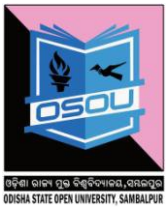

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Certificate in Legal Awareness (CLA)

CLA-03

Cyberspace Technology and Social Issues

Block – I

Introduction to ICT and Cyberspace

UNIT 1 EVOLUTION AND GROWTH OF ICT

Structure

1.1 INTRODUCTION

ICT deals with how digital information passes between the devices. The most prolific example is the Internet, a worldwide network of computers linked together by telephone lines. There are however, other examples, like mobile phones, interactive televisions and personal organizers. It is a cross cutting theme in the objective of the programme because of the recognition by the European Commission and UK Government that ICT has the potential to have a major impact on the prosperity of Merseyside. When ICT is applied to business, it can Lower Costs, raise productivity and improve customer and supplier relationship. In learning, ICT widens participation and raises attainment. In public services, ICT engages people with services more effectively and in communities, ICT links people to economic opportunity and brings together those with common agendas.

1.2 OBJECTIVES

After going through this unit, you should be able to:

- describe the meaning and different forms of ICT;
- explain the evolution of ICT;
- list the advantages of ICT;
- state the E-readiness assessment of States/UTs;
- discuss the global scenario of ICT; and
- discuss the role of ICT in economic growth.

1.3 EVOLUTION OF ICT

The first major use of Information Technology (IT) could be said to have started with the introduction of early mainframe computers to respond to the needs of scientific research and the Government's statistical data gathering and processing, where the technology helped to speed up research and forecasting. These techniques were later applied to the business environment where mainframe computers and robotics were used to automate business processes and number crunching functions. From automation of business processes, IT was then applied to higher value-adding, functions such as design, resource planning, sophisticated manufacturing and mission critical functions the developments and applications of IT have stretched beyond imagination. Together with the rapid development and innovation in telecommunication technology and the Internet, this evolution has ushered in many new business models and applications.

ICT is robust that it can be harnessed in many ways, but its true potential is limited only to the human mind. With ICT, the physical boarder dissipates as information moves freely through the digital medium which is less controlled as compared to other existing mass media. Globalisation is said to accelerate, and enabled by ICT, making market bigger and more accessible by business with strong capital, management and technology. Business or E-commerce has started to be done virtually and transaction occurs at a click of a mouse anywhere and any time. Scientific findings churn faster and newer discoveries and inventions through the journal and reports are made available through ICT. The technology that began life as a faster way to process data and compute statistics has become pervasive in almost all parts of our life today. So ICT has become the backbone of Techsavvy Society, having combined both information technology and communication through digital environment today.

Please answer the following Self Assessment Question.

Self Assessment Question 1 *Spend 2 Min.*

i) ICT has become the backbone of _____.

ii) _____, _____, interactive televisions are few examples of ICT.

1.4 MEANING OF ICT

ICT is an acronym that stands for Information Communications Technology

However, apart from explaining an acronym, there is not a universally accepted definition of ICT Why? Because the concepts, methods and applications involved in ICT are constantly evolving on an almost daily basis. It is difficult to keep up with the changes because they happen very fast.

Let us focus on the three words behind ICT:

- INFORMATION,
- COMMUNICATIONS, and
- TECHNOLOGY

A good way to think about ICT is to consider all the uses of digital technology that already exist to help individuals, businesses and organizations also use information.

ICT covers any product that will store, retrieve, manipulate, transmit or receive information electronically in a digital form. For example, personal computers, digital television, email and robots.

ICT is concerned with the storage, retrieval, manipulation, transmission or receipt of digital data. Importantly, it is also concerned with the way these different uses can work with each other.

In business, ICT is often categorised into two broad types of product: -

1) The traditional computer-based technologies (things you can typically do on a personal computer or using computers at home or at work); and

2) The more recent and fast growing range of digital communication technologies (which allow people and organizations to communicate and share information digitally)

Let us have a brief look at these two categories to demonstrate the kinds of products and ideas that are covered by ICT:

Traditional Computer Based Technologies

These types of ICT include:

Application Use

Standard Office Applications - Main Examples are as below:

Word processing, e.g. Microsoft Word: Write letters, reports etc;

Spreadsheets, e.g. Microsoft Excel, Analyse financial information, calculations, create forecasting models etc.

Database software, e.g. Oracle, Microsoft SQL Server, Access, Managing data in many forms, from basic lists (e.g. customer contacts to complex material like catalogue).

Presentation software, e.g. Microsoft PowerPoint, make presentations, either directly using a computer screen or data projector, publish in digital format via email or over the Internet

Desktop publishing, e.g. Adobe In design, Quark Express, Microsoft Publisher, produce newsletters, magazines and other complex documents; and

Graphics software, e.g. Adobe PhotoShop and Illustrator, Macromedia Freehand and Fireworks, create and edit images such as logos, drawings or pictures for use in DTP, web sites or other publications

Specialist Applications - Examples

Accounting packages, e.g. Sage, Oracle, manage an organization's accounts including revenues/sales, purchases, bank accounts etc. A wide range of systems are available ranging from basic packages suitable for small businesses to sophisticated ones aimed at multinational companies.

Computer Aided Design (CAD) is the use of computers to assist the design process. Specialized CAD programs exist for many types of design like architectural, engineering, electronics and roadways.

Customer Relations Management (CRM) is a software that allows businesses to better understand their customers, by collecting and analysing data, such as their product preferences, buying habits etc. Often linked to software applications that run call centers and loyalty cards, for example, traditional computer based technologies.

The C part of ICT refers to the communication of data by electronic means, usually over some distance. This is often achieved via networks of sending and receiving equipment, wires and satellite links. The technologies involved in communication tend to be complex. You certainly do not need to understand them for your ICT course. However, there are certain aspects of digital communications that you need to be aware of. These relate primarily to the types of network and the ways of connecting to the Internet. Let us look at these two briefly (further revision notes provide the details to support your study).

i) Internal networks

Network which used to share information between a specific group or peoples of an entity. Internal network is also known as private network. In corporate world internal network mean the entire employ realm login to one common domain "not Microsoft OS domain" to access the enterprise's shareable application like payroll, health insurance, or emergency services or business development services. This type of applications are proprietary to the particular organization. To share the information between employees or different groups of organization, it requires its own network which is also called as private network or internal network.

This is also usually referred to as a local area network (LAN), this involves linking a number of hardware items (input and output devices plus computer processing) together within an office or building. The aim of a LAN is to be able to share hardware facilities such as printers or scanners, software applications and data. This type of network is invaluable in the office environment where the colleagues need to have access to common data or programs.

ii) External networks

Like we discussed the internal network is the private network and restricted from the outer world. External network is also called public network. A business entity or the corporate provide the information and business solution on the www form or web page to the public on external network of the company, so all the individuals can go the external network and fetch the information from anywhere according to their requirement. External network is provided by the service provider or also called backbone carrier. For example, AT& T "the mother bell" is also known as the backbone carrier or service provider world wide. It means when two remote business entity like to share the private information they can use any service provider network i.e. "External network" to complete their communication path.

Often you need to communicate with someone outside your internal network; in this case you will need to be a part of a Wide Area Network (WAN). The Internet is the ultimate WAN - it is a vast network of networks.

ICT in a Broader Context

ICT will almost certainly cover the above examples of ICT in action, perhaps focusing on the use of the key applications such as spreadsheets, databases, presentations, graphics and web design software.

It will also consider the following important topics that deal with the way ICT is used and managed in an organization:

– The nature of information (the "I" in ICT): this covers topics such as the meaning and value of information, how information is controlled, the limitations of ICT, legal considerations;

– Management of information: this covers how data is captured, verified and stored for effective use the manipulation, processing and distribution of information, keeping information secure, designing networks to share information; and

– Information systems strategy: this considers how ICT can be used within a business or organization as part of achieving goals and objectives.

Thus, ICT is a broad and fast-changing subject.

A new generation of computer network software aims at building virtual communities: permanent (or at least recurring) online meeting places where people can work and play, buy and sell, gossip and govern, flirt and fight and generally seek their fortunes. The first such places are being built more or less ad hoc. Their builders are mostly innocent of the history of human efforts to shape the spaces where people live so that these might better serve people's needs and express their dreams. Construction tools appropriate to the physical (i.e. electronic) constraints of shared online environments are rapidly becoming available. But there is no generally accepted conceptual framework for their design, nobody of validated experience to guide their construction. There is not yet any architecture for cyberspace.

In a world so new that its most fundamental properties are still being created (gravity, for example), cyberspace designers confront - consciously or unconsciously – many of the classic architectural challenges which may be classified as:

i) Selecting from alternative construction approaches and materials: The "native" medium of cyberspace, a finely woven mesh of polygons with subtly refractive polychrome surfaces, demands more machine resources than most visitors can currently afford to. A richly realised environment is thus, in cyberspace as elsewhere, inevitably an elitist one. Buildings based on simple cubes covered with low-resolution bitmaps are accessible to all, but are also banal and dispiriting. How can we build virtual villages that are at once idiomatic, pleasant to be in and socially inclusive?

ii) Using pre-fabricated elements to reduce costs and speed up construction. Cyberspace is made of software; and software engineers have been wrestling for decades with a problem that is also central to modern architecture – how systems can be modularly designed to make them more economic and more reliable. Here, however, the issues are more complex, since cyberspace communities are built on a constantly shifting infrastructure. In fact, the relationship between structure and infrastructure is all but reversed; how can

we design places for human community that can survive a continual re-design of the foundations on which they are built?

iii) Supporting sensible patterns of traffic flow: In most virtual settings, people can fly. In some, they can also "beam" instantly from one point to the next, ignoring all barriers. People may be present without taking up any visible space, or alternatively their virtual representative ("avatar") may be so huge or so resource-intensive that it fills a space intended to hold a hundred visitors. What is "traffic" when the users of a space are themselves constructs produced by other (perhaps even antagonistic) designers?

iv) Designing to human scale: In the virtual world, the role of "size" as a design factor is disconcertingly variable. It depends on the visitor's/user's field of view and functional reach, which in turn depends on the power of the user's display and controls. It is like the shift to electronic music, where timbre, volume and tonal range, once given by the physical nature of instrument, become variables, which the composer/performer must learn to control. Issues of appropriate scale do not go away, but must be redefined in relative terms: what is the ratio of sizes that must be maintained to support different experiences?

v) Designing new structures (or re-purposing the old ones) to enhance existing settings: The Musee D'Orsay and the new subterranean entrance arcade created for the Louvre will soon have their analogues in cyberspace; perhaps a conference room smuggled into the design model of an automobile engine, or an entire city whose "streets" are the circuit diagrams of a computer processor. Current work to build a database of 3D mages (the "Digital Human") to serve as an explorable setting for medical education suggests part of the challenge; how can virtual reality help making physical/natural structures more accessible? The far broader issue is: how can we connect the various virtual environments we build to one another? What design criteria can be established to aid the process of linking new worlds to the old?

There would-be cyber-architect navigating this maze of conflicting constraints in search of more than just the solution to a puzzle. In cyberspace as in the physical world, the goal of architectural design is always a place which, while fulfilling its various functions, also communicates something to (and about) the people.

Please answer the following Self Assessment Question.

Self Assessment Question 2 *Spend 3 Min.*

Discuss the meaning of the term information and communication technology?

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1.5 BENEFITS OF ICT

Obviously, there are significant tangible and intangible benefits of ICT:

- Can be a powerful enabler of development goals because its unique characteristics dramatically improve communication and the exchange of information to strengthen and create new economic and social networks;
- Is pervasive and cross cutting as it can be applied to the full range of human activity from personal use to business and government. It is multifunctional and flexible, allowing for tailored solutions — based on personalisation and localisation — to meet diverse needs; and
- Facilitates disintermediation, as it makes it possible for users to acquire products and services directly from the original provider, reducing the need for intermediaries. This not only become a considerable source of efficiency, but has in fact been one of the factors leading to the creation of an alternative development paradigm that skips the formation of Co-operatives and self-help groups.

It is, thus, evident that ICT has the potential to bring in multiple benefits in the areas of governance, integration of marginalized sections, development of rural areas profitability, and productive improvement in major sectors of the economy. This would provide the much-needed forward linkage by adding value to information for using it as an enabler that has been discussed widely in literature. What needs to be tested are the various hypotheses that evaluate the role of ICT and its contribution and impact on the Indian economy.

1.6 E-READINESS ASSESSMENT OF STATES/UTs

It is defined as the degree to which a country/state is prepared to participate in the networked world. It would demand the adoption of important applications of ICTs in offering interconnection between government, business and citizens.

In this context, it has become important to regularly take stock of e-readiness at the country level, states/UTs level and in major verticals to ascertain the status of underlying infrastructure, human resources, policy regimes, investments climate etc and arrive at what steps need to be taken to optimize investment and reach free potential. In that sense, "India: E-readiness Assessment Reports 2003 & 2004" which carry out the assessments at the disaggregated level of states/UTs throw up some useful and valuable insights.

Encouraged by the overwhelming response and positive feedback received on the E-readiness Assessments 2003 & 2004, Department of Information Technology (DIT), Govt. of India (GOI) has initiated E-readiness Assessment 2005 for the states and UTs. National Council of Applied Economic Research (NCAER), which is a premier research agency has once again been entrusted the task of state government and ranking based on the fair selection process.

States have used e-readiness assessment reports to carry out the road map of improving their network readiness as well as increasing the penetration of ICT for economic development; in fact the states are engaged in policy competition for improving the e-readiness.

E-readiness Assessment 2005

In the current report, effort has been given to analyse the time series data to understand how states have adopted strategies/action plan to improve the network-readiness. The section on case studies in the current report would not only confine to appearing projects but also would examine e-governance initiatives undertaken, general governance changes, policy changes initiated as per the act of increased penetration of ICT etc.

E-readiness Framework 2005

The network readiness index framework will be used for the e-readiness study 2005 and is based on the following broad parameters, which are further classified into sub indication:

- Environment for ICT offered by agent country or community:
  - Market; Political/regulating; and Infrastructure;
- Readiness of the community's key stakeholder to use ICT:
  - Individual readiness; Business readiness; and Government readiness;
- Usage of ICT among the stakeholders:
  - Individual usage; Business usage; and Government usage. The chosen framework is based upon the following premium.
  - There are 3 stakeholders to consider in the development and use of ICT: Individual, Business & Government.
  - The degree of usage of ICT by (and hence the impact of ICT on) the three stakeholders is linked to their degrees of readiness (or capability) to use and benefit from ICT.
  - There is a general macro economic and regulatory environment for ICT in which the stakeholders play out their respective rules.

E-readiness Index 2005

A factor analytic technique will be used to construct the e-readiness index and based on this, the states will be classified into following six categories:

- Leaders
- Aspiring Leaders
- Encepeatants
- Average Achievers
- Below Average Achievers
- Leant Achievers

Please answer the following Self Assessment Auestion.

Self Assessment Question 3 *Spend 3 Min.*

True or False:

i) E-readiness is the degree to which a country/state is prepared to participate in the networked world. ( )

ii) States have used e-readiness assessment reports to carry out the road map of improving their network readiness as well as increasing the penetration of ICT for economic development. ( )

iii) A factor analytic technique will be used to deconstruct the e-readiness index. ( )

1.7 THE GLOBAL SCENARIO

All the countries are making serious efforts to participate in the digital economy. Asia has become an emblem of the borderless economy. India's famed IT-enabled service (ITES) sector, which now contributes an estimated US$17bn to the economy annually, is a Shining example to the emerging markets. India's success story has been replicated throughout the region — there are booming call centres surrounding Manila, customer help desk centres in Malaysia, and Korean and Japanese language software production houses in China. It is ironic that India hardly appears on the e-ready radar screen, though it is starting to push ahead. Many countries are reaping benefits from being at least partially e-ready, even if they do not have all the components that support digital services (Complete technology infrastructure, favourable policy, business and social environments) in place. But it is also clear that having one or more of the basics in place can go a long way, as a country leverages what e-assets it has to generate competitive advantage. In the Indian context, it would be helpful to look at the level of e- preparedness of the Indian states, as this would be helpful in assessing the strengths and weaknesses in the e-readiness environment and consequently appropriate remedies can be planned.

During 1991, the twin programs of macro economic stabilisation and structural reforms were initiated. It has been argued that reforms carried out till date are not enough for the Indian economy if the country wishes to ensure the quality and sustainability of growth on a long-term basis. This, the policy planners argue, would be accomplished through second-generation reforms. The second-generation reforms simply aim at improving government efficiency through a reduction in the fiscal deficit. They aim to bring about increased private sector participation in developmental activities and sustaining high growth through appropriate institutional mechanisms. It can be observed from factors that indicate the health of the state (debt to GSDP, levels of fiscal deficit, primary deficit and revenue deficits to GSDP) that the objective of the second-generation reforms is to improve the governance and observe the requisite fiscal discipline. It is here that one can see a major role for ICT and e-governance. In practice, state reform and government modernisation nowadays can hardly proceed without calling upon ICTs. In fact, from long-term perspective the second-generation reforms are needed to sustain the ICT revolution. The second-generation reforms in general suggest that increased

involvement of the private sector in development activities and promotion of private investment in the industry and infrastructure segments of the state is required. Hence, reforms, particularly in the areas of right institutions, administrative, legal and regulatory functions of the state coupled with the restructuring of the incentives and actions that are required for greater participation of the private sector in developmental activities has become imperative.

E-governance: ICT has made the development of a new service delivery model possible, which can bring about a major shift in the way the government does business. Anywhere anytime access brings in incredible opportunities, but there is a downslide for state and local governments.

First, the public sector is held to a higher standard than the private sector particularly in terms of risk. Second, with new technologies come whole new levels of competition. Digital government is all about using technology to improve the access to and delivery of public services. The goal is to create a network that builds closer relationships with all stakeholders – citizens, businesses, governments and the workforce – while maintaining security. With the expansion of e-governance, there are increasing concerns about the security of transactions, which also need to be addressed. Specific e-governance initiatives that provide particular solutions to some governmental problems which are associated with ICT components, can contribute to one or more of these valued functions:

- increasing the efficiency of government operations: economists and social scientists call this "greater efficiency of the public administration by the automation/digitization of administrative functions"—in other words, simplifying processes and improving service delivery. Resources are used more effectively, and better tools are made available to both staff and agencies, as well as to the clients' interaction with the service. Efficiency gains are the first quoted arguments for ICT infusion. It is usually the first step, which started decades ago when automation was brought in, but the process is a long, continuous one.

1.8 ICT AND ECONOMIC GROWTH

According to NASSCOM data, the IT industry's contribution to the Indian GDP has also increased from approximately 1.4 per cent in 1998-99 to more than 3 per cent in 2002-03 and is estimated to grow further to 3.8 per cent, highlighting its increasing importance to the Indian economy. Contrast this share of ICT around 3.8 per cent of GDP with the combined share of all registered manufacturing in various industry segments ranging from food processing, beverages, textiles, leather, basic chemicals, petrochemicals, iron and steel, basic metals such as aluminum, copper, rubber and petroleum, machinery, both electrical and mechanical which is just around 11 per cent of GDP. This combined share had marginally declined during the 1990's while the ICT sector in the national income is increasing at a brisk pace now . Obviously the importance of this sector needs no further emphasis. Apart from the indirect contribution that IT makes to the Indian Economy through e-governance etc the direct contribution of IT exports is becoming increasingly important. The sectors that exhibit strong backward-linkages with other sectors of the economy are presumed to have a higher output multiplier. Sectors, which have an output multiplier of two or more, can be treated as key sectors for economic growth. The ICT sector which reveals an output multiplier that is higher than the average– contrary

to the popular perception that this sector may not have strong backward linkages– can be an eye-opener for the Indian policy planners. The ICT sector, in context of the output multiplier, has a rank of 30 of a total 115 sectors and the Software Sector corresponds to a rank of 80 out of 115 sectors. The increase in ICT output does have a significant output multiplier effect and should thus be encouraged. The employment multiplier for the ICT industry has been estimated at 0.183 man-years per lakh of output in 2000-01 prices. In other words, an additional output of the ICT sector to the tune of Rs 1 lakh would ensure 0.183 man-years of jobs created. For the software sector alone, which is the sector of interest, the output multiplier is 1.78 and the employment multiplier is 0.2096. In other words, increased output of one lakh in the software sector creates an additional employment of 0.2096 man-years. The rank for both the ICT and the software sector in terms of the employment multiplier is 110 out of total 115 sectors.

It is important to look at the economic implications of the above observations. For instance, the CSO has estimated that the value of output at current prices for the software sector during 1999-2000 is at Rs 21,263. The linkages among different sections of an economy are of crucial significance in understanding the trajectory of any industry. The significance and potential of any industry can be observed by looking at three important indicators, i.e. the output multiplier, the employment multiplier and the degree of forward linkage. As elaborated earlier, the output multiplier can be defined as a total increase in output generation for one unit increase of final demand in a particular sector. The employment multiplier is specified as man-years of additional employment created for an increased unitary output of the sector. Both these measures spell out the backward linkages with the other sectors of the economy in terms of output and employment effect. Forward linkages refer to the inter relationship between a particular sector and all other sectors which demand the output of the former as inputs. To better understand the macroeconomics of the ICT sector we analyse these parameters. In the input-output table, the' Other Services Sector's'' employment and output multiplier coefficients were taken as output and employment multiplier of "ICT sector" in the first iteration. However, the importance of ICT sector cannot be clubbed with Other Services category. Thus, the NCAER research team looked at direct coefficients (employment/output and input/output) for ''Software Sector'' from the CSO and for ''Hardware Sector'' from the ASI data. Since the direct coefficients from input-output table and CSO table were available, we used two sets of direct coefficients; one from the 114th sector of the input - output table which corresponds to the "Other Services Sector" and the other for software and hardware clubbed together to obtain output and employment multiplier coefficient that is reflective of the entire ICT sector. For the ICT sector (software and hardware) output in 2000-01 is at Rs. 21,263 crores and at Rs. 50,302 crores in 2002-03. Within this short gap of 3 years, the output of the software sector has increased by 29,039 crores and in this period the economy has been able to create 6.8 lakh man-years of employment, or in simpler terms, this sector has been able to create jobs for 24,500 people who would be able to work in this sector for the next 25 years. Its contribution to GDP in 1999-2000 was Rs 14,619 crores and Rs. 34,584 crores in 2002-03 current prices. The contribution of the software sector alone out of the ICT sector, in GDP has increased from 0.83 per cent in 1999-2000 to 1.54 per cent in 2002-03 (all figures in current prices). Direct employment in the software sector in 1999-2000 was 322983 according to CSO (corresponding figures for the year 2002-03 are not available). The

contribution of the hardware sector to GDP in 1999-2000 was Rs 796 crores and employed around 16,800 persons. The output of the hardware sector in 1999-2000 was Rs. 4400 crores. Though the ICT industry in India is mainly export oriented, domestic consumption does show a forward linkage that is not high as on date but is expected to increase in the coming years as the economy and the using domestic sectors mature making greater use of ICT in business, governance and society.(Resource:CSO report 2005, NASSCOM MCKINSEY Report 2005)

Please answer the following Self Assessment Question.

Self Assessment Question 4 *Spend 3 Min.*

What are the indicators to determine the importance and potential of any industry?

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Let us now summarize the points covered in this unit.

1.9 SUMMARY

- ICT stands for information, communication and technology.
- ICT is concerned with the storage, retrieval, manipulation, transmission or receipt of digital data. Importantly it is also concerned with the way these different uses can work with each other.
- ICT is very essential for businesses, individual and government.
- E-readiness is the degree to which a country/state is prepared to participate in the networked world and demand the adoption of important applications of ICTs in offering interconnection between the government, business and citizens.
- It is important to regularly take stock of e-readiness at the country level, states/UTs level and in major verticals to ascertain the status of under lying infrastructure, human resources, policy regimes, investments climate etc and arrive at what steps need to be taken to optimize investment and reach free potential.
- ICT has the potential to bring in multiple benefits in the areas of governance, integration of marginalized section, development of rural areas profitability and productive improvement in major sectors of the country's economy.
- In practice, state reforms and government modernisation can hardly proceed without calling upon ICT.

1.10 TERMINAL QUESTIONS

1) What are the advantages of ICT? Explain.

2) How does ICT help to grow the economy? Analyse it from Indian point of view.

3) Describe about the global status of ICT in brief.

4) Discuss E-readiness assessment of State/UTs?

1.11 ANSWERS AND HINTS

Self Assessment Questions

1) (i) Tech Savvy Society and (ii) the Internet, Mobile Phone

2) ICT stands for Information Communications Technology. ICT is concerned with the storage, retrieval, manipulation, transmission or receipt of digital data.

3) (i) True, (ii) True (iii) False.

4) The significance and potential of any industry can be observed by looking at three important indicators, i.e. the output multiplier, the employment multiplier and the degree of forward linkage.

Terminal Questions

1) Refer to section 1.5 of the unit.

2) Refer to section 1.8 of the unit.

3) Refer to section 1.7of the unit.

4) Refer to section 1.6 of the unit.

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UNIT 2 COMPUTER HARDWARE, SOFTWARE AND PACKAGES

Structure

2.1 INTRODUCTION

Modern computers are equipped with powerful hardware facilities driven by extensive software packages. Today computing speed is very high and it is capable of doing huge amount of work within seconds with proper accuracy. Nowadays computing and telecommunication both controls the whole universe with multiple manners. To access the state of art of computing, it is always better to review the historical milestones in the developments of computers. Nowadays the computer system plays such a vital role that no corporate or individual can survive without it by any means. Starting from the country's national security to any common issue, the use of the computer system is enormous.

In general, the computer accepts inputs, then processes it, and gives the output.

2.2 OBJECTIVES

After studying this unit, you will be able to:

- describe the evolution and development of computing;
- list hardware components of a computer;
- explain what is software and the different types of software; and
- discuss major problems faced by the management, namely software crisis.

2.3 EVOLUTION AND DEVELOPMENT OF COMPUTING

As far as hardware technology is concerned, the first generations (1945-1954) used vacuum tubes and relay memories interconnected by insulated wires. The second generation (1955-1964) was marked by the use of discrete transistors, diodes, and magnetic ferrite cores, interconnected by printed circuits. The third generation (1965-1974) was started with integrated circuits (ICs) for both logic and memory in small scale or medium scale integration (SSI or SMI) and multilayered printed circuits. The fourth generation (1974-1991) was started with large scale or very large scale integration (LSI or VLSI) having core memory replaced with semiconductor memory. High density and high-speed processors are used in the fifth generation (1991-Present) and memory chips based on even more improved VLSI technology are used. For example, 64-bit 3.0 GHz microprocessors are now available on a single chip. Random Access Memory (RAM) of more than 1024 MB is commonly available in the market now.

The First Generation: From architectural and software point of view, these were built with a single central processing unit (CPU) which performed serial fixed-point arithmetic using a program counter, branch instructions, and an accumulator. The CPU must be involved in all memory access and input/output (I/O) operations. Machine and assembly language were used in first generation computers.

The Electronic Numerical Integrator And Calculator (ENIAC), built at the school of the University of Pennsylvania in 1950, was the first model of the first generation Computers.

The Second Generation: In this era of computers, index registers, floating-point arithmetic, multiplexed memory, and I/O processors were introduced. High-level Languages (HLLs), such as Fortran, ALGOL, and Cobol were introduced along with compilers, subroutines and batch processing monitors. Irving Reed (1957) developed registers Transfer Language for systematic design of digital Computers. Example for the above system is IBM 7030 (the stretch computer) featuring instruction look ahead and error-correcting memories built in 1962.

The Third Generation: These were being started with microprogrammed control. Pipelining and cache memory were introduced to close up the speed gap between the CPU and main memory. The idea of multiprogramming was implemented to interleave CPU and I/O activities across multiple user programs. Example of the third generation system is IBM/360-370 series.

The Fourth Generation: Parallel computers in various architectures were started in this era, using shared or distributed memory or optional vector hardware. Multiprocessing OS, Special languages and compilers were developed for parallelism. Software tools and environments were created for parallel processing or distributed computing. During this period, the technology of parallel processing matured and entered the production mainstream. Example of fourth generation system is VAX 9000.

The Fifth Generation: The development in the fifth generation is still in progress. Here more importance is placed on massively parallel processing (MPP). Scalable

and latency to lerant architecture is being adopted in MPP system using VLSI silicon, GaAs technologies, high-density packaging and optical technologies.

2.4 HARDWARE COMPONENTS OF COMPUTERS

The electronics or mechanical parts of the computer are generally called hardware components. From a layman point of view, the common visibility hardware of computers are Central Processing Unit (CPU), Display Unit (Monitor), Input Unit (Keyboard), Pointing Device (mouse), Multimedia Unit (Sound, video and Game) and Output Unit (Printer). Apart from these, there are so many enhancing devices like pen drive (high capacity removable storage device, scanner (for scanning Photo etc), combo drive (for DVD play) which are easily available in market.

As our study is basically concerned with cyberspace (Internet related) only, so it is better to understand more about network and the Internet application hardware. These are the essential components, which are needed if somebody desires to work on the Internet:

a) Autonomous computer,

b) Modem or Lan Card,

c) Connection from ISP,

d) Normal phone line (If dial up connection), and

e) Browsing software.

Nowadays broadband connection (speed is more than 256 KBPS) is available almost everywhere throughout India. So customers are generally attracted towards high speed Internet instead of dial-up access.

Though the Internet may run on Pentium-I machine having min 32 MB RAM, the following system configuration is highly desirable:

A) Pentium 2.0 GHz (or more), cache 512, Intel Genuine Based Motherboard Chip set and Min FSB 512,

B) At Least 128 MB RAM (or more) having 80 GB HDD (Hard disk Drive),

C) Ideally 17" Color Monitor,

D) Quality VGA card (min 32 MB) with better sound Quality, and

E) Branded Modem or Ethernet Card.

Modem is the most important hardware when the need of the Internet arises. Let us analyse how modem works.

Modem stands for modulator/demodulator. It is the most popular type of Data Circuit-terminating Equipment (DCE).

Additionally, some other enhancing device like the web cam and microphone may also be used for better multimedia facilities.

Please answer the following Self Assessment Question.

Self Assessment Question 1 *Spend 2 Min.*

Fill in the blanks:

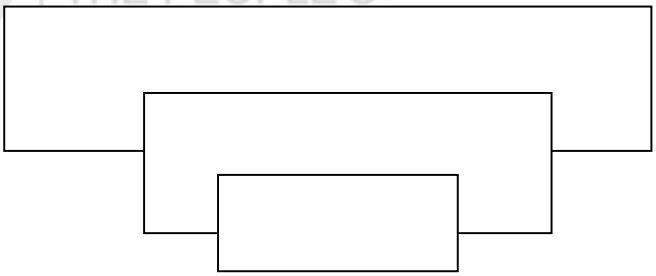
i) The _____ part of the computer is called hardware components.

ii) _____ is the most popular type of Data Circuit-Terminating Equipment (DCE).

2.5 WHAT IS SOFTWARE?

Software is a program, which controls hardware and user interface. It combines the user and hardware through common set of instructions of particular software. So, for starting a computer, an Operating System (OS) is needed first. An OS makes a computer prompt to understand what the human input coming in and what output needed there. As computer understands only binary code (means only 0 and 1), OS converts human code to binary code.

Software consists of computer programs, which are sequences of instructions for the computer. The process of writing (coding) programs is called programming and individuals who perform this task are called programmers. The computer is unable to do anything until it is instructed by software. Although computer hardware is, made for, general purpose, software enables the user to instruct a computer system to perform specific functions that provides commercial value to individual as well as corporate. There are two major types of software: system software and application software. The relationship between hardware, system software and application software is pictured here in figure.



The relationship between Hardware, System Software and Application Software.

2.5.1 Difference between System Software and Application Software

System Software is a set of instructions that serves primarily as an intermediary between computer hardware and application programs and also is directly manipulated by skilled users. System software provides important self-regulatory functions for computer systems, such as loading itself when the computer is first turned on, managing hardware resources such as secondary storage for all applications and providing commonly used sets of instructions for all applications to use. System programming is either the creation or maintaince of system software.

Application software is a set of computer instructions that provide more specific functionality to the user. That functionality may be broad, such as general Excel

Sheet or narrow such as a Stock Programming. An application program applies to a computer to a certain need. Application programming is either the creation or modification and improvement of application software. There are large numbers of application software available in the market today.

Finally, the basic difference between both of them is the application programs primarily manipulate data or test to produce or provide information where as system programs manipulate computer hardware resources.

Please answer the following Self Assessment Question.

Self Assessment Question 2 *Spend 3 Min.*

True or False:

i) Software consists of computer programs, which are sequences of instructions for the computer. ( )

ii) The computer can do everything without any instructions by the software. ( )

iii) Application programs manipulate data or test to produce or provide information where as system programs manipulate computer hardware resources. ( )

2.6 SYSTEM SOFTWARE: FUNCTIONAL CATEGORIES

Basically two major functional categories come under the system software:

System Control Programs

System Support programs

2.6.1 System Control Programs

System control programs control the use of the hardware, software and data resources of a computer system. The main system control program is the Operating System. The operating system provides the overall operations of the computer including monitoring the computer's status and scheduling operations, which includes the input and output process. In addition, the operating system allocates CPU time and main memory to programs running on the computer and it also provides an interface between the user and the hardware. Especially the operating system provides services that include process management, virtual memory, file management, security, fault tolerance and the user interface.

Process management involves managing the program or programs (jobs) running on the processor at a given time. In a desktop operating system, it loads a program into the main memory and executes it. The program utilizes the computer resources until it relinquishes control. Some operating systems offer more sophisticated forms of process management, such as multitasking, multithreading and multiprocessing.

The management of two or more tasks or programs, running on the computer system at the same time is called multitasking, or multiprogramming. The first program is

executed until any interruption occurs, such as request for input or with the priority defined by the batch process. While the input request is handled, the execution of second program begins. Multithreading is a form of multitasking that focuses on running multiple tasks within a single application at a time. When the parent process generates multiple child process on the same parent process ID is called threading. The idea of threading is to faster the application process with higher resource utilization. For example, a word processor application may edit one document while another document is being checked for spelling. Time-sharing is an extension of multiprogramming. In this mode, a number of users operate online with the same CPU, but each user uses a different input/output terminal. The programs of these users are placed into partitions in primary storage. Execution of these programs rotates among all users, occurring so rapidly that it appears to each user as though he or she were the only one using the computer.

Multiprocessing occurs when a computer system with two or more processors can run more than one program, or thread, at a given time by assigning them to different processors. Multiprocessing uses simultaneous processing with multiple CPUs, whereas multiprogramming involves concurrent processing with one CPU. The idea of multiprocessing is, all the processors will continue different jobs of the application program without interrupting or waiting for the other processor, to complete or release the resources, multiprocessing is highly recommended where application response time is critical like less than one millisecond.

Virtual memory simulates more main memory than what actually exists in the computer system. It allows a program to behave as if it had access to the full storage capacity of a computer, rather than just access to the amount of primary storage installed on the computer. Virtual memory divides an application program or module into fixed-length portions called pages. The system executes some pages of instructions while pulling others from the secondary storage. In effect, primary storage is extended into a secondary storage device, allowing users to write programs as if the primary storage were larger than it actually is. This enlarged capability boosts the speed of the computer and allows it to efficiently run programs with very large number of instructions. Virtual memory is not good for high memory intensive program. High memory intensive program requires higher memory space and memory access time, since the virtual memory is defined or secondary storage, to access the page of program or data again required some I/O operation or extra CPU and other resource cycle.

The operating system is responsible for resource management of the system like**,** file management, memory management or device management and security management up to some extent. The file management is to create and manages a directory structure that allows file to be created and retrieved by name, and it also responsible to manage the indexes for it is internal usages. It may control access to those files based on permissions and access controls. The operating system provides other forms of security as well. For example, it must typically provide protected memory and maintain access control on files in the file system. The operating system also must keep track of the users and their authority level as well as audit charges to security permissions.

Fault tolerance is the ability of a system to produce correct results and to continue to operate even in the presence of fault or errors. Fault tolerance can involve error-

correcting memory, redundant computer components and related software that protect the system from hardware, operating systems or user errors.

Although operating systems perform some of their functions automatically, for certain tasks, the user interacts directly with the computer through the system software. The ease or difficulty of such interaction is to a large extent determined by the interface design. Older text-based interfaces like Disk Operating System (DOS) needed typing in cryptic commands. In an effort to make computers user-friendlier, the Geographical User Interface (GUI) was developed.

The GUI allows users to have direct control of visible objects (such as icons) and actions that replace complex command syntax. The GUI was developed by researchers at Xerox Palo Alto Research Center (PARC) and then popularized by the Apple Macintosh computer. Microsoft soon introduced its GUI-based Windows operating system for IBM-style PCs. The next generation of GUI technology will improve features such as wireless communication, artificial intelligence, etc. The next step in the evolution of GUIs is social interfaces. A social interface is a user interface that guides the user through computer applications by using carttonlike characters, graphics, animations and voice commands. The carttonlike characters can be cast as puppets, narrators, guides, inhabitant's avatars (computer generated human like figures), or hosts.

Types of Operating System: If hardware is the skeleton and software is the body then operating system (O.S.) is the soul of the system. It manages all the hardware and gives operating environments, from which the user can communicate with the system, it allows system developers to create system applications or share the system resources by requesting the allowed operating system services and allow the application developers to develop the run user application from application environment. Operating system can directly and indirectly interact with user programs. Operating environments are not operating systems, but work only with an operating system. For example, the early versions of Windows were operating environments that provided a graphical user interface and worked only with MS-DOS.

Operating system can be categorised by the number of users they support as well as by their level of sophistication. OS, for mobile devices, are designed to support a single person using a mobile, handled device, or information appliance. Desktop operating systems are designed to support a single user or a small workgroup of users. Departmental server OSs generally support thousands of simultaneous users and millions or billions of simultaneous transactions. Super computer operating system supports the particular processing needs of a supercomputer.

Supercomputer and enterprise server operating system offer the greatest functionality, followed by departmental server operating systems, desktop operating systems and finally mobile device operating systems. An important exception is that the user interface, which is most sophisticated on desktop operating system is least sophisticated on supercomputer and enterprise server operating systems.

Mobile device operating systems are Embedded Linux, Windows CE 32 bit, Pocket PC, Windows Embedded NT 4.0 32 bit, and Palm Operating System.

Desktop and notebook computer operating system: The Windows family is the leading series of desktop operating system. The MS-DOS (Microsoft Disk

Operating System) was one of the original operating systems for the IBM PC and its clones. This 16-bit operating system, with its text-based interface, has now been almost totally replaced by GUI operating system such as Windows 2000 and XP. Windows 1.0 through 3.1 were not operating system, but were operating environments that provided the GUI that operated with and extended the capabilities of MS-DOS.

Windows 95, released in 1995, was the first version of a series of products in the Windows operating system that provided a streamlined GUI by using icons to provide instant access to common tasks. It is a 32 bit processing that features multitasking, multithreading, networking, etc. It also offers plug-and-play capabilities, which is a feature that can automate the installation of the new hardware by enabling the operating system to recognise the new hardware and install the needed software (called device drivers) automatically.

Subsequent products in the Microsoft Windows Operating System are:

Windows 98,Wndows Millennium Edition, Windows NT, Windows 2000, Windows XP, Windows 2003 and Windows 2005.

UNIX provides many desktop features including multiprocessing and multitasking. It is more secured than desktop operating system so, big commercial organizations use the UNIX servers. Linux is a powerful version of the UNIX that is totally free of charge. Nowadays, various organizations use Linux as most windows version are being pirated in the market.

2.6.2 System Support Programs

The second major category of systems software, system support program, supports the operations, management, and users of a computer system by providing a variety of support services. Examples of system support programs are system utility programs, performance monitors, and security monitors.

System utilities are the programs that have been written to accomplish common tasks such as sorting records and checking the integrity of diskettes and creating directories and subdirectories. They also restore accidentally erased files, locate files within the directory structure, manage memory usage, and redirect the output.

System performance monitors are programs that monitor the processing of jobs on a computer system. They monitor computer system performance and produce reports containing detailed statistics relating to the use of system resources such as processor time, memory space, and application program. These reports are used to plan and control the efficient use of the computer system resources and to help troubleshoot the system in case of problems.

System security monitors are programs that monitor the use of a computer system to protect it and its resources from unauthorized use, fraud or destruction. Such programs provide the computer security needed to allow only authorized users access to the system. Security monitor also controls the use of the hardware, software and data resources of a computer system.

Please answer the following Self Assessment Question.

Self Assessment Question 3 *Spend 3 Min.*

What do you mean by software? How many types of software are there?

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2.7 SOFTWARE CRISIS

At present, software comprises a much larger percentage of the cost of modern computer system then it was earlier. There are so many grounds for this trend. First, the price of the hardware has dramatically reduced, while the performance of hardware has exponentially increased. Second, building applications–a process called software development–is slow, complex and error-prone. Software is, therefore, expensive and getting more so as its complexity grows. Thirdly, salaries of software developers are steadily increasing because there is an increased demand for their skills.

The above factors have led to major problems for the management, called Software Crisis. The software crisis arises when the organizations are not able to develop new software applications fast enough to keep up with rapidly changing business conditions and the rapidly evolving technologies. Computer hardware can be designed and manufactured on automated assembly lines and so can be turned out quickly but, software must be engineered by hand. Therefore, software generally lags several generations behind hardware. The result is that the organizations are unable to make full use of hardware due to a lack of software to effectively exploit the hardware.

The increasing complexities of software exacerbate the software crises. This complexity naturally leads to the increased potential for error or bugs. Large applications today may contain millions of lines of computer code, written by hundreds of people over the course of several years. So the potential for errors is huge and testing and debugging software is expensive and time-consuming.

2.8 APPLICATION SOFTWARE OR PACKAGES

Application software consists of an instruction that directs a computer system to perform specific information processing activities and that provides functionality for users. As there are so many different users for the computers, there are correspondingly large numbers of different application softwares available. A controversial set of software applications involves surveillance.

Application software includes a proprietary software and off-the-shelf application software. Proprietary software addresses a specific business need for an organization. This type of software may be developed in-house by the organization's IT experts or it may be commissioned from a software vendor. Such specific software programs developed for a particular company by a vendor is called Contract Software.

Alternatively, off-the-shelf application software can be purchased, leased or rented from a vendor that develops programs and sells them to many organizations. It may be a standard package or it may be customizable.

Personal applications software is designed to help the individual users to increase their productivity. Some of them are highlighted below:

Spreadsheet: This software transforms a computer screen into a ledger sheet, or grid, of coded rows and columns. Users can enter numeric or textual data into each grid (cell). In addition, formula can be entered into a cell to obtain a calculated answer displayed in those cells location. It is very useful for financial transaction such as income statements or cash flow analysis.

Data Management: It supports the storage, retrieval and manipulation of related data. DBMS and RDBMS are most popular in this regard.

Word Processing: It allows the user to manipulate the text rather than just numbers. Modern word processors contain many productive writing and editing features. MS Word is popular in this regard.

Desktop Publishing: It allows microcomputers to perform photographs, pictures and other images combined with text, to produce a readymade document.

Graphics: It allows the user to create, store and display or print charts, graphs and maps and drawings. There are basically three categories of graphics software packages: presentation graphics, analysis graphics and computer aided-design software. Example of this software is PhotoShop and CorelDraw, etc.

Multimedia: It combines at least two media for input or output of data. These media include audio, voice, animation, video, text, graphics, and images.

Communications: To exchange information between networked computers, computers utilize communication software. E-mail and video conferencing rely on communication software.

Speech-Recognition Software: Two categories of this are available today: discrete speech and continuous speech. Many firms and people use speech-recognition software when use of a mouse and a keyboard is impractical.

GroupWare: It is a class of software that facilities communication coordination and collaboration among people. It is useful because it allows the workgroups to communicate and share information even when they are working together at a distance. The most elaborate system, IBM's Lotus Notes/Domino, is a document management system, a distributed client/server database, and a basic for Intranet and electronic commerce system as well as a communication support tool.

So the importance of software in the computer system has brought new issues to the forefront for the organizational managers. These issues include software evaluation and selection, software testing, software upgradations, open systems, and open source software.

Please answer the following Self Assessment Question.

Self Assessment Question 4 *Spend 3 Min.*

Write about the different types of application software

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Let us now summarize the points covered in this unit.

2.9 SUMMARY

- Computer accepts Inputs, then processes the inputs and finally produces the output.
- The VLSI technology is the latest technology used in the modern computers.
- The electronic and mechanical parts of a computer are generally called Hardware components of the system.
- A computer system consists of a CPU, monitor, keyboard, mouse and multimedia the device.
- For simple Internet connection, an autonomous computer with modem or LAN card, an Internet account or broadband connection and browsing software are must.
- Broadband connection means an Internet connection with speed more than 256 KBPS without interruption.
- Modem stands for modulator /demodulator. It is the most popular type of Data Circuit Termination Equipment.
- Software is a program, which controls the hardware and the user interface.
- System Software is a set of instructions that serves primarily as an intermediary between computer hardware and application program.
- Application software is a set of instructions that provides more functionality to the user.
- Software crisis are the unbalanced situation between changing hardware and software version.

2.10 TERMINAL QUESTIONS

1) How computer was developed? Write about its generation-wise progress.

2) What do you mean by Software crisis? How can it be managed?

3. What are DBMS and RDBMS? Do you think there is any difference between these two?

4. Define system software. Discuss its functional categories.

2.11 ANSWERS AND HINTS

Self Assessment Questions

1) (i) electronics or mechanical (ii) Modem

2) (i) True, (ii) False (iii) True

3) Software is a program, which controls the hardware and user interface. There are two types of software: System Software and Application Software.

4) Application software includes proprietary software and off-the-shelf application software. Proprietary software addresses a specific business need for an organization. This type of a software may be developed in-house by the organization's IT experts or it may be commissioned from a software vendor. Such specific software programs developed for a particular company by a vendor is called Contract Software. Alternatively, off-the-shelf application software can be purchased, leased or rented from a vendor that develops programs and sells them to many organizations. It may be a standard package or it may be customizable.

Terminal Questions

1) Refer section 2.3 of the unit.

2) Refer section 2.7 of the unit.

3) Refer section 2.8 of the unit.

4) Refer section 2.6 of the unit.

2.12 REFERENCES AND SUGGESTED READINGS

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2. Turban, Rainer and Potter. Introduction to Information Technology. 2nd ed. John Wiely & Sons, INC 2003, 2004.

UNIT 3 NETWORKING CONCEPTS

Structure

3.1 INTRODUCTION

Two computers are said to be interconnected if they are able to exchange information by any means. Basically in this chapter, computer networks to mean an interconnected connection of autonomous computers. If one computer can forcibly start, stop or control another one, the computers are not autonomous, system with one control unit and many slaves is not a network; nor is a large computer with remote printers and terminals.

When the concept of network comes to mind before that we have to understand the confusion between computer networks and Distributed system. In a network, each system treated as a node or terminal and each terminal must have an unique identification on the network. A node can share its own resources like file system or its own resources like printer using network spooling. It is also possible to define multiple subnet networks under main network under one or multiple domain. Parent domain normally use to control the user access or authentication and sub domain can have fine grain authentication. It is also possible to create a virtual network under a network, where other people can access or utilize the resources of virtual network under certain rule and access rights. In computer network each node or participant agreed to communicate with certain rules and protocols layer like TCP/IP , IPX or netBois.

Users must explicitly log onto one machine, can submit jobs remotely, or move files around and generally handle all the network management personally. With a distributed system, nothing has to be done explicitly; it is all automatically done by the system without the user's knowledge.

A network is a set of devices (often referred to as nodes) connected by the media links. Node can be a computer, printer, or any other device capable of sending and/ or receiving data generated by other nodes on the network. The links connecting the devices are often called communication channels.

Data communication is the exchange of data (in the form of 0s and 1s) between two devices via some form of transmission medium (such as a wire cable). The effectiveness of a data communication system depends on three fundamental characters:

- Delivery
- Accuracy
- Timeliness

3.2 OBJECTIVES

After studying this unit, you should be able to:

- describe different types of networks, viz. local, metropolitan and wide networks;
- explain the topologies on which networks work;
- list the difference between OSI and TCP Reference Model;
- describe protocols used for networks; and
- list organizations dedicated for establishing standards for controlling the Internet.

3.3 TYPES OF NETWORKS

The computer networks can be classified into three broad categories:

Local Area Networks (LAN)

Metropolitan Area Networks (MAN)

Wide Area networks (WAN)

All the three above networks are briefly discussed below:

Local Area Networks (LAN)

Local Area Networks, generally called LANs, are high speed, fault-tolerant data networks that cover a relatively small geographic area. They are widely used to connect personal computers and work stations in company offices and factories to share resources (e.g. files) and exchange information. LAN offers computer users many advantages including shared access to devices and applications, file exchanges, file exchange between connected users, and communication between the users via electronic mail and other applications.

LANs are restricted in size, which means that the worst case transmission time is bounded and known in advance. Knowing this time bound makes it possible to use certain kinds of designs that would not otherwise be possible. It also simplifies the network management.

General Characteristics of LAN:

- Cost of setting up network is usually low.
- Data transfer rates are in- between 10 to 100 Mbps.
- Each device connected in the network can either operate standalone or in the Network.
- Area covered is small.
- All the connected devices in the network share the transmission media.

Metropolitan Area Networks (MAN)

The Metropolitan Area Networks or MAN is basically a bigger version of LANs and normally uses the same technology. It might cover a group of near by corporate offices or a city and might be either private or public. A MAN can support both data and voice and might even be related to the local cable television network. A MAN just has one or two cables and does not contain switching elements, which shunt packets over one of the several potential output lines. Not having to switch simplifies the design.

The main reason for even distinguishing MANs as a special category is that a standard is now being implemented. It is called DQDB (Distributed Queue Dual Bus) or for people who prefer numbers to letters, 802.6(the number of the IEEE standard that defines it). DQDB consists of two unidirectional buses (cables) to which all the computers are connected. A key aspect of MAN is that there is a broadcast medium (for 802.6, two cables) to which all the computers are attached. This greatly simplifies the design compared to other kinds of networks.

Wide Area Networks (WAN)

A wide Area Network or WAN covers large geographical area, often a country or continent. Suppose a company having its head office at Delhi and branch office at USA and Italy wants to be in a single network then WAN is the only solution here. WAN contains a collections inter for running users (i.e. applications) programs.

Please answer the following Self Assessment Question.

Self Assessment Question 1 *Spend 3 Min.*

What do you mean by Network? Discuss about types of Networks?

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3.4 NETWORK TOPOLOGY

The term topology refers to the way a network is laid out, either physically or logically. The topology of a network is the geometric representation of the relationship of all the links and linking devices (usually called nodes) to each other. Though there are various topologies for broadcasting LANs, some of them are briefly highlighted here:

- Bus
- Ring
- Star
- Tree
- Mesh

1) A Bus Topology is a linear LAN artitecture in which all the stations are connected to a single communication line, transmission from the network stations propagate the length of the medium and are received by all other stations. The arbitration mechanism may be centralized or distributed. IEEE 802.3, popularly called EATHERNET, for example, is a bus based broadcast network with decentralized control, operating at 10 or 100 Mbps.

2) A Ring topology is a LAN Architecture that consists of a series of devices connected to one another by unidirectional transmission links to form a single form loop, i.e. local area networks that have each station attached to an adjacent station using point-to-point link from a physical ring. Each station attached and active to the ring regenerated the information frame, and then retransmits the information frame on the ring. The ring itself is logically circular and the information travels in one direction.

   Failure of a station in ring topology disrupts the ring because the information frame is not generated. Additions or deletions of stations to the ring can be disruptive, if the change is not managed properly. Both token ring and FDDI (Fiber Distributed data Interface) networks implement a ring topology.

3) A Star topology is a LAN architecture in which the ends points of one network are connected to a common central hub, or switch, by dedicated links. Logical bus and ring topologies are often implemented physically in star topology. Communications on the connecting links between the stations and the central station of a star topology cab are bi-directional and point-to-point. A station on this type of network passes an information frame to the central controller, which then forwards the information to the destination station. The central controller manages and controls all communications between the stations on the network.

   Failure of station on a star network is easy to detect and can be removed from the network. However failure of the central controller will disable the communication throughout the whole network.

4) A Tree Topology is a LAN architecture that is identical to the bus topology, except those branches with multiple nodes are possible in this case.

5) In a Mesh topology, every device has a dedicated point-to-point link to every other device. The term dedicated means that the link carries traffic only between the two devices it connects. A fully connected mesh network therefore has n (n – 1)/2 physical channels to link n devices. To accommodate that many links, every device on the network must have (n – 1) input/output (I/O) ports.

Advantages of this network are:

a) The use of the dedicated links guarantees that each connection can carry its own data load, thus eliminating the traffic problems that can occur when the links must be shared by multiple devices;

b) Privacy or security is good enough here; and

c) A mesh topology is robust.

The main disadvantages are related to the amount of cabling and the number of I/O ports needed.

Devices commonly used in LANs include repeaters, hubs, LAN extenders, bridges, LAN switches and routers.

Please answer the following Self Assessment Question.

Self Assessment Question 2 *Spend 3 Min.*

Define the term Topology?

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3.5 REFERENCE MODELS

The two most important reference models are OSI (Open System Interconnection) and TCP/IP model.

THE OSI Reference Model: This model is based on a proposal developed by the International Standards Organizations (ISO). It deals with connecting open systems that are open for communication with the other systems. The OSI model has seven layers:

- The physical layer
- The data link layer
- The transport layer
- The network layer

- The session layer
- The presentation layer
- The application layer

The physical layer is concerned with transmitting raw bits over a communication channel. The design issues have to do with making sure that when one side sends a 1 bit, the other side as a 1 bit, not as a 0 bit receives it.

The main task of data link layer is to take a raw transmission facility and transform it into a line that appears free of undetected transmission errors to the network layer. It accomplishes this task by having the sender break the input data up into data frames, transmit the frames sequentially and in the process the acknowledgement frames are sent back by the receiver.

The network layer is concerned with controlling the operation of the subnet. A key design issue is to determine how packets are routed from the source to destination. Routes can be based on static tables that are "wired into" the network and rarely changed.

The basic function of the transport layer is to accept the data from the session layer, split it up into smaller units if need be, pass these to the network layer and ensure that the pieces all arrive correctly at the other end.

The session layer allows users on different machines to establish sessions between them. A session allows ordinary data transport, as does the transport layer, but it also provides enhanced services useful in some applications. A related session service is TOKEN Management.

The presentation layer performs certain functions that are requested sufficiently often to warrant finding a general solution for them, rather than letting each user solve the problems. The presentation layer manages abstract data structures and converts from the representation used inside the computer to the network standard representation and back.

The application layer contains a variety of protocols that are commonly needed. All the virtual terminal software is in the application layer. Another application layer function is file transfer.

The TCP/IP Reference Model: This model has been created from ARPANET. TCP stands for Transmission controls protocol and the Internet protocol. There are four layers:

- Host-to-network
- Internet
- Transport
- Application

TCP is a reliable connection-oriented protocol that allows a byte stream originating on one machine to be delivered without error on any other machine in the Internet. The second protocol in this layer is UDP (User Datagram Protocol) is an unreliable, connectionless protocol.

The OSI and TCP/IP have much in common. Both are based on the concept of a stack of independent protocols. Also the functionality of the layers is roughly similar.

Despite these fundamental similarities, the two models also have many differences in the following ways:

- Provisions of service
- Interfaces
- Protocols

3.6 NETWORKING PROTOCOLS

In computer networks, communication occurs between entities in different systems. For communication to occur, the entities must agree on a protocol which is a set of rules that govern data communication. A protocol defines what is communicated, how it is communicated, and when it is communicated. The key elements of a protocol are syntax, semantics, and timing.

The TCP/IP protocol suite is most important for the Internet. This was developed prior to OSI model, so this suite does not match exactly with those in the OSI model. The TCP/IP protocol suite is made of five layers: physical, data link, network, transport and application. The first four layers provide physical standards, network interface, internetworking, and transport functions that correspond to the first four layers of the OSI model. The three topmost layers in the OSI model, however, are represented in TCP/IP by a single layer called the application layer.

At the Transport Layer, TCP/IP defines two protocols: Transmission Control Protocol (TCP) and User Datagram Protocol (UDP). At the network layer, the main protocol is IP (Internet Protocol).

In addition to the Internet Protocol (IP), which is used for data transfer, the Internet has several control protocols used in the network layer, including Internet Control Message Protocol (ICMP), Address Resolution Protocol (ARP), Reverse Address Resolution Protocol (RARP) and BOOTP. Every host and router on the Internet has an IP address, which encodes its network and host number. The combination is unique: no two machines have the same IP address. All IP addresses are 32 bits long.

Network addresses are usually written in dotted decimal notation. Network numbers are assigned by the Network Information Center (NIC).

Internet Control Message Protocol (ICMP): When something unexpected occurs, the event is reported by it. About a dozen types of ICMP messages are defined. Each ICMP message type is encapsulated in an IP packet.

Address Resolution Protocol (ARP): Although every machine on the Internet has one (or more) IP addresses, these cannot actually be used for sending packets because the data link layer hardware does not understand the Internet address. ARP will resolve the address confusion.

Reverse Address Resolution Protocol (RARP): ARP solves the problem of finding out, which Ethernet address corresponds to a given IP address. But sometimes how can we find IP address when Ethernet addresses are given? This solution is being solved by RARP protocol.

These above protocols are very much vital when the concept of network stands. But in case of the Internet, Domain Name System (DNS) is a very important aspect by which Uniform Resource Locator (URL) address is being maintained globally.

DNS is a protocol that can be used in different platforms in the Internet. The domain name space (tree) is divided into three different sections: generic domains, country domains and inverse domains.

Generic Domains define registered hosts according to the generic behavior. These are com, edu, gov, int, mil, net, and org.

The Country Domain system follows the same format as the generic domains but uses two-character country abbreviations (e.g. in for India). But at present the country domain can be like www.mtnl.in (for Example).

Inverse Domain is used to map an address to a name. This may happen, for example, when a server has received a request from a client to do a task. Where the server has a file that contains a list of authorized clients, the server lists only the IP address of the client (extracted from the received IP packet).

3.6.1 TELNET

It is a general-purpose client-server application program. It is an abbreviation of Terminal Network. It enables the establishment of a connection to a remote system in such a way that the local terminal appears to be a terminal at the remote system. Both local login and remote login are quite possible through TELNET. It solves the remote login problem by defining a universal interface called the network virtual terminal (NVT) character set. Through this interface, the client TELNET translates characters (data and commands) that come from the local terminal into NVT form and delivers them to the network. The server TELNET, on the other hand, translates data and the commands from NVT form into the form acceptable by the remote computer.

File Transfer Protocol (FTP) is the standard mechanism provided by TCP/IP for copying a file from one host to another. Transferring files from one computer to another is one of the most common tasks expected from networking or internetworking environment. These problems can be solved by FTP: two systems may use different file name conventions. Again two systems may have different ways to represent text and data. Two systems may have different directory structure. All the above problems are solved by FTP in a very simple and elegant approach.

The actual mail transfer is done through mail transfer agents(MTAs). To send a mail, a system must have a client MTA, and to receive a mail, a system must have a server MTA. Although Simple Mail Transfer Protocol (SMTP) does not define a specific MTA, send mail is commonly used by the UNIX system MTA.

The post office protocol (POP) is used for retrieving a message. POP3 version is very popular to download messages from server.

The Simple Network Management Protocol (SNMP) is a framework for managing devices in an Internet using TCP/IP protocol suite. It provides a set of fundamentals operations for monitoring and maintaining the Internet.

The Hypertext Transfer protocol (HTTP) is a protocol used mainly to access data on the World Wide Web. The protocol transfers data in the form of plain text,

hypertext, audio, video, and so on. It functions like a combination of FTP and SMTP. It is similar to FTP because it transfers files and uses the services of TCP.

The World Wide Web (WWW) is a repository of information spread all over the world and linked together. It has a unique combination of flexibility, portability, and user-friendly features that distinguish it from other services provided by the Internet. It is a subset of the Internet. It must be clear that the term Internet and World Wide Web are not similar.

Please answer the following Self Assessment Question.

Self Assessment Question 3 *Spend 3 Min.*

Define Protocol and list key elements of Protocol?

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3.7 AUTHORITIES TO CONTROL INTERNET

Day by day hundreds of stations are being connected to the Internet. So it is very difficult to control the naming system worldwide. To solve this problem, Domain Name System (DNS) was invented previously. The essence of DNS is the invention of a hierarchical, domain-based naming scheme and a distributed database system for implementing this name scheme. It is primarily used for mapping host names and email destinations to IP addresses but can be also used for other purposes. DNS is defined in RFCs 1034 and 1035.

Scenario is quite different as Internet Corporations for Assigned Names and Numbers (ICANN), controls how to assign the IP addresses. Though India is a member country of ICANN, it is not satisfied with the functionality of this organization as it supports the USA directly.

Standards are developed by cooperation among standard creation committees, forums, and government regulatory authorities. While many organizations are dedicated to the establishment of standards, some of the reputed ones are described below:

International Standard Organizations (ISO): It is a multinational body whose membership is drawn mainly from the standards creation committees of various Governments through the world. Created in 1947, the ISO is an entirely voluntary organization dedicated to worldwide agreement on the international standards.

Institute of Electrical and Electronics Engineers(IEEE): It is the largest professional engineering society in the world. It aims to advance theory, creativity, and product quality in the fields of electrical engineering, electronics and radio as well as all the related branches of engineering. The IEEE oversees the development and adoption of international standards for computing and communication. The IEEE has a special committee for local area networks (LANs), out of which has come project 802 (the 802.3, 802.4 and 802.5 standards.)

International Telecommunication Union-Telecommunication Std. Sector (ITU-T):

On March 1993, it was formed. It is divided into two study groups, each devoted to a different aspect of the industry. A national committee such as CEPT in Europe and ANSI in the USA submits proposals to these study groups. If the study group agrees, the proposal is ratified and becomes part of the ITU-T standard, issued every four years. The best known ITU-T standards are the V series (V.32, V.33, and V.42) which define transmissions over public phone lines: the X series (X.25, X.400, and X.500), which defines transmission over public digital networks. Information Highway is one of the successful projects of it.

Internet Corporation for Assigned Names and Numbers (ICANN) : It is a co-ordinate private sector non-profit organization, which was set up by the United States in1998 to take over the activities performed for thirty years, amazingly by a single pony tailed professor in California. India is a member country of ICANN. But its private-sector approach favours the United States, so the other member countries have no real power in case of any decision. All domain names are maintained by this organization.

With the rapid growth of high-speed technology, the basic concept of networking is going to face a tremendous change. Nowadays, network and telecommunication have already been merged into a single entity. Therefore, network security is becoming more and more crucial as the volume of data being exchanged on the Internet increases largely. Though at present lot of attentions are been given to network security, still a review is needed for further strengthening the universal cryptological background.

Please answer the following Self Assessment Question.

Self Assessment Question 4 *Spend 3 Min.*

What is Domain Name System? Write about the role of ICANN.

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Let us now summarize the points covered in this unit.

3.8 SUMMARY

- A network is a set of device (often referred to as nodes) connected by media links.
- Three types of networks are LAN, MAN and WAN.
- The Internet is the bigger version of WAN.
- Network topology is the way in which network is laid out either physically or logically.

- Some important topologies are bus, star, ring, tree and mesh.
- TCP/IP and OSI are two basic reference models.
- OSI has seven layers where as TCP/IP has four layers.
- TCP/IP is the main protocol suite on which the Internet is based.
- TELNET is a general purpose client-server application program.
- Through TELNET both local login and remote login are possible.
- To control the naming system worldwide, previously domain name system (DNS) was invented. It is primarily used for mapping host names and e-mail destinations to IP addresses.
- ICANN is a non-profit private organization that controls the domain name system in the Internet.

3.9 TERMINALQUESTIONS

1) What is the basic difference between OSI and TCP/IP models?
2) Write about TELNET and FTP.
3) What are the advantages of LAN?
4) Discuss various Network Topologies.

3.10 ANSWERS AND HINTS

Self Assessment Questions

1) A network is set of devices (often referred to as nodes) connected by media links. Node can be a computer, printer, or any other device capable of sending and/or receiving data generated by other nodes on the network. The links connecting the devices are often called communication channels. The computer networks can be classified into three broad categories: Local Area Network (LAN), Metropolitan Area Networks (MAN) and Wide Area networks (WAN).
2) The term topology refers to the way a network is laid out, either physically or logically. The topology of a network is the geometric representation of the relationship of all the links and linking devices (usually called nodes) to each other.
3) A protocol defines what is communicated, how it is communicated, and when it is communicated. The key elements of a protocol are syntax, semantics, and timing.
4) The Domain Name System (DNS) helps the users find their way around the Internet. Every computer on the Internet has a unique address called its "IP address" (Internet Protocol address). Because IP addresses (which are strings of numbers) are hard to remember, the DNS allows a familiar string of letters (the "domain name") to be used instead. So rather than typing "192.0.34.163", you can type "www.icann.org". ICANN is responsible for coordinating the management of the technical elements of the DNS to ensure universal

resolvability so that all the users of the Internet can find all valid addresses. It does this by overseeing the distribution of unique technical identifiers used in the Internet's operations, and the delegation of Top-Level Domain names (such as .com, .info, etc.).

Terminal Questions

1) Refer to section 3.5 of the unit.

2) Refer to section 3.6 of the unit.

3) Refer to section 3.3 of the unit.

4) Refer to section 3.4 of the unit.

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UNIT 4 INTRODUCTION TO CYBERSPACE AND ITS ARCHITECTURE

Structure

4.1 INTRODUCTION

Cyberspace is such a term, which is not yet completely defined and also has no geographical limitation. It is a term associated with application of the Internet world-wide. It is also called as a virtual space as physical existence of cyberspace is not detectable at all. Cyberspace is "the total interconnectedness of human beings through computers and telecommunication without regard to physical geography. Cyberspace is a term coined by science fiction author William Gibson to describe the whole range of information resources available through computer networks. For our purposes, cyberspace is a realm in which communication and interaction between two individuals or between an individual and a computer is facilitated by digital data exchanged over computer networks. This interaction or communication can be used for a host of different purposes.

The Internet is currently the biggest network for linking computers, but cyberspace, as a concept, is independent of the Internet. Cyberspace communication began before the Internet and the World Wide Web, and cyberspace interaction and

communication will continue to take place after the Internet is no longer the network of choice.

Currently there is no generic system for identification in cyberspace. It is not possible to absolutely identify an entity or to accurately tell whether an object has a specific characteristic. Digital environments have inherent differences from real space which causes this discrepancy, and when implementing an identity system for cyberspace one needs to consider more than just the architectural nature of the system any system chosen will have the social repercussions which need to be also taken into account. Identity is a unique piece of information associated with an entity. Identity itself is simply a collection of characteristics which are either inherent or are assigned by another. The colour of a person's hair is good or bad and whether he is attractive or not is part of a person's identity which is usually reviewed by another person.

Interactions done in real space inherently carry the identity of the person originating the transaction. Generally, physical traits are carried along in a transaction - for example when one purchases a book from a book store, the book dealer may remember the buyer's face or build.

4.2 OBJECTIVES

After studying this unit, you should be able to:

- describe what is Cyberspace;
- explain the difference between Real Space and Cyberspace;
- explain the concept of Digital Identity;
- describe Computer and Cyber Crimes;
- describe the architecture of Cyberspace;
- state implications of choosing the link system; and
- list the barriers before cyberspace identity mechanism.

4.3 THE DIFFERENCE BETWEEN REAL SPACE AND CYBERSPACE

The difference between real space and cyberspace is that the essence of any digital transaction is unbundling. Ones and zeros do not inherently carry any separate information along with them; a real space transaction carries along inseparable secondary information. Digital transmissions can only transmit; there is no secondary information encoded in the transmission unless explicitly put there. Thus, for authentication purposes, additional information needs to be carried with cyberspace transactions for identity purposes.

Providing extra information in digital communication introduces the possibility for identity theft. Because nothing prevents the transmission of false identity information, or the duplication of another's identity information. To prevent these problems, the actual identity must not be transmitted along with the message; instead a verification scheme needs to be used to convince the recipient that the message was actually sent by the sender. This eliminates the need to send one's actual identity. The concept of verifying instead of revealing provides an extra layer of security to the sender.

The other point of insecurity is in the digital certificates which were issued to verify

these characteristics. These certificates are meant to be used only by their owner, but if another party obtains them, then that party can falsify his identity, representing him as the individual for whom he has digital certificates.

Architecturally, we must decide how to store and use these certificates. The certificates can be stored on a smart card for use on a computer terminal, or the certificates can be stored in an "identity server" locked via password or biometrics information and available for transmission over the Internet.

In real space, it is difficult to select, to verify or reveal portions of one's identity: most forms of identification contain more information than is needed for any transaction. The unbundling that is possible in cyberspace allows portions of identity to be disassociated and verified by a third party. This not only creates the ability to verify via the least revealing means, but it also creates the framework for anonymous transactions – it is possible to merely verify the proper information without ever distributing the same characteristic. Further, cyberspace users have control over the strength of the link between their real world and the cyber-identities.

4.4 OVERVIEW: WHAT IS DIGITAL IDENTITY?

A digital identity system must serve several functions. First: authentication-ensuring that when a message purports to be from Alice, Alice sent it, not someone pretending to be Alice. Second: message integrity-providing certainty that when a message arrives from Alice, it is the same message that Alice sent, not modified en route in any way. Third: non-repudiation-ensuring the inability of Alice later to deny that she sent the message, and the inability of the recipient of Alice's message to deny that the message was received. Fourth: establishing a digital identity architecture may have the beneficial side effect of facilitating confidentiality through encryption–the knowledge that no one besides Alice can read a message intended for her.

Before proceeding with cyber artitecture, however, it is important to examine the concept of identity itself. This section develops a working definition of identity, considers the ways in which people use their identities, and articulates the reasons why it is important to protect our identities, especially in the digital context.

4.4.1 Working Definition of Identity

It is difficult to craft a formal definition of identity. Basically, the essential and unique characteristics of an entity are what identity it. For example, how the system will identifies this person is called Joe Jindo where there are many Joe Jindo around the world. These characteristics might include, among other things, the unchanging physical traits of the person, his preferences, or other people's perceptions of the individual's personality. The skills that a person possesses can also become part of one's identity. For example, a person's identity could include the fact that he "has the ability to drive" or that he "has brown hair". Some characteristics, such as height, have one correct setting. Those traits of an individual that reflect someone else's perceptions do not have to have an absolute setting. Bob may set Alice's "is friendly" flag to true, whereas Charles may set the same flag to false. Even if Bob and Charles agree on what should be the flag's setting for Alice, Alice's own view may differ from theirs. Thus, in practice, there is a degree of fuzziness to the definition of an entity's identity, and most certainly to how others perceive it.

No two identities are the same. Each identity maps to a unique set of characteristics. Two people may share some of the same characteristics, such as being old enough to

drive or having the same hair colour, but that does not mean that they have the same identity. If Jow Jindo 2 can identified himself as Joe Jindo 1 then Joe Jindo 2 can access and manipulate all the private information of Joe Jindo 1 which is called identity theft.

4.4.2 Identity as a Commodity

In today's economy, information on identity often is viewed as a valuable commodity. This view of identity is worth a closer examination.

Businesses desire to advertise their products to the markets most interested in them, and may even retool their products to be more appealing to certain segments of a market. Knowing the preferences of individuals allows a corporation to target perfectly their products to those who would prefer and, thus, be most likely to purchase them. Making a detailed survey of an individual's preferences, though, is very difficult, if not impossible. Often an individual cannot specify the exact motivation for her purchase of a particular product. From the seller's perspective, determining which questions to ask purchasers can be a daunting task. Further, certain questions, despite their potential usefulness, are not likely to be answered by a purchaser. To work around this problem, businesses use identity information as a proxy for preferences. For example, rather than trying to discover the exact reason why an individual purchased a Ford Mustang, a car dealer might instead try to find out the purchaser's profession or income level. Suppose the car dealer discovers that a number of his customers who have purchased Ford Mustangs are lawyers. Although the car dealer may not understand why they purchased Ford Mustangs, he can assume with some level of confidence that there is something about lawyers that leads them to purchase Mustangs instead of Cougars.

Please answer the following Self Assessment Question.

Self Assessment Question 1 *Spend 3 Min.*

Why identity is viewed as a valuable commodity?

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4.5 VERIFYING VERSUS REVEALING AN IDENTITY

Cyberspace creates opportunities for identity theft. One inherent property of digital media is that, it can be duplicated perfectly and easily. Exact copies of everything sent over a digital communications channel can be recorded. Consider the act of

sending a signed letter to someone. In the real space, I reveal to the recipient the exact form of my signature, but the difficulty of mastering the art of forgery protects me from the possibility that the recipient would begin signing letters with my signature. However, if I send a digital letter that contains the digital representation of my signature, the recipient could easily duplicate and use my signature to assume my identity when signing documents. The seriousness of this problem is highlighted when you consider that future technologies will allow extremely important identifiers, such as a retinal scan or a fingerprint, to be represented digitally. These biometrics characteristics are protected in real space because they are embedded in the physical body of the person. This is lost in cyberspace. Thus, cyberspace needs a system that allows individuals to verify their identities to others without revealing to them the digital representation of their identities. A verification system would let Bob, for example, know the identity of Alice or that she possesses a particular trait, but would not give him the ability to impersonate Alice or use the trait identifier as if it was his own. In our digital letter example, Bob would be able to verify that the letter contains Alice's signature but would not let him sign the documents as Alice. Similarly, a verification that someone is of the proper age to purchase alcohol would not give the person a change to verify this identifier anything that would allow him to represent himself as being of the proper age to purchase alcohol. Such a system helps both the parties obtain what they want out of exchanging identity information without the risk of identity theft.

4.6 CYBER AND COMPUTER CRIMES

Computer crimes can involve criminal activities that are traditional in nature, such as theft, fraud, forgery and mischief, all of which are subject everywhere to criminal sanctions. The term computer misuse and abuse are also used frequently but they have significantly different implications. Annoying behaviour must be distinguished from criminal behaviour in Law. As per IT Act, 2000, no description has been categorically made for computer crime and cyber crime. So till today, it is very difficult to differentiate between these two words. In relation to the issue of intent, the principle of claim of right also informs the determinations of criminal behaviour. For example, an employee who has received a password from an employer, without direction as to whether a particular database can be accessed, is unlikely to be considered guilty of a crime if he or she accesses those databases. So a distinction must be made between what is unethical and what is illegal, the legal response to the problems must be proportional to the activity that is alleged. Common types of computer crimes are:

- Forgery;
- Fraud by system manipulation intentionally;
- Any modification to data or programs or databases; and
- Accessing computers without authorization;

But cyber crimes are somehow different from computer crimes. Computer crime happens in physical space with or without the network. Cyber crime takes place in a virtual space through digital environment. Recent example of cyber crime was Bazzee.com case, which is a MMS scandal. Cyber crimes may happen globally as there is no geographical limit for cyberspace.

Please answer the following Self Assessment Question.

Self Assessment Question 2 *Spend 3 Min.*

Give two examples of Computer Crimes.

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4.7 ARCHITECTURE OF CYBERSPACE

Practically cyberspace architecture for global standard is not yet possible, though certain groups of networks are maintaining some rules and regulations to make a minimum architecture through TCP/IP and a virtual global server system. Here some theoretical architectural choice has been described.

4.7.1 Link and No-Link: An Architectural Choice

As identified earlier, any digital identification system must determine where to lie upon the continuum of anonymity and accountability; that is, a system must adopt an appropriate degree of Type II unbundling. However, within the context of law enforcement it becomes clear that not all points along this continuum are equal. One point is very different from all the others: the point at the far end of the spectrum where there is absolutely no traceability. For the sake of clarity in our further discussion, this point will be called "no-link". At the no-link point, there exists within the digital identification the architecture which has no mechanism for determining the link between data in cyberspace and the real world recipient or sender. The no-link point implies only that there is no mandatory link between cyberspace and the real world; this does not preclude an additional, non-mandatory method of determining an identity that could be layered on the top of the no-link architecture. All other points along the spectrum will be designated as "link" points. This indicates that there is some mandatory architectural mechanism for determining the real world identity of the sender and receiver of data in cyberspace.

Both link and no-link architecture have benefits and drawbacks associated with them. With a link architecture, access to the link information can be limited, presumably, only to an appropriately regulated law enforcement agency with specific regulatory processes in place for obtaining the information. However, the immediate point is that not everyone will have the access to the information contained in the architectural link; to those without access, link architecture is identical to no-link architecture. The benefit of identification is still present, but the ability to gain knowledge of the person's real world identity from the architecture of the system is limited to those specific bodies with access. Thus, once again, the interesting area of discussion is that pertaining to law enforcement: when can a link system effectively be used as a no-link system, and are there benefits able to determine a link which outweigh any corresponding drawbacks?

At all the points along the continuum, except for the extreme of one-to-one identity, there is a need to distinguish between "transient anonymity" and "persistent anonymity". With transient anonymity, no persistent link remains to the sender of the information; this is analogous to anonymous leafleting. Persistent anonymity is perhaps more useful: it allows continuity of cyber identity, generally without disclosing the real world identity, i.e both the sender and receiver mutually agreed and define their private communication channel in the network which is not accessible to any other at any circumstances unless the private information of any party is not tempered or compromised. It only permits disclosure of the real world identity within a link system. In a no-link system, continuity is preserved, but without facilitating the link. Both the types of anonymity are useful in some circumstances, but persistent anonymity is likely to be more generally useful.

No Link

The benefits of a no-link system are, as mentioned above, those pertaining mostly to issues of freedom of speech and freedom of action. In the commercial domain, the wheels of capitalism are greased by the no-link architecture. People who have no fear of ever being personally associated with what they buy are far less likely to be concerned about the social norms which might have previously restricted them from purchasing a product. Unbundling facilitates the necessary degree of identification that commerce will require without necessitating the revelation of the entire real world identity. Free speech is likewise assisted by the absence of traceability: where potential oppressors are unable to determine the sender's real world identity, there is no danger of oppression.

Link Architecture

No-link architecture provides protection from McCarthyism. But in so doing, it removes all accountability from speech. It is an architecture that completely eliminates the power of social norms, market regulation, and legal regulation to govern interaction on the Internet. Society should not overlook the more general consequences that may result from the ability to avoid accountability in all speech, especially the speech which would not be considered criminal: people may routinely and without concern spout inaccurate and misleading information, and the responsibility may disappear even further from the moral landscape. However, the aspects which can be most clearly identified and discussed are those which result in criminal behaviour.

Please answer the following Self Assessment Auestion.

Self Assessment Question 3 *Spend 3 Min.*

Discuss about the various types of Cyberspace Architecture.

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4.8 PREVENTING CRIMES

The issue then becomes one of the preventing crimes, while simultaneously attempting to mitigate this potential "chilling effect" on free speech. At the heart of this discussion, lies the distinction between transactional information and content information. Transactional information is the information regarding the sender, recipient, and other information associated with the transmission of the information, but not regarding the content of the information. Thus, so far the argument has centered on transactional information; however, the value of content to law enforcement must be considered: if it is absolutely necessary to have content as well as transactional information, then it will do no good to consider offering the latter without the former. If, on the other hand, transactional information without content is a tool that can be utilized, it may result an effective compromise between the needs of law enforcement and the desires of the society.

Encryption represents the single largest barrier to law enforcement obtaining content from a computer. This is an issue that is relatively unique to cyberspace, as handwritten and telephone encryption is relatively rare. One choice can be made with respect to encryption: allow it, without regulation, or disallow it. Disallowing encryption altogether is pragmatically different from allowing only key escrowed encryption, but for the purposes of this discussion, they are effectively the same. The overwhelming response of the government has been that, encryption controls are in fact necessary, and several initiatives have been proposed to this effect; however, both the public and legal reaction to these initiatives have been negative: many organizations are resisting the degree of control which law enforcement would be given, and the Communications Decency Act was recently ruled as too general to be constitutional. In this situation, law enforcement's claims of what it needs to be effective are strongly disputed by the public: the equilibrium between the two is harder to strike in cyberspace.

4.9 IMPLICATIONS OF CHOOSING THE LINK SYSTEM

The negative implications of choosing the link system are clear: it may place an unreasonable burden on free speech. Even if it is not unconstitutional in this manner, it may simply deter people from speaking out in situations where their voices would be most useful. In order to convince the society that its interests in avoiding unreasonable persecution are maintained, the architectural decision to include the link must be combined with legal regulations regarding who is given sanction to disclose the link, and under what circumstances such disclosure is acceptable. While the negative impacts of providing a link with all the transmitted data can never be fully accounted for, the goal of a system which provides an architectural link must be to mitigate the impact of the architecture as fully as possible.

No-link architecture has more tangible drawbacks. Crimes can be easily planned and carried out on a system with no accountability, and there is no reason to think that they would not be. However, practical concerns such as sovereignty and providing unrestricted speech to political dissidents regardless of their governments' policy on free speech may outweigh the potential societal costs. It may be also that suitable mechanisms for regulating their identity can be created in a legal or market based way; it is hard to see how these methods would be enforceable in a cost-effective manner, but the number of criminal deviants might be small enough that the identification by law enforcement could be reasonably achieved.

A Note on Architectural Choice

It is very important whether the architecture of a digital authentication mechanism

should be designed to permit traceability. Although the discussion focuses on how traceability on the Internet would meet the needs of the government in carrying out its law enforcement function, it should be noted that businesses also have an interest in the development of architecture with such a feature. Many corporations have established Intranets to facilitate communication between the various divisions of their companies. Traceability in the architecture would help the leadership of a business monitor the activities of its employees. Monitoring of this sort might be motivated by a desire to track the productivity of the individual workers or a need to ensure procedures designed to govern access to the company's sensitive information are followed. The development of architecture for the Internet that included traceability would provide a standard that could be adopted for the corporate internal networks, without the associated research and development costs.

Aside from the caveat presented above, business-domain interests in the use of identity do not require the developers of the architecture to make any fundamental architectural choices for the system. Instead, most of the concerns regarding the business arena are related to how businesses and consumers will behave in an environment using the digital authentication mechanism proposed.

Social Aspects

Community in cyberspace is based on the interaction between people.

Cyberspace has an important social aspect to it that must not be overlooked. Ever since the ARPA Net was created, its primary use has been to communicate with other people. With the advent of a faster backbone, different types of communication media became possible namely, interactive communications. Community in cyberspace is based on the interaction between people.

Although a community is a group of people who interact with each other, at the basic level it comprises a group of people who exist with each other in a common plane. Cyberspace can be treated as a conduit touching portion of real space at key points. Ideas are passed through the conduit, and business is transacted through this conduit. The cyberspace communities are members of the global community interacting on a different plane than in real space. These members rarely interact in the real space, but they communicate through multimedia means in cyberspace whether it be by text, image, sound, or a combination of the three. It is not possible to use the Internet without being part of this community of people; you cannot avoid being a part of the community, even if you are using the Internet as a conduit: by e-mailing people, reading web pages, reading newsgroups, or doing commerce online, one has joined the cyberspace community.

4.10 ROAD TO IMPLEMENTATION

The current state of cyberspace identification mechanisms is far from the flexible, broad potential of the identity architecture. There is still a long way to go from the 'here' of the Internet as it exists in 1998 to the 'there' of the ubiquitous, secure identity architecture. In order for the Internet to reach its full potential, a secure mechanism for managing and verifying the digital identity is necessary. There remain ranges of hurdles to overcome before a cyberspace identity mechanism will be deployed and ubiquitous. These hurdles can best be analysed in four categories: social norms, market, legal, and architectural barriers.

Social Norms Barriers

The main social obstacle to implementation of a cyberspace identification mechanism is that the general public does not recognise that there is a problem with the existing

identification architecture. The general public does not understand the need for an improved, secure cyberspace identification system. Even without any effective identification mechanism, the use of the Internet – for both casual and secure applications – has soared, with double-digit growth rates measured month-to-month rather than year-to-year. While more sophisticated Internet users may recognise the need for a digital identity mechanism, these advanced users represent a shrinking percentage of the overall Internet? Community? Many people using popular Internet applications seem to be satisfied with the existing levels of security and identification. E-mail, for instance, is often self-identifying through the content of the message. Forged e-mail, while easy to create in the current architecture, is not perceived to be a major problem. E-mail eavesdropping, also a relatively simple technical task, has not slowed the flood of e-mail communications. On-line commerce is booming even based on systems requiring credit card numbers and the overly revealing identification that credit card numbers enable.

Market Barriers

The market barriers to the implementation of a secure Internet identification system stem from the difficult business economics inherent in solving this type of problem. One of the key problems is that, there is significant business model risk for companies providing identity verification solutions. In other words, it is unclear exactly how these companies can make money. In addition, economic incentives do not encourage the development of an open-standard identity infrastructure. Ultimately, success of an open-standard identification architecture, such as our proposed system, may require government intervention in the marketplace.

Legal Barriers

The most critical legal obstacle to the development and adoption of any effective digital identity mechanism is the current confusion over legal liability rules. In other words, who is responsible if someone's digital identity is misused or stolen? Who bears the cost if a digital identification mechanism is compromised? The lack of a clear legal liability regime for these two issues discourages the cyberspace identity market from emerging in the first place and from operating efficiently once it does become widespread. Legislatures may need to enact liability laws that cover digital identity before the identity infrastructure can be effectively implemented.

The appropriate liability rules must reconcile two competing principles. First, because the market for the digital identity mechanisms is in its infancy, the selected liability rules must help create incentives that will drive towards the widespread adoption of a secure identity infrastructure. According to this goal, the liability for identity misuse should be placed on whichever party can best induce the introduction and implementation of the identity architecture. Second, in order to have an efficiently operating marketplace for identity mechanisms, it is desirable for the selected liability rules to place liability on the party who is the "least cost avoider" of harm. Adopting this goal, liability for identity misuse should be placed on whoever is best able to avoid misuse of the digital identity. If these two goals point towards the same party, both goals can be accomplished together. However, if these two goals suggest that different parties should bear liability, then one goal or another must be made paramount or the goals must be balanced.

Architectural Barriers

In broad terms, there are just three types of identification mechanisms. Authentication can be based on a person's shared knowledge (such as a password); a person's possession of unique information or device (such as a digital certificate); or a person's inherent unique characteristics (such as a fingerprint or other biometric).

Please answer the following Self Assessment Question.

Self Assessment Question 4 *Spend 3 Min.*

What are the barriers before cyberspace identity mechanism can be deployed?

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Let us now summarize the points covered in this unit.

4.11 SUMMARY

- There is no proper definition of Cyberspace yet. Only some concepts have been derived.
- Cyberspace is the total interconnection of human beings through networked computers and telecommunications without any regard to physical geography.
- The difference between real space and cyberspace is that the essence of any digital transaction is unbundling. Main problems are to identify the reality.
- Digital Identity is the mechanism to identify the man or product through digital environment.
- In the present scenario, digital identity is also often viewed as a commodity.
- Computer crime and cyber crime seem to be similar but both are different.
- Computer crime belongs to any individual computer without the Internet connection i.e. physically whereas cyber crime happens in cyberspace through the Internet only.

- Cyberspace architecture, which is not properly defined now, is a design in which virtual space transactions are being made through digital environment.
- Presently the cyberspace identification mechanism is not flexible; there are a number of barriers, for example: social norms, market, legal and architectural, before a cyberspace identity mechanism could be deployed.

4.12 TERMINAL QUESTIONS

1) What is Cyberspace and how it differs from the physical space?

2) Write about the concept of Digital Identity.

3) Differentiate between the computer crimes and the cyber crimes.

4.13 ANSWERS AND HINTS

Self Assessment Questions

1) As there is no chance of physical verification of personal identity in cyberspace, the identity, in cyberspace plays a crucial role for electronic identity. So, this electronic identity (called identity only) is viewed as valuable commodity for commercial purpose.

2) Forgery, Accessing the Computer without Authorization.

3) In practice, there is no specific architecture defined for cyberspace but some theoretical concept has been yet proposed for the same like link and no-link architecture for architecture frame work.

4) The cyberspace identification mechanism is not flexible; there are a number of barriers, for example: social norms, market, legal and architectural, before a cyberspace identity mechanism could be deployed.

Terminal Questions

1) Refer to section 4.2 and 4.3of the unit.

2) Refer to section 4.4 of the unit.

3) Refer to section 4.6 of the unit.

4.14 REFERENCES AND SUGGESTED READINGS

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2. "Digital & Electronic Signatures". WTV Home page. 5Dec.1997. Winchel "Todd" Vincent, III.8Jan.2007<members.aol.com/Winchel3/Links/Legal/Signatures/Signatures LegalLinks.htm>.

3. Uniform Electronic Transactions Act.23 Mar. 1998.

UNIT 5 EVOLUTION AND BASIC CONCEPTS OF INTERNET

Structure

5.1 INTRODUCTION

There are so many networks exiting in the world, often with different hardware and software. But Internet is a term which is very common to all irrespective to any age group. Perhaps there is no such human being in the universes, who is unaware of the term Internet. In other words, Internet is the backbone of rapid growth of technological revolution. The word Internet is derived from Internetworking that is a collection of individual networks, connected by intermediate networking devices that function as a single large network. Network is a collection of terminals, computer servers and components which allow for the easy flow of data and use of resources between one another. In simple words, a network is a group of two or more computer systems linked together.

5.2 OBJECTIVES

After studying this unit, you will be able to:

- explain the concept of Network and the Internet;
- describe the History of Internet;
- explain the Internet Terminology;
- describe the ways by which the Internet can be connected ;
- list services provided by the Internet;
- know the importance of browsers in connecting the internet;
- describe the functions of a search engine; and
- describe the concept of E-commerce, various types of E-commerce, its application and security requirement needed for conducting electronic commerce.

5.3 HISTORY OF THE INTERNET

The Internet has a glorious history. It has come across a long way to reach its current position.When traditional circuit-switched telephone networks were considered too vulnerable, DoD (Department of Defence of USA) turned to its research arm, Advanced Research projects Agency (ARPA). ARPA was created in response to the Soviet Union's launching Sputnik in 1957 and had the mission of advancing technology that might be useful to the military. This network is popularly known as ARPANET. In the late 1970s, NSF (The U.S. National Science Foundation) found the enormous impact the ARPANET was having on University research, allowing scientists across the contry to share data and collaborate on research projects. However, to get on the ARPANET, a University had to have a research contact with the DoD, which many did not have. This lack of Universal access prompted NSF to set up a virtual network, CSNET, centered around a single machine at BBN that supported Dial-up lines and had connections to the ARPANET and other networks. NSF also founded some (eventually about 20) regional networks that connected to the backbone to allow users at thousands of universities, research labs, and museums to access any of the supercomputers and to communicate with one another. The complete network, including the backbone and the regional networks, was called NSFNET. It connected to the ARPANET through a link between an Interface Message Processors (IMP) and fuzzball in the Carnegie-Mellon machine room.

The number of networks, machines, and users connected to the ARPANET grew rapidly after TCP/IP became the only official protocol on 1st January 1983. When NSFNET and ARPANET were interconnected, the growth became exponential. So finally a global network was created, which connected all the types of networks around the globe, it is popularly known as the Internet.

Technically a machine is on the Internet if it runs the TCP/IP protocol stack, has an IP address and has the ability to send IP Packets to all other machines on the Internet. The mere ability to send and receive the electronic mail is not enough, since e-mail is

a gateway to many networks outside the Internet. However this issue is clouded somewhat by the fact that many personal computers have the ability to call up an Internet service provider using a modem, be assigned a temporary IP address and send IP packets to other Internet hosts. It makes sense to regard such a machine being on the Internet for as long as they are connected to the service provider's router.

With tremendous growth, the old informal way of running the Internet no longer works. In January 1992, the Internet Society was set up to promote the use of the Internet and perhaps eventually taken over managing it.

Traditionally, Internet had five main Applications as follows:

- E-mail
- News
- Remote Login
- File Transfer
- Research

Please answer the following Self Assessment Question.

Self Assessment Question 1 *Spend 3 Min.*

What is the Internet? How it differs from the network?

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5.4 THE INTERNET TECHNOLOGY

Internet uses TCP/IP. TCP stands for Transmission Control Protocol and IP stands for Internet Protocol. Every host and router on the Internet has an IP address, which encodes its network number and host number which are usually written in Dotted Decimal Notation Ex: 212.32.46.1. There are two versions of IP, IPv4 and IPv6. Each IP Address is 32 bits long and is used in the Source address and Destination Address fields of IP packets. There are five classes as A, B, C, D and E. First two classes are for general networks or private network like LAN, Class C is defined for public network and accessible by any user on internet and class D stands for Multicast Address and class E is reserved for future use. Network's number is assigned by Network Information Centre (NIC) to avoid conflicts. The lowest IP address is 0.0.0.0 and the highest is 255.255.255.255. The IP address specifies a computer where the information is present, i.e. the physical domain on the Internet. The web server placed over Internet are registered to a domain. An IP address

registered to a domain is also known by the alias name. For example, a host with IP address like 212.15.20.4 can have host name as ignou and if this ip address is registered in the domain called ac.in, then the host can be identified in the network as ignou.ac.in, it is also possible to defined the alias of ignou.ac.in as www.ac.in or www.ignou.ac.in . One web server can serve multiple virtual web server and where each virtual server mapped or registered to different or unique names. For example, in the web server ignou.ac.in it is possible to defined virtual server physics.ac.in and english.ac.in and both the server may point to different web container on the same physical system or can redirect to any server on the network. All the servers / systems on the network on different network ID communicate each other through the particular path called gateway. Internet is also called and inter network, mean all networks are inter connected, each system on network can send or receive the packet from other network using one particular path which is also called next hop or gateway, in the internet world it is also some time called internet gateway, because a server on network may have multiple destination like one for back-up and one for back hand access and one if for www services. The back hand access or back up access may be required for system admin so the traffic of those specific can be routed on different gateway call back up gateway**.** The physical networks are called the Internet Backbone, which is called heterogeneous systems network.

Each domain name has an extension to it depending on the service provided by it. A domain name describes organizational or geographic realities. They indicate which country the network connection is in, what kind of organization owns it and the further details also.

There are six common domain top levels types:

.COM for Commercial Organizations	Ex: www.yahoo.com
.NET for Network Organizations	Ex:www.internic.net
.GOV for parts of Govt within US	Ex:www.nasa.gov
.EDU for educational Institutes	Ex:www.mit.edu
.MIL for classified Military networks	Ex:www.xxx.mil
.ORG for nonprofit Organizations	Ex:www.cdc.org

5.5 ACCESSING THE INTERNET

There are different ways to connect the IP base network or the internet. A home user can connect to public domain of the network through a service provider. One can access the service provider network over serial line like modem, or ADSL, or from cable line called broadband services, or through the Wireless network using blue tooth or wireless ADSL broadband modem, or from any wi-fi terminal of service provider. This mean, an end user need to connect to service provider and uses the backbone of service provider to sending or receiving the information or data. In the corporate network, a user or employee can connect to internet by login or connecting to local area network with proper authorization, provided if the corporate network is allowed to connect the public network with defined internet gateway.

There are three main ways to connect to the Internet. These methods include connecting via a LAN server, connecting via SLIP/PPP, or connecting via an online service.

Connect via LAN Server: This approach needs the user's computer to have specific protocol "Example IP" with specific configuration, which provides a set of communications rules that perform the complete functions of the seven layers of the OSI communication model. LAN servers are typically connected to the internet at 2 Mbps or faster. This type of connection is expensive, but cost can be spread over multiple LAN users.

Connect via Serial Line Internet Protocol/Point-to-point Protocol (SLIP/PPP): This approach needs that the users have modem and specialized software that allows them to dial into a server through a service provider at some specific cost. This type of connection is advantageous, for example, for employees working at home who need to access the Internet or their own Intranet.

Connect via an Online Service: This approach needs a modem, standard communication software and an online information service account with an Internet service provider. The cost includes the online service fee, per-hour connect charge and where applicable, e-mail service charges. There are so many Service providers throughout India like Satyam and Sify.

Connect through Broadband: This type of connection is very popular right now because here the data transfer speed is more than 256 KBPS without interruption. In India, almost all Internet Service Providers (ISP) provides Broadband connection with a very nominal cost.

5.6 SERVICES PROVIDED BY THE INTERNET

The Internet is provides four major types of services. These are communication, Information retrieval, Web services and World Wide Web (WWW). Communication services include electronic mail, USENET newsgroup, chatting, telnet, Internet telephony and Internet fax, etc. Information retrieval services include gophers, archie, WAIS, file transfer protocol and Veronica etc. Web service provides software application over the Internet. The WWW is an application that uses transport functions.

5.6.1 Communication Service

This type of service is most popular both for personal and business community. A tremendous variety of data can be accessed through the Internet. Users are no longer strictly dependent on telephony for one-to-one communication. Also some of these services enable interactive communication with individuals and groups around the world who share personal and professional information.

Electronic Mail(E-mail)

E-mail is the most widely used application of the Internet. It is an application that allows an electronic message to be sent between individuals through World Wide Web. E-mail is not limited to simple text messages. Users can embed sound and images in their message and can attach files that contain text documents, spreadsheets, graphs and executable programs. For sending a mail, you have to write the e-mail address and subject matter in the specified column. CC (Carbon copy) and BCC (by carbon copy) options also can enable one to send the same matter to many addresses.

USENET newsgroup (forums)

It is a protocol that delineates how groups of messages can be stored on and sent between computers. Users send e- mail messages on a specific topic to the USENET server machine, which acquires this information by following this protocol. Users can log on to the server to read messages or have the computer automatically download messages to be read at the user convenience. It provides a form for the interested users on the Internet. This forum is divided into newsgroups. USENET newsgroups are international discussions groups in which people share information and ideas on a particular topic.

Chatting

It allows two or more people who are at a time connected to the Internet to hold live (real-time), interactive, written conversation. Internet Relay Chat (IRC) is a general chat program for internet though nowadays so many chat programs are easily available in the market. Chat groups are divided into channels each assigned its own topic of conversion. It is the third most-used application in the Internet after e-mail and search.

Instant Messaging

It is an online, real time communication between two or more people who are connected to the Internet. Users can send instant text messages to other users who are logged on. A window appears on the screen of all the people engaged in the messaging. Each window displays what one person is typing, in real-time. A number of companies are providing Instant Messaging like Yahoo, Hotmail and Indiatimes, etc.

Telnet

It allows users to be on one computer while doing work on another. It is the protocol that establishes an error-free but not secure access from source to target computers provided the target server running the telnet services. Users can log on to their office computers while travelling or from their homes. Also users can log on and use third-party computers that have been made accessible to the public, such as using the catalog of the U.S Library of Congress.

Internet Telephony

It is otherwise called as Voice over IP or VoIP. Here users talk across the Internet throughout the world to any personal computer as well as any phone line (Restricted by Law of any Country). It carries voice calls over the Internet, normally the data line and voice line communicate through the same communication media like cable with different frequency, VoIP can either partially or completely bypassing the public switched telephone networks. Sound quality may be poor due to Latency and Jitter.

Internet Fax

It is just similar to general fax techniques but it is possible only through the computer having Internet and Fax software. This application is useful because faxes can be sent long distances at local call rates and delivery can be guaranteed through store and forward mechanism.

Streaming Audio and Video

It allows the Internet users to see and hear data as it is transmitted from the host server instead of waiting until the entire file is downloaded. For Example, real network's real audio allows a web site to deliver an on-demand audio over the Internet and can work over connections. Streaming audio enables the broadcast of radio programs, music, press conference, speeches, and new programs over the Internet. It is well predicted that streaming audio and Internet telephony use will overlap and complement one another.

Real-Time Audio and Video

With the help of it, the transmission from source is live or only slightly delayed. These applications include point-to-point conversations between two people conferences among more than two people collaborative "white boarding" (where two or more users can interactively create graphic images) and shared hypermedia documents live broadcasts of news, talk shows, or sporting events and broadcasts of music and concerts.

5.6.2 Information Retrieval Services

It allows the users to access through the Internet, thousands of huge online library catalogs, as well as millions of databases that have been opened to the public by corporations, Government, and agencies and non-profit organizations. Apart from that, many users download free, high quality software made available by the developers over the Internet. This chapter will focus on five methods of accessing the computers and locating files. These are free to any Internet user. The Internet is a voluntary, decentralized collection of Networks with no central listing of sites and no central listing of the data located at those sites.

File Transfer Protocol (FTP)

It enables the users to access a remote computer and retrieve files from it. After the users have logged on to the remote computer, they can search the directories that are accessible to FTP, looking for the files they want to retrieve.

Archie

It is a tool that allows to the user to search the files at FTP sites. It regularly monitors hundreds of FTP sites and updates a database (called an Archie server) on software, documents and data files available for downloading. By clicking on a list of Archie server, it will take them to another computer system where relevant files are stored. Once there, the archie server may allow users to continue their searches for files until they locate what they need actually.

Gophers

It is a computer client tool that enables the users to locate the information stored on the Internet gopher servers through a series of hierarchical menus. Most files and digital information that are accessible through FTP are also available through gophers. Each gopher server contains its own system of menus listing subject-matter topics, local files, and other relevant gopher sites. When the users access gopher software to search a specific topic and select an item from a menu, the server will automatically transfer them to the appropriate file on that server or to the selected server wherever it is located. Once on that server, the process goes on.

Veronica

It stands for Very Easy Rodent-Oriented Net wide Index to Computer Archives. It provides the capability of searching for the text that appears in gopher menus. When the user enters a key word, veronica will search through thousands of gopher sites to find the titles containing that keyword. It places these files on a temporary menu on the local server, so that the users can browse through them.

Wide Area Information Service (WAIS)

It also allows the users to locate files around the Internet. It is the most thorough way to locate a specific file, but it needs that the users know the names of the database they want to search. After the users specify the database names and key identifying words, WAIS searches for the key words in all the files in those databases. When the search is finished, users obtain a menu listing all the files that contain the key words.

Web Services

These are the unique pieces of computer codes (components) accessed through a web site that delivers a specific type of function. Web service allows us to transparently access the rich software content from any site on the web. In Web services the application code normally deployed to one or more web server but controlled by the app server. Web services accept the information as a input from the called program and return the output like XML format.

Sun's JSP is a Java platform tool which is mostly used for making Java based active server pages. It is also an object-oriented language that enables the programmers to build wide range of applications for the JAVA platform.

5.6.3 The World Wide Web (WWW)

This concept has changed the way in which the Internet used to work earlier. It is not the same as the Internet today. The Internet functions as the transport mechanism and the WWW is an application that uses those transport functions. It is a system with universally accepted standards for storing, retrieving, formatting, and displaying information via a client/server system. The web handles all types of digital information including text, hypermedia, graphics, and sound. It is very easy to use as it uses the graphical user interface.

The web is based on a standard hypertext language called Hypertext Markup Language (HTML), which formats documents and incorporates dynamic hypertext links to other documents stored on the same or different computers. HTML is a simpler subset of Standard Generalized Markup Language (SGML), and incorporates tables, applets, text flow around images, superscripts and subscripts. Using this hypertext links, (which are typically blue and underlined), the user points at a highlighted word, clicks on it and is transported to another document. Users are able to navigate around the web freely with no restrictions, following their own logic, needs, or interests.

Offering the information through the web needs establishing a home page, which is a text and a graphical screen display that usually welcomes the user and explains the organization that has created the page. In most cases, the home page will lead the users to other pages too. All the pages of a particular company or individual are

known as Web site. Most web pages provide a way to contact the organization or the individual. The person in-charge of an organization's web site is its web master.

For accessing a web site, the user must specify a uniform resource locator (URL), which points to the address of a specific resource on the web. For example, the URL for Indira Gandhi National Open University is http://www.ignou.ac.in. HTTP stands for Hypertext Transport Protocol, which is the communication standard used to transfer a page across the WWW portion of the Internet.

Please answer the following Self Assessment Question.

Self Assessment Question 2 *Spend 3 Min.*

What is Internet Telephony? How does it differ from chatting?

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5.7 BROWSERS

To get connected into the Internet, a browser is the minimum requirement. It is capable of communicating via HTTP, managing HTML and displaying certain data types such as Graphic Interchange Format (GIF) and Joint Photographic Experts Group (JPEG) for graphics. The two leading browsers are Internet Explorer from Microsoft and Netscape Navigator. The competition between both of them has been extremely beneficial for the users, providing them highly capable applications at almost no costs. Microsoft's strategy is to minimize the importance of the browser as a distinct application by building the browser functionality directly into its latest operating system. Netscape's strategy is to make the browser the core of a compelling suite of applications for corporate users.

Netscape's Browser Suite

It includes Netscape Navigator, Netscape Mail, Netscape Instant Manager, Netscape Composer and Netscape Address Book. The suite provides functions for running web applets, audio playback, streaming media, web content, and Net2phone for free PC-to-phone calls anywhere within the United States. Netscape communicator is a comprehensive set of components that integrates e-mail, web-based word processing, and chat to allow users to easily communicate, share and access the information.

Microsoft's Internet Explorer

This software comes with the window operating system for free. AS Netscape has established its own market, so Microsoft embarked on a strategy to gain market share and penetrate the installed base. It also provides all the facilities that are

provided by Netscape. At present, IE 6.0 version is very much popular in the browser market. IE 7.0 from Microsoft is the most reliable browser available today for PC world. Many browsers are platform/OS oriented.

Beside these two browsers, there are so many browsers available in the market, like Fire Fox, which comes with so many advanced options.

Offline browsers (pull products) enable a user to retrieve pages automatically from web sites at predetermined sites, often during the night. Web Whacker and Web Copier are offline browsers that allow the users to define a group of sites by their URLs and then download the text and images from those sites to their local storage.

Please answer the following Self Assessment Question.

Self Assessment Question 3 *Spend 3 Min.*

Name two leading browsers

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5.8 SEARCH ENGINE

Search engine is the most popular option after e-mail over the Internet. These are the programs that return a list of web sites or pages (with URLs) that match a selected criteria. To use one of the publicly available search sites, the user navigates to the search engine's site and types in the subject of the search.

Goggle is the largest, search engine and the first search engine to index more than one billion pages. Goggles method of searching is called Page Rank. The more links there are to a page, the higher it moves in Goggle's ranking. Page Rank improves both recall and precision ratio.

Meta search engine automatically enters search queries into a number of other search engines and returns the results. Example of it includes All4one, Meta crawler and starting point.

Some popular search engine URLs are given here:

Alta Vista	*altavista.com*
Excite	excite.com
LookSmart	looksmart.com
Yahoo	Yahoo.com
MSN	search.msn.com
Oingo	oingo.com

5.9 E-COMMERCE

Electronic commerce (e-commerce) has changed the life style of the society. With the help of e-commerce, it is possible to buy, sell and exchanging the products, services and information via computer networks, primarily through the Internet. Though the definition of E-commerce is quite debatable, still it is very much useful for both individual and the corporate.

5.9.1 Types of E-commerce

Previously it was assumed that e-commerce is applicable only to a business community. But with the great use of high-speed technology, the idea has been changed. At present, basically five types of E-commerce can be summarized here:

- Business-to-Consumer (B2C) E-commerce;
- Business-to-Business (B2B) E-commerce;
- Consumer-to-Consumer (C2C) E-commerce;
- Peer-to-Peer (P2P) E-commerce; and
- Mobile Commerce or M-commerce.

In India, E-commerce is not so much successful as it was desired because Indian customers mostly believe in the practical market as they are very much economical and they have no good faith upon the product provider through E-commerce or other mode of net booking.

On the other part, the product provider does not give so much positive attention to the net customer as there is no direct contact between both of them. For better E-commerce, it is very much vital that a good faith must exist between the product provider and the customer.

5.9.2 Application of E-Commerce

E-commerce has various forms of applications. Some of them are described here:

1) Electronic Payments: This is the best form of payment throughout the universe at present. Electronic payments can be done through the following ways: electronic credit cards, electronic cash, smart cards, electronic fund transfer (EFT), and e-wallets and purchasing cards.

2) Banking Gateway: E-commerce plays a vital role in the banking sector for inter-bank transactions and building a separate gateway for the unified banking gateway.

3) E-Governance: Now the government of India has initiated total online transactions for tax payment, phone bill payment, loan EMI payment from banks, etc.

5.9.3 Security in Electronic Payment

Two main issues need to be considered under this topic: what is needed in order to make EC payment safe, and another one is which methods can be used for?

Security requirements needed for conducting Electronic Commerce (EC) are:

- Authentication for identity for both the parties;
- Integrity for unaltered transactions;
- Non-repudiation for unjustified denial of placing orders;
- Privacy for identity to be secured; and
- Safety for providing the credit card number over the Internet.

Security Protection: Several methods and mechanism can be used for the security protection. One of the most used mechanisms is Encryption. Encryption is a process of making messages indecipherable except by those who have an authorized decryption key. The key is a code composed of a very large collection of letters, symbols, and numbers. For example, "A" might be coded as some other forms like 123 etc.

Encryption is of two types, one is symmetric key and another one is symmetric key, which is known as Public Key Infrastructure (PKI). Public Key Infrastructure also includes digital certificates and signature, which are provided by the trusted third party, called Certified Authority (CA).

Security Protocols: Protocols are a set of rules and procedures that govern the transfer of information. Two major payment protocols are being used in E-commerce.

Secure Socket layer (SSL): It is a mostly used protocol on the Internet payment system. It may be of 40 bits, 64 bits and 128 bits. It appears as a lock symbol in the bottom of the browser. It is very important for a net user when he pays through the credit cards to know that the site is SSL secured and is valid. As a user, you may also read all about SSL from that SSL certificates.

Secure Electronic Transactions (SET): It is also very useful for credit card transactions, but due to its more cost and complexity, it is very less used over the net transactions.

Please answer the following Self Assessment Question.

Self Assessment Question 4 *Spend 2 Min.*

Fill in the blanks:

i) With the help of _____, it is possible to buy, sell and exchange the products, services and information via the computer networks.

ii) There are _____ types of E-commerce.

Let us now summarize the points covered in this unit.

5.10 SUMMARY

- ARPANET was the first Network in the world.
- Internet is defined as the network of networks. It has mainly the following applications:

E-mail,

Search,

File Transfer,

Research, and

Electronic Transactions.

- The Internet is based upon TCP/IP protocol. Every host and router over the Internet has a unique IP address. All IP addresses are 32 bits long.
- The lowest IP address is 0.0.0.0 and highest is 255.255.255.255.
- There are six common top levels domains: com, net, gov, edu, mil and org.
- At present, broadband connection is the best one to access the Internet for home or remote users (speed more than 256 Kbps).
- World Wide Web (WWW) is the basic infrastructure on which HTTP works.
- Browsers are the browsing software for the Internet. For example, the Internet Explorer.
- Search Engines are the internet Tools to search a file from various locations from the Internet within some seconds.
- E-commerce is the electronic way on which buying, selling and exchange of products is possible over the Internet.
- Secure Socket Layer (SSL) is the Internet security protocol for online financial or secure transactions. 40 bits, 64 bits and 128 bits SSL are available in the market.
- Due to the demand of the Internet, many challenges have to be faced in future regarding Internet Regulation, New Technology, Internet Expansion and Internet Privacy etc. As far as India is concerned, it should formulate a suitable Data protection legal framework to cope with the International standard. Again the Information Technology Act 2000 has to be modified with strong a technological as well as legal concept.

5.11 TERMINAL QUESTIONS

1) Define IP. Why every computer on the Internet has a unique IP address? What is its length?

2) E-commerce has changed the life style. Examine it critically.

3) What is the security over the Internet for Monetary Transactions?

5.12 ANSWERS AND HINTS

Self Assessment Questions

1) A network is a group of two or more computer systems linked together. The Internet is network of Computer Networks.

2) Chatting allows two or more people who are at a time connected to the Internet to hold live (real-time), interactive, written conversation. Internet Telephony is also called as voice over IP or VoIP. Here the users talk across the Internet throughout the world to any personal computer as well as any phone line (restricted by law of any country).

3) Internet Explorer from Microsoft and Netscape Navigator.

4) i) E-commerce, and (ii) five.

Terminal Questions

1) Refer to section 5.4 of the unit.

2) Refer to section 5.9 of the unit.

3) Refer to section 5.9.3 of the unit.

5.13 REFERENCES AND SUGGESTED READINGS

1. Behrouz A. Forouzan. Data Communication and Networking. 3rd ed. Tata McGrawhill, 2003.

2. Turban, Rainer and Potter. Introduction to Information Technology. 2nd ed. John Wiely & Sons, INC 2003, 2004.