

BROCADE NETIRON CES 2000 SERIES



HIGH- PERFORMANCE ETHERNET SWITCHING

Compact Carrier Ethernet Switch Series

HIGHLIGHTS

- Compact 1 RU Layer 3 switch that is purpose-built for advanced Carrier Ethernet applications
- MEF 9 and MEF 14 certified
- Provider Backbone Bridge (IEEE 802.1ah) and Provider Bridge (IEEE 802.1ad) support
- Comprehensive OAM capabilities based on IEEE 802.1ag-2007 and MEF Service OAM Framework provide rapid troubleshooting of Layer 2 networks and Carrier Ethernet services
- Innovative Ethernet Service Instance (ESI) framework provides complete flexibility in separating, combining and managing customer service instances
- MEF standard E-LINE, E-LAN and E-TREE services
- Full IPv4 unicast and multicast capabilities
- Powered by field-proven Multi-Service IronWare™ OS that also runs on NetIron XMR/MLX Series routers
- Available in a variety of configurations (24-port and 48-port) in both Hybrid Fiber (HF) and RJ45 versions
- Wire-speed, non-blocking performance in all configurations
- Flexible 100M/1G SFP support and 10G XFP support with advanced optical monitoring

Network planners today must expand and extend the range of services offered further into the edge of the network. This requires extending the intelligence and high-touch processing capabilities to the network edge—whether in a metro network, a campus network or in a data center. The challenge at the network edge is compounded by the need to flexibly define and easily manage customer services in an intuitive manner. Further, the expanding role of the converged network makes Quality of Service (QoS), resiliency and security crucial to the success of many rollouts.

Whether deployed from a central office or from remote huts, availability of space often determines the feasibility of deploying new equipment and services within a service provider's environment.

To meet these challenges, the NetIron Carrier Ethernet Switch (CES) 2000 Series is purpose-built to offer flexible, resilient, secure and advanced services in a compact form factor. The Brocade® NetIron® CES 2000 Series is a compact 1 RU, multi-service edge/aggregation switch with a powerful set of capabilities that combine performance with rich functionality at the network edge. The NetIron CES 2000 Series switch offers network planners a broad set of high performance IPv4, Classic Layer 2, Provider Bridge (PB) and Provider Backbone Bridge (PBB) functionalities in the same device. With these capabilities, the NetIron CES 2000 Series addresses a diverse set of applications in metro edge networks, ISP networks, mobile backhaul networks, data centers, large enterprises, government networks and education/research.



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Applications

- Large-scale Carrier Ethernet build-outs at the global, national and metro levels, when combined with the award-winning NetIron MLX/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
 - Mobile backhaul over a Carrier Ethernet infrastructure
 - Fiber To The Home (FTTH) or Fiber To The Building (FTTB) applications with stringent SLAs
 - Aggregation switch in ISP networks
 - Data center top-of-the-rack server access switch with high-touch processing and deep buffering
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The NetIron CES 2000 Series is available in a variety of flexible configurations optimized to meet different provider needs:

- 24-port 10/100/1000 RJ45 model with 4 combination 100/1000 Hybrid Fiber (HF) ports and an optional field upgradeable 2x10G uplink slot
- 24-port 100/1000 Hybrid Fiber (HF) model with 4 combination 10/100/1000 RJ45 ports and an optional field upgradeable 2x10G XFP uplink slot
- 48-port 10/100/1000 RJ45 model with 4 combination 100/1000 Hybrid Fiber (HF) ports
- 48-port 10/100/1000 RJ45 model with 2x10G XFP uplink ports
- 48-port 100/1000 Hybrid Fiber (HF) model
- 48-port 100/1000 Hybrid Fiber (HF) model with 2x10G XFP uplink ports.

CARRIER-CLASS RESILIENCY WITH MULTI-SERVICE IRONWARE

The NetIron CES 2000 Series is built on Multi-Service IronWare, the same operating system software that powers the widely deployed NetIron XMR and NetIron MLX Series of routers, thereby allowing ease of integration with existing networks. With over 12 years of proven routing protocol and advanced switching support, the

Brocade Multi-Service IronWare powers a large number of mission-critical networks around the world. These capabilities include support for robust routing protocols, advanced Layer 2 protocols, industry-standard user interface, a broad range of OAM protocols, security and simplified management capabilities. Multi-Service IronWare on NetIron CES 2000 Series includes all these capabilities and additionally supports Provider Bridge and Provider Backbone Bridge functionalities. With this foundation, the NetIron CES 2000 Series can also be easily integrated with existing OSS systems that are already certified to interoperate with Multi-Service IronWare-based products.

ENABLING TRUE CARRIER-GRADE ETHERNET SERVICES

Carrier Grade Ethernet, or Carrier Ethernet for short, is a ubiquitous, standardized service that is defined by five attributes: standardized services, scalability, service management, reliability and Quality of Service. 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 underlying transport mechanisms that could be used are native Ethernet using 802.1Q VLANs, MPLS-based

Layer 2 VPNs, IEEE 802.1ad Provider Bridges, IEEE 802.1ah Provider Backbone Bridges, Ethernet over SONET, etc. The NetIron CES 2000 Series supports all five key attributes of Carrier Ethernet.

Standardized Services

The NetIron CES 2000 Series is compliant with both the MEF 9 and MEF 14 specifications. Using the NetIron CES 2000, a provider 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, Provider Bridges or Provider Backbone Bridges.

Scalability

The NetIron CES 2000 Series supports up to 128k 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, ensures that abundant capacity is available on user facing ports to accommodate provider's customers who wish to upgrade to a higher bandwidth service. Additionally, the use of Link Aggregation Groups (LAG) allows multiple links to be aggregated and offer even higher bandwidth services at the user network interface (UNI) to the end-user. When combined with NetIron

MLX/XMR as the PE router, VPLS services on the Netron MLX/XMR complemented with 802.1Q/PB/PBB functions on the Netron CES 2000 allow the creation of highly scalable Carrier Ethernet services. To support these technologies, Brocade developed an innovative framework called “Ethernet Service Instance” (ESI). Using the ESI framework, customer VLANs can be flexibly defined and assigned to service instances within the network, thereby allowing the provider to rapidly instantiate and easily manage an array of E-LINE, E-LAN and E-TREE services. The ESI framework allows reuse of VLAN-IDs on each port, and it facilitates isolation or coexistence of multiple UNIs in the same service instance.

Service Management

Recently developed specifications such as IEEE 802.1ag-2007 (Connectivity Fault Management) and MEF 17 (Service OAM Framework and Specifications) allow the rapid and proactive identification and isolation of faults in the network or service, thereby maintaining service uptime and maximizing the ability to meet customer SLAs. The Netron 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 (MEP) and Maintenance Intermediate Points (MIP) within a network. Fault management functions of MEF 17 Service OAM are also supported on the Netron CES 2000 Series. These tools provide the ability to monitor, diagnose and centrally manage the network

Reliability

To provide a high level of reliability in the Carrier Ethernet service, the Netron CES 2000 Series supports the innovative Metro Ring Protocol (MRP/MRP-II), the ring resiliency protocol of choice on several metro networks worldwide. Standard Layer 2 protocols such as MSTP, RSTP and STP are also supported. The Brocade MRP/MRP-II allows Carrier Ethernet services to be delivered over ring-based topologies, including overlapping rings that help optimize the use of fiber in metro rings and provide fast recovery from node/link failures in milliseconds. Brocade MRP/MRP-II can also be used within a PB/PBB network.

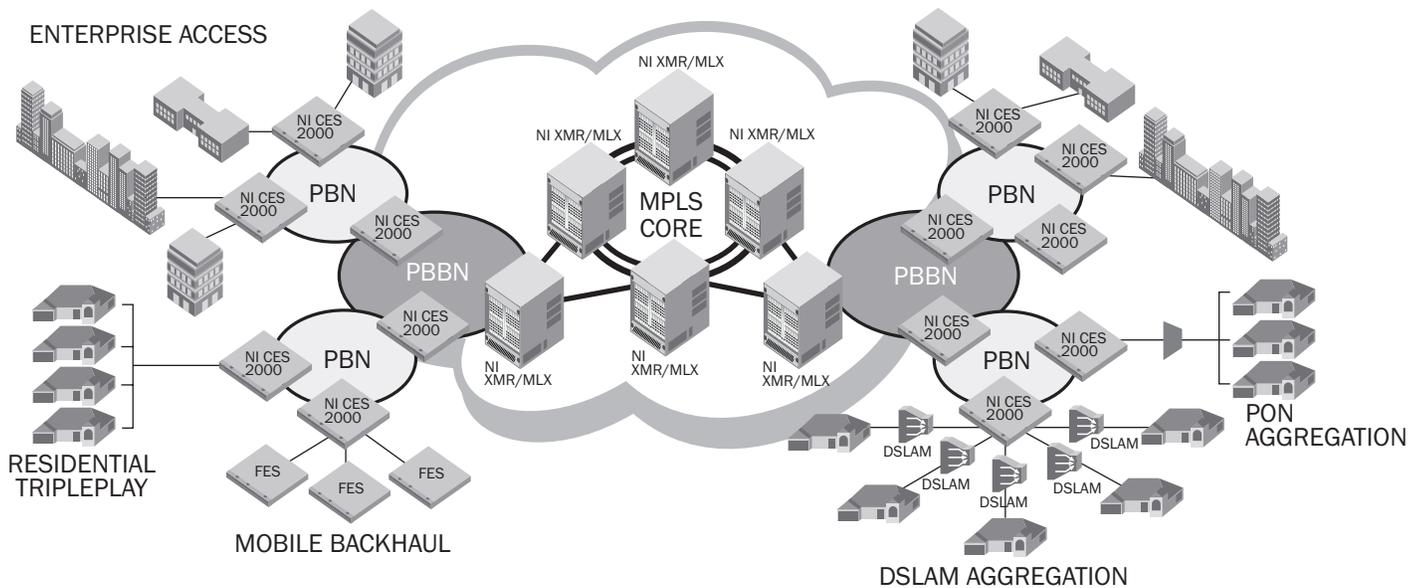
Hard QoS

The Netron CES 2000 Series supports up to 8 queues per port, each with a distinct priority level. Advanced QoS capabilities such as the use of 2-rate, 3-color traffic policers, Egress shaping and priority remarking may also be applied to offer deterministic “hard QoS” capability to customers of the service. The Netron CES 2000 can be configured with Ingress and Egress bandwidth profiles per UNI that are in compliance with the rigid traffic management specifications of MEF 10/MEF 14.

EVOLVING CARRIER ETHERNET SERVICES

Carrier-grade Ethernet service delivery has evolved significantly since the early days of metro build-outs. Many providers today deliver Carrier Ethernet services over an MPLS core but rely on native Ethernet technologies at the edge of the network. These native Ethernet technologies have recently been the subject of considerable interest in the standards bodies. Provider Backbone Bridges and Provider Bridges are based on these recent standards, i.e., IEEE 802.1ah and 802.1ad, and provide the ability to substantially scale a Carrier Ethernet network particularly at the edge of a network.

Figure 1: Example application of Netron 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.

Provider Bridges, as specified in IEEE 802.1ad, allows reuse of the entire range of 4096 VLAN-IDs on each port. By adding a 12-bit VLAN-ID, called the Service VLAN-ID (S-VID) and associated tags to a customer frame, it is possible to map these customer VLAN-IDs (C-VID) to service instances in a provider's network. Traffic received from different ports on customer VLANs may thus be flexibly mapped to service instances. However, the number of service instances is still limited to 4096, because of the size of an S-VID. To overcome this, Provider Backbone Bridges (PBB) as specified in IEEE 802.1ah, separates the identification of a service instance from forwarding information. Service instance identification is done with a 24-bit identifier called I-SID, whereas forwarding is determined by Backbone MAC address and a Backbone VLAN-ID. To support these capabilities, the entire customer frame is encapsulated within an outer Backbone MAC header that contains Backbone Source/Destination MAC addresses, Backbone VLAN-ID and an I-SID. Consequently, Provider Backbone Bridges can be used to scale up to 16 million service instances in a network.

Using PBB/VPLS to Scale Carrier Ethernet Services

Most network cores today are built based on MPLS. Specifically, by using VPLS, an existing MPLS network can be easily leveraged 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, hierarchical VPLS is often desired by operators to limit the number of PE devices that participate in the full mesh.

Provider Backbone Bridge (PBB) technology can be used 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 radically increases the scalability of the overall solution, since the MPLS PE router is now completely insulated from customer MAC addresses—it maps frames based on the backbone MAC header to a VPLS instance. Figure 1 depicts an example use of Provider Backbone Bridge technology on the Netron CES 2000 Series with VPLS on the Netron XMR/MLX Series to achieve unparalleled scale in service delivery.

MULTICAST SUPPORT

Multicast transport is a key enabler of next-generation services like IPTV. It is also typically a major consumer of capacity in many multiservice networks. It is therefore critical for next-generation edge switches to efficiently handle multicast traffic. The Netron CES 2000 Series has comprehensive support for multicast switching and routing via a variety of protocols including PIM-SM, PIM-DM, PIM-SSM, IGMP v2/v3 and other platform-independent multicast capabilities built in Multi-Service IronWare.

Multicast traffic within the Netron CES 2000 Series is handled with a very high degree of efficiency by avoiding unnecessary replications and conserving bandwidth within the system. By performing Egress interface based replication, switch performance and buffer usage are optimally used within the system thereby maximizing network performance when running multicast traffic.

ROUTING CAPABILITIES

Based on Multi-Service IronWare, the operating system software that successfully powers thousands of NetIron XMR/MLX Series routers deployed around the world, the NetIron CES 2000 Series offers routing capabilities that are commonly required in edge aggregation and other applications within a provider's domain. These include advanced hardware-based routing technology, which ensures secure and robust wire-speed routing performance. Multi-Service IronWare on the NetIron CES 2000 includes support for IPv4 unicast protocols—RIP, OSPF, IS-IS and BGP. Further, to increase overall service availability, the NetIron CES 2000 supports Graceful Restart helper mode for both OSPF and BGP to support hitless management failover and hitless OS upgrades on adjacent modular routers with these functions.

The powerful feature set of the NetIron CES 2000 Series makes it an ideal candidate for applications beyond Carrier Ethernet service delivery. For example, data center networks and edge/aggregation routing within ISP networks often require a compact Layer 3 switch with sufficient scalability in IPv4 routes. The comprehensive support for IPv4 routing protocols, when complemented with VRRP, and VRRP-E makes the NetIron CES 2000 Series ideally suited for such applications.

SECURITY CAPABILITIES

Multi-Service IronWare contains a broad range of proven security capabilities that are also available on the NetIron CES 2000 platform. These include support for both inbound and outbound ACLs, ACL logging, advanced Layer 2 controls such as BPDU guard/root guard, limits for broadcast/unknown unicast/multicast and more. Receive ACLs assist in placing controls on unwanted traffic targeted toward the control plane. Additionally, using 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.

KEY FEATURES

Advanced Carrier-Grade Ethernet services

- Up to 128k MAC addresses
- 4k VLANs/S-VLANs/B-VLANs
- Ability to reuse VLAN-ID on each port using our innovative “Ethernet Service Instance” (ESI) framework
- 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, MSTP
- MEF 9 and MEF 14 certified
- E-LINE (EPL and EVPL), E-LAN and E-TREE support
- Protocol tunneling of customer BPDUs

Comprehensive IPv4 unicast routing support based on the rich feature set of Multi-Service IronWare

- High performance, robust routing via Brocade Direct Routing (FDR) for complete programming of Forwarding Information Base (FIB) in hardware
- RIP, OSPF, IS-IS, BGP-4 support
- Support for VRRP and VRRP-E
- 8-path Equal Cost Multipath (ECMP)
- Up to 32k IPv4 unicast routes in FIB stack-members

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 trunk

Rich multicast support

- Supported IPv4 multicast protocols include PIM-DM, PIM-SM, PIM-SSM
- IGMP v2/v3 routing and snooping support
- IGMP static groups support
- Multicast boundaries facilitate admission control
- Up to 4k multicast groups in hardware
- Multicast traffic distribution over LAGs
- Efficient Egress interface based replication maximizes performance and conserves buffer usage

Deep Egress buffering for handling transient bursts in traffic

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

Advanced Quality of Service

- Inbound and outbound two rate three color traffic policers with accounting
- 8 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

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

Interface capabilities

- Jumbo frame support up to 9,216 bytes
- Optical monitoring of SFP and XFP optics for rapid detection of fiber faults
- UDLD, 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 from 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 2x10G XFP uplinks	24 100/1000 Hybrid Fiber SFP ports with optional slot for 2x10G XFP uplinks	48 10/100/1000 RJ45 ports	48 100/1000 SFP ports	48 10/100/1000 RJ45 ports with 2x10G XFP uplinks	48 100/1000 Hybrid Fiber (HF) SFP ports with 2x10G XFP uplinks
10G Uplinks	Yes (optional slot for 2x10G XFP uplinks)	Yes (optional slot for 2x10G XFP uplinks)	No	No	Yes (built-in)	Yes (built-in)
Combination (Combo) 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 2x10G module installed)	48 Gbps 88 Gbps (with 2x10G module installed)	96 Gbps	96 Gbps	136 Gbps	136 Gbps
Packet Forwarding Performance	36 Mpps 65 Mpps (with 2x10G module installed)	36 Mpps 65 Mpps (with 2x10G module installed)	71 Mpps	71 Mpps	101 Mpps	101 Mpps
Buffering	64 MB 128 MB (with 2x10G uplinks)	64 MB 128 MB (with 2x10G 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
Air Flow	Front to back	Front to back	Front to back	Front to back	Front to back	Front to back

SOFTWARE OPTIONS

In order to optimize the cost of deployment for a provider, the rich software functionality is organized into different packages. The functionality of the NetIron CES 2000 Series switch can be upgraded by purchasing the pertinent license package. The various software packages are organized as follows:

Premium License	Content
BASE	Fundamental Layer 2 and 3 functions: <ul style="list-style-type: none"> • 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: <ul style="list-style-type: none"> • Provider Bridges (IEEE 802.1ad) • Provider Backbone Bridges (IEEE 802.1ah) • OSPF and ISIS • Connectivity Fault Management (IEEE 802.1ag) and Service OAM • Ethernet Service Instance (ESI) framework
L3_PREM (Layer 3 Premium License)	All functions in BASE plus: <ul style="list-style-type: none"> • Full Layer 3 including OSPF, ISIS, BGP

BROCADE NETIRON CES 2000 SERIES POWER SPECIFICATIONS

Configuration	Maximum AC Power Consumption (WATTS) (100 – 240V AC)	Maximum DC Power Consumption (WATTS)	Maximum Thermal Output (BTU / HOUR)
NetIron CES 2024C	120	120	410
NetIron CES 2024C with 2x10G uplink installed	170	170	580
NetIron CES 2024F	145	145	495
NetIron CES 2024F with 2x10G 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	17.44"w x 1.7"h x 17.64"d	44.3w x 4.4h x 44.8d cm
NetIron CES 2024C with 2x10G uplink installed	17.44"w x 1.7"h x 17.64"d	44.3w x 4.4h x 44.8d cm
NetIron CES 2024F	17.44"w x 1.7"h x 17.64"d	44.3w x 4.4h x 44.8d cm
NetIron CES 2024F with 2x10G uplink installed	17.44"w x 1.7"h x 17.64"d	44.3w x 4.4h x 44.8d cm
NetIron CES 2048C	17.44"w x 1.7"h x 17.25"d	44.3w x 4.4h x 43.9d cm
NetIron CES 2048CX	17.44"w x 1.7"h x 17.25"d	44.3w x 4.4h x 43.9d cm
NetIron CES 2048F	17.44"w x 1.7"h x 17.25"d	44.3w x 4.4h x 43.9d cm
NetIron CES 2048FX	17.44"w x 1.7"h x 17.25"d	44.3w x 4.4h x 43.9d 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

RFC Compliance

- | | |
|-------|---|
| BGPv4 | <ul style="list-style-type: none">• RFC 4271 BGPv4• RFC 1745 OSPF Interactions• RFC 1997 Communities & 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 |
| OSPF | <ul style="list-style-type: none">• 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 |

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|-------------------|---|
| IS-IS | <ul style="list-style-type: none">• 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 | <ul style="list-style-type: none">• RFC 1058 RIP v1• RFC 1723 RIP v2• RFC 1812 RIP Requirements |
| IPv4 Multicast | <ul style="list-style-type: none">• RFC 1122 Host Extensions• RFC 1112 IGMP• RFC 2236 IGMP v2• RFC 3376 IGMP v3• RFC 3973 PIM-DM• RFC 2362 PIM-SM |
| General Protocols | <ul style="list-style-type: none">• 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 | <ul style="list-style-type: none">• 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 | <ul style="list-style-type: none">• RFC 1354 IP Forwarding MIB• RFC 2665 Ethernet Interface MIB• RFC 1757 RMON Groups 1,2,3,9• RFC 2068 HTTP• RFC 2030 SNMP• RFC 2865 RADIUS• RFC 3176 sFlow• RFC 2863 Interfaces Group MIB• Draft-ietf-tcpm-tcpsecure TCP Security |

Network Management

- IronView Network Manager (INM) Web-based graphical user interface
- 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%, @40° C (104° F), non-condensing
- Operating Altitude: 10,000 ft (3,048 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 (4,500 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. Supersedes: EN 50082-1
- EN 55024 Immunity Characteristics. 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

Designed to meet the following specifications (formal testing under way):

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

Physical Design and Mounting

- | | |
|---|--|
| 19-inch rack mount supporting racks compliant with: | <ul style="list-style-type: none">• ANSI/EIA-310-D• ETS 300 119• GR-63-CORE Seismic Zone 4 |
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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, 24x1G Copper (RJ45) configuration with 4 combination 100/1000 SFP ports, one optional slot and 1 500W AC Power supply
NI-CES-2024C-DC	NetIron CES 2024C, 24x1G Copper (RJ45) configuration with 4 combination 100/1000 SFP ports, one optional slot and 1 500W DC Power supply
NI-CES-2024F-AC	NetIron CES 2024F, 24x1G Hybrid Fiber (HF) SFP configuration with 4 combination 10/100/1000 RJ45 ports, one optional slot and 1 500W AC Power supply
NI-CES-2024F-DC	NetIron CES 2024F, 24x1G Hybrid Fiber (HF) SFP configuration with 4 combination 10/100/1000 RJ45 ports, one optional slot and 1 500W DC Power supply
NI-CES-2024-2x10G	NetIron CES 2000 Series 2x10G XFP uplink for 24-port NetIron CES 2000 Series switches (both AC and DC models)
NI-CES-2048C-AC	NetIron CES 2048C, 48x1G Copper (RJ45) configuration with 4 combination 100/1000 SFP ports and 1 500W AC Power supply
NI-CES-2048C-DC	NetIron CES 2048C, 48x1G Copper (RJ45) configuration with 4 combination 100/1000 SFP ports and 1 500W D
NI-CES-2048F-AC	NetIron CES 2048F, 48x1G Hybrid Fiber (HF) SFP configuration with 1 500W AC Power supply
NI-CES-2048F-DC	NetIron CES 2048F, 48x1G Hybrid Fiber (HF) SFP configuration with 1 500W DC Power supply
NI-CES-2048CX-AC	NetIron CES 2048CX, 48x1G Copper (RJ45) with 2x10G XFP uplinks configuration and 1 500W AC Power supply
NI-CES-2048CX-DC	NetIron CES 2048CX, 48x1G Copper (RJ45) with 2x10G XFP uplinks configuration and 1 500W DC Power supply
NI-CES-2048FX-AC	NetIron CES 2048FX, 48x1G Hybrid Fiber (HF) with 1 500W AC Power supply and 2x10G XFP uplinks configuration
NI-CES-2048FX-DC	NetIron CES 2048FX, 48x1G Hybrid Fiber (HF) with 1 500W DC Power supply and 2x10G XFP uplinks configuration
NI-CES-2024-MEU	Metro Edge Premium upgrade for NetIron CES 2000 Series 24-port models
NI-CES-2024-L3U	L3 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	L3 Premium upgrade for NetIron CES 2000 Series 48-port models

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