MANAGEMENT INFORMATION SYSTEMS

COURSE PLAN
&
COURSE MATERTIAL

SEMESTER II

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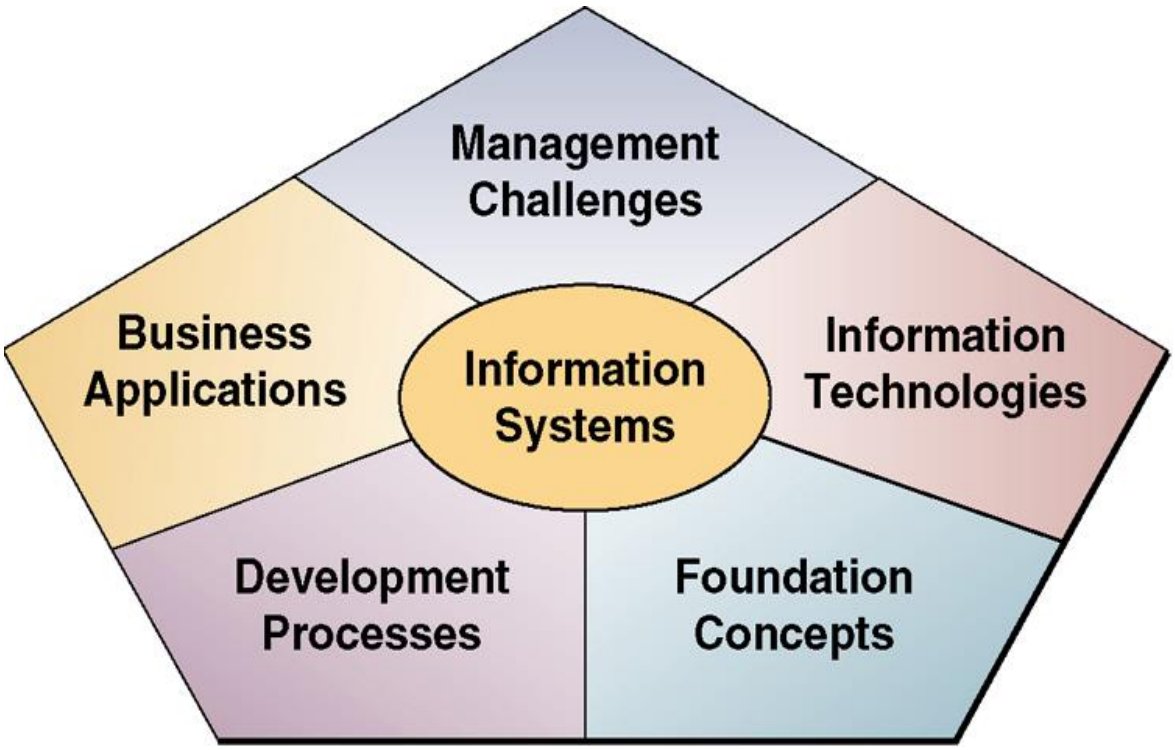
Subject Teacher

INSTITUTE OF MANAGEMENT EDUCATION
RESEARCH AND TRAINING, PUNE

Need and Purpose of IS

1. a. IS framework for Business Professionals



Five areas of knowledge are important to end users in order to understand information systems:

Foundation Concepts. End users must be familiar with with the basic components and types of information systems there are. But they also need to be familiar with general systems theory and theories of information processing (machine and human).

Information Technology. End users should understand technology, more precisely, the information technology of hardware, software, telecommunications, database management, and how all these elements interaction in a

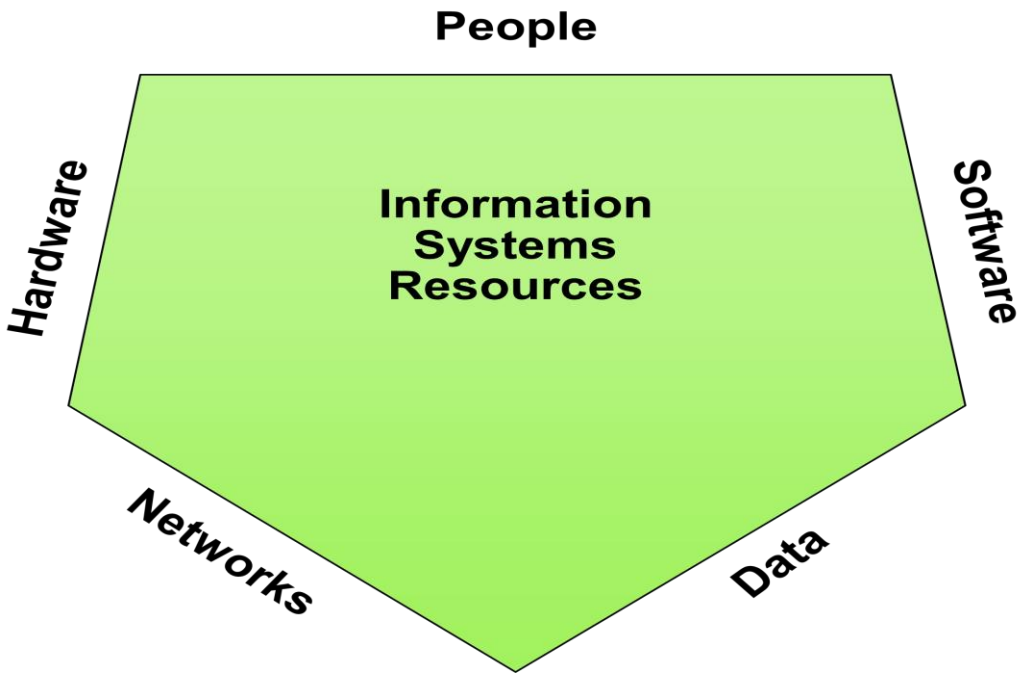
dynamic process of very rapid change, development, and new ways of doing business.

Business Applications. How information systems are applied to business problems is more complex than it might seem. The informed end users seeks to learn both about how to use information systems to solve existing problems and to begin using IS as a new way of defining problems and meeting business opportunities. End users should gain a basic understanding in the areas of user needs, office automation, transaction processing, the functional areas of business, management reporting, decision support, executive support, competitive advantage, and artificial intelligence.

Development Processes. End users of IS need to know the fundamental concepts of problem-solving and development. Here you should become familiar with methodologies such as the systems approach, the systems development life cycle, and prototyping.

Management Challenges. How managers make use of IS resources is a key concern for end users. More than ever, a knowledge of management methods is required by each end users, as IT demands that end users make more independent decisions that support the company's overall objectives.

1. b. Components of IS



An *Information System* is an organized combination of people, hardware, software, communications networks, and data resources that collects, transforms, and disseminates information in an organization.

Key concepts of the text include:
Information Technology (IT). The dynamic interaction of computer-based information systems with telecommunications forms the backbone of IT.

End User Perspective. An end user is anyone who uses an information system or the information it produces. As a perspective on management information systems, the end user focuses designers, developers, and all information systems personnel on how the system does and should function in use. Information systems are

powerful tools -- and all the more powerful when made to fit the needs of those who use them everyday. This involves adapting the system to the user, not the other way around.

An Enterprise Perspective. Information technology can provide the information a business needs for efficient operations. It can even be the foundation of a company's competitive advantage. But to function properly, an information system must be developed in support of the strategic objectives, business operations, and management needs of the enterprise.

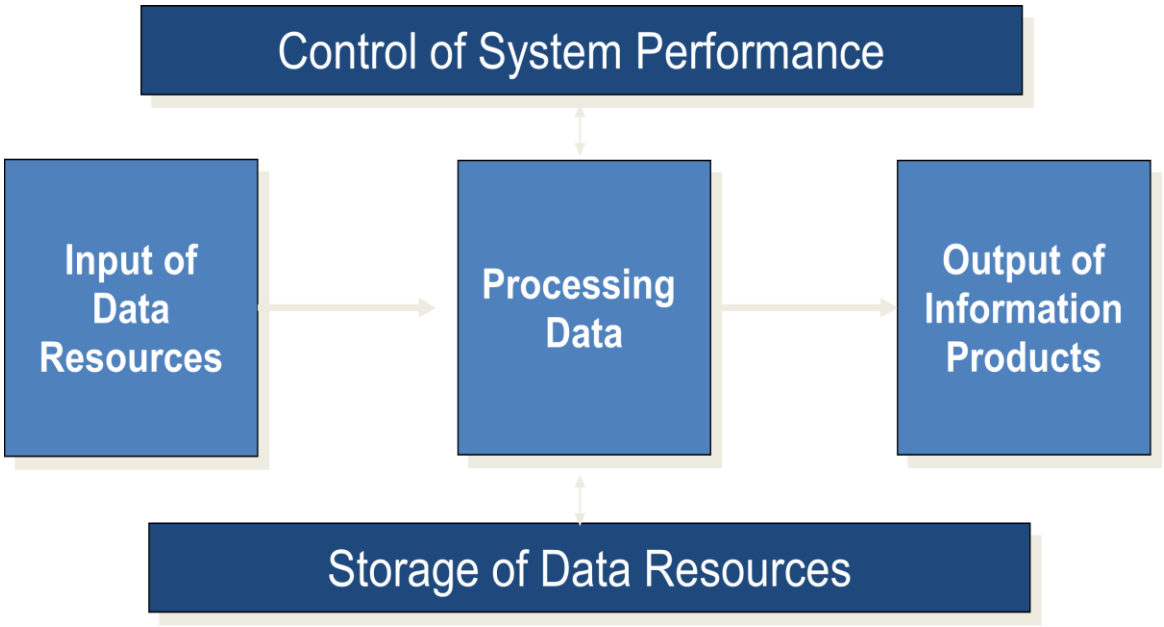


Fig An Information System

This *information system model* expresses a fundamental conceptual framework for the major components and activities of information systems. An information system depends on the resources of people (end users and IS specialists), hardware (machines and media), software (programs and procedures), data (data and knowledge bases), and networks (communications media and network support) to perform input, processing, output, storage, and control activities that covert data resources into information products.

- Data resources are transformed by information processing activities into a variety of information products for end users.

- Information processing consists of input, processing, output, storage and control activities.

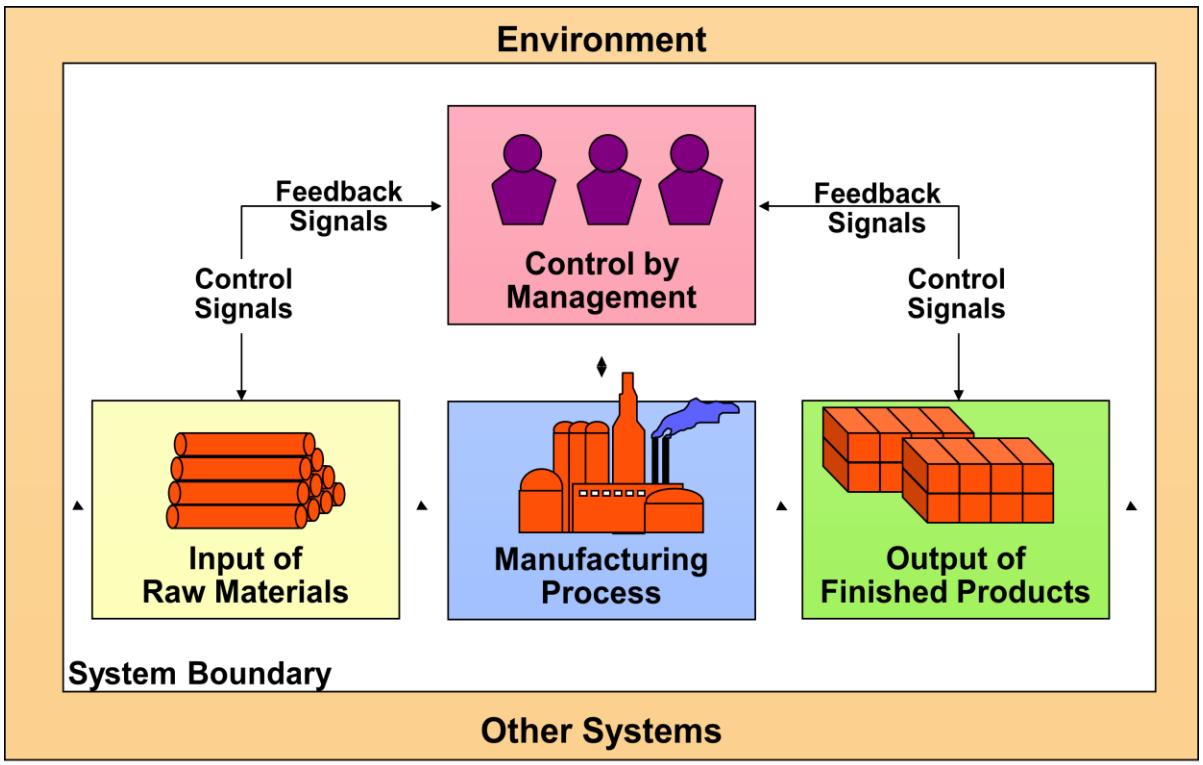


Fig. System

System concepts underlie the field of information systems. From the end user perspective, it is necessary to understand the fundamentals of systems theory:

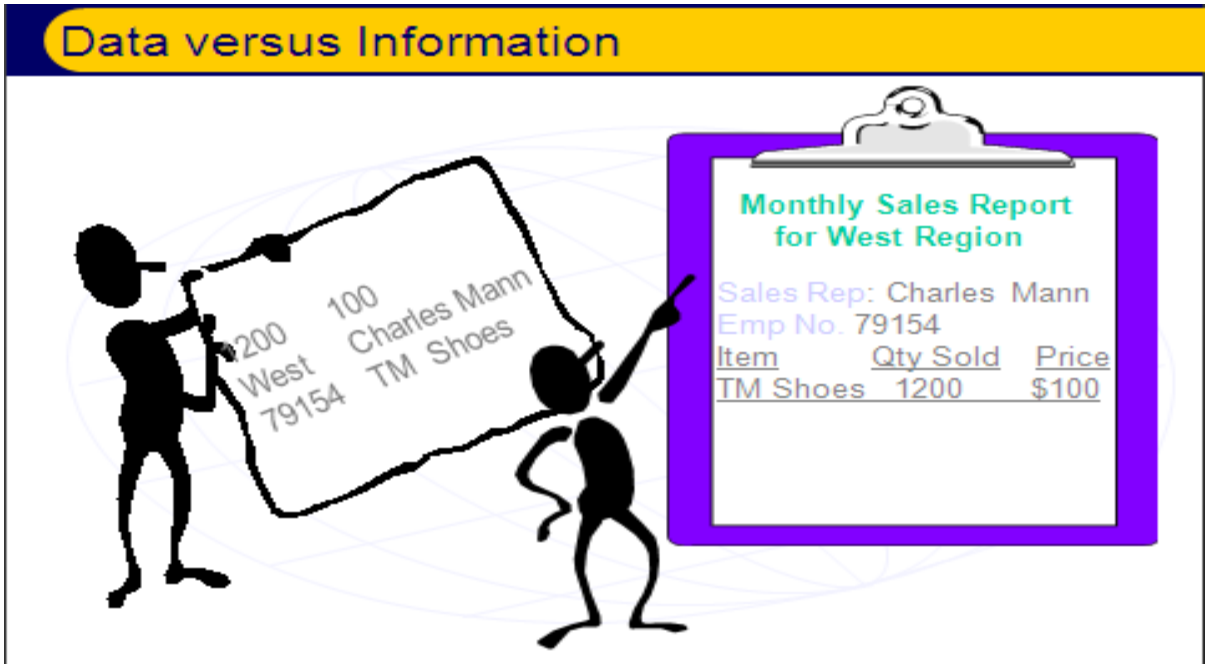
System. A system is a group of interrelated components working together toward a common goal by accepting inputs and producing outputs in an organized transformation process. Systems have the following three basic interacting functions.

Input. Input involves capturing and assembling elements that enter the system to be processed.

Processing. Processing involves the transformation of input into output.

Output. Output is the end result of the transformation process. Output involves transferring elements that have been produced by a transformation process to their ultimate destination.

1. c. Data Vs Information



Data:

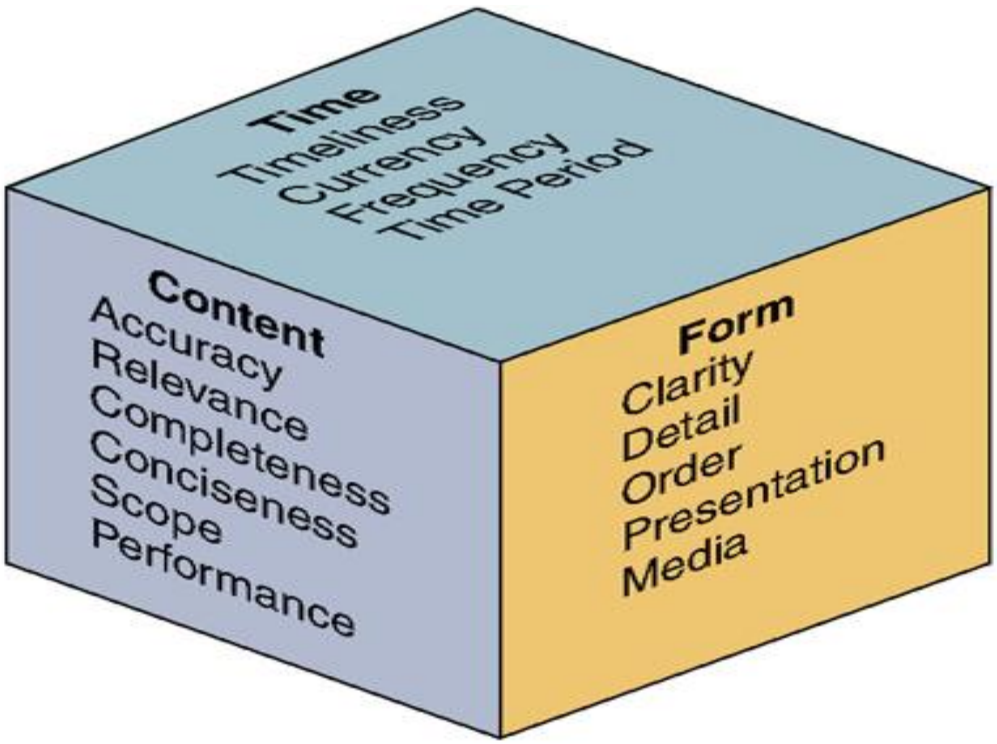
- Data is the plural of datum, though data commonly represents both singular and plural forms.
- Data are raw facts or observations, typically about physical phenomena or business transactions.

- Data should be viewed as raw material resources that are processed into finished information products.
- Data are usually subjected to a value-added process (data processing or information processing) where
    - Its form is aggregated, manipulated, and organized
    - Its content is analyzed and evaluated
    - It is placed in a proper context for a human user

Information:

- Information can be defined as data that have been converted into a meaningful and useful context for specific end users.
- Information should be viewed as processed data which has been placed in a context that gives it value for specific end users.

1. d. Attributes of information quality



Time Dimension:

Timeliness Information should be provided when it is needed

Currency Information should be up-to-date when it is provided

Frequency Information should be provided as often as needed

Time Period Information can be provided about past, present, and future time periods.

Content Dimension:

Accuracy Information should be free from errors

Relevance Information should be related to the information needs of a specific recipient for a specific situation

Completeness All the information that is needed should be provided

Conciseness Only the information that is needed should be provided

Scope Information can have a broad or narrow scope, or an internal or external focus

Performance Information can reveal performance by measuring activities accomplished, progress made, or resources accumulated.

Form Dimension:

Clarity Information should be provided in a form that is easy to understand

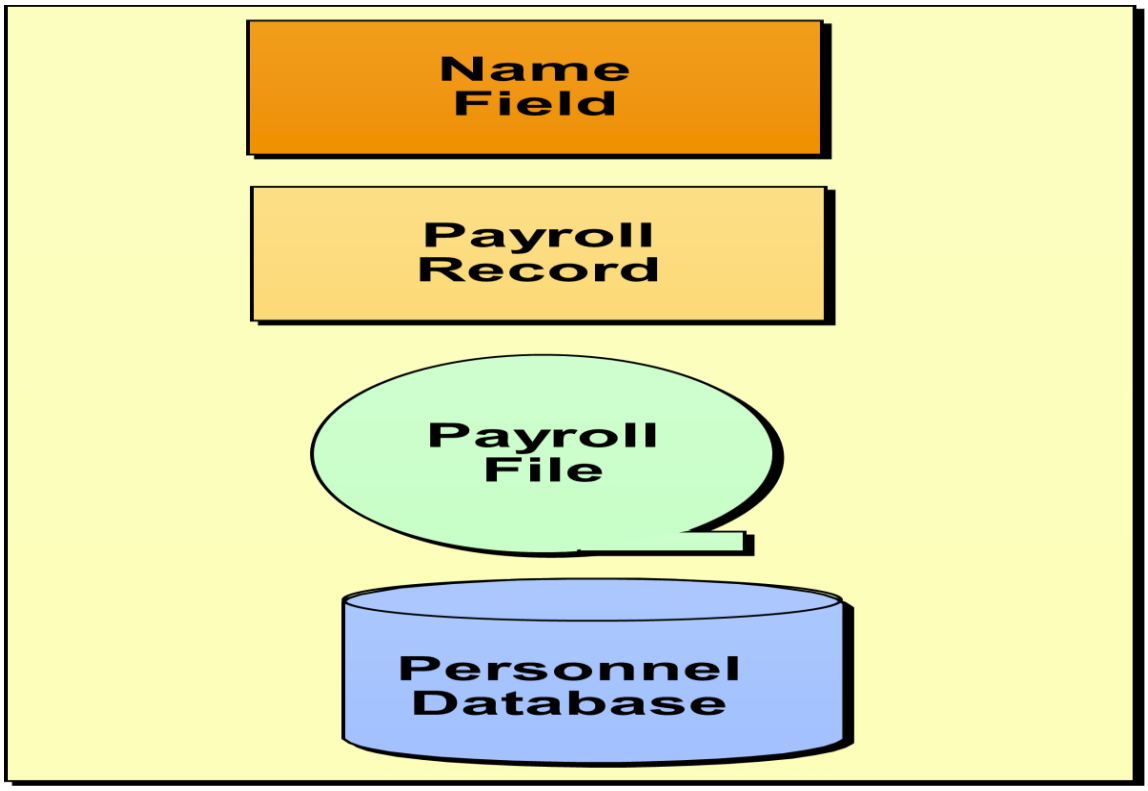
Detail Information can be provided in detail or summary form

Order Information can be arranged in a predetermined sequence

Presentation Information can be presented in narrative, numeric, graphic, or other forms.

Media Information can be provided in the form of printed paper documents, video displays, or other media.

1. e. logical data element



Storage is the information activity in which data and information are retained in an organized manner for latter use. For storage purposes, data are typically organized into the following categories:

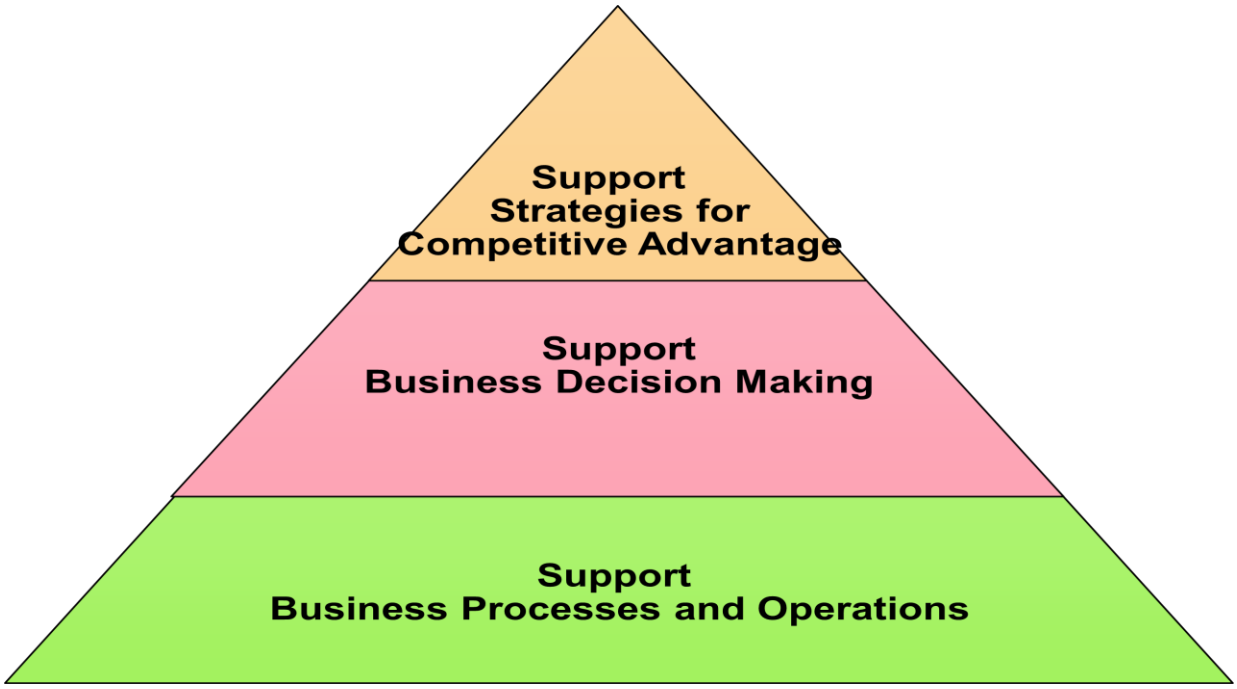
Field. A field is a grouping of characters that represent a characteristic of a person, place, thing, or event. On the slide, a person's name constitutes a field.

Record. A record is a collection of interrelated fields. For example, an employee's payroll record usually contains several fields, such as their name, social security number, department, and salary.

File. A file is a collection of interrelated records. For example, a payroll file might contain all of the payroll files for all the employees of a firm.

Database. A database is an integrated collection of interrelated records or files. For example, the personnel database of a firm might contain payroll, personnel action, and employee skills files.

1. f. Major roles of IS



Information Technology is increasingly important in the competitive marketplace. Managers need all the help they can get. Information systems perform three vital roles in business:

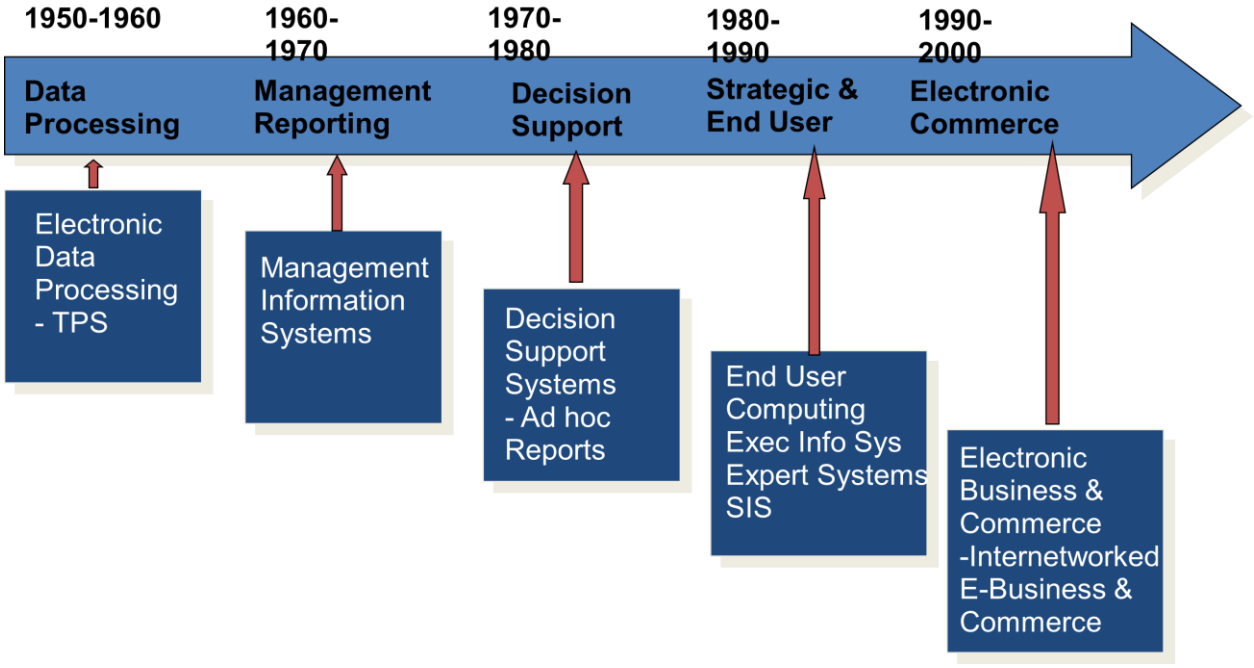
Support Business Operations. From accounting to tracking customers' orders, information systems provide management with support in day-to-day business operations. As quick response becomes more important, the ability of information systems to gather and integrate information across business functions is become crucial.

Support Managerial Decision Making. Just as information systems can combine information to help run the business better, the same information can help managers identify trends and to evaluate the outcome of previous decisions. IS helps managers make better, quicker, and more informed decisions.

Support Strategic Advantage. Information systems designed around the strategic objectives of the company help create competitive advantages in the marketplace.

Types of Information systems

2. a. History of the role of Information Systems



Data Processing: 1950s – 1960's:

Electronic data processing systems. Transaction processing, record-keeping, and traditional accounting applications

Management Reporting: 1960s – 1970's:

Management Information systems. Management reports of pre specified information to support decision making.

Decision Support: 1970s – 1980s:

Decision Support systems. Interactive ad hoc support of the managerial decision-making process.

Strategic and End User Support: 1980s – 1990's:

End User computing systems. Direct computing support for end user productivity and work group collaboration.

Executive information systems. Critical information for top management

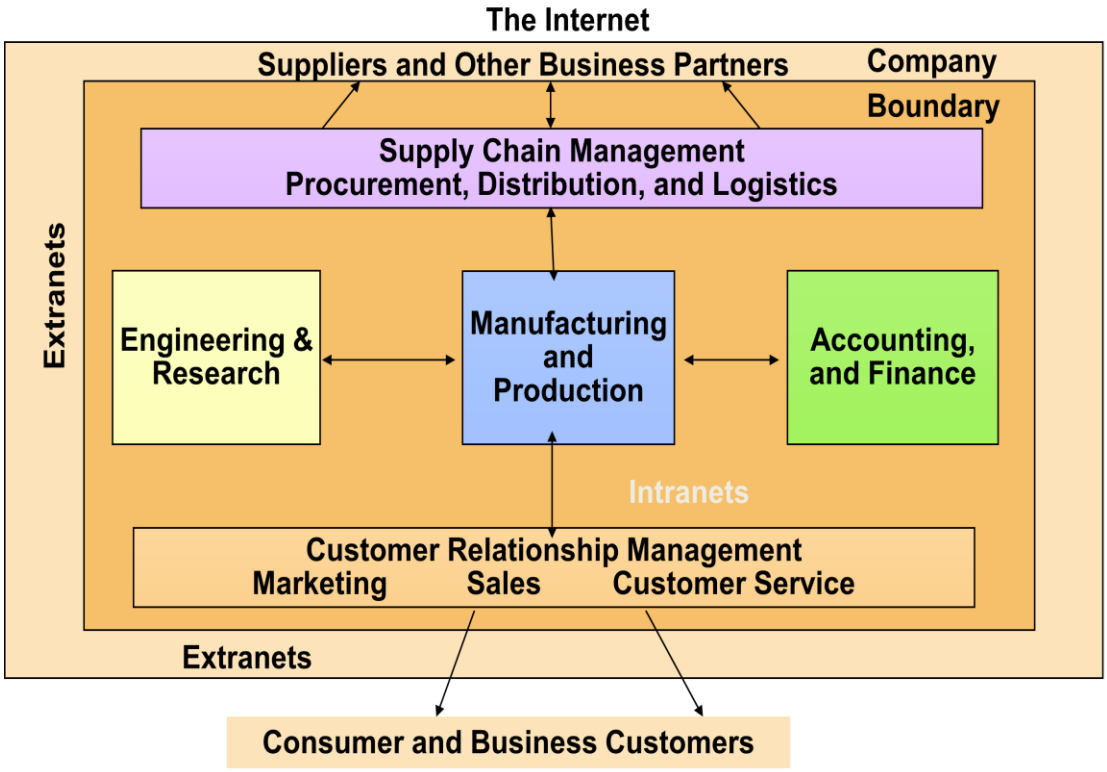
Expert systems: Knowledge-based expert advice for end users

Strategic Information Systems. Strategic products and services for competitive advantage

Electronic Business and Commerce: 1990's - 2000's:

Internetworked e-business and e-commerce Systems. Internetworked enterprise and global e-business operations and e-commerce on the Internet, intranets, extranets, and other networks.

2. b. The e-Business Enterprise



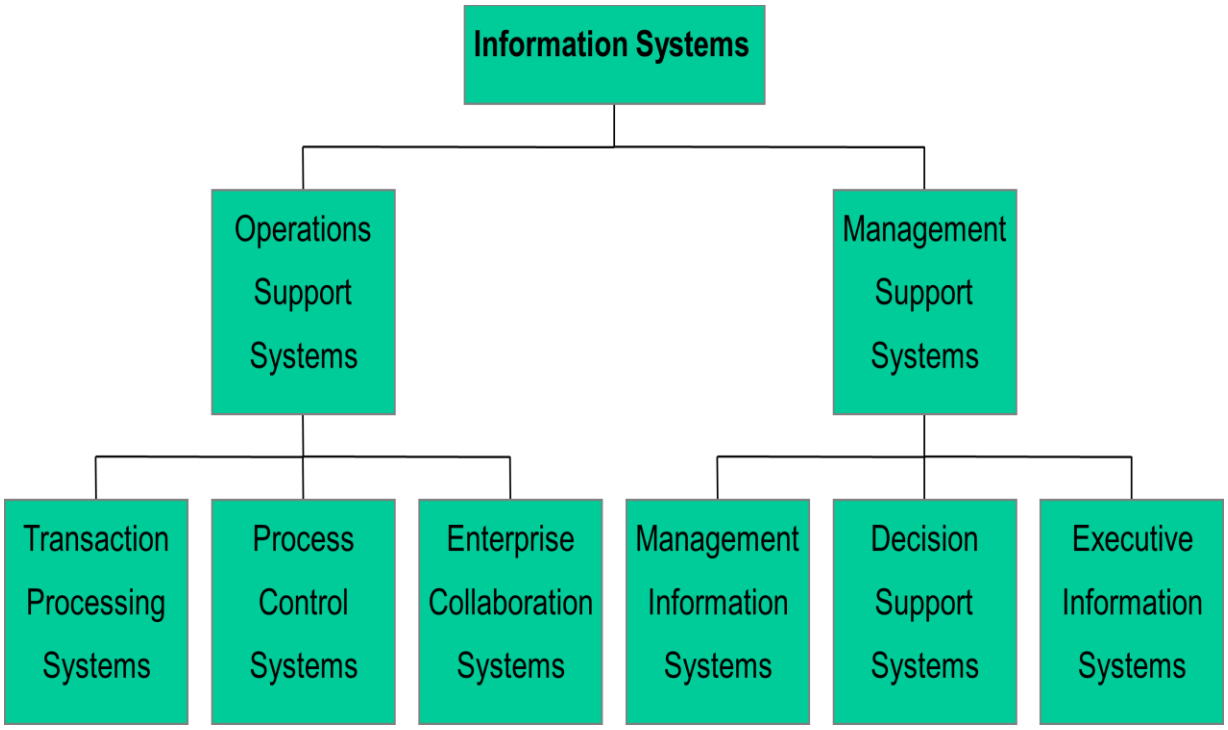
The Internet and related technologies and applications is revolutionizing the way businesses are operated and people work, and how information technology supports business operations and end user work activities.

Businesses are quickly becoming e-business enterprises.
The Internet and Internet-like networks – inside the enterprise (intranets), and between an enterprise and its trading partners (extranets) – have become the primary information technology infrastructure that supports the business operations of many companies.

E-business enterprises rely on such technologies as to:
1. Reengineer and revitalize internal business processes
2. Implement electronic commerce systems among businesses and their customers and suppliers.
3. Promote enterprise collaboration among business teams and workgroups.

E-Business: is defined as the use of Internet technologies to internetwork and empower business processes, electronic commerce, and enterprise communication and collaboration within a company and with its customers, suppliers, and other business stakeholders.

2. c. Types of Information Systems



Information Systems can be classified by the type of the support they provide an organization.

- Operations support systems process data generated by and used in business operations. They produce a variety of information products for internal and external use. Operations support systems do not emphasize producing the specific information products that can best be used by managers. Further processing by management information systems is usually required. The role of a business firm's operations support systems is to:

1. Effectively process business transactions
2. Control industrial processes
3. Support enterprise communications and collaboration
4. Update corporate databases.

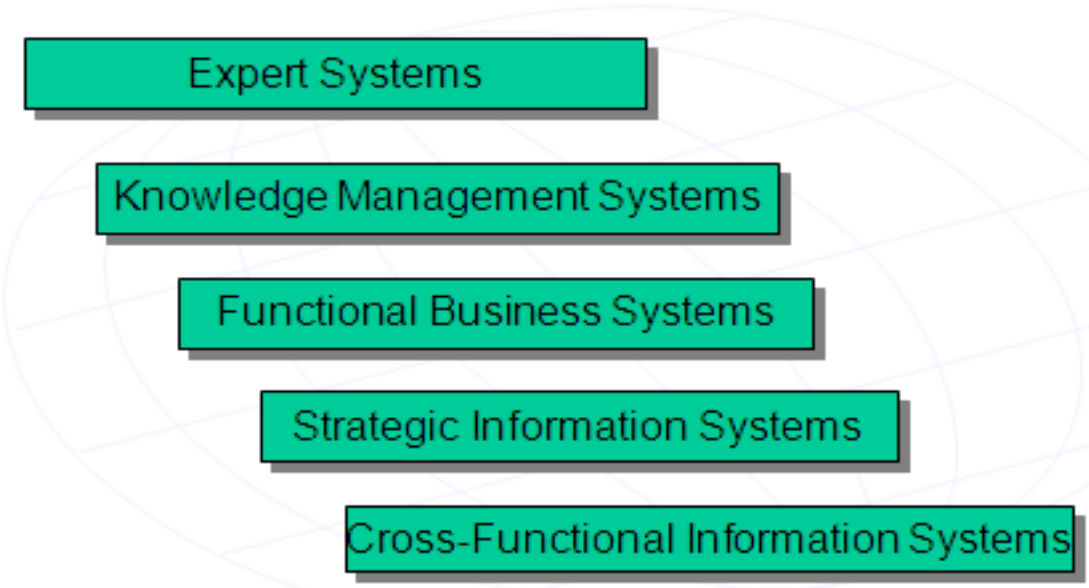
- Management support systems assist managers in decision making. Providing information and support for decision making by all types of managers and business professionals is a complex task. Conceptually, several major types of information systems support a variety of decision-making responsibilities.

1. Management information systems – provide information in the form of reports and displays to managers and many business professionals.

2. Decision support systems – give direct computer support to managers during the decision-making process.

3. Executive information systems – provide critical information from a wide variety of internal and external sources in easy-to-use displays to executives and managers.

2. d. Other categories of Information Systems



Expert Systems: Knowledge-based systems that provide expert advice and act as expert consultants to users. Examples: credit application advisor, process monitor, and diagnostic maintenance systems.

Knowledge Management Systems: are knowledge-based information systems that support the creation, organization, and dissemination of business knowledge to employees and managers throughout a company. Examples: intranet access to best business practices, sales proposal strategies, and customer problem resolution systems.

Functional Business Systems: Support a variety of operational and managerial applications in support of basic business functions of a company. Examples: information systems that

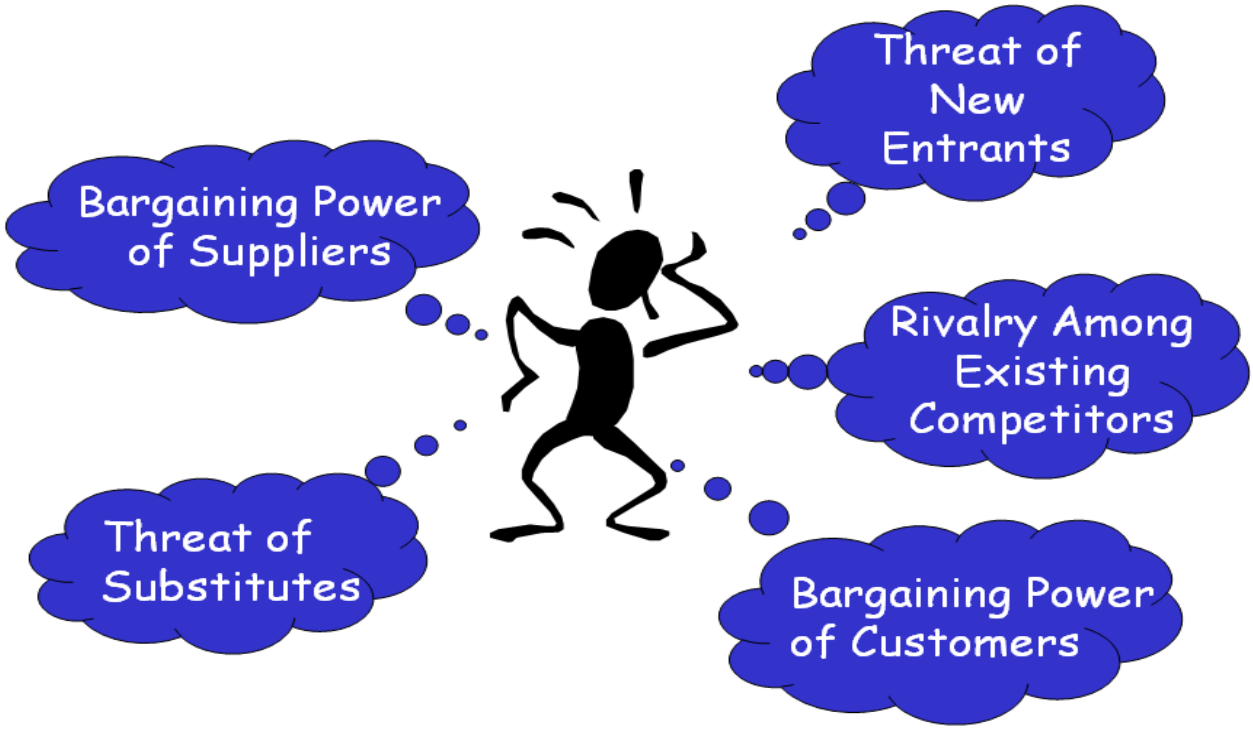
support applications in accounting, finance, marketing, operations management, and human resource management.

Strategic Information Systems: are information systems that support operations or management processes that provide a firm with strategic products, services, and capabilities for competitive advantage. Examples: online stock trading, shipment tracking, and e-commerce Web systems.

Cross-Functional Information Systems: are information systems that are integrated combinations of business information systems, thus sharing information resources across the functional units of an organization

Information
as a
Strategic resource

3. a. Competitive environment



A firm can survive in the long run if it successfully develops strategies to confront five generic competitive forces that operate in the firm's relevant environment. As illustrated on the slide these forces include:

Threat of New Entrants. Many threats to long run survival come from companies that do not yet exist or have a presence in a given industry or market. The threat of new entrants forces top management to monitor the trends, especially in technology, that might give rise to new competitors. .

Bargaining Power of Suppliers. Suppliers with access to key or limited resources, or who dominate their industries, may exert undue influence on the firm. Many firms seek to reduce their dependence on a single firm to limit the suppliers' bargaining power.

Rivalry Among Existing Firms. In mature industries, existing competitors are not much of the threat: typically each firm has found its "niche". However, changes in management, ownership, or "the rules of the game" can give rise to serious threats to long term survival from existing firms.

Bargaining Power of Customers. Customers can grow large and powerful as a result of their market share. For example, Wal-Mart is the largest customer for consumer package goods and often dictates terms to the makers of those goods -- even a giant like Procter & Gamble.

Threat of Substitutes. To the extent that customers can use different products to fulfill the same need, the threat of substitutes exists.

3.b. Competitive strategies

Competitive Advantage is created or maintained with the company succeeds in performing some activity of value to customers significantly better than does its competition. According to Porter, competitive advantage can be developed by following one or more of these strategies:

Cost Strategies. Becoming a low-cost producer in the industry allows the company to lower prices to customers. Competitors with higher costs cannot afford to compete with the low-cost leader on price.

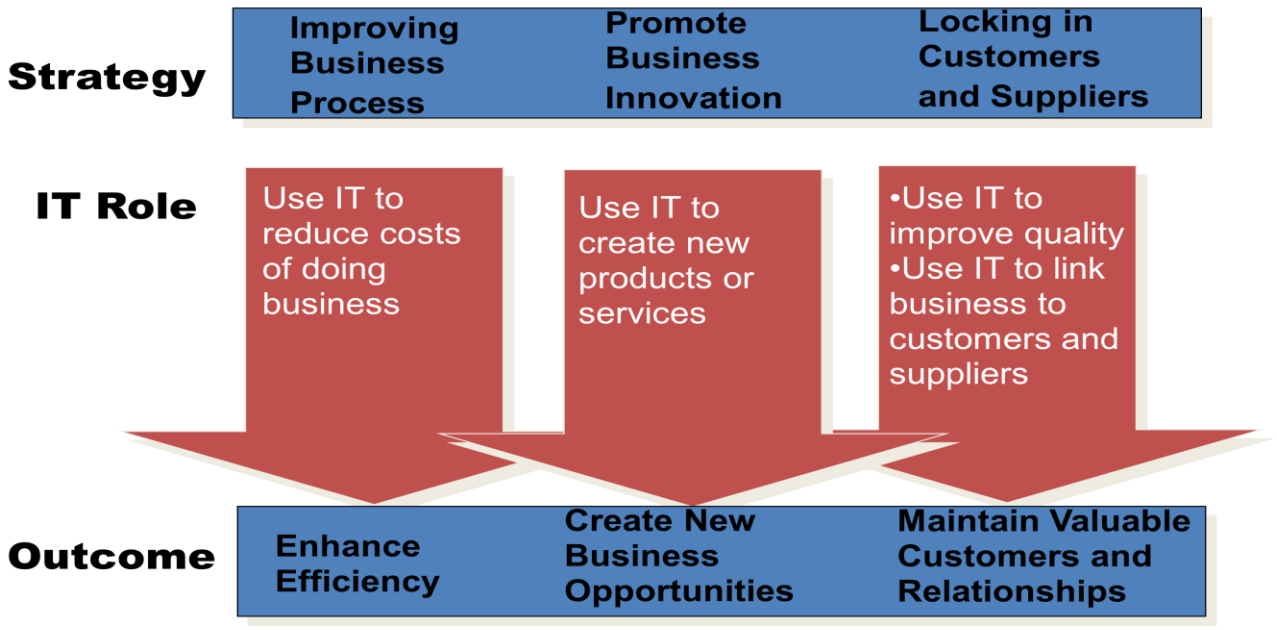
Differentiation Strategies. Some companies create competitive advantage by distinguishing their products on one or more features important to their customers. Unique features or benefits may justify price differences and/or stimulate demand.

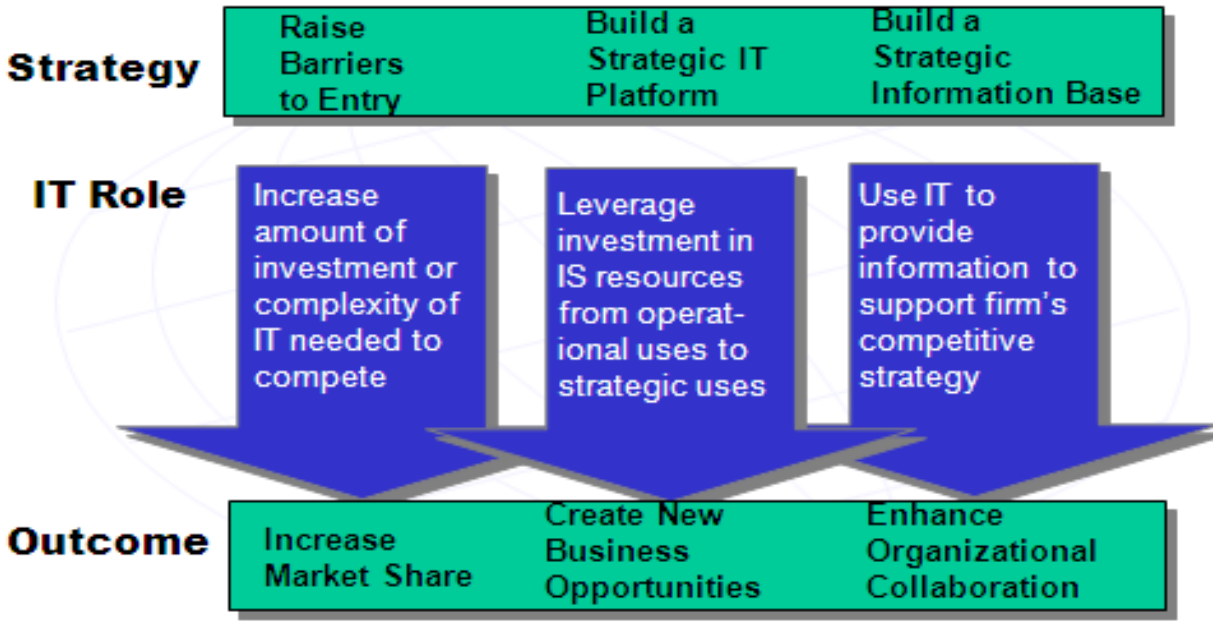
Innovation Strategies. Unique products or services or changes in business processes can cause fundamental changes in the way an industry does business.

Growth Strategies. Significantly expanding production capacity, entering new global markets, diversifying into new areas, or integrating related products or services can all be a springboard to strong company growth.

Alliance Strategies. Establishing new business linkages and alliances with customers, suppliers, former competitors, consultants, and others can create competitive advantage

3.c. Strategic uses of IT





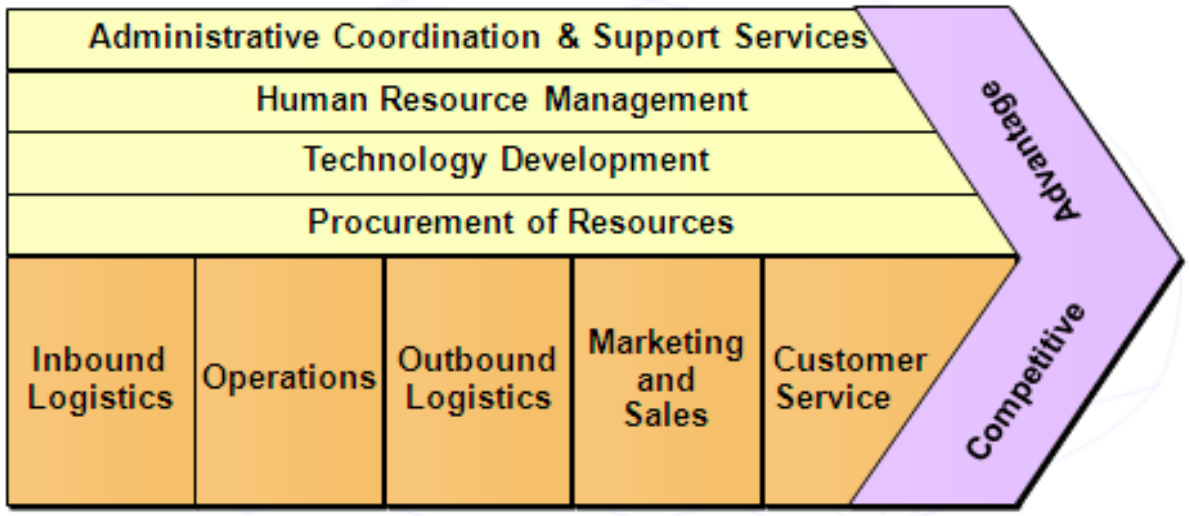
- Develop inter enterprise information systems whose convenience and efficiency create switching costs that lock in customers or suppliers.

- Make major investments in advanced IT applications that build barriers to entry against industry competitors or outsiders.

- Include IT components in products and services to make substitution of competing products or services more difficulty.

- Leverage investment in IS people, hardware, software, databases, and networks from operational uses into strategic applications.

3.d. Value chain



The *Value Chain Concept* developed by Michael Porter views a firm as a series of basic activities (the "chain") that add value to its products and services that support a profit margin for the firm. In the value chain concept, some business activities are primary activities and others support activities. For each activity, the role of strategic information systems (SIS) can contribute significantly to that activity's contribution to the value chain:

Support Activities. Support activities create the internal infrastructure that provides direction to and support for the specialized work of primary activities:

- Management and Administrative Services. The key role of SIS here is in automated office systems.
- Human Resources Management. SIS role: Employee Skills Database.

- Technology Development. SIS role: Computer-Aided Design.
- Procurement of Resources. SIS role: EDI with suppliers.

Primary Activities. These activities directly contribute to the transformation process of the organization.

- Inbound Logistics. SIS role: Automated Warehousing, JIT.
- Operations. SIS role: Computer-Aided Manufacturing.
- Outbound Logistics. SIS role: Online Data Entry.
- Marketing and Sales. SIS role: Market Analysis.
- Service. SIS role: Diagnostic Expert System.

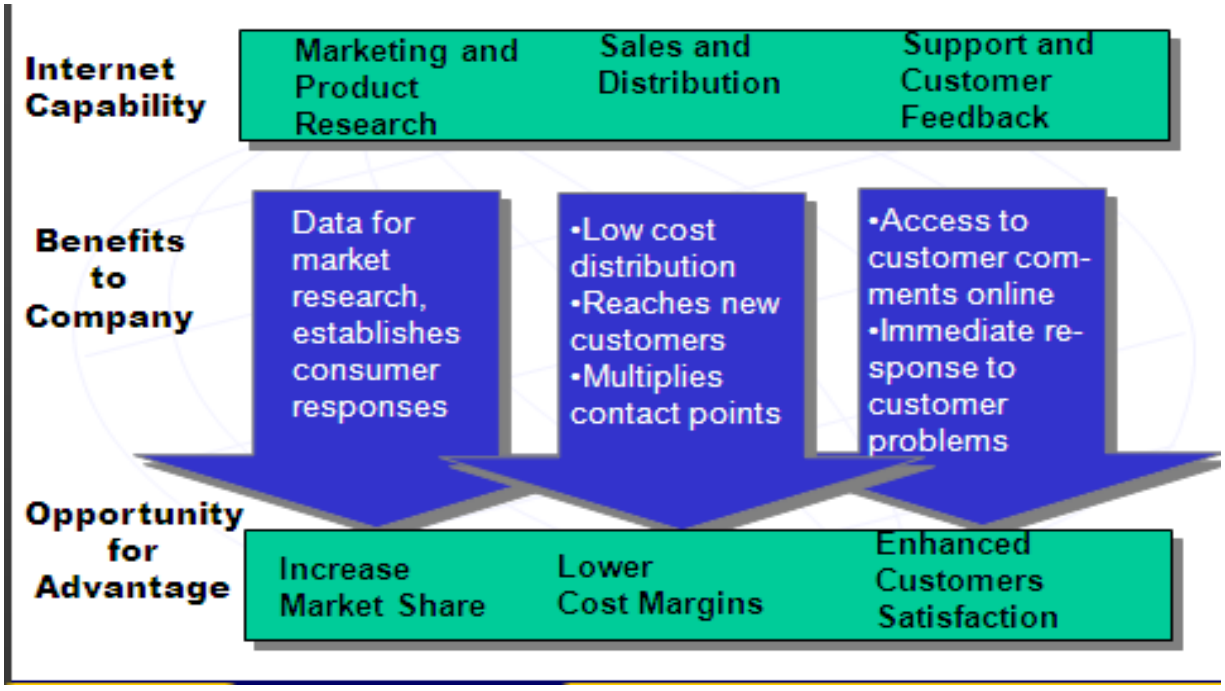


Fig. Internet value chain

Value chains can be used to strategically position a company's Internet-based applications to gain competitive advantage.

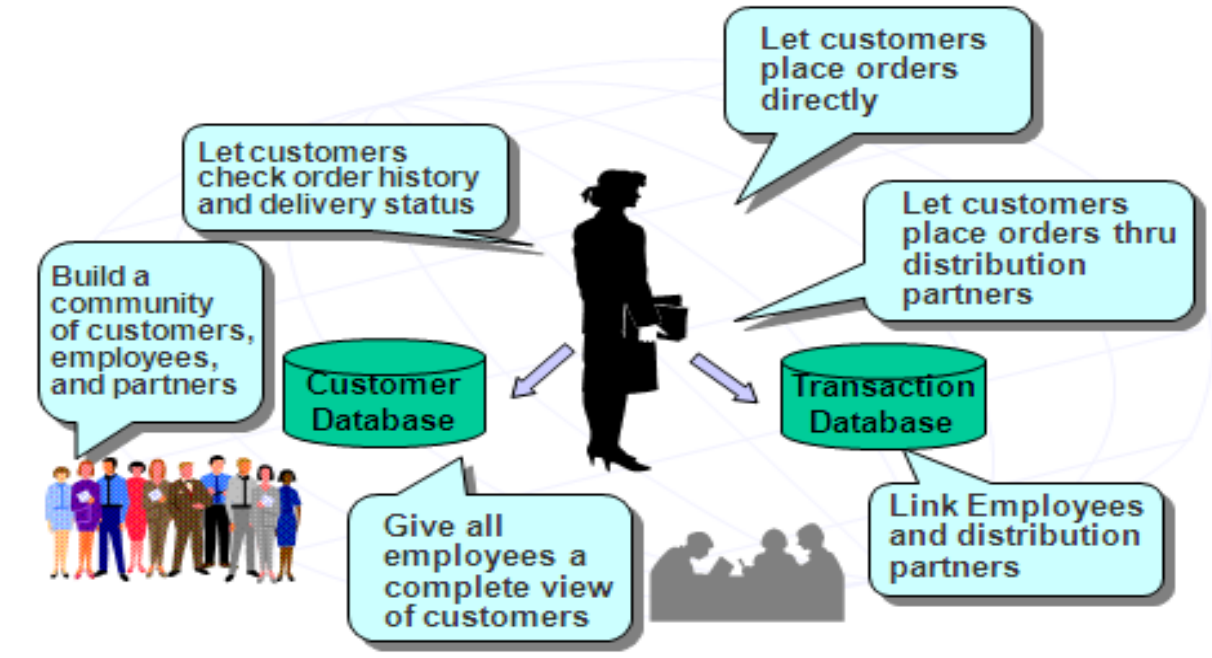
1. This value chain model outlines several ways that a company's Internet connections with its customers could provide business benefits and opportunities for competitive advantage.
Example: Company-managed Internet newsgroups, chat rooms, and e-commerce websites are powerful tools for market research and product development, direct sales, and customer feedback and support.

2. Company Internet connections with its suppliers could be used for competitive advantage.
Example: Online auctions and exchanges at suppliers' e-commerce websites and online shipping, scheduling, and status information at an e-commerce portal that gives employees immediate access to up-to-date information from a variety of vendors. This can substantially lower costs, reduce lead times, and improve the quality of products and services.

Conclusion:

- Value chain concept can help you decide where and how to apply the strategic capabilities of information technology.
- Value chain shows various types of information technologies that might be applied to specific business processes to help a firm gain competitive advantages in the marketplace.

3. e. Customer focused e-business



There are other key strategies enabled by IT that can be used to enable a business to become successful and to maintain their success. These will be discussed on the next slides.
A key strategy for becoming a successful e-business is to maximize **customer value**. This strategic focus on customer value recognizes that quality rather than price becomes the primary determinant in a customer's perception of value. **A Customer-Focused e-business, then, is one that uses Internet technologies to keep customer loyal by anticipating their future needs, responding to concerns, and providing top quality customer service.**

As the slide indicates, such technologies like intranets, the Internet, and extranet websites create new channels for interactive communications within a company, with

customers, and with suppliers, business partners, and others in the external business environment. Thereby, encouraging cross-functional collaboration with customers in product development, marketing, delivery, service and technical support.

A successful Customer-Focused e-business attempts to 'own' the customer's total business experience through such approaches as:

- Letting the customer place orders directly, and through distribution partners
- Building a customer database that captures customers' preferences and profitability, and allowing all employees access to a complete view of each customer.
- Letting customers check order, history and delivery status. Nurturing an online community of customers, employees, and business partners.

Information Systems Architecture
&
Telecommunication

4. a. Overview of Hardware

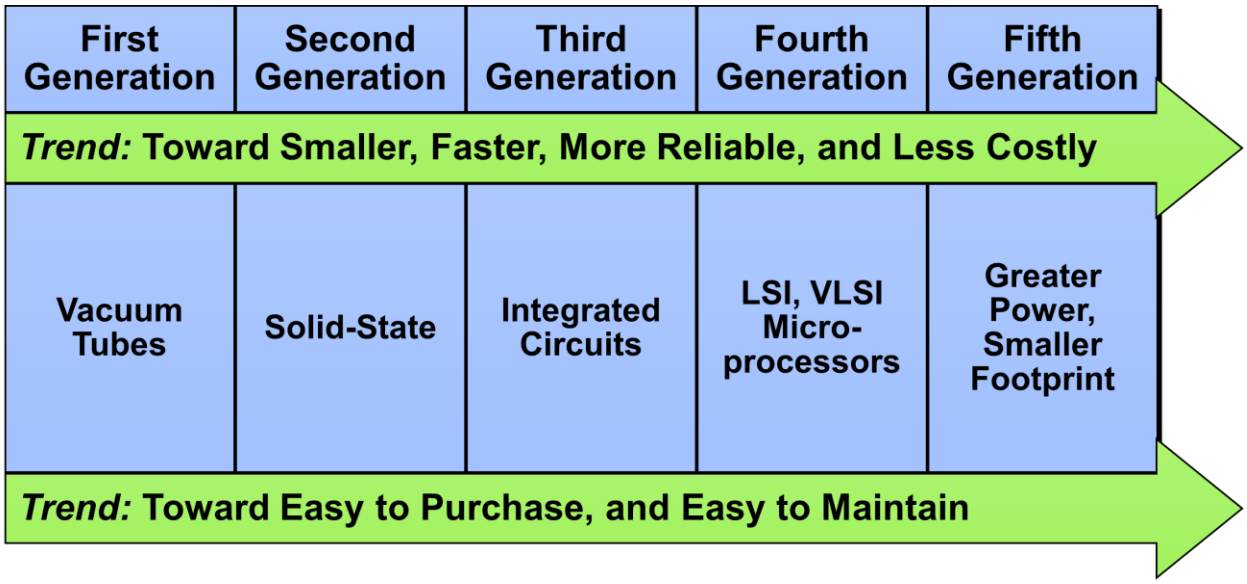


Fig. Generations of computer (Microprocessor)

What is a computer system? A computer system is an interrelated combination of components performing specialized functions to provide end users with a powerful information-processing tool.

Computers have radically changed from their early beginnings. As the figure indicates, the…

First Generation. First generation computers (1951-1958) used hundreds or thousands of vacuum tubes for their processing and memory circuitry. These were room size computers that generated a great deal of heat requiring large air conditioning and maintenance support.

Second Generation. Second generation computers (1959-1963) used transistors and other solid-state semiconductor devices wired to circuit boards. Magnetic cores were used for

memory and removable magnetic disk packs and magnetic tape were used for secondary storage.

Third Generation. Third generation computers (19654–1979) began using integrated circuits consisting of thousands of transistors and other circuit elements etched on tiny chips of silicon allowing for increased memory and processing speeds of several millions of instructions per second (MIPS).

Fourth Generation. Fourth generation computers (1979–present) use large scale integration (LSI) and very large scale integration (VLSI) that cram hundreds of thousands or millions of transistors and other circuit elements on each chip.

Fifth Generation. The next generation of computers should continue the trend toward more power, more speed, smaller size, and longer terms of service. Fifth generation computers may use superconductor circuits or other developing technologies to process and store information

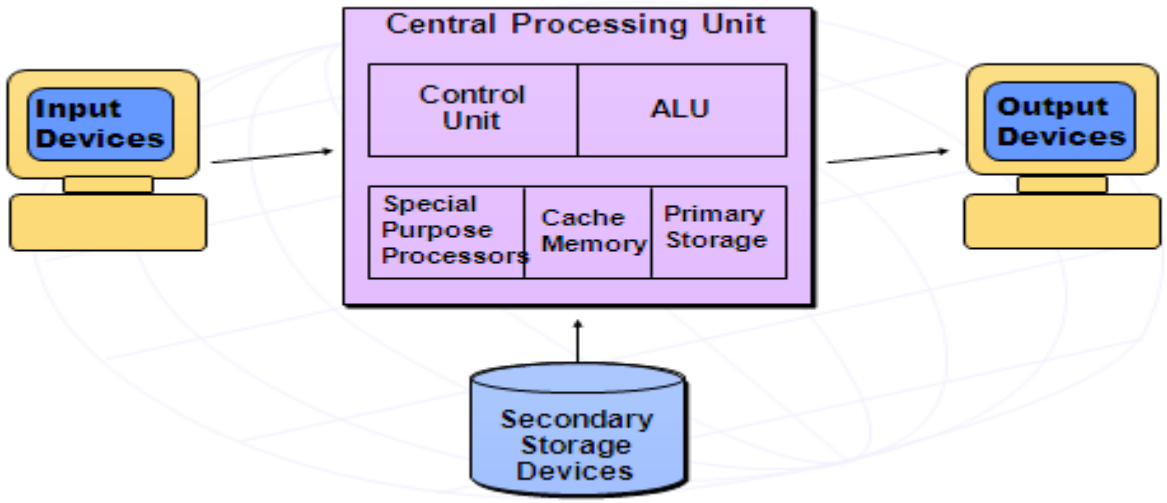


Fig. Computer System component

A computer system is an interrelated combination of components performing specialized basic functions to provide end users with a powerful information processing tool. Key functions include:

Input. The input devices of a computer system include keyboards, touch screens, pens, electronic "mice," optical scanners, and other peripheral hardware components that convert electronic data into electronic machine-readable form. Input may be direct entry (by the end user) or through telecommunications links.

Processing. The *central processing unit* (CPU) is the main processing component of a computer system. A key component of the CPU is the *arithmetic-logic unit* (ALU), which performs the arithmetic and logic functions required in computer processing.

Output. Output devices convert the electronic information produced by the computer system (binary or digital information) into human-intelligible form for presentation to end users. Output devices include video display units, printers, audio response units, and other peripheral hardware components specialized in this function.

Storage. Storage devices store data and programs instructions needed for processing. A computer's *primary storage* or memory is used to hold key information needed to run the computer while *secondary storage* (such as magnetic

disks and tape units) hold larger parts of programs used less frequently and the content files created by end users.

Control. The control unit of the CPU interprets computer program instructions and transmits directions to the other components of the computer system.

Fig. Input devices

Let's take a moment to review some of the more popular means and devices used for capturing input.

Keyboards. Are the most widely used devices for entering data and text.

Pointing Devices. Are widely used with operating systems that have a graphical user interface. They include a range of devices:

- Electronic mouse

- Trackball
- Pointing stick-- a small button-like device centered on a row above the keyboard in some notebook PCs.
- Touchpads-- rectangular touch-sensitive surface usually below the keyboard, found in notebook PCs
- Touch screens-- devices that allow you to use a computer by touching the face of its video display screen.
-

Pen-based Computing Devices. Are used in many handheld computers. These computers use special software to recognize and digitize handwriting and drawings using a stylus.

Speech Recognition Systems. Use software to digitize, analyze, and classify your speech and its sound patterns. Recognized words are then passed to your application software.

Optical Scanning. Are devices that read text or graphics and convert them into digital input. There are various types of optical scanning devices including:

- Desktop Scanners-- used with PCs to capture images
- Optical Character Recognition (OCR)-- reads special OCR characters and codes on documents

Magnetic Ink Character Recognition (MICR). Used by the banking industry to read checks. Uses special ink and a special reader to read bank and customer identification data written on the bottom of the check.

Magnetic Stripe. Uses a magnetic stripe on the back of cards to store up to 200 bytes of data. Data is read using a magnetic stripe reader.

Smart Cards. Embeds a microprocessor chip with several kilobytes of memory.

Digital Cameras. Enables you to capture and store still photos or full motion video in digital form.

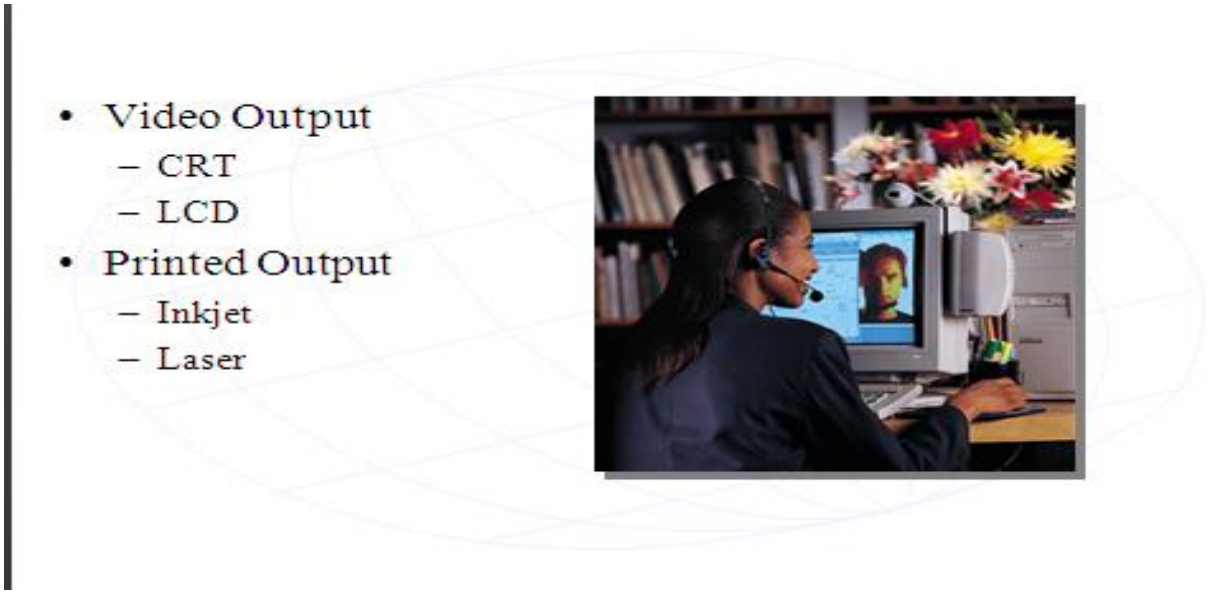


Fig. Output devices

Video displays and printed documents have been, and still are, the most common forms of output from computer systems. But other natural and attractive output technologies such as voice response systems and multimedia output are increasingly found along with video displays in business applications.

Video images can serve as input as well as output. TV signals or photographs can be digitized and used by the computer. Video displays are the most common type of computer output. Typical video displays include:

Cathode Rate Tube (CRT). Most video displays use a cathode ray tube technology similar to the picture tubes used in home TV sets. Although the clarity of the display is dependent upon the graphic capability of the computer, CRTs are capable of a very high level of clarity. This is especially important for graphics-intensive work needed in research and development and visual presentations.

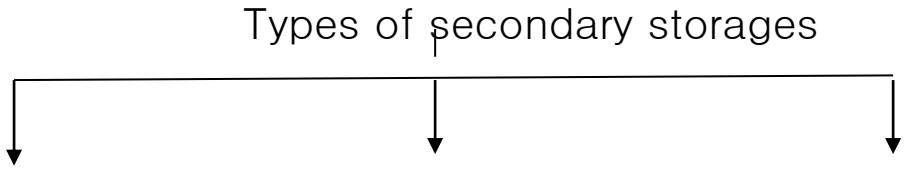
Liquid Crystal Displays (LCDs). LCDs are the same technology used in electronic calculators and digital watches. LCDs can be made small and require very little current to operate, making them ideal for portable devices.

Plasma Displays. Plasma displays are generated when electrically charged particles of gas are trapped between glass plates. These displays produce very high quality graphics on a flat service at faster speeds than LCDs. They are much more expensive than LCD output but necessary in portable computers that require very high resolution video output, such as full motion video and full color business presentations.

Printed output on paper is still the most common form of output after video displays.

Inkjet printers: spray ink onto a page one line at a time.

Laser printers: use an electrostatic process similar to a photocopying machine to produce many pages per minute of high-quality output.



Magnetic Storages Optical Storages
Semiconductor storages

Data and information need to be stored after input, during processing, and before output. The figure on the slide illustrates the speed, capacity, and cost relationships of several alternative primary and secondary storage media. High speed storage media cost more per byte and provide lower total capacities. Conversely, large-media storage is less expensive but slower. Storage media also differ in how they are accessed by the computer:

Direct Access. Primary storage media such as semiconductor memory chips and secondary storage devices like magnetic disks and optical disks have direct access. This means that any element of data can be directly stored and retrieved by the CPU by selecting and using any of the locations on the

storage media. Each location is unique and is available to the CPU independently of other stored elements.

Sequential Access. Sequential access storage media such as magnetic tape do not have unique storage addresses. Instead, data must be stored and retrieved using a sequential or serial process. Locating an individual item of data requires searching from the beginning of the sequence procedure through all of the data elements that proceed it in the sequence.

Semiconductor Memory. The primary storage of your computer is composed of microelectronic semiconductor memory chips. This includes specialized memory like external cache memory and flash memory. There are tow types of semiconductor memory:

- Random Access Memory (RAM). Volatile memory that can be sensed (read) and changed written).
- Read Only Memory (ROM). Nonvolatile memory that are used for permanent storage.

Magnetic Disk. The most common form of secondary storage consists of metal or plastic disks covered with an iron oxide recording material. Data are recorded on tracks in the form of magnetized spots to form binary digits. Electromagnetic read/write heads, positioned by access arms are used to read and write data. The two most popular forms of magnetic disks are *floppy disks* and *hard disks*.

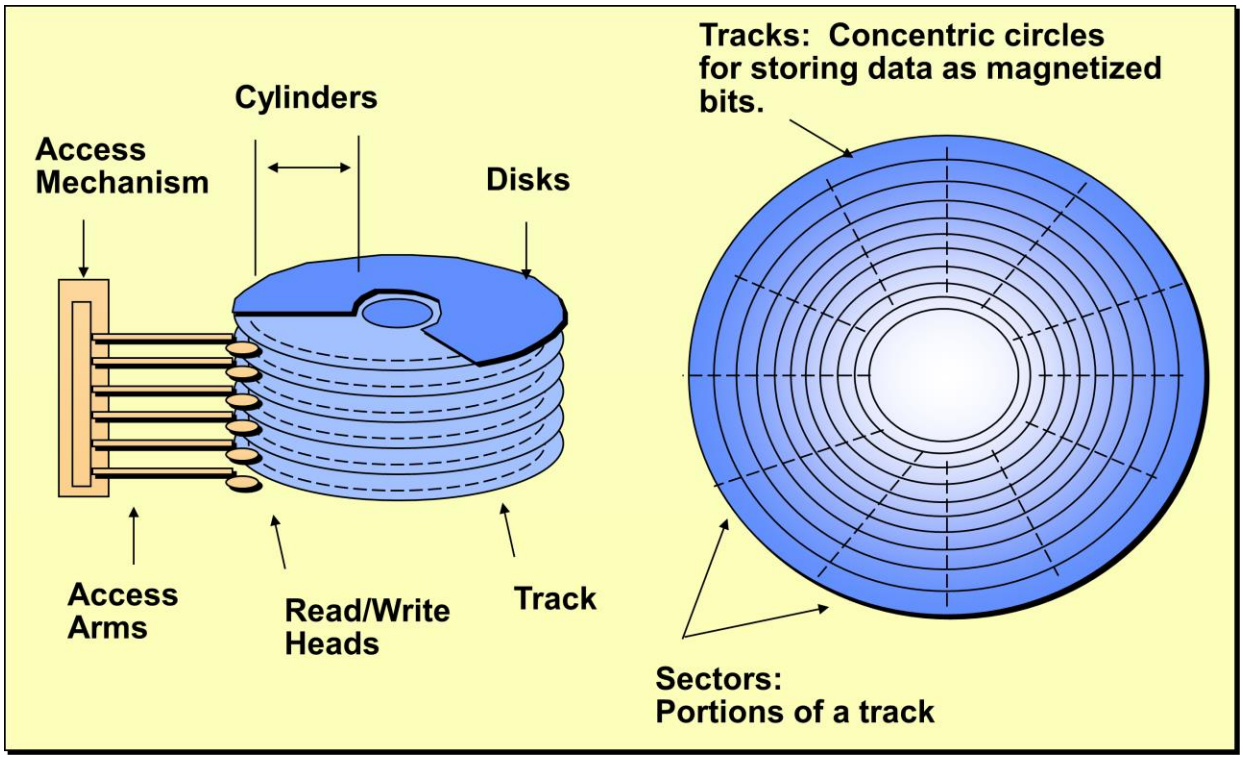


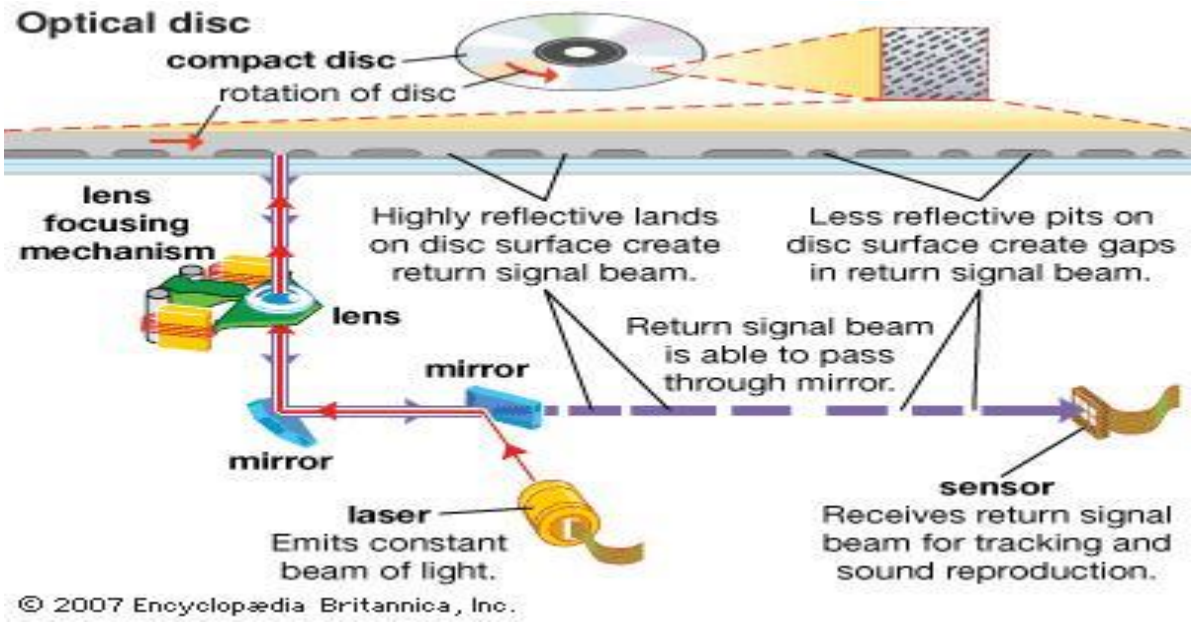
Fig. Hard disk

Magnetic Tape. Sequential access secondary storage that uses read/write heads within magnetic tape drives to read and write data in the form of magnetized spots on the iron oxide plastic coating of plastic tape. Magnetic tape devices include tape reels and cartridges in mainframes and midrange systems, and small cassettes or cartridges for PCs. Magnetic tape is most often used for archival storage and backup.

Optical Disk Storage. Are a popular storage medium for image processing that records data by using a laser to burn pits in a plastic disk and reads data by using a laser to read

the binary codes formed by those pits. There are several different types of optical disks.

- Compact Disk-Read Only Memory (CD-ROM)-- each disk can store more than 600MB.
- Compact Disk Recordable (CD-R)-- Enables users to record their own data once on a CD, and read the data indefinitely.
- Compact Disk Rewriteable (CD-RW)-- Enables users to record and erase (rewrite) data.
- Digital Video Disk (DVD)-- each disk can store from 3.0 to 8.5 GB of data on each side of a compact disk. It is expected that DVD will replace CD-ROM and CD-RW technologies.



On optical discs such as compact discs (CDs) and digital videodiscs (DVDs), information is stored as a series of lands, or flat areas, and pits. A laser assembly reads the spinning

disc, converting lands and pits into sequences of electric signals. When the beam hits a land, it is reflected onto a photodiode, which produces an electric signal. Laser beams are scattered by pits, so no signal is generated.

4.b. Software

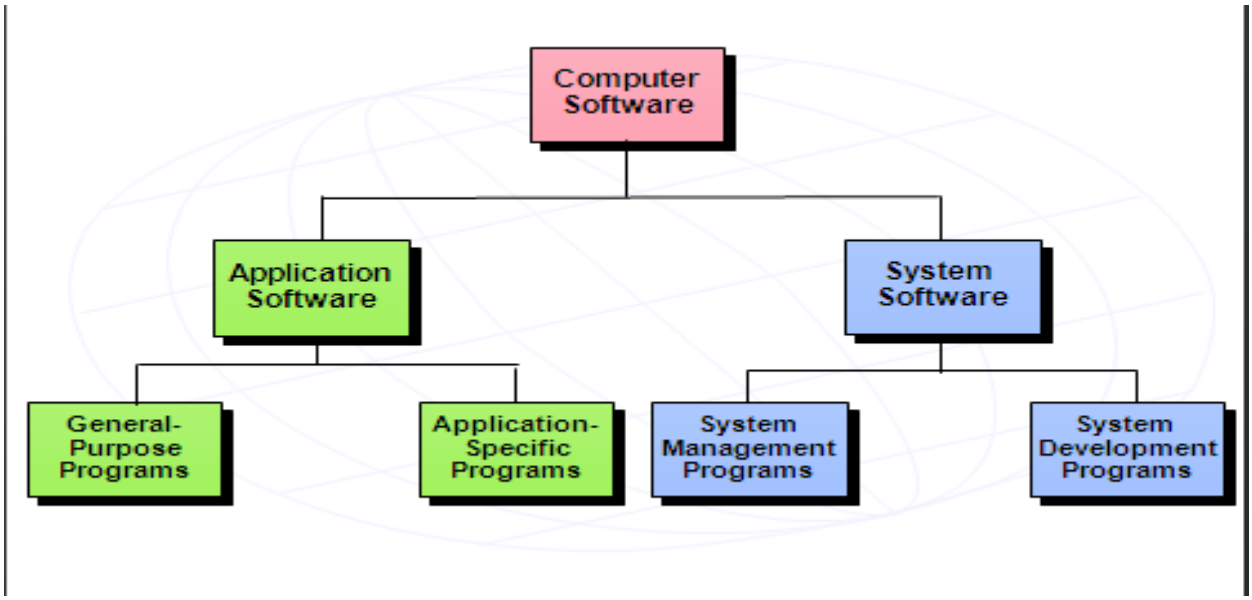


Fig. Categories of Computer Software

Information systems depend on software resources to help end users use computer hardware to transform data into information products. Software handles the input, processing, output, storage, and control activities of information systems. Computer software is typically classified into two major types of programs:

Systems Software. These are programs that manage and support the resources and operations of a computer system.

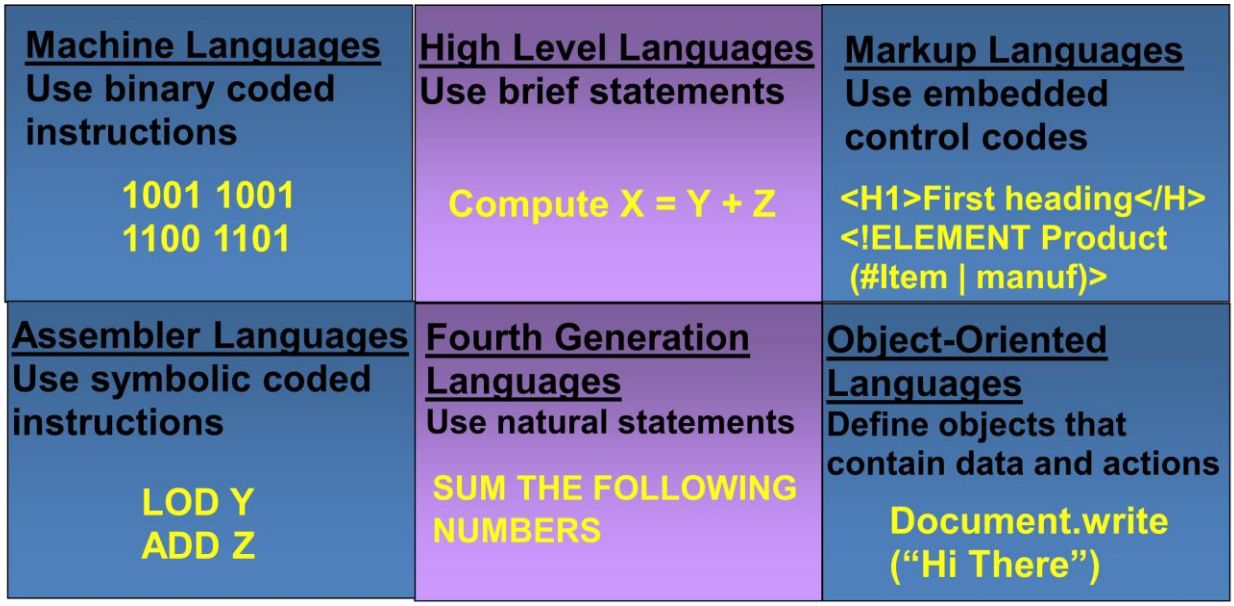
A. System Management Programs. These programs help run the hardware and communicate critical information throughout the IS. Examples are operating systems, operating environments (such as GUI interfaces), database management systems, and telecommunications monitors.

B. System Development Programs. These programs are used to build new application programs or specific information systems applications. Examples include programming language translators, programming environments, and CASE packages.

Applications Software. These are programs that direct the performance of a particular use, or application, of computers to develop specific information products by end users.

A. General-Purpose Application Programs. These programs allow end users to create a great many different information products within a general knowledge category. Examples include word processing, spreadsheets, database managers, graphics, and integrated packages.

B. Application-Specific Programs. These programs are dedicated to very
specific functions within a knowledge area. Examples include programs for accounting, generating marketing plans, or handling financing.



A programming language allows a programmer or end user to develop the set of instructions that constitute a computer program. Each programming language has its own unique vocabulary, grammar, and uses. The major categories of programming languages are identified on the slide and described below:

Machine Languages. Machine languages (or first-generation languages) are the most basic level of programming languages. These use binary codes unique to the computer, requiring programmers to have a detailed knowledge of the specific CPU they wish to write software for.

Assembler Languages. Assembler languages (or second-generation languages) reduce the difficulties in writing language code by using translator programs (assemblers) that convert the symbolic language of the code into machine language.

High-Level Languages. High-level languages (or third-generation languages) use instructions, called statements that closely resemble human language or the standard notation of mathematics. They are translated into machine language by compilers or interpreters.

Fourth-Generation Languages. Fourth-generation languages describe a variety of programming languages that are more nonprocedural and conversational than previous languages. Nonprocedural languages have programmers specify the results they want while the program works with the computer to determine the sequence of instructions that will accomplish those results.

Object-Oriented Languages. Object-oriented programming (OOP) ties data and instructions together into objects that can be combined in many different ways with other objects to create programs. Unlike procedural languages, OO systems objects tell other objects to perform actions on themselves. Thus, objects are more efficient and can be reused to create new programs. *Java* is an example of an OOP, which is specifically designed for real-time, interactive, web-based network applications. What makes Java so special is that it is computing platform independent. This means that any computer and any operating system anywhere in a network can execute Java programs.

HTML. Is a page description language that creates hypertext or hypermedia web documents. HTML embeds control codes, or tags, in the ASCII text of a document. These tags

are used to designate titles, headings, graphics, multimedia components, as well as hyperlinks within the document.

XML. Unlike HTML, XML describes the content of web pages by applying identifying tags or contextual labels to the data in web documents. By classifying data in this way, an XML website's information is more searchable, sortable, and easier to analyze.

4. c. Telecommunication

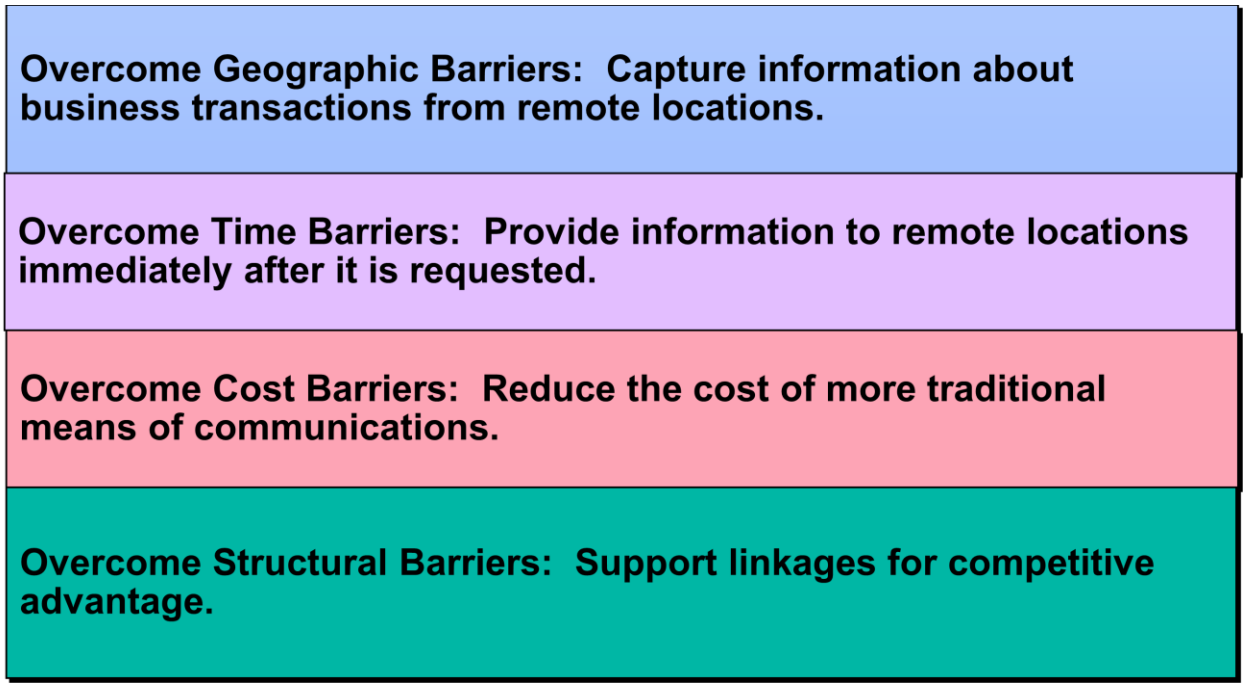


Fig. Telecommunication capabilities

The figure of the slide outlines the four major strategic capabilities of information technology:

Time Barriers. Strategic use of information systems helps overcome time barriers by focusing on interval reduction and just-in-time operations. The goal is to shorten the response time to customer demands and reduce inventory investment to a minimum. Operating in real time means no time lag between the identification and fulfillment of a need.

Geographic Barriers. Telecommunications and computing technologies make it possible to distribute key business activities to where they are needed most, where they are best performed, or where they best support the competitive advantage of a business. Telecommunication networks allow instantaneous access to all members and resources of the organization, however remote, so that the best combination of talent and ability can be brought to bear on problems or opportunities.

Cost Barriers. Information systems help reduce costs in many areas: production, inventory, distribution, or communications. For example, decentralized decision making can be combined with centralized implementation of those decisions for greater economy without sacrificing the efficiency of the process.

Structural Barriers. Structural barriers in business include traditional constraints in how business is conducted (such as hours of operation and labor costs) and the processing time various firms in a channel of distribution take to act on customer demand. An IS can extend hours of operation (example: automatic teller machines at banks), service support (example: 24 hour customer support for software

products), and improve distribution (example: EDI between manufacturers and suppliers, or wholesalers and retailers).

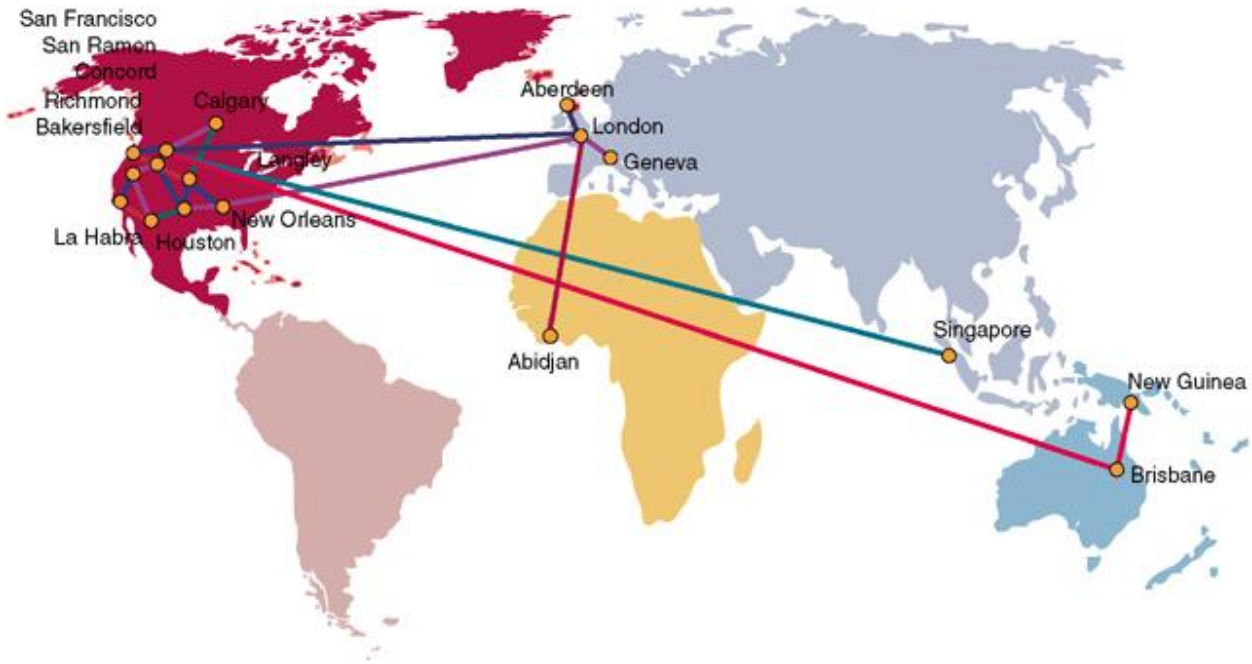


Fig. WAN

Wide Area Networks (WAN) cover a large geographic areas. Networks that cover a large city or metropolitan area (MAN) are also included in this category. Such large networks have become a necessity for carrying out the day-to-day activities of many business and government organizations and their end users.

Example: WANs are used by many multinational companies to transmit and receive information among their employees, customers, suppliers, and other organizations across cities, regions, countries, and the world.

Local Area Networks (LAN) connect computers and other information processing devices within a limited physical area, such as an office, classroom, building, manufacturing plant, or other work site. LANs have become commonplace in many organizations for providing telecommunications network capabilities that link end users in offices, departments, and other workgroups.

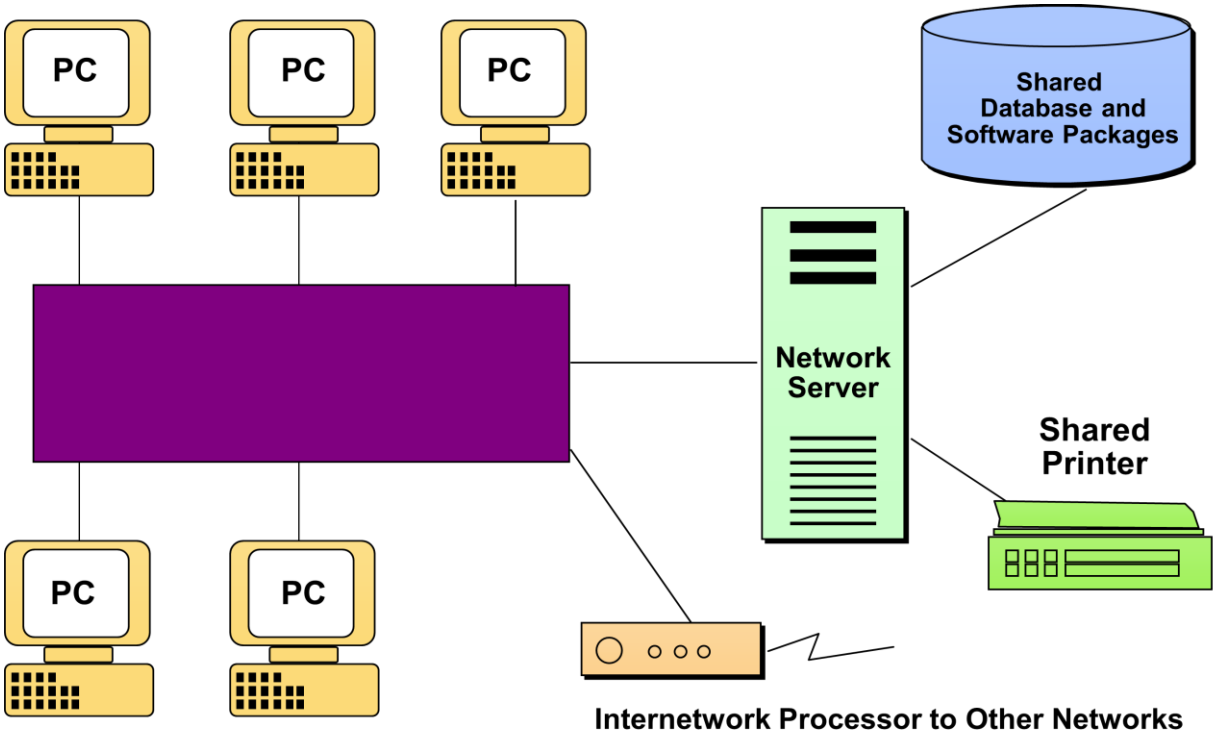


Fig.LAN

Local Area Networks (LANs) connect computers and other information processing devices within a limited physical area, such as an office, a building, or work site. LANs use a variety

of telecommunications media. Key concepts and components of LANs include:

Network Interface Card. PCs on a network must have a circuit board installed to handle the network interface. This is the typical way of expanding PC capability.

Network Server. As mentioned earlier, this is a dedicated PC with a large hard disk capacity for secondary storage. Many servers also have more RAM than the individual workstations on the network.

Network Operating System. Just as individual PCs have their own operating systems, the network operating system controls the interface between users and machine hardware as well as the telecommunications peripherals linking them.

Internetworks. Most LANs are connected via telecommunications to other networks, which might be other LANs, wide area networks (WANs), mainframes, or very large networks like the Internet.

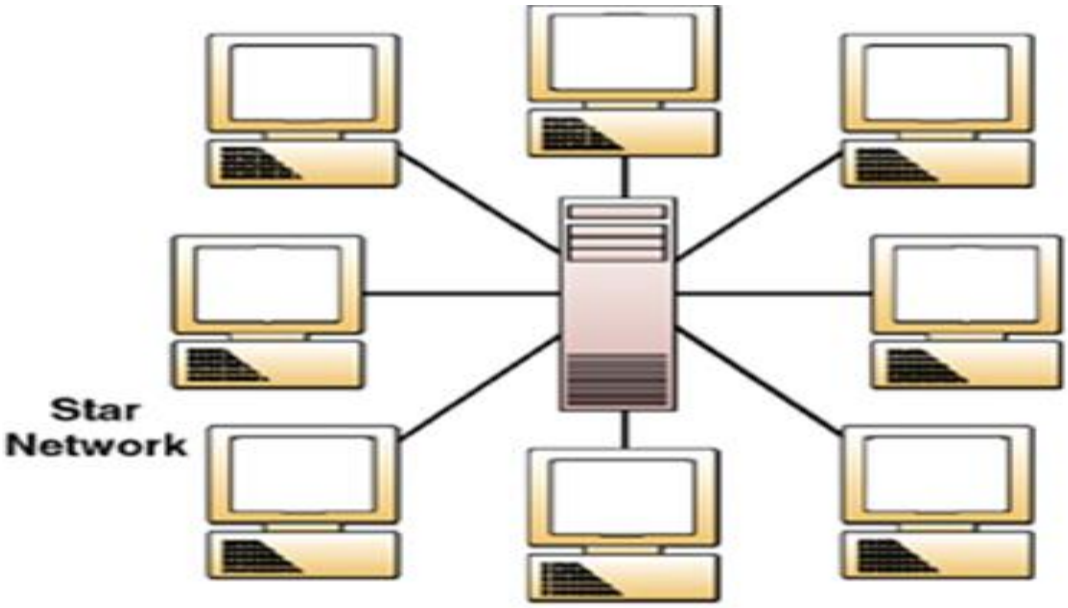
Network topology is the arrangement of the various elements (links, nodes, etc.) of a computer.

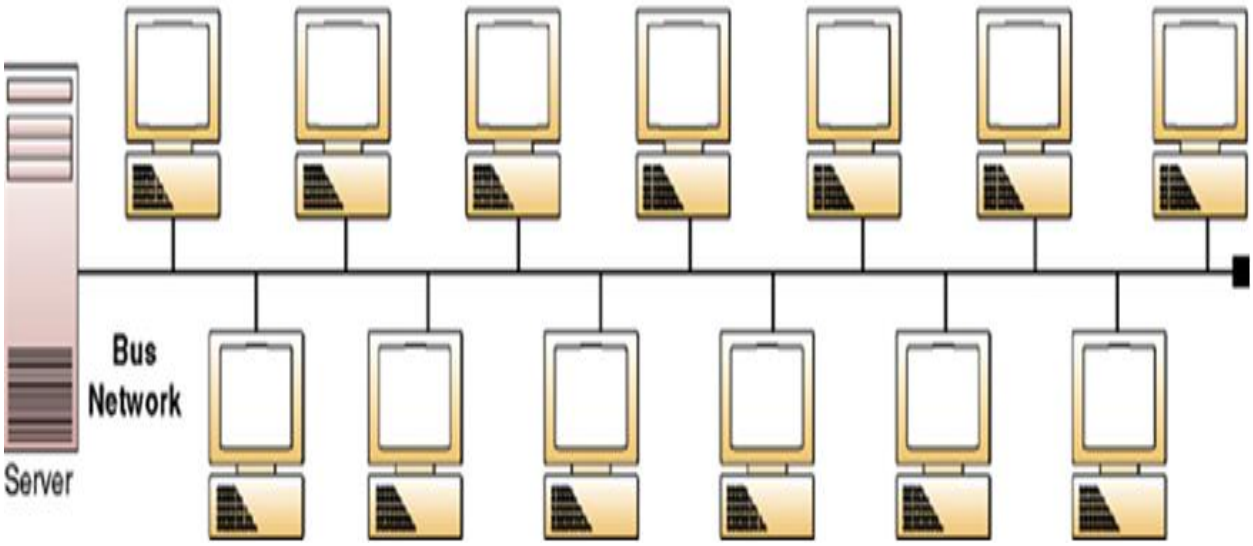
Physical **topology** refers to the placement of the network's various components, including device location and cable installation, while

Logical **topology** shows how data flows within a network, regardless of its physical design.

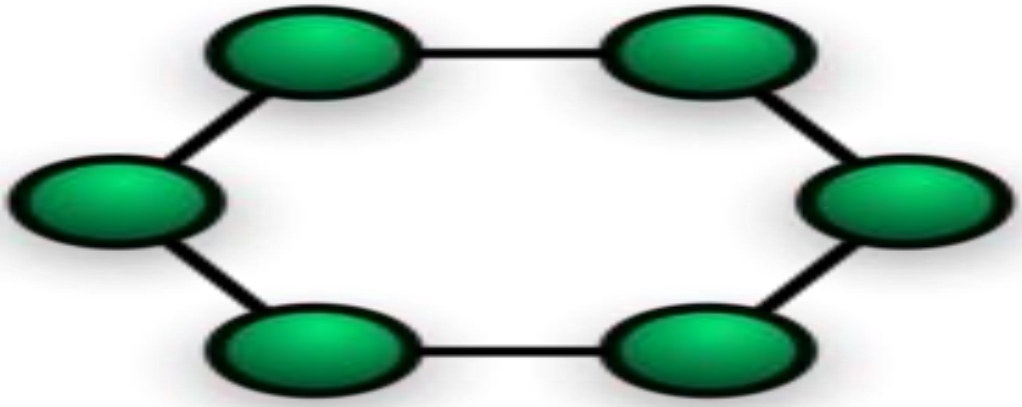
There are several basic types of network topologies, or structures, in telecommunications networks. Three basic topologies used in wide area and local area telecommunications networks are:

1. Star: A star network ties end user computers to a central computer.
2. Ring: A ring network ties local computer processors together in a ring on a more equal basis.
3. Bus: A bus network is a network in which local processors share the same bus, or communications channel.

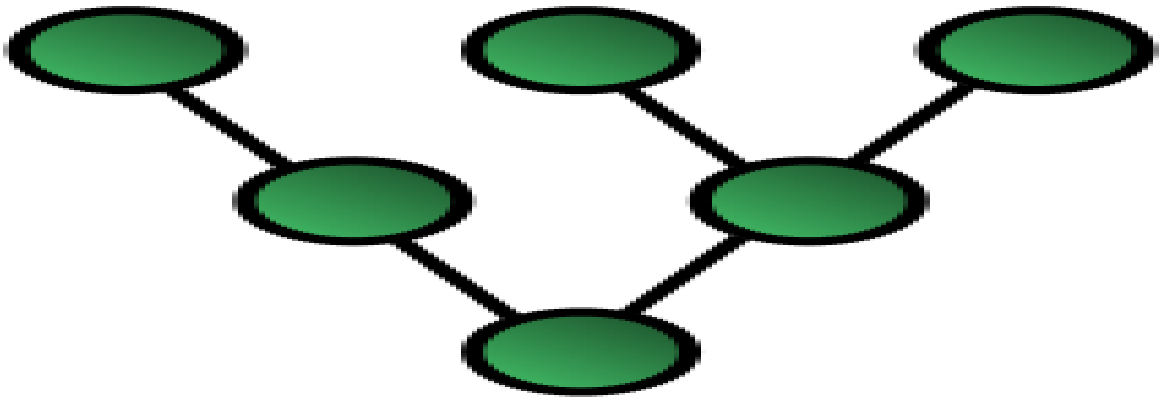




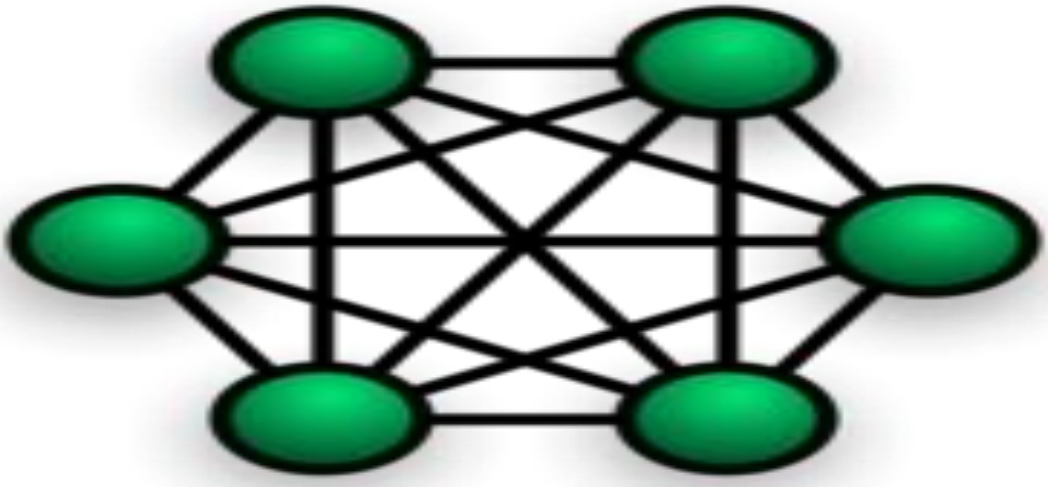
Ring



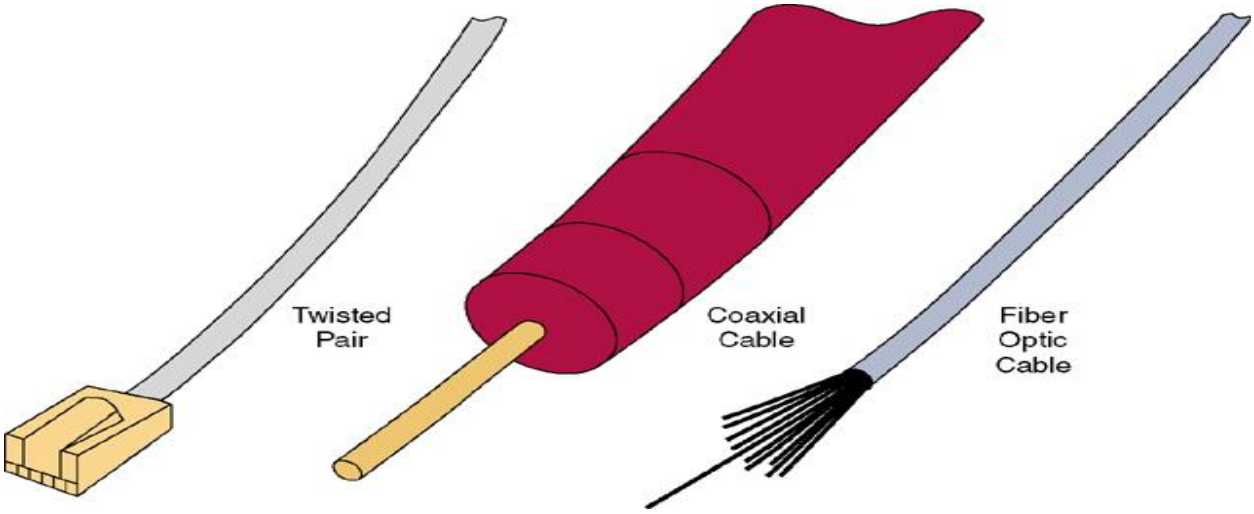
Tree



Mesh



Telecommunications Communication Media 1. Twisted Pair, 2. Coaxial Cable 3. Fiber Optics 4.Terrestrial Microwave



Telecommunications channels make use of a wide variety of media. In some cases, the media are complementary and the use of more than one media increases the functions and features of the telecommunications network. In other cases, the media are in direct competition with each other, hoping to capture customers from other media choices.

Discussion Note: The dual nature of telecommunications has implications yet to be resolved for open systems architecture.

Some major types of telecommunications media include:

Twisted-Pair Wire. This is the traditional phone line used throughout the world. It is the most widely distributed telecommunications media but is limited in the amount of data and speed of transmission.

Coaxial Cable. This is a sturdy copper or aluminum wire wrapped in spacers to insulate and protect it. Coaxial cable can carry more information and at higher speeds than twisted

pair wires. It also is a higher-quality carrier, with little interference.

Fiber Optics. These are hair-thin glass filaments spun into wires and wrapped in a protective jacket. Fiber optics transmit light pulses as carriers of information and so are extremely fast and produce no electromagnetic radiation. This makes them extremely reliable channels, although splicing cables for connections is difficult.

Terrestrial Microwave. Earthbound microwave radiation transmit high-speed radio signals in line-of-sight paths between relay stations..

Fig. Microwave

Communications Satellites. Satellites in geosynchronous orbit are used to transmit microwave signals to any place on earth using dish antennas for sending and receiving.

Cellular Radio. Low power transmitters on each cell of the system allow users to take advantage of several frequencies for communications.

Wireless LANs. Using radio or infrared transmission, some LANs are completely wireless, thus eliminating the cost of installing wire in existing structures.

Fig. Wireless LAN

Architectures

Distributed Systems

Distributed computing also refers to the use of distributed systems to solve computational problems. In *distributed computing*, a problem is divided into many tasks, each of which is solved by one or more computers,[3] which communicate with each other by message passing.

Distributed programming typically falls into one of several basic architectures: client–server, three–tier, *n*–tier, or peer–to–peer; or categories: loose coupling, or tight coupling.

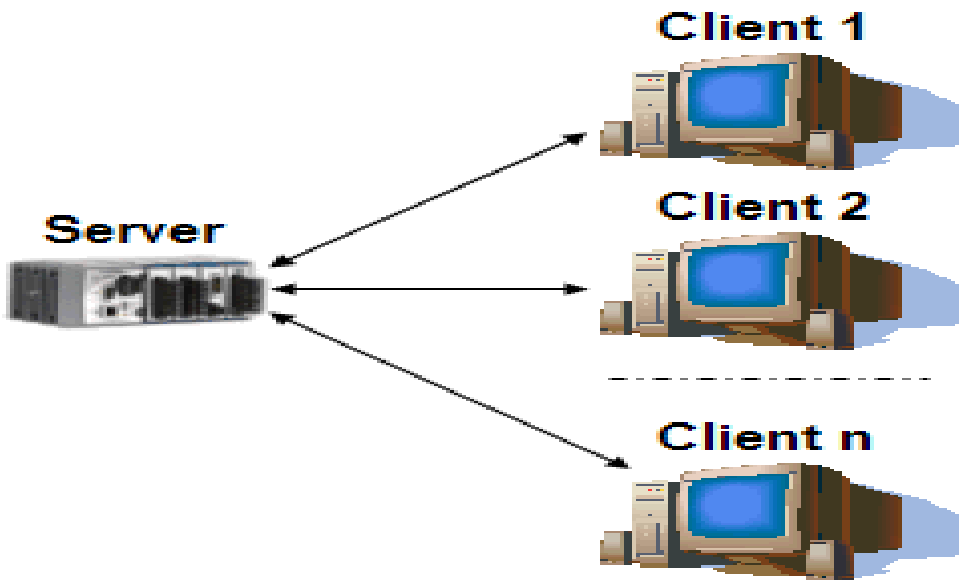


Fig. Client Server architecture

Client Server architecture

A network is a system of microcomputers linked together with telecommunications hardware and software. Networked computers draw additional computing power from the other computers on the network, which can include other microcomputers, minicomputers, and mainframes. Key concepts of networked computing include:

Client. A client on a network is typically a microcomputer that serves an end user for most of her or his processing needs. Programs for the client and extra processing capacity are provided as needed by the network.

Server. A server is a host or central computer that is dedicated to managing the logistics of routing data, information, and processing capacity among the clients on the system. In small networks, the server might be a single

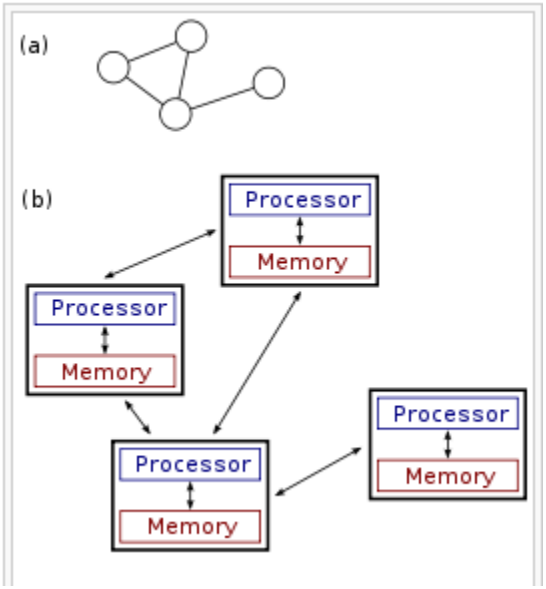
PC. On larger networks, the server can be a minicomputer or a mainframe. In very large organizations, several networks might be served, each by their own minicomputer, which in turn, is linked to the host mainframe.

Network Computers. Provide a browser-based user interface for processing small applications programs called applets. Thin clients include network computers, Net PCs and other low-cost network devices or information appliances. Application and database servers provide the operating system, application software, applets, databases, and database management software needed by the end users in the network.

Network computing is sometimes called a three-tier client/server model, since it consists of thin clients, application servers, and database servers.

Peer to Peer Distributed architecture

A collection of autonomous computers
a) linked by a network
b) using software to produce an integrated computing facility



Peer-to-Peer System : The term peer-to-peer is used to describe distributed systems in which labour is divided among all the components of the system. All the computers send and receive data, and they all contribute some processing power and memory. As a distributed system increases in size, its capacity of computational resources increases. In a peer-to-peer system, all components of the system contribute some processing power and memory to a distributed computation.

Key characteristics of distributed system

Resource Sharing
Resource:
- hardware – disks and printers
- software – files, windows, and data objects

Hardware sharing for:
- convenience
- reduction of cost

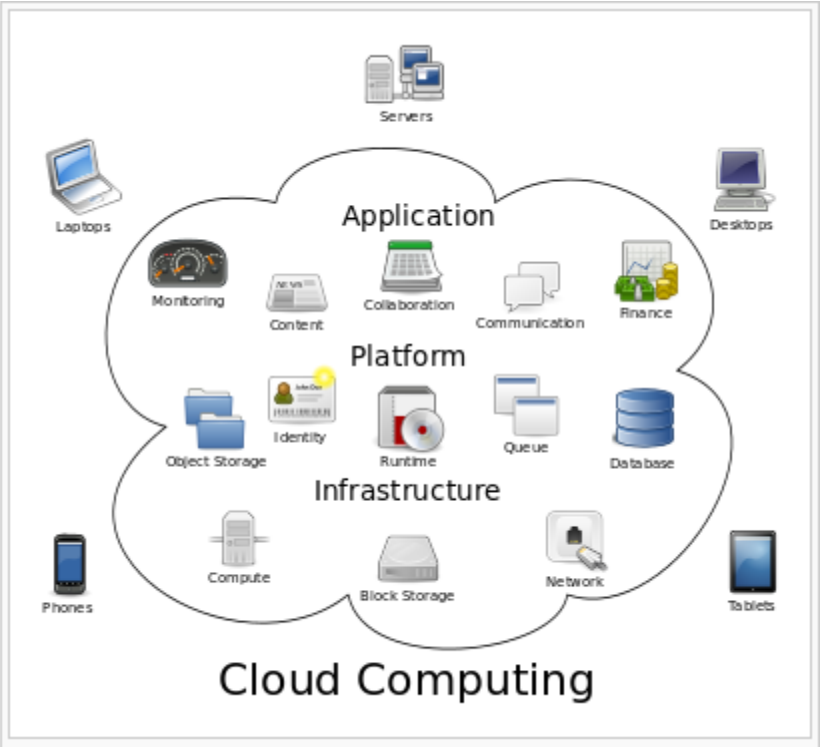
Data sharing for:
- consistency – compilers and libraries

exchange of information – database
cooperative work – groupware

Concurrency
Multi-programming
Multi-processing

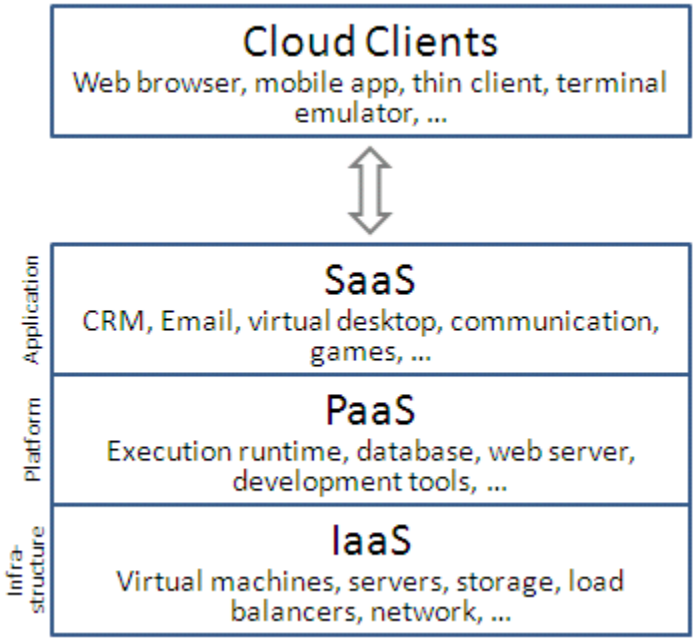
Cloud Computing

Cloud computing involves deploying groups of remote servers and software networked that allow centralized data storage and online access to computer services or resources.



Infrastructure as a service (IaaS)

IaaS clouds often offer additional resources such as a virtual-machine disk image library, raw block storage, and file or object storage, firewalls, load balancers, IP addresses, virtual local area networks (VLANs) and software bundles.



Telecommunications Processors and Software

- Modems
- Multiplexers
- Internetwork Processors
  - Switches
  - Routers
  - Hubs
  - Gateways

- Fire walls
- Network Operating System
- Telecommunications Monitor
- Middleware
- Network Management Software

Modem (Modulator–DEModulator). A device that converts the digital signals from input/output devices into appropriate frequencies at a transmission terminal and converts them back into digital signals at a receiving terminal.

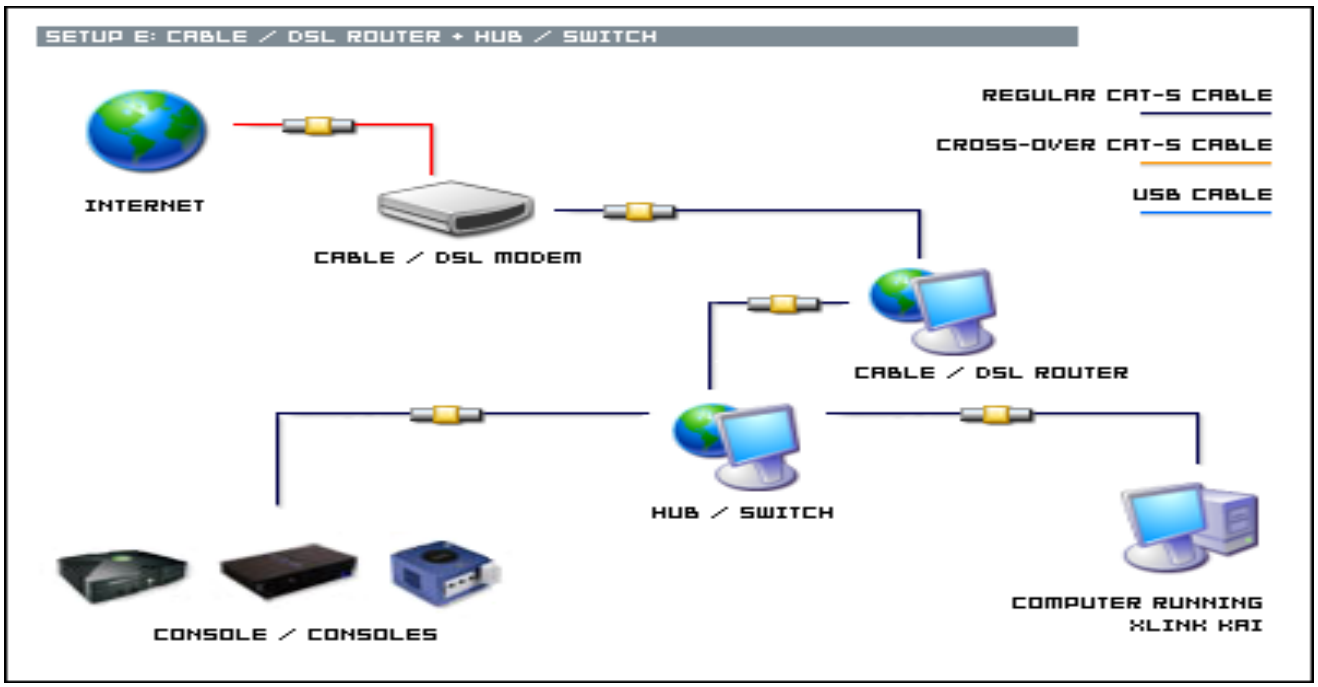
Multiplexer: An electronic device that allows a single communications channel to carry simultaneous data transmission from many terminals.
Internetwork Processors: Communications processors used by local area networks to interconnect them with other local area and wide area networks. Examples include switches, routers, hubs, and gateways.

The router forwards data packets along networks. It is connected to at least two networks, commonly two LANs or WANs or a LAN and its ISP's network. A network router is quite different from a switch or hub since its primary function is to route data packets to other networks, instead of just the local computers. Essentially, a router bridges the gap between other networks and gives your network access to more features, e.g., a firewall, traffic monitoring and more.

In networks the switch is the device that filters and forwards packets between LAN segments. When a switch receives a

packet of data, it determines what computer or device the packet is intended for and sends it to that computer only. It does not broadcast the packet to all computers as a hub does which means bandwidth is not shared and makes the network much more efficient.

A hub is a common connection point for devices in a network A network hub is designed to connect computers to each other with no real understanding of what it is transferring



Fire wall: Computers, communications processors, and software that protect computer networks from intrusion by screening all network traffic and serving as a safe transfer point for access to and from other networks.

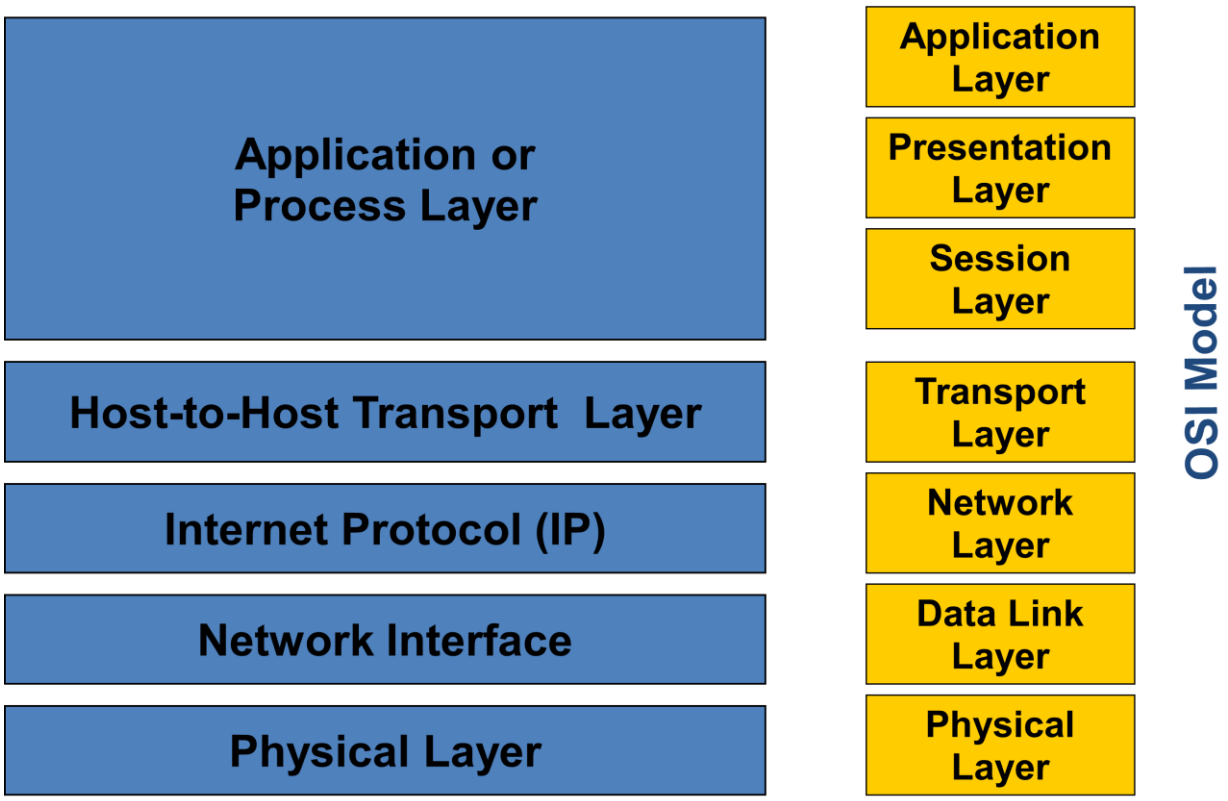
Network Operating System: Is a program that controls telecommunications and the use and sharing of network resources.

Telecommunications Monitor: Computer programs that control and support the communications between the computers and terminals in a telecommunications network.

Middleware: Software that helps diverse networked computer systems work together, thus promoting their interoperability.

Network Management Software: Software packages such as network operating systems and telecommunications monitors used to determine transmission priorities, route (switch) messages, poll terminals in the network, and form waiting waiting lines (queues) of transmission requests

The Internet's TCP/IP



The International Standards Organization (ISO) has developed a seven-layer Open Systems Interconnection (OSI) model to serve as a standard model for network architecture.

Application Layer. This layer provides communications services for end user applications.

Presentation Layer. This layer provides appropriate data transmission formats and codes.

Session Layer. This layer supports the accomplishment of telecommunications sessions.

Transport Layer. This layer supports the organization and transfer of data between nodes in the network.

Network Layer. This layer provides appropriate routing by establishing connections among network links.

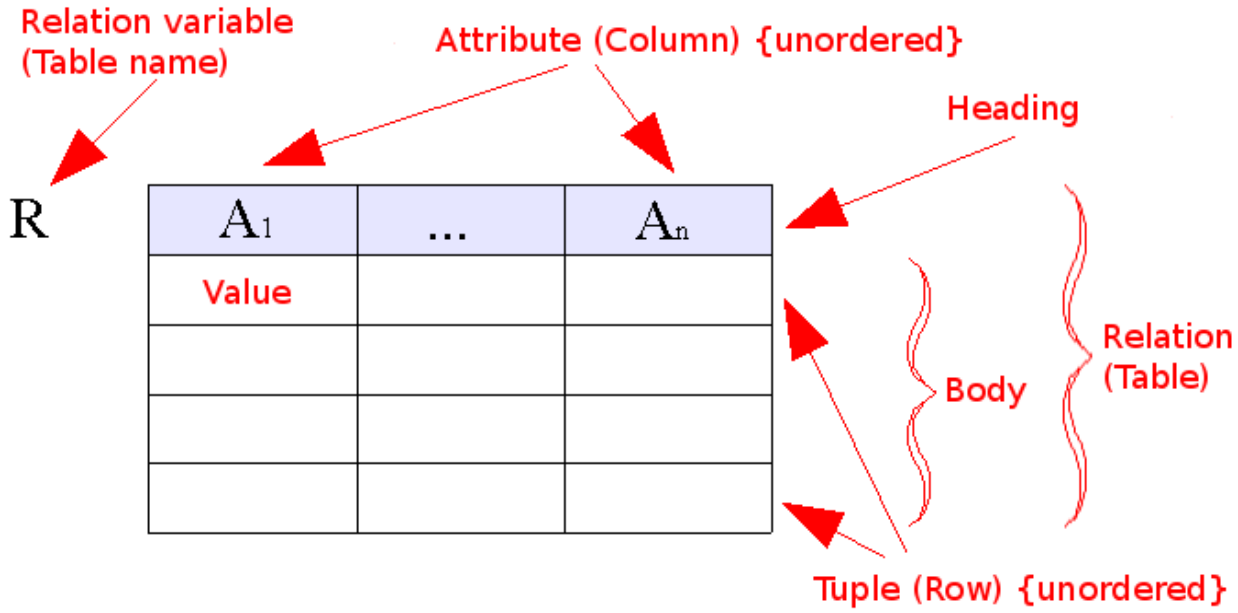
Data Link Layer. This layer supports error free organization and transmission of data in the network.

Physical Layer. This layer provides physical access to the telecommunications media in the network.

Data Base Management Systems

A **database management system (DBMS)** is system software for creating and managing databases. TheDBMS provides users and programmers with a systematic way to create, retrieve, update and manage data.

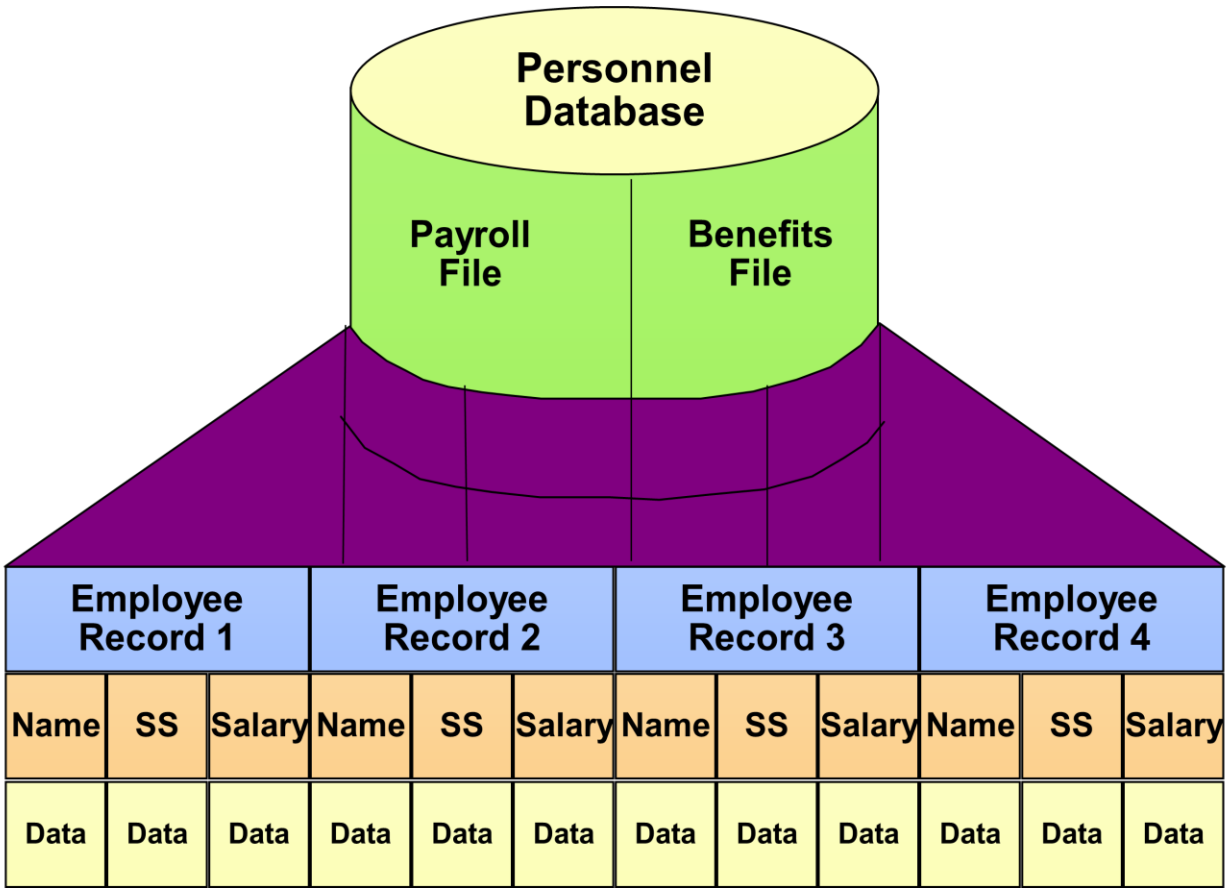
The **relational model (RM)** for **database** management is an approach to managing data using a structure and language consistent with **first-order predicate logic**, first described in 1969 by **Edgar F. Codd**, where all data is represented in terms of tuples, grouped into **relations**. A database organized in terms of the relational model is a **relational database**.



Customer table

Customer ID	Tax ID	Name	Address	[More fields…]
1234567890	555-5512222	Munmun	323 Broadway	…
2223344556	555-5523232	Wile E.	1200 Main Street	…

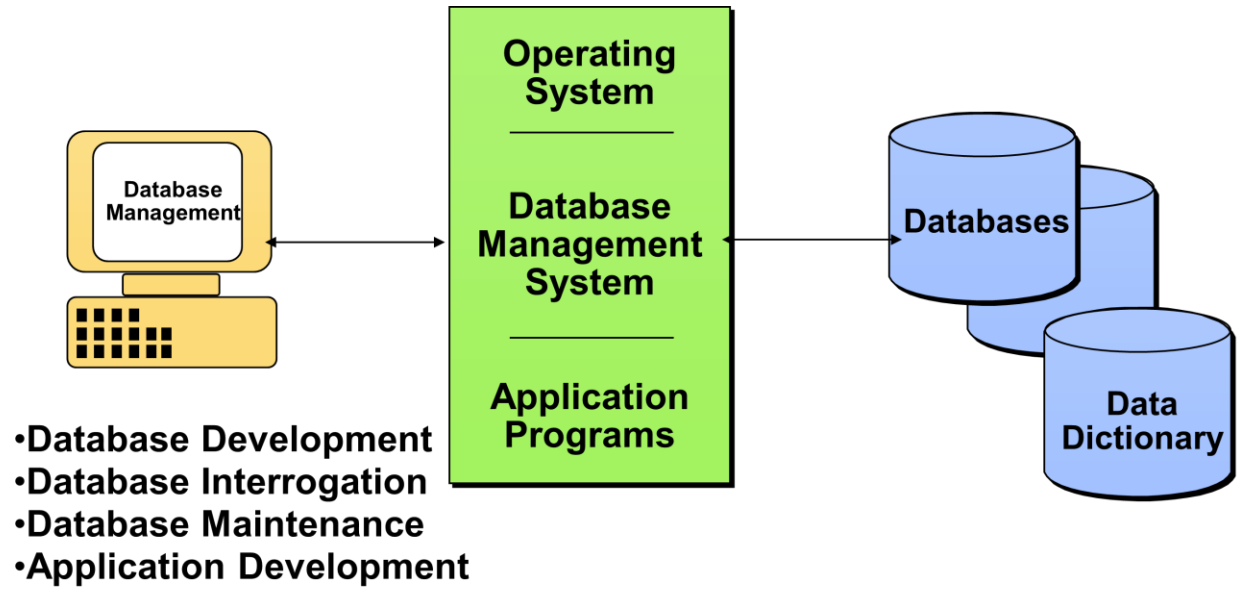
3334445563	555-5533323	Ekta	871 1st Street	…
4232342432	555-5325523	E. F. Codd	123 It Way	…



- To understand databases, it is useful to remember that the elements of data that make up the database are divided into hierarchical levels. These logical data elements make

up the foundation data concepts upon which a database is built.

- Character. The most basic logical element is the character, which consists of a single alphabetic, numeric, or other symbol. While it may take several bits or bytes to represent a character digitally, remember that these refer to physical storage, not the logical concept of the character itself.
- Field. A field is a grouping of characters that represent a characteristic of a person, place, thing, or event. A person's name is typically placed in a field. A field is a data item. A data field represents an attribute or some entity.
- Record. A record is a collection of interrelated fields. For example, an employee's payroll record usually contains several fields, such as their name, social security number, department, and salary. Records may be fixed-length or variable-length.
- File. A file is a collection of interrelated records. For example, a payroll file might contain all of the payroll files for all the employees of a firm. Files are usually classified by the application for which they are used.
- Database. A database is an integrated collection of logically interrelated records or files. For example, the personnel database of a firm might contain payroll, personnel action, and employee skills files. The data stored in a database is independent of the application programs using it and of the type of secondary storage devices on which it is stored.



Under the database management approach, data records are consolidated into databases that can be accessed by many different application programs. A database management system **(DBMS) is a set of computer programs that control the creation, maintenance, and use of the databases of an organization and its end users.** Four major DBMS facilities include:

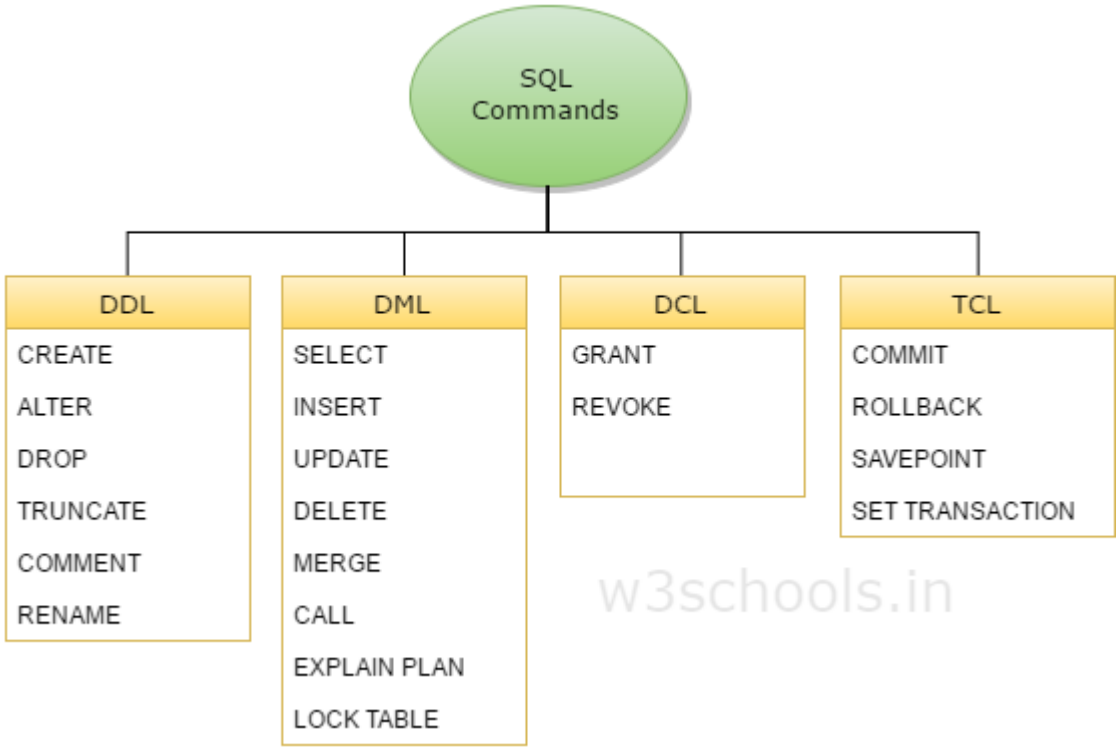
Database Development. A DBMS allows control of development to be placed with database administrators. The administrator uses a **data definition language (DDL) to develop and specify the data contents, relationships, and structure of each database, and to modify these specifications when necessary.** This approach improves integrity and security for the organizational databases. The information is stored in a data dictionary, which uses data definitions to specify what all the records and files are, can be, and, if desired, to automatically enforce data element definitions when fields, records, or files are modified.

Database Interrogation. A DBMS allows end users without programming skills to ask for information from a database using a query language or report generator. Queries are usually made one of two ways:

- SQL (Structured Query Language). This uses the basic form of SELECT ...FROM...WHERE. After SELECT the user lists the data fields to be retrieved. After FROM the user lists the files or tables from which the data must be retrieved. After WHERE the user specifies conditions that limit the search.
- QBE (Query by Example). This method allows users to point and click on display boxes for each of the data fields in one or more files to specify the rules of the search

Database Maintenance. Updating the databases and other maintenance are conducted by transaction processing programs.

Application Development. A DBMS makes application development much easier and quicker by allowing developers to include data manipulation language (DML) statements in their programs that let the DBMS perform necessary data-handling activities.



DDL

DDL is short name of Data Definition Language, which deals with database schemas and descriptions, of how the data should reside in the database.

- CREATE – to create database and its objects like (table, index, views, store procedure, function and triggers)
- ALTER – alters the structure of the existing database
- DROP – delete objects from the database
- TRUNCATE – remove all records from a table, including all spaces allocated for the records are removed
- COMMENT – add comments to the data dictionary
- RENAME – rename an object

DML

DML is short name of Data Manipulation Language which deals with data manipulation, and includes most common SQL statements such SELECT, INSERT, UPDATE, DELETE etc, and it is used to store, modify, retrieve, delete and update data in database.

- SELECT – retrieve data from the a database
- INSERT – insert data into a table
- UPDATE – updates existing data within a table
- DELETE – Delete all records from a database table
- MERGE – UPSERT operation (insert or update)
- CALL – call a PL/SQL or Java subprogram
- EXPLAIN PLAN – interpretation of the data access path
- LOCK TABLE – concurrency Control

DCL

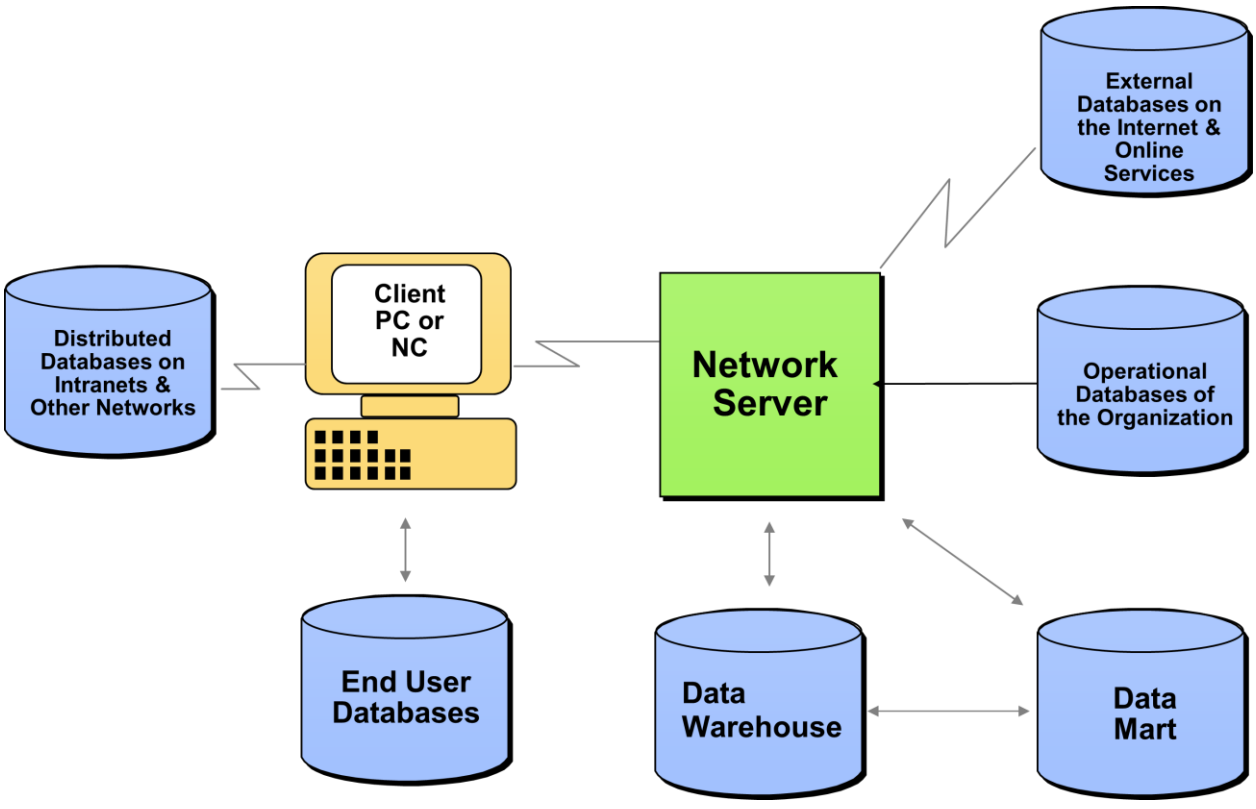
DCL is short name of Data Control Language which includes commands such as GRANT, and mostly concerned with rights, permissions and other controls of the database system.

- GRANT – allow users access privileges to database
- REVOKE – withdraw users access privileges given by using the GRANT command

TCL

TCL is short name of Transaction Control Language which deals with transaction within a database.

- COMMIT – commits a Transaction
- ROLLBACK – rollback a transaction in case of any error occurs
- SAVEPOINT – to rollback the transaction making points within groups
- SET TRANSACTION – specify characteristics for the transaction



Six major types of databases are illustrated on the slide and used by computer-based organizations:

Operational Databases. These databases store detailed data needed to support the operations of the entire organization. They are also called subject area databases (SADB), transaction databases, and production databases. These also include databases of Internet and electronic commerce activity, such as click stream data or data describing online behavior of visitors at a company's website.

Data Warehouse Databases. These store data from current and previous years that has been extracted from the various operational and management databases of the organization. As a standardized and integrated central source of data, warehouses can be used by managers for pattern processing, where key factors and trends about operations can be identified from the historical record.

Data Marts. Are subsets of the data included in a Data Warehouse which focus on specific aspects of a company, e.g. department, business process, etc.

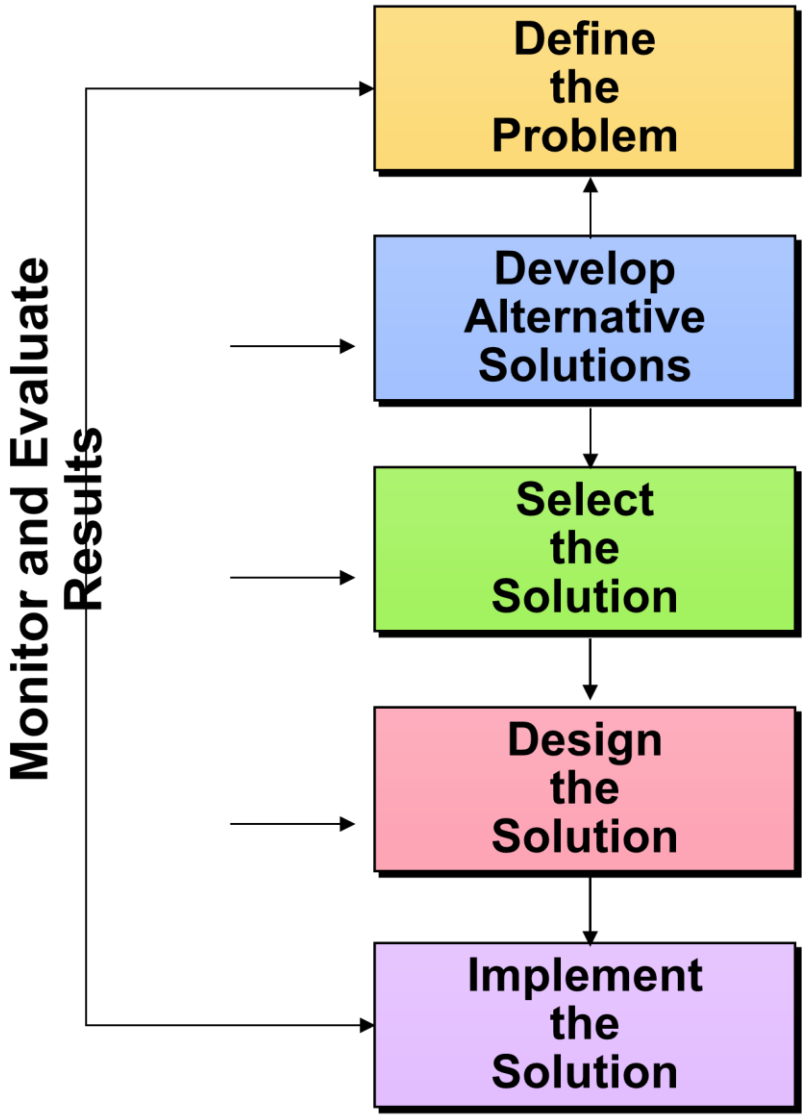
Distributed Databases. These are the databases of local workgroups and departments at regional offices, branch offices, and other work sites needed to complete the task at hand. They include relevant information from other organizational databases combined with data and information generated only at the particular site. These databases can reside on network servers, on the World Wide Web, or on Intranets and Extranets.

End User Databases. These consist of a variety of data files developed by end users at their workstations. For example, an end user in sales might combine information on a customer's order history with her own notes and impressions from face-to-face meetings to improve follow-up.

External Databases. Many organizations make use of privately generated and owned online databases or data banks that specialize in a particular area of interest. Access is usually through a subscription for continuing links or a one-time fee for a specific piece of information (like the results of a single search). Other sources like those found on the Web are free.

Systems Analysis and Design

Systems Approach to Problem Solving



The systems approach views a business process as a system that has 5 components: input, process, output, feedback and control. The systems approach to problem solving uses the systems orientation to conceptualize the nature of the problem. Under the systems orientation, all elements of a problem interact with one another. Consequently, the

systems approach considers each "step" to influence and provide feedback on every other step:

Define the Problem. A problem is a basic condition that is causing an undesirable result. An opportunity is a basic condition that presents the potential for desirable results. A key task at this stage is to separate symptoms -- signs that a problem exists -- from the actual problems themselves.

Develop Alternative Solutions. It is almost always true that every problem or opportunity has more than one effective course of action. As a problem solver, you must resist the tendency to move to the most immediate solution that comes to mind. It is good management practice to generate several alternatives and choose among them on the basis of clearly defined evaluative criteria.

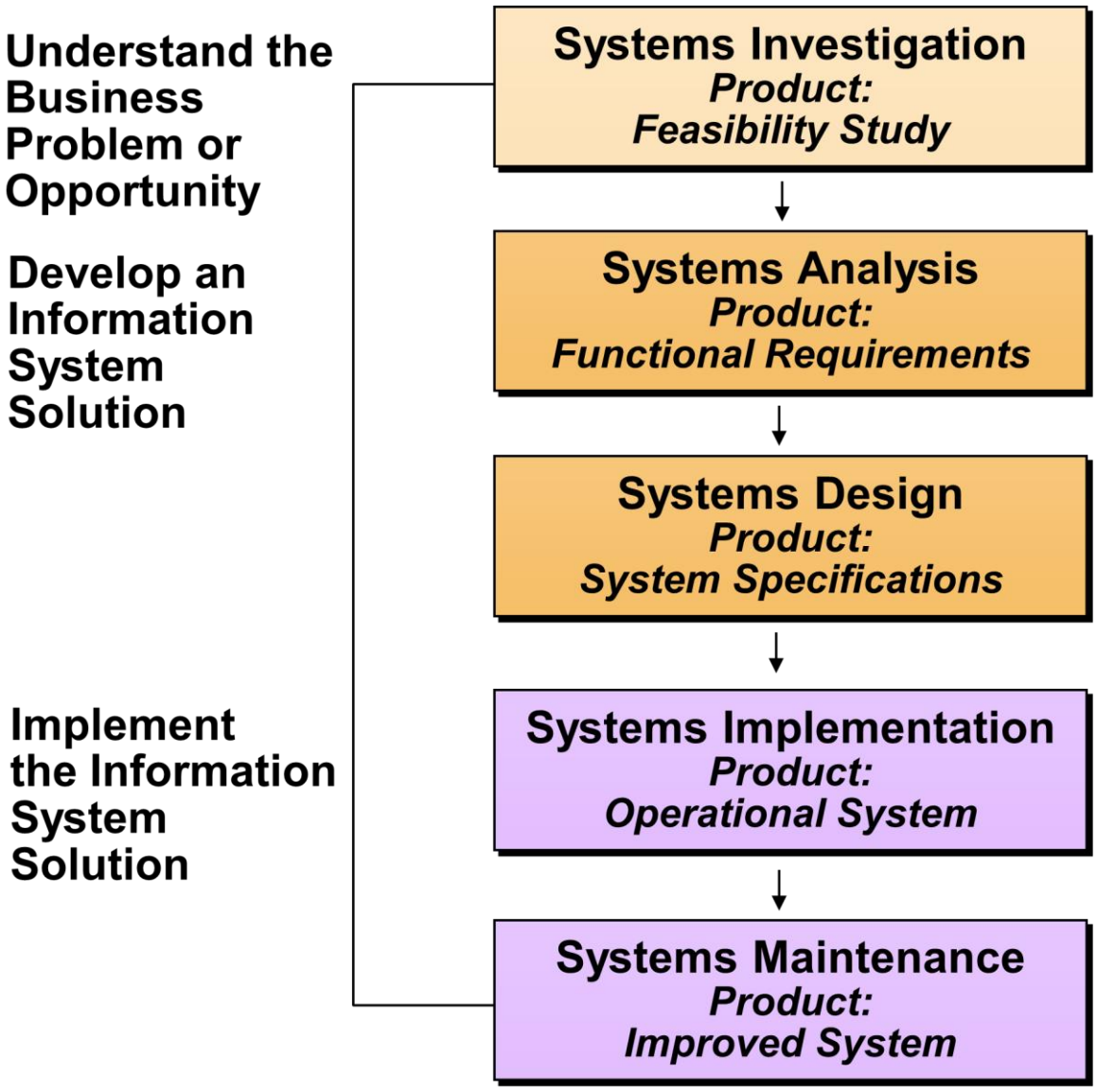
Select the Solution. On the basis of evaluative criteria, it is possible to compare alternatives to each other. Selection is important because there must be firm commitment to the alternative before committing organizational resources to solving the problem.

Design the Solution. The selected solution to an IS problem next requires designing how the solution will be created. Here it is a good idea to meet with business end users and technical staff to develop design specifications and an implementation plan.

Implement the Solution. When ready, the solution must be implemented. It is a good idea to monitor implementation carefully so that an assessment of the solution, design, and

the logistics of bringing it into action can all be evaluated objectively.

System Development Life Cycle



The traditional information systems development cycle is based upon the stages in the systems approach to problem

solving, where each step is interdependent on the previous step:

Systems Investigation. This stage may begin with a formal information systems planning process to help sort out choices from many opportunities. Typically, due to the expense associated with information systems development this stage includes a cost/benefit analysis as part of a feasibility study.

Systems Analysis. This stage includes an analysis of the information needs of end users, the organizational environment, and any system currently used to develop the functional requirements of a new system.

Systems Design. This stage develops specifications for the hardware, software, people, network, and data resources of the system. The information products the system is expected to produce are also designated.

Systems Implementation. Here the organization develops or acquires the hardware and software needed to implement the system design. Testing of the system and training of people to operate and use the system are also part of this stage. Finally, the organization converts to the new system.

Systems Maintenance. In this stage, management uses a post implementation review process to monitor, evaluate, and modify the system as needed.

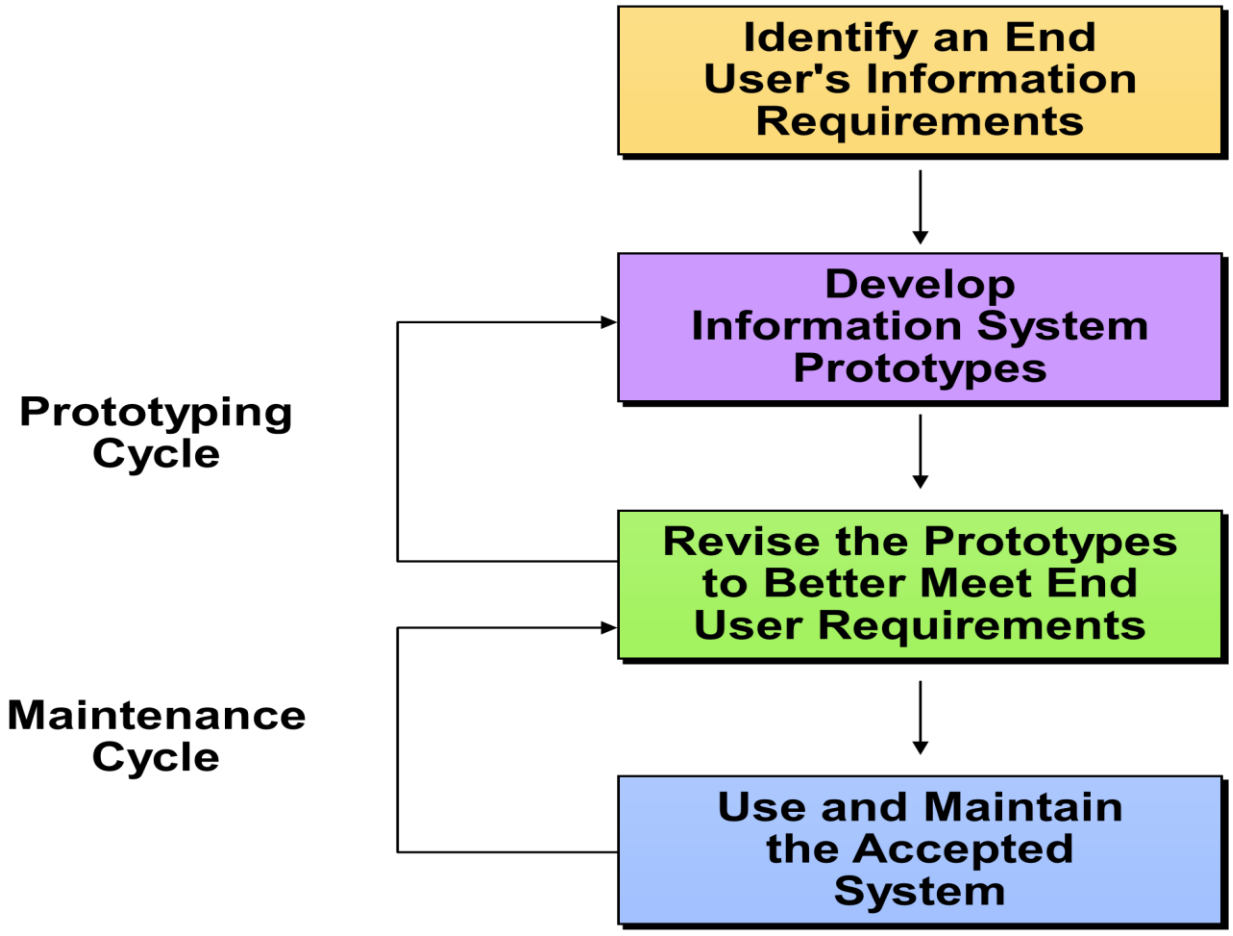
Prototype

A **prototype** is an early sample, model, or release of a product built to test a concept or process or to act as a thing to be replicated or learned from.

Fig. A prototype of the Polish economy hatchback car Beskid 106 designed in the 1980s.

Prototyping

Prototyping is the rapid development and testing of working models, or prototypes, of new applications. Prototyping is an iterative, interactive process that combines steps of the traditional development cycle with the increased involvement of end users to provide feedback that improves the prototype and the final IS.



Application development using prototyping proceeds through the following steps:

Identify Requirements. Here end users identify their information needs and assess the feasibility of several alternative information system solutions.

Develop Prototype. Here end users and/or systems analysts use application development packages to interactively design and test prototypes of information system components that meet end user information needs.

Revise Prototype. During this stage, the information system prototypes are used, evaluated, and modified repeatedly until end users find them acceptable.

Use and Maintain. The accepted system can be modified easily since most system documentation is stored on disk.

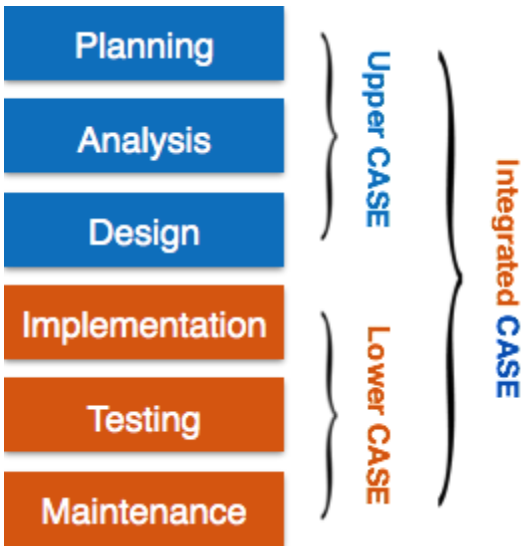
CASE stands for Computer Aided Software Engineering. It means, development and maintenance of software projects with help of various automated software tools.

CASE Tools

CASE tools are set of software application programs, which are used to automate SDLC activities. CASE tools are used by software project managers, analysts and engineers to develop software system.

There are number of CASE tools available to simplify various stages of Software Development Life Cycle such as Analysis tools, Design tools, Project management tools, Database Management tools, Documentation tools are to name a few.

Use of CASE tools accelerates the development of project to produce desired result and helps to uncover flaws before moving ahead with next stage in software development.



- Upper Case Tools – Upper CASE tools are used in planning, analysis and design stages of SDLC.
- Lower Case Tools – Lower CASE tools are used in implementation, testing and maintenance.
- Integrated Case Tools – Integrated CASE tools are helpful in all the stages of SDLC, from Requirement gathering to Testing and documentation.

CASE tools can be grouped together if they have similar functionality, process activities and capability of getting integrated with other tools.

Case Tools Types

Now we briefly go through various CASE tools

Diagram tools

These tools are used to represent system components, data and control flow among various software components and system structure in a graphical form. For example, Flow Chart Maker tool for creating state-of-the-art flowcharts.

Process Modeling Tools

Process modeling is method to create software process model, which is used to develop the software. Process modeling tools help the managers to choose a process model or modify it as per the requirement of software product. For example, EPF Composer

Project Management Tools

These tools are used for project planning, cost and effort estimation, project scheduling and resource planning. Managers have to strictly comply project execution with every

mentioned step in software project management. Project management tools help in storing and sharing project information in real-time throughout the organization. For example, Creative Pro Office, Trac Project, Basecamp.

Documentation Tools

Documentation in a software project starts prior to the software process, goes throughout all phases of SDLC and after the completion of the project.

Documentation tools generate documents for technical users and end users. Technical users are mostly in-house professionals of the development team who refer to system manual, reference manual, training manual, installation manuals etc. The end user documents describe the functioning and how-to of the system such as user manual. For example, Doxygen, DrExplain, Adobe RoboHelp for documentation.

Analysis Tools

These tools help to gather requirements, automatically check for any inconsistency, inaccuracy in the diagrams, data redundancies or erroneous omissions. For example, Accept 360, Accompa, CaseComplete for requirement analysis, Visible Analyst for total analysis.

Design Tools

These tools help software designers to design the block structure of the software, which may further be broken down in smaller modules using refinement techniques. These tools provides detailing of each module and interconnections among modules. For example, Animated Software Design

Configuration Management Tools

An instance of software is released under one version. Configuration Management tools deal with −

- Version and revision management
- Baseline configuration management
- Change control management

CASE tools help in this by automatic tracking, version management and release management. For example, Fossil, Git, Accu REV.

Change Control Tools

These tools are considered as a part of configuration management tools. They deal with changes made to the software after its baseline is fixed or when the software is first released. CASE tools automate change tracking, file management, code management and more. It also helps in enforcing change policy of the organization.

Programming Tools

These tools consist of programming environments like IDE (Integrated Development Environment), in−built modules library and simulation tools. These tools provide comprehensive aid in building software product and include features for simulation and testing. For example, Cscope to search code in C, Eclipse.

Prototyping Tools

Software prototype is simulated version of the intended software product. Prototype provides initial look and feel of the product and simulates few aspect of actual product.

Prototyping CASE tools essentially come with graphical libraries. They can create hardware independent user interfaces and design. These tools help us to build rapid prototypes based on existing information. In addition, they provide simulation of software prototype. For example, Serena prototype composer, Mockup Builder.

Web Development Tools

These tools assist in designing web pages with all allied elements like forms, text, script, graphic and so on. Web tools also provide live preview of what is being developed and how will it look after completion. For example, Fontello, Adobe Edge Inspect, Foundation 3, Brackets.

Quality Assurance Tools

Quality assurance in a software organization is monitoring the engineering process and methods adopted to develop the software product in order to ensure conformance of quality as per organization standards. QA tools consist of configuration and change control tools and software testing tools. For example, SoapTest, AppsWatch, JMeter.

Maintenance Tools

Software maintenance includes modifications in the software product after it is delivered. Automatic logging and error reporting techniques, automatic error ticket generation and root cause Analysis are few CASE tools, which help software organization in maintenance phase of SDLC. For example, Bugzilla for defect tracking, HP Quality Center.

Computer Aided Design CAD technology is used in the design of tools and machinery and in the drafting and design of all

types of buildings, from small residential types (houses) to the largest commercial and industrial structures (hospitals and factories).[8]

CAD is mainly used for detailed engineering of 3D models or 2D drawings of physical components, but it is also used throughout the engineering process from conceptual design and layout of products, through strength and dynamic analysis of assemblies to definition of manufacturing methods of components. It can also be used to design objects such as jewelry, furniture, appliances, etc. Furthermore, many CAD applications now offer advanced rendering and animation capabilities so engineers can better visualize their product designs.

Computer-aided manufacturing (CAM) is an application technology that uses computer software and machinery to facilitate and automate manufacturing processes. In addition to materials requirements, modern CAM systems include real-time controls and robotics

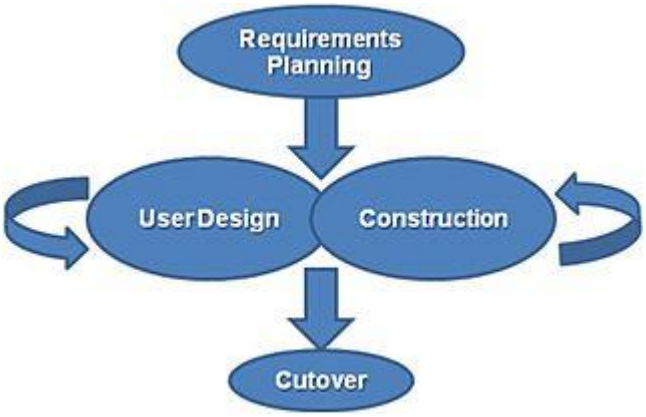
Example :- CATIA (an acronym of computer-aided three-dimensional interactive application) is a multi-platform software suite for computer-aided design (CAD), computer-aided manufacturing (CAM).

CASE tools are similar to and were partly inspired by computer-aided design (CAD) tools used for designing hardware products. CASE tools are used for developing high-quality, defect-free, and maintainable software.

Rapid Application Development RAD

RAD approaches to software development put less emphasis on planning and more emphasis on an adaptive process. Prototypes are often used in addition to or sometimes even in place of design specifications.

The James Martin approach to RAD divides the process into four distinct phases:



1. Requirements planning phase – combines elements of the system planning and systems analysis phases of the Systems Development Life Cycle (SDLC). Users, managers, and IT staff members discuss and agree on business needs, project scope, constraints, and system requirements. It ends when the team agrees on the key issues and obtains management authorization to continue.
2. User design phase – during this phase, users interact with systems analysts and develop models and prototypes that represent all system processes, inputs, and outputs. The RAD groups or subgroups typically use a combination of Joint Application Development (JAD) techniques and CASE tools to translate user needs into working models. *User Design* is a continuous interactive process that allows users to understand, modify, and

eventually approve a working model of the system that meets their needs.

3. Construction phase – focuses on program and application development task similar to the SDLC. In RAD, however, users continue to participate and can still suggest changes or improvements as actual screens or reports are developed. Its tasks are programming and application development, coding, unit-integration and system testing.
4. Cutover phase – resembles the final tasks in the SDLC implementation phase, including data conversion, testing, changeover to the new system, and user training. Compared with traditional methods, the entire process is compressed. As a result, the new system is built, delivered, and placed in operation much sooner.[6]

Business Intelligence and Analytics

Data Warehousing

- A **Data Warehouse** (**DW**) is a database used for reporting and analysis.
- The data stored in the warehouse is uploaded from the operational systems.

- Data warehouses can be subdivided into data marts.
- Data Warehouse focuses on data storage.
- Data Warehousing includes business intelligence tools, tools to extract, transform and load data into the repository, and tools to manage and retrieve metadata.
- The main source of the data is cleaned, transformed, catalogued and made available for use by managers and other business professionals for
- Data Mining,
- Online Analytical processing,
- Market research and decision support.

Bottom-up design of DWH

- The single data mart often models a specific business area such as "Sales" or "Production."
- These data marts can eventually be integrated to create a comprehensive data warehouse.

Top-down design of DWH

- Data at the lowest level of detail, are stored in the data warehouse

- Dimensional data marts containing data needed for specific business processes or specific departments are created from the data warehouse. Bill Inmon

Data Mining

- Data Mining : The analysis step of the **knowledge discovery in databases** process

- The process of **discovering new patterns** from large data sets

Data mining involves six tasks

- **Anomaly detection (deviation detection)** – The identification of unusual data records, that might be interesting or data errors and require further investigation.

- **Association rule learning (Dependency modeling)** – Searches for relationships between variables.

For example a supermarket might gather data on customer purchasing habits. Using association rule learning, the supermarket can determine which products are frequently

bought together and use this information for marketing purposes.

- Clustering – is the task of discovering groups and structures in the data that are in some way or another "similar", without using known structures in the data.

Rather than randomly contacting a prospect or customer through a call center or sending mail, a company can concentrate its efforts on prospects that are predicted to have a high likelihood of responding to an offer.

Data clustering can also be used to automatically discover the segments or groups within a customer data set.

- Classification – is the task of generalizing known structure to apply to new data.

For example, an email program might attempt to classify an email as legitimate or spam.

- Regression – Attempts to find a function which models the data with the least error.

- Summarization – providing a more compact representation of the data set, including visualization and report generation

OLAP On-Line Analytical Processing

OLAP tools enable users to interactively analyze multidimensional data from multiple perspectives.

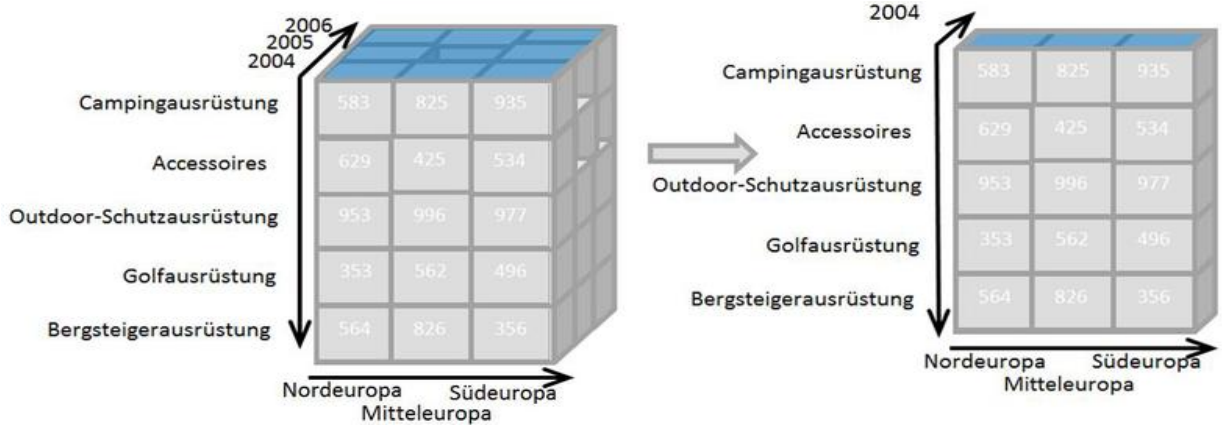
Typical applications of OLAP include

- business reporting for sales, marketing, management reporting,
- business process management (BPM),
- budgeting and forecasting, financial reporting and similar areas

In computing, **online analytical processing**, or **OLAP** is an approach to swiftly answer multi-dimensional analytical (MDA) queries

OLAP cubes can be thought of as extensions to the two-dimensional array of a **spreadsheet**.

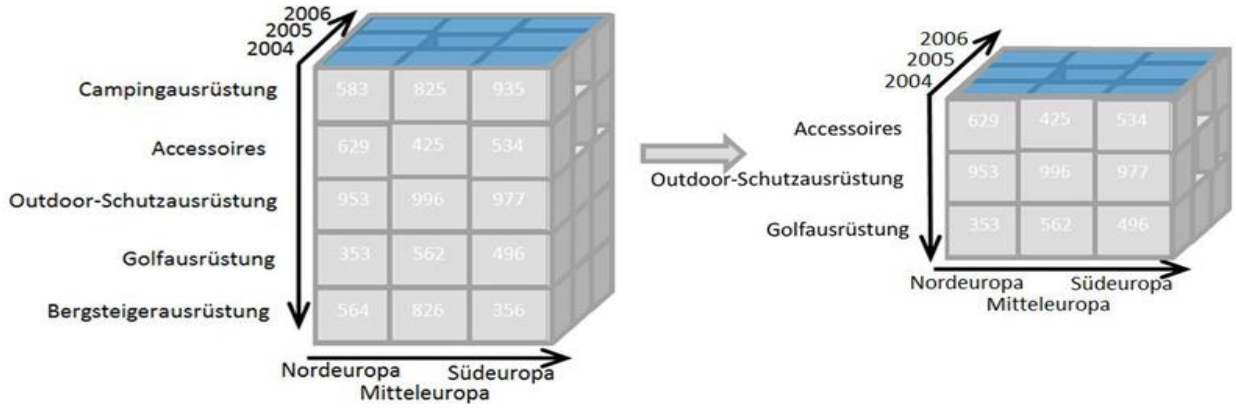
Slicing



A slice is a subset of a multi-dimensional array corresponding to a single value.

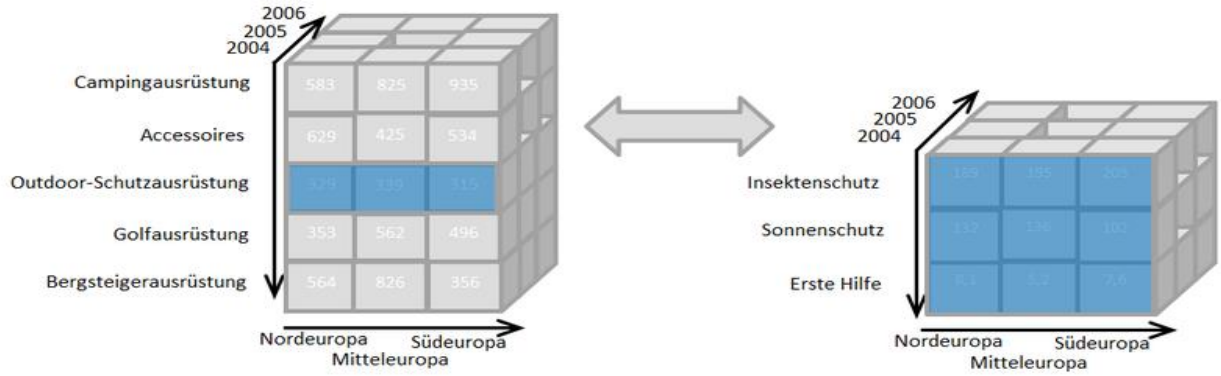
Dicing

The sales figures of all sales regions and all product categories of the company in the year 2004 are "sliced" out the data cube.



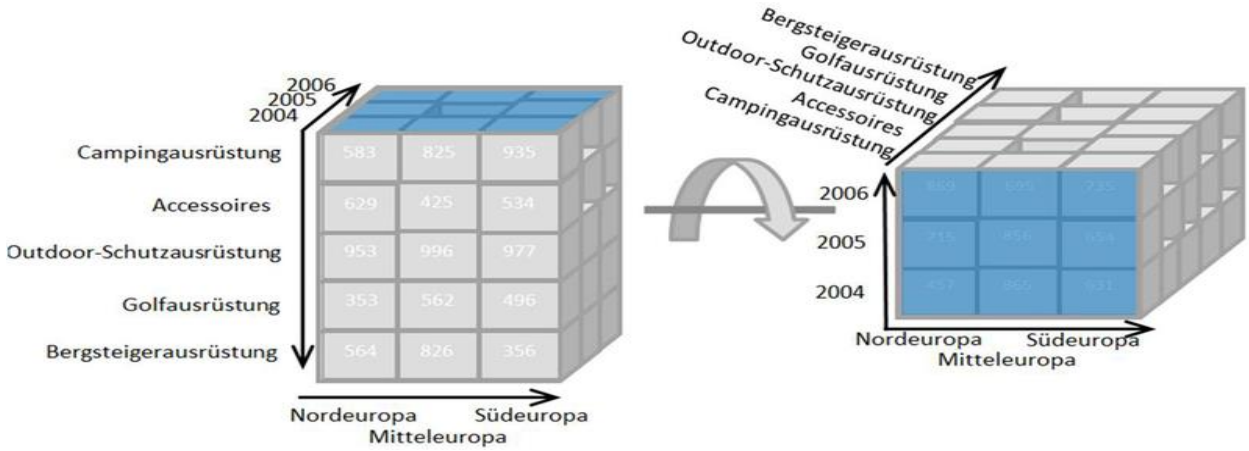
The new cube shows the sales figures of a limited number of product categories, the time and region dimensions cover the same range as before.

Drill Down



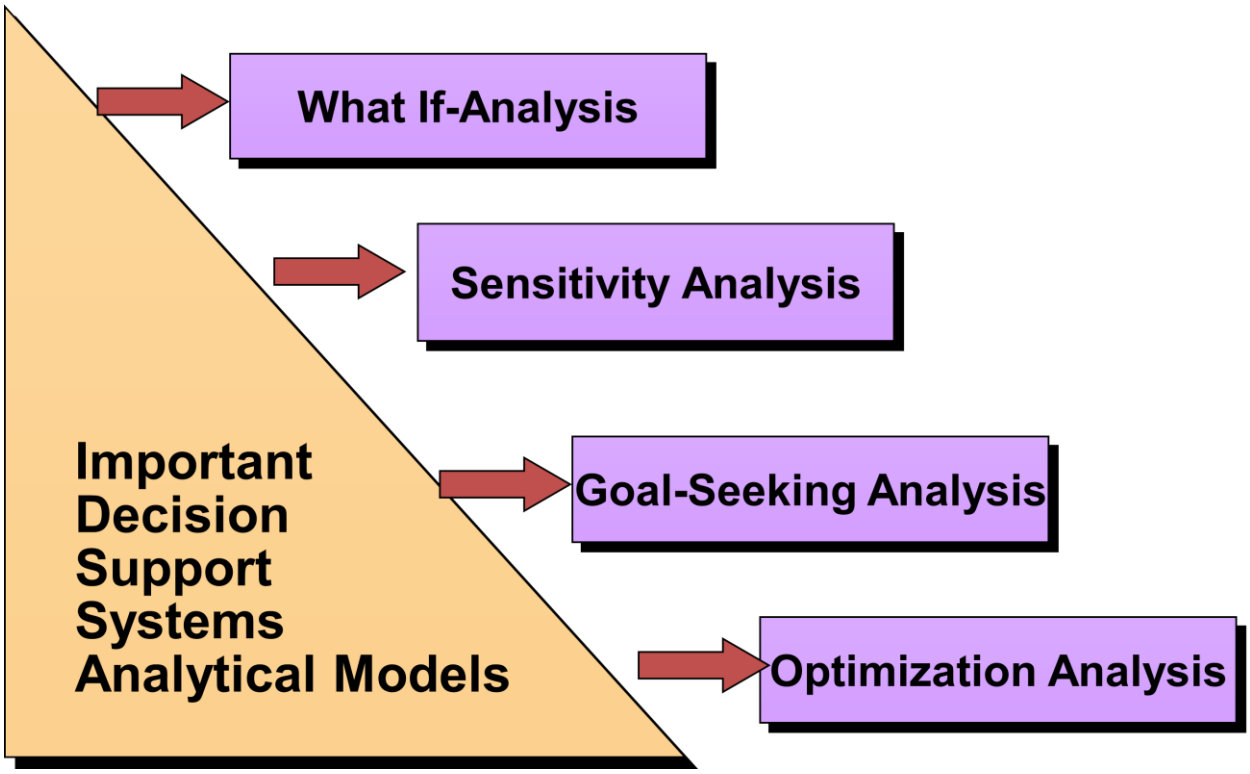
There is a better understanding of the sales figures of the product category "Outdoor-Schutzausrüstung" since you now see the sales figures for the single products of this category.

Pivoting



This operation is also called rotate operation. The whole cube is rotated, giving another perspective on the data.

DSS Decision Support System



Decision support systems (DSS) are computer-based systems that provide managers and business professionals interactive information support for semi-structured and unstructured decisions. Unlike management information systems, DSS rely on model bases.

A model base is a software component that consists of models used in computational and analytical routines that mathematically express relationships between variables.

There are various types of DSS analytical model bases. These include:

What-If Analysis. An end user makes changes to variables, or relationships among variables, and observes the resulting change in the value of other variables.

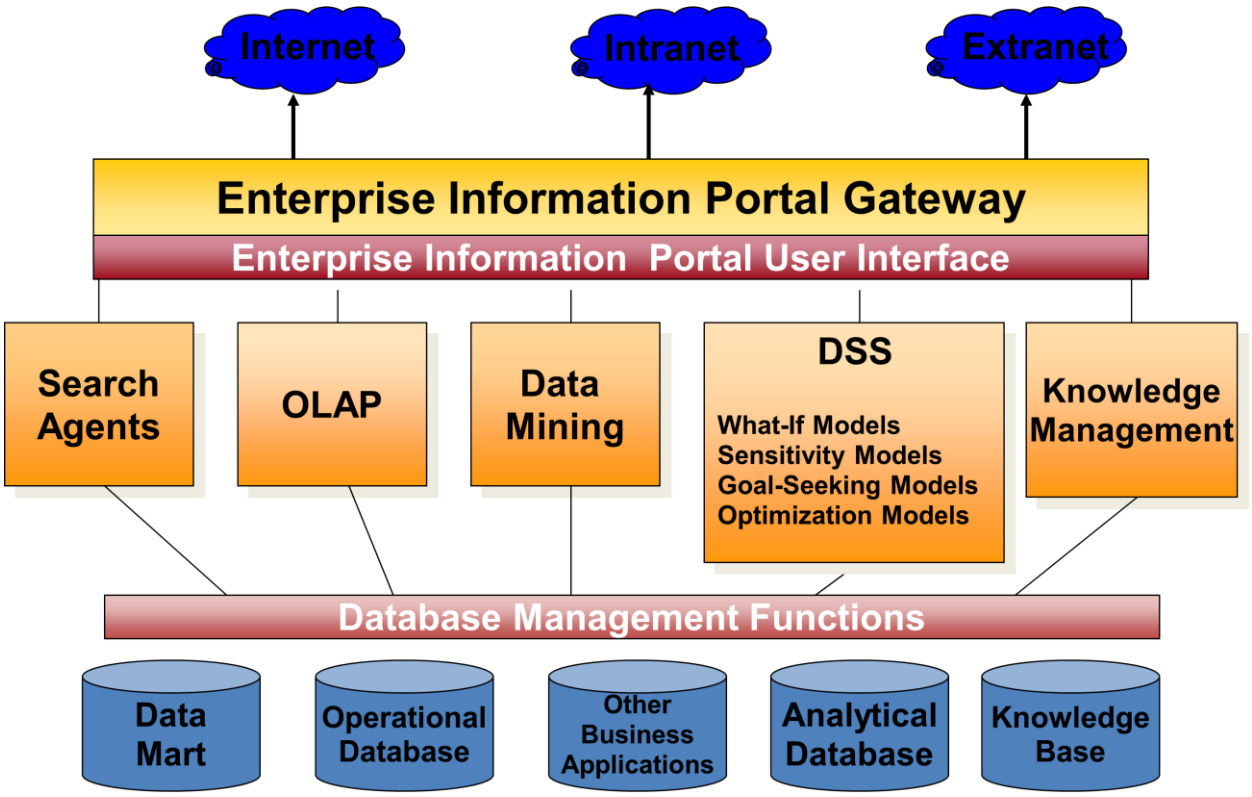
Sensitivity Analysis. A special type of what-if analysis in which the value of only one variable is changed repeatedly, and the resulting changes on other variables are observed.

Sensitivity analysis is a way to predict the outcome of a decision if a situation turns out to be different compared to the key prediction(s).

Goal-Seeking Analysis. Instead of observing how changes in a variable affect other variables, goal-seeking analysis sets a target value for a variable, and then repeatedly changes other variables until the target value is achieved.

Optimization analysis. A more complex goal-seeking model. Instead of setting a specific target value for a variable, the goal is to find the optimum value for one or more target variables, given certain constraints.

Enterprise Information Portals and DSS



Cross-platform integration is one of the main objectives of today's e-business. As shown in the figure, newer DSS packages not only are capable of running under different computer platforms, but can be integrated with corporate data resources, including operational databases, data marts, and data warehouses.

These packages are no longer limited to numeric input and response, but can use data visualization systems to represent complex data using interactive three dimensional graphical forms. This in turns helps users discover patterns and links between decision variables quicker and easier.
As we stated earlier, the objective of today's e-business is to provide information to anyone that needs it, whenever, and wherever they are. More and more companies are developing

Enterprise Information Portals to provide web-enabled access to information. When deployed successfully, this portal provides a universal interface to both corporate knowledge and decision-making tools as well as a wealth of other tools.

Attributes of Intelligent Behavior

- Think and reason
- Use reason to solve problems
- Learn or understand from experience
- Acquire and apply knowledge
- Exhibit creativity and imagination
- Deal with complex or perplexing situations
- Respond quickly and successfully to new situations.
- Recognize the relative importance of elements in a situation
- Handle ambiguous, incomplete,or erroneous information

Artificial intelligence (AI) is a field of science and technology based on disciplines such as computer science, biology, psychology, linguistics, mathematics, and engineering.

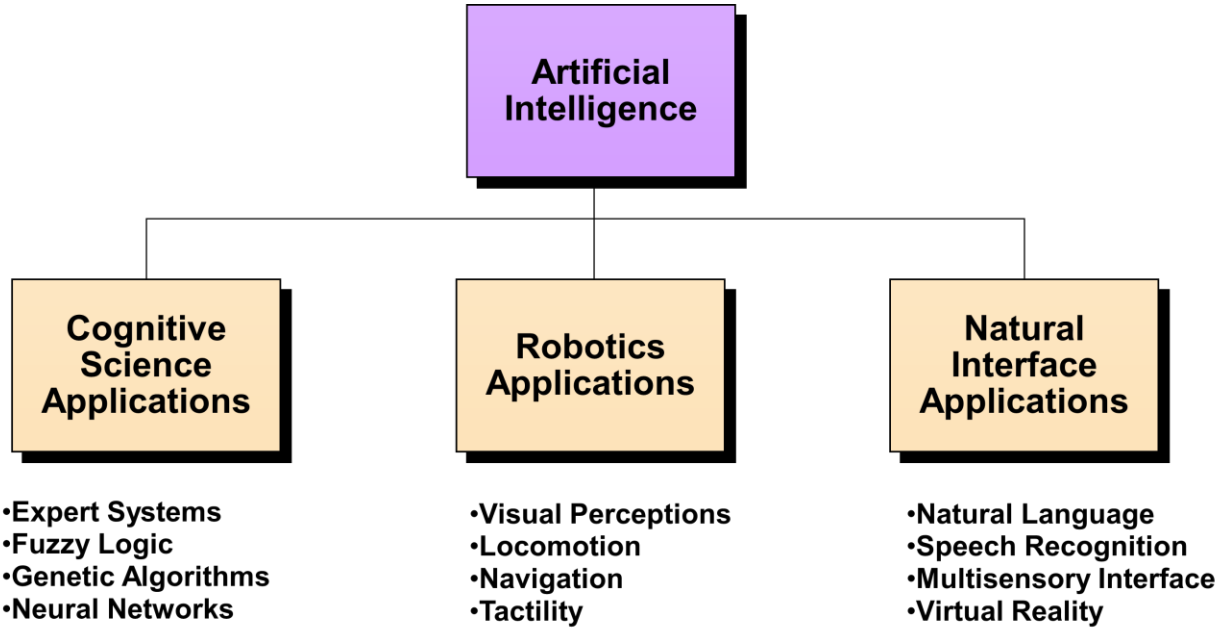
The goal of AI is to develop computers that can think, as well as see, hear, walk, talk, and feel.

A major thrust of AI is the development of computer functions normally associated with human intelligence, such as reasoning, learning, and problem solving.

Alan Turing in 1950 proposed a test for determining if machines could think. According to the Turing test, a computer could demonstrate intelligence of a human

interviewer, conversing with an unseen human and an unseen computer, could not tell which was which. Critics believe that no computer can truly pass the Turing test. They claim that developing intelligence to impart true humanlike capabilities to computers is simply not possible. But progress continues, and only time will tell if the ambitious goals of AI will be achieved.

Artificial Intelligence Applications



Artificial Intelligence (AI) is a science and technology based on disciplines such as computer science, biology, psychology, linguistics, mathematics, and engineering. AI works to develop computer functions normally associated with human intelligence. Its goal is to develop computers that can

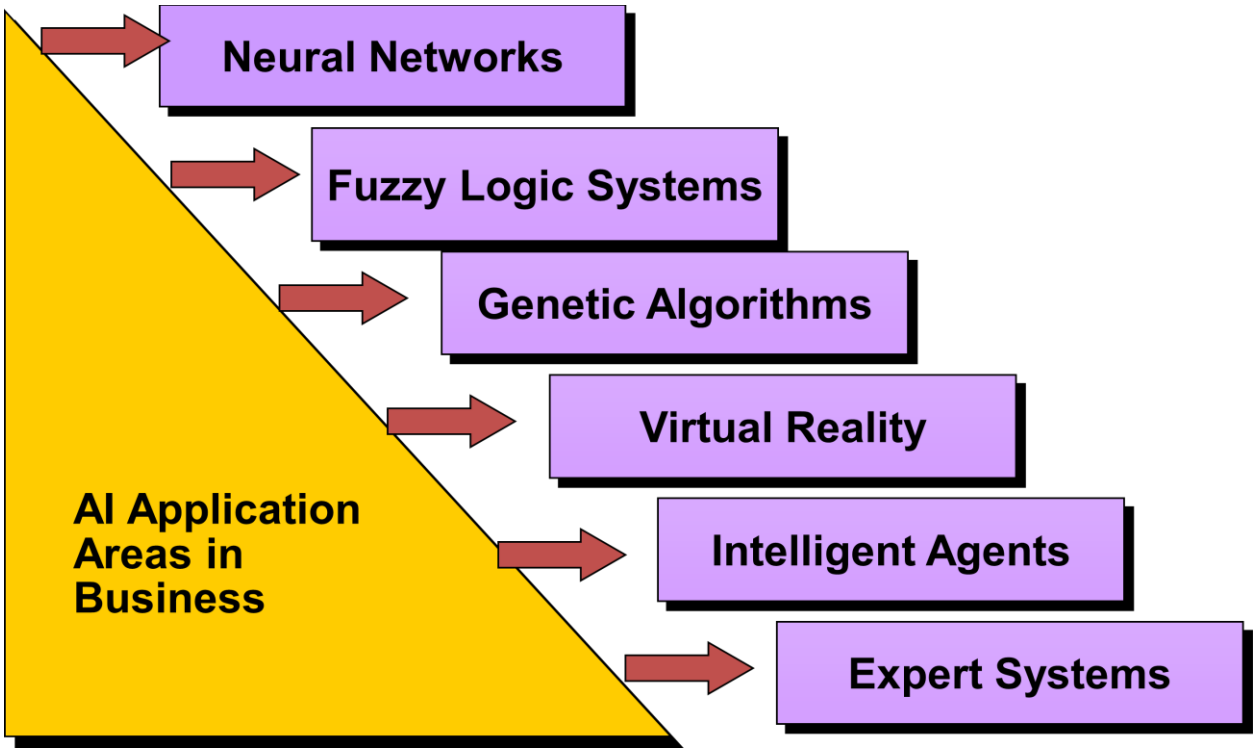
think, see, hear, walk, talk, and even feel. The major application areas of AI can be grouped into three categories:

Cognitive Science. Much of AI development is based upon research in human information processing, which focuses on understanding how the human brain works and how humans think and learn. Major applications in this area include: expert systems, learning systems, fuzzy logic, genetic algorithms, neural networks, and intelligent agents.

Robotics. Robotics is concerned with deploying computers in ways that duplicate the actions (and even the appearance) of humans. Areas of development include visual perception, tactility, dexterity, locomotion, and navigation.

Natural Interface. AI developers hope to make the human–computer interface as natural as possible. Natural language programming, speech recognition, multisensory interfaces, and virtual reality are all areas of development.

AI Application Areas in Business



There are numerous AI application areas in business. These include:

Neural Networks. Computing systems modeled after the brain's mesh-like network of interconnected processing elements, called neurons. The interconnected processors in a neural network operate in parallel and interact dynamically. This enables the network to learn to recognize patterns and relationships in the data it processes. For example, a neural network can be used to learn which credit characteristics result in good or bad loans.

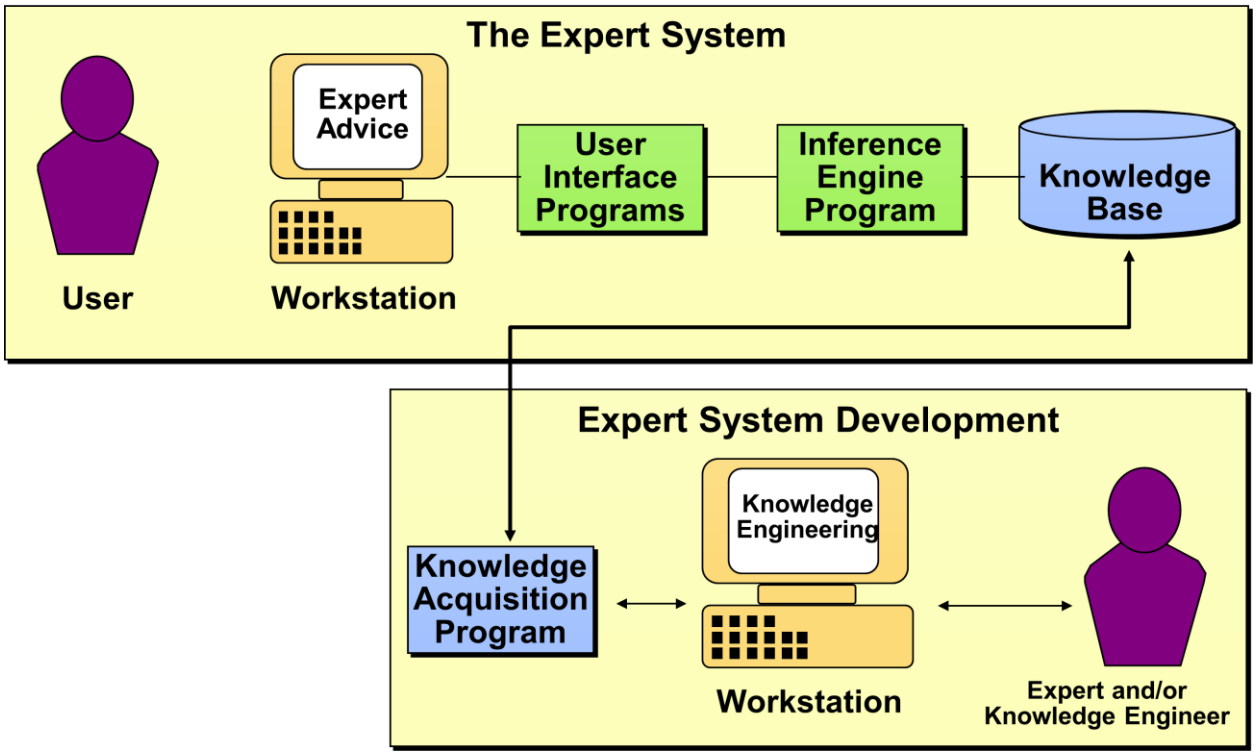
Fuzzy Logic. A method of reasoning that allows for approximate values and inferences. This enables fuzzy systems to process incomplete data and quickly provide approximate, but acceptable solutions. Fuzzy systems are

used in fuzzy process controller microchips that are incorporated in many Japanese appliances.

Genetic Algorithms. Uses Darwinian randomizing and other mathematical functions to simulate an evolutionary process that yields increasingly better solutions to a problem. They are especially useful for situations in which thousands of solutions are possible and must be evaluated to produce an optimal solution.

Virtual Reality. Is a computer-simulated reality that uses such devices as tracking headsets and data gloves to. create virtual worlds that can be experienced through sight, sound, and touch. Current applications of virtual reality include computer-aided design, medical diagnostics, flight simulation, and 3-D video arcade games.

Components of Expert Systems



An Expert System (ES) is a knowledge-based information system that uses its knowledge about a specific, complex application area to act as an expert consultant to end users. The components of an ES include:

Knowledge Base. A knowledge base contains knowledge needed to implement the task. There are two basic types of knowledge:

Factual knowledge. Facts, or descriptive information, about a specific subject area.

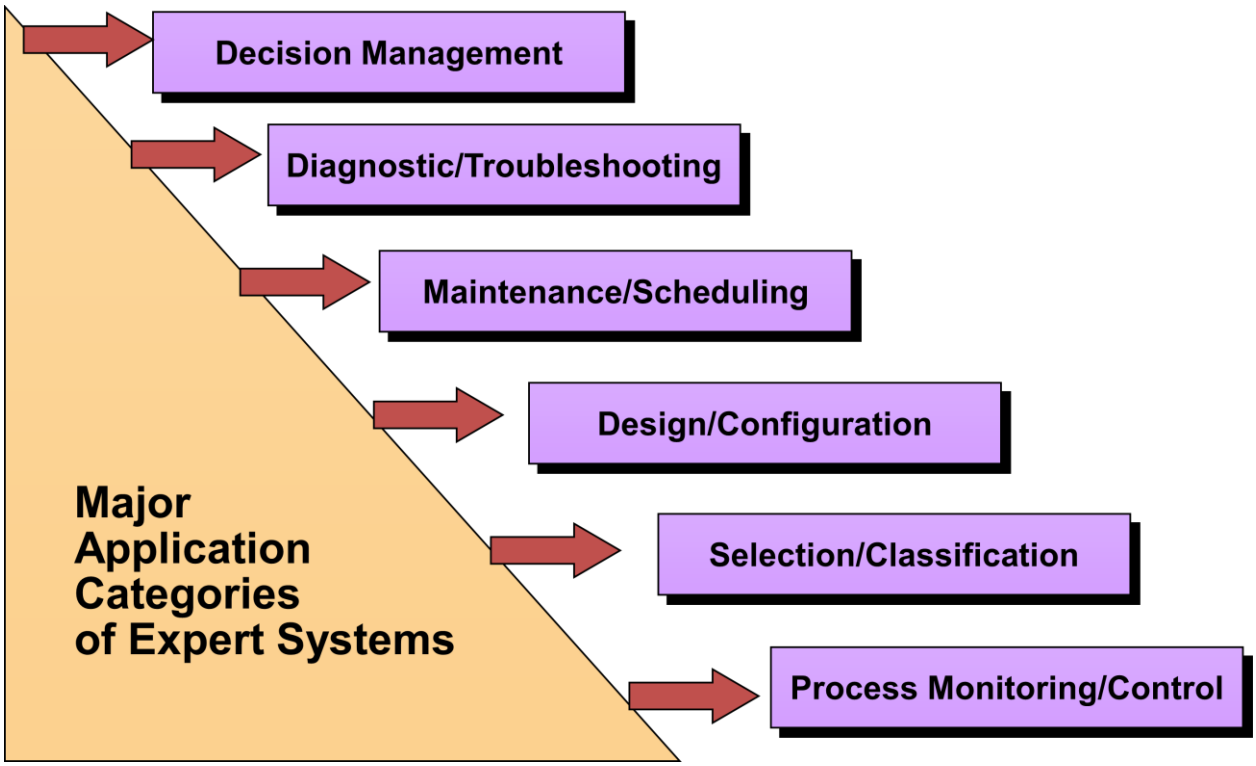
Heuristics. A rule of thumb for applying facts and/or making inferences, usually expressed as rules.

Inference Engine. An inference engine provides the ES with its reasoning capabilities. The inference engine processes the knowledge related to a specific problem. It then makes associations and inferences resulting in recommended courses of action.

User Interface. This is the means for user interactions.

To create an expert system a knowledge engineer acquires the task knowledge from the human expert using knowledge acquisition tools. Using an expert system shell, which contains the user interface and inference engine software modules, the KE then encodes the knowledge into the knowledge base. A reiterative approach is used to test and refine the expert system's knowledge base until it is deemed complete.

Expert System Applications



Expert Systems can be used to accomplish many business tasks:

Decision Management. This includes systems that appraise situations or consider alternatives and make recommendations based on criteria supplied during the discovery process. Examples include loan portfolio analysis, employee evaluation, insurance underwriting, demographic forecasts.

Diagnostic/Troubleshooting. This is the use of systems that infer underlying causes from reported symptoms and history.

Examples include equipment calibration, help desk operations, software debugging, medical diagnosis.

Maintenance/Scheduling. This includes systems that prioritize and schedule limited or time-critical resources. Examples include maintenance scheduling, production scheduling, education scheduling, project management.

Design/Configuration. This is the use of systems that help configure equipment components, given existing constraints that must be taken into account. Examples include computer option installation, manufacturability studies, communications networks, optimum assembly plan.

Selection/Classification. These are systems that help users choose products or processes from among large or complex sets of alternatives. Examples include material selection, delinquent account identification, information classification, suspect identification.

Process Monitoring/Control. This includes systems that monitor and control procedures or processes. Examples include machine control (including robotics), inventory control, production monitoring, chemical testing.

Expert systems provide a business with faster, consistent expertise. They also help preserve organizational knowledge. However, they are not without limitations. ES are not suitable for every problem situation. They excel only in solving specific types of problems in a limited domain of knowledge. They fail to solve problems requiring a broad knowledge base. Expert Systems are also difficult and costly to develop and maintain.

Digital firm Perspective

An **e-business model** is simply the approach a company takes to become a profitable business on the Internet.

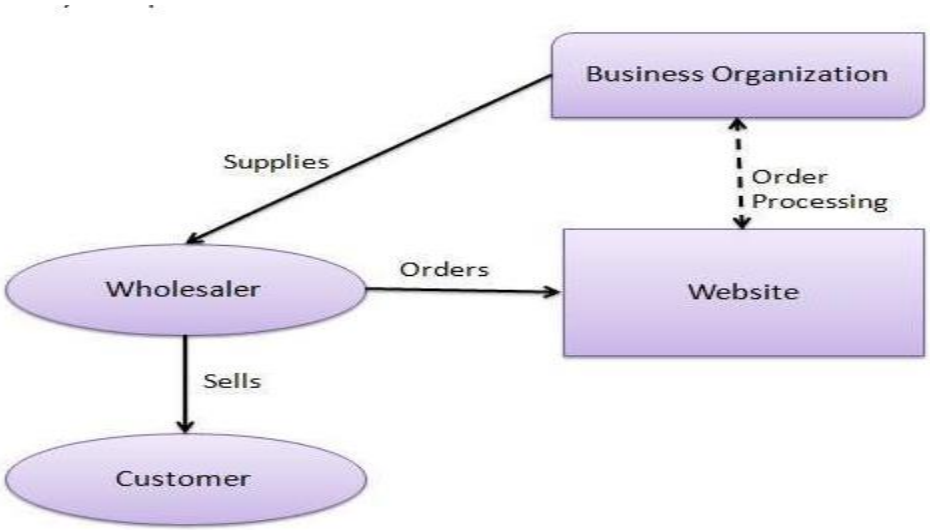
Eg.,Yahoo Inc. in Santa Clara, Calif., operates a successful portal site, providing content and an Internet search engine.

E-commerce business models can generally be categorized into the following categories.

- Business – to – Business (B2B)
- Business – to – Consumer (B2C)
- Consumer – to – Consumer (C2C)
- Consumer – to – Business (C2B)
- Business – to – Government (B2G)
- Government – to – Business (G2B)
- Government – to – Citizen (G2C)

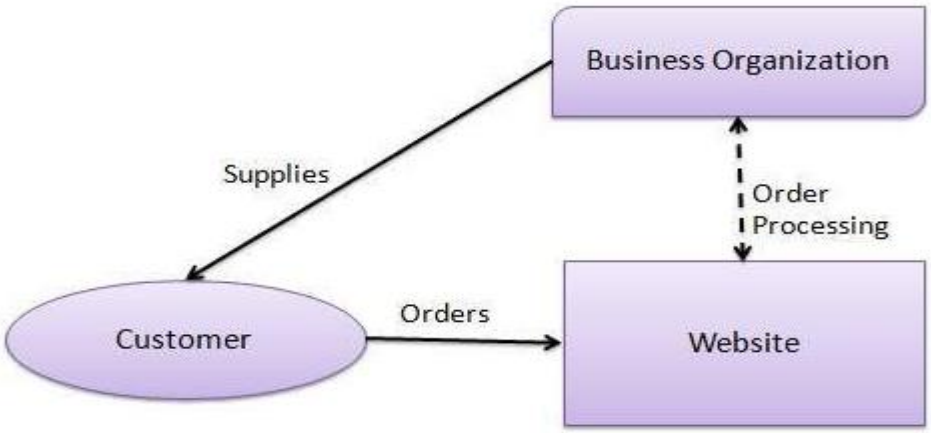
Business – to – Business

A website following the B2B business model sells its products to an intermediate buyer who then sells the product to the final customer.



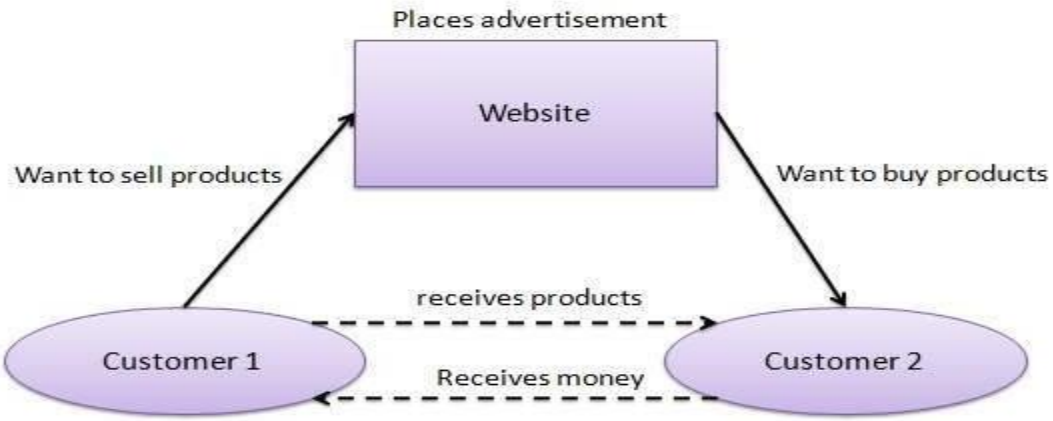
Business – to – Consumer

A website following the B2C business model sells its products directly to a customer. A customer can view the products shown on the website. The customer can choose a product and order the same.



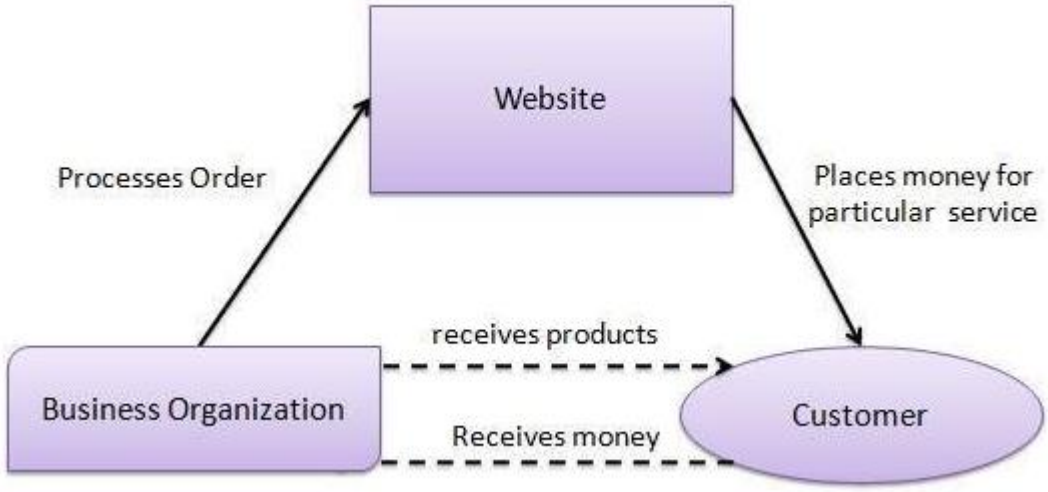
Consumer – to – Consumer

A website following the C2C business model helps consumers to sell their assets like residential property, cars, motorcycles, etc., or rent a room by publishing their information on the website.



Consumer – to – Business

In this model, a consumer approaches a website showing multiple business organizations for a particular service. The consumer places an estimate of amount he/she wants to spend for a particular service. For example, the comparison of interest rates of personal loan/car loan provided by various banks via websites. A business organization who fulfills the consumer's requirement within the specified budget, approaches the customer and provides its services.

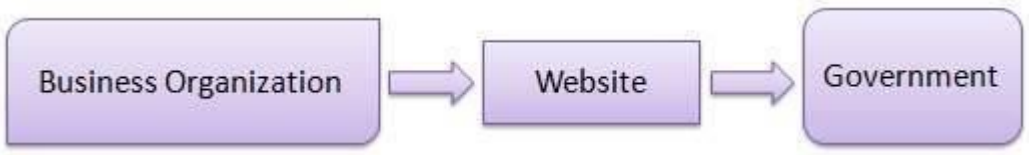


Business – to – Government

B2G model is a variant of B2B model. Such websites are used by governments to trade and exchange information with various business organizations. Such websites are accredited by the government and provide a medium to businesses to submit application forms to the government.

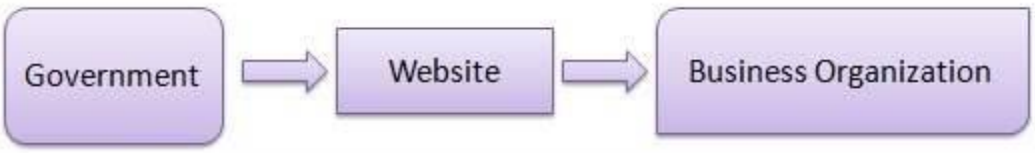
Example :- FirstTender.Com Is The Most Comprehensive Tender-Specific Search Engine On The Internet Driven By The Latest Search Engine Technology. We At FirstTender.Com Believe In Customer Satisfaction. FirstTender.Com Helps Companies Derive The Measurable Business Value That They Have Always Been Looking For From Tender Related Business.

If You Are Looking For New Business Opportunities Originating Via Tender, Request For Information (RFI) Or Request For Proposal (RFP) Processes, You Have Come To The Right Place.



Government – to – Business

Governments use B2G model websites to approach business organizations. Such websites support auctions, tenders, and application submission functionalities.



Government – to – Citizen

Governments use G2C model websites to approach citizen in general. Such websites support auctions of vehicles, machinery, or any other material. Such website also provides services like registration for birth, marriage or death certificates. The main objective of G2C websites is to reduce the average time for fulfilling citizen's requests for various government services.

G2B (Government to Business) is a term that refers to the relationships between organizations of public administration and businesses.

In G2B model the initiative comes from a government organization and businesses are the target group.

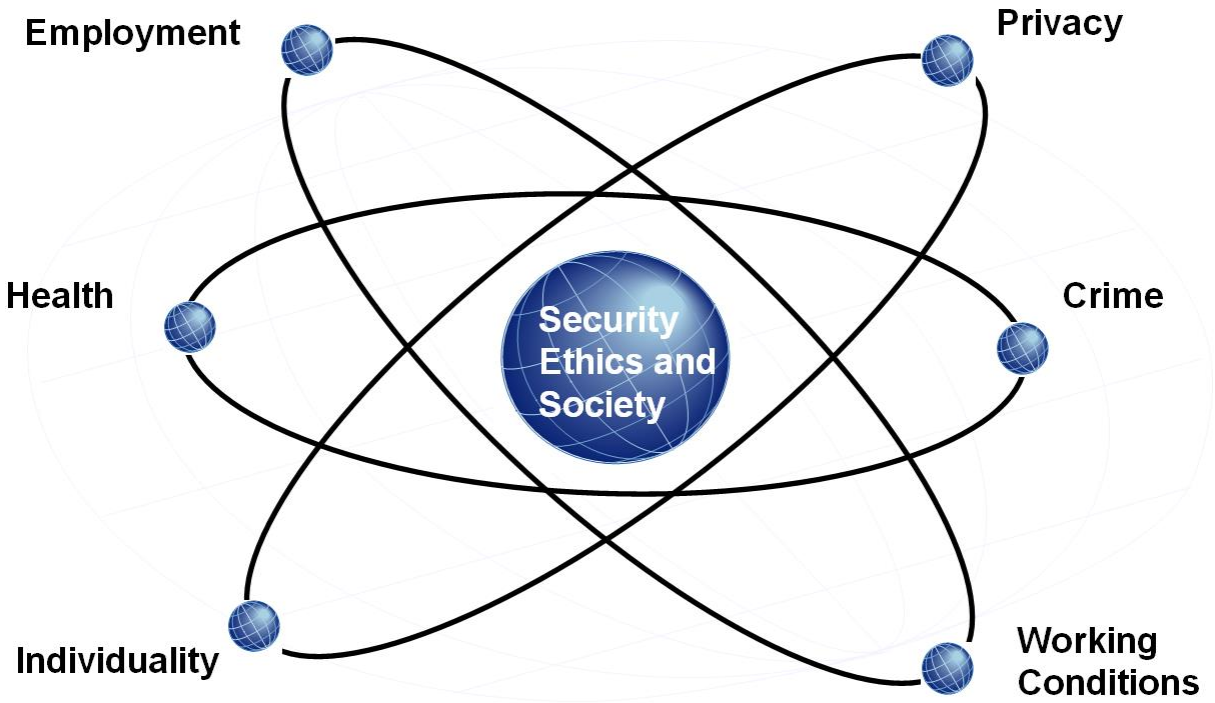
To distinguish B2G (Business to Government) where the initiative comes from businesses. While some other sources consider both G2B and B2G as equal without important no significant difference.

Government-to-Business (G2B) is the online non-commercial interaction between local and central government and the commercial business sector with the purpose of providing businesses information and advice on e-business 'best practices'. G2B:Refers to the conduction through the Internet between government agencies and trading companies.

B2G:Professional transactions between the company and the district, city, or federal regulatory agencies. B2G usually include recommendations to complete the measurement and evaluation of books and contracts.

Management Issues in MIS

Security and Ethical Challenges



Information technology can support both beneficial and detrimental effects to a business and society on a whole. The use of information technology in e-business operations presents major security challenges, poses serious ethical questions, and affects society in significant ways. Some of the important aspects are shown on this slide. In this lecture we will discuss these issues and describe how business professionals should act to minimize the detrimental effects of e-business systems.

Privacy Issues. The power of information technology to store and retrieve information can have a negative effect on the

individuals' right to privacy. The Internet itself gives users a feeling of anonymity while actually being quite the opposite. Important privacy issues being debated in business and government include:

Violation of Privacy. Accessing individuals' private e-mail conversations, and/or collecting and sharing information about individuals without their knowledge or consent.

Unauthorized Personal Files. Collecting telephone numbers, credit card numbers, e-mail addresses, and other personal information to build individual customer profiles.

Computer Monitoring. Using technology to monitor conversations, employee productivity or an individual's movement.

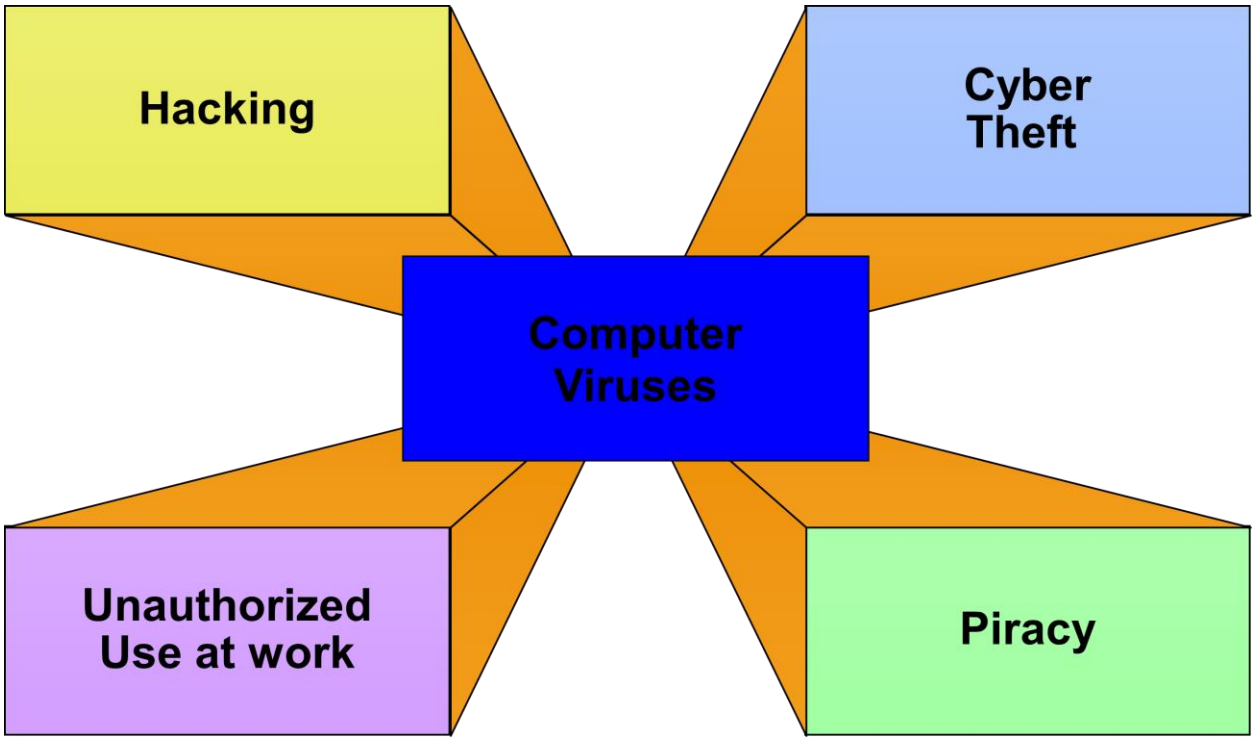
Computer Matching. Using customer information gained from multiple sources to create customer profiles that can be sold to information brokers or other companies and used to market business services.

User Privacy Protection. Privacy Laws attempt to address some of these issues. The Electronic Communications Privacy Act and the Computer Fraud and Abuse Act prohibit intercepting data communication messages, stealing or destroying data. The Computer Matching and Privacy Act regulates the matching of data held in federal agency files. Individuals can also protect their privacy by using such software and services like encryption and anonymous remailers.

Censorship. The right of people to know about matters others may want to keep quiet, the rights of people to express their opinion, and to publish those opinions, is the center of a major debate between the rights of the individual and the rights of society. Issues regarding spamming, flaming,

pornography, and copyright protection are just some of the issues being debated by various groups and government.

Computer Crime



Computer crime is a growing threat to today's e-business. It is defined as the unauthorized use, access, modification, and destruction of information, hardware, software or network resources, and the unauthorized release of information. There are several major categories of computer crime that include:

Hacking. The unauthorized access and use of networked computers. Examples of common hacking tactics include

Spoofing, Trojan Horses, Logic Bombs, Denial of Service, War Dialing, and Scans. These tactics can be used to retrieve passwords, access or steal network files, overload computer systems, or damage data and programs.

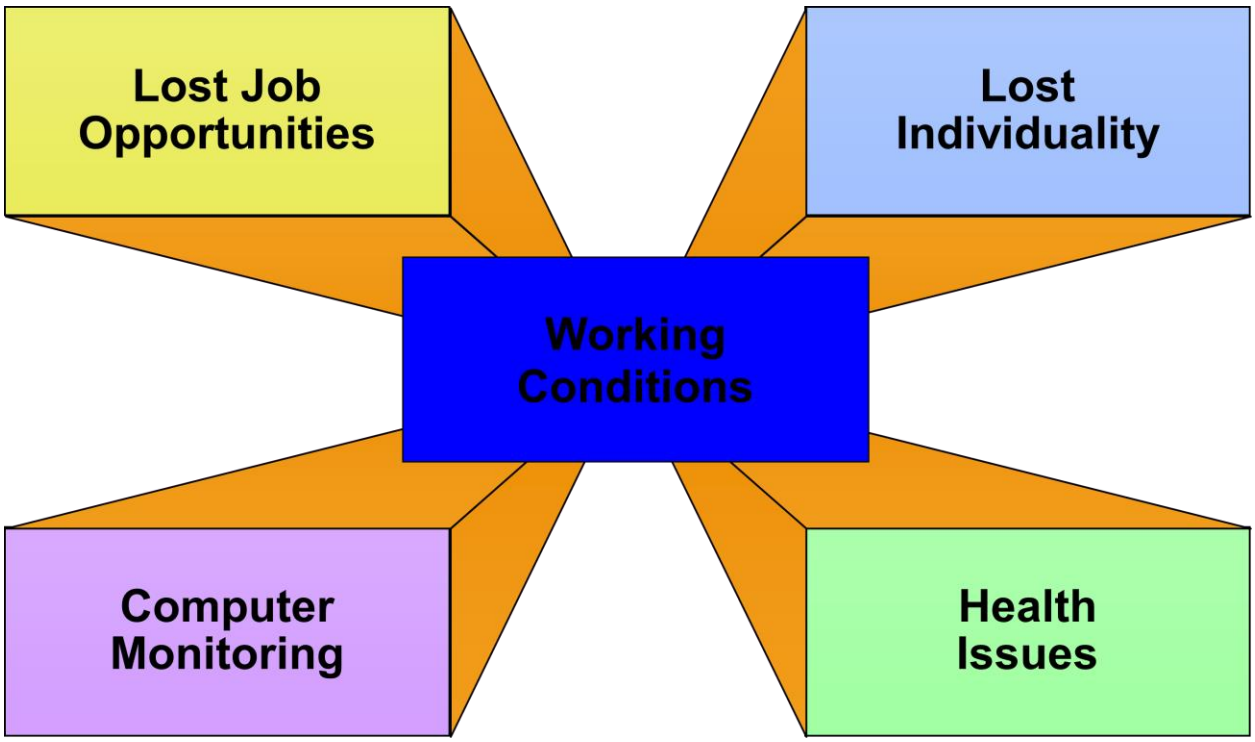
Cyber Theft. Electronic breaking and entering involving the theft of money. More recent examples involve using the Internet to access major banks' computer systems.

Unauthorized Use at Work. Unauthorized use of computer systems and networks by employees. Recent surveys suggest 90% of U.S workers admit to using work resources for personal use.

Piracy. Software piracy is the unauthorized copying of software and is a violation of federal copyright laws. Such piracy results in millions of dollars of lost profits by software publishers.

Computer Viruses. A virus is a program that once inserted into another program can spread destructive program routines that can result in destroying the contents of memory, hard disks, and other storage devices. The use of antivirus programs can reduce the risk of receiving a virus.

Employment Challenges



he impact of information technologies on employment is a major ethical concern to managers of today's e-business.

Lost Job Opportunities. Information technology has created new jobs and increased productivity, while also causing a significant reduction in some types of job opportunities.

Individuality. A frequent criticism of e-business systems concerns their negative effect on the individuality of people. Computerized systems can depersonalize human transactions, forcing people to confront and respond to impersonal programmed logic. Information systems also often require strict adherence to detailed procedures. Such regimentation is incompatible with human ideals of flexibility and empathy. However, widespread use of personal computers and the Internet has dramatically improved the development of people-oriented and personalized systems.

Working Conditions. Many others suggest that while computers have eliminated monotonous or obnoxious tasks in the office place, thereby improving the quality of work, they have also made some jobs both repetitive and routine.

Computer Monitoring. Computer monitoring is used by many employers to collect productivity data about their employees. However, many argue that such technology can be used to monitor individuals, not just their work, thus, violating their privacy. Moreover, such 'Big Brotherism' increases stress in the workplace. Political pressure is building to outlaw or regulate computer monitoring in the workplace.

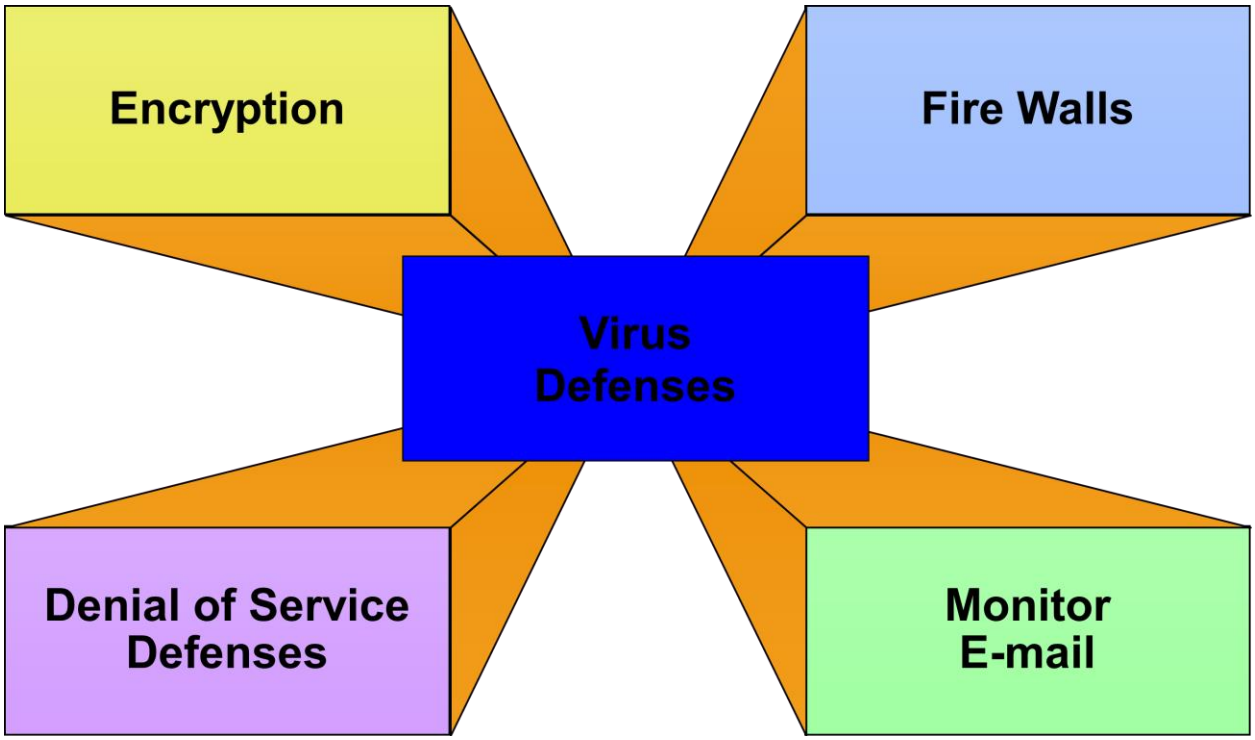
Stress is not the only health-related issue raised by the use of information technology. Heavy use of computers is linked to eyestrain, damaged arm and neck muscles, and radiation exposure.

Solutions to some of these health problems are based on the science of ergonomics. The goal of ergonomics is to design healthy work environments that are safe, comfortable, and pleasant for people to work in, thus increasing employee morale and productivity.

Ergonomics examines three major factors in the workplace:

- The tools used by the worker; e.g. computer screens, computer human interfaces, etc.;
- The work environment, e.g. lighting, work surfaces, climate etc.; and
- The job content and context, e.g. characteristics of the task, shift work, rest breaks etc.

Security Management of e-Business



As discussed earlier, there are many significant threats to the security of e-business and e-commerce. Business managers are responsible for the security, quality, and performance of their e-business systems. Hence, these corporate resources must be protected. The goal of security management is to ensure the accuracy, integrity, and safety of all e-business processes and resources. The slide illustrates many of the types of security measures needed by the e-business today. These include:

Encryption. Is an important way to protect data that is transmitted via the Internet, intranets, or extranets. The

contents of files can be scrambled using special mathematical algorithms. Users must have access to passwords that engage the scrambling and descrambling processing.

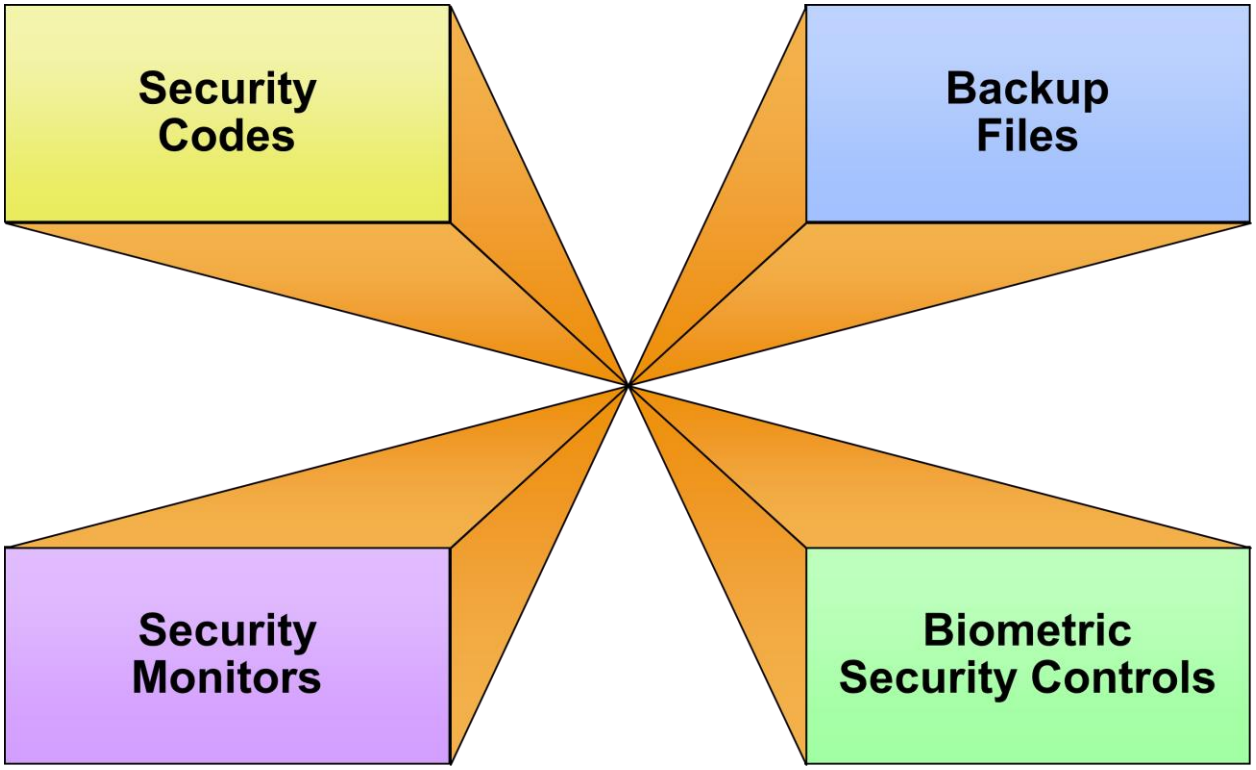
Fire Walls. A network fire wall is a computer that protects computer networks from intrusion by serving as a safe transfer point for access to and from other networks. The fire wall computer screens external connections and requests to make sure that they are valid and compatible with the network. Irregular or unauthorized access requests are denied. Hence, fire walls serve as 'gatekeepers'; keeping the system safe from intrusion.

Denial of Service Defenses. Denial of Service is a hacking tactic that can be used to crash a site by clogging the system with too many requests for information. To defend against such attacks an e-business must set and enforce security policies to prevent the infiltration of destructive programs like Trojan Horses. They should monitor and block traffic spikes, and should install multiple intrusion-detection systems and multiple routers for incoming traffic in order to reduce choke points.

Monitor e-Mail. While there is considerable debate about the violation of employee privacy, it is also true that e-mail is one of the favorite avenues of attack by hackers for spreading viruses or breaking into networked computers. Moreover, companies often have an interest in preventing illegal, personal, or damaging messages by employees. Companies should establish a clear e-mail monitoring policy that communicates to employees the reasons for monitoring, the appropriate use of e-mail, and disciplinary actions that can be taken in the case of violations.

Virus Defenses. Many companies are building defenses against the spread of viruses by centralizing the distribution and updating of antivirus software.

Other e-Business Security Measures



There are hosts of other security measures that can be used to protect network resources.

Security Codes. Multilevel passwords can be used to control access to information assets. For example, a user might be required to have one password for logging on to the system, another password to gain access to a particular application and still another password to access a particular file.

Passwords can also be encrypted to avoid theft or improper use. In some companies smart cards are used to generate random numbers to add to the end of a user's password, providing an additional level of security.

Backup Files. Duplicate or back up files are an important security measure. Files can also be protected by file retention measures that involve storing copies from previous periods. These can be used to reconstruct current files. Such files may be stored off-premises and can be a key component in disaster recovery.

Security Monitors. These are programs that monitor the use of computer systems and networks and protect them from unauthorized use, fraud, and destruction. Security monitors can control the use of hardware, software, and data resources of a computer. They can also be used to collect statistics on any attempt of misuse.

Biometric Security Controls. Biometric controls include such detection devices as voice recognition and fingerprinting, which must correspond to the authorized person before admitting personnel to the system.

Disaster Recovery

- Who will participate?
- What will be their duties?
- What hardware and software will be used?
- Priority of applications to be run?

- What alternative facilities will be used?

- Where will databases be stored?

Natural and man-made disasters can effectively disrupt a company's systems. For many companies the loss of a few hours of computer processing capabilities can spell disaster. To survive such an event businesses develop disaster recovery procedures and formalize them in a disaster recovery plan. Such a plan describes:

- Which employees will participate in disaster recovery and what their duties will be?
- What hardware, software and facilities will be used?
- The priority of applications to be processed.
- Identification of alternative facilities for disaster recovery site.
- Identification of off-site storage of databases.

Intellectual Property

Ideas and knowledge form the quintessential of trade in modern times.

The value of a new product lies in the amount of invention, innovation, research, design and testing that go behind its successful production.

Information or Information Product such as business rule, business model, pattern, layout, diagram or specific compilation in certain format used for business advantage can be classified as Intellectual property.

Corporations, particularly those having multi-national operations need to prevent others from using their inventions, designs or other creations – and to use that right to negotiate payment in return for others using them. These are referred to as "intellectual property rights – IPR" in the present day parlance.

Trade-related Aspects of Intellectual Property Rights

The TRIPs Agreement divided intellectual property rights into the following seven heads –

1. Patents,
2. Trademarks,
3. Copyrights,
4. Industrial designs,
5. Layout designs of integrated circuits,
6. Undisclosed information (trade secrets), and
7. Geographical indications.

Trade Secrets

A trade secret refers to data or information relating to the business which is not generally known to the public and which the owner reasonably attempts to keep secret and confidential.

Software if it is unique in design, architecture, process, and it is creation from within the organization then the software is a Trade Secret.

It must not be generally known or readily accessible by people who normally deal with such type of information

It must have commercial value as a secret

The lawful owner must take reasonable steps to keep it secret.

Examples of Trade Secrets
A business may have certain internal business processes that it follows for its day-to-day operations that give it an edge over its competitors.

The formula for making coke is considered to be the most well guarded trade secret in the world.

Unlike the US and other developed countries India has no legislation dealing with trade secrets.

In India protection of trade secrets is Common Law based. However, section 27 of the Indian Contract Act provides some sort of limited remedy, it bars any person from disclosing any information which he acquires as a result of a contract.

Tools to Protect Trade Secrets

- Employment agreement
- Trade Secret Policy
- Non-disclosure Agreements (NDAs)
- Adequate Documentation
- Security Systems

Trade secret law protects ideas in a work product, not only their manifestations.

It is difficult to prevent ideas in work from falling into public domain when the software is widely distributed.

Copyright

Copyright is a form of intellectual property protection granted under Indian law to the creators of original works of authorship such as literary works (including computer programs, tables and compilations including computer databases which may be expressed in words, codes, schemes or in any other form, including a machine readable medium), dramatic, musical and artistic works, cinematographic films and sound recordings.

Copyright law protects manifestations of ideas rather than the ideas.

A Competitor can use your software, understand how it works, and build a new software that follows the same concepts without infringing on a copyright.

These rights can be exercised only by the owner of copyright or by any other person who is duly licensed in this regard by the owner of copyright.

These rights include the right of adaptation, right of reproduction, right of publication, right to make translations, communication to public etc.

Original means, that the work has not been copied from any other source.

Copyright protection commences the moment a work is created, and its registration is optional.

However it is always advisable to obtain a registration for a better protection.
The reference to on-line copyright issues can be found in the following two major enactments:

(1) The Copyright Act, 1957, and

(2) The Information Technology Act, 2000.

The copyright in a work is infringed if it is copied or published without its owner's consent
without a license granted by the owner of the copyright.

If a person knowingly makes use on a computer of an infringing copy of a computer Programme, he shall be held liable for punishment of imprisonment for a term which shall not be less than seven days but which may extend to three years and with fine which shall not be less than fifty thousand rupees but which may extend to two lakh rupees.

Information Technology Act, 2000
If any person without permission of the owner or any other person who is in charge of a computer, accesses or secures

access to such computer, or downloads, copies or extracts any data, computer data base or information from such computer, including information or data held or stored in any removable storage medium, he shall be liable to pay damages by way of compensation not exceeding one crore rupees to the person so affected.

Indian Patents Act, 1970

The object of patent law is to encourage scientific research, new technology and industrial progress.

The price of the grant of the monopoly is the disclosure of the invention at the Patent Office, which, after the expiry of the fixed period of the monopoly, passes into the public domain.

The fundamental principle of Patent law is that a patent is granted only for an **INVENTION which must have novelty and utility.**

To decide whether an alleged invention involves novelty and an inventive step, certain broad criteria can be indicated.

Firstly if the "manner of manufacture" patented, was publicly known, used or practiced in the country before or at the date of the patent, it will **negative novelty**.