

Informatics

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LAN TECHNOLOGIES

Continuing with our on-going series of Lead Stories on Networking Technologies, we present another important aspect, namely, LAN technologies and Internet Access over LAN

In general terms, LAN (Local Area Network) refers to a group of computers interconnected into a network so that they are able to communicate, exchange information and share resources (e.g. printers, application programs, database etc). In other words, the same computer resources can be used by multiple users in the network, regardless of the physical location of the resources.

Each computer in a LAN can effectively send and receive any information addressed to it.

This information is in the form of data 'packets'. The standards followed to regularize the transmission of packets, are called LAN standards. There are many LAN standards as Ethernet, Token Ring , FDDI etc. Usually LAN standards differ due to their media access technology and the physical transmission medium . Some popular technologies and standards are being covered in this article.

Media Access Control methods

There are different types of Media Access Control methods in a LAN, the prominent ones are mentioned below :

🌟 **Ethernet** - Ethernet is a 10Mbps LAN that uses the Carrier Sense Multiple Access with Collision Detection (CSMA/CD) protocol to control access network. When an endstation (network device) transmits data, every endstation on the LAN receives it. Each endstation checks the data packet to see whether the destination address matches its own address. If the addresses match, the endstation accepts and processes the packet. If they do not match, it disregards the packet. If two endstations transmit data simultaneously, a collision occurs and the result is a composite, garbled message. All endstations on the network, including the transmitting endstations, detect the collision and ignore the message. Each endstation that wants to transmit waits a random amount of time and then attempts to transmit again. This method is usually used for traditional Ethernet LAN.

🌟 **Token Ring** - This is a 4-Mbps or 16-Mbps token-passing method, operating in a ring topology. Devices on a Token Ring network get access to the media through token passing. Token and data pass to each station on the ring. The devices pass the token around the ring until one of the computer who wants to transmit data , takes the token and replaces it with a frame. Each device passes the frame to the next device, until the frame reaches its destination. As the frame passes to the intended recipient, the recipient sets certain bits in the frame to indicate that it received the frame. The original sender of the frame strips the frame data off the ring and issues a new token.

🌟 **Fast Ethernet** - This is an extension of 10Mbps Ethernet standard and supports speed upto 100Mbps. The access method used is CSMA/CD .For physical connections Star wiring topology is used. Fast Ethernet is becoming very popular as an upgradation from 10Mbps Ethernet LAN to Fast Ethernet LAN is quite easy.

🌟 **FDDI (Fiber Distributed Data Interface)** - FDDI provides data speed at 100Mbps which is faster than Token Ring and Ethernet LANs . FDDI comprise two independent,

counter-rotating rings : a primary ring and a secondary ring. Data flows in opposite directions on the rings. The counter-rotating ring architecture prevents data loss in the event of a link failure, a node failure, or the failure of both the primary and secondary links between any two nodes. This technology is usually implemented for a backbone network.

Topologies

The various ways in which cables are arranged constitute the topologies in a LAN. Some of the Ethernet Topologies are described here :

- **Bus Topology** : Thick and thin Ethernet LANs use a bus topology, in which devices connect directly to the backbone at both the physical and logical levels . This type of LAN is very easy to use and cheap to implement, but the problem is to troubleshoot and maintain.
 - **Star Topology** : In this topology , a individual twisted pair or fiber optic cable is coming from each node and terminating at central network concentrator as hub/switch. The star wiring simplifies LAN administration and maintenance.
 - **Token Ring Topology** : Stations on a Token Ring network attach to the network using a multistation access unit (MAU) through UTP/STP cable. Although the Token Ring is logically a ring, physically it is a star, with devices radiating from each MAU .
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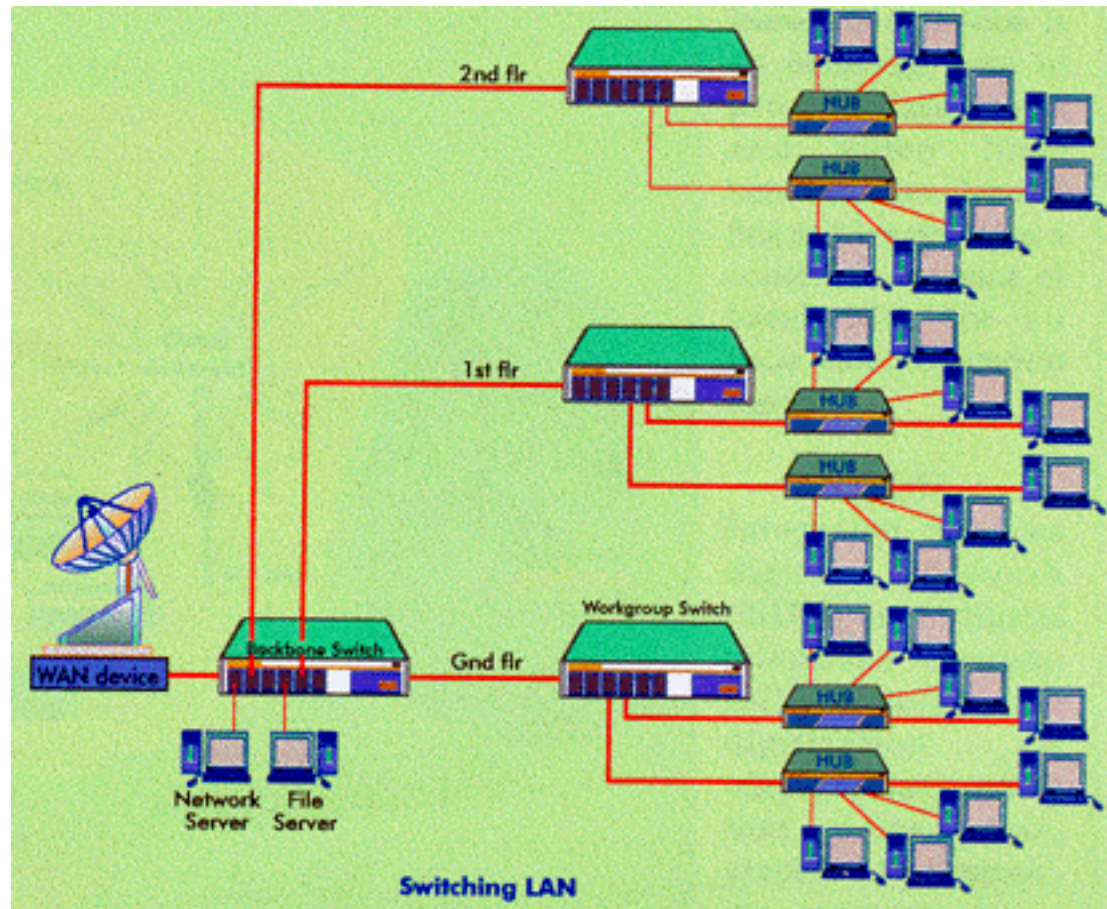
Basic LAN components

There are essentially five basic components of a LAN.

- **Network Devices** such as Workstations, Printers, File Servers which are normally accessed by all other computers

- **Network Communication Devices** i.e. devices such as hubs, routers, switches etc., used for network operations

- **Network Interface Cards (NICs)** for each network device required to access the network .



- **Cable** as a physical transmission medium.

- **Network Operating System** - software applications required to control the use of the network LAN standards.

Network Communication devices

A LAN comprises of different communication devices across the network such as the following :

- **Repeater** : A Device that amplifies and regenerates signals , so that they can travel for longer distance on the cable.

- **Router** : The basic function of the router is to route the traffic from one network to another network efficiently. It provide intelligent redundancy and security required to select the optimum path. Usually routers are used for connecting remote networks.

🌟 **Hub** : A typical hub is a multi-port repeater. The signals received at the backbone is regenerated and transmitted to all other ports.

🌟 **Switch** : This is a device with multiple ports which forwards packets from one port to another. In case of 10Mbps Ethernet switch, each port supports dedicated 10Mbps bandwidth. Ethernet switch is fast emerging as a replacement of the traditional thick backbone and best way to improve performance of the network.

Physical Transmission Media

Cables constitute the Physical Transmission Medium in a LAN and could be of the following types.

🌟 Cables

🌟 **Coaxial cable** : Coaxial cable consists of a stiff copper conductor wire as core surrounded by an insulating material. There are two type of coaxial cables used in Ethernet LAN - Thick coaxial cable used for distances upto 500m and thin coaxial cables upto 185m.

🌟 **Twisted pair cable**: They are four pairs of insulated copper conductors twisted and bounded by single plastic sheath with or without conductor shield termed as STP and UTP respectively.

🌟 **Fiber Optic Cables** : In Fiber Optic cable, the medium used is optical fiber instead of any conductors .The information is transmitted in form of optical signal. Due to the high speed of optical signals the cable can support high bandwidth for longer distance. Depending upon the type of fiber, there are two types of Fiber Optic cables, single mode and multi-mode.

Asynchronous Transfer Mode (ATM)

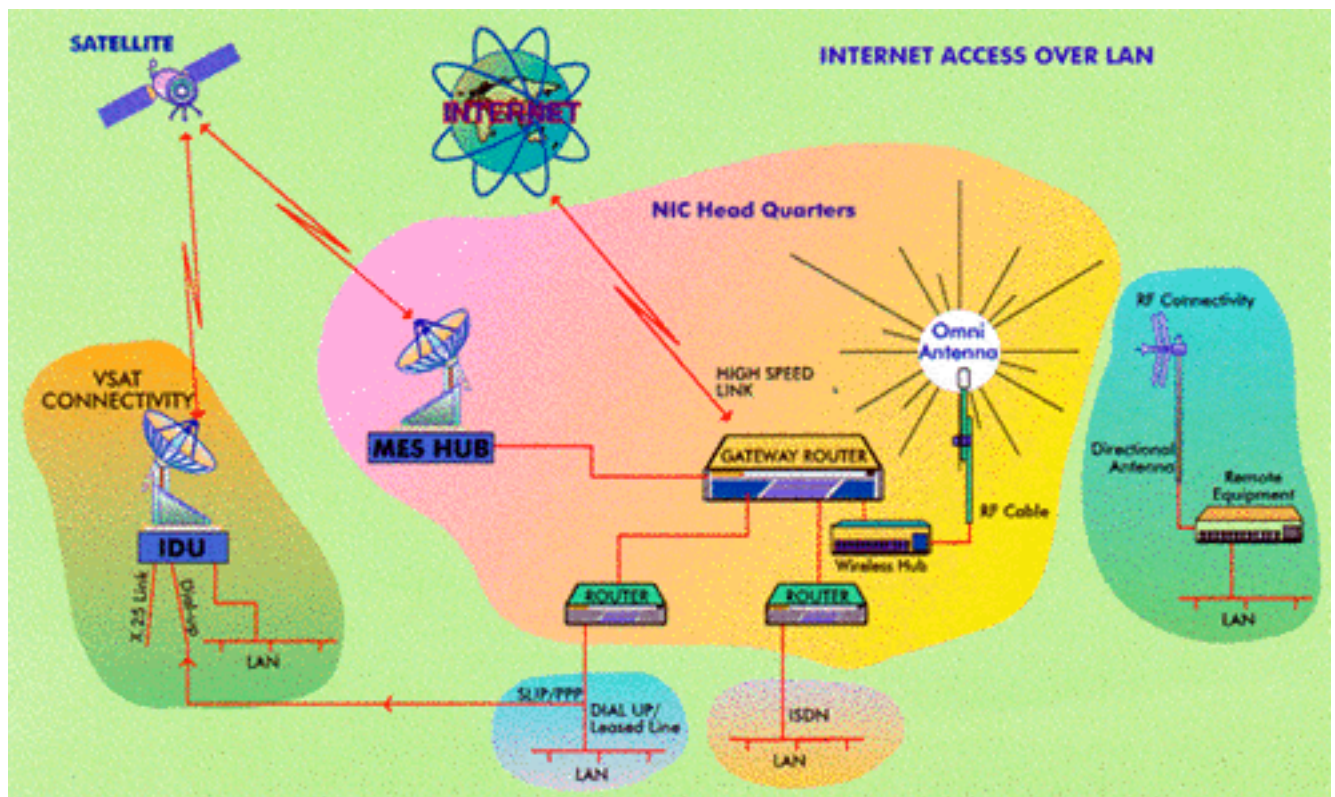
In recent years, with the boom in information technology leading to new GUI based

applications, more emphasis is being given to improving backbone and inter LAN performance. This has led to a new concept of connecting the backbone through ATM switches. **ATM (asynchronous transfer mode)** is the switching technology where data is sent in forms of fixed length cells instead of packets of various lengths. The speed of , in case of the ATM switches, is comparatively much faster than the traditional Ethernet switch, as the network overhead is less for ATMs.

Internet Access over LAN

There are various methods of connecting a LAN to the Internet Gateway, which are explained as below :

- Dial-up
- Leased Line
- ISDN
- VSAT Technology
- RF Technology (Wireless Access)
- Cable Modem



Dial - Up

A common way of accessing Internet over LAN is the Dial-Up approach. In this method, a remote user gets to Internet as follows - Initially the remote user's PC is linked to the local gateway through an existing dialup line using modems, once the user has reached the local gateway, further routing up to Internet is taken care of, by the local gateway itself. The routing procedures are transparent to the end user.

Leased line

Leased line facility provides reliable, high speed services starting as low as 2.4kbps and ranging as high as 45 Mbps (T3 service). A leased line connection is an affordable way to link two or more sites for a fixed monthly charge. Leased Lines can be either fiber optic or copper lines High capacity leased line service is an excellent way to provide data, voice and video links between sites. Leased line service provides a consistent amount of bandwidth for all your communication needs.

ISDN

Integrated Services digital Network (ISDN) is a digital telephone system. ISDN involves the digitization of telephone network so that voice, data, graphics, text, music, video and other source material can be provided to end users from a single end-user terminal over existing telephone wiring.

ISDN BRI (Basic Rate ISDN) delivers two 64 kbps channels called B channels and one at 16kbps (D channel). ISDN offers speed at 64 Kbps and 128 Kbps and is an alternative for those with a need for greater Bandwidth than dial service. For utilizing the ISDN service, the User needs to have an ISDN Terminal Adapter and an ISDN Card on the system.

VSAT

VSAT technology has emerged as a very useful, everyday application of modern telecommunications. VSAT stands for 'Very Small Aperture Terminal' and refers to 'receive/transmit' terminals installed at dispersed sites connecting to a central hub via satellite using small diameter antenna dishes (0.6 to 3.8 meter). VSAT technology represents a cost effective solution for users seeking an independent communications network connecting a large number of geographically dispersed sites. VSAT networks offer value-added satellite-based services capable of supporting the Internet, data, voice/fax etc. over LAN. Generally, these systems operate in the Ku-band and C-band frequencies.

RF Technology (Wireless Access)

Please refer to cover story of [October, 1998 issue \(Volume 7 No.2\)](#) of Informatics

Cable Modem

The Internet Access over cable modem is a very new and fast emerging technology. A "Cable Modem" is a device that allows high speed data access via a cable TV (CATV) network. A cable modem will typically have two connections, one to the cable wall outlet and the other to the PC. This will enable the typical array of Internet services at speeds of 100 to 1000 times as fast as the telephone modem. The speed of cable modems range from 500 Kbps to 10 Mbps.

NOTE

For Related Stories on Networking Technologies, please refer to the following previous issues of Informatics.

April, 1998 issue (Volume 6 No.4)

October, 1998 issue (Volume 7 No.2)

Around the NIC world

- [WORKSHOP AT JAMMU](#)
- [VIDEO CONFERENCING SESSIONS HELD](#)
- [FACILITATION COUNTER AT ARUNACHAL](#)
- [NIC BAGS THE MIS-ASIA AWARD](#)
- [WEB SITES LAUNCHED ON NIC'S WEB SERVER](#)
- [ACCIDENT INFO ON WEBSITE](#)

Products/Services

- **Parliament Q&A Software**
- **Multimedia Information System on Hill Area Development**
- **Commissioner's Court Automated**

Parliament Q&A Software

The Civil Aviation Information Division of NIC has successfully developed and implemented a software package on "Parliament Questions and Answers" for the Ministry of Civil Aviation. This software enables all the sections to generate draft and final replies along with the supplementaries, if any, of Parliament Questions. The salient features include :

- Easy tracking of questions and answers using various parameters.
- Easy generation of Draft/Final Replies.

The software also helps in maintaining the records of assurances given in the Parliament and also a database of all questions and answers. The software has been developed using SCO Foxbase+, SCO Lyrix and "C" language and can be easily adopted by other Ministries for preparing quick replies to the Parliament Questions.

Multimedia Information System on Hill Area Development

An interactive Multimedia Information System on "**Hill Area Development with specific reference to Uttarakhand**" has been designed and developed by NIC for the Deen Dayal Upadhyay State Institute of Rural Development , Lucknow. The Information System has been specially designed to provide extensive information about the life in Hill Areas with Uttarakhand as a reference. The package is intended to be used during the various training courses conducted for the Civil Services Officers by the Rural Development Institutes. The Information System is compatible to run on any Windows based multimedia workstation and has been aesthetically enriched with colourful visuals. The system is highly modular in nature and provides for easy navigation so that the user can reach any part from another. At a broad level, there are five interlinked modules :

🌺 **Orientation** : This module introduces Hill Systems in general and describes the features of the Indian Mountain System and also the Uttarakhand Hills.

🌺 **Sub-Systems** : The characteristic features of the three sub-systems of Hill Areas namely Physical, Resources and Socio-Economic.

🌺 **Problems & Solutions** : This module describes the typical problems faced by the inhabitants of the Hill Areas and the possible solutions for the same.

🌺 **Development Mechanisms** : Information about the Government Schemes for development of Hill Regions and details of the various NGOs working in these areas.

🌺 **Recommendations** : As the name suggests, this module attempts to present concrete suggestions and recommendations for improving the quality of life in Hill Areas.

Commissioner's Court Automated

The NIC-Hisar Unit at Haryana has developed an Application Package for the effective monitoring of the court cases filed in the Court of Divisional Commissioner, Hisar. The System facilitates the monitoring of court cases in the Commissioner's Office by providing the following :

- 🌺 Computerized Institution Register
- 🌺 Peshi Register
- 🌺 Daily Cause List
- 🌺 Consolidated Peshi Details

- Monthly Statement
- Replies to the relevant queries

The System will replace the manual handling of Court Records in a phased manner. In Hisar, the System has been installed successfully at the Divisional Commissioner's Office and all the court related reports/queries are being generated through the Package only. The System can also be replicated in other Divisions of Haryana with minor modifications as per local need.

Projects

- **Monitoring Export Performance in EPZs**
- **Computerization Projects for Education Department**
- **SSLC Result Dissemination in Tamil Nadu**

Monitoring Export Performance in EPZs

There are seven Export Processing Zones (EPZs) in the Country to provide an environment of production at low costs, so that the exporting firms may operate profitably in the international market by availing the incentives and the facilities given by Government of India. The Ministry of Commerce regularly undertakes monitoring exercises to review the performance of various Units set up in the Export Processing Zones.

NIC-Chennai has taken up the task of facilitating this monitoring as a turnkey project. Under the Phase-I programme, NIC Officials visited all the zones, imparted training and implemented the following software subsystems

- **Receipts and Issues** : This system ensures the accountability for each letter received by the office and tracks the status of the same at various stages till a reply is sent or action is taken.
- **Customs Import/Export Bills Monitoring** : This system allows on-line entry of Shipping Bill details and Bill of Entry details thereby recording the Import & Export figures for each Zone.
- **Estate Management System** : This system helps the users to monitor the allotment and

Management of plots/constructed buildings inside the zone.

MIS for Industrial Approvals : Every unit inside the zone reports Quarterly/Annually to the Ministry in a specified format. In order to monitor the performance of these units, the prescribed proforma lists are generated using this system.

MIS for Export Oriented Units (EOU) : In order to monitor the performance of the EOUs, the prescribed proforma lists of the Ministry are generated using this system.

Computerization Projects for Education Department

The NIC Karnataka State Unit has been playing a catalytic role in the automation of the State Education Department. A separate cell has been set up by NIC in the Karnataka Education Department in order to speed up the computerization process and to develop the necessary software. In this pursuit, two new projects were recently implemented.

Teachers Recruitment and Posting Project :

Due to the Government's commitment to provide free primary education, hundreds of new schools have been opened up in the State. Consequently, the manpower need has also grown manifold. NIC undertook the task of computerizing the Teachers' Posting through its Selection and Counselling software. The software ranks the selected teachers according to merit cum seniority. The vacancy database of all schools in the Districts has already been created. Using this, the selected teachers opt for the school of their choice. The posting of teachers has thus been made extremely convenient and effective and all the related databases are updated simultaneously. The system has already been implemented in all the State Districts.

Centralized Admission Cell for Teachers' Training Courses :

Every year, about seventy to eighty thousand candidates apply for various Teacher Training Courses. Previously, the admissions were handled independently by various Districts and the admission was restricted to local candidates only. This resulted in highly deserving candidates being denied seats. The NIC -Karnataka Unit was then assigned the task of setting up the computerized central admission cell. Under this project, the entire admission process has been simplified and an online counselling system has been introduced whereby the candidates can opt for seats in the order of merit, with complete transparency. The whole admission process takes about three months. The system is totally stabilized, foolproof and user-friendly to

operate.

SSLC Result Dissemination in Tamil Nadu

The NIC Tamil Nadu State Unit undertook the exercise of Information Dissemination, Web Publishing and Auto Mailing of the Tenth Standard(SSLC) Results in the State. The entire exercise, the first of its kind in the Country, benefitted lakhs of students who were keen to know their Board Results. The Results were disseminated in three distinct modes :

Through World Wide Web

A web site was specially created for result dissemination through the WWW and the URL was announced in the local newspapers. For this purpose, four web servers were set-up at the NIC building, which were maintained round the clock for four days to allow maximum access. More than 4,00,000 students obtained their results through this facility.

Through Local Databases

The data was also loaded on Local Servers in NIC Centres located in different parts of Chennai and all the State Districts. These centres disseminated information to about 2,50,000 users.

Through Auto Email

Email facility was extensively used for result dissemination . The User could send a request to two specified mailboxes with the Roll Number in the Subject column and the result was automatically sent back to his/her mailbox. More than 18,000 users obtained their results through this facility.



Students flocking to NIC Centre for obtaining Results

In the Limelight

NIC Satna - Breaking New Grounds

- NIC's Emergence at Satna
 - Support Services
 - Major Achievements
 - During Elections
 - NICNET Services
-

NIC Satna - Breaking New Grounds

The Satna District, in the largest Indian State of Madhya Pradesh, is situated in the Vindhya region. Having a population of over 14.5 lakhs and spread over an area of 7,502 sq.km, Satna District covers 2,124 villages under 5 Tehsils. The region possesses vast reserves of lime stone and hosts a number of large scale industries. The District is a famous tourist attraction as well, with the historical Chitrakoot Dham and Ma Sharda temple situated here.

NIC's Emergence at Satna

The NIC District Unit Satna was established in the year 1988, with an aim to provide relentless informatics services to the District Administration in planning and development. Ever since, the NIC centre has been helping the authorities by providing the necessary IT support in various

important Projects being run in the region. Though it was a tough task initially to motivate the officials to adopt the computer culture, NICNET has since become an indispensable tool for the District Administration over the passage of time.

Support Services

In the process of carrying out the computerization activity in the District, various MIS reports are generated by the NIC unit which are extremely useful for the Authorities in formulating development schemes.

The MLA Legislative Assembly wise reports of works sanctioned have been of great support to the concerned MLAs, District Planning Officers and other officials in review meetings of the Zila Yojana Samiti and Planning Board.

Similarly, the computerized Reports generated from Census'91 data have been of critical use to the Election Department for drawing out the SC/ST reservation lists.

The services of NIC-Satna Unit have also been utilized by the Administration in analysing the Rainfall Data for preparation of relief measures related reports. The District Unit has also extended Technical Support in maintaining the Directory of Panchayats and in computerization of Departments such as District Treasury, Central Excise, Land Records Department, DRDA, Food Corporation of India (FCI) , Madhya Pradesh Oil Federation (MPOILFED) etc.

Major Achievements

During the past ten years, NIC-Satna has been extending its computer support to many departments and has undertaken key projects of implementing useful software in the District. The Time Limit & DO Letters Monitoring System (caters to the weekly review requirements of the disposal of time limit papers by various departments)

The Schemes Monitoring System (helps in close monitoring of every development work under various schemes in Satna.)

The Arms Licenses MIS (helped in computerization of all licenses issued from the District since 1951)

Government Vehicles Information System (has facilitated the preparation of updated lists of all

Government vehicles).

Revenue Cases Information System (developed to monitor the status and progress of revenue related cases which are pending in the Courts.

During Elections

The success story of NIC Satna includes the efficient computer and communication support in the form of computerized tabulation, round-wise preparation and onward transmission of the election results over NICNET, during Parliamentary Elections in 1996 and 1998 and also the Assembly Elections in 1998. Extensive support was given in the entire election process of nominations, withdrawals, final sorted listings of candidates, ballot paper requirements, generating details of polling stations and voters etc.

NICNET Services

Apart from implementing all the relevant National/State level NICNET based projects, NIC-Satna has provided dial-up connectivity to major organizations such as MPOILFED etc. The Unit has also facilitated wide spread use of DISNIC Plan and GISNIC data among a wide cross section of Government and Non-Government Departments.

The above are only a few milestones covered....and several challenging paths are still to be treaded by NIC-Satna Unit. But viewing the fact that the services provided by the District Centre have generated wide interest in Government circles, the dream of complete computerization and informatics culture in the Satna District will definitely be realized in the years to come.



Staff of NIC Santa Unit on a busy day
