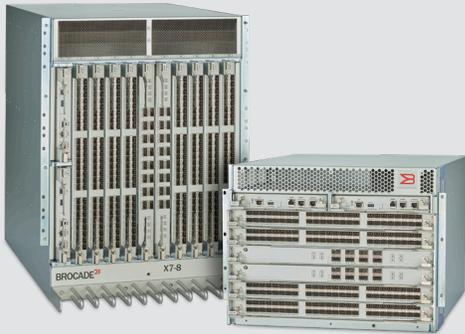


Product Brief



Highlights

- Scale more devices, applications, and workloads with 64Gb/s links
- Maximize NVMe and high-transaction workloads with 50% lower network latency
- Transform telemetry data into actionable insights to optimize performance and ensure reliability
- Automate actions to simplify management and resolve issues without intervention
- Increase visibility and simplify operations with a modern SAN management tool
- Seamlessly integrate next-generation NVMe into the storage fabric without a disruptive rip-and-replace
- Design flexible architectures to increase agility with concurrent Fibre Channel, NVMe, FICON, FCIP, or FCoE connectivity
- Extend replication over distance with a highly scalable extension solution for Fibre Channel, IP, and FICON

Brocade[®] X7 Director

A Faster, More Intelligent, More Resilient Foundation for the On-Demand Data Center

Overview

Technology is evolving at an incredible pace, and businesses are demanding more from their IT resources and infrastructure. Rapid adoption of flash storage and the ramp-up of NVMe-based storage unleash advancements in application design that drive new levels of performance and capacity requirements, such as advanced analytics, business intelligence, and data-intensive workloads. With the integration of new technologies that are accelerating the delivery of data and services, the network will need to evolve to keep pace with innovations in storage and demands of modern applications to maximize the full value of investments in next-generation data center infrastructure.

To meet ever-increasing demands for faster, more reliable data access, it is essential for organizations to deploy a modernized infrastructure that reduces latency, increases bandwidth, and ensures continuous availability. Unprecedented performance is not enough on its own. Powerful analytics and advanced automation capabilities are required to transform current storage networks into an autonomous SAN. This requires a network that is capable of delivering these capabilities to maximize performance, simplify management, and reduce operational costs. Legacy infrastructure was not designed to support the performance requirements of evolving workloads and NVMe-based storage. In fact, an aging network will impede the performance of the on-demand data center. By modernizing the storage network with Brocade[®] Gen 7, organizations will enable a faster, more intelligent, and more resilient network. This will maximize the performance, productivity, and efficiency of their storage investments and resources, even as they rapidly scale their environments.

The Brocade X7 Director provides a modular building block, purpose-built for scalability to accommodate growth and power large-scale storage environments. With a 50% latency reduction compared to the previous generation, Brocade X7 Directors maximize the performance of NVMe storage and high-transaction workloads, eliminating I/O bottlenecks and unleashing the full performance of next-generation storage. In addition, the Brocade X7 Director lays the foundation for the autonomous SAN. With autonomous SAN technology, the director harnesses the power of analytics and the simplicity of automation

to optimize performance, ensure reliability, and simplify management. Leveraging these capabilities enables organizations to realize a self-learning, self-optimizing, and self-healing SAN.

Brocade X7 Directors provide up to 384 64Gb/s line rate ports or up to 512 32Gb/s line rate ports, enabling organizations to scale more devices, applications, and workloads. With diverse deployment options, multiprotocol flexibility, and mixed blade capability, organizations can adapt and optimize their businesses to meet next-generation storage and server requirements. The Brocade X7 Director supports the

Gen 7 Fibre Channel

Brocade Gen 7 Fibre Channel is the modern storage network infrastructure for mission-critical storage, enabling organizations to realize a self-learning, self-optimizing, and self-healing autonomous SAN. It combines powerful analytics and advanced automation capabilities to accelerate data access, adapt to evolving requirements, and drive always-on business operations. The Brocade X7 Director with Gen 7 Fibre Channel and Brocade Fabric Vision® technology is the foundational building block to realize the autonomous SAN for the on-demand data center. Ultra-low latency and 64Gb/s links provide the highest level of performance for NVMe workloads. With data-center-proven reliability, seamless scalability, integrated analytics, and automation, the Brocade X7 maximizes the performance, productivity, and efficiency of storage investments and resources.

Unmatched Mainframe Technology Innovation and Leadership

The Brocade X7 Director delivers seamless FICON connectivity for mainframe storage environments. The Brocade X7 complements System Z mainframes by offering the industry's fastest, most reliable, and scalable FICON infrastructure, along with unique, innovative features—all of which help deliver the greatest ROI. Brocade builds on more than 25 years of mainframe leadership that includes contributing to the FICON standard and authoring many FICON patents.

concurrent use of both traditional Fibre Channel and NVMe storage traffic, allowing organizations to seamlessly integrate Brocade Gen 7 Fibre Channel networks with next-generation NVMe-based storage, without a disruptive rip-and-replace.

Modern Modular Building Block Designed for Enterprise Deployments

Designed to meet continuous data growth and critical application demands, the Brocade X7 Director is purpose-built to power large-scale storage environments that require increased capacity, greater throughput, and higher levels of resiliency and operational efficiency. This modular building block enables organizations to build the highest performing data center SAN fabric that is required for all-flash and NVMe storage environments. The Brocade X7 Director modular design provides flexibility with two customizable chassis that can scale on-demand for more devices, applications, and workloads. Both chassis utilize Brocade UltraScale ICL technology to scale out modular SANs while preserving blade ports for device connectivity and allowing flexible SAN design that supports core-edge or mesh topologies.

The 14U Brocade X7-8 Director is built for large enterprise networks and has eight vertical blade slots to provide up to 384 64Gb/s line rate ports or up to 512 32Gb/s line rate ports for device connectivity. An additional 32 UltraScale Inter-Chassis Link (ICL) connections provide 128 ports for chassis-to-chassis interconnect.

The 8U Brocade X7-4 Director is built for midsize networks and has four horizontal blade slots to provide up to 192 64Gb/s line rate ports or up to 256 32Gb/s line rate ports for device connectivity.

An additional 16 UltraScale ICL connections provide 64 ports for chassis-to-chassis interconnect.

Each blade slot within the Brocade X7 chassis can be populated with optional port or extension blades. For device connectivity, the following blades are available:

- Brocade FC64-48 Fibre Channel port blade provides 48 x 64Gb/s Fibre Channel ports with backward-compatibility support for 8, 10, 16, and 32Gb/s Fibre Channel connectivity.
- Brocade FC32-X7-48 Fibre Channel port blade provides 48 x 32Gb/s Fibre Channel ports with backward-compatibility support for 4, 8, 10, and 16Gb/s Fibre Channel connectivity.
- Brocade FC32-64 Fibre Channel port blade provides 64 x 32Gb/s Fibre Channel ports with backward-compatibility support for 4, 8, and 16Gb/s Fibre Channel connectivity as well as support for 10, 25, and 40GbE FCoE connectivity.

To support disaster recovery and data protection storage solutions over long distances, the Brocade SX6 Extension Blade provides flexible Fibre Channel and IP storage replication deployment options with 16 32Gb/s Fibre Channel ports, 16 1/10-GbE ports, and 2 40GbE ports. This blade allows organizations to seamlessly integrate extension capabilities within the Brocade X7 Director to provide replication services for large-scale, multisite data center environments that implement block, file, and tape data protection solutions. The Brocade SX6 Extension Blade can be deployed with the Brocade 7840 Extension Switch and the Brocade 7810 Extension Switch in a data-center-to-edge architecture as a cost-effective option for connecting primary data centers with remote data centers and offices.

Autonomous SAN

The combination of SAN analytics and automation technologies is unlocking the capabilities to deliver a self-learning, self-optimizing, and self-healing autonomous SAN.

Self-Learning:

- Gather and transform millions of data points into network intelligence
- Visualize application and device-based performance and health metrics
- Detect abnormal traffic behaviors and degraded performance
- Eliminate operational steps by automatically learning application flows

Self-Optimizing:

- Optimize critical application performance by automatically prioritizing traffic
- Guarantee application performance by proactively monitoring and actively shaping traffic
- Eliminate human errors and performance impacts through open DevOps automation technology
- Optimize administrative resources with cloud-like SAN orchestration

Self-Healing:

- Instantly notify end devices of congestion for automatic resolution
- Ensure data delivery with automatic failover from physical or congestion issues
- Detect and automatically reconfigure out-of-compliance fabrics
- Eliminate performance impacts by automatically taking corrective action on misbehaving devices

Brocade directors build upon years of innovation and leverage the core technology of Brocade systems to consistently deliver five-nines availability in the world's most demanding data centers. Delivering non-disruptive software upgrades, hot-pluggable components, and a no-single-point-of-failure design, the Brocade X7 offers a highly resilient solution for today's enterprise-class storage environments.

Autonomous SAN Innovation

The Brocade X7 Director with Fabric Vision technology provides a robust analytics architecture that delivers autonomous SAN technology through self-learning, self-optimizing, and self-healing capabilities. Brocade Fabric Vision technology is a collection of features that leverage comprehensive data collection capabilities with powerful analytics to quickly understand the health and performance of the environment and identify any potential impacts or trending problems.

Analyze the SAN to Optimize Performance and Reliability

IT organizations are responsible for delivering non-stop performance and reliability to ensure that service-level agreements (SLAs) are met. They need analytics to help extract actionable intelligence from their environment and simplified management tools to quickly and easily understand the state of their environment. This requires an infrastructure that can automatically learn its performance and health characteristics, identify potential risks, and provide recommended actions to resolve issues.

With Gen 7, Brocade enables a self-learning SAN that gathers and transforms millions of data points into actionable intelligence to make fast, informed decisions to optimize performance and ensure reliability. Brocade products proactively monitor I/O performance and behavior data points through integrated network sensors to gain deep insight into the environment. The information captured is displayed in Brocade SANnav™ Management Portal to quickly identify and isolate problems before they impact application availability. With built-in best practice recommendations, organizations can simplify troubleshooting by identifying and isolating issues to resolve them as fast as possible. Combining these tools with automation, Brocade technology can detect abnormal traffic behaviors and degraded performance to automatically take corrective action, eliminating the potential impact of this issue. These new autonomous SAN technologies greatly simplify SAN management and enable unparalleled network performance and reliability.

Automate the SAN to Simplify Management Complexity

IT organizations spend nearly half of their time performing repetitive daily management tasks, such as zoning, inventory reporting, and operational validation checks. By automating these repetitive tasks, IT organizations can significantly improve their efficiency and dramatically decrease the risk of operational mistakes. Automation in large-scale IT environments integrates diverse infrastructure components with consistency and predictability to deliver greater operational efficiency and agility.

With Brocade automation, the Brocade X7 Director can automate actions to simplify management and resolve issues without intervention to avoid network disruptions and outages. Through open DevOps automation technology, organizations can reliably perform resource-intensive tasks, such as infrastructure deployment and provisioning, in a fraction of the time to expedite IT services, while eliminating human error. In addition, automation proactively monitors the network to self-optimize performance and automatically mitigate fabric-related issues with self-healing capabilities.

With self-optimizing capability, Brocade technology utilizes actionable intelligence to maximize performance. Real-time monitoring of health and performance characteristics enables the network to make smarter decisions on traffic prioritization, congestion management, and notification to ensure optimal network performance for applications and storage. Gen 7 delivers a traffic optimizer that guarantees critical application performance by automatically prioritizing traffic. This advanced capability classifies and separates traffic with similar characteristics.

Brocade Gen 7 raises the bar for network availability through automatic avoidance and recovery features, delivering a self-healing SAN. When detection of potential disruptions occurs, the network will automatically mitigate or resolve issues without intervention. Brocade software identifies abnormal or unexpected behavior and automatically takes action to avoid a degradation in performance. If congestion occurs, it will instantly notify end devices of the congestion problem through an alerting and signaling process. Once they are alerted, the software ensures data delivery with automatic failover or

adjustment of traffic to mitigate the impact of the problem. Brocade SAN management tools can identify various latency severity levels, pinpointing exactly which devices are causing the issues or are impacted by a bottleneck, and quarantine misbehaving devices automatically.

Instant Visibility and Simplified Processes

Brocade SANnav Management Portal and SANnav Global View empower IT administrators with comprehensive visibility across the entire SAN, from a global view down to local environments. By contextualizing data into visual dashboards and topology views, administrators can quickly detect and isolate points of interest to increase operational efficiencies. In addition, Brocade SANnav streamlines management workflows to accelerate the deployment of new applications, switches, servers, and storage.

Maximum Performance for the On-Demand Data Center

Evolving critical workloads and higher density virtualization are continuing to demand greater, more predictable performance. The Brocade X7 Director features industry-leading Gen 7 Fibre Channel that increases performance for demanding workloads across 64Gb/s line-speed links and up to 31Tb/s of chassis bandwidth to address next-generation I/O-intensive and bandwidth-intensive applications. This breakthrough performance speeds up data-intensive application response times and allows more transactions in less time, ultimately improving SLAs. In addition, the Brocade X7 Director increases scalability with double the throughput for high-density VM deployments and larger fabrics.

This allows organizations to support more storage devices and meet bandwidth requirements.

Brocade X7 Directors provide unmatched chassis, slot-to-slot, and port performance, delivering the lowest port-to-port latency for any director. For the lowest possible latency, local switching enables data traffic in the same port group to switch within a single ASIC, instead of going through the chassis backplane.

The Brocade X7 Director with the Brocade FC32-X7-48 and Brocade FC32-64 port blades features IO Insight for non-intrusive, real-time monitoring of NVMe workloads, helping to ensure optimal performance. IO Insight monitors I/O performance and behavior through integrated network sensors, providing deep insight into problems and helping to ensure service levels. This capability non-disruptively and non-intrusively gathers I/O statistics from any device port and then feeds them to a monitoring policy that sets thresholds and generates alerts. VM Insight applies the IO Insight visibility for each virtual machine (VM). Integrated VM, application, and device-level I/O latency and IOPS monitoring enable administrators to set baseline application performance and identify the VM or physical layer responsible for the degraded performance. Integrated network sensors provide I/O performance management to avoid dependence on invasive and disruptive physical taps.

Simplified Scale-Out Network Design

Organizations need to adapt to continuous data growth and seamlessly scale out their storage environments. Brocade UltraScale chassis connectivity leverages optical Inter-Chassis Links (ICLs).

These links can connect up to 12 Brocade Gen 5, Gen 6, or Gen 7 directors, enabling flatter, faster, and simpler fabrics that increase consolidation while reducing network complexity and costs.

UltraScale ICLs are QSFP-based and enable scalable core-edge and active-active mesh chassis topologies. These high-density chassis topologies reduce inter-switch cabling by 75%. With the UltraScale ICL connections residing on the core routing blades instead of consuming ports on the port blades, up to 33% more device ports are available for server and storage connectivity. This maximizes overall port density within the smallest amount of rack space while freeing up front-facing device ports for server and storage connectivity.

Extended Distance and Replication with a Scalable, Multiprotocol Extension Solution

Connecting distributed data centers enables data mobility for advanced data protection. Enterprise data centers need a disaster recovery infrastructure to ensure fast, continuous, and easy replication of mission-critical data to anywhere in the world. Storage administrators need to replicate large amounts of data quickly, securely, reliably, and simply while minimizing operational and capital expenses.

With the Brocade SX6 Extension Blade, the Brocade X7 Director provides integrated metro and global connectivity with a purpose-built data center extension solution for Fibre Channel and IP storage environments. This solution delivers unprecedented performance, strong security, continuous availability, and simplified management to handle the unrelenting transfer of data between data centers and to maintain SLAs.

The Brocade X7 Director can scale up to four Brocade SX6 Extension Blades per chassis. Each Brocade SX6 Extension Blade provides 16 32Gb/s Fibre Channel/FICON ports, 16 1GbE/10GbE ports, and 2 40GbE ports to deliver the high bandwidth, port density, and throughput required for maximum application performance over WAN connections and to address the most demanding disaster recovery requirements.

Brocade Fabric Vision technology with SANnav Management Portal provides insight and visibility for connections between data centers, as well as the fabrics within each data center. With its powerful, integrated monitoring, management, and diagnostic tools, Fabric Vision technology enables organizations to minimize the impact of disruptions and outages for non-stop business operations. Fabric Vision monitors replication traffic for both Fibre Channel and IP storage. Brocade SANnav Management Portal visualizes the traffic for Fibre Channel and IP storage through in-context topology views to simplify managing complex multifabric environments.

Adapting to Next-Gen Storage Requirements with Flexible Deployment Options

To realize the full benefits of flash, organizations will need to transition their high-performance, latency-sensitive workloads to flash-based storage with NVMe over Fibre Channel. The simplicity and efficiency of NVMe enable significant performance gains for flash storage.

The Brocade X7 Director enables flexibility with multiprotocol connectivity, allowing administrators to seamlessly adapt to next-gen requirements and design

architectures with concurrent Fibre Channel, NVMe, or FCoE connectivity options. Organizations can seamlessly integrate Brocade Gen 7 Fibre Channel networks with NVMe without a disruptive rip-and-replace. Leveraging the efficiency of NVMe, combined with the high performance and low latency of Brocade Gen 7 Fibre Channel, organizations can accelerate IOPS to deliver the performance, application response time, and scalability needed for next-generation data centers. Using the Brocade FC32-64 port blade, the Brocade X7 Director provides FCoE host connectivity support to design flexible architectures for increased agility. This FCoE connectivity supports 10GbE, 25GbE, and 40GbE speeds and requires the use of the appropriate QSFP transceiver.

For investment protection, Brocade X7 Directors offer three generations of backward-compatibility support for connectivity to 8, 16, and 32Gb/s Fibre Channel products. Furthermore, the Brocade X7 supports mix-and-match blades, allowing for Gen 6 and Gen 7 blades to be installed within the chassis.

Brocade Global Support

Brocade Global Support has the expertise to help organizations build resilient, efficient SAN infrastructures. Leveraging 25+ years of expertise in storage networking, Global Support delivers world-class technical support, implementation, and migration services to enable organizations to maximize their hardware and software investments, accelerate new technology deployments, and optimize the overall performance of their network.

Maximizing Investments

To help optimize technology investments, Brocade, a Broadcom Inc. company, and its partners offer complete solutions that include professional services, technical support, and education. For more information, contact a Brocade sales partner or visit broadcom.com/brocade.

Brocade X7 Director Specifications

System Architecture	
Chassis	<p>Single Chassis:</p> <p>Brocade X7-8: Non-blocking architecture</p> <ul style="list-style-type: none"> X7-8 Director with 48 64Gb/s port blades: 31Tb/s of aggregate chassis bandwidth (384 device ports with a 64Gb/s data rate plus 32 4xGen7 ICLs) X7-8 Director with 64 32Gb/s port blades: 22.8Tb/s of aggregate chassis bandwidth (512 device ports with a 32Gb/s data rate plus 32 4xGen7 ICLs) <p>Brocade X7-4: Non-blocking architecture</p> <ul style="list-style-type: none"> X7-4 Director with 48 64Gb/s port blades: 15.5Tb/s of aggregate chassis bandwidth (192 device ports with a 64Gb/s data rate plus 16 4xGen7 ICLs) X7-4 Director with 64 32Gb/s port blades: 11.4Tb/s of aggregate chassis bandwidth (256 device ports with a 32Gb/s data rate plus 16 4xGen7 ICLs) <p>Each provides support for (E, F, D, M, SIM, and EX) Fibre Channel ports using 48-port 64Gb/s Fibre Channel blades.</p>
Control processor	Redundant (active/standby) control processor modules.
Scalability	Full-fabric architecture of 239 switches.
Certified maximum	6000 active devices per switch; 56 switches, 19 hops in Brocade Fabric OS® (FOS) fabrics; larger fabrics certified as required.
Fibre Channel blades	<p>Brocade FC64-48 port blade provides 48 ports of 64Gb/s Fibre Channel.</p> <p>Brocade FC32-X7-48 port blade provides 48 ports of 32Gb/s Fibre Channel.</p> <p>Brocade FC32-64 port blade provides 64 ports of 32Gb/s Fibre Channel.</p>
Extension blades	Brocade SX6 Extension Blade provides Fibre Channel extension (16×32Gb/s Fibre Channel ports) and IP extension over IP networks (16×1GbE/10GbE and 2×40GbE ports).
Performance	<p>Brocade FC64-48 Port Blade:</p> <p>Fibre Channel: 8.5Gb/s line speed, full duplex; 10.53Gb/s line speed, full duplex; 14.025Gb/s line speed, full duplex; 28.05Gb/s line speed, full duplex; 57.8Gb/s line speed, full duplex. Autosensing of 8, 16, 32, and 64Gb/s port speeds depending on SFPs used. 10Gb/s port speeds with dedicated SFPs.</p> <p>Brocade FC32-X7-48 Port Blade:</p> <p>Fibre Channel: 4.25Gb/s line speed, full duplex; 8.5Gb/s line speed, full duplex; 10.53Gb/s line speed, full duplex; 14.025Gb/s line speed, full duplex; 28.05Gb/s line speed, full duplex. Autosensing of 4, 8, 16, and 32Gb/s port speeds depending on SFPs used. 10Gb/s port speeds with dedicated SFPs.</p> <p>Brocade FC32-64 Port Blade:</p> <p>Fibre Channel: 4.25Gb/s line speed, full duplex; 8.5Gb/s line speed, full duplex; 14.025Gb/s line speed, full duplex; 28.05Gb/s line speed, full duplex. Autosensing of 4, 8, 16, and 32Gb/s port speeds depending on QSFPs used.</p> <p>FCoE: 10GbE, 25GbE, or 40GbE FCoE speeds. Support for 10GbE, 25GbE, and 40GbE speeds requires the use of the appropriate QSFP transceiver.</p>
ISL trunking	Frame-based trunking with up to eight 64Gb/s ports per ISL trunk; up to 256Gb/s per ISL trunk; exchange-based load balancing across ISLs with DPS included in Brocade FOS.
UltraScale ICL trunking	<p>Chassis-to-chassis linkage through connectors on the Core Routing (CR) blade. Can configure the following maximum number of QSFPs per trunk depending on blade type, connecting:</p> <ul style="list-style-type: none"> Up to four QSFP ports in a trunk group between two Brocade CR64-4 blades. For trunks that contain four or fewer QSFP ports, ports in a trunk must be located in the same port group on each blade. Up to four QSFP ports in a trunk group between a Brocade CR64-4 blade and a CR64-8 blade. For trunks that contain four or fewer QSFP ports, ports in a trunk must be located in the same port group on each blade. <p>A minimum of two QSFP connections are required for a trunk, and up to four QSFP trunks between pairs of Brocade CR64-8 (CR64-4) and CR32-8 (CR32-4).</p>
Multichassis with UltraScale ICL ports	Up to 4608 Fibre Channel ports; UltraScale ICL ports (32 for 8-slot or 16 per 4-slot chassis, optical QSFP) connect up to 9 chassis in a full-mesh topology or up to 12 chassis in a core-edge topology.
Chassis bandwidth	<p>Brocade X7-8: 31Tb/s per chassis with 384 device ports + 32 UltraScale ICL connections supporting 128 ports.</p> <p>Brocade X7-4: 15.5Tb/s per chassis with 192 device ports + 16 UltraScale ICL connections supporting 64 ports.</p>

Slot bandwidth	3072Gb/s (line rate) providing line-rate performance for the Brocade FC64-48 blade.
Switch latency	<p>Brocade FC64-48 at Gen 7 64Gb/s speeds: 460 ns (including FEC); any-port-to-any-port local switching and 1.6 μs blade to blade at 64Gb/s, cut-through routing.</p> <p>Brocade FC32-X7-48 at Gen 6 32Gb/s speeds: 560 ns (including FEC); any-port-to-any-port local switching and 1.9 μs blade to blade at 32Gb/s, cut-through routing.</p> <p>Brocade SX6 blade and Brocade FC32-64 port blade: <780 ns (including FEC) and 2.6 μs any-port-to-any-port at 32Gb/s, cut-through routing.</p>
Maximum frame size	2112-byte payload.
Frame buffers	24,000 per switching ASIC.
Classes of service	Class 2, Class 3, Class F (inter-switch frames).
Fibre Channel port types	<p>CR64-8 and CR64-4 CR blades: E_Port, EX_Port, and D_Port.</p> <p>FC32-X7-48, FC64-48, FC32-64 port blades: F_Port, E_Port, EX_Port, M_Port, SIM, and D_Port.</p> <p>SX6 extension blade: F_Port, FL_Port, E_Port, SIM, and EX_Port on FC and VE_Port on GbE.</p> <p>Self-discovery is based on switch type (U_Port) with an optional port type control.</p>
Data traffic types	Fabric switches supporting unicast, multicast (255 groups), and broadcast.
Media types	<p>Brocade FC64-48 port blade: Supports hot-pluggable Brocade Fibre Channel SFP+ at 8/10/16/32Gb/s SWL/LWL/ELWL and 64Gb/s SWL.</p> <p>Brocade FC32-X7-48 port blade: Supports hot-pluggable Brocade Fibre Channel SFP+ at 4/8/10/16/32Gb/s SWL/LWL/ELWL.</p> <p>Brocade FC32-64 port blade: Supports hot-pluggable QSFP connector; 4x32Gb/s SWL and 4x16Gb/s SWL, MPO 1x12 ribbon cable connector (66m OM3, 100m OM4); 4x32Gb/s QSFP (fixed 4x32Gb/s speed and SMF LC); Brocade FC32-64 QSFPs support only 4/8/16/32Gb/s (no 10Gb/s Fibre Channel); 10GbE, 25GbE, or 40GbE FCoE QSFP.</p> <p>Brocade SX6 Extension Blade: Supports hot-pluggable Brocade Fibre Channel SFP28 at 32Gb/s SWL/LWL; SFP+ at 16Gb/s SWL/LWL/ELWL; SFP at 10Gb/s FC SWL/LWL and Ethernet SFP+ at 1GbE copper, 1GbE 1000BASE-SX/LX/CWDM, SFP+ at 10GbE SR/LR; SFP+ at 10GbE tunable DWDM 80 km, and QSFP at 40GbE SR4/LR4/ER4.</p> <p>Core Routing (CR) blades, Brocade CR64-4 and CR64-8: Support hot-pluggable Brocade Fibre Channel Gen 7 SWL QSFP, 4x32Gb/s SWL QSFP, and 4x32Gb/s QSFP for ICL connections.</p>
USB	One USB port per control processor for firmware download, support save, and configuration upload or download.
Fabric services	Adaptive Networking (QoS); BB Credit Recovery; Brocade Advanced Zoning (Default Zoning, Port/WWN Zoning); Dynamic Path Selection (DPS); Extended Fabrics; Fabric Congestion Notification; Fabric Vision; FDMI; FICON CUP; Flow Vision; FSPF; Integrated Routing; ISL Trunking; Management Server; N_Port Trunking; NPIV; NTP v3; Peer Zoning; Port Fencing; Registered State Change Notification (RSCN); Reliable Commit Service (RCS); Simple Name Server (SNS); Syslog; Target-Driven Zoning; Traffic Optimizer; Virtual Fabrics (Logical Switch, Logical Fabric).
Extension	Supports DWDM, CWDM, and FC-SONET Devices; Fibre Channel; In-flight Compression (Brocade LZ0) and Encryption (AES-GCM-256); BB Credit Recovery; FCIP; IP Extension; Adaptive Rate Limiting (ARL); Data Compression; Fast Write; Read/Write Tape Pipelining; QoS.
FICON	FICON cascading; support for lossless DLS; FICON CUP; Advanced Accelerator for FICON (IBM z/OS Global Mirror and read/write Tape Pipelining).
System Components	
Fibre Channel ports	<p>Brocade X7-8: Up to 384 64Gb/s ports or up to 512 32Gb/s ports, universal (E_Port, F_Port, EX_Port, M_Port, D_Port, SIM Port, FICON).</p> <p>Brocade X7-4: Up to 192 64Gb/s ports or up to 256 32Gb/s ports, universal (F_Port, E_Port, EX_Port, M_Port, D_Port, SIM Port, FICON).</p>
Classes of service	Class 2, Class 3, Class F (inter-switch frames).
ANSI Fibre Channel protocol	FC-PH (Fibre Channel Physical and Signaling Interface standard).
Fabric initialization	Complies with FC-SW 5.0.
Port-to-port latency	Local switching: 460 ns at 64Gb/s (including FEC as part of the FC standard). Blade to blade: 1.6 μ s.

High Availability	
Architecture	Non-blocking shared memory; passive backplane; redundant active/passive control processor; redundant active/active core switching blades; redundant WWN cards.
Chassis power	<p>Brocade X7-8</p> <ul style="list-style-type: none"> • Four power supplies required for AC low-line (100 VAC to 120 VAC). • Two power supplies required for AC high-line (200 VAC to 240 VAC). • Two power supplies required for high voltage AC (200 VAC to 277 VAC) or high voltage DC (240 VDC to 380 VDC). • Chassis ships empty only. PSU and fans must be ordered separately. Three PSUs are required for 2+1 redundancy. Two PSUs provide system power, but four PSUs must be installed to provide power efficiency and 2+2 redundancy. <p>Brocade X7-4</p> <ul style="list-style-type: none"> • Two power supplies required for AC low-line (100 VAC to 120 VAC). • One power supply required for AC high-line (200 VAC to 240 VAC). • One power supply required for high voltage AC (200 VAC to 277 VAC) or high voltage DC (240 VDC to 380 VDC). • Chassis ships empty only. PSU and fans must be ordered separately. One PSU provides system power, but both PSUs must be installed to provide power efficiency and 1+1 redundancy.
Cooling	<p>Brocade X7-8</p> <ul style="list-style-type: none"> • Requires three fan tray assemblies. A failure condition is one failed fan from any fan tray. • Each assembly contains two fans for a total of six fans. The system requires five of six functioning fans for operation in the Brocade X7-8. One fan tray assembly can be hot-swapped and should be replaced immediately in the event of a failure. <p>Brocade X7-4</p> <ul style="list-style-type: none"> • Requires two fan tray assemblies. A failure condition is one failed fan from any fan tray. • Each assembly contains two fans for a total of four fans. The system requires three of four functioning fans for operation in the Brocade X7-4. One fan assembly can be hot-swapped and should be replaced immediately in the event of a failure.
Airflow	Non-port-side intake (NPI) to port-side exhaust and port-side intake to non-port-side exhaust (NPE) options are available.
Solution availability	Designed to provide 99.999% uptime capabilities; hot-pluggable redundant power supplies, fans, WWN cards, processors, core switching, port blades, and optics; online diagnostics; non-disruptive firmware download and activation.
Management	
Management	HTTP; SNMP v1/v3 (FE MIB, FC Management MIB); SSH; Auditing; Syslog; Brocade Advanced Web Tools; Brocade SANnav Management Portal and SANnav Global View; Command Line Interface (CLI); SMI-S compliant; RESTful API; trial licenses for add-on capabilities.
Security	AES-GCM-256 encryption on ISLs; DH-CHAP (between switches and end devices); FCAP switch authentication; FIPS 140-2 compliant; HTTPS; IP filtering; LDAP with IPv6; OpenLDAP; Device Connection Control (DCC); RADIUS; user-defined Role-Based Access Control (RBAC); Secure Copy (SCP); SFTP; SSH v2; TLS v1.2/v1.3; Switch Binding; TACACS+; Fabric Configuration Server (FCS); USGv6 compliant; Secure Boot.
Management access	10/100/1000Mb/s Ethernet (RJ-45) per control processor; serial console port (RJ-45) and one USB per control processor module; DHCP/DHCPv6; call-home integration enabled through Brocade SANnav Management Portal.
Diagnostics	IO Insight for SCSI and NVMe monitoring (FC32-X7-48 blade and FC32-64 blade only); ClearLink® optics and cable diagnostics, including electrical/optical loopback, link traffic/latency/distance; built-in flow generator; POST and embedded online/offline diagnostics, including environmental monitoring, FCping, and Pathinfo (FC traceroute); flow mirroring; frame viewer; non-disruptive daemon restart; optics health monitoring; power monitoring; RAStrace logging; and Rolling Reboot Detection (RRD).
Mechanical Specifications	
Enclosure	<p>Brocade X7-8 12-blade slots: 14U rack-mountable chassis; 27 in. to 31 in. and 22 in. rail kits for the four-post rack; mid-mount kit for the two-post rack.</p> <p>Brocade X7-4 8-blade slots: 8U rack-mountable chassis; 27 in. to 31 in. rail, 18 in. to 24 in. rail, and airflow diversion rack-mount kits for the four-post rack; mid-mount kit for the two-post rack.</p>
Mounting	Rack-mountable in a standard 19-inch EIA cabinet.

Size	<p>Brocade X7-8 Height: 61.23 cm (24.11 in., 14U) Width: 43.74 cm (17.23 in.) Depth: 61.04 cm (24.04 in.)</p> <p>Brocade X7-4 Height: 34.45 cm (13.56 in., 8U) Width: 43.74 cm (17.23 in.) Depth: 61.04 cm (24.04 in.)</p> <p>Brocade X7-4 with airflow diversion rack-mount kit Height: 40.00 cm (15.75 in., 9U) Width: 43.74 cm (17.23 in.) Depth: 61.29 cm (24.09 in.)</p>	
System weight	<p>Brocade X7-8 35.61 kg (78.5 lb) for chassis 145.8 kg (321.5 lb) maximum fully populated configuration</p> <p>Brocade X7-4 24.5 kg (54 lb) for chassis 68.95 kg (152.0 lb) maximum fully populated configuration</p>	
Environment		
Temperature	Operating: 0°C to 40°C (32°F to 104°F). Non-operating: -25°C to 70°C (-13°F to 158°F).	
Humidity	Operating humidity: 5% to 93% RH non-condensing at 40°C (104°F) with a maximum gradient of 10% per hour. Non-operating humidity: 10% to 93% RH non-condensing at 70°C (158°F).	
Altitude	Up to 3000 meters (9842 feet).	
Shock	Operating: 10g, 11 ms, half sine wave. Non-operating: 20g, 11 ms, half sine wave.	
Vibration	Operating: 5 Hz to 10 Hz at +5 dB/oct; 10 Hz to 200 Hz at 0.0005 grms; 200 Hz to 500 Hz at -5 dB/oct; scale 0.05 grms. Non-operating: 3 Hz to 10 Hz at +5 dB/oct; 10 Hz to 200 Hz at 0.0065 grms; 200 Hz to 500 Hz at -5 dB/oct; scale 1.12 grms.	
Heat dissipation	<p>Brocade X7-8 512-port configuration: Typical: 10,010 Btu/hr; Max: 18,362 Btu/hr. Power consumed: Typical: 2693W; Max: 4046W. Note: Input power is at 200 VAC with full PSU redundancy.</p> <p>Brocade X7-4 256-port configuration: Typical: 5283 Btu/hr; Max: 10,049 Btu/hr. Power consumed: Typical: 1443W; Max: 2264W. Note: Input power is at 200 VAC with full PSU redundancy.</p>	
Power		
Supported power range	<p>Standard AC Power Supplies</p> <p><i>Input Voltage</i></p> <p>Standard AC input: Range: 90 VAC to 264 VAC auto-volt Nominal: 100 VAC to 240 VAC</p> <p><i>Power</i></p> <p>85 VAC to 132 VAC: 1450W 180 VAC to 264 VAC: 2870W</p> <p><i>80 PLUS Platinum certified</i></p>	<p>High Voltage (HV) Power Supplies</p> <p><i>Input Voltage</i></p> <p>Range: 90 VAC to 132 VAC Nominal: 100 VAC to 120 VAC</p> <p>Range: 180 VAC to 305 VAC Nominal: 200 VAC to 277 VAC</p> <p>Range: 192 VDC to 400 VDC Nominal: 240 VDC to 380 VDC</p> <p><i>Power</i></p> <p>90 VAC to 132 VAC: 1450W 180 VAC to 305 VAC: 2870W</p> <p>192 VDC to 400 VDC: 2870W</p>
In-rush current	35A maximum, peak	
Frequency	50 Hz to 60 Hz (Nominal: 50 Hz to 60 Hz)	