Infinera Instant Network

NETWORK operations have been constrained by the complexity of optical capacity engineering for too long. Making changes to the network has entailed a cumbersome process of forecasting traffic demands, calculating the spectral allocation and expansion potential of deployed systems, purchasing new equipment, installing and testing the new gear, and finally activating the new capacity. To date, software-defined networking (SDN) has primarily focused on virtualizing services on Layers 1 through 3 within existing fixed optical capacity, but when more capacity is needed a truck roll is required.

Software defined capacity (SDC) is a term that describes the ability to engineer, provision and transfer optical capacity around the network via software control – it complements SDN and is an essential foundation for fully cognitive networks. Infinera's initial SDC offering, Instant Bandwidth, enabled optical capacity to be activated via software on a line module-by-line module basis. With Instant Network, SDC now takes a huge leap forward, supporting the ability to analyze and engineer optical routes and provision capacity across the entire network in order to support upper-layer services and other changes in network demands.

For transport network operators, Infinera Instant Network reduces capital expenditures (CapEx) and eliminates business risk associated with provisioning new capacity for emerging applications such as 5G mobile services, the Internet of Things (IoT), streaming video, Carrier Ethernet and cloud-based on-demand business services. It reduces overprovisioning of capacity and idle CapEx by activating new capacity only when revenue-generating services demand it and helps reduce business risk by shrinking the time between paying for capacity and activating services.

Instant Network also enables service providers to accelerate service delivery and lower operational expenditures (OpEx) by automating optical capacity engineering and by reducing truck rolls to install additional hardware. It uses industry-standard application programming interfaces (APIs) like Metro Ethernet Forum's MEF 55, Optical Internetworking Forum's Transport API (TAPI), and representational state transfer (REST) to interoperate with service orchestration software and operates as part of Infinera's Xceed Multi-Layer SDN Controller.

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Infinera's Unique Ingredients

Instant Network combines Infinera's leading-edge photonics with open software to automate optical capacity engineering. Products built using Infinera's 500 gigabits per second (500G) optical engine and up to 2.4 terabits per second (2.4T) Infinite Capacity Engine enable software defined capacity to be active as service demands request it, reducing idle CapEx and helping match the timing of capacity expense to service revenue. Instant Network amplifies the success of Infinera Instant Bandwidth by adding three new capabilities: Bandwidth License Pools, Transferable Licenses and Automated Capacity Engineering (ACE).

Bandwidth License Pools

- Deploy capacity in minutes at the same time as a revenue-generating service is activated.
- Receive an invoice after the capacity is deployed.
- Reduce capital expenditures for overprovisioning and idle capacity.

Transferable Licenses

- Use software to transfer bandwidth licenses across the network as traffic conditions change or fiber cuts occur.
- Bandwidth licenses are no longer fixed to a specific line module or platform.
- Reduce capital expenses by reducing idle capacity provisioned specifically for network resiliency.

Automated Capacity Engineering Application

- Automate in real time the previously offline, manual network planning function.
- A microservices-based path computation element (PCE) that is aware of optical impairments computes optimal Layer 0 routes between nodes across multiple paths.
- Provides automatic routing and wavelength assignment with multiple path constraints such as traffic engineering cost, distance and latency.

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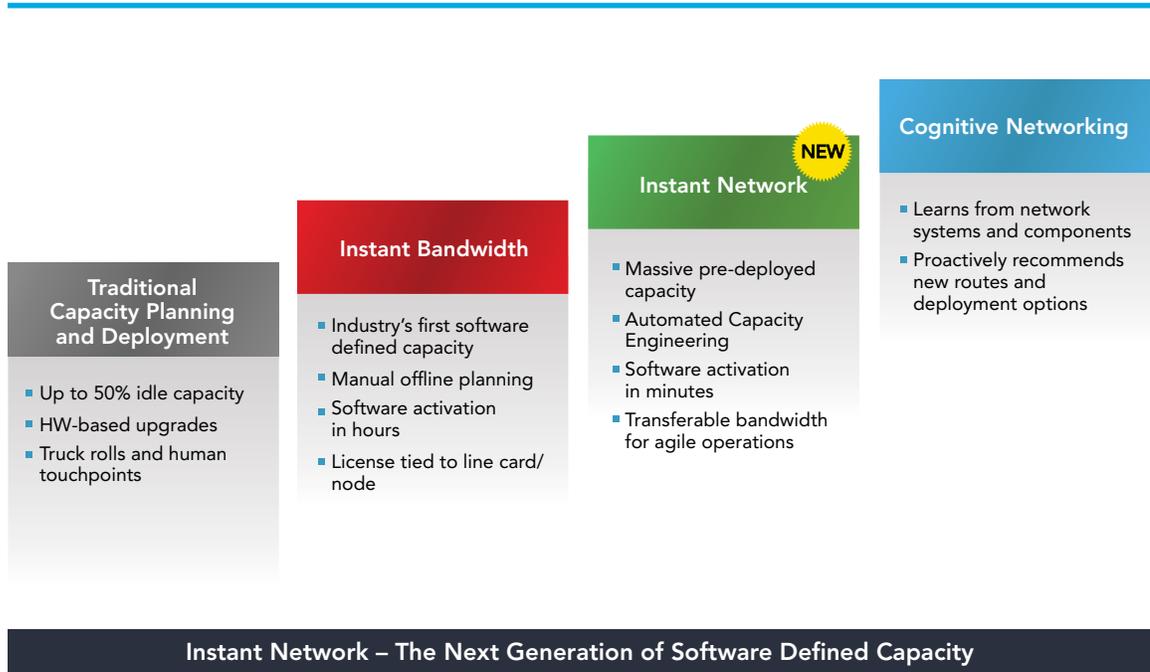
Infinera®

Delivering Benefits to Operators Every Step of the Way

Infinera Instant Network delivers for the first time the power of software defined capacity for cloud scale networking, setting the foundation for cognitive networking. Network operators can automate optical capacity engineering and the deployment of new optical capacity in minutes.

Infinera introduced Instant Bandwidth in 2012, enabling for the first time software activation of service-ready optical capacity in a few hours on networks powered by the DTN-X platform and equipped with Infinera's unique photonic integrated circuits (PICs). In 2015, Infinera introduced Time-based Instant Bandwidth, enabling software activation of bandwidth licenses for a limited duration and extended both types of licenses to new products such as the Cloud Xpress.

Instant Network Bandwidth License Pools allow operators to activate capacity in minutes and are billed after the fact for that capacity. This significantly increases the economic efficiency of the network by reducing the overprovisioning of capacity that is paid for up front and sits idle. No longer is capacity overprovisioned before customers are actually ready to use it.
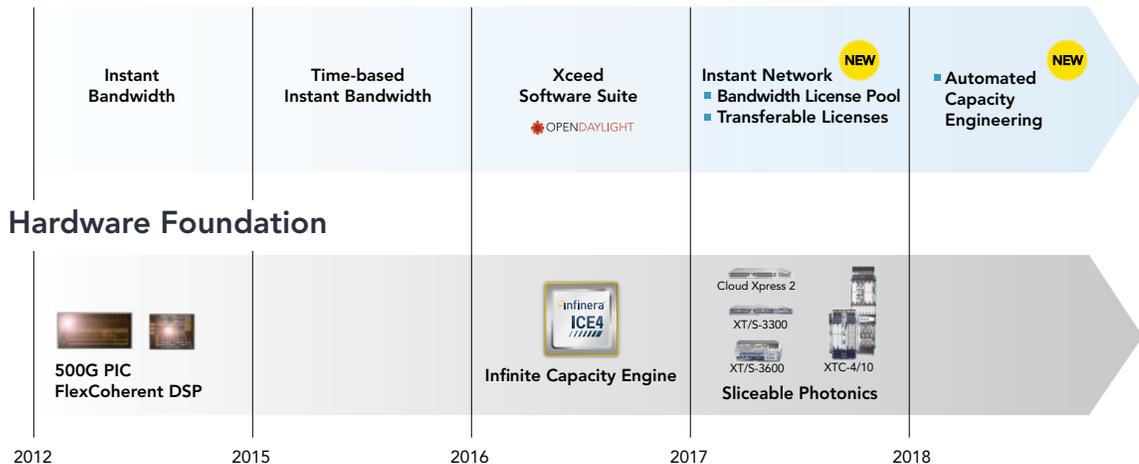
Traditional Capacity Planning and Deployment
- Up to 50% idle capacity
- HW-based upgrades
- Truck rolls and human touchpoints

Instant Bandwidth
- Industry's first software defined capacity
- Manual offline planning
- Software activation in hours
- License tied to line card/node

Instant Network NEW
- Massive pre-deployed capacity
- Automated Capacity Engineering
- Software activation in minutes
- Transferable bandwidth for agile operations

Cognitive Networking
- Learns from network systems and components
- Proactively recommends new routes and deployment options

Instant Network – The Next Generation of Software Defined Capacity

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Infinera's Transferable Licenses bring a new degree of freedom to network operators. Capacity is no longer tied to a particular node but can be transfered in minutes. This alleviates the economic constraints associated with overinvesting along one route in the network when demand suddenly increases or fiber cuts occur.

The ability to deploy, transfer and retire capacity in the network using software licenses can dramatically reduce truck rolls and human interactions, with the network lowering OpEx and increasing network reliability.

Conventional optical engineering is a highly manual process often taking up to four months, including coordination across multiple departments and using vendor planning tools to forecast capacity needs. The Automated Capacity Engineering application automates optical capacity engineering in a microservices PCE. ACE computes optimal Layer 0 routes between nodes across multiple paths, including automatic routing and wavelength assignment with multiple path constraints such as traffic engineering cost, distance and latency. By automating optical engineering and

Software Foundation

| Instant Bandwidth | Time-based Instant Bandwidth | Xceed Software Suite OPENDAYLIGHT | Instant Network **NEW** ▪ Bandwidth License Pool ▪ Transferable Licenses | ▪ Automated Capacity Engineering **NEW** |

Hardware Foundation

			Cloud Xpress 2	
		ICE4 Infinera	XT/S-3300	
500G PIC FlexCoherent DSP		Infinite Capacity Engine	XT/S-3600 XTC-4/10 Sliceable Photonics	

| 2012 | 2015 | 2016 | 2017 | 2018 |

Foundation for Software Defined Capacity

Infinera

bandwidth deployment OpEx is reduced, reliability is increased and service delivery is accelerated from months to minutes.

Leading the Way to Cognitive Networking

Infinera Instant Network builds a critical foundation for cognitive networking, including implementing and advancing the industry's first software defined capacity offering.

In the future, cognitive networking will leverage advanced analytics, machine learning from streams of network telemetry data, autonomous operation of routine tasks, predictive analysis of network problems before they occur and proactive recommendations for network optimization to further reduce operational expense and improve service reliability.
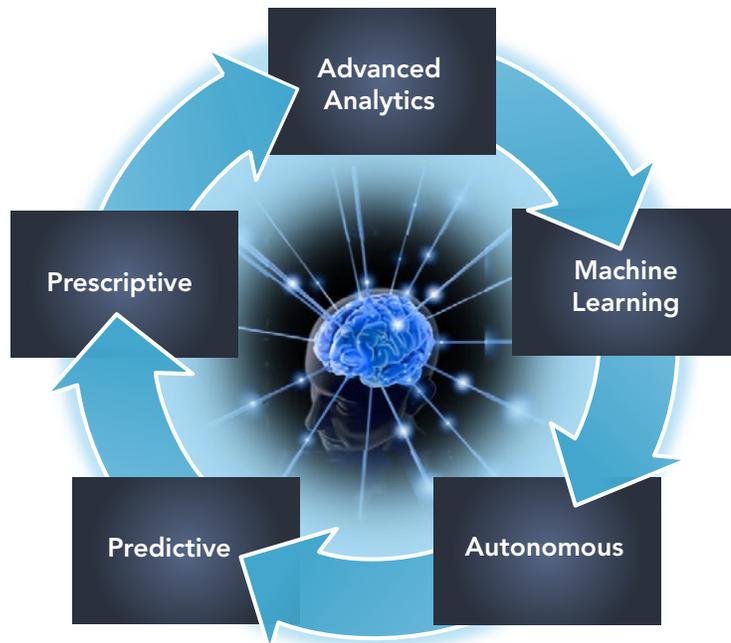
Benefits
- Network Learns Over Time From Systems and Components
- Proactively Optimize Network Capacity