Family 2499+03 IBM Systems Storage SAN768B-2 and SAN384B-2

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Product life cycle dates

Type Model	Announced	Available	Marketing Withdrawn	Service Discontinued
2499-416	2011-08-16	2011-08-26	2020-04-29	-
2499-816	2011-08-16	2011-08-26	2020-04-29	-

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Abstract

The IBM 2499 System Storage SAN768B-2 and SAN384B-2 fabric backbones are the industry's newest FC switching infrastructure, providing reliable, scalable, high-performance foundations for private cloud storage and highly virtualized environments.

Model abstract 2499-816

The IBM 2499 System Storage SAN768B-2 Model 816 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

Model abstract 2499-416

The IBM 2499 System Storage SAN384B-2 Model 416 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

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Highlights

IBM System Storage SAN768B-2 and SAN384B-2 fabric backbones with the new 16 Gbps Fibre Channel (FC) technology offer a long-term solution for mission-critical applications that require high-performance, low-latency storage networks. These new models offer maximum investment protection by:

- Interfacing with existing 2, 4, and 8 Gbps FC ports
- Offering configurable ports for 10 Gbps metro optical connectivity
- Leveraging existing 8 Gbps 2499 fabric backbone ports and specialty blades
- Integrating with the IBM Network Advisor unified network management solution to bridge operational gaps across server, network, and storage administrators

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Description

They are designed to:

- Enable simpler, flatter, low-latency chassis connectivity to reduce network complexity, management, and costs
- Increase business agility while providing access to information and reducing infrastructure and administrative costs
- Support of private cloud storage with improved scalability, performance, and reliability

SAN768B-2 and SAN384B-2 are designed to address key requirements while helping to protect investments already made by the deployment of existing SANs, servers, storage hardware, and advanced functions:

- Support 2, 4, 8, 10, and 16 Gbps FC and FCIP, as well as advanced fabric services and management tools
- Include up to 384 (SAN768B-2) or 192 (SAN384B-2) 16 Gbps universal (E, F, D, M, and EX) FC ports using 32-or 48-port FC blades, or up to 512 (SAN768B-2) or 256 (SAN384B-2) 8 Gbps universal (E, F, M, and EX) FC ports using 64-port 8 Gbps FC blades
- Deliver forward and backward compatibility with 8 and 16 Gbps IBM System Storage SAN director, switch, and router models

SAN768B-2 and SAN384B-2 are connecting distributed data centers enabled for data mobility and advanced data protection solutions. These fabric backbones include integrated metro and global Storage Area Network (SAN) extensions designed to provide application agility, flexible business continuity, and disaster recovery solutions. These fabric backbones:

- Optimize data center connectivity over distance with integrated high-performance metro and global connectivity

- Simplify and centralize end-to-end SAN management with comprehensive diagnostics, monitoring, and automation
- Maximize performance for I/O-and bandwidth-intensive applications with more than seven times the performance of competitive offerings
- Protect investments in existing SAN fabrics and automation tools while reducing operational costs and minimizing business disruption

The 16 Gbps 2499 fabric backbones are available in two modular form factors. Built for large enterprise networks, the 14U SAN768B-2 (2499-816) has eight vertical blade slots to provide up to 384 16 Gbps FC ports. Built for mid-sized networks, the 8U SAN384B-2 (2499-416) has four horizontal blade slots to provide up to 192 16 Gbps FC ports. These new models support 2, 4, 8, 10, and 16 Gbps FC, and 1/10 Gbps Fibre Channel over IP (FCIP).

Bandwidth-intensive applications, critical workloads, and higher density virtualization are continuing to push the limits of SAN infrastructure. The 2499 16 Gbps models address next-generation I/O requirements by providing increased slot-to-slot and port performance bandwidth with 16 Gbps performance. In addition, local switching capabilities ensure that data traffic within the same port group does not consume slot bandwidth, maximizing the number of line-rate ports.

Optical Inter-Chassis Links (ICLs) can connect up to ten SAN768B-2 and SAN384B-2 fabric backbones, enabling flatter, faster, and simpler fabrics that increase consolidation while reducing network complexity and costs. ICLs enable scalable core-edge and active-active mesh chassis topologies. These high-density chassis topologies reduce inter-switch cabling by 75%, and free up to 33% of ports for server and storage. This maximizes overall port density in the amount of rack space.

SAN768B-2 (2499-816) performance capabilities:

- Up to 384 ports (equivalent to 512 with ICLs) at 16 Gbps
- Up to 8.2 Tbps chassis bandwidth, 6.1 Tbps universal ports, and 2.1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

SAN384B-2 (2499-416) performance capabilities:

- Up to 192 ports (equivalent to 256 with ICLs) at 16 Gbps
- Up to 4.1 Tbps chassis bandwidth, 3.1 Tbps universal ports, and 1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

The 16 Gbps platforms support port-based encryption and compression on an Inter-Switch Link (ISL) between two 16 Gbps E-ports. The encryption and compression feature on an E-port can be enabled on a per port basis. The same port that has been configured for compression can also be configured for encryption. However, only two ports per ASIC can be configured for encryption and compression in FOS 7.0.

The 16 Gbps fabric backbones are designed to provide high-speed replication and backup solutions over metro or wide area network (WAN) links with native FC (10 and 16 Gbps) and optional FCIP (1/10 GbE) extension support. The integrated metro connectivity includes in-flight compression to optimize bandwidth and minimize the risk of unauthorized access.

FOS 7.0 introduces the new Diagnostic port (D-port) type. The D-port is designed to debug the components associated with the link, such as transceivers and cables. This feature is only supported on 16 Gbps ports. The D-Port is statically configured by the user with the intention to run diagnostics. A D-port does not carry any control or data traffic and is purely used for the link diagnostics purpose and to isolate link level faults.

SAN768B-2 and SAN384B-2 base systems require FOS 7.0.0, and later. They are always enabled with the following:

- **Full fabric:** Enables E_ports. The switch cannot be connected to another switch until full fabric is installed
- **Web tools:** Enables administration, configuration, and maintenance of fabric switches and SANs
- **Virtual Fabrics (VF):**
  - Supports ANSI standards-based implementation of VF
  - Adds the capability for physical switches to be partitioned into independently managed logical switches, each with its own data, control, and management paths
  - Allows logical switches to be used to allocate fabric resources on a per-port basis rather than on a per-switch basis
  - Enables simplification or resource allocation by customer, department, application, or storage tier
  - Consolidate resources across multiple fabrics
- **Zoning:** Segments a fabric into virtual private SANs
- **Enhanced group management (EGM):** When added to Brocade element management, the EGM enables additional device-level management functionality for IBM b-type products and also allows large consolidated operations to groups of devices (for example: firmware download, configuration upload and download)

Enterprise Software Bundle features

- **Adaptive networking:** Represents a set of features providing tools and capabilities to incorporate network policies to enable traffic differentiation and prioritization. The FOS 7.0 release supports two types of quality of service (QoS) features with the 16 Gbps fabric backbones:
  - Ingress Rate Limiting to limit the throughput on the ingress side of the port by delaying the return of buffer to buffer credits to the external device
  - SID/DID Based Prioritization used to prioritize the FC flow using a Virtual Channel (VC) by which an FC flow is assigned to different behavior aggregates
- **Advanced performance monitoring:** Helps identify end-to- end bandwidth usage by host or target pairs and is designed to provide information for capacity planning
- **Extended fabrics:** Extend SAN fabrics beyond the FC standard 10 km by optimizing the internal switch buffers to maintain performance on ISLs at distances up to 500 kilometers.
- **Fabric Vision** technology includes several critical diagnostic, monitoring and management capabilities that designed to help increase fabric resiliency, reduce downtime, optimize application performance, and dramatically simplifies SAN deployment and management. The following features are introduced with the base Fabric OS (FOS) 7.2.0 release:
  - ClearLink Diagnostics: Helps ensure optical and signal integrity for Gen 5 Fibre Channel optics and cables, simplifying the deployment and support of high-performance fabrics.
  - Bottleneck Detection: Identifies and alerts administrators about device or ISL congestion, as well as abnormal levels of latency in the fabric.
  - Critical diagnostic and monitoring capabilities: Help ensure early problem detection and recovery.
  - Forward Error Correction (FEC): Enables recovery from bit errors in ISLs, enhancing transmission reliability and performance.
  - Credit Loss Recovery: Helps overcome performance degradation and congestion due to buffer credit loss.

  Flow Vision, Monitoring and Alerting Policy Suite (MAPS), and customizable dashboard advanced technologies and capabilities are made available with the optional Fabric Vision licensed feature. This feature also enables ClearLink (D_Port) functionality for Gen 5 FC platforms when connected to non-b-type end-devices.

  - **Flow Vision** enables 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 monitor, flow mirror, and flow generator features.
  - **Monitoring and Alerting Policy Suite (MAPS)** is a new, easy to use, policy-based threshold monitoring and alerting suite that pro-actively monitors the health and performance of the SAN infrastructure to ensure application uptime and availability. By leveraging pre-built rule/policy-based templates, MAPS simplifies threshold configuration, monitoring and alerting. Organizations 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 ll through a single dialog. The integrated dashboard displays an overall 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. MAPS capabilities provide policy- based monitoring, CLI dashboard of health and error statistics, bottleneck detection information, proactive flow monitoring.

  Automated Migration of Fabric Watch configurations to 'MAPS' automatically imports existing thresholds into a MAPS policy, enabling seamless migration from Fabric Watch to MAPS to take advantage of the new MAPS capabilities and usability enhancements.

Fabric Vision license is included with FOS 7.2.0, and later. Once the switch is upgraded to FOS 7.2.0 or higher and the Fabric Vision license is enabled, Fabric Watch configuration and any Fabric Watch related features are no longer supported.

- **Fabric watch:** Monitors mission-critical switch operations and includes port fencing capabilities.
- **Trunking:** Enables FC packets to be efficiently distributed across multiple inter-switch connections (links) between two SAN btype fabric switches, while preserving in-order delivery. Both SAN b-type fabric switches must have ISL trunking activated. Both SAN768B-2 and SAN384B-2 adds Enhanced ISL trunking support using 16 Gbps ports and enable FC packets to be distributed across up to eight 16 Gbps capable ISLs for a combined bandwidth of up to 128 Gbps. When connecting the 16 Gbps capable models to legacy 2, 4, or 8 Gbps capable b-type fabric switch models, ISL trunking is supported at the lowest operational link speeds.
- **Server application optimization:** When deployed with Brocade Server Adapters, this function optimizes overall application performance for physical servers and virtual machines by extending virtual channels to the server infrastructure. Application specific traffic flows can be configured, prioritized, and optimized throughout the entire data center infrastructure.

Optional features

SAN7686B-2 and SAN384B-2 are available with a number of selectable options. The base systems do not include any blades, but at least one blade is required for host and storage connectivity.

SAN768B-2 may be configured by adding up to a total of eight of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), and 8 Gbps Encryption (#3895) blades. All activated ports must be populated with a mixture of short wave and long wave optical transceivers up to the maximum number of ports.

The SAN768B-2 (2499-816) base model has two power supplies providing 2000W of total power using only 200/240VAC. The base model (core blades, controller blade, fans) consume 830W power, leaving users with 1170W available power for the optional port (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, #3648, #3649, #3664, #3864) and specialty blades (#3890, #3891, #3895). Based on the different power consumption of each port or specialty blades, various configurations will result in higher than 2000W power usage and customer will be required to purchase feature #7880 pair of optional power supplies. Further details can be found in Appendix A of the SAN768B-2 Installation, Service, and User's Guide. Please consult the following table to calculate the power usage:

Power Demands per Component

Components	Maximum Power Draw (Watts)	Type of Blade	Max blades in chassis
2499-816	830	Base chassis	N/A
#3632, #3633 #3034, #3634, #3635	140	32-port Blades	8
#3648, #3649 #3035, #3636, #3637	160.4	48-port Blades	8
#3664, #3864	126.4	64-port Blades	8
#3890, #3891	235	Extension Blade	4
#3895	250	Encryption Blade	4

SAN384B-2 may be configured by adding up to a total of four of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 64-port (#3664) 16 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), or 8 Gbps Encryption (#3895). All activated ports must be populated with a mixture of short wave and long wave optical transceivers, up to the maximum number of ports.

4 Gbps 10 km LW SFP Transceiver (#2411): This feature provides one longwave SFP transceiver, designed to provide Fibre Channel connections at distances up to 10 km (6.2 miles), while using the appropriate 9.0/125 micrometer single mode fiber optic cable.

16 Gbps FC port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648): 32 or 48 port blades provide 2, 4, 8, or 16 Gbps on each port to be configured as E, F, M, EX, D-ports with no over subscription at 16 Gbps on the 32-port blade. Within a group of 8 ports in a port blade, two of the following three port speed combinations are allowed:

- 2, 4, and 8 Gbps
- 10 Gbps
- 16 Gbps

The default setting is:

- 2, 4, and 8 Gbps
- 16 Gbps

Any eight ports of the 16 Gbps port blades can be enabled for 10 Gbps FC when feature #7892 is activated.

Enhanced 8 Gbps FC port blades (#3633 and #3649): The two port blades (32 or 48 ports) provide 2, 4, or 8 Gbps on each port to be configured as E, F, M, EX port with no over subscription at 8 Gbps speed. These port blades cannot be upgraded to 10 or 16 Gbps speed and do not support in-flight encryption and compression. The #3633 and #3649 blades do not support FICON. Also, no Diagnostic (D-port) support on these blades. Up to four 8-port external trunk groups per #3633 blade and up to six 8-port external trunk groups per #3649 blade.

SAN768B FC 8 Gbps 64-port blade (#3864): The SAN768B FC 8 Gbps 64-port Blade is designed to allow mid to large enterprise customers to deploy high-density, chassis-based solutions to minimize physical footprint without compromising performance. This blade provides 64 E, EX, F and M ports operating at 2, 4, and 8 Gbps, offering low latency and cut-through switching with full 8 Gbps line rate on local switching and 2:1 over subscription at 8 Gbps across the backplane. There can be up to eight 8-port trunk groups created with the 64-port blade, with a maximum of 8 ports per trunk group. The #3864 blade does not support FICON and cannot co-exist with blades running FICON traffic.

To achieve this high-density solution, the 64-port blade uses an optimized version of the standard Small Form-factor Pluggable (mSFP) transceiver and requires a structured cable management solution. The mSFPs retain all of the performance and functionality of the standard SFP+ and include individual port isolation for improved serviceability and availability. Each 64-port blade is populated and shipped with 64 8 Gbps shortwave mSFP fiber optic transceivers. The mSFP fiber pitch and width are narrower than standard SFPs, resulting in the need for newer OM-3 fiber cables with narrower LC connectors. The standard LC connector was modified by major cable vendors to accommodate the new fiber pitch and width. The new cables provide the same flexibility in connectivity as standard LC cables and they are available in the following configurations:

- **MSFP-LC cable** provides the #3864 port blade with the ability to connect to other port blades, switches, devices, and LC patch panels.
- **MSFP-MSFP cable** allows one #3864 port blade to connect to another #3864 port blade as ISLs.
- **MSFP-MPO cable** is a trunked MPO cable to connect to multiple mSFP ports; six mSFP connectors are supported in one trunk cable.

Only the trunked mSFP-MPO cable solution is recommended when multiple directors using the #3864 64-port blades are installed into a 2109-C36 cabinet.

Refer to the Cable Management Considerations for 8 Gbps and 16 Gbps 64 Port Blades guide posted on the IBM Support website to find installation guidelines and the list of recommended part numbers and vendor information.

8 Gbps Extension Blade (#3890): The 8 Gbps Extension Blade combines FC switching and routing capabilities with hardware-assisted FCIP traffic forwarding over IP WAN. The twelve 8 Gbps FC ports and ten 1 Gigabit Ethernet (GbE) port blade is designed to provide remote storage and SAN connectivity. The 8 Gbps Extension Blade integrates a variety of capabilities to deliver a high performance, reliable, and secure distance-connectivity solution, such as:

- **FCIP Trunking** is designed to virtualize two or more TCP connections as part of a single FCIP tunnel. FCIP Trunking combines multiple IP source and destination address pairs into a logical high-bandwidth FCIP trunk spanning multiple physical ports to provide load balancing and network failure resiliency.
- **Adaptive rate limiting** is designed to meet minimum bandwidth requirements for each tunnel while fully utilizing the available network bandwidth without adverse throughput performance impact at high traffic load.
- **Hardware-based compression** delivers the ability to increase throughput over lower bandwidth links in the WAN, supporting the cost efficiencies of FCIP. The 8 Gbps Extension Blade compresses FC frames before they are encapsulated into FCIP packets.
- **FCIP QoS** provides high, medium, and low-priority handling of initiator target flows within the same FCIP tunnel for transmission over the WAN.
- **FC routing** delivers fabric isolation in conjunction with FCIP, enabling separate fabrics to share devices without merging across the IP network.
- **FCIP fast write** accelerates SCSI write processing, maximizing performance of synchronous and asynchronous replication applications across high-latency WAN connections.
- **Open systems tape pipelining** accelerates read and write tape processing over distance, minimizing backup and restore windows.
- **Storage optimized TCP** helps improve TCP window size and flow control, accelerating TCP transport for storage applications.
- **Multiple logical FCIP tunnels** allow for scalable connectivity between sites, between two SAN06B-R models, or when it is connected to a 8 Gbps Extension Blade.

Enhanced 8 Gbps Extension Blade (#3891): The Enhanced 8 Gbps Extension Blade in addition to all features and function of the #3890 8 Gbps Extension Blade capable of running IPSec on both 10 GbE interface doubling encrypted throughput for each #3891 blade.

Encryption Blade (#3895): A 16-port, auto-sensing 8 Gbps FC blade provides fabric-based encryption for data-at-rest and compression. The Encryption Blade scales nondisruptively, providing from 48 Gbps up to 96 Gbps of encryption processing power to meet the needs of the most demanding environments with flexible, on-demand performance. It also provides compression services at speeds up to 48 Gbps for tape storage systems. The Encryption Blade is supported with the Tivoli Key Lifecycle Manager for both disk and tape encryption applications. Following August 1, 2012 each #3895 Encryption Blade will include six Smart Cards.

2499-816 Firmware upgrade renewal, one year (#7710): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-816 Firmware upgrade renewal, two years (#7711): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, one year (#7714): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, two years (#7715): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

Inter-chassis QSFP bundle (#7868): This feature provides sixteen pieces of 4 X 16 Gbps QSFP transceiver bundle to be used on the 16 Gbps Core Blade. Customer supplied QSFP cable up to 50 meters long can be used as an ICL cable.

Inter-chassis license conversion (#7869): This feature is used to convert an ICL activation transferred from an 8 Gbps model as part of the model conversion process. Features #7882 or #7883 converts into one #7869, while feature #7885 counts as two of #7869.

Inter-Chassis License with 16x4x16Gbps QSFP (#7871): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code only enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 platform. A second POD feature code enables all ICL ports on a 2499-816 platform. In addition, each feature ships sixteen 4 x 16 Gbps QSFP transceivers. Customer supplied off-the-shelf QSFP cable up to 50 meters long can be used as an ICL cable.

ICL Enterprise Connectivity License 5-10 2499-416 (#7872): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN384B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

ICL Enterprise Connectivity License 5-10 2499-816 (#7873): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN768B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

Inter-Chassis License with 16x (4 x 16 Gbps) QSFP (#7874): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code (#7871 or #7874) enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 models. A second POD feature code enables all ICL ports on a 2499-816 models. In addition, each feature ships sixteen 4 x 16 Gbps QSFP 100 m transceivers. Customer supplied off-the-shelf OM4 QSFP cable up to 100 meters long can be used as an ICL cable.

FICON with CUP activation (#7884): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by system automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON directors, in addition to supported SAN b-type switch and director products with FICON.

FICON with CUP activation (#7886): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by System Automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System Automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON Directors, as well as supported SAN b-type switch and director products with FICON.

Integrated Routing (#7889): Integrated Routing allows any 8 or 16 Gbps FC port in a SAN768B-2 to be configured as an EX_port supporting Fibre Channel Routing (FCR). FCR support on the 8 or 16 Gbps ports is a native capability, therefore these ports are referred to as native EX_ports. FCR capability on native EX_ports requires the Integrated Routing feature (#7889). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

Integrated Routing License (#7890): Integrated routing (EX_port) allows any 8 or 16 Gbps port in a SAN384B-2 to be configured supporting FCR. Integrated routing enables FCR support on the 8 or 16 Gbps ports as a native capability, therefore they are referred to as native EX_ports. FCR capability on native EX_ports requires the integrated routing feature (#7890). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

8 Gbps Advanced Extension Activation (#7891): This feature code enables two advanced extension features, FCIP Trunking and Adaptive Rate Limiting (ARL), on SAN768B-2 or SAN384B-2 systems. The FCIP Trunking feature allows multiple IP source and destination address pairs (defined as FCIP Circuits) via multiple 1 GE interfaces to provide a high bandwidth FCIP tunnel and failover resiliency. The ARL feature provides a minimum bandwidth guarantee for each tunnel with full utilization of the available network bandwidth without impacting throughput performance under high traffic load. ARL is performed on the FCIP tunnel connection to dynamically change the rate at which the FCIP tunnel transmits data through the TCP connection. ARL will use the information from the TCP connection to determine and adjust the rate limit for the FCIP tunnel dynamically. This allows FCIP connections to utilize the maximum available bandwidth. Each 8 Gbps Extension Blade (#3890 or #3891) must have one 8 Gbps Advanced Extension (#7891) activation feature installed.

8 Gbps Extension Blade 10 GbE activation (#7892): This feature code enables up to two 10 GbE ports on the 8 Gbps Extension Blade (#3890) or Enhanced 8 Gbps Extension Blade (#3891). With this feature, two additional operating modes, in addition to ten 1 GbE ports mode, can be selected. Either two 10 GbE ports or ten 1 GbE and one 10 GbE ports can be configured on a #3890 or #3891 blade when this feature is activated. This feature is available on the SAN768B-2 and SAN384B-2 models and one feature applies for each 8 Gbps Extension Blade (#3890 or #3891).

This same feature can be used to enable 10 Gbps FC on any eight ports of the 16 Gbps port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648). 10G FC feature code must be installed before any port can run at 10 Gbps speed. One feature code should be activated for each port blades to be enabled for 10 Gbps FC.

8 Gbps FICON Accelerator Activation (#7893): The 8 Gbps FICON Accelerator Activation is an optional software authorization feature that uses advanced networking technologies, data management techniques, and protocol intelligence to accelerate FICON disk and tape read and write operations over distance, while maintaining the integrity of command and acknowledgment sequences. It supports emulation for IBM z/OS Global Mirror (formerly eXtended Remote Copy or XRC), in addition to tape pipelining for FICON tape and virtual tape. In combination with the 8 Gbps Advanced Extension Activation (#7891) feature code for FCIP tunneling, FICON Accelerator can provide improved application performance across long distance IP WANs. Each 8 Gbps FICON Accelerator Activation feature is licensed for one 8 Gbps Extension Blade (#3890) or one Enhanced 8 Gbps Extension Blade (#3891) to be used in the SAN768B-2 or the SAN384B-2 fabric backbone.

Encryption 96 Gbps disk Performance Upgrade activation (#7895): Disk Encryption Performance Upgrade feature enables scalability of performance on the Encryption Blade (#3895) features. The upgrade provides increased throughput for disk encryption applications up to 96 Gbps, effectively doubling encrypted throughput performance for disk-based storage with no disruption to operations.

Transceivers

SAN768B-2 and SAN384B-2 offer the following optical transceivers:

- 16 Gbps SW (#2601 or #2602), 10 km LW (#2611 or #2612)
- 10 Gbps SW (#2609), 10 km LW (#2610)
- 8 Gbps SW (#2802 or #2803), 10 km LW (#2821 or #2822), 25 km LW (#2881 or #2886)

Selected transceivers are also available in 8-pack convenience packages:

- 16 Gbps SW (#2608 or #2603), 10 km LW (#2618 or #2613)
- 8 Gbps SW (#2809 or #2804), 10 km LW (#2828 or #2823)

Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

http://www.ibm.com/able/product_accessibility/index.html

For hardware offerings

The following features support use by people with disabilities:

- Controls and latches operable with one hand and minimal dexterity
- Keys discernible by touch without activating them
- Ports and connectors support connection of industry-standard devices

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Models

Model summary matrix

Models	16 Gbps FC port blades (min / max)	8 Gbps FC port blades (min / max)	10 Gbps port blades (min / max)
816	0 / 8	0 / 8	0 / 2
416	0 / 4	0 / 4	0 / 2

Customer setup (CSU)

No.

Devices supported

Specific details on supported devices; storage products attachability, SAN connectivity products, and configuration options are available on the web at

http://www.ibm.com/system/storage/san/b-type

Model conversions

Not applicable.

Feature conversions

Not applicable

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Technical description

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IBM System Storage SAN768B-2

The IBM System Storage SAN768B-2 (2499-816) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include redundant and hot-swappable Control Processors, Core Switching Blades, fully redundant N+1 power subsystem with hot-swappable power supplies, dual or quad redundant AC inputs auto-sensing from 110-240v, and hot-swappable blowers in a redundant cooling system. Three blowers provide cooling and SAN768B-2 will continue to operate indefinitely even if one blower fails (N+1 redundancy). Four power supply bays providing space for fully redundant power using any blade configurations. Regardless of blade types installed, the system only requires two power supplies in any bay for full redundancy.

SAN768B-2 features a modular and scalable mechanical construction that allows a wide range of flexibility in installation, fabric design, and maintenance. Using a 14U mechanical design, up to two SAN768B-2 systems can be mounted in an IBM 2109-C36 cabinet, supporting as many as 768 ports. The chassis may be mounted with the cables facing either the front or rear of the equipment. Cables and blade assemblies serviced from the cable side of the switch, blowers and power supplies are serviced from the non-cable side. The use of Cable Management Comb and chassis door offers enhanced cable management. Dual hot swappable World Wide Name (WWN) card maintains chassis-specific information such as WWNs, IP address(s) and summary status information of each port and blade assembly via a LED interface.

The SAN768B-2 base model includes the following components enclosed in a 14U chassis with doors:

- Zero FC Switch Blades
- Zero fiber optic transceivers
- Cable Comb
- Two Control Processor Blades
- Two Core Blades
- Dual power supplies
- Three blower fans
- Ship Group

The Ship Group contains Install Guide hardcopy, CD-ROM (with manuals), 14U rack mounting kit, two rack PDU power cords, wrap tools, RJ-45 cable, and SFP extraction tool.

IBM System Storage SAN384B-2

The IBM System Storage SAN384B-2 (2499-416) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include dual, redundant and hot-swappable Control Processors, Core Switching Blades, power supplies, and blower assemblies. SAN384B-2 will operate indefinitely if a single blower fails. SAN384B-2 can utilize up to two power supplies to maintain full system redundancy. One power supply is required to power a completely loaded system in any system configuration. If a power supply fails, the remaining supply modules continue to provide uninterrupted power to the chassis. Each power supply has its own power cable connector. AC input power is provided to the chassis by means of up to 2 detachable line cords. The geography specific power cord types must be selected based on country in which the system is installed. The input socket to the power supplies is an IEC320-C19 straight.

SAN384B-2 features a modular and scalable horizontal chassis enclosure that allows a wide range of flexibility in installation, fabric design, and maintenance. The chassis may be mounted with the ports facing either the front or rear of the equipment. Ports and blade assemblies serviced from the port side of the switch, blowers and power supplies are serviced from the non-port side.

The SAN384B-2 chassis has non-port side air intake and standard port side and side air exhaust. An exhaust kit is provided to divert the side exhaust air flow to port side thereby making the SAN384B-2 air exhaust fully on non-port side. The mechanical design of the SAN384B-2 allows rack mounting from the port side facing the front of the equipment rack. The SAN384B-2 chassis is an 8U tall mechanical design, 9U with the air flow accessory kit. Its maximum height

Family 2499+03 IBM Systems Storage SAN768B-2 and SAN384B-2

IBM Asia Pacific Sales Manual
Revised: April 20, 2021

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Product life cycle dates

Type Model	Announced	Available	Marketing Withdrawn	Service Discontinued
2499-416	2011-08-16	2011-08-26	2020-04-29	-
2499-816	2011-08-16	2011-08-26	2020-04-29	-

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Abstract

The IBM 2499 System Storage SAN768B-2 and SAN384B-2 fabric backbones are the industry's newest FC switching infrastructure, providing reliable, scalable, high-performance foundations for private cloud storage and highly virtualized environments.

Model abstract 2499-816

The IBM 2499 System Storage SAN768B-2 Model 816 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

Model abstract 2499-416

The IBM 2499 System Storage SAN384B-2 Model 416 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

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Highlights

IBM System Storage SAN768B-2 and SAN384B-2 fabric backbones with the new 16 Gbps Fibre Channel (FC) technology offer a long-term solution for mission-critical applications that require high-performance, low-latency storage networks. These new models offer maximum investment protection by:

- Interfacing with existing 2, 4, and 8 Gbps FC ports
- Offering configurable ports for 10 Gbps metro optical connectivity
- Leveraging existing 8 Gbps 2499 fabric backbone ports and specialty blades
- Integrating with the IBM Network Advisor unified network management solution to bridge operational gaps across server, network, and storage administrators

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Description

They are designed to:

- Enable simpler, flatter, low-latency chassis connectivity to reduce network complexity, management, and costs
- Increase business agility while providing access to information and reducing infrastructure and administrative costs
- Support of private cloud storage with improved scalability, performance, and reliability

SAN768B-2 and SAN384B-2 are designed to address key requirements while helping to protect investments already made by the deployment of existing SANs, servers, storage hardware, and advanced functions:

- Support 2, 4, 8, 10, and 16 Gbps FC and FCIP, as well as advanced fabric services and management tools
- Include up to 384 (SAN768B-2) or 192 (SAN384B-2) 16 Gbps universal (E, F, D, M, and EX) FC ports using 32-or 48-port FC blades, or up to 512 (SAN768B-2) or 256 (SAN384B-2) 8 Gbps universal (E, F, M, and EX) FC ports using 64-port 8 Gbps FC blades
- Deliver forward and backward compatibility with 8 and 16 Gbps IBM System Storage SAN director, switch, and router models

SAN768B-2 and SAN384B-2 are connecting distributed data centers enabled for data mobility and advanced data protection solutions. These fabric backbones include integrated metro and global Storage Area Network (SAN) extensions designed to provide application agility, flexible business continuity, and disaster recovery solutions. These fabric backbones:

- Optimize data center connectivity over distance with integrated high-performance metro and global connectivity
- Simplify and centralize end-to-end SAN management with comprehensive diagnostics, monitoring, and automation
- Maximize performance for I/O-and bandwidth-intensive applications with more than seven times the performance of competitive offerings
- Protect investments in existing SAN fabrics and automation tools while reducing operational costs and minimizing business disruption

The 16 Gbps 2499 fabric backbones are available in two modular form factors. Built for large enterprise networks, the 14U SAN768B-2 (2499-816) has eight vertical blade slots to provide up to 384 16 Gbps FC ports. Built for mid-sized networks, the 8U SAN384B-2 (2499-416) has four horizontal blade slots to provide up to 192 16 Gbps FC ports. These new models support 2, 4, 8, 10, and 16 Gbps FC, and 1/10 Gbps Fibre Channel over IP (FCIP).

Bandwidth-intensive applications, critical workloads, and higher density virtualization are continuing to push the limits of SAN infrastructure. The 2499 16 Gbps models address next-generation I/O requirements by providing increased slot-to-slot and port performance bandwidth with 16 Gbps performance. In addition, local switching capabilities ensure that data traffic within the same port group does not consume slot bandwidth, maximizing the number of line-rate ports.

Optical Inter-Chassis Links (ICLs) can connect up to ten SAN768B-2 and SAN384B-2 fabric backbones, enabling flatter, faster, and simpler fabrics that increase consolidation while reducing network complexity and costs. ICLs enable scalable core-edge and active-active mesh chassis topologies. These high-density chassis topologies reduce inter-switch cabling by 75%, and free up to 33% of ports for server and storage. This maximizes overall port density in the amount of rack space.

SAN768B-2 (2499-816) performance capabilities:

- Up to 384 ports (equivalent to 512 with ICLs) at 16 Gbps
- Up to 8.2 Tbps chassis bandwidth, 6.1 Tbps universal ports, and 2.1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

SAN384B-2 (2499-416) performance capabilities:

- Up to 192 ports (equivalent to 256 with ICLs) at 16 Gbps
- Up to 4.1 Tbps chassis bandwidth, 3.1 Tbps universal ports, and 1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

The 16 Gbps platforms support port-based encryption and compression on an Inter-Switch Link (ISL) between two 16 Gbps E-ports. The encryption and compression feature on an E-port can be enabled on a per port basis. The same port that has been configured for compression can also be configured for encryption. However, only two ports per ASIC can be configured for encryption and compression in FOS 7.0.

The 16 Gbps fabric backbones are designed to provide high-speed replication and backup solutions over metro or wide area network (WAN) links with native FC (10 and 16 Gbps) and optional FCIP (1/10 GbE) extension support. The integrated metro connectivity includes in-flight compression to optimize bandwidth and minimize the risk of unauthorized access.

FOS 7.0 introduces the new Diagnostic port (D-port) type. The D-port is designed to debug the components associated with the link, such as transceivers and cables. This feature is only supported on 16 Gbps ports. The D-Port is statically configured by the user with the intention to run diagnostics. A D-port does not carry any control or data traffic and is purely used for the link diagnostics purpose and to isolate link level faults.

SAN768B-2 and SAN384B-2 base systems require FOS 7.0.0, and later. They are always enabled with the following:

- **Full fabric:** Enables E_ports. The switch cannot be connected to another switch until full fabric is installed
- **Web tools:** Enables administration, configuration, and maintenance of fabric switches and SANs
- **Virtual Fabrics (VF):**
    - Supports ANSI standards-based implementation of VF
    - Adds the capability for physical switches to be partitioned into independently managed logical switches, each with its own data, control, and management paths
    - Allows logical switches to be used to allocate fabric resources on a per-port basis rather than on a per-switch basis
    - Enables simplification or resource allocation by customer, department, application, or storage tier
    - Consolidate resources across multiple fabrics
- **Zoning:** Segments a fabric into virtual private SANs
- **Enhanced group management (EGM):** When added to Brocade element management, the EGM enables additional device-level management functionality for IBM b-type products and also allows large consolidated operations to groups of devices (for example: firmware download, configuration upload and download)

Enterprise Software Bundle features

- **Adaptive networking:** Represents a set of features providing tools and capabilities to incorporate network policies to enable traffic differentiation and prioritization. The FOS 7.0 release supports two types of quality of service (QoS) features with the 16 Gbps fabric backbones:
    - Ingress Rate Limiting to limit the throughput on the ingress side of the port by delaying the return of buffer to buffer credits to the external device
    - SID/DID Based Prioritization used to prioritize the FC flow using a Virtual Channel (VC) by which an FC flow is assigned to different behavior aggregates
- **Advanced performance monitoring:** Helps identify end-to- end bandwidth usage by host or target pairs and is designed to provide information for capacity planning
- **Extended fabrics:** Extend SAN fabrics beyond the FC standard 10 km by optimizing the internal switch buffers to maintain performance on ISLs at distances up to 500 kilometers.
- **Fabric Vision** technology includes several critical diagnostic, monitoring and management capabilities that designed to help increase fabric resiliency, reduce downtime, optimize application performance, and dramatically simplifies SAN deployment and management. The following features are introduced with the base Fabric OS (FOS) 7.2.0 release:
    - ClearLink Diagnostics: Helps ensure optical and signal integrity for Gen 5 Fibre Channel optics and cables, simplifying the deployment and support of high-performance fabrics.
    - Bottleneck Detection: Identifies and alerts administrators about device or ISL congestion, as well as abnormal levels of latency in the fabric.
    - Critical diagnostic and monitoring capabilities: Help ensure early problem detection and recovery.
    - Forward Error Correction (FEC): Enables recovery from bit errors in ISLs, enhancing transmission reliability and performance.
    - Credit Loss Recovery: Helps overcome performance degradation and congestion due to buffer credit loss.

  Flow Vision, Monitoring and Alerting Policy Suite (MAPS), and customizable dashboard advanced technologies and capabilities are made available with the optional Fabric Vision licensed feature. This feature also enables ClearLink (D_Port) functionality for Gen 5 FC platforms when connected to non-b-type end-devices.

    - **Flow Vision** enables 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 monitor, flow mirror, and flow generator features.
    - **Monitoring and Alerting Policy Suite (MAPS)** is a new, easy to use, policy-based threshold monitoring and alerting suite that pro-actively monitors the health and performance of the SAN infrastructure to ensure application uptime and availability. By leveraging pre-built rule/policy-based templates, MAPS simplifies threshold configuration, monitoring and alerting. Organizations 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 ll through a single dialog. The integrated dashboard displays an overall 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. MAPS capabilities provide policy- based monitoring, CLI dashboard of health and error statistics, bottleneck detection information, proactive flow monitoring.

  Automated Migration of Fabric Watch configurations to 'MAPS' automatically imports existing thresholds into a MAPS policy, enabling seamless migration from Fabric Watch to MAPS to take advantage of the new MAPS capabilities and usability enhancements.

  Fabric Vision license is included with FOS 7.2.0, and later. Once the switch is upgraded to FOS 7.2.0 or higher and the Fabric Vision license is enabled, Fabric Watch configuration and any Fabric Watch related features are no longer supported.

- **Fabric watch:** Monitors mission-critical switch operations and includes port fencing capabilities.
- **Trunking:** Enables FC packets to be efficiently distributed across multiple inter-switch connections (links) between two SAN btype fabric switches, while preserving in-order delivery. Both SAN b-type fabric switches must have ISL trunking activated. Both SAN768B-2 and SAN384B-2 adds Enhanced ISL trunking support using 16 Gbps ports and enable FC packets to be distributed across up to eight 16 Gbps capable ISLs for a combined bandwidth of up to 128 Gbps. When connecting the 16 Gbps capable models to legacy 2, 4, or 8 Gbps capable b-type fabric switch models, ISL trunking is supported at the lowest operational link speeds.
- **Server application optimization:** When deployed with Brocade Server Adapters, this function optimizes overall application performance for physical servers and virtual machines by extending virtual channels to the server infrastructure. Application specific traffic flows can be configured, prioritized, and optimized throughout the entire data center infrastructure.

Optional features

SAN7686B-2 and SAN384B-2 are available with a number of selectable options. The base systems do not include any blades, but at least one blade is required for host and storage connectivity.

SAN768B-2 may be configured by adding up to a total of eight of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), and 8 Gbps Encryption (#3895) blades. All activated ports must be populated with a mixture of short wave and long wave optical transceivers up to the maximum number of ports.

The SAN768B-2 (2499-816) base model has two power supplies providing 2000W of total power using only 200/240VAC. The base model (core blades, controller blade, fans) consume 830W power, leaving users with 1170W available power for the optional port (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, #3648, #3649, #3664, #3864) and specialty blades (#3890, #3891, #3895). Based on the different power consumption of each port or specialty blades, various configurations will result in higher than 2000W power usage and customer will be required to purchase feature #7880 pair of optional power supplies. Further details can be found in Appendix A of the SAN768B-2 Installation, Service, and User's Guide. Please consult the following table to calculate the power usage:

Power Demands per Component

Components	Maximum Power Draw (Watts)	Type of Blade	Max blades in chassis
2499-816	830	Base chassis	N/A

#3632, #3633 #3034, #3634, #3635	140	32-port Blades	8
#3648, #3649 #3035, #3636, #3637	160.4	48-port Blades	8
#3664, #3864	126.4	64-port Blades	8
#3890, #3891	235	Extension Blade	4
#3895	250	Encryption Blade	4

SAN384B-2 may be configured by adding up to a total of four of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 64-port (#3664) 16 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), or 8 Gbps Encryption (#3895). All activated ports must be populated with a mixture of short wave and long wave optical transceivers, up to the maximum number of ports.

4 Gbps 10 km LW SFP Transceiver (#2411): This feature provides one longwave SFP transceiver, designed to provide Fibre Channel connections at distances up to 10 km (6.2 miles), while using the appropriate 9.0/125 micrometer single mode fiber optic cable.

16 Gbps FC port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648): 32 or 48 port blades provide 2, 4, 8, or 16 Gbps on each port to be configured as E, F, M, EX, D-ports with no over subscription at 16 Gbps on the 32-port blade. Within a group of 8 ports in a port blade, two of the following three port speed combinations are allowed:

- 2, 4, and 8 Gbps
- 10 Gbps
- 16 Gbps

The default setting is:

- 2, 4, and 8 Gbps
- 16 Gbps

Any eight ports of the 16 Gbps port blades can be enabled for 10 Gbps FC when feature #7892 is activated.

Enhanced 8 Gbps FC port blades (#3633 and #3649): The two port blades (32 or 48 ports) provide 2, 4, or 8 Gbps on each port to be configured as E, F, M, EX port with no over subscription at 8 Gbps speed. These port blades cannot be upgraded to 10 or 16 Gbps speed and do not support in-flight encryption and compression. The #3633 and #3649 blades do not support FICON. Also, no Diagnostic (D-port) support on these blades. Up to four 8-port external trunk groups per #3633 blade and up to six 8-port external trunk groups per #3649 blade.

SAN768B FC 8 Gbps 64-port blade (#3864): The SAN768B FC 8 Gbps 64-port Blade is designed to allow mid to large enterprise customers to deploy high-density, chassis-based solutions to minimize physical footprint without compromising performance. This blade provides 64 E, EX, F and M ports operating at 2, 4, and 8 Gbps, offering low latency and cut-through switching with full 8 Gbps line rate on local switching and 2:1 over subscription at 8 Gbps across the backplane. There can be up to eight 8-port trunk groups created with the 64-port blade, with a maximum of 8 ports per trunk group. The #3864 blade does not support FICON and cannot co-exist with blades running FICON traffic.

To achieve this high-density solution, the 64-port blade uses an optimized version of the standard Small Form-factor Pluggable (mSFP) transceiver and requires a structured cable management solution. The mSFPs retain all of the performance and functionality of the standard SFP+ and include individual port isolation for improved serviceability and availability. Each 64-port blade is populated and shipped with 64 8 Gbps shortwave mSFP fiber optic transceivers. The mSFP fiber pitch and width are narrower than standard SFPs, resulting in the need for newer OM-3 fiber cables with narrower LC connectors. The standard LC connector was modified by major cable vendors to accommodate the new fiber pitch and width. The new cables provide the same flexibility in connectivity as standard LC cables and they are available in the following configurations:

- **MSFP-LC cable** provides the #3864 port blade with the ability to connect to other port blades, switches, devices, and LC patch panels.
- **MSFP-MSFP cable** allows one #3864 port blade to connect to another #3864 port blade as ISLs.
- **MSFP-MPO cable** is a trunked MPO cable to connect to multiple mSFP ports; six mSFP connectors are supported in one trunk cable.

Only the trunked mSFP-MPO cable solution is recommended when multiple directors using the #3864 64-port blades are installed into a 2109-C36 cabinet.

Refer to the Cable Management Considerations for 8 Gbps and 16 Gbps 64 Port Blades guide posted on the IBM Support website to find installation guidelines and the list of recommended part numbers and vendor information.

8 Gbps Extension Blade (#3890): The 8 Gbps Extension Blade combines FC switching and routing capabilities with hardware-assisted FCIP traffic forwarding over IP WAN. The twelve 8 Gbps FC ports and ten 1 Gigabit Ethernet (GbE) port blade is designed to provide remote storage and SAN connectivity. The 8 Gbps Extension Blade integrates a variety of capabilities to deliver a high performance, reliable, and secure distance-connectivity solution, such as:

- **FCIP Trunking** is designed to virtualize two or more TCP connections as part of a single FCIP tunnel. FCIP Trunking combines multiple IP source and destination address pairs into a logical high-bandwidth FCIP trunk spanning multiple physical ports to provide load balancing and network failure resiliency.
- **Adaptive rate limiting** is designed to meet minimum bandwidth requirements for each tunnel while fully utilizing the available network bandwidth without adverse throughput performance impact at high traffic load.
- **Hardware-based compression** delivers the ability to increase throughput over lower bandwidth links in the WAN, supporting the cost efficiencies of FCIP. The 8 Gbps Extension Blade compresses FC frames before they are encapsulated into FCIP packets.
- **FCIP QoS** provides high, medium, and low-priority handling of initiator target flows within the same FCIP tunnel for transmission over the WAN.
- **FC routing** delivers fabric isolation in conjunction with FCIP, enabling separate fabrics to share devices without merging across the IP network.
- **FCIP fast write** accelerates SCSI write processing, maximizing performance of synchronous and asynchronous replication applications across high-latency WAN connections.
- **Open systems tape pipelining** accelerates read and write tape processing over distance, minimizing backup and restore windows.
- **Storage optimized TCP** helps improve TCP window size and flow control, accelerating TCP transport for storage applications.
- **Multiple logical FCIP tunnels** allow for scalable connectivity between sites, between two SAN06B-R models, or when it is connected to a 8 Gbps Extension Blade.

Enhanced 8 Gbps Extension Blade (#3891): The Enhanced 8 Gbps Extension Blade in addition to all features and function of the #3890 8 Gbps Extension Blade capable of running IPSec on both 10 GbE interface doubling encrypted throughput for each #3891 blade.

Encryption Blade (#3895): A 16-port, auto-sensing 8 Gbps FC blade provides fabric-based encryption for data-at-rest and compression. The Encryption Blade scales nondisruptively, providing from 48 Gbps up to 96 Gbps of encryption processing power to meet the needs of the most demanding environments with flexible, on-demand performance. It also provides compression services at speeds up to 48 Gbps for tape storage systems. The Encryption Blade is supported with the Tivoli Key Lifecycle Manager for both disk and tape encryption applications. Following August 1, 2012 each #3895 Encryption Blade will include six Smart Cards.

2499-816 Firmware upgrade renewal, one year (#7710): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-816 Firmware upgrade renewal, two years (#7711): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, one year (#7714): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, two years (#7715): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

Inter-chassis QSFP bundle (#7868): This feature provides sixteen pieces of 4 X 16 Gbps QSFP transceiver bundle to be used on the 16 Gbps Core Blade. Customer supplied QSFP cable up to 50 meters long can be used as an ICL cable.

Inter-chassis license conversion (#7869): This feature is used to convert an ICL activation transferred from an 8 Gbps model as part of the model conversion process. Features #7882 or #7883 converts into one #7869, while feature #7885 counts as two of #7869.

Inter-Chassis License with 16x4x16Gbps QSFP (#7871): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code only enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 platform. A second POD feature code enables all ICL ports on a 2499-816 platform. In addition, each feature ships sixteen 4 x 16 Gbps QSFP transceivers. Customer supplied off-the-shelf QSFP cable up to 50 meters long can be used as an ICL cable.

ICL Enterprise Connectivity License 5-10 2499-416 (#7872): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN384B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

ICL Enterprise Connectivity License 5-10 2499-816 (#7873): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN768B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

Inter-Chassis License with 16x (4 x 16 Gbps) QSFP (#7874): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code (#7871 or #7874) enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 models. A second POD feature code enables all ICL ports on a 2499-816 models. In addition, each feature ships sixteen 4 x 16 Gbps QSFP 100 m transceivers. Customer supplied off-the-shelf OM4 QSFP cable up to 100 meters long can be used as an ICL cable.

FICON with CUP activation (#7884): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by system automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON directors, in addition to supported SAN b-type switch and director products with FICON.

FICON with CUP activation (#7886): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by System Automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System Automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON Directors, as well as supported SAN b-type switch and director products with FICON.

Integrated Routing (#7889): Integrated Routing allows any 8 or 16 Gbps FC port in a SAN768B-2 to be configured as an EX_port supporting Fibre Channel Routing (FCR). FCR support on the 8 or 16 Gbps ports is a native capability, therefore these ports are referred to as native EX_ports. FCR capability on native EX_ports requires the Integrated Routing feature (#7889). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

Integrated Routing License (#7890): Integrated routing (EX_port) allows any 8 or 16 Gbps port in a SAN384B-2 to be configured supporting FCR. Integrated routing enables FCR support on the 8 or 16 Gbps ports as a native capability, therefore they are referred to as native EX_ports. FCR capability on native EX_ports requires the integrated routing feature (#7890). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

8 Gbps Advanced Extension Activation (#7891): This feature code enables two advanced extension features, FCIP Trunking and Adaptive Rate Limiting (ARL), on SAN768B-2 or SAN384B-2 systems. The FCIP Trunking feature allows multiple IP source and destination address pairs (defined as FCIP Circuits) via multiple 1 GE interfaces to provide a high bandwidth FCIP tunnel and failover resiliency. The ARL feature provides a minimum bandwidth guarantee for each tunnel with full utilization of the available network bandwidth without impacting throughput performance under high traffic load. ARL is performed on the FCIP tunnel connection to dynamically change the rate at which the FCIP tunnel transmits data through the TCP connection. ARL will use the information from the TCP connection to determine and adjust the rate limit for the FCIP tunnel dynamically. This allows FCIP connections to utilize the maximum available bandwidth. Each 8 Gbps Extension Blade (#3890 or #3891) must have one 8 Gbps Advanced Extension (#7891) activation feature installed.

8 Gbps Extension Blade 10 GbE activation (#7892): This feature code enables up to two 10 GbE ports on the 8 Gbps Extension Blade (#3890) or Enhanced 8 Gbps Extension Blade (#3891). With this feature, two additional operating modes, in addition to ten 1 GbE ports mode, can be selected. Either two 10 GbE ports or ten 1 GbE and one 10 GbE ports can be configured on a #3890 or #3891 blade when this feature is activated. This feature is available on the SAN768B-2 and SAN384B-2 models and one feature applies for each 8 Gbps Extension Blade (#3890 or #3891).

This same feature can be used to enable 10 Gbps FC on any eight ports of the 16 Gbps port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648). 10G FC feature code must be installed before any port can run at 10 Gbps speed. One feature code should be activated for each port blades to be enabled for 10 Gbps FC.

8 Gbps FICON Accelerator Activation (#7893): The 8 Gbps FICON Accelerator Activation is an optional software authorization feature that uses advanced networking technologies, data management techniques, and protocol intelligence to accelerate FICON disk and tape read and write operations over distance, while maintaining the integrity of command and acknowledgment sequences. It supports emulation for IBM z/OS Global Mirror (formerly eXtended Remote Copy or XRC), in addition to tape pipelining for FICON tape and virtual tape. In combination with the 8 Gbps Advanced Extension Activation (#7891) feature code for FCIP tunneling, FICON Accelerator can provide improved application performance across long distance IP WANs. Each 8 Gbps FICON Accelerator Activation feature is licensed for one 8 Gbps Extension Blade (#3890) or one Enhanced 8 Gbps Extension Blade (#3891) to be used in the SAN768B-2 or the SAN384B-2 fabric backbone.

Encryption 96 Gbps disk Performance Upgrade activation (#7895): Disk Encryption Performance Upgrade feature enables scalability of performance on the Encryption Blade (#3895) features. The upgrade provides increased throughput for disk encryption applications up to 96 Gbps, effectively doubling encrypted throughput performance for disk-based storage with no disruption to operations.

Transceivers

SAN768B-2 and SAN384B-2 offer the following optical transceivers:

- 16 Gbps SW (#2601 or #2602), 10 km LW (#2611 or #2612)
- 10 Gbps SW (#2609), 10 km LW (#2610)
- 8 Gbps SW (#2802 or #2803), 10 km LW (#2821 or #2822), 25 km LW (#2881 or #2886)

Selected transceivers are also available in 8-pack convenience packages:

- 16 Gbps SW (#2608 or #2603), 10 km LW (#2618 or #2613)
- 8 Gbps SW (#2809 or #2804), 10 km LW (#2828 or #2823)

Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

http://www.ibm.com/able/product_accessibility/index.html

For hardware offerings

The following features support use by people with disabilities:

- Controls and latches operable with one hand and minimal dexterity
- Keys discernible by touch without activating them
- Ports and connectors support connection of industry-standard devices

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Models

Model summary matrix

Models	16 Gbps FC port blades (min / max)	8 Gbps FC port blades (min / max)	10 Gbps port blades (min / max)
816	0 / 8	0 / 8	0 / 2
416	0 / 4	0 / 4	0 / 2

Customer setup (CSU)

No.

Devices supported

Specific details on supported devices; storage products attachability, SAN connectivity products, and configuration options are available on the web at

http://www.ibm.com/system/storage/san/b-type

Model conversions

Not applicable.

Feature conversions

Not applicable

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Technical description

↓ Physical specifications
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IBM System Storage SAN768B-2

The IBM System Storage SAN768B-2 (2499-816) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include redundant and hot-swappable Control Processors, Core Switching Blades, fully redundant N+1 power subsystem with hot-swappable power supplies, dual or quad redundant AC inputs auto-sensing from 110-240v, and hot-swappable blowers in a redundant cooling system. Three blowers provide cooling and SAN768B-2 will continue to operate indefinitely even if one blower fails (N+1 redundancy). Four power supply bays providing space for fully redundant power using any blade configurations. Regardless of blade types installed, the system only requires two power supplies in any bay for full redundancy.

SAN768B-2 features a modular and scalable mechanical construction that allows a wide range of flexibility in installation, fabric design, and maintenance. Using a 14U mechanical design, up to two SAN768B-2 systems can be mounted in an IBM 2109-C36 cabinet, supporting as many as 768 ports. The chassis may be mounted with the cables facing either the front or rear of the equipment. Cables and blade assemblies serviced from the cable side of the switch, blowers and power supplies are serviced from the non-cable side. The use of Cable Management Comb and chassis door offers enhanced cable management. Dual hot swappable World Wide Name (WWN) card maintains chassis-specific information such as WWNs, IP address(s) and summary status information of each port and blade assembly via a LED interface.

The SAN768B-2 base model includes the following components enclosed in a 14U chassis with doors:

- Zero FC Switch Blades
- Zero fiber optic transceivers
- Cable Comb
- Two Control Processor Blades
- Two Core Blades
- Dual power supplies
- Three blower fans
- Ship Group

The Ship Group contains Install Guide hardcopy, CD-ROM (with manuals), 14U rack mounting kit, two rack PDU power cords, wrap tools, RJ-45 cable, and SFP extraction tool.

IBM System Storage SAN384B-2

The IBM System Storage SAN384B-2 (2499-416) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include dual, redundant and hot-swappable Control Processors, Core Switching Blades, power supplies, and blower assemblies. SAN384B-2 will operate indefinitely if a single blower fails. SAN384B-2 can utilize up to two power supplies to maintain full system redundancy. One power supply is required to power a completely loaded system in any system configuration. If a power supply fails, the remaining supply modules continue to provide uninterrupted power to the chassis. Each power supply has its own power cable connector. AC input power is provided to the chassis by means of up to 2 detachable line cords. The geography specific power cord types must be selected based on country in which the system is installed. The input socket to the power supplies is an IEC320-C19 straight.

SAN384B-2 features a modular and scalable horizontal chassis enclosure that allows a wide range of flexibility in installation, fabric design, and maintenance. The chassis may be mounted with the ports facing either the front or rear of the equipment. Ports and blade assemblies serviced from the port side of the switch, blowers and power supplies are serviced from the non-port side.

The SAN384B-2 chassis has non-port side air intake and standard port side and side air exhaust. An exhaust kit is provided to divert the side exhaust air flow to port side thereby making the SAN384B-2 air exhaust fully on non-port side. The mechanical design of the SAN384B-2 allows rack mounting from the port side facing the front of the equipment rack. The SAN384B-2 chassis is an 8U tall mechanical design, 9U with the air flow accessory kit. Its maximum height

Family 2499+03 IBM Systems Storage SAN768B-2 and SAN384B-2

IBM Asia Pacific Sales Manual
Revised: April 20, 2021

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Product life cycle dates

Type Model	Announced	Available	Marketing Withdrawn	Service Discontinued
2499-416	2011-08-16	2011-08-26	2020-04-29	-
2499-816	2011-08-16	2011-08-26	2020-04-29	-

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Abstract

The IBM 2499 System Storage SAN768B-2 and SAN384B-2 fabric backbones are the industry's newest FC switching infrastructure, providing reliable, scalable, high-performance foundations for private cloud storage and highly virtualized environments.

Model abstract 2499-816

The IBM 2499 System Storage SAN768B-2 Model 816 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

Model abstract 2499-416

The IBM 2499 System Storage SAN384B-2 Model 416 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

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Highlights

IBM System Storage SAN768B-2 and SAN384B-2 fabric backbones with the new 16 Gbps Fibre Channel (FC) technology offer a long-term solution for mission-critical applications that require high-performance, low-latency storage networks. These new models offer maximum investment protection by:

- Interfacing with existing 2, 4, and 8 Gbps FC ports
- Offering configurable ports for 10 Gbps metro optical connectivity
- Leveraging existing 8 Gbps 2499 fabric backbone ports and specialty blades
- Integrating with the IBM Network Advisor unified network management solution to bridge operational gaps across server, network, and storage administrators

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Description

They are designed to:

- Enable simpler, flatter, low-latency chassis connectivity to reduce network complexity, management, and costs
- Increase business agility while providing access to information and reducing infrastructure and administrative costs
- Support of private cloud storage with improved scalability, performance, and reliability

SAN768B-2 and SAN384B-2 are designed to address key requirements while helping to protect investments already made by the deployment of existing SANs, servers, storage hardware, and advanced functions:

- Support 2, 4, 8, 10, and 16 Gbps FC and FCIP, as well as advanced fabric services and management tools
- Include up to 384 (SAN768B-2) or 192 (SAN384B-2) 16 Gbps universal (E, F, D, M, and EX) FC ports using 32-or 48-port FC blades, or up to 512 (SAN768B-2) or 256 (SAN384B-2) 8 Gbps universal (E, F, M, and EX) FC ports using 64-port 8 Gbps FC blades
- Deliver forward and backward compatibility with 8 and 16 Gbps IBM System Storage SAN director, switch, and router models

SAN768B-2 and SAN384B-2 are connecting distributed data centers enabled for data mobility and advanced data protection solutions. These fabric backbones include integrated metro and global Storage Area Network (SAN) extensions designed to provide application agility, flexible business continuity, and disaster recovery solutions. These fabric backbones:

- Optimize data center connectivity over distance with integrated high-performance metro and global connectivity
- Simplify and centralize end-to-end SAN management with comprehensive diagnostics, monitoring, and automation
- Maximize performance for I/O-and bandwidth-intensive applications with more than seven times the performance of competitive offerings
- Protect investments in existing SAN fabrics and automation tools while reducing operational costs and minimizing business disruption

The 16 Gbps 2499 fabric backbones are available in two modular form factors. Built for large enterprise networks, the 14U SAN768B-2 (2499-816) has eight vertical blade slots to provide up to 384 16 Gbps FC ports. Built for mid-sized networks, the 8U SAN384B-2 (2499-416) has four horizontal blade slots to provide up to 192 16 Gbps FC ports. These new models support 2, 4, 8, 10, and 16 Gbps FC, and 1/10 Gbps Fibre Channel over IP (FCIP).

Bandwidth-intensive applications, critical workloads, and higher density virtualization are continuing to push the limits of SAN infrastructure. The 2499 16 Gbps models address next-generation I/O requirements by providing increased slot-to-slot and port performance bandwidth with 16 Gbps performance. In addition, local switching capabilities ensure that data traffic within the same port group does not consume slot bandwidth, maximizing the number of line-rate ports.

Optical Inter-Chassis Links (ICLs) can connect up to ten SAN768B-2 and SAN384B-2 fabric backbones, enabling flatter, faster, and simpler fabrics that increase consolidation while reducing network complexity and costs. ICLs enable scalable core-edge and active-active mesh chassis topologies. These high-density chassis topologies reduce inter-switch cabling by 75%, and free up to 33% of ports for server and storage. This maximizes overall port density in the amount of rack space.

SAN768B-2 (2499-816) performance capabilities:

- Up to 384 ports (equivalent to 512 with ICLs) at 16 Gbps
- Up to 8.2 Tbps chassis bandwidth, 6.1 Tbps universal ports, and 2.1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

SAN384B-2 (2499-416) performance capabilities:

- Up to 192 ports (equivalent to 256 with ICLs) at 16 Gbps
- Up to 4.1 Tbps chassis bandwidth, 3.1 Tbps universal ports, and 1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

The 16 Gbps platforms support port-based encryption and compression on an Inter-Switch Link (ISL) between two 16 Gbps E-ports. The encryption and compression feature on an E-port can be enabled on a per port basis. The same port that has been configured for compression can also be configured for encryption. However, only two ports per ASIC can be configured for encryption and compression in FOS 7.0.

The 16 Gbps fabric backbones are designed to provide high-speed replication and backup solutions over metro or wide area network (WAN) links with native FC (10 and 16 Gbps) and optional FCIP (1/10 GbE) extension support. The integrated metro connectivity includes in-flight compression to optimize bandwidth and minimize the risk of unauthorized access.

FOS 7.0 introduces the new Diagnostic port (D-port) type. The D-port is designed to debug the components associated with the link, such as transceivers and cables. This feature is only supported on 16 Gbps ports. The D-Port is statically configured by the user with the intention to run diagnostics. A D-port does not carry any control or data traffic and is purely used for the link diagnostics purpose and to isolate link level faults.

SAN768B-2 and SAN384B-2 base systems require FOS 7.0.0, and later. They are always enabled with the following:

- **Full fabric:** Enables E_ports. The switch cannot be connected to another switch until full fabric is installed
- **Web tools:** Enables administration, configuration, and maintenance of fabric switches and SANs
- **Virtual Fabrics (VF):**
  - Supports ANSI standards-based implementation of VF
  - Adds the capability for physical switches to be partitioned into independently managed logical switches, each with its own data, control, and management paths
  - Allows logical switches to be used to allocate fabric resources on a per-port basis rather than on a per-switch basis
  - Enables simplification or resource allocation by customer, department, application, or storage tier
  - Consolidate resources across multiple fabrics
- **Zoning:** Segments a fabric into virtual private SANs
- **Enhanced group management (EGM):** When added to Brocade element management, the EGM enables additional device-level management functionality for IBM b-type products and also allows large consolidated operations to groups of devices (for example: firmware download, configuration upload and download)

Enterprise Software Bundle features

- **Adaptive networking:** Represents a set of features providing tools and capabilities to incorporate network policies to enable traffic differentiation and prioritization. The FOS 7.0 release supports two types of quality of service (QoS) features with the 16 Gbps fabric backbones:
  - Ingress Rate Limiting to limit the throughput on the ingress side of the port by delaying the return of buffer to buffer credits to the external device
  - SID/DID Based Prioritization used to prioritize the FC flow using a Virtual Channel (VC) by which an FC flow is assigned to different behavior aggregates
- **Advanced performance monitoring:** Helps identify end-to- end bandwidth usage by host or target pairs and is designed to provide information for capacity planning
- **Extended fabrics:** Extend SAN fabrics beyond the FC standard 10 km by optimizing the internal switch buffers to maintain performance on ISLs at distances up to 500 kilometers.
- **Fabric Vision** technology includes several critical diagnostic, monitoring and management capabilities that designed to help increase fabric resiliency, reduce downtime, optimize application performance, and dramatically simplifies SAN deployment and management. The following features are introduced with the base Fabric OS (FOS) 7.2.0 release:
  - ClearLink Diagnostics: Helps ensure optical and signal integrity for Gen 5 Fibre Channel optics and cables, simplifying the deployment and support of high-performance fabrics.
  - Bottleneck Detection: Identifies and alerts administrators about device or ISL congestion, as well as abnormal levels of latency in the fabric.

  - Critical diagnostic and monitoring capabilities: Help ensure early problem detection and recovery.
  - Forward Error Correction (FEC): Enables recovery from bit errors in ISLs, enhancing transmission reliability and performance.
  - Credit Loss Recovery: Helps overcome performance degradation and congestion due to buffer credit loss.

  Flow Vision, Monitoring and Alerting Policy Suite (MAPS), and customizable dashboard advanced technologies and capabilities are made available with the optional Fabric Vision licensed feature. This feature also enables ClearLink (D_Port) functionality for Gen 5 FC platforms when connected to non-b-type end-devices.

  - **Flow Vision** enables 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 monitor, flow mirror, and flow generator features.
  - **Monitoring and Alerting Policy Suite (MAPS)** is a new, easy to use, policy-based threshold monitoring and alerting suite that pro-actively monitors the health and performance of the SAN infrastructure to ensure application uptime and availability. By leveraging pre-built rule/policy-based templates, MAPS simplifies threshold configuration, monitoring and alerting. Organizations 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 ll through a single dialog. The integrated dashboard displays an overall 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. MAPS capabilities provide policy- based monitoring, CLI dashboard of health and error statistics, bottleneck detection information, proactive flow monitoring.

  Automated Migration of Fabric Watch configurations to 'MAPS' automatically imports existing thresholds into a MAPS policy, enabling seamless migration from Fabric Watch to MAPS to take advantage of the new MAPS capabilities and usability enhancements.

  Fabric Vision license is included with FOS 7.2.0, and later. Once the switch is upgraded to FOS 7.2.0 or higher and the Fabric Vision license is enabled, Fabric Watch configuration and any Fabric Watch related features are no longer supported.

- **Fabric watch:** Monitors mission-critical switch operations and includes port fencing capabilities.
- **Trunking:** Enables FC packets to be efficiently distributed across multiple inter-switch connections (links) between two SAN btype fabric switches, while preserving in-order delivery. Both SAN b-type fabric switches must have ISL trunking activated. Both SAN768B-2 and SAN384B-2 adds Enhanced ISL trunking support using 16 Gbps ports and enable FC packets to be distributed across up to eight 16 Gbps capable ISLs for a combined bandwidth of up to 128 Gbps. When connecting the 16 Gbps capable models to legacy 2, 4, or 8 Gbps capable b-type fabric switch models, ISL trunking is supported at the lowest operational link speeds.
- **Server application optimization:** When deployed with Brocade Server Adapters, this function optimizes overall application performance for physical servers and virtual machines by extending virtual channels to the server infrastructure. Application specific traffic flows can be configured, prioritized, and optimized throughout the entire data center infrastructure.

Optional features

SAN7686B-2 and SAN384B-2 are available with a number of selectable options. The base systems do not include any blades, but at least one blade is required for host and storage connectivity.

SAN768B-2 may be configured by adding up to a total of eight of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), and 8 Gbps Encryption (#3895) blades. All activated ports must be populated with a mixture of short wave and long wave optical transceivers up to the maximum number of ports.

The SAN768B-2 (2499-816) base model has two power supplies providing 2000W of total power using only 200/240VAC. The base model (core blades, controller blade, fans) consume 830W power, leaving users with 1170W available power for the optional port (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, #3648, #3649, #3664, #3864) and specialty blades (#3890, #3891, #3895). Based on the different power consumption of each port or specialty blades, various configurations will result in higher than 2000W power usage and customer will be required to purchase feature #7880 pair of optional power supplies. Further details can be found in Appendix A of the SAN768B-2 Installation, Service, and User's Guide. Please consult the following table to calculate the power usage:

Power Demands per Component

Components	Maximum Power Draw (Watts)	Type of Blade	Max blades in chassis
2499-816	830	Base chassis	N/A
#3632, #3633 #3034, #3634, #3635	140	32-port Blades	8
#3648, #3649 #3035, #3636, #3637	160.4	48-port Blades	8
#3664, #3864	126.4	64-port Blades	8
#3890, #3891	235	Extension Blade	4
#3895	250	Encryption Blade	4

SAN384B-2 may be configured by adding up to a total of four of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 64-port (#3664) 16 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), or 8 Gbps Encryption (#3895). All activated ports must be populated with a mixture of short wave and long wave optical transceivers, up to the maximum number of ports.

4 Gbps 10 km LW SFP Transceiver (#2411): This feature provides one longwave SFP transceiver, designed to provide Fibre Channel connections at distances up to 10 km (6.2 miles), while using the appropriate 9.0/125 micrometer single mode fiber optic cable.

16 Gbps FC port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648): 32 or 48 port blades provide 2, 4, 8, or 16 Gbps on each port to be configured as E, F, M, EX, D-ports with no over subscription at 16 Gbps on the 32-port blade. Within a group of 8 ports in a port blade, two of the following three port speed combinations are allowed:

- 2, 4, and 8 Gbps
- 10 Gbps
- 16 Gbps

The default setting is:

- 2, 4, and 8 Gbps
- 16 Gbps

Any eight ports of the 16 Gbps port blades can be enabled for 10 Gbps FC when feature #7892 is activated.

Enhanced 8 Gbps FC port blades (#3633 and #3649): The two port blades (32 or 48 ports) provide 2, 4, or 8 Gbps on each port to be configured as E, F, M, EX port with no over subscription at 8 Gbps speed. These port blades cannot be upgraded to 10 or 16 Gbps speed and do not support in-flight encryption and compression. The #3633 and #3649 blades do not support FICON. Also, no Diagnostic (D-port) support on these blades. Up to four 8-port external trunk groups per #3633 blade and up to six 8-port external trunk groups per #3649 blade.

SAN768B FC 8 Gbps 64-port blade (#3864): The SAN768B FC 8 Gbps 64-port Blade is designed to allow mid to large enterprise customers to deploy high-density, chassis-based solutions to minimize physical footprint without compromising performance. This blade provides 64 E, EX, F and M ports operating at 2, 4, and 8 Gbps, offering low latency and cut-through switching with full 8 Gbps line rate on local switching and 2:1 over subscription at 8 Gbps across the backplane. There can be up to eight 8-port trunk groups created with the 64-port blade, with a maximum of 8 ports per trunk group. The #3864 blade does not support FICON and cannot co-exist with blades running FICON traffic.

To achieve this high-density solution, the 64-port blade uses an optimized version of the standard Small Form-factor Pluggable (mSFP) transceiver and requires a structured cable management solution. The mSFPs retain all of the performance and functionality of the standard SFP+ and include individual port isolation for improved serviceability and availability. Each 64-port blade is populated and shipped with 64 8 Gbps shortwave mSFP fiber optic transceivers. The mSFP fiber pitch and width are narrower than standard SFPs, resulting in the need for newer OM-3 fiber cables with narrower LC connectors. The standard LC connector was modified by major cable vendors to accommodate the new fiber pitch and width. The new cables provide the same flexibility in connectivity as standard LC cables and they are available in the following configurations:

- **MSFP-LC cable** provides the #3864 port blade with the ability to connect to other port blades, switches, devices, and LC patch panels.
- **MSFP-MSFP cable** allows one #3864 port blade to connect to another #3864 port blade as ISLs.
- **MSFP-MPO cable** is a trunked MPO cable to connect to multiple mSFP ports; six mSFP connectors are supported in one trunk cable.

Only the trunked mSFP-MPO cable solution is recommended when multiple directors using the #3864 64-port blades are installed into a 2109-C36 cabinet.

Refer to the Cable Management Considerations for 8 Gbps and 16 Gbps 64 Port Blades guide posted on the IBM Support website to find installation guidelines and the list of recommended part numbers and vendor information.

8 Gbps Extension Blade (#3890): The 8 Gbps Extension Blade combines FC switching and routing capabilities with hardware-assisted FCIP traffic forwarding over IP WAN. The twelve 8 Gbps FC ports and ten 1 Gigabit Ethernet (GbE) port blade is designed to provide remote storage and SAN connectivity. The 8 Gbps Extension Blade integrates a variety of capabilities to deliver a high performance, reliable, and secure distance-connectivity solution, such as:

- **FCIP Trunking** is designed to virtualize two or more TCP connections as part of a single FCIP tunnel. FCIP Trunking combines multiple IP source and destination address pairs into a logical high-bandwidth FCIP trunk spanning multiple physical ports to provide load balancing and network failure resiliency.
- **Adaptive rate limiting** is designed to meet minimum bandwidth requirements for each tunnel while fully utilizing the available network bandwidth without adverse throughput performance impact at high traffic load.
- **Hardware-based compression** delivers the ability to increase throughput over lower bandwidth links in the WAN, supporting the cost efficiencies of FCIP. The 8 Gbps Extension Blade compresses FC frames before they are encapsulated into FCIP packets.
- **FCIP QoS** provides high, medium, and low-priority handling of initiator target flows within the same FCIP tunnel for transmission over the WAN.
- **FC routing** delivers fabric isolation in conjunction with FCIP, enabling separate fabrics to share devices without merging across the IP network.
- **FCIP fast write** accelerates SCSI write processing, maximizing performance of synchronous and asynchronous replication applications across high-latency WAN connections.
- **Open systems tape pipelining** accelerates read and write tape processing over distance, minimizing backup and restore windows.
- **Storage optimized TCP** helps improve TCP window size and flow control, accelerating TCP transport for storage applications.
- **Multiple logical FCIP tunnels** allow for scalable connectivity between sites, between two SAN06B-R models, or when it is connected to a 8 Gbps Extension Blade.

Enhanced 8 Gbps Extension Blade (#3891): The Enhanced 8 Gbps Extension Blade in addition to all features and function of the #3890 8 Gbps Extension Blade capable of running IPSec on both 10 GbE interface doubling encrypted throughput for each #3891 blade.

Encryption Blade (#3895): A 16-port, auto-sensing 8 Gbps FC blade provides fabric-based encryption for data-at-rest and compression. The Encryption Blade scales nondisruptively, providing from 48 Gbps up to 96 Gbps of encryption processing power to meet the needs of the most demanding environments with flexible, on-demand performance. It also provides compression services at speeds up to 48 Gbps for tape storage systems. The Encryption Blade is supported with the Tivoli Key Lifecycle Manager for both disk and tape encryption applications. Following August 1, 2012 each #3895 Encryption Blade will include six Smart Cards.

2499-816 Firmware upgrade renewal, one year (#7710): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-816 Firmware upgrade renewal, two years (#7711): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, one year (#7714): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, two years (#7715): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

Inter-chassis QSFP bundle (#7868): This feature provides sixteen pieces of 4 X 16 Gbps QSFP transceiver bundle to be used on the 16 Gbps Core Blade. Customer supplied QSFP cable up to 50 meters long can be used as an ICL cable.

Inter-chassis license conversion (#7869): This feature is used to convert an ICL activation transferred from an 8 Gbps model as part of the model conversion process. Features #7882 or #7883 converts into one #7869, while feature #7885 counts as two of #7869.

Inter-Chassis License with 16x4x16Gbps QSFP (#7871): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code only enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 platform. A second POD feature code enables all ICL ports on a 2499-816 platform. In addition, each feature ships sixteen 4 x 16 Gbps QSFP transceivers. Customer supplied off-the-shelf QSFP cable up to 50 meters long can be used as an ICL cable.

ICL Enterprise Connectivity License 5-10 2499-416 (#7872): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN384B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

ICL Enterprise Connectivity License 5-10 2499-816 (#7873): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN768B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

Inter-Chassis License with 16x (4 x 16 Gbps) QSFP (#7874): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code (#7871 or #7874) enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 models. A second POD feature code enables all ICL ports on a 2499-816 models. In addition, each feature ships sixteen 4 x 16 Gbps QSFP 100 m transceivers. Customer supplied off-the-shelf OM4 QSFP cable up to 100 meters long can be used as an ICL cable.

FICON with CUP activation (#7884): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by system automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON directors, in addition to supported SAN b-type switch and director products with FICON.

FICON with CUP activation (#7886): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by System Automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System Automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON Directors, as well as supported SAN b-type switch and director products with FICON.

Integrated Routing (#7889): Integrated Routing allows any 8 or 16 Gbps FC port in a SAN768B-2 to be configured as an EX_port supporting Fibre Channel Routing (FCR). FCR support on the 8 or 16 Gbps ports is a native capability, therefore these ports are referred to as native EX_ports. FCR capability on native EX_ports requires the Integrated Routing feature (#7889). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

Integrated Routing License (#7890): Integrated routing (EX_port) allows any 8 or 16 Gbps port in a SAN384B-2 to be configured supporting FCR. Integrated routing enables FCR support on the 8 or 16 Gbps ports as a native capability, therefore they are referred to as native EX_ports. FCR capability on native EX_ports requires the integrated routing feature (#7890). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

8 Gbps Advanced Extension Activation (#7891): This feature code enables two advanced extension features, FCIP Trunking and Adaptive Rate Limiting (ARL), on SAN768B-2 or SAN384B-2 systems. The FCIP Trunking feature allows multiple IP source and destination address pairs (defined as FCIP Circuits) via multiple 1 GE interfaces to provide a high bandwidth FCIP tunnel and failover resiliency. The ARL feature provides a minimum bandwidth guarantee for each tunnel with full utilization of the available network bandwidth without impacting throughput performance under high traffic load. ARL is performed on the FCIP tunnel connection to dynamically change the rate at which the FCIP tunnel transmits data through the TCP connection. ARL will use the information from the TCP connection to determine and adjust the rate limit for the FCIP tunnel dynamically. This allows FCIP connections to utilize the maximum available bandwidth. Each 8 Gbps Extension Blade (#3890 or #3891) must have one 8 Gbps Advanced Extension (#7891) activation feature installed.

8 Gbps Extension Blade 10 GbE activation (#7892): This feature code enables up to two 10 GbE ports on the 8 Gbps Extension Blade (#3890) or Enhanced 8 Gbps Extension Blade (#3891). With this feature, two additional operating modes, in addition to ten 1 GbE ports mode, can be selected. Either two 10 GbE ports or ten 1 GbE and one 10 GbE ports can be configured on a #3890 or #3891 blade when this feature is activated. This feature is available on the SAN768B-2 and SAN384B-2 models and one feature applies for each 8 Gbps Extension Blade (#3890 or #3891).

This same feature can be used to enable 10 Gbps FC on any eight ports of the 16 Gbps port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648). 10G FC feature code must be installed before any port can run at 10 Gbps speed. One feature code should be activated for each port blades to be enabled for 10 Gbps FC.

8 Gbps FICON Accelerator Activation (#7893): The 8 Gbps FICON Accelerator Activation is an optional software authorization feature that uses advanced networking technologies, data management techniques, and protocol intelligence to accelerate FICON disk and tape read and write operations over distance, while maintaining the integrity of command and acknowledgment sequences. It supports emulation for IBM z/OS Global Mirror (formerly eXtended Remote Copy or XRC), in addition to tape pipelining for FICON tape and virtual tape. In combination with the 8 Gbps Advanced Extension Activation (#7891) feature code for FCIP tunneling, FICON Accelerator can provide improved application performance across long distance IP WANs. Each 8 Gbps FICON Accelerator Activation feature is licensed for one 8 Gbps Extension Blade (#3890) or one Enhanced 8 Gbps Extension Blade (#3891) to be used in the SAN768B-2 or the SAN384B-2 fabric backbone.

Encryption 96 Gbps disk Performance Upgrade activation (#7895): Disk Encryption Performance Upgrade feature enables scalability of performance on the Encryption Blade (#3895) features. The upgrade provides increased throughput for disk encryption applications up to 96 Gbps, effectively doubling encrypted throughput performance for disk-based storage with no disruption to operations.

Transceivers

SAN768B-2 and SAN384B-2 offer the following optical transceivers:

- 16 Gbps SW (#2601 or #2602), 10 km LW (#2611 or #2612)
- 10 Gbps SW (#2609), 10 km LW (#2610)
- 8 Gbps SW (#2802 or #2803), 10 km LW (#2821 or #2822), 25 km LW (#2881 or #2886)

Selected transceivers are also available in 8-pack convenience packages:

- 16 Gbps SW (#2608 or #2603), 10 km LW (#2618 or #2613)
- 8 Gbps SW (#2809 or #2804), 10 km LW (#2828 or #2823)

Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

http://www.ibm.com/able/product_accessibility/index.html

For hardware offerings

The following features support use by people with disabilities:

- Controls and latches operable with one hand and minimal dexterity
- Keys discernible by touch without activating them
- Ports and connectors support connection of industry-standard devices

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Models

Model summary matrix

Models	16 Gbps FC port blades (min / max)	8 Gbps FC port blades (min / max)	10 Gbps port blades (min / max)
816	0 / 8	0 / 8	0 / 2
416	0 / 4	0 / 4	0 / 2

Customer setup (CSU)

No.

Devices supported

Specific details on supported devices; storage products attachability, SAN connectivity products, and configuration options are available on the web at

http://www.ibm.com/system/storage/san/b-type

Model conversions

Not applicable.

Feature conversions

Not applicable

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Technical description

- Physical specifications
- Operating environment
- Limitations
- Hardware requirements
- Software requirements

IBM System Storage SAN768B-2

The IBM System Storage SAN768B-2 (2499-816) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include redundant and hot-swappable Control Processors, Core Switching Blades, fully redundant N+1 power subsystem with hot-swappable power supplies, dual or quad redundant AC inputs auto-sensing from 110-240v, and hot-swappable blowers in a redundant cooling system. Three blowers provide cooling and SAN768B-2 will continue to operate indefinitely even if one blower fails (N+1 redundancy). Four power supply bays providing space for fully redundant power using any blade configurations. Regardless of blade types installed, the system only requires two power supplies in any bay for full redundancy.

SAN768B-2 features a modular and scalable mechanical construction that allows a wide range of flexibility in installation, fabric design, and maintenance. Using a 14U mechanical design, up to two SAN768B-2 systems can be mounted in an IBM 2109-C36 cabinet, supporting as many as 768 ports. The chassis may be mounted with the cables facing either the front or rear of the equipment. Cables and blade assemblies serviced from the cable side of the switch, blowers and power supplies are serviced from the non-cable side. The use of Cable Management Comb and chassis door offers enhanced cable management. Dual hot swappable World Wide Name (WWN) card maintains chassis-specific information such as WWNs, IP address(s) and summary status information of each port and blade assembly via a LED interface.

The SAN768B-2 base model includes the following components enclosed in a 14U chassis with doors:

- Zero FC Switch Blades
- Zero fiber optic transceivers
- Cable Comb
- Two Control Processor Blades
- Two Core Blades
- Dual power supplies
- Three blower fans
- Ship Group

The Ship Group contains Install Guide hardcopy, CD-ROM (with manuals), 14U rack mounting kit, two rack PDU power cords, wrap tools, RJ-45 cable, and SFP extraction tool.

IBM System Storage SAN384B-2

The IBM System Storage SAN384B-2 (2499-416) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include dual, redundant and hot-swappable Control Processors, Core Switching Blades, power supplies, and blower assemblies. SAN384B-2 will operate indefinitely if a single blower fails. SAN384B-2 can utilize up to two power supplies to maintain full system redundancy. One power supply is required to power a completely loaded system in any system configuration. If a power supply fails, the remaining supply modules continue to provide uninterrupted power to the chassis. Each power supply has its own power cable connector. AC input power is provided to the chassis by means of up to 2 detachable line cords. The geography specific power cord types must be selected based on country in which the system is installed. The input socket to the power supplies is an IEC320-C19 straight.

SAN384B-2 features a modular and scalable horizontal chassis enclosure that allows a wide range of flexibility in installation, fabric design, and maintenance. The chassis may be mounted with the ports facing either the front or rear of the equipment. Ports and blade assemblies serviced from the port side of the switch, blowers and power supplies are serviced from the non-port side.

The SAN384B-2 chassis has non-port side air intake and standard port side and side air exhaust. An exhaust kit is provided to divert the side exhaust air flow to port side thereby making the SAN384B-2 air exhaust fully on non-port side. The mechanical design of the SAN384B-2 allows rack mounting from the port side facing the front of the equipment rack. The SAN384B-2 chassis is an 8U tall mechanical design, 9U with the air flow accessory kit. Its maximum height

Family 2499+03 IBM Systems Storage SAN768B-2 and SAN384B-2

IBM Asia Pacific Sales Manual
Revised: April 20, 2021

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Product life cycle dates

Type Model	Announced	Available	Marketing Withdrawn	Service Discontinued
2499-416	2011-08-16	2011-08-26	2020-04-29	-
2499-816	2011-08-16	2011-08-26	2020-04-29	-

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Abstract

The IBM 2499 System Storage SAN768B-2 and SAN384B-2 fabric backbones are the industry's newest FC switching infrastructure, providing reliable, scalable, high-performance foundations for private cloud storage and highly virtualized environments.

Model abstract 2499-816

The IBM 2499 System Storage SAN768B-2 Model 816 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

Model abstract 2499-416

The IBM 2499 System Storage SAN384B-2 Model 416 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

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Highlights

IBM System Storage SAN768B-2 and SAN384B-2 fabric backbones with the new 16 Gbps Fibre Channel (FC) technology offer a long-term solution for mission-critical applications that require high-performance, low-latency storage networks. These new models offer maximum investment protection by:

- Interfacing with existing 2, 4, and 8 Gbps FC ports
- Offering configurable ports for 10 Gbps metro optical connectivity
- Leveraging existing 8 Gbps 2499 fabric backbone ports and specialty blades
- Integrating with the IBM Network Advisor unified network management solution to bridge operational gaps across server, network, and storage administrators

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Description

They are designed to:

- Enable simpler, flatter, low-latency chassis connectivity to reduce network complexity, management, and costs
- Increase business agility while providing access to information and reducing infrastructure and administrative costs
- Support of private cloud storage with improved scalability, performance, and reliability

SAN768B-2 and SAN384B-2 are designed to address key requirements while helping to protect investments already made by the deployment of existing SANs, servers, storage hardware, and advanced functions:

- Support 2, 4, 8, 10, and 16 Gbps FC and FCIP, as well as advanced fabric services and management tools
- Include up to 384 (SAN768B-2) or 192 (SAN384B-2) 16 Gbps universal (E, F, D, M, and EX) FC ports using 32-or 48-port FC blades, or up to 512 (SAN768B-2) or 256 (SAN384B-2) 8 Gbps universal (E, F, M, and EX) FC ports using 64-port 8 Gbps FC blades
- Deliver forward and backward compatibility with 8 and 16 Gbps IBM System Storage SAN director, switch, and router models

SAN768B-2 and SAN384B-2 are connecting distributed data centers enabled for data mobility and advanced data protection solutions. These fabric backbones include integrated metro and global Storage Area Network (SAN) extensions designed to provide application agility, flexible business continuity, and disaster recovery solutions. These fabric backbones:

- Optimize data center connectivity over distance with integrated high-performance metro and global connectivity
- Simplify and centralize end-to-end SAN management with comprehensive diagnostics, monitoring, and automation
- Maximize performance for I/O-and bandwidth-intensive applications with more than seven times the performance of competitive offerings
- Protect investments in existing SAN fabrics and automation tools while reducing operational costs and minimizing business disruption

The 16 Gbps 2499 fabric backbones are available in two modular form factors. Built for large enterprise networks, the 14U SAN768B-2 (2499-816) has eight vertical blade slots to provide up to 384 16 Gbps FC ports. Built for mid-sized networks, the 8U SAN384B-2 (2499-416) has four horizontal blade slots to provide up to 192 16 Gbps FC ports. These new models support 2, 4, 8, 10, and 16 Gbps FC, and 1/10 Gbps Fibre Channel over IP (FCIP).

Bandwidth-intensive applications, critical workloads, and higher density virtualization are continuing to push the limits of SAN infrastructure. The 2499 16 Gbps models address next-generation I/O requirements by providing increased slot-to-slot and port performance bandwidth with 16 Gbps performance. In addition, local switching capabilities ensure that data traffic within the same port group does not consume slot bandwidth, maximizing the number of line-rate ports.

Optical Inter-Chassis Links (ICLs) can connect up to ten SAN768B-2 and SAN384B-2 fabric backbones, enabling flatter, faster, and simpler fabrics that increase consolidation while reducing network complexity and costs. ICLs enable scalable core-edge and active-active mesh chassis topologies. These high-density chassis topologies reduce inter-switch cabling by 75%, and free up to 33% of ports for server and storage. This maximizes overall port density in the amount of rack space.

SAN768B-2 (2499-816) performance capabilities:

- Up to 384 ports (equivalent to 512 with ICLs) at 16 Gbps
- Up to 8.2 Tbps chassis bandwidth, 6.1 Tbps universal ports, and 2.1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

SAN384B-2 (2499-416) performance capabilities:

- Up to 192 ports (equivalent to 256 with ICLs) at 16 Gbps
- Up to 4.1 Tbps chassis bandwidth, 3.1 Tbps universal ports, and 1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

The 16 Gbps platforms support port-based encryption and compression on an Inter-Switch Link (ISL) between two 16 Gbps E-ports. The encryption and compression feature on an E-port can be enabled on a per port basis. The same port that has been configured for compression can also be configured for encryption. However, only two ports per ASIC can be configured for encryption and compression in FOS 7.0.

The 16 Gbps fabric backbones are designed to provide high-speed replication and backup solutions over metro or wide area network (WAN) links with native FC (10 and 16 Gbps) and optional FCIP (1/10 GbE) extension support. The integrated metro connectivity includes in-flight compression to optimize bandwidth and minimize the risk of unauthorized access.

FOS 7.0 introduces the new Diagnostic port (D-port) type. The D-port is designed to debug the components associated with the link, such as transceivers and cables. This feature is only supported on 16 Gbps ports. The D-Port is statically configured by the user with the intention to run diagnostics. A D-port does not carry any control or data traffic and is purely used for the link diagnostics purpose and to isolate link level faults.

SAN768B-2 and SAN384B-2 base systems require FOS 7.0.0, and later. They are always enabled with the following:

- **Full fabric:** Enables E_ports. The switch cannot be connected to another switch until full fabric is installed
- **Web tools:** Enables administration, configuration, and maintenance of fabric switches and SANs
- **Virtual Fabrics (VF):**
  - Supports ANSI standards-based implementation of VF
  - Adds the capability for physical switches to be partitioned into independently managed logical switches, each with its own data, control, and management paths
  - Allows logical switches to be used to allocate fabric resources on a per-port basis rather than on a per-switch basis
  - Enables simplification or resource allocation by customer, department, application, or storage tier
  - Consolidate resources across multiple fabrics
- **Zoning:** Segments a fabric into virtual private SANs
- **Enhanced group management (EGM):** When added to Brocade element management, the EGM enables additional device-level management functionality for IBM b-type products and also allows large consolidated operations to groups of devices (for example: firmware download, configuration upload and download)

Enterprise Software Bundle features

- **Adaptive networking:** Represents a set of features providing tools and capabilities to incorporate network policies to enable traffic differentiation and prioritization. The FOS 7.0 release supports two types of quality of service (QoS) features with the 16 Gbps fabric backbones:
  - Ingress Rate Limiting to limit the throughput on the ingress side of the port by delaying the return of buffer to buffer credits to the external device
  - SID/DID Based Prioritization used to prioritize the FC flow using a Virtual Channel (VC) by which an FC flow is assigned to different behavior aggregates
- **Advanced performance monitoring:** Helps identify end-to- end bandwidth usage by host or target pairs and is designed to provide information for capacity planning
- **Extended fabrics:** Extend SAN fabrics beyond the FC standard 10 km by optimizing the internal switch buffers to maintain performance on ISLs at distances up to 500 kilometers.
- **Fabric Vision** technology includes several critical diagnostic, monitoring and management capabilities that designed to help increase fabric resiliency, reduce downtime, optimize application performance, and dramatically simplifies SAN deployment and management. The following features are introduced with the base Fabric OS (FOS) 7.2.0 release:
  - ClearLink Diagnostics: Helps ensure optical and signal integrity for Gen 5 Fibre Channel optics and cables, simplifying the deployment and support of high-performance fabrics.
  - Bottleneck Detection: Identifies and alerts administrators about device or ISL congestion, as well as abnormal levels of latency in the fabric.
  - Critical diagnostic and monitoring capabilities: Help ensure early problem detection and recovery.
  - Forward Error Correction (FEC): Enables recovery from bit errors in ISLs, enhancing transmission reliability and performance.
  - Credit Loss Recovery: Helps overcome performance degradation and congestion due to buffer credit loss.

  Flow Vision, Monitoring and Alerting Policy Suite (MAPS), and customizable dashboard advanced technologies and capabilities are made available with the optional Fabric Vision licensed feature. This feature also enables ClearLink (D_Port) functionality for Gen 5 FC platforms when connected to non-b-type end-devices.

  - **Flow Vision** enables 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 monitor, flow mirror, and flow generator features.
  - **Monitoring and Alerting Policy Suite (MAPS)** is a new, easy to use, policy-based threshold monitoring and alerting suite that pro-actively monitors the health and performance of the SAN infrastructure to ensure application uptime and availability. By leveraging pre-built rule/policy-based templates, MAPS simplifies threshold configuration, monitoring and alerting. Organizations 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 ll through a single dialog. The integrated dashboard displays an overall 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. MAPS capabilities provide policy- based monitoring, CLI dashboard of health and error statistics, bottleneck detection information, proactive flow monitoring.

  Automated Migration of Fabric Watch configurations to 'MAPS' automatically imports existing thresholds into a MAPS policy, enabling seamless migration from Fabric Watch to MAPS to take advantage of the new MAPS capabilities and usability enhancements.

  Fabric Vision license is included with FOS 7.2.0, and later. Once the switch is upgraded to FOS 7.2.0 or higher and the Fabric Vision license is enabled, Fabric Watch configuration and any Fabric Watch related features are no longer supported.

- **Fabric watch:** Monitors mission-critical switch operations and includes port fencing capabilities.
- **Trunking:** Enables FC packets to be efficiently distributed across multiple inter-switch connections (links) between two SAN btype fabric switches, while preserving in-order delivery. Both SAN b-type fabric switches must have ISL trunking activated. Both SAN768B-2 and SAN384B-2 adds Enhanced ISL trunking support using 16 Gbps ports and enable FC packets to be distributed across up to eight 16 Gbps capable ISLs for a combined bandwidth of up to 128 Gbps. When connecting the 16 Gbps capable models to legacy 2, 4, or 8 Gbps capable b-type fabric switch models, ISL trunking is supported at the lowest operational link speeds.
- **Server application optimization:** When deployed with Brocade Server Adapters, this function optimizes overall application performance for physical servers and virtual machines by extending virtual channels to the server infrastructure. Application specific traffic flows can be configured, prioritized, and optimized throughout the entire data center infrastructure.

Optional features

SAN7686B-2 and SAN384B-2 are available with a number of selectable options. The base systems do not include any blades, but at least one blade is required for host and storage connectivity.

SAN768B-2 may be configured by adding up to a total of eight of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), and 8 Gbps Encryption (#3895) blades. All activated ports must be populated with a mixture of short wave and long wave optical transceivers up to the maximum number of ports.

The SAN768B-2 (2499-816) base model has two power supplies providing 2000W of total power using only 200/240VAC. The base model (core blades, controller blade, fans) consume 830W power, leaving users with 1170W available power for the optional port (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, #3648, #3649, #3664, #3864) and specialty blades (#3890, #3891, #3895). Based on the different power consumption of each port or specialty blades, various configurations will result in higher than 2000W power usage and customer will be required to purchase feature #7880 pair of optional power supplies. Further details can be found in Appendix A of the SAN768B-2 Installation, Service, and User's Guide. Please consult the following table to calculate the power usage:

Power Demands per Component

Components	Maximum Power Draw (Watts)	Type of Blade	Max blades in chassis
2499-816	830	Base chassis	N/A
#3632, #3633 #3034, #3634, #3635	140	32-port Blades	8
#3648, #3649 #3035, #3636, #3637	160.4	48-port Blades	8
#3664, #3864	126.4	64-port Blades	8
#3890, #3891	235	Extension Blade	4
#3895	250	Encryption Blade	4

SAN384B-2 may be configured by adding up to a total of four of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 64-port (#3664) 16 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), or 8 Gbps Encryption (#3895). All activated ports must be populated with a mixture of short wave and long wave optical transceivers, up to the maximum number of ports.

4 Gbps 10 km LW SFP Transceiver (#2411): This feature provides one longwave SFP transceiver, designed to provide Fibre Channel connections at distances up to 10 km (6.2 miles), while using the appropriate 9.0/125 micrometer single mode fiber optic cable.

16 Gbps FC port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648): 32 or 48 port blades provide 2, 4, 8, or 16 Gbps on each port to be configured as E, F, M, EX, D-ports with no over subscription at 16 Gbps on the 32-port blade. Within a group of 8 ports in a port blade, two of the following three port speed combinations are allowed:

- 2, 4, and 8 Gbps
- 10 Gbps
- 16 Gbps

The default setting is:

- 2, 4, and 8 Gbps
- 16 Gbps

Any eight ports of the 16 Gbps port blades can be enabled for 10 Gbps FC when feature #7892 is activated.

Enhanced 8 Gbps FC port blades (#3633 and #3649): The two port blades (32 or 48 ports) provide 2, 4, or 8 Gbps on each port to be configured as E, F, M, EX port with no over subscription at 8 Gbps speed. These port blades cannot be upgraded to 10 or 16 Gbps speed and do not support in-flight encryption and compression. The #3633 and #3649 blades do not support FICON. Also, no Diagnostic (D-port) support on these blades. Up to four 8-port external trunk groups per #3633 blade and up to six 8-port external trunk groups per #3649 blade.

SAN768B FC 8 Gbps 64-port blade (#3864): The SAN768B FC 8 Gbps 64-port Blade is designed to allow mid to large enterprise customers to deploy high-density, chassis-based solutions to minimize physical footprint without compromising performance. This blade provides 64 E, EX, F and M ports operating at 2, 4, and 8 Gbps, offering low latency and cut-through switching with full 8 Gbps line rate on local switching and 2:1 over subscription at 8 Gbps across the backplane. There can be up to eight 8-port trunk groups created with the 64-port blade, with a maximum of 8 ports per trunk group. The #3864 blade does not support FICON and cannot co-exist with blades running FICON traffic.

To achieve this high-density solution, the 64-port blade uses an optimized version of the standard Small Form-factor Pluggable (mSFP) transceiver and requires a structured cable management solution. The mSFPs retain all of the performance and functionality of the standard SFP+ and include individual port isolation for improved serviceability and availability. Each 64-port blade is populated and shipped with 64 8 Gbps shortwave mSFP fiber optic transceivers. The mSFP fiber pitch and width are narrower than standard SFPs, resulting in the need for newer OM-3 fiber cables with narrower LC connectors. The standard LC connector was modified by major cable vendors to accommodate the new fiber pitch and width. The new cables provide the same flexibility in connectivity as standard LC cables and they are available in the following configurations:

- **MSFP-LC cable** provides the #3864 port blade with the ability to connect to other port blades, switches, devices, and LC patch panels.
- **MSFP-MSFP cable** allows one #3864 port blade to connect to another #3864 port blade as ISLs.
- **MSFP-MPO cable** is a trunked MPO cable to connect to multiple mSFP ports; six mSFP connectors are supported in one trunk cable.

Only the trunked mSFP-MPO cable solution is recommended when multiple directors using the #3864 64-port blades are installed into a 2109-C36 cabinet.

Refer to the Cable Management Considerations for 8 Gbps and 16 Gbps 64 Port Blades guide posted on the IBM Support website to find installation guidelines and the list of recommended part numbers and vendor information.

8 Gbps Extension Blade (#3890): The 8 Gbps Extension Blade combines FC switching and routing capabilities with hardware-assisted FCIP traffic forwarding over IP WAN. The twelve 8 Gbps FC ports and ten 1 Gigabit Ethernet (GbE) port blade is designed to provide remote storage and SAN connectivity. The 8 Gbps Extension Blade integrates a variety of capabilities to deliver a high performance, reliable, and secure distance-connectivity solution, such as:

- **FCIP Trunking** is designed to virtualize two or more TCP connections as part of a single FCIP tunnel. FCIP Trunking combines multiple IP source and destination address pairs into a logical high-bandwidth FCIP trunk spanning multiple physical ports to provide load balancing and network failure resiliency.
- **Adaptive rate limiting** is designed to meet minimum bandwidth requirements for each tunnel while fully utilizing the available network bandwidth without adverse throughput performance impact at high traffic load.
- **Hardware-based compression** delivers the ability to increase throughput over lower bandwidth links in the WAN, supporting the cost efficiencies of FCIP. The 8 Gbps Extension Blade compresses FC frames before they are encapsulated into FCIP packets.
- **FCIP QoS** provides high, medium, and low-priority handling of initiator target flows within the same FCIP tunnel for transmission over the WAN.
- **FC routing** delivers fabric isolation in conjunction with FCIP, enabling separate fabrics to share devices without merging across the IP network.
- **FCIP fast write** accelerates SCSI write processing, maximizing performance of synchronous and asynchronous replication applications across high-latency WAN connections.
- **Open systems tape pipelining** accelerates read and write tape processing over distance, minimizing backup and restore windows.
- **Storage optimized TCP** helps improve TCP window size and flow control, accelerating TCP transport for storage applications.

- **Multiple logical FCIP tunnels** allow for scalable connectivity between sites, between two SAN06B-R models, or when it is connected to a 8 Gbps Extension Blade.

Enhanced 8 Gbps Extension Blade (#3891): The Enhanced 8 Gbps Extension Blade in addition to all features and function of the #3890 8 Gbps Extension Blade capable of running IPSec on both 10 GbE interface doubling encrypted throughput for each #3891 blade.

Encryption Blade (#3895): A 16-port, auto-sensing 8 Gbps FC blade provides fabric-based encryption for data-at-rest and compression. The Encryption Blade scales nondisruptively, providing from 48 Gbps up to 96 Gbps of encryption processing power to meet the needs of the most demanding environments with flexible, on-demand performance. It also provides compression services at speeds up to 48 Gbps for tape storage systems. The Encryption Blade is supported with the Tivoli Key Lifecycle Manager for both disk and tape encryption applications. Following August 1, 2012 each #3895 Encryption Blade will include six Smart Cards.

2499-816 Firmware upgrade renewal, one year (#7710): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-816 Firmware upgrade renewal, two years (#7711): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, one year (#7714): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, two years (#7715): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

Inter-chassis QSFP bundle (#7868): This feature provides sixteen pieces of 4 X 16 Gbps QSFP transceiver bundle to be used on the 16 Gbps Core Blade. Customer supplied QSFP cable up to 50 meters long can be used as an ICL cable.

Inter-chassis license conversion (#7869): This feature is used to convert an ICL activation transferred from an 8 Gbps model as part of the model conversion process. Features #7882 or #7883 converts into one #7869, while feature #7885 counts as two of #7869.

Inter-Chassis License with 16x4x16Gbps QSFP (#7871): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code only enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 platform. A second POD feature code enables all ICL ports on a 2499-816 platform. In addition, each feature ships sixteen 4 x 16 Gbps QSFP transceivers. Customer supplied off-the-shelf QSFP cable up to 50 meters long can be used as an ICL cable.

ICL Enterprise Connectivity License 5-10 2499-416 (#7872): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN384B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

ICL Enterprise Connectivity License 5-10 2499-816 (#7873): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN768B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

Inter-Chassis License with 16x (4 x 16 Gbps) QSFP (#7874): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code (#7871 or #7874) enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 models. A second POD feature code enables all ICL ports on a 2499-816 models. In addition, each feature ships sixteen 4 x 16 Gbps QSFP 100 m transceivers. Customer supplied off-the-shelf OM4 QSFP cable up to 100 meters long can be used as an ICL cable.

FICON with CUP activation (#7884): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by system automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON directors, in addition to supported SAN b-type switch and director products with FICON.

FICON with CUP activation (#7886): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by System Automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System Automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON Directors, as well as supported SAN b-type switch and director products with FICON.

Integrated Routing (#7889): Integrated Routing allows any 8 or 16 Gbps FC port in a SAN768B-2 to be configured as an EX_port supporting Fibre Channel Routing (FCR). FCR support on the 8 or 16 Gbps ports is a native capability, therefore these ports are referred to as native EX_ports. FCR capability on native EX_ports requires the Integrated Routing feature (#7889). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

Integrated Routing License (#7890): Integrated routing (EX_port) allows any 8 or 16 Gbps port in a SAN384B-2 to be configured supporting FCR. Integrated routing enables FCR support on the 8 or 16 Gbps ports as a native capability, therefore they are referred to as native EX_ports. FCR capability on native EX_ports requires the integrated routing feature (#7890). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

8 Gbps Advanced Extension Activation (#7891): This feature code enables two advanced extension features, FCIP Trunking and Adaptive Rate Limiting (ARL), on SAN768B-2 or SAN384B-2 systems. The FCIP Trunking feature allows multiple IP source and destination address pairs (defined as FCIP Circuits) via multiple 1 GE interfaces to provide a high bandwidth FCIP tunnel and failover resiliency. The ARL feature provides a minimum bandwidth guarantee for each tunnel with full utilization of the available network bandwidth without impacting throughput performance under high traffic load. ARL is performed on the FCIP tunnel connection to dynamically change the rate at which the FCIP tunnel transmits data through the TCP connection. ARL will use the information from the TCP connection to determine and adjust the rate limit for the FCIP tunnel dynamically. This allows FCIP connections to utilize the maximum available bandwidth. Each 8 Gbps Extension Blade (#3890 or #3891) must have one 8 Gbps Advanced Extension (#7891) activation feature installed.

8 Gbps Extension Blade 10 GbE activation (#7892): This feature code enables up to two 10 GbE ports on the 8 Gbps Extension Blade (#3890) or Enhanced 8 Gbps Extension Blade (#3891). With this feature, two additional operating modes, in addition to ten 1 GbE ports mode, can be selected. Either two 10 GbE ports or ten 1 GbE and one 10 GbE ports can be configured on a #3890 or #3891 blade when this feature is activated. This feature is available on the SAN768B-2 and SAN384B-2 models and one feature applies for each 8 Gbps Extension Blade (#3890 or #3891).

This same feature can be used to enable 10 Gbps FC on any eight ports of the 16 Gbps port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648). 10G FC feature code must be installed before any port can run at 10 Gbps speed. One feature code should be activated for each port blades to be enabled for 10 Gbps FC.

8 Gbps FICON Accelerator Activation (#7893): The 8 Gbps FICON Accelerator Activation is an optional software authorization feature that uses advanced networking technologies, data management techniques, and protocol intelligence to accelerate FICON disk and tape read and write operations over distance, while maintaining the integrity of command and acknowledgment sequences. It supports emulation for IBM z/OS Global Mirror (formerly eXtended Remote Copy or XRC), in addition to tape pipelining for FICON tape and virtual tape. In combination with the 8 Gbps Advanced Extension Activation (#7891) feature code for FCIP tunneling, FICON Accelerator can provide improved application performance across long distance IP WANs. Each 8 Gbps FICON Accelerator Activation feature is licensed for one 8 Gbps Extension Blade (#3890) or one Enhanced 8 Gbps Extension Blade (#3891) to be used in the SAN768B-2 or the SAN384B-2 fabric backbone.

Encryption 96 Gbps disk Performance Upgrade activation (#7895): Disk Encryption Performance Upgrade feature enables scalability of performance on the Encryption Blade (#3895) features. The upgrade provides increased throughput for disk encryption applications up to 96 Gbps, effectively doubling encrypted throughput performance for disk-based storage with no disruption to operations.

Transceivers

SAN768B-2 and SAN384B-2 offer the following optical transceivers:

- 16 Gbps SW (#2601 or #2602), 10 km LW (#2611 or #2612)
- 10 Gbps SW (#2609), 10 km LW (#2610)
- 8 Gbps SW (#2802 or #2803), 10 km LW (#2821 or #2822), 25 km LW (#2881 or #2886)

Selected transceivers are also available in 8-pack convenience packages:

- 16 Gbps SW (#2608 or #2603), 10 km LW (#2618 or #2613)
- 8 Gbps SW (#2809 or #2804), 10 km LW (#2828 or #2823)

Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

http://www.ibm.com/able/product_accessibility/index.html

For hardware offerings

The following features support use by people with disabilities:

- Controls and latches operable with one hand and minimal dexterity
- Keys discernible by touch without activating them
- Ports and connectors support connection of industry-standard devices

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Models

Model summary matrix

Models	16 Gbps FC port blades (min / max)	8 Gbps FC port blades (min / max)	10 Gbps port blades (min / max)
816	0 / 8	0 / 8	0 / 2
416	0 / 4	0 / 4	0 / 2

Customer setup (CSU)

No.

Devices supported

Specific details on supported devices; storage products attachability, SAN connectivity products, and configuration options are available on the web at

http://www.ibm.com/system/storage/san/b-type

Model conversions

Not applicable.

Feature conversions

Not applicable

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IBM System Storage SAN768B-2

The IBM System Storage SAN768B-2 (2499-816) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include redundant and hot-swappable Control Processors, Core Switching Blades, fully redundant N+1 power subsystem with hot-swappable power supplies, dual or quad redundant AC inputs auto-sensing from 110-240v, and hot-swappable blowers in a redundant cooling system. Three blowers provide cooling and SAN768B-2 will continue to operate indefinitely even if one blower fails (N+1 redundancy). Four power supply bays providing space for fully redundant power using any blade configurations. Regardless of blade types installed, the system only requires two power supplies in any bay for full redundancy.

SAN768B-2 features a modular and scalable mechanical construction that allows a wide range of flexibility in installation, fabric design, and maintenance. Using a 14U mechanical design, up to two SAN768B-2 systems can be mounted in an IBM 2109-C36 cabinet, supporting as many as 768 ports. The chassis may be mounted with the cables facing either the front or rear of the equipment. Cables and blade assemblies serviced from the cable side of the switch, blowers and power supplies are serviced from the non-cable side. The use of Cable Management Comb and chassis door offers enhanced cable management. Dual hot swappable World Wide Name (WWN) card maintains chassis-specific information such as WWNs, IP address(s) and summary status information of each port and blade assembly via a LED interface.

The SAN768B-2 base model includes the following components enclosed in a 14U chassis with doors:

- Zero FC Switch Blades
- Zero fiber optic transceivers
- Cable Comb
- Two Control Processor Blades

- Two Core Blades
- Dual power supplies
- Three blower fans
- Ship Group

The Ship Group contains Install Guide hardcopy, CD-ROM (with manuals), 14U rack mounting kit, two rack PDU power cords, wrap tools, RJ-45 cable, and SFP extraction tool.

IBM System Storage SAN384B-2

The IBM System Storage SAN384B-2 (2499-416) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include dual, redundant and hot-swappable Control Processors, Core Switching Blades, power supplies, and blower assemblies. SAN384B-2 will operate indefinitely if a single blower fails. SAN384B-2 can utilize up to two power supplies to maintain full system redundancy. One power supply is required to power a completely loaded system in any system configuration. If a power supply fails, the remaining supply modules continue to provide uninterrupted power to the chassis. Each power supply has its own power cable connector. AC input power is provided to the chassis by means of up to 2 detachable line cords. The geography specific power cord types must be selected based on country in which the system is installed. The input socket to the power supplies is an IEC320-C19 straight.

SAN384B-2 features a modular and scalable horizontal chassis enclosure that allows a wide range of flexibility in installation, fabric design, and maintenance. The chassis may be mounted with the ports facing either the front or rear of the equipment. Ports and blade assemblies serviced from the port side of the switch, blowers and power supplies are serviced from the non-port side.

The SAN384B-2 chassis has non-port side air intake and standard port side and side air exhaust. An exhaust kit is provided to divert the side exhaust air flow to port side thereby making the SAN384B-2 air exhaust fully on non-port side. The mechanical design of the SAN384B-2 allows rack mounting from the port side facing the front of the equipment rack. The SAN384B-2 chassis is an 8U tall mechanical design, 9U with the air flow accessory kit. Its maximum height

Family 2499+03 IBM Systems Storage SAN768B-2 and SAN384B-2

IBM Asia Pacific Sales Manual
Revised: April 20, 2021

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Product life cycle dates

Type Model	Announced	Available	Marketing Withdrawn	Service Discontinued
2499-416	2011-08-16	2011-08-26	2020-04-29	-
2499-816	2011-08-16	2011-08-26	2020-04-29	-

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Abstract

The IBM 2499 System Storage SAN768B-2 and SAN384B-2 fabric backbones are the industry's newest FC switching infrastructure, providing reliable, scalable, high-performance foundations for private cloud storage and highly virtualized environments.

Model abstract 2499-816

The IBM 2499 System Storage SAN768B-2 Model 816 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

Model abstract 2499-416

The IBM 2499 System Storage SAN384B-2 Model 416 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

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Highlights

IBM System Storage SAN768B-2 and SAN384B-2 fabric backbones with the new 16 Gbps Fibre Channel (FC) technology offer a long-term solution for mission-critical applications that require high-performance, low-latency storage networks. These new models offer maximum investment protection by:

- Interfacing with existing 2, 4, and 8 Gbps FC ports
- Offering configurable ports for 10 Gbps metro optical connectivity
- Leveraging existing 8 Gbps 2499 fabric backbone ports and specialty blades

- Integrating with the IBM Network Advisor unified network management solution to bridge operational gaps across server, network, and storage administrators

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Description

They are designed to:

- Enable simpler, flatter, low-latency chassis connectivity to reduce network complexity, management, and costs
- Increase business agility while providing access to information and reducing infrastructure and administrative costs
- Support of private cloud storage with improved scalability, performance, and reliability

SAN768B-2 and SAN384B-2 are designed to address key requirements while helping to protect investments already made by the deployment of existing SANs, servers, storage hardware, and advanced functions:

- Support 2, 4, 8, 10, and 16 Gbps FC and FCIP, as well as advanced fabric services and management tools
- Include up to 384 (SAN768B-2) or 192 (SAN384B-2) 16 Gbps universal (E, F, D, M, and EX) FC ports using 32-or 48-port FC blades, or up to 512 (SAN768B-2) or 256 (SAN384B-2) 8 Gbps universal (E, F, M, and EX) FC ports using 64-port 8 Gbps FC blades
- Deliver forward and backward compatibility with 8 and 16 Gbps IBM System Storage SAN director, switch, and router models

SAN768B-2 and SAN384B-2 are connecting distributed data centers enabled for data mobility and advanced data protection solutions. These fabric backbones include integrated metro and global Storage Area Network (SAN) extensions designed to provide application agility, flexible business continuity, and disaster recovery solutions. These fabric backbones:

- Optimize data center connectivity over distance with integrated high-performance metro and global connectivity
- Simplify and centralize end-to-end SAN management with comprehensive diagnostics, monitoring, and automation
- Maximize performance for I/O-and bandwidth-intensive applications with more than seven times the performance of competitive offerings
- Protect investments in existing SAN fabrics and automation tools while reducing operational costs and minimizing business disruption

The 16 Gbps 2499 fabric backbones are available in two modular form factors. Built for large enterprise networks, the 14U SAN768B-2 (2499-816) has eight vertical blade slots to provide up to 384 16 Gbps FC ports. Built for mid-sized networks, the 8U SAN384B-2 (2499-416) has four horizontal blade slots to provide up to 192 16 Gbps FC ports. These new models support 2, 4, 8, 10, and 16 Gbps FC, and 1/10 Gbps Fibre Channel over IP (FCIP).

Bandwidth-intensive applications, critical workloads, and higher density virtualization are continuing to push the limits of SAN infrastructure. The 2499 16 Gbps models address next-generation I/O requirements by providing increased slot-to-slot and port performance bandwidth with 16 Gbps performance. In addition, local switching capabilities ensure that data traffic within the same port group does not consume slot bandwidth, maximizing the number of line-rate ports.

Optical Inter-Chassis Links (ICLs) can connect up to ten SAN768B-2 and SAN384B-2 fabric backbones, enabling flatter, faster, and simpler fabrics that increase consolidation while reducing network complexity and costs. ICLs enable scalable core-edge and active-active mesh chassis topologies. These high-density chassis topologies reduce inter-switch cabling by 75%, and free up to 33% of ports for server and storage. This maximizes overall port density in the amount of rack space.

SAN768B-2 (2499-816) performance capabilities:

- Up to 384 ports (equivalent to 512 with ICLs) at 16 Gbps
- Up to 8.2 Tbps chassis bandwidth, 6.1 Tbps universal ports, and 2.1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

SAN384B-2 (2499-416) performance capabilities:

- Up to 192 ports (equivalent to 256 with ICLs) at 16 Gbps
- Up to 4.1 Tbps chassis bandwidth, 3.1 Tbps universal ports, and 1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

The 16 Gbps platforms support port-based encryption and compression on an Inter-Switch Link (ISL) between two 16 Gbps E-ports. The encryption and compression feature on an E-port can be enabled on a per port basis. The same port that has been configured for compression can also be configured for encryption. However, only two ports per ASIC can be configured for encryption and compression in FOS 7.0.

The 16 Gbps fabric backbones are designed to provide high-speed replication and backup solutions over metro or wide area network (WAN) links with native FC (10 and 16 Gbps) and optional FCIP (1/10 GbE) extension support. The integrated metro connectivity includes in-flight compression to optimize bandwidth and minimize the risk of unauthorized access.

FOS 7.0 introduces the new Diagnostic port (D-port) type. The D-port is designed to debug the components associated with the link, such as transceivers and cables. This feature is only supported on 16 Gbps ports. The D-Port is statically configured by the user with the intention to run diagnostics. A D-port does not carry any control or data traffic and is purely used for the link diagnostics purpose and to isolate link level faults.

SAN768B-2 and SAN384B-2 base systems require FOS 7.0.0, and later. They are always enabled with the following:

- **Full fabric:** Enables E_ports. The switch cannot be connected to another switch until full fabric is installed
- **Web tools:** Enables administration, configuration, and maintenance of fabric switches and SANs
- **Virtual Fabrics (VF):**
  - Supports ANSI standards-based implementation of VF
  - Adds the capability for physical switches to be partitioned into independently managed logical switches, each with its own data, control, and management paths
  - Allows logical switches to be used to allocate fabric resources on a per-port basis rather than on a per-switch basis
  - Enables simplification or resource allocation by customer, department, application, or storage tier
  - Consolidate resources across multiple fabrics
- **Zoning:** Segments a fabric into virtual private SANs
- **Enhanced group management (EGM):** When added to Brocade element management, the EGM enables additional device-level management functionality for IBM b-type products and also allows large consolidated operations to groups of devices (for example: firmware download, configuration upload and download)

Enterprise Software Bundle features

- **Adaptive networking:** Represents a set of features providing tools and capabilities to incorporate network policies to enable traffic differentiation and prioritization. The FOS 7.0 release supports two types of quality of service (QoS) features with the 16 Gbps fabric backbones:
  - Ingress Rate Limiting to limit the throughput on the ingress side of the port by delaying the return of buffer to buffer credits to the external device
  - SID/DID Based Prioritization used to prioritize the FC flow using a Virtual Channel (VC) by which an FC flow is assigned to different behavior aggregates

- **Advanced performance monitoring:** Helps identify end-to- end bandwidth usage by host or target pairs and is designed to provide information for capacity planning
- **Extended fabrics:** Extend SAN fabrics beyond the FC standard 10 km by optimizing the internal switch buffers to maintain performance on ISLs at distances up to 500 kilometers.
- **Fabric Vision** technology includes several critical diagnostic, monitoring and management capabilities that designed to help increase fabric resiliency, reduce downtime, optimize application performance, and dramatically simplifies SAN deployment and management. The following features are introduced with the base Fabric OS (FOS) 7.2.0 release:
    - ClearLink Diagnostics: Helps ensure optical and signal integrity for Gen 5 Fibre Channel optics and cables, simplifying the deployment and support of high-performance fabrics.
    - Bottleneck Detection: Identifies and alerts administrators about device or ISL congestion, as well as abnormal levels of latency in the fabric.
    - Critical diagnostic and monitoring capabilities: Help ensure early problem detection and recovery.
    - Forward Error Correction (FEC): Enables recovery from bit errors in ISLs, enhancing transmission reliability and performance.
    - Credit Loss Recovery: Helps overcome performance degradation and congestion due to buffer credit loss.

  Flow Vision, Monitoring and Alerting Policy Suite (MAPS), and customizable dashboard advanced technologies and capabilities are made available with the optional Fabric Vision licensed feature. This feature also enables ClearLink (D_Port) functionality for Gen 5 FC platforms when connected to non-b-type end-devices.

    - **Flow Vision** enables 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 monitor, flow mirror, and flow generator features.
    - **Monitoring and Alerting Policy Suite (MAPS)** is a new, easy to use, policy-based threshold monitoring and alerting suite that pro-actively monitors the health and performance of the SAN infrastructure to ensure application uptime and availability. By leveraging pre-built rule/policy-based templates, MAPS simplifies threshold configuration, monitoring and alerting. Organizations 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 ll through a single dialog. The integrated dashboard displays an overall 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. MAPS capabilities provide policy- based monitoring, CLI dashboard of health and error statistics, bottleneck detection information, proactive flow monitoring.

  Automated Migration of Fabric Watch configurations to 'MAPS' automatically imports existing thresholds into a MAPS policy, enabling seamless migration from Fabric Watch to MAPS to take advantage of the new MAPS capabilities and usability enhancements.

  Fabric Vision license is included with FOS 7.2.0, and later. Once the switch is upgraded to FOS 7.2.0 or higher and the Fabric Vision license is enabled, Fabric Watch configuration and any Fabric Watch related features are no longer supported.

- **Fabric watch:** Monitors mission-critical switch operations and includes port fencing capabilities.
- **Trunking:** Enables FC packets to be efficiently distributed across multiple inter-switch connections (links) between two SAN btype fabric switches, while preserving in-order delivery. Both SAN b-type fabric switches must have ISL trunking activated. Both SAN768B-2 and SAN384B-2 adds Enhanced ISL trunking support using 16 Gbps ports and enable FC packets to be distributed across up to eight 16 Gbps capable ISLs for a combined bandwidth of up to 128 Gbps. When connecting the 16 Gbps capable models to legacy 2, 4, or 8 Gbps capable b-type fabric switch models, ISL trunking is supported at the lowest operational link speeds.
- **Server application optimization:** When deployed with Brocade Server Adapters, this function optimizes overall application performance for physical servers and virtual machines by extending virtual channels to the server infrastructure. Application specific traffic flows can be configured, prioritized, and optimized throughout the entire data center infrastructure.

Optional features

SAN7686B-2 and SAN384B-2 are available with a number of selectable options. The base systems do not include any blades, but at least one blade is required for host and storage connectivity.

SAN768B-2 may be configured by adding up to a total of eight of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), and 8 Gbps Encryption (#3895) blades. All activated ports must be populated with a mixture of short wave and long wave optical transceivers up to the maximum number of ports.

The SAN768B-2 (2499-816) base model has two power supplies providing 2000W of total power using only 200/240VAC. The base model (core blades, controller blade, fans) consume 830W power, leaving users with 1170W available power for the optional port (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, #3648, #3649, #3664, #3864) and specialty blades (#3890, #3891, #3895). Based on the different power consumption of each port or specialty blades, various configurations will result in higher than 2000W power usage and customer will be required to purchase feature #7880 pair of optional power supplies. Further details can be found in Appendix A of the SAN768B-2 Installation, Service, and User's Guide. Please consult the following table to calculate the power usage:

Power Demands per Component

Components	Maximum Power Draw (Watts)	Type of Blade	Max blades in chassis
2499-816	830	Base chassis	N/A
#3632, #3633 #3034, #3634, #3635	140	32-port Blades	8
#3648, #3649 #3035, #3636, #3637	160.4	48-port Blades	8
#3664, #3864	126.4	64-port Blades	8
#3890, #3891	235	Extension Blade	4
#3895	250	Encryption Blade	4

SAN384B-2 may be configured by adding up to a total of four of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 64-port (#3664) 16 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), or 8 Gbps Encryption (#3895). All activated ports must be populated with a mixture of short wave and long wave optical transceivers, up to the maximum number of ports.

4 Gbps 10 km LW SFP Transceiver (#2411): This feature provides one longwave SFP transceiver, designed to provide Fibre Channel connections at distances up to 10 km (6.2 miles), while using the appropriate 9.0/125 micrometer single mode fiber optic cable.

16 Gbps FC port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648): 32 or 48 port blades provide 2, 4, 8, or 16 Gbps on each port to be configured as E, F, M, EX, D-ports with no over subscription at 16 Gbps on the 32-port blade. Within a group of 8 ports in a port blade, two of the following three port speed combinations are allowed:

- 2, 4, and 8 Gbps
- 10 Gbps
- 16 Gbps

The default setting is:

- 2, 4, and 8 Gbps
- 16 Gbps

Any eight ports of the 16 Gbps port blades can be enabled for 10 Gbps FC when feature #7892 is activated.

Enhanced 8 Gbps FC port blades (#3633 and #3649): The two port blades (32 or 48 ports) provide 2, 4, or 8 Gbps on each port to be configured as E, F, M, EX port with no over subscription at 8 Gbps speed. These port blades cannot be upgraded to 10 or 16 Gbps speed and do not support in-flight encryption and compression. The #3633 and #3649 blades do not support FICON. Also, no Diagnostic (D-port) support on these blades. Up to four 8-port external trunk groups per #3633 blade and up to six 8-port external trunk groups per #3649 blade.

SAN768B FC 8 Gbps 64-port blade (#3864): The SAN768B FC 8 Gbps 64-port Blade is designed to allow mid to large enterprise customers to deploy high-density, chassis-based solutions to minimize physical footprint without compromising performance. This blade provides 64 E, EX, F and M ports operating at 2, 4, and 8 Gbps, offering low latency and cut-through switching with full 8 Gbps line rate on local switching and 2:1 over subscription at 8 Gbps across the backplane. There can be up to eight 8-port trunk groups created with the 64-port blade, with a maximum of 8 ports per trunk group. The #3864 blade does not support FICON and cannot co-exist with blades running FICON traffic.

To achieve this high-density solution, the 64-port blade uses an optimized version of the standard Small Form-factor Pluggable (mSFP) transceiver and requires a structured cable management solution. The mSFPs retain all of the performance and functionality of the standard SFP+ and include individual port isolation for improved serviceability and availability. Each 64-port blade is populated and shipped with 64 8 Gbps shortwave mSFP fiber optic transceivers. The mSFP fiber pitch and width are narrower than standard SFPs, resulting in the need for newer OM-3 fiber cables with narrower LC connectors. The standard LC connector was modified by major cable vendors to accommodate the new fiber pitch and width. The new cables provide the same flexibility in connectivity as standard LC cables and they are available in the following configurations:

- **MSFP-LC cable** provides the #3864 port blade with the ability to connect to other port blades, switches, devices, and LC patch panels.
- **MSFP-MSFP cable** allows one #3864 port blade to connect to another #3864 port blade as ISLs.
- **MSFP-MPO cable** is a trunked MPO cable to connect to multiple mSFP ports; six mSFP connectors are supported in one trunk cable.

Only the trunked mSFP-MPO cable solution is recommended when multiple directors using the #3864 64-port blades are installed into a 2109-C36 cabinet.

Refer to the Cable Management Considerations for 8 Gbps and 16 Gbps 64 Port Blades guide posted on the IBM Support website to find installation guidelines and the list of recommended part numbers and vendor information.

8 Gbps Extension Blade (#3890): The 8 Gbps Extension Blade combines FC switching and routing capabilities with hardware-assisted FCIP traffic forwarding over IP WAN. The twelve 8 Gbps FC ports and ten 1 Gigabit Ethernet (GbE) port blade is designed to provide remote storage and SAN connectivity. The 8 Gbps Extension Blade integrates a variety of capabilities to deliver a high performance, reliable, and secure distance-connectivity solution, such as:

- **FCIP Trunking** is designed to virtualize two or more TCP connections as part of a single FCIP tunnel. FCIP Trunking combines multiple IP source and destination address pairs into a logical high-bandwidth FCIP trunk spanning multiple physical ports to provide load balancing and network failure resiliency.
- **Adaptive rate limiting** is designed to meet minimum bandwidth requirements for each tunnel while fully utilizing the available network bandwidth without adverse throughput performance impact at high traffic load.
- **Hardware-based compression** delivers the ability to increase throughput over lower bandwidth links in the WAN, supporting the cost efficiencies of FCIP. The 8 Gbps Extension Blade compresses FC frames before they are encapsulated into FCIP packets.
- **FCIP QoS** provides high, medium, and low-priority handling of initiator target flows within the same FCIP tunnel for transmission over the WAN.
- **FC routing** delivers fabric isolation in conjunction with FCIP, enabling separate fabrics to share devices without merging across the IP network.
- **FCIP fast write** accelerates SCSI write processing, maximizing performance of synchronous and asynchronous replication applications across high-latency WAN connections.
- **Open systems tape pipelining** accelerates read and write tape processing over distance, minimizing backup and restore windows.
- **Storage optimized TCP** helps improve TCP window size and flow control, accelerating TCP transport for storage applications.
- **Multiple logical FCIP tunnels** allow for scalable connectivity between sites, between two SAN06B-R models, or when it is connected to a 8 Gbps Extension Blade.

Enhanced 8 Gbps Extension Blade (#3891): The Enhanced 8 Gbps Extension Blade in addition to all features and function of the #3890 8 Gbps Extension Blade capable of running IPSec on both 10 GbE interface doubling encrypted throughput for each #3891 blade.

Encryption Blade (#3895): A 16-port, auto-sensing 8 Gbps FC blade provides fabric-based encryption for data-at-rest and compression. The Encryption Blade scales nondisruptively, providing from 48 Gbps up to 96 Gbps of encryption processing power to meet the needs of the most demanding environments with flexible, on-demand performance. It also provides compression services at speeds up to 48 Gbps for tape storage systems. The Encryption Blade is supported with the Tivoli Key Lifecycle Manager for both disk and tape encryption applications. Following August 1, 2012 each #3895 Encryption Blade will include six Smart Cards.

2499-816 Firmware upgrade renewal, one year (#7710): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-816 Firmware upgrade renewal, two years (#7711): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, one year (#7714): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, two years (#7715): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

Inter-chassis QSFP bundle (#7868): This feature provides sixteen pieces of 4 X 16 Gbps QSFP transceiver bundle to be used on the 16 Gbps Core Blade. Customer supplied QSFP cable up to 50 meters long can be used as an ICL cable.

Inter-chassis license conversion (#7869): This feature is used to convert an ICL activation transferred from an 8 Gbps model as part of the model conversion process. Features #7882 or #7883 converts into one #7869, while feature #7885 counts as two of #7869.

Inter-Chassis License with 16x4x16Gbps QSFP (#7871): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code only enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 platform. A second POD feature code enables all ICL ports on a 2499-816 platform. In addition, each feature ships sixteen 4 x 16 Gbps QSFP transceivers. Customer supplied off-the-shelf QSFP cable up to 50 meters long can be used as an ICL cable.

ICL Enterprise Connectivity License 5-10 2499-416 (#7872): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN384B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

ICL Enterprise Connectivity License 5-10 2499-816 (#7873): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN768B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

Inter-Chassis License with 16x (4 x 16 Gbps) QSFP (#7874): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code (#7871 or #7874) enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 models. A second POD feature code enables all ICL ports on a 2499-816 models. In addition, each feature ships sixteen 4 x 16 Gbps QSFP 100 m transceivers. Customer supplied off-the-shelf OM4 QSFP cable up to 100 meters long can be used as an ICL cable.

FICON with CUP activation (#7884): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by system automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON directors, in addition to supported SAN b-type switch and director products with FICON.

FICON with CUP activation (#7886): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by System Automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System Automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON Directors, as well as supported SAN b-type switch and director products with FICON.

Integrated Routing (#7889): Integrated Routing allows any 8 or 16 Gbps FC port in a SAN768B-2 to be configured as an EX_port supporting Fibre Channel Routing (FCR). FCR support on the 8 or 16 Gbps ports is a native capability, therefore these ports are referred to as native EX_ports. FCR capability on native EX_ports requires the Integrated Routing feature (#7889). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

Integrated Routing License (#7890): Integrated routing (EX_port) allows any 8 or 16 Gbps port in a SAN384B-2 to be configured supporting FCR. Integrated routing enables FCR support on the 8 or 16 Gbps ports as a native capability, therefore they are referred to as native EX_ports. FCR capability on native EX_ports requires the integrated routing feature (#7890). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

8 Gbps Advanced Extension Activation (#7891): This feature code enables two advanced extension features, FCIP Trunking and Adaptive Rate Limiting (ARL), on SAN768B-2 or SAN384B-2 systems. The FCIP Trunking feature allows multiple IP source and destination address pairs (defined as FCIP Circuits) via multiple 1 GE interfaces to provide a high bandwidth FCIP tunnel and failover resiliency. The ARL feature provides a minimum bandwidth guarantee for each tunnel with full utilization of the available network bandwidth without impacting throughput performance under high traffic load. ARL is performed on the FCIP tunnel connection to dynamically change the rate at which the FCIP tunnel transmits data through the TCP connection. ARL will use the information from the TCP connection to determine and adjust the rate limit for the FCIP tunnel dynamically. This allows FCIP connections to utilize the maximum available bandwidth. Each 8 Gbps Extension Blade (#3890 or #3891) must have one 8 Gbps Advanced Extension (#7891) activation feature installed.

8 Gbps Extension Blade 10 GbE activation (#7892): This feature code enables up to two 10 GbE ports on the 8 Gbps Extension Blade (#3890) or Enhanced 8 Gbps Extension Blade (#3891). With this feature, two additional operating modes, in addition to ten 1 GbE ports mode, can be selected. Either two 10 GbE ports or ten 1 GbE and one 10 GbE ports can be configured on a #3890 or #3891 blade when this feature is activated. This feature is available on the SAN768B-2 and SAN384B-2 models and one feature applies for each 8 Gbps Extension Blade (#3890 or #3891).

This same feature can be used to enable 10 Gbps FC on any eight ports of the 16 Gbps port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648). 10G FC feature code must be installed before any port can run at 10 Gbps speed. One feature code should be activated for each port blades to be enabled for 10 Gbps FC.

8 Gbps FICON Accelerator Activation (#7893): The 8 Gbps FICON Accelerator Activation is an optional software authorization feature that uses advanced networking technologies, data management techniques, and protocol intelligence to accelerate FICON disk and tape read and write operations over distance, while maintaining the integrity of command and acknowledgment sequences. It supports emulation for IBM z/OS Global Mirror (formerly eXtended Remote Copy or XRC), in addition to tape pipelining for FICON tape and virtual tape. In combination with the 8 Gbps Advanced Extension Activation (#7891) feature code for FCIP tunneling, FICON Accelerator can provide improved application performance across long distance IP WANs. Each 8 Gbps FICON Accelerator Activation feature is licensed for one 8 Gbps Extension Blade (#3890) or one Enhanced 8 Gbps Extension Blade (#3891) to be used in the SAN768B-2 or the SAN384B-2 fabric backbone.

Encryption 96 Gbps disk Performance Upgrade activation (#7895): Disk Encryption Performance Upgrade feature enables scalability of performance on the Encryption Blade (#3895) features. The upgrade provides increased throughput for disk encryption applications up to 96 Gbps, effectively doubling encrypted throughput performance for disk-based storage with no disruption to operations.

Transceivers

SAN768B-2 and SAN384B-2 offer the following optical transceivers:

- 16 Gbps SW (#2601 or #2602), 10 km LW (#2611 or #2612)
- 10 Gbps SW (#2609), 10 km LW (#2610)
- 8 Gbps SW (#2802 or #2803), 10 km LW (#2821 or #2822), 25 km LW (#2881 or #2886)

Selected transceivers are also available in 8-pack convenience packages:

- 16 Gbps SW (#2608 or #2603), 10 km LW (#2618 or #2613)
- 8 Gbps SW (#2809 or #2804), 10 km LW (#2828 or #2823)

Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

http://www.ibm.com/able/product_accessibility/index.html

For hardware offerings

The following features support use by people with disabilities:

- Controls and latches operable with one hand and minimal dexterity
- Keys discernible by touch without activating them
- Ports and connectors support connection of industry-standard devices

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Models

Model summary matrix

Models	16 Gbps FC port blades (min / max)	8 Gbps FC port blades (min / max)	10 Gbps port blades (min / max)
816	0 / 8	0 / 8	0 / 2
416	0 / 4	0 / 4	0 / 2

Customer setup (CSU)

No.

Devices supported

Specific details on supported devices; storage products attachability, SAN connectivity products, and configuration options are available on the web at

http://www.ibm.com/system/storage/san/b-type

Model conversions

Not applicable.

Feature conversions

Not applicable

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Technical description

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IBM System Storage SAN768B-2

The IBM System Storage SAN768B-2 (2499-816) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include redundant and hot-swappable Control Processors, Core Switching Blades, fully redundant N+1 power subsystem with hot-swappable power supplies, dual or quad redundant AC inputs auto-sensing from 110-240v, and hot-swappable blowers in a redundant cooling system. Three blowers provide cooling and SAN768B-2 will continue to operate indefinitely even if one blower fails (N+1 redundancy). Four power supply bays providing space for fully redundant power using any blade configurations. Regardless of blade types installed, the system only requires two power supplies in any bay for full redundancy.

SAN768B-2 features a modular and scalable mechanical construction that allows a wide range of flexibility in installation, fabric design, and maintenance. Using a 14U mechanical design, up to two SAN768B-2 systems can be mounted in an IBM 2109-C36 cabinet, supporting as many as 768 ports. The chassis may be mounted with the cables facing either the front or rear of the equipment. Cables and blade assemblies serviced from the cable side of the switch, blowers and power supplies are serviced from the non-cable side. The use of Cable Management Comb and chassis door offers enhanced cable management. Dual hot swappable World Wide Name (WWN) card maintains chassis-specific information such as WWNs, IP address(s) and summary status information of each port and blade assembly via a LED interface.

The SAN768B-2 base model includes the following components enclosed in a 14U chassis with doors:

- Zero FC Switch Blades
- Zero fiber optic transceivers
- Cable Comb
- Two Control Processor Blades
- Two Core Blades
- Dual power supplies
- Three blower fans
- Ship Group

The Ship Group contains Install Guide hardcopy, CD-ROM (with manuals), 14U rack mounting kit, two rack PDU power cords, wrap tools, RJ-45 cable, and SFP extraction tool.

IBM System Storage SAN384B-2

The IBM System Storage SAN384B-2 (2499-416) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include dual, redundant and hot-swappable Control Processors, Core Switching Blades, power supplies, and blower assemblies. SAN384B-2 will operate indefinitely if a single blower fails. SAN384B-2 can utilize up to two power supplies to maintain full system redundancy. One power supply is required to power a completely loaded system in any system configuration. If a power supply fails, the remaining supply modules continue to provide uninterrupted power to the chassis. Each power supply has its own power cable connector. AC input power is provided to the chassis by means of up to 2 detachable line cords. The geography specific power cord types must be selected based on country in which the system is installed. The input socket to the power supplies is an IEC320-C19 straight.

SAN384B-2 features a modular and scalable horizontal chassis enclosure that allows a wide range of flexibility in installation, fabric design, and maintenance. The chassis may be mounted with the ports facing either the front or rear of the equipment. Ports and blade assemblies serviced from the port side of the switch, blowers and power supplies are serviced from the non-port side.

The SAN384B-2 chassis has non-port side air intake and standard port side and side air exhaust. An exhaust kit is provided to divert the side exhaust air flow to port side thereby making the SAN384B-2 air exhaust fully on non-port side. The mechanical design of the SAN384B-2 allows rack mounting from the port side facing the front of the equipment rack. The SAN384B-2 chassis is an 8U tall mechanical design, 9U with the air flow accessory kit. Its maximum height

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Product life cycle dates

Type Model	Announced	Available	Marketing Withdrawn	Service Discontinued
2499-416	2011-08-16	2011-08-26	2020-04-29	-
2499-816	2011-08-16	2011-08-26	2020-04-29	-

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Abstract

The IBM 2499 System Storage SAN768B-2 and SAN384B-2 fabric backbones are the industry's newest FC switching infrastructure, providing reliable, scalable, high-performance foundations for private cloud storage and highly virtualized environments.

Model abstract 2499-816

The IBM 2499 System Storage SAN768B-2 Model 816 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

Model abstract 2499-416

The IBM 2499 System Storage SAN384B-2 Model 416 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

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Highlights

IBM System Storage SAN768B-2 and SAN384B-2 fabric backbones with the new 16 Gbps Fibre Channel (FC) technology offer a long-term solution for mission-critical applications that require high-performance, low-latency storage networks. These new models offer maximum investment protection by:

- Interfacing with existing 2, 4, and 8 Gbps FC ports
- Offering configurable ports for 10 Gbps metro optical connectivity
- Leveraging existing 8 Gbps 2499 fabric backbone ports and specialty blades
- Integrating with the IBM Network Advisor unified network management solution to bridge operational gaps across server, network, and storage administrators

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Description

They are designed to:

- Enable simpler, flatter, low-latency chassis connectivity to reduce network complexity, management, and costs
- Increase business agility while providing access to information and reducing infrastructure and administrative costs
- Support of private cloud storage with improved scalability, performance, and reliability

SAN768B-2 and SAN384B-2 are designed to address key requirements while helping to protect investments already made by the deployment of existing SANs, servers, storage hardware, and advanced functions:

- Support 2, 4, 8, 10, and 16 Gbps FC and FCIP, as well as advanced fabric services and management tools
- Include up to 384 (SAN768B-2) or 192 (SAN384B-2) 16 Gbps universal (E, F, D, M, and EX) FC ports using 32-or 48-port FC blades, or up to 512 (SAN768B-2) or 256 (SAN384B-2) 8 Gbps universal (E, F, M, and EX) FC ports using 64-port 8 Gbps FC blades
- Deliver forward and backward compatibility with 8 and 16 Gbps IBM System Storage SAN director, switch, and router models

SAN768B-2 and SAN384B-2 are connecting distributed data centers enabled for data mobility and advanced data protection solutions. These fabric backbones include integrated metro and global Storage Area Network (SAN) extensions designed to provide application agility, flexible business continuity, and disaster recovery solutions. These fabric backbones:

- Optimize data center connectivity over distance with integrated high-performance metro and global connectivity
- Simplify and centralize end-to-end SAN management with comprehensive diagnostics, monitoring, and automation
- Maximize performance for I/O-and bandwidth-intensive applications with more than seven times the performance of competitive offerings
- Protect investments in existing SAN fabrics and automation tools while reducing operational costs and minimizing business disruption

The 16 Gbps 2499 fabric backbones are available in two modular form factors. Built for large enterprise networks, the 14U SAN768B-2 (2499-816) has eight vertical blade slots to provide up to 384 16 Gbps FC ports. Built for mid-sized networks, the 8U SAN384B-2 (2499-416) has four horizontal blade slots to provide up to 192 16 Gbps FC ports. These new models support 2, 4, 8, 10, and 16 Gbps FC, and 1/10 Gbps Fibre Channel over IP (FCIP).

Bandwidth-intensive applications, critical workloads, and higher density virtualization are continuing to push the limits of SAN infrastructure. The 2499 16 Gbps models address next-generation I/O requirements by providing increased slot-to-slot and port performance bandwidth with 16 Gbps performance. In addition, local switching capabilities ensure that data traffic within the same port group does not consume slot bandwidth, maximizing the number of line-rate ports.

Optical Inter-Chassis Links (ICLs) can connect up to ten SAN768B-2 and SAN384B-2 fabric backbones, enabling flatter, faster, and simpler fabrics that increase consolidation while reducing network complexity and costs. ICLs enable scalable core-edge and active-active mesh chassis topologies. These high-density chassis topologies reduce inter-switch cabling by 75%, and free up to 33% of ports for server and storage. This maximizes overall port density in the amount of rack space.

SAN768B-2 (2499-816) performance capabilities:

- Up to 384 ports (equivalent to 512 with ICLs) at 16 Gbps
- Up to 8.2 Tbps chassis bandwidth, 6.1 Tbps universal ports, and 2.1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

SAN384B-2 (2499-416) performance capabilities:

- Up to 192 ports (equivalent to 256 with ICLs) at 16 Gbps
- Up to 4.1 Tbps chassis bandwidth, 3.1 Tbps universal ports, and 1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

The 16 Gbps platforms support port-based encryption and compression on an Inter-Switch Link (ISL) between two 16 Gbps E-ports. The encryption and compression feature on an E-port can be enabled on a per port basis. The same port that has been configured for compression can also be configured for encryption. However, only two ports per ASIC can be configured for encryption and compression in FOS 7.0.

The 16 Gbps fabric backbones are designed to provide high-speed replication and backup solutions over metro or wide area network (WAN) links with native FC (10 and 16 Gbps) and optional FCIP (1/10 GbE) extension support. The integrated metro connectivity includes in-flight compression to optimize bandwidth and minimize the risk of unauthorized access.

FOS 7.0 introduces the new Diagnostic port (D-port) type. The D-port is designed to debug the components associated with the link, such as transceivers and cables. This feature is only supported on 16 Gbps ports. The D-Port is statically configured by the user with the intention to run diagnostics. A D-port does not carry any control or data traffic and is purely used for the link diagnostics purpose and to isolate link level faults.

SAN768B-2 and SAN384B-2 base systems require FOS 7.0.0, and later. They are always enabled with the following:

- **Full fabric:** Enables E_ports. The switch cannot be connected to another switch until full fabric is installed
- **Web tools:** Enables administration, configuration, and maintenance of fabric switches and SANs
- **Virtual Fabrics (VF):**
  - Supports ANSI standards-based implementation of VF
  - Adds the capability for physical switches to be partitioned into independently managed logical switches, each with its own data, control, and management paths
  - Allows logical switches to be used to allocate fabric resources on a per-port basis rather than on a per-switch basis
  - Enables simplification or resource allocation by customer, department, application, or storage tier
  - Consolidate resources across multiple fabrics
- **Zoning:** Segments a fabric into virtual private SANs
- **Enhanced group management (EGM):** When added to Brocade element management, the EGM enables additional device-level management functionality for IBM b-type products and also allows large consolidated operations to groups of devices (for example: firmware download, configuration upload and download)

Enterprise Software Bundle features

- **Adaptive networking:** Represents a set of features providing tools and capabilities to incorporate network policies to enable traffic differentiation and prioritization. The FOS 7.0 release supports two types of quality of service (QoS) features with the 16 Gbps fabric backbones:
  - Ingress Rate Limiting to limit the throughput on the ingress side of the port by delaying the return of buffer to buffer credits to the external device
  - SID/DID Based Prioritization used to prioritize the FC flow using a Virtual Channel (VC) by which an FC flow is assigned to different behavior aggregates
- **Advanced performance monitoring:** Helps identify end-to- end bandwidth usage by host or target pairs and is designed to provide information for capacity planning
- **Extended fabrics:** Extend SAN fabrics beyond the FC standard 10 km by optimizing the internal switch buffers to maintain performance on ISLs at distances up to 500 kilometers.
- **Fabric Vision** technology includes several critical diagnostic, monitoring and management capabilities that designed to help increase fabric resiliency, reduce downtime, optimize application performance, and dramatically simplifies SAN deployment and management. The following features are introduced with the base Fabric OS (FOS) 7.2.0 release:
  - ClearLink Diagnostics: Helps ensure optical and signal integrity for Gen 5 Fibre Channel optics and cables, simplifying the deployment and support of high-performance fabrics.
  - Bottleneck Detection: Identifies and alerts administrators about device or ISL congestion, as well as abnormal levels of latency in the fabric.
  - Critical diagnostic and monitoring capabilities: Help ensure early problem detection and recovery.
  - Forward Error Correction (FEC): Enables recovery from bit errors in ISLs, enhancing transmission reliability and performance.
  - Credit Loss Recovery: Helps overcome performance degradation and congestion due to buffer credit loss.

  Flow Vision, Monitoring and Alerting Policy Suite (MAPS), and customizable dashboard advanced technologies and capabilities are made available with the optional Fabric Vision licensed feature. This feature also enables ClearLink (D_Port) functionality for Gen 5 FC platforms when connected to non-b-type end-devices.

  - **Flow Vision** enables 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 monitor, flow mirror, and flow generator features.
  - **Monitoring and Alerting Policy Suite (MAPS)** is a new, easy to use, policy-based threshold monitoring and alerting suite that pro-actively monitors the health and performance of the SAN infrastructure to ensure application uptime and availability. By leveraging pre-built rule/policy-based templates, MAPS simplifies threshold configuration, monitoring and alerting. Organizations 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 ll through a single dialog. The integrated dashboard displays an overall 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. MAPS capabilities provide policy- based monitoring, CLI dashboard of health and error statistics, bottleneck detection information, proactive flow monitoring.

  Automated Migration of Fabric Watch configurations to 'MAPS' automatically imports existing thresholds into a MAPS policy, enabling seamless migration from Fabric Watch to MAPS to take advantage of the new MAPS capabilities and usability enhancements.

  Fabric Vision license is included with FOS 7.2.0, and later. Once the switch is upgraded to FOS 7.2.0 or higher and the Fabric Vision license is enabled, Fabric Watch configuration and any Fabric Watch related features are no longer supported.

- **Fabric watch:** Monitors mission-critical switch operations and includes port fencing capabilities.
- **Trunking:** Enables FC packets to be efficiently distributed across multiple inter-switch connections (links) between two SAN btype fabric switches, while preserving in-order delivery. Both SAN b-type fabric switches must have ISL trunking activated. Both SAN768B-2 and SAN384B-2 adds Enhanced ISL trunking support using 16 Gbps ports and enable FC packets to be distributed across up to eight 16 Gbps capable ISLs for a combined bandwidth of up to 128 Gbps. When connecting the 16 Gbps capable models to legacy 2, 4, or 8 Gbps capable b-type fabric switch models, ISL trunking is supported at the lowest operational link speeds.

- **Server application optimization:** When deployed with Brocade Server Adapters, this function optimizes overall application performance for physical servers and virtual machines by extending virtual channels to the server infrastructure. Application specific traffic flows can be configured, prioritized, and optimized throughout the entire data center infrastructure.

Optional features

SAN7686B-2 and SAN384B-2 are available with a number of selectable options. The base systems do not include any blades, but at least one blade is required for host and storage connectivity.

SAN768B-2 may be configured by adding up to a total of eight of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), and 8 Gbps Encryption (#3895) blades. All activated ports must be populated with a mixture of short wave and long wave optical transceivers up to the maximum number of ports.

The SAN768B-2 (2499-816) base model has two power supplies providing 2000W of total power using only 200/240VAC. The base model (core blades, controller blade, fans) consume 830W power, leaving users with 1170W available power for the optional port (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, #3648, #3649, #3664, #3864) and specialty blades (#3890, #3891, #3895). Based on the different power consumption of each port or specialty blades, various configurations will result in higher than 2000W power usage and customer will be required to purchase feature #7880 pair of optional power supplies. Further details can be found in Appendix A of the SAN768B-2 Installation, Service, and User's Guide. Please consult the following table to calculate the power usage:

Power Demands per Component

Components	Maximum Power Draw (Watts)	Type of Blade	Max blades in chassis
2499-816	830	Base chassis	N/A
#3632, #3633 #3034, #3634, #3635	140	32-port Blades	8
#3648, #3649 #3035, #3636, #3637	160.4	48-port Blades	8
#3664, #3864	126.4	64-port Blades	8
#3890, #3891	235	Extension Blade	4
#3895	250	Encryption Blade	4

SAN384B-2 may be configured by adding up to a total of four of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 64-port (#3664) 16 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), or 8 Gbps Encryption (#3895). All activated ports must be populated with a mixture of short wave and long wave optical transceivers, up to the maximum number of ports.

4 Gbps 10 km LW SFP Transceiver (#2411): This feature provides one longwave SFP transceiver, designed to provide Fibre Channel connections at distances up to 10 km (6.2 miles), while using the appropriate 9.0/125 micrometer single mode fiber optic cable.

16 Gbps FC port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648): 32 or 48 port blades provide 2, 4, 8, or 16 Gbps on each port to be configured as E, F, M, EX, D-ports with no over subscription at 16 Gbps on the 32-port blade. Within a group of 8 ports in a port blade, two of the following three port speed combinations are allowed:

- 2, 4, and 8 Gbps
- 10 Gbps
- 16 Gbps

The default setting is:

- 2, 4, and 8 Gbps
- 16 Gbps

Any eight ports of the 16 Gbps port blades can be enabled for 10 Gbps FC when feature #7892 is activated.

Enhanced 8 Gbps FC port blades (#3633 and #3649): The two port blades (32 or 48 ports) provide 2, 4, or 8 Gbps on each port to be configured as E, F, M, EX port with no over subscription at 8 Gbps speed. These port blades cannot be upgraded to 10 or 16 Gbps speed and do not support in-flight encryption and compression. The #3633 and #3649 blades do not support FICON. Also, no Diagnostic (D-port) support on these blades. Up to four 8-port external trunk groups per #3633 blade and up to six 8-port external trunk groups per #3649 blade.

SAN768B FC 8 Gbps 64-port blade (#3864): The SAN768B FC 8 Gbps 64-port Blade is designed to allow mid to large enterprise customers to deploy high-density, chassis-based solutions to minimize physical footprint without compromising performance. This blade provides 64 E, EX, F and M ports operating at 2, 4, and 8 Gbps, offering low latency and cut-through switching with full 8 Gbps line rate on local switching and 2:1 over subscription at 8 Gbps across the backplane. There can be up to eight 8-port trunk groups created with the 64-port blade, with a maximum of 8 ports per trunk group. The #3864 blade does not support FICON and cannot co-exist with blades running FICON traffic.

To achieve this high-density solution, the 64-port blade uses an optimized version of the standard Small Form-factor Pluggable (mSFP) transceiver and requires a structured cable management solution. The mSFPs retain all of the performance and functionality of the standard SFP+ and include individual port isolation for improved serviceability and availability. Each 64-port blade is populated and shipped with 64 8 Gbps shortwave mSFP fiber optic transceivers. The mSFP fiber pitch and width are narrower than standard SFPs, resulting in the need for newer OM-3 fiber cables with narrower LC connectors. The standard LC connector was modified by major cable vendors to accommodate the new fiber pitch and width. The new cables provide the same flexibility in connectivity as standard LC cables and they are available in the following configurations:

- **MSFP-LC cable** provides the #3864 port blade with the ability to connect to other port blades, switches, devices, and LC patch panels.
- **MSFP-MSFP cable** allows one #3864 port blade to connect to another #3864 port blade as ISLs.
- **MSFP-MPO cable** is a trunked MPO cable to connect to multiple mSFP ports; six mSFP connectors are supported in one trunk cable.

Only the trunked mSFP-MPO cable solution is recommended when multiple directors using the #3864 64-port blades are installed into a 2109-C36 cabinet.

Refer to the Cable Management Considerations for 8 Gbps and 16 Gbps 64 Port Blades guide posted on the IBM Support website to find installation guidelines and the list of recommended part numbers and vendor information.

8 Gbps Extension Blade (#3890): The 8 Gbps Extension Blade combines FC switching and routing capabilities with hardware-assisted FCIP traffic forwarding over IP WAN. The twelve 8 Gbps FC ports and ten 1 Gigabit Ethernet (GbE) port blade is designed to provide remote storage and SAN connectivity. The 8 Gbps Extension Blade integrates a variety of capabilities to deliver a high performance, reliable, and secure distance-connectivity solution, such as:

- **FCIP Trunking** is designed to virtualize two or more TCP connections as part of a single FCIP tunnel. FCIP Trunking combines multiple IP source and destination address pairs into a logical high-bandwidth FCIP trunk spanning multiple physical ports to provide load balancing and network failure resiliency.

- **Adaptive rate limiting** is designed to meet minimum bandwidth requirements for each tunnel while fully utilizing the available network bandwidth without adverse throughput performance impact at high traffic load.
- **Hardware-based compression** delivers the ability to increase throughput over lower bandwidth links in the WAN, supporting the cost efficiencies of FCIP. The 8 Gbps Extension Blade compresses FC frames before they are encapsulated into FCIP packets.
- **FCIP QoS** provides high, medium, and low-priority handling of initiator target flows within the same FCIP tunnel for transmission over the WAN.
- **FC routing** delivers fabric isolation in conjunction with FCIP, enabling separate fabrics to share devices without merging across the IP network.
- **FCIP fast write** accelerates SCSI write processing, maximizing performance of synchronous and asynchronous replication applications across high-latency WAN connections.
- **Open systems tape pipelining** accelerates read and write tape processing over distance, minimizing backup and restore windows.
- **Storage optimized TCP** helps improve TCP window size and flow control, accelerating TCP transport for storage applications.
- **Multiple logical FCIP tunnels** allow for scalable connectivity between sites, between two SAN06B-R models, or when it is connected to a 8 Gbps Extension Blade.

Enhanced 8 Gbps Extension Blade (#3891): The Enhanced 8 Gbps Extension Blade in addition to all features and function of the #3890 8 Gbps Extension Blade capable of running IPSec on both 10 GbE interface doubling encrypted throughput for each #3891 blade.

Encryption Blade (#3895): A 16-port, auto-sensing 8 Gbps FC blade provides fabric-based encryption for data-at-rest and compression. The Encryption Blade scales nondisruptively, providing from 48 Gbps up to 96 Gbps of encryption processing power to meet the needs of the most demanding environments with flexible, on-demand performance. It also provides compression services at speeds up to 48 Gbps for tape storage systems. The Encryption Blade is supported with the Tivoli Key Lifecycle Manager for both disk and tape encryption applications. Following August 1, 2012 each #3895 Encryption Blade will include six Smart Cards.

2499-816 Firmware upgrade renewal, one year (#7710): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-816 Firmware upgrade renewal, two years (#7711): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, one year (#7714): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, two years (#7715): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

Inter-chassis QSFP bundle (#7868): This feature provides sixteen pieces of 4 X 16 Gbps QSFP transceiver bundle to be used on the 16 Gbps Core Blade. Customer supplied QSFP cable up to 50 meters long can be used as an ICL cable.

Inter-chassis license conversion (#7869): This feature is used to convert an ICL activation transferred from an 8 Gbps model as part of the model conversion process. Features #7882 or #7883 converts into one #7869, while feature #7885 counts as two of #7869.

Inter-Chassis License with 16x4x16Gbps QSFP (#7871): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code only enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 platform. A second POD feature code enables all ICL ports on a 2499-816 platform. In addition, each feature ships sixteen 4 x 16 Gbps QSFP transceivers. Customer supplied off-the-shelf QSFP cable up to 50 meters long can be used as an ICL cable.

ICL Enterprise Connectivity License 5-10 2499-416 (#7872): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN384B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

ICL Enterprise Connectivity License 5-10 2499-816 (#7873): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN768B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

Inter-Chassis License with 16x (4 x 16 Gbps) QSFP (#7874): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code (#7871 or #7874) enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 models. A second POD feature code enables all ICL ports on a 2499-816 models. In addition, each feature ships sixteen 4 x 16 Gbps QSFP 100 m transceivers. Customer supplied off-the-shelf OM4 QSFP cable up to 100 meters long can be used as an ICL cable.

FICON with CUP activation (#7884): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by system automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON directors, in addition to supported SAN b-type switch and director products with FICON.

FICON with CUP activation (#7886): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by System Automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System Automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON Directors, as well as supported SAN b-type switch and director products with FICON.

Integrated Routing (#7889): Integrated Routing allows any 8 or 16 Gbps FC port in a SAN768B-2 to be configured as an EX_port supporting Fibre Channel Routing (FCR). FCR support on the 8 or 16 Gbps ports is a native capability, therefore these ports are referred to as native EX_ports. FCR capability on native EX_ports requires the Integrated Routing feature (#7889). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

Integrated Routing License (#7890): Integrated routing (EX_port) allows any 8 or 16 Gbps port in a SAN384B-2 to be configured supporting FCR. Integrated routing enables FCR support on the 8 or 16 Gbps ports as a native capability, therefore they are referred to as native EX_ports. FCR capability on native EX_ports requires the integrated routing feature (#7890). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

8 Gbps Advanced Extension Activation (#7891): This feature code enables two advanced extension features, FCIP Trunking and Adaptive Rate Limiting (ARL), on SAN768B-2 or SAN384B-2 systems. The FCIP Trunking feature allows multiple IP source and destination address pairs (defined as FCIP Circuits) via multiple 1 GE interfaces to provide a high bandwidth FCIP tunnel and failover resiliency. The ARL feature provides a minimum bandwidth guarantee for each tunnel with full utilization of the available network bandwidth without impacting throughput performance under high traffic load. ARL is performed on the FCIP tunnel connection to dynamically change the rate at which the FCIP tunnel transmits data through the TCP connection. ARL will use the information from the TCP connection to determine and adjust the rate limit for the FCIP tunnel dynamically. This allows FCIP connections to utilize the maximum available bandwidth. Each 8 Gbps Extension Blade (#3890 or #3891) must have one 8 Gbps Advanced Extension (#7891) activation feature installed.

8 Gbps Extension Blade 10 GbE activation (#7892): This feature code enables up to two 10 GbE ports on the 8 Gbps Extension Blade (#3890) or Enhanced 8 Gbps Extension Blade (#3891). With this feature, two additional operating modes, in addition to ten 1 GbE ports mode, can be selected. Either two 10 GbE ports or ten 1 GbE and one 10 GbE ports can be configured on a #3890 or #3891 blade when this feature is activated. This feature is available on the SAN768B-2 and SAN384B-2 models and one feature applies for each 8 Gbps Extension Blade (#3890 or #3891).

This same feature can be used to enable 10 Gbps FC on any eight ports of the 16 Gbps port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648). 10G FC feature code must be installed before any port can run at 10 Gbps speed. One feature code should be activated for each port blades to be enabled for 10 Gbps FC.

8 Gbps FICON Accelerator Activation (#7893): The 8 Gbps FICON Accelerator Activation is an optional software authorization feature that uses advanced networking technologies, data management techniques, and protocol intelligence to accelerate FICON disk and tape read and write operations over distance, while maintaining the integrity of command and acknowledgment sequences. It supports emulation for IBM z/OS Global Mirror (formerly eXtended Remote Copy or XRC), in addition to tape pipelining for FICON tape and virtual tape. In combination with the 8 Gbps Advanced Extension Activation (#7891) feature code for FCIP tunneling, FICON Accelerator can provide improved application performance across long distance IP WANs. Each 8 Gbps FICON Accelerator Activation feature is licensed for one 8 Gbps Extension Blade (#3890) or one Enhanced 8 Gbps Extension Blade (#3891) to be used in the SAN768B-2 or the SAN384B-2 fabric backbone.

Encryption 96 Gbps disk Performance Upgrade activation (#7895): Disk Encryption Performance Upgrade feature enables scalability of performance on the Encryption Blade (#3895) features. The upgrade provides increased throughput for disk encryption applications up to 96 Gbps, effectively doubling encrypted throughput performance for disk-based storage with no disruption to operations.

Transceivers

SAN768B-2 and SAN384B-2 offer the following optical transceivers:

- 16 Gbps SW (#2601 or #2602), 10 km LW (#2611 or #2612)
- 10 Gbps SW (#2609), 10 km LW (#2610)
- 8 Gbps SW (#2802 or #2803), 10 km LW (#2821 or #2822), 25 km LW (#2881 or #2886)

Selected transceivers are also available in 8-pack convenience packages:

- 16 Gbps SW (#2608 or #2603), 10 km LW (#2618 or #2613)
- 8 Gbps SW (#2809 or #2804), 10 km LW (#2828 or #2823)

Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

http://www.ibm.com/able/product_accessibility/index.html

For hardware offerings

The following features support use by people with disabilities:

- Controls and latches operable with one hand and minimal dexterity
- Keys discernible by touch without activating them
- Ports and connectors support connection of industry-standard devices

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Models

Model summary matrix

Models	16 Gbps FC port blades (min / max)	8 Gbps FC port blades (min / max)	10 Gbps port blades (min / max)
816	0 / 8	0 / 8	0 / 2
416	0 / 4	0 / 4	0 / 2

Customer setup (CSU)

No.

Devices supported

Specific details on supported devices; storage products attachability, SAN connectivity products, and configuration options are available on the web at

http://www.ibm.com/system/storage/san/b-type

Model conversions

Not applicable.

Feature conversions

Not applicable

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IBM System Storage SAN768B-2

The IBM System Storage SAN768B-2 (2499-816) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include redundant and hot-swappable Control Processors, Core Switching Blades, fully redundant N+1 power subsystem with hot-swappable power supplies, dual or quad redundant AC inputs auto-sensing from 110-240v, and hot-swappable blowers in a redundant cooling system. Three blowers provide cooling and SAN768B-2 will continue to operate indefinitely even if one blower fails (N+1 redundancy). Four power supply bays providing space for fully redundant power using any blade configurations. Regardless of blade types installed, the system only requires two power supplies in any bay for full redundancy.

SAN768B-2 features a modular and scalable mechanical construction that allows a wide range of flexibility in installation, fabric design, and maintenance. Using a 14U mechanical design, up to two SAN768B-2 systems can be mounted in an IBM 2109-C36 cabinet, supporting as many as 768 ports. The chassis may be mounted with the cables facing either the front or rear of the equipment. Cables and blade assemblies serviced from the cable side of the switch, blowers and power supplies are serviced from the non-cable side. The use of Cable Management Comb and chassis door offers enhanced cable management. Dual hot swappable World Wide Name (WWN) card maintains chassis-specific information such as WWNs, IP address(s) and summary status information of each port and blade assembly via a LED interface.

The SAN768B-2 base model includes the following components enclosed in a 14U chassis with doors:

- Zero FC Switch Blades
- Zero fiber optic transceivers
- Cable Comb
- Two Control Processor Blades
- Two Core Blades
- Dual power supplies
- Three blower fans
- Ship Group

The Ship Group contains Install Guide hardcopy, CD-ROM (with manuals), 14U rack mounting kit, two rack PDU power cords, wrap tools, RJ-45 cable, and SFP extraction tool.

IBM System Storage SAN384B-2

The IBM System Storage SAN384B-2 (2499-416) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include dual, redundant and hot-swappable Control Processors, Core Switching Blades, power supplies, and blower assemblies. SAN384B-2 will operate indefinitely if a single blower fails. SAN384B-2 can utilize up to two power supplies to maintain full system redundancy. One power supply is required to power a completely loaded system in any system configuration. If a power supply fails, the remaining supply modules continue to provide uninterrupted power to the chassis. Each power supply has its own power cable connector. AC input power is provided to the chassis by means of up to 2 detachable line cords. The geography specific power cord types must be selected based on country in which the system is installed. The input socket to the power supplies is an IEC320-C19 straight.

SAN384B-2 features a modular and scalable horizontal chassis enclosure that allows a wide range of flexibility in installation, fabric design, and maintenance. The chassis may be mounted with the ports facing either the front or rear of the equipment. Ports and blade assemblies serviced from the port side of the switch, blowers and power supplies are serviced from the non-port side.

The SAN384B-2 chassis has non-port side air intake and standard port side and side air exhaust. An exhaust kit is provided to divert the side exhaust air flow to port side thereby making the SAN384B-2 air exhaust fully on non-port side. The mechanical design of the SAN384B-2 allows rack mounting from the port side facing the front of the equipment rack. The SAN384B-2 chassis is an 8U tall mechanical design, 9U with the air flow accessory kit. Its maximum height

Family 2499+03 IBM Systems Storage SAN768B-2 and SAN384B-2

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Product life cycle dates

Type Model	Announced	Available	Marketing Withdrawn	Service Discontinued
2499-416	2011-08-16	2011-08-26	2020-04-29	-
2499-816	2011-08-16	2011-08-26	2020-04-29	-

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Abstract

The IBM 2499 System Storage SAN768B-2 and SAN384B-2 fabric backbones are the industry's newest FC switching infrastructure, providing reliable, scalable, high-performance foundations for private cloud storage and highly virtualized environments.

Model abstract 2499-816

The IBM 2499 System Storage SAN768B-2 Model 816 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

Model abstract 2499-416

The IBM 2499 System Storage SAN384B-2 Model 416 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

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Highlights

IBM System Storage SAN768B-2 and SAN384B-2 fabric backbones with the new 16 Gbps Fibre Channel (FC) technology offer a long-term solution for mission-critical applications that require high-performance, low-latency storage networks. These new models offer maximum investment protection by:

- Interfacing with existing 2, 4, and 8 Gbps FC ports
- Offering configurable ports for 10 Gbps metro optical connectivity
- Leveraging existing 8 Gbps 2499 fabric backbone ports and specialty blades
- Integrating with the IBM Network Advisor unified network management solution to bridge operational gaps across server, network, and storage administrators

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Description

They are designed to:

- Enable simpler, flatter, low-latency chassis connectivity to reduce network complexity, management, and costs
- Increase business agility while providing access to information and reducing infrastructure and administrative costs
- Support of private cloud storage with improved scalability, performance, and reliability

SAN768B-2 and SAN384B-2 are designed to address key requirements while helping to protect investments already made by the deployment of existing SANs, servers, storage hardware, and advanced functions:

- Support 2, 4, 8, 10, and 16 Gbps FC and FCIP, as well as advanced fabric services and management tools
- Include up to 384 (SAN768B-2) or 192 (SAN384B-2) 16 Gbps universal (E, F, D, M, and EX) FC ports using 32-or 48-port FC blades, or up to 512 (SAN768B-2) or 256 (SAN384B-2) 8 Gbps universal (E, F, M, and EX) FC ports using 64-port 8 Gbps FC blades
- Deliver forward and backward compatibility with 8 and 16 Gbps IBM System Storage SAN director, switch, and router models

SAN768B-2 and SAN384B-2 are connecting distributed data centers enabled for data mobility and advanced data protection solutions. These fabric backbones include integrated metro and global Storage Area Network (SAN) extensions designed to provide application agility, flexible business continuity, and disaster recovery solutions. These fabric backbones:

- Optimize data center connectivity over distance with integrated high-performance metro and global connectivity
- Simplify and centralize end-to-end SAN management with comprehensive diagnostics, monitoring, and automation
- Maximize performance for I/O-and bandwidth-intensive applications with more than seven times the performance of competitive offerings
- Protect investments in existing SAN fabrics and automation tools while reducing operational costs and minimizing business disruption

The 16 Gbps 2499 fabric backbones are available in two modular form factors. Built for large enterprise networks, the 14U SAN768B-2 (2499-816) has eight vertical blade slots to provide up to 384 16 Gbps FC ports. Built for mid-sized networks, the 8U SAN384B-2 (2499-416) has four horizontal blade slots to provide up to 192 16 Gbps FC ports. These new models support 2, 4, 8, 10, and 16 Gbps FC, and 1/10 Gbps Fibre Channel over IP (FCIP).

Bandwidth-intensive applications, critical workloads, and higher density virtualization are continuing to push the limits of SAN infrastructure. The 2499 16 Gbps models address next-generation I/O requirements by providing increased slot-to-slot and port performance bandwidth with 16 Gbps performance. In addition, local switching capabilities ensure that data traffic within the same port group does not consume slot bandwidth, maximizing the number of line-rate ports.

Optical Inter-Chassis Links (ICLs) can connect up to ten SAN768B-2 and SAN384B-2 fabric backbones, enabling flatter, faster, and simpler fabrics that increase consolidation while reducing network complexity and costs. ICLs enable scalable core-edge and active-active mesh chassis topologies. These high-density chassis topologies reduce inter-switch cabling by 75%, and free up to 33% of ports for server and storage. This maximizes overall port density in the amount of rack space.

SAN768B-2 (2499-816) performance capabilities:

- Up to 384 ports (equivalent to 512 with ICLs) at 16 Gbps
- Up to 8.2 Tbps chassis bandwidth, 6.1 Tbps universal ports, and 2.1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

SAN384B-2 (2499-416) performance capabilities:

- Up to 192 ports (equivalent to 256 with ICLs) at 16 Gbps
- Up to 4.1 Tbps chassis bandwidth, 3.1 Tbps universal ports, and 1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

The 16 Gbps platforms support port-based encryption and compression on an Inter-Switch Link (ISL) between two 16 Gbps E-ports. The encryption and compression feature on an E-port can be enabled on a per port basis. The same port that has been configured for compression can also be configured for encryption. However, only two ports per ASIC can be configured for encryption and compression in FOS 7.0.

The 16 Gbps fabric backbones are designed to provide high-speed replication and backup solutions over metro or wide area network (WAN) links with native FC (10 and 16 Gbps) and optional FCIP (1/10 GbE) extension support. The integrated metro connectivity includes in-flight compression to optimize bandwidth and minimize the risk of unauthorized access.

FOS 7.0 introduces the new Diagnostic port (D-port) type. The D-port is designed to debug the components associated with the link, such as transceivers and cables. This feature is only supported on 16 Gbps ports. The D-Port is statically configured by the user with the intention to run diagnostics. A D-port does not carry any control or data traffic and is purely used for the link diagnostics purpose and to isolate link level faults.

SAN768B-2 and SAN384B-2 base systems require FOS 7.0.0, and later. They are always enabled with the following:

- **Full fabric:** Enables E_ports. The switch cannot be connected to another switch until full fabric is installed
- **Web tools:** Enables administration, configuration, and maintenance of fabric switches and SANs
- **Virtual Fabrics (VF):**
  - Supports ANSI standards-based implementation of VF
  - Adds the capability for physical switches to be partitioned into independently managed logical switches, each with its own data, control, and management paths
  - Allows logical switches to be used to allocate fabric resources on a per-port basis rather than on a per-switch basis
  - Enables simplification or resource allocation by customer, department, application, or storage tier

  - Consolidate resources across multiple fabrics
- **Zoning:** Segments a fabric into virtual private SANs
- **Enhanced group management (EGM):** When added to Brocade element management, the EGM enables additional device-level management functionality for IBM b-type products and also allows large consolidated operations to groups of devices (for example: firmware download, configuration upload and download)

Enterprise Software Bundle features

- **Adaptive networking:** Represents a set of features providing tools and capabilities to incorporate network policies to enable traffic differentiation and prioritization. The FOS 7.0 release supports two types of quality of service (QoS) features with the 16 Gbps fabric backbones:
  - Ingress Rate Limiting to limit the throughput on the ingress side of the port by delaying the return of buffer to buffer credits to the external device
  - SID/DID Based Prioritization used to prioritize the FC flow using a Virtual Channel (VC) by which an FC flow is assigned to different behavior aggregates
- **Advanced performance monitoring:** Helps identify end-to- end bandwidth usage by host or target pairs and is designed to provide information for capacity planning
- **Extended fabrics:** Extend SAN fabrics beyond the FC standard 10 km by optimizing the internal switch buffers to maintain performance on ISLs at distances up to 500 kilometers.
- **Fabric Vision** technology includes several critical diagnostic, monitoring and management capabilities that designed to help increase fabric resiliency, reduce downtime, optimize application performance, and dramatically simplifies SAN deployment and management. The following features are introduced with the base Fabric OS (FOS) 7.2.0 release:
  - ClearLink Diagnostics: Helps ensure optical and signal integrity for Gen 5 Fibre Channel optics and cables, simplifying the deployment and support of high-performance fabrics.
  - Bottleneck Detection: Identifies and alerts administrators about device or ISL congestion, as well as abnormal levels of latency in the fabric.
  - Critical diagnostic and monitoring capabilities: Help ensure early problem detection and recovery.
  - Forward Error Correction (FEC): Enables recovery from bit errors in ISLs, enhancing transmission reliability and performance.
  - Credit Loss Recovery: Helps overcome performance degradation and congestion due to buffer credit loss.

  Flow Vision, Monitoring and Alerting Policy Suite (MAPS), and customizable dashboard advanced technologies and capabilities are made available with the optional Fabric Vision licensed feature. This feature also enables ClearLink (D_Port) functionality for Gen 5 FC platforms when connected to non-b-type end-devices.

  - **Flow Vision** enables 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 monitor, flow mirror, and flow generator features.
  - **Monitoring and Alerting Policy Suite (MAPS)** is a new, easy to use, policy-based threshold monitoring and alerting suite that pro-actively monitors the health and performance of the SAN infrastructure to ensure application uptime and availability. By leveraging pre-built rule/policy-based templates, MAPS simplifies threshold configuration, monitoring and alerting. Organizations 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 ll through a single dialog. The integrated dashboard displays an overall 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. MAPS capabilities provide policy- based monitoring, CLI dashboard of health and error statistics, bottleneck detection information, proactive flow monitoring.

  Automated Migration of Fabric Watch configurations to 'MAPS' automatically imports existing thresholds into a MAPS policy, enabling seamless migration from Fabric Watch to MAPS to take advantage of the new MAPS capabilities and usability enhancements.

  Fabric Vision license is included with FOS 7.2.0, and later. Once the switch is upgraded to FOS 7.2.0 or higher and the Fabric Vision license is enabled, Fabric Watch configuration and any Fabric Watch related features are no longer supported.

- **Fabric watch:** Monitors mission-critical switch operations and includes port fencing capabilities.
- **Trunking:** Enables FC packets to be efficiently distributed across multiple inter-switch connections (links) between two SAN btype fabric switches, while preserving in-order delivery. Both SAN b-type fabric switches must have ISL trunking activated. Both SAN768B-2 and SAN384B-2 adds Enhanced ISL trunking support using 16 Gbps ports and enable FC packets to be distributed across up to eight 16 Gbps capable ISLs for a combined bandwidth of up to 128 Gbps. When connecting the 16 Gbps capable models to legacy 2, 4, or 8 Gbps capable b-type fabric switch models, ISL trunking is supported at the lowest operational link speeds.
- **Server application optimization:** When deployed with Brocade Server Adapters, this function optimizes overall application performance for physical servers and virtual machines by extending virtual channels to the server infrastructure. Application specific traffic flows can be configured, prioritized, and optimized throughout the entire data center infrastructure.

Optional features

SAN7686B-2 and SAN384B-2 are available with a number of selectable options. The base systems do not include any blades, but at least one blade is required for host and storage connectivity.

SAN768B-2 may be configured by adding up to a total of eight of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), and 8 Gbps Encryption (#3895) blades. All activated ports must be populated with a mixture of short wave and long wave optical transceivers up to the maximum number of ports.

The SAN768B-2 (2499-816) base model has two power supplies providing 2000W of total power using only 200/240VAC. The base model (core blades, controller blade, fans) consume 830W power, leaving users with 1170W available power for the optional port (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, #3648, #3649, #3664, #3864) and specialty blades (#3890, #3891, #3895). Based on the different power consumption of each port or specialty blades, various configurations will result in higher than 2000W power usage and customer will be required to purchase feature #7880 pair of optional power supplies. Further details can be found in Appendix A of the SAN768B-2 Installation, Service, and User's Guide. Please consult the following table to calculate the power usage:

Power Demands per Component

Components	Maximum Power Draw (Watts)	Type of Blade	Max blades in chassis
2499-816	830	Base chassis	N/A
#3632, #3633 #3034, #3634, #3635	140	32-port Blades	8
#3648, #3649 #3035, #3636, #3637	160.4	48-port Blades	8
#3664, #3864	126.4	64-port Blades	8
#3890, #3891	235	Extension Blade	4
#3895	250	Encryption Blade	4

SAN384B-2 may be configured by adding up to a total of four of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 64-port (#3664) 16 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), or 8 Gbps Encryption (#3895). All activated ports must be populated with a mixture of short wave and long wave optical transceivers, up to the maximum number of ports.

4 Gbps 10 km LW SFP Transceiver (#2411): This feature provides one longwave SFP transceiver, designed to provide Fibre Channel connections at distances up to 10 km (6.2 miles), while using the appropriate 9.0/125 micrometer single mode fiber optic cable.

16 Gbps FC port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648): 32 or 48 port blades provide 2, 4, 8, or 16 Gbps on each port to be configured as E, F, M, EX, D-ports with no over subscription at 16 Gbps on the 32-port blade. Within a group of 8 ports in a port blade, two of the following three port speed combinations are allowed:

- 2, 4, and 8 Gbps
- 10 Gbps
- 16 Gbps

The default setting is:

- 2, 4, and 8 Gbps
- 16 Gbps

Any eight ports of the 16 Gbps port blades can be enabled for 10 Gbps FC when feature #7892 is activated.

Enhanced 8 Gbps FC port blades (#3633 and #3649): The two port blades (32 or 48 ports) provide 2, 4, or 8 Gbps on each port to be configured as E, F, M, EX port with no over subscription at 8 Gbps speed. These port blades cannot be upgraded to 10 or 16 Gbps speed and do not support in-flight encryption and compression. The #3633 and #3649 blades do not support FICON. Also, no Diagnostic (D-port) support on these blades. Up to four 8-port external trunk groups per #3633 blade and up to six 8-port external trunk groups per #3649 blade.

SAN768B FC 8 Gbps 64-port blade (#3864): The SAN768B FC 8 Gbps 64-port Blade is designed to allow mid to large enterprise customers to deploy high-density, chassis-based solutions to minimize physical footprint without compromising performance. This blade provides 64 E, EX, F and M ports operating at 2, 4, and 8 Gbps, offering low latency and cut-through switching with full 8 Gbps line rate on local switching and 2:1 over subscription at 8 Gbps across the backplane. There can be up to eight 8-port trunk groups created with the 64-port blade, with a maximum of 8 ports per trunk group. The #3864 blade does not support FICON and cannot co-exist with blades running FICON traffic.

To achieve this high-density solution, the 64-port blade uses an optimized version of the standard Small Form-factor Pluggable (mSFP) transceiver and requires a structured cable management solution. The mSFPs retain all of the performance and functionality of the standard SFP+ and include individual port isolation for improved serviceability and availability. Each 64-port blade is populated and shipped with 64 8 Gbps shortwave mSFP fiber optic transceivers. The mSFP fiber pitch and width are narrower than standard SFPs, resulting in the need for newer OM-3 fiber cables with narrower LC connectors. The standard LC connector was modified by major cable vendors to accommodate the new fiber pitch and width. The new cables provide the same flexibility in connectivity as standard LC cables and they are available in the following configurations:

- **MSFP-LC cable** provides the #3864 port blade with the ability to connect to other port blades, switches, devices, and LC patch panels.
- **MSFP-MSFP cable** allows one #3864 port blade to connect to another #3864 port blade as ISLs.
- **MSFP-MPO cable** is a trunked MPO cable to connect to multiple mSFP ports; six mSFP connectors are supported in one trunk cable.

Only the trunked mSFP-MPO cable solution is recommended when multiple directors using the #3864 64-port blades are installed into a 2109-C36 cabinet.

Refer to the Cable Management Considerations for 8 Gbps and 16 Gbps 64 Port Blades guide posted on the IBM Support website to find installation guidelines and the list of recommended part numbers and vendor information.

8 Gbps Extension Blade (#3890): The 8 Gbps Extension Blade combines FC switching and routing capabilities with hardware-assisted FCIP traffic forwarding over IP WAN. The twelve 8 Gbps FC ports and ten 1 Gigabit Ethernet (GbE) port blade is designed to provide remote storage and SAN connectivity. The 8 Gbps Extension Blade integrates a variety of capabilities to deliver a high performance, reliable, and secure distance-connectivity solution, such as:

- **FCIP Trunking** is designed to virtualize two or more TCP connections as part of a single FCIP tunnel. FCIP Trunking combines multiple IP source and destination address pairs into a logical high-bandwidth FCIP trunk spanning multiple physical ports to provide load balancing and network failure resiliency.
- **Adaptive rate limiting** is designed to meet minimum bandwidth requirements for each tunnel while fully utilizing the available network bandwidth without adverse throughput performance impact at high traffic load.
- **Hardware-based compression** delivers the ability to increase throughput over lower bandwidth links in the WAN, supporting the cost efficiencies of FCIP. The 8 Gbps Extension Blade compresses FC frames before they are encapsulated into FCIP packets.
- **FCIP QoS** provides high, medium, and low-priority handling of initiator target flows within the same FCIP tunnel for transmission over the WAN.
- **FC routing** delivers fabric isolation in conjunction with FCIP, enabling separate fabrics to share devices without merging across the IP network.
- **FCIP fast write** accelerates SCSI write processing, maximizing performance of synchronous and asynchronous replication applications across high-latency WAN connections.
- **Open systems tape pipelining** accelerates read and write tape processing over distance, minimizing backup and restore windows.
- **Storage optimized TCP** helps improve TCP window size and flow control, accelerating TCP transport for storage applications.
- **Multiple logical FCIP tunnels** allow for scalable connectivity between sites, between two SAN06B-R models, or when it is connected to a 8 Gbps Extension Blade.

Enhanced 8 Gbps Extension Blade (#3891): The Enhanced 8 Gbps Extension Blade in addition to all features and function of the #3890 8 Gbps Extension Blade capable of running IPSec on both 10 GbE interface doubling encrypted throughput for each #3891 blade.

Encryption Blade (#3895): A 16-port, auto-sensing 8 Gbps FC blade provides fabric-based encryption for data-at-rest and compression. The Encryption Blade scales nondisruptively, providing from 48 Gbps up to 96 Gbps of encryption processing power to meet the needs of the most demanding environments with flexible, on-demand performance. It also provides compression services at speeds up to 48 Gbps for tape storage systems. The Encryption Blade is supported with the Tivoli Key Lifecycle Manager for both disk and tape encryption applications. Following August 1, 2012 each #3895 Encryption Blade will include six Smart Cards.

2499-816 Firmware upgrade renewal, one year (#7710): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-816 Firmware upgrade renewal, two years (#7711): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, one year (#7714): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, two years (#7715): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

Inter-chassis QSFP bundle (#7868): This feature provides sixteen pieces of 4 X 16 Gbps QSFP transceiver bundle to be used on the 16 Gbps Core Blade. Customer supplied QSFP cable up to 50 meters long can be used as an ICL cable.

Inter-chassis license conversion (#7869): This feature is used to convert an ICL activation transferred from an 8 Gbps model as part of the model conversion process. Features #7882 or #7883 converts into one #7869, while feature #7885 counts as two of #7869.

Inter-Chassis License with 16x4x16Gbps QSFP (#7871): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code only enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 platform. A second POD feature code enables all ICL ports on a 2499-816 platform. In addition, each feature ships sixteen 4 x 16 Gbps QSFP transceivers. Customer supplied off-the-shelf QSFP cable up to 50 meters long can be used as an ICL cable.

ICL Enterprise Connectivity License 5-10 2499-416 (#7872): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN384B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

ICL Enterprise Connectivity License 5-10 2499-816 (#7873): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN768B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

Inter-Chassis License with 16x (4 x 16 Gbps) QSFP (#7874): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code (#7871 or #7874) enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 models. A second POD feature code enables all ICL ports on a 2499-816 models. In addition, each feature ships sixteen 4 x 16 Gbps QSFP 100 m transceivers. Customer supplied off-the-shelf OM4 QSFP cable up to 100 meters long can be used as an ICL cable.

FICON with CUP activation (#7884): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by system automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON directors, in addition to supported SAN b-type switch and director products with FICON.

FICON with CUP activation (#7886): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by System Automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System Automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON Directors, as well as supported SAN b-type switch and director products with FICON.

Integrated Routing (#7889): Integrated Routing allows any 8 or 16 Gbps FC port in a SAN768B-2 to be configured as an EX_port supporting Fibre Channel Routing (FCR). FCR support on the 8 or 16 Gbps ports is a native capability, therefore these ports are referred to as native EX_ports. FCR capability on native EX_ports requires the Integrated Routing feature (#7889). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

Integrated Routing License (#7890): Integrated routing (EX_port) allows any 8 or 16 Gbps port in a SAN384B-2 to be configured supporting FCR. Integrated routing enables FCR support on the 8 or 16 Gbps ports as a native capability, therefore they are referred to as native EX_ports. FCR capability on native EX_ports requires the integrated routing feature (#7890). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

8 Gbps Advanced Extension Activation (#7891): This feature code enables two advanced extension features, FCIP Trunking and Adaptive Rate Limiting (ARL), on SAN768B-2 or SAN384B-2 systems. The FCIP Trunking feature allows multiple IP source and destination address pairs (defined as FCIP Circuits) via multiple 1 GE interfaces to provide a high bandwidth FCIP tunnel and failover resiliency. The ARL feature provides a minimum bandwidth guarantee for each tunnel with full utilization of the available network bandwidth without impacting throughput performance under high traffic load. ARL is performed on the FCIP tunnel connection to dynamically change the rate at which the FCIP tunnel transmits data through the TCP connection. ARL will use the information from the TCP connection to determine and adjust the rate limit for the FCIP tunnel dynamically. This allows FCIP connections to utilize the maximum available bandwidth. Each 8 Gbps Extension Blade (#3890 or #3891) must have one 8 Gbps Advanced Extension (#7891) activation feature installed.

8 Gbps Extension Blade 10 GbE activation (#7892): This feature code enables up to two 10 GbE ports on the 8 Gbps Extension Blade (#3890) or Enhanced 8 Gbps Extension Blade (#3891). With this feature, two additional operating modes, in addition to ten 1 GbE ports mode, can be selected. Either two 10 GbE ports or ten 1 GbE and one 10 GbE ports can be configured on a #3890 or #3891 blade when this feature is activated. This feature is available on the SAN768B-2 and SAN384B-2 models and one feature applies for each 8 Gbps Extension Blade (#3890 or #3891).

This same feature can be used to enable 10 Gbps FC on any eight ports of the 16 Gbps port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648). 10G FC feature code must be installed before any port can run at 10 Gbps speed. One feature code should be activated for each port blades to be enabled for 10 Gbps FC.

8 Gbps FICON Accelerator Activation (#7893): The 8 Gbps FICON Accelerator Activation is an optional software authorization feature that uses advanced networking technologies, data management techniques, and protocol intelligence to accelerate FICON disk and tape read and write operations over distance, while maintaining the integrity of command and acknowledgment sequences. It supports emulation for IBM z/OS Global Mirror (formerly eXtended Remote Copy or XRC), in addition to tape pipelining for FICON tape and virtual tape. In combination with the 8 Gbps Advanced Extension Activation (#7891) feature code for FCIP tunneling, FICON Accelerator can provide improved application performance across long distance IP WANs. Each 8 Gbps FICON Accelerator Activation feature is licensed for one 8 Gbps Extension Blade (#3890) or one Enhanced 8 Gbps Extension Blade (#3891) to be used in the SAN768B-2 or the SAN384B-2 fabric backbone.

Encryption 96 Gbps disk Performance Upgrade activation (#7895): Disk Encryption Performance Upgrade feature enables scalability of performance on the Encryption Blade (#3895) features. The upgrade provides increased throughput for disk encryption applications up to 96 Gbps, effectively doubling encrypted throughput performance for disk-based storage with no disruption to operations.

Transceivers

SAN768B-2 and SAN384B-2 offer the following optical transceivers:

- 16 Gbps SW (#2601 or #2602), 10 km LW (#2611 or #2612)
- 10 Gbps SW (#2609), 10 km LW (#2610)
- 8 Gbps SW (#2802 or #2803), 10 km LW (#2821 or #2822), 25 km LW (#2881 or #2886)

Selected transceivers are also available in 8-pack convenience packages:

- 16 Gbps SW (#2608 or #2603), 10 km LW (#2618 or #2613)
- 8 Gbps SW (#2809 or #2804), 10 km LW (#2828 or #2823)

Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

http://www.ibm.com/able/product_accessibility/index.html

For hardware offerings

The following features support use by people with disabilities:

- Controls and latches operable with one hand and minimal dexterity
- Keys discernible by touch without activating them
- Ports and connectors support connection of industry-standard devices

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Models

Model summary matrix

Models	16 Gbps FC port blades (min / max)	8 Gbps FC port blades (min / max)	10 Gbps port blades (min / max)
816	0 / 8	0 / 8	0 / 2
416	0 / 4	0 / 4	0 / 2

Customer setup (CSU)

No.

Devices supported

Specific details on supported devices; storage products attachability, SAN connectivity products, and configuration options are available on the web at

http://www.ibm.com/system/storage/san/b-type

Model conversions

Not applicable.

Feature conversions

Not applicable

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Technical description

↓ Physical specifications
↓ Operating environment
↓ Limitations
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IBM System Storage SAN768B-2

The IBM System Storage SAN768B-2 (2499-816) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include redundant and hot-swappable Control Processors, Core Switching Blades, fully redundant N+1 power subsystem with hot-swappable power supplies, dual or quad redundant AC inputs auto-sensing from 110-240v, and hot-swappable blowers in a redundant cooling system. Three blowers provide cooling and SAN768B-2 will continue to operate indefinitely even if one blower fails (N+1 redundancy). Four power supply bays providing space for fully redundant power using any blade configurations. Regardless of blade types installed, the system only requires two power supplies in any bay for full redundancy.

SAN768B-2 features a modular and scalable mechanical construction that allows a wide range of flexibility in installation, fabric design, and maintenance. Using a 14U mechanical design, up to two SAN768B-2 systems can be mounted in an IBM 2109-C36 cabinet, supporting as many as 768 ports. The chassis may be mounted with the cables facing either the front or rear of the equipment. Cables and blade assemblies serviced from the cable side of the switch, blowers and power supplies are serviced from the non-cable side. The use of Cable Management Comb and chassis door offers enhanced cable management. Dual hot swappable World Wide Name (WWN) card maintains chassis-specific information such as WWNs, IP address(s) and summary status information of each port and blade assembly via a LED interface.

The SAN768B-2 base model includes the following components enclosed in a 14U chassis with doors:

- Zero FC Switch Blades
- Zero fiber optic transceivers
- Cable Comb
- Two Control Processor Blades
- Two Core Blades
- Dual power supplies
- Three blower fans
- Ship Group

The Ship Group contains Install Guide hardcopy, CD-ROM (with manuals), 14U rack mounting kit, two rack PDU power cords, wrap tools, RJ-45 cable, and SFP extraction tool.

IBM System Storage SAN384B-2

The IBM System Storage SAN384B-2 (2499-416) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include dual, redundant and hot-swappable Control Processors, Core Switching Blades, power supplies, and blower assemblies. SAN384B-2 will operate indefinitely if a single blower fails. SAN384B-2 can utilize up to two power supplies to maintain full system redundancy. One power supply is required to power a completely loaded system in any system configuration. If a power supply fails, the remaining supply modules continue to provide uninterrupted power to the chassis. Each power supply has its own power cable connector. AC input power is provided to the chassis by means of up to 2 detachable line cords. The geography specific power cord types must be selected based on country in which the system is installed. The input socket to the power supplies is an IEC320-C19 straight.

SAN384B-2 features a modular and scalable horizontal chassis enclosure that allows a wide range of flexibility in installation, fabric design, and maintenance. The chassis may be mounted with the ports facing either the front or rear of the equipment. Ports and blade assemblies serviced from the port side of the switch, blowers and power supplies are serviced from the non-port side.

The SAN384B-2 chassis has non-port side air intake and standard port side and side air exhaust. An exhaust kit is provided to divert the side exhaust air flow to port side thereby making the SAN384B-2 air exhaust fully on non-port side. The mechanical design of the SAN384B-2 allows rack mounting from the port side facing the front of the equipment rack. The SAN384B-2 chassis is an 8U tall mechanical design, 9U with the air flow accessory kit. Its maximum height

Family 2499+03 IBM Systems Storage SAN768B-2 and SAN384B-2

IBM Asia Pacific Sales Manual
Revised: April 20, 2021

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Product life cycle dates

Type Model	Announced	Available	Marketing Withdrawn	Service Discontinued
2499-416	2011-08-16	2011-08-26	2020-04-29	-
2499-816	2011-08-16	2011-08-26	2020-04-29	-

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Abstract

The IBM 2499 System Storage SAN768B-2 and SAN384B-2 fabric backbones are the industry's newest FC switching infrastructure, providing reliable, scalable, high-performance foundations for private cloud storage and highly virtualized environments.

Model abstract 2499-816

The IBM 2499 System Storage SAN768B-2 Model 816 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

Model abstract 2499-416

The IBM 2499 System Storage SAN384B-2 Model 416 fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to four hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN384B-2 provides up to 192 16 Gbps ports, increased up to 384 ports across ICLs between two chassis, with each port capable of throughput speeds of 2, 4, 8, or 16 Gbps. Additionally, each port offers auto-sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

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Highlights

IBM System Storage SAN768B-2 and SAN384B-2 fabric backbones with the new 16 Gbps Fibre Channel (FC) technology offer a long-term solution for mission-critical applications that require high-performance, low-latency storage networks. These new models offer maximum investment protection by:

- Interfacing with existing 2, 4, and 8 Gbps FC ports
- Offering configurable ports for 10 Gbps metro optical connectivity
- Leveraging existing 8 Gbps 2499 fabric backbone ports and specialty blades
- Integrating with the IBM Network Advisor unified network management solution to bridge operational gaps across server, network, and storage administrators

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Description

They are designed to:

- Enable simpler, flatter, low-latency chassis connectivity to reduce network complexity, management, and costs
- Increase business agility while providing access to information and reducing infrastructure and administrative costs
- Support of private cloud storage with improved scalability, performance, and reliability

SAN768B-2 and SAN384B-2 are designed to address key requirements while helping to protect investments already made by the deployment of existing SANs, servers, storage hardware, and advanced functions:

- Support 2, 4, 8, 10, and 16 Gbps FC and FCIP, as well as advanced fabric services and management tools
- Include up to 384 (SAN768B-2) or 192 (SAN384B-2) 16 Gbps universal (E, F, D, M, and EX) FC ports using 32-or 48-port FC blades, or up to 512 (SAN768B-2) or 256 (SAN384B-2) 8 Gbps universal (E, F, M, and EX) FC ports using 64-port 8 Gbps FC blades
- Deliver forward and backward compatibility with 8 and 16 Gbps IBM System Storage SAN director, switch, and router models

SAN768B-2 and SAN384B-2 are connecting distributed data centers enabled for data mobility and advanced data protection solutions. These fabric backbones include integrated metro and global Storage Area Network (SAN) extensions designed to provide application agility, flexible business continuity, and disaster recovery solutions. These fabric backbones:

- Optimize data center connectivity over distance with integrated high-performance metro and global connectivity
- Simplify and centralize end-to-end SAN management with comprehensive diagnostics, monitoring, and automation
- Maximize performance for I/O-and bandwidth-intensive applications with more than seven times the performance of competitive offerings
- Protect investments in existing SAN fabrics and automation tools while reducing operational costs and minimizing business disruption

The 16 Gbps 2499 fabric backbones are available in two modular form factors. Built for large enterprise networks, the 14U SAN768B-2 (2499-816) has eight vertical blade slots to provide up to 384 16 Gbps FC ports. Built for mid-sized networks, the 8U SAN384B-2 (2499-416) has four horizontal blade slots to provide up to 192 16 Gbps FC ports. These new models support 2, 4, 8, 10, and 16 Gbps FC, and 1/10 Gbps Fibre Channel over IP (FCIP).

Bandwidth-intensive applications, critical workloads, and higher density virtualization are continuing to push the limits of SAN infrastructure. The 2499 16 Gbps models address next-generation I/O requirements by providing increased slot-to-slot and port performance bandwidth with 16 Gbps performance. In addition, local switching capabilities ensure that data traffic within the same port group does not consume slot bandwidth, maximizing the number of line-rate ports.

Optical Inter-Chassis Links (ICLs) can connect up to ten SAN768B-2 and SAN384B-2 fabric backbones, enabling flatter, faster, and simpler fabrics that increase consolidation while reducing network complexity and costs. ICLs enable scalable core-edge and active-active mesh chassis topologies. These high-density chassis topologies reduce inter-switch cabling by 75%, and free up to 33% of ports for server and storage. This maximizes overall port density in the amount of rack space.

SAN768B-2 (2499-816) performance capabilities:

- Up to 384 ports (equivalent to 512 with ICLs) at 16 Gbps
- Up to 8.2 Tbps chassis bandwidth, 6.1 Tbps universal ports, and 2.1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

SAN384B-2 (2499-416) performance capabilities:

- Up to 192 ports (equivalent to 256 with ICLs) at 16 Gbps
- Up to 4.1 Tbps chassis bandwidth, 3.1 Tbps universal ports, and 1 Tbps ICL bandwidth
- Up to 512 Gbps bandwidth per slot

The 16 Gbps platforms support port-based encryption and compression on an Inter-Switch Link (ISL) between two 16 Gbps E-ports. The encryption and compression feature on an E-port can be enabled on a per port basis. The same port that has been configured for compression can also be configured for encryption. However, only two ports per ASIC can be configured for encryption and compression in FOS 7.0.

The 16 Gbps fabric backbones are designed to provide high-speed replication and backup solutions over metro or wide area network (WAN) links with native FC (10 and 16 Gbps) and optional FCIP (1/10 GbE) extension support. The integrated metro connectivity includes in-flight compression to optimize bandwidth and minimize the risk of unauthorized access.

FOS 7.0 introduces the new Diagnostic port (D-port) type. The D-port is designed to debug the components associated with the link, such as transceivers and cables. This feature is only supported on 16 Gbps ports. The D-Port is statically configured by the user with the intention to run diagnostics. A D-port does not carry any control or data traffic and is purely used for the link diagnostics purpose and to isolate link level faults.

SAN768B-2 and SAN384B-2 base systems require FOS 7.0.0, and later. They are always enabled with the following:

- **Full fabric:** Enables E_ports. The switch cannot be connected to another switch until full fabric is installed
- **Web tools:** Enables administration, configuration, and maintenance of fabric switches and SANs
- **Virtual Fabrics (VF):**
  - Supports ANSI standards-based implementation of VF
  - Adds the capability for physical switches to be partitioned into independently managed logical switches, each with its own data, control, and management paths
  - Allows logical switches to be used to allocate fabric resources on a per-port basis rather than on a per-switch basis
  - Enables simplification or resource allocation by customer, department, application, or storage tier
  - Consolidate resources across multiple fabrics
- **Zoning:** Segments a fabric into virtual private SANs
- **Enhanced group management (EGM):** When added to Brocade element management, the EGM enables additional device-level management functionality for IBM b-type products and also allows large consolidated operations to groups of devices (for example: firmware download, configuration upload and download)

Enterprise Software Bundle features

- **Adaptive networking:** Represents a set of features providing tools and capabilities to incorporate network policies to enable traffic differentiation and prioritization. The FOS 7.0 release supports two types of quality of service (QoS) features with the 16 Gbps fabric backbones:
  - Ingress Rate Limiting to limit the throughput on the ingress side of the port by delaying the return of buffer to buffer credits to the external device
  - SID/DID Based Prioritization used to prioritize the FC flow using a Virtual Channel (VC) by which an FC flow is assigned to different behavior aggregates
- **Advanced performance monitoring:** Helps identify end-to- end bandwidth usage by host or target pairs and is designed to provide information for capacity planning
- **Extended fabrics:** Extend SAN fabrics beyond the FC standard 10 km by optimizing the internal switch buffers to maintain performance on ISLs at distances up to 500 kilometers.
- **Fabric Vision** technology includes several critical diagnostic, monitoring and management capabilities that designed to help increase fabric resiliency, reduce downtime, optimize application performance, and dramatically simplifies SAN deployment and management. The following features are introduced with the base Fabric OS (FOS) 7.2.0 release:
  - ClearLink Diagnostics: Helps ensure optical and signal integrity for Gen 5 Fibre Channel optics and cables, simplifying the deployment and support of high-performance fabrics.
  - Bottleneck Detection: Identifies and alerts administrators about device or ISL congestion, as well as abnormal levels of latency in the fabric.
  - Critical diagnostic and monitoring capabilities: Help ensure early problem detection and recovery.
  - Forward Error Correction (FEC): Enables recovery from bit errors in ISLs, enhancing transmission reliability and performance.
  - Credit Loss Recovery: Helps overcome performance degradation and congestion due to buffer credit loss.

  Flow Vision, Monitoring and Alerting Policy Suite (MAPS), and customizable dashboard advanced technologies and capabilities are made available with the optional Fabric Vision licensed feature. This feature also enables ClearLink (D_Port) functionality for Gen 5 FC platforms when connected to non-b-type end-devices.

  - **Flow Vision** enables 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 monitor, flow mirror, and flow generator features.

  - **Monitoring and Alerting Policy Suite (MAPS)** is a new, easy to use, policy-based threshold monitoring and alerting suite that pro-actively monitors the health and performance of the SAN infrastructure to ensure application uptime and availability. By leveraging pre-built rule/policy-based templates, MAPS simplifies threshold configuration, monitoring and alerting. Organizations 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 ll through a single dialog. The integrated dashboard displays an overall 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. MAPS capabilities provide policy- based monitoring, CLI dashboard of health and error statistics, bottleneck detection information, proactive flow monitoring.

  Automated Migration of Fabric Watch configurations to 'MAPS' automatically imports existing thresholds into a MAPS policy, enabling seamless migration from Fabric Watch to MAPS to take advantage of the new MAPS capabilities and usability enhancements.

  Fabric Vision license is included with FOS 7.2.0, and later. Once the switch is upgraded to FOS 7.2.0 or higher and the Fabric Vision license is enabled, Fabric Watch configuration and any Fabric Watch related features are no longer supported.

- **Fabric watch:** Monitors mission-critical switch operations and includes port fencing capabilities.
- **Trunking:** Enables FC packets to be efficiently distributed across multiple inter-switch connections (links) between two SAN btype fabric switches, while preserving in-order delivery. Both SAN b-type fabric switches must have ISL trunking activated. Both SAN768B-2 and SAN384B-2 adds Enhanced ISL trunking support using 16 Gbps ports and enable FC packets to be distributed across up to eight 16 Gbps capable ISLs for a combined bandwidth of up to 128 Gbps. When connecting the 16 Gbps capable models to legacy 2, 4, or 8 Gbps capable b-type fabric switch models, ISL trunking is supported at the lowest operational link speeds.
- **Server application optimization:** When deployed with Brocade Server Adapters, this function optimizes overall application performance for physical servers and virtual machines by extending virtual channels to the server infrastructure. Application specific traffic flows can be configured, prioritized, and optimized throughout the entire data center infrastructure.

Optional features

SAN7686B-2 and SAN384B-2 are available with a number of selectable options. The base systems do not include any blades, but at least one blade is required for host and storage connectivity.

SAN768B-2 may be configured by adding up to a total of eight of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), and 8 Gbps Encryption (#3895) blades. All activated ports must be populated with a mixture of short wave and long wave optical transceivers up to the maximum number of ports.

The SAN768B-2 (2499-816) base model has two power supplies providing 2000W of total power using only 200/240VAC. The base model (core blades, controller blade, fans) consume 830W power, leaving users with 1170W available power for the optional port (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, #3648, #3649, #3664, #3864) and specialty blades (#3890, #3891, #3895). Based on the different power consumption of each port or specialty blades, various configurations will result in higher than 2000W power usage and customer will be required to purchase feature #7880 pair of optional power supplies. Further details can be found in Appendix A of the SAN768B-2 Installation, Service, and User's Guide. Please consult the following table to calculate the power usage:

Power Demands per Component

Components	Maximum Power Draw (Watts)	Type of Blade	Max blades in chassis
2499-816	830	Base chassis	N/A
#3632, #3633 #3034, #3634, #3635	140	32-port Blades	8
#3648, #3649 #3035, #3636, #3637	160.4	48-port Blades	8
#3664, #3864	126.4	64-port Blades	8
#3890, #3891	235	Extension Blade	4
#3895	250	Encryption Blade	4

SAN384B-2 may be configured by adding up to a total of four of the available optional blades: 32-port (#3034, #3632, #3634, #3635) and 48-port (#3035, #3648, #3636, #3637) 16 Gbps FC port blades, 32-port (#3633) and 48-port (#3649) 8 Gbps FC port blades, 64-port (#3864) 8 Gbps FC port blades, 64-port (#3664) 16 Gbps FC port blades, 8 Gbps Extension (#3890), Enhanced 8 Gbps Extension (#3891), or 8 Gbps Encryption (#3895). All activated ports must be populated with a mixture of short wave and long wave optical transceivers, up to the maximum number of ports.

4 Gbps 10 km LW SFP Transceiver (#2411): This feature provides one longwave SFP transceiver, designed to provide Fibre Channel connections at distances up to 10 km (6.2 miles), while using the appropriate 9.0/125 micrometer single mode fiber optic cable.

16 Gbps FC port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648): 32 or 48 port blades provide 2, 4, 8, or 16 Gbps on each port to be configured as E, F, M, EX, D-ports with no over subscription at 16 Gbps on the 32-port blade. Within a group of 8 ports in a port blade, two of the following three port speed combinations are allowed:

- 2, 4, and 8 Gbps
- 10 Gbps
- 16 Gbps

The default setting is:

- 2, 4, and 8 Gbps
- 16 Gbps

Any eight ports of the 16 Gbps port blades can be enabled for 10 Gbps FC when feature #7892 is activated.

Enhanced 8 Gbps FC port blades (#3633 and #3649): The two port blades (32 or 48 ports) provide 2, 4, or 8 Gbps on each port to be configured as E, F, M, EX port with no over subscription at 8 Gbps speed. These port blades cannot be upgraded to 10 or 16 Gbps speed and do not support in-flight encryption and compression. The #3633 and #3649 blades do not support FICON. Also, no Diagnostic (D-port) support on these blades. Up to four 8-port external trunk groups per #3633 blade and up to six 8-port external trunk groups per #3649 blade.

SAN768B FC 8 Gbps 64-port blade (#3864): The SAN768B FC 8 Gbps 64-port Blade is designed to allow mid to large enterprise customers to deploy high-density, chassis-based solutions to minimize physical footprint without compromising performance. This blade provides 64 E, EX, F and M ports operating at 2, 4, and 8 Gbps, offering low latency and cut-through switching with full 8 Gbps line rate on local switching and 2:1 over subscription at 8 Gbps across the backplane. There can be up to eight 8-port trunk groups created with the 64-port blade, with a maximum of 8 ports per trunk group. The #3864 blade does not support FICON and cannot co-exist with blades running FICON traffic.

To achieve this high-density solution, the 64-port blade uses an optimized version of the standard Small Form-factor Pluggable (mSFP) transceiver and requires a structured cable management solution. The mSFPs retain all of the performance and functionality of the standard SFP+ and include individual port isolation for improved serviceability and availability. Each 64-port blade is populated and shipped with 64 8 Gbps shortwave mSFP fiber optic transceivers. The mSFP fiber pitch and width are narrower than standard SFPs, resulting in the need for newer OM-3 fiber cables with narrower LC connectors. The standard LC connector was modified by major cable vendors to accommodate the new fiber pitch and width. The new cables provide the same flexibility in connectivity as standard LC cables and they are available in the following configurations:

- **MSFP-LC cable** provides the #3864 port blade with the ability to connect to other port blades, switches, devices, and LC patch panels.
- **MSFP-MSFP cable** allows one #3864 port blade to connect to another #3864 port blade as ISLs.
- **MSFP-MPO cable** is a trunked MPO cable to connect to multiple mSFP ports; six mSFP connectors are supported in one trunk cable.

Only the trunked mSFP-MPO cable solution is recommended when multiple directors using the #3864 64-port blades are installed into a 2109-C36 cabinet.

Refer to the Cable Management Considerations for 8 Gbps and 16 Gbps 64 Port Blades guide posted on the IBM Support website to find installation guidelines and the list of recommended part numbers and vendor information.

8 Gbps Extension Blade (#3890): The 8 Gbps Extension Blade combines FC switching and routing capabilities with hardware-assisted FCIP traffic forwarding over IP WAN. The twelve 8 Gbps FC ports and ten 1 Gigabit Ethernet (GbE) port blade is designed to provide remote storage and SAN connectivity. The 8 Gbps Extension Blade integrates a variety of capabilities to deliver a high performance, reliable, and secure distance-connectivity solution, such as:

- **FCIP Trunking** is designed to virtualize two or more TCP connections as part of a single FCIP tunnel. FCIP Trunking combines multiple IP source and destination address pairs into a logical high-bandwidth FCIP trunk spanning multiple physical ports to provide load balancing and network failure resiliency.
- **Adaptive rate limiting** is designed to meet minimum bandwidth requirements for each tunnel while fully utilizing the available network bandwidth without adverse throughput performance impact at high traffic load.
- **Hardware-based compression** delivers the ability to increase throughput over lower bandwidth links in the WAN, supporting the cost efficiencies of FCIP. The 8 Gbps Extension Blade compresses FC frames before they are encapsulated into FCIP packets.
- **FCIP QoS** provides high, medium, and low-priority handling of initiator target flows within the same FCIP tunnel for transmission over the WAN.
- **FC routing** delivers fabric isolation in conjunction with FCIP, enabling separate fabrics to share devices without merging across the IP network.
- **FCIP fast write** accelerates SCSI write processing, maximizing performance of synchronous and asynchronous replication applications across high-latency WAN connections.
- **Open systems tape pipelining** accelerates read and write tape processing over distance, minimizing backup and restore windows.
- **Storage optimized TCP** helps improve TCP window size and flow control, accelerating TCP transport for storage applications.
- **Multiple logical FCIP tunnels** allow for scalable connectivity between sites, between two SAN06B-R models, or when it is connected to a 8 Gbps Extension Blade.

Enhanced 8 Gbps Extension Blade (#3891): The Enhanced 8 Gbps Extension Blade in addition to all features and function of the #3890 8 Gbps Extension Blade capable of running IPSec on both 10 GbE interface doubling encrypted throughput for each #3891 blade.

Encryption Blade (#3895): A 16-port, auto-sensing 8 Gbps FC blade provides fabric-based encryption for data-at-rest and compression. The Encryption Blade scales nondisruptively, providing from 48 Gbps up to 96 Gbps of encryption processing power to meet the needs of the most demanding environments with flexible, on-demand performance. It also provides compression services at speeds up to 48 Gbps for tape storage systems. The Encryption Blade is supported with the Tivoli Key Lifecycle Manager for both disk and tape encryption applications. Following August 1, 2012 each #3895 Encryption Blade will include six Smart Cards.

2499-816 Firmware upgrade renewal, one year (#7710): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-816 Firmware upgrade renewal, two years (#7711): The initial purchase of an IBM System Storage SAN768B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, one year (#7714): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides one additional year of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

2499-416 Firmware upgrade renewal, two years (#7715): The initial purchase of an IBM System Storage SAN384B-2 includes one year of firmware upgrade entitlement. This feature provides two additional years of renewal for upgrades included in future releases of the FOS firmware. You are not eligible to access new features and functions without the purchase of this feature.

Inter-chassis QSFP bundle (#7868): This feature provides sixteen pieces of 4 X 16 Gbps QSFP transceiver bundle to be used on the 16 Gbps Core Blade. Customer supplied QSFP cable up to 50 meters long can be used as an ICL cable.

Inter-chassis license conversion (#7869): This feature is used to convert an ICL activation transferred from an 8 Gbps model as part of the model conversion process. Features #7882 or #7883 converts into one #7869, while feature #7885 counts as two of #7869.

Inter-Chassis License with 16x4x16Gbps QSFP (#7871): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code only enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 platform. A second POD feature code enables all ICL ports on a 2499-816 platform. In addition, each feature ships sixteen 4 x 16 Gbps QSFP transceivers. Customer supplied off-the-shelf QSFP cable up to 50 meters long can be used as an ICL cable.

ICL Enterprise Connectivity License 5-10 2499-416 (#7872): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN384B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

ICL Enterprise Connectivity License 5-10 2499-816 (#7873): This feature number is required in addition to the ICL features (#7871 or #7874) on each SAN768B-2 chassis when it is connected into a full mesh or core-to-edge topologies with five or greater number of SAN384B-2 and SAN768B-2 chassis. Fabric topologies with fewer than 5 SAN384B-2 or SAN768B-2 chassis using ICLs do not require any ICL Enterprise Connectivity features.

Inter-Chassis License with 16x (4 x 16 Gbps) QSFP (#7874): This feature number activates ICL ports on the core blades of the 16 Gbps platforms. One ICL POD feature code (#7871 or #7874) enables half of the ICL ports on core blades of a 2499-816 or all of the ICL ports on the core blades of a 2499-416 models. A second POD feature code enables all ICL ports on a 2499-816 models. In addition, each feature ships sixteen 4 x 16 Gbps QSFP 100 m transceivers. Customer supplied off-the-shelf OM4 QSFP cable up to 100 meters long can be used as an ICL cable.

FICON with CUP activation (#7884): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by system automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON directors, in addition to supported SAN b-type switch and director products with FICON.

FICON with CUP activation (#7886): FICON with CUP Activation provides in-band management of the supported SAN b-type switch and director products by System Automation for z/OS from IBM System z10 EC, z10 BC, z9 EC, z9 BC, zSeries 990, 890, zEnterprise z196, and z114 servers. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. This support provides a single point of control for managing connectivity in active FICON I/O configurations. System Automation for OS/390 or z/OS can now concurrently manage IBM 9032 ESCON Directors, as well as supported SAN b-type switch and director products with FICON.

Integrated Routing (#7889): Integrated Routing allows any 8 or 16 Gbps FC port in a SAN768B-2 to be configured as an EX_port supporting Fibre Channel Routing (FCR). FCR support on the 8 or 16 Gbps ports is a native capability, therefore these ports are referred to as native EX_ports. FCR capability on native EX_ports requires the Integrated Routing feature (#7889). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

Integrated Routing License (#7890): Integrated routing (EX_port) allows any 8 or 16 Gbps port in a SAN384B-2 to be configured supporting FCR. Integrated routing enables FCR support on the 8 or 16 Gbps ports as a native capability, therefore they are referred to as native EX_ports. FCR capability on native EX_ports requires the integrated routing feature (#7890). This functionality eliminates the need to add a routing blade or router for FCR purposes, and also increases the bandwidth for each FC router connection when connected to another 8 or 16 Gbps capable port.

8 Gbps Advanced Extension Activation (#7891): This feature code enables two advanced extension features, FCIP Trunking and Adaptive Rate Limiting (ARL), on SAN768B-2 or SAN384B-2 systems. The FCIP Trunking feature allows multiple IP source and destination address pairs (defined as FCIP Circuits) via multiple 1 GE interfaces to provide a high bandwidth FCIP tunnel and failover resiliency. The ARL feature provides a minimum bandwidth guarantee for each tunnel with full utilization of the available network bandwidth without impacting throughput performance under high traffic load. ARL is performed on the FCIP tunnel connection to dynamically change the rate at which the FCIP tunnel transmits data through the TCP connection. ARL will use the information from the TCP connection to determine and adjust the rate limit for the FCIP tunnel dynamically. This allows FCIP connections to utilize the maximum available bandwidth. Each 8 Gbps Extension Blade (#3890 or #3891) must have one 8 Gbps Advanced Extension (#7891) activation feature installed.

8 Gbps Extension Blade 10 GbE activation (#7892): This feature code enables up to two 10 GbE ports on the 8 Gbps Extension Blade (#3890) or Enhanced 8 Gbps Extension Blade (#3891). With this feature, two additional operating modes, in addition to ten 1 GbE ports mode, can be selected. Either two 10 GbE ports or ten 1 GbE and one 10 GbE ports can be configured on a #3890 or #3891 blade when this feature is activated. This feature is available on the SAN768B-2 and SAN384B-2 models and one feature applies for each 8 Gbps Extension Blade (#3890 or #3891).

This same feature can be used to enable 10 Gbps FC on any eight ports of the 16 Gbps port blades (#3034, #3035, #3632, #3633, #3634, #3635, #3636, #3637, and #3648). 10G FC feature code must be installed before any port can run at 10 Gbps speed. One feature code should be activated for each port blades to be enabled for 10 Gbps FC.

8 Gbps FICON Accelerator Activation (#7893): The 8 Gbps FICON Accelerator Activation is an optional software authorization feature that uses advanced networking technologies, data management techniques, and protocol intelligence to accelerate FICON disk and tape read and write operations over distance, while maintaining the integrity of command and acknowledgment sequences. It supports emulation for IBM z/OS Global Mirror (formerly eXtended Remote Copy or XRC), in addition to tape pipelining for FICON tape and virtual tape. In combination with the 8 Gbps Advanced Extension Activation (#7891) feature code for FCIP tunneling, FICON Accelerator can provide improved application performance across long distance IP WANs. Each 8 Gbps FICON Accelerator Activation feature is licensed for one 8 Gbps Extension Blade (#3890) or one Enhanced 8 Gbps Extension Blade (#3891) to be used in the SAN768B-2 or the SAN384B-2 fabric backbone.

Encryption 96 Gbps disk Performance Upgrade activation (#7895): Disk Encryption Performance Upgrade feature enables scalability of performance on the Encryption Blade (#3895) features. The upgrade provides increased throughput for disk encryption applications up to 96 Gbps, effectively doubling encrypted throughput performance for disk-based storage with no disruption to operations.

Transceivers

SAN768B-2 and SAN384B-2 offer the following optical transceivers:

- 16 Gbps SW (#2601 or #2602), 10 km LW (#2611 or #2612)
- 10 Gbps SW (#2609), 10 km LW (#2610)
- 8 Gbps SW (#2802 or #2803), 10 km LW (#2821 or #2822), 25 km LW (#2881 or #2886)

Selected transceivers are also available in 8-pack convenience packages:

- 16 Gbps SW (#2608 or #2603), 10 km LW (#2618 or #2613)
- 8 Gbps SW (#2809 or #2804), 10 km LW (#2828 or #2823)

Accessibility by people with disabilities

A US Section 508 Voluntary Product Accessibility Template (VPAT) containing details on accessibility compliance can be requested at

http://www.ibm.com/able/product_accessibility/index.html

For hardware offerings

The following features support use by people with disabilities:

- Controls and latches operable with one hand and minimal dexterity
- Keys discernible by touch without activating them
- Ports and connectors support connection of industry-standard devices

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Models

Model summary matrix

Models	16 Gbps FC port blades (min / max)	8 Gbps FC port blades (min / max)	10 Gbps port blades (min / max)
816	0 / 8	0 / 8	0 / 2
416	0 / 4	0 / 4	0 / 2

Customer setup (CSU)

No.

Devices supported

Specific details on supported devices; storage products attachability, SAN connectivity products, and configuration options are available on the web at

http://www.ibm.com/system/storage/san/b-type

Model conversions

Not applicable.

Feature conversions

Not applicable

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Technical description

↓ Physical specifications
↓ Operating environment
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↓ Hardware requirements
↓ Software requirements

IBM System Storage SAN768B-2

The IBM System Storage SAN768B-2 (2499-816) fabric backbone is a highly available, modular, and scalable platform. It contains slots for up to eight hot-swappable Port Blades, two for Control Processor Blades, and two for Core Switching Blades assemblies. SAN768B-2 provides up to 384 16 Gbps FC ports, increased up to 768 ports across ICLs between ten chassis, with each port capable of throughput speeds of 2, 4, 8, 10 or 16 Gbps. Additionally, each port offers auto sensing and self-negotiating to the highest speed supported by the attached server, storage, or switch, as well as self-configuration according to the supported port type.

High-availability features include redundant and hot-swappable Control Processors, Core Switching Blades, fully redundant N+1 power subsystem with hot-swappable power supplies, dual or quad redundant AC inputs auto-sensing from 110-240v, and hot-swappable blowers in a redundant cooling system. Three blowers provide cooling and SAN768B-2 will continue to operate indefinitely even if one blower fails (N+1 redundancy). Four power supply bays providing space for fully redundant power using any blade configurations. Regardless of blade types installed, the system only requires two power supplies in any bay for full redundancy.

SAN768B-2 features a modular and scalable mechanical construction that allows a wide range of flexibility in installation, fabric design, and maintenance. Using a 14U mechanical design, up to two SAN768B-2 systems can be mounted in an IBM 2109-C36 cabinet, supporting as many as 768 ports. The chassis may be mounted with the cables facing either the front or rear of the equipment. Cables and blade assemblies serviced from the cable side of the switch, blowers and power supplies are serviced from the non-cable side. The use of Cable Management Comb and chassis door offers enhanced cable management. Dual hot swappable World Wide Name (WWN) card maintains chassis-specific information such as WWNs, IP address(s) and summary status information of each port and blade assembly via a LED interface.

The SAN768B-2 base model includes the following components enclosed in a 14U chassis with doors: