A comprehensive guide to Next-Gen PON decisions

Decades of FTTH deployment experience to help you create a future-ready network

COMMSCOPE®

COMMSCOPE®

Contents

Introduction

The gigabit revolution has begun. Today, humans are creating, storing, and sharing massive amounts of data, and our digital footprints continue to grow at a stunning rate. It is estimated, that in 2020, people created 1.7 MB of data every second, and, by 2025, it is expected that over 200 zettabytes will be housed in cloud storage worldwide. This data is not only constantly growing, it is constantly flowing as it helps educate, inform, entertain, and connect people around the globe.

CommScope is committed to doing its part to keep the data flowing, and we are constantly pushing the boundaries of communications technology to help people interact and thrive in our hyper-connected world. Our experience and leadership have never been as important as they are today, when service providers are making decisions that will shape the networks of tomorrow. Among the most critical considerations for network operators is on the design and deployment of next-generation passive optical networking (PON), which delivers 10 Gbps now and continues to grow.

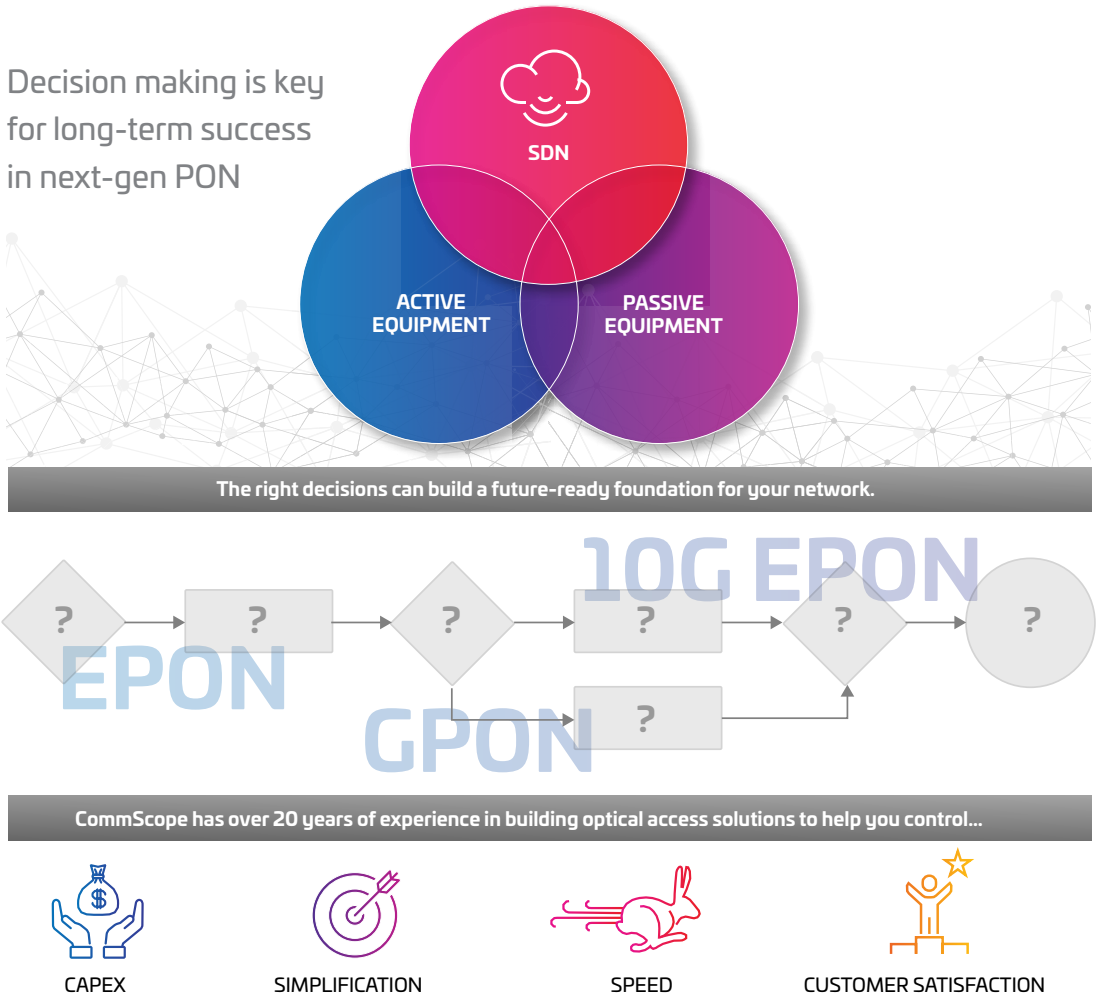
To be successful in next generation PON, service providers need to consider their technology options carefully. The right decisions on active, passive, and software solutions can build a future-ready foundation that can create new opportunities to ensure long-term success.

Chief among these are the abilities to reduce infrastructure costs, to simplify and speed the addition of new subscribers, and to accelerate the delivery of new features. In planning for these outcomes, experience can make a world of difference.

After building optical access solutions for more than 20 years, CommScope understands what it takes to architect PON networks that have stood the test of time. We have deployed thousands of OLTs and millions of ONTs and have gained significant experience in the deployment of GPON, EPON, and 10G EPON. We operate one of the largest PON development, testing, and interoperability labs in the networking industry, and have become a leading advocate for open, standards-based PON solutions.

CommScope first deployed a disaggregated access network in 2002, and in 2016 we predicted that the road to disaggregation also required a distributed approach that moves the control and management software out of the network device and into the cloud. This approach is now commonly referred to as software-defined networking (SDN), which we believe is the single most important architectural principal for service providers to consider when choosing a PON platform. But there are many more.

The lessons and considerations in this eBook reflect CommScope's long heritage as an innovator in PON solutions, a leader within the key forums that are driving FTTH technology, and one of the industry's earliest architects of disaggregated, software-defined networks. Here are what CommScope believes are the most important areas to consider as you prepare for next-generation PON deployment.



Chapter 1

Prioritizing CapEx efficiency with a holistic approach

As with any network upgrade, the ability for service providers to control CapEx is critical in ensuring their investment provides a solid path to profitability. One way to reduce CapEx is to focus on hardware cost reduction. CommScope has learned that customers are able to significantly improve their return on hardware investments by maximizing their use of existing infrastructure. The key is to utilize as many existing facilities as possible and to choose hardware that is built for investment protection.

Reuse existing points of presence

Launching a PON network often requires that active OLTs are located where power, cooling, and environmental protection are assured. But, for many service providers—particularly those who have traditionally delivered DSL over twisted pair—cabinets, enclosures, and other points of presence aren't always where they need to be to support the density and distance requirements of today's PON architectures.

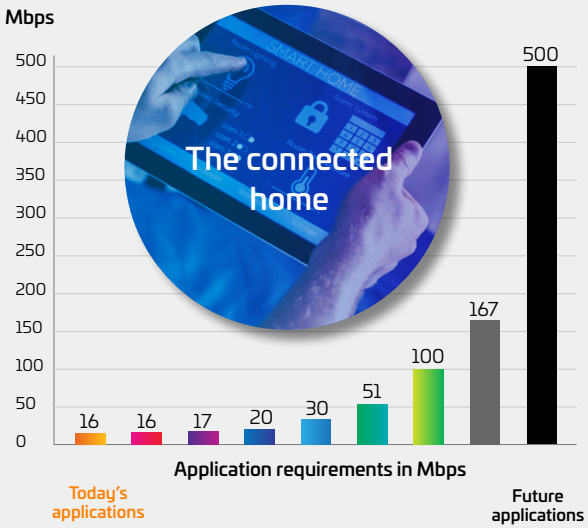
Because it can be extremely expensive to build new facilities to host actives, service providers should seek out OLT hardware that can be deployed in a variety of locations, including the central office, remote cabinets, and MDU environments.

Leverage existing fiber runs

One of the keys to launching PON is the availability of fiber where it is needed. But the high cost of fiber deployment, particularly for fiber runs between central facilities and remote locations, can be prohibitive. Unlike the fiber runs from the drop to the customer premises, spans between the central office and remote OLTs may cover long distances and need to be constructed well ahead of subscriber revenues. Such fiber runs also require rights of way, which can be time consuming and expensive to procure. This is a critical area for cost control.

The good news is that service providers often have existing fiber in these locations that can be leveraged for PON networks—even if it is

Applications continue to develop and consume more bandwidth—the case for FTTH with 10G access



Source: Cisco Annual Internet Report, 2018-2023

being used for other services. To maximize its use, choose PON solutions that support large-capacity network-side interfaces such as DWDM or 100G long-reach optics. Maximizing the capacity on existing fiber between the central facility and remote OLT will help avoid the need to run new fiber over long spans, thus significantly reducing the time and capital costs of PON deployment.

Lower the costs of PON hardware

For years, managing networking systems has relied on specialized hardware running on each device, which handles service provisioning, software updates, monitoring, and other important functions. But running the management software on the OLT device is inefficient and costly. That is because the specialized processing hardware it requires is expensive and needs to be replicated for each OLT in the network.

To reduce these hardware costs, consider running the management functions for OLT devices on COTS servers instead. These standard servers have achieved a level of commoditization that makes them the most cost-effective hardware choice for running PON management software. The cost advantage grows as the system scales, since COTS servers are designed for virtualization and can be shared among a variety of applications—and they are designed to be power efficient. But there are even greater cost advantages associated with this server-based approach.

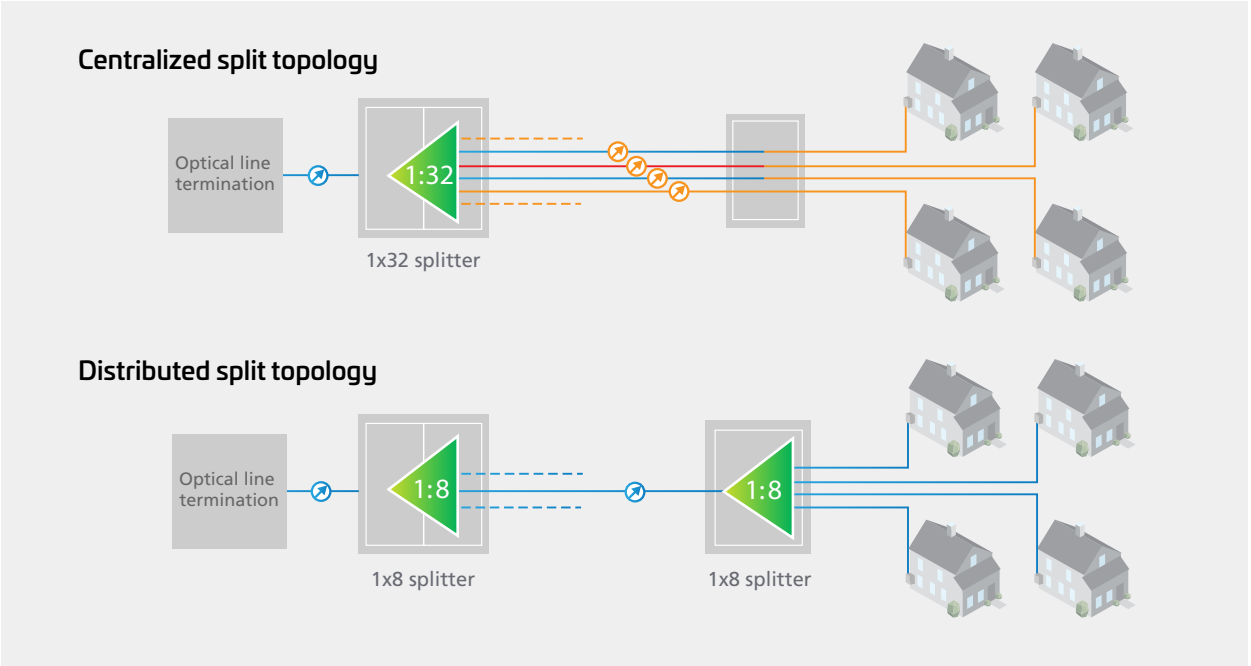
By disaggregating management software from the network hardware, it can be containerized and deployed on virtual machines within a range of popular cloud platforms. By moving network management to the cloud, service providers can reduce their fixed capital expenses and transition to an OpEx cost model where compute resources are spun up and torn down as needed for maximum cost savings.

Reduce the need for specialized networking hardware

Performing all network processing within a PON device can be costly and inefficient. While some networking functions, such as creating a hardened, non-blocking architecture, are well suited to OLT hardware, efficiencies can be achieved by decoupling layer 2 routing and switching from the network device. By combining a domain controller built on open standards with best-in-class routing and switching solutions, service providers can create a software-defined network throughout the PON.

This provides multiple benefits. The first is that hardware costs decline since the processing requirements are reduced for each OLT. In addition, maintaining an SDN within the PON provides a framework that lowers operational costs and improves service velocity, which is detailed later in this eBook. The use of open standards and software-defined networking also allows the service provider to choose the right network hardware for a given application, service, use case, or budget.

Two main network topology options



Choose the right network topology for fiber passives

When it comes to PON topologies using fiber cables and connectivity, there is no "one size fits all" approach that works well for every service provider and application. That is because today's networks have evolved in different ways and on different schedules, and service providers may place different priorities on costs, time to market, and other factors. By understanding the options upfront and choosing the right topology, service providers can maximize their use of existing cabling while either reducing their passive infrastructure costs or streamlining network deployment.

For networks that have abundant fiber between the splitter location and customer premises, a centralized splitting architecture can leverage existing fiber while enabling management and testing to be administered centrally within the hub. Service providers that have less fiber in the distribution area may instead choose a cascaded architecture to reduce the costs of cables, splice closures, and splicing labor. Other topologies,

such as daisy-chain and star architectures, can speed up deployments by using cabling more efficiently or reducing the requirement for splicing labor, respectively. And in rural networks, optical fiber tapping can be used to cover long distances efficiently where housing density is low.

In today's environment of escalating labor shortages, consideration should be given to assess the value of using some of the newer technologies that can simplify fiber network deployment. Advanced technologies such as fiber indexing, pre-connectorized cabling, and modular splice enclosures can also be effective in making the deployment of passives fast and cost effective in a variety of topologies.

Avoid vendor lock-in

While tightly integrated, proprietary hardware and software solutions have their advantages, they can also put service providers at a disadvantage in different ways. Long term, these single-vendor solutions can drive capital costs higher, slow down the rollout of new technologies and features, and create supply chain issues. That is why service providers are wise to continue to ask PON solutions providers for standards-based, open, and interoperable infrastructure.

Open PON solutions not only avoid locking service providers into OLT/ONU hardware, but management systems as well. A multivendor approach ensures continuous competition, which encourages vendors to keep device costs low, product availability high, and new capabilities flowing.

Key considerations for CapEx efficiency

Reuse existing points of presence	Seek out OLT hardware that can be deployed in a variety of facilities and locations
Leverage existing fiber runs	Choose PON solutions that support large-capacity network-side interfaces such as DWDM or 100G long-reach optics
Lower the costs of PON hardware	Consider running the management functions for OLT devices on COTS servers instead.
Reduce the need for specialized networking hardware	Efficiencies can be achieved by decoupling layer 2 routing and switching from the network device
Choose the right network topology for fiber passives	Assess your environment to reveal your options. Choose between centralized or cascaded, daisy-chain or star architectures or even optical fiber tapping for long rural runs
Avoid vendor lock-in	Ask PON solutions providers for standards-based, open, and interoperable infrastructure




Looking ahead

For service providers, the journey to next-generation PON deployment offers exciting new opportunities to prepare their networks for growth. In addition to being efficient with CapEx, today's service providers have a unique ability to architect PON in a way that simplifies network evolution and streamlines the addition of new subscribers and services. They also have a chance to build networks for operational efficiency, using machine learning and artificial intelligence to reduce service issues and downtime while speeding time to repair when issues arise.

CommScope is committed to sharing our next-generation PON experience with service providers and helping them carefully consider their technology choices. In the coming months, we will be adding new chapters to this eBook and providing valuable insights on the issues worth considering as service providers build PON networks that are ready to scale for tomorrow. We hope you will join us on this exciting journey.