Lab Testing Summary Report

March 2012

Report SR120121B

Product Category:

Enterprise Switch

Vendor Tested:

HUAWEI

Product Tested:

S7700 Series Switches

Key findings and conclusions:

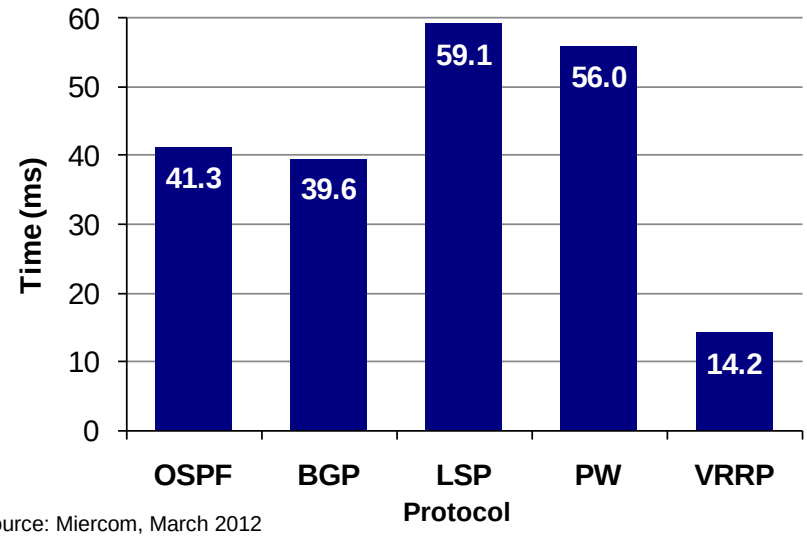
- **Huawei S7706 switch supports patented Cluster Switching System technology for high availability**
- **Smart Ethernet Protection (SEP) protocol is supported with highly advanced capabilities**
- **Interoperable with switches from other manufacturers**
- **Supports a variety of high performance interface boards, including 40*-, 16*- and 12*10GE blades**
- **Hardware BFD and OAM exhibited perfect performance in fault detection and switchover**

Huawei Technologies engaged Miercom to evaluate the S7700 series of high-end smart routing enterprise switches. The S7700 series includes the S7703, S7706, and S7712 models. For this report, the S7706 switch was tested. The S7700 is an extensible and reliable platform integrating switching and routing functions to facilitate end-to-end integrated networks. Use case scenarios include WANs, MANs, campus networks, and data centers to help enterprises build application-oriented networks.

The features in this model are supported on the other switches in the S7700 series making the results applicable for the entire series. The S7700 series of switches provide high performance Layer 2 through 4 switching, and is highly redundant to meet high availability requirements. The S7700 series of switches have a dedicated daughter card for fault detection.

S7706 chassis has six card slots available for various network deployments. Card types are 10/100, 10/100/1000, 10G, PoE interface and service processing unit cards. Their switching capacity and port

Figure 1: Huawei S7706 Enterprise Switch
Bidirectional Forwarding Detection Convergence Time



Source: Miercom, March 2012

Failover convergence times with various protocols. Network resiliency is improved with lower times. See discussion on page 3.

density can be expanded. The service processing unit cards include value-added features, such as firewall support, IPsec, and load balancing functionality.

In addition, feature testing was performed to show interoperability with switches from other manufacturers, and to verify the extensive capability of the switch and the installed cards.

Basic Features

IPv6 IPv6 service support is enabled and the S7700 has achieved the IPv6 Phase 2 (Gold) designation from Huawei. This includes supporting features, such as IPv4/IPv6 dual stacking, tunneling, IPv6 static routing, RIPng, OSPFv3, BGP+, IS-ISv6, and IPv6 multicasting.

Two-level CPU Protection Hardware security is also established by including a two-level CPU protection design that supports 1K queues. Separating the data and control planes can help in preventing DoS and unauthorized access from overloading the control plane. There is a 1.25GB cache on board shared on all ports, and less than 200ms response times.

Wireless AC Card The S7700 Wireless AC card supports radio frequency management, which allows for APs to select their radio channels and power automatically. In an AP region, APs automatically adjust channels and strength to avoid interference using the Receive Signal Strength Indicator (RSSI) and Signal-To-Noise Ratio (SNR).

QoS Improved QoS mechanisms perform traffic classification based on information from Layers 2 through 7. With the queue scheduling algorithm, the S7700 performs accurate multi-level scheduling for data flows, as well as hierarchal scheduling at the access side to satisfy SLA requirements.

Multicast Multicast for Layers 2 and 3 are functional, implementing replication among VLANs at line rate, and providing independent multicast QoS queues.

Table 1: Chart of Features of the S7700 Series of Switches

Model	S7703	S7706 ✱	S7712
Features			
Service Slots	3	6	12
Forwarding Rate	540 Mpps	1152 Mpps	1344 Mpps
Switching Capacity	720 Gbps	2 Tbps	2 Tbps
40*10G and 16*10G Blades	✓	✓	✓
Integrated Firewall Card	✓	✓	✓
IPv6	✓	✓	✓
Clustering	✓	✓	✓
MPLS	✓	✓	✓
LACP	✓	✓	✓
STP/MSTP	✓	✓	✓
VRRP	✓	✓	✓
Multicast	✓	✓	✓
PoE and PoE+	✓	✓	✓
Wireless Access Controller	✓	✓	✓
Advanced Security Features	✓	✓	✓
802.3az Energy Efficient Ethernet	✓	✓	✓
Integrated Firewall and NAT Cards	✓	✓	✓

Source: Miercom, March 2012 ✱ - Tested Model

High Reliability

ISSU The S7700 series switches aim to reach 99.999% uptime reliability, to achieve carrier-class requirements. The S7700 supports In-Service Software Upgrades (ISSU) which is designed to eliminate the disruption of mission-critical services while allowing for up-to-date software to be used across a network infrastructure.

CSS Technology Huawei S7700 supports patented Cluster Switching System (CSS) technology. CSS enables a higher level of redundancy not possible in link teaming, trunking, or spanning trees. The cluster can support 256G bandwidth between chassis to ensure that no traffic will be lost when there is a fault in either uplink or downlink connections. The S7700 is ideal in scenarios where low latency but high redundancy and high throughput are required in the terabit routing class. By keeping a common synchronization across devices in the Ethernet trunk, minimal packet loss occurs after disabling a link. Typically, a CSS requires multiple switching processes and tends to lower switch performance in the exchange of raising its resiliency. We found in the S7700 cluster, the CSS allowed not only saving on card slots, but 256 Gbps bandwidth, a throughput higher than any switch of this class tested to date.

Hot-Swappable The S7706 switch supports hot-swappable power and fan modules. With this advantage, one module can be replaced without having to shut down and reboot the switch. By reducing network downtime, businesses are able to keep operations up and running. In addition to fan and power modules, entire switch routing units can be replaced or swapped without shutting down the switch.

CPU Protection The S7700 series of switches also supports two-level CPU protection. This separates the data plane and control plane and helps prevent DoS attacks, overloads to the control plane, and unauthorized access.

Advanced Features

Hardware BFD and OAM Huawei S7700 has hardware fault detection built into their daughter cards. Bidirectional Forwarding Detection (BFD) and Operations, Administration and Maintenance (OAM) are designed to detect and correct specific faults.

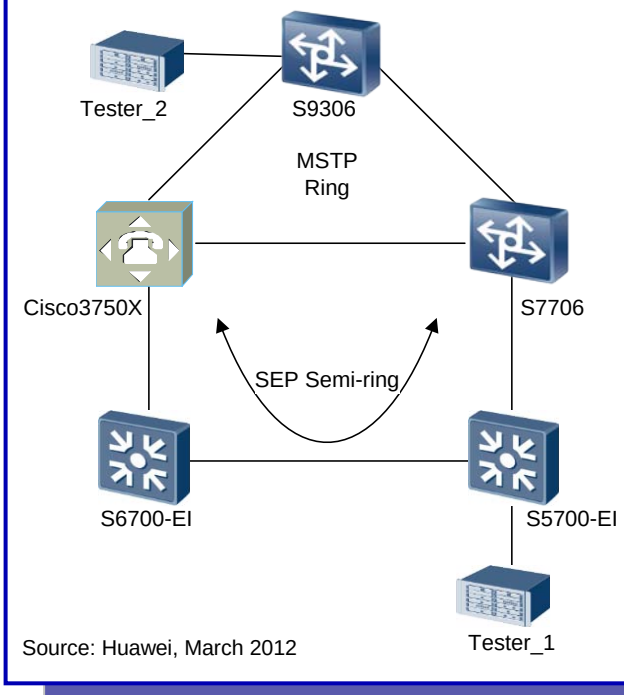
Additionally, an integrated firewall card is included in the S7700 series. The card allows for virtual firewalls and multi-instance NATing, which enables a firewall for multiple clients over VPN.

Fault detection and switchover had times of 3.3ms for trouble detection and 50ms for convergence. The switch was able to detect a fault and switch to another card or network path with minimal packet loss incurred.

To test this feature, BFD was associated with different protocols, such as OSPF, BGP, LSP, PW, and VRRP. All successfully achieved trouble protection and convergence. These tests were conducted by setting up a network with the BFD associated with one protocol at a time. We verified convergence time by unplugging a network cable and measuring the total packets dropped. Then the time to detect fault and switchover was recorded and calculated. 50 ms time was met in all of our tests. See *Figure 1* on *page 1*.

The S7700 series was very responsive to fault detection and convergence handling. OAM maintained fault detection in less than 10ms. Network problems were detected quickly. Identification and convergence were handled in under 50ms.

Figure 2: Huawei S7706 Switch MSTP Ring and SEP Semi-Ring Topology



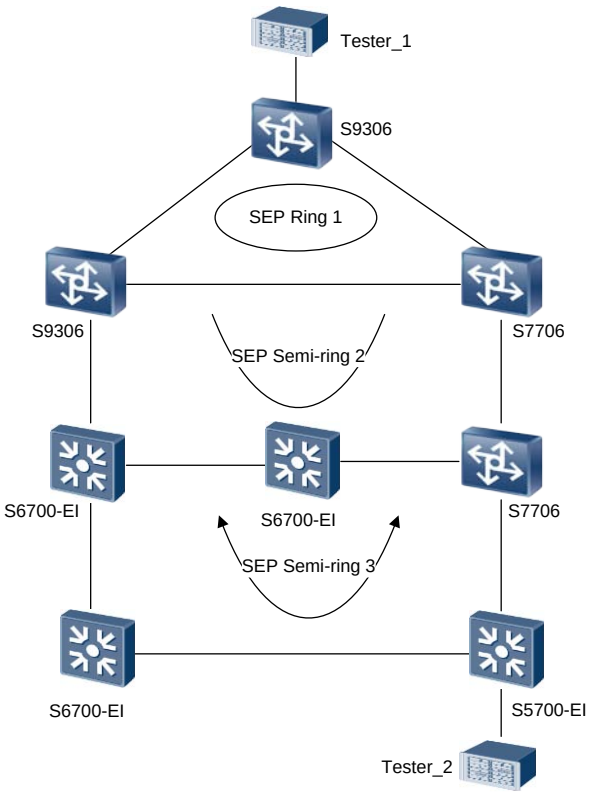
MSTP ring setup using two Huawei switches and a Cisco switch. Below the MSTP ring, an SEP semi-ring network is configured.

Interoperability

MSTP and SEP S7700 series supports multi-ring and semi-ring network topologies. For interoperability, a SEP and MSTP ring network was configured with a Huawei S7706 switch and a Cisco C3750X switch. These switches were able to work together and were fully functional with a Huawei ring setup. For the SEP and MSTP ring networks, an MSTP ring was set up using two Huawei switches and a Cisco switch. A SEP semi-ring was connected to the MSTP ring and network traffic was verified. *Figure 2* shows the ring topology used for this test.

The switches are designed to unblock a port in the event a network cable is down and the blocked port is required for ring completion. In the setup of the topology, one port on the MSTP ring was set to discard packets or block, and one port on the SEP ring was also set to discard packets. Traffic was still able to pass from Tester 1 to Tester 2 using the unblocked path. Both testers in the topology were traffic load generators.

Figure 3: Huawei S7706 Switch
SEP Multi-Ring Topology



Source: Huawei, March 2012

SEP ring network stacked on top of two SEP semi-ring network for redundant network performance.

To test convergence of the rings, one cable was pulled from the MSTP ring. It was noted that once the switch detected a pulled cable, the blocked port was unblocked, enabling traffic delivery between load generators. Next, a cable was pulled on the SEP ring and had the same results. The blocked port was unblocked and traffic was re-routed across the new path to reach the second load generator.

SEP open rings, that can be stacked into multi-ring setups, were also tested. This type of setup allows for large, redundant networks across several types of switches with complex and varying configurations. Aside from standard rings, Rapid Ring Protection Protocol (RRPP) and semi-ring were also enabled. *Figure 3* shows one of the test scenarios used to verify operation of the rings.

This ring topology was tested using the same methodology as the previous rings. All rings tested worked and converged in a minimal amount of time with low packet loss.

LACP S7700 series of switches support Link Aggregation Control Protocol. This feature is interoperable with other vendor switches, allowing it to be used in a mixed network.

OSPF Routing through the switches using the Cisco 7609 switch with Huawei S7700 proved to be fully functional as well. Both Cisco and Huawei console outputs indicated the OSPF route had been established and the test center verified the results.

BGP S7700 series supports BGP in their devices. This device can also operate with third party switches.

STP/MSTP Both STP and MSTP are supported protocols on the S7700 series of switches. These protocols work in mixed vendor networks as well as Huawei-only networks.

PoE We validated the S7700 PoE functionality. It can supply power and basic routing to different vendor products. This was tested and verified for Cisco 7975 IP phone and Avaya 9620 IP phone. In addition to power and function, we validated switch functionality showing nearest neighbor LLDP. Both devices were properly recognized.

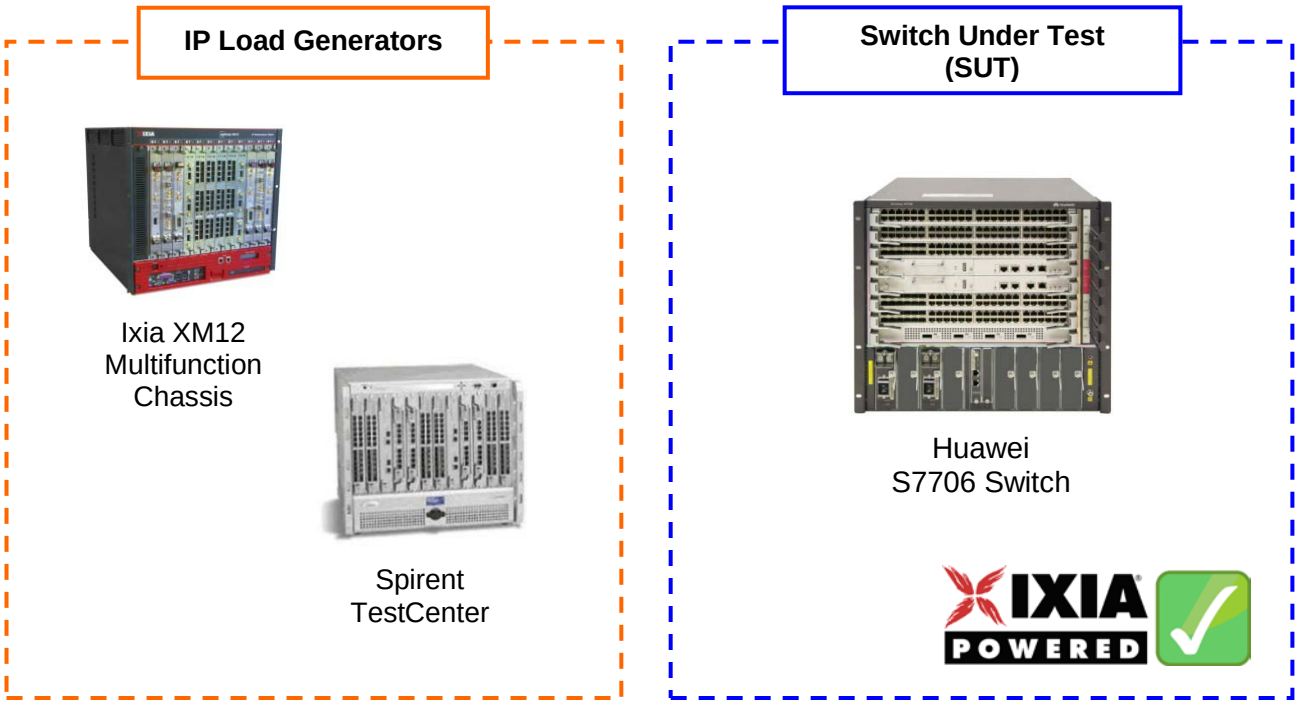
VRRP Routing through VLANs and with different vendor products is a key feature required to increase reliability and availability of routing paths. VRRP, a standard Huawei feature, can be deployed as a substitute for HSRP from Cisco.

Bottom Line

The Huawei S7700 series of switches are very resilient and feature-rich. They are capable of being deployed in enterprise network environments and can maintain operation during power outages, network cable malfunctions, and card failures. BFD and OAM allow the switch to achieve fault detection and convergence time in less than 50ms, which ensures that minimal packets are lost during the convergence.

The S7700 series of switches can also be deployed in different ring network topologies including MSTP, SEP, and semi-rings. These different ring networks allow numerous options for deploying switches based on actual use in any setting. The S7700 series is also capable of interoperability with other switches, allowing it to be deployed in ring networks with mixed vendor configuration.

Test Bed Diagram



Source: Miercom, March 2012

How We Did It

The Huawei S7700 series of switches was evaluated for feature functions and operation in ring topologies. Testing was conducted to verify that the features in this report operated as advertised. Ring convergence was verified by constructing various ring networks with blocked ports and then pulling cables out of the ring. This action forced the switch to unblock the ports to deliver traffic from one tester to the other.

The Huawei S7706 switch was running the latest firmware, version 5.7 OS. Sections of testing required using a traffic generator to evaluate the features of the product. Two different traffic generators were used, Ixia XM12 running IxNetwork version 5.50.121.48 and Spirent TestCenter running version 3.76.0076.

Miercom recognizes Ixia (www.ixiacom.com) as an industry leader in energy efficiency testing of networking equipment. Ixia's unique approach utilizes coordination of energy measurements with network traffic load – allowing energy consumption to be graphed against network traffic volume. Real-world traffic is generated by Ixia's test platform and test applications, principally IxNetwork for Layer 2-3 routing and switching traffic and IxLoad for Layer 4-7 application traffic.

The tests in this report are intended to be reproducible for customers who wish to recreate them with the appropriate test and measurement equipment. Current or prospective customers interested in repeating these results may contact reviews@miercom.com for details on the configurations applied to the Device Under Test and test tools used in this evaluation. Miercom recommends customers conduct their own needs analysis study and test specifically for the expected environment for product deployment before making a product selection.

Miercom Performance Verified

The performance of Huawei S7706 enterprise-class switch was verified by Miercom. In hands-on testing, Huawei demonstrated advanced performance features such as:

- Rich value-added function boards including wireless Access Controller blade and integrated firewall/NAT blade
- Smart Ethernet Protection (SEP) provides excellent Ethernet ring solution with convergence time within 50ms, far lower than convergence time of xSTP ring
- Interoperable with Cisco and other switches for mixed vendor networks
- Hot-swappable power and fan modules can be replaced without disrupting the network

S7706 Switch

Huawei Technologies, Co., Ltd.
http://enterprise.huawei.com

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