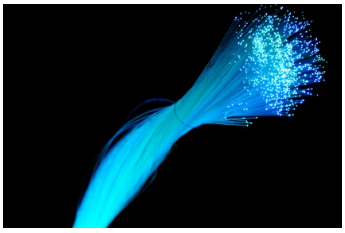
Pipeline
Technology for Service Providers.
www.pipelinepub.com Volume 14, Issue 2

The Impacts of Open Optical Systems - Now and In the Future

By: Dean Campbell



In the 2018 IHS Markit Optical Network Strategies Service Provider survey, it was found that, “of service providers using optical transmission and switching equipment, 47 percent of respondents indicated interest in the use of disaggregated optical equipment in their networks, up from 33 percent in 2016.” Breaking down network functionality into smaller elements allows for more network flexibility, faster updates, and more reliable systems. A fundamental requirement to make this architecture work, however, is the availability of standardized management interfaces (API’s) – “open” interfaces that facilitate the integration of elements within a network.

What Does “Open” Really Mean?

In most contexts, “open” would denote that the protocols, API’s, and other interfaces are well-documented; that they are available for use by resources outside of the vendor’s control. Although documented, an individual vendor could provide its own set of unique interfaces and still be considered “open.” Using this definition, most of the networking devices and software in use today are “open;” they document various API’s that are available for use to configure, manage, and monitor their hardware and software. Each requires customization to the network management tools to account for variation in commands, parameters, and configuration data.

If we look at “open” in a more recent definition—which is the adherence to industry-wide standards (both protocol and parameters)—then the picture becomes considerably different. Although we have common protocols (languages) for management of devices, the parameters (nouns and verbs) are still unique for each manufacturer’s device. There are few true industry-wide management standards for network element types.

Nearly all vendors support Simple Network Management Protocol (SNMP) standards. SNMP provides the ability to retrieve settings and status and receive alerts. Furthermore, SNMP provides the ability to update configuration settings. However, much of the data sent and retrieved from each device is custom for that vendor and device. Vendors publish the Management Information Base (MIB)—the definition of the custom data structures used in the SNMP communication—for each device. When using SNMP, there is a consistent communication mechanism, but most of the content varies by vendor and element.

Network Configuration Protocol (NETCONF) is defined as, “the standard for installing, manipulating and deleting configuration of network devices,” and is quickly gaining traction in the marketplace for managing packet networks. Yet Another Next Generation (YANG) data models are taking the functionality previously provided by MIBs. NETCONF provides the communication mechanism, and the YANG data models provide definition of the data available for reading and writing through the NETCONF interface—very similar to capabilities provided by SNMP and MIBs. Even in this newer interface, though, there is little standardization of the data exchanged. Each vendor strives to differentiate its own products in the marketplace.

In the optical space, the picture is a similar. We have well-defined interface standards (TL-1 for example), but even simple things like alarms can have widely varying content and descriptions. Some of the work from the packet domain is bleeding into the optical space, as many new optical devices support SNMP/MIBs and NETCONF/YANG as monitoring and configuration interfaces.

But, as with packet devices, even when these interfaces are implemented, they utilize custom product data.

Describing today's carrier networks as "open" points to a distinctly mixed picture. Management communication protocols are consistent, but the content and syntax of commands are unique to each manufacturer and product. To date, there has been little prospect for industry-led adoption of fully-standardized API's. Most of the efforts that are currently underway are driven by consumer constituency rather than having full industry-wide support. In order to truly benefit from "open" systems, there needs to be increased "standardization" of the commands and parameters exchanged across the management protocols. We believe there to be both pros and cons to this goal, as outlined below.

Pros:

5G and the Internet of Things (IoT) are two trends that require extensive amounts of new bandwidth. The latest Ericsson Mobility Report states that, "5G will cover more than 20 percent of the global population six years from now." The adoption of 5G and IoT is also increasing the pace of change in the network environment. Because future bandwidth demands will be significantly more mobile and dynamic, enhancing the network's ability to adapt to these changes becomes a "must have." Applications that perform intelligent decision-making, made and applied at machine speed, will start to become the norm. This demands the creation of an intelligent, automated control plane. Standardization of management across network element functionality is required to enable this upper-layer control plane to function effectively.

We can envision an environment where all similar elements respond to a well-known set of commands and parameters, and where machine intelligence can be applied to enhance the speed of response to changing traffic conditions. Openness holds the promise of an environment where software applications manage, monitor and provision elements across the network regardless of the manufacturer.

Cons:

The downside to the open optical systems model is that it may inhibit the creation of new and innovative features. In this more homogenous environment, incremental and evolutionary refinements are driven quickly into the network, as each vendor is competing for market share with a similar product. In effect, common problems are "crowdsourced" and resolved quickly across the market. This is a huge plus for operators.

The caveat? Product differentiation becomes trickier. Deploying revolutionary "leaps" in performance are challenging when constrained by existing standards. IHS Markit finds that the "loss of spectral efficiency gains, system integration and maintenance, lack of operational tools to manage disaggregated networks and slow or disparate standards development," is a concern to network operators. Open systems allow for a more granular product development, speeding development cycles. But the "compartmentalization" of functionality could constrain improvements (breakthroughs) that require changes to multiple elements and changes or additions to configuration parameters. And the lack of standardized management today is limiting the development of truly multi-vendor, network-wide management systems.

Standardization is generally a good thing for customers. Openness is a model that drives flexibility and automation up while bringing prices down. But by eliminating vendors' "innovation margin" from product prices, the model minimizes their ability to perform fundamental research, develop new technology, and drive change into the market while getting a satisfactory return on investment.

With all the cards laid out on the table, where does the "openness" go from here?

"Oh, the Places You'll Go"

To date, we have seen little prospect for industry-wide adoption of “openness” in optical systems. Mega players, like the Internet Content Providers, have enough market leverage to drive some level of standardization into products, but few manufacturers have made a business case for developing a completely standards-based product. It is hopeful to believe that, with enough customer pressure, the vendors will provide hardware which has a base level of standardized functionality and standardized interfaces for accessing that functionality.

By creating a basic level of functionality, core and common functions can be automated. Software applications can handle repetitive operational tasks, allowing for operators to focus on more productive efforts, like implementing new and innovative functions and more quickly adapting to network conditions. This allows for the creation of the kind of network adaptability required to support 5G, IoT, and other new network trends.

With standardized core functionality, vendors will be free to create innovative implementations for those standards. Those core functions and elements may be commoditized, with competition in this part of the market focusing on costs. But this allows manufacturers to focus investment on more difficult network tasks—extensions (new functions and elements) that provide additional functionality. At LightRiver, we implement the 80/20 rule. By this we mean automate and standardize the 80 percent of common functionality, allowing manufacturers to focus their product investments on the 20 percent of leading edge capabilities. This may actually accelerate the development of new network technologies (and coincident with this, the profitability for manufacturers).

Finally, the development of more consistent interfaces allows for creative re-use of the devices. With chunks of functionality available, without need to consider implementation details, network operators are free to “wire-together” network elements in new and unusual ways.

Historically, “open” developments often meet resistance from the entrenched leaders at first, but are then accepted and embraced as both consumer and creators of product realize that focus on consistency, compatibility and interoperability benefits everyone. It appears that the telecommunications market is at an inflection point, with standardization and interoperability just beginning to unlock the power of software automation and allowing the technical creative forces to focus on advanced functionalities that are required to drive the next leap in communications capabilities.