ELE 548 Research Essays
Topic 3: Cable Modem vs. Traditional (Telephone) Modem

Li Li
Department of Electrical and Computer Engineering
University of Rhode Island

In the 1960s, modems (modulator-demodulators) were developed to permit the transmission of digital signals over telephone lines. The modulator of a modem converts bits into sounds in the frequency range transmitted by the telephone lines, and the demodulator converts such sounds back into bits. Until recently, the only way to transmit information between home computers and the Internet was through telephone-based modems.

A Cable Modem is a device that allows high-speed data access via a cable TV (CATV) network. Most cable modems are currently external devices that connect to the PC through a standard 10 BASE-T Ethernet card and twisted-pair wiring. Like telephone modems, cable modems link to computers to translate data, called “modulation and demodulation”, converting data from digital to analog and vice versa.

The other similarity of telephone modem (56 K) and cable modem is the majority of them provide an asymmetric service, which means that the modems send and receive data at different speed. In this type of setup, the upstream (from computer to network) data flow often has less bandwidth allocated to it than the downstream (from network to computer) data flow. The arrangement reflects the fact that downstream demands on home consumer networks are usually higher than upstream requirements.

Although cable modem and telephone modem have the same function and other similarities, they differ from each other in many ways. The first and most important difference is speed. A 56 K modem can support 56 Kbps downstream and 30 Kbps upstream transmission rate. Cable modem is designed to transfer data at a very high speed and much faster than telephone modem. Individual cable modem speeds vary widely, depending on the type and model of modems, cable network architecture, and traffic load. For the downstream data transfer, speed can be up to 27 Mbps, an aggregate amount of bandwidth that is shared by users. Typically, they are capable of speeds ranging between 1 Mbps to 5 Mbps. For the upstream data transfer, speed can be up to 10 Mbps. Most modems selected speed between 500 Kbps to 2.5 Mbps.

The speed increase in cable modems is due to their medium - high bandwidth cable line, vs. standard phone line. The same line used to transfer 20-60 cable channels to home can easily support some Internet access, even while transmitting television program. This also frees up phone line.

Another benefit offered by cable modem is its constant connectivity. A subscriber's PC is always online with the network. That means there's no need to dial-in to begin a session, so users do not have to worry about receiving busy signals.

Telephone modems generally connect to computer’s COM (communications) port, a standard but slow component of computer system and not designed to handle data at high speed. Unlike most telephone modems, most cable modems currently used are external devices and use a NIC (Network Interface Card), such as Ethernet card, which fits into the standard PCI, ISA or PCMCIA slots in computer. NIC cards allow for much faster data transmission than standard COM ports. Since a cable modem is connected directly to computer via a standard 10 BASE-T

Ethernet card, it is already running currently network protocols. This makes it very easy to connect the computer to a LAN.

Unlike circuit-switched telephone networks where a caller is allocated a dedicated connection, cable modem users do not occupy a fixed amount of bandwidth during their online session. Instead, they share the network with other active users and use the network's resources only when they actually send or receive data.

Because cable networks are shared resources, it's possible that someone might try to access private transmission while it's in transit. If this happens, they might be able to intercept personal data and reconstruct it. Some cable modems are being designed to include encryption and decryption capability. The way it works is when you send data across the Internet, your modem encrypts it, and the cable modem at the head-end of the cable network decrypts it, then send it across the Internet. Similarly, when data is sent to you, it's encrypted by the head-end cable modem, then decrypted by your modem. Encryption of data by cable modems is not to be confused with other encryption used by Netscape Navigator and Microsoft Internet Explorer because cable modems only encrypt data along the cable network.

How about the expenses of using cable modem comparing to telephone modem? The normal price for using telephone modem is around $20 per month, adding another $20 if a second telephone line is used. The cable operators typically charge $40-$60 per month for an Internet service package that includes software, unlimited Internet access, specialized content and rental of a cabal modem. For example, COX Communications at Rhode Island charges residential internet service price at $44.95 per month for unlimited access and modem rental with a $149 installation fee. In spite of the installation fee, cable modem sounds a good deal for those are tired of waiting for something download to their computers. And the installation fee is expected to be decreased along more and more subscribers.

The market of cable modem belongs to only one or two companies in most regions, such as Rhode Island. People don't have as much choice as when we are selecting telephone company. More competition should be induced into future cable modem market.

There are two kinds of cable modem services provided be cable companies. Some cable companies offer two-way cable modem service: you send and receive data through the cable modem. Unfortunately, other cable networks are one-way. To access the Internet through a one-way cable system, you have to dial in with a regular modem and phone line. Uploads go through the regular modem, while downloads go through the cable modem. Although most Internet surfing involves downloading information to customer's computer, this is inconvenient. The customer still has to own a conventional telephone modem, and still has to tie up a phone line while online.

Another inconvenience is the realistic speed of cable modem will be lower than the maximum speed advertised by its providers since you connect to your computer through a 10 BASE-T Ethernet card. The maximum bandwidth of that card is 10 Mbps, and actually few get more than 4 Mbps. Being on a cable modem will be like being on an office LAN. Early in the morning before everybody else gets to work, the network at the office is nice and speedy. When other people show up and start printing and accessing the file server, the network slows down. Exactly the same thing will happen with cable modems if the networks aren't upgraded to keep up with the subscriber base.

The first generation cable modems use various proprietary protocols which is not based on widely accepted standards. It is impossible for the CATV network operators to use multiple vendors cable modems on the same system. The Institute of Electronic and Electrical

Engineering's (IEEE) 802.14 Cable TV Media Access Control (MAC) and Physical (PHY) Protocol Working Group was formed in May 1994 by a number of vendors to develop international standards for data communications over cable. The original goal was to submit a cable modem MAC and PHY standard to the IEEE in December 1995, but the delivery date slipped to late 1997. Tired of waiting for the IEEE 802.14, cable operators combined their purchasing power to jump-start the standards process. Multimedia Cable Network System Partners Ltd. (MCNS), which represented the majority of the North American cable industry, released its Data Over Cable System Interface Specification (DOCSIS) for cable modem products to vendors in March 1997. At the physical layer, which defines modulation formats for digital signals, the IEEE and MCNS specifications are similar. For the media access control (MAC), which sets the rules for network access by users, 802.14 has specified Asynchronous Transfer Mode (ATM) as its default solution from the head-end to the cable modem. MCNS used a scheme based on variable-length packets that favors the delivery of Internet Protocol (IP) traffic. Both cable modem solutions specify a 10Base-T Ethernet connection from the cable modem to the PC. Although no major vendors are currently building modems based on the initial IEEE standard, it may become the third generation due to its quality of service (QoS).

Cable Datacom News publisher Kinetic Strategies Inc. estimates the number of cable modem subscribers in North America passed the 500,000 mark by January 1, 1999. North American cable operators are currently adding more than 2,000 cable modem subscribers per day. At this pace, Kinetic Strategies estimates the North American cable modem subscribers count will surpass the 1 million mark in the third quarter of 1999.

An Internet research firm Pioneer Consulting reported that 1.5 million subscribers worldwide currently utilize cable modem Internet access, including approximately 790,000 North American users. Pioneer estimates that the residential global cable modem market will expand to more than 1.5 million subscribers in 1999, by the year 2007, more than 45 million Internet connections will be made through cable modems worldwide. North America’s share of the market is estimated to be just under 24 percent, or 11 million users.

References

[1] Vincent P. Heuring, Harry F. Jordan, “*Computer Systems Design and Architecture* ”, Addison Wesley Longman, Inc., 1997

[2] David A. Patterson, John L. Hennessy, “*Computer Organization and Design*”, Morgan Kaufmann Publishers, Inc., 1998

[3] Jean Walrand, “*Communication Networks*”, WCB/McGraw-Hill, Inc., 1998

[4] William Stallings, “*High-Speed Networks*”, Prentice-Hall, Inc., 1998

[5] Andrew S. Tanenbaum, “*Computer Networks*”, Prentice-Hall, Inc., 1996

[6] URL: http://www.cablemodems.com

[7] URL: http://www.catv.org/modem

[8] URL: http://www.cablemodeminfo.com