Hybrid Interactive TV

Many interactive TV systems do not fit simply into the low-end or high-end categories. For example, one recent unsuccessful system added interactivity to regular programs such as game shows or sporting events. There was nothing interactive within the programs. Rather, the interaction took place on a separate terminal and display screen where questions were posed and viewers could answer. One major commercial broadcast network has recently launched a very successful online data business around categorized news clips from its broadcast news and cable business news services. It offers these clips tagged with special content identification labels and content sorting software as a pay service to computer terminals for industrial subscribers. The clips can be sorted by topic, company name, industry or by a variety of other means decided upon by the users. The network can send alert notifications to any user terminal about major events about to be broadcast concerning the user-selected categories. Videotape copies of the program segments also are available at extra cost. Another system one with a good track record–uses four channels on a cable system to provide viewers with some choices. For example, in sports programs, viewers can pick one of four camera angles by switching to one of the channels; in news programs, viewers can pick the order of stories they watch and get more in-depth coverage of a story by picking one of the four channels.

Technical and Financial Issues

There are many technical and financial issues surrounding interactive TV. The most difficult is in trying to predict consumer acceptance and response to any new service. It is clear that there are varying limits to how much most people are willing to pay and how much complexity they will tolerate in the home in order to receive different types of services. Caption decoders provide a good price barrier example. The portion of the middle-income audience making use of captioning services has grown since caption decoding receivers have entered the market. This is surprising because most of us would have characterized captioning as the type of service which would already be available in such households. VCRs are an excellent example of how to exceed complexity tolerance. Very few people use time offset recording, for example, the typical VCR owner cannot even remember how to set the clock. Cost and complexity are the only way to explain why the general public has not responded well to home recording or pay-per-view television but has funded the creation and growth of a very large videotape rental and sales industry. It is worth noting that people will overcome both cost and complexity barriers if they place sufficient value on the resulting service. For example, video games and the Internet have fueled an explosion in sales of personal computers which are not always easy to set up or operate and which sell at more than twice the price of television receivers.

Clearly, the industry must continue to study and try a variety of new interactive services to find its way through the unpredictable maze of consumer attitudes.

High-end interactive TV has captured most of the media attention, with its promise of an almost infinite quantity of programming on demand and two-way video. System trials in various parts of the country are very impressive but leave many unanswered questions, such as:

- What will the equipment cost for system providers and end users? For system providers, there are many costs including video servers, video switches, new transmission lines and storage costs. These equipment costs will be very high in the near term, e.g., $1,000 to $2,000 per subscriber. So, a system built for 50,000 users might cost $50 to 100 million. These costs are expected to drop over time and they can be further reduced by employing a clever strategy in building the architecture for the network. For end users, one significant cost will be the new set-top box that will be needed to decompress and convert digital video packets into regular television signals. Estimates vary between $200 and $700, although early set-top boxes in trials cost considerably more. A second issue is the cost of interactive TV service. This is largely unknown and will not be clear until after a few trials have determined what system provider costs are and what users will be willing to pay.

VIDEO SERVER COSTS	COST FOR NCUBE SERVER		
	Level 1	Level 2	Level 3
Price	$1 Million	$4 Million	$15 Million
Storage Capacity	190 Hours	885 Hours	3,500 Hours
Number of Simultaneous Video Streams	1,800	7,200	28,800

Source: Multichannel News

- What is the best system architecture for interactive TV services? Cable operators and telephone companies are investigating many technical options in building systems. For example, should they build new fiber optic networks that go directly into homes and schools, rely on existing coaxial cable or twisted-pair telephone lines with more sophisticated compression of signals, or create hybrid networks that mix some new fiber optic cable with existing coaxial cable and twisted pair? Similarly, should they put most of the "intelligence" required to offer interactive TV in the computers at cable systems and telephone companies or place more intelligence in the set-top box? These engineering questions will have significant impacts on costs and the timing of service developments.

- Managing user traffic and other new problems. In broadcast TV, there is no question about how many people can simultaneously receive a TV signal–everyone within the range of a broadcast transmission can receive a TV channel. In interactive television, things are very different. If too many people simultaneously try to access an interactive service, some may get a video "busy signal." If an interactive TV system becomes overloaded in trying to send the appropriate video packets to everyone, the television picture may stop in some homes or there might be a jump in the action. The only way to resolve these issues and determine how many people will do what, as well as how much equipment is needed to service them, is through rigorous testing in real world trials and tests.

All of the uncertainties surrounding high-end interactive TV suggest that service development is likely to be slower than many companies have predicted. Further, initial costs for system providers and end users are likely to be high. These costs will drop over time and large scale manufacturing of equipment will lead to lower prices, as engineers better understand the most efficient ways to provide services. While near-term interactive consumer services are likely to be geared to more modest systems, there are many other applications for this technology that are likely to be developed soon. These include interactive TV for corporate training, for the purpose of ordering movies in hotels, and the use of video servers to insert ads or promotional announcements in regular television programs. These applications, in turn, will help to reduce costs and increase knowledge about the best ways to design interactive TV systems.

Upgrades to Cable Systems

Traditional cable TV systems in the 1980s provided a modest number of television channels (10 to 35). Today, cable TV systems are being upgraded to provide many more TV channels as well as data, voice and two-way video services. They are preparing for competition with telephone companies and direct broadcast satellite services. The components in the upgrading process include fiber optics, digital compression, switched video, cable modems and personal communication services (PCS).

Fiber optic cable is replacing traditional coaxial cable in many cable systems. The advan-

tages of fiber optic cable include lower maintenance costs, higher capacity and better signal quality. Most cable operators are not replacing all of their traditional coaxial cable. They are replacing part of the older plant in order to keep the cost of upgrading manageable. As a result, many new terms are emerging that reflect where the fiber is located in the cable architecture: fiber-in-the-backbone, fiber-to-the-neighborhood, and fiber-to-the-pole. For example, fiber-in-the-backbone means that the cable system has fiber in its main trunk lines only; fiber-to-the-pole means that fiber lines go right to the pole outside a subscriber's home. The closer a cable operator brings fiber to a subscriber, the higher the capacity of the service and the more it is likely to cost. Also, some cable multiple system operators (MSOs) are using fiber to link their cable systems in a region. This allows them to share the use of some expensive equipment and reduce the demand on the cable headend of each system.

Digital compression is another technique to increase the capacity of a cable system. By converting analog TV pictures to digital signals and compressing them through complex electronic processing, a cable operator can effectively squeeze more signals through the same pipeline. The amount of compression employed by a cable operator varies by the type of programming (e.g., a talk show can be compressed more than a football game) and the quality of picture that a consumer is willing to accept.

Digital compression is a key element in the promised "500 channel" cable environment. However, it has proceeded more slowly than some had predicted because it requires special equipment in homes to "de-compress" the compressed signals and display them on regular TV sets. The estimated cost of this equipment is $300 if it is in a separate box. More recently, some companies have offered a set of computer chips that could be placed in VCRs or TV sets. This would reduce the cost significantly and may speed up the implementation of digital compression.

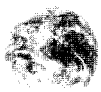
Two-way switched video is at the heart of advanced interactive television systems or "full service networks," such as Time Warner's experimental system in Orlando. Switched video allows each household to receive separate video programming under their command and control, e.g., to order a movie from a library of hundreds of movies. However, switched video is very expensive. In early experimental systems such as in Orlando, the household equipment costs approximately $5,000; headend equipment costs are in the millions. Even when switched video is implemented on a large scale, the cost for cable operators will be significant–approximately $850 per subscriber. Such costs are more likely to be justified in a multiple service environment where a wide variety of video, data and voice including telephone services are offered.

Cable systems are beginning to offer data services to homes, businesses and schools, e.g., access to the Internet and commercial online services. It is also possible to download video games to home game terminals. The long-term advantage of cable in offering data services is very high speed (see chart).

ESTIMATED COST OF A FULL SERVICE NETWORK
(LARGE SCALE IMPLEMENTATION)

Technology	Estimated Cost Per Subscriber
Home Equipment	$300
Cable Infrastructure	$300
Video Servers & Headend Electronics	$250
Total Cost Per Subscriber	$850

Source: Multichannel News



TIME TO TRANSMIT A 10 MEGABIT FILE

(10 Megabits equals approximately 10 seconds of compressed video)

MODEM/TRANSMISSION SPEED		
Regular Telephone Line		
9.6	Kilobits (Kbps) per second	138 minutes
14.4	Kbps	93 minutes
28.8	Kbps	46 minutes
Enhanced Telephone Line		
56	Kbps	24 minutes
128	Kbps (ISDN)	10 minutes
1.54	Megabits (Mbps) per second (T-1)	52 seconds
Cable TV System		
4	Mbps	20 seconds
10	Mbps	8 seconds

Source: Convergence Systems Inc. & Cable World

In the near term, cable systems are transmitting data services at more modest speeds–closer to ISDN speed over a telephone network. Some early trials experienced problems in sending data at very high speeds. In addition to these technical problems, the barriers to very fast cable data services include the high cost of early cable modems and a need to have a return signal from homes or schools. Most current cable systems are not two-way. In order to implement data services, a cable operator has to add a return signal from end users or use the telephone network to obtain return signals. This latter hybrid arrangement of downstream data through cable and upstream data from end users through the telephone network requires a complex installation.

Personal communication services (PCS) are a form of telephone service. Just as telephone companies want to offer a form of cable TV service, many cable operators want to compete with telephone companies in providing telephone service. PCS is actually a hybrid telephone service because it uses both the cable system and some radio spectrum to provide two-way audio. There are many technical issues that must be resolved for PCS to be viable, including standards, backup power supplies and interoperability (i.e., how PCS interconnects with regular telephones as well as cellular telephones). Further, some question the technical skills of cable operators to provide telephone service. In order to deal with this issue along with the high cost of building the new infrastructure, some cable operators plan to form joint ventures with telephone companies from outside their region to offer PCS.

Upgrades to Telephone Networks

Not too long ago, the telephone network was used to provide plain old telephone service (POTS) and little else. Then came faxes, electronic mail, voice mailboxes and other services that used the traditional telephone network. In the near future, the telephone network may provide high-speed multimedia services, video telephone calls, cable TV and interactive TV. How can the telephone network handle all of these new services? The answer lies in how telephone companies are upgrading their traditional networks into modern telecommunication highways.

During the past decade, telephone companies have been replacing old copper telephone lines with fiber optic cables and introducing new digital switches that connect one household to another. Today, virtually all telephone transmission lines between cities are fiber optic; more than half of the transmission lines to local central offices are fiber optic; and many transmission lines into local neighborhoods are fiber optic. However, to complete the job and bring fiber optic cables into every home will cost $200-$300 billion and may take another 20 years.

TELEPHONE COMPANY FIBER DEPLOYMENT*				
Thousands Of Fiber Miles				
1990	1991	1992	1993	1994
5,397	6,826	8,270	10,230	11,930

Source: FCC
**(Includes Long Distance, Local Operating Companies & Urban Fiber Systems)*

Telephone companies do not have to complete the job of wiring America with fiber optics before offering advanced services. The infrastructure that is currently in place will support many new services. Further, by adding other components to the telephone network in selected markets, they can offer advanced services to those markets.

Integrated services digital network (ISDN) is one example of a service that is widely available within the current telephone network infrastructure. ISDN is made possible by the electronic digital switches that have been installed in telephone company central offices. Essentially, ISDN offers a complete digital path from one end user to another. Basic ISDN service provides two moderately high speed voice/data channels and an additional lower capacity data channel. These channels can be used separately, e.g., for two high fidelity telephone lines, or they can be combined into a single 144-Kpbs data channel that will support low-end video telephone service or a very high-speed access to multimedia content such as photographs and sound on the Internet. ISDN service costs $30-50 per month for the line plus six to ten cents per minute of use.

The toughest decision facing telephone companies is how to offer video service. There are four basic options. Two involve upgrading the telephone network and two involve going outside the network.

- VIDEO DIALTONE is the most sophisticated and costly option. It involves upgrading the telephone network with fiber to a point close to homes (the signal going into homes can be carried by fiber or a coaxial cable like the one used by cable TV systems) and installing video servers (discussed earlier) as well as asynchronous transfer mode (ATM) packet switching technology. ATMs manage digital traffic and move packets of data at very high speeds to their intended destinations where the packets are re-assembled.

  In addition to high cost, video dialtone has many regulatory implications for telephone companies and their customers. Under video dialtone, telephone companies are common carriers. This means that they must allow anyone to offer video services just as anyone can make a telephone call. This lack of control is not attractive to telephone companies. For this reason, as well as high cost, they have been slow to implement video dialtone.

- ASYMMETRICAL DIGITAL SUBSCRIBER LINE (ADSL) is a second option for upgrading the telephone network to provide video service. It is much less costly than video dialtone but also provides a lower quality video signal. ADSL uses existing twisted-pair copper cables in homes as well as on poles in neighborhoods and the existing fiber optic backbone of the telephone network to deliver highly compressed digital video. ADSL requires little or no upgrading to the telephone transmission lines but it does involve costs for video servers and requires special hardware in homes.

  A few telephone companies have tested ADSL (e.g., Bell Atlantic) and claim that the "VCR quality" picture it delivers is acceptable to consumers. Some critics argue that early adopters of new video services will demand very high-quality pictures–at least as good as their cable TV picture. Others warn that faulty telephone wiring in many homes (often installed by consumers) will seriously degrade ADSL video signals–even though it is good enough for regular telephone service.

- OVERBUILDS or constructing regular cable TV systems in competition with an existing cable TV system, are an

option outside the telephone network. Under this scenario, a telephone company may decide that video dialtone is too expensive and ADSL service won't work. Instead, it goes into the cable TV business in direct competition with existing cable operators. A more feasible alternative from a technical perspective would be to integrate the fiber optic telephone network infrastructure with existing coaxial cable networks. This was the planned arrangement between Bell Atlantic and TCI until the cable industry was re-regulated. This alternative continues to have appeal to both industries and may re-emerge as a result of recent moves toward deregulation.

- WIRELESS CABLE is the second option outside the regular telephone network. Wireless cable uses microwave transmission to deliver television channels to homes that are equipped with special receiving antennas that look like small satellite dishes. Wireless cable has been available for a long time, although it has been plagued by many technical problems. Recently, some advances in wireless technology along with digital compression that greatly expands the capacity of a wireless cable system have made the technology more attractive.

Evolution of the Personal Computer

The personal computer has become a mainstream consumer electronics item for the home. It is estimated that by 1995 more than 40 percent of the homes in the U.S. had a personal computer. Further, the number of PCs sold to consumers each year has been growing rapidly. According to the Electronic Industries Association, the amount of money spent by consumers on PCs in 1994 ($8.07 billion) nearly equaled the amount spent on television sets ($8.4 billion). When the IBM PC was first introduced in 1981, the approximate cost (monitor, keyboard and computer) was $3000. Today, the cost of a PC for the home has dropped significantly while the processing speed, memory and other features have advanced past the levels of some mainframe computers that were sold before 1981.

PROJECTED GROWTH FOR COMPUTER HOUSEHOLDS, 1995-1998

Year	Computer Households (Millions)
1995	40.0
1996	43.0
1997	46.0
1998	48.0

Source: Veronis, Suhler & Associates

Two of the most significant enhancements to the personal computer are modems and CD-ROM drives. Modems transform the PC from an information storage and data processing device into a communication tool. Modems link a PC to other PCs and large mainframe computers over telephone lines and, in some cases, cable television networks. Through these links, users in homes, schools and businesses can send electronic mail, exchange opinions on electronic bulletin boards, obtain information from large databases and play games with other PC users. Approximately one-third of PC households have a modem and the percentage is growing rapidly since almost all new PCs sold are equipped with a modem.

PROJECTED GROWTH FOR CD-ROMS IN HOUSEHOLDS

Year	Millions of Households
1995	9
1996	12
1997	16
1998	21
1999	24

Source: Multimedia PC Marketing Council & Cable World

The CD-ROM drive is a storage device with very high capacity. One CD-ROM can hold an encyclopedia or a large database. CD-ROMs can also store audio and some limited video segments. As CD-ROMs evolve and digital compression improves, video storage capacity will expand to include movies and other full-length video programs.

CHANGES IN COMPUTER COST & PROCESSING SPEED

	Approximate number of instructions per second	Price
1975 IBM Mainframe	10,000,000	$10,000,000
1976 Cray 1	160,000,000	20,000,000
1979 Digital VAX	1,000,000	200,000
1981 IBM PC	250,000	3,000
1984 Sun Microsystems 2	1,000,000	10,000
1994 Pentium-Chip PC	66,000,000	3,000
1995 Sony PCX Video Game	500,000,000*	500*
1995 Microunity Set-Top Box	1,000,000,000*	500*

Sources: Company reports; The New York Times
** Estimated*

The addition of modems and CD-ROMs as well as microphones and speakers is rapidly changing the PC into a multimedia terminal with significant new capabilities for education, entertainment and communication. This is made possible by the extraordinary increase in computing power over the past decade, as prices have declined.

The computing power found in PCs is also finding its way into televisions, VCRs and video games. These are sometimes called "smart TVs" or "smart VCRs" because they can process information much like a computer. For example, computers are facilitating new combinations of home entertainment and information linked to TV sets. Such home information centers allow viewers to use their television to display interactive text versions of news, sports and weather as well as provide banking services, electronic mail and shopping. Also, new TV set top converter boxes with computer technology are being distributed by cable and direct broadcast satellite service providers.

Some industry analysts believe the TV and PC will merge over the next ten years. They argue that one device will serve both functions. Others believe that the functions of TVs and PCs will remain distinct but, at the same time, each device will share many features, i.e., TVs will have computer power and PCs will be able to play video and sound.

Direct Broadcast Satellite

Satellite transmission of TV signals began in the mid 1970s as a way for broadcast networks and other distributors of TV programs to reach local stations and cable headends. Public broadcasting led in the use of satellites for distribution of TV signals to local stations. Consumers first became aware that they could pick up TV signals directly from satellites in the late 1970s when Neiman Marcus advertised a satellite dish in their catalogue for over $30,000. There were no buyers at that price, but soon companies began to offer TV receive-only (TVRO) satellite dishes for a few thousand dollars. The dishes were 10 to 12 feet in diameter and could pick up dozens of TV signals (eventually, over 100 TV channels). A small market emerged during the 1980s, primarily in rural areas where there were no cable systems and relatively few over-the-air broadcast channels. TVRO dishes also became popular in hotels, bars and other businesses that wanted to attract customers by providing many TV channels.

In the early 1980s, several companies announced plans to launch a new generation of high-powered satellites that would serve consumers directly and require much smaller dishes. After examining the cost of launching the satellites and developing services, however, each of the companies dropped its plans. By the early 1990s, the costs associated with launching high-powered satellites had dropped and plans were renewed to launch direct broadcast satellite (DBS) service for consumers. These plans were helped significantly by the 1992 Cable Act that required program suppliers to sell their programming to non-cable distributors. This prohibited cable MSOs from denying access to their programming by satellite service providers.

As plans for DBS moved forward, cable companies attempted to beat the high-power service providers to the punch by launching their own DBS service on a medium-powered satellite. The medium-power service required a six-foot receiving dish whereas the high-power services could be picked up with 18-to-20-inch dishes. But in other respects, the services were similar.

By 1995, approximately five percent of U.S. households had a satellite dish. Most of these were the older and larger TVRO dishes, but approximately one-third were the new generation of DBS medium power or high-power dish receivers. This is low compared to some countries, e.g., 40 percent of homes in Ireland have a satellite dish, but it is a greater percentage than in most countries. High or low penetration of satellite dishes varies enormously and is affected by country regulations, cable penetration and the ability of households to pay for the technology.

PENETRATION OF SATELLITE DISHES IN SELECTED COUNTRIES - 1995

Country	Percentage of Households With Satellite Dish
U.S.*	5 percent
Ireland	40
Germany	16
Japan	19
France	1
India	1

Source: The New York Times *& Electronic Industry Association*
** Includes TVROs, Medium Power and High Power DBS*

The advantages of DBS are that it is cheaper to build a system compared to cable (there are no wires on streets), so a company can reach the entire U.S. very quickly. Also, DBS service providers have been the first group to use digital compression. This has increased sharply the number of channels they can provide and it produces a superior picture and sound compared to cable. (It should be noted that some DBS customers complain that the picture can break up momentarily during fast-action sporting events.) The extra capacity has also allowed some DBS operators to offer 50 channels of pay-per-view movies, which has been attractive to many customers. In addition, the next generation of digital receiving equipment will have some interactive capabilities.

The disadvantages of DBS include a lack of local broadcast signals–DBS provides a single national service. Consumers can subscribe to an off-the-air alternative DBS package that includes an affiliate for each of the networks as well as one public TV station. Under current FCC rules, the DBS provider can do this without approval of the local station so long as the DBS service is blocked in any household where the network programming can be received from broadcast signals from a network-affiliated station. It is not clear that there has been strict compliance to this rule in some DBS markets. Several of the high-power DBS service providers require potential subscribers to pay approximately $700 for the hardware to feed one TV set and $900 for the hardware to feed two TV sets. These costs are expected to decline in 1996 when additional manufacturers offer equipment in the marketplace. Medium power DBS service providers currently include and install the equipment as a part of their subscription service. In either case, program service fees are slightly higher than equivalent packages offered by local cable systems.

When DBS services were launched in 1994, it was assumed that the early adopters would be people in areas with no cable service and people who were dissatisfied with their local cable operator. While these groups have been prominent among early DBS subscribers, a surprisingly large percentage of early adopters have been people who also subscribe to cable. That is, they are video aficionados who want more of everything.

Some analysts believe that DBS has a narrow window of opportunity to establish itself before cable upgrades are completed and new wireless cable services are offered by telephone companies. DBS system operators argue that they do not require a very large number of subscribers to be viable—five to ten percent of U.S. households would provide a profitable business. However, it is unclear how many DBS service providers can survive if the total audience is 5 to 10 percent of U.S. households.

Digital TV

Television is about to change from analog to digital. Our current system established by the National Television Systems Committee (NTSC) uses analog

mit images as well as sounds. Over the next decade, television will move towards a digital system in which images and sounds are captured and transmitted as zeroes and ones—the digital code used in computers. Digital television has many advantages. It does not degrade through many generations of editing and it also can be compressed to provide four, five or more channels in the same bandwidth required for one channel of NTSC television. It also provides a crystal clear, snow-free picture to all TVs that can receive a minimum level signal. There are limitations, however, and any TV receiving a signal below this minimum gets no picture at all. In this sense, pictures do not degrade with distance as with NTSC television. They "drop off a cliff" when the signal does not meet the minimum requirements for a complete picture. Even so, field tests conducted by PBS show that the advanced television coverage provided within the service area is much greater than the coverage provided by the current NTSC service. Everyone associated with the ATV development process was surprised by the number of locations within the service areas where reflections or interference made the over-the-air NTSC picture unwatchable. Some cable subscriber drops located furthest from the headend exhibited similar problems with several NTSC channels. The ATV services did not exhibit such problems. Similarly, a poorly installed coaxial cable in a home—one that would provide a ghost-filled image of NTSC television—might not produce any picture at all with digital TV.

There are several important issues associated with digital television, including its role in high definition TV (HDTV), how digital TV signals can be compressed, what advanced television alternatives are made possible by digital technology, how TV studios are changing to digital, and what new set-top boxes in homes are necessary to receive digital signals.

- DIGITAL COMPRESSION is a technique to squeeze video, audio and data signals into a smaller transmission pipeline or storage device. It is used to store computer programs on a smaller number of diskettes than would otherwise be required and to hold more audio on a compact disc. In television, digital compression takes advantage of the fact that many things do not change from one video frame to the next. For example, the background may remain the same as an actor moves his face and body. A compressed signal only transmits changes in the video. This sounds simple, but it is a very complex process.

  Digital compression has evolved slowly. Many different systems have been introduced. However, it now appears that a common standard is emerging for the television industry—MPEG II, a standard set by the Motion Picture Experts Group, an industry technical committee. The process of digitally compressing a signal has improved significantly in the past few years. The cost of equipment to digitize and compress video also has come down significantly.

- HIGH DEFINITION TV (HDTV) will provide much sharper images, better quality sound and a different picture shape (more like a wide-screen motion picture in theaters than a traditional TV picture) compared to the 50-year-old NTSC television system that is now in use. The FCC began the process of looking for a next generation TV system in 1987. Over the next few years, 23 different HDTV systems were proposed. Most of the early proposals were for analog HDTV. The analog proposals followed the lead set by the Japanese, who launched an HDTV system in Japan via direct broadcast satellite in 1989. Sales in Japan have been slow due to the high cost of HDTV sets and the lack of good quality HDTV programming.

HDTV IN JAPAN

HDTV SET COSTS & SALES, 1991-1994

	Average Cost of Sets (US Dollars)	Estimated Number Sold
1991	$25,000	100
1992	$12,000	8,000
1993	$8,000	12,000
1994	$6,000	30,000
Price of HDTV Sets in 1995 = $ 4,500		

Sources: Wall Street Journal; The New York Times; Broadcasting & Cable

Over time, however, the advantages of digital HDTV became apparent and most industry groups rallied around digital HDTV. Eventually, a "grand alliance" was formed at the urging of the Technical Committee of the FCC Advisory Committee in order to combine the best features of each of the four proposed digital systems. The combined system has completed testing and has been judged to meet or exceed all industry requirements. The FCC Advisory Committee Technical Committee has unanimously approved this system and recommended that the grand alliance system be adopted by the FCC and approved the industry standards describing this system. The latest FCC timetable for adoption of the ATV standards has been delayed through congressional action until late 1996 or early 1997 in order to evaluate the potential for carrying out an auction of the new channels. This delay should not have an impact either on the cable or DBS industries, which are likely to proceed with plans to introduce ATV by the fall of 1997. One preliminary estimate by Zenith is that early HDTV sets will cost $1,500 above the cost of a current TV set. So, a 30-inch NTSC set that costs $1,000 today will cost $2,500 as an HDTV set.

An encouraging development recently announced by Hitachi uses a slightly expanded MPEG II decoder to filter the incoming HDTV signal in an inexpensive way to match the resolution of pictures to smaller or existing TV sets. Such an approach could significantly reduce the costs of more conventional sized ATV sets and make it practical to upgrade existing TV sets.

One of the problems facing the FCC in trying to implement HDTV has been how to find spectrum for the high-bandwidth signal. The original analog HDTV proposals would have required at least four times the bandwidth of NTSC TV. With digital HDTV, the signal can be compressed into approximately the same space as a regular NTSC channel. The broadcast industry determined that it was feasible to assign the currently unused channels within the existing TV broadcast band to each existing station to broadcast in HDTV without causing interference to existing NTSC channels. The coverage areas of the new channels could match the coverage areas of existing channels in nearly all cases if a very carefully constructed channel assignment plan were followed. This approach was recommended to the FCC so that the industry could simultaneously transmit in NTSC and HDTV. In this way, consumers with old NTSC TVs would not have to throw them away. The marketplace could slowly move over to HDTV. After a number of years, when everyone had purchased an HDTV set, broadcasters would be required to give back the extra spectrum they had received for the transition period. The proposal has met with much opposition, as the concept of advanced television emerged.

▲ ADVANCED TELEVISION was initially coined by the U.S. broadcast industry as a term to cover a variety of ways in which the existing NTSC service could be improved, added to or replaced with a separate higher quality service. At that time, it was assumed that true HDTV could not become a broadcast service because it contains five times the information of NTSC. The eventual development of digital HDTV has demonstrated that it is possible to provide all this information within a single broadcasting channel. This in turn has highlighted the inefficiencies and waste associated with existing broadcast channels. If one digital channel can carry five times the program information, why not carry five different programs of existing program quality?

This recognition has led to a redefinition of the term "advanced television" to cover all the possible uses for the digital channels and has thrown both HDTV and the channel assignment process into greater confusion. In theory,

a broadcaster could offer four or five channels of programming instead of one. Similarly, a cable operator could significantly increase the capacity of a cable system and "multiplex" pay services such as HBO, i.e., transmit HBO on three channels so that each movie is shown several times per month. Others have argued that in a digital world there is no need for a single standard. There could be many picture resolutions depending upon the need and willingness to pay. For example, some extra digital channels could be transmitted at NTSC resolution, others could have slightly higher resolution, and still others could be transmitted with full HDTV.

- DIGITAL PRODUCTION STUDIOS AND TRANSMITTERS are likely to be commonplace early in the next decade, as stations and cable operators evolve towards a future that is completely digital. However, it involves some very large expenditures for capital equipment. Broadcasters estimate that the full conversion of production and transmission of HDTV may cost about $10 million. Fortunately, the digital conversion can enable stations to significantly improve production and broadcast quality and, at the same time, reduce some operating costs. In the near term, many stations are moving towards a digital environment in stages. Among the first pieces of digital equipment that have been broadly adopted are digital graphics workstations. In addition, many broadcast groups including PBS have purchased digital insertion equipment. Commercial stations use this equipment to insert commercials efficiently. PBS and some public TV stations use it to insert promotional announcements and underwriting messages. Some new cable networks, e.g., Home and Garden TV, have built fully digital studios. Many groups are beginning to adopt digital recorders and digital editing suites. Digital compression technology has provided the foundation for the huge expansion of satellite transmission channels by both public television state networks and by PBS. Automated digital program feed systems and the large number of highly compressed digital satellite channels form the foundation that makes the start-up of commercial DBS services financially feasible.

- DIGITAL SET-TOP BOXES are expected to be introduced on a large scale in 1996-1997. Cable set-top boxes were originally used to provide cable TV service to TVs that were not cable-ready. Later, set-top boxes became addressable. This allowed cable operators to activate channels in a home without having to physically visit the home, e.g., for pay-per-view movies or when someone ordered a premium movie channel such as HBO. Recently, a new generation of set-top boxes has been introduced. These accept digital signals and provide a variety of sophisticated features. The boxes are analog devices enhanced by computer technology to provide some digital processing. An important business decision facing service providers is whether to use the enhanced analog boxes now or wait for the next generation of fully digital boxes. Some of the largest cable operators have decided that the risks of waiting are simply too great. These large operators currently have standing orders for more than ten million digital boxes.

Some of the advanced features offered by enhanced analog and fully digital set-top boxes include graphic and text display of electronic program guides and the ability to allow various software downloads to change what the set-top box can do. Fully digital boxes will support these functions as well as process digitally compressed video. They also can be configured for interactive television and video telephone calls over cable.

One of the problems in designing a set-top box in today's environment is that it must be flexible enough to adjust to rapid changes in technology. It must also be inexpensive enough–under $250–to be viable in the marketplace. Cost can be reduced if the components

ADOPTION OF ADDRESSABLE CABLE BOXES 1983-1995	
Year	Millions Of Cable Households
1983	1.7
1985	2.4
1987	5.4
1989	13.0
1991	17.6
1993	20.9
1995	23.0

Source: Showtime Event Television

of the set-top box are built into a TV set or VCR.

CONSUMER SERVICE IMPLICATIONS

Competition and New Services

The communication marketplace is filled with new competitors: direct broadcast satellite is competing with cable, cable is competing with telephone companies and online services are competing with print. In an environment with high levels of competition, lower prices and innovations that will lead to new services are expected. So far, consumers have not seen lower prices. DBS is more expensive than cable, and cable operators have not lowered their prices in the face of competition from DBS or telephone companies. Innovation also is illusive. Generally, new competitors have offered consumers more of the same types of services they already have. When examined more closely, however, innovations are emerging. Some are genuinely new services offered in market trials and tests, others are advances to existing services, and still others are a new wave of services that were tried in the past but not broadly adopted.

Telebanking/Commuting/Education/ Medicine/Shopping

There has been an explosion of interest in providing services to people who are far from a bank, school, hospital, etc. Many of these services were touted in the past as the next wave of technological innovation, but then failed to find a market. As in the past, it is not clear which services will become a permanent part of the landscape and which will find too little support to become viable. Some of the services that are emerging include:

- TELESHOPPING seems to have become a permanent part of television programming through QVC and HSN. Another form of teleshopping involves the selection and purchase of products through telephone-based online services such as Prodigy or America Online. Many groups have announced or begun online shopping services over the Internet, although questions remain about the security of credit card information sent over the Internet. The next wave of development is teleshopping on fully interactive television systems. In these shopping services, users can control what products are displayed and can place an order using a special interactive television remote control.

- TELEBANKING or "virtual banking," also is emerging as a new consumer service. Home banking has been available for more than a decade, but it has received only modest acceptance by consumers. More recently, a number of large and small financial institutions have announced plans to provide a new generation of money management services including checking accounts, money market and mutual fund accounts, credit and debit cards, brokerage and bill payment services. These financial services do not require a visit to a branch. Rather, they are available through a combination of telephone and computer-based delivery systems. Customers can choose to do their banking in conjunction with readily available money management software for their computers or use special software provided by the financial institution.

- TELECOMMUTING is another concept that has been around for a long time. Serious attention to telecommuting started in the early 1970s during the

OPEC oil embargo, but the cost of telecommuting technology was prohibitive 20 years ago. Telecommuting has gained momentum recently because of the increased penetration of personal computers in homes and lower costs for devices such as fax machines. The availability of low-cost office equipment for homes has transformed working remotely from an exotic activity to a natural extension of the office.

- TELE-EDUCATION has been part of the technology and media environment for more than 50 years, beginning with the use of radio for distance learning in rural areas during the 1930s. It gained some momentum in the late 1970s when satellite technology made it possible to distribute live video instruction almost anywhere in the U.S. and further momentum in the 1980s when low-cost computers and modems were adopted by many schools. It also has established a good track record. There is now renewed interest in sharing scarce teaching resources through telecommunications not just in rural areas but in all school districts and college campuses.

- TELEMEDICINE continues to hold the promise of easier access to scarce resources both medical specialists and expensive diagnostic equipment at a site that is remote from the patient who is being treated. As with tele-education, economic pressure is creating a favorable atmosphere for using telecommunications to give doctors and patients access to expensive resources located at a distance. The increased use of visiting nurses to care for patients in their homes also has created new applications of telephone-based support for health care professionals.

Interactive Programs

The promise of interactive programming is to place video under the complete control of viewers. This might include choosing which segments in a news program to watch first and the ability to call up extra video segments about a story. It also could include choosing how a mystery program will end, participating in game shows from home or competing in a TV game of chess against someone in another household. Interactive TV also is likely to include many commercial applications such as home shopping shows in which a viewer can choose which products will be shown and the ability to select what version of a commercial will be shown, e.g., a commercial for a station wagon, sports utility vehicle or an economy sedan. Most of these applications of interactive programming are still in market trials or trade show demonstrations. The most common form of interactive programming in the marketplace is educational, e.g., live telecourses in which students at a distant site can communicate with the instructor. Some interactive programming in education also allows teachers to give exams over TV (students answer questions with special data terminals), poll student opinions and even see the students at remote sites.

Killer Applications

There is much talk about "killer applications" for interactive TV and other advanced communication services. This refers to a service or program offering which is so compelling and profitable that it renders the entire service a success. In the cable industry, some argue that HBO was a "killer application." When cable was entering major cities in the mid-1970s, HBO was a very compelling offer that led many to adopt cable. Today, there is much debate about what might be a killer application for interactive TV, e.g., interactive games, home shopping or movies-on-demand. It is also possible that there is no killer application. Often, new services win acceptance in the marketplace by offering a broad collection of reasonably attractive services at a moderate price.

Video-on-Demand (VOD)

Video-on-demand is a potential "killer application" in the minds of some. With VOD, a large selection of movies or television programs is stored on a video server. Users can order a specific movie or video program and see it immediately. VOD can accommodate many users at the same time the actual number depends on the capacity of the video server. Further, many people can watch the same movie or TV program, each starting at a different time. Some VOD systems also provide VCR functions

for end users. They can stop, rewind and fast forward through content on the video server.

Near-Video-on-Demand (NVOD)

Near-video-on-demand is a less expensive alternative to VOD. With NVOD, a moderate number of movies are carried on special pay-per-view channels. Each movie is carried on three or four channels, with starting times 10 or 15 minutes apart. As a result, each movie is available "nearly" on demand: it will always be starting within a few minutes. A large capacity cable system (or a moderate capacity system with digital compression) might assign 60 channels to NVOD and carry 15 movies, each on four channels.

Electronic Program Guides (EPG)

With the promise of cable systems offering hundreds of channels to their customers, a variety of EPG services are moving into the marketplace. Electronic program guides provide viewers with listings of TV shows for the current day and several days ahead. The on-screen guides can custom-sort programs by themes and subjects. This feature may be used to sort a day or week's worth of programs into specific categories such as "sports" or "movies." In addition, some of the more sophisticated functions provided by EPG services include point-and-click VCR recording, program searches by title and features that allow the viewer to sample segments of movies and shows prior to making a selection.

The program guide field is crowded and very competitive. Several companies are trying to win acceptance; only a few are likely to succeed. Delays in the roll-out of digital set-top boxes recently have prompted a few aspiring service providers to drop out of competition.

There are three critical issues associated with electronic program guides:

- How many consumers will be willing to pay $50 per year (the subscription cost for some on-screen TV guides) plus the initial cost of hardware to receive the service?

- There are many companies competing for this market and many complex marketing arrangements. The field of EPG service providers has narrowed recently and is likely to narrow even more. Winners and losers may be sorted out more by marketing alliances than by who offers the best service.

- The way EPGs present program choices could have a significant impact on program providers. An EPG can "steer" viewers toward certain programs and highlight or promote specific programs. Marketing affiliations may affect who receives prime shelf space in the program guides. Also, EPGs are likely to encourage more program viewing by content category. For example, sports fans could program their guide so that they see sports programs predominantly.

Multimedia

What does the term "multimedia" mean? It implies that two or more forms of media are used in a service or device. Television and films have pictures and sound, but are not called "multimedia." The term has become an all purpose descriptor for new combinations of sound, pictures, text and data. Often, "multimedia" is used to describe an enhancement to a familiar medium, e.g., a computer that can play sound and video is called a multimedia computer. As these enhancements become more common or popular, the new combination may come to be known by a unique name or simply be integrated under the old name.

Personalized and Customized Services

In the same way that telemarketing personalizes a sales presentation ("Good evening Mr. Burns, I'm calling you tonight because....") and direct marketing customizes advertisements by including your name in the text of a letter, new media are providing many ways to personalize and customize their services. For example, online services encourage users to set up their own "path" to go to the services and content areas that interest them. With games and other participatory activities, the names of participants and the winning scores are posted and shared with other players. Channel selection on TV systems also can be customized so users can surf through their favorite channels and skip

over channels they do not like. Over the next few years, there will be many new ways to personalize and customize media.

Multiple Channels

Video compression technology enables more than one channel to be broadcast within the same bandwidth. Broadcasters are beginning to think about expanding their franchise by supplementing their prime feed with additional channels. For example, a public TV station could take its existing content and create three or four services, e.g., an education service, a children's service, a news and documentaries service and a nature service, each broadcast on a separate digitally compressed channel. The proper extent of and mix of such services will represent a major challenge to the station programming organizations. Multiple channels–even if originated from the same public television station–can compete with each other for the same audience if they have similar audience appeal. The acquisition of more programs can complicate an already difficult problem of obtaining high quality primetime programming. Even so, a well-organized schedule containing a variety of properly selected standard resolution programs, combined with some high-quality single channel primetime programs offered in HDTV, might prove to become a very successful broadcast service for many public television stations. In a cable or telephone environment supported by video servers, some channels could be created temporarily. For example, if a major news story broke during coverage of a sporting event, a station could create a temporary second channel and provide the news story for those who wanted to view it, while others could continue to watch the sporting event.

CHAPTER 11
COMMERCIAL ACTIVITIES & QUESTIONS FOR PUBLIC TV

COMMERCIAL ACTIVITIES

Online Services

Dozens of commercial online services offer access to large information databases, electronic mail, games, education services, shopping, banking, bulletin boards on special interest topics and live chat sessions. After growing slowly during the 1980s, they expanded rapidly in 1994 and 1995. They have benefited from the increased number of homes with PCs and faster speed modems as well as lower costs for computing equipment. Over the next few years, users will be able to access online services at even faster speeds via ISDN (a high-speed data service over the telephone network) and through broadband cable networks. Some of the major services and their focus of activities include:

- COMPUSERVE The oldest of the main online services, CompuServe, an H&R Block company, began in the early 1980s. It was established originally to make use of the spare capacity of a large computer system during off-hours. CompuServe quickly established itself as a service for working professionals to share information about topics of interest to specialized groups. Employing a bare bones, text-only format and an emphasis on communication, CompuServe grew at a moderate pace and was one of the first services to become profitable. Later, it added graphics capability and began to provide access to the World Wide Web.

- AMERICA ONLINE (AOL)–Started in 1989, America Online grew rapidly to become the most popular online service in the U.S. It accomplished this through lower pricing and strong marketing that placed AOL in the basic software package of many PCs sold to businesses and consumers. AOL also established relationships with many strong information providers. *The New York Times, Omni* magazine, Scholastic and American Express are a few of the companies that have established feature sections on America Online. Such an arrangement is mutually beneficial for the sponsoring company and AOL. That is, this type of participation allows a company or organization to control content and promotions within its unique section as if it had its own online service. Through this, AOL has been able to provide a larger variety of features to its subscribers without having to create the content. Like other major online services, AOL recognized the growing popularity of the World Wide Web and began to offer Web access to its customers in 1995.

- PRODIGY–Prodigy, an online service owned jointly by IBM and Sears, began in the mid 1980s. It started as an information and entertainment service targeted to a wide audience of adults, teens and children. For this reason, it adopted a strong graphics look and feel from the beginning. Prodigy has expanded some of its content areas through partnerships with third party information providers. Companies such as ESPN and CBS now sponsor and update featured sections within Prodigy.

  Prodigy also became the first major service to provide a fully operational World Wide Web browser to its subscribers. With increasing interest in the Internet, the Prodigy Web browser attracted a large number of new users who wished to explore the rapidly growing number of graphics-oriented Web sites. Prodigy also moved rapidly to increase access speeds, including access via high speed ISDN. The biggest need for ISDN lines comes from customers who are interested in

gaining more efficient access to World Wide Web sites on the Internet. In addition, the high speed access means faster downloading of video clips offered by CBS and Home Box Office over Prodigy.

- THE MICROSOFT NETWORK (MSN)–No online service has received as much advance publicity as the Microsoft Network. Launched in 1995, with cable operator TCI as a major partner and hundreds of companies as information providers, the Microsoft Network is included in Windows 95, an operating system for many PCs. This ensures that a large number of potential subscribers will have access to the service. The Microsoft Network is similar to other online services in terms of content but it has a different pricing strategy–one that allows each information service provider to set its own price.

  MSN also offers a few different pricing packages for its basic service, including a low-cost package for those who will use it only occasionally. Subscribers can access the service through the telephone network, and through selected cable systems at much higher speeds. MSN has a powerful server and software tools, called Blackbird, that can provide seamless access to the Internet.

- THE INTERNET AS A SUPERHIGHWAY–The Internet has grown at a very fast rate, both in usage and in the number of businesses and organizations creating home pages on the World Wi Web, a part of the Internet with easy-to-use graphical interface. M businesses have established Web s the hope of selling traditional me chandise or services to consumers log onto the Internet each day. Sc companies have even established tual shopping malls" providing ac to hundreds of retailers and catalogers. In addition to those sellir merchandise on the Web, some c nies are trying to make a profit b charging a subscription or usage those accessing their site. For exa some newspapers will allow you t access their main Web page at nc but charge a monthly fee and ask an established password to gain entrance to their features and art

  A majority of commercial sites or World Wide Web are using their advertise, promote an image or si to join the "Web Fever" while sea for a niche on the "information s highway." While the number of users has grown rapidly, it is less how businesses will earn a profit Web. The fact remains, though, t the Internet has captured the ima tion and interest of a lot of peopl

  Nearly every type of business, ins tion or organization can be found some capacity on the World Wid Some businesses, however, have embraced the Internet in a very spicuous manner. Some of the m common types of businesses foun the Web are banks, newspapers a magazines, TV and radio, and re and cataloguers.

PROJECTED GROWTH OF ONLINE SERVICES IN HOUSEHOLDS
(MILLIONS OF HOUSEHOLDS)

Year	Onlines Service Subscribers
1995	8
1996	11
1997	15
1998	18
1999	20

Source: Multimedia PC Marketing Council

Cable Services and Activities

Cable companies are exploring m new services including telephone service, ROMs, online services, interactive televisio direct broadcast satellite. They are compet new arenas, e.g., against local telephone c nies, and hedging their bets by becoming partners in new services that compete wit such as direct broadcast satellites.

With the promise of very large capacity cable systems in the near future, many groups have launched or announced new cable channels. However, the reality is that until digital compression is implemented on a large scale, there will continue to be very little channel availability on cable systems.

Gaining access to cable systems often involves striking marketing deals with cable operators. This is clear in the negotiations that have taken place between electronic program guides (EPGs) and cable operators. The EPG companies that now stand firmly in position to test the market include StarSight, Gemstar, Prevue Interactive and TV Guide On Screen. Each has been negotiating relationships with major cable operators. These arrangements will make it very difficult for any newcomers to enter the market. StarSight, for example, has agreements with Viacom Cable, KBLCOM, Colony Communications (*Providence Journal*), Cox Cable Communications and Times Mirror Cable TV. Prevue and TV Guide On Screen, likewise, have established relationships with MSOs representing a large share of the nation's cable households.

Cable is moving ahead in ways that are important to public television. For example, Cable in the Classroom (CIC), an industry trade group that represents cable system operators and a consortium of program suppliers (including PBS), has successfully wired over two-thirds of classrooms in the U.S. It also provides a package of noncommercial programming to classrooms. Public television is the largest program supplier for Cable in the Classroom. Further, CIC research shows that public television is the most heavily used CIC service–69 percent of teachers surveyed indicated that they use public television programs regularly.

NEW CABLE NETWORKS COMPETING FOR CHANNEL SPACE

Access Television Network
The American West Network
America's Health Network
The Applause Network
The Art & Craft Network
Arts & Antiques Network
The Auto Channel (TACH)
BBC World Channel
BET On Jazz: The Cable Jazz Chl.
The Boating Channel
Booknet
Car & Driver Channel
Catalog 1
Celtic Vision: The Irish Channel
The CEO Channel
Children's Cable Network
Cine Latino
Classic Arts Showcase
Classic Music Channel
Classic Sports Network
C/Net: The Computer Network
Collector's Channel
Conservative Television Network
Consumer Resource Network
Crime Channel
C-Span 3,4 & 5
Deviance Time & Space
Discovery's Four New Networks
The Ecology Channel
The Enrichment Channel
ESPN 3,4 & 5 and ESPNanol
FAD TV
FXTV, Fitness and Exercise TV
Gaming & Entertainment TV
Golden American TV
Good Health Channel
The Health Channel
The History Network
Hobby Craft Network
Horizons Cable Network
Interactive Channel
Int'l. Cable Channel Partners
Infomall Cable Network
Kaleidoscope
Merchandise Entertainment TV
The Military Channel
Music Video Service (Unnamed)
National Health Network
New Culture Network
Newsworld International
The 90s Channel
The Outdoor Channel
Outdoor Life Channel
Outdoors, Motorsports & Collectibles Network
Ovation: The Fine Arts Network
Parent Television
Parenting Satellite Network
The Parents Channel
Planet Central TV
The Popcorn Channel
Premier Horse Network
The Real Estate Network
Recovery Net/The Wellness Channel
Romance Classics
Shop At Home
The Singles Network
Speedvision
Sundance Film Channel
TCI-Microsoft Computer Channel
TMZ, The Music Zone
TRAX: High Performance TV
TRIO
TV Guide On Screen
TV Macy's
TV Shopping Mall
VIA TV Network
Video Catalog Channel
WEB Sports Network
Wingspan
Women's Sports Channel (Unnamed)
Women's Sports Network
World African Network
XTV

Source: Cablevision

CABLE CHANNEL AVAILABILITY-1995

Number of Available Channels	Percentage of Systems
1	8
2	18
3	21
4	10
5-9	16
10-14	11
15-19	10
20+	7

Source: Beta Survey

Other cable activities include:

- CNN AND CNBC DESKTOP VIDEO. Both CNN and CNBC have launched desktop video services. They provide video feeds of their news services to businesses and other organizations. CNN's service, "CNN At Work," is a partnership with Intel. They charge $150 per user per year for the service, which delivers video at 12 frames per second (compared to 30 frames per second for normal video over cable or broadcast). It does not provide true video-on-demand but a user can store the incoming video feed and view it later with near-video-on-demand control.

- DISCOVERY CHANNEL. Discovery Channel is very active in developing applications for new technologies. It has developed a video-on-demand service, Your Choice TV, that has been tested in a few markets. It offers television programs to users for prices ranging from less than $1 to a few dollars. It is also participating in a trial of interactive television with Microsoft in Seattle. Discovery Channel's multimedia group has also created PC software and CD-ROMs, including the CD-ROM *Sharks! An Interactive Journey.*

After launching modest services on Prodigy and America Online, Discovery Channel launched an ambitious World Wide Web site with monthly features about science, nature and hist These are supplemented by daily n reports, bulletin boards and live cha about specific topics. Revenue is derived from an online store, adver ing and a planned subscription fee $24 per year.

- VIACOM ONLINE DATA ACCESS. Via is providing online access to Prodig America Online and the Internet t group of trial households in Castro Valley, California. Viacom is testing system from both technical and ma ing perspectives. Cox Cable also is testing data delivery over cable on systems in Omaha, Phoenix and Sa Diego. Data can be sent over cable much higher speeds than over a sta dard telephone line. However, cabl modems are expensive compared t telephone modems. Most cable modems cost $500 or more, compa to $50-$200 for telephone modems Zenith recently introduced a cable modem for $300.

- TIME WARNER'S FULL SERVICE NETWORK. Time Warner's high-en interactive television service in Orl do, Florida–The Full Service Network–was announced with grea fanfare in 1993. It was to be launc in early 1994 and was scheduled t provide video-on-demand, home b ing and shopping, telephone servic video conferencing, and video gam played between households, among other services, to 4,000 households was launched and installed in late in just a few households. The numl of services and users grew slowly i 1995; a full service network is not expected to be in place until 1996. delays experienced by Time Warn are not unusual. New technologies services invariably take longer to i ment than planned.

Telephone Company Activities

Telephone companies have annou many plans to offer video services to consu They also have changed their plans many t A few important trends are now becoming

First, telephone companies have put high-end interactive TV on a much slower path of development. Several trials have been canceled; others have been postponed. The reasons for this are the high cost of the technology, the equally high cost of creating new content, and uncertain demand by consumers.

Secondly, telephone companies are exploring alternative ways to deliver video to homes, including wireless cable (transmission of video by microwave to small dishes on homes), ADSL (transmission of VCR-quality video over ordinary telephone lines), and hybrid fiber-coaxial cable systems that are similar to the systems used by cable TV operators. A high-end system that utilizes fiber throughout the entire system is simply too expensive in the near term.

Third, telephone companies are forming new partnerships to create or acquire content. Bell Atlantic, NYNEX and Pacific Telesis have formed a $300 million partnership to acquire and produce programs. The partnership is called Tele-TV. SBC Communications (formerly Southwestern Bell), Bell South, GTE and Ameritech have formed a $500 million partnership with Disney to create a national program service.

- BELL ATLANTIC is pursuing many different paths simultaneously. It has formed a partnership with two other large telephone companies to acquire and produce programs. It also has formed a partnership with NYNEX to buy a large wireless cable company. Using wireless cable's over-the-air microwave transmission and digital compression, it will be able to offer 100+ channels of TV. Bell Atlantic believes that wireless cable is a less expensive first step into the video business, to be followed by higher-end fiber systems when the costs to build those systems come down. At the same time, Bell Atlantic is experimenting with a high-end fiber optic system in Northern New Jersey and conducting a trial with low-end ADSL technology (i.e., video sent over regular telephone lines) in Northern Virginia.

- AMERITECH is pursuing a relatively simple strategy. It is "overbuilding" cable systems in its five-state territory. This means that it is building new cable systems in direct competition with existing cable operators. The Ameritech systems mix fiber and coaxial cable. They can provide hundreds of channels through the use of digital compression and can evolve over time to provide advanced services such as interactive TV. In the short term, however, it is becoming a regular cable TV operator. At the same time, it has formed a programming alliance with three other large telephone companies and the Disney company.

- SNET (SOUTHERN NEW ENGLAND TELEPHONE) has a very ambitious plan to completely replace its own copper infrastructure with a sophisticated high-capacity fiber broadband network. By 1998, SNET plans to reach approximately 500,000 customers in Connecticut (one-third of its overall customer base) with a broadband network called I-SNET. It hopes to complete the network by 2009. This would place Connecticut among the first states to have a broadband fiber optic network that is widely available to homes, schools and businesses. SNET has reported positive results from its 1995 video-on-demand trial that was designed to test service appeal prior to a large-scale service launch.

- US WEST is pursuing a strategy with many components. It also has changed direction from an earlier strategy. Like some other large telephone companies, it submitted an ambitious plan to the FCC to build high-end video dialtone systems throughout its territory. It then withdrew the video dialtone applications and announced a more modest approach. This includes a market test of a high-end fiber system in Omaha to help it determine what path to pursue. It is also evaluating wireless cable, ADSL and direct broadcast satellite as alternative delivery systems for video. In addition, it has invested in one large cable company (Time Warner Entertainment) and purchased a regular cable system in Atlanta. It is rebuilding this cable system in order to offer more

PROJECTED GROWTH OF VIDEO DISTRIBUTION COMPETIT

Millions of Subscribing Households

System	1996	1997	1998	1999	200
Cable TV	61.5	62.5	63.4	64.2	65.
Telco Cable	0.8	1.5	2.5	4.5	7.
DBS	3.5	4.0	4.5	4.8	5.
Wireless Cable	1.9	2.3	2.6	3.0	3.

Source: Paul Kagan Associates & Cable World

video services and to provide telephone service over cable in competition with the local telephone company.

Direct Broadcast Satellite Services

Direct broadcast satellite services must compete with cable TV, new telephone fiber optic and coaxial cable systems, and wireless cable systems. Many analysts believe that DBS will be adopted by a modest share of U.S. households. After competing with these alternative systems, however, DBS operators must then compete among themselves for DBS customers. The field is crowded and growing more crowded.

- PRIMESTAR is a medium-powered direct broadcast satellite service that was begun by six cable operators and General Electric to head off the onslaught by high-power DBS operators. Primestar uses a Ku-band satellite that can deliver TV signals to a three-foot dish. This is much smaller than the 10-foot TVRO dishes but larger than the 18-to-20-inch dishes for high-power DBS. Primestar began with a 10-channel service but quickly moved to digital compression, increasing its capacity to 73 channels. It also has attempted to overcome the barrier of high equipment costs by leasing the satellite dish to consumers. A subscriber can lease the equipment and receive a package of channels for approximately $30 per month. Like its competitors, Primestar also offers pay-per-view movie channels and special sports packages, e.g., the NFL, NBA and NHL offer packages of 200 to 400 games for seasonal fees ranging from $69 to $149. Primestar hopes to purchase additional sat transponders and switch to smal dishes in 1996, pending FCC ap

- DIRECTV is a high-powered D vice that is owned by Hughes Electronics, a subsidiary of Gen Motors. DirecTV owns the satel supports its service of 150 chan of these are pay-per-view). It als space on its satellite to a compet DBS service–U.S. Satellite Broa ing. DirecTV is the most ambiti DBS service to date. It invested cant funds in the high-powered as well as ground operations an keting. In spite of these high inv costs, it claims that it can be pro with three million subscribers. T this goal, it has forged an impor alliance with the National Rural Telecommunications Cooperati market the service in rural areas finding some resistance to the h of hardware, DirecTV also has to offer a monthly price that inc lease of equipment.

- GALAXY INSTITUTE is a DBS ed project funded by Hughes' Dire uses the DirecTV satellite to tra 15-minute course-related segme schools. In its pilot phase it is fr schools, but the fully operationa will charge $6,000 per school fo courses (two science courses an English course). The programm taped, but it lets students send f which may be read or displayed sequent course segments.

There are other operating and planned DBS services, including U.S. Satellite Broadcasting (owned by Hubbard Broadcasting and a consortium of private companies), EchoStar and AlphaStar. It is unclear how many DBS services the marketplace can support. In Europe, where DBS services were launched prior to those in the U.S., there has been a consolidation of services because multiple DBS providers could not compete profitably. The same type of shakeout may occur in the U.S.

QUESTIONS FOR PUBLIC TELEVISION

What do these commercial sector trends and activities mean for public television? It is important to assess the implications of commercial trends for individual stations and public television generally. Are new opportunities emerging for public television as a result of commercial sector activities? Do any of the new services pose a competitive threat? More fundamentally, which of the new services are viable in the marketplace and which are public relations hype?

Among the many issues that are relevant to public TV, there are six noteworthy questions that this section will examine:

- Do homes and schools have the necessary equipment and means of access to utilize these new services?
- What do these new technologies or services cost, are people willing to pay for them, and do they work?
- Will commercial groups shape the development of new technology services?
- Will public television have access to the 500-channel cable environment and the video dialtone environment of telephone companies?
- Should stations participate in technology trials with telephone companies, cable operators and computer organizations?
- What are the missing pieces in the new technology environment and can public television supply any of these missing pieces?

DO HOMES AND SCHOOLS HAVE THE NECESSARY EQUIPMENT AND MEANS OF ACCESS TO UTILIZE THESE NEW SERVICES?

Ownership of equipment and access vary a great deal based in part upon financial resources, need and interest. In mid-1995, 64 percent of U.S. households had cable service, 40 percent owned a personal computer, eight percent used online services and five percent had a satellite dish. However, these percentages change when there is a strong need. For example, in Montana and other rural states with relatively few cable systems, more than 20 percent of households have a satellite dish. For this reason, a station must evaluate ownership of equipment in its local market and among the target group of users.

For schools, there are also many variations in ownership and access based upon the location of the school district, the financial

ACCESS TO TECHNOLOGIES BY K-12 PUBLIC SCHOOLS

Technology	Percentage of Schools With Access
• Computer With Telecommunications Capability	75
• Cable TV	74
• Broadcast TV	70
• Online Services (Commercial, Public or Internet)	49
• Internet	35
• Closed Circuit TV	25
• One-Way Video/Return Audio On Computer	10
• Two-Way Video Service/Two-Way Audio	6

Source: U.S. Dept of Education, National Center for Educational Statistics

resources of the local community, and the commitment of each state to technology as a resource for education. In general, there is a reasonably high level of ownership and access for many new services. A survey of K-12 schools by the U.S. Department of Education in late 1994 found that approximately half of schools were connected to an online service or the Internet but only three percent of instructional rooms were hooked up. Teachers were the primary users of these services.

WHAT DO THESE NEW TECHNOLOGIES OR SERVICES COST, ARE PEOPLE WILLING TO PAY FOR THEM, AND DO THEY WORK?

Technologies are often very expensive when they are first introduced. When black and white TVs were introduced in the late 1940s, they cost the average household the equivalent of six weeks' salary. Over time, economies of scale bring the costs of technology down. Today, mature technologies like TVs are relatively inexpensive, more recent technologies such as personal computers are much cheaper than five or six years ago, and new technologies such as HDTV are very expensive. In planning to offer a new service, it is important to consider who the likely user groups will be in years 1-3, 4-6 and 7-10 of the service.

Many new technologies and services are plagued with technical problems. Some problems are eliminated through de-bugging but some are fundamental flaws. It is important to rely on the expertise of your station's engineering staff and reports from reliable industry sources --not the press releases of those marketing a service or technology.

WILL COMMERCIAL GROUPS SHAPE THE DEVELOPMENT OF NEW TECHNOLOGY SERVICES?

The interests of commercial groups can shape the development of new technology services either because they develop them first or because they can put enormous resources behind marketing. In this sense, public television should be aware of what technologies commercial groups are developing and which audiences they are targeting. The tough decision that follows is whether to join the direction of commercial groups or move in a different direction. For example, commercial groups may develop new technology services for consumers and businesses, while ignoring education.

The importance of innovation should not be overlooked. Public television has a strong track record in developing innovative uses for new technologies. The use of satellite to distribute programming is just one example. Here, commercial groups followed the lead of public television. In other cases, however, public television has developed innovative uses for a new technology but the lack of interest by commercial groups doomed the chances for the innovation. Teletext (an on-demand text service that piggybacks on a regular broadcast signal) provides an example. Public television developed a number of innovative applications for teletext but commercial groups showed little interest in the technology. As a result, the technology was never marketed to consumers and the innovative applications never had a chance to be developed.

WILL PUBLIC TELEVISION HAVE ACCESS TO THE 500-CHANNEL CABLE ENVIRONMENT AND THE VIDEO DIALTONE ENVIRONMENT OF TELEPHONE COMPANIES?

This is a crucial issue, with regulatory and marketing components. On the regulatory side, the Association of America's Public Television Stations (APTS) has waged an intensive campaign at the national level to secure access for public television in the new mega-channel environments. However, the national effort must be supplemented at the state and local levels.

It is equally important to show cable and telephone companies that public television is a vital asset in the new technology environment. Developing innovative new services is one way to demonstrate the value of public television. Audience research also supports public TV's case. For example, PBS research shows that cable subscribers who watch public television regularly have a more positive attitude about cable TV than cable subscribers who do not watch public TV regularly. In other words, public television adds value to cable.

SHOULD STATIONS PARTICIPATE IN TECHNOLOGY TRIALS WITH TELEPHONE COMPANIES, CABLE OPERATORS AND COMPUTER ORGANIZATIONS?

Each station has to weigh the pros and cons of participating in trials based upon its resources and the potential benefits. Assuming that it does not drain resources significantly, there are a number of potential benefits associated with participation in trials. First, a station

gains firsthand experience in creating new services, and adds to the skill-set of its employees. Second, there is much to be learned from the reactions of those who use the service in homes or schools: do they like the service, how do they use it, and are they willing to pay for it? Third, a station can position itself to move into the marketplace quickly when and if the trial becomes a regular service. There is also an intangible value in being recognized as a "significant player" by the cable, telephone and computing industries.

WHAT ARE THE MISSING PIECES IN THE NEW TECHNOLOGY ENVIRONMENT AND CAN PUBLIC TELEVISION SUPPLY ANY OF THESE MISSING PIECES?

There are many missing pieces in the new technology environment. For example, where will the content come from, especially local content? This is clearly a missing piece in proposed interactive television systems. Second, do we really know what end users in homes and schools want? And, who do end users trust to bring truly valuable services into the marketplace? Third, what social benefits or negative effects will be derived from new technology services? And, who will assure that new services bring positive social benefits?

These are missing pieces that public television can supply. Public TV has both a solid track record in each area as well as the trust of the public. Public television is a major producer of content, especially local programming and services. It has placed a strong emphasis on the end user and there has been a demonstrated trust in public television by its viewers. In addition, public TV has an established history of using technology to benefit all components of society–individuals, schools, government and social organizations.

CHAPTER 2: TELEVISION TRENDS AND ACTIVITIES

Press coverage about new media activities has missed an important story: public television is a major innovator of advanced telecommunication technologies and services. While cable operators and telephone companies have made headlines based upon promised services, public television has been implementing a broad variety of new services. These include direct broadcast satellite services, multichannel services, interactive programming, multimedia and online computer services, among others. The future communication environment will be very exciting and public television is leading the way to make it a reality.

What are some of the areas where public television can point with pride to its leadership role? There are several technologies and services. For example, public TV is a leading provider of direct broadcast satellite services: Georgia, Louisiana, Kentucky, Nebraska, South Carolina and more than 20 states that participate in the Satellite Educational Resources Consortium (SERC) all provide DBS services. At a national level, PBS provides multiple channels of direct broadcast satellite services. No commercial broadcasters, cable operators or telephone companies can match public television's record of achievements in DBS.

Public television also leads in providing multiple channels of service. More than three dozen stations provide second and third channels of programming in their service areas, e.g., many program a second channel on their local cable system. PBS also feeds multiple channels to local stations.

In addition, public television leads commercial broadcasters, cable and telephone companies in providing online services, through PBS Online, Learning Link, Community-Wide Education and Information Service (CWEIS) sites, and dozens of Internet sites. The same holds true for interactive content: public television has been creating interactive content for more than a decade, including interactive telecourses, videodiscs and (more recently) CD-ROMs. Public television's leadership role also has included digital compression and multimedia as well as important participation in testing HDTV and video-on-demand.

SELECTED TELECOMMUNICATION ACTIVITIES BY PUBLIC TV STATIONS

Activity	Percentage of Stations
Have existing two-way link to local, state or regional fiber optic network or plan link	56
Plan to purchase digital equipment in 1995	57
Provide locally generated content on the Internet for local community or plan to provide service	49
Provide PBS online services to local community	65
Program extra cable channel	18
Manage programming on cable for public, educational, or government access channel	22

Source: CPB 1995 Annual Station Activity Survey (204 Respondents)