ENTERPRISE DATA CENTER INTERCONNECTIVITY

Increase Simplicity and Improve Reliability with VPLS on the MX Series Routers

Challenge

As enterprises improve business continuity by enabling resource allocation and reliability across data centers, they seek a scalable and reliable transport to interconnect data centers. The infrastructure must be elastic to respond to changing business needs and maintain business continuity even during live server migration.

Solution

Juniper's standards-based network virtualization solution is powered by the MX Series 3D Universal Edge Routers. The solution is designed to deliver maximum scalability and resiliency, in both hardware and transport, while enabling customers to dynamically provision their network for improved flexibility.

Benefits

- **Massive scalability**—Efficient space and energy savings without compromising feature set and performance
- **Pay as you grow**—Ability to scale easily from 20 Gbps to 80 Gbps within the midrange devices (MX5, MX10, MX40, and MX80)
- **Ease of management**—Managing one product line that scales from 20 Gbps to 2.6 Tbps for operational efficiency

Businesses are interconnecting data centers to migrate data for purposes such as disaster recovery, data center consolidation, data center migration, and load balancing of virtual machines. As the number of interconnections grows, enterprises are not only running into scalability and reliability challenges but also degradation in performance.

Enterprises need data center connectivity that can reduce network complexity and improve scalability, reliability, and application performance. Juniper's MPLS cloud-based solution achieves these goals using four fundamental design principles—Simplify, Share, Secure, and Automate. The following sections describe the challenges of data center interconnectivity and the Juniper Networks solution in greater detail.

The Challenge

Figure 1 illustrates an example of a real customer impacted by rapid organic business growth. To address challenges such as poor application performance, resiliency, and lack of scalability, this customer deployed application dedicated links (red links for application A and blue links for application B) to interconnect data centers. Over time, this practice resulted in over 20 dedicated 10GbE links, with only 1% utilization per link. The dedicated links severely impacted the ability to scale the network and to adapt it to changing business needs, and they resulted in huge costs.

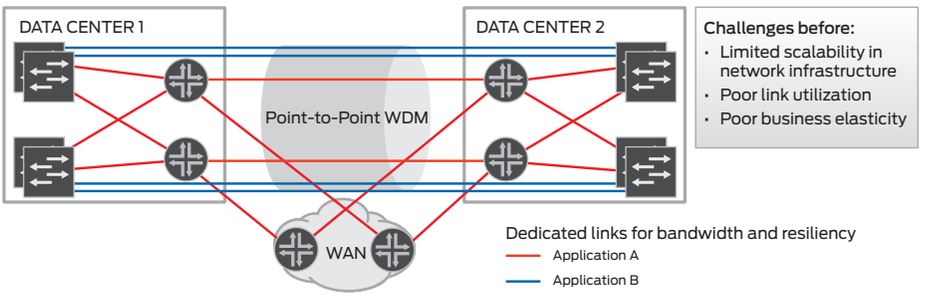

Figure 1: Before: Example of a real customer with 20 x 10GbE dedicated links by application, resulting in 1% utilization

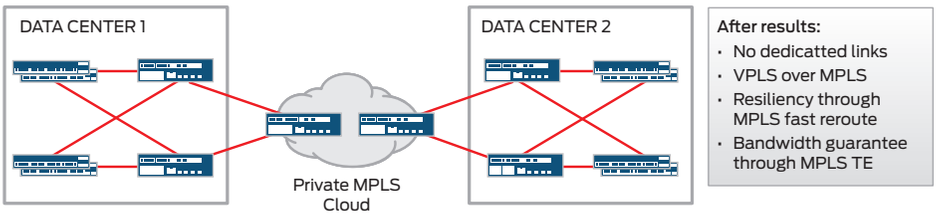

Figure 2 After: Example of the customer with a virtualized network that eliminates dedicated links and delivers 100% improvement in utilization

The Juniper Networks Enterprise Data Center Interconnectivity Solution

VPLS over MPLS

With Juniper's enterprise WAN solution as shown in Figure 2, the private MPLS cloud replaces dedicated link interconnectivity between the different locations using virtual paths that can be set up on demand. Business continuity is maintained using MPLS fast reroute, while custom application bandwidth is maintained using quality of service (QoS) and traffic engineering (TE), thereby guaranteeing application performance. The enterprise achieves significant CapEx and

OpEx savings using the new design, while improving privacy and security using logical MPLS separation.

The solution described in Figure 2 is powered by high-performance Juniper routers and network virtualization, and it supports several features that bring a range of benefits to the enterprise customer.

VPLS over IP

Enterprises that have only an IP core can use generic routing encapsulation (GRE) tunnels to transport virtual private LAN service (VPLS) traffic between data centers. Customers can benefit from building a solution using the Juniper Networks® MX Series 3D Universal Edge Routers that offer thousands of GRE tunnels for massive scalability.

Although a GRE transport is simple to establish and ideal for a small number of sites, it is difficult to manage for a large number of GRE tunnels and does not offer MPLS benefits such as traffic engineering and resiliency.

Features and Benefits

MX Series 3D Universal Edge Routers offer unmatched scalability, performance, reliability, and QoS for a variety of enterprise WAN needs. Juniper is now extending the MX Series product line to the midrange (MX5, MX10, MX40, and MX80) without compromising on proven features such as high-performance routing. These midrange routers bring superior value to the enterprise WAN edge.

Improved Flexibility Reduces Costs and Improves Value for Investment

MX Series routers provide enterprises with a wide range of high-performance routing technologies to meet WAN requirements. These include improved application performance, resiliency, reduced network complexity, and improved operational efficiency:

- **Virtualization**—Network virtualization features such as MPLS make applications completely transparent to underlying network architecture. This allows changes to architecture without impact to applications enabling greater flexibility. Virtualization also provides better utilization of resources for lowering costs and improving power utilization.
- **Scalable multicast**—Multicast technologies provide timely delivery of services to a large number of users, and they distribute that traffic efficiently.
- **Carrier-class reliability**—Juniper provides hardware resiliency; and also network and software redundancy.
- **QoS**—Sophisticated policies expedite delay sensitive content with predictable and measurable results.
- **IPv6 and IPv4**—Native support for IPv4 and IPv6 eases the transition to IPv6 and ensures long-term investment protection.

Massive upgradeability options:

The MX Series offers massive upgradeability options. Enterprises deploy multiple devices to support a range of functionality such as MPLS, IP routing, switching, security, legacy technology such as Frame Relay, and so on. This often requires the frequent replacement of routers to meet growing bandwidth needs. With Juniper's midrange MX Series portfolio, enterprises can now consolidate multiple single purpose devices with one powerful 2 RU midrange router that provides a number of Ethernet and non-Ethernet interfaces.

Enterprises can also benefit from the seamless upgradeability of midrange routers to ensure investment protection. Any of the midrange routers can be upgraded through purchase of a software license and additional Modular Interface Controllers (MICs). For instance, Juniper Networks MX5 3D Universal Edge Router can be upgraded to an MX10 3D Universal Edge Router, MX40 3D Universal Edge Router, or MX80 3D Universal Edge Router. MX10 can be upgraded to an MX40 or MX80, etc. The MX Series midrange router interfaces can be upgraded from 10/100/1000 Mbps to 1 Gbps to 10 Gbps Ethernet and to OC3/OC12/OC48 for non-Ethernet.

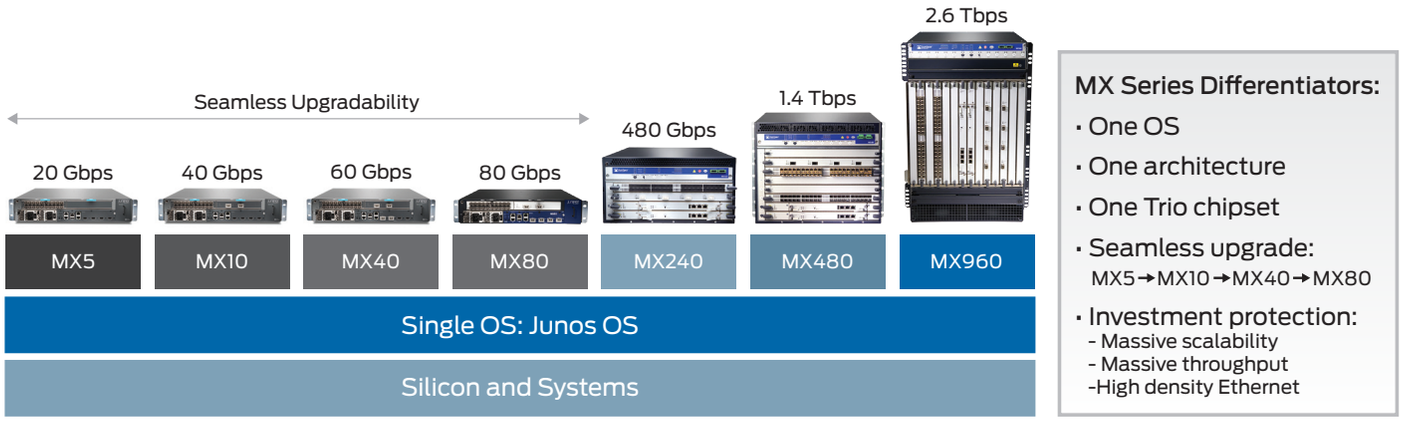

Figure 3: MX Series enterprise WAN routing portfolio simplifies the WAN using one Junos OS, the same Trio silicon, and a consistent architecture

Improved Efficiency Reduces Costs with Lower Power and Space Utilization

The MX Series has been optimized for space and power without compromising features and performance. Enterprises can benefit from increased efficiency by deploying the powerful midrange routers in the enterprise WAN. At only 320 W, the MX Series midrange routers consume the lowest power in their class on the market today. The high-end MX Series can use up to two times less power than comparable routers without compromising performance.

Increased Simplicity Reduces Operational Expense and Improves Network Stability

All MX Series routers are powered by Juniper Networks Junos® operating system, and this provides consistency of features across the MX Series product portfolio. Feature consistency ensures that enterprises can not only port configurations across the product line but also get a seamless user experience. The resulting simplicity reduces operating expenses and improves network stability.

Solution Components

Enterprises can achieve improved flexibility, improved efficiency, and increased simplicity by designing a Juniper powered solution that is based on four fundamental design principles:

- Simplify
- Share
- Secure
- Automate

Simplify—the network infrastructure by reducing the number of devices, links, and operating systems

Figure 3 shows the MX Series product family ranging from the Juniper Networks MX5 3D Universal Edge Router to MX960 3D Universal Edge Router. These appliances offer a range of throughput from 20 Gbps to 2.6 Tbps to provide a comprehensive routing solution for the enterprise WAN. The compact 2 RU MX5, MX10, MX40, and MX80 routers can seamlessly scale to support a range of speeds (20 Gbps, 40 Gbps, 60 Gbps, or 80 Gbps) using a software license. These midrange routers are ideal for both Ethernet and non-Ethernet environments, and they deliver uncompromised functionality in a compact form factor. The high-end MX Series routers (Juniper Networks MX240 3D Universal Edge Router, MX480 3D Universal Edge Router, and MX960 3D Universal Edge Router) support industry-leading density, scalability, and throughput. These routers have integrated routing, switching, and security suitable for a variety of enterprise needs. The MX Series portfolio uniquely addresses several high-performance routing needs with a single platform, powered by our innovative silicon, OS, and architecture common across MX Series appliances. By deploying highly scalable MX Series routers, customers can simplify the network by eliminating multiple special purpose devices.

Share—the network infrastructure through network virtualization

Network virtualization features such as MPLS, logical systems, virtual routers, etc., provide better utilization of resources and help in lowering costs. Network virtualization also enables customers to quickly respond to changing business needs by hiding the physical infrastructure changes to applications.

Figure 4 shows two data centers (data center 1 and data center 2) connected using an MPLS cloud. Data center 1 has the MX Series midrange routers in the WAN edge and the high-end MX Series routers in the data center core. Data center 1 uses the Juniper Networks SRX Series Services Gateways to provide firewall and security features to selected traffic passing through the MX Series routers using MPLS virtualization. To achieve Layer 2 stretch, the two data centers use VPLS over MPLS. The MPLS terminates at the service edge boundary layer of the data centers. The VLANs from the access layer are mapped to the MPLS paths at the core layer (indicated by the red solid line showing the MPLS and VLAN division). Note that the MX Series midrange routers are ideal for

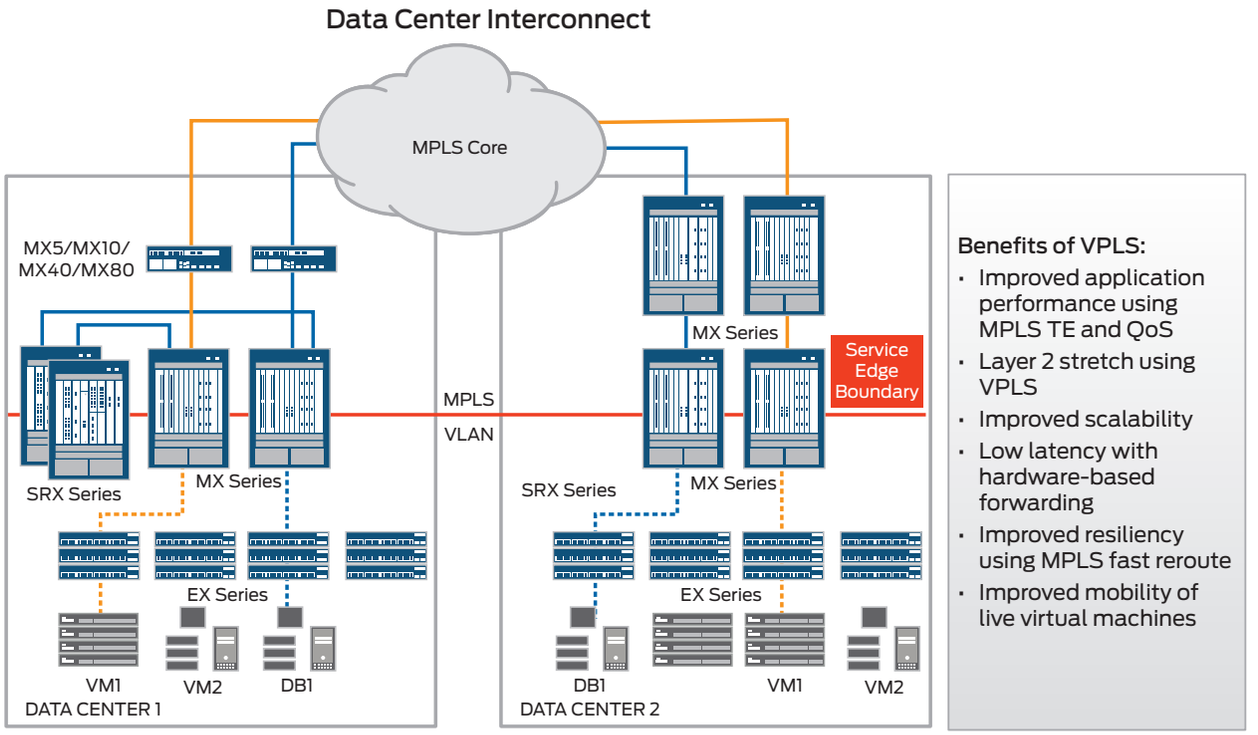

Figure 4: Example of sharing across two data centers using VPLS over MPLS and showing the positioning of compact midrange routers and high-end MX Series devices

many data center WAN edge deployments because they support high-performance routing features such as MPLS and QoS in a compact form factor.

Secure—the network comprehensively

Today's security requirements have grown as an organization's interconnected network must support an increasing number of remote users that include suppliers, partners, customers, and employees at remote locations. Attacks have also grown in sophistication and frequency. The MX Series supports integrated security modules that protect the WAN:

1. **Comprehensive security**—A comprehensive set of security features that include Web filtering, deep inspection, as well as J-Flow monitoring of flows and intrusion detection.
2. **Distributed denial of service (DDoS) attack prevention**—The MX Series routers are built to protect the enterprise WAN from Address Resolution Protocol (ARP) storms. They include sophisticated access control list (ACL) rules to protect against control plane attack, protection against SYN and Internet Control Message Protocol (ICMP) attacks, etc.
3. **VPNs**—IPsec VPN and MPLS VPN provide a logical separation of data and improve the privacy of data. These also offer a cost-effective alternative to expensive dedicated links to provide traffic separation.

Enterprises that need a comprehensive and dedicated security device can benefit from deploying SRX Series gateways in a solution with MX Series devices. Both platforms support comprehensive virtualization technologies and can be easily combined using MPLS to create a powerful and secure routing solution.

Automate—the network provisioning, monitoring, and troubleshooting

To simplify network provisioning, monitoring, and maintenance, several management tools are recommended to accelerate service deployment, reduce network downtime, and minimize human error.

Juniper Networks Junos Space offers a range of tools ideal for the enterprise WAN, some of which include:

- **Junos Space Ethernet Design**—Provides best practice service definition such as port security, QoS, spanning tree, etc., to plan, simulate, model, and diagnose issues in the network
- **Junos Space Network Activate**—Provides a best practice definition for Ethernet services to quickly, accurately, and easily provision VPNs
- **Junos Space Route Insight**—Provides a tool to easily plan, simulate, model, and diagnose issues in the MPLS network

Enterprises can also benefit from Junos OS automation that simplifies operational tasks, automates responses to specific events, and minimizes human error by enforcing best practices for device configurations. Customers can also automate many mundane tasks such as tracking bug and end-of-life (EOL) status, and managing inventory using Juniper Care.

Summary—VPLS on the MX Series Enables Scalable, Reliable, and Flexible Data Center Interconnectivity

As enterprises move large amounts of mission critical data to the data center, they are interconnecting data centers for purposes such as disaster recovery, data center consolidation, data center migration, and load balancing. Enterprises seeking scalable, secure, and resilient transport for data center interconnectivity can benefit from deploying Juniper's solution that is designed to:

- **Simplify**—the network infrastructure by reducing the number of devices, links, and operating systems
- **Share**—the network infrastructure through virtualization to improve performance and asset utilization
- **Secure**—the network comprehensively
- **Automate**—the network provisioning, monitoring, and troubleshooting

Next Steps

To learn more about Juniper's enterprise WAN solution, please visit the following links for additional information or contact your Juniper Account team.

- Enterprise WAN Reference Architecture: **www.juniper.net/us/en/local/pdf/reference-architectures/8030009-en.pdf**
- Extending the Virtualization Advantage with Network Virtualization: **www.juniper.net/us/en/local/pdf/whitepapers/2000342-en.pdf**
- **www.juniper.net/us/en/solutions/enterprise**
- **www.juniper.net/us/en/products-services/routing**

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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