



## **HIGH- PERFORMANCE NETWORKS**

# **Introducing the Brocade MLXe: Brocade's High-Density 100 Gigabit Ethernet IP/MPLS Router**

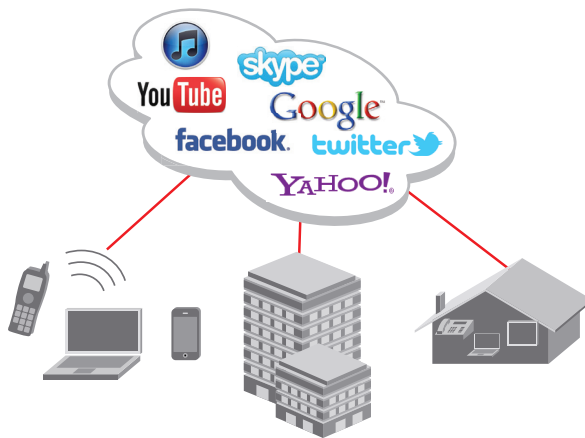
The Brocade MLXe multiservice IP/MPLS routers, part of the Brocade One network architecture, reflect the Brocade imperative of unmatched simplicity, optimized applications, non-stop networking, and investment protection in delivering customer solutions.

# **BROCADE**

**Massive scalability and astounding 10 Gigabit and 100 Gigabit Ethernet (GbE) price points and density deliver significant economic advantages to customers. The breakthrough performance and capacity of the Brocade® MLXe enable next-generation service provider networks and virtualized data centers to support increasing application traffic and deliver services using less infrastructure, vastly improving operational efficiency and lowering costs. The Brocade MLXe delivers new 4-, 8-, 16-, and 32-slot chassis models, double the chassis backplane capacity, new higher performance switch fabric modules, higher density 10 GbE modules, 100 GbE modules, and energy efficient rear airflow for all chassis models.**

#### **INTRODUCTION**

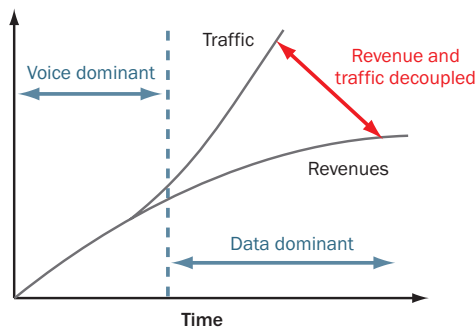
Service provider bandwidth requirements are driven by increased broadband access through wired and wireless infrastructure to always-on devices. The “killer app” is not a single application: it is ubiquitous high bandwidth that delivers on-demand personalized content at any time and anywhere. Businesses and consumers want cheap, always-on, high-speed access for the applications of their choice on any device—at work, on the go, and at home. Service providers must scale their networks to meet this rising commodity traffic demand—more users, mobile video, HD images—and compete for services while maximizing the revenue-cost gap. High-density 10 and 100 Gigabit Ethernet are the industry innovations that service providers are eagerly awaiting to meet traffic demand.



**Figure 1.**

Ubiquitous broadband delivers on-demand personalized content anytime and anywhere.

While traffic over service provider networks is growing at a rate of 40 to 60 percent annually, revenue per bit is dropping and competitive price pressures are driving rock-bottom bandwidth prices. Lowering the cost per bit by decreasing CapEx and OpEx, while increasing capacity and service offerings to customers, directly equates to profitability.



**Figure 2.**

Emerging 3G/4G service offerings require significantly more bandwidth at a much lower cost per bit. (Source: Infonetics Research, 2009).

## THE NEED FOR COST-EFFECTIVE TERABIT-SCALE NETWORKS

Due to the heavy pressure to optimize CapEx and OpEx, combined with massive traffic growth and falling prices, it is no longer practical to carry commodity IP traffic over networks built with low-density, expensive routers optimized for legacy SONET/SDH interfaces. Service providers need a high-capacity, scalable core Ethernet-optimized router with robust Layer 2, IPv4, IPv6, MPLS, and VPN features to offer services and massive bandwidth capacity.

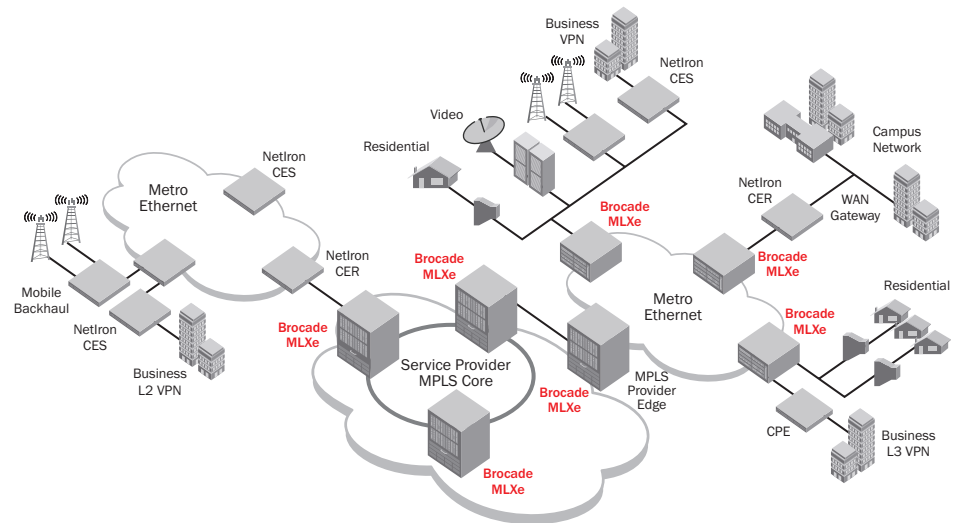
In addition to port density, resiliency and scalability technologies such as terabit-scale Link Aggregation (LAG), Multi-Chassis Trunking (MCT), and Equal-Cost Multi-Path (ECMP) routing are key features needed to expand network capacity to keep ahead of customer bandwidth requirements. The Brocade MLXe chassis delivers full, standards-based routing capabilities and supports all existing Brocade MLX and XMR modules, providing extraordinary investment protection. With 10 Gigabit and 100 Gigabit Ethernet port densities up to four times greater than competitive products, the Brocade MLXe delivers compelling economics with less complexity at a lower cost through innovative technology and capacity licensing features.

Designed from the ground up as a resilient high-performance, Ethernet-optimized router, the Brocade MLXe doubles the density and combines Brocade MLX and XMR capacities into a single next-generation chassis, which can be deployed once and upgraded via hardware or software licenses as network requirements change. Capacity licensing is a key new feature that helps service providers manage capital costs. Instead of paying for port capacity or features that will remain unused, the Brocade MLXe allows you to license and upgrade from edge routing to Internet-scale hardware routing table capacity without deploying new line modules. On the 100 Gigabit Ethernet module, ports can be licensed individually and enabled to closely match CapEx with network capacity needs and to ensure that a service provider has the option to pay only for active ports in the network.

## BROCADE SOLUTIONS FOR TERABIT-SCALE NETWORKS

The Brocade One™ network architecture includes a suite of high-capacity and service-rich features that enable service providers to deploy the Brocade NetIron® and MLX® product families in metro and backbone networks. At the core of the network the Brocade MLXe provides high-density 10 Gigabit and 100 Gigabit Ethernet port density and terabit-scale resilient carrier trunks using LAG with up to 64 ports in a group. Each technology is available in flexible form factors and port densities to offer customers several technology choices that will meet their cost and network design requirements. These solutions can be deployed and scaled up as bandwidth requirements change.

**Figure 3.**  
Brocade One network  
architecture for  
service providers.

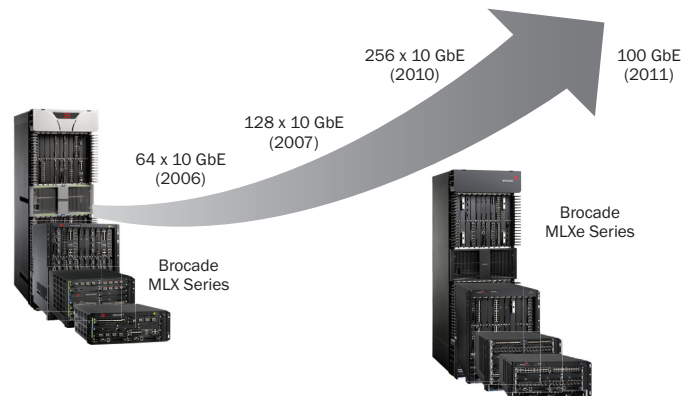


## Introducing Brocade MLXe Core Routers

The Brocade MLX Series of high-performance routers, which includes existing Brocade MLX Routers and new Brocade MLXe Core Routers, is designed to meet the Brocade One requirements for service providers. Brocade MLXe routers provide several enhancements to the product family, including rear exhaust for all chassis, timing capabilities for future applications, and a backplane that delivers higher slot capacity. They also support existing Brocade NetIron XMR management and line modules, providing additional scaling capabilities.

Built with a state-of-the-art, sixth-generation, network processor-based architecture and terabit-scale switch fabrics, the Brocade MLXe 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 of 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, and distributed enterprises.

**Figure 4.**  
The evolution of the  
Brocade MLX Series  
offers flexibility and CapEx  
investment protection.



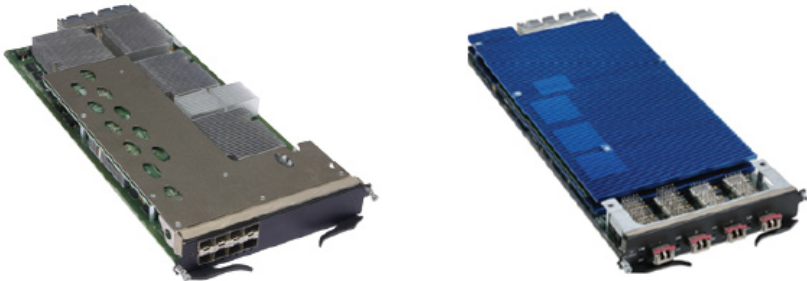
Brocade MLXe routers extend the lifetime of existing Brocade MLX and XMR capital investments by doubling the switching capacity of the chassis, while maintaining backward compatibility with previous-generation line modules. In 2006 the Brocade MLX supported a maximum of 64 x 10 GbE ports, doubled the 10 GbE density to 128 ports in 2007, and now scales up to 256 x 10 GbE ports or 32 x 100 GbE ports in a single chassis. Customers can deploy a new Brocade MLXe chassis with a mixture of existing and new line modules as their networks grow to maximize their Return On Investment (ROI) on CapEx with the flexibility to configure the Brocade MLXe to make use of existing line modules.

The Brocade MLXe is highly optimized for IP/MPLS Ethernet deployments, providing symmetric scaling with chassis options that include 4-, 8-, 16-, and 32-slot systems. These routers offer industry-leading, wire-speed port capacity without compromising the performance of advanced capabilities such as IPv6, MPLS, and MPLS Virtual Private Networks (VPNs). For example, the Brocade MLXe-32 delivers data-forwarding performance in excess of 6 Terabits per second (Tbps) today and scales to 15.36 Tbps, enough capacity to future-proof networks for years to come.

The Brocade MLXe supports a wide range of leading-edge Ethernet modules and traditional SONET/SDH modules. The flexible half-slot 10/100 Mbps, 10 Gbps, and full-slot 100 GbE modules enable organizations to use a single platform for both low-speed and high-speed applications.

### High-Density 10 Gigabit Ethernet

A variety of 10 GbE modules are offered to give customers a choice in cost and feature scalability. For example, 10 GbE modules for the Brocade MLX Series are available in 8-port and 4-port models, as shown on the left and right respectively in Figure 5.



**Figure 5.**  
8-port 10 GbE module  
(left) and 4-port 10 GbE  
module (right).

The half-slot 8-port 10 GbE module provides the highest 10 GbE port density in a single router. It is available in two versions: the 8x10 GbE-M and the 8x10 GbE-D. Both support wire-speed performance on all ports simultaneously, irrespective of the service deployed. The 8x10 GbE module supports hot-swappable SFP+ optical transmitters with software-configurable LAN PHY and WAN PHY modes.

The 8x10 GbE-D module supports Layer 2/IPv4/IPv6 functionality with hardware table capacity optimized for edge routing applications and 10 GbE server aggregation. It is ideal for network providers and data centers that need a Layer 2/3 architecture with Layer 2 and IP services.

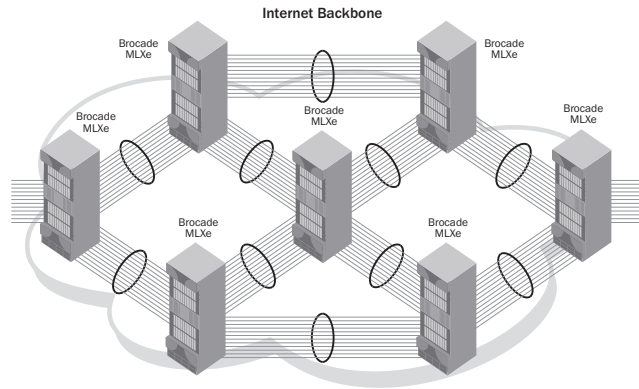
The 8x10 GbE-M module supports full Layer 2/IPv4/IPv6 functionality with advanced features such as MPLS, VPLS, and QinQ. It is designed for metro aggregation and transit networks that require advanced Layer 2, IP, and MPLS services as well as greater scalability.

This half-slot module supports Layer 2/IPv4/IPv6 and advanced MPLS features, enabling network planners to follow a pay-as-you-grow model. The 4x10 GbE module supports hot-swappable XFP optical transmitters with software-configurable LAN PHY and WAN PHY modes for applications that require greater distances or integration with DWDM systems.

## Carrier Trunks and Multi-Chassis Trunking

Carrier trunks is a highly scalable feature that provides customers the ability to build terabit-scale links using standard LAG. Up to 64 x 10 GbE, or 16 x 100 GbE ports can be aggregated into a single link, providing ultra-high capacity and link redundancy. Carrier trunk LAGs can be combined with IP ECMP and MPLS LSP load balancing to further increase scalability at higher network layers.

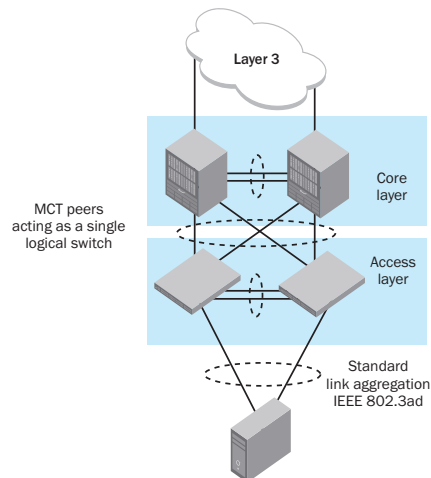
**Figure 6.**  
Carrier trunks  
and MCT.



Load-balancing algorithm efficiency is critical to ensure that all types of traffic are uniformly distributed among LAG members. The Brocade MLXe supports several flexible algorithms in hardware for advanced hashing and load balancing that have been successfully deployed in production 10 Gigabit Ethernet networks, and are now extended to 100 Gigabit Ethernet to achieve the same distribution efficiency at wire speed. Advanced, patent-pending algorithms that hash into 64 KB buckets based on outer and inner packet headers ensure that Layer 2, IPv4, IPv6, MPLS, and MPLS L2/L3 VPN traffic is evenly distributed regardless of the packet type.

For greater redundancy, carrier trunks can be combined with the Brocade Multi-Chassis Trunking (MCT) feature suite, shown in Figure 7. An enhancement to standard LAG, Brocade MCT is run between two Brocade routers to enable them to act as a single logical chassis. In addition to the link and module redundancy of standard LAG, this configuration provides chassis redundancy, with sub-second link failover between chassis. Devices connected to the logical chassis use standard LAG and are unaware of the logical chassis topology.

**Figure 7.**  
Multi-Chassis  
Trunking (MCT).





### Introducing the Industry's First High Density 100 GbE Module

The Brocade 2-port 100 GbE module is the first high-density 100 GbE module in a routing platform that uses true 100 Gbps packet processing technology. Using an advanced sixth-generation, network processor-based architecture, each 100 GbE port is powered by 100 Gbps input and output packet processing ASICs, a 100 Gbps traffic manager ASIC, and 200 Gbps of data slot capacity into the router's Clos switching fabric. The use of 100 Gbps processors and a 100 Gbps data path through the router enable each port to run at full 100 Gbps wire speed without compromising performance.



**Figure 8.**  
2-port 100 GbE module.

The 2-port 100 GbE module provides unmatched performance and scalability with 32 wire-speed 100 GbE ports in a single Brocade MLXe-32 router and 16 wire-speed 100 GbE ports in a single Brocade MLX-32 router. This full-slot module supports CFP-based short-reach and long-reach optics. Each 100 GbE module delivers 400 Gbps of data throughput per module which enables line-rate performance of features such as Layer 2, IPv4, IPv6, and MPLS.

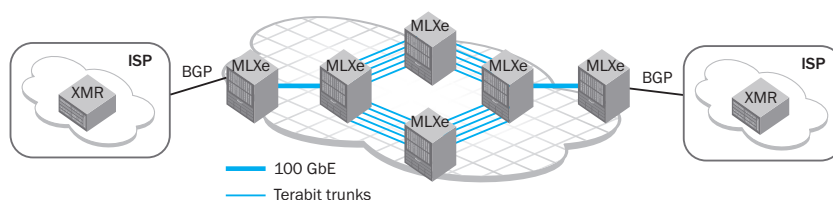
Service providers that want to scale beyond 100 GbE can utilize the industry's only terabit trunks to achieve superior scalability and performance for Internet backbones. Terabit trunks are logical connections formed by aggregating multiple 100 GbE links. The Brocade MLX Series can aggregate up to 16 100 GbE links in a link aggregation group. Using an innovative hashing algorithm, the Brocade MLX Series can support up to 1.6 Tbps of capacity in a single trunk. For network planners following a pay-as-you-grow strategy, the 2-port 100 GbE module supports an innovative ports-on-demand feature, which seamlessly enables the second port via a software license as bandwidth needs increase, without disrupting the network.

### 100 GbE IN THE SERVICE PROVIDER CORE

The core of a service provider's network experiences peak traffic levels every single day, and this is where the demand for 100 GbE links is the greatest. Currently, most service providers use 10 GbE LAGs to combat the heavy load of traffic, but there are some serious limitations to this method. In the service provider network core, traffic flows are very heavy, and LAGs are ineffective when the traffic flow is large relative to individual constituent links. Also when there is little to no variability in the traffic flow, 100 GbE significantly outperforms LAGs. Not only is 100 GbE a better performance option in the core, but it also offers considerable economic benefits compared to 10 GbE LAG solutions.

By deploying a Brocade MLXe with 100 GbE wire-speed performance, service providers can scale to a massive capacity of up to 1.6 Tbps, which will provide unmatched scalability for many years to come. In Figure 9, the Brocade MLXe is interconnected in the core utilizing the industry's first terabit trunks. Between the core and the core-edge the Brocade MLXe and MLX are connected through one single managed connection, significantly reducing the complexity of the network.

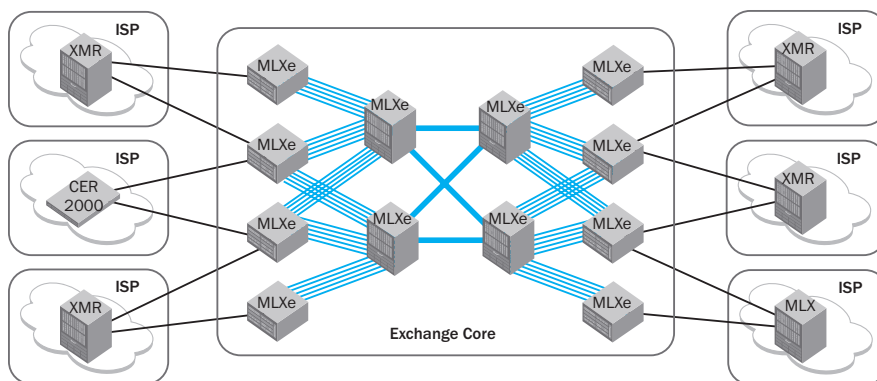
**Figure 9.**  
Brocade MLXe  
deployed in the service  
provider network core.



### 100 GbE FOR INTERNET EXCHANGE POINTS

IXPs experience extraordinary volumes of traffic, which makes the low latency and wire-speed performance of Brocade 100 GbE solutions ideal for them. Brocade service provider solutions are proven by powering the largest IXPs in the world. With the introduction of the Brocade MLXe and 100 GbE density, Brocade continues to provide optimal solutions for IXPs, along with value-added services such as IPv6 and MPLS VPNs. Figure 10 illustrates a typical Internet Exchange Point and how it utilizes 10 GbE and 100 GbE LAGs to meet network demands.

**Figure 10.**  
Representative IXP with  
10 and 100 GbE LAGs.



Mobile devices, cloud computing, point-to-point video, and other advanced services are contributing to the explosive bandwidth requirements across the entire network. The evolution toward 100 GbE is just beginning, and as it continues more and more applications will require 100 GbE. In order to provide cloud services, service providers will need the scalability that 100 GbE offers to interconnect data centers. Beyond the network core, service providers will also deploy it closer to the network edge. Brocade offers the most scalable 100 GbE solution to simplify operations at a fraction of the cost of competitive offerings.



## SUMMARY

The Brocade MLXe is the industry's most advanced service delivery platform to offer Layer 2, IPv4, IPv6, MPLS, and VPN services so that service providers can address rapid broadband growth, cloud shared services, anytime and anywhere access, and IP service convergence.. Its robust, scalable architecture coupled with a rich feature set in multiservice Brocade IronWare® software makes it the leading router in its class. An industry-leading density of GbE, 10 GbE and 100 GbE ports in a flexible chassis form factor makes it an excellent investment for service providers planning to build a converged, multiservice network that scales to terabit capacities to handle future growth. With over 9000 deployments around the globe including large IP transit backbones, content delivery networks, Internet exchange points, and mission-critical data centers, the advanced routing capabilities of the Brocade MLX Series are well proven and are now extended with the Brocade MLXe router series. The breakthrough performance and capacity of the Brocade MLXe enables service providers to support the rising application traffic demand so that they can deliver services using less infrastructure while vastly improving operational efficiency and lowering costs.

For a technology overview, see a White Paper entitled, *40 Gigabit and 100 Gigabit Ethernet Are Here!* on [www.brocade.com](http://www.brocade.com). For more about the Brocade MLXe, see the Data Sheet for the Brocade MLX Series on [www.brocade.com](http://www.brocade.com).

## ABOUT BROCADE

Brocade networking solutions help the world's leading organizations transition smoothly to a virtualized world where applications and information reside anywhere. This approach is based on the Brocade One™ unified network strategy, which enables a wide range of consolidation, convergence, virtualization, and cloud computing initiatives.

Offering an industry-leading family of Ethernet, storage, and converged networking solutions, Brocade helps organizations achieve their most critical business objectives through unmatched simplicity, non-stop networking, application optimization, and investment protection. To ensure a complete solution, Brocade partners with world-class IT companies and provides a full range of education, support, and professional services offerings. Learn more at [www.brocade.com](http://www.brocade.com).

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