

Huawei S5720-LI Series Simplified Gigabit Ethernet Switches

Feature Validation and Performance Evaluation

Executive Summary

The S5720-LI series switches are next-generation energy-saving gigabit Ethernet switches developed by Huawei, providing flexible gigabit access and GbE/10GbE uplink ports. Based on next-generation high-performance hardware and the Huawei Versatile Routing Platform (VRP), the S5720-LI supports intelligent stack (iStack), flexible Ethernet networking, diversified security control, multiple Layer 3 routing protocols, higher performance and better service processing capability. It provides customers with a green, easy-to-manage, easy-to-expand, and cost-effective enterprise access gigabit to the desktop solution.

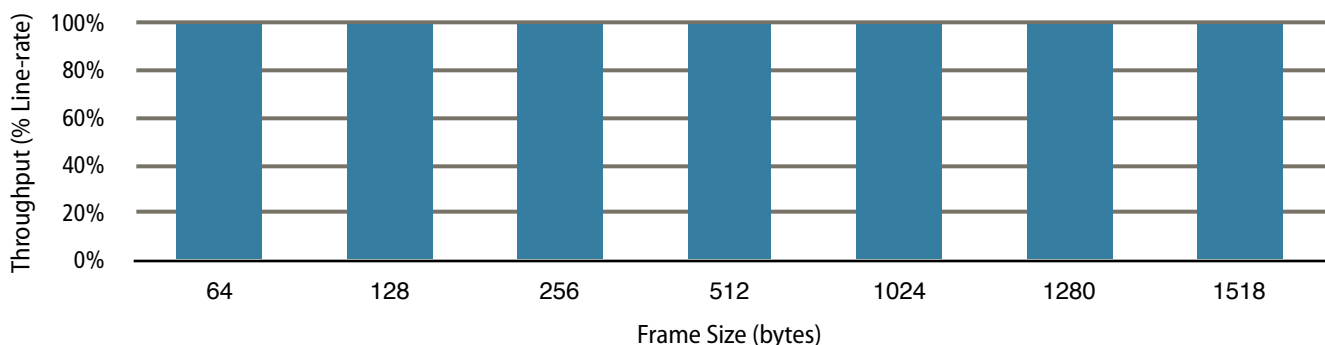
Tolly engineers evaluated Huawei's S5720-LI series switches in multiple areas including the OpenFlow 1.3 compliance, NETCONF feature, forwarding capability, capacity, high performance stack, high availability, security, Zero Touch Provisioning, Super Virtual Fabric (SVF), and Energy Efficient Ethernet (EEE) power saving.

The Bottom Line

Huawei S5720-LI Series Switches:

- 1 Support 100% line-rate forwarding without frame loss
- 2 Support OpenFlow 1.3 and NETCONF SDN protocols
- 3 Support stacking with GbE copper service ports or uplink ports using the iStack technology
- 4 Support working as Super Virtual Fabric (SVF) clients
- 5 Support Layer 3 routing protocols including OSPF/RIP/RIPng
- 6 Support numerous security features including DHCP snooping, DAI, SAVI, MFF, CPU attack defense, etc.
- 7 Support Easy Operation and Zero Touch Provisioning

Huawei S5720-LI Switch Layer 2 Throughput
 with 8/24/48 GbE ports and four 2.5Gbps/12Gbps stacking ports
 (as reported by Spirent TestCenter 4.42)



Note: 100% line-rate throughput with zero frame loss in all tests. Full-mesh topology was used for the GbE ports. The GbE uplink ports on -P models can work as 2.5Gbps stacking ports; the 10GbE uplink ports on -X models can work as 12Gbps stacking ports. Tolly engineers verified the four GbE uplink ports on each -P model supported 10Gbps unidirectional (20Gbps bidirectional aggregated) stacking throughput for each frame size. The four 10GbE uplink ports on each -X model supported 48Gbps unidirectional (96Gbps bidirectional aggregated) stacking throughput for each frame size. The packet forwarding capability was 144Mpps for 48 ports -X models, 87Mpps for 48 ports -P models, 108Mpps for 24 ports -X models, 51Mpps for 24 ports -P models, and 27Mpps for 8 ports -P models.

Source: Tolly, October 2016

Figure 1



Test Results

SDN

OpenFlow 1.3 Compliance

Tolly engineers verified that the S5720-LI switch passed all 416 test cases in Huawei's OpenFlow 1.3 Compliance Test Suite.

The test cases provided comprehensive coverage of the OpenFlow basic protocols exercising various kinds of OpenFlow messages, connection, flow_table, group table, multi-table, meters, counters, MPLS, VLAN, IPv6, etc.

NETCONF

Tolly engineers verified that the S5720-LI switch could be configured with the Network Configuration Protocol (NETCONF) as a cloud-managed switch.

Performance

Forwarding Capability

Tolly engineers verified that the S5720-LI switch provided 100% line-rate forwarding with all the ports for 64-, 128-, 256-, 512-, 1024-, 1280- and 1518-byte frame sizes. Full-mesh topology was used for all GbE service ports. The GbE uplink ports in -P models worked as 2.5Gbps stacking ports; the 10GbE uplink ports in -X models worked as 12Gbps stacking port. Tolly engineers verified the four GbE uplink ports on each -P model supported 10Gbps unidirectional (20Gbps bidirectional aggregated) stacking throughput for each frame size. The four 10GbE uplink ports on each -X model supported 48Gbps unidirectional (96Gbps bidirectional aggregated) stacking throughput for each frame size. See Figure 1 for the results.

The packet forwarding capability was 144Mpps for 48 ports -X models, 87Mpps for 48 ports -P models, 108Mpps for 24 ports -X models, 51Mpps for 24 ports -P models, and

27Mpps for 8 ports -P models. See the Test Methodology section for detail.

Capacity

MAC Table

The S5720-LI switch's MAC table supported 16K MAC addresses.

ARP Table

The S5720-LI switch's ARP table supported 2K entries.

IPv4 FIB

The S5720-LI switch's IPv4 FIB table supported 4K routes. Traffic matching the destination addresses in the FIBv4 table was forwarded without loss.

VLAN

The S5720-LI supported 4K VLANs.

1:1 Port Mirroring

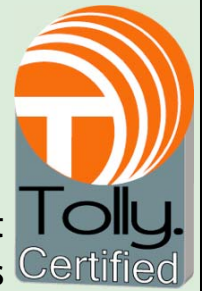
The S5720-LI supported 6 pairs of 1:1 port mirroring.

Stack

The S5720-LI switch supported stacking with the iStack technology using the GbE copper service ports.

Also, Tolly engineers verified the four GbE uplink ports on each -P model worked as 2.5Gbps stacking ports. The four 10GbE uplink ports on each -X model worked as 12Gbps stacking ports. All ports supported line-rate forwarding for stacking to provide 10Gbps unidirectional (20Gbps bidirectional aggregated) stacking throughput for -P models and 48Gbps unidirectional (96Gbps bidirectional aggregated) stacking throughput -X models. See Figure 1.

Huawei Technologies, Co., Ltd



S5720-LI Series Simplified Gigabit Ethernet Switches

Feature Validation and Performance Evaluation

Tested October 2016

Layer 2 Features

STP/RSTP/MSTP

The S5720-LI switch supported STP, RSTP and MSTP protocols.

RRPP

The S5720-LI switch supported the Rapid Ring Protection Protocol (RRPP).

Layer 3 Features

IPv4 Routing Protocols

The S5720-LI switch supported IPv4 routing protocols including RIP and OSPF.

IPv6 Routing Protocols

The S5720-LI switch supported the IPv6 routing protocol RIPng.

Super Virtual Fabric (SVF)

Tolly engineers verified that the S5720-LI switch could act as the Super Virtual Fabric (SVF) client. With SVF, administrators can manage the core switches, aggregation switches, access switches and wireless access points as one virtual device. The S5720-LI switch supports plug-and-play in an SVF environment when the SVF parent switch is properly configured.



Huawei S5720-LI Series Simplified Gigabit Ethernet Switch Tolly Certified Features, Performance and Capacity

SDN		High Availability	
✓	Full OpenFlow 1.3 Compliance - 100% passed 416 Huawei OpenFlow 1.3 Compliance Test Cases	✓	SEP Ring Protection
✓	NETCONF	✓	ITU-T G.8032 Ethernet Ring Protection Switching (ERPS) with Multiple Instances
Performance		✓	Rapid Ring Protection Protocol (RRPP)
✓	100% Line-rate forwarding with 24/48 x GbE ports + 4 x 2.5Gbps/12Gbps stacking ports (GbE uplink ports in -P models worked as 2.5Gbps stacking ports; 10GbE uplink ports in -X models worked as 12Gbps stacking ports) for 64- to 1518-byte frame sizes 27Mpps/51Mpps/87Mpps/108Mpps/144Mpps packet forwarding capability for 8/24/48 ports models	Security	
Capacity		✓	DHCP Snooping
✓	MAC Table: 16K MAC addresses	✓	DAI
✓	ARP Table: 2K entries	✓	Source Address Validation Improvements (SAVI)
✓	IPv4 FIB: 4K routes	✓	MAC-forced Forwarding (MFF)
✓	VLAN: 4K VLANs	✓	CPU Attack Defense: Blacklist, Control Plane Committed Access Rate (CPCAR)
✓	Port Mirroring: six 1:1 pairs	Easy-Operation (as the client)	
Stack		✓	Zero-touch deployment of new switches Commander switch automatically loads the specified configuration to out of box member switches
✓	Stacking with GbE copper service ports	✓	Centralized software upgrading and patch deployment Update the software or load a patch to a member switch from the commander switch
✓	Stacking with the 10GbE or GbE uplink ports The 10GbE uplink ports worked as 12Gbps stacking ports. 48Gbps unidirectional (96Gbps bidirectional aggregated) stacking links with line-rate forwarding for -X models The GbE uplink ports worked as 2.5Gbps stacking ports. 10Gbps unidirectional (20Gbps bidirectional aggregated) stacking links with line-rate forwarding for -P models	✓	Faulty device replacement without configuration Commander switch automatically load the backed up configuration of the faulty member device to the replacement switch
Layer 2 Features		Zero Touch Provisioning	
✓	STP/RSTP/MSTP	✓	Zero Touch Provisioning (ZTP) using the eSight Unified Management Platform as the remote client
Layer 3 Features		Power Saving	
✓	RIP and OSPF routing protocol	✓	Energy Efficient Ethernet (EEE)
✓	RIPng IPv6 routing protocols	Hardware	
Centralized Management (SVF Client)		✓	Quiet Operation: Certain models have no fans S5720(S)-12TP-LI-AC, S5720(S)-12TP-PWR-LI-AC, S5720(S)-28P-LI-AC, S5720-28TP-LI-AC, S5720(S)-28TP-PWR-LI-ACL, S5720-16X-PWH-LI-AC
✓	Working as Super Virtual Fabric (SVF) clients with the plug-and-play capability		

Source: Tolly, October 2016

Table 2



High Availability

Huawei SEP Ring

Smart Ethernet Protection (SEP) is Huawei's technology for ring topology high availability.

ITU-T G.8032 ERPS

The S5720-LI switch supported ITU-T G.8032 Ethernet Ring Protection Switching (ERPS) with multiple instances.

Security

DHCP Snooping

The S5720-LI switch supported the DHCP snooping feature to make sure that only the DHCP server connected to the trusted ports can distribute IP addresses. It also created the DHCP snooping binding table to record the mapping of each client's IP address, MAC addresses, VLAN and port.

Dynamic ARP Inspection (DAI)

DAI validates the source IP and MAC addresses of ARP packets to see whether they match the DHCP snooping table on the switch. With DAI enabled on the S5720-LI, when the IP or MAC address of a DHCP client was manually changed, the S5720-LI blocked the ARP request packets from the client and thus the gateway could not receive them.

SAVI

With the Source Address Validation Improvements (SAVI) feature, the S5720-LI switch was able to check the validity of the source addresses in the Neighbor Discovery (ND) packets, DHCPv6 packets, and IPv6 data packets. The S5720-LI was able to filter out invalid packets based on the bindings between IP addresses and ports. The bindings are generated by ND snooping and DHCPv6 snooping. To check the validity of the source addresses in IPv6 data packets, the IP source guard feature was enabled.

MFF

MAC-forced Forwarding (MFF) isolates user devices in a broadcast domain at Layer 2 and allows the user devices to communicate with each other at Layer 3. It takes advantage of Ethernet broadcast domains and conserves IP addresses and VLANs. 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. The S5720-LI switch supported MFF.

CPU Attack Defense

Certain types of protocol packets including ARP requests, ICMP, DHCP Discover, etc. are sent to switch's CPU for processing. It's critical that the switch provides certain attack defense features to prevent the CPU from overloading.

CPU Attack Defense

Two functions of CPU Attack Defense were verified on the S5720-LI switch by Tolly engineers.

Blacklist - Administrators can create a blacklist by defining an ACL. Then the switch discard the packets matching the ACL rules.

CPCAR - Control Plane Committed Access Rate (CPCAR) limits the rate of protocol packets sent to the control plane and schedules the packets to protect the control plane. The switch identifies service packets based on ACLs and applies the default CAR value to protocol packets so that a limited number of protocol packets are sent to the control plane.

Easy-Operation

Three features of easy-operation was verified:

Zero-touch Deployment of New Switches - Administrators can specify a configuration file for each type of switch. When an out-of-

box switch is connected to the network, it receives the commander switch's IP address using option 148 from the DHCP server. Then it gets the easy deployment configuration for the type of switch it belongs to and receives the FTP server's IP address and credential as well as the configuration file's position. Lastly, it downloads the configuration file from the FTP server and runs it.

Centralized software upgrading and patch deployment - Administrators can remotely upgrade software or deploy a patch to a member switch from the command switch.

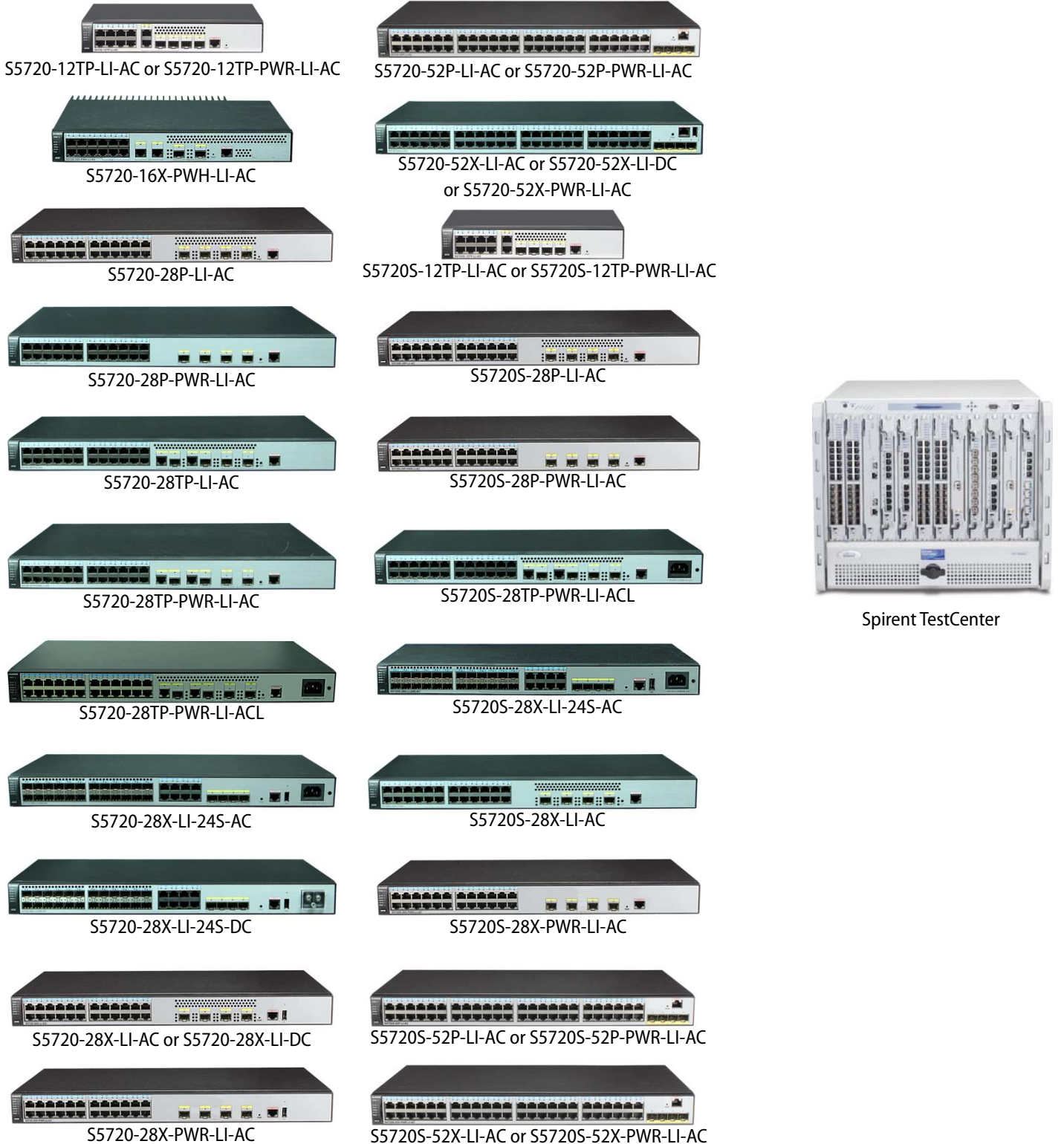
Faulty device replacement without configuration - The commander switch backs up the configuration of all member switches periodically. When a member switch fails, administrators can take it down and put an out-of-box switch of the same model to the network. The commander switch automatically loads the latest backup configuration file of the faulty switch to the new switch so no configuration is needed on the replacement switch.

Tolly engineers verified the three features when the S5720-LI switch was a client switch.

Zero Touch Provisioning

Tolly engineers verified that the Huawei eSight Unified Management Platform supported the Zero Touch Provisioning (ZTP) feature. Administrators can plan the network topology using eSight's graphic Web interface and specify the configuration for each remote device. A root switch managed by eSight can then automatically deploy planned configurations to the remote devices when the out-of-box remote devices connects to the network. The S5720-LI switch supported working as the remote client device.

Huawei S5720-LI Series Simplified Gigabit Ethernet Switches Test Bed



Source: Tolly, October 2016

Figure 2



Tolly.

Power Saving

The Energy Efficient Ethernet (EEE) function reduces the power on the electrical interface when the interface is idle and restores the power when the interface starts to transmit data.

Tolly engineers verified that the Energy Efficient Ethernet (EEE) feature could save up to 31% power consumption on one S5720-LI switch.

Hardware

Certain S5720-LI models operate quietly without any fans. The following models are included S5720(S)-12TP-LI-AC, S5720(S)-12TP-PWR-LI-AC, S5720(S)-28P-LI-AC, S5720-28TP-LI-AC, S5720(S)-28TP-PWR-LI-AC, S5720-16X-PWH-LI-AC.

Test Setup & Methodology

Test Methodology

Capacity

Each capacity level was evaluated individually in a manner appropriate to that feature.

Performance

In the networking industry, some vendors' data sheets use 1.4881 as the ratio to convert Gbps throughput to Mpps packet forwarding rate while some vendors round the ratio to 1.5. When using 1.5 as the ratio, the forwarding capability of one S5720-52X-LI-AC switch is $96 * 1.5 = 144$ Mpps.



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Test Equipment Summary

The Tolly Group gratefully acknowledges the providers of test equipment/software used in this project.

Vendor	Product	Web
Spirent	TestCenter 4.42	 http://www.spirent.com

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