TEST REPORT
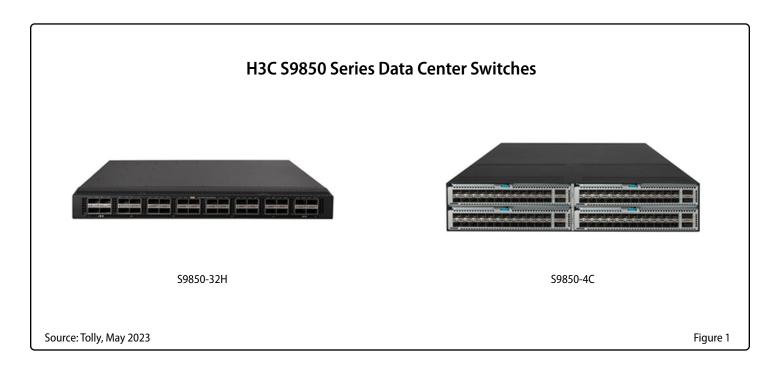
Tolly.

Commissioned by
New H3C Technologies Co., Ltd.

H3C S9850 Series Data Center Switches
Performance Evaluation and Feature Validation

Executive Summary

With the rapid development of new-generation technologies such as 5G, cloud computing, and AI, the accelerated integration of information technology and traditional industries, data centers, as the physical carrier for the operation of information systems in various industries, have become indispensable for economic and social operations.

The S9850 series data center switches are developed by H3C for data centers and cloud computing networks. The S9850 series includes S9850-32H (32*100GE QSFP28 ports + 2*GE SFP ports) and S9850-4C (four card slots + 2*GE SFP ports) models. They are ideal for high-density 100GE or 25GE accessing and aggregation at data centers and cloud computing networks. They can also operate as ToR access switches on an overlay or integrated network. Tolly engineers evaluated H3C S9850 series data center switches' performance and validated their features.

H3C S9850 Series Data Center Switches

S9850-32H

S9850-4C

Source: Tolly, May 2023

Figure 1

Report link: https://www.tolly.com/publications/detail/223152

Test Results

Tolly engineers tested functions and performance of the H3C S9850 series data center switch (hereinafter referred to as the S9850). Unless specified, test results apply to both S9850 models. For a summary of the performance test cases, refer to Table 1. For a summary of the feature test cases, refer to Table 3 and Table 5 on Page 6 to Page 8. Test results are as follows.

Performance

Throughput

Tolly engineers evaluated throughput of the S9850-32H switch model with 32*100GE ports using the RFC2544 test in Spirent TestCenter. It supports 100% Layer 2 and Layer 3 line-rate for frame sizes of 248-byte and above. Please see Table 1 for detailed results.

Energy Efficiency (TEER)

According to the ATIS Energy Efficiency for Telecommunication Equipment standard, TEER (Telecommunications Energy Efficiency Ratio) is defined as a ratio of maximum demonstrated throughput to weighted power.

The H3C S9850-32H switch model demonstrated 3,200Gbps maximum throughput. The ATIS weighted power of the S9850-32H switch is 284.6W. So the TEER of the S9850-32H switch is 11.24Gbps/Watt. Please see Table 2 on Page 3 for detailed results.

IRF2

The Intelligent Resilient Framework 2 (IRF2) technology virtualizes multiple physical devices at the same layer into one virtual fabric to provide data center class availability and scalability. An IRF2 fabric appears as one node for easy management, redundancy, multi-chassis link aggregation with load balancing, scalability and resiliency. The S9850 switch supports IRF2.

ISSU

An S9850 IRF2 fabric supports In-Service Software Upgrade (ISSU) with no packet loss to upgrade IRF2 members' software. ISSU upgrades IRF2 members in sequence and migrate traffic out of the member before upgrading it.

New H3C Technologies Co., Ltd.

S9850 Series Data Center Switch

Performance Evaluation and Feature Validation

Tested May 2023

H3C S9850 Series Switch Throughput (Percentage of Line-rate)
Dual-snake topology, 32*100GE ports
(as reported by Spirent TestCenter)

Frame Size	248-Byte	512-Byte	1024-Byte	1280-Byte	1518-Byte	9416-Byte
Layer 2/Layer 3 Throughput	100%	100%	100%	100%	100%	100%

Note: The S9850-32H model was used in the test. Throughput was tested with bidirectional traffic using all 100GE ports in a snake topology. All test results had 0 frame loss. 100% line-rate means 3.2Tbps throughput.

Source: Tolly, May 2023

Table 1

M-LAG

H3C S9850 supports multi-chassis link aggregation group (M-LAG). Two switches in an M-LAG system connects to the uplink or downlink device through links in an M-LAG. It provides high availability for traditional VLAN and new VXLAN overlay networks.

GIR

An S9850 M-LAG system supports Graceful Insertion and Removal (GIR) with no packet loss to upgrade M-LAG members' software. GIR upgrades M-LAG members in sequence. GIR maintenance mode automatically switch traffic on one member to the other member before upgrading it.

Link Aggregation

LAG with Load Balancing

H3C S9850 supports static link aggregation group (LAG) or dynamic LAG. The LAG supports load balancing between member links for unicast, multicast and broadcast traffic.

VXLAN

Basic VXLAN Functions

H3C S9850 supports the VXLAN overlay network which is widely used to build modern campus networks and data center networks.

Tolly engineers verified that H3C S9850 can provide Layer 2 and Layer 3 endpoint connectivity over the VXLAN overlay network. It can provide IPv6 endpoint connectivity over the IPv4 VXLAN overlay network. It can also provide endpoint connectivity between VXLAN and traditional VLAN (non-VXLAN) networks.

EVPN VXLAN with Distributed Gateways

VXLAN with the BGP-EVPN control plane and distributed gateways is the most popular VXLAN implementation with many advantages including high scalability and easy deployment. H3C S9850 supports EVPN VXLAN with distributed gateways.

S9850 also supports centralized L3 gateway for traditional VXLAN deployment.

VXLAN Capacity

H3C S9850 supports 15,360 IPv4 VXLAN tunnels.

VXLAN OAM

H3C S9850 supports VXLAN Ping to the VXLAN tunnel destination (loopback interface) address for VXLAN operations, administration, and maintenance (OAM).

Routing

Routing Protocols

H3C S9850 supports OSPF, IS-IS and BGP IPv4 routing protocols.

H3C S9850 supports OSPFv3, IS-IS for IPv6, and BGP4+ IPv6 routing protocols.

H3C S9850 also supports IPv4 and IPv6 dual-stack network with routing protocols.

Graceful Restart (GR)

H3C S9850 supports graceful restart for IPv4 routing protocols.

Tolly engineers verified that there was no packet loss when the routing protocol process was reset on the switch.

H3C S9850 Series Switch Power Consumption (TEER)
(as reported by Chroma Programmable AC Source)

	0% utilization power	30% utilization power	100% utilization power	ATIS weighted power	Maximum demonstrated throughput	TEER
S9850-32H	239W	284W	335W	284.6W	3,200Gbps	11.24Gbps/Watt

Note: TEER = (maximum demonstrated throughput) / (ATIS weighted power) = 3,200Gbps / 284.6W = 11.24Gbps/Watt. Test used the same topology as the throughput test in Table 1. The Spirent TestCenter default iMIX profile was used. The switch was fully loaded with two AC power modules and five fan modules. According to the ATIS-0600015.03.2016 standard, ATIS weighted power = 0.1* (0% utilization power) + 0.8* (30% utilization power) + 0.1 * (100% utilization power).

Source: Tolly, May 2023   Table 2

Non-stop Routing (NSR)

H3C S9850 supports non-stop routing for IPv4 routing protocols.

In a Layer 3 network, Tolly engineers verified that there was no packet loss when a master-standby switchover was run in an IRF2 fabric of S9850 switches.

The difference between GR and NSR is that GR can only work properly when the device neighbors also support GR. NSR does not have this requirement.

BFD

H3C S9850 supports bidirectional forwarding detection (BFD) with 3ms minimum sending interval in control mode.

MPLS

MPLS VPN

H3C S9850 supports MPLS VPWS L2VPN (point-to-point), MPLS VPLS L2VPN (point-to-multipoint), and MPLS L3VPN.

MPLS TE

H3C S9850 supports MPLS Traffic Engineering (MPLS TE).

MPLS MCE

MPLS Multi-VPN-Instance Customer Edge (MPLS MCE) enables a switch to function as the CE of multiple VPN instances in a BGP/MPLS VPN network to reduce equipment investment. H3C S9850 supports MPLS MCE.

VPN Routing Protocols

When the H3C S9850 switch acts as the MCE, it supports RIP, OSPF, IS-IS, and BGP routing protocols for the VPN instances (VRFs).

IP Overlap in Different VPNs

When the H3C S9850 switch acts as the MCE, the IP address in one VPN can overlap with IP addresses in other VPNs to save IP resources.

Ring Protection Protocols

RRPP

H3C S9850 supports Rapid Ring Protection Protocol (RRPP) with less than 20ms failover time.

ERPS

H3C S9850 supports Ethernet Ring Protection Switching (ERPS) with less than 40ms failover time.

O&M

Telemetry

H3C S9850 supports real-time and high performance gRPC-based Telemetry for network monitoring (e.g. device hardware and traffic statistics.)

INT

H3C S9850 supports Inband Network Telemetry (INT) which collects data from the device and sends data to a collector in real time for performance and network monitoring.

Telemetry Stream

H3C S9850 supports Telemetry Stream which collects data from the device and streams data to a collector in real time for performance and network monitoring. Telemetry stream is similar to INT, but is different in that it requires configuration only on the device to collect data from.

MoD

H3C S9850 supports Mirror on Drop (MoD) to detect packet drops during the forwarding process on the device. It can send the packet drop reason and the characteristics of the dropped packet to the collector.

PTP

H3C S9850 supports working as the Precision Time Protocol (PTP) server or client. It supports 1588v2, 802.1AS, and SMPTE 2059 standards.

Ansible

H3C S9850 can be configured by Ansible for automation.

Puppet

H3C S9850 can be configured by the Puppet open source configuration management tool for automation.

NETCONF

H3C S9850 can be controlled by a controller via NETCONF.

SNMP

H3C S9850 can be managed by a network management system via SNMP.

ZTP

H3C S9850 supports Zero Touch Provisioning (ZTP) with the DHCP option and a TFTP server.

ERSPAN

H3C S9850 supports Encapsulated Remote Switch Port Analyzer (ERSPAN) to mirror traffic on a port to a remote port using a GRE tunnel.

RSPAN

H3C S9850 supports Remote Switch Port Analyzer (RSPAN) to mirror traffic on a port to a remote port on another device.

NetStream

H3C S9850 supports NetStream to monitor traffic flow statistics on the device and send it to a NetStream server.

iNQA

H3C S9850 supports Intelligent Network Quality Analyzer (iNQA) which measures the service packets directly to calculate packet loss results, thus reflecting the real network quality.

Capacity

MAC Table

H3C S9850 supports up to 288,000 MAC addresses in the MAC table.

MAC Learning Rate

H3C S9850 supports learning up to 137,000 MAC addresses per second to the MAC table.

ARP Table

H3C S9850 supports up to 272,000 ARP entries in the ARP table.

Tolly engineers verified that the switch forwarded traffic matching all entries in its ARP table, without any packet loss.

ND Table

H3C S9850 supports 136,000 ND entries in the ND table.

Tolly engineers verified that the switch forwarded traffic matching all entries in its ND table, without any packet loss.

FIBv4

H3C S9850 supports up to 324,000 IPv4 routes in the FIB.

Tolly engineers verified that the switch forwarded traffic matching all routing entries in the FIBv4 table, without any packet loss.

FIBv4 Learning Rate

H3C S9850 supports learning up to 6,200 IPv4 routes per second to the FIB.

FIBv6

H3C S9850 supports up to 162,000 IPv6 routes in the FIB.

Tolly engineers verified that the switch forwarded traffic matching all routing entries in the FIBv6 table, without any packet loss.

FIBv6 Learning Rate

H3C S9850 supports learning up to 16,000 IPv6 routes per second to the FIB.

Features

DCI

H3C S9850 supports Data Center Interconnect (DCI) for VXLAN fabrics. Layer 2 known unicast, broadcast, unknown unicast and Layer 3 traffic was all forwarded between two data centers properly.

DLB ECMP

H3C S9850 supports Equal-Cost Multi-Path Routing (ECMP) load balancing for high availability and efficient use of available bandwidth.

DLB Link-aggregation

H3C S9850 supports link-aggregation load balancing for high availability and efficient use of available bandwidth.

TCB

H3C S9850 supports Transient Capture Buffer (TCB) to monitor packet drop events on a set of memory management unit (MMU) resources. When a packet is dropped on a queue, the system collects drop time, drop reason, packet metadata, and other information and reports them to a network management system through gRPC.

MACsec

The S9850-4C model support MACsec with the MACsec-capable interface card. It encrypts Layer 2 traffic for security.

FCoE

H3C S9850 supports FCoE for the storage network.

Micro-segment

H3C S9850 supports micro-segment. Administrators can group IP addresses into a microsegment and use ACL to define access permissions between the micro-segments.

PBR Service Chain

H3C S9850 supports Policy-Based Routing (PBR) for service chain.

PFC Deadlock Detection

PFC deadlock may happen in certain networks due to a loop or other causes to block forwarding on multiple devices.

H3C S9850 supports deadlock detection. So administrators can recover the network from PFC deadlock after receiving the alarm.

Mice Elephant Flow QoS

H3C S9850 supports the EM mode for the mice elephant flow scenario. In some data centers, a few elephant flows occupies a large portion of bandwidth and may cause

packet loss for lots of mice flows. H3C S9850 can automatically detects the elephant flows and forward mice flows with higher priority.

DCBX and PFC

H3C S9850 supports Data Center Bridging Exchange (DCBX) and Priority-based Flow Control (PFC) for a lossless data center network.

ECN

H3C S9850 supports Explicit Congestion Notification (ECN) for a lossless data center network.

RoCE Lossless Ethernet

H3C S9850 supports RoCE lossless Ethernet with AI ECN and one-click PFC.

OpenFlow

H3C S9850 supports OpenFlow to forward traffic according to the flow table.

Component Redundancy

Fan Redundancy

H3C S9850 supports fan module redundancy. When one fan module was unplugged, there was no packet loss.

Power Redundancy

H3C S9850 supports power module redundancy. When one power module was unplugged, there was no packet loss.

Mixed Power Supply Modules

H3C S9850 supports using the AC power module and the DC power module together on the same switch.

H3C S9850 Series Data Center Switch
Tolly Verified Features - Part 1 of 3

IRF2 Stack		VXLAN	
✔	IRF2	✔	Layer 2 connectivity over the VXLAN overlay network with the same VXLAN Network Identifier (VNI)
✔	ISSU	✔	Layer 3 connectivity over the VXLAN overlay network with different VNIs
M-LAG		✔	IPv6 connectivity over IPv4 VXLAN overlay network
✔	Multi-chassis Link Aggregation Group (M-LAG)	✔	Connectivity between VXLAN and non-VXLAN (VLAN only) networks
✔	Graceful Insertion and Removal (GIR) — No packet loss to upgrade M-LAG members' firmware. GIR upgrades M-LAG members in sequence. M-LAG maintenance mode automatically switch traffic on one member to the other member before upgrading it	✔	Distributed VXLAN L3 gateway with an IPv4 or IPv6 underlay network
Link Aggregation		✔	Centralized VXLAN L3 gateway with an IPv4 or IPv6 underlay network
✔	Static Link Aggregation Group (LAG)	✔	EVPN VXLAN — Widely used modern network architecture. VXLAN with the BGP EVPN control plane
✔	Dynamic Link Aggregation Group (LAG) with LACP	✔	VXLAN tunnel capacity: 15,360 IPv4 VXLAN tunnels
✔	Load Balancing — for unicast, multicast and broadcast traffic with either the static LAG or dynamic LAG	✔	VXLAN OAM — Simulate the ping from a source endpoint to a destination endpoint via the VXLAN tunnel for VXLAN operations, administration, and maintenance (OAM)

Source: Tolly, May 2023   Table 3

H3C S9850 Series Data Center Switch
Tolly Verified Features - Part 2 of 3

Routing		Ring Protection Protocols	
✔	IPv4 routing protocols: OSPF, IS-IS, BGP	✔	Rapid Ring Protection Protocol (RRPP) less than 20ms failover time
✔	IPv6 routing protocols: OSPFv3, IS-IS for IPv6, BGP4+	✔	Ethernet Ring Protection Switching (ERPS) less than 40ms failover time
✔	Dual-stack OSPF and OSPFv3; IS-IS and IS-IS for IPv6; BGP and BGP4+	**O&M**	
✔	Graceful Restart (GR)	✔	Telemetry Real-time and high performance gRPC-based Telemetry for network monitoring (e.g. device hardware and traffic statistics)
✔	Non-stop Routing (NSR)	✔	INT
BFD		✔	Telemetry Stream
✔	Minimum BFD sending interval: 3ms in control mode	✔	Mirror on Drop (MoD)
MPLS		✔	Precision Time Protocol (PTP) server and client 1588v2, 802.1AS, and SMPTE 2059 standards
✔	MPLS VPWS L2VPN Point-to-point	✔	Ansible
✔	MPLS VPLS L2VPN Point-to-multipoint	✔	Puppet
✔	MPLS L3VPN	✔	NETCONF
✔	MPLS TE (Traffic Engineering)	✔	SNMP
✔	MPLS MCE MPLS Multi-VPN-Instance Customer Edge (MPLS MCE) enables a switch to function as the CE of multiple VPN instances in a BGP/MPLS VPN network to reduce equipment investment	✔	Zero Touch Provisioning (ZTP)
✔	VPN routing protocol support for MPLS MCE RIP/OSPF/IS-IS/BGP	✔	ERSPAN
✔	IP overlap in different VPNs	✔	RSPAN
		✔	NetStream
		✔	iNQA

Source: Tolly, May 2023   Table 4

H3C S9850 Series Data Center Switch
Tolly Verified Features - Part 3 of 3

	Capacity			MACsec
		✔		S9850-4C only, requires the MACsec-capable interface card
✔	MAC table: 288,000 MAC addresses	✔		FCoE
✔	MAC learning rate: 160,000 MAC addresses/sec	✔		Micro-segment
✔	ARP table: 272,000 ARP entries	✔		Service Chain
✔	ND table: 136,000 ND entries	✔		PFC deadlock detection
✔	IPv4 FIB: 324,000 routes	✔		Mice Elephant Flow QoS
✔	IPv4 FIB learning rate: 4,900 routes/sec	✔		DCBX and PFC Data Center Bridging Exchange (DCBX), Priority-based Flow Control (PFC)
✔	IPv6 FIB: 162,000 routes	✔		ECN Explicit Congestion Notification
✔	IPv6 FIB learning rate: 13,400 routes/sec	✔		RoCE Lossless Ethernet (AI ECN + One-click PFC)
	Features	✔		OpenFlow Forwarding traffic according to the flow table
✔	DCI		Component Redundancy	
✔	ECMP Dynamic Load Balancing (DLB)	✔		Fan Redundancy
✔	Link-aggragation DLB	✔		Power Redundancy
✔	TCB	✔		Mixed power supply modules Using the AC power module and the DC power module together on the same switch

Note: The switch supports multiple modes. Please contact H3C for detailed capacity in different modes.

Source: Tolly, May 2023   Table 5

About Tolly

The Tolly Group companies have been delivering world-class ICT services for over 35 years. Tolly is a leading global provider of third-party validation services for vendors of ICT products, components and services.

You can reach the company by E-mail at sales@tolly.com, or by telephone at +1 561.391.5610.

Visit Tolly on the Internet at:
http://www.tolly.com

Learn More About H3C

H3C is an industry leader in the provision of Digital Solutions, and is committed to becoming the most trusted partner of its customers in their quest for business innovation and digital transformation. H3C offers a full portfolio of Digital Infrastructure products, spanning across compute, storage, networking, 5G, security and related domains, and provides a comprehensive one-stop digital platform that includes cloud computing, big data, artificial intelligence (AI), industrial internet, information security, intelligent connectivity, new safety, and edge computing, as well as end-to-end technical services. H3C is also the exclusive provider of HPE® servers, storage and associated technical services in China.

For more information, visit: https://www.h3c.com/en/

Terms of Usage

This document is provided, free-of-charge, to help you understand whether a given product, technology or service merits additional investigation for your particular needs. Any decision to purchase a product must be based on your own assessment of suitability based on your needs. The document should never be used as a substitute for advice from a qualified IT or business professional. This evaluation was focused on illustrating specific features and/or performance of the product(s) and was conducted under controlled, laboratory conditions. Certain tests may have been tailored to reflect performance under ideal conditions; performance may vary under real-world conditions. Users should run tests based on their own real-world scenarios to validate performance for their own networks.

Reasonable efforts were made to ensure the accuracy of the data contained herein but errors and/or oversights can occur. The test/ audit documented herein may also rely on various test tools the accuracy of which is beyond our control. Furthermore, the document relies on certain representations by the sponsor that are beyond our control to verify. Among these is that the software/ hardware tested is production or production track and is, or will be, available in equivalent or better form to commercial customers. Accordingly, this document is provided "as is", and Tolly Enterprises, LLC (Tolly) gives no warranty, representation or undertaking, whether express or implied, and accepts no legal responsibility, whether direct or indirect, for the accuracy, completeness, usefulness or suitability of any information contained herein. By reviewing this document, you agree that your use of any information contained herein is at your own risk, and you accept all risks and responsibility for losses, damages, costs and other consequences resulting directly or indirectly from any information or material available on it. Tolly is not responsible for, and you agree to hold Tolly and its related affiliates harmless from any loss, harm, injury or damage resulting from or arising out of your use of or reliance on any of the information provided herein.

Tolly makes no claim as to whether any product or company described herein is suitable for investment. You should obtain your own independent professional advice, whether legal, accounting or otherwise, before proceeding with any investment or project related to any information, products or companies described herein. When foreign translations exist, the English document is considered authoritative. To assure accuracy, only use documents downloaded directly from Tolly.com. No part of any document may be reproduced, in whole or in part, without the specific written permission of Tolly. All trademarks used in the document are owned by their respective owners. You agree not to use any trademark in or as the whole or part of your own trademarks in connection with any activities, products or services which are not ours, or in a manner which may be confusing, misleading or deceptive or in a manner that disparages us or our information, projects or developments.

223152 ivcfs20-yx-20240717-VerC