

# Passive vs. Active Optical Networking

## Real Estate Developers Wonder

By Bill Zakowski ■ *Amedia Networks*

**M**ulti Dwelling Unit / Multi Tenant Unit (MDU/MTU) owners understand that networking a new development from the start is a relatively inexpensive method to significantly boost property value. Developers can cost-effectively pull fiber optic cable to each residence or office suite, paving the way for high-speed services (video conferencing and voice over IP,

tenants? There are two key deciding factors at play here: the services or applications that are available and the access method over which those services are delivered.

There is no question that fiber provides nearly unlimited (for the foreseeable future) bandwidth, and the current cost of optics makes new builds as economical as copper access networks.

neighborhood and Polish to another, for example.

Video on Demand (4 Mbps) is increasingly popular. High-speed data (2-4 Mbps) is a necessity for today's Small Office/Home Office (SOHO) worker, gamer and for transfer of large (e.g. digital photos and videos) files. Security services for the home and business can alert central alarm-monitoring centers of fire or intrusion, and, with high-speed video over IP, remote real-time video monitoring is now possible to homes and businesses. Our next-generation home and office appliances will be Ethernet-enabled: imaging printing documents from home on your office printer and turning on the oven from the office before your trip home. Voice over IP (VoIP) services are currently available from multiple sources at rates as low as \$39.99 per month for unlimited domestic calls. And have you noticed the steady drop in prices for High Definition TV (HDTV) sets? The consumer electronics industry is driving pricing for a large HDTV to under \$1,000. Some programming services are offering over 10 HDTV channels.

Looking at the bandwidth needs for these applications yields the following: standard quality video, 4 Mbps x 4 channels (16 Mbps), plus high-speed data (3 Mbps), plus VoIP (less than 1 Mbps), equals ~20 Mbps. With HDTV's current requirements of over 19 Mbps—using Motion Picture Experts Group (MPEG)-2 level encoding—multiple HDTV streams with VoIP and data can readily approach 100 Mbps required per tenant/subscriber. And these applications are just an example of what is possible with the right broadband access network.

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for example) that tenants value highly. By partnering with service providers, property developers can share in multiple revenue streams from broadband access networks.

But will today's most prevalent fiber-to-the-home/business networking access solutions deliver on the vision they promise? Real-estate developers and service providers planning to expand content-on-demand offerings are exploring the differences between passive and actively switched optical networking, especially in the areas of security, fault isolation and service isolation.

### Content in demand

How will real broadband (20 Mbps and higher) availability enable property developers and real-estate owners to increase the value of their buildings so as to attract more profitable and long-term

So with regard to access to services, the question is not copper versus fiber but whether you build a passive power splitting or an actively switched Ethernet optical network.

Let's look at the broadband needs of the MDU/MTU and Master Planned Communities (MPC). What applications are or will be available that can be offered as a differentiator to secure tenants and buyers? What are some of the drivers of the offers and applications?

One key driver is the diversity of the population. As the United States continues to be a melting pot, our new citizens want more choices in TV and video programming. TV services cannot continue to offer news, sports, shopping and movies in English only. Service providers must offer targeted packages to various ethnic communities—Spanish-language programming to one development or

### Property manager, content provider needs

The property manager is looking for an access network that is:

- **Flexible** so it can handle multiple services from many service providers,
- **Scalable** so that it cost-effectively provides the bandwidth needed today and can economically provision additional bandwidth with the addition of new applications tomorrow,
- **Secure** so content can not be diverted, corrupted or split, and
- **Serviceable** so that faults can be isolated and failure groups minimized.

The content providers most certainly have many of the same concerns. Their business is centered on a high-quality user experience and content protection. Thus, a guaranteed quality of service (QoS) level, regardless of video format (standard or high definition) is important in the presentation of their product. Bandwidth sharing makes extremely high QoS a challenge, and broadcast and select schemes expose a content provider to theft.

Content theft is not limited to video providers. In the case of a work-at-home employee receiving proprietary files from headquarters, the file content is delivered to every home served by the power splitter. Networks must be robust and secure so as to prevent rogue customer-premises equipment from stealing content without detection and malicious hackers from taking down service from an entire group of tenants (up to 32) by simply transmitting a laser upstream to a passive power splitter. This is where the optical access network technology comes to play.

### Get active

Today, there are two major architecture types: actively switched and passively split. Stated simply, active access networks contain an active electronic element, a switch aggregator, between the central office or headend switch and the customer-premises equipment. This active element can be located inside the central office, in the case of a point-to-point system, or in the outside plant, in the case of a point-to-multi-point network.

The passive access network does not contain any electronics between the central office/headend switch and the customer-premises equipment. The trade off is simply one additional active or powered element for every 48 subscribers (the number of customer-premises equipment served by each distribution element) versus a passive power splitter with an inherently lower failure rate but no ability to isolate faults, switch local traffic or provision narrow or uni-cast transmissions.

In a passive network the entire downstream bandwidth is transmitted to the power splitter and delivered to each subscriber. The customer-premises equipment contains optical transceivers that switch on and off during the allocated time slots and select their content; this prevents them from accessing content not intended for them. In an active system, only the content destined for a particular customer-premises device is delivered to that subscriber. Even if rogue CPE is installed in an active network, no content is delivered to it.

Active networks can be initially provisioned to deliver, say, 20 Mbps to all subscribers and later remotely upgraded to anywhere up to 100 Mbps. Passive networks must physically restrict the number of subscribers on a power splitter to achieve higher throughputs. If the total network capacity is exhausted then the electronics at each end (central office/head end and customer-premises equipment) must be upgraded to a newer technology.

Active networks are symmetric in nature, so that 100 Mbps can be delivered in both the upstream and downstream directions. That may not seem necessary to everyone, but, with the increasing popularity of file-sharing applications (e.g., large file attachments to e-mail messages), the bandwidth needs of users have changed radically. These peer-to-peer sharing applications are demanding more and more upstream bandwidth. Is video file sharing the next application that gobbles up backhaul bandwidth?

Finally, while both passive and active networks can support content from mul-

iple service providers, remember that with passive networks the entire content destined for any subscriber is mixed and broadcast to all subscribers. This means that content from Time Warner, for example, is mixed with content from Sony and broadcast to everyone. In an active system all subscriber content is transmitted to the aggregation switch and then distributed to the appropriate subscribers only. At the aggregation switch, all content is converted from an optical signal to an electrical signal, separated from other content, and converted again to an optical signal and delivered appropriately over separate fibers to each destination.

### In summary

Active networks have additional intelligence located closer to the subscriber that can reduce latency, flexibly add bandwidth, isolate faults, switch, schedule and queue traffic—and maximize bandwidth utilization between the switch aggregator and central office.

What does all this mean to the owner/operator of MTU/MDU/MPC? It means that it is insufficient to simply request fiber to the development. Rather, the owner/operator must work with the service provider to understand how it will manage growth, change and support the flexibility to offer service from any content provider – not just the one that the service provider happens to have a partnership with at the moment.

The opportunity to vary and customize the services and content available to your tenants and customers is now technically unlimited. But freedom of choice will come only if service and content providers feel secure transmitting on your network. ■

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### About the Author

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