

## Strategic plans for designing information systems under local government

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Now local bodies which are concerned with various administrative, educational and development issues and the planning for use of technology have started to recognize the value of information. This study attempts to evolve technical guidelines for building up an information system under local government that provides networking services by connecting various offices and institutions like Block Panchayat Office, Village Panchayat Office, District Educational Office, schools, colleges, and other organizations existing in the geographical jurisdiction under District Panchayat.

### **1. Technical Model**

The concept of a modern information system serving all educational research and development institutions and offices has been a serious topic of discussion in many forums. In developed countries most of the local governments have efficient information systems. In India also in geographical areas coming under local governments many institutions have implemented information systems and networks in response to their own perception of the importance of this resource. It is better that a standard network implementation model to assist local governments in their planning may be designed by NIC or Other National or State level government agencies so that all such implementations will be compatible with each other and with any national level information system plans.

The possibilities offered by ICT for materialising an integrated voice, data, and video network extending to every institution, offices and home is very exciting. But the investment in money and time will be beyond the powers of

the local bodies unless there is a strong awareness of its importance as well as careful planning and provisions from higher levels of government. But local bodies can do a great deal within the limitations of resources under their control if the network and communication facilities of institutions in the locality can be pooled and shared by providing possible support also to them.

National policy should be to define a highly functional, homogenous, and well supported network system that could interconnect all district, state and nation wide institutions and departments to enable every one to use new communication tools and network based information resources. It will take considerable time to adapt the procedures and activities of the institutions and offices at various levels to take full advantage of the current information technology. Using standard models for implementation of information systems District Panchayats can begin the process. Many institutions existing in various districts have already developed information systems and services which can be shared under the support and cooperation of District Panchayats. This can also enable extracting the maximum utility of the systems developed.

Modem accessible systems are available in many district headquarters. They serve to encourage people to become familiar with network resources and capabilities. But they will always be limited in functionality and capacity. Considering the emerging bandwidth intensive information resource applications and the functionality that they will require, it is essential to provide direct access to Internet from computers in every office and institution in the district.

TCP/IP which the Internet communication protocol will allow all computers to communicate. Software's that implement this protocol is available with most of the present packages. This protocol supports wide variety of applications, from electronic messaging to client server data access. The use of this protocol will ensure that all networked computers will have direct access to the vast range of existing information on the Internet as well as the National Information Infrastructure that is coming up.

## **2. Implementation**

Current proven and cost effective technology which would be expandable and up gradable to later technology with minimum additional investment should be used. This study proposes a modular design to meet the criteria.

- ? physical infrastructure development that will be general and flexible enough to be reused as technology improves.
- ? integrating as much as possible the existing equipments and systems in various offices and institutions into the information system.
- ? locating the network server in a place where it can be efficiently managed and supported.
- ? using inter connect topologies that will be both cost effective and manageable.

In many institutions that come under the local government or the geographical area under its jurisdiction already there is some form of network and communication infrastructure. While implementing a district level information system in some cases such infrastructures can be adopted to newer technologies and in other cases they are to be replaced within a span of time.

### **2.1 Implementation Model**

No single design for an Information System can be considered to be fit for every District Panchayat. Location, physical constraints functional needs, existing technology base, funds, opportunities for sharing resources with major institutions or organizations existing in the region etc will necessitate major modifications. Hence at national or state level a set of general guidelines that can be followed for the planning of an information system under local government at District Panchayat level can be formed. Using Internet protocols in developing local information systems can enable avoiding the major expenses of building new backbone infrastructure at district and state level for the time being. Inter connection of institutions,

offices at district level to district headquarters and then to departments and headquarters at state level can be achieved by getting Internet connections services from Department of Telecommunications (DOT) Videsh Sanjar Nigam Limited (VSNL) which has established Gateway Internet Access Services and hubs in most of the district headquarters. Connection to Internet service will provide communication capability to all local bodies and institutions subscribing to from within the state and country. Internet technology is designed to allow very flexible intensity topology. A hierarchical topology is the simplest to develop. This means hierarchical connection of facilities at offices and institutions from institution to Panchayat level which will be further aggregated at district headquarters and finally a link to VSNL hub in the district. Circuit services co ordination and a single point of connection to GIAS enables minimizing overall costs and increasing of chances to use current technology. The basic network implementation under District Panchayat is not a complicated process. A LAN is to be created within each institution, office or cluster of buildings with one network server for that LAN. Such LAN's can be interconnected with a similar LAN existing at the District Panchayat Office. The centrally managed information resources will exist there. This LAN at district headquarters is to be connected to the nearest GIAS. Primary technical support for network monitoring and solving problems should come from the district head quarters to avoid unnecessary duplication at the institutional /office level. When expertise is developed at the local level more of the responsibility for daily operation and problem solving can be undertaken at the institution, office level. It will be impossible to cover all conceivable scenarios for implementation of information networks under District Panchayats. But general principles can be given which should be followed in designing and implementing information networks under local governments in any region.

### **3. LAN Implementation**

An institution or office mean a building or a cluster of buildings that are managed as a unit under District Panchayat or one existing in the geographical area under the jurisdiction of the local government. Here the

wide meaning of under local government is taken which include institutions existing in that locality also. LAN implementation in this setting will include installation of a cabling system to distribute the network throughout the building or cluster of buildings, installation of premise wiring to support connections of computers and terminals to the network distribution system, installation of one or more network server machines in a central location and provision of network router and telecommunications circuit or radio link to connect that office to the district headquarters. Popular LAN technology is Ethernet. It is cost effective and easy to install and maintain. Ethernet is adaptable to most modern computers and is now built in to high performance workstations available in Indian market also. Hence it is good for all computer connections and for network distribution system and LAN backbones.

Individual computer will need network or communication adapters and necessary software. Basic communication software is available free of cost for most computers. Software packages with advanced facilities for applications such as E-mail, distance learning, multimedia database access etc are also available from many software solution providers. LAN developers should look at all available software and base choices on required functionality and support costs. In locations where computers will be purchased the choice of computer type should be driven by the availability of software for the particular applications to be supported. Most of the computer systems presently available in the market can be attached to all networks.

### **3.1 LAN Cabling**

One important work for the LAN implementation will be installation of cabling to connect individual computers or group of computers to the LAN. The advisable topology is a star type where each computer is wired directly to a hub site within the building. A cluster of computers to be placed in a single room can be interconnected there itself and the cluster can be connected to the hub site with a single cable. UTP wire that meets Category 5 standards

for high speed data communication service should be utilized. Their ends will terminate on a standard 110 distribution block at the hub site utility closet. Installation and wiring in a building is to be planned and installed professionally after considering both current and future requirements. It will be cost effective to install premise wiring to as many locations as might ever serve a computer. In high density locations consideration should be given to installation of two UTP cables to each outlet location in order to provide the potential for several computers or workstations. Terminating both cables on the same wall plate will add little to the overall wiring project costs and will add greatly to the flexibility of the system. Premise wiring that is not to be used initially will not be connected to any electronics in the hub site. Hub sites should be utility closets or other protected, non occupied areas. Hub sites can be created by construction of small closets or cabinets in low use areas. A hub site must be located within three hundred feet of any connection. Multiple hub sites will be required in large or multi-story buildings.

#### **4. Interconnections**

The hub sites within an institution or office must be inter connected to complete that institution's LAN. The design of such network will depend mainly on the physical lay out of the buildings of the office or institution. If all hub sites are within 300 cable feet of a central location, then 10-base-T wiring can be used from a central hub to connect each hub site. If distance is longer thin-net or standard thick ethernet can be used. Fiber optic cable can be used if distance necessitates it and resources are available. If fiber optic cable is used; multimedia fiber for current and future data requirements and single mode fiber for video and future high speed data systems should be kept in mind. Specific design of the backbone network distribution system will depend on the layout of the buildings to be served. Many computers can be connected to a single ethernet segment.

Each institution should install a network server to support local storage of commonly used information, files, software, electronic mail and other

functions that may require high-speed communication to the users computer. The connection to the outside network will be much slower than the institutional LAN. Hence it will be very efficient to access information locally. The software that is to be shared among the institutions computers must be stored locally since it will be very difficult to transmit it through the slower external link. The network server will be connected directly to the ethernet network. The location of the server should be chosen carefully to ensure its protection from abuse and environmental damage. Traditionally most offices and institutions coming under local bodies are doing the information gathering and storage activities. Examples are the records section of the present collectorates, plans and documents section of the village offices, information about houses, residents etc. in Panchayat Offices and the files and document collections in various other offices, organizations and institutions as well as records in Panchayat and district libraries. Many institutions like village offices, libraries of educational and research institutions etc. have already installed cluster of computers or terminals. The libraries in the institutions or offices are the most logical place to locate the network server computer. The network router also should be located in the library.

The network server will be a small but powerful computer with large amount of disk storage capacity, typically of two to eight GB. It will run software capable of supporting access by a large number of users simultaneously. It could also support dial-in access from officer's homes using standard inexpensive modems. Access control with user authentication is essential when dial-in service is also provided. If dial-in access is to be provided to more than a few institutions within a district, a single central modem pool maintained at the district office will be cost effective.

#### **4.1 External Connection.**

One communication circuit will connect the institutional LAN to other local offices and institutions. In the institution or office there will be a network router attached between the LAN and this circuit. On the LAN side, the

connection will be a typical ethernet cable. On the external side the connection will depend on the communication circuit used.

All the offices and institutions within a district should be connected individually to the network router at the district Panchayat office. This star topology will be much easier to manage and the capacity of each institution or office connection can be increased appropriately as needs change. A standard communication circuit service may be used to effect this connection. Where limited use only is there dial up using high speed modems is advisable. This is not apt for heavy and serious use because of its limited capacity.

Most offices receive telephone service under business tariffs. Hence usage will be measured and the cost will be dependent on how long the connection is used. Dedicated communication circuits are good because they will allow unattended access to and from the institutional network at all hours. This will be particularly important if information files are to be loaded during night to local network servers or officers and users have to access the institutions information resources from home.

## **5. Communication Options**

For communication; frame relay communication service can be used. It is a shared, packet-based data transport service. An office site would contract for frame relay service as part of a larger service group that includes the District Panchayat Office and may include the Internet service provider. All members of that group could share the communications capacity. This enables each member to order a connection to the common service and the capacity offered to each member can be upgraded independently. The cost of frame relay service will not be dependent on distance to the service provider which can make the service to Grama Panchayats, Village Offices, schools etc. much less expensive than any equivalent services. Overall system costs can be minimized since the central router at the District Panchayat Office will need fewer connections. Frame relay necessitates careful planning of overall



services. As all institutions, offices in the locality will share connection to the District Panchayat and possibly to the VSNL; that must be a high capacity connection. Initially the aggregate capacity of all office/institution links should not exceed the capacity of the District Panchayat Office by more than a factor of three. The virtual connection topology, the connection to VSNL etc. also should be considered while designing the system. Future options for such information systems will include Community Access Television Cable System offering either share or dedicated bi-directional data communication services, fiber optic communication service providers, Asynchronous Transfer Mode connection services supporting voice data and video communications at high speed etc. As demand for network speed will increase due to heavy use of multimedia and other band width - intensive applications, high-speed communications circuits can replace the initial circuits with minimal change in the equipment or LAN. This can enable flexibility necessitated by finance and applications.

## **6. District Panchayat Office LAN**

The District Panchayat Office should form the focal point for inter-connection of all offices and institutions in the District. Within the District Panchayat Office LAN network operations can be monitored and problem resolution managed. One or more network servers can provide essential network support as well as central archiving of common information and software. An important work of the District Panchayat Office LAN will be to manage Internet Domain Name System service for the Block Panchayats, Grama Panchayats and other offices and institutions in the district. This is defining of the basic network level identity of each computer, workstation, server and active network component. The GPO should be wired in a manner similar to the offices/institutions in the district described earlier. This will allow Block Panchayats, Grama Panchayats and other offices and institutions in the district to share information easily. Network Access Server connected to the Central Pool of modems can provide dial - in access to the District Panchayat Network.

## **7. Internet Connectivity**

Internet connection of the entire district should take place through the District Panchayat Office interconnect site. This hierarchical model can be extended another level to inter connection of the District Panchayat Offices through the State Headquarters to national level systems. Many administrative information resources could be located at the state level and there might be cost savings if the entire state connects to VSNL through a single point. But, the bandwidth required for this single connection will be higher than that required for each District Panchayat Office since traffic will be aggregated. This hierarchical topology also provides a logical model for network support and information resource management. District Panchayat Offices or State headquarters can provide continuous monitoring of the network and provide high level technical expertise for problem resolution, relieving the individual District Panchayat Office=s of this burden. Interactions with Internet service providers will be more effective if handled through state headquarters. Network users should get a single reliable point of contract in case of problems or questions. Connection will require a high quality router that can be configured to interact correctly with the VSNL's routers. This can be the same router used to support District Panchayat Offices connections.

Village Offices, libraries and many other institutions would already have developed LANs to support of their specialized activities or administrative functions. The technologies used may be obsolete or different. If they are capable of transporting Internet protocols they can be integrated into the new LAN system and upgraded or replaced later.

## **8. System Management**

All information systems require some level of network management to ensure reliable and efficient service. Monitoring the functionality of the network can help to identity problems before they became detrimental to network users. It also can help predict trends in traffic patterns and volume. Network

management consists primarily of determining the proper routing parameters for optimal and reliable network operation, assignment of network Internet Protocol (IP) addresses and maintenance of a network-accessible database of node names corresponding to each address and monitoring the daily operation of the network. These functions are to be performed by staff of a network operations centre.

### **8.1 Domain Name System**

Domain Name System (DNS) is the mechanism for documenting and distributing information about the name and address of each computer attached to the network. DNS service is provided by software that runs on the main network server. An Internet address is the numerical identifier for a node and it must be unique among all nodes associated with the network. DNS node names are hierarchical and by appropriately using this hierarchy sub domains can be assigned to each Block Panchayat Office, Grama Panchayat, Village Office and other institution sites or District Panchayat Office.

While planning network installation a norm for assignment of IP network addresses and node names should be developed. At first the database serving DNS should exist on the District Panchayat Office server so that there is one site at which all assignments are officially registered. As the network grows and expertise is developed, secondary DNS service can be run on the servers at sites of big institutions or offices. The main DNS server for the District Panchayat Office should be located close to Internet connection so that network problems within the district will have minimal impact on access to the server. Associated with the assignment of node names and addresses there should be a database of specific information about the computers connected to the network. When resolving problems this can help to know where the computers and other nodes are located in the district, what type of computer and software are in use and what type of network connections are installed.

Network monitoring serves three basic purposes. Firstly it helps constant observation of the proper functioning of the network, its components and external connectivity. Standard simple network management protocol support is built into most active packages available these days. Network servers and workstations also can be monitored in this way. Secondly, it collects statistics on the performance of the network and patterns of traffic in order to identify needed enhancements or re-engineering. Thirdly, it enables more rapid problem resolution. When problems occur simple network management protocol tools can help to pinpoint the source of the problem. Since network management and monitoring is a technically demanding task and requires special equipments and software it should be a centralized function in the initial design of information networks under District Panchayat.

## **9. Conclusions**

District Panchayat Information system proposed here is based on various documents proposing such systems, as well as technical designs of such systems prepared by the Library and Information services unit in Kerala Agricultural University and other institutions. Such a system can be a leap towards bringing information resource to bear for enriching all the District Panchayat Office's programmes. The design suggested here can be the foundation at the district level in preparation for future high capacity networks and information systems for the people.

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