

# Juniper Networks Open Cloud Interconnect Solution

Cloud business. Unconstrained.

## Challenge

Data center operators must optimize network resources and scale network capacity between sites to support escalating traffic growth while controlling capital and operating expenses.

## Solution

The Open Cloud Interconnect solution combines versatile, end-to-end packet-optical networking platforms with robust, open management and control software and APIs, helping users simplify operations, quickly activate and expand capacity, and accelerate network innovation.

## Benefits

- Common cross-portfolio management and control platforms ensure fast, simple service activation and operations.
- Multiple approaches spanning IP, MPLS, Ethernet, and coherent WDM enable solutions to be flexibly tailored to any DCI use case.
- Open solution helps avoid vendor lock-in, enables faster innovation, and eases the transition to open, software-controlled DCI networks.

Service providers, cloud and internet exchange providers, and enterprises across the globe are building out new data centers, expanding network capacity to keep pace with growing business demands. The skyrocketing volume of video, social media, and distributed application traffic poses significant capacity planning and network engineering challenges for data center operators. In response, these operators must expand capacity and optimize network resources between data centers as well as to points of presence (POPs) and peering points in order to support this rapid traffic growth and enable workload mobility, business continuity, and disaster recovery.

Juniper Networks® Open Cloud Interconnect solution enables operators to ensure network optimization in a distributed cloud environment, activating and controlling inter-data center capacity quickly and cost effectively. By leveraging a diverse portfolio of packet-optical technologies, network virtualization, and open, standards-based network control, Open Cloud Interconnect helps operators achieve superior levels of scale, efficiency, security, and network visibility.

## The Challenge

Businesses and consumers are flocking to the cloud to support and deliver a wide range of services. The cloud, however, fundamentally changes the way applications are built and delivered, creating complex capacity planning and design challenges for network operators. Today's mobile-first, cloud-first application traffic increasingly flows into and out of the data center to peering points, partner networks, and other data centers.

Networks designed to support traditional traffic flows and data transport services are too costly, complex, and inflexible for today's dynamic cloud environments. The first generation of Data Center Interconnect (DCI) solutions was designed for scale, but typically built on separate layers of switching, routing, and optical networking elements, each with unique vendor-specific administrative interfaces and limited APIs. This led to operational complexity and vendor lock in. As a result, first-generation solutions tended to hamper network innovation at a time when cloud business opportunities were expanding, thereby impeding growth.

## The Juniper Networks Open Cloud Interconnect Solution

With Juniper Networks Open Cloud Interconnect, Juniper ushers in the next generation of DCI networks. Open Cloud Interconnect gives operators the versatility to interconnect data centers with a combination of high-capacity coherent optics and DCI-optimized packet, security, virtualization, and network control technologies—all in an open, programmable environment unconstrained by operational silos, vendor lock-in, and interoperability challenges.

The Open Cloud Interconnect network infrastructure portfolio includes Juniper Networks MX Series 3D Universal Edge Routers, Juniper Networks QFX Series switches, and Juniper Networks BTI7800 line of Packet Optical Transport Platforms. Data center operators can optimize network management and control with the Open Cloud Interconnect software tools—such as Juniper Networks proNX Service Manager, Junos® Space, Contrail, and NorthStar Controller—that best suit their needs.



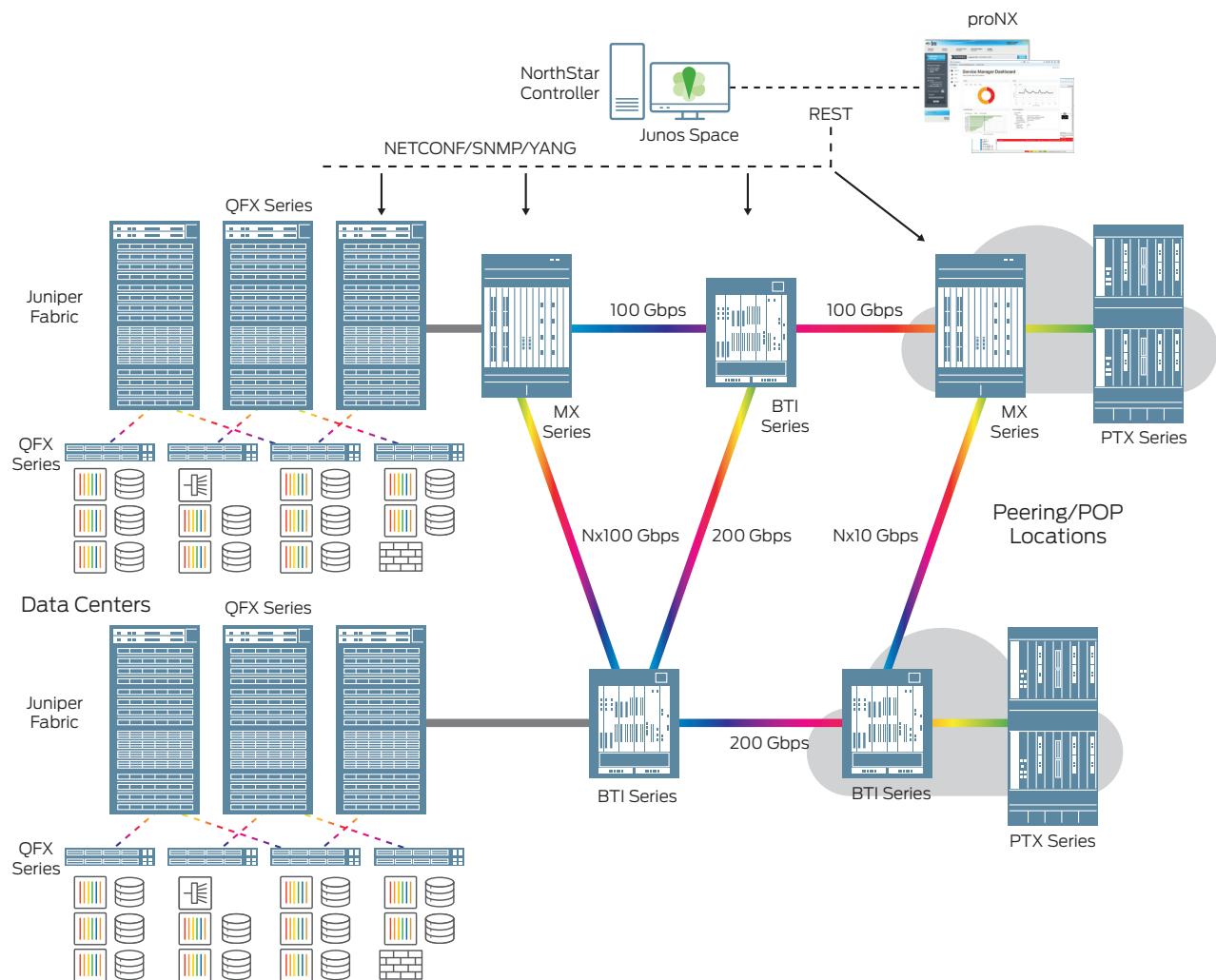


Figure 1. Juniper's packet optical Open Cloud Interconnect solution includes MX Series routers, QFX Series switches, BTI Packet Optical Platforms, NorthStar Controller, and proNX Management Applications.

## Features and Benefits

### Solution Versatility

Open Cloud Interconnect enables a diverse range of network operators to design, implement, and operate distributed, multilayer DCI architectures based on their unique business needs. With Open Cloud Interconnect, data center operators can build DCI networks with an unparalleled combination of protocols, tunneling, transport, and control technologies that drive superior performance of the content, services, and applications running on the network.

Open Cloud Interconnect enables a wide range of cloud business models and DCI use cases employing a number of network design approaches:

- **IP Overlays:** For enterprises and cloud service providers adopting a Layer 2-based IP overlay DCI approach, Open Cloud Interconnect supports multiple designs including Ethernet VPN (EVPN) with Virtual Extensible LAN (VXLAN) or Unicast VXLAN. For IP overlays, data center operators

employ QFX10000 switches at the spine layer, offering leading scale based on the Juniper Networks Q5 ASIC.

- **DCI from the Data Center Edge:** For operators requiring a separate IP/MPLS-based DCI network, DCI from the data center edge is the ideal fit. In these scenarios, MX Series routers can support Layer 3 and Layer 2 workloads in an isolated domain from the data center edge distribution network, delivering proven advantages in scalability, traffic engineering, QoS, and high availability.

Whether Open Cloud Interconnect is employed at the data center spine layer (IP overlay) or at the edge, Juniper gives operators the flexibility to either integrate coherent WDM into the QFX10000 switches or MX Series routers, or deploy BTI7800 Packet Optical Transport Platforms in conjunction with the packet layer. For integrated DWDM scenarios, the QFX10000 Coherent DWDM Line Card provides 1.2 Tbps of capacity with flexible modulation and low power consumption, all in a small footprint, collapsing packet and optical domains into a converged DCI network managed and controlled by Junos Space. Additionally, network

operators can combine the packet layer with the BTI7800 line of Packet Optical Transport Platforms, including the compact, one rack-unit BTI7801, equipped with UFM6 modules supporting 400 Gbps of coherent WDM.

## Simple Operations

Open Cloud Interconnect drives operational simplicity through the easy activation of integrated or disaggregated packet-optical networking solutions and end-to-end software control. The QFX10000 DWDM Coherent Line Card, installed in Juniper Networks QFX10000 line of switches, offers 1.2 Tbps of easily configurable DCI bandwidth in a low-power, single-slot footprint. For operators deploying MX Series routers for DCI at the data center edge, integrated coherent wavelength-division multiplexing (WDM) enables the simple design of IP-based DCI over WDM.

Open Cloud Interconnect also features the 400 Gbps UFM6 muxponder card for the BTI7800 line of Packet Optical Transport Platforms, delivering flexible, high-density coherent WDM in a single rack unit to create a simple, pay-as-you-grow, disaggregated architecture that enables incremental scalability with minimal initial investments. Offering high density in a compact footprint conserves precious rack space, reducing the number of cables and transponders required as well as the number of network elements to manage.

Whether integrating coherent WDM into Juniper switching and routing platforms, deploying the BTI7800 line of Packet Optical Transport Platforms in a disaggregated architecture, or combining both designs using multiple Juniper portfolio elements, Open Cloud Interconnect gives network operators an end-to-end management and control environment that accelerates service delivery and simplifies bandwidth activation, monitoring, and control.

## Unconstrained Innovation

One critical challenge faced by data center operators is driving network innovation with the speed and agility required to meet cloud services demand. As a result, many network operators are adopting open, programmable, disaggregated network architectures enabling the practical deployment of best-in-class hardware and software components. By opening up and disaggregating the network, data center operators can expand network footprint and capacity faster while controlling costs and deploying only the networking components that best suit their needs.

Open Cloud Interconnect provides operators with multiple ways to build DCI networks, including solutions available today for enabling an open and disaggregated DCI architecture. Open Cloud Interconnect is proven to interoperate with third-party optical line systems—including open line systems—and supports open APIs for easy integration into SDN-based network controllers and applications. Open Cloud Interconnect network control solutions such as proNX Service Manager support open northbound interfaces over which network topology data is exchanged with the Juniper Networks NorthStar Controller (or other third-party controllers) via a standards-based YANG model, making open, multilayer control and full DCI network visibility a reality.

## Solution Components

### MX Series 3D Universal Edge Routers

Ideally positioned in DCI designs leveraging the data center edge, MX Series 3D Universal Edge Routers are carrier-grade edge routing platforms that ensure high network and service availability with a broad set of multilayered physical, logical, and protocol-level resiliency features. Used to connect data centers, peering points, and POP sites, the MX Series delivers a comprehensive set of switching, routing, and security functions for DCI networks.

### QFX Series Switches

The QFX10000 line of switches delivers industry-leading performance and density for DCI IP overlay networks defined at the data center spine layer. Offering throughput up to 6 Tbps per slot, QFX10000 switches provide sustained wire-speed switching with low latency and can be deployed as 10GbE, 40GbE, or 100GbE access, spine, core, or aggregation devices.

### BTI7800 line of Packet Optical Transport Platforms

Utilized for optical DCI and in conjunction with MX Series routers and QFX10000 switches for multilayer DCI, the BTI7800 line of Packet Optical Transport Platforms supports large-scale 10 Gbps, 100 Gbps, and 200 Gbps wavelength capacities in a programmable platform. Featuring a rich set of optical capabilities, including coherent modules with integrated reconfigurable optical add/drop multiplexers (ROADMs), the BTI7800 increases network capacity, reduces operating costs, improves network utilization, and simplifies DCI deployment.

### proNX Service Manager

proNX Service Manager software allows network operators to control any coherent WDM interface deployed on any Juniper platform (MX Series routers, QFX Series switches, PTX Series Packet Transport Routers, or BTI Series Packet Optical Platforms), delivering a level of flexibility that makes cross-portfolio optical DCI networks easy to manage. The proNX software suite includes provisioning templates, configuration wizards, and one-click service activation features that eliminate manually intensive and error-prone tasks, accelerating bandwidth turn-up and capacity expansion. RESTful APIs simplify integration with external management applications, including controllers such as NorthStar, service orchestration solutions, and operations and business support systems (OSS/BSS).

### NorthStar Controller

Serving primarily in IP/MPLS-based DCI networks, Juniper Networks NorthStar Controller is a flexible traffic engineering solution that delivers granular visibility and control over IP/MPLS and optical layer flows. It streamlines capacity planning, enables proactive monitoring, and lets service providers dynamically route traffic and balance loads based on administratively defined policies.

## Contrail Networking

Complementing the Open Cloud Interconnect solution, Contrail Networking enables the “cloudification” of operator data centers, networks, central offices, and POPs. Contrail Networking ensures network resources are optimized across data center borders, supporting a wide range of distributed cloud business models and accelerating time to revenue for cloud services.

## Use Cases

### Data Center-to-Data Center

The Open Cloud Interconnect solution establishes resilient, high-capacity packet-optical connectivity between two or more data centers, enabling workload mobility, business continuity, disaster recovery, and tenant-to-tenant connectivity across sites. Point-to-point connections between data centers or mesh networks interconnecting several data centers can also be implemented.

### Peering/Collocation

With Open Cloud Interconnect, users can establish 10 Gbps, 100 Gbps, or 200 Gbps connections to POPs and peering points, giving tenants high-capacity cross-connects to content providers, business partners, and service providers to move up the value chain.

### Cloud/Metro Connect

Open Cloud Interconnect offers enterprise customers high-bandwidth, low-latency cloud connections that bypass the public Internet for superior throughput, reliability, and security. Direct connectivity to multiple cloud providers over a private IP service enhances revenues and margins with value-added connectivity services backed by SLAs.

## Summary—Open Cloud Interconnect Unleashes the Potential of Cloud-Enabled Business

Continued rapid inter-data center traffic growth is a given. The challenge ahead for data center operators is to scale the DCI network, simplify network operations, and accelerate the delivery of high-growth cloud services. Open Cloud Interconnect is designed to meet these challenges head-on by enabling a versatile range of DCI network designs, collapsing operational silos and opening up the network in order to drive faster innovation—ultimately helping data center operators build better and more cost-effective cloud services.

## Next Steps

To learn more about how Open Cloud Interconnect can help your company gain a competitive edge, contact your Juniper sales representative or visit [www.juniper.net](http://www.juniper.net).

## About Juniper Networks

Juniper Networks challenges the status quo with products, solutions and services that transform the economics of networking. Our team co-innovates with customers and partners to deliver automated, scalable and secure networks with agility, performance and value. Additional information can be found at [Juniper Networks](http://Juniper Networks) or connect with Juniper on [Twitter](http://Twitter) and [Facebook](http://Facebook).

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