

BROCADE CEE/FCOE SERVER I/O CONSOLIDATION SOLUTIONS



CONVERGED NETWORK

Consolidating Server I/O for a Strategic Advantage

HIGHLIGHTS

- A unified CEE/FCoE solution for server I/O consolidation: server CNAs, top-of-rack FCoE switches, end-of-row FCoE blades, and management software
- Lower acquisition costs (CapEx) and lower operating costs (OpEx) with lower device power consumption resulting in reduced power and cooling costs
- Flexibility for initial deployment as powerful Layer 2 Ethernet top-of-rack switches, with Fibre Channel and FCoE capabilities activated when needed
- A cut-through, non-blocking architecture providing line-rate performance across all 10 Gbps CEE ports on switches and blades
- Industry-leading 8 Gbps Fibre Channel performance on all Fibre Channel products
- Industry-leading CNA performance with up to 500,000 IOPS per port
- The industry's lowest latency for high-performance applications

Organizations that want to leverage the benefits of new Fibre Channel over Ethernet (FCoE) and Converged Enhanced Ethernet (CEE) technologies in their data centers often start by consolidating server ports and the related cabling and switch ports. This type of server I/O consolidation uses FCoE and CEE solutions to connect servers to corporate LANs as well as shared Fibre Channel SAN storage via FCoE switches.

Today, Brocade® leads the industry in delivering forward-thinking solutions that help organizations integrate CEE and FCoE into their current data center environments through a unified management umbrella that supports both existing Fibre Channel infrastructures and new FCoE deployments.

Brocade FCoE and CEE solutions provide unique cost advantages for many areas of data center operations and management, such as:

- **Reduced acquisition costs:** Because converged networks require fewer cables, switch ports (switches), and server

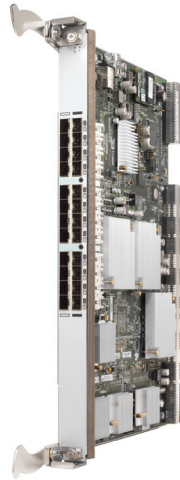
adapters—known as Converged Network Adapters (CNAs)—compared to traditional technologies, acquisition costs are typically lower. These financial savings will be magnified in the future as 10 Gigabit Ethernet (GbE) solutions become more cost-effective.

- **Reduced operating costs:** Fewer hardware components result in lower power consumption and cooling costs—as well as lower maintenance, SKU management, and other asset management expenses.
- **Additional cost savings:** By deploying FCoE solutions that are compatible with existing Fibre Channel infrastructures, organizations can continue using their Fibre Channel management tools—and avoid education and retraining costs. In addition, simpler network configurations, reduced cabling, and fewer management tools combine to help streamline troubleshooting and diagnostics—while reducing the potential for human error.

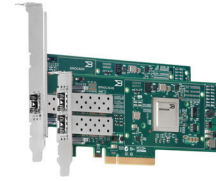
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BENEFITS OF SERVER CONSOLIDATION

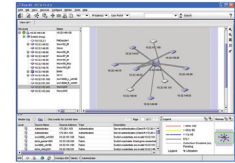
- Lower CapEx
- Fewer adapters, switch ports, and cables
- Simpler configurations and diagnostics
- Lower OpEx
- Lower power consumption and cooling costs



Brocade FCOE10-24 Blade for Brocade DCX Backbone



Brocade 10x0 CNAs



Brocade DCFM Manager



Brocade 8000 Switch

UNIFIED BROCADE CEE/FCoE SOLUTION

By providing forward and backward interoperability in its data center networking solutions, Brocade enables organizations to deploy new technologies at their own pace—leveraging specific capabilities when the time is right. These organizations can begin implementing CEE/FCoE solutions at the server edge for server I/O consolidation while laying the foundation for extended deployments into the data center in the future.

The industry-leading, unified Brocade CEE/FCoE solution provides all the benefits of server I/O consolidation in a high-performance, integrated solution. Key components of this solution include:

- Brocade 8000 Switch for top-of-rack CEE or FCoE deployment
- Brocade 1010/1020 CNAs for server connectivity
- Brocade FCOE10-24 Blade for the Brocade DCX® Backbone (for end-of-row deployment)
- Brocade Data Center Fabric Manager (DCFMTM) for simplified end-to-end management

TOP-OF-RACK DEPLOYMENT: BROCADE 8000 SWITCH

The Brocade 8000 Switch is a Layer 2, 32-port, 1U form factor top-of-rack switch with:

- Twenty-four 10 GbE CEE ports (see Figure 1) that support FCoE and provide line-rate, low-latency, lossless, deterministic connectivity based on Brocade 10 Gbps cut-through and non-blocking switching technology
- Eight 8 Gbps Fibre Channel ports with auto-sensing for 1, 2, 4, and 8 Gbps speeds

The Brocade 8000 provides flexible migration and deployment options with a CEE-only model that can be used as a top-of-rack switch for 10 GbE connectivity. This particular configuration provides a building block for future migration to FCoE. When the time is right, organizations simply

enable the Fibre Channel ports and FCoE capabilities via an upgrade license to support converged server I/O.

The top-of-rack Brocade 8000 connects to server CNAs in server racks through CEE ports and connects to the storage infrastructure over the Fibre Channel ports. The CNAs encapsulate the Fibre Channel traffic destined for the storage networks as FCoE, and the IP traffic flows as 10 GbE frames to the 24 CEE ports on the Brocade 8000. The switch then forwards traditional Ethernet-based IP traffic from the CEE ports onto the LAN, and the Fibre Channel data in Fibre Channel frames over the Fibre Channel ports to the SAN (see Figures 2 and 3).

End of Row: Brocade FCOE10-24 Blade

Organizations that want to implement FCoE and CEE capabilities in the core of their SAN environments can utilize the Brocade FCOE10-24 Blades in conjunction with the Brocade DCX Backbone family (see Figure 4).



CEE Ports

Fibre Channel Ports

Figure 1.

Brocade 8000 Switch port-side view with CEE (black) and Fibre Channel (red) ports.

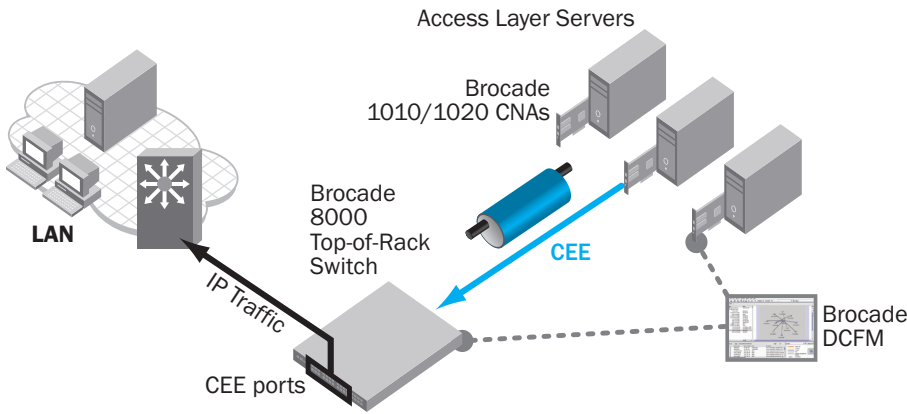


Figure 2.
Brocade 8000 Switch in an Ethernet environment.

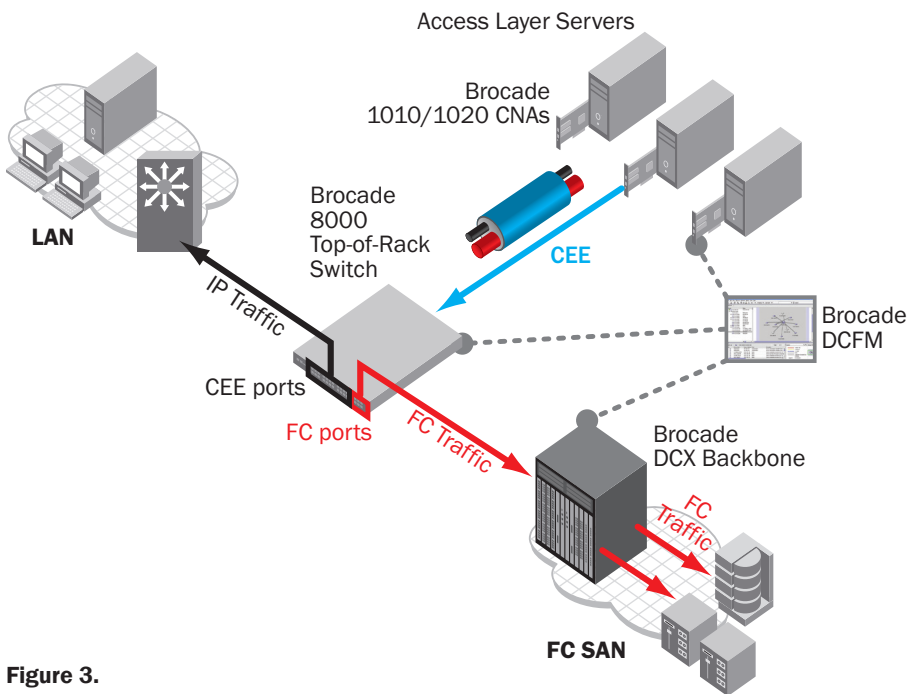


Figure 3.
Brocade 8000 Switch in a top-of-rack server I/O environment.

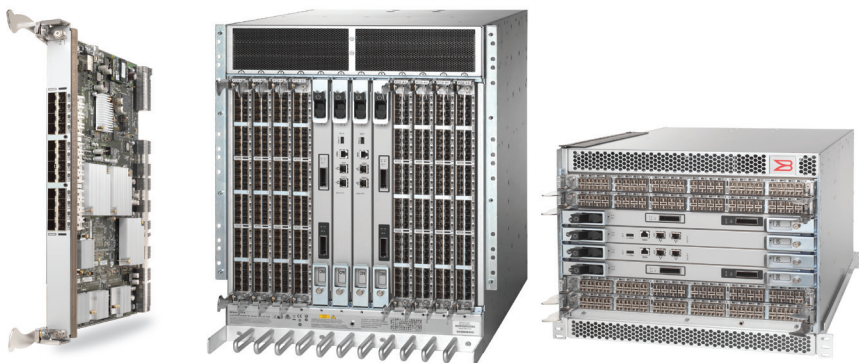


Figure 4.
Brocade FCOE10-24 Blade for the Brocade DCX Backbone family.

The Brocade FCOE10-24 is a resilient, hot-pluggable CEE/FCoE blade for end-of-row deployment (see Figure 5). It features 24 10 Gbps CEE ports with a Layer 2 cut-through and non-blocking architecture that provides wire-speed performance for both traditional Ethernet and CEE traffic.

The FCOE10-24 also features a high-performance T11 FCoE hardware engine (Encap/Decap), and can utilize 8 Gbps Fibre Channel ports on other Brocade DCX blades to integrate seamlessly into existing Fibre Channel SANs and management infrastructures.

**SERVER CONNECTIVITY:
BROCADE 1010/1020
CONVERGED NETWORK ADAPTERS**

The Brocade 1010 (single port) and Brocade 1020 (dual port) CNAs consolidate connectivity for networking and Fibre Channel-based storage I/O consolidation using FCoE and CEE. By offering a single adapter to replace the dedicated Fibre Channel HBAs and Ethernet NICs in a data center server, the Brocade 1010/1020 CNAs reduce both capital and operational expenses—while simplifying management through Brocade DCFM.

The Brocade 1010 and 1020 CNAs provide the industry's highest levels of IOPS per port: up to 500,000. In addition to that, these CNAs provide the industry's highest sustained FCoE throughput performance, making them ideal for highly demanding storage and transaction-intensive applications. In addition, they draw low amounts of energy, helping to keep servers running efficiently.

Brocade CNAs support open industry standards such as T11 FCoE, FIP, and IEEE Data Center Bridging (DCB) capabilities, including Priority-based Flow Control (PFC 802.1Qbb) and Enhanced Transmission Selection (ETS 802.1Qaz). As a result, they are designed to provide a smooth transition of CEE/FCoE into existing data center infrastructures.

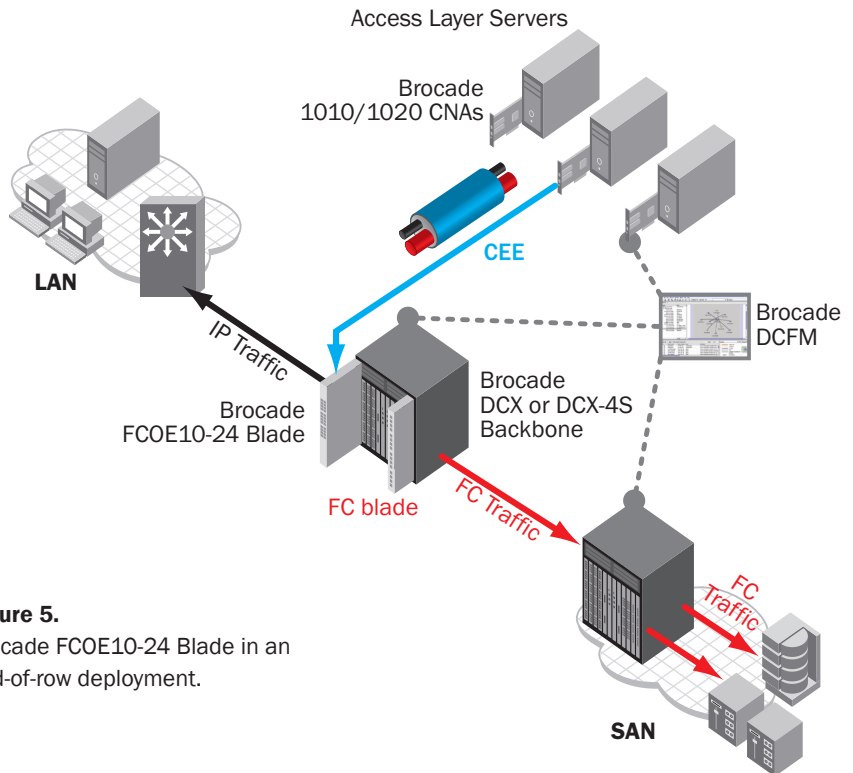


Figure 5. Brocade FCOE10-24 Blade in an end-of-row deployment.

DATA CENTER FABRIC MANAGEMENT

Brocade DCFM is a unified management application for existing Fibre Channel SAN resources and new CEE/FCoE resources. In addition to providing a common management interface for the Brocade 1010/1020 CNAs, the Brocade 8000 Switch, and the Brocade FCOE10-24 Blade, it manages the Brocade DCX platforms and other Fibre Channel SAN resources.

Taking advantage of role-based management, organizations can assign specific tasks to storage administrators or networking administrators, depending on their unique skills or responsibilities. Organizations can also utilize Brocade DCFM to develop common networking and storage skill sets that they might need in their particular environments.

Brocade DCFM is designed to manage entire data center fabrics, from the storage ports to the HBAs and CNAs, both physical and virtual. Moreover, Brocade DCFM tightly integrates with Brocade Fabric OS® (FOS)

to leverage key features such as Advanced Performance Monitoring, Fabric Watch, and Adaptive Networking services. As part of a common management ecosystem, Brocade DCFM also integrates with leading partner data center automation solutions through frameworks such as the Storage Management Initiative-Specification (SMI-S).

DEPLOYMENT FLEXIBILITY

Organizations can begin utilizing the Brocade 8000 10 GbE CEE and Layer 2 Ethernet capabilities today, even if they are not yet ready to introduce FCoE into their data centers. In the CEE-only configuration, the Brocade 8000 provides broad, standards-based Data Link Layer (Layer 2) capabilities covering Quality of Service (QoS), security, and Layer 2 protocols. The 24 CEE ports provide uplink connections to conventional 10 GbE port aggregation layer Ethernet switches (Brocade or third-party devices). All Layer 2 functions are configured and administered accordingly at the access layer.

When organizations are ready to upgrade to CEE/FCoE, they can obtain an optional upgrade license that activates the Fibre Channel ports and the FCoE hardware engine, providing a seamless path to server I/O consolidation.

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.

BROCADE 8000 AND BROCADE FCOE10-24 SPECIFICATIONS

System Architecture	Brocade 8000 Switch	Brocade FCOE10-24 Blade
Deployment options	Brocade 8000 with 24 CEE ports, eight Fibre Channel ports, and FCoE support enabled (includes 8 Gbps Fibre Channel SFP+) Brocade 8000 with only 24 CEE ports enabled (requires optional licenses to enable Fibre Channel and FCoE support)	Brocade FCOE10-24 with 24 CEE ports enabled
CEE ports	24 ports with 10 GbE line speed	Same as Brocade 8000
Fibre Channel ports	Eight Fibre Channel universal (E, F, M, and FL) ports with 1, 2, 4, and 8 Gbps full duplex	N/A
Maximum frame size	2112-byte Fibre Channel payload 9048-byte Ethernet frame	9048-byte Ethernet frame for CEE ports
Data traffic types	Fabric switches supporting unicast, multicast (255 groups), and broadcast	Same as Brocade 8000
MAC address table entries	32,000 MAC addresses	Same as Brocade 8000
USB	One USB port for firmware download, support save, and configuration upload/download	N/A
Media types	Fibre Channel media type: Hot-pluggable, industry-standard Small Form Factor Pluggable (SFP) and SFP+, LC connector; Short-Wave Laser (SWL) and Long-Wave Laser (LWL); distance depends on fiber-optic cable and port speed; supports SFP+ (2, 4, and 8 Gbps) and SFP (1, 2, and 4 Gbps) optical transceivers CEE media type: Hot-pluggable, Brocade 10 GbE SFP+ supports any combination of Short-Reach (SR) and Long-Reach (LR) optical transceivers; Brocade copper Twinax cables of one, three, or five meters	CEE media: Hot-pluggable, Brocade 10 GbE SFP+ supports any combination of Short-Reach (SR) and Long-Reach (LR) optical transceivers
CEE features	Priority-based Flow Control (PFC): IEEE 802.1Qbb Enhanced Transmission Selection (ETS): IEEE 802.1Qaz Data Center Bridging eXchange (DCBX)	Same as Brocade 8000
Data link layer (Layer 2) features	Layer 2 Virtual Local Area Networks (VLANs): 4096 VLAN Encapsulation 802.1Q Rapid Spanning Tree Protocol (RSTP) Multiple Spanning Tree MSTP (802.1s): 16 instances STP PortFast and PortFast Guard STP Root Guard Link Aggregation Control Protocol (LACP) IEEE- 802.3ad Brocade enhanced frame-based trunking Advanced PortChannel hashing based on Layer 2, 3, and 4 information Pause Frames (802.3x) Storm Control (unicast, multicast, and broadcast) Address Resolution Protocol (ARP) RFC 826	Same as Brocade 8000
Layer 2 security	Ingress Access Control Lists (ACLs) Standard and extended Layer 2 ACLs VLAN-based ACLs (VACLs) Port-based ACLs (PACLs) Named ACLs ACL statistics Optimized ACL distribution Port-based Network Access Control: IEEE 802.1X	Same as Brocade 8000
Layer 2 Quality of Service (QoS)	Eight priority levels for QoS IEEE 802.1p Class of Service (CoS) Eight hardware queues per port Per-port QoS configuration CoS trust: IEEE 802.1p Modular QoS CLI (MQC) compliance Per-port Virtual Output Queuing CoS-based egress queuing Egress strict priority queuing Egress port-based scheduling: Weighted Round-Robin (WRR)	Same as Brocade 8000

BROCADE 8000 AND BROCADE FCOE10-24 SPECIFICATIONS (CONT.)

System Architecture	Brocade 8000 Switch	Brocade FCOE10-24 Blade
ISL Trunking	Frame-based ISL Trunking (optional license) enables up to eight ports between a pair of switches to be combined into a logical ISL with speeds of up to 64 Gbps (128 Gbps full duplex) for optimal bandwidth utilization and load balancing; exchange-based load balancing across ISLs with DPS (included in Fabric OS)	Same as Brocade 8000
Fibre Channel port types	FL_Port, F_Port, M_Port (Mirror Port), E_Port; self-discovery based on switch type (U_Port); optional port type control	N/A
Fibre Channel classes of service	Class 2, Class 3, Class F (inter-switch frames)	N/A
Fibre Channel fabric services	Simple Name Server (SNS), Registered State Change Notification (RSCN), NTP, RADIUS, LDAP, Reliable Commit Service (RCS), Dynamic Path Selection (DPS), Enhanced Group Management (EGM), and Web Tools; optional fabric services include Fabric Watch, ISL Trunking, and Advanced Performance Monitoring	N/A
CEE services	Spanning Tree Protocol (STP, MSTP, RSTP), VLAN Tagging (802.1q), MAC address learning and aging; native FCoE switching; IEEE 802.3ad Link Aggregation (LACP); ACLs based on VLAN, source, destination address, and port; eight priority levels for QoS and approximately 4000 VLANs; Priority-based Flow Control (PFC); Data Center Bridging eXchange (DCBX)-Capabilities Exchange; Enhanced Transmission Selection (ETS)	Same as Brocade 8000
Management software	<p>Brocade Data Center Fabric Manager (DCFM) Professional, DCFM Professional Plus, and DCFM Enterprise:</p> <ul style="list-style-type: none"> • DCFM uses HTTP/HTTPS and SNMP protocols to communicate with the Brocade 8000 to manage and monitor CEE features • DCFM enhancements support the following FCoE/CEE functionality: <ul style="list-style-type: none"> – Discovery, connectivity map, and product list – Configuration management – Performance management – Fault management – Security management <p>HTTP/HTTPS, Telnet; SNMP (FE MIB, FC Management MIB, and IF-MIB for CEE); Web Tools; SMI-S; RADIUS</p>	Same as Brocade 8000
Management protocols	<p>Industry-common Command Line Interface (CLI)</p> <p>Security Shell (SSH) v2</p> <p>Authentication, Authorization, and Accounting (AAA)</p> <p>Simple Network Management Protocol (SNMP) v1, v2, and v3</p> <p>Unified username and passwords across CLI and SNMP</p> <p>Syslog</p> <p>Microsoft Challenge Handshake Authentication Protocol (CHAP)</p> <p>Remote Monitoring (RMON)</p> <p>Per-port ingress and egress counters</p> <p>Role-Based Access Control (RBAC)</p> <p>Power-On Self-Test (POST)</p> <p>Comprehensive bootup diagnostics</p>	Same as Brocade 8000
Management access	One 10/100/1000 Megabit Ethernet, in-band over Fibre Channel, one serial port, and one USB port	Via Brocade DCX platform management
Diagnostics	POST and embedded online/offline diagnostics, including FCping and Pathinfo (FCtracroute)	Power-On Self-Test (POST): Tests are port blade-oriented to ensure that the switch is ready for use. Testing is performed on physical ports.

Mechanical	Brocade 8000 Switch	Brocade FCOE10-24 Blade
Enclosure	Non-port to port side airflow; 1U, 19-inch EIA-compliant, power from non-port side	N/A
Size	Width: 42.9 cm (16.9 in) Height: 4.3 cm (1.7 in) Depth: 63.4 cm (25.0 in)	Width: 27.9 cm (11.0 in) Height: 41.2 cm (16.2 in) Thickness: 3.6 cm (1.4 in)
System weight	13.0 kg (28.6 lb) with two power supply FRUs, without transceivers	N/A
Environmental	Brocade 8000 Switch	Brocade FCOE10-24 Blade
Temperature	Operating: 0°C to 40°C (32°F to 104°F) Non-operating: -25°C to 70°C (-13°F to 158°F)	Same as Brocade 8000
Humidity	Operating: 10% to 85% non-condensing Non-operating: 10% to 90% non-condensing	Same as Brocade 8000
Altitude	Operating: Up to 3000 meters (9842 feet) Storage: Up to 12 kilometers (39,370 feet)	Same as Brocade 8000
Shock	Operating: 20 g, 6 ms half-sine Non-operating: Half-sine, 33 g 11 ms, 3/eg Axis	Same as Brocade 8000
Vibration	Operating: 0.5 g sine, 0.4 grms random, 5 to 500 Hz Non-operating: 2.0 g sine, 1.1 grms random, 5 to 500 Hz	Same as Brocade 8000
CO ₂ emissions	335 kg per year (with 40 ports at 0.42 kg/kWh) 1.05 kg per Gbps per year	N/A
Airflow	Maximum: 42 CFM Nominal (65% speed): 35 CFM	N/A
Heat dissipation	32 ports: 1044 BTU/hr	N/A
Power	Maximum: 350 watts Consumption: 306 watts	Nominal: 250 watts
Input voltage	85 to 264 VAC nominal	40 to 50 VAC nominal
Input line frequency	47 to 63 Hz	Same as Brocade 8000
Inrush current	60 amps maximum	Same as Brocade 8000
Maximum current	29 amps at 12V DC	Same as Brocade 8000

BROCADE 1010/1020 CNA SPECIFICATIONS

Host specifications		Physical specifications	
Server platform	Intel (IA32, IEM64T), AMD (x86, 64), and Sun (x86, SPARC)	Transceivers	10 Gbps SFP+
Server chip set	Intel, nVidia, ServerWorks/Broadcom, AMD/ATI, and SPARC	Form factor	Low-profile MD2 form factor PCI Express Card; 16.77 cm × 6.89 cm (6.60 in × 2.71 in)
Bus interface	PCI Express Gen 2.0 Compatible (x8) with MSI-X and INTx	Bracket size	Standard/full height: 1.84 cm × 12.08 cm (.73 in × 4.76 in) Low profile: 1.84 cm × 8.01 cm (.73 in × 3.15 in)
FCoE specifications		Distance support	Up to 300 meters at 10 Gbps on multimode fiber Up to five meters at 10 Gbps over Twinax cable
Protocols	FC-SP, FC-LS, FC-GS, FC-FS2, FC-FDMI, FC-CT, FCP, FCP-2, FCP-3, FC-BB-5	Environment and power requirements	
Performance	Up to 500,000 IOPS per port	Airflow	45 Linear Feet/Minute (LFM)
Logins	Support for 2048 logins and 4096 exchanges	Temperature	Operating: 0° C/32° F to 50° C/122° F (dry bulb) Non-operating: -43° C/-40° F to 73° C/163° F (dry bulb)
Class of service	Class 3 and Class 2 control frames supported	Humidity	Operating: 5% to 93% (relative, non-condensing) Non-operating: 5% to 95% (relative, non-condensing)
Ethernet specifications		Power dissipation	8.5 W (typical)
CEE support	Same as Brocade 8000	Operating voltage	3.3 V
Performance	10 Gbps full-duplex line rate	Agency approvals	
Frame sizes	9600 jumbo frames and mini-jumbo frames supported	United States	CSA 60950-1-03 First Ed; ANSI C63.4; cCSAus; FCC Class B
Ethernet standards compliance	802.3ae, 802.1P/Q, 802.3x, 802.3ad	Canada	UL60950-1, First Ed; ICES-003 Class B; cCSAus
Stateless offload	IPv4/IPv6, TCP, and UDP checksum offload; IPv4 header checksum offload; TCP Segmentation Offload (TSO); Receive Side Scaling (RSS); Header Data Split (HDS); VLAN insertion/stripping and VLAN filtering	Japan	CISPR22 Class B and JEIDA (Harmonics); VCCI-B
		European Union	EN60950-1; EN55022 Class B and EN55024; TÜVBauart, CE Mark
Software		Australia, New Zealand	EN55022 and CISPR22 Class B or AS/NZS; CISPR22; C-Tick
Driver- and Brocade Host Connectivity Manager (HCM)-supported operating systems	Windows Server 2008; Windows Server 2003; RHEL 4/5; SLES 9/10/11; Solaris 10 (x86 and SPARC); and VMware ESX 3.5	Russia	IEC60950-1; 51318.22-99 and .24-99; GOST Mark
Brocade DCFM support	Yes	Korea	KN22 and KN24; KCC Mark Class B
Management APIs	SNIA HBA API v2.0, SMI-S, and FDMI-1	Taiwan	CNS 14336(94); CNS 13438(95) Class A; BSMI Mark
		Warranty and support	
		Three years Advanced Replacement, standard Three years 24×7×365 live support, standard	

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For information about hardware regulatory compliance, visit www.brocade.com/regulatorycompliance

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Corporate Headquarters

San Jose, CA USA
T: +1-408-333-8000
info@brocade.com

European Headquarters

Geneva, Switzerland
T: +41-22-799-56-40
emea-info@brocade.com

Asia Pacific Headquarters

Singapore
T: +65-6538-4700
apac-info@brocade.com

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