

THE CLOUD-READY DATA CENTER NETWORK

Applying the lessons of cloud computing
to vastly improve economics of
networking and the user experience



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CLOUD-READY DATA CENTER SOLUTION OVERVIEW

CIOs are looking for ways to achieve greater IT efficiencies and agility to meet their requirements for an improved user experience and lower costs. Cloud computing represents a new way of meeting these goals by delivering services on a dynamic and shared IT infrastructure. Previously, applications were linked to hardware that was specifically designated for compute and storage. With cloud computing, the functionality of these same software and hardware products is delivered in a more scalable fashion as services over a network. CIOs are looking to apply the lessons of the cloud to their own IT departments to optimize results. However, they are limited because, as application architectures, server virtualization, and storage technology have evolved over time, innovation in the network has not kept pace. Because networks are the foundation of a cloud-ready data center, businesses need a new network to unleash the promise of the cloud.

THE JUNIPER NETWORKS SOLUTION FOR CLOUD COMPUTING

Cloud computing can vastly improve the performance, scale, agility, and security of applications in any data center. This reduces IT costs while improving the user experience. IT services are delivered by infrastructures that are centrally managed and shared through consolidation and virtualization. Any of the standard data center elements—such as servers, appliances, storage, and other networking devices—can be contained within a cloud-like architecture. By abstracting the logical from the physical, these elements can be arranged in resource pools that are shared securely across multiple applications, users, departments, suppliers, and customers.

The resources in these pools can also be dynamically allocated to accommodate the changing capacity requirements of different applications and improve asset utilization levels. Consequently, cloud infrastructures have proven to simplify management, reduce operating and ownership costs, and allow services to be provisioned with unprecedented speed. Juniper Networks has dedicated itself to building simplified, scalable, agile, and secure networks with these design objectives for the cloud-ready data center in mind.

SUCCESS IN BUILDING A CLOUD-READY DATA CENTER NETWORK INVOLVES THREE STEPS: (1) SIMPLIFY, (2) SHARE, (3) SECURE – AND AUTOMATE AT EACH STEP

Getting Ready

Success in building a cloud-ready data center network requires three steps: (1) simplify, (2) share, (3) secure. It is also important to automate at each step. Whether you are running your internal IT infrastructure to be cloud-like or plan to connect with public cloud services, designing a cloud-ready data center network involves removing the restrictions related to where you place your resources. This gives you significant operational advantages that can help you lower costs, increase efficiency, and keep your data center agile enough to accommodate any changes in your business or your technology infrastructure.

Key Components

Juniper recommends three steps to making your network infrastructure cloud-ready, reducing the cost and complexity of networking while improving performance, ability to scale, and business agility:

- **Simplify the architecture**—Consolidate siloed systems and collapse inefficient tiers using a network fabric and a single network operating system. This gives you fewer devices, a smaller operational footprint, reduced complexity, easier management operations, and improved application performance.
- **Share the resources**—Virtualize network resources to segment the network into simple, logical, and scalable partitions for your various applications and services while using fabric technology to ensure seamless connectivity to those resources regardless of where they are located. Keep privacy, flexibility, high performance, and quality of service (QoS) as primary goals. This sharing enables agility for multiple users, applications, and services.
- **Secure the data flows**—Make sure that integrated and dynamic security services are resident in the network to provide security scale, threat visibility, and enforcement. These comprehensive

services secure data flows across both physical and virtual environments, while leveraging centralized orchestration to drastically simplify the enforcement of dynamic, application-aware, and identity-aware policies, ultimately ensuring better application availability and network performance.

You can also automate network operations at each step with an open, extensible software platform. This reduces operational costs and complexity, enables rapid scaling, minimizes operator errors, and increases reliability through a single network operating system. A powerful network application platform with innovative applications enables network operators to leverage Juniper or third-party applications for simplifying operations and scaling application infrastructure to improve operational efficiency.

SIMPLIFY

The network design that used to work for the business might not be capable of supporting new demands on IT infrastructure and, most importantly, new business requirements. Networks built on fragmented and oversubscribed tree structures have problems with scaling and consistent performance. Operations and management complexity and costs increase exponentially as more devices are added.

3-2-1 Data Center Network Architecture

Juniper simplifies the data center network and eliminates layers of cost and complexity with a “3-2-1 Data Center Network Architecture.” Using technologies such as virtual private LAN service (VPLS) network virtualization on Juniper Networks® MX Series 3D Universal Edge Routers, Virtual Chassis on Juniper Networks EX Series Ethernet Switches, and Juniper Networks QFabric™ architecture on our new Juniper Networks QFX Series product family, Juniper helps flatten data center

3 — 2 — 1 The legacy network, 3 tiers.

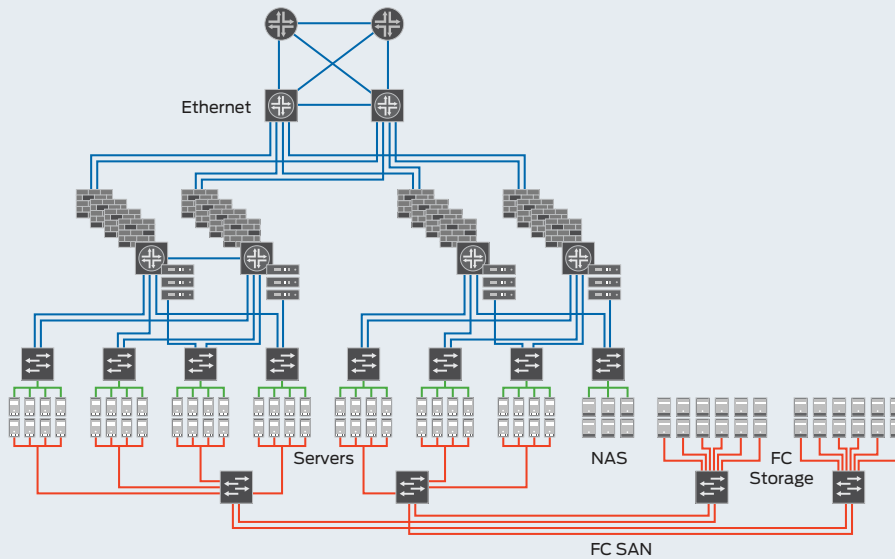


Figure 1: The legacy network.

3 — 2 — 1 2-tier data center network architecture.

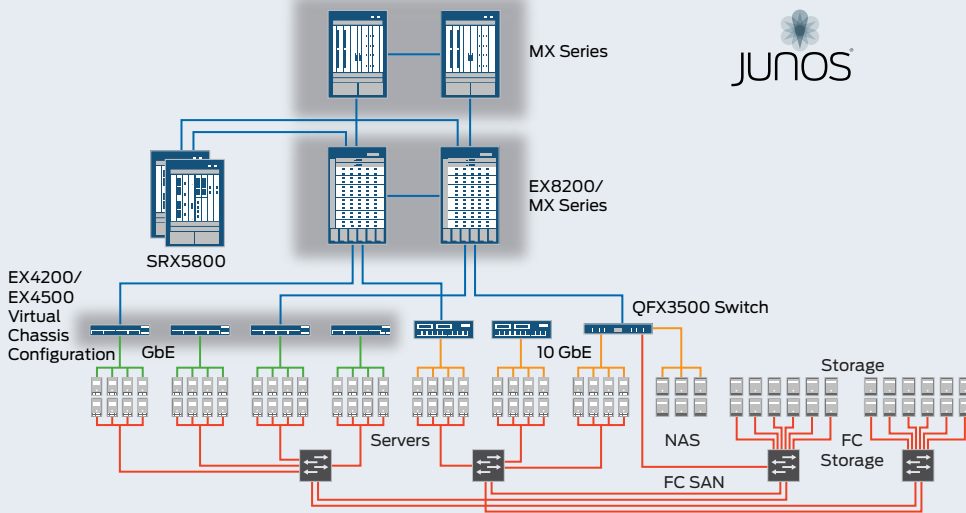


Figure 2: Juniper delivers a simplified two tier network today with Virtual Chassis fabric technology.

3 — 2 — 1 Single tier network fabric architecture.

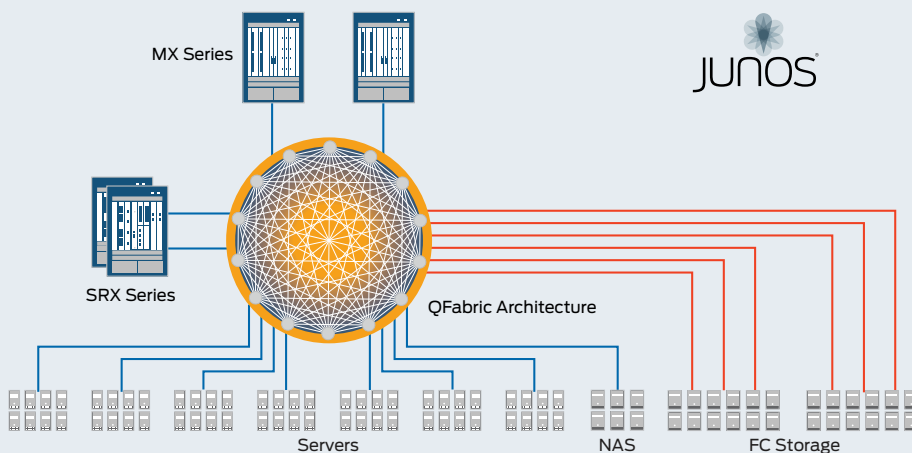


Figure 3: The ultimate simplification of the data center is a single fabric that provides any-to-any connectivity.

networks, reducing them from three layers to two or even one layer. The key to QFabric is fundamentally simplifying the data center network to allow businesses to meet today's exponential demands. This gives CIOs the ability to deliver the scale, connectivity, and resiliency of the data center network with the performance and simplicity of a switch.

Edge Service Consolidation and Management

At the data center's edge where connections to other data centers and networks occur over the WAN, the Internet, or a partner's network, the number of deployed devices can be consolidated into fewer, more agile and scalable devices with Juniper solutions. This consolidation simplifies management and control of the connections, and it lowers operational costs. The Juniper Networks M Series Multiservice Edge Routers* and MX Series 3D Universal Edge Routers are powerful, reliable, and the industry's most scalable solutions for the intelligent edge and inter-data center mobility.

* In many deployments that require robust advanced routing capabilities in the core, the MX Series with L2 Ethernet services can be used as a collapsed core and WAN edge, further simplifying the data center network.

Service Consolidation

Network-based security services—intrusion detection and prevention, encryption, and application monitoring—can be consolidated into highly scalable dynamic security platforms to reduce security “sprawl.” The Juniper Networks SRX Series Services Gateways can condense previously siloed security platforms by a ratio of 5:1. The SRX Series enables rapid provisioning and simplified operation of multiple security controls for dynamic scaling of security services across physical and logical platforms.

Unified Management

By using Juniper Networks Junos® operating system as the single OS across routing, switching, and security platforms, as well as Juniper Networks Junos Space network orchestration applications, Juniper is able to significantly simplify configuration and problem management for multiple applications and user groups. These gains are crucial to maintaining service levels and flexibility in IT infrastructure, while following the constant business imperative of doing more with less.

SHARE

Economic and agility imperatives of the cloud-ready data center require network resources to be allocated, expanded, and reallocated efficiently at scale. Juniper's uniquely architected platforms deliver the agility and scaling required by virtualizing network configurations, segmenting services into logical domains, and using industry-leading hardware designs to scale without complexity. With a large pool of resources to draw on, customers can efficiently partition their resources to meet service requirements, remain flexible, and ensure operational performance, security, and control.

Resource Allocation

Juniper's recommended approach to sharing the network revolves around aligning capacities, bandwidth, priorities, and availability goals with application requirements using technologies based on standards and simplified policies.

Solutions such as Virtual Chassis and QFabric allow multiple devices to behave as a single logical device. In each of Juniper's routing and switching lines, customers have unmatched scale and agility in processing access control lists that forward traffic according to previously established rules for designated types, rates, and packet sizes. Juniper security services and policies nest VLANs within logical zones for security segmentation. With Juniper's scalable MPLS and VPLS technologies on the MX Series routers, VPNs can be used to extend zones, while VLANs can be stretched across data centers or pods for more flexible shared links to the cloud.

Supporting Server Virtualization

There are a number of ways to address the management and security challenges raised by the explosion of virtualized servers and virtual machines in today's data centers. Most require coordination between physical and virtual resources, so that delivery of services is appropriately synchronized. Juniper provides the needed flexibility with the Juniper Networks vGW Series Virtual Gateways and SRX Series products, automation and orchestration capabilities with Junos Space Virtual Control, as well as our endorsement of an emerging IEEE standard called Virtual Ethernet Port Adaptor (VEPA), which specifies that switching between virtual machines be

handled by the external physical switch connected to the server. Once approved, the VEPA standard will be supported on all EX Series and QFX Series switches through a simple software upgrade.

Converged Networks

I/O and network convergence bring together the various disparate networks within the data center. For many of our customers, this means bringing together the Ethernet and the Fibre Channel Storage Area Network using protocols such as IEEE Data Center Bridging (DCB) and Fibre Channel over Ethernet (FCoE). These are both supported on EX Series and QFX Series 10GbE switching platforms.

SECURE

Security administrators in a cloud-ready data center must protect client-to-server traffic, traffic between virtual machines on servers, and traffic between physical and virtual servers, applications, and systems in other data centers. The ability to scale is a primary security requirement in these environments. Increasing user access and the rising sophistication of security threats in a cloud-ready data center also require expanded visibility into threat vectors and related protection. At the same time, security solutions still need to consistently enforce policies, while remaining flexible to adapt to the changes in traffic volumes and data flows that occur because of virtualization, Web 2.0 applications, and cloud services. Appropriate policies affect the availability of business critical applications and operations.

To address these challenges, capabilities such as scale, visibility, and enforcement controls must work together to comprehensively secure a cloud-ready data center. Security services must be consolidated and pooled in a coordinated fashion to complement the simplification and sharing of the network. This approach enhances the flexibility and efficiency of the entire solution.

Juniper Networks has developed high-performance, cloud-enabled dynamic security services to meet today's security and performance requirements, while accommodating future on-demand growth. Services such as application identification and monitoring, stateful firewall, intrusion detection and prevention, and VPNs are

consolidated on an expandable platform that flexibly and dynamically assigns resources as needed. Security services must be application- and identity-aware, while providing the mobile workforce with secure access to data center applications. Juniper solutions now include integrated and comprehensive vGW Series virtual machine security capabilities for securing virtualized data centers. Businesses can deploy a consistent set of security policies and services from the hypervisor all the way across the network fabric, bridging virtual and physical network layers. As a result, customers can realize the full value of virtualization, while protecting against the associated security risks.

AUTOMATE

Juniper's open, extensible network automation software makes it easier to manage and administer the data center by simplifying repetitive and complex tasks, defining and implementing policies within the network, and orchestrating implementation across multiple systems using network-based software. This greatly reduces operational expenses by reducing configuration errors, measurably improving reliability, and freeing up labor resources to innovate rather than administer.

The Junos Space network application platform was designed to provide end-to-end visibility and control of the network to enable network resources to be orchestrated in response to business needs. Operators can significantly simplify the network life cycle, including configuration, provisioning, and troubleshooting with an open, automation platform (Figure 4).

Junos Space includes a core set of collaborative applications from Juniper and third parties that help managers improve operational efficiencies, rapidly scale their infrastructure, and increase the reliability and agility of the network.

With the Junos Space easy-to-use Web 2.0 user interface, operators can complete their tasks easily, quickly, and accurately.

Junos Space provides applications for network infrastructure and automation that include:

- **Junos Space Ethernet Design**—helps deploy an enterprise network just as easily as it is to deploy a single switch

- **Junos Space Virtual Control**—provides access and visibility into the virtual network and automated orchestration between the physical and virtual networks for server virtualization deployments
- **Junos Space Network Activate**—facilitates fast and easy setup of VPLS services and allows for full life cycle management of MPLS services
- **Junos Space Route Insight**—enables rapid planning, troubleshooting, and change simulation for L3 services
- **Junos Space Security Design**—enables bulk configuration and provisioning of complex security policies
- **Junos Space Service Insight**—provides targeted and network intelligence to maximize network performance and minimize risk
- **Junos Space Service Now**—reduces operating expenses and speeds problem resolution by streamlining operational procedures and automating diagnostics

SUMMARY

Improve the Economics and Experience of Information Technology to Deliver Greater Business Value

Many organizations can benefit from cloud-ready data center networks, whether building a cloud-like infrastructure for internal purposes, connecting to public cloud services, or preparing to connect to public cloud services in the future. Juniper Networks, as a partner with broad real-world experience, can help organizations reduce complexity and overall costs in IT while accelerating delivery of IT services to users in a secure, simplified network.

JUNIPER SOLUTION COMPONENTS

Switching

EX Series Ethernet Switches: Deliver unmatched scale and performance for L2 and L3 data center networks. The high-density, high-performance EX8208 and EX8216 modular switches support data center and cloud computing environments. EX4200 line supports gigabit top-of-rack deployments and can work with the EX4500 in a Virtual Chassis configuration for a mixture of 1GbE and 10GbE top-of-rack ports. Virtual Chassis fabric technology interconnects multiple switches to operate as a single device, reducing management overhead.

QFabric Family: From the high-performance QFX3500 and QFX3600 top-of-rack switches to the QFabric System, which supports thousands of ports within a single, low latency and easily manageable fabric, Juniper delivers a wide variety of solutions designed to accelerate and simplify the data center network.

The QFX3500 and QFX3600 access switches deliver high-performance, low latency, feature rich Layer 2 and Layer 3 solutions for supporting deployment scenarios such as traditional and virtualized data centers, high-performance computing, network-attached storage, converged server I/O, and cloud computing.

The QFabric System is highly scalable, delivering unparalleled application performance and converged services with unmatched simplicity. The QFabric System is composed of three separate but interdependent components that represent the three primary components of a switch—line cards, backplane, and routing engines:

- **QFabric Node:** QFabric Nodes are high-density, fixed-configuration edge devices that connect to servers, storage and other networking devices using standards-based Ethernet interfaces, providing access into and out of the fabric.
- **QFabric Interconnect:** QFabric Interconnects are high-speed transport devices that connect all QFabric Node edge devices in a full-mesh topology.
- **QFabric Director:** The QFabric Director provides all control and management services for the QFabric System, making it operate as a single device.

Working together, these components operate as a unified, efficient switch that creates a true network fabric enabling any-to-any connectivity for servers, storage and other critical systems while providing a foundation for a cloud-ready data center environment. Users can initially deploy a QFX3000-M QFabric System, ideally suited for mid-tier data centers supporting up to 768 10GbE ports with an average latency of 3 microseconds port to port. As demands grow, with the simple replacement of the Interconnect, or for larger enterprise IT data centers or cloud environments, the QFX3000-G QFabric System can scale to support up to 6,144 10GbE ports with latency of 5 microseconds under typical loads in a nonblocking and lossless architecture that supports Layer 2, Layer 3 and Fibre Channel over Ethernet (FCoE) traffic.

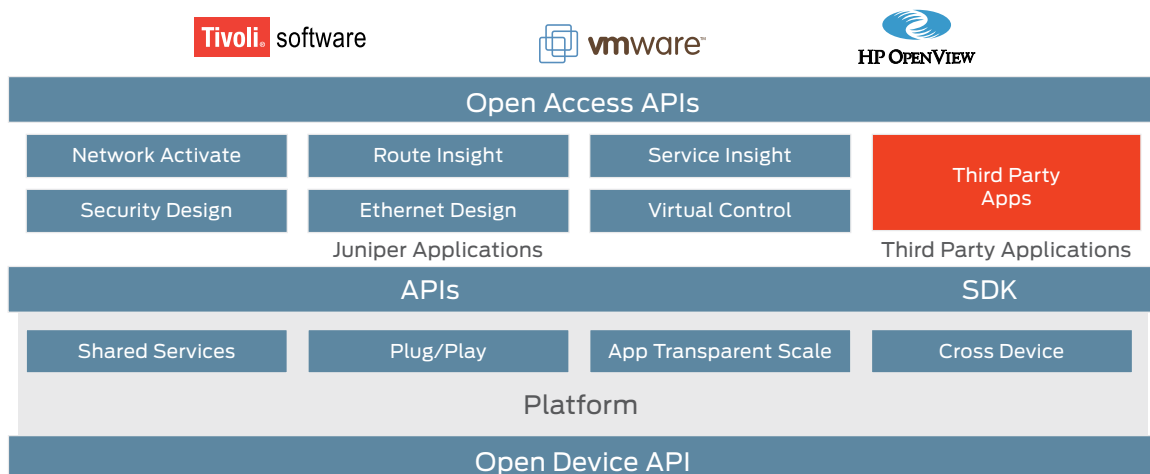


Figure 4: Open automation platform

Existing QFabric System components can be redeployed into a scalable data center-wide network fabric, protecting previous investments.

Routing

MX Series 3D Universal Edge Routers:

A family of high-performance Ethernet services routers with powerful switching and security features, the MX Series delivers the most advanced routing features as well as the ability to scale functionality without compromising performance. Advanced routing features include MPLS network virtualization, low latency multicast, advanced QoS, carrier-class reliability, and security. MX Series routers are designed for future support of Juniper's unique Virtual Chassis technology, which will enable multiple interconnected MX Series routers to operate as a single device to simplify manageability.

M Series Multiservice Edge Routers: Deliver the most advanced routing features with a large array of WAN interface options to connect the cloud-ready data center to the WAN.

Security

SRX Series Services Gateways: The Junos-based SRX Series offers integrated security services, delivering comprehensive, layered network security at scale for firewall, IPS, IPsec VPN, AppSecure, NAT, and security for virtualized data centers and clouds—via a single platform, eliminating the need to purchase and support multiple single-service appliances.

vGW Virtual Gateway: Secure virtual data center and cloud computing environments, and enforce a continuously compliant virtual machine security posture through a combination of high-performance stateful firewall, integrated intrusion detection, on demand and on access antivirus, as well as automated compliance monitoring and enforcement. Integration with SRX Series zones delivers coordination with physical network security making vGW a reliable UTM system for clouds.

Unified Access Control with Junos Pulse: Provides powerful identity- and role-based access control that increases agility in service deployment and overall quality of experience. Juniper Networks Unified Access Control can be deployed within a data center or across an extended enterprise to protect networks and applications.

SA Series SSL VPN Appliances with

Junos Pulse: provide scalable, simplified, and secure access for remote and mobile employees, customers, and partners from multiple remote networks and platforms (SSL VPN) to data center resources.

Operating System

Junos OS: integrates routing, switching, and security services, and offers the power of one operating system to reduce complexity, achieve operational excellence, and deliver dynamic services with lower total cost of ownership (TCO).

Network Application Platform

Junos Space is an open, extensible network platform for developing and deploying applications that simplify operations, scale automation tasks, and maximize operational accuracy. The platform includes a scalable runtime environment with multitenant, hot-pluggable network application support, a complete rapid network application development framework, and an easy Web 2.0 user interface. Junos Space includes a plug-and-play environment for applications developed by Juniper and third parties, for devices to be added to the platform without system restart, and to allow in-service device upgrades.

Network Client

Junos Pulse allows the data center to become identity-aware, while providing the mobile workforce with secure access to data center applications. This dynamic, standards-based multiservice network client delivers integrated connectivity, access, application acceleration, and security anytime/anywhere, while drastically simplifying the user experience.

Professional Services

Juniper Networks Professional Services offers a robust portfolio of consulting services designed around a time-to-value experience that delivers the greatest value from investments at every phase of the network life cycle. It is staffed with uniquely qualified engineers who bring broad industry experience, coupled with deep Juniper technical expertise to help enterprises or service providers design, implement, and optimize their networks for confident operation and rapid returns on infrastructure investments.

Technical Services

Juniper Networks Technical Services is a family of services that protect the investment in your high-performance network, while increasing operational effectiveness and lowering operational cost. These services combine Juniper's service automation technology to increase productivity, reduce risk, and increase network uptime by automating diagnostics and reducing mean time to resolution (MTTR). This industry-leading innovation increases operational efficiency by allowing your staff to concentrate on running the business, not fixing the equipment.

At the highest level, Technical Services provide proactive and personalized services so that you achieve the optimal level of operational effectiveness with support that is customized to your needs. The Technical Services portfolio also consists of complementary options to give you additional access to the best resources to support your environment.

All of these are backed by an award-winning support organization and a suite of e-support tools that give you optimal operational stability, thus reducing your overall network TCO.

KEY BUSINESS PARTNERSHIPS

Partnerships with market leaders and innovators are critical to enable proven and cutting-edge solutions. Juniper has key alliances in place today with IBM and Dell, both of whom offer Junos OS-based routing, switching, and security solutions. Both companies also offer simplified data center architectures based on the building blocks of Juniper's cloud-ready data center network. Partnerships with virtualization leaders like VMware enable simplified automation. Enhanced security capabilities are available through partnerships with companies such as FireEye. Together with our alliance partners, Juniper offers solutions that can be deployed with confidence.

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