

# A NEW TELECOMMUNICATIONS WORLD



Lawrence K. Vanston, Ph.D.

**TECHNOLOGY  
FUTURES INC.**

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WORLD**

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*Lawrence K. Vanston, Ph.D.  
Technology Futures, Inc.*

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13740 Research Boulevard, Building C

Austin, Texas 78750-1859 U.S.A.

(800) 835-3887

(512) 258-8898

Fax: (512) 258-0087

[www.tfi.com](http://www.tfi.com)

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## INTRODUCTION AND SUMMARY

The telephone network was built to provide narrowband voice service to essentially every home and office. This massive, dedicated network required hundreds of billions of dollars of investment in telephone plant comprised of metallic and fiber cable, switching equipment, and various types of circuit equipment, not to mention buildings, poles, conduit, trucks, etc. For the local exchange industry this investment amounted to \$411 billion at year-end 2006.<sup>1</sup> Some of the cable investment has been in place for decades, and some switches and circuit equipment have lasted a decade or more. Market share was almost 100%. Quality of service was high. Revenue kept growing, investment was continuous, profits were dependable, lives were long and the property was easy to find...ideal from a tax revenue perspective.

That world is disappearing.

The reasons include:

- ❖ The dramatic decline in narrowband access lines due to competition from cellular, cable telephony, and VoIP (voice over Internet protocol), as well as broadband replacing dialup Internet access.
- ❖ The resulting imperative by telephone companies to offer bundled phone, television, and broadband service to compete with their rivals from the cable television industry.
- ❖ The demand for new interactive video and television services, and the demand for much higher broadband data rates than DSL can provide.
- ❖ The rapid rollout of new networks such as AT&T's Project Lightspeed or Verizon's FiOS, which meet these demands via state-of-the-art fiber optics technology.

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<sup>1</sup> FCC, ARMIS report.

- ❖ The absorption of voice into integrated Internet applications, so that voice becomes less of a standalone service.

Research and forecasts from recent TFI studies for the telecommunications industry quantify these trends<sup>2</sup> and indicate that these changes are happening very rapidly as discussed herein.

The implications of these developments for property valuation are profound and will require serious adjustments by the property tax community. These implications include:

- ❖ Shorter depreciation lives for existing and new property.
- ❖ Sharply diminished value of existing property.
- ❖ Shorter life-cycles for new property, approaching that of computers in some cases.
- ❖ Potential reclassifications of industry type, e.g., telecommunications to video.
- ❖ Entirely new providers of telecommunications such as Google.

## CONVERGENCE

Convergence is happening in so many ways and so fast that it is hard to keep track of. Figure 1 shows three important types of convergence impacting telecommunications companies. First, there is the convergence of voice, data, and video. As we shall see, this is more than the "triple-play" of carrying all three on the same facilities or putting them on the same bill; ultimately, it involves all three becoming simply applications on the broadband Internet. The boundaries between wireless and wireline are also beginning to dissolve, not just with the "quadruple-play" that adds wireless to the bill, but also with using

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<sup>2</sup> L. K. Vanston, *Broadband Equipment Lives for Local Exchange Carriers* (Austin, TX: Technology Futures, Inc., 2007); L. K. Vanston, *The Conversion of Narrowband Access Lines to VHS Broadband Facilities: Analyses & Forecasts* (Austin, TX: Technology Futures, Inc., 2007); and L. K. Vanston and R. L. Hodges, *Transforming the Local Exchange Network: Third Edition* (Austin, TX: Technology Futures, Inc., 2006).

wireless broadband to access the same Internet content regardless of location or device. Third, computers, handsets, and consumer electronics (TVs, VCRs, CD players, etc.) were once distinct devices in their own right. Now, people watch TV or listen to music on their computers or their cell phones, with the Internet, or at least Internet technology, playing the key communications role. In summary, the common convergence point for voice, data, and video, wireless, or wireline, regardless of device, is the broadband Internet.

The significance of convergence is truly driven home when we consider the convergence of content. Consider each item listed in Figure 2 and how far we have gotten in the transition from traditional standalone content to computer/ Internet-based content.

Figure 1  
Telecom Convergence

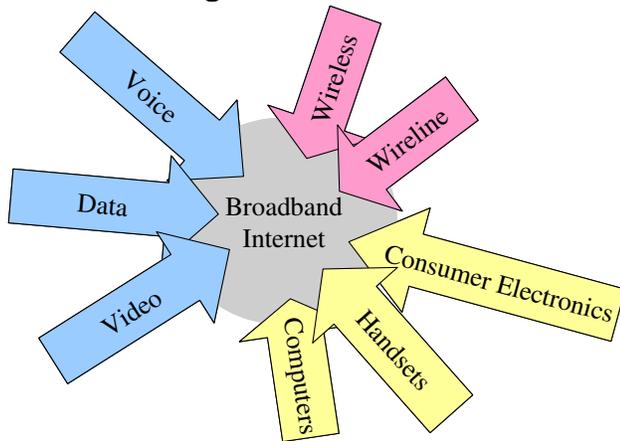


Figure 2  
Convergence of Content

How did you do these 5 years ago? How do you* do these today? In 5 years?		
• Photos	• Voice	• Documents
• Music	• Location	• Information
• Text	• Games	• Sensors
• Messages	• Newspapers	• Transactions
• Images	• Magazines	
• Personal Video	• Books	
• Movies	• Journals	
• TV	• Brochures	
*or your kids or grandkids!		

## THE DRAMATIC DECLINE IN NARROWBAND ACCESS LINES

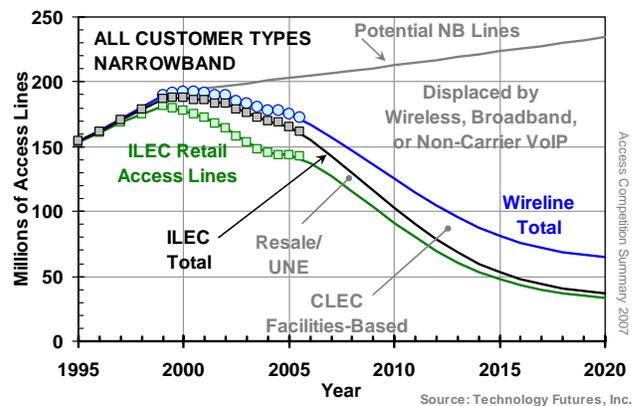
Nationwide, the loss of ILEC narrowband access lines due to competition from wireless, broadband, cable telephony, and VoIP has been dramatic. As illustrated in Figure 3, since the peak in 2000, ILEC access lines (including resale and UNE) have fallen from a high of 187 million in 2000 to 161 million at mid-year 2006.<sup>3</sup> The total is forecasted to fall further to 98 million by 2010 and 45 million by 2015. This is the ILECs traditional core business – landline access lines.

The figure shows the decline has two main components:

- ❖ The substitution of wireline narrowband access (both ILEC and CLEC<sup>4</sup>) by wireless, broadband, and non-carrier VoIP.
- ❖ Facilities-based CLECs capturing wireline market share from ILECs.

Each of these components is discussed below.

Figure 3  
Narrowband Access U.S. Industry



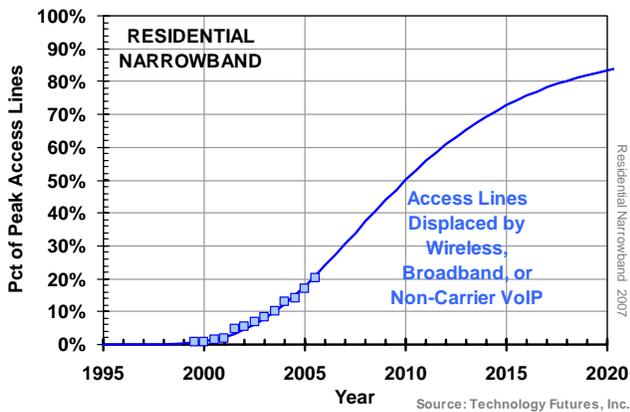
<sup>3</sup> FCC, *Local Telephone Competition: Status as of June 30, 2006*.

<sup>4</sup> Competitive local exchange carrier. CLECs include fiber optic access providers and cable television companies offering telephone service.

## SUBSTITUTION BY WIRELESS, BROADBAND, AND NON-CARRIER VOIP

The first component in the decline of ILEC narrowband access lines, substitution by wireless, broadband, and non-carrier VoIP, is isolated in Figure 4. (By broadband competition, we mean the decline in wireline access lines caused by broadband users dropping second lines that were used for dialup Internet access.) The figure plots the percentage of access lines captured by these technologies, both historical and forecast. The forecast is based on a standard S-shaped substitution model of how a new technology (in this case, several new technologies together) replaces an old technology in the market.

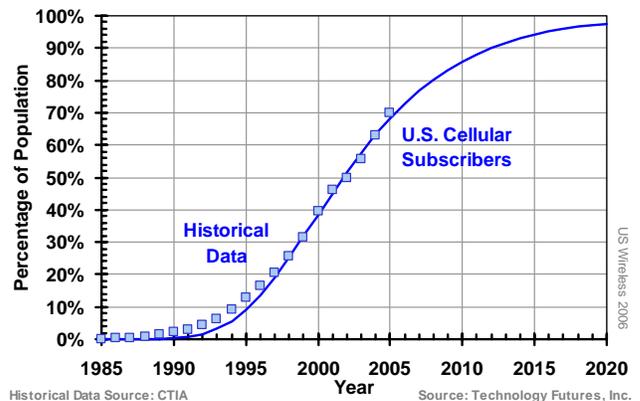
Figure 4  
Residential Narrowband Access Lines Displaced by Wireless, Broadband, or Non-Carrier VoIP



The most important replacement technology is wireless, that is, cellular telephony. Cellular continues its rapid penetration as shown in Figure 5, reaching 70% of the population in 2005. Flat-rate cellular pricing plans, large buckets of free minutes, large free calling areas, and free long distance plans have encouraged people to rely on their cell phones to the extent that many have abandoned their landline phones. The historical trend is shown in Figure 6. Recently, the figure has been reported to exceed 10% of the adult population. Younger people are more inclined to use wireless only as shown in Figure 6. For 18 to 25 year olds, the percentage exceeds 20%! This will support a continued long-term wireless-only trend.

VoIP is beginning to rival wireless as a replacement technology for traditional wireline access lines. As noted below, cable television companies have already embraced VoIP. Apart from the cable companies, non-carrier VoIP is also having an impact. For example, Vonage had captured 2.2 million customers as of December 2006,<sup>5</sup> and peer-to-peer VoIP services, such as Skype, are growing rapidly. Skype, for example, had 171 million registered users worldwide as of March 2007.<sup>6</sup> Originally viewed as a cheap partial substitute for “real” telephone service, VoIP quality is much improved and, ultimately, may surpass circuit switching’s quality.<sup>7</sup> It will also be infinitely more flexible as voice becomes integrated with the Internet as we discuss later.

Figure 5  
U. S. Wireless Subscribers



## COMPETITION FROM CABLE TV CLECS

The second major component in the decline of ILEC access lines is competition from facilities-based competitors. For the residential market, these are mainly cable television companies such as Cablevision, Comcast, and Time Warner. As shown in Figure 7, cable telephony has captured 6% of wireline access lines as of mid-year 2006. For the first few

<sup>5</sup> www.vonage.com.

<sup>6</sup> Skype Press Release, *Celebrating 500m Downloads, Skype Has Offers, Goodies, Up Its Sleeve* (Luxemburg, March 15, 2007).

<sup>7</sup> This is because its bandwidth is virtually unlimited. Superior VoIP quality assumes that any residual technical problems with delay and jitter are overcome or are negligible.

years, only a few cable television companies offered voice telephony. These companies used traditional circuit switches. Now, most cable companies are offering voice telephony, and are mostly using the much cheaper VoIP technology. Thus, we expect the rate of penetration to increase rapidly as shown in the figure.

Figure 6  
Wireless-Only Market Share

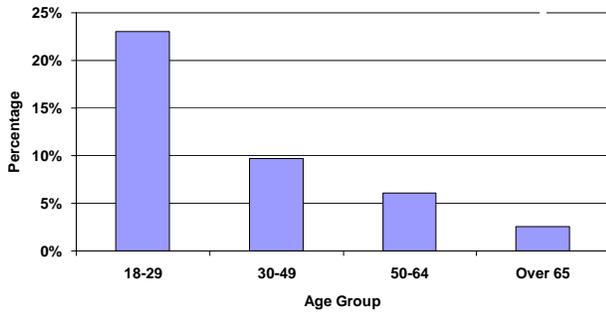
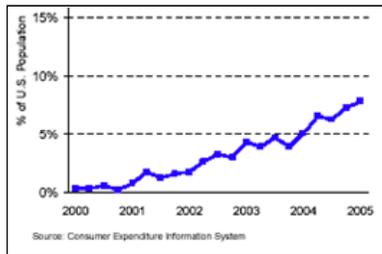
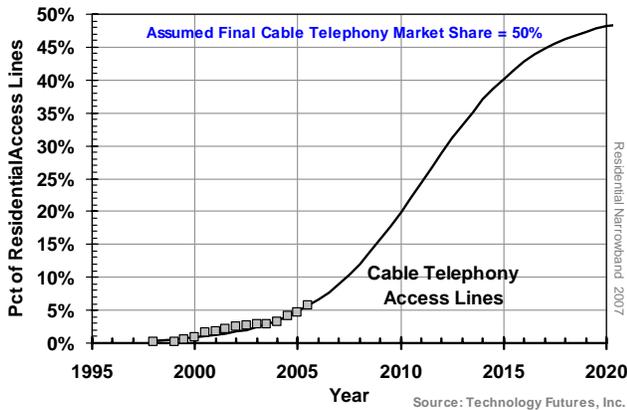


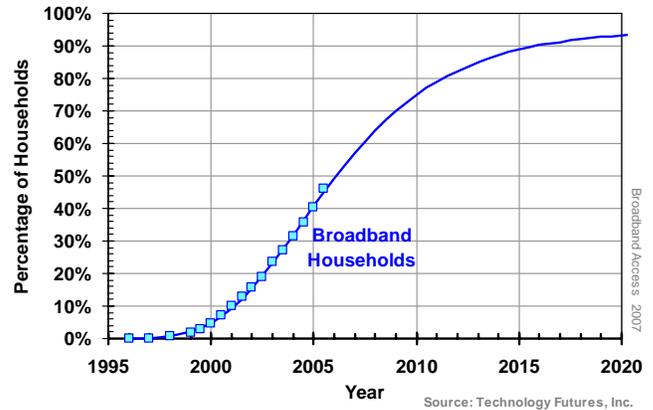
Figure 7  
Cable Telephony Market Share



## BROADBAND INTERNET ACCESS

As of June 2006, 46% of U.S. households subscribed to broadband services, up from 36% in June 2005.<sup>8</sup> Cable modems have a 57% market share, compared with the 42% market share of the telephone company (mostly DSL). Wireless broadband, including satellite broadband, comprises about 1%.<sup>9</sup> Broadband penetration in California is significantly higher than the national average (over 70% versus 46% as of June 2006). Our forecast, shown in Figure 8, anticipates continued broadband growth, with broadband following a classical consumer electronics adoption pattern, as illustrated in Figure 9, ultimately achieving ubiquity similar to telephony, radio, and television. (We assume an ultimate 95% penetration.) This reflects not only the rapid acceptance of broadband so far, but the prospect for it to serve as the basis for landline telephony, entertainment (e.g., video, music, and games), home offices, and other Internet applications.

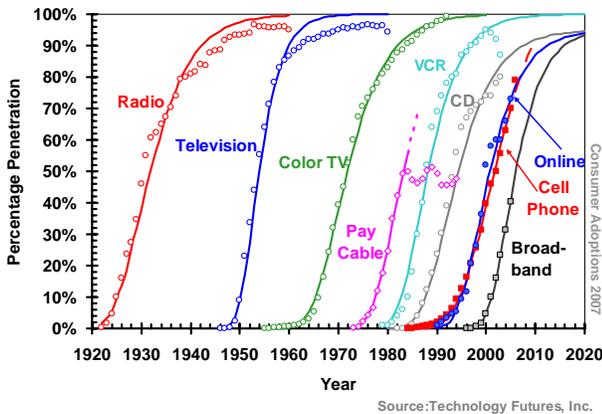
Figure 8  
Broadband Households



<sup>8</sup> FCC. This excludes mobile wireless broadband, which the FCC now reports, but it includes a small percentage of fixed wireless broadband.

<sup>9</sup> Estimated from FCC, *High-Speed Services for Internet Access: Status as of June 30, 2006* (Dec 2006), Table 3. Excludes mobile wireless broadband.

**Figure 9**  
Adoption of Various Consumer Communications Products and Services



**RESEARCH BRIEF**  
FROM THE CENTER FOR MEDIA RESEARCH

Wednesday, May 23, 2007

**Americans Spend Half of Their Spare Time Online**

According to Netpop I Play, a new report from Media-Screen, broadband users spend an hour and 40 minutes (48% of their spare time) online in a typical weekday, and more than half of that is spent accessing activities related to entertainment and communication...

Search engines and social networking sites are gaining in popularity, says the report, influencing an equal number of people as magazines and newspapers. 48% of younger users say they learn about new entertainment through community, review and video sharing sites and blogs. Only 25% say they learn about new entertainment through television.

Two online media activities - sending email and visiting Web sites for personal reasons - are more popular than watching television...

Source: Media-Screen and Netpop | Play 2006

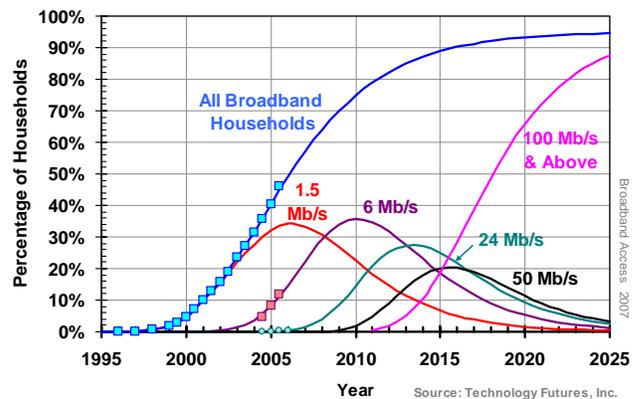
## INCREASING DATA RATES

Most residential broadband customers still use first-generation broadband, nominally 1.5 Mb/s, provided on either cable modems or DSL. Some customers are now demanding and being offered premium data rates, in the range of 5 Mb/s to 10 Mb/s via DSL, cable modems, or fiber. We have also begun the shift to much higher data rates in the neighborhood of 24 Mb/s. The next shift to even higher rates of 50 Mb/s to 100 Mb/s is still a few years off, although there are a few 50 Mb/s offerings to selected FiOS customers. TFI's industry forecast for the transition to higher data rates is shown in Figure 10.<sup>10</sup> Also shown

<sup>10</sup> The forecast reflects the assumption that the average data rate increases by 42% per year, the typical rate experienced with

is the early data for the 6 Mb/s and 24 Mb/s categories, based on recent FCC data on broadband technologies excluding cable modems.<sup>11</sup>

**Figure 10**  
U.S. Broadband Households by Nominal Data Rate, (Excludes Cable Modems)



**Figure 11**  
Trend in Residential Access Data Rates

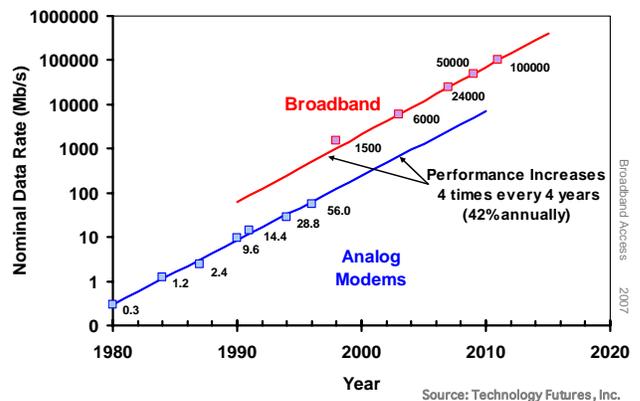


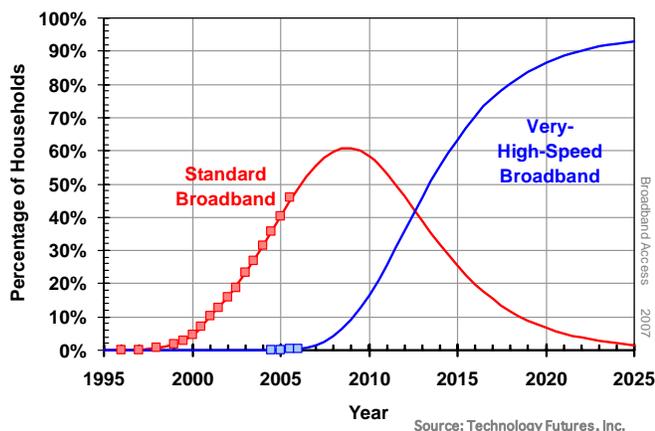
Figure 12 consolidates the data rate forecast into standard and very-high-speed (VHS) broadband

analog modems. This is roughly equivalent to quadrupling every four years or doubling every two years. It thus reflects Moore's Law, which implies that computer performance doubles every 18 months to two years (see Figure 11).

<sup>11</sup> Including cable modems would show a higher penetration of the higher data rates. We were not able to confirm how close actual experienced data rates over cable's shared medium are to the advertised rates reported to the FCC. For this analysis, which applies to ILEC assets, we decided to use the DSL and FTTH percentages only.

categories.<sup>12</sup> The distinction between standard and VHS broadband is very important from both a service and network perspective. From the service perspective, VHS is required to provide the Internet video applications discussed below, while standard broadband is sufficient for today's most-used Internet applications. From the network perspective, the shift to VHS requires new fiber-based architectures, such as Project Lightspeed and FiOS, while standard broadband can be provided on DSL (although network upgrades are often required to provide 6 Mb/s on DSL). Overall subscriber penetration cannot exceed availability (i.e., homes passed), and, in fact, there is a minimum availability to support a given level of subscribership. Figure 13 illustrates the minimum availability for 24 Mb/s service to support the subscriber forecast shown in Figure 12.<sup>13</sup>

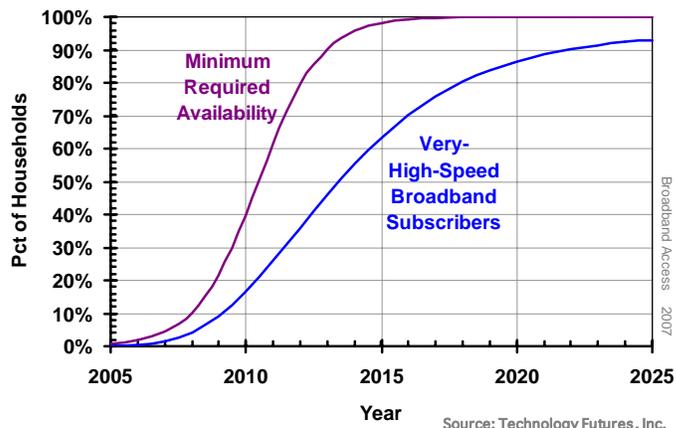
Figure 12  
Adoption of Standard and Very-High-Speed Broadband (U.S.)



<sup>12</sup> The standard curve is the sum of the 1.5 Mb/s and 6 Mb/s curves in Figure 2.5; the VHS curve is the sum of the 24 Mb/s, 50 Mb/s and 100 Mb/s curves in Figure 2.5.

<sup>13</sup> The quantitative relationship is based on analogies to other adoptions, specifically, cable television, pay cable, and pay-per-view. See L. K. Vanston, J. A. Marsh, and S. M. Hinton, *Telecommunications for Television/Advanced Television* (Austin, TX: Technology Futures, Inc., 1992), pp 123-144.

Figure 13  
Minimum Availability of Very-High-Speed Broadband



## FORECASTS FOR IP VIDEO

Video services are probably the key driver for the deployment of systems that support increased subscriber bandwidth. We distinguish between three basic types of IP video:

- ❖ *Online Video.* Video clips over the open Internet. YouTube is an example of online video. Picture size, resolution, frame rates, quality, and length are limited by bandwidth and other factors.
- ❖ *IPTV.* Carrier-provided television service, competitive with cable television, that uses IP technology to deliver programming over a dedicated broadband link to the customer.
- ❖ *Internet TV.* Television, either streaming or downloaded, over the open Internet. Like online video, but with TV-like performance and program length. Like IPTV, but the carrier only provides the broadband channel not the programming.

Online video is an exciting Internet application that has opened a whole new realm of video communications, production, and distribution. For example, 42% of online U.S. adults say they have watched a video on YouTube, and 14% say they visit the site frequently. Almost one in three (32%) of these frequent YouTube users say they are watching less

TV as a result of the time they spend there.<sup>14</sup> Figure 14 shows the trend in the percentage of broadband households using online video (of any type) at least once a month. The percentage is currently at about 60% and forecast to rise to 80% by 2010.

**HarrisInteractive**

**One-Third of Frequent YouTube Users are Watching Less TV to Watch Videos Online**

ROCHESTER, N.Y. – January 29, 2007 Few vehicles are as effective at reaching large segments of the population as television...Over four in 10 (42%) online U.S. adults say they have watched a video at YouTube, and 14 percent say they visit the site frequently. Almost one in three (32%) of these frequent YouTube users say they are watching less TV as a result of the time they spend there.

**CNNMoney.com**

**Teens can't name major TV networks**  
Online poll shows that most 16- to 18-year-olds can't identify the big four broadcasters, and prefer Web to TV in their free time.

May 16, 2006: 11:25 AM EDT

NEW YORK (CNNMoney.com) - Most teenagers can't name the four top television broadcasters, finds an online poll Monday.

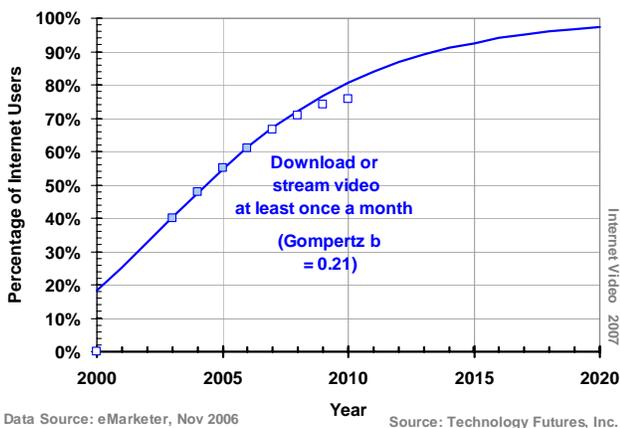
Almost 80 percent of 16- to 18-year-olds were unable to name the big 4 broadcasters, said Bolt Media.

Of the total audience, which ranged from 16 to 34 in age, 33 percent correctly responded with NBC, ABC, CBS (Research) and Fox.

A vast majority of respondents - 85 percent - said they spend their free time on the Internet, compared to only 69 percent who said they spend their free time watching TV.

**Fortune 500**

Figure 14  
Broadband Households Using Online Video at Least Once a Month



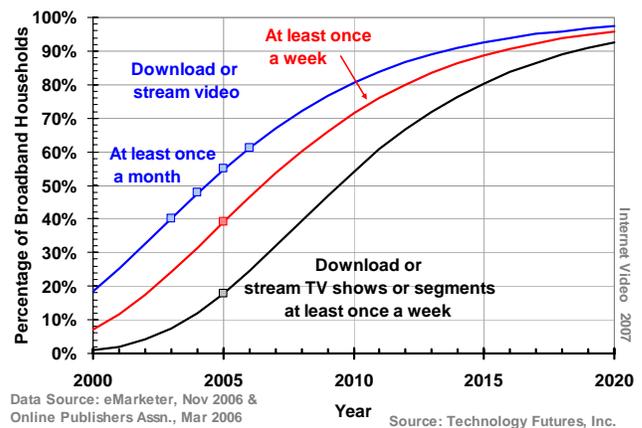
<sup>14</sup> Harris Interactive, *One-Third of Frequent YouTube Users are Watching Less TV to Watch Videos Online*, Press Release, Rochester, N.Y., January 29, 2007.

Online video is interesting not only in its own right, but also as a precursor for Internet television. It has proven that people want to acquire television programming via the Internet. Now, it is a question of bandwidth (i.e., quality) and digital rights management. Currently, about 25% of broadband households stream TV shows or segments at least once a week. If it follows the same trend as online video, we would expect the level to reach 50% by 2010 and 80% by 2015, as shown in Figure 15.

IPTV is both a way for ILECs to compete with cable television service using limited bandwidth and a new service that can offer features and performance beyond that of normal cable television. IPTV is most important to those ILECs such as AT&T that are deploying fiber to the node which, unlike fiber to the premises, cannot deliver a standard analog RF cable television signal.

In the long run we expect the distinction between IPTV and Internet TV to blur, especially as the distinction between computers and televisions blur. Put another way, when people expect to watch TV on their computers and access the Internet on their TVs, they will have similar expectations regarding the delivery channel.

Figure 15  
Broadband Households Using Online Television at Least Once a Week



**CBS to offer programming free on the Internet**

MEDIA [statesman.com](http://statesman.com)  
**CBS to offer its programming free on Internet**  
 TV network announces partnership with MSN, AOL and others.

By Bob Keefe  
 WEST COAST BUREAU

Friday, April 13, 2007

In the television industry's latest major push into the Internet, CBS Corp. announced Thursday that it will make its programming widely available online for free to consumers willing to watch shows that come with commercials....The move...comes just a few weeks after NBC Universal and Fox broadcasting owner News Corp. said they were joining forces to similarly push their programming on the Internet. Other networks, including Walt Disney Co.'s ABC, are exploring similar moves.

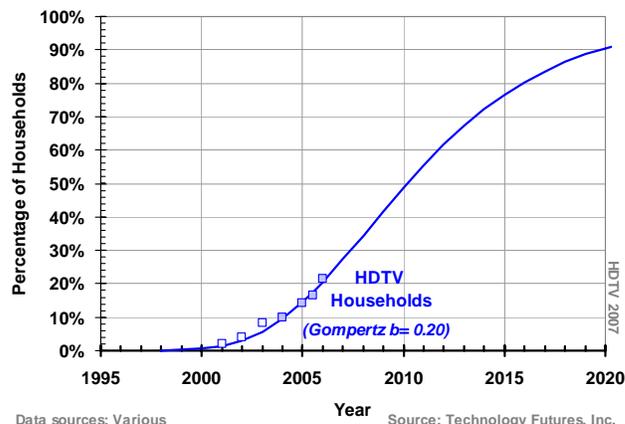
Though the vast majority of television viewers would prefer to watch shows on a television rather than on a computer, the TV networks' growing interest in the Web is another indication that the Internet is coming into its own as a place for video.

Misses the point re convergence

Fans of popular CBS shows such as, clockwise from top left, 'CSI,' 'Survivor,' 'Late Night with David Letterman,' and 'CBS Evening News with Katie Couric' will soon be able to watch them online. The TV network announced a partnership with MSN, AOL and others. [MORE](#)

CBS BROADCASTING INC.

Figure 16  
 HDTV Households

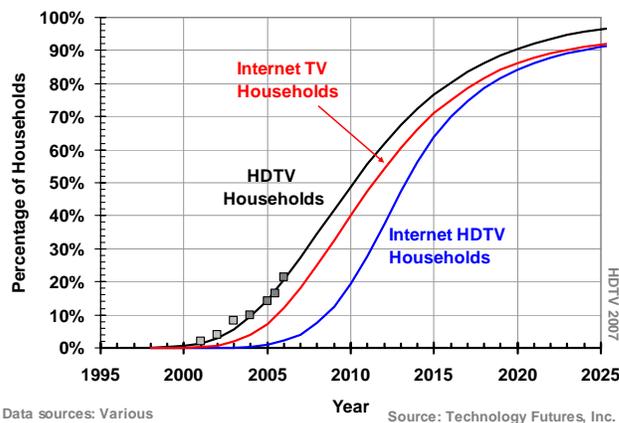


## HIGH-DEFINITION TELEVISION

High-definition television (HDTV) has now penetrated about 20% of U.S. households and is forecast to approach 50% by 2010, as shown in Figure 16. Although HD requires more bandwidth than standard video, it is obviously now a requirement for any competitive television delivery system. Ultimately, any video application, whether broadcast or online, will need to deliver HD. As entertainment—e.g., gaming, pay-per-view movies, and sports—continues to shift from broadcast to online delivery, HD will become as much a computer phenomenon as a television one.

As HDTV becomes prevalent, consumers will want to access HD programming via the Internet. Combining the Internet TV forecast and the HDTV forecast provides a forecast of Internet HDTV, as shown in Figure 17. According to this forecast, about 20% of households will use Internet HDTV by 2010 and over 60% by 2015.

Figure 17  
 Internet HDTV Households



**In-Stat White Paper**  
 In-Stat Predictions—2007

SKU: IN0603389WHT  
 Analyst: Research Team  
 +1.480.483.4440  
 December 12, 2006

**Featured 2007 Prediction!**

**High Definition TV Programming will Become Available Via the Broadband Internet**

In-Stat is predicting that more than 60 million households will have at least one wide screen, high-definition TV display in their home by the end of 2007. People who shelled out US\$ 2,000 for a great looking HDTV during 2006 will be willing to pay a few hundred extra for a high-end entertainment PC that connects directly to their HDMI-equipped HDTV display.

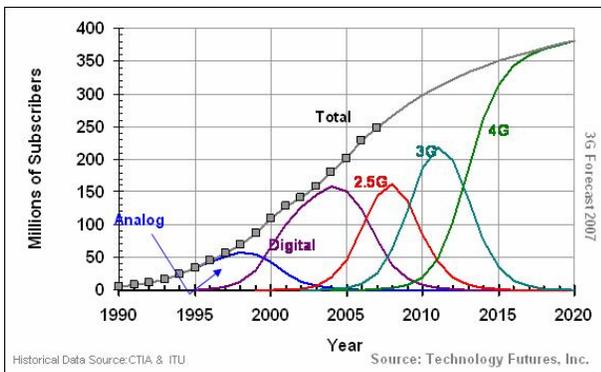
## WIRELESS BROADBAND

Wireless broadband allows users to connect to the Internet at speeds comparable to the low end of what is available with DSL and cable modems. It is coming primarily from two directions: the cellular telephone world and the wireless data world.

### CELLULAR 3G

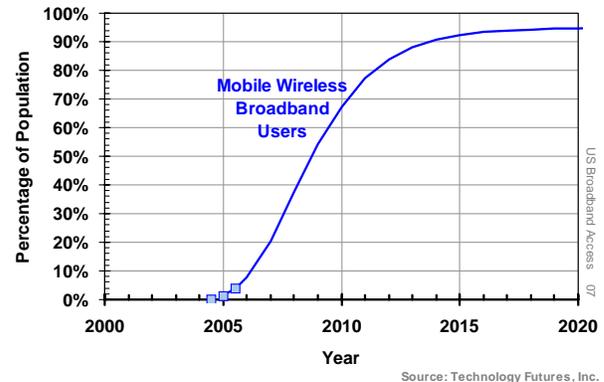
For the last decade, the cellular industry has been steadily upgrading from a voice-only network to a voice and data network with increasing bandwidth. Over this period, the cell phone has evolved from being a cordless telephone to a universal device for talking, texting, photos, videos, music, games, calculating, etc. As shown in Figure 18, there have been four major generations of equipment, with the most advanced generation being called 3G. The previous generation, 2.5G, enabled narrowband applications like picture sharing and downloading tunes, whereas 3G offers enough bandwidth (400 Mb/s to 700 Mb/s) to handle broadband applications. However, system capacity is lot less than DSL and cable modems, meaning that it cannot handle lots of customers using data intensive applications without bogging down. It also costs more \$60 per month, but it is mobile with lots of coverage, explaining its rapidly growing popularity (see Figure19). For example, mobile wireless data users increased from below one million in June 2005 to eleven million in June 2006.<sup>15</sup>

Figure 18  
Wireless Generations



<sup>15</sup> FCC, *Local Telephone Competition: Status as of June 30, 2006*.

Figure 19  
Wireless Mobile Broadband



### WIMAX

The other major wireless broadband technology is WiMAX, which was originally developed as an alternative way to provide broadband to stationary computers users.<sup>16</sup> For example, Clearwire, founded by in 2003 by Craig McCaw, of early cellular fame, offers service in dozens of mostly smaller markets for \$29.99 to \$49.99. It uses indoor antennas and off-the-shelf customer equipment, provides service up to 1.5 Mb/s, and, in most cases, competes directly with DSL and cable modem service. The biggest WiMAX player, at least for now, is Sprint/Nextel which controls the lion's share of the currently available WiMAX spectrum in the major metropolitan areas (85% of pops in the top 100 BTAs). Sprint/Nextel has committed to a new mobile version of WiMAX, called 802.16e, making it competitive with 3G cellular. (A glance at Figure 20 makes clear why it's the right choice.) With its gobs of spectrum (120 MHz in most areas), the Sprint/Nextel network will have much larger capacity than 3G. In fact, Sprint/Nextel is calling Mobile WiMAX "4G" in reference to the cellular generation that comes after 3G.

<sup>16</sup> For an analysis of the capacity and costs of WiMAX, see L. K. Vanston, *Assessment of Wireless Broadband as a Competitor to Wireline Broadband* (Austin, TX: Technology Futures, Inc., 2006)



Source: www.clearnet.com

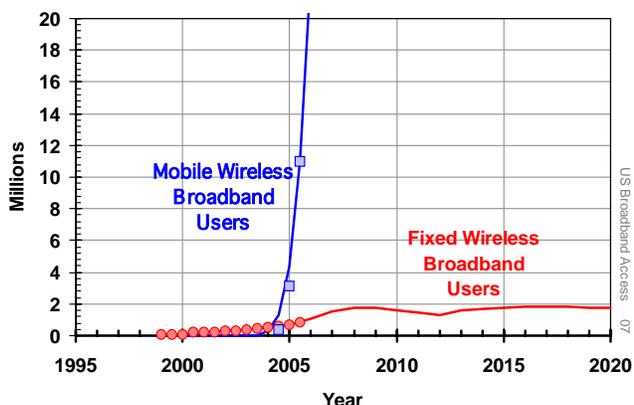
## INTERNET VOICE (VOIP)

VoIP uses Internet technology (packet switching) instead of traditional telephone technology (circuit switching) to make voice phone calls. There are several forms of VoIP. With one form, VoIP is used internally by the carrier (or carriers) offering what otherwise appears to be standard telephone service. For example, the digital telephone service offered by most cable companies uses VoIP. The carriers use this technology because it is more efficient, cutting the cost of switching by at least half compared to traditional circuit switching. Similarly, many enterprises are also adopting VoIP on their private networks. These developments make voice service cheaper and make traditional switching obsolete, but they won't change the world fundamentally.

Another form of VoIP, non-carrier VoIP, will change the world. Non-carrier VoIP includes peer-to-peer services like Skype that run directly on the Internet. It also includes voice services tied to instant messaging service such as MSN Messenger, AOL Messenger, Yahoo! Messenger Voice Chat, and Google Talk. Finally, there are any number of integrated applications including interactive games, unified messaging, help desks, net meetings. Although non-carrier VoIP can be used to make cheap calls, the real potential is in these integrated applications where voice is simply an element of a larger experience. An early application is eBay using Skype to connect bidders to sellers to ask questions about merchandise. We don't know whether that particular application will be successful, but it's a good bet that if it's not, others will be. VoIP makes voice part of the hyper-dynamic Internet world, subject to all the creativity, new ideas, and danger on an international scale.

Figure 20

### Why Mobile WiMAX?



Source: Technology Futures, Inc.

## APPARENTLY GOOGLE IS INTERESTED IN WIRELESS BROADBAND, TOO

May 23, 2007

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News of the Day

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TRANSITION NETWORKS

Google pitches idea on radio-spectrum auction to FCC

Google has proposed to the FCC that it allow a "real-time airwaves auction model" for the radio spectrum that the FCC will auction off. The Google model would allow a holder of a spectrum license to auction off unused spectrum to other bidders on a wholesale basis. As the basis for its proposal, Google said that in some cases only 5% of available spectrum was currently being used.

USA TODAY/Associated Press (5/22)

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### Integrated Applications - Examples

- Network-based meetings, including conference calls
- Unified Messaging
- Unified Help Desks
- eBay – contact seller
- Games, e.g., Counter-Strike
- A million other applications the Interworld will dream up



Further, this world is not limited to the wireline Internet, but to wireless as well, especially now that we have wireless broadband. Most wireless voice today goes through the normal voice channel controlled and switched by the cellular carrier. However, sophisticated enough handsets could do the equivalent of wireline non-carrier VoIP. Given that cellular carriers control much of the handset market in the United States, this may take some time. However, given that 3G communications are already being used in laptops and PDAs, and given the convergence of devices, it only that...a matter of time.

A precursor indicating the potential of marrying wireless, voice, and the Internet is an experimental directory assistance service by Google where users dial an 800 number to reach Google, which recognizes what they say and provides information on the businesses in the city that fit their criteria. It's not much of a leap from there to providing maps, directions, Web pages, or completing the phone call. Eventually, with VoIP, such a service could bypass the cellular carrier's voice service, or with WiMAX, cut out the cellular network completely.

Wireless, wireline, voice, data and video converge in this world. Call processing, including switching, is integrated with other Internet functions such as searching, Web browsing, messaging, gaming, etc. With VoIP and the broadband Internet, this can be done anywhere, including the server farms owned by the Yahoos, Microsofts, and Googles of the world.

**WSJ** THE WALL STREET JOURNAL

**Google Targets Voice Searches**  
*Service Helps Users Find Businesses, Rivaling Microsoft*  
 By DON CLARK  
 April 12, 2007; Page B3

Google Inc. appears headed for a battle with Microsoft Corp. and others over voice-based search technology, which can take the place of conventional directory assistance and offer new benefits for mobile-phone users.

The Web-search titan, based in Mountain View, Calif., released a free experimental service last week called Google Voice Local Search. It allows users to dial a number -- 1-800-GOOG-411 -- and search for businesses in specific cities, using technology that recognizes what callers say.

- Microsoft** to buy **Tellme Networks** Inc. specializing in services that combine voice-recognition technology with the Web...
- Yahoo** in January launched a cellphone-search service called oneSearch. Requires typing queries into handset browser or text messages. Spoken queries could eventually become an option
- Tellme**: test service lets users start with a spoken query, but display the results on their handset. Besides the name of a pizza shop, e.g., a user could instantly see a map to it.
- Google's** service, like the Web, works even if callers don't know the name of a business. A user can ask about a type of business, such as a coffee shop, and specify an intersection or ZIP Code. The service will read off a list of nearby businesses that fit the criteria.
- Google**: "having quick, free access to local business information over the phone may prove to be very valuable to our end users."

WSJ 4/12/07 p. B3

**The Googleplex**

- Best guess 450,000 servers spread over at least 25 locations worldwide tied together by a high-capacity fiber network.



Google Data Center at The Dalles  
 Source: The New York Times

## REVIEW

Let's review some of what we know about the probable telecom future:

- ❖ Narrowband access lines will continue to be stranded.
- ❖ Broadband will be ubiquitous.
- ❖ People will spend a lot of time online.
- ❖ People will watch lots of video and TV online.
- ❖ Most video will be HDTV.
- ❖ Users will need more and more bandwidth.
- ❖ Broadband wireless will become ubiquitous.
- ❖ People will use wireless handsets for everything.

- ❖ VoIP in its various forms will replace circuit switching.
- ❖ Voice will become just another Internet application
- ❖ Voice will become integrated with other Internet functions like searching, web browsing, messaging, gaming, etc.
- ❖ Internet entities, such as Google, Yahoo, and Microsoft, will play a larger role in providing communications.

This future means the following for providers of traditional telecommunications:

- ❖ Circuit switches are obsolete and have short remaining lives and marginal value.<sup>17</sup>
- ❖ Fiber optics will get closer and closer to the home, reducing the remaining life and economic value of metallic cable.<sup>18</sup>
- ❖ Other equipment will be subject to short life-cycles as bandwidth and other requirement accelerate to Internet speed. This includes DSL/VDSL electronics, packet switches, headend equipment, and customer premises equipment.<sup>19</sup>
- ❖ Cellular equipment will have to be continuously upgraded to keep up with bandwidth and mobility requirements.
- ❖ Broadband, including wireless broadband, will be extremely competitive, which will keep a lid on profits and revenue.
- ❖ Telecom providers must become television providers to make up for the lost telephony revenue, but they cannot become too dependent because traditional TV is being replaced too.

- ❖ Telecom providers face new players trying to skim off the most profitable parts of the traditional business such as voice, messaging, directory. A large portion of the new players' assets will be somewhere else.

Should this seem too negative, the bright side is that traditional carriers are making the investment that provides the lynch-pin in this future...broadband access. Thus, they are not likely to go away, but will become totally transformed in their infrastructure and business. Rapid obsolescence, driven by technology and intense competition from multiple sources, will make equipment lives very short. Telecom providers will face frequent replacement of current equipment and the continuous requirement for ever new investment dollars. It's a whole new world.

<sup>17</sup> L. K. Vanston, *The Conversion of Narrowband Access Lines to VHS Broadband Facilities: Analyses & Forecasts* (Austin, TX: Technology Futures, Inc., 2007) and L. K. Vanston and R. L. Hodges, *Transforming the Local Exchange Network: Third Edition* (Austin, TX: Technology Futures, Inc., 2006).

<sup>18</sup> *Ibid.*

<sup>19</sup> L. K. Vanston, *Broadband Equipment Lives for Local Exchange Carriers* (Austin, TX: Technology Futures, Inc., 2007).