

Huawei S600-E Series Education-Tailored Switches

Feature Validation and Performance Evaluation

Executive Summary

The S600-E series switches are next-generation education-tailored switches developed by Huawei. Based on next-generation high-performance hardware and the Huawei Versatile Routing Platform (VRP), the S600-E supports numerous IPv6 features and multiple security control including SAVI, IP source guard, etc. It can work as Super Virtual Fabric (SVF) clients to simplify network management and fulfill requirements in education campus access and aggregation application scenarios.

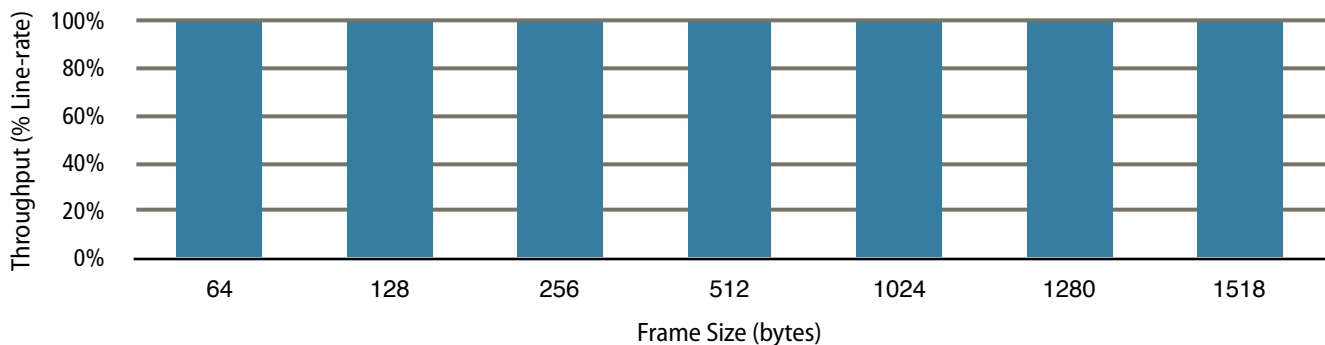
Tolly engineers evaluated Huawei's S600-E series switches in multiple areas including the OpenFlow 1.3 compliance, NETCONF feature, forwarding capability, capacity, high performance stack, high availability, security, Zero Touch Provisioning (ZTP), Super Virtual Fabric (SVF), and Energy Efficient Ethernet (EEE) power saving.

The Bottom Line

Huawei S600-E 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, ND snooping, SAVI, IP source guard, MAC/portal/802.1x authentication, etc.
- 7 Support Easy Operation and Zero Touch Provisioning

Huawei S600-E 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 non X 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 non X 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 non X models, 108Mpps for 24 ports X models, and 51Mpps for 24 ports non X models.

Source: Tolly, October 2016

Figure 1



Tolly. Test Results

SDN

OpenFlow 1.3 Compliance

Tolly engineers verified that the S600-E 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 S600-E switch could be configured with the Network Configuration Protocol (NETCONF) as a cloud-managed switch.

Performance

Forwarding Capability

Tolly engineers verified that the S600-E 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 non X 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 non X 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 non X models, 108Mpps for 24 ports X models, and 51Mpps for 24 ports non X

models. See the test methodology section for detail.

Capacity

MAC Table

The S600-E switch's MAC table supported 16K MAC addresses.

ARP Table

The S600-E switch's ARP table supported 1K entries.

IPv4 FIB

The S600-E switch's IPv4 FIB table supported 2K routes. Traffic matching the destination addresses in the FIBv4 table was forwarded without loss.

ACL

The S600-E supported 1,250 ACL rules.

1:1 Port Mirroring

The S600-E supported 6 pairs of 1:1 port mirroring.

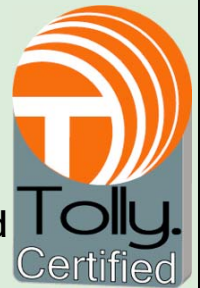
Stack

The S600-E switch supported stacking with the iStack technology using the GbE copper service ports.

Also, Tolly engineers verified the four GbE uplink ports on each non X 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 non X models and 48Gbps unidirectional (96Gbps bidirectional aggregated) stacking throughput X models. See Figure 1.

Huawei Technologies, Co., Ltd

S600-E Series Education-Tailored Switches



Feature Validation and Performance Evaluation

Tested October 2016

Layer 2 Features

VCMP

The S600-E switch supported Huawei VLAN Central Management Protocol (VCMP) to synchronize VLAN information across devices.

Policy VLAN

Tolly engineers verified that the S600-E switch supported policy VLAN based on MAC address, IP subnet, etc..

Layer 3 Features

IPv4 Routing Protocols

The S600-E switch supported IPv4 routing protocols including RIP and OSPF.

IPv6 Routing Protocols

The S600-E switch supported the IPv6 routing protocol RIPng.

Super Virtual Fabric (SVF)

Tolly engineers verified that the S600-E 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



Huawei S600-E Series Education-Tailored Switch Tolly Verified 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		Access Security	
✓	100% Line-rate forwarding with 24/48 x GbE ports + 4 x 2.5Gbps/12Gbps stacking ports (GbE uplink ports in non X 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 51Mpps/87Mpps/108Mpps/144Mpps packet forwarding capability for 24/48 ports models	✓	DHCP Snooping (v4/v6)
Capacity		✓	ND Snooping
✓	MAC Table: 16K MAC addresses	✓	IP Source Guard
✓	ARP Table: 1K entries	✓	Source Address Validation Improvements (SAVI)
✓	IPv4 FIB: 2K routes	✓	PPPoE+ (PPPoE Intermediate Agent)
✓	ACL: 1,250 ACL Rules	✓	MAC authentication
✓	Port Mirroring: six 1:1 pairs	✓	Portal authentication
Stack		✓	802.1x authentication
✓	Stacking with GbE copper service ports	Easy Operation (as the client)	
✓	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	✓	Zero-touch deployment of new switches Commander switch automatically loads the specified configuration to out of box member switches
Layer 2 Features		✓	Centralized software upgrading and patch deployment Update the software or load a patch to a member switch from the commander switch
✓	VCMP	✓	Faulty device replacement without configuration Commander switch automatically load the backed up configuration of the faulty member device to the replacement switch
✓	Policy VLAN	Zero Touch Provisioning	
Layer 3 Features		✓	Zero Touch Provisioning (ZTP) using the eSight Unified Management Platform as the remote client
✓	RIP and OSPF routing protocol	Power Saving	
✓	RIPng IPv6 routing protocols	✓	Energy Efficient Ethernet (EEE)
Centralized Management (SVF Client)		Hardware	
✓	Working as Super Virtual Fabric (SVF) clients with the plug-and-play capability	✓	Quiet Operation: The S628-E model has no fans
Traffic Monitoring			
✓	sFlow		

Source: Tolly, October 2016

Table 2



S600-E switch supports plug-and-play in an SVF environment when the SVF parent switch is properly configured.

Traffic Monitoring

sFlow

Tolly engineers verified that the S600-E switch supported the sFlow protocol to monitor the traffic statistics and upload the information to an sFlow server.

High Availability

Huawei SEP Ring

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

ITU-T G.8032 ERPS

The S600-E switch supported ITU-T G.8032 Ethernet Ring Protection Switching (ERPS) with multiple instances.

Security

DHCP Snooping (v4/v6)

The S600-E 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.

ND Snooping

Neighbor Discovery (ND) snooping is a security feature of IPv6 ND and applies to Layer 2 networks. It creates the ND snooping binding table to record the mapping of source IPv6 addresses, MAC addresses, VLANs, and inbound ports of Neighbor Solicitation (NS) packets from IPv6 clients. Tolly engineers verified that the S600-E switch supported ND snooping.

IP Source Guard

IP Source Guard is a security feature that restricts IP traffic on untrusted Layer 2 ports by filtering traffic based on the DHCP snooping table or manually configured IP source bindings.

After the IP or MAC address of a client was manually changed to not match the DHCP snooping table, Tolly engineers verified that the client could not access the network through the S600-E switch.

SAVI

With the Source Address Validation Improvements (SAVI) feature, the S600-E switch was able to check the validity of the source addresses in the Neighbor Discovery (ND) packets, DHCPv6 packets, and IPv6 data packets. The S600-E 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.

PPPoE+ (PPPoE IA)

PPPoE+, also called PPPoE Intermediate Agent 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.

Tolly engineers verified that the S600-E switch supported PPPoE+.

Portal/802.1x/MAC Authentication

Tolly engineers verified that the S600-E switch supported portal authentication, 802.1x authentication, as well as MAC authentication.

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 S600-E 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 S600-E switch supported working as the remote client device.



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 S600-E switch.

Hardware

The S628-E model operates quietly without any fans.

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 S652X-E switch is $96 * 1.5 = 144$ Mpps.

Huawei S600-E Series Simplified Gigabit Ethernet Switches Test Bed



S628-E



S652-E



S628-PWR-E



S652-PWR-E



S628X-E



S652X-E



S628X-PWR-E



S652X-PWR-E



Spirent TestCenter

Source: Tolly, October 2016

Figure 2



About Tolly


The Tolly Group companies have been delivering world-class IT services for more than 25 years. Tolly is a leading global provider of third-party validation services for vendors of IT products, components and services.

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

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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