BROCADE NETIRON CES 2000 SERIES

HIGH-PERFORMANCE ETHERNET SWITCHING

Multi-Service Compact Ethernet Switch Series

HIGHLIGHTS

- Compact 1U IP/MPLS/VRF-enabled switch that is purpose-built for advanced Carrier Ethernet and large data center applications
- Wire-speed, non-blocking performance in all configurations
- Available in 24-port and 48-port configurations in both Hybrid Fiber (HF) and RJ45 versions to suit versatile access/aggregation media
- Powered by the field-proven Brocade Multi-Service IronWare OS that also runs on NetIron XMR/MLX Series routers
- Advanced, scalable Carrier Ethernet services, including E-LINE, E-LAN, and E-TREE
- Comprehensive IPv4 and IPv6 routing
- Virtual Routing in non-MPLS environments via Multi-VRF
- MEF 9, MEF 14, and MEF 21 certified, with comprehensive OAM capabilities

Network planners today must increasingly extend the range of their service offerings to the edge of carrier networks. However, extending intelligence and high-touch processing capabilities to the network edge requires the ability to flexibly define and easily manage services in an efficient manner. As a result, Quality of Service (QoS), resiliency, and security are critical factors in the deployment of these Ethernet-based services.

Whether they are located at a central office or remote site, the availability of space often determines the feasibility of deploying new equipment and services within a service provider, campus, or data center environment. To meet these challenges, the Brocade® NetIron® CES 2000 Series is purpose-built to provide flexible, resilient, secure, and advanced Ethernet and MPLS-based services in a compact form factor.

The NetIron CES 2000 Series is a family of compact 1U, multiservice edge/aggregation switches that combine powerful capabilities with high performance and availability. The switches provide a broad set of advanced Layer 2, IPv4, IPv6, and MPLS capabilities in the same device. As a result, they support a diverse set of applications in metro edge, service provider, mobile backhaul, data center, and large enterprise networks.

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Key Applications

- Large-scale Carrier Ethernet build-outs at the global, national, and metro levels—combined with NetIron MLX and XMR Series routers
- High-density aggregation of access devices such as DSLAMs, PON ONTs, or CMTS systems at the network edge
- Edge aggregation switching and routing applications in metro networks
- MPLS access and aggregation
- Multiple security zones and simplified VPNs for enterprise and campus networks using Multi-VRF
- Mobile backhaul over Carrier Ethernet infrastructure
- Fiber To The Home (FTTH) and Fiber To The Building (FTTB) applications with stringent Service Level Agreements (SLAs)
- Aggregation in ISP networks
- High-performance data center top-of-rack server access with high-touch processing and deep buffering

PROVIDING CARRIER-CLASS RESILIENCY WITH MULTI-SERVICE IRONWARE

The NetIron CES 2000 Series is built on the same Brocade Multi-Service IronWare® operating system that powers mission-critical NetIron XMR and NetIron MLX Series routers, simplifying integration with existing networks. Key capabilities include an industry-standard interface, support for robust routing protocols, MPLS VPNs, advanced Layer 2 protocols, a broad range of OAM protocols, advanced security, and simplified management.

In addition, IronWare supports Provider Bridge (PB) and Provider Backbone Bridge (PBB) functionalities. This rich set of functionality makes it easier to integrate the NetIron CES 2000 Series with existing OSS systems that are certified to interoperate with Multi-Service IronWare-based products.

ENABLING TRUE CARRIER-GRADE ETHERNET SERVICES

Carrier Ethernet is a ubiquitous offering defined by five attributes—standardized services, scalability, service management, reliability, and QoS—all of which are supported by the NetIron CES 2000 Series.

A Carrier Ethernet service can be delivered over any transport technology as long as it satisfies the standards and attributes associated with the service. Examples of possible underlying transport mechanisms include native Ethernet using 802.1Q VLANs, MPLS-based Layer 2 VPNs, IEEE 802.1ad PBs, and IEEE 802.1ah PBBs.

Standardized Services

Because the NetIron CES 2000 Series is certified for MEF 9, MEF 14, and MEF 21, providers can offer E-LINE, E-LAN, and E-TREE services—the standardized service names for point-to-point, multipoint, and rooted multipoint services. These services can be offered using 802.1Q VLANs, PBs, PBBs, or MPLS Layer 2 VPNs.

Scalability

The NetIron CES 2000 Series supports up to 128,000 MAC addresses per system. Support for 100/1000 Mbps SFP ports or 10/100/1000 Mbps RJ45 ports (with wire-speed performance even at full load) helps ensure available capacity on user-facing ports to accommodate provider customers that want to upgrade to a higher-bandwidth service. In addition, the use of Link Aggregation Groups (LAGs) enables the aggregation of multiple links to provide even higher-bandwidth services at the User Network Interface (UNI).

To support highly scalable Carrier Ethernet services, Brocade has developed an innovative framework called Ethernet Service Instance (ESI). Using the ESI framework, providers can flexibly define and assign VLANs to service instances within the network—enabling them to rapidly instantiate and easily manage E-LINE, E-LAN, and E-TREE services.

Service Management

Specifications such as IEEE 802.1ag-2007 (Connectivity Fault Management) and MEF 17 (Service OAM Framework and Specifications) enable fast, proactive identification and isolation of faults in the network or service, helping to increase service uptime and the ability to meet SLAs.

The NetIron CES 2000 Series supports all the capabilities in IEEE 802.1ag, including Connectivity Check Messages, Loopback Message/Response, and LinkTrace Message/Response. It allows flexible association and definition of both Maintenance End Points (MEPs) and Maintenance Intermediate Points (MIPs) within a network. Fault management functions of MEF 17 Service OAM are also supported. Together, these tools provide the capabilities to monitor, diagnose, and centrally manage the network.

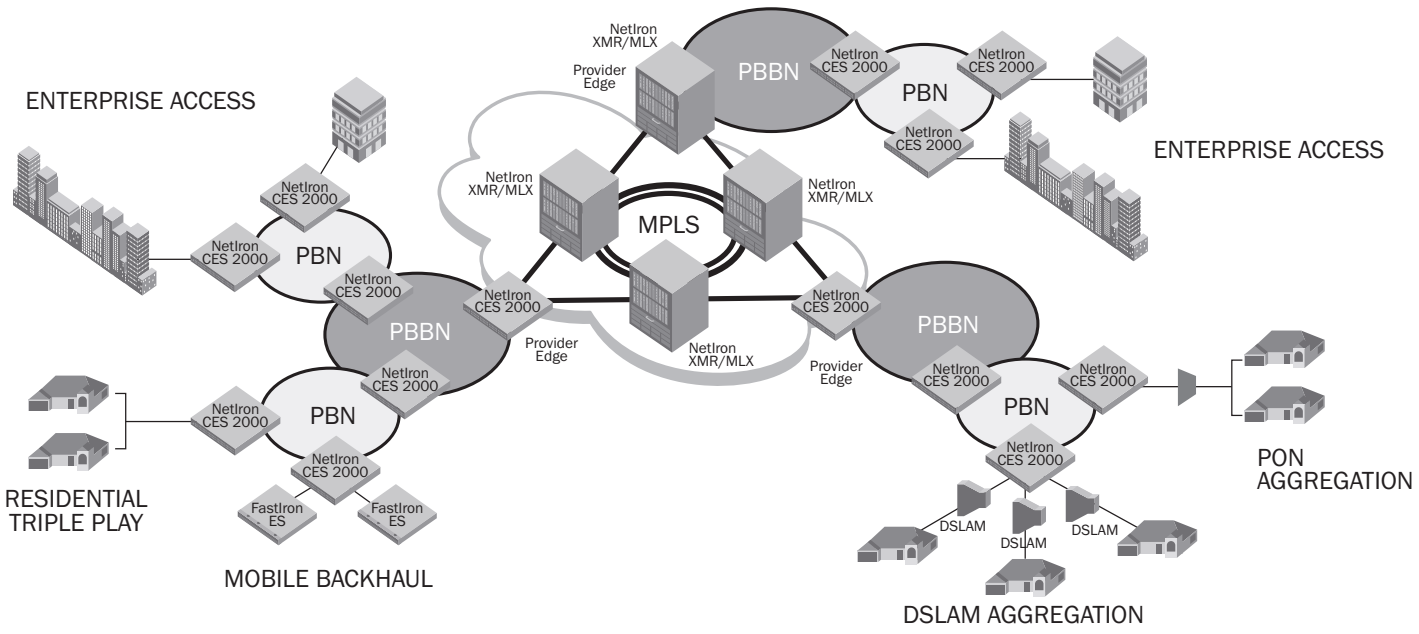
Reliability

To provide higher reliability in Carrier Ethernet services, the NetIron CES 2000 Series supports Metro Ring Protocol (MRP/MRP-II), the ring resiliency protocol of choice on many metro networks worldwide. Standard Layer 2 protocols such as MSTP, RSTP, and STP are also supported. The Brocade MRP/MRP-II implementation enables the delivery of Carrier Ethernet services over ring-based topologies, including overlapping rings that help optimize the use of fiber in metro rings and provide recovery from node/link failures in milliseconds. Brocade MRP/MRP-II can also be used within PB/PBB networks.

Hard QoS

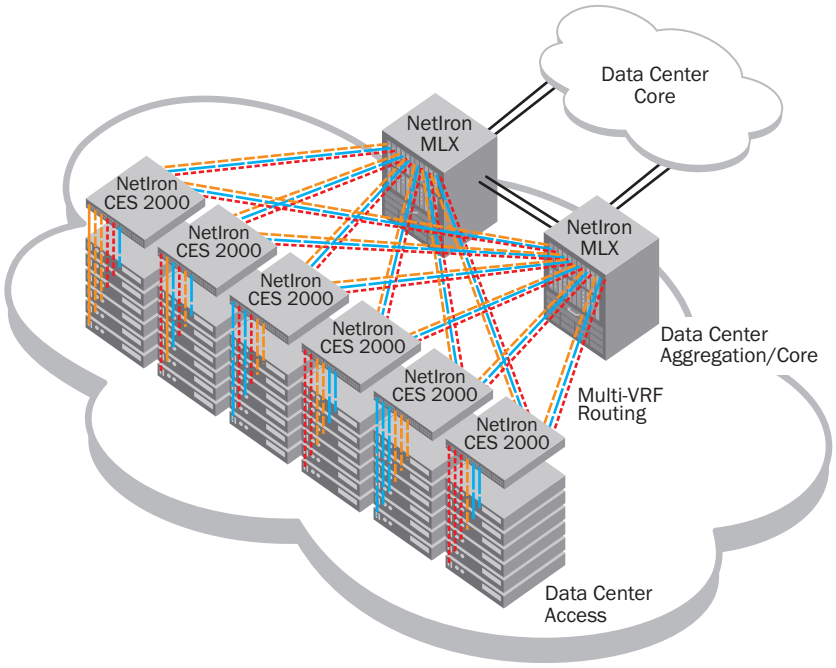
The NetIron CES 2000 Series supports up to eight queues per port, each with a distinct priority level. Providers can apply advanced QoS capabilities (such as the use of 2-rate, 3-color traffic policers, egress shaping, and priority remarking) to offer a deterministic "hard QoS" capability to customers of the service. In addition, the NetIron CES 2000 Series can be configured with ingress and egress bandwidth profiles per UNI that comply with the rigid traffic management specifications of MEF 10/MEF 14.

Figure 1.
A possible application of using PBB technology on NetIron CES 2000 Series switches in a large Carrier Ethernet network.



LEGEND: **PB:** Provider Bridge (802, 1AD). **PBB:** Provider Backbone Bridge (802, 1AH). **PBN:** Provider Bridged Network. **PBBN:** Provider Backbone Bridged Network.

Figure 2.
The NetIron CES 2000 Series supports Multi-VRF to help increase both security and ROI.



USING PBB/VPLS TO SCALE CARRIER ETHERNET SERVICES

Most network cores today are based on MPLS. By using VPLS, providers can easily leverage an existing MPLS network to offer Carrier Ethernet services. In a VPLS network, participating Provider Edge (PE) devices establish a full mesh of pseudo-wires among all nodes in a VPLS instance. To ensure scalability of the VPLS service, providers can utilize hierarchical VPLS to limit the number of PE devices that participate in the full mesh.

In addition, they can use PBB technology to implement hierarchical VPLS by cross-connecting VPLS at the PE router (the hub device) to PBB spokes at the network edge. Implementing hierarchical VPLS with PBB spokes provides an extremely simple way to scale the VPLS service while reducing signaling overhead within the MPLS network.

More importantly, it significantly increases the scalability of the overall solution, because the MPLS PE router is completely insulated from customer MAC addresses—it maps frames based on the backbone MAC header to a VPLS instance. Figure 1 shows an example of using PBB technology on the NetIron CES 2000 Series with VPLS on the NetIron XMR/MLX Series to achieve unparalleled scalability in service delivery.

HIGH-PERFORMANCE TOP-OF-RACK SWITCH FOR DATA CENTERS

In the data center, cost reduction, virtualization, security, and consolidation continue to be the top priorities. Growth in data traffic and rising application demands require higher levels of performance and the ability to scale with more storage and network bandwidth.

The NetIron CES 2000 Series is designed to meet the challenges of campus and large data center networks by providing a broad set of capabilities, including wire-speed performance, deep packet buffers, and low latency in a compact 1U form factor. Comprehensive support for IPv4 routing protocols, when complemented with VRRP and VRRP-E, is well suited for these environments. In addition, the NetIron CES 2000 series supports advanced services such as MPLS (VLL, VPLS), QoS, and Layer 3 Virtualization (VRF)—making it an ideal top-of-rack switch in high-end data centers or an edge router in campus networks.

Figure 2 shows an example of using Multi-VRF on the NetIron CES 2000 Series. Multi-VRF enables a single device to host multiple routing tables and allows application traffic separation at Layer 3 for SLA assurance, regulatory compliance, and security. An additional benefit of Multi-VRF is reduced maintenance and capital costs as well as better bandwidth utilization to increase ROI.

MULTICAST SUPPORT

Multicast transport is a key enabler of next-generation services such as IPTV as well as the use of video, financial, and other one-to-many applications. To meet this challenge, the NetIron CES 2000 Series provides comprehensive support for multicast switching and routing 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 switch performance and buffer usage within the system to help maximize network performance for multicast traffic.

ROUTING CAPABILITIES

The NetIron CES 2000 Series offers routing capabilities that are commonly required in edge aggregation and other applications within a provider's domain. These capabilities include advanced hardware-based routing technology, which ensures secure and robust wire-speed routing performance.

The NetIron CES 2000 Series supports IPv4 and IPv6 unicast protocols—RIP/RIPng, OSPF/OSPFv3, IS-IS/IS-IS for IPv6, and BGP/BGP-MP for IPv6. To increase overall service availability, it also supports Graceful Restart helper mode for both OSPF and BGP, enabling hitless management failover and hitless OS upgrades on adjacent modular routers with these functions.

SECURITY CAPABILITIES

Multi-Service IronWare contains security capabilities that are available on the NetIron CES 2000 Series. These capabilities support inbound and outbound ACLs, ACL logging, advanced Layer 2 controls, limits for broadcast/unknown unicast/multicast, Multi-VRF, Layer 2 VPNs, and more.

Receive ACLs assist in placing controls on unwanted traffic targeted toward the control plane. Through tools such as ACL-based traffic policers, ACL-based sFlow, and ACL-based mirroring, malicious traffic can be easily identified and preventive measures taken in the network. In addition, Multi-VRF can help segment the network into different zones for security and isolation.

MAXIMIZING INVESTMENTS

To help optimize technology investments, Brocade and its partners offer complete solutions that include education, support, and services. For more information, contact a Brocade sales partner or visit www.brocade.com.

KEY FEATURES

Advanced Carrier-Grade Ethernet services

- Up to 128,000 MAC addresses
- 4000 VLANs/S-VLANs/B-VLANs
- Ability to reuse VLAN-ID on each port using the Brocade Ethernet Service Instance (ESI) framework
- MPLS services: IP over MPLS, Virtual Leased Line (VLL), and Virtual Private LAN Service (VPLS)
- IEEE 802.1ad Provider Bridges
- IEEE 802.1ah Provider Backbone Bridges
- IEEE 802.1ag Connectivity Fault Management
- Comprehensive set of Layer 2 control protocols: Brocade MRP/MRP-II, VSRP, RSTP, and MSTP
- MEF 9, MEF 14, and MEF 21 certification
- E-LINE (EPL and EVPL), E-LAN, and E-TREE support
- Protocol tunneling of customer BPDUs

Comprehensive IPv4/IPv6 unicast routing support based on the Brocade Multi-Service IronWare OS

- High-performance, robust routing using Forwarding Information Base (FIB) programming in hardware
- RIP/RIPng, OSPF/OSPFv3, IS-IS/IS-IS for IPv6, and BGP-4/BGP-MP for IPv6
- Secure Multi-VRF routing to support Virtual Routing applications over non-MPLS backbones
- Support for VRRP and VRRP-E
- 8-path Equal Cost Multipath (ECMP)
- Up to 32,000 IPv4 unicast routes in FIB

Support for trunks (link aggregation groups) using either IEEE 802.3ad LACP or static trunks

- Up to 12 links per trunk
- Support for single-link trunks

Rich multicast support

- Supported IPv4 multicast protocols, including PIM-DM, PIM-SM, and PIM-SSM
- IGMP v2/v3 routing and snooping support
- IGMP static groups support
- Multicast boundaries to facilitate admission control
- Up to 4000 multicast groups in hardware
- Multicast traffic distribution over LAGs
- Efficient egress interface-based replication to maximize performance and conserve buffers

Deep egress buffering for transient bursts in traffic

- 64 MB to 192 MB of buffering, based on configuration

Advanced QoS

- Inbound and outbound two-rate three-color traffic policers with accounting
- Eight queues per port, each with a distinct priority level
- Multiple queue servicing disciplines: Strict Priority, Weighted Fair Queuing, and hybrid
- Advanced remarking capabilities based on port, VLAN, PCP, DSCP, or IPv4 flow
- Egress port and priority-based shaping

Comprehensive hardware-based security and policies

- Hardware-based Layer 3 and Layer 2 ACLs (both inbound and outbound) with logging
- Ability to bind multiple ACLs to the same port
- Hardware-based receive ACLs
- Hardware-based Policy-Based Routing (PBR)

Additional security capabilities

- Port-based network access control using 802.1x or MAC port security
- Root guard and BPDU guard
- Broadcast, multicast, and unknown unicast rate limits
- ARP Inspection for static entries

Advanced monitoring capabilities

- Port- and ACL-based mirroring that enables traffic mirroring based on incoming port, VLAN-ID, or IPv4/TCP/UDP flow
- Hardware-based sFlow sampling that allows extensive Layer 2-7 traffic monitoring for IPv4 and Carrier Ethernet services
- ACL-based sFlow support

Interface capabilities

- Jumbo frame support up to 9216 bytes
- Optical monitoring of SFP and XFP optics for fast detection of fiber faults
- UDLD and LFS/RFN support

Intuitive, comprehensive status indication via LEDs

- Per-port UP/DOWN/ACTIVITY indicators
- FAN tray status
- Power supply status

Redundancy

- Redundant, hot-swappable AC/DC power supplies at the rear
- Removable fan tray with fan redundancy

BROCADE NETIRON CES 2000 SERIES BY THE NUMBERS

Features	NetIron CES 2024C	NetIron CES 2024F	NetIron CES 2048C	NetIron CES 2048F	NetIron CES 2048CX	NetIron CES 2048FX
Port Density	24 10/100/1000 RJ45 ports with optional slot for 2x10 G XFP uplinks	24 100/1000 Hybrid Fiber SFP ports with optional slot for 2x10 G XFP uplinks	48 10/100/1000 RJ45 ports	48 100/1000 SFP ports	48 10/100/1000 RJ45 ports with 2x10 G XFP uplinks	48 100/1000 Hybrid Fiber SFP ports with 2x10 G XFP uplinks
10 G Uplinks	Yes (optional slot for 2x10 G XFP uplinks)	Yes (optional slot for 2x10 G XFP uplinks)	No	No	Yes (built in)	Yes (built in)
Combination Ports	Yes (4 100/1000 SFP ports)	Yes (4 10/100/1000 RJ45 ports)	Yes (4 100/1000 SFP ports)	No	No	No
Forwarding Performance	48 Gbps 88 Gbps (with 2x10 G module installed)	48 Gbps 88 Gbps (with 2x10 G module installed)	96 Gbps	96 Gbps	136 Gbps	136 Gbps
Packet Forwarding Performance	36 Mpps 65 Mpps (with 2x10 G module installed)	36 Mpps 65 Mpps (with 2x10 G module installed)	71 Mpps	71 Mpps	101 Mpps	101 Mpps
Buffering	64 MB 128 MB (with 2x10 G uplinks)	64 MB 128 MB (with 2x10 G uplinks)	128 MB	128 MB	192 MB	192 MB
Power Supply Options	Internal AC or DC	Internal AC or DC	Internal AC or DC	Internal AC or DC	Internal AC or DC	Internal AC or DC
Power Supply Redundancy	1+1	1+1	1+1	1+1	1+1	1+1
Fan Redundancy	M+N	M+N	M+N	M+N	M+N	M+N
Airflow	Front to back	Front to back	Front to back	Front to back	Front to back	Front to back

SOFTWARE OPTIONS

Premium License	Content
BASE	Fundamental Layer 2 and 3 functions: • All Classic Layer 2 capabilities • Base Layer 3 (RIP and static routes) • QoS and ACLs • Management via SNMP/CLI • Bundled with base hardware
ME_PREM (Metro Edge Premium License)	All functions in BASE plus: • Provider Bridges (IEEE 802.1ad) • Provider Backbone Bridges (IEEE 802.1ah) • In-band management for PB/PBB network • IPv4 routing: OSPF and ISIS • IPv6 routing: RIPng, OSPFv3, and IS-IS for IPv6 • Connectivity Fault Management (IEEE 802.1ag) and Service OAM • Ethernet Service Instance (ESI) framework • Multi-VRF • MPLS (IPoverMPLS, VPLS, VLL) • 802.3ah Link OAM
L3_PREM (Layer 3 Premium License)	All functions in BASE plus: • IPv4 routing: OSPF, ISIS, and BGP • IPv6 routing: RIPng, OSPFv3, IS-IS for IPv6, and BGP-MP for IPv6 • Multi-VRF

Note: To optimize deployment, software functionality is available in different licensed packages.

BROCADE NETIRON CES 2000 SERIES POWER SPECIFICATIONS

Configuration	Maximum AC Power Consumption (Watts) (100 to 240V AC)	Maximum DC Power Consumption (Watts)	Maximum Thermal Output (BTU/hour)
NetIron CES 2024C	120	120	410
NetIron CES 2024C with 2x10 G uplink installed	170	170	580
NetIron CES 2024F	145	145	495
NetIron CES 2024F with 2x10 G uplink installed	195	195	666
NetIron CES 2048C	205	205	700
NetIron CES 2048CX	255	255	870
NetIron CES 2048F	245	245	836
NetIron CES 2048FX	295	295	1007

BROCADE NETIRON CES 2000 SERIES PHYSICAL SPECIFICATIONS

	Dimensions
NetIron CES 2024C	17.4 in. W × 1.7 in. H × 17.6 in. D (44.3 cm × 4.4 cm × 44.8 cm)
NetIron CES 2024C with 2x10 G uplink installed	17.4 in. W × 1.7 in. H × 17.6 in. D (44.3 cm × 4.4 cm × 44.8 cm)
NetIron CES 2024F	17.4 in. W × 1.7 in. H × 17.6 in. D (44.3 cm × 4.4 cm × 44.8 cm)
NetIron CES 2024F with 2x10 G uplink installed	17.4 in. W × 1.7 in. H × 17.6 in. D (44.3 cm × 4.4 cm × 44.8 cm)
NetIron CES 2048C	17.4 in. W × 1.7 in. H × 17.3 in. D (44.3 cm × 4.4 cm × 43.9 cm)
NetIron CES 2048CX	17.4 in. W × 1.7 in. H × 17.3 in. D (44.3 cm × 4.4 cm × 43.9 cm)
NetIron CES 2048F	17.4 in. W × 1.7 in. H × 17.3 in. D (44.3 cm × 4.4 cm × 43.9 cm)
NetIron CES 2048FX	17.4 in. W × 1.7 in. H × 17.3 in. D (44.3 cm × 4.4 cm × 43.9 cm)

BROCADE NETIRON CES 2000 SERIES SPECIFICATIONS

IEEE Compliance

- IEEE 802.3 10Base-T
- IEEE 802.3u 100Base-TX, 100Base-FX, 100Base-LX
- IEEE 802.3z 1000Base-SX/LX
- IEEE 802.3ab 1000Base-T
- 802.3 CSMA/CD Access Method and Physical Layer Specifications
- 802.3ae 10 Gigabit Ethernet
- 802.3x Flow Control
- 802.3ad Link Aggregation
- 802.1Q Virtual Bridged LANs
- 802.1D MAC Bridges
- 802.1w Rapid STP
- 802.1s Multiple Spanning Trees
- 802.1x Port-based Network Access Control
- 802.1ad Provider Bridges
- 802.1ah Provider Backbone Bridges
- 802.1ag Connectivity Fault Management (CFM)

MEF Specifications

- MEF 2 Requirements and Framework for Ethernet Service Protection
- MEF 4 Metro Ethernet Network Architecture Framework Part 1: Generic Framework
- MEF 6.1 Metro Ethernet Services Definitions Phase 2
- MEF 9 Abstract Test Suite for Ethernet Services at the UNI
- MEF 10.1 Ethernet Services Attributes Phase 2
- MEF 11 User Network Interface (UNI) Requirements and Framework
- MEF 12 Metro Ethernet Network Architecture Framework Part 2: Ethernet Services Layer
- MEF 13 User Network Interface (UNI) Type 1 Implementation Agreement
- MEF 14 Abstract Test Suite for Traffic Management Phase 1
- MEF 15 Requirements for Management of Metro Ethernet Phase 1 Network Elements
- MEF 17 Service OAM Framework and Requirements (partial)
- MEF 19 Abstract Test Suite for UNI Type 1
- MEF 21 Abstract Test Suite for UNI Type 2 Part 1 Link OAM

RFC Compliance

BGPv4	• RFC 4271 BGPv4 • RFC 1745 OSPF Interactions • RFC 1997 Communities and Attributes • RFC 2439 Route Flap Dampening • RFC 2796 Route Reflection • RFC 1965 BGP4 Confederations • RFC 2842 Capability Advertisement • RFC 2918 Route Refresh Capability • RFC 1269 Managed Objects for BGP • RFC 2385 BGP Session Protection via TCP MD5 • RFC 3682 Generalized TTL Security Mechanism, for eBGP Session Protection • RFC 4273 BGP-4 MIB • RFC 4893 BGP Support for Four-octet AS Number Space • RFC 5396 Textual Representation of Autonomous System (AS) Numbers • draft-ietf-idr-restart Graceful Restart Mechanism for BGP (helper mode)
OSPF	• RFC 2328 OSPF v2 • RFC 3101 OSPF NSSA • RFC 1745 OSPF Interactions • RFC 1765 OSPF Database Overflow • RFC 1850 OSPF v2 MIB • RFC 2370 OSPF Opaque LSA Option • RFC 3630 TE Extensions to OSPF v2 • RFC 3623 Graceful OSPF Restart (helper mode)
MPLS	• RFC 3031 MPLS Architecture • RFC 3032 MPLS Label Stack Encoding • RFC 3036 LDP Specification • RFC 2205 RSVP v1 Functional Specification • RFC 2209 RSVP v1 Message Processing Rules • RFC 3209 RSVP-TE • RFC 3270 MPLS Support of Differentiated Services • RFC 3812 MPLS MIB • RFC 4090 Fast Reroute Extensions to RSVP-TE for LSP Tunnels; partial support
L2VPN and PWE3	• draft-ietf-l2vpn-framework Framework for Layer 2 Virtual Private Networks • draft-ietf-l2vpn-requirements Service Requirements for Layer 2 Provider Provisioned Virtual Private Networks • RFC 4762 VPLS using LDP Signaling • draft-ietf-pwe3-arch PWE3 Architecture • RFC 4447 Pseudowire Setup and Maintenance using LDP • RFC 4448 Encapsulation Methods for Transport of Ethernet over MPLS Networks • draft-ietf-pwe3-pw-tc-mib Definitions for Textual Conventions and OBJECT-IDENTITIES for Pseudo-Wires Management • draft-ietf-pwe3-pw-mib Pseudo Wire (PW) Management Information Base
IS-IS	• RFC 1195 Routing in TCP/IP and Dual Environments • RFC 1142 OSI IS-IS Intra-domain Routing Protocol • RFC 2763 Dynamic Host Name Exchange • RFC 2966 Domain-wide Prefix Distribution
RIP	• RFC 1058 RIP v1 • RFC 1723 RIP v2 • RFC 1812 RIP Requirements
IPv4 Multicast	• RFC 1122 Host Extensions • RFC 1112 IGMP • RFC 2236 IGMP v2 • RFC 3376 IGMP v3 • RFC 3973 PIM-DM • RFC 2362 PIM-SM • RFC 4610 Anycast RP using PIM
IPv6 core	• RFC 2460 IPv6 Specification • RFC 2461 IPv6 Neighbor Discovery • RFC 2462 IPv6 Stateless Address—Auto-Configuration • RFC 4443 ICMPv6 • RFC 4291 IPv6 Addressing Architecture • RFC 3587 IPv6 Global Unicast—Address Format • RFC 2375 IPv6 Multicast Address Assignments • RFC 2464 Transmission of IPv6 over Ethernet Networks • RFC 2711 IPv6 Router Alert Option
IPv6 routing	• RFC 2080 RIPng for IPv6 • RFC 2740 OSPFv3 for IPv6 • draft-ietf-isis-ipv6 Routing IPv6 with IS-IS • RFC 2545 Use of BGP-MP for IPv6

BROCADE NETIRON CES 2000 SERIES SPECIFICATIONS (CONTINUED)

General Protocols	• RFC 791 IP • RFC 792 ICMP • RFC 793 TCP • RFC 783 TFTP • RFC 826 ARP • RFC 768 UDP • RFC 894 IP over Ethernet • RFC 903 RARP • RFC 906 TFTP Bootstrap • RFC 1027 Proxy ARP • RFC 951 BootP • RFC 1122 Host Extensions for IP Multicasting • RFC 1256 IRDP • RFC 1519 CIDR • RFC 1542 BootP Extensions • RFC 1812 Requirements for IPv4 Routers • RFC 1541 and 1542 DHCP • RFC 2131 BootP/DHCP Helper • RFC 3768 VRRP • RFC 854 TELNET • RFC 1591 DNS (client)
QoS	• RFC 2475 An Architecture for Differentiated Services • RFC 3246 An Expedited Forwarding PHB • RFC 2597 Assured Forwarding PHB Group • RFC 2698 A Two Rate Three Color Marker
Other	• RFC 1354 IP Forwarding MIB • RFC 2665 Ethernet Interface MIB • RFC 1757 RMON Groups 1,2,3,9 • RFC 2068 HTTP • RFC 4330 SNTP • RFC 2865 RADIUS • RFC 3176 sFlow • RFC 2863 Interfaces Group MIB • Draft-ietf-tcpm-tcpsecure TCP Security • draft-ietf-bfd-base Bidirectional Forwarding Detection (BFD) • RFC 2784 Generic Routing Encapsulation (GRE)

Network Management

- Brocade IronView® Network Manager (INM) Web-based GUI
- Integrated industry-standard Command Line Interface (CLI)
- sFlow (RFC 3176)
- Telnet
- SNMP v1, v2c, v3
- SNMP MIB II
- RMON

Element Security Options

- AAA
- RADIUS
- Secure Shell (SSH v2)
- Secure Copy (SCP v2)
- HTTPs
- TACACS/TACACS+
- Username/Password (Challenge and Response)
- Bi-level Access Mode (Standard and EXEC Level)
- Protection against Denial of Service attacks, such as TCP SYN or Smurf Attacks

Environmental

- Operating temperature: 0° C to 40° C (32° F to 104° F)
- Relative humidity: 5% to 90%, at 40° C (104° F), non-condensing
- Operating altitude: 10,000 ft (3048 m)
- Storage temperature: –25° C to 70° C (–13° F to 158° F)
- Storage humidity: 95% maximum relative humidity, non-condensing
- Storage altitude: 15,000 ft (4500 m) maximum

Safety Agency Approvals

- CAN/CSA-C22.2 No. 60950-1-3
- UL 60950-1
- IEC 60950-1
- EN 60950-1 Safety of Information Technology Equipment
- EN 60825-1 Safety of Laser Products—Part 1: Equipment Classification, Requirements and User's Guide
- EN 60825-2 Safety of Laser Products—Part 2: Safety of Optical Fibre Communication Systems

Electromagnetic Emission

- ICES-003 Electromagnetic Emission
- FCC Class A
- EN 55022/CISPR-22 Class A/VCCI Class A
- AS/NZS 55022
- EN 61000-3-2 Power Line Harmonics
- EN 61000-3-3 Voltage Fluctuation & Flicker
- EN 61000-6-3 Emission Standard (Supersedes: EN 50081-1)

Immunity

- EN 61000-6-1 Generic Immunity and Susceptibility; this supersedes EN 50082-1
- EN 55024 Immunity Characteristics. This supersedes:
  - — EN 61000-4-2 ESD
  - — EN 61000-4-3 Radiated, radio frequency, electromagnetic field
  - — EN 61000-4-4 Electrical fast transient
  - — EN 61000-4-5 Surge
  - — EN 61000-4-6 Conducted disturbances induced by radio-frequency fields
  - — EN 61000-4-8 Power frequency magnetic field
  - — EN 61000-4-11 Voltage dips and sags

Telco NEBS/ETSI

- Telcordia GR-63-CORE NEBS Requirements: Physical Protection
- Telcordia GR-1089-CORE EMC and Electrical Safety
- Telcordia SR-3580 Level 3
- ETSI ETS 300-019 Physical Protection:
  - - Part 1-1, Class 1.1, Partly Temperature Controlled Storage Locations
  - - Part 1-2, Class 2.3, Public Transportation
  - - Part 1-3, Class 3.1, Temperature Controlled Locations (Operational)
- ETSI ETS 300-386 EMI/EMC

Power and Grounding

- ETS 300 132-1 Equipment Requirements for AC Powered Equipment Derived from DC Sources
- ETS 300 132-2 Equipment Requirements for DC Powered Equipment
- ETS 300 253 Facility Requirements

Physical Design and Mounting

Rack mount	19-inch rack mount supporting racks compliant with: • ANSI/EIA-310-D • ETS 300 119 • GR-63-CORE Seismic Zone 4
Tabletop	

Environmental Regulatory Compliance

- EU 2002/95/EC RoHS
- EU 2002/96/EC WEEE

ORDERING INFORMATION

Part Number	Description
NI-CES-2024C-AC	NetIron CES 2024C, 24x1 G Copper (RJ45) configuration with four combination 100/1000 SFP ports, one optional slot, and one 500-watt AC power supply
NI-CES-2024C-DC	NetIron CES 2024C, 24x1 G Copper (RJ45) configuration with four combination 100/1000 SFP ports, one optional slot, and one 500-watt DC power supply
NI-CES-2024F-AC	NetIron CES 2024F, 24x1 G Hybrid Fiber (HF) SFP configuration with four combination 10/100/1000 RJ45 ports, one optional slot, and one 500-watt AC power supply
NI-CES-2024F-DC	NetIron CES 2024F, 24x1 G Hybrid Fiber (HF) SFP configuration with four combination 10/100/1000 RJ45 ports, one optional slot, and one 500-watt DC power supply
NI-CES-2024-2x10G	NetIron CES 2000 Series 2x10 G XFP uplink for 24-port NetIron CES 2000 Series switches (both AC and DC models)
NI-CES-2048C-AC	NetIron CES 2048C, 48x1 G Copper (RJ45) configuration with four combination 100/1000 SFP ports and one 500-watt AC power supply
NI-CES-2048C-DC	NetIron CES 2048C, 48x1 G Copper (RJ45) configuration with four combination 100/1000 SFP ports and one 500-watt DC power supply
NI-CES-2048F-AC	NetIron CES 2048F, 48x1 G Hybrid Fiber (HF) SFP configuration with one 500-watt AC power supply
NI-CES-2048F-DC	NetIron CES 2048F, 48x1 G Hybrid Fiber (HF) SFP configuration with one 500-watt DC power supply
NI-CES-2048CX-AC	NetIron CES 2048CX, 48x1 G Copper (RJ45) with 2x10 G XFP uplinks configuration and one 500-watt AC power supply
NI-CES-2048CX-DC	NetIron CES 2048CX, 48x1 G Copper (RJ45) with 2x10 G XFP uplinks configuration and one 500-watt DC power supply
NI-CES-2048FX-AC	NetIron CES 2048FX, 48x1 G Hybrid Fiber (HF) with one 500-watt AC power supply and 2x10 G XFP uplinks configuration
NI-CES-2048FX-DC	NetIron CES 2048FX, 48x1 G Hybrid Fiber (HF) with one 500-watt DC power supply and 2x10 G XFP uplinks configuration
NI-CES-2024-MEU	Metro Edge Premium upgrade for NetIron CES 2000 Series 24-port models
NI-CES-2024-L3U	Layer 3 Premium upgrade for NetIron CES 2000 Series 24-port models
NI-CES-2048-MEU	Metro Edge Premium upgrade for NetIron CES 2000 Series 48-port models
NI-CES-2048-L3U	Layer 3 Premium upgrade for NetIron CES 2000 Series 48-port models

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