Chapter - 2

COMMUNICATIONS INFRASTRUCTURE AND USAGE OF INFINET

2.1   Introduction :

2.1.1   Some of the important aspects on which the terms of reference of the Committee mainly concentrated on relate to issues such as network architecture and application architecture, for the Indian Financial Network (INFINET). The Committee therefore held detailed deliberations on the strategies to be followed on the following issues:

- The components of the financial system backbone and the need for integration of INFINET and terrestrial links keeping in view the future traffic needs, backup and disaster management system.
- The type of applications to be given priority for implementation on the backbone being provided by the Institute for Development and Research in Banking Technology (IDRBT) set up by the Reserve Bank of India.
- The technology plan for the financial sector.
- Optimal utilisation of network resources.

2.1.2 It is well known that the media for communication backbone can be terrestrial links, terrestrial as well as satellite and microwaves. The reliability and fault tolerance of the communication backbone architecture is essential for running applications and services in a mission critical environment. The Reserve Bank of India decided to establish INFINET using Very Small Aperture Terminal (VSAT) technology in the first instance since leased line solutions have not been successful so far for running mission critical applications in our country. The task of setting up the VSAT network was entrusted to the IDRBT. The technical part and architecture of the INFINET are given in **Annexure 1**.

2.1.3   The Committee has taken a long-term view on the matter of communication infrastructure to be utilised by the financial sector in the country. Considering the growing volume and diversity of operations that the sector has to undertake, throughout the length and breath of the country, the Committee felt that it is essential to have a communication backbone consisting of satellite as well as terrestrial media. The network architecture of the communication backbone is to be designed and integrated seamlessly to provide transparency and reliability to the user organisations (see **Annexure-2 Fig.1**). The INFINET communication backbone network, designed and implemented by IDRBT, will be primarily utilised for inter-bank / intra-bank applications.

2.2   INFINET - Network component

2.2.1   In order to upgrade the country's payment and settlement systems, the Reserve Bank of India took the initiative of providing a communication backbone in the form of a satellite network based on VSAT technology to the Banking and Financial Sector and entrusted the work to IDRBT. As the bandwidth at present on INFINET is limited, it may have to be optimally used. This would need allocation of bandwidth to various users and

appropriate configuration of ports for dealing with different types of applications viz., bursty, transaction oriented, streams by employing appropriate Access Mechanism.

Three access modes viz., the aloha mode, the transaction reservation mode and the stream mode, would be in place in the VSAT based INFINET. Details in this regard are set out in **Annexure 3.**

2.3   Financial Network Architecture

2.3.1   A Financial Network in the form of a reliable communication backbone facilitates running different applications / services, which eventually result in:
- Banking and Financial services independent of their location
- Extended banking business reach and hours as well as increased business volume and better fund utilisation, thereby facilitating reduced operational cost
- Increased security
- Reduction / elimination of payment risks
- Efficient Housekeeping
- Improvement in decision making process
- Innovative customer-oriented delivery mechanisms

2.3.2   The primary objective of INFINET for the banking and financial sector is to enhance efficiency and productivity on the one hand and provide state-of-the-art customer services through innovative delivery channels such as Internet banking, home banking etc., on the other.

2.3.3   Both the inter-bank and intra-bank applications that will use the INFINET are still in the development stage. As time progresses, both the RBI and participating banks would go for bandwidth hungry applications. The total bandwidth available currently will be shared by all the participating banks. Apart from the State Bank of India (SBI), its associates and public sector banks, other banks, financial institutions, non-banking finance companies, Primary/Satellite dealers in Government Securities which need to communicate with the RBI are also keen to have connectivity to INFINET. The participating banks would in course of time connect their regional / controlling offices with currency chest branches and branches with other commercially critical activities.

2.3.4   The Committee, therefore, expects growing demand for bandwidth and is of the opinion that the following recommendations should be taken into consideration:
- IDRBT should continuously monitor the traffic on INFINET and as soon as the usage exceeds 50 per cent of the peak load, bandwidth enhancement should be planned.
- Inter-bank applications should be accorded the highest priority.
- Users should forecast their traffic requirements three months in advance and inform IDRBT about the need for increased bandwidth as the time requirement for enhancement would be little over 3 months. If this discipline is not followed, all the network users will get affected. In order to ensure that users do not have more applications than originally planned, the option of assigning fixed bandwidth for individual users would need to be explored.

- The INFINET has two outroutes of 512 kbps (in 1 + 1 redundancy configuration) and 16 inroutes of 64 kbps (with 1:1 redundancy), this capacity needs to be substantially augmented keeping in view the fact that banks will run Web based applications in future which will require voice, video, images and data to run on the network with adequate Quality of Service (QoS). The applications and services for multimedia requirements demand higher information throughput and lower latency. For example: interactive voice and video require connection-oriented services. Transmission Control Protocol / Internet Protocol (TCP/IP) network is a connection less network. Some of the applications as mentioned above will require prioritising traffic to provide adequate QoS. An issue of concern in the VSAT based backbone networks is the delay which affects the QoS for the above applications. This requirement can be best achieved by having a combination of VSAT and terrestrial backbone rather than by VSAT backbone alone. The internetworking equipment and the associated software will have to provide the necessary environment for different applications.

2.3.5 The Committee, therefore, suggests a blend of Microwave (terrestrial and satellite) and land links as media for payment and settlement systems backbone for INFINET. Different types of media have to co-exist drawing from each other's strength. This blend would facilitate disaster recovery also.

2.4 Integration of VSAT and Terrestrial Network

2.4.1 While the INFINET should ideally be a blend of different types of media with seamless integration so that the backbone is transparent to the users of the network, the existing rules of the regulatory Authority permit intra-city link to VSATs only through leased lines. Public Switched Telephone Network (PSTN) dial-up link with intra-city and inter-city links to VSATs are not allowed. However, a bank's existing network can be linked to the Hub site through leased lines. The current restrictions result in a major bottleneck in providing cost effective connectivity to the users. This matter has to be vigorously pursued with the regulatory Authority, by the Reserve Bank of India and Indian Banks Association, and the constraints removed. The need for Integrated Subscribers Digital Network (ISDN) connection to VSAT - both inter and intra-city - should also be pursued with the regulatory Authority.

2.4.2 Since the applications implemented on the INFINET would also relate to Payment and Settlement Systems, there is a need to have a suitable backup and disaster management strategy. The strategy could be to go in for either a similar solution in another city or to go for a VSAT based network solution based on Ku band (which is the most popular frequency band being employed all over the world) in different cities. In the latter case, a suitable solution to integrate the two networks viz., the extended C-band based and Ku band based ones, will have to be in place. This could be done through protocol conversions at the Network Layer.

2.4.3 Another alternative would be to integrate VSAT network and the proposed high-speed optical fibre network mentioned above in such a way that each will serve as a back up to the other. The Network Management System (NMS) for the fibre-optics network

will have to be in a city other than Hyderabad. The mission critical application servers could be located at Hyderabad. It should be possible to integrate the two networks through an appropriately designed gateway.

2.4.4   The participating banks would like to consider the design and development of their corporate network with INFINET as the backbone, providing the high level connectivity. Most of the banks have identified their VSAT locations to be Head Offices and Zonal / Controlling offices. The Regional and Divisional offices, other administrative units and computerised branches have to be appropriately connected and integrated to form their own Transmission Control Protocol / Internet Protocol (TCP/IP) based network. **Annexure 2, Figures. 2 to 4** explain the options for connectivity.

2.4.5   The participating banks will have Local Area Network (LAN) solutions at their administrative locations and computerised branches. They will choose appropriate Wide Area Network (WAN) technology to get connected to the INFINET backbone. The software will have to be architectured by the respective banks to run end-to-end applications and services in a distributed environment. The network will then graduate into a corporate network of the bank. Effective utilisation of Internet technologies on this corporate network will result in the banks having their own corporate ***Intranet***.

2.4.6   **IP Addressing and Domain Name System (DNS) Scheme** - An IP addressing and DNS scheme has been designed for implementation in the Closed User Group (CUG) network. The addressing scheme will essentially be of the form 10.x.x.x, where 10 (first octet of the IP address) represents a private corporate network. The remaining 3 octets will be used to represent banks, locations (branches/offices/local area networks) and the nodes within the locations. Banks will be represented through 10 bits (1022 banks), locations through 9 bits (510 locations) and nodes through 5 bits (30 nodes). Banks with large number of branches will have adequate number of address ranges to represent the concerned bank branches. IDRBT has already finalised the IP addressing scheme and the addresses have been intimated to the banks.

2.5   Financial Applications Architecture

2.5.1   In the banking sector, applications are of both inter-bank and intra-bank in nature. Some of the intra-bank applications are given in **Part I of Annexure 4**. As regards inter-bank applications, a Subgroup set up by the INFINET Users' Group has already identified the applications as given in **Part II of Annexure 4**.

2.5.2   In using the INFINET network it is important to note that each bank has to come out with standard based software architecture taking into account all their core applications and also allied services. The IT solution architecture should be derived out of the business goals, objectives and processes and not the other way round. In short, it is the business architecture which should drive the IT architecture.

2.5.3   It will take some time for designing and development of an integrated payment and settlement system but in the short run certain applications are needed to be operated

on this network. The banking industry could, for instance, use enabling technologies such as secured messaging, E-mail with appropriate security, collaborative and workflow environment etc., and cast their applications utilising the framework provided in these environments. Several banks are considering the possibility of running cash management services through an E-mail backbone.

2.5.4 The applications architecture will, of course, depend on the applications themselves. The transactional and operational parts of various application components can be implemented either in a centralised set-up or in a decentralised set-up in groups like Region / Zonal / Service branch levels depending upon the organisational structure, decision making process, concentration of transactions in a Region / Zone / Service Branch area etc. In a specific case like clearing, one could consider four-tier architecture with processing taking place at district, State, regional (consisting of a few adjacent States) and national levels. Depending upon the applications, the number of levels or tiers can be determined. **Annexure 5** gives a tiered approach for bank specific applications, with provision for some inter-bank transactions to flow towards the central server of a specific application.

2.5.5 For applications like the Inter Branch Reconciliation (IBR), the flow will stop at the bank level server. The IBR can be implemented either in a centralised set up or in a decentralised set up depending on the number of branches and the volume of transactions. For a bank with very few branches, a centralised set up may be a good option to pursue. For banks with large number of branches and geographically widely distributed locations, a decentralised approach at Zone/Regional levels may turn out to be useful. It is found that in an IBR application, 70 per cent of the transactions are of intra-regional / intra-zonal character and for large banks therefore, a decentralised approach will be more suitable. **Annexure 6** gives a schematic picture of the current scenario and the possible scenario in a networked environment.

2.5.6 The design and development of the applications and services should take into account the VSAT network with which INFINET is launched. The applications, if possible, have to be decentralised to ensure that the VSAT backbone does not carry intra-city traffic. Further, in order to achieve economies of scale banks should attempt to share their application software. It hardly needs to be emphasised that the application software should be invariably standards based.

2.5.7 The settlement of accounts from various components of the payment and settlement systems should be done synchronously / asynchronously at central system (settlement server) so that the participants of payment and settlement systems get an integrated view of their funds and manage the funds more efficiently. The settlement server (primary) at the central site should have hot-standby and warm backup sites. The hot-standby site should be updated synchronously (simultaneously) with the primary settlement server. The warm backup site can be updated asynchronously. Since all the RBI offices are in the network, it should be feasible to implement the settlement operations in a centralised set up. Settlement will be done at the RBI, as settlement is one

of the major functions of the Reserve Bank. The architecture for the settlement server could be as per **Annexure 7**.

2.5.8   The inter-bank applications will be developed by the RBI / IDRBT or any software agency identified by them in co-ordination with the INFINET User Group. Except for RTGS and DvP applications, others will be mostly of batch oriented type.

2.5.9   It should be left to the individual banks to choose their own platforms. Specific platform should be made mandatory only for inter-bank applications. Even in this case, only interfaces need be defined and it should be the responsibility of individual banks to plug in the interfaces for inter-bank applications.

2.6   Recommendations:

2.6.1   The Committee after deliberating extensively on the needs of the communications infrastructure and looking at the current applications and future trends, recommends the following.

2.6.2   The approach that could be considered for improving the effectiveness of INFINET would comprise -
*   Enhancing the transponder capacity to the extent feasible and the number of outroutes as the demand grows; and simultaneously
*   Working towards having a high performance fiber backbone initially with 2 mbps and 64/128 kbps connectivity appropriately integrating with the VSAT network as given in **Annexure 2 - Fig 1.**

The mix of satellite based and optical fibre backbone with appropriate routing strategies could be **the** network architecture to provide reliability and adequate performance for differing traffic needs. In other words the INFINET should be a blend of satellite, microwave and terrestrial links, appropriately configured depending upon availability and accessibility. It may be borne in mind that there are a number of places in India which are inaccessible and with difficult terrain and in such places, use of VSATs will be particularly effective.

2.6.3   *Terrestrial network -* Keeping the above in view, the Committee has identified the cities for high speed land links: Mumbai, Chennai, Calcutta, New Delhi, Hyderabad, Bangalore, Ahmedabad, Nagpur to have **2 Mbps links**, Bhopal, Guwahati, Chandigarh, Thiruvananthapuram, Kanpur, Patna, Bhubaneshwar, Jaipur, Pune to have **64/128 Kbps links**. Such a terrestrial network (as detailed vide **Annexure 2** - **Fig.1**) needs to be set in place; this could be effectively done if it is entrusted to IDRBT.

The fibre optics link will connect the RBI Regional Offices in the above centres and there will be alternate links to take care of any link failure. These offices will have necessary routing equipment. The mission critical application servers could preferably be located at Hyderabad. Other banks and FIs will connect to the routers in the respective centres.

2.6.4   Banks will need to have servers for files, mail, Web and name services. As mentioned earlier, some of the applications like Inter Branch Reconciliation (IBR) can be implemented either in a centralised set up or in a decentralised set up depending on the number of branches and volume of transactions. For a bank with very few branches, a centralised set up may be the best option. For banks with large number of branches and geographically widely distributed locations, decentralised approach at Regional / Controlling offices levels may be most useful. This is one way of avoiding too much traffic to the centralised site from all the branches.

2.6.5   In order to conserve satellite resources, mission critical application servers like Real Time Gross Settlement (RTGS), Electronic Data Interchange (EDI), certification, security related servers may be connected to the hub site through backhaul links with 64 Kbps or more speed using leased lines, ISDN, Radio modems etc. This facility should be available to the existing as well as future members of the INFINET.

2.6.6   To the extent possible, multiple branches of a bank may be connected to the branch with VSAT through leased lines within a city. Banks may also consider sharing of VSATs by allowing branches of other banks to get connected to their VSATs through leased line links within a city. As and when PSTN link is made available, dial-up connection to VSAT also can be used. Thus viewed, the usage of VSAT backbone needs to be resorted to only for inter-city / inter-region / inter-zone traffic. This strategy is particularly relevant for DNS servers.

2.6.7   Usage of INFINET for intra-bank applications is likely to lead to bandwidth crunch for important inter-bank applications. It would, therefore, be desirable that participating banks consider setting up their own corporate networks and connect them with the INFINET through appropriate technologies.

2.6.8   The Committee recommends that for both inter-bank and intra-bank applications, it is necessary to have an application architecture keeping in mind that the INFINET backbone network will be VSAT based. The requirements document and the specifications for each of the applications will have to be prepared considering the VSAT backbone and its characteristics and limitations while casting the applications.

2.6.9   The Committee recommends that based on the growth in the network traffic, which will be continuously monitored by IDRBT, INFINET may be expanded by using a blend of satellite and land links as media for payment and settlement systems backbone.