INTERNET DELIVERY - REVISITED

Part I - The Headend System

Part 1 of this 2 Part series provides an overview of the system to be installed at the Headend, as well as hardware & bandwidth costs involved, for both Cable Modems & LAN networks.

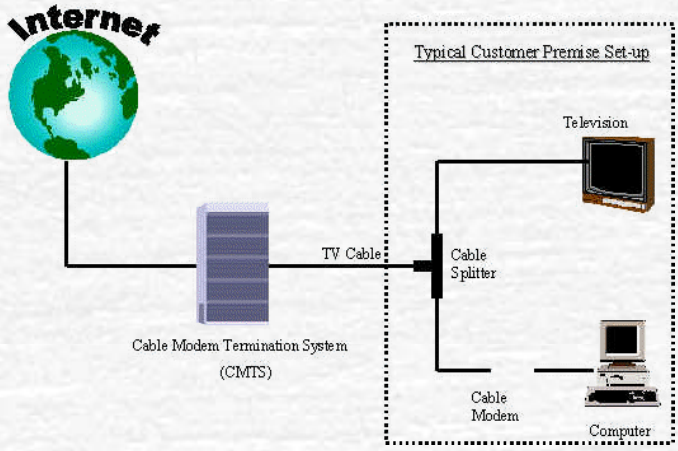
INTRODUCTION

With convergence setting in, cable networks can no longer be content with merely delaying satellite broadcast. Consumers now have a growing appetite for the Internet and probably for a host of new services that the digital revolution promises to usher in.

The next frontier clearly is delivery of Internet content to cable subscribers. The world over, Internet delivery through broadband (CATV) networks is being offered through cable modems. Cable modems offer the capability of delivering Internet content at mind boggling speeds of upto 30 Mbps on a network that is not heavily loaded. Even for a loaded network - with a large number of simultaneous cable modem users - cable modems can easily achieve speeds of 2 Mbps.

Details of cable modems and how they operate has already been covered earlier in the magazine. This month, we take a look at a few practical solutions that are currently being implemented in India for delivery of Internet.

TELEPHONE DELIVERY



The conventional vanilla flavored mode of Internet delivery is through a regular telephone line using a modem. This solution has been widely adopted the world over and most popular in the US which has over 150 million telephone connections but 65 million cable connections. Further, local telephone calls in the US are free. A monthly telephone subscription at US $20 is cheaper than cable rentals that range from US $30 to US $60 per month.

The situation in India is quite the reverse. With 30 million cable homes, India has more cable connections that telephone connections. Cable services are probably the cheapest worldwide - far cheaper than telephone usage.

Given this background the Indian consumer needs to be delivered the Internet via means other than the connection. The Indian entrepreneurs have already established 2 alternate modes of Internet delivery - cable modems and Internet delivery through LAN networks. Lets take a closer look at both, with actual pricing, options to the customer and expansion capabilities of both these methods.

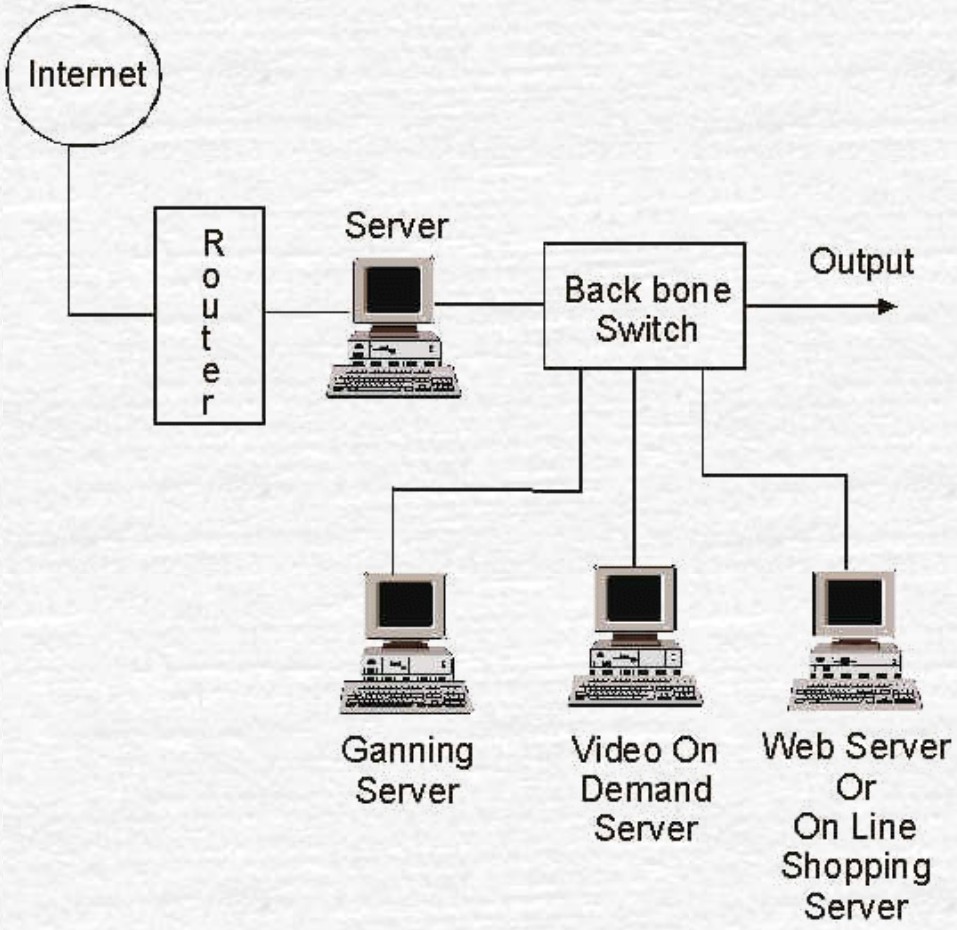
To review this SCaT spoke to Hathway Cable & Datacom that provides a cable modem service in Bombay as well as 2 vendors of LAN networks.

CABLE MODEMS

The cable modem promises to be the best mode of delivery for the Internet but is also the highest priced. The large capital cost of a cable modem have so far restricted their use by large MSOs only. Hathway is probably the first MSO to have commercially deployed Cable Modems to customer. Their service in South Bombay, (Nariman Point, Colaba and Cuffe Parade) has over 25-0 subscribers. Service to existing customers is well accepted and the company is now extending its reach.

CABLE MODEM OVERVIEW

Without dwelling too much into the working of a cable modem (which has been covered in earlier articles), lets take a quick overview on the capabilities of a cable modem and the advantages it offers to customers.



Some of the noteworthy features of a cable modem are:

* Down load speeds upto 30 Mbps. Typically 2 Mbps even on a fully loaded system.
* Connected through a CATV network - no telephone charges.
* Docsis products are interoperable - products from different manufacturers can be used on the same network.
* Expandable to service approximately 2500 simultaneous users.
* Network modem can feed multiple computers.

Figure 1 indicates the block diagram of a basic cable modem service. Typically the

headend which incorporates cable modem delivery will receive an internet feed through a high capacity leased line. The leased line capacity can vary upto 2 Mbps and multiple 2 Mbps lines can be used for even higher Internet bandwidth.
These internet lease lines would feed a Cable Modem Termination System (CMTS). The CMTS would typically cost between Rs.20 to Rs.50 lakhs, depending on the configuration. The CMTS finally provides an RF output which is directly mixed, using a two way splitter to the cable TV trunk line.

The CMTS sends out signals to cable modems in the forward path and checks for unused bandwidth at any frequency in the forward path. Typically a single channel bandwidth in the forward path is adequate to support all cable modems on the network.

REVERSE SIGNALS

The internet is an interactive medium. The customer asks for a particular website or file and then receives this file. The customers request is sent from the customers computer to the CMTS which then routes it to the internet. This calls for a reverse path signal from the customers home to the headend.

REVERSE PATH FREQUENCY ALLOCATION

Conventionally we in India operate the reverse path for video over the 5 MHz to 30 MHz frequency range. However practical experience has shown that the 5 MHz to 20 MHz frequency band is extremely noisy and practically unusable, particularly for data. The 20 MHz to 30 MHz frequency band provides a reasonable window but often noise is prevalent again 25 MHz to 27 MHz. This effectively leaves a very small bandwidth for actual use. Cable modem service providers in India have therefore preferred to use the American sub split system which provides a reverse path bandwidth over 5 MHz to 48 MHz with the forward path commencing from 52 MHz. In effect, this implies that channel 2 is sacrificed from the forward path and the bandwidth allocated to the reverse path. Considering the large number of channels available in the forward path, this is an acceptable compromise, as a result, Indian MSOs are now installing diplexers designed for the American forward and reverse path frequency allocations.

SYSTEM COST

As indicated earlier, a CTMS system cost between Rs.20 lakhs to Rs.50 lakhs. At the customer end, a cable tv splitter is required to provide 2 separate feeds, one to the TV set and another to the cable modem and computer. Hathway Cable & Datacom indicate that practical experience has shown that no Indian CATV splitter provides good performance. Infact only the Japanese DX splitters have proved to be the best and unfortunately also the most expensive.

The cable modem installed at each customer premise is typically priced at Rs.12,500 to Rs.15,000. This amount is charged to the customer at the time of initial installation.

MONTHLY COSTS

Typically cable modem services in India are priced at approximately Rs.2,000 per month for a commercial user and Rs.1,000 per month for a domestic user. In effect, commercial users' cable modems are enabled for download speeds of upto 128 KBps and domestic users are constrained to 64 KBps. This is clearly a far cry from the 2 MBps capability of a cable modem ! While the cable modem is capable of tremendous download speeds, it is apparent that for commercial reasons, this capability of cable modems is actually disabled and a cable modem user effectively receives download speeds comparable to that of a 128 KBps ISDN connection for a commercial subscriber paying approx. Rs 2,000 per month, and about half that or 64 KBps for a residential user. These are the hard facts and ground

realities.

From the above it is clear that the capabilities of a Cable Modem are unlikely to be properly utilised, for atleast the medium term future, in India. A few years down the line, Cable Modems & related equipment will certainly be more reasonably priced, and bandwidth too should be available for less. Until then, the Cable modem is high priced option that cannot be fully exploited.

Keeping this in mind, let us now take a look at a completely different solution - internet delivery through LAN (or MAN) networks.

LAN SOLUTION

A Local Area Network (LAN) is commonly used in offices to inter connect multiple computers for sharing of files between these computers. It is a mature technology, proven and implemented for tens of years. It is therefore a logical extension to connect 1 of the computers on a LAN network to the internet. With this, all other computers on the LAN network can also send and receive files and data from the Internet.

This is infact used even with cable modems where one cable modem can be connected to multiple computers through a cable modem, as shown in Figure 2.

It is important to keep in mind that a LAN network cannot be integrated on to an existing Cable TV distribution plant. The LAN network must be run as a separate network altogether. This calls for two independent networks to be set up one for cable TV and the other for LAN.

We will look into the intricacies and demands made on the distribution networks for cable modem delivery as well as for LAN distribution, in Part II of this article, to be carried next month.

A LAN network is inherently simple and versatile. We spoke to two vendors who offer LAN networks configured specially to deliver the Internet through a distribution network, targeted at cable operators. Web-maniacs and Internet Datacom Technologies (Mumbai) Pvt. Ltd., are both Bombay based companies and offer quite different approaches and radically different prices for their solutions.

INTERNET DATACOM

We spoke to Mr. Prebjyot Singh and Mr. Sawant at the company who briefed us in detail about the solution they offer. Figure 3 shows a block diagram of the Internet Datacom Tech solution.

THE ROUTER

An internet lease line - typically an ISDN lease line is fed to a router. The router feeds the server. The system capabilities can be significantly enhanced by adding a backbone switch which provides interconnection to other dedicated servers for example a gaming server, a video o demand server, a web server that could be used for caching content or even for on-line shopping.

THE SERVER

The main functions of the server are:

BANDWIDTH

The internet is basically an infinitely large network that provides for sharing of computer files. Any computer can join the internet by "logging on" to the internet. The means with which a computer is connected to the internet will determine the maximum speed with which the computer can send data to or receive data from the internet. A normal dial up modem provides a maximum download speed of 56 KBps. An ISDN line provides speeds of 64 KBps, 128 KBps and more. Typically connections providing speeds of upto 2 MBps are available. For higher speeds, multiple 2 MBps lines or alternate technologies such as satellite links and fiber optics can be employed. As speeds increase, so does the cost of the line. As an example, listed below are some of the current rates charged by VSNL for a permanent (leased) connection to the Internet. The rates indicated are for an annual rent of a leased line.

64 KBps Rs 4.25 Lakhs
128 KBps Rs 6.5 Lakhs
512 KBps Rs 13.0 Lakhs
2 MBps Rs 35.5 Lakhs

From the above its clear that a 2 MBps line is currently very, very expensive ! A quick look at cable modem specs indicate that a single cable modem can easily download 2 MBps ! Keeping this in mind clearly a very large bandwidth would need to be rented from VSNL to support even a few hundred cable modems with download speeds around 2 MBps each. Even considering the fact that all cable modems will not simultaneously call for files, a 2 MBps lease line will not be able to support a large number of cable modems.

Infact, the 2 MBps lease line from VSNL is typically shared (distributed by VSNL) between 4 subscribers, effectively providing each subscriber a genuine throughput of approximately 0.5 MBps.

PRACTICAL IMPLICATIONS

It is reliably learnt that Hathway's cable modem service in Mumbai, has leased 8 MBps of bandwidth from VSNL and this bandwidth supports about 250 cable modem users only. This would assure a good throughput to subscribers for browsing & bandwidth, but is not economically viable. ETH, another ISP has preferred to sign a contract with Singapore Telecom for a satellite based 2 MBps bandwidth at Rs.1 crore per year instead of taking a feed from VSNL at less than half the cost because they feel that the effective bandwidth from VSNL is far less than 2 MBps and a genuine 2 MBps from Singapore Telecom at Rs.1 crore a year would effectively prove cheaper. To summarise the bandwidth issue - internet bandwidth is extremely expensive currently in India. Consider the fact that a 1.5 MBps lease line in the US is available for just US $600 per month.

Hence while it is not exorbitantly expensive to support cable modems with a large bandwidth and fast down load speeds in the US, it is economically unviable to provide large bandwidths to cable modem users in India.

AUTHENTICATION

This refers to a server checking a user's name and password to validate that the user is indeed authorised to access the service. His authorisation may be suspended or cancelled if past bills are not paid.

ROUTING

The server in conjunction with the router routes signals from each user to the internet and

again identifies the signal coming down from the internet and sends it to the specific user.

BILLING AND ACCOUNTS

Details of bills raised and payments received from each customer are maintained on the server and coordinated with the authentication process when the user "logs on".

MAIL SERVER

The mail server locally stores all emails that a customer sends out or those that come in from the internet for the customer. Without going into great detail, it suffices to say that a Pop 3 account for mail (such as those provided by telephone based ISPs) can be provided if a permanent / lease line (not a dial up line) is provided as a link to the internet.

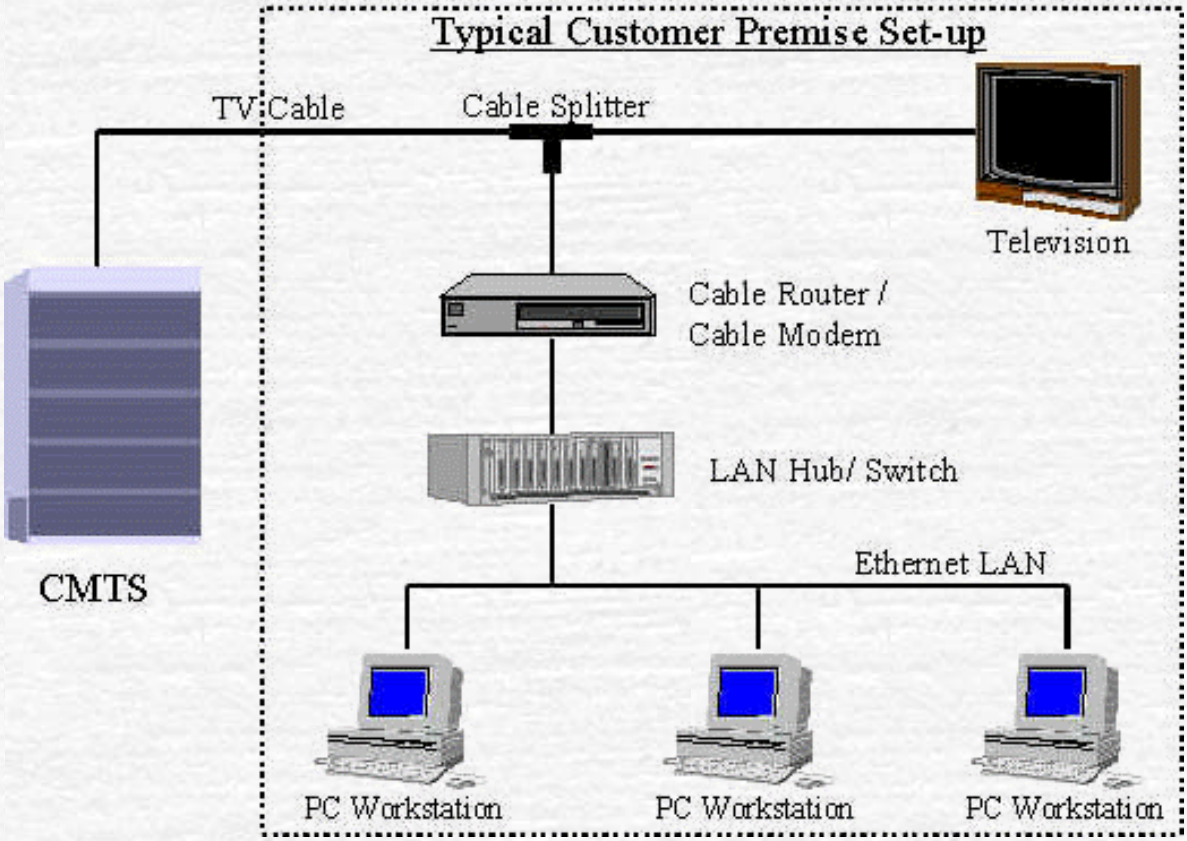
The machine configuration suggested by and included with the Internet Datacom Tech (IDT) package includes a Pentium P3 dual processor with 2 x 9 GB SCSI hard disks and 256 MB ECC RAM. IDT reckons that this configuration will adequately support 200 subscribers. The server is based on the Linux operating system and supported by Java, Radius and Adlab - all of which are free ware. Use of free ware ensures that no software copyright violations are made and no additional costs need to be incurred for software.

"The full billing and administration can be done remotely through the Internet, on our system", says Mr. Prebjyot Singh. "A company head quartered in Delhi could remotely supervise billing, collections and monitor the system operation through the internet, for its servers located in Bombay, Calcutta or for that matter anywhere in the world", he added.

IDT FEATURES

- "In addition to the features indicated above, the IDT system provides the following additional facilities", says Mr. Sawant of IDT.
- Customer's usage can be monitored and billed hourly, monthly or even according to the time of the day e.g. a customer can be provided access during non peak hours say 8 PM to 8 AM on a reduced tariff plan. "This facility of billing by the hour or minute is not available on cable modems", claims Prebjyot.
- The system speed for LAN users is 10 MBps. Hence even if distribution is provided via a 8 way hub, each user would receive a bandwidth of more than 128 KBps.
- The IDT system can be enhanced by adding separate PCs for different functions such as pay-per-view delivery of movies as a video on demand service.
- A PC acting as a gaming server can also be connected to the backbone switch. This would enable any two individuals to game against each other, at high speeds.
- On line shopping can be provided through an additional PC based server. This would provide substantial advertisement and e-commerce revenue for e.g. by booking orders for fast food, local groceries, etc.

One has also to keep in mind the high cost of internet bandwidth. Any alternate service which keeps customers logged on to local servers, without wanting to access the internet and utilise expensive bandwidth would be most welcome.



THE WEB MANIACS SOLUTION

We also spoke to Mr. Ashok Lalwani at Web-maniacs. Mr. Lalwani has been associated with the convergence of CATV and computers for several years. He has provided PC based solutions for video titling, animation and other related topics for several years and has an excellent knowledge of the PC, its capabilities and software protocols. Web-maniacs believe that cost is a key consideration for a cable operator when purchasing a system. "We have engineered our solution from scratch and every effort has been made to keep cost to a minimum", says Ashok Lalwani. Mr. Lalwani believes that it is not appropriate in the Indian context to over engineer a system on Day 1, to provide hardware that he believes is unnecessary for the service.

Web-maniacs' solution consist of a regular Pentium 3 Personal Computer (PC) configured as a DHCP server. This he says is a similar protocol used on a cable modem service. Each customer is authenticated at log on based on his allocated IP address. Unlike the IDT solution, web maniacs do not authenticate using the MAC address (the MAC address is, in simple terms, the serial number of the LAN card fitted on ever user's machine). The Web-maniacs solution utilises VPN (Virtual Public Network) Tunneling Protocol. "Our system too includes caching of the Internet content on the server", says Mr. Lalwani.

The Web-maniacs system can be configured for Win95, Win98, WinNT, Win2000 or even Linux, depending on the user's preference. "The Linux operating system is not as easy to operate as Win95 / Win98 and I doubt if cable operators would feel comfortable operating and maintaining their server on Linux", added Mr. Lalwani.

To keep cost low, the entire system is configured on a single PC. This PC offers all functions such as authentication, routing, billing / accounting as well as web caching. They do not believe that there is a need for a dual Pentium processor server for this application. Even on this system, customers can be logged and monitored for their usage by the minute or even allocated specific time slots (e.g. 10 PM to 8 AM). "Considering the fact that many

small cable networks would want to install these systems, we have developed software that permits remote access and fault finding even if it is connected to the Internet through a dial up connection and not just a lease line, as required in other systems", added Mr. Lalwani.

Infact keeping in mind such low budget installations, their server software will automatically disconnect from the internet if there is no user on the system for a predetermined period of time say 10 minutes. This could happen at lean periods such as 2 AM to 4 AM. After disconnection, the server would auto dial and log on to the net on demand, if a user logs on. This could be a distinct advantage for small town users who cannot afford the high cost of a lease line and would commence operations with a dial up connection. The Web-maniacs system besides monitoring the usage time can also monitor data down loaded and customers can even be billed according to the amount of data they down load or upload. Subscribers systems can be remotely configured from the headend. For basic internet distribution services the company recommends their Webman PC configuration which consists of a 550 MHz P3, 17 GB HDD, 128 MB RAM and a colour monitor. The system requirements are modest and Mr. Lalwani confirms that an external router and backbone switch are not necessary for the system configuration. "Our single machine based solution is cable of providing all the necessary services. This is primarily due to the advanced software that we have specifically developed and deployed in our systems", says Mr. Ashok Lalwani confidently. "We have a permanent system set up in our office to demonstrate all aspects of its functioning to any potential customer. Several satisfied customers have been convinced after seeing our demonstration, first hand", added Mr. Lalwani.

Infact Mr. Lalwani indicated that paradoxically, a major concern for his customers was the apparently low system price of Rs.1,10,000 compared to system selling for more than 4 times that price through other vendors. A hands on demonstration was usually the best means to convince potential customers, he said.

VIDEO ON DEMAND

Video on demand - a service that could provide Video CD based movies to customers against a "Pay Per View" (PPV) has always been a dream for cable networks. This feature is included in the Webman Pro system offered by Web-maniacs. In most video delivery systems, the video is sent to the customers machine, buffered on his hard disk and played from there. The video clip is therefore stored on the customer's machine and if carefully manipulated, the customer can retain the entire video clip or movie on his hard disk for viewing again, later. This would defeat the PPV concept. Hence the Web-maniacs solution puts out streaming video that is not cached on the customers hard disk.

For video on demand applications, the company recommends their Webman Pro server which consists of a 550 MHz P3, 17 GB HDD, 256 MB RAM, 50 GB additional SCSI-II hard disk for video storage and playout with MPEG decoders.

CONCLUSION

To summarise, internet can be distributed to customers through coaxial cable, either by cable modems or through a LAN based network. While in theory a cable modem offers a vastly superior solution with tremendous down loads speeds, the system is very demanding and requires a low noise return path. Also given the exorbitant cost of a high bandwidth internet feed, it is economically unviable to fully exploit the cable modem's high speed data delivery capacity. The CMTS equipment at the headend is priced over Rs.20 lakhs and would typically be a deterrent for smaller networks with a small customer base. The high cost of a cable modem - approximately Rs.15,000 is another deterrent.

However on the positive side, the cable modem is the correct long term solution, providing seamless delivery of internet and CATV entertainment over a single integrated broadband network. The network can then be enhanced to provide futuristic services such as digital interactive services, video on demand, pay per view..... the possibilities are endless.

The LAN solution is a novel use of a mature and proven technology. Here too, different approaches prevail and clearly there is more than one way to "skin the cat". We have detailed two solutions which offer the same services using radically different hardware configurations and accompanying system cost. The Web-maniacs solution at Rs.1,10,000 for the entire headend set up seems extremely attractive for small networks or for larger networks that want to "test the water" before committing large sums of money for Internet delivery. LAN solution vendors have built in user friendly features such as remote monitoring and diagnostics, auto disconnect and reconnect on demand, monitoring of usage time or data as well as providing video on demand, on line shopping and other such solutions.

It must be remembered that the LAN network is a completely independent network that needs to be laid out for internet delivery. It is almost like a parallel, new Cable TV network. Operators providing this solution however often charge a connection or membership fee of Rs.3,000 per customer. This more than adequately reimburses the entire cost of the LAN distribution network set up to service each customer.

PART II

This concludes Part I of the article which has detailed the headend equipment, facilities, hardware requirement as well as cost involved. Next month Part II will provide a detailed review of the distribution network, its design, layout, down load speeds as well as practical considerations such as remote powering of distribution equipment. It is hoped that the two parts of this article will provide a reasonable overview of the technology and cost involved for internet delivery on a CATV network so that cable operators feel confident to address a market that provides convergence of entertainment, communication and information.

WHAT IS CACHING ?

Often, different users on a large network may access the same sites at different periods of time. It is estimated that the thousand most popular internet sites receive approximately 20% of all internet traffic. This is very significant when you consider that the internet consists of tens of millions of sites. To reduce the demand for bandwidth, an ISP (Internet Service Provider) may decide to store on his server some of the popular sites and files frequently demanded by his customers. This local storage is called Local Caching. When the cache stores websites, the server is referred to as a Web Caching Server.

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