



## Executive Summary

Infinera, a company long known for its industry leading photonic integration, has announced the release of its Xceed Software Suite. The suite consists of an open-source, OpenDaylight (ODL) controller, microservices based multi-layer path computation element (ML-PCE) and multiple dynamic services applications. Network abstraction is achieved by leveraging open APIs, information modeling and Infinera's Open Transport Switch (OTS) technology.

Although software defined networking (SDN) deployments are common in data centers and some Webscale networks, transport SDN has been slower to emerge from trials and proof-of-concepts (POCs) and gain broad network adoption. The launch of the Infinera Software Suite with its Instant Virtual Networks (IVN) and Dynamic Bandwidth applications will help service providers accelerate transport SDN adoption and on-demand services.

Xceed's agile, automated service delivery model enables organizations to better match networking costs to bandwidth demands and revenue. In addition, service providers can grow profitably by offering advanced services with incremental revenue, minimal operational costs and maximum networking efficiency.

### Key Findings

- A purpose-built, open-source architecture within the ODL framework
- Multi-layer visibility, control and network optimization with Transport SDN and ML-PCE
- Network abstraction and simplified 3<sup>rd</sup> party application development via REST-APIs and YANG information modeling
- Differentiated on-demand services with two initial applications: Instant Virtual Network and Dynamic Bandwidth
- Addresses the #1 dynamic service capability, bandwidth on demand
- Addresses the #1 purchase driver for dynamic Ethernet services, faster provisioning

## Dynamic On-Demand Services

Enterprise and data center customers are looking for agile, on-demand services that enable them to purchase the networking capacity they require when, where and for the duration needed with flexible service agreements. In addition, service providers are seeking ways to enhance revenue, minimize OPEX and improve overall profitability.

In response, multiple service providers announced on-demand services. In 2015, AT&T reported the expansion of its Switched Ethernet Service with Network on Demand to more than 100 cities. Telstra launched its Network on Demand service in 2015 following the acquisition of Pacnet's SDN-enabled network, which was powered in part by Infinera's Open Transport Switch (OTS) solution. Telstra subsequently expanded the PEN network to include 26 global points-of-presence and launched PEN Exchange, enabling on-demand circuit connectivity with other PEN customers. Windstream just announced its intention to utilize the Xceed SDN solution to reduce provisioning times for high-capacity OTN wavelength services.

An MEF webinar (February, 2016) disclosed the results of a 2015 survey on dynamic services. Some key findings include:

- 60% of Ethernet SP respondents plan to offer dynamic services by 2018<sup>1</sup>

- The #1 dynamic service capability is adjusting bandwidth on demand<sup>1</sup>
- The #1 purchase driver for dynamic Ethernet services is faster provisioning<sup>1</sup>

In ACG Research's engagement with enterprise and data center customers, we continue to hear requests for dynamic, on-demand services that enable organizations to better align networking costs to bandwidth usage and revenue. Automated, agile and rapid service delivery can also enhance service providers' top-line revenue. In recent business case analyses, ACG Research has seen as much as 13% per-service increase in first-year revenue correlated to faster service launch and reduced time per service instantiation<sup>2</sup>. With transport SDN and dynamic, on-demand services early in their respective adoption cycles, the launch of the Xceed Software Suite can help to accelerate both.

### Putting the Pieces Together

The Infinera Xceed Software Suite consists of an open source ODL-based controller, custom multi-layer PCE with bandwidth calendaring, and two initial applications. Embracing the DevOps research and development model for Xceed, Infinera ensures continuous development, integration and testing of its multi-layer platform and applications.

### Open Source

The Xceed Multi-Layer SDN Platform was developed within the ODL framework. ODL is an

open source, Linux Foundation collaborative project created to accelerate SDN adoption and unite the industry around a common SDN platform. As a reflection of its broad industry appeal, ODL now has more than 50 member companies with more than 600 active development contributors working on its recent Beryllium (the fourth release) release<sup>3</sup>. The ODL community is committed to rapid, open source software development, placing greater application development control and platform visibility in the hands of service providers.

### Open, Extensible, Purpose-Built

Developing the Xceed Multi-layer SDN Platform in an open framework delivers a number of benefits for service providers.

1) As a platform based on open source software, service providers are assured that the solution is developed in a collaborative and nonproprietary manner within a large community, thereby preventing vendor lock-in and accelerating application development.

2) Xceed utilizes a model-driven approach to describe the network and the applications the network supports. Infinera is active in the standards community, helping adapt transport layer information modeling to a multi-layer environment. For example, Infinera is contributing its expertise to the IETF I2RS and TEAS working groups to help unify the packet and optical layers with YANG, a common modeling

language that can bind layers together to achieve multi-layer optimization.

3) Xceed utilizes REST APIs on the northbound interface to further abstract the network and open it up to a broad range of application development. With a common YANG information model and published REST APIs, application developers don't have to be optical networking experts.

4) Xceed supports a broad range of traditional and emerging protocols including OpenFlow, NETCONF, RESTCONF, XML, SNMP and OVSD. This support enables the Xceed SDN Controller to interface with Infinera's OTS while at the same time also support the resources of other suppliers.

By developing the Xceed Multi-layer SDN Platform from the ground up to be open and extensible, Infinera delivers a flexible solution that can be deployed in a wide range of service provider environments. Xceed can be deployed across Infinera's metro and core domains and can be easily integrated into multi-vendor environments through open northbound integration to third-party orchestration systems.

### **Custom Multi-Layer PCE**

One key component of the Xceed Multi-Layer SDN Platform is its advanced intelligent multi-layer PCE. ML-PCE provides the logic for allocating resources and routing paths across the network. With access to centralized topology

information and network state information, ML-PCE has visibility to resource utilization and availability across networking layers. The advanced computational analysis of ML-PCE can take into consideration constraints beyond the traditional shortest path or least cost metrics. Networking attributes such as availability, latency, performance, consumption, diversity, and oversubscription can all be taken into consideration by the computational engine.

When coupled with operator-defined policies, ML-PCE calculates the desired action for a new service. For example, when computing a path for a new E-Line service between two end-points with a nearly full Layer 1 OTN circuit, ML-PCE can arrive at different outcomes depending upon the service provider's enumerated policies: 1) reusing the existing circuit, 2) creating a new circuit, 3) hitlessly expanding the existing circuit or 4) rejecting the service request altogether.

In addition to computing the appropriate path at the time of service instantiation, the ML-PCE software analyzes the network for efficiency improvements that can be made throughout the lifecycle of the service. An example of a multi-layer optimization use for ML-PCE is resource reallocation and re-grooming to improve network efficiency.

Over time, services can become fragmented across multiple layers. ML-PCE supplies the necessary

computational horsepower to analyze the network and optimally repackage services for the most efficient and cost-effective transport, saving resources, reducing capital expenses and maximizing network utilization.

### **Modular, Deployable Applications**

In addition to developing the Xceed Multi-Layer SDN Platform with advanced ML-PCE capabilities, Infinera is also developing a number of applications for service providers and their enterprise and data center customers. By utilizing a common information model and communicating with the platform via APIs, applications can instantiate, modify and terminate networking resources while abstracting the details. The YANG information model and REST APIs are public domain information that anyone can utilize to create an application and program the network, including the service providers themselves.

The two Infinera applications that are initially available with the Xceed Software Suite include Instant Virtual Networks (IVN) and Dynamic Bandwidth. Other applications are under development for future releases.

The IVN application enables the overlay of multiple virtual transport networks on a shared physical underlay across metro and core domains. End-customers have full multi-layer visibility and control of their virtual network slice and each IVN has its own container-based ML-PCE instance. By virtualizing the network, SPs

can deliver highly tailored and differentiated services without additional capital investments.

The Dynamic Bandwidth application enables the on-demand creation of Layer 1 (OTN) and Layer 2 (Ethernet) services. Dynamic Bandwidth enables service additions to be calendared for known events such as the World Cup or the Olympics or for unplanned events such as network outages that impact service level agreements or severe weather that causes the partial loss of a data center. The Dynamic Bandwidth application's behavior during unplanned events is policy driven. A set of policies or rules are created that provides the Dynamic Bandwidth application with guidelines about actions to be taken under various conditions.

Policy and intent-based networking remains a hot topic for the networking industry and includes discussion and collaboration among ODL, ONF, IETF, TMForum and MEF. We expect Infinera to remain an active participant in this evolution.

### **Conclusion**

Enterprise and data center customers are looking for agile, on-demand services that enable them to purchase the capacity they need when, where and for the duration needed with flexible service agreements. In addition, service providers are seeking ways to increase revenue, minimize operational costs and improve overall profitability. Infinera's Xceed Software Suite delivers

dynamic service applications over an open source SDN controller with advanced multi-layer path computation and a rich network abstraction layer. Xceed's automated and programmatic approach helps service providers achieve profitable growth by maximizing multi-layer networking efficiency and minimizing operational costs.



[Tim Doiron](#)  
[tdoiron@acgcc.com](mailto:tdoiron@acgcc.com)

Tim Doiron is principal analyst for ACG's Intelligent Networking practice, which includes Packet Optical Transport solutions, Data Center Interconnect (DCI), Transport/Multi-Layer SDN (ML-SDN) and fixed-line NFV.

### Sources:

- 1) New Dynamic, Assured Third Network Services Powered by LSO, MEF Webinars, Moderator: Stan Hubbard, February 16, 2016.
- 2) ACG Research, Various Business Case Analyses, 2015-2016.
- 3) PowerPoint Presentation, March 2016, 2016 ONS Conference, Neela Jacques, Executive Director, OpenDaylight.

www.acgcc.com, © Copyright 2016 ACG. Reproduction is prohibited unless authorized. All rights reserved.