

Brocade X6 Director Frequently Asked Questions

Introduction

Brocade provides the industry's leading family of Storage Area Network (SAN) switches and directors, including the Gen 6 Fibre Channel Brocade® X6 Director. This high-performance, highly reliable Fibre Channel director addresses a wide range of business requirements for the most demanding midsize to large enterprise data centers.

This document answers frequently asked questions about the Brocade X6 Director family.

For product information, visit: www.brocade.com/x6.

General Questions and Answers

Q. What are Brocade X6 Directors?

A. Brocade X6 Directors are the industry's most reliable, scalable, and high-performance storage networking infrastructure designed to meet relentless growth, mission-critical application demands, and flash-based storage technology. The Brocade X6 Director with Brocade Fabric Vision® technology combines innovative hardware, software, and integrated network sensors to ensure the industry's highest level of operational stability while redefining application performance. It provides a modular building block for increased scalability to accommodate growth for large-scale enterprise infrastructures.

Integrated Fabric Vision technology enhances visibility into the health of the storage environment, providing administrators with greater control and insight to quickly identify problems and achieve critical Service Level Agreements (SLAs). Breakthrough 32 Gbps performance accelerates application response time by up to 71 percent, eliminating IO bottlenecks, and unleashes the full performance of flash and next-generation Non-Volatile Memory Express (NVMe)-based storage. And with diverse deployment options, organizations can seamlessly adapt and optimize their businesses to meet next-generation storage requirements.

The Brocade X6 Director family, which includes the eight-slot Brocade X6-8 and four-slot Brocade X6-4, enables organizations to:

- Enhance operational stability, maximize application performance, and increase business agility with enterprise-class Gen 6 directors
- Accelerate application response time by up to 71 percent across 32 Gbps links
- Consolidate infrastructure with high-density solutions built with 128 Gbps Brocade UltraScale ICL connectivity for simpler, flatter, low-latency fabrics
- Simplify end-to-end management of large-scale environments by automating monitoring and diagnostics

- Proactively monitor and optimize the health and the performance of individual Virtual Machines (VMs) and identify anomalies with VM Insight
- Automatically detect degraded application or device performance with IO Insight, the industry's first integrated network sensors
- Extend replication over distance with a highly scalable extension solution for Fibre Channel, IP, and FICON
- Seamlessly integrate next-generation NVMe over Fabrics with Gen 6 Fibre Channel networks without a disruptive rip and replace
- Mitigate risk with backward compatibility to existing infrastructure while further protecting future investments with Gen 7-ready support

Q. What is Brocade Gen 6 Fibre Channel?

A. Brocade Gen 6 Fibre Channel delivers integrated network sensors, industry-leading 32/128 Gbps performance, and increased business agility to accelerate data access, adapt to evolving requirements, and drive always-on business operations. The Brocade X6 Director with Brocade Fabric Vision technology—which includes IO Insight and VM Insight—delivers data center-proven availability, breakthrough performance, and seamless scalability to ensure greater consistency, predictability, and performance.

Q. What distinguishes Brocade X6 Directors from Brocade DCX® 8510 Backbones?

A. The Brocade X6 Director is the most advanced 32 Gbps networking platform in the industry to enable data-intensive, ultra-fast applications and unlock the full capabilities of flash. With its modular chassis design, the Brocade X6 increases business agility with seamless storage connectivity and flexible deployment offerings.

The Brocade X6 Director is available in two modular form factors, 14U and 8U. Built for large enterprise networks, the 14U Brocade X6-8 has eight vertical blade slots to provide up to 384 32 Gbps Fibre Channel device ports and 32 additional 128 Gbps Brocade UltraScale ICL ports. The 8U Brocade X6-4, built for midsize networks, has four horizontal blade slots to provide up to 192 32 Gbps Fibre Channel device ports and 16 additional 128 Gbps UltraScale ICL ports. Each blade slot can be populated with two optional blades.

For device connectivity, the Brocade FC32-48 Fibre Channel device port blade provides 48 32 Gbps Fibre Channel ports. To support disaster recovery and data protection storage solutions over long distances, the Brocade SX6 Extension Blade provides 16 32 Gbps Fibre Channel ports, 16 1/10 GbE ports, and 2 40 GbE ports for Fibre Channel and IP replication traffic. The Brocade X6 family supports 4, 8, 10, 16, and 32 Gbps Fibre Channel; FICON®; and 1, 10, and 40 GbE.

The Brocade X6 Director family provides investment protection through three generations of backward-compatibility support for connectivity to 4, 8, and 16 Gbps Fibre Channel products. To further protect future investments, the Brocade X6 supports future Fibre Channel generations as a Gen 7-ready storage networking platform. In addition, the Brocade X6 Director allows for current Gen 6 and future generation switch blade modules to be added within the chassis.

See the table below for a detailed comparison of Brocade X6 Directors and Brocade DCX 8510 Backbones.

	Brocade X6-8 Directors with Gen 6 Fibre Channel	Brocade DCX 8510-8 with Gen 5 Fibre Channel	Brocade X6-4 Directors with Gen 6 Fibre Channel	Brocade DCX 8510-4 with Gen 5 Fibre Channel
Total Bandwidth with Brocade UltraScale vs. Standard ICLs	16.2 Tbps	8.2 Tbps	8.1 Tbps	4.1 Tbps
Maximum Total Ports	384 at 32 Gbps	512 at 16 Gbps	192 at 32 Gbps	256 at 16 Gbps
Slot Bandwidth	1.5 Tbps	512 Gbps	1.5 Tbps	512 Gbps
Maximum Chassis Connected via UltraScale ICLs	12 core-edge 9 active-active mesh	12 core-edge 9 active-active mesh	6 core-edge 5 active-active mesh	6 core-edge 5 active-active mesh
UltraScale ICL Ports	32 at 128 Gbps	32 at 64 Gbps	16 at 128 Gbps	16 at 64 Gbps
UltraScale ICL Bandwidth	4.096 Tbps	2 Tbps	2.048 Tbps	1 Tbps
UltraScale ICL Cables	Up to 100 m optical at 4x32 Gbps speeds Up to 2 km at 16 Gbps speeds	Up to 2 km optical	Up to 100 m optical at 32 Gbps speeds Up to 2 km at 16 Gbps speeds	Up to 2 km optical
Energy Efficiency	0.26 watts/Gbps	0.30 watts/Gbps	0.26 watts/Gbps	0.30 watts/Gbps
IO Insight and VM Insight	Yes	N/A	Yes	N/A
ClearLink Diagnostic Ports (D_Ports)	Yes	Yes	Yes	Yes
In-flight Compression	Yes	Yes	Yes	Yes
In-flight Encryption	Yes	Yes	Yes	Yes
10 Gbps Native Fibre Channel	Included	Optional license	Included	Optional license
Forward Error Correction (FEC)	Yes	Yes	Yes	Yes
ASIC-Enabled Buffer Credit Loss Detection and Automatic Recovery at Virtual Channel Level	Yes	Yes	Yes	Yes

The Future of Fibre Channel Technology

Q. Is Fibre Channel still the best infrastructure for data center storage?

A. Yes. Fibre Channel remains the de facto standard in networking infrastructure for mission-critical storage in the data center.

Digital transformation is pushing mission-critical storage environments to the limit, with users expecting data to be accessible from anywhere, at any time, on any device. Faced with exponential data growth, the network must evolve to enable businesses to thrive in this new era. To meet these dynamic and growing business demands, organizations need to deploy infrastructure that can deliver greater consistency, predictability, and performance. Legacy infrastructure, however, was not designed to support the performance requirements of evolving workloads and flash-based storage technology.

Brocade Gen 6 Fibre Channel delivers integrated network sensors, industry-leading performance and increased business agility to accelerate data access, adapt to evolving requirements, and drive always-on business operations. The Brocade X6 Director with Brocade Fabric Vision technology—which includes IO Insight and VM Insight—delivers data center-proven availability, breakthrough performance, and seamless scalability to ensure greater consistency, predictability, and performance.

Q. Will the Brocade X6 Director seamlessly support Non-Volatile Memory Express (NVMe)?

A. 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. Moreover, NVMe enables users to achieve faster application response times and harness the performance of hundreds of solid state drives for better scalability across virtual data centers with flash.

Organizations can seamlessly integrate Brocade Gen 6 Fibre Channel networks with next-generation NVMe without a disruptive rip and replace. Leveraging the efficiency of NVMe, combined with the high performance and low latency of Brocade Gen 6 Fibre Channel, organizations can accelerate IOPS to deliver the performance, application response time, and scalability needed for next-generation data centers.

Q. What value does 32 Gbps port speed provide when I currently have sufficient bandwidth at 8/16 Gbps?

A. Legacy infrastructure was not designed to support today's dynamic and growing business demands and requirements for evolving workloads and flash-based storage technology. An aging network will impede the performance of an all-flash data center.

Gen 6 Fibre Channel solutions with unmatched 32/128 Gbps performance are ideally designed to enable these applications and unlock the full capabilities of flash. However, the true value of Gen 6 Fibre Channel extends beyond performance and higher throughput. Higher reliability and innovative integrated technologies—such as IO Insight, VM Insight, Brocade Inter-Chassis Links (ICL connectivity), and Fabric Vision technology—dramatically simplify end-to-end management of large-scale environments and drive down operational costs.

Gen 6 Fibre Channel with Fabric Vision technology delivers powerful monitoring, management, and diagnostic tools to improve operational stability and dramatically reduce costs. Fabric Vision technology now includes IO Insight, which provides organizations with deeper visibility into the performance of their environments. This enhanced visibility enables organizations to easily identify degraded application performance at the host and storage tiers. As a result, administrators can quickly identify issues, avoid problems, and meet SLA objectives.

Feature	Gen 5 Fibre Channel	Gen 6 Fibre Channel
Flow-level monitoring for storage SLAs	Frame level	Device and application level
Automatically detect degraded application performance with IO Insight through integrated network sensors	Not available	Available
Visibility and metrics to tune device performance	Not available	Available
Gen 7-ready storage networking infrastructure	Not available	Available
Non-oversubscribed backplane for 48 line-rate ports	Available with local switching (32 line-rate ports without local switching)	Available
VM or device connectivity scale	Accommodates high-density VM deployments	2x scale capability of Gen 5 VM deployments
Deployment flexibility: Dual direction airflow	Not available	Available
Higher supportability, RAS features	Available	Enhanced
IP and Fibre Channel extension for flexible storage DR/BC requirements	Appliance-based	Modular platform-integrated
In-flight compression	Supported	3x the Gen 5 bandwidth
Forward Error Correction (FEC)	Available	More robust and flexible
Maximum port speed	Up to 16 Gbps	Up to 128 Gbps
More buffers per switching ASIC	8K	15K

Q. What Brocade Global Services offerings are available for Brocade X6 Directors?

A. Brocade offers assessment, design, implementation, and Brocade Resident Consultant services, as well as Brocade Technical Support, for the Brocade X6 Director.

Q. What is Brocade Fabric Vision technology?

A. Brocade Fabric Vision technology is an advanced hardware and software solution that combines capabilities from the Brocade Fibre Channel ASIC, Brocade Fabric OS® (FOS), and Brocade Network Advisor to help administrators address problems before they impact operations, accelerate new application deployments, and dramatically reduce operational costs.

Fabric Vision technology provides unprecedented visibility and insight across the storage network through innovative diagnostic, monitoring, and management technology.

Q. What features and capabilities does Brocade Fabric Vision technology offer?

A. Brocade Fabric Vision technology, an extension of Brocade Gen 5 and Gen 6 Fibre Channel solutions, offers technology innovation that is unmatched in the industry. Fabric Vision technology includes:

- **IO Insight:** Proactively and non-intrusively monitors storage device IO performance and behavior through integrated network sensors at the storage tier, providing deep insight into problems and ensuring service levels. (Available only on the Brocade G620 Switch and Brocade X6 Directors.)
- **VM Insight:** Seamlessly monitors VM performance throughout a storage fabric with standards-based, end-to-end VM tagging. Administrators can quickly determine the source of VM/application performance anomalies, as well as provision and fine-tune the infrastructure based on VM/application requirements to meet service-level objectives.
- **Monitoring and Alerting Policy Suite (MAPS):** Leverages prebuilt, rule-/policy-based templates within MAPS to simplify fabric-wide threshold configuration, monitoring, and alerting. Administrators can configure the entire fabric (or multiple fabrics) at one time using common rules and policies, or customize policies for specific ports or switch elements. With Flow Vision and VM Insight, administrators set thresholds for VM flow metrics in MAPS policies in order to be notified of VM performance degradation.
- **Fabric Performance Impact (FPI) Monitoring:** Leverages predefined MAPS policies to automatically detect and alert administrators to different latency severity levels, and to identify slow drain devices that could impact network performance. This feature identifies various latency severity levels, pinpointing exactly which devices are causing or are impacted by a bottlenecked port, and quarantines slow drain devices automatically to prevent buffer credit starvation.
- **Dashboards:** Provides integrated dashboards that display an overall SAN health view, along with details on out-of-range conditions, to help administrators easily identify trends and quickly pinpoint issues occurring on a switch or in a fabric.
- **Configuration and Operational Monitoring Policy Automation Services Suite (COMPASS):** Simplifies deployment, safeguards consistency, and increases operational efficiencies of larger environments with automated switch and fabric configuration services. Administrators can configure a template or adopt an existing configuration as a template and seamlessly deploy the configuration across the fabric. In addition, they can ensure that settings do not drift over time with COMPASS configuration and policy violation monitoring within Brocade Network Advisor dashboards.
- **Brocade ClearLink Diagnostics:** Ensures optical and signal integrity for Fibre Channel optics and cables, simplifying deployment and support of high-performance fabrics. ClearLink Diagnostic Port (D_Port) is an advanced capability of Brocade Fibre Channel platforms.

- **Flow Vision:** Enables administrators to identify, monitor, and analyze specific application and data flows in order to simplify troubleshooting, maximize performance, avoid congestion, and optimize resources.
 - **Flow Monitor:** Provides comprehensive visibility into flows within the fabric, including the ability to automatically learn flows and non-disruptively monitor flow performance. Administrators can monitor all flows from a specific host to multiple targets/LUNs, from multiple hosts to a specific target/LUN, or across a specific ISL. Additionally, they can perform LUN-level monitoring of specific frame types to identify resource contention or congestion that is impacting application performance. With the IO Insight capability on the Brocade G620 Switch and Brocade X6 Directors, administrators can monitor first IO response time, IO completion time, the number of pending IOs, and IOPS metrics for a specific host and target, or a specific host, target, and LUN. With VM Insight on Brocade G610 and G620 Switches and Brocade X6 Directors, administrators can monitor network throughput and IO statistics for each VM.
 - **Flow Learning:** Enables administrators to non-disruptively discover all flows that go to or come from a specific host port or a storage port, or traverse ISLs/IFLs or FCIP tunnels, to monitor fabric-wide application performance. In addition, administrators can discover top and bottom bandwidth-consuming devices and manage capacity planning.
 - **Flow Generator:** Provides a built-in traffic generator for pretesting and validating the data center infrastructure for robustness—including route verification and integrity of optics, cables, ports, back-end connections, and ISLs—before deploying applications.
 - **Flow Mirroring:** Provides the ability to non-disruptively create copies of specific application and data flows or frame types that can be captured for in-depth analysis.
- **Forward Error Correction (FEC):** Automatically detects and recovers from bit errors, enhancing transmission reliability and performance.
- **Credit Loss Recovery:** Helps overcome performance degradation and congestion due to buffer credit loss.

For more information about Brocade Fabric Vision technology, visit www.brocade.com/fabricvision.

Q. What are the advantages of Brocade Fabric Vision technology?

A. Brocade Fabric Vision technology provides a breakthrough hardware and software solution that helps simplify monitoring, maximize network availability, and dramatically reduce costs. Featuring innovative monitoring, management, and diagnostic capabilities, Fabric Vision technology enables administrators to avoid problems before they impact operations, helping their organizations meet SLAs. For more information about Fabric Vision technology, visit www.brocade.com/fabricvision.

Q. What is IO Insight?

A. IO Insight is integrated within the Brocade G620 Switch and Brocade X6 Directors. It helps organizations achieve greater control and insight to quickly identify the root cause of problems at the storage tier, reducing time to resolution so critical SLAs can be met. The IO Insight capability non-intrusively gathers IO statistics, which can be used within an intuitive, policy-based monitoring and alerting suite to configure thresholds and alarms. In-band device latency and IOPS monitoring detects degraded storage performance, allowing administrators to proactively optimize performance and availability to ensure maximum performance. Additional features include:

- Provides proactive, non-intrusive, real-time monitoring and alerting with visibility into storage IO health and performance
- Monitors individual host or storage devices to gain deeper insights into the performance of the network in order to maintain SLA compliance
- Obtains IO latency and IOPS metrics for a storage device in order to diagnose IO operational issues

Q. What is VM Insight?

A. VM Insight uses standards-based, end-to-end VM tagging to gain VM visibility in a storage fabric. VM Insight enables storage administrators to monitor VM-level application performance and set baseline workload behavior. Using this information, they can quickly determine whether a storage fabric is the source of performance anomalies for VM-level applications. VM Insight also enables fast correlation with other Fabric Vision metrics to identify the root cause of problems before operations are affected. VM Insight provides the visibility for administrators to provision and plan storage networks based on application requirements, and to fine-tune the infrastructure to meet service-level objectives.

Q. What is Brocade ClearLink Diagnostics?

A. The Brocade ClearLink Diagnostics tool leverages Brocade ClearLink Diagnostic Port (D_Port) mode to ensure optical and signal integrity for Fibre Channel optics and cables, simplifying deployment and support of high-performance fabrics. By proactively verifying the integrity of critical transceivers, organizations can quickly address any physical layer issues without the need for special optical testers.

ClearLink Diagnostics allows users to automate a battery of tests to measure and validate latency and distance across the switch links, as well as to verify the integrity of the fiber and optical transceivers in the fabric—prior to deployment or when there are suspected physical layer issues. With ClearLink Diagnostics, only the ports attached to the link being tested need to go offline, leaving the rest of the ports to operate online.

In addition to switch-to-switch link validation, ClearLink Diagnostics also provides the following:

- Support between Gen 5 and Gen 6 Fibre Channel switches and fabric adapters from QLogic and Emulex when running at 16 Gbps or 32 Gbps, allowing administrators to initiate tests from the adapter.
- The ability to configure settings to ensure consistency and automatically run D_Port tests based on port or switch events, including links over xWDM.
- D_Port pre-provisioning to improve operational control and avoid costly mistakes.
- D_Port integration into MAPS for threshold-based monitoring and alerting.
- Port LED for a visual indication of D_Port test result failures.
- Link power (dB) loss information with D_Port test results.
- Through collaboration with industry partners, Brocade will extend ClearLink Diagnostics to additional end devices and adapters, providing end-to-end physical layer diagnostics and validation.

Q. What is MAPS?

A. Brocade Monitoring and Alerting Policy Suite, or MAPS, is an easy-to-use, policy-based threshold monitoring and alerting suite that proactively monitors the health and performance of the SAN infrastructure to ensure application uptime and availability. By leveraging prebuilt, pre-validated, rule-/policy-based templates, MAPS takes the guesswork out of defining appropriate rules and actions, simplifying threshold configuration, monitoring, and alerting. With MAPS, organizations can apply thresholds and alerts via a simple two-step process:

1. Define all host ports, storage ports, and E_Ports that belong to a specific group, or use the predefined default groups.
2. Go to the list of predefined policies (each with more than 250 highly tuned rules) and select one to apply to that group, or create a custom policy.

Organizations can configure an entire fabric (or multiple fabrics) at one time using common rules and policies, or customize rules for specific ports—all through a single dialog. The integrated dashboard displays a switch health report, along with details on out-of-policy conditions, to help administrators quickly pinpoint potential issues and easily identify trends and other behaviors occurring on a switch or fabric. With Flow Vision and VM Insight, administrators set thresholds for VM flow metrics in MAPS policies in order to be notified of VM performance degradation.

Q. What is Flow Vision?

- A.** The Brocade Flow Vision tool suite allows administrators to identify, monitor, and analyze specific application and data flows in order to maximize performance, avoid congestion, and optimize resources. Flow Vision includes:
- **Flow Learning:** Enables administrators to non-disruptively discover all flows that travel to or from a specific host or storage port, or traverse ISLs/IFLs or FCIP tunnels, to monitor fabric-wide application performance. In addition, administrators can discover top and bottom bandwidth-consuming devices, and manage capacity planning.
 - **Flow Monitoring:** Provides comprehensive visibility into flows in the fabric, including the ability to automatically learn (discover) flows and non-disruptively monitor flow performance. Administrators can monitor all flows from a specific host to multiple targets/LUNs or from multiple hosts to a specific target/LUN; monitor all flows across a specific ISL; or perform LUN-level monitoring of specific frame types to identify resource contention or congestion that is impacting application performance. With the IO Insight capability, administrators can monitor first IO response time, IO completion time, the number of pending IOs, and IOPS metrics for a specific host and target, or a specific host, target, and LUN.
 - **Flow Generator:** Provides a built-in traffic generator for pretesting and validating the SAN infrastructure, including internal connections within a switch, for robustness before deploying applications—without requiring 16 Gbps hosts, targets, or external traffic generators.
 - **Flow Mirroring:** Provides the ability to non-disruptively create copies of specific application and data flows or frame types for in-depth analysis.

Q. What Fabric Vision technology capabilities are supported in Brocade 8 Gbps, Gen 5, and Gen 6 platforms?

- A.** Some Fabric Vision technology features are supported on Brocade 8 Gbps platforms; others are available only on Brocade Gen 5 Fibre Channel platforms. The chart below shows the various Fabric Vision technology features supported on each generation of products.

Features	8 Gbps Platforms	Gen 5 Platforms	Gen 6 Platforms
Forward Error Correction (FEC)	No	Yes	Yes
VC-level BB_Credit Recovery	No	Yes	Yes
Brocade ClearLink Diagnostics (D_Port)	No	Yes	Yes
MAPS	Yes	Yes	Yes
Fabric Performance Impact (FPI) Monitoring	Yes	Yes	Yes
Flow Learning	No	Yes	Yes
Flow Monitor	Yes, with some limitations	Yes	Yes
Flow Mirroring	No	Yes	Yes
Flow Generator	No	Yes	Yes
COMPASS	Yes	Yes	Yes
IO Insight	No	No	Yes
VM Insight	No	No	Yes

Q. What are the advantages of Brocade Fabric Vision technology?

A. Brocade Fabric Vision technology provides a breakthrough hardware and software solution that helps simplify monitoring, maximize network availability, and dramatically reduce costs. Featuring innovative monitoring, management, and diagnostic capabilities, Fabric Vision technology enables administrators to avoid problems before they impact operations, helping their organizations meet SLAs. For more information about Fabric Vision technology, visit www.brocade.com/en/possibilities/technology/storage-fabrics-technology.html.

Q. What value do Brocade UltraScale Inter-Chassis Links (ICLs) provide for the Brocade X6?

A. Both Gen 5 backbones and Gen 6 directors provide up to 32 QSFP ports on the 8-slot chassis and up to 16 QSFP ports on the 4-slot chassis to help preserve switch ports for end devices. Each QSFP port actually has four independent 16/32 Gbps links, providing a total of 64/128 Gbps of bandwidth.

Gen 6 UltraScale ICL technology provides a high-density solution that doubles the bandwidth with 128 Gbps connectivity to enable flatter, faster, and simpler fabrics that increase consolidation while reducing network complexity and costs.

The Gen 6 UltraScale ICL connectivity ports support standard optical cables up to 100 meters at Gen 6 (4x32 Gbps) speed and 2 km at Gen 5 (4x16 Gbps) speed for longer distances. Gen 6 UltraScale ICLs are backward-compatible and can connect to Gen 5 ICL ports, enabling organizations to maximize their investments. UltraScale ICLs enable connections of up to 12 chassis in a core-edge, and up to nine chassis in an active-active mesh topology. These high-density chassis topologies reduce inter-switch cabling by 75 percent and free up to 33 percent of ports for servers and storage. This maximizes overall port density within the smallest amount of rack space while freeing up front-facing device ports for server and storage connectivity.

Q. What UltraScale Inter-Chassis Link (ICL) kits are required to enable these ports on the Brocade X6?

A. The Brocade X6 Director requires two ICL kits to enable the full capacity of chassis. To license all ports on the Brocade X6-8, two Brocade X6-8 ICL kits are required; to license all ports on the Brocade X6-4, two Brocade X6-4 ICL kits are required. These ICL kits can provide connectivity for Gen 6 to Gen 6, or Gen 6 to Gen 5.

Kit	Number of Optics in the Kit	Licensed Ports	Purpose
Brocade X6-8 ICL Kit 100 m P/N: BR-X68ICLKIT-100M-02	16	16 QSFP ports per chassis (8 QSFP ports per CR blade)	Gen 6 to Gen 6 at 4x32 Gbps for up to 100 m or Gen 6 to Gen 5 at 4x16 Gbps for up to 100 m
Brocade X6-8 Gen 6 ICL Kit 2 km	8	16 QSFP ports per chassis (8 QSFP ports per CR blade)	Gen 6 to Gen 6 at 4x32 Gbps for up to 2 km
Brocade X6-8 Gen 5 ICL Kit 2 km	8	16 QSFP ports per chassis (8 QSFP ports per CR blade)	Gen 6 to Gen 5 at 4x16 Gbps for up to 2 km
Brocade X6-4 ICL Kit 100 m P/N: BR-X64ICLKIT-100M-02	8	8 QSFP ports per chassis (4 QSFP ports per CR blade)	Gen 6 to Gen 6 at 4x32 Gbps for up to 100 m or Gen 6 to Gen 5 at 4x16 Gbps for up to 100 m
Brocade X6-4 Gen 6 ICL Kit 2 km	8	8 QSFP ports per chassis (4 QSFP ports per CR blade)	Gen 6 to Gen 6 at 4x32 Gbps for up to 2 km
Brocade X6-4 Gen 5 ICL Kit 2 km	8	8 QSFP ports per chassis (4 QSFP ports per CR blade)	Gen 6 to Gen 5 at 4x16 Gbps for up to 2 km

The following kits will soon be obsolete due to a superior and more flexible offering.

Obsolete P/N	Replacement P/N	Reason for Obsolescence
BR-X68ICLKIT-100M-01 (Brocade X6-8 ICL Kit)	BR-X68ICLKIT-100M-02	Replacement kit bundles are technologically superior, with flexible QSFPs capable of supporting both 4×32 Gbps and 4×16 Gbps speeds, rendering previous kits obsolete.
BR-X68GEN5ICLKIT-01 (Brocade X6-8 Gen 5 ICL Kit)	BR-X68ICLKIT-100M-02	
BR-X64ICLKIT-100M-01 (Brocade X6-4 ICL Kit)	BR-X64ICLKIT-100M-02	
BR-X64GEN5ICLKIT-01 (Brocade X6-4 Gen 5 ICL Kit)	BR-X64ICLKIT-100M-02	

Q. What is the throughput of the UltraScale ICL connections? What happens if an UltraScale ICL connection fails?

- A.** Each UltraScale ICL port provides 128 Gbps of bandwidth over a QSFP (4×32 Gbps) link. A minimum of four ports (two from each core switching blade) are required to connect chassis together.

The Brocade X6-8 has a total of 32 UltraScale ICL ports (16 per Brocade CR16-8 core switching blade) that deliver 4.1 Tbps of bandwidth. This is equivalent to 128 32 Gbps ISLs. The Brocade X6-4 has a total of 16 UltraScale ICL ports (eight per Brocade CR16-4 core switching blade) that deliver 2 Tbps of bandwidth. This is equivalent to 64 32 Gbps ISLs.

Frame-based trunking is enabled between up to four UltraScale ICLs. Brocade Dynamic Path Selection (DPS) balances exchanges across all ICL connections using a hash of the SID, DID, RxPort, and OxID. If an UltraScale ICL connection fails, all traffic will travel over remaining active links.

Q. Can UltraScale ICLs and ISLs be used together to connect chassis?

- A.** Simultaneous ICL and ISL connectivity between two Brocade X6 chassis is not supported. However, if Brocade Virtual Fabrics is enabled, simultaneous ICLs and ISLs can coexist between a pair of Brocade X6 and/or Brocade DCX 8510 chassis if ICLs are in a different logical switch than the ISLs.

Q. What kinds of cables are used with the 4×32 GFC 100 m QSFP+ for UltraScale ICLs?

- A.** Brocade X6 UltraScale ICL cables connect UltraScale ICL ports over OM3 or OM4 optical cables up to 100 meters in the following manner:
- Brocade X6 4×32 GFC 100 m QSFPs require MPO 1×12 OM4 ribbon cable connectors and multimode ribbon fiber cable, limited to 100 meters.
 - Although the connector has 12 lanes in a row, the 4×32 GFC QSFP uses only the outer eight lanes (four from each end). The central four lanes are not used.
 - Plug orientation does not matter because the plug is polarized—it takes care of itself, just like RJ-45. Specifically, it is female-female and key-up to key-up orientation.

Cables are available from:

Vendor	1 m (OM3 part number)	10 m (OM3 part number)	50 m (OM3 part number)	50 m (OM4 part number)	100 m (OM4 part number)
Molex	106283-1005	106283-1015	106283-1050	N/A	N/A
Wave2Wave	50-4120P-1M	50-4120P-10M	50-4120P-50M	50-9120P-50M	50-9120P-100M
CWI Trading	N/A	N/A	N/A	QSFP-PFPF-4R-50M	QSFP-PFPF-4R-100M

For more information, visit www.molex.com or www.wave-2-wave.com, or contact CWI Trading (kit.yee@cwitrading.com).

Q. What types of QSFPs are used with the new 4×32 GFC 100 m QSFP+ for UltraScale ICLs?

A. Brocade-branded 4×32 Gbps (100 m and 2 km) and 4×16 Gbps (100 m and 2 km) are supported. The new Brocade 4×32 Gbps QSFP offering supports interoperability with Gen 5 4×16 Gbps QSFPs for up to 100 m. This new QSFP is offered as an ICL kit (BR-X68ICLKIT-100M-02/BR-X64ICLKIT-100M-02) and as a FRU (XBR-000275). The 4×16 Gbps 2km QSFPs are required on the Brocade X6 for connectivity to Brocade DCX 8510 ICL ports for distances greater than 100 m, up to a maximum of 2 km.

Q. What is integrated metro and geo connectivity?

A. Brocade X6 Directors also support integrated storage extension over native Fibre Channel (metro connections up to 100 km) or over Fibre Channel over IP (FCIP) (geo connections beyond 100 km) on all ports. Native Fibre Channel connections now include in-flight encryption and compression as well as optional support for 10 Gbps Fibre Channel over DWDM and dark fiber.

With the Brocade SX6 Extension Blade, the Brocade X6 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 X6 Director can scale up to four Brocade SX6 blades per chassis. Each Brocade SX6 Extension Blade provides 16 32 Gbps Fibre Channel/FICON ports, 16 1/10 Gigabit Ethernet (GbE) ports, and 2 40 GbE 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.

Q. What are the benefits of in-flight compression over ISLs?

A. In-flight compression optimizes network performance within the data center and over long-distance links. Data is compressed at the source and uncompressed at the destination. Performance varies by data type, but Brocade uses an efficient algorithm to generally achieve 2:1 compression with minimal impact on performance. In-flight compression is only available on Gen 6 Fibre Channel port blades.

Q. What are the benefits of in-flight encryption over ISLs?

A. In-flight encryption minimizes the risk of unauthorized access for traffic within the data center and over long-distance links. It is switch-to-switch encryption, not device or data-at-rest encryption. Data is encrypted at the source and decrypted at the destination. Encryption and decryption are performed in hardware using the AES-GCM-256 algorithm, minimizing any impact on performance. Encryption can be used in conjunction with in-flight compression. In-flight encryption is available only on the Brocade FC32-48 Gen 6 Fibre Channel port blade for the Brocade X6 and is complementary with in-flight IP encryption provided by the Brocade SX6 Extension Blade.

Q. How does the Gen 6 ASIC compare to previous generations?

A. The Gen 6 ASIC is the industry’s most powerful and efficient Fibre Channel switching technology. In addition to Gen 6 Fibre Channel 32 Gbps speed and 128 Gbps speed, it includes more bandwidth (2 Tbps), faster IO performance (566 million frames switched per second), 33 percent more density (allowing the Brocade X6 to gain three times more slot bandwidth than Gen 5), and more functionality that includes Fabric Vision, IO Insight, ClearLink Diagnostics, in-flight encryption and compression, and Forward Error Correction (FEC).

Q. What power management features are included?

A. Brocade X6 port blades and Brocade Gen 6 Fibre Channel switches (Brocade G620 Switches) support real-time power measurement, providing insight into power consumption in the fabric.

Brocade X6 Director Hardware

Q. What 8 Gbps or 16 Gbps Brocade DCX and DCX 8510 blades are compatible with Brocade X6 chassis?

A. The Brocade X6 will not support any of the existing 8 Gbps or 16 Gbps blades; however, the Gen 6 Brocade FC32-48 blade does support 4, 8, and 16, Gbps connectivity.

Q. Can Brocade FC16-32, FC16-48, and FC16-64 16 Gbps blades be upgraded to 32 Gbps blades?

A. No. Brocade FC16-32, FC16-48, and FC16-64 blades are not upgradable to 32 Gbps functionality.

Q. What blades are available for the Brocade X6 Directors and Brocade DCX 8510 Backbones?

A. The following table lists the blades supported by each.

Brocade Blade	Brocade X6-8	Brocade X6-4	Brocade DCX 8510-8	Brocade DCX 8510-4
FC32-48	✓	✓	N/A	N/A
FC16-32	N/A	N/A	✓	✓
FC16-48	N/A	N/A	✓	✓
FC16-64	N/A	N/A	✓	✓
FC8-32E	N/A	N/A	✓	✓
FC8-48E	N/A	N/A	✓	✓
FC8-64	N/A	N/A	✓	✓
SX6	✓	✓	N/A	N/A
FCOE10-24	N/A	N/A	✓	N/A
FX8-24	N/A	N/A	✓	✓
Brocade DCX 8510 Control Processor	N/A	N/A	✓	✓
Brocade X6 Control Processor	✓	✓	N/A	N/A
Core Switching	Brocade CRX-8	Brocade CRX-4	Brocade CR16-8	Brocade CR16-4

Q. How many Brocade SX6 Extension Blades can be utilized per Brocade X6 chassis?

A. Up to four Brocade SX6 blades per chassis are currently supported.

Q. How is chassis bandwidth calculated for Brocade X6 Directors?

A. With all 384 (Brocade X6-8) or 192 (Brocade X6-4) ports running at full 32 Gbps speed (data rate) and with all traffic traveling over the backplane (utilizing slot bandwidth), there will be no oversubscription or 1:1 for either model. Brocade X6 Directors also support local switching—with ingress/egress traffic on the same blade—which yields no oversubscription as well.

ICL bandwidth adds an additional 4.1 Tbps (Brocade X6-8) and 2.1 Tbps (Brocade X6-4). The combination of port and ICL bandwidth yields the total chassis bandwidth of 16.2 Tbps (Brocade X6-8) or 8.1 Tbps (Brocade X6-4).

Q. Are Brocade Small Form-Factor Pluggable plus (SFP+) optics required for the Gen 6 Fibre Channel Brocade X6 Director or switches?

A. Yes. Brocade X6 Directors and Brocade G620 Switches require Brocade-branded SFP+ optics.

Q. Why do Brocade X6 Directors require Brocade SFP+ optics?

A. Brocade SFP+ optics have advanced features, such as Brocade ClearLink Diagnostics, that help ensure optical and signal integrity for Gen 5 and Gen 6 Fibre Channel optics and cables, simplifying the deployment and support of high-performance fabrics.

In addition, using Brocade optics provides quality control that in turn avoids application downtime. The greater the port speed—especially 32 Gbps—the less tolerance that directors and switches have for out-of-spec wavelengths that lead to port failure and application interruption.

Q. Are supported cable distances affected by 32 Gbps?

A. Yes. Supported distances are reduced as Fibre Channel speed increases. See the table below.

Transceiver Type	Form Factor	Speed	Multimode Maximum Distance				Single Mode Maximum Distance
			OM1	OM2	OM3	OM4	9 μm
SWL	SFP+	32 Gbps	-	-	70 m	100 m	Not applicable
	SFP+	16 Gbps	15 m	35 m	100 m	125 m	
	SFP+	10 Gbps	33 m	82 m	300 m	550 m	
	SFP+	8 Gbps	21 m	50 m	150 m	190 m	
LWL	SFP+	32 Gbps	Not applicable				10 km
	SFP+	16 Gbps	Not applicable				10 km
	SFP+	10 Gbps	Not applicable				10 km
	SFP+	8 Gbps	Not applicable				10 km
ELWL	SFP+	32 Gbps	Not applicable				10 km
	SFP+	16 Gbps	Not applicable				10 km, 25 km
	SFP+	8 Gbps	Not applicable				25 km

Q. What cable management solutions are available for Brocade X6 Directors?

A. Brocade X6 Directors include horizontal (Brocade X6-8) and vertical (Brocade X6-4) cable combs for basic cable management. Brocade cable management and patch panel partners offer structured cable management solutions using patch panels for existing (1U LC patch panel) and high-density (1U MPO patch panel) solutions.

Q. Which components are common between the Brocade X6-8 and Brocade X6-4 models? Which are different?

A. Both the Brocade X6-8 and Brocade X6-4 models utilize the same Gen 6 Fibre Channel SFP+ (32 Gbps and 128 Gbps SFP+), Brocade FC32-48 (32 Gbps 48-port) port blade, and Brocade SX6 Extension Blade (for FCIP). They also use the same Control Processor (CPX) blade, power supply, fan, WWN cards, and Brocade UltraScale ICL cables and optics. Besides the chassis, the only components that differ between the Brocade X6-8 and Brocade X6-4 models are the core switching blades (Brocade CR32-8 and CR32-4).

Q. Will Brocade X6 Directors work with existing firmware versions in current fabrics?

A. Brocade X6 models require Brocade FOS 8.0.1 or greater. Brocade X6 models are compatible with all 8 Gbps platforms running Brocade FOS 7.3.1 or later connectivity. Any 4 Gbps legacy devices running prior versions of Brocade FOS are supported only through Fibre Channel routing. For complete support information, please refer to the respective Brocade FOS release notes.

Q. The Brocade X6-8 model accommodates four power supplies. Why does it ship with three? Do both the Brocade X6-8 and Brocade X6-4 support 240 VAC and 110 VAC power supplies?

A. Three 240 VAC power supplies come standard with the Brocade X6-8 model for a 2+1 configuration for redundancy. All are active, but if one fails, the others will provide enough power to maintain the entire chassis. Four total power bays are available for higher (power) availability, and four must be installed to provide the greatest power efficiency and a 2+2 redundant configuration. The Brocade X6-8 also supports using 110 VAC power input (on the same power supply units) in place of the 240 VAC power input.

The Brocade X6-4 has two power supply bays and ships fully populated. Both are active/active, but if one fails, the other will provide power for the entire chassis. The 110 VAC power input can also be used to provide power, but with some restrictions. Please refer to the Brocade X6 Director hardware installation guide for additional information.

Q. Do Brocade X6 Directors support High Voltage AC (HVAC) or High Voltage DC (HVDC) power supplies?

A. Yes. Starting with Brocade Fabric OS (FOS) v8.1.0, Brocade X6 Directors support HVAC and HVDC input via a new Power Supply Unit (PSU). Both HVAC and HVDC inputs are supported via this single new PSU. This HV PSU is rated as follows:

Type	Related Input Voltage	Operating Input Voltage Range (Nominal)
High Voltage DC (HVDC)	240 V to 380 V DC	192 V to 400 V DC
High Voltage AC (HVAC)	100 V to 120 V AC 200 V to 277 V AC	90 V to 277 V AC

Please refer to the Brocade X6 Director hardware installation guide for additional information.

Q. Will Brocade offer/support upgrades to HV PSUs on an existing Brocade X6 chassis (already shipped with 240 V AC PSUs)?

A. No. Due to regulatory requirements, upgrading existing Brocade X6 Director chassis to include HVAC/HVDC PSUs in the install base will not be supported.

Q. Are there new base chassis SKUs that bundle HV power supplies?

A. No. However, HV power supplies can be added to a build-to-order base chassis. This build-to-order base chassis does not include fans or power supplies. After selecting a build-to-order chassis, you may add fans and the type of PSU (regular or HV), depending on the configuration and airflow required.

Q. What types of power cords are supported with HV power supplies?

A. Brocade offers two power cords for HV power supplies based on compliance and regional requirements:

- PC-UNIVERSAL-LUGS-SAFD: For the OT-M6 port (LUGS) on the terminal side. This power cord is IEC57/CCC-compliant and rated at 400 V 75 C. It is supported in China.
- PC-UNIVERSAL-SAFD: Provides unterminated wires on the terminal side and hence provides flexibility in deployment, as termination connectors and connectivity would vary based on the application (AC, DC) and country plug type. This power cord is UL- and TUV-compliant and rated at 14 AWG 600 V and up to 90 C. It is supported in all other regions outside of China.

Q. Are the 240 V AC power cords (that are currently available) supported with HV power supplies?

A. No, 240 V AC power cords are not compatible with HV power supplies. This is due to a SAF-D type connector on the PSU, which is different than the C19 connector that exists on 240 V AC power supplies.

Brocade X6 Software

Q. What advance software is bundled with the Brocade X6-8 and X6-4?

A. The Brocade X6-8 and X6-4 models both ship standard with the Enterprise bundle, which includes Brocade Fabric Vision technology, Brocade Extended Fabric, Brocade Trunking, and CUP.

Q. What optional software licenses are available for Brocade X6 Directors?

A. Two optional value-add licenses are available: Integrated Routing Ports on Demand and ICL Ports on Demand (PoD). The Integrated Routing Ports on Demand license provides a maximum of 128 Fibre Channel ports with Integrated Routing capability. The ICL PoD license, offered together with optics as part of the ICL kits, enables the UltraScale ICL ports on Brocade X6 Directors. All other value-add software is included within the Brocade X6 Director, including integrated 10 Gbps Fibre Channel extension and the Enterprise ICL license.

Q. What key storage networking management capabilities does Brocade Network Advisor provide?

A. Brocade Network Advisor provides comprehensive management of data center SAN fabrics, including configuration, monitoring, diagnostics, best-practices validation, and management of Brocade X6 Directors and Brocade Gen 6 switches. Brocade Network Advisor 14.0.1 provides support for all Brocade Fabric Vision technology, such as Monitoring and Alerting Policy Suite (MAPS), Flow Vision, Configuration and Operational Monitoring Policy Automation Services Suite (COMPASS), and IO Insight. Brocade Network Advisor also provides out-of-the-box support for leading data center management solutions from IBM, HP, and EMC, as well as seamless support for leading hypervisors from VMware and Microsoft. Furthermore, Brocade Network Advisor features a REST API and SMI-S interface for integrating capabilities into partner and customer management applications.

Brocade Network Advisor provides organizations with a programmable, Web-based interface through a standard REST API to reduce operational tasks by automating zoning, scripting, and reporting. To further simplify management tasks, administrators can quickly search through events, historical data, and base inventory, and apply filters. In addition, a standard REST API leverages Brocade Fabric Vision technology to gain fabric-wide health and performance visibility via easy-to-read dashboards.

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



© 2017 Brocade Communications Systems, Inc. All Rights Reserved. 06/17 GA-FAQ-5740-04

Brocade, the B-wing symbol, and MyBrocade are registered trademarks of Brocade Communications Systems, Inc., in the United States and in other countries. Other brands, product names, or service names mentioned of Brocade Communications Systems, Inc. are listed at www.brocade.com/en/legal/brocade-Legal-intellectual-property/brocade-legal-trademarks.html. Other marks may belong to third parties.

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 