SDN COMES TO ACCESS NETWORKS

BUT THERE ARE CHALLENGES

Chris Page, CTO, Telecommunications and Network Systems Division at Precision OT, explains how controller interoperability, machine learning-powered analytics and open source will drive SDN adoption.

Software-defined networking (SDN) is continuing to revolutionise how data centres, service providers and enterprises manage and control their optical networks. Over the past several years, SDN has mainly been used to virtualise and automate core networks, saving network administrators valuable time in managing their digital traffic. By separating decisions about where traffic goes on a network from how it is forwarded, SDN application programming interfaces (APIs) allow administrators to control traffic directly from a centralised console without manually reconfiguring individual switches or routers. As a result, SDN can provide flexible and scalable network architectures for companies needing to adapt to the changing demands of modern applications.

Despite its benefits, SDN adoption has proven to be slower than experts had expected – a Verizon survey in 2018 found that only 15% of companies surveyed had deployed SDN solutions. One of the reasons why network operators, especially those outside the Tier 1 category, remain cautious in approaching SDN is the complexity of determining just how best to leverage it to improve the agility and intelligence of their networks. Now, as SDN use cases evolve beyond easily controllable core networks to the multi-technological topographies of access networks, we see two major requirements that SDN products need to satisfy for widespread adoption: interoperability with equipment from multiple vendors and the ability to leverage data trends in real-time to prevent errors before they happen.

To demonstrate these points, this article examines the recent trends involving gradual SDN adoption in access networks; the role open source collaborations are playing in facilitating SDN integration with legacy equipment and how SDN applications can leverage artificial intelligence (AI) and machine learning to enhance the intelligence and uptime of optical networks.

NEW CHALLENGES FOR SDN ADOPTION

With the advent of revolutionary cellular systems like 5G and the proliferation of last mile fibre-to-the-home (FTTH) deployments, cable access networks are becoming increasingly fibre deep and relying on innovative techniques like Remote-PHY to improve quality of service for their subscribers. As a result, industry interest in SDN functionality is now moving beyond core networks to fixed access networks.

For years, fixed access networks across the world have been evolving to keep pace with the rising bandwidth demands of subscribers. From copper to fibre, these networks have become complex, yet interconnected webs of various types of vendor technology involving multiple distributed access nodes. Software-defined access networks (SDAN) promise operators an effective way to consolidate the management of their network environments to keep operating expenditures down and network adaptability high. The challenge for prospective adopters, as always, lies in finding an SDN controller platform that works with differing types of legacy networking equipment currently in use. Here, open source collaborations are proving to be an attractive option.

The widening number of use cases for SDN is paving the way for the rise of open standards, open source software and open source-design products to diminish vendor-lock and accelerate deployments. Thanks to work done by the Open Compute Project (OCP) and the Central Office Re-architected as a Datacentre (CORD), consumers now have much more choice in how they meet their network's unique requirements. When it comes to access networks, ONOS, a relatively new carrier-grade SDN network operating system, is beginning to make headlines for assisting network operators in revitalising their legacy networks with software-defined architectures. Offering support for both legacy and next-generation devices, ONOS is showing promise for simplifying SDN deployments for access networks.

Yet, as community-based projects, it is important for companies to recognise that open-source SDN controller platforms might not always align with their specific needs. On the other hand, the same argument could be made regarding brand-name SDN APIs. No matter what option network operators pursue, it is critical to invest only in SDN applications that can be easily customised and integrated into networks with complex topographies.

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PREVENTING ERRORS THROUGH MACHINE LEARNING

In addition to simplifying network operations, a new frontier is quickly arising for SDN applications. In fact, a growing number of network operators are beginning to recognise that the future of optical transport is as much a function of software intelligence as it is capacity. Real-time network analytics, supported by emerging technologies like AI and machine learning, are becoming paramount in improving the agility of today's optical networks. Whereas traditional SNMP-based network monitoring operates as a pull model where network telemetry data is gathered by administrators, the new trend is a push model, in which data is forwarded by the software in real time.

Unfortunately, most software vendors producing SDN applications for network analytics only focus on the higher layers of a network, ignoring the optical level completely. However, gathering data directly from layer 1 is of fundamental importance for identifying and addressing anomalies before they turn into outright errors.

When analytics applications only examine the higher layers of a network, they essentially prioritise digital data over its analogue counterpart. At the higher layers, network administrators study how data packets are sent through their networks; this involves analysing data units like packets and frames as well as segments like TCP and UDP protocols. With this methodology, a network administrator can only know whether an error exists or not, because digital data uses sampling to encode what is measured. While various application algorithms exist to help amend errors, the key point is that, with high layer analytics, a network operator is put in a position of waiting for an error to occur before being able to fix it. By contrast, drilling down to the physical layer helps administrators detect and address anomalies well before they even turn into errors. Because analogue devices use data that is continuous, they can provide a real-time picture of what is occurring. In this way, SDN analytics applications that gather data from the analogue devices of an optical network can identify anomalies before they turn into future errors.

One metaphorical example that can prove helpful here is to compare digital versus analogue optical network analytics to watching a favourite show on modern and older television sets. With today's digital models, content is either displayed fully or not at all; but, with older analogue models, it is possible to observe a more gradual fade of the picture as the television set is powered down. To be truly helpful in avoiding downtime and improving maintenance for network operators, SDN applications must be able to draw on analytics from the optical layer.

So, just how can machine learning empower such applications? In this scenario, the software will continually crawl the network to gather as much information as it can from any optical device that can deliver information about what it is doing. Typical optical devices covered include transceivers, optical channel monitors, amplifiers, optical time-domain reflectometers (OTDRs) and reconfigurable optical add-drop multiplexers (ROADMs). As this occurs, the application stores data continuously in order to establish a time series data set that covers the operations of the entire network. At this point, using pre-defined characteristics of potential errors, the machine learning technology enables the application to begin differentiating between normal and anomalous data trends. In this way, going optical with a network's analytics can help operators ensure the health of their individual optical links, addressing anomalies before they ever become actual errors and affect end-users.

At Precision OT, we recently rolled out a machine learning-powered SDN application for optical network analytics called Lightseer. Designed to help operators across the globe automate the logistics of monitoring and configuring increasingly complicated networks, our software uses data from the optical level to improve network intelligence. Because analogue data is so valuable in preventing failures and maximising optical network uptime, we foresee growing demand for these types of applications from network operators.

THE FUTURE OF SDN ADOPTION

Here's the bottom line: SDN applications continue to evolve in ways that make them viable for complex, modern optical networks. With emerging technologies like AI and machine learning beginning to power SDN analytics applications, network administrators are now able to leverage powerful tools to improve the health, agility and intelligence of their optical infrastructure. Yet, they would do well to remember that, with SDN technologies, there is no one-size-fits-all solution. Network operators must carefully assess their needs and be open to partnering with trusted experts that can help them integrate new applications into their networks. Overall, the future of the SDN market is bright.