produces a list if links to potentially useful sites
- There are two types of searches
  - Keyword searches
  - Concept-based searches

Instant Messaging

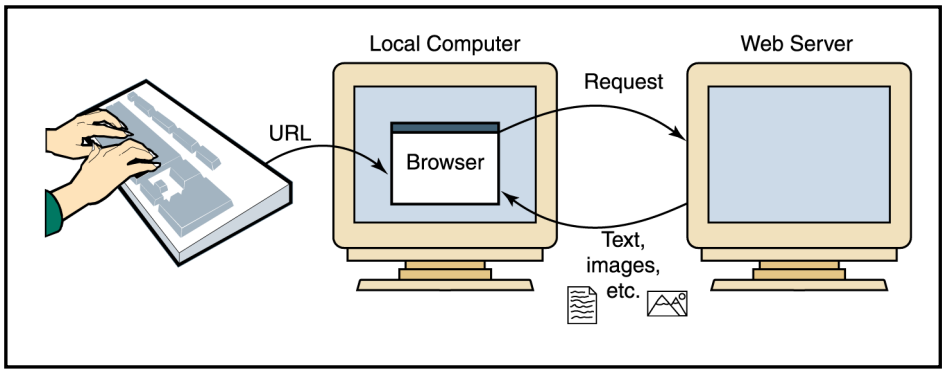
- Instant messaging (IM) An application that allows people to send and receive messages in real time
  - Both sender and receiver must have an IM running
  - Most IM applications use a proprietary protocol that dictates the precise format and structure of the messages that are sent across the network to the receiver.
  - Instant messages are not secure

Cookies

- Cookie A small text file that a web server stores on your local computer's hard disk
  - A cookie contains information about your visit to the site
  - Cookies can be used
    - to determine number of unique visitors to the site
    - to customize the site for your future visits
    - to implement shopping carts that can be maintained from visit to visit
  - Cookies are not dangerous

Web Browser

- Browser A software tool that issues the request for the web page we want and displays it when it arrives
- We often talk about “visiting” a website, as if we were going there
  - In truth, we actually specify the information we want, and it is brought to us
  - The concept of visiting a site is understandable in that we often don’t know what’s at a particular site until we “go to it” and see
- Web server The computer that is set up to respond to web requests
- Web address The core part of a Uniform Resource Locator, or URL, which uniquely identifies the page you want out of all of the pages stored anywhere in the world



A browser retrieving a Web page

Interactive Web Pages

- When HTML was first developed, there was no way to interact with the information and pictures presented in a web page
- As users have clamored for a more dynamic web, new technologies were developed to accommodate these requests

Java Applets

- Java applet A program that is designed to be embedded into an HTML document and transferred over the Web to someone who wants to run the program

Ethical Issues :

1. Should the use of the Internet be monitored or regulated? If so, by whom?

2. How much time do you spend accessing the Internet ? Is the time well spent? Has the Internet access altered your social activities ? Do you find it easier to talk to people via the Internet than in person ?

3. The ability to connect via networks have popularized the concept of working from home. What are some pros and cons of this movement.