IMPLEMENTATION OF VSAT, WIDE AREA NETWORK A CASE STUDY OF HABIB NIGERIA BANK LIMITED

BY

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APPROVAL

This project has been examined and found acceptable in fulfillment of the requirement for the award of Post-graduate Diploma in Computer Science, Federal University of Technology, and Minna.

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CERTIFICATION

I hereby certify that this project work was carried out by Baba Gana Abbas to meet the requirement for the award of post Graduate Diploma in Computer Science, Federal University of Technology, Minna.

DEDICATION

This project is dedicated to my wife Amina Abbas and my first child Aisha Abbas.

ACKNOWLEDGEMENT

The completion of this project was made possible by God Almighty. I thank him for his grace, blessings and protections coming all the way from Kaduna every Saturdays for lectures. Several people have also contributed in various ways towards fulfillment of this project and such people deserve my appreciation. My profound gratitude and special thanks goes to my supervisor who is also my Head of Department. Special thanks go to Mr. Isah Audu for his invaluable guidance and advice. I wish to express my gratitude to all my lecturers in the department of mathematics and computer science, Federal University of Technology, Minna.

I enjoyed a good relationship with my classmates and friends during the period of this programme. The efforts of Surajo Garba, Bari, a colleague of mine, with whom we always travel together from Kaduna to Minna to attend lectures.

A special regard goes to my colleagues in my present place of work, information Technology and Systems, Habib Nigeria Bank Limited, Kaduna. The effort of all other persons towards the success of this work is highly appreciated.

ABSTRACT

Banks and financial institutions today have devised an effective and reliably faster ways of efficient service delivery to their customers by means of high tech communications equipments. In view of the global advancement in electronic Banking System, Habib Nigeria Bank Limited is not an exception.

Being a Bank with over 60 branches spread across the country, there is the need for a customer who has an account in a particular branch in one part of the country to get the same and faster customer service delivery when he goes to a branch in another part of the country. This lead to the implementation of VSAT Wide Area Network Link in 22 branches and 9 Radio Wave Links totaling to 31 on-line real time urban sites of Habib Nigeria Bank Limited across the country.

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CHAPTER ONE

1.1 INTRODUCTION TO WIDE AREA NETWORK

A wide area network is data communication network that covers a relatively broad geographic area and often uses transmission facilities provided by common carriers, such as telephone companies. Wide area network originated to solve the problem of connecting Local area network LAN to a distant workstation or another remote LAN when the distances exceed cable media specifications or when physical cable connections are not possible. WANs are usually required for high volume, long-distance data traffic. When local area network LAN uses modems, Direct digital devices, Public switch telephone network PSTN, High-speed high bandwidth dedicated leased circuits, High speed fibre optic cable, satellite link, microwave transmission links, Wireless radiated media RF to outgrow its building or campus and connects to a distant LAN, it may become large enough to cover a metropolitan Area Network called MAN, Where as when a network grows even larger than a metropolitan area network MAN, it becomes what is called a Wide Area Network WAN.

Wide Area Networks (WAN) are set of connecting links between local area networks and these links are made over Modems, Direct digital devices, Public Switch Telephone Network (PSTN), High speed high bandwidth dedicated leased circuits, High speed fiber optic cable, Satellite links, Microwave transmission links, Wireless radiated media (RF), or the internet which is an interconnected web of wide area networks. Through they are very reliable, but far more expensive than a leased telephone lines. Wide Area Network is a computer network that is meant to cover a wide geographical area, usually over telephone lines or

er medium as compared to a local area network that operates in a

gle company or institution.

1.2 Approaches in WAN

N connection services include:

- X.25
- ISDN
- Frame relay
- ATM

nplement WANs, you can use the following transmission media:

- The public switched telephone network (PSTN)
- High-speed, high-bandwidth dedicated leased circuits
- High-speed, fiber-optic cable
- Satellite links
- Wireless radiated media (radio frequencies)
- The Internet

When a LAN uses modems, direct digital devices, and any of the media types listed above to outgrow its building or campus and connect to a

APPROACHES IN WIDE AREA NETWORK (WAN)

WAN connection services includes:-

- The public switched telephone network (PSTN).
- High speed, high-bandwidth dedicated leased circuit.
- High-speed fibre-optic cable
- Satellite Links
- Wireless radiated media RF
- The internet.

PUBLIC SWITCHED TELEPHONE NETWORK

Virtually every country in the world has public switched telephone network PSTN. All of these networks together represent the world's largest network. PSTN were originally designed exclusively for telephones but became sophisticated, able to handle different kinds of data transmission, including digital data transmission.

PSTN consists of a complex assortment of components including the following:-

- Subscriber wiring and equipment
- Demarcation point
- Local loops
- Central Offices
- Switching Offices
- Long-distance carriers
- Points of presence

1.3 Objectives:-

The specific objectives of this project are to:-

i) Examine the former Local Area Network Structure.

ii) Design and Migrating from LAN to VSAT WAN Link.

iii) Design and implementation VSAT WAN link.

iv) Identify shortcomings of WAN.

1.4 Scope of Study:-

This study is concerned with the former Network Structure of Habib Nigeria Bank Limited and its migration to VSAT technology. The dynamic nature of running business with faster means of communication lead Habib Nigeria bank to adopt one of most efficient, faster, and reliable channels of customer service delivery by implementing VSAT technology.

1.5 Methodology: -

The data for this study were obtained from two main sources: - primary sources and secondary sources.

The primary sources were obtained through personal interview directly with the head of information Technology & Systems Department Habib Nigeria Bank Limited, headquarters Kaduna. Emphasis was placed on Network architecture and topology used formally and presently in the Bank. The findings of the

1.6 GLOSSARY OF TERMS:-

LOCAL AREA NETWORK (LAN):- is a high –speed fault tolerant data network that cover a relatively small geographical area and it connects workstations, personal computers, printers and other devices.

Metropolitan Area Network (MAN):- It is a computer network larger than local area network that span across a single city or metropolitan area.

Wide area network (WAN):- is a data communication network that covers a relatively broad geographic area and often uses transmission facilities provided by common carriers such as telephone companies.

Single Channel Per Carrier (SCPC):- *Single channel connection between links in which there is a constant dedicated connection whether it is in use or not.*

DAMA:- Demand assigned multiple access .

VSAT:- very small aperture terminal.

DATA:- in telephone system, any information other than human speech.

COMPUER:- A versatile and complex electronic machine capable of storing and processing large amount of information and performing calculations.

Network:- computers, printers, scanners and other electronic devices connected together sharing resources from each other.

1.7 INTRODUCTION TO SWITCHING:

Switching is an important technique that can determine how connections are made and how data movement is handled on a WAN. Data sent across the PSTN or other internetworks (the media connecting WANS) can travel along different paths from sender to receiver. Switching sends data along different routes much the way trains are switched over multiple tracks.

Three major switching techniques are available to route messages through internetworks: circuit switching, message switching and packet switching.

Circuit switching connects the sender and receiver by a single physical path for the duration of the conversation. In contrast, message switching does not establish a dedicated path between two stations, instead, messages are stored and forwarded from one intermediate device to the next. Packet switching combines the advantages of both circuit and message switching by breaking longer messages into small parts called packets.

The following section discuss each of these switching technique in detail:

CUICUIT SWITCHING

In circuit switching, a dedicated physical connection is established between the sender and the receiver and maintained for the entire conversation. For example, the PSTN uses a circuit-switching system. When you make a call, a physical link between the two phones is dedicated during the entire conversation When one phone hangs up, the connection is terminated and the circuit is released. A computer network performs circuit switching in a similar way.

Before any two computers can transfer data, a dedicated circuit must be established between the two. The sending machine requests a connection to the destination, after which the destination machine signals that it is ready to accept data. The data is then sent from the source to the destination, and the destination sends acknowledgements back to the destination, indicating that the connection is no longer needed, and disconnects itself.

The major advantage of circuit switching is that the dedicated transmission channel the machines establish provides a guaranteed data rate. This is important for time-critical applications such as audio and video. Also, once the circuit is established, there is virtually no

channel access delay; since the channel is a[illegible] data need to be requested again.[illegible]on

Circuit switching does have its disadv[illegible] inefficient use of the transmission media. [illegible] dedicated even when it is idle, no other devic[illegible] Dedicated channels require more bandwidth [illegible] channels, so transmission media can be expensive. Als[illegible] can be subject to long connection delays; it may take several [illegible] establish the connection.

MESSAGE SWITCHING

Message switching is unlike circuit switching in that it does not establish a dedicated path between two communication devices. Instead, each message is treated as an independent unit and includes its own destination and sources addresses. Each complete message is then transmitted from device to device through the internetwork . Each intermediate device receives the message, stores it until the next devices is ready to receive it, and then forwards it to the next device. For this reason, a message-switching network is sometimes referred to as store-and –forward network.

Message switching can be programmed with information about the most efficient routes, as well as information regarding neighboring switches that can be used to forward messages to their ultimate destination. Because of this information, and because network conditions vary, message-switching systems typically route message through the network along varying paths.

The devices that perform message switching are often PCs using custom software for this purpose, the PC must be prepared to store potentially long messages until those messages can be forwarded. These messages are stored on a hard disk or in RAM. The amount of storage space needed depends on the network traffic through the switch.

One example of a store-and-forward system is e-mail. An e-mail message is forwarded as a complete unit from server to server until it reaches the correct destination. It may take several seconds to several minutes (or in the case of slow connections to the Internet, several hours), but it usually beats the postal service. Clearly, e-mail would be an inefficient use of a dedicated connection. Scheduling and calendaring applications, as well as group databases such as Lotus Notes, can also send updates as messages in this system.

- It provides efficient traffic management. By assigning priorities to the messages to be switched, you can ensure that higher-priority messages get through in a timely fashion, rather than being delayed by general traffic. Resources are set aside to handle these messages, similar to the extra resources a post office or parcel-delivery services maintains for priority mail.

- It reduces network traffic congestion. The intermediate devices (the message switches) are able to store message until a communications sage switches) are able to store message until a communications channel becomes available, rather than choking the network by trying to transmit everything in real time.

- Its use of data channels is more efficient than circuit switching. With message switching, the network devices share the data channels. This increases efficiency because more of the available bandwidth can be used.

- It provides asynchronous communication across time zones. Messages can be sent even though the receiver may not be present, which can make communication across time zones easier. For example, if you have corporate offices in Sydney, Frankfurt, and

Chicago, the last thing you'll want to do is communicate regularly in real time.

On the other hand, the delay introduced by storing and forwarding complete messages makes message switching unsuitable for real-time applications such as voice or video. For these applications (and especially video-conferencing), you need circuit switching. Another disadvantage of message switching is that it can be costly to equip intermediate devices with enough storage capacity to store potentially long messages.

PACKET SWITCHING

Packet switching provides the advantage of circuit switching and message switching and avoids the main disadvantages of both. In packet switching, messages are broken up into packets, each of which includes a header with sources, destination, and intermediate node address information. Individual packets don't always follow the same route; this is called independent routing Independent routing offers two advantages:

- Bandwidth can be managed by splitting data onto different routes in a busy circuit.
- If a certain link in the network goes down during the transmission, the remaining packets can be sent through another route.

low, then, is packet switching different from message switching? Then hain different is that packet switching restricts packets to a maximum ength. This length is short enough to allow the switching devices to store he packet data in memory without writing any of it to disk. By cutting he disk out of the process, packet switching works for more quickly and fficiently than message switching.

n the following sections sections we discuss two methods of packet switching: datagram packet switching, which has many similarities to message switching, and virtual-circuit packet switching, which is quite similar to circuit switching.

DATAGRAM PACKET SWITCHING

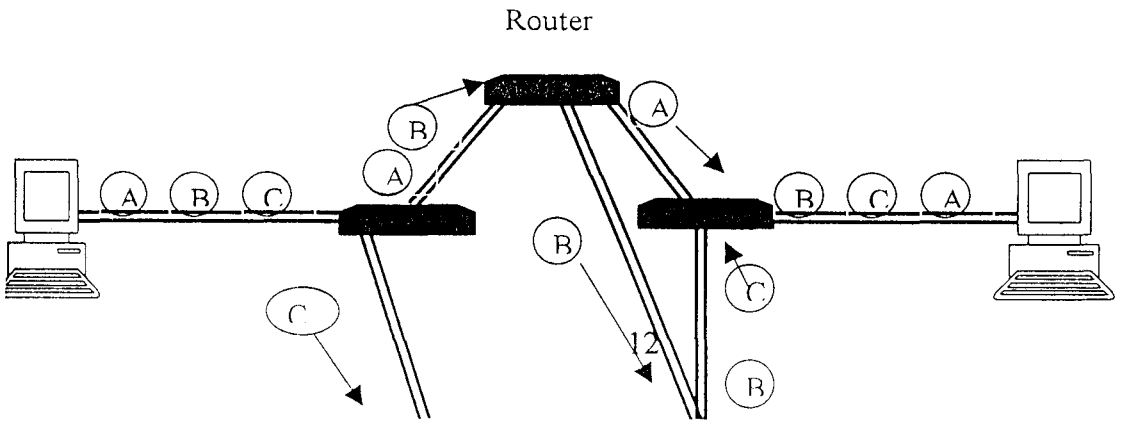
In a datagram packet-switched network, a message is divided into a stream of packets. Each packet is separately addressed and treated as an independent unit with its own control instructions, rather than being a

ece of something larger. The switching devices route each packet dependently through the network, with each intermediate node termining the packets next route segment. Before transmission starts, ie sequence of packets and their destinations are established by the xchange of control information between the sending terminal, the etwork, and the receiving terminal.

acket sizes are kept small to prevent extended switch clogging and to nake retransmission (to compensate for errors) a lot easier.

he switching devices can direct packet around busy network links (rather han blindly sending them into the thickest of the traffic) and make sure hey reach their destination without undue delay. As Figure 11.4 llustrates, the packets that make up a message may arrive at their destination after taking very different routes through the internetwork.

Figure 11.4: Datagram packet switching can send individual packets through different routes.



Because the datagram packets can follow different routes through the inter-network, they are likely to arrive at their destination out for order. The packet headers include a sequence number that the receiving device uses to reassemble the packets and reconstruct the original message. Datagram packet switching lets you transmit large message quickly and efficiently by using a smaller frame size. The network layer on the sending device divide the messages from upper layers into smaller datagrams that the data link layer can handle. Then the packets are transmitted through the inter-network. Finally, the network layer on the receiving machine reconstructs the messages from the data link layer frames into message for the upper-layer protocols.

VIRUAL-CIRCUIT PACKET SWITCHING

Virtual-circuit packet switching establishes a logical connection between the sending and receiving devices, called a virtual circuit. The sending device starts the conversation by communicating with the receiving device and agreeing on communication parameters, such as maximum message size and the network path to be taken. Once this virtual circuit is established, the two devices use it for the rest of the conversation, or for as long as the two devices are operational.

irtual-circuit packet switching is radically different from datagram packet witching. In virtual-circuit packet switching, all the packets travel rough the logical connection established between the sending device and he receiving device. In datagram packet switching, the packets travel ifferent routes through the internetwork.

he logical connection that the sending and receiving machine establishes s termed virtual because there is no dedicated physical circuit between he machines, even though the machines area acting as though they have stablished one. A logical connection is established. Each node in the ogical path can perform switching and error control.

One of the main areas where you'll see virtual circuits used frequently is connection-oriented services such as audio and video.

ADVANTAGES AND DISADVANTAGES OF PACKET SWITCHING

Packet switching has a great advantage over circuit switching in that it improves the use of network bandwidth by enabling many devices to communicate though the same network channel. A switching node may concurrently route packets to several different destination devices and is able to adjust the routes as required by changing network conditions in order to get the packets through in good order.

lother advantage of packet switching is that it suffers far shorter nsmission delays than does message switching because the switching des are handling the packets entirely in memory rather than committing em to disk before forwarding them.

hen considering packet switching, take the following factors into ccount:

- **RAM versus hard disk space:** Switching nodes for packet switching will require large amounts of RAM to handle large quantities of packet successfully. By way of compensation, they won't need such large hard drives (because they won't be writing the messages to disk)
- **Processing power:** The packet-switching protocols are more complex than message-based protocols, so the switching nodes will need more processing power.
- **Lost packets:** Because the data is divided into a larger number of piece packets are more easily lost than entire message. Packet-switching protocols need to be able to recognize which packets have been lost and to request that those packets be retransmitted. The sequence numbers play an important role in helping to identify missing packets.

INE

nalog and digital lines offer one of the most popular media for onnection WANs. As you saw in Chapter 9, lines can be either dial-up or edicated.

Dial-up Line provides connections across the PSTN. Dial-up lines open a new circuit with each call and may use different routing paths to the same destination.

The public switched telephone network is slow because it was originally designed for used grade analog communication.

Because the PSTN is a circuit-switched network, end-to-end circuit links between any two-original/destination points, as well as the line quality of those links, may vary from one call to the next. Consequently, transmission quality may vary from one call to the next. Over long distances, the variable circuit quality may show up as differences in modem connect speed, throughput, or loss of carrier (abnormal disconnect).

ALOG DEDICATED LINE

dicated, or leased, analog lines provide subscribers with direct end-to-d exclusive circuits that are always available. In contrast with a dial-up nnection that opens a new circuit with each and call and may use fferent routing paths to the same destination, dedicated circuits are ore reliable and more costly because they are unstitched, always vailable, and dedicated to your exclusive use.

IGITAL LINES

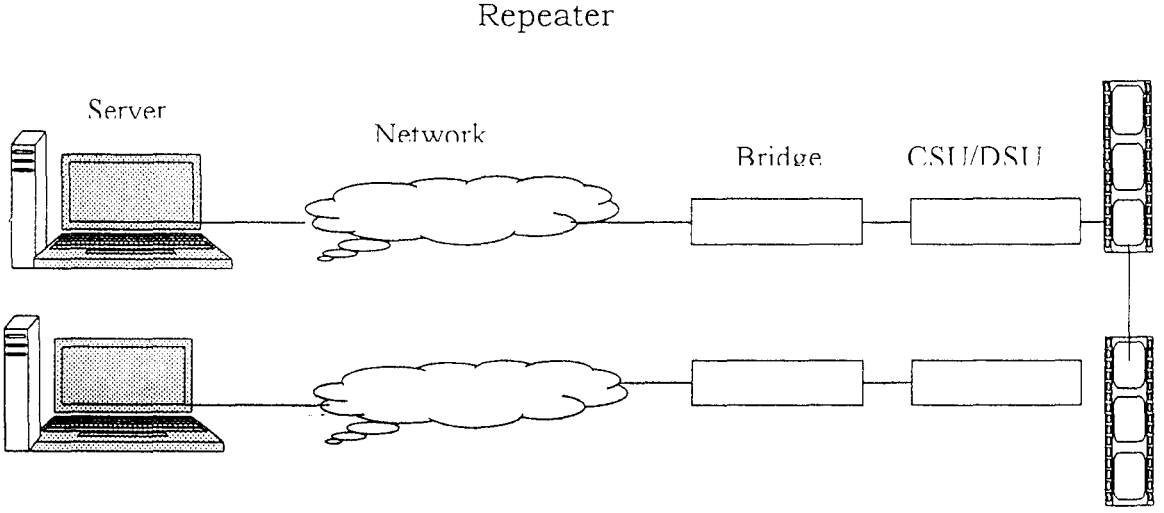
For high-quality, continuous connections, digital lines are preferred over dedicated analog lines. For many non-critical network operations, dial-up or dedicated analog lines are adequate. However, analog signal quality is often degraded by voice frequency limitations. So-called "noisy" lines can corrupt data or even drop a carrier connection altogether. A poor-quality line will cause modems to fall back to the next highest mutually acceptable transmission rate until line quality improves or the connection is lost.

After a connection is lost, bottlenecks can occur while a new connection is being established.

hen a WAN carries the heavy traffic of critical operations, data rruption and bottlenecks quickly become expensive burdens. A solution noisy analog lines is to switch to digital lines. Digital lines are more xpensive, but if your need for a faster, more reliable, and more secure ansmission environment justifies the cost, you might consider digital ata service (DDS), lines.

Figure 11.5 illustrates a DDS line.

wo remote networks connected via a digital data service (DDS) line



DDS line are popular for several reasons:

- they provide nearly error-free synchronous transmission.
- Transmission speeds offered are 240bps, 4800bps, 9600bps and 56Kbps.
- Connections are permanent, end-to-end, and full-duplex.
- Local phone companies typically offer the service.

T-CARRIER

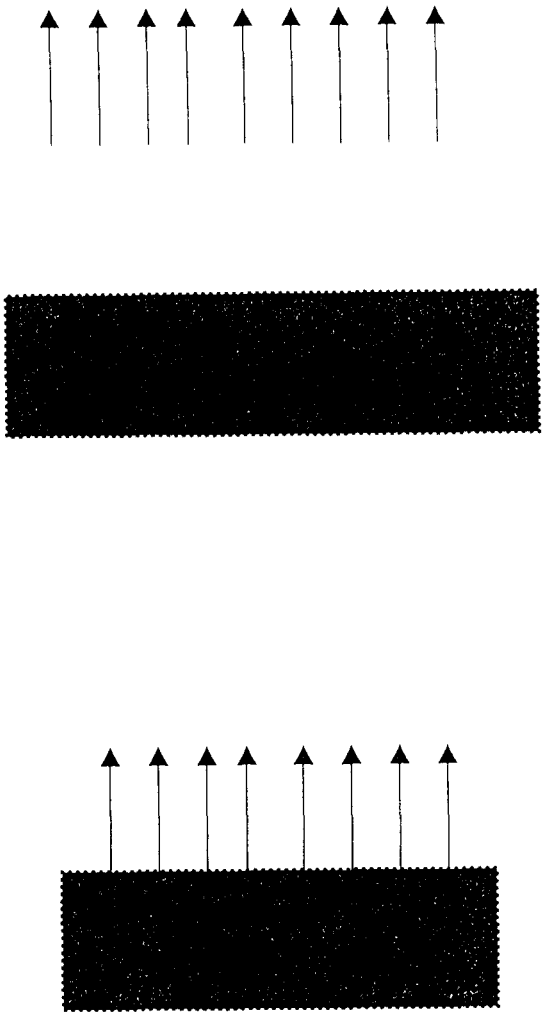
T-carrier are a type of high-speed leased telephone line used for voice and data transmission. There are four main T-carrier service levels:

- T1 (1.544Mbps)
- T2 (6.312Mbps)
- T3 (44.736Mbps)
- T4 (274.176Mbps)

T-carrier service employers multiplexing to allow the bit streams of the smaller carrier (such as T1) to be multiplexed into the larger ones, as illustrated in Figure 11.6. The following table compares the number of T1 channels that are multiplexed into the other T-carrier services.

T-CARRIER	NUMBER OF T1 CHANNELS USED
T1	1
T2	4
T3	28
T4	168

Figure 11.6 T-carriers are multiplexed like "Chinese boxes"



Because T-carrier service is too expensive for some purpose, service provides often allow you to lease subdivisions of a full T-carrier service. This less expensive service, based on the 64Kbps channels is known as fractional T.

SWITCHED 56

Switched 56 is a version of DDS that is used on demand; it is not dedicated. Recall that DOS lines are the entry point into dedicated high-speed (56Kbps) point-to-point digital transmission. Switched 56, therefore, represents a way to reduce the full cost of a dedicated DDS line.

THE X.25 PACKET-SWITCHING PROTOCOL

X.25 PACKET SWITCHED networks allow remote devices to communicate with each without the expense of individual leased lines.

One of the key design features of packet-switched networks is redundant error checking, which allows for the limitations of analog voice-grade lines when they are used for data communications X.25 is a packet-switching protocol that defines the interface between a synchronous packet-switching host computer and analog dedicated circuits or dial-up switched virtual circuits in the voice-grade public data network. Therefore, it implements the original design objectives of packet switching. Its dominant features are:

- Virtual circuit switching and dynamic virtual routing to transport self-contained, self-addressed message packets.
- Ability to use any available network channels or links.
- Ability to use redundant error checking at every node.

X.25 allows a variety of devices that are designated as data terminal equipment (DTE) to talk to the public data network (PDN). The PDN is designated as data communications equipment (DCE), as are devices such as modems, packet switches, and other ports. Hardware/software devices, such as terminals, hosts, and routers, that deliver data to or from a network I/O point are DTE. The X.25 protocol as a DTE-to-DCE synchronous interface.

To begin communication, one DTE device (for example, a router) calls another DTE to request a data exchange session. The DTE called can accept or refuse the connection. If the called DTE accepts the connection, the two systems begin full-duplex data transfer. Either side can terminate the connection at any time.

X.25 has been used since the mid 1970s, so it is pretty well debugged and stable. There are literally no data errors on modern X.25 networks.

X.25 does have some drawbacks. The store-and-forward mechanism causes delays. On most single networks the turn-around delay is about 0.6 seconds.

This does not affect large block transfers, but in transmissions that require extensive "back and forth" communication, the delay can be very noticeable.

Frame relay (also called fast packet switching) does not store and forward it simply switches to a destination partway through the frame, considerably reducing the transmission delay.

Line speeds normally used with X.25 are too slow to provide most LAN application services on a WAN. Transmission speeds of up to 64Kbps are typical.

FRAME RELAY

Like X.25, frame relay is a packet-switching network service that uses variable-length packets to provide high-speed data transmission rates. Frame relay, however, is less robust than X.25. by eliminating some of the accounting and error-checking services that X.25 requires, frame relay

achieves greater efficiency and higher throughput. Because it uses a permanent virtual circuit in a reliable environment, frame relay does not need as much overhead as X.25.

Frame Relay evolved from X.25. it can, however, provide speeds of up to 1.544 Mbps and can employ fiber-optic media.

Because it eliminates unnecessary overhead, frame relay outperforms other systems with its fast packet-switching technology. Frame relay uses permanent virtual circuits (PVCs) to establish stable end-to end circuits. They system doesn't need to build and abandon circuits or instantaneously create temporary best path routes, which occurs with traditional packet switching. The resulting transmission speeds account for its increasing popularity. Add to that a dynamically responsive bandwidth and you have a transmission medium that accommodates mixed and irregular demands. Frame relay is cost effective, mostly because the network buffering requirements are carefully optimized.

(ATM) ASYNCHRONOUS TRANSFER MODE

ATM is a descendant of packet-switching. Its high-speed advantage comes from transmitting uniform data packets that are subdivided into data frames, and each frame is enclosed within an addressable 53-byte cell and routed by hardware switching. The switching achieves very high-speed data transmission rates, between 155- and 622Mbps (and theoretically, up to 1.2 gigabits per second). ATM offers fast, real-time, demand-responsive switching for efficient use of network resources using broadband and baseband LANs or WANs.

ATM METHODS

Unlike other switching technologies, which use frames that vary in length, ATM is based on 53-byte cells of fixed size. Each cell comprises 48 bytes of application information and a 5-byte ATM header. The consistent, standardized cells allow switching mechanisms to achieve faster switching rates.

ATM cells are compatible with both time-division multiplexing and packet-switching data scheme.

Instead of relaying on slower software switching and error checking at every node, which is what occurs in traditional packet switching, ATM uses hardware switching at the data link medium access layer of the OSI model. Its high-quality, nearly noise-free dedicated digital lines do not require the burden of error checking associated with traditional analog packet-switching lines; the destination computer assumes that burden.

At each switching node, the ATM header identifies a virtual circuit that will route the cell's message to the destination computer. The cell header enables the switch to forward the cell and data to the next neighboring link in the total circuit. The virtual circuit is set up through the appropriate ATM switches when two endpoints wish to communicate. This scheme allows ATM switching to be implemented in hardware that is fast enough to support transmission rates to 1.0 gigabits per second.

ATM can provide for simultaneous data, video, and voice transmissions.

ATM MEDIA COMPATIBILITY

ATM is compatible with current and widely used cable media such as twisted pair, coaxial, and fiber-optic, as well as a great deal of LAN and

WAN technology. However, some cable media lacks sufficient bandwidth to fully realize ATM's potential. The sticking point that slows ATM conversations is that ATM networks require consistent, compatible hardware throughout.

To date, there are ATM standards for transmitting at 2.5Mbps, 45Mbps, 52Mbps, 100Mbps, 155Mbps and 622Mbps. ATM is compatible with other transmission methods: ATM cells can be encapsulated in other protocols, including those of FDDI, SONET,T3, OC3, and Fiber Channel.

(ISDN) INTERGRATED SERVICES DIGITAL NETWORK

ISDN is switched digital service that is typically sold on a time-and-distance rate schedule, just like ordinary phone calls. It is provided by local telephone service providers where telephone companies have converted from analog to digital switching systems.

ISDN channels are available in bandwidth increments of 56/64Kbps, 384Mbps, and 1.544Mbps. the most common service options are Basic Rate and primary Rate. Basic Rate ISDN divides its available bandwidth into three data channels. Two channels are designated as B channels and transmit data at 64Kbps, and a third D channel, also known as a service

nnel, transmits signaling and link management data at 16Kbps. ISDN c rate desktop service is called 2B+D.

omputer connected to an ISDN services can used both B channels ther for a combined 128Kbps speed, when both the sending and eiving computers support compression, much higher throughput is ssible. Optionally, one 64Kbps B channel can be used for data nsmission while the other B channel is simultaneously used for voice. hen one B channel is being used for voice, the data transmission rate on he other B channel will drop back to 64Kbps. When the user stops using ne channel for voice, the data rate will resume its 128Kbps speed.

SDN has long been viewed as a replacement for the slower PSTN services.

Primary Rate ISDN or PRI (23B+D) uses the entire 1.544Mbps T1 bandwidth to provide 23 B channels at 64Kbps and one D channel at 64Kbps. The D channels is used for signaling and link management.

The billing method is both an advantage and a liability, depending on how many hours a month the ISDN channels are to be used. When used continuously, ISDN channels in the United States are substantially more

expensive than using the bandwidth equivalents offered over dedicated leased lines (FT1/T1), which are based on fixed monthly charges, distance factors, and clock time. However, if ISDN channel usage is limited to only a few dial-up hours a month, it can be more cost effective than full –time leased lines.

FDDI) FIBER DISTRIBUTED DATA INTERFACE

FDDI (Fiber Distributed Data Interface) is a topology standard that transmits information packets using light produced by a laser or LED (light-emitting diode) and offers tremendous speed. FDDI uses fiber-optic cable and equipment to transmit data packets. Typical data rates are around 100Mbps. Cable lengths can easily be up to 100 kilometers (with repeaters at least every two kilometers).

TP-PMD (twisted pair-physical medium dependent) is a type of FDDI that uses copper cable for transmission over short distances.

This topology manages access to the network using IEEE 802.5, like Token Ring. It also has many improvements over Token Ring, including a system fault-tolerance strategy that employs two rings instead of one and a technique called wrapping.

HOW FDDI WORKS

With FDDI, a station must have a token before it can transmit frames. The size of FDDI frames can be between 17 and 45000bytes. Stations on the network read the messages that travel around the ring from NIC to NIC. When a station reads a frame that matches its address, it copies the frame and creates an acknowledgement frame. Then it transfers the token to the next attached network node.

FDDI used the primary ring to move data and a second ring to provide system fault tolerance and backup. The two rings rotate (Send messages) in opposite directions, so they are called dual counter-rotating rings. The second ring is inactive until it is needed. Figure 11.7 shows the design of an FDDI topology.

Devices such as workstations, bridges, and routers can be attached to the rings. There are two types of stations: Class A and Class B, Class A station will be isolated from the network is there are two breaks in both rings on both sides of one station.

Wiring concentrators can also be used to provide protection against breaking the rings. FDDI concentrators function much like Token Ring

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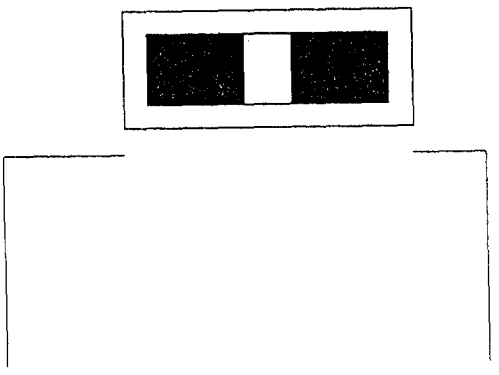
SAUs, but they are more intelligent. FDDI concentrators can mmunicate with stations to verify the integrity of the station-to-ncentrator connection, and they can reroute packets instantaneously.

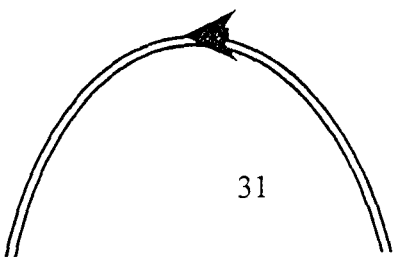
rapping is the system fault-tolerance feature that takes effect when a reak occurs on one or both of the rings. When a break occurs in a ring, he first step is the identification of a failure domain (the area affected by he break that cannot carry data). The failure domain includes the machine closest.

(FDDI) Fiber Distributed Data Interface

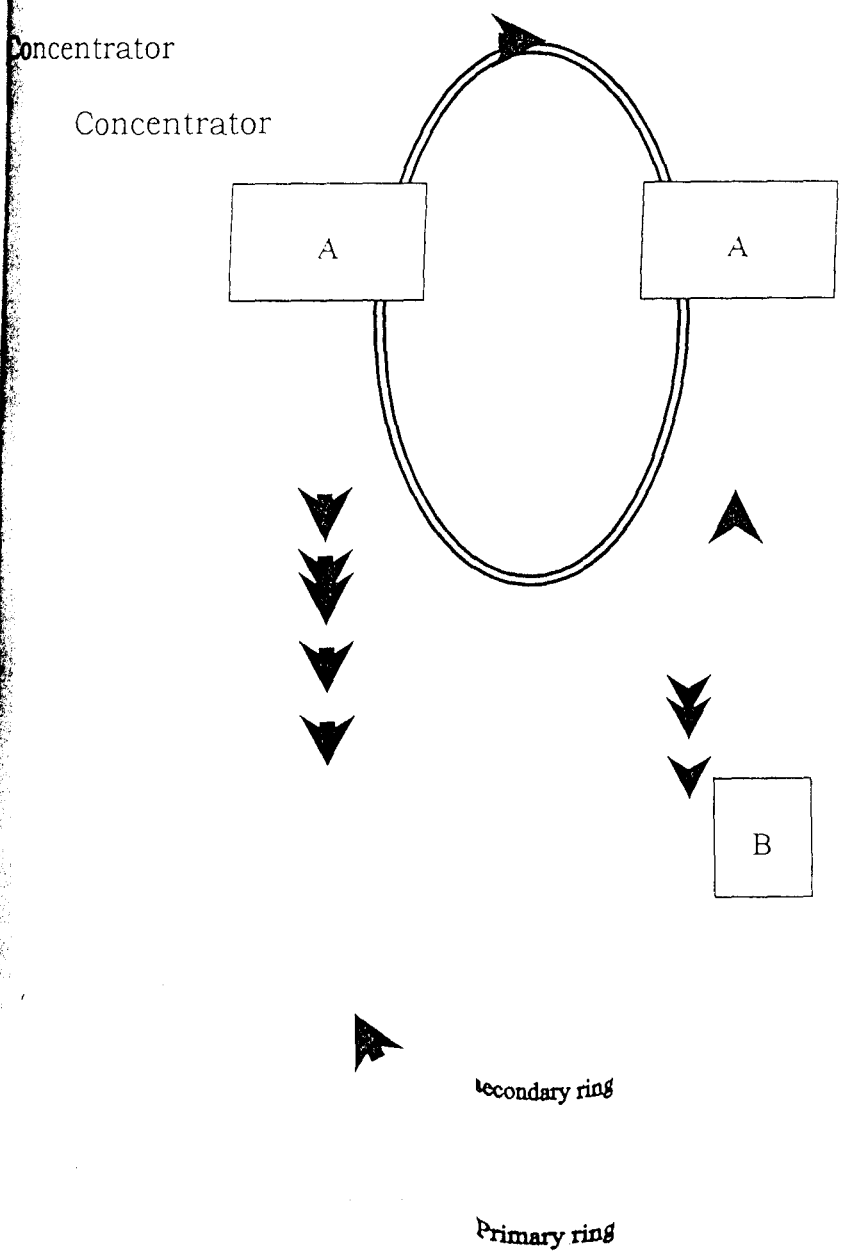
Router



FDDI

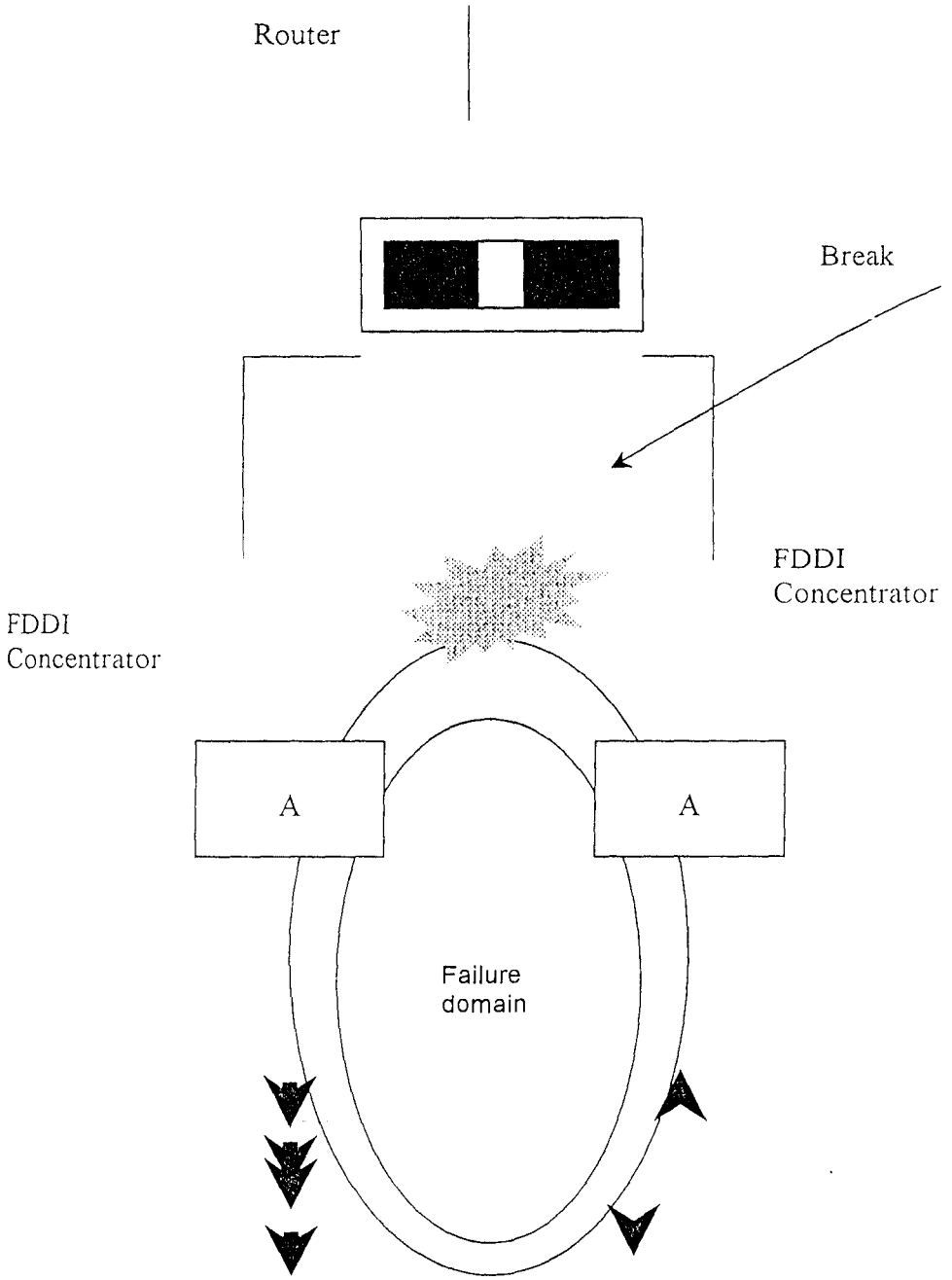


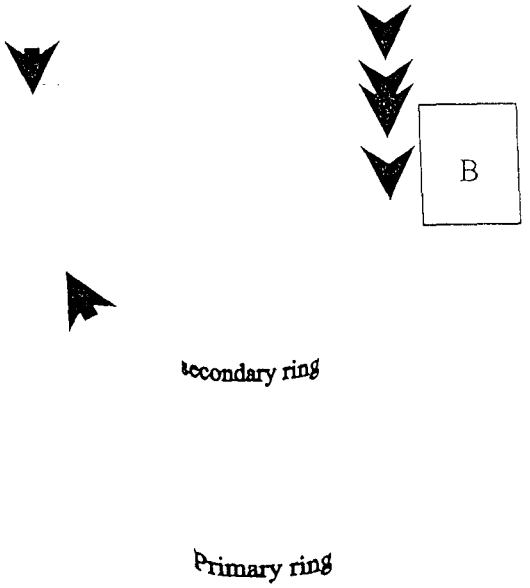
FDDI



To the cable break and its nearest upstream neighbor. Wrapping reroutes the packets around the two workstations bordering that failure domain. Two Class A machines can then use the second ring to route packets around the failure domain. Class B workstations cannot take advantage of wrapping because they are connected to only one ring. During this time,

DDI concentrators play an important role and must be able to reroute formation instantaneously. Figure 11.8 show how FDDI wrapping orks.





DVANTAGES AND DISADAVANTAGES OF FDDI

FDDI has some strong advantages. Advantages resulting from the use of fiber optic able (described in the next section) include the following:

- High bandwidth: Using light provides enormous bandwidth, as high as nearly 250Gbps. High bandwidth allows for tremendous speed. As stated earlier, most FDDI implementations can handle data rates of 100Mbps.

- Security: It is difficult to eavesdrop on fiber-optic cable transmission.

- Physical durability: Fiber-optic able doesn't break as easily as do other kinds of cable.

- Resistance to EMI: Fiber-optic cable is not susceptible t EMI.

- Cable distance: Fiber-optic cable transmit signals over 2 kilometers. Under experimental conditions distances of hundreds of kilometers are possible.

- Weight: Fiber-optic cable weighs a lot less than copper wire with similar other advantages:

In addition to those resulting from the use of fiber-optic cable, FDDI has other advantages:

- Use of multiple tokens: FDDI uses multiple token to improve network speed.

- Ability to prioritize workstations: FDDI can designated some workstations as low-priority workstations when necessary, providing faster services to high-priority stations.

- System fault tolerance: FDDI can isolate faulty nodes with the use of wiring concentrators for instantaneous rerouting. Wiring concentrators function as centralized cabling connection devices for workstations. The other big advantage is wrapping.

As you can see, there are a number of advantages to FDDI. As with all topologies and systems, there are also some disadvantages. FDDI is a complex technology. Installation and maintenance require a great deal of expertise. However, this is a new technology, and advancements should be coming.

The other disadvantage of FDDI is cost. Fiber-optic cable itself is becoming more inexpensive. However, other equipment, such as adapters and concentrators, can be very expensive. With some of this core equipment costing a great deal (a typical FDDI concentrator might run more than a thousand dollars per network node), costs for even a small network add up quickly.

CABLING FOR FDDI

Rings in FDDI are made of fiber-optic cables. Fiber-optic cable, which was discussed in Chapter 2, consists of optical fibers made from glass

(or plastic). The fiber consists of an inner glass core surrounded by more glass, called clouding. Light is flashed at either end of the cabling by LEDs or ILDs (injection laser diodes). The signals are then sent through the core, and the cladding acts as a mirror, reflecting light back into the core. Fibers are often bundled together to allow multiple signals to be sent at one time. Each fiber can carry signals in only one direction.

Today, many fiber-optics manufacturers are working to improve fiber-optic cable to make it less expensive and easier to use. Some manufacturers have begun to offer cable with plastic rather than glass. Plastic, however, typically does not have the purity to allow long cable runs or high throughput.

A second improvements has been more successful: snap-in connectors. Formerly, fiber-optic termination included using epoxy preparation and polishing of the glass; it was an involved process. Snap-in connectors have simplified the connection process greatly.

Fiber-optic cable comes in various types and wavelengths. To make the best selection, choose a fiber-optic cable based on its intended use. Then be careful to match the cable to its appropriate connectors.

(SONET) SYNCHRONOUS OPTICAL NETWORK

SONET is high-speed, fiber-optic data transmission system. It can move data at rates faster than 1 gigabit per second. SONET data rates begin at 51.84Mbps. Higher data rates come in multiples of the basic rate. Rates for SONET are calculated in terms of optical carrier (OC) speed.

SONET can easily surpass 1gbps. 10Gbs SONET metropolitan area rings, supporting gigabit ATM applications, have been implemented.

Applications for SONET (as well as the other very high-speed transmission systems covered here) include.

- High-speed, large-scale LAN interconnection
- Video-on-demand
- Full-motion catalogs, movies, and so on
- Professional services
- High-resolution imaging
- High-fidelity sou

Chapter Two

Literature Review

2.1 Introductions to Habib Bank and its Services

Habib Nigeria Bank Limited is a partnership between Habib Bank Limited Pakistan and a group of Nigerian private and institutional investor. Habib Bank Limited, which is wholly owned by the Government of Pakistan, holds 40% equity in Habib Nigeria Bank limited. The remaining 60% is owned by a group of individuals and institutional investors who jointly holds 50% and 10% belongs to staff of Habib Nigeria Bank limited.

The bank commenced operations in May 1983 with two branches at Kaduna and Lagos. As at 31 December 2002, the branch network has grow to sixty (60) spread in thirty six(36) states of the federation and the federal capital territory. Our branches are located at Abuja wuse, Abuja CDB, Kano Main, Kano City, Kano Fagge ta Kudu, Kaduna South, Kaduna Main, NDA, Bank Road Branch, Kaduna, Malunfashi, Katsina, Kankara, Kachako, Daura, Zakirai, Sokoto, Tutunku, Makarfi, Gusau, Yola, Bauchi, Jalingo, Gombe, Maiduguri, Damaturu, Fufore, Jos, Minna, Ilorin, New Bussa, Birnin Kebbi, Makurdi, Bidda, Sulaja, Ikeja, Ikoyi, TBS, Apapa, Idumota, Ibafon, Port Harcourt, Aba, Onitsha, Ibadan, Abeokuta, Uyo, Oshogbo, Warri, Owerri, Koko, Yenagua, Abakaliki and Enugu.

Arrangement has reached advanced stage towards raising the recently increased Capital Base for Commercial Banks to 25 Billion by the Central Bank of Nigeria.

It may be of interest to you to know that we currently provide the following services to the Banking public:-

1. CURRENT AND DEPOSIT ACCOUNTS SERVICES

   Our Branches are being fully automated in order to guarantee fast, efficient and above all, secure services to its customers. They are well positioned to meet the conventional banking requirements in the tested Habib Bank tradition of curtesy, efficiency and responsibility informed by the need to promote the socio-economic development of host community.

2. FUNDS MANAGEMENT

   Aside the generous concessions on conventional term deposit, we are also in a position to undertake funds management through our wholly owned subsidiary – HNB Trustees Limited. Under this arrangement, long term idle funds could be invested in the money and capital market for considerably higher yields and adequacy of security.

3. WORLD BANK ASSITED PROJECTS

   The Bank is very active in developmental projects as it relates to agriculture, health and water schemes especially under World Bank Assisted Projects.

4. FOREIGN OPERATIONS

The Bank provides domiciliary account services for funds denominated in foreign currency. Other foreign related services include; Establishment of Letter of Credit (LC), Remittances, Import/Export financing etc.

5. PENSION COLLOCTION AND MANAGEMENT

Similarly, HNB Trustees Limited can design and implement an efficient scheme for the administration and investment of Pension Funds. In just over to years of its existence, the Company has already carved a niche for itself in the area of Pension Funds Management.

6. REVENUE COLLECTION

We have designed and put min place for some State Governments a revenue collection system for their State Boards of Internal Revenue.

The scheme allows tax payers to pay directly to our Branches for the credit of the Board's account with the Bank. Periodic returns are rendered to the Boards enabling them to update individual tax payer's records. The additional advantage of the scheme is that it is computerized in order to eliminate waste and frauds.

In addition to above, we also collect for Federal Inland Revenue Department VAT and other taxes.

7. CUSTOMS DUTIES COLLECTION

The federal Government has also appointed us as one of the Banks to participate in the collection of Custom duties. All these are testimony of our financial strength in the Banking Industry.

8. LENDING TO SMALL SCALE FARMERS

Our Bank is a leading participant in Agricultural lending to small-scale farmers. Over the years, individuals and farmers groups financed by the Bank were adjudged the best farmers in some States.

9. INFORMATION TECHNOLOGY

We have upgraded and are continuously reviewing our Information Technology facilities for the provision of on-line real-time Banking Services in most of our Branches.

CONCLUSION

As highlighted above, we have over 60 branches and are presently in 36 states of the Federation including Abuja.

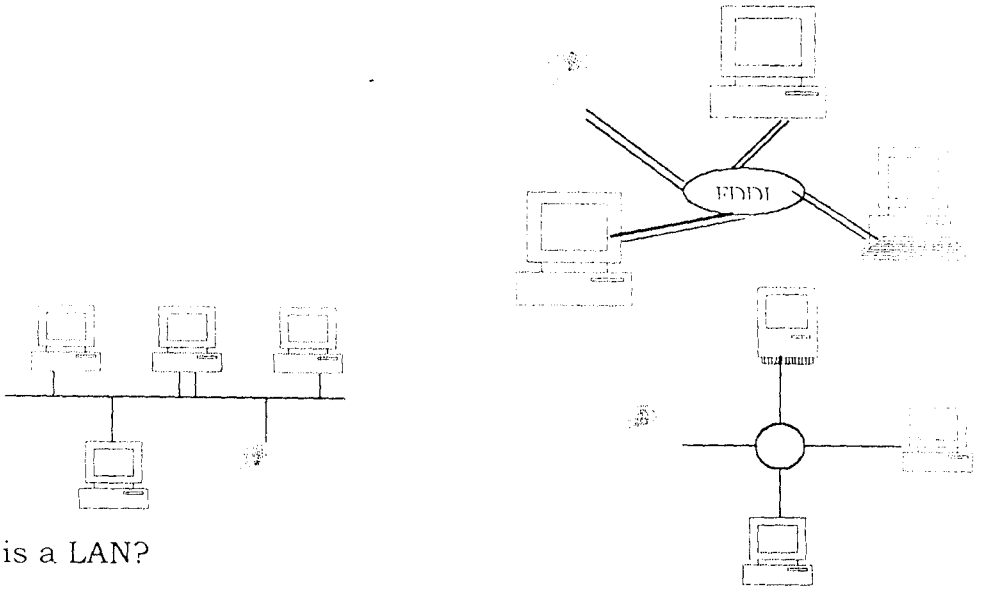
We are therefore well positioned in terms of spread, level of computerization and efficiency to provide you a diverse range of services. We shall therefore be grateful if you give us the opportunity to serving you through any of our range of services.

CHAPTER THREE
PROJECT DESIGN AND IMPLEMENTATION

3.1 Design and Implementation of Habib Nigeria Bank Limited, Kaduna Local Area Network (LAN)

This chapter introduces the various media-casess methods, transmission method, topologies, and devices used in a local area network (LAN). Topics addressed focus on the methods and devices used in Ethernet/IEEE 802.3, Token Ring/IEEE 802.5, and Fiber Distributed Data Iterface (FDDI).

Three LAN Implementations are used most commonly.

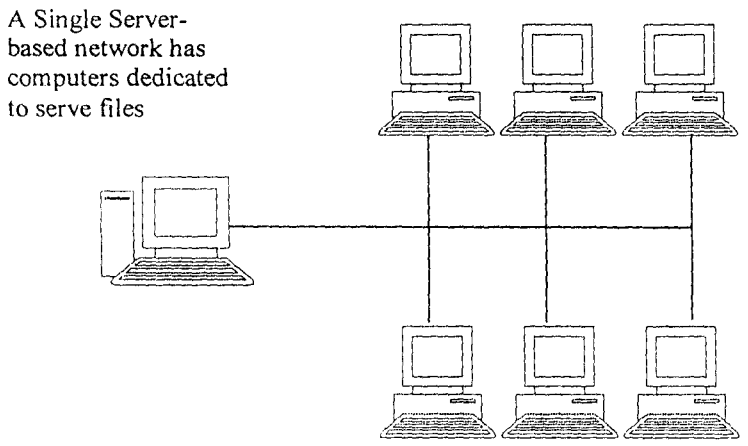


What is a LAN?

A LAN is a high-speed, fault-tolerant data network that covers a relatively small geographic area. It typically connects workstations, personal computers, printers, and other devices. LANs offer computer users many advantages, including shared access to devices and applications, file exchange between connected users, and communication between users via electronic mail nd other applications.

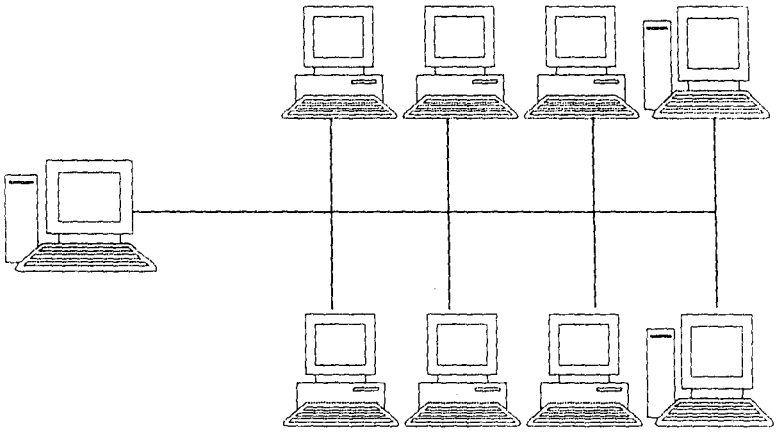
Single Server Network (10 – 50 Users) (LAN)

If you have fewer than about 50 people, you can run your entire organization with a single server. This allows you to centralize a number of services and maintain strong control over your network environment. Networking with a single server also has some benefits that can cost a lot in multiple-server networks, such as easy segmentation. Figure 5.2 illustrates a single-server network.



A multi-server network is applicable for decentralised type of network if you have over 50 users belonging to different department each controlling its unit. It is a distributed kind of network that does not depend only on a single server for its operations.

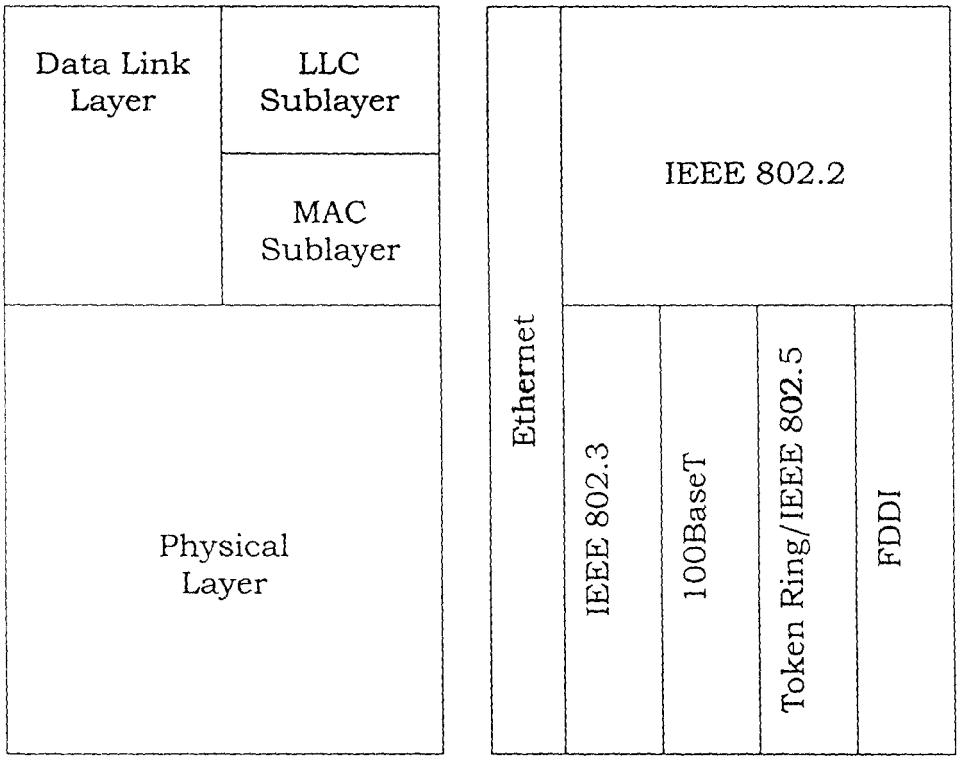
A Simple Multi-user network diagram is shown below:-



LAN Protocols and the OSI Reference Model

LAN protocols function at the lowest two layers of the OSI reference model. The diagram below illustrates how several popular LAN protocols map to the OSI reference model.

Popular LAN protocols mapped to the OSI reference model



LAN Media-Access Methods

LAN protocols typically use one of two methods to access the physical network medium; carrier sense multiple access collision detect (CSMA/CD) and token passing.

In the CSMA/CD media-access scheme, network devices contend for use of the physical network medium. CSMA/CD is therefore sometimes

called contention access. Examples of LANs that use the CSMA/CD media-access scheme are Ethernet/IEEE 802.3 networks, including 100BaseT.

In the token-passing media-access scheme, network devices access the physical medium based on possession of a token. Examples of LANs that use the token-passing media-access scheme are Token Ring/IEEE 802.5 and FDDI.

LAN Transmission Methods

LAN data transmissions fall into three classifications; unicast, multicast, and broadcast. In each type of transmission, a single packet is sent to one or more nodes.

In a unicast transmission, a single packet is sent from the source to a destination on a network. First, the source node addresses the packet by using the addresses of the destination node. The package is then sent onto the network, and finally, the network passes the packet to its destination.

A multicast transmission consists of a single data packet that is copied and sent to a specific subset of nodes on the network. First, the source node addresses the packet by using a multicast address. The packet is then sent into the network, which makes copies of the packet and send a copy to each node that is part of the multicast address.

A broadcast transmission consists of a single data packet that is copied and sent to all nodes on the network. In these types of transmissions, the source node addresses the packet by using the broadcast address.

The packet is then sent into the network, which makes copies of the packet and sends a copy to every node on the network.

LAN Topologies

LAN topologies define the manner in which network devices are organized. Four common LAN topologies exist; bus, ring, star, and tree. These topologies are logical architectures, but the actual devices need not be physically organized in these configurations. Logical bus and ring topologies, for example, are commonly organized physically as a star. A bus topology is a linear LAN architecture in which transmissions from network stations propagate the length of the meduium and are received by all other stations. Of the three most widely used LAN implementations, Ethernet/IEEE 802.3 networks, implement a bus topology, which is illustrated in table below:-

A ring topology is a LAN architecture that consists of a serie3s of devices connected to one another by unidirectional transmission links to form a single closed loop. Both Token Ring/IEEE 802.5 and FDDI networks implement a ring topology. The table 1 below depicts a logical ring topology.

A star topology is a LAN architecture in which the endpoints on a network are connected to a common central hub, or switch, by dedicated links. Logical bus and ring topologies are often implemented physically in star topology.

A tree topology is a LAN architecture that is identical to the bus topology, except that branches with multiple nodes are possible in this case under table 2.

Some networks implement a logical ring topology

Table 1

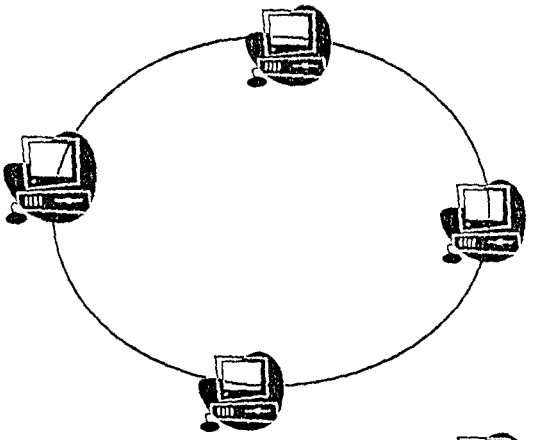
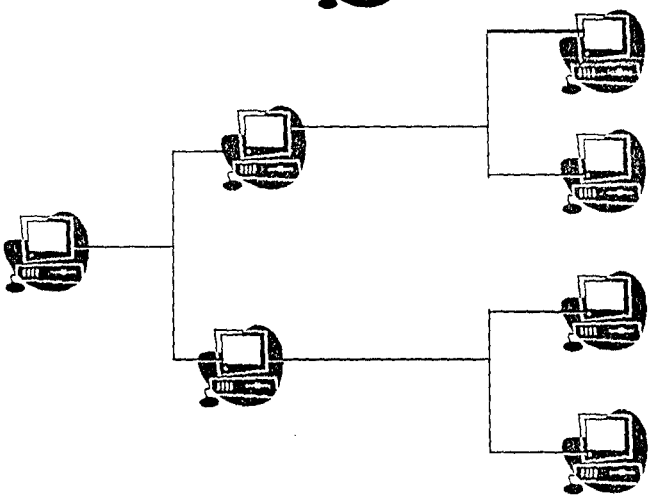


Table 2



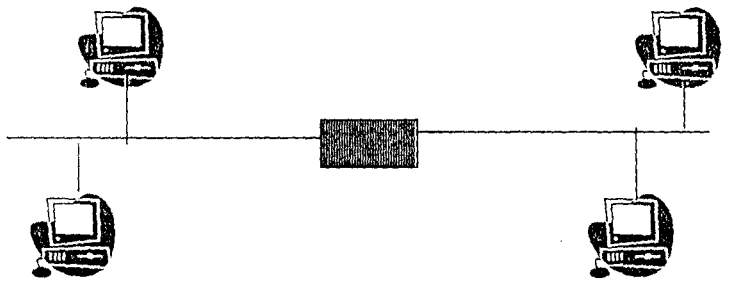
LAN Devices

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

A repeater is a physical layer device used to interconnect the media segments of an extended network. A repeater essentially enables a series of cable segments to be treated as a single cable. Repeater receive

signals from one network segment and amplify, retime, and retransmit those signals to another network segment. These actions prevent signal deterioration caused by long cable lengths and large numbers of connection devices. Repeaters are incapable of performing complex filtering and other traffic processing. In addition, all electrical signals, including electrical disturbances and other errors, are repeated and amplified. The total number of repeaters and network segments that can be connected is limited due to timing and other issues. Table below illustrates a repeater connecting two network segments.

A repeater connects two network segments

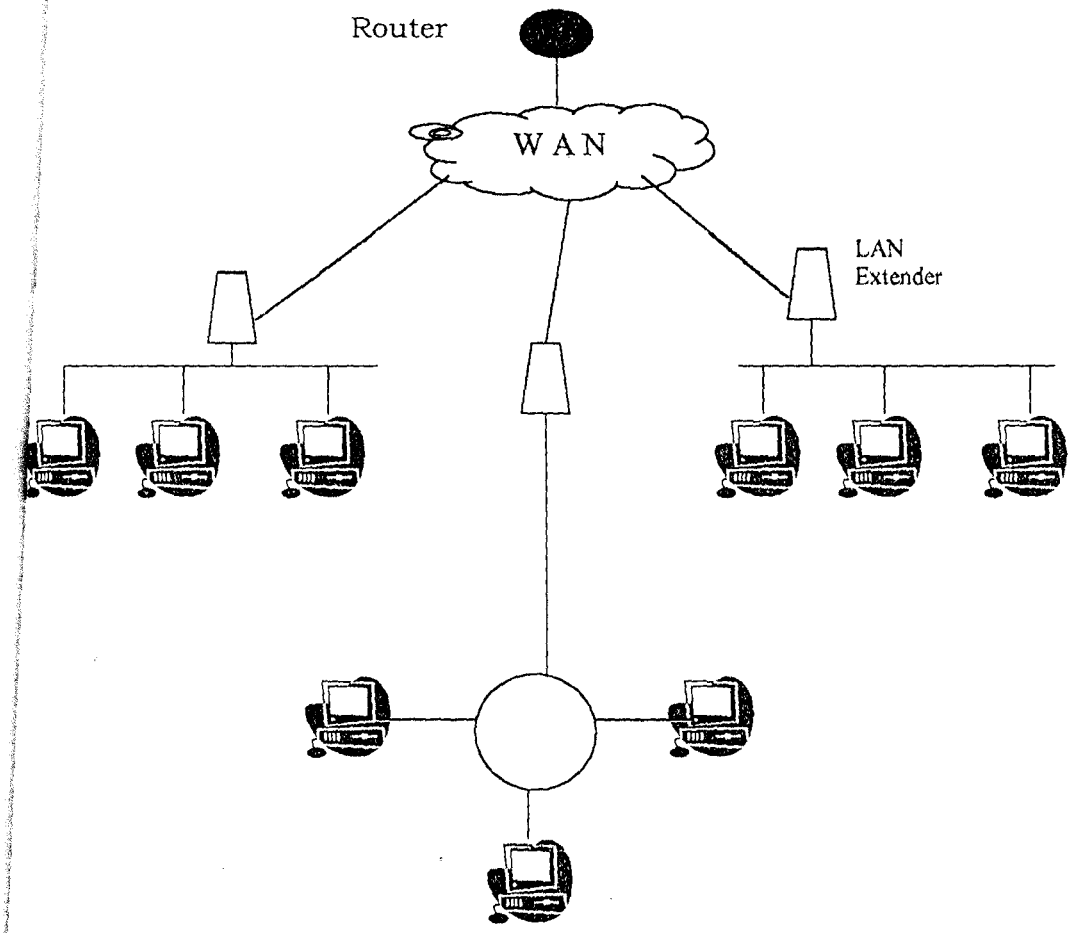


A hub is a physical-layer device that connects multiple stations, each via a dedicated cable. Electrical interconnections are established inside the hub. Hubs are used to create a physical star network while maintaining the logical bus or ring configuration of the LAN. In some respects, a hub functions as a multi-port repeater.

A LAN extender is a remote-access multilayer switch that connects to a host router. LAN exteders forward traffic from all the standard network-layer protocols (such as IP,L IPX, and AppleTalk), and filter traffic based on the MAC address or network-layer protocol type. LAN extenders scale well because the host router filters out unwanted broadcasts and

multicasts. LAN extenders, however, are not capable of segmenting traffic or creating security firewalls. The table below illustrates multiple LAN extenders connected to the host router through a WAN.

Multiple LAN extenders can connect to the host router through a WAN



3.2. Design and implementation of Habib Bank Kaduna's Metropolitan Area Network (MAN)

Metropolitan Area Network just as the name implies, is a computer network larger than a Local Area Network that span across a single city or metropolitan area.

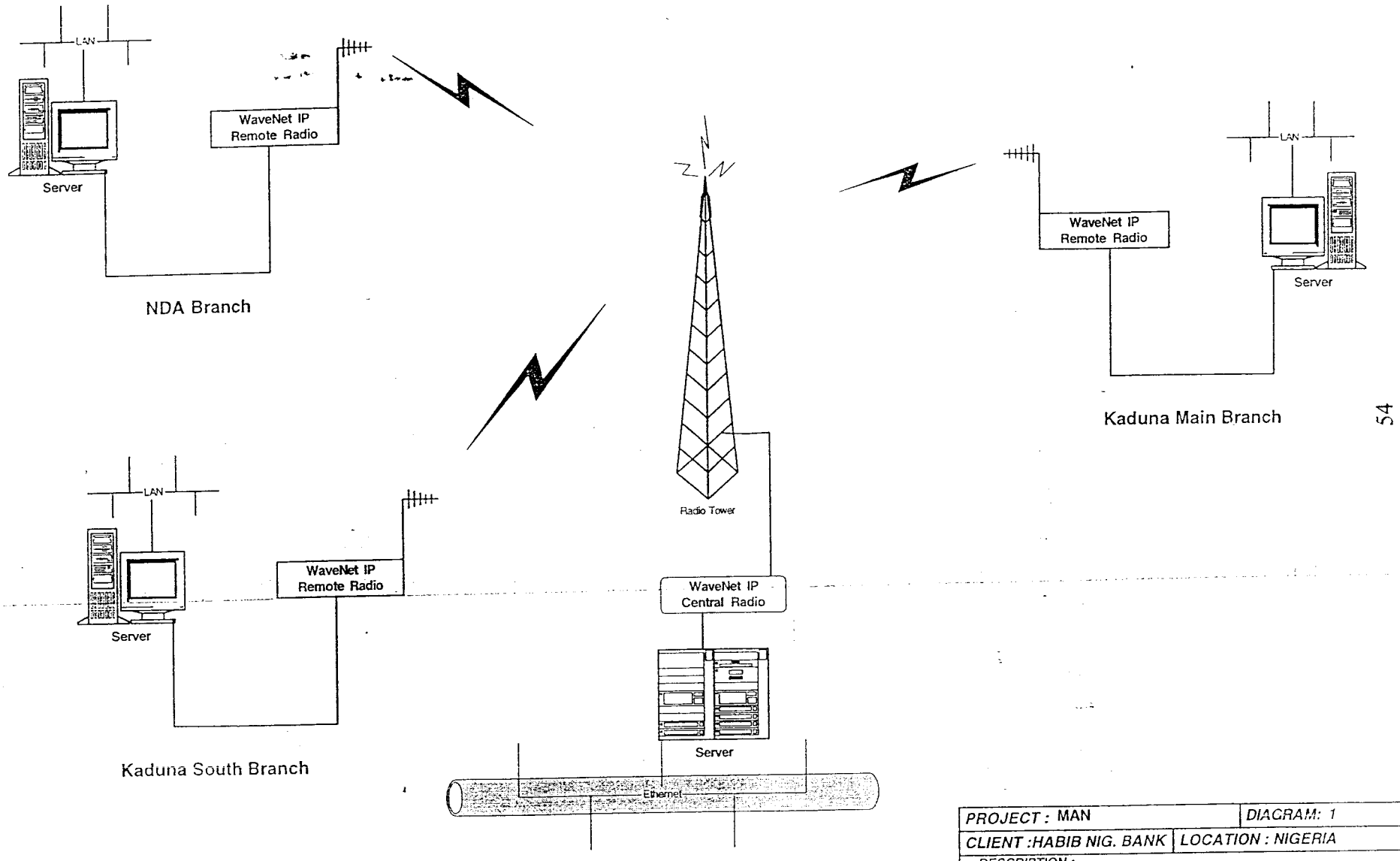
Habib Bank with its four Branches spread across Kaduna metropolis, decided to implement a Metropolitan Area Network (MAN) to Link-up the four branches to operate an on-line real time banking system.

The following lists of equipments are the requirement for the installation of the MAN in Kaduna metropolis:-

KADUNA MAN EQUIPMENT	QTY
WaveNet IP Cenral Access Radio System(HQ)	#1
WaveNet IP Remote Access Radio System	#3
½" Heliax Antenna Cable	400m
Cable Connectors & Terminals	#16
10Base-T Cable	400m
Omni Antenna for (HQ)	#1
Directional Remote Antenna	#3
Cisco Switch 2621	#4
3 COM Hub	#4

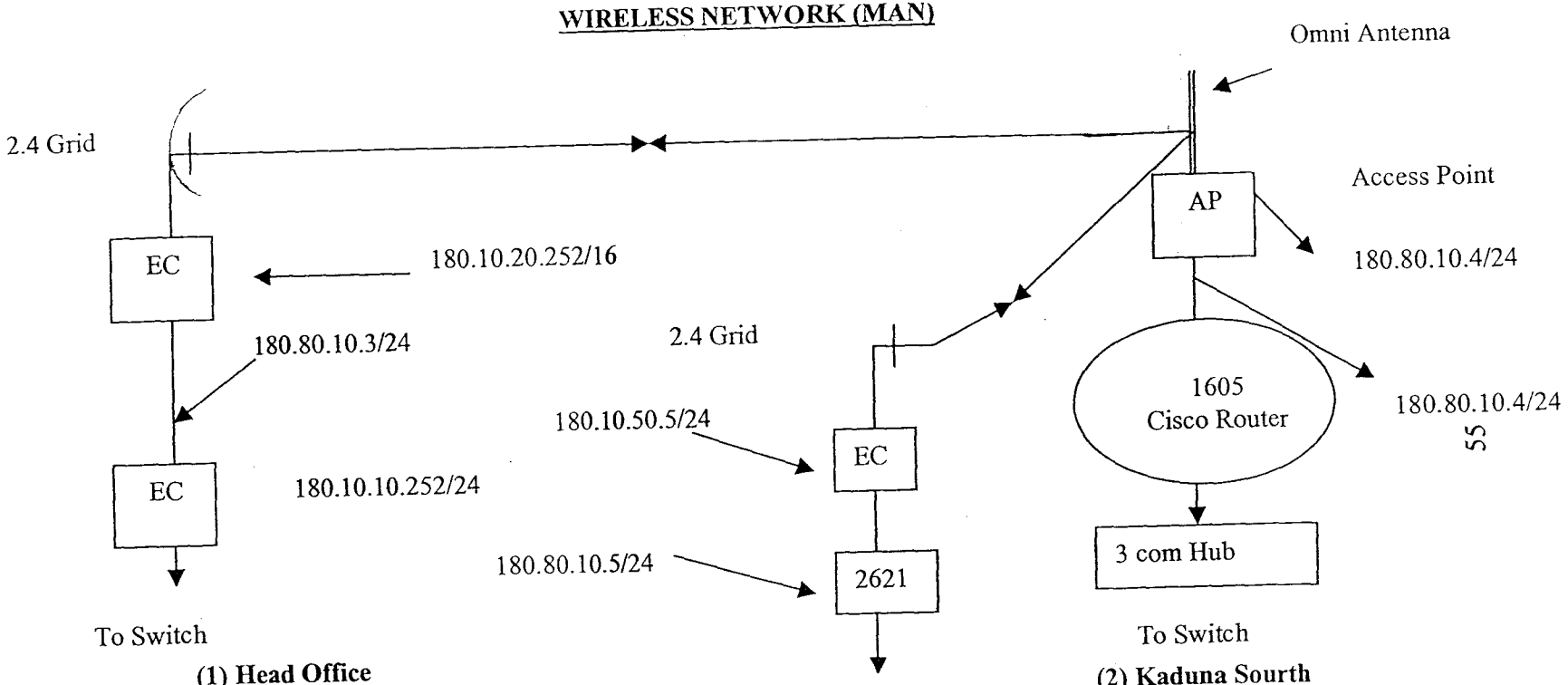
An overview of the design for Kaduna **MAN** is shown in figure 3.1 as follows:-

PROPOSED HABIB NIGERIA BANK METROPOLITAN AREA NETWORK (KADUNA).



PROJECT : MAN		DIAGRAM: 1
CLIENT :HABIB NIG. BANK		LOCATION : NIGERIA
DESCRIPTION : METROPOLITAN AREA NETWORK DRAWING		
BY : GS TELECOM		DRAWING BY: Engr. George OKOYE
REV : A	18/9/97	APPROVED BY :

WIRELESS NETWORK (MAN)



55

(1) Head Office

Note:

- Radio to act as transparent Bridge
- Static routes to be employed.
- Encryption and/oraccess list to be included in routes.
- So/o on 2621 is backup link to head office data center.

(3) Kaduna Manin Branch

(2) Kaduna Sourth

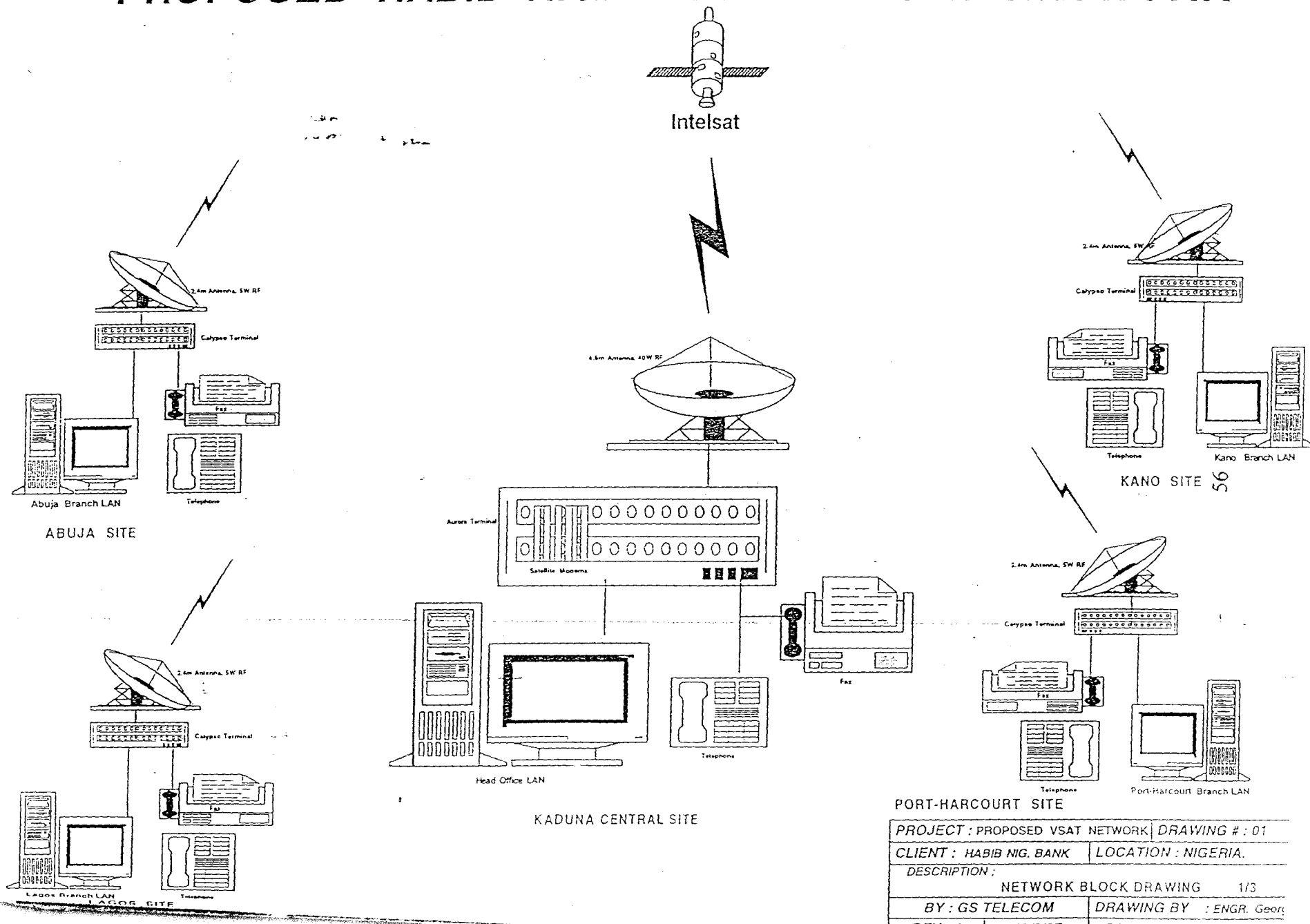
RIP

Network 180.80.0.0
Network 180.10.0.0
Network 180.1.0.0

Router Eigrp

Network 180.10.0.0
Network 180.90.0.0

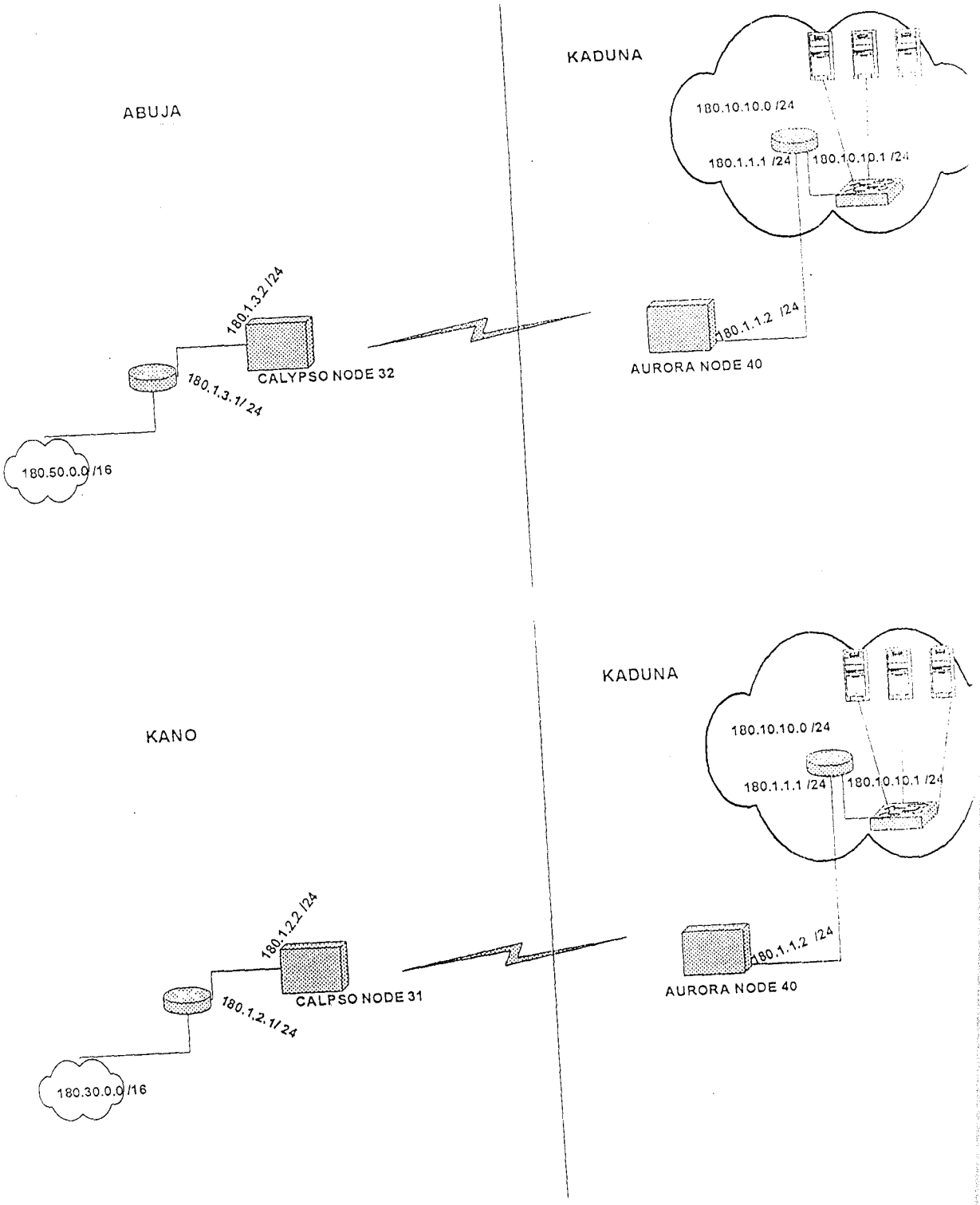
PROPOSED HABIB NIGERIA BANK VSAT NETWORK

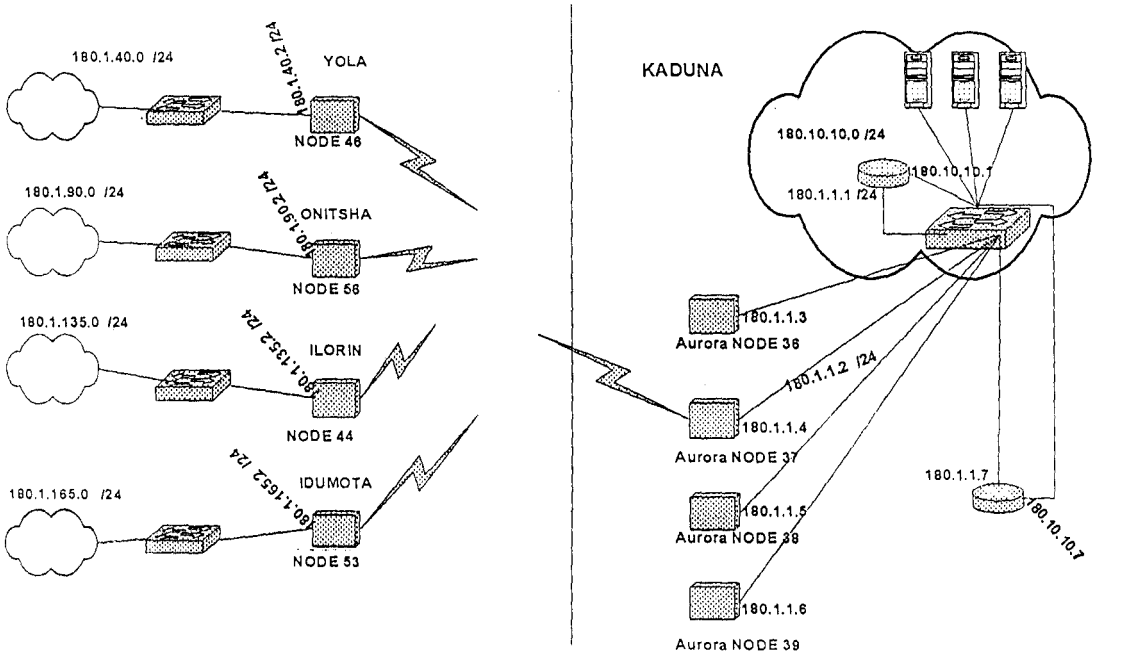


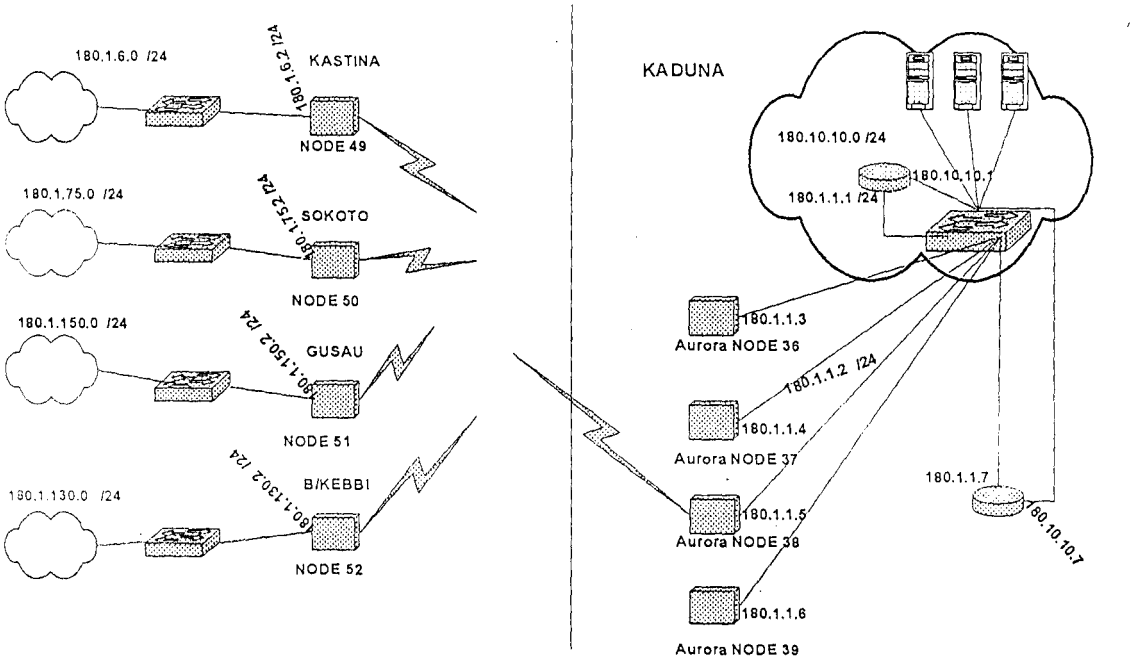
PROJECT : PROPOSED VSAT NETWORK		DRAWING # : 01
CLIENT : HABIB NIG. BANK		LOCATION : NIGERIA.
DESCRIPTION : NETWORK BLOCK DRAWING		1/3
BY : GS TELECOM		DRAWING BY : ENGR. Geor
REV : A	18/9/97	APPROVED BY :

3.4 Design Approach

KADUNA – ABUJA PATH:




180.1.40.0 /24
180.1.40.2 /24
YOLA
NODE 46
180.1.90.0 /24
180.1.90.2 /24
ONITSHA
NODE 56
180.1.135.0 /24
180.1.135.2 /24
ILORIN
NODE 44
180.1.165.0 /24
180.1.165.2 /24
IDUMOTA
NODE 53
KADUNA
180.10.10.0 /24
180.10.10.1
180.1.1.1 /24
180.1.1.3
Aurora NODE 36
180.1.1.2 /24
180.1.1.4
Aurora NODE 37
180.1.1.5
Aurora NODE 38
180.1.1.6
Aurora NODE 39
180.1.1.7
180.10.10.7


180.1.6.0 /24
180.1.6.2 /24
KASTINA
NODE 49
180.1.75.0 /24
180.1.75.2 /24
SOKOTO
NODE 50
180.1.150.0 /24
180.1.150.2 /24
GUSAU
NODE 51
180.1.130.0 /24
180.1.130.2 /24
B/KEBBI
NODE 52
KADUNA
180.10.10.0 /24
180.10.10.1
180.1.1.1 /24
180.1.1.3
Aurora NODE 36
180.1.1.2 /24
180.1.1.4
Aurora NODE 37
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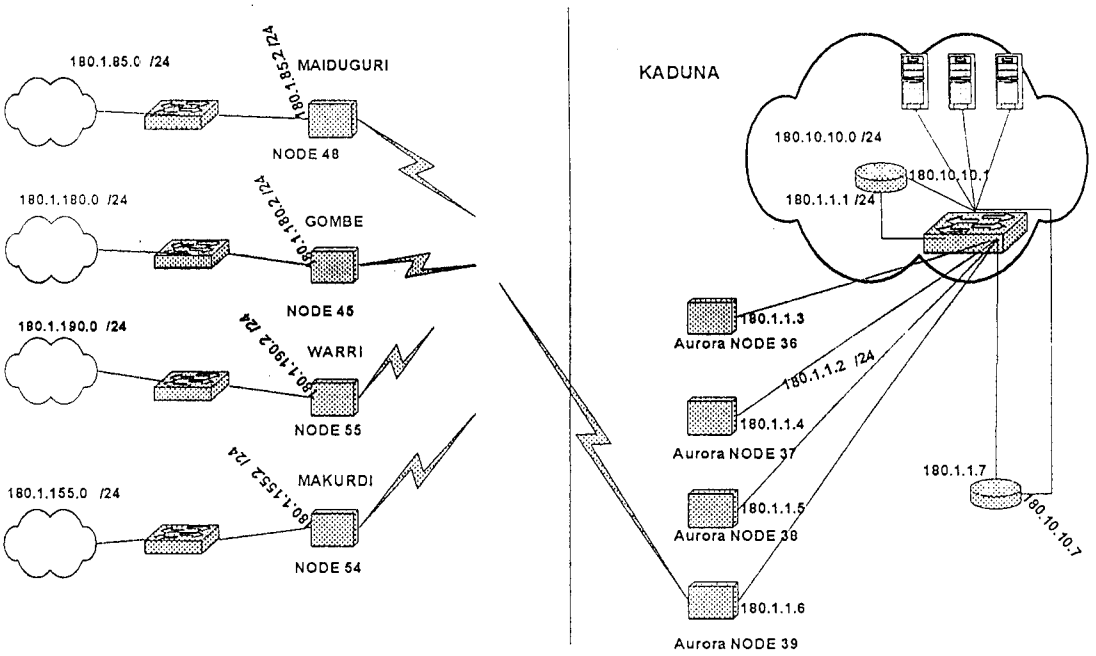
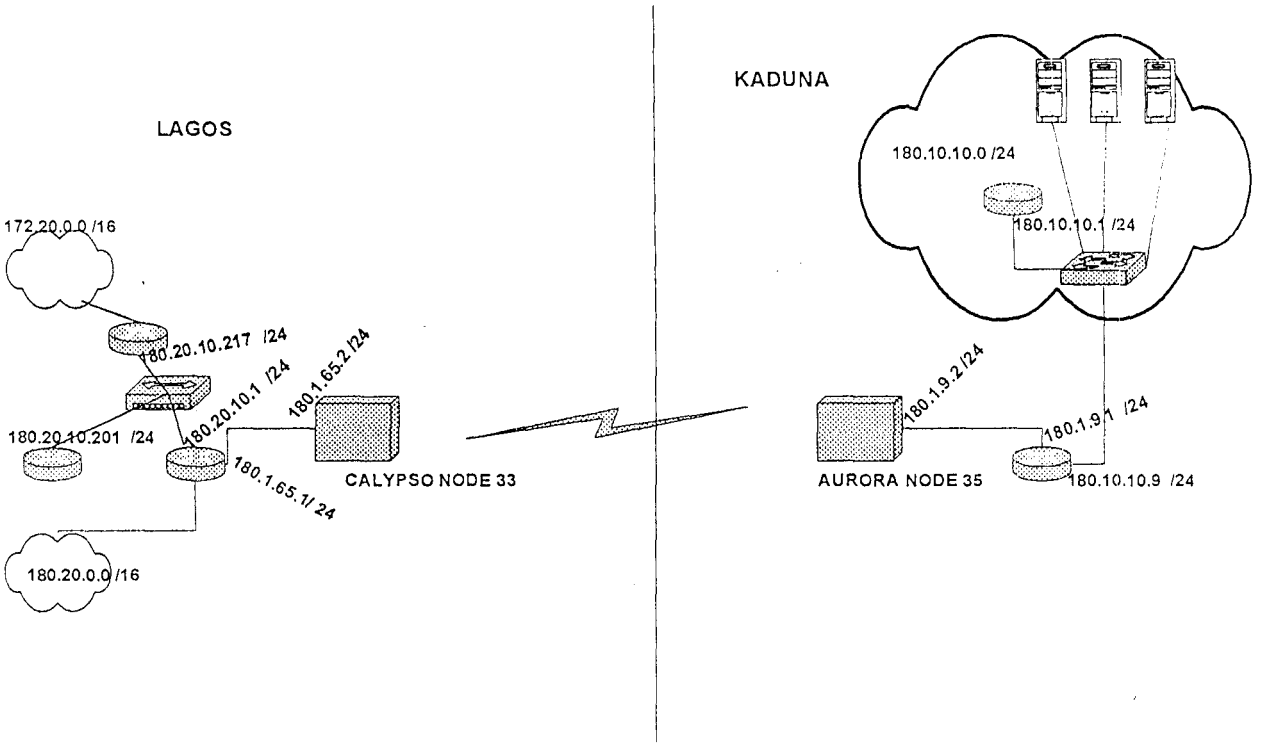
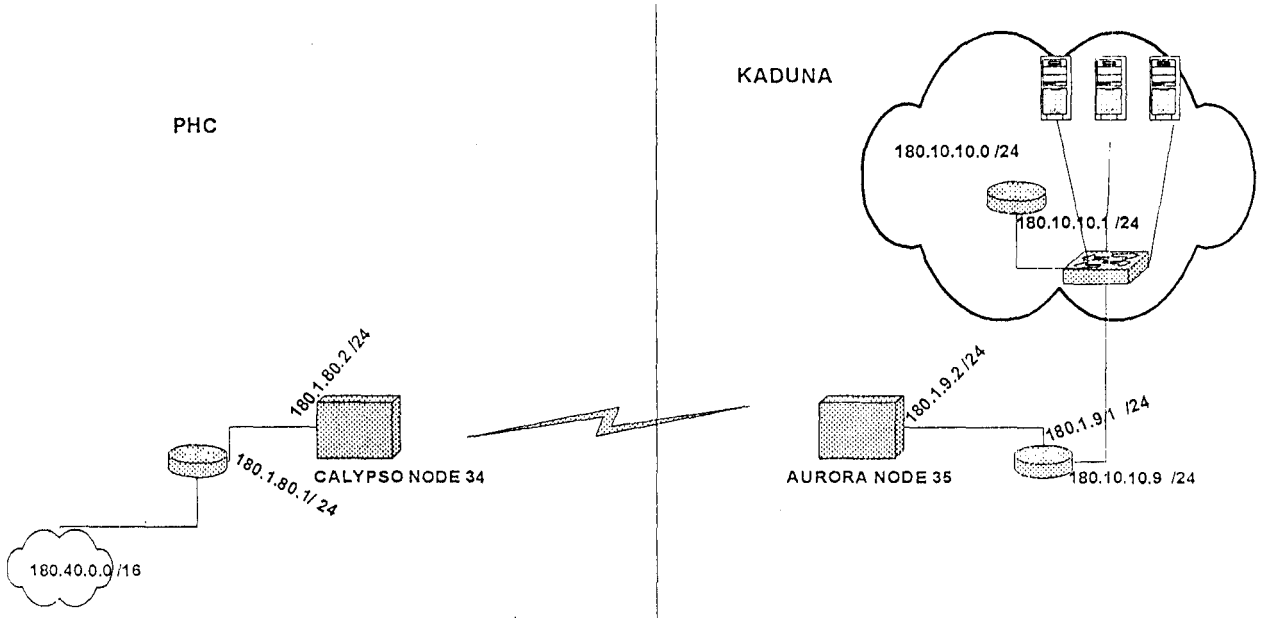
Aurora NODE 38
180.1.1.6
Aurora NODE 39
180.1.1.7
180.10.10.7


180.1.85.0 /24
MAIDUGURI
180.1.85.2 /24
NODE 48
180.1.180.0 /24
GOMBE
180.1.180.2 /24
NODE 45
180.1.190.0 /24
WARRI
180.1.190.2 /24
NODE 55
180.1.155.0 /24
MAKURDI
180.1.155.2 /24
NODE 54
KADUNA
180.10.10.0 /24
180.10.10.1
180.1.1.1 /24
180.1.1.3
Aurora NODE 36
180.1.1.2 /24
180.1.1.4
Aurora NODE 37
180.1.1.7
180.10.10.7
180.1.1.5
Aurora NODE 38
180.1.1.6
Aurora NODE 39

KADUNA – LAGOS PATH:





CHAPTER FOUR

4.1 PROGRAMMING & SYSTEM IMPELEMENTATION

Programming Algorithm

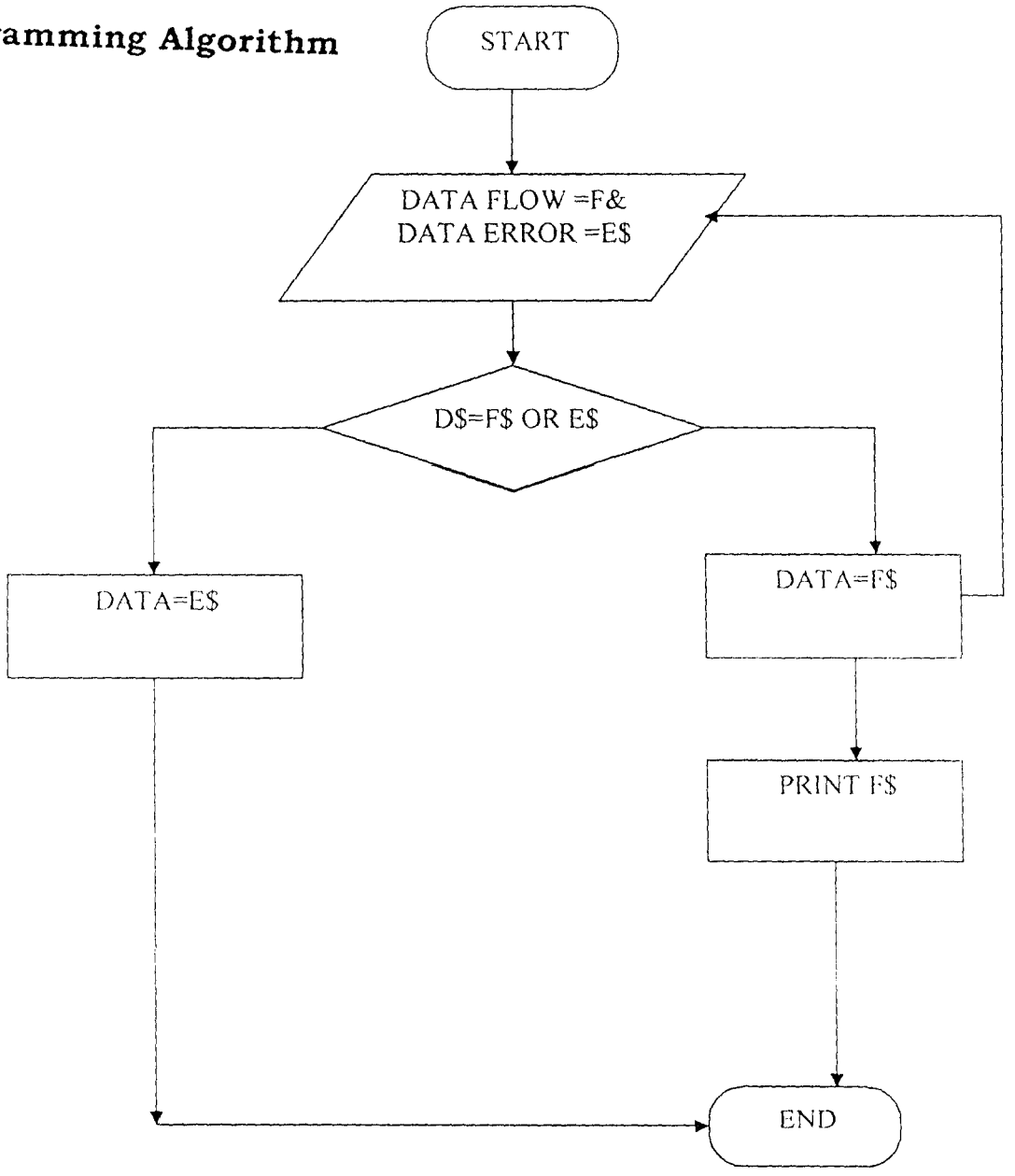


FIGURE: FLOWCHART ILLUSTRATING THE FLOW OF DATA IN WIDE AREA NETWORK

4.2 PROGRAMMING LANGUAGE

BASIC PROGRAM TO ILLUSTRATE THE FLOW OF DATA IN WIDE AREA NETWORK

4.3 RESULT PRESENTATION

```
10  REM ILLUSTRATES FLOW OF DATA IN WIDE
    AREA NETWORK
20  LET F$ = "DATA FLOW"
30  LET E$ = "DATA ERROR"
40  LET D$ = "F$ OR E$
50  IF D$ = E$ THEN
60  GOTO 80
70  PRINT F$
80  STOP
```

CHAPTER FIVE

SUMMARY, CONCLUSION AND RECOMEMENDATION

5.1 SUMMARY / CONCLUSION

The proposed network architecture is based on the SCPC / DAMA technology which is highly flexible and can be re-configured quickly and easily to meet HABIB NIGERIA BANK's dynamic business needs. It is even compatible with terrestrial networks which can be used for satellite diversity to cope with peak overload demands, new services between locations and disaster recovery situations. It is full – mesh, demand assigned,

single – hop satellite architecture which supports transmission of information, regardless of whether it is voice, data, video or fax to securely link HABIB NIGERIA BANK's geographically dispersed operational offices. The network is SCPC DAMA and such can be either star or mesh.

The network configuration is full mesh single hop satellite design which allows seamless transmission of voice / fax and data directly between any two sites.

5.2 RECOMMENDATION

The following are recommended:-

Redundancy equipment should always should always be in place in case of equipment damage or brake down for easy replacement without any downtime.

Training of staff should be given adequate attention especially on VSAT and Wireless Technology.

State of the earth equipment/latest technologies should always be sourced to update and upgrade existing ones.

REFERENCE

1. MCSE WINDOWS 2000 NETWORK ADMINISTRATION BY MARK MINASI

2. DESIGN OF METROPOLITAN AREA NETWORK (MAN) BY GS TELECOM
3. DESIGN OF WIDE AREA NETWORK (WAN) BY GS TELECOM
4. COMPUTER STUDIES BY C.S FRENCH
5. THE COMPUTER AS A PRODUCTIVITY TOOL IN EDUCATION BY RICHARD C. FORCIER
6. HABIB NIGERIA BANK PLC. INFORMATION TECHNOLOGY AND SYSTEMS NEWS LETTER 2003.