



# NVIDIA Spectrum SN5000 Series Switches

Bringing accelerated Ethernet to every data center for AI and cloud.

## Accelerating Data Center Fabrics

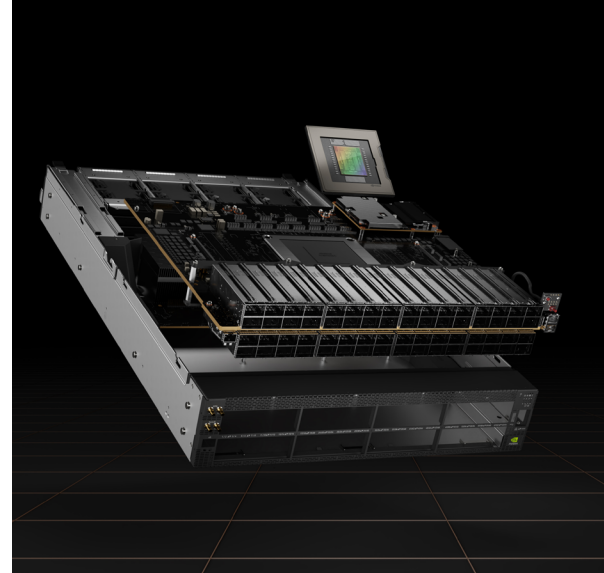
The NVIDIA Spectrum™ SN5000 series of Ethernet switches is the fifth generation of NVIDIA Ethernet switches, purpose-built to accelerate data center fabrics. With port speeds spanning from 10 to 800 gigabits per second (Gb/s), the SN5000 series switches deliver accelerated Ethernet to every data center without compromising performance or feature set.

The SN5000 series is ideal for enabling cloud-scale infrastructures for data centers of any size. SN5000 switch systems provide high performance, consistent low latency, and support for advanced data center networking features, making them ideal for cloud networks and end-to-end data center fabrics.

Powered by the NVIDIA Spectrum-4 application-specific integrated circuit (ASIC), the SN5000 series features dynamic, flexible shared buffers and predictable performance. SN5000 switches are built to accelerate clouds and power NVIDIA platforms, including the NVIDIA Spectrum-X networking platform, NVIDIA EGX™, NVIDIA DGX™, NVIDIA HGX™, and NVIDIA OVX™, and AI software tools such as NVIDIA AI Enterprise and NVIDIA LaunchPad.

As part of the Spectrum platform, SN5000 systems are pretested and prevalidated with NVIDIA's full portfolio of Ethernet networking technology, including NVIDIA® BlueField® SuperNICs and data processing units (DPUs), ConnectX® smart network interface cards (SmartNICs), and LinkX® interconnects. While each element is fully compatible with standard Ethernet fabrics, the end-to-end switch-to-host solution is critical to powering accelerated workloads, delivering the high performance and innovative features needed to supercharge AI and cloud-native applications at scale.

SN5000 switches are also a key component of the NVIDIA Spectrum-X networking platform. This platform integrates Spectrum-4 Ethernet switches with BlueField-3 SuperNICs, standing out as the world's first Ethernet fabric built specifically for AI. This unique design accelerates generative AI network performance, boasting a 1.6X improvement over traditional Ethernet fabrics. Additionally, Spectrum-X ensures consistent and predictable outcomes for thousands of simultaneous AI jobs at every scale by maximizing resource utilization and performance isolation. It not only enables advanced cloud multi-tenancy but also offers robust zero-trust security. For cloud service providers, this translates into faster AI solution development, quicker deployment, and accelerated time to market, ultimately enhancing their return on investment.



## Key Features

### Performance

- > Up to 800Gb/s per port for 51.2Tb/s aggregate switch bandwidth
- > Fully shared packet buffer provides a fair, predictable, and high-bandwidth data path
- > Consistent and low cut-through latency
- > Accelerated remote direct-memory access (RDMA) over converged Ethernet (RoCE) with extensions for AI cloud servers built on Ethernet
- > Best-in-class Virtual Extensible LAN (VXLAN) scale
- > 512,000 forwarding entries flexibly shared across access control list (ACL), longest prefix match (LPM) routes, host routes, media access control list (MAC), equal-cost multi-path (ECMP), and tunnel applications

## Flexible, High-Performance Configuration

With a bidirectional switching capacity of 51.2 terabits per second (Tb/s), SN5000 platforms are available in a range of configurations. Each delivers high performance with feature-rich layer-2 and layer-3 forwarding, ideally suited for both leaf and spine and suitable for replacing modular chassis switches. SN5000 switches provide full wire-speed performance with ultra-low cut-through latency, leveraging the fully shared 160 megabyte (MB) packet buffers for fair and predictable performance. By combining the low latency of the Spectrum-4 ASIC with the large switch radix of SN5000 systems, thousands of hosts can be connected in a two-tier network architecture while maintaining minimal port-to-port latencies. Adding a wide range of innovations in the areas of programmability, telemetry, and tunneling, the NVIDIA SN5000 series can address the complex networking requirements of today's data centers. With a range of system form factors and a rich software ecosystem, NVIDIA SN5000 series allows you to pick and choose the right components for your data center.

### SN5400

The SN5400 smart-leaf, spine, and super-spine switch offers 64 ports of 400 gigabit Ethernet (GbE) in a 2U form factor. The SN5400 offers diverse quad small form factor double density (QSFP-DD) connectivity in combinations from 1 to 400GbE and boasts a total throughput of 25.6Tb/s, making it ideal for 400G data center fabrics.

### SN5600

The SN5600 smart-leaf, spine, and super-spine switch offers 64 ports of 800GbE in a dense 2U form factor. The SN5600 is ideal for NVIDIA Spectrum-X deployments and enables both standard leaf/spine designs with top-of-rack (ToR) switches as well as end-of-row (EoR) topologies. The SN5600 offers diverse connectivity in combinations of 1 to 800GbE and boasts an industry-leading total throughput of 51.2Tb/s.

## High Availability

The NVIDIA Spectrum SN5000 series of Ethernet switches is designed with the following features for high availability:

- > 1+1 hot-swappable power supplies and N+1 hot-swappable fans
- > Color-coded power supply units (PSUs) and fans
- > Ethernet VPN (EVPN) multi-homing
- > Multi-chassis link aggregation group (MLAG) for active/active L2 multipathing
- > Hardware-assisted in-service software upgrades (ISSU)
- > 256-way equal-cost multi-path (ECMP) routing for load balancing and redundancy

## Platform Security

SN5000 series switches offer a complete security suite at all switch layers. Hardware, firmware, and software are authenticated by a built-in root of trust, from the basic input and output system (BIOS) to the network operating system (NOS). Any attempt to run an altered component or image that wasn't originally signed by NVIDIA is automatically blocked, ensuring the safest network installation within data centers.

## Agility and Security

- > Comprehensive layer 2 and layer 3
- > Advanced network virtualization with high-performance, single-pass VXLAN routing
- > Cloud-scale network address translation (NAT)
- > Programmable pipeline that can programmatically parse, process, and edit packets
- > Up to 12.8Tb/s MACsec VXLANsec encryption (available Q2 2024)
- > Secured switch offerings via hardware root of trust

## Visibility

- > NVIDIA What Just Happened® (WJH) telemetry dramatically reduces mean time to issue resolution
- > Hardware-accelerated histograms powered by NetQ track and summarize queue depths at submicrosecond granularity
- > Inband network telemetry (INT)
- > Streaming telemetry
- > 512,000 on-chip flow counters



SN5400 switch image



SN5600 switch image

## **NVIDIA Cumulus Linux**

NVIDIA Cumulus® Linux is a powerful open network operating system that enables advanced automation, customization, and scalability using web-scale principles hardened in the world's largest data centers. Cumulus Linux was built for building data center networks ideally suited to diverse business needs. And it's the only open NOS that enables the building of affordable and efficient network operations like the world's largest data center operators, unlocking web-scale networking for businesses of all sizes.

## **SONiC**

Designed for hyperscalers, service providers, and enterprises, SONiC is a fully open-sourced, hardware-agnostic NOS, perfect for preventing vendor lock-in and ideal for next-generation data centers. SONiC's containerized design makes it flexible and customizable, allowing customers to combine and manage SONiC and non-SONiC switches within the same networking fabric. NVIDIA's pure SONiC offering removes distribution limitations and enables enterprises to take full advantage of the benefits of open networking while adding the NVIDIA expertise and support that best guarantee success. NVIDIA is proud to guide the direction of SONiC as a member of the SONiC Governing Board and Technical Steering Committee. Pure SONiC is fully supported on all SN5000 switch systems.

## **Linux Switch**

With Linux Switch, users can natively install and use any standard Linux distribution as the switch operating system. Linux Switch is based on a Linux kernel driver model for Ethernet switches (switchdev).

## **Platform Software Options**

### **NVIDIA Air**

The NVIDIA Air infrastructure simulation platform creates digital twins of SN5000 switch systems (as well as the rest of the Spectrum portfolio). The digital twin includes logical instances of every switch and cable, so it can be used to validate security policy compliance, automation processes, monitoring tools, interoperability, and upgrade procedures. The digital twin is key to transforming network operations models, allowing IT architects and infrastructure specialists to deploy and update networks up to 95 percent faster through continuous integration and continuous delivery (CI/CD) integration.

### **NVIDIA NetQ**

NVIDIA NetQ™ is a highly scalable network operations toolset that provides visibility, troubleshooting, and validation of networks in real time. NetQ delivers actionable insights and operational intelligence about the health of data center networks—from the container or host all the way to the switch and port—enabling a NetDevOps approach. NVIDIA NetQ is the leading network operations tool that utilizes telemetry for deep troubleshooting, visibility, and automated workflows from a single interface, reducing mean time to innocence (MTTI) and network downtimes.

## **NVIDIA Spectrum-4: An ASIC for Accelerated Data Centers**

NVIDIA's Spectrum-4 is the fifth-generation Ethernet switch ASIC, delivering a solid balance of performance, virtualization, telemetry, and scalability capabilities.

### **Groundbreaking Performance and Features**

Packet buffer architecture has a major impact on overall switch performance. The Spectrum-4 ASIC features a fully shared and monolithic packet buffer across all ports, supporting cut-through traffic from all ports without compromising scale or features. With its fast packet buffer, Spectrum-4 provides a high-performance, fair, and bottleneck-free data path for mission-critical applications. In addition, Spectrum-4 provides the most advanced and innovative feature set yet. This includes unique features like RoCE extensions for NVIDIA Spectrum-X and end-to-end nanosecond-level timing precision from switch to host.

### **Centralized Visibility**

Spectrum-4 provides deep and contextual network visibility, which allows network operators to proactively manage issues and reduce mean time to recovery (MTTR) and innocence (MTTI). Available through the switch SDK, NVIDIA User Experience (NVUE), or SONiC command-line interface (CLI), What Just Happened leverages the underlying silicon and software capability to provide granular and event-triggered information about infrastructure issues. In addition, Spectrum-4's rich telemetry information is readily available via open APIs and tools such as gNMI that can be integrated with NetQ, as well as third-party software tools and workflow engines.

### **Unprecedented Agility**

For modern data center infrastructure to be software-defined and agile, both its compute and network building blocks need to be agile. Spectrum-4 includes a unique, feature-rich packet processing pipeline that offers data center network virtualization without compromising on performance or scale. Spectrum-4 has a programmable pipeline and a deep packet parser and editor that can process payloads up to the first 512 bytes. Spectrum-4 supports single-pass VXLAN routing and bridging. In addition, Spectrum-4 supports advanced virtualization features such as routing and NAT.

### **Massive Scale**

Spectrum-4 uses intelligent algorithms and efficient resource sharing and supports unprecedented scale for forwarding tables, counters, and policies. This fine-grained resource allocation enables Spectrum-4 to fit all specific needs, allowing up to 512,000 entries to be dynamically shared across media access control (MAC), Address Resolution Protocol (ARP), Internet Protocol version 4 (IPv4) routes, ACLs, ECMP, and VXLAN tunnels.

## Technical Specifications

Switch Model	SN5600	SN5400
<b>Connectors</b>	<b>64 OSFP 800GbE + 1 SFP28 25GbE</b>	<b>64 QSFP-DD 400GbE + 2 SFP28 25GbE</b>
<b>Max. 800GbE ports</b>	64	-
<b>Max. 400GbE ports</b>	128	64
<b>Max. 200GbE ports</b>	256	128
<b>Max. 100GbE ports</b>	256	256
<b>Max. 50GbE ports</b>	256	256
<b>Max. 40GbE ports</b>	128	128
<b>Max. 25 ports</b>	256+1	256+1
<b>Max. 10GbE ports</b>	256+1	256+1
<b>Max. 1GbE ports</b>	1	2
<b>Switching capacity (Tb/s)</b>	51.2Tb/s	25.6Tb/s
<b>Wire-speed switching (Bpps)</b>	33.3Bpps	33.3Bpps
<b>Lanes per port x max. speed per lane</b>	8x 100G PAM4	8x 50G PAM4
<b>CPU</b>	Hexa-core x86	Hexa-core x86
<b>System memory</b>	32G	32G
<b>SSD memory</b>	160GB	160GB
<b>Packet buffer</b>	160MB	160MB
<b>100/1000Mb/s management ports</b>	RJ45	RJ45
<b>Serial ports</b>	RJ45	RJ45
<b>USB ports</b>	USB Type 3	USB Type 3
<b>Hot-swap power supplies</b>	2 (1+1 redundant)	2 (1+1 redundant)
<b>Hot-swappable fans</b>	4 (N+1 redundant)	4 (N+1 redundant)
<b>Airflow</b>	Reverse	Reverse
<b>Power supplies</b>	Frequency: 50–60Hz Input range: 208–264Vac	Frequency: 50–60Hz Input range: 208–264Vac
<b>Operating conditions</b>	0–35°C	0–40°C
<b>Size (H x W x D)</b>	3.39" (H) x 17.2" (W) x 28.3" (D)  86.2mm (H) x 438mm (W) x 720mm (D)	3.39" (H) x 17.2" (W) x 28.3" (D)  86.2mm (H) x 438mm (W) x 720mm (D)

## Compliance

Standards Compliance	
Safety	CB, CE, cTUVus, CU
EMC	CE, ICES, FCC, RCM, VCCI
Non-operating conditions	-40–70°C
Relative humidity	5–85%
Operating altitude	0–3,050m
RoHS	RoHS compliant

## Enterprise Support and Services

A minimum of one year of **Enterprise Business-Standard Support** is required when purchasing NVIDIA Spectrum SN5000 switches.

- > NVIDIA Enterprise Support provides access to NVIDIA experts, the NVIDIA Enterprise Support Portal, advanced return material authorization (RMA), and more.
- > Add-on services—including installation, configuration, technical account manager, four-hour on-site engineer, expedited RMA, media retention, and more—are available

For details, visit the **NVIDIA Enterprise Support and Services User Guide**.

## Product Specifications

Details of the NVIDIA Spectrum SN5000 series switches are available in the **SN5000 Switch Systems User Manual**.

### Transceivers and Cables

- > For details on NVIDIA cables and transceivers, visit the **Interconnect documentation hub**.
- > Some transceivers may require higher than typical power delivery. Please refer to the **SN5000 Switch Systems User Manual** for detailed information on switch ports' power specifications.

## Ready to Get Started?

To learn more about NVIDIA Spectrum SN5000 switches, including product specifications and ordering information, refer to the **SN5000 Switch Systems User Manual**.