

H3C S5170-EI Series Intelligent Gigabit Access Switches

Performance Evaluation and Feature Validation

Executive Summary

H3C S5170-EI series switches adopt the industry-leading ASIC technology to be developed as a new generation of high-performance, high-port density, high-security and easy-to-install intelligent network-managed Gigabit Ethernet switches that support IPv4/IPV6 dual-stack management and forwarding. They support static routes and dynamic routing protocols such as RIP, OSPF, IS-IS, and BGP. They also support rich management and security features.

H3C S5170-EI series switches are mainly positioned at the access layer and aggregation layer of enterprise and campus networks to meet high-density Gigabit access and fixed 10Gigabit uplink ports.

H3C S5170-EI series switches include S5170-28S-EI, S5170-54S-EI, S5170-28S-HPWR-EI, and S5170-54S-PWR-EI models.

H3C commissioned Tolly to evaluate S5170-EI switch's performance, capacity and features.

H3C S5170-EI Series Intelligent Gigabit Access Switches



Source: Tolly, December 2023

Figure 1

Report link: <https://www.tolly.com/publications/detail/224144>



Test Results

Tolly engineers tested functions and performance of the H3C S5170-EI series switches (hereinafter referred to as the S5170-EI). Test results apply to all H3C S5170-EI models. For a summary of the performance test cases, refer to Table 1 and Table 2. For a summary of the feature test cases, refer to Table 3 to Table 5 on Page 6 to Page 8. Test results are as follows.

Performance

Port Performance

Tolly engineers evaluated the port performance of the S5170-EI switch using the RFC2544 test in Spirent TestCenter.

With two GE ports in port-to-port topology, and two 10GE ports in port-to-port topology, the ports on the S5170-EI switch supported bidirectional 100% line-rate forwarding for all tested frame sizes. See Table 1 for details.

Latency

Tolly engineers evaluated latency between two GE ports and two 10GE ports on the

New H3C
Technologies Co.,
Ltd.

S5170-EI Series
Switch

Performance
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*Tested
December
2023*

S5170-EI switch. Please see Table 2 for detailed results.

H3C S5170-EI Series Switch Port Performance (% of Line-rate)

Two ports, port-to-port, bidirectional
(as reported by Spirent TestCenter)

Frame Size		64-Byte	128-Byte	256-Byte	512-Byte	1024-Byte	1280-Byte	1518-Byte	9216-Byte
Switch Model									
S5170-28S-EI	GE ports	100%	100%	100%	100%	100%	100%	100%	100%
	10GE ports	100%	100%	100%	100%	100%	100%	100%	100%

Source: Tolly, December 2023

Table 1

H3C S5170-EI Series Switch Latency (μ s)

Port-to-port, LIFO (last-in-first-out) latency type
(as reported by Spirent TestCenter)

Frame Size		64-Byte	128-Byte	256-Byte	512-Byte	1024-Byte	1280-Byte	1518-Byte	9216-Byte
Switch Model									
S5170-28S-EI	GE ports	3.21	3.55	3.53	3.53	3.58	3.63	3.54	3.55
	10GE ports	1.36	1.44	1.44	1.44	1.45	1.44	1.44	1.45

Note: 100% line-rate traffic between two ports were used as the test traffic to evaluate the latency between the two ports.

Source: Tolly, December 2023

Table 2



IRF Stack

Intelligent Resilient Framework (IRF) is H3C's stacking technology to stack multiple switches into one for management and forwarding with high availability.

IRF Stacking Bandwidth

With 2*10GE links as the stacking links between two S5170-EI switches, the stack supports 20Gbps stacking bandwidth with 40Gbps aggregated throughput.

Load Balancing

In an IRF stack with S5170-EI switches, the stacking links support load balancing for the traffic between IRF members.

Single-point Management

Administrators can connect to any one of the stack members to manage the entire stack of S5170-EI switches.

Stack Link Failover

When one stack link fails between two S5170-EI switches, it takes 16.4ms for the traffic to failover to the other stack link.

Layer 2 Features

STP/RSTP/MSTP/PVST

The S5170-EI switch supports the Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), Multiple Spanning Tree Protocol (MSTP), and Per VLAN Spanning Tree (PVST).

ERPS

The S5170-EI switch supports the Ethernet Ring Protection Switching (ERPS) protocol with less than 50ms failover time.

RRPP

The S5170-EI switch supports the Rapid Ring Protection Protocol (RRPP) with less than 50ms failover time.

Smart Link

The S5170-EI switch supports Smart Link with less than 50ms failover time.

Link Aggregation High Availability

With link aggregation from the IRF stack members to the uplink or downlink device, traffic is load balanced between the IRF members with S5170-EI switches.

VLAN

The S5170-EI switch supports 4,094 VLANs.

Layer 3 Features

BFD for VRRP

The S5170-EI switch supports BFD for VRRP. With the 100ms BFD sending interval, the traffic failover time is less than 300ms when the link to the VRRP master fails.

BFD for IPv4 Routing Protocols

The S5170-EI switch supports BFD for IPv4 routing protocols to quickly detect the forwarding path failure with the current active routes and trigger the route and traffic failover.

Tolly engineers tested BFD for static route, BFD for RIP, BFD for OSPF, BFD for IS-IS, and BFD for BGP. The failover time for each IPv4 routing protocol in the test is below 300ms.

BFD for IPv6 Routing Protocols

The S5170-EI switch supports BFD for IPv6 routing protocols to quickly detect the forwarding path failure with the current

active routes and trigger the route and traffic failover.

Tolly engineers tested BFD for static route, BFD for RIPng, BFD for OSPFv3, BFD for IS-IS IPv6, and BFD for BGP4+. The failover time for each IPv6 routing protocol in the test is below 300ms.

OSPF Fast Re-Route (FRR) LFA

The S5170-EI switch supports OSPF FRR LFA with less than 50ms failover time for a direct link failure.

Policy Route

The S5170-EI switch supports policy route.

IP Fragmentation and Reassembly

The S5170-EI switch supports IP fragmentation and reassembly.

Multicast Features

IGMP/MLD Snooping

The S5170-EI switch supports IGMP snooping and MLD snooping for IPv4 and IPv6 Layer 2 multicast.

Layer 3 Multicast

The S5170-EI switch supports IGMP and PIM for IPv4 Layer 3 multicast. It also supports MLD and IPv6 PIM for IPv6 Layer 3 multicast.

Security Features

User Authentication

The H3C S5170-EI switch supports MAC authentication, 802.1X authentication, and Web Portal authentication. It also supports triple authentication with all three user authentication methods. Users can use either one of the method to log in to the network.



DHCP Snooping/DHCPv6 Snooping/ND Snooping

H3C S5170-EI supports the DHCP snooping feature to make sure that only the DHCP server connected to the trusted port can distribute IPv4 addresses. It also creates the DHCP user-bind table to record the mapping of each client's IPv4 address, MAC address, VLAN and port.

H3C S5170-EI also supports DHCPv6 snooping and ND snooping for IPv6.

DHCP Relay and DHCPv6 Relay

H3C S5170-EI supports DHCP relay and DHCPv6 relay.

DHCP Server and DHCPv6 Server

H3C S5170-EI supports working as the DHCP server and DHCPv6 server to allocate dynamic IPv4 and IPv6 addresses to DHCP clients.

PPPoE Relay

PPPoE Relay is deployed on the switch that is located between the PPPoE client and the PPPoE server. It binds the user authentication information with the interface information to provide security for PPPoE access.

The S5170-EI switch supports PPPoE Relay.

CPU Defend

H3C S5170-EI supports CPU defend to limit the rate of certain protocol packets (e.g. ARP) that need to be processed by the device CPU to prevent the CPU from overloading.

Attack Source Tracing

H3C S5170-EI supports attack source tracing to identify the attacker and respond with

certain actions (interface error down, alarm, etc.)

MFF

MAC-forced Forwarding (MFF) isolates user devices in a broadcast domain at Layer 2. MFF ensures that all traffic, including traffic in the same VLAN, is sent to the gateway, so that the gateway can monitor data traffic and prevent malicious attacks between users. H3C S5170-EI supports MFF.

IP Source Guard

H3C S5170-EI supports IP source guard to prevent IP address spoofing attacks (unauthorized hosts access and attack the network with forged IP addresses). The device validates IP packets' source IP, source MAC, VLAN ID and interface with the binding table (static or DHCP snooping) for forwarding.

DAI

H3C S5170-EI supports Dynamic ARP Inspection (DAI) to prevent man-in-the-middle attacks and theft on authorized users' information. The device validates ARP packets' source IP, source MAC, VLAN ID and interface with the binding table (static or DHCP snooping) for forwarding.

SAVI

With the Source Address Validation Improvements (SAVI) feature, the S5170-EI switch is able to check the validity of the source addresses in the Neighbor Discovery (ND) packets, DHCPv6 packets, and IPv6 data packets. The S5170-EI switch is able to filter out invalid packets based on the user-bind table. The user-bind table is generated by ND snooping and DHCPv6 snooping. To check the validity of the source addresses in IPv6 data packets, the IP source guard feature needs to be enabled.

Secure Boot

H3C S5170-EI supports secure boot with multiple methods to ensure the switch boots from a legit image.

O&M

Port Mirroring

H3C S5170-EI supports local port mirroring to mirror all traffic of the specified mirroring port to the observation port. It supports maximum four mirroring groups.

RSPAN

H3C S5170-EI supports Remote Switched Port Analyzer (RSPAN) for remote port mirroring.

Flow Mirroring

H3C S5170-EI supports flow mirroring to mirror specified flows on the device to the observation port.

NQA

H3C S5170-EI supports Network Quality Analyzer (NQA) for network connectivity monitoring.

Cloud Management

H3C S5170-EI can be managed by H3C hosted cloud management platform Cloudnet (cloudnet.h3c.com) from anywhere with Internet.

ZTP

H3C S5170-EI supports Zero Touch Provisioning (ZTP) with a DHCP option specifying the TFTP server address and the configuration file on the TFTP server.



Automation with Ansible

H3C S5170-EI can be configured by Ansible for automation.

SmartMC

H3C S5170-EI supports SmartMC with one commander - Topology Master (TM) device managing multiple member devices - Topology Clients (TC) for configuration file backup and download, software upgrade, configuration deployment, and faulty member replacement.

Telemetry

H3C S5170-EI supports Telemetry with GRPC dial-out and dial-in.

QoS

VoQ

H3C S5170-EI supports Virtual Output Queuing (VoQ) to avoid head-of-line (HoL) blocking.

Capacity

MAC Table

H3C S5170-EI supports up to 32K (32,767) MAC addresses in the MAC table. Tolly engineers verified that the switch forwarded traffic matching all entries in the MAC table, without frame loss or broadcasts occurring.

ARP Table

H3C S5170-EI supports up to 4,096 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 S5170-EI supports up to 2,048 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 S5170-EI supports up to 6,128 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.

FIBv6

H3C S5170-EI supports up to 2,041 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.

ARP Learning Rate

H3C S5170-EI supports learning 200 ARP entries per second.

Route Learning/Withdrawing Rate

H3C S5170-EI supports learning 460 IPv4 BGP routes per second. It supports withdrawing 445 IPv4 BGP routes per second.

H3C S5170-EI supports learning 297 IPv6 BGP4+ routes per second. It supports withdrawing 404 IPv6 BGP4+ routes per second.

ACL

H3C S5170-EI supports 1,280 inbound or 512 outbound ACL rules. Tolly engineers verified that all rules worked properly to match the traffic and perform the configured actions (e.g. blocking).

DRAM and Flash

H3C S5170-EI provides 1GB DRAM and 256MB Flash.

Test Methodology

The H3C Comware Software, Version 7.1.070 was used as the switch firmware in the test.

Capacity

In the capacity test, each item was tested independently.



H3C S5170-EI Series Converged Gigabit Switch

Tolly Verified Features - Part 1 of 3

IRF		Layer 3 Features	
✓	IRF Stacking Bandwidth up to 20Gbps stacking bandwidth with 2*10GE stacking links	✓	BFD for VRRP less than 300ms failover time with 100ms BFD interval
✓	Load Balancing between Stacking Links When switches are stacked with multiple stacking links, traffic between the stack members is load balanced between stacking links	✓	BFD for IPv4 Routing Protocols BFD for static route BFD for RIP BFD for OSPF BFD for IS-IS BFD for BGP
✓	Single-point Management Administrators can connect to any one of the stack members to manage the entire stack	✓	BFD for IPv6 Routing Protocols BFD for static route BFD for RIPng BFD for OSPFv3 BFD for IS-IS IPv6 BFD for BGP4+
✓	16.4ms failover time for the IRF stacking link failure	✓	OSPF Fast Re-route (FRR) LFA less than 50ms failover time
Layer 2 Features		✓	Policy Route
✓	STP/RSTP/MSTP/PVST	✓	IP Fragmentation and Reassembly
✓	ERPS <50ms failover time	Multicast Features	
✓	RRPP <50ms failover time	✓	IPv4 IGMP Snooping for Layer 2 Multicast
✓	Smart Link <50ms failover time	✓	IPv6 MLD Snooping for Layer 2 Multicast
✓	VLAN The device supports 4,094 VLANs	✓	IPv4 Multicast with IGMP and PIM
		✓	IPv6 Multicast with MLD and IPv6 PIM

Source: Tolly, December 2023

Table 3



H3C S5170-EI Series Converged Gigabit Switch

Tolly Verified Features - Part 2 of 3

Security Features		✓	PPPoE Relay Add the PPPoE client-side interface and VLAN information to the PPPoE packets for the BRAS to distinguish between end hosts
✓	MAC Authentication	✓	CPU Defend Limit the rate of certain protocol packets (e.g. ARP) that need to be processed by the device CPU to prevent the CPU from overloading
✓	802.1X Authentication	✓	Attack Source Tracing Identify the attacker and respond with certain actions (interface error down, alarm, etc.)
✓	Portal Authentication	✓	MAC-Forced Forwarding (MFF) Layer 2 isolation. All Layer 2 communications have to go through the gateway
✓	Triple Authentication MAC, 802.1X and Web Portal authentication on the same port	✓	IP Source Guard (IPSG) Prevent IP address spoofing attacks (unauthorized hosts access and attack the network with forged IP addresses). The device validates IP packets' source IP, source MAC, VLAN ID and interface with the binding table (static or DHCP snooping)
✓	DHCP Snooping, DHCPv6 Snooping Trusted port for the DHCPv6 server; Binding table creation	✓	Dynamic ARP Inspection (DAI) Prevent man-in-the-middle attacks and theft on authorized users' information. The device validates ARP packets' source IP, source MAC, VLAN ID and interface with the binding table (static or DHCP snooping)
✓	DHCP Relay, DHCPv6 Relay	✓	Source Address Validation Improvements (SAVI) Validate DHCPv6 and ND protocol packets, and IPv6 data packets with the binding table
✓	ND Snooping Trusted port for ND; Binding table creation	✓	Secure boot Multiple methods to ensure the switch boots from a legit image
✓	DHCP Server, DHCPv6 Server		

Source: Tolly, December 2023

Table 4



H3C S5170-EI Series Converged Gigabit Switch

Tolly Verified Features - Part 3 of 3

O&M		Capacity	
✓	Port Mirroring Local port mirroring with total 4 mirroring groups	✓	MAC Table 32,767 MAC addresses
✓	Remote Switched Port Analyzer (RSPAN)	✓	ARP Table 4,096 entries
✓	Flow Mirroring Mirror specified flow on the device to the observation port	✓	ND Table 2,048 entries
✓	Network Quality Analyzer (NQA) Network connectivity monitoring	✓	IPv4 Routing Table/FIBv4 6,128 usable routes (6,144 total including built-in direct connect routes)
✓	Cloud Management The switch can be managed by H3C hosted cloud management platform Cloudnet (cloudnet.h3c.com)	✓	IPv6 Routing Table/FIBv6 2,041 usable routes (2,048 total including built-in direct connect routes)
✓	Zero Touch Provisioning (ZTP) with a DHCP option specifying the TFTP server address and the configuration file on the TFTP server	✓	ARP learning rate 200 ARP entries per second
✓	Automation with Ansible The switch can be configured by Ansible	✓	BGP route learning rate 460 routes per second
✓	Smart Management Center (SmartMC) One commander - Topology Master (TM) device manages multiple member devices - Topology Clients (TC) for configuration file backup and download, software upgrade, configuration deployment, and faulty member replacement	✓	BGP route withdrawing rate 445 routes per second
		✓	BGP4+ route learning rate 297 routes per second
		✓	BGP4+ route withdrawing rate 404 routes per second
✓	Telemetry GRPC Dial-out and Dial-in	✓	ACL 1,280 inbound rules, 512 outbound rules
QoS		✓	DRAM and Flash 1GB DRAM, 256MB Flash
✓	Virtual Output Queuing (VoQ) to avoid head-of-line (HoL) blocking		

Source: Tolly, December 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.

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