

VDSL for MxU's: The Fast Track to Interactive Broadband

VDSL, using existing copper, can give MDU owners years of breathing room

By Dean Grumlose ■ *Ikanos Communications*

More than half the world's population lives in densely populated areas where multi-dwelling units (MDUs) are the norm. Building owners and their service-provider partners in European and Asian cities have led the market in deploying broadband connections. Overseas, broadband isn't what it used to be.

It's better.

Providers in Japan, Korea, Belgium, France, and elsewhere are now delivering much higher bandwidth to their tenants to support new services such as HDTV, videoconferencing, home surveillance, massive data file transfers, and interactive gaming. As North American carriers extend high-capacity fiber links farther out into their networks to support these new services – even to the basements or curbsides of most MDUs – building owners and local providers are finding ways to deliver enhanced broadband services throughout their properties. This article explores the pros and cons of various technology options that building owners and service providers can use to meet this challenge.

Evolution of Interactive Broadband

Since the mid-1990s, the evolution of broadband services has largely been one of delivering faster Internet access, with a focus on higher “downstream” speeds from the service provider to the customer. After dial-up modem technology reached its limits at 56 Kbps, cable operators upgraded their networks and rolled out broadband services at 1.5 Mbps. Telephone carriers followed in the late 1990s with 1.5 Mbps digital subscriber line (DSL) services, which allowed them

to deliver high-speed data over the same pair of wires that carried telephone service. Since then, cable operators and telephone carriers have saturated urban areas with connections and have continually upped the bandwidth ante to 3, 4, and even 6 Mbps.

In Europe and Asia, where cable was uncommon, most of the broadband connections were based on ADSL (asymmetrical digital subscriber line) equipment, which delivers 1.5Mbps or more downstream from the carrier, but far less (typically 384Kbps) upstream from the subscriber to the carrier. This technology worked well for most e-mail and web browsing, but some customers longed for higher upstream speeds to support large file transfers. Until 2002, these customers could choose between T1 services (dedicated connections to the carrier at 1.5 Mbps in both directions) or symmetrical DSL (SDSL), which also offered 1.5Mbps in both directions but was typically less reliable.

Beginning in 2002, chipmakers began offering another DSL technology called Very High Bit Rate DSL (VDSL), which can deliver up to 100 Mbps in both directions. Countries with the most advanced telecommunications systems are now massively upgrading to VDSL. Korea has been deploying VDSL since 2003; the number of installed lines surpassed 1 million in 2003 and 2 million in 2004, in a country with about 15 million households. Japan's Post and Telecommunications Office expects that 100 Mbps VDSL deployments will overtake new ADSL deployments in 2005. According to market researcher In-Stat, VDSL port shipments are expected to

grow from 7.1 million ports in 2003 to 40.9 million ports in 2007.

With the ability to offer higher bandwidth in both directions, customers are taking advantage of it. In Japan, customers began using 50 Mbps downstream and 30 Mbps upstream in 2002, went to 100 Mbps downstream and 50 Mbps upstream in 2004, and are now going to 100 Mbps symmetrical service this year.

The availability of so much more bandwidth is also changing carrier service plans, enabling carriers to create new revenue streams by offering interactive services enabled by higher upstream bandwidth. Overseas operators have begun offering services such as video-on-demand (VOD), online karaoke, interactive gaming, and videoconferencing to increase revenue per subscriber. If overseas markets are any indication (and they usually are; witness the cell phone service explosion), “broadband” is taking on a whole new meaning that includes much higher bandwidth in both directions to support a wide range of new, revenue-producing services.

Even a small improvement in services will require far more bandwidth per customer than is being delivered today. Table 2 shows a rough estimate of current service requirements, based on services now being delivered by carriers or cable operators in North America.

As most readers of this magazine are well aware, cable operators are now offering VoIP to complete the so-called “triple play” bundle of voice, video, and data services. North American telephone carriers are revamping their networks to deliver enough bandwidth to match or outperform their cable competitors. Their approaches vary.

	Dial-Up	ADSL	SDSL/T1	VDSL
Max. Speed Upstream / Downstream	56/56 Kbps	1.5 Mbps/ 384 Kbps	1.5/1.5 Mbps	100/100 Mbps
Services	E-mail, Web	E-mail, Web	E-mail, Web	Standard Services: E-mail, Web and HDTV Interactive Services: Videoconferencing, gaming, peer-to-peer file sharing

Table 1. Interactive broadband evolution.

U.S. Carrier Buildouts

Telephone carriers have a choice in reworking their network architectures to support new services. Among major U.S. carriers, Verizon is pursuing a fiber-to-the-home (FTTH) architecture, upgrading its entire network to bring fiber directly to each customer. Much of Verizon’s network uses overhead lines, so stringing fiber is less costly than having to dig trenches for underground deployment. Nevertheless, Verizon missed its self-imposed deadline of connecting 1 million of its customers to fiber by the end of 2004. And even without a lot of trenching, building an all-new FTTH architecture is very costly – as much as \$1600 per customer, although the average has been trending lower and some estimates are now in the \$1200 range.

Among other large carriers, SBC and

BellSouth have announced plans to use fiber-to-the-node (FTTN) architecture, which extends fiber only as far as neighborhood terminals, and then distributes service to customers over existing copper lines. This approach has the advantage of leveraging carriers’ existing investments in tens of millions of copper lines already in the ground, and is less expensive. One SBC representative suggested that the cost of FTTN would be roughly a tenth of the FTTH approach. The other advantage is time to market: while laying all-new fiber networks is time-consuming, the FTTN approach enables faster service upgrades because it uses existing networks. This reduced time to market gives carriers an opportunity to immediately create additional revenue streams from interactive services. SBC hopes to bring broadband to 17 million homes by

2008 using FTTN in existing neighborhoods and FTTH in greenfield developments. Verizon’s fiber deployments would be roughly half of that. BellSouth’s spending on fiber is unclear.

Other major U.S. carriers haven’t yet publicly announced whether they’ll use an FTTH or FTTN architecture. For building owners, it doesn’t really matter. The issue is that much higher amounts of bandwidth will be available at the carrier network connection point on the property. From there, the challenge is to choose a network option that distributes new, interactive broadband services to every tenant with the least cost and disruption.

Building Operator Challenges

Before we look at the different technology choices available for on-premises

Service	Downstream Bandwidth Required	Upstream Bandwidth Required
HDTV (compressed) (2-3 sets per household)	6-8 Mbps per TV channel	0.5 Mbps per TV channel
High-speed Internet (upstream and downstream)	10-30 Mbps	1 to 5 Mbps
IP voice telephony	0.5 Mbps	0.5 Mbps
Video Conferencing	2 to 5 Mbps	2 to 5 Mbps
On-line Gaming	1 to 3 Mbps	1 to 3 Mbps
Total Bandwidth Needed	19.5 to 46.5 Mbps	5 to 14 Mbps

Table 2. Sample service and bandwidth requirements for one household, considering only today’s needs rather than entirely new services.

	CAT-5 Ethernet	Fiber	ADSL2+	VDSL
Downstream/upstream Bandwidth (Mbps)	100+/100+	100+/100+	20/2	100/100
Deployment time	Long	Long	Short	Short
Deployment cost	High	High	Low	Low
Scalability	Excellent	Excellent	Poor	Very good
Investment protection	None	None	Fair	Excellent

Table 3. Network technologies vs. building owner requirements.

distribution of interactive broadband services, let's review the main considerations for building owners looking to upgrade their in-building networks: Quality of service, scalability, and investment protection.

Quality of Service: Any change to the building network should bring significantly better service to tenants. Because the cost of upgrading the network will probably be passed on to the tenants in some way, it's important that tenants experience an improvement in service levels.

This also means that the upgrade should be as transparent as possible. For commercial property owners in particular, tenants will not easily tolerate major disruptions in their connectivity with the outside world. In terms of technology choices, this means that solutions that are fully compatible with existing networks will be less disruptive to implement.

Scalability: However transparent, any change to the communications network will involve some disruption and cost, and services are evolving at a rapid pace. Building owners should opt for solutions that will last at least ten years, which means that the communications technology should have enough extra capacity to support additional bandwidth for future services.

Investment Protection: To minimize the cost of the upgrade, building owners should carefully weigh the cost of deploying an all-new network (such as fiber or CAT-5 Ethernet cabling) against the quality of service and scalability it

offers. If possible, owners will want to maximize their leverage from existing network investments rather than enduring the expense and disruption of laying an all-new network. Depending on the age of the property, however, it may not be possible to use the existing network at all.

Technology Choices

When it comes to choosing in-building network technology, most building owners focus on physical issues such as the amount of power required, the size of the communications terminal, or whether it offers enough connection ports to serve every tenant. However, the underlying technology used to transport the data can be just as important, if not more so, to long-term tenant satisfaction and a steady stream of recurring revenues. There are three basic choices for distributing services throughout a building: CAT-5 Ethernet cable, fiber, and existing telephone wiring using ADSL2+ or VDSL technologies. It is also possible in some circumstances to use existing coaxial cable; that's the subject of another article in this issue. Table 3 summarizes the pros and cons of each approach.

CAT-5 Ethernet: CAT-5 Ethernet cabling is the standard for local area networks (LANs) in businesses, and it can be used to distribute services from an Ethernet switch to each tenant in the building. It has the advantage of delivering 100 Mbps in both directions, so it will satisfy the need for scalability. Commercial office parks and college dormitories built within the last ten years probably

have CAT-5 wiring already in place, so this is a great solution in those situations. In residential properties, however, CAT-5 is rare, and this option will require a full infrastructure upgrade for the building, including new wall jacks inside tenant units.

Fiber optic cable: Fiber optic cable offers even higher bandwidth per customer, if needed, but like CAT-5 Ethernet cable, it will typically have to be installed from scratch. In addition, the optical components required to deliver fiber-based services throughout a building can be expensive – \$750 per subscriber or even more, depending on the type of system used. Such a deployment will require all-new distribution equipment, including an Optical Line Terminal (OLT) to distribute optical signals to each subscriber, and Optical Network Units (ONUs) for each subscriber.

Existing telephone wiring: The third option – and the only one that offers maximum leverage of existing investments in every case – is to deliver new services using existing telephone wiring. The greatest benefit of this option is that the wiring in place already connects every tenant to the building's telecommunications terminal, and it is already available (via wall jacks) in every location where tenants will want it. There are two technologies currently in the market for this purpose: ADSL2+ and VDSL.

Although both ADSL2+ and VDSL are being touted as solutions for new interactive broadband networks, there is a big difference between using ADSL2+ and VDSL technologies. ADSL2+ technol-

ogy delivers a maximum of 18-20Mbps downstream, and only 2.2Mbps upstream. VDSL, on the other hand, delivers up to 100 Mbps in both downstream and upstream directions.

By using VDSL, building owners can upgrade their existing networks to deliver new interactive services with the confidence that the network will scale to support any future service needs for the next ten years. Much like CAT-5 Ethernet or fiber, VDSL delivers very high, symmetrical bandwidth to each subscriber, but it does so much more quickly and with far lower costs and disruption. In many cases, tenants will be able to continue using their existing DSL modems to receive the higher bandwidth that VDSL delivers. All that will be required is a retrofit of the DSL terminal (or DSLAM) in the building's communications center to support VDSL technology. In some cases, this may be a simple line card swap, and in others, it will require a newer DSLAM.

While VDSL has been delivering services for several years now, the International Telecommunications Union (ITU-T) recently ratified a standard called VDSL2, which will ensure broad availability of interoperable VDSL network systems. Major carriers like SBC and BellSouth have already announced plans to use VDSL2 in their FTTH network deployment strategies for individual residential and business customers, and most of the world's best-known network equipment makers are or soon will be offering VDSL2 products.

Interactive broadband services will soon be coming to MDUs and MXUs everywhere in North America, and building owners will have to find the fastest, least disruptive, and most cost-effective ways to deliver those services to their tenants. With its unique ability to leverage existing telecom networks while delivering fiber-level bandwidth to each tenant, VDSL technology stands out as the best choice. Building owners in Asia have already proven its value to millions of tenants, and North American and European property owners can now do the same. ♦

About the Author

Dean Grumlose is vice president of marketing at Ikanos Communications. He has been in the communications industry for more than 24 years. In his last position as the VP of Marketing at Azanda Network Devices, Mr. Grumlose was recruited to drive the product roadmap and new product development for the company. Grumlose held vice

president positions at both Velio Communications and PMC-Sierra, where he oversaw the engineering and marketing of a broad set of communications semiconductor products in the traffic management, network processing and switch fabric areas. Mr. Grumlose joined PMC-Sierra from Conexant Systems, where he led the Multi-Service Access business unit through four years of extremely rapid growth.

Who would have ever imagined?

Telkonet® iWire System™

With intelligent Wire Technology

Transform your existing electrical wiring into an intelligent broadband network platform.

Years of research, testing and then, an immense breakthrough. Suddenly the ordinary electrical wires already running through buildings everywhere have a stunning new capacity: delivering reliable Broadband through any electrical outlet.

Too good to be true? Remarkably, not anymore: introducing iWire with intelligent Wire Technology. The astonishingly simple solution that changes everything about providing Internet access for all your residents. Construction dust disappears. Entry costs are completely transformed. Network security and reliability soar. Video, voice, data? Expand away.

The future has arrived and it is right there, waiting inside your walls. Explore the possibilities. Discover your solutions. Find out more at www.telkonet.com/iWire.



(866) 375-6276
mdu@telkonet.com