MANAGEMENT INFORMATION SYSTEMS

Edited By

Pooja

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SYLLABUS

Management Information Systems

Objectives: To provide the student with a comprehensive grounding in many facets of Information systems, an analysis of different information systems and exposure to recent development developments in the field.

Sr. No.	Description
1.	The Need for Information Systems: Digital Convergence and the changing Business Environment; Information and Knowledge Economy; Contemporary Approach to IS and Management Challenges.
2.	Information Systems in the Enterprise: Types of Information Systems in the Organisation; TPS, DSS, MIS and ESS. Functional Perspective of IS; Enterprise Systems; Strategic uses of Information Systems; Economic Organisational and Behavioural Impacts; IT Impact on Decision Making; Leveraging Technology in the Value Chain; MIS and Core Competencies; Strategic Information Systems (SIS).
3.	Electronic Commerce and the Digital Organisation: Internet based Business Models. B2B, EDI and B2C Models; Role of Intranets.
4.	Business Hardware Software and IT Infrastructure: Evolution of IT Infrastructure; Moore's law, law of Mass Digital Storage; IT Infrastructure Components; Current Trends in Hardware Platforms; Enterprise Software; Groupware.
5.	Business Networks and Telecommunications: Communication Technologies in Business, Videoconferencing, Wireless Payments; Bandwidth and Media; Networks and their Types; Protocols; Internet Networking Services; Future of Networking Technologies; Broadband telephony, VOIP, RFID and Convergence.
6.	Databases and Data Warehouses: Traditional vs Database approach; Database Models, Relational Model, and Object Oriented Model; Relational Operations SQL; Data Modelling; Databases on the Web; Data Warehousing.
7.	The Wireless Revolution: Introduction. Business Value; Wi-Max and EVDO; M-Commerce; Applications in CRM , Supply Chain and Healthcare.
8.	Enhancing Decision Making for the Digital firm: Decision making and Decision Support Systems; Business Intelligence and Decision Support; Business Decision Making and the Decision Making Process, GDSS, GIS.
9.	Managing Knowledge in the Digital Firm: Knowledge Management System, Enterprise-wide Knowledge Management Systems. Intelligent Techniques: Expert Systems, Fuzzy Logic Systems, Neural Networks, Genetic Algorithm, Hybrid AI Systems, Intelligent Agents.
10.	Redesigning the Organization with Information Systems: BPR and Process Improvement; Systems Analysis, System Design; Alternative System Building Approaches; Management Opportunities Challenges and Solutions.

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Unit 1: Management Information Systems

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Objectives

After studying this unit, you will be able to:

- Discuss the concept of information system
- Understand the concept of digital convergence and changing business environment

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- Discuss Information and knowledge economy
- Understand contemporary approach to IS
- Recognize management challenges

Introduction

Management Information System is an old management tool, which has been long used by people for better management and scientific decision-making.

Management Information System is mainly dependent upon information, which is a vital ingredient of any Management Information System. Information is the most critical resource of Management Information System. We all know that information is a vital factor for our existence. Just as our body needs air, water and clothes, we are as much dependent upon information. To make life more interesting and to achieve the feeling of being a part of the social system, we want to know our surroundings and for that we need information. Information is an important input for achieving our goals such as learning to help each other and to become integral part of society.

Actually, information system is not a new concept; it is as old as the hills. From biblical times, humans have been making the use of information generated through information systems in all times. There have been systems that generated and communicated information. Kings and rulers had their own ways of designing information systems to retrieve information. The main objective of these information systems was to ascertain the well being of their people in the kingdom and to effectively and efficiently manage the kingdom. The church had its own information system. In India, Tainali Rama, Akbar and many others had impressive management information systems in operation. Similarly, the merchants of Venice had their own fully functional appropriate management information system in place.

1.1 Information Systems

Now, it is time to see the real meaning and concept of Information Systems. Too often you hear someone say, "Oh yeah, I know how to use a computer. I can surf the Web with the best of them and I can play Solitaire for hours. I'm really good at computers." Okay. So that person can pound a keyboard, use a mouse at lightning speed, and has a list of favorite Web sites a mile long. But the real question is "Is that person's information literate?" Just because you can pound the keyboard it doesn't necessarily mean that you can leverage the technology to your advantage or the advantage of your organization. An organization can gather and keep all the data on its customers that a hard drive can hold. You can get all the output reports that one desk can physically hold. You can have the fastest Internet connection created to date. But if the organization doesn't take advantage of customer data to create new opportunities, then all it has is useless information. If the output report doesn't tell the management that it has a serious problem on the factory floor, then all that's been accomplished is to kill a few more trees. If you don't know how to analyze the information from a Web site to take advantage of new sales leads, then what have you really done for yourself today?

Most of us think only of hardware and software when we think of an Information System. There is another component of the triangle that should be considered, and that's the people side, or "liveware."

We talk about the input, processing, output and feedback processes. Most important is the feedback process; unfortunately it's the one most often overlooked. Just as we discussed above, the hardware (input and output) and the software (processing) receive the most attention. With those two alone, you have computer literacy. But if you don't use the "liveware" side of the

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triangle to complete the feedback loop, you don't accomplish much. Add the "liveware" angle with good feedback and then you have the beginnings of information literacy.

An information system differs from other kinds of systems in that its objective is to monitor/ document the operations of some other system, which we can call a target system. An information system cannot exist without such a target system.

Example: Production activities would be the target system for a production scheduling system, human resources in the business operations would be the target system of a human resource information system, and so on. It is important to recognize that within a vending machine there is a component/sub-system that can be considered an information system. In some sense, every reactive system will have a sub-system that can be considered an information system whose objective is to monitor and control such a reactive system.

Did u know? **What is Information System?**

Information system is defined as a collection of elements that capture data and convert it in information and disseminate to the decision-makers in an organization.

Task Before discussion of information system you should know the information technology in detail.

1.1.1 The Need for Information Systems

Ask managers to describe their most important resources and they'll list money, equipment, materials, and people - not necessarily in that order. It's very unusual for managers to consider information an important resource and yet it is. This unit will help explain why you need to manage this resource as closely as any other in your organization.

The Competitive Business Environment

For many years computer technology was relegated to the backrooms or basements of a corporation. Only the "techies" worried about it and were often the only ones who really knew how it all worked. Now computers are all over the organization - one on every desk. It's not enough for you to know how to pound a keyboard or click a mouse. It is not even enough for you to know how to surf the Web. Now every employee, including you, must know how to take advantage of Information Systems to improve your organization and to leverage the available information into a competitive advantage for your company.

Why Business Need Information Technology?

Information Technology is reshaping the basics of business, customer service, operations, product and market strategies, and distribution are heavily, or sometimes even entirely, dependent on IT. The computers that support these functions can be found on the desk, on the shop floor; in the store, even in briefcases. Information technologies, and its expense, have become an everyday part of business life. The fundamental reasons for the use of information technology in business are:

- Support of business operations
- Support of managerial decision making
- Support of strategic competitive advantage.

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Emergence of the Global Economy

Next time you purchase a product, any product, look at the fine print and see where it's made. It could be China, or the Philippines, or India, or even USA. You can disagree with many manufacturing jobs that are being moved from other U.S. to foreign countries. But look at the vast number of jobs that are being created in this country. Maybe they aren't the traditional factory jobs we're used to. In fact, many of our new jobs are in the information industry. Many of them service entirely new markets that didn't exist just a few years ago. There was no position called "Webmaster" in 1991 because the Web didn't exist. But now, that particular job category is one of the fastest growing in the overseas. The global economy I am talking about is being made possible by technology. And that's why it's so important that you understand how to use Information Systems Technology instead of just computer technology.

Transformation of the Business Enterprise

You can't help but know about the entire job cuts occurring in our country. It seems like every week we hear about thousands and thousands of people losing their jobs. Back in the 80s most of the job losses were in the blue-collar sector. In the 90s it seems many of the cuts were being made in the white collar, management jobs. Why? Think about it. Technology, to a large extent, has driven organizations to change the way they operate and that includes the way they manage. We're going to take an in-depth look at how organizations work and how they've been transformed by technology.

But it isn't always bad! You just have to ask yourself this question: "With all the job losses in the last few years, many driven by technological changes, why has the Indian unemployment rate dropped to it's lowest in decades and remained so low?"

Self Assessment

Fill in the blanks:

1. An information system differs from other kinds of systems in that its objective is to monitor/document the operations of some other system, which we can call a .... system.
2. Information Technology is ..... the basics of business, customer service, operations, product and market strategies, and distribution are heavily, or sometimes even entirely, dependent on IT.

1.2 Digital Convergence

Digital convergence is an approach by which all types of media and communication will be digitized allowing them to be used through a single worldwide network. The speed and computing capacity of technology continues to advance at dizzying speeds and in ways we can hardly imagine.

1.2.1 Interactive Multimedia

One trend highly touted by the experts is that of the "information appliance." Do we need to have a separate device for watching television, another one for listening to music, a different one called a telephone, and yet a whole separate device for computing? Some people say we can do all of that with one central appliance with a variety of input and output devices.

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If you watch the mergers taking place in the corporate world between the telephone companies and cable TV companies, you can start to understand another major change that may be in store for us. The companies are working toward a convergence of the "entertainment outlets" we know as television and the Internet. Why can't we download a movie off the Internet whenever we're ready to watch it instead of having to follow a TV channel's set schedule? This idea may be a reality in a few years.

The music industry is struggling with the issue of music downloaded from websites. How do the musicians protect their copyrighted work while making the music more accessible to the public? How do the music publishing companies protect their business from disintermediation, the process of eliminating the middleman from transactions?

1.2.2 Role of Information Technologies on the Emergence of New Organizational Forms

During the last years, a consensus is emerging that to survive in the competitive turbulence that is engulfing a growing number of industries, firms will need to pinpoint innovative practices rapidly, to communicate them to their suppliers and to stimulate further innovation. In order to be competitive, companies are forced to adopt less hierarchical and more flexible structures, and to define strategies able to combine reduced costs, high quality, flexibility and a quick answer to customer requirements. Nowadays, there are very few companies with enough resources to form its value chain on their own.

Therefore, some changes are taking place within individual companies and in their relations with other organizations, creating new structures in which relationships between customers and suppliers are suffering considerable changes. One of these changes is concerned with the formation of networks in which there is a division of labour that allows each company to exploit their distinctive advantages, and be more competitive globally.

In a network model, a set of juridically independent companies establish cooperative long-term links in order to achieve a higher level of competitiveness. The enterprises that belong to a network have not all the elements needed for manufacturing a product or providing a service under their absolute control. Therefore, the success of this kind of structures is conditioned by the coordination degree obtained along the realization of inter-organizational activities, which requires an efficient communication system among the partners. The Information Technology (IT) represents a supportive element that facilitates the transfer of information across organizational boundaries. In this paper we analyze the inclusion of the Interorganizational Information Systems (IOS) concept within the network model and discuss the role IT plays in enabling organizational transformation towards emergent forms of organization.

In order to attain relatively low costs in the last two decades the enterprises followed strategies of backward-forward integration, based on the improvement of the effects of the experience curve and the scale economies. We consider that this internal growth may be inadequate to face the new situations appearing in the nineties and, no doubt, those that will appear in the next century. The individual enterprise has less capability for foreseeing the consequences of the different business decisions; however, the need for competing in a more and more complex context requires the adoption of quick decisions, which facilitate the flexibility of the enterprise. New technologies, fast changing markets and global competitiveness are revolutionizing relationships both within and between organizations. Thus, the new environment requires from the enterprises a strategy able to agglutinate reduced costs, high quality, flexibility, and a quick response to the needs of the customer.

Nowadays, the enterprises have to compete in a more and more turbulent scene, which obliges them to adopt less hierarchical and more flexible structures. During the last years, a major

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transformation in the strategy of many enterprises has been observed with a tendency to disintegration. This is accompanied by a need for increasing the quality of the products or services offered, which requires more interdependency among the different corporate units. As a consequence of it, several transformations both inside the enterprises and in the relationships between them are taking place, which establishes new structures through which the relationships among competitors, customers and suppliers are changing substantially. One of these changes is the cooperation established among different enterprises, which allows them to develop their competitive capability. Companies are forming strategic alliances because there is an increasing acknowledgement that organizations operate in a relational context of environmental connectedness and that organizational survival and performance depend upon connections with other organizations.

Notes The co-operation among enterprises allows their flexibility and their innovative capacity to be increased. Current products are based on so many critical technologies that most of the enterprises cannot keep constantly updated in all of them.

The Network Structure

The concept of the network's form of organization has been particularly popular with management writers for its potential to build the flexible organization with the ability to meet the challenges of a changing and global environment. Despite both the abundant available literature and the existence of a certain consensus on some aspects, there is still too much ambiguity in the concepts used in this area. Taking into account the formation of networks, which is an interesting field of recent development with strong repercussions on the inter-organizational relationships, it is necessary to clear the existing terminological confusions in order to formulate its theory and to improve its implementation.

Starting from the definition, a network is a specific kind of relationship joining a particular group of people, objects, or events. Two factors needed for constituting a network can be obtained from this definition; first, a network is formed by a group of elements; second, these elements establish specific relationships among them. We must show that the establishment of a co-operative network is not a purpose itself but "it must be a dynamic structure that allows consolidating the competitive position of its members".

By means of a network structure, the competitive position of the enterprises can be reinforced as these concentrate on what they do best, and on what maintains their success in the market. In this way, other enterprises make the activities left, in which they have distinctive competencies too. The enterprises outsource those activities that are ballast and bureaucratize them.

The enterprises that belong to a network have not all the elements needed for manufacturing a product or providing a service under their absolute control. Within the networks, the involved elements belong to independent enterprises and are placed along the value system of a product or service.

All this drives to an organizational structure in which the enterprises generate more value in those areas where they have specific competencies. The success of these emergent organizational forms seems to be based, on a great extent, on an effective co-ordination by means of the use of advanced information systems, which are based on the Information Technologies (IT). There is an increasing interest in the relationship between the emerging organizational ways and the function of the IT/IS insofar as the progresses in each field have influenced the others.

Information Technology on the Emergence of Networks

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At the moment, the most spectacular and potentially powerful uses of the information systems technology go beyond the individual borders of the enterprises. In fact, the most important function of IT in the nineties is the better management of the interdependencies among the enterprises. Information Technology has to be the most powerful instrument to reduce the co-ordination costs». While the traditional uses of IT tried to facilitate the internal processes of the enterprises, the Interorganizational Information Systems (IOS) are addressed towards the efficiency of a group of enterprises.

Most of the studies about IOS have focused on the incidence of IT on the flows of information among the organizations, its capability of reducing the transaction costs, and its potential to achieve competitive advantages. Many authors have verified that:

- IT influences the nature, punctuality and detail level of the information shared by enterprises
- IT reduces the transaction costs, while it provides a better management of the risks
- IT reduces the co-ordination costs.

In order to benefit from the advantages of IT, the enterprises have to keep in mind that IT cannot be isolated from its organizational context». We do not agree with the existence of causation between the implementation of IT and the organizational changes in the enterprise driving to an increase in the competitiveness of the enterprises. On the contrary the technological and organizational implementations are both sides of the same issue, since they depend on and determine each other». We think that, although IT might have the above mentioned positive effects on the organizations, the will and capabilities of the directors of the company are needed in order to make the most of those advantages.

In order to make the most of the whole potential of the IOS, it will be required that the managing directors get involved with the project, since they have a wider and more strategic view of the company. In this way, a system coherent with the objectives of the company would be implemented. This system would allow taking even more profit from IT, what would have positive repercussions on the enterprise and would facilitate the achievement of its objectives. The active participation of the Management Board in the planning of the IOS brings a problem related to the fact that IT is a relatively new resource that did not exist when most of the current managers were trained. Therefore, they usually do not feel comfortable with these new technologies.

As a proof of this, we will consider an example.

Example: McKesson was a dealer company of chemical products. This company knew that its success was linked to that of its customers, which were small stores, so it established a close relationship with them. By means of an appropriate use of Information Technologies, it helped its customers to maximize their profits, since it gave them useful information for competing with the big pharmaceutical chains, which were getting a greater market share. The McKesson Corporation directors' idea was so successful that many other enterprises of the sector tried to imitate it, but they made a terrible mistake. They thought that the network created by McKesson was just a computerized system with terminals connected in other enterprises.

The secret of the success of this company were not the computer links; information technology did not create the network. The network's success was due to the fact that the directors of McKesson were aware of both the relationships along the added value chain and the need to strengthen as much as possible every link within the chain, so cooperative behaviors could be established in order to provide the share of information and the quick response to the changes of the demand.

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Example: Widely mentioned in the literature on Information Systems, is the one of the American Hospital Supply Company whose success has shown up the need to consider the network established not only as a mere system of electronic data exchange, but also as a better implementation of the technology found within a context of changes in the commercial relationships between the enterprise and its main customers.

A positive consequence of the revolution of communication and Information Technologies is that there are more available options for designing the labour now, because the technology can be used to increase the capacities of the workforce, and the information can be transferred to those places were the labour is carried out. Workers do not need to be located according to parameters of time and space to co-ordinate any more.

We consider that technology, although it is not the ground for the emergence of a new and innovative way of organizing the enterprises, plays an important role in its operation.

Technology allows doing things in a different way, which provides the directors some organizational possibilities that would be unthinkable without its implementation. Thus, using a mathematical expression, we can state that Information Technologies are necessary but they are not enough to achieve greater business competitiveness.

The Role of IOS within the Network Structure

The enterprises involved in an alliance must decide whether to use the manual management of all the exchanged data, or to complement that management with the interconnection of their respective computer applications. This interconnection may bring, however, compatibility problems in the integration of the data from the different enterprises, since those applications would have possibly been designed without taking into account any requirement of integration among enterprises. The establishment of co-operation networks implies the need for wider communication in the organizational field, as well as the requirement of capability to integrate the information systems from different enterprises.

The enterprises inside a network cannot operate properly if they have not the possibility to communicate quickly, accurately, and over long distances. Within a network, it does not make any sense to restrict the application of modern computer technologies to the individual borders of each enterprise. The Management Board of the enterprises in the network must, on the contrary, consider the possibilities of coordinating the processing of data outside the limits of their own organizations by means of an IOS.

The application of the IT which provides the electronic integration among the shareholders of an industry may make easier the outsourcing of activities, as well as be a basic part of the proper operation of the reticular structures. An IOS may play an important role in the coordination of interdependent activities, which would be carried out by distant organizational units. Thus, the enterprises can reduce their dependency on strategies of backward-forward integration in order to ensure the control over the production process.

The concept of network emphasizes the interdependency among enterprises, which is provoked by the presence and the sharing of the following key attributes: objectives, experience, labour, taking of decisions, responsibility, trust, and acknowledgement or reward. The enterprises within a network will adopt a common objective, namely to provide a quicker and better service to the final customer. With this aim in view, independent organizations will have to establish close interrelationships, in which Information Technologies have a vital role to play. In this way, the aim of optimizing the flow of profits along the supply chain could be achieved too. IOSs are, basically, new means to facilitate the relationships among organizations; they are, therefore, a strategic instrument.

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However, an IOS allows to obtain operative advantages too, such as:

- Reducing paperwork and manual operations;
- Reducing the stock levels;
- Accelerating the product and material flow;
- Standardizing of procedures;
- Accelerating the flow of information about changes on the demand;
- Reducing telecommunication costs.

The IT is a basic support that facilitates the co-ordination of different enterprises through EDI systems, shared databases, e-mail, video conferences, which will allow them to work together. They will be able to share information on the markets, on the needs for materials, on stock levels, production schedules, and delivery programs. A key factor in an efficient exchange of information within a network is the computer connection of its members. The computer links accelerate the transference of information, since it provides the automatic transmission of data between physically distant computers. These links can be used as a strategic instrument to increase the competitiveness of the enterprise, binding it electronically with its customers and suppliers through inter-organizational systems. The electronic connection facilitates the approaching of the linked enterprises, which means that the companies may provide the customers direct access to the internal databases, as well as just-in-time stock control.

Task What should be the structure of network in the organization? Explain.

Self Assessment

Fill in the blanks:

3. ..... is an approach by which all types of media and communication will be digitized allowing them to be used through a single worldwide network.
4. A ..... is a specific kind of relationship joining a particular group of people, objects, or events.
5. The ..... inside a network cannot operate properly if they have not the possibility to communicate quickly, accurately, and over long distances.

1.3 Changing Business Environment

The powerful worldwide changes have altered the environment of business. These changes in the business environment and climate are classified into political, social, economical and technological categories.

Environmental, organizational, and technological factors are creating a highly competitive business environment where customers are the focal point. Further, environmental, organizational, and technological factors can change quickly, sometimes in an unpredictable manner.

Therefore, companies need to react often and quickly to both the problems and the opportunities resulting from this new business environment. This dramatic change is due to a set of business pressures or drivers. They maintain that in order to succeed (or even to survive) in this dynamic world, companies must not rely only on traditional actions such as lowering cost, but also encourage innovative activities by empowering employees.

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Organizations are composed of five major components:IT, organizational structure and corporate culture, management and business processes, organization's strategy, and individuals and roles. These components are in stable condition, called equilibrium, as long as no significant changes occur in the environment or in any of the components. However, as soon as a significant change occurs, the system becomes unstable.

Caution It is necessary to adjust some or all of the internal components since all are interrelated.

1.3.1 IT and Organizational Design

An important and fast growing technological innovation during this century is computer-based information systems. Computer-based information systems (CBIS or only IS) provide an opportunity for businesses to improve their efficiency and effectiveness, and even to gain a competitive advantage. IT is also a catalyst of fundamental changes in the structure, operations and management of organizations. Most businesses in the industrial world could not compete, and many could not even survive without computers and software. Now IT is an integral part of the products and services delivered to customers.

Competition leads to environmental uncertainty and increases both the need for and the rate of innovation adoption. By adopting IS, businesses will be able to compete in three ways:

- IS can change the industry structure and, in doing so, alter the rules of competition;
- IS can also create competitive advantage by offering business new ways to outperform their rivals; and
- IS spawns new businesses, often from within existing operations of the business.

1.3.2 IT-enabled Organizational Transformation

There is a growing body of conceptual papers and case studies on IT-enabled organizational transformation in the information systems literature. Most of the studies suggest that the use of IT without concomitant organizational changes is unlikely to yield significant gains in terms of organizational performance.

1.3.3 Four R's of Business Transformation

Business Transformation can be defined as "The orchestrated redesign of the genetic architecture of the corporation, achieved simultaneously – although at different speed – along the four dimensions of reframing, restructuring, revitalization and renewal." By this definition a biological model has been developed that we call the Four R's of transformation are:

- ***Reframing*** is the shifting of a company's conception of what it is and what it can achieve with new visions and a new resolve.
- ***Restructuring*** is a girding of corporate loins, getting it to achieve a competitive level of performance by dealing with the body of corporation and competitiveness. The need to be lean and fit is the primary consideration.
- ***Revitalization*** is about igniting growth by linking the corporate body to the environment.
- ***Renewal*** deals with the people side of transformation, and with the spirit of the company. It is about investing individuals with new skills and new purposes, thus allowing the company to regenerate itself.

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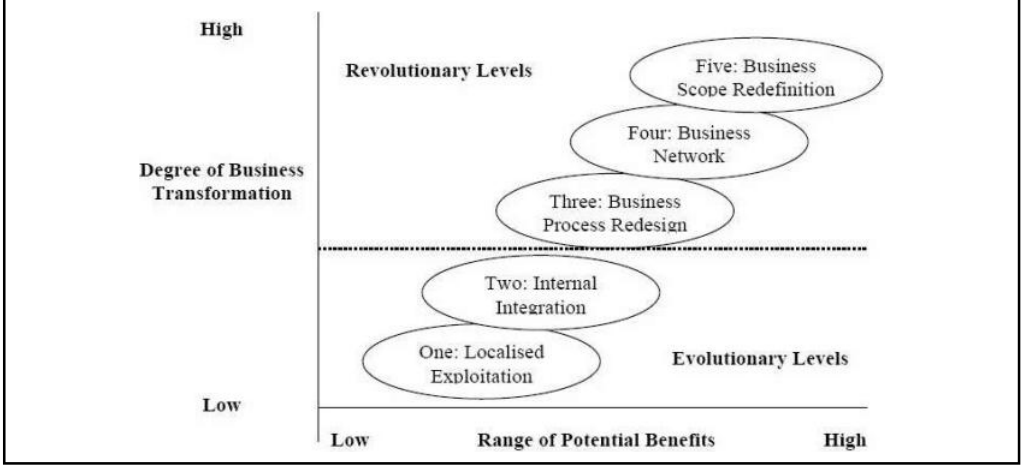
1.3.4 Five Levels of IT-induced Reconfiguration

The figure below is a schematic representation of these five levels along two basic dimensions – the degree of business transformation and the range of potential benefits from IT. Organizations thereby proceed to higher levels of transformation as the demands of competition and value creation for customer increases. The first two levels are evolutionary, requiring relatively incremental changes in the existing organizational processes. In contrast, the other three levels are conceptualized as revolutionary, requiring fundamental changes in the nature of business processes.

Figure 1.1: Levels of IT-induced Reconfiguration



These five levels are explained as following:

- ***Level 1:*** Localized Exploitation (Automation), which is concerned with the exploitation of IT within business functions.
- ***Level 2:*** Internal Integration, a logical extension of the first in the sense that IT capabilities are exploited in all the possible activities within the business process. Two types of integration are critical here: technical integration and the organizational integration by using common IT platform to integrate the organization's business processes to enhance efficiency and effectiveness.
- ***Level 3*****:** Business Process Redesign, involving the reconfiguration of the business using IT as a central lever.
- ***Level 4:*** Business Network Redesign concerned with the reconfiguration of the scope and tasks of the business network involved in the creation and delivery of the products and services.
- ***Level 5:*** Business Scope Redefinition concerned with the underlying principle of a corporation, pertaining to the possibilities of enlarging the business mission and scope (through related products and services) as well as shifting the business (through substitution of traditional capabilities with IT-enabled skills).

Self Assessment

Fill in the blanks:

6. ..... can be defined as "The orchestrated redesign of the genetic architecture of the corporation, achieved simultaneously – although at different speed – along the four dimensions of reframing, restructuring, revitalization and renewal."

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7. ..... is about igniting growth by linking the corporate body to the environment.

8. ..... deals with the people side of transformation, and with the spirit of the company.

1.4 Information and Knowledge Economy

Information work is the art of creating and processing information. We use the term "art" because some companies do a very good job of creating, processing, and managing their information; others do such a poor job that these tasks become a detriment to the success of the organization. Which kind of company do you want to work for or own?

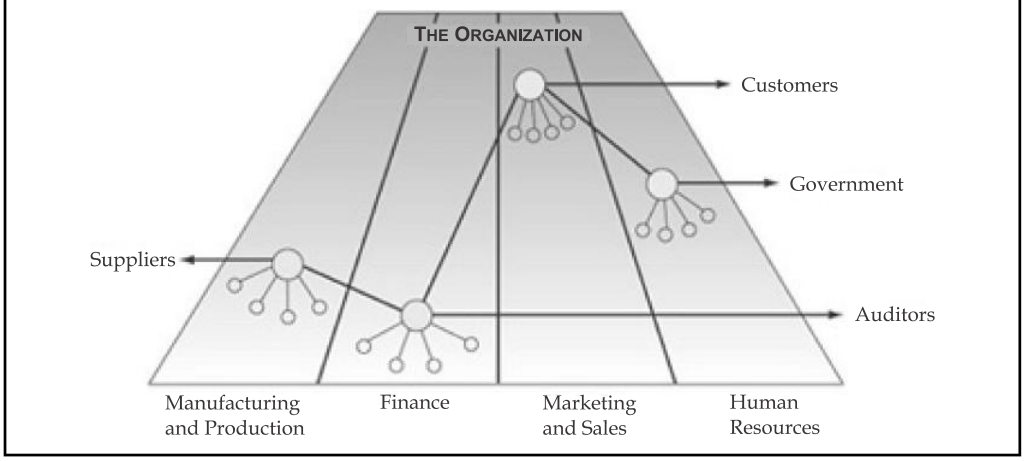
The two groups of employees primarily concerned with KWS are the data workers who process and distribute information and the knowledge workers who create knowledge and information. There are several ways to distinguish these two groups. You can also distinguish the two by the type of work they perform and how they create and use information. Here are some questions to help you:

- Do they create original ideas, or do they process, record, and store someone else's?
- Do they make their own original decisions regarding the information?
- Do they establish procedures to create and process the information, or do they follow someone else's procedures?

Task Explain the use of four R's of business transformation in an organization.

1.4.1 Distributing Knowledge – Office and Document Management Systems

Figure 1.2



The office, as we know it in the traditional sense, is the setting for the generation and processing of information. As the above figure shows, it's where different roles mesh into a smooth "machine" of producing information, knowledge, and ideas instead of a product that you can touch, feel, or smell.

Notes

Table 1.1

Office Activity	Technology
Managing documents	Word processing, desktop publishing, document imaging, web publishing, work flow managers
Scheduling	Electronic calendars, groupware, intranets
Communicating	E-mail, voice mail, digital answering systems, groupware, intranets
Managing data	Desktop databases, spreadsheets, user-friendly interfaces to mainframe databases

The table describes typical Office Automation Systems and the activities they support, all of which are vital to the success of the organization. While some OAS still rely on stacks and stacks of paper, modern technology emphasizes digital sourcing, storage, and distribution. As computers and associated technology become more embedded into the normal workflow of offices, more is being done without paper. For instance, a clerical worker can create a document, send it to co-workers or supervisors for their input via email, have it returned electronically, correct it, and distribute it online.

But no matter how much we talk about a paperless society, we are actually generating more paper than ever. One of the emerging technologies that is enhancing the productivity and ease-of-use of Office Automation Systems and reducing paper problems is the document imaging system, which converts documents and images into digital form so they can be stored and accessed by computer.

Documents not in use are stored on-line on an optical disk system called a jukebox. The index server maintains the information the system will use to locate, access, and retrieve a document.

Example: An example of document imaging systems is bank checks. Most banks don't return canceled checks any more. They make a digital image of the check, store it electronically, and then destroy the piece of paper. If you ever need a copy of one of your old checks, you have to request it. While the initial use of paper isn't reduced, the cost of processing and mailing the checks to the customer is gone altogether.

The advantages of using document imaging systems lie in the chance to redesign workflows. If companies aren't willing to do this, then they are laying out a lot of money to buy and install a system that they'll never fully use.

1.4.2 Creating Knowledge – Knowledge Work Systems

Now we'll review many different Knowledge Work Systems (KWS) so that you have a clear understanding of how they differ from OAS and other Information Systems. These systems help create new products or improve old ones, and they're also used to integrate new data into the flow of information that is so vital to an organization.

It's important that you understand the functions KWS perform. They:

- Keep the organization up-to-date in knowledge
- Serve as internal consultants
- Act as change agents

Notes

Self Assessment

Fill in the blanks:

9. The two groups of employees primarily concerned with KWS are the data workers who process and distribute information and the ..... who create knowledge and information. There are several ways to distinguish these two groups.
10. Documents not in use are stored on-line on an optical disk system called a .....
11. The office, as we know it in the traditional sense, is the setting for the generation and processing of .....

1.5 Contemporary Approach to Information Systems

There are several different approaches to Information Systems: technical, behavioral, socio-technical. Think of this analogy: A "techie" looks at most things associated with computing as a series of zeroes or ones. After all, everything in a computer is ultimately reduced to a zero or a one. So using the technical approach, you could say that 2 + 2 = 4. The behavioral approach, on the other hand, takes into account the very nature of human beings. Nothing is totally black and white. Therefore, the behavioral approach to the same equation would be "2 + 2 = maybe 4 or perhaps 3.5 to 5.5, but we'll have to put it before the committee and see what the next quarter's figures say." Neither approach is better than the other, depending on the situation. Neither approach is more right than the other, depending on the situation.

An organization can't afford to view its information resources as belonging to either the techies (technical approach) or the non-techies (behavioral approach). Responsibility for information belongs to everyone in the organization. This is the socio-technical approach, that is, a combination of the two. Everyone has to work together to ensure that Information Systems serve the entire organization.

To help you understand the importance of viewing Information Systems through the socio-technical approach, look at what the current trade journals are saying. David Haskin, writing in the April 1999 issue of Windows Magazine, quotes Steve Roberts, vice president of information technology for Mind Spring Enterprises, an Atlanta-based Internet service provider: "The gap in understanding between technical and non technical people is the biggest challenge I've seen." Haskin goes on to say, "Because technology is the bedrock on which successful businesses are built, the stakes in making this relationship work are high. Failing to use the correct technology can put you at a competitive disadvantage, and glitches in existing technologies can bring a business to a grinding halt."

Information Systems and the use of technology belong to everyone in an organization. This concept is best carried out through a socio-technical approach, which allows both the technical and behavioral approaches to be combined for the good of the organization.

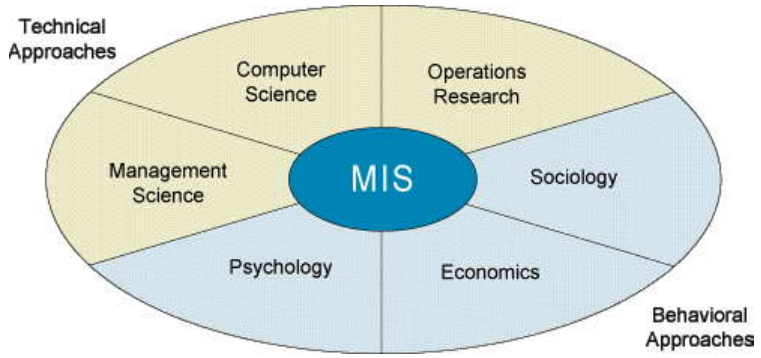
Information systems are socio-technical systems. Through they are composed of machines, devices, and "hard' physical technology, they require substantial social, organizational, and intellectual investments to make them work property.

The study of information systems deals with issues and insights contributed from technological and behavioral disciplines.

Task In your word what is the meaning of knowledge work systems.

Notes

Figure 1.3: Contemporary Approaches to Information Systems



1.5.1 Technical Approach

The technical approach to information systems emphasizes mathematically based models to study information systems, a well as the physical technology and formal capabilities of these systems.

The disciplines that contribute to the technical approach are:

- Computer science,
- Management science
- Operations research

Computer science is related with instituting speculations of computability, methods of computation, and techniques of efficient data storage and access.

Management science highlights the expansion of models for decision-making and management practices.

Operations research concentrates on mathematical techniques for optimizing chosen parameters of organizations like transportation, inventory control, and transaction costs.

From a technical approach, an information system is observed from a mathematical point of view. Mathematical models are used to study information systems and to elucidate how they can be applied. By means of a technical perspective, management would like to establish speculations of computability which can be utilized to recognize how to apply information systems.

Let us consider an analogy: A "techie" looks at most things linked with computing as a sequence of zeroes or ones. After all, everything in a computer is eventually diminished to a zero or a one. So by means of the technical approach, you could state that 2 + 2 = 4.

1.5.2 Behavioural Approach

An important part of the information systems field is concerned with behavioral issues that arise in the development and long-term maintenance of information systems. Issues such as strategic business integration, design, implementation, utilization, and management cannot be explored usually with the model used in the technical approach.

Notes

1.5.3 Approach of this Text – Socio-technical Systems

MIS combined the theoretical work of computer science, management science, and operations research with a practical orientation toward building systems and applications. Technology must be changed and designed in such way as to fit organizational and individual needs. At times, the technology may have to be "de-optimized" to accomplish this fit.

Self Assessment

Fill in the blanks:

12. The ..... approach to information systems emphasizes mathematically based models to study information systems, a well as the physical technology and formal capabilities of these systems.
13. The ..... approach takes into account the very nature of human beings.

1.6 Management Challenges

Is this new technology worth the headaches and heartaches associated with all the problems that can and will arise? Yes. The opportunities for success are endless. The new technologies do offer solutions to age-old problems. Improvements are possible to the way you operate and do business.

1.6.1 The Strategic Business Challenge

Companies spend thousands of dollars on hardware and software, only to find that most of the technology actually goes unused. "How can that be?" you ask. Usually because they didn't pay attention to the full integration of the technology into the organization. Merely buying the technology without exploiting the new opportunities it offers for doing business smarter and better doesn't accomplish much. Think and rethink everything you do and figure out how you can do it better. Change is inevitable, and information must be managed just as you would any other resource.

Creating a digital firm and obtaining benefit is a long and difficult journey for most organizations. Despite heavy information technology investments, many organizations are not realizing significant business value from their business systems, nor or they become digitally enabled. The power of computer hardware and software has grown much more rapidly than the ability of organizations to apply and to use this technology. To fully benefit form information technology, realize genuine productivity, and take advantage of digital firm capabilities, many organizations actually need to be redesigned. They will have to make fundamental changes in organizational behavior, develop new business models and eliminate the inefficiencies of outmoded organizational structures. If organizations merely automate what they are doing today, they are largely missing the potential of information technology.

1.6.2 The Globalization Challenge

The world becomes smaller every day. Competition increases among countries as well as companies. A good Management Information System meets both domestic and foreign opportunities and challenges. The rapid growth in international trade and the emergence of a global economy call for information systems that can support both producing and selling goods in many different countries. In the past, each regional office of a multinational corporation focused on solving its own unique information problems. Given language, cultural and political

Notes

differences among countries, this focus frequently resulted in chaos and the failure of central management controls. To develop integrated, multinational, information systems, businesses must develop global hardware, software and communication standards; create cross-cultural accounting and reporting structures; and design transnational business processes.

1.6.3 The Information Architecture Challenge

You have to decide what business you are in, what your core competencies are, and what the organization's goals are. Those decisions drive the technology, instead of the technology driving the rest of the company. Purchasing new hardware involves more than taking the machine out of the box and setting it on someone's desk. Remember the triangle of hardware, software, and persware. Take care of the people and they will take care of the rest! Information architecture describes how to incorporate technology into the mainstream processes in which the business is involved. How will the new Information System support getting the product produced and shipped? How will Advertising and Marketing know when to launch ad campaigns? How will Accounting know when to expect payment?

Many companies are saddled with expensive and unwieldy information technology platforms that cannot adapt to innovation and change. Their information systems are so complex and brittle that they act as constraints on business strategy and execution.

Notes Meeting new business and technology challenges may require redesigning the organization and building new information architecture and information technology infrastructure.

Did u know? **What is IT Architecture?**

A conceptual design for the execution of information technology in an organization, together with its hardware, software, and network technology platforms, data resources, application portfolio, and IS organization.

1.6.4 The Information Systems Investment Challenge

Too often managers look at their technological investments in terms of the cost of new hardware or software. They overlook the costs associated with the non-technical side of technology. Is productivity up or down? What is the cost of lost sales opportunities and lost customer confidence from a poorly managed E-Business Web site? How do you determine if your Management Information System is worth it?

A major problem raised by the development of powerful, inexpensive computers involves not technology but management and organizations. It's one thing to use information technology to design, produce, deliver and maintain new products. It's another thing to make money doing it. How can organizations obtain a sizeable payoff from their investments in information systems? How can management make sure that the management information systems contribute to corporate value?

1.6.5 The Responsibility and Control Challenge

Remember, humans should drive the technology, not the other way around. Too often we find it easier to blame the computer for messing up than to realize it's only doing what a human

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being told it to do. Your goal should be to integrate the technology into the world of people. Humans do control the technology, and as a manager, you shouldn't lose sight of that.

How can we define information systems that people can control and understand? Although information systems have provided enormous benefits and efficiencies, they have also created new problems and challenges of which managers should be aware. The following table describes some of these problems and challenges.

Management's focus must continually change to take advantage of new opportunities. They require lots of attention and planning for smooth execution.

Caution Changes should take place throughout the organization.

Table 1.2: Positive and Negative Impacts of Information Systems

Positive Impact of Information Systems	Negative Impact of Information Systems
Information system can perform calculations or process paperwork much faster than people.	By automating activities that were previously performed by people, information systems may eliminate jobs.
Information systems can help companies learn more about the purchase patterns and the preferences of the customers.	Information systems may allow organisations to collect personal details about people that violate their privacy.
Information systems provide new efficiencies through services such as automated teller machines (ATMs), telephone systems, or computer controlled airplanes and air terminals.	Information systems are used in so many aspects of everyday life that system outages can cause shutdowns of businesses or transportation services, paralyzing communities.
Information systems have made possible new medical advances in surgery, radiology, and patient monitoring.	Heavy uses of information systems may suffer repetitive stress injury, technostress, and other health problems.
The internet distributes information instantly to millions of people across the world.	The internet can be used to distribute illegal copies of software, books, articles, and other intellectual property.

Self Assessment

Fill in the blanks:

14. In case of ..... Challenge, creating a digital firm and obtaining benefit is a long and difficult journey for most organizations.

15. A good ..... meets both domestic and foreign opportunities and challenges.

Case Study

Hospital Information System

Molecular biology is one of two technologies that will shape how medicine will be practiced for future time (generation). Now-a-day's, we diagnose on the basis of present symptoms which require immediate control & attention but future doctors will be able to spot the signs of any disease years before the disease actually

Contd...

Notes

occurs. But at the same time information is another important factor which will effect on healthcare.

Because of the vital importance & roll of information on healthcare, the number of healthcare websites in every country is increasing. In America, out of 90 mn. people with access to web more than two-third (majority) are reported to have used into it to search the health information, and as a result doctor-patient relationship has been turned upside-down.

Because of the patient activism, which started in 1980 and with the help of the Internet, the role of doctors has been changing. With the help of Internet, the patients can form small groups and exchange their ideas, opinions, experience and can demand from society, doctors & pharma companies and can make independent decisions. This empowerment of consumers is one of the great benefits of electronic connectivity. As a result, patients will no longer accept medical paternalism, incompetence and arrogance and will become much more forceful about taking decisions related to their own care.

In India also because of the electronic technology break-thorough patients may demand drugs available in US. That would put pressure on Government to change their decisions on certain issues like raising the pharma budgets or allowing the patients to buy the drugs privately.

Now doctors also predict that patients will also be aware rebellion about extravagant and alarming variations in treatment procedures and will raise their voice. Doctors can't ignore & avoid the best clinical practice for treatment and rather they will forcefully have to make it standardized treatment procedure.

Doctors of 2020 will have less excuses to deviate from standards, will be well equipped with latest, more sophisticated & reliable diagnostic information, data about a patient's genetic make-up and access to online guidelines & suggestions of best clinical practices, and even physician's-decision support software's will tell them what to do.

Questions:

1. How the use & application of computers in medical science & research can improve the standard in medical research?
2. What is the importance of databases in modern medical research?
3. How different managers in the hospital management hierarchy will use the information for their own different purposes?
4. Comment on whether the Decision Support System for doctors will be welcomed by doctors and patients. (With reference to doctor's cognitive style & their background)
5. Identify & discuss the importance of informal & formal information to medical researchers & medical practitioners outlined in this case study.

Source: Management Information System by Dharmenda and Sangeeta Gupta

1.7 Summary

- Information is the most critical resource of Management Information System.
- Information Literacy is more than just clicking a mouse, pounding the computer keyboard, or surfing the Web.
- Digital convergence is an approach by which all types of media and communication will be digitized allowing them to be used through a single worldwide network.

Notes

- The powerful worldwide changes have altered the environment of business. These changes in the business environment and climate are classified into political, social, economical and technological categories.
- Information work is the art of creating and processing information. We use the term "art" because some companies do a very good job of creating, processing, and managing their information.
- There are several different approaches to Information Systems: technical, behavioral, socio-technical.
- The study of information systems deals with issues and insights contributed from technological and behavioral disciplines.
- A good Management Information System meets both domestic and foreign opportunities and challenges.

1.8 Keywords

Digital Convergence: It is an approach by which all types of media and communication will be digitized allowing them to be used through a single worldwide network.

Information System: A collection of elements that capture data and convert it in information and disseminate to the decision-makers in an organization.

Information Technology: Hardware and software that perform data processing tasks, such as capturing, transmitting, storing, retrieving, manipulating or displaying data.

Input: Consists of data, instructions and involves capturing and assembling elements that enter the system to be processed.

IT Architecture: A conceptual design for the implementation of information technology in an organization, including its hardware, software, and network technology platforms, data resources, application portfolio, and IS organization.

Knowledge Work Systems (KWS): These systems help create new products or improve old ones, and they're also used to integrate new data into the flow of information that is so vital to an organization.

1.9 Review Questions

1. Why are information systems essential in business today? Identify at least two trends in the global business environment that have made information systems so important.
2. Evaluate the role of information systems in supporting various levels of business strategy. Why is there considerable resistance in organizations towards introduction of information systems?
3. How are information systems changing the management process? What specific managerial roles can information systems support?
4. How can information systems support an organization's business operations, decision making by their managers and give them a competitive advantage? Identify examples within your organization to illustrate your answer.
5. What are the key management challenges involved in building, operating and maintaining information systems today?

Notes

6. Most of the studies suggest that the use of IT without concomitant organizational changes is unlikely to yield significant gains in terms of organizational performance. Comment.
7. Elucidate how digital convergence is used to digitize the types of media and communication.
8. Make distinction between various approaches to information system.
9. How IT provides help in the design of organization?
10. What are the roles of information technology on the emergence of new organizational system?

Answers: Self Assessment

1.	target	2.	reshaping
3.	Digital convergence	4.	network
5.	enterprises	6.	Business Transformation
7.	Revitalization	8.	Renewal
9.	knowledge workers	10.	jukebox
11.	information	12.	technical
13.	behavioral	14.	Strategic Business
15.	Management Information System		

1.10 Further Readings

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Online link

www.web-source.net

Notes

Unit 2: Information Systems in the Enterprise

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Objectives

After studying this unit, you will be able to:

- Understand types of information systems in the organization
- Recognize the functional perspective of IS
- Understand the concept of enterprise systems
- Discuss strategic uses of information systems

Notes

Introduction

The classification of Information Systems can be done on the basis of business functions also. This classification is done to achieve the maximum efficiency in business functions. There are lot many considerations we have to bother while we do business. The role played by the Internet and Information Technologies to support electronic commerce, enterprise communications and collaboration, and Web-enabled business processes both within a networked enterprise, and with its customers and business partners will definitely require specialized Information Systems for Business functions.

2.1 Information Systems in the Enterprise

Information systems can be grouped into business function categories; however, in the real world information systems are typically integrated combinations of functional information systems. Functional business systems are composed of a variety of types of information systems (transaction processing, management information, decision support, etc.) that support the business functions of:

- Accounting
- Finance
- Marketing
- Productions/operations management
- Human resource management

There is a strong emphasis in many organizations to develop such composite or cross-functional information systems that cross the boundaries of traditional business functions in order to reengineer and improve vital business processes. These organizations view cross-functional information systems as a strategic way to share information resources and improve the efficiency and effectiveness of a business, thus helping it attain its strategic objectives.

Business firms are turning to Internet technologies to integrate the flow of information among their internal business functions and their customers and suppliers. Companies are using the World Wide Web and their intranets and extranets as the technology platform for their cross-functional and inter-organizational information systems.

Let us review some foundation concepts which will help us to understand the detailed explanation of these systems.

E-Business Systems describes how information systems integrate and support enterprise-wide business processes and the business functions of marketing, manufacturing, human resource management, accounting, and finance.

Functional Business Systems – Functional business information systems support the business functions of marketing, production/operations, accounting, finance, and human resource management through a variety of e-business operational and management information systems.

Marketing – Marketing information systems support traditional and e-commerce processes and management of the marketing function. Major types of marketing information systems include interactive marketing at e-commerce websites, sales force automation, customer relationship management, sales management, product management, targeted marketing, advertising and promotion, and market research. Thus, marketing information systems assist marketing managers in electronic commerce product development and customer relationship decisions, as well as in planning advertising and sales promotion strategies and developing the e-commerce potential of new and present products, and new channels of distribution.

Notes

Manufacturing – Computer-based manufacturing information systems help a company achieve computer-integrated manufacturing (CIM), and thus simplify, automate, and integrate many of the activities needed to quickly produce high-quality products to meet changing customer demands.

Example: Computer-aided design using collaborative manufacturing networks helps engineers collaborate on the design of new products and processes. Then manufacturing resource planning systems help plan the types of resources needed in the production process. Finally, manufacturing execution systems monitor and control the manufacture of products on the factory floor through shop floor scheduling and control systems, controlling a physical process (process control), a machine tool (numerical control), or machines with some humanlike work capabilities (robots).

Human Resources Management – Human resource information systems support human resource management in organizations. They include information systems for staffing the organization, training and development, and compensation administration. HRM websites on the Internet or corporate intranets have become important tools for providing HR services to present and prospective employees.

Accounting and Finance – Accounting information systems record, report, and analyze business transactions and events for the management of the business enterprise.

Example: Common accounting information systems include order processing, inventory control, accounts receivable, accounts payable, payroll, and general ledger systems.

Information systems in finance support financial manager in decisions regarding the financing of a business and the allocation of financial resources within a business. Financial information systems include cash management, online investment management, capital budgeting, and financial forecasting and planning.

Did u know? **What is accounting system?**

Information systems that record and report business transactions, the flow of funds through an organization, and produce financial statements.

Cross-Functional Enterprise Systems – Many e-business applications are integrated cross-functional enterprise applications like Enterprise Resource Planning (ERP), Customer Relationship Management (CRM), and Supply Chain Management (SCM), which also reengineers the business processes involved. Enterprise Collaboration Systems (ECS) support and enhance communication and collaboration among the teams and workgroups in an organization.

These systems themselves are being interconnected with Enterprise Application Integration (EAI) software so that the business users of these applications can more easily access the information resources they need to support the needs of customers, suppliers, and business partners.

Transaction Processing Systems - Online transaction processing systems play a vital role in e-commerce. Transaction processing involves the basic activities of (1) data entry, (2) transaction processing, (3) database maintenance, (4) document and report generation, and (5) inquiry processing. Many firms are using the Internet, intranets, extranets, and other networks for online transaction processing to provide superior service to their customers and suppliers.

Notes

Self Assessment

Fill in the blanks:

1. ..... describes how information systems integrate and support enterprise-wide business processes.
2. Human resource information systems support ..... in organizations.
3. ..... support and enhance communication and collaboration among the teams and workgroups in an organization.

2.2 Types of Information Systems in the Organization

Management Information Systems comprise many sub-systems and are influenced by the organization's structure, activities, risk profile, and technological capabilities. Within an organization set up, depending on the level of management, the information systems perform various activities and play certain roles. Information systems support top management in setting long-term goals, policies and achieving strategic competitive advantage. For middle management, information systems help in taking tactical decisions. For lower level management, an information system processes daily transactions. The role of information systems has developed during the years. The original conception was of automation of existing manual and pre-computer mechanical processes. This was quickly succeeded by the rationalization and integration of systems.

Notes In both of these forms, information system was regarded primarily as an operational support tool, and secondarily as a service to management.

We may look in some detail information systems below:

2.2.1 Transaction Processing System

Transaction processing systems were among the earliest computerized systems. Their primary purpose is to record, process, validate, and store transactions that take place in the various functional areas/of a business for future retrieval and use. A Transaction Processing System (TPS) is an information system that records company transactions (a transaction is defined as an exchange between two or more business entities).

Transaction Processing Systems (TPS) are cross-functional information systems that process data resulting from the occurrence of business transactions.

Transactions are events that occur as part of doing business, such as sales, purchases, deposits, withdrawals, refunds, and payments. Transaction processing activities are needed to capture and process data, or the operations of a business would grind to a halt.

Example: Let us look at a simple example of a business transaction. McDonald's, which sells a large number of hamburgers everyday, orders raw materials from its suppliers. Each time the company places an order with a supplier, a transaction occurs and a transaction system records relevant information, such as the supplier's name, address, and credit rating, the kind and quantity of items purchased, and the invoice amount.

Notes

Types of Transactions

There are mainly two types of transaction and these are:

- Internal transaction
- External transaction

Internal Transactions: Those transactions, which are internal to the company and are related with the internal working of any organization.

Example: Recruitment Policy, Promotion Policy, Production Policy, etc.

External Transactions: Those transactions, which are external to the organization and are related with the external sources, are regarded as External Transaction. For example sales, purchase, etc.

When a department orders office supplies from the purchasing department, an internal transaction occurs, when a customer places an order for a product, an external transaction occurs.

Characteristics of Transaction Processing Systems

Various characteristics of TPS are:

- A TPS records internal and external transactions for a company. It is a repository of data that is frequently accessed by other systems.
- A TPS performs routine, repetitive tasks. It is mostly used by lower-level managers to make operational decisions.
- Transactions can be recorded in batch mode or online. In batch mode, the files are updated periodically; in online mode, each transaction is recorded as it occurs.
- There are six steps in processing a transaction. They are data entry, data validation, data processing and revalidation, storage, output generation, and query support.

Features of TPS

Various features of TPS are:

- A TPS supports different tasks by imposing a set of rules and guidelines that specify how to record, process, and store a given transaction. There are many uses of transaction processing systems in our everyday lives, such as when we make a purchase at retail store, deposit or withdraw money at a bank, or register for classes at a university. Almost all organizations, regardless of the industry in which they operate, have a manual or automated TPS.
- A TPS is the data lifeline for a company because it is the source of data for other information systems, such as MIS and DSS (Decision Support Systems). Hence, if the TPS shuts down, the consequences can be serious for the organization.
- A TPS is also the main link between the organization and external entities, such as customers suppliers, distributors, and regulatory agencies.
- TPS exist for the various functional areas in an organization, such as finance, accounting, manufacturing, production, human resources, marketing quality control, engineering, and research and development. Until a few years ago, many companies viewed the TPS for each business function as separate entity with little or no connection to other systems in the company. Today, however, many companies are trying to build cross-functional TPS

to promote the free exchange of information among different business units. This is a desirable goal, but is still very difficult to achieve.

2.2.2 Decision Support System

A broad description of a decision support system is human and computer interaction used in decision-making. A Decision Support System (DSS) is an interactive computer-based system, which helps decision-makers utilize data and models to solve unstructured problems. Decision support systems couple the intellectual resources of individuals with the capabilities of the computer to improve the quality of decisions. It is a computer-based support system for management decision-makers who deal with semi-structured and unstructured problems.

A decision support system is an information system whose primary purpose is to provide knowledge workers with information on which to base informed decisions. The decision support systems take the data and present it in various formats to aid the individual or group in reaching a decision. The decision support systems are generally used by the highest level of management as an aid for the unstructured decisions they have to make. A decision support system provides facilities for verification of information integrity, and for discovery of discrepancies in received information. Statistical methods and rule-based systems provide some tools for the analysis and pre-processing of data used for generation and evaluation of alternative decisions.

A decision support system is a computer-based system consisting of three interacting components:

1. ***A language system:*** A mechanism to provide communication between the user and other components of the DSS,
2. ***A knowledge system:*** The repository of problem domain knowledge embodied is DSS either as data or procedures, and
3. ***A problem processing system:*** The link between the other two components, containing one or more of the general problem-handling capabilities required for decision-making.

   So, a decision support system is:

   (a) An information system

   (b) Which is used by managers

   (c) In making decisions

   (d) And to support, not to replace people

   (e) Used when the decision is semi-structured or unstructured

   (f) Incorporate a database of some sort

   (g) It also incorporates models

2.2.3 Management Information System

An Management Information System (MIS) is a subset of the overall internal controls of a business covering the application of people, documents, technologies, and procedures by management accountants to solve business problems such as costing a product, service or a business-wide strategy. Management information systems are distinct from regular information systems in that they are used to analyze other information systems applied in operational activities in the organization. Academically, the term is commonly used to refer to the group of information management methods tied to the automation or support of human decision making, e.g. Decision Support Systems, Expert systems, and Executive information systems.

Notes

It has been described as, "MIS 'lives' in the space that intersects technology and business. MIS combines tech with business to get people the information they need to do their jobs better/faster/smarter. Information is the lifeblood of all organizations - now more than ever. MIS professionals work as systems analysts, project managers, systems administrators, etc., communicating directly with staff and management across the organization."

An 'MIS' is a planned system of the collecting, processing, storing and disseminating data in the form of information needed to carry out the functions of management. In a way it is a documented report of the activities those were planned and executed. According to Philip Kotler "*A marketing information system consists of people, equipment, and procedures to gather, sort, analyze, evaluate, and distribute needed, timely, and accurate information to marketing decision makers.*"

The terms MIS and information system are often confused. Information systems include systems that are not intended for decision making. That area of study should not be confused with computer science. IT service management is a practitioner-focused discipline. MIS has also some differences with Enterprise Resource Planning (ERP) as ERP incorporates elements that are not necessarily focused on decision support.

Management Information System (M.I.S.) is basically concerned with processing data into information which is then communicated to the various Departments in an organization for appropriate decision-making.

Figure 2.1: Management Information System

Data collection involves the use of Information Technology (IT) comprising: computers and telecommunications networks (E-Mail, Voice Mail, Internet, telephone, etc.)

Computers are important for more quantitative, than qualitative, data collection, storage and retrieval; Special features are speed and accuracy, and storage of large amount of data.

Telecommunications provide the means for one-way or two-way communication and for the transmission of messages. A combination of IT is used: telephone, computer, processor, printer, etc. A lot of time and money are saved and the security of data and messages is ensured.

MIS provides several benefits to the business organization: the means of effective and efficient coordination between Departments; quick and reliable referencing; access to relevant data and documents; use of less labour; improvement in organizational and departmental techniques; management of day-to-day activities (as accounts, stock control, payroll, etc.); day-to-day assistance in a Department and closer contact with the rest of the world.

Did u know? The area of study called MIS is sometimes referred to, in a restrictive sense, as information technology management.

2.2.4 Executive Support System (ESS)

Executive Support Systems (ESS) supply the necessary tools to senior management. The decisions at this level of the company are usually never structured and could be described as "educated guesses." Executives rely as much, if not more so, on external data than they do on data internal to their organization. Decisions must be made in the context of the world outside the organization. The problems and situations senior executives face are very fluid, always changing, so the system must be flexible and easy to manipulate.

Notes

The Role of ESS in the Organization

Executives often face information overload and must be able to separate the chaff from the wheat in order to make the right decision. On the other hand, if the information they have is not detailed enough they may not be able to make the best decision. An ESS can supply the summarized information executives need and yet provide the opportunity to drill down to more detail if necessary.

As technology advances, ESS are able to link data from various sources both internal and external to provide the amount and kind of information executives find useful. As common software programs include more options and executives gain experience using these programs, they're turning to them as an easy way to manipulate information. Many executives are also turning to the Web to provide the flexibility they need.

The Nature of Executive's Work

We now know the basics of ESS. Now before continuing further I want to discuss the nature of an executives work. This means that which type of work executives normally do or perform for which they require not a DSS but ESS. This is highly required before building an ESS because without the knowledge of executives work we cannot decide about the system which is suitable for him.

Basically manager's role is divided into three categories:

- ***Interpersonal Role:*** Roles like figurehead, leader, and liaison
- ***Informational Roles:*** Roles of monitor, disseminator, spokesperson
- ***Decisional Roles:*** Entrepreneur, disturbance handler, resource alligator, negotiator.

Most of the ESS support all these roles for executive's successful working. If we pay attention then we can see that for interpersonal roles and informational roles with very few advances to DSS the executives can start using ESS. But executives mainly require the ESS for decisional roles.

Caution To determine the information needs of executives, it is necessary to specify the activities, which are performed in decisional role.

We divide the work of executives in relation to the decision roles into 2 phases. Phase 1 is the identification of problems or opportunities. Phase 2 is the decision of what to do about it. The figure below provides the flowchart that describes about the process of information flow in decisional roles.

Functional units like finance, production, accounting, and personnel, etc. generate the internal information. The external information comes from the sources such as online databases, newspaper, industry newsletters, government reports, personal contacts, etc. We know that the combined information is very important because that is the source needed for successful competition and survival. As the data is large the information is needed to be scanned further. The collected information is then checked and verified for its correction that is it is evaluated for the further use of the organization. Finally, the evaluated information is sent for qualitative or quantitative analysis. Then the executive makes a decision whether an opportunity occurs or problem occurs. If there is a problem then information is given as an input for the next step else it is again scanned for further evaluation. Finally the executives take the decision.

Task Describe MIS in a virtual organization.

Notes

Benefits of ESS

As more executives come up through the ranks, they are more familiar with and rely more on technology to assist them with their jobs. Executive Support Systems don't provide executives with ready-made decisions. They provide the information that helps them make their decisions. Executives use that information, along with their experience, knowledge, education, and understanding of the corporation and the business environment as a whole, to make their decisions.

Executives are more inclined to want summarized data rather than detailed data (even though the details must be available). ESS rely on graphic presentation of information because it's a much quicker way for busy executives to grasp summarized information.

Because of the trend toward flatter organizations with fewer layers of management, companies are employing ESS at lower levels of the organization. This trend will probably continue as more managers become knowledgeable about the power and flexibility of ESS.

Advantages of ESS

Advantages of ESS are:

- Simple for high-level executives to use Operations do not require extensive computer experience.
- Provides timely delivery of company summary information.
- Provides better understanding of information.
- Filters data for better time management.
- Provides system for improvement in information tracking.

Disadvantages of ESS

Disadvantages of ESS are:

- Computer skills required to obtain results.
- Requires preparation and analysis time to get desired information.
- Detail oriented Provides detailed analysis of a situation.
- Difficult to quantify benefits of DSS, How do you quantify a better decision?
- Difficult to maintain database integrity.
- Provides only moderate support of external data and graphics capabilities.

Self Assessment

Fill in the blanks:

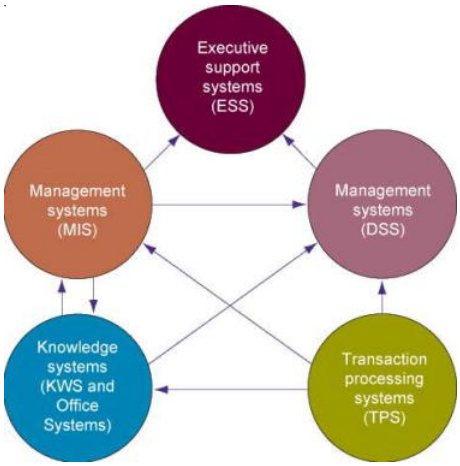
4. ..... are cross-functional information systems that process data resulting from the occurrence of business transactions.
5. A ..... is a mechanism to provide communication between the user and other components of the DSS.
6. ..... supply the necessary tools to senior management.
7. An ..... is a planned system of the collecting, processing, storing and disseminating data in the form of information needed to carry out the functions of management.

Notes

2.3 Functional Perspective of Information Systems

Information systems can be classified by the specific organizational function they serve as well as by organizational level.

Figure 2.2: Interrelationships Among Systems



The various types of systems in the organization have interdependencies. TPS are a major producer of information that is required by the other systems which, in turn, produce information for other systems.

Notes These different types of systems are only loosely coupled in most organizations.

2.3.1 Sales and Marketing Systems

The sale and marketing function is responsible for selling the organization's products or services. Marketing is concerned with identifying the customers for the firm's products or services, determine what they need or want, planning and developing products and services to meet their needs, and advertising and promoting these products and services.

2.3.2 Manufacturing and Production Systems

The manufacturing and production function is responsible for actually producing the firm's goods and services. Manufacturing and production activities deal with the planning, development, and maintenance of production facilities; the establishment of production goals; the acquisition, storage, and availability of production materials; and the scheduling of equipment, facilities, materials, and labor required to fashion finished products.

2.3.3 Finance and Accounting Systems

The finance function is responsible for managing the firm's financial assets, such as cash, stocks, bonds, and other investments, in order to maximize the return on these financial assets. The finance function is also in charge of managing the capitalization of the firm. In order to determine whether the firm is getting the best return on its investments, the finance function must obtain a considerable amount of information from sources external to the firm.

Notes

2.3.4 Human Resources Systems

The human resource function is responsible for attracting, developing, and maintaining the firm's workforce. Human resources information systems support activities such as identifying potential employees, maintaining complete records on existing employees, and creating programs to develop employees' talents and skills.

Strategic-level human resources system identify the employee requirements (skills, educational level, types of positions, number of positions, and cost) for meeting the firm's long term business plans.

Self Assessment

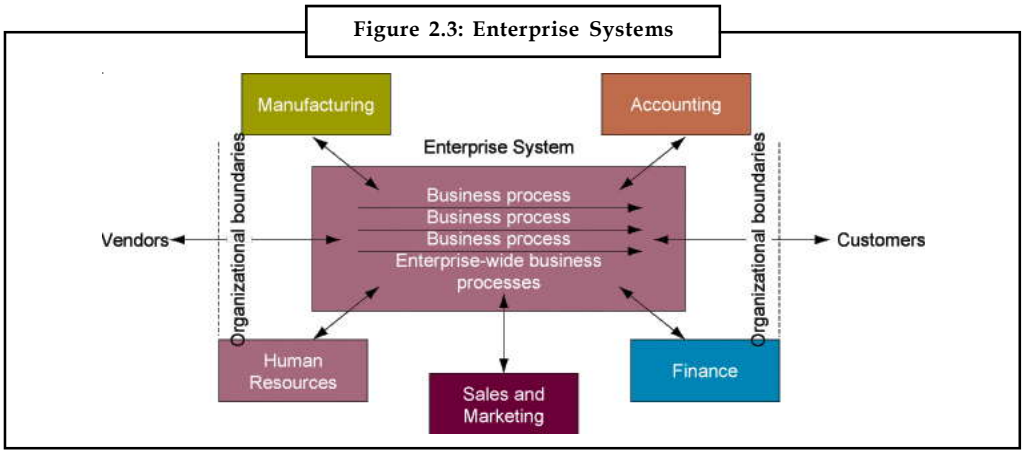
Fill in the blanks:

8. The ..... function is responsible for selling the organization's products or services.
9. The ..... function is responsible for attracting, developing, and maintaining the firm's workforce.

2.4 Enterprise Systems

A large organization typically has many different kinds of information systems that support different functions, organizational levels, and business processes. Many organizations are also building enterprise systems, also known as Enterprise Resource Planning (ERP) systems, to provide firm wide integration.

Figure 2.3: Enterprise Systems



Enterprise systems can integrate the key business processes of an entire firm into a single software system that allows information to flow seamlessly throughout the organization. These systems may include transactions with customers and vendors.

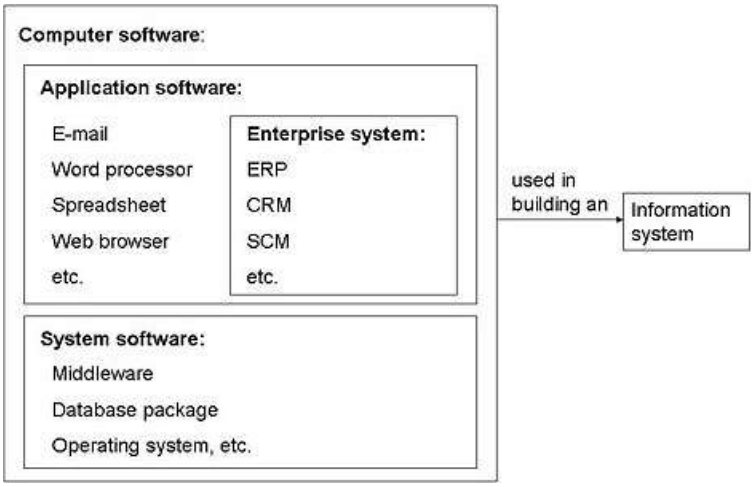
Enterprise Systems (ES) are large-scale, integrated application-software packages that use the computational, data storage, and data transmission power of modern Information Technology (IT) to support processes, information flows, reporting, and data analytics within and between complex organizations. In short, ES are Packaged Enterprise Application Software (PEAS) systems, where all three adjectives, "packaged", "enterprise", and "application", in combination, restrict the set of things that can be called ES. Although some people have equated the terms "enterprise system" and "Enterprise Resource Planning (ERP) system", since the term "ERP" now has a reasonably clear meaning it is convenient to use the term "enterprise system" to refer to the larger set of all large organization-wide packaged applications with a process orientation

Notes

including Enterprise resource planning (ERP), Customer Relationship Management (CRM), Supply Chain Management (SCM). Enterprise systems are built on, though do not include, software platforms such as SAP's NetWeaver and Oracle's Fusion and, usually, a relational database. In addition, although data warehousing or business intelligence systems are enterprise-wide packaged application software often sold by ES vendors, since they do not directly support execution of business processes, it is often convenient to exclude them from the definition of ES.

ES is a special class of enterprise application software (namely packaged enterprise application software), which, in turn, is a type of enterprise software. Here, the adjective "enterprise" is used to connote "enterprise class" software, i.e., software designed for use in large organizations. Clearly, under the preceding definition, ES is also a special class of application software (namely packaged enterprise application software).

Figure 2.4: Enterprise Systems



Computer-based systems built using ES are types of Enterprise Information System, or Management Information System, which, in turn, are types of information system (IS). The distinction between ES and IS is that "ES" refers to software, whereas an IS is a social system that uses IT, i.e., an IS includes people—often in an organizational setting—as well as IT.

2.4.1 Benefits of Enterprise Systems

The various benefits of enterprise systems are:

- ***Firm Structure and Organization: One Organization***: Companies can use enterprise systems to support organizational structures that were not previously possible or to create a more disciplined organizational culture.
- ***Management: Firm wide Knowledge-based Management Process***. In addition to automating many essential business transactions, such as taking orders, paying suppliers, or changing employee benefit status, enterprise systems can also improve management reporting and decision making.
- ***Technology: Unified Platform***: Enterprise systems promise to provide firms with a single, unified, and all-encompassing information system technology platform and environment. Enterprise systems promise to create a single, integrated repository that gathers data on all the key business processes.
- ***Business: More Efficient Operations and Customer-driven Business Process***: Enterprise systems can help create the foundation for a customer-driven or demand organization. By

Notes

integrating discrete business processes such as sales, production, finance, and logistics, the entire organization can efficiently respond to customer requests for products or information, forecast new products, and build and deliver them as demand requires.

2.4.2 The Challenge of Enterprise Systems

Although enterprise systems can improve organizational coordination, efficiency, and decision making, they have proven very difficult to build. Employees must take on new job functions and responsibilities. Enterprise systems require complex pieces of software and large investment of time, money, and expertise.

Daunting Implementation

Enterprise systems bring dramatic changes to business. They require not only deep-seated technological changes but also fundamental changes in the way the business operates.

High Up-front Cost and Future Benefits

The costs of enterprise systems are large, up-front, highly visible, and often politically changed. Although the costs to build the system are obvious, the benefits often cannot be precisely quantified at the beginning of an enterprise project. One reason is that the benefits often accrue from employees using the system after it is completed and gaining the knowledge of business operations heretofore impossible to learn.

Inflexibility

Enterprise system software tends to be complex and difficult to master, with a worldwide shortage in people with the expertise to install and maintain it. The software is deeply intertwined with corporate business.

Realizing Strategic Value

Companies may also fail to achieve strategic benefits from enterprise systems if integrating business process processes using the generic models provided by standard ERP software prevents the firm from using unique business processes that had been sources of advantage over competitors.

2.4.3 Enterprise Information Systems

Enterprise Information System is generally any kind of computing system that is of "enterprise class". This means typically offering high quality of service, dealing with large volumes of data and capable of supporting some large organization ("an enterprise").

Enterprise Information Systems provide a technology platform that enables organizations to integrate and coordinate their business processes. They provide a single system that is central to the organization and ensure that information can be shared across all functional levels and management hierarchies. Enterprise systems are invaluable in eliminating the problem of information fragmentation caused by multiple information systems in an organization, by creating a standard data structure.

A typical Enterprise Information System would be housed in one or more Data centers, run Enterprise software, and could include applications such as Content management systems and typically cross organizational borders.

Notes

The word enterprise can have various connotations. The term may be used to mean virtually anything, by virtue of it having become the latest corporate-speak buzzword.

Task Discuss various challenges of enterprise systems.

Caution Frequently the term enterprise is used only to refer to very large organizations.

Self Assessment

Fill in the blanks:

10. ..... can integrate the key business processes of an entire firm into a single software system that allows information to flow seamlessly throughout the organization.
11. The distinction between ES and IS is that "ES" refers to ....., whereas an IS is a social system that uses IT.
12. Enterprise Information System is generally any kind of computing system that is of "……".

2.5 Strategic Uses of Information Systems

Organizations are now investing heavily in information systems and information technology. However, there is a general dissatisfaction with the benefits that accrue from this investment. Argues that information systems and technology can be centrally instrumental in achieving corporate goals but only where the organization has a clearly defined corporate and competitive strategy, and understands the information needs that underpin these strategies. It demonstrates the interrelationships between strategy and information systems.

An effective strategy is not necessarily one that promises maximum efficiency or least total cost, but rather one that fits the needs of the organization and strives for consistency between the organization's capabilities and the competitive advantage being sought by the organization. The successful application of strategy in the contemporary global environment requires an organization to have an effective strategic management process. In turn, an effective strategic management process increasingly depends on the effective application of advances in information technology.

2.5.1 Firm-Level Strategy and Information Technology

Think of a picture puzzle with all its separate pieces scattered on the table. Separately, the pieces don't make a very pretty picture. But if you fit them together, they make quite a beautiful piece of art. So too for businesses. Separately, the various units of a business don't function well and certainly aren't successful on their own. But if you fit them all together, so they work in conjunction, you can create a successful business. Information technology can help you do this.

What does a business do better than anyone else? Does it make the best jeans in the world? Do they produce the best movies? Does it deliver flowers faster and fresher than any of the competition? Whatever its main product or service is, that's its core competency. Successful companies can use information technology to improve their core competencies by sharing information across business units. They can also use technology to expand their core competencies by using knowledge stored in their information systems.

Notes

Firstly we will recognize the definition of firm and business to understand firm-level strategy in a clear manner.

A microeconomic notion specifies that a firm is a corporation that exists and makes decisions so as to make the most of profits. The speculation of the firm goes along with the speculation of the consumer, which specifies that consumers search for maximizing their on the whole utility.

Business is defined as an organization or enterprising unit occupied in commercial, industrial or professional activities. A business can be a for-profit unit, like a publicly-traded firm, or a non-profit organization involved in business activities, such as an agricultural cooperative. Businesses communicate with the market to verify pricing and demand and then assign resources as per the models that require maximize net profits.

2.5.2 Industry-Level Strategy and Information Systems

The industry level strategy and information system based on:

- Competitive Forces and Network Economics
- Information Partnerships

Competitive Forces and Network Economics

Look at the relationship between America OnLine and Microsoft. On one hand, they are fierce competitors, going head to head in attracting Web users to their respective Web sites. On the other hand, they work together to supply Web users with desktop icons for accessing the Web. How is it that they can compete so vigorously in one area and yet cooperate so well in another? Because both make sense and make money for each company.

Information Partnerships

Many times it's more productive and cheaper to share information with other companies than to create it yourself. Information partnerships between companies, even competitors, can enhance a company's products by aligning them with an industry-wide standard. Vehicle tire manufacturers form information partnerships to share information about standard widths and sizes of tires. Can you imagine how difficult it would be for consumers and other businesses if each tire maker built tires differently?

Other companies form information partnerships to add extra elements to their products which they couldn't offer on their own. Lots of companies offer credit cards with their logo and company information. They then share customer information with the credit card companies. Both companies win because they can offer extra services and products not available if they had to act alone.

Industry is defined as a fundamental category of business activity. The term industry is sometimes used to illustrate a very specific business activity (such as semiconductors) or a more common business activity (such as customer durables). If a company contributes in numerous business activities, it is generally considered to be in the industry in which most of its profits are derived.

Competitive Force Model

The most renowned support for scrutinizing competitiveness is competitive forces model. It has been used to produce approaches for companies to augment their competitive frame. It also illustrates how IT can increase the competitiveness of corporations. The model identifies the chief forces that could jeopardize a company's position in a specified industry. Even though the particulars of the model vary from one industry to another, its common structure is worldwide.

Notes

The five chief forces can be generalized as follows:

1. The threat of entry of new competitors
2. The bargaining influence of suppliers
3. The bargaining influence of customers (buyers)
4. The risk of alternate products or services
5. The competition between present firms in the industry.

The strength of every force is determined by factors associated to the industry's structure. While the Internet has changed the nature of business, it has also modified the nature of competition. Some have recommended semi radical variations in the model. For example, Harmon et al. (2001) suggest adding a sixth force- negotiating influence of employees-to the original five. Porter himself quarrels that the Internet doesn't vary the model, but that it is only another tool to be used in looking for competitive advantage. Alternatively, "The Internet per se will hardly ever be a competitive advantage. Many of the companies that achieve success will be the ones that utilize the Internet as a complement to traditional manners of competing, not those that set their Internet initiatives besides their recognized functions".

There are some recommended ways the Internet influences competition in the five factors:

1. ***The threat of new competitors:*** For many of the firms, the Internet *enhances* the threat of new competitors. Initially, the Internet penetratingly decreases conventional obstruction to entry, like the require for a sales force or a physical storefront to sell goods and services. All a competitor needs to do is set up a Web site. This threat is particularly sharp in industries that carry out an intermediation role in addition to industries in which the primary product or service is digital. Secondly, the geographical goal of the Internet facilitates remote competitors to bring rivalry into the local market, or even an indirect competitor to compete more directly with an existing firm.
2. ***The bargaining power of suppliers:*** The Internet's influence on suppliers is mixed. On the one hand, buyers can locate substitute suppliers and evaluate prices more easily, diminishing the supplier's bargaining influence. Alternatively, as companies utilize the Internet to combine their supply chain and link digital exchanges, participating suppliers will flourish by locking in consumers and rising switching costs.
3. ***The bargaining influence of customers:*** The Web extensively enhances a buyer's use to information regarding products and suppliers, Internet technologies can decrease customer switching costs, and buyers can more simply acquire from downstream suppliers. These factors signify that the Internet significantly enhances customers' bargaining influence.
4. ***The threat of alternate products or services:*** Information-dependent industries are in the greatest danger here. Any industry in which digitalized information can substitute material goods must observe the Internet as a threat.
5. ***The competition among existing firms in the industry:*** The visibility of Internet functions on the Web makes proprietary systems harder to keep undisclosed, decreasing differences between opponents. In many of the industries, the propensity for the Internet to lower variable costs in relation to fixed costs supports price discounting simultaneously that competition transfers to price. Both are forces that support destructive price competition in an industry. The on the whole impact of the Internet is to enhance competition, which pessimistically influences profitability.

Notes

2.5.3 IS Techniques to Gain Competitive Advantage

Competitive advantage may be achieved with many techniques in business. Information technology is one area that may provide several opportunities. In general, MIS techniques may not be better than other methods. However, some firms have experienced considerable success from using these techniques, so they are well worth considering.

Additionally, the rapid changes in technology often lead to competitive advantages if your firm is the first to find a creative use for the new technology. The other side of the coin is that untested new technologies may not work as planned. Hence, the pioneer is taking a risk: If the project fails, the development costs may put the firm at a competitive disadvantage.

The question we wish to examine is how information systems can take advantage of these techniques. The fundamental mechanisms for gaining competitive advantage are barriers to entry, switching costs, lower production costs, product differentiation, control over distribution channels, innovation, and quality control.

Sources of Barriers to Entry

The sources of entries are:

- Economies of scale (size)
- Economies of scope (breadth)
- Product differentiation
- Capital requirements
- Cost disadvantages (independent of size) Distribution channel access Government policy.

Barriers to Entry

The additional costs of creating a sophisticated information system make it harder for firms to enter the industry.

- ***Distribution Channels:*** Control over distribution prevents others from entering the industry. Consumers are reluctant to switch to a competitor if they have to learn a new system or transfer data.
- ***Lower Production Costs:*** Using technology to become the least-cost producer gives an advantage over the competition.
- ***Product Differentiation:*** Technology can add new features to a product or create entirely new products that entice consumers.
- ***Quality Management:*** Monitoring production lines and analyzing data are important aspects of quality control. Improving quality leads to more repeat sales.
- ***The Value Chain:*** Evaluating the entire production process identifies how value is added at each step. Combining steps or acquiring additional stages of the value chain can lead to greater profits.

Self Assessment

Fill in the blanks:

13. The successful application of ..... in the contemporary global environment requires an organization to have an effective strategic management process.

Notes

14. The industry level strategy and information system is based on Competitive Forces and Network Economics and .....

15. Monitoring production lines and analyzing data are important aspects of .....

2.6 Summary

- Information systems can be grouped into business function categories; however, in the real world information systems are typically integrated combinations of functional information systems.
- Management Information Systems comprise many sub-systems and are influenced by the organization's structure, activities, risk profile, and technological capabilities.
- Transaction Processing Systems (TPS) are cross-functional information systems that process data resulting from the occurrence of business transactions.
- A Decision Support System (DSS) is an interactive computer-based system, which helps decision-makers utilize data and models to solve unstructured problems.
- An 'MIS' is a planned system of the collecting, processing, storing and disseminating data in the form of information needed to carry out the functions of management.
- Executive Support Systems (ESS) supply the necessary tools to senior management. The decisions at this level of the company are usually never structured and could be described as "educated guesses."
- The various types of systems in the organization have interdependencies. TPS are a major producer of information that is required by the other systems which, in turn, produce information for other systems.
- Enterprise Systems (ES) are large-scale, integrated application-software packages that use the computational, data storage, and data transmission power of modern Information Technology (IT) to support processes, information flows, reporting, and data analytics within and between complex organizations.

2.7 Keywords

Accounting Systems: Information systems that record and report business transactions, the flow of funds through an organization, and produce financial statements. This provides information for the planning and control of business operations, as well as for legal and historical record-keeping.

Computer-Aided Manufacturing: The use of computers to automate the production process and operations of a manufacturing plant. Also called factory automation.

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

E-Business: e-business is the use of the Internet and other networks and information technologies to support electronic commerce, enterprise communications and collaboration, and web-enabled business processes both within an internetworked enterprise, and with its customers and business partners.

Manufacturing Systems: Information systems that support the planning, control, and accomplishment of manufacturing processes. This includes concepts such asComputer-Integrated Manufacturing (CIM) and technologies such as Computer-Aided Manufacturing (CAM) or Computer-Aided Design (CAD).

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Marketing Systems: Information systems that support the planning, control, and transaction processing required for the accomplishment of marketing activities, such as sales management, advertising and promotion.

Online Transaction Processing Systems: A real-time transaction processing system.

Real-time Processing: Data processing in which data is processed immediately rather than periodically. Also called online processing.

Transaction Processing Cycle: A cycle of basic transaction processing activities including data entry, transaction processing, database maintenance, document and report generation, and inquiry processing.

2.8 Review Questions

1. Try to know the Information Systems in any one of the companies existing in Marketing or Manufacturing. Find out their advantages and Disadvantages.
2. If you have not decided which area of business for your career, choose your favorite industry (Automobile, Food/Restaurant, Healthcare/Hospital, Hospitality/Hotel, Leisure/Tourism, etc.), and write the report on emerging (new) technology in that particular industry.
3. Discuss the features of transaction processing system with the help of suitable example.
4. What are the major uses of information system in the enterprise? Explain sales and marketing information in detail.
5. Why we use Computer Integrated Manufacturing (CIM) in manufacturing information system. Give suitable reason.
6. What do you think Executive Support System (ESS) make some effect on the organization?
7. Briefly explain the advantage and disadvantage of ESS in detail.
8. Discuss any five information systems in a business organization.
9. What are enterprise systems? Illustrate the benefits of enterprise systems.
10. Make distinction between the various interactive components of decision support system.

Answers: Self Assessment

1. e-Business Systems
2. human resource management
3. Enterprise collaboration systems (ECS)
4. Transaction processing systems
5. language system
6. Executive Support Systems (ESS)
7. MIS
8. sale and marketing
9. human resource
10. Enterprise systems
11. software
12. enterprise class
13. strategy
14. Information Partnerships
15. quality control

2.9 Further Readings

Notes

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Online link

www.dakshasoft.com

Notes

Unit 3: IT Impacts

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Objectives

After studying this, unit, you will be able to:

- Study economic organizational and behavioural impacts
- Understand IT impact on decision making
- Discuss leveraging technology in the value chain
- Discuss MIS and core competencies
- Understand strategic information system

Introduction

In this unit, we will discuss various economic impacts of IT and Organizational and Behavioral impacts of IT. Also you will understand the impact of IT on decision making. At the business level the most common analytic tool is value chain analysis. We will discuss leveraging technology in the value chain in this unit. A Strategic Information System (SIS) is system that assists companies change or otherwise alters their business strategy and/or structure. The concept of Strategic Information System is also discussed in detail.

Notes

3.1 Economic Organizational and Behavioural Impacts

3.1.1 Economic Impacts

Information technology helps firms contract in size, because it can reduce transaction costs—the costs incurred when a firm buys on the marketplace what it cannot make itself. According to transaction cost theory, firms and individuals seek to economize on transaction costs, much as they do on production cost. Using markets is expensive because of costs such as locating and communicating with distant suppliers monitoring contract compliance, buying insurance, obtaining information on products and so fort.

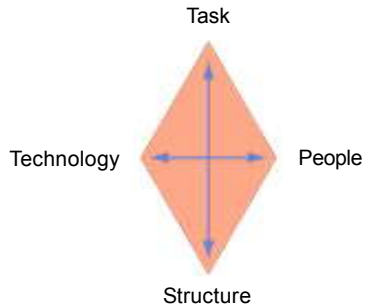
Information technology also can reduce internal management costs. According to agency theory, the firm is viewed as a "nexus of contracts" among self-interested individuals rather than as a unified, profit-maximizing entity. A principle (owner) employs "agents" (employees) to perform work on his or her behalf. However agents need constant supervision and management, because they otherwise will tend to pursue their own interests rather than those of the owners.

Notes As firms grow in size and scope, agency costs or coordination cost rise, because owners must expend more and more effort supervising and managing employee.

3.1.2 Organizational and Behavioral Theories

Behavioral researchers have theorized that information technology could change the hierarchy of decision making in organizations by lowering the costs of information acquisition and broadening the distribution of information. Information technology could bring information directly from operating units to senior managers, thereby eliminating middle managers and their clerical support workers. Alternatively, information technology could distribute information directly to lower- level workers, who could then make their own decisions based on their own knowledge and information without any management intervention.

Figure 3.1: The Agency Cost Theory of the Impact of Information Technology on the Organization



As firms grow in size and complexity, traditionally they experience rising agency costs. IT shifts the agency cost curve down and to the right, allowing firms to increase size while lowering agency costs.

Implementing information systems has consequences for task arrangements, structures, and people.

Notes

Caution According to this model, in order to implement change, all four components must be change simultaneously.

Self Assessment

Fill in the blanks:

1. Information technology helps firms contract in size, because it can reduce ..... costs.
2. According to ..... theory, the firm is viewed as a "nexus of contracts" among self-interested individuals rather than as a unified, profit-maximizing entity.
3. ..... researchers have theorized that information technology could change the hierarchy of decision making in organizations by lowering the costs of information acquisition and broadening the distribution of information.

3.2 IT Impact on Decision-making/Role of Information Technology

Decision-making increasingly happens at all levels of a business. The Board of Directors may make the grand strategic decisions about investment and direction of future growth, and managers may make the more tactical decisions about how their own department may contribute most effectively to the overall business objectives. But quite ordinary employees are increasingly expected to make decisions about the conduct of their own tasks, responses to customers and improvements to business practice. This needs careful recruitment and selection, good training, and enlightened.

Times have changed and so have the methods by which managers make decisions. Information technology has helped speed the change in methods.

Did u know? Decision making is an integral part of every manager's day-to-day activities at work place. Due to this fact managers are also known as "decision makers" in business organizations.

Task Discuss what kind of IT impact on decision-making process

3.2.1 Traditional and Contemporary Management

Technology has enabled companies to flatten their hierarchies. The last few years has seen an exodus of middle managers. Companies simply didn't need the extra layers because of technological advances that allow lower levels of employees to communicate and collaborate easier and faster than ever before. Managers in these newly flattened organizations are now responsible for making sure employees know the environmental influences on the organization, know the goals of the organization, and adjust the organization to meet the new influences. Managers then free their employees to meet not only the organization's goals, but also their personal goals.

Information systems can help managers and employees work more efficiently and effectively in this new environment by increasing the amount of information available to all employees. Communications are faster and more widespread with new technologies that enable employees

Notes

and managers to collaborate more closely and work better in teams. New information systems also enable virtual organizations and geographically dispersed teams and groups to work together to meet personal and organizational goals.

3.2.2 Implications for System Design

The decision-making process is much different in today's organization than it was just a few years ago. The danger of building a system to accommodate today's process is that it will not take these changes into account. Understanding how people and organizations make decisions will help build a system that can accommodate the organization and the employees.

Information systems should be created not only to help mangers and employees make decisions, but also help them better communicate between all levels and units of the organization. Remember, decisions are not made in isolation. More important, decisions affect a wide range of people, and the system should accommodate this fact.

The real danger in using information systems to help make decisions is that the decision-making process will be based on the wrong information. Because managers may assume that the situation is similar to one they experienced before, they may not be as careful as they would be if it were an entirely new situation. For instance, management may decide that the new packaging materials are as good as the old ones because they are the same color.

Therefore managers won't be as careful in studying all the data, all the possible outcomes and the alternatives when making the decision to change suppliers. They make the decision based on the first available alternative that moves them toward their ultimate goal. They find out too late that the packaging materials are not as good as the old ones and they end up with more damaged goods and irate customers.

Information systems should have these characteristics:

- They are flexible and provide many options for handling data and evaluating information.
- They are capable of supporting a variety of styles, skills, and knowledge.
- They are powerful in the sense of having multiple analytical and intuitive models for the evaluation of data and the ability to keep track of many alternatives and consequences.
- They reflect the bureaucratic and political requirements of systems.
- They reflect an appreciation of the limits of organizational change and an awareness of what information systems can and cannot do.

Did u know? **What is system design?**

Systems analysis describes what a system should do to meet information requirements and system design shows how the system will fulfill this objective.

Self Assessment Questions

Fill in the Blanks:

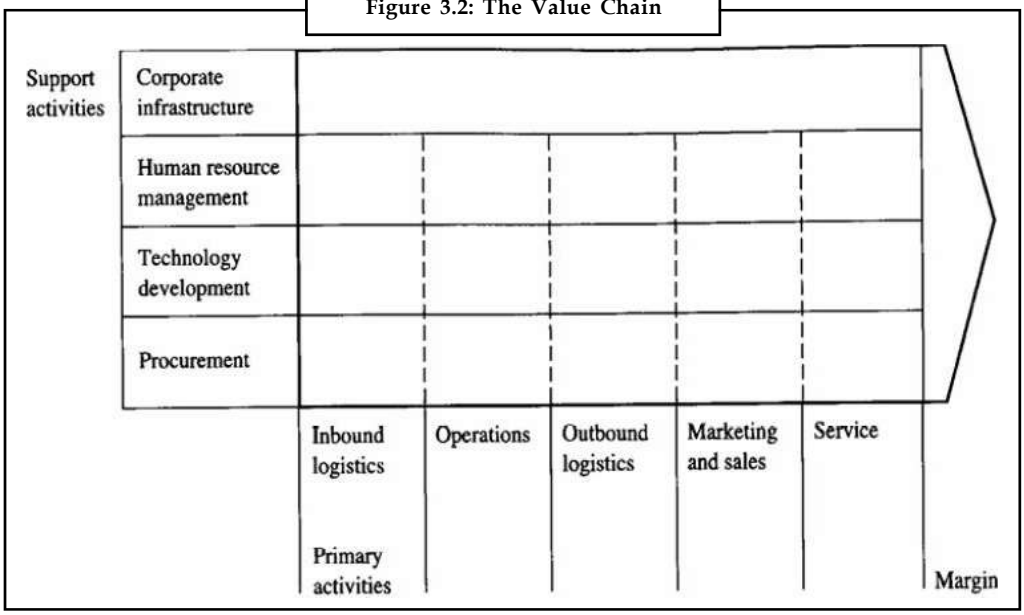
4. Information systems can help managers and employees work more efficiently and effectively in this new environment by increasing the amount of ..... available to all employees.
5. Information systems should be created not only to help mangers and employees make decisions, but also help them better ..... between all levels and units of the organization.

Notes

3.3 Leveraging Technology in the Value Chain

At the business level the most common analytic tool is value chain analysis. The value chain model highlights specific activities in the business where competitive strategies can be best applied and where information systems are most likely to have a strategic impact. Primary activities are activities most directly related to the production and distribution of a firm's products or services. It include inbound logistics, operations, outbound logistics, sales and marketing, and service. Supporting activities make the delivery of a firm's primary activities possible. Consist of the organization's infrastructure, human resources, technology, and procurement.

Figure 3.2: The Value Chain



Be better than the competition. That's the mantra of most companies that are serious about winning the game. Areas of the organization most affected by leveraging technology are producing the product, getting it to the stores, and making the customer happy. Think of all the activities that go into getting the Cybernuts candy bar made, from procuring raw materials to actual production. Then consider how the candy bar gets from the factory to the store shelves. And what about all those product commercials? These are primary activities. Just as important are support activities: Human Resources, Accounting, Finance. These functions support the primary functions of Production, Shipping, and Sales and Marketing. The value chain model below will help an organization focus on these activities and determine which are critical to its success.

Notes

The detail of value chain model discussed in the Table 3.1 below.

Table 3.1

Activity	Definition
Inbound logistics	Materials receiving, storing, and distribution to manufacturing premises.
Operations	Transforming inputs into finished products.
Outbound logistics	Storing and distributing products.
Marketing and sales	Promotion and sales force
Service	Service to maintain or enhance product value
Corporate infrastructure	Support of entire value chain, such as general management, planning, finance, accounting, legal services, government affairs and quality management.
Human resource management	Recruiting, hiring, training, and development.
Technology development	Improving product and manufacturing process
Procurement	Purchasing input.

Task Discuss the specific activities used in value chain model.

Self Assessment

Fill in the blanks:

6. The ..... model highlights specific activities in the business where competitive strategies can be best applied and where information systems are most likely to have a strategic impact.
7. ..... activities are activities most directly related to the production and distribution of a firm's products or services.
8. Areas of the organization most affected by ..... technology are producing the product, getting it to the stores, and making the customer happy.

3.4 MIS and Core Competencies

Management Information Systems (MIS) is the term given to the discipline focused on the integration of computer systems with the aims and objectives on an organization.

The development and management of information technology tools assists executives and the general workforce in performing any tasks related to the processing of information. MIS and business systems are especially useful in the collation of business data and the production of reports to be used as tools for decision making.

The field of MIS can deliver a great many benefits to enterprises in every industry.

Example: Expert organizations such as the Institute of MIS along with peer reviewed journals such as MIS Quarterly continue to find and report new ways to use MIS to achieve business objectives.

Notes

Every market leading enterprise will have at least one core competency – that is, a function they perform better than their competition. By building an exceptional management information system into the enterprise it is possible to push out ahead of the competition.

Notes MIS systems provide the tools necessary to gain a better understanding of the market as well as a better understanding of the enterprise itself.

Self Assessment

Fill in the blanks:

9. Management Information Systems (MIS) is the term given to the discipline focused on the ..... of computer systems with the aims and objectives on an organization.
10. By building an exceptional management information system into the ..... it is possible to push out ahead of the competition.
11. MIS and business systems are especially useful in the collation of business data and the production of reports to be used as tools for .....

3.5 Strategic Information Systems (SIS)

A Strategic Information System (SIS) is a system that helps companies change or otherwise alter their business strategy and/or structure. It is typically utilized to streamline and quicken the reaction time to environmental changes and aid it in achieving a competitive advantage.

Key features of the Strategic Information Systems are the following:

- Decision support systems that enable to develop a strategic approach to align Information Systems (IS) or Information Technologies (IT) with an organization's business strategies.
- Primarily Enterprise resource planning solutions that integrate/link the business processes to meet the enterprise objectives for the optimization of the enterprise resources.
- Database systems with the "data mining" capabilities to make the best use of available corporate information for marketing, production, promotion and innovation. The SIS systems also facilitate identification of the data collection strategies to help optimize database marketing opportunities.
- The real-time information Systems that intend to maintain a rapid-response and the quality indicators.

The Strategic Information Systems (SIS) can give a business a competitive advantage. Strategic position is recognized by observing competitive indicators. A business with good competitive indicators is usually in a good competitive position.

- Information Systems can be Strategic (SIS) if they:
  - Support the competitive strategy of the firm.
  - Change the way a firm competes.
  - Change industry structure.
- SIS can provide a competitive advantage.

Notes

- Indicators of competitive position are as follows:
  - Increased market share (fixed size or not)
  - Increased sales
  - New customers
  - Increased customer loyalty
  - Decrease in production costs
  - Decrease in operations (service) costs
  - Improved reputation in the market.

Caution A firm is said to have a competitive advantage when the firm produces greater return on investment (ROI) than its industry's average return.

3.5.1 Observing Strategic Behaviour

It is difficult to observe how a firm competes because:

- Boasting of greater ROI can encourage other firms in the industry to claim unfair competitive practises, to bring up litigation charges.
- Providing information on the SIS can make it easier to imitate the SIS.
- Failures are not discussed.
- Customers of the IT have different uses for the IT, and also different values which can not be compared to each other. A small store or a big firm can make use of the IT.
- The IT technology is diverse. It can be a simple database or a complex expert system. The IT should not be confused with the data itself or with the information value customers gain from the data. The IT provides access to the data or information. It also allows customers to manipulate the data.
- Identifying the costs and benefits attributed to the new strategic element of an existing IT system can be difficult.

3.5.2 Characteristics of SIS

Some characteristics of successful SIS are:

- They are innovative, unique, original in some way.
- They are not easily copied (combine IT leverage with organizational resources).
- They are developed through some pre-existing resources of the organization.

For example, special skills of the employees, or protected market segment (patents), brand name (reputation), product scope, etc.

- The SIS system is supported by top management.
- Strategic partnerships. (R and D is expensive, standardization requires cooperation, reduce technical risks and training, allow global access, etc.)
- Can be analyzed by strategic frameworks.

Notes

Self Assessment

Fill in the blanks:

12. A ..... is a system that helps companies change or otherwise alter their business strategy and/or structure.
13. A firm is said to have a ..... when the firm produces greater return on investment (ROI) than its industry's average return.
14. ..... position is recognized by observing competitive indicators.
15. The SIS system is supported by .....

Case Study

Why Call Centres?

Call centres are basically, now a days act as an interface between public and the organization, called sometimes as a point of contact for customers and public at large. Away from the public & the organization itself, it routes the calls to a particular department and acts as a first-stage filter for calls. Simple & routine enquiries are dealt with automatically, using computer-generated messages or can be handled & satisfied by the operators who have some understanding of business and its operations and are aware of FAQ's (Frequently asked questions).

In present day scenario, the goal & role of call centres has changed from mere traditional operational services providers for financial sectors companies to large companies including entertainment, cinema, tours & travel operators & local authorities to use call centres to handle first-line enquiries. The credit of the success of call centres goes undoubtedly to the rapid growth in IT sector and especially in telephony. Now, smaller size computerized systems have replaced big switch boards, and even many systems employee voice-recognition softwares.

The most fundamental effort of establishing a call centre is for the organizations to gain a competitive advantage. The cost of dealing with customers enquiries falls, and is set up with core, the quality of customer satisfaction & service is increased.

The workflow through call centre is controlled by the system itself. The agents are very important as they are customer's first point of contact with the Company. Call centres in the past, have shown very high employee-turnover and high level of absenteeism because of intense working atmosphere and wages were relatively low. So, the agents needs to be managed effectively & tactfully.

Questions:

1. Describe the system model for a call centre & the organization.
2. "Decision making process is supported largely by data collected both automatically and by the agents at the call centre." Justify.
3. Consider two organizations of your choice, each involved in different activity or business. Consider the different types of calls that can be taken by their call centres.

Source: Management Information System by Dharmenda and Sangeeta Gupta

Notes

3.6 Summary

- Information technology helps firms contract in size, because it can reduce transaction costs—the costs incurred when a firm buys on the marketplace what it cannot make itself.
- Behavioral researchers have theorized that information technology could change the hierarchy of decision making in organizations by lowering the costs of information acquisition and broadening the distribution of information.
- Decision-making increasingly happens at all levels of a business. The Board of Directors may make the grand strategic decisions about investment and direction of future growth, and managers may make the more tactical decisions about how their own department may contribute most effectively to the overall business objectives.
- Information systems can help managers and employees work more efficiently and effectively in this new environment by increasing the amount of information available to all employees.
- At the business level the most common analytic tool is value chain analysis. The value chain model highlights specific activities in the business where competitive strategies can be best applied and where information systems are most likely to have a strategic impact.
- Management Information Systems (MIS) is the term given to the discipline focused on the integration of computer systems with the aims and objectives on an organization.
- A Strategic Information System (SIS) is a system that helps companies change or otherwise alter their business strategy and/or structure.
- The Strategic Information Systems (SIS) can give a business a competitive advantage. Strategic position is recognized by observing competitive indicators.

3.7 Keywords

Management Information Systems (MIS): MIS is the term given to the discipline focused on the integration of computer systems with the aims and objectives on an organization.

Strategic Information System (SIS): A Strategic Information System (SIS) is a system that helps companies change or otherwise alter their business strategy and/or structure.

Value Chain: The value chain model highlights specific activities in the business where competitive strategies can be best applied and where information systems are most likely to have a strategic impact.

3.8 Review Questions

1. Illustrate how Information technology is used to reduce internal management costs.
2. Behavioral researchers have theorized that information technology could change the hierarchy of decision making in organizations by lowering the costs of information acquisition and broadening the distribution of information. Comment.
3. Elucidate the impact of IT on decision making.
4. Enlighten the inferences for System Design.
5. What is value chain model? Explain the concept of leveraging technology in the Value Chain.

Notes

6. Explain the use of primary activities in value chain analysis.
7. Enlighten the theory of MIS and Core Competencies.
8. What is Strategic Information System? Discuss the key features of Strategic Information System.
9. How Strategic Information Systems (SIS) is used to provide business a competitive advantage.
10. Explicate the traits of successful Strategic Information Systems.

Answers: Self Assessment

1.	transaction	2.	agency
3.	Behavioral	4.	information
5.	communicate	6.	value chain
7.	Primary	8.	leveraging
9.	integration	10.	enterprise
11.	decision making	12.	Strategic Information System (SIS)
13.	competitive advantage	14.	Strategic
15.	top management		

3.9 Further Readings

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Online links

www.netmba.com

www.virtualsalt.com

Notes

Unit 4: Electronic Commerce and the Digital Organization

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Objectives

After studying this unit, you will be able to:

- Discuss the concept of electronic commerce
- Understand internet based business models
- Discuss B2B, EDI, and B2C models
- Understand role of intranets

Notes

Introduction

It is radically changing how people learn, work, play, enjoy and consume. The centre of revolution is browser technology. The "technology" has moved from the "Back office" to the front line. Increasingly, technology is shifting the firm's relationships, with its customers from "face to face" to "screen to face" interactions. The impact of Internet on business is akin to previous innovations that transformed not just one business sector but every sector. The Internet concerns every sector of economy as it changes the way business should sensibly organize its activities and go to market. In this unit we will study the concept, advantages-disadvantages and history of e-commerce.

4.1 Electronic Commerce

E-commerce is a selling and transfer process requiring several institutes. It is systematic and organized network for the exchange of goods between produces and consumers. The Net aims to establish the interconnections between producers and consumers directly and in this, the Internet embraces all those related activities which are indispensable for maintaining a continuous, free and uninterrupted distribution and transfer of goods. The Website or portals may be categorized into commercial and non-commercial.

Any website or portal that offers products and/or services for sale is a commercial website. There are thousands of commercial web sites on the Internet. Some of them have been successful, and some weren't so lucky. What elements make up a good commercial web site? Of course, web pages should look attractive to a customer. However, even the most attractive web pages will not make a person come back to a website where it takes too long to find the right product or where order forms don't work. In this unit we will discuss what functionality is needed for a successful commercial web site and what technology implements various web site elements.

4.1.1 Definition of Electronic Commerce

E-commerce is a general concept covering any form of business transaction or information exchange executed using information and communication technologies (ICTs). E-commerce takes place between companies, between companies and their customers, or between companies and public administration. E-commerce includes electronic trading of both goods and electronic material.

"e-commerce denotes the use of electronic transmission media (telecommunication) to engage in the exchange of products and services requiring transportation either physically or digitally, from location to location".

—M. Greenstein and T.M. Feinman

"e-commerce describes the process of buying and selling (or exchanging) of products, services and information via computer networks including the internet".

—E. Turban and others.

E-commerce is the means to complete online transaction and integrate the supply chain into the transaction management process such as receiving orders, making payments and tracking down the deliveries or order.

"e-commerce can be defined as the technology-mediated exchanges between parties (individuals, organisations, or both) as well as the electronic based intra or inter organisational activities that facilitate such exchanges".

—J.F. Rayport and B.I. Jaworski.

Notes

According to World Trade Organization (WTO): "E-commerce as a commercial process includes production, distribution, marketing, sale or delivery of goods and services electronically."

E-commerce is used everywhere in everyday life. It ranges from credit/debit card authorization, travel reservation over a phone/network, wire fund transfers across the globe, point of sale (pas) transactions in retailing, electronic banking, electronic insurance, fund raising, political Campaigning, on-line education and training, on-line auctioneering, on-line lottery and so on.

Caution Many people use the term e-commerce and e-business interchangeably, which is factually wrong.

Task Discuss the meaning of e-commerce.

Self Assessment

Fill in the blanks:

1. ..... is defined as a systematic and organized network for the exchange of goods between produces and consumers.
2. E-commerce includes ..... trading of both goods and electronic material.

4.2 Digital Organization

Given the wish of some designers to be able to digitally express form and to integrate their expressions into a process of analysis, what then happens to these design intentions in the context of office practice? One would expect creative design practices to exploit emerging digital technologies in imaginative ways that support the realization of their design visions. On the other hand, it is evident that offices of a more corporate nature are more readily influenced by administrative diktat and managerial doctrine and guidance. Sir Michael Latham's report, Constructing the Team, aimed to provide guidelines for the organization of the construction industry in the United Kingdom. If defined the responsibilities of designers, clients and contractors in terms of deliverable outcomes. The report also commented upon patient issues in the construction industry ranging from the role of clients through to tendering procedures, contracts, and resolving disputes, particularly in relation to payments. At various points in the report, comments in turn led to firmer recommendations on specific topics. It is evident that the Latham Report has already had a significant effect on working practices in the UK construction industry. A favour of its effect on design practice can be gleaned by looking at some of its observations and aspirations in more details.

Once a prospective client has decided that a project should proceed in principle, and roughly how much risk and direct involvement to accept, the project and design briefs can be prepared. The client who knows exactly what is required can instruct the intended provider. That may involve appointing a Project Manager, or a client's representative to liaise with the designers, or a lead designer, or a contractor for direct design and build procurement.

It could be argued that clients today have a better appreciation of quality than they may have had prior to the Latham Report. Some clients realize that the panache of projects is invariably design driven, and see architects as capable of managing projects themselves. Do project managers inhibit this design impetus?

Notes

Effective management of the design process is crucial for the success of the project. If should involve:

- A lead manager
- The co-ordination of the consultants, including and interlocking matrix of their appointment documents which should also bare a clear relationship with the construction contract.
- A detailed check list of the design requirements in the appointment documents of consultants. This should also be se out in the main context documentation.
- Ensuring the client fully understands the design proposals.
- Particular care over the integration of the building services design, and the avoidance of "fuzzy edges" between consultants and specialist engineering contractors.
- The use of Coordinated Project Information
- Signing off the various stages when they have been achieved, but with sufficient flexibility to accommodate the commercial wishes of clients.

Self Assessment

Fill in the blanks:

3. One would expect creative design practices to exploit emerging ..... in imaginative ways that support the realization of their design visions.
4. The ..... who knows exactly what is required can instruct the intended provider.

4.3 Internet based Business Models

The last thing you want to do is throw up a Website or a Web page, include an email address, and call it done! Regardless of the type of business, you have to determine what you're going to do behind the scenes and how your electronic commerce efforts will fit in with your regular business processes.

There is no simple step-by-step list of things you need to do to establish an E-commerce process, no "one size fits all" method. But remember these facts:

- It's not cheap.
- It's not easy.
- It's not fast.

Some companies have spent millions of dollars only to fold up their E-commerce operations because they just weren't working. Some companies have built a Website without thinking through the entire process; only to find out they have seriously hurt their normal operations. Some companies have realized that E-commerce was simply not the Holy Grail it was made out to be.

You need to analyze what you want the mission of the Website to be. Are you going to have a Website that simply offers information about your company and its products? Are you going to sell only to consumers? What impact will that have on your current retail outlets? How are you going to get people to your Website in the first place? How are you going to keep them coming back? If you sell business-to-business, do you have the back-end processes in place to handle the increased sales? Who will host the Website: your company internally? a Web host service?

Notes

Who's going to create the Website, what services will you offer on it, and how are you going to keep your information secure?

We don't mean to discourage you from electronic commerce; just the opposite. Thousands of businesses are finding new opportunities to connect to customers, suppliers, and employees.

Table 4.1: Internet Business Models

Category	Example
Virtual Storefront	Amazon.com
Marketplace Concentrator	ShopNow.com
Information Broker	Travelocity.com
Transaction Broker	Ameritrade.com
Auction Clearinghouse	EBay.com
Digital Product Delivery	Bluemountain.com
Content Provider	WSJ.com
On-line Service Provider	Tuneup.com

The above table shows some ways companies use the Internet to conduct business. Even more intriguing is the disruption new, upstart companies are causing in traditional industries. MP3.com introduced the Rio music appliance, which uses music downloaded for free from Web sites. Recording companies are jumping through hoops trying to respond to this threat to their business.

Notes Note that no business can afford to rest on its laurels and assume its business or industry is safe from changes caused by the Internet.

Customer-Centered Retailing

Some of the most successful consumer E-commerce companies have found that it isn't enough to set up a Website to sell products: consumers want information about the products themselves and how to integrate the products into their lives.

Amazon.com, probably the most talked-about consumer retail Web site, doesn't just sell books and CDs. It also offers book reviews from other customers, links to other books related to the one they're purchasing and the opportunity to purchase gifts for friends and relatives which are then gift-wrapped and sent out. Amazon.com is moving into other markets such as online auctions and now owns part of an online grocery shopping service.

Disintermediation, removing the middleman, has allowed many companies to improve profits while reducing prices. Now we're starting to see a phenomenon called reintermediation, the process of creating new middlemen. Many people are concerned about selling products online because of the possibility of fraud.

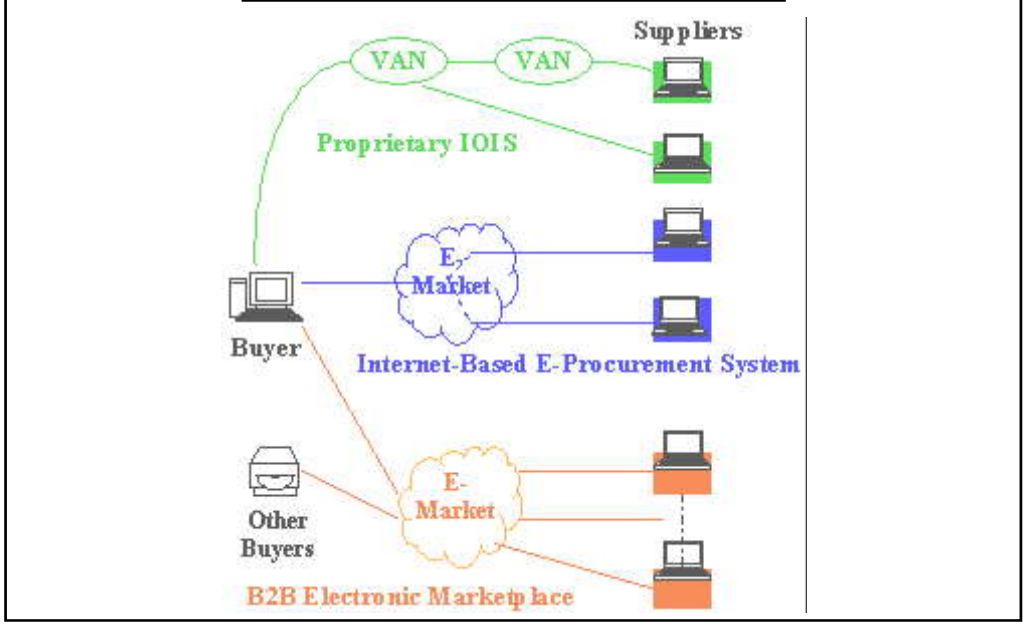
Let's say you want to sell an antique car through your Web site. A stranger in Ohio e-mails you with an offer of $10,000. You hesitate to seal the deal because you don't know anything about this individual. You can use an electronic escrow service that will hold the buyer's funds to ensure he receives the merchandise while you make sure you get paid. Online auction services such as eBay.com offer a form of reintermediation through their Web sites to get buyers and sellers connected. That's the great thing about the Internet: One door closes and another door opens!

Notes

Information Technology (IT) has been applied to support information sharing between organizations and to streamline corporate purchasing. Such IOISs , as they are often referred to, can form electronic marketplaces where buyers and sellers in a vertical market can exchange information and make transactions. Before the commercial application of the Internet and the World Wide Web, proprietary information systems such as electronic data interchange (EDI) systems were the major means by which firms exchanged business documents electronically in a standard machine-processable format. Although the EDI systems continue to enable firms to achieve more efficient data and information management and to improve supply chain management, there are still a lot of companies that do not yet use EDI due to the relatively high costs of implementing and running such systems. These costs include the investments in installing the systems and the expenses involved in leasing communications networks, or value added networks (VANs), among other cost drivers.

Internet-based e-procurement systems and business-to-business (B2B) electronic marketplaces are different from proprietary IOISs that involve EDI. They are open systems that enable firms to reach and transact with suppliers and customers in virtual markets without investments in dedicated systems. Figure 4.1 displays the above three IT-enabled procurement mechanisms.

Figure 4.1: IT-Enabled Procurement Mechanisms



According to a recent report, the value of goods and services sold via B2B electronic markets will reach $2.7 trillion by year 2004, representing some 27% of the overall B2B market and almost 3% of global sales transactions. This growth is slated to occur in the context of a global market for B2B transactions worth $953 billion, growing to about $7.29 trillion by 2004. With more corporate procurement completed online every month, the number of virtual marketplaces in the United States has soared from 300 in June 1999 to more than 1000 in 2000. It is clear that by offering lower prices and a wider range of suppliers, electronic markets are changing the way firms procure their materials, equipments and supplies.

By connecting in the new electronic marketplaces of the World Wide Web, a buyer firm is able to streamline its purchasing activities electronically, even when not all of its suppliers can automatically process electronic orders.

Notes

Example: H-E-B Food Stores, a $7-billion supermarket chain, purchases its wholesale supplies via Inc2Inc.com (www.Inc2Inc.com), a new electronic marketplace, instead of using proprietary extranets. H-E-B Food Stores does this because it has suppliers who do not have automated computerized systems, but still they can be integrated for purchasing via the Internet and a Web system. In this way, H-E-B Food Stores is still able to transact with those suppliers, even when the company is in the midst of automating its purchasing processes. Recognizing the benefits from its initial testing, the firm plans to move 80% of its procurement online.

B2B electronic markets function as digital intermediaries that focus on industry verticals or specific business functions. They set up virtual marketplaces where firms participate in buying and selling activities after they obtain membership.

Example: CheMatch.com (www.chematch.com) is a B2B exchange for buying and selling bulk commodity chemicals, polymers and fuel products. Firms subscribing to CheMatch.com can log onto its virtual exchange floor, and then post requests to buy and offers to sell, and respond to offers. When two firms agree to transact, the transacting terms are faxed to both parties and the deal is settled. The marketplace creates value by bringing buyers and sellers together to create transactional immediacy and supply liquidity, and by supporting the exchange of demand and supply information.

E-procurement systems are usually integrated with corporate enterprise systems and organizational intranets. They typically consist of two parts. One part resides on the top of the company's intranet behind its firewall, where employees can search and place order for desired supplies. The purchase orders, after they have been approved and consolidated, are sent out to a third party, usually a neutral electronic marketplace. This is where the second part of the e-procurement system resides. At the electronic marketplace, these orders are transformed into various formats according to different protocols so that they can be received and processed by different suppliers. The major benefits of adopting e-procurement systems are reduced operating costs and searching costs, which lead to high returns on investments.

Did u know? **Full form of IOIs**

Inter-organizational Information Systems

4.3.1 How Internet Business Models Work

While there are many e-commerce business models, most depend on two fundamental building blocks: businesses (B) and consumers (C). From this foundation, you can derive four basic models: B2B, B2C, C2B, and C2C. Somehow, most businesses (both online and off) fall into one or more of these categories, although they use a wide variety of ways to link buyers, sellers, and manufacturers. A business might sell goods it has manufactured itself, resell those made by another company, or simply act as a middleman, connecting the buyer and seller. The revenue streams flowing between these parties is potentially even more complex, because one company might (and should!) have numerous sources of revenue, ranging from product sales to affiliate commissions and advertising income.

The various model of Internet business are:

Business-To-Consumer

The business-to-consumer (B2C) business model is perhaps the most familiar e-commerce model. Vendors sell goods and services over the Web to connected consumers.

Notes

Web retailer Amazon.com is an example of a purely online model. Classic brick-and-mortar businesses such as Williams-Sonoma have become bricks-and-clicks shops, selling products online that are also old in their physical outlets.

Example: Gear.com, Barnes&Noble.com, and Gateway.com

Business-To-Business

Business-to-business (B2B) commerce is less in the public eye than B2C but is a rapidly growing segment of the Internet economy. In this model, businesses offer goods and services to other businesses over the Internet. For instance, Safetylogic.com provides corporations with an easy way to distribute safety materials to satellite plants and fill out OSHA reports online. We will discuss B2B in detail later in the unit.

Example: Extensity.com, StaplesLink.com, Lexis-Nexis

Consumer-To-Business

Consumer-to-business (C2B) describes a system where consumers use an online agent to look for a product or service that suits their needs. Priceline.com is a prime example of the C2B model.

Example: ShopBot.com, AutobyTel.com

Consumer-To-Consumer

Consumer-to-consumer (C2C) businesses act as agents between consumers with goods and services to sell. Online auction site eBay is perhaps the most prominent online C2C company.

Example: Excite classifieds, Yahoo! Auctions

Peer-To-Peer

Peer-to-peer (P2P) is a relatively new e-commerce model. Not unlike C2B and C2C, online agents assist in P2P transactions. P2P businesses transact exchanges of information (such as files or dollar amounts) between PCs or hand-held computing devices.

Example: 1. Napster is currently the most prominent example of an online P2P business.

2. PayPal, ProPay, Ecount.

Self Assessment

Fill in the blanks:

5. While there are many e-commerce business models, most depend on two fundamental building blocks: businesses (B) and .....

6. ..... describes a system where consumers use an online agent to look for a product or service that suits their needs.

Notes

7. ..... businesses transact exchanges of information (such as files or dollar amounts) between PCs or hand-held computing devices.

4.4 Business-2-Business (B2B) Model

Traditionally, when one thinks of business paradigms, one of the first things that springs to mind is the concept of companies selling to consumers. The department chain store or the big box store down the street are prime examples of this business model. Historically, this meant that the business had a brick-and-mortar location where it employed its own personnel. Even with the advent of the Information Age, this model changed only slightly, with information technology being used to support the way that business was done by making standard operations more efficient.

Example: Manual cash registers have been replaced in most modern businesses by high tech models that keep track of various aspects of transactions including tender type (i.e., whether the transaction was cash, check, charge, etc.) and amount paid as well as inventory control information or other administrative data. Such automated information collection makes closing the store at night and balancing the books a much easier task and can also help store and chain managers to make decisions about the type of inventory to carry, new services that could be offered to customers, and demographics that can be used in marketing efforts.

However, information technology not only allows organizations to perform various business processes more efficiently, in many cases it also allows them to reengineer organizational processes by improving the effectiveness and efficiency of the various processes within an organization. With advances in information systems, however, this model can now be taken a step further. Electronic business-to-consumer paradigms allow a business to market and sell directly to consumers.

Example: Business model include Amazon.com, (the online purveyor of books and a wide variety of other items) and Travelocity (the online travel agency) businesses that sell electronically directly to consumers.

Task Discuss the various business model of internet.

However, not all businesses sell directly to consumers, nor should they. Automobile parts manufacturers frequently sell to the automotive industry rather than to the car owner. Precious stones' miners sell to the gem industry where the stones are cut and sold, in turn, to jewelers and suppliers who, in turn, sell to suppliers.

Pharmaceutical companies sell to directly or indirectly to pharmacies and hospitals who sell the products to customers. As with business to consumer paradigms, the model of business-to-business (B2B) commerce has been revolutionized by advances in information technology and systems.

Despite the increasing popularity of business-to-consumer e-commerce with its ease of ordering and comparing items online, many experts predict that business-to-business transactions will exceed those of business-to-consumer e-commerce. This makes sense.

Example: Although a consumer may order a book over the Internet, the business from whom the book is purchased not only has to interact with the purchaser but also with the publisher who printed the book. The publisher, in turn, needs to interact with the paper and ink

Notes

suppliers, the maintenance firm that keeps the printing presses running, the authors who submit their manuscripts online, and so forth.

4.4.1 Business Models for Conducting B2B E-Commerce

Just as there are different business models for non-electronic businesses, there is also more than one model for business-to-business e-commerce. In general, a business model is an organization's approach to doing business. Although there are many different business models available, most business models have several core concepts in common.

- At the level of the most basic business model, an organization must have something of value to offer to the marketplace, whether it be goods, products, or services.

Example: A bookstore may offer books and magazines as well as various services such as special ordering. To be successful, the thing which the organization offers its customers needs to be of value – something that the customer either wants or needs (or both).

- Another part of the business model is the customer – the target market to whom the organization is trying to sell its offering. The business model needs to articulate how the business will gain, maintain, and foster relationship with customers.
- In order to get the product into the hands of the customer, the organization also needs an infrastructure in place. The infrastructure includes such things as having the right mix of people and skills necessary to produce the product as well as to run the business. This may include not only the people working directly for the organization, but partners as well who provide skills or services that business does not provide for itself but that are necessary to get the product into the hands of the customer. This may include companies that provide complementary skills necessary to make the product (e.g., suppliers) as well as supply chain partners that provide raw materials, supplies, or components or that distribute, warehouse or sell finished products.
- The business model also needs to include consideration of the company's income and cash flow as well as its cost structure.

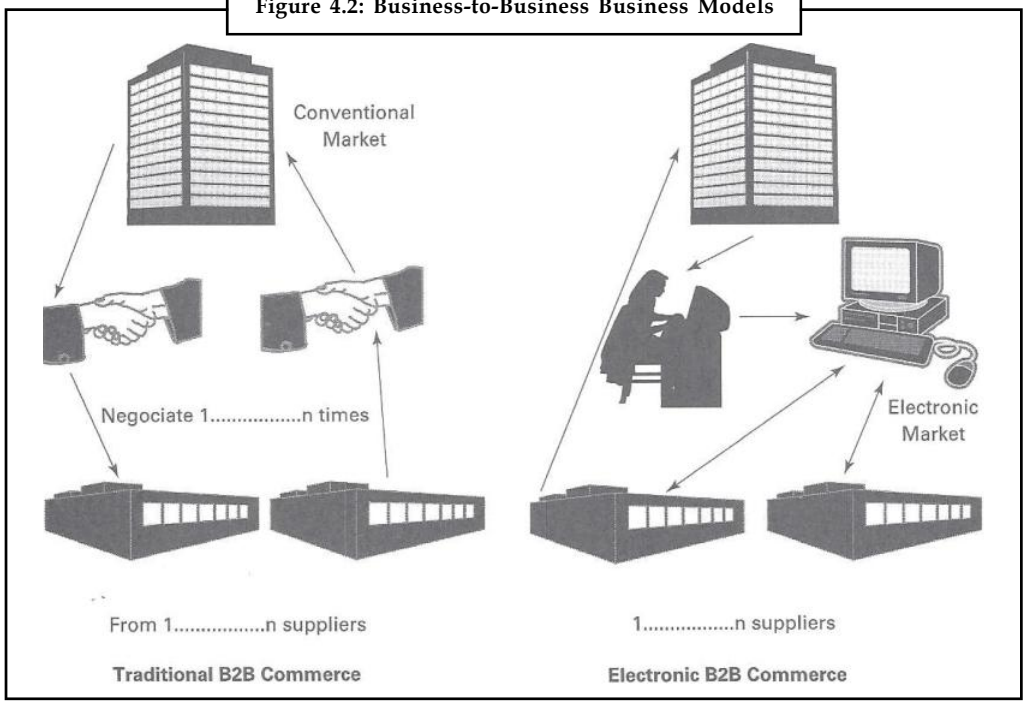
4.4.2 Advantages of E-Commerce for B2B Businesses

As shown in Figure 4.2, the traditional business model for business-to-business operations involves a procurement staff that negotiates with various suppliers.

Example: A bookstore may procure books from several distributors and office supplies from one or more other suppliers. In the e-commerce business model, a procurement staff (typically smaller than the staff necessary in the traditional business-to-business model) shops online for supplies and other items necessary to the business. Just as it does for the consumer in the business-to-consumer business model, the Internet allows businesses to comparison shop online in order to find the most appropriate product at the best price. This reduces many of the front-end costs for finding goods and products that are incurred in the traditional model.

Notes

Figure 4.2: Business-to-Business Business Models



4.4.3 Systems for Improving B2B E-Commerce

Business-to-business e-commerce is still in a state of flux as enterprises learn how to leverage information technology in general and the Internet in particular into systems that help them more efficiently and effectively does business. Observers are looking at several.

- First, to make business-to-business e-commerce worthwhile, systems need to evolve to handle not only simple transactions but complex ones as well. To facilitate this need, standards will need to be developed and put into place.
- In addition, as markets become more competitive, transaction fees will most likely decrease or even disappear. Among other implications, this means that providers will need to shift from dealing in transactions to offering more comprehensive solutions to business needs.

  For example, products can be bundled with related information and services in an effort to forge customer loyalty and long-lasting relationships.

New business-to-business models will continue to appear as technology continues to evolve and enterprises seek creative solutions.

Among new business-to-business e-commerce models that are beginning to emerge are the mega exchange that maximizes liquidity and sets common transaction standards, the specialist originator that deals with complex and relatively expensive products, the e-speculator model that has a high degree of product standardization and moderate to high price volatility, the solution provider in which product costs are only a small portion of the overall costs, and the sell-side asset exchange with high fixed costs and a relatively fragmented supplier and customer base.

Notes

4.4.4 Examples for Online Business-to-Business (B2B) Model

Consider an automobile or home appliance spares manufacturing company having an online store to cater the requirements of the retailers. Each of the following two examples implements the concept of b2b business model.

Example: http://www.golna.com

Ningbo GOLNA PARTS Co., Ltd is a 10 year old manufacturers and exporters in the home appliance components in Ningbo of China, which is the electric appliance producing base and also 2nd biggest container port in China.

The products include washing machine spare parts, refrigerator spare parts, air conditioner spare parts, vacuum cleaner spare parts, heater spare parts, etc. The company owns modern production lines and Hi-tech quality control equipment. With scientific management, professional engineers, highly trained technicians and skilled workers.

Example: http://www.hawtuoh.com

Auto spare parts company in Taiwan.

Self Assessment

Fill in the blanks:

8. The ..... business model for business-to-business operations involves a procurement staff that negotiates with various suppliers.
9. Business-to-business e-commerce is still in a state of flux as enterprises learn how to ..... information technology in general and the Internet in particular into systems that help them more efficiently and effectively does business.

4.5 Electronic Data Interchange (EDI)

EDI was developed in early 60s as a means of accelerating the movement of documents related to shipments and transportation. However, from the beginning of 80s it is now widely used in various other sectors like automotives, retails, and international trade. Its relevance and usage is growing at a very fast pace.

EDI is based on a set of standardized messages for the transfer of structured data between computer applications. It may have many applications e.g., sending the test results from the pathology laboratory to the hospital or dispatching exam results from exam boards/university to school/college, but it is primarily used for the trade exchanges: order, invoice, payments and many other transactions that can be used in national and international trade exchange.

Notable users of EDI are vehicle assemblers, ordering components for their production lines, and supermarkets (and other multiple retailers), ordering the goods needed to restock their shelves. EDI allow the stock control/material management system of the customer to interface with the stock control/production systems of the suppliers without the use of paper documents or the need of human intervention.

The EDI is used for regular repeat transactions. EDI is a formal system and it does not really have a place in the search and negotiation phases. EDI, when initially introduced was seen by many as a universal, or at least a generalized form of trading.

Notes

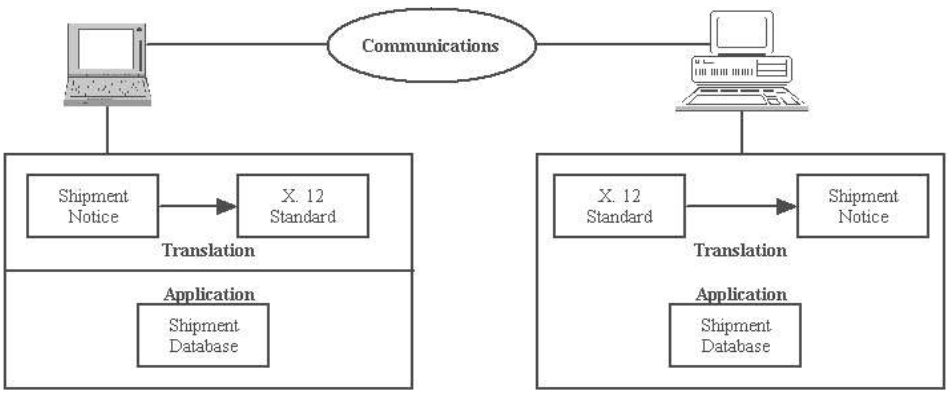
In the event its adoption has been limited to a number of trade sectors where the efficiency of supply chain is of vital importance. EDI is apart of schemes for just-in-time manufacture of quick response supply.

Notes Mature use of EDI allows for a change in the nature of the product or service being offered mass customization is such an instance.

Did u know? **Full form of EDI**

Electronic Data Interchange

Figure 4.3: The EDI Process



4.5.1 Definition of EDI

- Electronic Data Interchange is the transmission, in a standard syntax, of unambiguous information of business or strategic significance between computers of independent organizations. (The Accredited Standards Committee for EDI of the American National Standards Institute)
- Electronic Data Interchange is the interchange of standard formatted data between computer application systems of trading partners with minimal manual intervention. (UN/EDIFACT Training Guide)
- Electronic Data Interchange is the electronic transfer, from computer to computer, of commercial and administrative data using an agreed standard to structure an EDI message.

Self Assessment

Fill in the blanks:

10. ..... is based on a set of standardized messages for the transfer of structured data between computer applications.
11. EDI, when initially introduced was seen by many as a universal, or at least a generalized form of .....

Notes

4.6 Business 2 Consumer (B2C)

Business-to-consumer (B2C, sometimes also called Business-to-Customer) describes activities of businesses serving end consumers with products and/or services.

Example: B2C transaction would be a person buying a pair of shoes from a retailer. The transactions that led to the shoes being available for purchase, that is the purchase of the leather, laces, rubber, etc. as well as the sale of the shoe from the shoemaker to the retailer would be considered (B2B) transactions.

More and more organizations are transforming their businesses using Internet technology in B2C relationships. The extent to which the Internet technology is used in an organization for B2C relationships depends on the relative Internet maturity of the organization, its customers, the Internet usage in its geographical market area, the nature of the organization's products/ services and the relative urgency to which the Internet is used to either achieve competitive advantage or to catch up with the competition. Accordingly, an organization may be resorting to a B2C e-commerce model, covering one or more of the following broad e-commerce activities:

- ***Informational (public):*** Making information regarding the organisation and its products available on the Internet for whoever wants to access the information.
- ***Customer self-service (informational):*** Making information, such as products/services and prices, available on the Internet for the customers of the organization.
- ***Customer self-service (transactional other than payments):*** In addition to making information available on the Internet, accepting customer transactions, such as orders and cancellations, through the Internet, but payments are handled through conventional means.
- ***Customer self-service (payments):*** Accepting customer transactions including payments or fund transfers (in the case of banks) through the Internet.
- ***Customer reporting:*** Providing reports, such as statement of accounts and order status to customers online.
- ***Interactive self-service:*** Providing interactive responses through e-mails for requests/ queries logged through a website.
- ***Direct selling:*** Selling products and services directly to prospective buyers through the Internet.
- ***Auctioning:*** Auctioning the products online.

4.6.1 Examples for Online Business to Consumer (B2C) Model

Consider an online music store selling audio CDs and DVDs to end users or customers through orders on Internet. Each of the following two examples implements the concept of B2C business model.

Example: http://www.hamaracd.com

A venture of Saregama India Ltd, An RPG enterprise Company.

HamaraCD.com is a unique concept where you have amazing option and complete freedom of creating your own audio CDs of your favourite songs. Your selection can be further personalized with your preferred image, CD Title and a message of your choice. By far, HamaraCD today is the largest, most popular and possibly the only legitimate site offering CD customization facility for Indian songs globally.

Notes

Example: http://www.amazon.com

Amazon.com is the leading online retailer of products that inform, educate, entertain and inspire. The Amazon group also has online stores in the United States, Germany, France, Japan and Canada.

What does Amazon.com do?

Amazon.co.uk is famous for selling books, but did you know that we now sell millions of other products too? From cameras to coffee machines, exercise videos to Elvis CDs, there's something for everyone. We also enable independent sellers to sell new and used items on our website via Amazon.co.uk Marketplace. In addition, we give you a variety of resources to help you make your choice, including customer reviews and personal recommendations.

Amazon.com, Inc. is a publicly traded company. NASDAQ:AMZN.

Self Assessment

Fill in the blanks:

12. ..... describes activities of businesses serving end consumers with products and/or services.
13. ..... is the process of providing reports, such as statement of accounts and order status to customers online.

4.7 Role of Intranets

An intranet is a private network that is contained within an enterprise. This is a network that is not available to the world outside of the Intranet. If the Intranet network is connected to the Internet, the Intranet will reside behind a firewall and, if it allows access from the Internet, will be an Extranet. The firewall helps to control access between the Intranet and Internet to permit access to the Intranet only to people who are members of the same company or organisation.

In its simplest form, an Intranet can be set up on a networked PC without any PC on the network having access via the Intranet network to the Internet.

Example: Consider an office with a few PCs and a few printers all networked together. The network would not be connected to the outside world. On one of the drives of one of the PCs there would be a directory of web pages that comprise the Intranet. Other PCs on the network could access this Intranet by pointing their browser (Netscape or Internet Explorer) to this directory – for example, U:\inet\index.htm.

From then onwards they would navigate around the Intranet in the same way as they would get around the Internet.

Figure 4.4: Intranet

Notes

4.7.1 How Intranets Support Electronic Business

Intranet can help the organizations create a richer, more responsive information environment. Intranet corporate applications bases on the Web page model can be made interactive using a variety of media, text, audio, and video. A principal use of intranets has been to create on-line repositories of information that can be updated as often as required. Product catalogs, employee handbooks, telephone directories, or benefits information can be revised immediately as changes occur. This "event-driven" publishing allows organizations to respond more rapidly to changing conditions than traditional paper-based publishing, which requires a rigid production schedule. Made available via intranets, documents always can be up to date, eliminating paper, printing, and distribution costs.

Task Discuss some examples of B2B and B2C business model.

4.7.2 Intranets and Group Collaboration

Intranet provide a rich set of tools for creating collaborative environments in which members of an organization can exchange ideas, share information, and work together on common projects and assignments regardless of their physical location.

Some companies are using intranets to create enterprise collaboration environments linking diverse groups, projects, and activities through the organization.

Example: The Global Village intranet of U.S. West (which merged with Qwest Communications International) is a prominent example.

4.7.3 Intranet Applications for Electronic Business

Intranets are springing up in all the major functional areas of the business, allowing the organization to manage more of its business processes electronically.

Figure 4.5: Function Applications of Intranets

Intranet applications have been developed for each of the major functional areas of the business.

Notes

Finance and Accounting

Many organization have extensive TPS that collect operational data on financial activities, but their traditional management reporting systems, such as general ledger systems and spreadsheets, often cannot bring this detailed information together for decision making and performance measurement. Intranets can be very valuable for financial and accounting information on-line in an easy-to-use format.

Human Resources

Human resource can use intranets for on-line publishing of corporate policy manuals, job postings and internal job transfers, company telephone directories, and training classes. Employee can use an intranet to enroll in healthcare, employee saving, and other benefit plans if it is linked to the firm's human resources or benefits system to take on-line competency test.

Sales and Marketing

One of the most popular applications for corporate intranets is to oversee and coordinate the activities of the sales force. Sales staff can dial in for updates on pricing, promotions, rebates, or customer or to obtain information about competitors. They can access presentations and sales documents and customize them for customers.

Manufacturing and Production

In manufacturing, information-management issues are highly complex, involving massive inventories, capturing and integrating real-time production data flows, changing relationships with suppliers, and volatile costs. The manufacturing function typically uses multiple types of data, including graphics as well as text, which are scattered in many disparate systems. Manufacturing information is often very time sensitive and difficult to retrieve, because files must be continuously updated.

Caution Developing intranets that integrate manufacturing data under a uniform user interface is more complicated than in other functional areas.

4.7.4 Roles of Intranet in Organization

The internet is to the internal system of the organization what the internet is to its external environment. That is it links internal data networks of the company but prevents access to other outside the company. It also facilitates data gathering from with the company. For example surveys can be easily conducted through the intranet to assess employee moral or popularity of benefit packages. The intranet can be creatively put to use. Cronin remarked that Ford's intranet success is so spectacular that the automaker's in-house website could save billion dollars and fulfill a cherished dream of building cars on demand. Cronin went on to explain how the carmaker's product development system documents thousand of steps that go into manufacturing, assembling and testing vehicles.

By opening its intranet to major suppliers, Ford customized every car and truck while reducing cost at the same time. For instance suppliers could provide car seats in the sequence of colors needed so that blue seats are ready just when the blue cars reach the seat installation station. By opening up its intranet to suppliers and coordinating the delivery and assembly of thousands of components some auto companies tried to move closer to manufacturing on demand.

Notes

Most organizations now have an intranet, often serving as a "one stop shop" for corporate information and documents.

Notes If intranets are to be truly successful, they need to have a clear purpose within the organization. The more this purpose is aligned with business and organizational needs, the easier it is to get the resources and budget needed.

4.7.5 Purposes of an Intranet

There are four fundamental purposes of an intranet:

- Content
- Communication
- Collaboration
- Activity

Historically, intranets have focused on content and communication, providing a platform for corporate information and news. To be successful, however, there needs to be a balanced focused on all four elements. Activity (the intranet as a 'place for doing things' rather than just a 'place for reading things') is particularly important in terms of building a business case for the intranet.

Self Assessment

Fill in the blanks:

14. An ..... is a private network that is contained within an enterprise.
15. The ..... function typically uses multiple types of data, including graphics as well as text, which are scattered in many disparate systems.

Case Study

The Internet and Business Strategy

ABC Company, an independent advisor to media cos. conducted a survey of 400 publishers. The responses on the role of the Internet in company's business strategy revealed that very few publishers expected sufficient on-line revenues from the Internet. Survey revealed that majority of publishers would increase Internet Investment in next financial year and they did not think Internet revenues would increase over next two years. Most of the publishers are still using web basically as a marketing tool.

However around 75% of the respondents said that Internet could be a great opportunity for magazine publishing industry rather than a threat. Survey also revealed that industry faces increased competition from Internet but industry would have to embrace the Internet to survive & compete in the market.

Questions:

1. What are the important opportunities and threats posed by the Internet for publishing industry.
2. What is the contribution of SWOT Analysis to formulate a business strategy in a publishing business?

Source: Management Information System by Dharmenda and Sangeeta Gupta

Notes

4.8 Summary

- E-commerce is a general concept covering any form of business transaction or information exchange executed using information and Ccommunication technologies (ICT's).
- Electronic Commerce is a term popularized by the advent of commercial services of the Internet.
- E-commerce is a selling and transfer process requiring several institutes. It is systematic and organized network for the exchange of goods between produces and consumers.
- Any web site or portal that offers products and/or services for sale is a commercial website.
- E-commerce is highly economical. Doing e-business on the Internet is extremely cost effective.
- E-commerce emphasizes better and quicker customer service. There are some problems and drawbacks of e-commerce like security, shortage of e-literate people, data protection and the integrity of the system, etc.
- E-commerce takes place between companies, between companies and their customers, or between companies and public administration.
- E-commerce includes electronic trading of both goods and electronic material. Today the largest electronic commerce is Business-to-Business (B2B). The four types of e-commerce are: Business to Business (B2B), Business to Consumer (B2C), Consumer to Consumer (C2C), Consumer to Business (C2B).

4.9 Keywords

Business to Business (B2B): B2B indicates to the full spectrum of e-commerce operation that can occur between two organisations.

Business to Consumer (B2C): It refers to exchange between business and consumer.

Consumer to Business (C2B): Consumers can band together to form and present themselves as a buyer group to business in a consumer-to-business (C2B) relationship.

Consumer to Consumer (C2C): It refers to exchanges involving transactions between and among consumers.

E-commerce: It is a general concept covering any form of business transaction or information exchange executed using information and communication technologies.

EDI: Electronic Data Interchange: The electronic transmission of source documents between the computers of different organizations.

Electronic Data Processing (EDP): The use of electronic computers to process data automatically.

Electronic Mail: Sending and receiving text messages between networked PCs over telecommunications networks. E-mail can also include data files, software, and multimedia messages and documents as attachments.

4.10 Review Questions

1. What is e-commerce? Give a definition of your own and discuss the history of e-commerce.
2. What are the advantages and limitations of e-commerce? Do you think the advantages outweigh the limitation?

Notes

3. What are the different types of e-commerce? Describe each type.
4. What is interdisciplinary nature of E-Commerce?
5. Discuss the exact meaning of digital organization. Give suitable example of digital organization.
6. Internet based business model helpful for business improvement. Explain
7. Discuss the advantage and disadvantage of electronic market over traditional market.
8. Explain the concept of intranet how it differs from internet.
9. What do you think online transaction is safe mode of transaction? Explain
10. What are the basic need of any conventional organization for convert it into the digital organization?

Answers: Self Assessment

1. E-Commerce
2. electronic
3. digital technologies
4. client
5. consumers (C).
6. Consumer-to-business (C2B)
7. P2P
8. traditional
9. leverage
10. EDI
11. trading
12. Business-to-consumer
13. Customer reporting
14. intranet
15. manufacturing

4.11 Further Readings

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Online links

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5.6.3 The Network Structure
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Objectives

After studying this unit, you will be able to:

- Study evolution of IT Infrastructure
- Understand Moore's law and law of mass digital storage
- Recognize IT Infrastructure components
- Discuss current trends in hardware platforms
- Discuss enterprise software and groupware

Notes

Introduction

The importance of Information Technology (IT) infrastructure is recognized more and more within companies and corporations. In addition to the increasing interest shown for IT infrastructure by practitioners, the academic literature abounds with research and studies related to the topic. The sooner companies realize the importance of building and leveraging IT infrastructure, the better will be the value and higher the return they can capitalize on. But what is IT infrastructure, actually? Firm-wide centrally coordinated IT infrastructure consists of technology components (such as communication technology and data) which individuals with technical and managerial competence use to produce standard and shared services. These services are then provided for shared and standard, firm-wide and business-specific applications, at the service levels required, according to standards defined in the IT architecture. It is understood, of course, that the flexibility of IT infrastructure and the securing of compatibility within and between the IT infrastructures of business units, industry and the public must also be arranged. This study, however, is delimited to firm-wide IT infrastructure.

5.1 IT Infrastructure

IT infrastructure is a complex entity, which explains over 50% of the IT budget of a typical organization, and the percentage is growing at a rate of 11% every year. However, defining the actual monetary value produced by IT infrastructure is difficult, even though its importance can be described in many ways, as a source of competitive advantage.

For example, One field of interest is the description of the properties of infrastructure as an explanation of its worth.

Despite the fact that IT infrastructure is ever more widely described and presented in an increasing number of academic articles, a more coherent and consistent view is still needed.

For example, it is used in a number of diverse and often inconsistent ways in current literature, which negates much of the seeming unity of concepts used. The objective of this paper is to offer a new, comprehensive model which combines the elements of IT infrastructure explained in different ways and emphasized to different degrees in previous studies.

IT infrastructure, as a separate element, is now more widely recognized than before and many justifications are used to describe its importance. On the basis of an analysis and synthesis of the definitions and purposes of IT infrastructure found in the literature review, IT infrastructure is seen to serve the following purposes:

- Forms a (technical and human) basis for business and business applications.
- Holds, routes, assembles and shares information, satisfying business and management needs for reducing costs and increasing efficiency.
- Enables the planning and modifications of business processes, supports the emergence of new organizational forms, improves connectivity among interest groups and helps globalization.
- Fosters the attainment of sustainable competitive advantage as a core competence of the firm, and, as a flexible platform, enables rapid new implementation of innovations and cost effective modifications of existing applications.

Notes

Self Assessment

Fill in the blanks:

1. ..... is a complex entity, which explains over 50% of the IT budget of a typical organization, and the percentage is growing at a rate of 11% every year.
2. IT infrastructure, as a ..... element, is more widely recognized than before and many justifications are used to describe its importance.

5.2 Evolution of IT Infrastructure

IT infrastructure is a complex entity, as it contains both technological and human components, and combinations of both. Lewis and Byrd (2003) attempt to evaluate these elements with an instrument which measures the degree of implementation of activities within companies on a 1-6 scale. The dimensions describing the activities are Chief Information Officer, IT planning, IT security, Technology Integration, Advisory Committee, Enterprise Model, and Data Administration. All these dimensions are processes or functions necessary for the proper maintenance and development of IT infrastructure.

Example: The Chief information Office dimension includes activities such as "CIO is responsible for corporate-wide information systems and technology policy" and "CIO is involved in the corporate business planning process". The instrument is one of the first endeavors to assess the readiness of IT infrastructure within firms, and it also guides practitioners in establishing necessary processes related to IT infrastructure.

The IT infrastructure in organizations today is an outgrowth of over 50 years of evolution in computing platforms. We have identified five stages in this evolution, each representing a different configuration of computing power and infrastructure elements (see Figure 5.1). The five eras are automated special-purpose machines, general-purpose mainframe and minicomputer computing, personal computers, client/server networks, and enterprise and Internet computing.

These eras do not necessarily end for all organizations at the same time, and the technologies that characterize one era may also be used in another time period for other purposes.

Example: Some companies still run traditional mainframe or minicomputer systems. Mainframe computers today are used as massive servers supporting large Websites and corporate enterprise applications.

5.2.1 Electronic Accounting Machine (Era 1930–1950)

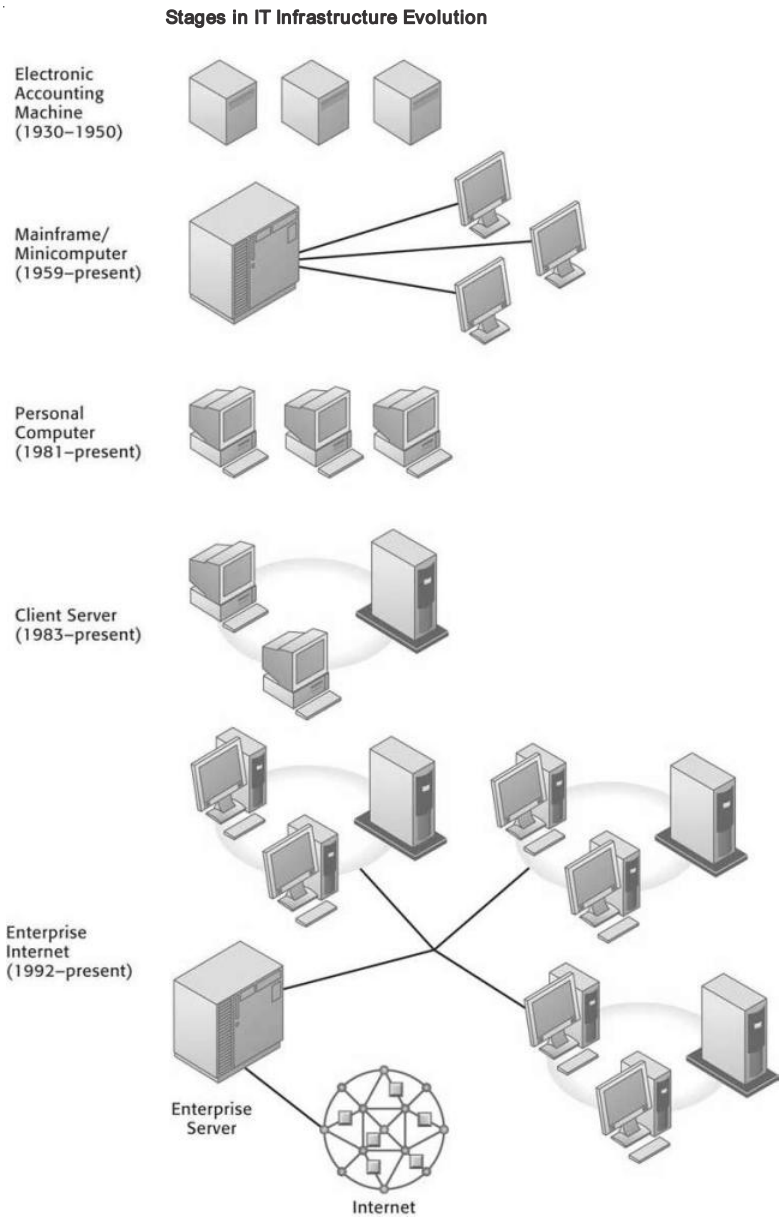
The first era of business computing used specialized machines that could sort computer cards into bins, accumulate totals, and print reports (DaCruz, 2004). Although the electronic accounting machine was an efficient processor of accounting tasks, the machines were large and cumbersome. Software programs were hardwired into circuit boards, and they could be changed by altering the wired connections on a patch board. There were no programmers, and a human machine operator was the operating system, controlling all system resources.

Notes

5.2.2 General-Purpose Mainframe and Minicomputer (Era 1959 to Present)

The first commercial all-electronic vacuum tube computers appeared in the early 1950s with the introduction of the UNIVAC computers and the IBM 700 Series. Not until 1959 with the introduction of the IBM 1401 and 7090 transistorized machines did widespread commercial use of mainframe computers begin in earnest. In 1965, the general-purpose commercial mainframe computer truly came into its own with the introduction of the IBM 360 series. The 360 was the first commercial computer with a powerful operating system that could provide time sharing, multitasking, and virtual memory in more advanced models.

Figure 5.1: Eras in IT Infrastructure Evolution



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Mainframe computers eventually became powerful enough to support thousands of online remote terminals connected to a centralized mainframe using proprietary communication protocols and proprietary data lines. The first airline reservation systems appeared in 1959 and became the prototypical online, real-time interactive computing system that could scale to the size of an entire nation.

IBM dominated mainframe computing from 1965 onward and still dominates this $27 billion global market in 2004. Today IBM mainframe systems can work with a wide variety of different manufacturers' computers and multiple operating systems on client/server networks and networks based on Internet technology standards.

The mainframe era was a period of highly centralized computing under the control of professional programmers and systems operators (usually in a corporate data center), with most elements of infrastructure provided by a single vendor, the manufacturer of the hardware and the software. This pattern began to change with the introduction of minicomputers produced by Digital Equipment Corporation (DEC) in 1965. DEC minicomputers (PDP-11 and later the VAX machines) offered powerful machines at far lower prices than IBM mainframes, making possible decentralized computing, customized to the specific needs of individual departments or business units rather than time sharing on a single huge mainframe.

5.2.3 Personal Computer Era (1981 to Present)

Although the first truly personal computers (PCs) appeared in the 1970s (the Xerox Alto, MIT's Altair, and the Apple I and II, to name a few), these machines had only limited distribution to computer enthusiasts. The appearance of the IBM PC in 1981 is usually credited as the beginning of the PC era because this machine was the first to become widely adopted in American businesses. At first using the DOS operating system, a text-based command language, and later the Microsoft Windows operating system, the Wintel PC computer (Windows operating system software on a computer with an Intel microprocessor) became the standard desktop personal computer. Today, 95 percent of the world's estimated 1 billion computers use the Wintel standard.

Proliferation of PCs in the 1980s and early 1990s launched a spate of personal desktop productivity software tools word processors, spreadsheets, electronic presentation software, and small data management programs that were very valuable to both home and corporate users. These PCs were standalone systems until PC operating system software in the 1990s made it possible to link them into networks.

5.2.4 Client/Server Era (1983 to Present)

Here, computer processing work is split between these two types of machines. The client is the user point of entry, whereas the server provides communication among the clients, processes and stores shared data, serves up Web pages, or manages network activities. The term server refers to both the software application and the physical computer on which the network software runs. The server could be a mainframe, but today server computers typically are more powerful versions of personal computers, based on inexpensive Intel chips and often using multiple processors in a single computer box.

The simplest client/server network consists of a client computer networked to a server computer, with processing split between the two types of machines. This is called a two-tiered client/server architecture. Whereas simple client/server networks can be found in small businesses, most corporations have more complex, multitiered (often called N-tier) client/server architectures in which the work of the entire network is balanced over several different levels of servers, depending on the kind of service being requested (see Figure 5.2).

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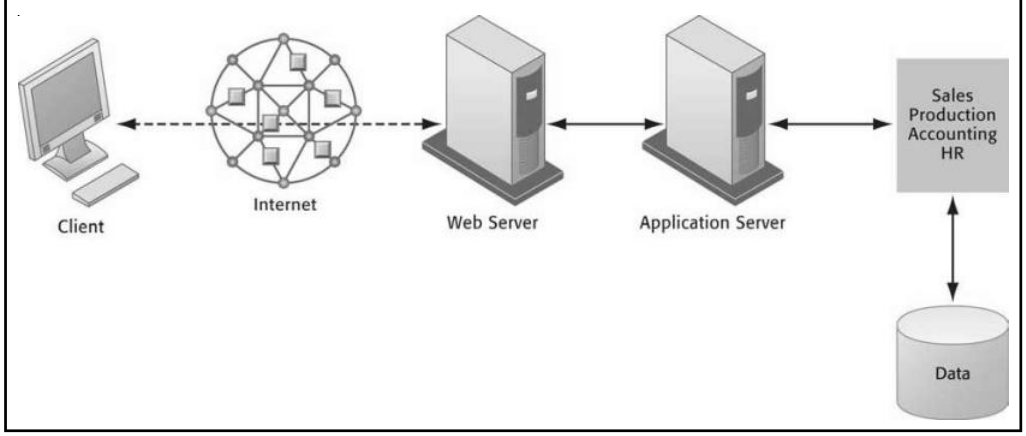
Figure 5.2: A Multitiered Client/Server Network (N-tier)



For instance, at the first level a Web server will serve a Web page to a client in response for a request for service. Web server software is responsible for locating and managing stored Web pages. If the client requests access to a corporate system (a product list or price information, for instance), the request is passed along to an application server. Application server software handles all application operations between a user and an organization's back-end business systems. The application server may reside on the same computer as the Web server or on its own dedicated computer.

Client/server computing enables businesses to distribute computing work across a number of smaller, inexpensive machines that cost much less than minicomputers or centralized mainframe systems. The result is an explosion in computing power and applications throughout the firm.

Notes Novell Netware was the leading technology for client/server networking at the beginning of the client/server era. Today Microsoft is the market leader, with its Windows operating systems (Windows Server, Windows XP, Windows 2000), controlling 78 percent of the local area network market.

Did u know? **What is client/server computing?**

In client/server computing, desktop or laptop computers called clients are networked to server computers that provide the client computers with a variety of services and capabilities.

5.2.5 Enterprise Internet Computing Era (1992 to Present)

The success of the client/server model posed a new set of problems for corporations. Many large firms found it difficult to integrate all of their local area networks (LANs) into a single, coherent corporate computing environment. Applications developed by local departments and divisions in a firm, or in different geographic areas, could not communicate easily with one another and share data.

In the early 1990s, firms turned to networking standards and software tools that could integrate disparate networks and applications throughout the firm into an enterprise-wide infrastructure. As the Internet developed into a trusted communications environment after 1995, business firms began using the Transmission Control Protocol/Internet Protocol (TCP/IP) networking standard to tie their disparate networks together.

Notes

Table 5.1: Stages in the IT Infrastructure Evolution

Infrastructure Dimension	Electronic Accounting Machine Era (1930-1950)	Mainframe Era (1959 to Present)	PC Era (1981 to Present)	Client/Server Era (1983 to Present)	Enterprise Era (1992 to Present)
Signature Firm (s)	IBM Burroughs NCR	IBM	Microsoft/Intel Dell HP IBM	Novel Microsoft	SAP Oracle PeopleSoft
Hardware Platform	Programmable card sorters	Centralized mainframe	Wintel computers	Wintel computers	Multiple: • Mainframe • Server • Client
Application and Enterprise Software	None; application software created by technicians	Few enterprise-wide applications; departmental applications created by in-house programmers	No enterprise connectivity; boxed software	Few enterprise-wide applications; boxed software applications for workgroups and departments	Enterprise-wide applications linked to desktop and departmental applications: • MySAP • Oracle E-Business Suite • PeopleSoft Enterprise One
Networking/Tele-communications	None	Vendor provided: • System Network Architecture (IBM) • DECNET (Digital) • AT&T voice	None or limited	Novell NetWare Windows 2003 Linux AT&T voice	LAN Enterprise-wide area network (WAN)TCP/IP Internet standard-enabled
System Integration	Vendor-provided	Vendor-provided	None	Accounting and consulting firms Service firms	Software manufacturer Accounting and consulting firms System integration firms Service firms
Data Storage and Database Management	Physical card management	Magnetic storage Flat files Relational database	Dbase II and III Access	Multiple database servers with optical and magnetic storage	Enterprise database servers
Internet Platforms	None	Poor to none	None at first Later browser enabled clients	None at first Later: • Apache server • Microsoft IIS	None in the early years Later: • Intranet and internet delivered enterprise services • Larger server farms

The resulting IT infrastructure links different types and brands of computer hardware and smaller networks into an enterprise-wide network so that information can flow freely across the organization and between the firm and other organizations. Enterprise networks link

Notes

mainframes, servers, PCs, mobile phones, and other handheld devices, and connect to public infrastructures such as the telephone system, the Internet, and public network services.

The enterprise infrastructure employs software that can link disparate applications and enable data to flow freely among different parts of the business. Other solutions for enterprise integration include enterprise application integration software, Web services, and outsourcing to external vendors that provide hardware and software for a comprehensive enterprise infrastructure.

The enterprise era promises to bring about a truly integrated computing and IT services platform for the management of global enterprises. The hope is to deliver critical business information painlessly and seamlessly to decision makers when and where they need it to create customer value. This could be everything from getting inventory data to the mobile salesperson in the customer's office, to helping a customer at a call center with a problem customer, or providing managers with precise up-to-the-minute information on company performance.

That is the promise, but the reality is wrenchingly difficult and awesomely expensive. Most large firms have a huge, tangled web of hardware systems and software applications inherited from the past. This makes achieving this level of enterprise integration a difficult, long-term process that can last perhaps as long as a decade and cost large companies hundreds of millions of dollars. Table 5.1 compares each era on the infrastructure dimensions discussed above.

Self Assessment

Fill in the blanks:

3. The five eras of IT infrastructure are ..... special-purpose machines, general-purpose mainframe and minicomputer computing, personal computers, client/server networks, and enterprise and Internet computing.
4. The ..... era was a period of highly centralized computing under the control of professional programmers and systems operators.

5.3 Moore's Law

Moore's Law describes a long-term trend in the history of computing hardware, in which the number of transistors that can be placed inexpensively on an integrated circuit has doubled approximately every two years. Rather than being a naturally-occurring "law" that cannot be controlled, however, Moore's Law is effectively a business practice in which the advancement of transistor counts occurs at a fixed rate.

The capabilities of many digital electronic devices are strongly linked to Moore's law: processing speed, memory capacity, sensors and even the number and size of pixels in digital cameras. All of these are improving at (roughly) exponential rates as well. This has dramatically increased the usefulness of digital electronics in nearly every segment of the world economy. Moore's law precisely describes a driving force of technological and social change in the late 20th and early 21st centuries. The trend has continued for more than half a century and is not expected to stop until 2015 or even later.

Task Discuss client/server era of evolution of IT infrastructure.

Notes

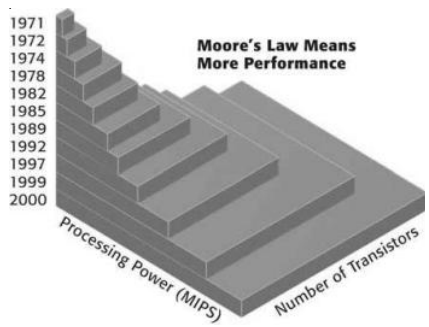
5.3.1 Moore's Law and Micro-processing Power

In 1965, Gordon Moore, the director of Fairchild Semiconductor's Research and Development Laboratories, an early manufacturer of integrated circuits, wrote in Electronics magazine that since the first microprocessor chip was introduced in 1959, the number of components on a chip with the smallest manufacturer costs per component (generally transistors) had doubled each year. This assertion became the foundation of Moore's Law. Moore later reduced the rate of growth to a doubling every two years. This law would later be interpreted in multiple ways. There are at least three variations of Moore's Law, none of which Moore ever stated:

1. The power of microprocessors doubles every 18 months (Tuomi, 2002);
2. Computing power doubles every 18 months; and
3. The price of computing falls by half every 18 months.

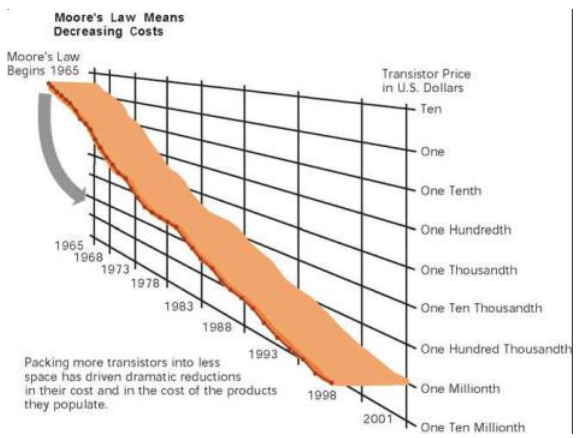
Figure 5.3 illustrates the relationship between number of transistors on a microprocessor and Millions of Instructions Per Second (MIPS), a common measure of processor power. Figure 5.3 shows the exponential decline in the cost of transistors and rise in computing power.

Figure 5.3: Moore's Law and Microprocessor Performance



There is reason to believe the exponential growth in the number of transistors and the power of processors coupled with an exponential decline in computing costs will continue into the future. Chip manufacturers continue to miniaturize components. Intel has recently changed its manufacturing process from 0.13-micron component size (a micron is a millionth of a meter), introduced in 2002, to a newer 90-nanometer process in 2004 (a nanometer is a billionth of a meter). With a size of about 50 nanometers, today's transistors should no longer be compared to the size of a human hair but rather to the size of a virus, the smallest form of organic life.

Figure 5.4: Falling Cost of Chips



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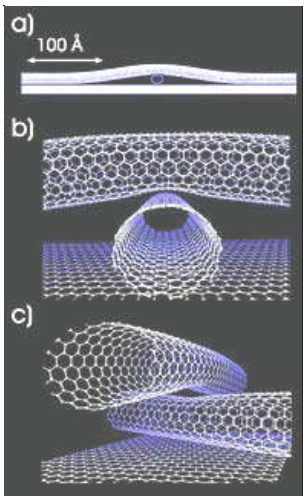
By using nanotechnology, Intel believes it can shrink the size of transistors down to the width of several atoms. IBM and other research labs have created transistors from nanotubes and other electrical devices (IBM, 2004) and have developed a manufacturing process that could produce nanotube processors economically (Figure 5.5). Other new technologies include strained silicon, 300-millimeter production wafers (which decrease the costs of production), and denser interconnections among components.

Whereas the first Pentium microprocessors operated at 75 megahertz, today's Pentiums are available with 3-gigahertz speeds. However, increasing processor speeds at the same exponential rate as in the past may no longer be possible.

Figure 5.5: Examples of Nanotubes



Caution As processor speeds increase, heat is generated that cannot be dissipated with air fans.

Another brake on future increases in microprocessor speed is more market-oriented:

Most consumers may not need vast increases in microprocessor speed but instead are more interested in low power consumption for longer battery life and low weight to increase laptop and handheld computer portability. For this reason, Intel and other firms are designing the next generation of chips to be less power hungry and lower in weight even if they are the same or even slower speeds. Other options include putting multiple processors on a single chip.

Did u know? **What is nanotechnology?**

Nanotechnology uses individual atoms and molecules to create computer chips and other devices that are thousands of times smaller than current technologies permit.

Self Assessment

Fill in the blanks:

5. ..... describes a long-term trend in the history of computing hardware, in which the number of transistors that can be placed inexpensively on an integrated circuit has doubled approximately every two years.

Notes

6. ..... uses individual atoms and molecules to create computer chips and other devices that are thousands of times smaller than current technologies permit.

5.4 Law of Mass Digital Storage

A second technology driver of IT infrastructure change is the Law of Mass Digital Storage. The world produces as much as 5 exabytes of unique information per year (an exabyte is a billion gigabytes, or 1018 bytes). The amount of digital information is roughly doubling every year (Lyman and Varian, 2003). Almost all of this information growth involves magnetic storage of digital data, and printed documents account for only 0.003 percent of the annual growth.

Fortunately, the cost of storing digital information is falling at an exponential rate. Figure 5.6 shows that PC hard drive capacity—beginning with a Seagate 506 in 1980 that had 5 megabytes of memory—has grown at a compound annual growth rate of 25 percent in the early years to over 60 percent a year since 1990. Today's PC hard drives have storage densities approaching 1 gigabyte per square inch and total capacities of over 200 gigabytes (IBM, Seagate).

Figure 5.6: The Capacity of Hard Disk Drives grows Exponentially, 1980–2004

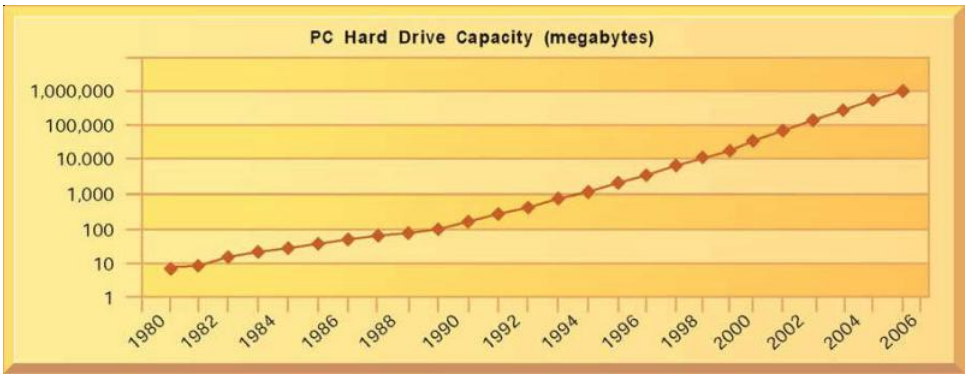


Figure 5.7: The Cost of Storing Data Declines Exponentially, 1950–2004

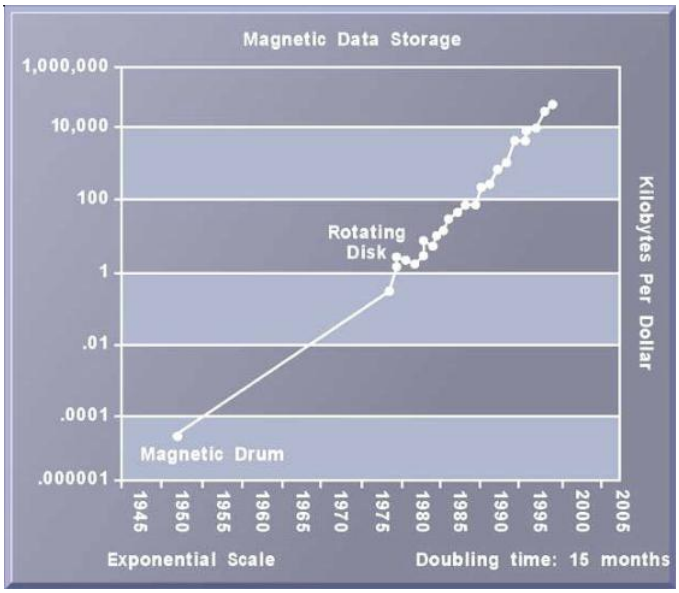


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Figure 5.7 shows that the number of kilobytes that can be stored on magnetic disks for one dollar from 1950 to 2004 roughly doubled every 15 months.

Self Assessment

Fill in the blanks:

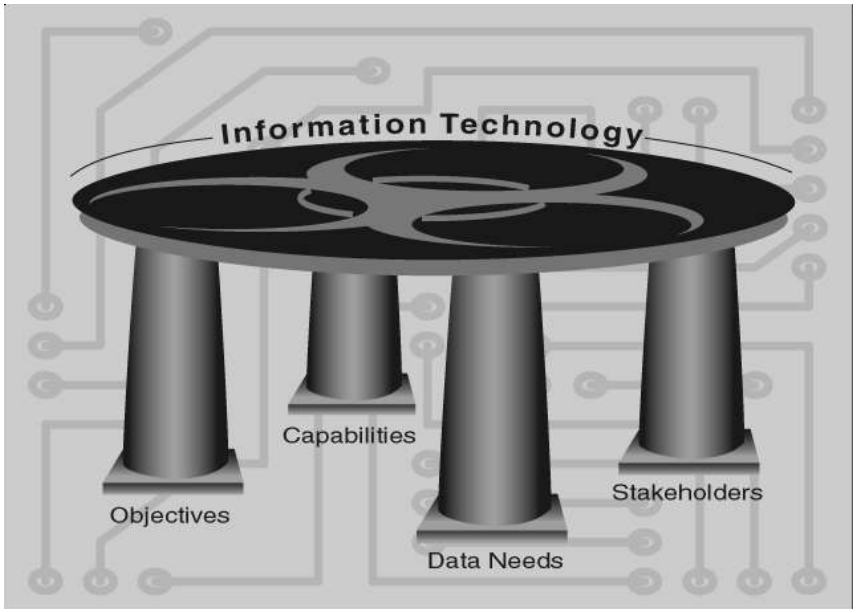
7. In law of mass digital storage, the amount of digital information is roughly ..... every year.
8. Almost all of the information growth involves ..... storage of digital data, and printed documents account for only 0.003 percent of the annual growth.

5.5 IT Infrastructure Components

The components of IT infrastructure are:

- Objectives
- Capabilities
- Data Needs
- Stakeholders

Figure 5.8: The Foundation for Defining an IT Infrastructure



The framework for the IT infrastructure made up of the following four components:

- ***Objectives***: What objectives will it support?
- ***Capabilities***: What capabilities will it need to support these objectives?
- ***Data***: What data are needed? How will the data be organized (architecture) and communicated (standards)?
- ***Stakeholders***: Who are the stakeholders and users?

Notes

5.5.1 Other Infrastructure Components

Other infrastructure components are:

- Internet Platforms (Apache, Microsoft IIS, .NET, Unix, Cisco, Nortel, Java)
- Computer Hardware Platforms (Dell, IBM, Sun, HP, Apple, Linux machines)
- Operating Systems Platforms (Microsoft Windows, Unix, Linux, Mac OS X)
- Enterprise Software Applications (including middleware, SAP, Oracle, PeopleSoft, Microsoft, BEA)
- Network/Telecommunications (Microsoft Windows Server, Linux, Novell, Cisco, Lucent, Nortel, MCI, ATT, Verizon)
- Consultants and System Integrators (IBM, KPMG, Accenture, Capgemini)
- Data Management and Storage (IBM DB2, Oracle, SQL Server, Sybase, MYSQL, EMC Systems)

Self Assessment

Fill in the blanks:

9. ..... Applications includes middleware, SAP, Oracle, PeopleSoft, Microsoft, and BEA.
10. Apache, Microsoft IIS, .NET, Unix, Cisco, Nortel, and Java are the examples of ..... Platforms.

5.6 Current Trends in Hardware Platforms

The speed and computing capacity of technology continues to advance at dizzying speeds and in ways we can hardly imagine.

5.6.1 Interactive Multimedia

One trend highly touted by the experts is that of the "information appliance." Do we need to have a separate device for watching television, another one for listening to music, a different one called a telephone, and yet a whole separate device for computing? Some people say we can do all of that with one central appliance with a variety of input and output devices.

If you watch the mergers taking place in the corporate world between the telephone companies and cable TV companies, you can start to understand another major change that may be in store for us. The companies are working toward a convergence of the "entertainment outlets" we know as television and the Internet. Why can't we download a movie off the Internet whenever we're ready to watch it instead of having to follow a TV channel's set schedule? This idea may be a reality in a few years.

The music industry is struggling with the issue of music downloaded from Web sites. How do the musicians protect their copyrighted work while making the music more accessible to the public? How do the music publishing companies protect their business from disintermediation, the process of eliminating the middleman from transactions?

Notes

5.6.2 Smart Cards and Microminiaturization

Take a credit card out of your wallet and look at the magnetic strip on the back. The strip may seem too small to hold much data. You might be surprised to learn that through microminiaturization, virtually all of your personal information, from health records to school records to credit records, can be stored on that small area with room to spare. Some states are now including vital medical information on the back of driver's licenses which can be accessed by paramedics if you're ever in an accident and need medical attention. The technology has already saved lives.

5.6.3 The Network Structure

The concept of the network's form of organization has been particularly popular with management writers for its potential to build the flexible organization with the ability to meet the challenges of a changing and global environment. Despite both the abundant available literature and the existence of a certain consensus on some aspects, there is still too much ambiguity in the concepts used in this area. Taking into account the formation of networks, which is an interesting field of recent development with strong repercussions on the inter-organizational relationships, it is necessary to clear the existing terminological confusions in order to formulate its theory and to improve its implementation.

Starting from the definition, a network is a specific kind of relationship joining a particular group of people, objects, or events. Two factors needed for constituting a network can be obtained from this definition; first, a network is formed by a group of elements; second, these elements establish specific relationships among them. We must show that the establishment of a co-operative network is not a purpose itself but "it must be a dynamic structure that allows consolidating the competitive position of its members".

By means of a network structure, the competitive position of the enterprises can be reinforced as these concentrate on what they do best, and on what maintains their success in the market. In this way, other enterprises make the activities left, in which they have distinctive competences too. The enterprises outsource those activities that are ballast and bureaucratize them.

The enterprises that belong to a network have not all the elements needed for manufacturing a product or providing a service under their absolute control. Within the networks, the involved elements belong to independent enterprises and are placed along the value system of a product or service.

All this drives to an organizational structure in which the enterprises generate more value in those areas where they have specific competencies. The success of these emergent organizational forms seems to be based, on a great extent, on an effective co-ordination by means of the use of advanced information systems, which are based on the Information Technologies (IT). There is an increasing interest in the relationship between the emerging organizational ways and the function of the IT/IS insofar as the progresses in each field have influenced the others.

5.6.4 Information Technology on the Emergence of Networks

At the moment, the most spectacular and potentially powerful uses of the information systems technology go beyond the individual borders of the enterprises. In fact, the most important function of IT in the nineties is the better management of the interdependencies among the enterprises. Information Technology has to be the most powerful instrument to reduce the co-ordination costs. While the traditional uses of IT tried to facilitate the internal processes of the enterprises, the Interorganizational Information Systems (IOS) are addressed towards the efficiency of a group of enterprises.

Notes

Most of the studies about IOS have focused on the incidence of IT on the flows of information among the organizations, its capability of reducing the transaction costs, and its potential to achieve competitive advantages. Many authors have verified that:

- IT influences the nature, punctuality and detail level of the information shared by enterprises
- IT reduces the transaction costs, while it provides a better management of the risks
- IT reduces the co-ordination costs.

In order to benefit from the advantages of IT, the enterprises have to keep in mind that IT cannot be isolated from its organizational context. We do not agree with the existence of causation between the implementation of IT and the organizational changes in the enterprise driving to an increase in the competitiveness of the enterprises. On the contrary the technological and organizational implementations are both sides of the same issue, since they depend on and determine each other. We think that, although IT might have the above mentioned positive effects on the organizations, the will and capabilities of the directors of the company are needed in order to make the most of those advantages.

In order to make the most of the whole potential of the IOS, it will be required that the managing directors get involved with the project, since they have a wider and more strategic view of the company. In this way, a system coherent with the objectives of the company would be implemented. This system would allow taking even more profit from IT, what would have positive repercussions on the enterprise and would facilitate the achievement of its objectives.

Notes The active participation of the Management Board in the planning of the IOS brings a problem related to the fact that IT is a relatively new resource that did not exist when most of the current managers were trained. Therefore, they usually do not feel comfortable with these new technologies.

Task Describe various components of IT infrastructure.

5.6.5 The Role of IOS within the Network Structure

The enterprises involved in an alliance must decide whether to use the manual management of all the exchanged data, or to complement that management with the interconnection of their respective computer applications. This interconnection may bring, however, compatibility problems in the integration of the data from the different enterprises, since those applications would have possibly been designed without taking into account any requirement of integration among enterprises. The establishment of co-operation networks implies the need for wider communication in the organizational field, as well as the requirement of capability to integrate the information systems from different enterprises.

The enterprises inside a network cannot operate properly if they have not the possibility to communicate quickly, accurately, and over long distances. Within a network, it does not make any sense to restrict the application of modern computer technologies to the individual borders of each enterprise. The Management Board of the enterprises in the network must, on the contrary, consider the possibilities of coordinating the processing of data outside the limits of their own organizations by means of an IOS.

The application of the IT which provides the electronic integration among the shareholders of an industry may make easier the outsourcing of activities, as well as be a basic part of the proper

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operation of the reticular structures. An IOS may play an important role in the coordination of interdependent activities, which would be carried out by distant organizational units.

The concept of network emphasizes the interdependency among enterprises, which is provoked by the presence and the sharing of the following key attributes: objectives, experience, labour, taking of decisions, responsibility, trust, and acknowledgement or reward. The enterprises within a network will adopt a common objective, namely to provide a quicker and better service to the final customer. With this aim in view, independent organizations will have to establish close interrelationships, in which Information Technologies have a vital role to play. In this way, the aim of optimizing the flow of profits along the supply chain could be achieved too. IOSs are, basically, new means to facilitate the relationships among organizations; they are, therefore, a strategic instrument. However, an IOS allows to obtain operative advantages too, such as

- Reducing paperwork and manual operations;
- Reducing the stock levels;
- Accelerating the product and material flow;
- Standardizing of procedures;
- Accelerating the flow of information about changes on the demand;
- Reducing telecommunication costs.

The IT is a basic support that facilitates the co-ordination of different enterprises through EDI systems, shared databases, e-mail, videoconferences, which will allow them to work together. They will be able to share information on the markets, on the needs for materials, on stock levels, production schedules, and delivery programs. A key factor in an efficient exchange of information within a network is the computer connection of its members. The computer links accelerate the transference of information, since it provides the automatic transmission of data between physically distant computers. These links can be used as a strategic instrument to increase the competitiveness of the enterprise, binding it electronically with its customers and suppliers through inter-organizational systems. The electronic connection facilitates the approaching of the linked enterprises, which means that the companies may provide the customers direct access to the internal databases, as well as just-in-time stock control.

Caution The enterprises can reduce their dependency on strategies of backward-forward integration in order to ensure the control over the production process.

Self Assessment

Fill in the blanks:

11. By means of a ..... structure, the competitive position of the enterprises can be reinforced as these concentrate on what they do best, and on what maintains their success in the market.
12. An IOS may play an important role in the coordination of ..... activities, which would be carried out by distant organizational units.

Notes

5.7 Enterprise Software

Enterprise software, also known as enterprise application software (EAS), is software intended to solve an enterprise problem (rather than a departmental problem) and often written using an Enterprise Software Architecture. Due to the cost of building what is often proprietary software, only large enterprises attempt to build such enterprise software that models the entire business enterprise and is the core IT system of governing the enterprise and the core of communication within the enterprise.

As business enterprises have similar departments and systems in common, enterprise software is often available as a suite of programs that have attached enterprise development tools to customize the programs to the specific enterprise. Generally, these development tools are complex enterprise programming tools that require specialist capabilities. Thus, one often sees in job advertisements that a programmer is required to have specific knowledge of a particular set of enterprise tools, such as "SAP developer" etc.

5.7.1 Types of Enterprise Software

Enterprise software is often designed and implemented by an Information Technology (IT) group within an enterprise. It may also be purchased from an independent enterprise software developer, that often installs and maintains the software for their customers. Another model is based on a concept called on-demand software, or Software as a Service. The on-demand model of enterprise software is made possible through the widespread distribution of broadband access to the Internet. Software as a Service vendors maintain enterprise software on servers within their own enterprise data center and then provide access to the software to their enterprise customers via the Internet.

Enterprise software is often categorized by the business function that it automates - such as accounting software or sales force automation software. Similarly for industries - for example, there are enterprise systems devised for the health care industry, or for manufacturing enterprises.

Enterprise application software is application software that performs business functions such as accounting, production scheduling, customer information management, bank account maintenance, etc. It is frequently hosted on servers and simultaneously provides services to a large number of enterprises, typically over a computer network. This is in contrast to the more common single-user software applications which run on a user's own local computer and serve only one user at a time.

Self Assessment

Fill in the blanks:

13. Enterprise software, also known as enterprise application software (EAS), is software intended to solve an enterprise problem and often written using an .....
14. Enterprise software is often categorized by the ..... function that it automates- such as accounting software or sales force automation software.

5.8 Groupware

Groupware refers to programs that help people work together collectively while located remotely from each other. Programs that enable real time collaboration are called synchronous groupware. Groupware services can include the sharing of calendars, collective writing, e-mail handling, shared database access, electronic meetings with each person able to see and display information

Notes

to others, and other activities. Sometimes called collaborative software, groupware is an integral component of a field of study known as Computer-Supported Cooperative Work or CSCW.

Collaborative software (also referred to as groupware or workgroup support systems) is software designed to help people involved in a common task achieve their goals. Collaborative software is the basis for computer supported cooperative work. Such software systems as email, calendaring, text chat, wiki, and bookmarking belong to this category. It has been suggested that Metcalfe's law — the more people who use something, the more valuable it becomes — applies to such software.

Collaboration, with respect to information technology, seems to have several definitions. Some are defensible but others are so broad they lose any meaningful application. Understanding the differences in human interactions is necessary to ensure the appropriate technologies are employed to meet interaction needs. There are three primary ways in which humans interact:

- Conversations
- Transactions
- Collaborations

5.8.1 Conversations

Conversational interaction is an exchange of information between two or more participants where the primary purpose of the interaction is discovery or relationship building. There is no central entity around which the interaction revolves but is a free exchange of information with no defined constraints. Communication technology such as telephones, instant messaging, and e-mail are generally sufficient for conversational interactions.

5.8.2 Transactions

Transactional interaction involves the exchange of transaction entities where a major function of the transaction entity is to alter the relationship between participants. The transaction entity is in a relatively stable form and constrains or defines the new relationship. One participant exchanges money for goods and becomes a customer. Transactional interactions are most effectively handled by transactional systems that manage state and commit records for persistent storage.

5.8.3 Collaborations

In collaborative interactions the main function of the participants' relationship is to alter a collaboration entity (i.e., the converse of transactional). The collaboration entity is in a relatively unstable form.

Examples include the development of an idea, the creation of a design, the achievement of a shared goal.

Therefore, real collaboration technologies deliver the functionality for many participants to augment a common deliverable. Record or document management, threaded discussions, audit history, and other mechanisms designed to capture the efforts of many into a managed content environment are typical of collaboration technologies.

Self Assessment

Notes

Fill in the blanks:

15. ..... refers to programs that help people work together collectively while located remotely from each other.

16. In ..... interactions the main function of the participants' relationship is to alter a collaboration entity (i.e., the converse of transactional).

Case Study

Online Store Sales Success

Overview of Our Client's Strategy

Our client had an online store. They were spending $15,000 each month on pay per click advertising. This resulted in about $225,000 per month in sales. They didn't know which clicks were leading to sales because they didn't track the clicks. There rankings in the natural listings was minimal because they hadn't done keyword research on what visitors were using to try to find a site like theirs. They weren't able to quantify results because their web statistics program only showed very general traffic information. They were also doing a an irregular email newsletter even though they had more than 32,000 emails in their database.

Analysis of the Situation

In the natural listings we suspected they were being penalized by the search engines for duplicate content. The search engines frown on this because they feel this is trying to fool them. Google will often give a site like this something called "Supplemental Results", which means that the search engines know the page exists but doesn't have any content in their database. We also suspected their email newsletter was being blocked by many spam blockers because the names of the products they sold were often on used in spam emails.

Implementation of a Solution

For the pay per click advertising we started tracking the clicks down to the individual terms and the actual results that came from them. We were able to delete terms that were not getting enough sales and increase the bids on ones that brought sales. For the natural listings we did keyword research and focused on the main keywords on the content for the home page and in the META tags. We also found that visitors search on product names rather than manufacturers, so in the Title tag for the page we switched and put the product name before the manufacturer. With the newsletter, we used a good mix of graphics and content to appease the spam blockers, as well as put the product names in graphics so they wouldn't be blocked. In order to analyze of the site's traffic, we implemented a powerful web statistics program.

Results of Our Work

Through our tactics, our client was able to move up to #4 on Google for their main search term, which got a lot of traffic. With pay per click, they went from $.62 per click to $.43. They decrease their budget to $10,000 per month, yet was able to increase their traffic by 33 percent. Through our optimization of their pay per click, their cost per conversion to sale decreased by at least 45 per cent.

Contd...

Notes

The deliverability of their newsletter increased as well. Within an year, their sales increased to over $600,000 per month.

Questions:

1. Discuss the client strategy for the success of store.
2. If you are the decision maker what would you suggest the client.

5.9 Summary

- IT infrastructure is described in a number of ways, but the elements for describing it remain largely the same.
- The foundation is formed by the technology components, which human IT infrastructure uses to provide the required IT services for business needs.
- The IT infrastructure in organizations today is an outgrowth of over 50 years of evolution in computing platforms. There are five stages in this evolution, each representing a different configuration of computing power and infrastructure elements.
- Moore's Law describes a long-term trend in the history of computing hardware, in which the number of transistors that can be placed inexpensively on an integrated circuit has doubled approximately every two years.
- The concept of the network's form of organization has been particularly popular with management writers for its potential to build the flexible organization with the ability to meet the challenges of a changing and global environment.
- The IT is a basic support that facilitates the co-ordination of different enterprises through EDI systems, shared databases, e-mail, videoconferences, which will allow them to work together.
- Enterprise level software is software which provides business logic support functionality for an enterprise, typically in commercial organizations, which aims to improve the enterprise's productivity and efficiency.
- Some enterprise software vendors using the latter definition develop highly complex products that are often overkill for smaller organizations, and the application of these can be a very frustrating task.
- Groupware refers to programs that help people work together collectively while located remotely from each other.

5.10 Keywords

Enterprise level software: It is software which provides business logic support functionality for an enterprise, typically in commercial organizations, which aims to improve the enterprise's productivity and efficiency.

Groupware: It refers to programs that help people work together collectively while located remotely from each other.

Hardware: Physical device in a computer system.

Network: A network is a specific kind of relationship joining a particular group of people, objects, or events.

Notes

5.11 Review Questions

1. Describe the evolution of IT infrastructure in detail with suitable example.
2. What is Moore's law? How it is related to Micro-processing Power.
3. Describe the laws of mass digital storage in detail.
4. Enlighten the various components of IT infrastructure.
5. Discuss the role of IOS within the network structure.
6. Why IT infrastructure is necessary for any organization? Give your suggestion.
7. What are the various trends in hardware platform? Explain.
8. Describe the impact of Information Technology on the Emergence of Networks.
9. The enterprises inside a network cannot operate properly if they have not the possibility to communicate quickly, accurately, and over long distances. Comment.
10. What is groupware? Explain the methods in which humans interact.

Answers: Self Assessment

1.	IT infrastructure	2.	separate
3.	automated	4.	mainframe
5.	Moore's Law	6.	Nanotechnology
7.	doubling	8.	magnetic
9.	Enterprise Software	10.	Internet
11.	network	12.	interdependent
13.	Enterprise Software Architecture.	14.	business
15.	Groupware	16.	collaborative

5.12 Further Readings

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Online links

http://www.cs.helsinki.fi

www.hcibook.com

Unit 6: Business Networks and Telecommunications

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Objectives

After studying this unit, you will be able to:

- Understand the concept of communication technologies in business
- Discuss videoconferencing and wireless payments
- Understand the concept of bandwidth and communication media
- Recognize networks and their types
- Understand network protocols and internetworking services

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Introduction

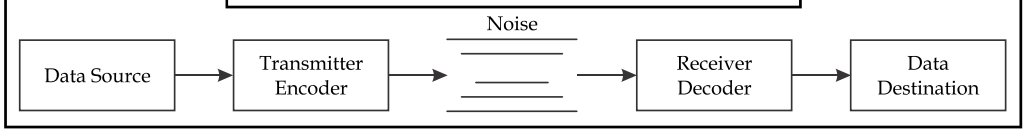
We are in the world of advanced Information Technology where things are moving in such a fast phase. The availability of information becomes cheaper and faster and the facilities existing to exchange the information among users all across the world has become more simpler due to the evolving of Information Super Highway. The internet provides fast and inexpensive communication channels that range from messages posted on bulletin boards to complex exchanges among many organizations. It also includes information transfer (among computers) and information processing. E-mail, chat groups, and newsgroups are examples of major communication media. Let us see the major components of Electronic Communication System as follows.

6.1 Telecommunication

Telecommunication implies the transmission of information from one point to another through a communication medium. In today's dynamic business environment, people, in order to perform their work activities and to compete successfully, need to communicate electronically within and outside the organization. As a result, telecommunication takes on a significant role in an organization. Sometimes, the term data communication, which is a narrow term and refers to the transmission of data, is also used and thus data communication is a more specific term.

A telecommunication system may be represented by way of a simple conceptual model as shown in Figure 6.1.

Figure 6.1: A conceptual Model of Communication System



The data source is the originator of information while data transmission is the receiver of information. The channel is the path through which the information is transmitted to the destination from the source. Before an information is sent through the communication channel it is converted into coded symbols by transmitted encoder, only to be decoded at the receiver's end by receivers decoder. The encoded data is transmitted through the channel by an electronic signal or waveform.

Self Assessment

Fill in the blanks:

1. ..... implies the transmission of information from one point to another through a communication medium.
2. The ..... is the path through which the information is transmitted to the destination from the source.

6.2 Communication Technologies in Business

Most traditional business communications rely on telephone and paper-based processes. These resources do not readily support the level of productive interaction that growing businesses need to excel, and can be easily overwhelmed in periods of rapid growth.

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"Organizations are looking to increase productivity by focusing on the interactions between colleagues, partners, and customers, says John Chambers, Cisco Chairman and CEO. "Productive interactions also help improve profitability and customer satisfaction, and they create new opportunities for corporate growth and success."

Today, successful companies around the world achieve that efficiency with network-based communications tools such as e-mail and a Web presence. These tools support the high levels of productivity and customer support that growing companies need to compete in larger and more lucrative markets. A sound network foundation will also support the new technologies and applications necessary to sustain ongoing competitiveness.

What is different about human communication in business organizations when it takes place via the new communication technologies like electronic mail? The most distinctive quality of these new technologies is that they are interactive in nature, in that they allow the participants in a communication process to have control over, and exchange roles in, their mutual discourse. Interactive communication technologies usually spread among the members of a system rather slowly until a critical mass of adopters is reached, as the case of Internet illustrates. After the critical mass occurred, the rate of adoption of Internet took off suddenly. Interactive communication provides a relatively high degree of flexibility, which in turn allows the user to have a high degree of control over the technology and the communication that takes place via the new interactive technologies.

Every successful business needs to have the best communication equipment available on the market. It's just a simple fact. If you can't properly communicate with your different branches, then your efficiency will take a big hit. Communicating isn't that hard though. There have been many advances in the past few years that grant great advantages to your efforts.

One of the easiest would be in the form of a simple teleconference through something like the polycom soundstation. You probably already know what this is. It's basically just one big conference, except you don't need to pack everyone into one board room. There are a number of advantages to this setup. The first is that you are in a perfect position to take full advantage of telecommuting. Any of your remote workers can just press a few buttons and log into the conference from their home phone. This also works for any remote branches who want to be involved. There are nearly countless benefits to having one installed. You will have greater function in your meetings and you'll be able to include everyone without annoying travel plans. There is also the usual ability to tape the conference for better archiving. Avaya IP office phones will work in this capacity to make everything function a bit better.

It is important that you take the time to setup the connection properly though. There is no reason to buy an inferior product for your teleconference. If you go cheap and don't have it professionally installed, then the static and poor pickup will effectively ruin any good conference. The good news is that you have a lot of options. The Polycom system works to give you a large microphone range which should be able to handle any small or medium room. There are other options though. Just a basic search online will show a number of companies who want your business.

You could go with a phone system through Avaya partner ACS. They offer similar setups for your conference needs. It's really just about getting what you want from a reputable company. Check to see who has local branches and then see whether one of their products fits your capacity needs better. It's hard to tell you what's the best without understanding your exact situation. These two companies should be a good place to start though. Just one phone call could let you start having teleconferences that make everything run smoother and more efficiently. The main communication technologies in business are:

1. Videoconferencing
2. Wireless Payments

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Task Discuss the basic features of telecommunication system.

6.2.1 Videoconferencing

A videoconference is a live connection between people in separate locations for the purpose of communication, usually involving audio and often text as well as video. At its simplest, videoconferencing provides transmission of static images and text between two locations. At its most sophisticated, it provides transmission of full-motion video images and high-quality audio between multiple locations.

Videoconferencing software is quickly becoming standard computer equipment. For example, Microsoft's NetMeeting is included in Windows 2000 and is also available for free download from the NetMeeting homepage. For personal use, free or inexpensive videoconference software and a digital camera afford the user easy - and cheap - live connections to distant friends and family. Although the audio and video quality of such a minimal setup is not high, the combined benefits of a video link and long-distance savings may be quite persuasive.

Figure 6.2: Videoconferencing

The tangible benefits for businesses using videoconferencing include lower travel costs and profits gained from offering videoconferencing as an aspect of customer service. The intangible benefits include the facilitation of group work among geographically distant teammates and a stronger sense of community among business contacts, both within and between companies. In terms of group work, users can chat, transfer files, share programs, send and receive graphic data, and operate computers from remote locations. On a more personal level, the face-to-face connection adds non-verbal communication to the exchange and allows participants to develop a stronger sense of familiarity with individuals they may never actually meet in the same place.

Notes A videoconference can be thought of as a phone call with pictures – Microsoft refers to that aspect of its NetMeeting package as a "web phone" – and indications suggest that videoconferencing will some day become the primary mode of distance communication.

What is Videoconferencing?

In videoconferencing technology, two or more people at different locations can see and hear each other at the same time, sometimes even sharing computer applications for collaboration. Videoconferencing offers possibilities for schools, colleges, and libraries to use these systems for a variety of purposes, including formal instruction (courses, lessons, and tutoring), connection

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with guest speakers and experts, multi-school project collaboration, professional activities, and community events.

Placing a video call is a lot like placing a telephone call. After you connect, you see the other person in color video on a TV screen and may be able to transfer files or collaborate via options such as document sharing or white boarding.

Basic Videoconferencing Technology

A videoconferencing system requires the audiovisual equipment, which includes a monitor, camera, microphone, and speaker, and a means of transmission.

Rather than an Internet-based connection, such as that used by webcams, which have to share bandwidth with other Internet data, a compressed video system on a dedicated bandwidth provides smooth audio and video.

The compressed videoconferencing may be transmitted via an ISDN (Integrated Services Digital Network) line or over IP (Internet Protocol) lines. It is an economical solution for high-quality videoconferencing.

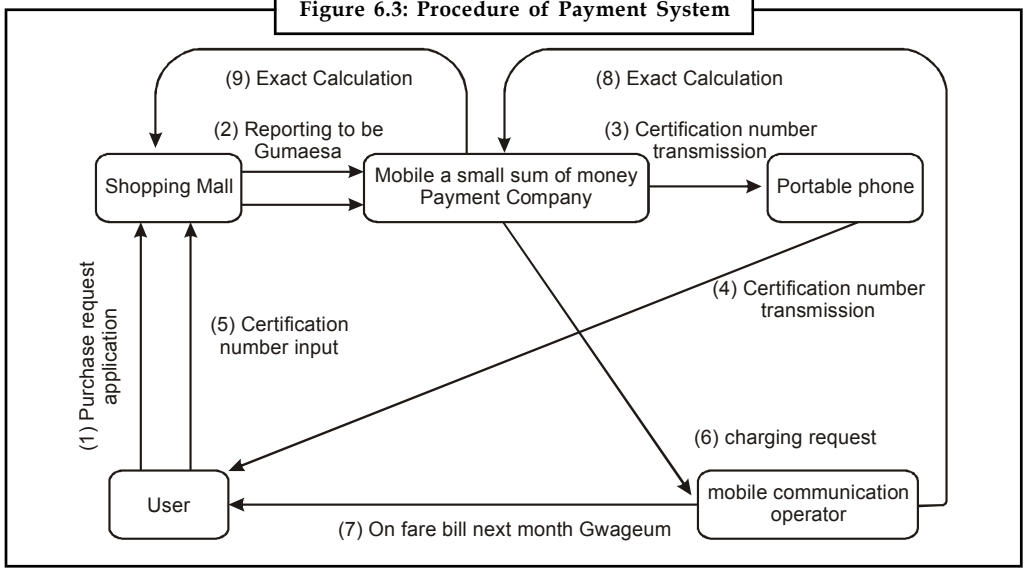
Did u know? **What is compressed video system?**

Compressed video system allows a larger audience to experience the benefits of high-quality videoconferencing at a reasonable cost.

6.2.2 Wireless Payments

Payment system refers to a service to pay the charges using credit card, debit card or mileage when we purchase service and product on and off lines. The processing procedure of the payment system is generally divided into customer security, payment at POS, imposition and request of payment and liquidation between payment service provider and consumer. Most of the payment systems take similar procedure regardless of its technical method. The small sum payment system, an early model of payment system, can be said to be the method to purchase products using wired internet and mobile device.

Figure 6.3: Procedure of Payment System



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In the small sum payment system, we choose a product on wired internet and the payment method as the small sum payment, and input user information like the number of the device and residence registration number, then it transfers after confirmation the authentication number to the mobile device, which is input again on wired internet to finish the authentication procedure. Figure 6.3 shows this procedure.

Wireless Payment System

The wireless payment system has two methods for payment, which is based on card (hardware type) or not on card (software type). The method based on card is equipped with a smart card having various financial applications saved in, such as credit card, debit card or mileage, for processing authentication and payment, and it can be classified according to the number of the equipped cards within the mobile device. The types are dual-slot type, dual-chip type and one-chip type. The dual-slot type is equipped with a separate smart card reader slot inside of the mobile device in order to process the payment with own smart card inserted. The dual-chip type is to have IC chip saving the payment application inside of the mobile device separately from SIM card. The one-chip type combines the member authentication function of SIM card with the financial application of IC chip in order to save in one SIM card. The method based not on card is to associate real-time authentication with payment system through the mobile communication wireless network without separate smart card to save inside the personal financial information, which is classified as cellular phone integrated charge method and mobile wallet method. The cellular phone integrated charge method is a method to pay the charges later with integrated payment bill for mobile communication at the next month. The mobile wallet method is to input user information in the server of a bank or a credit card firm, to which the user logs on through the mobile device.

Task Discuss the various advantages of wireless payment over traditional payment.

Design of Wireless Payment System

Configuration of System: The wireless payment system proposed in this paper is based on MobileC that is practicable on GVM based on the application download solution. The overall system is divided into a client as the mobile device and a server. The client plays a role to save user interface and fundamental user information, and the server takes the intermediary role between the client and the card firm and authentication organization and the save role of the certificates of each user.

The process of this system comprises of initialization process and transaction process, and the details of these will be mentioned in the next section. Figure 6.4 shows the overall configuration and process of the wireless payment system.

Initialization Process: The initialization process is a preparation process for operating the wireless payment system on a mobile device. Basically the mobile device does not have the wireless payment system equipped inside. Thus it requires a procedure to download and install from the server, the wireless payment system necessary for the mobile device, and requires initial configuration procedure to operate the wireless payment system installed in the device. This initialization has the following order for process.

1. Connecting GVM download server using the mobile device.
2. Downloading the wireless payment system from the GVM download server.
3. Inputting user's personal password for operating the wireless payment system.
4. Inputting card information to be used in the wireless payment system.

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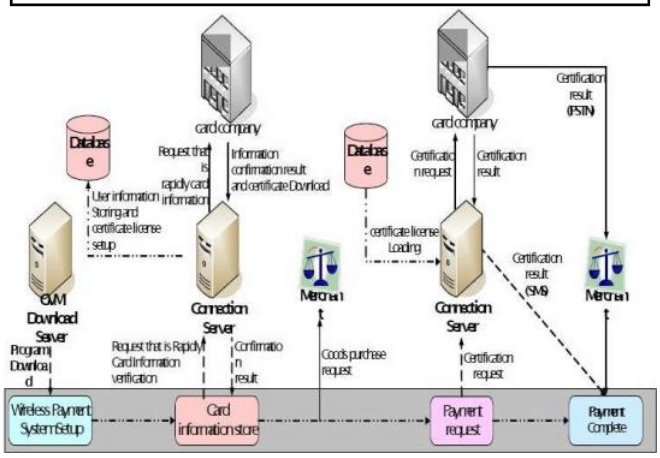
Figure 6.4: Configuration of Wireless Payment System



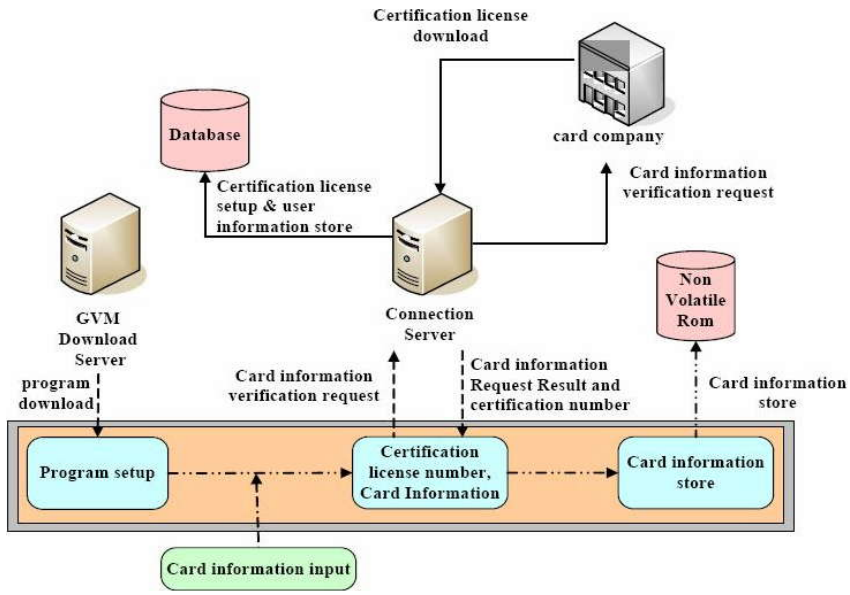
5. Transmitting the personal identification number and card information to the connection server in order to confirm the input information of card.

6. The connection server transmits the information from the mobile device to the server of card company or authentication organization and requests the certificate.

7. As the authentication process is normally over, it downloads the certificate of the card company or authentication organization to save in the connection server and transmits the authentication result to the mobile device.

8. The mobile device taking the authentication result saves the personal card information in the non-volatile memory of the mobile device.

Figure 6.5: Initialization Process

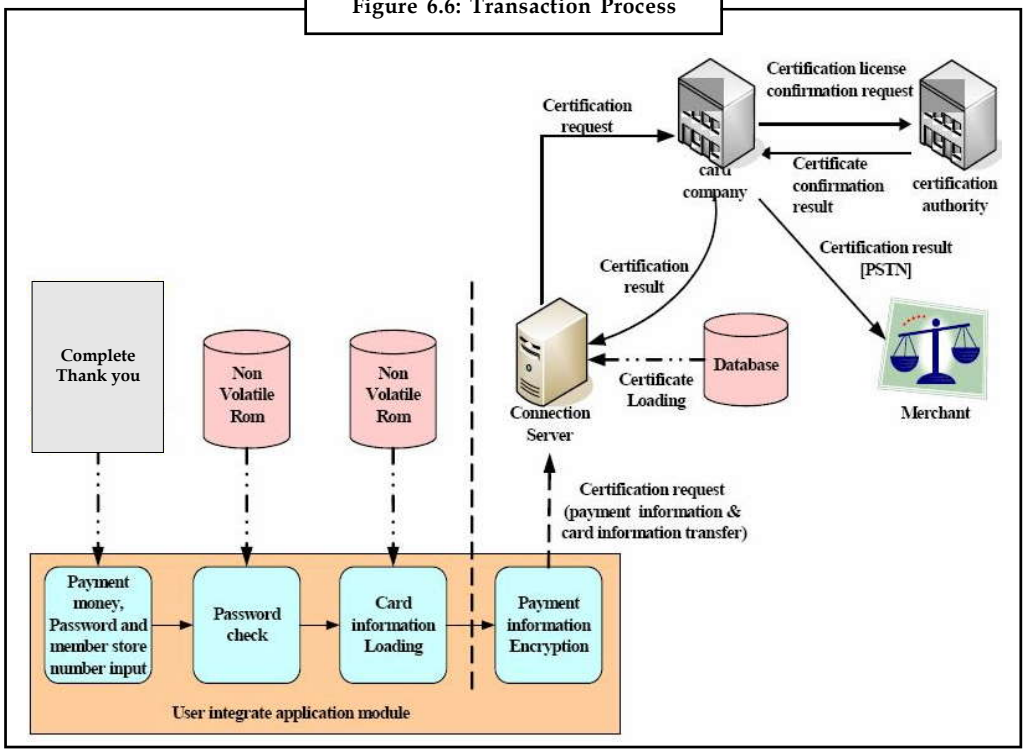


This is the initialization procedure of the wireless payment system that requires only one performance. However, if it requires user's card replacement when the wireless payment system is used, the initialization is processed by stepping up from the 4th stage of the overall procedure. Figure 6.5 shows the initialization process of the wireless payment system.

Notes

Transaction Process: The transaction process is a procedure of payment for the purchases of products through user's mobile device on and off lines. The mobile device transmits card information, mobile device identification number (e.g. telephone number), unique identification number of the store where the product is purchased (e.g. store ID given in advance) and the amount to the connection server, which confirms the payment information transmitted from the mobile device to load the certificate corresponding to the card information and the mobile device identification number. And, using the encryption key of the loaded certificate, it enciphers the overall payment information before transmitting it to the authentication server. If the card information equals to that of the user, it transmits the admission number about the payment in question to the connection server and the store. The connection server transmits the admission number sent from the authentication server to the mobile device to finish the all the transaction procedure. The admission number transmitted to the store from the authentication server is receivable through the previously constructed card reader of the store. Figure 6.6 indicates the transaction process of the wireless payment system.

Figure 6.6: Transaction Process



Did u know? **What is authentication server?**

The authentication server verifies the overall payment information transmitted from the connection server.

Self Assessment

Fill in the blanks:

3. A ..... is a live connection between people in separate locations for the purpose of communication, usually involving audio and often text as well as video.

Notes

4. The ..... system has two methods for payment, which is based on card (hardware type) or not on card (software type).
5. The ..... process is a preparation process for operating the wireless payment system on a mobile device.

6.3 Bandwidth

Bandwidth in computer networking refers to the data rate supported by a network connection or interface. One most commonly expresses bandwidth in terms of bits per second (bps). The term comes from the field of electrical engineering, where bandwidth represents the total distance or range between the highest and lowest signals on the communication channel (band).

Bandwidth represents the capacity of the connection. Network bandwidth is not the only factor that contributes to the perceived speed of a network. A lesser known but other key element of network performance - latency - also plays an important role.

Caution The greater the capacity, the more likely that greater performance will follow, though overall performance also depends on other factors, such as latency.

6.3.1 Network Bandwidth

Bandwidth is the primary measure of computer network speed. Virtually everyone knows the bandwidth rating of their modem or their Internet service that is prominently advertised on network products sold today.

In networking, bandwidth represents the overall capacity of the connection. The greater the capacity, the more likely that better performance will result. Bandwidth is the amount of data that passes through a network connection over time as measured in bps.

Bandwidth can refer to both actual and theoretical throughput, and it is important to distinguish between the two.

Example: A standard dial-up modem supports 56 Kbps of peak bandwidth, but due to physical limitations of telephone lines and other factors, a dial-up connection cannot support more than 53 Kbps of bandwidth (about 10% less than maximum) in practice. Likewise a traditional Ethernet network theoretically supports 100 Mbps of bandwidth, but this maximum amount cannot reasonably be achieved due to overhead in the computer hardware and operating systems.

6.3.2 Internet Connection Bandwidths

Following Table 6.1 shows the maximum bandwidth (the physical layer net bit rate, often slightly more than the maximum throughput) of common Internet access technologies.

Table 6.1: Transaction Process

Bandwidth	Device
56 KBPS	Modem/Dial-up
1.5 MBPS	ADSL Lite
1.544 MBPS	T1
10 MPBS	Wireless 802.11b

Contd...

Notes

44.736 MPBS	T3
54 MPBS	Wireless-G 802.11g
100 MPBS	Fast Ethernet
155 MPBS	OC3
300 MPBS	Wireless-N 802.11n
622 MPBS	OC12
1000 MPBS	Gigabit Ethernet
2.5 GBPS	OC48
9.6 GBPS	OC192
10 GBPS	10 Gigabit Ethernet

Task Discuss the effect of bandwidth on the network.

Self Assessment

Fill in the blanks:

6. ..... in computer networking refers to the data rate supported by a network connection or interface.
7. Bandwidth is the amount of data that passes through a network connection over time as measured in .....

6.4 Network Media

The typical fiber optic cable used for a fiber link segment is a multimode fiber cable (MMF) with a 62.5 micron fiber optic core and 125 micron outer cladding (62.5/125). Each link segment requires two strands of fiber, one to transmit data, and one to receive data. There are many kinds of fiber optic cables available, ranging from simple two-strand jumper cables with a PVC outer jacket material on up to large inter-building cables carrying many fibers in a bundle.

The fiber connectors used on link segments are generally known as "ST" connectors. The formal name of this connector in the ISO/IEC international standards is "BFOC/2.5." The ST connector is a spring-loaded bayonet connector, whose outer ring locks onto the connection, much like the BNC connector used on 10BASE2 segments. The ST connector has a key on an inner sleeve and also an outer bayonet ring. To make a connection you line up the key on the inner sleeve of the ST plug with a corresponding slot on the ST receptacle, then push the connector in and lock it in place by twisting the outer bayonet ring. This provides a tight connection with precise alignment between the two pieces of fiber optic cable being joined.

The wavelength of light used on a fiber link segment is 850 nanometers (850 nm), and the optical loss budget for a fiber link segment must be no greater than 12.5 dB. The loss budget refers to the amount of optical power lost through the attenuation of the fiber optic cable, and the inevitable small losses that occur at each fiber connector.

The more connectors you have and the longer your fiber link cable is, the higher the optical loss will be. Optical loss is measured with fiber optic test instruments that can tell you exactly how much optical loss there may be on a given segment at a given wavelength of light. A standard grade fiber optic cable operating at 850 nm will have something in the neighborhood of from 4 dB to 5 dB loss per 1000 meters. You can also expect something in the neighborhood of from 0.5

Notes

to around 2.0 dB loss per connection point, depending on how well the connection has been made. If your connectors or fiber splices are poorly made, or if there is finger oil or dust on the connector ends, then you can have higher optical loss on the segment.

The older FOIRL segment typically used the same type of fiber optic cable, connectors, and had the same optical loss budget. The 10BASE-FL specifications were designed to allow backward compatibility with existing FOIRL segments. The major difference is that the 10BASE-FL segment may be up to 2,000 meters in length if only 10BASE-FL equipment is used on the segment.

Network media is the actual path over which an electrical signal travels as it moves from one component to another. This unit describes the common types of network media, including twisted-pair cable, coaxial cable, fiber-optic cable, and wireless.

6.4.1 Twisted-pair Cable

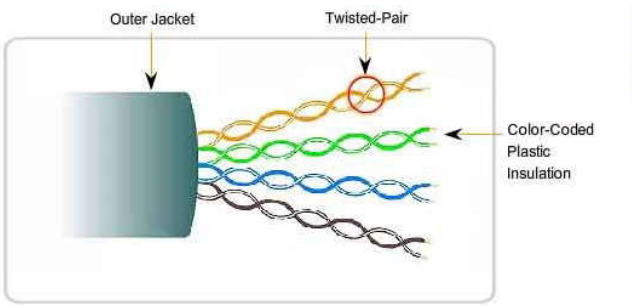
Twisted-pair cable is a type of cabling that is used for telephone communications and most modern Ethernet networks. A pair of wires forms a circuit that can transmit data. The pairs are twisted to provide protection against crosstalk, the noise generated by adjacent pairs. When electrical current flows through a wire, it creates a small, circular magnetic field around the wire. When two wires in an electrical circuit are placed close together, their magnetic fields are the exact opposite of each other. Thus, the two magnetic fields cancel each other out. They also cancel out any outside magnetic fields. Twisting the wires can enhance this cancellation effect. Using cancellation together with twisting the wires, cable designers can effectively provide self-shielding for wire pairs within the network media.

Two basic types of twisted-pair cable exist: Unshielded twisted pair (UTP) and Shielded twisted pair (STP).

Unshielded Twisted Pair (UTP) Cable

UTP cable is a medium that is composed of pairs of wires (see Figure 6.7). UTP cable is used in a variety of networks. Each of the eight individual copper wires in UTP cable is covered by an insulating material. In addition, the wires in each pair are twisted around each other.

Figure 6.7: Unshielded Twisted-Pair Cable



UTP cable relies solely on the cancellation effect produced by the twisted wire pairs to limit signal degradation caused by electromagnetic interference (EMI) and radio frequency interference (RFI). To further reduce crosstalk between the pairs in UTP cable, the number of twists in the wire pairs varies. UTP cable must follow precise specifications governing how many twists or braids are permitted per meter (3.28 feet) of cable.

UTP cable often is installed using a Registered Jack 45 (RJ-45) connector (see Figure 6.8). The RJ-45 is an eight-wire connector used commonly to connect computers onto a local-area network (LAN), especially Ethernets.

Notes

Figure 6.8: RJ-45 Connectors

When used as a networking medium, UTP cable has four pairs of either 22- or 24-gauge copper wire. UTP used as a networking medium has an impedance of 100 ohms; this differentiates it from other types of twisted-pair wiring such as that used for telephone wiring, which has impedance of 600 ohms.

UTP cable offers many advantages. Because UTP has an external diameter of approximately 0.43 cm (0.17 inches), its small size can be advantageous during installation. Because it has such a small external diameter, UTP does not fill up wiring ducts as rapidly as other types of cable. This can be an extremely important factor to consider, particularly when installing a network in an older building. UTP cable is easy to install and is less expensive than other types of networking media. In fact, UTP costs less per meter than any other type of LAN cabling. And because UTP can be used with most of the major networking architectures, it continues to grow in popularity.

Disadvantages also are involved in using twisted-pair cabling, however. UTP cable is more prone to electrical noise and interference than other types of networking media, and the distance between signal boosts is shorter for UTP than it is for coaxial and fiber-optic cables.

Although UTP was once considered to be slower at transmitting data than other types of cable, this is no longer true. In fact, UTP is considered the fastest copper-based medium today. The following summarizes the features of UTP cable:

1. Speed and throughput-10 to 1000 Mbps
2. Average cost per node-Least expensive
3. Media and connector size-Small
4. Maximum cable length-100 m (short)

Commonly used types of UTP cabling are as follows:

1. Category 1 – Used for telephone communications. Not suitable for transmitting data.
2. Category 2 – Capable of transmitting data at speeds up to 4 megabits per second (Mbps).
3. Category 3 – Used in 10BASE-T networks. Can transmit data at speeds up to 10 Mbps.
4. Category 4 – Used in Token Ring networks. Can transmit data at speeds up to 16 Mbps.
5. Category 5 – Can transmit data at speeds up to 100 Mbps.
6. Category 5e – Used in networks running at speeds up to 1000 Mbps (1 gigabit per second [Gbps]).
7. Category 6 – Typically, Category 6 cable consists of four pairs of 24 American Wire Gauge (AWG) copper wires. Category 6 cable is currently the fastest standard for UTP.

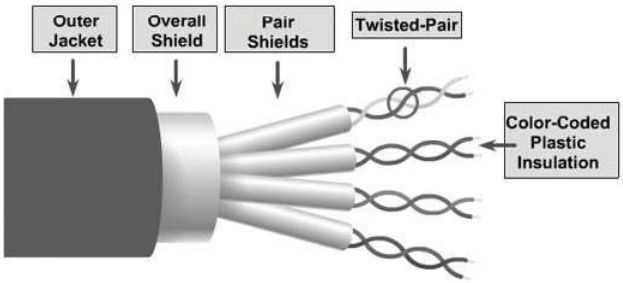
Shielded Twisted Pair (STP) Cable

Shielded twisted-pair (STP) cable combines the techniques of shielding, cancellation, and wire twisting. Each pair of wires is wrapped in a metallic foil (see Figure 6.9). The four pairs of wires then are wrapped in an overall metallic braid or foil, usually 150-ohm cable. As specified for use in Ethernet network installations, STP reduces electrical noise both within the cable

Notes

(pair-to-pair coupling, or crosstalk) and from outside the cable (EMI and RFI). STP usually is installed with STP data connector, which is created especially for the STP cable. However, STP cabling also can use the same RJ connectors that UTP uses.

Figure 6.9: Shielded Twisted-Pair Cable



The metallic shielding must be grounded at both ends. If it is improperly grounded, the shield acts like an antenna and picks up unwanted signals. Because of its cost and difficulty with termination, STP is rarely used in Ethernet networks. STP is primarily used in Europe. The following summarizes the features of STP cable:

1. Speed and throughput-10 to 100 Mbps
2. Average cost per node-Moderately expensive
3. Media and connector size-Medium to large
4. Maximum cable length-100 m (short)

When comparing UTP and STP, keep the following points in mind:

1. The speed of both types of cable is usually satisfactory for local-area distances.
2. These are the least-expensive media for data communication. UTP is less expensive than STP.
3. Because most buildings are already wired with UTP, many transmission standards are adapted to use it, to avoid costly rewiring with an alternative cable type.

Caution Although STP prevents interference better than UTP, it is more expensive and difficult to install.

6.4.2 Coaxial Cable

Coaxial cable consists of a hollow outer cylindrical conductor that surrounds a single inner wire made of two conducting elements. One of these elements, located in the center of the cable, is a copper conductor. Surrounding the copper conductor is a layer of flexible insulation. Over this insulating material is a woven copper braid or metallic foil that acts both as the second wire in the circuit and as a shield for the inner conductor. This second layer, or shield, can help reduce the amount of outside interference. Covering this shield is the cable jacket. (See Figure 6.10)

Coaxial cable supports 10 to 100 Mbps and is relatively inexpensive, although it is more costly than UTP on a per-unit length. However, coaxial cable can be cheaper for a physical bus topology because less cable will be needed. Coaxial cable can be cabled over longer distances than twisted-pair cable.

Notes

Figure 6.10: Coaxial Cable

For LANs, coaxial cable offers several advantages. It can be run with fewer boosts from repeaters for longer distances between network nodes than either STP or UTP cable. Repeaters regenerate the signals in a network so that they can cover greater distances. Coaxial cable is less expensive than fiber-optic cable, and the technology is well known; it has been used for many years for all types of data communication.

When working with cable, you need to consider its size. As the thickness, or diameter, of the cable increases, so does the difficulty in working with it. Many times cable must be pulled through existing conduits and troughs that are limited in size. Coaxial cable comes in a variety of sizes. The largest diameter (1 centimeter [cm]) was specified for use as Ethernet backbone cable because historically it had greater transmission length and noise-rejection characteristics. This type of coaxial cable is frequently referred to as Thicknet. As its nickname suggests, Thicknet cable can be too rigid to install easily in some situations because of its thickness. The general rule is that the more difficult the network medium is to install, the more expensive it is to install. Coaxial cable is more expensive to install than twisted-pair cable. Thicknet cable is almost never used except for special-purpose installations.

A connection device known as a vampire tap was used to connect network devices to Thicknet. The vampire tap then was connected to the computers via a more flexible cable called the attachment unit interface (AUI). Although this 15-pin cable was still thick and tricky to terminate, it was much easier to work with than Thicknet.

In the past, coaxial cable with an outside diameter of only 0.35 cm (sometimes referred to as Thinnet) was used in Ethernet networks. Thinnet was especially useful for cable installations that required the cable to make many twists and turns. Because it was easier to install, it was also cheaper to install. Thus, it was sometimes referred to as Cheapernet. However, because the outer copper or metallic braid in coaxial cable comprises half the electrical circuit, special care had to be taken to ensure that it was properly grounded. Grounding was done by ensuring that a solid electrical connection existed at both ends of the cable. Frequently, however, installers failed to properly ground the cable. As a result, poor shield connection was one of the biggest sources of connection problems in the installation of coaxial cable. Connection problems resulted in electrical noise, which interfered with signal transmittal on the networking medium. For this reason, despite its small diameter, Thinnet no longer is commonly used in Ethernet networks.

The most common connectors used with Thinnet are BNC, short for British Naval Connector or Bayonet Neill Concelman, connectors (see Figure 6.11). The basic BNC connector is a male type mounted at each end of a cable. This connector has a center pin connected to the center cable conductor and a metal tube connected to the outer cable shield. A rotating ring outside the tube locks the cable to any female connector. BNC T-connectors are female devices for connecting

two cables to a network interface card (NIC). A BNC barrel connector facilitates connecting two cables together.

Figure 6.11: Thinnet and BNC Connector

The following summarizes the features of coaxial cables:

1. Speed and throughput – 10 to 100 Mbps
2. Average cost per node – Inexpensive
3. Media and connector size – Medium
4. Maximum cable length – 500 m (medium)

Self Assessment

Fill in the blanks:

8. ..... is the actual path over which an electrical signal travels as it moves from one component to another.
9. ..... cable combines the techniques of shielding, cancellation, and wire twisting.
10. ..... consists of a hollow outer cylindrical conductor that surrounds a single inner wire made of two conducting elements.

6.5 Networks and Their Types

Communication networks are formed by interconnection of a number of different communications through communication facilities. There are multiple devices on the network with multiple users, able to choose among them. A path is established by pair-wise linking of nodes in the network. A node is a physical box that can accept and redirect a message along an access path; it may be a computer, a multiplexor, or a terminal controller. A network can be configured in many different ways, depending primarily on the applications and geographic location to be supported. The placement of the nodes and the number of alternate communication paths between them determine the configuration. The communications network is needed to connect:

1. Remote devices to a central computer.
2. A computer in one location to a computer in another within or among organisations.
3. An intelligent device (having microprocessor logic and processing capability) to other intelligent devices.

Functions

- Communication among users of computer systems.
- Communication among applications being executed on different systems.
  - Sharing computer resources.
  - Distribution of computer applications among computers in different locations.

Notes

6.5.1 Local Area Network (LAN)

The Local Area Network (LAN) is the most common type of data network. As the name suggests, a LAN serves a local area (typically the area of a floor of a building, but in some cases spanning a distance of several kilometers). Usually, a LAN is installed in industrial plants, office buildings, college or university campuses, or similar locations. In these locations, it is feasible for the owning organisation to install high quality, high-speed communication links interconnecting nodes. Typical data transmission speeds are one to 100 megabits per second.

A Local Area Network (LAN) is a group of computers and associated devices that share a common communications line or wireless link and share the resources of a single processor or server within a small geographic area usually within an office building. Usually, the server has applications and data storage that are shared in common by multiple computer users. A local area network may serve as few as two or three users (for example, in a home network) or as many as thousands of users (for example, in an FDDI network). LANs have become commonplace in many organisations for providing telecommunications network capabilities that link end users in offices, departments, and other work groups. In summary, a LAN is a communications network which is:

- Local i.e. one building or group of buildings
- Controlled by one administrative authority
- Assumes other users of the LAN are trusted
- Usually high speed and is always shared

A wide variety of LANs have been built and installed, but a few types have more recently become dominant. The most widely used LAN system is the Ethernet system developed by the Xerox Corporation. Major local area network technologies are:

- Ethernet
- Token Ring
- FDDI (Fibre Distributed Data Interface)

Ethernet is by far the most commonly used LAN technology. A number of corporations use the Token Ring technology. FDDI is sometimes used as a backbone LAN interconnecting Ethernet or Token Ring LANs. Another LAN technology, ARCNET, once the most commonly installed LAN technology, is still used in the industrial automation industry. In some situations, a wireless LAN may be preferable to a wired LAN because it is cheaper to install and maintain.

A suite of application programmes can be kept on the LAN server. Users who need an application frequently can download it once and then run it from their local hard disk. Users can order printing and other services as needed through applications run on the LAN server. A user can share files with others at the LAN server; read and write access is maintained by a LAN administrator. A LAN server may also be used as a Web server if safeguards are taken to secure internal applications and data from outside access.

LAN provides access to more computing power, data, and resources than would be practical if each user needed an individual copy of everything. LAN provides the benefits of personal computing. One is not forced to do personal work through a central computer that may not be able to respond to the users' requests when many of them share its capacity.

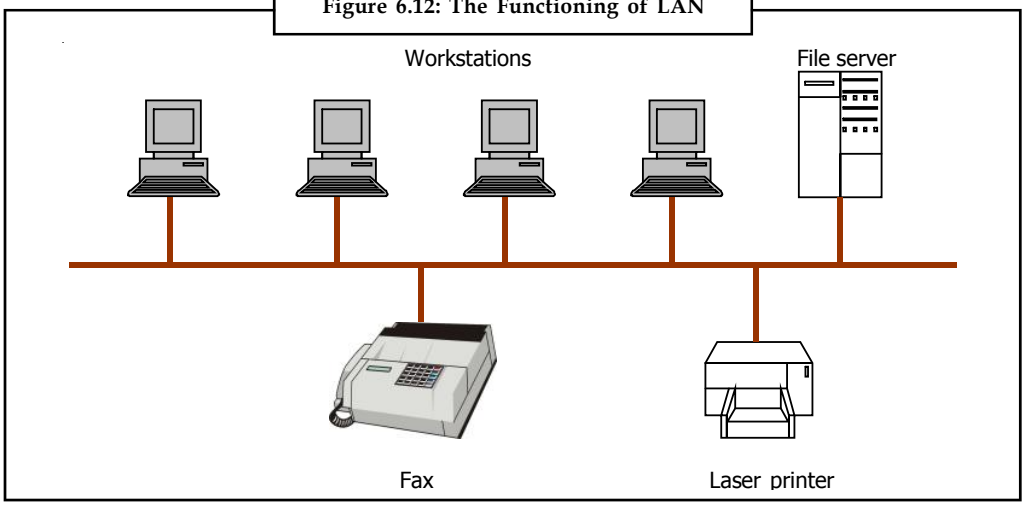
LAN can link multiple workstations to one laser printer, fax machine, or modem. This makes a single piece of equipment available to multiple users and avoids unnecessary equipment purchases.

Notes

LAN users can select personal files that they want co-workers to see, such as engineering drawings, department plans, contracts, or drafts of memos. Co-workers can look at these files without delays for printing paper copies. LAN can be used to transmit and manage electronic mail and messages.

LAN also provides access to shared databases. Figure 6.12 shows a LAN system that is set up for this purpose because it contains a file server for retrieving data requested by the workstations. The file server is linked to a disk that contains shared databases, such as the firm's customer list and telephone directory. When a workstation needs data in a shared database, it sends a request message to the file server, which performs the retrieval from the disk and sends the data to the requesting workstation. This arrangement avoids maintaining redundant copies of data. In addition to not wasting storage, having the databases in one place avoids problems with inconsistent data.

Figure 6.12: The Functioning of LAN



Instead of storing separate copies of spreadsheet or work-processing software at each workstation, the LAN can deliver a temporary copy of processing software to each workstation. Handling software this way assures that everyone uses only the latest version of the software. Upgrading to a new software version involves only one replacement instead of finding and replacing each copy. This approach also reduces the number of copies of the software that must be purchased.

Example: If no more than 10 out of 25 people on a LAN use a spreadsheet at the same time, the firm can purchase a license for 10 copies instead of 25, and can use the LAN to monitor the number of copies in use.

Intermediate nodes (i.e. repeaters, bridges and switches) allow LANs to be connected together to form larger LANs. A LAN may also be connected to another LAN or to WANs and MANs using a Router1. LANs allow users to share resources on computers within an organisation, and may be used to provide a (shared) access to remote organisations through a router connected to a Metropolitan Area Network (MAN) or a Wide Area Network (WAN).

A device that determines the next network point to which a data packet should be forwarded enroute toward its destination. The router is connected to at least two networks and determines which way to send each data packet based on its current understanding of the state of the networks it is connected to. Routers create or maintain a table of the available routes and use this information to determine the best route for a given data packet.

Notes

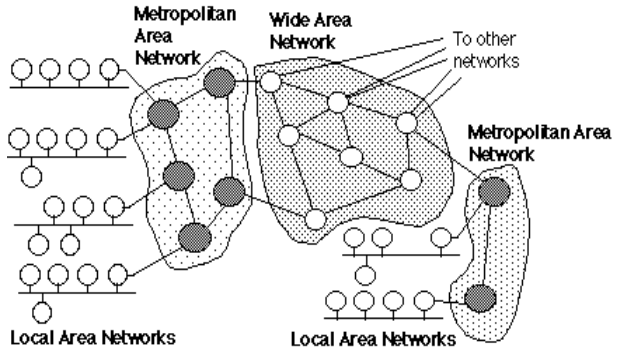
6.5.2 Metropolitan Area Network (MAN)

A Metropolitan Area Network (MAN) is one of a number of types of networks. A MAN is a relatively new class of network; it serves a role similar to an ISP, but for corporate users with large LANs. It is a network that interconnects users with computer resources in a geographical area larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN). The term is applied to the interconnection of networks in a city into a single larger network (which may then also offer efficient connection to a wide area network). It is also used to mean the interconnection of several local area networks by bridging them with backbone lines. This is sometimes referred to as a campus network. Large universities also sometimes use the term to describe their networks. A recent trend is the installation of wireless MANs. There are three important features which distinguish MANs from LANs or WANs:

- The network size falls in between LANs and WANs. A MAN typically covers an area of between 5 and 50 km diameter. Many MANs cover an area the size of a city, although in some cases MANs may be as small as a group of buildings.
- A MAN, like a WAN, is not generally owned by a single organisation. The MAN, its communications links and equipments are generally owned by either a group of users or by a single network provider who sells the service to the users. This level of service provided to each user must be negotiated with the MAN operator, and some performance guarantees are normally specified.
- A MAN often acts as a high-speed network to allow sharing of regional resources (similar to a large LAN). It is also frequently used to provide a shared connection to other networks using a link to a WAN.

A typical use of MANs to provide shared access to a wide area network is shown in the Figure 6.13 below:

Figure 6.13: The Functioning of MAN



6.5.3 Wide Area Network (WAN)

WAN provides communication over long distances, covering a large geographical area and are also called remote networks. It covers a large city or a metropolitan area. Such large networks are becoming a necessity for carrying out the day to day activities of many businesses and governmental organisations and their end users. They are used by manufacturing firms, retailers, distributors, transportation companies, government agencies etc., and receive information across cities, regions, countries, or the world. In most countries, this is a government monopoly. In USA, it is Bell system companies, AT & T and other private companies. It can use regular

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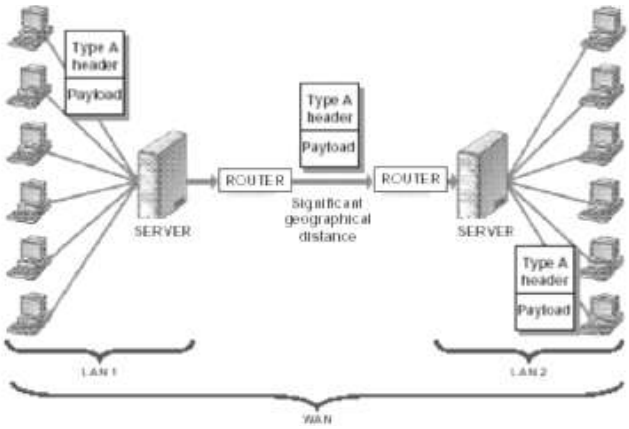
telephone network, but this is expensive and relatively poor for large volumes of data transmission.

Figure 6.14



Wide Area Network (WAN) is a telecommunication network which covers a large geographical area, and uses communications circuits to connect the intermediate nodes. A wide area network spans a wide geographical area such as a state or country. Numerous WANs have been constructed, including public packet networks, large corporate networks, military networks, banking networks, stock brokerage networks, and airline reservation networks. WANs are used for many different purposes. Some are designed as a communications backbone for a large distributed organisation. Other WANs focus on particular transaction packages. Many WANs are used to transfer and consolidate corporate data, such as daily transaction summaries from branches. Some WANs are very extensive, spanning the globe, but most do not provide true global coverage. A major factor which influences WAN design and performance is the requirement of lease communications circuits from telephone companies or other communications carriers. Transmission rates are typically 2 Mbps, 34 Mbps, 45 Mbps, 155 Mbps, 625 Mbps or sometimes even more.

Wide area networks are often implemented in the form of a Virtual Private Network (VPN) a private network configured within a public network. Telephone companies have provided non-switched-leased lines for decades by dedicating portions of their high - capacity trunk lines to links between specific company sites. VPNs go a step further by supporting communication to any point within the private network but not supporting communication outside. This type of VPN service costs more than a pure leased line approach, but a telephone company manages the network. Today, there is tremendous interest in building VPNs that use the Internet to provide a secure and encrypted connection between two points. These VPNs are run by Internet Service Providers (ISPs), who are responsible for maintaining bandwidth, network availability, and security.

WANs can link to workstations or terminals through LANs. The LANs perform local data processing, and they link to the WAN for data needed or provided beyond the local environment. An example of this approach is the long-term direction of Apollo, the United Airlines reservation system. In this system, LANs are gradually being installed at travel agencies to replace dumb terminals linked to midrange computers and mainframes. The LANs maintain local copies of reservation data. New reservations are uploaded through the WAN, and travel data is downloaded to the LANs. With this arrangement, agents who are booking reservations at travel agencies can keep working even if the WAN or one of the central computers is down.

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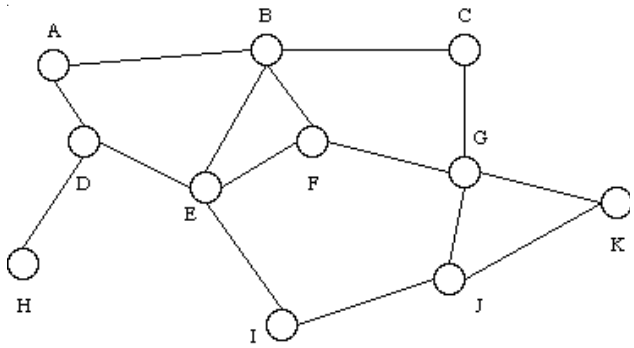
Organisations supporting WAN using the Internet Protocol are known as Network Service Providers (NSPs). These form the core of the Internet. By connecting the NSP and WAN together, using links at Internet Packet Interchanges, a global communication infrastructure is formed. NSPs do not generally handle individual customer accounts (except for the major corporate customers), but instead deal with intermediate organisations whom they can charge for high capacity communications. They generally have an agreement to exchange certain volumes of data at a certain quality of service with other NSP. So practically any NSP can reach any other NSP, but may require the use of one or more other NSP networks to reach the required destination. NSPs vary in terms of the transit delay, transmission rate, and connectivity offered.

A WAN system is shown in the Figure 6.15 below. This connects a number of End Systems e.g. A, C, H, K and a number of Intermediate Systems e.g. B, D, E, F, G, I, J to form a network over which data may be communicated between the End Systems. The characteristics of the transmission facilities lead to an emphasis on efficiency of communications techniques in the design of WANs. Controlling the volume of traffic and avoiding excessive delays is important. Since the topologies of WANs are likely to be more complex than those of LANs, routing algorithms also receive more emphasis. Many WANs also implement sophisticated monitoring procedures to account for which users consume the network resources. This is, in some cases, used to generate billing information to charge individual users.

Figure 6.15: The Functioning of WAN



6.5.4 Value Added Network (VAN)

VAN is also an acronym for virtual area network. A Value-Added Network (VAN) is a private network provider that is hired by a company to facilitate Electronic Data Interchange (EDI) or provide other network services. VANs are public networks that add value by transmitting data and by providing access to commercial databases and software. The use of VANs is usually sold by subscription, with users paying for the amount of data they move. VANs are used for a number of reasons. They can be considered as a way of transmitting computerized data, offering a service similar to what the telephone networks do for telephone calls. VANs can send data between computers in different cities or even different countries. They are often used in Electronic Data Interchange (EDI) systems because they reduce the complexity of connecting to the disparate EDI systems of various trading partners.

In this application they collect forms in an electronic mailbox, translate and forward them to recipients, and guarantee they will reach their destinations intact. Other common VAN services include electronic mail, access to stock market data and other public databases, and access to electronic banking and other transaction processing services.

VANs are a cost-effective solution for companies that need data communication services but do not want to invest in setting up their own private networks. In addition, companies that lack the

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technical expertise to maintain a network commonly use them. Even small companies can enjoy the benefits of data communications by using VANs and leaving the technical details to the vendors. VANs permit companies to use part of a network instead of paying a large fixed cost for their own under-utilized network. VANs also provide for easier expansion because they are set up to use their capacity efficiently and to bring in new capacity if required.

Self Assessment

Fill in the blanks:

11. A ..... is a group of computers and associated devices that share a common communications line or wireless link and share the resources of a single processor within a small geographic area.
12. ..... is a network that interconnects users with computer resources in a geographical area larger than that covered by even a large local area network (LAN) but smaller than the area covered by a wide area network (WAN).
13. WAN provides communication over long distances, covering a large geographical area and are also called ..... networks.
14. A ..... is a private network provider that is hired by a company to facilitate Electronic Data Interchange (EDI) or provide other network services.

6.6 Protocols

Protocol is the special set of rules that end points in a telecommunication connection use when they communicate. Protocols exist at several levels in a telecommunication connection.

6.6.1 Classification of Protocols

Various types of protocols used in computer networks are:

1. TCP/IP
2. HTTP
3. FTP
4. UDP
5. IRP
6. ICMP
7. IGMP
8. SMTP

TCP/IP

TCP/IP stands for Transmission Control Protocol/Internet Protocol. It was developed with the objective to specify a suite of protocols capable of providing transparent communications interoperability services between computers of all sizes, regardless of the hardware or operating system platforms supporting them. Over the years, TCP/IP has become the most widespread of today's protocols. One reason for TCP/IP's popularity is the public availability of its protocols' specifications. In this sense, TCP/IP can justifiably be considered an open system. Most users rely on TCP/IP for the purpose of file transfers, electronic mail (e-mail), and remote login services.

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HTTP

In order to access any website, the web browsers are used which are assisted by the URL that uses the http scheme. It is the URL or the port number that assists the browser to link with a Website. The server indicates a computer connected to the Internet while the port number indicates a type of socket to which the browser plugs in to link with the Web server. The web server not only provides the requisite web pages but also describes a computer program that runs on a computer to provide web pages. When a browser receives an URL will attempt to connect with the server computer having the required web pages by connecting to the specified port number. The URL can be provided to the browser either by typing it at its specified location or by clicking on the link available on some already displayed web page or document.

It is the role of the browser to connect with the server where the requisite requests from client or user is stored or available. When the web server receives the request from browser it replies back to the browser, which is client in this case. The information basically contains the HTTP protocol version, name of the server, the media type of the document and date, etc. The media type of the document is quite important information because the browser is required to know what kind of document this is before it can process it. HTML is the most common media type transferred over the Web. Other media types are GIF image and JPEG image. Several times when a response like "HTTP 404 Not Found" is displayed which means that the request document is not available at the link. There are different responses defined in HTTP. Briefly, in order to access a web page, HTTP involves browser that issues a request followed by a few headers. In response, the server replies back with a few headers and a document.

The web server basically maps the URLs to files on its hard disks. The web server interprets the path in any URL to map it with a filename on its hard disk. In order to make it work to map with the requisite file, the web server is configured to contain a "document root" directory relative to which all URLs are resolved as filenames. Let us take an example, suppose the URL is http://myspace.tutorial.in, and the document root is D:\WWWFiles\. When a user types the URL http://myspace.tutorial.in/ lesson1/networking.htm into browser, the browser requests the server for the document/lesson1/networking.htm. The web server begins searching in the directory D:\WWWFiles\lesson1 for a file called networking.htm. If the requisite file is available it responds with a header followed by the document. If it is not available, it responds a 404 Not Found followed by a helpful error message telling the user to search elsewhere.

FTP

The File Transfer Protocol is among the oldest protocols still used in the Internet. FTP is widely available on almost all-browsers indicating that all computing platforms, including DOS, OS/2, UNIX, and up to the mainframe level have this service available. You can very well understand from its name that it facilitates the majority of file transfers across the Internet. In other word, FTP is a file server access protocol that enables a user to transfer files between two hosts across the network or Internet using TCP. You may see the versatility of this application layer protocol, it accomplishes its job even intended hosts at separate locations could potentially be running different operating systems, using different file storage systems, and using different character sets. Accessing FTP sites over the Internet requires that the user must have the knowledge of the location and the name of the desired files.

Unlike Telnet, FTP does not require any familiarity with the remote operating system. The user is still required, however, to be familiar with the FTP command set built into the protocol itself so that he or she can productively manage the session.

Modern FTP servers known as ftpd support two different TCP connections, namely control and data connections. First control connection is invoked for the entire duration of transfer of file or

Notes

FTP session. It facilitates the exchange of commands issued by the client, and replies originating from server. Data connection is established as and when it is required. Its main function is to facilitate transfer of files and directory listings to and from the client at the client's request.

Whenever you wish to do FTP, you need to invoke a few commands. These commands basically are related to transfer a file from remote computer to your computer or from your computer to the remote computer. There are anonymous as well as authorized privileges with regard to transfer of a file from a server. In case of anonymous FTP servers, you can do FTP without authorization. You need to login with a user name, which is anonymous, and a password that is your e-mail address. Apart from this, there are authorized servers for which you need to register before you are permitted to do FTP. After registration, you will get a password.

UDP

The User Datagram Protocol enables application programs to have direct access to a datagram delivery service like the delivery service that IP provides. This enables applications to exchange messages over the network with a minimum of protocol overhead. UDP is connectionless unreliable datagram protocol in which the sending terminal does not check whether data has been received by receiving terminal. The unreliable service indicates that there is no guarantee that the data reaches at the receiving end of the network correctly. It can be understood more clearly by Figure 6.16.

However, this protocol makes it possible to omit a variety of processes thus reducing the load on the CPU. UDP has 16-bit Source Port and Destination Port numbers. Figure 6.16 shows the data structure of the UDP header. The simplicity of the UDP header stems from the unsophisticated nature of the services it provides.

Figure 6.16: UDP vs TCP

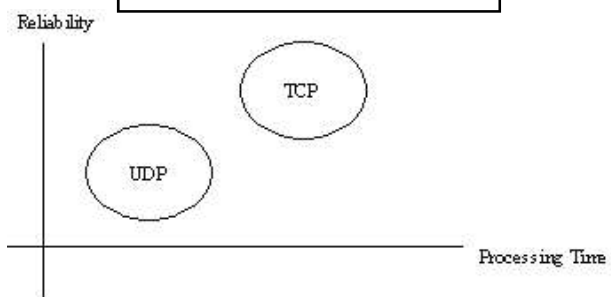


Figure 6.17: UDP Format

0	16 32
Source Port	Destination Port
Length	UDP Checksum
Data	

Following is a brief description of each field:

Source Port: Source port specifies port number of the application relating to the user data.

Destination Port: As it name indicates, this pertains to the destination application.

Length: It describes the total length of the UDP datagram, including both data and header information.

Notes

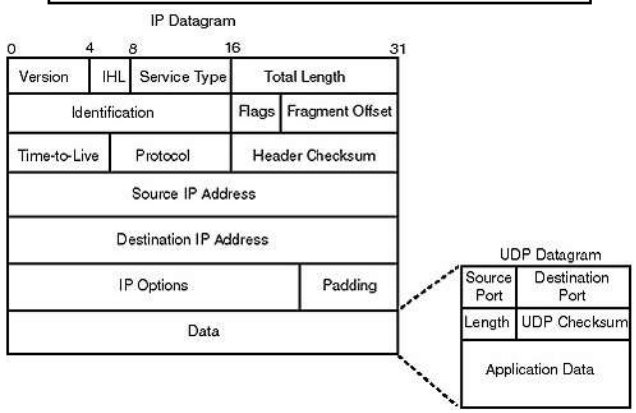
UDP Checksum: It gives an option of integrity checking.

At this point, it is important to understand the layering concept along with the need for headers. The relationship between the IP and UDP has been depicted in Figure 6.18.

There are a number of good reasons for choosing UDP as a data transport service. When the amount of data being transmitted is small, UDP is considered the most efficient choice for a transport layer protocol because of the overhead for establishing connections and ensuring reliable delivery may be greater than the work of retransmitting the entire data. Applications for a query-response model also works excellent for using UDP. The response is used as a positive acknowledgment to the query. When a response is not received within a certain time period, the application initiates another query.

Some examples of the usage of UDP are Remote file server (RFS), name translation (DNS), intra-domain routing (RIP), network management (SNMP), multimedia applications and telephony.

Figure 6.18: Relationship between the IP and UDP



IRP

Routing refers to the process of selecting the shortest and most reliable path intelligently over which to send data to its ultimate destination. IP routing protocol makes the distinction between hosts and gateways. A host is the end system to which data is ultimately delivered. An IP gateway, on the other hand, is the router that accomplishes the act of routing data between two networks. A router can be a specialized device supporting multiple interfaces, with connected to a different network or a computer multiple interfaces (commonly called a multihomed host) with routing services running in that computer.

By OSI norms and standards, a gateway is not only a router but also a connectivity device that provides translation services between two completely hybrid networks.

Example: A gateway (not a router) is needed to connect a TCP/IP network to an AppleTalk network.

It is important to know that both hosts and IP routers (gateway) perform routing functions and therefore, compatible implementations of the IP protocol are necessary at both ends. In other words, datagrams are submitted either to a host that shares the same physical network with the originating host or to a default gateway for further routing across the network. As such, IP on a host is responsible for routing packets that originate on this host only, fulfilling local needs for routing. A gateway, on the other hand, is responsible for routing all traffic regardless of its originator (as long as the TTL field is valid).

Notes

A default gateway is a router that a host is configured to trust for routing traffic to remote systems across the network. However, the trusted router must be attached to the same network as the trusting host. A router on a remote network cannot be used for providing the functionality of the default gateway.

ICMP

The Internet Control Message Protocol (ICMP), an error reporting protocol that is an integral part of the IP protocol. ICMP communicate control data, information data, and error recovery data across the network. Problems that is less severe than transmission errors result in error conditions that can be reported.

Example: Suppose some of the physical paths in Internet fail, causing the Internet to be partitioned into two sets of networks with no path between the sets, a datagram sent from a host in one set to a host in other cannot be delivered.

The TCP/IP suite includes a protocol called ICMP that IP uses to send error messages when condition such as the one described above arises. The protocol is required for a standard implementation of IP. We will see that the two protocols are co-dependent. IP uses ICMP when it sends an error message, and ICMP uses IP to transport messages.Following is a brief description of some of the error messages defined by ICMP protocol:

1. ***Source Quench:*** A router or host whose receive communication buffers are nearly full normally triggers this message. A source quench message is sent to the sending host, the receiver is simply requesting the sending host to reduce the rate at which it is transmitting until advised otherwise.
2. ***Time Exceeded:*** A time-exceeded message is sent in two cases. Whenever a router reduces the TTL field in a datagram to zero, the router discards the datagram and sends a time-exceeded message. In addition, a time-exceeded message is sent by a host if the reassembly timer expires before all fragments from a given datagram arrive.
3. ***Route Redirect:*** A router sends this message to a host that is requesting its routing services. When a host creates a datagram destined for a network, it sends the datagram to a router, which forwards the datagram to its destination. If a router determines that a host has incorrectly sent a datagram that should be sent to a different router, the router uses route redirect message to cause the host to change its route. In this manner, a route redirect message improves the efficiency of the routing process by informing the requesting host of a shorter path to the desired destination.
4. ***Host unreachable:*** Whenever a gateway or a router determines that a datagram cannot be delivered to its final destination (due to link failure or bandwidth congestion), an ICMP host unreachable message is sent to the originating node on the network. Normally, the message includes the reason the host cannot be reached.
5. ***Fragmentation and Reassembly:*** The largest datagram the IP protocol can handle is 64 Kbytes. The maximum datagram size is dictated by the width of the total length field in the IP header. Realistically, most underlying data link technologies cannot accommodate this data size.

Example: The maximum size of the data frame supported by Ethernet is 1,514 bytes. Unless rectified, something is done about situations like this. IP has to discard data that is delivered to it from upper-layer protocols with sizes exceeding the maximum tolerable size by the data link layer. To circumvent this difficulty, IP is built to provide data fragmentation and reassembly.

Notes

Whenever an upper-layer protocol delivers data segments whose sizes exceed the limit allowed by the underlying network, IP breaks the data into smaller pieces that are manageable within the allowed limit. The small datagrams are then sent to the target host, which reassembles them for subsequent delivery to an upper-layer protocol.

Data fragments, however, takes the same route but there is instances when they may adopt alternate route too. Fragments traversing different routes may reach their destination out of the order in which they were sent. To allow for recovery from such a behavior, IP employs the fragmentation-offset field in its header. The fragmentation-offset field includes sequencing information that the remote IP host uses to recover the sequence in which the datagrams were sent. The fragmentation-offset field also contains information for detecting missing fragments, which is used by IP. Data is passed to the protocol described in the protocol field only when all related fragments are duly received and reordered, it is known as data reassembly.

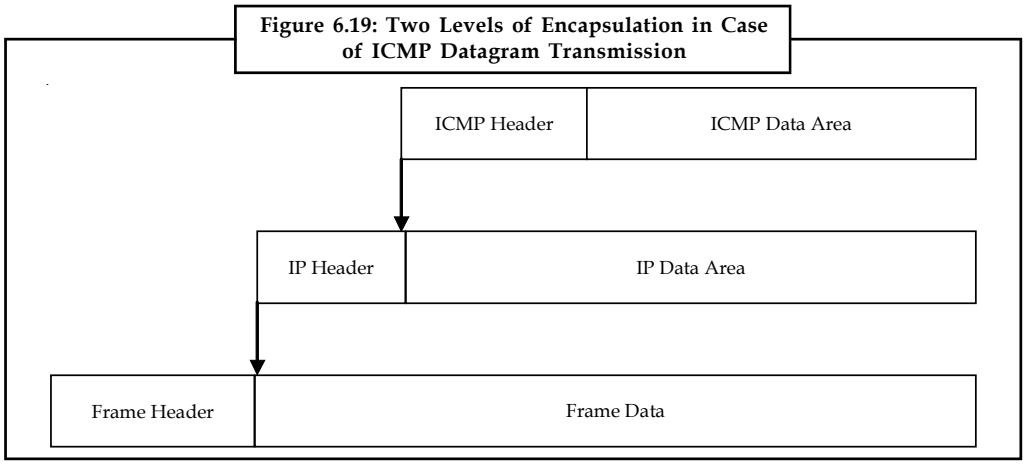
Fragments belonging to two or more independent large data can be differentiated by IP using identification field. Fragments of the same datagram are uniquely assigned in the identification field. The receiving end uses this number to recover the IP fragments to their respective datagrams.

A host that creates a datagram can set a bit in the flag field to specify the fragmentation. This bit is set to 1 in all fragments belonging to a datagram except for the final fragment. This ensures that all fragments of a datagram are received.

1. ***Echo request/Echo reply:*** These two ICMP messages are exchanged between ICMP software on any two hosts in a bid to check connectivity between them. The ping command is an example of a diagnostic command commonly used by network users to check for the reachability of a certain host. On invoking this command, ICMP echo request message is sent to the target host. The target host responds with an echo as proof of reachability. It should however be operational and connected to the network. In other words, the reply carries the same data as the request.

2. ***Address Mask Request/Reply:*** A host broadcasts an address mask request when it boots, and routers that receive the request send an address mask reply that contains the correct 32-bit subnet mask being used on the network.

Figure 6.19: Two Levels of Encapsulation in Case of ICMP Datagram Transmission



ICMP uses IP to transport each error message. When a router has an ICMP message to send, it creates an IP datagram and encapsulates the ICMP message in the datagram. It means that the ICMP message is placed in the data area of the IP datagram. The datagram is forwarded as usual with the complete datagram being encapsulated in a frame for transmission. Figure 6.19 illustrates two levels of data encapsulation.

IGMP

Notes

The computer networks offer a collaborative and best effort to reliable deliver by forwarding a data packet from one node to another so that it could reach to destination in the best possible ways. The nodes receiving multicast messages inform their immediately neighboring routers. In the IGMP, each node belongs to one or more multicast groups to receive multicast data packets. Hence, Internet Group Management Protocol (IGMP) enables nodes to exchange information with their local routers and provides a mechanism through which a host can join or leave a multicast group at any time (dynamic membership). The IGMP used by IP hosts and adjacent multicast routers aims to manage the membership of IP multicast groups.

RFC 1112 defines 3 versions of IGMP. Similar to ICMP, IGMP is also an integral part of the Internet Protocol (IP) and operates above the network layer. It is the job of the routers to use IGMP periodically to check if the known group members are active or not. A host group is the collection of hosts interested in traffic for a particular multicast address. If there is more than one multicast router on a subnetwork, one of them is selected as the "querier" to keep track of the membership state of the multicast groups having active members on its subnetwork. When router receives a multicast packet, it checks whether there is at least one member of that group on its subnetwork to forward the message to that subnetwork, otherwise, router discards the multicast packet. Figure 6.20 shows the IGMP packet format. Some of the applications where IGMP finds extensive uses are online streaming video and gaming.

Figure 6.20: IGMP Packet Format

4 bits	4 bits	8 bits	16 bits
Version	Type	Code	Checksum
Group address			

Different fields of IGMP packet are given below:

Version: 3 versions 1-2-3 of IGMP messages exist. IGMP Version 2 defines extensions in terms of the procedure for the election of the multicast querier for each subnet and faster pruning as well as group-specific query messages. The router with the lowest IP address is elected as the querier. IGMP Version 3 allows a host to join a group and specify a set of sources of that group from which it wants to receive multicast messages.

Type: IGMP provides 2 types of messages. They are Host Membership Query for which field flag value is set up to 1 and Host Membership Report with filed value 2.

Code: Code field becomes zero when IGMP message is sent and is ignored when an IGMP is received.

Checksum: The checksum field contains 16-bits.

Group Address: This field holds the IP host group address of the group being reported In a Host Membership Query message.

IGMP messages to enable routers to keep track of group memberships in their immediately connected subnetwork follow certain rules. A node sends an IGMP report for joining a group to its router but never sends a report when it wants to leave a group. Multicast routers forward

Notes

IGMP queries to the all nodes group periodically to see whether any group members exists on their subnetworks. When it receives no response after a number of queries, the router assumes that there is not any group member on the network. IGMP messages are of 2 types. They are Host Membership Query and Host Membership Report. Host membership query multicast routers send Host Membership Query messages to find out those nodes which have members on their attached local networks. The Host membership report node responds to a Query by generating Host Membership Reports reporting each host group to which they belong on the network interface from which the Query was received.

SMTP

Electronic mail (E-mail) is considered the most widely used TCP/IP application. The Internet mail protocols enable a client machine to exchange mail and message between TCP/IP hosts. Three standard protocols are applied to provide such mail application. The SMTP is one of them. The three standards are given below:

1. ***SMTP:*** It is a standard for exchange of mail between two computers (STD 10/RFC 821), which specifies the protocol used to send mail between TCP/IP hosts.
2. ***Mail:*** It is a standard (STD 11) defining the format of the mail messages, syntax of mail header fields, a set of header fields and their interpretation and about a set of document types other than plain text ASCII to be used in the mail body.
3. ***DNS-MX:*** It is a standard for the routing of mail using the Domain Name System (RFC 974).

SMTP, an application layer protocol, is used to send e-mail messages across the Internet. It utilizes TCP as the transport protocol to send email to a destination mail exchanger, referred as mail server. A client machine sends email to a mail exchanger or an email is sent from mail exchanger to another mail exchanger. E-mail transmitted using SMTP is normally transmitted from one mail exchanger to another directly. E-mail was never designed to be instantaneous but it appears so often.

Mail Exchangers are nothing but the software application programs to support the SMTP protocol. Mail Exchangers such as sendmail or Microsoft Exchange wait for IP datagrams that arrive on the network interface with a TCP port number of 25. When a message is arrived, the mail exchanger checks to find out if it is for one of its users and accordingly move the mail to the user's mailbox. The data sent using SMTP is 7-bit ASCII data, with the high-order bit cleared to zero is found adequate in most instances for the transmission of English text messages but is inadequate for non-English text or non-textual data. To overcome these limitations, Multipurpose Internet Mail Extensions (MIME) defines a mechanism for encoding text and binary data as 7-bit ASCII within the mail envelope and SMTP Service Extensions specifies a mechanism to extend the capabilities of SMTP beyond the limitations.

Self Assessment

Fill in the blanks:

15. It is the ..... that assists the browser to link with a Website.
16. ..... is a file server access protocol that enables a user to transfer files between two hosts across the network or Internet using TCP.
17. The ..... enables application programs to have direct access to a datagram delivery service like the delivery service that IP provides.
18. ..... , an application layer protocol, is used to send e-mail messages across the Internet.

Notes

6.7 Internet Networking Services

Both organization and individuals can choose from a variety of options when subscribing to networking services. Table 6.2 summarizes the major services offered by telecommunications companies. Note that the bit rates shown are for downstream, which is the speed of receiving from the network; upstream speeds, the speeds of transmitting into the network, are usually much lower. Also be aware that these are typical speeds in the United States. They might be different in other countries. Monthly costs, too are typical but vary from region to region. For some services such as T1 and T3 companies also offer fractions of the speeds for lower fees.

For most individuals and businesses, a service that provides a much lower transmission rate (upstream speed) than reception rate (downstream speed) is suitable. This is because they rarely upload large files to web sites or transmit large amounts of e-mail that must arrive at its destination in a fraction of a second. However, organizations such as online businesses and media companies that must upload large files quickly must also have high upstream speeds. Such organizations may opt for internet communication lines that allows high speeds both downstream and upstream.

The proliferation of high-speed connection services, also called broadband services, is mainly the result of businesses and individuals rush to the internet. Some of the services, such as cable, DSL, and satellite links are offered both to businesses and residences. Others such as T1 and T3 lines and the OC class are offered only to businesses, largely because of their high cost.

Notes Some of the services are actually groups of services that differ in speeds.

Example: Some DSL services designed for businesses provide the same speed downstream and upstream, while options for households always provide a greater downstream speed than upstream speed.

Table 6.2: Typical Features of Internet Services

Services	Downstream Speed	Availability	Monthly Fee
Dial-up	56 Kbps	Universal	$9-11
BPL	3 Mbps	Limited Availability	$30-40
Cable	0.5-3 Mbps	Widespread; available nearly everywhere TV cable service is offered	$30-50
DSL	0.5-8 Mbps	More limited than cable, but spreading faster speed also depends on distance from telco office	$30-50
T1, T3	1.544 M, 44.736 Mbps	Widespread	$300-1,000 $3,000-10,000
Satellite	1 Mbps	Widespread, practical only with view to the southern sky	$40-50
Fixed Wireless	100 Mbps	Limited, but spreading	$2,000
Fiber to the Premises	5-30 Mbps	Limited, but spreading	$30-180
OC-3	155.52 Mbps	Limited availability	$60,000
OC-12	622.08 Mbps	Limited availability	Several hundred thousand dollars
OC-48	2.488 Gbps	Limited availability	Several hundred thousand dollars

Notes

6.7.1 Cable

Cable Internet links are provided by television cable firms. The medium is the same as for television reception, but the firms connect the cable to an internet server. At the subscriber's residence, the cable is split one part is connected to the television set, and the other us connected to computer via a bridge that is often called a cable modem. Both television transmission and data are transmitted through the same line. The cable link is always on, so the computer is constantly connected to the internet. More than 90 percent of cable operators in the United States offer internet access.

The major downside of cable is that cable nodes are shared by all the subscribers connected to the node. Therefore, at peak times, such as television prime time (7-11 p.m.), communication speed slow down. The speed also slow down as more subscriber's join service in a given territory.

6.7.2 Digital Subscriber Line (DSL)

With normal landline telephone service, the telephone company filters information that arrives in digital form and then transforms it to analog from; thus, it requires a modem to transform the signal back to digital form. This conversion constraints and capacity of the link between your telephone and the telephone company's switching center to a low speed of 56 Kbps.

With Digital Subscriber Line (DSL) data remains digital throughout the entire transmission; it is never transformed into analog signals. So, the telephone company can transmit to subscriber's computers at significantly higher speeds up to 8 Mbps (although speed rarely exceeds 1.5 Mbps). To provide DSL service, the telecommunications company connects your telephone line to a DSL bridge. At the telephone company's regional central office, DSL traffic is aggregated and forwarded to the ISP or data network provider with which the subscriber has a contract. Often, the telephone company is also the ISP.

Point to Interest: The United States, a Broadband Laggard

Because of little competition among telecommunications companies and a high proportion of rural communities, the United States lags behind other countries in the proportion of households that enjoy broadband links to the internet. Moreover, the communication speeds offered to households in some other countries ate significantly higher while the cost per Gpbs is significantly lower. Seventy percent of American households had broadband in 2007 (mainly through cable and DSL). The maximum speed that U.S. households can receive is 30 Mpbs at a cost of $180 per month. Practically all South Koreans can receive 100 Mbps for $10 per month, and 73 percent of households in South Korea had broadband service in 2007, the highest proportion in the world. Japan and most European nations are also ahead of the United States in terms of broadband speed and monthly fees. In 2007, only 75 percent of U.S. households had any link to the internet at all, including dial-up. About 20 percent of U.S. households could not have access to broadband even if they chose to subscribe to the service, because broadband is not offered where they live. DSL generally can be placed in one of two categories:

1. Symmetric
2. Asymmetric

Asymmetric DSL: Asymmetric DSL allows reception at a much faster rate than transmission that is it is faster downstream than upstream. The reason for the faster download is that home users and small businesses usually receive significantly more information than they transmit.

Symmetric DSL: Symmetric DSL is designed for short-distance connections that require high speed in both directions. Some ADSL technologies let subscribers use the same telephone lines for both internet connection and analog voice telephone service. Symmetric DSL lines cannot share lines with telephones.

Notes

The bit rates of DSL lines are closely related to the distance of the subscriber's computer from the regional central office of the telephone company. Telecommunications companies might offer the service to subscribers as far as 6,100 meters from the central office, but the speed then is usually no faster than 144 Kbps, unless the company has installed a DSL repeater on the line. Some companies do not offer the service if the if the subscriber's address is not within 4,500 meters of the central office. Most subscribers have ADSL so the upstream speed is significantly lower than the downstream speed.

6.7.3 T1 and T3 Lines

T1 and T3 lines are point-to-point dedicated digital circuits provided by telephone companies. A T1 line is made up of 24 channels of 64 Kbps each. T3 lines are made up of 672 channels of 64 Kbps. T1 and T3 lines are expensive. Therefore, only businesses that must rely on high speeds are willing to accept the high cost of subscribing to the service. Most universities as well as large companies use T1 and T3 lines for their backbone and internet connections.

6.7.4 Satellite

Businesses and households in rural and other regions that do not have access to cable or DSL might be able to obtain satellite services, which use microwave radio transmission. In fact, satellite service providers target these households. The service provider installs a dish antenna that is tuned to a communications satellite. Satellite connections might reach a speed of 45 Mbps. The antenna for satellite communication can be fixed, as the roofs for large trucks. Most of the subscribers of fixed satellite dishes are households most mobile dish users are shipping and trucking businesses. Subscribers to fixed satellite service must purchase the dish antenna, with a typical cost of $400, and pay a monthly fee of about $50. Trucking companies must have an antenna installed on each truck.

Many people use a free satellite service the Global Positioning System (GPS). While a proper device is required to enable reception from the satellites, anyone van communicate free of charge. The satellite transmits back to any GPS device its location on earth by longitude and latitude.

6.7.5 Fixed Wireless

Another alternative for households and small business that cannot obtain cable or DSL connections to the internet is fixed wireless. Fixed wireless is point-to-point transmission between two stationary devices, usually between two buildings, as opposed to mobile wireless in which people carry a mobile device. Companies such as Sprint, AT&T, and many ISPs offer the service. ISPs that specialize in fixed wireless services are often referred to as WISPs wireless ISPs. They install microwave transceivers on rooftop instead of laying physical wires and cables. Subscribers connect their computers to the rooftop transceiver. They can communicate at speed up to 2 Mbps. Repeaters are installed close to each other to enhance the signal, which can deteriorate in the presence of building trees, and foul weather. Transmission rates depend on the distance between the receiver and the base station. Up to 14 kilometers from the base station, the speed is 100 Mbps, speeds drop to about 2 Mbps at about 56 kilometers from the base.

Fixed wireless is highly modular the telecommunications company can add as many transceivers as it needs to serve a growing number of subscribers. Unlike cable service, the company does not need franchise licenses. The technology is suitable for both urban and rural areas.

Notes

Example: Daytona Beach, Florida is served by a fixed wireless network that provides a broadband connection to anyone who is interested in the service. The local government of rural Owensboro, Kentucky, wanted to keep the town's businesses competitive. Since other options were not available it built a fixed wireless network that provides broadband links to the internet for $25 per month.

6.7.6 Fiber to the Premises

Fiber to the premises connects a building to the internet via optical fiber. The service is widely available in the United States and other countries, but at varying speeds. In Hong Kong and South Korea, the maximum speed the providers of this service allow is 100 Mbps. In the United States, Verizon provides the service, which it call FiOS (Fiber Optic Service), but limits the speed to 30 Mbps. While Verizon had deployed the service on a large scale, other companies such as AT&T provide similar service to some communities. When the optical fiber reaches the subscriber's living or work space, it is referred to as Fiber to the Home (FTTH). Subscribers simply connect their computer or LAN's router to the optical fiber socket in the wall. In some communities, Verizon has also provided television programming on the same optical lines.

6.7.7 Optical Carrier

Companies willing to pay high fees can enjoy very high connection speeds. These services are denoted with OC, the acronym for optical carrier, because they are provided through optical fiber lines. The number next to OC refers to data speed in multiples of 51.84 Mbps, considered the base rate bandwidth. Thus, when available, the services are denoted as C-1, C-3, C-9, C-12, C-18, C-48, and so on through C-3072. For illustration, OC-768 enables you to transmit the content of seven CDs in a second. Typical businesses that purchase the services are ISPs provides of search engines, and businesses that wish to support content-rich websites and high volume traffic. However media companies have also purchased such services because the high speeds support streaming video. Among companies that use OC-768, for instance are Deutsche Telecom, NBC, Disney, the U.S. Department of Defense Advance Research Projects Agency, NASA, and Nippon TV.

Some of the internet services are:

1. E-mail
2. Archie
3. Finger
4. Usenet and Mailing list
5. WWW

Task Discuss symmetric DSL.

1. ***E-mail:*** Electronic Mail is a method of sending message from a user at a computer to a recipient on another computer.

   An e-mail message consists of a header and the body of the message The first part, the header, contains the information about where the message has to be sent, and the path that has followed to reach its destination, as well as other information like date, return path, etc. The body is the actual message that is being sent.

Notes

An e-mail address has the form user@subdomain.subdomain.domain, e.g. rakesh@iimcal.ac.in

How does one send an e-mail?

(a) Connect up to a service provider, by dial up, leased line, or having access to some network.

(b) Many different mail programs are available, from the most basic one in UNIX, called "mail" up to some sophisticated ones like "elm", "pine".

(c) These same programs allow you to read your mail, and reply by simply pressing a key. You can also have some aliases, so you do not need to remember the exact address of people to whom you mail quite often.

E-mail also provides services to people without full Internet connectivity.

Example: Many FTP sites (see below) have an electronic address to which you can send a message, asking for certain file, and that file will be mailed to your. Other services that can be done via e-mail are archie lookup, IP address resolver, WHOIS service.

2. ***Telnet (Logging in to Remote Network Computers):*** Telnet is the Internet facility that allows you to execute commands on a remote host (another computer, most likely one to which you do not have physical access) as if you were logged in locally. You need to know the name of the machine to which you want to connect, and to have a valid user name in it. There is no such thing as "anonymous" telnet.

   The commands for telnet are:

   (a) *telnet hostname:* it will open a connection to the host you name.

   For example, "telnet math.sunysb.edu" will connect you to the machine named math.sunysb.edu

   (b) *telnet "address":* it opens a connection to the host at "address".

3. ***Archie:*** Suppose you know about some program that you want to install in your machine, and you know the program is available some where out there in the Internet. How do you find a machine with such program, so you can get it via FTP? Instead of searching randomly at various FTP sites, let ARCHIE do it for you. This facility maintains a database with the names of hundreds of Internet sites accessible via anonymous ftp. There are several ARCHIE servers, some of them are:

Name	IP address
archie.rutgers.edu	128.6.18.15
archie.cs.mcgill.ca	132.206.51.250
archie.funnet.fi	128.214.6.102
archie.rediris.es	130.206.1.2
archie.sura.net	192.239.16.13
archie.doc.ic.ac.uk	146.169.16.11

   The way to access an ARCHIE server is via telnet, e.g. "telnet archie.rutgers.edu". Log in as "archie". No password is required. There are several ways you can look for files.

4. ***Usenet and Mailing List:*** If you want to receive periodically information about certain topics, there are two things you can do. The first possibility is to read the news groups of

Notes

the Internet. This is a mechanism to broadcast news, called articles, from your local host to the world. The news servers are not common in India; unfortunately, to read news you may need to set up a server in your local host, and that takes quite a lot of memory (you will have to reserve about half a Gigabyte for it). If you do not have full Internet connectivity, you can subscribe to a mailing list. What you have to do is to send your name to some server, and every day you will receive an e-mail containing news concerning the topic you have subscribed to. There are news groups and mailing list about anything you can imagine, from computers to research, sports, politics, etc.

5. ***WWW:*** The official description describes the World-Wide Web as a "wide-area *hypermedia* information retrieval initiative aiming to give universal access to a large universe of documents". The operation of the Web relies on hypertext as its means of interacting with users. Hypertext is basically the same as regular text - it can be stored, read, searched, or edited - with an important exception: hypertext contains connections within the text to other documents.

Example: By clicking here you can get to the next document, while clicking in this place will take you back to the Internet page.

Self Assessment

Fill in the blanks:

19. With ..... data remains digital throughout the entire transmission.
20. ..... is point-to-point transmission between two stationary devices, usually between two buildings, as opposed to mobile wireless in which people carry a mobile device.

6.8 Summary

- Telecommunication implies the transmission of information from one point to another through a communication medium.
- Most traditional business communications rely on telephone and paper-based processes. These resources do not readily support the level of productive interaction that growing businesses need to excel, and can be easily overwhelmed in periods of rapid growth.
- A videoconference is a live connection between people in separate locations for the purpose of communication, usually involving audio and often text as well as video.
- Payment system refers to a service to pay the charges using credit card, debit card or mileage when we purchase service and product on and off lines.
- The wireless payment system has two methods for payment, which is based on card (hardware type) or not on card (software type).
- Bandwidth in computer networking refers to the data rate supported by a network connection or interface. One most commonly expresses bandwidth in terms of bits per second (bps).
- Network media is the actual path over which an electrical signal travels as it moves from one component to another.
- Communication networks are formed by interconnection of a number of different communications through communication facilities.

Notes

- Protocol is the special set of rules that end points in a telecommunication connection use when they communicate. Protocols exist at several levels in a telecommunication connection.

6.9 Keywords

Client/Server Network: A computing environment where end user workstations (clients) are connected to network servers and possibly to mainframe super servers.

IT Architecture: A conceptual design for the implementation of information technology in an organization, including its hardware, software, and network technology platforms, data resources, application portfolio, and IS organization.

Local Area Network (LAN): A communications network that typically connects computers, terminals, and other computerized devices within a limited physical area such as an office, building, manufacturing plant, or other worksite.

Network Computer: A low-cost networked microcomputer with no or minimal disk storage, that depends on Internet or intranet servers for its operating system and Web browser, Java-enabled application software, and data access and storage.

Network Media: It is the actual path over which an electrical signal travels as it moves from one component to another.

Network: An interconnected system of computers, terminals, and communications channels and devices.

Protocol: It is the special set of rules that end points in a telecommunication connection use when they communicate.

Telecommunications: Pertaining to the transmission of signals over long distances, including not only data communications but also the transmission of images and voices using radio, television, and other communications technologies.

Teleconferencing: The use of video communications to allow business conferences to be held with participants who are scattered across a country, continent, or the world.

6.10 Review Questions

1. Using the Internet, find at least two software packages that will back up data across a LAN. Briefly explain how the software functions and what components need to be installed. Estimate the price of the software for a network of four servers and 100 clients.
2. Find out applications where data is stored and maintained through Networks. Demonstrate the benefits associated with it.
3. Discuss the various issues related with the implementation and development of Networks.
4. Explain the concepts of networks and its benefits to business organizations.
5. Find out the process of business through Internet and try to know at least two sites doing business through internet? How the data has been communicated from one point to another point.
6. How to integrate the information globally by making the data communication capability of computers?
7. Discuss the role of internet played in data communication.

Notes

8. What are the main reasons behind the need of data communication? Discuss
9. What are all the different types of networks? Enlighten their advantages also.
10. What are the different communication channels generally used in networking? Explain each in detail.
11. What are network protocols? What is their role? Discuss.
12. Explicate the design of wireless payment system.

Answers: Self Assessment

1.	Telecommunication	2.	channel
3.	videoconference	4.	wireless payment
5.	initialization	6.	Bandwidth
7.	bps	8.	Network media
9.	Shielded twisted-pair (STP)	10.	Coaxial cable
11.	Local Area Network (LAN)	12.	Metropolitan Area Network (MAN)
13.	remote	14.	value-added network (VAN)
15.	URL	16.	FTP
17.	User Datagram Protocol	18.	SMTP
19.	Digital Subscriber Line (DSL)	20.	Fixed wireless

6.11 Further Readings

Books

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Online link

www.unctad.org

Notes

Unit 7: Future of Networking Technologies

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Objectives

After studying this unit, you will be able to:

- Understand the future of network technologies
- Discuss the concept of broadband telephony, VOIP, RFID
- Discuss Convergence

Introduction

In this unit we look at networking technologies and trends that are likely to have a significant impact on businesses and the management of information in the near future. We will discuss in this unit the concept of broadband telephony, VOIP, RFID, and convergence.

7.1 Future of Networking Technologies

The futures of networking technologies are:

1. Broadband Telephony
2. VOIP
3. RFID and Convergence

All of the above technologies are discussed in this unit.

7.2 Broadband Telephony

Broadband Telephony is a revolutionary office telephone system. By converting phone calls into data and delivering them over a broadband connection, it offers:

1. Substantial cost savings on the maintenance and operation of traditional office phone systems (PBXs), with no hardware investment

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2. Free calls to other Broadband Telephony users
3. Improved corporate communication via a wide range of sophisticated calling features for individuals, small and large offices alike
4. Full enterprise call centre features
5. User friendly control tools embedded in Outlook/Lotus Notes
6. Reduced calling costs to other destinations

The solution works by plugging broadband phones into the broadband-connected local area network (LAN). Redwood Broadband Telephony then passes this traffic on to a carrier class, IP Centrex switch to make your existing office phone system (BT line rental, PBX phone system, PBX maintenance, voice mail etc.) entirely redundant.

Broadband Telephony is also ideal for connecting a small remote or branch office to a central site, through a service known as Business Trunking.

Broadband Telephony Business Trunking hooks existing PBXs up to the Broadband Telephony service, using IP Gateways and passing calls over a broadband connection. As such, the service replaces expensive analogue or ISDN lines traditionally necessary to carry the voice service.

By carrying high quality, business-class calls and functionality over a broadband connection the trunking solution offers free on-net calls (between branches), cost-effective upgrades, improved scalability and a unified dialling plan between remote locations.

As Broadband Telephony Trunking supports digital and analogue phones via gateways on the network, user investment is protected. Additionally, existing TDM and IP-based PBXs are also supported, so that Broadband Telephony can bring them into the wider network, and in many cases integrate their call dialling number systems.

7.2.1 Key Features of Broadband Telephony

The key features of broadband telephony are:

1. ***A Single Centralised System:*** Broadband Telephony, a next-generation telephone service, can connect multiple sites, wherever they are, enabling other offices to be reached via extension numbers, for free, as if they were in the same building. The system includes a full range of PBX and smart phone capabilities with a single system catering to all sites, providing full functionality for all users.
2. ***Cost Effective Telephony:*** All calls between connected sites are free of charge, entirely eliminating long distance call charges between remote offices. Calling costs to other locations are also dramatically reduced.
3. ***Scalability:*** Broadband Telephony is based on a carrier grade system and modular design, capable of scaling to support millions of simultaneous calls.
4. ***Advanced Voice Mail:*** Advanced voice mail services include customisable voice prompts, for different situations, and a message centre, embedded into Outlook or Lotus Notes, enabling messages to be retrieved from the desktop or any phone.
5. ***Self-Care Management Tools:*** The phone system can be managed via user friendly, easily accessible, web-based tools, with different access and authorisation levels for individuals and site administrators.
6. ***Follow Me and Call Screening:*** Users can easily configure follow-me and call screening preferences via their Outlook or Lotus notes.

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7. ***Fax to Email:*** Faxes can be sent directly to email addresses as attachments, without recipients even having a fax machine. There is no need to check for incoming faxes and privacy is no longer compromised as a result of faxes sitting on a shared machine. Multiple faxes can be received simultaneously and once received they can be saved and forwarded in soft-copy.

Self Assessment

Fill in the blanks:

1. Broadband Telephony, VOIP, RFID and Convergence are the ..... technologies and trends that are likely to have a significant impact on businesses and the management of information in the near future.
2. ..... is a revolutionary office telephone system.
3. Broadband Telephony is also ideal for connecting a small remote or branch office to a central site, through a service known as .....
4. Broadband Telephony is based on a carrier grade system and modular design, capable of ..... to support millions of simultaneous calls.

7.3 VOIP

Voice over Internet Protocol (VOIP) is a standard for software that digitizes and compresses voice signals and transmits the bits via the internet link. Organizations can purchase the proper software or use the services of companies that specialize in providing IP telephony. Companies such as Vonage, Cablevision, Comcast, and many others offer inexpensive use of their VOIP telephone-to-telephone voice communication.

Computer-to-computer calls can be conducted free of charge by using the service of a company such as Skype or Jajah. Phone-to-phone service requires an additional modem, but it does not require a new phone or phone number, and it does not require routing calls through a home computer. Jajah also offers a free or low per-minute phone-to-phone service, if both the caller and recipient register at the company's web site. The caller uses a computer to dial, the caller's phone rings and when the caller picks up his phone the service dials the recipients number. Thus, no VOIP modem is required.

VOIP can save companies and households money. According to the research firm In-Stat 20 percent of U.S. firms used VOIP in 2006, and two-thirds were expected to use VOIP by 2010.

Voice over Internet Protocol (VoIP) is a general term for a family of transmission technologies for delivery of voice communications over IP networks such as the Internet or other packet-switched networks. Other terms frequently encountered and synonymous with VoIP are IP telephony, Internet telephony, voice over broadband (VoBB), broadband telephony, and broadband phone.

VoIP systems employ session control protocols to control the set-up and tear-down of calls as well as audio codecs which encode speech allowing transmission over an IP network as digital audio via an audio stream.

Notes Codec use is varied between different implementations of VoIP (and often a range of codecs are used); some implementations rely on narrowband and compressed speech, while others support high fidelity stereo codecs.

Notes

VoIP (Voice over IP) is an IP telephony term for a set of facilities used to manage the delivery of voice information over the Internet. VoIP involves sending voice information in digital form in discrete packets rather than by using the traditional circuit-committed protocols of the Public Switched Telephone Network (PSTN). A major advantage of VoIP and Internet telephony is that it avoids the tolls charged by ordinary telephone service.

Companies providing VoIP service are commonly referred to as providers, and protocols which are used to carry voice signals over the IP network are commonly referred to as Voice over IP or VoIP protocols. They may be viewed as commercial realizations of the experimental Network Voice Protocol (1973) invented for the ARPANET providers. Some cost savings are due to utilizing a single network - see attached image - to carry voice and data, especially where users have existing underutilized network capacity that can carry VoIP at no additional cost. VoIP to VoIP phone calls are sometimes free, while VoIP to PSTN may have a cost that's borne by the VoIP user.

There are two types of PSTN to VoIP services: DID (Direct Inward Dialing) and access numbers. DID will connect the caller directly to the VoIP user while access numbers require the caller to input the extension number of the VoIP user. Access numbers are usually charged as a local call to the caller and free to the VoIP user while DID usually has a monthly fee.

Notes Hamon Corp., a company that manufactures devices for control of air pollutants, noticed a significant increase in telephone costs as its staff grew from 130 to 500. The firm's CFO decided to subscribe the company to a VOIP service. The company's telephone cost decreased by at least $ 12,000 per month.

Caution There are also DIDs that are free to the VoIP user but chargeable to the caller.

Task Discuss the use of VOIP protocols.

Self Assessment

Fill in the blanks:

5. ..... is a standard for software that digitizes and compresses voice signals and transmits the bits via the internet link.
6. Voice over Internet Protocol (VoIP) is a general term for a family of ..... technologies for delivery of voice communications over IP networks.
7. Companies providing VoIP service are commonly referred to as .....
8. Protocols which are used to carry ..... signals over the IP network are commonly referred to as VoIP protocols.
9. There are two types of PSTN to VoIP services, ... and access numbers.

7.4 RFID

Radio-frequency identification (RFID) is the use of an object (typically referred to as an RFID tag) applied to or incorporated into a product, animal, or person for the purpose of identification

Notes

and tracking using radio waves. Some tags can be read from several meters away and beyond the line of sight of the reader.

Most RFID tags contain at least two parts. One is an integrated circuit for storing and processing information, modulating and demodulating a radio-frequency (RF) signal, and other specialized functions. The second is an antenna for receiving and transmitting the signal.

There are generally three types of RFID tags: active RFID tags, which contain a battery and can transmit signals autonomously, passive RFID tags, which have no battery and require an external source to provoke signal transmission, and battery assisted passive (BAP) which require an external source to wake up but have significant higher forward link capability providing great read range.

RFID systems can be used just about anywhere, from clothing tags to missiles to pet tags to food – anywhere that a unique identification system is needed. The tag can carry information as simple as a pet owners name and address or the cleaning instruction on a sweater to as complex as instructions on how to assemble a car. Some auto manufacturers use RFID systems to move cars through an assembly line. At each successive stage of production, the RFID tag tells the computers what the next step of automated assembly is.

Radio frequency identification (RFID) is a generic term that is used to describe a system that transmits the identity (in the form of a unique serial number) of an object or person wirelessly, using radio waves. It's grouped under the broad category of automatic identification technologies.

RFID is in use all around us. If you have ever chipped your pet with an ID tag, used EZPass through a toll booth, or paid for gas using SpeedPass, you've used RFID. In addition, RFID is increasingly used with biometric technologies for security.

Unlike ubiquitous UPC bar-code technology, RFID technology does not require contact or line of sight for communication. RFID data can be read through the human body, clothing and non-metallic materials.

One of the key differences between RFID and bar code technology is RFID eliminates the need for line-of-sight reading that bar coding depends on. Also, RFID scanning can be done at greater distances than bar code scanning. High frequency RFID systems (850 MHz to 950 MHz and 2.4 GHz to 2.5 GHz) offer transmission ranges of more than 90 feet, although wavelengths in the 2.4 GHz range are absorbed by water (the human body) and therefore has limitations.

7.4.1 RFID Components

A basic RFID system consists of three components:

1. An antenna or coil
2. A transceiver (with decoder)
3. A transponder (RF tag) electronically programmed with unique information

The antenna emits radio signals to activate the tag and to read and write data to it.

The reader emits radio waves in ranges of anywhere from one inch to 100 feet or more, depending upon its power output and the radio frequency used. When an RFID tag passes through the electromagnetic zone, it detects the reader's activation signal.

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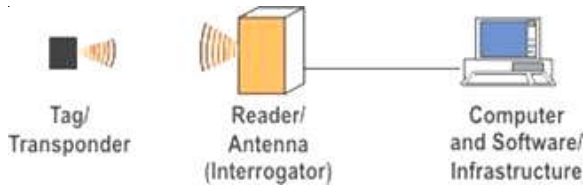
Figure 7.1: RFID Components



The reader decodes the data encoded in the tag's integrated circuit (silicon chip) and the data is passed to the host computer for processing.

The purpose of an RFID system is to enable data to be transmitted by a portable device, called a tag, which is read by an RFID reader and processed according to the needs of a particular application. The data transmitted by the tag may provide identification or location information, or specifics about the product tagged, such as price, color, date of purchase, etc. RFID technology has been used by thousands of companies for a decade or more. . RFID quickly gained attention because of its ability to track moving objects. As the technology is refined, more pervasive - and invasive - uses for RFID tags are in the works.

A typical RFID tag consists of a microchip attached to a radio antenna mounted on a substrate.

To retrieve the data stored on an RFID tag, you need a reader. A typical reader is a device that has one or more antennas that emit radio waves and receive signals back from the tag. The reader then passes the information in digital form to a computer system.

Task How to retrieve the data stored on RFID tag?

Did u know? The chip can store as much as 2 kilobytes of data.

7.4.2 Uses of RFID

RFID can be used in a variety of applications such as:

1. Access management
2. Tracking of goods and RFID in retail
3. Tracking of persons and animals
4. Toll collection and contactless payment
5. Machine readable travel documents
6. Smart dust (for massively distributed sensor networks)
7. Location-based services
8. Tracking Sports memorabilia to verify authenticity
9. Airport Baggage Tracking Logistics

Self Assessment

Fill in the blanks:

10. ..... is the use of an object applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves.

Notes

11. ..... tags contain a battery and can transmit signals autonomously.
12. ..... tag requires an external source to wake up but have significant higher forward link capability providing great read range.
13. A ..... tag consists of a microchip attached to a radio antenna mounted on a substrate.

7.5 Digital Convergence

Digital convergence refers to the convergence of four industries into one conglomerate, ITTCE (Information Technologies, Telecommunication, Consumer Electronics, and Entertainment.

Example: Shifting trend are: Microsoft's Xbox (From IT to Entertainment), Apple's iPhone (From IT to Telecom), and Sony's Vaio (From Consumer Electronics to IT).

This provides new, innovative solutions to consumers and business users. Based on digital technologies and digitized content it encompasses converged devices (such as smartphones, laptops, internet enabled entertainment devices and set top boxes), converged applications (e.g. music download on PC and handheld) and converged networks (IP networks). According to Harry Strasser, former CTO of Siemens "digital convergence will substantially impact people's lifestyle and work style". The next hot trend in digital convergence is converged content, mixing personal (user generated) content with professional (copyright protected) content.

Example: Personal music video that combine own photos with chart music and sharing them in social communities on PCs, mobile phones and digital set top boxes.

Digital convergence also refers to the digitalization of traditional media.

Example: During the advent of personal computers, text-only documents were the first to be digitized. Increasingly, graphics would be digitized, at first simple illustrations, then eventually photographs. Digital sound evolved from series of single-tone "beeps" to very detailed audio encodings.

The term doesn't necessarily refer only to the existence of technology, but also the mainstream integration of such technology.

Example: As of the beginning of the 21st century, animated holograms exist, but are far from being commonplace, whereas one might imagine that such technology will be available for home use in the same way as laptops are available to the general public today.

Digital Convergence is the priming of underlying digital technology components and features such as voice, texts, video, pictures, broadcasts, presentation, streaming media, global connectivity and personalized services; the combination of all of these features and abilities from multiple electronic systems into a simplified, converged and computer-mediated communication system to enable individuals interact, play, communicate, collaborate and share information in many new and different ways.

—Ifeanyi O. Asonye

Technology is changing so fast that no one may be capable of giving you a one hundred percent detail of what is happening at any given time.

It is worth noting that presently, there are tons of futuristic designs in software and hardware. Many of them happened several years ago, and are still fairly expensive for the consumer

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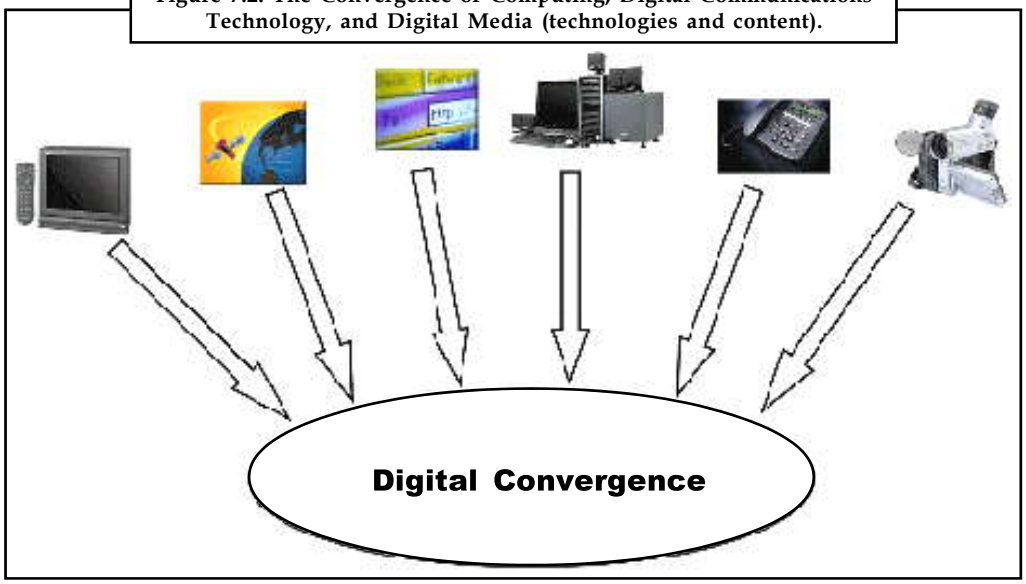
market. Many of the current systems, and some of the designs are still very expensive to upgrade. There are lots of prototype in the research laboratories. In the academic area, algebra, physics, engineering math and algorithms has many "constants" and "variables". From "silicon chips" to the "point charges", the possibilities and products of the end results in combination with physical properties of the materials are exceedingly great.

Many of the potentials has yet to be offered and implemented for consumers. When you go to the Microsoft® Research, for example, you will see lots of things that are going on there. Microsoft® spends billions of dollars researching technologies that neither has anything to do with windows, office, nor would you ever think the consumers will need them for anything.

You will observe that if you upgraded or purchased a new business PC with an Operating System such as Windows 2000, and if you are not a "Power User", there is probably not enough reason to upgrade very quickly, in 2003-2004. What we are seeing is transition on how computer systems will be used in many different ways in the very near future, and that is the promise of the Digital Convergence Technology.

Digital Convergence would have become widespread before we can seize complete control of the internet and enjoy its full capabilities. We shall discuss Digital Convergence briefly so that you can explore, enjoy and profit from the new capabilities offered by the emerging Digital Convergence Technology.

Figure 7.2: The Convergence of Computing, Digital Communications Technology, and Digital Media (technologies and content).



Voice Over IP Solutions (VoIP) application meets the challenges of combining the legacy voice networks and packet networks by allowing both voice and signaling information to be transported over the packet network. The concept of VoIP is used in Wireless LAN Networks; and sometimes referred to as wVoIP, VoFi, VoWi-Fi and Wi-Fi VoIP.

A fax-over-Internet protocol (FoIP) application accomplishes this by extracting the fax image from an analog signal and carrying it as digital data over the packet network. The email fax system allows you to send and receive faxes using a regular fax number(s) over the internet using any email account.

An IPTV- provides an integrated environment to deliver broadcast-quality video over the IP-based communications using high-speed internet broadband networks such as DSL, High-Speed Internet Cable, and T1, T2 and T3 lines.

Notes

Example: There is a recent and huge explosion with the major telecommunications companies around the Globe, starting in Europe. They are beginning to offer consumers what is called triple play of voice, high speed Internet, and an interactive TV- All at once! Basically, you get all that you already can get right now, and even much more. This decade and century is extremely promising!

An end-user experiences all the market-leading features such as instant channel change (ICC), multiple picture-in-picture (PIP) along with VOD, DVR and PVR. It's nice to know that the system will integrate seamlessly with PCs, phones, pocket Pcs and other consumer electronic devices.

Presently, the commercial delivery of Cable TV, Broadcast TV, all formats, all kinds of content-including HDTV, and all media information to be delivered over IP-based High-Speed Internet connections are ready, complete, and in progress with the leading broadband network operators around the world and in the US.

Then when we take the Global "Mobility" features of the new generation Internet Protocol, the IPv6 into the picture and design architecture, we will get the capability to take all our Cable TV, Broadcast TV, Streaming Media, Radio, Voice, Phone, Text, Video, and Data along with us to any of our electronic devices and PC from anywhere to any part of the Globe, using the Global Compatible Digital Architecture and Infrastructure that has continued to be put into place.

Did u know? **What is FOIP?**

A fax-over-Internet protocol (FoIP) application enables the inter-working of standard fax machines with packet networks.

Notes Understanding Digital Convergence is neither about the ability to identify components of the emerging digital environment nor the ability to quickly and visually distinguish between say, a Palm Pilot PDA, Digital Mobile Phone, a Pocket PC, or the Tablet PC and a Laptop. It is important to understand the features and benefits for you as an individual or a professional in today's fast paced and competitive business environment.

Self Assessment

Fill in the blanks:

14. ..... refers to the convergence of four industries into one conglomerate, ITTCE (Information Technologies, Telecommunication, Consumer Electronics, and Entertainment.

15. A ..... application enables the interworking of standard fax machines with packet networks.

Notes

Case Study

Data Capturing Methods used by a Transport Company

A large car (taxi) rental company has high-street branches throughout the country. Customers typically sign the contracts and payment is made monthly. Majority of customers pay by direct debit through banking system, however, minority pay at the high street branches every month. Customers account records are fed to a mainframe computer at the head-office and require regular updation with customers payments details.

Questions:

1. Suggest two suitable methods of data capturing and input for those customers paying at branch offices.
2. Enlist the important advantages & disadvantages of your proposals.

Source: Dharmendra and Sangeeta Gupta, *Management Information System*, Excel Books, New Delhi.

7.6 Summary

- Broadband Telephony, VOIP, RFID and Convergence are the networking technologies and trends that are likely to have a significant impact on businesses and the management of information in the near future.
- Broadband Telephony is a revolutionary office telephone system. The solution works by plugging broadband phones into the broadband-connected local area network (LAN).
- Voice over Internet Protocol (VOIP) is a standard for software that digitizes and compresses voice signals and transmits the bits via the internet link.
- Companies providing VoIP service are commonly referred to as providers, and protocols which are used to carry voice signals over the IP network are commonly referred to as Voice over IP or VoIP protocols.
- Radio-frequency identification (RFID) is the use of an object (typically referred to as an RFID tag) applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves.
- The purpose of an RFID system is to enable data to be transmitted by a portable device, called a tag, which is read by an RFID reader and processed according to the needs of a particular application.
- Digital convergence refers to the convergence of four industries into one conglomerate, ITTCE (Information Technologies, Telecommunication, Consumer Electronics, and Entertainment).
- Digital convergence also refers to the digitalization of traditional media.

7.7 Keywords

Digital Convergence: It refers to the convergence of four industries into one conglomerate, ITTCE (Information Technologies, Telecommunication, Consumer Electronics, and Entertainment).

Notes

Radio-frequency Identification (RFID): RFID is the use of an object (typically referred to as an RFID tag) applied to or incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves.

Voice over Internet Protocol (VOIP):VOIP is a standard for software that digitizes and compresses voice signals and transmits the bits via the internet link.

7.8 Review Questions

1. What are the networking technologies and trends that are likely to have a significant impact on businesses and the management of information in the near future? Discuss.
2. Explain the working of broadband telephony system. Also enlighten the concept of business trunking.
3. Explain the main features of broadband telephony.
4. What is Voice over Internet Protocol (VOIP)? How VOIP is used for voce communications over IP networks?
5. Scrutinize the two types of PSTN to VoIP services. Explain.
6. Make distinction between DID (Direct Inward Dialing) and access numbers.
7. Unlike ubiquitous UPC bar-code technology, RFID technology does not require contact or line of sight for communication. Comment.
8. Make distinction between different types of RFID tags.
9. Elucidate the functioning of RFID system components.
10. Identify various applications in which RFID is used.
11. Illustrate the impact of digital convergence on people's lifestyle and work style.

Answers: Self Assessment

1.	networking	2.	Broadband Telephony
3.	Business Trunking	4.	scaling
5.	Voice over Internet Protocol (VOIP)	6.	transmission
7.	providers.	8.	voice
9.	Direct Inward Dialing	10.	Radio-frequency identification (RFID)
11.	Active RFID	12.	Battery assisted passive (BAP)
13.	typical RFID	14.	Digital convergence
15.	fax-over-Internet protocol (FoIP)		

7.9 Further Readings

Books

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Online links

www.jmlcable.com

www.iop.org

Unit 8: Databases and Data Warehouses

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Objectives

After studying this unit, you will be able to:

- Understand the concept of databases
- Differentiate between Traditional and Database Approach
- Explain Database Model and Relational Model
- Discuss Object Oriented Model
- Recognize Relational Operations SQL
- Understand Data Modelling
- Discuss Database on the Web
- Explain Data Warehousing

Notes

Introduction

Effective use of information depends on how data are stored, organised and accessed in an organisation. Proper delivery of information not only depends upon the capabilities of computer hardware and software but also on the organisation's ability to manage data as an important resource. After seeing the various methods and approaches of system development, now, let us have some understanding of how important are the data resources in an organisation and how the information system we developed is going to handle them.

It has been very difficult for organizations to manage their data effectively. In trying to do so, we have to meet two very big challenges which are standing out. Implementing a database requires a widespread organisational change in the role of information and information managers, the allocation of power at senior levels, the ownership and sharing of information, and patterns of organisational agreement. A database management system (DBMS) challenges the existing power arrangements in an organisation and for that reason often generate political resistance. In a traditional file environment, each department constructed files and programs to fulfill its specific needs. Now, with a database, files and programs must be built that take into account the full organization's interest in data. Although the organisation has spent the money on hardware and software for a database environment, it may not reap the benefits it should if it is unwilling to make the requisite organisational changes.

8.1 Database

A database is a collection of data, which is organized in a way that allows for easy data retrieval and manipulation. While a folder with several files in it may be viewed as a simple database, database professionals usually require that a database have a database management system (DBMS). A DBMS is a software tool, which stores data in a specified form and provides access to this data for a user or an application. Specifically, a DBMS provides some or all of the following functionality:

1. ***Data Definition:*** A DBMS must define a structure for stored data, and provide a means for a user to define and organize their data within that structure.
2. ***Data Retrieval:*** A DBMS must provide a toolset that allows a user to retrieve data stored in the database (for instance, query tools).
3. ***Access Control:*** The database administrator should be able to define data access for an individual or a group.
4. ***Data Sharing:*** More than one user should be able to use the database at the same time without a danger of overwriting each other's data changes.
5. ***Data Integrity:*** A DBMS should provide mechanisms for maintaining data integrity through system failures and inconsistent, or incomplete, updates.

Self Assessment

Fill in the blanks:

1. A ..... is a collection of data, which is organized in a way that allows for easy data retrieval and manipulation.
2. A DBMS is a ..... tool, which stores data in a specified form and provides access to this data for a user or an application.

Notes

8.2 Traditional vs Database Approach

8.2.1 Files: The Traditional Approach

Traditionally, data files were developed and maintained separately for individual applications. Thus, the file processing system relied on the piecemeal approach of data across the organization where every functional unit like marketing, finance, production, etc. used to maintain their own set of application programs and data files.

No doubt such an organization was simple to operate and had better local control but the data of the organization is dispersed throughout the functional sub-systems.

This approach was rendered inadequate, especially when organizations started developing organization-wide integrated application. The major drawbacks of file processing system may be outlined due to the following reasons.

1. Data duplication
2. Data inconsistency
3. Lack of data integration
4. Data dependence
5. Program dependence

Data Duplication

Since each application has its own data file, the same data may have to be recorded and stored in several files.

Example: Payroll application and personnel application, both will have data on employee name, designation, etc. This results in unnecessary duplication/redundancy of common data items.

Data Inconsistency

Data inconsistency leads to the data inconsistency especially when data is to be updated. Data inconsistency occurs because the same data items which appear in more than one file do not get updated simultaneously in all the data files.

Example: Employee's designation, which is immediately updated in the payroll system may not necessarily be updated in the provident fund application. This results in two different designations of an employee at the same time.

Lack of Data Integration

Because of independent data files, users face difficulty in getting information on any ad hoc query that requires accessing data stored in more than one file. Thus, either complicated programs have to be developed to retrieve data from each independent data file or users have to manually collect the required information from various outputs of separate applications.

Notes

Data Dependence

The applications in file processing systems are data dependent, i.e., the file organization, its physical location and retrieval from the storage media are dedicated by the needs of the particular application.

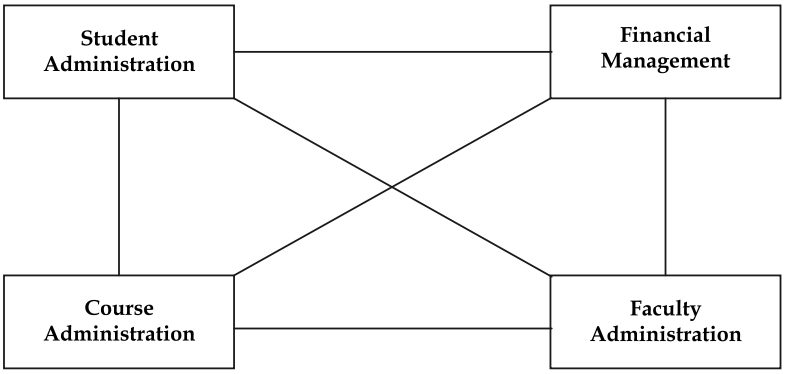
Example: In order processing application, the file may be organized on customers records stored on their last name, which implies that retrieval of any customer's records has to be through his/her last name only.

Program Dependence

The report produced by the file processing system are program dependent, which implies that if any change in the format or structure of data and records in the file is to be made, a corresponding change in the programs have to be made. Similarly, if any new report is to be produced, a new program will have to be developed.

It is because of these drawbacks in the traditional files approach of organizing data that led to the development of databases.

Figure 8.1: File System Approach



Task Discuss the main functions of a database.

8.2.2 Database – The Modern Approach

An alternative approach to the file processing system in the modern approach known as the database approach. A database is an organized collection of records and files which are related to each other. In a database system, a common pool of data can be shared by a number of applications as it is data and program independent. Thus, unlike a file processing system, data redundancy and data inconsistency in the database system approach are minimized. The user is free from the detailed and complicated task of keeping up with the physical structure of the data.

Features of Database Approach

- Creates and maintains databases
- Eliminates requirement for data definition statements

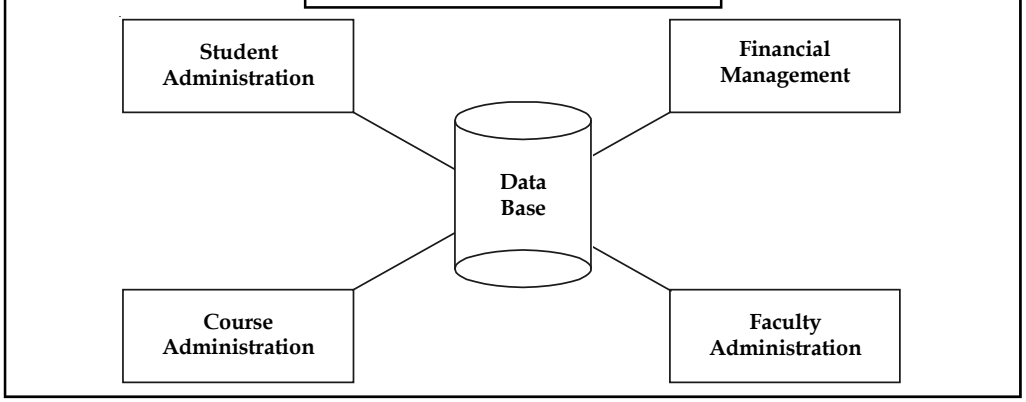
Notes

- Acts as interface between application programs and physical data files
- Separates logical and physical views of data

Advantages of Database Approach

- All the managers can view database as per their needs.
- Data validation and updation will be once and same for all.
- All the users share data.
- Security and privacy can be managed.
- Control of data redundancy.
- Data consistency.
- More information from the same amount of data.
- Sharing of data.
- Improved data integrity.
- Improved security.
- Enforcement of standards.
- Economy of scale.
- Balance of confliction requirements.
- Improved data accessibility and responsiveness.
- Increased productivity.
- Improved maintenance through data independence.
- Increased concurrency.
- Improved backup and recovery services.

Figure 8.2: Database Approach



Self Assessment

Fill in the blanks:

3. ..... occurs because the same data items which appear in more than one file do not get updated simultaneously in all the data files.

Notes

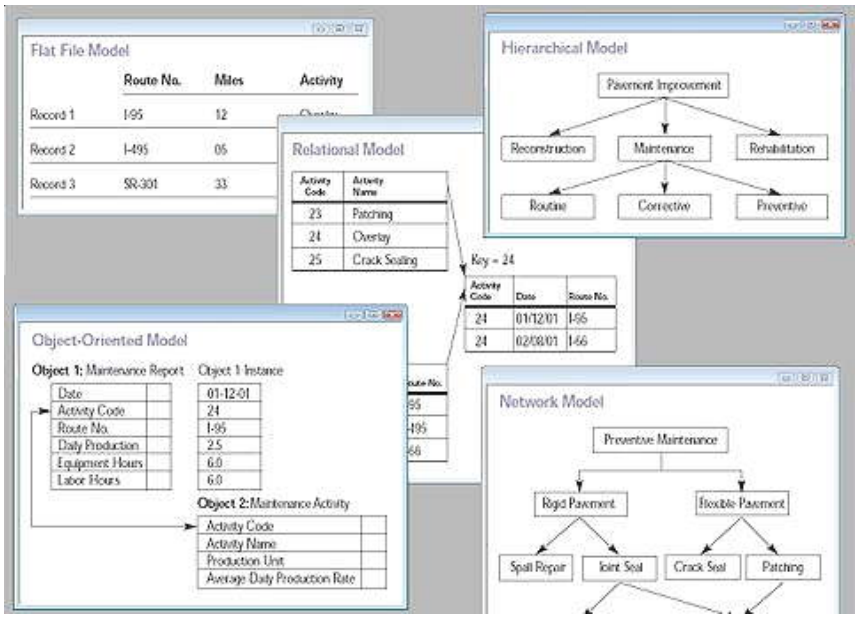
4. Because of ..... data files, users face difficulty in getting information on any ad hoc query that requires accessing data stored in more than one file.

5. Unlike a file processing system, data redundancy and data inconsistency in the database system approach are .....

8.3 Database Models

A database model or database schema is the structure or format of a database, described in a formal language supported by the database management system, In other words, a "database model" is the application of a data model when used in conjunction with a database management system.

Figure 8.3: Database Model



Different types of database models are:

1. Relational model
2. Object-oriented model
3. Hierarchical model
4. Network model
5. Flat file model

A data model is not just a way of structuring data: it also defines a set of operations that can be performed on the data. The relational model, for example, defines operations such as select, project, and join.

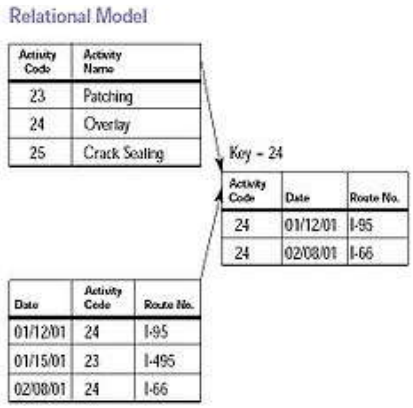
Caution Although these operations may not be explicit in a particular query language, they provide the foundation on which a query language is built.

Notes

8.3.1 Relational Model

The relational model was introduced by E.F. Codd in 1970 as a way to make database management systems more independent of any particular application. It is a mathematical model defined in terms of predicate logic and set theory.

Figure 8.4: Relational Model



The products that are generally referred to as relational databases in fact implement a model that is only an approximation to the mathematical model defined by Codd. Three key terms are used extensively in relational database models: relations, attributes, and domains. A relation is a table with columns and rows. The named columns of the relation are called attributes, and the domain is the set of values the attributes are allowed to take.

The basic data structure of the relational model is the table, where information about a particular entity (say, an employee) is represented in rows (also called tuples) and columns. Thus, the "relation" in "relational database" refers to the various tables in the database; a relation is a set of tuples. The columns enumerate the various attributes of the entity (the employee's name, address or phone number, for example), and a row is an actual instance of the entity (a specific employee) that is represented by the relation. As a result, each tuple of the employee table represents various attributes of a single employee.

All relations (and, thus, tables) in a relational database have to adhere to some basic rules to qualify as relations. First, the ordering of columns is immaterial in a table. Second, there can't be identical tuples or rows in a table. And third, each tuple will contain a single value for each of its attributes.

A relational database contains multiple tables, each similar to the one in the "flat" database model. One of the strengths of the relational model is that, in principle, any value occurring in two different records (belonging to the same table or to different tables), implies a relationship among those two records. Yet, in order to enforce explicit integrity constraints, relationships between records in tables can also be defined explicitly, by identifying or non-identifying parent-child relationships characterized by assigning cardinality (1:1, (0)1:M, M:M). Tables can also have a designated single attribute or a set of attributes that can act as a "key", which can be used to uniquely identify each tuple in the Table.

A key that can be used to uniquely identify a row in a table is called a primary key. Keys are commonly used to join or combine data from two or more Tables.

Example: An Employee Table may contain a column named Location which contains a value that matches the key of a Location table. Keys are also critical in the creation of indexes,

Notes

which facilitate fast retrieval of data from large tables. Any column can be a key, or multiple columns can be grouped together into a compound key. It is not necessary to define all the keys in advance; a column can be used as a key even if it was not originally intended to be one.

A key that has an external, real-world meaning (such as a person's name, a book's ISBN, or a car's serial number) is sometimes called a "natural" key. If no natural key is suitable (think of the many people named Brown), an arbitrary or surrogate key can be assigned (such as by giving employees ID numbers). In practice, most databases have both generated and natural keys, because generated keys can be used internally to create links between rows that cannot break, while natural keys can be used, less reliably, for searches and for integration with other databases.

Example: Records in two independently developed databases could be matched up by social security number, except when the social security numbers are incorrect, missing, or have changed.

The basic structure of the relational model is as follows:

1. RDBMS allows operations in a human logical environment
2. The relational database is perceived as a collection of tables
3. Each table consists of a series of row/column intersections
4. Tables (or relations) are related to each other by sharing a common entity characteristic (called a key)
5. The relationship type is often shown in a relational schema
6. A table yields complete data & structural independence.

A visual representation of this model is shown below.

Table 8.1: Relational Model: Name - Student

Code	Surname	Name	Street	City	Tutor Code
01	Vadodaria	Reetesh	Powai	Mumbai	15
11	Jani	Apurva	Chandivali	Mumbai	19
17	Patel	Sameer	Peddar Rd.	Mumbai	02
25	Agrawal	Umang	Malad	Mumbai	05
30	Bansal	Shilpi	Borivli	Mumbai	22

Table 8.2: Link through Tutor Code: Name – Faculty

Tutor Code	Surname	Name	Street	City
02	Kumta	Gita	Goregaon	Mumbai
05	Acharya	Neeta	Santacruz	Mumbai
15	Agnihotri	Prafulla	Dindoshi	Mumbai
19	Sirur	Pratap	Malabar Hill	Mumbai
22	Sunder Ram	K.	Mira Rd.	Mumbai

The advantages of the relational model are:

1. Structural independence
2. Improved conceptual simplicity

Notes

3. Easier database design, implementation, management & use
4. Ad hoc querying (a query that is not predefined) capability through SQL
5. Powerful data management system.

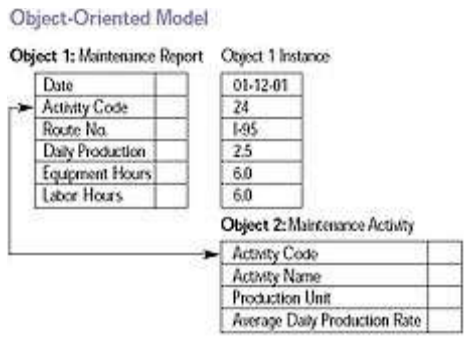
The disadvantages, on the other hand, are:

1. Substantial hardware & system software overhead
2. Possibility of poor design & implementation
3. Potential "islands of information" problem.

8.3.2 Object-oriented Model

The object-oriented paradigm has been applied to database technology, creating a new programming model known as object databases. These databases attempt to bring the database world and the application programming world closer together, in particular by ensuring that the database uses the same type system as the application program. This aims to avoid the overhead (sometimes referred to as the impedance mismatch) of converting information between its representation in the database (for example, as rows in tables) and its representation in the application program (typically as objects). At the same time, object databases attempt to introduce the key ideas of object programming, such as encapsulation and polymorphism, into the world of databases.

Figure 8.5: Object Oriented Model



A variety of these ways have been tried for storing objects in a database. Some products have approached the problem from the application programming end, by making the objects manipulated by the program persistent. This also typically requires the addition of some kind of query language, since conventional programming languages do not have the ability to find objects based on their information content. Others have attacked the problem from the database end, by defining an object-oriented data model for the database, and defining a database programming language that allows full programming capabilities as well as traditional query facilities.

Object databases suffered because of a lack of standardization: Although standards were defined by ODMG, they were never implemented well enough to ensure interoperability between products. Nevertheless, object databases have been used successfully in many applications: usually specialized applications such as engineering databases or molecular biology databases rather than mainstream commercial data processing.

Notes Object database ideas were picked up by the relational vendors and influenced extensions made to these products and indeed to the SQL language.

Notes

8.3.3 Relational Operations SQL

Structured Query Language, popularly known as SQL is the language that is used in most relational database systems. It is called structured query language because it follows a rigorous set of rules and procedures in answering queries. SQL is also termed as 4GL to distinguish it from other 3GL programming languages like, PASCAL, COBOL or C.

SQL is a simple and powerful query language that is capable of answering simple to most complex queries. Any query on a single table can be performed by using only two basic operators, namely SELECT and PROJECT.

The select operator selects a set of records from the table, whereas PROJECT takes out selected fields from the table. The two operators may be understood, in the user's view, as a horizontal cut and vertical cut, respectively of the table. Another operator JOIN is also used in SQL when the query requires more than one table. JOIN links or combines two tables together over a common field.

Now, we illustrate the working of RDBMS system with the help of the following examples.

The Tables are created using data definition language. Typical constructs for creating Table 8.3 and 8.4 would be as follows:

Create Table Course

CNO Char (5),

CTITLE Char (25),

CREDITS integer,

STDNO integer,

TCODE Char (3),

Create Table Teacher

TCODE Char (3),

NAME Char (20),

DEPTT Char (5),

DESIG Char (12),

PHONE Char (8),

Table 8.3: Data Table Course

CNO	CTITLE	CREDITS	STDNO	TCODE
CS101	MIS	6	25	07
CS201	SAD	4	25	15
CS304	Software Engineering	4	25	30
CS406	Information Technology	3	20	06
CS303	Strategic Systems	4	20	11

Notes

Table 8.4: Data Table Teacher

TCODE	NAME	DEPTT	DESIG	PHONE
07	R.Balekar	MGT	Reader	235467
06	S.C. Sharma	IT	Reader	219834
30	P. Gupta	IT	Professor	230956
15	Rakesh Kumar	ENGG	Reader	327654
11	Anuj Saxena	MGT	Professor	351087

Having created the Tables and having entered the data as shown in Table 8.3 and Table 8.4, the above mentioned basic operators, viz., SELECT, PROJECT and JOIN may be used.

Example:

1. SELECT DEPTT = 'IT'

   FROM the table Teacher, we get Table 8.5 (a)

Table 8.5(a)

TCODE	NAME	DEPTT	DESIG	PHONE
06	S.C. Sharma	IT	Reader	219834
30	P. Gupta	IT	Professor	230956

2. PROJECT CNO, STDNO.

   FROM the table Course, we get Table 8.5 (b).

Table 8.5(b)

CNO	STDNO
CS101	25
CS201	25
CS304	25
CS406	20
CS303	20

3. Similarly, two or more than two Tables can be joined over a common field.

Example: Table course and table teacher may be joined together over a common field TCODE to obtain the following result. (Table 8.5 (c))

Table 8.5(c)

CNO	CTITLE	CREDITS	STDNO	TCODE	NAME	DEPTT
CS101	MIS	6	25	07	R. Balekar	MGT
CS201	SAD	4	25	15	S.C. Sharma	IT
CS304	Software Engineering	4	25	30	P. Gupta	IT
CS406	Information Technology	3	20	06	Rakesh Kumar	ENGG
CS303	Strategic Systems	4	20	11	Anuj Saxena	MGT

Notes

In the above example, the use of three basic operators has been explained. However, it may be noted that SQL does not use the SELECT, PROJECT and JOIN formats at the syntactic level, rather it follows a generic format consisting of three sub-commands as follows.

SELECT Filed list

FROM List of tables

WHERE Condition

Example: We want to know the name of course(s) where the number of students are less than 21 from our earlier database stored as relation course (Table 8.3).

SLECT CNO, CTITLE, CREDITS, STDNO

FROM Course

WHERE STDNO <21

This will produce the report as given below.

Table 8.6

SNO	CTITLE	CREDITS	STDNO
CS406	Information Technology	3	20
CS303	Strategic Systems	4	20

Information from two different tables may be extracted by using dot (.) notation as shown below.

SELECT CTITLE, NAME

FROM Course, Teacher

WHERE Course.TCODE = Teacher.TCODE;

SQL can also perform many other functions that include sorting (ordering), group functions of averaging, summing, locating maximum and minimum values, counting the numbers in a column, etc.

Task Discuss relational model with suitable example.

8.3.4 Data Modelling

Data modelling is the analysis of data objects that are used in a business or other context and the identification of the relationships among these data objects. A data model is a collection of logical constructs used to represent the data structure & the data relationships found within the database. The two different categories of data models are:

1. ***Conceptual Models:*** Focus on the logical nature of the data representation. They are concerned with what is represented rather than how it is represented. The Entity-relationship model is a popular conceptual model.

2. ***Implementation Models:*** Place the emphasis on how the data are represented in the database or on how the data structures are implemented. The examples are:

   (a) Hierarchical

Notes

(b) Network

(c) Relational

(d) Object-oriented

(e) Semi-structured

Before we move on to the study of the common data models, let us understand the concepts of data relationships. Two pieces of data may have any of the following three relationships:

1. ***One-to-one (1:1):*** for example, each store-is managed by a single employee & each store manager (employee) only manages a single store, i.e., employee (1) manages store (1).
2. ***One-to-many (1:M):*** for example, a painter paints many different paintings but each one of them is painted by only that painter, i.e., painter (1) paints painting (M).
3. ***Many-to-many (M:N):*** for example, an employee may learn many job skills & each job skill might me learned by many employees, i.e., employee (M) learns skill (N).

8.3.5 Hierarchical Model

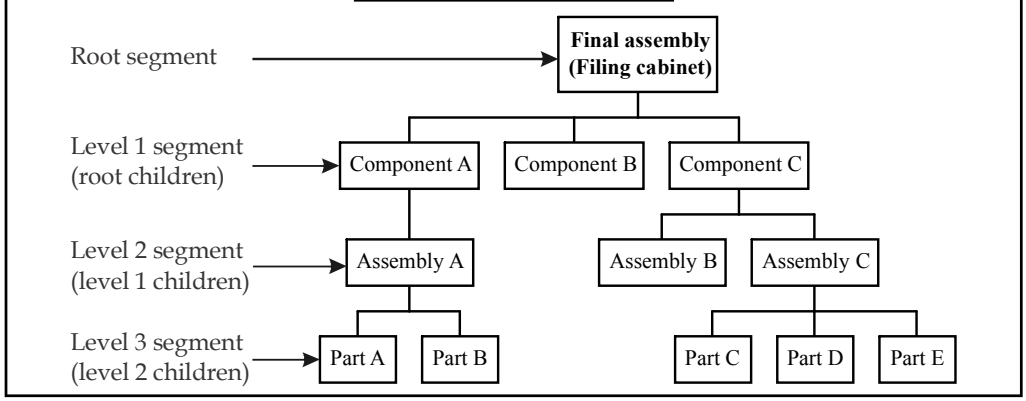
In 1966, IBM released the first commercially available DBMS - IMS (Information Management System) based on the hierarchical data model. The basic structure of this model is:

1. Collection of records is logically organized to conform to the upside-down tree (hierarchical) structure.
2. The top layer is perceived as the parent of the segment directly beneath it.
3. The segments below other segments are the children of the segment above them.
4. A tree structure is represented as a hierarchical path on the computer's storage media.

The following diagram shows the organization of a hierarchical DBMS.

Organization of a Hierarchical DBMS

Figure 8.6



The major advantages of this model are:

1. Conceptual simplicity
2. Database security
3. Data independence

Notes

4. Database integrity
5. Efficiency dealing with a large database.

The model went out of favour due to the following limitations:

1. Complex implementation
2. Difficult to manage
3. Lacks structural independence
4. Complexity of application programming & use
5. Implementation limitations
6. Lack of standards.

8.3.6 Network Model

General Electric (GE) developed a DBMS called IDS (Integrated Data System) based on the network data model in 1967. In this model, a relationship is called a set. Each set is composed of at least two record types: an owner (parent) record & a member (child) record. A set represents a 1:M relationship between the owner & the member. The following is a visual representation of a network DBMS. The major advantages of this model are:

1. Conceptual simplicity
2. Handles more relationship styles
3. Data access flexibility
4. Promotes database integrity
5. Data independence
6. Conformance to standards.

The model was discarded owing to the following disadvantages:

1. System complexity
2. Lack of structural independence.

Entity-relationship Model

It is one of the most widely accepted graphical data modelling tools. It represents data as entities (e.g., customers, accounts, and bank branch) & their relationships (e.g., account 23456 is held by Reetesh) in a database. A relationship set depositor associates customers with accounts. It complements the relational model concepts. The database design in the E-R model is usually converted into the relational model that is used for storage & processing. E-R models are normally represented in an Entity-Relationship Diagram (ERD). In these diagrams, an entity is represented by a rectangle; a diamond connected to the related entities defines a relationship. Each entity is also described by a set of attributes. An attribute describes a particular characteristic of the entity.

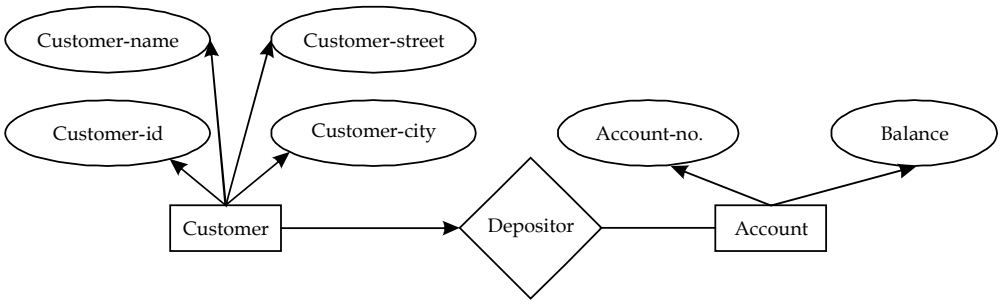
The advantages of the ER model are:

1. Exceptional conceptual simplicity
2. Visual representation

Notes

3. Effective communication tool
4. Integrated with the relational database model.

Figure 8.7: ER Model



However, this model suffers from serious limitations:

1. Limited constraint representation
2. Limited relationship representation
3. No data manipulation language
4. Loss of information content

Self Assessment

Fill in the blanks:

6. A ..... database contains multiple tables, each similar to the one in the "flat" database model.
7. ..... is a simple and powerful query language that is capable of answering simple to most complex queries.
8. ..... is the analysis of data objects that are used in a business or other context and the identification of the relationships among these data objects.
9. A set represents a ..... relationship between the owner & the member.

8.4 Database on the Web

Traditionally databases were available to users with login access to the CDS server itself or by means of Client/Server software. More recently we have been able to provide an increasing number of systems directly via the CDS website.

8.4.1 Web Database

A web database is a database for the internet. You can get access to your data via the internet from anywhere in the world or you can create a database driven website by using such databases. A web database stores large amount of information in an organized format that is easily accessible from scripting languages (like PHP).

In web databases, modifications can be performed without any hassles. That makes the dense editing of the html code obsolete.

Notes

Did u know? Repeated types of data, such as contact information, can be generated automatically in your website through a web database.

8.4.2 Daffodil DB: A Web Database

Daffodil DB is a SQL-99 and JDBC standards compliant Java RDBMS. It is the first Java database that is compatible with PHP. With the release of PHP extension module, Daffodil DB has joined the select list of Java enabled web databases.

Daffodil DB is an ideal for anyone who is looking for a web database. It can be embedded within any application and delivers high performance with minimum system resource usage - thereby striking the right balance between size, features, and performance. At less than 3 MB, Daffodil DB is a small/compact database.

Daffodil DB can run virtually on any platform as it supports all platforms for which a Java Virtual Machine (JVM) is available. These include Windows, Linux, Solaris, and UNIX. With the help of Daffodil DB, developers can build applications for any platform and these can be compiled and delivered on all other major platforms.

Task Discuss the use of ER model.

8.4.3 PHP

PHP (Hypertext Preprocessor) is an open source server-side scripting language that is particularly suited for web development and can be used to generate dynamic web content.

PHP scripts are embedded within web pages along with HTML, similar to other web scripting languages, such as Microsoft's ASP or Sun Microsystems's JSP. Like ASP and JSP, PHP runs on a web server (rather than on the Web browser or other client) when a page is requested via HTTP.

PHP enables you to insert instructions into your Web pages, which your Web server software (be it Apache, Personal Web Server, or whatever) executes before sending it to a browser that requests them.

PHP is easy to use for web development because it has been designed from the onset for the web environment. PHP has many built-in functions that make web programming simpler, so that programmers can focus on the logic of programming without wasting precious development time.

PHP as a language has its own way of doing things, and it has borrowed features from other languages. Moreover, PHP is cross platform means it allows you to develop/use your solution on multiple OSs.

PHP is one of the fastest growing server side scripting languages and you need to add it to your current arsenal of Perl, ASP, JSP, JavaScript, VBScript, and Java.

Notes For many people, the main reason for learning a scripting language like PHP is because of the interaction with databases it can offer.

Notes

8.4.4 PHP and Daffodil DB: Together?

Daffodil has come up with a PHP extension module that makes Daffodil DB/One$DB compatible with PHP. It is a database extension module driver that is required to work with Daffodil DB in PHP. This extension module uses the capabilities of a Java database and extends it to your web infrastructure.

By using this extensive module, PHP developers can create sophisticated data-driven web applications having Daffodil DB as a web database in a fraction of the time and with reduced cost.

PHP extension for Daffodil DB provides a simple, yet effective means for connecting to Daffodil DB within PHP. JVM is created using JNI invocation interface and everything runs in-process.

This PHP Extension module boosts open source activities around Daffodil DB. Moreover, open Source stack -Linux, Apache, One$DB, and PHP; all being open source products give an ultimate combination to web development community.

PHP is platform independent and Daffodil DB is also platform independent. PHP is free and Daffodil DB is also free (having open source version). So What about using the powers of two most promising technologies, PHP and Daffodil DB together?

The capabilities of Daffodil DB and PHP can make up what must be the best blend for data-driven Websites on the globe.

Users can use PHP and the Daffodil DB database to access/store information on the web and include it into their website. By using PHP as a front-end and Daffodil DB as a back-end web database, users can benefit from huge savings on the licensing costs of commercial alternatives.

Here are some practical examples where PHP and Daffodil DB used together can do wonders.

Self Assessment

Fill in the blanks:

10. A ..... stores large amount of information in an organized format that is easily accessible from scripting languages.
11. ..... is an open source server-side scripting language that is particularly suited for web development and can be used to generate dynamic web content.
12. Daffodil DB can run virtually on any platform as it supports all platforms for which a ..... is available.

8.5 Data Warehousing

Data mining potential can be enhanced if the appropriate data has been collected and stored in a data warehouse. A data warehouse is a relational database management system (RDBMS) designed specifically to meet the needs of transaction processing systems. It can be loosely defined as any centralized data repository which can be queried for business benefits but this will be more clearly defined later. Data warehousing is a new powerful technique making it possible to extract archived operational data and overcome inconsistencies between different legacy data formats. As well as integrating data throughout an enterprise, regardless of location, format, or communication requirements it is possible to incorporate additional or expert information. It is,

The logical link between what the managers see in their decision support EIS applications and the company's operational activities.

—John McIntyre of SAS Institute Inc.

Notes

In other words, the data warehouse provides data that is already transformed and summarized, therefore making it an appropriate environment for more efficient DSS and EIS applications.

You should be able to know the data mining concept as well with the concept of data warehouse. Data mining is the process of extracting patterns from data. As more data are gathered, with the amount of data doubling every three years, data mining is becoming an increasingly important tool to transform these data into information. It is commonly used in a wide range of profiling practices, such as marketing, surveillance, fraud detection and scientific discovery.

While data mining can be used to uncover patterns in data samples, it is important to be aware that the use of non-representative samples of data may produce results that are not indicative of the domain. Similarly, data mining will not find patterns that may be present in the domain, if those patterns are not present in the sample being "mined". There is a tendency for insufficiently knowledgeable "consumers" of the results to attribute "magical abilities" to data mining, treating the technique as a sort of all-seeing crystal ball. Like any other tool, it only functions in conjunction with the appropriate raw material: in this case, indicative and representative data that the user must first collect.

Caution The discovery of a particular pattern in a particular set of data does not necessarily mean that pattern is representative of the whole population from which that data was drawn.

Did u know? An important part of the data warehousing process is the verification and validation of patterns on other samples of data.

8.5.1 Characteristics of Data Warehouse

According to Bill Inmon, author of Building the data Warehouse and the guru who is widely considered to be the originator of the data warehousing concept, there are generally four characteristics that describe a data warehouse:

1. ***Subject Oriented:*** Data are organized according to subject instead of application, e.g., an insurance company using a data warehouse would organize their data by customer, premium, and claim, instead of by different products (auto, life, etc.). The data organized by subject contain only the information necessary for decision support processing.
2. ***Integrated:*** when data resides in many separate applications in the operational environment, encoding of data is often inconsistent. For instance, in one application, gender might be coded as "m" and "f" in another by 0 and 1. When data are moved from the operational environment into the data warehouse, they assume a consistent coding convention, e.g., gender data is transformed to "m" and "f".
3. ***Time-variant:*** The data warehouse contains a place for storing data that are five to 10 years old, or older, to be used for comparisons, trends, and forecasting. These data are not updated.
4. ***Non-volatile:*** Data are not updated or changed in any way once they enter the data warehouse, but are only loaded and accessed.

Notes

8.5.2 What is a Data Warehouse?

Data warehouse provides architectures and tools for business executives to systematically organise, understand, and use their data to make strategic decisions. In the last several years, many firms have spent millions of dollars in building enterprise-wide data warehouses as it is assumed a way to keep customers by learning more about their needs.

In simple terms, a data warehouse refers to a database that is maintained separately from an organisation's operational databases. Data warehouse systems allow for the integration of a variety of application systems. They support information processing by providing a solid platform of consolidated, historical data for analysis.

According to W.H. Inman, a leading architect in the construction of data warehouse systems, "a data warehouse is a subject-oriented, integrated, time-variant, and nonvolatile collection of data in support of management's decision making process." The four keywords, subject-oriented, integrated, time-variant, and non-volatile, distinguish data warehouses from other data repository systems, such as relational database systems, transaction processing systems, and file systems. Let us understand the four key words in more detail as follows:

1. ***Subject-oriented:*** A data warehouse focuses on the modeling and analysis of data for decision makers. Therefore, data warehouses typically provide a simple and concise view around particular subject issues by excluding data that are not useful in the decision support process. For example, a typical data warehouse is organised around major subjects, such as customer, vendor, product, and sales rather than concentrating on the day-to-day operations and transaction processing of an organisation.
2. ***Integrated:*** As the data warehouse is usually constructed by integrating multiple heterogeneous sources, such as relational databases, flat files, and on-line transaction records, the data cleaning and data integration techniques need to be applied to ensure consistency in naming conventions, encoding structures, attribute measures, and so on.
3. ***Time-variant:*** Data are stored to provide information from a historical perspective (e.g., the past 5-10 years). Every key structure in the data warehouse contains, either implicitly or explicitly, an element of time.
4. ***Non-volatile:*** A data warehouse is always a physically separate store of data transformed from the application data found in the operational environment. Due to this separation, a data warehouse does not require transaction processing, recovery, and concurrency control mechanisms. It usually requires only two operations in data accessing: initial loading of data and access of data.

8.5.3 Use of Data Warehouses in Organizations

Many organisations are creating data warehouse to support business decision-making activities for the following reasons:

1. To increasing customer focus, which includes the analysis of customer buying patterns (such as buying preference, buying time, budget cycles, and appetites for spending),
2. To reposition products and managing product portfolios by comparing the performance of sales by quarter, by year, and by geographic regions, in order to fine-tune production strategies,
3. To analysing operations and looking for sources of profit, and
4. To managing the customer relationships, making environmental corrections, and managing the cost of corporate assets,

Notes

5. Data warehousing is also very useful from the point of view of heterogeneous database integration. Many organisations typically collect diverse kinds of data and maintain large databases from multiple, heterogeneous, autonomous, and distributed information sources.

Query Driven Approach versus Update Driven Approach for Heterogeneous Database Integration

For heterogeneous database integration, the traditional database implements query-driven approach, which requires complex information filtering and integration processes, and competes for resources with processing at local sources. It is inefficient and potentially expensive for frequent queries, especially for queries requiring aggregations.

In query-driven approach, data warehousing employs an update-driven approach in which information from multiple, heterogeneous sources is integrated in advance and stored in a warehouse for direct querying and analysis. In this approach, a data warehouse brings high performance to the integrated heterogeneous database system since data are copied, preprocessed, integrated, annotated, summarized, and restructured into one semantic data store. Furthermore, query processing in data warehouses does not interfere with the processing at local sources. Moreover, data warehouses can store and integrate historical information and support complex multidimensional queries. As a result, data warehousing has become very popular in industry.

Differences between Operational Database Systems and Data Warehouses

The first major stepping stone in understanding Data Warehousing is to grasp the concepts and differences between the two overall database categories. The type most of us are used to dealing with is the On Line Transactional Processing (OLTP) category. The other major category is On Line Analytical Processing (OLAP).

OLTP is what we characterise as the ongoing day-to-day functional copy of the database. It is where data is added and updated but never overwritten or deleted. The main needs of the OLTP operational database being easily controlled insertion and updating of data with efficient access to data manipulation and viewing mechanisms. Typically only single record or small record-sets should be manipulated in a single operation in an OLTP designed database. The main thrust here is to avoid having the same data in different tables. This basic tenet of Relational Database modeling is known as "normalising" data.

OLAP is a broad term that also encompasses data warehousing. In this model data is stored in a format, which enables the efficient creation of data mining/reports. OLAP design should accommodate reporting on very large record sets with little degradation in operational efficiency. The overall term used to describe taking data structures in an OLTP format and holding the same data in an OLAP format is "Dimensional Modeling" It is the primary building block of Data Warehousing.

The major distinguishing features between OLTP and OLAP are summarised as follows:

Notes

Figure 8.8: Major Characteristics Features of OLTP and OLAP

Feature	OLTP System	OLAP System
Characteristic	Operational Processing	Informational Processing
Users	Clerks, clients, and information technology professionals.	Knowledge workers, including managers, executives, and analysts.
System orientation	Customer oriented and used for transaction and query processing Day to day operations	*Market-oriented and* used for data analysis long term informational requirements, decision support.
Data contents	Manages current data that typically, are too detailed to be easily used for decision making.	Manages large amounts of historical data, provides facilities for summarisation and aggregation, and stores and manages information at different levels of granularity.
Database design	Adopts an entity-relationship (ER) data model and an application-oriented database design	Adopts either a *star* or *snowflake* model and a subject-oriented database design.
View	Focuses mainly on the current data within an enterprise or department, without referring to historical data or data in different organisations.	In contrast, an OLAP system often spans multiple versions of a database schema, due to the evolutionary process of an organisation. OLAP systems also deal with information that originates from different organisations, integrating information from many data stores.
Volume of data	Not very large	Because of their huge volume, OLAP data are stored on multiple storage media.
Access patterns	Consists mainly of short, atomic transactions. Such a system requires concurrency control and recovery mechanisms.	Accesses to OLAP systems are mostly read-only operations (since most data warehouses store historical rather than up-to-date information), although many could be complex queries.
Access mode	Read/write	Mostly write
Focus	Data in	Information out
Operations	Index/hash on primary key	Lots of scans
Number of records accessed	Tens	Millions
Number of users	Thousands	Hundreds
DB size	100 MB to GB	100 GB to TB
Priority	High performance, high availability	High flexibility, end-user autonomy
Metric	Transaction throughput	Query response time

Task Discuss the characteristics of data warehouse.

8.5.4 Need to Build a Data Warehouse

You know that data warehouse queries are often complex. They involve the computation of large groups of data at summarized levels and may require the use of special data organization, access, and implementation methods based on multidimensional views. Processing OLAP queries in operational databases would substantially degrade the performance of operational tasks. Moreover, an operational database supports the concurrent processing of several transactions as well recovery mechanism such as locking and logging to ensure the consistency and robustness of transactions. An OLAP query often needs read-only access of data records for summarization and aggregation. Concurrency control and recovery mechanisms, if applied for such OLAP operations, may jeopardize the execution of concurrent transactions and thus substantially reduce the throughput of an OLTP system.

Self Assessment

Fill in the blanks:

13. A ..... is a relational database management system (RDBMS) designed specifically to meet the needs of transaction processing systems.

Notes

14. ..... is the process of extracting patterns from data.

15. The overall term used to describe taking data structures in an OLTP format and holding the same data in an OLAP format is "..... "

Case Study

Data Warehousing: A Strategic Tool

Datawarehouse is a massive independent business database system that is populated with data that has been extracted from a range of sources. The data is held separately from its origin and is used to help to improve the decision-making process.

Many traditional Databases are involved in recording day to day operational activities of the business, called Online Transaction Processing (OLTP), commonly implemented in Airline Bookings & Banking Systems, for fasters response and better control over data.

After establishment of OLTP Systems, reports and summaries can be drawn for giving inputs to decision-making process and this process is called Online Analytical Processing (OLAP).

For better customer relationships management strategy, the call centres and datawarehouses must be fully integrated. Datawarehouse works as a strategic tool for decision-support which requires lot of time for establishment, and needs to be updated with operational information on daily weekly or monthly basis.

Datawarehouse is used for proactive strategies formulation in critical & complex situations. A number of CRM vendors are advocating for single integrated customer database which includes call centre, web sites, branches and direct mail, but it lacks in analytical functioning of datawarehouse. This Database can't be expanded also, and carry decision support operations on call centre Database becomes slow & the query processing and inquiries handling operations also become slow & inefficient for agents dealing with customers.

Datawarehouse is must for identifying most profitable & loyal customers and those customers can be offered better customized services which increases the chances of additional profits.

Although call centre systems & datawarehouses are altogether different systems yet dependant on each other to fully exploit their potential respectively.

Questions:

1. Explain OLTP & OLAP processes with their respective advantages.
2. How the response time in performing OLAP queries can be improved?
3. Explain the importance of regular updation of data in a datawarehouse.
4. Explain the role of datawarehousing in the functioning of a call centre.
5. "Datawarehouse works as a strategic tool for decision support". Comment.

Source: Dharmendra and Sangeeta Gupta, *Management Information System*, Excel Books, New Delhi.

Notes

8.6 Summary

- A database is a collection of data, which is organized in a way that allows for easy data retrieval and manipulation.
- The file processing system relied on the piecemeal approach of data across the organization where every functional unit like marketing, finance, production, etc. used to maintain their own set of application programs and data files.
- Unlike a file processing system, data redundancy and data inconsistency in the database system approach are minimized.
- A database model or database schema is the structure or format of a database, described in a formal language supported by the database management system.
- A relational database contains multiple tables, each similar to the one in the "flat" database model.
- The object-oriented paradigm has been applied to database technology, creating a new programming model known as object databases.
- SQL is a simple and powerful query language that is capable of answering simple to most complex queries.
- Data modelling is the analysis of data objects that are used in a business or other context and the identification of the relationships among these data objects.
- A web database is a database for the internet. You can get access to your data via the internet from anywhere in the world or you can create a database driven website by using such databases.
- A data warehouse is a relational database management system (RDBMS) designed specifically to meet the needs of transaction processing systems.

8.7 Keywords

Data Model: A conceptual framework that defines the logical relationships among the data elements needed to support a basic business or other process.

Data Modeling: A process where the relationships between data elements are identified and defined to develop data models.

Data Warehouse: An integrated collection of data extracted from operational, historical, and external databases, and screened, edited, and standardized for retrieval and analysis to provide business intelligence for managerial decision making.

Data: Facts or observations about physical phenomena or business transactions. More specifically, data are objective measurements of the attributes (characteristics) of entities such as people, places, things, and events.

Database Administrator: A specialist responsible for maintaining standards for the development maintenance, and security of an organization's databases.

Database Management System (DBMS): A set of computer programs that controls the creation, maintenance, and utilization of the databases of an organization.

Database: A collection of logically related records or files. A database consolidates many records previously stored in separate files so that a common pool of data records serves many applications.

Notes

8.8 Review Questions

1. Find at least five e-Business websites that are connected to database management systems. (***Hint:*** look for something that indicates it is retrieving business data.)
2. Assume that you need to buy a DBMS for a midsize company. Research the components needed and the approximate cost of at least two database management systems.
3. List and describe some of the problems of the traditional file environment.
4. Why is file management important for overall system performance?
5. Contact the librarian of your institution. Determine the scope of information available to library users. How many different files are maintained? What DBMS is being used? Document the benefits that have resulted from the use of the DBMS, if not already in use. How extensively is the database used?
6. How would you differentiate between hierarchical and network data models.
7. Describe the concept of data modeling in detail with suitable example.
8. What are the advantages of database approach over traditional database?
9. What do you mean by data warehousing? Also explain the characteristics of data warehouse.
10. Describe the various functions of database.

Answers: Self Assessment

1.	Database	2.	Software
3.	Data inconsistency	4.	Independent
5.	Minimized	6.	Relational
7.	SQL	8.	Data modelling
9.	1:M	10.	Web database
11.	PHP	12.	Java virtual machine (JVM)
13.	Data warehouse	14.	Data mining
15.	Dimensional modeling		

8.9 Further Readings

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Online link www.peterindia.net

Notes

Unit 9: The Wireless Revolution

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Objectives

After studying this unit, you will be able to:

- Understand the concept of Wireless Revolution
- Recognize Business Value
- Discuss WiMax, EVDO and M-commerce
- Explain Application in CRM
- Describe Applications in Supply Chain and Healthcare

Notes

Introduction

Wireless is everywhere these days from federal disaster areas to less-troubled climes like Philadelphia and San Francisco, both of which are planning low-cost or free city-wide wireless networks. And in fact, we're actually just at the beginning of the true wireless revolution as three technologies WiMAX, mesh networks and smart radios – converge to create a new generation of seamless networks that extend from your pocket and living room to your automobile and beyond.

The first big game-changer will be WiMAX, which can reach thirty miles or more, blanketing an entire region with an Internet connection as fast as or faster than currently available over telephone or cable lines.

WiMAX has competition, of course. Companies like Verizon, Sprint and Cingular are already rolling out high-speed Internet networks across the country and other telephone companies providers won't be far behind. The telephone folks have a head start – they've been planning 3G (third-generation) technology for years now. But they also have a big disadvantage: in the U.S., the carriers are adopting incompatible systems – Verizon broadband.

Example: Can't use the same equipment as Sprint broadband. WiMAX, on the other hand, is like Wi-Fi: a single standard supported by many brands of hardware.

9.1 Wireless Revolution

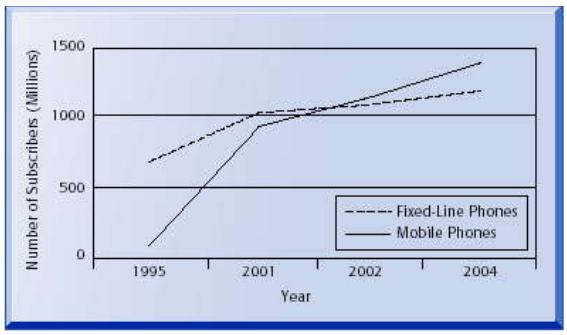
Mobile phones have become mobile platforms for delivering digital data, used for recording and downloading photos, video and music, Internet access, and transmitting payments.

An array of technologies provides high-speed wireless access to the Internet for PCs and other wireless handheld devices and cell phones.

Businesses increasingly use wireless to cut costs, increase flexibility, and create new products and services.

Small entrepreneurs provide Internet and voice services within their own communities by purchasing inexpensive basic radio equipment and transmitting on unlicensed frequencies. Collections of these local operators, collaborating (and interconnecting) with larger Internet and basic service operators, begin to weave together a patchwork of universal access where little or no telecommunications services existed before. This access patchwork would be cheap, robust, and extremely responsive to innovation. While more has to be done to prove this model will be sustainable, recent experiments in India and elsewhere have been demonstrating that the basic approach is sound.

Figure 9.1: Mobile Versus Fixed-line Subscribers Worldwide



Notes

New and creative enterprises can make rural and poor markets profitable, affordable, sustainable and served in ways that meet national and local development objectives. But this requires innovation, advanced technology and creative business and public policies. In order to make universal access profitable – and in order for this wireless revolution to truly take off for these communities – several critical innovations are necessary, including the following:

1. ***New and low-cost technologies, especially terrestrial wireless infrastructure:***Per-line costs, and prices for subscriber premises equipment, can and should be brought down, by an order of magnitude, from thousands to hundreds of dollars.
2. ***Micro and small enterprises that provide locally tailored value-added services:*** A broad basket of value-added services flowing from community-based ICT facilities can ensure revenue flows and create value to the community.
3. ***Supportive public policy:*** Policy-makers must view rural and universal access as drivers of development and not sources of government revenue. In particular, spectrum license exemptions can allow for low entry barriers for small entrepreneurs.

9.1.1 Wireless Network Technologies

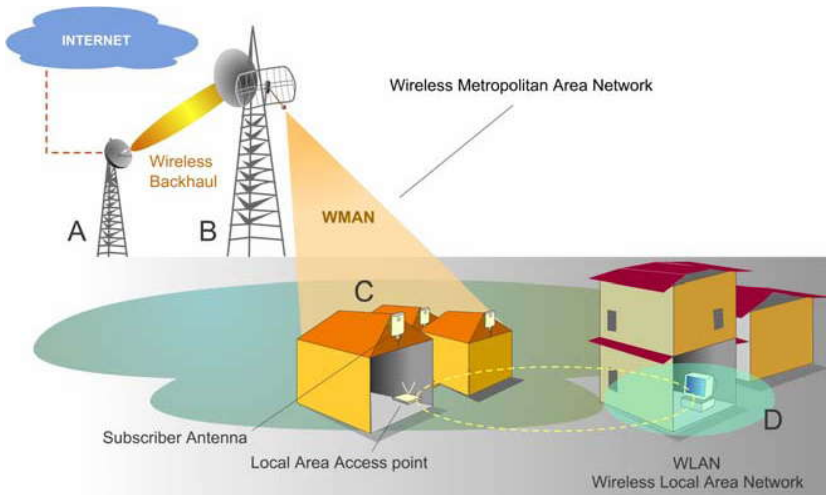
The Network Standards

A central requirement for profitability in the context of universal access is that capital costs for network construction and user equipment is low. The good news is that new technologies – especially in the terrestrial wireless domain – are dramatically driving down these costs.

In order to understand current wireless technologies it is necessary to first appreciate some of the basic concepts. Consider a hypothetical wireless network installation, as depicted in Figure 9.2. This schematic drawing shows two radio towers (A and B), houses and other buildings (C), and a personal computer inside a building (D). Radio tower A is connected through a wireline link to an Internet point of presence owned by an Internet service provider. So the PC shown at point D ultimately is connected to the Internet by several wireless links.

Each of these wireless links illustrates important differences in the way radio technologies can be deployed. The link from radio tower A to tower B is a point-to-point connection, because it supports just a single radio and antenna on either side of the link. A point-to-point radio connection is a bit like a spotlight; it is a highly focused beam of radiation.

Figure 9.2: Connectivity in Wireless Networks



On radio tower B, below the point-to-point connection to tower A, is a set of radios and antennas that establish a point-to-multipoint connection. Tower B serves as a single point on a link, but it emits a broad sweep of radiation that covers an entire area around it, including all of the buildings marked C. A point-to-multipoint connection will use one or more broad coverage antennas at the hub side (at tower B) and very focused antennas at the multiple subscriber points (buildings marked C). A point-to-multipoint connection, then, is a bit like a theatrical light with a broad beam emitting from the hub.

Finally, the picture envisions a radio connection between the subscriber equipment mounted on the side of the building (point C) and the individual personal computer inside the building (point D). Here, an access point emits radiation throughout the interiors of the building, allowing all personal computers outfitted with a simple wireless network interface card to connect to the access point – and ultimately, back up the chain to the Internet. Continuing the lighting-fixture metaphor, an access point is a bit like a standard incandescent light bulb, but without any sort of lampshade or focus. It lights up the entire room but cannot travel the distances of a spotlight or theatrical light.

With this simple illustration in mind, it is possible to apply some of today's common wireless terms. The access point inside the building is providing what is called a Wireless Local Area Network (WLAN) connection. The point-to-multipoint connection from tower B to the buildings marked C is often referred to as a Wireless Metropolitan Area Network (WMAN) connection, which necessarily covers more area than a WLAN. And the point-to-point connection from towers B to A can be called a wireless backhaul. As one moves from WLANs to WMANs and then to backhaul systems, the use of more intensely focused microwave radiation allows transmission over greater distances. It can also diminish the chances of interference and reduce the necessary power emitted. Further down the network, toward the less-focused end, WLANs and point-to-multipoint WMAN deployments allow multiple subscribers to share the same hub. They also support greater flexibility and mobility and can be easier to install.

Notes Discuss the main purpose of wireless revolution.

Self Assessment

Fill in the blanks:

1. The ..... point inside the building is providing what is called a Wireless Local Area Network (WLAN) connection.
2. WLANs and point-to-multipoint WMAN deployments allow multiple subscribers to share the same .....

9.2 Business Value

Information system can have several different values for business firms, a consistently strong information technology infrastructure can over the long-term, play an important strategic role in the life of the firm. Considered less grandly, information systems can simply facilitate a firm's survival.

It is important also to realize that systems can have value but that the firm may not capture all or even some of the value. Although system projects can result in firm benefits such as profitability and productivity some or all of the benefits can go directly to the consumer in the form of lower prices or more reliable services and products. Society can reward firms that enhance consumer surplus by allowing them to survive or by rewarding them with increase in business revenues.

Notes

But from a management point of view, the challenge is to retain as much of the benefit of systems in vestments as is feasible in current market conditions.

The worth of systems from a financial perspective essentially revolves around the question of return on invested capital. The value of systems comes down to one questions: Does a particular IS investment produce sufficient returns to justify its costs? There are many problems with this approach, not the least of which is how to estimate benefits and count the costs. The business values of wireless networking are:

1. Wireless communication helps businesses easily stay in touch with customers, suppliers, and employees.
2. Wireless networking increases worker productivity and output, as workers take less time to establish contact with people and to access information.
3. Companies can save on wiring offices, moving, and making network changes by using wireless networks.
4. Wireless technology has also been the source of new products, services, and sales channels in a variety of industries, e.g. OnStar, Starbucks "hot spots".

Self Assessment

Fill in the blanks:

3. The worth of systems from a ..... perspective essentially revolves around the question of return on invested capital.
4. ..... communication helps businesses easily stay in touch with customers, suppliers, and employees.

9.3 WIMAX

WiMAX is a wireless digital communications system also known as IEEE 802.16, that is intended for wireless "metropolitan area networks". WiMAX can provide broadband wireless access up to 30 miles (50 km) for fixed stations, and 3 - 10 miles (5 - 15 km) for mobile stations. In contrast, the WiFi/802.11 wireless local area network standard is limited in most cases to only 100 - 300 feet (30 - 100 m).

With WiMAX, WiFi like data rates are easily supported, but the issue of interference is lessened. WiMAX operates on both licensed and non-licensed frequencies, providing a regulated environment and viable economic model for wireless carriers.

WiMAX can e used for wireless networking in must the same way as the more common WiFi protocol. WiMAX is a second generation protocol that allows for more efficient bandwidth use interference avoidance and is intended to allow higher data rates over longer distances.

The IEEE 802.16 standard define the technical features of the communications protocol. The WiMAX Forum offers a means of testing manufactures's equipment for compatibility as well as an industry group dedicated to fostering the development and commercialization of the technology.

WiMAX is defined as "Worldwide Interoperability for Microwave Access" by the WiMAX Forum, formed in June 2001 to promote conformance and interoperability of the IEEE 802.16 standard, officially known as Wireless MAN. The Forum describes WiMAX as "a standards-based technology enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL".

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"WiMAX is not a technology, but rather a certification mark, or 'stamp of approval' given to equipment that meets certain conformity and interoperability tests for the IEEE 802.16 family of standards. A similar confusion surrounds the term Wi-Fi, which like WiMAX, is a certification mark for equipment based on a different set of IEEE standards from the 802.11 working group for wireless local area networks (WLAN). Neither WiMAX, nor Wi-Fi is a technology but their names have been adopted in popular usage to denote the technologies behind them. This is likely due to the difficulty of using terms like 'IEEE 802.16' in common speech and writing."

The bandwidth and reach of WiMAX make it suitable for the following potential applications:

1. Connecting Wi-Fi hotspots with each other and to other parts of the Internet.
2. Providing a wireless alternative to cable and DSL for last mile (last km) broadband access.
3. Providing high-speed mobile data and telecommunications services (4G).
4. Providing a diverse source of Internet connectivity as part of a business continuity plan. That is, if a business has a fixed and a wireless internet connection they are unlikely to be affected by the same service outage.
5. Providing Nomadic connectivity.

Did u know? **Full form of WiMAX**

Worldwide Interoperability for Microwave Access

9.3.1 Broadband Access

Many companies are closely examining WiMAX for "last mile" connectivity at high data rates. This could result in lower pricing for both home and business customers as competition lowers prices.

In areas without pre-existing physical cable or telephone networks, WiMAX will, it appears, be a viable alternative for broadband access that has been economically unavailable. Prior to WiMax, many operators have been using proprietary fixed wireless technologies for broadband services.

WiMAX subscriber units are available in both indoor and outdoor versions from several manufacturers. Self install indoor units are convenient, but the subscriber must be significantly closer to the WiMAX base station than with professionally installed units. As such, indoor installed units require a much higher infrastructure investment as well as operational cost (site lease, backhaul, maintenance) due to the high number of base stations required to cover a given area. Indoor units are comparable in size to a cable modem or DSL modem. Outdoor units allow for the subscriber to be much further away from the WiMAX base station, but usually require professional installation. Outdoor units are roughly the size of a textbook, and their installation is comparable to a residential satellite dish.

9.3.2 Limitations

A commonly held misconception is that WiMAX will deliver 70 Mbit/s, over 70 miles (112.6 kilometers). Each of these is true individually, given ideal circumstances, but they are not simultaneously true. In practice this means that in Line of sight environments you could deliver symmetrical speeds of 10Mbps at 10Km but in Urban Environments it is more likely that 30% of installations may be Non Line of sight and therefore Users may only receive 10Mbps over 2 Km. WiMAX has some similarities to DSL in this respect, where one can either have high bandwidth

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or long reach, but not both simultaneously. The other feature to consider with WiMAX is that available bandwidth is shared between users in a given radio sector, so if there are many active users in a single sector, each will get reduced bandwidth. However, unlike SDSL where contention is very noticeable at a 5:1 ratio if you are sharing your connection with a large media firm for example WiMax does not have this problem. Typically each cell has a 100 Mbps backhaul so there is no contention here. On the radio side in practice many users will have a range of 2, 4, 6, 8 or 10 Mbps services and the bandwidth can be shared. If the network becomes busy the business model is more like GSM or UMTS than DSL in that it is easy to predict the capacity requirements as you sign more customers and additional radio cards can be added on the same sector to increase the capacity.

Notes **How WiMax differ from Wi-Fi?**

Comparing WiMax to WiFi is akin to comparing apples to oranges. Initially it's easy to see why the comparison would exist, as most people think WiMax is merely a more robust version of WiFi. Indeed they are both wireless broadband technologies, but they differ in the technical execution and ultimately their business case is very different. In addition to the technical differences that exist, the marketplace difference is that equipment is more or less non-existent for WiMax and certainly not geared towards a residential environment with very high pricing to be expected. It will take at least 2 years to see equipment of mass market uptake pricing.

WiMax will not be commercially available until the second half of 2005, and even then at a very controlled level. This is primarily due to standardization issues. In fact, it won't be until 2006 that a robust production and implementation will happen due to the ramp-up period for manufacturers. This is certainly one challenge to the widespread adoption of WiMax. Additionally, WiMax will have issues of pricing, and will remain far more expensive than WiFi. WiMax will be primarily adopted by businesses to replace or displace DSL, and offices that want to cover a lot of territory without entering the world of endless repeaters that are necessary with the 802.11 technologies.

Notes It will take some time (2 years) for WiMax to significantly reduce its price-point for residential uptake. WiMax will not displace WiFi in the home because WiFi is advancing in terms of speed and technology. Each year brings a new variant to the 802.11 area with various improvements.

Self Assessment

Fill in the blanks:

5. ..... is a wirless digital communications system also known as IEEE 802.16, that is intended for wireless "metropolitan area networks".
6. In areas without pre-existing physical cable or telephone networks, WiMAX will, it appears, be a viable alternative for ..... that has been economically unavailable.

9.4 EVDO

Evolution-Data Optimized or Evolution-Data only, abbreviated as EV-DO or EVDO and often EV, is a telecommunications standard for the wireless transmission of data through radio signals,

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typically for broadband Internet access. It uses multiplexing techniques including code division multiple access (CDMA) as well as time division multiple access (TDMA) to maximize both individual user's throughput and the overall system throughput. It is standardized by 3rd Generation Partnership Project 2 (3GPP2) as part of the CDMA2000 family of standards and has been adopted by many mobile phone service providers around the world – particularly those previously employing CDMA networks. It is also used on the Globalstar satellite phone network.

EV-DO was designed as an evolution of the CDMA2000 (IS-2000) standard that would support high data rates and could be deployed alongside a wireless carrier's voice services. An EV-DO channel has a bandwidth of 1.25 MHz, the same bandwidth size that IS-95A (IS-95) and IS-2000 (1xRTT) use. The channel structure, on the other hand, is very different. Additionally, the back-end network is entirely packet-based, and thus is not constrained by the restrictions typically present on a circuit switched network.

The EV-DO feature of CDMA2000 networks provides access to mobile devices with forward link air interface speeds of up to 2.4 Mbit/s with Rev. 0 and up to 3.1 Mbit/s with Rev. A. The reverse link rate for Rev. 0 can operate up to 153 kbit/s, while Rev. A can operate at up to 1.8 Mbit/s. It was designed to be operated end-to-end as an IP based network, and so it can support any application which can operate on such a network and bit rate constraints.

EVDO, also known as EV-DO, 1xEvDO and 1xEV-DO, is a standard for high speed wireless broadband. The acronym is short for "Evolution, Data Only" or "Evolution, Data Optimized". The official name, defined by the Telecommunication Industry Association, is "CDMA2000, High Rate Packet Data Air Interface". It is one of two major Third Generation, or 3G, wireless standards. The competing standard is known as W-CDMA.

3G is designed to provide voice and high-speed mobile data using the cellular approach already proven to work in mobile phone networks. The biggest obstacle to implementing high speed wireless networks is the lack of bandwidth, or range of usable frequencies. Just as only so many radio stations can be squeezed onto the FM dial, only so much data can be transmitted across the available bandwidth. EVDO is an advanced CDMA technology developed by Qualcomm to deal with this limitation.

CDMA, Code Division Multiple Access, uses advanced mathematical techniques to allow multiple wireless devices to transmit simultaneously on the same frequency. Every device, such as a cell phone, is assigned a unique mathematical signature. It applies this signature to the original signal and transmits the modified signal. A receiver applies the inverse of the mathematical operation to recover the original signal.

Traditional wireless networks create a physical path between receiving and sending devices, much like traditional telephone networks. EVDO instead adopts the same approach used for the internet. IP, the Internet Protocol, breaks data into small pieces called packets. Each packet is sent independently of all the other packets. This saves bandwidth for use by other devices; when neither party on a phone call is speaking, the connection consumes no bandwidth because there are no packets to send. Or, when an internet web site is accessed, no bandwidth is used until the site starts sending the web page.

EVDO has a theoretical throughput of 2.4 megabits per second. This is as fast as many residential DSL and cable broadband connections currently available in the United States. Qualcomm has produced impressive demonstrations of EVDO's capabilities; in one, a video conference was conducted with a participant traveling in a car at 60 miles per hour (96 km/hour). In another demonstration, a phone call was placed from a bullet train moving in excess of 150 miles per hour (240 km/hour).

A significant advantage of EVDO over competing technologies is that it uses the same broadcasting frequencies as existing CDMA networks. As purchasing spectrum from regulatory agencies is

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extremely expensive, this brings down the cost of building and using the new networks. The major EVDO deployments in the US are by Verizon and Sprint, and there is also a large network in Korea. At present, EVDO has not made significant impact in Europe or other major Asian markets; W-CDMA is the 3G standard of choice in those regions.

Task Discuss how Wi-MAX is more powerful in comparison to a normal network.

9.4.1 First Sight of EVDO

1. EV-DO - Evolution Data Optimized.
2. EVDO is a Personal broadband wireless service for a wide range of customers, from business people to students.
3. EVDO can be Always on – similar to DSL (wherever EVDO capability is available).
4. Rides on CDMA signal- 1x data capability available everywhere CDMA voice service available.
5. Up to 10 times the peak data rate of the next best public wireless solution - 500 to 2,400 Kbps average (kilobits per second) comparable to DSL speeds.
6. EVDO allows the user to be connected wherever they are not only for email, but for downloads, large files, photos, spreadsheets, etc.
7. EVDO Users can work on a large variety of applications, including the MS Office Suite and others, so they can do business anywhere! Access mission-critical documents and information wherever they are.
8. EVDO available within the provider's wireless network.
9. EVDO gives plug and play of business functions, games and Internet access anywhere!
10. Customer voice and data experience should become seamless.
11. EVDO Advantages over WiFi:
    (a) Always on with seamless roaming!
    (b) Signal can travel on same cell sites as cell phones
    (c) No 300-ft range from the cell tower or hot spot
    (d) Customers can access their corporate VPN (virtual private network) anywhere they can get a cellular signal via a secure, encrypted signal
    (e) Can download and run video clips in real time
    (f) Can provide service to customers outside of cable-modem or DSL areas.
12. Relatively low cost with high capacity - allows rich web browsing and application usage.
13. 1xRTT 50Kbps - 100Kbps Upload and Download, bursts to 144Kbps.
14. EVDO Rev 0 400kbps-700kbps Download, bursts up to 2.4Mbps, 50kbps-100kbps Upload Speed, bursts to 144Kbps.
15. EVDO Rev A 500Kbps-1,000Kbps Download, bursts to 3.0Mbps, 300Kbps-400Kbps Upload Speed, bursts to 1.8Mbps.

Self Assessment

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Fill in the blanks:

7. ..... is a telecommunications standard for the wireless transmission of data through radio signals, typically for broadband Internet access.

8. ..... uses advanced mathematical techniques to allow multiple wireless devices to transmit simultaneously on the same frequency.

9.5 M-commerce

M-commerce (mobile commerce) is the buying and selling of goods and services through wireless handheld devices such as cellular telephone and Personal Digital Assistants (PDAs). Known as next-generation e-commerce, m-commerce enables users to access the Internet without needing to find a place to plug in. The emerging technology behind m-commerce, which is based on the Wireless Application Protocol (WAP), has made far greater strides in Europe, where mobile devices equipped with Web-ready micro-browsers are much more common than in the United States.

In order to exploit the m-commerce market potential, handset manufacturers such as Nokia, Ericsson, Motorola, and Qualcomm are working with carriers such as AT&T Wireless and Sprint to develop WAP-enabled smart phones, the industry's answer to the Swiss Army Knife, and ways to reach them. Using Bluetooth technology, smart phones offer fax, e-mail, and phone capabilities all in one, paving the way for m-commerce to be accepted by an increasingly mobile workforce.

As content delivery over wireless devices becomes faster, more secure, and scalable, there is wide speculation that m-commerce will surpass wireline e-commerce as the method of choice for digital commerce transactions. The industries affected by m-commerce include:

1. Financial services, which includes mobile banking (when customers use their handheld devices to access their accounts and pay their bills) as well as brokerage services, in which stock quotes can be displayed and trading conducted from the same handheld device.

2. Telecommunications, in which service changes, bill payment and account reviews can all be conducted from the same handheld device.

3. Service/retail, as consumers are given the ability to place and pay for orders on-the-fly.

4. Information services, which include the delivery of financial news, sports figures and traffic updates to a single mobile device.

Mobile Commerce (also known as M-Commerce, mCommerce or U-Commerce, owing to the ubiquitous nature of its services) is the ability to conduct commerce, using a mobile device e.g. a mobile phone (cell phone), a PDA, a smartphone and other emerging mobile equipment such as dashtop mobile devices. Mobile Commerce has been defined as follows:

"Mobile Commerce is any transaction, involving the transfer of ownership or rights to use goods and services, which is initiated and/or completed by using mobile access to computer-mediated networks with the help of an electronic device."

Did u know? **Full form of WAP**

Wireless Application Protocol

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9.5.1 Future of M-commerce

The futures of mobile commerce are:

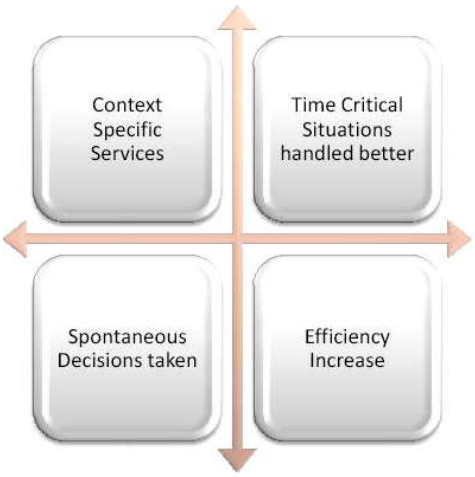
1. ***Ubiquity:*** It means that the user can avail of services and carry out transactions largely independent of his current geographic location.
2. ***Immediacy:*** It provides real-time availability of services.
3. ***Localization:*** Location based services such as GPS, allow companies to offer goods and services to the user specific to his current location.
4. ***Instant connectivity:*** This feature brings convenience to the user, due to introduction of services like GPRS which keeps users always in touch and connected.
5. ***Simple authentication:*** Mobile telecommunication devices function with an electronic chip called SIM, which is easily identifiable. This in combination with an individual Personal Identification Number (PIN) makes the authentication process simple.

9.5.2 Specific Advantages of Mobile Commerce

The specific advantages of mobile commerce are:

1. ***Context-specific services:*** Mobile Commerce makes it possible to offer location based services, which are specific to a given context (e.g. time of the day, location and the interests of the user).
2. ***Time-critical situations:*** The ubiquity and immediacy of Mobile Commerce allows the user to perform urgent tasks in an efficient manner, irrespective of his current geographic location.
3. ***Spontaneous decisions and need:*** Spontaneous needs are not externally triggered and generally involve decisions that do not require a very careful consideration, e.g. purchase decisions involving small amounts of money.
4. ***Efficiency increase:*** Mobile Commerce helps increase the productivity of the workforce by increasing the efficiency of their daily routines. Time-pressured consumers (employees) can use 'dead spots' in the day, e.g. during the daily travel to and from workplace, more effectively.

Figure 9.3



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9.5.3 M-Commerce Services and Applications

Table 9.1

Types of Mobile Applications	Category	Examples
Mobile Financial Applications	B2C, B2B	Banking, brokerage and mobile payments
Mobile Advertising	B2C	Sending user-specific and location-specific advertisements
Mobile Office	B2C	Working from traffic jams, conferences, etc.
Mobile Inventory Management	B2B, B2C	Location tracking of goods, people, etc.
Wireless Data Center	B2B, B2C	Information downloaded by mobile users/vendors
Mobile Entertainment	B2C	Video on demand and other services
Mobile Distance Education	B2C	Taking a class using streaming audio and video
Product Shopping	B2C, B2B	Ordering items by a mobile device

Figure 9.4

Task Discuss the basic advantage or M-commerce to organization.

Self Assessment

Fill in the blanks:

9. ..... is the buying and selling of goods and services through wireless handheld devices such as cellular telephone and personal digital assistants (PDAs).

10. As content delivery over wireless devices becomes faster, more secure, and scalable, there is wide speculation that m-commerce will surpass wireline e-commerce as the method of choice for ..... commerce transactions.

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9.6 Application in CRM

CRM is a multifaceted process, mediated by a set of information technologies that focuses on creating two-way exchanges with customers so that firms have an intimate knowledge of their needs, wants, and buying patterns. In this way, CRM helps companies understand, as well as anticipate, the needs of current and potential customers. Functions that support this business purpose include sales, marketing, customer service, training, professional development, performance management, human resource development, and compensation. Many CRM initiatives have failed because implementation was limited to software installation without alignment to a customer-centric strategy.

It is a process or methodology used to learn more about customers' needs and behaviors in order to develop stronger relationships with them. There are many technological components to CRM, but thinking about CRM in primarily technological terms is a mistake. The more useful way to think about CRM is as a process that will help bring together lots of pieces of information about customers, sales, marketing effectiveness, responsiveness and market trends.

CRM helps businesses use technology and human resources to gain insight into the behavior of customers and the value of those customers.

There are many aspects of CRM which were mistakenly thought to be capable of being implemented in isolation from each other.

CRM is the philosophy, policy and coordinating strategy connecting different players within an organization so as to coordinate their efforts in creating an overall valuable series of experiences, products and services for the customer.

Figure 9.5: CRM Cycle

Successes

While there are numerous reports of "failed" implementations of various types of CRM projects, these are often the result of unrealistic high expectations and exaggerated claims by CRM vendors.

Many of these "failures" are also related to data quality and availability. Data cleaning is a major issue. If the company CRM strategy is to track life-cycle revenues, costs, margins and interactions between individual customers, this must be reflected in all business processes. Data must be extracted from multiple sources (e.g., departmental/divisional databases, including sales, manufacturing, supply chain, logistics, finance, service, etc.), requiring an integrated, and

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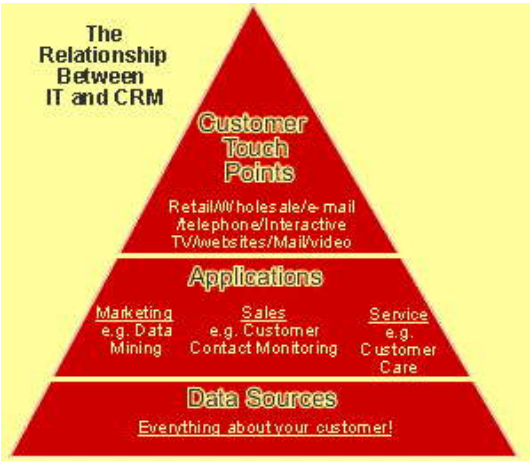
comprehensive business processing system to be in place with defined structures and data quality. If not, interfaces must be developed and implemented to extract data from different systems. This creates a demand far beyond customer satisfaction to understand the full business-to-business relationship. For this reason, CRM is more than a sales or customer interaction system.

The experience from many companies is that a clear CRM requirement with regard to reports (e.g., input and output requirements) is of vital importance before starting any implementation. With a proper demand specification, a great deal of time and money can be saved based on realistic expectations of systems capability. A well operating CRM system can be an extremely powerful tool for management and customer strategies.

Privacy and Data Security

One of the primary functions of CRM software is to collect information about customers. When gathering data as part of a CRM solution, a company must consider customer privacy and data security with respect to legal and cultural environments. Some customers prefer assurance that their data is not shared with third parties without their consent and that it cannot be illicitly accessed by third parties.

Figure 9.6: Relationship between IT and CRM



CRM Applications

Figure 9.7: CRM Applications

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Sales Force Automation

- ***Contact Management:*** Contact management software stores, tracks and manages contacts, leads of an enterprise.
- ***Lead Management:*** Enterprise Lead management software enables an organization to manage, track and forecast sales leads. Also helps understand and improve conversion rates.

eCRM or Web based CRM

- ***Self Service CRM:*** Self service CRM (eCRM) software enables web based customer interaction, automation of email, call logs, web site analytics, campaign management.
- ***Survey Management Software:*** Survey Management Software automates an enterprise's Electronic Surveys, Polls, Questionnaires and enables understand customer preferences.

Customer Service

- Call Center Software
- Help Desk Software

Partner Relationship Management

- **Contract Management Software**-Contract Management Software enables an enterprise to create, track and manage partnerships, contracts, agreements.

Example: Upside Software, Accruent Software, diCarta, I-Many.

- Distribution Management Software

Using CRM, a business can

- Provide better customer service
- Increase customer revenues
- Discover new customers
- Cross sell/Up Sell products more effectively
- Help sales staff close deals faster
- Make call centers more efficient
- Simplify marketing and sales processes

The types of data CRM projects collect

- Responses to campaigns
- Shipping and fulfillment dates
- Sales and purchase data
- Account information
- Web registration data
- Service and support records
- Demographic data
- Web sales data.

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Systems help the managers interactions with customers by improving sales, marketing and customer support processes. Companies are now realizing that customer service is a key differentiator to reduce customer agony and increase customer loyalty.

Companies engaged in mobile commerce products and services are on a relentless quest to create a so-called "killer app," a must-have product or service that could guarantee breakthrough success.

Unfortunately, the m-commerce products and services now available, from the speed of connection to the ease of navigation, have disappointed many m-commerce customers. On top of that, users have experienced a near-universal lack of simplicity, relevance and personalization. Only one application, short messaging service (SMS), has become popular in Europe. Accenture's experience reflects that SMS at best accounts for only 10 percent to 12 percent of average revenue per user.

For mobile operators, overcoming these negative customer experiences—and ensuring future customer interactions are successful and positive—is the critical next step in fulfilling m-commerce's promise of vast opportunity and significant revenue. In other words, success will not be about the killer app, but about the killer process.

9.6.1 Killer app Elusive, Probably Impossible

Online purchases are a good example of the customer service challenges facing mobile data operators. According to Accenture research, ordering a book with a credit card requires about 140 keystrokes or clicks for a customer using a personal computer, versus nearly 350 for a customer using a phone equipped with wireless application protocol (WAP).

M-commerce customers have a low tolerance for such cumbersome processes. As early adopters of new technology, they are willing to pay a premium price and are ready to become emotionally involved with the products and services they use. In return, however, they expect immediate results and high value. If a product fails to meet their expectations, they take it personally and are quick to criticize, drop the technology and inform their friends and colleagues about the negative experience.

9.6.2 Customers will Choose their Personal Killer app

To satisfy these key customers, mobile phone operators have been in perpetual competition to take advantage of the existing technology to create a killer app, which has eluded operators so far. And the likelihood of future success is slim, due to the complexity and range of customer needs.

Figure 9.8: Understanding Mobile Commerce Customers

Instead, we believe each customer will choose his or her own killer app. For some, the killer app may be e-mail; for others, it may be restaurant recommendations or sports results.

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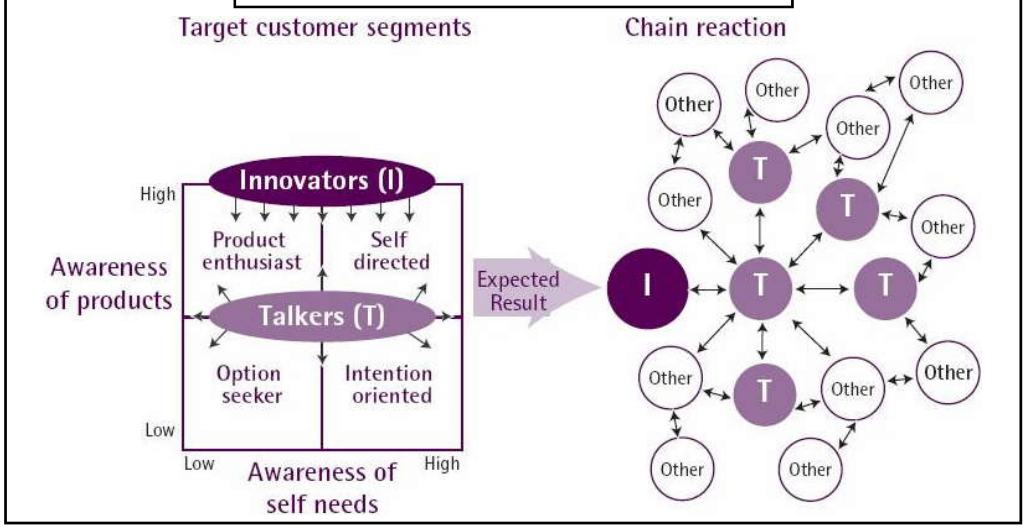
9.6.3 Four Principles for Building Mobile Customer Relationships

Principle 1: Target your customers to build critical mass: Because of multiple complex products, targeting customers is no longer as simple as dividing them into high-volume business users and low-volume prepaid consumers. Instead, mobile operators should begin by learning more about customers to understand their product awareness and needs and then segment them into "needs categories".

The next step is adding attributes, such as age and occupation, and using the resulting customer profiles to define a customer acquisition strategy for achieving critical mass. During this step, operators must identify "innovators", the highly influential people who buy products shortly after launch, and "talkers", people who have extensive personal networks of family, friends and work colleagues. The innovators and the talkers have the ability to win over non-users; they should be targeted first in any marketing effort (see Figure 9.9).

Figure 9.9: Innovators and Talkers Chain Reaction



Principle 2: Match products to customers: Instead of chasing after the one "perfect" product, mobile operators should seek the right product for the right customer.

Operators should start by seeding the market with basic products to test readiness for other products. Next, they should create open technology platforms and set relationship rules for content and go-to-market partners.

Principle 3: Make acquisition a positive experience: Customer experience can be tested at three stages: awareness, relevance and purchase.

- ***The awareness stage*** requires trust in a brand name associated with mobile data—either the operator's or a new brand for a particular offering—and messages targeted to specific customer segments.
- ***In the relevance stage***, companies must go beyond traditional media and use opinion leaders and other innovative channels to deliver tailored messages that demonstrate how the product meets each segment's needs.
- ***At the purchase stage,*** the operators' main goal must be a smooth interaction that eliminates last-minute surprises and meets all expectations regarding performance, service, and payment and usage terms.

Principle 4: Develop customers – one at a time: Once customers are acquired, they must be developed to increase depth and scope of usage and leverage lifetime value. There are five steps to effective development:

- Understand the customer, including usage patterns, needs and preferences.
- Obtain permission to provide relevant personalization. In addition, given privacy issues being examined by a number of European governments, operators should provide a privacy statement.
- Educate customers to help them evolve from simple to complex m-commerce applications.
- Maintain and reinforce permission so that customers do not feel taken for granted.
- Direct customers to appropriate new products and services.

9.6.4 Web based CRM Vs Hosted CRM

The expense and complexity of large-scale on-premise hosted CRM implementations has lead companies to investigate the cost of on demand CRM solutions. For some smaller companies, the SaaS (Software as a Service) offerings of providers such as Sales force, Netsuite, and Salesboom may make sense, particularly if companies are not expected to continue beyond a few years. For companies that plan to grow and remain in business, the on demand CRM solution may actually be more expensive and not meet the needs of the business. One of the important limitations of web based CRM is a lack of customizability. The truth about the software is that it may cost a great deal to customize for a particular customer's needs, and few programmers are available to do the customized programming.

Caution Relying on the on demand software as a service manufacturer for custom programming could be a very risky strategy.

Management CRM have helped thousands of clients discover and adopt new CRM solutions providing CRM training and support and their businesses have excellent ROI.

Task How e-CRM is helpful for organization growth

Self Assessment

Fill in the blanks:

11. ..... is a process or methodology used to learn more about customers' needs and behaviors in order to develop stronger relationships with them.
12. ..... software enables web based customer interaction, automation of email, call logs, web site analytics, campaign management.
13. When gathering ..... as part of a CRM solution, a company must consider customer privacy and data security with respect to legal and cultural environments.

9.7 Applications in Supply Chain and Healthcare

SCM has evolved through the application of E-Business technologies into a powerful strategic function. Establishing wired business process across multiple organization is a challenging

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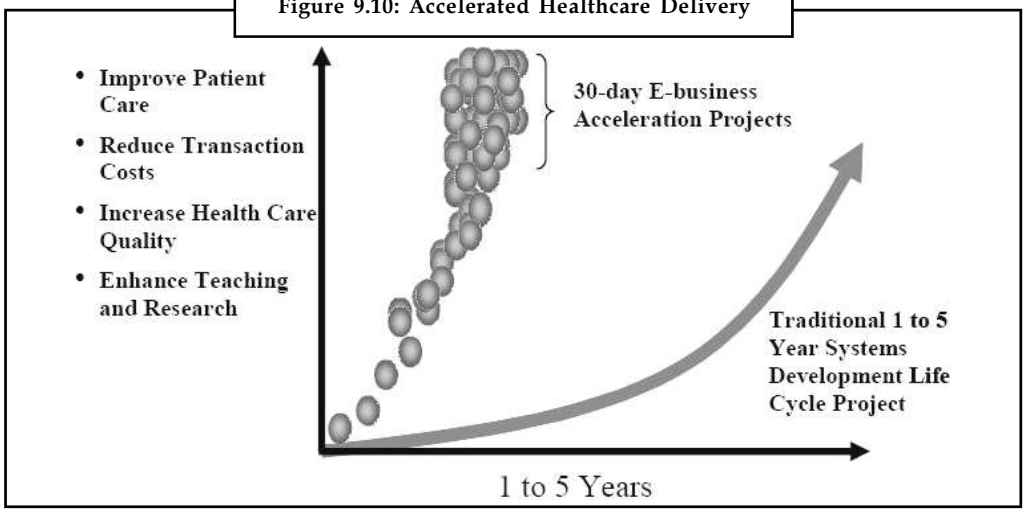
task, which involves several inefficacies including incompatible technologies, operating systems, protocols, etc.

The mobile capabilities of mobile SCM extension provide a convenient, time saving, and highly accurate means of capturing data on movements of goods and other events. They simplify checking and monitoring tasks and provide up-to-date information on process status, enabling the users to react swiftly to unforeseen events.

Healthcare is the largest service industry in the world and none of us throughout the course of our life can avoid some interaction with this industry. While no country spends more per capita on healthcare delivery than the US, most of the 29 countries of the Organization for Economic Cooperation and Development (OECD) have doubled their healthcare expenditure over the last 20 years1. Thus, cost effective, efficient high quality healthcare delivery is a critical challenge for healthcare at a global level.

Healthcare systems in each nation have to date been shaped by their country's traditions, culture, payment mechanisms and patient expectations. Now however, it is not these differences but rather the commonalties of a global and apparent terminal malady of exponentially increasing costs, an informed and empowered consumer, the need for e-health adaptability and a shift from focusing on primarily curing to the prevention of diseases that are the major challenges of healthcare management in the 21st century. Most are agreed that the key lies in the adoption and use of information systems/information technology (IS/IT) in healthcare management; however, views vary tremendously when it comes to how this should actually be brought about. In short then, the healthcare industry is finding itself in a state of turbulence and flux. The key is likely to lie in the adoption of a mobile/wireless solution.

Figure 9.10: Accelerated Healthcare Delivery



Over a period of two years INET International Inc. has been conducting research that has been directed at how to apply mobile Internet wireless technologies' low cost advantages to evolve a wireless healthcare portal. A portal is a single point of contact for healthcare providers and handheld technology applications (HTA) to access and process various data pertaining to patients such as: (1)Patient specific-data (i.e. Patient ID, radiology reports, Lab results, Clinical findings, and research data.), (2) Medical Knowledge (primarily from evidence based medicine training and journals), (3) Clinical guidelines (i.e. association guidelines such as the Association of Radiologists clinical practice publications.) and (4) Reimbursement rules and data (i.e. Ontario Health Insurance Plan, known as OHIP.) The research has shown that mobile/wireless solutions for healthcare can achieve four critical goals of (1) Improve patient care (2) Reduce Transaction Costs, (3) Increase healthcare quality and (4) Enhance teaching and research.

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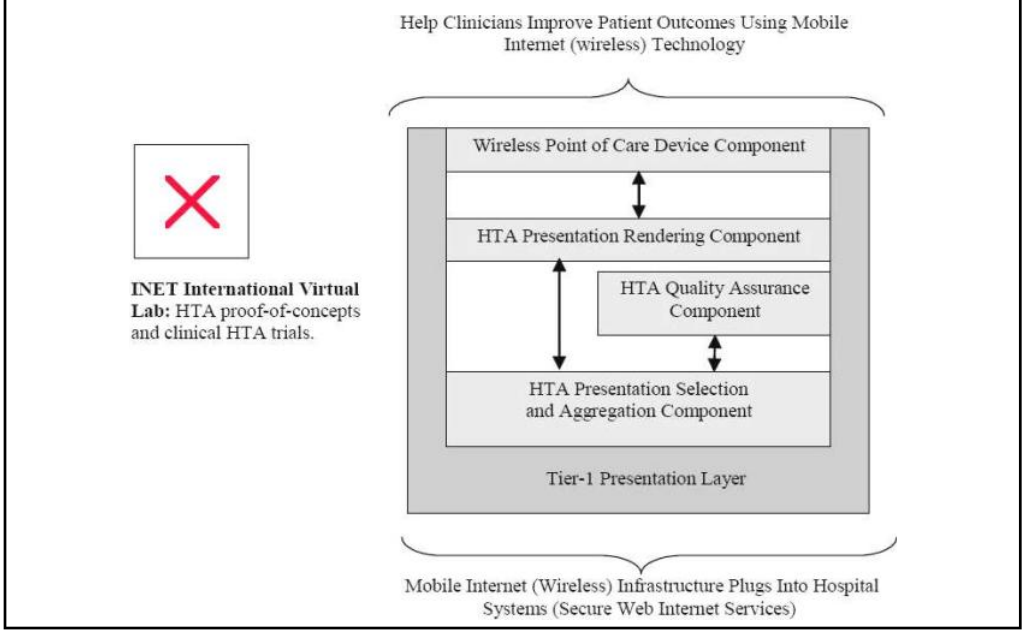
Figure 9.11: A Standardized Mobile Internet (wireless) Environment

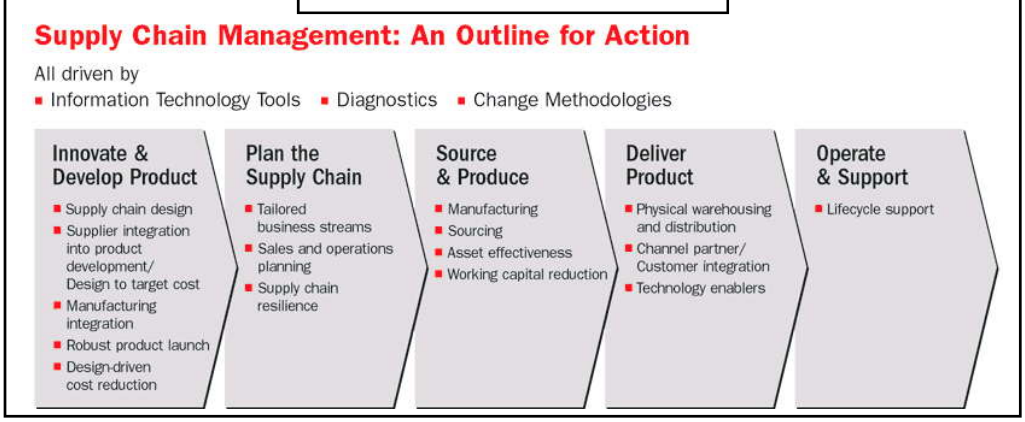


Supply Chain Management is the process of planning, implementing and controlling the operations of the supply chain as efficiently as possible. Supply Chain Management spans all movement and storage of raw materials, work-in-process inventory, and finished goods from point-of-origin to point-of-consumption.

The definition one American professional association put forward is that Supply Chain Management encompasses the planning and management of all activities involved in sourcing, procurement, conversion, and logistics management activities. Importantly, it also includes coordination and collaboration with channel partners, which can be suppliers, intermediaries, third-party service providers, and customers. In essence, Supply Chain Management integrates supply and demand management within and across companies. More recently, the loosely coupled, self-organizing network of businesses that cooperates to provide product and service offerings has been called the Extended Enterprise.

Some experts distinguish Supply Chain Management and logistics, while others consider the terms to be interchangeable.

Figure 9.12: SCM Outline



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Supply Chain Management can also refer to Supply chain management software which are tools or modules used in executing supply chain transactions, managing supplier relationships and controlling associated business processes.

Figure 9.13: SCM Connected with various Domains

9.7.1 Supply Chain Management Challenges

Supply chain management must address the following problems:

- ***Distribution Network Configuration:*** Number, location and network missions of suppliers, production facilities, distribution centers, warehouses, cross-docks and customers.
- ***Distribution Strategy:*** Including questions of operating control (centralized, decentralized or shared); delivery scheme (e.g., direct shipment, pool point shipping, Cross docking, DSD (direct store delivery), closed loop shipping); mode of transportation (e.g., motor carrier, including truckload, parcel; railroad; intermodal, ocean freight; airfreight); replenishment strategy (e.g., pull, push or hybrid); and transportation control (e.g., owner-operated, private carrier, common carrier, contract carrier, or 3PL).
- ***Information:*** Integration of and other processes through the supply chain to share valuable information, including demand signals, forecasts, inventory, transportation, and potential collaboration, etc.
- ***Inventory Management:*** Quantity and location of inventory including raw materials, work-in-process and finished goods.
- ***Cash-Flow:*** Arranging the payment terms and the methodologies for exchanging funds across entities within the supply chain.

Supply chain execution is managing and coordinating the movement of materials, information and funds across the supply chain. The flow is bi-directional.

9.7.2 Activities/Functions

Supply chain management is a cross-functional approach to managing the movement of raw materials into an organization, certain aspects of the internal processing of materials into finished goods, and then the movement of finished goods out of the organization toward the end-consumer. As organizations strive to focus on core competencies and becoming more flexible, they have reduced their ownership of raw materials sources and distribution channels. These functions are increasingly being outsourced to other entities that can perform the activities

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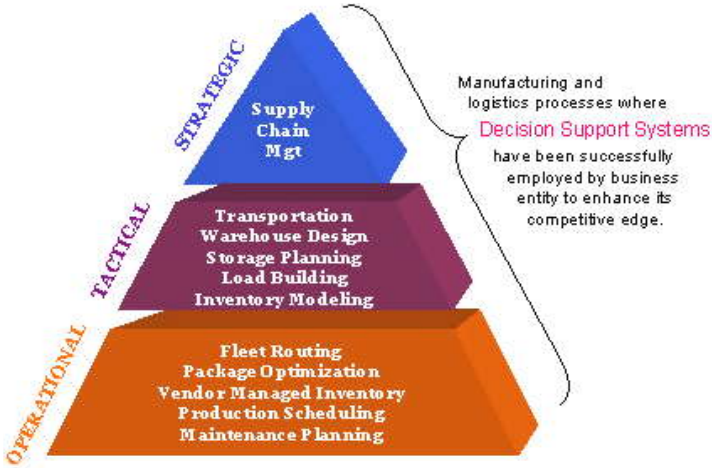
better or more cost effectively. The effect is to increase the number of organizations involved in satisfying customer demand, while reducing management control of daily logistics operations. Less control and more supply chain partners led to the creation of supply chain management concepts. The purpose of supply chain management is to improve trust and collaboration among supply chain partners, thus improving inventory visibility and improving inventory velocity.

Several models have been proposed for understanding the activities required to manage material movements across organizational and functional boundaries. SCOR is a supply chain management model promoted by the Supply Chain Management Council. Another model is the SCM Model proposed by the Global Supply Chain Forum (GSCF). Supply chain activities can be grouped into strategic, tactical, and operational levels of activities.

Figure 9.14: Supply Chain Activities



Strategic

- Strategic network optimization, including the number, location, and size of warehouses, distribution centers and facilities.
- Strategic partnership with suppliers, distributors, and customers, creating communication channels for critical information and operational improvements such as cross docking, direct shipping, and third-party logistics.
- Product design coordination, so that new and existing products can be optimally integrated into the supply chain, load management.
- Information Technology infrastructure, to support supply chain operations.
- Where-to-make and what-to-make-or-buy decisions.
- Aligning overall organizational strategy with supply strategy.

Tactical

- Sourcing contracts and other purchasing decisions.
- Production decisions, including contracting, locations, scheduling, and planning process definition.
- Inventory decisions, including quantity, location, and quality of inventory.

Notes

- Transportation strategy, including frequency, routes, and contracting.
- Benchmarking of all operations against competitors and implementation of best practices throughout the enterprise.
- Milestone payments.

Operational

- Daily production and distribution planning, including all nodes in the supply chain.
- Production scheduling for each manufacturing facility in the supply chain (minute by minute).
- Demand planning and forecasting, coordinating the demand forecast of all customers and sharing the forecast with all suppliers.
- Sourcing planning, including current inventory and forecast demand, in collaboration with all suppliers.
- Inbound operations, including transportation from suppliers and receiving inventory.
- Production operations, including the consumption of materials and flow of finished goods.
- Outbound operations, including all fulfillment activities and transportation to customers.
- Order promising, accounting for all constraints in the supply chain, including all suppliers, manufacturing facilities, distribution centers, and other customers.

Task Discuss m-commerce application in supply chain management.

Reverse Supply Chain Reverse Logistics is the process of planning, implementing and controlling the efficient, effective inbound flow and storage of secondary goods and related information opposite to the traditional supply chain direction for the purpose of recovering value or proper disposal. Reverse logistics is also referred to as "Aftermarket Customer Services". In other words, anytime money is taken from a company's Warranty Reserve or Service Logistics budget that is a Reverse Logistics operation.

Self Assessment

Fill in the blanks:

14. SCM has evolved through the application of ..... technologies into a powerful strategic function.
15. ..... is the process of planning, implementing and controlling the operations of the supply chain as efficiently as possible.
16. ..... is the process of arranging the payment terms and the methodologies for exchanging funds across entities within the supply chain.

Notes

Case Study

University Administration and Information Technology

A large university in extending its network and IT infrastructure to support all its academic & administrative functions.

Current network infrastructure is used for internal personnel, payroll, accounting, students registration, administration & financial functions. All the staff members should have a PC connected to the college network and all students and non lead. Teaching staff have IT staffs training, especially in the use of word processing & spreadsheet softwares. Labs are also upgraded under the direction of computer centre. Since, the CSE Department is unhappy with the services provided by the computer centre, these departments have well developed labs of desktop PCs, Cabled & Networked for students. Staff in those department also have been networked using a separate cabling system. Because the HOD believes that with computing students there is danger that these knowledge will allow them a unauthorized excess to staff data traffic.

Questions:

1. Principal of college is concerned that there is absence of strategic planning & control and is unhappy with the situation.
2. Advise the principal on a course of action.

Source: Management Information System by Dharmenda and Sangeeta Gupta

9.8 Summary

- WiMAX is a wirless digital communications system also known as IEEE 802.16, that is intended for wireless "metropolitan area networks".
- With WiMAX, WiFi like data rates are easily supported, but the issue of interference is lessened.
- Evolution-Data Optimized or Evolution-Data only, abbreviated as EV-DO or EVDO and often EV, is a telecommunications standard for the wireless transmission of data through radio signals, typically for broadband Internet access.
- M-commerce (mobile commerce) is the buying and selling of goods and services through wireless handheld devices such as cellular telephone and personal digital assistants (PDAs).
- CRM is a multifaceted process, mediated by a set of information technologies that focuses on creating two-way exchanges with customers so that firms have an intimate knowledge of their needs, wants, and buying patterns.
- The expense and complexity of large-scale on-premise hosted CRM implementations has lead companies to investigate the cost of on demand CRM solutions.
- SCM has evolved through the application of E-Business technologies into a powerful strategic function.
- Supply Chain Management is the process of planning, implementing and controlling the operations of the supply chain as efficiently as possible.

Notes

9.9 Keywords

Contract Management Software: Contract Management Software enables an enterprise to create, track and manage partnerships, contracts, agreements.

Customer Relationship Management: CRM is the philosophy, policy and coordinating strategy connecting different players within an organization so as to coordinate their efforts in creating an overall valuable series of experiences, products and services for the customer.

Healthcare: Healthcare is the largest service industry in the world and none of us throughout the course of our life can avoid some interaction with this industry.

Inventory Management: Quantity and location of inventory including raw materials, work-in-process and finished goods.

M-Commerce: M-commerce (mobile commerce) is the buying and selling of goods and services through wireless handheld devices such as cellular telephone and personal digital assistants (PDAs).

SCM: Supply Chain Management is the process of planning, implementing and controlling the operations of the supply chain as efficiently as possible.

Survey Management Software:Survey Management Software automates an enterprise's Electronic Surveys, Polls, Questionnaires and enables understand customer preferences.

Wi-Max: WiMAX is a wireless digital communications system also known as IEEE 802.16, that is intended for wireless "metropolitan area networks".

9.10 Review Questions

1. Discuss various advantages of wireless network over traditional network in detail.
2. What is the technology behind WI-MAX success?
3. Illustrate the various wireless network technologies in detail.
4. Describe the various features of EVDO in details.
5. What do you mean by M-Commerce? Also explain the features of M-Commerce.
6. Describe the various application of M-Commerce with the help of suitable example.
7. What you think technology used in CRM is good for organization? Give suggestion.
8. How we build mobile customer relationship management?
9. How we use technology in supply chain management?
10. Describe the various challenges of supply chain management in detail.

Answers: Self Assessment

1.	access	2.	hub
3.	financial	4.	Wireless
5.	WiMAX	6.	broadband access
7.	EVDO	8.	CDMA (Code Division Multiple Access)
9.	M-commerce	10.	digital

Notes

11. CRM
12. Self service CRM
13. data
14. E-Business
15. Supply Chain Management
16. Cash-Flow

9.11 Further Readings

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Online link

www.freewimaxinfo.com

Notes

Unit 10: Enhancing Decision Making for the Digital Firm

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Objectives

After studying this unit, you will be able to:

- Understand the concept of decision making and decision support system
- Discuss business intelligence and decision support
- Explain business decision making and the decision making process
- Describe GDSS and GIS

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Introduction

Decision making is an integral part of every manager's day-to-day activities at work place. Due to this fact manager's are also known as "decision makers" in business organizations. Now, what is a decision and what is a decision-making process. The word decision is derived from the Latin word "Decide", meaning "to cut off" or "to come to a conclusion". So the word decision means a resolution, a settlement, a judgement, etc. More precisely decision is a course of action consciously selected from available alternatives to achieve a desired goal. So it is an outcome of judgement and represents a commitment. Simply decision is a choice of an alternatives among the various available alternatives.

10.1 Decision Making and Decision Support Systems

Everybody makes decisions. It's a natural part of life, and most of the time we don't even think about the process. In an organization, decisions are made at every level.

Caution The level at which the decision is made can also determine the complexity of the decision in relation to the input of data and output of information.

10.1.1 Levels of Decision Making

The levels of decision-making are:

- ***Strategic Decision Making:*** These decisions are usually concerned with the major objectives of the organization, such as "Do we need to change the core business we are in?" They also concern policies of the organization, such as "Do we want to support affirmative action?"
- ***Management Control:*** These decisions affect the use of resources, such as "Do we need to find a different supplier of packaging materials?" Management-level decisions also determine the performance of the operational units, such as "How much is the bottleneck in Production affecting the overall profit and loss of the organization, and what can we do about it?"
- ***Knowledge-Level Decision Making:*** These decisions determine new ideas or improvements to current products or services. A decision made at this level could be "Do we need to find a new chocolate recipe that result in a radically different taste for our candy bar?"
- ***Operational control:*** These decisions determine specific tasks that support decisions made at the strategic or managerial levels.

Example: "How many candy bars do we produce today?"

10.1.2 Structured and Unstructured Decisions

Structured Decision

Many analysts categorize decisions according to the degree of structure involved in the decision-making activity. Business analysts describe a structured decision as one in which all three components of a decision—the data, process, and evaluation are determined. Since structured decisions are made on a regular basis in business environments, it makes sense to place a comparatively rigid framework around the decision and the people making it.

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Structured decision support systems may simply use a checklist or form to ensure that all necessary data is collected and that the decision making process is not skewed by the absence of necessary data. If the choice is also to support the procedural or process component of the decision, then it is quite possible to develop a program either as part of the checklist or form. In fact, it is also possible and desirable to develop computer programs that collect and combine the data, thus giving the process a high degree of consistency or structure. When there is a desire to make a decision more structured, the support system for that decision is designed to ensure consistency. Many firms that hire individuals without a great deal of experience provide them with detailed guidelines on their decision making activities and support them by giving them little flexibility. One interesting consequence of making a decision more structured is that the liability for inappropriate decisions is shifted from individual decision makers to the larger company or organization.

Unstructured Decisions

At the other end of the continuum are unstructured decisions. While these decisions have the same components as structured ones data, process, and evaluation there is little agreement on their nature.

Example: Each decision maker may use different data and processes to reach a conclusion. In addition, because of the nature of the decision there may only a limited number of people within the organization that are even qualified to evaluate the decision.

Another approach is to monitor and document the process that was used so that the decision maker(s) can readily review what has already been examined and concluded. An even more novel approach used to support these decisions is to provide environments that are specially designed to give these decision makers an atmosphere that is conducive to their particular tastes. The key to support of unstructured decisions is to understand the role that individuals experience or expertise plays in the decision and to allow for individual approaches.

Structured versus Unstructured Decisions

Some decisions are very structured while others are very unstructured. You may wake up in the morning and make the structured, routine decision to get out of bed. Then you have to make the unstructured decision of what clothes to wear that day (for some of us this may be a very routine decision!). Structured decisions involve definite procedures and are not necessarily very complex.

Caution The more unstructured a decision becomes, the more complex it becomes.

10.1.3 Stages of Decision Making

Some people seem to make sudden or impulsive decisions. Other people seem to make very slow, deliberate decisions. But regardless of appearances, the decision-making process follows the same stages of development and implementation. Let's use the example of purchasing a new television, using the Figure 10.1.

- ***Intelligence:*** You identify the facts: You don't have a television or the one that you do have isn't any good. You intuitively understand what the problem is and the effect it's having on you. You missed your favorite show last night.

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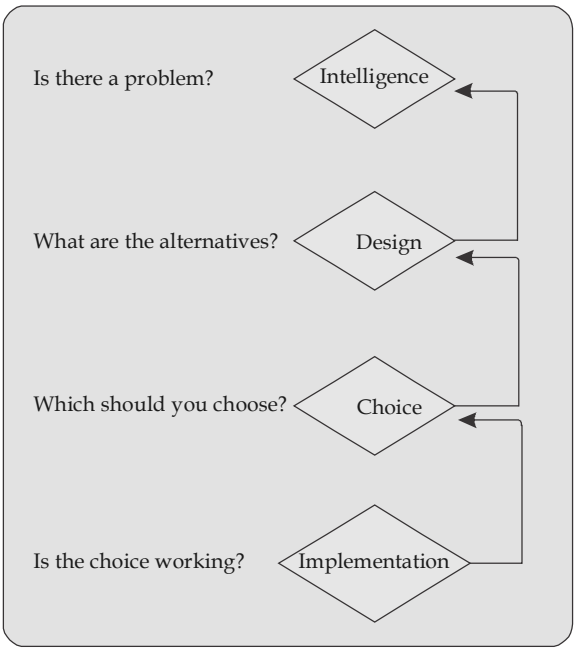
- ***Design:*** You design possible solutions: You could watch the television in your neighbor's apartment or you could purchase a new one for yourself. Your neighbor will get annoyed if you keep coming over. On the other hand, you won't be able to go on vacation if you use your money to buy a new television.

Figure 10.1: The Decision-making Process



- ***Choice:*** You gather data that helps you make a better decision: Your neighbor doesn't like the same shows you like or she's getting rather tired of you being there. You also determine that televisions cost a lot of money so you figure out how you can afford one. You choose to purchase a new television instead of watching your neighbor's.
- ***Implementation:*** You implement the decision: You stop at the appliance store on your way home from work and carry out your decision to purchase a new television.
- ***Feedback:*** You gather feedback: You're broke but you can watch anything you want!

Of course, this is a simplified example of the decision-making process. But the same process is used for almost every decision made by almost every person.

Information Systems help improve the decision-making process by:

- Providing more information about the problem
- Presenting a greater variety of possible alternatives
- Showing consequences and effects of choices
- Measuring the outcome of different possible solutions
- Providing feedback on the decision that is made.

Different types of decisions require different types of systems. All decisions follow the same pattern although some may be more complex and require several iterations of the decision-making stages.

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10.1.4 Decision Support System

Decision Support Systems (DSS) help executives make better decisions by using historical and current data from internal Information Systems and external sources. By combining massive amounts of data with sophisticated analytical models and tools, and by making the system easy to use, they provide a much better source of information to use in the decision-making process.

Decision Support Systems (DSS) are a class of computerized information systems that support decision-making activities. DSS are interactive computer-based systems and subsystems intended to help decision makers use communications technologies, data, documents, knowledge and/or models to successfully complete decision process tasks.

10.1.5 Need for an Expanded Framework

Decision Support Systems should be defined as a broad category of information systems for informing and supporting decision-makers. DSS are intended to improve and speed-up the processes by which people make and communicate decisions. We need to improve how we define Decision Support Systems on both a conceptual level and on a concrete, technical level. Both managers and DSS designers need to understand categories of decision support so they can better communicate about what needs to be accomplished in informing and supporting decision makers.

The DSS literature includes a number of frameworks for categorizing systems. Steven Alter (1980) developed the broadest and most comprehensive one more than 20 years ago. A new, broader typology or framework than Alter's (1980) is needed because Decision Support Systems are much more common and more diverse than when he conducted his research and proposed his framework.

Decision Support Systems do vary in many ways. Some DSS focus on data, some on models and some on communications. DSS also differ in scope, some DSS are intended for one "primary" user and used "stand-alone" for analysis and others are intended for many users in an organization. A Decision Support System could be categorized in terms of the generic operations it performs, independent of type of problem, functional area or decision perspective. His seven types included: file drawer systems, data analysis systems, analysis information systems, accounting and financial models, representational models, optimization models, and suggestion models.

10.1.6 Types of Decision Support System

The various types of DSS are:

- Data driven DSS
- Model driven DSS
- Knowledge driven DSS
- Document driven DSS
- Communications driven and Group DSS
- Inter-organizational and Intra-organizational DSS
- Function specific or General purpose DSS

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Data-Driven DSS

Data-Driven DSS take the massive amounts of data available through the company's TPS and MIS systems and cull from it useful information which executives can use to make more informed decisions. They don't have to have a theory or model but can "free-flow" the data.

The first generic type of Decision Support System is a Data-Driven DSS. These systems include file drawer and management reporting systems, data warehousing and analysis systems, Executive Information Systems (EIS) and Spatial Decision Support Systems**.** Business Intelligence Systems are also examples of Data-Driven DSS. Data- Driven DSS emphasize access to and manipulation of large databases of structured data and especially a time-series of internal company data and sometimes external data. Simple file systems accessed by query and retrieval tools provide the most elementary level of functionality. Data warehouse systems that allow the manipulation of data by computerized tools tailored to a specific task and setting or by more general tools and operators provide additional functionality. Data-Driven DSS with Online Analytical Processing (OLAP) provide the highest level of functionality and decision support that is linked to analysis of large collections of historical data.

Model-Driven DSS

A second category, Model-Driven DSS, includes systems that use accounting and financial models, representational models, and optimization models. Model-Driven DSS emphasize access to and manipulation of a model. Simple statistical and analytical tools provide the most elementary level of functionality. Some OLAP systems that allow complex analysis of data may be classified as hybrid DSS systems providing modeling, data retrieval and data summarization functionality. Model-Driven DSS use data and parameters provided by decision-makers to aid them in analyzing a situation, but they are not usually data intensive. Very large databases are usually not needed for Model-Driven DSS.

Model-Driven DSS were isolated from the main Information Systems of the organization and were primarily used for the typical "what-if" analysis. That is, "What if we increase production of our products and decrease the shipment time?" These systems rely heavily on models to help executives understand the impact of their decisions on the organization, its suppliers, and its customers.

Knowledge-Driven DSS

The terminology for this third generic type of DSS is still evolving. Currently, the best term seems to be Knowledge- Driven DSS. Adding the modifier "driven" to the word knowledge maintains a parallelism in the framework and focuses on the dominant knowledge base component. Knowledge-Driven DSS can suggest or recommend actions to managers. These DSS are personal computer systems with specialized problem-solving expertise. The "expertise" consists of knowledge about a particular domain, understanding of problems within that domain, and "skill" at solving some of these problems. A related concept is Data Mining. It refers to a class of analytical applications that search for hidden patterns in a database.

Did u know? **What is data mining?**

Data mining is the process of sifting through large amounts of data to produce data content relationships.

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Document-Driven DSS

A new type of DSS, a Document-Driven DSS or Knowledge Management System, is evolving to help managers retrieve and manage unstructured documents and Web pages. A Document-Driven DSS integrates a variety of storage and processing technologies to provide complete document retrieval and analysis. The Web provides access to large document databases including databases of hypertext documents, images, sounds and video.

Example: Documents that would be accessed by a Document-Based DSS are policies and procedures, product specifications, catalogs, and corporate historical documents, including minutes of meetings, corporate records, and important correspondence.

A search engine is a powerful decision-aiding tool associated with a Document-Driven DSS.

Communications-Driven and Group DSS

Group Decision Support Systems (GDSS) came first, but now a broader category of Communications-Driven DSS or groupware can be identified. This fifth generic type of Decision Support System includes communication, collaboration and decision support technologies that do not fit within those DSS types identified. Therefore, we need to identify these systems as a specific category of DSS. A Group DSS is a hybrid Decision Support System that emphasizes both the use of communications and decision models. A Group Decision Support System is an interactive computer-based system intended to facilitate the solution of problems by decision-makers working together as a group. Groupware supports electronic communication, scheduling, document sharing, and other group productivity and decision support enhancing activities We have a number of technologies and capabilities in this category in the framework – Group DSS, two-way interactive video, White Boards, Bulletin Boards, and Email.

Inter-Organizational or Intra-Organizational DSS

A relatively new targeted user group for DSS made possible by new technologies and the rapid growth of the Internet is customers and suppliers. We can call DSS targeted for external users an Inter-organizational DSS. The public Internet is creating communication links for many types of inter-organizational systems, including DSS. An Inter-Organizational DSS provides stakeholders with access to a company's intranet and authority or privileges to use specific DSS capabilities. Companies can make a Data-Driven DSS available to suppliers or a Model-Driven DSS available to customers to design a product or choose a product. Most DSS are Intra-Organizational DSS that are designed for use by individuals in a company as "standalone DSS" or for use by a group of managers in a company as a Group or Enterprise-Wide DSS.

Function-Specific or General Purpose DSS

Many DSS are designed to support specific business functions or types of businesses and industries. We can call such a Decision Support System a function-specific or industry- specific DSS. A Function-Specific DSS like a budgeting system may be purchased from a vendor or customized in-house using a more general-purpose development package. Vendor developed or "off-the-shelf" DSS support functional areas of a business like marketing or finance; some DSS products are designed to support decision tasks in a specific industry like a crew scheduling DSS for an airline. A task-specific DSS has an important purpose in solving a routine or recurring decision task. Function or task-specific DSS can be further classified and understood in terms of the dominant DSS component, that is as a Model-Driven, Data-Driven or Suggestion DSS. A function or task-specific DSS holds and derives knowledge relevant for a decision about some function

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that an organization performs (e.g., a marketing function or a production function). This type of DSS is categorized by purpose; function-specific DSS help a person or group accomplish a specific decision task. General-purpose DSS software helps support broad tasks like project management, decision analysis, or business planning.

Self Assessment

Fill in the blanks:

1. ..... Decision Making determine new ideas or improvements to current products or services.
2. Business analysts describe a ..... decision as one in which all three components of a decision—the data, process, and evaluation are determined.
3. ..... are a class of computerized information systems that support decision-making activities.
4. ..... DSS includes systems that use accounting and financial models, representational models, and optimization models.

10.2 Business Intelligence and Decision Support

Business intelligence is defined as a novel expression in information technology. The importance of business intelligence varies from context to context. The term illustrates the procedure of converting data into information and then into knowledge. The intelligence is claimed to be more functional to the user as it passes during each step. BI illustrates a set of concepts and methods to perk up business decision making by means of actuality based support systems. Gartners's definition of business intelligence involves all the ways an enterprise can explore, access and examine information in the data warehouse to expand insights that guide to improved, informed decisions. BI tools comprise ad hoc query, report writing, decision support systems, executive information systems and methods like statistical analysis and online analytical processing (OLAP).

One of most absolute definitions of the business intelligence can be located on the IBM' website:

"Business intelligence is the gathering, managing, analyzing and sharing of information so as to gain insights that can be used to make enhanced decisions. Business intelligence converts information into intelligence, intelligence into knowledge, and knowledge into business perception. Combining advanced methods like data warehousing, data mining, and decision support, business intelligence systems provide the capability to convert information into influential customer relationship management systems that can assist generate stronger, more profitable relationships, recognize new business opportunities – even anticipate customer demands." Business Intelligence (BI) can be seen as an umbrella that covers a whole range of concepts. BI can be approached approximately as being a Data Warehouse, with three layers on top of it: Queries & Reports, OnLine Analytical Processing and Data Mining (see the pyramid below). Authors and companies accept this ordering extensively. Though, other orderings exist as well, with the consequence that some contradict each other. That is just because the boundaries among the diverse components are very vague.

The above ordering of components hanging below Business Intelligence is extensively adopted. Though, it must be said that there are authors who do not accept these four components, or who name only some of them and add other components.

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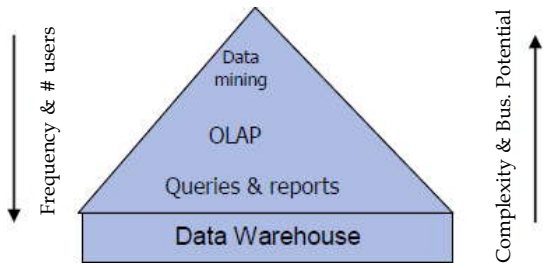
Figure 10.2: Components of Business Intelligence



Source: http://dspace.upce.cz/bitstream/10195/32436/1/CL585.pdf

There are also diverse views that describe BI as successor of DSS. The next production of DSS applications evolved into business intelligence systems. These applications offer users with the aptitude to simply take out data from one or more different sources and subject matters. Formatting the data for a report or graphical demonstration is also easier. Additionally, BI applications offer users with the ability of multidimensional analysis.

Example: Users can drill down on an income statement moving from net sales to sales by product to sales by product/region and, finally, to sales by product/region/customer.

This capability offers users with the ability to reply questions like: What was the sales mix of products sold? Which geographic regions did we sell the most and the least products? Who are our top customers by geographic region and by product?"

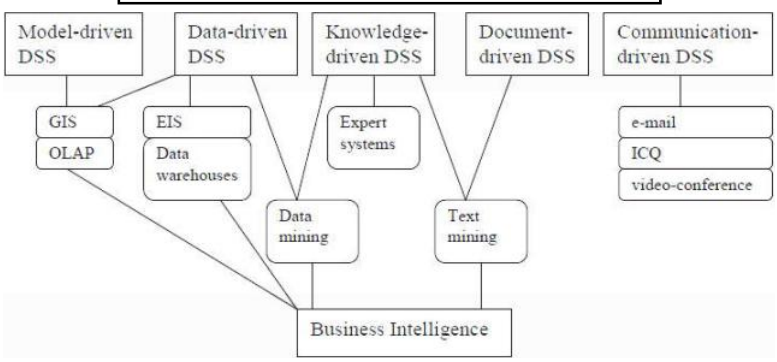
BI applications are converted into group of data driven DSS and to make it more complex, there are BI solution providers including text mining, web mining and statistical models into their applications.

Above stated explanation illustrates problems that emerge in connection with choice of suitable decision support technology.

Managers are specified many perplexing and sometimes conflicting information about probable tools. Whilst scientific community functions with term decision support systems to elucidate tools for decision making, software producers use term business intelligence for similar functionality.

To make it much clearer we introduce symbolic synopsis of BI and DSS components on the Figure 10.3.

Figure 10.3: Components of BI and DSS



Source: http://dspace.upce.cz/bitstream/10195/32436/1/CL585.pdf

Notes

Figure 10.3 clearly illustrates content similarity among BI and DSS. However structure of BI is not steady; producers of business intelligence solutions may include only some constituents into their products or enlarge utility function as per their customer wish. We can say now that the branch of BI is rising and future components can be completely different.

Self Assessment

Fill in the blanks:

5. ..... describes the process of turning data into information and then into knowledge.
6. BI ..... include ad hoc query, report writing, decision support systems, executive information systems techniques such as statistical analysis and online analytical processing (OLAP).

10.3 Business Decision Making and the Decision Making Process

Decision-making more and more appears at all stages of a business. The Board of Directors may make the striking strategic decisions regarding investment and direction of future growth, and managers may formulate the more tactical decisions concerning how their own department may give most efficiently to the whole business goals. But pretty ordinary employees are ever more expected to make decisions about the manner of their own tasks, responses to clients and improvements to business practice. This requires careful recruitment and selection, good training, and progressive management.

10.3.1 Decision Making Process

Decision making is a managerial process of choosing a particular course of action out of several alternative courses for the purpose of achieving the given objective.

Decision making process is goal oriented process in which, certain goals are achieved like for a student to pass the examination is a major goal and to achieve this goal he has to take certain decisions like to study four or five hours in a day, etc.

Decision making process is an ongoing process because at every moment the manager has to take certain decisions like to conduct a meeting to implement certain policies, etc.

Decision making process is a complex process. Complexity is the result of many factors such as inter-relationship among the experts, qualification, experience of the decision maker, constraints from the external world, etc.

Decision making is called a managerial process because it is a combination of several steps shown in Figure 10.3.

(a) ***Identification phase:*** In which, definition of problem as well as its diagnosis is analyzed.

(b) ***Development Phase:*** In this, identify the constraints and opportunities and develop alternatives.

(c) ***Selection Phase:*** Evaluate each alternative and choose the best one.

(d) ***Implementation Phase:*** In this phase, the decision is implemented and acceptance of the decision by others taken and follow up monitoring is also done by the decision maker, so that further action can be taken.

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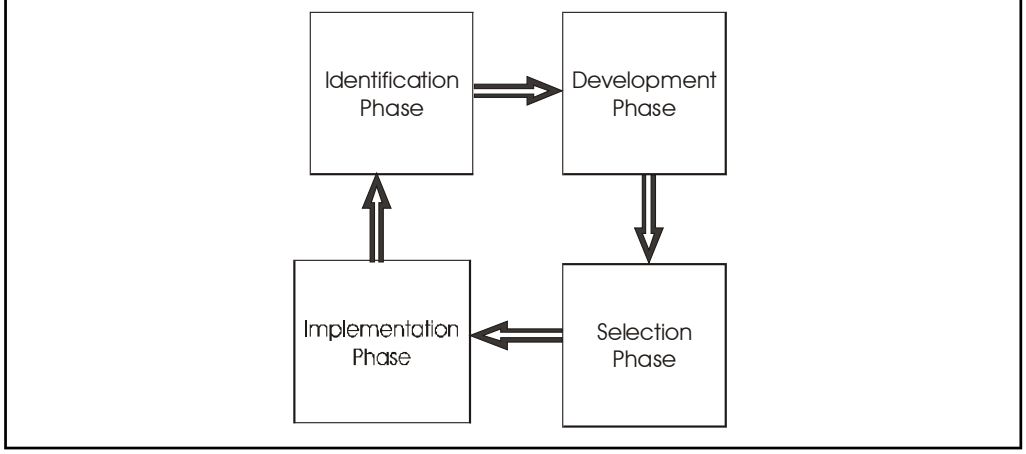
Figure 10.4: Decision Making Process



Self Assessment

Fill in the blanks:

7. ..... process is an ongoing process because at every moment the manager has to take certain decisions like to conduct a meeting to implement certain policies, etc.

8. Decision making is a ..... process of choosing a particular course of action out of several alternative courses for the purpose of achieving the given objective.

10.4 Group Decision Support Systems (GDSS)

More and more, companies are turning to groups and teams to get work done. Hours upon hours are spent in meetings, in group collaboration, in communicating with many people. To help groups make decisions, a new category of systems was developed—the group decision-support system (GDSS).

You've been there: a meeting where nothing seemed to get done, where some people dominated the agenda and others never said a word, which dragged on for hours with no clear agenda. When it was all over no one was sure what was accomplished, if anything. But the donuts and coffee were good!

Organizations have been struggling with this problem for years. They are now using GDSS as a way to increase the efficiency and effectiveness of meetings. The text includes a list of elements that GDSS use to help organizations. We'll highlight a few of them:

- ***Preplanning:*** A clear-cut agenda of the topics for the meeting.
- ***Open, collaborative meeting atmosphere:*** Free flow of ideas and communications without any of the attendees feeling shy about contributing.
- ***Evaluation objectivity:*** Reduces "office politics" and the chance that ideas will be dismissed because of who presented them instead of what was presented.
- ***Documentation:*** Clear communication about what took place and what decisions were made by the group.
- ***Preservation of "organizational memory":*** Even those unable to attend the meeting will know what took place; great for geographically separated team members.

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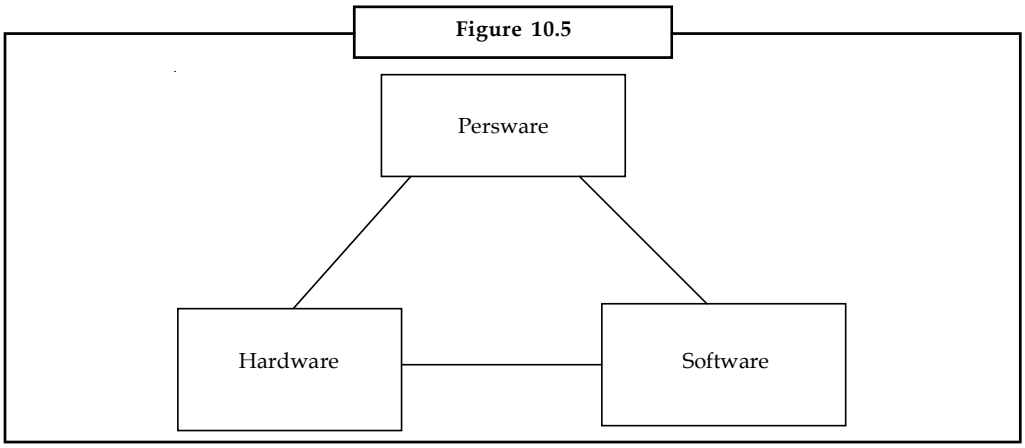
10.4.1 GDSS Characteristics and Software Tools

Figure 10.5



In GDSS the hardware includes more than just computers and peripheral equipment. It also includes the conference facilities, audiovisual equipment, and networking equipment that connect everyone. The persware extends to the meeting facilitators and the staff that keeps the hardware operating correctly. As the hardware becomes more sophisticated and widely available, many companies are bypassing specially equipped rooms in favor of having the group participants "attend" the meeting through their individual desktop computers.

Many of the software tools and programs discussed, Groupware, can also be used to support GDSS. Some of these software tools are being reworked to allow people to attend meetings through Intranets or Extranets. Some highlights:

- ***Electronic Questionnaires:*** Set an agenda and plan ahead for the meeting.
- ***Electronic Brainstorming:*** Allows all users to participate without fear of reprisal or criticism.
- ***Questionnaire Tools:*** Gather information even before the meeting begins, so facts and information are readily available.
- ***Stakeholder Identification:*** Determines the impact of the group's decision.
- ***Group Dictionaries:*** Reduce the problem of different interpretations.

Now instead of wasting time in meetings, people will know ahead of time what is on the agenda. All of the information generated during the meeting is maintained for future use and reference. Because input is anonymous, ideas are evaluated on their own merit. And for geographically separated attendees, travel time and dollars are saved. Electronic meeting systems make these efficiencies possible. The following figure shows the sequence of activities at a typical EMS meeting.

All is not perfect with EMS, however. Face-to-face communications is critical for managers and others to gain insight into how people feel about ideas and topics. Body language can often speak louder than words.

Notes Some people still may not contribute freely because they know that all input is stored on the file server, even though it is anonymous. And the system itself imposes disciplines on the group that members may not like.

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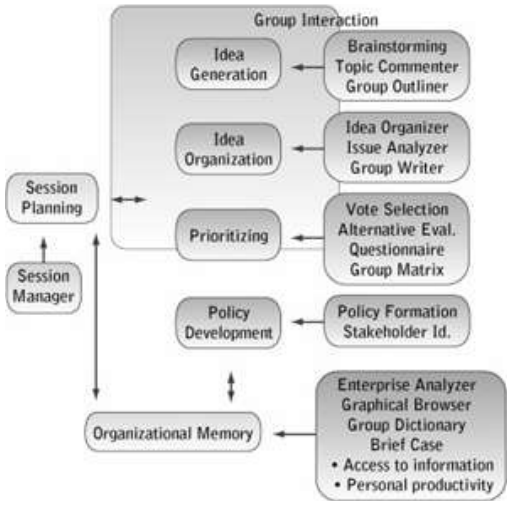
Figure 10.6: Group System Tools



10.4.2 Features of GDSS

Most versions of GDSS use special meeting rooms where each participant is seated at a networked computer. A facilitator operates the network and keeps the discussion moving in the right direction. Before the meeting, the primary decision maker meets with the facilitator to establish the objective of the meeting. They setup sample questions and design the overall strategy.

Typical meetings begin with a brainstorming session, where participants are asked to think of ideas, problems and potential solutions. They type each of these into categories on their computers. The basic ideas and suggestions are stored in a database and shared with the group through the networked computers.

In terms of discussions and comments, the facilitator can choose individual items and project them on the screen for the entire group to analyze. Participants can write comments or criticisms of any idea at any time. This system is particularly helpful if many participants come up with many ideas and comments at the same time. The computer enables everyone to enter comments at the same time, which is faster than waiting for each person to finish speaking.

Another feature of using the computer for the entry of ideas and comments is that they can be anonymous. Although each comment is numbered, they are not traced back to the original author, so people are free to criticize their supervisor's ideas. Anonymity reduces embarrassment and encourages people to submit riskier ideas.

At various points, the facilitator can call for participants to vote on some of the ideas and concepts. Depending on the software package, there can be several ways to vote. In addition to traditional one-vote methods, there are several schemes where you place weights on your choices. The votes are done on the computer and results appear immediately. Because it is so easy to vote, the GDSS encourages the group to take several votes. This approach makes it easier to drop undesirable alternatives early in the discussion.

One useful feature of conducting the meeting over a computer network is that all of the comments, criticisms, and votes are recorded. They can all be pointed at the end of the session. Managers can review all of the comments and add them to their reports.

In theory, a meeting could be conducted entirely on a computer network, saving costs and travel time if the participants are located in different cities. Also, if it is designed properly, a GDSS can

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give each participant access to the corporate data while he or she is in the meeting. If a question raises about various facts, the computer can find the answer without waiting for a second meeting.

10.4.3 Goals of GDSS

The goals of GDSS are:

- ***Mitigate the Problems of Group Work:***
  - Social pressures of conformity may result in "groupthink".
  - Lack of co-ordination of work and poor planning of meetings.
  - Inappropriate influence of group dynamics.
  - Tendency of group members to rely on others to do most of the work.
  - Tendency toward compromised solutions of poor quality.
  - Social "loafing"
  - Tendency to repeat what was already said.
  - Larger costs of making decisions.
  - Tendency of group to take riskier decisions than they should.
  - Incomplete or inappropriate use of information.
  - Inappropriate representation in group.
- ***Accentuate the Benefits of Group Work:***
  - Groups are better than individuals at understanding problems.
  - Groups are better than individuals at catching errors.
  - A group has more knowledge/information than any one member.
  - Working in a group may stimulate the participants and the process.
  - The participation of the members in a decision means less likelihood to resist implementation.
  - People are accountable for the decisions that they participate in.
- ***Support Multiple Group Processes:***
  - Provide methods that aid the decision and judgment process.
  - Provide access to rules that will aid the choice between alternatives.
  - Provide methods for reconciling conflict.

Task Discuss how GDSS differ from DSS?

10.4.4 Limitations of GDSS

Perhaps the greatest drawback to a GDSS is that it requires participants to type in their ideas, comments and criticisms. Most people are used to meetings based on oral discussions. Even if they have adequate typing skills, a GDSS can inhibit some managers.

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Along the same lines, in a traditional meeting, only one person speaks at a time, and everyone concentrates on the same issue at the same time. With a GDSS your focus is continually drawn to the many different comments and discussions taking place at the same time. People who type rapidly and fit from topic to topic will find that they can dominate the discussions.

In terms of costs, maintaining a separate meeting room with networked computers can be expensive. Unless the facility is used on a regular basis, the computers will be idle a great deal of then time. When you factor in the costs for network software, the GDSS software, and other utilities, the costs multiply. One way to minimize this problem is to lease the facilities that have been established by a couple of universities and some companies.

The use of GDSS also requires a trained facilitator – someone who can lead discussions, help users, and control the GDSS software on the network. Hiring an in-house specialist can be very expensive of there are only a few meetings a year. Again, using facilities are scrupulously honest; there might be some topics that you do not want to discuss with non-employees.

One way to overcome these limitations is to alter the approach to the meetings. Instead of requiring everyone to get together at the same time in on room, meetings could be held via network discussion groups. Each participant could read the messages, add comments, and vote on issues electronically at any time from any location. Again, the internet offers possibilities to provide these facilities, but it could be a few years before organizations and managers can accept the changes required.

Self Assessment

Fill in the blanks:

9. To help groups make decisions, a new category of systems was developed known as .....
10. Most versions of GDSS use special meeting rooms where each participant is seated at a ..... computer.
11. A ..... operates the network and keeps the discussion moving in the right direction.

10.5 Geographic Information System

A geographic information system (GIS), or geographical information system captures, stores, analyzes, manages, and presents data that is linked to location. Technically, GIS is geographic information systems which includes mapping software and its application with remote sensing, land surveying, aerial photography, mathematics, photogrammetry, geography, and tools that can be implemented with GIS software. Still, many refer to "geographic information system" as GIS even though it doesn't cover all tools connected to topology.

In the strictest sense, the term describes any information system that integrates, stores, edits, analyzes, shares, and displays geographic information. In a more generic sense, GIS applications are tools that allow users to create interactive queries (user created searches), analyze spatial information, edit data, maps, and present the results of all these operations. Geographic information science is the science underlying the geographic concepts, applications and systems, taught in degree and GIS Certificate programs at many universities.

In simplest terms, GIS is the merging of graphic map entities and databases. Consumer users would likely be familiar with applications for finding driving directions, like a GPS program on their hand-held device. GPS (Global Positioning System) is the real time location component that uses satellites to show your current position, "where am I now" on your device.

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GIS allows us to view, understand, question, interpret, and visualize data in many ways that reveal relationships, patterns, and trends in the form of maps, globes, reports, and charts.

A GIS helps you answer questions and solve problems by looking at your data in a way that is quickly understood and easily shared.

GIS technology can be integrated into any enterprise information system framework.

A typical GIS can be understood by the help of various definitions given below:

- A geographic information system (GIS) is a computer-based tool for mapping and analyzing things that exist and events that happen on Earth.
- Burrough in 1986 defined GIS as, "Set of tools for collecting, storing, retrieving at will, transforming and displaying spatial data from the real world for a particular set of purposes".
- Arnoff in 1989 defines GIS as, "a computer based system that provides four sets of capabilities to handle geo-referenced data:
  - Data input
  - Data management (data storage and retrieval)
  - Manipulation and analysis
  - Data output."

Hence GIS is looked upon as a tool to assist in decision-making and management of attributes that needs to be analysed spatially.

10.5.1 Views of GIS

A GIS is most often associated with a map. A map, however, is only one way you can work with geographic data in a GIS, and only one type of product generated by a GIS. A GIS can provide a great deal more problem-solving capabilities than using a simple mapping program or adding data to an online mapping tool (creating a "mash-up").

A GIS can be viewed in three ways:

- Database view
- Map view
- Model view

Database View

A GIS is a unique kind of database of the world—a geographic database (geodatabase). It is an "Information System for Geography." Fundamentally, a GIS is based on a structured database that describes the world in geographic terms.

Figure 10.7: Database View

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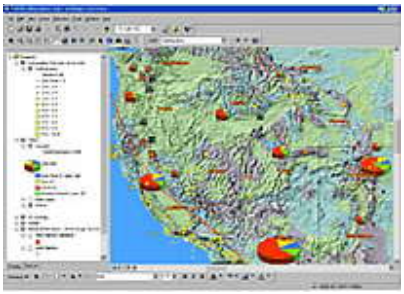
The Map View

A GIS is a set of intelligent maps and other views that show features and feature relationships on the earth's surface. Maps of the underlying geographic information can be constructed and used as "windows into the database" to support queries, analysis, and editing of the information.

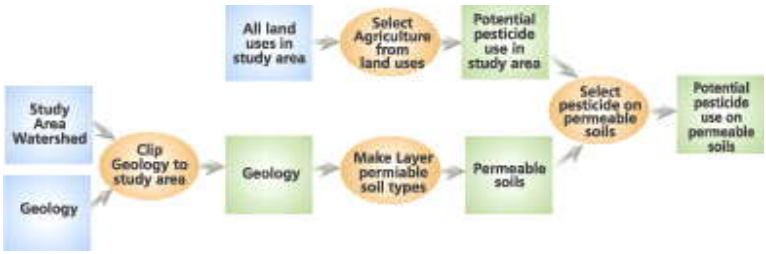
Figure 10.8: Map View



The Model View

A GIS is a set of information transformation tools that derive new geographic datasets from existing datasets. These geoprocessing functions take information from existing datasets, apply analytic functions, and write results into new derived datasets.

Figure 10.9: Model View



10.5.2 Components of GIS

GIS constitutes of five key components:

- Hardware
- Software
- Data
- People
- Method

Hardware

It consists of the computer system on which the GIS software will run. The choice of hardware system range from 300MHz Personal Computers to Super Computers having capability in Tera FLOPS. The computer forms the backbone of the GIS hardware, which gets it's input through the Scanner or a digitizer board. Scanner converts a picture into a digital image for further processing.

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The output of scanner can be stored in many formats e.g. TIFF, BMP, JPG, etc. A digitizer board is flat board used for vectorisation of a given map objects. Printers and plotters are the most common output devices for a GIS hardware setup.

Software

GIS software provides the functions and tools needed to store, analyze, and display geographic information. GIS softwares in use are MapInfo, ARC/Info, AutoCAD Map, etc. The software available can be said to be application specific. When the low cost GIS work is to be carried out desktop MapInfo is the suitable option. It is easy to use and supports many GIS feature. If the user intends to carry out extensive analysis on GIS, ARC/Info is the preferred option.

Did u know? For the people using AutoCAD and willing to step into GIS, AutoCAD Map is a good option.

Data

Geographic data and related tabular data can be collected in-house or purchased from a commercial data provider. The digital map forms the basic data input for GIS. Tabular data related to the map objects can also be attached to the digital data. A GIS will integrate spatial data with other data resources and can even use a DBMS, used by most organization to maintain their data, to manage spatial data.

People

GIS users range from technical specialists who design and maintain the system to those who use it to help them perform their everyday work. The people who use GIS can be broadly classified into two classes. The CAD/GIS operator, whose work is to vectorise the map objects. The use of this vectorised data to perform query, analysis or any other work is the responsibility of a GIS engineer/user.

Method

And above all a successful GIS operates according to a well-designed plan and business rules, which are the models and operating practices unique to each organization. There are various techniques used for map creation and further usage for any project. The map creation can either be automated raster to vector creator or it can be manually vectorised using the scanned images. The source of these digital maps can be either map prepared by any survey agency or satellite imagery.

Task Discuss why GIS is very popular in today's business world.

10.5.3 Advantages of GIS

The Geographic Information System has been an effective tool for implementation and monitoring of municipal infrastructure. The use of GIS has been in vogue primarily due to the advantage mentioned below:

- Planning of project
- Make better decisions

Notes

- Visual Analysis
- Improve Organizational Integration

Planning of Project

Advantage of GIS is often found in detailed planning of project having a large spatial component, where analysis of the problem is a pre requisite at the start of the project. Thematic maps generation is possible on one or more than one base maps.

Example: The generation of a land use map on the basis of a soil composition, vegetation and topography.

The unique combination of certain features facilitates the creation of such thematic maps. With the various modules within GIS it is possible to calculate surface, length, width and distance.

Making Decisions

The adage "better information leads to better decisions" is as true for GIS as it is for other information systems. A GIS, however, is not an automated decision making system but a tool to query, analyze, and map data in support of the decision making process. GIS technology has been used to assist in tasks such as presenting information at planning inquiries, helping resolve territorial disputes, and siting pylons in such a way as to minimize visual intrusion.

Visual Analysis

Digital Terrain Modeling (DTM) is an important utility of GIS. Using DTM/3D modeling, landscape can be better visualized, leading to a better understanding of certain relations in the landscape. Many relevant calculations, such as (potential) lakes and water volumes, soil erosion volume (Example: landslides), quantities of earth to be moved (channels, dams, roads, embankments, land leveling) and hydrological modeling becomes easier.

Not only in the previously mentioned fields but also in the social sciences GIS can prove extremely useful. Besides the process of formulating scenarios for an Environmental Impact Assessment, GIS can be a valuable tool for sociologists to analyze administrative data such as population distribution, market localization and other related features.

Improving Organizational Integration

Many organizations that have implemented a GIS have found that one of its main benefits is improved management of their own organization and resources. Because GIS has the ability to link data sets together by geography, it facilitates interdepartmental information sharing and communication. By creating a shared database one department can benefit from the work of another—data can be collected once and used many times.

As communication increases among individuals and departments, redundancy is reduced, productivity is enhanced, and overall organizational efficiency is improved. Thus, in a utility company the customer and infrastructure databases can be integrated so that when there is planned maintenance, affected people can be informed by computer generated letters.

10.5.4 Applications of GIS

Computerized mapping and spatial analysis have been developed simultaneously in several related fields. The present status would not have been achieved without close interaction between various fields such as utility networks, cadastral mapping, topographic mapping, thematic

Notes

cartography, surveying and photogrammetry remote sensing, image processing, computer science, rural and urban planning, earth science, and geography.

The GIS technology is rapidly becoming a standard tool for management of natural resources. The effective use of large spatial data volumes is dependent upon the existence of an efficient geographic handling and processing system to transform this data into usable information.

The GIS technology is used to assist decision-makers by indicating various alternatives in development and conservation planning and by modelling the potential outcomes of a series of scenarios.

Notes It should be noted that any task begins and ends with the real world. Data are collected about the real world. Of necessity, the product is an abstraction; it is not possible (and not desired) to handle every last detail. After the data are analysed, information is compiled for decision-makers. Based on this information, actions are taken and plans implemented in the real world.

Major Areas of Application

The major areas of GIS application are:

1. ***Different Streams of Planning:*** Urban planning, housing, transportation planning architectural conservation, urban design, landscape.
2. ***Street Network Based Application:*** It is an addressed matched application, vehicle routing and scheduling: location and site selection and disaster planning.
3. ***Natural Resource Based Application:*** Management and environmental impact analysis of wild and scenic recreational resources, flood plain, wetlands, acquifers, forests, and wildlife.
4. ***View Shed Analysis:*** Hazardous or toxic factories sitting and ground water modelling. Wild life habitat study and migrational route planning.
5. ***Land Parcel Based:*** Zoning, sub-division plans review, land acquisition, environment impact analysis, nature quality management and maintenance, etc.
6. ***Facilities Management:*** Can locate underground pipes and cables for maintenance, planning, tracking energy use.

Self Assessment

Fill in the blanks:

12. A ..... captures, stores, analyzes, manages, and presents data that is linked to location.
13. GIS technology can be integrated into any ..... information system framework.
14. A GIS will integrate spatial data with other data resources and can even use a ..... , used by most organization to maintain their data, to manage spatial data.
15. Using ..... , landscape can be better visualized, leading to a better understanding of certain relations in the landscape.

Notes

Case Study

Decision Making in Financial Institution

ABC Credit Corporation is a financial institution fully owned by the State Govt. and under the portfolio of State Ministry of Finance. Its mission is to encourage economic development through strategic disbursement of various kinds of loans.

ABC Corporation is divided in to two main divisions-operational & administration. The operational division manages the process for loan arrangements in various situations like agriculture, housing, hire purchase, etc.

Corporation has a good support of an MIS for various decision-making activities at strategic, tactic and operational levels:

- ***Strategic Level***: For introduction of new services to be offered by the corporation, shift MIS can be useful e.g., introduction of new schemes at lower interest rates can be offered for small business groups.
- ***Management Level***: Evaluation of performance of various types of loan's schemes can be done on the basis of some indicators and this indicator's information can be vital tool for future budget allocation on various future activities.
- ***Operational Level***: All the transactions related to repayments of loans, interests, etc. are managed by MIS and used for customer's enquiries related to current schemes/ offers, interest rates, or outstanding balances, etc.

MIS can be used to support structured, unstructured and semi-structured decisions e.g., providing complete application, meeting all the requirements for mortgage purpose, and the application where some criteria are met can be referred to the manager to make an informed decision.

MIS is supported by various sub-systems for different functional areas such as: personnel, training & legal issues, asset management, fund management etc., to assist the mainstream activity of recording customers details and repayments of loans and is continuously added and upgraded by MIS.

Questions:

1. Outline the different kinds of decisions taken by ABC corporation under the structured, semi-structured and unstructured categories.
2. For the decisions outlined in the previous question, identify the level of management associated with these decisions.
3. Consider a very small Co., where only a few people are decision makers. Explain how different levels of decision-making might be allocated.

Source: Management Information System by Dharmenda and Sangeeta Gupta

10.6 Summary

- Decision is a course of action consciously selected from available alternatives to achieve a desired goal.
- All decisions follow the same pattern although some may be more complex and require several iterations of the decision-making stages.

Notes

- Decision Support Systems (DSS) are a class of computerized information systems that support decision-making activities.
- Business Intelligence describes the process of turning data into information and then into knowledge.
- Decision making is a managerial process of choosing a particular course of action out of several alternative courses for the purpose of achieving the given objective.
- To help groups make decisions, a new category of systems was developed—the group decision-support system (GDSS).
- A geographic information system (GIS), or geographical information system captures, stores, analyzes, manages, and presents data that is linked to location.
- A GIS can provide a great deal more problem-solving capabilities than using a simple mapping program or adding data to an online mapping tool (creating a "mash-up").

10.7 Keywords

Data Driven DSS: Data-Driven DSS take the massive amounts of data available through the company's TPS and MIS systems and cull from it useful information which executives can use to make more informed decisions.

Decision Support System (DSS): An information system that utilizes decision models, a database, and a decision maker's own insights in an ad hoc, interactive analytical modeling process to reach a specific decision by a specific decision maker.

Decision-Making Process: A process of intelligence, design, and choice activities that result in the selection of a particular course of action.

Digital Terrain Modeling: Digital Terrain Modeling (DTM) is an important utility of GIS.

GIS: A geographic information system (GIS), or geographical information system captures, stores, analyzes, manages, and presents data that is linked to location.

Group Decision Making: Decisions made by groups of people coming to an agreement on a particular issue.

Group Decision Support System (GDSS): A decision support system that provides support for decision making by groups of people.

Model Driven DSS: A Model- Driven DSS may use a simple flat-file database with fewer than 1,000 records, but the model component is very important.

10.8 Review Questions

1. What is a decision support system? Discuss its components, characteristics and capabilities in detail.
2. Make distinction between structured and unstructured decision in detail.
3. Describe decision making process in detail.
4. How would you differentiate data driven DSS from model driven DSS?
5. What do you mean by GDSS? Also discuss the various features of GDSS in detail.
6. What do you mean by geographic information system in detail? Explain the various views of GIS.

Notes

7. Describe the advantages of GIS with suitable example.
8. You look near by you and check where your apply GIS for your future prospect.
9. Decision making process is necessary for all organization. Give your suggestion.
10. How does business intelligence helps in improving decision making?

Answers: Self Assessment

1.	Knowledge-Level	2.	structured
3.	Decision Support Systems (DSS)	4.	Model-Driven
5.	Business Intelligence	6.	tools
7.	Decision making	8.	managerial
9.	group decision-support system (GDSS)	10.	networked
11.	facilitator	12.	geographic information system (GIS)
13.	enterprise	14.	DBMS
15.	Digital Terrain Modeling (DTM)		

10.9 Further Readings

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Online link

w.gis.com/whatisgis

Notes

Unit 11: Managing Knowledge in the Digital Firm

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Objectives

After studying this unit, you will be able to:

- Understand the concept of knowledge management system
- Describe enterprise-wide knowledge management systems

Introduction

In today's new age economy, knowledge and information are the most important factors in the long-term success of both an individual and an organization. Knowledge and knowledge management have emerged as a vital component for many organizations. In fact, knowledge may soon be the only source of competitive advantage for an organization. All too often one part of an organization repeats the work of another part simply because it is impossible to keep track of, and makes use of knowledge in other parts. To manage knowledge it must first of all be captured or acquired in some useful form. In this unit, we will discuss the concept of knowledge management systems and enterprise-wide knowledge management systems.

11.1 Knowledge Management

Knowledge management is a critical component of an organizations success. Knowledge assets are the knowledge that an organization owns or needs to own, to achieve its goals.

Every company's knowledge requirements are a unique combination of knowledge strategy, tools and technologies, processes and procedures. Knowledge management technologies capture this intangible element in an organization and make it universally available. This approach has

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come to be known as knowledge management: the practice of capturing and organizing information to make it more accessible and valuable to those who need it.

With the impact of globalization, the Internet, and the rapid evolution of technology, managing knowledge for competitive advantage has become more important than ever. Knowledge management is therefore an "essential ingredient of success" for all organizations.

Did u know? **What is knowledge?**

Knowledge is information extracted, filtered or formatted in some way.

Task Discuss why business intelligence is necessary for organization in today scenario.

Self Assessment

Fill in the blanks:

1. ..... is information, extracted, filtered or formatted in some way.
2. Knowledge ..... are the knowledge that an organization owns or needs to own, to achieve its goals.
3. ..... is the practice of capturing and organizing information to make it more accessible and valuable to those who need it.
4. Knowledge management technologies capture the ..... element in an organization and make it universally available.

11.2 Types of Knowledge

Knowledge can be divided into two types – Tacit knowledge and Explicit knowledge. Tacit knowledge is implicit, whereas Explicit knowledge is rule-based knowledge that is used to match actions to situations by invoking appropriate rules. An organization promotes the learning of Tacit knowledge to increase the skills and creative capacities of its employees and takes advantage of Explicit knowledge to maximize efficiency.

11.2.1 Explicit Knowledge

Knowledge that can be more easily attained and is often expressed or documented in a formal, systematic manner - frequently in words and numbers.

Example: Include Management Directives, Executive Orders, policy manuals, and reference guides.

- Explicit knowledge is used in the design of routines, standard operation procedures, and the structure of data records. These forms of knowledge can be found in any organization.
- It allows an organization to enjoy a certain level of operational efficiency and control.
- Explicit knowledge promotes equable, consistent organizational responses.

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11.2.2 Tactic Knowledge

Knowledge that can also be attained, but is not as easily transferred. Tacit knowledge can be attained through dialogue, job shadowing, story-telling, and sharing of best practices and lessons learned. It usually is rooted in an individual's experiences, intuition, insight, judgment, and knowledge of organizational values. Individuals with tacit knowledge are usually considered to be experts within their organizations and frequently sought out for guidance and input.

- Tacit knowledge includes hands-on skills, best practices, special know-how, and intuitions. Personal knowledge that is difficult to articulate.
- Tacit knowledge in an organization ensures task effectiveness. It also provides for a kind of creative vitality – intuition and spontaneous insight can often tackle tough problems that would otherwise be difficult to solve.
- Traditionally the transfer of Tacit knowledge is through shared experience, through apprenticeship and job training.
- Tacit knowledge is cultivated in an organizational culture that motivates through shared vision and common purpose.

An organization must adopt a holistic approach to knowledge management that successfully combines Tacit and Explicit knowledge at all levels of the organization.

Did u know? Personal knowledge is leveraged with Explicit knowledge for the design and development of innovative products, services and processes.

Self Assessment

Fill in the blanks:

5. ..... knowledge is the one that can be attained, but is not as easily transferred.
6. ..... knowledge is rule-based knowledge that is used to match actions to situations by invoking appropriate rules.
7. The ..... of Tacit knowledge is through shared experience, through apprenticeship and job training.
8. ..... knowledge is leveraged with Explicit knowledge for the design and development of innovative products, services and processes.

11.3 Knowledge Work Systems

Knowledge work systems are there to help to deal with problems requiring technical expertise or knowledge. Software includes:

- ***Word-processing*** for clerical staff;
- ***Spreadsheets for accounts***, and sales staff;
- ***Database managements systems*** for keeping records;
- ***CAD*** for designers;
- ***Project management*** systems;

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- *Expert systems for specialist staff*. An example of this may be a system that enables an engineer to select a particular metal alloy for a bearing. He could type in the parameters he needs and the system can suggest several different alloys. It is then up to the engineer to us his knowledge and experience to decide what alloy he will use.

KWS help the professional specialist.

11.3.1 Requirements of KWS

- Help knowledge workers create and integrate knowledge into the organization.
- Need links worker to external and internal (organization) information.
- Software needs include powerful graphics, analytic capabilities, document management, and communication capabilities.
- Usually need much processing power.

Examples of KWS

- **Computer Aided Design (CAD)** systems for sophisticated graphics,
- **Virtual Reality** systems for simulating the real world (entertainment and work, i.e. flight simulators). Use interactive graphics and sensor equipment.
- **Virtual Reality Modeling Language (VRML)** is a standardized modeling language to 3-D modeling on the WWW. It can include multimedia types (image, animation, audio) to simulate real world settings. Browsers by Netscape and Microsoft are VRML compliant.
- **Investment Workstations** integrate data from many sources. Used in the financial industry. i.e., The Bloomberg Terminal.

Self Assessment

Fill in the blanks:

9. ..... are used to help to deal with problems requiring technical expertise or knowledge.
10. KWS help knowledge workers create and ..... knowledge into the organization.
11. ..... is a standardized modeling language to 3-D modeling on the WWW.

11.4 Enterprise-wide Knowledge Management Systems

Effective knowledge management needs a unified, managed technique that traverses the enterprise and exceeds departmental restrictions.

Each organization, regardless of its size, depends on ready access to information to attain its goals, serve consumers and make the most of productivity. But for an organization's knowledge management attempts to be really effective in the information age, we must construct a single-source knowledge management system that crosses all organizational restrictions and obtains effective knowledge sharing both inside and away from the enterprise.

Let us take the condition at most organizations today: The position of individuals in most professional services firms has occurred to comprise research and knowledge recovery as a core job duty. Individuals across the enterprise are tasked with the recovery of information so as to carry out their duties productively.

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But hardly ever can individuals from faraway reaches of the enterprise search via shared or linked data repositories. Instead, information is more probable to be managed into a closed system where it is used by one efficient user group for a particular set of tasks. What is obtainable to one workgroup is not obtainable to another. This is the basic design of knowledge management nowadays.

Knowledge management, as it appears at most organizations, addresses the limited requirements of individual departments and workgroups, is duplicative, and distributed. Wouldn't it be more competent to frame an enterprise-wide knowledge management infrastructure that crosses all functional boundaries inside the organization, and generates general data objects and definitions that can be accessed with equivalent ease and success by all employees? This is what we call Enterprise Knowledge Management (EKM), and it is a critical feature of any business plan in the information age.

Researcher and advisor Karl-Erik Sveiby and others have illustrated knowledge management as the management of an organization's insubstantial assets. There are three types of insubstantial assets:

- External: relationships, brand names, reputation, and image
- Internal: patents, concepts, models, and processes
- Individual: skills, education, experience, and values.

The role of knowledge management has typically been seen as the conversion of individual assets – those connected with the employees – into internal assets – those preserved by the organization.

Notes We have noticed recently that knowledge management is playing a larger role in the attraction and retention of staff.

Every one of our employees needs to know how they will cultivate in their jobs and what they will study from us. Actually, it is the major query on their minds – right after how many stock choices they are going to obtain.

So Knowledge Management is now having a dual role:

- To attract employees to the organization and retain them, if possible
- To retain their knowledge, if not.

Organizations cannot efficiently influence the control of knowledge management until the framers of organizational communication look at the "big picture" of a company's organizational resources and requirements.

Caution The cautious execution of an enterprise-wide knowledge management system will provide increase to a cross-functional and consolidated corporate data repository depending on open data access standards that generates new levels of communications, remove inefficiencies, and is translucent to its users.

Task Make distinction between external and internal asset.

Notes

11.4.1 Building Enterprise Knowledge Management

Enterprise knowledge management can be defined as a consistent and incorporated vision of the sources and uses of knowledge across an association. Enterprise knowledge management considers into account every knowledge source—from what employees identify to what clients tell us—and combines it with traditional corporate knowledge like standard operating procedures. To implement enterprise knowledge management initiate by creating a single corporate data model that recognizes common data and objects and makes them usable across the whole enterprise.

The enterprise knowledge management scheme depends on a few simple principles and traits:

1. The first principle of enterprise knowledge management is that there is no "natural" view of data. Each and every data object is generated in a manner that is autonomous of the eventual use of that data. To generate data objects, standard definitions of them must be formed and adhered to. In the same way that relational databases must normalize data—remove redundant data and replication of objects—so as to be efficient and avoid maintenance confusion and errors, so too does enterprise knowledge management rely on normalized knowledge for smooth operation and ease of management.
2. Enterprise knowledge management needs open architectures and standard protocols. The individual applications that will maintain enterprise knowledge management all through the organization must be able to converse with each other, which is why applications with proprietary data stores have no position in enterprise knowledge management.
3. Enterprise knowledge management must incorporate internal and external data. The restrictions of corporate knowledge go beyond internal knowledge. The knowledge shared by suppliers, distributors, and clients in their transactions with us is significant company data that must, along with internal data, be managed. Additionally, every company requires access to analyst reports, aggressive information, macroeconomic information, and much more. While we typically have some control over the format of internal data, we normally have much less control over external data. This is why standards like XML tags will in the upcoming days be critical.
4. The enterprise knowledge management effort must embrace all electronic corporate communications; intranets, extranets, and public Web sites must all sketch from the same data resources. The traditional view of intranets, extranets, and Websites is that they represent diverse repositories or networks. They were considered of as exclusive entities with little in common beyond their shared infrastructure. But this view is incorrect. To generate separate repositories of data for each of these entities is redundant and unnecessary. There is plenty of data that can and should be shared across these sites: project data, phone numbers, news, etc. It's the data that should be labelled as public or private, confidential or non-confidential, not the network.
5. Ultimately, and most significantly, enterprise knowledge management must cross functional boundaries inside the organization. Businesses are managed into functional groups (IT, HR, Sales, Research) to make management simpler. Don't make the error of trying to make your corporate knowledge fit into the same inflexible structure. Corporate organizational structures occur to make it simpler to organize people, not knowledge. There is no reason that your corporate knowledge and your people should share the similar organization chart. Once you appreciate the different uses for your corporate data, the structure of the data mapping should fall into position.

Notes

Notes Enterprise knowledge management considers every probable use of such knowledge—internal use, from human resources to sales; and outwardly, from clients to probable business partners. No source or use of information is unaccounted for inside the system.

Self Assessment

Fill in the blanks:

12. ..... intangible asset includes relationships, brand names, reputation, and image.
13. ..... knowledge management takes into account every knowledge source and merges it with traditional corporate knowledge.
14. To create ..... objects, standard definitions of them must be created and adhered to.
15. The role of knowledge management has usually been seen as the transformation of individual assets into ..... assets.

11.5 Summary

- Knowledge management is a critical component of an organizations success. Knowledge assets are the knowledge that an organization owns or needs to own, to achieve its goals.
- Knowledge is information, extracted, filtered or formatted in some way.
- With the impact of globalization, the Internet, and the rapid evolution of technology, managing knowledge for competitive advantage has become more important than ever.
- Tacit knowledge is implicit, whereas Explicit knowledge is rule-based knowledge that is used to match actions to situations by invoking appropriate rules.
- Knowledge work systems are there to help to deal with problems requiring technical expertise or knowledge.
- Effective knowledge management needs a unified, managed technique that traverses the enterprise and exceeds departmental restrictions.
- The role of knowledge management has typically been seen as the conversion of individual assets – those connected with the employees – into internal assets – those preserved by the organization.
- Enterprise knowledge management can be defined as a consistent and incorporated vision of the sources and uses of knowledge across an association.

11.6 Keywords

Business Partners: Business partners are essential to any business, whether it is suppliers, payment processing companies, customer support companies or delivery companies that help your business throughout its cycle.

Knowledge base: This is the domain knowledge that is used to guide the search or evaluate the interestingness of resulting patterns.

Notes

Knowledge Management: Knowledge management is a critical component of an organizations success. Knowledge assets are the knowledge that an organization owns or needs to own, to achieve its goals.

Knowledge: Knowledge is information, extracted, filtered or formatted in some way.

11.7 Review Questions

1. Explain the role played by the Knowledge Management in Organizations.
2. Explain the various steps in the attempt to implement Knowledge Management in a company.
3. Discuss the difference between Office Automation Systems and Knowledge Work Systems in the way they create and use knowledge and information.
4. Make distinction between explicit knowledge and tactic knowledge.
5. Explain the requirements of knowledge work systems with examples.
6. Interview a local manager and discuss the applications of OAS in his organisation. Try to gather information about the attempts made to create Knowledge Base in the company.
7. Explain the concept of Enterprise-wide knowledge management systems in detail.
8. Illustrate how to implement enterprise knowledge management.
9. Explain various principles and traits on which enterprise management scheme depends.
10. Enlighten the different types of assets used in enterprise-wide knowledge management systems.

Answers: Self Assessment

1.	Knowledge	2.	assets
3.	Knowledge management	4.	intangible
5.	Tactic	6.	Explicit
7.	transfer	8.	Personal
9.	Knowledge work systems	10.	integrate
11.	Virtual Reality Modeling Language (VRML)		
12.	External	13.	Enterprise
14.	data	15.	internal

11.8 Further Readings

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Online link www.web-source.net

Notes

Unit 12: Intelligent Techniques

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Objectives

After studying this unit, you will be able to:

- Understand the concept of expert systems
- Discuss fuzzy logic systems
- Explain neural networks
- Understand the concept of genetic algorithm
- Discuss hybrid AI systems
- Explain intelligent agents

Introduction

In this unit we will discuss various intelligent techniques such as expert systems, fuzzy logic systems, Neural networks, genetic algorithm, hybrid AI systems, and intelligent agents.

Notes

12.1 Expert System

First of all we must understand that an expert system is nothing but a computer program or a set of computer programs which contains the knowledge and some inference capability of an expert, most generally a human expert, in a particular domain. As expert system is supposed to contain the capability to lead to some conclusion based on the inputs provided, information it already contains and its processing capability, an expert system belongs to the branch of Computer Science called Artificial Intelligence.

Mere possessing an algorithm for solving a problem is not sufficient for a program to be termed an expert system, it must also possess knowledge i.e., if there is an expert system for a particular domain or area and if it is fed with a number of questions regarding that domain then sooner or later we can expect that these questions will be answered. So we can say that the knowledge contained by an expert system must contribute towards solving the problems for which it has been designed.

Also knowledge in a expert system must be regarding a specific domain. As a human being cannot be an expert in every area of life, similarly, an expert system which tries to simulate the capabilities of an expert also works in a particular domain. Otherwise it may be require to possess potentially infinite amount of knowledge and processing that knowledge in finite amount of time is an impossible task.

Taking into consideration all the points which have been discussed above, let us try to give one of the many possible definitions of an Expert System.

An Expert System is a computer program that possesses or represents knowledge in a particular domain, has the capability of processing/manipulating or reasoning with this knowledge with a view to solving a problem, giving some achieving or to achieve some specific goal.

An expert system may or may not provide the complete expertise or functionality of a human expert but it must be able to assist a human expert in fast decision making. The program might interact with a human expert or with a customer directly.

12.1.1 Expert System Definition

A model and associated procedure that exhibits, within a specific domain, a degree of expertise in problem solving that is comparable to that of a human expert.

An expert system is a computer system which emulates the decision-making ability of a human expert.

Simply put, an expert system contains knowledge derived from an expert in some narrow domain. This knowledge is used to help individuals using the expert system to solve some problem.

Notes The narrow domain is mentioned since it is quite difficult to encode enough knowledge into a system so that it may solve a variety of problems. We have not reached the point yet where this can be done.

The traditional definition of a computer program is usually:

algorithm + data structures = program

In an expert system, the definition changes to:

inference engine + knowledge = expert system

Notes

12.1.2 Basic Properties of an Expert System

The basic properties of expert system are:

- It tries to simulate human reasoning capability about a specific domain rather than the domain itself. This feature separates expert systems from some other familiar programs that use mathematical modeling or computer animation. In an expert system the focus is to emulate an expert's knowledge and problem solving capabilities and if possible, at a faster rate than a human expert.
- It perform reasoning over the acquired knowledge, rather than merely performing some calculations or performing data retrieval.
- It can solve problems by using heuristic or approximate models which, unlike other algorithmic solutions are not guaranteed to succeed.

AI programs that achieve expert-level competence in solving problems in different domains are more called knowledge based systems. A knowledge-based system is any system which performs a job or task by applying rules of thumb to a symbolic representation of knowledge, instead of employing mostly algorithmic or statistical methods. Often the term expert systems is reserved for programs whose knowledge base contains the knowledge used by human experts, in contrast to knowledge gathered from textbooks or non-experts. But more often than not, the two terms, expert systems and knowledge-based systems are taken us synonyms. Together they represent the most widespread type of AI application. The area of human intellectual endeavour to be captured in an expert system is sometimes called the task domain.

Did u know? **What is task domain?**

Task refers to some goal-oriented, problem-solving activity. Domain refers to the area within which the task is being performed. Some of the typical tasks are diagnosis, planning, scheduling, configuration and design.

Example: A program capable of conversing about the weather would be a knowledge-based system, even if that program did not have any expertise in meteorology, but an expert system must be able to perform weather forecasting.

12.1.3 Characteristics of Expert System

1. Expert system is an application of artificial Intelligence which incorporates knowledge and problem solving skills of a human being into an information system.
2. Expert system can replace human beings.
3. Expert systems are not designed for one level of management because their primary goal is to provide expertise to whole organization.
4. Expert system has three components such as knowledge base, the inference engine and the user interface.

12.1.4 Need of Expert System

There are many reasons to use an expert system. Here are some of the primary reasons:

- Helps preserve knowledge-builds up the corporate memory of the firm.

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- Helps if expertise is scarce, expensive, or unavailable.
- Helps if under time and pressure constraints.
- Helps in training new employees.
- Helps improve worker productivity.

Expert systems are necessitated by the limitations associated with conventional human decision-making processes, including:

- Human expertise is very scarce.
- Humans get tired from physical or mental workload.
- Humans forget crucial details of a problem.
- Humans are inconsistent in their day-to-day decisions.
- Humans have limited working memory.
- Humans are unable to comprehend large amounts of data quickly.
- Humans are unable to retain large amounts of data in memory.
- Humans are slow in recalling information stored in memory.
- Humans are subject to deliberate or inadvertent bias in their actions.
- Humans can deliberately avoid decision responsibilities.
- Humans lie, hide, and die.

Coupled with these human limitations are the weaknesses inherent in conventional programming and traditional decision-support tools. Despite the mechanistic power of computers, they have certain limitations that impair their effectiveness in implementing human-like decision processes. Conventional programs:

- Are algorithmic in nature and depend only on raw machine power
- Depend on facts that may be difficult to obtain
- Do not make use of the effective heuristic approaches used by human experts
- Are not easily adaptable to changing problem environments
- Seek explicit and factual solutions that may not be possible.

12.1.5 Building Block of Expert System

There are basically four steps to building an expert system:

- Analysis
- Specification
- Development
- Deployment

The spiral model is normally used to implement this approach. The spiral model of developing software is fairly common these days. Expert system development can be modeled as a spiral, where each circuit adds more capabilities to the system. There are other approaches, such as the incremental or linear model, but we prefer the spiral model.

Notes

Analysis

The purpose of analysis is to identify a potential application. Possible applications include diagnostics, a controller, etc. During analysis the developer must also assess the suitability of knowledge-engineering technology for this application. You must ask yourself the question Will something else work better? This is true for applying any type of artificial intelligence to solve a problem.

Caution If there is a numerical method or heuristic that is well established, then stick with that approach and use artificial intelligence to solve problems which are difficult.

Specification

The specification step is where the developer defines what the expert system will do. Here the developer must also work with the expert to learn enough about the task to plan system development. The expert is a human who is identified as being the domain expert in a particular field. The developer must familiarize himself with the problem so that system development can be performed. The developer will spend a significant amount of time in this phase acquiring knowledge.

Defining what an expert system should do can be challenging. It may be difficult to obtain reliable information. Some experts may solve problems differently, or tell the developer what they think he wants to hear. The experts may envision a different functionality for the system than the developer, who better understands the limitations of the software. It is also important to assure the experts that the purpose of the expert system is not to replace the experts, but to proliferate their knowledge and expertise throughout the organization. It is up to the human experts to continually refine their knowledge and find better ways of solving problems.

Caution Once an expert system is developed, it cannot create new ways to solve problems.

Development

The development step consists of several important tasks. Here, the developer must learn how the expert performs the task (knowledge acquisition) in a variety of cases. There are basically three kinds of cases the developer should discuss with the expert: current, historical, and hypothetical. Current cases can be covered by watching the expert perform a task. Historical cases can be discussed by discussing with the expert a task that was performed in the past. And, hypothetical cases can be covered by having the expert describe how a task should be performed in a hypothetical situation.

The knowledge acquisition process, which started in the specification phase, continues into the development phase. The developer must extract knowledge from the previous case discussions. The types of knowledge the developer looks for can be grouped into three categories: strategic, judgemental, and factual. Strategic knowledge is used to help create a flow chart of the system. Judgemental knowledge usually helps define the inference process and describes the reasoning process used by the expert.

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Did u know? Factual knowledge describes the characteristics and important attributes of objects in the system.

Deployment

In the deployment phase the developer installs the system for routine use. He also fixes bugs, updates, and enhances the expert system.

Task Discuss specification building block of expert system.

Self Assessment

Fill in the blanks:

1. An ..... is a computer system which emulates the decision-making ability of a human expert.
2. A ..... system is any system which performs a job or task by applying rules of thumb to a symbolic representation of knowledge, instead of employing mostly algorithmic or statistical methods.
3. The ..... step is where the developer defines what the expert system will do.
4. Expert system development can be modeled as a ....., where each circuit adds more capabilities to the system.

12.2 Fuzzy Logic Systems

Fuzzy Logic Systems are defined as computer-based systems that can access data that are incomplete or only partially accurate. These systems can solve unstructured problems with incomplete knowledge by producing approximate inferences and solutions.

Fuzzy Logic is a technique of reasoning that appears similar human reasoning as it permits for approximate values and inferences (fuzzy logic) and incomplete data (fuzzy data) rather than depending only on Crisp data, like binary (yes/no) options.

Fuzzy Logic in Business

Instances of applications of fuzzy logic are various in Japan, but rate in the United States. The United States has tended to favor by means of AI solutions such as expert systems or neural networks. Japan has executed many fuzzy logic applications, especially the use of special-purpose fuzzy logic microprocessors chips, known as fuzzy process controllers.

Example: Fuzzy logic applications in Japan include:

- Riding in subway trains and elevators
- Riding in cars that are guided or supported by fuzzy process controllers
- Trading shares on the Tokyo Stock Exchange by means of a stock-trading program depending on fuzzy logic

Notes

- Japanese-made products that use fuzzy logic microprocessors comprise auto-focus cameras, auto-stabilizing, camcorders, energy-efficient air conditioners, self-adjusting washing machines, and automatic transmissions.

Self Assessment

Fill in the blanks:

5. Fuzzy Logic Systems are ..... systems that can process data that are incomplete or only partially correct.
6. ..... is a method of reasoning that resembles human reasoning since it allows for approximate values and inferences and incomplete data instead of relying only on Crisp data, such as binary (yes/no) choices.

12.3 Neural Networks Artificial Neural Systems

Neural networks are defined as computing systems modeled on the human brain's mesh-like network of interlinked processing elements, known as neurons. Neural networks can be executed on microcomputers and other computer systems through software packages, which simulate the actions of a neural network of many processing elements. Specialized neural network co-processor circuit boards are also obtainable. Special-purpose neural net microprocessor chips are used in some application areas. Uses comprise:

- Military weapons systems
- Voice recognition
- Check signature verification
- Manufacturing quality control
- Image processing
- Credit risk assessment
- Investment forecasting
- Data mining

Notes Obviously, neural networks are much easier than the human brain (measured to have more than 100 billion neuron brain cells). Similar to brain, however, such networks can process many parts of information at the same time and can study to identify patterns and program themselves to solve associated problems on their own.

Self Assessment

Fill in the blanks:

7. Neural networks are computing systems modelled on the human brain's mesh-like network of interconnected processing elements, called .....
8. Neural networks can be implemented on ..... and other computer systems via software packages.

Notes

12.4 Genetic Algorithm

The use of genetic algorithms is a rising application of artificial intelligence. Genetic algorithm software accesses Darwinian (survival of the fittest); randomizing, and other mathematical functions to create an evolutionary process that can capitulate increasingly better solutions to a problem. Genetic algorithms were initially used to create millions of years in biological, geological, and ecosystem evolution in just a few minutes on a computer. Now genetic algorithm software is being accessed to model numerous scientific, technical, and business processes. Genetic algorithms are especially useful for conditions in which thousands of solutions are probable and must be calculated to form a best possible solution. Genetic algorithm software accesses sets of mathematical process rules (algorithms) that mention how combinations of process components or steps are to be produced. This may comprise:

- Trying random process combinations (mutation)
- Merging parts of several good processes (crossover)
- Choosing good sets of processes and discarding poor ones (selection).

Self Assessment

Fill in the blanks:

9. The use of genetic algorithms is a growing application of .....
10. Genetic algorithms were first used to ..... millions of years in biological, geological, and ecosystem evolution in just a few minutes on a computer.
11. Genetic algorithm software uses sets of ..... process rules (algorithms) that specify how combinations of process components or steps are to be formed.

12.5 Hybrid AI Systems

Hybrid system is defined as a software system which employs, in parallel, a mixture of methods and techniques from artificial intelligence subfields as Neuro-fuzzy systems, hybrid connectionist-symbolic models, Fuzzy expert systems, etc.

Every natural intelligent system is considered as hybrid since it accomplishes mental functions on both the symbolic and sub symbolic stages. From the previous few years there has been an growing conversation of the significance of A.I. Systems Integration. Relying on ideas that there have already been produced simple and particular AI systems and now is the time for integration to generate broad AI systems.

Example: Hybrid is a hierarchical control system where the lowest, reactive layers are sub-symbolic.

Notes

12.6 Intelligent Agents

An intelligent agent (also called intelligent assistants/wizards) is software replacement for an end user or a process that accomplishes a specified requirement or activity. An intelligent agent accesses an incorporated and learned knowledge base regarding a person or process to make decisions and finish tasks in a manner that accomplishes the intentions of a user. One of the most well recognized uses of intelligent agents is the wizards located in Microsoft Office and other software suites.

Figure 12.1

Types of Intelligent Agents

User Interface Agents

- **Interface Tutors.** Observe user computer operations, correct user mistakes, and provide hints and advice on efficient software use.
- **Presentation Agents.** Show information in a variety of reporting and presentation forms and media based on user preferences.
- **Network Navigation Agents.** Discover paths to information and provide ways to view information that are preferred by a user.
- **Role-Playing Agents.** Play what-if games and other roles to help users understand information and make better decisions.

Information Management Agents

- **Search Agents.** Help users find files and databases, search for desired information, and suggest and find new types of information products, media, and resources.
- **Information Brokers.** Provide commercial services to discover and develop information resources that fit the business or personal needs of a user.
- **Information Filters.** Receive, find, filter, discard, save, forward, and notify users about products received or desired, including e-mail, voice mail, and all other information media.

The use of intelligent agents is expected to grow quickly as a way for users to:

- Simplify software use.
- Locate websites on the Internet and corporate intranets
- Assist customers do comparison-shopping between the many e-commerce sites on the Web.

Task Make distinction between user interface agents and information management agents.

Self Assessment

Fill in the blanks:

12. Every natural intelligent system is considered as ..... since it accomplishes mental functions on both the symbolic and sub symbolic stages.
13. An ..... is a software surrogate for an end user or a process that fulfils a stated need or activity.
14. An intelligent agent uses a ..... and learned knowledge base about a person or process to make decisions and accomplish tasks.

Notes

15. Intelligent agents help customers do comparison-shopping among the many ..... sites on the Web.

12.7 Summary

- An expert system is nothing but a computer program or a set of computer programs which contains the knowledge and some inference capability of an expert, most generally a human expert, in a particular domain.
- An expert system is a computer system which emulates the decision-making ability of a human expert.
- Expert systems are necessitated by the limitations associated with conventional human decision-making processes.
- Expert system development can be modeled as a spiral, where each circuit adds more capabilities to the system.
- Fuzzy Logic Systems are defined as computer-based systems that can access data that are incomplete or only partially accurate.
- Neural networks are defined as computing systems modeled on the human brain's mesh-like network of interlinked processing elements, known as neurons.
- Genetic algorithm software accesses Darwinian (survival of the fittest); randomizing, and other mathematical functions to create an evolutionary process that can capitulate increasingly better solutions to a problem.
- An intelligent agent is a software replacement for an end user or a process that accomplishes a specified requirement or activity.

12.8 Keywords

Expert System: An Expert System is a computer program that possesses or represents knowledge in a particular domain, has the capability of processing/manipulating or reasoning with this knowledge with a view to solving a problem, giving some achieving or to achieve some specific goal.

Fuzzy Logic Systems: Fuzzy Logic Systems are defined as computer-based systems that can access data that are incomplete or only partially accurate.

Genetic Algorithm: Genetic algorithm software accesses Darwinian (survival of the fittest); randomizing, and other mathematical functions to create an evolutionary process that can capitulate increasingly better solutions to a problem.

Intelligent Agent: An intelligent agent is a software replacement for an end user or a process that accomplishes a specified requirement or activity.

Neural Networks: Neural networks are defined as computing systems modeled on the human brain's mesh-like network of interlinked processing elements, known as neurons.

12.9 Review Questions

1. What do you mean by expert system? Why organization need expert system?
2. Explain the fundamental properties of expert system.
3. Enlighten the various traits of expert system.

Notes

4. What are the steps included in building an expert system? Explain each of them.
5. What are fuzzy logic systems? How do you compare it with human reasoning?
6. Illustrate the process of fuzzy logic in business.
7. Exemplify the concept of neural networks. Also enlighten its uses.
8. Explain the use of genetic algorithm with examples.
9. What is intelligent agent? Also discuss the use of intelligent agents.
10. Elucidate the concept of hybrid AI Systems.

Answers: Self Assessment

1.	expert system	2.	knowledge-based
3.	specification	4.	spiral
5.	computer-based	6.	Fuzzy Logic
7.	neurons	8.	microcomputers
9.	artificial intelligence	10.	simulate
11.	mathematical	12.	hybrid
13.	intelligent agent	14.	built-in
15.	e-commerce		

12.10 Further Readings

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Online link

www.gis.com/whatisgis

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Unit 13: Redesigning the Organization with Information Systems

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Objectives

After studying this unit, you will be able to:

- Understand the concept of redesigning the organization
- Discuss BPR and Process Improvement
- Explain system analysis
- Describe system design

Notes

Introduction

Redesigning the organization is not a easy task no body can change the organization in a short period every activity take some time to improvement. Redesigning the organization with the help of information system also take some time. In this unit you read some aspects related to information system those play important role in the organization change according to the environment or condition.

13.1 Systems as Planned Organizational Change

The introduction of a new information system involves much more than new hardware and software. It also includes change in jobs, skills, management, and organization. In the socio-technical philosophy, one cannot install new information system, we are redesigning the organization.

One important thing to know about building a new information system is that is process is one kind of planned organizational change. System builders must understand how a system will affect the organization as a whole, focusing particularly on organization conflict and change in the locus of decision marking. Builders must also consider how the nature of work groups will change under the new system. Systems can be technical successes but organizational failures because of a failure in the social and political process of building the system. Analysts and designers are responsible for ensuring that key member of the organization participate in the design process and permitted to influence the system's ultimate shape.

13.1.1 Linking Information Systems to the Business Plan

Deciding which new systems to be build an essential component of the organizational planning process. Organization need to develop an information systems plan that supports their overall business plan and that incorporates strategic systems into top-level planning. One specific project have been selected within the overall context of a strategic plan for the nosiness and the systems area, an information system plan can be developed. The plan serves as road map indicating the direction of systems development, the rationale, the current situation, the management strategy, the implementation plan, and the budget.

13.1.2 Establishing Organizational Information Requirements

In order to develop an effective information systems plan, the organization must have a clear understanding of both its long-term and short-term information requirements. Two principal methodologies for establishing the essential information requirements of the organization as whole are enterprise analysis and success factors.

Enterprise Analysis (Business Systems Planning)

Enterprise analysis argues that the firm's information requirements can only be understood by looking at the entire organization units, functions, processes, and data elements. Enterprise analysis can help identify the key entities and attributes of the organization's data.

The central method used in the enterprise analysis approach is to take a large sample of managers and ask them how they use information, where they get their information, what their environments are like, what their objectives are, how they make decision, and what their data needs are.

Notes

Figure 13.1: Process/Data Class Matrix

LOGICAL APPLICATION GROUPS	PROCESSES \ DATA CLASSES	Actuarial estimates	Agency plans	Budget	Program reqs./policy	Admin. reqs./policy	Labor agreements	Data standards	Procedures	Automated systems documentation	Educational media	Public agreements	Intergovernmental agreements	Grants	External	Exchange control	Administrative accounts	Program expenditures	Audit reports	Organization/position	Employee identification	Recruitment/placement	Complaints/grievances	Training resources	Security	Equipment utilization	Space utilization	Supplies utilization	Workload schedules	Work measurement	Enumeration I.D.	Enumeration control	Earnings	Employer I.D.	Earnings control	Claims characteristics	Claims control	Decisions	Payment	Collection/waiver	Notice	Inquiries control	Quality appraisal
PLANNING	Develop agency plans	C	C	C	U	U										U																											
	Administer agency budget	C	C	C	U	U						U	U	U		U	U	U		U	U					U	U	U		U		U			U		U			U		U	U
	Formulate program policies	U	U		C				U							U			U				U														U						U
	Formulate admin. policies		U		U	C	C		U							U			U	U			U																				
	Formulate data policies		U	U		U		C	U	U															U	U	U	U															
	Design work processes		U		U	U			C	C		U	U						U																		U						U
GENERAL MANAGEMENT	Manage public affairs		U		U	U			U		C	C	C																														
	Manage intrgovt. affairs	U	U		U	U			U		U		C	C	C															U	U		U	U		U			U				
	Exchange data				U				U			U	U	U	U	C	U	U												U													
	Maintain admin. accounts			U		U			U			U	U				C				U					U	U	U								U			U				
	Maintain prog. accounts			U	U				U			U	U					C														U			U		U	U	U	U		U	
	Conduct audits				U	U			U	U							U	U	C		U								U														
	Establish organizations			U		U			U											C	U								U	U													U
	Manage human resources			U		U	U		U											C	C	C	C	C																			
	Provide security				U	U		U	U	U															C	C	C	C		U													
	Manage equipment			U		U		U	U	U															C	C	C	C															
	Manage facilities			U		U			U																U	U	C																
	Manage supplies			U		U			U																C	U	U	C															
	Manage workloads	U		U	U	U			U							U										U	U	U	C	C		U				U		U				U	U
PROGRAM ADMIN.	Issue Social Security nos.								U				U		U																C	C											
	Maintain earnings								U				U	U	U																U		C	C	C	U							
	Collect claims information				U	U			U						U																U	U				C	C	U	U	U			
	Determine elig./entitlmt.								U																						U	U	U			U		C	U	U			
	Compute payments				U				U									U													U		U			U		U	C	C			
	Administer debt mgmt.				U				U									U																					U	C			
SUPPORT	Generate notices								U						U																U		U			U		U	U	U	C		
	Respond to prog. inquiries				U				U		U																				U		U	U		U		U	U	U	U	C	
	Provide quality assessment				U	U			U	U																					U		U			U		U			U		C

KEY
C = creators of data U = users of data

This chart depicts which data classes are required to support particular organizational process and which processes and which processes and which processes are the creators and users of data.

The weakness of enterprise analysis is that it produces an enormous amount of data that is expansive to collect and difficult to analyze.

Did u know? Most of the interviews are conducted with senior or middle managers, with little effort to collect information from clerical workers and supervisory manager.

Strategic Analysis or Critical Success Factors

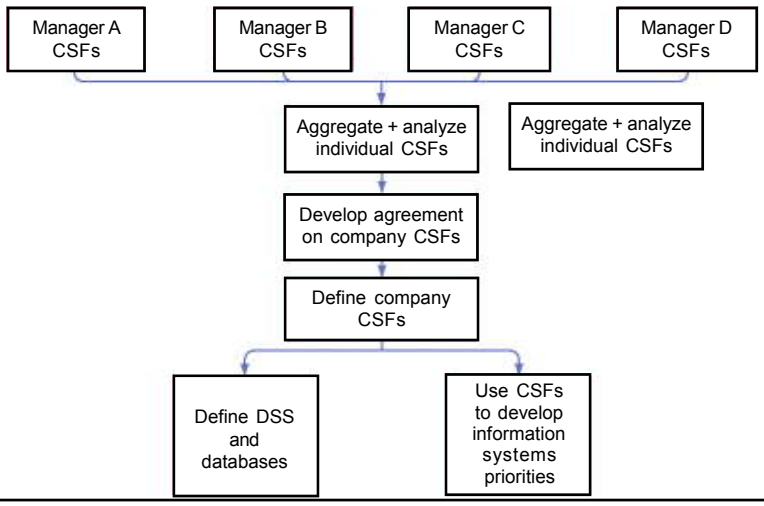
The strategic analysis, or critical factors, approach argues that an organization's information requirements are determined by small number of critical success factors (CSFs) of managers. If these goals can be attained, the firm's or organization's success is assured (Rockart, 1979: Rockart and Treacy, 1972). CSFs are shaped by the industry, the firm, the manager, and the broader environment. An important premise of the strategic analysis approach is there are a small number of objectives that managers can easily identify and on which information systems can focus.

The strength of the CSFs method is that to produces a smaller data set to analyze than does enterprise analysis. Only top managers are interviewed, and the questions focus on a small number of CSFs rather than a broad inquiry into what information is used or needed. It is especially suitable for top management and for the development of DSS and ESS. Unlike enterprise analysis, the CSF method focuses organizational on how information should be handled.

Notes

The CSF approach relies on interviews with key managers to identify their CSFs. Individual CSFs are aggregated to develop CSFs for the entire firm. Systems can then be built to deliver information on these CSFs.

Figure 13.2: Using CSFs to Develop System



The method's primary weakness is that the aggregation process and the analysis of the data are art forms. There is no particularly rigorous way in which individual CSFs can be aggregated into a clear company pattern. Second, there is often confusion among interviewees (and interviewer) between individual and organizational CSFs.

Caution Before the use of any technology you should know the good and bad effect of that technology in your business or organization.

13.1.3 System Development and Organizational Change

New information systems can be powerful instrument of organizational change, enabling organizational change, enabling organizations to redesign their structure, scope, power relationship, workflows, products, and service.

The Spectrum of Organization Change

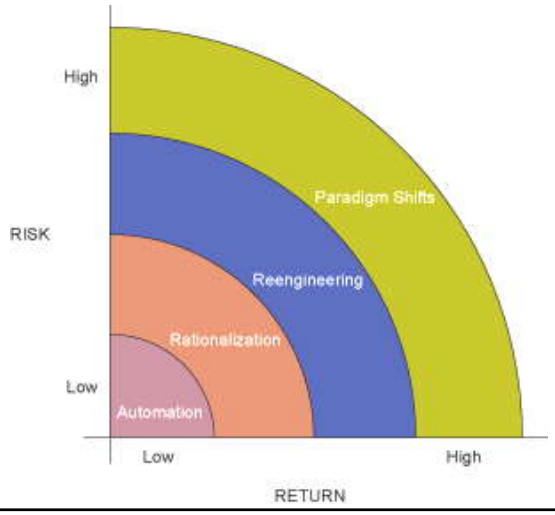
Information technology can promote various degrees of organizational change, ranging from incremental to far-reaching form illustration show four kinds structural organization change that are enabled by information technology:

- Automation
- Rationalization
- Reengineering
- Paradigm shifts.

Each carries different rewards and risks.

Notes

Figure 13.3: Organizational Change Carries Risk and Rewards



The most common forms of organizational change are automation and rationalization. These relatively slow-moving and slow-changing strategies present modest returns but involve little risk. Faster and more comprehensive change like reengineering and paradigm shifts carry high rewards but offer a substantial chance of failure.

The most common form of IT-enabled organization change is automation. The first applications of information technology involved assisting employee in performing their tasks efficiently.

Example: Calculating paychecks and payroll registers, giving bank tellers instant access to customer deposit recodes, and developing a nationwide network of airline reservation terminals of airline reservation agents are all examples of early automation.

Self Assessment

Fill in the blanks:

1. ..... and designers are responsible for ensuring that key member of the organization participate in the design process and permitted to influence the system's ultimate shape.
2. Deciding which new systems to be build an essential component of ..... process.
3. ..... analysis can help identify the key entities and attributes of the organization's data.
4. The ..... approach relies on interviews with key managers to identify their CSFs.

13.2 Business Process

Davenport & Short (1990) define business process as "a set of logically related tasks performed to achieve a defined business outcome." A process is "a structured, measured set of activities designed to produce a specified output for a particular customer or market. It implies a strong emphasis on how work is done within an organization" (Davenport 1993). In their view processes have two important characteristics: (i) They have customers (internal or external), (ii) They cross

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organizational boundaries, i.e., they occur across or between organizational subunits. One technique for identifying business processes in an organization is the value chain method proposed by Porter and Millar (1985).

Processes are generally identified in terms of beginning and end points, interfaces, and organization units involved, particularly the customer unit. High Impact processes should have process owners.

Example: Processes developing a new product; ordering goods from a supplier; creating a marketing plan; processing and paying an insurance claim; etc.

Processes may be defined based on three dimensions (Davenport & Short 1990):

- ***Entities:*** Processes take place between organizational entities. They could be Interorganizational (e.g. EDI), Interfunctional or Interpersonal (e.g. CSCW).
- ***Objects:*** Processes result in manipulation of objects. These objects could be Physical or Informational.
- ***Activities:*** Processes could involve two types of activities: Managerial (e.g. develop a budget) and Operational (e.g. fill a customer order).

13.2.1 Business Process Reengineering

Business Process Reengineering (BPR) is known by many names, such as 'core process redesign', 'new industrial engineering' or 'working smarter'. All of them imply the same concept that focuses on integrating both business process redesign and deployment of information technologies (IT) to support the reengineering work.

Business process reengineering ideas are based on the premise that every organization needs a sense of direction. Without that direction in the form of strategic plans and business plans, the organization has no foundation upon which to build process improvements.

BPR is a method of improving the operation and therefore the outputs of organizations. Generally the topic of BPR involves discovering how business processes currently operate, how to redesign these processes to eliminate the wasted or redundant effort, improve efficiency, and how to implement the process changes in order to gain competitiveness.

The purpose of BPR is to find new ways to organize tasks, organize people and redesign information technology so that the processes support the organization's goals. It means analyzing and altering the business processes of the organization as a whole.

For a thorough and effective reengineering project, organizations should first meet certain conditions before starting such a project. Initially, the management should abandon all the rules and procedures that have been used up to that time. In addition they should abandon other inadequate organizational and production principles. At this point, the design of a renovated and redesigned organization should begin.

Business process reengineering (BPR) is, in computer science and management, an approach aiming at improvements by means of elevating efficiency and effectiveness of the business process that exist within and across organizations. The key to BPR is for organizations to look at their business processes from a "clean slate" perspective and determine how they can best construct these processes to improve how they conduct business.

The BPR movement arose with the publication of two academic articles in 1990. In the first article, Thomas H. Davenport and James R. Short argued that the combined use of IT and business process redesign could transform organizations and improve business processes to the degree

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Taylor's scientific management once did. They defined business process redesign as "… the analysis and design of work flows and processes within and between organizations."

They prescribe a five-step methodology for achieving process redesign. The methodology starts with setting business vision and process objectives. Instead of rationalizing tasks to eliminate bottlenecks, as done in previous process redesign works, they suggest that process redesign should be performed on entire processes to achieve desired business vision and process objectives. The second step is to identify the processes to be redesigned. This is similar to the Pareto analysis practiced in TQM. Instead of redesigning all processes, key processes that offer the most impact should be redesigned. The next step is to understand and measure the existing processes. This is to understand the problems in the existing processes and to set baseline performance measurements to judge future improvements. The fourth step in their five-step methodology is to identify how IT can be leveraged in the process redesign. Instead of simply supporting process redesign, Davenport and Short argue that IT can actually create process redesign options. The last step is to implement a prototype of the process.

This prototype should extend beyond IT applications and into business organization and serves as the base for iterative improvement before being phased into full implementation. The combination of IT and business process redesign creates what the authors term new industrial engineering. Just as scientific management created the original industrial engineering discipline, IT, and business process redesign would be essential tools in the new industrial engineering discipline.

About the same time that Davenport and Short published their ideas on business process redesign, Michael Hammer published his radical sounding concept of BPR. Hammer claims the process rationalization and automation efforts of the past have not improved productivity and performance significantly. He believes corporations were simply automating processes designed prior to the wide usage of computers. This type of automation does not address fundamental process limitations. He argues that corporations need to radically change business processes to take advantage of computers. The reengineering efforts need to be broad and encompassing. They should have cross-functional boundaries and utilize IT to enable the new processes that come out of the reengineering efforts. In Reengineering the Corporation: A Manifesto for Business Revolution, Hammer and co-author James Champy, further discuss the need for change. They debunk Adam Smith's labor specialization theory and the functional hierarchical organization that resulted from it. They state that the new post-industrial economy, started in the 1980s, is different from the mass production economy of the past. In this new economy, customers have the upper hand, competition has intensified, and constant changes are normal for the conduct of business. To compete in this new customer economy, companies need to reinvent how tasks are performed. Instead of incremental improvements to business processes, companies need to start from scratch and invent a better way of performing business processes. The goal of radical change is to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service, and speed. Hammer and Champy offer a set of prescriptions to reengineer business processes. The guiding principle is to organize around processes instead of tasks. Workers who share complementary tasks report to the same supervisor even though they do not share the same skills. In essence, the authors suggest that corporations should be grouped along process boundaries rather than functional boundaries. Every process should have a process owner. The role of the process owner is to attend to the performance of the process. They further state that workers should be trained to perform all the tasks in the process rather than only a single step. In other words, labor specialization, as espoused by Smith, Taylor, and Ford, should be dismantled. Shared databases are essential to BPR. Traditional IT infrastructures have often been designed to satisfy independent business. Various functions have their own information systems and databases. This created barriers to process performance because transactions had to be recreated in different applications and information replicated in different functional databases. Using a common database eliminates this barrier and presents an opportunity to reengineer the business processes without functional systemic limitations.

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Notes The key enabler for BPR is IT. IT serves as the disruptive technology that allows generalists to do the work traditionally performed by specialists, enables everyone to make decisions (as opposed to managers making all the decisions), and offers shared databases that allow direct access to the same information regardless of functions.

13.2.2 Implications of Business Process Reengineering

Undoubtedly, Michael Hammer has garnered most of the BPR press because of the radical rhetoric with which he communicates. However, the ideas expressed by Hammer (and later Hammer and Champy) are similar to the new business process redesign concepts of Davenport and Short. They agree that the processes should be transformed holistically rather than by fixing bottlenecks in small increments. Furthermore, they agree on the essential role IT should play in business process transformation. Most importantly, their ideas point to a formulation of the process enterprise that is different from the functional hierarchical organization with which corporations had been aligned. In their writings, the founders of BPR have repeatedly demonstrated the poor coordination of functional organizations and the superiority of process organizations in coordination and in achieving performance gains. In its most radical form, the process enterprise is one that eliminates functional structure in favor of an exclusive process-based structure. The more realistic approach for becoming a process enterprise is to have a matrix structure of process-hierarchy and functional-hierarchy. Table 13.1 illustrates the differences between process organization versus functional organization.

As illustrated above, process enterprise holds the promise of being more responsive to market requirements, and it is suited for companies that offer differentiated products/services rather than competing on cost alone. However, organizational realignment by itself does not result in improvements. Organizational realignment has to be accompanied by change in management practices and mindsets. A 1996 Harvard Business Review article by Ann Majchrzak and Qianwei Wang of University of Southern California presents data supporting this viewpoint.

Table 13.1: Functional versus Process Organization

	Functional Organization	Process Organization
Work Unit	Department	Team
Key Figure	Functional Executive	Process Owner
Benefits	Functional excellence Easier work balancing because workers have similar skills Clear management direction on how work should be performed	Responsive to market requirements Improved communication and collaboration between different functional tasks Performance measurements aligned with process goals
Weaknesses	Barrier to communication between different functions Poor handover between functions that affects customer service. Lack of end-to-end focus to optimize organizational performance	Duplication of functional expertise Inconsistency of functional performance between processed Increased operational complexity
Strategic Value	Support cost leadership strategy	Supports differentiation strategy

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In their study, the cycle times of 86 printed circuit board assembling departments at electronic companies were analyzed. These departments performed the same manufacturing processes at large and small electronics companies. They labeled 31 of the 86 departments as process-complete, meaning these departments perform manufacturing processes, support tasks, and customer interfacing. The rest are traditional functional departments that do not perform most activities outside of the manufacturing processes. To the authors' surprise, they discovered process-complete departments did not have faster cycle times than functional departments. After more analysis, they found process-complete departments had faster cycle times when management practices were put in place to foster collective responsibility. These practices include jobs with overlapping tasks, group-based rewards, open workspaces, and collaborative work procedures. Analysis of the data, after taking into account these management practices, revealed that process-complete departments that implemented these practices achieve cycle times as much as 7.4 times faster than process-complete departments that have not implemented these practices. Furthermore, process-complete departments that operated on traditional functional mindsets have cycle times as much as 3.5 times longer than functional departments. Organizational restructuring alone does not inherently bring about forecasted improvements. Structural change has to be accompanied by changes in managerial practices and mindsets to reach the desired objectives. In fact, as we will discuss a little later, the lack of focus on the human side of change is one of the biggest drawbacks of traditional BPR practices.

What are the effects of BPR on corporate performance? Several success stories have been widely publicized. Ford was able to reduce 75 percent of its staff in its accounting department, Mutual Benefit Life achieved 60 percent productivity improvement in its insurance applications department, Hewlett-Packard improved on-time delivery performance by 150 percent in its purchasing department, and American Express was able to reduce average time for transaction processing by 25 percent. However, by

Hammer's own admission, 50 percent to 70 percent of business process reengineering projects failed. In addition to Hammer's own assessment of the failure rate, one study indicated that only 16 percent of corporate executives were fully satisfied with their BPR implementations.

The radical nature of BPR implementation has often been associated with its failure. Instead of building on what already existed, BPR implementations approached business process changes as blank slates. In the ideal world, this approach should bestow competitive advantage from innovative business process designs. The reality often turned out to be quite different. There was usually inadequate representation of the business users and decision makers on the project implementation teams. IT and outside consultants often comprised the majority of project team members. This resulted in solutions heavily influenced by best practices suggested by ERP systems being implemented. These best practice business processes are generic and usually do not represent innovative, differentiating processes. BPR has often been used to disguise restructuring. Thus, it often engendered resentment from the employees. Initial BPR prescriptions did not include recommendations on how to cope with organizational change and human resource issues. Change management on many BPR projects often served only training and communication roles. The combination of a top-down implementation approach and an inadequate change management function in BPR project methodologies resulted in strong resistance from frontline workers and middle managers. Furthermore, early BPR implementations were heavily technical and process focused. Often, these changes were undertaken without corresponding changes in the organizational setup. This resulted in halfway measures of reengineering with redesigned cross-functional processes that were partly owned by various functional departments. The lack of identifiable process ownership often led to chaos. These various factors led to unsatisfactory opinions of BPR in the corporate world.

Do these explanations of failure and the high failure rate mean the fundamental approach of BPR is faulty? Studies that profile successful BPR projects do not come to this conclusion. A McKinsey

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study conducted in 1993, at the height of the BPR fad, discovered BPR projects that are broadbased and in-depth generate the highest business unit benefits. This study analyzed the BPR implementation results of 20 companies. It found that 11 of the 20 projects achieved performance improvements of less than 5 percent. The performance measure evaluated was earnings before interest and taxes, or reduction in total business unit cost. These results hardly show the massive improvements BPR gurus had in mind. However, six of the 20 projects achieved an average of 18 percent in business unit cost reduction. The authors investigated these six projects and discovered these projects were more radical (in terms of breadth and depth) than the rest of the 20 projects. Breadth is defined as the number of key processes that have been reengineered. Depth is defined as the number of the six organizational elements (roles and responsibilities, measurements and incentives, organization structure, IT, shared values and skills) that are included in the reengineering projects. In their study, the six successful projects include all the key processes and organization elements in their BPR implementations. The authors conclude the degree of radical change is proportional to the business benefits that BPR projects generate. Perhaps it is important to remember that this study profiles successful implementations rather than all implementations and was published during the height of the BPR craze. Teng et al. published another study that profiled successful BPR projects in 1998. This was a broad-based survey of 105 firms that completed at least one BPR project. The authors discovered there is a strong correlation between the degree of radical change and the level of success at responding firms. The degree of radical change is determined by respondents' perceived level of change in seven aspects of reengineering. The seven aspects of reengineering are similar to those of the McKinsey study: process work flows, roles and responsibilities, performance measurements and incentives, organizational structure, IT, culture and skill requirements. Other interesting results from this study are, the importance of process evaluation, process transformation, and social design. Respondents rate these three stages as most important to success among the eight project stages. The eight stages in sequence are as follows:

- Identification of BPR opportunities
- Project preparation
- Analysis of existing process
- Development of process vision
- Technical design
- Social design
- Process transformation
- Process evaluation.

Respondents rated analysis of existing process and technical design as least important to perceived success. The two studies discussed here illustrate that successful BPR projects share a high degree of radical change. We can also conclude from the second study that existing processes and technical designs are not important factors in BPR success. However, social design, execution of process transformation, and the ability to evaluate reengineered processes are important to the success of the BPR implementations. These results correlate to the contention that change management and the human side of implementations are more important than the solutions themselves.

Task What are the reasons of using automation tool in the organization

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Early BPR results led to the formulation of a new generation of BPR rhetoric from its founders. This revisionist BPR thinking increasingly focuses on the cultural context of the organization. The founders no longer stress the radical approach that was in the original BPR thinking. The new rhetoric of BPR emphasizes the importance of people and the change management aspects of implementation. Instead of dramatic and wide ranging process changes, revised BPR thinking calls for a holistic approach to reengineering that involves business processes, technology, and social system issues (including culture). Revisionist BPR thinking looks to redesign critical business processes that will confer the most value through targeted changes to organization, processes, technology, and culture. The aim is no longer to change the organization's entire culture but only to target those aspects of culture that are critical to the success of reengineering implementation. An illustration of this is the case of instituting multiskilled jobs and job rotations in a culture that values specialized trade skills. A blanket enforcement of this change will undoubtedly engender widespread resistance. The recognition that wholesale change of the corporation is likely to fail led to changes in BPR thinking toward focusing on small leap improvement projects. It is often easier to achieve consensus among the affected parties in this type of project, which has been shown to significantly reduce implementation timeline. Although IT is still a key enabler, it has become less important in revisionist BPR thinking. People led change, rather than system-led change, is increasingly viewed as critical to achieve project success. In short, the ideal of process enterprise is still the goal; however, the path to this goal is not in one gigantic step but a series of smaller steps.

13.2.3 Definition of BPR

BPR was first introduced in a research program at MIT (Massachusetts Institute of Technology) in the early nineties. The term was used in the description of Davenport and Short's 1990 research project. They found out that the implementation of modern information technology in organizations means not only automation of managerial and production tasks but that it also has a direct effect on the quality of the work done. Davenport (1993), one of the fathers of BPR describes 'business process redesign' as:

"The analysis and design of workflows and processes within and between organizations. Business activities should be viewed as more than a collection of individual or even functional tasks; they should be broken down into processes that can be designed for maximum effectiveness, in both manufacturing and service environments."

It is argued by some researchers that there is no commonly agreed definition of BPR. However, the book Reengineering the Corporation: A Manifesto for Business Revolution by Hammer and Champy (1993) is widely referenced by most BPR researchers and is regarded as one of the starting points of BPR. The following is their definition of BPR:

"*Reengineering is the fundamental rethinking and radical redesign of business processes to achieve dramatic improvements in critical, contemporary measures of performance, such as cost, quality, service and speed.*"

Self Assessment

Fill in the blanks:

5. Processes could involve two types of activities, ... and operational.
6. ..... is an approach aiming at improvements by means of elevating efficiency and effectiveness of the business process that exist within and across organizations.
7. The key to BPR is for organizations to look at their business processes from a "..... " perspective and determine how they can best construct these processes to improve how they conduct business.

Notes

13.3 Process Improvement

In addition to increasing organizational efficiency, companies are also changing their business processes to improve the quality in their product, service, and operations. Many are using the concept of TQM to make quality the responsibility of all people and functions within an organization. TQM holds that the achievement of quality control is an end itself. Everyone is expected to contribute to the overall improvement of quality- the engineer who avoids design error, the production worker who sports defects, the sales representative who presents the product properly to potential customers, and even the secretary who avoids typing mistakes.

Did u know? **Full form of TQM**

Total Quality Management

13.3.1 How Information System Contribute to Total Quality Management

TQM is considered to be more incremental than Business Process Reengineering (BPR) because its effects often focus on marking a series of continuous improvement a rather than dramatic bursts of change. Information systems can help firms achieve their quality goals by helping them simplify products or processes, meet benchmarking standards, make improvement based on customer demands reduce cycle time and increase the quality and precision of design production.

Simplifying the Production Process

The fewer step in process the less time and opportunity for an error to occur.

Benchmarking

Setting strict standard for products, services, or activities and measuring organizational performance against those standards.

Use Customer Demands as a Guide to Improving Products and Service

Improving customer service, making customer service the number one priority, will improve the quality of the product itself.

Reduce Cycle Time

Reducing the amount of time from the beginning of process to its end (cycle time) usually results in fewer steps. Shorter cycle mean that errors are often caught earlier in production (or logical or design or whatever the function), often before the process is compete, eliminating many hidden costs.

Improve the Quality and Precision of the Design

Computer-aided design (CAD) software has made dramatic quality improvements possible in wide range of businesses form aircraft manufacturing to production razor blades.

Increase the Precision of Production

Notes

For many products, one key way to achieve quality is make the production process more precise and decrease the amount of variation from one part to another.

Self Assessment

Fill in the blanks:

8. The concept of ..... is used to make quality the responsibility of all people and functions within an organization.
9. The fewer step in process the less time and opportunity for an ..... to occur.

13.4 System Analysis

System analysis is a relatively new field in the knowledge of mankind but demand for system analysis existed many centuries before the introduction of computers. In mid 19 century, practitioners in labour, organisation and methodology had established many improved methods of working. This is the first approach to system analysis. With the development of information technology, system analysis too, develops more and more vigorously and has a significant role in a life cycle of an IT application and of IT projects in general. At the moment, there is no method that ensures success and that can be viewed as a "right" way for analysis but the application of structured system analysis increases the chance of success for most of typical applications and it proves efficient in a range of analysis in real life.

Until today, system approach was still viewed as a sound foundation for structured system analysis. Structural system analysis is a modern approach to different analysis and design phrases of the system development process, which is accepted because of its advantages over other traditional approaches.

The structural system analysis has the following main characteristics:

- The system is developed in the top-down order.
- During system analysis and design, several tools, techniques and models are used to record and analyze the current system and new requirements of the users, and define a format for the future system.
- The major tools used in structural system analysis include, function diagram, data flow diagram, data dictionary, process specification and entity relationship diagram.
- Separation between physical model and logical model. A physical model is often used in surveying the current system and designing the new system while a logical model is used in analyzing system's requirements. This is a significant advantage brought about by the structural system analysis method.
- Acknowledging users' role in different steps of system development.
- Different steps in structural analysis and designing can be carried out at the same time rather than in one by one order. Each step can improve the analysis and designing made in the previous step.
- Structural analysis is supported by advanced technology in both hardware and software, therefore system development with this method is less complicated.
- Structural analysis when put together with the prototype method can help users and analysts to have an idea of the new system and help make best use of both methods.

Notes

Two Models of Structural System Analysis

- ***Waterfall Model:*** Has been a basis for a majority of structural system analysis methods since the 1970s. This model consists of different phases carried out one after the other. Each phase can be assigned to a group of experts.
- ***Spiral Model:*** Initiated by Barry Boehm, has become more and more popular and a basis to iterative development systems. This approach also consists of various phases carried out one after the other as in the Waterfall model. However, the system development process is divided into different steps and smoothened after repetitive steps, the system becomes more perfect.

Task Discuss the traits of structural system analysis.

13.4.1 Nature of Analysis

Analysis focus on systems' requirements specification and clarification and is the stage, when system designers have to work at two levels of definition regarding the study of situational issues and possible solutions in terms of "what to do" and "how to do". System analysis process in its most general form includes the following main steps:

- Identify the operation of the existing system;
- Understand what the existing system does;
- Understand the needs of the users;
- Decide on what the new system should be doing;
- Decide on how the new system will function.

In the process of system analysis, it is not always possible to study every aspect of each of the above steps and this is the time to pay attention to the following points:

- If the method of working applied to participants of system development (users, analysts, designers, and programmers) is efficient;
- If the updation of changes that happens in the process of system development is touched upon;
- Tool for analysis;
- If workload allocation is reasonable. (Users have to take part in 2 systems; old and new, at the same time);
- If documents are easy to understand by all participants.

13.4.2 Role and Requirement of System Analysts

The system analyst is a key member of any systems development project. In a broader sense, the systems analyst plays several roles:

- ***Archaeologist and Scribe:*** As a systems analyst, one of the main job is to uncover detail and to document business policy that may exist only as "tribal folklore", passed down from generation to generation of users.

Notes

- ***Innovator:*** The systems analyst must separate the symptoms of the user's problem from the true causes. With his or her knowledge of computer technology, the analyst must help the user explore useful, new applications of the computer.
- ***Mediator:*** The system analyst who often finds himself in the midst of users, managers, programmers, auditors and various other players, all of whom frequently disagree with one another.
- ***Project Leader:*** Because the systems analyst is usually more experienced than the programmers on the project and since he is assigned to the project before the programmers begin working, there is a natural tendency to assign project management responsibilities to analyst. Which means, as a systems analyst, you need:
  - More than just the ability to draw flowchart and other technical diagrams;
  - Skills to interview users, mediate disagreements;
  - Application knowledge to understand and appreciate the user's business;
  - Computer skills to understand the potential uses of computer hardware and software in the user's business;
  - Able to view a system from different perspectives;
  - Able to partition it into levels of subsystems;
  - Able to think of a system in abstract terms as well as physical terms.

Example: Library Management System

A library management system is required to receive books and magazines number or code them, store and manage them, and produce index of document. The library manages two main kinds of documents - books and magazines. Whenever a new document is received, the librarian writes down all information about it into a register of document and lists it into the list of document in library for readers to look up If it is a new book, the librarian lists on three fields (in a card): book name , book number, and author name. If it is a magazine, the librarian lists on these fields: magazine name, magazine number, and magazine volume. These cards will be stored in the library, and the readers will look up documents by these cards. There is only one book number, and only one magazine number.

Only the staff of the Institute is served by the library. Each staff member should belong to a department in the Institute, and is provided with his/her own number which never coincides with number of other staff. Whenever a reader borrows a document, the librarian writes down this information: reader number, reader name, document number, document name, borrowing day and returning deadline into the register of borrowing readers. When a reader returns a document, the librarian looks up for the reader's number, document number in the register of borrowing readers, and deletes it. At the end of each month, each quarter, or each year, the librarians have to make report of the all new documents in the library , the borrowing and returning status, the list of readers who did not meet deadline and did not return the document. After surveying the library management system with interviewing method, we can conclude that all the functions the system has to perform are:

- Receiving new documents and store all information about it;
- Establish document numbers and looking up fields;
- Manage readers;
- Mahina library cards/tickets for borrowing and returning;
- Report situation about the documents and readers in the library.

Notes

Requirements of the new library management system on computer:

- The form which is used for entering information of documents must be convenient and easy to use. The number of each document (include books and magazines) must be automatically built base on their information.
- The documents can be looked up in many fields such as: document name, author name (for books), volume of document (for magazines), speciality of documents, collection of documents, master keyword, slave keyword, and so on. The speed of looking up documents must be fast and easy to use.
- Manage readers of the library with their departments in such a way that it is a simple task to reports and easy for managing and searching.
- The new library management system on computer has to make many complicated reports for serving the library management process.
- Readers can look up for documents on their computers which are connected to the library's computer (through LAN) instead of going to the library and searching for them on the library cards.

Self Assessment

Fill in the blanks:

10. ..... is a modern approach to different analysis and design phrases of the system development process.
11. In ..... model, each phase can be assigned to a group of experts.
12. In spiral model, the system development process is divided into different steps and smoothened after ..... steps, the system becomes more perfect.

13.5 Systems Design

Systems analysis describes what a system should do to meet information requirements and system design shows how the system will fulfill this objective. The design of and information system is the overall plan or model foe that system. Like the blueprint of a building or house, it consists of all the specifications that give the system its form the structure.

The system designer details the system specifications that will deliver the functions identified during systems analysis.

Caution The specifications of system design should address all of the management organizational and technological components of the system solution.

13.5.1 The Role of End Users

User information requirement drive the entire system-building effort. User must have sufficient control over the design process to ensure the system reflects their business priorities and information needs, not the biases of the technical staff.

Notes

13.5.2 Completing the Systems Development Process

The remaining step in the system development process translates the solution specifications established during systems analysis and design into fully operational information system. There concluding steps consist of programming, testing, conversion, production, and maintenance.

Programming

The process of translating the system specifications prepared during the design stage into program code.

Testing

The exhaustive and through process that determines whether the system produces the desired results under know conditions. Testing information can be broken down into three type of activities: unit, system, and acceptance testing. Unit testing, or program testing, consists of test each program separately in the system. System testing test the functioning of the information system as whole in order to determine if discrete modules will function together as planned and whether discrepancies exist between the way the system actually works and the way it was conceived. Acceptance testing provides the final and management certification that the system is ready to be used in a production setting.

Notes Systems test are evaluated by user and reviewed by management. When all parties are satisfied that the new system meet their standard, the systems is formally accepted for installation.

Conversion

Conversion is the process of changing form the old system to the new system. Four main conversion strategies be employed: the parallel strategy, the direct cut over strategy, the pilot study strategy, and the phased approach strategy.

Parallel strategy a safe and conservative conversion approach where both the old system and its potential replacement are run together for a time until everyone is assured that the new functions correctly.

The direct cut over a risky conversion approach where the new system completely replaces the old one on an appointed day.

Pilot study a strategy to introduce the new system to limited area of the organization until it is proven to be fully functional; only then can the conversion to the new system across the entire organization take place.

The phased approach strategy introduces the new system in stages, either by functions or by organization units

Production and Maintenance

After the new system is installed and conversion is complete, the system is said to be in production. During this stage the system will be reviewed by both user and technical specialists to determine how well it has met its original objectives and decide whether any revisions or

Notes

modifications are in order. Changes in hardware, software, documentation, or procedures to production system to correct errors, meet new requirements, or improve processing efficiency are termed maintenance.

Self Assessment

Fill in the blanks:

13. ..... is used to show how the system will fulfill this objective.
14. The system designer details the system specifications that will deliver the functions identified during .....
15. ..... is the process of changing form the old system to the new system.

13.6 Summary

- Two principal methodologies for establishing the essential information requirements of the organization as whole are enterprise analysis and success factors.
- Enterprise analysis argues that the firm's information requirements can only be understood by looking at the entire organization units, functions, processes, and data elements.
- The strategic analysis, or critical factors, approach argues that an organization's information requirements are determined by small number of critical success factors (CSFs) of managers.
- Business Process Reengineering (BPR) is known by many names, such as 'core process redesign', 'new industrial engineering' or 'working smarter'.
- With the development of information technology, system analysis too, develops more and more vigorously and has a significant role in a life cycle of an IT application and of IT projects in general.
- Analysis focus on systems' requirements specification and clarification and is the stage, when system designers have to work at two levels of definition regarding the study of situational issues and possible solutions in terms of "what to do" and "how to do".
- The system analyst is a key member of any systems development project.
- The system designer details the system specifications that will deliver the functions identified during systems analysis.

13.7 Keywords

BPR: The purpose of BPR is to find new ways to organize tasks, organize people and redesign information technology so that the processes support the organization's goals.

Enterprise Analysis: Enterprise analysis argues that the firm's information requirements can only be understood by looking at the entire organization units, functions, processes, and data elements.

Strategic Analysis: The strategic analysis, or critical factors, approach argues that an organization's information requirements are determined by small number of critical success factors (CSFs) of managers.

Systems Analysis: Analyzing in detail the components and requirements of a system. Also analyzing in detail the information needs of an organization, the characteristics and components

Notes

of existing information systems, and the functional requirements of proposed information systems.

Systems Approach: A Systematic process of problem solving that defines problems and opportunities in a systems context. Data are gathered describing the problem or opportunity, and alternative solutions are identified and evaluated. Then the best solution is selected and implemented, and its success evaluated.

Systems Design: Deciding how a proposed information system will meet the information needs of end users. Includes logical and physical design activities, and user interface, data, and process design activities that produce system specifications that satisfy the system requirements developed in the systems analysis stage.

13.8 Review Questions

1. What are the factors behind the organizational change? Explain
2. How enterprise analysis play important role in the organizational change?
3. Illustrate the methodologies used for establishing the essential information requirements of the organization.
4. What is your suggestion to an enterprise how they use BPR in suitable manner.
5. What are the basic stages of information system lifecycle?
6. How automation play important role in the process of system development?
7. Elucidate the various roles played by system analyst.
8. Suppose you are a manager of restaurant where you apply information system what are the change's you want in the restaurant.
9. How total quality management help in process improvement?
10. How system design and system analysis play vital role in the design of organization?

Answers: Self Assessment

1. Analysts
2. organizational planning
3. Enterprise
4. Critical Success Factor (CSF)
5. managerial
6. Business process reengineering (BPR)
7. clean slate
8. total quality management (TQM)
9. error
10. Structural system analysis
11. waterfall
12. repetitive
13. System design
14. systems analysis
15. Conversion

13.9 Further Readings

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Unit 14: Alternative System Building Approaches

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Objectives

After studying this unit, you will be able to:

- Understand alternative system building approaches
- Describe Management Opportunities Challenges and Solutions

Introduction

System differs in terms of their size and technological complexity, and in terms of the organizational problems they are meant to solve. Because there are different kinds of systems, a number of methods have been developed to build systems. In this unit we will discuss various alternative system building approaches. Also we will discuss management opportunities challenges and solutions. *Gopika Juneja, Lovely Professional University*

14.1 Alternative System Building Approaches

This section describes these alter native methods: the traditional systems lifecycle, prototyping, application software packages, end-user development, and outsourcing.

14.1.1 Traditional Systems Lifecycle

The system lifecycle is the oldest method for building information systems and is used today for medium or large complex systems projects. The lifecycle for an information system has stages:

- Project definition
- Systems study

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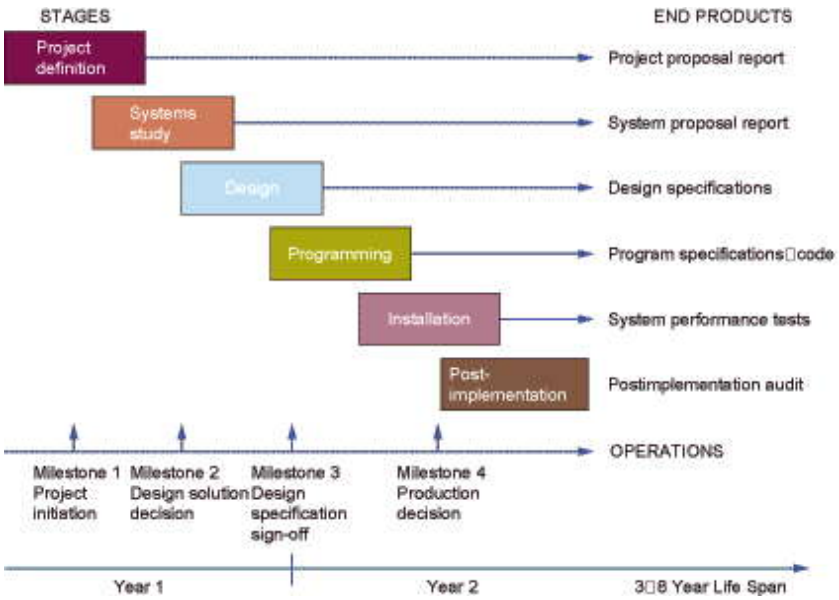
- Design
- Programming
- Installation
- Post implementation.

Figure 14.1: The Lifecycle Methodology for Systems Development



The lifecycle methodology divides systems development in to formal stages with specific milestones and products at each stage.

Stages of the Systems Lifecycle

The project definition stage determines whether the organization has a problem and whether that problem can be solved by building a new information system or by modifying an existing one.

The systems study stage analyzes the problems of existing systems in detail, identifies objectives to be attained by a solution to these problems, and describes alternative solutions.

The design stage produces the design specification for the solution. The lifecycle emphasizes formal specifications and paperwork, so many design documents are generated during this stage.

The programming stage translates the design specifications produced during the design stage into software program code. Systems analysts work with programmers to prepare specification for each program in the system.

The installation stage consists of the final steps to put the new or modified system into operation: testing, training, and conversation.

The post-implementation stage consists of using and evaluating the system after to is installed and is in production.

Did u know? Much of the information gathered during the systems study phase will be used to determine information system requirement.

Notes

Task Discuss the function of systems study stage.

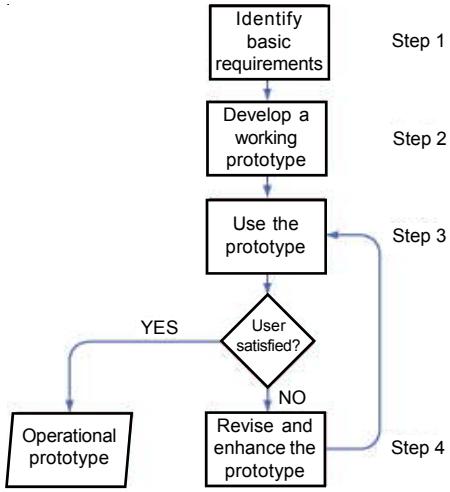
Limitations of the Lifecycle Approach

The system lifecycle is still useful for building large complex systems that require a rigorous and formal requirement s analysis, predefined specifications, and tight controls over the systems-building process.

14.1.2 Prototyping

The prototype is working version of an information system or part of the system, but it is meant to be only a preliminary model. Once operational, the prototype will be further refined until it conforms precisely to users' requirements.

Figure 14.2: The Prototyping Process



The process of developing a prototype can be broken down into four steps. Because a prototype can be developed quickly and inexpensively, system builders, repeating step 3 and 4, it refine and enhance the prototype before arriving at the final operational one.

Steps in Prototyping

Step 1: Identify the user's basic requirements. The system designer works with user only long enough to capture his or her basis information needs.

Step 2: Develop an initial prototype. The system designer creates a working prototype quickly, using fourth-generation software, interactive multimedia, or computer aided software engineering (CASE) tools.

Step 3: Use the prototype. The user is encouraged to work with the system in order to determine how well the prototype meets his or her needs and to make suggestions for improving the prototype.

Step 4: revise and enhance to prototype. The system builder notes all changes the user requests and refines the prototype accordingly. After the prototype has been revised, the cycle returns to step 3. And 4 are repeated until the user is satisfied.

Notes

Did u know? Once the design has been finalized, the prototype can be converted to a polished production system.

Notes When no more iterations are required, the approved prototype then becomes an operational prototype that furnishes the final specifications for the application. Sometime the prototype itself is adopted as the production version of the system.

14.1.3 Application Software Packages

Information systems can be built using software from application software packages. There are many applications that are common to all business organizations. If a software package can fulfill most of an organization's requirement, the company does not have to write its owner software.

If an organization has unique requirements that the package does not address, many packages include capabilities for customization. Customization features allow a software packages to be modified to meet an organization's unique requirements without destroying the integrity of the packaged software.

Example: Applications software packages include database programs, word processors, and spreadsheets.

Caution The company can save time and money by using the prewritten, redesigned, protested software programs from the package.

14.1.4 End-User Development

It is the development of information system by end user with little or no formal assistance from technical specialists.

Benefits and Limitation of End-User Development

End–user computing also poses organizational risks because it occurs outside of traditional mechanisms foe information system management and control. When systems are rapidly, without a formal development methodology, testing and documentation systems department. When users create their own applications and files, same piece of information is used consistently throughout the organization.

Managing End-User Development

To help organization maximize the benefits of end- user applications development, management should control the development of end-user applications by requiring cost justifications of end-user information system projects and by establishing hardware, software, and quality standards for user developed applications.

Example: End-users include spreadsheet users who write formulas and macros.

Notes

Self Assessment

Fill in the blanks:

1. The system lifecycle is the oldest method for building ..... and is used today for medium or large complex systems projects.
2. The ..... stage determines whether the organization has a problem and whether that problem can be solved by building a new information system or by modifying an existing one.
3. The ..... stage analyzes the problems of existing systems in detail, identifies objectives to be attained by a solution to these problems, and describes alternative solutions.
4. The design stage produces the design ..... for the solution.
5. The programming stage ..... the design specifications produced during the design stage into software program code.
6. ..... work with programmers to prepare specification for each program in the system.
7. The ..... stage consists of the final steps to put the new or modified system into operation: testing, training, and conversation.
8. The ..... is a working version of an information system or part of the system
9. When no more iteration is required, the approved prototype then becomes an ..... prototype that furnishes the final specifications for the application.
10. If an organization has unique requirements that the package does not address, many packages include capabilities for .....
11. ..... is the development of information system by end user with little or no formal assistance from technical specialists.

14.2 Management Opportunities Challenges and Solutions

Management challenges and opportunities are based on the following:

14.2.1 Unproven Business Models

Doing business over the Internet is not necessarily more efficient or cost effective than traditional business methods. Virtual retailers may not need to pay for costly storefronts and retail workers, but they often requires, but they often require heavy outlays for warehousing, customer service call centers, and customer acquisition.

Challenges also confront businesses that are trying to use the Web to supplement or enhance a traditional business model. Many businesses are finding that it is not enough to "get on the Web" Business that are unclear about their on-line strategy can waste thousands and even millions of dollars building and maintaining a Web site that fails to deliver the desired results. Even successful Web sites can incur very high costs.

14.2.2 Business Process Change Requirements

Electronic commerce and electronic business require careful orchestration of the firm's division, production sites, and sales offices, as well as close relationships with customer, suppliers, and other business partners in its network of value creation. Essential business processes must be redesigned and more closely integrated, especially those for supply chain management.

Notes

Channel Conflicts

Using the Web for on-line sales and marketing may create channel conflict with the firm's traditional channels, especially for less information-intensive products that require physical intermediaries to reach buyers. The firm's sale force and distributors may fear that their revenues will drop as customers make purchase directly from the Web or that they will be displaced by this new channel. The Window on Management describes how several companies are detailing with this problem. Channel conflict is an especially troublesome issue in business-to-business electronic commerce, where customers buy directly from manufacturers via the Web instead of through distributors with this problem.

Task What are the challenges faced by any organization while they change or add new technology in the system.

Legal Issues

Law governing electronic commerce are still being written. Legislatures, courts, and intentional agreements are just starting to settle such issues as the legality and force of e-mail contracts, the role of electronic signatures, and the application of copyright laws to electronically copied documents.

Security and Privacy

The web provides an unprecedented ability to learn about and target customers. But the same capability can also undermine individual privacy. Through the use of Web site monitoring software and other technology for tracking Web visitors, companies can gather detailed information about individuals without their knowledge. Web site visitors knowingly supply personal information, such as their name, address, e-mail address, and special interests, in exchange for access to sites without realizing how the organization that owns the site may use the information.

Notes Companies collecting detail customer information over the Web will need to balance their desire to profit from such information with the need to safeguard individual privacy.

Self Assessment

Fill in the blanks:

12. Using the Web for ..... sales and marketing may create channel conflict with the firm's traditional channels.
13. The ..... on Management describes how several companies are detailing with this problem.
14. ..... is an especially troublesome issue in business-to-business electronic commerce, where customers buy directly from manufacturers.
15. Companies collecting detail customer information over the Web will need to balance their desire to profit from such information with the need to safeguard individual .....

Notes

Case Study

Office Automation System

ABC Company processes more than 5,000 customer-orders a month, drawing on a combined inventory of over 500 office products stock at the Co's warehouse. About 40 workstations, with printers are installed at Co's headquarters and are connected to a LAN.

Orders are received by phone or mail and entered into the system by order entry personnel at network computers. Entry of orders is assisted by formatted screens. As the order is entered, the mid-range computer checks the availability of the products, updates the customer & product databases stored on computer's magnetic disks. It then sends the pick list to warehouse printer, for further processing by warehouse personnel.

Co's sales manager, inventory manager and others executives have PC workstations in their offices. They use simple Data Base Management inquiry commands to get responses & reports concerning sales orders, customers and inventory to review product demand & service trends.

Questions:

1. Outline the important Informations System component in ABC Co's order processing system.
2. Identify network software and data, network resources of order processing Informations System.
3. Identify the various activities occurring in this Information System.

Source: Management Information System by Dharmenda and Sangeeta Gupta

14.3 Summary

- The system lifecycle is the oldest method for building information systems and is used today for medium or large complex systems projects.
- The lifecycle methodology divides systems development in to formal stages with specific milestones and products at each stage.
- The prototype is working version of an information system or part of the system, but it is meant to be only a preliminary model.
- Information systems can be built using software from application software packages. There are many applications that are common to all business organizations.
- Customization features allow a software packages to be modified to meet an organization's unique requirements without destroying the integrity of the packaged software.
- End-User Development is the development of information system by end user with little or no formal assistance from technical specialists.
- The project definition stage determines whether the organization has a problem and whether that problem can be solved by building a new information system or by modifying an existing one.
- The installation stage consists of the final steps to put the new or modified system into operation: testing, training, and conversation.

Notes

14.4 Keywords

Customization: Customization features allow a software packages to be modified to meet an organization's unique requirements without destroying the integrity of the packaged software.

End- User Development: It is the development of information system by end user with little or no formal assistance from technical specialists.

Prototype: The prototype is working version of an information system or part of the system, but it is meant to be only a preliminary model.

14.5 Review Questions

1. Examine the various stages of system lifecycle.
2. Discuss the various limitations of the Lifecycle Approach.
3. What is prototyping? Enlighten the various steps used in the prototyping process.
4. How to build information systems using application software packages?
5. Explain the concept of end-user development with its advantages and disadvantages.
6. Illustrate the process of managing end-user development.
7. If an organization has unique requirements that the package does not address, many packages include capabilities for customization. Comment.
8. Explain the concept of channel conflicts.
9. Describe the requirements based on business process.
10. What are the opportunities obtained by changing or redesigning the organization?

Answers: Self Assessment

1. information systems
2. project definition
3. systems study
4. specification
5. translates
6. Systems analysts
7. installation
8. prototype
9. operational
10. customization
11. End User development
12. on-line
13. Window
14. Channel conflict
15. privacy

14.6 Further Readings

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