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Accelerating Network Automation and Innovation with Middleware

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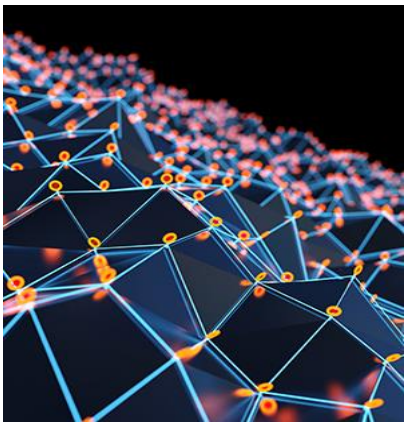

Today's optical transport networks continue to grow in bandwidth, spectral efficiency, and with greater frequency, and are more commonly constructed out of purpose-built disaggregated devices.

Additionally, the disaggregation of functions, from amplification and flexible ROADM to traditional transponding—and more recently, pluggable coherent optics—has accelerated the need for communications service providers to develop automation tools for the operation and maintenance of their networks. The result is a win-win for both network administration as well as the business it serves, creating more efficient operations that also eliminate costly human performance of repetitive functions.

Today's tools to achieve these outcomes largely rely on vendor-specific point solutions, but these aspirations largely work against each other. For example, in the case where automation tools need to be updated any time a vendor changes their control structure or a CSP introduces a new vendor—it can delay network innovation. This conflict can be resolved, however, by introducing multi-vendor middleware between the tool development process and the physical network elements.

Middleware Defined, Market Outlook

According to TechTarget, middleware is software that is used to bridge the gap between applications and operating systems. Its use is relatively common, as many organizations and developers draw on middleware to build applications more efficiently. For example, middleware can be used in application integrations to link both applications together.

And, a fun fact: The name middleware stems from it being software that sits between the client-side requests on thefront-end and the back-end resource being requested.

It's also showing no sign of slowing down; in fact, the global middleware software market will grow from $72.37 billion in 2022 to $75.25 billion in 2023 at a compound annual growth rate (CAGR) of 4.0%.

Benefits of Multi-Vendor Middleware

What are the benefits of using multi-vendor middleware for the ramping up of both network automation and network innovation? Let's explore together, and review real-life examples of multi-vendor middleware as a mechanism to enable the rapid automation of network operations or network functions. These include:

Faster Tool Development. A key outcome in choosing a multi-vendor middleware solution is its use of a single API across vendors, resulting in developing interfaces to one unchanging data structure, rather than a unique one for every type and every vendor of optical transport available in a network. As a result, tool development is accelerated since it is readily taking advantage of common development as enabled by multi-vendor middleware providers. An added bonus is validation testing on a quarterly basis with new releases when they occur with existing or new vendors.

Better Tool Development. Not surprisingly, rapid tool development coincides with better tool development, from network visibility to passive devices. This extends across inventory fiber type and health as well as visibility by wavelength, wavelength performance across disparate vendors' equipment, as well as fiber span.

But how is this benefit realized in a real-world situation? A multi-vendor middleware customer that integrates network assets, cloud connectivity, security solutions, and voice and collaboration tools into a single platform—to enable businesses to leverage their data and adopt next generation technologies—shared some of these benefits and we include them here for your consideration.

In their case, they use their middleware solution to provision automation and as a user interface tool for their next gen optical backbone in the US and Europe. It features full through provisioning for wavelengths and client services on two different vendornetworks and includes myriad varieties of native xponders, disaggregated xponders, and OTN switches, all via the same set of APIs. As a result, their middleware becomes the optical domain controller communicating bi-directionally with the network southbound and northbound (so to speak) with the customer's home-grown orchestration tools. An additional benefit is provided by real-time inventory for both networks, once again via a set of vendor and technology-agnostic APIs.

Rapid Integration. Continuing down the path of APIs and their relationship with middleware reflects other advantages. A single API, by function, can also mean little to no development, or delays in the development, associated with a new solution for the physical network. In many instances, this new transport technology accelerates this progression, creating even faster savings. Moreover, given the persistence and strata of unpredictable supply chains, this can also facilitate timeline capacity by actually increasing vendor choices when bottlenecks occur, and delivery is delayed by an incumbent vendor.

In this case, one of the nation's largest providers of shared communication infrastructure with over 40,000 cell towers and approximately 85,000 route miles of fiber supporting small cells and fiber solutions uses a 5G backhaul switch in two different POP sites connected to filters and amplifiers. In turn, these are connected point-to-point across the outside fiber plant with up to five passive add/drop filters, each tuned to a set of eight wavelengths that feed cell tower routes. In terms of middleware, both multiple vendors and multiple technologies are combined into a single view of middleware for inventory as well as automated maintenance. In an effort to eliminate enrollment time and human error, network designs are fed directly into this solution from an external inventory system. The result? Validation happens at no cost to the CSP in the lab of the multi-vendor middleware, while promoting competitive advantage—and, keenly, disrupting optical transport innovation.

Single Data Structure and AI-Enabled Tools. By using multi-vendor middleware, data is normalized to facilitate AI-centric tools that are implemented between layers of the physical network, including: Layer 0 physical, Layer 0 passive, Layer 1 transponder, Layer 1 line, and Layer 1 functions embedded in the Layer 2 devices, and even extending to some Layer 2 functions.

In certain instances, there are dependencies, (e.g., where products of one tool are essential to the function of another tool). Having a common database and single APIs allow elegant automation as visibility to passive devices and logical inventory of their presence and function make AI tools sharper and more precise.

A primary focus for this single data structure is the experience of one of the largest telecommunication companies by revenue and a leading provider of mobile telephone services in the U.S.—and whose main focus in its largest US tier 1 is maintenance. DWDM, disaggregated Circuit Emulation, SONET, and TDM networks are all interconnected to visualize the true end-to-end circuit paths through multiple network segments.

Key automated maintenance functions include Circuit Analysis Tool (CAT) and Proactive Optical Wavelength Restoration (POWR). In this instance, both are vendor and technology agnostic, available through the UI and API, and capable of gathering real-time data from every network port in its service path. This enables myriad outcomes, to include seamless integration to ticketing systems, test platforms, and external customer "self-test" capabilities. In terms of metrics, CAT API is executed on roughly 5,000 services a day from TDM through DWDM networks. POWR API is focused exclusively on isolating troubles and even autonomously clearing issues on next gen OTN networks executed nearly 40 times a day.

In its next phase, maintenance automation evolves into service layer alarm correlation for Circuit Emulation networks. This correlation engine identifies an events root cause, correlates children services and alarms, and only reports on the common lowest level service. As a result, this can reduce NOC ticket volume by 90%, while also reducing Mean Time To Repair (MTTR). Coupled with a middleware solution, these combined tools provide automated troubleshooting, trouble isolation, and trouble resolution. In other words, an obligatory single pane of glass for users, and automation for any layer 0/1 network across the globe.

CSP Commonality. Innovation and IP ownership focused on the business processes of each Communications Service Provider (CSP) and their unique applications is an additional accrued benefit to those leveraging a multi-vendor middleware solution. This benefit extends to the purchase of third-party tools for areas of commonality with other CSPs that already exist and are easily integrated with standard APS to multi-vendor middleware. As a result, it economizes internal development resources resulting in highest value work.

No tool redevelopment. An additional benefit of utilizing multi-vendor middleware might mean that adding a new transponder or coherent pluggable optic (400GZR/ZR+) to an existing network might require NO tool re-development. Moreover, if one vendor presents new functionality, it becomes common to all vendors in the multi-vendor middleware at the same time, so it can be visible when they collectively catch up to this innovation. Also, testing of existing tools could be outsourced to multi-vendor middleware providers.

Continuous Validation. For those in organizations responsible for quantifying total cost of ownership (TCO) and return on investment (ROI), multi-vendor middleware is highly economical as it provides continuous validation for instances like new software releases, data structure, and functionality from every vendor's solution—even those that take place apart from CSP development cycles and resource pools.

Additionally, compare a multi-vendor middleware maintenance fee measured against the developer time and delay using self-serving continuous vendor interoperability (and validation) as old products cycle out of the network, their respective software licenses can be reused and repurposed for modern devices of the same type.

A turnkey middleware solution also provides a range of related benefits including custom development for integration to any automation, dashboard tooling, external ticketing, inventory, or orchestration any customer may want to utilize to meet their specific business requirements.

Software Defined Network Functions. A robust multi-vendor middleware can serve as a platform for internally developed or third-party tools, such as computation engine and a focus on innovation, leaving implementation to the proven experts.

Other possible outcomes include having a single unchanging API for network inventory to all vendors; a single unchanging API to monitor network health; easy integration of coherent optics into routers and open transport devices; and rapid adoption of new space and power saving long-haul transponders resulting from the continuous advancement in DSP technology and density.Other possible outcomes include having a single unchanging API for network inventory to all vendors; a single unchanging API to monitor network health; easy integration of coherent optics into routers and open transport devices; and rapid adoption of new space and power saving long-haul transponders resulting from the continuous advancement in DSP technology and density.

Doing More With Less

As global markets continue to contract with some regularity, and expand to accommodate the dynamics of multinational economic models and the continued workforce reduction realities that persist amongst technology standard bearers, it is multi-vendor middleware that can serve as both substitute and support for these reimagined and increasingly realigned resources—especially when it comes to doing more with less, and its natural extension, developing more with less.