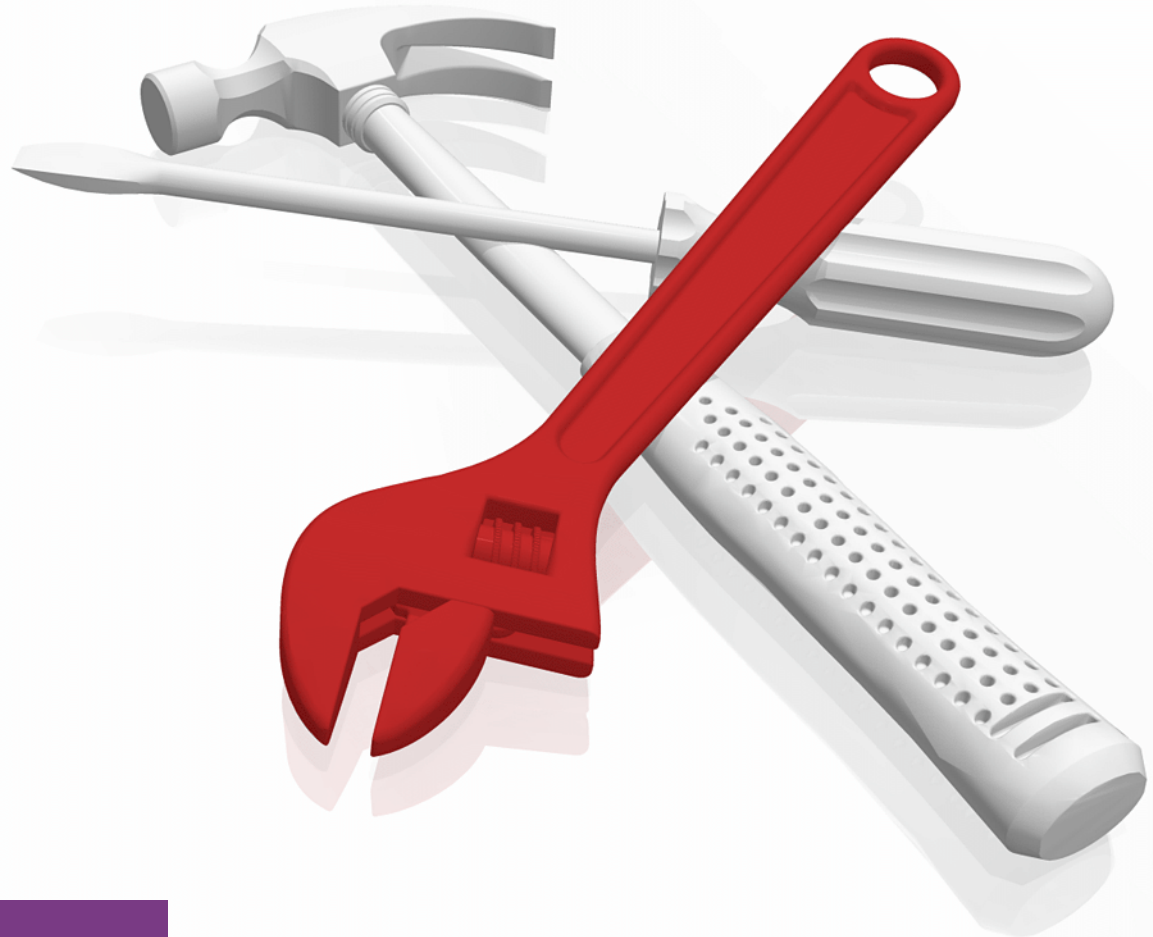


IBM Storage Networking SAN64B-6 Switch

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Storage

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This IBM® Redbooks® product guide describes the IBM Storage Networking SAN64B-6 switch. Faced with explosive data growth, data centers need more input/output (IO) capacity to accommodate massive amounts of data, applications, and workloads. In addition to this surge in data, users expect applications to be available and accessible from anywhere, at any time, on any device.

To meet these business demands, organizations need to deploy and scale up applications quickly, moving to higher virtual machine densities, and deploying flash storage to help those applications scale to support thousands of users. To realize the full benefits of these architectures, organizations treat the network as a strategic part of a highly virtualized environment to increase optimization and efficiency to support rapid scalability.

The SAN64B-6 switch is designed to meet the demands of hyper-scale virtualization, larger cloud infrastructures, and growing flash-based storage environments by delivering market-leading Gen 6 Fibre Channel technology and capabilities.

SAN64B-6 delivers unmatched 32/128 gigabits per second (Gbps) performance, industry-leading port density, and built-in instrumentation to accelerate data access, drive always-on business, and support data center consolidation in small to large-scale enterprise infrastructures.

SAN64B-6 is built for maximum flexibility, scalability, and ease of use supporting “pay-as-you grow” scalability from 24 to 64 ports, with 48 enhanced small-form-factor pluggable (SFP+) and four Q-Flex ports, in an efficient 1U package.

Figure 1 shows the SAN64B-6 switch.

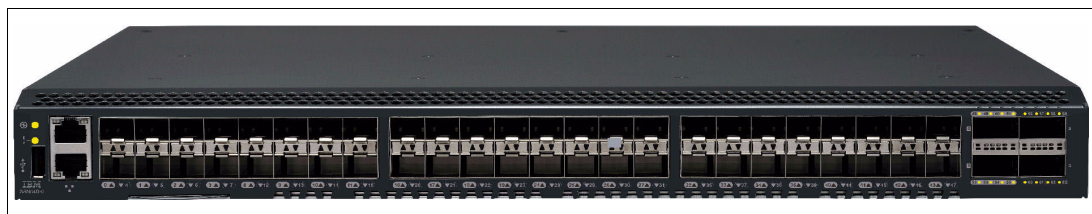


Figure 1 SAN64B-6 switch

Did you know?

The IBM SAN64B-6 switch provides the following benefits:

- ▶ Meet demands of virtualization, cloud, and flash-based storage
- ▶ Deliver market-leading Gen 6 Fibre Channel technology and capabilities
- ▶ Provide scalability to support growth, demanding workloads, and data center consolidation

Product highlights

The IBM SAN64B-6 switch has the following highlights:

- ▶ Provide high scalability in an ultra-dense, 1U, 64-port switch to support high-density server virtualization, cloud architectures, and flash-based storage environments.
- ▶ Increase performance for demanding workloads across 32 Gbps links. Shatter application performance barriers with up to 100 million input/output operations per second (IOPS).
- ▶ Enable “pay-as-you-grow” scalability for on-demand flexibility.
- ▶ Detect degraded application performance with built-in device latency and IOPS metrics.
- ▶ Optimize end-to-end performance and availability tuning with IO Insight and VM Insight intelligence.

Product overview

The SAN64B-6 with Gen 6 Fibre Channel, Fabric Vision technology with IO Insight and VM Insight delivers unmatched 32/128 Gbps performance for application acceleration, industry-leading port density for data center consolidation, and built-in instrumentation for deep network monitoring and diagnostics, all managed with a command-line interface (CLI), b-type Advanced Web Tools, or with IBM Network Advisor.

Gen 6 Fibre Channel

Gen 6 Fibre Channel is the purpose-built network infrastructure for mission-critical storage, delivering breakthrough performance, increased scalability, and operational stability. The SAN64B-6 with Gen 6 Fibre Channel, Fabric Vision technology with IO Insight and VM Insight delivers unmatched 32/128 Gbps performance, industry-leading port density, and built-in instrumentation.

These next-generation storage networking technologies and capabilities enable the SAN64B-6 to accelerate data access, adapt to evolving requirements, and drive always-on business operations for hyper-scale virtualization, larger cloud infrastructures, and growing flash-based storage environments.

Fabric Vision technology

Fabric Vision technology provides unprecedented insight and visibility across the storage network with powerful built-in monitoring, management, and diagnostic tools that enable organizations to complete the following tasks:

- ▶ Simplify monitoring:
 - Deploy more than 20 years of storage networking best practices in predefined, threshold-based rules, actions, and policies with a single click
 - Automatically detect degraded application and device performance with the industry’s first built-in IO Insight device latency and IOPS metrics monitoring tool
 - Gain comprehensive visibility into network health, performance, latency, and congestion issues in the fabric, using browser-accessible dashboards with drill-down capabilities

- ▶ Increase availability:
 - Avoid 50% of common network problems with proactive monitoring and advanced diagnostic tools that address problems before they impact operations
 - Identify hot spots and automatically mitigate network problems (*before* they impact application performance) through intuitive reporting, trend analysis, and integrated actions
 - Minimize downtime and accelerate troubleshooting with live monitoring, integrated diagnostics, and point-in-time playback
- ▶ Dramatically reduce costs:
 - Eliminate nearly 50% of maintenance costs through automated testing and diagnostic tools that validate the health, reliability, and performance of the network prior to deployment
 - Save up to millions of dollars on capital expenditure (CapEx) costs by eliminating the need for expensive third-party tools through built-in monitoring and diagnostics
 - Leverage specialized tools for pre-testing and validating IT infrastructure to accelerate deployment, simplify support, and reduce operational costs

Maximize performance for application and solid-state storage architectures

Faced with unpredictable virtualized workloads and growing flash storage environments, organizations need to ensure that the network does not become the bottleneck. The SAN64B-6 delivers increased performance for growing and dynamic workloads through a combination of market-leading throughput and low latency across 32 Gbps and 128 Gbps links.

With Gen 6 application-specific integrated circuit (ASIC) technology providing up to 566 million frames switched per second, the SAN64B-6 switch shatters application performance barriers with up to 100 million IOPS to meet the demands of flash-based storage workloads. At the same time, port-to-port latency is minimized to 700 nanoseconds (ns) through the use of cut-through switching at 32 Gbps.

With 48 SFP+ ports and 4 Q-Flex ports, each providing four 32 Gbps connections, the SAN64B-6 can scale up to 64 device ports for an aggregate throughput of 2 terabits per second (Tbps). Moreover, each Q-Flex port is capable of 128 Gbps parallel Fibre Channel for device or inter-switch link (ISL) connectivity, enabling administrators to consolidate and simplify cabling infrastructure.

Administrators can achieve optimal bandwidth utilization, high availability, and load balancing by combining up to eight ISLs in a 256 Gbps framed-based trunk. This can be achieved through eight individual 32 Gbps SFP+ ports or two 4 × 32 Gbps quad small form-factor pluggable (QSFP) ports.

In addition, exchange-based Dynamic Path Selection (DPS) optimizes fabric-wide performance and load balancing by automatically routing data to the most efficient, available path in the fabric. This augments b-type ISL Trunking to provide more effective load balancing in certain configurations.

Simplify scalability and management complexity

The SAN64B-6 features up to 64 Fibre Channel ports in an efficiently designed 1U form factor, delivering industry-leading port density and space utilization for simplified scalability and data center consolidation. With this high-density design, organizations can pack more into a single data center with a smaller footprint, reducing costs and management complexity.

Designed for maximum flexibility and value, this enterprise-class switch offers “pay-as-you-grow” scalability with Ports on Demand (PoD) capability. Organizations can quickly, easily, and cost-effectively scale from 24 to 64 ports with a combination of 12-port SFP+ PoD and 16-port Q-Flex PoD.

Each of the 48 SFP+ ports supports 4, 8, 10, 16, and 32 Gbps Fibre Channel speeds, while each of the 4 Q-Flex ports is capable of supporting 4x32 Gbps, or 128 Gbps, Fibre Channel speeds. In addition, Q-Flex ports are designed to support QSFP optics to deliver 4-to-1 cable consolidation (combining four cables into one cable per port).

SAN64B-6 ports are available for device port or ISL port connectivity. As such, Q-Flex ports can be used as ISLs to provide simple build-out of fabrics, with more switching bandwidth. In addition, flexible, high-speed 32 Gbps and 16 Gbps optics allow organizations to deploy bandwidth on demand to meet growing data center needs. With its flexible PoD capability, the SAN64B-6 provides excellent overall value, and the agility needed to deliver rapid deployments to meet user demands and support higher growth.

Along with providing best-in-class scalability, the SAN64B-6 simplifies end-to-end network management by automating monitoring and diagnostics through Fabric Vision technology. The switch is easy to deploy with the EZSwitchSetup wizard, and provides validation prior to deployment with the ClearLink Diagnostic Ports (D_Ports) feature. For maximum flexibility, the switch also features dual airflow direction options to support the latest hot aisle/cold aisle configurations.

Gain control and insight to quickly identify problems and meet critical SLAs

The SAN64B-6, with Gen 6 technology and built-in instrumentation, helps organizations achieve greater insight and control so that critical SLAs can be met.

IO Insight monitoring gathers IO statistics, including device latency and IOPS metrics, to provide intelligence for early detection of application and device-level performance degradations. If VM Insight capabilities are supported within the ecosystem along with IO Insight, then individual virtual machine metrics can also be monitored.

Administrators can also use this information to configure policy-based monitoring and alerting, and set thresholds in order to be alerted if there is a degradation of application or device-level performance. They can then proactively monitor against SLAs, reduce time to resolution, obtain crucial insight for troubleshooting, and take action to optimize end-to-end performance to ensure the highest levels of availability.

IO Insight and VM Insight monitoring enables administrators to achieve the following goals:

- ▶ Gain deep insights into the performance and availability across physical and virtual infrastructures
- ▶ Quickly identify issues and understand key performance, health, and utilization trends
- ▶ Monitor application flows with no physical taps, no downtime, and no disruption
- ▶ Ensure that the end-to-end storage infrastructure is tuned to optimize performance and safeguard operational stability

Forward Error Correction (FEC) capabilities further increase resiliency by automatically detecting and recovering network transmission errors. To ensure predictable performance before deployment, organizations can validate infrastructure with ClearLink Diagnostics and Flow Generator features, and benchmark end-to-end or device-level performance using IO Insight.

Also, if VM Insight capabilities are supported within the ecosystem, then individual virtual machine metrics can be benchmarked and monitored.

Simplified management and robust network analytics

Fabric Vision technology provides a breakthrough hardware and software solution that helps simplify monitoring, maximize network availability, and dramatically reduce costs. Featuring innovative monitoring, management, and diagnostic capabilities, Fabric Vision technology enables administrators to avoid problems before they affect operations, helping their organizations meet SLAs. Fabric Vision technology includes the following components:

- ▶ **IO Insight:** Proactively and non-intrusively monitors application and device-level IO and latency to gain deep insights into performance and availability, ensuring predictable performance and operational stability.
- ▶ **VM Insight:** Monitors virtual machine (VM) performance throughout a storage fabric to quickly determine the source of VM/application performance anomalies and fine-tune the infrastructure based on VM/application requirements.
- ▶ **Monitoring and Alerting Policy Suite (MAPS):** Leverages pre-built, rule and policy-based templates within MAPS to simplify fabric-wide threshold configuration, monitoring, and alerting. Administrators can configure the entire fabric (or multiple fabrics) at one time using common rules and policies, or customize policies for specific ports or switch elements. In addition, administrators can include IO Insight and VM Insight metrics in MAPS policies to be notified of performance degradation.
- ▶ **Fabric Performance Impact (FPI) monitoring:** Leverages predefined MAPS policies to automatically detect and alert administrators to different latency severity levels, and to identify slow drain devices that could affect network performance. This feature identifies various latency severity levels, pinpointing exactly which devices are causing or are impacted by a bottlenecked port, and quarantines slow drain devices automatically to prevent buffer credit “starvation.”
- ▶ **Dashboards:** Provides integrated dashboards that display an overall storage area network (SAN) health view, including 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, to seamlessly deploy a configuration across the fabric. In addition, they can ensure settings do not drift over time, using COMPASS configuration and policy violation monitoring within IBM Network Advisor dashboards.
- ▶ **ClearLink Diagnostics:** Ensures optical and signal integrity for Fibre Channel optics and cables, simplifying deployment and support of high-performance fabrics. ClearLink Diagnostic Port (D_Port) is an advanced capability of Fibre Channel platforms.

- ▶ **Flow Vision:** Enables administrators to identify, monitor, and analyze specific application flows in order to simplify troubleshooting, maximize performance, avoid congestion, and optimize resources. Flow Vision includes the following components:
 - **Flow Monitor:** Provides comprehensive visibility, automatically learns, and non-disruptively monitors 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/LUN, or across a specific ISL. Additionally, they can perform LUN-level monitoring of specific frame types to identify resource contention or congestion that is impacting application performance.

With IO Insight capability, administrators can monitor first IO response time, IO completion time, number of pending IOs, and IOPS metrics for a flow from a specific host to a target or LUN.
 - **Flow Generator:** Provides a built-in traffic generator for pre-testing and validating the data center infrastructure for robustness (including route verification and integrity of optics, cables, ports, back-end connections, and ISLs) before deploying applications.
 - **Flow Mirroring:** Provides the ability to non-disruptively create copies of specific application and data flows or frame types that can be captured for in-depth analysis.
- ▶ **Forward Error Correction (FEC):** Enables recovery from bit errors in device connections and ISLs, enhancing transmission reliability and performance.
- ▶ **Credit Loss Recovery:** Helps overcome performance degradation and congestion due to buffer credit loss.

IBM Network Advisor

IBM Network Advisor simplifies Gen 6 Fibre Channel management and helps organizations proactively diagnose and resolve issues to maximize uptime, increase operational efficiency, and reduce costs. The wizard-driven interface dramatically reduces deployment and configuration times by allowing fabrics, switches, and ports to be managed as groups. Customizable, immediately available dashboards graphically display performance and health indicators, including all data captured using Fabric Vision technology.

To accelerate troubleshooting, administrators can use dashboard playback to quickly review past events and identify problems in the fabric. Dashboards and reports can also be configured to show only the most relevant data, enabling administrators to more efficiently prioritize their actions and maintain network performance.

Fabric Operating System and management software

The Fabric Operating System (FOS), included with the SAN64B-6 Gen 6 Fibre Channel switch, contains all of the functions that are necessary to operate the base system. These switches require FOS V8.01 or later and IBM Network Advisor 14.0 or later to take advantage of the advanced Gen 6 functions that are delivered through Fabric Vision technology.

The Fabric OS for the SAN64B-6 switch is enabled with the following features:

- ▶ **Web Tools:** Enable graphical user interface (GUI)-based administration, configuration, and maintenance of fabric switches and SANs.
- ▶ **Advanced Zoning:** Segments a fabric into virtual private SANs to restrict device communication and apply certain policies only to members within the same zone.

- ▶ **Full Fabric:** Enables E_Ports and allows SAN64B-6 switches to connect to other switches.
- ▶ **Virtual Fabrics:** Enable a physical switch to be partitioned into independently managed logical switches, each with its own data, control, and management paths.

Optional licenses for additional capabilities

The features listed in Table 1 are offered as options for the SAN64B-6 switch.

Table 1 Available additional capabilities

Feature	Feature code	Description
Integrated routing	7407	Enables any Fibre Channel port to be configured as an EX_Port that supports Fibre Channel Routing (FCR), providing improved scalability and fault isolation, along with multi-vendor interoperability.
Enterprise Bundle	7420	The enterprise bundle includes additional features: <ul style="list-style-type: none"> ▶ Extended Fabrics: Extend SAN fabrics beyond the Fibre Channel standard of 10 kilometers (km) by optimizing internal switch buffers to maintain performance on ISLs that are connected at extended distances. ▶ ISL Trunking: Enables Fibre Channel frames 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. SAN64B-6 switches add enhanced ISL Trunking support using 32 Gbps ports, and enable Fibre Channel packets to be distributed across up to eight 32 Gbps-capable ISLs for a combined bandwidth of up to 256 Gbps. ▶ Fabric Vision: This license offers a collection of breakthrough features and tools that are bundled into an optional licensed feature. It includes Flow Vision, IO Insight, VM Insight, and Monitoring and Alerting Policy Suite (MAPS) advanced technologies and capabilities. Fabric Vision requires FOS V8.01 or later.
IBM FICON® Enterprise Bundle	7421	The FICON Enterprise Bundle includes all of the Enterprise Bundle functionality, and this additional feature for FICON configurations: <ul style="list-style-type: none"> ▶ FICON with Control Unit Port (CUP) activation: Provides in-band management of the supported SAN b-type switch and director products by system automation for IBM z/OS®, performance data for IBM Resource Measurement Facility™ (IBM RMF™), and to provide unsolicited status to IBM MVS™.

A building block for virtualized, private cloud

The SAN64B-6 provides a critical building block for today's highly virtualized and cloud environments. It both simplifies server virtualization and meets the high-throughput demands of solid state drives (SSDs). It also supports multitenancy in cloud environments through virtual fabrics, quality of service (QoS), and fabric-based zoning features. In addition, it provides efficient link utilization and security, with up to 64 Gbps of in-flight encryption and 64 Gbps of data compression over ISLs.

Organizations can have up to four ports at 16 Gbps of in-flight encryption and data compression per SAN64B-6. Internal fault-tolerant and enterprise-class reliability, availability, and serviceability (RAS) features help minimize downtime to support mission-critical cloud environments.

Access Gateway mode

The SAN64B-6 can 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 utilizes N_Port ID Virtualization (NPIV) switch standards to present physical and virtual servers directly to the core of SAN fabrics.

This makes it transparent to the SAN fabric, greatly reducing management of the network edge. The SAN64B-6 in Access Gateway mode can connect servers to NPIV-enabled b-type, or other SAN fabrics.

Organizations can easily enable Access Gateway mode with IBM Network Advisor or a CLI. Access Gateway mode includes the following key benefits:

- ▶ 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

Specifications

The SAN64B-6 has two airflow options.

Airflow options:

The SAN64B-6 offers two airflow options, either non-port side intake (NPI) or non-port side exhaust (NPE) airflow, providing greater rack installation flexibility. The IT administrator can use the airflow option that best suits the cooling strategy within their data center.

Note that the two power-fan assemblies must match airflow direction. All replacement field-replaceable unit (FRU) assemblies must match the direction of the original assemblies being replaced.

Table 2 lists the system architecture specifications for the SAN64B-6 switch.

Table 2 System architecture

Feature	Description
Product number	8960-F64 (Front/Port-Side Exhaust). 8960-N64 (Rear/Non-Port Side Exhaust).
Fibre Channel ports	Switch mode (default): Minimum of 24 ports and maximum of 64 ports configuration. Port numbers above minimum are enabled through 12-port SFP+ increments with Ports on Demand (PoD) licenses, and through one 4-port QSFP PoD, providing 16-port increments through a Q-Flex license: E_Ports, F_Ports, D_Ports, and EX_Ports. Access Gateway default port mapping: 40 SFP+ F_Ports, 8 SFP+ N_Ports.
Scalability	Full-fabric architecture with a maximum of 239 switches.
Certified maximum	6,000 active nodes; 56 switches, 19 hops in Fabric OS fabrics; larger fabrics certified as required.
Fibre Channel performance	<ul style="list-style-type: none"> ▶ 4.25 Gbps line speed, full duplex. ▶ 8.5 Gbps line speed, full duplex. ▶ 10.53 Gbps line speed, full duplex. ▶ 14.025 Gbps line speed, full duplex. ▶ 28.05 Gbps, full duplex. ▶ Auto-sensing of 4, 8, 16, 32 Gbps port speeds and capable of supporting 128 Gbps speeds. ▶ 10 Gbps optionally programmable to fixed port speed.
ISL trunking	Frame-based trunking with up to eight 32 Gbps ports per ISL trunk; up to 256 Gbps per ISL trunk. Exchange-based load balancing across ISLs with DPS included in Fabric OS.
Aggregate bandwidth	2 Tbps.
Maximum fabric latency	Latency for locally switched ports is 700 ns; encryption/compression is 1 µsec per node.
Maximum frame size	2,112-byte payload.
Frame buffers	15,360 dynamically allocated.
Classes of service	Class 2, Class 3, Class F (inter-switch frames).
Port types	<ul style="list-style-type: none"> ▶ D_Port (ClearLink Diagnostic Port), E_Port, EX_Port, F_Port, AE_Port optional port-type control. ▶ b-type Access Gateway mode: F_Port and NPIV-enabled N_Port.
Data traffic types	Fabric switches supporting unicast.
Hot-swap components	Power supplies, fan modules, SFPs.
Warranty	One-year; customer-replaceable unit (CRU); and onsite, next-business-day response; warranty service upgrades are available.

Feature	Description
Media types	<ul style="list-style-type: none"> ▶ 32 Gbps: SAN64B-6 requires b-type hotpluggable SFP+, LC connector; 32 Gbps SWL. ▶ 16 Gbps: SAN64B-6 requires b-type hotpluggable SFP+, LC connector; 16 Gbps SWL. ▶ 10 Gbps: SAN64B-6 requires b-type hotpluggable SFP+, LC connector; 10 Gbps SWL. ▶ 128 Gbps: SAN 64B-6 requires b-type hot-pluggable QSFP, MPO connector; 128 SWL Fibre Channel distance subject to fiber-optic cable and port speed.
USB	One USB port for system log file downloads or firmware upgrades.
Fabric services ^a	<ul style="list-style-type: none"> ▶ Monitoring and Alerting Policy Suite (MAPS). ▶ Flow Vision. ▶ Adaptive Networking (Ingress Rate Limiting, Traffic Isolation, QoS). ▶ Fabric Performance Impact (FPI) monitoring. ▶ Slow Drain Device Quarantine (SDDQ). ▶ Advanced Zoning (default zoning, port/WWN zoning, broadcast zoning, peer zoning, target-driven zoning). ▶ Dynamic Fabric Provisioning (DFP). ▶ Dynamic Path Selection (DPS). ▶ Extended Fabrics; Enhanced BB Credit Recovery. ▶ FDMI; Frame Redirection. ▶ Framebased Trunking; Fibre Channel shortest path first (FSPF). ▶ Integrated Routing. ▶ Internet Protocol over Fibre Channel (IPFC). ▶ ISL Trunking. ▶ Management Server. ▶ NPIV; Time Server. ▶ Registered State Change Notification (RSCN). ▶ Reliable Commit Service (RCS). ▶ Simple Name Server (SNS). ▶ Virtual Fabrics (Logical Switch, Logical Fabric). ▶ Read Diagnostics Parameter (RDP).
Extension	<ul style="list-style-type: none"> ▶ Fibre Channel, in-flight compression (b-type LZO) and encryption (AES-GCM-256); integrated optional. ▶ 10 Gbps Fibre Channel for dense wavelength division multiplexing (DWDM) metropolitan area network (MAN) connectivity.

a. Some fabric services do not apply or are unavailable in Access Gateway mode.

Table 3 lists the management features of the SAN64B-6 switch.

Table 3 Management features

Feature	Description
Supported management software	<ul style="list-style-type: none"> ▶ HTTP, SNMP v1/v3 (FE MIB, FC Management MIB), SSH; Auditing, Syslog; NTP v3 ▶ Advanced Web Tools ▶ IBM Network Advisor SAN Enterprise or IBM Network Advisor SAN Professional/Professional Plus ▶ EZSwitch ▶ Command Line Interface (CLI) ▶ SMI-S compliant ▶ REST AP ▶ Administrative Domains ▶ Trial licenses for add-on capabilities

Feature	Description
Security	<ul style="list-style-type: none"> ▶ AES-GCM-256 encryption on ISLs ▶ DH-CHAP (between switches and end devices) ▶ FCAP switch authentication ▶ HTTPS ▶ IPsec ▶ IP filtering ▶ LDAP with IPv6 ▶ OpenLDAP ▶ Port Binding ▶ RADIUS ▶ TACACS+ ▶ User-defined Role-Based Access Control (RBAC) ▶ Secure Copy (SCP) ▶ Secure RPC ▶ Secure Syslog ▶ SFTP ▶ SSH v2 ▶ SSL ▶ Switch Binding ▶ Trusted Switch
Management access	10/100/1000 Mbps Ethernet (RJ-45), in-band over Fibre Channel, serial port (RJ-45), and one USB port
Diagnostics	<ul style="list-style-type: none"> ▶ ClearLink optics and cable diagnostics, including electrical/optical loopback, link traffic/latency/distance ▶ Flow mirroring ▶ Built-in flow generator ▶ POST and embedded online/offline diagnostics, including environmental monitoring, FCping and Pathinfo (FC traceroute), frame viewer, nondisruptive ▶ Daemon restart, optics health monitoring, power monitoring, RATrace

Table 4 lists the mechanical characteristics of the SAN64B-6 switch.

Table 4 Mechanical characteristics

Item	Description
Enclosure	<ul style="list-style-type: none"> ▶ Front-to-back airflow; non-port-side exhaust; power from back, 1U ▶ Back-to-front airflow; non-port-side intake; power from back, 1U
Size	Width: 44.00 cm (17.32 in.) Height: 4.39 cm (1.73 in.) Depth: 35.56 cm (14 in.)
System weight	7.73 kg (17 lb) with two power supply FRUs, without transceivers.

Table 5 lists the environmental characteristics of the SAN64B-6 switch.

Table 5 Environmental characteristics

Item	Description
Operating environment	Temperature: 0°C to 40°C/32°F to 104°F Humidity: 10% to 85% (non-condensing)
Non-operating environment	Temperature: -25°C to 70°C/-13°F to 158°F Humidity: 10% to 90% (non-condensing)

Item	Description
Operating altitude	Up to 3,000 m (9,842 ft.)
Storage altitude	Up to 12 km (39,370 ft.)
Shock	<ul style="list-style-type: none"> ▶ Operating: Up to 20 G, 6 ms half-sine ▶ Non-operating: Half-sine, 33 G 11 ms, 3/eg axis
Vibration	<ul style="list-style-type: none"> ▶ Operating: 0.5 g sine, 0.4 grms random, 5 - 500 Hz ▶ Non-operating: 2.0 g sine, 1.1 grms random, 5 - 500 Hz
Heat dissipation	64 ports at 716 BTU per hour

Table 6 lists the electrical specifications of the SAN64B-6 switch.

Table 6 Electrical specifications

Item	Description
Power supply	Dual, hot-swappable redundant power supplies with integrated system cooling fans Two airflow options available: Non-port side intake and non-port side exhaust
AC input	90 V to 264 V ~3.5 A
AC input line frequency	47 Hz to 63 Hz
AC power consumption	<ul style="list-style-type: none"> ▶ 206 W with all 64 ports populated with 48 × 32 Gbps SFP+ SWL optics and 4× (4 × 32 Gbps) QSFP SWL optics ▶ 85 W for empty chassis with no optics

Related information

For more information, see the following links:

- ▶ IBM SAN64B-6 product page
<https://www.ibm.com/us-en/marketplace/san64b-6>
- ▶ IBM Network Advisor, TIPS1124
<https://www.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=TS012443USEN&>
- ▶ Fabric Vision Technology, REDP5400
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On this page, enter SAN64B-6, select the information type, and then click **Search**. On the next page, narrow your search results by geography and language.

Authors

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REDP-5399-00

ISBN 0738455679

Printed in U.S.A.

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