



MODERNIZE EDUCATION AND RESEARCH DATA CENTERS WITH JUNIPER ETHERNET SWITCHING

Support the advanced switching performance needed by next-generation learning and research environments with simplicity

Industry

Higher Education



Challenges

As colleges, universities, and research institutions decentralize, their data centers—already struggling to support new applications, technologies, and traffic patterns—are becoming more geographically dispersed. Efforts to overcome these challenges with traditional architectures merely add complexity and compromise service agility.

Solution

QFX Series Switches support the modern data center architectures that education and research institutions need, enabling deployments that scale from dozens to thousands of ports.

Benefits

- **Scalable:** Architectures based on QFX Series Switches scale from dozens to thousands of ports.
- **Time to value:** The Juniper solution accelerates the deployment and delivery of applications within and across multiple sites and clouds.
- **Simplified network management:** Juniper Ethernet switching reduces ITs burden by automating data center operations with intent-based management and orchestration tools.

Data centers that support education and research are being pushed to their limits by new technologies, new applications, and ever-changing traffic patterns. To improve service agility, these data centers need to be built around architectures that reduce management complexity, accelerate deployment, and improve time to value.

Juniper Networks® QFX Series Switches offer education and research institutions a number of innovative architectures, supporting deployments that scale from dozens to thousands of ports to deliver a highly flexible solution for virtually any data center environment.

The Challenge

The pressures on today's education and research networks are unprecedented. Virtualized and cloud-based applications, big data, SDN, and increasingly mobile users—employing multiple disparate devices—are straining the data center to the breaking point.

In an effort to mitigate congestion, network architects attach more components to existing architectures that were not necessarily designed for scalability and flexibility. While these additions may temporarily ease the immediate pain, they create a more serious long-term problem: network complexity. Complex networks can't adapt as quickly to changes and cost a lot more to manage, severely compromising their agility.

Juniper Networks Solution for Education and Research Data Centers

This solution brief presents an overview of Juniper Networks data center switching architectures. Acting as flexible building blocks for networks that scale from dozens to thousands of ports, QFX Series Switches—working with Juniper routing, security, SDN, intent-based orchestration, monitoring, and open ecosystem solutions—support a comprehensive architecture that accelerates the deployment and delivery of applications within and across multiple sites and clouds.



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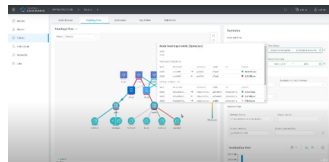
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Solution Components

The primary building blocks of Juniper's data center switching architectures include:

- The Juniper Networks QFX5000 line of Switches, which is a flexible, high-performance, low-latency, and feature-rich family of fixed-configuration Layer 2 and Layer 3 switches optimized for data center environments
- The Juniper Networks QFX10000 line of Switches, which offers a variety of feature-rich fixed-configuration and modular switches optimized for high-scale, automated, and virtualized aggregation environments with support for high-density 10GbE, 40GbE, and 100GbE
- Juniper Sky™ Enterprise, which is a simple and intuitive cloud-based network management platform for smaller scale data centers
- Contrail® Enterprise Multicloud, which offers full-scale IP fabric and overlay/underlay management



QFX Series Switches are flexible enough to be used in a Juniper Virtual Chassis configuration as well as spine-and-leaf IP fabric deployments. These technologies simplify any size data center and allow you to scale from dozens to thousands of ports.

Virtual Chassis

Juniper Virtual Chassis technology enables up to 10 interconnected QFX5000 line switches to perform and be managed as a single, logical device. Using Virtual Chassis technology, network architects can separate physical topology from logical groupings of endpoints to drive more efficient resource utilization, creating highly resilient topologies using uplink ports to extend the deployment across long distances spanning multiple wiring closets, floors, or even buildings. The operational simplicity and small form factors of the Virtual Chassis-enabled switches make the technology an excellent architecture for education customers who want a flexible solution in small data centers.



Figure 1: Virtual Chassis implementation

IP Fabrics

A number of data center use cases—such as Software as a Service (SaaS) and SDN—are best served with an IP fabric architecture.

As the go-to architecture in modern data center design, IP fabrics are commonly deployed in a spine-and-leaf arrangement, where spine nodes interconnect with leaf nodes in an any-to-any topology that can scale from hundreds to thousands of servers to support high traffic and application workflows.

A major design tenet of IP fabrics and spine-and-leaf designs is that traffic can be forwarded on optimal paths between switch nodes at Layer 3; alternate paths may be used if an outage occurs, ensuring high performance and highly resilient operations. Cross-sectional interconnect bandwidth can be improved through link aggregation groups (LAGs) and by multipathing between leafs and spines.

QFX Series Switches offer flexible, cost-effective, high-density interfaces for server and intra-fabric connectivity, from 1GbE on up through 10GbE, 25GbE, 40GbE, 100GbE, and 400GbE.

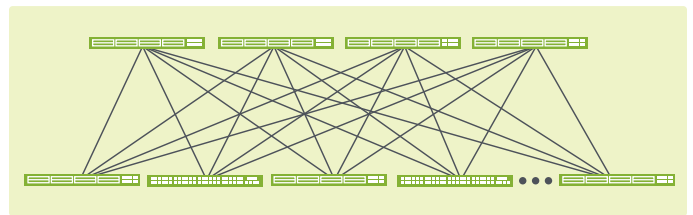


Figure 2: Spine-and-leaf IP fabric implementation

Ethernet VPN-Virtual Extensible LAN (EVPN-VXLAN) provides a common framework for managing data center networks. An EVPN-VXLAN architecture supports efficient L2/L3 network connectivity with scale, simplicity, and agility while also reducing OpEx.

Customers can deploy overlay networks to provide Layer 2 adjacencies for applications over IP fabrics. The overlay networks use VXLAN in the data plane and EVPN in the control plane for routing and reachability. The overlays can operate without a controller, or they can be orchestrated with Contrail Enterprise Multicloud to provide L2/L3 overlay virtual networking and security for bare-metal servers and virtual workloads.

Data Center Interconnect

The EVPN protocol delivers an end-to-end solution that encompasses data center as well as WAN networks, providing seamless connectivity from an application server to a database server, whether located in the same or different data centers.

EVPN supports a wide variety of deployment options:

1. EVPN leverages an MPLS-based forwarding plane in MPLS networks, making it ideally suited for WAN deployments as well as deployments in MPLS-enabled data centers.

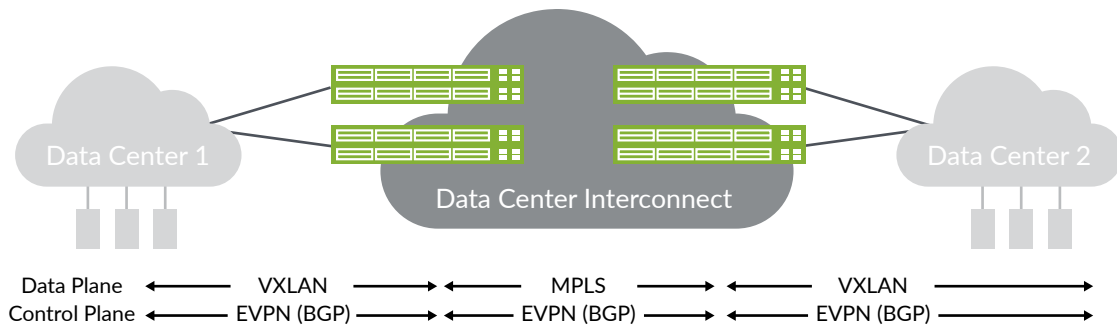


Figure 3: Juniper EVPN for DCI implementation

2. EVPN leverages a VXLAN-based forwarding plane, making it ideal for data centers with IP fabrics as well as WAN deployments where customers need to enable a VPN service over a plain IP infrastructure.
3. Implementing EVPN-VXLAN in data centers with virtual tunnel endpoint (VTEP) tunnels starting and ending in virtual routers also allows L2 stretch functionality to virtual machines (VMs) directly from the server infrastructure.

Contrail Enterprise Multicloud

QFX Series Switches can be managed with Contrail Enterprise Multicloud, a fabric management and SDN overlay solution that provides full life-cycle management for both data center and Data Center Interconnect (DCI) infrastructures. Contrail Enterprise Multicloud automates data center operations so network administrators can focus on revenue-generating services rather than operational networking procedures.

Contrail Enterprise Multicloud works with any standard IP fabric architecture, performing configuration operations across virtual networks and physical devices by leveraging open protocols such as Network Configuration Protocol/remote procedure call (NETCONF/RPC). Using a centralized controller with a management interface, Contrail Enterprise Multicloud provides customizable configuration templates that adapt to a vast array of architectures and use cases to ease network and device operations. Contrail Enterprise Multicloud abstracts network connectivity using virtual overlays connecting cloud-native workloads with traditional workloads running on bare-metal servers attached to the QFX Series Switches.

Contrail Enterprise Multicloud enables the provisioning and automation of data center fabrics and DCI using a common, consistent data model for configuring devices. Key capabilities include:

- Overlay and underlay management from a single orchestration layer
- Autodiscovery, zero-touch provisioning (ZTP), zero-touch replacement (ZTR), and upgrades of data center fabrics using QFX Series Switches

- Open, scalable, and standards-based protocol support: EVPN-VXLAN, BGP, NETCONF/RPC, sFlow/gRPC/SNMP
- Network and device topology discovery with role configuration
- Seamless connection between legacy and cloud-native workloads
- BGP EVPN across QFX Series Switches and virtual routers
- Infrastructure, multicloud interconnect, and service life-cycle management

To tie in network and device monitoring, Contrail Insights provides comprehensive visualization and smart analytics for QFX Series Switches. Powered by machine learning and artificial intelligence, Contrail Insights automatically learns network and device performance profiles, detects faults, and facilitates preventative remediation in real time at scale.

Based on a distributed policy and analytics architecture, Contrail Insights seamlessly collects and analyzes telemetry in real time from the QFX Series platforms via Junos® telemetry interface (JTI) or Contrail Enterprise Multicloud, generating event and alert notifications and providing actionable insights to the operator.

HealthBot

Combining the power of telemetry, programmability, advanced algorithms, and machine learning, HealthBot revolutionizes data analytics. Integrated with JTI, HealthBot aggregates large volumes of real-time telemetry data and correlates analytics to provide predictive insights that offer a multidimensional view across the entire network, as well as the applications running on it. Open programmability supports customized playbooks, enabling service providers and enterprises to build highly customized health monitoring and diagnostics workflows.

By focusing on actionable insights, simplified consumption, and a programmable framework supported by open-sourced data pipelines and collectors for data ingestion, HealthBot democratizes network analytics and encourages collaboration across business units, ultimately enhancing agility and innovation across the entire ecosystem.

Features and Benefits

- Increase education and research applications performance within the data center
- Design around a common framework and architecture supporting efficient L2/L3 network connectivity, reducing OpEx
- Simplify operations and reduce complexity through intent-based management and orchestration
- Increase agility to meet the requirements of education and research networks today and into the future

Summary—Portfolio of Juniper Data Center Switches for Education

If you are designing a data center architecture and want to reduce complexity, increase service agility, and improve time to value, Juniper Networks QFX Series Switches belong in your toolkit. QFX Series Switches meet the toughest requirements for data center performance, scalability, and ease of management. A longtime leader in the industry, Juniper has earned the trust of schools and institutions to deliver networks with ample performance, reliability, resiliency, and security to meet digital learning and business goals.

Next Steps

To learn more about Juniper's data center switching architectures, please visit www.juniper.net/us/en/products-services/switching/data-center-switching-architectures/.

To learn more about QFX Series Switches, visit www.juniper.net/us/en/products-services/switching/qfx-series/.

To learn more about Contrail Enterprise Multicloud, visit www.juniper.net/us/en/products-services/sdn/contrail/contrail-enterprise-multicloud/.

To learn more about HealthBot, visit www.juniper.net/us/en/products-services/sdn/contrail/contrail-healthbot/.

About Juniper Networks

Juniper Networks brings simplicity to networking with products, solutions and services that connect the world. Through engineering innovation, we remove the constraints and complexities of networking in the cloud era to solve the toughest challenges our customers and partners face daily. At Juniper Networks, we believe that the network is a resource for sharing knowledge and human advancement that changes the world. We are committed to imagining groundbreaking ways to deliver automated, scalable and secure networks to move at the speed of business.

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