Part - IV

Explain in detail

1. Define computer networking and Internet. Explain different developments on computer network and Internet.
2. Explain the growth of the computer networking.
3. Mention some uses of network at business, home, mobile, social application.

STUDENT ACTIVITIES

List out the wireless network ?

1. Find out how your family members and public members uses the network ?
2. Instead of landline (wired network) what were the types of wireless network you know
3. Some of example devices with wireless networks

How social media has its memory management ?

1. Do you have a account on social media (or) create an account
2. Analyse how the social media applications transfer a huge data

11
CHAPTER

Network Examples and Protocols

8D4TCC

LEARNING OBJECTIVES

- To know network examples like Intranet, Intranet, Extranet
- Different types of mobile networks
- Know about wlans :802.11
- To Know about RFID
- Discus briefly about osi, tcp,ip and other network protocols

11.1 Introduction

Internet Protocol (IP) is the principle of the communications protocol in the Internet protocols for layering on datagram across boundaries of other networks. The main function is to allows Internet working and boost up the Internet.

Internet protocol (IP) will deliver packets from the source host and it will deliver to the destination host via through an IP address in the packets header. Vint Cerf and Bob Kahnin in 1974 introduced IP connection less datagram service was in the transmission control program. Now the IP is referred as TCP/IP Transmission Control Protocol/Internet Protocol.

Network protocols is that the usual procedures, rules, formal standards and policies comprised of formats which allocates communication between more than one device which connected to the network. Network protocols have to do end-to-end process of secure on time and manage data or network communication.

All requirements which combine process, on network protocols such as to carry out the communication between routers, servers, computers, laptop, and other authorized networked device. Here on network protocols might be installed and rooters in both sender and receiver to ensure data or network communication and apply to software and hardware nodes which communicate on a network.

The broad types of networking protocols, including:

- Network communication protocols is that the Basic data communication protocols which specific as HTTP and TCP/IP .
- Network security protocols is that which implement security over

Figure: 11.1 INTERNET

network communications and include HTTP, SFTP and SSL.

- Network management protocols will Provide network governance and maintenance and include ICMP and SNMP.

11.1.1 Internet/Intranet/ Extranet

INTERNET: The **Internet**, "the Net," is a worldwide system of computer networks- A network of networks where the users at any one computer can, if they have permission, get information from any other computer. The Internet is a network of global connections – comprising private, public, business, academic and government networks – linked by guided, wireless and fiber-optic technologies. It was perceived by the Advanced Research Projects Agency (ARPA) of the U.S. government in 1969 and was first recognized as the ARPANet. The unique aim was to generate a network that would permit users of a research computer from one university to "talk to" research computers on other universities. The jargons Internet and World Wide Web are frequently used interchangeably, but they are not precisely the same thing; the Internet denotes to the global communication system, including infrastructure and hardware, whereas the web is one of the services interconnected over the Internet. See Figure 11.1

INTRANET: It is a private network within an enterprise to share company data and computing resources between the employees. It may consist of many interlinked local area networks. It includes connections through one or more gateway (connects two networks using different protocols together known as protocol convertor) computers to outside Internet. See Figure 11.2

Figure 11.2 Intranet

EXTRANET: It is a private network that uses Internet technology and the public telecommunication system to securely share business's information with suppliers, vendors, partners, customers, or other businesses. See Figure 11.3 and 11.4

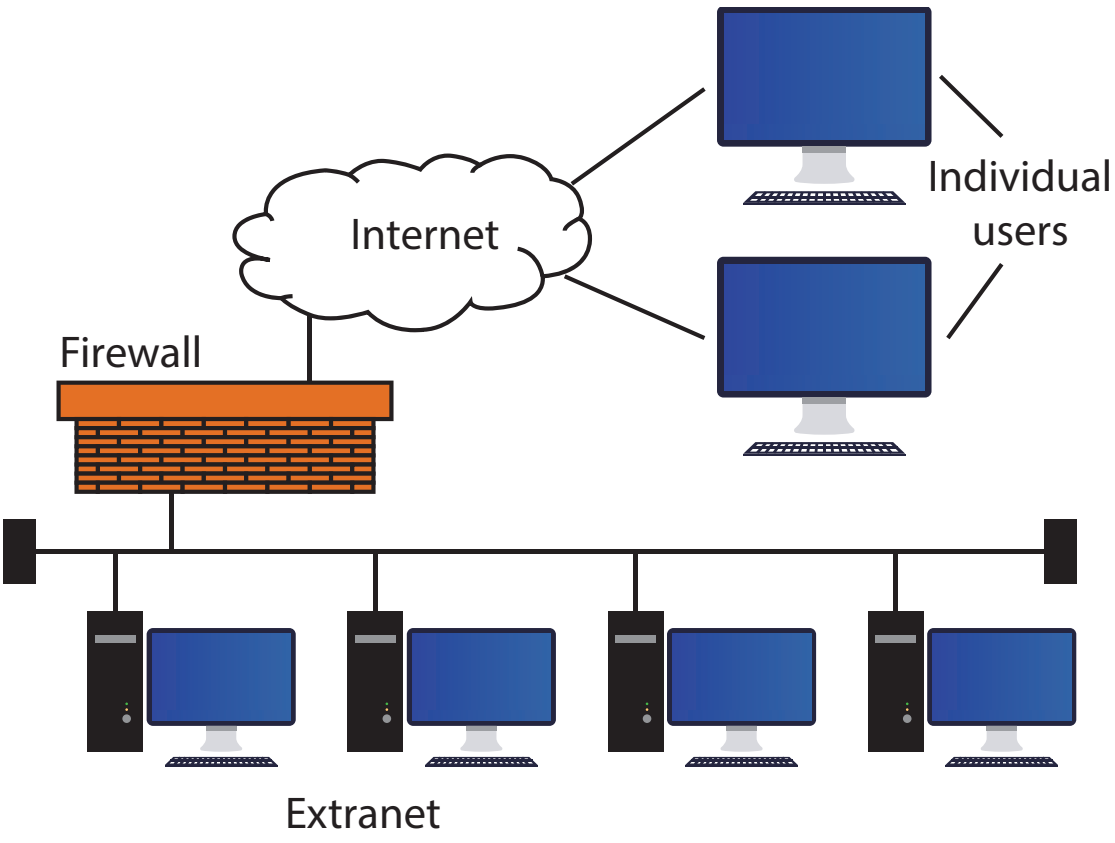

Figure 11.3 Extranet

Internet of Things refers to the digital interconnection of everyday objects (home applicances, wearable devices or automobiles) with the Internet. The 'thing' in IoT refers to an objects that have been assigned an IP address and have the ability to collect and transfer data over a network without manual assistance or intervention.

Comparison

Table 11.1 Comparison between Internet, Intranet and Extranet

Type	Definition	Example
Internet	a global network, public TCP/IP network used by over a billion people all over the world	Sending email to a friend
Intranet	a TCP/IP network with access restricted to members of an organization	Accessing your record in the employee personnel file
Extranet	TCP/IP network with restricted access to members	Checking availability of inventory from an outside supplier

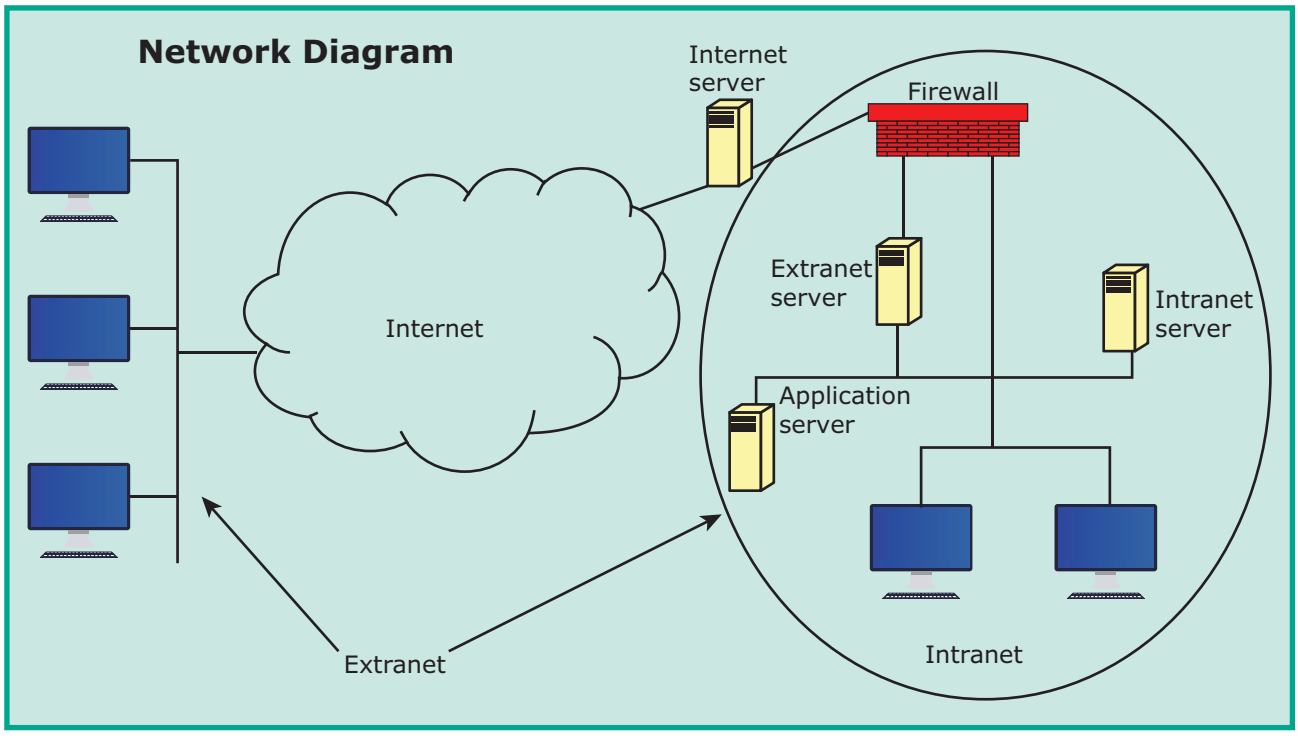

Figure 11.4 Internet, Intranet and Extranet

Table 11.2 Network Applications

Application of Internet.	Application of Intranet	Application of Extranet
• Download programs and files • Social media • E-Mail • E-Banking • Audio and Video Conferencing • E-Commerce • File Sharing • E- Governance • Information browsing • Search the web addresses for access through search engine • Chatting and etc	• Sharing of company policies/rules and regulations • Access employee database • Distribution of circulars/ Office Orders • Access product and customer data • Sharing of information of common interest • Launching of personal/ departmental home pages • Submission of reports • Corporate telephone directories.	• Customer communications • Online education/ training • Account status enquiry • Inventory enquiry • Online discussion • Supply – chain managements • Order status enquiry • Warranty registration • Claims • Distributor promotions

11.1.2 Mobile Networks

A mobile network or cellular network as it is made up of a large number of signal areas called cells. These cells join to form a large coverage area. Users can cross into different cells without losing their connection. Within each cell there is a base station, which sends and receives the mobile signals. A mobile device will connect to the nearest or least base station. The base stations are connected to digital exchange where the communication is sent to other telephone

or data networks. Cells will often be smaller in size in large towns, as the number of users in the area is more. Communication over mobile network is be made up of voice, data, images and text messages. See Figure 11.5

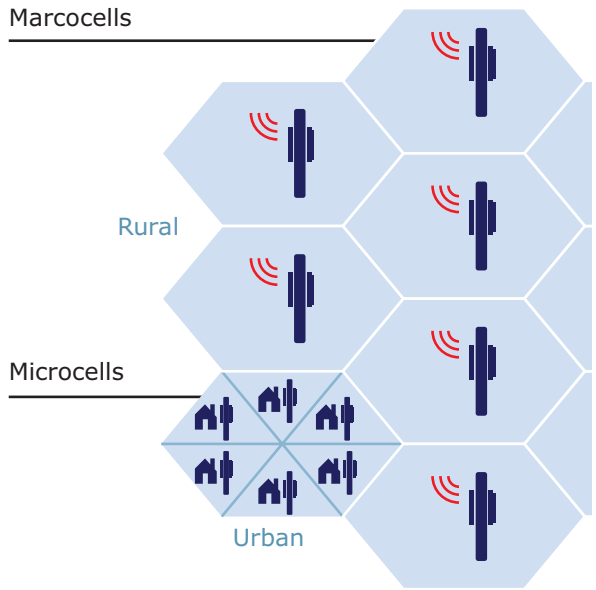

Figure 11.5 Mobile Network

Mobile networking assign to the technology and supports voice/data, network connectivity using via radio transmission solution. Mobile networking assign to the technology that can support data / voice, network connectivity using via radio transmission solution, wireless. Similarly the common application of mobile networks is mobile phones, tablets, etc.. In past, wireless communications largely used circuit switching to carry only voice over a network, but now currently both data and voice are being transmitted over both circuit via switched networks and packet-switched networks.

The generations of mobile networks are as follows.

- First Generation(1G) 1981- NMT launch
- Second Generation(2G) 1991-GSM Launch
- Second to Third Generation Bridge (2.5)2000 – GPRS launch
- Third Generation(3G) 2003- UK 3G launch
- Fourth Generation (4 G) 2007
- Fifth Generation (5G) 2019+

First Generation (1G) 1981 – NMT launch

During the initial periods the mobile systems were based on analog transmission. NMT stands for Nordic Mobile Telephone communication. They had a very low traffic density of one call per radio channel, and a very poor voice quality, and they used unsure and unencrypted transmission, which leads to the spoofing of its identities.

Second Generation (2G) 1991 – GSM launch

Later the second generation of mobile systems were placed on digital transmission with GSM. **GSM stands for (Global System for Mobile communication)** was most popular standard which is used in second generation, using 900MHz and 1800MHz for the frequency bands. GSM mobile systems grown digital transmission using SIM. SIM stands for (**Subscriber Identity Module)** technology to authenticate a user for identification and billing purposes, and to encrypt the data to prevent listen without permission (eavesdropping). The transmission used as TDMA. TMDA stands for (**Time Division Multiple Access**) and CDMA One stands for **(Code Division Multiple Access)** method to increase the amount of information transported on the network. Mobility is supported at layer 2, which

stops seamless roaming across assorted access networks and routing domains. This means each operator must cover the entire area or have agreements in place to permit roaming.

Second to Third Generations Bridge (2.5G) 2000 – GPRS launch

GPRS was introduced here, it seen as an excess period of mobile networking development, between 2G and 3G. GPRS stands for(**General Packet Radio Service**).GPRS is a data service which enables mobile devices to send and receive messages, picture messages and e-mails. It allows most popular operating speeds of up to 115kbit/s, latterly maximum of 384kbit/s by usingEDGE. EDGE stands for **EDGE (Enhanced Data rates for Global Evolution)**. GSM data transmission rates typically reached 9.6kbit/s.

Third Generation(3G)2003 – First UK 3G launch

This generation of mobile systems merges different mobile technology standards, and uses higher frequency bands for transmission and Code Division Multiple Access to delivery data rates of up to 2Mbit/s supports multimedia services (MMS: voice, video and data). European standard is UMTS **(Universal Mobile Telecommunication Systems).** Mobile phones systems continue to use digital transmission with SIM authentication for billing systems and for data incorruption. Data transmission used a WCDMA. WCDMA stands for (Wideband Code Division Multiple Access). One technique to obtain data rates between 384kbit/s and 2048kbit/s. Few 3G suppliers use ATM (Asynchronous Transfer Mode) for their '**over the air**' network with in MPLS (Multiprotocol Label Switching) or IP for theirs backbone network.

Mobility still supported at layer 2, and hence like 2G it still prohibits seamless roaming beyond heterogeneous access networks and routing domains. The transmission were band frequencies are between 1900 and 2200 MHz. All UMTS license holders at the UK holds a 20 year license with the condition that 80% population coverage is achieved by 31 December 2007. The present third generation licensed operators in the UK can be seen below as at August 2004.

Fourth Generation(4G) 2007

4G is at the research stage. 4G was based on an adhoc networking model where there was no need for a fixed infrastructure operation. Adhoc networking requires global mobility features (e.g. Mobile IP) and connectivity to a global IPv6 network to support an IP address for each mobile device. Logically roaming in assorted IP networks (for example: 802.11 WLAN, GPRS and UMTS) were be possible with higher data rates, from

Li-Fi is a wireless technology which uses light-emitting diodes (LEDs) for data transmission whereas Wi-Fi uses radio frequencies for data transmission. Li-Fi is the short form of Light Fidelity.

The term Li-Fi was first used by Harald Haas, Professor in Edinburgh University. The computer scientists achieved speeds of 224 gbps in the lab and research is going on. The biggest revolution in the Internet world is going to happen

2Mbit/s to 10–100Mbit/s, offering reduced delays and newly services. Mobile devices will not expect on a fixed infrastructure, they will require enhanced intelligence to self configure in adhoc networks and having a routing capabilities to route over a packet-switched network.

Fifth Generation (5G) 2019+

5G is the stage succeeds the 4G (LTE/ WiMAx), 3G(umts) and 2G(GSM) syetems. 5G targets to performance the high data rate, reduced latency, energy saving, cost reduction, higher system, capacity, and massive device connectivity. The two phases of 5G, First one will be Release-15 complete by March 2019,Second one Release-16 is expected to complete at March2020, for submission to the ITU(International Telecommunication Union) as a candidate IMT-2020 technology. The ITU IMT – 2020 provides speeds up to 20 gigabits per second it has been demonstrated with millimeter waves of 15 gigahertz and higher frequency. 3 GPP standard includes any network using th New Radio software. 5G New Radio can access at lower frequencies from 600 MHz to 6 GHz. Speed in the lower frequencies are only modest higher than 4G systems, estimated at 15% to 50% faster.

11.1.3 WLANS 802.11

Wi-Fi stands for Wireless Fidelity. It is a wireless network technology that permits computers and alternative devices to be connected to every alternative into a local area network and to the net without wires and cables. Wi-Fi is additionally stated as wireless local area networkthat stands for wireless local area network, and 802.11, that is that the technical code for the protocol. See Figure 11.6

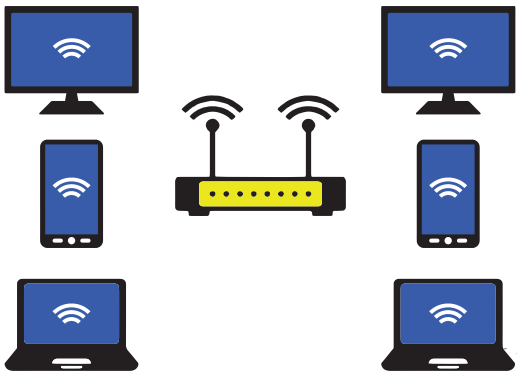

Figure 11.6 Wi-Fi

ADVANTAGES: Benefits of Wi-Fi are

- It provides mobility. Example: I get Internet connection wireless through my laptop computer at home and at work, because of Wi-Fi, hotspots both at home and at work.
- It provides connection to Internet.
- Flexibility of LAN.
- Ensures connectivity.
- It allows places that are remote to benefit from connectivity.
- Low cost, high benifts.

11.1.4 RFID

1. RFID - Radio Frequency Identification.
2. RFID uses RF wireless technology to identify.

RFID stands for Radio –Frequency Identification (RFID). RFID used for radio waves to read and capture information stored on a tag attached to an object. Tag can be read from several feet away and does not need to be in direct-line-of-sight of the reader to be tracked. RFID has been made up of two parts a reader and a tag or a label. RFID tags are installed with a transmitter and receiver.

RFID component on the tags has two parts: a microchip which stores and processes the information, and the antenna to receive and transmit a signal. The Tag replies the information from its memory bank. The reader will transmit to read the result to RFID computer program.

Two types of RFID tags were Active RFID and Passive RFID systems.

1. Passive RFID tag will be used the reader radio wave energy to really its stored information back to the reader.
2. Battery powered RFID tag is installed with small battery that powers the broadcast of information

Main Components of a RFID System

- **A RFID tag:** It has silicon microchip attached to a small antenna and mounted on a substrate. See Figure 11.7

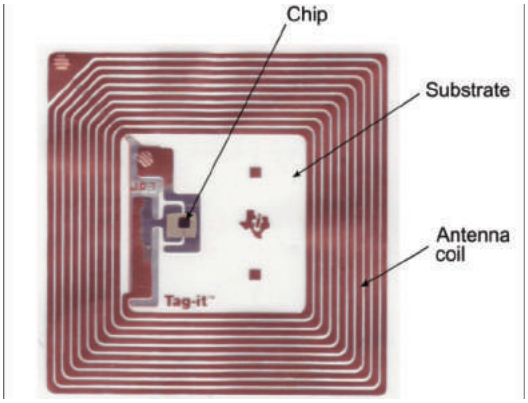

Figure 11.7 RFID Tag

- **A reader:** It has a scanner with antennas to transmit and receive signals, used for communication. See Figure 11.8

Figure 11.8 An RFID Reader

- **A Controller**: It is the host computer with a Microprocessor which receives the reader input and process the data.

Two types of RFID Systems:

1. Active RFID system: the tag has its own power source. These systems used for larger distances and to track high value goods like vehicles.
2. **Passive RFID system:** the tag gets power through power from a reader antenna to the tag antenna. They are used for shorter range transmission.

Working of Passive RFID System

A Passive RFID system using Induction coupling method:

The RFID tag gets power from the reader through the inductive coupling method. See Figure 11.9

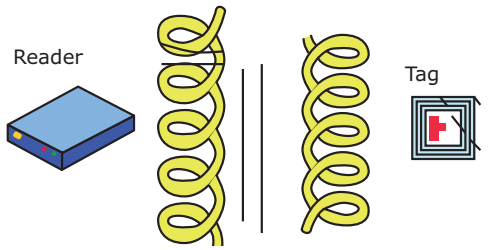

Figure 11.9 Passive RFID using Inductive Coupling

A Passive RFID system using EM wave propagation method:

The reader antenna transmits the electromagnetic waves that are received by the antenna. See Figure 11.10

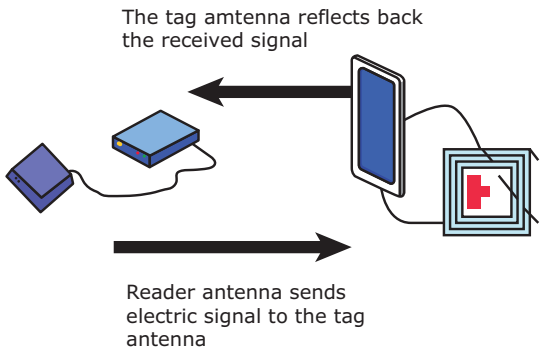

Figure 11.10 Passive RFID using EM-wave transmission

Working Of Active RFID System

The reader sends signal to the tag using an antenna. See Figure 11.11

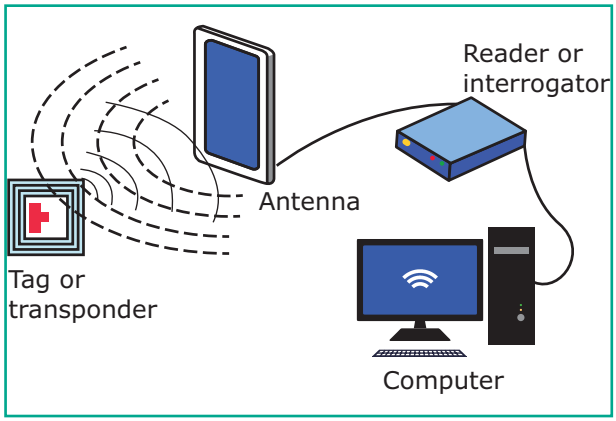

Figure 11.11 An Active RFID system

11.2 Refenrence Model

11.2.1 OSI Model

Open System Interconnection (OSI) model was found in the year 1934, general framework that enables network protocols along with software and systems to be developed based on general set of guidelines. It describes the standards for the inter-computer communication. See Figure 11.12

TIPS

There are many prompts used to remember the OSI layer order:

- Everyone Needs Data Processing.
- Everyone Should Try New Diet Pepsi.

OSI Layers:

1. **Physical Layer:** This is the 1st layer, it defines the electrical and physical specifications for devices.
2. **Data Link Layer:** It is the 2nd layer and it guarantees that the data transmitted are free of errors. This layer has simple protocols like "802.3 for Ethernet" and "802.11 for Wi-Fi".
3. **Network Layer:** It is the 3rd layer determining the path of the data packets. At this layer, routing of data packets is found using **IP Addressing**.
4. **Transport Layer:** It is the 4th layer that guarantees the transportation/sending of data is successful. It includes the error checking operation.
5. **Session Layer:** It is the 5th layer, identifies the established system session between different network

	OSI Layer	TCP/IP	Datagrams are called
Software	Layer 7 Application	HTTP, SMTP, IMAP, SNMP, POP3, FTP	Upper Layer Data
	Layer 6 Presentation	ASCII Characters, MPEG, SSL, TSL, Compression (Encryption & Decryption)	
	Layer 5 Session	NetBIOS, SAP, Handshaking connection	
	Layer 4 Transport	TCP, UDP	Segment
	Layer 3 Network	IPv4, IPv6, ICMP, IPSec, MPLS, ARP	Packet
Hardware	Layer 2 Data Link	Ethernet, 802.1x, PPP, ATM, Fiber Channel, MPLS, FDDI, MAC Addresses	Frame
	Layer 1 Physical	Cables, Connectors, Hubs (DLS, RS232, 10BaseT, 100BaseTX, ISDN, T1)	Bits

Figure 11.12 OSI LAYERS

entities. It controls dialogues between computers .For instance, while accessing a system remotely, session is created between your computer and the remote system.

6. **Presentation Layer:** It is the 6th layer that does the translation of data to the next layer (Prepare the data to the Application Layer). Encryption and decryption protocols occur in this layer such as, Secure Socket Layer (SSL).
7. **Application Layer:** It is the 7th layer, which acts as the user interface platform comprising of software within the system.

11.2.2. TCP/IP

Transmission Control Protocol/Internet Protocol, **TCP/IP** is a set of protocols which governs communications among all computers on the Internet. TCP/IP protocol tells how information should be packaged, sent, and received, as well as how to get to its destination. See Figure 11.3

TCP WORKING: TCP/IP is a combination of two protocols: Transmission Control Protocol (TCP) and Internet Protocol (IP). The Internet Protocol typically specifies the logistics of the packets that are sent out over networks; it specifies the packets which have to go, where to go and how to get there. The Transmission Control Protocol is accountable for guaranteeing the trustworthy transmission of data. It sees that the packets for errors and submits the requests for re-transmissions incase any of them are missing'

Frequent TCP/IP Protocols

- **HTTP** – It is used between a web client and a web server and it guarantees non-*secure* data transmissions.
- **HTTPS** – It is used between a web client and a web server ensures *secure* data transmissions.
- **FTP** – It is used between computers for sending and receiving file.

Domain Names and TCP/IP Addresses

The address for any website is not as easy as to remember, domain name are used instead. For example, **216.58.216.164** is one of the IP address for Google and **google.com** is the domain name.

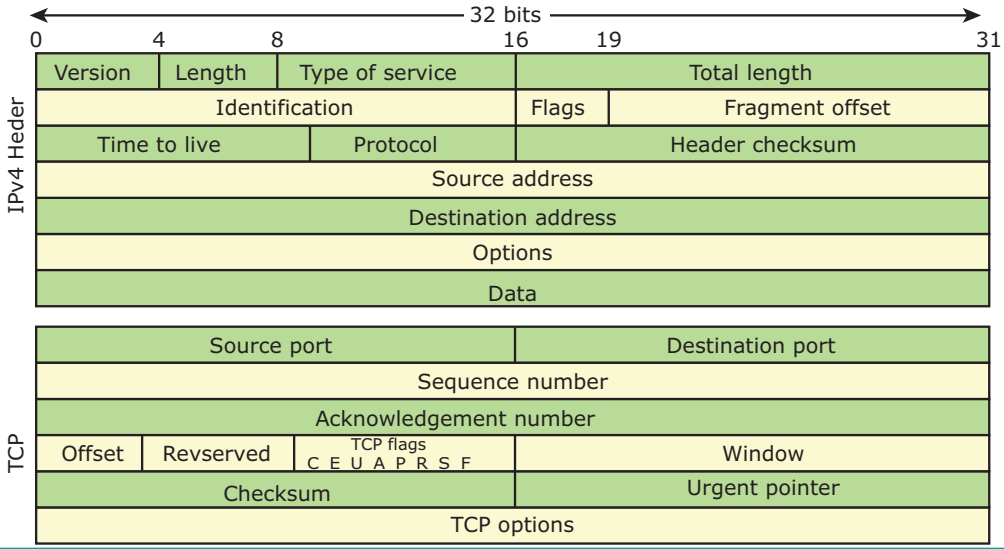

Figure 11.13 TCP/IP Layer

The Different Layers of TCP/IP

There are four total layers of TCP/IP protocol, each of which is listed below with a brief description.

- **Network Access Layer** - concerned with building packets.
- **Internet Layer** - describes how packets are to be delivered.
- **Transport Layer** - ensure the proper transmission of data.
- **Application Layer** - application network processes. These processes include File Transfer Protocol (FTP), Hypertext Transfer Protocol (HTTP), and Simple Mail Transfer Protocol (SMTP).

11.2.3 Other Network Protocols

Network protocols other than OSI and TCP/IP were simply known as other network protocols which implements security over the network communication that include **HTTPs, SSL,** and **SFTP**. Other networks similarly classified in network layer **IP, ARP, ICMP,IGMP,** at transport layer **TCP,UDP** at Application Layer **HTTP, FTP, Telenet, SMTP,** and **DNS.**

HTTPS positions for Hypertext Transfer Protocol Secure. It's a protocol where encoded data transfer on a secure connection. This HTTPS make data more and provides data security over the network mainly on public networks like Wi-Fi. See Figure 11.14

For example, let us take a bank website, say hdfcbank.com. https it support for our secured bank transaction in networks Frequently we go to login page, we may watch an HTTPS in address bar with some specific design. HTTPS mainly deals with financial transactions or transfer users personal data were highly sensitive. Banking websites were common examples for HTTPS. Data exchanged between the user and the website is not stolen, read or altered by a third party. But it can be encode everything, with some limitations too. For example, can encode port numbers and host addresses.

In layman's terms, HTTPS gurantees that users watch websites that they want to watch. Data exchanged between the user and the website is not read, stolen or tampered with by a third party. But it can't encrypt everything - it has some limitations too. For example, HTTPS can't encrypt host addresses and port numbers.

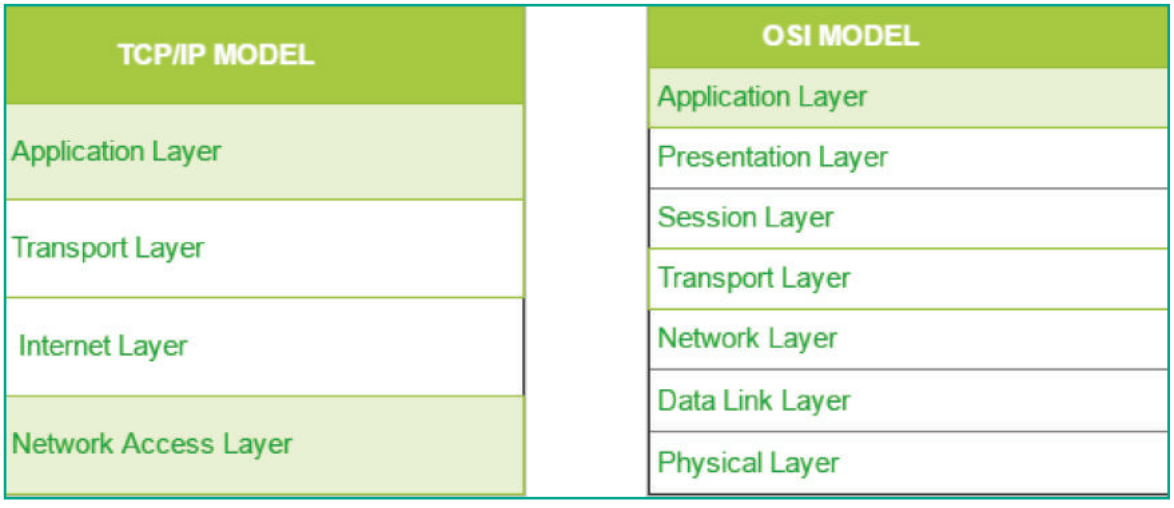

Figure 11.14 Network Layers

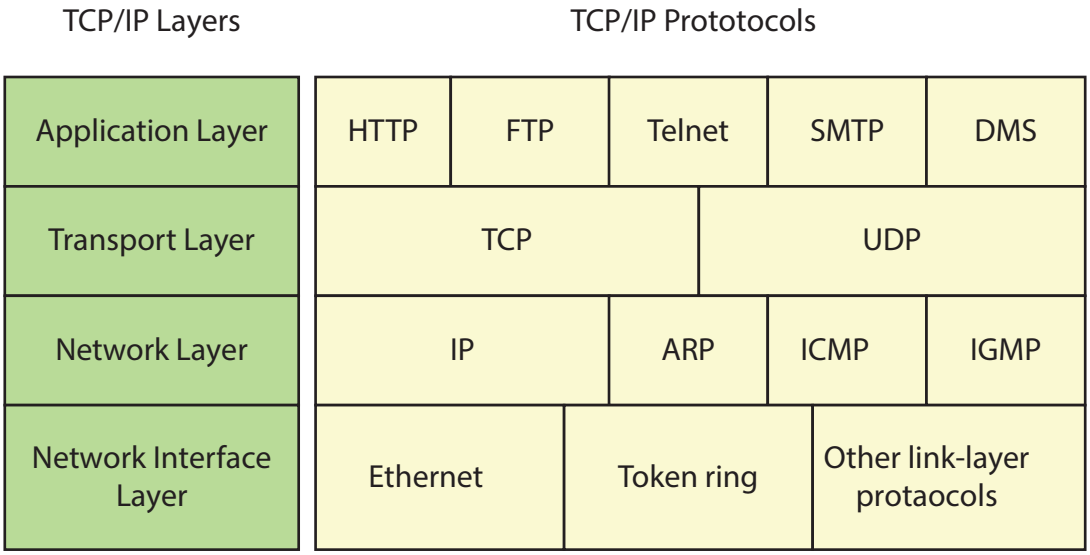

Figure 11.15 TCP/IP Protocols

TCP/IP procedures are based on a layered framework. TCP/IP has four layers. See Figure 11.15

Network Interface Layer

It is the bottommost level layer. It is comparable to that of the Open System Interconnection Physical and Data Link layers. Different TCP/IP protocols are being used at this layer, Ethernet and Token Ring for local area networks and protocols such as X.25, Frame Relay, and ATM for wide area networks. It is assumed to be an unreliable layer.

Network Layer

It is the layer where data is addressed, packaged, and routed among networks. The important Internet protocols that operate at the Network layer are:

- **Internet Protocol (IP):** Routable protocol which uses IP addresses to deliver packets. It is an unreliable protocol, does not guarantee delivery of information. **Address Resolution Protocol (ARP):** Resolves IP addresses to MAC (Medium Access Control) addresses. (A MAC address is a hardware identification number that uniquely identifies each device on a network.)i.e., to map IP network addresses to the hardware addresses. **Internet Control Message Protocol (ICMP):** Used by network devices to send error messages and operational information. Example: A host or router might not be reached or a requested service is not presented.
- **Internet Group Management Protocol (IGMP):** It is a communication protocol used by hosts and routers to send Multicast (group Communication) messages to multiple IP addresses at once.

Transport Layer

The sessions are recognized and data packets are swapped between hosts in this layer. Two main protocols established at this layer are:

- **Transmission Control Protocol (TCP):** Provides reliable connection oriented transmission between two hosts. It ensures delivery

of packets between the hosts. **User Datagram Protocol (UDP):** Provides connectionless, unreliable, one-to-one or one-to-many delivery.

Application Layer

The Application layer of the TCP/IP model is similar to the Session, Presentation, and Application layers of the OSI Reference Model. The most popular Application layer protocols are:

Hypertext Transfer Protocol (HTTP): The core protocol of the World Wide Web. **File Transfer Protocol (FTP):** enables a client to send and receive complete files from a server. **Telnet:** connect to another computer on the Internet. **Simple Mail Transfer Protocol (SMTP):** Provide e-mail services. **Domain Name System (DNS):** Refer to other host computers by using names rather than numbers.

POINTS TO REMEMBER

- The Internet is a network of global connections – comprising private, public, business, academic and government networks – linked by guided, wireless and fiber-optic technologies.
- ARPANET was Advanced Research Projects Agency (ARPA) of the U.S. government in 1969 and was first recognized
- **INTRANET:** It is a private network within an enterprise to share company data and computing resources between the employees.
- **EXTRANET:** It is a private network that uses Internet technology and the public telecommunication system to securely share business's information with suppliers, vendors, partners, customers, or other businesses.
- Communication over mobile network is be made up of voice, data, images and text messages.
- RFID –(**R**adio **F**requency **Id**entification) uses **RF** wireless technology to **identify**.
- Open System Interconnection (OSI) model was found in the year 1934, over all basis that permits network protocols along with software and schemes to be developed based on Universal guidelines.
- **Transmission Control Protocol/Internet Protocol**, **TCP/IP** is a set of protocols permitting communications among all computers on the Internet.
- **HTTP** – A protocol used between a web client and a web server protects non-*secure* data transmissions. The core protocol of the World Wide Web.
- **HTTPS** - A protocol used between a web client and a web server permits *secure* data transmissions.
- **FTP** - Used between computers for sending and receiving data. Enables a client to send and receive complete files from a server.

- **Internet Protocol (IP):** routable protocol which uses IP addresses to deliver packets. It is an unreliable protocol, does not guarantee delivery of information.
- **Address Resolution Protocol (ARP):** Resolves IP addresses to MAC (Medium Access Control) addresses.(A MAC address is a hardware identification number that uniquely identifies each device on a network.)
- **Internet Control Message Protocol (ICMP):** Used by network devices to send error messages and operational information.
- **Transmission Control Protocol (TCP):** Provides reliable connection oriented transmission between two hosts. It guarantees delivery of packets between the hosts.
- **Simple Mail Transfer Protocol (SMTP):** Provides e-mail services.
- **Domain Name System (DNS):** A method of refering to other host computers by using names rather than numbers.

A-Z GLOSSARY

Internet	Several networks, small and big all over the world, are connected together to form a Global network called the Internet.
Intranet	It is a website used by organizations to provide a place where employees can access company related information.
Extranet	It is a private network using Internet technology to share part of business information with supplier's partners and customers.
APRANet	Advanced Research Projects Agency Network
TCP/IP	Transmission Control Protocol / Internet Protocol
Wi-Fi	Wireless Fidelity.
RFID	Radio Frequency Identification.
OSI	Open System Interconnection
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
FTP	File Transfer Protocol
SMTP	Simple Mail Transfer Protocol
UDP	User Datagram Protocol
SMTP	Simple Mail Transfer Protocol
DNS	Domain Name System

EVALUATION

LYK75V

Part - I

Choose the correct answer

1. The----------, "the Net," is a worldwide system of computer networks
   a) Internet
   b) mobile
   c) communication
   d) protocol
2. Which one of the following will be easy the way to uses Internet technology and the public telecommunication system to securely share business's information with suppliers, vendors, partners and customers.
   a) Extranet b) Intranet
   c) arpanet d) arcnet
3. Match the following and choose the correct answer
   i. HTTP -The core protocol of the World Wide Web.
   ii. FTP- enables a client to send and receive complete files from a server.
   iii. SMTP - Provide e-mail services.
   iv. DNS- Refer to other host computers by using names rather than numbers.
   a) i, ii, iii, iv b) ii, iii, iv, i
   c) iii, iv, i, ii d) iv, iii, ii, i
4. Communication over ----------is be made up of voice, data, images and text messages.
   a) Social media
   b) mobile network
   c) whatsapp
   d) software
5. Wi-Fi stands for----------
   a) Wireless Fidelity
   b) wired fidelity
   c) wired optic fibre
   d) wireless optic fibre
6. A TCP/IP network with access restricted to members of an organization
   a) LAN b) MAN
   c) WAN d) Intranet
7. RFID stands for ----------
   a) Radio Free identification
   b) real Frequency identity
   c) Radio Frequency indicators
   d) Radio Frequency Identification.
8. It guarantees the sending of data is successful and which checks error on operation at OSI layer is----------
   a) Application layer
   b) Network layer
   c) Transport Layer
   d) Physical layer
9. Which one of the following will secure data on transmissions
   a) HTTPS b) HTTP
   c) FTP d) SMTP
10. ---------- provides e-mail service
    a) DNS b) TCP
    c) FTP d) SMTP

11. ---------- refer to other host computers by using names rather than numbers.

a) DNS b) TCP c) FTP d) SMTP

12. TCP/IP is a combination of two protocols:

i. Transmission Control Protocol (TCP) ii. Internet Protocol (IP)

iii. Selection Protocol (SP) iv. Captial Protocol (CP)

a) i, ii b) i, iii c) iii, iv d) ii, iii

Part - II

Short Answers

1. Define Intranet
2. What is the uses of mobile networks?
3. List out the benefits of WiFi
4. How many types of RFID system available and what are they?
5. Expand HTTP, HTTPS, FTP.

Part - III

Explain in Brief Answer

1. Compare Internet, Intranet and Extranet
2. List out the components of a RFID enabled system.
3. Write short notes on HTTP, HTTPS, FTP.
4. What are the layers available in TCP/IP Reference Model?
5. Expand ARP, ICMP, SMTP and DNS.

Part - IV

Explain in detail

1. Explain about Internet, Intranet and Extranet.
2. Discuss about OSI model with its layers.
3. Difference between TCP/IP and OSI Reference Model.
4. Explain about the development, merits and demerits in Mobile networks.

STUDENT ACTIVITIES

List out some web address with http and https

1. Find some of the http web addresses
2. Give some example for https
3. Can you know difference between http and https.

12
CHAPTER

DNS (Domain Name System)

BRSVJM

LEARNING OBJECTIVES

- To understand the need of Domain Name System for proper functioning of Internet
- To know the importance of IP addresses
- To know the parts of URL and its types
- To know the components of Domain name system and its functions
- To know how the DNS is working

12.1 Introduction

In earlier, websites were accessed through their IP addresses. It was difficult for an individual to remember all the IP address to access the websites. So, the domain names were created and mapped with IP addresses. Like phonebook where all the contact numbers are stored under respective names and are accessed by the contact names, Domain Name System (DNS) maintains all the directory of domain names/host names and help us to access the websites using the domain/host names.

12.2 Overview of DNS

For the communication to takes place, the information should pass through seven layers. Application layer is one among the seven layers. There are several applications in the application layer and DNS (Domain Name System) is one among them. Internet is based on IP addresses, not domain names. But it is easy to use domain names to refer them rather than the long numbers (IP address). To enable the use of domain names in a network, the Domain Name System (DNS) is used. Domain names to IP address mapping must be consistent across the network to ensure interoperability. DNS provides the domain name to IP address mapping through Name servers. To know more about DNS working we must first know about IP address, URL, DNS components. So, let us see about each in detail. Refer Figure 12.1

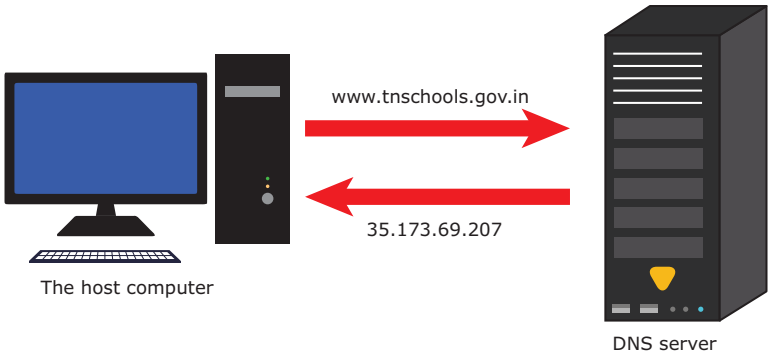

Figure 12.1 Domain Name Systems

While typing a web address, e.g., www.tnschools.gov.in, DNS translates it into a machine friendly IP address (for example 35.173.69.207 is the IP for www.tnschools.in) and directs your Internet connection to the correct website.

DO YOU KNOW?

American computer scientist Paul V. Mockapetris together with Jon Postel, invented the Internet Domain Name System (DNS) Jon Postel was an administrator of the Internet Assigned Numbers Authority (IANA) until his death and he was known as "God of the Internet".

Jon Postel

Paul V. Mockapetris

12.3 IP Address

Internet Protocol (IP) address is simply the logical address in the network layer. Like how the door number/flat number is used to differentiate individual house from others in the same apartment IP address is also used to find the host system in the whole network. Due to increase in the number of system in a network there is a need of more addresses which lead to two addressing methods i.e., IPv4 and IPv6.

QD99D6

12.3.1 IPv4 Address

IPv4 address is a 32-bit unique address given to a computer system. No two systems can have same IP address. If the network has p connections then 'p' addresses should be there. An address space is the total number of addresses that can be made by that protocol. It is determined by the number of bits that the protocol use. If the protocol uses 'n' bits then the address space of that protocol would be '2^n' addresses can be formed. So, the number of addresses that can be formed in IPv4 is 2^{32}. There are two ways to represent the IP address

- Binary notation
- Dotted-decimal notation

In binary notation the address is expressed as 32-bit binary values.

For E.g. 00111001 10001001 00111000 00000111

In dotted-decimal notation the address is written in decimal format separated by dots(.). Refer Figure 12.2

For e.g. 128.143.137.144

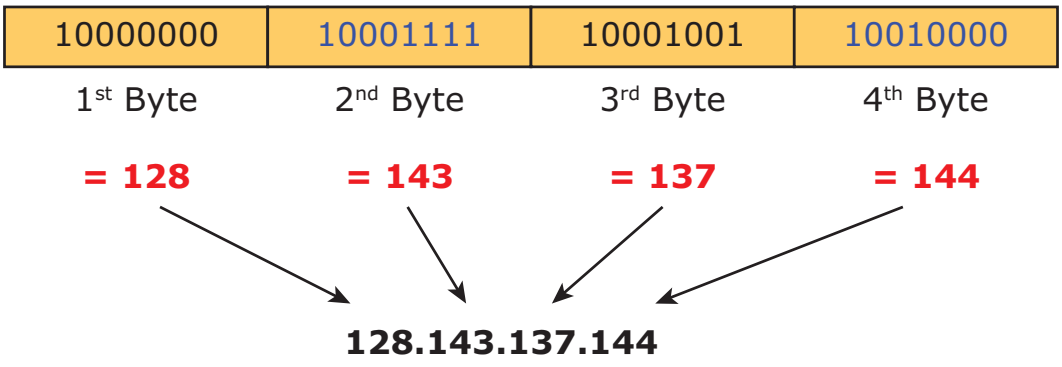

Figure 12.2 IPv4 Address

12.3.2 IPv6 Address

IPv6 address is a 128-bit unique address given to a computer system. The number of addresses that can be formed in IPv6 is 2^{128}. In IPv6 address, the 128 bits are divided into eight 16-bits blocks. Each block is then changed into 4-digit Hexadecimal numbers separated by colon symbols. E.g. 2001:0000:32313:DFE1:0063:0000:0000:FEFB. Refer Figure 12.3

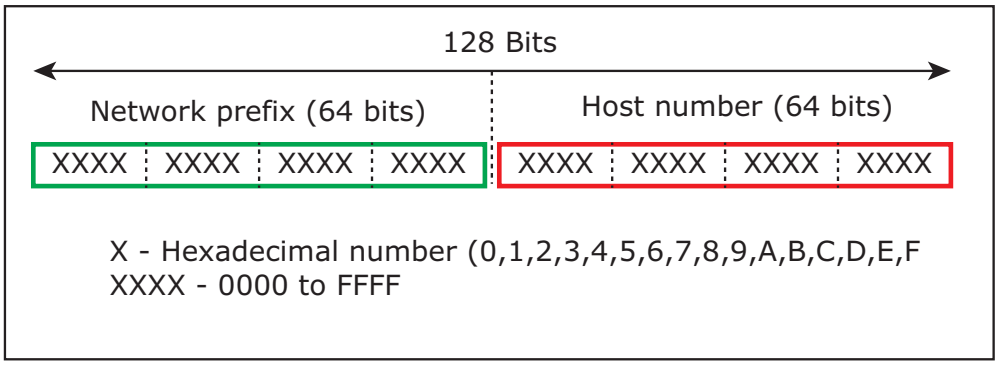

Figure 12.3 IPv6 Address

12.4 Uniform Resource Locator (URL)

URL (Uniform Resource Locator) is the address of a document on the Internet. URL is made up four parts–protocols, hostname, folder name and file name. Each part has its own specific functions. Depending on the applications, additional information can be added to the URL but the common and fundamental URL consists of these four parts. Refer Figure12.4

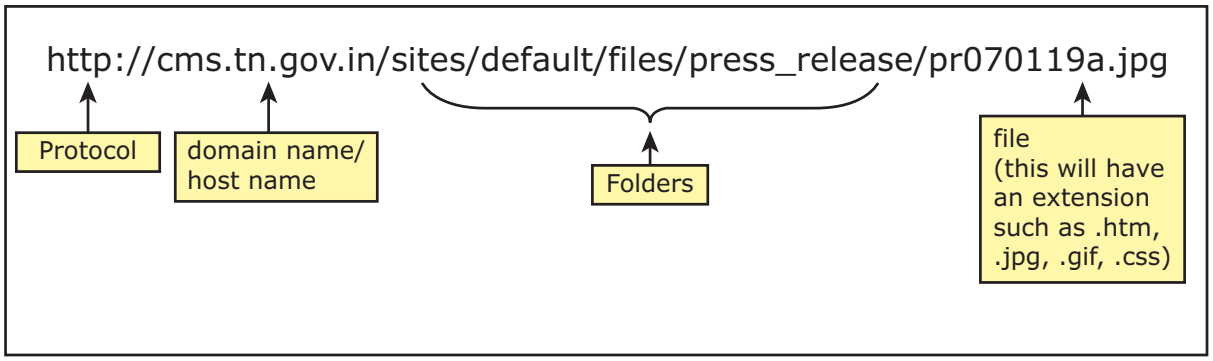

Figure 12.4 URL Parts

Figure 12.4 shows the basic URL where http is a protocol, www.cms.tn.gov.in is a hostname / domain name, sites/default/files/press_release are the folders and pr070119a.jpg is the file name. These are all the basic information which can be obtained from a URL.

URL Type

Depending on the location of the document the URL is divided into 2 types

- Absolute URL
- Relative URL

12.4.1 Absolute URL

Absolute URL is the complete address of a document on the Internet. Absolute URL contains all the information that are required to find the files on the Internet. These are similar to postal address if any of the information is missing then the post will not be able to deliver to the right person. Similarly, if any of the four parts is missing then the browser would not able to link to the specific file. So, all the four parts is very important in absolute URL.

12.4.2 Relative URL

Relative URL is the partial address of a document on the Internet. Relative URL contains only file name or file name with folder name. We can use this type of URL when the file is on the same server related to original document.

12.5 DNS Components

There are three important components in the Domain Name System. They are

- Namespace
- Name server
- Zone

12.5.1 Name Space

The domain names must be very unique and appropriate. The names should be selected from a namespace. The name space can be organized in two ways

- Flat name space
- Hierarchical name space

Flat name space is where the name is assigned to the IP address. They do not have any specific structure. In this flat name space, some meaningful names are been given to IP address for accessing. The major disadvantage of flat name space is that they cannot be used in large system. Because they need to be accessed and controlled centrally to avoid ambiguity and redundancy. But it is difficult in flat name system. To avoid this major disadvantage hierarchical name space is used in large.

Hierarchical name space is where the name is made up of several parts. The first part may represent the nature of organization, the second part may represent the name of organization, and third part may represent the department of the organization and so on. In this way the power to control the name space can be decentralized. The centralized authority can be given to nature and then to name of the organization and so on. To achieve hierarchical name space, Domain Name Space was designed.

Domain Name Space

Domain name space was designed to achieve hierarchical name space. In this, the names are represented as a tree like structure with root element on the top and this tree can have a maximum of 128 levels starting from root element taking the level 0 to level 127.

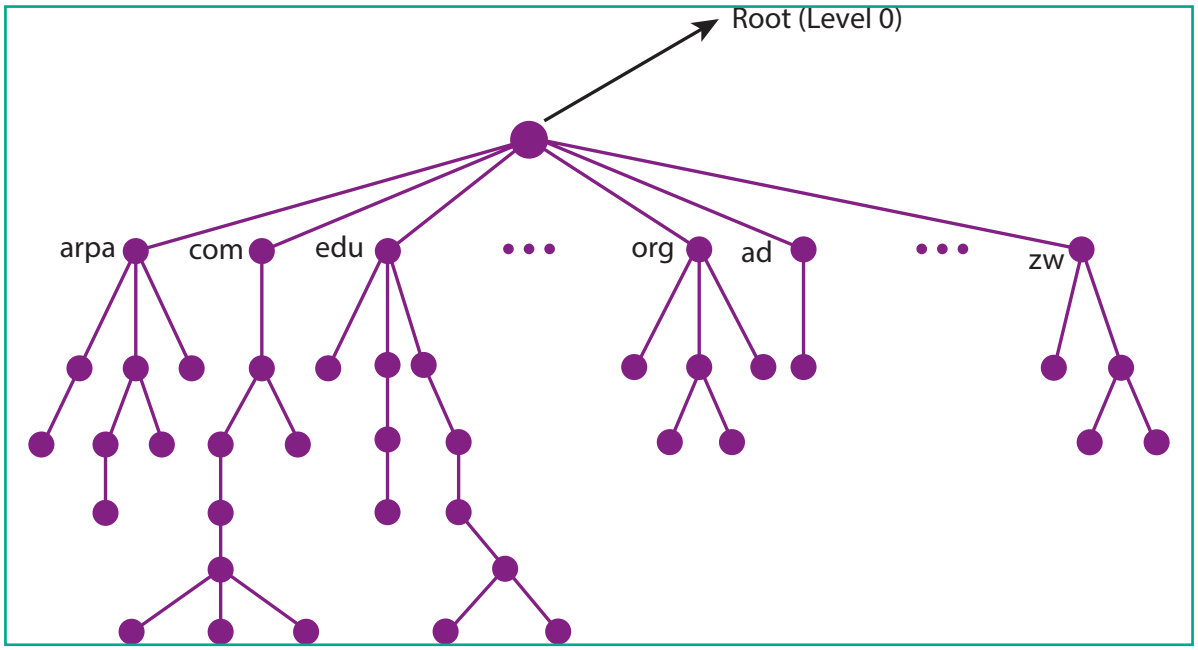

Figure 12.5 Domain Name Space

Figure 12.5 represent the domain name space where the root element is present at the top most level i.e., level 0. The root element always represents the NULL string (empty string). The next level to the root element is node (children of root element). Each node in the tree has a **label** and a **domain name**.

Label

It is a string which can have maximum of 63 characters. Each node in that level should have different labels thereby assuring the individuality of the domain name.

In other words, Labels are the names given to domains. **Domain** is a sub tree in domain name space tree structure. The domain can be further divided into sub domains.

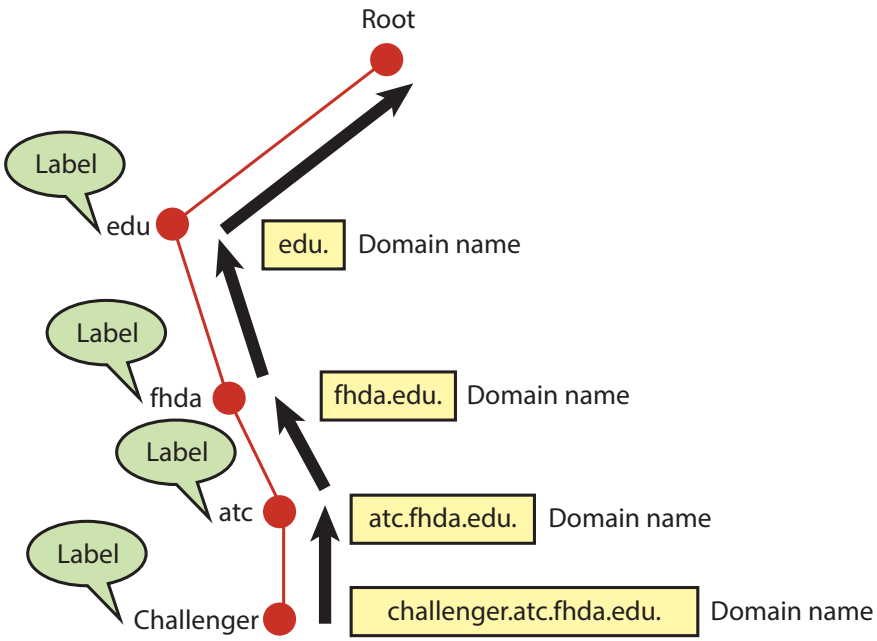

Figure 12.6 Domain Name and Label

Figure 12.6 explain the domain name and label clearly. challenger.atc.fhda.edu. is the domain name which is obtained by reading the labels from bottom to top, separating each label by dot (.) Refer Figure 12.7

Domain name

It is the sequence of labels. In domain name the sequence of labels are separated by dot (.). The domain name is always read from the lower level to higher level i.e., from the leaf node to root node. Since the root node always represent NULL string, all the domain name ending with dot.

Basic rules of Domain names

- Domain can consists of Alphabets a through z, and the digits 0 through 9.
- Hyphens are allowed, but hyphens can not be used as first character of a domain name.
- Spaces are not allowed
- Special symbols (such as !, $, &, _ and so on) are not permitted.
- Domain names have the minimum length of 2, and the maximum length of 63 characters. The entire name may be at most 253 characters long.
- Domain names are not case-sensitive. (It may be upper, lower or mixing of both case letters)

Generic Top-Level Domain names:

Top level domain is the last part of a domain name. Generic top level domains are used for generic purpose and maintained by IANA. Refer Table 12.1

Table 12.1 Generic Domain Names

Domain Name	Meaning
com	Commercial Organisation
edu	Educational Institutions
gov	Government (US)
mil	Military groups
org	Non profit Organization
net	Networking organization
info	Information service providers

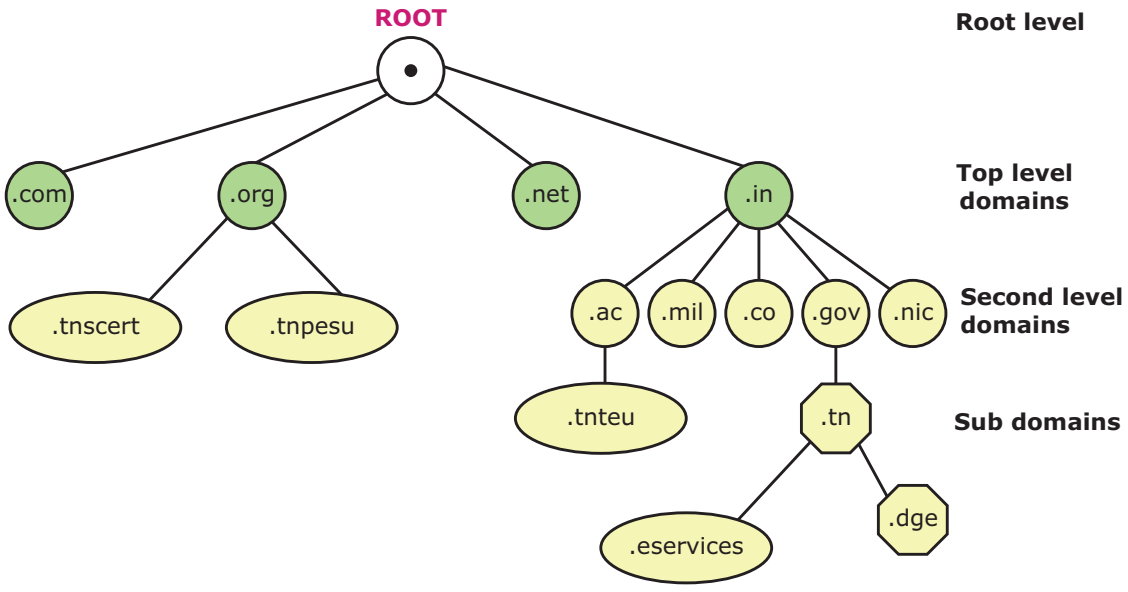

Figure 12.7 Domain representation of www.tnscert.org

Country top-level domain names

Country domain uses 2-character country abbreviation according to country. For e.g., google.in – for INDIA, google.us for US. Refer Table 12.2

Table 12.2 Country domain names

Domain Name	Meaning
in	India
us	United States
fr	France
uk	United Kingdom
ca	Canada
au	Australia
lk	Srilanka
bd	Bangladesh
cn	China
pk	Pakistan
jp	Japan
sg	Singapore

Domain names may also be used in other than English languages in UNICODE format. Tamil language is also used in three country Top Level Domain names which are. இந்தியா,.சிங்கப்பூர் and .இலங்கை

Domain Name	Meaning
இந்தியா	India
சிங்கப்பூர்	Singapore
இலங்கை	Srilanka

12.5.2 Name Servers

The information which needs to be stored in Domain name space is quite large. Single system would be inefficient and insufficient to store such a huge amount as responding to requests from all over the world. It also becomes unreliable because in case of any failure the data becomes inaccessible.

The solution to this problem is to distribute the information among many computers. The best way to do that is to divide the entire space into many domains and sub domains. DNS also allows domains to be further divided into sub domains. By this, the solution to the problem is obtained and hierarchy of servers is also maintained. Name servers store the data and provide it to clients when queried by them. Name Servers are programs that run on a physical system and store all the zone data.

Inverse domain performs the opposite task of normal DNS query. It converts the IP address to domain name.

Name Server is a main part in the Domain Name System (DNS). It translate the domain names to IP addresses. Name server contains the DNS database which consists of domain names and their corresponding IP addresses. There is a need to store large number of domain names for the world wide usage, so plenty of servers are used in the hierarchical manner. Name servers do the important task of searching the domain names. While you searching a website, Local Name server (provided by ISP) ask the different name servers until one of them find out your answer. At last it returns IP address for that domain name. Your computer can now connect to the requested webpage stored on the webserver. Refer Figure 12.8

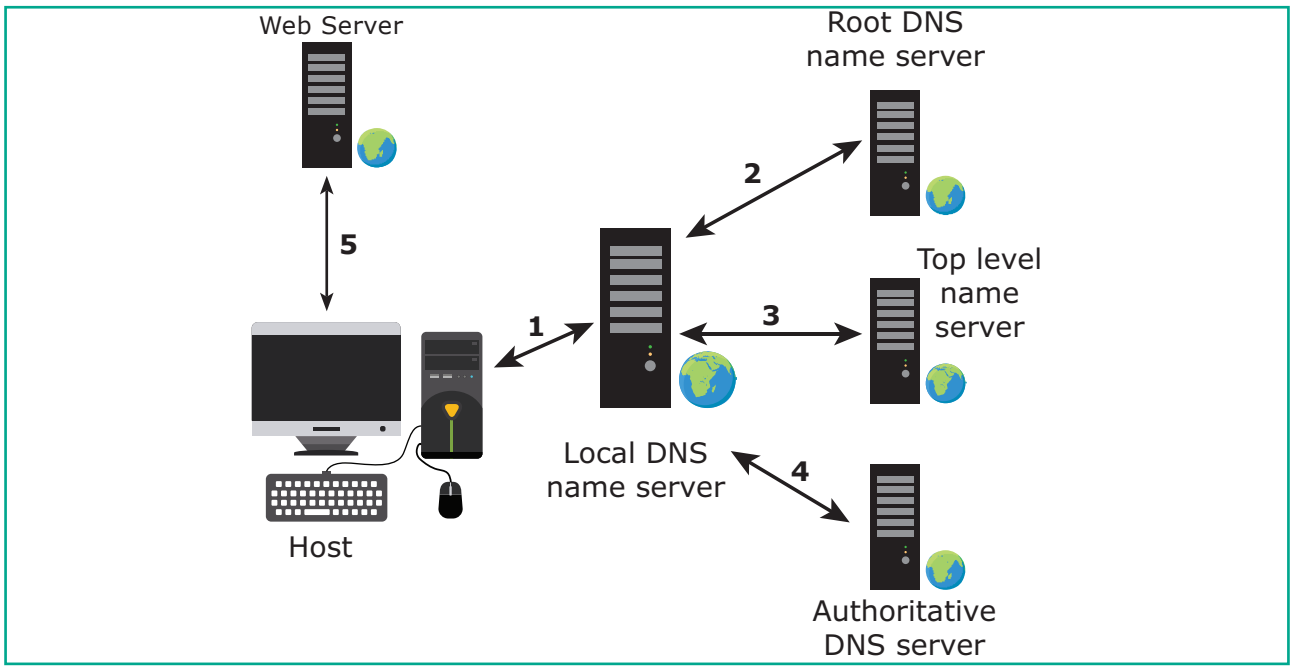

Figure 12.8 working structure of Name server

Types of Name Servers

There are three types of Name Servers which control the entire Domain Name System:

1. Root Name Server - top level server which contains entire DNS tree, maintained by ICANN. There are 13 servers.
2. Primary/Master Name Server– contains a zone resource records. These records are updatable by domain name holders such as organizations.
3. Secondary/Slave Name Server – contains a copy of primary server files. This server has no authority to update, but reduce the workload of master server by sharing the queries.

DO YOU KNOW?

ICANN, Internet Corporation for Assigned Name and Numbers is the Non-profit Organization which assigns names and numbers for all Internet resources like domain names and IP addresses.

12.5.3 Zone

The entire name space is divided into many different zones. It is the area up to which the server has access. Zone is defined as a group of contiguous domains and sub domains. If the zone has a single domain, then zone and domain are the same.

Every zone has the server which contains a database called zone file. Using the zone file, the DNS server replies the queries about hosts in its zone. There are two copies of zone files available, Master file and slave file. Refer Figure 12.9

LET'S RECAP

- A domain is a single node of the Domain Namespace.
- A zone is a subset of the Domain namespace generally stored in a file.
- Domain Name space is an entire collection Domains, Sub domains and Zones
- Name server manages the database of domain names and corresponding IP addresses.
- A server can contain more than one zone files (Zones). A zone can contain more than one sub domains

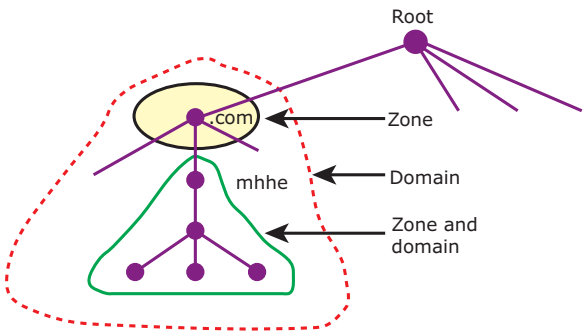

Figure 12.9 Zone and Domains

12.5.4 Resolver

Domain Name System is a client/ server application. A host system need to map domain name to IP address or vice versa according to the call and that work is done by resolver. Resolver either asks server to provide information about IP address. If it doesn't find any information, then it sends the request to other servers and so on. Once the resolver receives the mapping, it checks whether it is an error or resolution (mapping) and provides result according to that.

The resolver is a program which is responsible for initiating the translation of a domain name into an IP address. Since a resolver is stored in the host, There is no need of any protocol to form a connection between the resolver and the user program.

12.5.5 How DNS works?

When the user enters the URL (consists of protocol, domain name, folder name, file name) in the browser, the system first checks its DNS cache for the corresponding IP address. If the IP address is found in the cache then the information is retrieved from cache. If not, then the system needs to perform DNS query i.e., the system needs to query the resolver about the IP address from Internet Service Provider (ISP). Each resolver has its own cache and if it is found in that then that information is retrieved. If not, then the query is passed to next domain

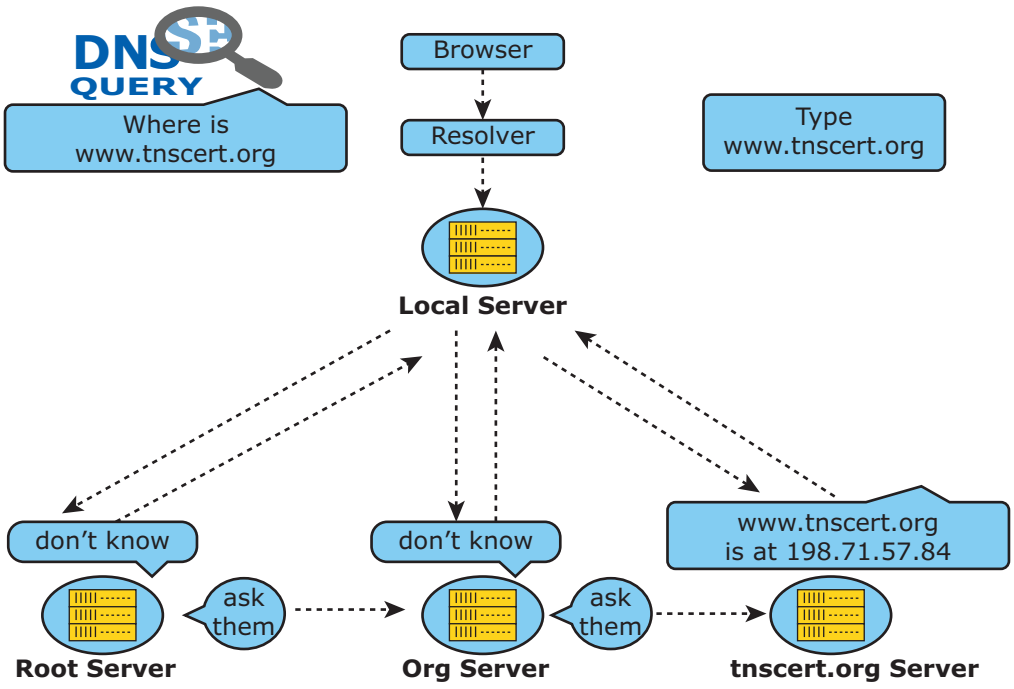

Figure 12.10 workflow of basic DNS

Web Server

Web server is a program running on dedicated machine which handle the queries of www enduser. Server is used to host the websites and to deliver the contents of websites using HTTP. While typing the URL in browser, the browser send the URL to DNS. After getting an IP address from DNS, It sends the request to the web server with IP address . Now the content of websites appear on browser.

server i.e., TLD (Top Level Domain) which reviews the request and direct the query to name servers associated with that specific domain. Until the query is solved it is passed to next level domains. At last the mapping and the record are returned to the resolver who checks whether the returned value is a record or an error. Then the resolver returns the record back to the computer browser which is then viewed by the user. Refer Figure 12.10

IANA is an affiliated authority of ICANN. IANA does the overall management of the DNS Root, IP addressing, and other Internet protocol resource handling. IANA takes care of a number of key aspects of the DNS, including the root zone, and the domains .int and .arpa.

https://www.iana.org/

The WHOIS is a service of ICANN. It is a free, publicly available directory containing the details of registered domain names and their owners (registrants). https://whois.icann.org/en

POINTS TO REMEMBER

- Domain Name System (DNS) maintains all the directory of domain names and help us to access the websites using the domain names. It translates the domain name into IP address.
- IP address is a logical address used to uniquely identify a computer over the network. There are two types: IPv4 and IPv6.
- IPv4 address is a 32 bit unique address given to a computer or a device. There are two ways to represent the IP address: Binary notation, Dotted-decimal notation.

- IPv6 address is a 128 bit unique address given to a computer or a device. It follows Hexadecimal number notation.
- URL (Uniform Resource Locator) is the address of a document on the Internet. URL is divided into two types: Absolute URL and Relative URL
- URL is made up of four parts- protocols, hostname, folder name and file name. Absolute URL contains all the four necessary and fundamental parts of URL.
- Relative URL contains only folder name and the file name or just the file name.
- There are 3 important components in the Domain Name System. They are **Namespace, Name server and Zone.**
- **Label** is a string which can have maximum of 63 characters. Each node in that level should have unique label.
- Domain name space is a tree like structure with root element on the top. It can have a maximum of 128 levels starting from root element taking the level 0 to level 127.
- Domain name is the sequence of labels separated by dot (.). The domain name is always read from the leaf node to root node. The root node always represent NULL string. So All the domain name ends with dot.
- In the domain name space (DNS) tree structure **domain** is a sub structure tree. The domain can be further divided into sub domains.
- Name Servers are programs that run on a physical system and store all the zone data. It provides to clients when queried by them.
- Zone is the contiguous part up to which the server has access. The domain assigned for the server does not divide into further sub domains then zone is same as domain.
- Resolver, a client/ server application, initiates the process of resolving the domain names.

GLOSSARY

DNS	Domain Name System an Internet service that translates domain name into IP address.
IP address	used to uniquely identify a computer over the network.
URL	Uniform Resource Locator, the address of a specific web page or file on the Internet.
Domain Name space	A naming system on which domain names are in a hierarchical and logical tree structure.
Domain Name	a symbolic name associated with an IP address
Name server	Contains the DNS database which consists of domain names and their corresponding IP addresses.
ICANN	Internet Corporation for Assigned Name and Numbers, Non-profit organization which regulates an Internet.
IANA	Internet Assigned Numbers Authority (IANA) is an affiliated authority of ICANN.
Zone	A group of contiguous domains and sub domains in the Domain Name Space.
The resolver	a program which is responsible for initiating the translation of a domain name into an IP address
TLD	Top Level Domain, domains below the root domain
IPv4 /IPv6	Internet Protocol version 4/6

EVALUATION

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Part - I

Choose the correct answer

1. Which of the following is used to maintain all the directory of domain names?
   a) Domain name system b) Domain name space
   c) Name space d) IP address
2. Which of the following notation is used to denote IPv4 addresses?
   a) Binary b) Dotted-decimal
   c) Hexadecimal d) a and b

3. How many bits are used in the IPv6 addresses?
   a) 32
   b) 64
   c) 128
   d) 16
4. Expansion of URL is
   a) Uniform Resource Location
   b) Universal Resource Location
   c) Uniform Resource Locator
   d) Universal Resource Locator
5. How many types are available in Relative URL?
   a) 2 b) 3 c) 4 d) 5
6. Maximum characters used in the label of a node?
   a) 255 b) 128 c) 63 d) 32
7. In domain name, sequence of labels are separated by
   a) ;
   b) .(dot)
   c) :
   d) NULL
8. Pick the odd one out from the following.
   a) node b) label
   c) domain d) server
9. Which of the following initiates the mapping of domain name to IP address?
   a) Zone
   b) Domain
   c) Resolver
   d) Name servers
10. Which is the contiguous area up to which the server has access?
   a) Zone
   b) Domain
   c)Resolver
   d) Name servers
11. ISP stands for
   a) International Service provider
   b) Internet Service Provider
   c) Internet service Protocol
   d) Index service provider
12. TLD stands for
   a) Top Level Data
   b) Top Logical Domain
   c) Term Level Data
   d) Top Level Domain
13. Which of the following statements are true?

i) Domains name is a part of URL.
ii) URL made up of four parts
iii) The relative URL is a part of Absolute URL
iv) URL doesn't contain any protocol

   a) i & ii b) ii
   c) i, ii & iii d) i, ii & iv
14.
   Assertion (A) : The number of addresses used in IPv6 addressing method is 128 .
   Reason (R) : IPv6 address is a 128 bit unique address.
   a) A is true and R is false.
   b) A is false and R is true.
   c) Both A and R are correct and R is the correct explanation of A.
   d) Both A and R are correct and R is not the correct explanation of A.

15. Match the following

a. domain	-	1. progress that initiates translation
b. zone	-	2. contains database of domain names
c. name server	-	3. single node
d. resolver	-	4. contiguous nodes

a. 1432
b.3421
c. 3214
d. 3412

Part - II

Short Answers

1. List any four domain names.
2. What is an IP address?
3. What are the types of IP address?
4. What is an URL?
5. List out four URLs you know.
6. What are the types of URL?
7. What is a domain?
8. What is a zone?
9. What is a resolver?
10. What are the categories available in domain name space?
11. Write any four generic Top Level Domain.

Part - III

Explain in Brief Answer

1. Write a note on DNS.
2. Differentiate IPv4 and IPv6.
3. Differentiate Domain name and URL
4. What are the differences between Absolute URL and Relative URL?
5. Write a note on domain name.
6. Differentiate web address and URL

Part - IV

Explain in detail

1. Explain briefly the components of DNS.
2. Classify and Explain the IP address.
3. Explain about the name server?
4. What is domain name space? Explain.
5. Explain how the DNS is working.

STUDENT ACTIVITIES

1. **Find out IP address of your system**

i. Click start menu and type command or cmd to open command prompt
ii. A command prompt window will be displayed. Type ipconfig and press enter.
iii. The IP number is listed under IPv4 Address and IPv6 Address.
iv. Find out the MAC address of the network card in the list.
v. Find out and analyze what the other information displayed on the screen.

2. Find out IP address for the websites using command prompt

   i. Click start menu and type command or cmd to open command prompt.

   ii. A command prompt window will be displayed. Type tracert and press enter.

   iii. From the displayed window, You'll see the IPv4 and IPv6 address.

   iv. Find out IP address for another website.

3. List out websites to find out IP address of other websites

   For example:

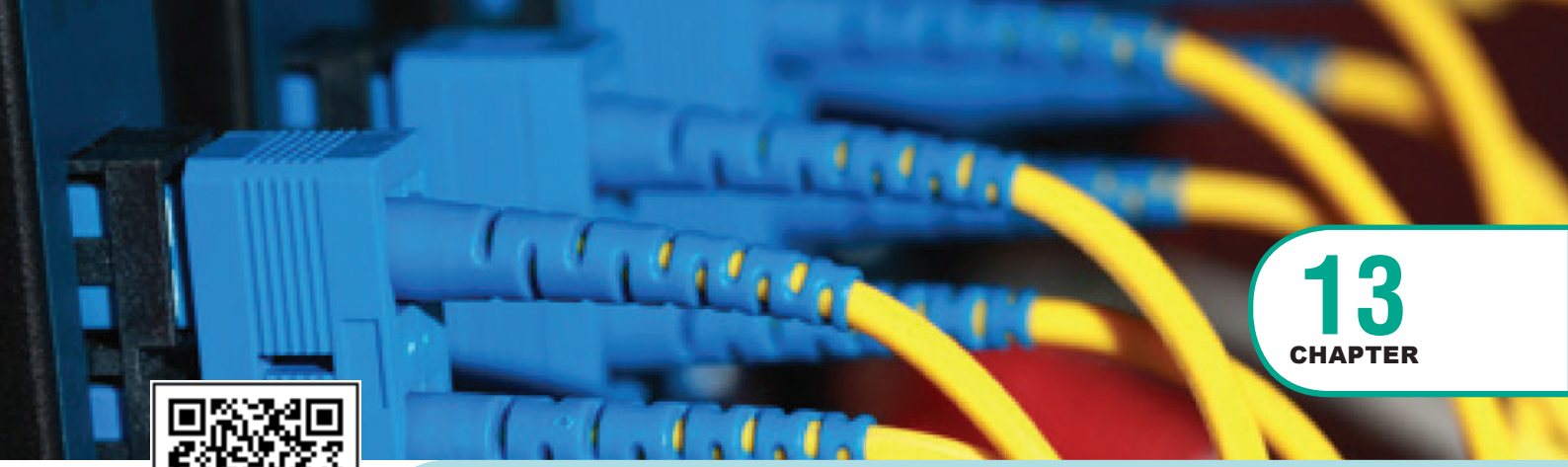
   https://ipinfo.info/html/ip_checker.php

4. Use nslookup in command line and analyse what purpose it is used.

5. Buy your own domain name or create free sub-domain and connect free hosting servers.

   For example:

   www.goDaddy.com, www.webs.com



13
CHAPTER

FKQWRL

Network Cabling

LEARNING OBJECTIVES

- To know the necessity of cabling in computer networking.
- To know the different types of cables used in networking.
- To know the components involved in making of Ethernet cable.
- To know the various types of Registered Jacks and its functions
- To know the wiring and colour coding techniques used in Ethernet cabling.
- To practice in making an Ethernet cable with desired length.

13.1 Introduction

Once the basics of computer was invented by Charles Babbage, the people started inventing much newer technology compatible with the computer. In the 19th Century the US military base had much technology to serve weapons and people but they did not have any technology to send a report from one place to another. Then slowly the word network grew bigger and bigger. Then the Advanced Research Projects Agency Network (ARPANET) was invented and the TCP/IP was adopted with ARPANET. Then the researchers began to research the "network of networks".

First the network was within one computer to another computer, then it moved to one place to another place, then one city to another, then slowly it grew up and became one as Internet. The essential service of Internet is WWW (World Wide Web) which was invented by Tim Berners Lee. Internet can be accessed easiliy from anywhere but the setting up of the network is a big nightmare. Still network cables are being used worldwide to produce a faster Internet to the people. The network cables are used to transfer the data from one device to another device.

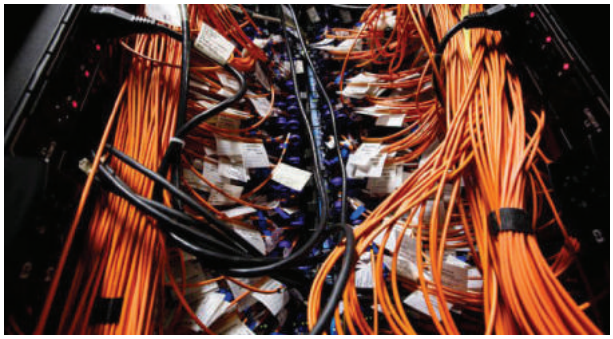


Figure 13.1 Network cables
Source: Data center knowledge

In the figure 13.1 huge and huge cables are used during network cabling, it really makes everyone confuse which wire should connect. So the process is going to reduce the number of cables and making alternatives in networking.

13.2 Types of Network Cables

There are many types of cables available in the networking. Here we discuss about six different cables.

1. **Coaxial Cables:** This cable was invented at late 1880's, which is used to connect the television sets to home antennas. This cable is used to transfer the information in 10 mbps. The cable is divided into thinnet and thicknet cables. These cables have a copper wire inside and insulation is covered on the top of the copper wire to provide protection to the cable. These cables are very difficult to install and maintain, because they are too big to carry and replace. The coaxial cable got its name by the word "coax". Nowadays coaxial cables are also used for dish TV where the setup box and the television is connected using the coaxial cable only. Some of the cable names are Media Bridge 50-feet Coaxial cable, Amazon basics CL2-Rated Coaxial cables, etc. See Figure 13.2

Figure13.2 Coaxial cables for connecting television sets

2. **Twisted Pair Cables:** It is type of cable with two or more insulated wires twisted together. It started with the speed of 10 mbps (10BASE-T cable is used). Then the cable is improved and the speed was higher and went to 100 mbps and the cable was renamed as 100BASE-TX. Then finally the cable improved more made to 10 gbps and named as 10GBASE-T. This twisted cable has 8 wires which are twisted to ignore electromagnetic interference. Also the eight wires cannot be placed in a single unit there could be a difficult in spacious, so it is twisted to make as one wire. There are two types of twisted pair cables, Unshielded Twisted Pair (UTP) and Shielded Twisted pair (STP). The UTP is used nowadays as modern cables for Internet and they are lower in cost and installation and maintenance is easy compared to the coaxial cables. STP is similar to UTP, but it is covered by an additional jackets to protect the wires from External interference. See Figure 13.3

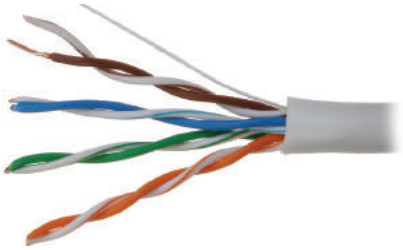


Figure13.3 Twisted pair cables

3. **Fiber Optics:** This cable is different from the other two cables. The other two cables had an insulating material at the outside and the conducting material like copper inside. But in this cable it is of strands of glass and pulse of light is used to send the information. They are mainly

used in Wide Area Network (WAN). The WAN is a network that extends to very large distance to connect the computers. One example of WAN is Internet. These cables are placed in deep underground to avoid any damage to the cables. The optic cable uses light to transmit the information from one place to another. There are two types of fiber optic cables available, One is single-mode (100BaseBx) another one is Multimode (100BaseSX). Single-mode cables are used for long distance transmission and at a high cost whereas the multimode cables are used for short distance transmission at a very low cost. The optic cables are easy to maintain and install. See Figure 13.4

Figure 13.4 Fiber optic cable with 4 cores combined with one cable.

4. **USB Cables:** The Universal Serial Bus are used to connect keyboard, mouse and other peripheral devices. But there are some special network devices used to connect the Internet through the USB called dongles. The dongle is a small peripheral device which has a compatible of mobile broadband with a sim slot in it and connects the Internet and acts as a modem to the computer. See Figure 13.5

The latest version of USB is USB 3.0 which has the data transfer rate 4.85 Gbps. But USB 2.0 has just 480 Mbps.

Micro USB is a miniaturized version of the USB used for connecting mobile devices such as smart phones, GPS devices and digital cameras.

5. **Serial and Parallel cables:** Before In the year of 1980s to 1990s the Ethernet and the USB were not developed. Then the Serial and Parallel interface cables are used to connect the Internet to the system. They were sometime used for PC to PC networking. Before the USB emerged, the system will have both serial port and parallel port. The serial port will send 1 bit at one time

Figure 13.5 The USB Cables and USB dongle connected to a laptop.

whereas the parallel port will send 8 bit at one time. The parallel cables are used to connect to the printer and other disk drivers. RS232 is one type of serial cable, also known as Null modem cable. See Figure 13.6

Figure 13.6 The serial cable at the left and parallel cable at the right.

6. **Ethernet Cables:** Ethernet cable is the most common type of network cable mainly used for connecting the computers or devices at home or office. This cable connects wired devices within the local area network (LAN) for sharing the resources and accessing Internet.

   The Crossover Ethernet cable is an example of the Null modem Cables. This cable is used to join two PCs or two network devices of the same type. This cable is the sophisticated Ethernet cable used to connect the Internet to the system. This cable works at a speed of 10 gbps and more. The Ethernet crossover cable is identical on both the ends. Nowadays Routers are being connected through the crossover cables to provide wireless network from the local network. See Figure 13.7

Figure 13.7 The Ethernet cables.

DO YOU KNOW?

Just like the crossover cable, RS-232 cable is also used for interconnecting two computers without modem. So it is also a null modem cable. A cable interconnecting two devices directly is known as a null modem cable.

13.3 Ethernet Cabling Components

Computer Networking is a group of interconnected computers or other devices for sharing the data and resources among them. Computers can be connected on the network with the help of wired media (Unshielded Twisted pair, shielded Twisted pair, Co-axial cables and Optical fibre) or wireless media (Infra Red, Bluetooth, WiFi)

Wireless networks enable more devices including mobiles sharing the resources and Internet connections remotely. But Compared to wireless networks, wired networks maintain a faster Internet speed and more secure. Wired networks for larger area are more expensive. Wired networks are still used widely in the offices where need increased speed and secure connections.

The computers with wired connections must be configured with

Ethernet cards. These cards enable the computers to have a connection with other devices by using Ethernet cables. The switches and routers may be used to increase the number of systems to be interconnected.

The Ethernet cable is the basic component of the Local Area Network (LAN); here the only one popular Ethernet wire is used, RJ45 Ethernet cable. Here we shall be discussing the different components used inside this Ethernet cable. The components of the Ethernet cable are RJ45 connector, patch cable (UTP cable), plastic covering. The RJ45 connector is made up of plastic cubes connected at the both the ends. With this connector we will connect one end at the computer and other end at the LAN port. The patch cables has eight small wires inside. The plastic covering is used to provide protection to the wires when it is bending or twisted during connecting to the system or to the LAN port.

Ethernet cabling is the process of connecting the computers with other devices using Ethernet cables. The three main components are used in the Ethernet cabling components are

1. Patch Cable (Twisted pair)
2. RJ45 Connector
3. Ethernet Ports
4. Crimping Tool

13.3.1 Patch Cable (Twisted Pair)

These Cables are generally made up of 8 wires in different colors. Four of them are solid colours, and the others are striped. The eight colors are white green, green, white orange, blue, white blue, orange, white brown and brown. The following figure 13.8 shows the patch cable.

Figure 13.8 Patch cable (Twisted pair)

Ethernet cables are normally manufactured in several industrial standards such as Cat 3, Cat 5, Cat 6, Cat 6e and cat 7. "Cat" simply stands for "Category," and the following number indicates the version. Latest version denotes faster and higher frequencies, measured in Mhz. Increasing the size of the cable also lead to slower transmission speed.

The cables together with male connectors (RJ45) on each end are commonly referred as Ethernet cables. It is also called as RJ45 cables, since Ethernet cable uses RJ45 connectors

A crossover Ethernet cable is specially designed for making a connection between two computers. Generally, the Ethernet cables are designed to make a connection between a computer and a router or switch.

13.3.2 RJ45 Connector

The RJ45 connector is a small plastic cup which will be used to connect the wire inside the connector and ready to connect the Internet. The RJ45 connector looks similar like a telephone jack but it looks a slightly wider. The Ethernet cables are sometime called as RJ45 cables. In RJ45 the "RJ" stands for the Registered Jack and the "45" simply refers to the number of interface standard in the cable. See Figure 13.9

Figure 13.9 RJ45 Connector

Each RJ45 connector has eight pins and connected to each end of the Ethernet cable. since it has 8-position, 8-contact (8P8C) modular plug, It is also known as 8P8C connector. These plugs (connector) are then inserted into Ethernet port of the network card.

Wiring schemes and colour codes of the connector

The RJ45 connector has eight small jack inside to connect eight small wires of the patch cable. The eight cables are in eight different colors. Let's discuss that eight colors and where does that eight colors connect to the RJ45 connector.

Wiring schemes specifies how the wires to be connected with RJ45 connector. There are two wiring schemes available to terminate the twisted-pair cable on each end, which are T-568A and T-568B. The Table 13.1 describes the pinouts and colour coding of these schemes.

Table 13.1 Wiring schemes with colour codes

Pin	T-568A	Pin	T-568B
1	white / green stripe (Tx+)	1	white / orange stripe (Tx+)
2	green (Tx-)	2	orange (Tx-)
3	white / orange stripe (Rx+)	3	White / green stripe (Rx+)
4	blue	4	blue
5	white / blue stripe	5	white / blue stripce
6	orange (Rx-)	6	green (Rx-)
7	white / brown stripe	7	white / brown stripe
8	brown	8	brown

Although four pairs of wires are available in the cable, Ethernet uses only two pairs: Orange and Green. The other two colors (blue and brown) can be used ISDN or phone connections.

As we have already discussed about the pin details in the Ethernet connector. The position of the pin details briefly. Now let's see the pin details of the Ethernet ports, the pin 1 shows the transmission positive the pin 2 shows the transmission negative the pin 3 shows the receiver positive. The pin 4 shows the reserved position it is nothing but tells the connection for some other use. The pin 5, 7, 8 are also used as reserved position. The pin 6 shows the receiver negative. The two main signals of the pins: the one is the

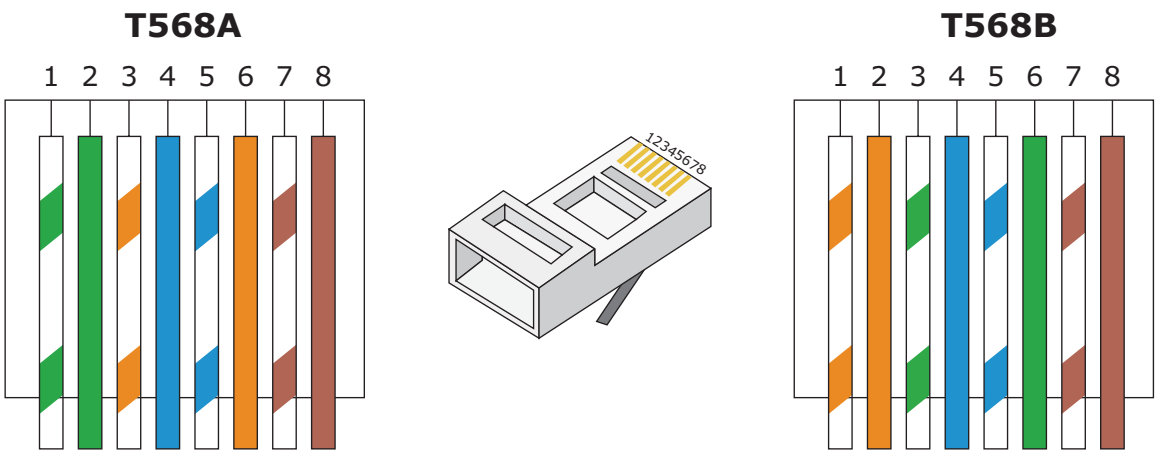


Figure 13.10 The Ethernet wiring schemes (T568A & T568B)

TX which is transmission of data and RX which is Receiver of data. See Figure 13.10 & Figure 13.11

1. In the Figure 13.10 the position of pin no. 1 describes the transmit data or bidirectional, the bidirectional means it can be sent to both connection with the TX (positive). The TX+ has positive terminal and the color is used in this position is white green.
2. In the position of pin no. 2 describes the transmit data or bidirectional with the TX (negative). The TX- has negative terminal and the color is used in this position is Green.
3. In the position of pin no.3 describes the receive data or bidirectional with the RX (positive). The RX is compatible to receive the data which has positive terminal and the color is used in this position is white orange.
4. In this position of pin no. 4 describes that it is not connected or bidirectional. It means there will be no transmitting or receiving will exist. But it can be used later for some other connection. The color used in this pin is blue.

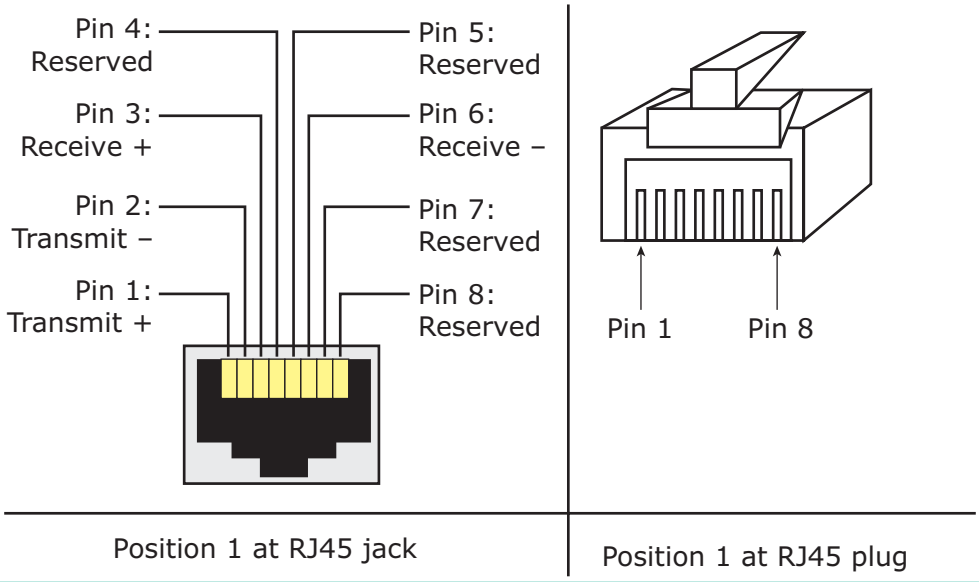


Figure 13.11 The Ethernet port pin details

5. In this position of pin no. 5 describes that it is not connected or bidirectional and the color is white blue.
6. In this position of pin no. 6 describes the receive data or bidirectional with the RX (Negative) which has a negative terminal and the color used in this position is orange.
7. In this position of pin no. 7 describes that it is not connected or bidirectional and the color is white brown.
8. In this position of pin no. 8 describes that it is not connected or bidirectional and the color is brown.

13.3.3 Ethernet card and Port

Ethernet card is a Network Interface Card (NIC) that allows computers to connect and transmit data to the devices on the network. It may be an expansion card or built-in type. Expansion card is a separate circuit board also called as PCI Ethernet card which is inserted into PCI slot on motherboard of a computer. Now a days most of the computers come with built-in Ethernet cards which resides on motherboard. Wireless Ethernet cards are also available, which uses radio waves to transmit data. See Figure 13.12

Ethernet port is an opening which is a part of an Ethernet card. It accepts RJ45 connector with Ethernet cable. It is also called as RJ45 jack. It is found on personal computers, laptops, routers, switches, hubs and modems. We can see an Ethernet port on the back side of a computer or a laptop. It connects Ethernet cable with Ethernet card mounted on motherboard.

In these days, most of the computers and laptops have a built-in Ethernet port for connecting the device to a wired network. Some of them not having an Ethernet port use an Ethernet dongles to form a network with other devices. Devices or computers which use wifi only for networking eliminates both the cable and its port. See Figure 13.13

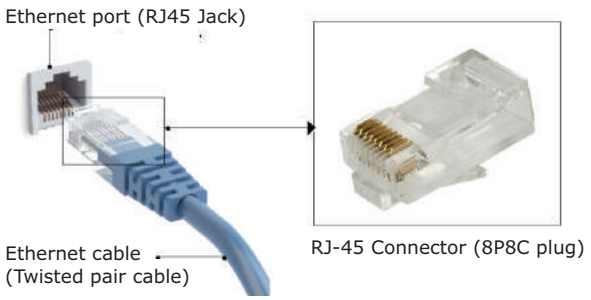
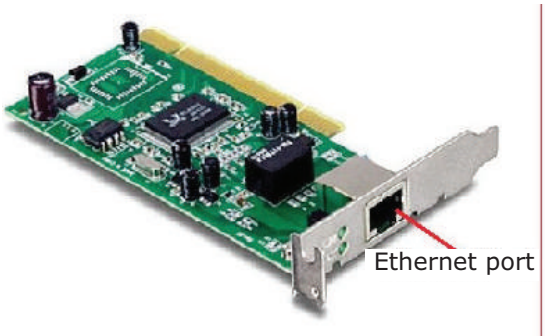
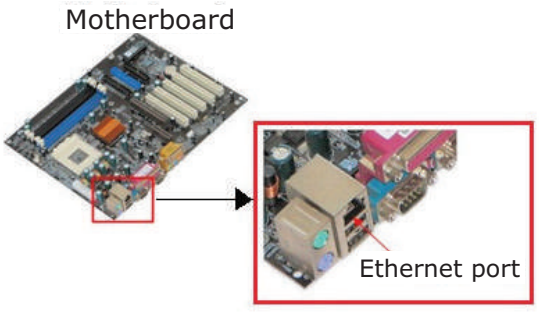


Figure 13.13 Ethernet cable with Port

Once you inject the plug into the port the two led lights will glow in the computer; the one is green and another one is orange. The orange light will start blinks then it means the Internet is connected.



PCI Ethernet port



Built-in Ethernet card

Figure 13.12 Ethernet Network Interface Cards

TIPS

Devices/Technology	Alternative Names
Ethernet Technology	RJ45, 802.3 (according to IEEE)
RJ45 Connector (male)	RJ45 plug, Ethernet connector, 8P8C connector
RJ45 socket (female)	Rj45 jack, Ethernet Port
RJ45 Cable	Ethernet cable,

13.3.4 Crimping Tool

Crimping is the process of joining two or more pieces of metal or wire by deforming one or both of them to hold each other. Joining RJ45 connector together with twisted pair cable at each end is an essential process in Ethernet cabling which lead the cable to function properly.

5DYL6D

The crimping tool is a physical tool which is used to connect the patch wire and the Ethernet connector. The crimping tool looks like a small cutting handle with two mold of Ethernet port. The tool will puncture the connector and makes the wire set in the connector. See Figure 13.14

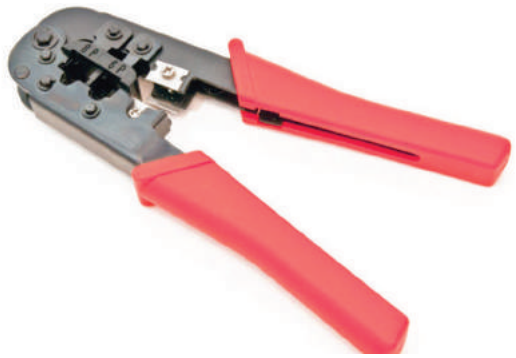


Figure 13.14 Crimping Tool for RJ-11 (6 pin) and RJ-45 (13 pin)

Crimping process for making Ethernet cables

1. Cut the cable with desired length
2. Strip the insulation sheath about 1 inch from both end of the cable and expose the Twisted pair wires
3. After stripping the wire, untwist the smaller wires and arrange them into the proper wiring scheme, T568B preferred generally.
4. Bring the wires tighter together and cut them down so that they all have the same length (½ inch).
5. Insert the all 8 coloured wires into the eight grooves in the connector. The wires should be inserted until the plastic sheath is also inside the connector.
6. Use the crimping tool to lock the RJ45 connector on the cable. It should be strong enough to handle manual traction. Now it is ready for data transmission.
7. Use a cable tester to verify the proper connectivity of the cable, if need. See Figure 13.15

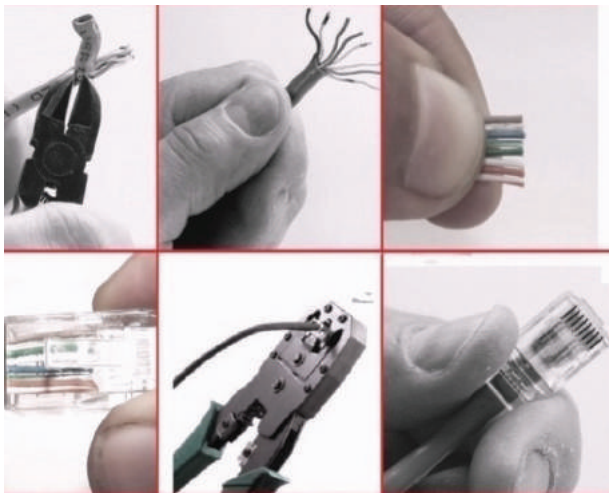


Figure 13.15 Crimping process using crimping tool

DO YOU KNOW?

HISTORY OF ETHERNET

Bob Metcalfe **invented Ethernet** in 1973 while at Xerox PARC (Palo Alto Research Center in California, USA) and the company patented it in 1975. It was used for interconnecting advanced computer workstations, making it possible to send data to one another and to high-speed laser printers. Metcalfe and others then finalized an open **Ethernet** standard in 1980, and by 1985 it had become an IEEE standard. An industry was born, and **Ethernet** was ready for its meteoric rise.

There have been a number of networking standards published in the 802 branch of the IEEE, including the 802.3 Ethernet and 802.5 Token Ring standards. The IEEE standard was first published in 1985 with the title *IEEE 802.3 Carrier Sense Multiple Access with Collision Detection (CSMA/CD) Access Method and Physical Layer Specifications* . The IEEE standard does not use "Ethernet" in the title, even though Xerox relinquished their trademark on the Ethernet name. That's because open standards committees are quite sensitive about using commercial names that might imply endorsement of a particular company. As a result, the IEEE calls this technology *802.3 CSMA/CD* or just *802.3*. However, most people still use the Ethernet name when referring to the network system described in the 802.3 standard.

Source : www.wikipedia.org

13.4 Types of Jacks

Registered Jacks: A Registered Jack commonly known as RJ is a network interface used for network cabling, wiring and jack construction. The primary function of the registered jack is to connect different data equipment and telecommunication devices. The commonly known registered jacks are RJ-11, RJ-45, RJ-21, and RJ-28. The registered jack refers to the male physical connector (Plug), a female physical connector (Jack) and it's wiring. We will talk some of the variety of registered jack below with some definitions. See Figure 13.16

1. **RJ-11:** It is the most popular modern form of registered jack. It is found in home and office. This registered jack is mainly used in telephone and landlines. When we look the pin details of the RJ-11, there are 6 pin where the two pins give the transmission configuration, the two pins give the receiver configuration and the other two pins will be kept for reserved. The two pin will have the positive terminal and the negative terminal.

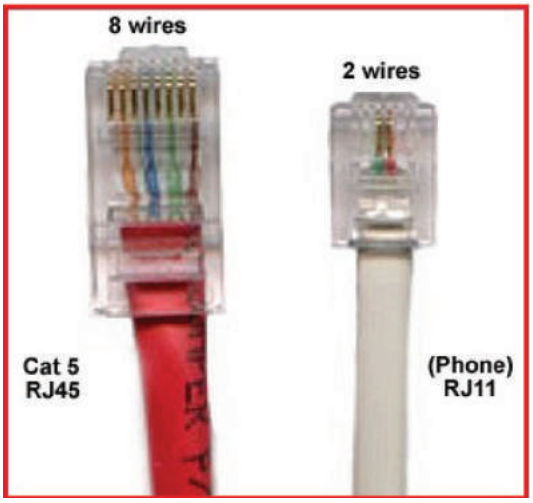


Figure 13.16 comparison of RJ-45 with RJ-11

2. **RJ-14 and RJ-61:** The RJ-14 is the same as RJ-11 which will be used for telephone lines where same it as 6 pins whereas the RJ-61 will

have 8 pins. This RJ-61 will use the twisted pair cable with a modular 8 connection. See Figure 13.17

Figure 13.17 RJ-14 Ethernet Connector

3. **RJ-21:** The RJ-21 connector has 50 pins with 25 pins at one end and 25 pins at the other end. It is also called as champ connector or Amphenol connector. The Amphenol is a connector manufacturer. The RJ-21 interface is typically used for data communication trucking applications. See Figure 13.18

Figure 13.18 The RJ-21 Ethernet port wire with many other ports on the other end.

13.5 Ethernet Cable Color Coding Techniques

There are three types of wiring techniques to construct the Ethernet cable. It is also known as color coding techniques. They are

- Straight-Through Wiring
- Cross-over Wiring
- Roll-over Wiring

13.5.1 Straight-Through Wiring

In general, the Ethernet cables used for Ethernet connections are "straight-through cables". These cable wires are in the same sequence at both ends of the cable, which means that pin 1 of the plug on one end is connected to pin 1 of the plug on the other end (for both standard – T568A & T568B). the straight through wiring cables are mostly used for connecting PC / NIC card to a hub. This is a simple physical connection used in printers, computers and other network interfaces. See Figure 13.19

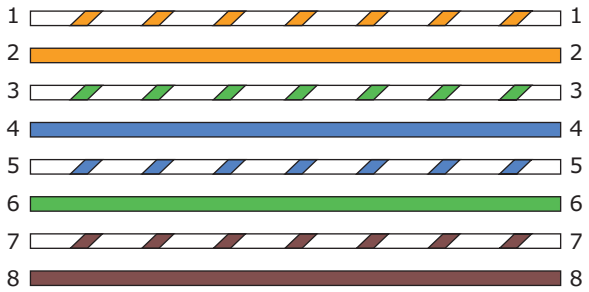


Figure 13.19 Straight through wiring connection

13.5.2 Cross-over Wiring

If you require a cable to connect two computers or Ethernet devices directly together without a hub, then you will need to use a Crossover cable instead. Then the pairs(Tx and Rx lines) will be crossed which means pin 1 & 2 of the plug on one end are connected with pin 3 & 6 of the plug on other end, and vice versa (3 & 6 to pin 1 & 2).

The easiest way to make a crossover cable is to make one end to T568A colour coding and the other end to T568B. Another way to make the cable is to remember the colour coding used in this type. Here Green set of wires at one end are connected with the Orange set of wires

at another end and vice versa. Specifically, connect the solid Green (G) with the solid Orange, and connect the green/white with the orange/white. See Figure 13.20

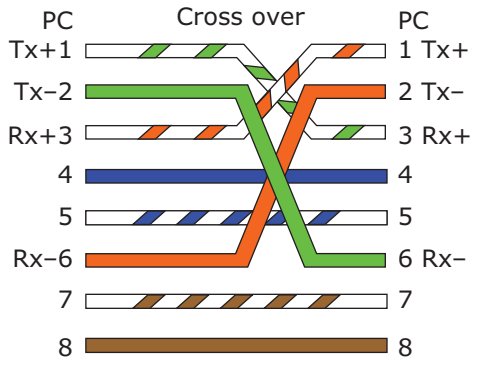


Figure 13.20 Cross over wiring

13.5.3 Roll-over Wiring

Rollover cable is a type of null-modem cable that is often used to connect a device console port to make programming changes to the device. The roll over wiring have opposite pin arrangements, all the cables are rolled over to different arrangements. In the rollover cable, The coloured wires are reversed on other end i.e. The pins on one end are connected with other end in reverse order (i.e. pin 1 to 8, 2 to 7, 3 to 6, 4 to 5, 5 to 4, 6 to 3, 7 to 2, 8 to 1).

Rollover cable is also known as Yost cable or Console cable. It is typically flat (and light blue color) to distinguish it from other types of network cabling.

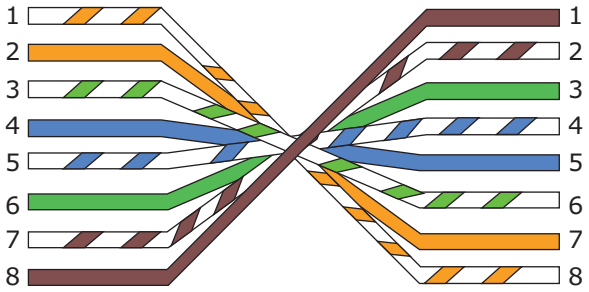


Figure 13.21 Roll over Wiring

These all the three arrangements are used to perform an interface change. But, all the three arrangements transmits the data at the same speed only. See Figure 13.21

How to determine the type of Ethernet cables?

Straight-through: The coloured wires are in the same sequence at both ends of the cable.

Cross-over: The first coloured wire at one end of the cable is the third coloured wire at the other end of the cable.

Roll-over: The coloured wires are in the opposite sequence at either end of the cable.

POINTS TO REMEMBER

- By using World Wide Web, now people can access the network from different parts of the world.
- The Network cables are used to transfer the data and information to another computer.
- Coaxial cables are used for connecting the television with setup box.
- Twisted cable has 13 wires which are twisted to ignore electromagnetic interference
- Two types of twisted pair cables are Unshielded Twisted Pair (UTP) and Shielded Twisted pair (STP).
- The optic cable uses light to transmit the information from one place to

another. They are mainly used in Wide Area Network (WAN).

- There are two types of fibre optic cables are available are Single-mode (100BaseBx) and Multimode (100BaseSX).
- Single-mode cables are used for long distance transmission and at a high cost whereas the multimode cables are used for short distance transmission at a very low cost.
- USB cables are used connect keyboard, mouse and other peripheral devices
- The serial port will send 1 bit at one time whereas the parallel port will send 13 bit at one time.
- The parallel cables are used to connect to the printer and other disk drivers.
- Cross over cable is used to join two network devices of the same type like example two PCs or two network devices. The Null modem Cables are the example of the crossover cables.
- The Ethernet cable is the basic component of the Local Area Network (LAN)
- The RJ45 Ethernet connector is a small plastic cup which will be used to connect the wire inside the connector and ready to use to connect the Internet.
- The RJ45 connector has eight small pins inside to connect eight small wires in the patch cable. The eight cables has eight different colours
- The Ethernet port is the jack where the Ethernet cable is to be connected. This port will be there in both the computers and the LAN port.
- The crimping tool is a physical tool which is used to connect the patch wire and the Ethernet connector(RJ45).
- A Registered Jack (RJ) is a network interface used for connecting different data equipment and telecommunication devices.
- RJ11 jack is mainly used in telephone and landlines
- There are three wiring techniques available in Ethernet cables: Straight through Wiring, Cross over Wiring and Roll over Wiring.

GLOSSARY

ARPANET	Advanced Research Project Agency Network, predecessor to the modern Internet
WWW	World Wide Web, Definition comes from the World Wide Web Consortium (W3C): "The World Wide Web is the universe of network-accessible information, an embodiment of human knowledge."
10BASE-T / 100BASE-TX / 100BASE-FX/ 100BASE-BX/ 100BASE-SX	10 Mbps / 100 Mbps Mbps stands for Mega bits per second T stands for Twisted pair X stands for number of paired copper wires F, B, S – Fibre optic cables

WAN	Wide Area Network, WAN is the network that spans large geographical area
USB	Universal Serial Bus, connects all the peripheral devices with the computers
Null modem cables	A communication method directly connects two computers without modem or any equipment.
LAN	Local Area Network in which the devices used in home or office interconnected for sharing the resources.
TX / RX	Transmit / Receive signals used in connectors
Dongles	The dongle is a small peripheral device with a sim slot in it and connects the Internet and acts as an Ethernet port to the computer.

EVALUATION

XKVCSF

Part - I

Choose the correct answer

1. ARPANET stands for
   a) American Research Project Agency Network
   b) Advanced Research Project Area Network
   c) Advanced Research Project Agency Network
   d) American Research Programs And Network
2. WWW was invented by
   a) Tim Berners Lee
   b) Charles Babbage
   c) Blaise Pascal
   d) John Napier
3. Which cable is used in cable TV to connect with setup box?
   a) UTP cable b) Fibre optics
   c) Coaxial cable d)USB cable
4. Expansion of UTP is
   a) Uninterrupted Twisted Pair
   b) Uninterrupted Twisted Protocol
   c) Unshielded Twisted Pair
   d) Universal Twisted Protocol
5. Which medium is used in the optical fibre cables to transmit data?
   a) Microwave b)infra red
   c)light d)sound
6. Which of the following is a small peripheral device with a sim slot to connect the computers to Internet?
   a) USB
   b) Dongles
   c) Memory card
   d) Mobiles
7. Which connector is used in the Ethernet cables?
   a) RJ11 b) RJ21
   c) RJ61 d) RJ45

8. Which of the following connector is called as champ connector?
   a) RJ11
   b) RJ21
   c) RJ61
   d) RJ45
9. How many pins are used in RJ45 cables?
   a) 8
   b) 6
   c) 50
   d) 25
10. Which wiring standard is used for connecting two computers directly?
   a) straight Through wiring
   b) Cross Over wiring
   c) Rollover wiring
   d) None
11. pick the odd one out from the following cables
   a) roll over
   b) cross over
   c) null modem
   d) straight through
12. Match the following

1. Ethernet	-	Port
2. RJ45 connector	-	Ethernet
3. RJ45 jack	-	Plug
4. RJ45 cable	-	802.3

   a.1, 2, 4, 3 b. 4, 1, 3, 2
   c. 4, 3, 1, 2 d. 4, 2, 1, 3

Part - II

Short Answers

1. Write a note on twisted pair cable.
2. What are the uses of USB cables?
3. Write a note on the types of RJ45 connector.
4. What is an Ethernet port?
5. What is the use of Crimping tool?
6. What are the types of twisted pair cables?
7. What is meant by champ connector?

Part - III

Explain in Brief Answer

1. Write a note on crossover cables.
2. Write a short note on RJ45 connector.
3. What are the differences between serial and parallel ports?
4. What is meant by null modem cable?
5. What are the components involved in Ethernet cabling?
6. What are the types of Fibre optic cables?

Part - IV

Explain in detail

1. What is meant by Registered Jack? Explain briefly the types of Jacks.
2. Explain wiring techniques used in Ethernet cabling.
3. Explain about RJ45 connector.
4. Explain the components used in Ethernet cabling.
5. Explain the types of network cables

STUDENT ACTIVITIES

1. Make your own Crossover cable.
   - A Purchase the following
     - i. a patch cable(UTP cat 5e / 6) with desired length
     - ii. RJ45 connector(8P8C modular plug) of both wiring schemes(T568A and T568B)
     - iii. Crimping Tool
   - B. Construct the cable using the method described in the text book, with the help of crimping tool
2. Connect two computers using Crossover cable for sharing resources

14
CHAPTER

Open Source Concepts

IZEYYW

LEARNING OBJECTIVES

To know the

- Need of Open Source Software.
- NS2 and its Use
- OpenNMS and Group which created OpenNMS
- OpenSource Hardware

14.1 Introduction

Free software and compilers were provided with early computer hardware. With these human understandable code the user can modify, add new code and identify the errors.

Can anyone change the codes in open source software?

Open source software has been developed by a variety of programmers. However, to add a new change to the software,the modified codewill be submitted to a group of dedicated programmers. These programmers then test the modified codes and if itsatisfies the appropriate rules, it will then be distributed toall

Why it called open source

Open Source simply refers to making the source code of the software freely available for users or other developers to use and make changes into the original repository or fork the project into and build a new one. Open source software is usually created and updated by many programmers around the world and made freely accessible. Proprietary software is owned by an organization or individual. The makers of proprietary software have not allowed the users or other developers to view or edit the source code. But the advantage of the proprietary software is that it gives more control, support, training, security and stability for user making the software reliable to the users

In a network it is not easy to find problems. Especially when there are more systems are connected, the complexity is more, so we need Network Software to Control , Analysis the Server, System, protocol, Network, Traffic flow and reports about ups and downs of network parts. Notification help the user and administrator easily find working status of network systems and hardware. Alert message give details of faults, where and when it happens.

NRCFOSS

National Resource Centre for Free and Open Source Software an Institution of Government of India. To help in development of FOSS in India

Organizations related to Open Source

- Apache Software Foundation
- The Document Foundation
- The Eclipse Foundation
- Free Software Foundation
- Linux Foundation
- OpenCourseWare Consortium
- Open Source Initiative

BOSS

BOSS (Bharat Operating System Solutions) Operating System Developed in India by C-DAC (Centre for Development of Advanced Computing) Help to prompt the use of open source software in India. It Supports many India Languge.

Types of open source license

- Apache License 2.0
- BSD 3-Clause "New" or "Revised" license
- BSD 2-Clause "Simplified" or "FreeBSD" license
- GNU General Public License (GPL)
- GNU Library or "Lesser" General Public License (LGPL)
- MIT license
- Mozilla Public License 2.0
- Common Development and Distribution License
- Eclipse Public License

When you change the source code, OSS requires the inclusion of what you altered as well as your methods. The software created after code modifications may or may not be made available for free.

Open-Source Software vs. Free Software

Although the terms are often used interchangeably, OSS is slightly different from free software. Both deal with the ability to download and modify software without restriction or charge. However, free software a concept developed in the 1980s by an MIT computer science researcher, Richard Stallman is defined by four conditions, as outlined by the nonprofit Free Software Foundation. These "four freedoms" emphasize the ability of users to use and enjoy software as they see fit.

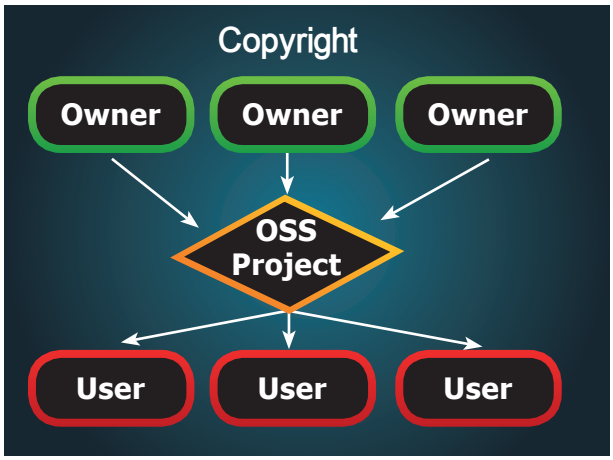
In contrast, the OSS criteria, which the Open Source Initiative developed a decade later, place more emphasis on the modification of software, and the consequences of altering source code, licensing, and distribution.

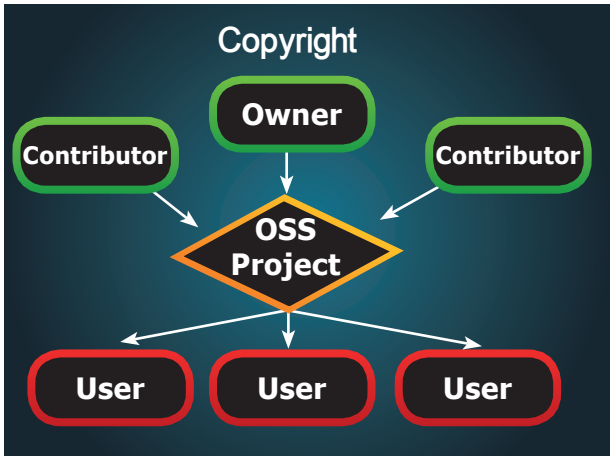
Obviously, the two overlap; some would say the differences between OSS and free software are more philosophical than practical. However, neither should be confused with freeware. Freeware usually refers to proprietary software that users can download at no cost, but whose source code cannot be changed.

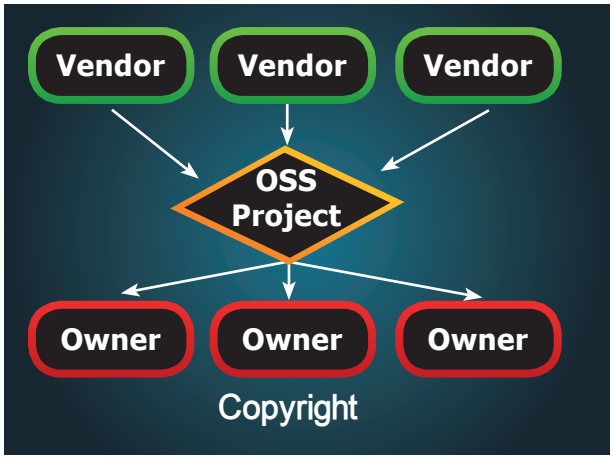
Open-Source Software and Developers

OSS projects are collaboration opportunities that improve skills and build connections in the field. Domains that developers can contribute to the open source community include:

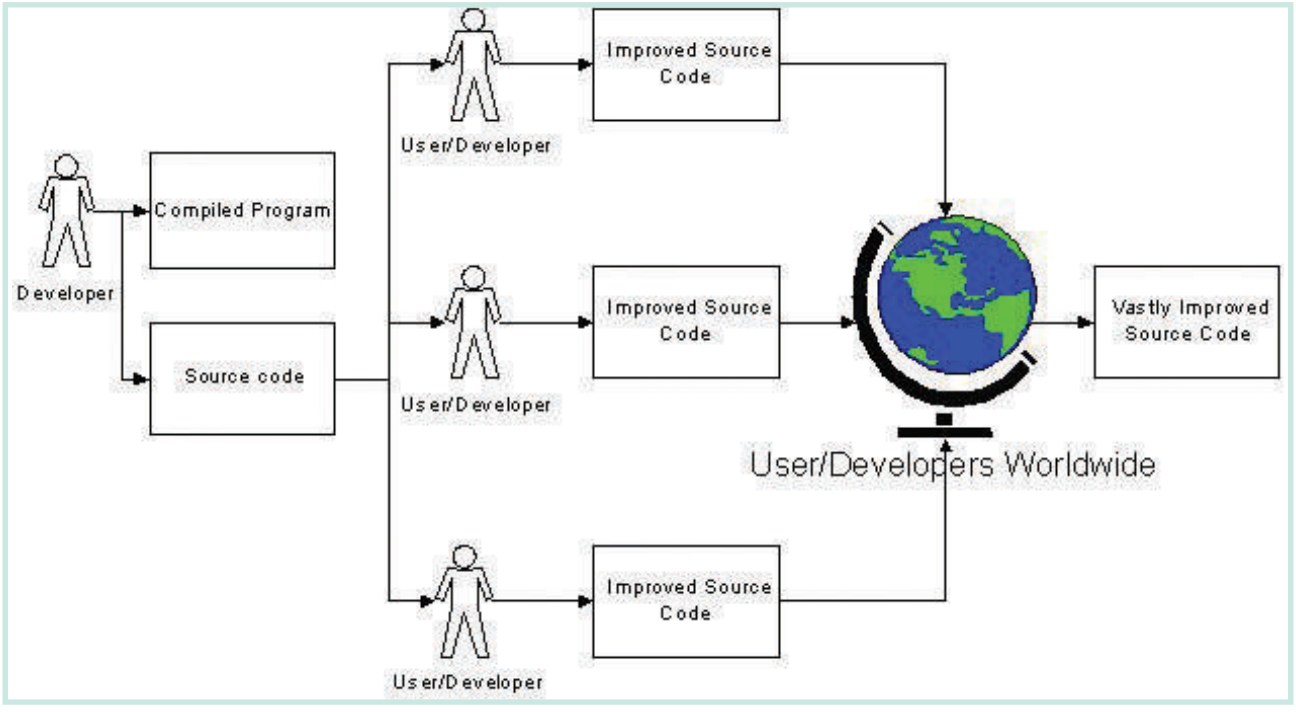
- **Communication tools.**
- **Distributed revision control systems.**
- **Bug trackers and task lists.**
- **Testing and debugging tools.**







How Open Source work



Benefits of Open Source software and tools

- There are many opensourcesoftwares. so, we can select and use any software that suits our needs.
- The complete options of the software can be used without any cost and restrictions.
- We can share our ideas with the team, write the required code and share it with many.
- As we can identify the programming techniques of group members, we can learn many ideas and make our program writing skills more efficient.
- The coding in opensourcesoftwaresare being groomed by many enthusiastical members of the group. So if we report problems that we have in the program they are quickly mended by the group's effort.
- As we can make changes to the opensourcesoftwares, we can add the most required features in the software
- Many open source software are very user friendly.

Like benefits Opensource Software also have Some Problems Like Difficult to work for beginners, Exchange of files to other softwares, Some time Lack of Responsibility, service and problems with hardware compatible.

Example of open source Application software

NS2 , OPEN NMS, Ubuntu , MySQL, PDF Creator, Open Office, 7zip GNUCASH, GIMP, BLENDER, AUDACITY, VLC, MOZILA FIREFOX, MAGENTO, ANDROID, PHP

14.2 Network simulation tool – NS_2

In computer **network**, **network simulation** is a method whereby a **software program** models the activities of a **network** by calculating the communication between the different **network** objects such as(routers, nodes, switches, access points, links etc.). A **network** simulator is a software program that replicates the functioning of a **computer network**. In simulators, the computer network is typically demonstrated with devices, traffic etc. and the performance are evaluated. Normally, users can then adapt the simulator to accomplish their precise analysis needs. The network parameters define the state of the network (node placement, existing links) and the events (data transmissions, link failures, etc.). A significant output of simulation is the trace files. Trace files can document every incident that happened in the simulation and are used for examination.

NS2 is the abbreviation of NETWORK SIMULATOR version 2. It was considered explicitly for exploration in network communication and event-driven open-source simulator in computer.

OTCL and c++ used to create and run NS2. NS2 works on Windows and Linux platforms, that supports wired or wireless network and also use the command line interface as a user interface, API a pure event base software tool with super simulation design, it has more models which help the user to get desired output easily.

14.3 Open NMS

Open NMS (Network Management System) is a free and open-source initiative grade network monitoring and management platform. It is established and maintained by a community of users ,developers and by the Open NMS Group, it offering services, training and support. The goal is for Open NMS to be an actually distributed, scalable management application platform for all features of the FCAPS (Fault, configuration, accounting, performance, security) network management model. Presently the emphasis is on Fault and Performance Management.

It was intended to cope tens of thousands of devices from a single server as well as achieve unlimited devices using a cluster of servers. OpenNMS comprises a discovery engine to routinely configure and manage network devices without operator intervention. It is written in Java and is issued under the GNU (General Public License.)

OpenNMS is the Worlds first software for Network monitor and management with opensource options. There are two types in this Meridian and Horizon. When we need stability and long term support choose Meridian which is best for Enterprises as well as businesses. Horizon used where innovation occurs frequently. It is Best for IT-ecosystem, new technologie monitoring. OpenNMS was Released in 1999 by Steve Giles, Brian Weaver, and Luke Rindfuss.

In 2004 OpenNMS Group was created by Balog, Matt Brozowski, and David Hustace. It is written in Java and can run on all type of platform. It gives us Event management & Notification, Discovery & Provisioning, service monitoring and Data Collection. Won lot of awards for best of opensource software.

OpenNMS has three main functional areas:

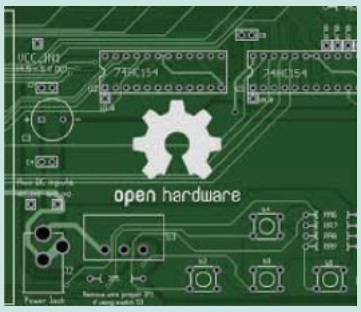
- Service monitoring, where a number of monitor modules can govern if network-based services (ICMP, HTTP, DNS, etc.) are accessible.
- Data Gathering by using SNMP and JMX.
- Event management and notifications, which comprises of alarm reduction and a robust announcement system with accelerations and duty schedules.

OpenNMS is recognized for its scalability. Though it can be easily used to handle a small SMB Network, it is also accessible enough to be used in place of large enterprise management products such as HP Open View, IBM Micro muse or IBM Tivoli.

In this period of increased competition and cyber crimes, the computers used by indivudals or business organisations may have spy hardwares of rivals. Open source hardware technology helps in such threats. In this technique we get the components of the hardware and its circuit diagram, so that we can remove suspicious spyware if found.

Open Source Hardware

- Remix
- Remake
- Remanufacture
- Redistribute
- Resell
- Study and Learn



POINTS TO REMEMBER

- Open Source denotes to some program whose source code is made available for usage or reform as users or other developers see appropriate
- In simulators, the computer network is typically demonstrated with devices, traffic etc. and the performance are evaluated.
- A significant output of simulation is the trace files. Trace files can document every incident that happened in the simulation and are used for examination.
- NS2 has C++ and Object-oriented Tool Command Language (OTcl) of languages 2.
- It link together for C++ and the OTcl using TclCL.
- Open NMS (Network Management System) is a free and open-source initiative grade network monitoring and network management platform.
- Network monitoring software notifications help the user/administrator for fixed errors.

GLOSSARY

NS2	Network Simulation 2
OpenNMS	First Open Source Network Management Software
Trace File	A document file, consists of every incident happens in a simulation
OTCL	Object-oriented Tool Command Language
FCAPS	Fault, configuration, accounting, performance, security
GNU	General Public License
SSFNet	Scalable Simulation Framework Net Models
API	APPLICATION PROGRAM INTERFACE
SOURCE CODE	Set of Instructions that decide, how the software should work
BOSS	Bharat Operating System Solutions
C-DAC	Centre for Development of Advanced Computing

EVALUATION

8SMNDN

Part - I

Choose the correct answer

1. If the source code of a software is freely accessible by the public, then it is known as
   a) freeware
   b) Firmware
   c) Open source
   d) Public source

2. Which of the following is a software program that replicates the functioning of a computer network?
   a) Network software
   b) Network simulation
   c) Network testing
   d) Network calculator

3. Which of the following can document every incident that happened in the simulation and are used for examination?
   a) Net Exam
   b) Network hardware
   c) Trace file
   d) Net document

4. Which is an example of network simulator?
   a) simulator
   b) TCL
   c) Ns2
   d) C++

5. Fill in the blanks : NS2 comprises of _____key languages?
   a) 13 b) 3 c) 2 d) 4

6. Choose the Correct Pair from the following to build NS2
   a) UNIX & TCL
   b) UNIX & a. C++
   c) C++ & OTcl
   d) C++ & NS2

7. Which of the following is not a network simulation software?
   a) Ns2
   b) OPNET
   c) SSFNet
   d) C++

8. Which of the following is a open source network monitoring software?
   a) C++
   b) OPNET
   c) Open NMS
   d) OMNet++

9. Open NMS was released in .....
   a) 1999 b) 2000
   c) 2003 d) 2004

10. OpenNMS Group was created by.....
    a) Balog
    b) Matt Brozowski
    c) David Hustace
    d) All of them.

Part - II

Short Answers

1. Explain the History of open source software
2. What is meant by network simulator?
3. What is trace file?
4. Write short notes on NS2.
5. Explain NRCFOSS.
6. Write short note on Open NMS?

Part - III

Explain in Brief Answer

1. What are the uses of Open source Network Software?
2. Explain Free software.
3. List out the Popular open source software.
4. Write note on open source hardware.
5. What are the main functional areas of Open NMS?
6. Explain Types of Organisations related to Open Source.

Part - IV

Explain in detail

1. Differentiate Proprietary and open source software.
2. List out the Benefits of Open Source Software
3. Explain various Open Source License.

STUDENT ACTIVITIES

1 Mention Open source software and free software names that not explain in this chapter.

2. Mention Software that are accounts related.
3. Mention Open Source Developing and maintaining companies

15
CHAPTER

ME4277

E-Commerce

LEARNING OBJECTIVES

- To learn the concept of E-Commerce.
- To know the brief history of E-Commerce.
- To analyze different types of E-Commerce business models and revenue models.
- To distinguish between E-Commerce and Traditional commerce.
- To understand the advantages and disadvantages of E-Commerce.

15.1 Introduction to E-Commerce

C7BQKY

"The wise possess all". Anyone who is quick to identify and adopts innovations would be successful. Commerce always profits from innovations. Successful businesses quickly identify developing opportunities in emerging new technology, and expand their commercial capabilities.

The customer goes to the market, checking out a variety of products, choosing required stuff, purchasing them and then paying the specific amount is traditional commerce. However, recent ways of buying or selling goods and services have come up with technology innovations.

In near future commercial activities such as buying or selling of goods between merchant and consumer will be bygone and forgotten like barter system.

Figure 15.1 Conventional commodities exchanging System

Like the most other things, the Internet and technology have changed the way that commerce is conducted. Refer Figure 15.1

In 1996, IBM coined the term E-Business. Just, as business is broader than commerce, E-Commerce is a subset of E-Business. E-Commerce is commercial transaction through Internet, but E-Business entirely depends on the Internet for its every intra-company and inter-company activities such as procurement of raw materials, marketing, finance, manufacturing, selling and negotiation.

While, E-Commerce is limited with monetary transactions using Internet E-Business is grounded on technologies such as Network Infrastructures (like Internet, Intranet, Extranet), Multimedia content & network publishing infrastructures (like HTML, Online Marketing), Messaging & information distribution infrastructures (like EDI, e-mail, http, Computerized Inventory Management Systems) and other Common business service infrastructures (like electronic payments gateways, globalized Supply Chain Management (SCM), Online Transaction Processing). See Figure 15.2

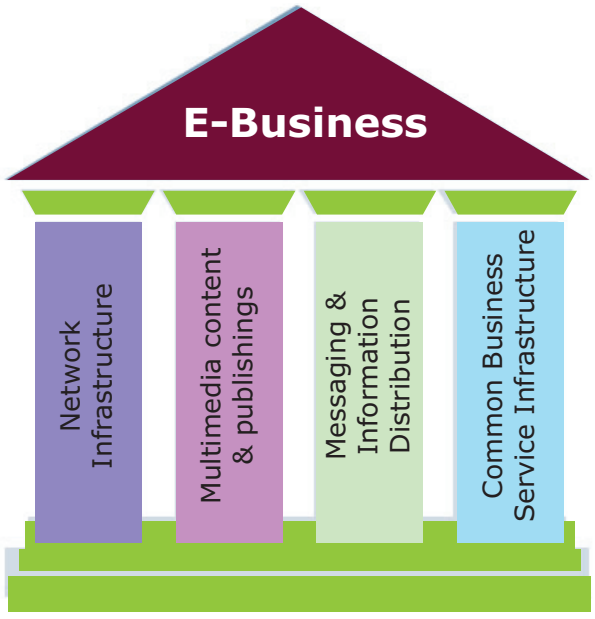


Figure 15.2 E-Business building block

A company can be called E-Business if and only if

- It has the ability to conduct business electronically over Internet.
- It manages payment transaction through Internet.
- It has a platform for selling products & services via Internet.

Definition

E-Commerce is currently one of the most important aspects of the Internet era. Just like the words e-mail, e-book with the prefix 'e' ('e' stands for electronic) Commerce and Internet makes E-Commerce. It also allows the consumers to exchange goods and services with no barriers of time or distance. Electronic commerce has expanded rapidly over the past few years and is predicted to accelerate.

> E-Commerce can be described as the process of buying or selling products, services or information via computer networks.

It could be a consumer based retail sites or auction sites or trade between large business organizations. The commodity could be a laptop or a wrist watch or it could be an operating system or a simple browser plugin.

The goods, information or services are delivered in tangible or electronic form. See Figure 15.3

Figure 15.3 Tangible and intangible goods.

- Goods - e.g. mobile phones, digital cameras, clothes, accessories, antivirus.
- Information - e.g. subscription to some newspapers, scientific journals, television channels.
- Services - e.g. matrimonial services, placement services.
- Tangible form – e.g. a digital camera purchased by a consumer from an online shopping website which might be delivered at the requested address.
- Electronic form – e.g. a music album or a software downloaded from a site which might be delivered in electronic form.

15.2 The Evolution of Electronic Commerce

E-Commerce is not a completely new type of commerce. The dawn of E-Commerce started few decades ago and, continues to grow exponentially. It first emerged on private networks in 1970s. Electronic Data Interchanges and teleshopping together paved the way for the E-Commerce.

The history of modern E-Commerce is closely twisted together with the history of the Internet. E-Commerce became really possible when the Internet was opened to commercial use. Online shopping started to grow when National Science Foundation opened the Internet to the public in 1991. Since then businesses have started to take up residence at websites.

With the progress of the Internet technology and vastly developed global Internet community, large number of Dotcoms, FinTech and Internet Startups have appeared and a strong foundation of electronic commerce continues to build.

The Internet had provided new commercial potential not only for large organizations, but also provided a sustainable entry point for Small and Medium-sized Enterprises (SMEs) of E-Commerce. Today, E-Commerce is no longer an exclusive domain of large organizations or private networks.

Even though E-Commerce has been existing since few decades, it has recently sustained significant growth. It is because the Internet has transformed from an auxiliary communication medium of academics and large organizations to an entrenched communication medium that extends nearly all parts of mainstream society. Integrated with commercialization of the Internet, personal computers and electronic payment systems together made E-Commerce flourish.

In 1979, Michael Aldrich, an English entrepreneur, proposed a technique that enables online transaction processing between consumers and businesses, or between businesses. It was later proficiently called as E-Commerce. In 1980 he invented a multi-purpose home infotainment device called Teleputer, which was a fusion of Television, Computer and Telecom networking technologies.

Growth of E-Commerce is also related to the socio-technological changes. The more, the medium becomes deep-rooted, the more, are the users drawn towards it. Increase of users, increases the markets. As the markets expand, more business organizations are attracted. The more businesses accumulate it create competition. The competition leads to innovation; innovation in turn drives the development of technology; technology facilitates E-Commerce's growth. See Figure 15.4

In August 11, 1994 by noon of the day, Phil Brandenberger of Philadelphia (U.S.A), bought a music CD (Sting's "Ten Summoners' Tales") from Kohn of Nashua (U.S.A) and paid $12.48 plus shipping charges using his credit card through online. This is marked as the first true E-Commerce transaction.

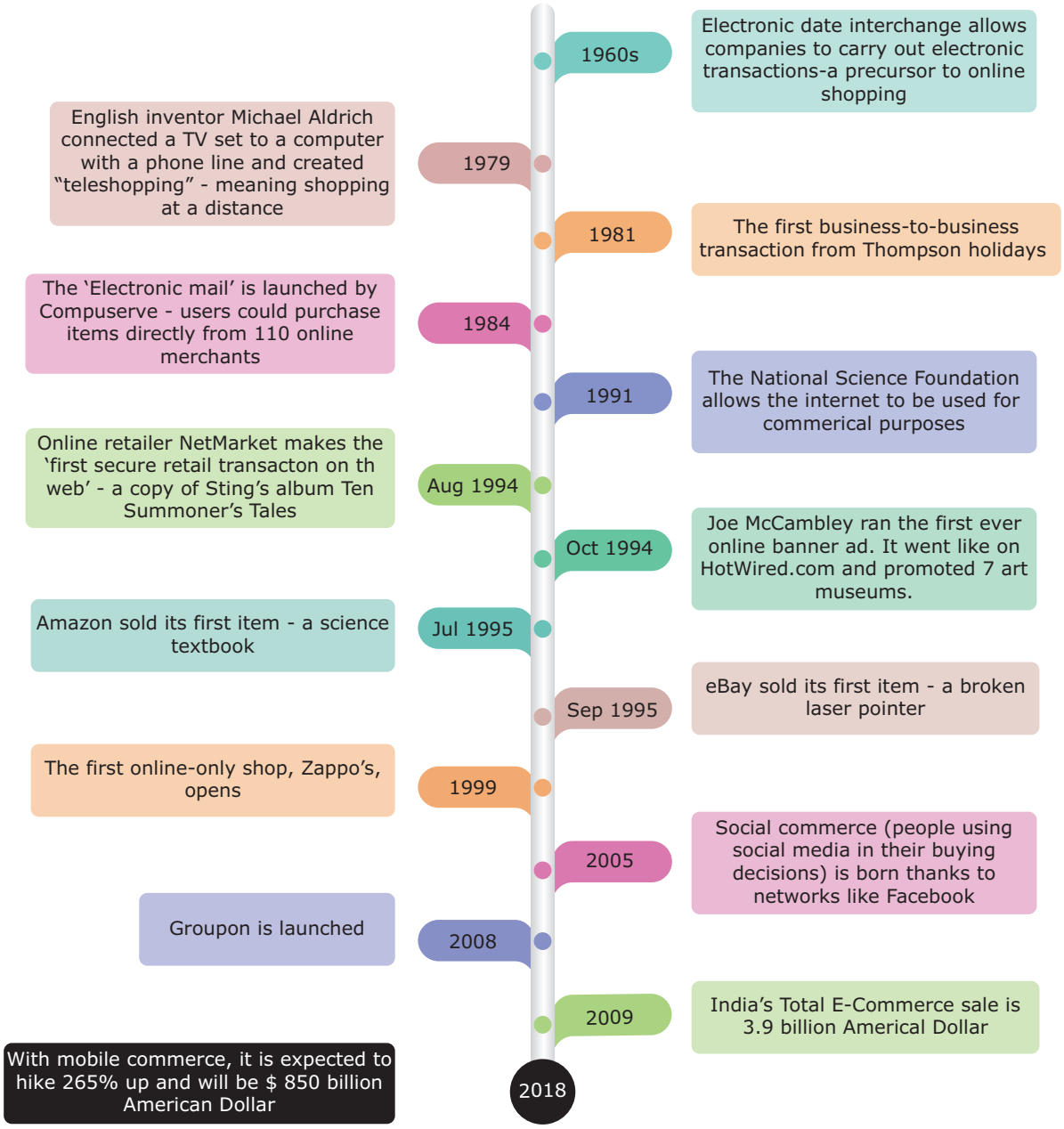


Figure 15.4 Timeline describing various events in E-Commerce

15.3 The Development and Growth of Electronic Commerce

Economists describe four distinct waves (or phases) that occurred in the Industrial Revolution. In each wave, different business strategies were successful. Electronic commerce and the information revolution brought about by the Internet likely go through such series of waves. Refer Figure 15.5

- **The First Wave of Electronic Commerce: 1995 -2003**

The Dotcom companies of first wave are mostly American companies. Thereby their websites were only in English. The Dotcom bubble had attracted huge investments to first wave companies.

As the Internet was mere read-only web (web 1.0) and network technology was in its beginning stage, the bandwidth and network security was very low. Only EDI and unstructured E-mail remained as a mode of information exchange between businesses. But the first wave companies enjoyed the first-move advantage and customers had left with no options.

- **The Second Wave of Electronic Commerce: 2004 – 2009**

The second wave is the rebirth of E-Commerce after the dotcom burst. The second wave is considered as the global wave, with sellers doing business in many countries and in many languages. Language translation and currency conversion were focused in the second wave websites. The second wave companies used their own internal funds and gradually expanded their E-Commerce opportunities. As a result E-Commerce grows more steadily, though more slowly. The rapid development of network technologies and interactive web (web 2.0, a period of social media) offered the consumers more choices of buying. The increased web users nourished E-Commerce companies (mostly B2C companies) during the second wave.

- **The Third Wave of Electronic Commerce: 2010 – Present**

The third wave is brought on by the mobile technologies. It connects users via mobile devices for real-time and on-demand transactions. mobile technologies. It connects users via mobile devices for real-time and on-demand transactions. Not only the information is filtered by time, but

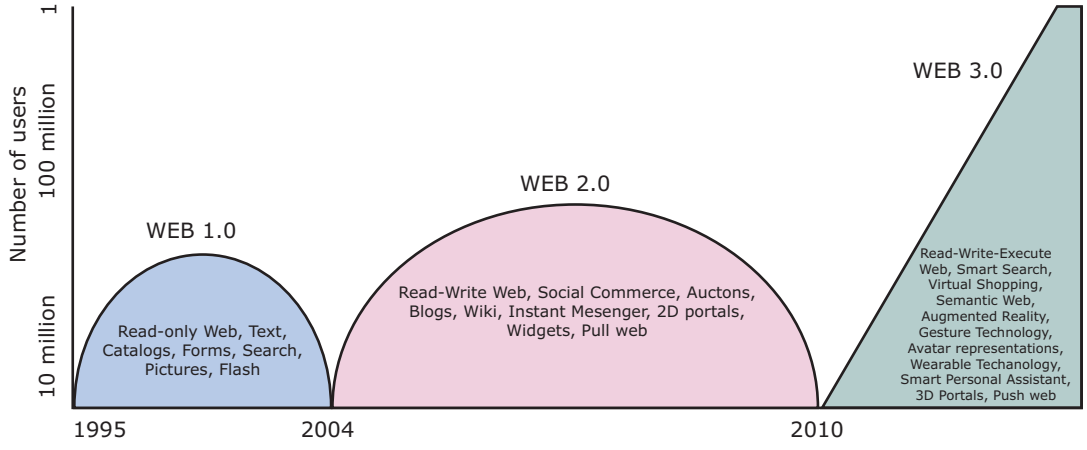


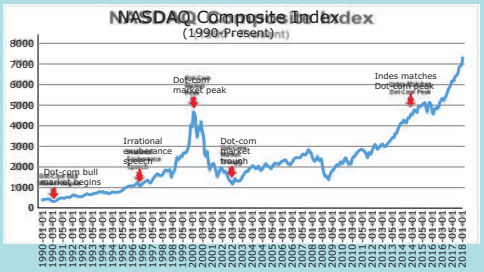
Figure: 15.5 Evolution of Electronic Commerce

also the geographic coordinates are used to screen the specific location-tailored information properly. The term Web 3.0, summarize the various characteristics of the future Internet which include Artificial Intelligence, Semantic Web, Generic Database etc.

Dotcom Bubble

The Dotcom Bubble was a historic excessive growth (excessive assumption) of economy that occurred roughly between 1995 and 2000. It was also a period of extreme growth in the usage and adaptation of the Internet as well.

In the late 1995, there was a tremendous development in US equity investments in Internet-based companies. During the dotcom bubble, the value of equity markets grew exponentially with the NASDAQ composite index of US stock market rising from under 1000 points to more than 5000 points.



Dotcom Burst

The Nasdaq-Composite stock market index, fell from 5046.86 to 1114.11. This is infamously, known as the Dotcom Crash or Dotcom Burst. This began on March 11, 2000 and lasted until October 9, 2002. During the crash, thousands of online shopping companies, like as Pets.com failed and shut down. Some companies like Cisco, lost a large portion of their market capitalization but survived, and some companies, like Amazon declined in value but recovered quickly.

15.4 Classification of E-Commerce Business models

Business organizations, Consumers and Government (also called as Administrations) are the major parties in the E-Commerce. Sometimes Employees (Informal workers) also indulge in this system. Based upon the entities involved in transaction, E-Commerce has been classified into the following typical categories. The model in which the government plays as an entity is termed as e- Governance. See Figure 15.7

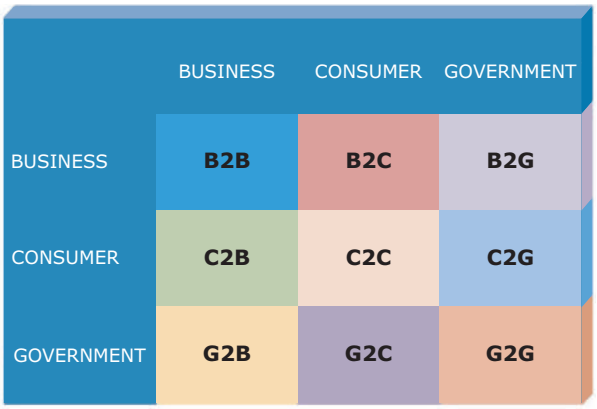


Figure 15.6 E-Commerce business models

1. Business to Business (B2B)
2. Business to Consumer (B2C)
3. Business to Government (B2G)
4. Consumer to Business (C2B)
5. Consumer to Consumer (C2C)
6. Consumer to Government (C2G)
7. Government to Business (G2B)
8. Government to Consumer (G2C)
9. Government to Government (G2G)

- **Business to Business (B2B)**

In B2B E-Commerce, commercial transactions take place between different business organizations, through the Internet. For example, a cycle company

may buy tyres from another company for their cycles. When compared to other models, the value per transaction in B2B transaction is high, because of bulk purchases. The company also might get the advantage of discounts on bulk purchases. See Figure 15.7

Out-sourcing and Off-shoring are generally associated with B2B E-Commerce.

- If a company's work is hired to another company, it would be termed as out-sourcing.
- If the work is outsourced to a company, which is outside of its own country, is termed as off-shoring.

Figure 15.7 Business to Business

- **Business to Consumer (B2C)**

In B2C E-Commerce, commercial transactions take place between business firms and their consumers. It is the direct trade between companies and end-consumers via the Internet. B2C companies sell goods, information or services to customers through online in a more personalized dynamic environment and is considered as real competitor for a traditional storekeeper. An example of B2C transaction is a book company selling books to customers. This mode is intended to benefit the consumer and can say B2C E-Commerce works as 'retail store' over Internet. See Figure 15.8

Figure 15.8 Business to Consumer

- **Business to Government (B2G)**

B2G is a business model that refers to business organizations sells products, services or information to Governments or to its administrations. In other words, when a company get paid for its goods, services by the Government through Internet it is called as B2G model. B2G networks models provide a way for businesses to bid on Government projects or products those Governments might need for their organizations. e.g. A Government or its administration buys laptops for students from a business. See Figure 15.9

Figure 15.9 Business to Government

- **Consumer to Business (C2B)**

C2B can be described as a form of E-Commerce where, the transaction is originated by the consumers. The consumers will fix a set of requirements or specific price for a service or a commodity. C2B model, is also called as reverse auction model. Here, customer bid his price for a service or a product. Then E-Commerce business entity will match the requirements of the consumers to the best possible extent.

For instance, in a travel website (eg.yatra.com) a consumer may specify his dates of travel, his source and destination, number of tickets required and range of hotel etc. The website then finds out the various options for him which best meets his requirements. These websites generate revenue through affiliate links, sponsored advertisement or even a small commission in every booking. e.g. Name-your-price websites. See Figure 15.10

Figure 15.10 Consumer to Business

- **Consumer to Consumer (C2C)**

C2C in E-Commerce provides opportunity for trading of products or services among consumers who are connected through the Internet. In brief when something is bought and sold between two consumers using Internet it is called C2C E-Commerce. Here the websites act as a platform to facilitate the transaction. The electronic tools and Internet infrastructure are employed to support transactions between individuals. Typically, this type of E-Commerce works as Consumer to Business to Consumer (C2B2C). It means that a consumer would contact a business in search for a suitable customer. Most of the auction websites and matrimonial websites are working on this methodology.

For example, a consumer who wants to sell his property can post an advertisement on the website (eg:timesclassifieds.com). Another person who is interested in buying a property can browse the property, advertisement posted on this site. Thus, the two consumers can get in touch with each other for sale/purchase of property through another business' website. See Figure 15.11

Figure 15.11 Consumer to Consumer

- **Consumer to Government (C2G)**

Citizens as Consumers and Government engage in C2G E-Commerce. Here an individual consumer interacts with the Government. C2G models usually include income tax or house tax payments, fees for issuance of certificates or other documents. People paying for renewal of license online may also fall under this category. See Figure 15.12

Figure 15.12 Consumer to Government

- **Government to Business (G2B)**

G2B is closely related to B2G. G2B in E-Commerce refers to a business model where Government providing services or information to business organization. It may be a formal offer such as a takeover bid for a road project. See Figure 15.13

Figure 15.13 Government to Business

G2B is a part of e-governance. The Government provides information about business rules, requirement and permission needed for starting a new business, and other specifications in its portal. The objective of G2B is to reduce burdens on business, provide one-stop access to information thereby boost the economy. e.g. ebiz.gov.in See Figure 15.14

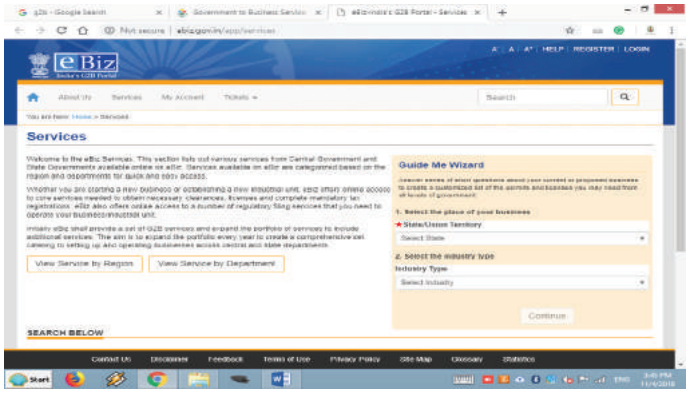


Figure 15.14 ebiz.gov.in

- **Government to Consumer (G2C)**

G2C in E-Commerce is very similar to C2G. Here the Government provides platform for its citizens to avail its services and information through th Internet. The services may be issuance of certificates through online.e.g. https://csc.gov.in/governmenttocitizen. See Figure 15.15

Figure 15.15 Government to Consumer

- **Government to Government (G2G)**

G2G is the online (usually non-commercial) interaction between Government organizations or departments. G2G's principle objective is to implement e-governance rather commerce. G2G model in e-governance involves distributing data or information between its agencies/departments. G2G systems can be classified into two types

- Internal facing or local level - joining up a single Government's bureaucracies. e.g. https://www.nic.in/
- External facing or international level - joining up multiple Governments' bureaucracy.

See Figure 15.16

Figure 15.16 Government to Government

15.5 E-Commerce Revenue Models

Apart from regular selling of commodities, today there are many other ways by which companies can make money from the Internet. The other forms of E-Commerce activities are:

1. Affiliate site is a form of third party marketing in which the site owner get paid based on the performance. The affiliate site may be a price comparison service or shopping directories or review sites or blogs that contain a link to a normal retailing site and are paid when a customer makes a purchase through it. The affiliate site usually attracts visitors by offering more information and tutorials on some specific product or a topic. See Figure 15.17 to Figure 15.23

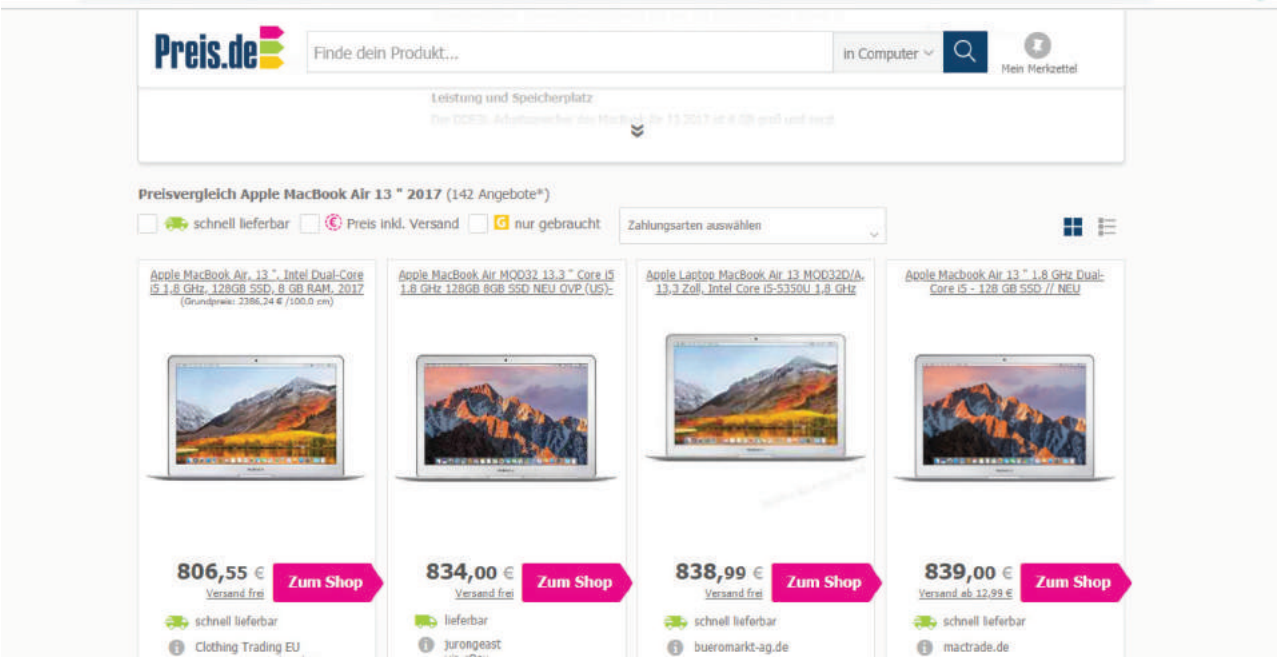


Figure 15.17 Affiliate site (price comparation website)

2. Auction site is a kind of website, that auctions items on the Internet and levies some commission from the sales. e.g. https://www.ebay.com/

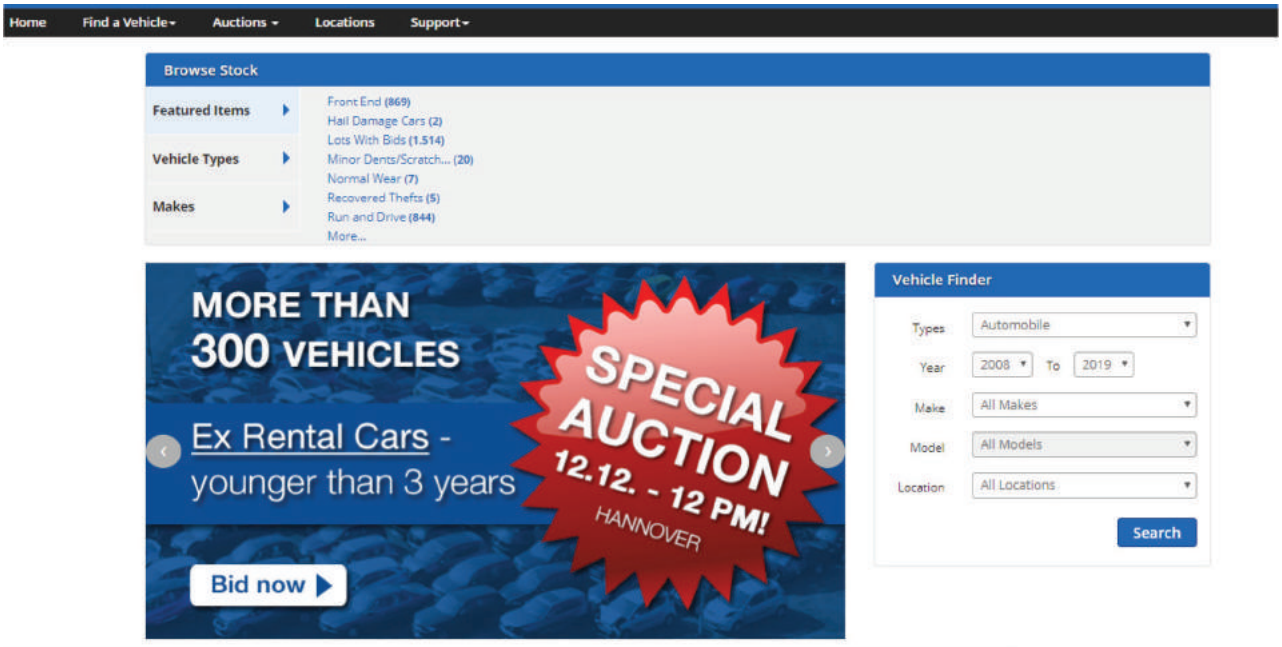


Figure 15.18 E-Auction website

3. Banner advertisement site displays advertisements of other companies in its websites and thereby earns revenue.

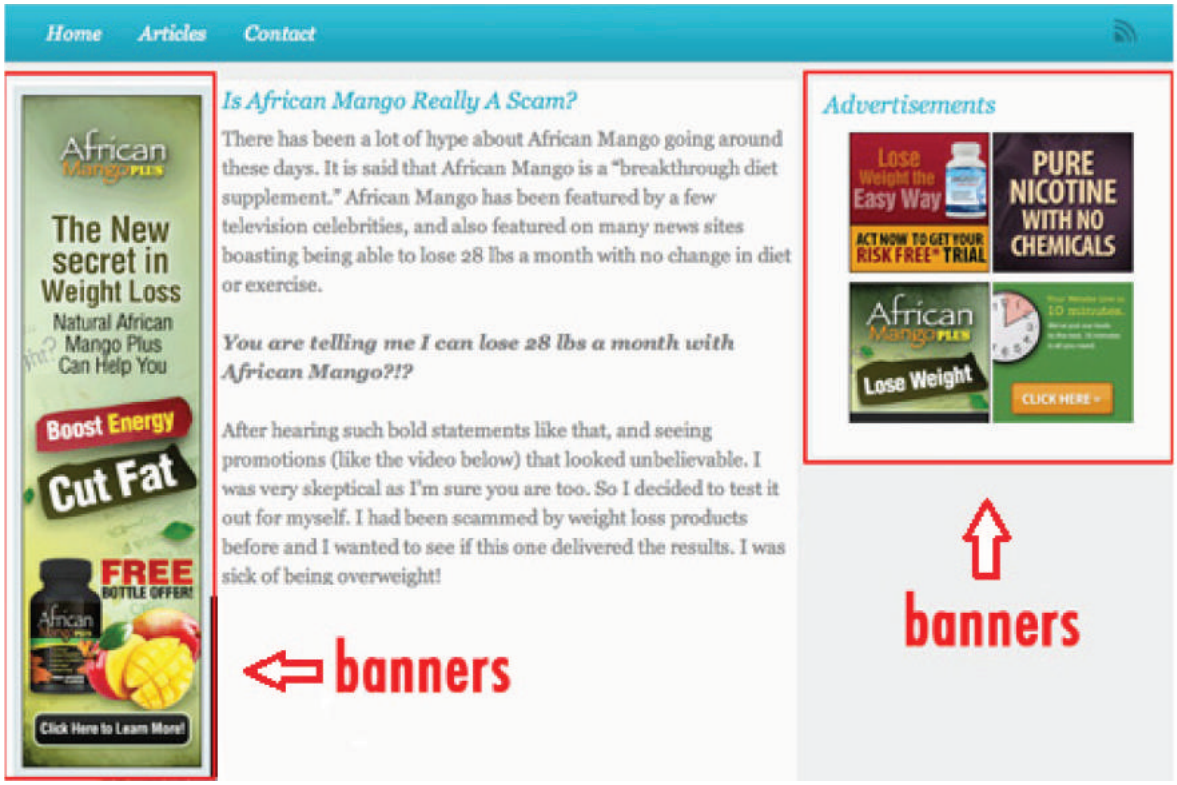


Figure 15.19 Banner advertisement site

4. Bulk-buying sites collect a number of users together all of who want to buy similar items; the site negotiates a discount with the supplier and takes a commission. e.g. https://www.alibaba.com/

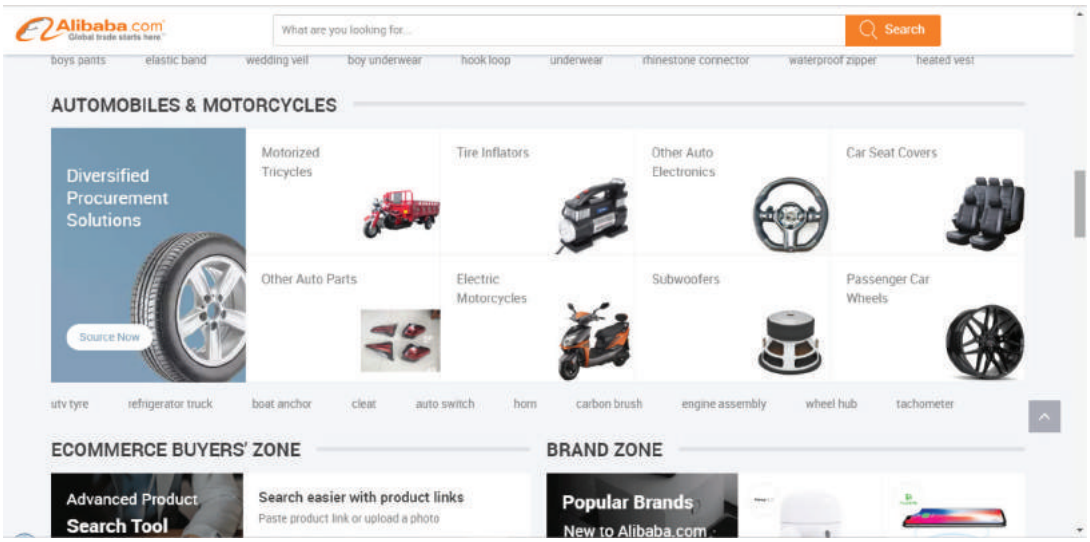


Figure 15.20 Bulk-buying sites

5. Digital publishing sites effectively host the e-books or magazines on the web. They make profits in a number of ways such as advertising, selling etc., https://wordpress.org/

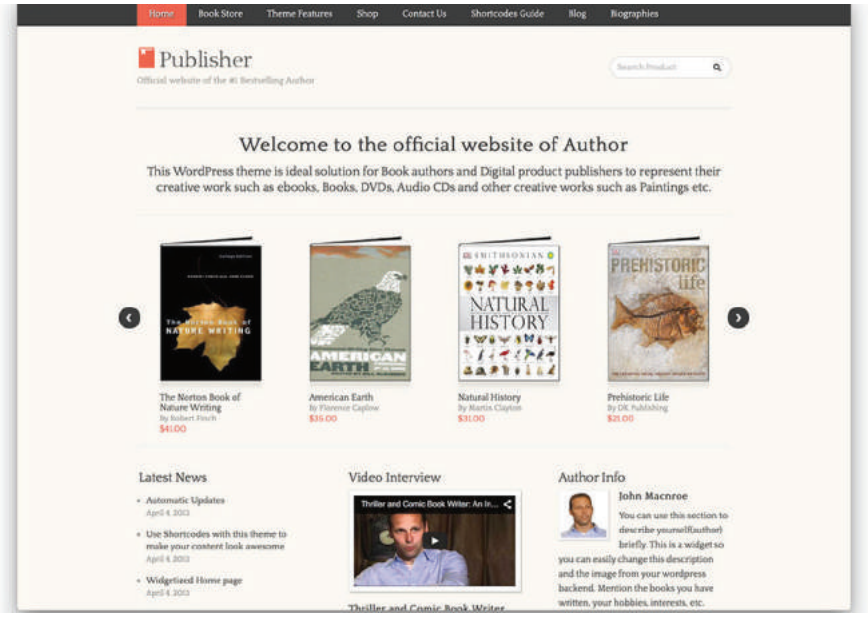


Figure 15.21 Digital Publishing website

6. Licensing sites allow other websites to make use of their software. For example, the search engines which allow a visitor of the site to search within the website more easily.

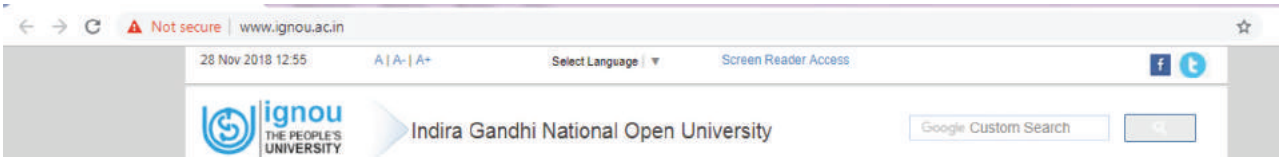


Figure 15.22 Google Search in IGNOU website

7. Name-your-price sites are just like normal retail sites. In contrast, the buyer negotiates with the retailer for a particular product or service. https://in.hotels.com/

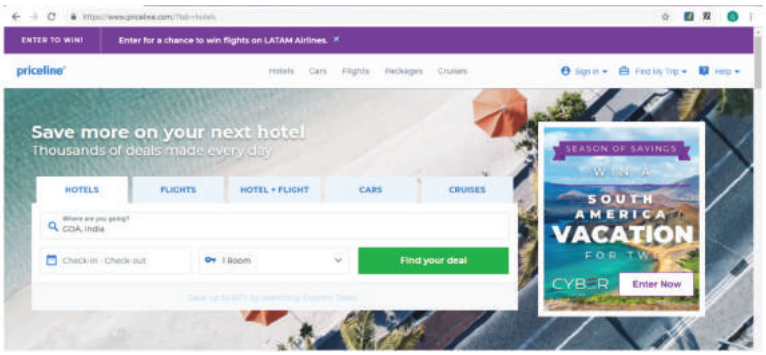


Figure 15.23 Name-your-price sites

8. Online Shopping mall site allows multi E-Commerce traders to assemble together on a single website. Often these sellers would be related to each other, for example they may all sell luxury goods. This site would take a percentage of their profit.

15.6 Comparison between Traditional Commerce and E-Commerce

E-Commerce isn't just commerce anymore. Even though they share the primary principle of buying and selling goods and services, there is a difference between traditional commerce and E-Commerce.

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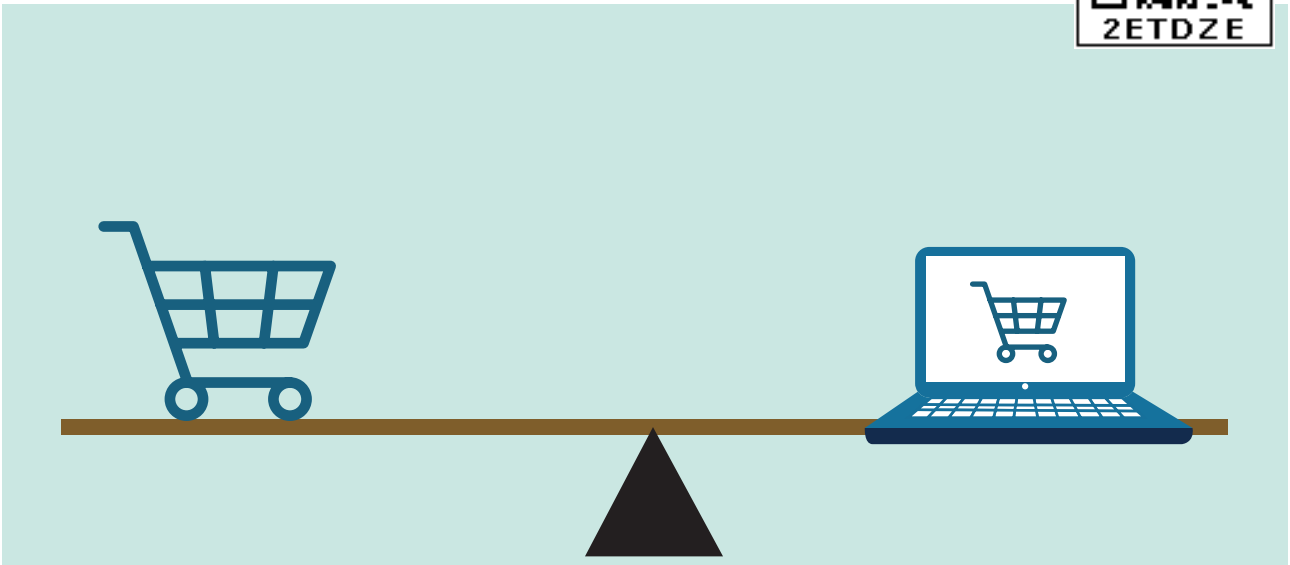


Figure 15.24 Traditional vs E-Commerce

Table 15.1 Traditional vs E-Commerce

Traditional Commerce	E-Commerce
Traditional commerce is buying or selling of products and services physically.	E-Commerce carries out commercial transactions electronically on the Internet.
Customer can easily identify, authenticate and talk to the merchant.	Neither customer nor merchant see the other.
Physical stores are not feasible to be open all the time.	It is always available on all time and all days of the year.
Products can be inspected physically before purchase.	Products can't be inspected physically before purchase.
Scope of business is limited to particular area.	Scope of business is global. Vendors can expand their business Worldwide.
Resource focus Supply side.	Resource focus Demand side.
Business Relationship is Linear.	Business Relationship is End-to-end.
Marketing is one way marketing.	One-to-one marketing.
Payment is made by cash, cheque, cards etc.	Payment system is mostly credit card and through fund transfer.
Most goods are delivered instantly.	It takes time to transport goods.

15.7 Advantages and Disadvantages of E-Commerce

The pros and cons of E-Commerce affect three major stakeholders: consumers business organisations, and society.

The following are the advantages and disadvantages of E-Commerce for a consumer.

Advantages

- E-Commerce system is operated on all days and all the day. It is able to conduct business 24 x 7. Neither consumer nor suppliers need physical store to be opened to do business electronically. People can interact with businesses at the time of their convenience.
- Speed is a major advantage in E-Commerce. Advanced Electronic communications systems allow messages to reach across the world instantaneously. There is no need to wait days for a catalogue to arrive by post. Communication delay is not a part of the Internet or E-Commerce world.
- The Internet is too easy to 'shop around' for products and services that may be more cheaper and effective than left to buy only in a Brick and Mortar shop. It provides an opportunity to buy at reduced costs. It is possible to, explore the Internet, identify original manufacturers, thereby bypass wholesalers and achieve a cheaper price.
- The whole world becomes a shop for today's customers. They can have wide choice by comparing and evaluating the same product at different websites before making a purchase decision.
- Customers can shop from home or anywhere at their convenience. They don't need a long wait to talk to a salesman. They can read the details regarding model numbers, prices, features etc. of the product from the website and buy at their own convenience. Payments can also be made through online.

Disadvantages

- E-Commerce is often used to buy goods that are not available locally but from businesses all over the world. Physical goods need to be transported, which takes time and costs money. In traditional commerce, when we walk out of a shop with an item, it's ours; we have it; we know what it is, where it is and how it looks. But in E-Commerce we should wait between placing the order and having the product in hand. Some E-Commerce companies handle this by engaging their customer updating status of their shipments.
- Unlike returning goods to a traditional shop returning goods through online is believed to be an area of difficulty. The doubts about the period of returning, will the returned goods reach source in time, refunds, exchange and postage make one tiresome.
- Privacy issues are serious in E-Commerce. In E-Commerce generating consumer information is inevitable. Not all the companies use the personal information they obtained to improve services to consumers. Many companies misuse the information and make money out of it. It is true that privacy concerns are a critical reason why people get cold feet about online shopping.

- Physical product disputes are a major disadvantage in E-Commerce. E-Commerce purchases are often made on trust. This is because, we do not have physical access to the product. Though Internet is an effective channel for visual and auditory information it does not allow full scope for our senses. We can see pictures of the perfumes, but could not smell their fragrance; we can see pictures of a cloth, but not its quality. If we want to inspect something, we choose what we look at and how we look at it. But in online shopping, we would see only the pictures the seller had chosen for us. People are often much more comfortable in buying the generic goods (that they have seen or experienced before and in which there is little ambiguity) rather than unique or complex things via the Internet.
- We couldn't think of ordering a single ice cream or a coffee from a shop in Paris. Though specialized and refrigerated transport can be used, goods bought and sold via the Internet need to survive the trip from the supplier to the consumer. This makes the customers turn back towards traditional supply chain arrangements for perishable and non-durable goods.
- Delivery ambiguity. Since supplying businesses can be conducted across the world, it can be uncertain whether they are indeed genuine businesses or just going to take our money. It is pretty hard to knock on their door to complain or seek legal recourse. Further, even if the item is sent, it is easy to start bothering whether or not it will ever arrive on time.

The following are some of the advantages and disadvantages of E-Commerce for a Business organisation.

Benefits of E-Commerce to a business organisation.

- Access to Global Market: The Internet spans the world of E-Commerce, and it is possible to trade with any business or a person who is connected with the Internet. It helps to access the global marketplace. Simple local businesses such as herbal product stores are able to market and sell their products internationally using E-Commerce. Thus, the whole world becomes a potential market for an E-Commerce company.

Disruptive innovations in E-commerce

The innovations which replace the existing technologies are called as disruptive innovations. Disruptive innovation creates a new market. Not all innovations are near disruptive. The first automobiles in the late nineteenth century were a great innovation. But it didn't affect existing animal-based road transport market until 1908 when Henry Ford introduced affordable motor cars. The term disruptive innovation was first coined by Clayton M in his book "The Innovator's Dilemma".

Example: Film cameras market is disrupted by digital camera innovations, floppy disk market is interrupted by CD and USB innovations. E-Commerce itself is a disruptive innovation.

Voice Shopping and chatbots

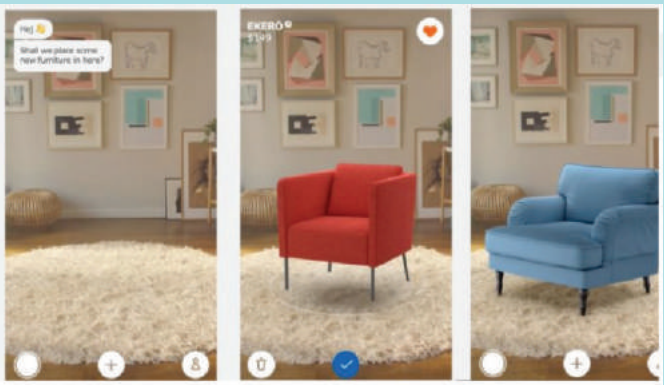
The future navigational experience is less text-based but more conversation-based in order to find any information. Humans can speak 150 words per minute but can type only 40 words. Voice activated speakers like google home / alexa are capable of doing much more than just playing favorites songs. Through vice shopping these devices place order to e-shopping websites. In the other end chatbots interact with consumers and take the orders. The Artificial Intelligence, machine learning and big data technology allows consumers interact with chatbots instead a customer relation officer to buy a things via phone.

- Lower Transaction Cost: E-Commerce reduces the cost of business transactions substantially. For instance, significant number of customer service representatives in a bank can be reduced by using net banking. Since these interactions are initiated by customers, the customers provide a lot of data for the transactions that may otherwise need to be entered by employees. This means that some of the work and costs are effectively shifted to customers; this is referred as 'customer outsourcing'.
- 24X7 working: A website is open all 24 hours, 7 days in a week. As E-Commerce firm can provide information about its products and services to customers around the clock, it can thus, take orders, keep an eye on delivery of goods and receive payments at any time.
- Low cost of entry: Though E-Commerce was first emerged in private networks it did not remain the same. Internet has changed the face of E-Commerce. The Internet is all about democratization. Internet is a place where the small guy can effectively fight against the giants and hope to win. Days when E-Commerce was only for affordable large national chains are gone. Today, it is common for retailers to move their traditional store to online with very less add-on only for building a good website.
- Computer platform-independent: Most computers have the ability to communicate via the Internet, irrespective of operating systems and hardware. Consumers need not have to upgrade their computer or network to participate in E-Commerce. They are not limited by existing hardware

Augmented reality

AR is a 3-dimensional experience of witnessing the virtual items by augmenting the real objects with the virtual ones. The AR technology allows customer see themselves and visualize how they would look like in a particular outfit. Customers don't have to wear it literally instead. Augmented reality (AR) and virtual reality (VR) keep changing customer experiences and motivate shoppers to buy as they get more enhanced buying experience.

Interior design and home decor sites were some of the early adopters of this technology, seeing the benefits of consumers interacting with products virtually. They allow consumers to virtually place furniture in their home and envision what the end result will look like via their mobile phones.



or software. Also the E-Commerce company need not worry about fast changes in computer network technology. E-Commerce applications can be more efficiently developed and distributed because they are platform independent. Internet's altruism helps E-Commerce.

- Snapping middleman: E-Commerce enjoys the benefit of bypassing middlemen and reaching the end customer directly through Internet. In B2C E-Commerce business firms establish a direct contact with their customers by eliminating middlemen. It helps to increase the sales of the organization without any interventions. This results in cheaper price for consumers and higher profit margins for the companies.

Limitations of E-Commerce

Every rose has its thorns. Similarly, E-Commerce also has some limitations. The following are the major drawbacks of E-Commerce for a business organisation.

- People won't buy all products online: There are certain products like high price jewels, clothes or furnishings which people might not like to buy online. They might want to, inspect it, feel the texture of the fabric etc. which are not possible in E-Commerce. As the online shopping does not allow physical inspection, customers have to rely on electronic images of the products. E-Commerce is an effective means for buying known and established services, that is, things that are being used every day. Example booking tickets, buying books, music

CDs and softwares. It is not suitable for dealing with the new or unexpected. Traditional commerce always takes advantage when it is perishables and touch and feel products.

- Competition and Corporate vulnerability: Access to Global Market is an beneficial on one hand but it also come with a competition. Open Internet has paved way to all business firms to operate in the global market. Many businesses have been already facing international competition from web-enabled business opponents. The competitors may access product details, catalogs, and other information about a business through its website and makes it vulnerable. They might then indulge in web harvesting. Web harvesting is the illegal activity of extracting business intelligence from competitor's web pages.
- Security: Security remains to be a problem for E-Commerce. Customers might be reluctant to give their credit card number to the website. As lot of cyber frauds takes place in E-Commerce transactions, people generally afraid to provide their personal information. Legal issues arise when the customer's data falls in the hands of strangers. Fraudulent activities in traditional commerce is comparatively less as there is personal interaction between the buyer and the seller.
- Customer loyalty: Business cannot survive long without loyal customers. The customers would like to buy from a website where they are able to get the best deal. They cannot be loyal to a particular seller. In traditional commerce, shopkeeper would interact with the consumer "face-to-face" and gain their loyalty too. In E-Commerce, the interaction between the business and the consumer is "screen-to-face". The customers would feel that they do not have received sufficient personal attention. Since there is no personal touch in E-Business, companies could not win over their loyalty easily.
- Shortage of skilled employees: Though most of the process in E-Commerce is automated, some sectors like packaging and delivery, needs manual interventions. There could be problems related to shipping delays which would need technically qualified staff with an aptitude to resolve. E-Commerce has difficulty in recruiting, training and retaining talented people. There is a great shortage of skilled employees. Traditional organizational structures and poor work cultures in some places inhibit the growth of E-Commerce.
- Size and value of transactions: The delivery cost of a pen surpasses the cost of pen itself. E-Commerce is most often conducted using credit card for payments, and as a result very small and very large transactions tend not to be conducted online.

For a successful implementation of E-Commerce, an organization must requires the well-designed website, adequate computer hardware and software, effective telecommunication system, technically qualified and responsive workforce and business service infrastructure

CASE STUDY

Steps to Start an E- Business

The following are the initial steps involved in the process to start an online business and start selling items instantly:

- **Business structure and Registration**

Operating an E-Commerce or E-Business does not exclude from requiring certain business licenses and permits. The company must be registered before starting the trade. Registration includes business name, trade name, type of company. (e.g., Private Ltd, Public Ltd, Partnership or Sole Proprietor, LLP - limited liability partnership etc.) The company must be registered to get the bank account opened in the company name and obtaining GST registration documents easily. Any one is allowed to enroll in an online platform and start selling immediately, but there will be no limited liability protection provided to litigation. Thus, if one need to sustain and grow it is best to start with an LLP or a company. http://www.mca.gov.in/

Home page of Ministry of Corporate Affairs to register a Business organization online

- **Tax Registration**

Taxation is unavoidable in any country. A company must have registered with tax department of the concerned nation. In India registration with GST and other tax norms is a necessary to begin selling online, it does not matter whether we are starting our own online business website or selling on a others' portal. https://services.gst.gov.in, https://ctd.tn.gov.in/home

- **Business Bank Account**

Bank account facilitate payment systems. Once the company or LLP is registered successfully, the next step is to apply for a bank account in the name of the online venture. GST certificate is necessary to open a bank account for a business firm.

- **Payment Gateway**

The next important step is to implement a payment gateways integrated with E-Commerce website to allow customers make their payments through credit card, debit card, Internet banking, etc. With digital payment gateway, the customers can make the payment online which automatically gets transferred to business's bank account.

- **Shipment Solution**

Once the above steps are accomplished and start receiving the order, the next step is to set up the logistics section. Logistics is a major part of the E-Commerce. Third party logistics companies may help us to deliver sold products to the customers at their mentioned destination.

- **Identifying suppliers**

Global market space comes along with competition in selling products online. so finding the best quality and best prices for the products we sell is very important. We should shop around until we find a supplier we find a suitable supplier.

- **Marketing**

Marketing plays a significant role in any business. Using Internet and social media effectively will take out product worldwide. Marketing could be started as early as it could be. Catchy captions and logos attract more new customers. It's a good idea to set up social media profiles and writing content for blogs from very first day because we do not want to wait when it is ready to serve.

- **Right technologies**

Updating our technical knowledge will give hand in E-Commerce. Technology makes so much of our work easier. So before we start our E-Commerce business, we should be familiar with some of the basic entities like customer relationship management, accounting, project management, email and marketing etc. The deeper we learn, the greater we grow..

POINTS TO REMEMBER

- E-Commerce can be described as the process of buying or selling products, services or information via Internet.
- FinTech Financial technology is a collective term for technologically advanced financial innovations. In simple words Fintech is a new finance industry that uses technology to improve financial activity.
- The dotcom bubble was a rapid rise in U.S. equity market of Internet-based companies during 1990s.
- Web 1.0 (Web of Content) is the early web that contained text, images and hyperlinks and allowed users only to search for information and read it. There was a very little in the way of user interaction or content generation.
- Web 2.0 (Web of Communication) is a read-write web that allowed users to interact with each other.
- Web 3.0 (Web of Context) is termed as the semantic web or executable web with dynamic applications, interactive services, and "machine-to-machine" interaction.

GLOSSARY

Affiliate	Business who promotes the products of another business for a commission.
Blog	An online platform for writing articles about a topic.
Brick and mortar	The term that refers to a business that has a physical store; opposite of online store.
Dotcom	Common name for Internet based companies.
Mobile commerce	Businesses that are conducted through the Internet using mobile phones or other wireless hand-held devices.
Nascent stage	Initial stage of growth.
Off-shoring	Company's work is given to overseas (another country) company
Out-sourcing	Hiring third party service providers to handle business on behalf.
Social media	In terms of E-Commerce, a platform for advertising products to targeted consumers e.g. Facebook, twitter.
Tangible form	Physical goods we receive.
Teleputer	Fusion of television, computer and telecom networking technologies.
Wordpress	A free, open source online blogging platform.

EVALUATION

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Part I
Objective Questions

1. A company can be called E-Business if
   a) it has many branches across the world.
   b) it conduct business electronically over the Internet.
   c) it sells commodities to a foreign country.
   d) it has many employees.
2. Which of the following is not a tangible good?
   a) Mobile
   b) Mobile Apps
   c) Medicine
   d) Flower bouquet
3. SME stands for
   a) Small and medium sized enterprises
   b) Simple and medium enterprises
   c) Sound messaging enterprises
   d) Short messaging enterprises
4. The dotcom phenomenon deals with _____
   a) Textile industries
   b) Mobile phone companies
   c) Internet based companies
   d) All the above
5. Which of the following is not correctly matched
   a) The First Wave of Electronic Commerce: 1985 -1990
   b) The Second Wave of Electronic Commerce: 2004 – 2009
   c) The Third Wave of Electronic Commerce: 2010 – Present
   d) Dotcom burst: 2000 – 2002
6. **Assertion (A):** The websites of first wave dotcom companies were only in English
   Reason (R): The dotcom companies of first wave are mostly American companies.
   a) Both (A) and (R) are correct and (R) is the correct explanation of (A)
   b) Both (A) and (R) are correct, but (R) is not the correct explanation of (A)
   c) (A) is true and (R) is false
   d) (A) is false and (R) is true
7. Off-shoring means
   a) Work outsourced to a branch of its own company
   b) Work outsourced to new employees
   c) Work outsourced to a third party locally
   d) Work outsourced to a third party outside its own country
8. G2G systems are classified into
   a) Internal facing and external facing
   b) Internet facing and Extranet facing
   c) Internal flag and external flag
   d) Internet flag and Extranet flag
9. ____ host the e-books on their websites.
   a) Bulk-buying sites
   b) Community sites
   c) Digital publishing sites
   d) Licensing sites

10. Which of the following is not a characteristics of E-Commerce
    a) Products cannot be inspected physically before purchase.
    b) Goods are delivered instantly.
    c) Resource focus supply side
    d) Scope of business is global.

Part - II

Short Answers

1. Define E-Commerce.
2. Distinguish between E-Business and E-Commerce
3. Differentiate tangible goods and electronic goods with example of your own.
4. What is dotcom bubble and dotcom burst?
5. Write a short note on out-sourcing.

Part - III

Explain in Brief Answer

1. Describe how E-Commerce is related to socio-technological changes.
2. Write a short note on the third wave of E-Commerce.
3. Explain B2B module in E-Commerce.
4. Write a note on name-your-price websites.
5. Write a note on physical product dispute of E-Commerce.

Part - IV

Explain in detail

1. Write about the development and growth of Electronic Commerce.
2. List all the E-Commerce business models and explain any four briefly.
3. Explain any five E-Commerce revenue models.
4. How would you differentiate a traditional commerce and E-Commerce?
5. What are the advantages and disadvantages of E-Commerce to a consumer?

STUDENT ACTIVITIES

- Draw a timeline describing various developments in E-Commerce.
- List the business around your society and sort it according to business modules.
- Interview a consumer who recently bought a product online and write his experience.

16
CHAPTER

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Electronic Payment Systems

LEARNING OBJECTIVES

- To understand what is Electronic payment systems
- To know the various types of E-payment methods
- To learn the basics of
  - Card Based Payment Systems
  - Electronic Account Transfer
  - Electronic Cash Payment Systems
  - Mobile Payment and Internet Payment Systems

16.1 Introduction to Electronic Payment systems

Everyday people buy or sell goods and services for money. Money becomes the major medium of exchange. Later some payment systems were developed out of a need to facilitate the growth of commerce and economic development.

The media used for transferring the value of money is very diversified, ranging from the use of simple payment instruments (e.g. cash) to the use of complex systems (e.g. cryptocurrency). Physical money (cash), is the traditional and most widely used payment instrument that consumers use, in their daily lives to buy goods and services.

As the volume and variety of transactions expands the volume of money expand. Using cash for each of large transactions is neither feasible nor practically possible. Security and transportation problems arise in cases where large amounts of cash transactions are involved.

Banks would support in such cases by offering other payment methods. The cashless society has been discussed for long time. The demise of cash and cheques could not be sudden. Though old habits hardly die, people do not hesitate adapting new things.

Definition

An Electronic payment system is a financial arrangement that consists an intermediator to facilitate transfer of money-substitute between a payer and

233

a receiver. Sometimes it is also called liquidation, clearing system or clearing service. It ensures the transfer of value from one subject of the economy to another and plays an important role in modern monetary systems.

Modern payment systems may be physical or electronic and each has its own procedures and protocols that guide the financial institution with payment mechanisms and legal systems. Standardization has allowed some of these systems to grow to globally.

The term electronic payment refers to a payment made from one bank account to another bank account using electronic methods forgoing the direct intervention of bank employees.

Payment system is an essential part of a company's financial operations. But it becomes complex, when many different payment systems are used. Further challenges come from the continuous introduction of newer payment systems such as paytm, UPI, bitcoin and various mobile payment options. As a result there are more than 750 payment systems throughout the world. See Figure 16.1

Figure 16.1 Electronic Payment Systems

16.2 Classification of Electronic Payment methods

Many electronic payment methods have been developed with the advancements in the Internet technologies. Based on the value of money transactions, processing time, processing requirements, security issues and usability electronic Payment systems are generally classified into two types. They are

- Micro electronic Payment Systems
- Macro electronic Payment Systems

16.2.1 Micro electronic Payment Systems

It is an on-line payment system designed to allow efficient and frequent payments of small amounts. In order to keep transaction costs very low, the communication and computational costs are minimized here. Unlike macro electronic payments, which use expensive public key cryptography, micro electronic payment are relaxed by using light weight cryptographic primitives and off-line payment verifications.

As the security of micro electronic payment systems is comparatively low it could be tampered but, the cost of fraud is much higher than the possible value to be gained by fraud itself. So the security in micro electronic payment methods is considered to be adequate. The majority of micro electronic payment systems were designed to pay for simple goods on the Internet. e.g., subscriptions of online games, read journals, listen to a song or watch a movie online etc.

In general, the parties involved in the micro on-line payments are Customer, Service Provider and Payment processor. The Micro electronic payment transactions can be explained in the following way.

Step 1 Customer proves his authentication and the payment processor issues micro payments.

Step 2: Customer pays the micro payments to the online service provider and gets the requested goods or services form them.

Step 3: Service provider deposits micro payments received from the customer to the payment processor and gets the money.

The micro electronic payments systems work on the basis of simple cryptographic algorithms. Based on the algorithm used, it is classified into the following categories.

- Hash chain based micro electronic payment systems.
- Hash collisions and hash sequences based micro electronic payment systems.
- Shared secrete keys based micro electronic payment systems.
- Probability based micro electronic payment systems.

16.2.2 Macro electronic payment systems

Macro electronic payment systems support payments of higher value. The security requirements are more rigorous in macro payment systems because of huge money transactions. Banks will impose a minimum transaction overhead on macro payment systems. These transactional over heads for the usage of computationally expensive cryptographic operations prevent these payment systems to be used for the payment of small amounts. Some of the popular macro on-line payment systems are mentioned below

- Card based payment systems
- Electronic account transfer
- Electronic cash payment systems
- Mobile payment systems and internet payment systems

16.3 Card Based Payments Systems

Payment cards are plastic cards that enable cashless payments. They are simple embossed plastic card that authenticates the card holder on behalf of card issuing company, which allows the user to make use of various financial services. More than 90% of online payments are card based payments, at the same time other e-payment methods are also gaining importance now-a-days.

Based on the transaction settlement method there are three widely used card based payment systems. They are

1. Credit card based payment systems (pay later)
2. Debit card based payment systems (pay now)
3. Stored value card based payment systems (pay before)

16.3.1 Credit Card

Credit card is an electronic payment system normally used for retail transactions. A credit card enables the bearer to buy goods or services from a vendor, based on the cardholder's promise to the card issuer to payback the value later with an agreed interest. Every credit card account

has a purchase limit set by the issuing bank or the firm. A credit card is different from a debit card where the credit card issuer lends money to customer instead of deducting it from customer's bank account instantly.

The term credit card was first mentioned in 1887 in the sci-fi novel "Looking Backward" by Edward Bellamy. The modern credit cards concept was born in the U.S.A, in the 1920s, when private companies began to issue cards to enable their customers to purchase goods on credit within their own premises.

In February 1950, Frank McNamara and Ralph Schneider created The Diners Club card which was made of paper-cardboard. Initially The card was accepted in only 27 restaurants and was used only by friends and acquaintances of the two founders (approximately 200 people). Later it was enhanced and accepted worldwide. From 1955, the card was made of plastic. The Diners Club still exists today under the name Diners Club International.

Advantages of credit card

- Most credit cards are accepted worldwide.
- It is not necessary to pay physical money at the time of purchase. The customer gets an extra period to pay the purchase.
- Depending on the card, there is no need to pay annuity.
- Allows purchases over the Internet in installments.
- Some issuers allows "round up" the purchase price and pay the difference in cash to make the transactions easy.

Key players in operations of credit card

1. Bearer: The holder of the credit card account who is responsible for payment of invoices in full (transactor) or a portion of the balance (revolver) the rest accrues interest and carried forward.
2. Merchant: Storekeeper or vendor who sell or providing service, receiving payment made by its customers through the credit card.
3. Acquirer: Merchant's bank that is responsible for receiving payment on behalf of merchant send authorization requests to the issuing bank through the appropriate channels.
4. Credit Card Network: It acts as the intermediate between the banks. The Company responsible for communicating the transaction between the acquirer and the credit card issuer. These entities operate the networks that process credit card payments worldwide and levy interchange fees. E.g. Visa, MasterCard, Rupay

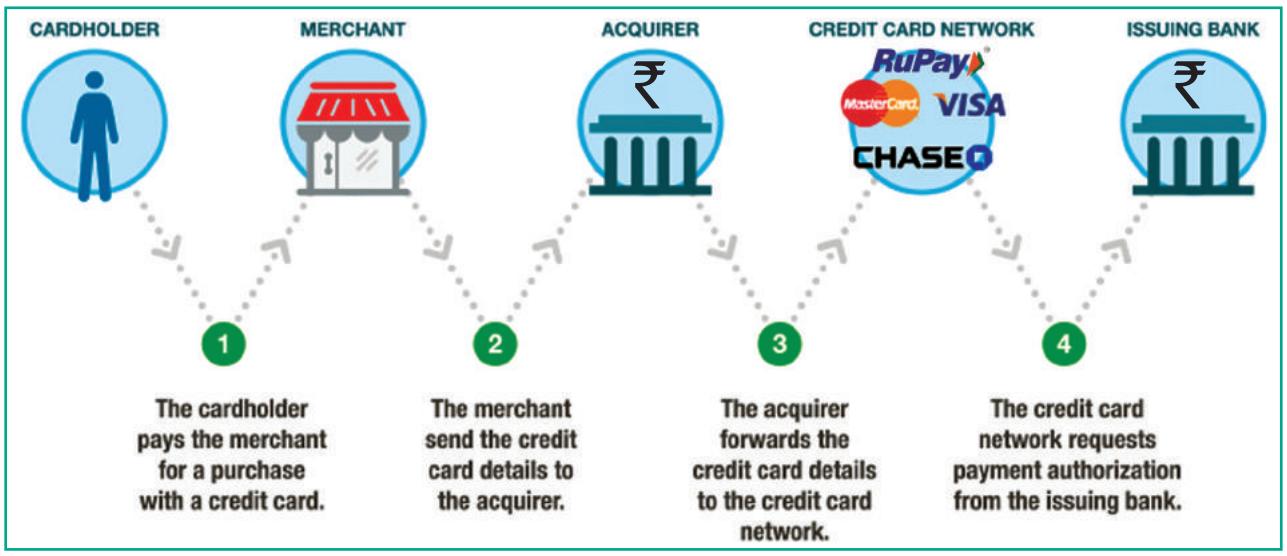


Figure 16.2 Key players of Credit card transaction

5. Issuer: Bearer's bank, that issue the credit card, set limit of purchases, decides the approval of transactions, issue invoices for payment, charges the holders in case of default and offer card-linked products such as insurance, additional cards and rewards plan. See Figure 16.2

Anatomy of a credit card

All Payment cards (including debit card) are usually plastic cards of size 85.60 mm width × 53.98 mm height, rounded corners with a radius of 2.88 mm to 3.48 mm and thickness of 0.76 mm. These standards dimensions are maintained universally in accordance with ISO/IEC 7810#ID-1. See Figure 16.3

1. Publisher: Emblem of the issuing bank (along with the sub category or scheme if any)
2. Credit card number: The modern credit card number has 16-digit unique identification number.
   - The first digit of the credit card number is Major Industry Identifier (MII). It identifies the issuer category. e.g. 1 – Airlines, 4 – Banks
   - The next 5 digits uniquely identifies the issuing organization.
   - The first 6 digits together called as Issuer Identifier number (IIN) or Bank Identification number (BIN)

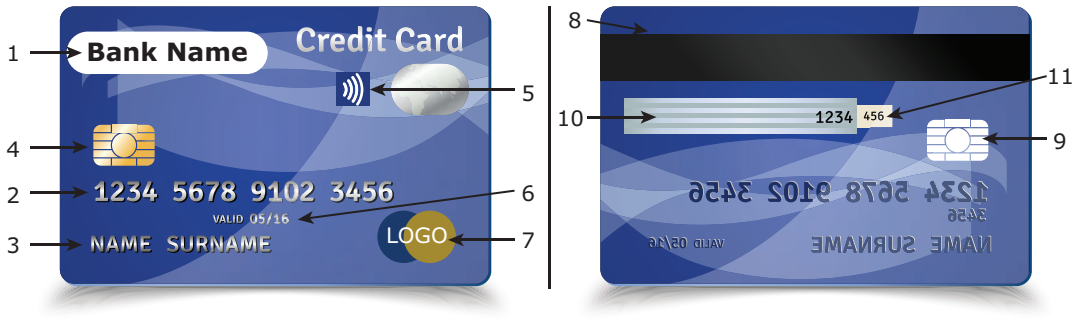


Figure 16.3 Credit Card

- The next 9 digits are the account number.
- The last digit is a check digit (based to the Luhn algorithm).

3. Name of the cardholder: It is visibly embossed on the front side (additionally stored on the magnetic stripe) some cards like gift cards do not hold any name.
4. EMV chip: It is integrated chip in addition to magnetic stripe to store cardholder's information. EMV stands for Europay, MasterCard, Visa. These three names correspond to the names of the companies which are responsible to develop this technology. It is categorized into Chip-and-Signature and Chip-and-PIN.
5. RFID symbol: It is four curved lines radiating rightwards similar to a tilted Wi-Fi symbol. It indicates that it is a contactless smartcard.
6. Expiration month and year: It is visible on the front side (also stored on the magnetic stripe or chip). The card is valid until the last day of the month printed on it.
7. Card brand logo: It is the name of the credit card network company. Visa and MasterCard are leading credit card network companies. Rupay is Indian domestic open loop card launched in 2012.
8. Magnetic stripe: It is an iron based magnetic material containing encrypted data about the card holder and account number.
9. Hologram: Hologram is a security feature that prevents duplication. It is a 3-dimentional image formed by interference of light beams.
10. Signature: It is cardholder's signature at the back of the card, used as an attempt to identify cardholder's identity. It also holds the last 4 digits of card number.
11. CVC/CVV: Card Verification code/ value is a 3 digit code usually printed to the left of signature pane validates the card. CVC2 is used in contact less transactions.

Apart from the these mentioned each credit card may also holds issuer's disclaimer, address and phone number.

16.3.2 Debit Card

Debit Card is an electronic payment card where the transaction amount is deducted directly from the card holder's bank account upon authorization. Generally, debit cards function as ATM cards and act as a substitute for cash The way of using debit cards and credit cards is generally the same but unlike credit cards, payments using a debit card are immediately transferred from the cardholder's designated bank account, instead of them paying the money back at a later with added interest. In modern era the use of debit cards has become so widespread.

The debit card and credit card are identical in their physical properties. It is difficult to differentiate two by their appearance unless they have the term credit or debit imprinted.

Currently there are three ways of processing debit card transactions:

1. EFTPOS (also known as online debit or PIN debit)
2. Offline debit (also known as signature debit)
3. Electronic Purse Card System

16.3.3 Stored value cards

Stored value card is a type of debit card that is pre-loaded with certain amount(value), with which a payment is made. It is a card that has default monetary value onto it. The card may be disposed when the value is used, or recharged to use it again. The major advantage of stored value card is that customers don't need to have a bank account to get prepaid cards. See Figure 16.4

Figure 16.4 Stored value card

Like a credit card or debit card it is a plastic and has a magnetic strip on its back. The magnetic strip stores the monetary value of the card. Stored value cards may not have the card holder's name always. It is also indistinguishable from a regular credit or debit card in appearance. What look like a credit card or debit card act like a credit or debit card. It is used to make purchases offline and online in the same way as in credit card or debit card.

There are two varieties for stored value card.

1. **Closed loop (single purpose)**

   In closed loop cards, money is metaphorically stored on the card in the form of binary-coded data. Closed loop cards are issued by a specific merchant or merchant group and can only be used to make purchases from specific place. e.g. chennai metro rail travel card.

2. **Open loop (multipurpose)**

   Open loop cards can be used to make debit transaction at variety of retailers. It is also called as prepaid-debit cards. It can be used anywhere the branded cards are accepted. e.g. Visa gift cards.

DO YOU KNOW?

In some countries it is legal for anyone to enter or leave the country with money that is stored on cards, unlike carrying cash in high amounts which is believed a form of money laundering.

16.3.4 Smart card

The modern version of card based payment is smart cards. Smart cards along with the regular features of any card based payment system holds a EMV chip. This chip is similar to well-known sim card in appearance but differ in its functionalities. The advantage of Smart cards is that it can provide identification,

Figure 16.5 Contact Smart card & POS

authentication, data storage and application processing. Smart cards can be classified into Contact smart cards and Contactless smart cards. See Figure 16.5

1. **Contact smart cards**

   Contact smart cards have a contact area of approximately 1 square centimeter, comprising several gold-plated contact pads. These pads provide electrical connectivity only when inserted into a reader, which is also used as a communications medium between the smart card and a host. e.g. a point of sale terminal(POS).

2. **Contactless smart cards**

   Contactless smart card is empowered by RF induction technology. Unlike contact smart cards, these cards require only near proximity to an antenna to communicate. Smart cards, whether they are contact or contactless cards do not have an internal power source. Instead, they use an inductor to capture some of the interrupting radio-frequency signal, rectify it and power the card's processes. See Figure 16.6

16.4 Electronic Account Transfer

Apart from card based payment systems there are many alternative electronic payment systems. With the advent of computers, network technologies and electronic communications a large number of alternative electronic payment systems have emerged. These include ECS (Electronic Clearing Services), EFT (Electronic funds transfers), Real Time Gross Settlement system (RTGS) etc. These Electronic Payment systems are used in lieu of tendering cash in domestic and international transactions.

16. 4.1 Electronic Clearing Services (ECS)

Electronic Clearing Service can be defined as repeated transfer of funds from one bank account to multiple bank accounts or vice versa using computer and Internet technology. The payer instructs the bank to debit from his bank account and credit it to one or more payee bank account provided amounts and dates of the payments earlier. This system provides the convenience of paperless payments.

Figure 16.6 Contactless smart card

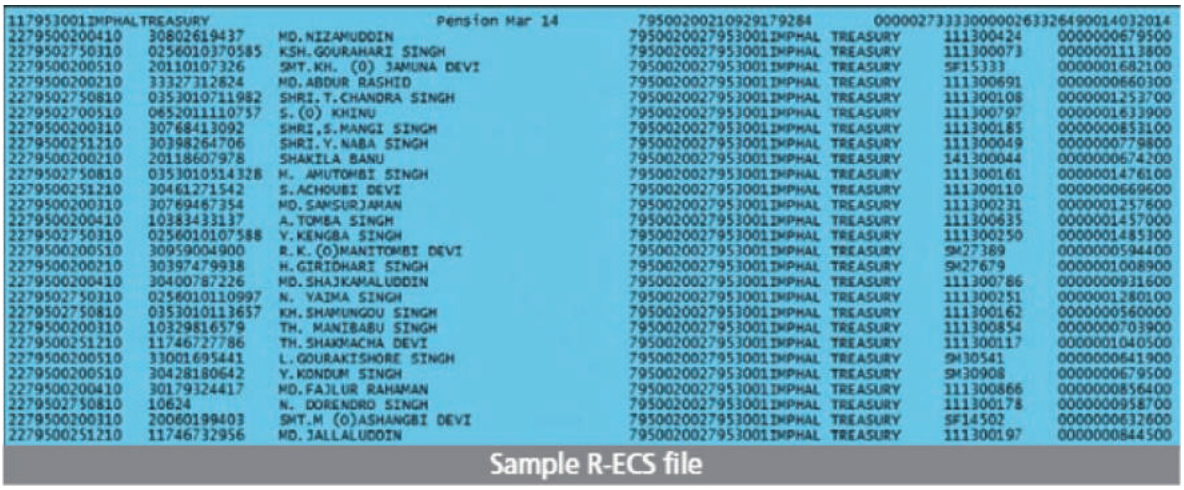


Figure 16.7 ECS

Advantages of this system are bulk payments, guaranteed payments and no need to remember payment dates. It can be used by institutions for making payments such as disbursing of salary, pension or dividend interest among shareholders. Similarly, individual bank customers also can make small value repetitive payments such as paying EMI of a loan, electricity bills, telephone bills, insurance premium, as well as SIP investments. See Figure 16.7

ECS can be used for both credit and debit purposes i.e. for making bulk payments or bulk collection of amounts.

- ECS credit: ECS credit is used for making bulk payment of amounts. In this mode, a single account is debited and multiple accounts are credited. This type of transactions are Push transactions. Example: if a company has to pay salary to its 100 employees it can use ECS credit system than crediting every employees' account separately.
- ECS debit: ECS debit is an inverse of ECS credit. It is used for bulk collection of amounts. In this mode, multiple accounts are debited and then a single account is credited. This type of transactions are Pull transactions. Example: The insurance premium of bulk number of customers is debited from customer's bank account on their

EFT is known by a number of names across countries. In India, it is called as N-EFT (National Electronic Fund Transfer), in the United States, they may be referred to as "electronic cheques" or "e-cheques". National Electronic Funds Transfer (NEFT) is an electronic funds transfer system initiated by the Reserve Bank of India (RBI) in November 2005. It is established and maintained by Institute for Development and Research in Banking Technology (IDRBT). NEFT enables a bank customer to transfer funds between any two NEFT-enabled bank accounts on a one-to-one basis. It is done via electronic messages. Unlike RTGS, fund transfers through the NEFT do not occur in real-time basis.

prior consent and paid to insurance company.

16.4.2 Electronic Funds Transfer

Electronic Funds Transfer (EFT) is the "electronic transfer" of money over an online network. The amount sent from the sender's bank branch is credited to the receiver's bank branch on the same day in batches. Unlike traditional processes, EFT saves the effort of sending a demand draft through post and the inherent delay in reaching the money to the receiver. Banks may charge commission for using this service. EFT is a widely used method for moving funds from one account to another in B2B business models.

16.4.3 Real Time Gross Settlement:

Real Time Gross Settlement system (RTGS) is a payment system particularly used for the settlement of transactions between financial institutions, especially banks. As name indicates, RTGS transactions are processed at the real-time. RTGS payments are also called as push payments that are initiated ("triggered") by the payer. RTGS payments are generally large-value payments, i.e. high-volume transactions.

The development and maintenance of NEFT or RTGS systems worldwide is driven primarily by the central bank of a country. (RBI in India)

Real-time gross settlement transactions are:

- Unconditional - the beneficiary will receive funds regardless of whether he fulfills his obligations to the buyer or whether he would deliver the goods or perform a service of a quality consistent with the order.
- Irrevocable - a correctly processed transaction cannot be reversed and its money cannot get refunded (the so-called settlement finality).

16.5 Electronic Cash Payment Systems

Electronic cash is (E-Cash) is a currency that flows in the form of data. It converts the cash value into a series of encrypted sequence numbers, and uses these serial numbers to represent the market value of various currencies in reality.

16.5.1 Cryptocurrency

People have always valued unique and irreplaceable things. A unique thing always has a demand and acclaims a price. A cryptocurrency is a unique virtual (digital) asset designed to work as a medium of exchange using cryptographic algorithm. This algorithm secures the transactions by recording it in blockchain and controls the creation of additional units of the currency. Cryptocurrency is also called as cryptocoins, e-cash, alternative currencies or virtual currencies and are classified as a subset of digital currencies.

Cryptocurrency can be defined as distributed accounting system based on cryptography, storing information about the state of ownership in conventional units. The state of ownership of a cryptocurrency is related to individual system blocks called "portfolios". Only the holder of the corresponding private key would have control over a given portfolio and it is impossible to issue the same unit twice.

The function of cryptocurrency is based on technologies such as Mining, Blockchain, Directed Acyclic Graph, Distributed register (ledger), etc. The information about the transaction is usually not encrypted and is available in clear text.

DO YOU KNOW?

In 1989, David Chaum an American cryptographer invented the first form of Cryptocurrency called "DigiCash" in the Netherlands. David Chaum, was offered with 180 million dollars by Microsoft for his DigiCash. But things changed and his company went bankrupt in 1998.

Bitcoin

The term "cryptocurrency" began to be used after the appearance of the Bitcoin. Bitcoin is the most popular and the first decentralized cryptocurrency. Bitcoin payment system, was developed in 2009 by an unknown person or a group under the pseudonym "SatosiNakamoto". The SHA-256, a cryptographic hash function, has been used as a working algorithm. Later forks like: Namecoin, Litecoin, Bitcoin-gold and many others appeared. See Figure 16.8

Figure 16.8 symbol of Bitcoin

Bitcoin is the most popular cryptocurrency, but there are many other cryptocurrencies, which are referred to as "altcoins". Currently, more than 1300 cryptocurrencies are listed over 200 special cryptocurrency stock exchanges. Most (not all) are based on different types of blockchain technology.

Many cryptocurrencies operate on the basis of the same source code, in which the authors make only a few minor changes in parameters like time, date, distribution of blocks, number of coins, etc. These currencies are called as fork. In fork, both cryptocurrencies can share a common transaction history in blockchain until the split.

Altcoins

Altcoins is the collective name for all cryptocurrencies that appeared after Bitcoin. The early Altcoins Litecoin and Namecoin appeared in 2011. Their miners sought to overcome a number of problems inherent in Bitcoin (for example, Litecoin has a higher transaction rate) or use blockchain technology in other areas (Namecoin was developed to build alternative root DNS servers).

Many altcoins are inherently very similar to Bitcoin in characteristics and structure. But some cryptocurrencies

have significant differences. About 400 altcoins were considered as "dead", as their value became zero.

Until July 2013, the software of all cryptocurrencies, except Ripple, was based on the open source code of the Bitcoin system. Since July 2013, cryptocurrency platforms began to appear to support various infrastructures like stock trading, shops, instant messengers, and so on. These cryptoplatforms includes BitShares, Mastercoin, Nxt.

From 2014, the 2nd generation of cryptocurrency appeared, such as Monero, Ethereum and Nxt. These crypto-coins have advanced features such as hidden addresses and smart contracts.

Mining

The cryptocurrency units are created by the solution of cryptographic tasks called mining. The miners not only generate new monetary units, but also initiate new transactions to the blockchain. As a reward, they will receive new Bitcoins.

DO YOU KNOW?

The process of mining is extremely electrical energy consumptive. For example while the whole Singapore nation consumes 48.59 TWh (as of Feb 2019) electrical energy, the computers used to mine cryptocurrencies around the world too consume approximately same energy. New cryptocurrencies are being created all the time.

In terms of trade, the creation of cryptocurrencies may be related to the ICO (Initial Coin Offer) procedure, i.e. the ICO, aimed at gathering the initial capital necessary for the further development of the system. The initial value of cryptographic currency is just the cost of consumed electricity. The secondary value is determined by the demand for the cryptocurrency.

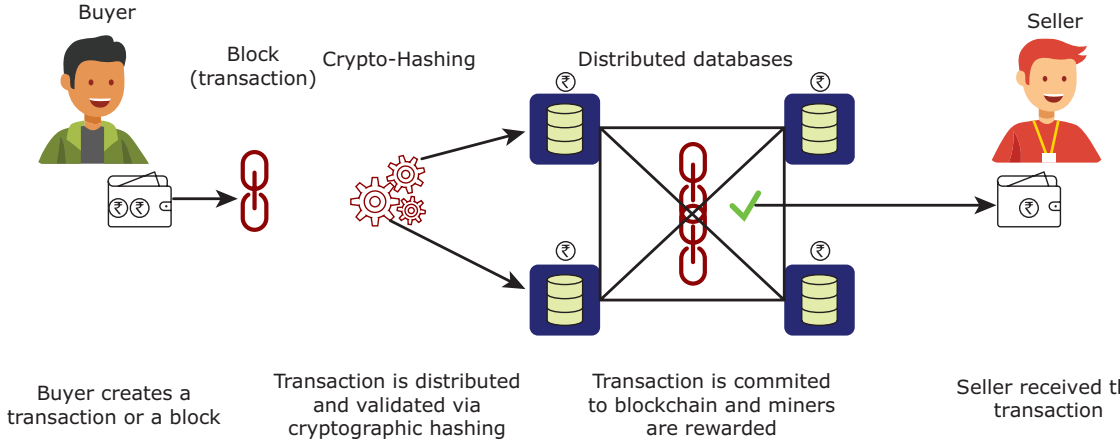


Figure 16.9 Blockchain

Blockchain

Blockchains are an open distributed book that records transactions of cryptocurrencies between any two parties in an efficient and verifiable manner. It is a continuously growing list of records, called blocks, which are linked to each other and protected using encryption algorithm. Each block typically contains a hash pointer as a link to a previous block. It records data about every transaction with its date and time. Once recorded, the data in any given block cannot be altered without the alteration of all subsequent blocks. Blockchains are by default resistant to data modification without the approval of a trusted authority. The validity of the coins of each cryptocurrency is also provided by a blockchain. See Figure 16.9

Since blockchains are safely designed with high fault tolerance it is best suited to distributed computing system. Decentralized structure of blockchain solves the problem of double spending.

16.5.2 Electronic wallets

Electronic wallets (e-wallets) or electronic purses allow users to make electronic transactions quickly and securely over the Internet through smartphones or computers. The electronic wallet functions almost the same as a physical wallet in term that it holds our money. Electronic wallets were first recognized as a method for storing money in electronic form, and became popular because it provides a convenient way for online shopping.

With the development of advanced Internet, the use of electronic wallets turned out as an efficient transaction tool. This is evidenced by the many E-Commerce websites that use electronic wallets as a transaction tool. There are several electronic wallet services that are now widely used. e.g. :PayPal, SBI Buddy. See Figure 16.10

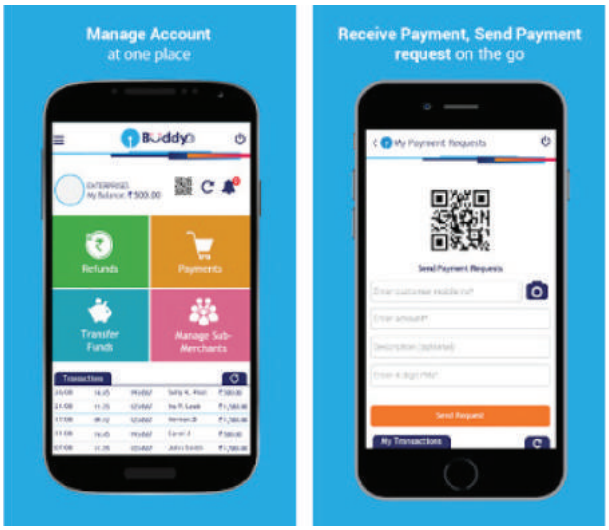


Figure 16.10 e-wallets

16.6 Mobile Banking and Internet Banking

As smartphones have already usurped the place of digital camera and voice recorders, soon it will double up as virtual debit cards. It enables to send or receive money instantly without any plastic cards.

16.6.1 Mobile Banking

Mobile banking is another form of net banking. The term mobile banking (also called m-banking) refers to the services provided by the bank to the customer to conduct banking transactions with the aid of mobile phones. These transactions include balance checking, account transfers, payments, purchases, etc. Transactions can be done at anytime and anywhere. See Figure 16.11

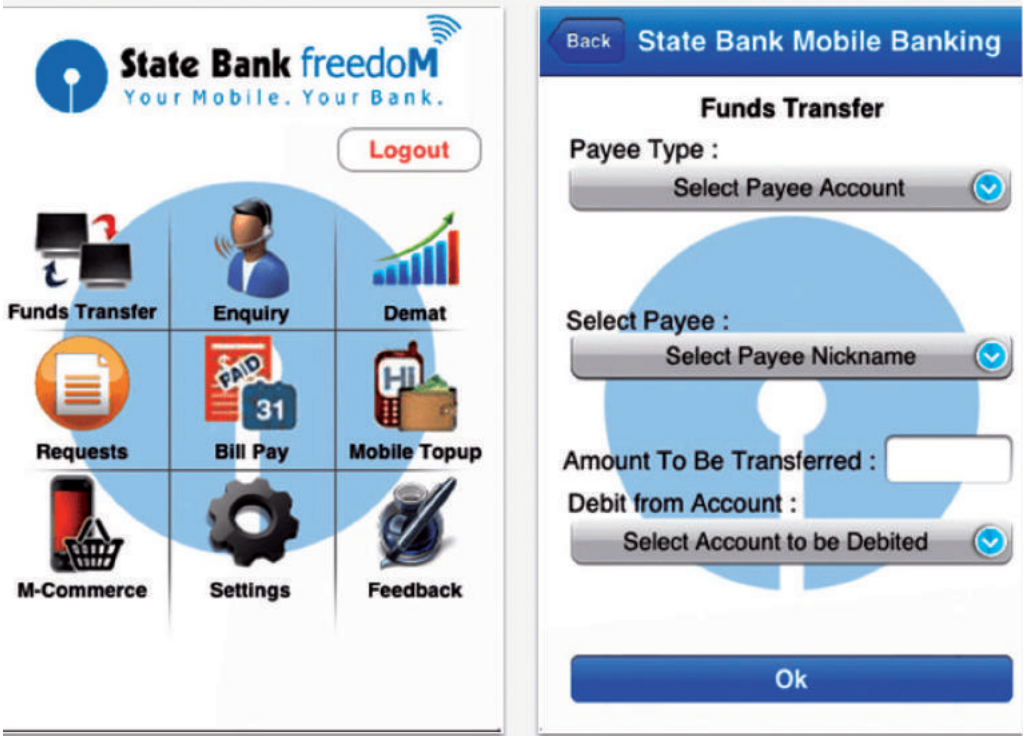


Figure 16.11 mobile banking through smartphone application

DO YOU KNOW?

Some of the latest mobile banking applications even have a cash withdrawal menu. The menu will create a specific code that can be used instead of an ATM card to operate an ATM. However, this can only be done at a special ATM (ATM with no card service).

The WAP protocol installed on a mobile phone qualifies the device through an appropriate application for mobile session establishment with the bank's website. In this way, the user has the option of permanent control over the account and remote management of his own finances.

Mobile Banking operations can be implemented in the following ways:

- contacting the call center.
- automatic IVR telephone service.
- using a mobile phone via SMS.
- WAP technology.
- Using smartphone applications.

16.6.2 Internet banking

Internet banking is a collective term for E-banking, online banking, virtual banking (operates only on the Internet with no physical branches), direct banks, web banking and remote banking.

Internet banking allows customers of a financial institution to conduct various financial transactions on a secure website operated by the banking institutions. This is a very fast and convenient way of performing any banking transactions. It enables customers of a bank to conduct a wide range of financial transactions through its website. In fact, it is like a branch exclusively operating of an individual customer. The online banking system will typically connect to the core

banking system operated by customers themselves (Self-service banking).

Advantages:

- The advantages of Internet banking are that the payments are made at the convenience of the account holder and are secured by user name and password. i.e. with Internet access it can be used from anywhere in the world and at any time.
- Any standard browser (e.g. Google Chrome) is adequate. Internet banking does not need installing any additional software.

Out of 7.7 billion world population roughly 3.2 billion have the Internet access. There by more than 50% of world population are accessed to Internet banking.

The following are the steps to transfer fund using net banking.

Step 1: Login to net banking account using unique user name and password provided by the bank earlier.

Step 2: Add the beneficiary as a payee to enable transfer of fund. The following details like Account Number, Name, IFSC about the beneficiary are to be filled in the 'Add New Payee' section.

Step 3: Once the beneficiary is added, choose RTGS / NEFT / IMPS as mode of Fund Transfer.

Step 4: Select the account to transfer money from, select the payee, enter the amount to be transfered and add remarks (optional).

Step 5: Click on submit.

Step 6: Enter the OTP received to mobile number linked to the corresponding account to complete the transaction.

Modern Electronic funds transfers are secured by a personal identification number (PIN), one-time password (OTP) etc. An automated clearing house (ACH) processes the payment then. See Figure 16.12

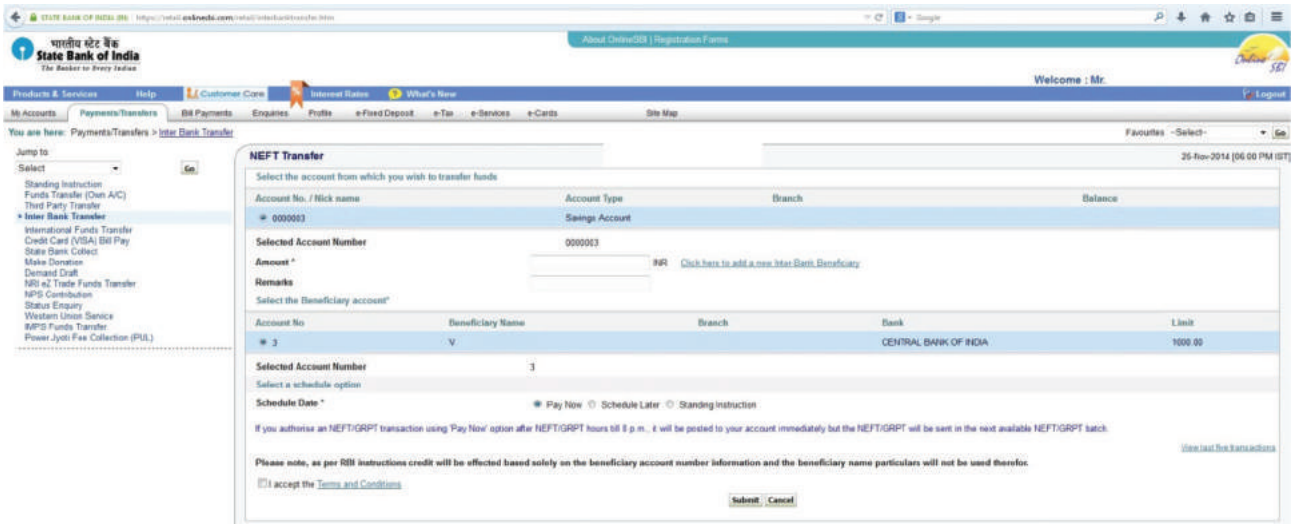


Figure 16.12 Home page of SBI Internet banking

DO YOU KNOW?

Indian Financial System Code (IFSC) is an 11 digit alpha-numeric code issued by Reserve Bank of India to uniquely identify individual bank's branch in India. It is used for domestic e-payments. SWIFT code is used for international bank transactions.

16.7 Unified Payments Interface

Unified Payments Interface (UPI) is a real-time payment system developed by National Payments Corporation of India (NCPI) to facilitate inter-bank transactions. It is simple, secure and instant payment facility. This interface is regulated by the Reserve Bank of India and used for transferring funds instantly between two bank accounts through mobile (platform) devices. http://www.npci.org.in/

Unlike traditional e-wallets, which take a specified amount of money from user and store it in its own account, UPI withdraws and deposits funds directly from the bank account whenever a transaction is requested. It also provides the "peer to peer" collect request which can be scheduled and paid as per requirement and convenience.

UPI is developed on the basis of Immediate Payment Service (IMPS). To initiate a transaction, UPI applications use two types of address - global and local.

- Global address includes bank account numbers and IFSC.
- Local address is a virtual payment address.

Virtual payment address (VPA) also called as UPI-ID, is a unique ID similar to email id (e.g. name@bankname) enable us to send and receive money from multiple banks and prepaid payment issuers. Bank or the financial institution allows the customer to generate VPA using phone number associated with Aadhaar number and bank account number. VPA replaces bank account details thereby completely hides critical information.

The MPIN (Mobile banking Personal Identification number) is required to confirm each payment. UPI allows operating multiple bank accounts in a single mobile application. Some UPI application also allows customers to initiate the transaction using only Aadhaar number in absence VPA.

DO YOU KNOW?

UPI is also available as an Unstructured Supplementary Service Data (USSD) service. Users who don't have Internet can dial *99# and get UPI services within India. The financial services like transferring fund, payment request and non-financial services like changing MPIN and balance check are currently available through the USSD.

Advantages

- Immediate money transfers through mobile device round the clock 24 x 7.
- Can use single mobile application for accessing multiple bank accounts.
- Single Click Authentication for transferring of fund.
- It is not required to enter the details such as Card no, Account number, IFSC etc. for every transaction.
- Electronic payments will become much easier without requiring a digital wallet or credit or debit card.

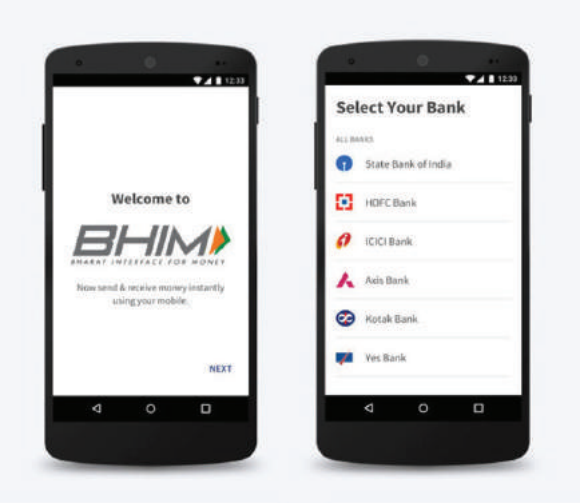
16.8 Cash on delivery

Cash on delivery (COD) also called as collection on delivery, describes a mode of payment in which the payment is made only on receipt of goods rather in advance. Originally, the term applies only to cash payment, but since other forms of payment have become more common, the word "cash" has sometimes been replaced by the word "collect" to transactions with checks, credit cards or debit cards.

COD is often used as an additional payment option in E-Commerce. It offers the recipient the advantage of paying only when commodity is handed over that is likely similar to traditional system. If the goods are not paid, they are returned to the retailer.

Bharat Interface for Money (BHIM)

Individual banks and financial institutions build and maintain their own mobile application for UPI transaction. Bharat Interface for Money (BHIM) is an exclusive mobile app for UPI developed by National Payments Corporation of India (NPCI) and launched on 30 December 2016. It is intended to facilitate e-payments directly through banks and drive towards cashless transactions.



POINTS TO REMEMBER

- Payments are the financial instruments used globally to transfer value in the form of money or its substitutes and are constantly changing due to new technology and Government regulations.
- Payment system can also be divided into two types, namely the cash payment system and the non-cash payment system based on the instruments used. In the cash payment system, the instruments used are in the form of currency (paper money and coins) while in the non-cash payment system the instruments used are card-based payment, Cheques or electronic money.
- A Credit card plays a major role in electronic payment system worldwide.
- ECS is treated as a electronic cheques by the bank. The advantages and disadvantages of the physical cheque is also extended to ECS. In electronic clearing services, bank process the instructions from the customer to debit his account and pay another automatically without much human interference.
- (POS) Point of Sale Terminal- It enables customers to make payment for purchase of goods and services by means of credit and debit cards. To facilitate customer convenience some banks also cash withdrawal using debit cards at POS terminals.

GLOSSARY

BIN	Bank Identification Number. The first six-digits of credit card number to uniquely identify financial institutions.
Brick and mortar	The term that refers to a business that has a physical store; opposite of online store.
(CVC2/CVV2)	Card Verification Code and Card Verification Value : A three digit code printed on the cardholder signature panel allows e-payments when the card is not physically accessible.
Credit card network / processor	Company responsible for communicating the transaction between the acquirer and the credit card issuer. E.g. MasterCard, Visa, Rupay
Double spend	A type of fraud where same cryptocurrency is spent in more than one transactions.
E-wallets	Electronic purses allow users to make electronic transactions quickly and securely
Gift cards	A magnetic stripe or chip card that holds the value of money to offer as a gift by a E-business
Internet banking	Is the activity of buying or selling of commodities through online services or over the Internet
PIN	Personal Identification Number. A static number that is assigned to consumers to secure card based payments.
Point of sale (POS)	Merchant's electronic device that enables the e-payments. It reads the card information from EMV or magnetic strip

EVALUATION

G19RSX

Part - I

Choose the correct answer

1. Based on the monetary value e payment system can be classified into
   a) Mirco and Macro
   b) Micro and Nano
   c) Maximum and Minimum
   d) Maximum and Macro

2. Which of the following is not a category of micropayment?
   a) Buying a movie ticket
   b) Subscription to e journals
   c) Buying a laptop
   d) Paying for smartphone app

3. **Assertion (A):** Micro electronic payment systems support higher value payments.
   Reason (R): Expensive cryptographic operations are included in macro payments
   a) Both (A) and (R) are correct and (R) is the correct explanation of (A)
   b) Both (A) and (R) are correct, but (R) is not the correct explanation of (A)
   c) (A) is true and (R) is false
   d) (A) is false and (R) is true

4. Which of the following is correctly matched
   a) Credit Cards - pay before
   b) Debit Cards - pay now
   c) Stored Value Card - pay later
   d) Smart card – pay anytime

5. ECS stands for
   a) Electronic Clearing Services
   b) Electronic Cloning Services
   c) Electronic Clearing Station
   d) Electronic Cloning Station

6. Which of the following is not a Altcoin
   a) Litecoin b) Namecoin
   c) Ethereum d) Bitcoin

7. Which of the following is true about Virtual payment address (VPA)
   a) Customers can use their e-mail id as VPA
   b) VPA does not includes numbers
   c) VPA is a unique ID
   d) Multiple bank accounts cannot have single VPA

8. Pick the odd one in the credit card transaction
   a) card holder
   b) merchant
   c) marketing manager
   d) acquirer

9. Which of the following is true about debit card
   i. debit cards cannot be used in ATMs
   ii. debit cards cannot be used in online transactions
   iii. debit cards do not need bank accounts
   iv. debit cards and credit cards are identical in physical properties
   a) i, ii, iii b) ii, iii, iv
   c) iii alone d) iv alone

10. Match the following

List A	List B
A1) First Digit	B1) Account number
A2) 9th to 15th Digit	B2) MII Code
A3) First 6 Digits	B3) BIN Code
A4) Last Digit	B4) Check digit

	A1	A2	A3	A4
a)	B4	B3	B2	B1
b)	B2	B1	B3	B4
c)	B2	B3	B4	B1
d)	B2	B4	B3	B1

Part - II

Short Answers

1. Define electronic payment system
2. Distinguish micro electronic payment and macro electronic payment
3. List the types of micro electronic payments based on its algorithm
4. Explain the concept of e-wallet
5. What is a fork in cryptocurrency?

Part - III

Explain in Brief Answer

1. Define micro electronic payment and its role in E-Commerce.
2. Compare and contrast the credit card and debit card.
3. Explain briefly Anatomy of a credit card.
4. Briefly explain the stored value card and its types.
5. Write a note on mining in cryptocurrency.

Part - IV

Explain in detail

1. What is credit card? Explain the key players of a credit card payment system and bring out the merits of it.
2. Briefly explain Electronic Account transfer and its types.
3. Write a note on
   a. Internet banking
   b. Mobile banking
4. What is cryptocurrency? Explain the same.
5. Explain in detail : Unified payments interface

STUDENT ACTIVITIES

Presentation about various payment systems

- Choose any presentation tool (e.g. Open office impress)
- Create a slide describing a payment method.
- List the futures of the particular payment method.
- List the advantages and disadvantages of the same.
- Repeat the steps for other payment methods.

17
CHAPTER

5THG7P

E-Commerce Security Systems

LEARNING OBJECTIVES

- To know basics of E-Commerce Security Systems
- To understand various types of E-Commerce threats
- To learn about dimensions of E-Commerce security
- To know about security technologies in E-Commerce transaction

17.1 E-Commerce Security

With the rapid development of the Internet, online transactions have increasingly become a new business model. E-Commerce transactions based on network resources have been accepted by the public. While enjoying the convenience brought by online transactions, the security of transactions has attracted much attention. The inherent openness and resource sharing of the network have seriously threatened the security of online transactions. To an E-Business security threats not only result in loss of revenue but also in reputation.

Definition

Security has become the critical factor and core issue in any emerging E-business. Solving the security problems in transactions is the basis for ensuring the smooth development of E-business.

E-Commerce security is a set of protocols that safely guide E-Commerce transactions through the Internet.

17.2 Types of E-Commerce Threats

Since E-Commerce is based on information technology and computer networks, it inevitably faces a series of security issues compared with traditional businesses. E-Commerce security threats can be accidental (caused by a human error) or intentional.

Foreign or domestic, internal or external, group or individual, business rivals or disgruntled employees, terrorists or hackers anyone with the capability, technology, opportunity, and intent to do harm can be a potential threat to E-Commerce. Though every business has pitfalls E-Commerce business would face the following specific threats.

DO YOU KNOW?

Viruses cause harm to the computers thereby harms the efficient and smooth functioning of E-Commerce. Some viruses destroy all the information stored in a computer and cause huge loss of revenue and time. The emergence of computer viruses and their variants has rapidly increased over the past decade. The Internet has turned to be the best medium for the spread of viruses. Many new viruses directly use the Internet as their mode of transmission causing huge economic losses to E-businesses.

1. Information leakage: The leakage of trade secrets in E-Commerce mainly includes two aspects: (a) the content of the transaction between the vendor and customer is stolen by the third party; (b) the documents provided by the merchant to the customer or vice versa are illegally used by the another. This intercepting and stealing of online documents is called information leakage.

DO YOU KNOW?

Phishing is also a E-Commerce threat in which a target is contacted by e-mail, telephone or text message by someone who pretend himself as a genuine authority. They try to trap individuals to provide sensitive data such as, banking and credit card details, OTP, PIN or passwords. Once they succeed, the results would lead to devastating acts such as identity theft and financial loss.

2. Tampering: E-Commerce has the problem of the authenticity and integrity of business information. When hackers grasp the data transmitted on the network, it can be falsified in the middle through various technical means, and then sent to the destination, thereby destroying the authenticity and integrity of the data.
3. Payment frauds: Payment frauds have subsets like Friendly fraud (when customer demands false reclaim or refund), Clean fraud (when a stolen credit card is used to make a purchase) Triangulation fraud (fake online shops offering cheapest price and collect credit card data) etc.
4. Malicious code threats: Within an E-Commerce site, there are multiple vulnerable areas that can serve as an intrusion point for a hacker to gain payment and user information. Using malware, Cross Site Scripting or SQL Injection, an attacker will extract the credit card information and sell the acquired data on black markets. Fraud is then committed to extract the greatest value possible through E-Commerce transactions or ATM withdrawals, etc.
5. Distributed Denial of Service (DDoS) Attacks: It is a process of taking down an E-Commerce site by sending continious overwhelming request to its server. This attack will be conducted from numerous unidentified computers using botnet. This attack will slow down and make the server inoperative. DDoS attacks is also called as network flooding.
6. Cyber Squatting: Cybersquatting is the illegal practice of registering an Internet

domain name that might be wanted by another person in an intention to sell it later for a profit. It involves the registering of popular trademarks and trade names as domain names before the particular company do. Cyber squatters also involve in trading on the reputation and goodwill of such third parties by inducing a customer to believe that it is an official web page.

DO YOU KNOW?

In September 2015, the domain google.com was bought for 12 American dollars by a former Google employee which he later sold it for 6006.13 American dollars.

7. Typopiracy: Typopiracy is a variant of Cyber Squatting. Some fake websites try to take advantage of users' common typographical errors in typing a website address and direct users to a different website. Such people try to take advantage of some popular websites to generate accidental traffic for their websites. e.g. www.goggle.com, www.faceblook.com

DO YOU KNOW?

Hacking refers to unauthorized intrusion into a computer or a network. That is to say breaking security to gain access to a website illegally and intercept confidential information. They would then misuse such information to their advantage or modify and even destroy its contents to harm the competitors.

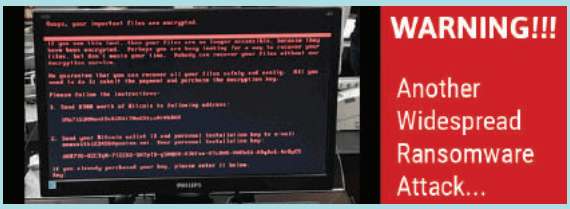
17.3 Dimensions of E-Commerce security

As the security issue is the most worrying issue for E-Business, ensuring the security of E-Commerce activities has become the core research field of E-Commerce. The following are some of the security elements involved in E-Commerce.

- Authenticity: conforming genuineness of data shared.
- Availability: prevention against data delay or removal.
- Completeness: unification of all business information.
- Confidentiality: protecting data against unauthorized disclosure.
- Effectiveness: effective handling of hardware, software and data.
- Integrity: prevention of the data being unaltered or modified.
- Non-repudiation: prevention against violation agreement after the deal.
- Privacy: prevention of customers' personal data being used by others.
- Reliability: providing a reliable identification of the individuals or businesses.
- Review ability: capability of monitoring activities to audit and track the operations.

DO YOU KNOW?

Ransomware: Ransomware is a type of malware that usually encrypt all the files in a target's computer and threatens to publish the critical data unless a ransom (money) is paid.



17.4 Security technologies in E-Commerce transaction

Since a large amount of confidential information are involved in E-Commerce activities it must be transmitted through the safe and secured network. Sophisticated security technologies are required to ensure the security of E-Commerce transactions. At present, the security technologies in E-Commerce transactions are roughly classified into

- Encryption technology
- Authentication technology
- Authentication protocols

17.4.1 Encryption technology

Encryption technology is an effective information security protection. It is defined as converting a Plaintext into meaningless Ciphertext using encryption algorithm thus ensuring the confidentiality of the data. The encryption or decryption process use a key to encrypt or decrypt the data. At present, two encryption technologies are widely used. They are symmetric key encryption system and an asymmetric key encryption system.

Symmetric key encryption

The Data Encryption Standard (DES) is a Symmetric key data encryption method. It was introduced in America in the year 1976, by Federal Information Processing Standard (FIPS).

DES is the typical block algorithm that takes a string of bits of cleartext (plaintext) with a fixed length and, through a series of complicated operations, transforms it into another encrypted text of the same length. DES also uses a key to customize the transformation, so that, in theory, the algorithm can only be deciphered by people who know the exact key that has been used for encryption. The DES key is apparently 64 bits, but in fact the algorithm uses only 56. The other eight bits are only used to verify the parity and then it is discarded.

Today, it is considered that DES is not safe for many applications, mainly because of its relatively smaller key size (56-bit). But the key length can be easily increased by multiple use of the DES, described as Triple-DES, also known as TDES, 3DES or DESede.

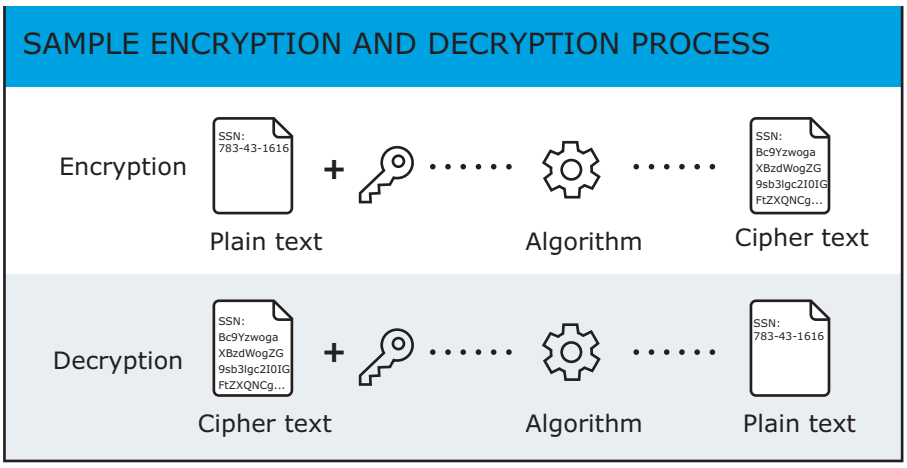


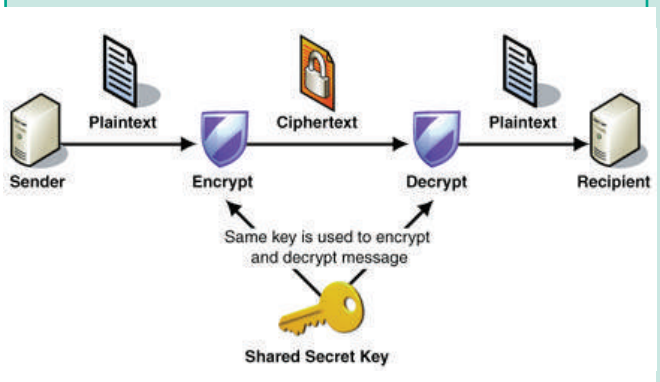
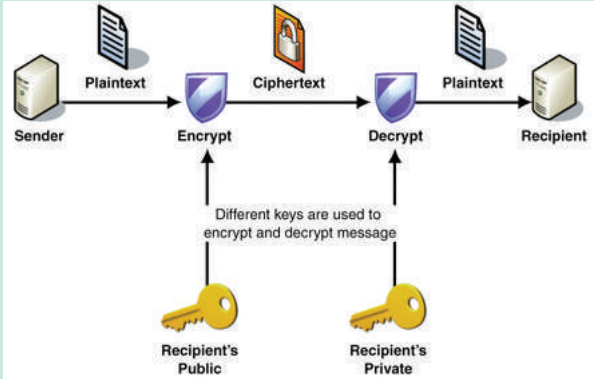
Figure 17.1 Data Encryption and Decryption process

Asymmetric or Public key encryption

Asymmetric encryption also called as RSA (Rivest-Shamir-Adleman) algorithm. It uses public-key authentication and digital signatures. Until 1970s, there were only symmetric cryptosystems in which transmitter and receiver must have the same key. This raises the problem of key exchange and key management. Unlike a symmetric encryption, the communicating parties need not know other's private-key in asymmetric encryption. Each user generates their own key pair, which consists of a private key and a public key. A public-key encryption method is a method for converting a plaintext with a public key into a ciphertext from which the plaintext can be retrieved with a private key.

17.4.2 Authentication Technology

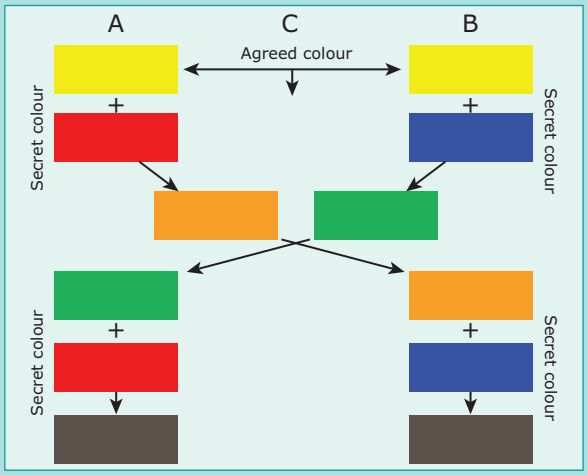
The main role of security certification is to ensure Authentication, Integrity and Non-repudiation. This can be achieved through digital signatures and digital certificates.

Symmetric Key Encryption	Asymmetric Key Encryption
Same key is used for both encryption and decryption	Different keys are used for encryption and decryption
Speed of encryption or decryption is very fast	Speed of encryption or decryption is comparatively slow
Plain text and cipher text are of same size	The size of cipher text is always greater than plain text.
Algorithms like DES, AES, RC4 uses symmetric key encryption	Algorithms like RSA, ECC, DSA use asymmetric key encryption
Provides confidentiality	Provides confidentiality, authenticity and non-repudiation
The number of key used grows exponentially with the number of users	The number of key used grows linearly with the number of users
	

DO YOU KNOW?

In 1976, Whitfield Diffie and Martin e. Hellman, devised an algorithm called public key encryption. The algorithm can be understood using color game. This how could "A" and "B" get a secret key without letting "C" finding it out. The trick is based on 2 facts

- It is easy to mix 2 colors together to get 3rd color
- Given a mixed color it's hard to reverse it in order to find the exact original colors



1. First A and B agree publicly on a starting color (yellow)
2. Now A select a random colour (red) mix it with yellow and send new color (yellow+red=orange) to B.
3. Similarly B selects a random colour (blue) mix it with yellow and send new colour (yellow+blue=green) to A.
4. Hacker "C" may have two new colours (orange) and (green) but not the A's (red) or B's (blue) private colours.
5. After interchanging colors, A adds his own private (red) to B's mixture (green) and arrive at a third secret colour(black).
6. Also B adds his own private (blue) to A's mixture (orange) and arrive at a same third secret color (black).
7. C is unable to have the exact color (black), since C needs one of the private color to do so.

Digital certificates

A digital certificate (also known as public key certificate) is an electronic document used to prove the ownership of a public key. This certificate includes the information about the sender's identity, digital signature and a public key.

Digital certificates function is similar to the functions of identification cards such as passports and driving licenses. Digital certificates are issued by recognized Certification Authorities (CA). When someone requests a digital certificate, the authority verifies the identity of the requester, and if the requester fulfills all requirements, the authority issues it. When the sender uses a certificate to sign a document digitally, receiver can trust the digital signature because he trusts that CA has done their part verifying the sender's identity.

Figure 17.2 Digital Certificates

Common digital certificate systems are X.509 and PGP.

- Pretty Good Privacy (PGP): Phil Zimmermann developed PGP in 1991. It is a decentralized encryption program that provides cryptographic privacy and authentication for data communication. PGP encryption uses a serial combination of hashing, data compression, symmetric-key cryptography and asymmetric-key cryptography and works on the concept of "web of trust".
- The X.509 system is a centralized system in which the authenticity of the key is guaranteed by the hierarchy of certification authorities formally certifying the key relationship with the identity of its owner. Due to its clear responsibility, it is easier to implant in the law, X.509 is currently world wide accepted certification technology.

The digital certificate are being issued by a licensed Certifying Authority (CA). NIC, Safescript, TCS, MTNL, e-Mudhra are some of the authorized Certifying Authorities under Government of India.

Digital signature

A digital signature is a mechanism that is used to verify that a particular digital document, message or transaction is authentic.

It provides a receiver the guarantee that the message was actually generated by the sender. It also confirms that the

Digital signature	Digital certificate
A digital signature is a mechanism that is used to verify that a particular digital document, message or transaction is authentic.	A digital certificate is a computer file which officially approves the relation between the holder of the certificate and a particular public key.
Digital signatures are used to verify the trustworthiness of the data being sent	Digital certificates are used to verify the trustworthiness of the sender.
Digital signature is to ensure that a data remain secure from the point it was issuedand it was not modified by a third party.	Digital certificate binds a digital signature to an entity
It provides authentication, non-repudiation and integrity	It provides authentication and security.
A digital signature is created using a Digital Signature Standard (DSS). It uses a SHA-1 or SHA-2 algorithm for encrypting and decrypting the message.	A digital certificate works on the principles of public key cryptography standards (PKCS). It creates certificate in the X.509 or PGP format.
The document is encrypted at the sending end and decrypted at the receiving end using asymmetric keys.	A digital certificate consist of certificate's owner name and public key, expiration date, a Certificate Authority 's name , a Certificate Authority's digital signature

information originated from the signer and has not been altered by a cracker in the middle. Digital signatures can provide the added assurances of evidence to the origin, identity and status, as well as acknowledging the consent of the sender.

Digital signatures use a standard, worldwide accepted format, called Public Key Infrastructure (PKI), to provide the highest levels of security and universal acceptance. In many countries, digital signatures have the same legal significance as the traditional forms of signed documents. Digital signatures are widely used for avoiding forging or tampering of important documents such as financial documents or credit card data.

A security token is a hardware component that are used to identify and authenticate users.

17.4.3 Authentication protocols

At present, there are two kinds of security authentication protocols widely used in E-Commerce, namely Secure Electronic Transaction (SET) and Secure Sockets Layer (SSL).

Secure Electronic Transaction

Secure Electronic Transaction (SET) is a security protocol for electronic payments with credit cards, in particular via the Internet. SET was developed in 1996 by VISA and MasterCard, with the participation of GTE, IBM, Microsoft and Netscape.

The implementation of SET is based on the use of digital signatures and the encryption of transmitted data with asymmetric and symmetric encryption algorithms. SET also use dual signatures to ensure the privacy.

The SET purchase involves three major participants: the customer, the seller and the payment gateway. Here the customer shares the order information with the seller but not with the payment gateway. Also the customer shares the payment information only with the payment gateway but not with the seller. So, with the SET, the credit card number may not be known to the seller and will not be stored in seller's files also could not be recovered by a hacker.

The SET protocol guarantees the security of online shopping using credit cards on the open network. It has the advantages of ensuring the integrity of transaction data and the non-repudiation of transactions. Therefore, it has become the internationally recognized standard for credit card online transaction.

SET system incorporates the following key features:

- Using public key encryption and private key encryption ensure data confidentiality.
- Use information digest technology to ensure the integrity of information.
- Dual signature technology to ensure the identity of both parties in the transaction.

Figure 17.3 Difference between http and https

Secure Sockets Layers

The most common Cryptographic protocol is Secure Sockets Layers (SSL). SSL is a hybrid encryption protocol for securing transactions over the Internet. The SSL standard was developed by Netscape in collaboration with MasterCard, Bank of America, MCI and Silicon Graphics. It is based on a public key cryptography process to ensure the security of data transmission over the internet. Its principle is to establish a secure communication channel (encrypted) between a client and a server after an authentication step.

The SSL system acts as an additional layer, to ensure the security of data, located between the application layer and the transport layer in TCP. For example, a user using an internet browser to connect to an SSL secured E-Commerce site will send encrypted data without any more necessary manipulations. Secure Sockets Layers (SSL) was renamed as Transport Layer Security (TLS) in 2001. But still it is popularly known under the name SSL. TLS differs from SSL in the generation of symmetric keys.

Today, all browsers in the market support SSL, and most of the secure communications are proceeded through this protocol. SSL works completely hidden for the user, who does not have to intervene in the protocol. The only thing the user has to do is make sure the URL starts with https:// instead of http:// where the "s" obviously means secured. It is also preceded by a green padlock.

3D Secure

"3-D Secure is a secure payment protocol on the Internet. It was developed by Visa to increase the level of transaction security, and it has been adapted by MasterCard. It gives a better authentication of the holder of the payment card, during purchases made on websites. The basic concept of this (XML-based) protocol is to link the financial authorization process with an online authentication system. This authentication model comprise 3 domains (hence the name 3D) which are:

1. The Acquirer Domain
2. The Issuer Domain
3. The interoperability Domain

CASE STUDY

The operating principle of SSL using public key encryption could be easily understood with the following scenario "kumar orders a mobile phone from an online store (abc.com)."

1. Kumar connects to abc.com website through a secure connection, from his computer browser.
2. The abc.com website sends Kumar an digital certificate and a public key (P). This digital certificate issued by a certification authority (CA) proves the identity of abc.com.
3. Kumar's browser checks the certificate. It (browser) then agrees with the remote server on a symmetric cryptographic system to use. Then it randomly choose a key for this algorithm (session key K).
4. Kumar's browser sends P (K) to abc.com. Using its secret key S, the abc.com server calculates S (P (K)) = K. Thus, Kumar's browser and abc.com server are in possession of the same key.
5. Kumar enters his credit card number and other data. They constitute the "information". The browser sends these "information" to abc.com, encrypted using the key K. It also sends a summary of this "information", using a mathematical function called hash function.
6. With the K key, the abc.com server can dencrypt the "information". It also calculates the summary of information, and compares with the summary sent by Kumar's browser. If they coincide, it is assumed that the data has been correctly transmitted.

POINTS TO REMEMBER

- Phishing: Phishing is acquiring critical data like login credentials through telephone, sms, e-mail or any social media by the crackers disguising as authentic.
- Authentication: Information of the entity sending the document is often included in the document, but the information may be inaccurate. A digital signature can be used to authenticate the source of a document.
- Integrity: In many scenarios, the sender and receiver of the document will require confidence that the document has not been tampered with during the transfer. If the document was digitally signed, any modification of the document will invalidate the signature.
- Non-repudiation: Repudiation refers to any act of relinquishing responsibility for a message. Non-repudiation ensures that the signer who digitally signed the document cannot deny having signed it. The digitally signed documents strengthen

its recipient integrity claims. Therefore, the recipient can strongly insist on the signature of the sender so as not to be easily denied at a later time.

- The difference between a digital signature and digital certificate is that a digital certificate binds a digital signature to an entity; whereas a digital signature ensures that a data remain secure from the point it was sent. In other words: digital certificates are used to verify the trustworthiness of the sender, while digital signatures are used to verify the trustworthiness of the data being sent.
- The certificate authority maintains a database of public keys called repository so that it can verify the user with digital signatures. Expired certificates are usually deleted from the database by the certificate authority.
- Brute-force attacks is the simplest attack method for breaking any encryption; that is, trying all the possible keys one by one.

GLOSSARY

3-D Secure	An additional security layer for online credit and debit card transactions.
Ciphertext	It is the encrypted data usually the output of an encryption algorithm
Cracker	A person who breaks computer network's security maliciously to gain access to critical data.
Cryptanalysis	Analyzing a suspecting document for hidden data or chiphertext
Cyber Squatting	Is the illegal practice of registering an Internet domain name that might be wanted by another person in an intention to sell it later for a profit
Decipher	A standard algorithm for decrypting data
Domain name	The website address of an online store, e.g.www.amazon.com
Encryption	A method of scrambling data using an algorithm to protect / hide from unauthorized access.
Friendly Fraud	Is an intentional falsely claim of a costumer that they really didn't buy(after receiving the goods)
Hacking	Unauthorized intrusion into a computer or a network. That is to say breaking security to gain access to a website illegally and intercept confidential information
Message digest (MD)	Is a representation of data in a form of single string of digits using one-way hashing formula.
One-Time Password (OTP)	A dynamic password that is valid for one login session or transaction provides a potential security for a e-payment transaction.
PIN (Personal Identification Number)	A static number that is assigned to consumers to secure card based payments.
Plaintext/ cleartext	It is the unencrypted information also called as input chip
Traffic	An indicator that marks the number of visitors for a particular site.

EVALUATION

JEXU18

Part - I

Choose the correct answer

1. In E-Commerce, when a stolen credit card is used to make a purchase it is termed as
   a) Friendly fraud
   b) Clean fraud
   c) Triangulation fraud
   d) Cyber squatting
2. Which of the following is not a security element involved in E-Commerce?
   a) Authenticity
   b) Confidentiality
   c) Fishing
   d) Privacy
3. Asymmetric encryption is also called as
   a) Secure Electronic Transaction
   b) Certification Authority
   c) RSA algorithm
   d) Payment Information
4. The security authentication technology does not include
   i) Digital Signatures
   ii) Digital Time Stamps
   iii) Digital Technology
   iv) Digital Certificates

   a) i, ii & iv b) ii & iii
   c) i, ii & iii d) all the above
5. PGP stands for
   a) Pretty Good Privacy
   b) Pretty Good Person
   c) Private Good Privacy
   d) Private Good Person
6. _____ protocol is used for securing credit cards transactions via the Internet
   a) Secure Electronic Transaction (SET)
   b) Credit Card Verification
   c) Symmetric Key Encryption
   d) Public Key Encryption
7. Secure Electronic Transaction (SET) was developed in
   a) 1999
   b) 1996
   c) 1969
   d) 1997
8. The websites secured by Secure Socket Layer protocols can be identified using
   a) html://
   b) http://
   c) htmls://
   d) https://
9. 3-D Secure, a protocol was developed by
   a) Visa
   b) Master
   c) Rupay
   d) PayTM

10. Which of the following is true about Ransomware
    a) Ransomware is not a subset of malware
    b) Ransomware deletes the file instantly
    c) Typopiracy is a form of ransomware
    d) Hackers demand ransom from the victim

Part - II

Short Answers

1. Write about information leakage in E-Commerce.
2. Write a short note on typopiracy.
3. Define non-repudiation.
4. List the different types of security technologies in E-Commerce
5. Write about digital signature.

Part - III

Explain in Brief Answer

1. Write a note on certification authorities (CA)
2. List some E-Commerce Security Threats?
3. Differentiate asymmetric and symmetric algorithms.
4. Write a note on PGP.
5. Explain 3D secure payment protocols

Part - IV

Explain in detail

1. Write about dimensions of E-Commerce Security.
2. Explain encryption technology.
3. Differenticate digital signatures and digital certificates.
4. Define Secure Electronic Transaction (SET) and its features.
5. Briefly explain SSL.

STUDENT ACTIVITY

Identifying the security protocols used in the particular payment gateway.

- Create a chart for a payment process.
- Describe the security technology used in that payment method.
- Repeat the process for few other payment process.

18
CHAPTER

Electronic Data Interchange- EDI

986IEZ

LEARNING OBJECTIVES

- To acquire basic knowledge on EDI
- To know the brief history of EDI
- To understand the various types of EDI
- To learn the advantages of EDI
- To know about the layers of EDI
- To study about UN/EDIFACT

18.1 Introduction to EDI

The Electronic Data Interchange (EDI) is the exchange of business documents between one trade partner and another electronically. It is transferred through a dedicated channel or through the Internet in a predefined format without much human intervention.

It is used to transfer documents such as delivery notes, invoices, purchase orders, advance ship notice, functional acknowledgements etc. These documents are transferred directly from the computer of the issuing company to that of the receiving company, with great time saving and avoiding many errors of traditional "on paper" communications.

Before the popularization of Internet-based E-Commerce, it was a major E-Commerce model. EDI includes data exchange between buyers and sellers, trade partners, and also internal data exchange within departments of a company. There are many internationally accepted EDI standard e.g. EDIFACT, XML, ANSI ASC X12, etc. See Figure 18.1

EDI is "Paperless Trade" and EFT (Electronic Transfer) is "Paperless Payment"

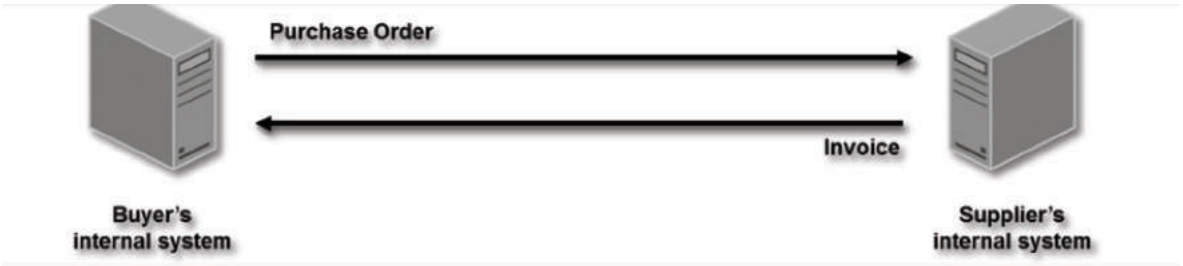


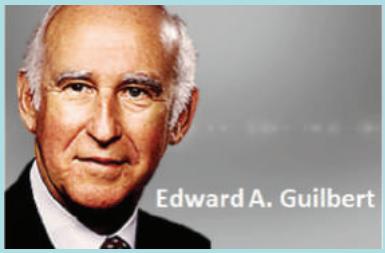
Figure: 18.1 Electronic Document Exchange

HISTORY OF EDI

With the popularity of computers, many companies and organizations use computers to store and process data. However, different organizations use different application systems, and the format of the data generated is not the same. When organizations need to communicate for their business needs they have to rekey. This was time consuming and a major obstacle in the business operations. In order to solve this problem, some enterprises have agreed a specific standard format, which can be regarded as the origin of the EDI application concept.

DO YOU KNOW?

Like many other early information technologies, EDI was also inspired by developments in Defense Research Organization. **Ed Guilbert**, is called as the father of EDI. He manifested shipping standardized format (much like the 856, or ASN) during the 1948 Berlin airlift. Guilbert with his team developed the first standardized system for business documents, that later influenced how documents would be passed from computer to computer. This standard helped to track "what was contained in the shipment", "who was delivering the cargo", while not allowing language barriers or confusing formats to delay the shipment.



Soon, businesses began to realize using the EDI will smoothen the business transactions and increase the profit. These standardizations made ordering and shipping faster, more organized, and less expensive. Earlier, EDI documents were transmitted electronically by the use of Radio teletype, telex messages, or telephone.

In late 1960s, shipping line, railroads, airlines, and truck companies of USA were exchanging electronic messages for their businesses. These messages were in different formats, and it resulted problems in transfer of goods. In 1968, these companies grouped together among themselves and formed the Transportation Data Coordinating Committee (TDCC) to develop EDI standard formats.

In 1975, first EDI standards were released by TDCC, of which Ed Guilbert was a major contributor. In 1977, a group of supermarket companies and their business partners begin drafting and using an EDI project. The TDCC is renamed as Electronic Data Interchange Association (EDIA) in 1978. Later in that year, the EDIA was undertaken by the American National Standards Institute and becomes the ANSIX12 committee. Since then this committee is responsible for the publication of EDI standards.

Later in 1985, UN created the EDIFACT to assist with the global reach of technology in E-Commerce. EDIFACT is the most widely used EDI.

DO YOU KNOW?

The first EDI messages was sent in 1965 from the Holland-American steamship line to Trans-Atlantic shipping company using telex messages. The computer had sent a full page of information in roughly 2 minutes. These messages were then written on the magnetic tapes that could be loaded onto another computer.

18.2 EDI Types

The types of EDI were constructed based on how EDI communication connections and the conversion were organized. Thus based on the medium used for transmitting EDI documents the following are the major EDI types.

- Direct EDI
- EDI via VAN
- EDI via FTP/VPN, SFTP, FTPS
- Web EDI
- Mobile EDI

Direct EDI/Point-to-Point

It is also called as Point-to-Point EDI. It establishes a direct connection between various business stakeholders and partners individually. This type of EDI suits to larger businesses with a lot of day to day business transactions.

EDI via VAN

EDI via VAN (Value Added Network) is where EDI documents are transferred with the support of third party network service providers. Many businesses prefer this network model to protect them from the updating ongoing complexities of network technologies. See Figure 18.2

DO YOU KNOW?

A value-added network is a company, that is based on its own network, offering EDI services to other businesses. A value-added network acts as an intermediary between trading partners. The principle operations of value-added networks are the allocation of access rights and providing high data security.

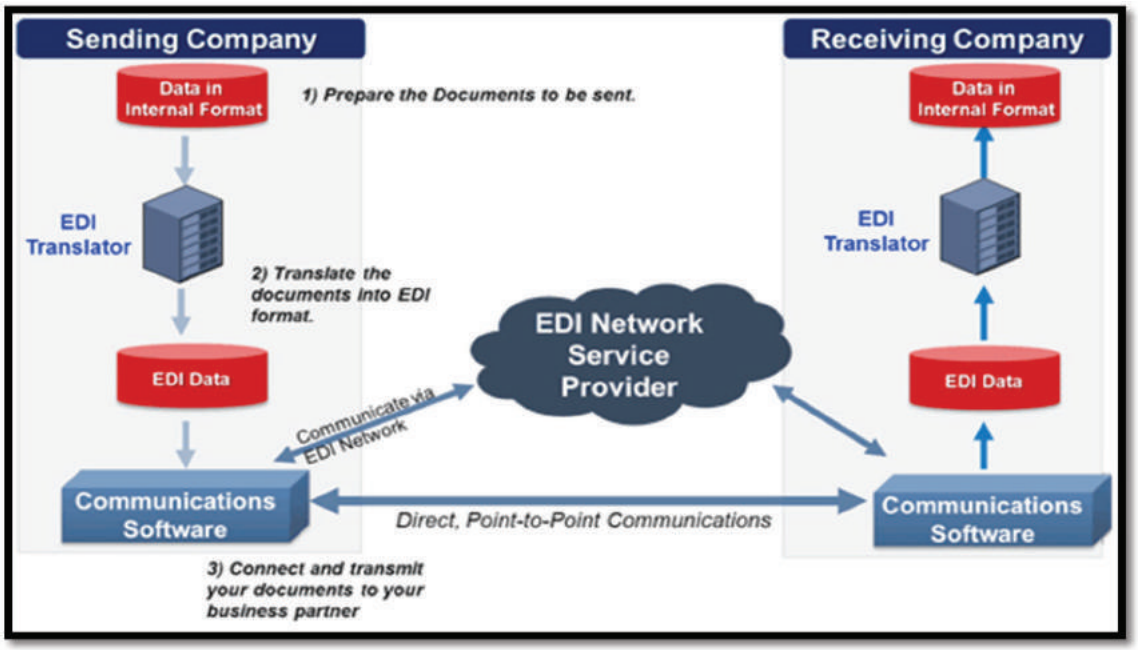


Figure: 18.2 EDI via VAN

EDI via FTP/VPN, SFTP, FTPS

When protocols like FTP/VPN, SFTP and FTPS are used for exchange of EDI based documents through the Internet or Intranet it is called as EDI via FTP/VPN, SFTP, FTPS.

Web EDI

Web based EDI conducts EDI using an web browser via the Internet. Here the businesses are allowed to use any browser to transfer data to their business partners. Web based EDI is easy and convenient for small and medium organizations.

Mobile EDI

When smartphones or other such handheld devices are used to transfer EDI documents it is called as mobile EDI. Mobile EDI applications considerably increase the speed of EDI transactions.

18.3 Advantages of EDI

EDI was developed to solve the problems inherent in paper-based transaction processing and in other forms of electronic communication. Implementing EDI system offers a company greater control over its supply chain and allow it to trade more effectively. It also increases productivity and promotes operational efficiency. The following are the other advantages of EDI.

- Improving service to end users
- Increasing productivity
- Minimizing errors
- Slashing response times
- Automation of operations
- Cutting costs
- Integrating all business and trading partners
- Providing information on process status
- Optimizing financial ratios

18.4 EDI Layers

Electronic data interchange architecture specifies four different layers namely

1. Semantic layer
2. Standards translation layer
3. Transport layer
4. Physical layer

These EDI layers describes how data flows from one computer to another. See Figure 18.3

<table>
<tr><td>EDI semantie layer</td><td colspan="2">Application level services</td></tr>
<tr><td rowspan="2">EDI standard layer</td><td colspan="2">EDIFACT business form standards</td></tr>
<tr><td colspan="2">ANSI X 12 business form standards</td></tr>
<tr><td rowspan="3">EDI transport layer</td><td>Electronic mail</td><td>X.435, MIME</td></tr>
<tr><td>Point to point</td><td>FTP. TELNET</td></tr>
<tr><td>World Wide Web</td><td>HTTP</td></tr>
<tr><td>Physical layer</td><td colspan="2">Dial-up line, internet, I-way</td></tr>
</table>

Figure: 18.3 EDI Layers

18.5 EDI Components

There are four major components of EDI. They are

1. Standard document format
2. Translator and Mapper
3. Communication software
4. Communication network

18.6 EDI Standards

The standard is the most critical part of the entire EDI. Since EDI is the data transmission and information exchange in the form of an agreed message format, it is important to develop a unified EDI standard. The EDI standard

is mainly divided into the following aspects: basic standards, code standards, message standards, document standards, management standards, application standards, communication standards and security standards.

The first industry-specific EDI standard was the TDCC published by the Transportation Data coordinating Committee in 1975. Then other industries started developing unique standards based on their individual needs. E.g. WINS in the warehousing industry.

Since the application of EDI has become more mature, the target of trading operations is often not limited to a single industry. In 1979, the American National Standards Institute Accredited Standard Committee (ANSI ASC) developed a wider range of EDI standard called ANSI X12.

On the other hand, the European region has also developed an integrated EDI standard. Known as GTDI (Guideline for Trade Data Interchange).

ANSI X12 and GTDI have become the two regional EDI standards in North America and Europe respectively.

After the development of the two major regional EDI standards and a few years after trial, the two standards began to integrate and conduct research and development of common EDI standards. Subsequently, the United Nations Economic Commission for Europe (UN/ECE/WP.4) hosted the task of the development of international EDI standards. In 1986, UN/EDIFACT is officially proposed. The most widely used EDI message standards are the United Nations EDIFACT and the ANSI X12.

18.7 UN/EDIFACT

United Nations / Electronic Data Interchange for Administration, Commerce and Transport (UN / EDIFACT) is an international EDI - standard developed under the supervision of the United Nations. In 1987, the UN / EDIFACT syntax rules were approved as ISO: ISO9735 standard by the International Organization for Standardization. See Figure 18.4

EDIFACT includes a set of internationally agreed standards, catalogs and guidelines for electronic exchange of structured data between independent computer systems.

Figure: 18.4 UN/EDIFACT

It is a cross-industry, standard data format of electronic data for commercial transactions. Maintenance and further development of this standard goes through the United Nations Center for Trade Facilitation and Electronic Business (UN/CEFACT), which is affiliated to the UN Economic Commission for Europe (UNECE).

EDIFACT directories

The versions of EDIFACT are also called as directories. These EDIFACT directories

will be revised twice a year; on 1st April and 1st October to include new or update existing EDIFACT messages. EDIFACT directories have names like D.18B

(D stands for Directory, 18 is the year and A/B indicates the month of release)

EDIFACT subsets

Due to the complexity, branch-specific subsets of EDIFACT have developed. These subsets of EDIFACT include only the functions relevant to specific user groups.

Example:

CEFIC - Chemical industry

EDIFURN - furniture industry

EDIGAS - gas business

EDIFACT Structure

EDIFACT is a hierarchical structure where the top level is referred to as an interchange, and lower levels contain multiple messages. The messages consist of segments, which in turn consist of composites. The final iteration is a data element. See Figure 18.5 and 18.6

Segment Tables

Segment table lists the message tags. It contains the tags, tag names, requirements designator and repetitation field. The requirement designator may be mandatory (M) or conditional (C). The (M) denotes that the segment must appear atleast once. The (C) denotes that the segment may be used if needed. e.g. C10 indicates repetitions of a segment or group between 0 and 10.

Position	Tag	Name	Req	Rept
0010	UNH	Message Header	M	1
0020	BGM	Beginning of Message	M	1
0030	BUS	Business Function	C	1
0040	DTM	Date/Time/Period	M	4
0060	RFF	Reference	M	1
0070	DTM	Date/Time/Period	C	1
0080	FTX	Free Text	C	5
0090	PAI	Payment Instructions	C	1
0100	FCA	Financial Charges Allocation	C	1
0120	MOA	Monetary Amount	M	1
0130	CUX	Currencies	C	1
0140	DTM	Date/Time/Period	C	2
0150	RFF	Reference	C	1
	etc.			
	etc.			

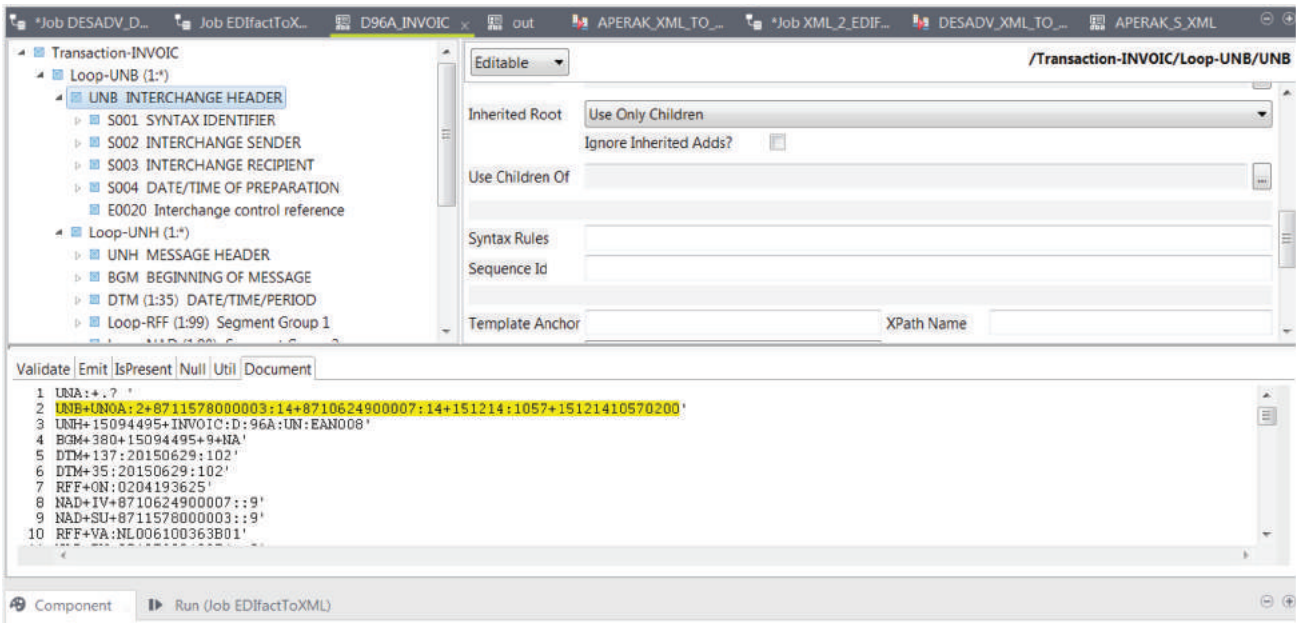


Figure 18.5 Sample EDI Application

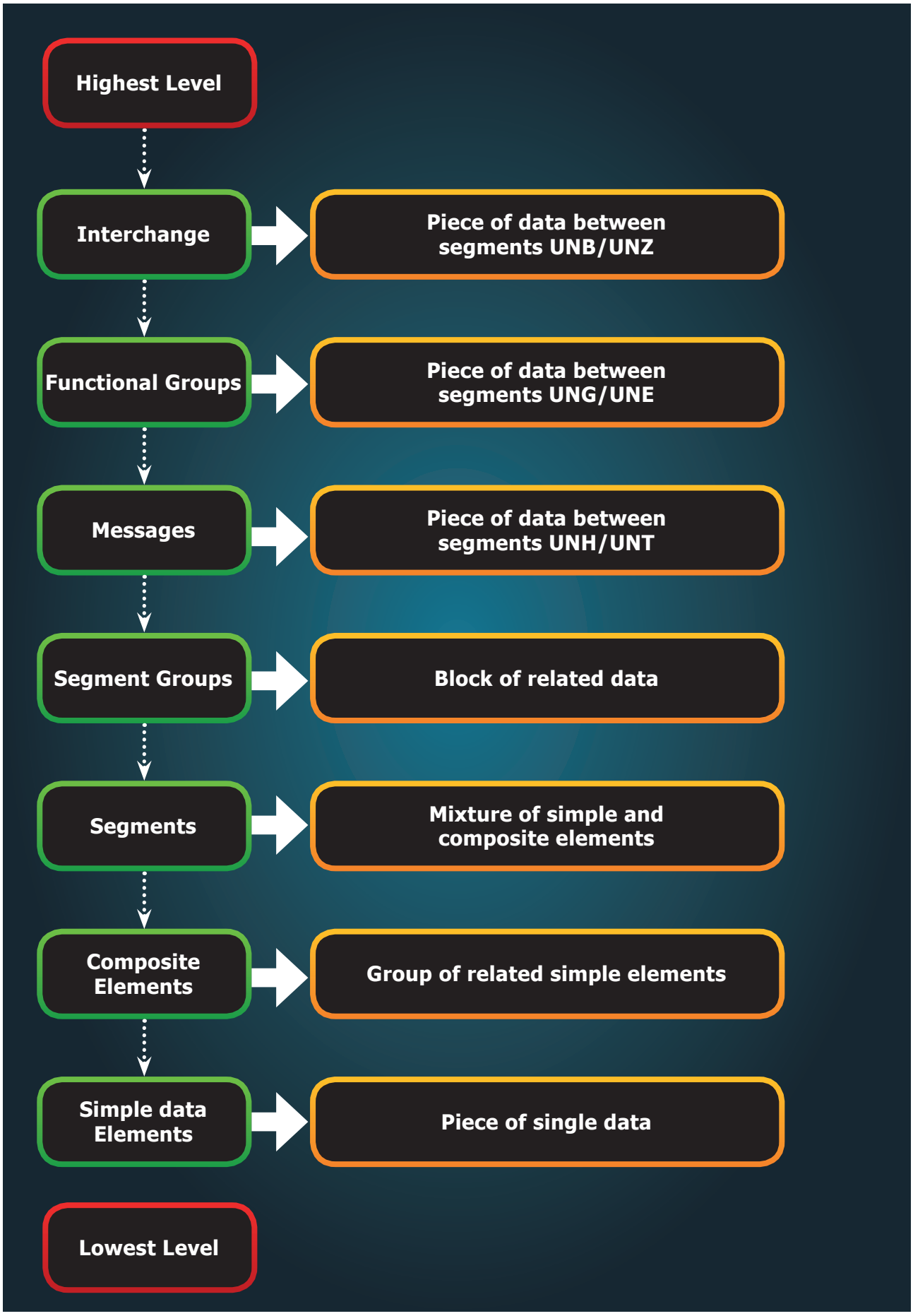


Figure: 18.6 UN/EDIFACT Message structure

EDI Interchange

Interchange is also called as envelope. The top level of EDIFACT structure is Interchange. An interchange may contain multiple messages. It starts with UNB and ends with UNZ

EDIFACT message

The basic standardization concept of EDIFACT is that there are uniform message types called United Nations Standard Message (UNSM). In so-called subsets, the message types can be specified deeper in their characteristics depending on the sector. The message types, all of which always have exactly one nickname consisting of six uppercase English alphabets. The message begins with UNH and ends with UNT

- Service messages
  To confirm / reject a message, CONTRL and APERAK messages are sent.
  - CONTRL- Syntax Check and Confirmation of Arrival of Message
  - APERAK - Technical error messages and acknowledgment
- Data exchange
  - CREMUL - multiple credit advice
  - DELFOR- Delivery forecast
  - IFTMBC - Booking confirmation

EDIFACT Segment

It is the subset of message. A segment is a three-character alphanumeric code. These segments are listed in segment tables. Segments may contain one, or several related user data elements.

EDIFACT Elements

The elements are the piece of actual data. These data elements may be either simple or composite.

An excerpt from an EDIFACT message might be:

DTM + 11: 200 606 200 730: 203'

This whole line is called a segment. The meaning of each code is as follows:

- DTM is the segment identifier and it indicates that the following data is date / time information.
- 11 is a data element. In this example, a qualifier describes what kind of event is meant. The code 11 means: time of dispatch / delivery of goods.
- 200606200730 is another element. Here it represents the date in the format CCYYMMDDHHMM.
- 203 is also an element. 203 is an identifier for the date format.

In this example, 203 means that the date is in the format CCYYMMDDHHMM (as of D.18B, CC – century, YY – Year, MM- Month, DD – Date, HH – Hour, MM – Minute)

EDI Separators

EDIFACT has the following punctuation marks that are used as standard separators.

Character	Uses
Apostrophe '	segment terminator
Plus sign +	segment tag and data element separator
Colon :	component data element separator
Question mark ?	release character
Period .	decimal point

Example:

```
UNA:+.? '
UNB+IATB:1+6XPPC:ZZ+LHPPC:ZZ+940101:0950+1'
UNH+1+PAORES:93:1:IA'
MSG+1:45'
IFT+3+XYZCOMPANY AVAILABILITY'
ERC+A7V:1:AMD'
IFT+3+NO MORE FLIGHTS'
ODI'
TVL+240493:1000::1220+FRA+JFK+DL+400+C'
PDI++C:3+Y::3+F::1'
APD+74C:0:::6++++++6X'
TVL+240493:1740::2030+JFK+MIA+DL+081+C'
PDI++C:4'
APD+EM2:0:1630::6+++++++DA'
UNT+13+1'
UNZ+1+1'
```

POINTS TO REMEMBER

- According to the National Institute of Standards and Technology, EDI is "the computer-to-computer interchange of strictly formatted messages that represent documents other than monetary instruments."
- EDI is "Paperless Trade" and EFT (Electronic Transfer) is "Paperless Payment"
- **Ed Guilbert**, is called as the father of EDI
- In 1985, UN created the EDIFACT to assist with the global reach of technology in E-Commerce.
- Direct EDI is also called as Point-to-Point EDI
- Every EDI message consist of six uppercase English Alphabets

GLOSSARY

Advance ship notice	A notification of pending deliveries
FTP	A standard network protocol used for the transfer of computer files between a client and server on a computer network.
Interchange	The top level message of EDI hierarchical structure
Invoice	A commercial document issued by a seller to a buyer containing product name, quantity and price.
Purchase order	A commercial and first official document issued by a buyer to a seller indicating types, quantities, and agreed prices for products or services.
Segment	Segments may contain one, or several related user data elements.
Separators	punctuation marks that are used to separate segments or elements.
TDCC	Transportation Data Communication Committee - The first industry-specific EDI standard.
Telex	A type of teleprinter
VAN	Value Added Network, a third party network service provider

EVALUATION

D24JLY

Part - I

Choose the correct answer

1. EDI stands for
   a) Electronic Details Information
   b) Electronic Data Information
   c) Electronic Data Interchange
   d) Electronic Details Interchange

2. Which of the following is an internationally recognized standard format for trade, transportation, insurance, banking and customs?
   a) TSLFACT
   b) SETFACT
   c) FTPFACT
   d) EDIFACT

3. Which is the first industry-specific EDI standard?
   a) TDCC
   b) VISA
   c) Master
   d) ANSI

4. UNSM stands for?
   a) Universal Natural Standard message
   b) Universal Notations for Simple message
   c) United Nations Standard message
   d) United Nations Service message

5. Which of the following is a type of EDI?
   a) Direct EDI
   b) Indirect EDI
   c) Collective EDI
   d) Unique EDI
6. Who is called as the father of EDI?
   a) Charles Babbage
   b) Ed Guilbert
   c) Pascal
   d) None of the above
7. EDI interchanges starts with ____ and ends with ____
   a) UNA, UNZ
   b) UNB, UNZ
   c) UNA, UNT
   d) UNB, UNT
8. EDIFACT stands for
   a) EDI for Admissible Commercial Transport
   b) EDI for Advisory Committee and Transport
   c) EDI for Administration, Commerce and Transport
   d) EDI for Admissible Commerce and Trade
9. The versions of EDIFACT are also called as
   a) Message types b) Subsets
   c) Directories d) Folders
10. Number of characters in an single EDIFACT messages
    a) 5 b) 6 c) 4 d) 3

Part - II

Short Answers

1. Define EDI.
2. List few types of business documents that are transmitted through EDI.
3. What are the 4 major components of EDI?
4. What is meant by directories in EDIFACT?
5. Write a note on EDIFACT subsets.

Part - III

Explain in Brief Answer

1. Write a short note on EDI.
2. List the various layers of EDI.
3. Write a note on UN/EDIFACT.
4. Write a note on EDIFACT message.
5. Write about EDIFACT separators

Part - IV

Explain in detail

1. Briefly explain various types of EDI.
2. What are the advantages of EDI?
3. Write about structure of EDIFACT.

STUDENT ACTIVITY

- Prepare a chart explaining various types of EDI standards. (e.g. web EDI)

01
EXERCISE

PageMaker-Page Formatting

AIM

To create a new document using thedefault given options.

1. Open Pagemaker 7.0 and create a new document layout which includes the following setup options:
   - Page size – A4.
   - Number of Pages – 4.
   - Margins 1.25 inches- top, and .75 inches - all other sides.

2. Type the following text:

   HAPPINESS

   Happiness is often confused with fun, good living, and riches. Sometimes fun is equated with happiness. Fun is what we experience while doing an activity, whereas happiness is a residual and long-lasting feeling. The path to happiness is long and full of challenges. Happiness requires life-long pursuit.

3. Set the heading 'HAPPINESS' in 18 points, Arial font, bold and alignment centre.

4. Format the paragraph as follows:

   (a) Font – Arial

   (b) Font size – 12

   (c) Alignment – Justified

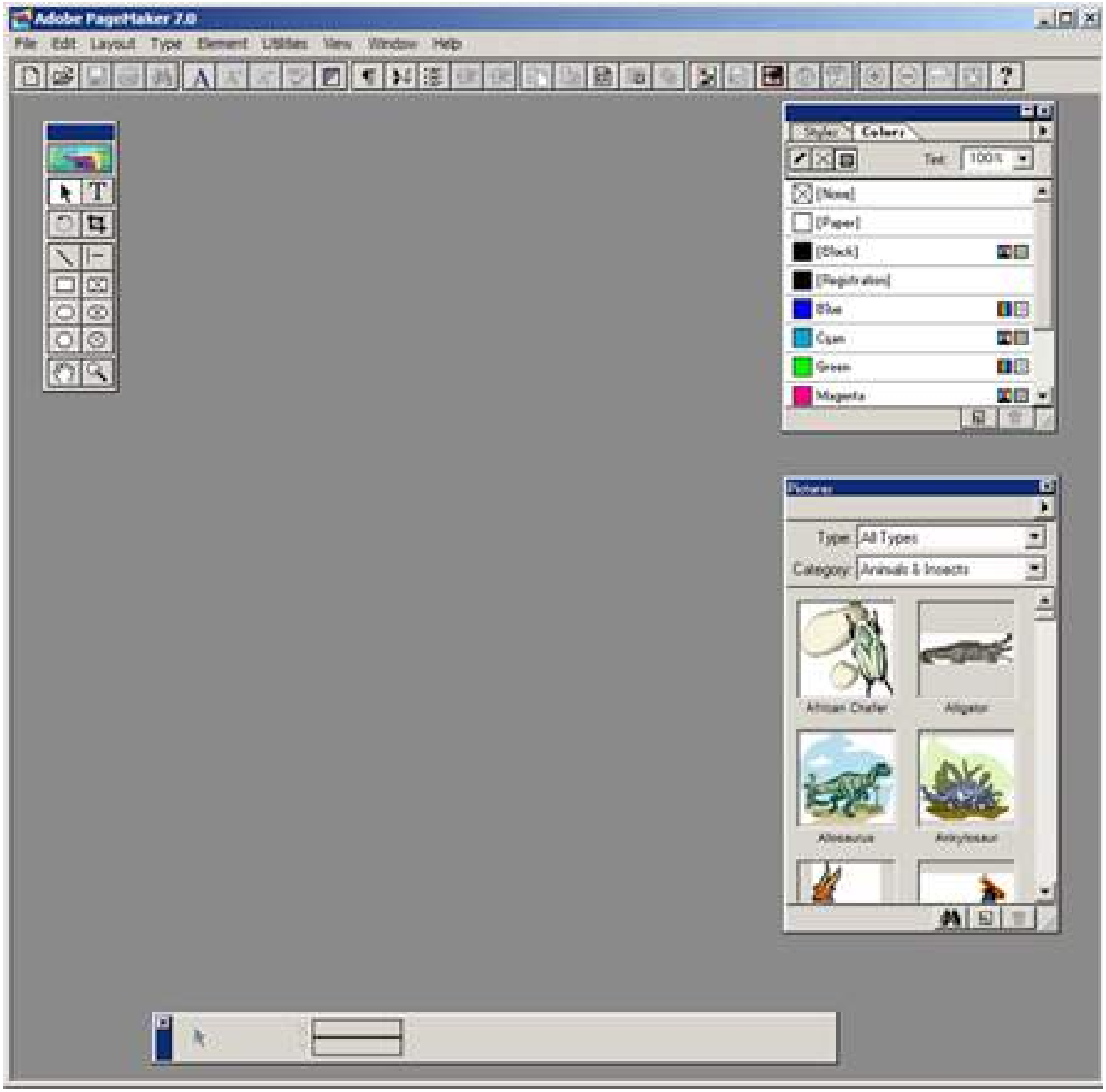
   (d) Leading – 20

5. Save the document as 'happiness'.

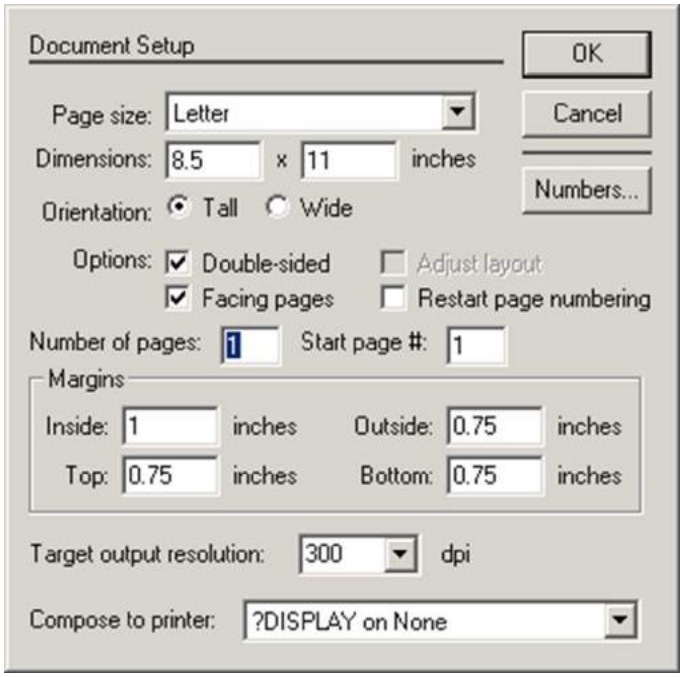
Procedure

1. Start the PageMaker using the following commands.

   Start -> All Programs -> Adobe -> PageMaker 7.0 -> Adobe PageMaker 7.0. The Adobe PageMaker window will be opened as shown in Figure.

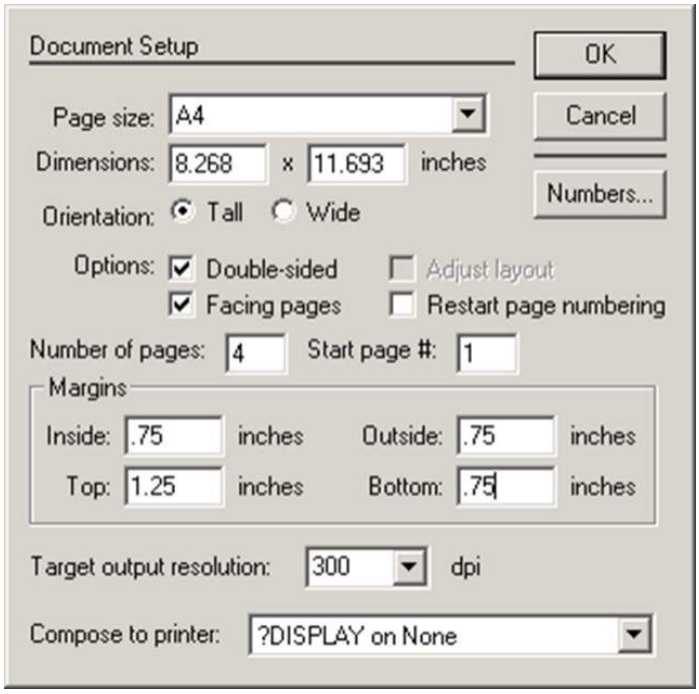


2. Choose File > New in the menu bar. (or) Press Ctrl + N in the keyboard. This opens the Document Setup dialog box.

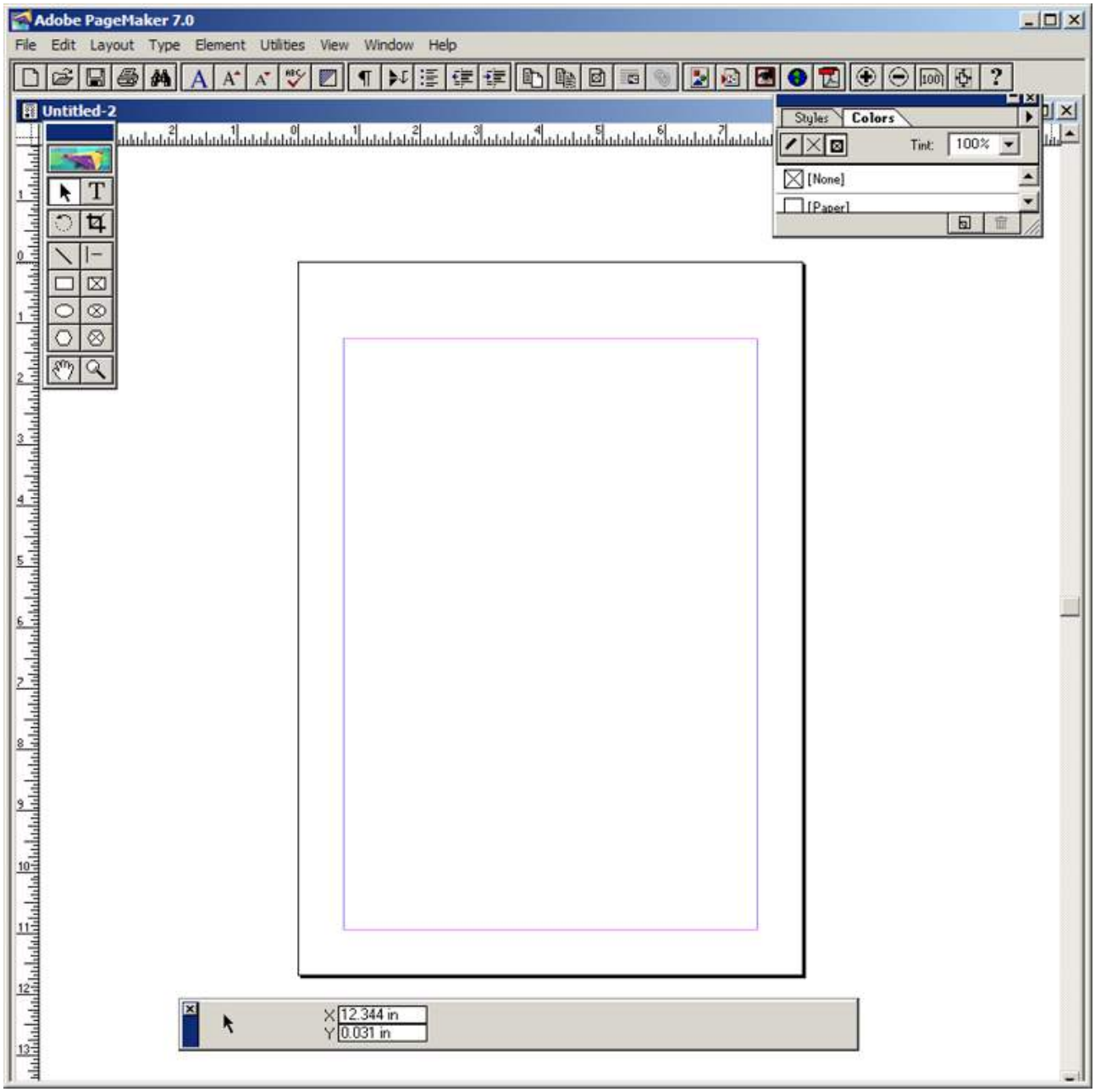


- Click the Page Size drop down list box and select A4 size.
- In the Number of pages text box, type 4.
- Set the values in the Margins sections as follows :

Inside	–	– 0.75 inches
Outside	–	0.75 inches
Top	–	1.25 inches
Bottom	–	0.75 inches



3. Click on OK. Now a new document called Untitled – 1 will appear on the screen as shown in Figure.

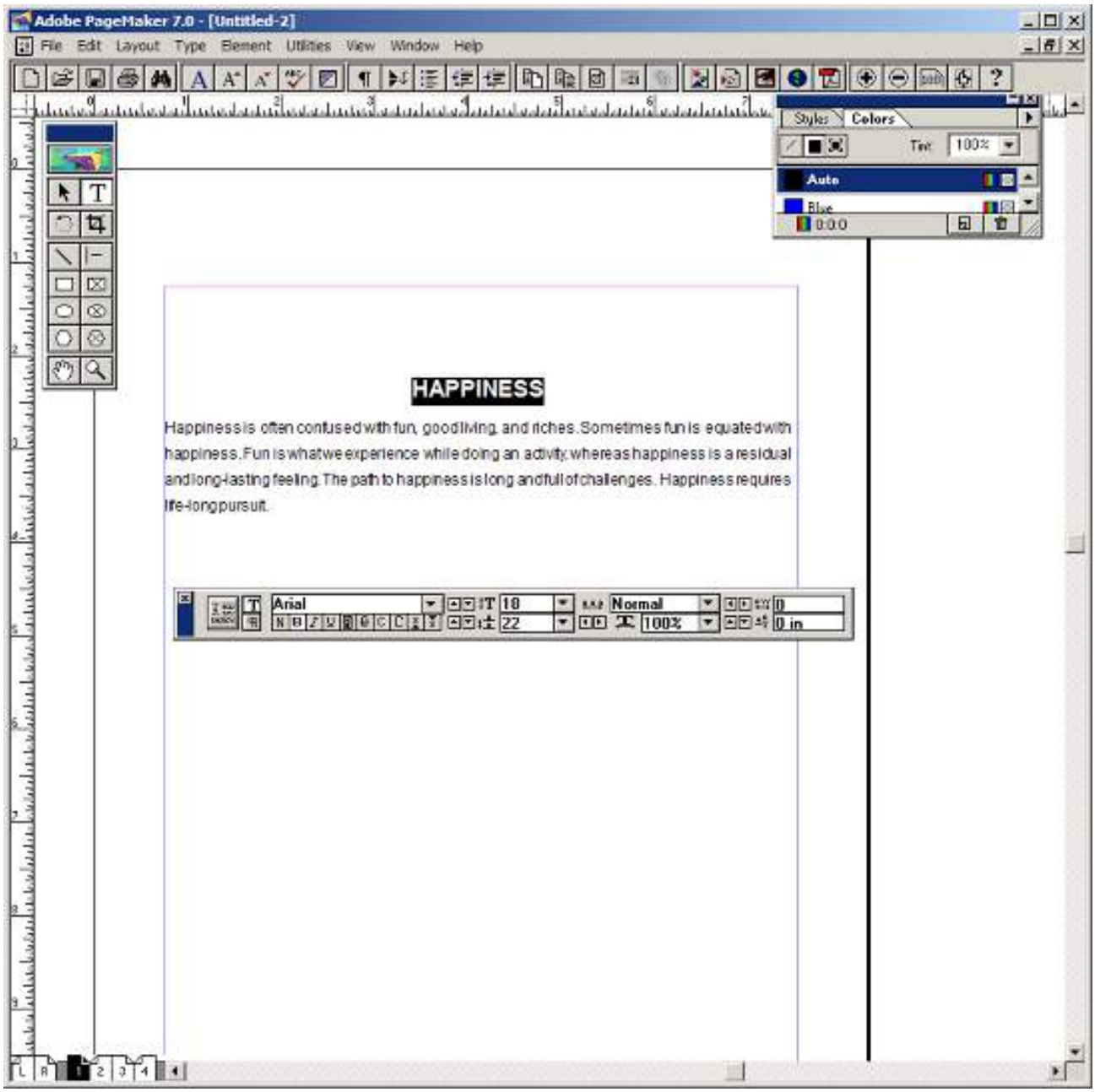


4. Click on the Text tool and create a text block. Then type the following text in the text block.

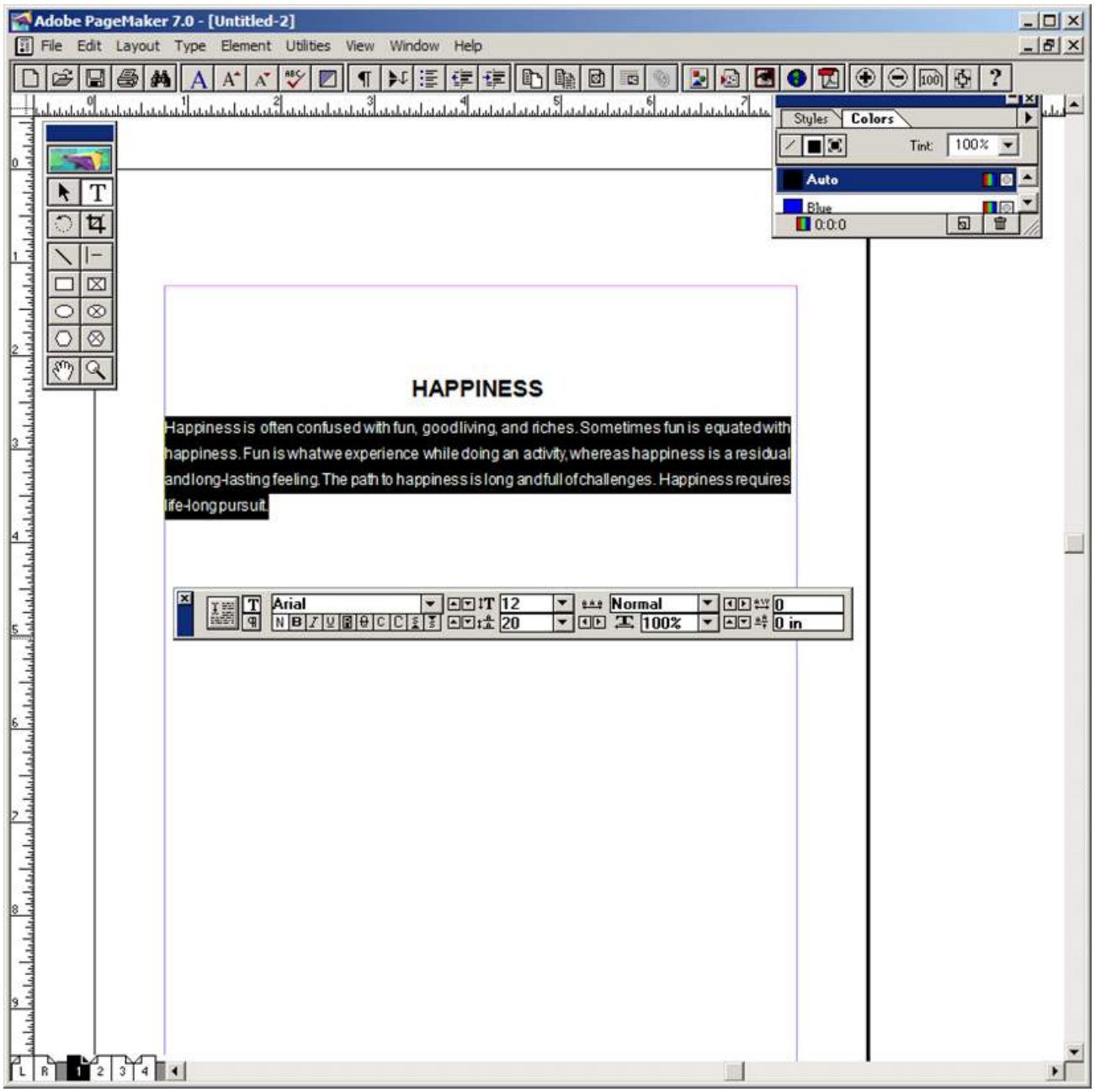
HAPPINESS

Happiness is often confused with fun, good living, and riches. Sometimes fun is equated with happiness. Fun is what we experience while doing an activity, whereas happiness is a residual and long-lasting feeling. The path to happiness is long and full of challenges. Happiness requires life-long pursuit.

5. Select the word '**HAPPINESS**' with Text tool. Using **Character Control Palette**, change the font to Arial, font size to 18, and Leading 22. Then click on **Bold** button. Then press **Shift + Ctrl + C** for centre alignment.

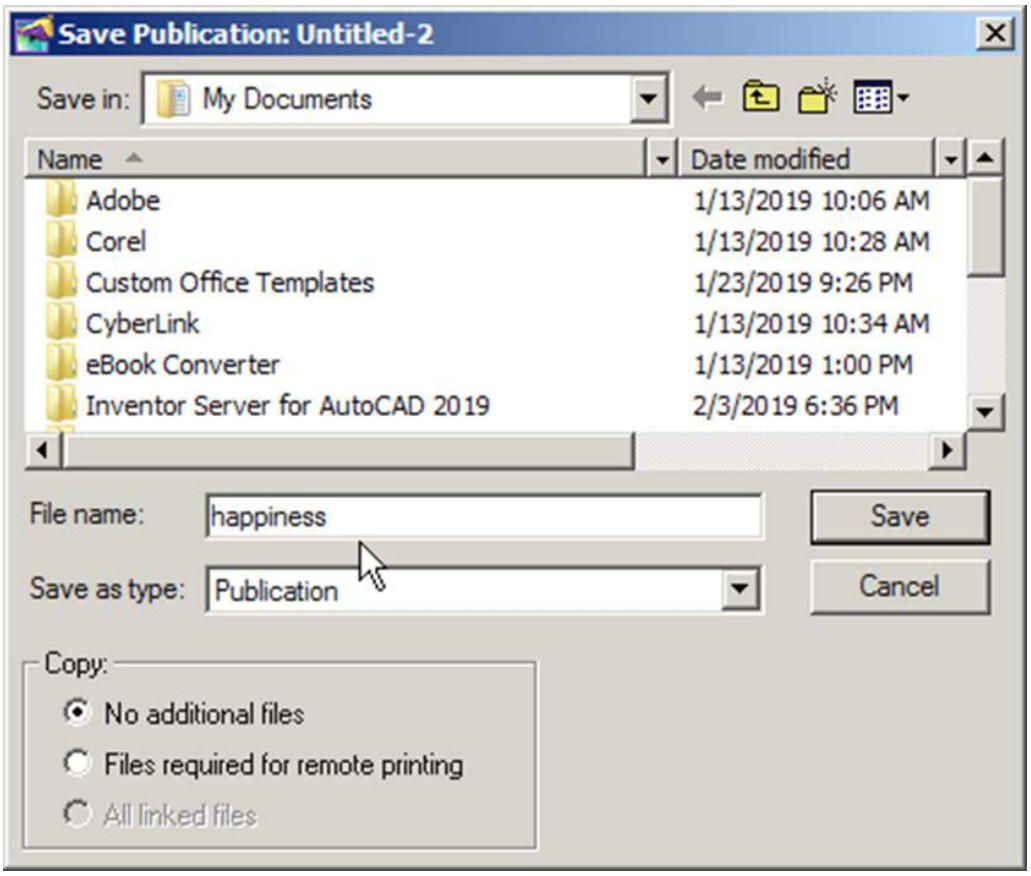


6. Select the paragraph with Text tool. Using **Character Control Palette**, change the font to Arial, font size to 12, and Leading 20. Then press **Shift + Ctrl + J** for Justify.



7. To save the document as ‘happiness’

(a) Press Ctrl + S (or) Choose File > Save in the menu bar. Save publication dialogue box appears. Type ‘happiness’ in the File name text box and press Save button.



Output

HAPPINESS

Happiness is often confused with fun, good living, and riches. Sometimes fun is equated with happiness. Fun is what we experience while doing an activity, whereas happiness is a residual and long-lasting feeling. The path to happiness is long and full of challenges. Happiness requires life-long pursuit.

Conclusion

The expected output is achieved.

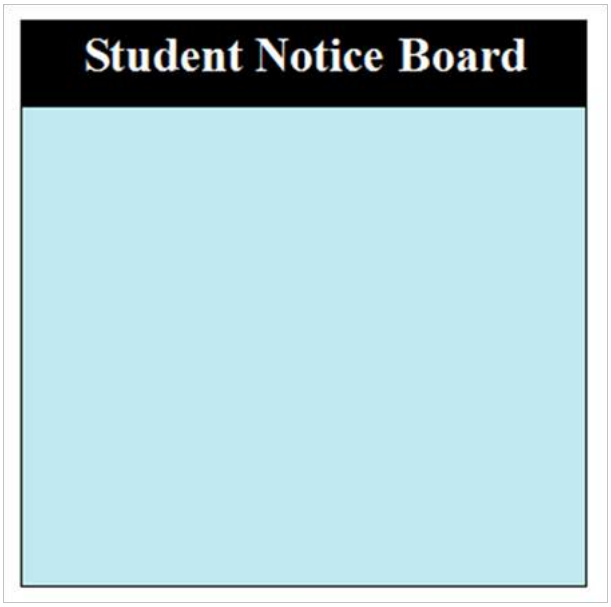
02
EXERCISE

PageMaker-Creating Notice Board

AIM

To create a Student Notice Board.

Create a Student Notice Board using PageMaker.



Procedure

1. Start the PageMaker using the following commands.

   Start -> All Programs -> Adobe -> PageMaker 7.0 -> Adobe PageMaker 7.0. The Adobe PageMaker window will be opened.

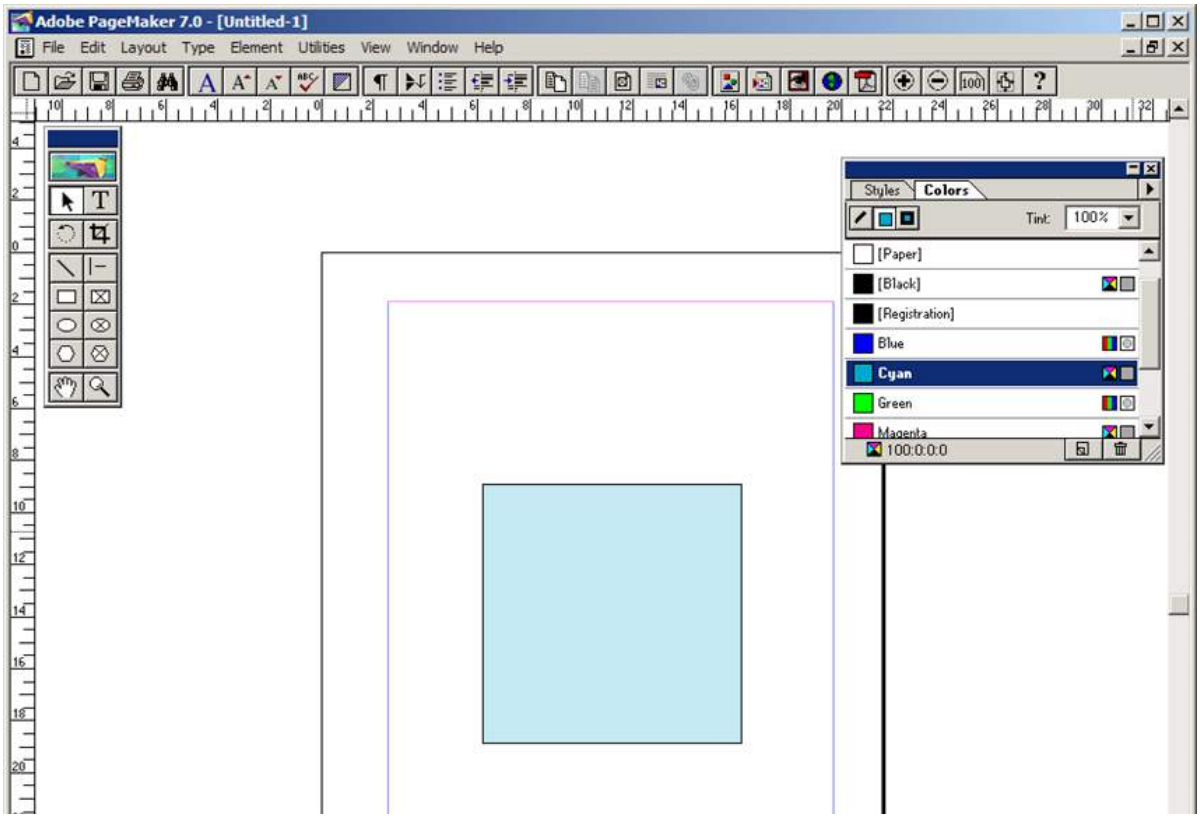
2. Choose File > New in the menu bar (or) Press Ctrl + N in the keyboard.

   This opens the Document Setup dialog box.

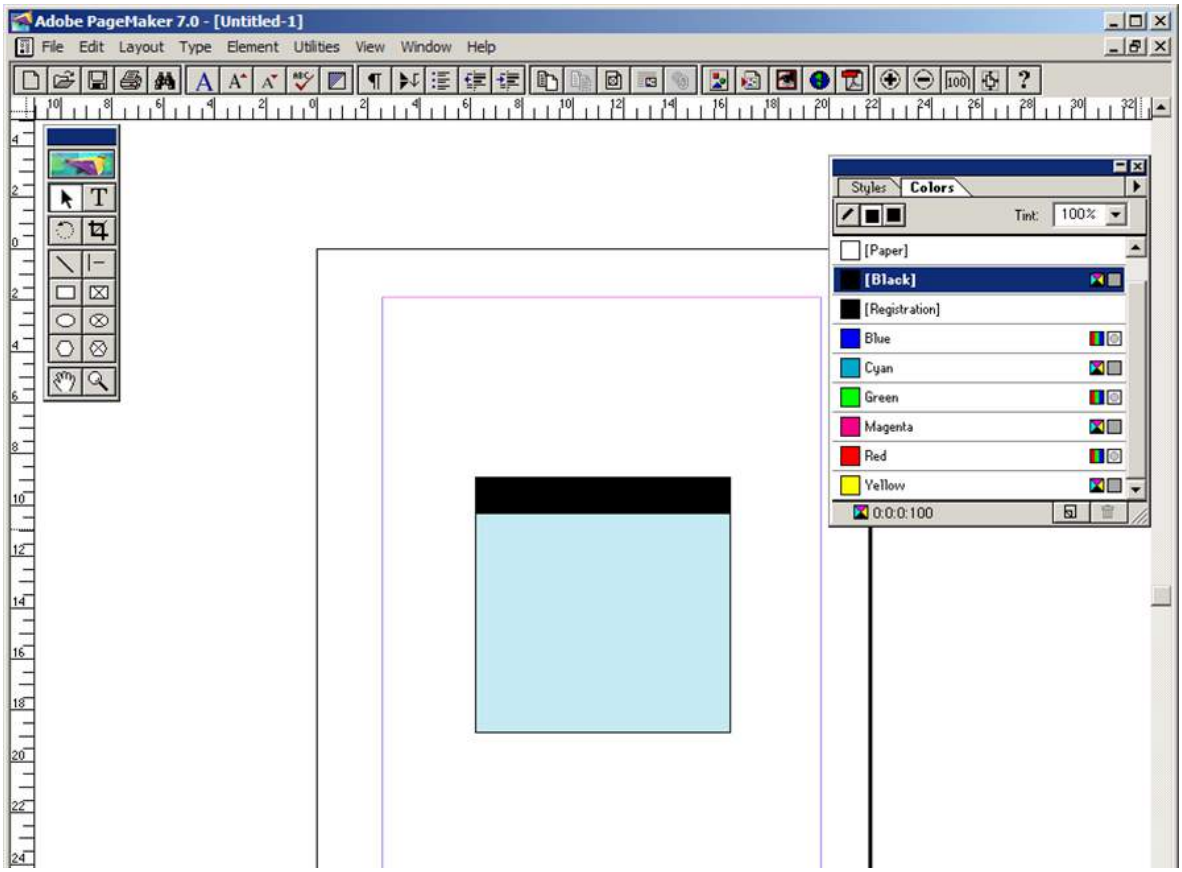
3. Click on OK button.

   Now a new document called Untitled – 1 will appear on the screen.

4. Create a box with dimension 100 mm x 100 mm using the Rectangle tool. Fill it with cyan colour and change the percentage value of tint to 25%. The resulting box is as shown in Figure.



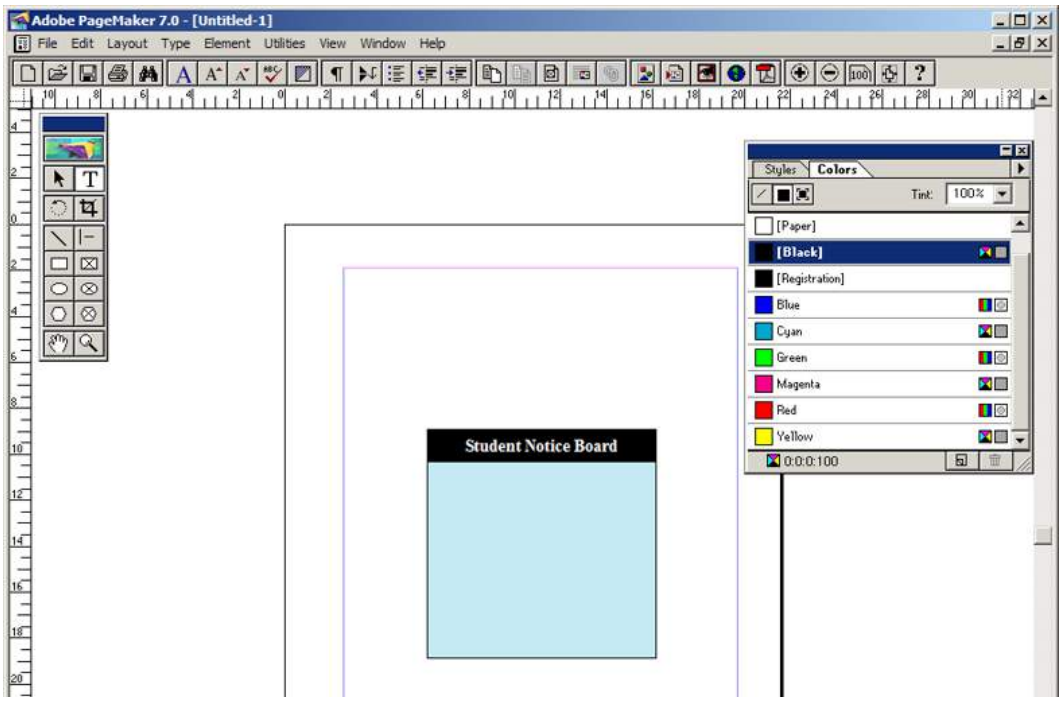
5. Similarly create another box with dimension 100 mm x 15 mm. Fill it with black colour and place it on the top portion of the cyan filled box as shown in figure.



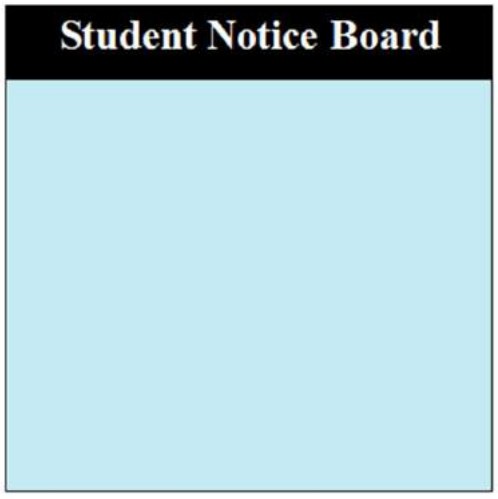
6. With the text tool click and drag the mouse from the left corner to the right corner of the black filled box and type the following words "Student Notice Board".

   The colour of the text and the colour of the box will be same black colour. As soon as you finish typing press Ctrl + A in the keyboard which will select the entire text.

   Using Character Control palette change the font size to 20 points and click on the Bold button. Then click on the Reverse button which will change the colour of the text to white and press Shift + Ctrl + C for centre alignment. The result is as shown in Figure.



Output



Conclusion

The expected output is achieved.

03
EXERCISE

PageMaker-Creating Visiting Card

AIM

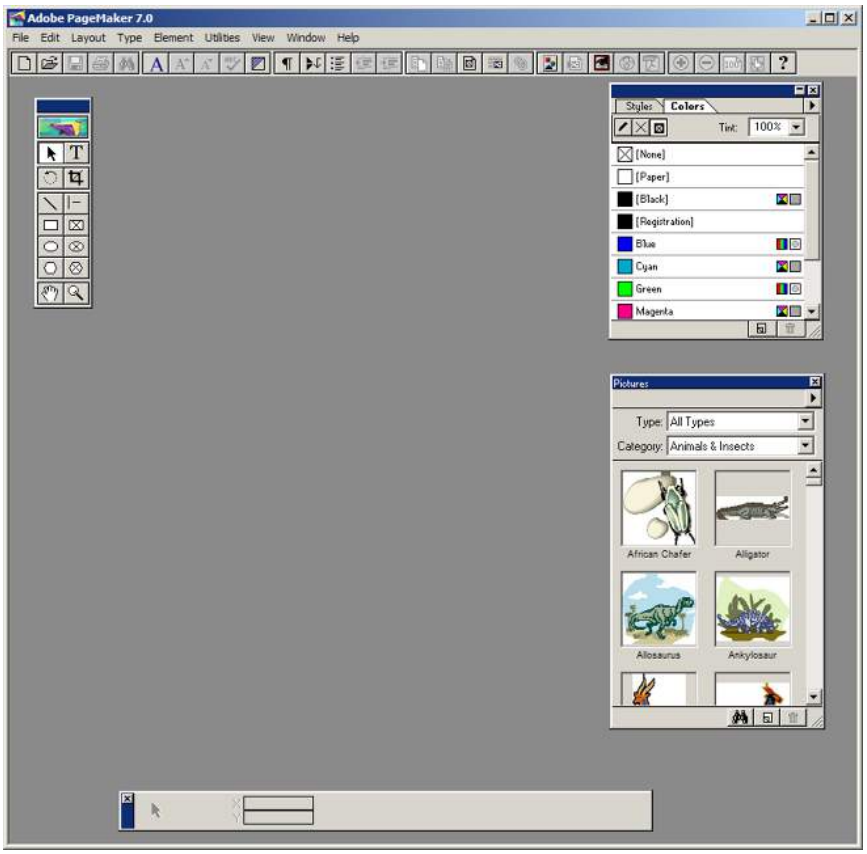
To create a Visiting Card using PageMaker software.

Create the following Visiting Card using PageMaker.

Procedure

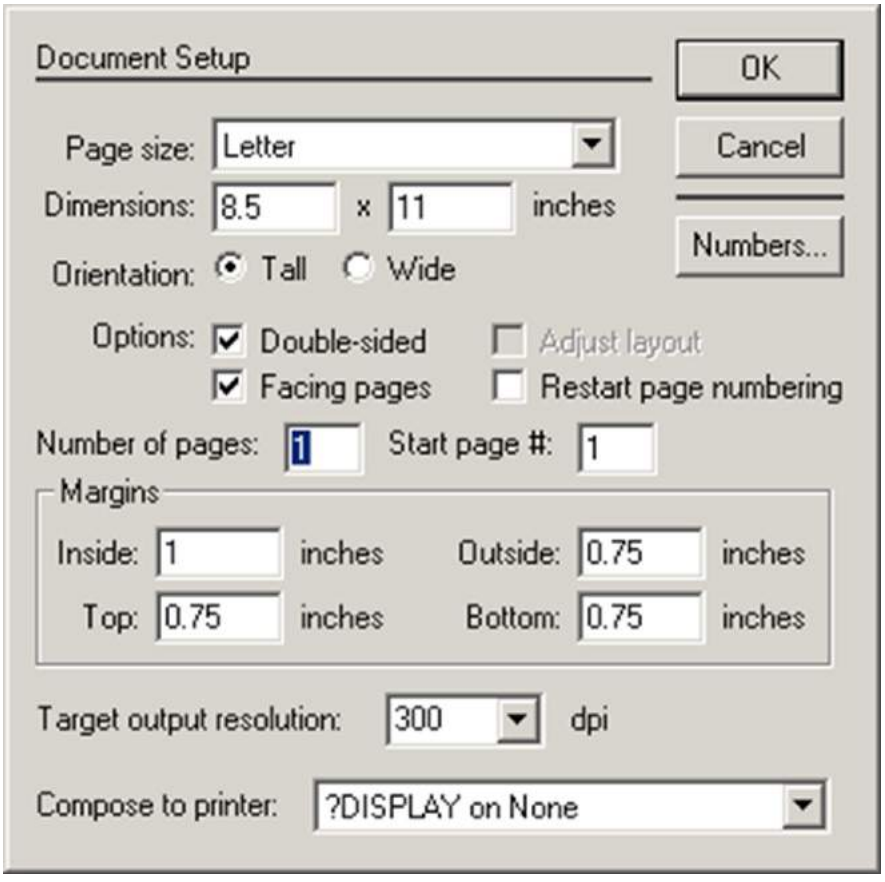
1. Start the PageMaker using the following commands.

   Start -> All Programs -> Adobe ->Pagemaker 7.0 -> Adobe PageMaker 7.0. The Adobe PageMaker window will be opened as shown in Figure 1.1.



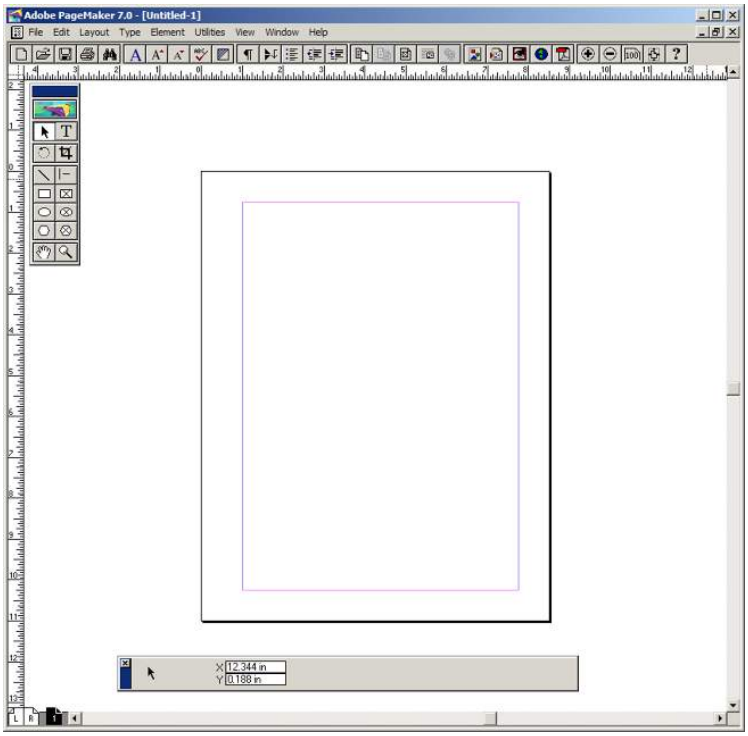
2. Choose File > New in the menu bar (or) Press Ctrl + N in the keyboard.

This opens the Document Setup dialog box.



3. Click on OK.

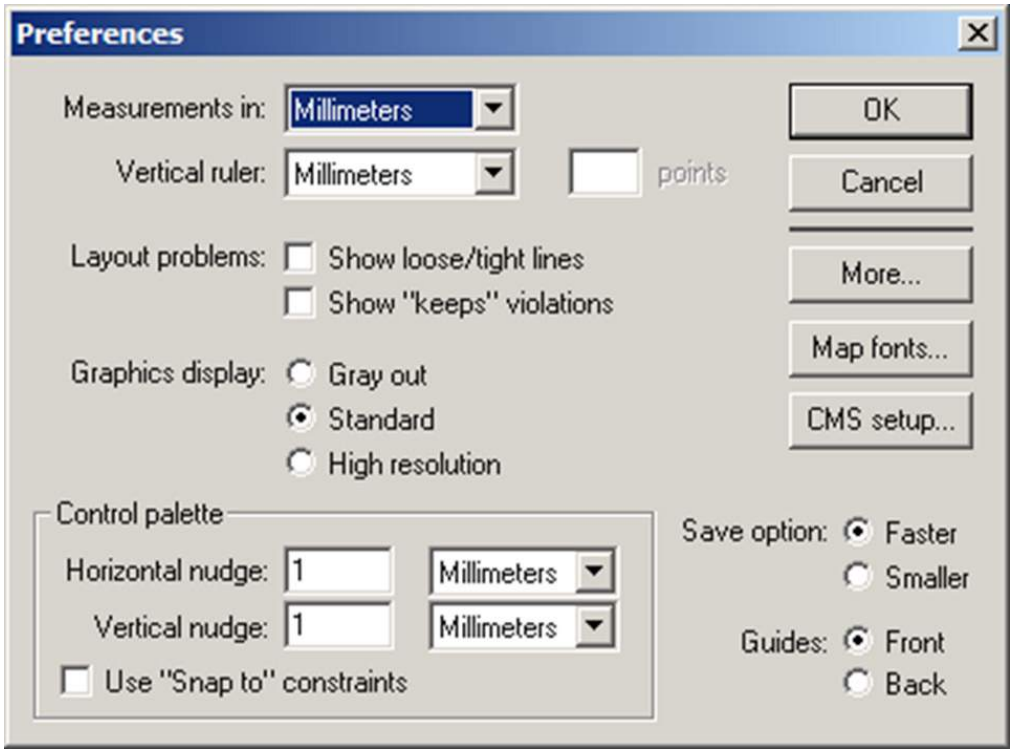
Now a new document called Untitled – 1 will appear on the screen as shown in Figure.



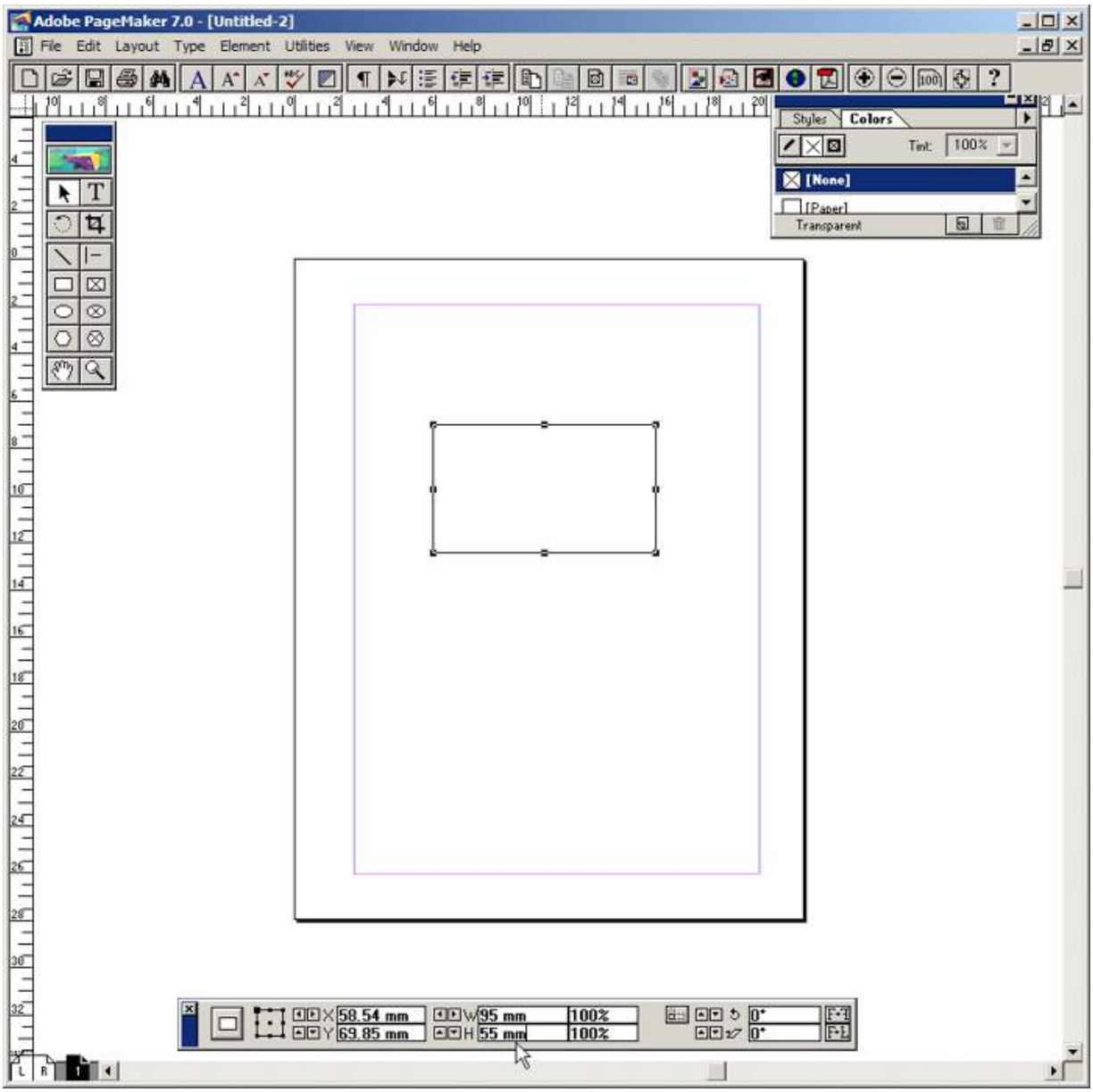
4. Now you can change Measuring Units from Inches to Millimeters.

Choose File > Preferences > general (or) Press Ctrl + K. Now Preferences dialogue box appears.

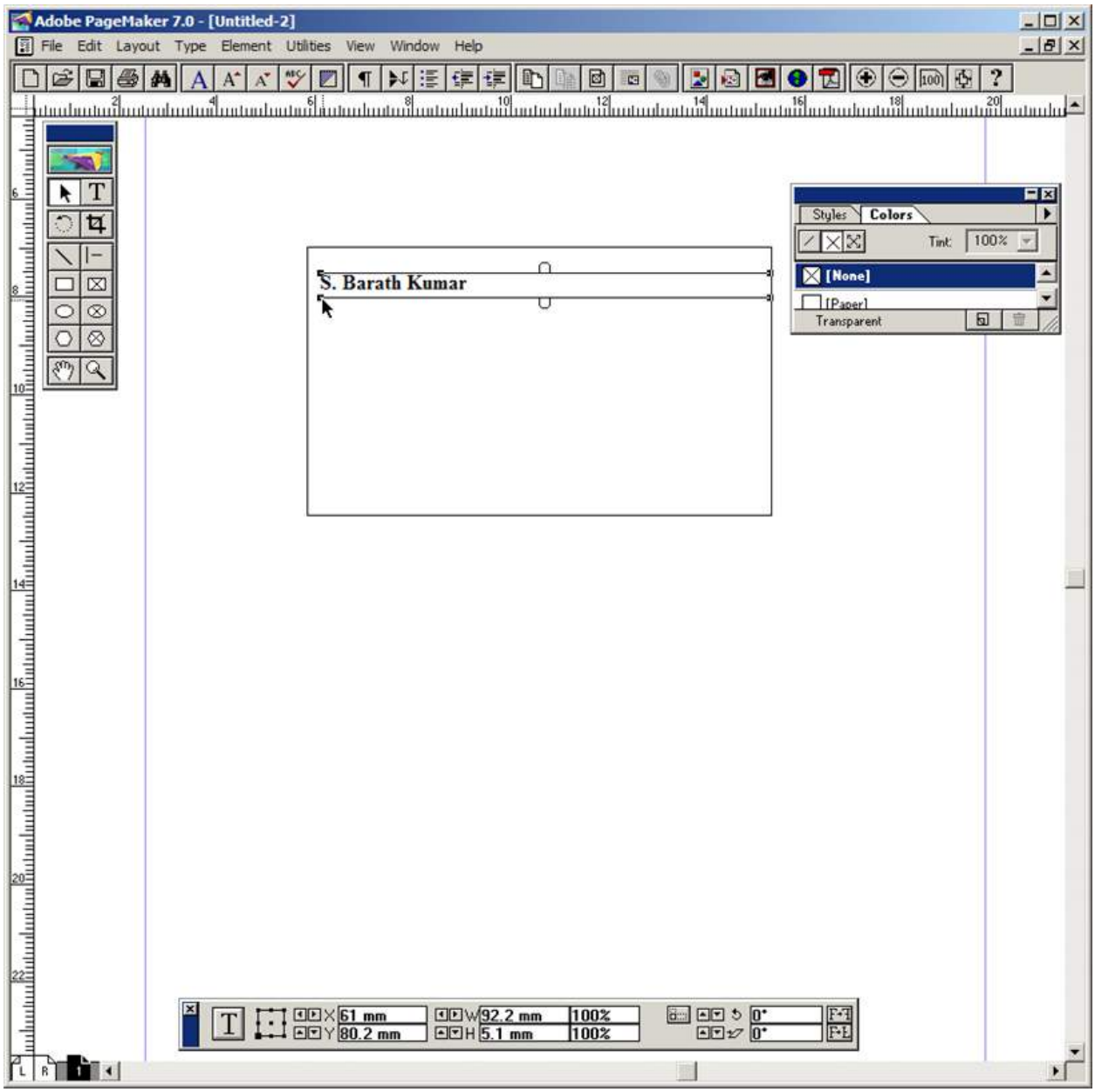
Change the unit of Measurements and Vertical ruler to Millimeters.



5. Select the Rectangle Tool from the Tool box and draw a rectangle.
6. Using Control Palette, the width and height value of the rectangle has to be set to 95 mm and 55 mm respectively.

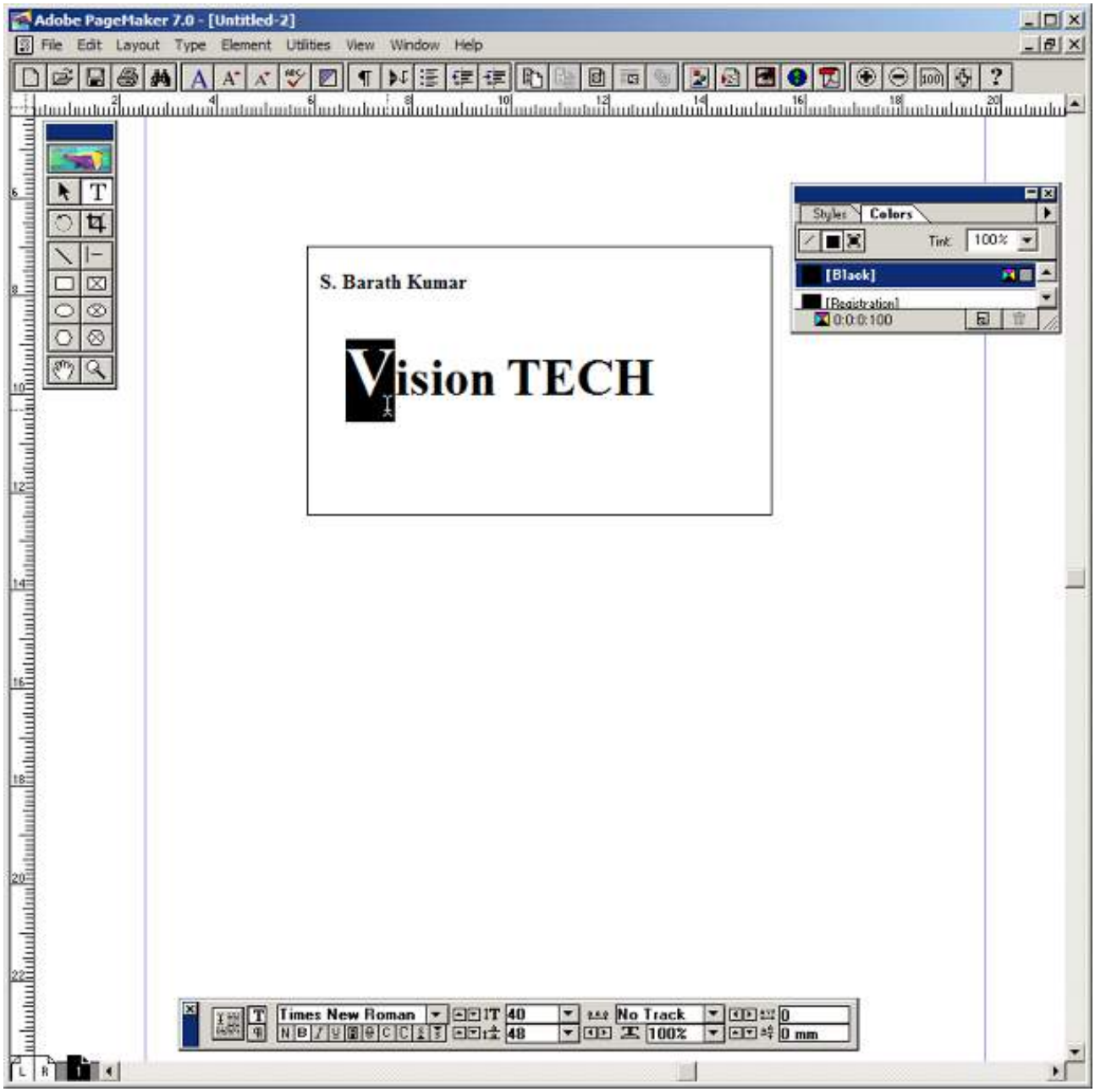


7. Select the Text Tool in the Tool box. Then drag from the left corner of the rectangle box to the right corner to specify the boundary of the text that is to be typed.
8. Type the Name of the person and select it using Text tool. Choose suitable Font and Font Size from the Control Palette. Then move it a little bit towards right side.

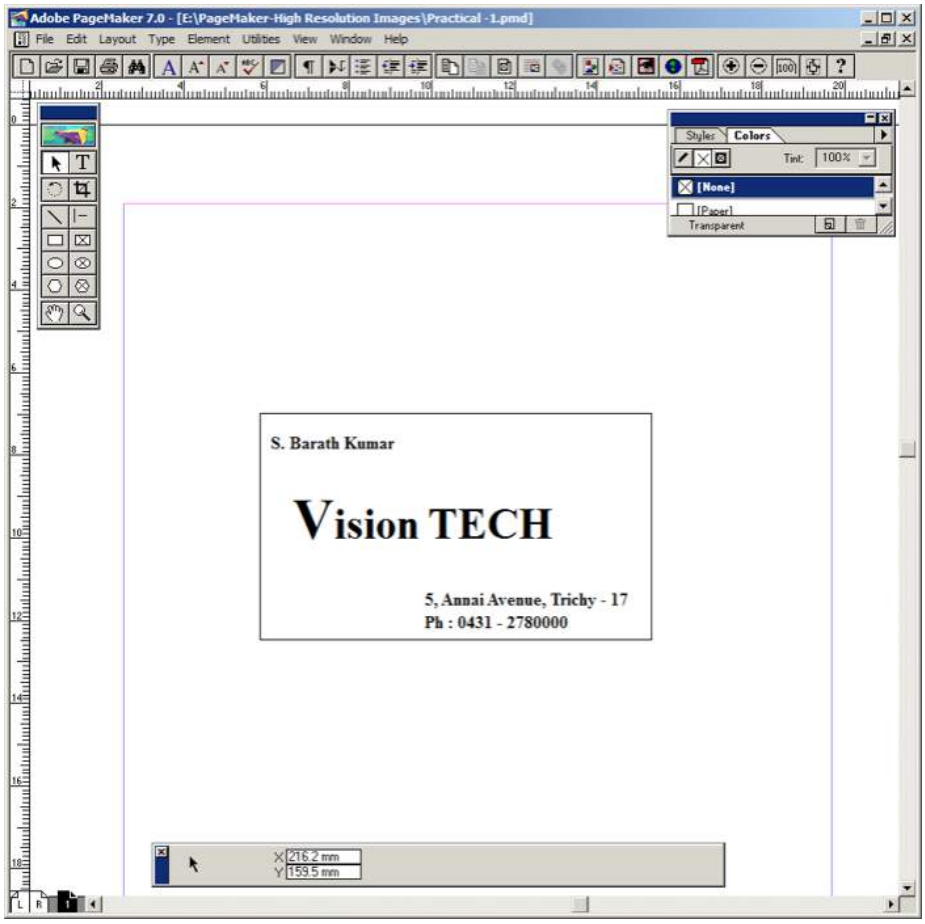


9. Repeat the step 7. Then type the Company name and select it using Text tool. Choose suitable Font and Font Size from the Control Palette. Then move it a little bit towards right side.

   Select the First character using the Text tool and increase the font size.



10. Repeat the step 7. Then type the Company Address and select it using Text tool. Choose suitable Font and Font Size from the Control Palette. Then move it towards right side.



Output

Conclusion

The expected output is achieved.

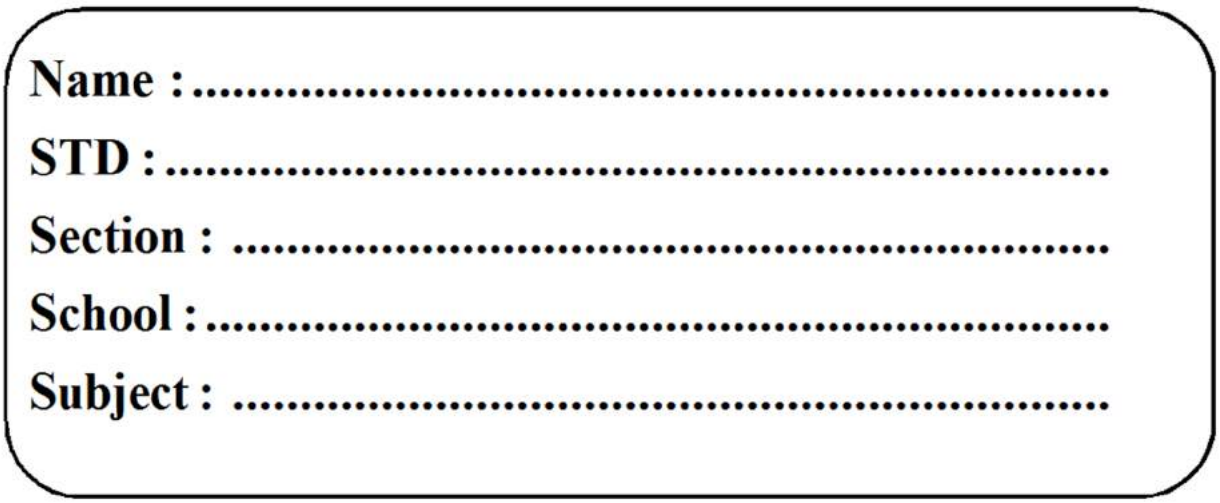
04
EXERCISE

PageMaker-Creating Notice Board

AIM

To create a Label using PageMaker software.

Create the following Label using PageMaker.



Procedure

1. Start the PageMaker using the following commands.
   Start -> All Programs -> Adobe ->Pagemaker 7.0 -> Adobe PageMaker 7.0.
2. Choose File > New in the menu bar (or) Press Ctrl + N in the keyboard.
   This opens the Document Setup dialog box.
3. Click on OK.
   Now a new document called Untitled – 1 will appear on the screen.
4. Now you can change Measuring Units from Inches to Millimeters.
   Choose File > Preferences > general (or) Press Ctrl + K. Now Preferences dialogue box appears.
   Change the unit of Measurements and Vertical ruler to Millimeters.

5. Select the Rectangle Tool from the Tool box and draw a rectangle.

6. Using Control Palette, the width and height value of the rectangle has to be set to 100 mm and 40 mm respectively.

7. Choose Element > Rounded corners from the menu bar.

8. Choose the required shape from the rounded corners dialog box. Now the rectangle appears with the rounded corners.

9. Select the Text Tool in the Tool box and create a text block within the rectangle.

10. Type **Name :** and press a Tab key and then press Enter key.

    Type **STD :** and press a Tab key and then press Enter key.

    Type **Section :** and press a Tab key and then press Enter key.

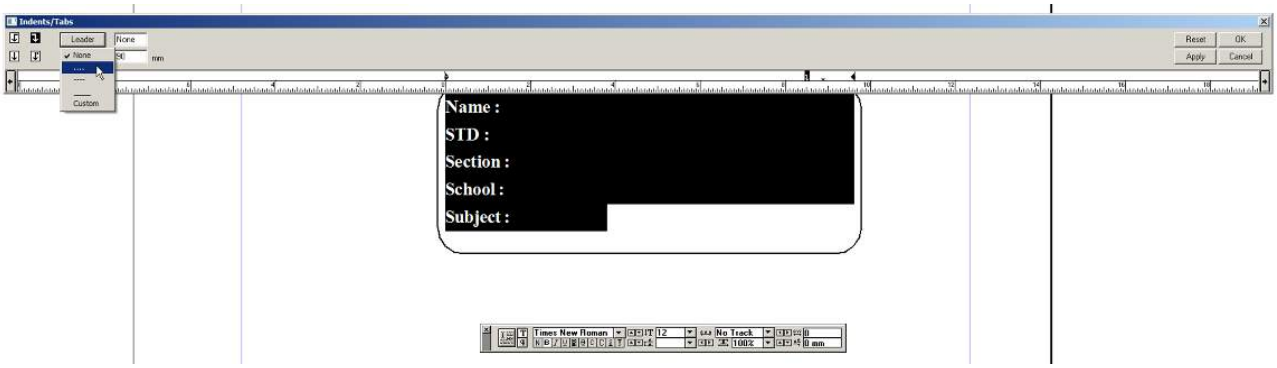
    Type **School :** and press a Tab key and then press Enter key.

    Type **Subject :** and press a Tab key.

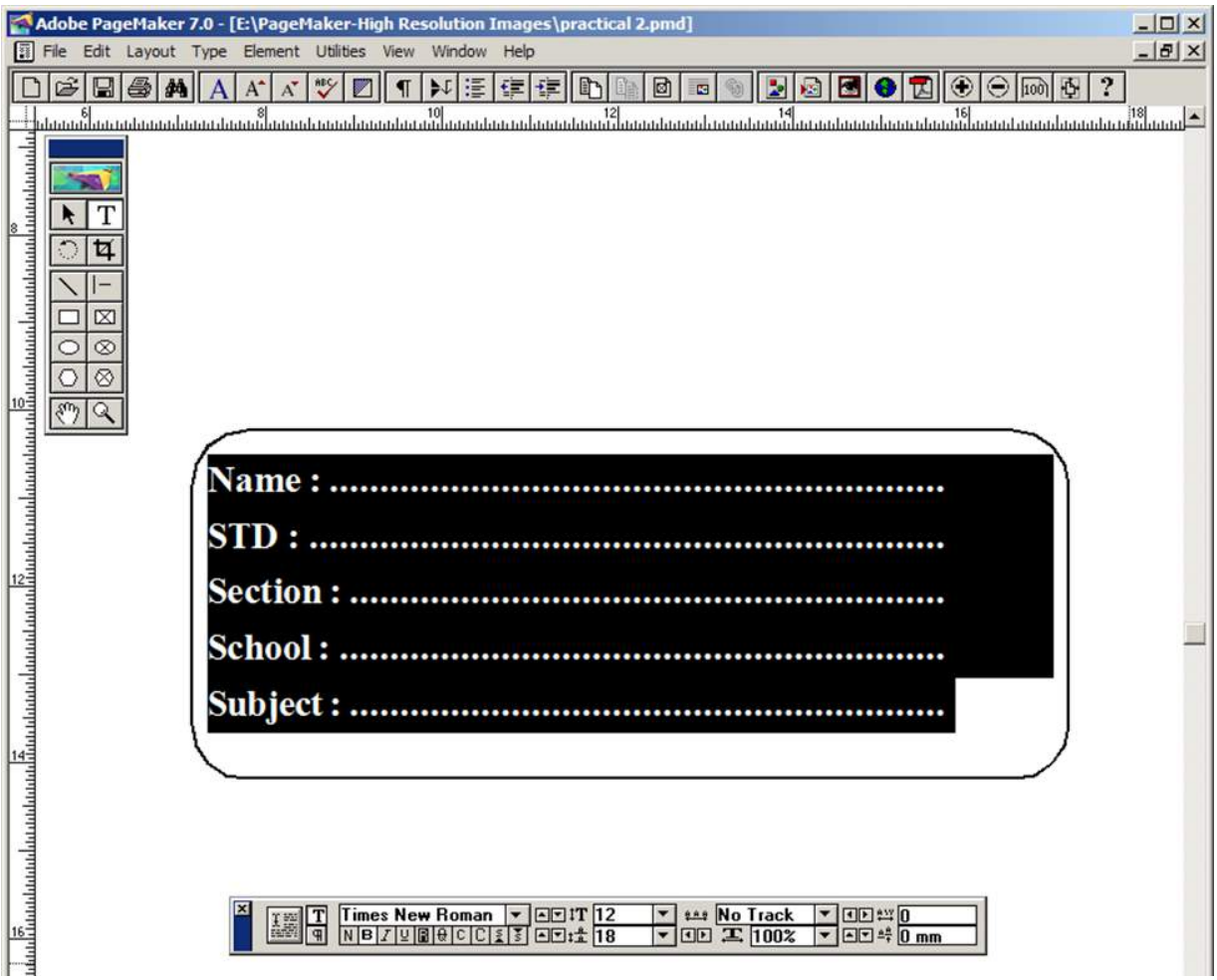
11. Select all the text using Text tool.

12. Choose Type > Indents / Tabs (or) press Ctrl + I.

13. Set a right tab at the value 90 mm and choose the dotted line style from the leader option and then press Apply button.



14. Now the required label is created.



Output

Name : .....

STD : .....

Section : .....

School : .....

Subject : .....

Conclusion

The expected output is achieved.

05
EXERCISE

MySQL - Usage of Commands in Data Base

AIM

To execute following DDL [Data definition Language] and DML [Data manipulating Language] MySQL queries

1. CREATE - to create a database and its objects like (table, index, views, store procedure, function, and triggers)
2. ALTER - alters the structure of the existing database.
3. DROP - delete objects from the database.
4. SELECT - retrieve data from a database.
5. INSERT - insert data into a table.
6. UPDATE - updates existing data within a table.
7. DELETE - Delete all records from a database table.

Procedure

1. Open MySQL command prompt from XAMPP Control panel.
2. To login in to your Database using User name and password.
3. Execute and get the output of given DDL MySQL queries.

SYNTAX:

Based on the below syntax queries are built and executed.

* CREATE DATABASE testDB;

* CREATE TABLE table_name (column1datatype,column2datatype,column3datatype, ...);

* ALTER TABLE `table_name` ADD COLUMN `column_name` `data_type`;

* DROP DATABASE databasename;

* SELECT * FROM TABLE NAME

* INSERT INTO table_name(field1, field2,...fieldN) VALUES (value1, value2,...valueN);

* UPDATE table_name SET field1 = new-value1, field2 = new-value2 [WHERE Clause]

* DROP TABLE table_name ;

PROGRAM:

```
CREATE DATABASE SchoolDB;

CREATE TABLE student(

        studentID int,

        LastName varchar(255),

        FirstName varchar(255),

        Address varchar(255),

        City varchar(255)

        );

ALTER TABLE `members` ADD COLUMN `credit_card_number` VARCHAR(25);

DROP DATABASE SchoolDB

SELECT * FROM student

INSERT INTO student   (studentID ,LastName , FirstName,Address,City  )   VALUES

  (“002”, “Ram””Kumar”, “ROJA NAGAR””CHENNAI”);

SELECT * FROM student

UPDATE student SET LastName = ‘SRI’ WHERE studentID = 003;

SELECT * FROM student

DROP TABLE student ;

SELECT * FROM student
```

OUTPUT

Database created

Table created:

studentID	LastName	FirstName	Address	City

Table Altered

Database dropped

StudentID	LastName	FirstName	Address	City
101	C	Priya	1, new street	Trichy
202	S	Ramu	5, North garden St	Madurai

One row inserted.

StudentID	LastName	FirstName	Address	City
101	C	Priya	1, new street	Trichy
202	S	Ramu	5, North garden St	Madurai
002	Ram	Kumar	ROJA NAGAR	CHENNAI
003	R	Krishna	Park Street	Coimbatore

StudentID	LastName	FirstName	Address	City
101	C	Priya	1, new street	Trichy
202	S	Ramu	5, North garden St	Madurai
002	Ram	Kumar	ROJA NAGAR	CHENNAI
003	SRI	Krishna	Park Street	Coimbatore

Table dropped.

Table not found.

06
EXERCISE

PHP–Basic Programing

AIM

To create and execute a basic PHP programing

Procedure

1. Start Xampp server (Apache)
2. Goto virtual path folder (C:\xampp\htdocs)
3. Create test.php file and type the program
4. Execute the program on your Web browser using by this URL link (http://localhost/test.php)

PROGRAM

```
<html>
<body>
<?php
echo “Welcome to  Our School”;
$color = “blue”;
echo “My car is “ . $color . «<br>”;
echo “My dress is “ . $COLOR . «<br>”;
echo “My box is “ . $coLOR . «<br>”;
// test whether a number is greater than 30, 20 or 10 using ternary operator
functiontrinary_Test($n){
```

```
$r = $n > 30
? “greater than 30”
: ($n > 20
? “greater than 20”
: ($n >10
? “greater than 10”
: “Input a number atleast greater than 10!”));
echo $n.” : “.$r.”\n”;
}
trinary_Test(32);
trinary_Test(21);
trinary_Test(12);
trinary_Test(4);
 ?>
</body>
</html>
```

OUTPUT

```
Welcome to  Our School

My car is blue
My dress is
My box is

32 : greater than 30
21 : greater than 20
12 : greater than 10
4 : Input a number atleast greater than 10!
```

07
EXERCISE

PHP–Create & Execute Variables

AIM

To create and execute a PHP Variables Example program

Procedure

1. Start Xampp server (Apache)
2. Goto virtual path folder (C:\xampp\htdocs)
3. Create Variable.php file and type the program
4. Execute the program on your Web browser using by this URL link (http://localhost/Variable.php)

PROGRAM

```
<html>
<body>
<?php
$a = 25; // Numerical variable
$b = “Hello”; // String variable
 $c = 5.7; // Float variable
echo ,Number is : “.$a.,<br/>”;
echo ,String is : “.$b.,<br/>”;
echo “Float value : “.$c;
$txt = “INDIA”;
echo “I love $txt!”;
$x = 2;
$y = 2;
```

```
echo $x + $y;
function demo() {
      echo «<p>Variable x inside function is: $x</p>»;
}
demo();
echo “<p>Variable x outside function is: $x</p>”;
function myTest() {
   static $a = 0;
   echo $a;
   $a++;
}

myTest();
echo “<br>”;
myTest();
echo “<br>”;
myTest();
 ?>
</body>
<html>
```

OUTPUT

```
Number is : 25
String is : Hello
Float value : 5.7
I LOVE INDIA
4
0
1
2
Variable x inside function is:
Variable x outside function is: 2
```

08
EXERCISE

Create & Execute ECHO and PRINT statements

AIM

To create and execute ECHO and PRINT statements in PHP program.

Procedure

1. Start Xampp server (Apache)
2. Goto virtual path folder (C:\xampp\htdocs)
3. Create echo-print.php file and type the program
4. Execute the program on your Web browser using by this URL link (http://localhost/ echo-print.php)

PROGRAM

```
<html>
<body>
<?php
//Use Echo
echo “Welcome to Tamilnadu<br>”;
 // Use ‘print’ to print on console
print “Welcome to our School!<br>**********”;
$txt1 = “Learn PHP”;
$txt2 = “Daily”;
$x = 5;
$y = 4;
```

```
echo “<h2>” . $txt1 . «</h2>»;
echo “Study PHP “ . $txt2 . «<br>”;
echo $x + $y;
$txt3 = “Hello”;
$txt4 = “Welcome”;
$x = 7;
$y = 3;

print “<h2>” . $txt3 . «</h2>»;
print “Hi “ . $txt4 . «<br>”;
print $x + $y;
?>
</body>
</html>
```

OUTPUT

Welcome to Tamilnadu

Welcome to our School!

****

Learn PHP

Study PHP Daily
9

HELLO

Hi Welcome
10

09
EXERCISE

String Functions

AIM

To create and execute String Functions in PHP

Procedure

1. Start Xampp server (Apache)
2. Goto virtual path folder (C:\xampp\htdocs)
3. Create funtion.php file and type the program
4. Execute the program on your Web browser using by this URL link

(http://localhost/ funtion.php)

```
<html>
<body>
<?php
// Displays the length of the string
echostrlen(“Hello world!”);
//Counting number of words in a String
echo str_word_count(“Good Morning All”);
// Reversing a string
echo strrev(“welcome”);
```

```
// calculates position of strong
echo strpos("Hello world!", "world");
// replacing the text
echo str_replace("Hi", "Hello", "Hi Everyone");
define("GREETING", "Good Morning!!!");
echo GREETING;
// changes the color of the first character of a word
$text = 'PHP Tutorial';
$text = preg_replace('/(\b[a-z])/i',"<span style="color:red;">\1</span>',$text);
echo $text;
?>
</body>
</html>
```

OUTPUT

```
12
3
emoclew
6
Hello Everyone
Good Morning!!!
PHP Tutorial
```

10
EXERCISE

Converting Word to Digit

AIM

Write a PHP program to convert word to digit.

Procedure

1. Start Xampp server (Apache)
2. Goto virtual path folder (C:\xampp\htdocs)
3. Create convert.php file and type the program
4. Execute the program on your Web browser using by this URL link

(http://localhost/convert.php)

```
<html>
<body>
<?php
functionword_digit($word) {
   $warr = explode(';',$word);
   $result = '';
foreach($warr as $value){
switch(trim($value)){
case 'zero':
            $result .= '0';
break;
case 'one':
            $result .= '1';
break;
case 'two':
```

```
            $result .= ‘2’;
break;
case ‘three’:
            $result .= ‘3’;
break;
case ‘four’:
            $result .= ‘4’;
break;
case ‘five’:
            $result .= ‘5’;
break;
case ‘six’:
            $result .= ‘6’;
break;
case ‘seven’:
            $result .= ‘7’;
break;
case ‘eight’:
            $result .= ‘8’;
break;
case ‘nine’:
            $result .= ‘9’;
break;
        }
    }
return $result;
}

echoword_digit(“zero;three;five;six;eight;one”).”\n”;
echoword_digit(“seven;zero;one”).”\n”;
?>
</body>
</html>
```

OUTPUT

035681

701

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INTERNET RESOURCES

Internet resources

1. https://whois.icann.org/en
2. https://www.iana.org/
3. https://en.wikipedia.org/wiki/Networking_cables
4. https://www.lifewire.com/
5. https://www.tutorialspoint.com/computer_fundamentals/computer_networking.htm
6. http://www.groundcontrol.com/galileo/ch5-ethernet.htm
7. https://www.tutorialsweb.com
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9. https://www.oshwa.org/
10. https://www.unece.org/cefact/edifact/welcome.html

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