

XCEED SOFTWARE SUITE

# XCEED MULTI-LAYER SDN PLATFORM AND APPLICATIONS

## Accelerating SDN in Transport Networks

### Introduction

Network operators are under pressure to move faster. Whether their customers are households, small businesses, large enterprises or other service providers, users want access to an increasingly diverse range of cloud-based services, applications and content instantly and with uncompromised network performance. Traffic patterns from cloud networks and applications are increasingly variable and unpredictable, requiring operators to activate bandwidth, reconfigure network resources and adapt to application demands in real time and with more awareness and intelligence across the packet, digital

and optical transport layers. Operators are responding to these challenges by migrating toward a new, simplified network architecture. This simpler architectural framework consists of only two layers – the converged packet-optical intelligent transport layer, Layer T, and the cloud services layer, Layer C, which includes virtualized network functions and applications running in the cloud.

For the past several years, service providers have evaluated software-defined networks (SDN) to help adapt to cloud-based business models and network operations. Initial SDN deployments addressed

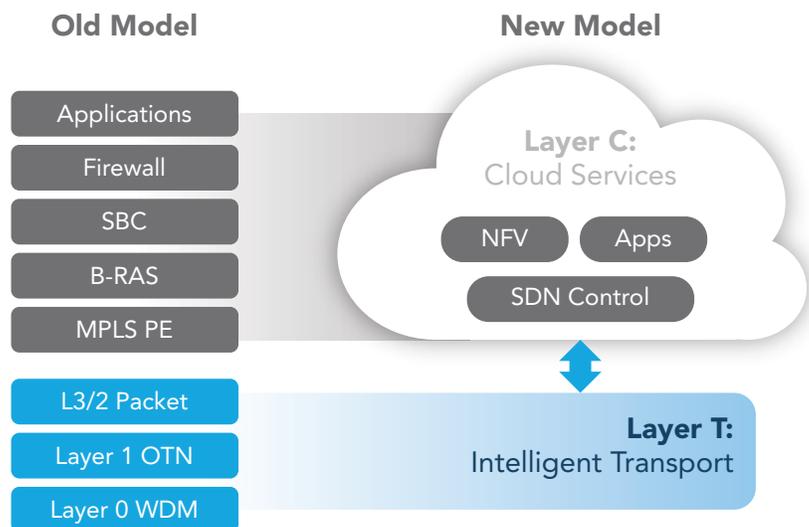


Figure 1: Layer C and Layer T

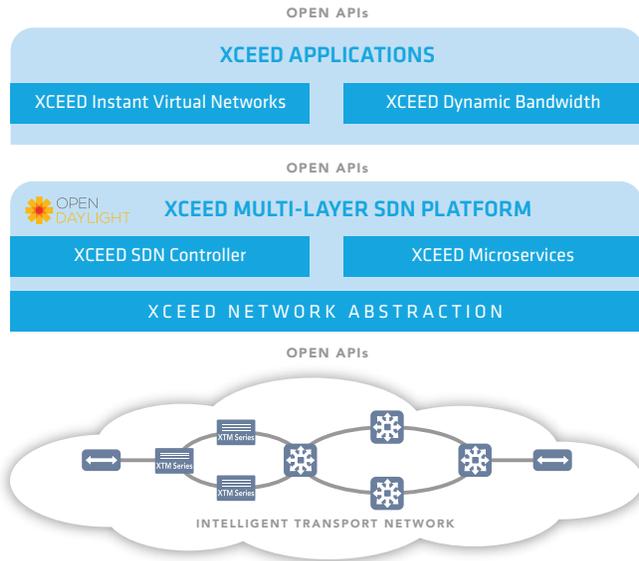


Figure 2: Xceed Software Suite

scale and automation challenges within the data center. Now SDN is expanding to the wide area network (WAN) as operators create and deploy new SDN applications to optimize network efficiency, drive revenue growth and increase customer loyalty. Operators are moving beyond trials to achieve business results and validate the SDN business case. Building on its leadership in open transport networking, photonic integrated circuit (PIC)-based optical technology and software designed for rapid bandwidth activation, the Xceed Software Suite helps network operators realize the promise of SDN in an open packet-optical transport environment and move toward a simplified network model.

### Introducing the Xceed Software Suite

The Infinera Xceed Software Suite is a portfolio of software solutions that make bandwidth more dynamic and flexible. Xceed combines an open, multi-layer SDN control platform with modular, commercially deployable applications that enable new revenue sources while improving network efficiency. Designed for multi-layer networks and unified SDN control across metro, long-haul and subsea networks, Xceed complements Infinera’s Digital Network Administrator (DNA) network management software and enhances Infinera’s robust portfolio of software solutions.

### Activating Terabit-scale, Pre-deployed Capacity

The prevailing model of activating optical capacity—one transponder at a time and reactive to network traffic changes and end-user

demand—is far too rigid, labor-intensive and slow for on-demand, cloud-based business. Moreover, the optical transport layer is typically operated in isolation with limited real-time awareness of packet-layer traffic demand, stranding capacity and leaving network assets underutilized as bandwidth is overprovisioned at each layer.

Infinera is redefining how transport networks scale and optimize network capacity. Three Infinera innovations work together to help network operators scale network capacity, automate service provisioning and realize network efficiencies through multi-layer intelligence:

- **Infinite Capacity Engine:** the industry’s first multi-terabit opto-electronic subsystem, the Infinite Capacity Engine allows operators to pre-deploy up to 2.4 terabits (2.4T) — unprecedented scale in a single package
- **Instant Bandwidth:** Infinera’s unique capability to activate granular slices of pre-deployed bandwidth, whether dedicated or in user-defined periods of time, resulting in a success-based business model
- **Xceed Multi-layer SDN Control:** Serves as the network’s nerve center, applying multi-layer visibility and control to an infinite pool of intelligent bandwidth, activating capacity dynamically through open application programming interfaces (APIs) to the transport layer

Working in harmony with the Infinite Capacity Engine and Instant Bandwidth, Xceed provides the multi-layer intelligence, open environment and automation that operators need to commercialize applications with speed and agility.

### Xceed Applications: Delivering Revenue-ready SDN-based Applications

Xceed Applications are commercially deployable SDN applications designed to help operators rapidly activate revenue-generating services. Built on the APIs of the Xceed Multi-layer SDN Platform, Xceed Applications also enable operators and third-party developers to create and deploy additional SDN applications quickly and easily. These applications span the optical, digital and packet layers and are deployable across metro and core packet-optical infrastructures, providing the flexibility to add on-demand characteristics to a wide range of end-user services. Leveraging standards-based YANG information models, Xceed Applications can be integrated into third-party orchestrators and operations support system (OSS) environments.

#### Xceed Dynamic Bandwidth

Dynamic Bandwidth provides end-users with on-demand provisioning of digital optical transport network (OTN) and Metro Ethernet Forum (MEF)-compliant Ethernet services. Dynamic Bandwidth can be deployed for a wide variety of use cases, including customer self-provisioned connectivity services and advanced, policy-based service

routing, such as minimum-latency routing for delay-sensitive applications or shortest-path routing for time-sensitive services. Network operators can invoke Infinera’s open APIs or use the Xceed graphical user interface to determine network policies, provision services and monitor and analyze network performance.

**Xceed Instant Virtual Networks**

Instant Virtual Networks (IVN) leverage Xceed’s rich network abstraction capabilities to create virtualized networks at the packet, digital and optical layers and across metro and core domains. Each IVN customer owns a logical partition of the network with isolation from other customers and visibility and control of their network. With IVN, Infinera makes the network infrastructure multi-tenant-capable, providing independent path computation functions for each partitioned network, enabling customers to customize routing policy for their own applications. Like Dynamic Bandwidth, IVN takes advantage of the physical layer automation, flexibility and PIC-based economics enabled only by Infinera.

**Xceed Multi-layer SDN Platform: Purpose-built, Open, Extensible and Scalable SDN Control**

The Xceed Multi-layer SDN Platform comprises a rich abstraction layer, open source-based SDN control functions and custom microservices designed from the ground up to optimize networks and deploy SDN applications with speed and agility. Based on the OpenDaylight open source platform, the Xceed Multi-layer SDN Platform supports Infinera-developed Xceed Applications and also enables operators

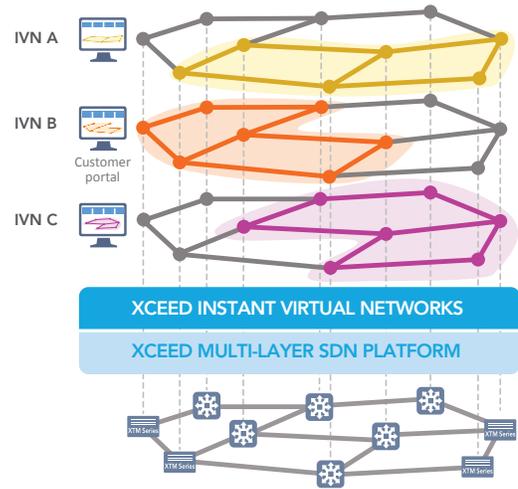


Figure 4: Xceed Instant Virtual Networks

and third-party application developers to create and deploy new SDN applications with greater feature velocity and more visibility and control of platform functions. The platform architecture is designed with easy extensibility and high availability to support the requirements of real-time changes in transport networks.

**Multi-layer Path Computation Element with Bandwidth Calendaring**

Xceed employs an intelligent multi-layer path computation element (PCE), which enhances traffic engineering and automates service provisioning across the packet, digital and optical layers. Xceed

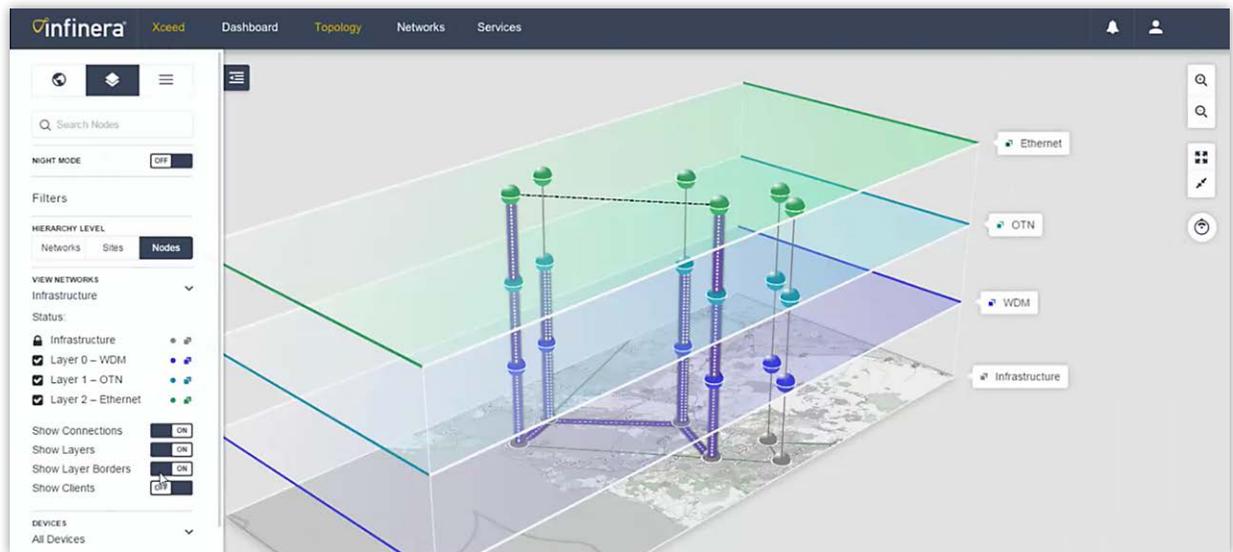


Figure 3: Xceed Graphical User Interface

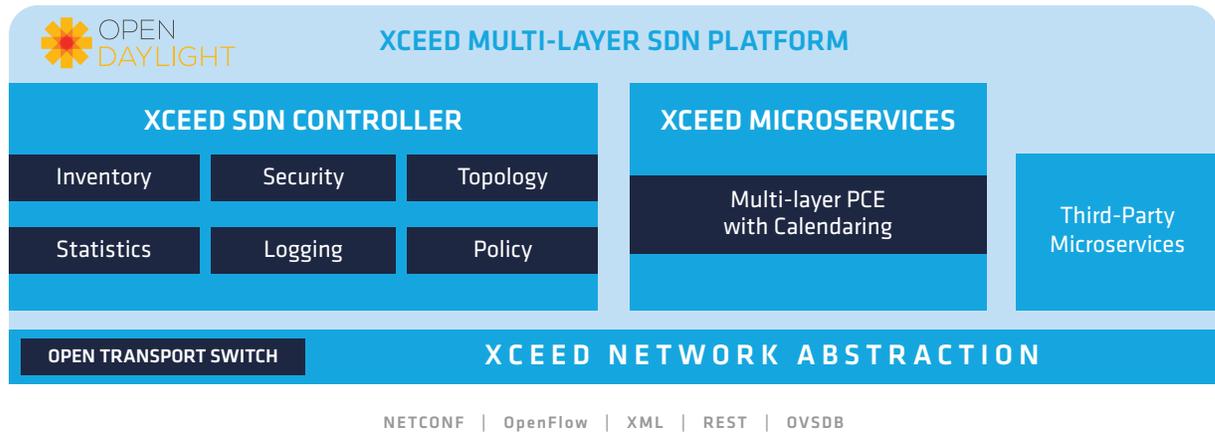


Figure 5: Xceed Multi-layer SDN Platform

Multi-layer PCE addresses the pain points of conventional networks that employ isolated, over-provisioned layers with uncoordinated, distributed intelligence. Designed and developed as a microservice by Infinera, the Xceed Multi-layer PCE provides awareness and analyzes traffic across layers, leveraging the agility of a programmable transport network to make the packet layer operate more efficiently with lower total cost of ownership. It is designed to provide global multi-layer, multi-constraint-based optimization with automated protection and restoration. Xceed Applications and customer-developed and partner applications use the PCE’s advanced policy-based routing function to customize services and realize multi-layer network efficiencies.

The Xceed Multi-layer SDN Platform provides network operators with the ability to plan and implement future service deployments through bandwidth calendaring, which can be applied to any Xceed or third-party application in the packet, digital and optical domains. Calendaring enables Instant Bandwidth activation at pre-determined start and end times based on policy and network availability. Use cases such as scheduled video streaming events, server replication across the WAN, and latency-sensitive transactions are ideally suited to Xceed’s Bandwidth Calendaring capability.

**Open APIs, Standards-based Information Models**

The Xceed Software Suite makes the network programmable through a comprehensive range of open APIs. Infinera supports open APIs

northbound and southbound from the controller and application layers, as well as open APIs to platform services such as the multi-layer PCE, allowing users to add their own intelligence to the platform. With years of practical SDN experience—highlighted by multiple SDN deployments with the Open Transport Switch (OTS)—Infinera provides a rich set of APIs at multiple layers and with highly flexible abstraction capabilities, enabling operators to gain greater control over how the transport network is optimized.

Infinera’s standards-based YANG models make packet-optical transport networks more programmable and help onboard applications rapidly (for example, to a third-party orchestrator). By contributing transport-layer information modeling expertise to leading standards bodies, Infinera is helping unify the packet and optical layers with YANG, a common language that can bind layers together to achieve multi-layer optimization.

**Xceed Abstraction Layer**

The Xceed Multi-layer SDN Platform incorporates multiple network abstraction functions to support end-to-end service control across a full range of packet optical platforms, from metro to long-haul and subsea. Infinera’s Open Transport Switch, deployed since early 2015 for long-haul and subsea network abstraction and programmability, is fully integrated into the Xceed Abstraction Layer.

Learn more at [www.infinera.com/xceed](http://www.infinera.com/xceed)

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