CenturyLink Takes Aim at XGS-PON FTTH

CenturyLink cites time to market and network speeds as the reasons to migrate to XGS-PON as the next evolution in its fiber-based broadband plan for consumers and business customers.

By Sean Buckley / *Broadband Communities*

CenturyLink has made fiber-to-the-home (FTTH) broadband services a priority in markets that can give it the best return as part of a companywide initiative to offset losses in its lower speed legacy DSL services. As part of its last-mile network transition, CenturyLink plans to migrate from GPON – the current FTTH platform that can deliver 1 Gbps – to XGS-PON.

XGS-PON is ITU-T's next-generation standard and enables service providers to deliver 10 Gbps symmetrical speeds. The XG-PON standard works only in 10/2.5G asymmetrical mode; XGS-PON works in both 10/2.5 and 10/10G symmetrical modes.

Glenn Garbelman, vice president of access architecture and engineering for CenturyLink, told attendees during the ADTRAN 2020 Virtual CONNECT Press & Analyst Event in August that the higher speeds makes XGS-PON attractive. "One of the key pieces is the X in XGS-PON," he said. "It offers 10 Gbps symmetrical speeds."

Garbelman cautions that there are several hurdles with any access network evolution. Whether for DSL or PON, every service provider must install and manage various components.

"When you put up your access network, traditionally it has different vendors for customer premises equipment (CPE), access and the OSS, so it is very complex," he said. "There's no multivendor support. Because there's a one-to-one relationship between that and the network element, scaling is hard. We believe over time this is something we can change."

CenturyLink is among many service providers that's in some stage of deploying XGS-PON. AT&T, Orange, DT, BT OpenReach and Proximus are moving to XGS-PON to provide symmetrical 10 Gbps services.

Global revenue for broadband access equipment rose to $3.3 billion, up 6 percent from the second quarter of 2019, according to a new Dell'Oro Group report. Growth came from spending on PON equipment, particularly in Europe, the Middle East and Africa, where total PON equipment revenue reached $876 million.

"XGS-PON rollouts are starting to pick up steam, which runs the gamut of operators from Tier 1s to Tier 3s," said Jeff Heynen, Dell'Oro's senior research director of broadband access and home networking, during the ADTRAN event.

ACHIEVING XGS-PON EFFICIENCIES

By migrating to XGS-PON, CenturyLink is confident it can gain more efficiencies. XGS-PON can offer higher bandwidth speeds of 10 Gbps to simultaneously support symmetrical fiber services for residents and business customers.

Service providers can also future-proof customer sites to accommodate current and future bandwidth needs.

Using XGS-PON-fed optical network terminals (ONTs), a provider such as CenturyLink can provision a platform that could initially satisfy a 1 Gbps bandwidth requirement for a residential customer or a small or medium-sized business. Later, it could increase the customer's bandwidth without requiring a technician to go in and make a change at the customer location.

"You're not limited to do a 1 Gbps ONT installation," Garbelman said. "Or, if the small business requires different bandwidth, it requires a provisioning event versus technicians needing to swap those devices out." He added it's an issue of "scale that grows as the bandwidth is requested."

Besides higher speeds, the XGS-PON standard offers a similar customer reach to GPON. It can support a higher split ratio of 1:128 and 1:64 users per PON.

CenturyLink sees potential split-ratio scenarios but it still needs to look at various datasets it is collecting in its trials.

"It is early, but I would like to see the 1 and 64 split and how a 1 and 128 and 1 and 32 work," Garbelman said. "It's about how we engineer it, how we deploy it, and what the performance is."

Another potential element that could work for CenturyLink and

SERVICE PROVIDERS SEEK VIRTUALIZATION OPTIONS

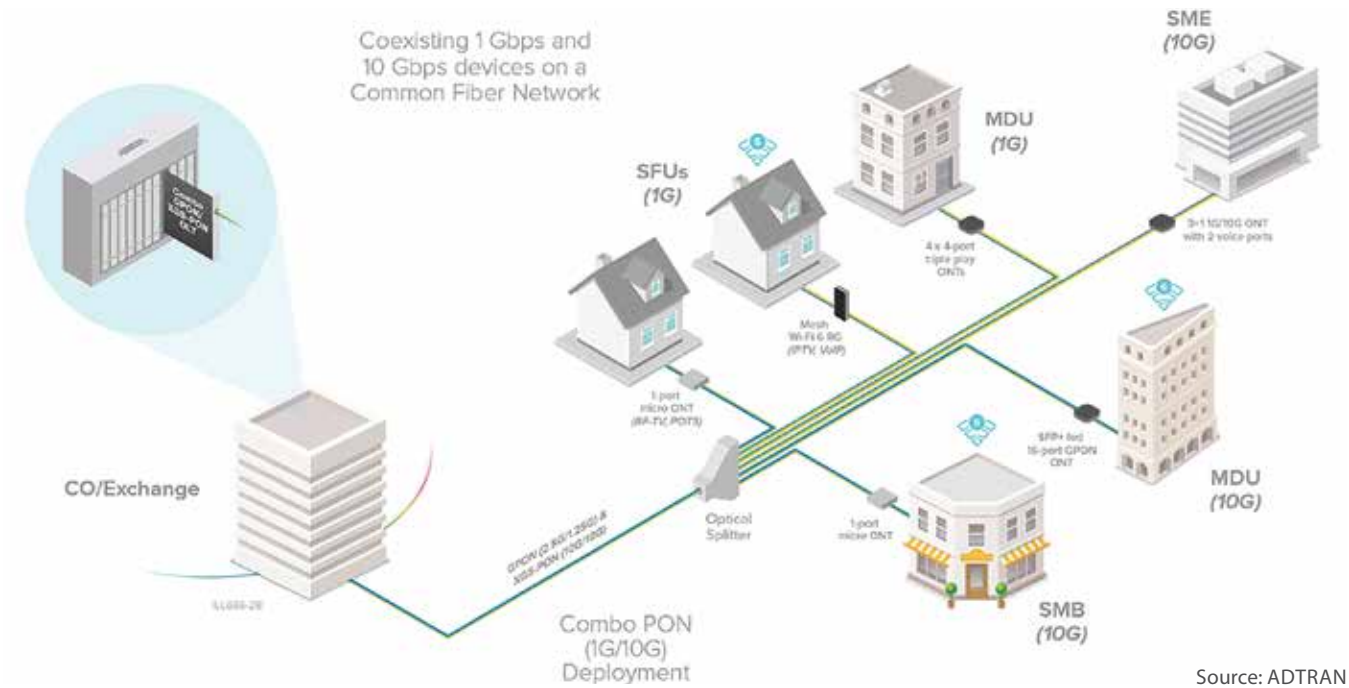
As providers migrate their fiber networks to accommodate 10G services via XGS-PON, they also evaluate how to move to an open disaggregated network architecture via software-defined networking (SDN) and network functions virtualization (NFV). "At the same time providers are transitioning to 10G, we're seeing the introduction of open and disaggregated architectures in fixed broadband networks," said Jeff Heynen, Dell'Oro's senior research director of broadband access and home networking. "There's no question we're still early in the adoption and transition phase of this technology."

AT&T, CenturyLink, Verizon and CBTS (Cincinnati Bell's integrator division) are in various stages of incorporating software-based network elements into their next-gen PON architectures.

Heynen noted a few key trends:

- **Standards:** Standards for network virtualization in access networks are maturing. The industry has general agreements on how these networks will be implemented. Google and Facebook make thousands of changes to their networks daily; traditional service providers also want the ability to quickly scale and adjust to new network demands.
- **Decoupling OSS/BSS:** Service providers can make their networks more agile by decoupling their OSS and BSS systems from the underlying network platforms. Although service providers and vendors have talked about the decoupling of OSS and BSS for years, it has never completely happened. Service providers cite legacy OSS and network management systems as an impediment to becoming as flexible as they want to be. Service providers are trying to rearrange the service delivery and management layer through SDN orchestration. They either purchase elements from third parties, develop SDN internally, or combine elements of both. What drives service providers to change OSS and BSS systems is twofold: gaining spare capacity from the bandwidth they would get from 10G systems to deliver residential and business broadband services, and wholesale wireless backhaul. They also want the flexibility to allocate service workloads based on application needs or geography.
- **Prioritizing technology above marketing:** Traditionally, a service provider's marketing team defines a service, puts together a business plan, and gives a list of the requirements to the technology group. The technology group works with the vendors, gets the new features, and 12 to 18 months later has a service. NFV allows the technology team to go to the marketing team and present a list of services and the pieces the marketing team can combine into an SD-WAN service, a VLAN-type service, or hosted parental controls.
- **Automation:** The No. 1 priority for service providers is automation. For example, service providers will have the ability to develop scripts to automate network monitoring or automate a time of day routing change. Heynen noted service providers also see an opportunity to move toward widely used programming languages, which gives them access to a larger employee base. Comcast, for one, uses virtualization projects to become a destination workplace for analytics graduates and people who understand Python and more modern scripting languages.
- **Self-Reliance:** Instead of waiting on vendors' release schedules, service providers want to define the development cycle themselves. Heynen said there's a "double-edged sword" to this because service providers don't have a solid history of service creation. There are two camps: One group will work with their vendors while others are moving quickly to become self-reliant.

Although service providers such as CenturyLink, AT&T and Verizon are still testing their last-mile virtual platforms and strategies, telcos can save time to manage, deliver, monitor, troubleshoot and provide customer care.



Source: ADTRAN

XGS-PON general diagram

other providers moving forward with XGS-PON is the advent of small-form pluggable (SFP) components in the ONTs. SFPs are used to enable XGS-PON transmission to support 10 Gbps speeds and support simultaneous upstream and downstream using internal WDM couplers.

"I am excited to see that SFPs can be included in residential gateways," Garbelman said. "It's a big benefit for us to be able to use something like that in the future."

HYBRID NETWORK ARCHITECTURE

Though there are various options for FTTH, CenturyLink has followed the PON path with a focus on GPON for its deployments. GPON allows CenturyLink to not only meet current

CENTURYLINK'S LUMEN BRAND TARGETS PROFITABLE FTTH MARKETS

As CenturyLink takes on the Lumen brand name, it will address its residential and FTTH customers via the Quantum Fiber platform. The service provider's XGS-PON plans likely will be fed into its rebranding efforts for the fiber broadband segment of its business.

Its operations will be housed under three brands: Lumen Technologies, CenturyLink and Quantum Fiber. The CenturyLink brand will address copper-based residential and small business services; Lumen and Quantum Fiber will address large businesses and FTTH customers.

Although specific, market-level rollout plans are being developed, Quantum Fiber will be in markets where it offers fiber-based internet services. Eligible customers will be notified when services become available in their area.

CenturyLink recently connected 14,000 homes and businesses in Boulder, Colorado, with fiber. In 2019, it expanded its fiber network to reach an estimated 300,000 additional homes and small businesses. CenturyLink lit FTTH service in parts of Spokane, Washington, and Tucson, Arizona. This year, CenturyLink will build out its fiber network to an additional 400,000 homes and small businesses in Denver; Omaha, Nebraska; Phoenix; Portland, Oregon; Salt Lake City; Spokane; and Springfield, Missouri.

Neel Dev, executive vice president and CFO of CenturyLink, told investors during the second-quarter earnings call that the company will build out parts of communities where it feels it can get a high subscriber density. "We don't really build an entire city," he said, according to a Seeking Alpha earnings transcript. "We really go pick the neighborhoods where we can get high returns because it's a function of population density or home density and the cost to build."

needs, but also have a path in place to migrate to XGS-PON.

"One of the benefits of PON is the hybrid nature and being able to convert to an XGS-PON network," Garbelman said. "I won't rule any technology out, but speed to market and how you care for it are important."

If CenturyLink started its PON network today, it would use a combination of GPON and XGS-PON. "When you look at controlling costs, each has its particular place, so I would use both," Garbelman said.

The other elements that will benefit providers moving to XGS-PON are lower cost components and network cards that can support GPON and XGS-PON.

"The refresh in ONT designs has enabled operators to take advantage of reductions in component costs and made the decision to go to XGS-PON easier," Heynen said. "Also, the availability of GPON and XGS-PON combo cards will give operators a smooth upgrade path and the opportunity to address individual serving areas based on congestion and demand."

Though Heynen can't predict the next step of what CenturyLink may need after XGS-PON in terms of speed, the telco foresees leveraging the two approaches of multiple wavelengths on the same PON and speeding up the 10G wavelengths.

"I am a fan of mid-step, so I would take a combination of both," Garbelman said.

Where will XGS-PON see the most use? Initially, XGS-PON 10 Gbps services will likely be for connecting nodes within multitenant units and commercial buildings. XGS-PON can also provide services to large and small business customers and for wireless backhaul.

Operating at a downstream wavelength of 1577 nm and an upstream wavelength of 1270 nm, XGS-PON allows multiple PON services to coexist on the same PON. It also allows for seamless service upgrade/migration or allows different service providers to use the same PON or offer different levels of service (e.g., business verses residential).

"As you look at the wider customer base, it does not have to be just for consumers," Garbelman said. "It can be for small and medium business customers, so I look for this architecture in the future to be ever expanding in its use cases."

HOME CPE BATTLEGROUND

Once a provider gets its XGS-PON architecture in place, the promise of greater bandwidth doesn't mean much without a robust home network. This comes as the number of connected devices in the home continue to rise.

Parks Associates revealed in its Technology Convergence and the Smart Home report that U.S. broadband households own more than 12 connected devices, including a mix of connected CE, smart-home and connected-health devices. Further, the research firm said, as consumers buy more devices, their purchase decisions are based on a product's ability to work with the existing devices in their home.

Garbelman agreed. In his own home, he said, he uses several connected devices. "It doesn't matter if it's IoT or computers and tablets, in-home devices are growing," he said. "I am surrounded in my home by seven or eight sitting right by me, and that does not include the other 50 spread throughout the home."

The COVID-19 pandemic is also having a greater impact on the home network. As businesses mandate that their employees work from home, bandwidth is being consumed not only for personal uses such as watching Netflix or streaming music, but also for business usage. Users are leveraging their broadband connections to access corporate virtual private networks and conduct video meetings.

"With the pandemic, working from home is on the rise," Garbelman said. "The in-home broadband connection is not just for personal use; it's now blended with business use."

Inside the home, several emerging technologies support the blended use case: Wi-Fi 6 and incorporating SFPs inside the home gateway that support GPON and/or XGS-PON for higher-speed connectivity.

"Wi-Fi 6 is continuing to grow and SFP cages are being installed into ONTs where you can put in an SFP for GPON and XGS-PON," Garbelman said. "The gateway needs to keep up with the connection speeds, but Wi-Fi 6 and Wi-Fi 6E will satisfy a customer's home network in-home bandwidth needs."

In addition, the advent of mesh Wi-Fi networks will drive whole-home coverage. Mesh Wi-Fi systems consist of a main router that connects directly to a customer's modem and a series of satellite modules placed around a house.

"Distributed Wi-Fi access points will enable better performance and a better customer experience with self-optimizing channel band steering and self-optimizing networks," Garbelman said.

DEEPER HOME INSIGHTS

As CenturyLink extends its GPON and its XGS-PON network, it wants to provide a good quality of experience by gaining greater insights into how home gateways perform. At the heart of the service provider's look into the home network environment is the network gateway that connects the customer to the last-mile network.

Garbelman said the biggest factor in ensuring customers get a good experience in the home is the "telemetry and the information we're able to get from the remote gateway."

"The remote gateway gives you the ability to look south at the Wi-Fi connection inside the consumer's home network, the LAN and the internal home connectivity," he said. "The home gateway is a unique place to look at the metrics and identify a problem before a customer call."

He added that because the gateway can look "north into the provider network, when you put those pieces together you can formulate what the customer experiences and get in there and proactively fix it." ❖

Sean Buckley is the executive editor of ***Broadband Communities****. He can be reached at sean@bbcmag.com.*