THE INFINERA INTELLIGENT TRANSPORT NETWORK PORTFOLIO

Providing operators with scalability, flexibility and programmability to build the next-generation transport network
THE NETWORKING WORLD is undergoing extensive transformation of its existing infrastructure. It is moving the upper layers of the Open Systems Interconnection (OSI) model to an on-demand delivery model; and moving from specialized, proprietary platforms to open, software-enabled cloud services, referred to as Layer C. These cloud services connect to end users as well as to each other. This connectivity is provided by the lower layers of the OSI stack and is achieved using a highly scalable packet-optical intelligent transport referred to as Layer T.

Industry analysts have highlighted the unrelenting growth in bandwidth demand across subsea, long-haul and metro, and have identified one of its key drivers as being east-west datacenter to datacenter traffic running over transport networks. While-long haul networks are transitioning to 100 gigabits per second (100G), the explosive growth in traffic and a shift to cloud-based delivery of applications is now forcing a similar transformation of metro networks from 10G to 100G. Numerous applications are on the cusp of being virtualized, such as cloud radio access networks (C-RAN) in mobile networks and the move toward remote PHY (physical layer) in cable networks. These applications are leading to the creation of mini datacenters closer to the end-user and a shift towards a cloud based infrastructure across the metro network. As metro network architectures evolve to Layer C and Layer T, the strategic importance of the transport layer has never been higher and as a consequence it is vital to build Layer T with the right attributes:

- **A scalable optical layer** is the foundation upon which this Layer T is built. It requires best in class, right-sized optics, including photonic integration, offering maximum capacity with minimum size, space and power consumption.
Next-generation services require **flexible and granular control** across the end-to-end packet-optical network to satisfy the unique needs of each service with application-specific capabilities. The rich suite of multi service applications requires the appropriate use of the techniques of packet, ITU-G.709 Optical Transport Network (OTN) and optical wavelength division multiplexing (WDM) transmission and switching. The network needs to deliver the highest available efficiency combined with key capabilities such as low latency, superior synchronization performance and multi-service transport.

- **Layer T** needs to be **Open, Programmable & Agile**, with software defined network (SDN) control and open application programming interfaces (APIs) for rapid service creation and delivery along the lines of the new DevOps model of engineering and development.

### The Infinera Intelligent Transport Network Portfolio

Infinera’s end-to-end portfolio expands on two existing platforms that have been serving their respective markets for over a decade.

In the metro market, Infinera is a pioneer of metro WDM through the TM-Series which today includes leading packet-optical metro access, aggregation and core platforms and is complemented by the TG-series passive WDM platforms. These deliver optimized services for applications such as triple play broadband, cable broadband, business Ethernet and mobile transport.

In the long-haul market the DTN-X Family is the world’s only 500G commercial super-channel system based on large scale photonic integrated circuit (PIC) technology. The DTN-X XTC-4 and XTC-10 Platforms are now joined by the new DTN-X XT-500 Platform, optimized for high bandwidth long-haul interconnect applications and the new DTN-X XTC-2 and XTC-2E Platforms which extend the DTN-X Family to metro core and regional applications. All platforms in the DTN-X Family are fully interoperable over the common Infinera FlexILS™ line system.

To complement the company’s strengths in metro and long-haul networking, Infinera moved into the metro DCI market with the Cloud Xpress Family, offering 500G of super-channel capacity in a 2 rack unit (2RU) form factor with low power consumption, Ethernet client services, and a simple 3-step setup process.
The Infinera Intelligent Transport Network portfolio is integrated with the foundation of scalable photonics, granular switching and the simplicity of an open, programmable control and management plane to deliver additional network applications in the future. A key advantage of this approach is that it enables the use of precise tools for each network function and location, such as the migration to 100G in the metro, while retaining the application-specific requirements for each service.

**The Infinera DTN-X Family:** Designed to address the ever-evolving needs of the transport network, the DTN-X Family is engineered with the latest generation of PIC technology to deliver scalability, simplicity and efficiency. Through a unique combination of innovative architecture and cutting-edge technology, the DTN-X Family brings network operators the ability to evolve their transport network quickly and cost-effectively. Sized to fit varying application needs, the DTN-X Family is built to scale in multiple dimensions without sacrifice. The DTN-X XTC-10 Platform integrates the world’s highest density 500G PICs, upgradeable in the future to 1.2T, and offers 5T of digital switching capacity today with up to 240T of capacity in the future. The DTN-X XTC-2 and XTC-2E Platforms are purpose built for metro core and regional networks, and are smaller form factor variants of the DTN-X XTC-4 and XTC-10 Platforms. In addition, the DTN-X Family automates many traditional network engineering steps, so operators spend less time engineering the network and more time delivering services and generating revenue. Further, with built-in generalized multi-protocol label switching (GMPLS) based intelligence, the network is always aware and able to tap into available resources, efficient routing paths and most importantly, mesh-based network protection that protects customer traffic, as fast as <50ms.

While the DTN-X XTC series of platforms offers integrated WDM and OTN switching, grooming and service protection capabilities in the network, the DTN-X XT-500 offers high bandwidth in a compact footprint that includes all of the benefits of PIC-based super-channels. It is a high bandwidth interconnect transport platform, optimized for delivery of Ethernet services over long-haul and regional networks spanning hundreds and thousands of kilometers.

The DTN-X XT-500 delivers a 500G super-channel output with 10 gigabit Ethernet (10GbE) or 40GbE or 100GbE clients in 2RU of rack space. It consumes only 1 Watt of power per Gb/s and delivers up to 10.5T of line-side capacity in a single rack. It can be seamlessly integrated with the Infinera FlexILS line system (ILS) and offers support for fixed and flexible grid to maximize spectral efficiency. It also helps service providers to take advantage of the colorless, directionless and contentionless (CDC) reconfigurable optical add/drop multiplexer (ROADM) architectures. This enables super-channel switching at the optical layer, L0, within an optical mesh network, improving overall network switching capability and thus, resulting in enhanced network efficiency. Moreover, Instant Bandwidth™ technology allows providers to adopt a cash-flow efficient business model in which additional bandwidth can be deployed rapidly with a few mouse clicks when demand increases. With Instant Bandwidth, there is no need to order, install and deploy additional equipment.

**Cloud Xpress Family:** Built for the metro cloud market, the efficiency, scalability and the small form factor of the Infinera Cloud Xpress enables service providers to support up to 500G of line-side capacity in just 3.5 inches (2RU) with a mix of 10GbE, 40GbE and 100GbE client interfaces. For datacenter operators that need scale, Cloud Xpress leads the industry with an unprecedented 21T of input and output per 42RU rack. Each fully integrated Cloud Xpress packs in a massive 1T of input and output capacity, while its maximum power consumption is a mere 500 watts of power (counting all components of the platform including client interfaces and built-in amplifiers). Cloud Xpress uses the least amount of space and power compared to other similar platforms.

Cloud Xpress also features rapid provisioning to help datacenter operators turn up bandwidth quickly. Infinera Cloud Xpress may
be managed with a simple command line interface (CLI) or Infinera’s robust graphical point-and-click DNA management system or by leveraging APIs to plug into an SDN control layer.

**TM-Series:** The TM-Series packet-optical networking platform for carrier-grade transport delivers high performance networks. Whether it’s used to push WDM all the way up to the antenna or to the cell site in mobile networks, to connect enterprises together or to the cloud, or to deliver high definition TV (HDTV), the TM-Series delivers a comprehensive set of capabilities to meet provider requirements in a metro network architecture designed to be flexible and future-proof. Supporting optical wavelengths up to multi-protocol label switching – transport profile (MPLS-TP), using technologies such as Ethernet, OTN, Synchronous Digital Hierarchy / Synchronous Optical Networking (SDH/ SONET), and Intelligent WDM (iWDM™), the TM-Series builds on key design philosophies such as low power, high density and a high level of scalability. The TM-Series offers a multitude of advanced capabilities that make the platform highly suited to a number of applications like synchronous Ethernet and WDM passive optical networks (PON).

The PT-Fabric provides terabit scale packet-optical transport switching that is compatible with the installed base of Infinera TM-Series platforms and will offer up to 960G of non-blocking switching capacity, with a rich set of Metro Ethernet Forum (MEF) Carrier Ethernet (CE) 2.0 and MPLS-TP service options. The feature set is compatible with the existing range of Ethernet Muxponder (EMXP) packet-optical transport switches, and expansion is achieved using an innovative front-plane technology.

**DTN Platform: The Original Game-Changer**

In 2004, the Infinera DTN changed the rules of optical networking by creating a Digital Optical Network. This forever broke the mold of how optical networks should be built, and was the precursor to the Intelligent Transport Network. With fully integrated transport and switching, the DTN not only dramatically simplified the service provisioning process, but also shortened time-to-revenue while eliminating the need for complex optical components.

DTN provides scalability and flexibility with an integrated WDM transport, OTN switching and GMPLS intelligence in a single platform. DTN uses the industry’s first 100G PIC and supports Bandwidth Virtualization. These features create a unique architecture designed to deliver speed of revenue, scale of services, and network efficiency.

**ATN Platform:** ATN extends Infinera’s Intelligent Transport Networking benefits into the metro environment through integration and interoperability with the Infinera DTN from a data plane as well as operations and management perspective. The management integration capability delivers seamless, centralized management of services across the network for simplified end-to-end management.

**FlexILS™: Unleash the power of your transport network—Automate Everything!** The Infinera FlexILS is the optical line system that enhances the scalability, efficiency and flexibility of Intelligent Transport Networks. FlexILS uses the ITU-T flexible grid channel plan with granularity of 12.5GHz, allowing efficient packing of any combination of optical carriers, modulations, and data rate on the same optical fiber, and enabling more capacity over optical fiber with terabit super-channels. FlexILS introduced the industry’s
INFINERA PRODUCT OVERVIEW

first super-channel FlexROADM for switching in optical domain. FlexILS, when deployed with the XTC Series, provides the benefits of multi-layer switching architecture: digital switching for efficient packing of client services, and super-channel based optical switching for operational simplicity and flexibility of express traffic. FlexILS can also be deployed with the XT Series for long-haul interconnect applications. FlexILS also supports the industry’s first GMPLS based, Spectrum Switched Optical Network (SSON) compliant, unified control plane providing efficient network planning and simpler end-to-end multi-layer service management in the network.

TG-Series: The TG-Series is a family of cost-effective, passive optical WDM products. Designed for access applications, it fits in a wide range of applications from controlled environments in central offices to street cabinets or even underground enclosures such as manhole applications that require environmentally hardened products. The TG-Series supports point-to-point, mesh, bus and ring-based network topologies and can be used in a number of network scenarios such as fiber to the curb (FTTC), fiber to the building (FTTB) and high-security access networks. The TG-Series is fully compatible and interoperable with the TM-Series.

Open Transport Switch: Infinera’s Open Transport Switch (OTS) is a software platform that enables a high degree of abstraction and virtualization of the underlying Intelligent Transport Network. This provides a simplified programming model that enables service providers to develop applications that rapidly deliver innovative services that meet service level agreements (SLAs) while using their network resources as efficiently as possible. The open and modular architecture of OTS allows it to easily integrate into a customer's application, SDN controller or orchestration software layer through standard and secure Web 2.0 APIs. OTS was purpose built with a modern IT mindset, and its lightweight approach and ability to rapidly innovate new features pave the way for service providers to transform to a DevOps model of software development. The hybrid control feature is intended to allow network operators to migrate to an SDN model without disturbing revenues from existing production services.

Network Management System: Unified network management that maximizes the value of the network elements as well as the network as a whole is critical to achieving scale and service simplicity. The Infinera Management Suite (IMS) is a feature-rich suite of tools to provision and operate the Intelligent Transport Network. IMS brings together GMPLS-based network intelligence, plug-and-play network elements and point-and-click service provisioning in a single package that leverages all the enhanced operations, administration and management (OAM) that is possible with an Intelligent Transport Network. Designed to integrate into virtually any information technology (IT) environment, IMS also features an easy-to-use graphical user interface that can view the entire network, down to an individual service element and its performance, in an environment that is secure and customizable to meet the needs of today’s demanding operators. The Infinera Enlighten is a management suite for managing TM-Series and TG-Series. With its extensive set of capabilities, Enlighten helps network operators carry out the day-to-day activities associated with managing their packet-optical network and services. Enlighten’s full lifecycle approach provides operators with a set of tools for planning, deploying and operating the packet-optical network in a cost effective and simple manner.

Infinera Intelligent Transport Networks provides scalability, flexibility and programmability from subsea to access with a precise set of tools to address specific network location and application requirements. And as the network infrastructure transforms to the new model of Layer C and Layer T, Infinera’s comprehensive and well-rounded Intelligent Transport Network portfolio will offer a foundation for what the network will be.