

# Brocade® Storage Extension Solutions Frequently Asked Questions

## Introduction

Brocade® extension switches and extension blades for Brocade director families are purpose-built, best-in-class extension platforms that provide a fast, highly reliable, and cost-effective network infrastructure to address today's most demanding disaster recovery requirements. They enable organizations to improve resilience and maximize throughput for replication and backup operations over distance, and work seamlessly with NetApp SnapMirror solutions. These extension solutions also increase visibility into storage extension network health and the performance of data protection applications, and work with NetApp AutoSupport for auto-generated support messages.

For information on Brocade extension products, visit [www.broadcom.com/extension](http://www.broadcom.com/extension)

## General Questions and Answers

### Q. What extension solutions does Brocade offer?

**A.** To address replication and disaster recovery requirements, Brocade offers a full extension solutions portfolio, all available from NetApp, designed to give organizations flexible deployment options for replication. The Brocade 7810 and 7840 Extension Switches are designed for small to large enterprise environments. The Brocade SX6 Extension Blade is an integrated option for the Brocade X6 Director, and designed for high-density, large-scale enterprise environments. In addition, the older-generation Brocade 7800 Extension Switch and the Brocade FX8-24 Extension Blade for the Brocade DCX® 8510 Director chassis are still available.

### Q. What is the Brocade 7810 Extension Switch?

**A.** The Brocade 7810 Extension Switch is a cost-effective solution that securely moves data faster over distance for continuous data protection. This powerful, reliable, and secure platform is purpose-built to handle the unrelenting growth of data traffic between data centers in Fibre Channel and IP storage environments. Whether supporting point-to-point connections, a multisite SAN, or remote offices, the Brocade 7810 Extension Switch offers enterprise-class capabilities to meet demanding disaster recovery requirements. With twelve 32 Gb/s-capable Fibre Channel ports, six 1/10-Gigabit Ethernet (GbE) ports, and a 2.5 Gb/s WAN tunnel, this switch offers the bandwidth and throughput required for maximum application performance. Designed to be affordable, the Brocade 7810 Extension Switch offers flexible configurations, meeting current and future requirements. Organizations can purchase a full configuration with 2.5 Gb/s WAN capacity or pay as they grow with an on-demand upgrade license to quickly and cost-effectively scale their WAN bandwidth. With aggressive compression, organizations can scale up to 10 Gb/s replication throughput, depending on the data and the WAN connection characteristics.

The Brocade 7810 base configuration provides four 32 Gb/s-capable Fibre Channel ports and six 1GbE Ethernet ports with Adaptive Rate Limiting (ARL) and encryption (IPsec). The on-demand upgrade license enables all 12 Fibre Channel ports, 10GbE on the Ethernet ports, Brocade Fabric Vision® technology, Brocade Extension Trunking, Brocade Fibre Channel Trunking, and Integrated Routing (FCR). The full configuration is a comprehensive bundle enabling all ports and includes Brocade Fabric Vision technology, Extension Trunking, Fibre Channel Trunking, ARL, IPsec, and Integrated Routing.

## **Q. What is the Brocade 7840 Extension Switch?**

**A.** The Brocade 7840 Extension Switch is a purpose-built extension solution that moves more data over distance faster while minimizing the impact of disruptions. With Gen 5 Fibre Channel, IP extension capability, and Brocade Fabric Vision technology, this switch delivers industry-leading performance, strong security, continuous availability, and simplified management to handle the unrelenting growth of data traffic between data centers. The Brocade 7840 accelerates performance over distance with up to

80 Gb/s of Fibre Channel over Internet Protocol (FCIP) throughput and up to 40 Gb/s of IP extension throughput to meet stringent disaster recovery objectives. Twenty-four 16 Gb/s Fibre Channel ports, sixteen 1/10-Gigabit Ethernet (GbE) ports, and two 40GbE ports provide the bandwidth, port density, and throughput required for maximum application performance over WAN links for large, complex environments. Designed for maximum flexibility, this enterprise-class extension switch offers pay-as-you-grow scalability with capacity on-demand upgrades. Organizations can quickly and cost-effectively scale from 20 Gb/s to 80 Gb/s application throughput per platform via software licenses to meet current and future requirements.

The Brocade 7840 base configuration is a bundle that includes a comprehensive set of advanced services: FCIP, IP extension, Enterprise Bundle, Brocade Fabric Vision technology, Extension Trunking, WAN-optimized TCP, Adaptive Rate Limiting (ARL), IPsec, Compression, Open Systems Tape Pipelining (OSTP), Fast Write, Adaptive Networking, and Extended Fabrics. Optional value-add licenses for Integrated Routing (FCR), FICON® CUP, and Brocade Advanced FICON Accelerator are available to address challenging extension and storage networking requirements in open system and mainframe environments.

## **Q. What is the Brocade 7800 Extension Switch?**

**A.** The Brocade 7800 is an older-generation extension switch that is compatible with the Brocade FX8-24 Extension Blade for the Brocade DCX 8510 Director chassis.

Two models of the Brocade 7800 are available to address a variety of capacity, functionality, and cost objectives:

- The Brocade 7800 16/6 with sixteen 8 Gb/s Fibre Channel ports and six 1GbE ports maximizes connectivity for multisite and point-to-point open systems disk and tape replication.
- The Brocade 7800 4/2 with four 8 Gb/s Fibre Channel ports and two 1GbE ports provides cost-effective connectivity for two sites or point-to-point open systems disk replication (OSTP is not available on the 4/2 model).

## **Q. What is the Brocade SX6 Extension Blade?**

**A.** The Brocade SX6 Extension Blade is a Fibre Channel and IP storage replication solution for the Brocade X6 Director family that moves more data over distance faster, delivers security without compromising performance, and scales to support the world's most demanding environments. This blade provides the Brocade X6 Director with integrated metro and global connectivity for Fibre Channel and IP storage environments. With Gen 6 Fibre Channel, IP extension capability, and Brocade Fabric Vision technology, this solution delivers industry-leading performance, strong security, continuous availability, unmatched flexibility, and simplified operations to handle the unrelenting transfer of data between data centers. This enables storage and mainframe administrators to optimize and manage the use of WAN bandwidth, secure data over distance, minimize the impact of disruptions, and maintain SLAs.

The Brocade SX6 blade accelerates performance over distance with up to 80 Gb/s of FCIP throughput and up to 40 Gb/s of IP extension throughput to meet stringent disaster recovery objectives. The Brocade X6 Director can scale up to four Brocade SX6 blades per chassis. Each Brocade SX6 Extension Blade provides 16 32 Gb/s Fibre Channel/FICON ports, 16 1/10-Gigabit Ethernet

(GbE) ports, and 2 40GbE ports, delivering the high bandwidth, port density, and throughput required for maximum application performance over WAN connections—and to meet the most demanding disaster recovery requirements.

The Brocade SX6 blade includes a comprehensive set of advanced services: FCIP, IP extension, Enterprise Bundle, Brocade Fabric Vision technology, Extension Trunking, WAN-optimized TCP, Adaptive Rate Limiting (ARL), IPsec, Compression, Open Systems Tape Pipelining (OSTP), Fast Write, Adaptive Networking, Extended Fabrics, FICON CUP, and Brocade Advanced FICON Accelerator. An optional value-add license for Integrated Routing (FCR) is available to address challenging extension and storage networking requirements in open systems environments.

## **Q. What is the Brocade FX8-24 Extension Blade?**

**A.** The Brocade FX8-24 Extension Blade is an older-generation blade-based solution for the Brocade DCX 8510 that is compatible with the older-generation Brocade 7800 Extension Switch. The Brocade FX8-24 Extension Blade provides enterprise-class Fibre Channel and FCIP performance, availability, and security for primary and secondary data centers. Aggregate bandwidth of 96 Gb/s for Fibre Channel switching and up to 20 Gb/s for FCIP provide industry-leading performance and throughput for open systems and mainframe storage applications. Two optional 10GbE ports, providing 10 Gb/s FCIP connectivity, maximize available FCIP bandwidth and enable consolidation of 1GbE ports. Up to four Brocade FX8-24 blades can be installed in a Brocade DCX 8510 chassis for simple expansion and enterprise data center reliability.

## **Q. What are the key platform features of the Brocade 7810, Brocade 7840, and Brocade SX6 platforms?**

**A.** The Brocade 7810, Brocade 7840, and Brocade SX6 maximize replication and backup throughput over distance using advanced compression, disk and tape protocol acceleration for open systems and mainframe environments, and extension networking technology. Advanced features and technologies include:

- WAN-optimized TCP: Optimizes TCP window size, flow control, fast retransmits, and slow starts, resulting in dramatically accelerated TCP transport for replication traffic, for both FCIP and IP extension.
- IP extension: Accelerates throughput performance, meets encryption criteria, manages bandwidth, provides visualization/monitoring/alerting, and enhances availability of IP storage replication.
- Extension Trunking: Creates logical tunnels spanning multiple physical ports for load balancing and network failure resiliency.
- IPsec support: Ensures secure transport over IP WAN links by encrypting data-in-flight with a standard 256-bit AES algorithm.
- Unparalleled, extremely efficient architecture: Uniquely permits the high-speed, low-latency processing of frames, making extension of synchronous applications possible.
- Adaptive Rate Limiting (ARL): Dynamically adjusts bandwidth limits to ensure efficient utilization and sharing of available bandwidth.
- Advanced compression architecture: Provides multiple modes to optimize compression ratios for various throughput requirements. FastWrite (FCIP-FW): Accelerates disk write processing, enabling asynchronous disk replication over any distance.
- Open Systems Tape Pipelining (OSTP): Accelerates read and write tape processing, minimizing backup and restore windows.
- Brocade Advanced Accelerator for FICON:\* Accelerates IBM z/OS Global Mirror (zGM, formerly known as eXtended Remote Copy, or XRC), mainframe tape read and write operations, and z/OS host connection to Teradata warehousing systems, maximizing performance over distance.
- PerPriority TCP Quality of Service (PTQ): Prioritizes flows within a tunnel, optimizing bandwidth and performance with individual TCP sessions per QoS priority. There are three separate priorities for IP extension flows and three separate priorities for FCIP flows.

- Seamless interoperability with Brocade SAN switches, directors, and extension platforms: Simplifies deployment and administration.

\*Note: Not available on the Brocade 7810 Switch.

## **Q. What are the use cases for Brocade extension solutions?**

**A.** Brocade extension solutions leverage cost-effective and sophisticated IP WAN transport to deploy high-performance disaster recovery and data protection solutions. They extend open systems and mainframe storage applications over distances that would otherwise be impossible, impractical, or too expensive with standard connections.

The Brocade 7810 Extension Switch, Brocade 7840 Extension Switch, and Brocade SX6 Extension Blade are robust platforms for small to large-scale, multisite data center environments implementing block, file, and tape data protection solutions. These solutions are unique in their ability to do FCIP and IP extension and are ideal for:

- Data protection for both open systems and mainframe
- Multisite synchronous and asynchronous storage replication
- Accelerating IP storage across the WAN
- Operational excellence with converged bandwidth management of IP storage and FCIP across the WAN (includes MAPS and diagnostic tools)
- Enhancing the availability of FCIP and IP extension by leveraging Extension Trunking across multiple WAN network paths
- Securing IP storage, Fibre Channel, and FICON\* data-in-flight across WAN infrastructure
- Centralized tape backup, recovery, and archiving for NAS, Fibre Channel, FICON\*, and IP-based backups
- Consolidation of replication I/O from heterogeneous arrays and multiple protocols

\*Note: Not available on the Brocade 7810 Switch.

## **Q. Are the Brocade extension switches and blades compatible with each other?**

**A.** The Brocade 7810 Extension Switch, Brocade 7840 Extension Switch, and Brocade SX6 Extension Blade are compatible with each other. The Brocade 7840 and Brocade SX6 on Brocade Fabric OS® (FOS) 8.0.1 and above or the Brocade 7810, Brocade 7840, and Brocade SX6 on Brocade FOS 8.2.1 and above can be connected seamlessly via extension tunnels over WAN links, providing flexible deployment options to address scalability, performance, and cost requirements for multisite extension. The Brocade 7810, Brocade 7840, and Brocade SX6 only connect via FCIP/IP extension to other Brocade 7810 and Brocade 7840 switches and Brocade SX6 blades.

The Brocade 7800 and Brocade FX8-24 are compatible with each other, and can be connected seamlessly via FCIP tunnels over WAN links, providing flexible deployment options to address scalability, performance, and cost requirements for multisite extension. However, these older-generation platforms are not compatible with the newer Brocade 7810, Brocade 7840, and Brocade SX6 platforms.

**Q. Do the Brocade 7810, Brocade 7840, and Brocade SX6 interoperate with other Brocade FOS switches?**

**A.** Yes. The Brocade 7810, Brocade 7840, and Brocade SX6 all utilize the same Brocade FOS that supports the entire Brocade storage networking product family. This helps ensure seamless interoperability with advanced features such as Brocade Fabric Vision technology, Brocade Integrated Routing, and Brocade Extension Trunking.

Although the Brocade 7810, Brocade 7840, and Brocade SX6 are compatible with current and previous generations of Fibre Channel switches, they do not support extension connections to the Brocade 7800 and Brocade FX8-24. The Brocade 7810, Brocade 7840, and Brocade SX6 can only connect to other Brocade 7810, Brocade 7840, and Brocade SX6 extension devices.

**Q. Are extension implementation services available through Brocade Professional Services?**

**A.** Yes. Extension implementation services are available. As part of this service, a Brocade expert will assess the network and application environment, provide an estimated throughput of the extension link, and verify that requirements align with the available capabilities and resources. Brocade will then implement the specific configuration for connections between fabrics.

**Q. Who sells Brocade extension products?**

**A.** Brocade extension solutions are available through all leading storage OEMs.

## Product Details

**Q. What are the key differences between Brocade extension switches and blades?**

The Brocade 7810 and Brocade 7840 are switch form-factor extension products; the Brocade SX6 is a blade form-factor extension product for the Brocade X6 Director. Each platform is purpose-built with the number of ports and features to meet small to large-scale data center replication requirements. The Brocade 7810 requires Brocade FOS 8.2.1 or later, Brocade 7840 requires Brocade FOS 7.3.0 or later, and the Brocade SX6 requires Brocade FOS 8.0.1 or later.

The table on the following page provides detailed hardware and feature comparisons of Brocade switches and blades.

Table 1: Brocade Extension Product Comparison

Standard Features	Brocade 7810	Brocade 7840	Brocade SX6
Form factor	Switch	Switch	Blade
Fibre Channel ports	12 (32 Gb/s)	24 (16 Gb/s)	16 (32 Gb/s)
1/10GbE ports	6×1/10GbE	16×1/10GbE	16×1/10GbE
40GbE ports	N/A	2	2
Maximum Fibre Channel replication throughput	10 Gb/s	20 Gb/s upgradable to 80 Gb/s	80 Gb/s
Maximum FCIP bandwidth (FCIP mode)	2.5 Gb/s	80 Gb/s at 2:1 cmp (40 Gb/s per data processor)	80 Gb/s at 2:1 cmp (40 Gb/s per data processor)
Non-disruptive firmware upgrade	Fibre Channel only	Fibre Channel and IP	Fibre Channel and IP
Integrated Routing (FCR)	Included in full configuration	Optional	Optional
IPsec (AES 256)	Included	Included	Included
FIPS	Included	Included	Included
FastWrite (FCIP-FW)	Included	Included	Included
Open Systems Tape Pipelining (OSTP)	Included	Included	Included
WAN-optimized TCP	Included	Included	Included
Quality of Service (PTQ, DSCP, IEEE 802.1P)	Included	Included	Included
Extension Trunking	Included in full configuration	Included	Included
Adaptive Rate Limiting (ARL)	Included	Included	Included
Advanced Accelerator for FICON	N/A	Optional	Included
FICON CUP	N/A	Optional	Included
MAPS	Included (tunnel, circuit, and QoS levels) in full configuration	Included (tunnel, circuit, and QoS levels)	Included (tunnel, circuit, and QoS levels)
Flow Monitor	Included in full configuration	Included	Included
Flow Generator	Included in full configuration	Included	Included
WAN Test Tool (Wtool)	Wtool	Wtool	Wtool
Automatic path MTU discovery (PMTU)	Included	Included	Included

## **Q. What optional extension features are available for the Brocade 7810?**

- A.** Designed to be affordable, the Brocade 7810 Extension Switch offers flexible configurations to meet current and future requirements. The Brocade 7810 base configuration provides four 32 Gb/s-capable Fibre Channel ports and six 1GbE Ethernet ports with Adaptive Rate Limiting (ARL) and IPsec. The on-demand upgrade license enables all 12 Fibre Channel ports, 10GbE on the Ethernet ports, Brocade Fabric Vision technology, Extension Trunking, Fibre Channel Trunking, and Integrated Routing. The full configuration is a comprehensive bundle enabling all ports and includes Brocade Fabric Vision technology, Extension Trunking, Fibre Channel Trunking, ARL, IPsec, and Integrated Routing.

## **Q. What optional extension features are available for the Brocade 7840 and Brocade SX6?**

- A.** A broad range of optional advanced extension, SAN fabric, and FICON services are available to address the most challenging extension and storage networking requirements in open systems and mainframe environments.

The Brocade 7840 Extension Switch includes:

- Enterprise Bundle
- Brocade Fabric Vision technology
- Advanced Extension License (Extension Trunking and Adaptive Rate Limiting)
- 10GbE license (all 10GbE interfaces are enabled)

The Brocade SX6 Extension Blade includes:

- Enterprise Bundle
- Brocade Fabric Vision technology
- Advanced Extension License (Extension Trunking and Adaptive Rate Limiting)
- 10GbE license (all 10GbE interfaces are enabled)
- Unlimited WAN rate (up to 40 Gb/s)
- Advanced Accelerator for FICON
- FICON Management Server Control Unit Port (CUP)

Optional licenses include:

- Integrated Routing (FCR) license for all extension products: There are no VEX\_Ports on the Brocade 7840 and Brocade SX6.

This license enables EX\_Ports for Fibre Channel Routing (FCR).

- Brocade 7840 optional upgrades: Enables pay-as-you-grow scalability with capacity on-demand upgrades:
  - Brocade 7840 Medium Configuration (Base + WAN rate upgrade #1): Enables 10 Gb/s WAN rate.
  - Brocade 7840 Maximum Configuration (Base + WAN rate upgrades #1 and #2): Enables two 40GbE ports, unlimited WAN rate (up to 40 Gb/s).

Optional FICON services are available for the Brocade 7840. These services address challenging extension and storage networking requirements in mainframe environments. They include:

- Advanced Accelerator for FICON: Enables high-performance FICON tape, zGM, and z/OS host connection to Teradata warehousing systems over distance.
- FICON Management Server: Control Unit Port (CUP) enables host control of switches in mainframe environments.

## **Q. What is required to enable the 40GbE ports on the Brocade 7840 and Brocade SX6?**

- A.** No license is required to enable the 40GbE ports on the Brocade SX6 blade. However, both WAN upgrade optional licenses are needed for the Brocade 7840 Extension Switch to enable the 40GbE ports.

## **Q. Are Brocade optics required for the Brocade 7810, Brocade 7840, and Brocade SX6 platforms ?**

- A.** Yes. The Brocade 7810, Brocade 7840, and Brocade SX6 require Brocade-branded Small Form-Factor Pluggable (SFP) and Quad Small Form-Factor Pluggable (QSFP) optics.

**Q. Does Brocade offer a choice of SFPs?**

**A.** Yes. The Brocade 7810, Brocade 7840, and Brocade SX6 can use a variety of Brocade hot-pluggable SFP and SFP+ transceivers to support distance, xWDM, cable type, and port-speed requirements.

**Q. What is the minimum version of Brocade FOS required for the Brocade SX6 Extension Blade?**

**A.** The Brocade SX6 requires Brocade FOS 8.0.1 or higher.

**Q. What is the minimum version of Brocade FOS required for the Brocade 7810 Extension Switch?**

**A.** The Brocade 7810 requires Brocade FOS 8.2.1 or higher.

**Q. What is the minimum version of Brocade FOS required for the Brocade 7840 Extension Switch?**

**A.** The Brocade 7840 requires Brocade FOS 7.3 or higher.

**Q. Can I use the Brocade 7810, Brocade 7840, and Brocade SX6 for FCIP and IP extension?**

**A.** Yes. The Brocade 7810, Brocade 7840, and Brocade SX6 support both FCIP and IP extension. However, please note that the older-generation Brocade 7800 and Brocade FX8-24 support only FCIP.

**Q. Do Brocade extension products support Brocade Fabric Vision technology? What are the benefits?**

**A.** Yes, Brocade extension products support Brocade Fabric Vision technology. Extending Brocade Fabric Vision technology between data centers provides unprecedented insight and visibility across the storage network. 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. Consolidating Fibre Channel/FICON flows and IP storage replication flows into a single tunnel contributes significantly to operational excellence. And by using custom, browser-accessible dashboards for combined Fibre Channel and IP storage, storage administrators have a centralized management tool to monitor the health and performance of their networks.

Brocade extension products support many Fabric Vision technology features for storage extension. See Table 2A and 2B on the following page for details.



Table 2A: Fabric Vision Technology Support by Feature and Product

Feature	Brocade SX6 Extension Blade	Brocade 7810 Extension Switch	Brocade 7840 Extension Switch
MAPS	Yes	Yes	Yes
Fabric Performance Impact (FPI) Monitoring	Yes**	Yes**	Yes**
Dashboards	Yes	Yes	Yes
Flow Learning	Yes	Yes	Yes
Flow Monitoring	Yes*	Yes*	Yes*
Flow Mirroring	Yes*	Yes*	Yes*
Flow Generator	Yes*	Yes*	Yes*
COMPASS	Yes	Yes	Yes
Forward Error Correction	Yes**	Yes**	Yes**
Credit Loss Recovery	Yes**	Yes**	Yes**
Brocade ClearLink Diagnostics (D_Port)	Yes**	Yes**	Yes**

\*Note: Not available on IP extension at this time.

\*\*Note: Only applicable to Fibre Channel ports.

Table 2B: Detailed Fabric Vision Technology Features Supported by Brocade Extension Products

Feature	Brocade 7810, Brocade 7840, Brocade SX6
Flow Generator	Generate, pass (including passing through VE_Port), and receive Flow Generator traffic
MAPS	Per tunnel/VE: Throughput, state change (VE fencing is supported for state change)
	Per circuit: RTT, jitter, throughput, packet loss, state change (circuit fencing is supported for state change)
	Per QoS (at tunnel level): Throughput, packet loss, RTT, jitter
Flow Monitor	Report IOPS and throughput per (SID, DID, LUN, SCSI Read/Write) flow (monitored on F/E_Port; LUN-level supported on F_Port only)

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

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 service-level agreements (SLAs). Fabric Vision technology features for storage extension management include (dependent on device, see Table 2A):

- **Monitoring and Alerting Policy Suite (MAPS):** Provides a prebuilt, policy-based threshold monitoring and alerting tool that proactively monitors storage extension network health based on a comprehensive set of metrics at tunnel, circuit, and QoS (tunnel and circuit) layers. Administrators can configure multiple fabrics at one time using predefined or customized rules and policies for specific ports or switch elements.
- **Fabric Performance Impact (FPI) Monitoring:** Uses predefined thresholds and alerts in conjunction with MAPS to automatically detect and alert administrators to severe levels or transient spikes of latency and identifies slow drain devices that might impact the network. This feature uses advanced monitoring capabilities and intuitive MAPS dashboard reporting to indicate various latency severity levels, pinpointing exactly which devices are causing or are impacted by a bottlenecked port. This feature also provides automatic mitigation or recovery from the effects of slow drain devices.
- **Dashboards:** Provides integrated dashboards that display overall SAN and IP extension health, along with details on out-of-range conditions and configuration drift, to 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 scale the configuration across the fabric. In addition, they can ensure settings do not drift over time with COMPASS configuration and policy violation monitoring within 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 Fibre Channel platforms.
- **Flow Vision:** Enables administrators to identify, monitor, and analyze specific application flows in order to simplify troubleshooting, maximize performance, avoid congestion, and optimize resources. Flow Vision includes:
  - **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 Inter-Switch Links/Inter-Fabric Links (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 Monitor:** Provides comprehensive visibility into flows across a storage extension network, including the ability to automatically learn flows and non-disruptively monitor flow performance. Administrators can monitor all flows from a specific storage device that are writing to or reading from a destination storage device/LUNs, or across a storage extension network. Additionally, they can perform LUN-level monitoring of specific frame types to identify resource contention or congestion that is impacting application performance.
  - **Flow Generator:** Provides a built-in traffic generator for pretesting and validating storage extension infrastructure—including route verification, QoS zone setup, extension trunking configuration, WAN access, IPsec policy setting, and integrity of optics, cables, and ports—for robustness before deploying applications.
- **Forward Error Correction (FEC):** Enables recovery from bit errors in Fibre Channel ISLs, enhancing transmission reliability and performance.
- **Credit Loss Recovery:** Helps overcome performance degradation and congestion due to buffer credit loss in Fibre Channel links.

For more information on Fabric Vision technology, visit [www.brocade.com/fabricvision](http://www.brocade.com/fabricvision).

## FCIP Technology

### Q. What is FCIP?

- A.** FCIP was designed as a simple tunneling protocol to link Fibre Channel over distance across standard IP networks. Used primarily for remote replication and tape backup, FCIP provides Fibre Channel connectivity over an IP network between Fibre Channel devices. FCIP leverages special high-speed and WAN-optimized TCP processing, which is essential for storage applications to be reliable and available, and maintain data integrity over long distances. Table 3 outlines how FCIP is designed and used.

Table 3: FCIP Protocol

Feature	FCIP
Use case	Enables replication, data migration and mobility, backup, storage access, accelerated performance, flow visibility, monitoring, alerting, encryption, bandwidth management, and high availability over long-distance connections
Benefit	Moves more data faster, farther, securely, and reliably for disaster recovery, data protection, and data mobility solutions
Network	WAN/MAN
Transport	Tunnel/TCP/IP/Ethernet
Encapsulation	Brocade encapsulates Fibre Channel data sequences into compressed batches. Those batches fill TCP segments to their maximum size and then form IP datagrams.
IP-routable	Yes

## IP Extension Technology

### Q. What is Brocade IP extension?

- A.** Brocade IP extension technologies help give storage administrators more control over their IP storage flows between data centers. There are five IP extension pillars: performance, operational excellence, enhanced availability, solid security, and easy deployment. IP extension uses the same VE\_Ports and circuits that FCIP uses, or it can use its own.

Brocade IP extension is used primarily for IP storage applications, such as remote host-based or database-based replication, NAS replication, IP backups, and tape grids. It leverages special high-speed and WAN-optimized TCP processing, which is essential for storage applications to be reliable, available, and maintain data integrity over long distances. Table 4 outlines how Brocade IP extension is designed and used.

Key advantages include:

- TCP acceleration occurs when Brocade IP extension proxies the local data center TCP sessions. This eliminates all latency effects and provides a clean, stable network that allows the end device to operate at its maximum performance. Brocade WAN-optimized TCP transports the data to the other data center, where another local TCP proxy communicates with the device on the other side.
- A multitude of IP storage flows is managed in a single tunnel so that oversubscribed WAN bandwidth is optimized and made more reliable. There is no way to optimize with rate limiting (or with other methods) a large number of individual autonomous flows across the WAN. Brocade IP extension manages individual flows using the TCP rwnd (Receive Window). Very large performance improvements have been demonstrated using this approach.

- The tunnel between data centers is optimized using Adaptive Rate Limiting, QoS, WAN-optimized TCP, and streams. WAN-optimized TCP is an aggressive and sophisticated TCP stack that maintains data transport across the most adverse conditions. It does what native TCP stacks on end-devices cannot do.
- Brocade provides operational excellence with tools such as Brocade SAN management, Monitoring Alerting Policy Suite (MAPS), and the latest versions of Brocade Fabric OS. The system provides Brocade Fabric Vision, Flow Generator, WAN Test Tool (Wtool), Extension Dashboard, and more—all the tools needed to diagnose issues in an extension network. IP networking administrators seldom make these tools available to storage administrators.
- Brocade IP extension can encrypt all IP storage flows using IPsec. Encryption on the Brocade 7810, Brocade 7840, and Brocade SX6 is a hardware implementation, which implies two important things: There is very little added latency (5  $\mu$ s) when performing encryption, and the throughput of encryption is exceptionally fast (line rate).
- Brocade has taken into account deployment concerns for IP extension. There is no need to re-cable, change IP subnets, or change VLANs. Only the gateway specific to the remote destination subnet(s) needs to be changed to the IP extension gateway on the Brocade extension platforms. This IP extension gateway forwards IP storage traffic across the WAN. The Brocade 7810, Brocade 7840, and Brocade SX6 provide Link Aggregation (LAG) to the data center LAN switch(es) to which the IP storage is connected. LAG delivers adequate bandwidth and link redundancy for high availability.

**Table 4: Brocade IP Extension Protocol**

Feature	IP Extension
Use case	Enables replication, data migration and mobility, backup, storage access, accelerated performance, flow visibility, monitoring, alerting, encryption, bandwidth management, and high availability over long-distance connections
Benefit	Moves more data faster, farther, securely, and reliably for disaster recovery, data protection, and data mobility solutions
Network	WAN/MAN
Transport	Tunnel/TCP/IP/Ethernet
Encapsulation	Brocade encapsulates IP flow (also called “streams”) data sequences into compressed batches. Those batches fill TCP segments to their maximum size and then form IP datagrams.
IP-routable	Yes

### Q. What are circuits?

- A.** Circuits are the building blocks for trunks. A trunk is a tunnel with more than one circuit. A circuit consists of a source and destination IP address pair and PerPriority TCP QoS (PTQ) connections. An Ethernet interface can be assigned one or more circuits. Each circuit automatically creates multiple TCP connections that are used for QoS prioritization. This is part of PTQ.

### Q. What is the impact of circuits on tunnels?

- A.** With the development of circuits, a tunnel is no longer bound to a single physical Ethernet interface or a single connection to a peer switch. The Brocade 7810, Brocade 7840, and Brocade SX6 extension products create tunnels composed of one or more circuits. More than one circuit enables Extension Trunking.

### **Q. What is Extension Trunking and how does it work?**

- A.** Extension Trunking is a feature that enables the creation of logical high-bandwidth tunnels (“trunks”) composed of multiple circuits, and spanning multiple physical Ethernet interfaces. Traffic within a trunk is weighted and balanced across all circuits to optimize bandwidth and performance. Trunks also overcome physical link failures via redundant paths, Lossless Link Loss (LLL), and guaranteed in-order data delivery.

The number of tunnels is synonymous with the number of VE\_Ports used. VE\_Ports are the endpoints of a tunnel (not the circuits). The Brocade 7840 and Brocade SX6 support up to 20 tunnels in FCIP mode and up to 10 tunnels in hybrid (IP extension) mode. Up to 20 tunnels are supported on the Brocade FX8-24. Up to four tunnels are supported on the Brocade 7810.

On the Brocade 7840 and Brocade SX6, the maximum extension trunk size is 20 Gb/s, and two such trunks can be configured for a total of 40 Gb/s. The maximum trunk size is 2.5 Gb/s on the Brocade 7810.

### **Q. What is Brocade Adaptive Rate Limiting and how does it work?**

- A.** Adaptive Rate Limiting (ARL) is a standard feature on the Brocade 7810, Brocade 7840, and Brocade SX6 platforms. ARL dynamically adjusts shared bandwidth between guaranteed minimum rates and available maximum rates for each circuit within a trunk. This overcomes the problem of fixed provisioning of bandwidth, which leads to over-provisioning and underutilization of links. ARL enables applications to exceed guaranteed minimum rates when competing bandwidth dissipates.

### **Q. What is PTQ (PerPriority TCP QoS), and how does it work?**

- A.** PTQ extends Brocade Fabric OS QoS across extension links by putting those traffic flows into dedicated WAN-optimized TCP sessions for each priority. The extension blade or switch prioritizes traffic as high, medium, or low on a per-flow basis within a tunnel to optimize bandwidth, which can be designated per application. QoS is enforced only when congestion occurs at egress from the extension blade or switch. FCIP QoS integrates seamlessly with Brocade Fabric OS QoS for consistency throughout the entire fabric, from end to end. IP extension QoS operates the same way with the same priorities (high, medium, low) and is separate from FCIP QoS. There are seven priorities altogether: three for FCIP, three for IP extension, and one for control.

### **Q. What is Brocade Integrated Routing (FCR)?**

- A.** Integrated Routing (FCR) is an optional licensed feature that leverages the latest Brocade ASIC technology to provide Fibre Channel routing on a per-port basis. Because a Fibre Channel E\_Port can be made into an EX\_Port, data can be communicated between fabrics while maintaining remote fabric isolation. Integrated Routing (FCR) eliminates the need for a dedicated router or consumption of chassis slots with special routing blades—thereby reducing cost, complexity, and management overhead.

## **Mainframe Technology**

### **Q. Does Brocade support mainframe solutions?**

- A.** Brocade provides as much as 95% of the total extension infrastructure used by the mainframe market, which includes FICON for local switching or remote business solutions. With more than 20 years of experience and thousands of customers around the globe, Brocade offers valued products and services to help organizations meet their critical business objectives.

### **Q. What is FICON?**

- A.** FICON is an I/O protocol used between IBM (and compatible) mainframes and storage arrays. It takes the higher-layer ESCON protocol and maps it into a Layer 2 transport frame. It is mapped into the same physical layer and framing specifications as Fibre Channel but is unique to the FICON protocol. FICON and Fibre Channel protocols can reside within the same switching infrastructure.

### **Q. What Brocade products support mainframe extension solutions?**

- A.** The Brocade 7840 Extension Switch and the Brocade SX6 Extension Blade provide unique solutions for mainframe storage

applications, including FICON disk emulation for IBM z/OS Global Mirror (zGM), also known as XRC (Extended Remote Copy), as well as FICON Tape Pipelining for write and read operations for IBM and Oracle virtual and standalone tape offerings. Brocade supports a wide range of array replication applications used in mainframe environments that are not FICON based, including EMC SRDF, Hitachi Universal Replicator (HUR), and IBM PPRC. System z writes to the volume via FICON, but the array replicates those volumes using Fibre Channel. Additionally, Brocade IP extension supports the acceleration and encryption of IP flows from IBM TS7700 Grid, Oracle VSM Grid, EMC DLM replication, and Luminex replication.

## **Q. What licenses are required for FICON functionality?**

**A.** For Brocade FOS fabrics, all functional capabilities required to support FICON are included in the base release. Optional FICON features separately licensed for the Brocade 7840 Extension Switch include:

- Brocade Advanced Accelerator for FICON: Enables high-performance FICON tape and zGM replication over distance.
- Brocade FICON Management Server: Control Unit Port (CUP) enables host control of switches in mainframe environments.

These FICON software licenses are also included within the Brocade SX6 LWL configuration. However, the Brocade SX6 SWL configuration and the Brocade 7810 do not support these FICON software features.

## **Q. What is CUP (FICON Management Server)?**

**A.** Control Unit Port (CUP) is an in-band management function that enables mainframe applications to perform configuration, monitoring, management, and statistics collection functions. Several IBM mainframe management applications require CUP functionality on FICON backbones, directors, or switches. The Brocade FICON Management Server license enables CUP functionality.

## **Q. What FICON data rates are supported?**

**A.** Brocade supports FICON at the data rates consistent with industry standards. Host and storage interfaces supported include 1, 2, 4, 8, 16, and 32 Gb/s FICON interfaces.

## **Q. Can FICON be intermixed with open systems?**

**A.** Yes. Brocade Virtual Fabrics is supported on the Brocade 7840 with Brocade FOS 7.3, and the Brocade SX6 with Brocade FOS 8.0.1. Brocade Virtual Fabrics allows fabrics that are each configured with specific characteristics for open systems or z/OS environments to share the same platform—and even the same Ethernet interface—enabling consolidation while providing traffic isolation in mixed environments. The Brocade 7840 with Brocade FOS 7.3 or later supports up to four logical switches/two CUP instances. The Brocade SX6 with Brocade FOS 8.0.1 or later supports up to eight logical switches/four CUP instances.

## **Extension Management**

### **Q. What management tools are available for the Brocade 7810, Brocade 7840, and Brocade SX6?**

**A.** Management and administrative operations can be performed through Brocade management tools, including Brocade Network Advisor,\* Brocade Web Tools, and the Command Line Interface (CLI). Moreover, optional FICON CUP capabilities enable IBM mainframe management applications to seamlessly support Brocade FICON environments. (FICON CUP is only available on the Brocade 7840 Switch and Brocade SX6 Blade with the Enterprise edition of Brocade Network Advisor.)

\*Note: Not available on the Brocade 7810 Switch.

**Q. Is Brocade Network Advisor required to manage the Brocade 7840, and Brocade SX6?**

**A.** No. However, Brocade Network Advisor includes the following enhanced extension management capabilities that help simplify and unify management of extension network infrastructures:

- View health and performance indicators in customizable browser-accessible dashboards, saving administrative time and effort
- Provide a comprehensive topology view of all tunnels and trunks across all fabrics Simplify tunnel and trunk configuration and management with a wizard interface
- Drill down through the topology or dashboards to view and configure connection and switch properties

**Q. What is the minimum version of Brocade Network Advisor required to manage the Brocade 7840 and Brocade SX6 extension products?**

**A.** Brocade Network Advisor 12.3 or above is required to manage the Brocade 7840. Brocade Network Advisor 14.0.1 or above is required to manage the Brocade SX6.

## Learn More

**Q. How do I find out more about Brocade extension products?**

**A.** Contact your Brocade sales representative or Brocade OEM Partner for details. Or visit [www.brocade.com/extension](http://www.brocade.com/extension).