

### **III. The ITV Rollout**

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## A. Introduction

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"You gotta receive to believe." That's becoming a rallying cry among those hawking new digital TV services. If consumers can receive these new wonders, ITV developers say, they'll believe how great they are.

Enabling consumers to receive ITV services is dependent on the growth of many distribution vehicles. Fortunately for ITV applications providers, distribution options have increased through expanded capabilities of cable, broadcasting, satellite, personal computers, the internet, telecommunications and consumer electronics. Unfortunately, distributors in each of those fields currently are not providing broad enough distribution of any ITV services to guarantee their success.

Interactive television is being revived by a host of developments in digital technology, all of which are contributing to its rollout. The pace of ITV deployment is being dictated largely by these technologies:

- Broadband fiber cable plant
- Advanced digital cable set-top boxes
- Computer storage and processing
- Advanced telecommunications networks
- Digital broadcast spectrum utilization
- Content applications platforms
- User interfaces and navigation tools
- Digital video production
- Digital TV sets and advanced consumer electronics
- Direct-broadcast satellite capabilities
- High-speed internet access
- Video and audio streaming
- Wireless technologies

Many of the previous technological impediments to scalable ITV deployment have largely disappeared. Today, ITV developers and distributors can take advantage of:

- Improved microprocessor capabilities
- Increased technical standards
- Lower costs per stream
- Proven network architectures
- Higher transmission speeds
- Economical set-top boxes
- Wider hybrid fiber-coax deployment
- Interoperable software platforms
- Conventional user interfaces and navigation tools
- Convergence of computer and TV devices
- Lower cost digital production equipment and techniques
- Federally authorized spectrum usage

Digital technology itself is breaking down the barriers between devices and fostering media convergence. By converting content into streams of zeros and ones, "digitization destroys compartmentalization," says Bob Pepper, chief of the Federal Communications Commission's Office of Plans and Policy. During a presentation at the Myers ITV Forum in February, he explained how in the digitized world "a bit is a bit," and bits are not constrained by a distribution medium:

- A bit does not know if it's broadcast, cable TV, telephony or computer networking
- Bits can be transmitted over twisted pairs, coax cable, satellite, radio, power lines or fiber
- Bits can be readily stored
- Bits can be processed anywhere
- Customer devices can readily manipulate bits
- Intelligence can be inserted everywhere-in the network and at the edges

To examine how the ITV rollout will progress, The Myers Group and eMarketer compiled the following market data on the key technologies involved.

## B. Digital Cable

Broadband cable represents the best delivery platform for ITV services. Respondents to Myers' Prospects for ITV Survey acknowledged cable operators as the greatest potential beneficiaries of ITV.

Over the past couple years, cable's multiple system operators (MSOs) have committed to major plant upgrades in order to provide broadband two-way capability. But some MSOs that have engaged in substantial acquisition activity, including AT&T BIS and Charter Communications, have found themselves with a large amount of plant that is out-dated or inferior. As a result, some systems have moved slowly toward delivering new digital services, especially high-speed internet access, until they are certain they can provide consumers with high reliability.

Kagan Media Appraisals, in a report for the National Cable Television Association, predicts that two-way cable plant will reach nearly 51 million U.S. cable subscribers by the end of 2000. However, that does not mean that all those subscribers will be accessing two-way services, since they require appropriate consumer premises equipment (e.g., digital set-tops, cable modems) and operators must offer the requisite services.

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**% of Subs Served by 2-Way Cable Plant**



Source: Kagan Media Appraisals, 2000

Cable's capacity for delivering ITV services is greatest with plant operating at 750 MHz or above. According to Kagan, nearly three-quarters of US cable plant will run at 750 MHz by year's end.

**US Cable Bandwidth by % Capacity Increase**

Bandwidth	Equivalent Channel Capacity	1998	1999	2000
% < 550 MHz	< 82 Channels	28%	13%	8%
% 550 Mhz	82 Channels	22%	17%	10%
% 750 Mhz	115 Channels	48%	65%	72%
% > 750 MHz	135 Channels	2%	5%	10%

Source: Kagan Media Appraisals, 2000

While continued growth in the cable market may be slower than desired, many of the larger cable providers are upgrading their systems at a very rapid rate. By the end of 2000, for example, six top cable providers in North America will have 70% of their service areas two-way cable ready, with some companies reaching 95% penetration, according to analysis by Goldman Sachs. Almost all systems run by these providers will be operating at 550 MHzs or higher by the end of 2000. This chart does not include the US's two largest MSOs, AT&T BIS and Time Warner Cable, both of which have engaged in extensive upgrade projects.

**Cable Plant Status, % of Service Area with Two-Way Capability, 1997-2000**

Service Provider		1997	1998	1999	2000
Cablevision	Two-Way	31.0%	45.0%	60.0%	70.0%
	550 MHzs +	78.0%	84.0%	90.0%	90.0%
Comcast	Two-Way	12.3%	50.0%	65.0%	70.0%
	550 MHzs +	65.0%	80.0%	90.0%	95.0%
Cox	Two-Way	30.0%	50.0%	67.0%	76.0%
	550 MHzs +	68.0%	79.0%	86.0%	96.0%
MediaOne	Two-Way	30.0%	60.0%	70.0%	80.0%
	550 MHzs +	55.0%	75.0%	95.0%	95.0%
Videotron (Canada)	Two-Way	13.9%	30.0%	47.7%	74.7%
	550 MHzs +	77.0%	77.0%	77.0%	77.0%
Rogers (Canada)	Two-Way	52.0%	75.0%	90.0%	95.0%
	550 MHzs +	70.0%	85.0%	95.0%	97.0%

Source: Goldman Sachs, 1999

Increased capacity can translate into more channels or additional services. The following shows the amount of subscribers that will have high channel capacity available to them. The actual number of channels that a cable system carries depends on its network carriage agreements and certain regulatory requirements.

Currently, most cable operators are continuing to provide analog cable service while adding a layer of digital services. The amount of digital cable that is made available is a critical factor in the carriage of new digital networks and ITV services.

**US Cable Bandwidth by Subscriber Count (Millions)**

Avg. Upgraded Subscribers	Equivalent Channel Capacity	1998	1999	2000
% < 550 MHz	< 82 Channels	18.30	8.67	5.43
% 550 Mhz	82 Channels	14.40	11.30	6.67
% 750 Mhz	115 Channels	31.40	43.40	48.00
% > 750 MHz	135 Channels	1.31	3.34	6.67
<b>Total</b>		<b>65.41</b>	<b>66.71</b>	<b>66.77</b>

Source: Kagan Media Appraisals, 2000

Fueling cable's upgrades are lower costs for key components. Digital set-tops prices have fallen into the long-awaited \$300 range, even lower priced in volume, while costs-per-stream, a key measure for video-on-demand, are said to be in the range of \$700-800.

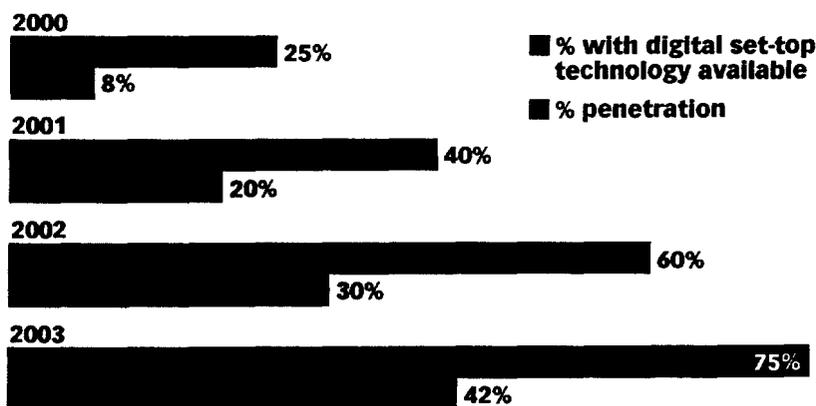
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The major manufacturers of digital set-tops have geared up digital set-top production. Motorola Broadband Communications (formerly General Instrument), provides set-tops through its DCT product line, including the DCT-5000 advanced digital set-top. Scientific-Atlanta, with its Explorer 2000 advanced set-top, Pioneer New Media and Zenith Electronics are other major US manufacturers. Sony entered the field through an agreement to provide set-tops for Cablevision Systems. UK-based Pace Micro Technology and Dutch-based Philips Consumer Electronics are also players in the US set-top market.

Despite these advancements, at this writing the industry continues to wrestle over technical standards to create interoperability with digital TV sets and to spur development of uniform, open digital set-top platforms, an effort that is being guided by CableLab's OpenCable project. In addition, set-top manufacturers have struggled with software integration and other issues that have interrupted production and in some cases caused set-top recalls.

The Myers Group, based upon operator survey research released in spring, 1999, projected that 42% of US cable households will have digital set-tops by the end of 2003. Myers is conducting further research on digital cable and will soon issue additional findings.

### Digital Set-top Projections, 2000-2003



Source: The Myers Group, 1999

While cable operators are increasing their installation of broadband plant, there is some question over how well cable will be able to exploit its window of opportunity. Two or three years ago, conventional wisdom at cable trade conventions was that the industry had about a two-to three-year lead on competitors in providing digital content and broadband services.

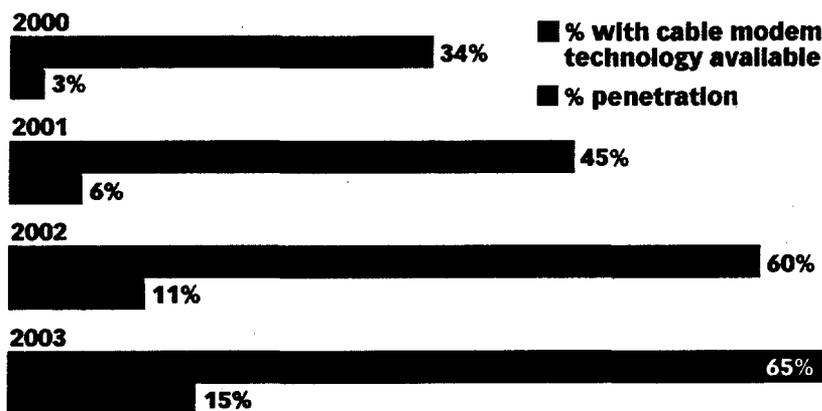
Now that window is closing, partly due to technological advancements by competitors and partly due to the dynamics of marketing. New services are being readied for market by all manner of service providers. Even if cable has the best distribution system, operators will find themselves vying with an increasing number of digital service providers for consumers' time and money.

## C. High-speed Internet Access

Broadband cable also gives operators the ability to provide high-speed internet access. Currently operators, with a few exceptions, are using cable modems to provide high-speed access to PCs, not TVs. In the near future, advanced digital set-tops for cable TV will provide both digital video and internet access capabilities, which could speed the rollout of internet over TV services and related offerings.

So far the rollout of cable modems is proceeding slowly. Cable operators surveyed by Myers do not foresee vast percentages of their subscribers using cable modems in the next couple of years. A primary reason, operators say, is that cable-fed internet service adds another \$40 or so to a subscriber's monthly bill. Based on Myers operator surveys, here are projections of cable modem growth.

### Cable Modem Projections, 2000-2003



Source: The Myers Group, 1999

The obvious advantage of broadband access is speed; but speed comes at a price. While a traditional analog modem may be cheaper than other forms of high-speed data transmission, as a ratio of dollars to rate of transmission, analog modems are by far the least efficient means of access. As the following chart demonstrates, analog modems function at a bits to buck ratio of only 1.4x. This figure is dwarfed when compared to that of cable modems, which boasts a bits to buck ratio of 75x.

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**Customer Costs of Various Access Technologies**

Technology	Down-stream Speed (Kbps)	Cost of Installation	Cost of Consumer Premises Equipment	Monthly Basic Service Fee	Monthly Internet Service Fee	Total 1st Year Cost to Consumer	Bits Per Buck Ratio*
Analog Modem	56.6	\$-	\$200	\$20	\$20	\$680.00	1.4x
ISDN	128.8	\$90-160	\$300	\$30-50	\$30-50	\$1,385.00	1.6x
Satellite	400	\$50	\$300	\$30-50	\$-	\$830.00	10.0x
ADSL	1500-8000	\$100	\$200	\$50-60	\$-	\$830.00	27.3x
Cable Modem	1200-27000	\$5-150	\$250**	\$40	\$-	\$593.00	75.0x

\*Ratio of downstream data rate/monthly basic service fee. \*\*Rental of equip. included in service fee. Source: US FCC, 1999

While its transmission speed and relative cheap price are impressive, cable modems are limited by the capabilities of the cable access providers. In order for ITV to become a reality, cable infrastructure must be able to support two-way data traffic, both downstream data from the access provider to the individual user, and upstream data from the individual user back to the provider. In addition to being two-way data enabled, cable systems must be able to support data flow at a speed of at least 550 MHz.

Until recently, most cable providers could not provide such technologies, thereby stunting the growth of internet over TV throughout the United States. According to Goldman Sachs, in 1998, only 20% of all American cable passed households were cable modem ready. Although a major push to upgrade systems increased cable modem ready households to 50% in 1999, Goldman predicts it will be 2002 before penetration reaches 70% of American cable passed households.

**Cable Modem Ready Households as a % of Cable Passed Houses, 1998-2003 (Millions)**

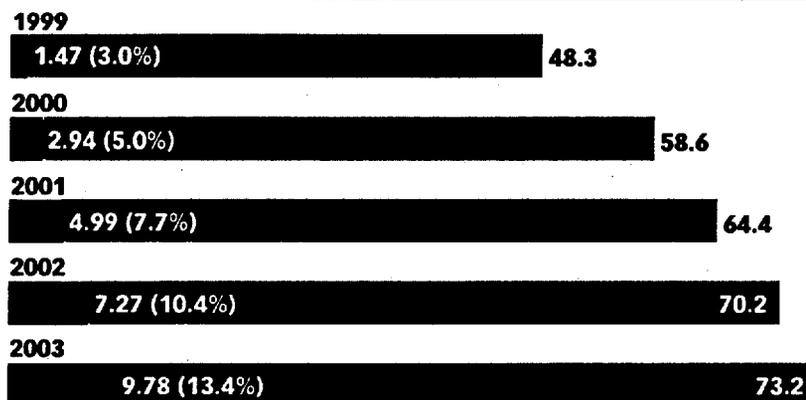
	Households passed by cable	% homes -passed modem ready	# of homes modem ready
1998	95.2	20%	19.0
1999	96.5	50%	48.3
2000	97.7	60%	58.6
2001	99.0	65%	64.4
2002	100.3	70%	70.2
2003	101.6	72%	73.2

Source: Goldman Sachs, 1999

Morgan Stanley Dean Witter projects a much slower rollout of cable modem services across the United States. MSDW projects that only about 45% of US homes will be passed by 2001, and a mere 51% by 2004.

According to eMarketer, at the end of 1999, there were only 1.47 million cable modem users in the United States. While significant user growth will take place over the next several years, actual cable modem subscribers will represent a very small percentage of houses actually equipped for the service. By 2003, there will only be 9.78 million cable modem subscribers versus the 73.2 million cable modem ready (using Goldman Sachs figure) homes, or a mere 13.4%.

### US Cable Modem Market, 1999-2003 (Millions)



■ Cable Modem Subscribers ■ Cable Modem Ready Houses

Source: eMarketer, 2000 (subscribers); Goldman Sachs, 1999 (Cable Ready Houses)

### Comparative Estimates: US Cable Modem Market, 1998-2003 (Millions)

	1998	1999	2000	2001	2002	2003
Goldman Sachs	0.60	1.50	4.00	8.00	12.50	17.00
Kinetic Strategies		1.50				
Morgan Stanley	0.40	1.10	2.50	4.60	7.10	10.00
Paul Kagan	0.50				7.30	
Pioneer Consulting		0.79	1.93	3.09	4.63	6.16
US Bancorp Piper Jaffray		1.80	3.10	5.90	8.50	
Veronis, Suhler & Associates		1.20	2.20	3.50	5.00	6.80
<b>eMarketer</b>	<b>0.55</b>	<b>1.47</b>	<b>2.94</b>	<b>4.99</b>	<b>7.27</b>	<b>9.78</b>

Source: eMarketer, 2000; various as noted

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Even as more households become cable modem ready, this in and of itself will become a problem for service providers. Cable bandwidth is shared among a number of households, unlike other forms of bandwidth, which are dedicated. As more and more people start to use cable modem technology, the amount of bandwidth used will be split among more users, resulting in significantly slower speeds, resulting in poorer transmission in data.

Meanwhile, telephone companies are providing high-speed access through digital subscriber lines (DSL), but the rollout is going equally slow. DSL growth is being stymied by the telecommunication industry's ongoing struggle between copper and fiber optic lines. While DSL is designed to create a high-speed internet connection through a copper line, it cannot run through fiber. As many Bell operating centers are upgrading their systems to fiber, the option of offering DSL services has been eliminated. Companies, such as SBC, BellSouth, and Alcatel, are manufacturing adapters, which allow DSL and fiber to interconnect. While promising, these adapters are still in field trials and have yet to reach the consumer market.

In addition to the fiber/cable quandary, DSL has other quirks which limit its availability to the general public. DSL signals can only travel a distance of about 15,000 feet without degradation. As such, people have to live within a 15,000 foot radius of a Bell central office, where DSL signals originate to be eligible for the service. In addition to distance issues, DSL service may be affected by the thickness of the wire that it is being transmitted through. Thin wires do not handle DSL very well. As such, one can easily understand the limited acceptance of such services, as DSL has gained only 500,000 subscribers at the year-end 1999.

**US DSL Market, 1998-2003 (Millions)**

	<b>DSL Subscribers</b>	<b># of Households DSL Capable</b>	<b>% Total</b>
1998	0.08	10.17	0.79%
1999	0.54	15.41	3.50%
2000	1.84	31.12	5.91%
2001	4.08	52.38	7.79%
2002	6.62	79.36	8.34%
2003	10.95	85.50	12.81%

Source: eMarketer, 2000 (Subscribers); Goldman Sachs, 1999 (DSL Households)

**Comparative Estimates: US DSL Market, 1998-2003 (Millions)**

	1998	1999	2000	2001	2002	2003
Cahner's In-Stat		0.40				12.00
Goldman Sachs	0.05	0.50	1.50	3.00	4.50	7.00
IDC		0.53				
Morgan Stanley	0.06	0.74	2.56	5.47	8.39	11.84
Pioneer Consulting		0.76	2.37	5.48	9.04	12.46
Telechoice		0.58	2.11	5.10	7.66	9.57
US Bancorp Piper Jaffray		0.44	1.68	4.19	7.69	
Veronis, Suhler & Associates		0.20	0.60	1.00	1.50	3.50
Yankee Group				2.00		6.00
<b>eMarketer</b>	<b>0.08</b>	<b>0.54</b>	<b>1.84</b>	<b>4.08</b>	<b>6.62</b>	<b>10.95</b>

Source: eMarketer, 2000; various as noted

Telephone companies jumped into the ITV fray in the mid-90s but then withdrew in favor of broader telecommunications offerings, internet strategies, and merger and acquisition activity. Recently U S West has been touting a DSL-based "full service" in Phoenix that delivers high-speed access, several digital video channels and additional voice services. U S West accomplishes this by installing fiber nodes very close (about 1,000 feet) to users. SBC reportedly has similar plans.

## D. Digital Broadcasting

By virtue of being granted digital spectrum by the federal government, broadcasters have an extraordinary digital distribution stream in their possession. In the past several months, plans have surfaced to aggregate stations' spectrum for digital services, most of which currently focus on delivery of PC-oriented internet services but by extension could serve the TV as well.

As of 1 May 2000, there were 126 stations broadcasting in digital in 49 markets, comprising 62.74% of the United States, according to the National Association of Broadcasters. But the service has caused headaches for many stations. While broadcasters have been spending money to retrofit their stations, only 200,000-plus digital TV sets have sold. Digital broadcasting therefore has been stuck in a classic chicken-or-egg dilemma with neither distributor nor product able to drive the service.

Adding to this dilemma are repeated arguments that the digital broadcasting technical standards are inferior and must be changed. All of this is occurring under the watchful eye of government regulators, some whom have grown weary that the spectrum allocation is not being used for its original intention: high-definition television. The latest line from Washington, however, is that key regulators are okay with the so-called "digicasting" plans.

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If the new digital broadcast services are able to generate consumer interest, they can help fuel the mix of available digital products and offerings. Additionally, they can provide new options for advertisers. Here is how Next Century Media foresees the future environment for advertisers.

<b>Future Environment for Advertisers, 2000-2005</b>						
	<b>2000</b>	<b>2001</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>
Total US HHS	99,851	100,710	101,576	102,449	103,330	104,198
Digital Satellite HHS	8,000	9,000	10,000	11,000	12,000	13,000
% of Satellite HHS	8.0%	8.9%	9.8%	10.7%	11.6%	12.5%
Digital Cable HHS	8,300	14,300	20,300	26,300	32,300	38,300
% of Cable HHS	8.3%	14.2%	20.0%	25.7%	31.3%	36.8%
Digital Broadcast HHS	300	1,000	3,000	6,000	12,000	18,000
% of Broadcast HHS	0.3%	1.0%	3.0%	5.9%	11.6%	17.3%
Avg. HDTV Set \$	\$1,200	\$500	\$450	\$400	\$350	\$300
HDTV Prog./Week	70	150	250	500	750	1,000
HDTV HHS	270	900	2,700	5,400	10,800	16,200
% of HDTV HHS	0.3%	0.9%	2.7%	5.3%	10.5%	15.5%
Internet TV HHS	6,950	11,750	17,050	23,100	30,400	37,700
% of Internet TV HHS	7.0%	11.7%	16.8%	22.5%	29.4%	36.2%
Total Digital HHS	14,375	20,225	26,725	33,725	42,225	50,725
% of Total Digital	14.4%	20.1%	26.3%	32.9%	40.9%	48.7%

*Households in thousands. Source: Next Century Media, from Cablevision Blue Book, 12/99*

## E. Consumer Electronics

Following the explosion in personal computers, digital technologies are spurring new consumer electronics devices that are providing interactive TV functionality.

The device that's gotten the most attention recently is the personal video recorder, from providers TiVo and Replay. DFC Intelligence forecasts that revenue from personal video recording will generate \$1.1 billion by 2005.

The rollout of digital set-tops could be increased if consumer electronics manufacturers, computer manufacturers and retail outlets decide to step up the sale of such devices at retail. Retail set-tops, which are being largely forestalled while technical standards and regulatory issues are cleared up, could provide a combination of digital cable, high-speed internet access and interactive features. Digital TV sets also could have such enhancements built in.

Sales of standard-definition digital TVs and high-definition sets have been moving at a snail's pace due to high-prices and lack of public buzz over digital broadcasting. The Consumer Electronics Association contends sales have picked up; at the end of April, it said total factory-to-dealer sales of DTV sets stood at 202,586 and that March sales of 24,332 sets marked an increase of 7% over February. Provided that industry players can work out differences over standards, digital and HD sales are expected to grow substantially.

**Advanced TV Set Market, 1999-2003, (Millions)**

	1999	2000	2001	2002	2003
SDTV/HDTV Capable Set-Top Box Households	-	-	0.1	0.5	1.1
SDTV/HDTV Capable Set-Top Box Units Sold	-	-	0.1	0.3	0.7
Standard-Definition TV Households	0.1	0.2	0.7	1.8	4.0
Standard-Definition TV Units Sold	0.1	0.2	0.4	1.1	2.2
High-Definition TV Households	0.1	0.2	0.3	0.7	1.1
High-Definition TV Units Sold	0.1	0.1	0.2	0.3	0.4
Total (Converters & TV's) households	0.2	0.4	1.1	3.0	6.2
Total (Converters & TV's) Units Sold	0.2	0.3	0.7	1.7	3.3

Source: Forrester Research, 1999; from *Cablevision Blue Book*

Convergence is blurring the lines between in-home devices and creating new multimedia options. IDC, an information technology market researcher, foresees a market of "Net TV" devices, including set-top boxes, enhanced TVs and cable boxes, that will reach a worldwide installed base totaling 81.2 million by 2004. Other "Net-appliance" devices set to explode, according to IDC, are game devices like PlayStation 2, to reach a predicted install base of 85.7 million worldwide in 2004, and "Net-smart handheld," to hit 67.4 million in that timeframe.

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**Worldwide Information Appliance Shipments (Millions)**

Type of Device	1999	2004	CAGR 1999-2004
Net TVs	6.10	17.80	23.8%
Net Screenphones	1.10	3.60	26.8%
Net Gaming Devices	2.00	22.60	62.4%
eMail Terminals	0.10	4.60	115.1%
Web Terminals	0.01	6.50	304.5%
Net Smart Handhelds*	1.70	33.20	81.2%
Other	0.01	0.69	133.2%
Total Appliances	11.02	88.99	51.9%

\*Includes Smart Phones. Source: IDC, 2000

The market for home entertainment devices, including TV set-top boxes, handheld computers and gaming consoles is growing dramatically. This market will grow from 11 million units shipped in 1999 to 89 million units in 2004, according to IDC. This increase in shipments will result in an increase in revenues from \$2.4 billion in 1999, to \$17.8 billion in 2004, or a compound annual growth rate (CAGR) of 49.3%.

**Sales of Home Entertainment Devices, 1999-2004 (Millions)**

**Units**

**1999 11**

**2004 89**

**Revenues**

**1999 \$2.4**

**2004 \$17.8**

Source: IDC, 1999

## F. Satellite Services

As noted earlier, direct-broadcast satellite providers DirecTV and EchoStar are moving to provide various ITV and internet-access options. If cable or others lag, it's possible that satellite services may ultimately become ITV's savior in the years to come. Developers who favor ITV services over cable counter that the laws of physics will limit the satellite service's two-way communications capabilities, but they could prove to be an attractive option for consumers.

According to the Carmel Group, by early this year, satellite providers such as DirecTV and EchoStar will have beaten cable providers to the punch by providing advanced interactive capabilities to its subscribers. By the end of 2000, the Carmel Group forecasts that satellite providers will have 5 million subscribers signed on for services, compared to 4 million for cable modems. By 2003 DBS operators will provide services to 9.3 million subscribers, compared to 7.8 million for cable modems.

### Satellite vs. Cable Modem Subscribers, 2000-2003 (Millions)

#### Satellite Subscribers

2000	5.0
2003	9.3

#### Cable Modem Subscribers

2000	4.0
2003	7.8

Source: Carmel Group, 2000

