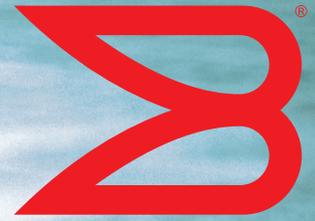# ROUTING SOLUTIONS FOR SERVICE PROVIDERS

BROCADE MLX SERIES

SDN-Enabled Programmatic Control of the Network

HIGHLIGHTS

- Scalable multiservice IP/MPLS Carrier Ethernet routers in 4-, 8-, 16-, and 32-slot options

- Fully distributed, non-blocking architecture with up to 15.36 Tbps fabric capacity, providing packet forwarding rates of approximately 9.5 billion packets per second

- 768 10 GbE, 128 40 GbE, and 32 100 GbE wire-speed ports in a single router

- Integrated support for OpenFlow in true hybrid-port mode, enabling Software-Defined Networking (SDN) for programmatic control of the network

- Advanced Layer 2/3 VPN and multicast capabilities to support residential triple-play and business services

- High-availability design with redundant management modules, switch fabrics, power supplies, and fans; hitless failover; hitless software upgrades; and non-stop routing

- Ideal for a wide range of advanced applications in service provider backbones, Metropolitan Area Networks (MANs), Content Service Provider (CSP) networks, data centers, and distributed enterprises

Software-Defined Networking (SDN) is a powerful new network paradigm designed for the world's most demanding networking environments and promises breakthrough levels of customization, scale, and efficiency. The Brocade® MLX® Series of routers enables SDN by supporting the OpenFlow protocol, which allows communication between an OpenFlow controller and an OpenFlow-enabled router. Using this approach, organizations can control their networks programmatically, transforming the network into a platform for innovation through new network applications and services.

The Brocade MLX Series delivers OpenFlow in true hybrid-port mode. With Brocade hybrid-port mode, organizations can simultaneously deploy traditional routing with OpenFlow on the same port. This unique capability provides a pragmatic path to SDN by enabling network operators to integrate OpenFlow into existing networks, giving them the programmatic control offered by SDN for specific flows while the remaining traffic is routed as before. Brocade hardware support for OpenFlow enables organizations to apply these capabilities at line rate in 10 GbE, 40 GbE, and 100 GbE networks.

MULTISERVICE IP/MPLS ROUTERS

Leading-edge services such as high-definition video streaming, cloud services, and mobile broadband have significantly altered network traffic behavior. Instead of localized flows with occasional bursts, traffic flows are more collaborative over geographical distances and last longer. These new traffic patterns not only consume enormous amounts of network capacity, but also add a greater degree of complexity to network operations. As a result, today's network planners are seeking solutions that provide the right mix of scalability, performance, operational simplicity, and cost-effectiveness.

Built with a state-of-the-art, sixth-generation, network processor-based architecture and terabit-scale switch fabrics, the Brocade MLX Series provides a rich set of high-performance IPv4, IPv6, and Multiprotocol Label Switching (MPLS) capabilities as well as advanced Layer 2 switching capabilities. As a result, these routers address the diverse needs in environments that include service provider backbones, Metro Ethernet networks, transit/wholesale networks, Internet Service Providers (ISPs), Content Delivery Networks (CDNs), Internet Exchange Points (IXPs), data centers, federal agencies, and distributed enterprises.

BROCADE

PROVIDER EDGE AND AGGREGATION

As service providers move rapidly to migrate business and residential services to IP/Ethernet infrastructure, the role of edge and aggregation routers becomes very critical. The routers not only need to deliver the necessary features but must do so in a cost-effective manner. The Brocade MLX Series includes unique capabilities that enable service providers to meet this challenge.

Advanced MPLS capabilities such as Label Distribution Protocol (LDP) and MPLS-TE—along with fast failover mechanisms such as Fast ReRoute (FRR) and Standby LSPs—enable the creation of dynamic label switched paths to support business and triple-play services over a common Ethernet infrastructure.

Business VPN Services

With the Brocade MLX Series, service providers can offer distributed enterprise connectivity services through a transparent service such as Layer 2 Virtual Private Networks (VPNs) or provide more control through Layer 3 VPN services. The transparent services are delivered as point-to-point or point-to-multipoint services. To facilitate both options, the Brocade MLX Series supports Virtual Private LAN Services (VPLS) and Virtual Leased Line (VLL) implementations using widely accepted LDP signaling.

The routers also support Border Gateway Protocol (BGP)-based MPLS VPNs and provide per-customer routing instances with a choice of BGP, Open Shortest Path First (OSPF), Routing Information Protocol (RIP), or static routing options. In addition, each virtual forwarding interface supports inbound and outbound Access Control Lists (ACLs) and rate-limiting features for accounting and Service Level Agreement (SLA) enforcement.

Metro Ethernet Services

With rich MPLS capabilities, the Brocade MLX Series provides an ideal suite of Layer 2 Metro Ethernet technologies for metropolitan service providers. The routers enable advanced Layer 2 Metro Ethernet services based on IEEE 802.1Q, Rapid Spanning

Tree Protocol (RSTP), standards-based Metro Ring Protocol (MRP) G.8032, and Virtual Switch Redundancy Protocol (VSRP). The routers provide unique scalability for Layer 2 metro applications with a capacity of up to two million Media Access Control (MAC) addresses per system.

In addition, these Layer 2 and MPLS-based capabilities facilitate the creation of scalable, resilient services that comply with Metro Ethernet Forum (MEF) specifications for Ethernet Private Line (EPL), Ethernet Virtual Private Line (EVPL), and Ethernet LAN (E-LAN). These advanced Carrier Ethernet features, combined with state-of-the-art QoS and wire-speed multicast routing capabilities, make the Brocade MLX Series ideal for aggregating both triple-play and business services (see Figure 1).

Video Delivery

As more service providers include digital entertainment (using MPEG2/4-quality video) in their offerings, they require enormous amounts of bandwidth per subscriber and efficient multicast delivery. Providing up to 15.36 Tbps of capacity, the Brocade MLX Series is ideally suited for the high-bandwidth, low-latency requirements of video traffic. The routers provide the flexibility of choosing between traditional IP multicast and VPLS to deliver high-quality video.

Figure 1.

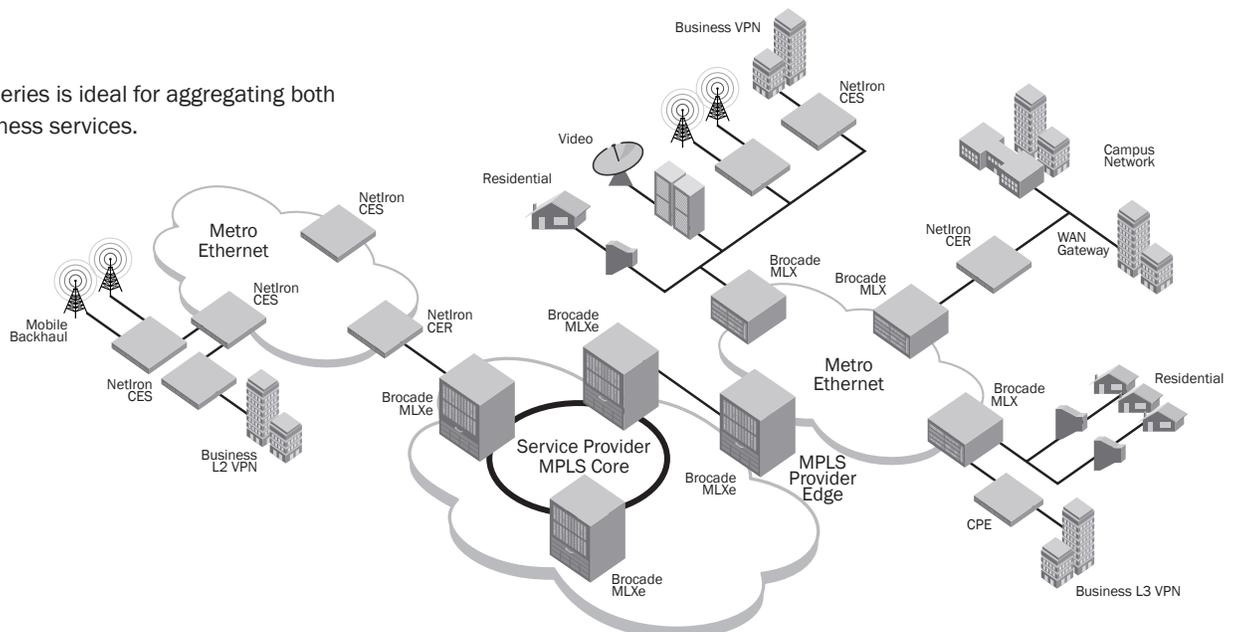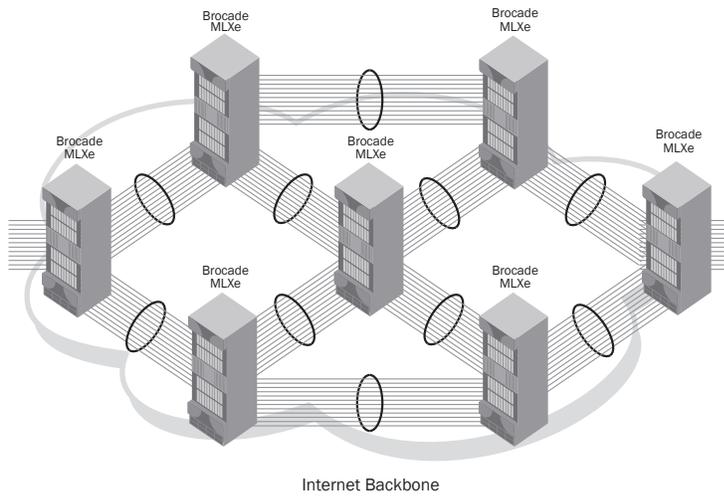The Brocade MLX Series is ideal for aggregating both triple-play and business services.

Figure 2.
The Brocade MLX Series provides the foundation for Internet backbone architectures with multiple carrier trunks.

Internet Backbone

The routers also provide comprehensive support for multicast routing and switching through a variety of protocols—including PIM-SM, PIM-DM, PIM-SSM, IGMP v2/v3—and other platform-independent capabilities. Egress interface-based replication optimizes performance and buffer usage to help maximize network performance for multicast traffic. In addition, the routers support static IGMP "Joins" and efficient processing of IGMP Join/Leave requests to help ensure a fast channel-zapping experience.

HIGH-CAPACITY INTERNET BACKBONES

The highly distributed hardware forwarding architecture of the Brocade MLX Series enables service providers to deploy robust, high-bandwidth IPv4 Internet cores. The routers support up to one million IPv4 routes in the hardware Forwarding Information Base (FIB) and up to 10 million BGP routes in the BGP Routing Information Base (RIB). These features, combined with graceful restart mechanisms, enable a highly scalable and reliable Internet core.

Robust BGP features, combined with the 2-port 100 Gigabit Ethernet (GbE) module on the Brocade MLX Series, provide a scalable solution for Internet backbones (see Figure 2).

Service providers that want to scale beyond 100 GbE can utilize the industry's only multi-terabit carrier trunks—a single logical connection formed by aggregating multiple 100 GbE ports. These carrier trunks incorporate an innovative load-sharing algorithm that efficiently utilizes all the links in the trunk while eliminating traffic polarization, such as in an Internet backbone.

Networks that need to scale to 40 GbE can rely on the Brocade MLX 4-port 40 GbE module, which delivers 128 ports of 40 GbE in a single chassis. This module supports up to 512,000 IPv4 or 128,000 IPv6 routes in the FIB, and supports full Layer 2/IPv4/IPv6 functionality with advanced features such as OpenFlow, MPLS, VPLS, QinQ, and H-QoS. The Brocade MLX 40 GbE module is ideal for the data center core, inter-data center border routing, and 100 GbE hand-off and 10 GbE fan-out applications within service provider and enterprise environments, such as education, healthcare, and government agencies.
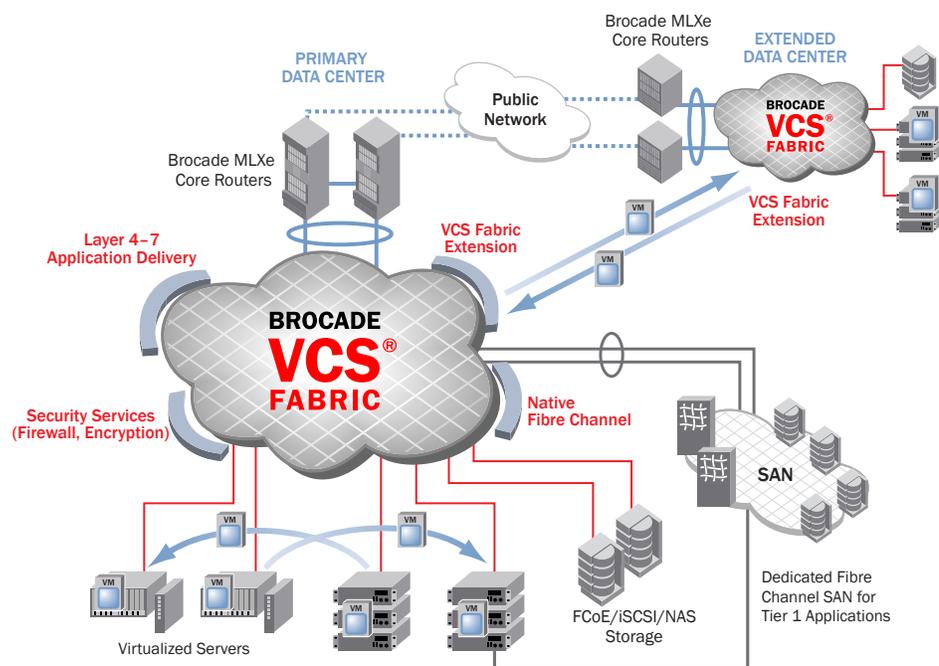

Figure 3.
The Brocade MLX Series connects geographically distributed data centers.

For deployments that require 10 GbE carrier trunks, the Brocade MLX Series also supports 640 Gbps carrier trunks with up to 64 10 GbE ports in a single Link Aggregation Group (LAG). In addition, the routers' intrinsic wire-speed sFlow capability provides scalable network-wide monitoring to detect malicious traffic and prevent intrusion. This capability also enables proactive management of network bandwidth through traffic trend analysis and capacity upgrade planning.

SERVICE PROVIDER DATA CENTERS

To expand their revenue potential, many network service providers now offer cloud-based services. The Brocade MLX Series provides a highly simplified and resilient solution that allows service providers to offer content and bandwidth-intensive services. The high-density 1 GbE, 10 GbE, and 40 GbE modules, combined with the Multi-Chassis Trunking (MCT) feature, support a highly reliable and efficient data center architecture. MCT enables providers to eliminate STP from the server-to-core layer, thereby maximizing network usage while achieving sub-second resiliency.

The advanced MPLS features at the data center core enable providers to connect geographically distributed data centers using standards-based technology such as VPLS. This approach greatly simplifies operations because the routers provide a common platform from the service provider network core to the data center core (see Figure 3).

INTERNET EXCHANGE POINTS

Internet Exchanges require high-performance Layer 2 topologies with high-density 10 GbE ports. These crossroads of the Internet connect high-performance routers from many service providers in peering relationships without requiring a full mesh of router connections. With its industry-leading wire-speed 10 GbE port density, the Brocade MLX Series is ideal for these environments. In addition, the routers enable the extension of MPLS into the Internet Exchange core, which provides superior load balancing and better multi-pathing using VPLS, and faster convergence with sub-50 ms failure protection.

SIMPLIFIED NETWORK MANAGEMENT

Today's exponential growth in video, voice, data, and mobile broadband traffic has significantly increased network complexity for Layer 2 metro networks with MPLS-based infrastructure. Administrators from regional service providers to large Telcos are seeking ways to simplify management, reduce operational costs, prevent bandwidth over-provisioning, and improve user service provisioning.

Brocade Network Advisor provides an easy-to-use solution for discovering, deploying, configuring, and managing Metro and Carrier Ethernet networks. It provides comprehensive management of MPLS services through the MPLS Manager, supporting MPLS-based VPLS, Label Switched Path (LSP), Local VPLS, MPLS VLL, and Local VLL services with an intuitive interface.

BROCADE GLOBAL SERVICES

Brocade Global Services has the expertise to help organizations build scalable, efficient cloud infrastructures. Leveraging 15 years of expertise in storage, networking, and virtualization, Brocade Global Services delivers world-class professional services, technical support, and education services, enabling organizations to maximize their Brocade investments, accelerate new technology deployments, and optimize the performance of networking infrastructures.

ABOUT BROCADE

Brocade is the pure-play networking company that innovates to make high-performance networks easier to deploy, manage, and scale in the most demanding environments. Through industry-leading technology, unmatched expertise, and strategic partnerships, Brocade delivers resilient networks that increase agility and efficiency while helping organizations stay ahead of change. Learn more at www.brocade.com.

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