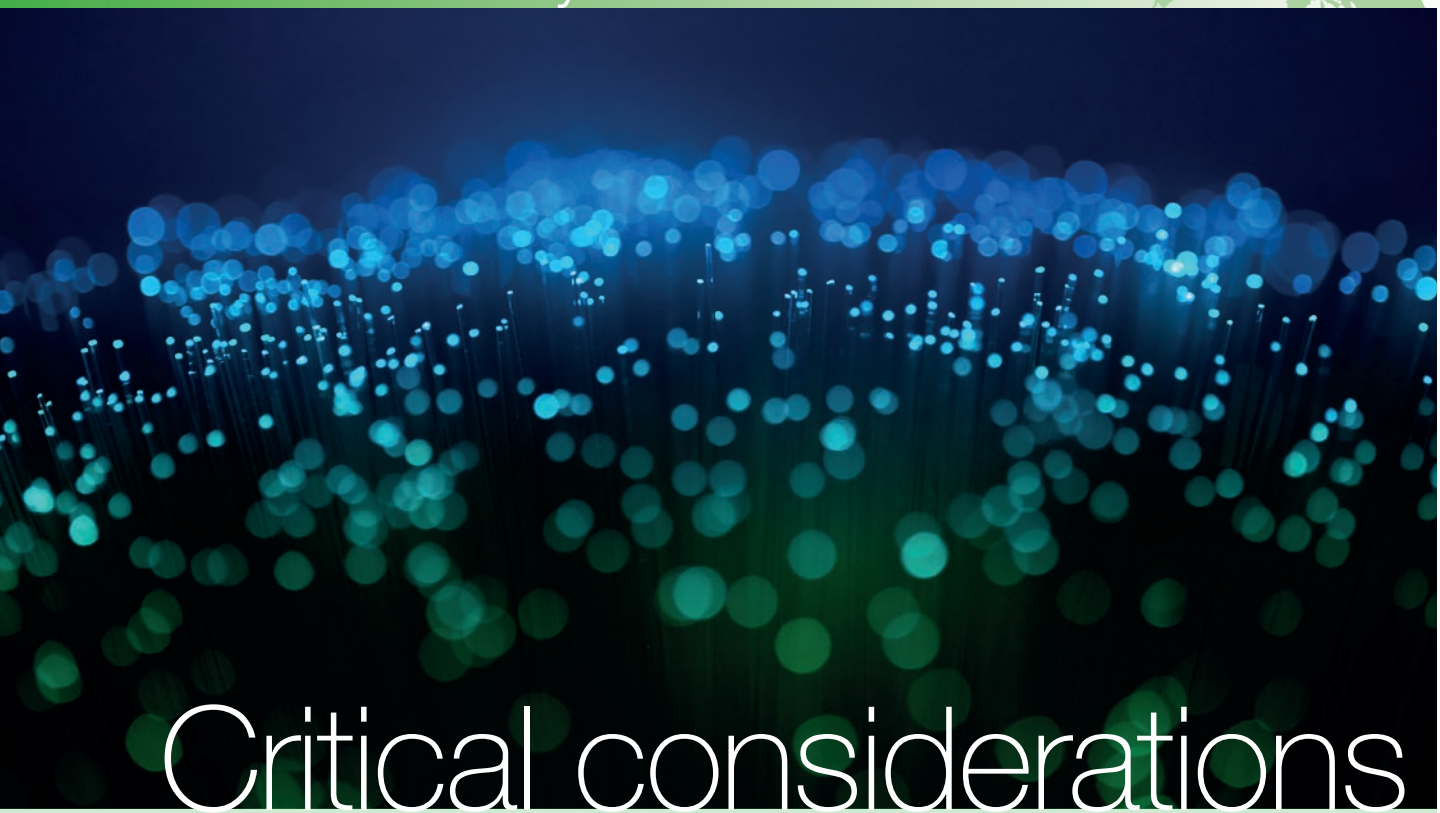

Critical considerations

for a future-ready passive optical network

By Brian Lane, Senior Product Manager, CommScope

Service providers must act on some key considerations in order to plan for future-ready, capital friendly passive optical networks.

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Brian joined the CommScope team in April 2019. Since 2001, he has held key technology and business management positions, in engineering, manufacturing/ operations and product management in the FTTX industry – focused on the development and support of PON products and technologies.

Brian has over 34 years of industry experience. Before focusing on the FTTX industry, he held various engineering and management positions in product development for telecommunications networks and consumer electronics products.

Brian has a Bachelor of Science in Electrical Engineering from the University of Tennessee, Knoxville, and a Master of Science in Electrical Engineering from the University of Texas, Arlington where his research thesis focused on the control theory of unstable systems.

As our world becomes more connected, data is being produced at an exceptional rate. On average, every individual generated 1.7MB of data per second, per day, during 2020. If we consider this on a global scale, we can see the immense significance that data has come to play in society. Not only do we rely on speedy access to data in our daily lives, but it is also becoming a defining success factor for enterprises across every industry.

With the creation and consumption of information and data continuously increasing, it's more important than ever that our networks are ready to handle growing demand. Having the right infrastructure, strategies and innovations in place will ensure access networks are set to become the foundations of future success and industry progression.

Service providers are therefore having to re-evaluate their access networks in terms of capacity while making crucial decisions around network evolution and technology investment. This is where passive optical networking, or PON, comes into play.

Why choose passive optical networks?

A PON is a point-to-multipoint fibre network which allows an individual strand of single-mode fibre to serve multiple end-users, by sending data upstream and downstream through unpowered splitters and fibre distribution equipment. The passive elements of the PON network are supported by two primary active components: the optical line terminals (OLTs), deployed at various points in the network and connected through the passive, shared outside plant components to optical network terminals (ONTs), which are positioned at subscriber's end-user locations.

As service providers develop access networks that can support the ongoing data growth in our hyper-connected world, PON networks which support data rates at 10 gigabits per second and beyond are therefore gaining momentum as the standard for future ready access technology.

When preparing for the deployment of next-generation PON networks, service providers need to consider and plan for several key factors. Primarily, they must ensure their PON networks will be able to successfully handle increasing data load over long periods of time while being deployed, operated, and upgraded in the most cost-effective manner.

A strategy that leverages existing infrastructure, while making targeted investments in key architectures and technologies – and is aligned with performance management capabilities – will enable network operators to meet their business objectives; minimising CAPEX, reducing OPEX, improving service quality and accelerating the pace of innovation in their networks as they scale to meet increased demand.

To bring these considerations together and plan for future-ready, capital friendly PON networks, here is a deep-dive on the areas that service providers should closely examine.

Maximising existing resources for PON access

When deploying a PON network, building brand new facilities and infrastructure to host and connect OLTs can be costly – and therefore it's crucial to maximise existing resources. A strategy that aims to utilise available fibre to deploy smaller, purpose-built, and hardened OLTs embedded into the access network at existing points of presence in nodes, cabinets and hub sites leverages existing fibre runs to multiple PON systems, by using long reach dense wavelength-division multiplexing (DWDM).

This allows service providers to expand their network capacity while avoiding the need to pull new fibre. This puts these energy efficient and passively cooled PON actives in closer proximity to customers to maximise the utilisation of the OLT's subscriber facing PON interfaces, increasing the number of subscribers served. The ability to utilise the current network infrastructure enables PON to serve existing areas where it meets subscriber needs and provides a launch point for expansion to new customers in adjacent areas to the existing plant. This results in a targeted, pay-as-you-grow strategy for lowering CAPEX and speeding scalability of the PON access network.

Splitting up the network functions - an SDN approach to scalability and speed

The management and control of next-generation PON networks benefit from several key innovations. While not typically found in legacy access networks, these are critical to the long-term operational success of today's highly scaled, distributed PON access network.

These include disaggregation of the OLT control and management functions from the physical OLT, utilising cloud-native control and management software, and embracing open standards for management and control.

Today, there are increasing numbers of ways to efficiently handle network functions among distributed elements. For the next-generation PON network, separating network management and control plane coordination from OLT devices and allowing disaggregated virtual control functions to reside in the cloud is the preferred approach. To make PON systems quicker to deploy and simpler to manage, a software-defined network (SDN) architecture with PON domain management for the distributed physical OLT devices and their virtual OLT control functions is key.

For example, numerous smaller distributed OLTs embedded through the outside plant can be time-consuming to administer throughout their lifecycle, especially when they are placed in remote locations. This is particularly true in the onboarding stage as technicians need to bring each new device online.

When the OLT's control plane software resides in the cloud, tasks such as initial software updates, system checks, and other start-up tasks can be automated by the cloud-based domain management function which recognises new OLTs as soon as they are powered up in the field. It then uses automation to bring these devices online quickly, which has the benefit of obviating the need for busy technicians to commission new OLTs. This process converts OLT deployment into a routine task, with hands-free onboarding and less operational impact from PON rollouts.

Onboarding is not the only stage of the OLT lifecycle where ease of administration is important. In a network environment where growth is a given, it is important to be able to add ports to the network quickly and easily. The ability to do this is enabled by the network's disaggregated control and management planes, which enable service providers to scale from very small to very large deployments at a rapid pace.

An OLT can be installed with as little as two ports, then additional ports can be added as required, with the necessary control plane resources (such as compute and memory) located in the cloud where they are easy and cost-effective to scale simply by provisioning compute resources, configuring a virtual machine, and enabling the software. This will improve speed and help to reduce hardware costs, as well as simplifying the process for operators to deploy new hardware and software features, as they won't have to align feature and service launches with periodic system updates.

A modern SDN domain manager also decouples new features from the control plane meaning software teams can create and deploy advanced capabilities on their own development schedules. This makes them available to subscribers quickly and allows updates as often as is needed to allow service providers to deploy competitive services and applications. This modern cloud-native approach built on modern microservices is becoming a requirement for many network operators.

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> **This type of enhanced performance management allows the network operations teams to make the right decisions at the right time for network scaling and technology investment.**

When it comes to implementing this next-generation provisioning and management infrastructure for PON networks, open, standards-based solutions are becoming the preferred option for many network operators, as they come with many network and cost benefits.

As well as spurring on market competition by helping service providers to develop multi-vendor network environments, open solutions will also maximise availability of critical equipment and minimise costs. While single vendor solutions do have some advantages, they can also end up being more expensive and less innovative in the long term, with the requirement of proprietary software as a barrier to launching new hardware and services solutions.

Enhancing customer happiness for a competitive edge

To enhance the quality of network experience, service providers should use assurance platforms to proactively monitor the health of the network, allowing network management teams to make operational decisions faster and spend their time on value-added activities to reduce OPEX, and enhance the satisfaction of subscribers and overall operation of the network.

A service assurance platform that keeps uptime as high as possible is a tried and tested method of enhancing the subscriber experience. Service providers should look out for a predictive, proactive service assurance system built on artificial intelligence (AI) and machine learning (ML) which collects key information about the health of the network, centralises it, and provides real-time visibility to the organisations and applications that rely on it.

This doesn't have to be complicated and, in many cases, ML and AI can then be employed to resolve small issues automatically before they grow and create downtime. This type of enhanced performance management allows the network operations teams to make the right decisions at the right time for network scaling and technology investment.

Proactive performance management is key to keeping a competitive edge. While network capacity and bandwidth are very important, the long-term race won't just centre around speeds and feeds alone. Service providers will soon be competing to go beyond bandwidth and deliver next-level subscriber value through advanced services such as 5G backhaul, VPNs, traffic prioritisation and unified communications.

Using the strategies for cost-effectively deploying PON, a scalable SDN based management system to allow new features and services to be deployed with frequent network updates – and with modern performance management to enhance operations – network operators have the potential to build highly scaled distributed PON networks which enable the rollout of advanced features and services and reward service providers with marked competitive advantage.

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