NATIONAL OPEN UNIVERSITY OF NIGERIA

SCHOOL OF SCIENCE AND TECHNOLOGY

COURSE CODE: DAM 361

COURSE TITLE: Business Communication and Networks

DAM 361
Business Communication and Networks

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Business communication and Networks is a Two[2] credit Unit with Tweleve units grouped into four modules.It is an introductory course which seeks to introduce the students to the basic concepts of communication, computer networks, Networking, Network Management, Business Organisations,Marketing and Marketing Plan.It provides an introduction to the different types of Networks, The configuration and advantages of these networks,it also covers the basic principles internetworking , internet protocols IP classes and Subnetting.The Course also covers principles of Network management finally the text provides an introduction to the different business organization, marketing and the Marketing plan.This course is divided into four modules.

Module 1 introduces the communication principles, networking, Network topologies, transmission media and Network protocols. amplifier.The block lays the foundation for the understanding of the Computer Networks.

Module 2 covers the IEEE 802 Lanstandards, Media acess control the introduction to the Internet .The different classes of the IP addresses, Domain Name System and the Dotted Decimal Notation are covered in this module.

Module 3 describes the principles of Subnetting,Internetworking and Network management. The different internetworking components are given an indept coverage in the module.

Module 4 has its focus on The business organization, marketing and the marketing plan. In this module the different business organizations the Marketing mix and orientation and the market planning process are treated in this module.

The aim of this course is to equip you with the basic underatanding of Networking and business concepts.

This Course Guide gives you a brief overview of the course content, course duration, and course materials.

What you will learn in this course

rse is to provide the foundational information ng of computer networks and networking and provide the necessary tool for the analysis and design of computer networks and business concepts, we intend to achieve through the following:

Course Aims

i. Introduce the concepts associated with computer networks and Networking.
ii. Introduce the concepts associated with business organizations, marketing and marketing plan;

Course Objectives
Certain objectives have been set out to ensure that the course achieves its aims. Apart from the course objectives, every unit of this course has set objectives. In the course of the study, you will need to confirm, at the end of each unit, if you have met the objectives set at the beginning of each unit. By the end of this course you should be able to:
Objective:
1.To introduce to the students the concept of Communications Technology, LAN and WAN basics, networking and protocols, Ethernet, ATM, Packet Switching, internetworking, TCP/IP architecture and Internet applications.
2. Explain the importance of data networks and the Internet in supporting business communications and everyday activities.
3. Explain how communication works in data networks and the Internet.
4. Recognize the devices and services that are used to support communications across an Internetwork.
5. Use network protocol models to explain the layers of communications in data networks.
6. Describe the importance of addressing and naming schemes at various layers of data networks.
7. Describe the protocols and services provided by the Application layer of the OSI and TCP/IP.
8. Analyze the operations and features of the Transport layer protocols and services.
9. Analyze the operations and feature of the Network layer protocols and services and explain the
fundamental concepts of routing.
10. Design, calculate, and apply subnet masks and addresses to fulfill given requirements.
11. Describe the operation of protocols at the Data link layer and explain how they support communications.
12. Explain the role of Physical layer protocols and services in

tworks.
et concepts such as media, services, and operation.
13. Employ basic cabling and network designs to connect devices in accordance with stated objectives.
14. Build a simple Ethernet network using routers and switches.

15. Analyze the operations and features of common Application layer.
16. Utilize common network utilities to verify small network operations and analyze data traffic.
17. Analyze business organizations
18. Develop marketing plans

Working Through This Course

In order to have a thorough understanding of the course units, you will need to read and understand the contents, practise the what you have learnt by studying the network of your organization or proposing one if there is none in existence.,and be committed to learning and implementing your knowledge.

This course is designed to cover approximately sixteen weeks, and it will require your devoted attention. You should do the exercises in the Tutor-Marked Assignments and submit to your tutors.

Course Materials

These include:
1. Course Guide
2. Study Units
3. Recommended Texts
4. A file for your assignments and for records to monitor your progress.

Study Units

There are Twelve study units in this course:

Module1

Unit 1 Introduction to Communication Networks

a

Module 2

Unit 1 IEEE 802 LAN Standards
Unit 2 Media Access Control
Unit 3 Introduction To the Internet

Module 3

Unit 1 Subnetting
Unit 2 Internetworking
Unit 3 Network Management

Module 4

Unit 1 Business Organizations
Unit 2 Marketing
Unit 3 Marketing Plan

Make use of the course materials, do the exercises to enhance your learning.

Textbooks and References

1. Data Communications and Networking, Forouzan, B. A, 3rd Ed. (2004), McGraw-Hill.
2. Computer Communications and Networking Technologies, M.A. Gallo and W.M Hancock, (2002), Brooks/Cole.
3. Business Data Communications & Networking, Fitzgerald & Dennis, 6th Ed. (1999), John Wiley & Sons
4. Data and Computer Communications, Stallings W, 5th Ed. (1997), Prentice Hall, NJ,
5. Business Data Communications and Networking, Fitzgerald and Dennis, ,John Wiley and Sons, 7th Edition, 2002
6. Applied Data Communications: A Business-Oriented Approach, 4th Edition Goldman James E. & Rawles Phillip T, John Wiley & Sons, 2003
7. Networking Series (Parts 1-6), Chappell David, Videos from Chappell and Associates
8. Periodical and Technical References of Text book by Goldman http://www.wiley.com/college/goldman/ref.html
9. Haykin, Simon, Communication Systems, Third Edition, John Wiley & Sons, N.Y. (1994).

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on-Wesley Publishing Co. (1996).
11. Editors of LAN Magazine, LAN Tutorial, Second Edition, Miller Freeman Inc., San Francisco (1992).
12. Comer, Douglas E., Computer Networks and Internets, Second Edition, Prentice-Hall International,Inc., N.J. (1999).
13. Computer Networks, 4th Edition by Andrew S. Tanenbaum
14. Computer Communications and Networking Technologies by Michael A. Gallo, William M. Hancock
15. Business Data Communications and Networking, 7th Edition Jerry FitzGerald, Alan Dennis
16 Business Data Networks and Telecommunications, fourth edition, by Raymond R. Panko.
17 TCP/IP for Windows2000 by Houde and Hoffman.

Assignments File

These are of two types: the self-assessment exercises and the Tutor-Marked Assignments. The self-assessment exercises will enable you monitor your performance by yourself, while the Tutor-Marked Assignment is a supervised assignment. The assignments take a certain percentage of your total score in this course. The Tutor-Marked Assignments will be assessed by your tutor within a specified period. The examination at the end of this course will aim at determining the level of mastery of the subject matter. This course includes seventeen Tutor-Marked Assignments and each must be done and submitted accordingly. Your best scores however, will be recorded for you. Be sure to send these assignments to your tutor before the deadline to avoid loss of marks.

Presentation Schedule

The *Presentation Schedule* included in your course materials gives you the important dates for the completion of tutor marked assignments and attending tutorials. Remember, you are required to submit all your assignments by the due date. You should guard against lagging behind in your work.

Assessment

There are two aspects to the assessment of the course. First are the tutor marked assignments; second, is a written examination.

In tackling the assignments, you are expected to apply information and knowledge acquired during this course. The assignments must be submitted to your tutor for formal assessment in accordance with the deadlines stated in the

submit to your tutor for assessment will count
rk.

At the end of the course, you will need to sit for a final three-hour examination. This will also count for 70% of your total course mark.

Tutor Marked Assignments (TMAS)

There are seventeen tutor marked assignments in this course. You need to submit all the assignments. The total marks for the best four (4) assignments will be 30% of your total course mark.

Assignment questions for the units in this course are contained in the Assignment File. You should be able to complete your assignments from the information and materials contained in your set textbooks, reading and study units. However, you may wish to use other references to broaden your viewpoint and provide a deeper understanding of the subject.

When you have completed each assignment, send it together with form to your tutor. Make sure that each assignment reaches your tutor on or before the deadline given. If, however, you cannot complete your work on time, contact your tutor before the assignment is done to discuss the possibility of an extension.

Examination and Grading

The final examination for the course will carry 70% of the total marks available for this course. The examination will cover every aspect of the course, so you are advised to revise all your corrected assignments before the examination.

This course endows you with the status of a teacher and that of a learner. This means that you teach yourself and that you learn, as your learning capabilities would allow. It also means that you are in a better position to determine and to ascertain the what, the how, and the when of your course learning. No teacher imposes any method of leaming on you.

The course units are similarly designed with the introduction following the table of contents, then a set of objectives and then the concepts and so on.

The objectives guide you as you go through the units to ascertain your knowledge of the required terms and expressions.

Course Marking Scheme

course marking is broken down.

Assessment	Marks
Assignment 1- 4	Four assignments, best three marks of the four count at 30% of course marks
Final Examination	70% of overall course marks
Total	100% of course marks

Table 1: Course Marking Scheme

Course Overview

Unit	Title of Work	Weeks Activity	Assessment (End of Unit)
	Course Guide	Week 1	
	Module 1		
1	Introduction to Communication Networks	Week 1-2	Assignment 1
2	Transmission Media	Week 3	Assignment 2
3	Network Protocols	Week 4	Assignment 3
	Module 2		
1	IEEE 802 LAN Standards	Week 5-6	Assignment 4
2	Media Access Control	Week 7-8	Assignment 5
3	Intrduction to the Internet		
	Module 3		
1	Subnetting	Week 9	
2	Internetworking	Week 10-11	
3	Network management	Week 12	Assignment 6
	Module 4		
1	Business Organization	Week 13	Assignment 7
2	Marketing	Week 14	Assignment 8
3	Marketing Plan	Week 15	
	Revision	Week 16	
	Examination	Week 17	
Total		17 weeks	

How to get the best from this course

nits replace the university lecturer. This is one of
ce learning; you can read and work through
specially designed study materials at your own pace, and at a time and place that suit you best. Think of it as reading the lecture instead of listening to a lecturer. In the same way that a lecturer might set you some reading to do, the study units tell you when to read your set books or other material. Just as a lecturer might give you an in-class exercise, your study units provide exercises for you to do at appropriate points.

Each of the study units follows a common format. The first item is an introduction to the subject matter of the unit and how a particular unit is integrated with the other units and the course as a whole. Next is a set of learning objectives. These objectives enable you know what you should be able to do by the time you have completed the unit. You should use these objectives to guide your study. When you have finished the units you must go back and check whether you have achieved the objectives. If you make a habit of doing this you will significantly improve your chances of passing the course.

Remember that your tutorôs job is to assist you. When you need help, donôt hesitate to call and ask your tutor to provide it.

Read this *Course Guide* thoroughly.

Organize a study schedule. Refer to the óCourse Overviewô for more details. Note the time you are expected to spend on each unit and how the assignments relate to the units. Whatever method you chose to use, you should decide on it and write in your own dates for working on each unit.

Once you have created your own study schedule, do everything you can to stick to it. The major reason that students fail is that they lag behind in their course work.

Turn to *Unit 1* and read the introduction and the objectives for the unit.

Assemble the study materials. Information about what you need for a unit is given in the óOverviewô at the beginning of each unit. You will almost always need both the study unit you are working on and one of your set of books on your desk at the same time.

Work through the unit. The content of the unit itself has been arranged to provide a sequence for you to follow. As you work through the unit you will be instructed to read sections from your set books or other articles. Use the unit to guide your reading.

study unit to confirm that you have achieved them. If you feel unsure about any of the objectives, review the study material or consult your tutor.

When you are confident that you have achieved a unitôs objectives, you can then start on the next unit. Proceed unit by unit through the course and try to pace your study so that you keep yourself on schedule.

When you have submitted an assignment to your tutor for marking, do not wait for its return before starting on the next unit. Keep to your schedule. When the assignment is returned, pay particular attention to your tutorôs comments, both on the tutor-marked assignment form and also written on the assignment. Consult your tutor as soon as possible if you have any questions or problems.

After completing the last unit, review the course and prepare yourself for the final examination. Check that you have achieved the unit objectives (listed at the beginning of each unit) and the course objectives (listed in this *Course Guide*).

Tutors and Tutorials

There are 12 hours of tutorials provided in support of this course. You will be notified of the dates, times and location of these tutorials, together with the name and phone number of your tutor, as soon as you are allocated a tutorial group.

Your tutor will mark and comment on your assignments, keep a close watch on your progress and on any difficulties you might encounter and provide assistance to you during the course. You must mail or submit your tutor-marked assignments to your tutor well before the due date (at least two working days are required). They will be marked by your tutor and returned to you as soon as possible.

Do not hesitate to contact your tutor by telephone, or e-mail if you need help. The following might be circumstances in which you would find help necessary. Contact your tutor if:

you do not understand any part of the study units or the assigned readings,
you have difficulty with the self-tests or exercises,
you have a question or problem with an assignment, with your tutorôs comments on an assignment or with the grading of an assignment.

nd the tutorials. This is the only chance to have tutor and to ask questions which are answered instantly. You can raise any problem encountered in the course of your study. To gain the maximum benefit from course tutorials, prepare a question list before attending them. You will learn a lot from participating in discussions actively.

Summary

Business communications and networks introduces you to basic principles and concepts of computer networks and business organizatios as well as networking and internetworking. The skills you need to understand the basics of computer networks ,networking etc. are intended to be acquired in this course. The content of the course material was planned and written to ensure that you acquire the proper knowledge and skills for the appropriate situations. Real-life situations have been created to enable you identify with and create some of your own. The essence is to get you to acquire the necessary knowledge and competence, and by equipping you with the necessary tools, we hope to have achieved that.

I wish you success with the course and hope that you will find it both interesting and useful.

etworks

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Course Co-ordinator

NATIONAL OPEN UNIVERSITY OF NIGERIA

MODULE ONE

UNIT ONE: INTRODUCTION TO COMMUNICATION NETWORKS

Table of contents

1.0 Introduction

Telecommunication can be defined as the assisted transmission of information over a distance for the purpose of communication. Modern telecommunication principles involves the use of electronic devices such as the telephones, television sets radios and computers. A basic telecommunication system as shown in Figure 1.1 consists of three elements:

n and converts it to a signal;

es the signal;

(iii) A receiver that receives the signal and converts it back into usable information.

2.0 Course Objectives:

At the end of this course, students are to

(i) Be able to identify basic communication principles

(ii) Be able to Identify and analyze Computer Networks and Topologies

(iii) To be able to identify the different classifications of computer networks

3.0 Communication Principles

In communication, signals can be either analogue or digital. In an analogue signal, the signal is varied continuously with respect to the information. In a digital signal, the information is encoded as a set of discrete values (for example ones and zeros). During transmission the information contained in analogue signals will be degraded by noise. Conversely, unless the noise exceeds a certain threshold, the information contained in digital signals will remain intact. Noise resistance represents a key advantage of digital signals over analogue signals. From the model diagram in Figure 1.1 the source can be audio or video signal. These signals on their own can not travel far due to the environmental factors so they are modulated at the transmitter. The process of modulation transfers the low frequency signal unto a high frequency carrier frequency. This carrier frequency is selected to overcome the fading effects of the of the transmission medium (channel) and provide a means of differentiation of the different transmitted signals at the receiver. At the receiver end the modulation process is reversed by a process known as demodulation whereby the carrier frequency is separated

d to the appropriate system for accurate interpretation of

he destination.

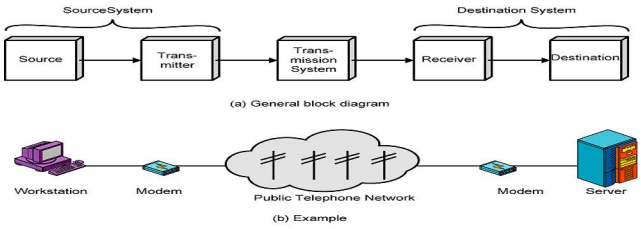


Figure 1.1 Simplified Communications Model

3.1 Computer Networks

Computers can be defined as powerful tools that enable users to store and process large amounts of data quickly. In the beginning, computers environment consisted of large mainframes with terminals attached directly to the mainframes. The large computers were kept in environmentally controlled computer rooms which were expensive to build and required specially trained personnel to maintain.

This early method had many disadvantages and advantages as can be seen from the diagram in Figure 3.1.

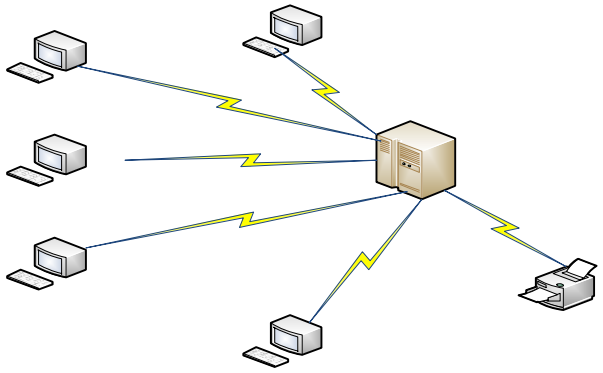


Figure 3.1: Centralized Computing Environment

This environment permitted multiuser application. Some applications run in this environment include

1 Electronic mail

2 Data bases

e centralized computing environment

Other advantages of centralized computing include:

(i) Ease of backup (since all information is stored on the server)

(ii) High security

(iii) Low risk of virus infection

The disadvantages of the centralized this type of computing environment include

(i) High cost of running individual cables

(ii) If the mainframe fails, the whole network fails

Multiple host connections were limited due to the limitation of the number of ports. Switches were used to allow connection with other hosts. The mainframes were very expensive

An example of the centralized computing environment in use today is the Automatic Teller Machines of Banks.

The limitations of the centralized computing environment coupled with the advances in technology leading to the development of the micro processor, led to the development of the personal computer by IBM in 1981.The PC gave the user more freedom and brought the mainframe functionality to the desktop. The personal computer led to the development of the personnel computing environment with the following advantages.

Advantages of the PC

(i) Mainframe power brought to the desktop

(ii) Individual word processing

(iii) Individual data base applications

(iv) Graphics

(v) Spreadsheet

(vi) Decentralized computing

g on the PCs were developed

vantages

(i) No electronic mail

(ii) No multiuser capabilities

(iii) Multiple modem and printers

(iv) Very expensive

The disadvantages of the PC were eliminated by the development of Networking

3.2 Introduction to Networking

A Network can be defined as a collection of transmitters, receivers and transceivers that communicate with each other. Digital networks consist of one or more routers that work together to transmit information to the correct user. An analogue network consists of one or more switches that establish a connection between two or more users. For both types of network, repeaters may be necessary to amplify or recreate the signal when it is being transmitted over long distances. This is to counter the effect of fading due to the distance between transmitter and receiver as this fading can render the signal indistinguishable from the surrounding noise/

Networking can also be defined as a process of connecting computers together either by cable or other media so that they can share information and resources such as

Printers

Fax devices

Electronic messages

Files and/or documents

Modems

Data

Messages

ed types listed below

the work station acts as both a client and a server. There is no central server and both data and resources are distributed on the network.

This type is common in houses with less than 10 clients and it is the cheapest type of network.

Materials required for per to peer networks include:

(i) Network adapters

(ii) Cables or other transmission media

(iii) Operating system (Windows 95, windows for workgroup etc)

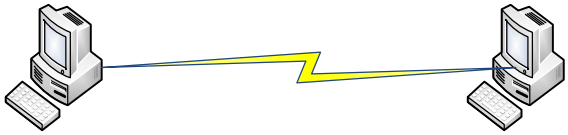


Figure 3.2: peer to peer networks

(ii) Server-Based:- In this network, one bigger computer called the server is dedicated to handing out files/information to clients . It controls the data, printers and other resources by needed by the clients. The server is a faster computer with a better processor with a bigger storage space. As the network grows, the number of servers will also increase. There are two main types of dedicated servers

(a) File and Print Server: There are servers optimized for handling printing requests and file handling requests. They are mainly used to store data and applications. The application files are stored on the server but the are run on the local PCs. The advantage of this is that updating of files on the server is what is needed to upgrade the application.

n server, arrangement, the application run by the client is

en sent to the server to be processed. Everything in this case is done by the server.

Specialized Serves

Some other servers exist with single specialized functions examples are:

Mail server, Communication servers etc.

For networks with more than 10 clients, the server based approach is recommended.

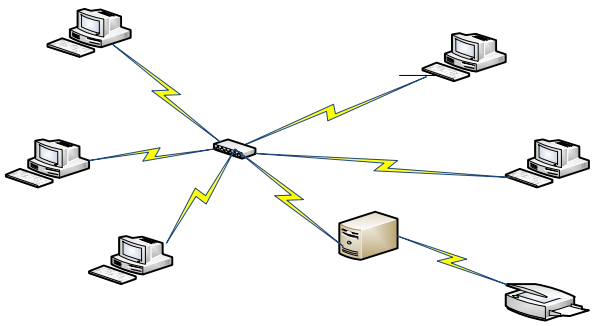


Figure 3.3 Server based computing environment

Advantages of server based networks includes

(i) Centralized security

(ii) Dedicated servers

(iii) Easy accessibility

(iv) Easy backup

Network Components

The following is a list of the component parts of a network

Server: This is a powerful that provides services to other computers on the network

Client: Less powerful computer that uses the services provided by the server.

Peer - A computer that acts both as a client and a server

Media ï Physical connection between devices on a network

Resources ï Anything available to a client on a network

o access resources on a network

ications between computer on a network.

3.3 Classification of Networks

Networks can also be classified according to size leading to the following configurations

LOCAL AREA NETWORK (LAN)

The local area network (LAN) is the smallest network size and it is normally contained in a building. Some characteristics of LANs include

High speed

Smaller error counts

Inexpensive price

METROPOLITAN AREA NETWORKS (MAN)

This is a group of LANs location in a city. MANs are slower than LANs and since they require special equipment to connect the LANs together and they are costlier. A Metropolitan Area Network (MAN) is a large computer network that spans a metropolitan area or campus. Its geographic scope falls between a WAN and LAN. MANs provide Internet connectivity for LANs in a metropolitan region, and connect them to wider area networks like the Internet. Some technologies used for this purpose are the ATM and the FDDI. MAN links between LANs have been built without cables using either microwave radio or infra-red laser links. Most companies rent or lease circuits from common carriers due to the fact that laying long stretches of cable can be expensive. Distributed Queue Dual Bus (DQDB), is the Metropolitan Area Network standard for data communication. Using DQDB, networks can be up to 30 km long and operate at speeds of 34 to 155 Mbit/s.

WIDE AREA NETWORKS (WAN)

Wide Area Network (WAN) is a computer network that covers a broad area with links across metropolitan, regional, or national boundaries. The largest and most well-known example of

ed to connect LANs and other types of networks

in one location can communicate with users and computers in other locations. Many WANs are built for one particular organization and are private. Others, built by Internet service providers, provide connections from an organization's LAN to the Internet. WANs are often built using leased lines with routers at the end of the leased lines. These routers serves as a means of connecting the LAN and a hub within the WAN together. Due to the high cost of leased lines Leased lines, WANs are being built using less costly circuit switching or packet switching methods. Network protocols including TCP/IP deliver transport and addressing functions. Protocols including Packet over SONET/SDH, MPLS, ATM and Frame relay are often used by service providers to deliver the links that are used in WANs. The Table 3.1lists the options available for WAN connectivity

Table 3.1: Options for WAN connectivity.

Option:	Description	Advantages	Disadvantages	Bandwidth range	Sample protocols used
Leased line	Point-to-Point connection between two computers or Local Area Networks (LANs)	Most secure	Expensive		PPP, HDLC, SDLC, HNAS
Circuit switching	A dedicated circuit path is created between end points. Best example is dialup connections	Less Expensive	Call Setup	28 - 144 kbps	PPP, ISDN
Packet switching	Devices transport packets via a shared single point-to-point or point-to-multipoint link across a carrier internetwork. Variable length packets are transmitted over Permanent Virtual Circuits (PVC) or Switched Virtual Circuits (SVC)		Shared media across link		X.25 Frame-Relay

Cell relay	variable length packets. Data is divided into fixed-length cells and then transported across virtual circuits	Best for simultaneous use of voice and data	Overhead can be considerable		ATM

Transmission rate usually range from 1200 bps to 6 Mbps, although some connections such as ATM and Leased lines can reach speeds greater than 156 Mbps. Typical communication links used in WANs are telephone lines, microwave links & satellite channels.

3.4 Network Topologies

LAN Topologies

The way the devices on the networks are physically connected is known as the topology. It includes transmission media, adaptors and the physical design of the network. There are four main topologies in use.

(i) BUS TOPOLOGY

This topology is the simplest to install. All devices on the network are connected to one primary trunk cable. The technology is passive and requires no special equipment to regenerate or amplify the signal. When a device wants to transmit across the bus, it has to determine whether the media is in use. If no other device is transmitting, then its signal is sent. Each device receives the signal and then determines when its address matches that on the message. If the addresses donôt match, the message is discarded.

For these networks, the trunk cable must be properly terminated or else the signals will be reflected back, along the cable causing collisions. The topology uses coaxial cables and the sections are connected with BNC connectors and T connectors are used to connect the computer to the trunk cable. An example of this is the Ethernet

l configure, inexpensive and easily extended. Both ends, a 50 ohm resistor. The topology is usually unstable and connectors used to extend the cable weakens the signals. A break anywhere on the cable brings down the entire network.

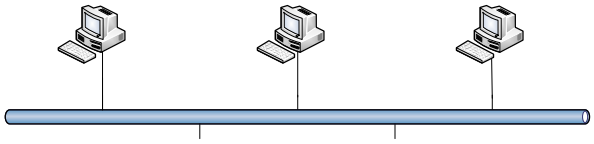
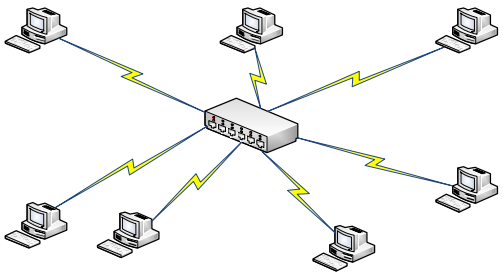


Figure 3.4 Bus topology

(ii) STAR TOPOLOGY.

In the star topology, a separate cable is used for each work station to a central device called a hub or concentrator. This is a very common and popular topology. A hub is a device installed in a central location that functions as a wining nexus for the network servers and workstation are all connected to the hub. In this topology, if any segment fails, only the computer attached to the segment fails and not the whole network. Hub can be active or passive. In a passive hub, the information sent to the hub is broadcast to all workstation with no regeneration or amplification. Passive hubs do not require external power examples are the patch panels in wiring

Active hubs use external power source and regenerates the signals before sending out the workstations on a broadcast network locater cable lengths can be supported by the active . Some active hubs are capable of switching. These type of hubs are called switched hubs. They direct the signal directly to the recipient. They help in greatly reducing network traffic.



ure 3.5: Star Topology

d as multiple cable types can be supported by the hubs. Disadvantages include requirement of more cable than other topologies.

(iii) RING TOPOLOGY

The ring topology looks like a bus topology with connected each data flow in a Ring network travels from computer to computer in one direction. The signal is retransmitted to each system which then passer the signal to its neighbor.

All stations are considered as repeaters enclosed in a loop. Such station will receive a transmission on one end of the repeater and repeat the transmission bit by bit with no buffering if any repeater (controller board) fails the whole network will go down. However the signal in this network can travel very far. For any station to transmit it must receive a token before transmitting and the destination device sends an acknowledgement after receiving. Token passing helps to create an orderly network where each device has an opportunity to transmit. This is a letter arrangement under heavy traffic than the contention system of the bus topology.

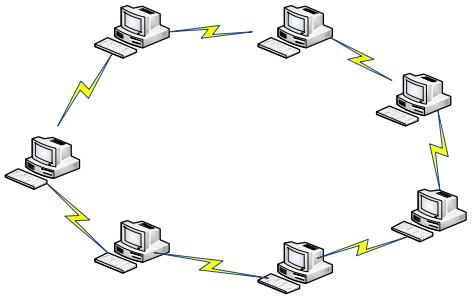


Figure 3.6 Ring topology

Wireless networking

Wireless Networking is a networking topology that does not require physical cabling. The client computers are connected to the Network by an access point. This architecture is

s for laptop users. It eliminates cable faults and cable

l interference is prone to security breaches.

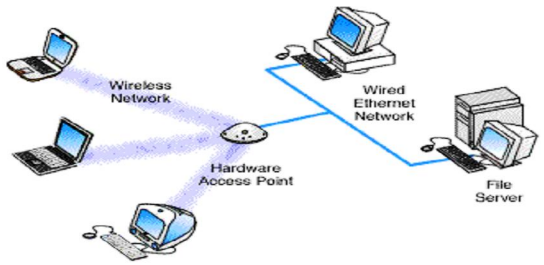


Figure 3.7 Wireless Networking

4.0 Conclusion

In this unit you have been introduced to the basic principles of communications and computer networks. The different types of networks and their topologies were also introduced.

5.0 Summary

In this unit we have been able to extend knowledge of the theory and applications of computer networks and the different topologies of the networks.

6.0 Tutor marked assignment

(1) Define Networking and list four advantages of Networking.

(2) Describe with neat diagrams the characteristics of the different network topologies

(3) List any three types of servers stating the functions of each

7.0 References

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UNIT TWO TRANSMISSION MEDIA

Table of contents

1.0 Introduction

There are three major classes of cables used in communication systems. These cables are

(i) Coaxial Cables

(ii) Twisted Pair

(iii) Optic fiber.

The cables have specific characteristics and the utilization of any type is determined by the amount of attenuation the present to the signal at the frequency of operation and required

um showing the regions of operation of the individual

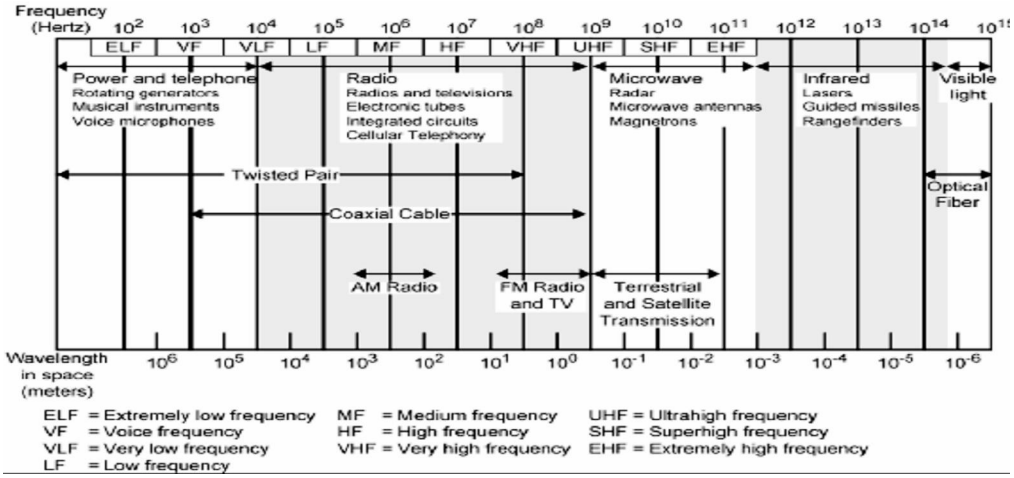

Figure 1.1: Electromagnetic Spectrum.

2.0 Course Objectives

The students are expected at the end of the course to

(i) Be able to identify the different cables used in communication Networks

(ii) Be able to distinguish between the different transmission media based on the characteristics of each

(iii) Be able to discuss basic Ethernet and ISDN networks

3.0 LAN Transmission Media

There are four main types of cabling employed for the LAN (or Ethernet network).

These cabling systems are

3.1 Thick Coaxial Cable

This is also known as the 10BASE5 or RG-8 or IEEE 802.3. It is the original Ethernet standard due to the use of the RG-8 cable. The cable uses an external transceiver. It has a capacity of 10Mbps using the RG-8 or RG-11 coaxial cable to transmit base band signal in 500 meter segments. The 10Base5 network is limited to 2500 meters. It follows the 5-4-3

rations of the Network and it states that the network

eaters and only 3 segments can have work stations.

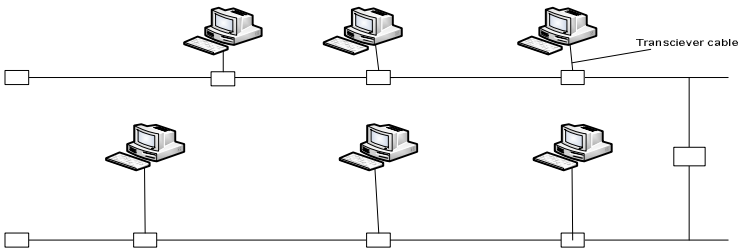

Figure 3.1 Thick coaxial cabling

The 10base5 cabling scheme is representative of a bus topology. The 10Base5 represents the primary characteristic of the cabling scheme as follows.

10 - 10Mbps

Base - Base band signaling

5 - longest cable segment that can be run without a repeater (500m)

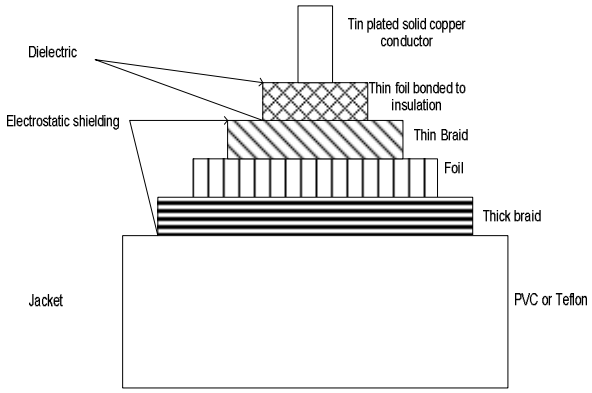

Figure 3.2 Diagram of a 10Base5 cable.

The cable is marked at 2.5m intervals to show the placement for the transceivers. The transceiver is an intermediate device that transmits and receives data from the Ethernet controller onto or from the cable. The transceiver is also known as the Media Access Unit (MAU) because it performs the following functions.

(i) Transferring transmitter data from controller to transmission system

ansmission system to controller

sion

(iv) Providing power to the transmission system

External transceivers are usually found on 10Base5 networks. An advantage of this cabling show is the shielding from electromagnetic interference (EMI) due to the amount of shielding on the cable. The total amount of stations per physical network is 1024. And the cable is used mainly for back bone connections.

3.2 Thin Coaxial Cable:-

The thin coaxial cable also known as 10Base2 was developed in 1985 as an alternative to the 10Base5 because the RG-8 cable used in the 10Base5 was very rigid and the external transceivers were expensive and many people did not need the length, provided by the 10 Base 5.

The 10 base 2 standard utilizes the RG-58 cable together with T connectors wired in a linear bus configuration. The transceiver was moved to the network interface card to produce a simpler network.10Base2 networks have a maximum length of 925m and follows the 5-4-3 rule with as much as 30 devices spaced 1.5 feet apart. The cable does not have to be pierced to fix the transceiver as the transceiver comes with the Ethernet card.

Work stations are attached to the RG 58 cable through the use of BNC and T connectors. Each cable segment endpoint contains a male BNC connector. These connectors attach to a T connector placed on the Ethernet card. The longest segment for the thin coax cable is 185m

The amount shielding is not as extreme as on thick coaxial cable.

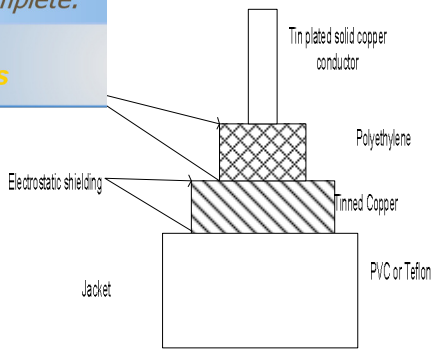

Figure 3.3: Diagram of 10Base2 cable

3.3 Unshielded Twisted Pair:

This cabling scheme is also known the 10BaseT standard. It utilized the 22 AWG UTP cable with RJ-45 Jacks arranged in star configuration. It eliminated the single point of failure associated with the bus topology as each device has a separate UTP cable connecting it to the hub. Several hubs can be connected for larger networks. The network standard however must follow the 5-4-3 rule with 5 segments, 4 connected hubs and 3 populated segments with up to 512 devices.

The UTP was first introduced by synoptic, an offshoot of The Xerox research centre. The 10 Base T is a point to point cabling scheme. The cable consists of four stands of 22-26 AWG wire and may be run for 100m between the Ethernet controller and repeater hub. The transceiver is located on the Ethernet card. One pair of the cables is used for Transmission while the other pair is used for reception. Poor quality cables lead to cross talk, delay and echoes.

Figure 3.4: Unshielded Twisted pair cable.

The UTP cables are classified as follows:

(i) Cat 3.This cables can be used for up to 16MHz and it has a twist length of between

for up to 100MHz.

Other types are the Cat 6 and Cat 7 cables.

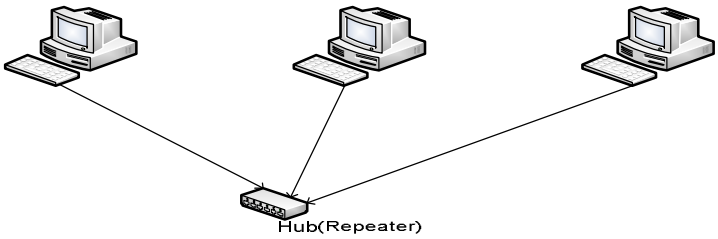

Figure 3.5 Diagram of a 10BaseT network

The 10BaseT also has the link status monitor (which is only found on this standard) built into the repeater module. The link status monitor is used for transmitting a signal between the repeater and the Ethernet controller to test the link. If the link is improper, the repeater will shut down that link.

3.4 Optic Fiber (10BaseFL)

This standard operates over fiber optic cable at 10 Mbps using baseband signaling. Data as transmitted as light instead of electrical signals. It provides better signal that can travel further than electrical signal. This network utilizes hubs and star wiring with either active or passive hubs being used. It allows a segment of up to 2000 meters. The cost of fiber optic cables and its handling has limited its use for now. The Table 3.1 shows typical operational specifications and characteristcs of the different transmission media used for data/computer communications.

Table 3.1 Transmission Media characteristics

Cable	Typical Bandwidths	Distances
Category 5 twisted pair	10-100 Mbps	100 m
Thin-net coax	10-100 Mbps	200 m
Thick-net coax	10-100 Mbps	500 m

	100 Mbps	2 km
Single-mode fiber	100-2400 Mbps	40 km

3.5 PBX Base LANs

Private branch exchanges were first developed to connect calls between parties on the same premises and to switch calls to facilities outside the premises though the public telephone network. Before the development of the Local Area Networks (LAN), Digital Private Branch Exchanges (DPBX) was used for linking terminals to a host processor or between processor and other devices. A connection to a DPBX is accomplished by running a cable between the device and the DPBX. Another connection is made to one or more hosts. DPBX are centralized switches that allow multiple host connections and terminal connections. A connection between the host and terminal is made by electrically switching the circuit to reach the host port. They have to be located near the host and a failure of the DPBX means that all the users will be idle until the DPBX is restored. Connections to the DPBX were through synchronous connections at 64kbps.The emergence of the Ethernet with its speed and other functions however led to the demise of the DPBX for interconnecting computers.

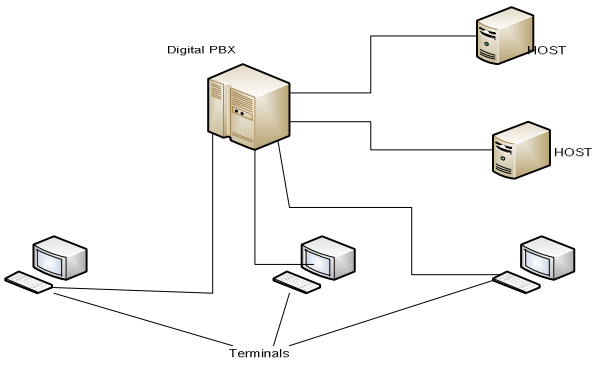

Figure 3.6: Digital PBX based LAN

3.6 Ethernet

gy in use and was invented by Bob Metcalfe of Xerox in ogy. There are no time slots and no central control of accessing the transmission medium.

Ethernet utilizes the following schemes for media access.

(i) Carrier sensing by each station to make sure no one is using the transmission line before it transmit.

(ii) Collision detention: Studying the signal or the transmission line to determine if another station has tried to transmit when it was transmitting.

These two techniques as regarded as CSMA/CD (Carrier Sense Multiple Access with Collision Detection)

(iii) Random Back Off:- When a collision is detected the systems all became silent and each systems with a packet to send selects a random delay before attempting to resend. If the collision reoccurs, the process is repeated but with larger time delay. This leads to low data rates on Ethernet network.

3.7 ISDN

ISDN is an acronym for Integrated Services Digital Network. Its is a telecommunications network which supports a wide range of services such as voice, fax, data, video etc with a digital end-to-end connectivity using a limited set of connection types and interface arrangements. The ISDN has two standard types of user-network interfaces. These are :

(a) Basic Rate Access (BRA)

BRA provides digital line connection of desktop terminal equipment to the ISDN. The BRA interface consists of two bearer channels (B-channels) and one data channel (D-channel).

Each B-channel transmits user information with a capacity of 64 kilo bits per second (kbit/s), while the D-channel carries call set-up and signaling information at 16 kbit/s. The BRA

+D connection which provides a total traffic carrying

(b) Primary Rate Access (PRA)

PRA provides a high speed digital trunk connection of medium/large terminal equipment to the ISDN. There are two options of PRA according to the different transmission standards employed:

(i) 23B+D connection consists of twenty-three Bchannels each at 64 kbit/s plus one D-channel at 64 kbit/s,with the total traffic carrying capacity thus at 1544 kbit/s

(ii) 30B+D connection which consists of thirty B-channels each at 64 kbit/s plus one D-channel at 64 kbit/s, with the total capacity thus at 2048 kbit/s

4.0 Conclusion

In this unit you have been introduced to the different types of transmission media utilized in the development and setting up of computer networks. The characteristics of these media and their areas of application have also been discussed.

5.0 Summary

In this unit we have been able to extend knowledge of the theory and applications of computer networks by treating the different transmission media utilized in setting up the different networks.

6.0 Tutor marked assignment

(1) Describe with appropriate diagrams the different types of the cables utilized in the development of computer networks

(2) Write short notes on the suitability or otherwise of the use of any of the cables for the implementation of a backbone connection.

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UNIT THREE: NETWORK PROTOCOLS

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6.0 Tutor Marked Assignment

7.0 References

1.0 Introduction

For computers to be able to communicate, a language must be defined among them that they understand. This language is called a protocol. The term protocol is often used to refer to a group or suite, of individual protocols that work together. The protocols within a suite are assigned different tasks, such as data translation, data handling, error checking, and addressing. The International Standards Organization in an attempt standardize this protocol developed a non proprietary reference model in 1984 called the Open System Interconnection (OSI). This model deals with the Interconnections of open systems.

2.0 Course Objectives

The students are expected at the end of the course to

(i) Be able to itemize the advantages of layered protocol.

(ii) Be able to discuss the OSI layer

(iii) Be able to distinguish between the different layers of the OSI layer

(iv) Be able to identify the different protocols associated with the different layers of the OSI layer.

3.0 Network Protocols

The OSI model divides a local Area Network System into seven processing layers with each layer performing specific functions as part of the overall task of allowing application programs on different systems located anywhere in the world to communicate with each other as if they programs resided on the same system.

ty and is not specific to software or hardware. No codes ementation of the model. Its ultimate goal in the inter possibility between communication products from different vendors.

These layers are chosen for the following advantages:

The design problems involved with computer network are broken down to manageable portions. With this layered approach, if an improved technique becomes available for a layer, that layer will be upgraded will be changed without affecting the whole system. The layered functionality of the different protocols in the OSI model is called a protocol stack. Layering breaks large complex set of concepts and protocols into smaller pieces making it easier to upgrade with hardware and software and also to troubleshoot.

Advantages of Layered Protocol Specification

(1) They can be easily learned

(2) Standardized interfaces among layers facilitate modular Engineering where different products can be designed to provide function for some layers e.g. router for layers 1-3

(3) Inter operability: One vendor can write program for some layers and another vendor writes for other layers and all the programs work together.

(4) Reduces complexity and allows faster product evolution

(5) It allows for the development of hardware and software optimized for specific functions.

(6) Each layer has a clearly defined set of responsibilities building on the services provided by the layer below it.

3.1 OSI LAYER

The OSI Layers are listed below:

Application Layer

Presentation Layer

Session Layer

Transport Layer

Network Layer

Data Layer

Physical Layer

Description of The layers

3.1 The Physical Layer:

This layer defines the methods used to transmit and receive data on the network. It consists of the wiring, devices that are on the network interface card to the wiring and the signaling involved in data transmission and reception over the network. It deals with the physical characteristics of the transmission medium, Connectors, pins, use of pins, modulation methods, speed of transmission, electrical current and voltage etc. Examples of protocols at this layer include the RJ-45, EIA/TIA-232, EIA/TIA-499, 802.3, etc. It is concerned with transmitting raw data over a communication channel.

Figure 3.1 Physical layer connection

3.2 The Data Link Layer:

This layer synchronizes transmission and handles packet error control and recovery so that the information can be transmitted over the physical layer. It is responsible for the MAC frame formatting and CRC (Cyclic Redundancy Check). It also defines the network access method. The layer breaks the input data into frames and transmits the frames sequentially and processes the acknowledged frame sent back by the receiver. It adds a header and a trailer to the frames its creates. The Data link layer is divided into two sub layers

Media access control (MAC)

s responsible for physical addressing and access to the network media.

The logical link control sublayer is responsible for establishing and maintaining data link connection between network devices. It performs flow control and error correction in the data link layer. Examples of protocol for the data link layer include high level data link control (HDLC), 802.5, frame relay, ATM, FDDI etc.

3.4 The Network Layer:

This layer controls the forwarding of information from one network device to another. It decides the path data will take if the destination device is located on another network. This path is through devices called intermediate devices (routers) and it is determined by time and cost factors. The messages received by the Network layer are converted to packets and the best route for its transfer to the destination is determined by the Network layer. Connections between devices at the Network layer are connectionless i.e no connection takes place at this layer. The best paths for transmission is determined by the process of

(1) Switching

(2) Routing

(3) Addressing

SWITCHING

This describes how data is forwarded across an internetwork. There are three types of switching techniques and the type utilized is determined by how fast the information needs to be delivered.

Circuit Switching: In this technique, a dedicated connection is made between the two communicating devices.

Advantages

dicated for that use

annel is available in demand

Disadvantages

(i) Inefficient use of the media

(ii) Possible long wait to establish a connection

Message Switching: In this technique, the message is sent from device to device in whole across the network. This is also known as the store and forward and the information is sent in whole. This method is not useful for real time applications like voice and video.

Packet Switching: In this technique, the information data is broken into small pieces and routed from device to device. Devices that forward the data only need to keep the information in memory and not physical storage.

ROUTING

The network layer utilizes tables set to show the shortest routes between two networks to route packets across a network. These tables can either be static or dynamic

Static routing tables: These are usually set by the Network Administrator

Dynamic routing : These protocols utilizes the following methods to define the shortest route.

Distance vector

Link state

ADDRESSING

A device on a network has a network address that tells other computers its location. This address is used in determine the position of the destination and also is used in determine how to reach it.

Examples of protocols for the network layer include IP. Apple talk, ICMP etc.

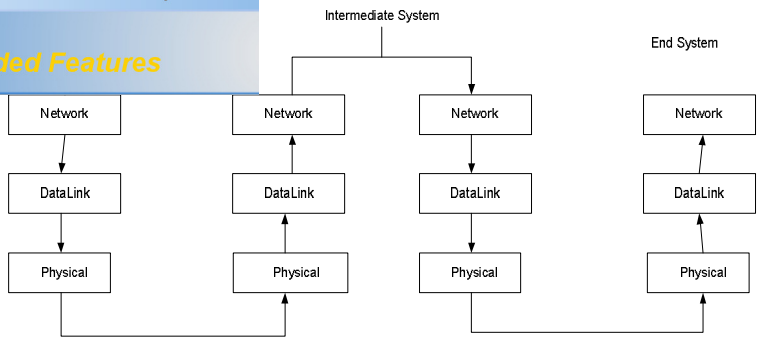

Figure 3.2 Network layer .

3.5 The Transport Layer

The transport layer is the fourth layers of the OSI model and it provides transport services between session layer and network layer. It provides end to end transmission of data and also checks to make sure that the information arrived at the destination device successfully. If an acknowledgement of reception is not received in a specified time out period, the data is resent.

The transport layer can then be said to

(i) Back up and restore data

(ii) Provide end to end reliability

(iii) Use connection oriented transmission of data (acknowledgement of delivery).

It also provides the following connection services segment sequencing, error control and flow control. Examples of protocols for this layer include TCP, UDP, SPX etc

3.6 The Session Layer

The session layer is responsible for the maintaining and establishing of a connection between devices. It defines how to start, control and end conversations. It ensures that the flow of information ends before the communication link is disconnected.

Sessions can be set up in three distinct forms. These are

(i) Half duplex ï One device sending information at a time

(ii) Simplex ï One way simultaneous connection (e.g TV and Radio stations)

ltaneous connections (e.g Phones)

ust provide the remote address to which they want to address. The names are the DNS names e,g, web address, examples of protocols used in the session layer includes SQL, NFS, NetBios, Apple talk etc

3.7 The Presentation Layer

This layer is responsible for the format in which the data is exchanged. It is responsible for any set of character or numeric translations e.g. EBCDIC data being translated to ASCII Binary to BCD etc. Encryption is also implemented in this layer. It is also responsible for ensuring that the data is sent in the correct order.

Data security compression and character translations are done at the presentation layer since the data is manipulated character by character at this layer.

EBCDIC ï Extended Binary Coded Decimal Interchange Code uses 8 bits to represent up to 256 characters.

ASCII ï American Standard Code for Information Interchange uses 7 bits to represent up to 128 bits. The 8^{th} bit is used for parity check.

Examples of protocols used in this layer include, JPEG, MIDI, ASCII, GIF etc

3.8 The Application Layer

This layer is the interface between the users application the network. This enables the users application to transfer files, send emails and do anything else it needs to do with network. An example of this protocol is the FTP. It enables the transfer of files across the internet. The SMTP (Simple Mail Transfer Protocol) provides the ability to distribute electronic mail across the network.

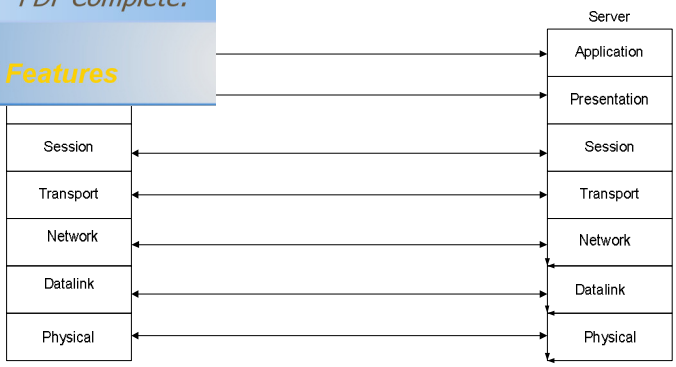

Figure 3.3: ISO model layer communication.

Each layer communicates with its associated layer at the client or server end by means of layer header that are appended to the packet.

Protocols vary according on their transmission efficiency, speed, utilisation of resources, ease of setup, compatibility, and ability to travel between one LAN segment and another. Protocols are said to be routable when the span more than one LAN segment. This is because they carry Network layer and addressing information that can be interpreted by a router. TCP/IP is the most commonly used of the major protocols, followed by IPX/SPX, NetBIOS and NetBEUI, and finally AppleTalk. A brief description of these major protocols is given below.

TCP/IP

TCP/IP represents the Transmission Control Protocol/Internet Protocol. It is low cost and provides the capability for communication between a multitude of dissimilar platforms, TCP/IP is very popular and has the advantage of being a routable protocol, which means that it carries network addressing information that can be interpreted by routers. It is also a flexible protocol running on any combination of network operating systems or network media. Because of its flexibility, however, it may require significant configuration.

IPX/SPX

enced Packet Exchange is a protocol responsible for the NetWare operating system. Other network operating systems, such as Windows NT, and workstation operating systems, such as Windows 95, can use IPX/SPX to internetwork with Novell NetWare systems.

NetBIOS and NetBEUI

NetBIOS is a protocol originally designed by IBM to provide Transport and Session layer services for applications running on small, homogenous networks. NetBEUI is a fast and efficient protocol that consumes few network resources, provides excellent error correction, and requires little configuration. Furthermore, because NetBEUI lacks a network layer (addressing information), it is non routable. Thus, this protocol is not suitable for large networks. Today, NetBEUI is most commonly used in small Microsoft-based networks while the TCP/IP has become the protocol of choice because it is more flexible and scalable than NetBEUI.

AppleTalk

AppleTalk is the protocol suite use to interconnect Macintosh computers. Although AppleTalk was originally designed to support peer-to-peer networking among Macintoshes, it can now be routed between network segments and integrated with NetWare or Microsoft-based networks. Although Apple has improved AppleTalk's ability to use different network models and span network segments, it remains unsuited to large LANs or WANs.

The Table 3.1shows the OSI layers and the possible protocols that operate at the different layers.

Table 3.1: OSI layers and possible protocols for the different layers

OSI MODEL	TCP/IP	**IPX/SPX**	**NetBEUI/NetBIOS**	**AppleTalk**

					AppleShare
Presentation Layer	**SMTP, SNMP, DNS, DHCP, NTP TFTP, HTTP, BOOTP**	NDS, NCP	**NetBEUI**		**AFP**
Session Layer	**Transport Layer**	**SAP**		**NetBIOS**	**ASP**
Transport Layer	**TCP, UDP**	**SPX**	**NCP TCP UDP**		**ATP RTMP NBP ZIP**
Network Layer	**Internet Layer IP, ARP, RARP, ICMP, IGMP, SLIP, CSLIP**	**IPX, RIP**			
Data Link Layer	**Network Interface**	**Transmission Layer**	**IPX IP**		**DDP**
Physical Layer					

3.9 Sample Connection

Below is the communication flow of a sample connection between two devices .Assume that a user is running some sort of chat application on their computer that enables them to connect to another personôs computer and talk to that person over a network. Figure 2-15 shows a protocol stack that I will use in this example.

The user types the message ñGood morningò into the chat application. The Application layer passes the data from the userôs application to the presentation layer. At the Presentation layer the data is translated and encrypted. The data is then passed to the session layer, where the dialogue is set for full-duplex communication. The Transport layer packages the data as

solved to the corresponding IP address. Checksums are

Next, the Network layer packages the data diagrams. After examining the IP address, the destination device is discovered to be on a remote network. The IP address for the intermediate device is then added as the next destination. Data is sent to the Data Link Layer, where it is packaged as frames. The physical address of the device is resolved. This is the address belonging to the intermediate device, which will forward the data on to its destination. The access type for the network is determined to be Ethernet.

The data is then passed on to the Physical layer, where it is packaged as bits and sent from the network adapter across the transmission media. The intermediate device reads the bits off the network media at the Physical layer. The data link layer packages the data as frames. The physical address of the destination device is resolved to its IP address. The network layer packages the data as datagrams .After examining the IP address of the destination device, the location of this device on the network is determined. The data is passed back to the MAC address. The access type for the network is determined to be Ethernet.

The data is then sent through the physical layer, packaged as bits, and sent across the network media. The destination device reads the bits off the network media at the physical layer. The Data Link layer packages the data as frames. The Physical address of the destination device is resolved to its IP address. The Network layer packages the data as datagrams. It is determined that the device has reached its final destination, where it is recorded into the sequence.

4.0 Conclusion

In this unit the layered protocol has been introduced and the OSI layers were discussed with protocols for each layer itemized.

5.0 Summary

nd knowledge of the theory and applications of

ered protocols and the OSI layers.

6.0 Tutor Marked Assignment

(1) List any five advantages of layered protocol

(2) Define the term protocol and list any three protocols

(3) Discuss the OSI layers functions and list one protocol for each layer.

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MODULE TWO

UNIT FOUR: IEEE 802 LAN STANDARDS

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4.0 Conclusions

5.0 Summary

6.0 Tutor Marked Assignment

7.0 References

1.0 Introduction

Standards are specifications brought to the public to allow a multi vendor environment. Standards ensure that products from different suppliers work together harmoniously. Propriety Standards on the other hands are standards that are not based on any national or international standard, they are company specific.

2.0 Course Objectives

At the end of this course, students are expected to

(1) Be able to identify the different types of networking standards

(ii) Be able to differentiate between the IEEE standards and other standards

(iii) Be able to differentiate between the different LAN standards.

3.0 Networking Standards

There are four types of networking standard in use today. These are:

(i) Emerging standards

(ii) Industry standards

(iii) Defacto standards

(iv) Committee standards.

All ISO Standards and other international standards come from the international standards organization (ISO), the Consultative Committee for International Telephone and Telegraph (CCITT) and the Institute for Electrical and Electronics Engineers (IEEE) The ISO is

d where it coordinates the efforts of National standard Standard Instituted (ANSI), the Standard Organization of Nigerian (SON) etc.

The IEEE is closely affiliated with ANSI and has made significant contribution to the development of LAN standards. The IEEE standards are developed by the 802 committees. The CCITT is a division of the ITU and it reports to the UN. Its primary assignment is to recommend standards for International adoption. CCITT recommendations are identified by the prefix X.IEEE standards are preceded by IEEE and a number e.g. IEEE 802. Another number can be attached e.g. IEEE 802.3 which specifies a sub group under the working group. IEEE standards are developed by Technical Committee and standard co-coordinating committee of the IEEE standards board. The standards are reviewed at least once in 5 years.

3.1 The IEEE 802 LAN Standards

The IEEE 802 standard is a suite of standards defining interfaces and protocols for LANs. The IEEE 802.X specifications are for the three lowest layers (physical, Data link and Network of the OSI layers).

This IEEE 802.1 defines the network layer while the remaining 802 specifications relate to the data link and physical layers. The IEEE divides the data link layer into the logical link control LLC and the Media Access Control sublayer.

The LLC is responsible for establishing a logical connection between computer on a network and also it interprets message packets called Protocol Data Unit (PDU) The MAC sub layer resides between the physical layer and the LLC and provides access to the physical network port as well as perform message packet framing, deframing and error detection.

3.2 The IEEE 802.2

The 802.2 standard defines the functions of the LLC sub layer. An 802.2 compatible interface provides services that fall into two major categories.

nless Services: This service permits network users transmit and receive information without establishing a confirmed link between source and destination.

(ii) Connection Oriented Services: A protocol for establishing, using and terminating virtual connections between network users

3.3 The IEEE 802.3

This specification defines the CSMA/CD protocol. The Ethernet protocol is based on the 802.3 The CSMA/CD works well for medium networks but as the networks grow in size, collisions increase and the network slow down. The permissible topologies for the CSMA/CD are the bus. Star and tree structures to prevent multiple paths between any two points as in Ring topologies.

3.4 The IEEE 802.4

The 802.4 standard defines the token passing bus access method. Hosts on the network are connected to a single cable using unidirectional taps like the CSMA/CD. The network operates like a token passing ring network because the hosts see themselves as being arranged in a loop with each host knowing the address of stations before and after it.

The token-passing eliminates the collision issues as only one token exist on the network at any time and only the host with the token is permitted to transmit per time. A token passing network is superior to the CSMA/CD network for heavy loads.

3.5 The IEEE 802.5

The standard utilizes a token passing techniques as discussed in the 802.4 but the topology in this case is truly a ring. A host is connected to the network via two cables. One cable for data reception from its upstream neighbor and the other for transmission to the downstream neighbor. In the token ring system, one host is used as the active monitor with the

ction of ring errors e.g. less of token, incorrectly formed

s include

IEEE 802.6

IEEE 802.7

IEEE 802.8

IEEE 802.9 etc

The list continues as the standard committees are set up to develop the required standards.

The list below shows the IEEE 802 standards available. The goal of the 802 standards was to create device standards for different LAN needs.

802.1 - This standard which is now known as the spanning tree algorithm is used to detect other bridges on the network.

802.2 - This defines the standards for the LLC layer of the data link layer

802.3 - This standard is the CSMA/CD standard which also in the Ethernet standard

802.4 - The 802.4 discussed the Token passing bus which never took off, so it is not used.

802.5 - This standard is based on IBMs token Ring network standard

802.6 - This network defines standards for MANs, itôs purpose was to define Distributed Queue Dial Bus (DQDB) a network with two physical channels

802.7 - This standard defines Broadband Technology

802.8 - This standard defines the Filter Optic Technology

802.9 - This standard the Integrated Data and voice network.

802.10- This standard defines Network Security issues

802.11 - This standard is responsible for wireless network.

802.12 - This standard is for the 100mbit data transfer data in next generation networks. It is called 100VG ï AnyLAN.

to the different IEEE standards and the development of these standards and their impact on the LAN.

5.0 Summary

In this unit we have been able to extend knowledge of the theory and applications of computer networks by treating the different IEEE standards.

6.0 Tutor marked assignment

(1) List any four types of standards

(2) List any three standard developing organizations and discuss any method of identifying their standards.

(3) Discuss any four IEEE standards

7.0 References

1. Data Communications and Networking, Forouzan, B. A, 3rd Ed. (2004), McGraw-Hill.

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UNIT FIVE: MEDIA ACCESS CONTROL

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Marked Assignment

ces

1.0 Introduction

The method of access to the LAN permits all devices attached to the transmission media to share that medium in a controlled manner. Only one device is permitted to transmit at a time. If two or more devices attempt to transmit at the same time, they will scramble each others messages.

2.0 Course Objectives

The student are expected at the end of this course to

(i) Be able to identify media access control methods

(ii) Be able to differentiate between the contention based and deterministic approaches to media access control

3.0 Media Access Control Methods

There are three ways to control access to the media and these are:

3.1 Addressing:

The data link layer is responsible for the physical address of devices on the network. Every device on the network has a hard coded address attached to it. This address is also referred to as the MAC address.

3.2 Contention based Approach:

In a contention based network any device can transmit but at the expense of collisions. To avoid the collisions, devices listen for other signals on the media before transmitting. The two most common collision access method are

le Access/Collision Detection)

ttached in the medium to transmit when the bus is free and to monitor for collision during transmission. The transmission sequence on a CSMA/CD is as follows:

The device listens to the media for any other transmission. This is known as carrier sensing.

If the network media is quiet, the device commences transmission

After transmitting, the device listens to the network to detect any collision.

If collision is detected, the device will send and a signal to all other devices to keep from sending data for a small period to clear the media.

The transmitting stations will wait a random amount of time before sending their data

If a second collision occur with the same devices, the repeat the above steps with double the random time out before the transmit again.

Ethernet uses the CSMA/CD method

(b) The second CSMA method is called CSMA/CA (Career Sense Multiple Access/Collision Avoidance)

The sequence of events in the CSMA/CA approach is as follows:

The device wanting to send checks the media for any active transmissions.

If the media is clear, the device sends a request to send message.

If it is okay to transmit, the network server responds with a clear to send signal.

When the signal is received, the device transmits.

When the transmission is complete, the device sends out an abort sequence to indicate that it has finished transmission.

3.3 Deterministic Approach

In a deterministic network, a transmitting order has to be established before transmission takes place. There are two types of deterministic network:

nall data frame pass from device to device across the he device in possession of the token has control of the medium for a predetermined maximum time while in possession of the message packet.

A token ring controller may be in any one of the following slate

(a) repeat mode (b) transmit mode (c) copy mode

On receiving the token, the device appends data and destination address to the token, places it on the network and waits for acknowledgement from the addressed destination host. The destination host on receiving the data sends a reply to the data source when the device has finished transmission, the token is passed to the next device in predetermine sequence.

There is currently no speed specification on Token Rings even through IBM support 4Mbps and 16Mbps as against the 10Mbps of the Ethernet. The networks operate only at one speed, either 4Mbps or 16Mbps. Two networks operating at difficult speeds may coexist but they must be separated by devises called BRIDGES.

Advantages of Token Ring include:

(1) Special devices can have higher priorities

(2) It is more efficient under high network load than contention based networks

(3) Network access is predictable

3.4 Polling System:

In this system, a master device checks order secondary devices in the network and their priorities can be set by the administrator. Its advantages includes the fact that little bandwidth is lost when the network reaches high utilization.

4.0 Conclusion

to the different media access control methods used in tages of each.

5.0 Summary

In this unit we have been able to extend knowledge of the theory of computer networks by a study of the different media access schemes and their characteristics.

6.0 Tutor marked assignment

(1) List any three media access control method, discuss the application of each method

(2) Discuss the disadvantage of Token passing networks

(3) Discuss the CSMA/CD media access scheme

7.0 References

1. Data Communications and Networking, Forouzan, B. A, 3rd Ed. (2004), McGraw-Hill.

2. Computer Communications and Networking Technologies, M.A. Gallo and W.M Hancock, (2002), Brooks/Cole.

3. Business Data Communications & Networking, Fitzgerald & Dennis, 6th Ed. (1999), John Wiley & Sons

UNIT SIX: INTRODUCTION TO THE INTERNET

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Decimal Notation

n Name System

4.0 Conclusions

5.0 Summary

6.0 Tutor Marked Assignment

7.0 References

1.0 Introduction

A network as defined earlier is a group of communicating devices. The INTERNET is a collaboration of more than hundreds of thousands of interconnected networks on more than 100 countries. It started in 1969.

Mainframes were used as standalone systems until when the Advanced Research Projects Agency (ARPA) in Department of Defense (DOD) decided to find a way of connecting mainframe computers in different locations, so that researchers could share their discoveries, reducing cost and eliminating duplication of effort.

The ARPANET, a small network of connected computers was presented in 1967 with each host being connected to a specialized computer called an Interface Messaging Processor (IMP). The IMP will in turn be connected to one another with the ability of communicating with one another or their connected hosts.

In 1969, the ARPNetwork was realized with four nodes at

University of California at Los Angeles (UCLA)

University of California at Santa Barbara (UCSB)

Stanford Research Institute (SRI)

University of Utah

MPs to form a network and a software called Network

mmunication between the hosts,

2.0 Course Objectives

The students are expected to

(i) Be able to discuss the Internet protocols

(ii) Describe the architecture of the internet

(iii) Describe the functions of the IP Protocol

(iv) Discuss the IP classes

(v) Discuss the principles of the domain name system and the dotted decimal notation

3.0 Transmission Control Protocol

In 1973 Vint Lerf and Bob Kahn, members of the ARPANET group presented a paper outlining the protocols to achieve end to end delivery of packets (Transmission Control Protocol) (TCP) The TCP was later Split unto two Protocols.

(1) Transmission Control Protocol ï (TCP for handling functions like segmentation, reassembly, error detention.

(2) Internetworking Protocol (IP) ï This was to handle datagram routing.

The Internetworking Protocol now became known as the TCP/IP.

The Internet is made up of several wide and local Area Networks joined by connecting devices and switching stations. Connection to the internet is via Internet Service providers. There are different levels at which ISPs operate.

International Service providers:- This is the top of the hierarchy and they connect nations together.

National Service Providers:- There are back bone networks created and maintained by specialized companies to provide connectivity between end users. The Back bone networks

Access Point. National Service Providers operate at high

Regional Internet Service Providers:- They are Smaller ISPs. Connected to NSPs. They operate at a lower date rate.

Local Internet Service Providers:- These are ISPs that provide service to the end users. It can be a company that provides Internet Services to users e.g. University, Nonprofit organization. They are usually connected to a regional or national service provider.

3.1 INTERNET PROTOCOLS

Network technologies such as Ethernet, Token Ring, and FDDI provide data link layer functions by allowing a reliable connection between one node and another on the same network. For data to be transferred from one network to the other, it requires an addressing structure which is read by a gateway or a router. The TCP/IP are the pair of protocols used for internetwork communications. The Internet uses TCP/IP to transfer data where such node on the internet is assigned a unique network address called an IP address

TCP - Transport layer

IP - Network layer

Ethernet - Data link layer

Data ï segments - packets ï frames ï Bits

Application ï Transport - Network ï Datalink ï Physical

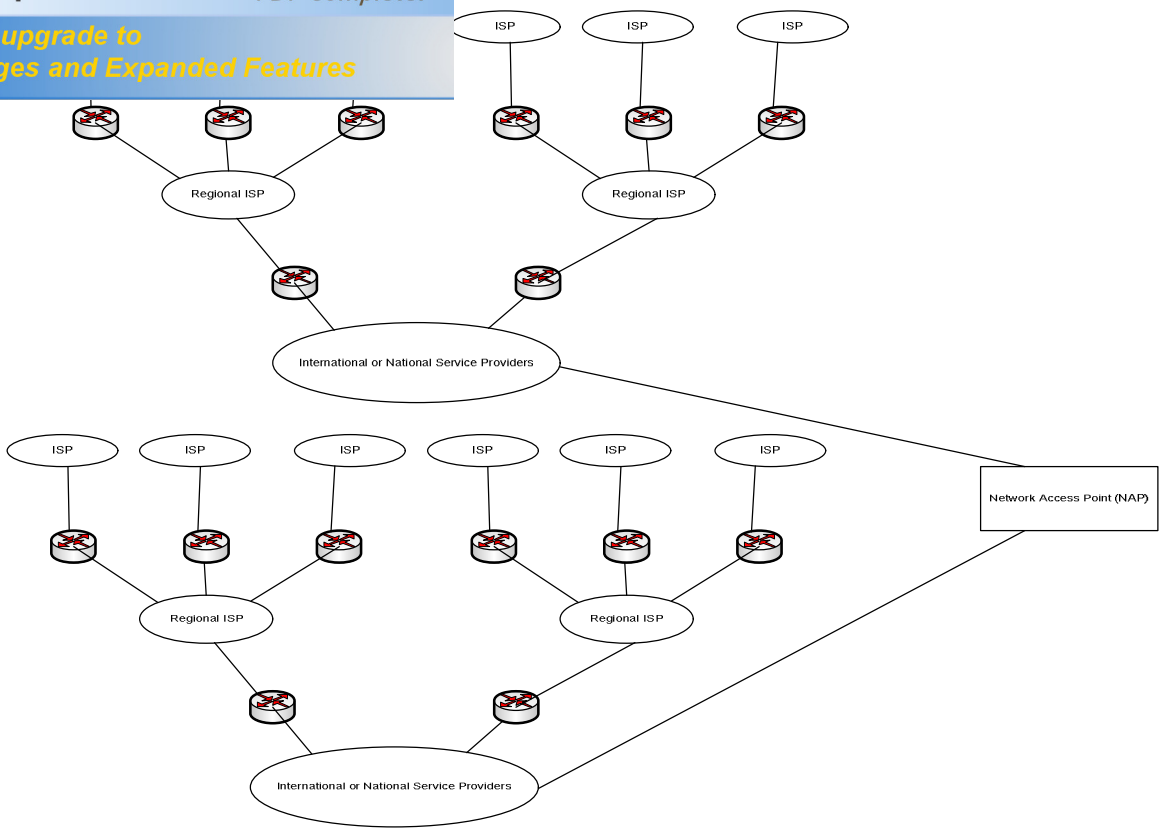

Figure 3.1 The architectural diagram of the Internet connection

3.2 Functions of the IP Protocol

The Router utilizes the IP address to connect networks of the same kind through a point to point link. The main functions of the IP protocols are

(i) Route IP data packets (Internet data grams) around the Internet. The IP protocol on each node knows the locations of the gateway and the gateway must be able to locate the nodes on the interconnected networks

(ii) Fragment the data into smaller units if it is greater than a given amount (64kB)

(iii) Report Errors: The node that detects the error sends a report back to the source. The errors can be as a result of the datagram traveling for more than a set time on the network. In this case they are deleted.

ion of the Network layer of the OSI model with the information. The resultant packet becomes an internet datagram. The header contains information such as source and destination IP addresses, version member of the protocol etc. A datagram can contain up to 65536 bytes (64KB) of data.

The fields of the IP datagram are:

Version: The TCP/IP version number helps gateways and nodes interpret the data Unit Correctly. The predominant version number now is 4 (IPv4) The Version field is 4 bits in length and can represent up to 16 version numbers.

Header length: This also is 4 bits and is used to determine which the header ends and differentiate it from the data.

Types of Service: This is an 8 bit field and it consists of two sub fields

Type of service (2) Precedence

The subfields consist of bit positions that when set indicate how a datagram should be handled.

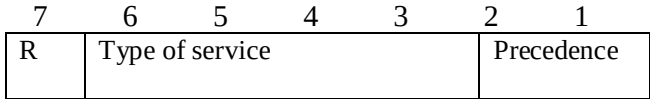

Figure 3.2: Type of service field showing the sub fields

The precedence field allows the transmitting station indicate to the IP layer the priority of sending the datagram.000 indicates normal precedence. 111 indicate the highest level of precedence usually used for network control.

The Type of Service field indicates how the datagram is to be handled.

0000 default
0001 minimize monetary cost
0010 maximize though put

ty

Total length: This field indicates the total length of an IP data gram in bytes. It is 16 bits in length resulting in an IP datagram having a maximum defined length of 3^{16} or 65536 bytes.

Time To Live (TTL): This field is 8 bits in length and the setting of the field is used to specify the maximum amount of time that and datagram can exist. It is used to prevent misaddressed datagram from wondering endlessly over the internet. The amount placed on this field is actually a router hop count and each router decrements this number by 1 as the datagram flows between the routers in the Network. Many applications set the default value to 32. (2^8 = 256 (max)).

Header Checksum: It contains a 16 bit patterns for error detection.

Source and Destination IP address: This specifies the source and destination IP addresses of the datagram

Options: This field contains Information such as debugging, error control, routing e.t.c

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

Version	Header length	Type of service
Total Length		
Identification		
O D M		Fragment Offset
Time To Live		Protocol
Header checksum		
Source IP address		
Destination IP address		
Options		

Figure 3.3: Internet datagram header format and contents

3.3 IP ADDRESSES

Each node using TCP/IP communications require an IP address which is then matched to its MAC address.

ields

lentifies the network

2. The Right field (Host member).This identifies the particular host.

The IP address is 32 bits long (4 Sets of 8 bits) and can address over 4billion users (2^{32}).There are three main address formats. Each of which is applicable to different types of networks.

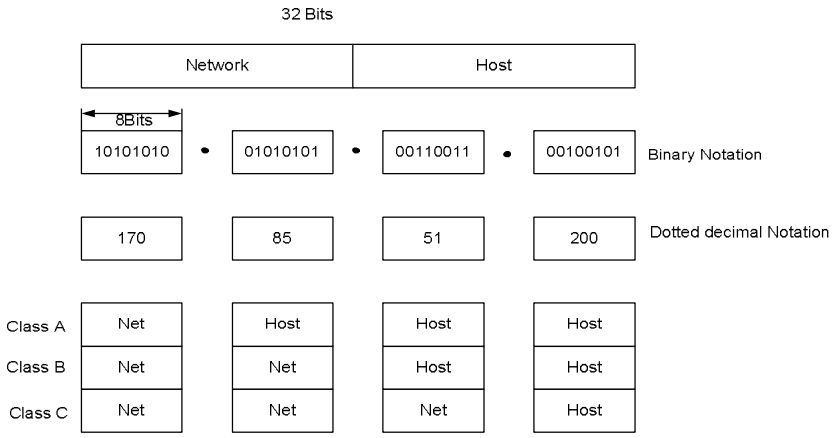

Figure 3.4: IP Address format

3.4 Classes of IP Addresses

There are five different classes of IP addressing schemes with each class having specific capabilities and capacities.

Class A:

This allows up to 128 (2^7) different networks and up to 16million host on each network (2^{24}).An example of this is an organization with many nodes or computers connected to the Internet (e.g universities like MIT, HAVARD etc).The dotted decimal number is from 0-127. 7 bits are used for the network portion. The first bit is set to 0.

Class B:

This allows up to 16384(2^{14}) networks and up to 65536(2^{16}) hosts on each network. This is for medium sized organizations with an average number of hosts. It is defined by setting the

ss to 10.The network portion is then represented by the section 2^{16}.(128-191).

Class C:

In this class the first 3 high order bits of the IP address are set to 110 and the network address is now represented by 2^{21} giving rise to approximately 2 million networks with a total host per network of 2^8=256.This class is used by organizations with small networks e .g in academics institutions, government agencies etc. Since these organizations can have multiple LANs, multiple class C addresses can also be assigned to them if their hosts are not large enough to justify a class B address .(192-223)

Class D:

It is defined by assigning 1110 to the first 4 most significant bits of the IP address. The remaining bits are used to form a multicast address thus there exists 2^{28}=268 million possible multicast addresses. Multicasting is an addressing technique which allows a source to send information to a selected group via the use of a multicast address.

Class E:

In this class, the first 4 MSB are given the value 1111, thus the remaining 28 bits representing 268.4 million address possibilities. This class is reserved for research purposes.

Note:

All Os in the host part is reserved for the entire network.

e.g 40.0.0.0 (Class A network address)

150.76.0.0 (Class B network address)

199.20.30.0 (Class C network address)

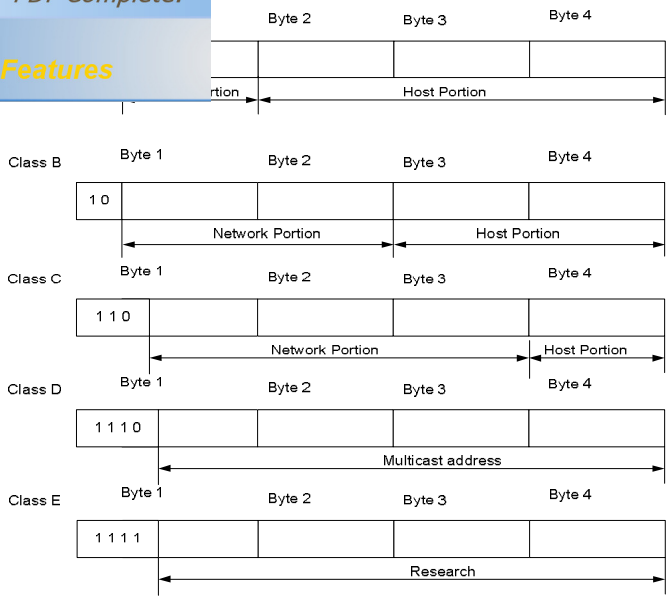

Figure 3.5: Classes of IP Addresses

3.5 Dotted Decimal Notation.

The difficulty experienced in the direct use of the 32 bit binary led to the development of the dotted decimal notation in which the IP addresses were expressed via the use of four decimal numbers separated from each other by decimal points. The 32 bit binary IP address is divided into four 8 bit fields and the value of each field specified by a decimal number ranging from 0-255 in bytes 2,3 and 4.With the setting of the first bit in class A address to 0 a maximum of 127 addresses is what can be obtained for class A.

E.g

128	64	32	16	8	4	2	1
1	0	1	1	0	1	0	1

128 x 1+ 64 x 0+32 x 1+16 x 1+8 x 0+4 x 1+2 x 0+1 x 1 = 181

10110101 = 181

3.6 Domain Name System (DNS)

The representation of IP addresses by the dotted decimal did not completely simplify IP address identification so the domain name service DNS was introduced.

glish type names assigned to hosts to their IP address. the internet determine the IP address of the named destination resource or application program. If the domain name cannot be resolved after querying other servers, an error message is displayed by the www browser.

Examples of some domain name suffixes are:

Suffix	Type of organization
.com	commercial organization
.edu	educational
.gov	Government agency
.mil	Military organization
.net	Networking organization
.org	Non- profit organization
.int	International organization

Once an organization has a registered name e.g yahoo.com, it can add a prefix to indicate specific hosts or applications residing on the host e.g www.yahoo.com meaning that yahoo is a server for a commercial site (a World Wide Web server).

Each Institution on the internet has a host that runs a process called the domain server. The DNS maintains a data base called directory information base (DIB) which contains directory information for that institution. When a new host is added, its name and IP address is added to the data base.

4.0 Conclusion

In this unit you have been introduced to the internet, the internet protocol and the classification of IP addresses and the IP addressing schemes.

nd knowledge of the theory of computer networks by a study of the Internet protocols and the process of addressing devices (hosts) on the computer network.

6.0 Tutor marked assignment

(1) Discuss the principles of the internet connection

(2) Discuss the component parts of the IP header

(3) List the different classes of the IP addresses and the number of hosts each class can accommodate.

7.0 References

1. Data Communications and Networking, Forouzan, B. A, 3rd Ed. (2004), McGraw-Hill.
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MODULE THREE

SEVEN: SUBNETTING

Table of contents

1.0 Introduction

The two level hierarchical numbering scheme of the IP addresses has a major problem in that it is inefficient and it leads to the waste of IP addresses .To overcome this waste, the Sub-netting is a process was developed.

2.0 Course objectives

AT the end of this unit, students are expected to

(i) Discuss the principles of Subnetting

(ii) List the advantages of Subnetting

(iii) Be able to identify the Subnet mask

3.0 Subnetting

Subnetting is a process that involves the division of the two level hierarchy of class A, B and C networks into a three level hierarchy. The host portion of each 32 bit network address is used both for the subnet number and the host number.

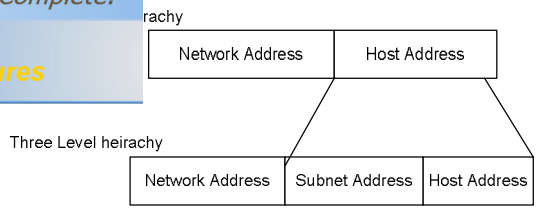

Figure 3.1:Relationship of the two and Three level Address hierarchy of IP addresses.

The increase in the number of bytes used for the network address from class A to C means a reduction in the bytes available for sub-netting from class A to C , so class C will have the lowest possible number of subnets. Sub-netting allows the division of class A, B and C address to other address used to identify networks in an organization

3.1 Advantages of Subnetting

Sub-netting was developed to solve the following problems

1 Waste of IP address space

Most of the addresses in the two level hierarchy were often not completely utilized e.g two networks with 30 systems in class C would mean that for each network not attaining its maximum, the excess addresses would be wasted as it can not be used by other networks since each class C network supports a maximum of 254 nodes (or devices).

2 Increase in Size of Routing Tables

New IP addresses meant an increase in the routing table and each router would have go through all the addresses. Subnetting on the other hand still left the network unchanged to external networks as only the network concerned has to learn the new addresses.

3 Management and Performance

The subdivision of the large networks into smaller groups facilitates efficient management and better network performance as congestion is low on the buses. Traffic is localized within the networks as fewer hosts transmit within a given network.

t enable devices on a network determine the separation of an IP address into its network, subnet and host portions.

Dividing the host portion into a 3-bit subnet field and a 5bit host field (given that we desire to represent or support 5 different sub-network s on the address, $2^3 = 8$ and $2^2=4$ so we use 3 bits) .This also means each sub network can support a total of 2^5 ï 2 = 30 addresses (because the host portion can not be all 0s or 1s (this leaves us with 5 bits) as these numbers confuse the router as all 1s represent a broad cast address and all Os represent the network address).

Given a network address, 198.78 46.96, to develop a subnet used in determining the extended network the subnet mask will become

11111111 . 11111111 . 11111111 . 11100000

255 . 255 . 255 . 224 → 3 bit subnet mask

The remaining 5-bit positions in the host field is used to identify the host

IP address: 198.78.46.97 11000000.01010000.00101110.01100001

Subnet mask 255.255.255.244 11111111.11111111.11111111.11100000

From the IP address, the first 2 bits are set, meaning it is a class C address. Since it is class C address, the host is identified by 1 byte (the 4th byte) The subnet using 3 bits will be identified in the IP address in 25-27 be 011 which represent subnet 3. The last five bit with value 00001 represent host number 1.

The IP address now represents host 1 on subnet 3 on network 198.78.46.0

The subnet mask, IP address and default gateway is usually required when configuring a system for the TCP/IP Network.

to the principles of Subnetting and the advantages of Subnetting. You have also been introduced to the subnet mask and the process involved in developing a subnet mask and identifying the capacity of computer networks given the subnet mask.

5.0 Summary

In this unit we have been able to extend knowledge of the theory of computer networks by a study of the Subnetting process and the subnet mask and the process of addressing devices (hosts) on the computer network.

6.0 Tutor marked assignment

(1) Define Subnetting and list any three advantages of Subnetting

(2) Define the subnet mask stating its functions.

7.0 References

1. Data Communications and Networking, Forouzan, B. A, 3rd Ed. (2004), McGraw-Hill.

2. Computer Communications and Networking Technologies, M.A. Gallo and W.M Hancock, (2002), Brooks/Cole.

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7 TCP/IP for Windows2000 by Houde and Hoffman.

GHT: INTERNETWORKING

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1.0 Introduction

As users on a local network grow, the LAN may reach its limits on distance or number of modes that can be supported on an individual segment, hardware devices are then needed to extend the network to form a larger network.

Internetworking and Intranetworking products fall into five different categories namely:

(1) Repeaters

(2) Routers

(5) Brouters (combination of Bridges and Routers)

Each device function that directly correspond to the ISO layer at which the internet working function is performed.

2.0 Course Objectives

At the end of this unit students are to

(i) Discuss the place and functionality of the Repeater in a network

(ii) Discuss the place and functionality of the Router in a network

(iii) Discuss the place and functionality of the Gateways in a network

(iv) Discuss the place and functionality of the Bridges in a network

(v) Discuss the place and functionality of the Switches in a network

3.0 REPEATERS

A repeater is a device that operates at the physical layer to regenerate the electrical signal on the network media. It is used to extend the geographical coverage of a local area network (LAN) by interconnecting multiple segments. The can also interconnect segments using different physical media such as **thicknet**, **thinnet** and **coaxial cables**. The repeaters have very little intelligence and they do not provide any type of traffic isolation. Repeaters also cannot connect dissimilar networks for example, it cannot connect a CSMA/CD based network to Token Ring based network

Most networks have a limit to the number of repeaters that can be used to connect segments. In Ethernet this rule is called the 5-4-3 rule meaning a total of 5 segments connected by 4 repeaters with only 3 segments populated. The repeaters are normally two port boxes. Signal comes through one port and leaves through the other.

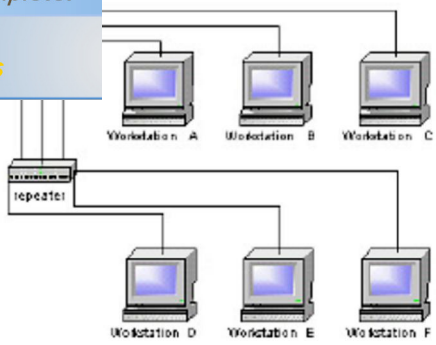

Figure 3.1 A Repeater based network configuration

This configuration can extend the maximum 500m length per segment to 2500m with repeaters interconnecting 5 segments.

3.1 BRIDGES

A bridge is a device that allows one local area network (LAN) medium to exchange frames with another. The bridges operate at the data link layer of the OSI model and connect two different networks together. Bridges are more intelligent than repeaters in that it monitors traffic in all its ports and stores the node addresses of the sending station to each port in a memory table when a bridge receivers information (data) for another port, it forwards it to the destination address based on the addresses on memory table. If it receives a packet for an unknown address, it will broadcast the data on all ports and listen for a response if a response is got from any port, it records that node address and adds it to its memory table. In this manner, each bridge eventually learns through which of its ports each node on the network can be reached.

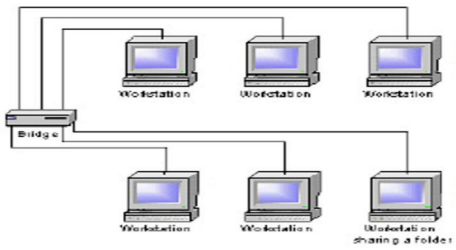

Figure 3.2: A Bridge based Network configuration.

nnect dissimilar networks. There are two main types of

(1) Transparent Bridges

Transparent bridges use hardware network card address to know which data to pass to a particular node and which to filter out. Computer addresses are stored in a table, one for each port. When data is received, the destination address is checked and compared against this table.

(2) Source-route bridges:

The type of bridges are utilized mainly by token ring networks, the information in the token ring frame is used to determine whether to pass the data or not as against the MAC addresses. As a standalone device bridges have been made largely obsolete by the introduction of more advanced switches and routers.

3.2 ROUTERS

Routers are multiport devices that can connect dissimilar networks running at different transmission speeds and using different protocols. Routers work in the Network layer of the O.S.I. Model, which allows them to redirect data from one network segment to another. Routers also have the ability to choose the most effective path for data transmission across a network, which combined with their ability to connect dissimilar network types, makes them very powerful. They make intelligent decisions on the path for the data using either the MAC address or administratively assigned logical address (e.g. IP addresses). This allows the segmentation of the network into subnets (a subnet is a network connected to another network in a router).

There are two types of routing

Static ï In the static routing, the paths are configured by the system administrator

, the routes are learned by the system using routing

A router is initially given the address of the network it belongs to. In large router Interconnected network, each network has its router that knows the addresses of all its hosts as well as the addresses of other networks routers.

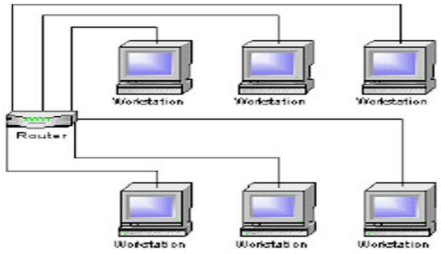

Figure 3.3: A router Based Network

Advantages of Bridges Over Routers are:

(i) Bridges are faster than routers as they do not have to make decisions for the best route

(ii) Bridges are cheaper

(iii) Bridges are less complicated and do not need specialized software to be operated.

With the advantages of both the Bridges and the Router being very relevant, a new product called BROUTER was developed to maximize both the Bridge and the Router.

3.3 BROUTER

A Brouter is a special device that allows for routing and bridging in the same box. The Brouter includes a firewall protection feature built in to ensure that a packet supported by the routing function of the brouter is not forwarded by the bridging function of the brouter.

3.4 GATEWAY

Gateways can operate at all seven layers of the OSI model. Their function is to do any necessary conversion of protocols between networks. They interconnect networks that have totally different communications architecture. It provides complete conversion from one protocol stack to another without altering the data that needs to be transmitted e.g. from

received by a router, the packet is sent to the nearest

his goes on until the packet arrives at the router of the destination network. This router then directs the packet to the receiving host.

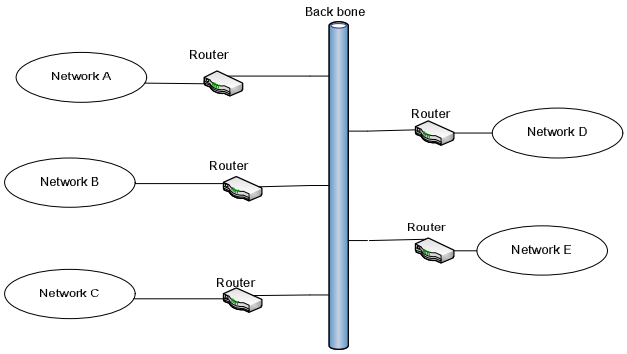

Figure 3.4 Router based network

A PC can be configured to serve as a router.

A Comparison between bridges and router.

(i) Routers are self configuring in that they know other routers and the best route in an interconnected segment.

(ii) Routers offer some form of intelligence by responding to an originating station when the destination is unreachable and also offering a better path.

(iii) Routers allow for different size packets e.g. if a segment data is 1518 bytes and the other segments capacity is 512, routers will fragment the packet and re assemble it at the other end.

(iv) Routers allow for load balancing by selecting another path if the currently used path is over loaded.

(v) Routers segment networks into logical subnets allowing for better network management.

evices includes

These are multiport repeaters for UTP. The range from four ports to up to several hundred and are specific to the network type. The follow the 5-4-3- rule and are of two types.

(a) Passive Hubs: These provide no signal regeneration and are simply cables connected together so that a signal is broken to other modes without regeneration. They are no longer in use due to the cable losers.

(b) Active Hubs: The act as repeaters and regenerate the data signal to all ports.

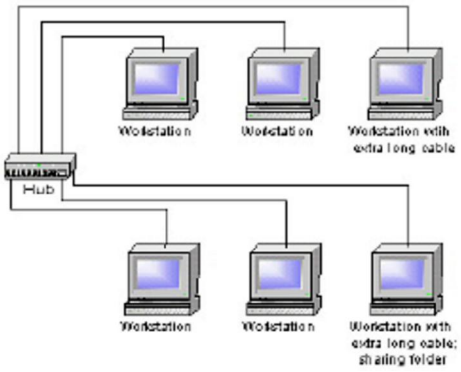

Figure 3.6: Hub based networks

3.6 Switches

Switches are multiport bridges. They filter traffic between ports on the switch by using the MAC address of computers transmitting through them. They are the key to large and fast Ethernet Networks. Switches can be used with hubs as shown in the figure .

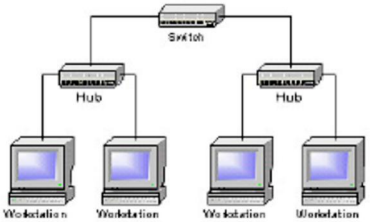

Figure 3.7: Switch based networks with hubs

networks over normal telephone lines (at slow speeds). They handle the conversion of signals between computers and telephone lines. This is because computers are digital as against the lines which are optimized for analog signals.

Most analog modems operate at speeds of 14.4kbps up to a theoretical 56kbps and have the capability of compression.

3.8 Multiplexer

These are devices used to enable the transmission of multiple signals across one transmission media. In modern networks however they have been replaced by routers.

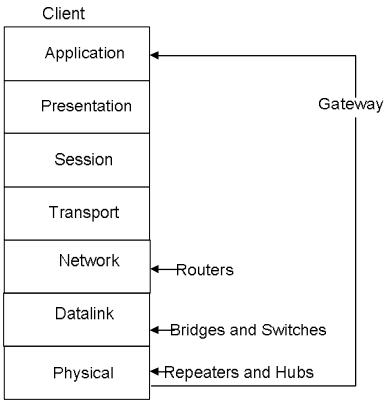

Figure 3.8: Internetworking devices and the OSI Layer. (Gateways operate at all levels)

Given a typical network in Figure 3.9, for communication to take place between A and D. The packet will have to go through different networks. The Network in the figure made up of 4 LANs and 1 WAN. The Bridge and the Repeater are responsible for communication within a network but when the communication is between networks, the Router (Network layer) comes in.

From the diagram S1 is a router. The Network layer is responsible for host to host delivery through several links and for routing the packets through the routers.

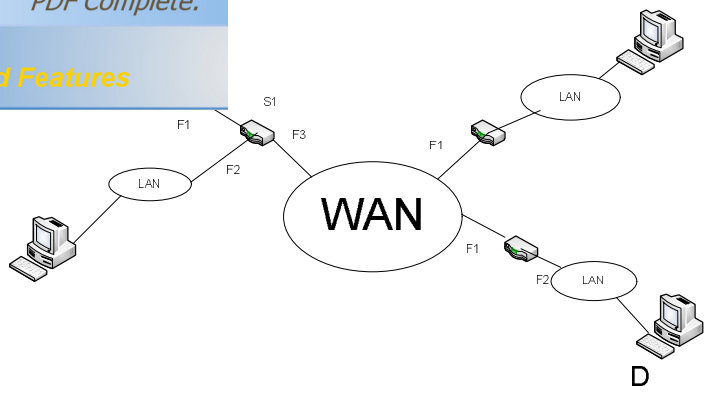

Figure 3.9: Communication path between A and D

PACKET SWITCHING VS CIRCUIT SWITCHING

This is a process of transmitting digital information by means of addressed packets which include data call control signals and error control information so that a channel is occupied only during transmission of the packet. This is contrasted to the option of using modems where those data occupy a circuit for the entire duration of transmission even when no data is actually being transmitted. With packet switching various packets of information can travel along different route on the network allowing the carrier to optimize network capacity.

The data transmitted over the internet is by the data communication method called Packet Switching. The data is broken down or divided into short chunks usually less than 1500 bytes and sent in segments one after the other. The packets may take different routes through the backbone in get to the destination where they are reassembled in the correct order.

There are three key parts to the packet switching system. These are.

Switches (ii) Routers (iii) Routers (iv) Software (TCP/IP)

3.9 Packet Switching Network

The packet switching system is a network of exchanges using high-speed switches to connect multiple inputs to multiple outputs. The exchanges are interlinked with others.

hing Systems (Protocols) and these are:

extensive error detection and correction and as a result was very slow. Every package was acknowledged and it operates at the Network layer

(2) Frame Relay: This is faster than the X.25 and it featured a variable length packet. Frame relay does not use acknowledgments and when the packet is corrupted, it does not request a re-transmission higher level protocols do that. It is based on the data link layer. Its speed starts at 56bkps up to 50Mbps depending on the vendor as against the maximum 64kbps of the X.25 networks.

(3) Asynchronous Transfer Mode (ATM): It was a fixed length packet of 53 bytes and can transmit at rates exceeding 1Gbps over fiber networks. It can transmit data voice or video in digital form at the same tune using Time Division Multiplexing

Most internet back bones use frame relay or ATM over the fiber optic back bone.

Data Packets

If only a small amount of data or information is to be transferred, setting up a circuit to transfer the data would be an inefficient use of the transmission medium. A better approach would be to address information to the data and send it in a self contained unit known as a packet. This unit is transmitted through the various nodes till it gets to its destination, The basic form of a packet is shown in the Figure 3.10.

Figure 3.10 Basic form of a packet.

The header will contain information that will identify the source, destination, synchronization bits indicating start or end of a packet, the route etc. The packets are transmitted stage by stage. There are two special types of Packet Switched Systems.

(i) Message Switching: In this type, the entire message forms a packet. This type also referred to as the store and forward, does not permit the splitting of the message into smaller

ges of variation in data packet sizes, Hardware being

(ii) Cell switching: In cell switching all packets (known as cells) have fixed length. This common format reduces the complexity of network design.

There are two popular approaches to packet switching.

(i) Virtual Circuit Approach

In the Virtual Circuit Approach, the relationship between all packets belonging to the message or session is preserved. A single route is chosen between receiver and sender and all packets travel one after the other on that circuit. Wide Area networks utilize this approach. A call set up is required to establish the Virtual Circuit and a cell tear down deletes the circuit.

(ii) Datagram Approach

In this approach, each packet is treated independently of others and they take different paths to arrive at their destination. It does not need call set up and the routing of the packet is based in the source and destination addresses included in the packet. The Routers each have a routing table that can decide on the best route based on the two addresses. The Internet utilizes that datagram approach.

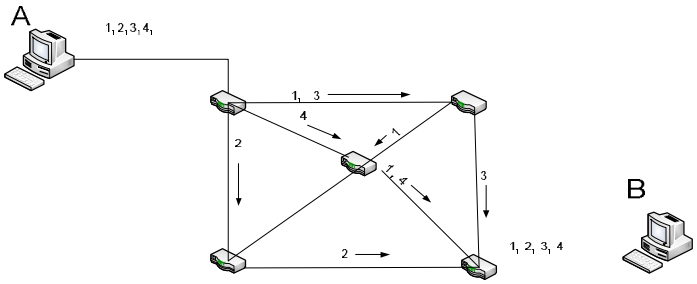

Figure 3.11:Datagram approach for Packet switching.

Packet reordering is carried out by a higher level layer.

4.0 Conclusion

In this unit you have been introduced to the principles of internetworking and the devices used in implementing the internet networks.

nd knowledge of the theory of computer networks by a study of the internetworking devices and their places in networks.

6.0 Tutor marked assignment

(1) Write short notes on ant three internetworking devices and state their location in the network architecture

(2) Define Packet switching and write short notes on any two packet switching based network technologies

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: NETWORK MANAGEMENT

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1.0 Introduction

Network management involves configuring, monitoring and possibly reconfiguring components in a network with the goal of providing optional performances, minimal down time, proper security, accountability and flexibility.

This type of management is usually accomplished by the use of a Network Management System which contains a software bundle designed to improve the overall performance and reliability of the system. In the small networks, network management systems is used to identify users who represent security hazards while for large systems, resource usage can be tracked for the purposes of accounting and charging. The most common computer network management system currently being implemented is known as the SIMPLE NETWORK MANAGEMENT PROTOCOL (SNMP).

The compounds that make up the system are usually from different vendors, so a network management system must be based on standards so that inter-operability and compatibility can be ensured.

e expected to be able to

(1) Discuss the principles of Network management

(2) Discuss the Simple Network Management Protocol

3.0 Network Management

Network management is a collection of tasks and responsibilities involved in maintaining a network. It can be broken down into five distinct categories.

1. Account management:- This is the gathering of information on which user or departments on the network is employing which network resource and determine better resource allocation.

2. Fault management:- This include troubleshooting, finding and correcting failed or damaged components, monitoring equipment for early problem indicators and tracking down distributed problems. It involves reconfiguring a network during faults to maintain the required service level.

3. Security: - This includes authorization, access control data encrypting and management of encrypting keys.

4. Configuration management: - This tracks hardware and software information such as the day to day monitoring and maintenance of the current physical and logical state of the network as well as registration and recognition of applications and services on the network.

5. Performance: - This involves the monitoring of the traffic on the network.

Most of these network management platforms are proprietary and as such, the use of computer network components by different vendors makes the use of such platforms

er of managed devices like Routers, Bridges, Switches cally involves monitoring and/or altering the configurations of these devices. An Agent is a part of the network management system that resides in the managed device and its tasks involves the provision of management information about the managed device. When an agent does not reside in the managed device, it is called a proxy agent. A network management station provides a text or graphical view of the entire network. This view is provided using the manager that resides on the station. Information exchange between the agent and the manager is via a network management protocol. The management station allows a human or automatic process to

1. Reconfigure a network
2. React to faults
3. Observe performance
4. Monitor security
5. Track Usage

More than one network management stations can exist on a network with each monitoring different parameters of the system or different locations.

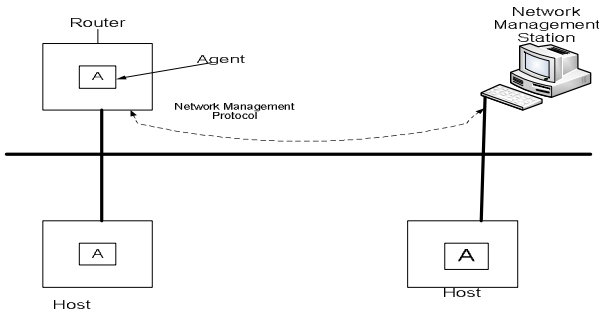

Figure 3.1 Managed Network

nts to access information and the managed device e.g., Router to access the number of packets transmitted from any Host.

Network Management System can operate in any of the two manners listed below:

(1) Centralized: In this case one computer system runs most of the applications required for network management.

(2) Distributed: In this approach, several peer network management systems run simultaneously with each monitoring a specific part of the network. The systems may be distributed geographically.

The current standard supported by most vendors today is the Simple Network Management Protocol. It is limited in functions but provides for vendor independent expansion.

3.1 Simple Network Management Protocol

The Simple Network Management Protocol was developed by the Internet Engineering Taskforce (IETF).This group is a large open community of individuals, network designers operators, vendors and researchers. The SNMP has only three elements and these are

(i) The Manager (ii) The Agent (iii) The Management Information Base

The Agent

The Agent is usually located on a network station and can only perform operations under the direction of the manager. The agent gathers and maintains certain information about its host and the information is stored is contained in the Management Information Base (MIB).

The Manager

The Manager queries the network node for information. This information is supplied through the User Datagram Protocol (UDP).

a weak security but very high level of compatibility. It is

n asynchronous request response protocol meaning that there is no need to wait for response before sending other messages.

The SNMP provides three ways to access the Management Information.

(1) Manager sends a request to the agent to other retrieve or modify the management information associated with the network device in question using one of the following requests.

(a) Get Request: PDU ï for requesting information on specific variables

(b) Get Next Request ï PDU ï for requesting for next set of information

(c) Get Bulk Request ï PDU ï for requesting bulk information retrieval

(d) Set Request ï PDU ï for creating or modifying management information

The agent must always reply using a respond ï PDU

(2) Manager sends a request to another manager for information associated with that manager.

(3) Unconfirmed interaction in which an agent sends an unsolicited Trap-PDU to a manager notifying the manager of an exceptional situation that has resulted in changes to the management information associated with the network device.

The Management Information Base

This is a virtual data based use to define the functional and operational aspects of the network device. The database contains an object for each functional aspect of a device that needs to be managed.

Each definition of a particular object contains information about the object name, data type, a human readable description, type of access (read/write) and an object identify.

Syntax ï Counter

Access - Read Only

Status - Mandatory

Description - ốThe number of input datagram discarded due to errors in their IP headers and other errors etcò.

The manager uses the Managed Information to access the statistics of the number of IP packets that is discarded due to various errors.

4.0 Conclusions

In this unit you have been introduced to the principles of network management and the tasks involved in network management. The Simple network management protocol has also been discussed

5.0 Summary

In this unit we have been able to extend knowledge of the theory of computer networks by a study of the network management principles and a network management protocol.

6.0 Tutor marked assignment

(1) Write short notes on network management and discuss any four tasks and responsibilities involved in maintaining a network.

(2) Describe the principles of Network management based on the Simple Network Management Protocol

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MODULE FOUR

BUSINESS ORGANIZATIONS

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1.0 Introduction

A Business is a legally recognized organization setup to provide goods and services to consumers with aim of making profit. It is also called a company, firm and enterprise. Businesses are predominant in economies with most of them being privately owned and formed to make profit that will increase the wealth of its owners and grow the business itself. The receipt or generation of a financial return in exchange for work and acceptance of risk is the main objective for the setting up of a business organization. Notable exceptions include cooperative enterprises and state-owned enterprises. Socialist systems involve government, public ownership, state-ownership or direct worker ownership of enterprises and assets that

alist economy. The distinction between these institutions

ions often have alternative or additional goals aside from maximizing or turning a profit.

2.0 Course Objectives

At the end of this unit students are expected to

(1) Itemize the principles of the sole proprietorship business organization

(2) List the principles of the partnership based business organization

(3) Discuss the principle of limited liability type of business organization

3.0 Forms of Business Organizations

A business organization can be classified into 5 major groups. These groups are

ÅA Sole Proprietorship

ÅA Partnership

ÅA Limited Liability Partnership

ÅA Company

ÅA Business Trust

3.1 SOLE PROPRIETORSHIPS

A Sole Proprietorship is defined as a business that is owned and wholly financed by an individual on his or her own.It is the simplest form of business organization. The law regards the sole proprietorship business and its owner as one and the same entity. As such, all rights that the business has are rights that belong to the proprietor and liabilities or debts that are incurred by the business are in law the liabilities or debts of the proprietor. The assets and profits that the business generates are owned by the proprietor who is personally liable to pay whatever tax payable in respect of these assets and profits. Should the proprietor die, the business will cease to exist.

rietor in Nigeria, he or she must first apply to register rovisions of the Corporate Affairs Commission (CAC) In Nigeria. This may be done by completing and submitting the relevant forms to the nearest CAC office. Subsequently, the proprietor must comply with all the requirements set out under the Business Registration Act.

3.2 PARTNERSHIPS

A Partnership is formed where two or more persons carry on a business in common with a view to making profit. Generally, the maximum number of partners allowed in a partnership is 20. The partners can either be individuals or corporate bodies. Should more than 20 persons wish to carry on business together, they will have to do so through a Company. A business partnership is also called a ófirmô.

The law treats a partnership as the same legal entity as its partners. The partners collectively own the assets of the partnership and are each individually liable for the debts and liabilities of the partnership. Each partner is personally liable for the full amount of debt owed by the partnership without any limit. Partners are taxed individually on their share of the partnershipôs profits. So long as there exists a relationship where two or more persons carry on business in common with a view to making profit, the law will recognize the existence of a partnership. In most situations, partnerships are created through a partnership agreement entered into by the partners in the business. The agreement may be made orally or in writing.

Relationships between partners

The relationship between partners is governed by the partnership agreement.The main elements usually found in such an agreement include details of:

ÅHow profits and liabilities of the firm should be shared amongst the partners;

ÅThe responsibilities of the various partners for the running of the business;

ÅThe obligations that the partners have to each other (e.g. to render proper accounts);

nd

should be distributed should the partnership be dissolved.

Partners are agents of each other and of the firm. A partnerôs acts in relation to the normal business operations of the firm will be treated as being the actions of the firm and all its partners. While the authority of any individual partner may be restricted by agreement, such a restriction will not affect an outside party dealing with the partner unless the restriction is known by that party or that party either does not know or believe that the person he is dealing with is a partner of the firm.

Liability of Partners

The partners are each (if dead, his estate) liable for all debts and obligations of the firm that have been incurred while he is a partner of the firm. The firm and all its partners may also be sued for any wrongful act committed by any partner in the course of the business of the firm or with the authority of his co-partners.

Dissolution of Partnerships

A partnership will automatically be dissolved should any partner die or leave the firm. The partnership agreement may also provide for other instances in which the partnership is to be dissolved. This may include situations where any one of the partners becomes bankrupt or becomes of unsound mind. It is also possible for an application to be made to the Court to have the partnership dissolved under circumstances specified in the CAC laws

3.3 LIMITED LIABILITY PARTNERSHIP

A Limited Liability Partnership (ôLLPô) is a business organization comprising two or more persons associated for carrying on a lawful business with an objective of making profit .Despite its name, it is not regarded as a partnership and general partnership law does not apply to LLPs. The LLP is a corporate body that has a separate legal personality. It can sue,

name. The LLP is liable for its own debts and the

not be made liable for such debts. Each of the partners are assessed and taxed individually on their respective share of the profits in the LLP.Every partner of the LLP is regarded as an agent of the LLP. However, the LLP is not bound by the acts of a partner which are not authorized where either this fact is known to the person dealing with the partner or the person does not know or believe the partner to be a partner in the LLP.

Formation of a Limited Liability Partnership

An LLP is formed by registration under the Limited Liability Partnership laws. It must have a minimum of two partners. There is no limit on the number of partners that an LLP may have . The partners can either be individuals or corporations.

Relation of Partners to Each Other

The relationships amongst partners in an LLP are governed by the Limited liability partnership agreement. A partner will cease to be a partner in an LLP upon death or dissolution. In such an event, the LLP is required to pay to the former partner (or his legal representative or its liquidator) an amount equal to the former partnerôs capital contribution to the LLP and the former partnerôs share in the accumulated profits of the LLP. The amount is determined as at the date the former partner ceased to be a partner.

3.4 COMPANIES

A Company is an entity that is registered with the CAC. It has its own legal personality that is distinct from its members and the persons who manage the company. Companies can therefore own property and sue or be sued in their own names. They are recognized as taxable entities in their own right.

ng to whether they are ñprivateò or ñpublicò as well as according to their membersô liability.

(1) Private Companies

A private company is one whose memorandum or articles of association:

Årestricts the right of its members to transfer their shares in the company; and

Ålimits the number of members that the company can have to not more than 50.

The restriction on the right to transfer shares in a private company usually takes the form of a requirement that the transfer be first approved by the companyôs board of directors or a requirement that the shares be first offered to be transferred to existing shareholders.

(2) Public Companies

Any company that is not a private company is a public company. Public companies may or may not be listed on a stock exchange. Where they are so listed, they are usually referred to as ñlisted companiesò and have to comply with the rules and regulations of the stock exchange on which they are listed.

Formation of Companies

A company comes into existence upon registration under the Corporate Affairs Commission. It can have a minimum of 1 member. Theoretically, there is no limit to the number of members that a company can have. The members can be individuals or corporations. The governance structure of a company and the interrelationship between the company, its members and its managers is governed by the Companyôs constitutional documents (the Memorandum of Association and the Articles of Association) as well as by the provisions of the Corporate Affairs Commission Companies Act. The members of companies (usually in joint venture arrangements) enter into óshareholder agreementsô as amongst themselves to

obligations in relation to how the company is to be

Membership of companies

A person can become a member either by subscribing for shares in the company during public offers or by purchasing the companyôs shares from another person. Members of a company are most commonly referred to as shareholders. The rights and obligations of the members in relation to each other and to the company are found in the companies Act as well as in the companyôs constitutional documents. The main rights that members have include:

ÅThe right to be given notice of and to attend and participate in general meetings of members;

ÅThe right to be treated fairly and to have the provisions of the companyôs constitutional documents complied with.

ÅThe right to make some key decisions in relation to the company through the general meeting (these include matters such as the appointment and removal of directors and auditors of the company; the issue of shares and the amendment of the companyôs constitutional documents);

ÅThe right to a share of declared dividends (dividends can only be declared out of available profits); and

ÅThe right to have the company wound up in specified circumstances and

to share in the residual assets of the company.

Members are not liable for the debts of the company.

3.5 BUSINESS TRUSTS

A ótrustô may be described as an arrangement where a person (called the ótrusteeô) holds property for the benefit of others (called óbeneficiariesô). A Business Trust is a trust that operates and runs a business enterprise. It is not a separate entity in that the trustee of the

owner of the assets in the trust. Under the general law are liable for the legal obligations of the trust. A business trust can distribute its operating cash flows to its beneficiaries. Depending on the circumstances and how the trust is structured, tax may be payable either on profit made by the trust or by the beneficiaries on their respective shares in the profit under the trust.

4.0 Conclusion

In this unit you have been introduced to the different forms of business organization and the characteristics of each.

5.0 Summary

In this unit we have been able to introduce the different forms of business organization and the principles of operation of each.

6.0 Tutor marked assignment

(1) Give a brief description of three forms of business organizations stating two advantages of each

(2) List four advantages of Partnerships over sole proprietorships.

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ELEVEN: MARKETING

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1.0 Introduction

Marketing as defined by the American Marketing Association is the activity, set of institutions, and processes for creating, communicating, delivering, and exchanging offerings that have value for customers, clients, partners, and society at large. The term developed from the original meaning which referred literally to going to market, as in shopping, or going to a market to buy or sell goods or services.

The definition of the Chartered Institute of Marketing is that Marketing is the "The management process responsible for identifying, anticipating and satisfying customer requirements profitably." The Marketing process starts with marketing research and goes through market segmentation, business planning and execution, ending with pre and post-sales promotional activities.

xpected to

(1) Discuss the basic concepts of Marketing

(2) Discuss the Principles of Market Orientations

(3) Discuss the different factors relating to the Market environment

(4) Discuss the principles of Market research.

3.0 Marketing orientations

In marketing, an orientation, relates to a perception or attitude a firm holds towards its product or service, essentially concerning consumers and end-users. There are different types of orientations and they are discussed below.

(1) Product orientation

Product orientation ensures that the firm is mainly concerned with the quality of its own product. The central assumption of the firm is that as long as its product is of high standard, its product will always be in high demand.

(2) Sales orientation

Sales orientation causes the firm to focus primarily on the selling/promotion of a particular product. This orientation entails simply selling an already existing product, and using promotion techniques to attain the highest sales possible.

(3) Production orientation

Production orientation causes the firm to specialize in producing as much as possible of a given good. Thus, the firm exploits economies of scale. A production orientation may be

good exists, coupled with a good certainty that consumer

he sales orientation).

(4) Marketing orientation

The marketing orientation is the most common orientation used in contemporary marketing. It involves a firm essentially basing its marketing plans around the marketing concept, and thus forging products to suit new consumer tastes. The marketing orientation often has three prime facets, which are:

Customer orientation

A company in the market economy survives by producing goods that consumers are willing and able to buy.

Organizational orientation

In this orientation, all departments of the firm are geared to satisfying consumer wants/needs. The firmôs marketing department is often seen as of prime importance within the functional level of the organization.

3.1 The Marketing Mix

Professor Neil Borden at Harvard Business School identified a number of company performance actions that can influence the consumer decision to purchase goods or services. These actions are represented in a Marketing Mix. The Marketing Mix is made up of 4 elements. These are product, price, place and promotion.

- Product: This deals with the actual specifications of the goods and services and how it satisfies the consumerôs needs and wants. The scope of a product generally includes supporting elements such as warranties, guarantees, and support.

cess of setting a price for a product, including discounts.

y; it can be what is exchanged for the product or services, e.g. time, energy, or attention.

- Placement: This refers to how the product gets to the customer; for example, point-of-sale placement or retail process. This P is also sometimes been called *Place*, referring to the channel by which a product or service is sold (e.g. online vs. retail), which geographic region or industry, to which segment (young adults, families, business people), etc.
- Promotion: This includes the advertising, sale promotion, promotional education, publicity and personal selling and branding. Branding refers to the various methods of promoting the product, brand or company.

These four elements are often used to develop a marketing plan.

3.2 The marketing environment

The term "marketing environment" relates to all of the factors (internal, external, direct or indirect) that affects a firm's marketing decision-making/planning. A firm's marketing environment consists of three main areas and these are:

- The macro-environment, over which a firm holds little control
- The micro-environment, over which a firm holds a greater amount (though not necessarily total) control
- The internal environment

The macro-environment

The marketing macro-environment of a firm consists of a variety of external factors that manifest on a large scale. These factors are typically economic, social, political or

ed using the PESTLE analysis. The PESTLE analysis

nomic, Social, Technological, Legal, Ecological analysis, within this analysis ,a firm would analyze national political issues, culture and climate, key macroeconomic conditions, health and indicators (such as economic growth, inflation, unemployment, etc.), social trends/attitudes, and the nature of technology's impact on its society and the business processes within the society.

The micro-environment

The marketing micro-environment of a firm consists of factors relating to the firm itself, or stakeholders closely connected with the firm.

3.3 Marketing research

Marketing research involves the conduct of research to support marketing activities, and the statistical interpretation of acquired data into information. This information is then used by managers to plan marketing activities, gauge the nature of a firm's marketing environment, attain information from suppliers, etc. This differ from Market research. Market research pertains to research in a given market. As an example, a firm may conduct research in a target market, after selecting a suitable market segment. In contrast, marketing research relates to all research conducted within marketing. Thus, market research is a subset of marketing research. Marketing researchers use different statistical methods to interpret their findings and convert data into information.

3.4 Marketing communications

Marketing communications breaks down the strategies involved with marketing messages into categories based on the goals of each message. There are distinct stages in converting strangers to customers that govern the communication medium that should be used. There are

keting communication. These are Personal sales and

4.0 Conclusion

In this unit the principles and advantages of the marketing has been discussed. The different factors relating to marketing have also been discussed.

5.0 Summary

This Unit has explored the principles of marketing and the associated advantages and concepts related to marketing.

6.0 Tutor Marked Assignment

(1) Define Marketing and discuss the four Ps that constitute the marketing Mix

(2) Write short notes on any three factors that affect the marketing environment of a firm

7.0 References

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ELVE MARKETING PLAN

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1.0 Introduction

A Marketing plan is a carefully developed and written document that specifies the details of the required actions needed to achieve one or more marketing objectives. It can be for a product or service , a brand or a product line Marketing plans can span a period of up to five years.

At the end of this unit, students are expected to

(1) Discuss the marketing plan Process

(2) Discuss the content of a marketing plan

(3) Be able to develop a marketing plan for goods and services.

3.0 The Marketing Plan Process

The marketing plan process is based on a model developed by Philip Kotler and it consists of 5 steps as shown in the diagram in Figure 3.1

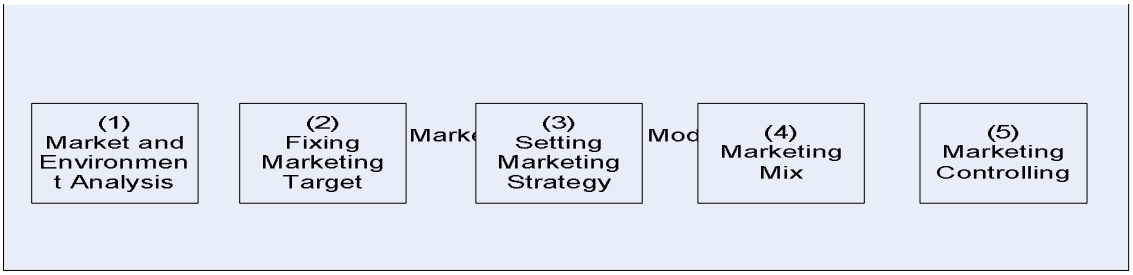

Figure 3.1: Marketing plan process model

The marketing plan process starts with the market and environmental analysis. The is done to ascertain the availability of a sufficient market for the goods or services to be delivered. The ultimate objective of this process is the determination the size of the market as this will enforce the decision to deliver the service or to abstain. The next stage is the Fixing of marketing target. This stage is required to enable the measurement of the success of the marketing process. The targets are realistically set to ensure an accurate assessment of the marketing process. The marketing strategy, marketing mix and Market control are an intertwined process that is executed and refined in a continuous manner to reflect the ever

g into consideration the effect of competitors, economic

For a plan to be effective, it has to be formalized usually in written form, as a formal "marketing plan." The essence of the process is that it moves from the general to the specific; from the overall objectives of the organization down to the individual action plans. It is also an interactive process, so that the draft output of each stage is checked to see what impact it has on the earlier stages - and is amended.

3.1 Marketing planning objectives

The marketing objectives is based on the organization's financial objectives; converting these financial measurements into the related marketing measurements. Marketing strategies can be defined as the means by which marketing objectives will be achieved The following key points are the factors that determine the manner the marketing strategy is structured. These are:

1. Price - The amount of money needed to buy products
2. Product - The actual product
3. Promotion (advertising)- Getting the product known
4. Placement - Where the product is located
5. People - Represent the business
6. Physical environment - The ambiance, mood, or tone of the environment
7. Process - How do people obtain your product
8. Packaging - How the product will be protected

To be effective, the objectives should be capable of measurement and therefore be quantifiable. This measurement may be in terms of sales volume, money value, market share,

outlets and so on. An example of such a measurable

r the market with particular product or service and capture a particular percent of the market for that product or service within a defined time frame. As it is quantified it can, within limits, be unequivocally monitored; and feedback gotten from results can be used to take any necessary action required to maintain or improve on the targets set out in the marketing plan as the need arises.

3.2 Detailed plans and programs

At this stage, the strategies are developed into detailed plans and program. The focus of the plans will be determined by the organization's specific strategies. A product-oriented company will focus its plans for the 7 P's around each of its products. A market or geographically oriented company will concentrate on each market or geographical area. Each will base its plans upon the detailed needs of its customers, and on the strategies chosen to satisfy these needs.

A critical part of the detailed plan involves the exact plans, programs and individual activities will take place over the period of the plan. Without these specified - and preferably quantified - activities the plan cannot be monitored, even in terms of success in meeting its objectives. It is these programs and activities which will then constitute the "marketing" of the organization over the period. These detailed marketing programs are the most important, practical outcome of the whole planning process. These plans are therefore required to be:

- Clear - They should be an unambiguous statement of 'exactly' what is to be done.
- Quantified - The predicted outcome of each activity should be, as far as possible, quantified; so that its performance can be monitored.

roliferate activities beyond the numbers which can be be avoided.

- Realistic - They should be achievable.
- Agreed - Those who are to implement them should be committed to them, and agree that they are achievable. The resulting plans should become a working document which will guide the campaigns taking place throughout the organization over the period of the plan.

3.3 Content of the marketing plan

A marketing plan for a small business typically includes the level of demand for the product or service and the strengths and weaknesses of competitors: The content includes

1. Description of the product or service, including special features
2. Marketing budget, including the advertising and promotional plan
3. Description of the business location, including advantages and disadvantages for marketing
4. Pricing strategy
5. Market Segmentation

The main contents of a marketing plan are:

1. Executive Summary
2. Situational Analysis
3. Opportunities / Issue Analysis ï SWOT Analysis
4. Objectives
5. Strategy
6. Action Program (the operational marketing plan itself for the period under review)

3.4 Measurement of progress

The final stage of any marketing planning process is to establish targets (or standards) so that progress can be monitored. Accordingly, it is important to put both quantities and timescales into the marketing objectives and into the corresponding strategies.

The effect of variation in the environmental factors that forecasts and related plans often have to be changed. Continuous monitoring of performance, against predetermined targets, represents a most important aspect of the monitoring process as with forecasts, in many cases the best planning cycle utilized to monitor the performance of the plan is a quarterly review cycle.

3.5 Performance analysis

The most important elements of marketing performance, which are normally tracked, are:

(1) Sales analysis

(2) Market share analysis

(3) Expense analysis

(4) Financial analysis

The above performance analyses concentrate on the quantitative measures which are directly related to short-term performance. Indirect measures of tracking the performance of an organization include the tracking of customer attitudes, which can also indicate the

of its longer-term marketing strengths and may

ndicators. Some useful measures are:

- market research - including customer panels (which are used to track changes over time)
- lost business - the orders which were lost because, for example, the stock was not available or the product did not meet the customer's exact requirements
- customer complaints - how many customers complain about the products or services, or the organization itself, and about what

3.6 Use of marketing plans

A formal, written marketing plan is essential; in that it provides an unambiguous reference point for activities throughout the planning period. However, perhaps the most important benefit of these plans is the planning process itself. This typically offers a unique opportunity, a forum, for information-rich and productively focused discussions between the various managers involved. The plan, together with the associated discussions, then provides an agreed context for their subsequent management activities.

4.0 Conclusion

In this unit the principles and advantages of the market planning process has been discussed. The content of the marketing plan and the market planning process has also been reviewed.

5.0 Summary

This Unit has explored the advantages of the marketing plan and it has also highlighted the importance of the market planning process in the attainment of the organizational goals.

(1) Define a market plan and discuss the process involved in the development of a market plan.

(2) Discuss any five factors that affect the implementation of a marketing objective

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