The Business Case for GPON

FTTN requires active electronics and higher service costs than FTTH GPON

By John Griffin ■ *Optical Solutions Inc.*

Ask economists, and they'll tell you that competition is good. It drives up service levels and pushes down prices, keeps vendors on their toes and provides an engine for innovation. Ask consumers the same question and they'll probably agree, but you might hear reservations as well. Choice can also be overwhelming.

Most buyers of voice, data, and video services will admit to some confusion regarding what services to buy, what packages will meet their needs, and whether to buy services bundled or separately. But as confusing as such decisions are for the consumer, they are more difficult for the service provider. For the service provider, infrastructure decisions can be a matter of survival.

Because a network's lifecycle can be … decades, a provider … must anticipate future competitors and offerings …. A single short-sighted decision can lock the provider into an impractical infrastructure … for years to come.

Competitive Markets

Today, a typical service provider competes with rivals, not just in individual service markets like voice, but in every possible combination of services. They compete service-by-service and package-by-package. And they don't just face current competitors and offerings. Because a network's lifecycle can be years or decades, a provider selecting infrastructure must anticipate future competitors and offerings as well. A single short-sighted decision can cost millions of dollars, locking the provider into an impractical infrastructure – maybe even a poor business strategy – for years to come.

Unfortunately for telcos, cable companies enter today's competition with an advantage. Their coax infrastructure into subscriber homes has more capacity than the telco's traditional copper. Cable is already carrying television and is capable of carrying high-speed data and voice as well. As a result, telcos are losing business, sacrificing margin to remain competitive, and paying heavily every time they lose *or win* a piece of business, bearing the heavy cost of copper connection and disconnection. For all these reasons, infrastructure choice, whether in existing service areas or in new ones, is a high-stakes decision.

The Right Services

One thing is obvious, and that is the winning combination of services. It is the "triple play" of voice, video, and high-speed data. Digging costs the same whether the infrastructure you install supports one service or several, but more services means better ROI. Administrative and technical support costs can be shared when a provider delivers multiple services, and even marketing can cost less.

In competitive markets, once the appropriate infrastructure is in place, each service becomes a potential door-opener for the others, and each helps enhance the provider's take-rate. Where a provider can't sell three services, he can still sell two or even one. This provides the opportunity to expand by cross-selling to existing customers, which is typically less expensive than trying to attract new customers. And while this can be a valuable market building strategy, it can also be an important defense against competitors – cable providers, for example – attempting to poach voice and data customers in the telco's existing market.

For the telephone service provider, voice and data are well known commodities. The third part of the trilogy is video. The emerging video technology of choice is IPTV – all digital, able to carry the widest range of programming, and with excellent future potential as a medium for video-on-demand (VOD). Combined with voice and data, IPTV completes a powerful product mix, one that is more than competitive with the offerings of cable operators. Arguably, it is the future of the wired services market.

The Right Architecture

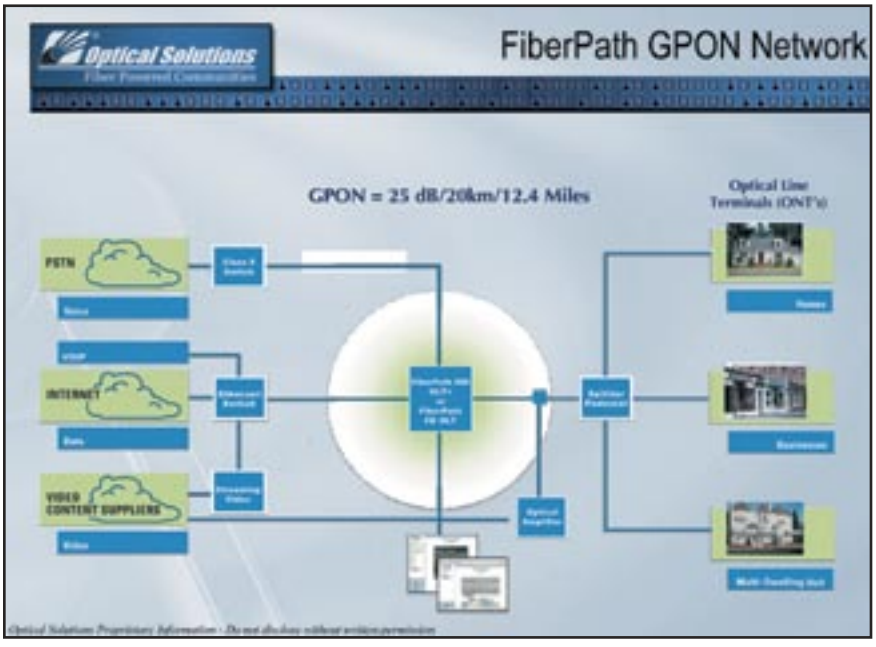
The logical delivery architecture for voice, data and IPTV is fiber-to-the-home (FTTH). Fiber has long been recognized as the ideal medium for carrying large amounts of data over long distances. Historically, it provided the trunk lines for traffic to central offices, where it was broken out and carried over copper to homes and businesses. But as user demand grows, the need for fiber's capacity moves closer and closer to the end user.

The move to FTTH is already underway. As of mid 2005, according to the Fiber-to-the-Home Council, over 400 communities have already installed FTTH systems, and this is just the beginning. A 2004 Jupiter Research report predicts that by 2009, average home bandwidth demand will have climbed

to over 50 Mbps. Lehman Brothers research suggests that over the same period, the compound annual growth rate of high definition television (HDTV) penetration into households will be 53 percent, and that over half of all households will have HDTV. If telcos are to compete with an increasingly aggressive cable industry, they are going to need the carrying capacity of fiber.

A Typical Installation

The following is a sample FTTH installation. Optical line terminals (OLTs) serve as the network aggregation point and interface with data and telephone switches. A centralized management system handles operations, administration, maintenance and provisioning (OAM&P). Optical network terminals at the customer's home, business, or multiple dwelling deliver the selected mix of voice, high-speed data, and multicast/unicast entertainment services.



FiberPath GPON Network diagram

FTTH Boosts Revenue

FTTH increases competitiveness both by increasing revenue and by cutting costs. On the revenue side, the most obvious change is the ability to take on cable competitors by offering video. But video over FTTH is not just a "me-too" offering. FTTH's ultra-high bandwidth capacity can support a broad spectrum of multicast (broadcast and pay-per-view) services as well as unicast video services like video on demand (VOD). It is fully capable of delivering multiple channels of HDTV as well. In short, with FTTH, telcos don't just catch up with their cable competitors; they potentially leapfrog cable providers in their own established market.

At the same time, because video takes less than half of FTTH's bandwidth, FTTH can deliver significantly more bandwidth for data access than either existing DSL offerings or the cable company's coax-based service. This is particularly important as competition drives down the cost of high-speed Internet service. While competition heats up on the supply side, Web sites are offering more bandwidth-hungry content – graphics, gaming, and streaming media – all of which increases demand for bandwidth. Providers that can respond to that demand will be well-positioned to keep prices (and hence revenues and margins) up despite competitive pressure.

The final area of revenue is voice, which telcos have traditionally taken for granted. No more. Cable companies, CLECs, and non-traditional providers like Google are moving into the market with cable telephony and VoIP offerings. In addition to providing cost-competitive voice service, multi-service offerings over FTTH will help retain voice business by eliminating churn. Adding bundled services like data has cut the rate of customer churn in the past, making it reasonable to conclude that the addition of bundled video services will reduce it even more.

FTTH Slashes Costs

The other significant benefit of FTTH is the reduction in ongoing costs. Where fiber replaces copper, it offsets the cost of expanding the existing infrastructure. It also eliminates the growing cost of maintaining aging copper. But the most significant cost reduction is in ongoing operation.

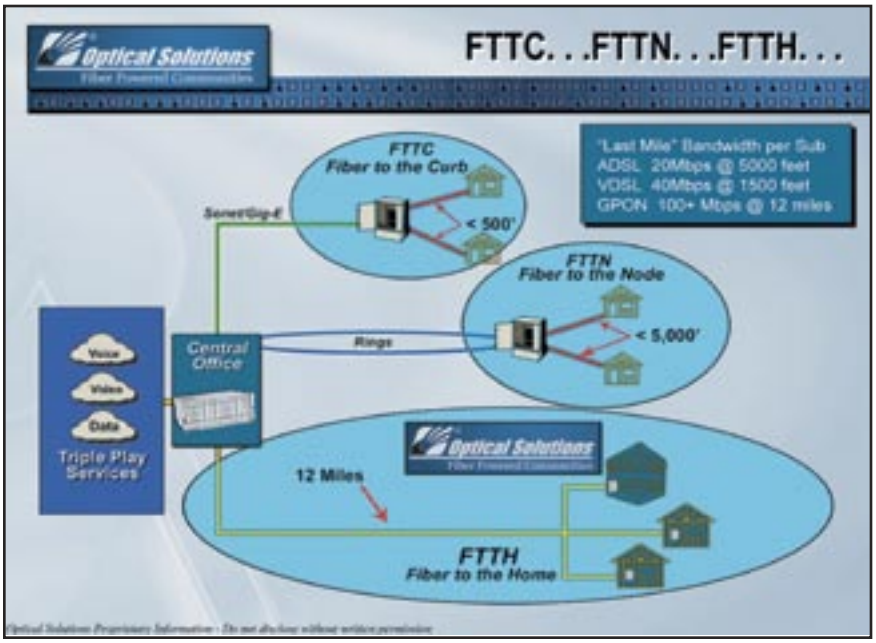
Because fiber does not have to be cross-connected, as does copper, provisioning becomes a simple, centralized process. A single fiber, once in place, can deliver any combination of services without the need to dispatch a technician to the field. Service changes are faster and can be performed remotely from a console than by a technician in the back of a truck. In some cases, they can even be performed online by subscribers themselves. In the May 2004 Bernstein Research Report, *Fiber: Revolutionizing the Bells' Telecom Networks*, the reduction in operational costs enabled by FTTH is estimated at 100 percent for central office installation, 90 percent for facility assignment, and 30 to 70 percent for customer service and central office network care.

Other Fiber Architectures

Obviously, a substantial part of the cost of FTTH is the extension of fiber all the way to the subscriber's home or business. For this reason, there has been some consideration of halfway measures like FTTN (fiber-to-the-node or neighborhood) as a means of cutting costs. The cost of FTTN deployment is significantly lower than that of FTTH. But penetration, bandwidth and distance is predictably lower as well. As a result, according to the Bernstein report, the cost

per subscriber of FTTN versus FTTH is almost the same, while FTTN revenues remain far lower than those for FTTH.

On the cost side, it should be noted that, unlike FTTH, which is a passive optical network (PON) and requires no active electronics in the network, FTTN does require active electronics in the field. This increases the complexity and vulnerability of the FTTN network and requires dispatching technicians for provisioning, eliminating a major source of cost reduction in an FTTH implementation. It is uncertain, in fact, whether FTTN can deliver any ongoing cost savings at all. Then there is the question of adaptation to change. FTTN lacks the inherent flexibility of FTTH. As demand drives up the bandwidth needed at individual premises, FTTN will have to be reconfigured to a FTTC (fiber-to-the curb) architecture at significant additional cost.



FTTH, FTTN & FTTC comparison diagram

Implementing FTTH

Costs for FTTH implementations vary, typically between $1,000 and $2,000 per customer. Equipment costs for triple-play implementations include the optical distribution network, optical network terminations, video and packet optical line terminations, fiber frames, backbone transport, and video equipment. Labor costs are divided among outside plant, central office and drop and cable installation costs. Actual final cost will depend on subscriber density, labor rates, mix of customer dwelling types, and the need to bury fiber.

Capital costs can be spread out over time depending on rate of rollout, but the Bernstein report strongly recommends rapid, aggressive FTTH implementation. It should be noted that this report primarily addresses the situation of RBOCs, but it is very specific in pointing out that its positive ROI forecasts for FTTH implementation assume an overbuild covering all customers in an area rather than building upon service-request. Still, a service provider's actual speed of implementation will depend largely on current and anticipated market conditions.

The report suggests that penetration of new video services over FTTH would be 15 percent almost immediately, rising to 35 percent over five years. Revenues would come from a mix of basic and premium services, and from non-content sources like DVR and set-top rentals and advertising. High-speed data services will be another growing source of revenue as more households and businesses go online and dial-up is replaced by high-speed service. Interestingly, real-world deployments are delivering even better results — as much as 50-65% in the first year, according to studies done at Optical Solutions.

In order to maximize cost reductions, customers will be encouraged toward self-service, replacing interaction with live service reps. They will shop for and order services, place repair orders, pay bills, and more, all online. To encourage this change, it will be critical that customer interfaces be accessible and easy to use. And as customers become more sophisticated in their use of the Internet, Web portals may become as effective at upselling services as service reps are today.

Freedom to Grow and Change

The traditional plodding rate of change among telcos is already a thing of the past. If anything, the rate of change will continue to accelerate, driven by new technology, consumer demand, and the actions of competitors. One of the beauties of FTTH is its flexibility. With fiber in place, new services can be offered and implemented quickly and easily, in some cases in weeks rather than months or years. This allows quick action when the necessary response is clear. But, equally important, it allows relatively risk-free experimentation when the ideal action is not so obvious.

Flexibility and ease of service delivery allow providers to try out new offerings, keeping those that work and replacing those that don't. It also makes it easier to find and cost-effectively serve niches in the market. FTTH helps telcos eliminate gaps into which competitors could move and also enables the provider to take advantage of weaknesses in competitors' markets.

The Right Protocol

As with any signaling system, fiber-based protocols are governed by standards. The passive optical network provides excellent signal transport while reducing the amount of equipment to

buy, install, and maintain. The passive architecture is easier to maintain and potentially reduces overall maintenance costs by 60 to 70 percent. And unlike active electronics in the outside plant, fiber is inherently resistant to attack by the elements, making PON over FTTH an obvious choice for new infrastructure.

There are three PON protocols, developed by two different standards bodies, in current use. BPON and GPON were both developed by the FSAN (Full Service Access Network) committee of the ITU (International Telecommunications Union), which serves service providers worldwide. A third protocol, EPON, was developed by the EFM (Ethernet in the First Mile) committee of the IEEE (Institute of Electrical and Electronics Engineers).

As might be expected of a standard developed by IEEE, EPON is strongly oriented toward data transport. While it offers high efficiency and valuable capabilities for a data-centered enterprise network, it is correspondingly weak in voice and video. That leaves BPON and GPON, both from the ITU. BPON was approved by the ITU in 2001, replacing APON, which had been approved in 1998. The GPON standard was approved in April of 2003.

EPON is strongly oriented toward data transport. While it offers … valuable capabilities for a data-centered enterprise network, it is … weak in voice and video. That leaves BPON [an old standard] and GPON.

BPON's only real advantage today is incumbency since some service providers have already implemented it. However, even that lead is subsiding as GPON moves to the forefront of RBOC's migration plans. GPON outperforms BPON by almost any measure. GPON's IP orientation is ideal for both data and video. In fact, GPON technology is the only standard that defines how IP video should be delivered across the access network in a manner that enables service providers to maintain optimum QoS and security.

Today, GPON is being implemented at 1.2 Gbps downstream and 622 Mbps upstream, more than adequate for current and anticipated voice, data, and video requirements. It can support either RF video or IPTV, which is important since IPTV's advantages over RF video will continue to increase over time. And GPON's 20 km reach maximizes its economy and flexibility of implementation.

GPON is being implemented at 1.2 Gbps …. It can support either RF video or IPTV… And GPON's 20 km reach maximizes its economy and flexibility of implementation.

As take rates climb, the high capacity of GPON will be crucial, as will GPON's quality of service (QoS) capabilities. In short, GPON is the only protocol that can reliably support a broad range of current and emerging services, including IPTV, 100 Mbps Ethernet, HDTV, transparent LAN, and VOIP, while maximizing the use of available bandwidth. The GPON protocol has the highest capacity of all available protocols since the ITU standard allows for bandwidth upgrades of 2.5 Gbps downstream and 1.2 Gbps upstream on the PON and is both flexible and scalable, allowing services to be rolled out as revenue comes online. And because it can support a mix of new fiber and legacy copper, GPON permits easy, cost-effective migration for providers with existing infrastructure in place.

Field Tested and Proven

GPON's advantages, both technical and financial, don't just show up on paper. The protocol has been implemented in well over 100 locations, over 30 of which include IPTV delivery. The following are examples of current implementations.

• Consolidated Telecommunications Company, which serves northern Minnesota, is incorporating a GPON network into its competitive build-out to 15,000 potential customers. The company plans to use the GPON network to deliver "a full range of IP services to residents, business owners, and public properties, including VoIP, IPTV, unlimited high-speed data, plus traditional carrier-class services." The company plans to have its 100 square mile overbuild completed by 2008.

• Tamarack Resort in Donnelly ID is developing a 2000 unit recreation area and is deploying GPON over fiber to all units. Services at each unit will include 5 MB/s of data bandwidth, VoIP, multiple voice lines, and digital video. It will soon include video on demand as well.

• Silver Star Communications of Freedom WY will serve both existing copper-based customers and two new subdivisions equipped with FTTH over an integrated GPON network. The network will deliver voice, high-speed data, and IPTV to as many as 1500 residences within its first year.

Where FTTH/GPON Fits

IOCs have led the move to FTTH and GPON, although the architecture is also viable for implementation by CLECs, overbuilders, and video service providers. Interestingly, although this architecture is eligible for RUS funding, the vast majority of implementations to date have been self-funded, a strong endorsement of its financial viability.

The most obvious application for FTTH is in new-build implementations, where the need for service is immediate, where there is no existing infrastructure to be integrated or written off, and where a multi-service revenue stream can be used to pay off the cost of building the network. The 80 percent of new homes being built in exurban areas are particularly appealing candidates for FTTH-based new-build services.

Of course, FTTH can also be used in overbuilding initiatives to deliver services like video that cannot be effectively delivered using other architectures. Roll-out of FTTH as a replacement for existing copper can also be justified where competitive pressure is driving the need to implement new or more cost-effective services or the life of the copper plant is at its limit. In such cases, the ability of FTTH to support new and legacy infrastructure simultaneously can ease the migration.

Similarly, with fiber in place, emerging services like VOD will be easy to deliver, with the resulting revenues going straight to the bottom line. At the same time, GPON's powerful QoS capabilities will enable providers to maximize the utilization of fiber's available bandwidth without jeopardizing the quality of service delivery.

A Window of Opportunity

While GPON is beginning to be widely recognized and appreciated at all levels of the industry, most of the actual implementers have been non-RBOC innovators. These are organizations with the freedom to move quickly, take advantage of emerging technologies, and fill market niches as they appear. For example, a North Dakota provider, having installed an overbuilt fiber network, offered 2,800 dial-up Internet service customers an affordable upgrade to high-speed Internet access; 2,600 accepted the offer, positioning the company to cross-sell profitable voice and video services.

Obviously, any infrastructure build-out can be costly, but the cost savings and revenue opportunities that FTTH delivers combine to maximize ROI. The flexibility of the system allows rapid response to competition and customer expectations, and bolsters the provider's ability to challenge or block competition. Flexibility and cost control are the "high ground" in a competitive confrontation, and early installation puts the innovator in a position to control the market.

Best of all, GPON presents relatively little risk for the early adopter. It is fully compliant with ITU standards and far exceeds the capabilities of any competing technology. Its capabilities have been field tested and proven. It supports both current technologies – traditional voice, high-speed data, and multicast television – and emerging technologies – VoIP, video on demand, and HDTV. And it is flexible enough to adapt to changes yet to come. For telcos in competitive markets – in other words, for all telcos – that makes FTTH the closest thing to a simple choice they may see for a long time. **BBP**

About The Author

John Griffin is executive vice president-marketing at Optical Solutions Inc.

Peak Performance

CTS

COMMUNICATION TECHNOLOGY SERVICES, LLC

Uncertainty is a Luxury You Can't Afford!

A lot of time, effort and resources have been dedicated to planning your FTTP network. The content and broadband providers have been identified, the construction budget has been secured and the services are in demand. Don't leave the often overlooked requirement of managing the customer experience to just anyone. With over 15 years of customer relationship experience…

CTS is your partner for success!

Premier Design, Installation and Maintenance Services

- **Fiber Drop Cable Placement**
- **Termination, splicing and testing**
- **ONT & Access Portal installation**
- **Inside Wiring**
- **Nationwide Coverage**

"We enhance the customer experience!"

Call Doug Hodges for a FREE RFP Template!
720-344-0673