

Network Operators Speak Out: The Challenges Associated with a Successful FTTH Deployment

Operators talk anonymously about the problems they face when building fiber, and the solutions they have evolved to get the job done right, and on budget.

By Bob Whitman ■ *Corning Cable Systems*

As an industry we have worked hard to convince the market that fiber to the home (FTTH) is an advantaged technology, has a positive business case, and is ready for mass deployment. With the success of FTTH deployments in Japan, Northern Europe and the US, it is clear we have been successful. By mid-2007 there were 9 million FTTH subscribers in Japan, 1.5 million in the US and 1 million in Europe. The investment commitments by NTT and Verizon have sparked FTTH innovation in products and technology, allowing other carriers worldwide to benefit from reduced costs, increased deployment efficiency and virtually bug-free equipment.

In the last few years we have seen a broadening of global broadband access construction as well as dramatic changes in attitudes toward FTTH. Of the 47 largest carriers around the globe, only a few were committed to deploying or trialing FTTH in 2004. These carriers covered less than 10 percent of access lines (Figure 1). By 2007 carriers representing more than 40 percent of access lines were either building or trialing next-generation fiber access networks.

In the US we are poised for continued FTTH growth due to a positive regulatory environment, evidence for

a successful business case, innovations that continue to lower the cost of deployment, the lowest operating cost of any broadband network and a growing list of consumer applications that drive bandwidth demand.

The growth of FTTH has been extraordinary. But like any new endeavor, unforeseen challenges arise as deployment evolves. Generally, network operators will address challenges immediately in front of them first, and work on the

harder or longer-term challenges over time. Getting the basics right first should be the focus of any new endeavor.

Industry efforts to promote FTTH initially focused on the hurdles associated with making the decision about whether or not FTTH was the right choice compared to other broadband architectures. The vendor community has helped solve many challenges in the deployment and turn-up of a new network. Now that the technology is well established, the focus needs to shift to network scaling and other challenges that deployers face with a new network.

For the most part equipment vendors can't help with the new set of challenges network operators face, but other network operators can. The difficulty in airing these challenges is that most net-

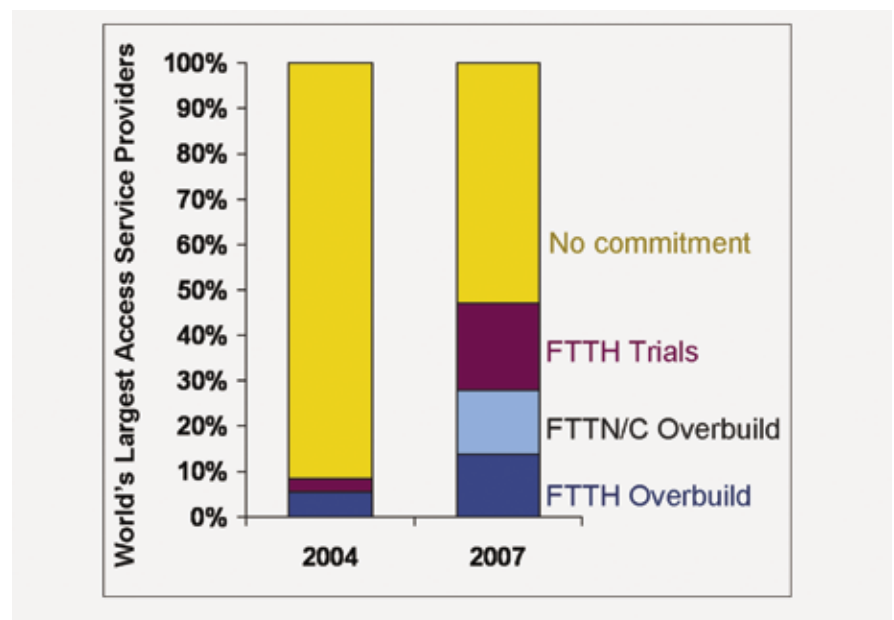


Fig 1. Growing carrier commitment to next-generation networks.

work operators are too busy deploying their new networks and fighting daily fires to spend time writing articles and speaking at conferences.

A compounding factor is that most operators don't want to talk about their challenges in public forums. But if we as an industry want the FTTH market to continue its success we have to get these challenges out in the open for discussion and debate.

In order to bring operational challenges to light, we have conducted anonymous interviews with network operators, infrastructure providers and service providers to insure openness. Operators represented in this article are big and small, public and private, with business models of both closed and open access. Common themes emerged among the challenges facing operators. The challenges can be grouped into several categories:

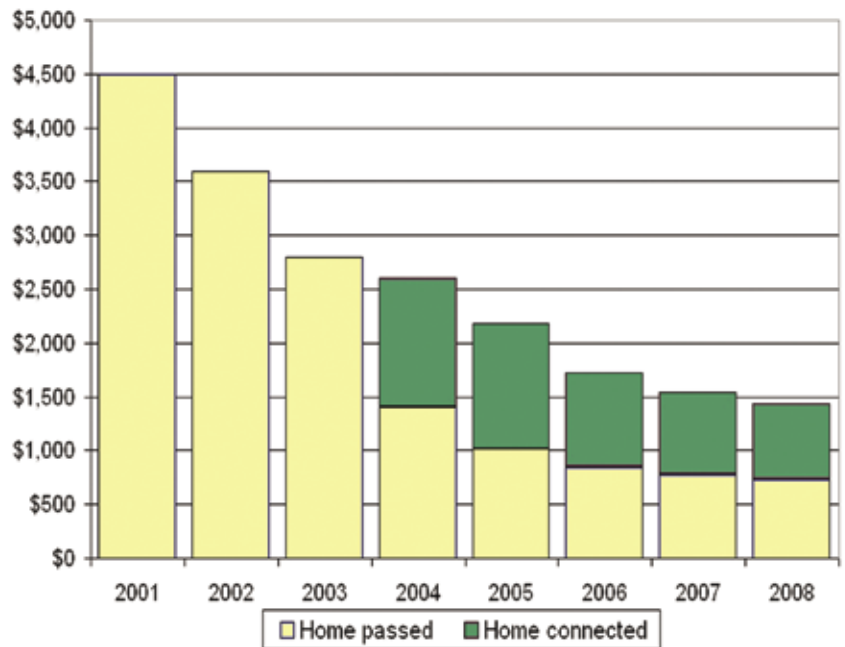
- Cash flow management
- Recruiting qualified personnel
- Scaling the operation of a new network
- Expanding to new locations or new network topologies
- Regulatory barriers

Cash is King

Regardless of company size or business model type, the resounding number-one challenge voiced is the management of cash flow, particularly in the case of successful deployments with higher-than-expected take rates.

While the cost of deploying FTTH has steadily declined, the first-installed cost on a per-home basis is significant (see Figure 2). The typical cost to pass a home today with FTTH is approximately \$800, while the cost to connect is an incremental of approximately \$750. This connect cost typically does not include ancillary electronic equipment such as set-top boxes, DVRs or wireless routers.

Depending on the services



Source: Render Vanderslice (2001-2003*) and Corning (2004-2008)

* No split for home passed and connected)

Fig. 2. Estimated cost for each home passed plus home connected.

requested by the consumer, the type and number of set-top boxes required and the choice of DVR, the cost outlay for these additional electronics can be several hundred dollars. While service providers typically charge monthly fees for each of the electronic "boxes," the payback period is long. Recovering the investment in equipment at each home may take several years.

In addition to the electronics costs, faster-than-expected penetration requires more trained technicians, instal-

lation equipment and trucks in order to maintain installation appointments acceptable to consumers. The last thing an operator wants after introducing a wonderful new fiber network is to disappoint the customer base with delays. Operators offering new services may only have one opportunity to unseat the incumbent, so it's important to get it right on the first try. According to market research firm RVA, penetration rates for FTTH projects range from a low of about 20 percent in the first few years of deployment

to typically 50 percent or more as deployments are completed. Understanding your market and modeling various penetration rates will help in planning for capital needs. If necessary, delay or limit service offerings by region to pace deployment with available capital. Miscalculating capital needs can be costly, resulting in higher interest rates or inability to raise more funds, depending on the operator.

New housing develop-

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Get the Basics Right First

FTTH technology is inherently advantaged when it comes to bandwidth, which makes network operators excited about services that can be offered. Operators must temper their enthusiasm and stay focused on insuring a robust service offering of the core voice, video and data services. Getting the basics right is the first step in securing customer loyalty. FTTH technology is still relatively new, and with any new technology there will be some glitches along the way. Following are some examples and suggestions from industry experts that have learned the hard way:

- Limit your commercial launch to a beta test group that fully understands you will be testing your services and is prepared to expect the unexpected. Do not expand beyond the beta group until the system is up and running properly. Example: A service provider launched IP video service to a large subset of its customer base with faulty set-top boxes, resulting in more than 25 percent cancellations of service.
- Limit the number of allowable “generations” of technology to prevent interoperability problems as well as the need to carry multiple inventories for the same product set. Example: A network operator allowed several new generations of electronics to be used in the network that were not fully interoperable or backward compatible, resulting in their selling inventory for pennies on the dollar.
- Include supply requirements and technical support in contracts. Several examples were provided of smaller network operators having to hold up deployment as vendors prioritized sales to larger customers. This also impacts cash flow as network operators hold higher inventories to avoid being held hostage by suppliers. Example: A network operator had to stop offering DVR services to new customers for several months while the supplier of the DVR prioritized other customers.
- Develop strong partnerships and create win-win solutions with other companies in the industry. Insure that partners are crystal clear about expectations and requirements. Write expectations and requirements into partnership agreements; this is particularly important if the service provider is not the network owner. Example: A wholesale operator had numerous customer complaints about a particular service provider and was forced to rewrite a service contract three times over the course of one year due to differences in the interpretation of customer service expectations.
- Anticipate the competitive response. Whether you are entering the market for the first time or just offering a new service you must provide a high-quality product at a reasonable price. Incumbent service providers will work hard to keep (or win back) customers with price declines, improved services or other tactics. Example: A new video provider was successful in securing a high penetration rate in an incumbent’s territory. Customers that switched to the new service provider started receiving “apology letters” from the incumbent pleading for a second chance (one of the milder incumbent responses).
- Continuously monitor and evaluate your processes for improvement. Example: A network operator cut installation time at the home by 50 percent. Synchronizing and preconfiguring all customer set-top boxes, DVRs and IP phones at the central office before leaving for the house call removed several steps in the service provision process.
- Avoid finger pointing between infrastructure providers and service providers on customer complaints. Customers don’t care whose problem it is. Example: An infrastructure provider allows service providers visibility to network alarms and performance metrics to help determine the cause of a customer issue and the responsible party to address it.

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ments (greenfields) represent a different challenge in managing cash flow. Increasingly, FTTH is the architecture of choice for new developments, because the business case is better than copper in nearly every deployment.

The primary reason for delays in full market acceptance of FTTH in new builds is the fact that builders and developers are slow to change and require education. Some network operators and infrastructure providers are able to secure an entire development through a homeowners’ association, essentially guaranteeing a 100 percent take rate in exchange for lower monthly fees.

Building homes can take several years, but much of the network infrastructure needs to be deployed while trenches are open, requiring the use of approximately 50 percent of total capital for the project just to “light” the first home. Managing cash flow in this type of deployment requires strict financial discipline as the revenue, while certain, requires patience.

Companies in this segment find themselves in a never-ending loop of searching for capital so they can expand to new projects. Where possible, grouping projects together will allow multiple projects to be funded all at once, saving time and effort while increasing flexibility. Infrastructure providers estimate the value of their networks in greenfield deployments at \$6,000 to \$8,000 per subscriber (accounting for future revenues); a nice return on investment considering the cost to build is typically less than \$2,000.

Finally, one of the best ways to insure adequate cash for your projects is to have a good fundraiser in your company. Having capital available will allow you to seize opportunities as well as build and operate your network at a high standard.

Personnel

The speed and scale of broadband growth is putting a drain on skilled and qualified workers to install networks and turn up services. Large operators deploying new services are rapidly hiring phone and cable technicians to work with fiber, contributing to the shortage of qualified personnel.

An additional challenge is to find personnel to fill positions that require working in consumers' homes. These positions require additional screening for drugs and background checks for aggressive behavior. A medium-sized infrastructure provider had more than 50 percent of applicants fail this first screening process, making hiring a very difficult process.

Once new employees are hired, they must be rigorously trained in company policies and procedures. Asking installers to do more than they have done before or more than they have been trained to do is a recipe for disaster. Figure 3 shows a passive splitter cabinet deployment that is the result of rapid network growth and poor monitoring of technicians.

There are several solutions to the technician shortage problem. One company we spoke with hires a contractor to perform installations. The contractor costs are higher on an hourly basis than permanent workers but the contractor does all personnel screening, usually has a well-trained work force, can provide additional trucks, tools and equipment and has the flexibility to scale personnel with demand.

This arrangement works well for companies with highly unpredictable demand or for those that want to temporarily augment their own workforce during periods of high infrastructure deployment and connect rates. An al-



Fig. 3. Disorganized fiber splitter cabinet.

ternative solution is to do the training yourself. An infrastructure provider

explained how he seeks and hires competent technicians and then creates the "universal technician" through the company's own training facility.

Some network operators run into culture shock issues relating to the new, fast-paced network deployment and constant change. Municipal utilities and established telcos have had similar experiences and challenges in assisting technicians in the transition from steady-state operations to the massive undertaking of deploying a brand-new fiber network, particularly when the requirement is for rapid deployment on a large scale.

Be aware that your people will occasionally be working in some very unique environmental conditions such as the

Regulatory Environment

A positive business case, innovative products and lower-cost networks are a recipe for FTTH growth, provided that the regulatory environment is clear and certain. While network operators do have some influence on regulatory policies, this is not an item directly under their control. They must rely on policy makers to maintain a clear and certain regulatory framework.

In the US, the large regional telephone companies have enjoyed a relatively positive regulatory environment following the 2003 Triennial Review Order (TRO) in which FTTH was largely granted unbundling relief. This gave carriers confidence to invest in next-generation networks. Following the TRO, video franchising became the next hot topic as telephone companies seeking to become broadband companies had the desire to roll out a quality and competitive video service.

The process of negotiating individual video franchises with the thousands of local franchising authorities in the US was labeled as a barrier to deployment. The process is time consuming, expensive and largely nonconstructive for new entrants seeking to bring video competition to the community. Local franchise authorities want to ensure they do not lose the revenue associated with franchise fees while providing a level playing field for competition.

All recently proposed compromises at the federal and state level allow for local franchise authorities to continue collecting franchise fees while speeding the approval process for new entrants. Numerous state governments have introduced streamlined statewide franchise processes that encourage competition. Figure 7 shows the 20 states that have a streamlined process and eight more that are currently considering a streamlined process. Assuming that the states adopt the new processes they are considering, AT&T and Verizon will have more than 80 percent of their territories covered by statewide processes. Video franchising is now largely a nonissue for new entrants.



Fig 4. Deployment conditions, courtesy of Zoomy Co.

one shown in Figure 4. The best defense to the challenges faced in the deployment of a new network is a highly skilled and equipped work force. The right people can make all the difference.

Well-trained installers should provide professional product demonstrations that lead to upselling of services. Customer service representatives should be polite, informed and able to handle customer issues and questions without transferring to four different departments. Customer service complaints have been a thorn in the side of many incumbent operators. As one service provider put it, “picture quality, content, data rates and new services help make the sale but customer service keeps the customer.”

Getting Beyond the Basics

Greenfield construction sites (new developments) were the first areas to adopt FTTH technology due to the better business case, lower first-installed cost relative to copper and the ease of access (open trenches) when deploying the network.

The next wave of FTTH has been aerial deployments to single-family homes (SFUs) where access to both public rights of way and the customer residence (ONT on the side of the home) are relatively straightforward. Buried solutions typically cost more to install, and some carriers have chosen in the short term to defer building to a portion of their buried plant as new deployment techniques and prod-

ucts emerge to lower the cost.

The most challenging FTTH deployments are overbuilds of multiple dwelling units (MDUs). MDUs currently represent 25 percent of all housing units in the United States, and in major metropolitan areas they can be the majority. As of August 2007 there were an estimated 9 million homes passed with FTTH in North America and 1.5 million FTTP subscribers. Of those 9 million homes passed, only 5 to 10 percent are MDUs, clearly indicating an imbalance in next-generation network deployment.

SFU deployments have well-established processes and are far less complex than the deployments in MDUs. In most cases the SFU demarcation point is located outside or on the side of the home, a power supply is readily available and connection from the home is easily accomplished by a drop cable (aerial or buried) to the carrier network on the public right of way.

In contrast, FTTH deployments in MDUs present technical challenges related to the installation of infrastructure, because almost every building is unique. Variations in building size, age, construction codes, materials, limited cable pathways, hardware locations, power location, building owner preferences, existing copper services and aesthetics all contribute to the complexity of deploying new MDU networks.

Network operators must decide whether to place fiber all the way to each living unit or to compromise by placing fiber to a common point in the building and using existing copper and/or coaxial cabling infrastructure to deliver services to each subscriber. The use of existing plant can save the carrier time and money (just as in an outside plant deployment) but comes at the expense of reduced service capability to building occupants.

New products are being introduced, enabled by the latest in optical fiber technology, to help solve several of the challenges associated with MDU deployments. While advances in optical fiber have been impressive over the years, one area that had been difficult to solve is the ability to maintain performance in

tight bends – around corners, improperly routed through a building or a variety of other deployments where fiber isn’t properly handled. A new development in optical fiber design will soon provide operators with the bandwidth of optical fiber while at the same time providing the handling capability and ruggedness of copper cables.

This new optical fiber uses Corning’s nanoStructures-based technology to maintain the light in the core while in a tight bend, resulting in bending capability 100 times better than standard optical fiber. Figure 5 demonstrates how tightly this fiber can be bent with essentially no loss or impact to system performance. If a standard fiber were bent in this manner, essentially all of the light would be lost.

While bending fiber cable around a small rod is impressive, a more realistic example of potential system performance impact is shown in Figure 6. This is an X-



Figure 5. Corning nanoStructures-based fiber in tight bends with no performance impact.

ray picture of an indoor drop cable being stapled to a 2x4. The mechanical stress of the staple is absorbed by the cable, but you can see how the staple puts the fiber in a tight bend that would otherwise affect system performance. In addition to the value created by improvements in handling, additional value is created by

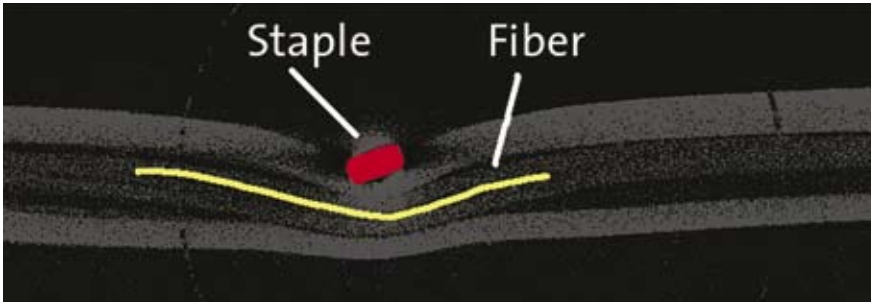


Fig 6. X-Ray image of stapled MDU drop cable with fiber, in sharp bend.

the ability to design a passive solution that addresses the many challenges of complexity, space, aesthetics, and costs that have delayed FTTH deployments in MDUs. Furthermore, this fiber meets all the specifications of standard single-mode and is completely backwards-compatible, providing necessary confidence to network operators.

Local Regulations

Despite the efforts to streamline video franchising, many infrastructure and service providers have challenges at the local level securing rights of way, permitting and gaining access to private poles and underground facilities. Rules differ in every state and jurisdiction, making this a time-consuming and costly process.

Several companies choose to go around these hassles by targeting new pri-

vate developments. In a private development, the infrastructure provider secures access to the easements, typically open trenches for utilities, to deploy their networks at a far lower cost than if they were to build later in the public rights of way. Service providers wishing to provide services in a development once public rights of ways are established can either dig new trenches or partner with the infrastructure provider for access to the customer. In the US, most large telcos and MSOs prefer to build their own networks rather than lease access.

Access to customers is a hotly debated topic at the moment, as the FCC has an open notice of proposed rule making (NPRM) on the use of exclusive video contracts with service providers for MDUs. The NPRM seeks to determine if consumers are disadvantaged by not

having access to service providers of their choice if the MDU owner allows one service provider exclusive rights to provide video services. No ruling has been made at the time of writing this article.

Another challenge for local governments in 14 states is the limited ability to enter into the provision of consumer telecommunications services. In 2004, these laws were challenged in the Supreme Court but the court ruled that the states had authority to set their own rules with regard to telecommunications services. This year, both the Senate and the House have introduced bills that seek to preempt states from prohibiting local governments from entering into the provision of telecommunications services. This provision was included in a major broadband bill last year and had bipartisan support but the bill failed to get through committee due to disagreements on how to treat the topic of net neutrality. This will be an interesting topic to watch throughout the year. **BBP**

About the Author

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Streamlined Video Franchise Approved
 Streamlined Video Franchise Pending

APPROVED	HHs	%total HHs
AT&T	32,524,495	73%
VZ	12,049,473	40%
Independents	8,268,426	45%
Qwest	628,680	6%
Total	53,470,974	52%

PENDING	HHs	%total HHs
AT&T	6,112,980	14%
VZ	14,601,475	48%
Independents	4,753,383	26%
Qwest	2,790,063	27%
Total	28,257,901	27%

Assuming ALL APPROVED	HHs	%total HHs
AT&T	38,637,475	87%
VZ	26,650,348	88%
Independents	13,021,809	70%
Qwest	2,790,063	27%
Total	81,100,295	78%

Fig 7. Statewide video franchise processes and coverage by telcos.