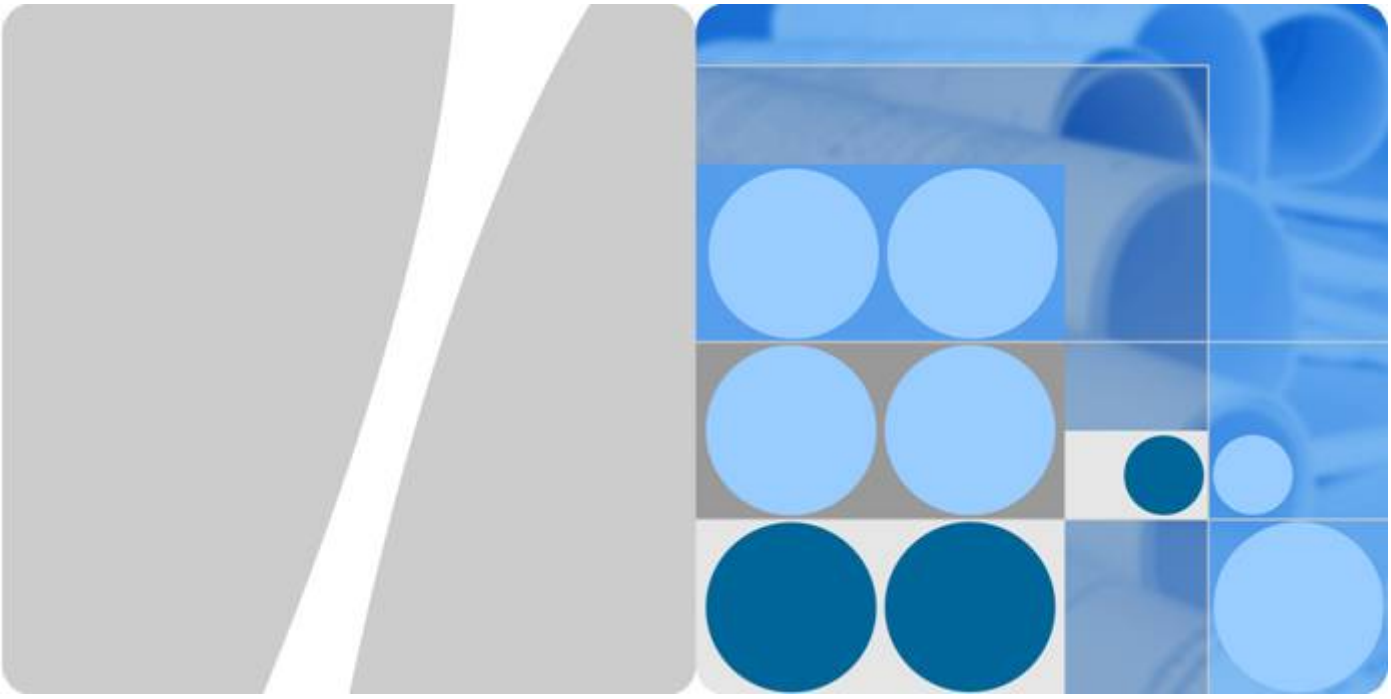

S5700 Series Ethernet Switches

V200R002C00

Product Description

Issue 06

Date 2013-06-04

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About This Document

Intended Audience

This document describes the positioning, characteristics, architecture, link features, service features, application scenarios, operation and maintenance functions, and technical specifications of the S5700.

This document helps you understand the characteristics and features of the S5700.

This document is intended for:

- Network planning engineers
- Hardware installation engineers
- Commissioning engineers
- Data configuration engineers
- On-site maintenance engineers
- Network monitoring engineers
- System maintenance engineers

Statement

The device provides the mirroring function for network monitoring and fault management, during which communication data of users may be collected. Huawei alone is unable to collect or save the content of users' communications. It is suggested that you activate the interception-related functions based on the applicable laws and regulations in terms of purpose and scope of usage. You are obligated to take considerable measures to ensure that the content of users' communications is fully protected when the content is being used and saved.

The device provides the NetStream function for network traffic statistics collection and advertisement, during which personal data of users may be used. You are obligated to take considerable measures, in compliance with the laws of the countries concerned and the user privacy policies of your company, to ensure that the personal data of users is fully protected.

Symbol Conventions

The symbols that may be found in this document are defined as follows.

Symbol	Description
 DANGER	Indicates a hazard with a high level or medium level of risk which, if not avoided, could result in death or serious injury.
 WARNING	Indicates a hazard with a low level of risk which, if not avoided, could result in minor or moderate injury.
 CAUTION	Indicates a potentially hazardous situation that, if not avoided, could result in equipment damage, data loss, performance deterioration, or unanticipated results.
TIP	Provides a tip that may help you solve a problem or save time.
 NOTE	Provides additional information to emphasize or supplement important points in the main text.

Change History

Updates between document issues are cumulative. Therefore, the latest document version contains all updates made to previous versions.

Changes in Issue 06 (2013-06-04)

The fifth commercial release has the following updates:

The documentation is modified according to updates in product features.

Changes in Issue 05 (2013-05-17)

The fifth commercial release has the following updates:

Modified:

- **7.2 Optical Module Attributes**
- **7.4 List of Software Features**

Changes in Issue 04 (2013-05-05)

The fourth commercial release has the following updates:

Modified: **7.1.4 S5700-EI**.

Changes in Issue 03 (2013-04-20)

The third commercial release has the following updates:

The documentation is modified according to updates in product features.

Changes in Issue 02 (2013-02-08)

The second commercial release has the following updates:

Modified: **1.2 Product Characteristics**.

Added: **7.5 Standards Compliance**.

Changes in Issue 01 (2012-12-08)

Initial commercial release.

Contents

1 Product Overview

About This Chapter

1.1 Product Positioning

The S5700 series ethernet switches (S5700 for short) are next-generation energy-saving switches developed by Huawei to meet the demand for high-bandwidth access and Ethernet multi-service aggregation. Based on cutting-edge hardware and Huawei Versatile Routing Platform (VRP) software, the S5700 provides a large switching capacity, high reliability (double power slots and hardware Ethernet OAM), and high-density GE ports to accommodate 10 Gbit/s upstream transmissions. It also supports Energy Efficient Ethernet (EEE) and iStack. The S5700 can be used in various enterprise network scenarios. For example, it can function as an access or aggregation switch on a campus network, a gigabit access switch in an Internet data center (IDC), or a desktop switch to provide 1000 Mbit/s access for terminals.

The S5700 is available in a lite (LI) series, a standard (SI) series, an enhanced (EI) series, and a hyper (HI) series. **Table 1-1** describes the differences among the four series.

Table 1-1 Differences among the four series

Features	LI	SI	EI	HI
IPv4 Routing Protocol	Static route	Static route/RIP	Static route/ RIP/OSPF/ BGP/ISIS	Static route/ RIP/OSPF/ BGP/ISIS
IPv6 Routing Protocol	Static route	Static route/ RIPng	Static route/ RIPng/OSPFv3/ BGP+/ISIS for IPv6	Static route/ RIPng/OSPFv3/ BGP+/ISIS for IPv6
Multicast	IGMP snooping/MLD snooping	IGMP Snooping/MLD Snooping	IGMP Snooping/MLD Snooping/ IGMP/MLD/ MSDP/PIM (IPv4)/PIM (IPv6)	IGMP Snooping/MLD Snooping/ IGMP/MLD/ MSDP/PIM (IPv4)/PIM (IPv6)
MPLS	Not supported	Not supported	MPLS LDP/ MPLS TE/ MPLS VPN **NOTE** Only the S5710-EI supports these functions.	MPLS LDP/ MPLS TE/ MPLS VPN
OAM/BFD	Software level	Software level	Software level	Hardware level
Traffic analysis	Not supported	Not supported	S5700EI: sFlow S5710EI: NetStream/ sFlow	NetStream/ sFlow

Features	LI	SI	EI	HI
iStack	Stacking through service ports **NOTE** The S5700-10P-LI-AC, S5700-10P-PWR-LI-AC and S5700S-LI do not support stacking.	Stacking through stack cards **NOTE** The S5700-26X-SI-12S-AC does not support stacking.	S5700EI: stacking through stack cards S5710EI: stacking through service ports	Not supported

1.2 Product Characteristics

Mature IPv6 Technologies

The S5700 uses the mature, stable Versatile Routing Platform (VRP) and supports IPv4/IPv6 dual stacks, IPv6 routing protocols (RIPng, OSPFv3, BGP4+, and IS-IS for IPv6), and IPv6 over IPv4 tunnels including manual, 6-to-4, and Intra-Site Automatic Tunnel Addressing Protocol (ISATAP) tunnels. With these IPv6 features, the S5700 can be deployed on a pure IPv4 network, a pure IPv6 network, or a shared IPv4/IPv6 network, helping realize IPv4-to-IPv6 transition.

Various Combination of Ports

The S5700-EI and S5710-EI support various extended subcards that provide high-density GE/10GE uplink ports. The S5710-EI has four fixed 10GE SFP+ ports. With different extended subcards installed, the S5710-EI can provide different combination of ports, such as 64xGE +4x10GE, 48xGE+8×10GE, and 56xGE+6x10GE. The flexible port combinations meet bandwidth expansion requirements, protecting customers' investment.

Intelligent Stack

The S5700 supports intelligent stack (iStack). This technology combines multiple switches into a logical switch.

Member switches in a stack implement redundancy backup to improve device reliability and use inter-device link aggregation to improve link reliability. iStack provides high network scalability. You can increase ports, bandwidth, and processing capacity of a stack by simply adding member switches to the stack. iStack also simplifies device configuration and management. After a stack is set up, multiple physical switches are virtualized into one logical device. You can log in to any member switch in the stack to manage all the member switches in the stack.

Innovative AHM Energy Saving Technologies

The S5700-LI series smart energy-saving switches reduce power consumption without degrading system performance and user experience. The S5700-LI series uses innovative energy-saving technologies including energy efficient Ethernet (EEE), port power detection, dynamic CPU frequency adjustment, and device sleeping. These technologies help reduce power

consumption by adjusting power depending on the Up/Down states of links, presence/absence of optical modules, shutdown and undo shutdown operations on ports, and peak and off-peak hours. The S5700-LI series is the industry's first switch series that supports entire device sleeping, and it provides three energy saving modes to adapt to different usage scenarios: standard mode, basic mode, and deep mode.

Comprehensive VPN Technologies

The S5700 supports the multi-VPN-instance CE (MCE) function, which allows users in different VPNs to connect to the same switch and isolates users through multi-instance routing. Users in multiple VPNs connect to a PE device through the same physical uplink port on the switch, which reduces the investment on network deployment. The S5710-EI and S5700-HI support Multiprotocol Label Switching (MPLS) QoS, MPLS traffic engineering (TE), virtual leased line (VLL), virtual private LAN service (VPLS), and Layer 3 virtual private network (L3VPN). They can provide high-quality private line access services for enterprises and are cost-effective case-shaped MPLS switches.

Easy Operation and Maintenance

The S5700 supports auto-configuration, USB-based deployment, batch remote upgrade and is a plug-and-play product. These functions facilitate device deployment, upgrade, service provisioning, and other management and maintenance operations, and also greatly reduce costs of operation and maintenance. The S5700 can be managed and maintained using Simple Network Management Protocol (SNMP) V1, V2, and V3, command line interface (CLI), web-based network management system, Telnet, or Secure Shell (SSH) V2.0. Additionally, it supports remote network monitoring (RMON), multiple log hosts, port traffic statistics collection, and network quality analysis that help in network consolidation and reconstruction.

The S5700 can use the General VLAN Registration Protocol (GVRP) to implement dynamic distribution, registration, and propagation of VLAN attributes. GVRP reduces manual configuration workload and ensures correct configuration. Besides, the S5700 supports the MUX VLAN function, which involves a principal VLAN and multiple subordinate VLANs. Subordinate VLANs are classified into group VLANs and separate VLANs. Ports in the principal VLAN can communicate with ports in subordinate VLANs. Ports in a subordinate group VLAN can communicate with each other, whereas ports in a subordinate separate VLAN can communicate only with ports in the principal VLAN.

Excellent Network Traffic Analysis

The S5700 provides the NetStream function and can function as a NetStream data exporter. It periodically collects data traffic statistics, encapsulates the statistics in standard V5, V8, or V9 packets, and sends the packets to the NetStream data collector according to NetStream configuration. The collected statistics are then processed to dynamically generate reports, analyze traffic attributes, and generate alarms on abnormal traffic. The NetStream function helps you optimize network structure and adjust resource deployment in a timely manner.

The S5700 supports the sFlow function. It uses a method defined in the sFlow standard to sample traffic passing through it and sends sampled traffic to the collector in real time. The collected traffic statistics are used to generate statistical reports, helping enterprises maintain their networks.

Flexible Ethernet Networking

In addition to traditional Spanning Tree Protocol (STP), Rapid Spanning Tree Protocol (RSTP), and Multiple Spanning Tree Protocol (MSTP), the S5700 supports Huawei-developed Smart

Ethernet Protection (SEP) technology and the latest Ethernet Ring Protection Switching (ERPS) standard. SEP is a ring protection protocol specific to the Ethernet link layer, and applies to various ring network topologies, such as open ring topology, closed ring topology, and cascading ring topology. This protocol is reliable, easy to maintain, and implements fast protection switching within 50 ms. ERPS is defined in ITU-T G.8032. It implements millisecond-level protection switching based on traditional Ethernet MAC and bridging functions.

The S5700 supports Smart Link and Virtual Router Redundancy Protocol (VRRP), which implement backup of uplinks. One S5700 switch can connect to multiple aggregation switches through multiple links, significantly improving reliability of access devices. In addition, the S5700 provides multiple connection fault detection mechanisms, including Ethernet OAM (IEEE 802.3ah/802.1ag /ITU Y.1731) and Bidirectional Forwarding Detection (BFD). The S5700HI provides hardware-based 3.3 ms Ethernet OAM and 10 ms BFD.

Diversified Security Control

The S5700 supports MAC address authentication and 802.1X authentication and implements dynamic delivery of policies (VLAN, QoS, and ACL) to users.

The S5700 provides a series of mechanisms to defend against DoS attacks and user-targeted attacks. DoS attacks are targeted at switches and include SYN flood, Land, Smurf, and ICMP flood attacks. User-targeted attacks include bogus DHCP server attacks, IP/MAC address spoofing, DHCP request flood, and change of the DHCP CHADDR value. The S5700 collects and maintains information about access users, such as IP addresses, MAC addresses, IP address leases, VLAN IDs, and access interfaces in a DHCP snooping binding table. In this way, it can defend againnst DHCP attacks on the network. You can specify DHCP snooping trusted and untrusted ports to ensure that users connect only to the authorized DHCP server.

The S5700 supports strict ARP learning. This feature prevents ARP spoofing attackers from exhausting ARP entries so that users can connect to the Internet normally.

2 Product Architecture

About This Chapter

2.1 Introduction

The S5700 series adopt the integrated hardware platform and have the front-access structure. The hardware consists of the chassis, power supply, fan, SCU, and interface card for upstream services. The width of the S5700 complies with the industry standards, and the S5700 can be installed in an IEC 297 cabinet or an ETSI cabinet.

The S5700 switches are provided in four series: LI, SI, EI, and HI.

The LI series include: S5700-28P-LI-AC, S5700-28P-LI-DC, S5700-52P-LI-AC, S5700-52P-LI-DC, S5700-28P-PWR-LI-AC, S5700-52P-PWR-LI-AC, S5700-10P-PWR-LI-AC, S5700-10P-LI-AC, S5700-28X-LI-AC, S5700-28X-LI-DC, S5700-52X-LI-AC, S5700-52X-LI-DC, S5700-28X-PWR-LI-AC, S5700-52X-PWR-LI-AC, S5700S-28P-LI-AC, S5700S-52P-LI-AC, S5700-28TP-LI-AC, S5700-28TP-PWR-LI-AC, S5701-28TP-PWR-LI-AC.

The SI series include: S5700-28C-SI, S5700-52C-SI, S5700-24TP-SI-AC, S5700-24TP-SI-DC, S5700-48TP-SI-AC, S5700-48TP-SI-DC, S5700-24TP-PWR-SI, S5700-48TP-PWR-SI, S5700-28C-PWR-SI, S5700-52C-PWR-SI, and S5700-26X-SI-12S-AC.

The EI series include: S5700-28C-EI, S5700-28C-EI-24S, S5700-52C-EI, S5700-28C-PWR-EI, S5700-52C-PWR-EI, S5710-28C-EI, S5710-52C-EI, S5710-28C-PWR-EI-AC, S5710-52C-PWR-EI-AC, and S5710-52C-PWR-EI.

The HI series include: S5700-28C-HI and S5700-28C-HI-24S.

2.2 Device Structure

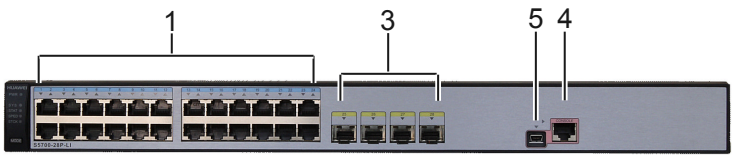
The S5700 Ethernet switches adopt an integrated hardware platform. An S5700 consists of the chassis, power supply unit, fan, switch control unit (SCU), and interface subcard. The width of an S5700 complies with industry standards, and the S5700 can be installed in an IEC297 cabinet or an ETSI cabinet.

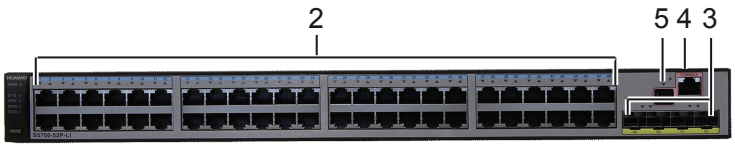
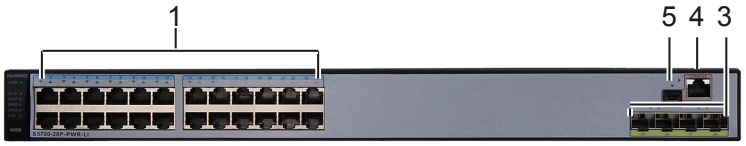
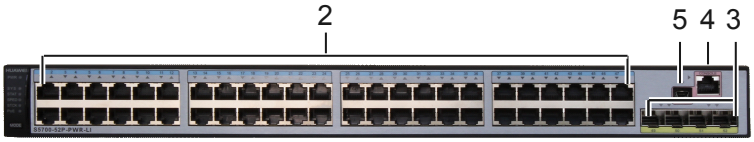
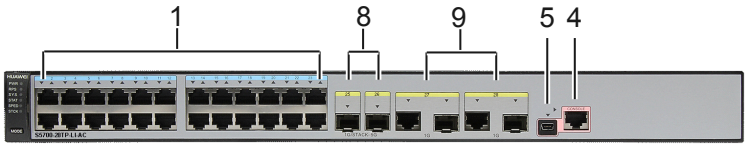
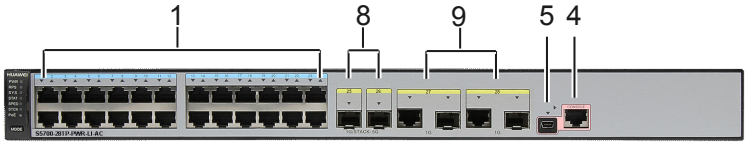
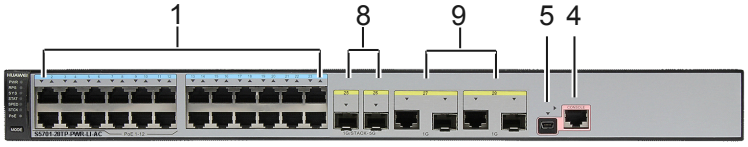
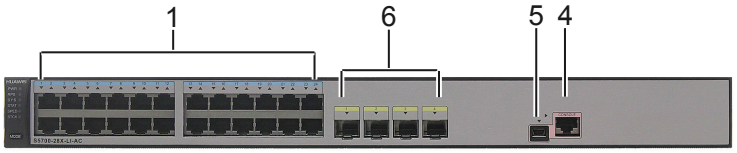
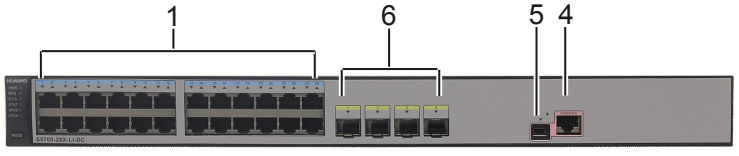
2.2.1 S5700-LI

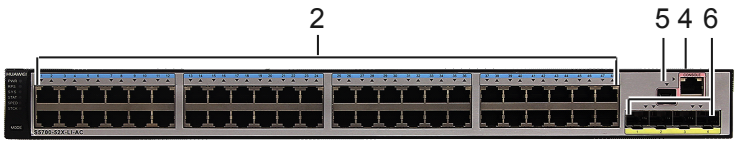
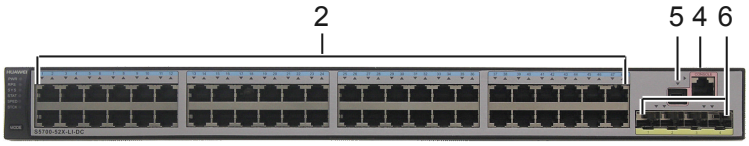
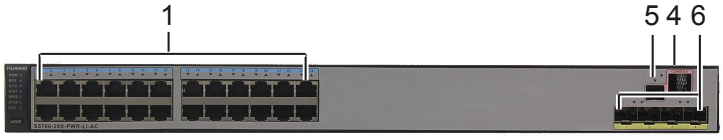
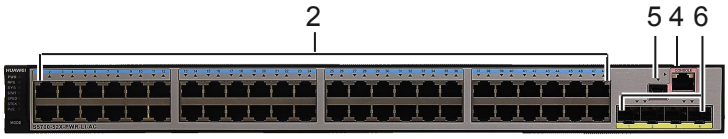
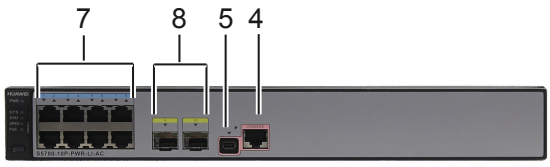
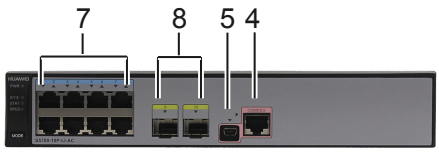
Front View

Table 2-1 shows the front view of the S5700-LI chassis.

Table 2-1 Front view of the S5700-LI chassis

Model	Image
S5700-28P-LI-AC S5700-28P-LI-DC	

Model	Image
S5700-52P-LI-AC S5700-52P-LI-DC	
S5700-28P-PWR-LI-AC	
S5700-52P-PWR-LI-AC	
S5700-28TP-LI-AC	
S5700-28TP-PWR-LI-AC	
S5701-28TP-PWR-LI-AC	
S5700-28X-LI-AC	
S5700-28X-LI-DC	

Model	Image
S5700-52X-LI-AC	
S5700-52X-LI-DC	
S5700-28X-PWR-LI-AC	
S5700-52X-PWR-LI-AC	
S5700-10P-PWR-LI-AC	
S5700-10P-LI-AC	

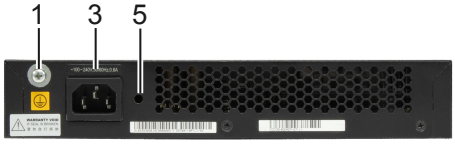
1. Twenty-four 10/100/1000BASE-T Ethernet electrical ports	2. Forty-eight 10/100/1000BASE-T Ethernet electrical ports	3. Four 1000BASE-X Ethernet optical ports	4. One console port
5. One Mini USB port	6. Four 10GE SFP+ Ethernet optical ports	7. Eight 10/100/1000BASE-T Ethernet electrical ports	8. Two 1000BASE-X Ethernet optical ports

9. Two combo ports (10/100/1000BASE-T+100/1000BASE-X)	-	-	-

Rear View

Table 2-2 shows the rear view of the S5700-LI chassis.

Table 2-2 Rear view of the S5700-LI chassis

Model	Image
S5700-28P-LI-AC S5700-28TP-LI-AC S5700-52P-LI-AC S5700-28X-LI-AC S5700-52X-LI-AC	
S5700-28P-LI-DC S5700-52P-LI-DC S5700-28X-LI-DC S5700-52X-LI-DC	
S5700-28P-PWR-LI-AC S5700-28TP-PWR-LI-AC S5701-28TP-PWR-LI-AC S5700-52P-PWR-LI-AC S5700-28X-PWR-LI-AC S5700-52X-PWR-LI-AC	
S5700-10P-PWR-LI-AC	
S5700-10P-LI-AC	

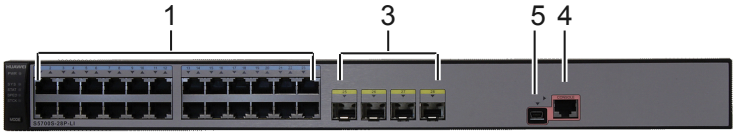
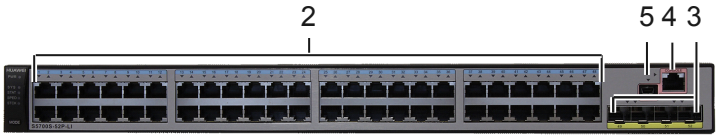
1. Ground screw **NOTE** It is used with a ground cable.	2. RPS socket **NOTE** ● It is used with an RPS cable which is not hot swappable. ● A PoE switch can have an RPS power supply connected to this socket to provide inputs for system power supply and PoE power supply. The two inputs are independent of each other. The RPS power supply can also be used as a backup of the system power supply when it does not provide PoE power input to the switch.	3. AC socket **NOTE** It is used with an AC power cable.	4. DC power terminal **NOTE** It is used with a DC power cable.
5. Jack for AC terminal locking latch **NOTE** The AC terminal locking latch is not delivered with the device. Customers need to prepare the locking latch themselves if they need it.	-	-	-

2.2.2 S5700S-LI

Front View

Table 2-3 shows the front view of the S5700S-LI chassis.

Table 2-3 Front view of the S5700S-LI chassis

Model	Image
S5700S-28P-LI-AC	
S5700S-52P-LI-AC	

1. Twenty-four 10/100/1000BASE-T Ethernet electrical ports	2. Forty-eight 10/100/1000BASE-T Ethernet electrical ports	3. Four 1000BASE-X Ethernet optical ports	4. One console port
5. One Mini USB port	-	-	-

Rear View

Table 2-4 shows the rear view of the S5700S-LI chassis.

Table 2-4 Rear view of the S5700S-LI chassis

Model	Image
S5700S-28P-LI-AC	
S5700S-52P-LI-AC	

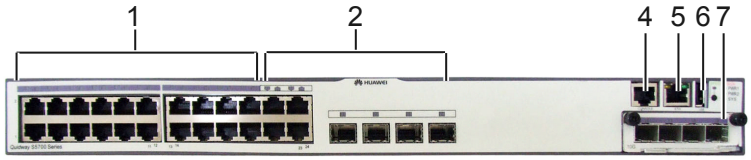
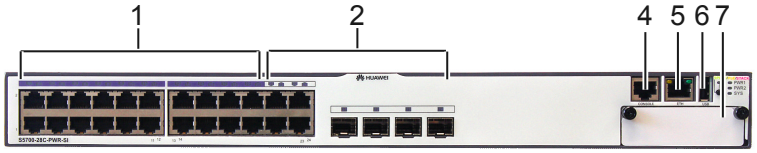
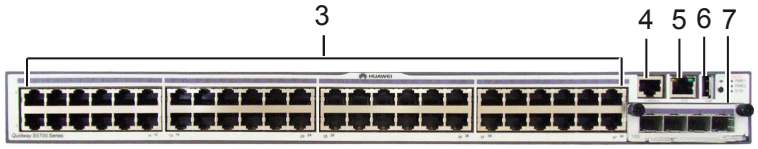
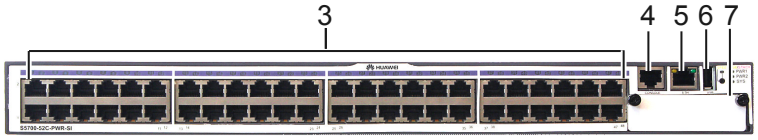
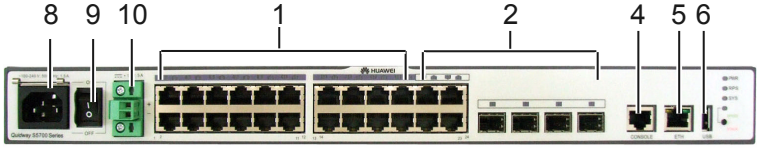
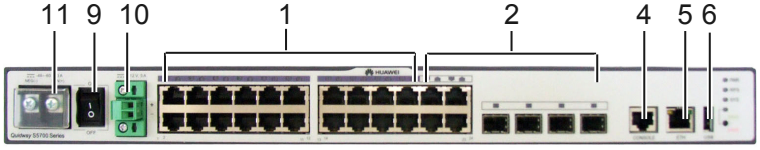
1. Ground screw **NOTE** It is used with a ground cable.	2. RPS socket **NOTE** It is used with an RPS cable which is not hot swappable.	3. AC socket **NOTE** It is used with an AC power cable.	-

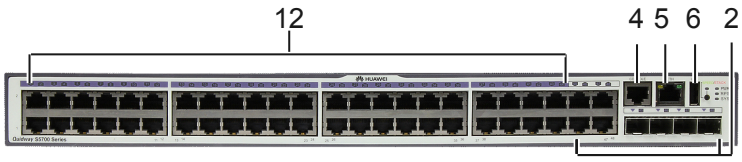
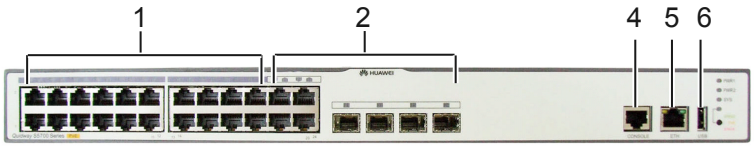
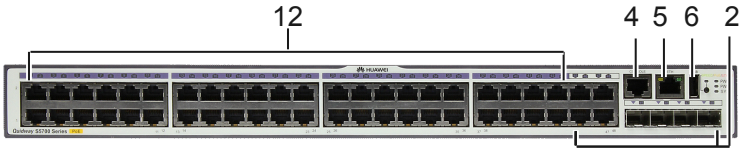
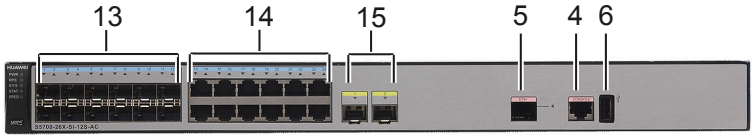
2.2.3 S5700-SI

Front View

Table 2-5 shows the front view of the S5700-SI chassis.

Table 2-5 Front view of the S5700-SI chassis

Model	Image
S5700-28C-SI	
S5700-28C-PWR-SI	
S5700-52C-SI	
S5700-52C-PWR-SI	
S5700-24TP-SI-AC	
S5700-24TP-SI-DC	

Model	Image
S5700-48TP-SI-AC S5700-48TP-SI-DC	
S5700-24TP-PWR-SI	
S5700-48TP-PWR-SI	
S5700-26X-SI-12S-AC	

1. Twenty 10/100/1000BASE-T Ethernet electrical ports	2. Four combo ports	3. Forty-eight 10/100/1000BASE-T Ethernet electrical ports	4. One console port
5. One ETH management port	6. One USB port **NOTE** The USB port is used to connect USB disks for deployment, configuration file transfer, and file upgrade.	7. Front card slot **NOTE** For details about the mapping between cards and the switch, see Cards.	8. AC socket **NOTE** It is used with an AC power cable.

9. Power switch	10. Backup power socket **NOTE** This socket can be connected to a backup power supply unit. The backup power supply unit must provide 12 V DC output voltage (ranging from 11 V to 13 V) and a minimum power of 100 W.	11. DC power terminal **NOTE** It is used with a DC power cable.	12. Forty-four 10/100/1000BASE-T Ethernet electrical ports
13. Twelve 100/1000BASE-X Ethernet optical ports	14. Twelve 10/100/1000BASE-T Ethernet electrical ports	15. Two 10GE SFP+ Ethernet optical ports	-

Rear View

Table 2-6 shows the rear view of the S5700-SI chassis.

Table 2-6 Rear view of the S5700-SI chassis

Model	Image
S5700-28C-SI S5700-52C-SI	
S5700-28C-PWR-SI S5700-52C-PWR-SI S5700-24TP-PWR-SI S5700-48TP-PWR-SI	
S5700-24TP-SI-AC S5700-24TP-SI-DC	
S5700-48TP-SI-AC	

Model	Image
S5700-48TP-SI-DC	
S5700-26X-SI-12S-AC	

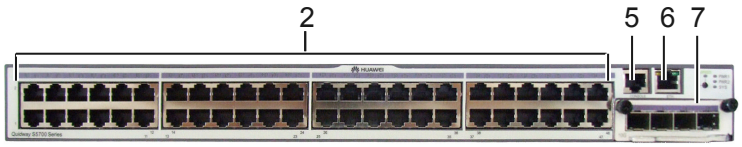
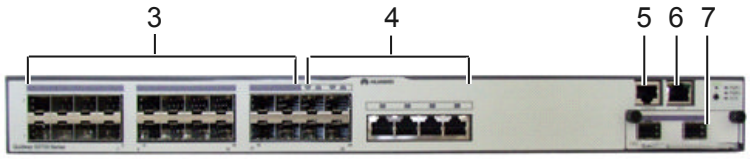
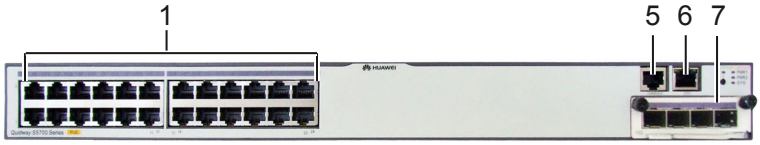
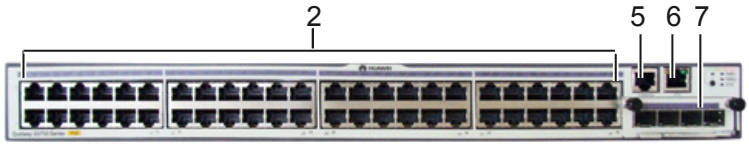
1. ESD jack **NOTE** When you install or maintain an S5700-SI chassis, wear an ESD wrist strap and insert the other end of the ESD wrist strap into this ESD jack.	2. Rear card slot **NOTE** For details about the mapping between cards and the switch, see Cards.	3. Fan module slot **NOTE** Available fans: CX7E1FANA Fan Module	4. Power module slot **NOTE** Available power modules: ● PoE switch: 250 W AC PoE Power Module; 500 W AC PoE Power Module ● Non-PoE switch: 150 W AC Power Module; 150 W DC Power Module
5. Backup power socket **NOTE** This socket can be connected to a backup power supply unit. The backup power supply unit must provide 12 V DC output voltage (ranging from 11 V to 13 V) and a minimum power of 100 W.	6. Ground screw **NOTE** It is used with a ground cable.	7. Power switch	8. AC socket **NOTE** It is used with an AC power cable.
9. DC power terminal **NOTE** It is used with a DC power cable.	10. RPS socket **NOTE** It is used with an RPS cable which is not hot swappable.	11. Jack for AC terminal locking latch **NOTE** The AC terminal locking latch is not delivered with the device. Customers need to prepare the locking latch themselves if they need it.	-

2.2.4 S5700-EI

Front View

Table 2-7 shows the front view of the S5700-EI chassis.

Table 2-7 Front view of the S5700-EI chassis

Model	Image
S5700-28C-EI	
S5700-52C-EI	
S5700-28C-EI-24S	
S5700-28C-PWR-EI	
S5700-52C-PWR-EI	

1. Twenty-four 10/100/1000BASE-T Ethernet electrical ports	2. Forty-eight 10/100/1000BASE-T Ethernet electrical ports	3. Twenty 100/1000BASE-X Ethernet optical ports **NOTE** The ports support the 1000BASE-T SFP copper module.	4. Four combo ports

5. One console port	6. One ETH management port	7. Front card slot **NOTE** For details about the mapping between cards and the switch, see Cards.	-

Rear View

Table 2-8 shows the rear view of the S5700-EI chassis.

Table 2-8 Rear view of the S5700-EI chassis

Model	Image
S5700-28C-EI S5700-52C-EI S5700-28C-EI-24S	
S5700-28C-PWR-EI S5700-52C-PWR-EI	

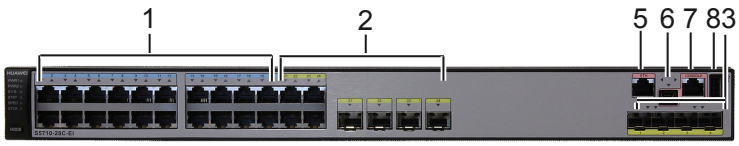
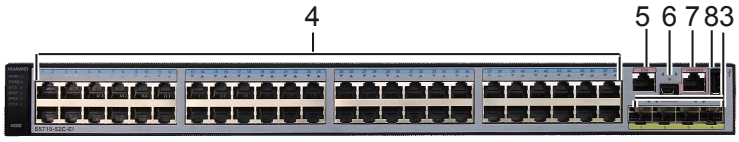
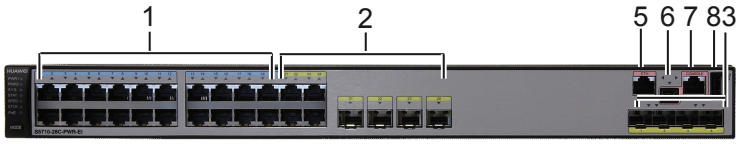
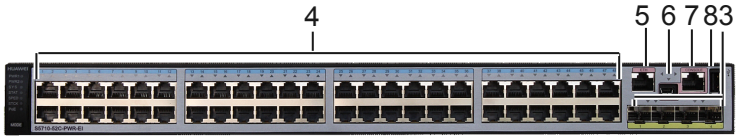
1. ESD jack **NOTE** When you install or maintain an S5700-EI chassis, wear an ESD wrist strap and insert the other end of the ESD wrist strap into this ESD jack.	2. Rear card slot **NOTE** For details about the mapping between cards and the switch, see Cards.	3. Fan module slot **NOTE** Available fans: CX7E1FANA Fan Module	4. Power module slot **NOTE** Available power modules: ● PoE switch: 250 W AC PoE Power Module, 500 W AC PoE Power Module ● Non-PoE switch: 150 W AC Power Module, 150 W DC Power Module

2.2.5 S5710-EI

Front View

Table 2-9 shows the front view of the S5710-EI chassis.

Table 2-9 Front view of the S5710-EI chassis

Model	Image
S5710-28C-EI	
S5710-52C-EI	
S5710-28C-PWR-EI-AC	
S5710-52C-PWR-EI-AC S5710-52C-PWR-EI	

1. Twenty 10/100/1000BASE-T Ethernet electrical ports	2. Four 1000M combo ports	3. Four 10GE SFP+ Ethernet optical ports	4. Forty-eight 10/100/1000BASE-T Ethernet electrical ports
5. One ETH management port	6. One Mini USB port	7. One console port	8. One USB port **NOTE** The USB port is used to connect USB disks for deployment, configuration file transfer, and file upgrade.

NOTE

The S5710-52C-PWR-EI and S5710-52C-PWR-EI-AC have the same appearance and provide the same functions. The S5710-52C-PWR-EI-AC is sold with a 580 W built-in power module, but the S5710-52C-PWR-EI is sold without a power module.

Rear View

Table 2-10 shows the rear view of the S5710-EI chassis.

Table 2-10 Rear view of the S5710-EI chassis

Model	Image
S5710-28C-EI S5710-52C-EI	
S5710-28C-PWR-EI-AC S5710-52C-PWR-EI-AC S5710-52C-PWR-EI	

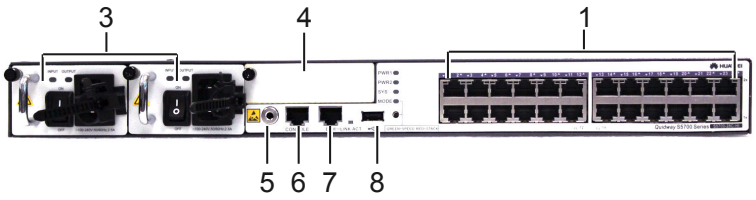
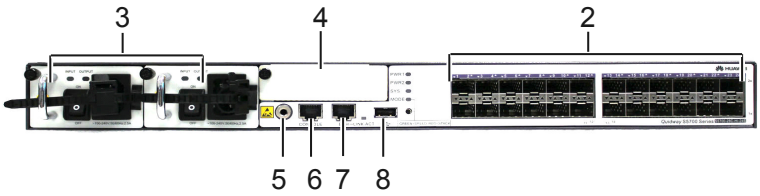
1. Ground screw **NOTE** It is used with a ground cable.	2. Rear card slot **NOTE** For details about the mapping between cards and the switch, see Cards.	3. Power module slot **NOTE** Power modules supported by the non-PoE switch: ● 150 W AC Power Module ● 150 W DC Power Module Power modules supported by the PoE switch: ● 580 W AC PoE Power Module ● 1150 W AC PoE Power Module (supported only on the S5710-52C-PWR-EI)	-

2.2.6 S5700-HI

Front View

Table 2-11 shows the front view of the S5700-HI chassis.

Table 2-11 Front view of the S5700-HI chassis

Model	Image
S5700-28C-HI	
S5700-28C-HI-24S	

1. Forty-eight 10/100/1000BASE-T Ethernet electrical ports	2. Twenty-four 100/1000BASE-X Ethernet optical ports **NOTE** The ports support the 1000BASE-T SFP copper module.	3. Power module slot **NOTE** Available power modules: ● 170 W AC Power Module ● 170 W DC Power Module	4. Front card slot **NOTE** For details about the mapping between cards and the switch, see Cards.
5. ESD jack **NOTE** When you install or maintain an S5700-HI chassis, wear an ESD wrist strap and insert the other end of the ESD wrist strap into this ESD jack.	6. One console port	7. One ETH management port	8. One USB port **NOTE** The USB port is used to connect USB disks for deployment, configuration file transfer, and file upgrade.

Rear View

Table 2-12 shows the rear view of the S5700-HI chassis.

Table 2-12 Rear view of the S5700-HI chassis

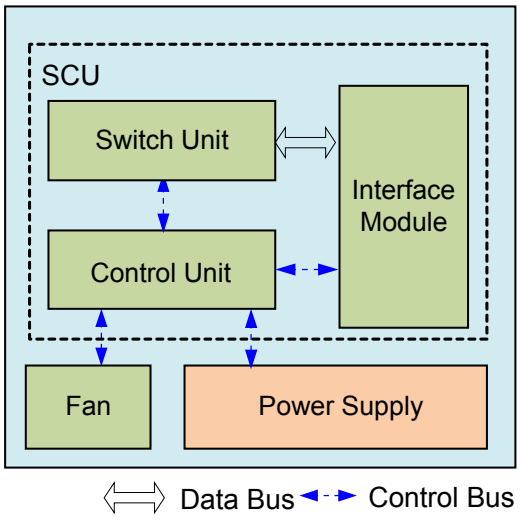
Model	Image
S5700-28C-HI S5700-28C-HI-24S	

1. Ground screw **NOTE** It is used with a ground cable.	2. Monitoring port **NOTE** The monitoring port monitors the cabinet door, power module, battery power, and power supply of the air conditioner.	-	-

2.3 Hardware Modules

Figure 2-1 shows the logical structure of hardware modules of the S5700.

Figure 2-1 Logical structure of hardware modules of the S5700



Hardware modules of the S5700 refer to the interface card, SCU, power supply, and fan.

2.3.1 SCU

The SCU is fixed on the S5700. Each S5700 has one SCU.

The SCU is responsible for packet switching and device management. It integrates multiple functional modules, namely, the main control module, switching module, and interface module.

Main Control Module

The main control module implements the following functions:

- Processing protocols
- Functioning as an agent of the user to manage the system and monitor the system performance according to instructions of the user, and report the running status of the device to the user
- Monitoring and maintaining the interface module and switching module on the SCU.

Switching Module

The switching module, also called the switching fabric, is responsible for packet exchange, multicast replication, QoS scheduling, and access control on the interface module of the SCU.

The switching module adopts high performance ASIC chips to implement line-speed forwarding and fast switching of data with different priorities.

Interface Module

The interface module provides Ethernet interfaces for accessing Ethernet services.

2.3.2 Power Supply

The S5700 can use either the DC power supply or the AC power supply.

Table 2-13 Power supply

Device Name	AC	DC	1+1 Backup
S5700-10P-LI-AC	Y	N	N
S5700-10P-PWR-LI-AC	Y	N	N
S5700-28P-LI-AC	Y	N	N
S5700-28P-LI-DC	N	Y	N
S5700-52P-LI-AC	Y	N	N
S5700-52P-LI-DC	N	Y	N
S5700-28P-PWR-LI-AC	Y	N	N
S5700-52P-PWR-LI-AC	Y	N	N
S5700-28X-LI-AC	Y	N	N
S5700-28X-LI-DC	N	Y	N
S5700-52X-LI-AC	Y	N	N
S5700-52X-LI-DC	N	Y	N
S5700-28X-PWR-LI-AC	Y	N	N
S5700-52X-PWR-LI-AC	Y	N	N

Device Name	AC	DC	1+1 Backup
S5700S-28P-LI-AC	Y	N	N
S5700S-52P-LI-AC	Y	N	N
S5700-28C-SI	Y	Y	Y
S5700-52C-SI	Y	Y	Y
S5700-28C-PWR-SI	Y	N	Y
S5700-52C-PWR-SI	Y	N	Y
S5700-24TP-SI-AC	Y	N	N
S5700-24TP-SI-DC	N	Y	N
S5700-24TP-PWR-SI	Y	N	Y
S5700-48TP-SI-AC	Y	N	N
S5700-48TP-SI-DC	N	Y	N
S5700-48TP-PWR-SI	Y	N	Y
S5700-28TP-LI-AC	Y	N	N
S5700-28TP-PWR-LI-AC	Y	N	N
S5701-28TP-PWR-LI-AC	Y	N	N
S5700-26X-SI-12S-AC	Y	N	N
S5700-28C-EI	Y	Y	Y
S5700-28C-EI-24S	Y	Y	Y
S5700-52C-EI	Y	Y	Y
S5700-28C-PWR-EI	Y	N	Y
S5700-52C-PWR-EI	Y	N	Y
S5710-28C-EI	Y	Y	Y
S5710-52C-EI	Y	Y	Y
S5710-28C-PWR-EI-AC	Y	N	Y
S5710-52C-PWR-EI-AC	Y	N	Y
S5710-52C-PWR-EI	Y	N	Y
S5700-28C-HI	Y	Y	Y
S5700-28C-HI-24S	Y	Y	Y

The S5700-LI (except the S5700-10P-LI-AC and S5700-10P-PWR-LI-AC), S5700S-LI, and S5700-26X-SI-12S-AC support the RPS1800 power supply. S5700-24TP-SI-AC, S5700-24TP-

SI-DC, S5700-48TP-SI-AC, and S5700-48TP-SI-DC have a single built-in power module and can connect to the DC backup power.

2.3.3 Fan

The fans can work in the intelligent mode or forcible mode.

The S5700-24TP-SI-AC, S5700-24TP-SI-DC, S5700-48TP-SI-AC, S5700-48TP-SI-DC support the intelligent mode.

The S5700-28C-HI, S5700-28C-HI-24S, S5700-52P-LI-AC, S5700-52P-LI-DC, S5700S-52P-LI-AC, S5700-28P-PWR-LI-AC, S5700-52P-PWR-LI-AC, S5710-28C-EI, S5710-52C-EI, S5700-28C-PWR-SI, S5700-52C-PWR-SI, S5700-52C-PWR-SI, S5710-28C-PWR-EI-AC, S5710-52C-PWR-EI-AC, S5710-52C-PWR-EI, S5700-26X-SI-12S-AC, S5700-28X-LI-AC, S5700-28X-LI-DC, S5700-52X-LI-AC, S5700-52X-LI-DC, S5700-28X-PWR-LI-AC, S5700-52X-PWR-LI-AC, S5700-28TP-PWR-LI-AC, and S5701-28TP-PWR-LI-AC support the forcible mode.

The S5700-28P-LI-AC, S5700-28P-LI-DC, S5700S-28P-LI-AC, S5700-10P-LI-AC, S5700-10P-PWR-LI-AC, and S5700-28TP-LI-AC have no fans and use natural heat dissipation.

The S5700-24TP-PWR-SI, S5700-48TP-PWR-SI, S5700-28C-SI, S5700-52C-SI, S5700-28C-PWR-EI, S5700-52C-PWR-EI, S5700-28C-EI, S5700-52C-EI, S5700-28C-EI-24S, S5700-28C-PWR-SI, and S5700-52C-PWR-SI support the hot pluggable fans. The fan module can be replaced on site and maintained in service.

2.3.4 Interface Card

The S5700C series switches (switches with a "C" in their names, for example, S5700-28C-HI) support the interface card for upstream services. The interface card improves the networking flexibility, and provides the cost-effective and personalized solutions to customers.

Except S5710-28C-EI, S5710-52C-EI, S5710-28C-PWR-EI-AC, S5710-52C-PWR-EI-AC, S5710-52C-PWR-EI, S5700-28C-HI, and S5700-28C-HI-24S, the S5700C series switches support the stack card. Multiple switches can be connected through stack cards to form a logical device. This function facilitates network expansion, saves investment, reduces management costs, and improves network reliability.

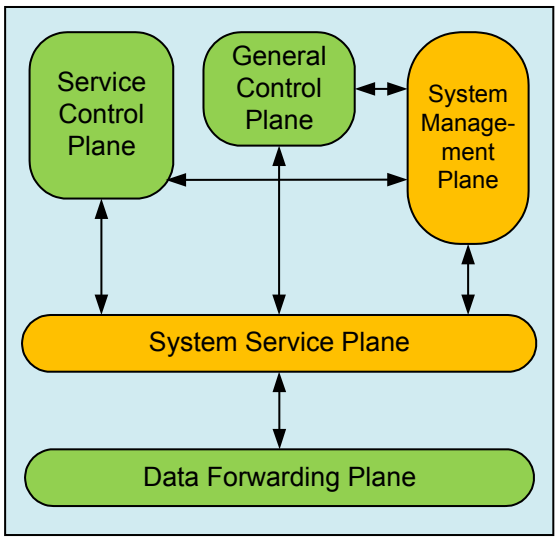
NOTE

The interface cards of the S5700C, except S5710-28C-EI, S5710-52C-EI, S5710-28C-PWR-EI-AC, S5710-52C-PWR-EI-AC, S5710-52C-PWR-EI, S5700-28C-HI, and S5700-28C-HI-24S are not hot swappable.

2.4 Software Architecture

The S5700 runs on the latest VRP version 5 (VRPv5) to provide various features. VRPv5 consists of the following parts:

Figure 2-2 Software architecture



- System service plane

  This plane provides task and memory management, timer, software loading and patching on the basis of the operating system. In addition, it enhances modular technology to facilitate system upgrade and customization.

- General control plane

  This plane is the core of the VRP data communication platform, providing link management, IP protocol stack, and routing protocol processing, and implementing the security and QoS functions. It is used to control the data forwarding plane and implement functions of the device.

- Data forwarding plane

  This plane forwards data under the control of the general control plane. The VRPv5 supports data forwarding based on software and hardware.

- Service control plane

  This plane controls and manages services based on users or interfaces. It implements the authentication, authorization, and accounting for users through DHCP Option 82 and implements authentication for access interfaces through IEEE 802.1x.

- System management plane

  This plane provides a graphic user interface and manages the input and output information for network management and maintenance.

3 Link Features

About This Chapter

3.1 Ethernet Features

3.1.1 Link Aggregation

Link aggregation is a function that binds multiple physical interfaces on one device or multiple devices into a logical interface (such as an Eth-Trunk). This logical interface is also called a load balancing group or a link aggregation group.

After multiple physical interfaces are bound into a logical interface, the S5700 load balances the traffic passing through the logical interface among the member interfaces. When a member interface fails, the traffic on this interface is shared by the other member interfaces without interrupting services. When the faulty interface recovers, the traffic is balanced among all interfaces again.

Currently, the S5700 implements link aggregation between XGE interfaces or GE interfaces. Load balancing can be implemented based on the following information:

- Source MAC address
- Destination MAC address
- Source MAC address and destination MAC address
- Source IP address
- Destination IP address
- Source IP address and destination IP address

Using the link aggregation technology, you can increase the bandwidth and improve link reliability without upgrading the hardware, thus saving costs.

3.1.2 Flow Control on an Interface

Flow control on an interface is a method of congestion management. It applies to all types of flows. The S5700 implements flow control on an interface by using the hardware backpressure mechanism. When an interface works in full duplex mode, the S5700 implements flow control complying with IEEE 802.3x. When the interface works in half duplex mode, the S5700 implements flow control through the backpressure mechanism.

When congestion occurs, the S5700 sends continuous Pause frames to the upstream device, requesting it to stop sending data for a specified period of time. When the upstream device receives the pause frames, it reduces the volume of traffic sent from its outbound interface. Flow control on an interface does not identify flow types.

3.1.3 Traffic Suppression

Traffic suppression limits the number of unknown unicast packets, multicast packets, and broadcast packets within a proper range to ensure network efficiency.

The S5700 can suppress the packets based on interfaces. When traffic suppression is enabled on an interface, the interface monitors received unknown unicast packets, multicast packets, and broadcast packets to check whether their traffic exceeds the threshold. If traffic exceeds the threshold, the S5700 discards excessive packets to keep the traffic volume within the limit and thus services on the network run normally.

The S5700 can also control the percentage of unknown unicast packets, multicast packets, and broadcast packets on an interface.

3.1.4 VLAN

A local area network (LAN) can be divided into several logical LANs. Each logical LAN is a broadcast domain, which is called a virtual LAN (VLAN). To put it simply, devices on a LAN are logically grouped into different LAN segments, irrespective of their physical locations. In this manner, VLANs isolate broadcast domains on a LAN.

Methods to Define VLANs

A physical LAN can be divided into several VLANs, and several physical LANs can be grouped into a VLAN. Devices on a VLAN belong to the same broadcast domain and can communicate with each other. Different VLANs are isolated from each other, so devices on different VLANs cannot communicate with each other.

The S5700 supports the following methods to define VLANs:

- Based on interfaces

  After an interface is added to a VLAN, packets received by the interface are sent on the VLAN.
- Based on MAC addresses

  VLAN members are defined according to source MAC addresses of packets. When an interface of the S5700 receives a packet, the S5700 determines the VLAN ID of the packet according to the source MAC address of the packet and sends the packet on the corresponding VLAN.
- Based on protocols

  The S5700 determines the VLAN ID of a received packet according to the protocol (or protocol suite) and encapsulation format of the packet.
- Based on IP subnets

  VLAN members are defined according to the source IP addresses and the subnet masks of packets. When an interface of the S5700 receives a packet, the S5700 determines the VLAN ID of the packet according to the source IP address of the packet and sends the packet on the corresponding VLAN.
- Based on policies

  VLAN members are defined according to the MAC+IP or MAC+IP+port binding policy. When an interface of the S5700 receives a packet, the S5700 determines the VLAN ID of the packet according to the binding policy and sends the packet on the corresponding VLAN.

VLAN Aggregation

To implement communication between VLANs on the S5700, you need to configure VLANIF interfaces and assign an IP address to each VLANIF interfaces. Therefore, this wastes IP addresses when there are many VLANs. VLAN aggregation can solve this problem.

VLAN aggregation means that multiple VLANs are aggregated into a super-VLAN. The VLANs that form the super-VLAN is called sub-VLANs.

NOTE

S5700LI and S5700S-LI do not support the VLAN Aggregation.

MUX VLAN

The MUX VLAN function is used to isolate Layer 2 traffic between the interfaces of a VLAN. For example, on an intranet, a user interface can communicate with a server interface, but the user interfaces cannot communicate with each other.

This function involves a MUX VLAN and several subordinate VLANs. Subordinate VLANs are classified into subordinate group VLANs and subordinate separate VLANs. Ports on subordinate VLANs can communicate with ports on the MUX VLAN. Ports on a subordinate group VLAN can communicate with each other but cannot communicate with ports on other subordinate group VLANs. Ports on a subordinate separate VLAN cannot communicate with each other.

DHCP Policy VLAN

After DHCP policy VLANs are configured on the S5700, VLANs are allocated to hosts connected to interfaces of the S5700 based on IP addresses of hosts. When a host is connected to an interface of the S5700, the host cannot be added to a VLAN because it has not obtained a valid IP address. The DHCP policy VLAN function enables new hosts to obtain valid IP addresses and be added to corresponding VLANs based on obtained IP addresses.

The S5700 supports the following DHCP policy VLAN functions:

- Generic DHCP policy VLAN
- DHCP policy VLAN based on MAC addresses
- DHCP policy VLAN based on interfaces

Voice VLAN

A voice VLAN is used to transmit voice data flows. You can create a voice VLAN and add the interface connected to the voice device to the voice VLAN. Then voice data flows can be transmitted on the voice VLAN.

You can apply special QoS configuration to the voice data packets transmitted on the voice VLAN so that voice data packets are transmitted with high priority. The quality of the voice service is ensured.

VLAN Mapping

VLAN mapping means that the S5700 replaces the outer VLAN tags of data frames to the specified VLAN tags according to the preset VLAN mapping table so that services are transmitted according to the network planning of the carrier.

The S5700 supports the mapping from one or more customer VLAN IDs (C-VLANs) to a service VLAN ID (S-VLAN).

NOTE

- C-VLAN is the VLAN that a user-side interface belongs to. It identifies a user or a type of users.
- An S-VLAN is a VLAN defined on the public network by the carrier. The S-VLAN ID identifies a service.

3.1.5 QinQ

The 802.1Q-in-802.1Q (QinQ) protocol is a Layer 2 tunneling protocol based on the IEEE 802.1Q. A frame transmitted on the public network has double 802.1Q tags. One tag identifies the public network and the other identifies the private network.

Usually, carriers define VLANs on the public network, and users define VLANs on their own private networks. Therefore, different private networks may use the same VLAN ID. Through the QinQ function, the S5700 adds public VLAN tags to the packets from private networks. Then the private VLAN tag becomes the inner VLAN tag. In this way, packets from user networks are transmitted transparently on the public network, and thus user networks are separated from the public network.

Currently, the S5700 supports basic QinQ and selective QinQ.

- Basic QinQ

  Basic QinQ is implemented based on interfaces. All the frames that reach the public network through an interface are tagged with the same public VLAN ID.

- Selective QinQ

  Selective QinQ extends the basic QinQ function. It enables an interface to determine the outer VLAN tag according to the private VLAN tag so that packets from different private networks are transmitted through different paths. Thus different services can be identified and service deployment is easier. For example, voice data packets from different VLANs are tagged with the same outer tag to obtain the same QoS level; common data services are tagged with another VLAN tag to obtain different QoS level.

3.1.6 GVRP

GVRP is a protocol used for dynamic registration and deregistration of VLANs. GVRP maintains the dynamic VLAN registration information in a switch and propagates the registration information to other switches on the network through GARP.

GVRP enables switches on the network to dynamically maintain and update VLANs. With GVRP, you do not need to expend time to analyze the topology and manage configurations. You can adjust the VLAN deployment on the entire network by configuring only a few devices.

The S5700 supports GARP and GVRP. Through GVRP, the S5700 can send VLAN declaration to other devices and dynamically create VLANs after receiving VLAN registration information from other devices.

3.2 STP/RSTP/MSTP

3.2.1 STP and RSTP

The Spanning Tree Protocol (STP) and the Rapid Spanning Tree Protocol (RSTP) are link-layer management protocols and are mainly applied to LANs to prevent loops. STP blocks redundant links and trims a network into a tree topology free from loops. RSTP enhances STP. It provides fast transition of interfaces status to speed up network convergence.

STP and RSTP prevent broadcast storms caused by loops and provides backup links for data forwarding.

3.2.2 MSTP

The Multiple Spanning Tree Protocol (MSTP) is developed based on STP and RSTP. MSTP divides a network into multiple regions. Based on VLAN tags, each region has several spanning trees that are independent of each other. As a result, the entire network is trimmed to a tree topology that is free from loops. Broadcast storms are thus prevented on the network.

MSTP associates VLANs with spanning trees so that packets of different VLANs are transmitted along different spanning trees. This speeds up network convergence and implements load balancing.

Different from STP and RSTP, MSTP provides multiple backup links to implement load balancing among VLANs.

3.2.3 MSTP Protection

BPDU Protection

The S5700 provides Bridge Protocol Data Unit (BPDU) protection when MSTP is enabled. When BPDU protection is enabled, the S5700 shuts down the edge port that receives a protocol BPDU instead of turning the edge port into a non-edge port. In this case, the spanning tree is not recalculated, and thus network flapping is prevented.

Root Protection

The S5700 provides root protection when MSTP is enabled. It retains the role of the root switch by maintaining the role of the designated port as follows:

When the designated port enabled with root protection receives a BPDU of higher priority, the port does not change to a non-designated port. Instead, it turns to the Listening state and stops forwarding packets. If the port does not receive protocol BPDUs of higher priority for a long time, it restores the Forwarding state. This prevents network flapping.

Loop Protection

After loop protection is enabled on the S5700, it sets the root port to the Blocking state if the root port does not receive protocol BPDUs from the upstream device. If the port receives protocol BPDUs again, it becomes the root port and changes to the Forwarding state. If no protocol BPDU is received, the port remains in the Blocking state and does not forward packets. In this way, loops are prevented on the network.

3.2.4 Partitioned STP and BPDU Tunnel

Partitioned STP

To improve the reliability of links on the enterprise network, the S5700 can be dual-homed to the upstream Ethernet. In addition, MSTP needs to run on the whole enterprise network to prevent loops. The traditional MSTP networks are not divided. In this case, the convergence speed of an MSTP network is low because the network is large. As a result, the forwarding capability of the network is degraded.

By using the partitioned STP technology, the S5700 logically allocates a VLAN for each partitioned STP network. The tagged BPDUs can be forwarded only within the VLAN that the

tag belongs to. Partitioned STP allows BPDUs to be transmitted within a certain range. This prevents loops and speeds up convergence.

BPDU Tunnel

On a partitioned STP network, the S5700 considers the tagged BPDUs as common Layer 2 frames. That is, the S5700 forwards the BPDUs within the VLAN to which the tag belongs rather than sending them to the MSTP module. After the BPDU tunnel is configured, the devices on the MAN do not participate in the topology calculation of the partitioned STP network. Thus, the convergence speed of the network is improved.

To implement the BPDU tunnel function, the access device at the edge of the MAN must be configured with MSTP Snooping. If the forwarding path is changed because of the topology change on the partitioned STP network, the device can detect the topology change, and then notify other devices on the network of the topology change. In this way, the packets are forwarded according to the new topology.

3.3 RRPP

The Rapid Ring Protection Protocol (RRPP) is a link layer protocol applied to the Ethernet ring. It can prevent the broadcast storm caused by the loops in the Ethernet ring. The topology convergence speed on the network running RRPP is much faster than that on the network running other protocols such as STP. This is because the RRPP packets are forwarded through hardware.

In addition, the RRPP ring supports link bundle, which is widely used on the high-bandwidth ring networks.

3.3.1 RRPP Ring Network Composition

An RRPP domain consists of a group of S5700s with the same domain ID and control VLAN ID. An RRPP domain consists of the following elements:

- A physical RRPP ring maps a ring-shaped Ethernet topology. An RRPP domain is composed of multiple rings connected with each other. One of them is the primary ring and the others are subrings.
- An RRPP domain can be configured with a main control VLAN and a sub control VLAN. The main control VLAN transmits packets of the primary ring; the sub control VLAN transmits packets of subrings.
- A control VLAN transmits only RRPP packets; a data VLAN transmits only data packets.
- The master node initiates the polling and determines how to handle topology changes.
- The transit node monitors the status of its directly connected RRPP links. When the link status changes, the transit node notifies the master node. The master node then decides how to handle the change.

3.3.2 How Does RRPP Work

The master node on a ring has a primary interface and a secondary interface. The primary interface on the master node periodically transmits hello messages. If the secondary interface on the master node receives the hello messages, it indicates that the path is a closed ring, and the master node blocks the secondary interface. This prevents loops on the network.

If the secondary interface on the master node fails to receive a hello message in a certain period, it indicates that the link on the ring is faulty, and the master node opens the secondary interface.

3.3.3 Various Topologies

Single RRPP Ring

There is only one Ethernet ring on a network and only one RRPP domain exists. In this case, the network can respond to topology changes quickly. The fast convergence of the RRPP ring is thus performed and Layer 2 and Layer 3 services can be quickly switched.

Tangent RRPP Rings

There are two or more Ethernet rings on a network and only one public node exits between each pair of rings. The rings belong to different RRPP domains.

This networking is suitable for large-scale networks that need to be managed in different domains. When one ring is faulty or recovers, other domains are not affected. The convergence process of the RRPP ring in the local domain is the same as the convergence process of a sing RRPP ring.

Intersecting RRPP Rings

There are two or more Ethernet rings on a network and two public nodes exit between each pair of rings. The rings belong to the same RRPP domain. One ring is the primary ring, and the others are the subrings.

The protocol packets on a subring are transmitted through the channel between the two interfaces connecting the primary ring and the subring. The primary ring can be considered as a node on the subring. This networking is applicable to the convergence of a dual-homing network. Through this networking, the upstream links are backed up.

Connecting RRPP Network with Other Networks

When an RRPP ring is adjacent to an Ethernet ring enabled with STP, only the tangent rings are supported, but the intersecting rings are not supported. This prevents the conflict between RRPP and STP if both of them calculate the interface status.

3.4 Smart Link

Smart Link is a flexible link backup mechanism, which provides an effective and reliable solution for dual-homed networking. Compared with STP, Smart Link provides faster convergence speed. On a dual-homed network, the configuration of Smart Link is simpler than the configuration of RRPP.

Smart Link implements fast protective switchover when the active link fails on the dual-homed network. In normal situations, there is an active link and a standby link in the two upstream links. That is, one upstream interface is in Forwarding state, and the other is in Block state. When the active link fails, the Smart Link group quickly switches traffic to the standby link.

Smart Link provides manual switchover and automatic switchover. When a link is faulty, the Smart Link group sends Flush packets to neighboring devices, requesting the devices to update their MAC tables and ARP tables.

When multiple devices at different layers are connected for convergence, Monitor Link that adopts the interface association mechanism monitors upstream links. This improves the backup

function of Smart Link. When an upstream link is faulty, Monitor Link blocks the downstream interface. After the upstream link recovers, the downstream interface is opened. This switches traffic between different paths for transmission.

3.5 SEP

The Smart Ethernet Protection (SEP) protocol is a ring network protocol applied to the link layer of an Ethernet network. The SEP protocol works on the basis of SEP segments. An SEP segment consists of a group of switching devices that are configured with the same SEP segment ID and control VLAN ID.

Most metropolitan area networks (MANs) and enterprise intranets adopt the ring networking to ensure high reliability. The services, however, are affected if any node on the ring fails. Generally, a ring network adopts the Resilient Packet Ring (RPR) or Ethernet ring technology. The costs of the RPR technology are high because it requires special hardware components. The Ethernet ring is improved and its costs are low; therefore, more and more MANs and enterprise intranets adopt the Ethernet ring.

Huawei originates the SEP protocol, which achieves the protective switchover on the open ring and closed ring and displays the uncertain blocked points or ring network topology. Compared with other Ethernet ring technologies, SEP has the following advantages:

- It can run on a network together with STP, RSTP, MSTP, and RRPP.
- It solves the problem of unidirectional traffic.
- Unidirectional traffic may cause unidirectional broadcast storms on the network. The SEP protocol can prevent unidirectional broadcast storms because it can detect the unidirectional traffic effectively.
- It supports the display of network topology. The network topology is displayed on the basis of SEP segments.
- When the devices of other vendors are used on the network, the SEP can also prevent loops, but does not need to be configured on these devices.

3.6 ERPS

NOTE

The ERPS is not available on S5700S–LI switches.

On a Layer 2 switching network, packets will be generated and transmitted infinitely once a loop occurs, causing a broadcast storm. All available bandwidth is consumed by the broadcast storm, and therefore valid packets cannot be transmitted on the network.

Ethernet Ring Protection Switching (ERPS) is defined in ITU-T G.8032 Recommendation. It prevents logical loops on a ring network by blocking redundant links.

ERPSv1 supports only the single-ring topology. When there is no faulty link on a ring network, ERPS can eliminate loops on the network. When a link fails on the ring network, ERPS can immediately restore the communication between the nodes on the network. Compared with other ring network protocols, ERPS has the following advantages:

- The network converges fast.
- ERPS is a standard protocol published by the ITU-T; therefore devices from different vendors can communicate with each other when they run ERPS.

3.7 Interface Security

Interface security is a security mechanism to control the access to a network. It checks whether the source MAC addresses of data frames received on an interface are valid. When detecting packets with invalid source MAC addresses, it takes certain actions to protect the interface.

After security protection is enabled on an interface, the S5700 considers the following types of MAC addresses valid:

- Static MAC addresses that are manually configured
- Dynamic or static MAC addresses in the DHCP snooping table
- Dynamic MAC addresses that are learned before the number of learned MAC addresses reaches the limit

When the interface receives frames with invalid source MAC addresses, the S5700 triggers the interface security function to discard the frames or generates an alarm according to the configuration.

3.8 Link Detection

Link detection includes loopback detection and virtual cable test (VCT). They provide users with two means to detect link faults on LANs.

- Loopback detection is used to check whether loops exist on a LAN. The switch sends specific packets to detect loopback on the entire LAN.
- VCT is mainly used to estimate the length of a network cable and locate the failure point of the cable. The S-switch simulates radar to detect cable faults and locate the failure points on the basis of a single link.

4 Service Features

About This Chapter

4.1 IPv4 Forwarding

4.1.1 IPv4 Features

The S5700 supports the following IPv4 features:

- TCP/IP protocol stack, including ICMP, IP, TCP, UDP, socket (TCP/UDP/Raw IP), and ARP
- Static DNS and specified DNS server
- FTP server/client, TFTP client, and SSH
- Ping, tracert, and Network Quality Analysis (NQA): NQA can detect the status of ICMP, TCP, UDP, DHCP, FTP, HTTP and SNMP services and test the response time of various services
- DHCP Server, DHCP Relay, DHCP Client, and DHCP Snooping
- BFD, including BFD for OSPF, BFD for ISIS, BFD for BGP, and BFD for PIM

NOTE

The BFD functions are not available on S5700-SI.

The DHCP Server, DHCP Relay and BFD functions are not available on S5700-LI and S5700S-LI.

4.1.2 Unicast Routing Features

NOTE

The static routes, RIP and RIPng are available on S5700SI. But the other routing protocols and routing policy are not available.

Only the static routes are available on S5700-LI and S5700S-LI. All of the routing protocols and routing policy are not available.

The S5700 supports the following unicast routing features:

- IPv4 unicast forwarding at line speed through bottom-layer ASIC chips
- IPv4 routing protocols, including RIP v1/v2, OSPF, IS-IS, and BGPv4
- Virtual Routing Forwarding (VRF)
- Static routes that are manually configured by the administrator, which simplify network configurations and improve network performance
- Selection of the optimal route through the perfect routing policy

4.1.3 Multicast Routing Features

NOTE

The multicast routing features are not available on S5700-LI, S5700S-LI, and S5700-SI.

The S5700 supports the multicast function. This saves network bandwidth and reduces network load. The S5700 also guarantees QoS of multicast traffic and forwards multicast traffic at line speed. It supports the following multicast routing features:

- IPv4 multicast forwarding at line speed through the bottom-layer ASIC chips
- Multicast protocols, including IGMP, PIM-SM, PIM-DM, MSDP, and MBGP

- ASM and SSM
- Anycast RP: Multiple RPs can exist in a domain and they are configured as MSDP peers. A multicast source can register with the nearest RP, and the receiver can also choose the nearest RP and join the shared tree of the RP. In this manner, load balancing is carried out among the RPs. When an RP fails, its previously registered sources and receivers choose another nearest RP. This implements the backup of RPs.
- Multicast static routes
- Routing policy used for receiving, importing, and advertising multicast routes. When forwarding IP multicast packets, the S5700 can filter and forward the packets based on policies.
- PIM BFD
- RPF check

4.2 IPv6

NOTE

The OSPFv3 and VRRP6 are not available on S5700-SI, S5700-LI and S5700S-LI.

The S5700-LI and S5700S-LI switches support IPv6 protocol stack only.

The S5700 provides the IPv6 function, which protects the investment of customers and prevents repeat investment during network upgrade.

The IPv6 functions supported by the S5700 include:

- IPv6 protocol stack
- Unicast routing protocols: RIPng, OSPFv3, BGP+ and ISISIPv6
- VRRP6
- IPv6 over IPv4 tunnel
- DHCPv6 relay and DHCPv6 server
- PIM-IPv6-DM, PIM-IPv6-SM and PIM-IPv6-SSM
- MLDv1 and MLDv2

4.3 Routing Protocol

The S5700 supports the following unicast routing features:

NOTE

The static routes, RIP and RIPng are available on S5700-SI. But the other routing protocols and routing policy are not available.

Only the static routes are available on S5700-LI and S5700S-LI. All of the routing protocols and routing policy are not available.

- Static routes that are manually configured by the administrator, which simplify network configurations and improve network performance
- IPv4 routing protocols:
  - Open Shortest Path First version 2 (OSPFv2)
  - Intermediate System-to-Intermediate System (IS-IS)

  - Border Gateway Protocol version 4 (BGPv4)
  - Routing Information Protocol (RIP)
- IPv6 routing protocols:
  - OSPFv3
  - RIPng
  - BGP+
  - ISISIPv6
- Selection of the optimal route through the perfect routing policy

4.4 Multicast

The Internet Group Management Protocol (IGMP) is a protocol used to manage IP multicast members. It sets up and maintains the member relationship between IP hosts and their directly connected multicast routers.

4.4.1 IGMP Snooping and MLD Snooping

Located between hosts and a multicast router, the S5700 supports static multicast forwarding entries and generates a dynamic Layer 2 multicast forwarding table with multicast groups, VLANs, and outbound interfaces by listening to IGMP/MLD messages.

When the S5700 receives a multicast packet, it forwards the packet only to the members on the VLAN corresponding to the multicast group. The multicast packet is transmitted in multicast mode on the VLAN according to the Layer 2 multicast forwarding table. This saves bandwidth and enhances the security of information transfer.

The S5700 supports IGMP snooping over VPLS and maintains multicast groups and outbound interfaces on a VPLS network by snooping IGMP messages. This function implements on-demand multicast forwarding on the VPLS network.

4.4.2 IGMP Snooping Proxy

IGMP Snooping proxy is deployed on the switch that is located between the router and hosts. Then the switch serves as an agent server. The switch terminates IGMP protocol packets sent by hosts to the router and responds to the IGMP Query messages for the hosts. In addition, the switch processes IGMP protocol packets sent by the router and the hosts. In this manner, the forwarding entries for Layer 2 multicast are created.

4.4.3 Prompt Leave of Multicast Member Interfaces

When a multicast member leaves a multicast group, the host sends an IGMP/MLD Leave message. When an interface on the S5700 is connected to only one host, the S5700 deletes the Layer 2 multicast forwarding entry of the interface immediately after receiving the IGMP/MLD Leave message. This saves bandwidth and system resources and implements fast switching of services.

4.4.4 Multicast Traffic Control

Unknown multicast packets refer to the multicast packets that do not have forwarding entries in the Layer 2 multicast forwarding table. When receiving unknown multicast packets, the

S5700 discards the packets or broadcasts them on the VLAN that the inbound interface belongs to.

The S5700 can also control inbound multicast traffic volume by limiting the percentage or rate (in pps) of multicast packets on an Ethernet interface.

4.4.5 Inter-VLAN Multicast Replication

Inter-VLAN multicast replication means that an MVLAN aggregates multicast flows and replicates the flows to different user VLANs.

The S5700 forwards multicast packets through the multicast VLAN, and then replicates the packets based on the L2 multicast forwarding entries. Then, the S5700 sends these packets to different MVLANs. user VLAN multicast replication transmits multicast data in different VLANs. It facilitates the management and control of multicast flows and saves bandwidth.

4.4.6 Controllable Multicast

Multicast protocols do not provide user authentication. Therefore, a user can join or leave a multicast group freely. The multicast source does not know when a user joins or leaves a multicast group, so the number of users receiving multicast traffic on a network in a certain period is unknown. Therefore, the carrier cannot perform accounting for the users. The controllable multicast technology is introduced to solve these problems. Users have to pass authentication before receiving multicast traffic. Furthermore, only authorized multicast traffic can be received by users. Users who pass authentication are allowed to preview unauthorized multicast traffic and can receive multicast traffic in specified periods within a day. Controllable multicast does not apply to static multicast.

4.5 MPLS & VPN

NOTE

Only the S5700-HI and S5710-EI support MPLS & VPN functions.

The S5700 can be used to construct MPLS networks. Services that are external to MPLS networks are forwarded based on VLAN IDs and MAC addresses. Services within an MPLS network are transmitted based on MPLS labels. This solves problems concerning VLAN tag capacity and limits the number of MAC table entries.

The S5700 can act as the PE device or Provider (P) device on an MPLS network.

The S5700 supports multiple MPLS & VPN features, including Label Distribution Protocol (LDP) or Resource Reservation Protocol for Traffic Engineering (RSVP-TE), MPLS TE, VLL, VPLS, and MPLS L3VPN.

4.5.1 Basic MPLS Functions

The S5700 supports the following basic MPLS functions:

- LDP
- Static LSP
- Two-layer MPLS labels
- 802.1p priority mapping to the MPLS EXP field

4.5.2 MPLS TE

The S5700 supports the MPLS Traffic Engineering (TE). MPLS TE is a technique that integrates TE with MPLS. Using MPLS TE, the S5700 can create an LSP tunnel to a specified path and implement re-optimization. MPLS TE also provides protection against link or node failures by using path backup and fast reroute.

The S5700 supports the following MPLS TE features:

- TE extension based on IGP protocols including IS-IS and OSPF to collect network information
- Preemption, route pinning, and re-optimization of CR-LSP
- Establishment of CR-LSP based on RSVP TE; hot standby backup and basic backup functions of the MPLS TE tunnels
- Constraint Shortest Path First (CSPF) algorithm used to calculate the shortest path of CR-LSP
- MPLS TE tunnel and the following tunnel features:
  - MPLS TE tunnel loop detection
  - Routing and labeling record
  - MPLS TE tunnel re-establishment
  - Tunnel priority

4.5.3 VLL

VLL is an emulation of a traditional leased line. By emulating a leased line through an IP network, it provides asymmetric, low cost point-to-point virtual leased line services. VLL is mainly applied in the access and convergence layers of a MAN.

The S5700 supports the following four modes of VLL:

- Martini

  The Martini mode uses double labels. The inner label uses the extended LDP as the signaling protocol to transmit information. The Martini mode conforms to draft-martini-l2circuit-trans-mpls. Martini extends LDP by adding the FEC type in the VC FEC to exchange the VC label.
- Kompella

  The Kompella mode uses MP-BGP as the signaling protocol. PEs set up BGP sessions to each other to discover L2VPN nodes. Kompella uses BGP as the signaling protocol to transmit Layer 2 information and VC labels to establish L2VPN in end-to-end (CE to CE) mode on an MPLS network.
- SVC

  The SVC outer label (public network tunnel) functions the same as the Martini mode. The inner label is manually specified during VC configuration without the need of VC label transmission signaling. The network topology and SVC packet interaction are also the same as in the Martini mode. Thus, the SVC is a simplified version of the Martini.
- CCC

  In Circuit Cross Connect (CCC), VCs are statically configured, similar to SVC. Different from the common MPLS L2VPN, CCC uses a single label to transmit data. This label is

used for label exchange on each Label Switching Router (LSR). Thus, the CCC uses the LSP exclusively. Static LSPs must be configured in both directions.

4.5.4 VPLS

Virtual Private LAN Service (VPLS) is used to connect more than one Ethernet LAN segment through a Packet Switched Network (PSN) and have them operate in an environment similar to a LAN. Using VPLS, an ISP can establish multipoint-to-multipoint VPN connections between widely dispersed users. This can even include enterprises located in different cities.

The S5700 functions as the PE device on a VPLS network, transmitting VPLS services by establishing through-connection between PEs.

The S5700 supports VPLS in the following modes:

- Martini
- Kompella

4.5.5 HVPLS

VPLS through-connections are required between PEs. For multiple nodes or across a large geographic area, a large-scale VPLS network is required. This requires twice as many PEs as there are established connections. In this case, HVPLS is used to establish a large-scale VPLS network.

The S5700 mainly functions as the User Provider Edge (UPE) device on an HVPLS network, converging services from CEs to Network Provider Edges (NPEs) or PE-AGGs (PE-Aggregation).

The S5700 supports HVPLS in Martini mode.

On the VPLS or HVPLS network, the S5700 maps services of different types to different Virtual Switch Instances (VSIs). The S5700 then transparently transmits these services to NPE or PE-AGG through the VPLS or HVPLS network.

4.5.6 MPLS L3VPN

This section describes the basics of MPLS L3VPN.

BGP/MPLS VPN provides Layer 3 VPN services over an MPLS network. MPLS facilitates the implementation of IP-based VPN services and meets the expansibility and manageability requirements of VPNs. The S5700 supports MPLS VPNs. A single access point can be configured with multiple VPNs, each of which identifies a type of services. This allows different types of services to be transmitted in a flexible manner over networks.

4.6 QoS

The S5700 provides the class-based QoS mechanism and supports the 802.1p priority. It provides guarantee of low end-to-end delay, jitter, and high bandwidth.

The S5700 classifies traffic according to certain rules and then performs corresponding actions on the packets such as priority re-marking, traffic policing, congestion management, congestion avoidance, and rate limit on the interface. In this way, value-added services such as NGN services, IPTV, and broadband access are provided with better network service.

4.6.1 Traffic Classification

Traffic classification is a function of identifying the packets of a certain type by matching information in the packet header. For example, the 802.1p priority of the packets sent by the Operating Support System (OSS) and NMS is set to 7; the 802.1p priority of VoIP packets is set to 6; the 802.1p priority of BTV packets and VOD packets is set to 5 or 4; the 802.1p priority of packets sent by VPN users is set to 3, 2, or 1 according to the level of VPN users; the 802.1p priority of packets of the Internet access service is set to 0. Then the packets can be classified based on their 802.1p priorities.

The S5700 adopts a hardware classifier to guarantee line-speed transmission of services data on interfaces.

Simple Traffic Classification

On the S5700SI, S5700EI, S5700S-LI, and S5700-LI, you can perform simple traffic classification for packets according to the mapping between priorities of packets and Per-Hop Behaviors (PHBs). If packets come from an upstream device, the S5700SI and S5700EI maps priorities of the packets to PHBs and colors. On the S5700SI and S5700EI, congestion management is performed for packets according to PHBs of packets and congestion avoidance is performed for packets according to colors of packets. The downstream device provides QoS services according to the priorities of packets.

On the S5700HI, you can perform simple traffic classification for packets according to the mapping between priorities of packets and Per-Hop Behaviors (PHBs) defined in a Differentiated Services (DiffServ) domain. If packets come from an upstream device, the S5700HI binds a DiffServ domain to the incoming interface. In the DiffServ domain, the S5700HI maps priorities of the packets to PHBs and colors. On the S5700HI, congestion management is performed for packets according to PHBs of packets and congestion avoidance is performed for packets according to colors of packets. If packets are sent to a downstream device, the S5700HI binds a DiffServ domain to the outgoing interface. In the DiffServ domain, the S5700HI maps PHBs and colors of the packets to priorities. Then, the downstream device provides QoS services according to the priorities of packets.

Simple traffic classification is based on:

- DiffServ Code Point (DSCP) priority of IP packets
- 802.1p priority of VLAN packets

Complex Traffic Classification

You can perform complex traffic classification according to Layer 2 or Layer 3 information in packets or through access control lists (ACLs). Then, you can bind a traffic classifier to a traffic behavior to process packets matching the traffic classifier.

The traffic behavior adopted is related to the current phase of packets and the current load of a network. For example, when packets enter an S5700, the S5700 performs traffic policing and access control for the packets according to the committed information rate (CIR); when packets exit an S5700, the S5700 shapes the traffic of packets and re-marks the priorities of packets.

Complex traffic classification is based on:

- 802.1p priority of VLAN packets
- VLAN ID of packets

- Double tags in VLAN packets

  NOTE

  The S5700SI, S5700S-LI and S5700-LI do not support complex traffic classification according to double tags in VLAN packets.

  The S5700-SI, S5700S-LI, and S5700-LI do not support complex traffic classification according to double tags in VLAN packets.

- Incoming or outgoing interface

  NOTE

  The S5700SI, S5700S-LI, and S5700-LI do not support complex traffic classification according to the outbound interface.

- IP priority of IP packets
- DSCP priority of IP packets
- SYN Flag field in Transmission Control Protocol (TCP) packets
- Source MAC address
- Destination MAC address
- Protocol type field encapsulated in Layer 2 packets
- Layer 3 protocol type
- IP quintuple

4.6.2 Access Control and Re-marking

After traffic classification, the S5700 performs access control on the packets, that is, permits or denies the packets. Then, the S5700 re-marks the following fields in the packets:

- 802.1p field, that is, the PRI field in a VLAN tag
- DSCP field
- Precedence field of IP packets
- Local precedence
- VLAN ID, that is, the outer VLAN ID or inner VLAN ID of QinQ packets
- Destination MAC addresses

4.6.3 Traffic Policing

The S5700 uses the token bucket algorithm to control the Committed Access Rate (CAR) of network traffic.

The S5700 controls the rate of traffic by adjusting the rate of placing tokens. Each token equals a forwarding rate of 64 kbit/s. The S5700 "punishes" the excessive traffic to limit the incoming traffic within a proper range and to protect the network resources.

4.6.4 Congestion Management

The S5700 manages traffic congestion through queue scheduling. Each outbound interface on the S5700 is configured with eight queues. After traffic classification, packets are sent to the corresponding queues based on their priorities.

The S5700 provides the following queue scheduling policies:

- Priority Queuing(PQ)

- Weight Round Robin(WRR)
- Deficit Round Robin(DRR)
- PQ + WRR
- PQ + DRR

4.6.5 Congestion Avoidance

Congestion avoidance is a flow control technology that relieves overload on a network by adjusting the network traffic. By monitoring the network resources in use, such as queues and memory buffers, the S5700 automatically discards packets when congestion occurs or tends to aggravate.

S5700-LI, S5700S-LI, S5700-SI and S5700-EI

The S5700-EI adopts the Simple Random Early Detection (SRED) technology to avoid congestion. After traffic classification, the S5700-EI marks packets with two types of drop precedence. Packets with low request for QoS are marked with high drop precedence, and the other packets are regarded as normal packets. Based on the drop precedence of the packets, the S5700-EI can discard packets to adjust the rate of the outbound traffic sent from its interfaces.

The SRED is not available on S5700-LI, S5700S-LI and S5700-SI. They adopt tail drop to avoid congestion.

S5700S-LI, S5710EI and S5700-HI

The S5700S-LI, S5710EI and S5700-HI supports the Weighted Random Early Detection (WRED) algorithm. WRED monitors packets in each queue and compares the length of the queue with the low threshold for dropping packets. Based on the result, the S5700S-LI, S5710EI and S5700-HI processes the packets in queues in the following ways when congestion occurs.

- When a queue is shorter than the minimum threshold, the device does not discard packets.
- When the length of a queue is between the low threshold and the high threshold, WRED begins to discard packets randomly.
- When a queue is longer than the high threshold, the device discards all incoming packets.

4.6.6 Rate Limit on an Interface

Rate limit on an interface is used to adjust the rate of traffic on an outbound interface or inbound interface to prevent burst traffic. The S5700 uses the token bucket and a buffer to limit the traffic rate on an outbound interface, implementing traffic shaping. When the rate of packets exceeds the rate limit, the S5700 buffers excessive packets and sends them when the traffic rate falls below the limit. In this manner, the transmission rate is smoothed.

4.6.7 Two-Rate-Three-Color

The S5700 controls traffic according to the result of traffic classification and discards the excessive packets. The S5700 supports two-rate-three-color. You can set the following parameters on the S5700:

- Committed Information Rate (CIR), which is the allowed rate at which traffic can pass through
- Committed Burst Size (CBS), which is the maximum size of traffic that can pass through

- Peak Information Rate (PIR), which is the peak rate at which traffic can pass through
- Peak Burst Size (PBS), which is the peak size of traffic that can pass through

In addition, the S5700 can mark packets red, green, or yellow according to traffic volume, and map behaviors to the colors, such as forwarding or discarding the packets. The S5700 can also re-mark packets.

4.6.8 Aggregate CAR

NOTE

Aggregate CAR is not available on the S5700-LI, S5700S-LI, S5710-EI and S5700-HI.

Aggregate CAR is the CAR applied to multiple interfaces to implement traffic policing for service flows on the interfaces. The sum of rate limits on the interfaces must be equal to or smaller than the aggregate CAR.

4.7 Security

The S5700 guarantees both device security and service security.

4.7.1 Device Security

Hierarchical Command Protection

When a user logs in to the S5700 from an Ethernet interface through Telnet, the S5700 authenticates the user to ensure security. The user can configure and maintain the S5700 only after passing the authentication.

The S5700 adopts a hierarchical protection mode for commands. Commands are classified into the visit level, monitoring level, configuration level, and management level, with their levels in ascending order. Login users are also classified into four levels, corresponding to the four levels of commands. After logging in to the S5700, a user can run only the commands at the same or lower level. This mode effectively controls the user authority.

The S5700 extends command levels and user levels to 16 levels so that users are managed more refinedly.

Remote SSH Login

The S5700 supports the Secure Shell (SSH). On an insecure network, SSH provides powerful security guarantee and authentication for login users and can defend against various attacks.

Encrypted Authentication Through SNMPv3

The S5700 supports encrypted authentication through SNMPv3. When S5700 is managed by an NMS workstation through SNMP, it adopts the encrypted authentication mode in user-based security mode (USM) to ensure security.

AAA

The S5700 supports the Authentication, Authorization, and Accounting (AAA). Using AAA and hierarchical command protection, the S5700 can authenticate and authorize login users. In

addition, it can authenticate the NMS administrator. AAA effectively prevents unauthorized users from logging in to the S5700.

The S5700 supports authentication methods such as local authentication, RADIUS authentication, and HWTACAS+ authentication.

CPU Channel Protection

The S5700 can filter the protocol packets and management packets sent to the CPU based on the protocol ID, interface, and combination of interface and VLAN. This protects the CPU channels against Denial of Service (DoS) attacks.

Limit of MAC Address Learning on Interfaces

You can set the maximum number of MAC addresses learned by an interface on the S5700 to prevent hackers from initiating source MAC address attack from the interface. This ensures that the MAC address entries of the S5700 will not be used up.

4.7.2 Service Security

VLAN

The S5700 supports the division of a LAN into multiple VLANs. Devices on different VLANs cannot communicate with each other. This isolates broadcast domains and improves service security.

Blackhole MAC Address Entry

The S5700 supports blackhole MAC address entries. When receiving a packet, the S5700 compares the source or destination MAC address of the packet with its MAC address entries. If the source or destination MAC address of packet is the same as a blackhole MAC address, the S5700 discards the packet.

When detecting attacking packets from a MAC address, you can set a blackhole MAC address entry on the S5700 to filter out the packets with the MAC address.

MAC Table Searching Based on VLAN+MAC

The S5700 supports MAC table searching based on VLANs and MAC addresses to improve interface security. You can add static MAC address entries in the MAC table to map specific MAC addresses to interfaces. In this way, specific devices are bound to interfaces so that hackers cannot attack the S5700 by using fake MAC addresses.

Port Isolation

Port isolation prevents ports on the same S5700 from sending Layer 2 packets to each other. The S5700 supports unidirectional and bidirectional port isolation. Port isolation ensures security of user networks and helps to construct low-cost intelligent community networks. Port isolation also limits unnecessary broadcast packets and thus increases network throughput.

Packet Filtering

Packet filtering is used to filter out invalid or unwanted packets.

The S5700 filters packets based on user-defined rules. For example, it filters packets by checking the MAC address, IP address, port number, and VLAN ID of packets. Packet filtering does not check the session status or analyze the data. By filtering packets, the S5700 can effectively control the packets passing through it.

4.7.3 Security Authentication

The 802.1x protocol is a port-based network access control protocol. It authenticates and controls access devices on a LAN based on interfaces. A user device can access resources on the LAN only after it passes the authentication on the access interface.

MAC address-based authentication controls the network access authority of a user based on the access interface and MAC address of the user. The user does not need to install any authentication client software. After detecting the MAC address of the user for the first time, the device starts authenticating the user. During the authentication, the user does not need to enter the user name or password.

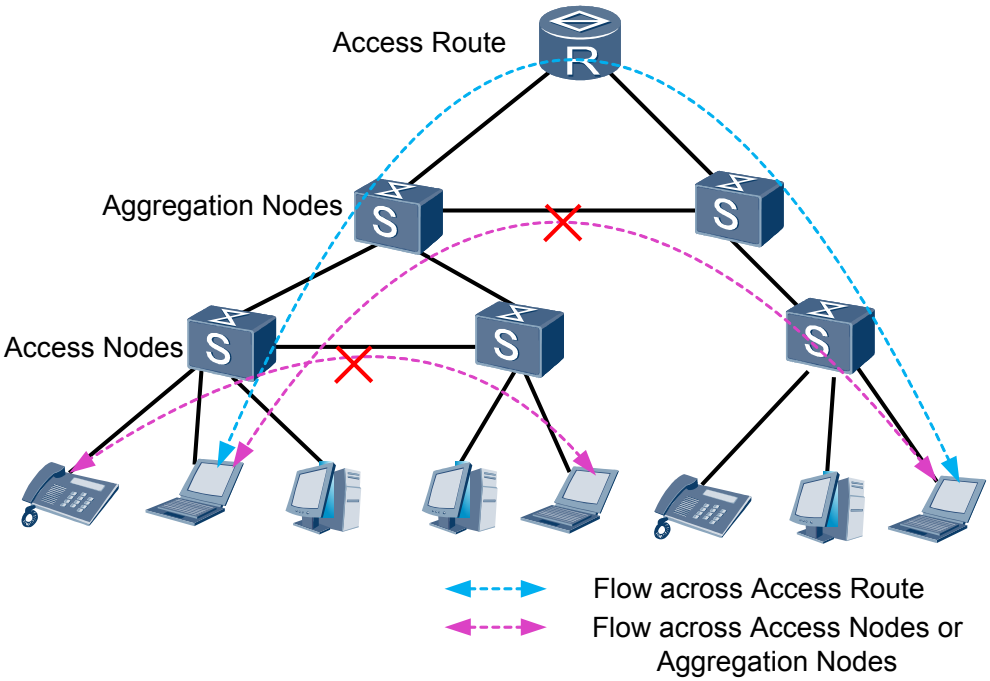
4.8 MAC-Forced Forwarding

The access layer provides network connections between the user-side hosts and the enterprise-side access routers (ARs), especially the reliable connections between the hosts with the Internet or other IP networks.

The access layer can be divided into the user network and convergence network. The user network is connected to the access node (AN) through a subscriber line, which is a physical line and usually called "the first mile."

The subscriber line is then connected to the convergence network through the AN. In this manner, the AN is the border between the subscriber line and the convergence network. User traffic is centralized and aggregated on the convergence network, which is usually called "the second mile." For details, see **Figure 4-1**.

Figure 4-1 Connections at the access layer



At the access layer, the enterprise-side has the following requirements:

- In order that the enterprise-side uses the AR to perform secure filtering, policy scheduling, and accounting for the traffic, the ARs need to perform Layer 3 forwarding for the traffic of different user hosts in different networks. The ARs, however, cannot forward packets through Layer 2 switching.
- The efficiency of address assignment needs to be improved to save IPv4 addresses. The effectiveness of address assignment needs to be improved if an address is assigned from a large address pool rather than a small and independent network segment to the host.

To implement user isolation at the access layer and meet the preceding requirements of the enterprise-side, the MAC-Forced Forwarding (MFF) protocol is introduced.

MFF is a security protocol that isolates the user hosts accessing the same device. When MFF is running, its security program applies to any shared access media, bringing no extra problems to these networks.

In addition to Layer 2 isolation, the AN that runs MFF discards any upstream broadcast packets except for DHCP packets and ARP request packets. The AN discards DHCP response packets received through the subscriber line and limits the rate of DHCP broadcast packets.

The AN that runs MFF must know the IPv4 addresses allocated to the subscriber line. This is to discard the upstream traffic with the fake IPv4 source addresses.

4.9 DHCP

NOTE

The DHCP Server and DHCP Relay are not available on S5700-LI and S5700S-LI switches.

DHCP Client and DHCP Server

DHCP adopts the client/server mode, that is, the DHCP client sends request messages to the DHCP server. Then, the DHCP server returns the reply messages according to the address pool policy.

The DHCP server assigns an IP address to the client by using an address pool. When the client sends a DHCP request to the server, the DHCP server selects a proper address pool, finds an idle IP address from the pool, and delivers the IP address along with other related parameters, such as the gateway address, the DNS address and the address lease, to the client.

To dynamically allocate IP addresses to clients, you need to first configure the address pool range on the DHCP server. Currently, an address pool can be configured with only one address range and the address range is determined by the mask length.

DHCP Snooping

The S5700 can be deployed between the DHCP server and the DHCP client and it monitors the DHCP messages between the DHCP server and the DHCP client. The S5700 creates the IP +MAC+PORT+VLAN binding table according to the monitoring result to filter out invalid packets.

The S5700 also supports Option 82.

- After receiving a Request message from the DHCP client, the S5700 appends the Option 82 field to the Request message. The DHCP server enforces the IP address allocation policy according to the Option 82 field.
- The DHCP server appends the Option 82 field to a Response message. The S5700 analyzes the Option 82 field, determines a forwarding interface, removes the Option 82 field, and then forwards the message to a user.

Option 82 can be implemented in two modes on the S5700, Option 82 insert and Option 82 rebuild.

The Option 82 field contains the user circuit IDs. The user circuit IDs include user device name, outer VLAN ID, inner VLAN ID and port number etc. This can effectively prevent attackers from modifying the DHCP messages.

DHCP Relay

The DHCP client and the DHCP server send broadcast packets during the allocation of IP addresses. Therefore, DHCP can be applied only when the DHCP client and DHCP server are in the same subnet. It is a waste of resource to deploy a DHCP server in each network segment.

The DHCP relay is introduced to solve this problem. Through DHCP relay, a DHCP client in a subnet can communicate with the DHCP server in another subnet and finally obtains an IP address. In this manner, the DHCP clients on different network segments can use the same DHCP server. This reduces costs and achieves centralized management.

4.10 Network-Level HA

4.10.1 MSTP Protective Switchover

The S5700 supports MSTP to eliminate broadcast storms on a network and provide redundant links for data transmission.

The S5700 provides the root protection function. To retain the role of the root device, you need to set the role of a designated interface to remain unchanged when the interface receives a BPDU with higher priority. This prevents incorrect change of the network topology.

The S5700 provides the loop protection function. If the root interface cannot receive any BPDU from the upstream device, the root interface enters the blocking state and stops forwarding packets. At the same time, no new root interface is elected. This prevents loops on the network.

4.10.2 RRPP Rapid Protective Switchover

An RRPP ring is applied to the protected dual-homed networks. The RRPP ring can be deployed between CEs and UPEs, or between UPEs and NPEs.

An RRPP ring is composed of a master node and multiple transit nodes that are connected to each other. The master node periodically sends out protocol packets from the primary interface to monitor the link status. If the link fails, the master node can enable the secondary interface to realize self-healing.

If a single-point failure occurs on the ring, the RRPP can enable the backup link as soon as possible and the link among nodes can recover quickly.

4.10.3 Smart Link Dual-Homing Protection

The S5700 is dual-homed to an upstream device through the Smart Link technology. The downstream links of the S5700 form a Monitor Link group. The layer-by-layer connection of convergence implements association between Smart Link and Monitor Link. When no upstream links exist, the S5700 disables the downstream interface and switches traffic between different paths through the interface association mechanism.

4.10.4 Ethernet OAM

Conforming to IEEE 802.3ah, the S5700 supports the point-to-point Ethernet fault management to detect faults in the first mile of the directly connected link on the user side of the Ethernet. At present, the S5700 supports the following functions defined in IEEE 802.3ah:

- OAM discovery
- Link monitoring
- Fault notification
- Remote loopback

The S5700 provides end-to-end Ethernet OAM complying with IEEE 802.1ag to detect connectivity faults on a network. The S5700 supports end-to-end connectivity fault detection, fault notification, fault verification, and fault location.

The S5700 provides the performance management function. Performance management is used to measure the packet loss ratio, delay, and jitter during packet transmission, and collect statistics on various types of packets. Performance management is performed at the user access points. By using performance management tools, a carrier can monitor the network running status and locate faults through the network management system. The carrier can then check whether the forwarding capacity of the network complies with the Service Level Agreement (SLA) signed with users.

Ethernet OAM improves management and maintenance capabilities on the Ethernet and guarantees a stable network.

The S5700-28C-HI and S5700-28C-HI-24S support high-performance IEEE 802.1ag based on hardware.

4.11 LLDP

The S5700 supports the Link Layer Discovery Protocol (LLDP) that conforms to IEEE 802.1ab. LLDP is a link layer protocol used for interconnected devices to obtain the connection information of each other.

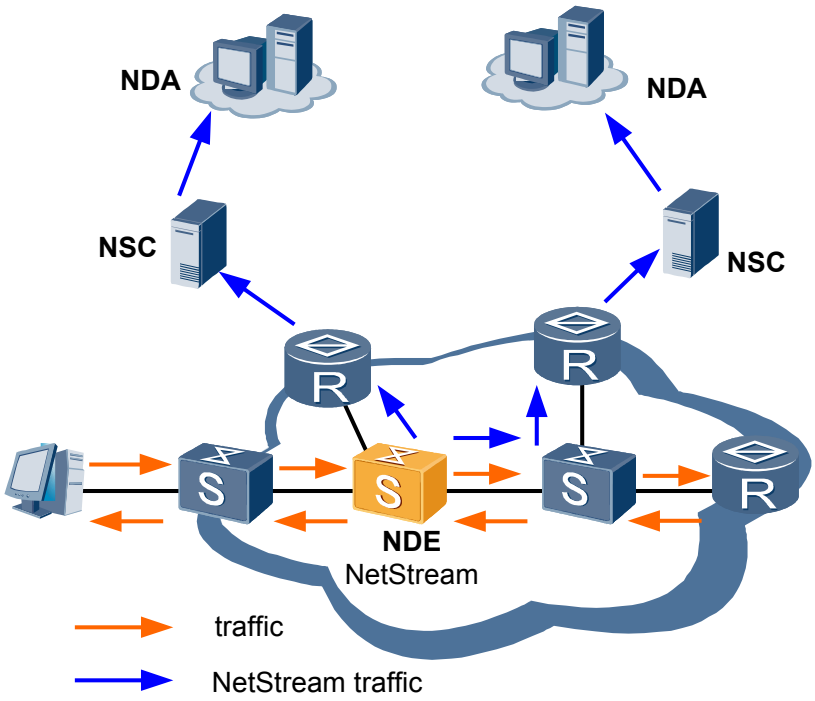
Using LLDP, the local NMS can obtain the link layer information of all devices on the local network and details about the network topology. Thus the NMS can manage a larger area on the network.

The LLDP-enabled interfaces on the S5700 periodically notify the neighbors of its own status. If the status of an interface changes, the interface sends status update messages to the directly connected neighboring device. The neighboring device stores the status update message in the standard SNMP MIB. Then the NMS can obtain the link layer information of the network from the MIB to calculate the topology of the entire network.

4.12 NetStream

With an overall increase in network services and applications, users require detailed statistical analysis of network traffic. NetStream provides network administrators with detailed records of data network activity.

Figure 4-2 Network diagram of NetStream



NDE: Netstream Data Exporter NSC: Netstream Collector NDA: Netstream Data Analyzer

NetStream provides the following functions:

- Network management and planning
- Enterprise accounting and department billing
- ISP billing report
- Data storage
- Data collection for business

Due to the connectionless-oriented features of IP networks, communication between different types of services are implemented by transmitting IP datagrams from one terminal to another. Such IP datagrams actually constitute a service's data flow across a network. Most data traffic on the network is temporary and bidirectional.

Based on packets' destination IP address, source IP address, destination port number, source port number, protocol number, Type of Service (ToS), and incoming or outgoing interface, NetStream identifies different streams and collects statistics for these steams independently.

The NDE regularly sends traffic statistics to the NSC for additional processing and then forwards the statistics to the NDA. The report generated based on these analysis results acts as the basis for accounting and networking planning.

The S5710-EI and S5700-HI support:

- NDE
- IPv4/IPV6/MPLS packet sampling
- Fix-packet sampling and fix-time sampling
- Original traffic, flexible traffic, and aggregation traffic
- V5/V8/V9 packet export format

4.13 sFlow

NOTE

Only the S5700-HI, S5710-EI and S5700-EI support sFlow function.

Sampled Flow (sFlow) is a traffic monitoring technology that collects and analyzes traffic statistics.

sFlow provides interface-based traffic analysis and displays traffic statistics in graphs or reports, facilitating preventive maintenance especially on enterprise networks without specialized network administrators.

NetStream is a technology that collects and analyzes statistics on network flows. Network devices need to preliminarily collect and analyze network flows, and store statistics in the cache. When the cache overflows or flow statistics expire, the statistics are exported. Compared with NetStream, sFlow does not require a cache, network devices only sample packets, and a remote collector collects and analyzes traffic statistics. Therefore, sFlow has the following advantages over NetStream:

- Saves resources and lowers costs. No cache is required, and a small number of network devices are used, which lower costs.
- Flexible collector deployment. A collector collects and analyzes traffic statistics based on various traffic characteristics as required. The collector is deployed flexibly.

4.14 NQA

As increasing services and applications are deployed on the Internet, traditional network performance analysis tools (such as ping and tracert) cannot meet customer requirements for diversified services and real-time monitoring.

The S5700 supports Network Quality Analysis (NQA), which sends test packets to analyze the network performance and quality of service. NAQ can provide various network performance parameters, including delay variation, total delay of the HTTP application, TCP connection delay, FTP connection delay, and file transfer rate. Using NAQ test results, you can:

- Obtain the network performance in real time and take measures to improve the network performance.
- Diagnose network problems and find the causes of network problems.

4.15 Stacking

NOTE

The S5700-10P-LI-AC, S5700-10P-PWR-LI-AC, S5700S-LI, S5700-26X-SI-12S-AC, S5700-28C-HI and S5700-28C-HI-24S do not support stacking.

Stacking means that the switches located in the same place are connected through the stacking cable or high-speed uplink interfaces, and thus the switches form a reliable switch group. Through stacking, the user can manage and maintain the switches uniformly; therefore, the stacking reduces the maintenance cost of the user. The stacked switches must be of the same type.

The stacked switches have three roles:

- Master switch

  A stack has only one master switch. The master switch manages the entire stack system by assigning stack IDs to member switches, collecting information about the stack topology, and notifying all the member switches of the information.

- Backup switch

  As the backup of the master switch, the backup switch becomes the master if the master switch is faulty and takes over the work of the master switch.

- Slave switch

  A slave switch only processes service traffic on the network and is managed by the master switch.

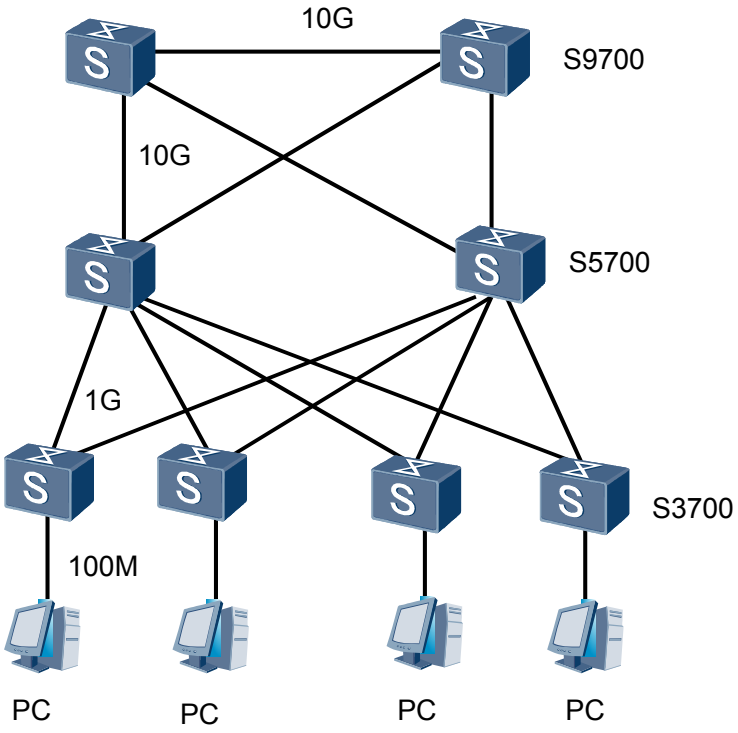
5 Networking and Applications

About This Chapter

5.1 Aggregation Device of Enterprise Network or Campus Network

On the enterprise network or campus network shown in **Figure 5-1**, the S5700s connect to access switches using 1000 Mbit/s interfaces, and connect to core switches S9700s using 10 Gbit/s optical interfaces. The network provides 10 Gbit/s rate for the backbone layer and 100 Mbit/s access rate for terminals. This solution provides high bandwidth and meets multi-service requirements.

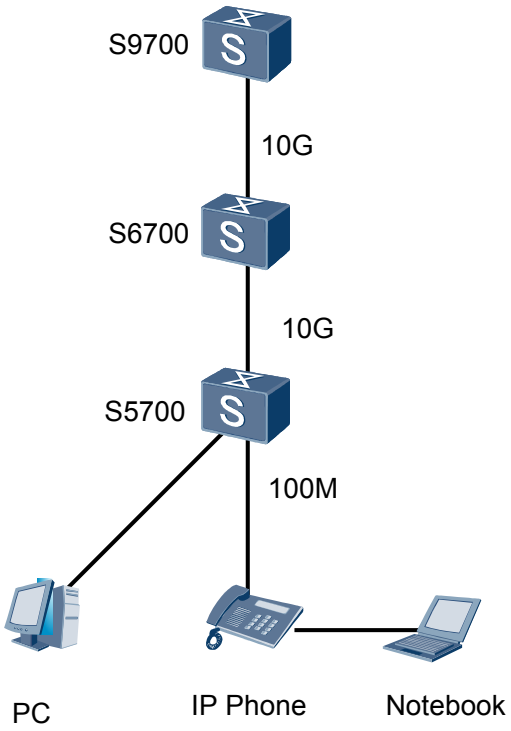
Figure 5-1 Aggregation device of enterprise network or campus network



5.2 Desktop Access

As shown in **Figure 5-2**, the S5700 provides the functions such as PoE, voice VLAN and NAC. The S5700 can be used for desktop access and provides 1000 Mbit/s access rate.

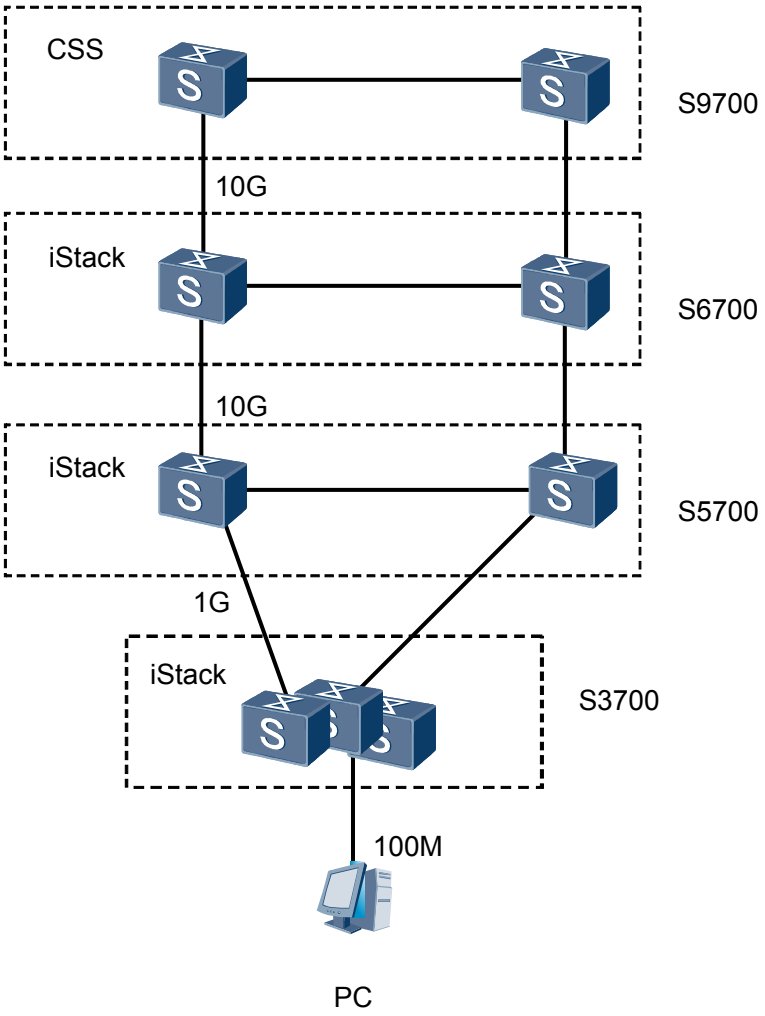
Figure 5-2 Desktop access



5.3 iStack

As shown in **Figure 5-3**, iStack improves performance and reliability of the access layer and aggregation layer. The S5700s use the iStack technology to form a stack system, implementing the distributed forwarding structure and fast fault recovery. The stack system increases the number of user interfaces and improves packet processing capability. The iStack-enabled S5700s can be managed in a uniform manner to facilitate network management and maintenance.

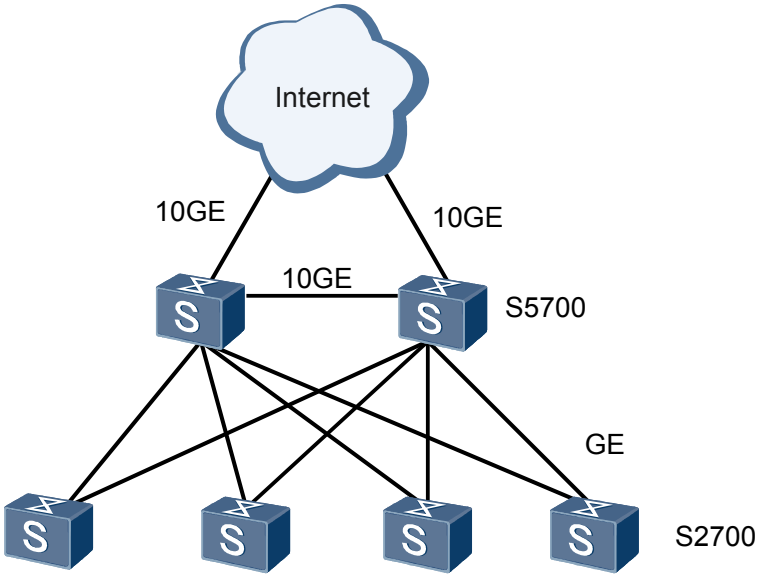
Figure 5-3 iStack



5.4 Core Device for Small Enterprise Network

As shown in **Figure 5-4**, the S5700s functioning as core switches on the small-sized enterprise network have powerful aggregation and routing capabilities.

Figure 5-4 Core device for small-sized enterprise network



6 Maintenance and Network Management System

About This Chapter

6.1 Maintenance and Management

6.1.1 Various Configuration Methods

Configuration Modes

The S5700 supports the following configuration and management modes:

- Command line

  A user connects to the console port of the S5700 through the console terminal or connects to the VLANIF interface or ETH Management port through Telnet, and then configures various functions and sets parameters in the command line interface (CLI).
- Network management station

  A user configures and manages the S5700 through the SNMP protocol.
- AutoConfig

  When the S5700 starts with the default configuration file, a user can automatically obtain and run the configuration file through AutoConfig.

Login Modes

The S5700 provides a console port. A user can connect to the console port through the serial port on a console terminal, and then configure the S5700 locally or remotely.

In addition, the user can telnet to the service interface of the S5700 for configuration and management.

The S5700 supports multiple authentication modes, including non-authentication, local authentication, and AAA.

6.1.2 Monitoring and Maintenance

Hardware Monitoring

The S5700 provides the following hardware monitoring functions:

- Sends a trap when the temperature of the device becomes abnormal.
- Provides the re-detection function to prevent incorrect detection because of instant interference.
- Checks version matching automatically when the system is running.
- Sends the Dying gasp trap to the upper-layer device before power-off.

  NOTE

  This Dying gasp trap is only supported by the S5700LI, S5700S-LI and S5700HI.

Device Management and Maintenance

The S5700 provides various management and maintenance functions:

- Provides flexible online help for the command line in Chinese or English.

- Provides hierarchical commands and user authority management.
- Provides an information center to uniformly manage logs, traps, and debugging information and redirects information as required.
- Provides the electronic labels. A user can view the basic information about the SCU and optical modules through the CLI, and back up the information to an external server through FTP.
- Supports the display of the software version, module status, ambient temperature, CPU usage, and memory usage.

6.1.3 Diagnosis and Debugging

Ping and TraceRoute

On traditional IP networks, the S5700 provides the following tools to check network connectivity:

- Ping
- TraceRoute

These tools are used to test network connectivity and record transmission paths of packets to assist fault location.

Debugging

The S5700 provides various debugging commands for each software feature. Each debugging command supports multiple parameters and can be flexibly controlled. The debugging commands display the detailed information about processes, packet receiving and sending, and error check during the running of a feature.

VCT

A user can run the VCT commands on the switch. According to Time Domain Reflectometry (TDR) theory, an interface can receive the reflected signal after transmitting the test signal. Then the user can know the cable status according to the characteristics of the reflected signal.

Mirroring

The S5700 supports interface-based or flow-based mirroring on a single switch. In addition, it supports the interface-based remote mirroring among multiple switches.

- Port mirroring

  The incoming traffic, outgoing traffic, or both incoming and outgoing traffic at an observed interface is completely copied to an observing interface.
- Flow mirroring

  The traffic at an observed interface is completely copied to an observing interface.
- Remote mirroring

  With the Remote Switched Port Analyzer (RSPAN), the observing interfaces and observed interfaces can be located on different switches on the network. This facilitates the remote management on the switches through NMS.

By connecting a monitoring host to an observing interface on the S5700, a network administrator can easily observe the packets that pass through the S5700 in real time. The mirroring result serves as a basis for traffic detection, fault location, and data analysis.

6.1.4 Software Upgrade and In-Service Patching

Software Upgrade

The S5700 can detect the integrity and validity of the system software before the upgrade and provides various methods of upgrading the software:

- Local upgrade

  When the S5700 is powered on, the software can be loaded and upgraded through the BootROM menu.

- Remote in-service upgrade

  When the S5700 runs normally, it can download the software through FTP or TFTP. The new software is run when the S5700 is restarted. This realizes the remote seamless software upgrade.

The S5700 supports rollback to the previous version in case of upgrade failure.

In-Service Patching

The S5700 supports in-service patching to protect services from being affected when a patch is installed. The software can be restored to the earlier version, and the device data before and after in-service patching is recorded.

In addition, the S5700 provides the one-key operation for patches. That is, based on the slot ID of a board, a user can quickly obtain information about the compatibility of a patch and the system software, status of a patch, and history operations of a patch.

6.1.5 Hardware Fault Handling

The S5700 supports automatic and manual intervention when a hardware fault occurs, for example, a chip on a board fails. The maintenance personnel can locate a hardware fault and handle it quickly to shorten service interruption.

6.2 Web Network Management

To facilitate maintenance and use of the S5700, the Web network management is introduced.

Web network management is a Web server embedded in the S5700. Users can log in using PCs to manage and maintain the S5700. By using Web network management, maintenance personnel only need to configure IP addresses and Web-based NMS accounts on the S5700, and then enter IP addresses in the address bar of the Microsoft Internet Explorer. The operations are easy to learn and perform, and network management efficiency is greatly improved.

6.3 eSight

The S5700 supports the eSight network management systems. The eSight network management system manages enterprise networks using the following features:

- Manages other vendors' devices.
- Manages specific services by analyzing network flows and focusing on core services.
- Manages application software, IT devices (such as servers and printers), and network devices.
- User-oriented operation and maintenance system: Ensures desktop access security by performing authentication, authorization, and accounting (AAA) on network access users.
- Secondary development platform: Provides a secondary development platform for customizing network management functions.
- Northbound integration: Integrates with upper-layer OSS system.

7 System Technical Specifications

About This Chapter

7.1 Specifications

The specifications of the S5700 switches.

7.1.1 S5700-LI

Table 7-1 lists specifications of the S5700-LI.

Table 7-1 Specifications of the S5700-LI

Item	Description
Packet forwarding capacity Switching capacity	● S5700-28P-LI-AC: 42 Mpps, 128 Gbit/s ● S5700-28P-LI-DC: 42 Mpps, 128 Gbit/s ● S5700-52P-LI-AC: 78 Mpps, 256 Gbit/s ● S5700-52P-LI-DC: 78 Mpps, 256 Gbit/s ● S5700-28P-PWR-LI-AC: 42 Mpps, 128 Gbit/s ● S5700-52P-PWR-LI-AC: 78 Mpps, 256 Gbit/s ● S5700-28TP-LI-AC: 42 Mpps, 128 Gbit/s ● S5700-28TP-PWR-LI-AC: 42 Mpps, 128 Gbit/s ● S5701-28TP-PWR-LI-AC: 42 Mpps, 128 Gbit/s ● S5700-28X-LI-AC: 96 Mpps, 128 Gbit/s ● S5700-28X-LI-DC: 96 Mpps, 128 Gbit/s ● S5700-52X-LI-AC: 132 Mpps, 256 Gbit/s ● S5700-52X-LI-DC: 132 Mpps, 256 Gbit/s ● S5700-28X-PWR-LI-AC: 96 Mpps, 128 Gbit/s ● S5700-52X-PWR-LI-AC: 132 Mpps, 256 Gbit/s ● S5700-10P-PWR-LI-AC: 15 Mpps, 26 Gbit/s ● S5700-10P-LI-AC: 15 Mpps, 26 Gbit/s
DDR memory	256 MB
Flash memory	200 MB

Item		Description
Mean time between failures (MTBF)		● S5700-28P-LI-AC: 49.69 years ● S5700-28P-LI-DC: 49.69 years ● S5700-52P-LI-AC: 39.26 years ● S5700-52P-LI-DC: 39.26 years ● S5700-28P-PWR-LI-AC: 44.24 years ● S5700-52P-PWR-LI-AC: 35.70 years ● S5700-28TP-LI-AC: 49.69 years ● S5700-28TP-PWR-LI-AC: 44.24 years ● S5701-28TP-PWR-LI-AC: 44.24 years ● S5700-28X-LI-AC: 68.95 years ● S5700-28X-LI-DC: 68.95 years ● S5700-52X-LI-AC: 61.86 years ● S5700-52X-LI-DC: 61.86 years ● S5700-28X-PWR-LI-AC: 61.53 years ● S5700-52X-PWR-LI-AC: 40.72 years ● S5700-10P-PWR-LI-AC: 36.89 years ● S5700-10P-LI-AC: 44.41 years
Mean time to repair (MTTR)		2 hours
Availability		> 0.99999
Surge protection	Service port protection	Common mode: ±6 kV
	Power supply protection	● DC: ±1 kV in differential mode; ±2 kV in common mode ● AC: – S5700-28P-LI-AC: ±2 kV in differential mode; ±4 kV in common mode – Others: ±6 kV in differential mode; ±6 kV in common mode

Item		Description
Dimensions (W x D x H)		● S5700-28P-LI-AC: 442.0 mm x 220.0 mm x 43.6 mm ● S5700-28P-LI-DC: 442.0 mm x 220.0 mm x 43.6 mm ● S5700-52P-LI-AC: 442.0 mm x 310.0 mm x 43.6 mm ● S5700-52P-LI-DC: 442.0 mm x 310.0 mm x 43.6 mm ● S5700-28P-PWR-LI-AC: 442.0 mm x 310.0 mm x 43.6 mm ● S5700-52P-PWR-LI-AC: 442.0 mm x 310.0 mm x 43.6 mm ● S5700-28TP-LI-AC: 442.0 mm x 220.0 mm x 43.6 mm ● S5700-28TP-PWR-LI-AC: 442.0 mm x 310.0 mm x 43.6 mm ● S5701-28TP-PWR-LI-AC: 442.0 mm x 310.0 mm x 43.6 mm ● S5700-28X-LI-AC: 442.0 mm x 220.0 mm x 43.6 mm ● S5700-28X-LI-DC: 442.0 mm x 220.0 mm x 43.6 mm ● S5700-52X-LI-AC: 442.0 mm x 310.0 mm x 43.6 mm ● S5700-52X-LI-DC: 442.0 mm x 310.0 mm x 43.6 mm ● S5700-28X-PWR-LI-AC: 442.0 mm x 310.0 mm x 43.6 mm ● S5700-52X-PWR-LI-AC: 442.0 mm x 310.0 mm x 43.6 mm ● S5700-10P-PWR-LI-AC: 320.0 mm x 220.0 mm x 43.6 mm ● S5700-10P-LI-AC: 250.0 mm x 180.0 mm x 43.6 mm
Weight		≤ 5 kg
Stack port		Four uplink 1000Base-X optical service ports, two uplink 1000Base-X optical service ports, or four uplink 10GE SFP+ optical service ports are used as stack ports. **NOTE** The S5700-10P-PWR-LI-AC and S5700-10P-LI-AC do not support stacking.
RPS		All S5700-LI series except the S5700-10P-PWR-LI-AC and S5700-10P-LI-AC support the RPS.
PoE		The PWR series support PoE.
Input DC voltage	Rated input voltage range	-48 V DC to -60 V DC
	Maximum voltage range	-36 V DC to -72 V DC
Input AC voltage	Rated input voltage range	100 V AC to 240 V AC; 50/60 Hz

Item		Description
	Maximum voltage range	90 V AC to 264 V AC; 47 Hz to 63 Hz
Maximum power consumption (100% throughput, 100% PoE loads, full speed of fans)		● S5700-28P-LI-AC: 24 W ● S5700-28P-LI-DC: 24 W ● S5700-52P-LI-AC: 48.4 W ● S5700-52P-LI-DC: 48.3 W ● S5700-28P-PWR-LI-AC: 436.5 W (power consumption: 66.5 W, PoE: 370 W) ● S5700-52P-PWR-LI-AC: 464.5 W (power consumption: 94.5 W, PoE: 370 W) ● S5700-28TP-LI-AC: 24 W ● S5700-28TP-PWR-LI-AC: 436.5 W (power consumption: 66.5 W, PoE: 370 W) ● S5701-28TP-PWR-LI-AC: 250 W (power consumption: 65 W, PoE: 185 W) ● S5700-28X-LI-AC: 41 W ● S5700-28X-LI-DC: 42 W ● S5700-52X-LI-AC: 61 W ● S5700-52X-LI-DC: 60 W ● S5700-28X-PWR-LI-AC: 448.8 W (power consumption: 78.8 W, PoE: 370 W) ● S5700-52X-PWR-LI-AC: 479.3 W (power consumption: 109.3 W, PoE: 370 W) ● S5700-10P-PWR-LI-AC: 142.4 W (power consumption: 18.4 W, PoE: 124 W) ● S5700-10P-LI-AC: 11.5 W
Temperature	Operating temperature	The operating temperature of the S5700-10P-PWR-LI-AC and S5700-10P-LI-AC is 0°C to +45°C at an altitude between 0 m and 1800 m. The operating temperature of the other S5700-LI series is 0°C to +50°C at an altitude between 0 m and 1800 m. **NOTE** When the altitude is between 1800 m and 5000 m, the operating temperature reduces 1°C every time the altitude increases 220 m.
	Storage temperature	-40°C to +70°C

Item	Description
Noise under normal temperature (23°C, Sound Power)	● S5700-28P-LI-AC: 0 (The device has no fans.) ● S5700-28P-LI-DC: 0 (The device has no fans.) ● S5700-52P-LI-AC: less than 43.8 dBA ● S5700-52P-LI-DC: less than 43.8 dBA ● S5700-28P-PWR-LI-AC: less than 49.2 dBA ● S5700-52P-PWR-LI-AC: less than 49.2 dBA ● S5700-28TP-LI-AC: 0 (The device has no fans.) ● S5700-28TP-PWR-LI-AC: less than 49.2 dBA ● S5701-28TP-PWR-LI-AC: less than 49.2 dBA ● S5700-28X-LI-AC: less than 44.9 dBA ● S5700-28X-LI-DC: less than 44.9 dBA ● S5700-52X-LI-AC: less than 47.9 dBA ● S5700-52X-LI-DC: less than 47.9 dBA ● S5700-28X-PWR-LI-AC: less than 49.5 dBA ● S5700-52X-PWR-LI-AC: less than 50.2 dBA ● S5700-10P-PWR-LI-AC: 0 (The device has no fans.) ● S5700-10P-LI-AC: 0 (The device has no fans.)
Relative humidity	5% RH to 95% RH, non-condensing
Operating altitude	● S5700-28P-LI-AC, S5700-28P-LI-DC, S5700-28TP-LI-AC: 0 m to 3000 m ● S5700-52P-LI-DC, S5700-28X-LI-DC, S5700-52X-LI-DC: 0 m to 2000 m ● S5700-52P-LI-AC, S5700-28P-PWR-LI-AC, S5700-28TP-PWR-LI-AC, S5701-28TP-PWR-LI-AC, S5700-52P-PWR-LI-AC, S5700-28X-PWR-LI-AC, S5700-52X-PWR-LI-AC, S5700-28X-LI-AC: 0 m to 4000 m ● S5700-52X-LI-AC, S5700-10P-PWR-LI-AC, S5700-10P-LI-AC: 0 m to 5000 m
EMC	● CISPR22 Class A ● CISPR24 ● EN55022 Class A ● EN50024 ● ETSI EN 300 386 Class A ● CFR 47 FCC Part 15 Class A ● ICES 003 Class A ● AS/NZS CISPR22 Class A ● IEC61000-4-2 ● ITU-T K 20 ● ITU-T K 44

Item	Description
Environmental standard	● RoHS ● REACH
Security	● IEC 60950-1 ● EN 60950-1/A11/A12 ● UL 60950-1 ● CSA C22.2 No 60950-1 ● AS/NZS 60950.1
Laser safety	● IEC60825-1 ● IEC60825-2 ● EN60825-1 ● EN60825-2

7.1.2 S5700S-LI

Table 7-2 lists specifications of the S5700S-LI.

Table 7-2 Specifications of the S5700S-LI

Item		Description
CPU		1 GHz dominant frequency
Packet forwarding capacity Switching capacity		● S5700S-28P-LI-AC: 42 Mpps, 128 Gbit/s ● S5700S-52P-LI-AC: 78 Mpps, 256 Gbit/s
DDR memory		256 MB
Flash memory		200 MB
Mean time between failures (MTBF)		● S5700S-28P-LI-AC: 49.69 years ● S5700S-52P-LI-AC: 39.26 years
Mean time to repair (MTTR)		2 hours
Availability		> 0.99999
Surge protection	Service port protection	Common mode: ±6 kV

Item		Description
	Power supply protection	● S5700S-28P-LI-AC: ±2 kV in differential mode; ±4 kV in common mode ● S5700S-52P-LI-AC: ±6 kV in differential mode; ±6 kV in common mode
Dimensions (W x D x H)		● S5700S-28P-LI-AC: 442.0 mm x 220.0 mm x 43.6 mm ● S5700S-52P-LI-AC: 442.0 mm x 310.0 mm x 43.6 mm
Weight		≤ 5 kg
Stack port		Not supported
RPS		Supported
PoE		Not supported
Input AC voltage	Rated input voltage range	100 V AC to 240 V AC; 50/60 Hz
	Maximum input voltage range	90 V AC to 264 V AC; 47 Hz to 63 Hz
Maximum power consumption (100% throughput, full speed of fans)		● S5700S-28P-LI-AC: 24 W ● S5700S-52P-LI-AC: 48.4 W
Temperature	Operating temperature	0°C to +50°C (at 0 m to 1800 m altitude) **NOTE** When the altitude is between 1800 m and 4000 m, the operating temperature reduces 1°C every time the altitude increases 220 m.
	Storage temperature	-40°C to +70°C
Noise under normal temperature (23°C, Sound Power)		● S5700S-28P-LI-AC: 0 (The device has no fans.) ● S5700S-52P-LI-AC: less than 43.8 dBA
Relative humidity		5% RH to 95% RH, non-condensing
Altitude		● S5700S-28P-LI-AC: 0 m to 3000 m ● S5700S-52P-LI-AC: 0 m to 4000 m

Item	Description
EMC	● CISPR22 Class A ● CISPR24 ● EN55022 Class A ● EN50024 ● ETSI EN 300 386 Class A ● CFR 47 FCC Part 15 Class A ● ICES 003 Class A ● AS/NZS CISPR22 Class A ● IEC61000-4-2 ● ITU-T K 20 ● ITU-T K 44
Environmental standard	● RoHS ● REACH
Security	● IEC 60950-1 ● EN 60950-1/A11/A12 ● UL 60950-1 ● CSA C22.2 No 60950-1 ● AS/NZS 60950.1
Laser safety	● IEC60825-1 ● IEC60825-2 ● EN60825-1 ● EN60825-2

7.1.3 S5700-SI

Table 7-3 lists specifications of the S5700-SI.

Table 7-3 Specifications of the S5700-SI

Item	Description
CPU	800 MHz dominant frequency

Item		Description
Packet forwarding capacity Switching capacity		● S5700-48TP-SI-AC: 72 Mpps, 288 Gbit/s ● S5700-48TP-SI-DC: 72 Mpps, 288 Gbit/s ● S5700-24TP-SI-AC: 36 Mpps, 144 Gbit/s ● S5700-24TP-SI-DC: 36 Mpps, 144 Gbit/s ● S5700-48TP-PWR-SI: 72 Mpps, 288 Gbit/s ● S5700-52C-PWR-SI: 132 Mpps, 288 Gbit/s ● S5700-24TP-PWR-SI: 36 Mpps, 144 Gbit/s ● S5700-28C-PWR-SI: 96 Mpps, 144 Gbit/s ● S5700-28C-SI: 96 Mpps, 144 Gbit/s ● S5700-52C-SI: 132 Mpps, 288 Gbit/s ● S5700-26X-SI-12S-AC: 66 Mpps, 144 Gbit/s
DDR memory		256 MB
Flash memory		S5700-26X-SI-12S-AC: 200 MB, others: 32 MB
Mean time between failures (MTBF)		● S5700-48TP-SI-AC: 34 years ● S5700-48TP-SI-DC: 34 years ● S5700-24TP-SI-AC: 37 years ● S5700-24TP-SI-DC: 37 years ● S5700-48TP-PWR-SI: 71.7 years ● S5700-24TP-PWR-SI: 84.3 years ● S5700-28C-PWR-SI: 53.6 years when a 2x10GE card is configured; 74.6 years when a 4xGE front card is configured; 25.68 years when a 4x10GE front subcard is configured ● S5700-52C-PWR-SI: 50.4 years when a 2x10GE card is configured; 68.6 years when a 4xGE front card is configured; 35.58 years when a 4x10GE front subcard is configured ● S5700-28C-SI: 53.7 years when a 2x10GE card is configured; 74.9 years when a 4xGE front card is configured; 29.58 years when a 4x10GE front subcard is configured ● S5700-52C-SI: 51.3 years when a 2x10GE card is configured; 70.3 years when a 4xGE front card is configured; 28.58 years when a 4x10GE front subcard is configured ● S5700-26X-SI-12S-AC: 91.74 years
Mean time to repair (MTTR)		2 hours
Availability		> 0.99999
Surge protection	Service port protection	● Non-PoE switch: S5700-26X-SI-12S-AC: ±6 kV in common mode; others: ±2 kV in common mode ● PoE switch: ±1 kV in common mode

Item		Description
	Power supply protection	● AC: S5700-26X-SI-12S-AC: ±6 kV in differential mode; ±6 kV in common mode; others: ±2 kV in differential mode; ±4 kV in common mode ● DC: ±1 kV in differential mode; ±2 kV in common mode
Dimensions (W x D x H)		● S5700-48TP-SI-AC: 442.0 mm x 420.0 mm x 43.6 mm ● S5700-48TP-SI-DC: 442.0 mm x 420.0 mm x 43.6 mm ● S5700-24TP-SI-AC: 442.0 mm x 220.0 mm x 43.6 mm ● S5700-24TP-SI-DC: 442.0 mm x 220.0 mm x 43.6 mm ● S5700-48TP-PWR-SI: 442.0 mm x 420.0 mm x 43.6 mm ● S5700-52C-PWR-SI: 442.0 mm x 420.0 mm x 43.6 mm ● S5700-24TP-PWR-SI: 442.0 mm x 420.0 mm x 43.6 mm ● S5700-28C-PWR-SI: 442.0 mm x 420.0 mm x 43.6 mm ● S5700-28C-SI: 442.0 mm x 420.0 mm x 43.6 mm ● S5700-52C-SI: 442.0 mm x 420.0 mm x 43.6 mm ● S5700-26X-SI-12S-AC: 442.0 mm x 310.0 mm x 43.6 mm
Weight	Fully loaded	≤ 8.5 kg
	Empty loaded	≤ 5 kg
Stack port		Two stack ports of the stack card **NOTE** The S5700-26X-SI-12S-AC does not support stacking.
RPS		Only the S5700-26X-SI-12S-AC supports the RPS.
PoE		The PWR series support PoE.
Input DC voltage	Rated input voltage range	-48 V DC to -60 V DC
	Maximum voltage range	-36 V DC to -72 V DC
Input AC voltage	Rated input voltage range	100 V AC to 240 V AC; 50/60 Hz
	Maximum voltage range	90 V AC to 264 V AC; 47 Hz to 63 Hz

Item		Description
Maximum power consumption (100% throughput, 100% PoE loads, full speed of fans)		● S5700-48TP-SI-AC: 64 W ● S5700-48TP-SI-DC: 64 W ● S5700-24TP-SI-AC: 40 W ● S5700-24TP-SI-DC: 40 W ● S5700-48TP-PWR-SI: 907 W (power consumption: 167 W; PoE: 740 W) ● S5700-52C-PWR-SI: 917 W (power consumption: 177 W; PoE: 740 W) ● S5700-24TP-PWR-SI: 455 W (power consumption: 85 W; PoE: 370 W) ● S5700-28C-PWR-SI: 836 W (power consumption: 96 W; PoE: 740 W) ● S5700-28C-SI: 56 W ● S5700-52C-SI: 78 W ● S5700-26X-SI-12S-AC: 42.3 W
Temperature	Operating temperature	S5700-26X-SI-12S-AC: 0°C to +50°C (at 0 m to 1800 m altitude); others: 0°C to +50°C **NOTE** When the altitude is between 1800 m and 4000 m, the operating temperature reduces 1°C every time the altitude increases 220 m.
	Storage temperature	-40°C to +70°C
Noise under normal temperature (23°C, Sound Power)		● S5700-48TP-SI-AC: 0 ● S5700-48TP-SI-DC: 0 ● S5700-24TP-SI-AC: 0 ● S5700-24TP-SI-DC: 0 ● S5700-48TP-PWR-SI: less than 51 dBA ● S5700-52C-PWR-SI: less than 45 dBA ● S5700-24TP-PWR-SI: less than 51 dBA ● S5700-28C-PWR-SI: less than 45 dBA ● S5700-28C-SI: less than 41 dBA ● S5700-52C-SI: less than 41 dBA ● S5700-26X-SI-12S-AC: less than 56.3 dBA
Relative humidity		S5700-26X-SI-12S-AC: 5% RH to 95% RH; others: 10% RH to 90% RH, non-condensing
Operating altitude		S5700-26X-SI-12S-AC: 0 m to 4000 m; others: 0 m to 2000 m

Item	Description
EMC	● CISPR22 Class A ● CISPR24 ● EN55022 Class A ● EN50024 ● ETSI EN 300 386 Class A ● CFR 47 FCC Part 15 Class A ● ICES 003 Class A ● AS/NZS CISPR22 Class A ● IEC61000-4-2 ● ITU-T K 20 ● ITU-T K 44
Environmental standard	● RoHS ● REACH
Security	● IEC 60950-1 ● EN 60950-1/A11/A12 ● UL 60950-1 ● CSA C22.2 No 60950-1 ● AS/NZS 60950.1
Laser safety	● IEC60825-1 ● IEC60825-2 ● EN60825-1 ● EN60825-2

7.1.4 S5700-EI

Table 7-4 lists specifications of the S5700-EI.

Table 7-4 Specifications of the S5700-EI

Item	Description
CPU	533 MHz dominant frequency
Packet forwarding capacity Switching capacity	● S5700-28C-EI: 96 Mpps, 144 Gbit/s ● S5700-52C-EI: 132 Mpps, 288 Gbit/s ● S5700-28C-EI-24S: 96 Mpps, 144 Gbit/s ● S5700-28C-PWR-EI: 96 Mpps, 144 Gbit/s ● S5700-52C-PWR-EI: 132 Mpps, 288 Gbit/s

Item		Description
DDR memory		256 MB
Flash memory		32 MB
Mean time between failures (MTBF)		● S5700-28C-EI: 53.11 years when a 2x10GE card is configured; 68.33 years when a 4xGE front card is configured; 25.52 years when a 4x10GE front card is configured ● S5700-52C-EI: 46.05 years when a 2x10GE card is configured; 57.08 years when a 4xGE front card is configured; 25.58 years when a 4x10GE front card is configured ● S5700-28C-EI-24S: 52.80 years when no card is configured; 41.33 years when a 2x10GE card is configured; 50.00 years when a 4xGE front card is configured; 26.52 years when a 4x10GE front card is configured ● S5700-28C-PWR-EI: 52 years when a 2x10GE card is configured; 55.4 years when a 4xGE front card is configured; 32.92 years when a 4x10GE front card is configured ● S5700-52C-PWR-EI: 44.8 years when a 2x10GE card is configured; 66.8 years when a 4xGE front card is configured; 29.89 years when a 4x10GE front card is configured
Mean time to repair (MTTR)		2 hours
Availability		> 0.99999
Surge protection	Service port protection	● Non-PoE switch: ±2 kV in common mode ● PoE switch: ±1 kV in common mode
	Power supply protection	● AC: ±2 kV in differential mode; ±4 kV in common mode ● DC: ±1 kV in differential mode; ±2 kV in common mode
Dimensions (W x D x H)		442.0 mm x 420.0 mm x 43.6 mm
Weight	Fully loaded	≤ 8.5 kg
	Empty loaded	≤ 5 kg
Stack port		Two stack ports of the stack card
RPS		Not supported
PoE		The PWR series support PoE.

Item		Description
Input DC voltage	Rated input voltage range	-48 V DC to -60 V DC
	Maximum voltage range	-36 V DC to -72 V DC
Input AC voltage	Rated input voltage range	100 V AC to 240 V AC; 50/60 Hz
	Maximum voltage range	90 V AC to 264 V AC; 47 Hz to 63 Hz
Maximum power consumption (100% throughput, 100% PoE loads, full speed of fans)		● S5700-28C-EI: 60 W ● S5700-52C-EI: 88 W ● S5700-28C-EI-24S: 63 W ● S5700-28C-PWR-EI: 842 W (power consumption: 102 W; PoE: 740 W) ● S5700-52C-PWR-EI: 930 W (power consumption: 190 W; PoE: 740 W)
Temperature	Operating temperature	0°C to +50°C
	Storage temperature	-40°C to +70°C
Noise under normal temperature (23°C, Sound Power)		● S5700-28C-EI: less than 41 dBA ● S5700-52C-EI: less than 41 dBA ● S5700-28C-EI-24S: less than 41 dBA ● S5700-28C-PWR-EI: less than 45 dBA ● S5700-52C-PWR-EI: less than 45 dBA
Relative humidity		10% RH to 90% RH, non-condensing
Operating altitude		0 m to 2000 m

Item	Description
EMC	● CISPR22 Class A ● CISPR24 ● EN55022 Class A ● EN50024 ● ETSI EN 300 386 Class A ● CFR 47 FCC Part 15 Class A ● ICES 003 Class A ● AS/NZS CISPR22 Class A ● IEC61000-4-2 ● ITU-T K 20 ● ITU-T K 44
Environmental standard	● RoHS ● REACH
Security	● IEC 60950-1 ● EN 60950-1/A11/A12 ● UL 60950-1 ● CSA C22.2 No 60950-1 ● AS/NZS 60950.1
Laser safety	● IEC60825-1 ● IEC60825-2 ● EN60825-1 ● EN60825-2

7.1.5 S5710-EI

Table 7-5 lists specifications of the S5710-EI.

Table 7-5 Specifications of the S5710-EI

Item	Description
CPU	1 GHz dominant frequency
Packet forwarding capacity Switching capacity	● S5710-28C-EI: 156 Mpps, 208 Gbit/s ● S5710-52C-EI: 192 Mpps, 416 Gbit/s ● S5710-28C-PWR-EI-AC: 156 Mpps, 208 Gbit/s ● S5710-52C-PWR-EI-AC: 192 Mpps, 416 Gbit/s ● S5710-52C-PWR-EI: 192 Mpps, 416 Gbit/s

Item		Description
DDR memory		512 MB
Flash memory		200 MB
Mean time between failures (MTBF)		● S5710-28C-EI: 55.98 years when a 8xGE optical interface subcard is configured; 54.93 years when a 8xGE electrical interface subcard is configured; 52.69 years when a 2x10GE interface subcard is configured ● S5710-52C-EI: 45.57 years when a 8xGE optical interface subcard is configured; 44.85 years when a 8xGE electrical interface subcard is configured; 43.33 years when a 2x10GE interface subcard is configured ● S5710-28C-PWR-EI-AC: 51.28 years when a 8xGE optical interface subcard is configured; 50.31 years when a 8xGE electrical interface subcard is configured; 48.25 years when a 2x10GE interface subcard is configured ● S5710-52C-PWR-EI-AC: 36.86 years when a 8xGE optical interface subcard is configured; 36.35 years when a 8xGE electrical interface subcard is configured; 35.27 years when a 2x10GE interface subcard is configured ● S5710-52C-PWR-EI: 36.86 years when a 8xGE optical interface subcard is configured; 36.35 years when a 8xGE electrical interface subcard is configured; 35.27 years when a 2x10GE interface subcard is configured
Mean time to repair (MTTR)		2 hours
Availability		> 0.99999
Surge protection	Service port protection	● Non-PoE switch: ±2 kV in common mode ● PoE switch: ±1 kV in common mode
	Power supply protection	● DC: ±1 kV in differential mode; ±2 kV in common mode ● AC: – S5710-28C-EI: ±2 kV in differential mode; ±4 kV in common mode – S5710-52C-EI: ±2 kV in differential mode; ±4 kV in common mode – S5710-28C-PWR-EI-AC: ±6 kV in differential mode; ±6 kV in common mode – S5710-52C-PWR-EI-AC: ±6 kV in differential mode; ±6 kV in common mode – S5710-52C-PWR-EI (using 580 W power modules): ±6 kV in differential mode; ±6 kV in common mode – S5710-52C-PWR-EI (using 1150 W power modules): ±2 kV in differential mode; ±4 kV in common mode

Item		Description
Dimensions (W x D x H)		442.0 mm x 420.0 mm x 43.6 mm
Weight	Fully loaded	≤ 10 kg
	Empty	≤ 6 kg
Stack port		Four 10GE SFP+ ports or two 10GE SFP+ rear card ports
RPS		Not supported
PoE		The PWR series support PoE.
Input DC voltage	Rated input voltage range	-48 V DC to -60 V DC
	Maximum voltage range	-36 V DC to -72 V DC
Input AC voltage	Rated input voltage range	100 V AC to 240 V AC; 50/60 Hz
	Maximum voltage range	90 V AC to 264 V AC; 47 Hz to 63 Hz

Item		Description
Maximum power consumption (100% throughput, 100% PoE loads, full speed of fans)		● S5710-28C-EI: 98 W ● S5710-52C-EI: 146.9 W ● S5710-28C-PWR-EI-AC: – Without subcard: 920 W (power consumption: 180 W, PoE: 740 W) – With two 8xGE electrical interface subcards: 934 W (power consumption: 194 W, PoE: 740 W) – With two 8xGE optical interface subcards: 942 W (power consumption: 202 W, PoE: 740 W) – With two 2x10GE optical interface subcards: 941 W (power consumption: 201 W, PoE: 740 W) ● S5710-52C-PWR-EI, S5710-52C-PWR-EI-AC (with two 580 W power modules configured): – Without subcard: 1023 W (power consumption: 283 W, PoE: 740 W) – With two 8xGE electrical interface subcards: 1035 W (power consumption: 295 W, PoE: 740 W) – With two 8xGE optical interface subcards: 1043 W (power consumption: 303 W, PoE: 740 W) – With two 2x10GE optical interface subcards: 1040 W (power consumption: 300 W, PoE: 740 W) ● S5710-52C-PWR-EI (with two 1150 W power modules configured): – Without subcard: 1605 W (power consumption: 165 W, PoE: 1440 W) – With two 8xGE electrical interface subcard: 1625 W (power consumption: 185 W, PoE: 1440 W) – With two 8xGE optical interface subcard: 1635 W (power consumption: 195 W, PoE: 1440 W) – With two 2x10GE optical interface subcard: 1633 W (power consumption: 193 W, PoE: 1440 W)
Temperature	Operating temperature	0°C to +50°C (at 0 m to 1800 m altitude) **NOTE** When the altitude is between 1800 m and 5000 m, the operating temperature reduces 1°C every time the altitude increases 220 m.
	Storage temperature	-40°C to +70°C

Item	Description
Noise under normal temperature (23°C, Sound Power)	● S5710-28C-EI: less than 53.9 dBA ● S5710-52C-EI: less than 53.9 dBA ● S5710-28C-PWR-EI-AC: less than 59.7 dBA ● S5710-52C-PWR-EI-AC: less than 60 dBA ● S5710-52C-PWR-EI: less than 60 dBA
Relative humidity	5% RH to 95% RH, non-condensing
Operating altitude	● S5710-28C-EI: 0 m to 3000 m when AC power module is configured; 0 m to 2000 m when DC power module is configured ● S5710-52C-EI: 0 m to 3000 m when AC power module is configured; 0 m to 2000 m when DC power module is configured ● S5710-28C-PWR-EI-AC: 0 m to 5000 m ● S5710-52C-PWR-EI-AC: 0 m to 5000 m ● S5710-52C-PWR-EI: 0 m to 5000 m
EMC	● CISPR22 Class A ● CISPR24 ● EN55022 Class A ● EN50024 ● ETSI EN 300 386 Class A ● CFR 47 FCC Part 15 Class A ● ICES 003 Class A ● AS/NZS CISPR22 Class A ● IEC61000-4-2 ● ITU-T K 20 ● ITU-T K 44
Environmental standard	● RoHS ● REACH
Safety	● IEC 60950-1 ● EN 60950-1/A11/A12 ● UL 60950-1 ● CSA C22.2 No 60950-1 ● AS/NZS 60950.1
Laser safety	● IEC60825-1 ● IEC60825-2 ● EN60825-1 ● EN60825-2

7.1.6 S5700-HI

Table 7-6 lists specifications of the S5700-HI.

Table 7-6 Specifications of the S5700-HI

Item		Description
CPU		1 GHz dominant frequency
Packet forwarding capacity Switching capacity		● S5700-28C-HI: 96 Mpps, 212 Gbit/s ● S5700-28C-HI-24S: 96 Mpps, 212 Gbit/s
DDR memory		512 MB
Flash memory		64 MB
Mean time between failures (MTBF)		● S5700-28C-HI: 28.7 years when a 4x10GE card is configured; 41.1 years when a 2x10GE card is configured; 42.9 years when a 4xGE card is configured ● S5700-28C-HI-24S: 25.5 years when a 4x10GE card is configured; 34.8 years when a 2x10GE card is configured; 36.1 years when a 4xGE card is configured
Mean time to repair (MTTR)		2 hours
Availability		> 0.99999
Surge protection	Service port protection	Common mode: ±2 kV
	Power supply protection	● AC: ±6 kV in differential mode; ±6 kV in common mode ● DC: ±1 kV in differential mode; ±2 kV in common mode
Dimensions (W x D x H)		442.0 mm x 220.0 mm x 43.6 mm
Weight	Fully loaded	≤ 6.5 kg
	Empty loaded	≤ 5 kg
Stack port		Not supported
RPS		Not supported
PoE		Not supported

Item		Description
Input DC voltage	Rated input voltage range	-48 V DC to -60 V DC
	Maximum voltage range	-36 V DC to -72 V DC
Input AC voltage	Rated input voltage range	100 V AC to 240 V AC; 50/60 Hz
	Maximum voltage range	90 V AC to 264 V AC; 47 Hz to 63 Hz
Maximum power consumption (100% throughput, full speed of fans)		● S5700-28C-HI: 76.6 W ● S5700-28C-HI-24S: 80.7 W
Temperature	Operating temperature	-5°C to +55°C (at 0 m to 1800 m altitude) **NOTE** ● When the switch has the 40 km SFP+ optical module installed, the operating temperature range is -5°C to +50°C. ● When the altitude is between 1800 m and 4000 m, the operating temperature reduces 1°C every time the altitude increases 220 m.
	Storage temperature	-40°C to +70°C
Noise under normal temperature (23°C, Sound Power)		Less than 60 dBA
Relative humidity		10% RH to 90% RH, non-condensing
Operating altitude		0 m to 4000 m

Item	Description
EMC	● CISPR22 Class A ● CISPR24 ● EN55022 Class A ● EN50024 ● ETSI EN 300 386 Class A ● CFR 47 FCC Part 15 Class A ● ICES 003 Class A ● AS/NZS CISPR22 Class A ● IEC61000-4-2 ● ITU-T K 20 ● ITU-T K 44
Environmental standard	● RoHS ● REACH
Security	● IEC 60950-1 ● EN 60950-1/A11/A12 ● UL 60950-1 ● CSA C22.2 No 60950-1 ● AS/NZS 60950.1
Laser safety	● IEC60825-1 ● IEC60825-2 ● EN60825-1 ● EN60825-2

7.2 Optical Module Attributes

Table 7-7 Attributes of FE optical modules

Model	Transmission Distance (km)	Standard	Fiber Type
SFP-FE-SX-MM1310 (SFP optical module)	≤ 2	100base-FX	● Fiber mode: multimode ● Core diameter: 50/125 μm or 62.5/125 μm ● Connector type: LC
eSFP-FE-LX-SM1310	≤ 15	100base-LX	● Fiber mode: single-mode ● Connector type: LC
S-SFP-FE-LH40-SM1310	≤ 40		
S-SFP-FE-LH80-SM1550	≤ 80		
SFP-FE-LX-SM1310-BIDI (Bidirectional optical module)	≤ 15	100base-BX	
SFP-FE-LX-SM1550-BIDI (Bidirectional optical module)			

Table 7-8 Attributes of GE optical modules

Model	Transmission Distance (km)	Standard	Fiber Type
eSFP-GE-SX-MM850	≤ 0.22	1000base-SX	● Fiber mode: multimode ● Pattern bandwidth: 160 MHz*km ● Core diameter: 62.5 μm ● Connector type: LC
	≤ 0.275		● Fiber mode: multimode (OM1) ● Connector type: LC
	≤ 0.5		● Fiber mode: multimode ● Pattern bandwidth: 400 MHz*km ● Core diameter: 50 μm ● Connector type: LC
	≤ 0.55		● Fiber mode: multimode (OM2) ● Connector type: LC

Model	Transmission Distance (km)	Standard	Fiber Type
	≤ 1		● Fiber mode: multimode (OM3) ● Connector type: LC
SFP-GE-LX-SM1310	≤ 10	1000base-LX/LH	● Fiber mode: single-mode ● Connector type: LC
S-SFP-GE-LH40-SM1310	≤ 40	1000base-LX/LH	
S-SFP-GE-LH40-SM1550		1000base-LX/LH	
S-SFP-GE-LH80-SM1550	≤ 80	1000base-ZX	
eSFP-GE-ZX100-SM1550	≤ 100	1000base-ZX	
SFP-GE-LX-SM1310-BIDI (Bidirectional optical module)	≤ 10	1000base-BX	
SFP-GE-LX-SM1490-BIDI (Bidirectional optical module)		1000base-BX	
LE2MGSC40DE0 (Bidirectional optical module)	≤ 40	1000base-BX	
LE2MGSC40ED0 (Bidirectional optical module)		1000base-BX	

Table 7-9 Attributes of CWDM optical modules

Center Wavelength (nm), Model	1471, CWDM-SFPGE-1471	1491, CWDM-SFPGE-1491	1511, CWDM-SFPGE-1511	1531, CWDM-SFPGE-1531
	1551, CWDM-SFPGE-1551	1571, CWDM-SFPGE-1571	1591, CWDM-SFPGE-1591	1611, CWDM-SFPGE-1611
Specifications	Encapsulation type: eSFP			
	Transmission distance: ⩽ 80 km			
	Fiber type: single-mode, LC			
	Standard: CWDM			
	Operating temperature: 0°C to 70°C			
	● Transmit power: 0 dBm to 5.0 dBm ● Receiver sensitivity: ⩽ -28.0 dBm ● Overload optical power: -9.0 dBm ● Extinction ratio: 8.5 dB			
Supported Switch	● S5700-LI (all optical ports) ● S5700S-LI (all optical ports) ● S5700-SI (all optical ports) ● S5700-EI (all optical ports except those on 10GE cards) ● S5700-HI (all optical ports) ● S5710-EI (all optical ports) **NOTE** The S5700-10P-PWR-LI-AC does not support CWDM optical modules.			

Table 7-10 Attributes of DWDM optical modules

Center Wavelength (nm), Model	1529.55, DWDM-SFPGE-1529-55	1530.33, DWDM-SFPGE-1530-33	1531.12, DWDM-SFPGE-1531-12	1531.90, DWDM-SFPGE-1531-90	1532.68, DWDM-SFPGE-1532-68
	1533.47, DWDM-SFPGE-1533-47	1534.25, DWDM-SFPGE-1534-25	1535.04, DWDM-SFPGE-1535-04	1535.82, DWDM-SFPGE-1535-82	1536.61, DWDM-SFPGE-1536-61
	1537.40, DWDM-SFPGE-1537-40	1538.19, DWDM-SFPGE-1538-19	1538.98, DWDM-SFPGE-1538-98	1539.77, DWDM-SFPGE-1539-77	1540.56, DWDM-SFPGE-1540-56

	1541.35, DWDM-SFPGE-1541-35	1542.14, DWDM-SFPGE-1542-14	1542.94, DWDM-SFPGE-1542-94	1543.73, DWDM-SFPGE-1543-73	1544.53, DWDM-SFPGE-1544-53
	1545.32, DWDM-SFPGE-1545-32	1546.12, DWDM-SFPGE-1546-12	1546.92, DWDM-SFPGE-1546-92	1547.72, DWDM-SFPGE-1547-72	1548.51, DWDM-SFPGE-1548-51
	1549.32, DWDM-SFPGE-1549-32	1550.12, DWDM-SFPGE-1550-12	1550.92, DWDM-SFPGE-1550-92	1551.72, DWDM-SFPGE-1551-72	1552.52, DWDM-SFPGE-1552-52
	1553.33, DWDM-SFPGE-1553-33	1554.13, DWDM-SFPGE-1554-13	1554.94, DWDM-SFPGE-1554-94	1555.75, DWDM-SFPGE-1555-75	1556.55, DWDM-SFPGE-1556-55
	1557.36, DWDM-SFPGE-1557-36	1558.17, DWDM-SFPGE-1558-17	1558.98, DWDM-SFPGE-1558-98	1559.79, DWDM-SFPGE-1559-79	1560.61, DWDM-SFPGE-1560-61
Specifications	Encapsulation type: eSFP				
	Transmission distance: ⩽ 120 km				
	Fiber type: single-mode, LC				
	Standard: DWDM				
	Operating temperature: 0°C to 70°C				
	● Transmit power: 0 dBm to 4.0 dBm ● Receiver sensitivity: ⩽ -28.0 dBm ● Overload optical power: -8.0 dBm ● Extinction ratio: 8.2 dB				
Supported Switch	● S5700-LI (all optical ports) ● S5700S-LI (all optical ports) ● S5700-SI (GE cards and 10GE SFP+ cards of the S5700-SI, and optical ports on the S5700-26X-SI-12S-AC) ● S5700-EI (only GE cards) ● S5700-HI (only GE and 10GE SFP+ cards) ● S5710-EI (all optical ports) **NOTE** The S5700-10P-PWR-LI-AC does not support DWDM optical modules.				

Table 7-11 Attributes of a GE SFP copper module

Model	Transmission Distance (km)	Connector Type	Standard	Supported Switch
SFP-1000 BaseT	0.1	RJ45	1000Base-T	● S5700-LI (all optical ports except combo ports) ● S5700S-LI (all optical ports) ● S5700-SI (all optical ports except combo ports) ● S5700-EI (all optical ports except those on 10GE cards and combo ports) ● S5700-HI (all optical ports) ● S5710-EI (all optical ports except those on GE cards and combo ports)

Table 7-12 Attributes of 10GE SFP+ optical modules

Model	Transmission Distance (km)	Standard	Fiber Type
OSXD22N00	⩽ 0.1	10Gbase-LRM	● Fiber mode: multimode ● Pattern bandwidth: 400 MHz*km ● Core diameter: 50 μm ● Connector type: LC
	⩽ 0.22		● Fiber mode: multimode ● Pattern bandwidth: 500 MHz*km ● Core diameter: 62.5 μm ● Connector type: LC
			● Fiber mode: multimode (OM1, OM2, OM3) ● Connector type: LC
OMXD30000	⩽ 0.026	10Gbase-SR	● Fiber mode: multimode ● Pattern bandwidth: 160 MHz*km ● Core diameter: 62.5 μm ● Connector type: LC
	⩽ 0.033		● Fiber mode: multimode (OM1) ● Connector type: LC

Model	Transmission Distance (km)	Standard	Fiber Type
	≤ 0.066		● Fiber mode: multimode ● Pattern bandwidth: 400 MHz*km ● Core diameter: 50 μm ● Connector type: LC
	≤ 0.082		● Fiber mode: multimode (OM2) ● Connector type: LC
	≤ 0.3		● Fiber mode: multimode (OM3) ● Connector type: LC
	≤ 0.4		● Fiber mode: multimode (OM4) ● Connector type: LC
OSX010000	≤ 10	10Gbase-LR	● Fiber mode: single-mode ● Connector type: LC
OSX040N01	≤ 40	10Gbase-ER	
LE2MXSC80FF0 linear	≤ 80	10Gbase-ZR	● Fiber mode: single-mode ● Connector type: LC

NOTE

For specifications of various optical modules, see "Optical Module" in the *S5700 Series Ethernet Switches Hardware Description*.

7.3 Performance and Capacity

Table 7-13 Performance specifications of the S5700

Attribute	Service Feature	Specifications
Ethernet	Number of MAC addresses	● S5700-LI: 16K ● S5700S-LI: 8K ● S5700-SI: 16K ● S5700-EI: 32K ● S5710-EI: 32K ● S5700-HI: 32K
	Number of VLANs	4K

Attribute	Service Feature	Specifications
	Number of link aggregation group	● S5700-LI: 64 ● S5700S-LI: 64 ● S5700-SI: 28 ● S5700-EI: 64 ● S5710-EI: 64 ● S5700-HI: 28
	Maximum number of member ports in a link aggregation group	8
	Number of static ARP entries in the system	● S5700-LI: 256 ● S5700S-LI: 256 ● S5700-SI: 2K ● S5700-EI: 8k ● S5710-EI: 8K ● S5700-HI: 8K
	Number of dynamical ARP entries in the system	● S5700-LI: 256 ● S5700S-LI: 256 ● S5700-SI: 2K ● S5700-EI: 8K ● S5710-EI: 16K ● S5700-HI: 16K
QoS	Number of QoS queues on a port	8
	CAR	● S5700-LI: 8 kbit/s ● S5700S-LI: 8 kbit/s ● S5700-SI: 64 kbit/s ● S5700-EI: 64 kbit/s ● S5710-EI: 8 kbit/s ● S5700-HI: 8 kbit/s

Attribute	Service Feature	Specifications
ACL	ACLv4	Number of IPv4 ACLs supported: ● S5700-LI: 900 (400 on the S5700-10P-LI-AC and S5700-10P-PWR-LI-AC ● S5700S-LI: 400 ● S5700-SI: 1024/256 ● S5700-EI: 2816/256 ● S5710-EI: 7168/512 ● S5700-HI: 3072/256 **NOTE** 1024/256 indicates that the 1024 ACLs are used for inbound traffic and 256 ACLs for outbound traffic. 400 indicates that the inbound and outbound traffic share 400 ACLs.
	ACLv6	Number of IPv6 ACLs supported: ● S5700-LI: 900 (400 on the S5700-10P-LI-AC and S5700-10P-PWR-LI-AC) ● S5700S-LI: 400 ● S5700-SI: 1024/256 ● S5700-EI: 512/128 ● S5710-EI: 3584/256 ● S5700-HI: 1536/128
MPLS	Number of LSPs	4K
	Number of LDP neighbors	> 64
L2VPN	Number of VLL entries	1K
	Number of VSI entries	256
L3VPN	Number of VRFs	● S5700-EI: 63 ● S5710-EI: 127 ● S5700-HI: 127 ● S5700-LI, S5700S-LI, S5700-SI: do not support L3VPN
IP unicast	Number of IPv4 routing entries and IPv4 FIB entries	● S5700-LI: 16 ● S5700S-LI: 16 ● S5700-SI: 4K ● S5700-EI: 12K ● S5710-EI: 16K ● S5700-HI: 12K

Attribute	Service Feature	Specifications
	Number of IPv6 routing entries and IPv6 FIB entries	● S5700-LI: 16 ● S5700S-LI: 16 ● S5700-SI: 1K ● S5700-EI: 6K ● S5710-EI: 8K ● S5700-HI: 6K
Multicast	Number of static multicast routes	128
	Number of L2 multicast forwarding entries	● S5700-LI: 1K ● S5700S-LI: 1K ● S5700-SI: 1K ● S5700-EI: 2K ● S5710-EI: 2K ● S5700-HI: 2K
	Number of L3 multicast forwarding entries	● S5700-EI: 2K ● S5710-EI: 2K ● S5700-HI: 2K ● S5700-LI, S5700S-LI, S5700-SI: do not support L3 multicast forwarding
Reliability	BFD	Number of BFD sessions: ● S5700-EI: 128 ● S5710-EI: 128 ● S5700-HI: 128 ● S5700-LI, S5700S-LI, S5700-SI: do not support BFD Minimum fault detection time: ● S5700-EI: 300 ms ● S5710-EI: 300 ms ● S5700-HI: 30 ms ● S5700-LI, S5700S-LI, S5700-SI: do not support BFD

Attribute	Service Feature	Specifications
	Ethernet OAM	● 802.1ag A maximum of 16 MDs supported A maximum of 256 MAs supported Fault detection time: – S5700-LI: 1s/10s – S5700S-LI: 1s/10s – S5700-SI: 1s/10s – S5700-EI: 100ms/1s/10s – S5710-EI: 100ms/1s/10s – S5700-HI: 3.3ms/10ms/100ms/1s/10s ● 802.3ah Fault detection time: 1s ● Y.1731: – S5700-EI: Millisecond delay measurement – S5710-EI: Millisecond delay measurement – S5700-HI: 1 microsecond delay measurement – S5700-LI, S5700S-LI, S5700-SI: do not support Y.173
	RRPP	● Maximum number of RRPP instances: 64 ● Maximum number of RRPP rings: 16 ● Maximum number of RRPP domains: 8
	VRRP	● Maximum number of VRRP groups: – S5700-SI, S5700-EI, S5710-EI, S5700-HI: 64 – Other models: do not support VRRP ● Maximum number of virtual IP addresses in each VRRP backup group: – S5700-SI, S5700-EI, S5710-EI, S5700-HI: 16 – Other models: do not support VRRP

Attribute	Service Feature	Specifications
	Smart Link	● Maximum number of instances supported in the system: 64 ● Maximum number of Smart Link groups supported in the system: 16
	MSTP	Maximum number of instances supported in the system: 64
	SEP	Maximum number of segments supported in the system: 16

7.4 List of Software Features

Table 7-14 List of software features supported

Attribute		Description
Ethernet features	Ethernet	● Operating modes, including full duplex, half duplex, and auto-negotiation ● Operating rates of an Ethernet interface, including 10 Mbit/s, 100 Mbit/s, 1000 Mbit/s, 10 Gbit/s, and auto-negotiation ● Flow control on interfaces ● Jumbo frames ● Link aggregation ● Load balancing among the links of a trunk ● Interface isolation and forwarding restriction on interfaces ● Suppression of broadcast storms
	VLAN	● Access modes of access, trunk, hybrid, and QinQ ● Default VLAN ● VLAN mapping. ● Selective QinQ ● Voice VLAN ● DHCP policy VLAN
	MAC	● Automatic learning and aging of MAC addresses ● Static, dynamic, and blackhole MAC address entries ● Packet filtering based on source MAC addresses ● Limitation on MAC address learning on interfaces
	ARP	● Static and dynamic ARP entries ● ARP on a VLAN ● Aging of ARP entries

Attribute		Description
	SmartLink	● SmartLink ● SmartLink multi-instance ● MonitorLink
	LLDP	● LLDP ● LLDP-MED
	NAC	NAC
	VCT	VCT
Ethernet loop protection	MSTP	● STP ● RSTP ● MSTP ● BPDU protection, Root protection, and loop protection ● Partitioned STP and BPDU tunnels
	RRPP	● RRPP protective switchover ● Single RRPP ring, tangent RRPP rings, and intersecting RRPP rings ● Hybrid networking of RRPP rings and other ring networks
IPv4/IPv6 forwarding	IPv4 features	● ARP/RARP ● ARP proxy ● Auto-detection
	Unicast routing	● Static routes ● RIP-1/RIP-2 ● OSPF ● BGP ● IS-IS ● Routing policies and policy-based routes ● uRPF check ● VRF ● DHCP Client/Server/Relay ● DHCP snooping

Attribute		Description
	Multicast routing	● IGMPv1/v2/v3 ● PIM-DM ● PIM-SM ● PIM-SSM ● MBGP ● MSDP ● Multicast routing policy ● RPF
	IPv6 features	● IPv6 protocol stack ● IPv6 unicast routing protocols: RIPng and OSPFv3 ● VRRP6 ● SNMP IPv6 ● IPv4/IPv6 transition technologies
MPLS	Basic MPLS functions	● LDP ● Two-layer MPLS labels ● 802.1p-MPLS EXP mapping
	VLL	SVC/Martini/CCC VLL
Device reliability	BFD	● Basic BFD functions ● BFD for OSPF ● BFD for IS-IS ● BFD for BGP ● BFD for PIM
	Others	VRRP
Layer 2 multicast	Layer 2 multicast	● IGMP snooping ● IGMP proxy ● Prompt leave ● Multicast traffic control ● Inter-VLAN multicast replication ● Controllable multicast
Ethernet OAM	EFM OAM	● Neighbor discovery ● Link monitoring ● Fault notification ● Remote loopback

Attribute		Description
	CFM OAM	● CCM check ● MAC Ping ● MAC Trace ● Hardware-based CCM check (only supported by 5700-28C-HI and 5700-28C-HI-24S)
	Y.1731	● Jitter and latency measurement ● Hardware-based CCM check (only supported by 5700-28C-HI and 5700-28C-HI-24S)
QoS	Traffic classification	● Traffic classification based on the combination of the L2 protocol header, IP quintuple, outgoing interface, and 802.1p field ● Traffic classification based on the C-VID and C-PRI of QinQ packets
	Traffic behaviors	● Access control after traffic classification ● Traffic policing based on traffic classification ● Re-marking based on traffic classification ● Class-based packet queuing ● Combination of traffic classification and traffic behaviors
	Queue scheduling	● PQ ● DRR ● PQ+DRR ● WRR ● PQ+WRR
	Congestion avoidance	● S5700EI: SRED ● S5700HI and S5710EI: WRED
	Rate limit on outbound interfaces	Rate limit on outbound interfaces
Configuration and maintenance	Terminal service	● Configurations through command lines ● Help information in English and Chinese ● Login through console and Telnet terminals ● Information exchange between terminals through the send function
	File system	● File system ● Directory and file management ● File upload and download through FTP, TFTP or SFTP

Attribute		Description
	Debugging and maintenance	● Centralized management of logs, alarms, and debugging information ● Electronic label ● User operation logs ● Detailed debugging information for diagnosing network faults ● Network test tools such as traceroute and ping commands ● Interface mirroring and flow mirroring
	Version upgrade	● Software loading on the entire equipment and online software loading ● Online upgrade of the BootROM ● In-service patching
Security and management	System security	● Hierarchical command line protection to prevent unauthorized users from accessing the S5700 ● SSH v2.0 ● RADIUS authentication and HWTACACS authentication ● ACL filtering ● DHCP packet filtering (with Option 82) ● Defense against control packet attacks ● Defense against attacks of source address spoofing, LAND, SYN flood (TCP SYN), smurf, ping flood (ICMP echo), Teardrop, and Ping of Death
	Network management	● NTP ● Ping and traceroute ● SNMPv1/v2c/v3 ● Standard MIB ● RMON

7.5 Standards Compliance

Table 7-15 IEEE

Standard		Description
802.1	802.1d	Spanning Tree Protocol
	802.1p	IEEE Standards for Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks
	802.1q	Virtual Bridged Local Area Networks

Standard		Description
	802.1s	Multiple Spanning Tree Protocol
	802.1w	Rapid Spanning Tree Protocol
	802.1x	Port based network access control protocol
802.3	802.3	Carrier Sense Multiple Access with Collision Detection (CSMA/CD) access method and physical layer specifications
	802.3ad	Aggregation of Multiple Link Segments
	802.3ab	Physical Layer Parameters and Specifications for 1000 Mb/s Operation Over 4 Pair of Category 5 Balanced Copper Cabling, Type 1000BASE-T
	802.3ae	10GE WAN/LAN
	802.3af	DTE Power via MIDI
	802.3u	100Base-T
	802.3x	Full Duplex and flow control
	802.3z	Gigabit Ethernet Standard, 1000BASE-X

Table 7-16 RFC

Feature	Standard	Description	S5700(S)-LI	S5700-SI	S5700-EI	S5710-EI	S5700-HI
General Routing Protocols	RFC 768	User Datagram Protocol (UDP)	Y	Y	Y	Y	Y
	RFC 791	Internet Protocol (IP)	Y	Y	Y	Y	Y
	RFC 792	Internet Control Message Protocol (ICMP)	Y	Y	Y	Y	Y
	RFC 793	Transmission Control Protocol (TCP)	Y	Y	Y	Y	Y
	RFC 826	Address Resolution Protocol (ARP)	Y	Y	Y	Y	Y
	RFC 854	Telnet Protocol Specification	Y	Y	Y	Y	Y

Feature	Standard	Description	S5700(S)-LI	S5700-SI	S5700-EI	S5710-EI	S5700-HI
	RFC 894	Standard for the transmission of IP datagrams over Ethernet networks. C. Hornig. Apr-01-1984. (Format: TXT=5697 bytes) (Also STD0041) (Status: STANDARD)	Y	Y	Y	Y	Y
	RFC 951	Bootstrap Protocol	Y	Y	Y	Y	Y
	RFC 1542	Clarifications and Extensions for the Bootstrap Protocol	Y	Y	Y	Y	Y
	RFC 1027	Using ARP to Implement Transparent Subnet Gateways	Y	Y	Y	Y	Y
	RFC 1122	Requirements for Internet Hosts - Communication Layers	Y	Y	Y	Y	Y
	RFC 1256	ICMP Router Discovery Messages	Y	Y	Y	Y	Y
	RFC 1519	Classless Inter-Domain Routing (CIDR): an Address Assignment and Aggregation Strategy	N	N	Y	Y	Y
	RFC 1812	Requirements for IP Version 4 Routers	Y	Y	Y	Y	Y
	RFC 2131	Dynamic Host Configuration Protocol	Y	Y	Y	Y	Y
	RFC 2338	Virtual Router Redundancy Protocol (VRRP)	N	N	Y	Y	Y
BGP	RFC 1269	Definitions of Managed Objects for the Border Gateway Protocol: Version 3	N	N	Y	Y	Y
	RFC 1771	A Border Gateway Protocol 4 (BGP-4)	N	N	Y	Y	Y
	RFC 1965	Autonomous System Confederations for BGP	N	N	Y	Y	Y

Feature	Standard	Description	S5700(S)-LI	S5700-SI	S5700-EI	S5710-EI	S5700-HI
	RFC 1966	BGP Route-Reflection	N	N	Y	Y	Y
	RFC 1997	BGP Community Attribute	N	N	Y	Y	Y
	RFC 2385	TCP MD5	N	N	Y	Y	Y
	RFC 2842	Capabilities Advertisement with BGP-4	N	N	Y	Y	Y
IP Multicast	RFC 1112	Host extensions for IP multicasting	Y	Y	Y	Y	Y
	RFC 1122	Requirements for Internet Hosts - Communication Layers	Y	Y	Y	Y	Y
	RFC 2236	Internet Group Management Protocol, Version 2	Y	N	Y	Y	Y
	RFC 2283	Multiprotocol Extensions for BGP-4	N	N	Y	Y	Y
	RFC 2362	Protocol Independent Multicast-Sparse Mode (PIM-SM): Protocol Specification	N	N	Y	Y	Y
	draft-ietf-pim-dm-new-v2-02	Protocol Independent Multicast - Dense Mode (PIM-DM)	N	N	Y	Y	Y
IS-IS	RFC 1195	Use of OSI IS-IS for Routing in TCP/IP and Dual Environments	Y	Y	Y	Y	Y
	RFC 2763	Dynamic Hostname Exchange Mechanism for IS-IS	N	N	Y	Y	Y
	RFC 2966	Domain-wide Prefix Distribution with Two-Level IS-IS	N	N	Y	Y	Y
MPLS	RFC 2702	Requirements for Traffic Engineering Over MPLS	N	N	N	Y	Y
	RFC 2547	BGP/MPLS VPNs	N	N	Y	Y	Y
	RFC 2961	RSVP Refresh Overhead Reduction Extensions	N	N	N	Y	Y

Feature	Standard	Description	S5700(S)-LI	S5700-SI	S5700-EI	S5710-EI	S5700-HI
	RFC 3031	Multiprotocol Label Switching Architecture	N	N	N	Y	Y
	RFC 3032	MPLS Label Stack Encoding	N	N	N	Y	Y
	RFC 3036	LDP Specification	N	N	N	Y	Y
OSPF	RFC 1583	OSPF Version 2 (obsoletes RFC 1247/ obsoleted by RFC 2178)	N	N	Y	Y	Y
	RFC 1587	The OSPF NSSA Option	N	N	Y	Y	Y
	RFC 1765	OSPF Database Overflow	N	N	Y	Y	Y
	RFC 1850	OSPF Version 2 Management Information Base	N	N	Y	Y	Y
	RFC 1997	BGP Community Attribute	N	N	Y	Y	Y
	RFC 2328	OSPF Version 2 (obsoletes RFC 2178)	N	N	Y	Y	Y
	RFC 2385	TCP MD5	N	N	Y	Y	Y
	RFC 2842	Capabilities Advertisement with BGP-4	N	N	Y	Y	Y
	RFC 2918	Route Refresh Capability for BGP-4	N	N	Y	Y	Y
RIP	RFC 1058	Routing Information Protocol	N	Y	Y	Y	Y
	RFC 2453	RIP Version 2	N	Y	Y	Y	Y
Denial-of-Service (DoS) Protection	RFC 2267	Network Ingress Filtering: Defeating Denial of Service Attacks which employ IP Source Address Spoofing (Obsolete)	Y	Y	Y	Y	Y
Network Management	RFC 854	Telnet Protocol Specification	Y	Y	Y	Y	Y
	RFC 951	Bootstrap Protocol	Y	Y	Y	Y	Y

Feature	Standard	Description	S5700(S)-LI	S5700-SI	S5700-EI	S5710-EI	S5700-HI
	RFC 1155	Structure and identification of management information for TCP/IP-based internets	Y	Y	Y	Y	Y
	RFC 1157	A Simple Network Management Protocol (SNMP)	Y	Y	Y	Y	Y
	RFC 1212	Concise MIB Definitions	Y	Y	Y	Y	Y
	RFC 1213	Management Information Base for Network Management of TCP/IP-based internets: MIB-II	Y	Y	Y	Y	Y
	RFC 1215	A Convention for Defining Traps for use with the SNMP	Y	Y	Y	Y	Y
	RFC 1256	ICMP Router Discovery Messages	Y	Y	Y	Y	Y
	RFC 1493	Definitions of Managed Objects for Bridges	Y	Y	Y	Y	Y
	RFC 1573	Evolution of the Interfaces Group of MIB-II	Y	Y	Y	Y	Y
	RFC 1643	Definitions of Managed Objects for the Ethernet-like Interface Types	Y	Y	Y	Y	Y
	RFC 1650	Definitions of Managed Objects for the Ethernet-like Interface Types using SMIv2	Y	Y	Y	Y	Y
	RFC 1657	Basic BGP4 MIB	N	N	Y	Y	Y
	RFC 1724	RIP Version 2 MIB Extension	N	Y	Y	Y	Y
	RFC 1757	Remote Network Monitoring Management Information Base	Y	Y	Y	Y	Y
	RFC 1850	OSPF Version 2 Management Information Base	N	N	Y	Y	Y

Feature	Standard	Description	S5700(S)-LI	S5700-SI	S5700-EI	S5710-EI	S5700-HI
	RFC 1901	Introduction to Community-based SNMPv2	Y	Y	Y	Y	Y
	RFC 1907	Management Information Base for Version 2 of the Simple Network Management Protocol (SNMPv2)	Y	Y	Y	Y	Y
	RFC 2021	Remote Network Monitoring Management Information Base Version 2 using SMIv2	Y	Y	Y	Y	Y
	RFC 2668	Definitions of Managed Objects for IEEE 802.3 Medium Attachment Units (MAUs)	Y	Y	Y	Y	Y
	RFC 2787	Definitions of Managed Objects for the Virtual Router Redundancy Protocol	N	N	Y	Y	Y
Security	RFC 1492	An Access Control Protocol, Sometimes Called TACACS	Y	Y	Y	Y	Y
	draft-grant-tacacs-02	TACACS+	Y	Y	Y	Y	Y
	RFC 2138	Remote Authentication Dial In User Service (RADIUS)	Y	Y	Y	Y	Y