



H3C S12500AI Data Center Switch

DDC switch

Product overview

H3C S12500AI series switch is a new-generation high-performance, high-density 800GE/400GE intelligent computing network solution launched by H3C for high-end data center and AIGC intelligent computing scenarios, based on the industry-leading DDC architecture. The S12500AI series provides high-density 800GE/400GE Ethernet ports and supports redundant pluggable power supplies and fans. The S12500AI can be used for high-density data center NCF and NCP networking, meeting the high-performance and high-speed requirements of AIGC for data center networks. A single POD can support a maximum networking scale up to 9,216 400GE ports or 4,608 800GE ports.

The S12500AI series Ethernet switch includes two types of physical devices: NCF (Network Connectivity Fabric, network switching unit), and NCP (Network Connectivity Processor, network service unit). Among them:

- 1) The NCF provides the same switching fabric module function as a chassis switch's SFU. If the ingress port and egress port of a packet are located on different NCPs, the packets received by the ingress NCP need to be forwarded to the egress NCP via the NCF.
- 2) The NCP provides the same line card function as a chassis switch's LPU to process packet forwarding. The ports on the NCP are used to connect service networks.

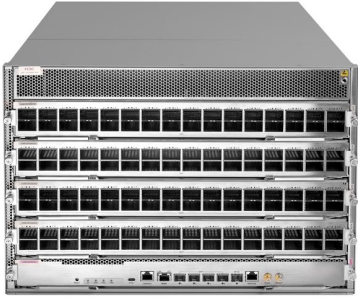
The models and port configurations for the N series of The S12500AI product are as follows:

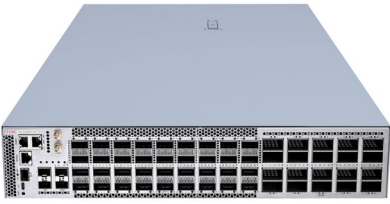
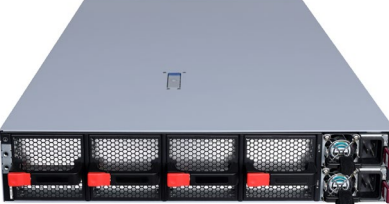
Network switching unit H3C S12500AI-NCFN: Distributed chassis NCF Ethernet switching device, supporting up to 128x 800G OSFP SFI ports

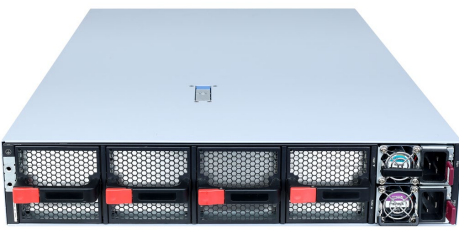
Network service unit H3C S12500AI- 18EP20EP-NCPN: 20x 800GE OSFP SFI ports, 18x 800GE OSFP service ports

Network service unit H3C S12500AI- 36DH20EP-NCPN: 20x 800GE OSFP SFI ports, 36x 400GE QSFP112 service ports

Views

	
S12500AI NCF front panel	S12500AI NCF rear panel

	
S12500AI-36DH20EP-NCPN front panel	S12500AI-36DH20EP-NCPN rear panel

	
S12500AI-18EP20EP-NCPN front panel	S12500AI-18EP20EP-NCPN rear panel

Features and highlights

High-density ports, flexible expansion

- The S12500AI switch supports high-density 800GE/400GE ports and possesses powerful forwarding capability, with

a maximum networking scale supporting up to 9216 400G ports or 4608 800G ports. It can meet the networking requirements for non-blocking access of high-density servers in mega data centers and AIGC computing power networks.

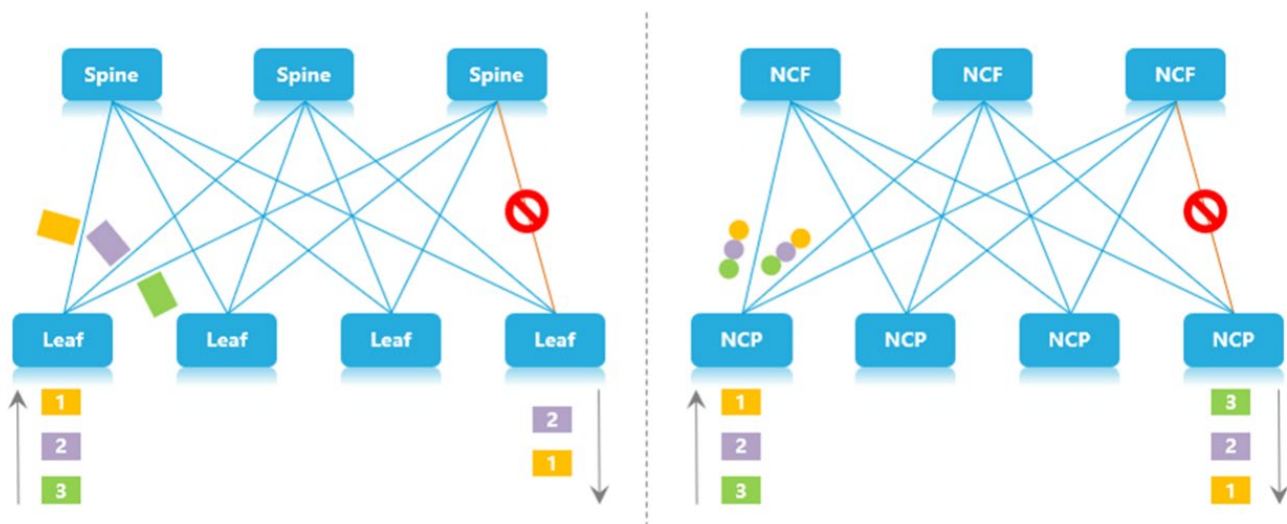
- Through the NCF-NCP architecture, the S12500AI series provides powerful flexibility expansion capability for data center networks, supporting larger network scale demands. In the NCF-NCP architecture, each NCP (Network Computing Processor) unit connects to lower-layer servers and storage resources, while the NCF (Network Convergence Fabric) unit acts as a powerful hub, efficiently connecting each NCP together. As the demand for processing power and storage capacity in data centers continues to grow, the S12500AI series, based on the DDC architecture, can easily add more NCFs or NCPs to linearly expand network capacity. This modular expansion method supports smooth network capacity expansion without service awareness, eliminating the need for large-scale modifications to the existing architecture or service disruption.

DDC Innovative Network Architecture

- The DDC (Diversified Dynamic-Connectivity) technology used by the S12500AI is an innovative network architecture design. It breaks away from traditional centralized chassis switch designs, using a distributed decoupling approach to improve the flexibility and scalability of data center networks. By splitting traditional large network switches into smaller, independent modular components—namely box switches—it achieves decentralized deployment of network functions. These box switches can act as line cards or switching fabric modules, and can be distributed across multiple cabinets, thereby providing better heat dissipation management, power consumption control, and overcoming limitations in device upgrades and space expansion. Simultaneously, this architectural solution can better decouple endpoint devices (such as NICs, GPUs, etc.) while maintaining high throughput and load efficiency.

Cell Switching

- In traditional Box Ethernet switch networking, traffic forwarding typically uses a combination of routing protocols and ECMP, which achieves a certain level of balanced traffic forwarding. However, factors such as the number and size of flows, as well as hash polarization, can all affect hash results. For example, when forwarding elephant flows, this can lead to load imbalance, thereby affecting performance. Moreover, the traditional ECMP method is based on hop-by-hop route forwarding and cannot effectively perceive the available bandwidth of the forwarding path. When congestion exists on the forwarding path, packet loss is prone to occur.
- Based on the DDC architecture, the S12500AI series uses cell-based switching. By segmenting packets into uniformly sized cell units and forwarding them one by one, it achieves absolute balanced forwarding of traffic across NCPs, greatly improving forwarding efficiency. At the same time, the DDC architecture also enables path awareness based on the VOQ (Virtual Output Queuing) mechanism. NCPs learn in advance whether path bandwidth is available before forwarding data packets, performing load balancing only on all available paths to achieve non-blocking balanced switching.



Traditional ECMP method is prone to packet loss during link congestion (left image), while the DDC cell switching mechanism proactively detects path bandwidth and enables non-blocking balanced forwarding (right image).

Enhanced SDN Capabilities

- The S12500AI switch uses industry-leading switching chips, allowing flexible definition of forwarding logic based on user requirements. It enables the development of new features that meet the evolving trends of customer networks and supports network evolution needs through software upgrades.

Comprehensive Data Center Features

- The S12500AI series switches fully support data center lossless network RoCE features, including PFC, ECN, and AI ECN, to build a zero-packet-loss, low-latency lossless network. They also support typical box+box networking for 800G/400G lossless fabrics, meeting the demands of ultra-large-scale data center networking and low latency. Additionally, AI ECN dynamically adjusts the ECN thresholds for each transmission queue, accommodating the varying resource requirements due to real-time changes in queue traffic, thereby comprehensively improving data forwarding efficiency and achieving a truly intelligent, lossless, zero-packet-loss, low-latency computing network..

Powerful Visualization Capabilities

- With the rapid development of data center technology, the scale of data centers has expanded quickly, making reliability and maintainability bottlenecks for further expansion. Aligning with the trend toward automated operations in data centers, The S12500AI series switches support visualization functions. Through protocols such as Telemetry and gRPC, they enable millisecond-level uploading of packet data (e.g., from QoS modules, device modules, IP firewall modules, etc.). Real-time resource information, RDMA statistics, and RDMA alarm messages from the switches are sent to the data center operations platform. By analyzing this real-time data, the platform can achieve network quality traceability, fault troubleshooting, risk warning, architecture optimization, and even automatically adjust network configurations to reduce congestion. This makes it possible to advance data center operations toward automation..

Multiple Reliability Protections

- Device-level and link-level backup: Units and modules in the S12500AI series architecture are typically equipped with

two or more devices and interconnected via multiple links. In the N-series S12500AI, a new Open DDC architecture solution is adopted, using an independent network element open networking mode. This eliminates the need for a centralized network control unit, avoiding the risk of collective network failures due to single network element management. BGP is used as the unified control protocol, significantly reducing network management complexity. In the data plane, NCP and NCF establish full-mesh connections to forward data packets.

- Support for microsecond-level link fault convergence enables automatic network device perception, adjustment, and diagnosis, enhancing automation levels and ensuring efficient and stable network operation.

Rich QoS Policies

- The S12500AI series switches support L2 to L4 packet filtering, providing traffic classification based on source MAC address, destination MAC address, source IP address, destination IP address, TCP/UDP port number, and protocol type. They offer flexible queue scheduling algorithms that can be configured based on both ports and queues, supporting five modes: SP (Strict Priority), WRR (Weighted Round Robin), SP+WRR, WFQ, and SP+WFQ. CAR (Committed Access Rate) functionality is supported with a granularity as fine as 8 Kbps. Port mirroring in both ingress and egress directions is available for monitoring packets on designated ports, copying data packets from these ports to monitoring ports for network inspection and troubleshooting.

Outstanding Management Capabilities

- Support for rich management interfaces, such as Console, USB ports, and out-of-band management ports.
- Support for SNMPv1/v2/v3 and the iMC network management platform, providing CLI, TELNET, and FTP management, with SSH2.0/SSL encryption for security.
- Support for standard Netconf interfaces, offering programmable configuration management methods to facilitate third-party software development.
- Support for sFlow functionality, enabling detailed packet statistics. Supports SPAN/RSPAN/ERSPAN mirroring and multiple mirroring observation ports, allowing analysis of network traffic for appropriate management and maintenance actions. This makes previously invisible network service application traffic clear and provides users with various NetStream analysis reports, helping them optimize network structures and adjust resource deployment promptly.
- Support for real-time monitoring of buffers and port queues, enabling dynamic adjustments for visualized operations.

Comprehensive Security Control Policies

- Support for AAA/RADIUS authentication, which can integrate with SDN platforms for real-time user management and handling of unauthorized activities.
- Provides enhanced ACL control logic, supporting high-capacity ingress and egress port ACLs.

Green Energy Efficiency

The S12500AI series switches, based on the DDC architecture, achieve simplified design and decoupled control planes, redefining the economic model of network construction and operation. This brings green energy efficiency while providing significant cost advantages. Compared to traditional high-performance monolithic switch chassis, their small-scale, low-cost network element device architecture offers a more economical and efficient network solution. The overall system improves its own power utilization through an ultra-short straight-through heat dissipation air duct design,

contributing to energy savings and environmental protection.

Technical specifications

Hardware specifications

Item	S12500AI-18EP20EP-NCPN	S12500AI-36DH20EP-NCPN	S12500AI-NCFN
Switching capacity	14.4T	14.4T	102.4T
Packet forwarding rate	5.4B	5.4B	-
Interfaces	18*OSFP 800G+20*OSFP 800G	36*QSFP-DD 400G+20*OSFP 800G	128*OSFP 800G
Console port	RJ45 *1	RJ45 *1	RJ45 *1
Out-of-band management port	RJ45 *1	RJ45 *1	RJ45 *1
USB port	Type-C *1	Type-C *1	Type-C *1
Dimensions (H× W × D, with package) (mm)	255×590×1135	255×590×1135	465×670×980
Dimensions (H× W × D,no package) (mm)	88.1×440×760	88.1×440×760	308.4×442×640
Weight (no package) (kg)	17.2kg	17.3kg	33.7kg
Weight (with package) (kg)	21.59kg	21.69kg	65.94kg
Height(RU)	2	2	7
Power supply	2(1+1 Redundancy), AC	2(1+1 Redundancy), AC	6(3+3 Redundancy),AC
Fan	4	4	12
Typical Power Consumption	660W (Ports using cables) 1192W (Ports using typical optical transceiver modules)	694W (Ports using cables) 1233W (Ports using typical optical transceiver modules)	1300W (Ports using cables) 3092W (Ports using typical optical transceiver modules)
Static Power Consumption	322W	322W	680W
Maximum Power Consumption	2135W	2120W	5640W
Typical Heat Dissipation	2055.45 BTU/h	2055.45 BTU/h	3846.12 BTU/h
Maximum Heat Dissipation	6302.15 BTU/h	6131.54 BTU/h	16296.19 BTU/h
MTBF(year)	38.382	38.209	22.038
MTTR(h)	0.5	0.5	0.5
Availability	0.9999985	0.99999849	0.99999739
DRAM Memory	32G	32G	32G
NOR Flash	32MB*2	32MB*2	32MB*2
Nand Flash	64GB	64GB	64GB
SSD	240GB M.2 SATA (Optional)	240GB M.2 SATA (Optional)	240GB M.2 SATA (Optional)
Operating temperature	0°C to 40°C	0°C to 40°C	0°C to 40°C
Storage temperature	-40°C~70°C	-40°C~70°C	-40°C~70°C

Item	S12500AI-18EP20EP-NCPN	S12500AI-36DH20EP-NCPN	S12500AI-NCFN
Operating humidity	5% to 95%, noncondensing	5% to 95%, noncondensing	5% to 95%, noncondensing

Software specifications

Item	Feature description
Forwarding mode	Cell-based switching
SDN controller	ADDC
Data center features	RDMA lossless network RoCEv2
	buffer visualization
	PFC and ECN
	intelligent traffic model identification and dynamic adjustment of AI ECN thresholds
Programmable	NETCONF
	openconfig
	gRPC
	Python
	Ansible automated configuration
Traffic Monitoring	sFlow
	Telemetry: gRPC, telemetry stream, MOD
	RoCE packets visibility
ARP	ARP, RARP, and gratuitous ARP
	ARP anti-attack
	ARP source suppression
	ARP Detection function
IPv4 routing	static route and default route
	BGP
	ECMP route and policy-based routing (PBR)
IPv6 routing	static route and default route
	BGP+
	ECMP route and policy-based routing (PBR)
QoS	port ingress and egress packet rate limiting
	ACL, CAR, precedence re-marking, and queues
	various queue scheduling algorithms such as SP, WRR, WFQ, SP+WRR, SP+WFQ
	Layer 2 to Layer 4 packet filtering

Item	Feature description
	traffic classification based on source MAC, destination MAC, source IP (IPv4/IPv6), destination IP (IPv4/IPv6), port, and protocol
	traffic shaping (TS)
	WRED, tail drop, and other congestion avoidance mechanisms
Mirroring	Port and flow based mirroring
	local and remote port mirroring (ERSPAN and ERSPANv3)
Security	user tiered management and password protection
	prevention of DoS, ARP, ICMP and other attacks
	SSL
Management and maintenance	zero configuration auto-config and configuration rollback
	command line interface (CLI) configuration
	configuration via Console, Telnet, SSH, etc.
	RMON (Remote Monitoring)
	SNMP v1/v2c/v3
	network management system
	NETCONF and Python
	syslog and user operation log
	hierarchical alarms
	power, fan, and temperature alarm functions
	NTP (Network Time Protocol)
	Jumbo Frame
	Ping, Tracert and other debugging information output
	uploading and downloading files via FTP, TFTP, USB, etc.
	XModem protocol load upgrade (supported under boot)

Performance and scalability

Item	Description	LS-12500AI-18EP24EP-NCPN	LS-12500AI-36DH23EP-NCPN	LS-12500AI-NCFN
ACL	IPv4 ingress ACL	2560	2560	2560
	IPv4 egress ACL	1024	1024	1024
	IPv6 ingress ACL	2560	2560	2560
	IPv6 egress ACL	1024	1024	1024
	Ingress CAR granularity	2560	2560	2560
Forwarding table	Buffer (chip-claimed value)	8G	8G	8G
	Maximum supported frame length	1536-9964, default 9964	1536-9964, default 9964	1536-9964, default 9964
	max number of ARP entries IPv4	88K	88K	88K

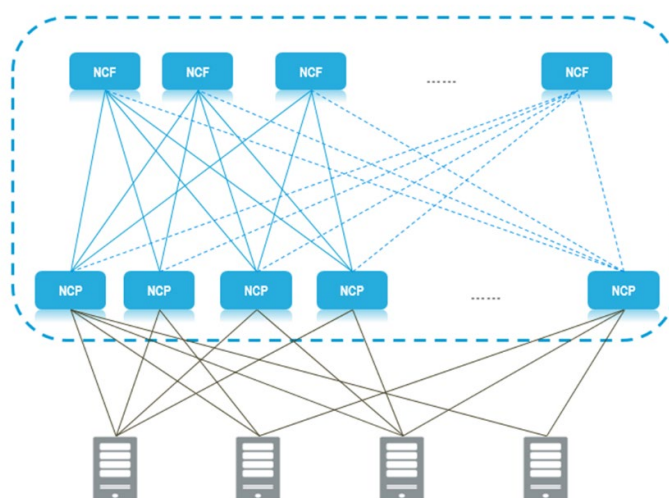
Item	Description	LS-12500AI-18EP24EP-NCPN	LS-12500AI-36DH23EP-NCPN	LS-12500AI-NCFN
	max ND table size for IPv6	88K	88K	88K
	max number of unicast routes IPv4	128K	128K	128K
	max number of unicast routes IPv6	128K	128K	128K
	Number of secondary IPs per interface	8192	8192	8192
	Number of BGP neighbors / BGP peers	IPv4: 1024; IPv6:1024	IPv4: 1024; IPv6:1024	IPv4: 1024; IPv6:1024
	BGP instance	65	65	65
	Number of BGP routes	128000	128000	128000
	static IPv4 routing table	128k	128k	128k
	static IPv6 routing table	128K	128K	128K

Application scenarios

DDC NCF-NCP Architecture Data Center Typical Networking

In data center networks, the DDC architecture's data plane uses an NCF-NCP topology, providing an efficient, scalable, and flexible network architecture. The NCF-NCP structure allows the data center network to be easily expanded horizontally in a "building block" manner to accommodate growing traffic demands.

As shown in the figure below, in the DDC NCF-NCP architecture, the data center network consists of two main layers: the NCF layer and the NCP layer. The NCF layer contains multiple high-performance switches (such as NCF network switching units), which are primarily responsible for providing high-capacity switching capabilities and enabling interconnection between different NCP switches (NCP network service units). The NCP layer consists of switches connected to servers, storage, and other network devices, and is linked to the switches in the NCF layer, forming a non-blocking network design to support high-throughput, low-latency data transmission.



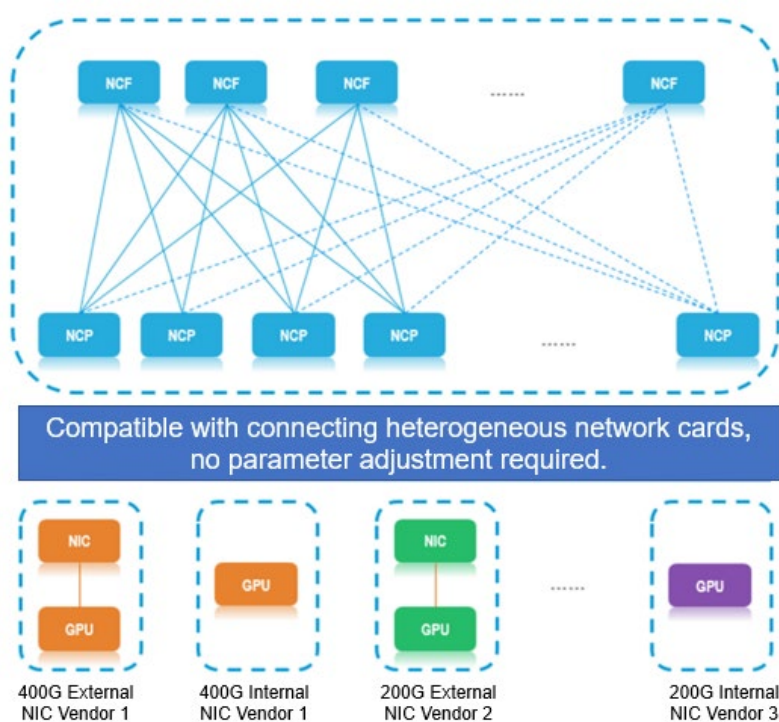
— Cross-NCP Forwarding Link (corresponding to SFI interface)

—Service Link (corresponding to NCP service interface)

S12500AI Series Switch DDC Architecture NCF-NCP Typical Networking

Heterogeneous Intelligent Computing Network Typical Network

The S12500AI switch uses NCP ports that support mainstream 200G/400G/800G NIC encapsulation, ensuring high compatibility. Through DDC technology, it achieves decoupling of the network from GPUs and optimizes traffic processing. When dealing with domestic GPUs with fewer QP numbers, the cell switching mechanism avoids the network congestion risks associated with traditional ECMP load balancing technology, improving overall network load balancing efficiency. This provides an efficient and stable networking solution for GPU-intensive computing environments.



S12500AI Switch Heterogeneous Intelligent Computing Network Typical Topology

Ordering information

Item		Description
Models	LS-12500AI-NCFN	H3C S12500AI-NCFN Distributed NCF Class N Ethernet Switch Router
	LS-12500AI-36DH20EP-NCPN	H3C S12500AI-36DH20EP-NCPN Distributed NCP Class N Ethernet Switch Router with 36 QSFP112 Ports and 20 OSFP800 Fabric Ports
	LS-12500AI-18EP20EP-NCPN	H3C S12500AI-18EP20EP-NCPN Distributed NCP Class N Ethernet Switch Router with 18 OSFP800 Ports and 20 OSFP800 Fabric Ports
Power	PSR2000-12A-S	2000W AC Power Supply Module(Power Panel Side Exhaust Airflow)

Item		Description
	PSR2700-12A-A	2700W AC Power Supply Module (Power Panel Side Exhaust Airflow)
Fan	FAN-80B-1-D	Fan Module (Fan Panel Side Exhaust Airflow)
MPU	LSXM1SUPNCFN1	H3C S12500AI-NCFN Supervisor Engine Unit,Type N



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