बैंकों के लिए संचार नेटवर्क और स्विफ्ट कार्यान्वयन संबंधी समितियों की रिपोर्ट

REPORT OF THE COMMITTEES ON COMMUNICATION NETWORK FOR BANKS AND SWIFT IMPLEMENTATION

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RESERVE BANK OF INDIA
MANAGEMENT SERVICES DEPARTMENT
CENTRAL OFFICE, BOMBAY 400 023.

नवम्बर 1987
NOVEMBER 1987

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Foreword

The Reserve Bank has been taking several steps for the upgradation of technology in the banking industry with a view to improving customer service. Phased computerisation of bank operations, computerised settlement of clearing house operations at major centres and introduction of magnetic ink character recognition technology for computerised processing of cheques in the metropolitan centres are some of the steps taken in this direction. Banking involves movement of funds across the country and beyond the frontiers. It also involves collection of data relating to banking transactions, consolidating them and using the information for different purposes such as decision making, control of operating centres and policy making by banks and others. Banking transactions take place at numerous branches spread throughout the country and for the quick movement of data relating to banking transactions, efficient communication facilities are necessary. The availability of dependable communication facilities would help in providing improved banking service to customers. Recognising the need for quick receipt and despatch of messages and data as well as on-line exchange of information among different banks and different offices of the same bank for various purposes, a Committee was constituted by the Reserve Bank under the Chairmanship of Shri T.N.A.Iyer, former Executive Director of the Bank to recommend a suitable communication network for banks in India. Government Departments (Banking Division, Department of Electronics, Department of Telecommunications), Indian Banks' Association and a few banks were represented on the Committee. The Committee also considered the modalities of implementation of SWIFT in India. Shri Iyer and the other members of the Committee have considered the matter in great depth and made useful and comprehensive recommendations towards the setting up of an efficient communications network for banks. The Reserve Bank is grateful to Shri T.N.A. Iyer and his colleagues for this valuable Report. It is hoped that the BANKNET project which will serve the Indian banking (commercial and cooperative) industry and all financial institutions and the participation by Indian banks in SWIFT as envisaged in the Report of the Committees on Communication Network for Banks and SWIFT Implementation would be realised soon and would result in better service to customers.

Reserve Bank of India
Bombay, 9.5.1988.

C. RANGARAJAN
Deputy Governor

REPORT OF THE COMMITTEES ON COMMUNICATION NETWORK FOR BANKS AND SWIFT IMPLEMENTATION

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Abbreviations used

ACH - Automated Clearing House, New York

ASYNC - Asynchronous

BACS - Bankers Automated Clearing Services, London

BISYNC - Binary synchronous

BNA - Burroughs Network Architecture

CCITT - International Telegraph and Telephone Consultative Committee, Geneva

CHAPS - Clearing House Automated Payment's Services, London

CHIPS - Clearing House Inter-bank Payments System, New York

CPU - Central Processing Unit

DEC - Digital Equipment Corporation, USA

DES - Data Encryption Standard

DOT - Department of Telecommunications, Government of India

EFT - Electronic Funds Transfer

EPABX - Electronic Private Automatic Branch Exchange

ES - Earth Station

FE - Foreign Exchange

FEP - Front End Processor

FOB - Free on Board

FRBNY - Federal Reserve Bank of New York

HO - Head Office

HW - Hardware

IBA - Indian Banks Association

IBAR - Inter Branch Account Reconciliation

IBM - International Business Machines Co.

ICICI - Industrial Credit and Investment Corporation of India

ICL - International Computers Ltd.

IDBI - Industrial Development Bank of India

IFC - Industrial Finance Corporation of India

INR - Indian Rupees

ITC - Irwing Trust Co.

KB - Kilo Bytes

KBPS - Kilo Bits Per Second

M - Metre

MHT - Manufacturers Hanover Trust

MICR - Magnetic Ink Character Recognition

MIS - Management Information System

MO - Main Office

NABARD - National Bank for Agriculture & Rural Development

NYCH - New York Clearing House

OCS - Overseas Communication Service

OSI - Open System Interconnection

PABX Private Automatic Branch Exchange

PAD Packet Assembler/ Disassembler

PSS - Packet Switched Stream (of British (Telecommunications)

RBI - Reserve Bank of India

RO - Regional Office

SAIL - Steel Authority of India Ltd.

SCPC - Single Channel Per Carrier

SFC - State Financial Corporation

SFT - Store and Forward Telegraph

SNA - System Network Architecture (of IBM)

STS - SWIFT Terminal Services

SW Software

SWIFT Society for Worldwide Inter-bank Financial Telecommunications

SYNC Synchronous

TDMA Time Division Multiple Access

TID - Terminal Identification Device

UK - United Kingdom

US - United States of America

VHF - Very High Frequency

ZO - Zonal Office

CHAPTER 1

Introduction

The multifold increase in the volume of cheque collection business and the number of branches of banks gave rise to the need for mechanical processing of cheques and payment instruments in the clearing houses, particularly in the metropolitan centres. As recommended by a Working Group appointed by the Reserve Bank of India, cheque processing has been mechanised at Bombay and Madras with the help of computers and cheque reader sorter systems. Similar processing will be extended to Delhi and Calcutta soon and to more centres progressively. The growth of the banking industry, the diversification of its activities in the seventies and the requirements of information systems for administration, control and policy formulation gave rise to the need for mechanisation and computerisation. These requirements were studied by the Committee on Mechanisation in Banking Industry appointed by the Reserve Bank of India under the Chairmanship of Dr. C. Rangarajan, Deputy Governor of the Reserve Bank of India. Mechanisation and Computerisation in banking industry is proceeding apace in a planned manner, pursuant to the recommendations of the Committee. Several important branches of banks have been mechanised and a number of minicomputers have been installed in zonal/regional office of banks; more branches and zonal offices will be mechanised/computerised in the next 2 years; by then Head Offices of banks will also have larger computers as envisaged by the Committee.

Use of communications for data transmission and networking of computers is, however, practically non-existent. In the absence of quick communication facilities, information regarding movement of funds (banks' own, customers', etc.) reach destinations late resulting in inefficient use of funds; data is transmitted by paper which is a slow and costly method since the papers have to be handled at several stages. Recognising the need to improve communication for (a) near instant receipt and despatch of digital, textual and other messages, between different offices of a bank and also different banks and (b) on line sharing of information amongst different banks as well as different offices of the same bank for prompt decision making, a Committee was constituted under the Chairmanship of Shri T.N.A. Iyer, Executive Director, Reserve Bank of India to recommend a suitable domestic communication network for banks in India.

Banks recognised the need for better communication to facilitate international transactions and foreign exchange business. They, therefore, desired to join the Society for Worldwide Interbank Financial Telecommunications (SWIFT). The Government of India approved in principle the proposal of banks in India becoming members of the SWIFT for availing of their communication facilities for sending and receiving international banking messages. A SWIFT Implementation Committee chaired by Shri T.N.A. Iyer, Executive Director, Reserve Bank of India and consisting of representatives of Reserve Bank of India, Government of India and banks was constituted by the Reserve Bank of India to work out the modalities for the implementation of the proposal. In view of the links between the subject matters under consideration of the Implementation Committee and the Committee on domestic communication network, they were reconstituted by the Reserve Bank of India in June 1987 as Committees with identical membership so that both matters could be discussed when meetings were held. A list of members of the Committees is given below:

Chairman	1.	Shri T.N. Anantharam Iyer Executive Director Reserve Bank of India
Members Representing RBI	2.	Controller, Exchange Control Department
	3.	Chief Officer, Department of Banking Operations & Development
	4.	Representative from Legal Department
	5.	Officer-in-charge, Management Services Department
	6.	Director, MSD (Member Secretary)
Government of India		
Banking Division	7.	Shri N. Balasubramanian, Director (BO)

Department of Electronics	8.	Dr. K.K. Bajai, Additional Director
Department of Electronics	9.	Dr. N Vijayaditya, Additional Director
Department of Telecommunications	10.	Shri V. Babuji, Deputy Director General, OCS
	11.	Shri Y.S. Rao, Deputy Director, TRC
	12.	Shri B.A.G.S. Rama Sarma, Deputy Director, TRC
Ministry of Home Affairs	13.	Representative from Home Ministry
Indian Banks' Association	14.	Shri N.S. Pradhan, Secretary
CMC	15.	Shri Dipak Basu, Corporate Manager, Indonet
Banks		
State Bank of India	16.	Shri Supriya Gupta, Chief General Manager
Punjab National Bank	17.	Shri D.K. Gupta, General Manager
Allahabad Bank	18.	Shri P.K. Das Gupta, General Manager
Corporation Bank	19.	Shri K.R. Shenoy, General Manager
Central Bank of India	20.	Shri S. Subramaniam, General Manager

SWIFT Implementation Committee - Terms of Reference

(1) To identify and examine areas requiring co-ordination with -

- (i) banks;
- (ii) concerned government departments viz. Ministry of Communication, Ministry of Finance, Ministry of Home Affairs, Department of Electronics etc.
- (iii) Reserve Bank of India

(2) To examine the legalities and risks involved in electronic transfer of funds and the safeguards to be adopted.

(3) To look into the infrastructural arrangements required to be made such as installation of equipment, communication channels, domestic communication back up for branches, etc.

(4) To examine matters pertaining to import of SWIFT system e.g. import licence, etc.

(5) To examine whether the features of the Indian Switching and Communication Programmes and that of SWIFT are compatible with each other and to recommend changes/modifications, if any.

(6) To look into the standardisation of message formats to be used.

(7) To evolve a mechanism for monitoring of messages and consider the feasibility of restricting the use of SWIFT to certain categories of messages only.

(8) To examine the actual operation of the system and organisational problems that may be encountered in this regard.

(9) Any other matter incidental to the above.

Communications Network - Terms of Reference

(1) Examining alternatives available to the banks and consideration thereof with reference to feasibility, time frame for implementation and cost, based on subscribing to the existing/proposed network systems, such as-

   (i) INDONET/BANKNET developed by CMC.
   (ii) Business Subscribers Network (BSN) and/or 'VIKRAM' of Department of Telecommunications.
   (iii) Network developed by other private agencies.

(2) Determining network system for Consortia or Groups of banks and identification of the Groups or Networks for individual banks.

(3) Suggest media for communication and networking, in the context of the technologies available and the reliability thereof.

(4) Identification of items of information that will be routed through the network between the nodes within the bank, as well as external nodes.

(5) Determining the topology of the network and architecture such as:

   (i) Pattern of interconnection between various nodes within the network, alternate routing plans, keeping in view the scope for future expansion needs.

(ii) Interlinking with external and international networks such as, SWIFT, NICNET, etc.

(6) Determine the support required for communication processing capabilities and inter-linking very large systems at metropolitan centres for generating data base for the industry.

(7) Indicate hierarchy and number of levels at which communication and networking is required.

(8) Suggest safeguards for data security - hardware as well as software.

(9) Imparting user training, development of software, protocols, interface, compatibility, etc.

Meetings of the Committees were held on 23rd July 1987 and 17th November 1987. Some of the members did not attend both the meetings. In some cases the members were represented by some of the officials of their organisation. In addition to the members, Shri V. Ananthakrishnan, Chief Executive, Foreign Exchange Dealers Association of India and Shri P.G. Damle, Retired Director General (OCS) and Consultant of Indian Banks' Association attended the meetings by invitation and actively participated in the deliberations. Inaugurating the meeting on 23rd July 1987, Dr. C. Rangarajan, Deputy Governor, Reserve Bank of India gave direction to the Committees and set out the approach. During subsequent discussions, Dr.Rangarajan gave the Chairman valuable suggestions in regard to the work of the Committees. The Member Secretary of the Committee Shri S. Venkateswaran, in consultation with Dr.K.K. Bajaj, Additional Director, Department of Electronics and Shri Dipak Basu, Corporate Manager, INDONET, CMC, had submitted a working paper on the communication network for banks and SWIFT communication. The Chairman also had extensive discussions with the officials of the Indian Banks' Association, Foreign Exchange Dealers' Association of India (FEDAI) and other Members of the Committees on the subject. A small Committee of officials of banks, Indian Banks' Association, and FEDAI discussed the question of message formats for SWIFT and communication network for banks and had expressed their views about the same. The Chairman and a few members of the Committees participated in the SWIFT International Banking Operations Seminar, observed the operations of SWIFT and some private/joint communication networks in some banks in the U.S and the U.K. Dr. K.K. Bajaj, Additional Director, Department of Electronics, Government of India has furnished a report on SWIFT implementation and communication network for banks. Shri Dipak Basu, Corporate Manager, INDONET, CMC and member of the Committee broadly studied the feasibility of a domestic communication network for Indian banks. The deliberations at the meetings of the committees, observations of members of SWIFT network operations in the U.S. and U.K., the working paper of the Member secretary, the reports of Dr.K.K.Bajaj, and Shri Dipak Basu, mentioned earlier, have been considered in drawing up our report which follows. (Chapters 2 to 8).

Acknowledgements

The Committees extend their most sincere thanks to Dr.C.Rangarajan, Deputy Governor, Reserve Bank of India who was kind enough to inaugurate the joint meeting of the two Committees and set out the approach and methodology for their work.

The Committees are grateful to Shri N. Balasubramanian, Director, Banking Division, Dr.K.K.Bajaj and Dr.N.Vijayaditya, Additional Directors, Department of Electronics, Shri V. Babuji, Deputy Director General, OCS and Shri B.A.G.S. Rama Sarma, Deputy Director, Telecommunication Research Centre who attended the meetings/discussions and unhesitantly placed their views on the various issues involved.

The Committees also express their thankfulness to the Indian Banks' Association and the Foreign Exchange Dealers' Association of India who readily responded to our requests and participated in the meetings and discussions. Particularly, our thanks are due to Shri N.S. Pradhan, Secretary and Smt. Das Gupta, Executive, Management Services, of the Indian Banks' Association and Shri Ananthakrishnan, Chief Executive, Foreign Exchange Dealers' Association of India.

We are thankful to the Reserve Bank of India, Management Services Department for the secretarial assistance provided to the Committees; particularly we wish to place on record our sincere appreciation of the assistance rendered to the Committees by Shri S. Venkateswaran,

Director, Management Services Department, Shri S.R. Khopkar, Assistant Director, S/Shri M.Y. Bhandary, K. Sivadas, O&M Oficers and the excellent secretarial help given by S/Shri A.J. Ghag, Y.S. Nikhare, K.P. Mayya and S.K. Kunji.

Rest of us in the Committees would like to make a special mention of the efforts put in by Shri T.N. Anantharam Iyer, Chairman of the two Committees in guiding the work of the Committees and in the preparation of the report.

CHAPTER 2

Communication Network for Banks

2.1 Present stage of Computerisation and Communication in banks in India

Computerisation :

In India mechanisation in banks in a planned way has just started. Mechanised cheque processing based on MICR technology has been introduced in Bombay and Madras Clearing Houses and will soon be introduced in the remaining two metropolitan centres of Delhi and Calcutta.

Ledger posting mechanisation has also started in a planned way recently. Over 2700 machines have been operationalised in some of the branches of the banks. Some of the book-keeping and information system functions in the zonal office/regional office of the banks have been computerised through the installation of mini computer systems.

The total number of branches of all scheduled commercial banks in the country is approximately 53,500. The number of systems that are expected to be installed for ledger posting by 1989 is about 5700. Very few banks have a mainframe computer in their Head Offices. A Committee has recently finalised the specifications for mainframe computer system required for Head Offices of the banks. It will take at least another year before the systems in the Head Offices of the banks are in position.

2.2 Communication:

Banks in India mostly use mail, telegraph and telex for inter-communication between their branches and others. A few banks have established Store and Forward Telegraph (SFT) systems to connect their important branches with their Head Offices. Bank of India and Central Bank of India are operating Store and Forward Telegraph Systems connecting their important offices/branches. State Bank of India also propose to introduce a communication network to connect their Regional Offices, Local Head Offices and Central Office. Use of telecommunications for data transmission and networking of computers is practically nonexistent.

In the absence of quick communication facilities information regarding movement of funds reaches destinations late delaying the benefit of funds to beneficiaries; results in inefficient use of funds; delay in receipt of advices makes interbranch reconciliation of accounts difficult. Banks in India provide to their customers basic banking service of deposits and withdrawals only at the branch where the account is maintained and not at any other branch. Data is transmitted nearly always by paper resulting in delay and high cost due to handling at several stages.

2.3 Need for better communication facilities

Efficient communication facilities would enable banks to overcome many of the existing shortcomings referred to above and improve customer service.

It may seem like a far fetched idea to think about a network for banks given the scenario of bank mechanisation in the country as outlined above. Though the total number of branches of banks is large, 100 centres account for nearly 10,000 branches of scheduled commercial banks. Though this number represents about 20% of their total branches, in terms of deposits and advances they account for 60% and 65% of the respective totals. Connecting the branches of banks at these centres with their Regional/ Head Offices will go a long away to meet their data transmission requirements. Also, it has to be planned now. The proposed connection to SWIFT (cf Chapter 5) makes it necessary that the countrywide network to connect the banks for domestic interbank fund transfer be planned now. It is only logical that the SWIFT messages do not end up merely in the Head Office from the international correspondent bank and then transferred from the Head Offices to the respective branches by slower methods of telex, telephone or ordinary mail. If this were to happen, the very purpose of connecting to SWIFT would be defeated.

Many of the banks in the West had their independent communication network to connect their branches with their Central computer and then felt the need to transmit messages, transfer funds to one another across the nations which resulted in the creation of SWIFT.Thus, there were a number of domestic networks and, in addition, the SWIFT connection -many having different message formats necessitating efforts and expenditure on reformating messages if transmission through more than one network is involved. Given the resource constraints in India and the need to ensure that the limited national telecommunication resources are not pre-empted by individual organisations developing independent networks, it is not desirable for each bank to try to have a communication network of its own. A common communications network needs to be planned on a co-operative basis within the country much like the common international SWIFT which is in operation on the basis of co-operation between the international banks. Such a network would serve the purpose of domestic interbank fund transfer and also facilitate communication through SWIFT.

A common network for Indian banks will also help to check the growth in the cheque volume, particularly in metropolitan centres in the wake of increased business. Electronic fund transfer can substitute for the credits to be made by one bank to another. The common network will help in introducing automated clearing facilities which in turn will help in effecting bulk payments of governments and large companies and corporations.

2.4 Developments elsewhere

Most of the large banks in the Western countries have independent communication networks. Historically these have evolved from the technology of 1970s of centralised computer system in the Head Office with branches connected to it in the form of a star network, to the packet switching network of recent years which are based on distributed nodes for transmitting messages. Many of them today have large packet switched communication networks based on X.25* protocol. The branches are connected to the Head Office computer systems and to a number of special purpose dedicated computer systems located in the central computer centre performing

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* X.25 is a standard recommended by the International Telegraph and Telephone Consultative Committee for interface between Data Terminal Equipment and Data Circuit terminating Equipment operating in Packet mode and connects Public Data Network by dedicated circuit. This interface is useful when equipments supplied by different vendors are used.

specialised functions such as the payments system, automated teller system and credit card systems. The automated teller machines spread over the entire country are also connected by the same network to the main book keeping and house keeping computer systems. Credit card handling, on-line banking, home banking etc. are some of the other areas that are managed through the same networks. For a better insight into the organisation of some of these networks, brief notes are included in the Annexures on the following:

CHIPS, CHAPS, FEDWIRE, Manufacturers Hanover Trust, Irving Trust Co., Midland Bank, National Westminister Bank, BACS.

2.5 Communication System Characteristics

Before considering a communication network for banking industry, it may be useful to look at the characteristics of a communication system. A communication system typically links Input/Output (I/O) devices such as computer terminals, printers at remote locations with one or more central computers. Modems, front-end processors and other communication processors etc. are used to bridge and control the different data communication equipment. Modems are used to permit the system to switch back and forth from computer digital data to analog signals that can be transmitted on voice communication lines, a front-end processor is a (micro/mini) computer used to monitor and control the data transmission channels and the data being transmitted, it relieves a main computer of a number of functions required to interact with and control the communications network; concentrators/multiplexers reduce transmission costs by receiving terminal input from many low speed lines and then concentrating and transmitting a compressed and smooth stream of data on a higher speed and a more efficient transmission channel; message switcher receives and analyses data messages from points in the network, determines the destination and the proper routing and then forwards the messages to other network locations. Data to be sent to a computer are entered on a remote terminal. The data in digital form are sent in a serial fashion to a nearby modem to be converted into an analog signal. The converted data are then transmitted over telephone lines to another modem located near the computer. This modem, converts the analog signal back into a digital form. The data in digital form are sent to a front-end processor which may check them for possible errors and then temporarily store them or route them to the computer for immediate processing. The same route is followed when output information is sent from the computer back to the remote location. The entire data communication activity is under the control of programmed instructions stored in communication processors and/or the computer.

The transmission media can be telephone lines (voice graded lines) of the public network or lines leased for the dedicated use of an organisation or party. The lines may be coaxial cables (groups of specially wrapped insulated wire lines), microwave channels (using very high frequency radio signals and repeater stations located about 25 miles apart for relaying the signals) or satellite channels (where the geostationary satellite acts as a reflector by accepting signals from one point on earth and returning the same signals to some other point on the earth). Fibre-optic cables now available permit huge amounts of data to be routinely transmitted at the speed of light through tiny threads of glass or plastic.

Sometimes the data are temporarily stored and organised near the point of origin into 'packets' of characters and transmitted at high speed over common carrier channels to a location near the destination point where they are reassembled into complete message for transmission to the destination. This method is known as packet switching.

Communication systems are characterised by:

Random input: The system is more or less designed to service the whims of the remote terminals of end-users

Remote input and/or output: Remote branches/organisational units can access and update central computer/s via communication facilities.

Immediate transaction processing: In a communication system each transaction is processed individually and immediately when it occurs.

Multiple simultaneous users: The systems are generally designed to serve a number of users at remote terminals (may be different terminals in the same office, different branches or even different banks).

On-line: Input data from the remote terminal enters the computer facility directly from the point of origin or in which output data is transmitted directly to the point where it is used.

2.6 Proposed Network - BANKNET

The proposed network should be a co-operative network (could be called "BANKNET") jointly owned by the Reserve Bank of India and public sector banks. The private sector and cooperative banks (including State, Central, Urban and Land Development banks) and financial institutions (such as IDBI, NABARD, ICICI, IFC, SFCs, EXIM Bank etc.) may also be allowed to use the same network on terms and conditions to be specified by Reserve Bank of India and the network implementation group. The ultimate aim of the BANKNET would be to provide communication access to all the branches in the country. The branch office systems of banks should be able to communicate with their Head Office systems.

2.7 Use of BANKNET - Applications

The processing capacity of the 4 computer systems with the Reserve Bank of India could be utilised to handle the following applications:

(i) Quick settlement in the RBI/banks of the following, leading to efficient use of funds

  (a) government transactions taking place at branches of public sector banks through their link/main offices

  (b) inter-bank fund transfers on their own and on customer's account

  (c) inter-branch fund transfers of banks on their own account and on account of customers/public

  (d) currency chest transactions.

(ii) Improvements in payments system by facilitating automated clearing services (similar to Bankers Automated Clearing Services - BACS[1]) in the U.K.

(iii) Improvements in service to customers by permitting them to withdraw/ deposit at several branches of the banks instead of restricting such transactions to the account maintaining branch as at present. This would be possible since the branch where the facility is sought can communicate with the account maintaining branch for collecting/passing on information concerning the account.

(iv) Maintenance of data bases of common interest from which information can be retrieved by banks: e.g.

- industry/business profiles
- profiles of geographical areas useful for lead banks and others
- country profiles useful for foreign exchange business

(v) Data transmission between banks and RBI and between Zonal/Regional Offices and Head Offices of banks. This would be possible as all of them will be interconnected in the shared common network.

(vi) Access to SWIFT international network from different centres in the country.

2.8 Phased Implementation of BANKNET

Phase 1:

The RBI has installed 3 computer systems for cheque processing in Bombay, Delhi and Madras and one more would be installed at Calcutta soon. These will form the basic hub of the network to begin with. The

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1 : BACS (Bankers Automated Clearing Services) is a limited company, jointly owned by some of the clearing banks which operates a highly efficient automated clearing service for the transfer of funds between accounts held with U.K. banking system.

Examples of the work processed by the BACS are :

i) Standing orders involving inter-bank payments and receipts;
ii) Salary payments involving a few debits to Governments/organisations but giving rise to credits to numerous accounts with various banks at different locations.
iii) Direct debits in which the customer does not issue cheques for payments but accepts the debits raised by electricity/gas/telephone, etc. authorities against his accounts and permits his bank to honour such debits.

The data for transfer of funds between accounts is submitted to BACS via telecommunication links or delivered on magnetic media. This data is processed by BACS and the processed data is used for (a) inter-bank settlement and (b) updating the customers' accounts. The introduction of BACS has done away with the need for use of cheques for the relative purposes.

computer systems are busy for cheque processing only during the night time. The systems are available for other possible usage during the day. Communication nodes may be located in these 4 cities and data bases and processing functions of common interest could be installed on these systems to make an effective network. X.25 based packet switched network may be commissioned in the first phase connecting these 4 communication nodes. The mainframe computer systems expected to be available in the Head Office of the public sector banks located in these 4 cities could be connected via leased lines to these nodes.

In the first phase inter-bank transmission of messages and the settling of inter-bank accounts could be handled on this network at the level of Head/Main Offices at these 4 centres. Electronic fund transfers between banks at these centres could also be done.

Phase 2:

In the first part of the second phase communication nodes can be located in the next 8-10 banking intensive cities such as Ahmedabad, Kanpur, Bangalore, Hyderabad, Pune, Chandigarh, Patna, Baroda etc. Mainframes of the remaining public sector banks could be connected to the nearest communication nodes located in these cities. This will cover almost all the Head Offices of the public sector banks and some of the bigger private banks. In the next part of the second phase all the State capitals and other important centres should have the communication nodes and the zonal office systems of the banks may all be attached through leased lines to the nearest communication node. (In actual implementation, care will have to be taken to ensure elimination of redundancy in connections from these zonal offices and Head Offices to the communication nodes). Moreover, the main network located in the metropolitan cities and the State capitals will have to be connected in such a way that alternative paths are always available in the event of a communication channel going down.

Phase 1 of the network can be built in a 6 month time schedule using equipment available with the Reserve Bank of India along with additional equipment required for communication networking. In phase 2, an integrated network can be developed by adding more centres covering all the public sector banks and increasing the availability and reliability of the network by using satellite and radio links, thereby enabling a nation-wide bank data communication network with the capability of connecting even remotely located offices at minimal costs. The time schedule for this network would be 3 years.

The details for realising the BANKNET are given in Chapters 3 and 4.

CHAPTER 3

BANKNET - PHASE 1

3.1 First phase communication needs

The primary objective of the interim network is to facilitate prompt exchange of operations and control information between the various RBI centres using the existing linkages. The HO systems of public sector banks may be connected to the nearest RBI centre for sending statutory reports and exchange of control and monitoring information.

The network has to cater to the major file transfer needs for applications like funds transfer, transfer of control information, summary reports, statistical data and remote data processing.

3.2 Existing infrastructure

The Reserve Bank of India has installed mainframe computers at Bombay, Madras and Delhi for cheque processing and would be shortly installing one more at Calcutta. Major RBI Centres are also linked up for telephone communication through voice grade lines leased from Department of Telecommunications (DOT) on point to point basis as shown in Fig.1. The RBI communication system includes electronic PABXs various locations for voice communication.

3.3 Network architecture considerations

(i) **Data over Voice Channels**

One of the considerations is the use of voice grade point to point links hired from DOT. The computer communications is basically data oriented and normal voice channels are very inefficient for carrying data, and are liable for breakdown, specially in the end links. With special conditioning of the voice circuits, it is possible to carry data at low speed. Typically data rates upto 2.4 KBPS are possible in the metropolitan trunk routes while the other circuits in many cases can carry data upto 1.2 KBPS only. For carrying data on voice channels, modems are required at either end of the line.

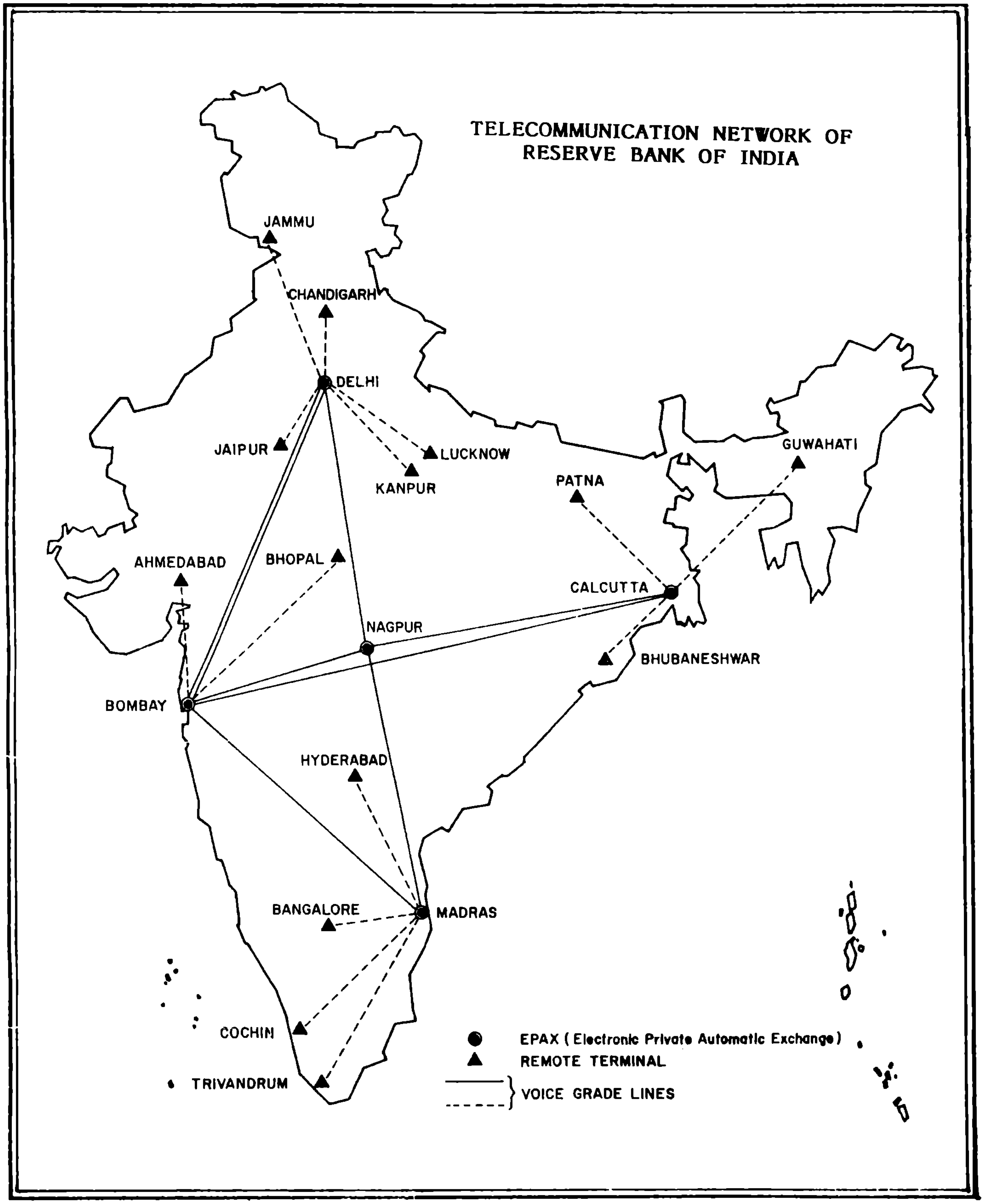

TELECOMMUNICATION NETWORK OF RESERVE BANK OF INDIA
JAMMU
CHANDIGARH
DELHI
JAIPUR
LUCKNOW
KANPUR
PATNA
GUWAHATI
AHMEDABAD
BHOPAL
CALCUTTA
NAGPUR
BHUBANESHWAR
BOMBAY
HYDERABAD
BANGALORE
MADRAS
COCHIN
TRIVANDRUM
EPAX (Electronic Private Automatic Exchange)
REMOTE TERMINAL
VOICE GRADE LINES

FIGURE I

(ii) **Use of Electronic PABX for Data Switching**

Electronic PABXs currently envisaged by RBI are designed for voice applications. Data communication employs special transmission and switching techniques. Computer communication requires error free data transmission. These can be met only with special network switching and transmission techniques. For reliable transmission, the data has to be packetised and error correction features are to be incorporated. Special data switches which can handle packets generally are used. Without these features satisfactory throughput or satisfactory information exchange in BANKNET cannot be obtained. Due to the same reasons, integrated operation of voice and data are also not possible with the usual PABX. Hence the PABX systems of RBI cannot be effectively used for the interim data network.

(iii) **Computers**

The existing machines operate with SNA (System Network Architecture) protocol. For networking purposes in a multi-machine and large network environment, special purpose Front End Processors (FEP) with SNA/X.25 protocol are needed for the existing systems.

3.4 Network architecture - Phase 1

(i) The network architecture for Phase 1 is shown in Fig.2.

(ii) In the first phase network, the data operation cannot be integrated with voice. Hence the network architecture is configured for independent data operation using the voice grade lines dedicated for data communications only. However, for remote access to a particular RBI/Centre, alternate voice/data operation is possible by switchable modems and by bypassing the PABX when data operation is desired. This can be done by physical coordination.

(iii) **For computer networking**

Front End Processors with SNA/X.25 protocol (FEPs) are required at the four nodal centres which enable the computers at the RBI to be networked through the communication links and to cater for switching and interfaces when the network has to be expanded to handle non-IBM systems.

The operation in the metropolitan network will be synchronous at 2.4 KBPS (kilo bits per second) typical. The remote access from other RBI centres to the associated metropolitan centres will be through either cluster controllers at 2400 BPS (Bits per second) or asynchronous interface controllers which operate at 1200 BPS. Modems operating at 2400/1200 BPS will be used at all the point to point voice grade channel ends near the computers. These speeds are suggested subject to capabilities of data lines provided by DOT. The remote terminals will require emulation interfaces for communicating with the available mainframes.

(iv) The four computers will be networked immediately as soon as front end processors and modems are in position. The other locations can be brought into the network as and when the remote machines are installed and communication equipment is available.

(v) For linkages with other public sector banks, separate links are required from their HO to the nearest RBI centre. At metropolitan centres these links can be directly interfaced with the FEP or Controller for synchronous or asynchronous interface, respectively, subject to approval by DOT.

(vi) Alternative routing will be possible at the four metropolitan centres through the FEPs. The SNA switching software residing in the available computers will do the switching control. No switch is included at the non-metropolitan RBI centres for switching data in the Interim network.

NETWORK CONFIGURATION-PHASE-1

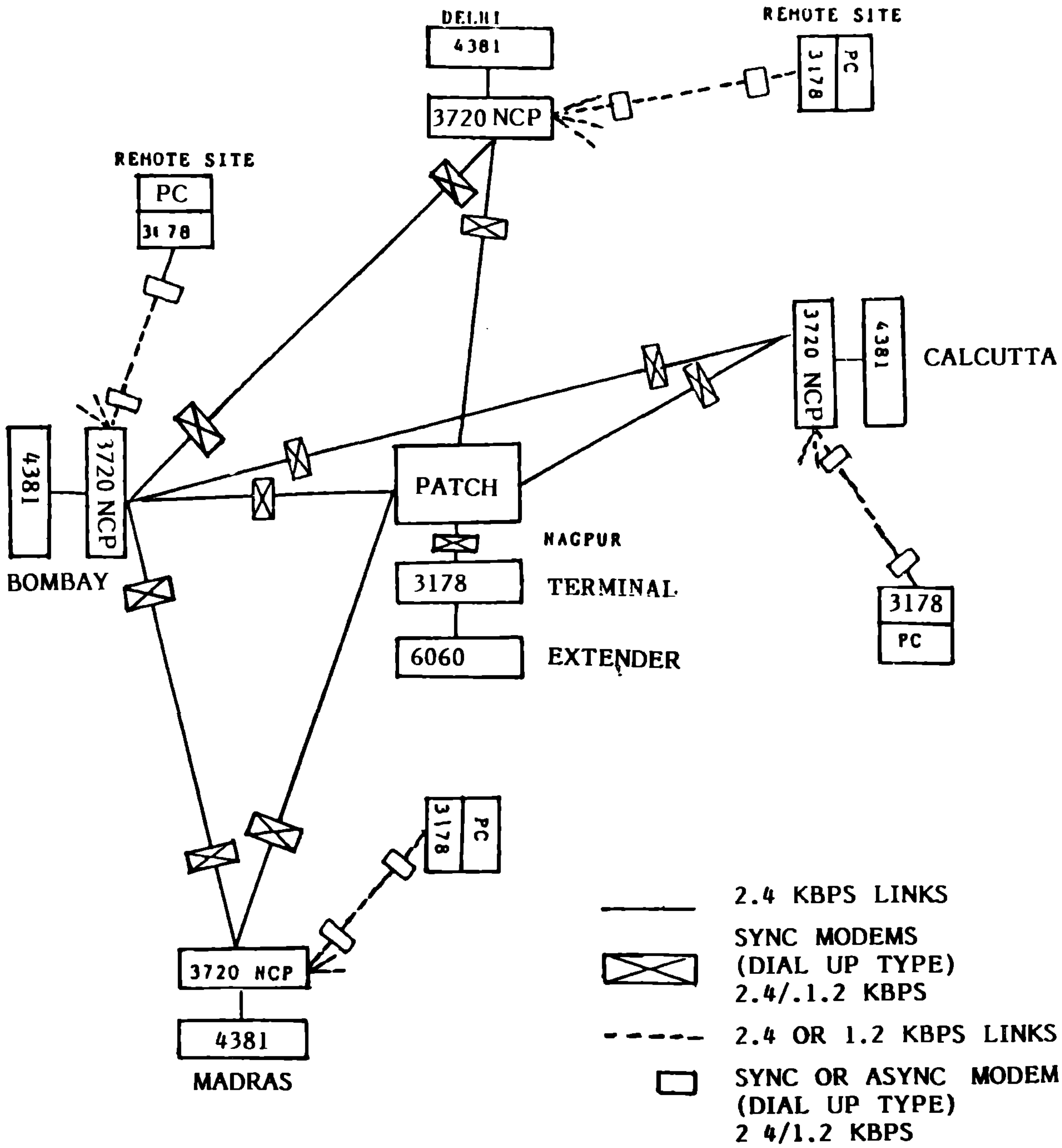


FIGURE 2

(vii) Nagpur is linked to Bombay, Delhi, Madras and Calcutta under the existing RBI infrastructure. Link strapping at Nagpur can provide alternate routing to Bombay-Delhi, Bombay-Madras and Bombay-Calcutta linkages providing network redundancy of the DOT links supporting 2.4 KBPS data operation in tandem connection.

3.5 Summary of Additional Hardware and Software

For realising the interim network, the hardware and software to be procured are listed in Table-1.

As the existing computers which would form the hub of the network are from the IBM, it is necessary that wholly compatible front-end processors with NCP (Network Control Program) terminals, cluster controllers etc., should be obtained for smooth functioning. These are necessary in the first phase and form the essential HW/SW communication interface in the Network-Phase 2 also.

The modems to be installed will be synchronous 2.4 KBPS or asynchronous 1.2 KBPS with dial up capability.

Data encryption will be line type units for use upto 64 KBPS custom designed or firm commercial sources.

Table 1

Summary of Additional HW and SW for Interim Phase of BANKNET

Location	IBM HW/SW	Modem	Encryption
Bombay	3720/NCP	4	4
Madras	3720/NCP	2	2
Delhi	3720/NCP	2	2
Calcutta	3720	2	2
Nagpur	3178	1+1	1+1
Other places (each location)	3274/3178 on each terminal	1	1

Budgetary Cost Estimates

The budget requirement for the four metropolitan cities and Nagpur network is estimated as follows:

Sl. No.	Sub-System	Qty.	Estimated Cost (FOB)
1.	IBM 3720	4	US$ 200,000 = INR 25.00 lakh
2.	3178 SW	1	US$ 2,000 = INR 0.25 lakh
3.	2.4 KBS Dial up Modems	12	US$ 24,000 = INR 3.00 lakh
4.	Encryption Units	12	US$ 36,000 = INR 4.5 lakh
5.	System Engineering Installation & Integration for above		INR 2.5 lakh
6.	Testing & Commissioning		INR 2.5 lakh
7.	Spares	10%	INR 3.5 lakh
	TOTAL (FOB)		INR 41.25 lakh

(Line leasing costs not included in the estimate.)

For inclusion of other stations the estimated cost for each additional station is as follows:

Sl. No.	Sub-system	Qty.	Cost (FOB)
1.	3274 Cluster Controller	1	US$ 6,000 = INR 75,000
2.	3178 SW emulation	As required 1/terminal	US$ 2,000 = INR 25,000
3.	1.2 KBPS dial up Modem	2	US$12,000 = INR 24,000
4.	Encryption Unit	2	US$ 6,000 = INR 75,000
5.	System Engineering, installation, integration testing & commissioning		INR 32,500
	Total (FOB)		INR 2,31,500

Time Schedule

(i)	Detailed specs	:	15 days
(ii)	Procurement/development of HW/SW	:	5 months
(iii)	Installation, Integration & testing	:	15 days
	Total	:	6 months

This schedule is based on usual procurement schedules and is subject to obtaining clearances from Indian and US Governments for import of the products.

CHAPTER 4

BANKNET - PHASE 2

4.1 Objectives

(i) In the late 1990's the banks will use computer terminals in a very extensive way. Functional processors, dedicated application processors and central computing will exist in harmony. A head office of a bank will have one or more large computers and other locations smaller compatible processing power. The required network architectures must provide for a combination of independent and interconnected computing capabilities in Head Office (HO) Zonal/Regional Office (ZO/RO) and branches The proper combination of standalone systems, decentralised computers and centralised processing will enable the banks to keep pace with their growth of operational needs.

(ii) Access to SWIFT, a currently functioning international network, will enhance the Indian banks capability in foreign trade and foreign exchange transactions. This access which will be available at Bombay (the international gateway for India) must be made possible from bank locations in other parts of the country as well.

(iii) The BANKNET is intended to provide the wide area communication facilities within the country and computer communication capabilities between HO's and their ZO/ROs and from individual banks to RBI centres and between banks. This network facility will also be capable of being extended to branch level for a number of centres at a later point of time.

(iv) The BANKNET is intended to facilitate faster and high volume communications and provide unlimited real-time, interactive and distributed processing capabilities in a computerised environment. The BANKNET is also intended to provide these communications with a very high order of reliability and in a cost effective way and capable of being implemented modularly.

4.2 Coverage and Information Flow:

(i) The banking sector is one of the largest in the country. The RBI is located in about 20 locations.

(ii) Head Offices of banks are responsible for corporate planning, policy formulations and monitoring of institutional performance. The Zonal/Regional Offices of banks are organised on a geographical basis depending on concentration of branches in the respective areas. These offices exercise control over branch operations, ensure follow-up of the instructions and monitor returns etc. The branches account and balance customer transactions.

(iii) The information flow in the network can be categorised broadly into control information/MIS and fund transfer/financial transactions.

(a) **Control Information and MIS**

The flow of information is generally organised as follows:

Branch - Zonal/Regional Offices

- Credit information
- Statistical returns
- Instructions
- MIS

Zonal/Regional Offices - Head Offices

- Statistical information
- Statutory returns
- Credit information
- Policies & Instructions
- MIS

Head Offices - RBI

- Monitoring reports
- Deposit & credit information
- Policy instructions

(b) **Fund Transfer and Financial Transactions**

The exchange of information will comprise:

Bank - RBI

- Funds transfer on Government business
- Foreign exchange
- Inter-branch account reconciliation
- Currency chest transactions

(iv) About 10,000 branches spread over 100 centres account for a major portion of banks' business (60 to 65% of deposits/ advances). Further, a detailed study of a major public sector bank shows that two types of information, Inter Branch Accounts Reconciliation (IBAR) and statistical returns account for about 90% of total information transmitted in the network and a fraction of the number of branches (360 out of 1850 in the case of this bank) accounts for nearly 90% of total transactions. The banks' computerisation plans also show that the mini computers installed at Zonal/Regional Offices of public sector banks will go upto about 400 in the near future.

(v) The BANKNET will achieve its major objectives if it could cover about 100 centres in the country in terms of information exchange needs.

Traffic analysis

An attempt to carry out a preliminary traffic analysis was made but was not pursued because of lack of data. For a thorough network design a complete traffic estimate has to be arrived at by making realistic assumptions about growth, sources and geographic coverage.

4.3 Shared banking network

The shared banking network is considered optimum and cost effective. This means the network will be the common carrier for information exchange of various banks for their internal use as well as for interbank data communication.The network principally provides for data communications only while voice communications is essentially to be carried through public telephone system.

Logically separate network for banks

The shared network will have logical independence i.e. the network hierarchy for the individual banks will be still available and controlled by software as mutually agreed. The network would be such that every bank would be able to view it as logical network of its own, while being in a position to access the network for inter-bank and international bank transactions.

The logical network architecture for BANKNET is shown in Fig.-3.

Network configuration

(i) It is considered that the BANKNET can be optimised with the following :

(a) Graded use of satellite, radio, fibre and cable links

(b) Star network architecture with multiple nodes and a central hub.

(c) Central network monitoring and control.

The network configuration is illustrated in Fig.-4

(ii) Each node is a switching centre which links a cluster of bank branches/Zonal/Regional offices through radio links or leased/dial up lines. The nodes are inter-connected through a network controller at the central node which provides switching and access control. Transmission is provided by satellite links. For achieving the required network throughput, as many carriers on the satellite as required can be added depending on traffic load.

(iii) CCITT (International Telegraph and Telephones Consultative Committee) X.25 network protocol will be used. This is the standardised international protocol which has built-in features for data packetising, routing, error correction and network administration.

(iv) The packet transmission, switching and access control techniques ensure optimal combination of efficient data transfer and minimum delay.

INTEGRATED LOGICAL BANKNET ARCHITECTURE

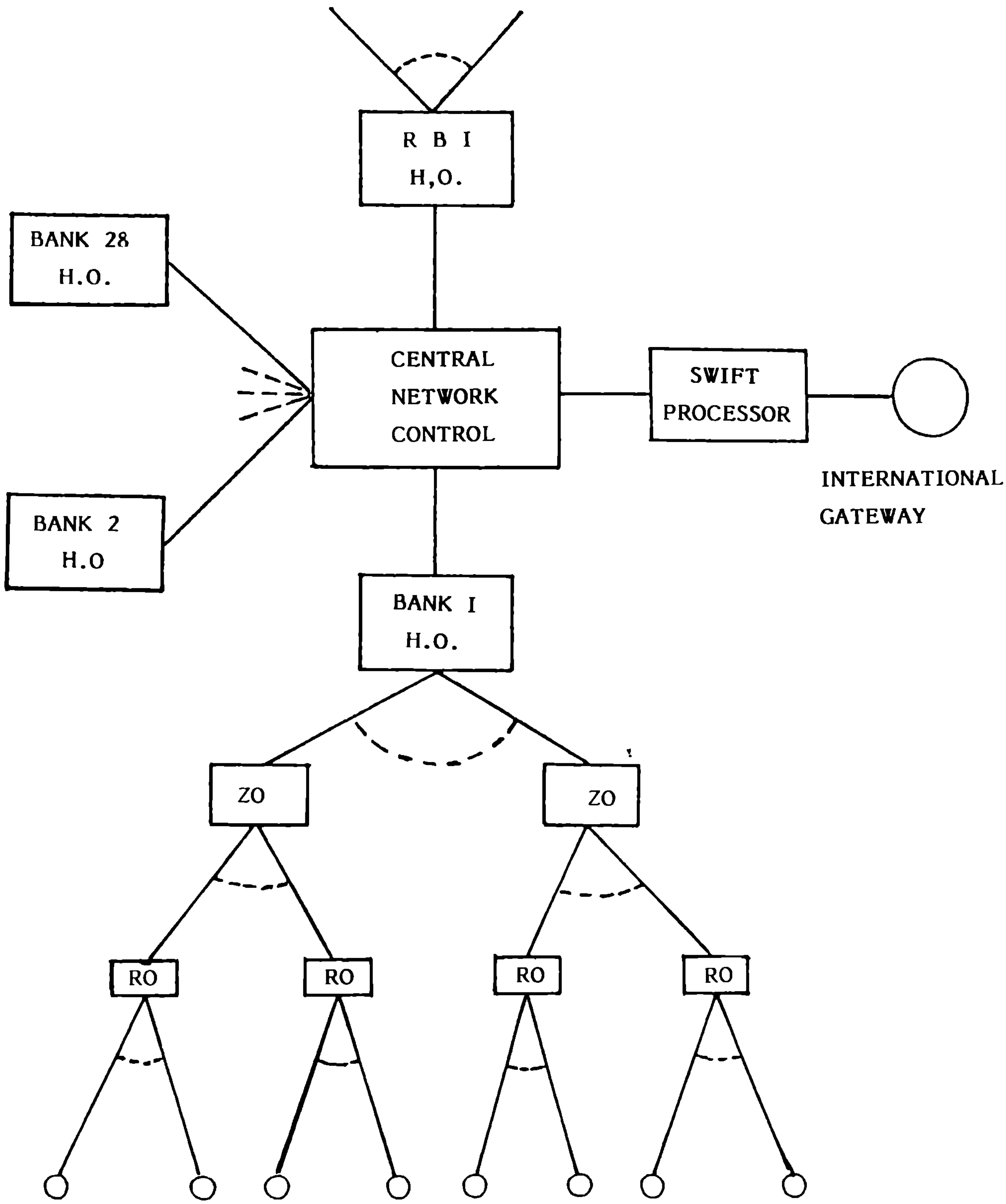
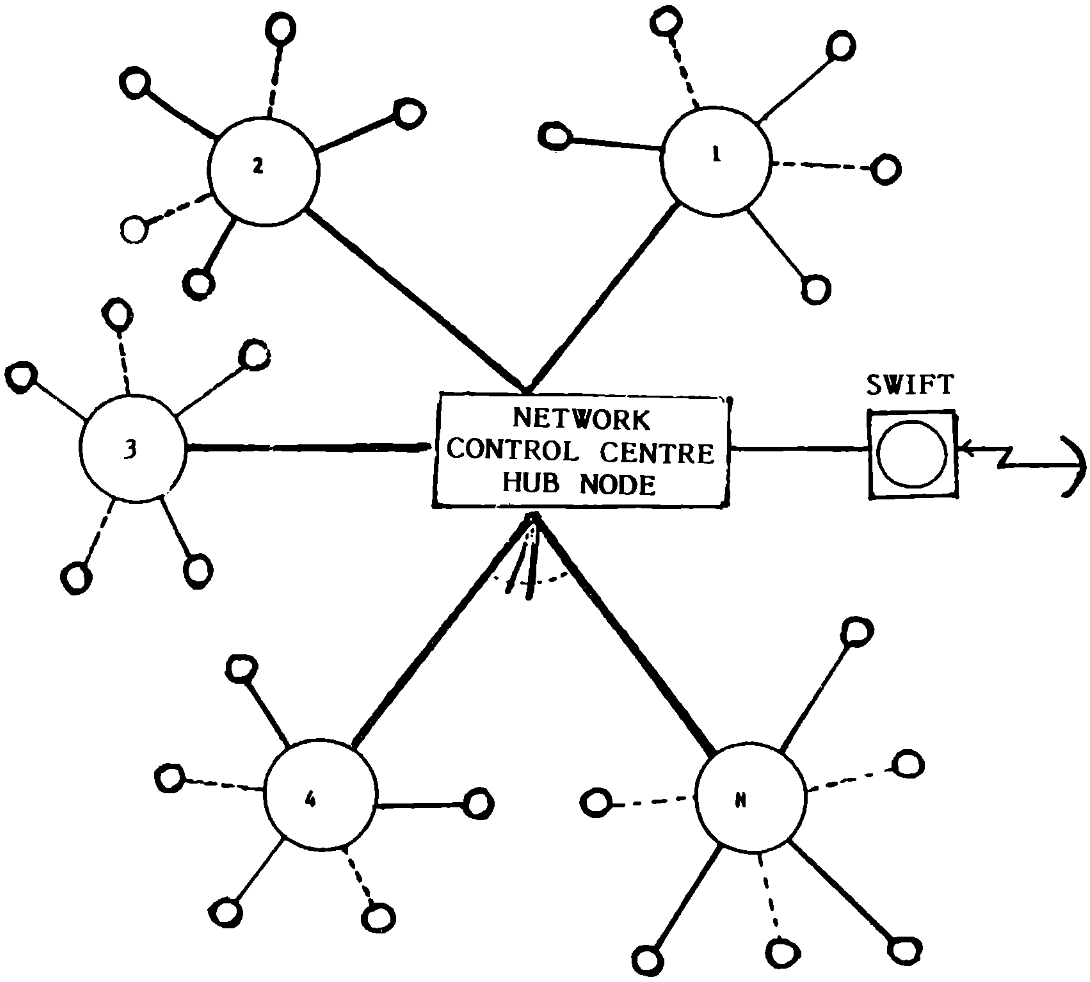


FIGURE 3

BANKNET NETWORK CONFIGURATION



NMC — NETWORK MONITOR AND CONTROL CENTRE

SWIFT GATEWAY

SWITCHING NODES

TERMINAL LOCATIONS

SATELLITE LINKS

RADIO LINKS

CABLE/LEASED LINKS

FIGURE 4

4.4 Communication System

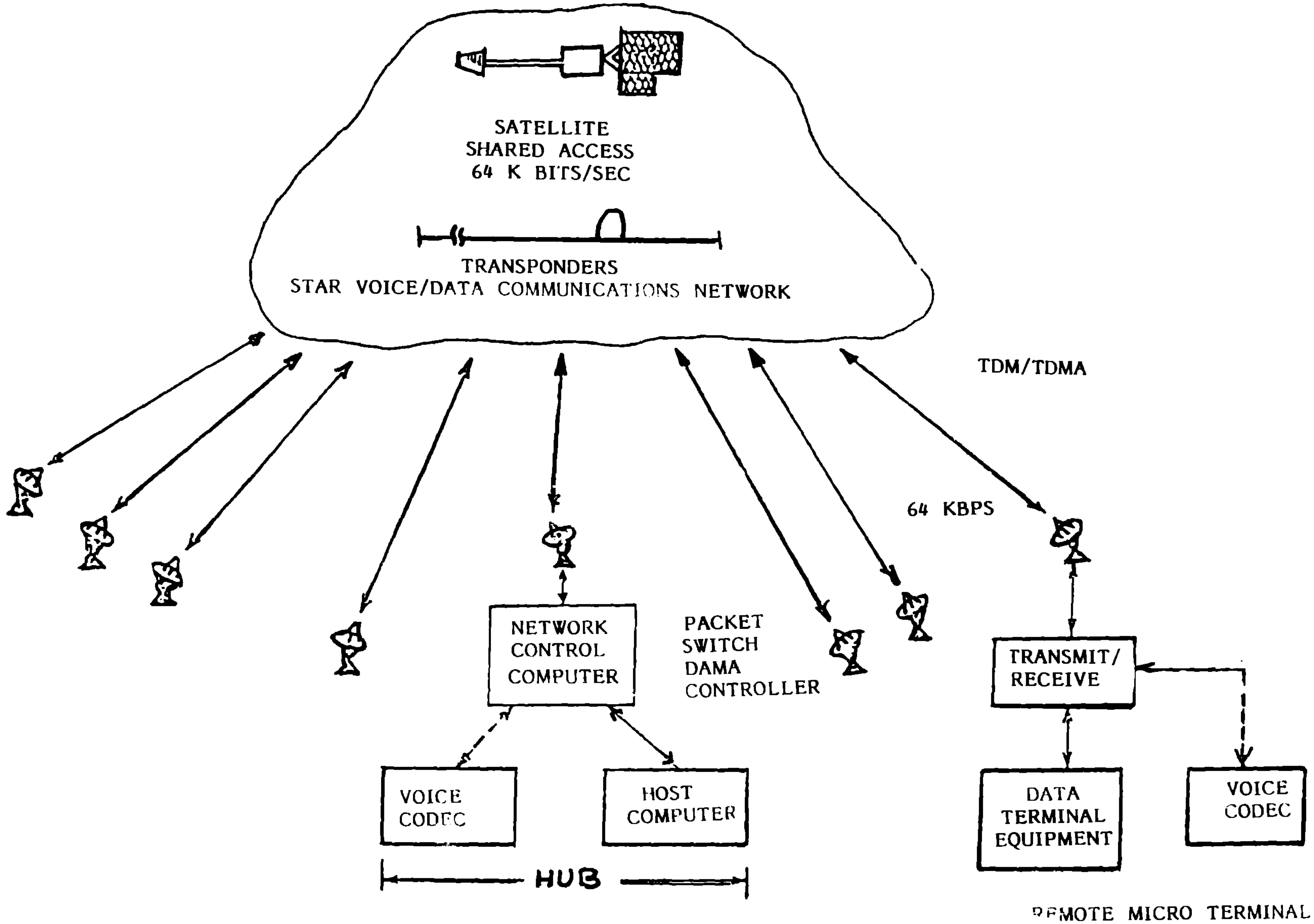
Backbone Satellite system

(i) The backbone network for BANKNET will be satellite based, connecting the major nodal centres through a central network controller. The satellite communication system is cost effective for this application due to the large geographical spread of the network, the high data rates required and multipoint connectivity. Digital transmission using packet switching, forward error correction, half rate encoding and Time Division Multiple Access (TDMA) techniques will be used to get error free data transmission and efficient use of transmission. This includes minimising satellite transponder capacity and use of inexpensive micro earth stations at the nodal centres and remotely located individual bank centres. A central station will typically use a 7.5 M Earth Station (ES) and will house the main packet switch and the Network Management and Control System. One-to-one redundancy will be provided for all active systems at this centre to give a network reliability of well over 99%. The remote stations will use 3 M Earth Station and will be equipped with X.25 access. The Network Management and Control System interfaces with the central and remote systems and provides for centralised network control and management.

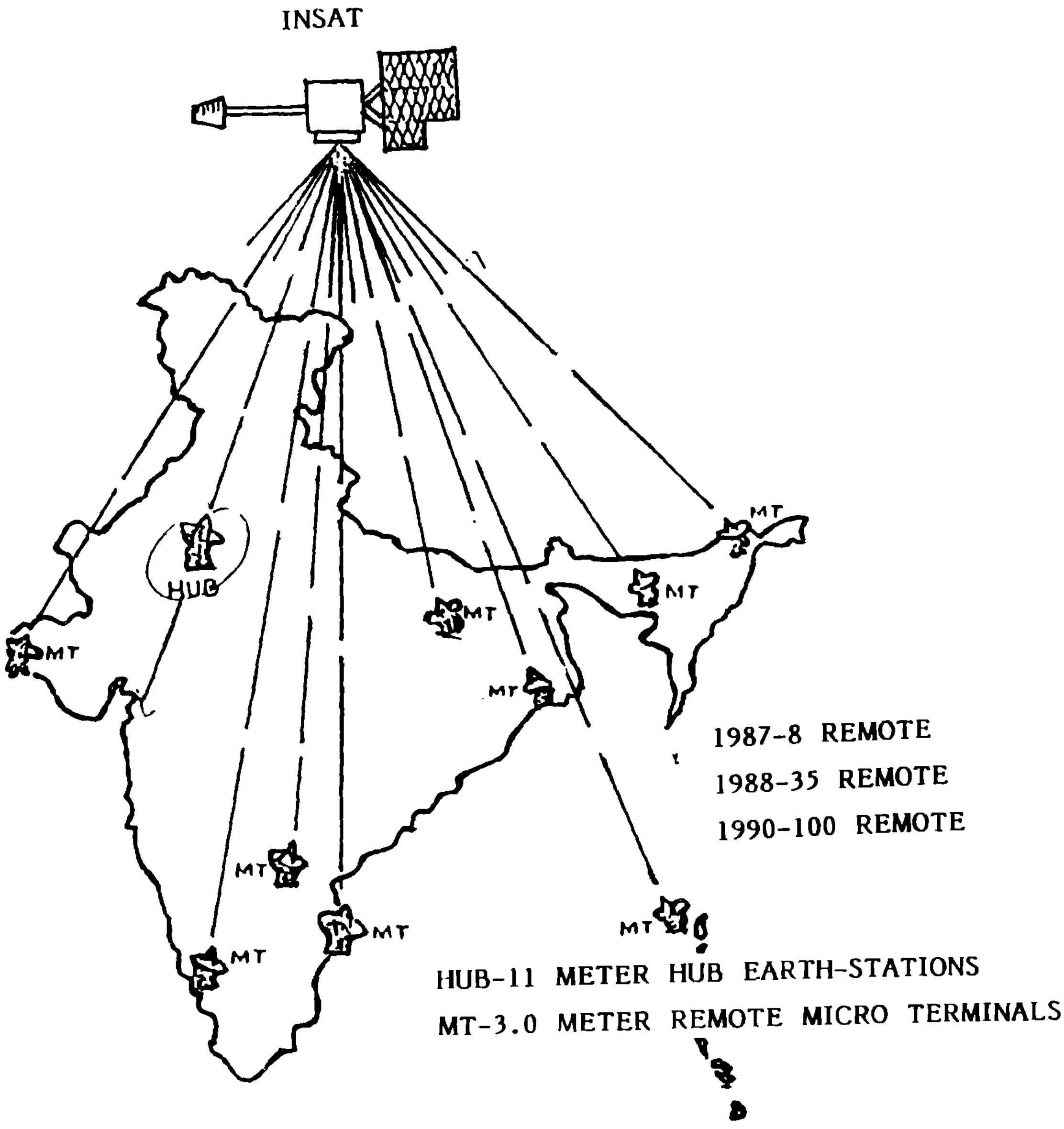
(ii) The satellite links will provide a throughput rate of 64 KBPS and operate in Random Access or TDMA mode depending on the network loading condition. The slot allocation and duration will be dynamically controlled by the central switch through a common signalling channel. Minimum effective data rate for each node can be allotted on demand between 2.4 to 9.6 KBPS or higher as required.

(iii) The satellite communication system architecture is shown in Fig. 5 and 6.

(iv) The satellite multiple access scheme will be decided after a thorough analysis of traffic requirements of BANKNET.



STAR NETWORK ARCHITECTURE FIGURE 5



SATELLITE COMMUNICATION SYSTEM

FIGURE 6

Radio links

(i) Radio links will provide the short distance communication linkage to bank centres close to the satellite nodes in a particular city. A packet radio system operating on a simplex channel will be shared by a group of banks. This packet radio system will serve the banks around each satellite node upto a maximum distance of 20 km and where radio line of sight is available. The advantage of this radio medium is the availability of larger transmission rates (upto 9.6 KBPS) and built-in error correction features. The problems of intra-city line reliability is eliminated.

(ii) The schematic diagram of the packet system and the interface to the satellite switching node is shown in Fig.7.

(iii) The actual number of bank centres that will be connected to each node will depend on the topology and will be decided at the time of actual implementation.

Leased line/dial up connections

(i) The feasibility of linking some of the bank centres which do not qualify satellite or radio links, by using leased voice grade lines or dial up voice circuits has been considered and found to be cost effective. Typical situations where this can happen are those in which satellite ES cannot be implemented due to frequency interferences or very low volume information transfer is required. The banks which can be linked in this mode to the network will be decided after detailed study.

(ii) The schematic diagram for leased line or dial up connection is shown in Fig.-8.

(iii) The links will be operated at 600/1200 BPS and in Async mode using modems. X.25 operation will be considered if the link data speeds are required to be above 1200 BPS.

4.5 The data network

Network architecture

(i) BANKNET should have independent communication nodes so that

DIGITAL PACKET RADIO SYSTEM

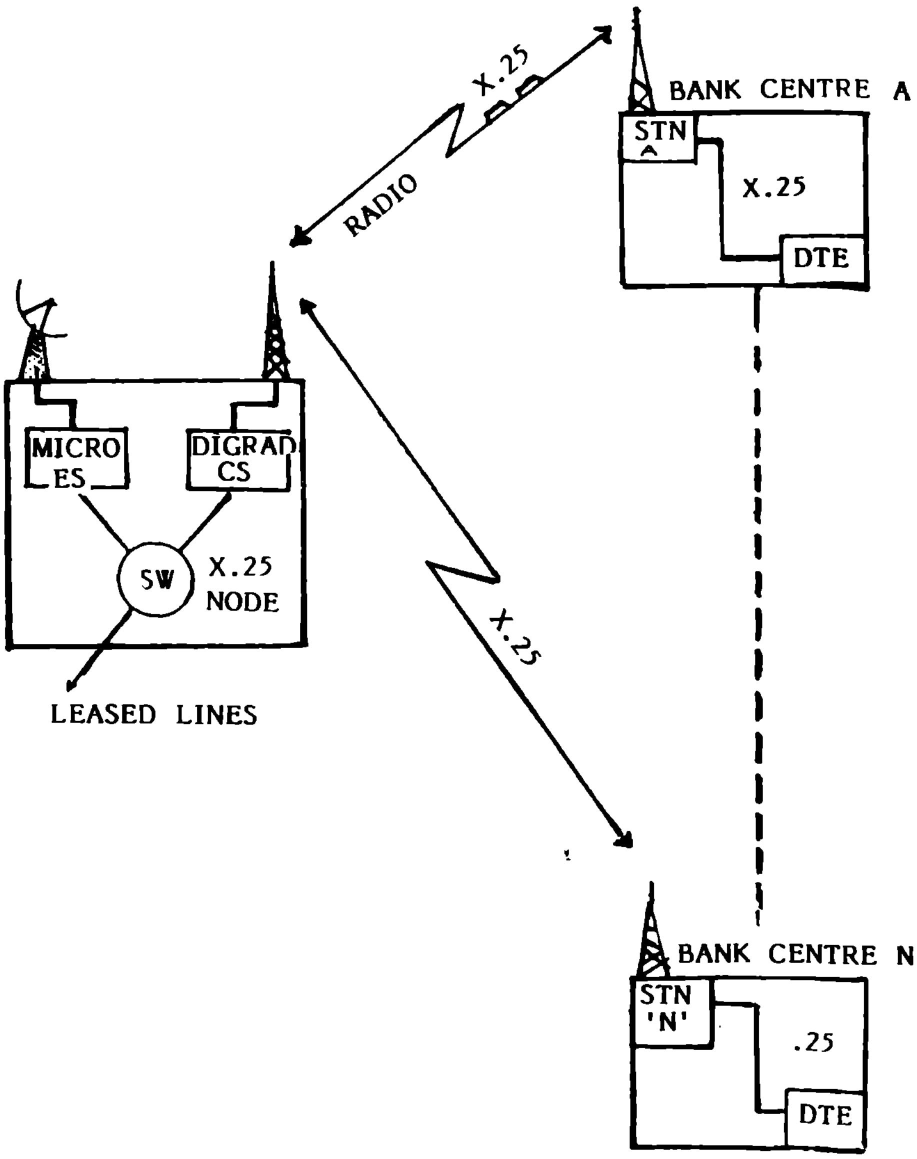


FIGURE 7

SCHEMATIC OF LEASED LINE/DIAL UP CIRCUIT CONNECTION

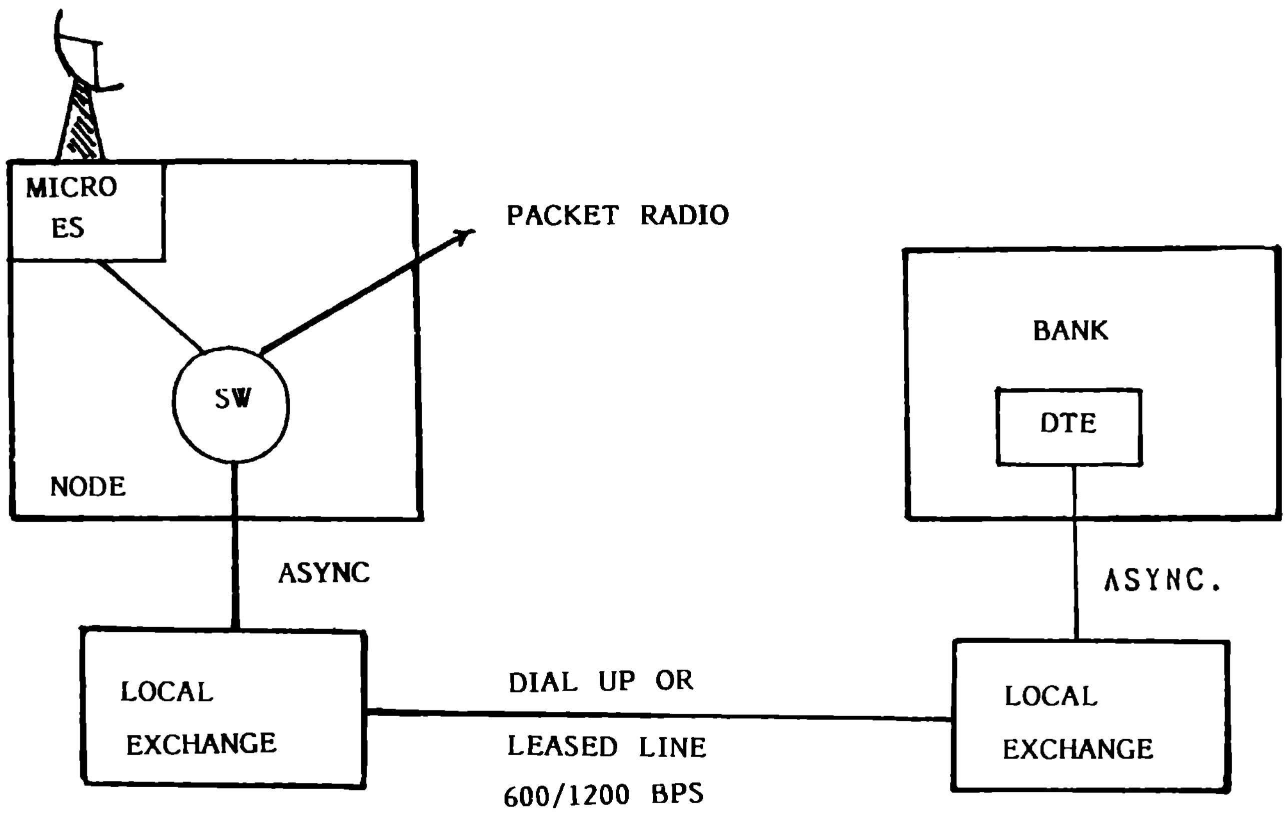


FIGURE 8

the communication work load is totally delinked from the banks' computer system. In the configuration defined, the main network switching function is organised at a central node which is located at the major Earth Station in the satellite network chosen for BANKNET. The micro Earth Stations from the other nodes in the network, each serving a group of banks (cluster) around them. In addition, individual banks in remote places with micro ES can have direct access to the central node.

(ii) BANKNET has a star architecture with a central node. Data transfer between nodes of the network is effected through a switch at the central node.

(iii) The other nodes serve as concentrators for data from banks connected to them. They route the data to the central node for switching. Data meant for transfer between end points in the same cluster however need not pass through the central node and is switched locally.

(iv) The communication processors and packet assembler/deassembler (PAD) at the central and other nodes provide the X.25 functions thus eliminating the need for separate X.25 switches.

4.6 RBI systems interfaces

The RBI Computer system network interface is defined in the schematic shown in Fig.-9. The hosts will be connected to either the communication processor at the central station or the PAD at the micro Earth Station. In either case the host-network interface will be through the Front End Processor (FEP) system, equipped with SNA/X.25 software. All the 4 RBI computers will have this incorporated in the first phase of implementation. Since the micro Earth Station in most centres will be mounted on the roof top of the buildings, RS232C cables can be directly used to connect them. In exceptional cases, line drivers or modem connections will be used for the host-network link.

Zonal/Regional Office system interfaces to BANKNET

For networking computer systems at ZO/RO, these systems will

IBM 4381 INTERFACE TO BANKNET

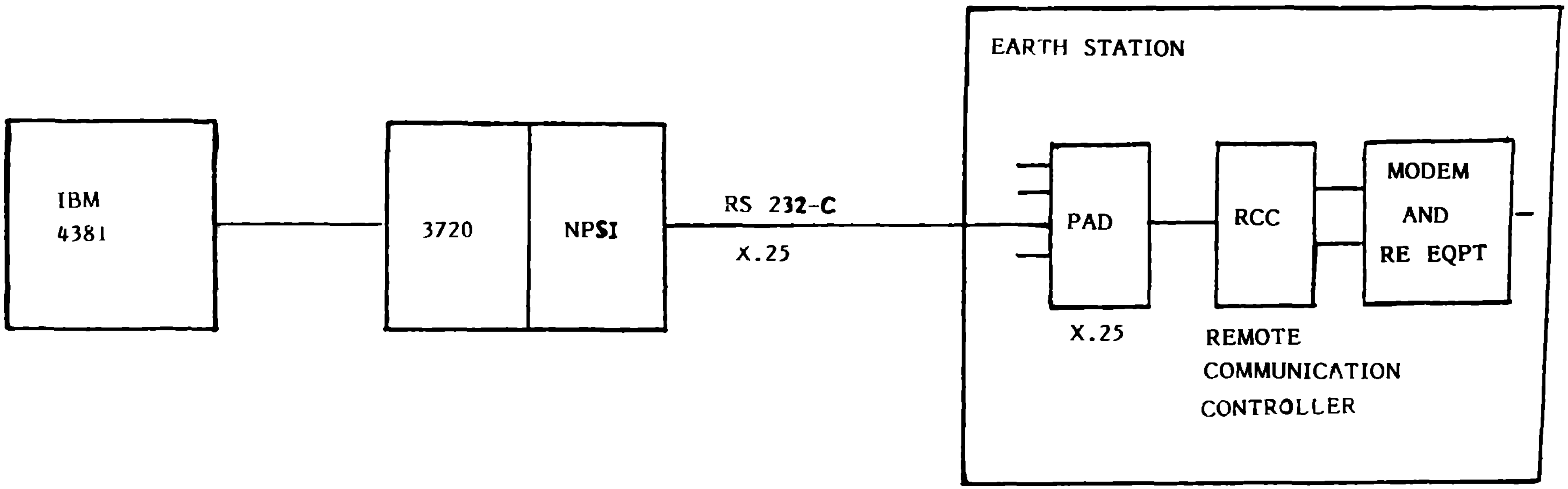


FIGURE 9

be required to be equipped with X.25 interface. Where these are directly connected to micro Earth Station, the interface will be RS232C. Other cases are radio linkages, leased line/dial up connections. The packet radio links have X.25 protocol and there will be no need for separate modems. Typical configuration is shown in Fig.-10.

For cable type connections dial-up modems of appropriate speed will be used.

Computer to computer links for heterogenous systems

For connecting computers of different makes and models for exchange of data, commands and responses, the appropriate presentation session and transport layer protocols of the OSI (Open System Interconnection)* Reference Model will be incorporated. These protocols are standardised for this purpose by the International Standards Organisation.

4.7 Integration of voice communications

Networking scheme

(i) For voice communications the basic structure of network nodes will remain unaltered. However, voice calls are established on direct node to node basis under the control of the central network controller. Signalling is carried out through a common signalling channel message initiated through the remote communication controllers at each micro Earth Station. The satellite channels on single channel per carrier basis (SCPC) are allotted on demand for the duration of the call. The use of the Demand Assignment coupled with TDMA used in the network provide the highest efficiency in using the satellite channel capacity and reduce the total number of voice circuits required in the entire network.

(ii) EPABX can be used to link the branches within a cluster through VHF radio or leased/dial-up lines. They cannot be used for node switching functions.

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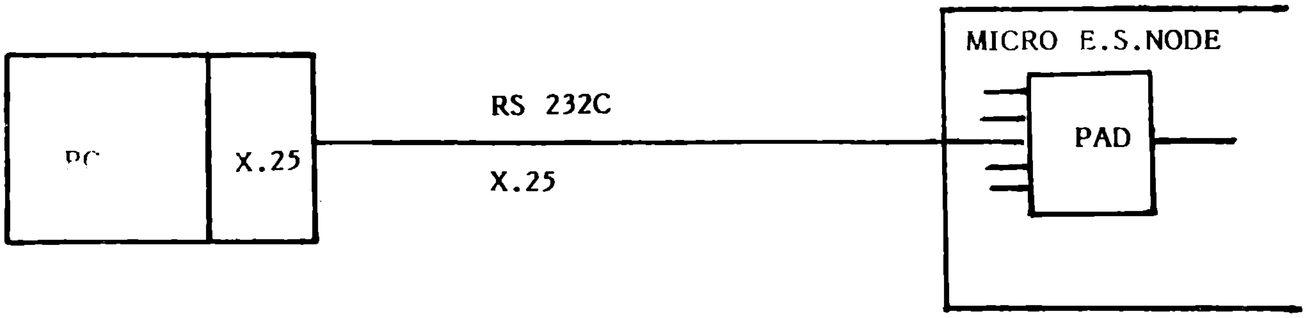
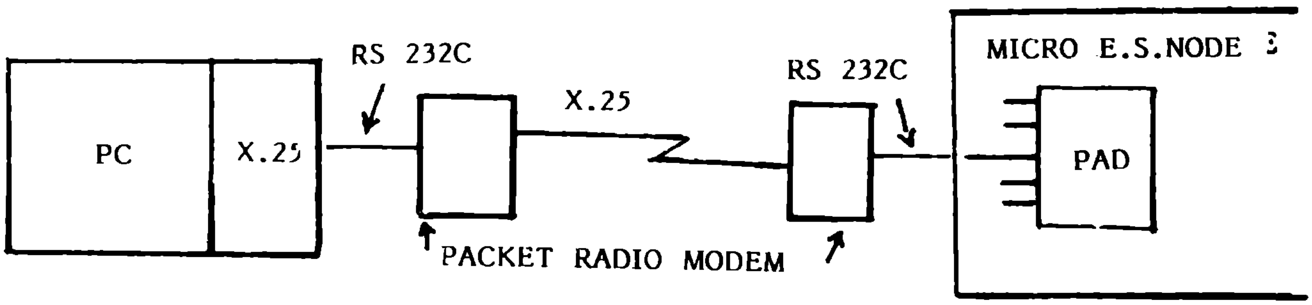
* As developed by the International Standards Organisation.

ZO/RO SYSTEM NETWORK INTERFACE

(i) CO-LOCATED (i.e located in the same building)



(ii) PACKET RADIO LINK



(iii) LINES

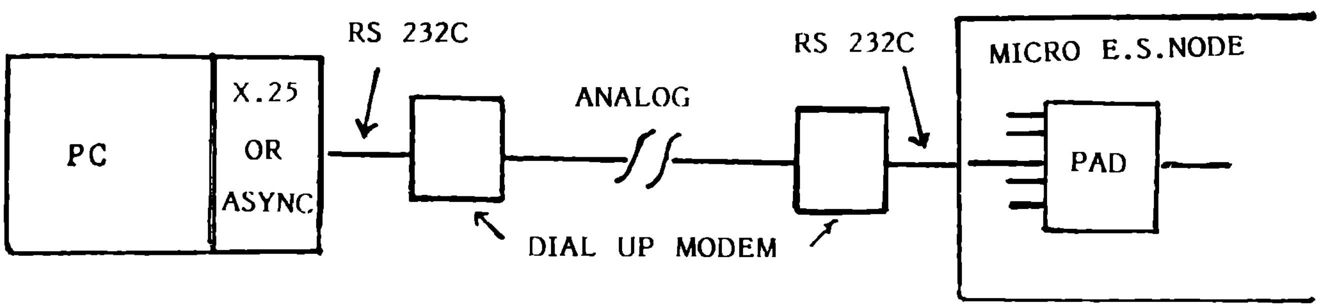


FIGURE 10

System requirements

(i) The equipment at the central and micro Earth Stations for voice calls will need augmentation with devices called voice codecs. The transmission of voice in the satellite is also digital and use adaptive delta modulation for compressing the data volume and increase system efficiency.

(ii) Voice operation requires 4.5M size Micro Earth stations to reduce the satellite power requirements. If voice circuits are required all the micro Earth Stations should be equipped with 4.5M instead of 3M antennas.

(iii) The EPABX and VHF radio equipment can be conventional.

(iv) More number of satellite SCPC carriers will have to be leased to meet the voice traffic load in the network.

(v) Voice usage in BANKNET should be reduced to the minimum as the network overheads increase. Further, data transfer is highly efficient for any information exchange.

4.8 Using INDONET as an alternative to BANKNET

CMC had offered that the network architecture for BANKNET with the exception of voice transmission can be made available in INDONET's Phase II, which is expected to be in operation in 13 Indian cities in the third quarter of 1988. The advantage of INDONET is that no capital investment will be required on the part of the banks and an established reliable and proven system will be available together with an expert operation staff.

Some concern on the banks' side was expressed on using INDONET, a network through which subscribers from public and private sector companies also transmit their data, notwithstanding the assurance of security of data transmission in this environment by sophisticated encryption and key management schemes.

The preliminary cost for the use of INDONET to link 500 major banks' offices in 35 Indian cities is calculated on the basis of :

(a) hours that the network is used by each bank @ Rs.200/- per hour.

(b) approximate traffic per hour @ Re. 0.50 per 1000 characters.

(c) equipment leased to the bank sites @ Rs.1500 per month per site.

This preliminary cost estimate is found to be approximately Rs.5 crores per year based on typical engineering figures for data volumes and studies that CMC has carried out at major nationalised Indian banks. INDONET is expected to be extended to 35 Indian cities by mid 1989.

INDONET is intended to be used by individuals, organisations etc. for availing of its computer power (both hardware and software); it was not conceived as a communication network. In the banking environment, RBI has considerable computer power; banks also have a number of minicomputers and more of them would be added; further there would be a number of mainframe computers in their Head Offices. By a suitable communication network, the available computers can be put to optimal use. We accordingly recommend a cooperative network specifically for the banking industry.

4.9 Private shared network

The alternative to using INDONET for the realisation of BANKNET, is for public sector banks to form a consortium and establish a separate network based on the architecture proposed in Chapters 3 and 4. In this case, the equipment is to be purchased, 40% or so from abroad, installed and operated by a nodal bank or a contracted agency. Approval of the Department of Electronics and Telecommunications will be required for this project which is estimated to take three years for completion.

The exact BANKNET configuration can be arrived at after a detailed information flow study and identification of all ZO/RO and major bank centre locations.

A preliminary cost estimate is made on a broad assumption that the network will be required to link 500 major bank centres and 100 satellite nodes will be required.

The estimated cost for this network is Rs.28.20 crores. Details are given in Table 2.

Table 2

Cost Estimate Summary

A. **Capital Investment**

Description	Qty.	Cost* (Rs.crores)
Central Station	1	1.5
Micro Earth Stations	100	4.2
Radio Equipment	400 links	16.0
Interface equipment	500 locations	5.0
System Engineering, installation, testing & commissioning		1.5
Total Cost		28.2

FE content approx. 40% of total cost.

B. **Recurring Expenses/Annum**

Transponder channel hire	20 circuits	0.4
Operation & Maintenance Expenses		2.0
Total		2.4

* Landed cost includes customs duties.

Note: This cost does not include voice communication; if voice is to be included, the cost is likely to go up by about 30% to 35%.

Typical implementation schedule is shown in the Bar Chart.

IMPLEMENTATION SCHEDULE

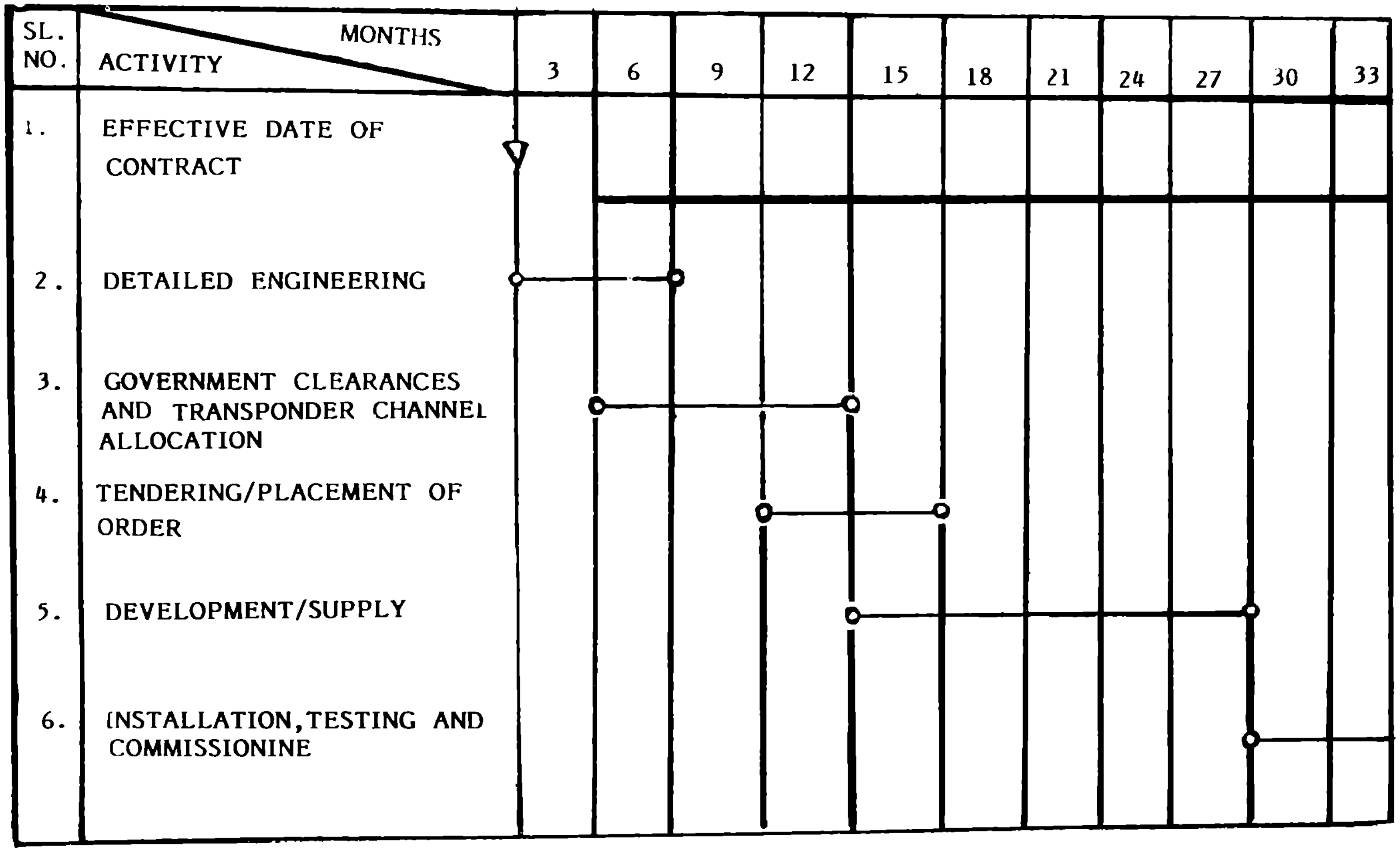


FIGURE 11

The network can be expected to be operational in about 3 years after the decision to go ahead with the project. Satellite channels are expected to be available in INSAT ID (1989-90) or INSAT II (1990-1991).

4.10 Modalities for realisation of BANKNET

Considering the criticality of the problem of communication, we are of the opinion that the network should be established expeditiously. The network has to be viewed as creation of general infrastructure for the banking industry. It would involve large investments. Banks may be hard put to commit large funds for this purpose. Further, the computers proposed to be networked in the first phase of implementation and which would form the basic hub are those installed by the Reserve Bank at its cost for the common use of banks for clearing purposes. The Committee, therefore, feels that on a similar basis the common infrastructure arrangements should be provided by the Reserve Bank of India at its cost and the operating costs should be borne by the participating banks in proportion to their use. As the BANKNET will be used by banks similar to the clearing facilities and as the computers used for clearing houses at the metropolitan centres will be used in the BANKNET, we recommend that the department in the Reserve Bank which is in charge of the four computer centres may look after the functions relating to BANKNET and SWIFT also. A Commmittee of Direction under the chairmanship of a Deputy Governor of Reserve Bank of India and members representing the Government of India (in the Ministry of Finance - Department of Banking and Department of Economic Affairs - Department of Electronics, Department of Telecommunications, Department of Space and the Ministry of Home Affairs - Cypher Bureau) the Indian Banks' Association, Foreign Exchange Dealers' Association of India, a few banks and financial institutions may be set up set up by the Reserve Bank of India to take all measures necessary to launch the project and to review at yearly or, in the initial stages, at more frequent intervals, the progress in the implementation of BANKNET/SWIFT projects and give guidelines in regard to course of implementation.

The development and implementation of the network require considerable technical knowledge and skill which is scarce. The CMC,a Government of India undertaking, who have successfully implemented their own INDONET and are helping more public sector undertakings such as Coal India, SAIL in developing their networks. There may be other agencies also who might possess skills and knowledge in hardware and software both in computers and communications as well as experience in establishing large network. A suitable agency may be selected by the RBI, in consultation with the Department of Electronics and the Department of Telecommunications. Pending final decision on details, the RBI may immediately seek the approval of DOT in principle for the establishment of the network and also apply to the Satellite Coordination Committee for necessary satellite channels for the network.

CHAPTER 5

SWIFT

Concept

5.1 The concept of the SWIFT system is to provide a fast, secure and reliable method for international banking community to communicate with each other in a standard way. The system is operated and administered by the Society for Worldwide Interbank Financial Telecommunications which is as cooperative non-profit making organisation established under Belgian law, with its headquarters at Brussels. It is wholly owned by the member banks by means of shares distributed proportionately to the use made of the system. Capital expenditure is met by loans from the members, with operating costs covered by charging for the use of the systems. The tariff structure includes fixed connection charges, a base charge per message sent and additional charges for ancillary functions and services - such as message retrieval, priority and multi-addressing. The SWIFT system has the capacity to handle 920,000 messages daily and it is now handling upwards of 800,000 messages. Standard message formats have been developed by SWIFT to handle customer transfers, bank transfers, foreign exchange (including loan and deposit transactions), collections, documentary credits, securities, statements and accounting entry confirmations plus supporting system messages. There are now over 2,000 transmitting/ receiving points in over 50 countries connected to the SWIFT. A number of Central Banks including Federal Reserve, Bank of England, Reserve Bank of Australia are SWIFT members.

5.2 SWIFT II

SWIFT II is an update of the current system and is now in the development stage. This will provide greater flexibility for additional message types and volume growth for the future. SWIFT II will take over from the old system in a phased manner between 1989 and 1991.

5.3 SWIFT II has been designed using the concept of distributed data processing architecture, proven operating system and is based on X.25 packet switched network. This network is expected to cater to the needs of international banking community for the next 10 years. Since SWIFT Regional Processor is likely to be provided in India in 1990, Indian banks will use SWIFT II. The internal organisation of member banks in each country is generally by means of a National User Group set-up to coordinate and control the national network, on-going standards development and day-to-day operational aspects of the system.

5.4 SWIFT provides its users with communication services. It has been designed to replace mail, cable and telex as the means of communication for international banking messages. The service is available 24 hours a day on all days of the week. The Society provides the service by means of an international data transmission network. This comprises a number of Operating Centres together with a large number of subsidiary Regional Processors interconnected by dedicated transmission lines. User banks are connected with the system through terminals connected to these Regional Processors.

The principal service offered is that of message transmission, the acceptance of messages originated by one authorised user and delivery to other authorised users in accordance with the directions of the originator. The system provides for adequate security of messages by restricting access to authorised users, monitoring the performance of these users in order to detect procedural and message format errors and protecting messages which are accepted for delivery against loss or multilation. It also provides for encryption and authentication keys to ensure that there is no piracy of the messages during transmission. The security details are discussed in Chapter 6.

5.5. Connecting banks to SWIFT

The banks can connect through computer based terminals to the SWIFT Regional Processor to be located in Bombay through any of the following three systems supplied by STS (SWIFT Terminal Services), which is a subsidiary of SWIFT:

ST-200

This handles small and medium volume traffic over SWIFT and telex networks. The ST-200 is ideal for banks in which the majority of SWIFT messages are entered manually.

ST-200 software runs on standard hardware available from UNISYS or NCR. The modular structure of the ST-200 product line enables the expansion of the system to accommodate higher traffic volumes and broader operational needs. Starting with a stand alone nucleus, the system can be expanded to a multi work station configuration serving local or remote departments. The addition of a second nucleus called an Integrated Backup provides protection against loss of essential data in the event of a failure within the main nucleus.

The software supports simple operating procedures. A step-by-step approach adopted through screen menus, prompts and guidance lead to easy and error-free operation. A prompt message on entry guides the operator through each field with syntax checks. A fast mode allows experienced operators enter messages directly without help from the prompting mechanism. Messages prepared on other computers such as the host computer to which ST-200 may be connected, can be entered in batch mode.

The ST-200 software uses the SWIFT authentication algorithm (described in detail in Chapter 6 - Security) to automatically add or verify authenticated results on messages sent or received by the bank. This procedure ensures the immediate detection of any changes in the message text.

The ST-200 software automatically channels different types of incoming and outgoing messages using the information stored by the bank in routing tables. The messages can be sent to one or more destinations for immediate action.

The software provides for detailed auditing information to help the bank to monitor network traffic and control system operation. A Log, a Journal and statistical reports give necessary data for audit trails.

In addition, an extensive range of application software packages assists transaction processing and communications. They improve the bank's operational efficiency by automating tedious manual tasks and streamlining message handling. Examples are Traffic Reconciliation, Nostro Reconciliation, Telex Interface and Mainframe Link.

Traffic Reconciliation

Traffic Reconciliation automatically reconciles all the SWIFT messages with checks for duplication and sequence number gaps and generates analytical reports.

Nostro Reconciliation

Nostro Reconciliation performs automatic matching and reconciliation of Nostro transactions according to amount, value, date and reference number. It helps the bank's foreign fund management through up-to-date reports on account balances and outstanding items.

Telex Interface

Telex Interface links the ST-200 system directly to the telex network and provides a common procedure for SWIFT and telex message handling. Added features include : automatic dialing, re-dialing, message routing, group transmission and automatic test key procedures.

Mainframe Link

Mainframe link connects the bank's computer to the ST-200 system for on-line message processing and transfers over SWIFT or telex.

Minimum Hardware Requirements

The main ST-200 software and all add-on application packages for the ST-200 run on standard hardware configurations available from UNISYS or NCR. The minimum hardware requirement for a ST-200 system is a nucleus consisting of:

One central processor unit;
One high resolution non-glare visual display unit

One Two-Position, slim-line keyboard with 10 SWIFT function keys
One mass storage unit
One Printer

The mass storage unit comprises a 5.25" floppy disk drive, a winchester hard disk and an optional tape streamer for backup.

ST-400

This is the latest release from SWIFT, providing an integrated approach offering not only automated traffic management of SWIFT, telex and other networks, but also processing power for the banking application packages required by the bank. A single ST-400 system handling transaction processing and international message traffic in the bank, makes maximum use of its hardware, software and human resources. The software includes sophisticated message handling and reporting, an integration with other resident banking applications through standard SWIFT message formats.

ST-400 software runs on Digital Equipment Corporation VAX computers, from MICRO-VAX to the VAX-8000 series. Software compatibility across the full range of DEC machine safeguards the bank's investment when migrating to larger capacity machine as message volume increases.

Moreover, one can install additional packages to interface with local or national payment systems. Message processing is standardized through the use of SWIFT format messages which provides a common basis for communication with mainframes, integrated application packages and external networks such as SWIFT and telex. For banks with traffic distributed over several networks and payment systems, the possibility is offered of inter-network and payment systems conversion, using packages available from independent software houses.

Automated functions provided by the ST-400 include:

Message transmission, message reception, message routing, message re-transmission and re-routing, expansion of coded message fields, SWIFT message authentication and message recall.

The investigation information allows one to scan the context and messages based on a wide range of parameters. A journal provides on-line reports of all system events and operator actions concerning commands and messages.

The ST-400 system allows the bank to present network log-in tables, enabling a log-in status to be maintained over pre-determined time period. This feature allows the unattended operation of the ST-400 system. For example, it can be set to start receiving messages and commence traffic print-outs, a few hours before the arrival of the staff in the morning. This eliminates delays while the overnight messages are being printed. As a result, the workload of the traffic handling staff has a smoother spread accross the day with the elimination of stressful and error prone morning peaks.

ST-400 systems allow connection of telex interfaces and the main-frame link as in the case of ST-200. It is also possible for a number of banks to share the same ST-400.

The number of terminals that can be connected to the ST-400 system depends upon its configuration. A total of 100 devices, including terminals and printers can be connected to a typical VAX-8600 systems.

ST-500

The ST-500 is a fully automatic gateway system providing a high performance transparent link between the bank's mainframe computers and global networks such as SWIFT and telex. It extends the bank's data processing power to automate its international message traffic. In addition to automatic network traffic management, the ST-500 system makes the message formats and operational procedures completely independent of the networks used.

Higher operational efficiency is achieved through:
24 hours a day unmanned operation;
Fast, secure transfer of medium to high message volumes;
Sophisticated message routing mechanism;

Automatic analysis of incoming and outgoing traffic;

Reduced mainframe workload.

Outgoing messages received from the mainframe are suitably authenticated and automatically transmitted over the specified network. Incoming messages are verified and routed to different destinations based on combinations of user defined routing criteria. Real time message checks eliminate double bookings, cancellations and interest charges, investigation costs and loss of funds.

On-line traffic reconciliation ensures an up-to-the status of all traffic with message history going back 14 days. These include hardware and traffic reports based on extensive selection criteria including time, day, value, date, message status etc.

Hardware requirements

The basic ST-500 system consists of the SWIFT application software running on standard IBM series/I hardware.

A typical configuration includes :

Dual processors, each with one SWIFT and one mainframe link

Two hard disks

Two floppy disk drives

Two control stations

Two matrix printers

One or two magnetic tape units shared between both processors

Disk capacities to match the traffic volumes and storage requirements.

The fail-safe nature of the ST-500 system is ensured by a "dual" configuration, with two identical processors and disk units. The two processors run in parallel, with disk mirroring to ensure identical data in all their files. In the event of a failure in one processor, the second processor automatically takes control of all operations.

Mainframe connections and protocols

The ST-500 system currently supports connections such as leased lines, channel attachments and public switched networks. Links with a wide variety of mainframe including IBM, Honeywell Bull, Data General and Tandem are supported. A number of industry standard mainframe protocols are supported including point-to-point BSC 3270 and LCC. The ST-500 system can be connected to the IBM mainframe message preparation and processing package DMNL, using IBM's "Director ST 500 Link" - D500. It allows interactive messages and command exchanges between the mainframe and the ST 500.

SWIFT connection software from other vendors

Many of the larger banks have developed extensive data communication networks within their countries. In a few cases, the networks span across the continents in the form of international networks. They have developed in-house solutions on their respective hardware for connecting to SWIFT. The systems include IBM, Burroughs, UNISYS, DEC, ICL, etc.

Some of these vendors, as well as independent software houses, are also providing hardware and software solutions for connecting to SWIFT. Basically, these packages perform the same functions as outlined above in the case of ST-200, ST-400 and ST-500 systems from STS. The latter being a subsidiary of SWIFT, guarantees all possible enhancements to SWIFT-II as well as any changes that may take place in the SWIFT network. In the case of independent software houses and the hardware vendors, these changes would have to be separately initiated with them unless the agreement provides for the same in the beginning itself.

5.6 Connecting the Indian banks to SWIFT

SWIFT have applied to the Government of India for permission to establish their Regional Processor at Bombay. After Government's approval, they will be entering into agreement with the Videsh Sanchar Nigam for necessary leased lines for overseas communications. Reserve Bank has conveyed its no objection to some of the banks becoming members of the SWIFT. These banks will pay their membership fees after the Government's approval mentioned above. A Regional Processor will be installed by the SWIFT in Bombay and it will be UNISYS machine. Each bank will be given one or more lines from this Regional Processor to connect its system.A one time fee will necessarily have to be paid by every bank for membership. Indigenous software is not available at present for SWIFT connection. Hardware cost component is minimal as compared to the total systems costs. As procurement of hardware and software from SWIFT Terminal Services (STS) carry the guarantee that they would work in SWIFT II environment also, it is desirable to get our initial requirements from STS. Banks can choose any of the three alternative systems viz. ST-200, ST-400 or ST-500 to connect to their mainframe systems in the Head Office, depending upon their traffic volumes. It is possible that none of the Indian banks may require a ST-500 system for connecting to SWIFT. Most of the banks may opt for ST-200 and ST-400 systems. Some of the banks although engaged in international business, do not have sufficient daily transactions to justify a dedicated system. Although one time fee for membership of SWIFT has to be paid, we may minimise the expenditure on hardware and software for achieving the SWIFT connection.

It is possible for a number of banks to share the same ST-400 system and this possiblity would need to be discussed with SWIFT authorities in detail. Since ST-400 supports multiple TIDS (terminal identification numbers), unique TID could be given to terminals of different banks. The TID comprises of bank code, country code, location code and branch code (4+2+2+3) characters). Alternatively, multiple copies of software can concurrently run on the same VAX machine, each copy supporting terminals of a given bank. Each bank will thus have a ST-400 connection to SWIFT through the same VAX machine. This might be a better solution with respect to security considerations for the banks.

The banks can transmit payment messages over the SWIFT network from their branches doing foreign exchange business throughout the country through their Head Office computer system attached to the SWIFT connection system such as ST-400. Alternatively, a branch can directly key in the message in the computer and enter all the details of the correspondent bank and directly transmit without any intervention at the Head Office level. This alternative necessitates massive training of all the concerned operators in the branches doing international business. To circumvent this problem, many banks in the West have encouraged relatively smaller international business branches to transmit the messages in free format to the head office where a group of trained operators analyse the messages and enter them in SWIFT formats: for example, National Westminister Bank in the U.K. The messages of all branches can be prepared in the SWIFT format on the bank's mainframe computer system. At the end of the day or at any other desired time, the message tape can be connected to the ST-400 system and transmitted over SWIFT in one shot. This saves the communication costs. To begin with, this method appears to be satisfactory for outstation branches. After the SWIFT formats have been assimilated by the Indian banks and the message transmission has progressed satisfactorily from the head office operators, the banks may consider training the operators in other international branches with heavy business.

Whatever the method of connection, banks in India should not use SWIFT for message transmission within India.

CHAPTER 6

SECURITY IN DATA NETWORKS

Security is a key element and an integral part of data network. Until recently, adequate levels of information security, computer security and access controls have only been the concern of military organisations. The commercial organisations have been satisfied with some thin security measures, although experts have held that poor security is worse than no security at all. In the last decade, however, with the implementation of financial networks such as SWIFT and private bank networks, a greater thrust has been placed on security of information transfer. Electronic transfer of funds is certainly worth tampering with by hackers, pirates, thieves etc., since the payoffs are high in view of the huge sums of money transferred over the network. But on other hand, it is precisely because of this reason that the EFT networks have taken due care to install the strictest possible security measures to prevent any frauds.

Before examining the security features of SWIFT international communication network, it may be worthwhile to note the techniques available for securing the network, in view of the domestic network for banks - BANKNET. The latter must also be atleast as secure as SWIFT.

It is physically impossible to secure the entire network, the costs being probibitive, to achieve complete security levels. An organisation has to strike a balance between security, risk, user convenience and service. But in the case of EFT networks, priority must be security procedures. The cost of network intrusion or penetration must out-weigh user convenience. Illegal access to the network can result in fraudulent transactions for EFT systems with funds landing up in the criminals' accounts. Theoretically any person with a telephone and computer terminal and technical skills and the time, can gain access to a data communication network. Security serves to act as a delaying tactic.

The computer crimes are mainly committed by two kinds of users - computer hackers and computer professionals who are company employees.

The former regard the breaking of the system and security as a challenge. The main threat, however, is from company employees engaged in unauthorised activities. In the case of a distributed network where the data base management system can be accessed by micro computers or data network users, the security risk is increased. Right from the time of planning of the system, the security aspect has to be an integral part of the total system rather than as an afterthought and that too at only a few points in the overall network. It goes without saying that the primary security involves controlling the access to main computer systems, communication processors and other sensitive hardware devices. Proper identification procedures and physically secure areas have to be created for using the terminal and the communication equipment. All terminal users must be properly identified and access controlled at various levels. Sometimes it is beneficial to have terminals identified application-wise and only authorised users engaged in the relative activities allowed entry to that particular area. The physical measures of security are quite obvious and are not elaborated.

The equipment has to be protected from physical destruction or damage. Similarly, the data also has to be protected from any possible damage. For this purpose, generally complete redundancy is built into the systems in the form of duplicate processors, storage devices, controllers, I/O channels, communication lines, etc. In the case of many EFI systems, in addition to these systems, an extra system is located at an altogether different site, in addition to the above duplicated hardware and I/O devices. It turns out that the need for protecting the data which is much more valuable than the equipment used to handle it necessitates such level of redundancy being built in as part of security of data networks.

In order to protect the data from being tampered with or being accessed by fraudulent users during transmission over the communication lines, the data is generally encrypted into undecipherable text through the use of some software keys or hardware encryption devices. Encryption is generally considered cumbersome and expensive; but for defence and finance networks in particular, there is no escape from using the encryption keys or devices.

Encryption is the method of scrambling information to be transmitted at source and reconstructing it at the receiving end. It converts data text to cipher text. Data encryption standard, (DES) is a standard approved by the US National Bureau of Standards and is available under license to EFT users throughout the world. They had approved a 64 bit pattern which provide over 72 quadrillion possible keys. The earlier estimated time of 100-2000 years to crack such a key has now been reduced to a few minutes, thanks to the availability of very large processing powers of the computers! Instead, now a public key encryption scheme based on 512 bit number seems to be gaining acceptability. It is estimated that even with the next generation of computers with their enormous processing powers, it would not be possible for anyone to break this key in the foreseeable future. The public key involves the host and terminal having two keys which do not need to be exchanged. One key, i.e. the public key is disclosed to all the parties between which a transaction can take place. The secret key, however, is known only to its owner. Public key systems like the DES are based on a mathematical algorithm. But public keys depend on one way mathematical functions. The simple process of multiplication is one of these operations. While it is easy to multiply two large prime numbers together, it is very much more difficult to take the resulting product and deduce the prime factors from which it was derived. If the original primes are such that they generate a 512 bit number, the process of factorisation is effectively impossible even with the fastest known computer resources today and those which will become available in the next 10 years.

The encryption algorithm of the DES type is supplied as a chip and added security can be obtained by incorporating validation keys which interact to decipher the message. These are known as authentication keys. On the EFT network the transmitting bank and the receiving bank have to use the same set of authentication keys to unlock the message even after encryption and decryption. But this method relies heavily on the secure distribution of the authentication keys.

Modern protection devices incorporate password, antitamper locks, PC driven security controls and monitor facilities. On a more routine basis individual users must be encouraged to change their password regularly and supervisors should check that this requirement is not neglected at all. In order to ensure that no unauthorised user can gain access to the network from remote locations, there should be a series of layers of passwords built into the systems.

The most recent security devices incorporate such technologies as bio-metric identification devices relating to finger and eye genetic characteristics.

Security on SWIFT

SWIFT aims at protecting the network against unauthorised access and protects traffic against loss or mutilation of messages, errors in transmission, loss of privacy and fraudulent change. Protection is provided on the SWIFT part of the network i.e between the Regional Processors in sending and receiving countries by message numbering, error checking, encryption,control of access to message at the Regional Processors and operating centres and by log-in procedures.

Authenticator keys:

The SWIFT authenticator is an improved and automated version of the telegraphic test keys traditionally used for the authentication of, and confirmation of amounts in messages between banks. It is automatically calculated on the entire message text. This ensures that any change in the message text would be detected.

SWIFT supplies the authenticator algorithm, gives guidelines for exchange for authenticator keys and checks that an authenticator result is present in the specified categories of messages. But SWIFT is not involved in the authentication process between the banks. The sending and the receiving bank have to be in tune with respect to the authenticator key. The receiving bank terminal checks the autheticator results by using the standard algorithm and the authenticator key. The algorithm is incorporated in the software of the computer based terminals. The authenticator keys agreed with correspondent banks are normally stored in the computer file in the terminal.

SWIFT has suggested authenticator key exchange procedures and has also prescribed formats for exchanging the keys between the banks.

SWIFT has defined the responsibility of the sender bank, the receiving bank with respect to message control, time, amount of payment etc. as well as the responsibility and the liability on the part of SWIFT with respect to losses. These are given in detail in the SWIFT user handbook.

The responsibility of SWIFT with respect to security of data messages is between the Regional Processors. SWIFT does not assume any responsibility of the messages between the Regional Processor and the banks. However, they have recently come out with a security device which can be conected to the SWIFT terminal connections and the bank side as well as on the Regional Processor side. This device is called STEN and guarantees complete security against the unauthorised use of data transmitted over any line, public or private. A pair of STEN units at the two ends of the communication lines between the bank and the SWIFT Regional Processor ensures this. STEN uses an exclusive SWIFT encryption process to automatically code the transmitted data and decode the receiving data. The encryption keys at both the STEN units are changed at random intervals making impossible for unauthorised user to decipher the transmitted data.

Security on BANKNET:

Password protection for preventing unauthorised access at computer centres is available as a normal feature in the IBM machines used by the Reserve Bank. Data security on the links in the BANKNET can be provided by controlled access at the network interfaces and through data encryption units if these are incorporated at the computer/modem interfaces. On-line data encryption for duplex line operation from commercial sources can be incorporated. This system uses user-programmed key combination with 10 variations which is expected to be sufficient for BANKNET use. One encryption unit will be needed at input of each line before the modem. Alternatively, indigenously custom designed chip encryption can be implemented.

The packet switching, encoding, scrambling and TDMA schemes used in the network provide built in inherent security at data level. The data encryption scheme for BANKNET will be exclusively designed and can be implemented at software level.

CHAPTER 7

Message Formats

Message standards are at the core of SWIFT Development of standards involves several stages such as identification of business areas to be standardised , detailed analysis (such as identification of parties, determination of what messages need to be exchanged, purpose of the message), creating a list of the information, both essential and desirable, which needs to be accommodated and expressing in a general structure for identifying information. The standards are developed by SWIFT with the participation of its members. The process is a lengthy one (Sandra Bleich, Standards Manager of SWIFT says: "it normally takes SWIFT from two to five years to complete this process for each business area and after this time span, we must still wait for another 18 months before these messages can be put on the network. This time is necessary for the member banks to prepare their operations and systems for the introduction of the new standards") The objective of standards is to identify the purpose of the message being transmitted, and providing the relevant information in a structure which the receiver will easily understand; the receiver will be able to route an incoming message to the appropriate department/location within the bank; once it has arrived there, the information will be clearly located for further processing. As the messages are clear, enquiries are minimised. Another benefit of standardisation is automation. By developing appropriate bank application systems, computerised processing of SWIFT messages without human intervention is facilitated (eg. posting of accounting entries, generating necessary advices and statements from the incoming instructions). As the banking industry grows and diversifies, SWIFT reviews the existing standards and adds new standards as necessary. Standard message formats have been developed by SWIFT to handle the following business areas:

- customer transfers
- bank transfers
- foreign exchange
- loan and deposit transactions
- collection of customers
- documentary credits
- securities

- statements of accounts
- accounting entry confirmations
- supporting system messages.

In addition, free format messages are also permitted.

BANKNET should also use standard message formats. The merit of SWIFT message types and standards lies in their acceptability by the banking industry as a whole. Banks such as Irwing Trust Co. of U.S.A., from day one of their going live on EFT chose to use SWIFT message formats even on their domestic network. It would be advantageous for banks in India also to adopt SWIFT formats for BANKNET also.

A small Committee consisting of Shri V.Ananthakrishnan, Chief Executive, FEDAI, Shri L.Raghavendra from Indian Banks' Association, Shri N.S.Kulkarni, General Manager, State Bank of India, Smt.H.S.Palav, Asisistant General Manager, Central Bank of India, Shri V.S. Vaidya from Bank of India, Shri D.S Angchekar of Reserve Bank of India and Shri S.-Venkateswaran, Director, Reserve Bank of India, Management Services Department, also considered the question of message formats for SWIFT and felt that since standard formats have been laid down by the SWIFT, we have no option but to accept the same. They also generally felt that it would be useful to adapt these formats for domestic network also since such a course of action would save considerable labour and time in developing fresh formats.

CHAPTER 8

Summary and recommendations

8.1 Mechanisation and computerisation in a planned manner has been recently started pursuant to the recommendations of Dr.Rangarajan Committee. Several branches of banks have been mechanised and a number of mini computers have been installed in Zonal/Regional Offices of banks; more branches/zonal offices will be mechanised/computerised in the next two years; by then, head offices of banks will have larger computers. Use of telecommunications for data transmission and networking of computers is, however, practically non existent in Indian banks.

8.2 Efficient communication facilities would enable banks to move funds (their own, customers's etc.) faster and transmit data faster at lesser cost. Though the total number of branches of banks is large, about 10,000 branches located in 100 centres account for 60% and 65% respectively of the total deposits and advances. Connecting these branches with their regional/ head offices will go a long way to meet their data transmission needs and facilitate control and policy formulation based on an efficient management information systems. If planned now, it will also facilitate proposed connection of Indian banks to SWIFT. Given the resource constraints in India and the need to ensure that the limited national telecommunication resources are not pre-empted by individual organisations for developing independent network, a common communication network needs to be planned on a co-operative basis.

8.3 The proposed co-operative network may be called 'BANKNET' and jointly owned by the Reserve Bank of India and public sector banks. The private sector and cooperative banks and financial institutions may also use the network on terms to be specified by the RBI and the network implementing group.

8.4 The computers available with the RBI at Bombay, Madras, New Delhi and Calcutta for cheque processing during night time and which are at present free during day time may form the basic hub of the network to start with. X.25 based packet switching network may be commissioned in the first phase connecting these 4 metropolitan centres which would be the nodes. The computer systems available in the Head Offices of public sector banks located in these four cities could be connected to these nodes. In the next phase, communication nodes could be located in 8-10 banking intensive centres, gradually raising the number of centres to about 100 in about 3 years' time.

8.5 The electronic private automatic exchange system proposed to be installed by RBI cannot be effectively utilised for the data network in the first phase and the data operation cannot be integrated with voice. It is, therefore, necessary in the first phase to configure a network for independent data operation using voice grade lines dedicated for data communication only.

8.6 The network may be implemented in two phases. In the first phase, Front End Processors with SNA X.25 protocol are required at the 4 nodal centres to connect the computers at RBI centres and to handle computer systems of different vendors later on. For linkages with public sector banks, separate links are required from their head office to the nearest RBI centre. The budgetary requirement for the 4 metropolitan centres is estimated at Rs.41.25 lakhs. For inclusion of other stations (including stations of public sector banks) the estimated cost for each additional station is Rs.2.32 lakhs. The time schedule for implementation of this first phase is about 6 months from commencement of work.

8.7 In the 1990's banks will have a mix of stand alone systems, decentralised computers and computerised processing to keep pace with their growth; they will need to access SWIFT to enhance their capability in international business. The 2nd phase of BANKNET is, therefore, intended to provide a wide area communication facilities within the country with access to SWIFT. About 10,000 branches spread over 100 centres in the country account for a major portion of banks' business (60% to 65% of deposits/advances) and the proposed network will achieve its objectives if it covers about 100 centres.

8.8 A shared banking network which will be a common carrier for information exchange of various banks for their internal use as well as inter-bank communication is recommended. Though it is a shared network, from individual bank's point of view, it will have logical independance and for internal purpose the network will be controlled by a bank by its software. Voice communication is essentially to be carried through public telephone system.

8.9 The BANKNET could be optimised by -

(1) graded use of satellite, radio, fibre optic and cable links

(2) network architecture with multiple nodes and a central hub and central monitoring and control.

8.10 BANKNET should have nodes with independent communication processors so that communication workload is totally delinked from the banks' computer systems. The main network switching will be organised at a central node located in the major Earth Station in the satellite network. Micro Earth Stations will form other nodes in the network each serving a group of banks around them; they will also serve as concentrators. The RBI systems will be connected to either the communication processors at the central station or the packet assembler/de-assembler at the Micro Earth Station. They will interface through the Front End processors equipped with SNA/X.25 software.

8.11 The zonal office/regional office systems of banks will be required to be equipped with X.25 interface.

8.12 For connecting computers of different makes, the appropriate presentation session and transport layer protocols of international Standards Organisation will be incorporated.

8.13 Voice usage in the BANKNET is not favoured as the network overheads will increase.

8.14 INDONET is essentially intended for availing of its computer power for information processing and software development; since, in the banking environment, RBI and banks have/will have considerable computer power, by establishing suitable communication network, available computers may be put to optimal use. A cooperative network specifically for the banking industry has, therefore, been recommended.

8.15 The cost of the network in the 2nd phase has been estimated at Rs.28 crores.

8.16 The network should be established expeditiously. The network has to be viewed as general infrastructure for the banking industry. As the investment for such infrastructure will be sizeable and since banks may be hard put to commit large funds for developing it, the common infrastructure arrangements may be provided by the RBI at its cost and the operating costs (including depreciation on the infrastructure) may be borne by participating banks.

8.17 The Department in the Reseve Bank of India looking after the 4 computer centres may look after the functions relating to BANKNET and SWIFT also.

8.18 A Committee of Direction under the chairmanship of a Deputy Governor of Reserve Bank of India, members representing Governement of India (Ministry of Finance- Department of Banking, and Department of Economic Affairs-Department of Electronics, Department of Telecommunications, Department of Space and Ministry of Home Affairs-Cypher Bureau), the Indian Banks' Association, Foreign Exchange Dealers' Association of India, a few banks and financial institutions may be set up by the Reserve Bank of India to launch the project and to review periodically the progress of impiementation of BANKNET/SWIFT project and give guidelines in regard to course of implementation.

8.19 The development and implementation of the network, require considerable technical knowledge and skill. The Reserve Bank of India may select a suitable agency, for this purpose, in consultation with the Department of Electronics and the Department of Telecommunications. It is possible to realise the first phase of the BANKNET in 6 months and the second phase in about 3 years.

8.20 SWIFT provides a fast, secure and reliable method for international banking community to communicate with each other in a standard way. The system is operated and administered by SWIFT SC, a co-operative non-profit making organisation established under Belgian law with head-quarters at Brussels.

8.21 The communication services provided by SWIFT are designed to replace mail, cable and telex as the means of communication for international banking messages.

8.22 Banks can connect through computer based terminals (CBT) to the SWIFT Regional Processor to be located at Bombay through any of the three systems (viz.ST 200,ST 400 or ST 500) supplied by SWIFT Terminal services (STS), a subsidiary of SWIFT. These three types of systems vary from one another in terms of their capacity and sophistication.

8.23 Many of the larger banks abroad have developed in-house solutions on their own respective hardware (IBM,Burroughs, UNISYS,DEC,ICL etc.)for connecting to SWIFT. Some of these vendors as well as independent software houses are also providing hardware and software solutions for connecting to SWIFT.

8.24 After Government of India approve the proposal of SWIFT to establish its Regional Processor at Bombay,banks in India will join SWIFT as members. Depending on the volume of message traffic, banks may choose ST 200 or ST 400 system offered by STS. None of the Indian banks may need ST 500 system. It is possible for a number of banks to share the same ST 400 system and by running multiple copies of software on the system, each copy supporting terminals of a given bank, security considerations of banks can be better taken care of. This possibility should be explored in detail by discussion with SWIFT authorities.

8.25 An outstation branch doing foreign exchange business can directly connect to SWIFT Regional Processor at Bombay. In such a case, massive training of the operators at all such branches will be required and may pose a problem. Many large banks in the West have encouraged smaller international business branches to send the messages in free format to the Head Office, where trained operators enter them in SWIFT formats for transmission purposes. Similar system is recommended for Indian banks in the initial stages.

8.26 Banks in India should not use SWIFT for message transmission within India.

8.27 SWIFT aims at protecting the network between the Regional Processors in the sending and receiving countries by message numbering and checking, encryption, control of access to message at Regional Processors/ Operating Centres and by log-in procedures. SWIFT also suggest authentication-key exchange procedures. Use of STEN, a security device recently brought out by SWIFT, guarantees complete security against unauthorised use of data transmitted over any line,public or private.

8.28 Password protection for preventing unauthorised access at computer centres is available in the IBM machines used by the RBI. Packet switching, encoding, scrambling and TDMA schemes used in the network provide built in in-house security at data level.

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- To identify the centres (about 100) to be connected to the network

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Banks:

- To identify H.O./M.O.s which would communicate with RBI offices for E.F.T.etc.

- To identify applications for which the network would be used in the first phase

- Pending installation of mainframe, to decide on P.C./mini-computer connection with the network

- To arrange for site preparation, acquisition of P.C. etc. if new facility is to be created

- To identify and train personnel for this new item of work (To decide on the mainframe computer to be acquired for H.Os).

Note: The aforesaid activities of individual banks may be coordinated by the Indian Banks' Association/Foreign Exchange Dealers' Association of India.

Government Departments

- To aprove the network for the banking industry

- To allot and commission data circuits for the network

- D.O.T., D.O.E., Department of Banking, Department of Economic Affairs and Cypher Bureau representatives to serve the Committee of Direction to be appointed by the RBI.

- To give approvals for import of equipment

Action Plan for BANKNET PHASE 2

- To be drawn up by the RBI on the advice of the Technical Committee within 3 months of starting the first phase

Action plan for SWIFT connection

RBI

- To secure the approval of Government of India for SWIFT Regional Processor to be set up in India
- To advise banks regarding payment of membership fees to SWIFT
- To discuss with SWIFT, the joint connection by a group of banks to SWIFT Regional Processor and advise banks in this regard.
- To identify site for location of Regional Processor
- To arrange for training of Personnel

IBA/Banks

- To identify branches to be connected to Regional Processor
- To plan for communication of messages from other branches to SWIFT through branch identified as above
- To train personnel in the operation of terminals and use of standard formats.

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Member-Secretary

Bombay
17th November 1987

CHAPTER 8

Summary and recommendations

8.1 Mechanisation and computerisation in a planned manner has been recently started pursuant to the recommendations of Dr.Rangarajan Committee. Several branches of banks have been mechanised and a number of mini computers have been installed in Zonal/Regional Offices of banks; more branches/zonal offices will be mechanised/computerised in the next two years; by then, head offices of banks will have larger computers. Use of telecommunications for data transmission and networking of computers is, however, practically non existent in Indian banks.

8.2 Efficient communication facilities would enable banks to move funds (their own, customers's etc.) faster and transmit data faster at lesser cost. Though the total number of branches of banks is large, about 10,000 branches located in 100 centres account for 60% and 65% respectively of the total deposits and advances. Connecting these branches with their regional/ head offices will go a long way to meet their data transmission needs and facilitate control and policy formulation based on an efficient management information systems. If planned now, it will also facilitate proposed connection of Indian banks to SWIFT. Given the resource constraints in India and the need to ensure that the limited national telecommunication resources are not pre-empted by individual organisations for developing independent network, a common communication network needs to be planned on a co-operative basis.

8.3 The proposed co-operative network may be called 'BANKNET' and jointly owned by the Reserve Bank of India and public sector banks. The private sector and cooperative banks and financial institutions may also use the network on terms to be specified by the RBI and the network implementing group.

8.4 The computers available with the RBI at Bombay, Madras, New Delhi and Calcutta for cheque processing during night time and which are at present free during day time may form the basic hub of the network to start with. X.25 based packet switching network may be commissioned in the first phase connecting these 4 metropolitan centres which would be the nodes. The computer systems available in the Head Offices of public sector banks located in these four cities could be connected to these nodes. In the next phase, communication nodes could be located in 8-10 banking intensive centres, gradually raising the number of centres to about 100 in about 3 years' time.

8.5 The electronic private automatic exchange system proposed to be installed by RBI cannot be effectively utilised for the data network in the first phase and the data operation cannot be integrated with voice. It is, therefore, necessary in the first phase to configure a network for independent data operation using voice grade lines dedicated for data communication only.

8.6 The network may be implemented in two phases. In the first phase, Front End Processors with SNA X.25 protocol are required at the 4 nodal centres to connect the computers at RBI centres and to handle computer systems of different vendors later on. For linkages with public sector banks, separate links are required from their head office to the nearest RBI centre. The budgetary requirement for the 4 metropolitan centres is estimated at Rs.41.25 lakhs. For inclusion of other stations (including stations of public sector banks) the estimated cost for each additional station is Rs.2.32 lakhs. The time schedule for implementation of this first phase is about 6 months from commencement of work.

8.7 In the 1990's banks will have a mix of stand alone systems, decentralised computers and computerised processing to keep pace with their growth; they will need to access SWIFT to enhance their capability in international business. The 2nd phase of BANKNET is, therefore, intended to provide a wide area communication facilities within the country with access to SWIFT. About 10,000 branches spread over 100 centres in the country account for a major portion of banks' business (60% to 65% of deposits/advances) and the proposed network will achieve its objectives if it covers about 100 centres.

8.8 A shared banking network which will be a common carrier for information exchange of various banks for their internal use as well as inter-bank communication is recommended. Though it is a shared network, from individual bank's point of view, it will have logical independance and for internal purpose the network will be controlled by a bank by its software. Voice communication is essentially to be carried through public telephone system.

8.9 The BANKNET could be optimised by -

(1) graded use of satellite, radio, fibre optic and cable links

(2) network architecture with multiple nodes and a central hub and central monitoring and control.

8.10 BANKNET should have nodes with independent communication processors so that communication workload is totally delinked from the banks' computer systems. The main network switching will be organised at a central node located in the major Earth Station in the satellite network. Micro Earth Stations will form other nodes in the network each serving a group of banks around them; they will also serve as concentrators. The RBI systems will be connected to either the communication processors at the central station or the packet assembler/de-assembler at the Micro Earth Station. They will interface through the Front End processors equipped with SNA/X.25 software.

8.11 The zonal office/regional office systems of banks will be required to be equipped with X.25 interface.

8.12 For connecting computers of different makes, the appropriate presentation session and transport layer protocols of international Standards Organisation will be incorporated.

8.13 Voice usage in the BANKNET is not favoured as the network overheads will increase.

8.14 INDONET is essentially intended for availing of its computer power for information processing and software development; since, in the banking environment, RBI and banks have/will have considerable computer power, by establishing suitable communication network, available computers may be put to optimal use. A cooperative network specifically for the banking industry has, therefore, been recommended.

8.15 The cost of the network in the 2nd phase has been estimated at Rs.28 crores.

8.16 The network should be established expeditiously. The network has to be viewed as general infrastructure for the banking industry. As the investment for such infrastructure will be sizeable and since banks may be hard put to commit large funds for developing it, the common infrastructure arrangements may be provided by the RBI at its cost and the operating costs (including depreciation on the infrastructure) may be borne by participating banks.

8.17 The Department in the Reseve Bank of India looking after the 4 computer centres may look after the functions relating to BANKNET and SWIFT also.

8.18 A Committee of Direction under the chairmanship of a Deputy Governor of Reserve Bank of India, members representing Governement of India (Ministry of Finance- Department of Banking, and Department of Economic Affairs-Department of Electronics, Department of Telecommunications, Department of Space and Ministry of Home Affairs-Cypher Bureau), the Indian Banks' Association, Foreign Exchange Dealers' Association of India, a few banks and financial institutions may be set up by the Reserve Bank of India to launch the project and to review periodically the progress of impiementation of BANKNET/SWIFT project and give guidelines in regard to course of implementation.

8.19 The development and implementation of the network, require considerable technical knowledge and skill. The Reserve Bank of India may select a suitable agency, for this purpose, in consultation with the Department of Electronics and the Department of Telecommunications. It is possible to realise the first phase of the BANKNET in 6 months and the second phase in about 3 years.

8.20 SWIFT provides a fast, secure and reliable method for international banking community to communicate with each other in a standard way. The system is operated and administered by SWIFT SC, a co-operative non-profit making organisation established under Belgian law with head-quarters at Brussels.

8.21 The communication services provided by SWIFT are designed to replace mail, cable and telex as the means of communication for international banking messages.

8.22 Banks can connect through computer based terminals (CBT) to the SWIFT Regional Processor to be located at Bombay through any of the three systems (viz.ST 200,ST 400 or ST 500) supplied by SWIFT Terminal services (STS), a subsidiary of SWIFT. These three types of systems vary from one another in terms of their capacity and sophistication.

8.23 Many of the larger banks abroad have developed in-house solutions on their own respective hardware (IBM,Burroughs, UNISYS,DEC,ICL etc.)for connecting to SWIFT. Some of these vendors as well as independent software houses are also providing hardware and software solutions for connecting to SWIFT.

8.24 After Government of India approve the proposal of SWIFT to establish its Regional Processor at Bombay,banks in India will join SWIFT as members. Depending on the volume of message traffic, banks may choose ST 200 or ST 400 system offered by STS. None of the Indian banks may need ST 500 system. It is possible for a number of banks to share the same ST 400 system and by running multiple copies of software on the system, each copy supporting terminals of a given bank, security considerations of banks can be better taken care of. This possibility should be explored in detail by discussion with SWIFT authorities.

8.25 An outstation branch doing foreign exchange business can directly connect to SWIFT Regional Processor at Bombay. In such a case, massive training of the operators at all such branches will be required and may pose a problem. Many large banks in the West have encouraged smaller international business branches to send the messages in free format to the Head Office, where trained operators enter them in SWIFT formats for transmission purposes. Similar system is recommended for Indian banks in the initial stages.

8.26 Banks in India should not use SWIFT for message transmission within India.

8.27 SWIFT aims at protecting the network between the Regional Processors in the sending and receiving countries by message numbering and checking, encryption, control of access to message at Regional Processors/ Operating Centres and by log-in procedures. SWIFT also suggest authentication-key exchange procedures. Use of STEN, a security device recently brought out by SWIFT, guarantees complete security against unauthorised use of data transmitted over any line,public or private.

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Bombay
17th November 1987

ANNEXURE - 1

CLEARING HOUSE INTERBANK PAYMENT SYSTEM (CHIPS) AND AUTOMATED CLEARING HOUSE (ACH)

1. CLEARING HOUSE INTERBANK PAYMENT SYSTEM

The Clearing House Interbank Payment System run by New York Clearing House Association has a unique place in Electronic Fund Transfer (EFT) systems among all the financial institutions throughout the world. It was created in 1970 as an electronic alternative to paper, substantially eliminating the use of cheques for the movement of payments from one bank to another. It conveys and settles these payments with great economy of time and labour. Credits initiated by a bank in New York city are paid into the accounts of the other banks' branches in New York at the end of the day. The net transfer of funds from a bank to another are paid through FEDWIRE by appropriately updating the accounts of banks maintained with the Federal Reserve of New York. Mostly international fund transfer advices go through CHIPS. This is because of the fact that most of the international trade is in US dollars. The domestic EFT also takes place on CHIPS but is relatively very small compared to the international payments. It is estimated that 90% of all dollar payments internationally are transmitted through CHIPS.

On a average CHIPS handles 1,55,000 transactions per day with peaks of 2,15,000 transactions per day on the first working day following a long week end. On such days, the money transfer through CHIPS is of the order of $850 billion whereas the average is around $500-600 billion every day. Average payment per transaction involves about $4 million.

CHIPS is owned and operated by the New York clearing House Association whose members are the 12 New York money centre banks. Over 80 New York branches or agencies of foreign banks and several dozen domestic banks' subsidiaries engaged in international business also use the services of CHIPS through these 12 banks. At present 139 banks are connected to the CHIPS system.

The financial transactions in respect of which CHIPS is used as the vehicle to transfer and settle US dollars for international and domestic business include:

Foreign and domestic trade services

- letters of credit
- collections
- reimbursement

International loans

- placements
- interest disbursements

Syndicated loans

- assembly
- disbursements

- Foreign Exchange sales and purchases
    - spot market
    - currency futures
    - interest and currency swaps

- Eurodollar placements

- Sale of short term funds

- Fund movement and concentration

- Euro securities settlements

CHIPS network is organised around B 7800 computer system (which is now being replaced by A 15 system from UNISYS). All the 139 banks are connected to the system in the form of a Star Network. The system provided about 500 ports for communication lines. Each bank has a minimum of two lines for complete redundancy to ensure uninterrupted transmission of transactions to the CHIPS system. Every participating bank must have an office in New York city in order to get connected to the CHIPS. Every participating bank has primary and backup computer systems, once again to ensure the connection to CHIPS at all times. The communication lines are in the form of leased telephone lines which operate at speeds varying from 2400 BPS to 1,92,000 BPS depending upon the traffic volumes of the banks. The banks' computers are connected through Modems over these communication lines. For complete safety of the data and to prevent any kinds of frauds, encryption and authentication devices are used at either side. The system at the main CHIPS site has an absolutely fault tolerant configuration in the sense that all devices and live databases are duplicated Transactions are all stored on magnetic tapes in the form of audit trails. In addition, one computer system identical in configuration and size is operational at a site other than the main CHIPS office to provide for emergency support in the event of any major disaster in the main building. The system has been operational for over 17 years now without any major technical problem. Burroughs Network Architecture (BNA) protocol is used in the CHIPS network. This is a bisync protocol.

The banks connected to CHIPS are in turn connected to SWIFT Network The messages received over SWIFT in the banks' New York office, from their correspondent banks are converted to the CHIPS formats and transmitted for payment settlements over CHIPS. Historically, CHIPS came into existence much before SWIFT was launched. The formats used by CHIPS are very different from those of SWIFT. The former have limitations. Improvements are currently underway.

2. AUTOMATED CLEARING HOUSE (ACH)

New York Automated Clearing House (NYACH) became operational in 1975. It processes payments throughout the day and night CHIPS and NYACH handle payments over and above those processed by the Clearing House in the form of 50 million cheques every day with a value in excess of $20 billion. The NYACH was developed for electronic transfer of payments among financial institutions in New York, New Jersey, Puerto Rico and the Virginia Islands. It subsequently became part of a national network linked by the Federal Reserve System. It processes payments which are submitted by large companies in the form of magnetic tapes for effecting transfer to the payees listed in the tape. The US Govt. is one of the major user of the ACH, using it for all the federal recurring payments. These payments relate to social security and other social welfare schemes.

The total number of participants in the Federal ACH system is 24000 with an average daily volume of $1.5 million. This results in savings of paper processing relating to all such payments.

The number of commercial participants in the country wide ACH is 16500. The daily average volume handled is $1.7 million. Typically large corporations give salaries to their employees directly into their banks through the mag tapes submitted to CHIPS instead of writing cheques to all of them every month. The ACH mostly handles relatively small payments compared to those handled on the CHIPS.

ANNEXURE-2

CLEARING HOUSE AUTOMATED PAYMENT SYSTEM (CHAPS)

The Clearing House Automated Payment System (CHAPS) in the U.K was conceived in 1978 for the transmission of high value, guaranteed sterling payments and settlements. It was proposed that CHAPS would operate in a similar manner to SWIFT in that a central computer system would be set up at the Bankers Automated Clearing Services Centre. The large clearing banks/settlements banks were to connect to these central system. However, in the wake of new technology the centralised concept was discarded. Instead, front-end processors of the same make and brand were installed in each of the settlements banks in 1980 for communicating with one another by means of new British Telecom network called Packet Switched Stream (PSS). The frond-end processor would thus work as a gateway between CHAPS and the existing systems of the respective banks. Tandem mini computer was chosen as the front-end processor and the British software house Logic designed and built the gateway software. Tandem is a non-stop machine with meantime between failure being of the order of several years. The CHAP System commenced live operation in February, 1984.

CHAPS network protects the high value payments and the messages passing over it through adequate security measures. All lines between the various gateways and PSS are equipped with encryption devices which scramble the data to ensure the secrecy of the messages. In addition to encryption of payments, messages are authenticated before transmission and de-authenticated when they reach their destination. This ensures that sensitive files within the fields cannot be altered between the source and the destination. Tamper resistance devices were specifically developed for the CHAPS system.

The smaller banks also participate for transmitting payments over CHAPS. In order to do so, they have to become participants of one of the settlement banks. They can become branch participants, terminal participants or SWIFT participants. Alternatively, they can have multi access facility of terminals, over SWIFT. The terminal participants are able to connect directly to the system through terminals in their own premises. SWIFT participants may send and receive their payments via an existing SWIFT connection. The SWIFT system then routes these instructions directly to the settlement banks of the CHAPS system. An average of 9,000 payments representing a value of 9 billion pounds passes through the central system every day. During 1986 a total of 3.16 million messages were processed over CHAPS.

FEDWIRE

There are 12 federal banks in the USA. Each of these banks controls the commercial banks in its region. All the 12 banks put together constitute the federal reserve system in the US. On a regional basis the funds are transferred from one bank to another through one of the FRBs. On an inter-regional basis the funds transfer takes place through the Funds Transfer Service-FEDWIRE, which is a computer network connecting all the 12 FRBs in the country. The total participating banks in the FEDWIRE system are 9,700 whereas corresponding number for FRB New York is 640 banks. The on-line participants in the total system are 6,700 of which 250 large banks have computer-to-computer connections, while another 1450 are using leased lines terminals only. The remaining 5000 banks use dial-up terminal to transmit payment whenever need arises. Approximately 99% of the transactions take place on line on the FEDWIRE. A total of 2,00,000 transactions with an average value per transaction of $2.7 million are handled on FEDWIRE. The average value per day works out to about $540 billion. Every bank pays a connection fee of $60 per month to the FEDWIRE. In addition, for every transaction it has to pay a fee of 50 cents.

The FEDWIRE is an X.25 protocol based packet switched network. All the 12 systems which are IBM 3081 machines are connected in the form of a network using high speed synchronous communication lines. Each fed bank is connected to 5-6 other fed banks to provide for a large number of paths for transmission of messages. Each of the FRB system is in turn connected to the local EFT network of that city or region. For example, CHIPS is connected to the FRBNY system. Stringent security machanisms including encryption and authentication are in force to prevent any fraudulent activity over the EFT network. The typical terminal configuration in a bank includes an IBM PC/AT with 640 KB memory, monochrome monitor, 30 MB hard disk, upto three printers, paradyne modem (2400 bps) DOS 3.1, printers spooler and Jones futurex (Communication, encryption board). The FEDWIRE system is older than that of CHIPS. It has been around since 1956. It uses only free formats for sending messages. There are, therefore, different message formats being used by SWIFT,CHIPS,FEDWIRE for the EFT. Since EFT is fully automated system across these networks, the appropriate format conversion from one network to another (e.g.SWIFT to CHIPS) takes place in the payments system software packages implemented in the banks' computer systems.

The FEDWIRE also provides securities transfer service on a regional basis through its regional systems, as well as national transfer service through the FEDWIRE system. About 2400 participants use the FEDWIRE National system with about 1000 of them being on-line participants. About 98% of the transactions are on-line. On an average about 40,000 security transfers take place every day over the FEDWIRE, with an average value per transfer being $7.5 million.

IRVING TRUST COMPANY (ITC)

This is one of the first companies which went live on SWIFT on the first day of its operation. The mainframe used for connecting to SWIFT is VAX 8600 system. The entire software has been developed inhouse by Irving Trust. An average of 15,000 transaction are handled through SWIFT everyday which included 8,000 incoming and 7,000 outgoing messages. 60% of these messages relate to payments and enquiries, 15% are foreign exchange message,15% are statements of accounts, and 7% relate to letters of credit/reimbursement. The VAX 8600 system is connected to two Regional Processors of SWIFT in Culpepper, Virginia with an alternative line to the SWIFT RP in Piscataway, New Jersey. Both the links are 4800 BPS, bisync protocol, protocol level acknowledge (DEC/VAX 8600) with ISN/OSM check. In addition, there is a dial-up pilot backup line path to primary and secondary locations. ITC is expected to connect to SWIFT-II based on X.25 protocol as soon as SWIFT-II is made operational.

A number of application software package developed inhouse by Irving Trust are operational on its VAX 8600 system for handling the SWIFT incoming and outgoing messages automatically.These include the funds control system, the foreign exchange system, letter of credit system etc. All these applications run on the IBM 3084 system. The communication protocols and the message systems architecture are developed on the VAX 8600.

The ITC also has an international communication network of its own. However, unlike the MHT, each of the international offices of ITC has a direct connection to the SWIFT Regional Processor located in that country. For example, the IBM 4361 located in the London branch uses the DMNL software (the equivalent of ST 400 software for connecting to SWIFT supplied by IBM) is connected directly to the SWIFT Regional Processor located in London. Similarly, the S 36 located in the Hong Kong branch using the ST 200 is connected directly through the Regional Processor located there. The representative offices located in cities such as Beirut and Bombay are routed through the nearest international branch.

In order to take advantage of the SWIFT standard message formats and not develop something of their own, the Irving Trust decided from day one, to use the SWIFT message formats for its internal communications as well. They claim to have greatly benefitted from the standardisation based on SWIFT formats. The domestic network uses leased lines and X.25 based TELENET for connecting its branches to the Head Office. The communication protocols handled by VAX 8600 system include not only the SWIFT but also X.25 protocols for TYMNET, telex network etc. This allows the Irving Trust talk to large number of other networks.

ANNEXURE-5

MANUFACTURERS HANOVER TRUST (MHT)

MHT has an international private communication network of its own, linking all its branches throughout the world. It is a packet switched network using X.35 protocol. A large number of communication nodes including 10 nos. in New York city and those at Los Angeles, Chicago, London, Frank Furt, Hong Kong, Singapore etc, form the basic packet switched communication grid. Each of these nodes is connected to more than 2 or 3 other nodes to provide for alternate communication paths. The network is called GEONET.

The terminals located in branches are connected to one of these nodes through appropriate concentrators or mini computers. Virtually, every kind of machine is in a position in the branches using different protocols such as Async, Bisync, etc. The concentrators in the branches have necessary software to convert these into X.25 and put the messages on the network through the nearest node.

Specialised application software is mounted on different computer systems located in the Head office at New York. These mainframe systems are connected to the packet network. Messages/transactions originating from a branch are routed to the specific computer system from the GEONET.For example, one mainframe in New York city handles only the SWIFT connection. All SWIFT applications from any terminal of any branch located in the USA or any other part of the world is routed to this mainframe via the GEONET. It is through this processor in New York that the message is then transmitted to SWIFT network. In view of the different time zones throughout the world, the hardware is optimally used throughout 24 hours.

M I D L A N D B A N K

MIDLAND bank has established an integrated data and voice communication network called MIDNET. It is one of the fully automated banks with all the branches connected on-line and with the facility of providing customer, detailed information about his accounts held in one branch from any other branch in the country. Over 2100 branches/retail outlets are connected via 150 communication lines, each of which may support 12 branches or more.

MIDNET is a packet switched network using X.25 protocol. There are 9 communication nodes which are TELENET nodes (Model TP 4000 provided by placci company of UK. British Telecome packet switched network also uses TP 4000 as the basic communication nodes for their PSS). Branches are connected via dedicated lines to concentrators located in the cities. There are about 70 concentrators located throughout UK which are in turn connected to one of the nine communication nodes. Each concentrator is connected to two nodes for providing a backup path in the case of failure of one. The nine communication nodes are connected through high speed trunks at 2 MB per second. This is called the Maga Stream Data Network.Concentrator to node lines speed is 9600 BPS whereas the branches are connected to concentrators using 2400 BPS lines. All these are leased lines. In the case of 4 major communication nodes,EPABXs are connected to them which take care of the integrated voice and data communication. The branches connected to these nodes can transmit voice also over the private MIDNET.

Burroughs and IBM computer systems are used for on-line banking and information systems in the MIDLAND Bank. Different branches can have a variety of equipment and yet communicate over the X.25 network. This is possible through the Network Access Concentrator located in every branch. The terminals are connected to the NAC.X.25, Async, bisync terminals etc., include PCs, IBM 3270, ATM,SWIFT terminals etc.

MIDNET also communicates to other X.25 networks in Canada, U.S.A. etc. using the X.75 protocols.

ANNEXURE-7

NATIONAL WESTMINISTER (NATWEST)

NATWEST is currently implementing a new digital integrated network. This network would support voice and data communication with full security alarms. Network is based around 16 communication nodes located throughout UK out of which 13 are connected by trunk lines operating at 2 Mega bits per second. The remaining three are connected over 64 KB circuits. The network uses X.25 protocol.

The branch interface equipment with specially commissioned software on an intelligent distributed processor is the key element in allowing two way interface between the network and the variety of terminals in the branch such as ATMs, key board screens, backup terminals, cashier terminals/dispensers, printers etc. It also has the capacity to support non-intelligent devices within the branches.

For high reliability of the network the contingency plans in the network include:

(1) Reserve CPUs and support routes to the communication nodes.

(2) Alternative routes over the trunk network.

(3) Larger branches with dual systems and separate route connections to two switching centres.

(4) All connected branches have links to the public switched network which could in an emergency,enable them to access from an alternative switched centre.

SWIFT traffic is handled through a B 1955 machine connected to the network. Approximately 22,000 messages are handled everyday. The overseas branches of NATWEST are connected directly through appropriate SWIFT terminal equipment to the Regional Processor located in those countries.

ANNEXURE-8

BANKERS AUTOMATED CLEARING SERVICES (BACS)

The Bankers Automated Clearing Services (BACS) is also a means of moving out of paper into automated payments and collection. The company is jointly owned by all the 12 High Street Banks located in London. It uses 4 major computer systems and provides a high level of security and reliability in the payments system. The transfer of funds between accounts held in the UK banking system are possible though BACS. More than 30,000 users, including most of the major corporation submit credits, standing orders, direct debits, directly into BACS either as transmission, on tape, cassette or floppy disk. More than 82 million entries, valued at about 29 billion pounds are handled through BACS every month. The certainty of payment provided by automated money transmission brings savings in the form of cash flow, reduced processing costs and faster transfer of funds.

Examples of the works handled by BACS are:

1. **Standing Orders:**

All interbank standing orders are processed by BACS.Input on magentic tapes are sorted and merged into bank output. files which can be fed directly into the computer system without any manual intervention

2. **Salaries and Wages payment:**

Over 75% of all salaries paid in the UK are credited to the employees' accounts through BACS each month. Over 1 million weekly paid wages are also processed thorugh BACS. No vouchers are used in the process.

3. **Direct debits:**

More than 70% of all life insurance premiums are collected using this method. Tapes containing direct debits are submitted to BACS who then sort and merge into bank sequence and return magnetic tape output to the banks for posting to the appropriate payees' accounts.