

## IBM Storage Networking SAN128B-6 Switch



The IBM Storage Networking SAN128B-6 high-density switch scales easily to support storage growth, demanding workloads, and data center consolidation.

### Highlights

- Adapt to storage growth and demanding workloads a high-density 128-port 32 Gbps b-type Gen 6 Fibre Channel switch
- Optimize performance and enhance reliability with advanced monitoring for NVMe
- Integrate NVMe-ready solutions without a rip-and-replace
- Accelerate operations with simple and open automation that increases productivity
- Simplify end-to-end management of large-scale environments by automating repetitive administrative tasks
- Provide proactive, real-time monitoring and alerting of storage IO health and performance with integrated network sensors
- Enable Virtual Machine (VM) visibility in a storage fabric to monitor and optimize VM performance, and identify VM anomalies

## Gen 6 Fibre Channel

IBM Storage Networking b-type Gen 6 Fibre Channel is the purpose-built network infrastructure for mission-critical storage, delivering NVMe-ready performance, advanced automation, and comprehensive management to accelerate application performance and drive always-on business operations. The IBM Storage Networking SAN128B-6 Switch with Gen 6 Fibre Channel and Fabric Vision technology delivers outstanding 32/128 Gbps performance, industry-leading port density, and automated operations to support storage growth, demanding workloads, and data center consolidation.

### Accelerate business operations with NVMe and automation

Data centers are under pressure to deliver maximum performance, business intelligence, and operational efficiency to address exponential data growth and dynamic business demands. To gain the performance required, organizations are transitioning to the all-flash data center, which requires a modern storage network that can keep pace with innovations in compute and storage resources. By modernizing the SAN, organizations will be able to maximize productivity and increase the efficiency of their storage investments, even as they rapidly scale their environments. Moreover, the addition of automation technology to Gen 6 Fibre Channel will transform SAN management by simplifying operations and freeing up resources to focus on business optimization and revenue opportunities.

The IBM® Storage Networking SAN128B-6 Fibre Channel switch provides the tools to optimize NVMe storage and automate SAN management tasks. It is a high port density building block with a management platform designed to support application, data, and storage growth. As an NVMe-ready switch, the SAN128B-6 allows organizations to seamlessly integrate b-type Gen 6 Fibre Channel networks with the next generation of flash storage, without a disruptive rip-and-replace. In addition, the SAN128B-6 features integrated network sensors for advanced monitoring of NVMe workloads, helping to ensure optimal performance.

The SAN128B-6 also delivers new automation capabilities that enable DevOps resources to automate and orchestrate SAN resources through open APIs and the Ansible automation engine. With IBM b-type storage network automation, organizations can quickly and reliably perform resource-intensive tasks, such as provisioning, and operationalize the continuous monitoring of the network, so that tasks can be completed in a fraction of the time. By combining b-type robust set of data collecting capabilities with b-type storage networking automation, organizations can automate repetitive daily tasks and deliver consistent performance by eliminating human error.

With the SAN128B-6, organizations can seamlessly transition to an all-flash data center and build a foundation to support future innovation and operational efficiency.

### Simple and Elegant Scalability with Industry-Leading Port Density

The SAN128B-6 enterprise-class switch delivers industry-leading port density with 128 Fibre Channel ports in an elegant 2U form factor. Organizations can both increase scalability and optimize space utilization. With 96 32 Gbps SFP+ ports and 8 4×32 Gbps Q-Flex ports, the compact design of the switch enables data centers to scale efficiently and deliver more connectivity with fewer switches. Built to support maximum flexibility and dense Fibre Channel fabrics, the SAN128B-6 Switch offers cost-effective pay-as-you-grow scalability, expanding from 48 to 128 ports with Ports on Demand (PoD).

Each Q-Flex port can support 128 Gbps parallel Fibre Channel for device or ISL connectivity with MTP/MPO cables, MTP/MPO to LC breakout cables, or patch panels, enabling administrators to consolidate and simplify cabling infrastructure. Each Q-Flex port is capable of 4×32 Gbps, 4×16 Gbps, 4×8 Gbps, or 4×4 Gbps Fibre Channel speeds. Q-Flex ports can be used to form dense, high-performance ISLs between the SAN128B-6 and the 32 Gbps high-density 128 port blade in the b-type Gen 6 directors, freeing up SFP+ ports for device connectivity. The switch also provides ISL trunking for up to 8 ports between a pair of switches to form a single logical ISL.

In addition to offering 128 32 Gbps ports, the SAN128B-6 delivers Gen 6 Fibre Channel performance to support growing and dynamic workloads. It achieves this level of performance through a combination of market-leading low latency and up to 566 million frames switched per second—shattering application performance barriers with up to 200 million IOPS. At the same time, port-to-port latency is minimized to < 780 ns (including FEC) through the use of cut-through switching. As a result, the SAN128B-6 provides both elegant scalability and powerful performance to stay ahead of the demands of flash storage workloads.

To support higher data volumes over long distance, the SAN218B-6 delivers up to 384 Gbps of combined in-flight encryption and 192 Gbps of in-flight data compression to optimize bandwidth and minimize the risk of unauthorized access. Moreover, internal fault-tolerant and enterprise-class RAS features help minimize downtime to support growing mission-critical environments.

### **Increase Productivity with Simple and Open Automation**

IT organizations spend nearly half of their time performing repetitive daily management tasks, such as zoning, inventory reporting, and operational validation checks (Rob Brothers, “Market Analysis Perspective: Worldwide Software and Hardware Support and Deployment Services, 2015,” IDC, June 2015.

[http://www.servicenetwork.org/wp-content/uploads/2016/02/IDC\\_Software-and-Hardware-Support\\_Deploy-Svcs-Report\\_June2015.pdf](http://www.servicenetwork.org/wp-content/uploads/2016/02/IDC_Software-and-Hardware-Support_Deploy-Svcs-Report_June2015.pdf)). By automating these repetitive tasks, IT organizations can significantly improve their efficiency and dramatically decrease the risk of operational mistakes. Automation in large-scale IT environments integrates diverse infrastructure components with consistency and predictability to deliver greater operational efficiency and agility. With more than 20 years of b-type storage networking experience, IBM understands the nuances that go into infrastructure management and what tasks can benefit from automation. By introducing REST APIs directly into its switch and management products, IBM offers through its b-type Storage Networking portfolio a broad range of choices to enable any SAN management solution. IT organizations that couple IBM’s robust data collecting capabilities with automation and orchestration tools (such as Ansible) gain the ability to automate configuration tasks and the visibility to monitor and detect any performance or health changes.

IBM’s b-type storage networking automation solutions are based on these pillars:

- Make standard REST APIs available directly from the switch to automate repetitive daily tasks, such as fabric inventory, provisioning, and operational state monitoring.
- Quickly integrate systems with open source PyFOS, a Python language, to simplify common SAN management practices.
- Leverage Ansible to easily scale automation and orchestration across the entire infrastructure.

## Enhanced Operational Stability for Always-on Business Operations

The SAN128B-6 with Fabric Vision® technology delivers a breakthrough hardware and software solution that helps simplify monitoring, increase operational stability, and dramatically reduce costs. Fabric Vision technology includes IO Insight and VM Insight, which provides organizations with deeper visibility into both SCSI and NVMe traffic. This enhanced visibility enables administrators to quickly identify the problem and accelerate root-cause analysis for faster time to resolution. The SAN128B-6 also optimizes the performance of NVMe over Fibre Channel by leveraging integrated, non-intrusive, real-time network monitoring and alerts. This proactive monitoring of NVMe traffic provides administrators with key insights for maintaining optimal network health and performance.

IO Insight proactively monitors IO performance and behavior through integrated network sensors, providing deep insight into problems and helping to ensure service levels. This capability non-disruptively and non-intrusively gathers IO statistics from any device port, then feeds them to a monitoring policy that sets thresholds and generates alerts. VM Insight applies IO Insight visibility for each VM. Integrated VM, application-, and device-level IO latency and IOPS monitoring enables administrators to set the baseline for application performance and identify the VM or physical layer responsible for the degraded performance.

Innovative Fabric Vision monitoring, management, and diagnostic capabilities enable administrators to avoid problems before they impact operations. Fabric Vision capabilities include the following:

- **Monitoring and Alerting Policy Suite (MAPS):** Simplifies fabric-wide threshold configuration, monitoring, and alerting with pre-built, rule- or policy-based templates. 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 use IO Insight metrics to set thresholds in MAPS policies to be notified of application, VM, and storage IO performance degradation.
- **Fabric Performance Impact (FPI) Monitoring:** Uses 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 SAN health view, along with details on out-of-range conditions, to help administrators easily identify trends and quickly pinpoint issues occurring on a switch or in a fabric.
- **Configuration and Operational Monitoring Policy Automation Services Suite (COMPASS):** Simplifies deployment, safeguards consistency, and increases operational efficiencies of larger environments with automated switch and fabric configuration services. Administrators can configure a template or adopt an existing configuration to seamlessly deploy a 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 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 to simplify troubleshooting, maximize performance, avoid congestion, and optimize resources. Flow Vision includes these applications:
  - **Flow Monitor:** Provides comprehensive visibility, automatic learning, and non-disruptive monitoring of a flow's performance. Administrators can monitor all flows from a specific host to multiple targets or volumes, from multiple hosts to a specific target/volume, or across a specific ISL. Additionally, they can perform volume-level monitoring of specific frame types to identify resource contention or congestion that is affecting application performance. With the IO Insight capability, administrators can monitor first IO response time, IO completion time, the number of

pending IOs, and IOPS metrics for a flow from a specific host to a target or volume running SCSI or NVMe over Fibre Channel traffic. With VM Insight, administrators can monitor network throughput and IO statistics for each VM.

- **Flow Learning:** Enables administrators to non-disruptively discover all flows that go to or come from a specific host port or a storage port, or traverse ISLs/IFLs or FCIP tunnels, to monitor fabric-wide application performance. In addition, administrators can discover top and bottom bandwidth-consuming devices and manage capacity planning.
- **Flow Generator:** Provides a built-in traffic generator for pretesting and validating the data center infrastructure for robustness, including route verification and integrity of optics, cables, ports, back-end connections, and ISLs, before deploying applications.
- **Flow Mirroring:** Enables administrators 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 a data stream, enhancing transmission reliability and performance. FEC is mandatory in Gen 6 links with more robust error recovery to support 32 Gbps performance.
- **Credit Loss Recovery:** Automatically detects and recovers buffer credit loss at the Virtual Channel (VC) level, providing protection against performance degradation and enhancing application availability.

### IBM Network Advisor

IBM Network Advisor simplifies b-type 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 dashboards graphically display performance and health indicators out of the box, 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. For more details about IBM Network Advisor capabilities, review the information in the data sheet and IBM Network Advisor Redbooks product guide.

### IBM Storage Networking SAN 128B-6 Switch specifications

Table 1 shows the system architecture specifications for the IBM Storage Networking SAN128B-6 Switch.

Table 1 System architecture specifications (part 1 of 2)

Product number*	8960-F96 Front exhaust (port side exhaust); 2U 8960-N96 Rear exhaust (non-port side exhaust); 2U
Fibre Channel ports	96 SFP+ ports capable of operating at 4/8/10/16/32 Gbps Fibre Channel auto-sensing speeds; 8 QSFP ports capable of operating at 4×32 / 4×16 / 4×8 / 4×4 Gbps Fibre Channel speeds. Offers a base configuration of 48 ports, two 24-port SFP+ Ports on Demand (PoD), and one 32-port QSFP PoD. The switch has a total of eight 32 Gbps QSPF ports. This allows users to grow from 48 ports to 128 ports. Supports F/E/EX_Port and D_Port types on the SFP+ ports and only F/E/EX_Port and D_Port types on the QSFP ports with Fabric OS® (FOS) v8.2.0.
Scalability	Full-fabric architecture with a maximum of 239 switches
Certified maximum	Single fabric: 56 domains, 7 hops MPR fabric: 19 hops

Table 1 System architecture specifications (part 2 of 2)

Performance	Fibre Channel: 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; 112.2 Gbps, full duplex; auto-sensing of 4/8/10/16/32 Gbps port speeds and capable of supporting 128 Gbps speeds; 10 Gbps optionally programmable to fixed port speed. Auto-sensing of 4×32 / 4×16 / 4×8 / 4×4 Gbps speeds on the QSFP ports with FOS v8.2.0.
ISL trunking	Frame-based trunking with up to eight 32 Gbps connections between a pair of switches combined to form a single logical ISL with a speed of up to 256 Gbps (512 Gbps full duplex) per ISL trunk. Exchange-based load balancing across ISLs with DPS included in FOS. On the QSFP ports 256 Gbps trunks are supported by trunking 2× (4×32 Gbps) QSFP ports.
Aggregate bandwidth	4 Tbps
Maximum fabric latency	Latency for locally switched ports is < 780 ns (including FEC); compression is 1 µs per node
Maximum frame size	2,112-byte payload
Frame buffers	15K frame buffers with dynamic buffer sharing capability across ports
Classes of service	Class 2, Class 3, Class F (inter-switch frames)
Port types	D_Port (ClearLink Diagnostic Port), E_Port, EX_Port, F_Port, AE_Port, optional port-type control
Data traffic types	Fabric switches supporting unicast
Media types	Hot-pluggable, industry-standard Small Form-Factor Pluggable Plus (SFP+), LC connector; Short-Wave Laser (SWL), Long-Wave Laser (LWL); Extended Long-Wave Laser (ELWL); distance depends on fiber optic cable and port speed. Supports SFP+ (32/16/8 Gbps), SFP+ (16/8/4 Gbps), SFP+ 10 Gbps optical transceivers, 4×32 Gbps QSFP SWL and 4×16 Gbps QSFP SWL optical transceivers.
USB	One USB port for system log file downloads or firmware upgrades
Fabric services	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 Path Selection (DPS); Extended Fabrics; Enhanced BB Credit Recovery; FDMI; Frame Redirection; Frame-based Trunking; FSPF; Integrated Routing; 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	Fibre Channel, in-flight compression (LZO) and encryption (AES-GCM-256); integrated optional 10 Gbps Fibre Channel for DWDM MAN connectivity

Table 2 shows the management specifications for the IBM Storage Networking SAN128B-6 Switch.

Table 2 Management specifications

Supported management software	HTTP, SNMP v1/v3 (FE MIB, FC Management MIB), SSH; Auditing, Syslog; Advanced Web Tools; IBM Network Advisor SAN Enterprise or IBM Network Advisor SAN Professional Plus; Command Line Interface (CLI); SMI-S compliant; trial licenses for add-on capabilities.
Security	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. The IBM Storage Networking SAN128B-6 switch provides up to 12 in-flight encryption and compression ports.
Management access	10/100/1000 Mbps Ethernet (RJ-45), serial port (RJ-45), and one USB port
Diagnostics	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, non-disruptive daemon restart, optics health monitoring, power monitoring, RAStrace logging, and Rolling Reboot Detection (RRD)

Table 3 shows the mechanical specifications for the IBM Storage Networking SAN128B-6 Switch.

Table 3 Mechanical specifications

Enclosure	Front-to-back airflow; non-port-side exhaust; port-side intake; 2U Back-to-front airflow; non-port-side intake; port-side exhaust; 2U
Size	Width: 44.0 cm (17.32 in.) Height: 8.67 cm (3.41 in.) Depth: 60.96 cm (24 in.)
System weight	21.31 kg (47.00 lb) with two power supply FRUs, and three fan FRUs without transceivers

Table 4 shows the environmental specifications for the IBM Storage Networking SAN128B-6 Switch.

Table 4 Environmental specifications

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)
Operating altitude	Up to 3,000 m (9,842 ft)
Storage altitude	Up to 12 km (39,370 ft)
Shock	Operating: Up to 20 G, 6 ms half-sine Non-operating: Half-sine, 33 G 11 ms, 3/eg axis
Vibration	Operating: 0.5 g sine, 0.4 grms random, 5 to 500 Hz Non-operating: 2.0 g sine, 1.1 grms random, 5 to 500 Hz
Heat dissipation	128 ports at 3,512 BTU/hr

Table 5 shows the power specifications for the IBM Storage Networking SAN128B-6 Switch.

Table 5 Power specifications

Power supply	Two power supply FRUs with integrated power module, voltage range of 90 V to 264 V AC (for AC units)
Fans	Three fan FRUs with two fans each
AC input (PSU)	100 V to 240 V nominal, 90 V to 264 V range, 12 A
AC input line frequency (PSU)	50 Hz to 60 Hz nominal, 47 Hz to 63 Hz range
AC power consumption (system)	Maximum 942 W with all 128 ports operating at 32 Gbps (96 ports populated with 32 Gbps SWL optics and 8 QSFP ports populated with 4×32 Gbps SWL optics) Maximum of 495 W for empty chassis with no optics in idle configuration

## Related information

For more information, see the following documents:

- IBM Network Advisor, TIPS1124  
<https://www.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=TS012443USEN&>
- Fabric Vision Technology, REDP-5400  
<https://www.ibm.com/common/ssi/cgi-bin/ssialias?htmlfid=TS012932USEN&>
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