Forever changing the access network

Fixed access network evolution can reduce OpEx by 80 percent and CapEx by 75 percent

**INTRODUCTION**

With the volume of data growing exponentially, driven by a huge number of connected devices, communications service providers (CSPs) are looking at new network technologies, like NG-PON2, and new architectures, like Software Defined Access (SDA), to meet the demand. Passive optical networking (PON) technologies, like NG-PON2, can deliver up to 40 Gbps and have inherently low maintenance requirements when compared to their copper- and coax-technology predecessors.

When combined, SDA architectures and NG-PON2 technology also lead to significant cost savings in the areas of reduced outside plant (OSP) expenses, improved time to market, and reduced support costs. In the following sections, we’ll discuss how new technologies — and more importantly new architectures — can help CSPs reduce operational expenditures (OpEx) and capital expenditures (CapEx) by as much as 80 and 75 percent, respectively. In addition, we’ll outline how these advances enable an ‘always on’ network. Given that subscribers expect to be connected all the time, there is never a good time to take down the network to perform maintenance or upgrades.

**REDUCE CAPITAL SPENDING BY 75 PERCENT**

SDA architectures that use NG-PON2 to deliver services can reduce CapEx by as much as 75 percent, when compared to traditional, fixed access networks. The drivers of these CapEx savings include:

- **Converged Services networks** NG-PON2 enables CSPs to move to a single, converged network for the delivery of multiple services – residential, business, and mobile. One common optical distribution network (ODN) means CSPs eliminate redundant routers, switches, and optical line terminals (OLTs);

- **Centralized SDA** This architecture enables the consolidation of the subscriber management and the aggregation switch functionality in to the OLT, eliminating equipment in the Access network as well as reducing the need to replace/upgrade costly upstream routers in the edge network; and

- **NFV Ready** An SDA architecture that is truly ready for network functions virtualization (NFV) enables the CSP to operate the system software on x86-based servers to perform upfront testing, integration, and certification work. This reduces the CapEx costs normally associated with securing lab space and purchasing equipment.

When CSPs put together a new architecture that converges their services onto a common ODN, using a true SDA that is NFV-ready, CSPs can reduce their CapEx by as much as 75 percent.
REDUCE OPERATING COSTS BY 80 PERCENT

The real benefits of the converged services, centralized SDA, and NFV-ready architecture are seen in the reduced OpEx. These benefits re-occur annually and can truly enable a CSP to re-direct funds to other parts of their business, enabling higher profit margins and revenue growth.

CONVERGED SERVICES NETWORKS

Many CSPs are operating multiple access networks. As shown in Figure 1, there can be one network for businesses services, a separate network for residential services and, in some cases, yet another network for mobile services.

In addition to managing separate networks for these services, CSPs also typically maintain separate systems for each network. Network provisioning is also done separately, by dedicated personnel. This is not a cost-effective model and does not scale in today’s fast-paced, subscriber-driven world, begging the question: Why haven’t we combined these networks?

With the advent and standardization of NG-PON2, a multi-wavelength technology, CSPs can converge the delivery of multiple services onto a single network (as shown in Figure 2).

NG-PON2 supports four separate wavelengths on a single fiber — growing to eight wavelengths in the future — with each wavelength capable of delivering 10 Gb/s. More importantly for the operation of a single network, the availability of multiple wavelengths enables a convergence of multiple services — residential, business, and mobile — on a single ODN. The ability to isolate each service on a dedicated wavelength provides important security benefits, while also recognizing that each service is likely to have different capacity requirements, operational constraints, maintenance schedules, and service level agreements (SLAs).
The convergence of multiple services onto a single ODN results in significant total cost of ownership (TCO) reduction when considering factors like the floor space required for multiple networks, heating, ventilation, and air conditioning (HVAC) costs, as well as reduced materials for fiber installations. The more significant savings, however, are in the reduced costs required to run the services network. Savings associated with traditional support costs can be doubled by reducing the number of systems to manage and maintain.

**CENTRALIZED SOFTWARE DEFINED ACCESS (SDA)**

Converging services to one network results in significant OpEx savings, but the single Access network that remains is still often not as efficient as it can be. For telephone operators (telcos), the Access network has an OLT and an aggregation switch. Subscriber and services management functions are performed in the Edge and Core of the network (as shown in Figure 3).

Figure 3: Traditional Access network (in the middle) uses Layer 2, but the IP Core and Edge networks (shown left) and the home network (shown right) use Layer 3

As telcos move to NG-PON2 this model creates choke points in the network as aggregation switches and upstream subscriber management systems struggle to handle the increased bandwidth coming from the OLT.

To improve throughput, and provide more visibility to subscriber behavior, it makes sense to centralize the functions of aggregation and subscriber management in the Access network alongside the other subscriber-related functions. This results in significant OpEx savings, as there are fewer systems to upgrade, configure, and manage. Further, routers and switches in the Edge network can be simplified. With subscriber management consolidated into the Access network, overhead can be further reduced by consolidating operations personnel functions.

The Calix AXOS platform, with AXOS Routing Protocol Module (RPm) and AXOS Subscriber Management Module (SMm), along with the Calix E9-2 Intelligent Edge System, enable the centralized SDA.

For more details on reducing the number of Access network elements, while providing enhanced network intelligence, please refer to the Calix technical brief titled “Enhanced network intelligence for fixed-access networks”.

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**Figure 3:**
Traditional Access network (in the middle) uses Layer 2, but the IP Core and Edge networks (shown left) and the home network (shown right) use Layer 3.
**ELIMINATE THE DREADED MAINTENANCE WINDOW**

Not only can CSPs not afford any network downtime, but performing a maintenance or software upgrade usually involves overtime as CSP employees typically perform these functions in the middle of the night, when the fewest number of subscribers are affected by an outage. The reality is that there is never a good time to take down the network because subscribers expect to be connected all the time.

With a PON-based Access network, CSPs can choose when they want to perform their upgrade, without needing to bring down the network or provide advanced notice to high-end business customers. Similarly, new revenue-generating services can be added quickly, without any service disruptions.

Calix takes these advantages to another level with AXOS, the only true SDA architecture. AXOS features in-service software upgrade capabilities that allow for the performance of routine maintenance during normal operating hours, eliminating many of the costs associated with employee overtime. For more details on how AXOS accelerates time-to-revenue, eliminates service disruptions, and reduces operational complexity, please visit calix.com/axos.

**IMPROVE TIME TO MARKET (TTM)**

Some of the biggest obstacles to successfully introducing new services are the complex back office systems and the internal processes needed to integrate, test, and certify new systems and applications. Getting to market faster with new technologies allows CSPs to keep ahead of the competition, capturing market share quickly.

AXOS Sandbox uses virtual instances of Calix AXOS system software to enable CSPs to do the lab testing, business support systems (BSSs) and operations support systems (OSS) integration work, and software certification needed on a virtual machine that simulates a real production environment. This accelerates deployment time, grows market share, enhances revenue, and significantly reduces OpEx by eliminating many time-consuming processes that are normally performed by engineers. It also reduces OpEx costs associated with hiring dedicated lab personnel.

**REDUCE SUPPORT COSTS**

Owing to a reduction in the number of network devices, CSPs can expect a significant reduction in the number of alarms that need to be monitored, investigated, diagnosed, and resolved. In fact, having fewer devices in the network will reduce the overall costs associated with system maintenance.

In addition, the Calix AXOS platform features "containerized" software components and the ability to auto-correct itself and continue to operate, constraining alarms that used to be critical, making them minor issues. This allows for automatic recovery from faults and saves a significant amount of time for operations staff, who no longer need to spend hours troubleshooting outages.

**CONCLUSION**

The benefits of a true SDA architecture and NG-PON2 can enable CSPs to reduce OpEx costs by as much as 80 percent (and CapEx by as much as 75 percent). With NG-PON2, CSPs can move to a single, converged network for the delivery of multiple services. With SDA and, more specifically, Calix AXOS, CSPs can consolidate functions into the Access network reducing systems and the overhead of those systems. Utilizing the Calix AXOS RPm and SMm enables the elimination of the aggregation switch and shifts subscriber management functionality from Edge network routers to the Access network. Last, but not least, by utilizing the AXOS Sandbox — which enables the virtualization of the system software — much of the testing, integration, and certification work that is normally required when introducing new services can be done well in advance of receiving actual systems with lower overall costs.

To get more details on how these cost savings are calculated, please request your free network TCO study at calix.com/save80.