Marconi

Breakthrough in broadband networking

The world's most scalable, multiservice switch router

Operators have been searching for a single networking solution that can simultaneously support new differentiated IP services and existing revenue-generating services. The BXR™48000, Marconi's next-generation multiservice switch router, provides this solution.

The BXR48000 is the industry's most flexible, scalable, and reliable multiservice switch router. The payload and protocol-agnostic BXR48000 enables operators to provide a range of multiservice applications — from best-effort IP to high-priority, real-time video and data — over a variety of network architectures. As such, the service mix and technology strategies can be tailored to meet operators' needs.

With the BXR48000, operators can redefine service differentiation for new predictable IP services, as well as simultaneously support existing multiservice offerings on one versatile platform. In addition, operators can gain a competitive edge by building networks that scale in terms of users, capacity, and services while supporting greater than 99.999 percent availability.

Unique in the industry, the BXR48000 is equally optimized for all traffic types; it can be configured for any mix of legacy or next-generation packet network support, either in an integrated fashion (supporting multiple physical networks) or via logical convergence of legacy services to a packet infrastructure. Ultimately, the BXR48000 removes "time" from the list of critical factors of any network migration scenario.

Key benefits

- **New revenue generation** – Service transparent platform meets the service profile requirements of all Layer 2 and Layer 3 multiservice offerings. As a result, operators can generate revenue by offering service guarantees for premium services — such as high-margin, predictable voice, video, and data services — based on service level agreements (SLAs).
- **Existing revenue protection** – Current cash-cow services can be protected in order to maintain existing quality levels that legacy service customers expect.
- **Cost savings** – The BXR48000 offers the edge and core capabilities required to support simultaneous Layer 2 and Layer 3 multiservice offerings on a common infrastructure. The architecture and its associated multiservice software scale in terms of services, capacity, and performance, providing a very attractive "total cost of ownership" model.
- **Investment protection** – Operators can select from several available architecture options for their multiservice networks and be confident that the solution will be flexible enough to meet any chosen pace of technology evolution while meeting the requirements of their service profiles.

The BXR48000 is a carrier-class, multiservice switch router that scales to 480 Gbps of full-duplex capacity. This deterministically non-blocking platform offers concurrent support of connectionless IP routing, Multiprotocol Label Switching (MPLS), and Asynchronous Transfer Mode (ATM) switching.

Overview

The BXR48000 is a next-generation, payload and protocol-agnostic multiservice switch router. This scalable and reliable platform enables operators to build a single multiservice network that maximizes revenue while reducing network costs.

The BXR48000 can be deployed to play several key roles in operator networks, three of which are outlined as follows and illustrated in Figure 1.

1. As a **high-speed, multiservice edge switch router**, the BXR48000 is an integrated transport element that enables the physical convergence or integration of existing networks onto a multiservice packet core, either immediately or at some point in the future. Service migration can be accomplished via software commands on a single technology-agnostic platform, which significantly reduces the cost, complexity, and risk of changing technology and services. The BXR48000 supports the ability to provide IP-based services such as Layer 3 virtual private networks (VPNs) via RFC 2547 Provider Edge (PE) routing.

2. When deployed as a **multiservice core router**, the BXR48000 enables IP network growth with the added capability to provide service guarantees for predictable, real-time services over an IP infrastructure.

3. The BXR48000 also can serve as a **multiservice core switch**, providing the capacity to grow service provider and enterprise networks through the support of Layer 2 services such as ATM, Frame Relay, Ethernet Transparent LAN Services (TLS), LAN Emulation (LANE), voice, and real-time video. In addition, the BXR48000 supports the ability to IP-enable — e.g., provide Layer 3 VPNs via RFC 2547 PE routing — existing Layer 2 services such as ATM, Ethernet, and Frame Relay.

Purpose-built for multiservice packet and cell service offerings

The BXR48000 is purpose-built to perform the functions of IP routers, MPLS switch routers, and ATM switches by natively aggregating, routing, and switching traffic from multiservice access and edge devices. As a result, operators can deploy a predictable infrastructure to enhance their best effort service offerings and increase revenue. Operators can also deploy a scalable infrastructure that provides new, predictable IP services and allows for evolution to a multiservice packet core. The BXR48000 provides operators with investment protection by offering a versatile, scalable, and reliable platform that allows them to build networks using a variety of architecture options. In contrast, competing solutions support only one general architecture option. These competing solutions require operators to take a revolutionary "forklift" approach to migrating services, jeopardizing existing revenues and profits.
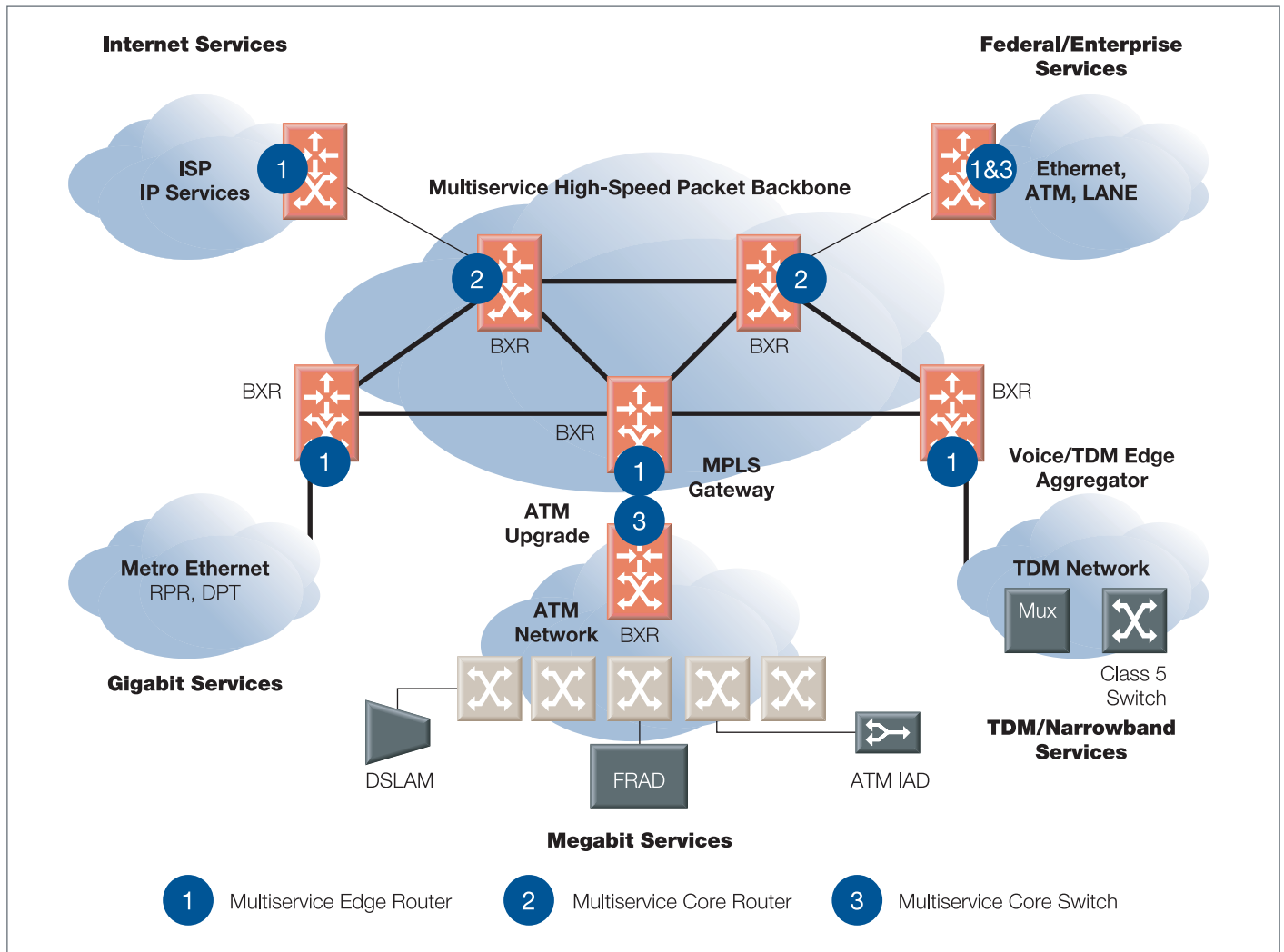
Figure 1 – BXR48000 multiservice packet applications

Enabling leading IP services

Many operators currently deploy onnectionless IP and IP/MPLS networks that support strictly best-effort services. These operators are facing several issues, including the following:

- Expansion of networks to meet the growing demand for IP services
- The reality that commoditization of IP services does not make the continued investment in best-effort IP architectures a cost-effective practice
- The need to support differentiated, predictable services — which are typically offered over ATM, Frame Relay, and Time Division Multiplexing (TDM) networks — with increased reliability to support continued investment in the packet infrastructure

Operators are looking for solutions that will enable them to address these issues via a multi-service packet infrastructure.

Building a next-generation IP-based multiservice network requires much more than just capacity, "speeds and feeds," and high-speed routing. Operators need a platform that will allow them to grow their backbones to support the explosion in bandwidth requirements while maintaining the intelligence required to manage best-effort and predictable traffic. As such, the infrastructure must meet the service profiles and reliability requirements of the services offered.

The more predictable and reliable the network, the greater the possibility for increasing revenue via differentiated service offerings. Operators can realize increased revenue streams if they are able to offer services over a predictable network that protects high-priority customer traffic in periods of heavy congestion, while reducing network expenses by optimizing their network resources. In addition to realizing revenue growth by offering service guarantees over a reliable network, operators can gain the benefit of customer confidence and goodwill.

Due to the explosive growth of IP services and the constrained state of the economy, operators also require devices with exceptional traffic management and traffic engineering functionality to efficiently utilize the resources deployed in their networks. These devices also must possess the "intelligence" of congestion aware and constraint-based routing in order to reroute connections around congestion points and optimize utilization across service provider networks. The ability to preserve the SLAs and revenue generated by new predictable IP services is a top priority.

Versatility for IP + multiservice offerings

To ensure low costs and high profits, operators require a network infrastructure that allows them to offer new differentiated services, preserve existing service offerings, and future proof the network against changing network architectures, technologies, and — most important — deployed platforms. The BXR48000 architecture supports Packet over SONET/SDH (POS), ATM and 1/10 Gigabit Ethernet interfaces and services. This platform is optimized for IP, MPLS, and ATM control planes and the services that each of these control planes supports.

The BXR48000's patented architecture is designed to switch and route variable-length traffic independently of its native format, while avoiding unnecessary segmentation and reassembly (SAR). IP packets, Ethernet packets and ATM cells are simultaneously sent through the fabrics in their native format to minimize latency and ensure maximum performance.

Configured as an IP/MPLS switch router, the BXR supports a wide range of IP protocols for best-effort service offerings, including the following:

- IPv4 and IPv6
- Border Gateway Protocol version 4 (BGP-4)
- Intermediate System–to–Intermediate System (IS-IS)
- Open Shortest Path First (OSPF)
- Protocol Independent Multicast, sparse mode (PIM-SM)
- PIM, dense mode (PIM-DM)
- Multicast BGP (MBGP)

The BXR48000 can function as an MPLS label edge router (LER) and originate and terminate label switched paths (LSPs); switch MPLS-labeled packets by acting as an MPLS label switch router (LSR); perform hop-by-hop routing between IP interfaces, virtual LANs (VLANs), and emulated LANs (ELANs); and originate and terminate RFC 1483 virtual circuits (VCs). In addition, the BXR48000 supports DiffServ-aware traffic engineering and MPLS signaling protocols — including Resource Reservation Protocol with traffic engineering (RSVP-TE) and Label Distribution Protocol (LDP) — to enable differentiated and scalable IP service offerings. It's also possible to configure the BXR48000 as a feature-rich ATM switch to support existing voice, video, and data multiservice offerings in a standards based fashion via User–Network Interface (UNI) 3.x/4.0, Hierarchical Private Network–Network Interface (H-PNNI), and ATM Inter-Network Interface (AINI).

However, the true differentiator of the BXR48000 is its uncompromising ability to support all of these services and control planes simultaneously on a single, integrated platform. The BXR48000 enables the interworking of multiservice networks (i.e., ATM, Ethernet, and Frame Relay) to a multiservice packet core using various modes, including the following:

- **Multiservice internetworking gateway** – This mode provides interworking and edge functionality such as ATM-to-MPLS interworking; Pseudo Wire Emulation Edge to Edge (PWE3) transport of ATM and Ethernet; ATM VPNs; and MPLS VPNs via RFC 2547bis, including Provider (P) and PE router functionality.
- **Integrated switch router** – This mode supports a logical and/or physical partition of resources — i.e., IP/MPLS and ATM control planes are dynamically supported on a per-port basis and/or IP/MPLS and ATM control planes are dynamically supported on a per-node basis.

With these capabilities, operators can reduce costs and increase revenues by building a single network to support all service offerings. Only the BXR48000 provides this level of versatility for new IP services and existing multiservice offerings over one efficient, scalable, high-performance platform.

Predictability for IP, MPLS, and ATM

Successful operators realize and grow revenues by creating product and service portfolios differentiated from their competitors' offerings. Predictability and service guarantees are key opportunities for differentiation.

Traditional IP services offer best-effort performance, providing little opportunity for service differentiation. By using MPLS and/or ATM, operators can offer differentiated, predictable IP services to generate additional revenue streams.

Service guarantees can be offered to customers if the infrastructure deployed to support these services provides the required predictability. Marconi products have earned the reputation as the industry's premier traffic management platforms by serving as key components in the cores of some of the world's largest Internet service provider (ISP) and interexchange carrier (IXC) networks.

Over the years Marconi has developed many connection-oriented traffic management and traffic engineering features for constraint-based signaling and routing protocols. Traffic management and traffic engineering features such as per–Quality of Service (QoS) class, per-VC, and per-LSP policing, queuing, and scheduling provide the greatest granularity of fairness to ensure that no one user can abuse a service provider's network. Additional features such as static and dynamic buffer/ queue management (e.g., cell loss priority [CLP] 0/1 and weighted random early discard [WRED]), load balancing, connection priorities, and protected QoS classes (guaranteed classes and best effort) ensure that service provider networks will support service growth and provide necessary service differentiation and guarantees to their customers.

These features also enable operators to intelligently build and manage IP/MPLS networks that support predictable IP services — such as voice over IP (VoIP), 3G mobile, premium IP VPNs, and business-to-business e-commerce — that scale without sacrificing performance.

The leading capabilities of the BXR48000 deliver predictability in service provider networks. The BXR48000 architecture provides deterministically non-blocking switching and routing. This architecture is ideal for optimizing throughput and multicast performance for all traffic and connection types. Operators can now build backbone networks that give their customers full throughput in all traffic scenarios, not just the "most typical" traffic scenarios. With the BXR48000 and Marconi's expertise in connection-oriented traffic management and traffic engineering for constraint-based signaling and routing protocols, operators have the freedom to redefine service differentiation with predictable IP-, MPLS-, and ATM-based service offerings.

Scalability without compromising performance
Operators require networks that scale in capacity, users, performance, and new services to provide the ability to grow revenues. A scalable network protects service provider investments by reducing the churn of network equipment caused by platforms with limited scalability, thereby providing a very attractive "total cost of ownership" model.

The BXR48000 redefines scalability. The fact that the BXR48000 achieves this massive scalability while continuing Marconi's tradition of delivering the highest-performance routing and switching products makes it unique in the industry.

Because of its deterministically non-blocking architecture, the BXR48000 is able to support an aggregate port capacity equal to its switching capacity (480 Gbps full duplex, fully configured). Amazingly, the BXR48000's 480 Gbps configuration is completely contained within two 23-in. x 7-ft racks (up to 240 Gbps in one chassis; up to 480 Gbps in two chassis). Less stringent methods can inflate capacity claims by double counting bandwidth, measuring internal capacities rather than actual usable capacity, or aggregating the total bandwidth of clustered chassis using a "rodeo" technique.

The BXR48000 boasts impressive port capacity, supporting up to 768 OC-3c/STM-1, 768 OC-12c/STM-4, 192 OC-48c/STM-16, 48 OC-192c/STM-64, 480 Gigabit Ethernet, or forty-eight 10 Gigabit Ethernet interfaces. Each of these ports supports full line-rate performance at all interface rates.

The BXR48000 also scales in terms of performance. Many fabric architectures are being implemented to emulate the performance of shared memory devices. While these architectures may theoretically scale in capacity, they may not scale in performance for multicast or even unicast services during periods of congestion.

The BXR48000 supports up to 12M connections of any type. In addition, the high performance system control processors and optimized system control architecture continue Marconi's tradition of leading signaling performance. The BXR48000 supports up to 10K connections per second (setups and teardowns). This performance is critical for supporting dynamic, on-demand, connection oriented services such as VoIP, voice over ATM (VoATM), 3G mobile, and video. The BXR48000 also supports extremely rapid reroute capabilities in the event of link failures. With this scalability and resiliency, operators can confidently grow their networks via dynamic and resilient connection capabilities — without sacrificing performance.

Closely related to the scalability of a network is the ability of the network to scale while efficiently utilizing its resources. Best-effort routed networks typically support QoS by providing significantly more bandwidth than is generally required for their services. As bandwidth needs grow, operators must augment the bandwidth in order to prevent service degradation.

In addition, an over-provisioned network is typically engineered for the "current state of affairs" with regard to services offered. Once a new service is proposed or offered, the entire network has to be re-engineered, first through modeling as a best guess at determining new congestion points, then through measurement after the service is turned on. In terms of operating costs, it is far more efficient to intelligently manage the bandwidth, especially in this new era of common, multiservice infrastructures that are expected to be enablers for new predictable and customized value-added services.

The traffic engineering capabilities provided by the BXR48000 for both MPLS and ATM infrastructures enable operators to efficiently grow multiservice networks in times of reduced capital spending. While a best-effort routed network has a significant amount of bandwidth available, the resources are not efficiently used. A traffic-engineered network, however, will allow the operator to utilize all the installed bandwidth while meeting service guarantees. Marconi and the BXR48000 provide industry leading traffic engineering capabilities to allow for efficient, predictable scalability.

Reliability for carrier-class networks
Operators depend on reliable network components to deliver uninterrupted service to their customers. The BXR48000 is engineered from the ground up to be carrier-class, exceeding 99.999 percent availability and complying with Network Equipment Building Systems (NEBS) Level 3 standards. The BXR48000 has no single point of failure, and all hardware components are hot swappable. Each hardware component — including power modules, fan trays, timing modules, system control processors, and port cards — is individually and optionally protected.

Fabric errors and failures are protected via a robust, unique, and patented zero-packet-loss fabric protection scheme. This is far superior to alternative protection schemes, which can take up to 50 msec to recover from a failure (more than 3M packets, assuming 20 Gbps fabrics).

On the BXR48000, port and port card failures are detected automatically via Synchronous Optical Network (SONET) automatic protection switching (APS)/Synchronous Digital Hierarchy (SDH) multiplex section protection (MSP) and/or intelligent internal diagnostics.

The BXR48000 offers several software features that build on its carrier-class reliability. Call/connection preservation maintains all ATM and MPLS connection types and traffic flow across all connections during software upgrades, component failures, and maintenance operations. As such, operators realize the benefits of non-stop routing and switching and a hitless upgrade path.

In addition, Marconi continues its tradition of supporting superior, user-programmable, prioritized connection rerouting for MPLS and ATM connections in the event of a link failure, as well as connection pacing to allow for more stable and efficient connection recovery. With the BXR48000 providing a reliable platform for carrier-class networks, operators can gain a competitive edge by providing service level guarantees to customers.

The switch router for next-generation networks

The BXR48000 is a best-in-class multiservice switch router that enables operators to best address the needs of their businesses, providing an infrastructure that increases revenue potential while reducing CapEx and OpEx. With the versatility offered by the BXR48000, operators can build IP/MPLS networks that support connectionless IP services and the revenue generating multiservice capabilities of today, as well as the predictable IP services that will provide the revenue growth of the future.

Marconi's multiservice switch routers are traditionally recognized as industry leaders with respect to functionality and performance, not only by Marconi's customers, but also by independent experts. The BXR48000 carries on the tradition of Marconi's industry-leading performance and extends these award-winning capabilities to the industry's most versatile, scalable, and reliable multiservice packet switch router.

Key features

- Payload and protocol-agnostic routing and switching architecture that supports IP/MPLS, ATM, Ethernet, Frame Relay, and TDM technologies
- Simultaneous ATM switching, IP routing, and MPLS switching and routing
- Edge and core routing and switching — i.e., MPLS LER/LSR, RFC 2547bis P/PE, UNI/Network–Network Interface (NNI), etc. — capabilities
- High-speed access, edge, and core functionality for Layer 2 and Layer 3 services such as ATM, MPLS, and IP VPN functionality
- Two modes of interworking: multiservice inter-networking gateway and integrated switch router
- Extensive traffic engineering/traffic management functionality for transparent routing and switching of IP, MPLS, and ATM-based services to support service level agreements
- Physical, ATM, MPLS, and IP layer protection mechanisms

Data summary

System architecture	• 40 to 480 Gbps, full duplex, deterministically non-blocking capacity • Payload and Protocol Agnostic architecture • High-performance system control processors and distributed module control processors • Up to 12M connections of any type • Up to 10K connection setups/teardowns per second, per system for on-demand service and fast connection reroute
Interfaces	• Up to 768 OC-3c/STM-1 POS, IP-Aware (IPA) ATM, ATM • Up to 768 OC-12c/STM-4 POS, IPA ATM, ATM • Up to 192 OC-48c/STM-16 POS, IPA ATM, ATM • Up to 48 OC-192c/STM-64 POS, IPA ATM, ATM • Up to 480 Gigabit Ethernet interfaces • Up to forty-eight 10 Gigabit Ethernet interfaces
IP/MPLS	• IP – Internet Control Message Protocol (ICMP), Internet Group Management Protocol (IGMP), OSPFv2-TE, BGP-4, IS-IS-TE, PIM-SM, PIM-DM, MBGP, IPv4, IPv6, and static and default routing • MPLS – RSVP-TE, LDP, and permanent LSP (P-LSP) • IP routing/forwarding • LER (edge) and LSR (core) switch router • Experimental-bit-inferred LSP (E-LSP) and label-inferred LSP (L-LSP) • LC-ATM and shim header support • DiffServ-aware traffic engineering • IP and MPLS DiffServ – class selector (CS), assured forwarding (AF), expedited forwarding (EF), and default forwarding (DF) • MPLS IntServ – guaranteed service (GS) and controlled load (CL) • Deep packet classification and filtering • Traffic conditioning, WRED, and per-class and per-connection queuing and scheduling • MPLS and IP VPNs – PWE3, RFC 2547bis (P and PE) • Line-rate performance up to 1.5B pps • More than 1M IP routes
Ethernet	• 802.1p/Q priority/VLAN tag • Link aggregation (intra-card) • Jumbo frames (9192) • DHCP relay • BootP forwarding • VRRP • 802.1 Spanning Tree/VLAN • Rapid Spanning Tree • Transparent LAN Service • Port Mirroring
ATM	• Permanent virtual connections (PVx), switched virtual connections (SVx), and soft PVx (SPVx) – point-to-point, point-to-multipoint, multipoint-to-point • ATM Forum UNI 3.0, 3.1, and 4.0; Interim Local Management Interface (ILMI) 4.0 • ATM Forum PNNI, H-PNNI, AINI, and Interim Interswitch Signaling Protocol (IISP) • Dynamic PNNI Hierarchy • Virtual path termination (VPT) and virtual UNI • Transit Network Selection (TNS) • ATM VPNs – network service access point (NSAP) filtering and closed user groups (CUGs) • Path Trace and Connection Trace • Connection Modify • SPVx traffic pacing and prioritized connection reroute • ATM Forum Traffic Management 4.x – constant bit rate (CBR), real-time variable bit rate (rt-VBR), non-real-time VBR (nrt-VBR), unspecified bit rate (UBR), available bit rate (ABR), guaranteed frame rate (GFR), and UBR with minimum desired cell rate (MDCR) • Dual generic cell rate algorithm (GCRA) policing • Per-VC queuing, per-QoS queuing and VC merge • Early packed discard (EPD), partial packet discard (PPD), and partial packet policing • RFC 1483/2684 permanent virtual circuit (PVC) support • ATM Forum LAN Emulation Client (LEC)

Data summary (continued)

Resilience
- Level 4 hot-swappable (zero traffic loss in system upon insertion/removal with power)
- Redundant system control processors, timing control modules (TCMs), port cards, power conditioning modules (PCMs), and cooling system
- Zero-packet-loss fabric protection and capacity upgrades
- Redundant line, Building Integrated Timing Supply (BITS), and Stratum 3E derived timing
- SONET 1+1 APS, SDH MSP
- Hitless software upgrades
- Call/connection preservation for ATM and MPLS connections
- Backup LSP, fast reroute, and non-stop forwarding and routing
- Dynamic protection switching
- Denial of service prevention/protection
- PNNI/MPLS traffic engineering/rerouting
- Management Plane Security: SNMPv3 w/ DES/3DES, SSH, SSL, AES, RADIUS, TACACS+, SecurID, Kerberos
- Control Plane Security: MD5 (OSPF, RSVP-TE, IS-IS, BGP-4, LDP), Route Filtering via RPCL
- Data Plane Security: Unicast RPF, Filtering & Rate Limiting, e.g., port ID, IP address, Tx/Rx port, etc.

Network management

General
- Out-of-band management via Ethernet and serial interfaces
- In-band management via LAN Emulation (LANE)/Classical IP (CLIP) and MPLS
- Command line interface (CLI) and Web-based graphical user interface (GUI)
- Simple Network Management Protocol (SNMP v3)
- Statistics based on ITU-T G.826; Telcordia GR-1248; ATM Forum Usage Measurement; and ITU-T I.610 Operation, Administration, and Maintenance (OAM) support
- Telcordia OSMINE/NGNESS: TIRKS, NMA, NCON, ServiceOn® suite of applications
- Automatic discovery, additions, deletions, and modifications to devices
- Configuration management and status monitoring
- Fault management
- Management of PVx, SPVx, and LSPs
- Northbound Common Object Request Broker Architecture (CORBA) interfaces
- Graphical display of statistics and performance data

General

Chassis dimensions (H x W x D)	74.6 in. (189.5 cm) x 21.5 in. (54.6 cm) x 21.7 in. (55.1 cm)
Emissions/immunity approvals	FCC/47CFR, ICES-003, EN300386, VCCI
Environmental approvals	GR-63-CORE, GR-1089-CORE (NEBS certification Level 3)
Safety approvals	UL/CSA 60950, EN60950, EN60825

Please note that this data sheet provides a summary of the BXR48000's planned features and functionality. Contact Marconi for specific availability information.

Marconi (logo)

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