pressurised with 30 psig dry nitrogen for high peak power handling and to avoid the breakdown. Water-cooling is provided for load as well as for the magnetron.

The magnetron was subjected to cold test as well hot test. In cold test, measurements were performed on non-operating magnetron, using signal generator. This test is carried out with the help of Vector Network Analyser. Return loss and VSWR of the resonant structure is measured for the frequency band. This is the primary test of magnetron that is carried out before subjecting the magnetron for life test.

In hot test, data is collected in the operating condition of magnetron. In this test the power, frequency electronic efficiency, tuning range, cathode-heating effects and stability are monitored. After the magnet current set to the desired value, anode voltage is applied to the magnetron and increased until stable oscillation begins. Around 30 kV anode voltage the oscillations are observed. The rate of rise of voltage is 110 kV/ μsec, so that as the magnetron passes through Π mode, oscillations have time to build up and the magnetron can lock-in to the desired mode of operation. If the rate of rise of voltage is too high, magnetron will not lock in to the mode and load the modulator. The presence of rf output is observed by crystal detector diode 1N21B, which is connected to the directional coupler ports through the attenuaters. Stability of the output is judged by viewing the forward and reflected pulse.

Again the anode voltage is increased and this procedure is continued until a limit is set by mode shifting, arcing or overheating of cathode. If one of this occurs voltage is again reduced to the starting value, magnetic field is increased and the process is repeated. Spark gap protection is provided on secondary of the transformer to protect the modulator. Also the hydrogen thyratron tube is protected

Various high power microwave waveguide components developed at CAT. Seen in the photograph are: microwave windows, dual directional couplers, circular to rectangular waveguide transitions, high power ceramic and glass type water load, vacuum wave guide section and bends.

from the back swing in the pulses, by putting a diode resistor assembly across the tube. The highest end frequency observed is 3004 MHz and the lowest frequency is 2991 MHz. The left side band observed is 21 dB down and the right side band is 22.6 dB down.

After reaching the desired power, pulse repetition rate is increased to 250 Hz. A Calorimeter is provided for monitoring the average power dissipated in the rf load. Temperature of the inlet and outlet is sensed and a electronic circuit displays the power.

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CATNet: Computer Network at CAT

"Information" is the major driving force behind the progress. Due to the proven reliability and fast data processing capability, computers have long been adopted as the only tool for processing and storing information. Computers being the universal information carrying agents, are interconnected by networks called the "information highways" to have a global pool of valuable information. In line with the global trend and using the available technology, CATNet is an Ethernet based information highway of approximately 400 interconnected diverse computer systems at CAT. CATNet aims to provide a real working solution to an *"office at desktop"* concept for the scientific, engineering and administrative communities at CAT.

CATNet is evolving ever since its inception in the early 90's. This article mainly focuses on the present infrastructure details of the CATNet and associated services. CATNet was conceived in the early 90's as a network of the 3 Unix servers and 20 odd PC's. Ethernet

with a speed of 10 Mbps being the fastest networking technology available during those days, was adopted as the technology for the CATNet. TCP/IP being the in-built network protocol suite in the UNIX servers was the only protocol suite used to connect any machine on the network. The remote access to this network was provided to users of other buildings by means of the line drivers at speeds of 9600 bps. Year 1993 saw the addition of a very important value added service of Email to the CATNet. Hundred odd users were provided access to this service, which was an offline UUCP connection. The UUCP connection was made over a Dial-up connectivity to NCST, Mumbai. Low email traffic and the STD connectivity to Mumbai demanded for only one time per day download of the mails. The unreliable telephone line connectivity used to affect the downloading of mails.

Presently, the focus of CATNet has shifted from mere email service and computing resources provider to Internet and Intranet services provider. The integration of CATNet

with internet has been one of the major changes affecting the CATNet. At present the Email connectivity in CAT is 24 Hrs online. CATNet now has independent Email, WWW, Name and FTP servers. Windows concept of workgroup resource sharing, like hard disk, printers and plotters, along with the growing number of users, requires the CATNet to be a high speed network. The CATNet is now a congregation of different technologies implemented with a clear goal of fulfilling the bandwidth requirement of users of different buildings with a cost effective solution. It has now reached a stage where a very satisfactory access to all the centralised resources is possible. With the recent commissioning of three new thick ethernet segments and structured cabling networks in MIA, LCW, B Block, Indus-1, Crystal Growth, Computer Centre, Library and MDL buildings, now CATNet has an estimated capacity to provide access to 600 odd users. Thick Ethernet still remains the standard for the backbone of CATNet. Structured cabling by CAT5 cables and 10/100 Base-T hubs/switches has replaced the intra building thin Ethernet cables and repeater components. The remote access to buildings having a fairly good network connectivity requirement is provided by 144 Kbps high speed leased line remote bridges. Buildings with low network connectivity requirements are connected by 38.4 Kbps modems. The single user connectivity requirements are fulfilled by DMKTs, Modems and line drivers with speeds ranging from 2400 to 38400 bps, depending on the location of the user. The recent implementation of security guidelines provided by the DAE network security council to CATNet for avoiding unwarranted intrusion by hackers have forced CATNet to be physically isolated from the Internet. Email continues to be the major service of CATNet at the desktop while a parallel network with full Internet access is being developed. Keeping in view the very low speed (8kbps) Internet access, presently the Internet facilities are being made available only from 4 Windows based machines for graphical browsing and one vt100 terminal for text based browsing.

CAT, with an approximate periphery of 10 km, has buildings located at large distances. Due to the distance limitation of each type of communication link, connections have been made by using 4 different types of links, namely the thin Ethernet and CAT-5 structured cables for interconnections within buildings, thick ethernet for inter building connections and the telephone cables for remote building connections. Telephone cables have been used to connect 4 different types of devices namely the remote leased line bridges, Modems, DMKTs and Line drivers, depending upon the bandwidth requirement of respective users. The CATNet is connected to Internet by a VSAT based ERNET network. The central hub of this network is located at STPI, Bangalore, which provides a 64/N Kbps

CATNet Access from different locations in CAT		
Device	Max. Speed	Location
Network Card	10 Mbps.	Library, ADL, MIA, Laser A,B,C & D Block, Indus, LCW, and CG buildings.
Network Card	144000 bps.	MDL building.
Network Card	38400 bps.	Medical, Admin
Network Card	19200 bps	Purchase
Modem	38400 bps	Any Building
DMKT	19200,9600bps	Lab area building
Line Driver	9600 bps	Lab area building

shared access to CAT users. N keeps on changing with the increase in the number of subscribers of ERNET. As per the last information N is 8 for CAT. CAT has been assigned a set of 8 'C' class IP addresses ranging from 202.141.112.0 to 202.141.119.0.
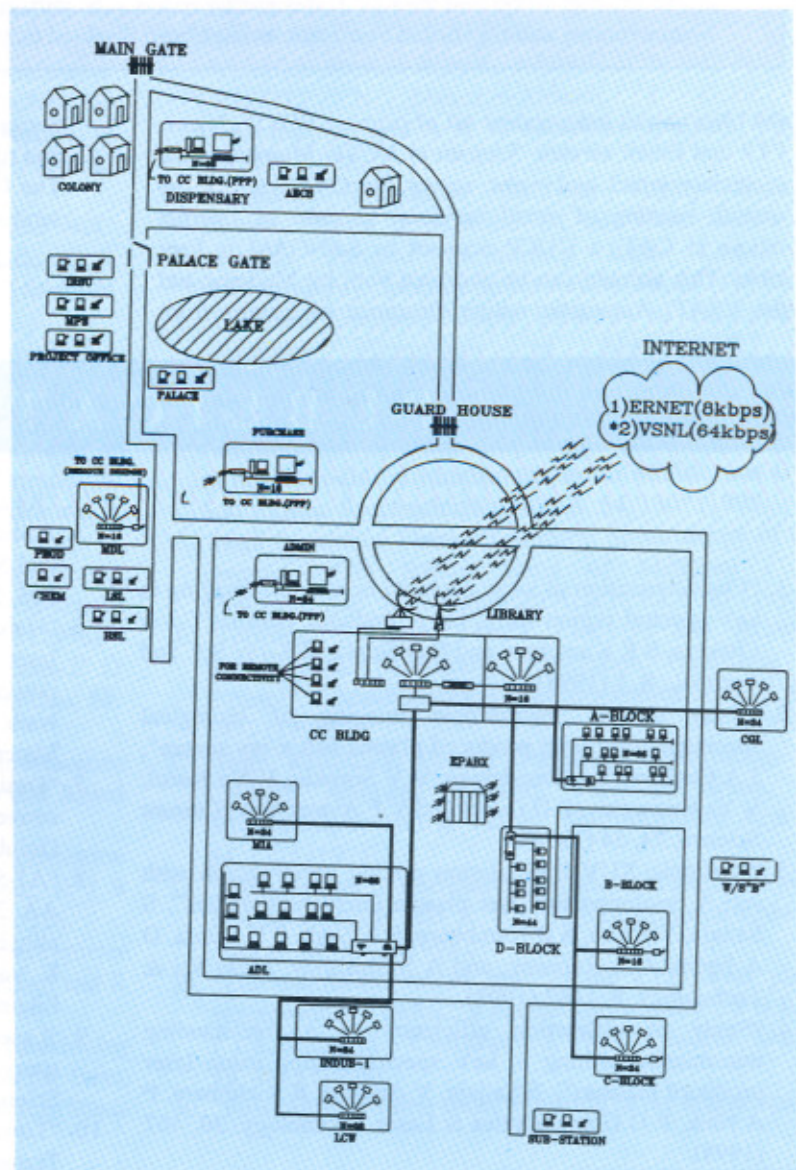
CATNet, The Security issues.

As per the DAE guidelines for network security, the following measures have been taken at CAT:

- The CATNet is divided into two networks. One with Full internet access and the other with the scientific computing resources and intranet access only. This has caused the withdrawal of all the Internet facilities except the Email from the individual's desktop. Isolation of Intranet from the Internet has been carried out by physically laying two separate networks. The email access at desktops has been made possible by establishing a serial line 38.4 Kbps one way UUCP connection between the two networks.

- The machines connected to the Internet access network have been given only a unidirectional access, by using the transport layer firewall feature of the CISCO 2501 series router. In no way can the machines connected to CATNet, be accessed from outside the CAT campus. Special provisions have been made to have the WWW pages of CATNet accessible from the Internet. The Nodal centre activities of the CAT are limited to provide only the UUCP based email accounts.

- The dialup modems connected to CATNet have been programmed to have the accessibility scope only within the CAT campus.

- Secured email tools like the PGP (Pretty good privacy) have been configured, to allow the users to send and receive encrypted mails, thus putting off any threat to the malicious, unwarranted reading of secret emails.

- User's email accounts have been created on the Intranet part of the CATNet. The mails are transferred from the Internet connected CATNet to the Intranet connected CATNet, as soon as they arrive, thus reducing the chances of any unauthorised poking by hackers on the Internet.

- The Internet server and the router have been permitted access by cryptic passwords. Since no user account is available on the Internet server and the router, this greatly reduces the intrusion threat even to the Internet part of the CATNet. Source routing and the trusted user features have been disabled to avoid any IP spoofing intrusion threat.

CATNet has an independent set of primary WWW, Name, FTP and Email servers. Sangam at NCST, Mumbai is the secondary email and name server for CATNet. For the smooth running of email services, in case of Internet failure at CAT, a UUCP account to SANGAM is kept alive. This account can be accessed both by Modems and the VSAT. Automatic online clearance of Emails from Sangam is carried out, at times, when the Internet is UP and running.

The CATNet users receive daily 600 mails into CAT and send about 250 mails from CAT.

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