Converged Supercore Architecture

Gain Network Efficiencies Through Network De-layering and SDN Traffic Optimization

Challenge

Growing traffic consumption and intense competition are challenging operators' ability to keep pace with demands while continually growing revenue.

Solution

Juniper Networks Converged Supercore architecture simplifies the overall network with three simple principles: industry-leading packet performance; network de-layering through optical integration; and leveraging of SDN traffic optimization tools.

Benefits

- **Cost-effective**—Juniper's Converged Supercore architecture lowers OpEx by leveraging IP/MPLS transit-optimized routers to deliver industry-best performance, low-power profile per gigabit transported (0.46 Watts per GbE), space optimization for any type of central office application (metro optical), and network-wide SDN concurrent traffic optimization.
- **Revenue-enhancing**—An open, standards-based, multilayer programmable SDN-controlled infrastructure, the architecture enables new revenue-generating services while optimizing existing traffic to increase revenue capacity.

Many operators are redesigning the way they build their metro and core networks to handle the growing demand for cloud-based services. For this reason, it has become paramount to rethink the approach to multilayer networking—specifically, how to bring routing and optical together to satisfy projected traffic demand and improve the overall TCO of the network in the future.

Juniper's Converged Supercore® architecture redefines the way networks are built, collapsing multiple layers into a flat elastic fabric, including performance-optimized IP/MPLS routing and metro dense wavelength-division multiplexing (DWDM) layers. The Converged Supercore architecture builds upon the virtual integration of IP/MPLS technology and integrated coherent interfaces for extended terrestrial optical interconnect with a centralized, near-real-time multilayer traffic optimization SDN controller. The extensible Juniper Networks® NorthStar Controller programmability enables operators to dynamically improve traffic utilization by enabling network visibility across both IP and optical layers that runs hotter than ever before while carrying more revenue-generating services.

The Challenge

The onslaught of new traffic dynamics like mobility, video, and cloud-based services is transforming traditional network patterns and topologies. Stratified, statically designed, and manually operated networks must evolve to meet demands quickly and more economically. Many operators have seen profitability stagnate and TCO increase under the weight that growing traffic demands have placed upon them.

Network operators for traditional models overprovision infrastructure months in advance in anticipation of increasingly unpredictable traffic patterns and volumes. This causes providers to outlay huge capital expenses in idle anticipation of the future. This imbalance in the fundamental financial equation can no longer be sustained—operators need to become more agile in order to optimize their existing network resources, shorten planning cycles, and remove rigid network layers. Once this is done, service providers can begin leveraging a highly intelligent Supercore infrastructure to increase revenues by creating new customizable services.

Converged Supercore Architecture

Juniper's Converged Supercore starts with the industry's highest-performance IP/MPLS transit-optimized routers with the lowest operational cost for transit applications, built specifically for full IP, express MPLS, fully collapsed optical integration and SDN control—Juniper Networks PTX Series Packet Transport Router family. Building upon that platform, Juniper WANDL IP/MPLSView and Juniper Networks NorthStar Controller extract even greater network traffic efficiencies with multilayer programmable SDN intelligence.

The solution comprises three distinct integration points:

- **Network Management Integration**—A fully collapsed PTX3000 metro DCI optical solution requires a network management solution to match. Junos® Space Connectivity Services Director replaces the separate tools used by IP and optical networking teams, eliminating swivel chair management and reducing overall complexity.

  The PTX Series also easily plugs into end-to-end service provisioning and performance/alarm management systems from existing optical transport vendors like BTI, ADVA and Coriant, virtually integrating the PTX Series' coherent optical interfaces into the BTI, ADVA and Coriant transport NMS, which enables plug-and-play in a traditional transport environment. Benefits include easy accommodation and preservation of operational environments with no disruption in operations.

- **Control Plane Integration**—Juniper Networks NorthStar Controller moves traditional distributed traffic engineering implementation models into an optimized, multilayer, network-wide, and centralized traffic engineering model, enabling operators to eliminate unforeseen capacity planning across IP and optical layers, extract more utilization from segments, create predictable network survivability scenarios, and shorten their reaction to new service rollouts. Operators can use the NorthStar Controller as a platform for building their customized applications for new revenue-generating services or leveraging pre-packaged applications such as bandwidth calendar, premium path service creation, premium risk-adverse path diversity, and elastic bandwidth grooming.

- **Data Plane Integration**—The PTX5000 and PTX3000 routers deliver industry-leading express IP/MPLS packet performance at 3 and 1 Terabit per-slot capacity, respectively, with consistent wire-rate performance across all packet lengths while maintaining end-to-end transport latency. These powerful capabilities are based upon Juniper Networks ExpressPlus™ Silicon, along with forwarding architectures optimized for full IP functionality, express MPLS and transport integration. The PTX5000 and PTX3000 routers integrate 80 and 32 (respectively) 100 Gbps coherent DWDM optical interfaces, setting yet another industry benchmark for transport integration.

Features and Benefits

Juniper's Converged Supercore architecture value proposition is realized at three different integration intersects:

Network Management Integration

Juniper's solution improves operators' service creation and troubleshooting time with end-to-end packet optical service provisioning and management across all layers based on a single, elegant, unified management application: Junos Space Connectivity Services Director. Through extensible management interfaces such as NETCONF/YANG, the IP/MPLS service layer is combined with the optical layer to become a full multilayer, service-aware platform, correlating alarms and faults faster than ever before. This lowers the time to resolve service outages, dramatically improving customer satisfaction.

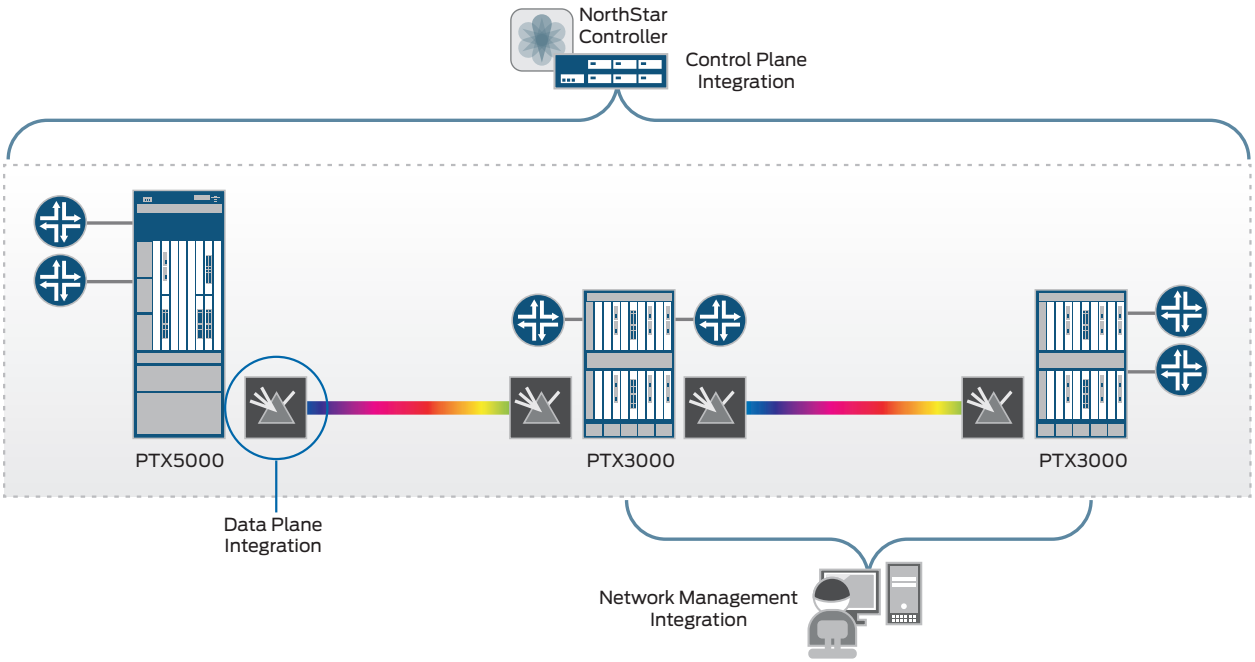

Figure 1: Integration points within Converged Supercore Architecture

Control Plane Integration

Juniper Networks NorthStar Controller provides a homogeneous, customizable, programmable traffic engineering platform with global multilayer network visibility, thereby ensuring predictable network behavior. The NorthStar Controller enables a self-optimizing network that automatically identifies the most optimal path through the network with multi-layer visibility, in near real time, allowing operators to increase traffic utilization by as much as 25% and avoid additional CapEx caused by overprovisioning by as much as 35%. This is all achieved by leveraging open, standards-based protocols such as BGP-LS, NETCONF/YANG, RESTful APIs and Path Computation Element Protocol (PCEP).

Data Plane Integration

The PTX Series product family enables world-class performance by lowering overall network latency by as much as 92% compared to traditional services routing platforms. This enormous reduction in latency enables operators for the first time to leverage IP/MPLS in latency-sensitive applications such as experimental research networks, 5G mobile transport networks, and Data Center Interconnect.

The power optimization focus of the PTX Series enables operators to lower power-related OpEx by as much as 340% compared to traditional services-oriented routing platforms. The industry-leading power footprint per bit transmitted enables operators to deploy PTX Series routers in legacy room, rack-cooled Computer Room Air Conditioning (CRAC) environments, or both, providing a better TCO compared to other routing platforms.

Integrating coherent optical interfaces and photonic layer elements directly into the PTX Series product family saves significant OpEx and CapEx for operators (up to 80%) by eliminating unnecessary optical-to-electrical-back-to-optical transponders and an assortment of external wavelength-selective switches, amplifiers, and multiplexer/demultplexers that consume additional space and power.

Solution Components

Junos Space Connectivity Services Director—Junos Space Connectivity Services Director gives service providers and enterprises the power to quickly design, provision, and deliver new IP/MPLS, Carrier Ethernet, and optical services across their networks for quick rollouts and lower costs.

Juniper WANDL IP/MPLSView—Juniper's WANDL IP/MPLSView delivers a multivendor, multiprotocol, and multilayer traffic management and engineering solution for both IP/MPLS and optical networks. The integrated software suite includes traffic engineering models for exhaustive single and concurrent device failures, traffic matrix estimation, MPLS diverse path design, fast reroute design, metric optimization, multilayer network optimization and more.

NorthStar Controller—NorthStar Controller is a powerful and flexible traffic engineering solution that provides granular multilayer visibility into and control over IP/MPLS flows in large service provider and enterprise networks. It enables network operators to optimize their network infrastructure through proactive monitoring, planning, and explicit routing of large traffic loads dynamically based on the constraints specified.

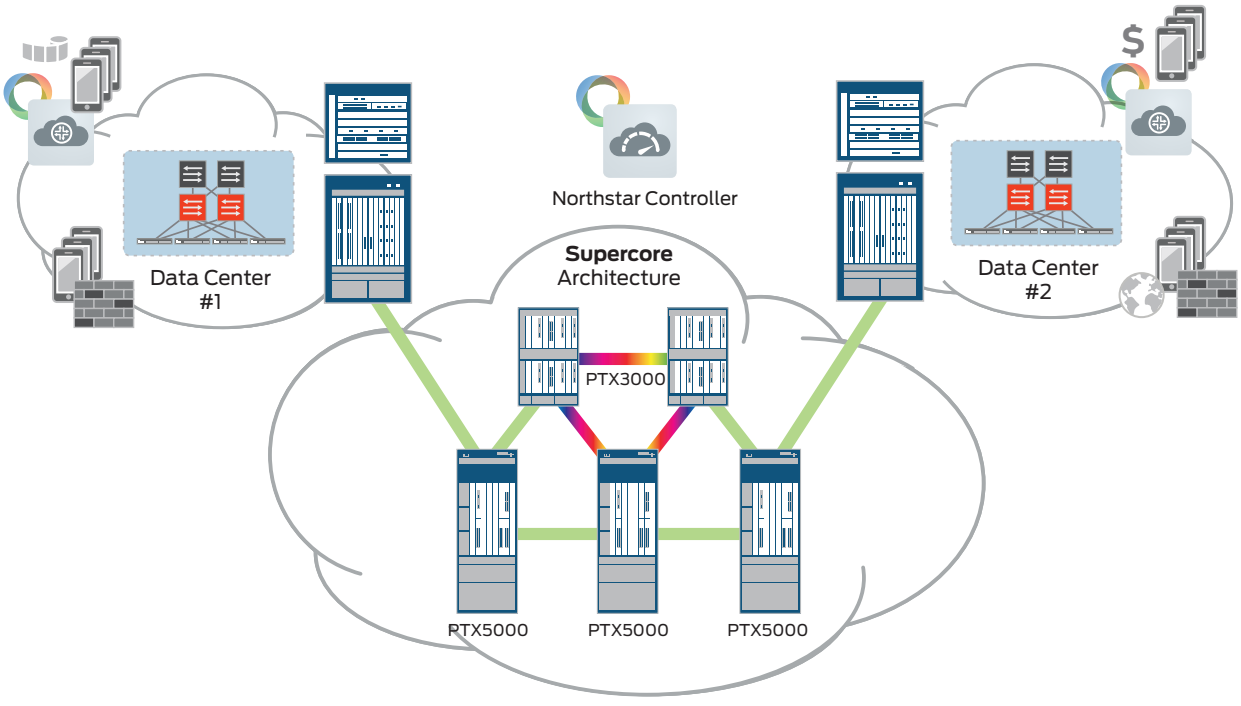

Figure 2: Converged Supercore Architecture

Juniper Networks PTX5000 Packet Transport Router—The PTX5000 is an industry-leading, high-performance Juniper Networks Supercore router at the heart of service provider networks. It delivers world-class packet performance based on Juniper ExpressPlus Silicon and features forwarding architectures that optimize full IP, express MPLS, and optical integration.

Juniper Networks PTX3000 Packet Transport Router—The PTX3000 is the only Supercore router that complies with 300 mm ETSI standards for both core and metro regional service provider networks. This router delivers world-class packet performance based on Juniper ExpressPlus Silicon and features forwarding architectures that optimize full IP, express MPLS, and fully collapsed optical integration.

5-Port 100-Gbps DWDM PTX PIC—The 5-port 100G DWDM PTX Series PIC enables service providers to deploy an ultra-long reach, coherent 100G DWDM router interface without sacrificing port density. Utilizing the latest coherent receiver technology, the PIC can support distances of over 2000 kilometers without regeneration for 100G long-reach Converged Supercore deployments.

Integrated Photonic Line Card (IPLC) PIC—The IPLC PTX3000 PIC collapses previous discrete photonic layer elements into a single 32-channel spaced optical linecard, eliminating the need to deploy multiple boxes consuming additional space and power.

BTI—The 7800 Series packet optical transport platform meets service provider needs for high-bandwidth metro networking solutions, scaling from 10 Gbps to 100 Gbps wavelength capacities and MPLS packet processing in an open SDN-enabled platform.

ADVA—The FSP 3000 is a scalable optical transport solution designed to respond to today's exploding bandwidth demands. The modular design of ADVA's FSP 3000 ensures your networks are built on a flexible WDM foundation representing the integration of optical and Ethernet provisioning in a seamless, end-to-end architecture, from the access to the metro and on to the long haul.

Coriant—The Coriant hiT 7300 is an industry-leading, high-performance optical transport platform optimized for flexible and efficient transport in metro, regional, long haul, and ultra long-haul networks. The hiT 7300 delivers superior density and reach, photonic mesh resiliency and agility, and scalability to 100 Gbps and beyond.

Summary—Make Every Bit Generate Revenue

Many operators realize that to enable new revenue-generating, cloud-based services, the fundamentals of how networks get built must change. Juniper Networks Converged Supercore architecture facilitates this change by de-layering the network into a virtual single fabric by combining IP/MPLS with optical, predictably allowing operators to optimize existing traffic patterns with offline design and planning tools or with programmable online SDN control.

Next Steps

For more information on Juniper Networks' Converged Supercore Architecture with programmable SDN control and the components that comprise this architecture, please contact your Juniper Networks representative.

About Juniper Networks

Juniper Networks is in the business of network innovation. From devices to data centers, from consumers to cloud providers, Juniper Networks delivers the software, silicon and systems that transform the experience and economics of networking. The company serves customers and partners worldwide. Additional information can be found at www.juniper.net.

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