Products and Services

There are certain classes of home networking products and services that lend themselves well to being sold at retail. The current crop of home networking kits and adapters is a good example of such a product category. These products are aimed at PC networking and thus fit nicely into the product portfolio of any retailer selling PCs or PC peripherals. With an increasing number of new PC purchases being made by consumers who already have a PC, home networking kits become a natural add-on component for retailers.

Outside of networking kits and adapter cards, which make up the bulk of retail products today, there are a few RGs that are also currently available through the retail channel. For example, 2Wire sells its HomePortal family of RGs through retailers Office Depot and CompUSA, while SOHOware has partnered with Best Buy to sell its Broadband Internet Gateway. In 2001, the number of RGs offered at retail will increase significantly, as companies like Netgear and 3Com place their RGs on store shelves. The majority of the new residential gateways introduced at retail this year will be "simple" RGs. These devices do not have an embedded broadband modem, but instead contain an Ethernet port connecting the device to an existing broadband modem. These RGs typically embed firewall functionality and have the ability to distribute access using one type of home networking media (e.g., wireless, powerline, phoneline).
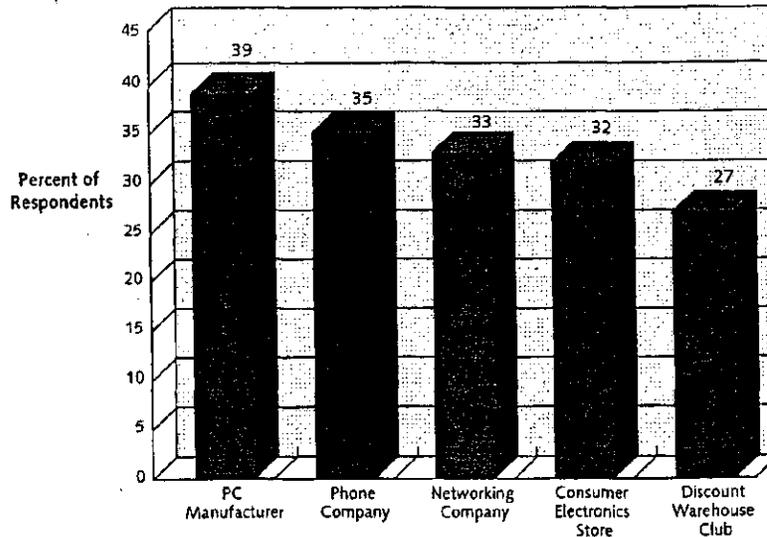
A new category of network products should also debut at retail in the coming year: network-enabled consumer electronics. At the Consumer Electronics Show held in January in Las Vegas, devices such as network-enabled alarm clocks and digital audio receivers were displayed, many of which are expected to make their appearance at retail in the coming months. Sales of these devices, however, will initially be limited given their high cost and the small installed base of home networks that can utilize them.

In the two- to four-year time horizon, we expect retailers to begin offering more complex broadband and multi-service gateways to customers as part of broad-range partnerships with service providers. Retailers may also begin selling networked phone systems that allow users to take advantage of advanced telephony functionality that will be delivered by service providers. Many of the product categories retailers will carry in this time period, however, will be the same ones they feature today—consumer electronics, PCs, and game consoles—but will consist of network-enabled versions of these products. As retailers move more aggressively into the home networking space, they will broaden as well as deepen their product portfolios, stocking a variety of products in each category and offering network-related services in conjunction with these, creating complete home network solutions as well as network solutions focused on specific application sets such as entertainment.

Will the bold moves many retailers are making into the home networking market bear fruit? Our 2000 Networked Home Survey indicates that retailers rate well when it comes to consumer purchasing preferences, especially consumer electronics retailers (see Exhibit 3). The fact that the largest number of respondents chose "PC Manufacturer" also boosts retailers' chances for success. Many of these respondents likely gravitated toward PC manufacturers because they associate networking with the PC; and as major distributors of PCs, retailers may benefit from such an association.

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Exhibit 3
Consumer Purchasing Preferences
Source: the Yankee Group, 2001

Percent of Respondents

Chart values (Percent of Respondents):
- PC Manufacturer: 39
- Phone Company: 35
- Networking Company: 33
- Consumer Electronics Store: 32
- Discount Warehouse Club: 27

III. Retailer Profiles

Up to this point in the Report we have discussed consumer electronics and computer retailers in general. To better illustrate the various ways in which retailers will participate in this market, we now specifically examine three retailers that have become proponents of home networking and will play key roles in bringing home networks to the mass market.

Best Buy

As one of the founding members of the Internet Home Alliance, Best Buy clearly sees home networking as a significant market opportunity. With its size and scale-the company currently operates over 400 stores in 40 states and is the largest volume retailer of consumer electronics, PCs, and audio and DVD packaged media in the United States—Best Buy is clearly in a position to help make home networking a reality for the average consumer (see Exhibit 4).

Best Buy's corporate strategy is to be a leader in providing consumers with technology and entertainment-related products. In view of this strategy, it is easy to see why Best Buy has jumped into the home networking and broadband markets. These markets represent the point of intersection between technology and entertainment, and thus fit comfortably within the company's overall strategy. When it comes to home networking specifically, Best Buy's strategy is to provide consumers end-to-end solutions focused on the applications of Internet sharing, entertainment, and home control. This desire to provide end-to-end solutions will lead to the company's coupling of home networking with broadband access and other WAN services that leverage a home network.

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Exhibit 4
Best Buy Company Information
Source: the Yankee Group, 2001

Number of Stores	400+
Key Product Segments	Home office, consumer electronics, appliances, and entertainment software
Broadband Service Provider Partners	MSN, DirecPC, AT&T Broadband, and Sprint
Current Home Network Product Types	Kits/adapters, residential gateways

As Exhibit 4 illustrates, Best Buy's current home networking product line consists of PC-centric home networking kits and adapters as well as "simple" RG devices. The company has also aggressively pursued the broadband market through partnerships with leading service providers in each of the key broadband technology areas—MSN for DSL access, AT&T Broadband for cable modem service, DirecPC for satellite broadband access, and Sprint for fixed wireless access—giving consumers a variety of choices when it comes to selecting a provider. These partnerships allow Best Buy to introduce consumers to broadband, get them signed up for service, and sell them the associated CPE in some cases.

In the future, Best Buy's home networking product portfolio will expand to include network-enabled devices in the other major product categories offered by the company, such as networkable appliances and audio/video consumer electronics. The company will also stock RGs and emerging home control devices and systems. Best Buy will not, however, be a key player in this market solely on the basis of the product lines it carries. Rather, the company's ability to act as an aggregator, and bring these various products together to offer consumers total home networking solutions, positions the retailer to be successful in this market. Best Buy will offer the consumer not only home networking infrastructure solutions, but also installation and maintenance services to get consumers up and running with networks; and then through its service provider partnerships, it will offer consumers compelling content and services that leverage this home network.

Best Buy will create awareness of its home network–related offerings through the print and television media channels it currently uses to advertise its stores. It will also create in-store kiosks and displays to educate consumers on their networking options and the network-related services available to them. Finally, the company will leverage its sales staff to help consumers create home network solutions that meet their specific needs.

RadioShack

RadioShack has been an active participant in the home networking market from its early stages. The company is so bullish on the potential of this market that it is creating a third core business around home connectivity, which will complement its current core businesses of parts and accessories as well as telecommunications. RadioShack's distribution network, unparalleled among retailers, boasts over 7,100 stores and 25,000 employees. By leveraging these assets, the company is in an excellent position to introduce networking to the mass market (see Exhibit 5).

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Exhibit 5
RadioShack Company Information
Source: the Yankee Group, 2001 .

Number of Stores	7,100+
Employees	25,000+
Key Product Segments	Electronics parts and accessories; telecommunications devices; store within a store for PCs; wireless
Broadband Service Provider Partners	NorthPoint MSN Excite@Home StarBand
Current Home Network Product Types	Kits/adapters

RadioShack's overall strategy for the home networking market is to build its stores into one-stop shops where consumers can learn about and purchase home networking products and sign up for network-related services.

RadioShack is agnostic when it comes to home networking and broadband technologies: the company wants to offer as wide a variety of products as possible so that it can create offerings that appeal to the diverse groups of consumers who come through its doors. This mindset is clearly illustrated by the company's current home network product offerings. RadioShack stores currently carry PC-centric home networking kits from various manufacturers based on HomePNA technology, HomeRF, and Ethernet, and in the future the company plans to also offer powerline devices based on the HomePlug standard. In the broadband arena, the company has partnerships with Excite@Home and NorthPoint to offer consumers cable modem and DSL service, respectively (see Exhibit 5). In November 2000, the company also announced a partnership with StarBand, a provider of two-way satellite based broadband access, to offer consumers StarBand's service through Microsoft MSN kiosks located in many RadioShack stores. Given the small size of its stores, RadioShack will not be able to stock a wide variety of network products. The company will instead focus on devices that complement its current PC- and telecommunications-related businesses, such as network phone systems, as well as those network devices that require an Internet connection, such as Internet radios. The company will also probably stock some RGs that it will sell in conjunction with service packages from its various service provider partners. A key component of RadioShack's Home Connectivity business will be installation services. The company employs a large staff of technicians and owns a fleet of trucks that it currently deploys to install systems such as satellite television for consumers, and it plans to build a home networking installation business around this fleet of trucks and technicians.

RadioShack currently claims that 94% of U.S. households are located within five minutes of one of its stores, and that its stores are visited by over 1 million customers a day. It is this kind of scale that makes the company ideal to educate consumers on the benefits of home networking. The company will leverage both broadcast and print media to advertise its home networking solutions and get customers into its stores.

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Once there, the company will put its sales staff, whom it will train extensively in this area, to work to educate these consumers on the uses and benefits of networks, allow them to test out devices, and outfit them with solutions that best meet their needs. Once a customer has made these decisions, Radio Shack will dispatch installers to the customer's home and use the time in the home to up-sell the customer additional products and services that he or she may find useful.

Sears

At over 100 years old, Sears is one of the oldest retailers in the United States, though it is hardly a name many would think of when it comes to cutting-edge technology markets like home networking. Sears, however, sees the home networking market as a natural extension of its current businesses (see Exhibit 6) and believes it can leverage its brand to create mass-market consumer awareness of home networking. As a first move into this market, the company helped to drive the formation of the Internet Home Alliance.

Like RadioShack, Sears's plan for the home networking market is to become the one-stop shop where consumers can purchase all their connected products and services. Unlike RadioShack, however, Sears can create more complete home network solutions by leveraging its vast product portfolio, which covers every room of the house and includes items from kitchen appliances to PCs to home lighting and heating and cooling systems. Sears plans to carry network-enabled products for each room in the house, and to offer consumers installation and maintenance services to tie all these disparate products and room systems together into a unified home network.

Sears does not currently stock any home network devices, and is still in the process of determining which types of products it wants to carry. The company is waiting for the market to develop further and for more types of products to be introduced before it puts anything in front of its customers. The company can afford to enter the market at a slower pace because it is concerned not with capturing early adopters of home networking, but with selling home networking to the mass market. Perhaps the single most important aspect of Sears's plan for the home networking market is its focus on creating a home network installation and maintenance business. Today Sears's business services segment, which encompasses the company's product installation and maintenance business, generates over $2 billion in annual revenue. With over 13,000

Exhibit 6
Sears Company Information
Source: the Yankee Group, 2001

Number of Stores	860 department stores
Installers/Technicians	13,000 +
Key Product Segments	Apparel; housewares; home electronics and appliances; automotive, lawn, and garden; and hardware
Broadband Service Provider Partners	None
Current Home Network Product Types	None

9

service technicians at its disposal, Sears can easily bundle network installation and maintenance services with the home network solutions it sells. No other retailer in this space has an installation business of this scale. By getting consumers' networks installed, and offering network maintenance services along with its products, Sears believes it can ensure a positive customer experience with home networking and differentiate itself from the competition.

Sears will initially concentrate its home networking marketing efforts on its current customer base mostly through print advertising. In the future, it will also utilize its national advertising power and broadcast media to create greater mass-market awareness of home networking and the solutions the company provides. Most importantly, Sears will utilize its stores to allow consumers to see and experience home networking solutions firsthand. The company will create room displays to showcase the various network products that fit into each room of the house and demonstrate the benefits of networking devices in these various rooms. Sears will also focus its in-store efforts on creating displays for network products that allow consumers to gain hands-on experience with them.

IV. Conclusion

Retailers will play a critical role in the home networking market as it continues to evolve. Unlike many OEMs involved in this market, retailers have day-to-day direct interaction with consumers and are best positioned to view and understand the problems consumers face with technology. Retailers will not only educate consumers on home networking and sell them network-related products and services; they will educate OEMs and service providers involved in the market on consumers' needs and wants. Retailers will be able to relay information to these companies as to the challenges consumers face and the problems they are trying to solve, helping OEMs and service providers create offerings that will be most compelling for consumers. The installation expertise many retailers can bring to the market, especially the three companies profiled in this Report, is also of tremendous importance. With service providers shying away from truck rolls, someone will have to step in and assume the responsibility of deploying and setting up networks for consumers if networking is ever going to reach the mass market. By assuming this responsibility, retailers can help make home networks a mass-market reality sooner rather than later.

Further Reading

"2000 TAF® Report-Home Networks: What a Consumer Wants," *Yankee Group Report, Consumer Market Convergence*, Vol. 17, No. 16, December 2000.

"Residential Broadband Begins to Blossom," *Yankee Group Report, Consumer Market Convergence*, Vol. 17, No. 12, September 2000.

"Everyone's Doing It: Service Providers Get into the Home Networking Game," *Yankee Group Report, Consumer Market Convergence*, Vol. 17, No. 5, June 2000.

"The Gateway to the Future," *Yankee Group Report, Consumer Market Convergence*, Vol. 17, No. 4, April 2000.

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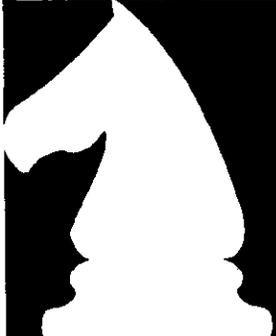
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To: . Cory Donovan/HNS@HNS, Holly Bowen/HNS@HNS, Rahul Savoor/HNS@HNS
cc:
Subject: Interesting analyst report on satellite broadband services

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You all probably know this information, but I thought it was an interesting
article regarding the long term attractiveness of the satellite broadband
service...

Dollars And Sense: Broadband: The Next Big Thing?

By Armand Musey

Phillips Business Information: Friday, June 8, 2001
via Comtex

Jun 10, 2001 (VIA Satellite/Phillips Publishing via COMTEX) -- Throughout the
next couple of years, satellite-based consumer services should make
significant headway in the market for broadband connectivity. We expect demand
will initially be strongest in the United States, driven by rural America's
appetite for broadband Internet access. We estimate there are roughly 20 to 30
million U.S. households that will not be served by cable modem or DSL in the
foreseeable future. DBS growth in rural areas has been consistently strong due
to a lack of viable alternatives. Broadband satellite services should achieve
similar levels of household penetration. The success of VSAT has proven there
are also significant opportunities to service businesses in these regions. We
are projecting there will be 5 million U.S. broadband satellite subscribers by
the end of 2005 generating total revenues of $4.5 billion, up from an
estimated 75,000 subscribers and revenue of less than $55 million in 2000.

The broader rollout of consumer broadband satellite services in North America
will occur in two stages. The first stage, which is already upon us, is
two-way Ku-band services that use leased capacity on existing satellites. The
two consumer services now available in the United States are DirecPC, from
Hughes, sold through DirecTV dealers, and Starband, from Gilat, sold through
Echostar dealers and Radioshack. The problem with these services is that they
are not as robust as cable modems or DSL (offing roughly 500 kbps on the
downlink and 50 to 150 kbps on the uplink) and at $60 to $70 per month, are
more expensive. This is because Ku-band satellites broadcast on a single
dedicated beam to all subscribers, which is an inefficient use of spectrum.
Therefore, these services must ration bandwidth to customers in high density
areas, particularly on the uplink. Hughes' acquisition of DSL reseller
Telocity to service its largely urban subscriber base is evidence of this
shortcoming.

The second stage of the rollout will follow the launch of new Ka-band
satellites that utilize spotbeam technology to focus signal transmission on
areas with higher population densities. This more efficient use of bandwidth
increases the effective capacity of the satellite and in theory will not only
permit these services to offer competitive performance, but also lower the
cost per user and increase the profitability of the services. Two Ka-band
services with strong backing are targeting introduction in the 2002 to 2003
timeframe: Wildblue, which is an independent company with ties to Echostar,
News Corp. and Liberty Media, and Spaceway, which is being developed by
Hughes. Wildblue plans to launch two satellites covering North and South

America. Spaceway is planning to launch three satellites for full North American coverage.

With the support of Hughes, the DirecPC and Spaceway Ku-band and Ka-band offerings would appear to have the advantage over Starband and Wildblue, at least for now. Not only will DirecPC and Spaceway benefit from Hughes' strong brand name recognition and distribution network, HNS offers strong in-house capability for producing consumer equipment efficiently and in mass quantities, and DirecTV's Home Service Network can insure proper installation on a national basis. Spaceway should also benefit from the transfer of some of Hughes' "blue- chip" VSAT customers to Spaceway enterprise solutions. Finally, Hughes has committed a reported $1.4 billion to financing Spaceway's development. Given the fact the chief hazard facing broadband satellite services is the large amount of capital that will be required before they are self-sufficient, having a deep- pocketed parent is a critical advantage.

Starband and Wildblue are facing greater financing challenges. We estimate that both will need at least $250-$300 million in additional equity financing in the next year. Both had planned to be public companies by this point. However, both have been facing a negative bias surrounding these types of companies as far as the public markets are concerned. This backdrop also has to do with the contraction of the market for technology and telecom issues. Not only is this making it hard for these companies to find financing at a critical juncture in their development, it could further erode their competitive position. Ultimately, we think the U.S. market is large enough to support two broadband satellite service providers, just as it supports two DBS providers, and that DirecPC will have an independent public competitor.

While the initial development of broadband satellite services will occur in the United States, we believe there is an even larger market opportunity outside the United States. Europe is likely to be the next major market to develop, where there are opportunities due to lower fiber penetration in key urban areas, a slower rollout of cable modems, and wide acceptance of satellite dishes. In the longer-term, developing markets in Asia and Latin America offer even greater growth potential. Pent-up demand exists in regions where terrestrial networks are inadequate and the per-capita incomes do not justify the necessary infrastructure investment. We are projecting 3.4 million broadband satellite subscribers outside of the United States by 2005, up from under 25,000 at year-end 2000. After 2005 we expect international subscriber growth to begin outstripping U.S. demand. In the next decade we expect broadband satellite services will become as ubiquitous as DBS on a global basis.

Armand Musey is the satellite communications analyst at Salomon Smith Barney ("SSB"). He can be reached at 212-816-6008. The foregoing article should not be considered as a recommendation with respect to any security. SSB and its affiliates may maintain a long or short position in, act as a market maker for, or purchase or sell a position in, securities of referenced entities and may also perform investment banking, advisory, or other services for any such entity.

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McKinsey Quarterly

BROADBAND

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Broadband media:
Look before you leap

The bad news: broadband's technology, infrastructure, and economics are still inadequate. The good news: broadcasters are far more secure from attack than they were at the dawn of the World Wide Web.

SCOTT A. CHRISTOFFERSON AND MICHAEL A. GATZKE
The McKinsey Quarterly, 2001 Number 4

As consumer broadband use multiplies, so do predictions that it is going to revolutionize television and video entertainment.[1] Probably it will at some point, but television and cable networks would be risking a repetition of their experience with the narrowband Internet if they invested heavily in programming for interactive TV or video on demand just yet.

Over the next three to five years, some 40 million households will gain access to broadband. Even so, only the simplest forms of enhanced TV and streaming-video programming will be profitable—though not profitable enough, in a million-channel world, to defray the high cost of creating and distributing shows that permit viewers to decide how they would like plotlines to turn out (interactive TV) or when they want to watch (video on demand). Yet the interactive programming that could be capable of extracting the necessary premiums from viewers still awaits important improvements in picture quality, and the broadband infrastructure will certainly have to be extended before broadcasters can realistically hope to attract an audience with a sufficient economic scale.

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Broadband media: Look before you leap, continued

PRODUCTION COSTS

Major television broadcasters today produce some programs in-house and buy some shows from independent production studios. They are likely to obtain the broadband content they air in the same manner. No matter where they get it, broadcasters need revenue from both advertisers and consumers to cover the cost of production, not to mention distribution.

To create broadband video programs, producers can convert existing analog television programs to digital format—the cheaper option—or create entirely new ones. Although programs developed either way can be viewed on both computers and broadband-enabled televisions, converted analog shows will lack interactive functionality; an example is PBS's *Nova* episode "Dying to be thin," which is now viewable on demand at the Web site pbs.org.[4] Reformatting analog programs costs $1,000 to $5,000 for each hour of content.

Broadband becomes more compelling, however, when programs are truly interactive. "Dying to be thin," for example, offers links to articles on the Web about eating disorders and to medical specialists and support groups; for a time, it even allowed viewers to correspond on-line with experts. More advanced interactive features might include links to related audio or video material or the ability to view a program out of sequence.[5] The incremental expense of adding low-bandwidth functions and features such as text links, polls, and "T-commerce" facilities is only a few thousand dollars for each hour of content. But shows that incorporate real-time video games[6] or alternative plotlines can cost many times more.

Ultimately, producers might create original broadband programs for the Web. Such shows cost about as much to make as a TV

program or a movie—far more than today's Web entertainment.[Z]
Production costs range from $45,000 an hour for, say, a
documentary relying on historic film footage to millions of dollars an
hour for programs using famous actors or elaborate animation and
special effects. On a per-viewer basis, costs could be even higher
than those of current TV productions because fewer people will
tune in to a given hour of programming in a broadband world of a
million channels (Exhibit 1).

The real challenge for program
producers will thus be to create
fundamentally new types of
programs that take advantage
of broadband's interactive
capabilities rather than merely
to replicate today's broadcast programming. Until production
technologies evolve and costs fall, such programming will need to
attract a mass audience. In the long run, broadband programs that
serve small niche audiences may become economical.

Notes:

[4]There is no widely accepted standard for streaming video.
Consequently, PBS has made "Dying to be thin" compatible
with both Apple's QuickTime and RealNetworks' RealPlayer.

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McKinsey Quarterly

BROADBAND

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Automotive
Basic Materials
Broadband
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Electronic Commerce
Energy
Environment
Financial Services
Food & Agriculture
Health Care
Media & Entertainment
Nonprofit
Public Sector
Retail
Telecom
Transportation

FUNCTION

Alliances
Corporate Finance
Economic Performance
Information Technology
Marketing
Operations
Organization
Strategy

REGION

Africa
Asia
Europe
Latin America
Oceania

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Broadband media: Look before you leap, continued

DISTRIBUTION COSTS

Once a program is created, getting it from the producer's server to the viewer's home involves a significant cost. Broadband signals are first transported over the Internet backbone to "edge" distribution points, where the local service provider's point of presence (POP) is located and content gets encoded and metered for distribution to households. Popular content can be stored (or cached) at the edge, easing the burden on backbone-network resources. Broadcasters will probably bear much of the cost of this part of the distribution process, and the revenue model will have to support these expenses.[8] The consumer's monthly broadband access fee covers the cost of getting the program from the edge to the home—a cost that will be the same whether consumers ultimately view the program on their PCs, on Internet-enabled TVs, or on any other device (Exhibit 2).

EXHIBIT 2

The long road home: Broadband's distribution path

The computer equipment and the information technology staff needed to undertake content hosting and Internet connections cost around $10 million a year for a midsize cable channel. This is the fixed cost of distribution. The problem for broadband programmers is that streaming a one-hour video in a unicast transmission adds 70 cents per household to those costs.[9] In other words, by far the greater part of the cost of distribution isn't amortized across the audience base, as it is in today's broadcast world; rather, the larger the audience, the higher the cost of distribution. To unicast just a single episode of *Friends*, NBC (National Broadcasting Company) would have to spend nearly $10 million.[10] Unfortunately, the most exciting broadband applications are unicast events: video on demand, interactive-TV shows with alternative plotlines, and distance-learning programs that allow viewers to skip around.

In multicast distribution, however, a program is transmitted only once to the viewers' PCs or Internet-enabled televisions, at the same cost as serving one user per edge distribution point.[11] This model has several obvious drawbacks. First, users must watch streaming content at set times. (Although it is possible to multicast the same program at frequent intervals—often called "near video on demand"—doing so often enough to mimic on-demand streaming would significantly erode multicasting's cost advantage.) In addition, a multicast can't link viewers to audio or video content or offer alternative plotlines. In short, multicast distribution precludes most of the things that would make broadband a compelling new technology in viewers' eyes—a drawback that is now more academic than real, since multicast routers at the edge are not yet in place and may not be for some time.

Notes:

[8]For more on content delivery, see the J. P. Morgan–McKinsey research report *IP!* and Ashish Bhandari, Hamid Biglari, Michael Burstein, Andre Dua, and John Rose, "The End of Broadcast?" *The McKinsey Quarterly*, 2000 Number 3, pp. 138–47.

[9]This analysis assumes video streamed at 300 kilobits per second, which is typical of Digital Subscriber Line connections and residential cable modems, or approximately 140 megabytes per hour of content at a cost of half a cent per megabyte, which reflects volume bandwidth discounts currently received by large streamers

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Broadband media: Look before you leap, continued

WILL CONSUMERS PAY?

It is far from certain that the creators of broadband programs will be able to recoup their production and distribution costs, especially those of interactive unicast programs. To understand why, consider the costs and revenues of three types of broadband programs. One might be a season of *Survivor* episodes converted to digital format and multicast on cbs.com at set times. Reformatting the video and creating a few interactive text links would cost roughly $100,000; a

> It is quite far from certain that the creators of broadband programs will **succeed in recouping** their production and distribution costs

month of frequent multicasts would cost another $100,000.[12] (The cost of producing the original analog *Survivor* series and of running cbs.com are, of course, additional.) Transmitting a *Survivor* episode on demand would cost roughly 70 cents per household. Production costs for each alternative plotline of, say, *ER* would be roughly the same as those of the broadcast show—several million dollars an hour—plus 70 cents to distribute an alternative plotline to each interactive viewer.

Now consider advertising and commerce revenues, which would cover the costs of only the simplest kind of broadband program, exemplified by a *Survivor* multicast. Advertising rates on the narrowband Internet average $5 per thousand user views (in industry parlance, a $5 CPM). For broadcast television, prime-time CPMs average $15 and can run as high as $20. Should broadband advertising rates fall somewhere in between, we can assume CPMs of $5 to $20. If a typical hour of broadband entertainment had the same number of ads as an hour of television, it would contain 20 to 30 ad spots, thus generating just 10 to 60 cents of gross ad revenue per user hour. This sum wouldn't cover even the 70 cent distribution cost of *Survivor* on demand or *ER* interactive, let alone the production costs of each show. But advertising revenue would

cover the cost of a *Survivor* multicast if as few as 185,000 people tuned in.

Commerce revenue won't offset the shortfalls. One broadcaster we worked with earns profit margins of 13 percent (typical for the industry) on sales of T-shirts and videotapes. A broadband program that prompted 3 percent of viewers—the average response rate for consumer catalogs—to make a $40 purchase would generate just 16 cents of profit per viewer. This sum doesn't come close to covering the production and distribution costs of *Survivor* on demand or *ER* interactive.

Consequently, consumers are going to have to pay either monthly subscription charges or pay-per-view fees for the more innovative broadband applications if those applications are to be profitable. Whether viewers will ante up is a big question, especially since such charges would come on top of broadband access fees, currently around $40 a month in the United States. On the narrowband Internet, consumers have been notoriously reluctant to pay for content. If they perceive broadband entertainment to be just a faster version of the Web, the economic outlook for program creators is bleak.

Of course, consumers do pay for cable television, but the rates for new broadband offerings would be higher. Of the roughly $40 a month that consumers pay for a cable package, only 14 cents goes to each channel. For MTV and Discovery Channel, that is just 2 cents a viewer per hour of content viewed—not enough to cover anything but the multicast version of *Survivor* or simple interactive TV.[13]

Video on demand or high-bandwidth interactive TV will be profitable only if consumers pay as much for it as they do for pay-per-view television or video rentals (an average of $4 an event or rental, or about $2.50 an hour).[14] But Hollywood movies and popular sporting events are one thing, the program archives of broadcasters quite another. Will consumers pay as much for reruns of *Dallas* as they do to see *Gladiator* or the football teams of their alma maters? Such charges would come on top of those for broadband access and an interactive-TV set-top box.[15]

In addition, interactive TV—and, to a lesser extent, video on demand—will require a huge shift in consumer behavior. Most people treat television as "lean-back" entertainment; interactive TV, by contrast, requires active user involvement. For this reason, broadcasters considering big investments today shouldn't count on a rapid adoption of this technology.

Thus, the only programs likely to approach or surmount the

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February 14, 2000
e-Digital Media Worldwide
Technology Analysis
Robert White

OpenCable: Will it Open for Business?

This analysis is designed to give readers a snapshot of an evolving technology specification called OpenCable. The specification could have a major impact on companies in several industries and markets, including set-top box hardware and software vendors, cable operators, television broadcasters and communications providers. OpenCable will also affect the U.S. cable-viewing public. While the OpenCable specification is not scheduled to be implemented until July 2000, important developments are occurring now.

— was it implemented in 7/2000 ?

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Key Business Issue

What new digital technologies will impact the consumer market?

Strategic Business Assumption

The OpenCable initiative will not result in the widespread retail availability of fully OpenCable-compliant digital cable set-top

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boxes until the end of 2000 (0.7 probability).   STB = Set-top box

OpenCable Overview   FCC Mandate

Cable Television Laboratories (CableLabs), the testing and standards arm of the North American cable television systems' consortium, is creating the OpenCable specification. OpenCable provides for interoperability of advanced digital cable host-based devices, currently set-top boxes (STBs), from multiple vendors. It is hoped that OpenCable will lead to the retail availability and portability of digital cable STBs by July 2000 as mandated by the Federal Communications Commission (FCC) and the U.S. Congress in the 1996 Telecommunications Act. In this case, portability and interoperability mean cable subscribers would be able to purchase their own OpenCable STBs and connect them to any cable outlet nationwide with full functionality. When subscribers move, they simply take their OpenCable STBs with them and are able to connect and receive full OpenCable services in the new location. These next-generation services enable a completely new range of digital and interactive opportunities for cable operators and customers, as well as providers of third-party applications and services.

The OpenCable specification is currently evolving and is not complete. For advanced digital devices from multiple vendors to be interoperable, it is necessary for CableLabs to conduct interoperability tests. This testing of OpenCable hardware and software elements is ongoing.

History of OpenCable

Following the FCC/Congressional mandate, CableLabs established OpenCable, a project designed to create a new generation of interoperable STBs, leading to the retail availability of digital cable STBs. The open specification is patterned after CableLabs' Data-Over-Cable-Service-Interface Specification (DOCSIS), which is primarily aimed at cable modems. DOCSIS interoperability testing is a continuing process at CableLabs, as is the evolution and interoperability testing of OpenCable.

As early as 1998, it was agreed that OpenCable STBs would be based on high-performance microprocessors with real-time operating systems. The CableLabs Executive Committee agreed not to specify a single microprocessor or a single vendor's operating system.

At that time CableLabs decided that interactive services would be implemented at the middleware layer using existing open Internet specifications, such as HTML, JavaScript, and currently available plug-ins. This decision made middleware interoperability one of the key elements of OpenCable implementation. To date, OpenCable has remained hardware and software "agnostic."

OpenCable Milestones

- November 1997 — The first step of OpenCable was CableLabs' Request For Information (RFI) on the OpenCable specification, which was sent to leading technology companies and consumer electronics manufacturers. The RFI included input into the open specification process and the creation of a draft specification for the OpenCable STBs. At the same time CableLabs' Executive Committee put OpenCable on fast track status.
- March 1998 — There is no IEEE 1394 versus USB controversy here. CableLabs announced that the interface between OpenCable STBs and other devices including television sets and VCRs would be the existing IEEE 1394 high-speed interconnect. Originally, IEEE 1394 was called Firewire by Apple Computer. Sony calls its 1394 interface, iLink. Whatever it is called, all OpenCable set-tops must employ the 1394 interface, which provides data pass-through rates up to 400 million bits per second (Mbps). This high-speed transfer rate is important when delivering digital video and data services.

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- Since 1394 is a digital interface, there is no analog conversion involved and no resulting loss of resolution.
- (July 1999) — CableLabs completed its initial interoperability testing. The tests involved various Point-of-Deployment (POD) security modules necessary for conditional access. The POD interface specification provides for removable security cards similar to PCMCIA cards that will allow video-on-demand and pay-per-view events via OpenCable STBs. This phase of interoperability testing illustrated just how complex the process can be. More than (40 companies participated) including set-top hardware and software vendors, cable head end companies, and POD security suppliers. General Instrument, Scientific Atlanta, Philips, Nagra, Mindport, as well as POD security/conditional access specialists SCM Microsystems and NDS, successfully demonstrated the required functionality.
- September 1999 — CableLabs issues an RFP for the middleware element of OpenCable software. Middleware enables interactive and enhanced television services and resides between the operating system software and the application software. It is hoped that a common but nonproprietary middleware format will foster the creation of more custom services and applications by the cable operators, making OpenCable set-tops more functional and therefore, more likely to succeed in the retail market.

Required Technologies

While many elements of OpenCable are designed to be completely open and vendor-agnostic, there are some basic requirements OpenCable devices must provide:

- Digital and analog video — Obviously, the key element here is digital video, which opens vast opportunities, including the ability to create high-definition television and apply compression algorithms. Compression is necessary to increase the total number of available cable channels within a cable system and provides the basis for high-speed transport such as MPEG-2. In addition to the digital video signals, analog video channels are also required, so that consumers are not forced to accept a "digital or nothing" solution.
- Digital audio — Dolby Digital (AC-3) is the required format for OpenCable. Dolby Digital provides surround-sound and audio compression. In addition to its television enhancements, OpenCable's digital audio enables significant possibilities for downloading digital music (please see "Technologies Benefiting from OpenCable"). To many consumers, CD-quality audio is equal in importance to digital video in the next-generation of digital cable set-tops.
- Point-of-deployment security module — The POD is necessary for implementing conditional access by subscribers to premium/pay TV services, pay-per-view events and video-on-demand.

OpenCable STBs employ MPEG-2 as the format for digital cable television transport. Thus, an MPEG tuner will be included in all OpenCable set-tops, along with an out-of-band tuner for interactive functions. Advanced interactive television services, such as Electronic Program Guides (EPG), multiplayer games and interactive advertising could be available through these out-of-band channels. High-speed Internet access and Internet-based applications such as e-mail are not required, but OpenCable STBs are expected to offer these functions along with data-casting. This should be delivered via a DOCSIS cable modem device or chipset within the set-tops. OpenCable set-tops are likely to include some RAM memory, although no minimum amount of RAM capacity has been specified thus far. Hard drives may also be included.

Other OpenCable Technologies

- Encryption — Competing encryption technologies from General Instrument and Scientific Atlanta created the need for interoperability in this area as well. The "Harmony Agreement" was created to ensure compatibility between GI and SA. For OpenCable, the encryption issue involves the

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- scrambling of some channels, primarily conditional access channels. While General Instrument has DigiCipher, Scientific Atlanta's solution is PowerKey. Through the Harmony Agreement, this issue has been resolved. OpenCable supports both DigiCipher and PowerKey (please see conditional access and POD signal security issues outlined in the July 1999 Milestones section discussed previously).
- Copy protection — Although related to encryption, copy protection is a slightly different matter. For OpenCable, copy protection is the prevention of casual copying of movies and "studio intellectual property" at some point in the OpenCable transport, usually between devices, whereas the Harmony Agreement's encryption is related to signal scrambling. The Motion Picture Association of America (MPAA) is behind the copy protection effort for OpenCable, which is designed to carry embedded information identifying the copyright owner. At present there is no interoperability testing and no copy protection standard for OpenCable. There are five very powerful companies, the so-called "5C" (Sony, Intel, Matsushita, Toshiba and Hitachi) that have developed a digital copy protection solution for the 1394 interface. 5C's solution is referred to as Digital Transmission Content Protection (DTCP).
- Another possibility is Macrovision, whose copy protection is currently used in DVD players and many digital set-top decoders. At this time, it seems likely either DTCP, Macrovision, or a combination of the two will become the de facto OpenCable copy protection standard, or will certainly provide some of the interoperable elements of that eventual agreement. Copy protection is one of the issues that requires resolution before OpenCable is fully implemented.

Major OpenCable Vendors

Hardware

These vendors are participants in the OpenCable process and are committed to produce OpenCable-compliant STBs. Just as OpenCable is not a completed specification, this is by no means a complete list of vendors that may produce OpenCable set-tops:

now Motorola

- General Instrument — GI is by far the largest supplier of digital cable STBs. GI is currently selling the DCT 2000 and 3000 series as well as the DCT 5000+. The DCT 5000+ is GI's advanced interactive digital cable set-top box expected to be a fully OpenCable-compliant STB by July 2000. As is the case with most OpenCable set-top hardware vendors, General Instrument's digital cable set-tops are compatible with software from various companies, including Microsoft. GI has announced that its DCT 5000+ will also be compatible with software from Sony, Sun Microsystems and Liberate Technologies, giving cable operators and application vendors greater flexibility. In a complicated deal involving Microsoft, AT&T/TCI has committed to purchase between six million and 12 million digital STBs over the next five years from General Instrument, with Microsoft's Windows CE/TVPAK as the operating system (See Microsoft in the software section that follows). Microsoft has invested $5 billion in AT&T to assure its OS would be used. In September 1999, General Instrument was acquired by Motorola for $17 billion.
- Scientific Atlanta — SA is one of the two leaders in the North American set-top box market, along with General Instrument. Having assisted CableLabs with the original system integration aspects of OpenCable, SA was one of the first participants in the formation of the specification. The Explorer series comprises SA's line of digital cable STBs. The company is currently selling the Explorer 2000 and 3000, and will introduce the Explorer 6000 as its OpenCable-compliant set-top before mid-2000. The Explorer series uses PowerTV's operating system software, which is to be expected since SA owns 80 percent of PowerTV. Some newer models offer cable operators the choice of using PowerTV or Microsoft TV software. However, SA has usually aligned itself with Sun Microsystems (Sun was part of the original Scientific Atlanta Group that helped write the first OpenCable draft spec). Now SA has licensed PersonalJava/JavaTV from Sun for use on its Explorer series. Although Java is middleware and requires an OS, this licensing puts Scientific Atlanta in the Java-ATSC camp rather

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than the Microsoft-ATVEF group.

- Pioneer — Voyager is Pioneer's series of digital cable STBs. Although Voyager models are not currently compliant with OpenCable, as the OpenCable spec nears completion it is expected that Pioneer will be one of the OpenCable hardware vendors. Pioneer has made a commitment to OpenCable as one of the original respondents to CableLabs' first OpenCable draft. Pioneer is partnering with SCM Microsystems on POD security and employs PowerTV's operating system (see PowerTV reference next section) on its advanced Voyager models, along with some of Pioneer's own software, which contains an interactive program guide. These are all signs that the company will be a leading set-top hardware vendor in the OpenCable rollout. Furthermore, Pioneer and Scientific Atlanta have already participated in Time Warner Cable's Pegasus program, selling digital cable set-tops in several U.S. regions.

- Sony — In September 1999, following a prolonged period of silence, Sony finally announced some details of its OpenCable hardware strategy. CableVision and Sony are expected to begin deploying 3 million of Sony's OpenCable-compliant STBs starting in mid-2000. The STBs will employ Sony's Aperios operating system (see Sony reference in next section) and HAVi (Home Audio-Video Interoperability) home networking software, as well as Sony's iLink 1394 interface, and contain copy protection using 5C Digital Transmission Content Protection. Sony was not among the companies that demonstrated POD security module functionality in the original OpenCable interoperability tests. Not surprisingly, Sony did not mention conditional access capabilities in its announcement, although Sony's STBs must incorporate such capabilities to be OpenCable-compliant. This is very likely to occur before Sony/CableVision's deployment.

- Philips — One of the leading European set-top box manufacturers, Philips is committed to OpenCable and will certainly be an OpenCable STB vendor. The company has already passed POD interoperability tests. Philips has announced plans to adopt the Microsoft TV Platform Adaptation Kit for its advanced set-tops with television applications. This figures to include Philips' OpenCable STBs, which is not surprising considering Philips is one of Microsoft's suppliers for WebTV devices. Philips is a European vendor with heavy commitments to DVB and MHP (see Related Specifications and Standards section), which means it supports Java APIs in addition to Microsoft's OS. In Europe, Philips STBs operate with OpenTV's OS. Therefore, Philips could be the platform for OpenTV to finally enter the North American cable market. In addition to JavaTV, Philips also supports Liberate, as well as ATVEF and ATSC. Because Philips crosses many barriers and supports competing vendors and standards, the company could exert a major influence in resolving compatibility issues, even beyond OpenCable.

Software

Beyond the operating system, middleware and application portions of the software for OpenCable listed in this section, software will play a vital role in giving cable subscribers the ability to update set-top functionality via downloads rather than trading them in or having to install new units.

- Microsoft (Windows CE/Microsoft TVPAK) - The Windows CE operating system is a large-scale OS compared to others running on OpenCable set-tops, which could be a negative given the memory constraints of set-tops. Windows CE's large footprint is due in part to the fact that it runs on numerous platforms and is not TV-centric. For television applications, the company created its Microsoft TV Platform Adaptation Kit (TVPAK), which is designed to run on top of the Windows CE operating system. As is the case with most application software in this space, Microsoft TVPAK has both client (set-top) and server (cable headend) components. Primary deployment of Windows CE on OpenCable occurs via General Instrument STBs.

- PowerTV - PowerTV provides a full OS solution and some elements of middleware and application software. Although PowerTV maintains its stance as an independent company, it is 80 percent owned by Scientific Atlanta; thus, PowerTV is operating on most of Scientific Atlanta's current Explorer