Creating a DOCSIS-to-PON Migration Strategy Is Critical in the Era of Overbuilders

Service providers have an opportunity to leverage existing DOCSIS infrastructure to deliver services and simultaneously migrate subscribers, as needed, to PON with minimal capital.

By Richard Rommes / *Harmonic*

Today, there is more funding for rural buildouts from government and private investors than ever. A common misconception in the cable industry is that DOCSIS networks are dead and are not worth maintaining. This is far from the truth. Revenue from DOCSIS subscribers will continue for years to come. Still, operators will likely need to upgrade infrastructure to stay competitive without completely overbuilding their networks with a PON-based fiber network.

The key is to utilize existing DOCSIS infrastructure to deliver competitive services to subscribers and simultaneously migrate subscribers, as needed, to PON with the minimum capital required.

Suppose operators sit still and continue to fund their legacy DOCSIS networks without upgrading infrastructure. In that case, they will potentially be made irrelevant by well-funded, fast-moving competition offering 100 percent fiber and gigabit speed networks.

BILLBOARD RATES VS. REALITY

Cable subscribers rarely push speeds requiring 1 Gbps symmetric services, but the sight of a shiny new billboard offering 1 Gbps symmetric services may give them reason to consider changing. To stem subscriber losses and give pause to new overbuilders, operators need to immediately start selling 1 Gbps symmetric services and then quickly deliver equivalent services while maintaining profitability.

Unfortunately, operators will not be able to build a path to PON unless they upgrade their existing legacy CMTSs and node equipment. Legacy DOCSIS networks are typically built using large, inefficient, purpose-built monolithic platforms that are power-hungry, take up lots of rack space, and, in many cases, have reached their end of life in terms of no longer being supported by the vendor. The evolution of a PON network requires a different approach.

VIRTUALIZED, DISAGGREGATED DOCSIS

How do cable operators leverage their existing infrastructure and simultaneously provide a path to PON? There is significant momentum behind virtualized multitenant and multi-access platforms, which allow cable operators to deploy both DOCSIS and PON using unified software, provisioning and management for all access technologies. Virtualization is the key to these scalable, multi-access platforms.

With the maturation of general-purpose computer platforms (i.e., servers) and system resource management architectures, such as Kubernetes, individualized functions such as virtualized cable modem termination systems (v-CMTSs) and virtual optical line terminals (vOLTs) can be run in individual software modules (i.e., PODs) running on off-the-shelf servers. Purpose-built, proprietary hardware is no longer needed. To expand capacity, operators simply add more computing resources. They only need to upgrade the specific POD on the control platform to add more functionality.

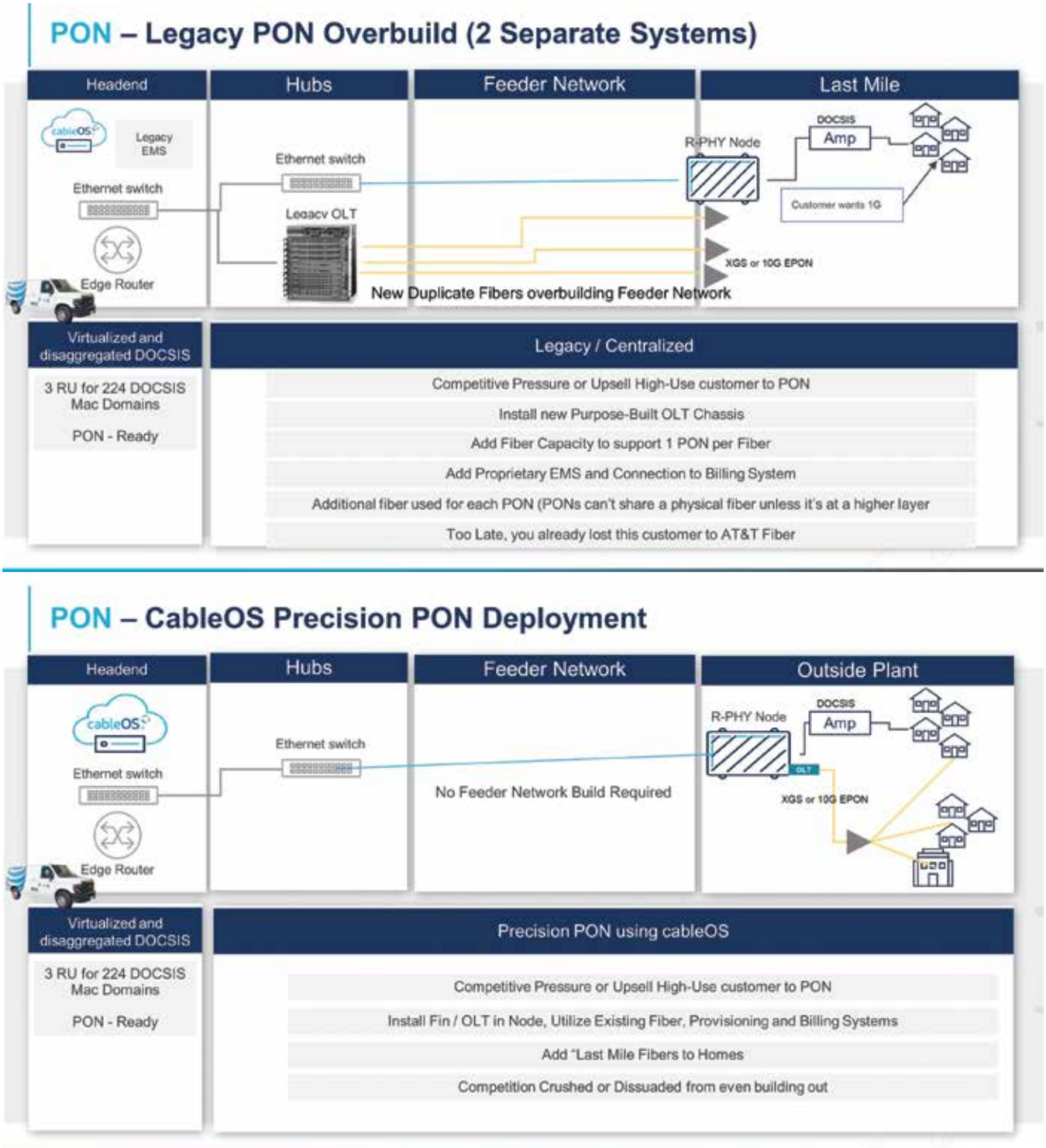

Figure 1. Legacy vs. Precision PON Architectures

DISTRIBUTED ACCESS ARCHITECTURE

With virtualization comes the ability to disaggregate, moving essential external hardware functions to a common platform. This enables multivendor interoperability and the ability to use best-in-class solutions instead of purpose-built systems. Virtualization also allows for easy migration to all-IP-based networks, eliminating the need for costly, complex RF combining in the headend. IP-based transmission of DOCSIS traffic will enable operators to replace an entire rack of combining

equipment with just a few Ethernet switches and inexpensive fiber optic transceivers. Disaggregation also allows far greater distances from the headend to the node than current analog transmission methods.

Migrating the nodes using IP and placing the RF transmission in the node is known as a distributed access architecture (DAA). DAA provides 10 Gbps of Ethernet/IP bandwidth to every node or remote PHY device/remote MAC device (RPD/RMD) in the network using a single wavelength on a single fiber. With DAA, operators have almost unlimited bandwidth capacity on their existing fiber networks.

PRECISION PON

PON was initially designed for the last mile, not for transport over IP/Ethernet aggregation networks. Every PON network requires its unique fiber for approximately every 32 homes. This isn't a problem when subscribers live in a dense environment. However, as subscribers have shifted to rural locations, the PON protocol does not efficiently support broadband delivery from the headend. As a result, PON transport has moved farther away from the headend and closer to subscribers.

Typically, this is achieved by installing an expensive cabinet, adding power and cooling and installing a chassis-based OLT.

Precision PON offers an alternative approach, enabling operators to manage and control PON from a central location in the network to active devices in the field. Under this method, DAA nodes effectively become the OLT leveraging existing 10 Gbps links from the headend to the node for DOCSIS. PON traffic is transmitted over the feeder network using standard Ethernet/IP packets. It can be multiplexed on a single wavelength or multiple wavelengths on a single fiber to scale as needed on existing fibers.

Enabling each PON to be placed much closer to the subscriber base, precision PON allows the number of subscribers per PON to grow from 32 to up to 128 per PON. For a node supporting 1,000 homes passed, a legacy deployment would require as many as 32 fibers, one per PON from the headend to the splitters. Precision PON supports the same number of PONs on a single fiber. (See Figure 1.)

Precision PON helps operators meet the demand for next-gen broadband in rural communities by providing optionality and significant capex and opex savings. With precision PON, operators don't need to invest expensive capex in fiber buildouts to support PON over feeder networks. Operators can now upgrade their legacy DOCSIS platform to a virtualized DAA that supports both DOCSIS and PON using their existing infrastructure. Deploying PON over a DAA network is as easy as adding a software license, putting a single SFP+ module (OLT) into a DAA node, and running fiber for the last mile to homes or areas in need.

Because precision PON is based on a virtualized, cloud-native infrastructure, deployments can be completed in about one-tenth of the time of overbuilding the network with fiber. Moreover, precision PON delivers a massive reduction in ongoing energy use and carbon emissions compared with legacy hardware-based networks. A transformative approach to next-gen broadband, precision PON enables operators to provide competitive 1 Gbps symmetric services, improve the experience for subscribers, increase customer retention, and optimize their network resources. ❖

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