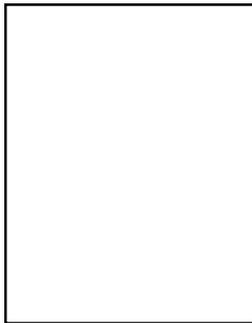


CABLE INDUSTRY OUTLOOK

Cable Modems and the Internet

Scott Evans



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Cable television, as an industry, is rushing head long into providing high-speed, on-line access. The vehicle for delivering this new service is the cable modem. In the last edition of *NTQ*, we took a look at how the Internet is remaking itself. Now, let's examine what is driving cable to commit billions in new capital expenditures to deploy a technology that has yet to prove itself. Then, we will look at the problems related to provisioning the service, and what it will take to bring the product to market.

The Greatest Thing Since The Disney Channel

At the recent CTAM (Cable Television Administration & Marketing) conference in Boston, the marketing mavens of the cable industry got together to figure out how to bring new services to market. Trapped in a techno-tangle and feeling the crush created by direct broadcast satellite (DBS) services with their crystal-clear digital pictures, CD-quality sound, and hundreds of channels for delivering movies and sports programs (the two cornerstones of cable)—and panicked by the hoofbeats of the recently free telephone companies charging into their franchise territories—the lethargic cable industry finally realized it was time to take action.

Scanning the horizon for a white knight to save them, they noticed that all available heroes were riding

off to join the Internet gold rush. Readers should realize that this took place over a two-year period—an eternity to most of us, but breakneck speed compared with their telephone counterparts who usually take a minimum of five years to make even minor changes in course.

So, the cable marketing armies converged on Boston proclaiming cable modem “the first real new revenue opportunity since The Disney Channel!” To those of us used to rolling out something new every year or so, this is scary. Our children have grown up watching The Disney Channel and MTV (diametrically opposed philosophies as ever existed), so imagine how excited the cable industry must be.

The keynote speaker was that guru of gurus, William Gates III, known to his friends as “Bill,” recognized by *Fortune* magazine as one of the “Lords Of Wintel.”¹ Bill Gates, founder of software giant Microsoft, and the Wintel combine he lords over with Andy Grove, is a master business strategist and acknowledged technology visionary. He rules the world of desktop and portable computing by wielding the mighty sword of Windows, the operating system software that controls 80% of the market. That software drives the Intel computing engine that his friend Andy supplies to 85% of the computing platforms in the world.

Today, the Windows/Intel axis allows the computing world to spin at ever-increasing speeds, processing multimedia content into a captivating and entertaining show on the computer screen. Multimedia content is what is fueling the exponential growth of the Internet, and is the reason Internet users crave faster communications links into their homes and businesses. The push created by the Internet is so powerful that it caused Microsoft to completely shift its business strategy² to incorporate the technology required to make access to the Internet an integral part of its software.

So, CTAM invited Bill to address their marketers in the hopes that he could show them the road ahead. Bill has become an icon in the cable industry through his partnerships with TCI in the Microsoft Network (MSN was created to compete with America Online and CompuServe) and @HOME, a combination content/access/transport provider hoping to become the America Online of the Internet delivered over cable. Further, Microsoft is in the thick of the interactive television (ITV) hunt with its MITV initiative that promises end-to-end control of the complex computing architectures required to deliver fully-interactive broadband signals.

Fear not, Bill told them, for the future holds great things for cable, and Microsoft is there with you. What he neglected to tell them was that Goliath was siding with cable because DAVID (a competing operating system for ITV created by Microwave, a Des Moines, Iowa software company which counts their revenues in millions, not billions) had forged an alliance with the telephone industry. But, Bill has made a habit of riding long shots to victory, not the least of which is Windows, the graphical user interface (GUI) that has relegated Apple Computing's Macintosh from being the "Computer for the rest of us" to the "Computer for the rest of them." Who better to advise them?

The Magic of Cable Modems

My apologies to the folks at Disney, but the magic of the cable modem is that it satiates the need for speed. For those of us who have abandoned real life and now live on the Internet, the cable modem is the Ferrari of the Information Superhighway. Al Gore covets one. Bill Gates has one. We all want one.

My first encounter with a cable modem was at the NCTA (National Cable Television Association) show in New Orleans, way back in May 1994. Turning a blind corner, I literally bumped into a fresh-faced engineer from (of all places) Intel, who was the sole demonstrator of a prototype cable modem. Having spent time in the modem industry a decade earlier, I was interested in what he had to say. His demonstration consisted of showing the "big three" on-line services (at that time CompuServe was #1, America Online was #2, and Prodigy was a distant #3) running simultaneously on a Windows-based PC.

My reaction was "Oh, great, now I can pay triple the on-line charges!" That was the state of things then. He wasn't demonstrating the Internet, because the World Wide Web, that has been the numenon of the

Internet phenomenon, was just beginning to be spun. On-line services were for information access, not entertainment, and CompuServe was the granddaddy (and using 9600 baud modems) being challenged by upstart AOL who believed that a snazzy look and faster (14.4 kilobits) modems would win the day. The cable modem had been developed on speculation by Intel, who believed that it could be used to deliver high-speed signals (including ITV), but could only show access to on-line services because they were a computer company. Intel's hope was that their partner Microsoft, who was showing a prototype of their "Tiger" streaming video server software on the other side of the kiosk, would find a way to get them into the cable industry. They weren't wrong.

Fast forward a year to NCTA '95 in Dallas. On-line services were now the rage, the traditional suppliers (General Instrument and Scientific-Atlanta) had failed to deliver the \$250 digital cable boxes as promised, and cable operators were starving for new revenues. Their hope was to find someone taking orders for a cable modem that could be delivered right away and would work on their cable systems. No such luck.

Intel was still stuck in a corner with the same demo as the year before, and a couple of other companies were showing something called "64 QAM" modems as prototypes. The only new gizmo that might work out was in the Sega Channel booth, where a cartridge that connected to cable was downloading video games to players gathered around the game machines. The modem used in the cartridge was developed by XBAND, but it was unidirectional (only working in a "downstream" mode). Worse, it only worked with Scientific-Atlanta headend equipment, so only 25% of cable systems could take advantage of it. Most cable operators went home disappointed.

Jump ahead again to the Western Cable Show in Anaheim, where cable modems are now in abundance. Intel has a whole booth, showing off a cable modem, the size of an encyclopedia volume, at three kiosks, while people crowd around watching the ESPN home page on the Internet show wide-screen, full-motion video of sports.

In another hall, Motorola was showing off their cable modem by connecting to Internet sites they knew had high-speed connections, so everyone could see just how fast surfing the 'Net could be. LAN City, by comparison a small company, had its cable modem connecting local area networks via cable at Ethernet (10 Megabits per second) speed. Almost every booth showing hybrid fiber/coax (HFC) equipment included

a cable modem, because HFC wasn't selling. ITV had lost its luster, and without some "killer app" to demonstrate, HFC was too expensive to warrant deployment. Internet fever was spreading, however, and cable modems looked like the cure for the virus.

By NCTA '96, held this April in Los Angeles, if cable operators could have taken home all of the cable modems on display, they could have met their first 90 days of demand. Major vendors were taking orders, but delivery dates were for late '96 in limited quantities, and the \$500 price tag was tough to swallow. Internet fever was now a plague across the land, and the few field trials completed had resulted in the trial users refusing to give up their cable attached turbochargers.

Where's the Service?

You can't say cable hadn't been trying. In 1994, it established Cable Labs, funded by a consortium, to set standards for the cable industry and resolve the technical and operational issues in a safe environment. But, as of NCTA '96, they were a full year behind on issuing a standards document for cable modems, and Andy Grove had moved Intel from being a potential supplier of cable modems to driving standards through alliances with AT&T, Hewlett-Packard, and Hybrid Networks to try and speed up the process. Any cable modems deployed at that point were for testing purposes.

Meanwhile, CTAM had completed a focus study of Internet users to determine what consumers wanted and measure their willingness to pay. The good news was that the focus interviews revealed not only a strong desire to have a faster onramp to the Internet, but the willingness to pay was on the order of \$30 to \$40 per month (including the modem). The bad news was that the sample was badly skewed. Conducted in scenic Tulsa, Oklahoma, because of its "typical" demographics, most of the people surveyed used AOL or one of the other on-line services to access the Internet. To sophisticated Internet users, this is folly. The on-line services provide the least satisfying Internet experience, while charging outrageous hourly fees to do so. Most serious 'Net surfers subscribe to personal or business accounts from ISPs (Internet service providers), most of which are local companies providing access at \$19.95 per month or less. So, the CTAM study had interviewed people who used the Internet on a less-than-serious basis, but were already paying \$40 a month or more in on-line service fees.

The Cost Factors

A small number of cable operators had begun deploying HFC systems, but this was motivated by maintenance and other operational issues, not to fulfill the broadband dreams of the future. The cost constraints had not changed. HFC still cost a minimum of \$800 per home passed on a 2,000 homes per node basis—just to get the basic physical plant into place. Fewer still were using HFC technology to test broadband capabilities, and most of those did not include cable modems in their trials.

One that did was the Viacom trial in Castro Valley, California. Conducted jointly with Intel over a cable plant provided by AT&T Network Systems (now Lucent Technologies), the trial had been so successful that Intel was using it as the main attraction in their booth at NCTA '96. A good personal friend of mine was a participant in the trial and, like most people, refused to give up the service when the trial ended. He compared it with the video on demand trial that Viacom had started earlier. He said that VOD (which was really "near" VOD) was a bust since he could take his kids to the Pleasanton Mall Cineplex and see a movie faster than waiting for the next start time. But, the cable modem was killer. He uses the Internet for business and pleasure, and had severely taxed his 28.8 Kb/s modem on his PC. The cable modem really made things zoom, so much so that when he hit a slowdown, he would often switch to his old modem and service to verify that the slowdown was at the far end. This was almost always the case. Would he pay \$40 per month for the service? Absolutely—especially since he writes it off as a business expense. What if he couldn't? Probably, he said, because once he got used to it, the alternatives were annoying.

Unfortunately for the cable industry, field trials do not a product make. And pent-up demand by crazed 'Net surfers does not a market make, unless you have free software at your Web site to download. Pity the poor cable operator, caught in a crossfire of deregulation of the telephone companies, blasted by signals from those DBS satellites, caught in a quagmire of proprietary solutions (no standards exist for HFC or cable modems), and serving a residential base of customers who think they charge too much for too little. *And*, all of the technology laid end-to-end still wouldn't deliver a service. So, the challenge becomes how to roll out a new service that hits an identifiable market within a reasonable timeframe.

Forecasting High-Speed Access Services

I've been tracking cable services for the past two years. A summary of my analysis identifies the factors driving and impeding roll out of a cable-based, high-speed access service. By examining a series of factors controlling the environment, I've created a timeline and forecast for high-speed access services. The demand for a faster Internet access product is being driven by penetration of multimedia computers in homes and businesses. The demand for cable modems is being driven by those households that have access to cable provided via HFC systems.

As shown in Table 1, estimates based on total U.S. households³ for the years 1996 through 2000 indicate that, for multimedia computers in cable homes with HFC access, the cable modem subscription penetration will grow from 5% in 1996 to 24% in the year 2000. The five categories calculated are:

- (1) *Computer HH*—Total computer households.
- (2) *Multimedia HH*—Households with multimedia-capable computers.
- (3) *Cable MM HH*—Multimedia households subscribing to cable.
- (4) *HFC Cable HH*—Cable MM HH with HFC access.
- (5) *Cable Modem HH*—HFC cable HH subscribing to cable modem services.

The calculations show a higher percentage of cable households with multimedia-capable computers than the general population at large. This is because

the cable demographics skew higher in the categories of income, education, and professions. With a higher percentage of computer households attached to cable than the population at large, cable has a customer base to target.

Within this target, how great is the need for speed? That depends on who is using the computer, and what applications are being used. Primarily, the applications fall into the information and entertainment categories of on-line access and video games. Few question the value of the Internet as an information and entertainment environment. Many question the technology used to deliver the content and the ability of service providers to improve their access speed and throughput.

As a work-around solution, many content providers using the Internet are moving to a "hybrid" base by using a CD-ROM that interacts with their Web site, including voice over data modem software that allows talking (taunting?) during game play. This places the large multimedia files on the disc and uses information available on the Web to drive the program flow. The most successful implementation of this is multiplayer video games. The game CD-ROM includes software that lets the player interact with other players through the Web site. Over the past year, multiplayer games have become the fastest growing segment of the video game industry.

At the same time, the Internet has become the multiplayer platform because of its ubiquity and support across multiple computing platforms. Even the latest generation of game machines all have

Table 1
Forecast Of U.S. Computing Households By Type

	1996	1997	1998	1999	2000
US Households ³	98,856,603	99,965,175	101,042,864	102,118,600	103,245,963
Computer HH	42,508,339	44,984,329	47,490,146	50,038,114	51,622,982
Multimedia HH	31,881,254	38,236,679	45,115,639	48,536,971	50,590,522
Cable MM HH	19,128,753	22,942,008	27,069,383	29,122,182	30,354,313
HFC Cable HH	1,912,875	3,670,721	5,955,264	9,901,542	15,177,157
Cable Modem HH	95,644	293,658	714,632	1,782,278	3,642,518

Source: Vector Communications

Internet adapters that allow multiplayer action coming to market for Christmas 1996. New software-based “streaming” technologies allow for large volumes of information to be acted on as they come in packet-by-packet, eliminating the wait for downloading to complete. These factors mitigate the need for speed, but they also significantly increase the number of users seeking access to the multiplayer Web sites.

Availability and Pricing of Cable Modem Services

Right now, the cable industry has roughly two years before the telephone companies begin serious deployment of alternative solutions, mainly ADSL (Asymmetrical Digital Subscriber Line) technology using the copper wires in the local loop. This ignores the fact that AT&T, MCI, Sprint, and a legion of others have ripped the pricing floor out of the ISP business by making \$19.95 the universal price point for unlimited Internet access. By year end, nearly every local telephone company will have a local Internet service available, and the price point will be down to \$14.95 per month or less. This is for analog access over POTS (plain old telephone service). ISDN access will not be a competitive factor, since it is still only available on a limited basis in larger metropolitan areas. Conversely, cable passes 97% of U.S. households.

The cost curve for cable modems does not show the dramatic drop of other technologies, although future iterations of chip sets will both reduce the cost

and allow the cable modem to be embedded in other devices, including computers and set-top boxes. The cost of providing the basic ISP service will remain flat at approximately \$4.00 per month per subscriber. This is governed by an increase in features and functions that offsets drops in headend hardware and software costs. The initial Internet access service is a log-on account with electronic mail, although hosting and home pages may be included at a higher price. Cable traditionally prefers to make services available in tiers with an incremental pricing structure, but the price wars between cable, telephony, and traditional ISPs may preclude this as an option. The price/cost matrix for the basic business model is shown in Table 2.

What will slow HFC availability to cable households is system density. There are more than 11,000 cable systems in the United States, but 82% of the population resides in only 3,000 of those, which are located in urban and suburban areas. Cable industry estimates indicate that HFC will grow from a penetration of 10% in 1996 to only 50% in 2000. This is because HFC currently requires a density of 20,000 homes within a system to be economically feasible, and only 650 cable systems meet this criteria.

Given the state of the art and absence of standards for both HFC and cable modems, the upper limits of cable modem density within an analog node is 50. This is due to a combination of upstream bandwidth available in the analog return path and the signal-to-noise limitations of the analog amplifiers used. An

**Table 2
Business Model Matrix For Cable Modem Services**

	1996	1997	1998	1999	2000
Cable Modem Cost	\$500.00	\$450.00	\$300.00	\$200.00	\$125.00
Lease (36 months)	\$18.00	\$16.25	\$10.83	\$7.22	\$4.51
ISP Cost	\$4.00	\$4.00	\$4.00	\$4.00	\$4.00
Service Cost	\$22.00	\$20.25	\$14.83	\$11.22	\$8.51
Service Price	\$39.95	\$39.95	\$34.95	\$29.95	\$24.95
Profit/Month	\$17.95	\$19.70	\$20.12	\$18.73	\$16.44
Gross Margin	44.93%	49.31%	57.56%	62.53%	65.88%

Source: Vector Communications

HFC system graded at 2,000 homes per node currently costs approximately \$800 per home passed. To achieve the targeted 24% penetration of households, system grading must be on the order of 500 homes per node, pushing the cost to \$1,200 per home passed.

Compounding the problem is the time required to upgrade a cable system. HFC deployment to provision high-bandwidth services is turning out to be a rebuild rather than an upgrade. Initial timelines of 12 months have stretched out to as long as three years due to learning curves. Once the fiber loops that make up the system backbone are up and working, the line amplifiers on the analog side of the nodes must be replaced in order to make the return path usable.

The deployment of HFC is currently a sunk cost to be amortized over the life of the cable plant (seven to 10 years minimum). Rate increases in the cable industry are subject to FCC regulation when applied to the basic cable service, and the rate of return is capped at 14% for regulated services. This means that the cost of HFC must be absorbed by new unregulated services, such as cable modems, premium service tiers, and other new services. The good news is that the HFC plant will support a range of new services, including video on demand, telephony, and interactive television. The bad news is that each of these services requires additional infrastructure, including a new device in the home. Today's costs for a home terminal device to support digital video signals for VOD and ITV is a minimum of \$500, the telephone device is \$500, and the cable modem is \$500. This \$1,500 per subscriber cost is prohibitive, and cable operators are calling for modular solutions that are more highly integrated than the current technology allows.

Conclusions

The market for cable modems obviously exists. In each of the test markets, demand has been strong. Even smaller systems that have upgraded to HFC for operations reasons are experiencing success. One example is Service Electric Corporation which serves a suburb of Philadelphia. Offering the Zenith cable modem, which only provides 500 Kb/s downstream data rates, at \$39.95 per month for unlimited access, the service is taxing their ability to deploy. The Zenith choice was driven by two factors: they were available now, and they did not load the cable plant as heavily as the 64 QAM modems from other vendors. At \$39.95 per month for service that is 20 times faster than an analog modem, and given the absence of ISDN or

ADSL service from Bell Atlantic, Internet users are anxious to get their hands on the fastest service available.

The cable industry is being forced to invest in new technology in order to remain competitive with the telephone companies that covet their service base. Both intend to offer enhanced services, including high-speed data, video, interactivity, and telephony. Both are struggling to deploy the infrastructure required to support these services, and both must be able absorb the sunk costs prior to recognizing revenues. The hype that has driven this environment for the past two years has now given way to the brutal reality that the first to provide service will most likely capture and retain market share in the long term.

The cable and telephone industries share a common problem in that their core products have gross margins in single digits and subscriber growth rates that are even smaller. New revenues and profits will be derived from new services that require significant investment up front. Both industries suffer from image problems related to quality of service and value, while lacking the marketing expertise to change that perception. Only by delivering new services that meet the market—at price points that are competitive—will they be able to capture the loyalty of customers. **NTQ**

Author's Note—Additional information on cable modems can be found on-line at <http://www.cablemodems.com/>.

¹ "A Conversation with the Lords of Wintel," *Fortune* (July 8, 1996): 42.

² "Inside Microsoft—The Untold Story of How the Internet Forced Bill Gates to Reverse his Corporate Strategy," *Business Week* (July 15, 1996):56.

³ U.S. Census Bureau, Projections of U.S. Households by Type: 1995 to 2010, Series 1 (July 1, 1996). [On-line.] Available: <http://www.census.gov/population/projection-extract/nation/table1n.asc>.