NETWORK CHALLENGE : CHOOSING THE RIGHT TECHNOLOGY

S. Upendra Rao
E. Rama Reddy

9

1. Introduction

The creation of vast new information systems through the convergence of previously distinct industries and dramatic advances in technology demonstrate that the information revolution has begun. The boundaries that once separated information industries such as computing, communications and electronics are disappearing. This is because of quantum leaps in technology - in performance, efficiency and connectivity.

One example of the rapid emergence of this new environment is the INTERNET, which began as a network primarily linking scientific and academic interests and has now moved well beyond those origins. It links more than 2 million host computers and 20,000 networks in 140 countries with more than 20 million users. And it is growing rapidly. A new net work connects to the INTERNET every 10 minutes. Many companies are developing new technologies and applications that will produce further advances in network products and services. The question is how to build a network that provides seamless access to corporate information, regardless of where we are - while at the same time, provide ease of use, growth flexibility, and graceful evolution at minimal costs.

2. Networking Components

Information is need to be shared beyond a single work group. To connect two work groups, many networking products are available. These products work at different layers of the OSI model.

System: A system is a individual computer with communication capabilities added. This can range from a PC to a Super Computer.

Network interface Unit: It is a device containing hardware and software which supply the intelligence to control access to and communication across the network and to perform all communication

processing. It is the means by which the computers are connected functionally and physically to the network.

Repeaters: These are used if a network is to be expanded in excess of the maximum permitted segment length. These are basically signal amplifiers. The repeaters can only connect identical LANS, such as Ethernet/802.3 to Ethernet/802.3 or token ring to token ring for different cables, different repeaters are available, Viz: twisted pair repeater, thin coaxial repeaters etc.

Bridge: It is to interconnect two networks that use identical protocols. The bridge acts as an address filter, picking up packets from one LAN that are intended for a destination on another LAN and passing those packets on. The bridge operates at Data Link Layer. Bridges do not forward local traffic, thus reduce overall traffic in a multi-LAN inter network.

There are two types of Bridges, Transparent Bridges keep routing tables of physical address of network devices and forward traffic. They use a Spanning Tree Algorithem scheme for routing. Source Routing Bridges do not keep track of the route by which packets are sent. To establish a route, the station initiating communication broadcasts a discovery packet, which makes its way through the network's source routing bridges. The discovery packet keeps track of the bridges at crosses on the way to the destination.

Router: Routers provide a reliable, cost effective solution for interconnecting two networks of different protocols. The router operates at Network layer of the OSI model. Different routers support different set of protocols. For example XYPLEX router support routing for DECnet and Apple talk. Local Routers interconnect small to medium-sized networks. Remote routers links joining geographically separate networks into a large, complex wide area network.

Gateway: If the complexity or sophistication required increases, as between networks from different vendors or between LANs and public nets, gateways are used to make physical and higher level protocol transformations. Gateways connect all seven layers of the OSI models.

Modem: A device which converts the digital signal to analog signal and vice-versa, capable of being transmitted over a conventional telephone line.

Cables: Different types of cables are available as transmission lines. The backbone of the network, come in two basic varieties; Baseband and Broadband. Baseband communications links are twisted

pair wire and baseband coaxial cable. Broadband media are broadband co-axial and fiber optic cable.

Twisted Pair Wire: It is the cable used for telephone. The twisting standardizes the electrical properties throughout the length of the cable, and minimizes the interference created by adjacent wires in multi pair cable.

Baseband Coaxial Cable : It is the cable used for CAT-V (Community Antenna Television) systems. The cable is approximates 3/8" diameter, a central carrier is surrounded by a fine woven mesh of copper which forms an outer shell. This cable carries a single digital signal at high data rate up to 10 to 12 Mbps.

Broadband Coaxial Cable: It comes in different diameters with varying amounts of insulation. The cable may have the same construction as baseband coaxial. It can carry 50 to 100 television channels or thousands of voice and low speed data channels at rates 9.2 to 50 Kbps. Fiber Optic Cable: In Fiber Optic Cable light signals are transmitted through a cable/waveguide composed of a bundle glass or plastic fibers.

Transreceiver: Transreceivers are used to connect nodes to the various Ethernet media. They are also known as Media Attachment Units (MAUs), attach to the Ethernet cable and provide an Application User Interface, or AUI, connector for the computer. The AUI connector consists of a 15 pin D-shell type connector, female on the computer side, male on the transreceiver side.

3. Network Design

It is the way that networking products are constructed and software is implemented on systems. Network design is much more than suggestions the vendor gives you for configuration of your network. As a potential user of network components, we have the final decision on any network configuration on and no matter what the vendor tells us to buy, the final decision to choose components rests upon our shoulders.

The network design cycle involves the following steps :

Step 1. The first step of network design is identification of the need for a network.

Step 2. Define the network functionality, that is to offer like, E-mail, file-transfer or task-to-task communications.

Step 3. The Site Survey: It involves the careful examination of organization facilities, viz

- building architecture,
- phone facilities if your phone lines are used,
- existing computer hardware and software,
- power facilities,
- wireway and wire centers,
- electromagnetic interference possibilities,
- radio frequency interference possibilities,
- safety, security, and fire issues.

Step 4.Network cost estimation consists of

- cost of hardware components
- cost of software components
- cost of operational services
- cost of consultancy for network topology,
- routing matrix, performance models, applications design, trouble shocking etc.
- cost of replacement if any.

Step 5. Basic network design which involves data collection, data analysis. The designer has to make use of mathematical modeling tools to figure out data flow ratios, probabilities of error, queuing delays, least cost network topological layouts, routing paths etc.

Step 6. Installation consists of

- Preparation of site
- Cable testing and installation of taps and Transreceivers
- Installation of network controllers
- Installation of communication software
- Activation of the network software
- Testing of network
- User training

It may be noted that, ETHERNET, the predominant LAN standard with more than 30 million installed nodes, presents a dilemma. The available channel of 10 megabytes per second has to be shared with all directly attached workstations, servers, and other networked devices. The usual solution to this problem has been to segment LANs using bridges and routers-adding to a network administrator's concerns. But a new method for dealing with logically related workstations, or work groups, offers a simpler solution. Intelligent switching hubs are the better answer for improved workgroup network performance because they can add dramatically faster speeds to a network by providing direct, not shared,

network connections.

4. Problems in Development of Networks

In addition to the problem of choosing right components there may be other problems in implementation, and management of Networks. Some of the problems are listed below:

a) Government policy on import of computers and peripherals forces to change network design. Rental structure of telecom charges may also make the network unviable.

b) Financial crunch will create delay in project implementation which affects users and rises project cost. The INFLIBNET project of UGC has suffered due to the same cause.

c) Time lag between planning and implementation will create many technical and financial problems. For example INFLIBNET approximately took three years duration for installation.

d) Decentralized decision making in the organization will delay the planning and implementation of the networks. This is evident in many cases among Indian Universities.

e) Outdated indigenous technology create problems in inter-network integration due to mismatching of technology with the imported equipment.

f) Lack of measurement and evaluation creates problem in convincing the top management for networking approval.

5. UHNET - A case study

The structure of the campuswide network is shown in Figure-1. The network consists of three segments of thick cable connected via 4 - port bridge. The bridge filters the traffic among the segments. The length of each segments is around 450 meters. All the science departments are connected to the Computer Center Segment via 8-port repeater using thin cables. The length of each thin segment is ranging from 50 meters to 150 meters. Technically speaking, a bridge is a better solution in place of 8-port repeater. Due to cost considerations a repeater is chosen. As the amount of traffic increases form the departments, the repeater will be replaced by a bridge. Departmental PCs are connected to the network using twisted pair cable via a Unshielded Twisted Pair Hubs. Users can login to any system connected to the network from any where.

Terminals and peripherals are connected to the network via Terminal Server. All the computer systems in the backbone are RISC based with TCP/IP. The network software being used are NFS and Net-

ILINK.

The university of Hyderabad is connected to ERNET via dial-up line connecting SUN SPARC 10 and SUN 3/60 at GT, Abids campus of the university. Users can send and receive messages at their end.

The duration of this network planning and implementation was around four months.

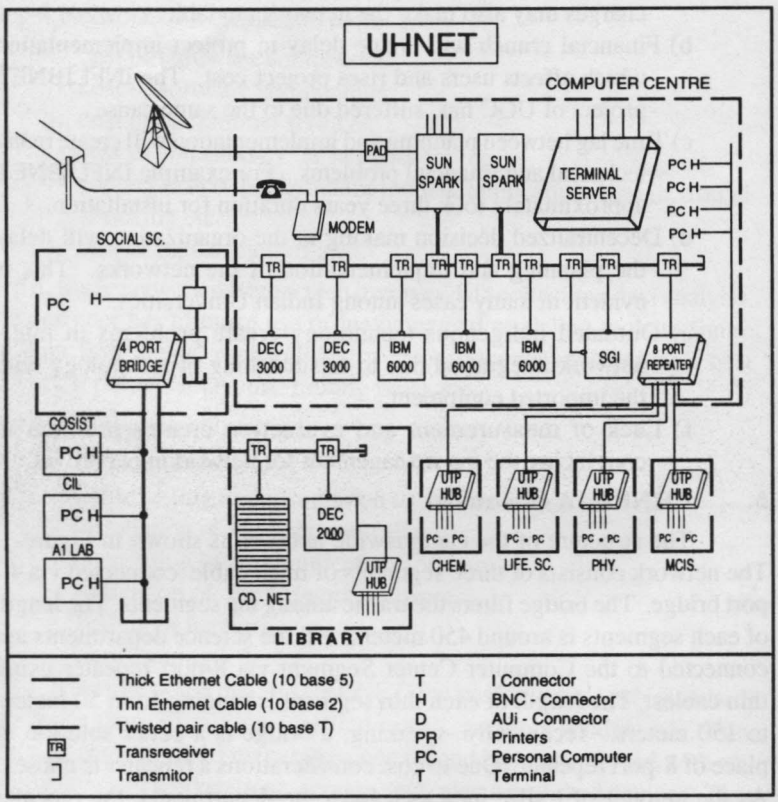

Fig. 1 University of Hyderabad Campuswide Network

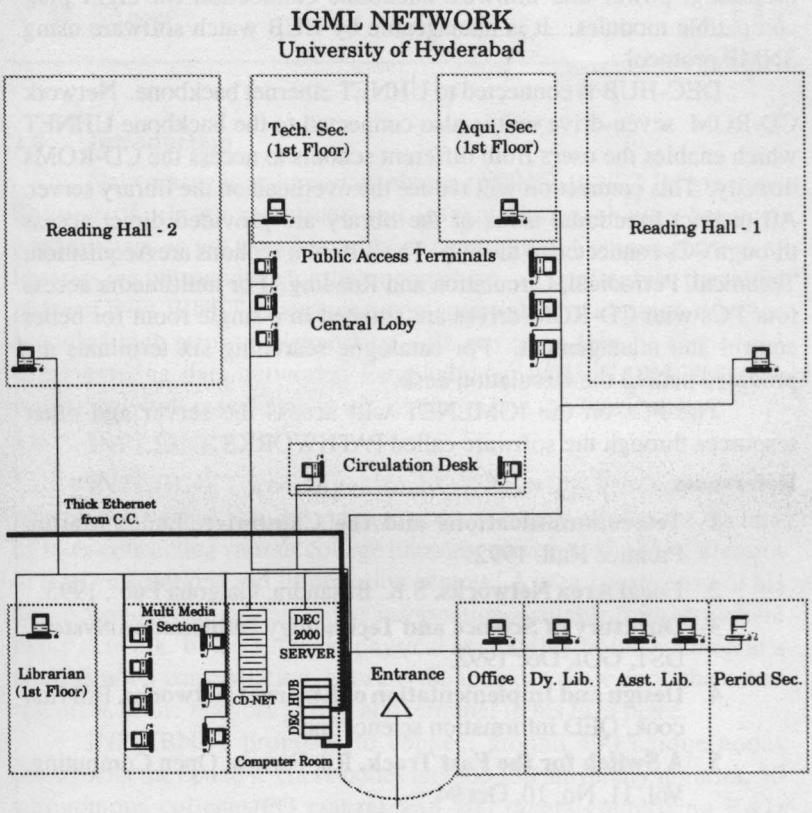
IGML NETWORK
University of Hyderabad
Tech. Sec.
(1st Floor)
Aqui. Sec.
(1st Floor)
Reading Hall - 2
Reading Hall - 1
Public Access Terminals
Central Loby
Circulation Desk
Thick Ethernet
from C.C.
Librarian
(1st Floor)
Multi Media
Section
CD-NET
DEC
2000
SERVER
DEC HUB
Computer Room
Entrance
Office
Dy. Lib.
Asst. Lib.
Period Sec.

Fig. 2

Indira Gandhi Memorial Library Network (IGMLNET):

It is a sub-network of UHNET designed for library. The structure of the sub-network is shown in Figure 2. DEC2000 M300 AXP acts as a centralized library server. Entire building network is laid using standard UTP cable. The entire network is built around the DEC HUB90. This hub is manageable and multifunction Ethernet backplane that provides mounting, power and thinwire backbone connection for eight plug compatible modules. It is manageable by HUB watch software using SNMP protocol.

DEC-HUB is connected to UHNET ethernet backbone. Network CD-ROM seven-drive unit is also connected to the backbone UHNET which enables the users from different schools to access the CD-ROMs directly. This connection will reduce the overhead on the library server. All distinct functional areas of the library are provided direct access through PCs connected to the hub. The different sections are Acquisition, Technical, Periodical, Circulation and Reading. For multimedia access four PCs with CD-ROM drives are situated in a single room for better control and management. For catalogue searching six terminals are provided behind the circulation desk.

The PCs on the IGMLNET will access the server and other resources through the software called PATHWORKS.

References

1. **Telecommunications and the Computer,** James Martin, Prentice Hall, 1992.
2. **Local Area Networks,** S.K. Basandra, Galgoha Pub., 1995.
3. **Directory of Science and Technology Information System,** DST, GOI, Dec 1992.
4. **Design and Implementation of Ethernet Networks,** Bill Han cook, QED information science Inc.
5. **A Switch for the Fast Track,** Rik Farrow, Open Computing, Vol. 11, No. 10, Oct 94.