

IBM System Storage SAN48B-5

IBM Redbooks Product Guide

This IBM® Redbooks® Product Guide describes the IBM System Storage® SAN48B-5 switch. The IBM System Storage SAN48B-5 switch is designed to meet the demands of hyper-scale private or hybrid cloud storage environments by delivering 16 Gbps Fibre Channel technology and capabilities that support highly virtualized environments. To enable greater flexibility and investment protection, the SAN48B-5 switch can be configured for 24, 36, or 48 ports, and supports 2, 4, 8, 10, or 16 Gbps speeds in an efficiently designed 1U package. This switch, now enhanced with enterprise connectivity options that add support for IBM FICON® connectivity, can provide a highly reliable infrastructure when used with fast, scalable IBM z Systems™ servers.

The SAN48B-5 switch also supports multitenancy in cloud environments through Virtual Fabrics, quality of service (QoS), and fabric-based zoning features. In addition, it enables secure metro extension to virtual private or hybrid clouds with 10 Gbps Dense Wavelength Division Multiplexing (DWDM) link support, and in-flight encryption and data compression over inter-switch links (ISLs). Organizations can have up to four ports at 8 Gbps and up to two ports at 16 Gbps of in-flight encryption and data compression per SAN48B-5 switch. The switch also features on-board data security and acceleration, minimizing the need for separate acceleration appliances to support distance extension. Internal fault-tolerant and enterprise-class RAS features help minimize downtime to support mission-critical cloud environments.

Figure 1 shows the SAN48B-5 switch.



Figure 1. IBM System Networking SAN48B-5 switch

Did you know?

- The SAN48B-5 switch provides great flexibility for diverse deployment strategies with the Gen 5 Fibre Channel switch, which delivers 16 Gbps performance with up to 48 ports in an energy-efficient, 1U form factor.
- Fabric Vision technology¹ simplifies management, which helps reduce operational costs and optimize application performance.
- Nondisruptive software upgrades and redundant, hot-pluggable components help maximize availability.

Key features and technical capabilities

The SAN48B-5 switch has the following features:

- 16 Gbps performance with up to 48 ports in an energy-efficient, 1U form factor
- Ports on Demand (PoD) capabilities for scaling 24 - 48 ports in 12-port increments
- 2, 4, 8, 10, or 16 Gbps speed on all ports, producing an aggregate 768 Gbps full-duplex throughput
- 16 Gbps optimized Inter-Switch Links (ISLs)
- 128 Gbps high-performance and resilient frame-based trunking
- Simplified deployment process and point-and-click user interface

The SAN48B-5 switch provides a critical building block for today's highly virtualized private or hybrid cloud storage environments. It can simplify server virtualization and virtual desktop infrastructure (VDI) management while meeting the high-throughput demands of enterprise data centers with capabilities such as the following ones:

- Native 10 Gbps Fibre Channel support, which provides integrated dense wavelength division multiplexing metro connectivity (DWDM)
- Multitenancy in cloud environments through virtual fabrics, integrated routing, quality of service (QoS), and fabric-based zoning features
- In-flight data compression and encryption, which provides efficient link utilization and security (up to four ports at 8 Gbps or up to two ports at 16 Gbps)

Technical capabilities

The Gen 5 Fibre Channel SAN48B-5 cloud storage networking-optimized switch offers the following capabilities:

- 48 x 16 Gbps Fibre Channel ports supporting 2, 4, 8, 10, and 16 Gbps speeds or FICON connections
- Scalable PoD configuration of 24 -48 ports to accommodate various sizes of SAN fabric environments
- Configurable ports for 10 Gbps metro optical connectivity
- Small footprint and low energy consumption in 1U and less than 18 inches wide and 18 inches deep
- Easy to use three-step deployment with EZSwitchSetup

Architecture and key components

In addition to providing scalability, the SAN48B-5 switch can address demanding reliability, availability, and serviceability (RAS) requirements to help minimize downtime to support mission-critical cloud environments through the following features:

- Fabric Vision technology simplifies management, reduces operational costs, and improves application performance.
- Redundant, hot-pluggable components and nondisruptive software upgrades.
- Real-time power monitoring, enabling users to monitor real-time power usage of the fabric at a node level.

The SAN48B-5 switch can also be deployed as a full-fabric switch or as an Access Gateway, which simplifies fabric topologies and heterogeneous fabric connectivity (the default mode setting is a switch). Access Gateway mode uses N_Port ID Virtualization (NPIV) switch standards to present physical and virtual servers directly to the core of SAN fabrics. This makes the switch transparent to the SAN fabric, greatly reducing management of the network edge. The SAN48B-5 switch in Access Gateway mode can connect servers to NPIV-enabled System Storage and TotalStorage b-type and m-type SAN directors, switches, and routers. Access Gateway mode for the SAN48B-5 switch is supported only in 48-port configurations.

Organizations can easily enable Access Gateway mode through IBM Network Advisor V11 or later or a command-line interface. Some fabric services do not apply or are unavailable when using Access Gateway mode. Here are the key benefits of Access Gateway mode:

- Improved scalability for large or rapidly growing server and virtual server environments
- Reduced management of the network edge because Access Gateway does not have a domain identity and appears transparent to the core fabric
- Support for heterogeneous SAN configurations without reduced functionality for server connectivity

The SAN48B-5 switch delivers outstanding price/performance for growing SAN workloads through a combination of enhanced throughput and an affordable switch form factor. The 48 ports produce an aggregate 768 Gbps full-duplex throughput; any eight ports can be trunked for 128 Gbps ISLs. Exchange-based dynamic path selection optimizes fabric-wide performance and load balancing by automatically routing data to the most efficient available path in the fabric (see Figure 2). It augments ISL Trunking to provide more effective load balancing in certain configurations.

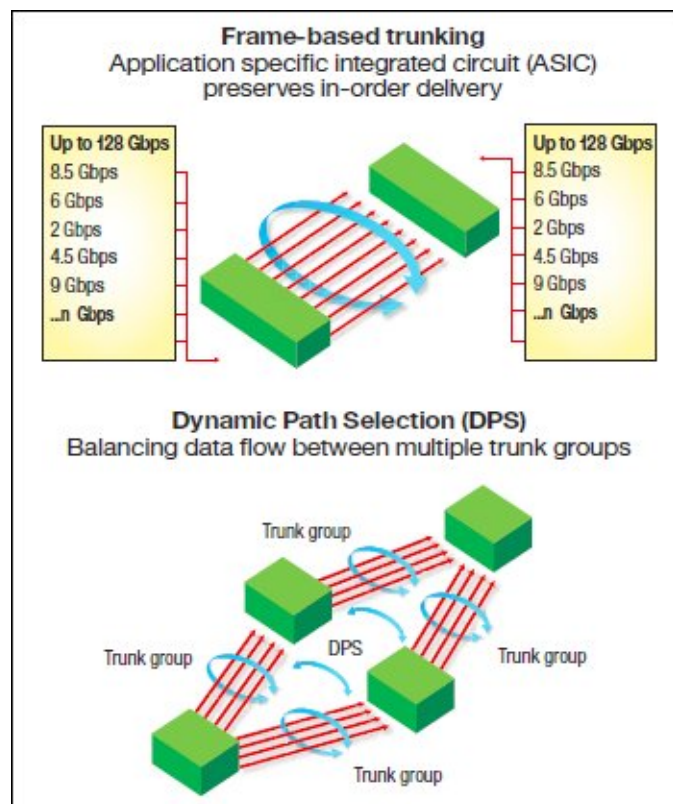


Figure 2. Exchange-based dynamic path selection optimizes fabric-wide performance and load balancing by automatically routing data to the most efficient and available path in the fabric

Fabric Operating System and management software

Fabric Operating System (FOS) is included with each SAN48B-5 switch and provides all the functions that are necessary to operate a base system. This Gen 5 Fibre Channel base system requires FOS V7.0 or later to take advantage of the advanced functions that are delivered through Fabric Vision technology.

The Advanced Web Tools, Advanced Zoning, Virtual Fabrics, Full Fabric, Fabric Watch, and Enhanced Group Management features are part of the base FOS and do not require a license. When you use FOS V7.2, the Server Application Optimization (SAO) and Adaptive Networking features become part of the base FOS and do not require a license. FOS V7.2 also introduces optional Fabric Vision capabilities, such as the Flow Vision and Monitoring and Alerting Policy Suite (MAPS) advanced technologies. The Fabric Vision license is not offered as an optional feature for the SAN48B-5 switch because combining Fabric Watch (installed by default for the SAN48B-5 switch) and Advanced Performance Monitoring allows you to activate the Fabric Vision capabilities without having to buy the Fabric Vision license itself. Optionally, the Fabric Vision license is offered as part of the Enterprise Bundle.

Here are more details about these features:

- **Advanced Web Tools** enable GUI-based administration, configuration, and maintenance of fabric switches and SANs.
- **Advanced Zoning** segments a fabric into virtual private or hybrid SANs to restrict device communication and apply certain policies only to members within the same zone.
- **Virtual Fabrics** allow a physical switch to be partitioned into independently managed logical switches, each with its own data, control, and management paths.
- **Full Fabric** allows a switch to be connected to another switch. It is required to enable expansion ports (E_Ports).
- **Fabric Watch** constantly monitors mission-critical switch operations for potential faults and automatically alerts administrators to problems before they become costly failures. Fabric Watch includes port fencing capabilities.
- **Enhanced Group Management (EGM)** enables additional device-level management functionality for IBM b-type SAN products when added to the element management and also allows large consolidated operations to groups of devices (such as firmware downloads and configuration uploads and downloads).

Advanced capabilities can be enabled with the following optional license activation features:

- **FICON with Control Unit Port (CUP) Activation** provides in-band management of the supported SAN b-type switch and director products through system automation for IBM z/OS® from IBM System z10® Enterprise Class and Business Class, IBM System z9® Enterprise Class and Business Class, IBM eServer™ zSeries 990 and 890, and IBM zEnterprise® 196 and 114 servers. This support provides a single point of control for managing connectivity in active FICON I/O configurations. To enable in-band management on multiple switches and directors, each chassis must be configured with the appropriate FICON CUP feature. System automation for IBM OS/390® or z/OS can now use FICON to concurrently manage IBM ESCON® Director 3092, in addition to supported SAN b-type switch and director products.
- The **Adaptive networking** service is a set of features that provides users with tools and capabilities for incorporating network policies to ensure optimal behavior of a large SAN. FOS V7.0 supports two types of quality of service features with the 16 Gbps fabric backbones: ingress rate limiting and SID/DID-based prioritization.
- **Advanced Performance Monitoring** helps identify end-to-end bandwidth usage by host/target pairs and provides for capacity planning.

- **ISL Trunking** enables Fibre Channel packets to be distributed efficiently across multiple ISLs between two IBM b-type SAN fabric switches and directors while preserving in-order delivery. Both b-type SAN devices must have trunking activated. The SAN48B-5 switch adds enhanced ISL Trunking support using 16 Gbps ports and enables Fibre Channel packets to be distributed across up to eight 16 Gbps-capable ISLs for a combined bandwidth of up to 128 Gbps.
- **Extended Fabrics** extends SAN fabrics beyond the Fibre Channel standard of 10 km by optimizing internal switch buffers to maintain performance on ISLs connected at extended distances.
- **Server Application Optimization (SAO)** 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.
- **12 Port SW Upgrade** enables the SAN48B-5 switch with two additional increments of 12 ports that can be enabled on demand. The SAN48B-5 switch ships with the first 24 ports activated and populated in the base product. Each 12 Port 16Gbps SW Upgrade bundles the POD activation license and the corresponding amount of transceivers.
- **Integrated Routing** allows any 8 or 16 Gbps Fibre Channel port in the SAN48B-5 switch to be configured as an EX_Port supporting Fibre Channel Routing.
- **Integrated 10 Gbps Fibre Channel Activation** enables Fibre Channel ports on the SAN48B-5 switch to operate at 10 Gbps; this 10 Gbps Fibre Channel activation license must be installed before any port can run at 10 Gbps speed.
- **Enterprise Bundle** offers a convenient method with which to order a set of optional features that are bundled into one feature number. It includes one license for each of the following items: Extended Fabric, Advanced Performance Monitoring, Trunking Activation, Adaptive Networking, SAO, and Fabric Vision. The Fabric Vision license included in the enterprise bundle offers a collection of breakthrough features and tools that are bundled into an optional licensed feature. It includes Flow Vision and Monitoring and Alerting Policy Suite (MAPS) advanced technologies and capabilities.

Note: Some features do not apply or are unavailable when using the switch in Access Gateway mode.

IBM Network Advisor Software supports SAN48B-5 Gen 5 Fibre Channel technology by providing end-to-end management of data center fabrics from storage ports on networked storage systems to host bus adapters that are attached to physical or virtualized servers. IBM Network Advisor V12.0 or later is necessary to support transitions to cloud environments. IBM Network Advisor V12.1 or later is required to support Fabric Vision license capabilities.

Fabric Vision technology

Fabric Vision technology, an extension of Gen 5 Fibre Channel, provides a breakthrough hardware and software solution that helps simplify monitoring, maximize network availability, and dramatically reduce costs. Featuring innovative monitoring, management, and diagnostic capabilities, the SAN48B-5 switch with Fabric Vision technology enables administrators to avoid problems before they impact operations, helping organizations meet Service Level Agreements (SLAs).

Fabric Vision technology includes the following items:

- **Monitoring and Alerting Policy Suite (MAPS):** Provides a new, easy-to-use solution for policy-based threshold monitoring and alerting. MAPS proactively monitors the health and performance of the SAN infrastructure to ensure application uptime and availability. By leveraging pre-built, rule-based and policy-based templates, MAPS simplifies fabric-wide threshold configuration, monitoring, and alerting. Administrators can configure the entire fabric (or multiple fabrics) at one time using common rules and policies, or customize policies for specific ports or switch elements.
- **Fabric Performance Impact (FPI) Monitoring:** Uses predefined thresholds and alerts in conjunction with MAPS to automatically detect and alert administrators to severe levels of latency and identifies

slow drain devices that might impact the network. This feature uses advanced monitoring capabilities and intuitive MAPS dashboard reporting to indicate various latency severity levels, pinpointing exactly which devices are causing or impacted by a bottlenecked port.

- **Dashboards:** Provides integrated dashboards that display an overall SAN health view, along with details about out-of-range conditions, to help administrators easily identify trends and quickly pinpoint issues occurring on a switch or in a fabric.
- **Configuration and Operational Monitoring Policy Automation Services Suite (COMPASS):** Simplifies deployment, safeguards consistency, and increases operational efficiencies of larger environments with automated switch and fabric configuration services. Administrators can configure a template or adopt an existing configuration as a template and seamlessly deploy the configuration across the fabric. In addition, they can ensure that settings do not drift over time with COMPASS configuration and policy violation monitoring within IBM Network Advisor dashboards.
- **ClearLink Diagnostics:** Ensures optical and signal integrity for Gen 5 Fibre Channel optics and cables, simplifying deployment and support of high-performance fabrics. ClearLink Diagnostic Port (D_Port) is an advanced capability of Gen 5 Fibre Channel platforms.
- **Flow Vision:** Enables administrators to identify, monitor, and analyze specific application flows in order to simplify troubleshooting, maximize performance, avoid congestion, and optimize resources. Flow Vision includes these items:
 - **Flow Monitor:** Provides comprehensive visibility into flows within the fabric, including the ability to automatically learn flows and nondisruptively monitor flow performance. Administrators can monitor all flows from a specific host to multiple targets or logical unit numbers (LUNs), from multiple hosts to a specific target or LUN, or across a specific ISL. Additionally, they can do LUN-level monitoring of specific frame types to identify resource contention or congestion that is impacting application performance.
 - **Flow Generator:** Provides a built-in test traffic generator for pretesting and validating the data center infrastructure (including route verification and integrity of optics, cables, ports, back-end connections, and ISLs) for robustness before deploying applications.
- **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.

The Fabric Vision license is included with FOS V7.2 or later. After the switch is upgraded to FOS V7.2.0 or later and the Fabric Vision license is enabled, the Fabric Watch configuration and any Fabric Watch-related features are no longer supported.

Fabric Vision technology, an extension of Gen 5 Fibre Channel, provides a breakthrough hardware and software solution that helps simplify monitoring, maximize network availability, and dramatically reduce costs. Featuring innovative monitoring, management, and diagnostic capabilities, the SAN768B-2 and SAN384B-2 fabric backbones with Fabric Vision technology enables administrators to avoid problems before they impact operations, helping organizations meet service-level agreements (SLAs).

Specifications

Table 1 lists the IBM System Networking SAN48B-5 switch specifications.

Table 1. IBM System Networking SAN48B-5 switch specifications (part 1 of 2)

Item	Description
Product number	2498-F48
Base fabric switch	<p>Components: Two power distribution unit (PDU) jumpers, fixed rack-mount rail kit, installation guide in hardcopy, EZSwitchSetup, CD-ROM (with manuals), service tools, RJ-45 wrap tools, wrist strap, and a small form-factor pluggable (SFP) extraction tool. No SFPs are included in the base switch.</p> <p>Functions: Advanced Web Tools, Advanced Zoning, Enhanced Group Management, Fabric Watch, Full Fabric, Virtual Fabrics, and FOS V7.0 or later</p>
Fibre Channel interfaces	<p>Auto-sensing of 2, 4, 8, or 16 Gbps port speeds. 10 Gbps and optionally programmable to a fixed port speed. ClearLink diagnostic technology (D_Port), E_Port, EX_Port, Fabric Port (F_Port), and Mirror Port (M_Port). Optional port type control Access Gateway mode: F_Port and NPIV-enabled N_Port</p>
Transceivers	<ul style="list-style-type: none"> • 16 Gbps: hot-pluggable SFP+, LC connector, 16 Gbps short-wavelength (SWL), 16 Gbps long-wavelength (LWL), and 16 Gbps extra long-wavelength (ELW) • 10 Gbps: hot-pluggable, 10 Gbps SFP, and LC connector, 10 Gbps SWL, and 10 Gbps LWL • 8 Gbps: hot-pluggable SFP+ and LC connector, 8 Gbps SWL, 8 Gbps LWL, and 8 Gbps extra-long wavelength (ELW)
Hot-swap components	Power supplies, fan modules, and small form-factor pluggables (SFPs)
Nonrack support	Nonrack installation is supported. Country-specific power cords are required and must be ordered.
Management software	HTTP, SNMP v1/v3 (FE MIB and Fibre Channel Management MIB), and Secure Shell (SSH), auditing and syslog, Advanced Web Tools, Advanced Performance Monitoring, and Fabric Watch, IBM Network Advisor, and command line interface
Servers supported*	<ul style="list-style-type: none"> • IBM Power Systems™ • IBM System p® • IBM System x® • IBM z Systems • Other Intel processor-based servers with Linux, Microsoft Windows 2008, and Windows 2012 • Selected Sun and HP servers

* For more information, see the product details in the IBM System Storage Interoperation Center (SSIC): <http://www.ibm.com/systems/support/storage/ssic/interoperability.wss>

** The Enterprise Bundle includes one license for each of the following items: Trunking Activation, Advanced Performance Monitoring, Adaptive Networking, Server Application Optimization, Extended Fabrics, and Fabric Vision.

Table 1. IBM System Networking SAN48B-5 switch specifications (part 2 of 2)

Item	Description
Operating systems supported*	<ul style="list-style-type: none"> • Windows 2008 and Windows 2012 • Red Hat Linux and Red Hat Linux Advanced Server • SUSE® Linux and SUSE Linux Enterprise Server • IBM AIX® • Other selected operating systems
Storage products supported*	<ul style="list-style-type: none"> • IBM XIV® Storage System • IBM System Storage DS8000® storage servers • IBM FlashSystem™ • IBM System Storage SAN Volume Controller • IBM Storwize® V3700, V5000, and V7000 • Other selected storage systems
Fibre Channel switches supported	System Storage and TotalStorage b-type and m-type SAN directors, switches, and routers, and other directors, switches, and routers that are manufactured by Brocade
Fiber optic cable	Fiber optic cables with LC connectors are required and available in various lengths in single-mode and multimode formats.
Power cords	Jumper cables are included for installation. Country-specific power cords must be ordered for desktop/stand-alone installation.
Warranty	One year, customer-replaceable unit (CRU), and onsite, next-business-day response. Warranty service upgrades are available.
Optional features	SFPs, fiber optic cables, upgraded power supplies, and twelve-port Activation, FICON with CUP Activation, Advanced Performance Monitoring, Enterprise Bundle**, Extended Fabrics, Integrated Routing, ISL Trunking, and Integrated 10 Gbps Fibre Channel Activation

* For more information, see the product details in the IBM System Storage Interoperation Center (SSIC): <http://www.ibm.com/systems/support/storage/ssic/interoperability.wss>

** The Enterprise Bundle includes one license for each of the following items: Trunking Activation, Advanced Performance Monitoring, Adaptive Networking, Server Application Optimization, Extended Fabrics, and Fabric Vision.

Physical characteristics

Table 2 lists the physical characteristics for the IBM System Networking SAN48B-5 switch.

Table 2. Physical characteristics

Specification	Description
Size	Width: 43.8 cm (17.23 in.) Height: 4.3 cm (1.7 in.) Depth: 44.3 cm (17.45 in.)
Weight	9.16 kg (20.2 lb) (maximum ports fully populated)

Operating environment

Table 3 describes the operating environment for the IBM System Networking SAN48B-5 switch.

Table 3. Operating environment

Name	Description
Temperature (operating)	0°C to 40°C (32°F to 104°F)
Humidity (operating)	10% - 85% noncondensing at 40°C (104°F)
Altitude (operating)	Up to 3,000 m (9,842 ft)
Airflow	Rear panel-to-door airflow

Electrical requirements

Table 4 lists the electrical requirements for the IBM System Networking SAN48B-5 switch.

Table 4. Electrical requirements

Name	Description
Nominal input voltage	85 - 264 V ac, universal
Input line frequency	47 - 63 Hz
Heat dissipation	338 BTU/hr.
Inrush current	Maximum of 35 amps

Notes

1. For the most current information, see the Fabric Vision technology solution brief:
<http://ibm.co/1GWNDKc>

Related information

For more information, see the following resources:

- IBM System Networking SAN b-type family product page:
<http://ibm.com/systems/networking/switches/san/b-type/>
- IBM System Networking SAN48B-5 switch product page:
<http://ibm.com/systems/networking/switches/san/b-type/san48b-5/>
- IBM Offering Information page (announcement letters and sales manuals):
http://www.ibm.com/common/ssi/index.wss?request_locale=en

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