IBM Storage Networking SAN96C-6

High-Performance Fibre Channel Switch

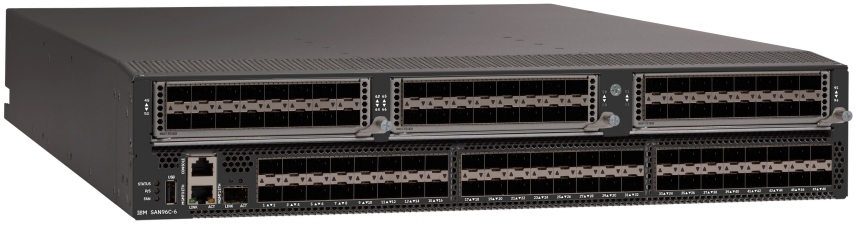
IBM Storage Networking SAN96C-6 Fibre Channel Switch (Figure 1) provides high-speed Fibre Channel connectivity for All-Flash arrays. This switch offers state-of-the-art analytics and telemetry capability built into its next-generation Application-Specific Integrated Circuit (ASIC) platform. It allows seamless transition to Fibre Channel Non- Volatile Memory Express (FC-NVMe) workloads whenever available without any hardware upgrade in the SAN.

The SAN96C-6 Fibre Channel Switch empowers small, midsize, and large enterprises that are rapidly deploying cloud-scale applications using extremely dense virtualized servers, providing the benefits of greater bandwidth, scale, and consolidation.

The benefits for a small-scale Storage Area Network (SAN) are automatic zoning, non-blocking forwarding, and smaller port groups of 16 ports. Benefits for a mid-to-large-size SAN include higher scale for Fibre Channel control-plane functions, virtual SANs, fabric login (FLOGI), device alias and name server scale. The 96-port switch of 32 Gbps non-oversubscribed line-rate ports, bidirectional airflow, and a fixed-form FC-NVMe-ready SAN switch with enhanced Buffer-to-Buffer (B2B) credits connecting both storage and host ports, and Fibre Channel link encryption. Large-scale SAN architectures built with SAN core directors can expand 32 Gbps connectivity to the server rack using these switches in either switch mode or Network Port Virtualization (NPV) mode. Additionally, the switch supports enhanced diagnostic features such as Inter-Switch Link (ISL) and Host-Bus-Adapter (HBA) diagnostics, read diagnostic parameter, link cable beacon, and advanced reliability features such as Forward Error Correction (FEC) with HBA ports.

Highlights

- Centralized nonblocking arbitration with low-latency performance
- Fully integrated feature-rich SAN analytics
- High availability and high scalability deliver flexibility
- Reliablity ensures errors in flight get corrected before reaching device
- Telemetry features drive cost-savings and efficiency
- Diagnostics provide reliability, faster resolution, and reduced costs
- Visibility into virtual machines that access the storage LUNs
- Provision, manage, monitor, and troubleshoot from a single pane



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The new 32 Gbps fabric switches address the requirement for highly scalable, virtualized, intelligent SAN infrastructure in current-generation data center environments. The industry is already poised to transition to 32 Gbps fixed switches with the availability of 32 Gbps HBAs and storage arrays from vendors. Additionally, as low-latency flash arrays and extremely dense virtualization deployments become more pervasive, fixed switches will be expected to provide 32 Gbps connectivity to the SAN core.

This solution offers several important benefits:

- Server port consolidation: The demand for 32 Gbps fabric switches will increase as hyperscale virtualization doubles the virtual-machine density per rack, increasing the need for higher-bandwidth HBA ports per rack of blade or standalone servers. Soon, 32 Gbps HBA ports will consolidate the current 16 Gbps HBA installed base, with the need to increase the server capacity in the same rack. Hence, the SAN96C-6, with 96-port switch density, provides an excellent solution, and the flexibility to grow from a 24-port base to 96 ports is an added advantage.
- Simplification: Through consolidation, the SAN administrator can reduce complexity and simplify management. A SAN96C-6 32 Gbps 96-Port switch in N_Port ID Virtualization (NPIV) core mode with fibre channel switches connecting to it in N_Port Virtualization (NPV) mode, device ports can scale very cost-effectively with time without adding the burden of managing the NPV switches. Auto-zoning facilitates zero-touch automatic zoning without any need for configuring zoning on the 32 Gbps fixed switches that are deployed in standalone SANs.
- Multiprotocol convergence: 32 Gbps links benefit from lower-latency when compared to lower-bandwidth links, bringing better-performing storage workloads to your storage array. Greater bandwidth also helps ensure less ISL congestion for the newer storage protocols that are

expected to be available on externally attached storage arrays: for instance, NVMe over Fibre channel can co-exist on the same link as existing SCSI workloads.

- Scale and performance: This fixed-form-factor switch supports the performance and scale required to deploy a dedicated and standalone Fibre Channel SAN connecting both initiators and targets without requiring any other switching infrastructure.

Table 1. Product specifications

Fibre Channel ports	• Fixed-switch form factor with 48 SFP+ ports base• Entry-level 24-port preactivated base model with flexibility to turn on any 24 ports• Incremental ports ◦ 8-ports upgrade license offers the option of upgrading to 32, 40, and 48 ports
Security	• VSAN fabric isolation• Intelligent packet inspection at port level• Hardware zoning by Access Control Lists (ACLs)• Fibre Channel Security Protocol (FC-SP) switch-to-switch authentication• FC-SP host-to-switch authentication• Role-based access control (RBAC) using RADIUS, TACACS+, or Lightweight Directory Access Protocol (LDAP) authentication, authorization, and accounting (AAA) functions• Secure FTP (SFTP)• Secure Shell Protocol Version 2 (SSHv2)• Simple Network Management Protocol Version 3 (SNMPv3) implementing Advanced Encryption Standard (AES)• Control-plane security• TrustSec payload encryption• Secure Boot and Anti-counterfeit technology
Performance	• Port speed: 4, 8, 16, and 32 Gbps autosensing with 32 Gbps of dedicated bandwidth per port• Aggregate bandwidth of 1.5 Tbps end-to-end full duplex• Buffer credits: Up to 8300 for a group of 16 ports, with a default of 500 buffer credits per port and a maximum of 8270 buffer credits for a single port in the group• Port groups: 3 port groups of 16 ports each• Port channel: Up to 16 load-balanced physical links grouped in one port channel
Diagnostics	• Power-On-Self-Test (POST) diagnostics• Online Health Management System (OHMS) diagnostics• Internal loopbacks• SPAN• Fibre Channel traceroute• Fibre Channel ping• Fibre Channel debug• IBM Fabric Analyzer• Syslog• Port-level statistics• Link diagnostics (E-port and F-port links)• Read Diagnostic Parameter
Serviceability	• Configuration file management• Call Home• Port beaconing• Link cable beacon• System LEDs• SNMP traps for alerts
Reliability and availability	• Hot-swappable, dual redundant power supplies• Hot-swappable fan tray with switch integrated temperature and power management• Hot-swappable SFP+ optics• Stateful process restart• Any port configuration for port channels• Fabric-based multipathing• Per-VSAN fabric services• Port tracking• Virtual Router Redundancy Protocol (VRRP) for management IP interface• FEC with HBA ports• Buffer-to-buffer state change notification with HBA ports

Protocols	• Fibre Channel standards• FC-PH, Revision 4.3 (ANSI INCITS 230-1994)• FC-PH, Amendment 1 (ANSI INCITS 230-1994/AM1-1996)• FC-PH, Amendment 2 (ANSI INCITS 230-1994/AM2-1999)• FC-PH-2, Revision 7.4 (ANSI INCITS 297-1997)• FC-PH-3, Revision 9.4 (ANSI INCITS 303-1998)• FC-PI, Revision 13 (ANSI INCITS 352-2002)• FC-PI-2, Revision 10 (ANSI INCITS 404-2006)• FC-PI-3, Revision 4 (ANSI INCITS 460-2011)• FC-PI-4, Revision 8 (ANSI INCITS 450-2008)• FC-PI-5, Revision 6 (ANSI INCITS 479-2011)• FC-PI-6 (ANSI INCITS 512-2015)• FC-FS, Revision 1.9 (ANSI INCITS 373-2003)• FC-FS-2, Revision 1.01 (ANSI INCITS 424-2007)• FC-FS-2, Amendment 1 (ANSI INCITS 424-2007/AM1-2007)• FC-FS-3, Revision 1.11 (ANSI INCITS 470-2011)• FC-FS-4• FC-LS, Revision 1.62 (ANSI INCITS 433-2007)• FC-LS-2, Revision 2.21 (ANSI INCITS 477-2011)• FC-LS-3, Includes revision 3.53• FC-SW-2, Revision 5.3 (ANSI INCITS 355-2001)• FC-SW-3, Revision 6.6 (ANSI INCITS 384-2004)• FC-SW-4, Revision 7.5 (ANSI INCITS 418-2006)• FC-SW-5, Revision 8.5 (ANSI INCITS 461-2010)• FC-SW-6• FC-GS-3, Revision 7.01 (ANSI INCITS 348-2001)• FC-GS-4, Revision 7.91 (ANSI INCITS 387-2004)• FC-GS-5, Revision 8.51 (ANSI INCITS 427-2007)• FC-GS-6, Revision 9.4 (ANSI INCITS 463-2010)• FC-GS-7, Includes revision 10.8• FCP, Revision 12 (ANSI INCITS 269-1996)• FCP-2, Revision 8 (ANSI INCITS 350-2003)• FCP-3, Revision 4 (ANSI INCITS 416-2006)• FCP-4, Revision 2b (ANSI INCITS 481-2011)• FC-SB-2, Revision 2.1 (ANSI INCITS 349-2001)• FC-SB-3, Revision 1.6 (ANSI INCITS 374-2003)• FC-SB-3, Amendment 1 (ANSI INCITS 374-2003/AM1-2007)• FC-SB-4, Revision 3.0 (ANSI INCITS 466-2011)• FC-SB-5, Revision 2.00 (ANSI INCITS 485-2014)• FC-BB-6, Revision 2.00 (ANSI INCITS 509-2014)• FC-BB-2, Revision 6.0 (ANSI INCITS 372-2003)• FC-BB-3, Revision 6.8 (ANSI INCITS 414-2006)• FC-BB-4, Revision 2.7 (ANSI INCITS 419-2008)• FC-BB-5, Revision 2.0 (ANSI INCITS 462-2010)• FC-VI, Revision 1.84 (ANSI INCITS 357-2002)• FC-SP, Revision 1.8 (ANSI INCITS 426-2007)• FC-SP-2, Revision 2.71 (ANSI INCITS 496-2012)• FAIS, Revision 1.03 (ANSI INCITS 432-2007)• FAIS-2, Revision 2.23 (ANSI INCITS 449-2008)• FC-IFR, Revision 1.06 (ANSI INCITS 475-2011)• FC-FLA, Revision 2.7 (INCITS TR-20-1998)• FC-PLDA, Revision 2.1 (INCITS TR-19-1998)• FC-Tape, Revision 1.17 (INCITS TR-24-1999)• FC-MI, Revision 1.92 (INCITS TR-30-2002)• FC-MI-2, Revision 2.6 (INCITS TR-39-2005)• FC-MI-3, Revision 1.03 (INCITS TR-48-2012)• FC-DA, Revision 3.1 (INCITS TR-36-2004)• FC-DA-2, Revision 1.06 (INCITS TR-49-2012)• FC-MSQS, Revision 3.2 (INCITS TR-46-2011)• Fibre Channel classes of service: Class 2, Class 3, and Class F• Fibre Channel standard port types: E, F, and B• Fibre Channel enhanced port types: SD, ST, and TE• FC-NVMe• In-band management using IP over Fibre Channel (RFC 2625)• IPv6, IPv4, and Address Resolution Protocol (ARP) over Fibre Channel (RFC 4338)• Extensive IETF-standards-based TCP/IP, Simple Network Management Protocol Version 3 (SNMPv3), and Remote Monitoring (RMON) MIBs

Network management	• Management access through 2 out-of-band Ethernet ports ◦ mgmt0: 10/100/1000BASE-T port ◦ mgmt1: 1/10G SFP+ port#• RS-232 serial console port• USB power-on auto-provision port• Access protocols• Command-Line Interface (CLI) using the console and Ethernet port• SNMPv3 using the Ethernet port and in-band IP over Fibre Channel access• Storage Networking Industry Association (SNIA)• Storage Management Initiative Specification (SMI-S)• NX-API for REST• Full access through HTTPS REST• Distributed device alias service• Network security• Per-VSAN RBAC using LDAP, RADIUS, and TACACS+-based AAA functions• Simple File Transfer Protocol (SFTP)• SSHv2 implementing AES• SNMPv3 implementing AES• Data Center Network Manager (DCNM)
Programming interfaces	• Scriptable CLI• DCNM web services API• NX-API RESTful interfaces• Onboard Python interpreter• Embedded Event Manager (EEM)• NX-OS Software scheduler
Physical dimensions (H x W x D) and weight	• 1 Rack Unit (1RU) (1.72 x 17.3 x 22.3 in. [4.37 x 43/9 x 56.6 cm]) excluding Power Supply Unit (PSU) and fan-tray handles• 16.7 lb. (8.5 kg)
Power	• 80 Plus Platinum certified power supplies• Power supply options ◦ 650W AC in base model, port-side exhaust variant (2 per switch) ◦ 650W AC in base model, port-side intake variant (2 per switch)• Power cord ◦ IEC60320 C14 plug on 650W power supply connecting to a notched C15 socket connector• AC input: 100 to 240 VAC (10% range)• Frequency: 50 to 60 Hz (nominal)• Typical power consumption ◦ 217W for Idle 48-Port switch without optics modules ◦ 251W for 48-Port switch with 24 32G SW optics modules under typical conditions ◦ 297W for 48-Port switch with 48 32G SW optics modules under typical conditions• Airflow ◦ Back to front (toward ports) using port-side exhaust fans ◦ Front to back (inward from ports) using port-side intake fans ◦ 50 Cubic Feet per Minute (CFM) through system fan assembly at 77°F (25°C) ◦ 100 CFM maximum
Temperature range	• Temperature, ambient operating: ◦ 32 to 104°F (0 to 40°C) with port-side exhaust and intake airflow variants• Temperature, ambient nonoperating and storage: –40 to 158°F (–40 to 70°C)• Relative humidity, ambient (noncondensing) operating: 10 to 90%• Relative humidity, ambient (noncondensing) nonoperating and storage: 10 to 95%• Altitude, operating: –197 to 6500 ft (–60 to 2000m)
Approvals and compliance	• Safety compliance• CE Marking• UL 60950• CAN/CSA-C22.2 No. 60950• EN 60950• IEC 60950• TS 001• AS/NZS 3260• IEC60825• EN60825• 21 CFR 1040• EMC compliance• FCC Part 15 (CFR 47) Class A• ICES-003 Class A• EN 55022 Class A• CISPR 22 Class A• AS/NZS 3548 Class A• VCCI Class A• EN 55024• EN 50082-1• EN 61000-6-1• EN 61000-3-2• EN 61000-3-3
Fabric services	• Name server• Registered State Change Notification (RSCN)• Login services• Fabric Configuration Server (FCS)• Broadcast• In-order delivery

Advanced function	• VSAN• IVR• Port Channel with multipath load balancing• Flow- and zone-based QoS

Service and support

IBM does not recommend the removal of its products batteries due to safety reasons. Please utilize the IBM Takeback and Recycle Program.

Why IBM?

Innovative technology, open standards, excellent performance, and a broad portfolio of proven storage software and hardware solutions offerings—all backed by recognized industry leadership—are just a few of the reasons to consider storage solutions from IBM. In addition, IBM delivers some of the best storage products, technologies, services and solutions in the industry without the complexity of dealing with different hardware and software vendors.

For more information

For more information about IBM SAN96C-6 Fibre Channel Switch, visit the product page or contact your local IBM account representative.