

BROCADE TURBOIRON 24X SWITCH



DATA CENTER

A Powerful Top-of-Rack Switch for Data Center and High-Performance Computing

HIGHLIGHTS

- A 1U, high-density top-of-rack data center switch for 10 GbE server access and aggregation with 24 10 GbE SFP+/1 GbE SFP dual-speed ports and four 1 GbE RJ45 ports
- A cost-effective 10 GbE platform for collapsed aggregation and core in midsize to large branch offices
- Flexibility to mix 10 GbE and 1 GbE servers, protecting investments and streamlining migration to 10 GbE-capable server farms
- Wire-speed performance with an ultra-low-latency, cut-through, non-blocking architecture ideal for HPC, iSCSI storage, real-time application environments
- Highly efficient power and cooling with front-to-back airflow, automatic fan speed adjustment, and use of SFP+ and direct attached SFP+ copper (Twinax)
- High availability with redundant, load-sharing, hot-swappable, auto-sensing/switching power supplies and triple-fan assembly
- End-to-end QoS with hardware-based marking, queuing, and congestion management
- Embedded per-port sFlow capabilities to support scalable traffic monitoring
- Protected by the Brocade Assurance™ Limited Lifetime Warranty for as long as the original purchaser continues to own and use the product

Today's data centers are expanding as demand for data and storage continues to grow exponentially. Moreover, requirements such as application convergence, non-stop operation, scalability, high availability, and power efficiency are placing even greater demands on the network infrastructure. To meet this challenge, today's data center network solutions must provide a broad set of capabilities—including higher levels of performance, reliability, security, and Quality of Service (QoS)—as well as low Total Cost of Ownership (TCO).

Specifically designed for data centers, the Brocade® Turbolron® 24X Switch is a compact, high-performance, high-availability, and high-density 10 Gigabit

Ethernet (GbE) solution that meets mission-critical data center and High-Performance Computing (HPC) requirements. With an ultra-low-latency, cut-through, non-blocking architecture, the Brocade Turbolron 24X provides a cost-effective solution for server or compute-node connectivity.

The Turbolron 24X can support 1 GbE servers until they are upgraded to 10 GbE-capable Network Interface Cards (NICs), simplifying migration to 10 GbE server farms. In addition, the Turbolron 24X can provide 10 GbE aggregation behind 1 GbE access switches such as Brocade FCX. Either way, the Turbolron 24X is designed to save valuable rack space, power, and cooling in the data center while delivering 24×7 service through its high-availability design.



BROCADE

LEADING-EDGE FLEXIBILITY AND RELIABILITY

The Turbolron 24X provides a highly flexible data center solution that offers the highest levels of reliability.

Flexible Data Center Deployment and Future-Proofing

The Turbolron 24X is a high-density 10 GbE solution for direct server or compute-node connectivity in data center and HPC cluster environments. Each dual-speed port on the Turbolron 24X can function as a 1 GbE port by plugging in a Small Form-Factor Pluggable (SFP), making it a flexible solution for environments where some servers have not yet been upgraded to 10 GbE-capable NICs.

When organizations upgrade a server's NICs to 10 GbE, they only need to replace the SFP optics with SFP+ optics or direct attached SFP+ copper (Twinax). This approach protects Ethernet-based investments and streamlines migration to 10 GbE. In data center environments where all servers are 1 GbE-capable, organizations can deploy the Turbolron 24X as a compact and cost-effective 10 GbE aggregation switch—moving it to the front layer when servers are ready for the 10 GbE upgrade.

The Turbolron 24X also includes four 1 GbE copper RJ45 ports for server connectivity or separate management network connectivity. The high density of dual-speed ports in a 1U space enables organizations to design highly flexible and cost-effective networks. In addition, organizations can utilize various combinations of short-range and long-range transceivers for a variety of connectivity options.

Increased Reliability through Redundancy and Intelligence

The Turbolron 24X includes internal power redundancy features, which are usually available only in a modular chassis form factor. Every Turbolron 24X has a single AC power supply, but organizations can

add another AC power supply for 1+1 redundancy. The AC power supplies are hot swappable and load sharing with auto-sensing and auto-switching capabilities, which are critical for power redundancy and deployment flexibility (see Figure 1).

The hot-swappable power supplies and fan assembly enable organizations to replace components without service disruption. In addition, several high-availability and fault-detection features help in failover of critical data flows, enhancing overall system availability and reliability. Organizations can use Brocade IronView® Network Manager (INM) and sFlow-based network monitoring and trending to proactively monitor risk areas and optimize network resources to avoid many network issues altogether.

The Brocade Virtual Switch Redundancy Protocol (VSRP) provides redundancy and sub-second failover for Layer 2 and Layer 3 mesh topologies, while the Metro Ring Protocol (MRP)-I and MRP-II prevent Layer 2 loops and faster re-convergence than Spanning Tree Protocol (STP) with sub-second failover in a ring topology.

GREENER DATA CENTERS WITH LOWER TCO

As application data and storage requirements continue to rise exponentially, demand for higher port density and bandwidth grows, as do the number of network devices and power consumption. Organizations looking to reduce TCO need solutions with higher scalability and density per rack unit that consume less power and dissipate less heat.

The Turbolron 24X addresses those needs with a state-of-the-art ASIC, front-to-back airflow, automatic fan speed control, and power-efficient optics to ensure the most efficient use of power and cooling. For low-cost, low-latency (0.25 µs), and low-energy-consuming (0.1 watts) cabling within and between the racks, the Turbolron

24X supports direct attached SFP+ copper (Twinax) cabling at up to 10 meters. For switch-to-switch connectivity, the Turbolron 24X supports low-power-consuming (1.0 watts) SFP+ optics at up to 300 meters. In high-port-density deployments, these features save significant operating costs.

SUPERIOR ROI AND INVESTMENT PROTECTION

The Turbolron 24X combines strategic performance, availability, and scalability advantages with investment protection for existing LAN environments. It utilizes the same Brocade IronWare® operating system used by other Brocade Ethernet/IP products. This helps ensure full forward and backward compatibility among the product family while simplifying software maintenance and field upgrades.

Moreover, the use of the same industry-standard Command Line Interface (CLI) eliminates the need for staff retraining. As a result, the Turbolron 24X enables organizations to better leverage their current training, tools, devices, and processes.

Brocade enables organizations to further maximize their investments by not requiring additional licensing fees for Layer 3 features.*

SIMPLIFIED, STANDARDS-BASED MANAGEMENT

Although deploying more switches in a data center infrastructure can increase overall network performance, it often inhibits the ability to receive a complete view of network capacity, bandwidth consumption, utilization, and overall health.

To overcome this challenge, the Turbolron 24X utilizes sFlow, a unique solution that helps simplify network management and monitoring. The Turbolron 24X uses sFlow to provide real-time network visibility so organizations can more effectively manage the transactions flowing throughout the network. This approach enables organizations to leverage a wide range of management, monitoring, and trending utilities. Brocade INM can manage all Brocade data center Ethernet/IP switches,



Figure 1.

The Turbolron 24X features hot-swappable power supplies and a triple-fan unit.

*Brocade reserves the right to charge for Layer 3 licenses in the future.

including the Brocade Turbolron, FastIron®, BigIron®, ServerIron®, and Brocade MLX Series of switches and routers.

The Turbolron 24X also supports the IEEE 802.1AB LLDP standard, enabling organizations to build open, converged, and advanced multivendor networks. LLDP greatly simplifies and enhances network management, asset management, and network troubleshooting.

With the resulting insight, organizations can quickly and accurately review overall data center operations, identify hot spots, and quickly diagnose and troubleshoot issues before they develop into widespread problems. The Turbolron 24X provides accurate SNMP/RMON statistics to Brocade INM, reducing the administrative burden normally associated with proactive network management, design, and capacity planning.

PURPOSE-BUILT FEATURE SET

The Turbolron 24X combines a wide range of unique features to help organizations overcome the most challenging business requirements.

Industry-Leading Advanced Layer 2 and Layer 3 Features

To provide self-healing topologies in Layer 2 configurations, the Turbolron 24X supports industry-standard Ethernet protocols, including multiple varieties of STP and link aggregation as well as optic-, link-, and switch-level fault detection and correction features. The advanced Layer 2 and Layer 3 feature set is leveraged from FastIron switches that have been field-proven in enterprise and data center networks for more than a decade. With rich Layer 3 features enabled, organizations can utilize the Turbolron 24X in several environments.

Data Protection through Robust Security

Security is a critical requirement in today's data centers and branch offices, and the Turbolron 24X provides robust security through a wide range of advanced features. Organizations can use both regular and extended Access Control Lists (ACLs) to control access to and through data center networks.

Organizations can use control policies that permit or deny traffic based on a wide variety of identification characteristics—such as source/destination MAC addresses, source/destination IP addresses, TCP/UDP ports/sockets, and well-known port numbers—further protecting and restricting network access. In addition, for maximum security the Turbolron 24X also leverages Dot1x security, MAC authentication, port MAC security, and MAC filter enhancements.

The Turbolron 24X implements ACL lookups at the hardware level, so security does not adversely affect switching performance. In addition, the Turbolron 24X provides hardware-based protection against Distributed Denial of Service (DDoS) attacks (ICMP flood and TCP SYN) as well as hardware-based Private VLAN attacks—with no impact on CPU utilization. Also, BPDU Guard and Root Guard prevent rogue hijacking of the spanning tree root and maintain a contention—and loop-free environment, especially during dynamic network deployments.

Advanced QoS to Improve Data Traffic Integrity

The Turbolron 24X offers superior QoS features designed to ensure high-reliability services throughout the data center. The Turbolron 24X can identify, mark, classify, reclassify, and manage traffic based on specific criteria. This enables organizations to classify bandwidth-critical application traffic, discriminating among various traffic flows and enforcing bandwidth policies.

After the traffic is classified, organizations have complete control over the method the system uses to service the queues: Weighted Round Robin (WRR), Strict Priority (SP), or a mix of both. For granular control to regulate bandwidth utilization, the Turbolron 24X can also perform ingress rate limiting and egress rate shaping.

Multicast-Based Applications

The use of video, financial, and other one-to-many applications requires support for scalable multicast services. The Turbolron 24X supports IGMPv1/2/3, PIM-SM, PIM-DM, MSDP, Anycast RP, and PIM Snooping for optimized multicast forwarding. In addition, the Turbolron 24X provides storm control features to contain and intelligently switch rather than broadcast multicast traffic.

KEY SOLUTION AREAS

The Turbolron 24X provides a high-performance, cost-effective solution for many types of data center and midmarket environments, including top-of-rack server connectivity, 10 GbE aggregation, iSCSI storage, and HPC environments.

Data Center Top-of-Rack Server Connectivity

The Turbolron 24X is designed to fit in server racks, and it consumes only one rack unit. To simplify cabling, the 10 GbE NICs in the servers connect to the Turbolron 24X 10 GbE ports by using SFP+ or direct attached SFP+ copper (see Figure 2).

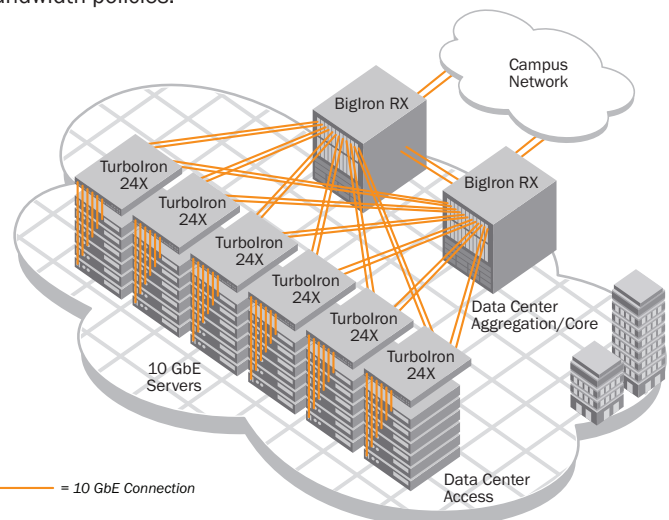


Figure 2.

The Turbolron 24X provides data center top-of-rack access while the Brocade BigIron RX or Brocade MLX Series provides an aggregation solution.

If any servers in the rack have only 1 GbE-capable NICs, organizations can connect them to the same Turbolron 24X by using a 10 GbE port as a 1 GbE port through an SFP. Some of the 10 GbE ports on the Turbolron 24X can connect to the data center middle-of-row/end-of-row aggregation chassis, usually through link aggregation.

Cost-Effective 10 GbE Aggregation

In data center environments where most servers are 1 GbE-capable, the Turbolron 24X provides a compact and cost-effective 10 GbE aggregation switch. It connects to the data center core through wire-speed 10 GbE while Brocade FCX or NetIron CES 1 GbE top-of-rack switches connect the 1 GbE servers through 10 GbE uplinks to the Turbolron 24X (see Figure 3).

High-Performance Cluster Computing Connectivity

HPC cluster connectivity has entered the mainstream marketplace with Ethernet switching as the technology of choice. Ultra-low-latency and high-density Ethernet switching are required for successful deployment, making the Turbolron 24X ideal for this type of environment.

The high performance, density, and reliability of the Turbolron 24X are designed for the most demanding HPC environments. In environments where high-speed inter-cluster connectivity is required over distance, organizations can use Brocade Metro-Ring Protocol (MRP)-supporting devices (such as the Brocade FastIron, NetIron, and BigIron offerings) in conjunction with the Turbolron 24X to provide dual-ring, fault-tolerant connectivity (see Figure 4).

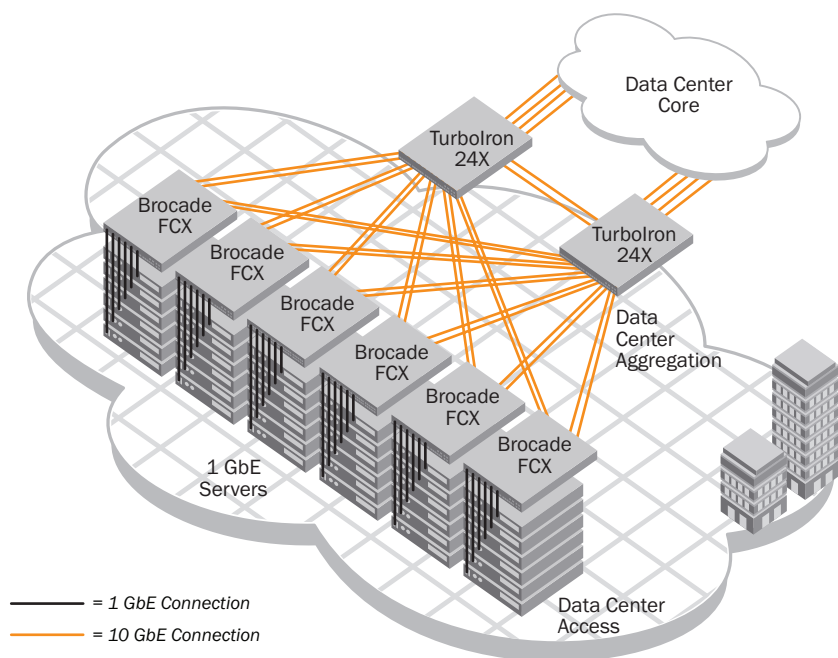


Figure 3.

The Turbolron 24X provides data center aggregation with the Brocade FCX offerings providing top-of-rack access.

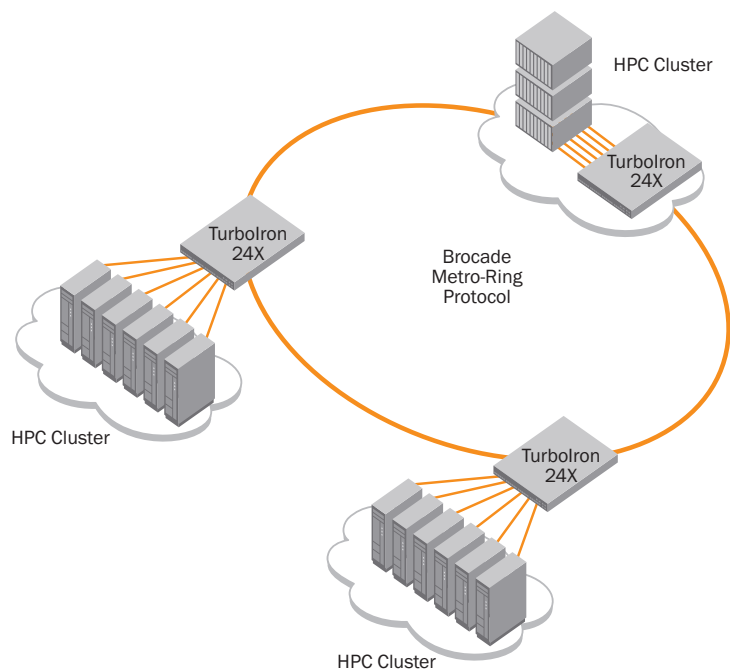


Figure 4.

The Turbolron 24X provides HPC cluster interconnectivity based on Brocade MRP.

Midmarket Collapsed Aggregation and Core Layer Deployment

In midsize to large branch offices, the aggregation and core may be collapsed due to a smaller number of connections from user access edge and uplinks. The need for a cost-effective, high-density 10 GbE platform becomes imperative. The Turbolron 24X provides the necessary advanced Layer 2 and Layer 3 features to be deployed in such networks (see Figure 5).

Cost-Effective Co-Located Financial Services

Brokerage firms, trading partners, and financial service providers use co-located data centers as a way to connect and exchange data. The Turbolron 24X acts as a border gateway for these data centers to efficiently and cost-effectively exchange BGP routes between sites using 1/10 GbE connectivity (see Figure 6).

10 GbE Server Connectivity with Brocade 1010 and 1020 CNAs/NICs

The Brocade 1010 and 1020 CNAs/NICs offer enterprise-class 10 GbE connectivity with industry-leading price, performance, and features. They offer stateless networking protocol offloads such as IPv4/

IPv6/UDP/TCP checksum offload, TCP Segmentation Offload (TSO), Large Receive Offload (LRO), Receive Side Scaling (RSS), and Header Data Split (HDS), making them ideal for high-performance applications, including iSCSI. In addition, they support Virtual Machine Optimized Ports (VMOP), a feature that provides hypervisor offload in virtual environments for greater Ethernet performance and lower CPU utilization. The Brocade 1010 and 1020 CNAs/NICs provide Data Center Bridging (DCB) support and full Fibre Channel over Ethernet (FCoE) protocol offload, offering the highest levels of investment protection. Also, the same management tool (future release) is used for configuring the CNAs/NICs and the Turbolron 24X for reduced operational costs.

BROCADE GLOBAL SERVICES

To help organizations get the most value from their technology investments, Brocade Global Services offers a variety of services with comprehensive hardware and 24x7 software support, including software fixes and new releases. Organizations can also

utilize Brocade Professional Services to assess, design, implement, and validate the functionality of Brocade products. Leveraging the Brocade Network Monitoring Service (NMS), organizations can maximize the availability and performance of their critical application environments while reducing infrastructure cost and complexity.

WARRANTY

The Turbolron 24X is covered by the Brocade Assurance™ Limited Lifetime Warranty for as long as the original purchaser continues to own and use the product. The warranty covers the product hardware, including internal power supplies and internal fans, as well as software defect repairs. To streamline the product replacement process, qualified customers can directly access the Brocade Knowledge Portal to initiate advanced replacement on registered products.

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.

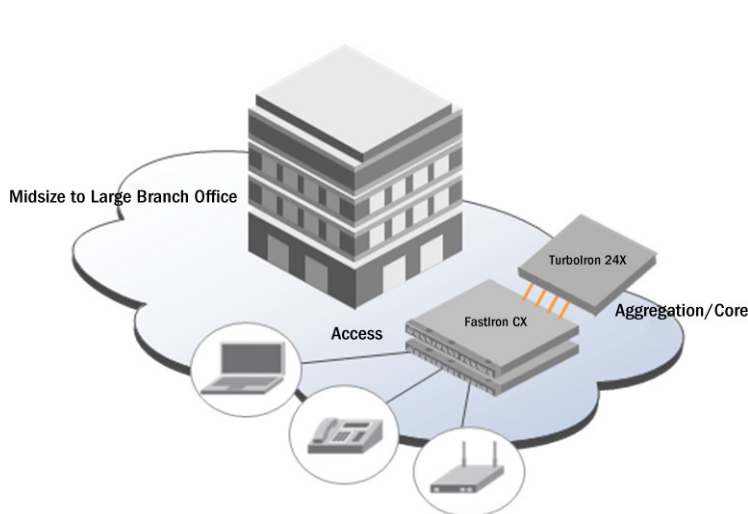


Figure 5.

The Turbolron 24X provides collapsed aggregation and core for midmarket networks, and the Brocade FastIron CX provides access to users.

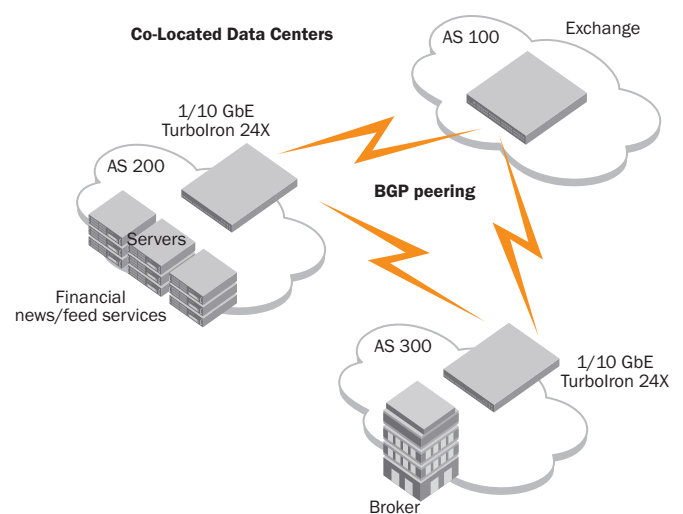


Figure 6.

Turbolron 24X acts as a border gateway to efficiently and cost-effectively exchange BGP routes between sites using 1/10 GbE connectivity.

BROCADE TURBOIRON 24X SPECIFICATIONS

System Architecture		Power	
1 Gigabit Ethernet ports	Four 10/100/1000 RJ45 ports + 24 10 GbE/1 GbE dual-speed ports	Power	Maximum power output: 300 watts per power supply Maximum power consumption: 176 watts per 24 10 GbE ports (7.3 watts per 10 GbE port)
10 Gigabit Ethernet ports	24 10 GbE ports	Input voltage	100 to 250 VAC nominal
Performance	488 Gbps line speed full-duplex throughput 363 Mpps forwarding capacity 1.5 micro-second latency	Input line frequency	50–60 Hz
Scalability	VLANs: 4000 MAC addresses: 32,000 ACLs: 2000 QoS queues per port: 8 Link aggregation: 8 links per group, 28 link groups per switch IPv4 routes 12K IGMP groups 4K	Inrush current	70 amps peak
Maximum frame size	9216-byte Ethernet frame	Maximum current	Input current: 5 amps 1.76 amps maximum at 100 VAC 0.73 amps maximum at 240 VAC
Data traffic types	Unicast, multicast, and broadcast IP traffic	Regulatory Compliance	
Media types	RJ45 1000 BASE-T copper (Cat6, Cat6a/7) SFP+ LR SMF 10 km reach SFP+ SR MMF short reach SFP+ USR MMF ultra-short reach Direct attached SFP+ copper (Twinax)	Environment and regulatory compliance	RoHS Compliant (5 of 6) WEEE Compliant
Licensing options	IronWare Advanced Layer 2 and Layer 3 feature set (included)	Safety	EN 60950 EN 60825-1 Safety of Laser Products – Part 1 EN 60825-2 Safety of Laser Products – Part 2 IEC 950 CSA 950 UL 1950 Third Edition CAN/CS-C22.2 No. 60950-00
Management		Electromagnetic emission certification	FCC Class A (Part 15) EN 55022/CISPR-22 Class A VCCI Class A
Supported management software	SSHv2, SNMPv1/v3, Telnet; SNMP; IronView Network Manager (INM); RADIUS	Immunity	Generic EN 50082-1
Management access	One 10/100/1000 Mbps (RJ-45) port and one DB9 serial console port	RFC Compliance and Features	
Diagnostics	POST and embedded online/offline diagnostics	Layer 2	Jumbo Frame IEEE 802.1D MAC Bridging/STP IEEE 802.1p Mapping to Priority Queue IEEE 802.1Q VLAN Tagging IEEE 802.1w Rapid Spanning Tree Protocol (RSTP) IEEE 802.1s Multiple Spanning Tree Protocol (MSTP) IEEE 802.1x Port Based Network Access Control IEEE 802.1AB LLDP IEEE 802.3ad Link Aggregation IEEE 802.3x Flow Control IEEE 802.3 10Base-T IEEE 802.3u 100Base-TX 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 802.1AX Link Aggregation 802.1ad Q-in-Q MRP-I, MRP-II Topology and VLAN Groups
Mechanical		Security	Access Control Lists ACL for RP candidate AES Encryption for SSHv2, SNMPv3 Port Mirroring sFlow Authentication, Authorization, and Accounting (AAA) Username/Password (Challenge and Response) Bi-Level Access Mode (Standard and EXEC Level)
Enclosure	Port to non-port side airflow; 1U; 17.1-inch EIA-compliant; power from non-port side		
Size	Width: 435.0 mm (17.1 in.) Height: 42.8 mm (1.7 in.) Depth: 393.7 mm (15.5 in.)		
System weight	6.0 kg (13.2 lb.) with one power supply, without transceivers 7.4 kg (16.3 lb.) with two power supplies, without transceivers		
Environmental			
Temperature	Operating: 0°C to 40°C (32°F to 104°F) Non-operating: –25°C to 70°C (–23°F to 158°F)		
Humidity	Operating: 5% to 95% non-condensing Non-operating: 5% to 80% non-condensing		
Operating noise	65 dB		
Altitude	Operating: Up to 9842 feet (3000 meters) Storage: Up to 9842 feet (3000 meters)		
Shock	IEC 68-2-29		
Vibration	IEC 68-2-36, IEC 68-2-6		
CO ₂ emissions	0.65 kg per year (with 24 ports of 10 GbE and four ports of GbE at 0.42 kg/kWh) 2.2 kg per Gbps per year		
Airflow	Maximum: 36.4 CFM Nominal (65% speed): 23.5 CFM		
Heat dissipation	600 BTU/hour		

Security (continued)	Secure Copy (SCP) Secure Shell (SSHv2) RFC 2865 RADIUS TACACS/TACACS+ MAC filter and authentication Port MAC Security 802.1X Accounting	Quality of Service	Rate Limiting Traffic Shaping MAC Address Mapping to Priority Queue ACL Mapping to Priority Queue ACL Mapping to ToS/DSCP ACL Mapping and Marking of ToS/DSCP QoS Queue Management using Weighted Round Robin (WRR), Strict Priority (SP), and a combination of WRR and SP 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
IP protocols	RFC 768 UDP RFC 783 TFTP RFC 791 IP RFC 792 ICMP RFC 793 TCP RFC 826 ARP RFC 894 IP over Ethernet RFC 903 RARP RFC 906 TFTP Bootstrap RFC 951 BootP RFC 1027 Proxy ARP RFC 1112 Host Extensions for IP Multicasting RFC 1519 CIDR RFC 1541 and 2131 DHCP RFC 1591 DNS (client) RFC 1812 Requirements for IPv4 Routers RFC 3768 VRRP VRRP-E (Enhanced VRRP) Brocade VSRP (Virtual Switch Routing Protocol) BGP RFC 1269 BGP-3 MIB RFC 1657 BGP-4 MIB RFC 1745 OSPF Interactions RFC 1771 BGP-4 RFC 1965 BGP-4 Confederations RFC 1997 Communities Attribute RFC 2385 TCP MD5 Authentication of BGP Session RFC 2439 Route Flap Dampening RFC 2796 Route Reflection RFC 2842 BGP4 Capabilities Advertisement RFC 2918 Route Refresh Capability OSPF RFC 2328 OSPF v2 RFC 3101 OSPF NSSA RFC 1745 OSPF Interactions RFC 1765 OSPF Database Overflow RFC 1850 OSPF v2 MIB RFC 2154 MD5 – Support RFC 3137 Stub Router Advertisement RFC 4222 Pri Treatment and Congestion Avoidance RIP RFC 1058 RIP v1 RFC 1723 RIP v2 ECMP IPv6 Host Support	Multicast	RFC 1112 IGMP RFC 2236 IGMPv2 RFC 3376 IGMPv3 IGMP Proxy RFC 1112 Host Extensions RFC 3973 PIM-DM RFC 2362 PIM-SM RFC 3618 MSDP
		Management	Industry-standard Command Line Interface (CLI) Configuration logging LLDP IronView Network Manager (INM) Web-based GUI Integration with HP OpenView for Sun Solaris, HP-UX, IBM AIX, and Windows NT IEEE 802.3 MAU MIB (RFC 2239) RFC 2571 Architecture for Describing SNMP Framework RFC 951 BootP RFC 1542 BootP Extensions RFC 2131 DHCP RFC 854 TELNET Client and Server RFC 2865 RADIUS RFC 1493 Bridge MIB RFC 1643 Ethernet-like Interface MIB RFC 3176 sFlow RFC 1213 MIB-II RFC 1516 Repeater MIB RFC 1354 IP Forwarding Table MIB RFC 1757 RMON MIB RFC 2572 SNMP Message Processing and Dispatching RFC 1573 SNMP MIB II RFC 1157 SNMPv1/v2c RFC 3411 SNMPv3 Framework RFC 3412 SNMPv3 Processing RFC 3414 SNMPv3 USM RFC 2030 SNMP

BROCADE TURBOIRON 24X ORDERING INFORMATION

Part Number	Description
TI-24X-AC	Turbolron 1U, 24 ports of 1 GbE/10 GbE SFP+, four ports of 10/100/1000 RJ-45, one AC power supply and fan assembly
RPS11	Turbolron 24X AC power supply (300 W)
TI-24X-FAN	Turbolron 24X fan assembly

Warranty	
Hardware	5-year limited lifetime hardware warranty
Software	90-day limited software warranty

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

© 2010 Brocade Communications Systems, Inc. All Rights Reserved. 11/10 GA-DS-1348-03

Brocade, the B-wing symbol, BigIron, DCFM, DCX, Fabric OS, FastIron, IronView, NetIron, SAN Health, ServerIron, Turbolron, and Wingspan are registered trademarks, and Brocade Assurance, Brocade NET Health, Brocade One, Extraordinary Networks, MyBrocade, and VCS are trademarks of Brocade Communications Systems, Inc., in the United States and/or in other countries. Other brands, products, or service names mentioned are or may be trademarks or service marks of their respective owners.

Notice: This document is for informational purposes only and does not set forth any warranty, expressed or implied, concerning any equipment, equipment feature, or service offered or to be offered by Brocade. Brocade reserves the right to make changes to this document at any time, without notice, and assumes no responsibility for its use. This informational document describes features that may not be currently available. Contact a Brocade sales office for information on feature and product availability. Export of technical data contained in this document may require an export license from the United States government.

**BROCADE**