

NEWS



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**GLOBAL
FTTX DEVELOPMENTS
FIBRE REACHING CLOSER
TO THE HOME
STATISTICS**

ICF NEWS

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COVER STORY:

GLOBAL FTTX DEVELOPMENTS

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STATISTICS

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NEW MEMBERS

We are very pleased to welcome OMAN CABLES INDUSTRY SAOG, Oman and KEI INDUSTRIES LTD., India as new members of ICF. More information about our new members can be found at www.omancables.com and www.kei-ind.com.

These recent additions to our membership (which now stands at 117) are a very encouraging trend. However there are still a substantial number of cable manufacturers in many regions of the world which the Council of ICF would like to see joining our Federation. The ICF Standing Commission has therefore been charged to develop proposals to make our Congress program even more attractive for participants and Council will review these proposals at the Rome Council meeting.

This initiative is regarded as being supplementary to our most efficient route to attract new members, i.e. current members convincing colleagues in their countries to enjoy the benefits of an ICF membership.

ICF CONGRESS 2007



As of the end of August 130 member delegates have registered for this year's Congress at the Hotel St. Regis from 2 to 6 October so we are expecting a slightly higher attendance than in Chicago last year. If you want to find out who you will be able to meet, log into our website under "congress" where we keep a register by name or company.

Renate and I look forward to seeing you in Rome and wish you a safe journey.

Thomas Neesen
Secretary-General

GLOBAL FTTX DEVELOPMENTS

FIBRE REACHING CLOSER TO THE HOME

Provided by CRU

INTRODUCTION

Growing Number of FTTx Subscribers

The wireless revolution has been underway for about 20 years, and the world now has more than 2.2 billion mobile cellular subscribers, compared with 1.3 billion main telephone lines in service. Except for early trials and small pioneering projects, optical fibre has been used to provide residential access services for less than 10 years. But now the world has about 12 million fibre-to-the-home (FTTH) subscribers and another 62 million subscribers served by fibre-to-the-building, fibre-to-the-curb or fibre-to-the-node (FTTN) systems. These architectures are collectively referred to as FTTx. The world's FTTx tally of 0.07 billion subscribers is therefore a small fraction – about 6% – of the 1.3 billion wire-line main lines. (These figures exclude CATV operations, which may use cable modems on hybrid-fibre-coax networks.)

Fibre Reaches Deeper

The use of fibre in telecom access networks is at an early stage, and the number of new FTTx systems being installed per year is accelerating. Furthermore, fibre is reaching deeper into the subscriber loop. Recent quarters have seen announcements from some of the world's major telecom operators saying that they have decided to take fibre all the way to the subscribers' premises rather than to a remote terminal or node that is shared by multiple subscribers.

A Wide Range of Drivers

Socioeconomic factors – how people live and work – are contributing to the demand for more bandwidth, which drives the demand for optical fibre. Many of the world's largest telecom markets have workforces that are shifting from manufacturing to information industries. These workers need faster connections for data, images, and increasingly video, in addition to voice telephony. At home, each user typically spends one to three hours per day on the Internet – the amount varies among countries. But the amount of time per month is increasing as users spend more time on-line for functions such as news, video entertainment, social networking, games, shopping, video-conferencing, education, security, banking and others.

Technical Developments

In addition to such workplace and lifestyle changes, there have been technical developments affecting the mix of fibre and copper in telecom network construction. These developments include:

- Maturing optoelectronics technology is reducing size, power requirement, and cost, while increasing reliability, bandwidth-times-distance performance, and ease-of-installation.
- Entertainment video is shifting from analogue to digital and from broadcast to narrowcast.
- Semiconductor integration has lowered the cost of remote electronics in telecom networks, as well as the cost of home electronics and premises networking.
- The price of fibre has dropped by more than 75% in the past six years, whereas the copper price has increased.

- Advances in display size and resolution, digital imaging, storage and processing are contributing to higher-bandwidth applications.

Double-Digit Growth in Cable Demand

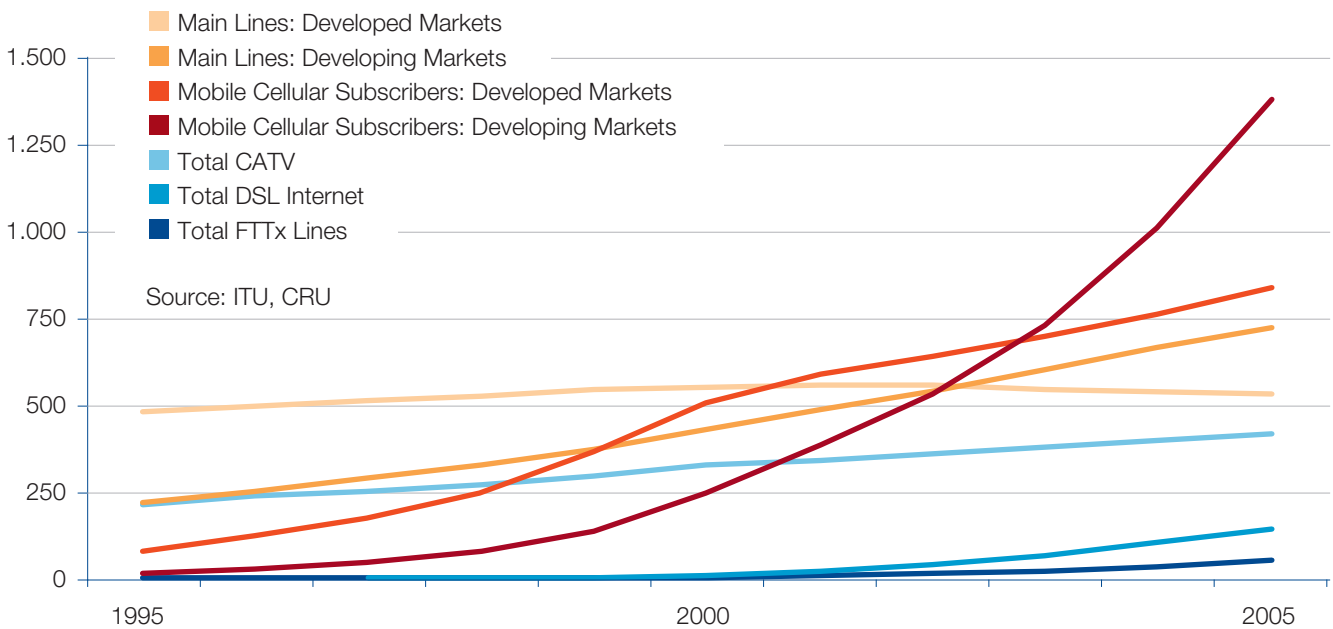
From a cable-manufacturer's perspective, one important upshot of these trends is that the worldwide market for fibre optic cable in FTTx applications exceeded US\$1 billion in 2006, up from US\$0.5 billion in 2003. About 80% of the FTTx cable market in 2003 was in Japan, but more rapid growth elsewhere had lowered this percentage to about 30% in 2006. Over the next five years, demand for fibre optic cable in FTTx applications will increase with a compound annual growth rate (CAGR) of about 25%, whereas the CAGR for fibre optic cable in other applications will be less than 10%. (Data are taken from two recent reports by CRU / KMI: North American Markets for Fiberoptics in Broadband Access Networks and Worldwide Markets for Fiberoptics in Broadband Access Networks.)

FUNDAMENTAL CHANGES

Telecom Markets and Economic Strength

The use of fixed line and mobile cellular telecom networks differs among markets in patterns that track with GDP, disposable income and other factors. One indicator, teledensity, or the number of subscribers per 100 population, is use-

TELECOM AND BROADBAND SUBSCRIBERS (MILLION)



ful for comparing countries. For example, Australia, Western Europe, the US, Canada, Hong Kong, Israel, Japan, Korea, New Zealand, Singapore, Taiwan and several other countries have teledensity greater than 40, and can be grouped into “developed telecom markets.” Using this criterion for separating worldwide markets into two broad segments, different trends can be seen for main lines and mobile cellular subscribers. In the chart above, the numbers of DSL and FTTx subscribers appear small, but their growth trajectory is stronger in terms of year-over-year percent change. The different indicators should not be interpreted as fully exclusive, or non-overlapping. That is, there are many customers that subscribe to more than one service, such as a fixed main line, a mobile cellular service, and a CATV service. The reason for plotting these indicators in this fashion is to show the trajectory and to highlight the relatively early status of FTTx.

Main Lines Decreasing in Major Markets

In some of the world’s advanced economies, fixed line telephony has been at a high level of household penetration for

decades. In the US, for example, 93% of households were local exchange carrier (LEC) subscribers in 2005. This percentage has actually decreased from a level of 96% in 2000. This situation is not unusual: advanced economies in Western Europe and North Asia are also exhibiting a decrease in fixed line telephone subscribers, from levels with more than 90% of households subscribing. For some LECs, the number of main line subscribers is decreasing at rates as much as 5% per year. This erosion is due to several phenomena:

- Residential customers discontinue use of additional lines, because they have broadband Internet service and no longer need a dedicated line for dial-up modem, or they no longer need a line for fax, or they no longer opt for additional lines for family members, who may rely more on cellular phones.
- Some customers cancel or decline fixed line service, relying solely on mobile cellular service (“cutting the cord”).
- Some users subscribe to services from companies that may not be included in the main line data, such

as voice-over-IP providers or CATV operators.

Mobile Growth is Strong but Slowing

The number of mobile cellular subscribers, on the other hand, is still increasing at double-digit annual growth rates, especially in developing markets. In the first half of 2007, for example, the number of mobile cellular subscribers in India has been increasing at rates of 6 million to 8 million new subscribers per month. The table on page 5 shows that mobile cellular subscribers increased with a CAGR of 42% in developing markets from 2000 to 2005. This growth rate will inevitably slow down in the next five years – it has to or mobile cellular subscribers would exceed world population!

Broadband Services Still in Early Stages

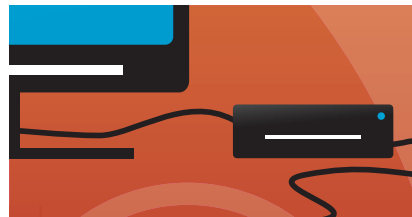
The annual increase in new DSL subscribers also is slowing down, from annual growth rates more than 100% in 2000 and 2001, to 40% in 2005 and 30% in 2006. FTTx is an even newer phenomenon than mobile cellular, and subscriber levels have been more than

WORLDWIDE TELEPHONE, WIRELESS AND BROADBAND

millions	1995	2000	2005	CAGR % 2000-05
Main Lines: Developed Markets	477	553	529	-1%
Main Lines: Developing Markets	214	426	721	11%
Total Main Lines	691	979	1250	5%
Mobile Cellular Subscribers: Developed Markets	77	500	83	11%
Mobile Cellular Subscribers: Developing Markets	13	240	1375	42%
Total Mobile Cellular Subscribers	91	740	2210	24%
Total CATV	210	323	415	5%
Total DSL Internet	0	6	139	87%
Total FTTx Lines	0	0,4	49	160%

Source: ITU, CRU

doubling on a worldwide basis in recent years. This growth also will slow down, because factors such as the cost and the rate of FTTx network construction will limit the number of new homes passed each year to a maximum figure in the tens of millions on a worldwide basis.



RULES ARE CHANGING

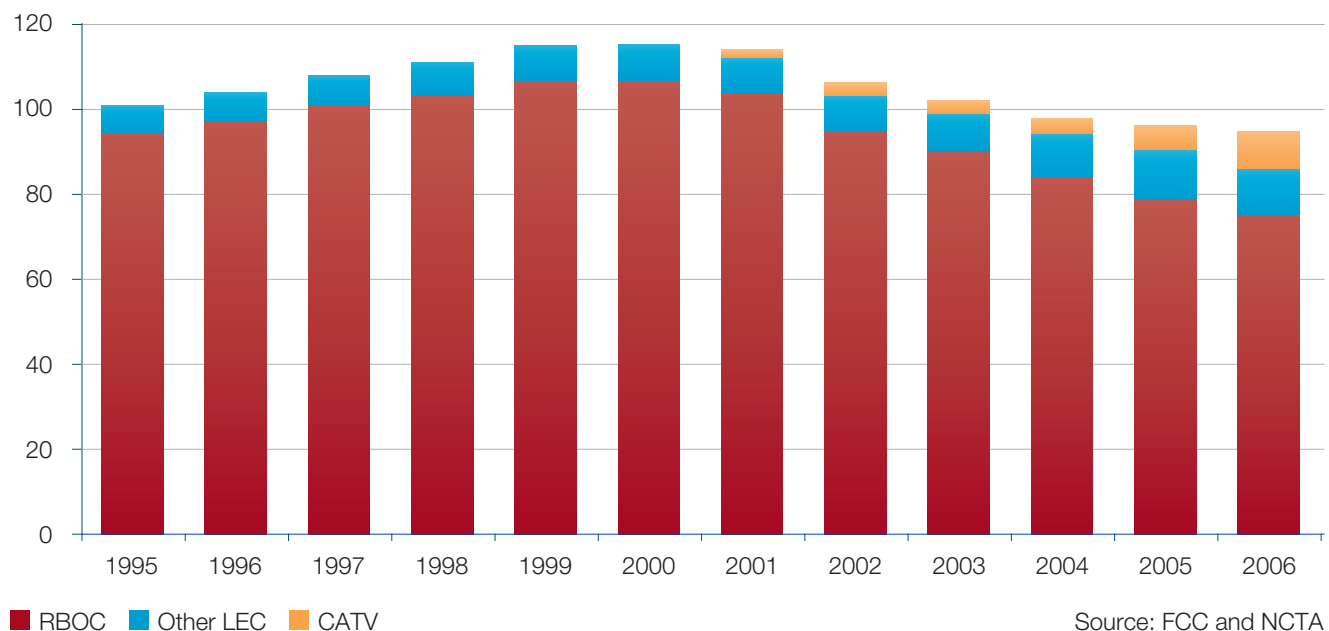
New Opportunities and New Competitors

Most of the world's developed telecom markets have undergone major changes in telecom policy in the last 20 years. Japan, the UK and the US, for example, began implementing new guidelines for competing carriers in the 1980s. Other markets have had legislation, white papers, or multi-national guidelines such as the EU policies, starting to affect them in the 1990s. From the perspective of incumbent LECs (ILECs), the new policies may appear a double-edged sword: the carriers have to contend with new competitors, in many cases leasing their facilities to them at rates determined or approved by the regulators; but the policies also have given the incumbent carriers opportunities to enter new voice, data, and video markets.

Liberalisation trend Spreads

Telecom regulatory policies therefore can have a major effect on decisions as to where and how much to spend on fibre upgrades. The wave of regulation or

RESIDENTIAL ACCESS LINES IN US (MILLION LINES)



Source: FCC and NCTA

liberalisation is also underway in developing markets, but in many countries of Africa, Asia, and Latin America, the policy changes have been or are being phased in more recently, and there are fewer competing operators. Many of these markets also have lower teledensity, lower telecom revenues, fewer Internet users, and there is more limited opportunity for fibre-based network upgrades.

Incumbent Telcos Can't Stand Still

As noted previously, the number of fixed line subscribers has decreased in many advanced telecom markets because some customers are opting to use only mobile cellular and because some have defected from the phone company to another service provider. In the US, for example, the major CATV operators have begun offering voice service. The chart on page 5 shows the number of residential access lines for a group of about 50 of the largest US LECs, including the former Bell companies, the RBOCs, plus the largest independents. The figure also shows the residential customers that use a CATV operator for telephone service. By the end of 2006, the CATV operators

had signed up 9.5 million telephony subscribers, almost all of which had defected from a phone company to obtain a bundle of services.

Lacklustre Revenues from Voice Service

The decreases in the number of wireline subscribers have affected telco service revenues. The chart below shows revenues from local telephone service for the same group of ILECs – the RBOCs plus the major independents. The ILEC local service revenues have decreased from 2000 to 2005 with the same negative CAGR as the number of lines, -5%. The other set of columns represents the CATV industry's revenues from video programming and associated advertising. These revenues have increased, with a positive CAGR of 6%, from 2000 to 2005.

CATV Revenues Grow

The CATV revenues include fees for basic monthly programs, premium service, which includes pay-per-view and movie channels, and advertising. Revenues from CATV telephony, Internet, and other services are not included in this chart. It is important to note that the

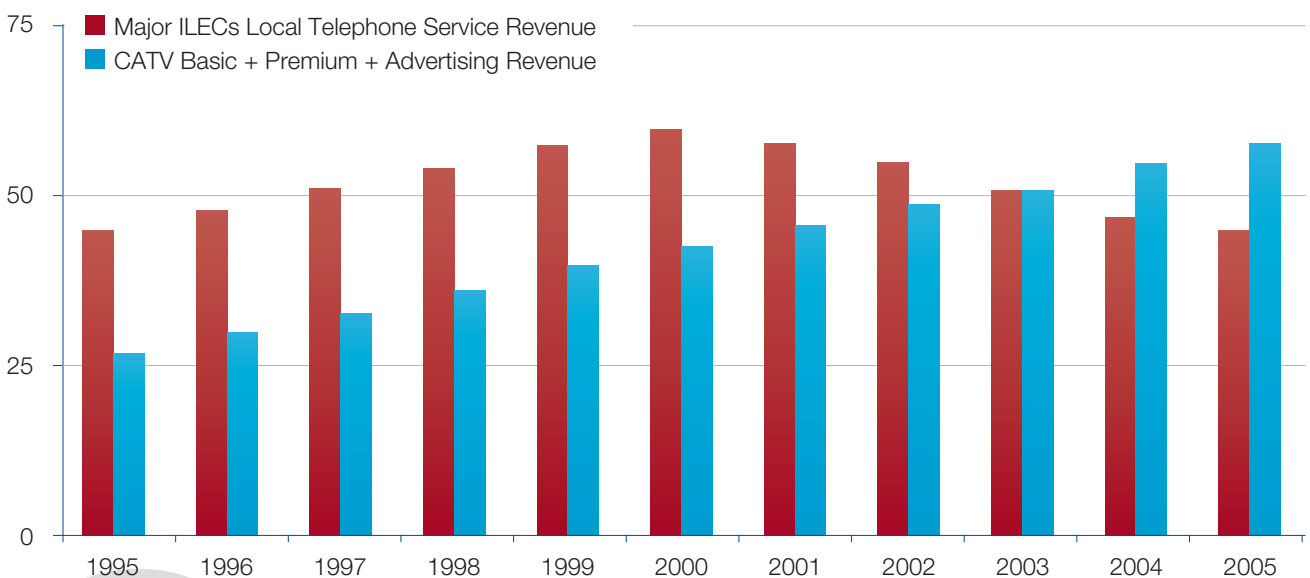
increases in CATV revenues shown in this chart were achieved without adding subscribers. The number of US households subscribing to CATV services has remained at about 66 million from 2000 to 2005. This figure therefore illustrates both a challenge and a potential opportunity for the incumbents: can the ILECs upgrade their networks, enter new service markets such as entertainment video, and sign up enough subscribers to achieve an attractive payback?

INTERNET ACCESS AND FIBRE

Broadband Internet Scales Up

Although local telephone revenues have been decreasing for the US ILECs, these companies have been able to maintain a fairly stable performance in terms of total revenues. This is because they have been able to offset declining local telephone revenues with increasing revenues in long-distance and Internet markets. The long-distance opportunity was realized

TELEPHONE SERVICE AND CATV REVENUES IN US (US\$ BILLION)



Source: FCC and NCTA

as the result of regulatory changes in the US, so ILECs in other markets may not have grown revenues in this fashion. The Internet revenues, however, have been increasing since the late 1990s as telecom carriers throughout the world have relied mainly on DSL technology to upgrade their customers from dial-up modems and establish a new line of business. The broadband Internet market has been estimated at US\$86 billion in 2006, up from US\$5 billion in 2001, according to the TIA. These figures are worldwide revenues from broadband services offered by all types of service providers, not only ILECs. In the US, for example, CATV companies offering cable-modem service had a larger share of the 2006 broadband Internet market than telephone companies, although phone companies have been adding a larger number of new lines with DSL and fibre optic systems in recent quarters. The US broadband Internet market was estimated at US\$27 billion in 2006.

DSL and Other Media

Most DSL systems use ADSL (asymmetric digital subscriber line) technology with the DSLAM (DSL access multiplexer) located in the central office. Data is transmitted entirely over twisted-pair copper cables to the customer. In cases where the copper pair's performance cannot support the required bandwidth, operators may situate the DSLAM between the central office and distribution areas – in a cabinet, hut, building or vault – the implementations known as fibre-to-the-node, fibre-to-the-building, etc. At the end of 2006, there were 182 million DSL subscribers worldwide, with more than 75% of them served with central-office ADSL systems (CO-ADSL). The remainder were served with various fibre-fed or, more recently, VDSL architectures. In addition to fibre optics, the other technologies used to provide broadband Internet service include cable-modems, broadband over power line, ISDN, and several types of fixed wireless systems.

What is Broadband?

If the opportunity to grow revenues is associated with new broadband serv-

ices, what exactly is meant by “broadband?” The US telecom regulator, the FCC, defines broadband as more than 200 kbps in at least one direction. Other regulators, operators, and organizations have proposed criteria ranging from 128 kbps to 1.5 Mbps, with 256 kbps being a commonly used minimum. This definition will distinguish a broadband line from dial-up modem service for Internet access, and it is consistent with the practice of most telecom industry participants that count ADSL lines as broadband.

Video May Be the Trigger for Fibre

If broadband can be achieved with DSL, why is fibre usage increasing? The interest in upgrading twisted-pair telecom networks with fibre is not only to provide broadband Internet service, but also to support a bundle of services that includes voice, Internet, and video. Furthermore, it is becoming increasingly common for carriers to offer subscribers a choice of different Internet access speeds at different monthly fees. The higher-speed services may prove attractive or cost-effective for customers who require higher data rates for telecommuting, playing games, or uploading and downloading videos.

IPTV Technology Attractive to Telcos

In addition to video programs being offered over the Internet, technology for IP (Internet Protocol) television has emerged as an alternative to the ubiquitous RF-based television, including over-the-air broadcast transmission and coaxial-based CATV service. IPTV technology gives many telecom operators an opportunity to offer new services and to compete with CATV operators. In the US, for example, CATV operators have been taking voice-telephony subscribers away from the phone companies by offering attractive triple-play packages. In response, phone companies recently have begun entering the video entertainment market using FTTH or FTTN with IPTV.

WHERE FIBRE MAKES SENSE

Various Scenarios for FTTx

Phone operators cannot build new fibre-based networks to enter the video market overnight. Both government and privately owned telecom operators have limited resources for such massive upgrades – capital, qualified staff, etc. But the bigger issue is whether future revenues can justify the cost. Despite the resource limitations, more and more carriers are deploying FTTx. Costs are decreasing and subscribers are showing increased willingness to change service providers or to pay more for an upgraded package of services. A key factor in the new revenues from broadband services has been the “triple play” package – a combined menu of voice, data, and video services. More recently, some operators are offering “quadruple-play,” which also includes mobile services.

FTTH Wins for Greenfield

The business case has improved to the point that many carriers believe that FTTH is clearly more cost-effective than fibre-fed (FTTN) or all copper loops in greenfield construction – areas of new housing developments. The situation is different in “brownfields” where houses, roads and infrastructure are already built and where customers are already served by other telecom networks. In such cases, the carriers have to evaluate whether or not the anticipated service revenues will justify the costs of upgrading with fibre.

No One-Size-Fits-All Solutions

The decision to upgrade copper telecom local loops to fibre in older brownfield situations depends on various factors, including the copper plant's age and performance, whether it is fully depreciated, network distances and density, the community's requirement for broadband services, and competitive factors that can affect market share and the revenue from broadband services. These competitive factors may also include the

regulatory requirements for sharing local telecom facilities. Because these factors differ not only between countries but also among cities or serving areas within a country, network operators around the world are pursuing different strategies.

FIBRE STRATEGIC ASSET

New Operators, New Types of Carriers

With large-scale programs underway by carriers such as NTT East, NTT West, Korea Telecom, and Verizon, the vast majority of homes subscribing to FTTH are served by ILECs. Until 2006, NTT East and West together represented a major percentage of the world's FTTH subscribers. On the other hand, there are hundreds of FTTH projects in service or under construction that are owned by electric-power utilities, municipal or local governments, real-estate corporations, competitive LECs (CLECs), or consortia of utilities, investors and local participants. Many of these non-ILEC operations are community based, often with less than 50,000 subscribers. The US, for example, had about 1.5 million FTTH subscribers at mid- 2007, of which Verizon accounted for two thirds. The remainder were served by more than 300 different operators, including independent telephone companies, utilities, municipalities, CLECs and real-estate developers. This means that the average number of subscribers for these community-based FTTH systems was less than 2,000. Of course, these numbers will change because many projects are still in construction and haven't nearly approached the targeted number of subscribers.

FTTH Can Attract New Residents

In the US there are several companies that work with real estate developers and communities to plan, design, install

and operate FTTH networks. One of these companies, Zoomy Communications, has estimated that about 50% of new homes in are in "master-planned communities," and 45% of those communities have owners or developers that want FTTH. Many groups are promoting broadband Internet access for a range of socioeconomic benefits, including education, health care, telecommuting, etc. These groups cite academic papers and survey data to show that broadband access networks are resulting in higher real-estate values, higher community tax bases, and more attractive environments for businesses and homeowners looking for new locations.

Fibre for Future Proofing

Another factor that carriers consider when deciding how to upgrade their networks' capacity is technical obsolescence. That is, how rapidly are bandwidth requirements changing, and how long will the new broadband or FTTx technology remain suitable? For more than a hundred years, this question was not an issue for the copper loop plant. The device at the end of a line – the telephone – was not undergoing major changes, at least not in terms of the bandwidth it used, and the capacity required for loop transmission was well understood. Since the Internet revolution began, operators have had to accommodate a much wider range of equipment that may be put on the end of the line. As a result, the bandwidth required can vary significantly from one subscriber to another. On average, the bandwidth requirement has shown a consistently increasing trend from dial-up modem rates of 3 to 56 kbps in the 1990s to xDSL and FTTx rates in the Mbps or tens of Mbps in the current decade. If the decision to build an all-fibre network is seen as risky, because the investment may not achieve adequate payback, then the decision to build a lower-capacity DSL or FTTN network may also be risky if the bandwidth proves inadequate and a second investment later becomes necessary.

HOW MUCH BANDWIDTH?

Digital Video is the Biggest Variable

Use of online video games, movie downloads, video conferencing, web-based television programs, video clips on social networking sites, and video-clip uploads and downloads (such as YouTube) are becoming increasingly widespread among Internet users. Digital video files in general represent an increasing percentage of backbone and access network transmission. And the requirements are changing rapidly as more consumers acquire high-definition (HD) TV sets and new video storage and on-premises networking products.

HDTV and IPTV Are Just Emerging

The phenomena of HDTV and IPTV are relatively new to consumers. Neither has been available long enough (or at prices low enough) to have penetrated more than a few percent of the world's 1.2 billion TV households. The leading markets, the US and Japan, had HDTV penetration in the range of 20% to 30% of households last year, according to estimates from electronics marketing firms. This suggests that these two countries had more than 75% of the world's HDTV households in 2006, with worldwide estimates ranging from 25 to 50 million households. The forecasts have worldwide penetration approach levels near 10% of TV households in 2011. About one-third of the world's TV households presently subscribe to some type of CATV service. The published estimates for the number of IPTV subscribers worldwide in 2006 are about 5 million – less than 1% of TV households and about 2% of CATV households. Forecasts for the number of IPTV subscribers in four or five years fall in a range of 70 to 150 million – again approaching levels near 10% of TV households.

Digital TV Provides a Moving Target

The currently low penetration figures for IPTV and HDTV do not mean that these

technologies have failed in the market. Rather, they mean that the growth is yet to come, and the bandwidth requirements for digital video may encounter a strong surge as more households adopt these technologies in three to five years. Transmission speeds needed to support HDTV depend on the compression technology. With MPEG-2 compression, an HDTV signal will require 15 Mbps to 20 Mbps. As of early 2007, MPEG-4 was not generally available, but estimates for streaming HDTV over digital channels ranged from 5 Mbps to 10 Mbps – about five times more than standard-definition TV.

Multiple HDTV Channels

The data on HDTV penetration into TV households suggests that there is potential demand for more than one simultaneous HDTV signal. Some households already have acquired a second HDTV set, and this percentage is expected to increase. There is also the possibility of subscribers seeking to watch one HDTV program while receiving and recording another, either in HD or SD. Thus, the bandwidth for simultaneous SDTV and HDTV channels is added together to determine the requirement per home in all digital networks.

Upstream Speed Also Important

In the table, Internet speeds are reported as the downstream bit rate. Upstream has a lower bit rate in many carriers' offerings. High users require higher-speed Internet for video editing, video conferencing, large-file downloads, high-end gaming, etc. The 10 Mbps proposed for high user require-

DOWNSTREAM BIT RATES FOR ALL-DIGITAL TRIPLE-PLAY

Video Services With MPEG-2 Compression			
	Mbps		Mbps
Internet (average user)	5	Internet (high user)	10
Telephony	0,1	Telephony	0,1
2 SDTV Channels	6	2 SDTV Channels	6
1 HDTV Channel	16	2 HDTV Channels	32
Total	27,1	Total	48,1

Video Services With MPEG-4 Compression			
	Mbps		Mbps
Internet (average user)	5	Internet (high user)	10
Telephony	0,1	Telephony	0,1
2 SDTV Channels	3	2 SDTV Channels	3
1 HDTV Channel	8	2 HDTV Channels	16
Total	16,1	Total	29,1

Source: ITU, CRU

ments may be conservative. High-end offerings from some carriers extend to 30 Mbps or 50 Mbps. Operators in Japan and Korea offer 100 Mbps services, and higher speeds are said to be under development. In summary, the near-term bandwidth requirement for all-digital triple-play might range from 16 Mbps to 48 Mbps per household. Some triple-play systems use less because they are not transmitting all the video applications in the digital bit stream. Verizon, for example, currently is using a second downstream wavelength channel to transport broadcast video services.

DIFFERENT APPROACHES TO BROADBAND

Key Questions for Service Providers

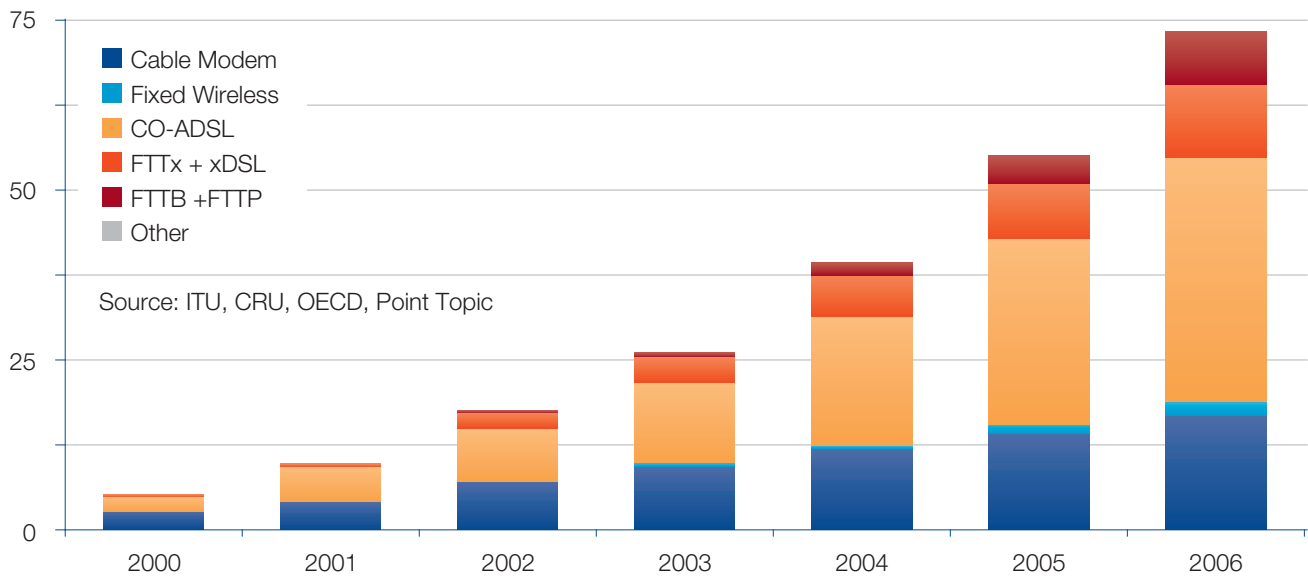
Of all the factors that affect the business case for fibre in broadband access networks, the competitive and regulatory factors are among the most critical. Are there government supports or incentives to promote broadband? Will the operator have to share facilities? If so, how are the rates determined and how will this affect revenue? Is there a well-established CATV industry or other competitor already offering broadband services? In addition, there are many market factors. What television viewing habits must be addressed? How many channels must be carried? How much will the consumers pay for TV or for Internet? Finally, there is a large group of network and infrastructure factors. What is the housing density? How long are the loops? Are there suitable rights-

BANDWIDTH FOR DIGITAL TV

bit rates per channel in Mbps	Range	Typical
SDTV with MPEG-2	2 to 5	3
SDTV with MPEG-4	1.5 to 2	1,5
HDTV with MPEG-2	15 to 20	16
HDTV with MPEG-4	5 to 10	8

Source: ITU, CRU

BROADBAND SUBSCRIBERS BY TECHNOLOGY (MILLION)



of-way for cable and equipment? Must the streets be dug up? How old is the existing copper plant, etc.?

FTTP v. FTTN v. FTTB

The result has been a range of approaches from aggressive FTTH deployment, as in the case of Verizon, NTT East, or NTT West, to more conservative strategies that patch together triple-play offerings by using existing facilities, including satellites for video services, as in the case of Qwest, Telstra, or Telecom Italia. When the approaches and the subscriber numbers for hundreds of network operators are added together by main technology, the result is shown in the column chart above, with fibre-to-the-premises (FTTP) and fibre-to-the-building (FTTB) representing 11% of all broadband access lines. The FTTP and FTTB subscribers also represent 2% of the world's wireline telecom subscribers.

US: AT&T Avoiding FTTP Expenses

AT&T executives have said consistently that they cannot justify the expense of FTTP. Verizon has come to a different conclusion, even though the two companies are governed by the same federal regulations and many of the same

state regulations. Both compete with CATV multiple system operators and CLECs in their major markets. The difference in approach reflects how they have weighed the expenses and the risks. AT&T has concluded that its FTTN architecture, used with switched digital video, delivers adequate bandwidth for the foreseeable future. In its June quarterly financial statement, however, AT&T reported only 50,000 subscribers to its U-Verse digital video service. Although AT&T has been building its FTTN networks for more than two years, the technologies it planned for IPTV took more than a year to get de-bugged and ready for mass deployment.

Australia: Haggling over Policies

The Australian government is eager to promote new investment in broadband access, especially for rural areas. In June, it awarded a consortium of operators other than the incumbent Telstra a license to deploy a network based on WiMAX technology, and it provided partial funding. Telstra has voiced its opposition to that award. A broadband license for urban areas will be subject to a separate decision, but the federal government will not provide financial support. Telstra has said it has designed

a nationwide FTTN network, but it has expressed concerns about unbundling requirements. This has led to contentious disputes over how much must be invested and how much is really at risk if other operators are able to pay wholesale fees to Telstra and resell broadband services to end-users. At mid-2007, the situation was at an impasse and pending federal ruling.

UK: BT 21CN But Staying with ADSL

In the UK BT has embarked on one of the telecom industry's most ambitious network upgrade plans (21CN) – spending about US\$20 billion to replace the circuit-switched network with an all-IP network. Milestones of this plan include:

- scrapping 6,000 central office switches;
- reconfiguring the fibre-based junction network;
- adding new core and feeder fibre optic cable routes;
- replacing exchanges with multi-service access nodes or aggregation units.

The result will be a core and access node network having 50 to 100 core-IP-router nodes and about 5,000 access nodes, all linked by fibre. But the plan as initially conceived is to retain twisted-

pair copper cable for the distribution and drop facilities, using ADSL2+. Like other incumbent operators, BT has been concerned that a FTTH program would be capital-intensive and might be subject to unbundling requirements, so that it would have to make the facilities available to competitors.

Bell Canada: Start with FTTN

Canada's ILECs compete with CATV operators and other LECs. The ILECs are experiencing access line erosion due to these competitors and also mobile cellular services. Canadian regulatory policies now allow the ILECs to enter video-service markets. As a result, Bell Canada, representing almost two-thirds of Canadian households and wireline subscribers, has formulated a plan to start with FTTN and upgrade to FTTH in subsequent years. The two-stage upgrade is designed to provide a rapid entry into video markets. The cabinets deployed at the FTTN nodes can later be re-used to upgrade the network with fibre-based PON systems. FTTN construction has been underway, with remote VDSL DSLAMs being installed in access nodes and buildings for the past two years.

Germany: Fighting EU Regulator

The world has been watching a dramatic battle over the unbundling requirements in Germany. The nation's incumbent telco, Deutsche Telekom, benefited when the German parliament acted in opposition to EU telecom policies late last year and passed a law that exempted DT's planned FTTN network from unbundling requirements. The EU has filed suit against the German government in the European Court of Justice. DT plans to spend about Euros 3 billion on a high-speed network, using FTTN / VDSL to offer IPTV in 50 cities. After deploying this technology in 10 cities, DT has shifted to ADSL2+. This represents a lower-cost alternative, but still allows DT to rollout IPTV services. The current strategy appears to be pursuit of new video customers, but with a smaller investment, while the regulatory uncertainties are being addressed. The

Court of Justice suit is scheduled for the latter part of 2007. Meanwhile, the German telecom regulator has tried to resolve the impasse: it has decreed that DT should allow competitors access to cable ducts in which fibre optic cables could be installed, and where space isn't available, DT would have to permit competitors access to existing cable. In the regulator's view, this approach would promote greater competition by allowing competitors to build their own access networks at a reasonable cost, but DT's response has been less than enthusiastic.



Slovenia: Aggressive Plans for FTTH

There are many cases that show it is not only the largest incumbent telcos that can justify FTTH. Telekom Slovenije, the incumbent operator in Slovenia, has said it will invest more than US\$600 million on a multi-year program to upgrade its entire nationwide network with FTTH,

using an active Ethernet architecture. The country has a population of 2 million and about 0.8 million access lines. The FTTH project is slated to reach 300,000 homes by 2010 and the remainder during the next decade.

US: Verizon in Hot Pursuit of Triple-Play

In 2003, the FCC ruled that FTTH projects would be exempt from unbundling requirements. The FCC's rationale for this ruling was a desire to stimulate investment in new broadband infrastructure. Verizon pursued FTTH construction most aggressively, ramping up to a rate of 3 million new homes passed per year from by 2006. Verizon has said it will continue building its network at this rate until 2010, when it will have passed 18 million homes. In the three years of construction completed so far, Verizon has achieved its construction targets on schedule, and it has consistently reported that the rate of subscribers to its FiOS service is meeting its expectations. In its Q2 2007 financial reports, Verizon said that it had passed the milestones of one million Internet data subscribers and a half million video subscribers. Currently, Verizon is signing up 2,600 new FiOS video subscribers per day.

CONCLUSION

Fundamental Changes Affect Copper's Role

Demand for twisted-pair copper cables in outside-plant telecom networks is being affected by two fundamental shifts. One is the spread of mobile cellular technology, which increasingly is being used as an alternative to wireline telecom rather than as an adjunct. The other dramatic shift is the spread of broadband Internet, with new services challenging the ability of copper wires to provide very high transmission speeds. The dominant technology for provision of broadband services at present is DSL over copper pair cables, but FTTH has been increasing in importance and the trend towards all-fibre FTTH networks is growing.



FIBRE REACHING CLOSER TO THE HOME

