THE IMPACT OF COMPUTER TECHNOLOGY IN TELECOMMUNICATIONS (A CASE STUDY OF INTERCELLULAR NIG. LTD)

BY

OKEREKE GREGORY UZOIGWE
PGD/MCS/2001/1067

DEPARTMENT OF MATHEMATICS/COMPUTER SCIENCE
FEDERAL UNIVERSITY OF TECHNOLOGY
MINNA, NIGER STATE

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This project work is submitted to the Department of Mathematics/Computer Science in partial fulfillment of the requirement for the award of POST GRADUATE DIPLOMA IN COMPUTER SCIENCE FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA NIGER STATE

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CERTIFICATION

This is to certify that the project titled, the impact of computer technology in telecommunications (A case study of intercellular Nigeria Ltd) is an original work undertaken by Okereke Gregory Uzoigwe (PGD/MCS/2002/1067) of the DEPARTMENT OF MATHEMATICS AND COMPUTE SCIENCE, FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA. This work has not been presented either in part or full elsewhere for the award of any degree.

Mallam Audu Isah	**Date**
Project Supervisor	
Dr. L.N. Ezeako	**Date**
Head of Department	
External Examiner	**Date**

DEDICATION

I dedicate this project to my sisters (Ify and Amy) for their emotional encouragement especially when this program was almost aborted because of my tight schedule in office.

ACKNOWLEDGEMENT

I express my unreserved gratitude to the ALMIGHTY GOD for His divine enablement (in cash and strength) to complete this Post Graduate program.

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ABSTRACT

This work is an appraisal of the impact of computer technology in telecommunications.

Telecommunications and information technology are merging and converging with the personal computer pushing the limits of the telephone system as more and more complex computer messages are sent over telephone lines at rapidly increasing speeds.

Intercellular Nig. Ltd is used as a case study here because of one , its unique speedy technology implementation and two, as the first indigenous wholly owned private telecommunication operator (PTO) with quality mobile and digital fixed wireless services.

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CHAPTER 1

GENERAL INTRODUCTION

1.0 INTRODUCTION:-

The distinctions between telecommunications, information processing and entertainment have fast broken down as digital technology permeates all three sectors. With the advancements in computer and telecommunication technology, the importance of information and communication technology (ICT) has gained widespread recognition in most parts of the world. The disappearance of the distinctions between computer and telecom has led to all encompassing definitions of ICT as the use, study or production of a range of technologies (especially Computer systems, digital electronic and telecommunications) to store, process and transmit information.

Computer which is basically an electronic device that accepts and process data following a set of instructions (PROGRAM) to produce an accurate and efficient result (INFORMATION):- can now be used to make cheap long distance voice-calls.

The internet (Computer based global information system) means that what appears to be a local task performed on a computer right in front of you, may actually be enacted on an anonymous

computer in a different country on a different continent. And the cable laid to connect your phone to the outside world could also be used to bring television, radio, computer games or video-on-demand to your home.

The major impact of computers tech. In tele communications is with the internet. Internet technology allows interconnection of any kind of computer network. No network is too large or too small, too slow or too fast to be interconnected. Thus the Internet includes inexpensive networks that can only connect a few computers with a single room as well as expensive networks that can span a continent and connect thousands of computers. The use of the Internet has grown tremendously since its inception and has its success attributed to it's flexibility.

TELECOMMUNICATION INDUSTRY IN NIGERIA

1.1 Fixed telephone dominated the country's telecommunications landscape for years before the advent of digital mobile telephone. The service of the national and incumbent operator, the Nigeria Telecommunications Limited (NITEL) was complemented by a small band of service providers collectively branded PTOs (Private Telephone Operators).

These Companies had an unusual beginning; as they ventured into the industry when it was difficult to invest in the country, and when provision of Loan facility to telecommunication operators was not attractive in the banking industry.

Faced with this Limitation, expansion was often restricted for these operators, leaving many subscribers scrambling for the few available lines. The entry hurdle was very high leading to outrageous call chargers (tarriff). Subscribers could afford to endure the problem, but the story has changed today as competition in the telecommunication industry is rife and operators are having a run for their money due to increase in the number of new-comers.

The primary objective of privatizing a telecom monopoly is to encourage sustainable competition in the telecom industry.

However, competition confers some benefits such as:

(a) Cheaper Telephone Services

(b) Incremental Telephone Services which includes improvements in the teledensity and

(c) The phone Services must be of a high quality.

Mobile phones or cellphones have come to stay in Nigeria and they are increasingly becoming, status symbols and business necessities,

fashion accessories and toys. The mobile phone is well on its way to becoming the technological device most central to a person's day-to-day activities.

In 1999, 280 million mobile phones were sold worldwide, making mobile phones the hottest consumers product segment for three years running. This number doubled in year 2002. The increasing availability of information on the cellphones reflects the growing importance of mobile phones in the daily lives of their user.

1.2 THE STUDY AREA – INTERCELLULAR NIGERIA LTD

Intercellular is a limited liability Company wholly owned by a group of private Nigerian investors. It was incorporated in December 1992 under the Companies and Allied Matters Act and licensed in 1996 by the Nigerian Communication Commission NCC to, among other things, provide and operate fixed wireless and limited Mobility Telecommunication Services through the Wireless Local loop (WLL) System.

At present, the Company operates four networks namely, Lagos with 50,000 line capacity switch, Port-Harcourt with the capacity of 25,000 lines, Abuja with the capacity of 30,000 lines and Kano with a 30,000 line capacity network.

Intercellular was the first fixed wireless operator since the deregulation some years back to open services in locations outside Lagos, in Nigeria.

Although the company was duly incorporated under the nation's companies and allied matter Act in 1992, the practical journey towards realizing the business of telecommunications services actually began in 1996 – that was when a cream of business driven entrepreneur's and investors started leveraging their long-term vision backed up with years of public network experiences and expertise, investing in solutions that will help the nation bridge the telecommunications divide through a gradual process of building a wireless Nigeria.

The company promoters vision were driven by the desire to make a difference in the nation's telecommunications business.

In a country of near 120 million people occupying a land mass of about one million square kilometers, there is actually very little to cheer for such a country with barely 1,000,000 telephone lines deployed by NITEL and the private telecommunications operations. There was therefore no choice than to take advantage of the gradual window of liberalization.

The company values rest in a Nigeria tailored towards the development of the Nigerian people. They believe that our common citizenship and belief in our collective development enjoin us to invest selflessly in high-end technological solutions that will assist the nation

meet its telecommunications needs through a slow but steady building of a wireless Nigeria.

Intercellular first started with Motorola CDMA WILL technology from Motorola Inc of USA while new contracts with ZTE corporation of China have been initiated for the provision of new and more compact CDMA networks in Maiduguri, Kaduna etc. Intercellular is presently expanding its networks in Lagos and Abuja to Broadband networks for easy communication access to INTERNET using our fixed wireless terminals as MODEMS.

The choice for CDMA (Code Division Multiple Access) technology is because of CDMA's benefits of excellent voice quality and clarity, privacy, improved capacity and coverage, and these qualities has made CDMA one of the leading wireless technologies in he world.

The fixed wireless eliminates the use of

Clumsy overhead and underground cables and allows subscribers the flexibility of moving their telephone about within a particular geographical area.

1.3 OBJECTIVES OF THE STUDY

The overriding objective of this study is to x-ray how computer technology has transformed the old wire line telecommunication services to digital fixed wireless and mobile phone systems.

The transformation is in such areas as:-

(A) How all lines calls are digitally coded thus avoiding old line diversion, jamming and tapping.

(B) How unique and fraud free billing system has taken care of the old crazy and wrong billings in wired lines.

(C) How infrastructure and high end-user equipment can be deployed much more quickly than wired systems which usually require extensive engineering and construction.

(D) How tedious planning, implementation and expansion of telecom systems has been made scalable and systems require minimal planning because subscribers exact location is not required.

1.4 THE CONCEPT OF COMPUTER COMMUNICATION NETWORK

Raw facts and figures are processed and interpreted in a systematic manner that can be easily retrieved, transferred, evaluated and stored within an integrated network.

Data communication is the process of transferring data from one point to another. Thus, the process of transferring data from one point to another with the aid of computer is referred to as computer communication. These processed data called information are transmitted via computer networks which depends on the geographical areas and its connectivity involves sharing hardware and software resources.

Early forms of computers communicating with each other was through electronic devices called MODEM which converts analog signals to their digital equivalents and vice versa. With MODEM, the public Telephone network usually serves as the transmission medium.

In managing a computer network, the continuous training of the resourceful personnel and security information is always on top priority.

The optimization of computer communication network is based on the evaluation of the performance of software, hardware and human resources in maximizing profit for the organization.

1.4 TYPES OF COMPUTER COMMUNICATION NETWORK

Based on their geographical size, networks are divided into 2 group, viz:-

(i) LOCAL AREA NETWORK (LAN) AND

(ii) WIDE AREA NETWORK (WAN)

1.5.1 LOCAL AREA NETWORK (LAN)

LANs are series of connected devices, such as personal computers or workstations which are distributed over a small geographical area. LANs have data rates up to 100 megabits per second. LAN can either be a client-server network or a peer-to-peer network.

A client-serve network is one in which the server provides dedicated services to other workstations or devices (ie clients).

A peer-to-peer network is one in which the server may alternatively provide or receive non-dedicated services.

LANs are designed to :

(a) Operate within a limited geographical area.

(b) Allow multi access to high-band width media.

(c) Connect physically adjacent devices

(d) Provide full time connectivity to local services

(e) Control the network privately under local administration using network devices such as Routers, Bridges, Hub etc.

1.5.2 WIDE AREA NETWORK (WAN)

WANs are concerned with the inter connection of computer network devices over a wide geographical area that extends over distance of up to 1000km. Many existing WANs have data rates of about 100kilibits per second. A typical example of WAN is the public switched telephone Network (PSTN).

COMMON WAN TECHNOLOGIES ARE:-

(a) MODEM

(b) ISDN (Integrated Service Digital Network)

(c) DSL (Digital Subscriber Line)

(d) Frame relay

(e) ATM (Asynchronous Transfer Mode)

(f) Sonet (Synchronous optical Network)

WANs are designed to

(a) Operate over large geographical Area

(b) Allow access over serial interfaces operating at low speeds

(c) Provide full-time and part time connectivity.

(d) Connect devices separated over wide, even global areas using communication network devices such as:

Routers, Modem, Communication Server etc.

1.6 OUTLINE OF THE STUDY

In chapter I, We have a general introduction of the project topic, telecom industry in Nigeria and the study Area were discussed, objectives of this study, and the concepts and types of communication network were discussed.

Chapter II, we discussed what communication media is and the types of communication device relevant to this study.

Chapter III, Explains in details what telecommunications and computer communications are, telecommunication Systems, the emergence of Internet as Computerized telecom, uses of the Internet access, protocols are applications.

Chapter IV Discussed in details the communication network of intercellular Nig. Ltd as regards switching and Billing equipment.

Chapter V Is the summary of the study and recommendations for future study.

CHAPTER 2

COMMUNICATION MEDIA & DEVICES

2.1 COMMUNICATION MEDIA

Telecommunications Systems deliver messages using a number of different transmission media, including Copper wires, fiber-optic cables, communication satellites, and microwave radio. One way to categorize telecommunications media is to consider whether or not the media uses wires. Wires-based (or wire-line) telecommunications provide the initial link between most telephones and the telephone network are a reliable means for transmitting messages.

Telecommunications without wires, commonly referred to as wireless communications, use technologies such as cordless telephones, cellular radio telephones, pagers and satellites. Wireless communications offer increased mobility and flexibility and is believed to offer high-speed Internet access.

2.1.1 WIRES AND CABLES

Wires and cables were the original medium for telecommunications and are still the primary means for telephone and computer connections. Wires connect telephone and computer together within a home or business and also connect these telephones to the nearest telephone switching facility.

Other wireline services employ coaxial cable, which is used by cable television to provide hundreds of video channels to subscribers. Because signal weaken as distance increase, the coaxial cable network includes amplifiers that process and retransmit the television signals.

2.1.2 FIBER-OPTIC CABLES

Fiber-optic cables use specially treated glass that can transmit signals in the form of pulsed beams of laser light. Fiber-optic cables carry many times more information than copper-wires can, and they can transmit several television channels or thousands of telephone conversations at the same time. Fiber-optic technology has replaced copper wires for most transoceanic routes and in areas where large amounts of data are sent. This technology uses laser transmitters to send pulses of light via hair-thin strands of specially prepared glass fibres. New improvements promise cables that can transmit millions of telephone calls over a single fiber. Already, fiber optic cables provide the high capacity "backbone" Links and growing volume of telecommunications and Internet traffic.

2.1.3 Radio Waves

Wireless telecommunications use radio waves, sent through space from one antenna to another, as the medium for communication. Radio waves are used for receiving AM and Fm radio and for receiving

television. Cordless telephone and wireless radio telephone service, such as cellular radio telephones and pagers also use radio waves. Telephone companies use microwaves to send signals over long distances.

Microwaves use higher frequencies than the radio waves used for AM, FM, or cellular telephones transmissions and they can transmit larger amounts of data more efficiently. Microwaves have characteristics similar to those of visible light waves and transmit pencil –thin beams that can be received using dish- shaped antennas. Such narrow beams can be focused to a particular destination and provide reliable transmission over short distances on Earth. Even higher and narrower beams provide the high capacity links to and from satellites. The high frequencies easily penetrate the ionosphere (a layer of Earth's atmosphere that blocks low- frequency waves and provide a high quality signal.

2.1.4 COMMUNICATION SATELLITES

Communication satellites provide a means of transmitting telecommunications all over the globe, without the need for a network of wires and cables. They orbit earth at a speed that enables them to stay above the same place on Earth at all times. This type of orbit is

called Geostationary or geosynchronous orbit because the satellites orbital speed operates in synchronicity with Earth's rotation. The satellites receive transmissions from earth and transmit them back to numerous earth station receivers scattered within the receiving coverage area of the satellite. Communication satellites as medium of communication are used by telephone and television companies to transmit signals a cross great distances. Ship, airplane and land navigators also receive signals form satellites to determine geographic positions.

2.2 COMMUNICATION NETWORK DEVICES

These are mostly LAN/WAN devices that are used in connecting PCS. to a LAN/WAN or Internet.

These devices include: Routers, Modems, gateways, repeaters, bridges and so on.

2.2.1. ROUTERS

Routers are used in connecting several networks by means of one device. The routers recognize what is going on the network and keeps an address table of the whole network structure. The purpose of the router is to examine in coming packets of data, choose best part for them through the network and then switch them to the proper outgoing

port. This is the most important traffic regulating devices on large networks hence has two (2) Primary purpose:-

(1) Data paths selection

(2) Switching of packers to the best route

It makes decisions based on groups of network addresses (classes) as opposed to individual MAC addresses. Routers are the backbone of the internet, running the IP protocol.

2.2.2. MODEMS

Modems interpret the digital signals of he UART (i.e Universal Asynchronous Receiver/ transmitter) to the analogue telephone system and vice versa.

They are the gateways between the computer and the telephone system. There are two types of modems;-

(i) Synchronous modems, and

(ii) Asynchronous modem.

Both modems function by converting the digital signals sent by the computers UART to two or more tones sent across a phone line.

(a) **SYNCHRONOUS MODEMS:-** are expensive modems that uses synchronized clocks to achieve high transmission rates, thereby permitting very efficient use of the phone line.

(b) **ASYNCHRONOUS MODEMS :-** are inexpensive modems that monitor frequency switches in the phone line. They use clocks to determine where one bit ends and another begins.

2.2.3 SWITCH

The best feature of he HUB (i.e. concentration and connectivity) and the best feature of the bridge (i.e. segmentation) were combined to form a switch. Switch has lots of ports but allows each port to pretend it had a connection to the other side of the bridge, thus allowing many users and lots of communication. This is also called multi-port bridge.

2.2.4 BRIDGE

This is a device designed to connect two network segments having similar or dissimilar topologies. The purpose of a bridge is to filter traffic on a LAN, to keep local traffic Local, yet allow connectivity to other parts (segment) of the LAN for traffic that has been directed there. The bridge uses the MAC address on the NIC (network interface connect) to determine which is local traffic or not.

We have local bridges (Full) and remote Bridge (HALF) that connect LAN and WAN respectively.

2.2.5. HUB

This is a device that its purpose is to regenerate and retime network signal. This is done at bit level to a large number of hosts using a process known as concentration. A HUB is also known as multi-port repeater. They only regenerate the signal and broadcast it out all of their ports (network connections).

CLASSIFICATION OF HUB

(a) Active or passive

(b) Intelligent or dumb – have console ports and can be programmed to manage network traffic.

2.2.6 GATEWAYS

Gateway are used to exchange information and access dissimilar networks as a single logical entity.

2.2.7 REPEATERS

The digital signal of a LAN gets weaker over a long distance, therefore a repeater acts as a devices to boost the signals on a LAN cable so that it can travel further.

CHAPTER THREE

TELECOMMUNICATION & COMPUTER TECH.

3.1 TELECOMMUNICATIONS

There are basically devices and systems that transmit electronic or signals across long distances. Telecommunication enables people around the world to contact one another, to access information instantly, and to communicate from remote areas. Telecom usually involves a sender of information and one or more recipients linked by a technology, such as a telephone system, that transmit information from one place to another.

Telecommunication provides the key medium for delivering news, data, information, and entertainment.

All telecommunication systems are constantly evolving as telecom technology improves. Many recent improvements, for example, offer high–speed Broadband connections that are needed to send multimedia information over the Internet.

Discussed below are various telecommunication system:-

3.1.1 TELEGRAPH

Telegraph services use both wireline and wireless media for transmissions, soon after the introduction of telegram in 1844, telegraph wires spanned the country, telegraph companies maintained a system of

wires and office located in numerous cities. A message sent by telegraph was called a telegraph. Telegrams were printed on paper and delivered to the receiving party by the telegraph company. With the invention of radio in the early 1900s telegraph signals could also be sent by radio waves. Wireless telegraph made it practical for ocean going ships as well as aircraft to stay in constant contact with land- based stations.

3.1.2 TELEPHONE

The telephone network also uses both wireline and wireless methods do deliver voice communications between people, and data communications between companies and people or other computers and people .

Digital transmission via fiber-optic cables is now used in some sections of the telephone network that send large amounts of cells over long distances. A complex system of network switches maintains the telephone links between callers especially with the wireline methods. Telephone networks also use microwave relay stations to send calls from place to place on he ground. Satellites are used by telephone networks to transmit telephone calls across countries and oceans.

3.1.3 TELETYPE, TELEX & FACSIMILE TRANSMISSION

Teletype, Telex, and facsimile transmission are all methods for transmitting text rather than sounds. These text delivery systems evolved from the telegraph. Teletype and telex systems still exits, but they have been largely replaced by facsimile machines, which are inexpensive and the existing telephone network .The internet increasingly provides an even more inexpensive and convenient option. The teletype, essentially a printing telegraph, is primarily a point-to-multi-point system for sending text. The Teletype converts the same pulse used by telegraphs into letters and numbers, and then prints out readable text. It was often used by news media organizations to provide newspaper stories and stock market data to subscribers. Telex is primarily a point – to –point system that uses a key board to transmit typed text over telephone lines to similar terminals situated at individual company locations.

Facsimile transmission now provides a cheaper and easier way to transmit text and graphics over distances. Fax machines contain optical scanner that converts texts and graphic into digital or machine readable codes. This coded information is sent over ordinary analog telephone wires through the use of a modem included in the fax machine. The receiving fax machines modem demodulates the signal and sends it to a printer also contained in the fax machine.

3.1.4 RADIO

Radios transmit and receive communication at various preset frequencies. Radio waves carry the signals heard on AM and FM radio, as well as the signals seen on a television set receiving broadcastings from an antenna. Radio is used mostly as a public medium, sending commercial broadcasts from a transmitter to anyone with a radio receiver within its range, so it is known as a point-to-multipoint medium. However, radio can also be used for private point –to-point transmissions. Two-way radios, cordless telephones, and cellular radio telephones are common examples of transceivers, which are devices that can both transmit and receive point-to-point messages. Personal radio communication is generally limited to short distances (usually a few kilometers), but powerful transmitters can send broadcast radio signals hundreds of kilometers.

Short-wave radio, popular with amateur radio enthusiasts, uses a range of radio frequencies that are able to bounce off the ionosphere. This electrically charged layer of the atmosphere reflects certain frequencies of radio waves. Such shortwave frequencies, while allowing higher frequency waves, such as microwaves, to pass through it. Amateur radio operators use the ionosphere to bounce their radio signals to other radio operators thousands of kilometers away.

3.1.5 TELEVISION

Television is primarily a public broadcasting medium, using point-to-point technology that is broadcast to any user within range of the transmitter. Television transmit news and Information, as well as entertainment. Commercial television is broadcast over very high frequency (VHF) and ultra high frequency (UHF) radio waves and can be received by any television set within range of the transmitter. Television have also been used for point-to-point, two way telecommunications. Teleconferencing, in which a television picture links two physically separated parties, is a convenient way for business people to meet and communicate without the expense or inconvenient of travel.

Video cameras on computers now allow personal computer users to teleconference over the internet. Videophones, which use tiny video cameras and rely on satellites technology, can also send private or public television images and have been used in news reporting in remote locations.

Cable television is a commercial service that links televisions to a source of many different types of video programming using coaxial cable. the cable provider obtains coded, or scrambled, programming from a communication satellite, as well as from terrestrial links, including broadcast television stations. The cable provider electronically

unscrambles the signal and supplies the decoded signals by cables to subscribers.

Television users with personal satellite dishes can access satellite programming directly without a cable installation. Personal satellite dishes are also a subscriber service. Fees are paid to the network operator in return for access to the satellite channels. Manufactory now after digital video and audio signal processing, which features even higher picture resolution and sound quality.

3.1.6 GLOBAL POSITIONING AND NAVIGATION SYSTEMS

The United States Global positioning system (GPS) and the Russion Global Orbiting Navigation satellite System (GLONASS) are networks of satellites that provide highly accurate positioning information from anywhere on Earth. Both systems are a group of satellites that orbit around the north and south poles at an altitude of 17,500km. These satellite constantly broadcast the time and their location above Earth. A GPS receiver pocks up broadcasts from these satellite and determines its position thorough the process of triangulation. Using the time information from each satellite, the receiver calculates the time the signal takes to reach it. Factoring in this time with the speed at which radio signals travel, the receiver calculates its distance form the satellite. Finally, using the location of three(3) Satellites and its distance form

each satellite, the receiver determine its position. Handheld GPS receivers allow users to pinpoint their location on Earth to within a few meters. One type of navigational tool used in automobiles integrates a GPS receiver with an intelligent compact disc player capable of displaying road maps and other graphical information, upon receiving the GPS location data, the CD player can pinpoint the location visually on the of the road maps contained on disc.

3.1.7 MERGER OF COMPUTER TECH (IT) AND TELECOM.

Personal computers have pushed the limited of the telephone system as more and more complex computer messages are being sent over telephone lines, and at rapidly increasing speeds. This need for speed has encouraged the development of digital transmission technology. The growing use of personal computers for telecommunications has increased the need for innovations in fiber-optic technology.

Telecommunications and information technologies are merging and converging. This means that many of the devices now associated with only one function may evolve into more versatile equipment. This convergence is already happening in various fields. Some telephones and pagers are able to store not only phone numbers but also names and personal information about callers. Wireless phones with keyboards

and small screens can access the internet and send and receiver E-mail (electronic mail) messages. Personal computers can now access information and video entertainment and are in effect becoming a combined television set and computer terminal. Television sets can access the internet through add-on appliances. Future modifications and technology innovations may blur the distinctions between appliances even more.

Convergence of telecommunications technologies may also trigger a change in then kind of content available. Both television and personal computers are likely to incorporate new multimedia, interactive, and digital features. However, in the rear term, before the actualization of a fully digital telecommunications world, devices such as MODEMS will still be necessary to provided an essential link between the old analog world and the upcoming digital one.

3.2 PERSONAL COMPUTERS (COMPUTER TECH)

Personal computers primarily communicate with each other and with larger net works, such as the internet, by using the ordinary telephone network. Increasing numbers of computers rely on broadband networks provide by telephone and cable television companies to send text, music, and video over the internet at high speeds. Since the telephone network functions by converting sound into electronic signals,

the computer must first convert its digital data into sound. Computers do this with a device called a modem, which is short for Modulator/ Demodulator. A modem converts the stream of is and Os from a computer into an analog signal that can then be transmitted over the telephone network, as a speaker's voice would. The modem of the receiving computer demodulates the analog sound signal back into a digital form that the computer can understand.

Personal computers use telecommunications to provide a transmission link for the delivery of audio, video, text, software, and multimedia services. Many experts believe that the convergence of these service will generate consumer demand for new generation of high –speed, broadband networks. Currently, the delivery of most of these audio, video, and text service occurs over existing telephone connections using the internet. Some computers connect directly to the digital portion of the telephone network using the integrated services digital network (ISDN) or digital subscriber lines (DSL), but this requires special equipment at user locations telephone and cable television companies must also make upgrades to their lines so that they can handle high-speed data transmission. In many locations companies and individual with high speed data requirements now have the option of securing DSL

service from telephone companies and cable modem service from cable television companies.

3.2.1 WHAT IS INTERNET

Internet is computer- based global information system. The internet is composed of many interconnected computer networks. Each network may link tens, hundreds, or even thousands of computers, enabling them to share information with one another and to share computational resources such as powerful supercomputers and databases of information. The Internet has made it possible for people all over the world to communicate with the another effectively and inexpensively. Unlike traditional broadcasting media, such as radio and television, the internet does not have a centralized distribution system. Instead, an individual who has internet access can communicate directly with anyone else on other internet, make information available to others, find information provide by others, or sell products with a minimum overhead cost. Use of the internet has grown tremendously since its, the internet's success arises from its flexibility. Internet technology allows interconnection of any type of computer network instead of restricting component networks to a particular manufacturer or particular type.

Internet service provides (ISPs) provide internet access to customers, usually for a monthly fee. A customer who subscribes to an ISPs, service use the ISPs network to access the internet. Because ISPs offer their services to the general public, the networks they operate are known as public access networks.

An organization that has many computers usually owns and operates a privates network, called an INTERNET, which connects all the computers within the organization.

To provide Internet service, the organization connects its intranet to the internet. Unlike public access networks, intranets are restricted to provide security while the organization restricts communication between the intranet and the global internet. The restrictions allow computers inside the organization to exchange information but keep the information confidential and protected form outside.

The internet has doubted in size every 9 to 14 months since it began in the late 1990s. in 1981 only 213 computers were connected to the internet. By 2000 the number had grown to more than 100million. The current number of people who use the internet can only be estimated.

3.2.2 INTERNET ACCESS

Internet Access refers to the communication between a residence or a business and an ISP that connects to the internet.

Access falls into two broad categories: Dedicated and Dial-up. With Dedicated Access, a subscriber's computer remains directly connected to the internet at all times through a permanent, physical connection. Most Large Business have high-capacity dedicated connections; small business or individuals that desire dedicated access choose technologies such as Digital subscriber line (DSL) or cable modems which both use existing wiring to lower cost. A DSL sends data across the same wires that telephone service uses, and cable modems use the same wiring that cable television uses. In each case, the electronic devices that are used to send data over the wires employ separate frequencies or channels that do not interfere with other signals on the wires. Thus, a DSL internet connection can send data over a pair of wires at the same time the wires are being used for a telephone call, and cable modems can send data over a cable at the same time the cable is being used to receive television signals.

Dial –up is the least expensive access technology, but it is also the least convenient. To use dial- up access, a subscriber must have a telephone MODEMS, a device that connects a computer to the telephone

into data. The user's ISP provides software that controls the modem. To access the internet, the user opens the software application, which causes the dial-up modem to place a toll free telephone call to the ISP. A modem at the ISP answers the call, and the two modems use audible tones to send data in both directions. When one of the modems is given data to send, the MODEM converts the data from the digital values used by computers-members stored as a sequence of Is and Os –into Tones.

The receiving side converts the Tones back into digital values. Unlike dedicated access technologies, a dial - up modem does not use separate frequencies, so the telephone line cannot be used for regular telephone calls at the same time a dial-up modem is sending data.

All information is transmitted across the internet in small units of data called packets. Software on the sending computer divides a large document into many packets for transmission; software on the receiving computer re- groups incoming packets into the original document. Similar to a post card, each packet has two parts: A packet header specifying the computer to which the packet should be delivered, and a packet payload containing the data being sent. The header also specifies how the data in the packet should be combined with the data in other

packets by recording which piece of a document is contained in the packet.

Computer communication protocols is a series of rules specifying how packets headers are formed and how packets are processed. The set or protocols used for the internet are named TCP/IP after the two most important protocols in the set: The transmission control protocols and the Internet the Internet are called IP routers because they follow the IP protocols when forwarding packets.

A router examines the header in each packet that arrives to determine the packet's destination. The router either delivers the packet to the destination computer across a Local network or forwards the packet to another router that is closer to the final destination. Thus, a packet travels from router to router as it passes through the Internet.

TCP/IP protocols enable the internet to automatically detect and correct transmission problems. For example, if any network or device malfunctions, protocols detect the failure and automatically find an alternative path for packets to avoid malfunction. Protocols software also ensures that data arrives complete and intact. If any packets are missing or damaged, protocols software on the receiving computer requests that the source resend them. Only when the data has arrived correctly does

the protocols software make it available to the receiving application program, and therefore to the user.

To be connected to the internet, a computer must be assigned a unique member, known as its IP (internet protocol) address. Each packet sent over the internet contains the IP address of the computer to which it is being sent. Intermediate routers use the address to determine how to forward the packet. User almost never need to enter or view IP address directly. Instead, to make it easier for users, each computer is also assigned a domain name; protocol software automatically translates domain names when they use applications such as the world wide web. Each page of information on the Web is assigned a URL (Universal Resource Locator) that includes the domain name of the computer on which the page is located.

3.2.4. INTERNET APPLICATION

A. Electronic Mail:- Electronic Mail, or E-mail , is a widely sued internet application that enables individuals or groups of individuals to quickly exchange messages, even if they are separated by long distances. A user creates an e-mail message and specifies a recipient using an e-mail address, which is a sting consisting of the recipient's Login name. E – mail followed by an @ (at) sign and then a domain name. E-mail software transfers the message access the internet to the

recipient's computer, where it is placed in the specified mailbox, a file on the hard drive. The recipient uses an e-mail application to view and reply to the message, as well as to save and delete it. Because e- mail is a convenient and inexpensive form of communication, it has dramatically improved personal and business communications.

B. **Electronic Commerce:-** E-commerce allows a store to be opened for business 24 hours a day, 7 days a week. Not only is this an important convenience for he customers, it also means more revenue for the company. An on-line store helps the company to reach new markets-a cross the country and even outside Nigeria. The most important part of selling on-line is accepting payment from customers ranging from a single transaction to a series of transactions online. Internet marketing is similar to marketing with other media, and as with traditional media, the bottom line is good product the ability to automate processes such as sign –up and purchasing any product is unique to the internet and it should be exploited. Automation allows firms to turn their website into a money machine that works even while they sleep. An – online store is no longer an option for a successful telecommunication business, it is a critical step in managing and growing the business. With intercellular card payment services, subscribers have access to a variety of comprehensive, professional –grade features like recurring Billing

services. Intercellular card payment services for instance, allow the organization offer the telecommunication subscribers the added benefit of peace of mind by using a brand they know and trust

C. TELNET:

The Telnet application enables a user to interactively access a remote computer. Telnet gives the appearance that the user's keyboard and monitor are connected directly to the remoter computer. For example, a business person who is visiting a location that has internet access can use Telnet to contact their office computer. Doing so is faster and less expensive than using dial-up modems.

D. IP-TELEPHONE

The Internet can also be used to transfer telephone calls using an application known as IP-telephone. This application requires a special phone that digitizes voice and sends it over the Internet to a second IP telephone.

E. FILE TRANSFER PROTOCOL (FTP)

Is used to down load files from an Internet site to a users computer. The FTP application is often automatically invoked when user down loads an updated version of a piece of software.

Applications such as FTP has been integrated with the world wide web, making them transparent so that they run automatically without

requiring users to open them. When a web browser encounters a URL that being with FTP:11 it automatically uses FTP to access the item.

CHAPTER FOUR

COMMUNICATION NETWORK OF INTERCELLULAR

This chapter explains the various types of technology deployed by intercellular for their communication network and the reasons for this technology; and finally the components of the network would be examined.

4.1 THE NETWORK TECHNOLOGY

The communication network of intercellular Nig. Ltd is Motorola CDMA (code Division Multiple Access) WILL technology from Motorola Inc of USA. The choice for CDMA technology is because of CDMA's benefits of excellent voice quality and clarity, privacy, improved capacity and coverage; and these qualities has made CDMA one of the leading wireless technologies in the world.

There are three(3) common technologies used by cellular/wireless phone networks for transmitting information. They are:-

1. Frequency Division Multiple Access (FDMA) – puts each call on a separate frequency.
2. Time Division Multiple Access (TDMA) – This assigns each call a certain portion of time on a designated frequency.
3. Code Division Multiple Access (CDMA) – This gives a unique code to each call and spread it over the available frequencies.

The title of each of these types of technology can be broken down in order to get a good sense of how they work.

The first word tells you what the access method is. The second word (Division) lets you know that it splits calls based on that access method and then the last part of each name is **MULTIPLE ACCESS** which means that more than one user can utilize each cell.

A. FDMA separates the spectrum into distinct voice channels by splitting it into uniform chunks of Bandwidth. FDMA is used mainly for analog transmission. While it is certainly capable of carrying digital information, FDMA is not considered to be efficient method for digital transmission. This is because in FDMA, each phone uses a different frequency resulting to waste of frequencies.

B. In TDMA, a narrow-band that is 30KH2 wide and 6.7 milliseconds long is split time-wise into three time slots. Each conversation gets the radio for one-third of the time. This is possible because voice data that has been converted to digital information is compressed so that it takes up significantly less transmission space. Therefore TDMA has three-times the capacity of an analog system using the same number of channels. TDMA systems operate in either the 800 MHz or 1900 MHz frequency bands.

GSM- This is Global System for mobile communications. TDMA is also used as the access technology for GSM, however, GSM implements TDMA in a compatible way from TDMA. GSM systems use to make phone calls more secure. GSM operates in the 900 MHz, 1800MHz and 1.9 GHz bands. It is used in the digital cellular and PCS-based systems. GSM is also the basis for Integrated Digital Enhanced Network (IDEN), a popular System introduced by Motorola and used by Nextel. GSM is the international standard in Europe, Australia, and much of Asia and Africa. In covered areas, cell phone users can buy one phone that will work anywhere where the standard is supported. To connect to the specific service providers in these different countries, GSM users simply switch subscriber identification Module (SIM) cards. SIM cards are small removable disks that slip and out of GSM cell phones. They store all the connection data and identification numbers you need to access a particular wireless service provider.

D. CDMA take an entirely different approach from TDMA. CDMA after digitizing data, spreads it out over the entire available band width. Multiple Calls are overlaid on each other on the Channel, with each assigned a unique sequence code. CDMA is a form of spread spectrum, which mean that data is sent in small pieces over a number of the discrete frequencies available for use at any time in the specified range.

ALL of the users transmit in the same wide-band chunk of spectrum. Each user's signal is spread over the entire bandwidth by a unique spreading code. At the receiver, that same unique code is used to recover the signal. Because CDMA systems need to put an accurate time – stamp on each piece of a signal, it references the GPS system for this information. Between eight (8) and ten (10) separate calls can be carrie space as one analog Amps call. CDMA technology operates in both the 800 MHZ and 1900MHZ frequency bands.

4.2 WHY CDMA TECHNOLOGY?

Having considered the attributes of other types of technology for a Network, chose CDMA technology for the following advantages:-

A. HIGH QUALITY

Motorola's CDMA WILL solutions offer numerous performance enhancing characteristics such as:-

- Precise power control to reduce interference
- Exceptional resistance to fading
- Higher link reliability
- Superior performance in difficult conditions often found in highly built –up urban areas.

Motorola's CDMA will system provides exceptional voice quality by taking advantages of CDMA Powerful error detection and correction

capabilities. It also considers spatial and time diversity to ensure consistent call quality that is virtually undistinguishable from wireline.

Motorola's CDMA will system provides its users with an added sense of security. This is because unlike the analogue voice signal, digital cellular systems transmit a digit bit-stream which makes eaves dropping and cloning extremely difficult.

B. ECONOMIC

1. **HIGH CAPACITY AND BETTER COVERAGE**: CDMA enables the operator to serve a lot more users per cell because:-

- Higher capacity allows an operator to deploy fewer cells, resulting in faster implementation and significantly reduced infrastructure, back-haul, site acquisition, operating and maintenance costs.
- Higher capacity results in the lowest-cost-per-subscriber of any wireless technology.

2. **MARKET**: Motorola's wireless systems help operators make more efficient use of investment capital because they help to ensure faster payback as-

-Infrastructure and end-user equipment can be deployed much more quickly than wired systems, which usually require extensive engineering and construction.

-Faster installation means faster revenue generation.

3. **LOWER MAINTENANCE COST**:- CDMA will system's high capacity means:-

- Fewer base stations are required than other cordless technologies, which translate into lower maintenance costs.
- System also eliminates the issue of the protection of copper facilities from theft and vandalism, which is a major cost concern in many areas of the world.

C. FLEXIBILITY:

Motorola CDMA WILL systems are an ideal choice for Local loop Service because they allow exceptional versatility by being available in both the 800MHz and 1.9GHz bands.

- Mobility options allow system operators to offer their customers both fixed and mobile service.
- Easy system installation in both high and low densities areas.
- System requires minimal planning because subscribers exact location is not required.
- Minimal planning is also required because systems can be deployed quickly, and offers effective service to thousands of subscribers in a matter of months, not years.
- Scalability of systems, which enables the operator to leverage previous infrastructure as the system grows.

4.3 THE COMPONENTS OF INTERCELLULAR NETWORK

CDMA is a digital system whereby many RF users can share the same spectrum simultaneously. Signals are discriminated by the code division used for each subscriber.

The Motorola cellular radiotelephone system is a fully automatic, wide-area, high capacity, mobile radiotelephone communications system that offers features and service comparable with those of the PUBLIC Wireless Network.

The CDMA network used by Intercellular consists of several components as black boxes:-

1. **PSTN – PUBLIC SWITCHED TELEPHONE NETWORK**: This provides paths to and from land –based subscribers.

2. EMX: this routes calls to an from the PSTN to the CBSC, it performs dialed digit translations, maintains the subscribers database and billings records.

3. **CBSC- CENTRALIZED BASE STATION CONTROLLER**: This consist essentially of two frames namely Transcoder and mobility manager frames.

(A) Transcoder (TX) frame has some slots that performs the following functions:-

- Echo cancellation by the Trimode Transcoder Card.

- Voice Coding and decoding (eg 8k, 13k vocoder)
- Data connection to other units
- Process and interpret commands by the Generic processor.
- Termination of signaling from BTS to Trancoder of the CBSC.

(B) Mobility Manager (MM) frame has some slots that performs the following functions:

- CPU cards that controls the center operations of the CBSC including the actual call processing in terms of messaging to the switch.
- Token ring cards that extends the fiber optic LAN to the Transcoder.
- Ethernet card that extends the LAN connecting the OMC-R ie Operations and Maintenance Center Radio.

4. IWU-INTER WORKING UNIT: this consists of banks of Modem cards (20 Nos) and each modem card had 4 channels.

5. OMC-R- OPERATIONS AND MAINTENANCE CENTER RADIO This is the main operator interface to the entire CBSC and BTS (Base Transceiver Station). Ie it will talk to the Transcoder, the Mobility manager, IWU and the BTS. It also generates system performance reports and logs alarms and events as they occur. It also keeps the CDL (call data Logs) ie all the call attempts whether successful or

unsuccessful. The software as well loads releases eg if a site is not performing optimally and are released using either the copy of the OMC or the MM copy.

6. CSM- CLOCK SYNCHRONIZATION MODULE

This terminate the GPS (geographical or Global Positioning Satellite) input and uses it to generate timing signal for the entire BTS (Note that the GPS antenna is mounted outside on top of the CBSC port cabin).

7. MPC-MULTICOUPLER PRESELECTOR CARD

This handles the noise filtering in conjunction with the filters.

8. HSO-HIGH STABILITY OSCILLATOR :

This is an alternative source of timing reference used if the source form the satellite is lost (ie the GPS source).

9. POWER AMPLIFIER FRAME

This consists of driver amplifiers, Error amplifiers and final Amplifiers. This is purely for the amplification of generated signals. The layout and configuration of this frame is such that if there is problem on one of the BTS links, it does not affect the availability of the carriers.

10. SITE INTERFACE FRAME

This houses the noise filters and the Modem for remote dial-up. Note that Modem for remote dial-up is link order wire assuming we have

a line from NITEL connected to it, and if the site is down, we could talk to the site though the Dial up.

This frame also houses the RFDS (Radio Frequency Diagnostic Subsystem) which is presently in use to stimulate a call process situation from the OMC-R to know the performance of the base station in terms of forward power, Reverse Power and voltage standing wave Radio (VSWR)

11 ANTENNAE CONFIGURATION (ON TOP OF THE TOWER)

Each sector of the BTS has three (3) Antennae with the one at the middle acting as the transmit Antennae while the other two acting as Receive Antennas for the sector. The two receive antennae are for diversity so that the system picks the one that has a better reception ie strength (from the Subscribers Terminal).

CHAPTER FIVE

CONCLUSION

The advent of the information superhighway otherwise known as Internet has been a major catalyst in the evolution of the global village. The ever increasing demand for cost effective voice, VOLP and high speed data connectivity and multimedia applications presented an opportunity to wireless network operators to offer these services through the gradual evolution of the 3G (CDMA 2000) wireless communication system.

The 3G wireless systems is essentially IP based architecture and due to the Internet protocols open interface nature, gradual migration and integration of the existing and future network elements make it easier to accomplish. With this in mind, wireless operators are guaranteed existing huge network investments while offering an opportunity to upgrade to 3G at ease.

The major advantages of the 3G (CDMA 2000) are:

1. Up to 2 times voice capacity increment over previous generations.
2. Attainment of Data rates of up to 144kbps.
3. Preservation of existing network infrastructure.
4. Increased source of revenue to the operator.

The CDMA 200 technology has taken a center stage in the technology driven economies live Japan, Europe and America. Intercellular being the pioneer CDMA WILL operator in the country would soon roll-out this latest CDMA technology to its teeming customers. This is because Intercellular and China's leading wireless systems and infrastructure manufacturer, ZTE corporation, have reached systems supply understanding towards ensuring accelerated deployment and expansion of CDMA 2000 (3G) Networks in Nigeria. Installations are already going-on.

Another reason for CDMA 2000 (3G) is the need to source cheaper CDMA systems that are globally tested and backed with supplier support.

SUGGESTION

With the convergence and merger of telecommunication and information technology to get the acronym ICT (Information and Communication Technology) new technologies are already challenging the monopoly and ubiquity of the telephone on internet access. These new technologies are proving that you can actually get on the net once you have an account with a service provider, without necessarily using a telephone line.

Innovations like this routes through it, wireless Local Area Networks (LANs) which allows workstations to communicate and access the network using radio signals as the transmission medium (without the trace of any cable).

The versatile implementation of this new technologies offers a package of advantages:-

1. There is no need for a specially dedicated phone line for the internet; therefore, the threat of interruptions each time a call comes through while you are surfing the Net is eliminated.
2. There are no bills to pay unlike getting on the net through a phone line where bills will still be paid though at the cost of a local call.
3. The energy consumption level is quite low. It can be Solar-powered, or, for rural areas, small dry-cell batteries are enough to power it.

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