

21st December 2006

Dear Mr. Prime Minister,

The National Knowledge Commission (NKC) strongly feels that to optimally utilise the potential of institutions engaged in generation and dissemination of knowledge in various areas, such as research laboratories, universities and other institutions of higher learning, including professional institutions, it is important to connect them through a high speed broadband network. In order to explore the feasibility of establishing broadband connectivity among such institutions, NKC spent six months studying various issues and alternatives. We conducted extensive consultations with experts, potential users, telecom service providers, government officials and various educational and research institutions (*list attached*) to understand the requirements, implementation issues and benefits of creating an integrated National Knowledge Network.

The purpose of such a knowledge network goes to the very heart of the country's quest to build quality institutions with requisite research facilities and create a pool of highly trained persons. Considering the enormity of the challenge, NKC believes an immediate objective of the network will be to share the existing content, coursework, expertise, ideas, innovations, equipment and facilities available in the limited number of centres of excellence, with a wider group of institutions, educators and students.

Globally, research and development activities and innovations are increasingly multidisciplinary, collaborative, and require substantial computational power. The key to successful research today demands live consultations, data sharing and resource sharing. Therefore it is essential to provide broadband connectivity to our knowledge institutions to improve access, quality and quantity of R&D activities.

The primary objective is to interconnect all our knowledge institutions in various fields, and at various locations throughout the country, through an electronic digital broadband network with adequate capabilities (minimum access speed of 100mbps or more) to encourage sharing of resources and collaborative research.

We commissioned an expert to examine what it would take to create a National Knowledge Network. NKC also held detailed discussions with the office of the Principal Scientific Advisor (PSA) to the Government of India. The discussions yielded a consensus on the optimal approach to be adopted for setting up such a network, whether it is for a broad range of institutions as envisaged by the NKC or a specific community of S&T research institutions. A detailed report by the expert outlining the need for such a network, the optimal architecture and the organizational structure required to manage this network, is being circulated separately to the concerned ministries. Based on the various discussions NKC recommends the following:

1.0 NATIONAL KNOWLEDGE NETWORK: Build a National Knowledge Network with gigabit capabilities to connect all universities, libraries, laboratories, hospitals and agricultural institutions to share data and resources across the country. This will require us to ultimately provide connectivity to around 5,000 nodes covering all major institutions. The actual implementation could be in phases targeting 500 to a 1,000 nodes in the first phase. However, the design of the network will have to be based on the final network. The prioritization of the nodes for implementation purposes should be on the basis of the institutions which are most likely to use the network from day one and which would be able to demonstrate the benefits of such a network. Based on a detailed analysis of the country's existing optic fibre infrastructure and technologies available, it is estimated that a 500 to 1000 node network can be commissioned within 3-6 months.

2.0 OPTIONS: Wide consultations with experts and technology providers suggest that there are four possible networking options:

- The first one involves hiring dark fibres that have been extensively laid out by various telecom service providers and lighting them.
- The second involves lit fibres and differs from the first in not requiring transmission equipment procurement and its maintenance.
- The third involves using existing commercial networks and therefore no capital investment in equipment is necessary. It also requires minimum maintenance and operations organization.
- The fourth is a hybrid approach where the Core consists of two layers in which the inner higher speed layer is wholly owned by the stakeholders while the lower layer is provided by commercial service providers.

From the viewpoint of cost, the third approach based on the utilization of the available commercial networks appears to be most attractive to start with. This is because the capital expenditure is negligible if the operator chosen has a well established network which is being used by a large number of existing customers. However, lack of experience of architectural flexibility and security aspects of virtual private networks (VPN) set up on a commercial basis, do not allow prospective users to be entirely comfortable with this approach. Therefore, we recommend that to begin with, existing commercial networks be utilized. Subsequently, based on feedback from this exercise we could slide into a hybrid network with a central Core, preferably of a relatively few nodes, and an outer network constituted by practically each one of the other operators' network.

3.0 ARCHITECTURE: The network should consist of a Core using Internet Protocol (IP) and Multi-Packet Labeled Services (MPLS) technology, an Aggregation or Distribution network, and an Access or Edge network linking the institution's local area network (LAN) to the Core. The Core network could be a single hierarchy or a two stage network with a higher speed network at the top to accommodate architecture flexibility and security concerns in a VPN based commercial IP-MPLS network. The detailed specification of the network will have to be drawn with a view to inviting bids for speedy implementation. The

network should be implemented in phases. The first phase should cover about 1000 institutions and should be commissioned in 3-6 months.

- 4.0 CONGRUENCE WITH E-GOVERNANCE:** The question of whether the network for e-governance and the Knowledge network should be one single network assumes importance and relevance depending upon the approach adopted for the realization of the network. In the recommended approach in the first phase, namely VPNs on commercial MPLS networks on Dense Wavelength Division Multiplexing (DWDM), this question becomes irrelevant because several VPNs can be created on a commercial network and they could be entirely un-correlated, as may be the case with these two networks. This question would assume importance only if we were to implement a purely owned network on lighted fibres. On the other hand even in the hybrid approach, the e-governance network with an entirely different geographical spread and much lower bandwidth requirements, can be realized as VPNs and the security and flexibility aspect could be addressed by the inner core. The issue of congruence of the two networks therefore no longer remains important and the two aspects can be totally de-linked.
- 5.0 SECURITY AND PRIVACY:** Methods will have to be evolved both at the time of commissioning of the network as well as during operations, to ensure security of data along with privacy and confidentiality. Access to data from the Data Centre of a given institution should be under the control of the institution being addressed. An arrangement for authentication and authorization, with the participation of the connected institutions is essential to launch the network.
- 6.0 ONE TIME SUPPORT FOR LANs:** The proposed broadband network envisages 100 Mbps or higher access bandwidth and therefore almost all the user institutions will have to upgrade their networks to be able to cater to these speeds. While several institutions may have the resources for doing so, a large number will need one time capital support to set up Fast Ethernet LAN (FELAN) which includes expenditure on routers, switches and optic fibre cable on the campus.
- 7.0 COSTS:** The Knowledge Net initially proposed to be launched on existing commercial networks will therefore involve a recurring cost of Rs 20-40 lakhs per institution connected, amounting to Rs 200-400 crores annually for 1000 institutions in the first phase. In addition there will be a one time capital investment in upgrading the LANs of these institutions to a 100 Mbps capability Fast Ethernet LAN. Thereafter, based on the feedback, the installation of the inner core network of 10 Gbps or higher capability will be taken up. This will involve a capital investment of around Rs.1000 crores on a 7 or 8 node Inner Core network, its Gigabit connectivity to the commercial IP-MPLS networks, as also direct connectivity to a few users who are particularly concerned about the security and internetworking experiments. This expenditure will be incurred over a period of time. There will be an additional recurring expenditure for this Inner Core on hiring large bandwidths from bandwidth service providers. This amount will depend on the number of nodes and the negotiated or bid-based price.

8.0 ORGANIZATION: To ensure day to day coordination, operation and efficient utilization we recommend establishing a Special Purpose Vehicle (SPV) consisting of major stakeholders. Such an SPV should have professional experts pooled from various stakeholder institutions for coordinating and guiding various private vendors for speedy implementation. The policy, security and overall management should be the responsibility of the SPV and the operational support requirements should be met by the industry. One of the compelling reasons for such a mechanism is to provide assurance that the use of cyber space will in no way compromise the security concerns of the country.

9.0 OWNERSHIP: The Knowledge Network should be owned by the SPV consisting of major stakeholders. Government ownership is not desirable, despite the fact that substantial funding will be from the government because:

- It is the government's policy to withdraw from direct operations and maintenance activities in the ICT sector.
- The type of trained manpower needed, though not large, is in great demand in the market, and therefore will require special remuneration and incentives.

10.0 SPECIAL GROUP: We recommend setting up a special working group of experts to finalize specifications, implementation plans, cost estimates, network plans as well as to carry out the actual task of procurement and commissioning of the network. This group will also establish the SPV needed for running the network on a day to day basis.

We firmly believe that a National Knowledge Network interconnecting our knowledge institutions and infrastructure with access speeds of 100 Mbps and more will give a major push to collaborations and sharing, needed to enhance the quality of our education, research and applications and at the same time will empower our people to be competitive in the global economy. We hope therefore that this proposal will be considered favorably and incorporated in the XIth plan.

Warm personal regards,



Sam Pitroda
Chairman,
The National Knowledge Commission

List of people consulted by the NKC in relation to National Knowledge Network

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CEO, Bharti Airtel Limited
5. Prof. N. Balakrishnan
Professor, Multimedia, Computational Electromagnetics, Computer and Network
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6. Mr. Subhash Bhargava
Chairman, VSNL Broadband Ltd
7. Mr R Chandrashekhar
Additional Secretary, Ministry of C& IT,
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8. Dr. R Chidambaram
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Former member Telecom Regulatory Authority of India (TRAI)
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34. Dr Sitaram
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35. Mr Anil Srivastava
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2. Shri Kapil Sibal, Minister for Science & Technology, Ocean Development
3. Shri Dayanidhi Maran, Minister for Communications & Information Technology.