SICOM3009A/3306/3216/KIEN7009 Series
Industrial Ethernet Switches
Web Operation Manual

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Contents

Preface

This manual mainly introduces the access methods and software features of SICOM3009A/3306/3216/KIEN7009 series industrial Ethernet switches, and introduces the Web configuration methods in detail.

Content Structure

The manual contains the following contents:

Main Content	Explanation
1. Product Introduction	➢ Overview ➢ Product Models ➢ Software Features
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3. Device Management	➢ Reboot ➢ Logout
4. Device status	➢ Basic Information ➢ Port Status ➢ Port Statistics
5. Basic configuration	➢ IP address ➢ Device Information ➢ Port Configuration ➢ Change Password ➢ Software Update ➢ Upload & Download
6. LLDP	
7. ARP *	
8. QoS configuration*	
9. Port Trunk *	

10. MAC Aging Time*	
11. Port Rate*	
12. Redundant	➢ DT-Ring Configuration ➢ RSTP/STP Configuration* ➢ RSTP/STP Transparent Transmission* ➢ DRP
13. Multicast*	➢ GMRP ➢ Static FDB Multicast ➢ IGMP Snooping
14. Diagnosis	➢ Port Mirroring* ➢ Link Check ➢ Virtual Cable Tester*
15. SNTP*	
16. Security*	➢ SSH ➢ Dot1x ➢ Port Security ➢ AAA Configuration ➢ TACACS+ Information ➢ SSL Configuration
17. VLAN	➢ VLAN Configuration ➢ PVLAN ➢ GVRP
18. RMON	
19. Unicast Configuration *	
20. Alarm and Syslog	➢ Alarm ➢ Syslog *
21. SNMP	➢ SNMP v2 ➢ SNMP v3
22. DHCP*	➢ DHCP server configuration

	➢ DHCP Snooping ➢ Option82 configuration

Note:

Features with an asterisk (*) are not available on KIEN7009.

Conventions in the manual

1. Text format conventions

Format	Explanation
< >	The content in < > is a button name. For example, click <Apply> button
[ ]	The content in [ ] is a window name or a menu name. For example, click [File] menu item
{ }	The content in { } is a group. For example, {IP address, MAC address} means that IP address and MAC address are a group and they can be configured and displayed together
→	Multi-level menus are separated by "→". For example, Start→All Programs→Accessories. Click [Start] menu, click the submenu [All programs], then click the submenu [Accessories].
/	Select one from two or more options that are separated by "/". For example "Add/Subtract" means addition or subtraction.
~	It means a range. For example, "1~255" means a range from 1 to 255

2. CLI conventions

Format	Explanation
Bold	Commands and keywords, for example, **show version**, appear in **bold** font.
Italic	Parameters for which you supply values are in *italic* font. For example, in the **show vlan** *vlan id* command, you need to supply the

	actual value of *vlan id*.

3. Symbol conventions

Symbol	**Explanation**
⚠ **Caution**	The matters need attention during the operation and configuration, and it is a supplement to the operation content
✎ **Note**	Necessary explanations to operation contents
⚡ **Warning**	The matters that call for special attention. Incorrect operation might cause data loss or damage to devices

Product Documents

The documents of SICOM3009A/3306/3216/KIEN7009 series industrial Ethernet switches include:

Name of Document	**Content Introduction**
SICOM3009A Series Industrial Ethernet Switches Hardware Installation Manual	Introduces hardware structure, hardware specifications, mounting and dismounting methods of SICOM3009A
SICOM3306 Series Industrial Ethernet Switches Hardware Installation Manual	Introduces hardware structure, hardware specifications, mounting and dismounting methods of SICOM3306
SICOM3216 Series Industrial Ethernet Switches Hardware Installation Manual	Introduces hardware structure, hardware specifications, mounting and dismounting methods of SICOM3216
KIEN7009 Series Industrial Ethernet Switches Hardware Installation Manual	Introduces hardware structure, hardware specifications, mounting and dismounting methods of KIEN7009
SICOM3009A/3306/3216/KIEN7009 Series Industrial Ethernet Switches Web Operation	Introduces the switch software functions, Web configuration methods and steps of

Manual	all functional modules

Document Obtainment

Product documents can be obtained by:

- CD shipped with the device
- Kyland website: www.kyland.com

1. Product Introduction

1.1 Overview

SICOM3009A/3306/3216/KIEN7009 includes a series of green DIN-rail industrial Ethernet switches applied in the wind power, distribution network automation, power, and intelligent transportation industries. The series switches provide Mini USB Console port, and supports IEC62439-6 and VCT. The Reset button allows one-touch recovery. The brilliant performance of the switches satisfies the needs of many industries.

1.2 Product Models

The series switches include four models (SICOM3009A, SICOM3306, SICOM3216, and KIEN7009) with extensive port types to suit customers' different needs, as listed in Table 1.

Table 1: Product Models

Model	**Gigabit**		**100M**	
	SFP Port	**Combo Port**	**RJ45 Port**	**SC/ST/FC Port**
SICOM3009A-8T	--	--	8	--
SICOM3009A-1S/M-7T	--	--	7	1
SICOM3009A-2S/M-6T	--	--	6	2
SICOM3009A-3S/M-6T	--	--	6	3
SICOM3306-1GX-8T	1	--	8	--
SICOM3306-2GX-6T	2	--	6	--
SICOM3306-3GX-6T	3	--	6	--
SICOM3306-1GX-2S/M-6T	1	--	6	2
SICOM3216-16T	--	--	16	--
SICOM3216-2S/M-14T	--	--	14	2
SICOM3216-2GX/GE-16T	--	2	16	--

SICOM3216-2GX/GE-2S/M-14T	--	2	14	2
KIEN7009-8T	--	--	8	--
KIEN7009-2S/M-6T	--	--	6	2
KIEN7009-2S/M-4T	--	--	4	2
KIEN7009-3S/M-6T	--	--	6	3
KIEN7009-1S/M-7T	--	--	7	1

1.3 Software Features

This series switches provide abundant software features, satisfying customers' various requirements.

- Redundancy protocols: RSTP/STP, DT-Ring, and IEC62439-6
- Multicast protocols: IGMP Snooping, GMRP, and static multicast
- Switching attributes: VLAN, PVLAN, GVRP, QoS, and ARP
- Bandwidth management: port trunk, and port rate limiting
- Synchronization protocol: SNTP
- Security: IEEE802.1X, TACACS+, SSH, SSL, port security, and AAA
- Device management: FTP/TFTP software update, FTP/TFTP file transmission, and log recording and uploading
- Device diagnosis: port mirroring, LLDP, VCT, and link status detection
- Alarming: port alarm, power alarm, and ring alarm
- Network management: management by CLI, Telnet, Web, and Kyvision network management software, and SNMP network monitoring
- ...

2. Switch Access

There are 4 ways to access a switch.

- Console port
- Telnet
- Web browser
- Kyvision management software

Kyvision network management software is designed by Kyland. Please refer to its user manual for more information.

2.1 View Types

When logging into CLI (Command Line Interface) by Console port or Telnet, user can enter different views or switch between different views by using different commands, as shown in Table 2.

Table 2: View Switching

View Prompt	**View Type**	**View Function**	**Command for View Switching**
SWITCH>	User View	➢ Show currently used commands ➢ Show IP address ➢ Show software version	Input "**enable**" to enter the management view
SWITCH #	Management View	➢ Show switch configuration information ➢ Upload/download configuration file ➢ Upload/download log record	➢ Input "**configure terminal**" to switch from the management view to the configuration view; ➢ Input "**exit**" to return

		➢ Restore default configuration ➢ Save current configuration ➢ Software update ➢ Reboot switch	to the user view
SWITCH(config) #	Configuration View	Configure all switch functional modules	Input "**exit**" or "**end**" to return to the management view

When a switch is configured by command lines, "?" can be used to get command help. In the help information, there are different parameter descriptions, for example, <1, 255> means a number range; <H.H.H.H> means an IP address; <H:H:H:H:H:H> means a MAC address; word<1,31> means a string range. In addition, ↑ and ↓ can be used to scroll through the last used 10 commands.

2.2 Console Port Access

User can access a switch by its Console port and the hyper terminal of Windows system or other software that supports serial port connection, such as HTT3.3. The following example shows how to use the Console port and Hyper Terminal to access the switch.

1. Install Mini USB serial port driver "Mini USB_driver.exe". See [Software download] folder in CD.
2. Use Mini USB cable to connect the USB port of PC and the switch Console port
3. Run the Hyper Terminal in Windows desktop. Click [Start]→[All Programs]→[Accessories]→[Communications]→[Hyper Terminal], as shown in Figure 1.

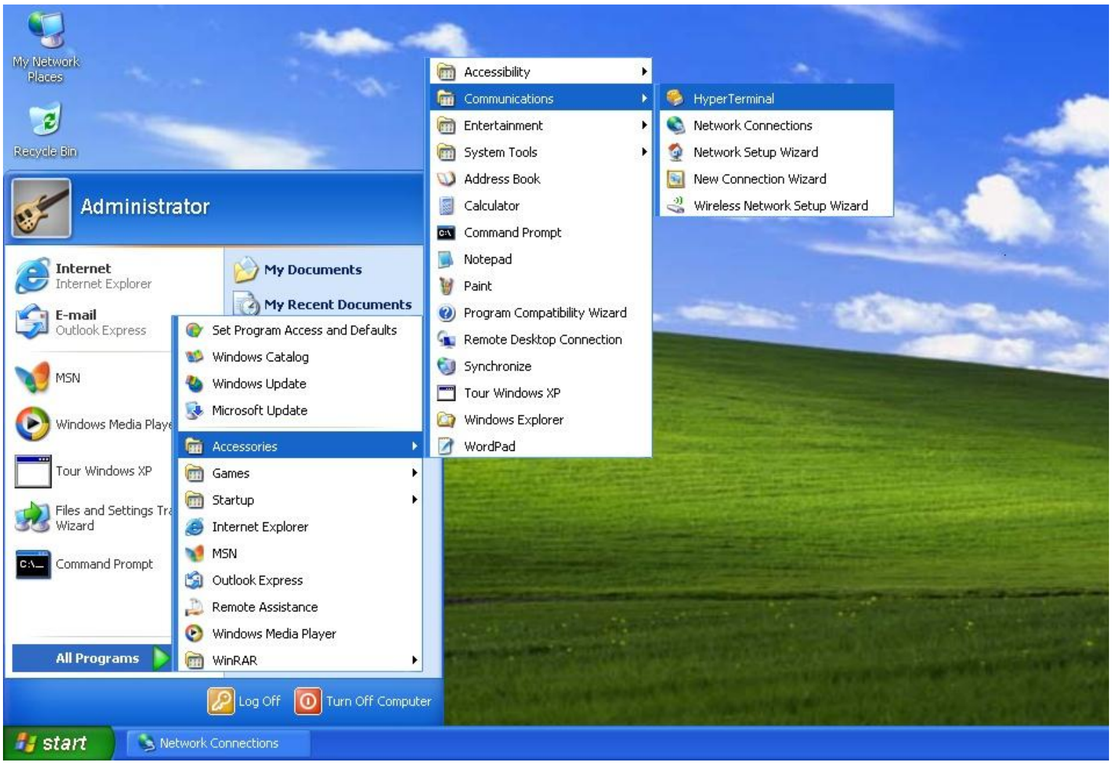
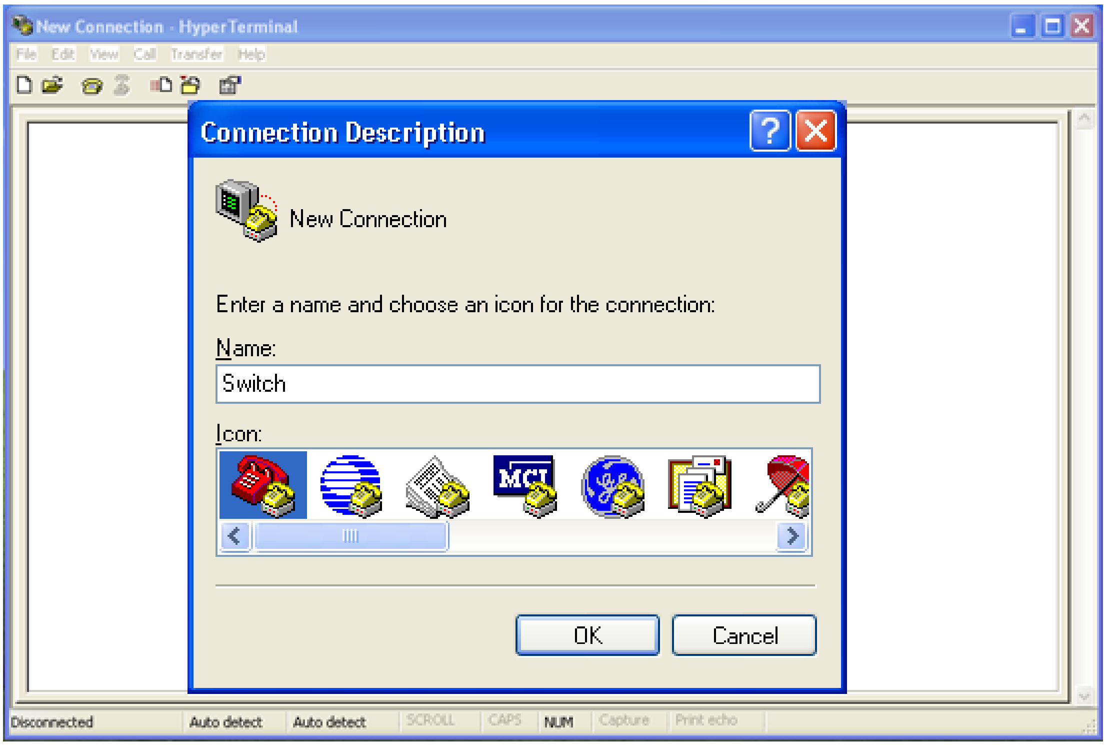


Figure 1: Hyper Terminal

4. Create a new connection "Switch", as shown in Figure 2.



Enter a name and choose an icon for the connection:

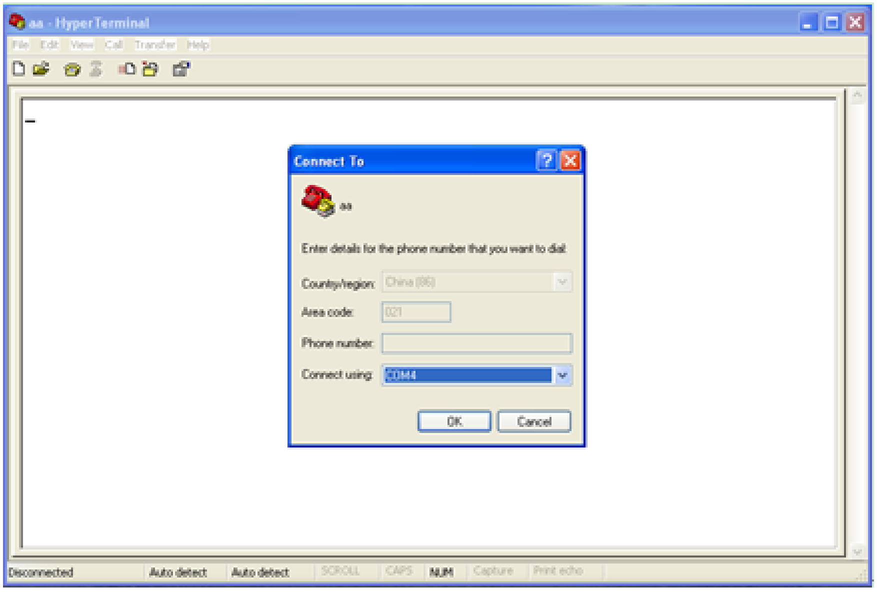
Name:

Switch

Icon:

Figure 2: New Connection

5. Connect a correct communication port, as shown in Figure 3.



Enter details for the phone number that you want to dial:

Country/region: China (86)

Area code: 021

Phone number:

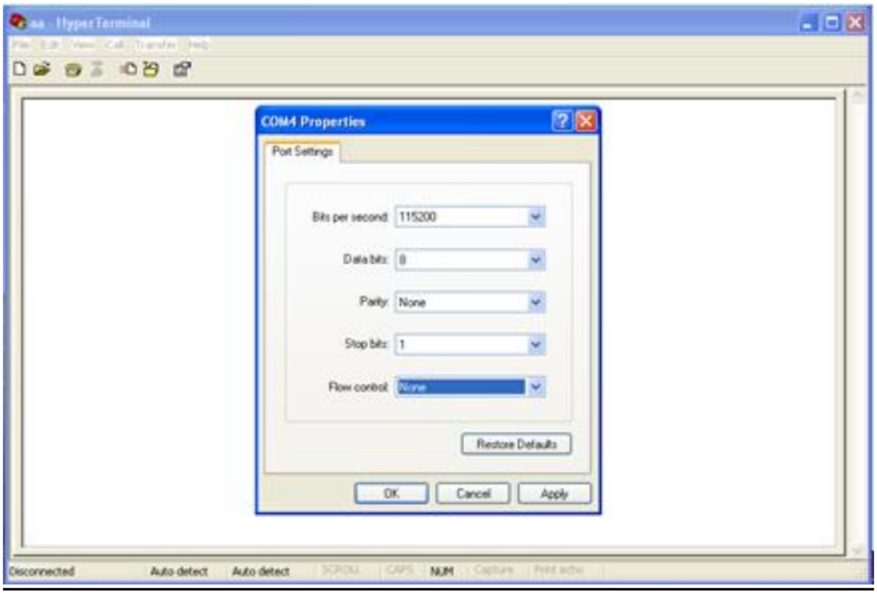
Connect using: COM4

Figure 3: Select communication port

Note:

To confirm communication port, please right click [My Computer]→[Property]→[Hardware]→[Device Manager]→[Port] to check the USB port-used communication port.

6. Serial port setting as shown in Figure 4. Bits per second (Baud rate): 115200; Data bits: 8; Parity: None; Stop bits: 1; Flow control: None



Bits per second: 115200

Data bits: 8

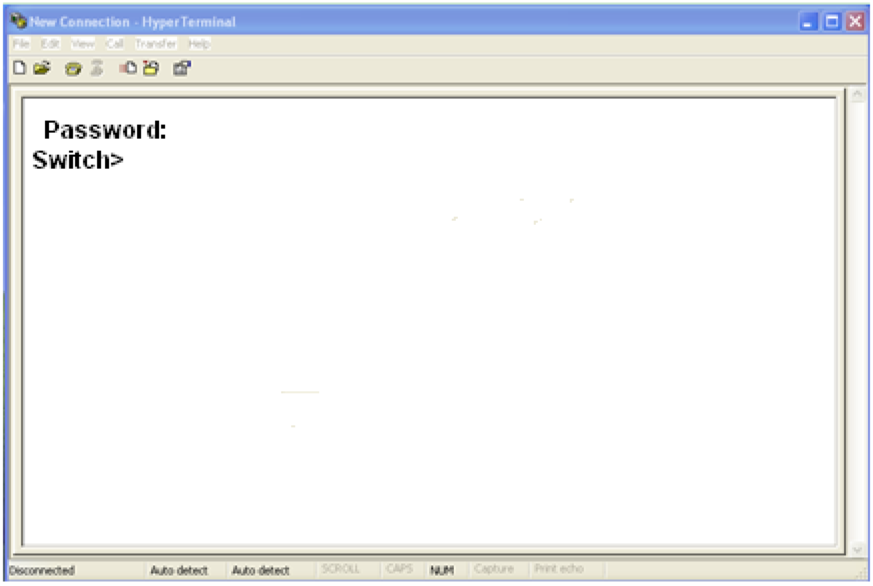
Parity: None

Stop bits: 1

Flow control: None

Figure 4: Port Setting

7. Click <OK> button to enter the switch CLI. Input password "admin" and press <Enter> to enter the user view, as shown in Figure 5.


New Connection - HyperTerminal
File Edit View Call Transfer Help

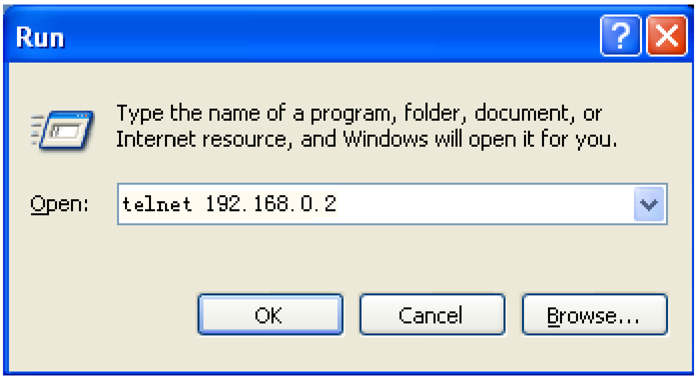
```
Password:
Switch>
```

Figure 5: CLI

2.3 Telnet Access

The precondition of accessing a switch by Telnet is the normal communication of PC and switch.

1. Type "**telnet** *IP address*" in the RUN dialog box, as shown in Figure 6.



Type the name of a program, folder, document, or Internet resource, and Windows will open it for you.

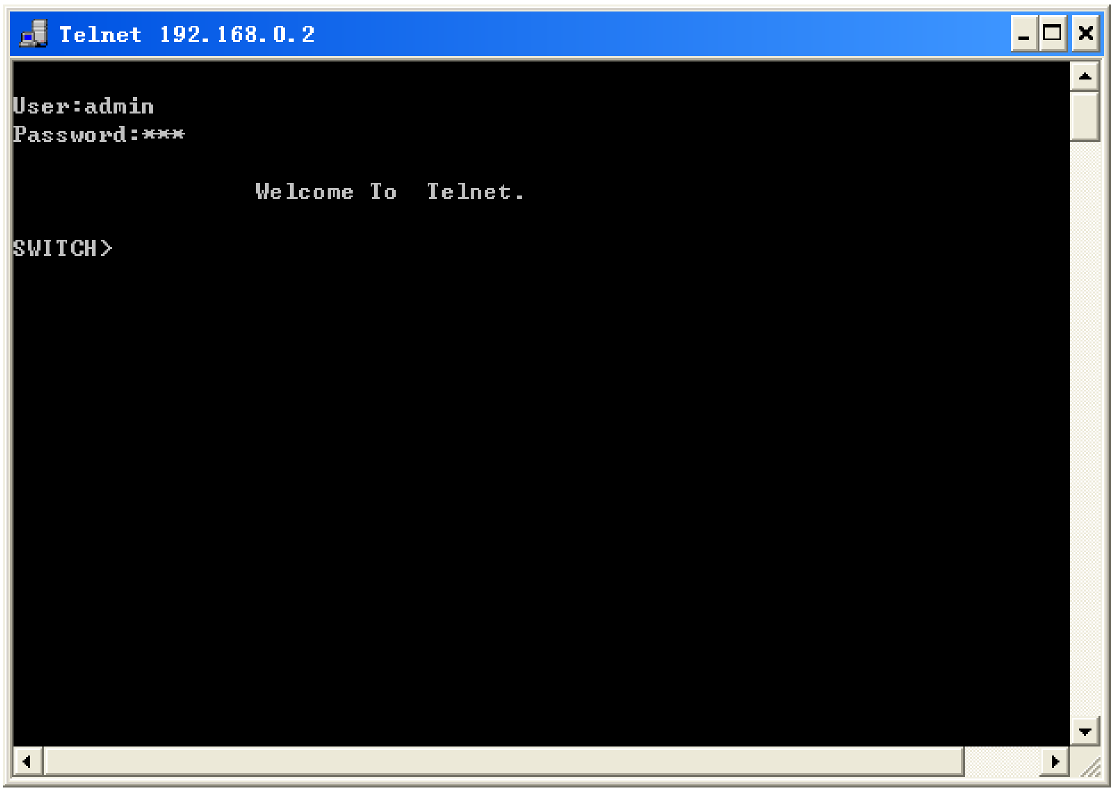
Open: telnet 192.168.0.2

Figure 6: Telnet Access

Note:

To confirm the switch IP address, please refer to "5.1 IP Address" to learn how to obtain the IP address.

2. In the Telnet interface, input "admin" in User, and "123" in Password. Click <Enter > to log in to the switch, as shown in Figure 7.



```
User:admin
Password:***

                    Welcome To  Telnet.

SWITCH>
```

Figure 7: Telnet Interface

2.4 Web Access

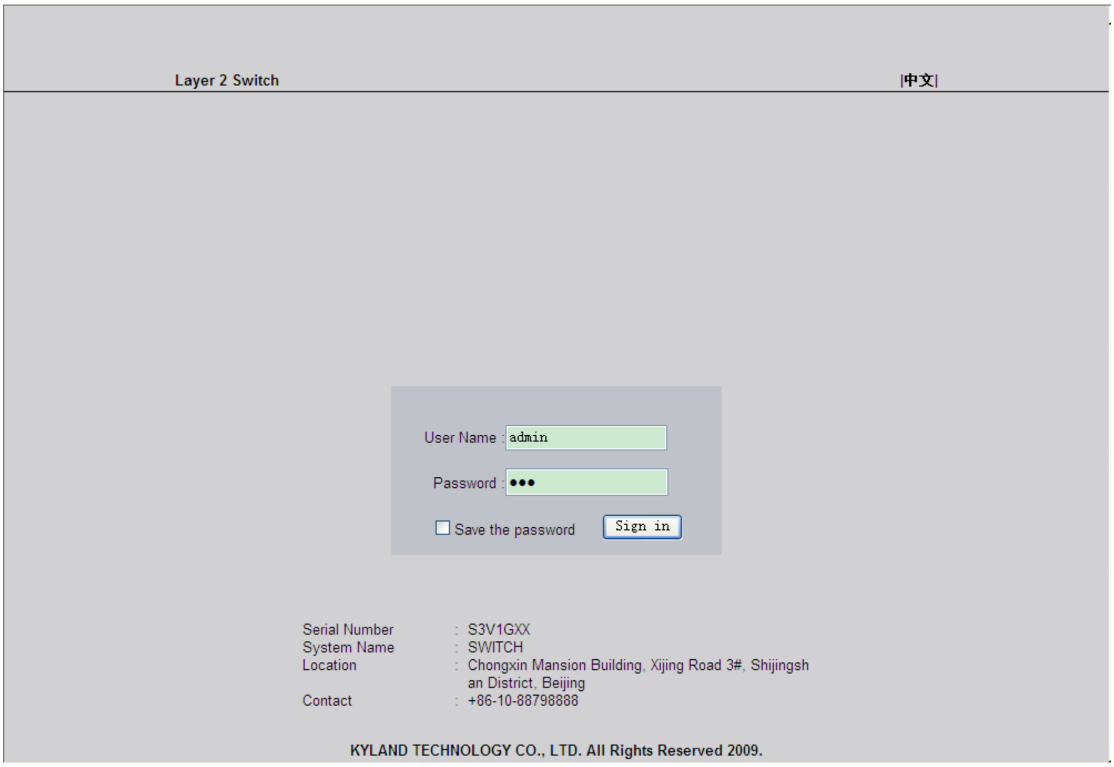
The precondition of accessing switch by Web is the normal communication of PC and switch.

Note:

IE8.0 or a later version is recommended for the best Web display results.

By default, HTTP protocol is used for Web login. If HTTPS protocol is used for login, please refer to "16.6 SSL" for more details.

1. Input "*IP address*" in the browser address bar. The login interface is displayed, as shown in Figure 8. Input the default user name "admin" and password "detmold". Click <Sign in>.



Layer 2 Switch |中文|

User Name : admin

Password : •••

□ Save the password

Serial Number : S3V1GXX
System Name : SWITCH
Location : Chongxin Mansion Building, Xijing Road 3#, Shijingshan District, Beijing
Contact : +86-10-88798888

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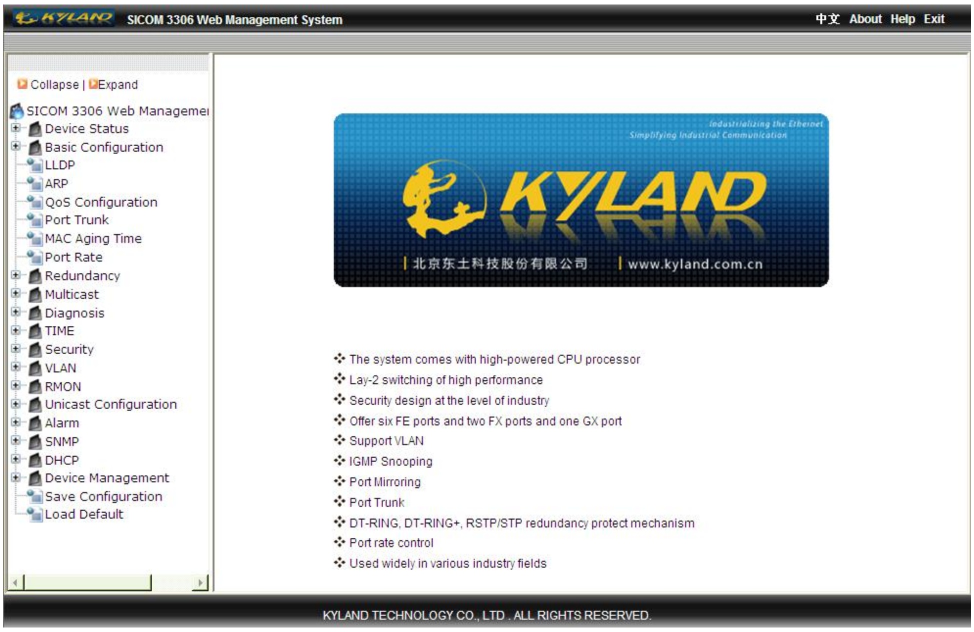
Figure 8: Web Login

The default setting is the English login interface. Click <中文> button to change to the Chinese login interface.

Note:

To confirm the switch IP address, please refer to "5.1 IP Address" to learn how to obtain the IP address.

2. After the success of Web login, there is a navigation tree on the left of the interface, as shown in Figure 9.



- The system comes with high-powered CPU processor
- Lay-2 switching of high performance
- Security design at the level of industry
- Offer six FE ports and two FX ports and one GX port
- Support VLAN
- IGMP Snooping
- Port Mirroring
- Port Trunk
- DT-RING, DT-RING+, RSTP/STP redundancy protect mechanism
- Port rate control
- Used widely in various industry fields

Figure 9 : Web Interface

You can expand or collapse the navigation tree by clicking <Expand> or <Collapse> on the top of the navigation tree. You can perform corresponding operations by clicking [Save Settings] or [Load Default] in the top menu. In the upper right corner, you can click <中文> to switch to the Chinese interface and <Logout> to exit the Web interface.

Caution:

After you have restored the default settings, you need to restart the device to make settings take effect.

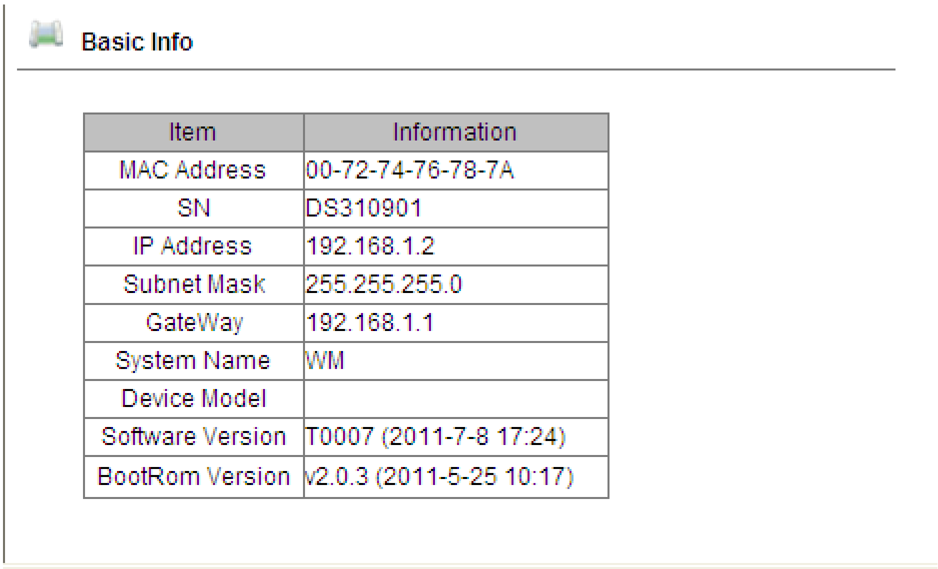
3. Device Management

Click [Device Management]→[Reboot]/[Logout]. You can reboot the device or exit the Web interface. Before rebooting the device, you need to save the current settings as required. If you have saved the settings, the switch automatically configures itself with the saved settings after restart. If you have not saved any settings, the switch restores the factory default settings after restart.

4. Device Status

4.1 Basic Information

The switch basic information contains MAC address, SN, IP address, subnet mask, gateway, system name, device model, software version, BootROM version, as shown in Figure 10.



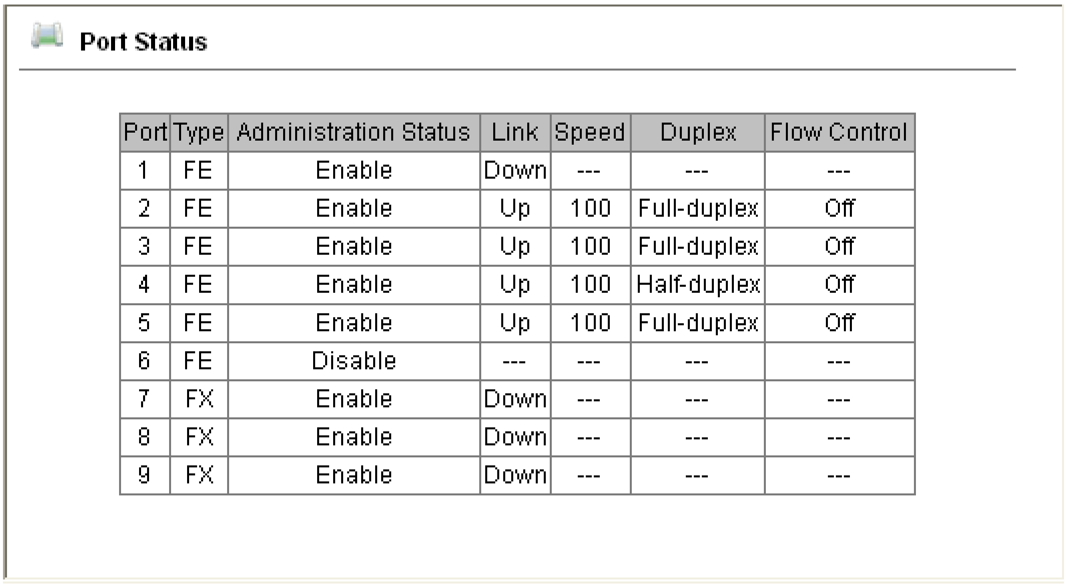
Basic Info

Item	Information
MAC Address	00-72-74-76-78-7A
SN	DS310901
IP Address	192.168.1.2
Subnet Mask	255.255.255.0
GateWay	192.168.1.1
System Name	WM
Device Model	
Software Version	T0007 (2011-7-8 17:24)
BootRom Version	v2.0.3 (2011-5-25 10:17)

Figure 10: Switch Basic Information

4.2 Port Status

Port status interface can automatically display port number, port type, administration status, link status, speed, duplex, flow control, as shown in Figure 11.



Port Status

Port	Type	Administration Status	Link	Speed	Duplex	Flow Control
1	FE	Enable	Down	---	---	---
2	FE	Enable	Up	100	Full-duplex	Off
3	FE	Enable	Up	100	Full-duplex	Off
4	FE	Enable	Up	100	Half-duplex	Off
5	FE	Enable	Up	100	Full-duplex	Off
6	FE	Disable	---	---	---	---
7	FX	Enable	Down	---	---	---
8	FX	Enable	Down	---	---	---
9	FX	Enable	Down	---	---	---

Figure 11: Port Status

Port

Show port number printed on the switch front panel

Type

FE: 10/100Base-TX RJ45 port

FX: 100Base-FX port

GE: 10/100/1000Base-TX RJ45 port

GX: Gigabit SFP port

Administration Status

Show the administration status of ports

Enable: the port is available and permits data transmission

Disable: the port is locked without data transmission

Link

Show the link status of ports

Up: the port is in LinkUp state and can communicate normally

Down: the port is in LinkDown state and cannot communicate normally

Speed

Show the communication speed of LinkUp ports

Duplex

Show the duplex mode of LinkUp ports

Full-duplex: the port can receive and transmit data at the same time

Half-duplex: the port only receives or transmits data at the same time

Flow Control

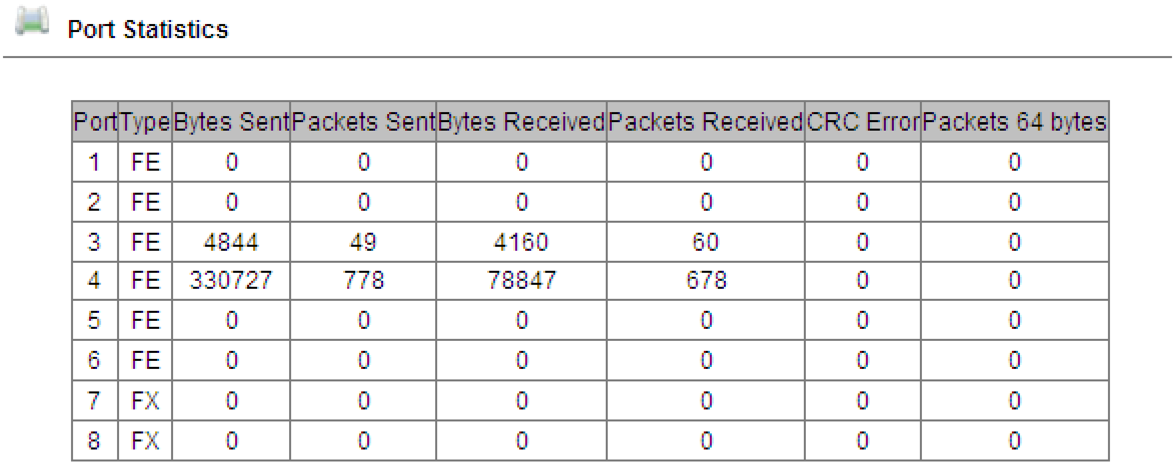
Show the flow control status of LinkUp ports

Note:

Please refer to "5.3 Port Configuration" for the details of duplex and flow control.

4.3 Port Statistics

The Port Statistics interface displays the number of bytes and packets that each port sends, and the number of bytes and packets that each port receives, CRC errors, and the number of packets whose lengths are less than 64 bytes, as shown in Figure 12.



Port Statistics

Port	Type	Bytes Sent	Packets Sent	Bytes Received	Packets Received	CRC Error	Packets 64 bytes
1	FE	0	0	0	0	0	0
2	FE	0	0	0	0	0	0
3	FE	4844	49	4160	60	0	0
4	FE	330727	778	78847	678	0	0
5	FE	0	0	0	0	0	0
6	FE	0	0	0	0	0	0
7	FX	0	0	0	0	0	0
8	FX	0	0	0	0	0	0

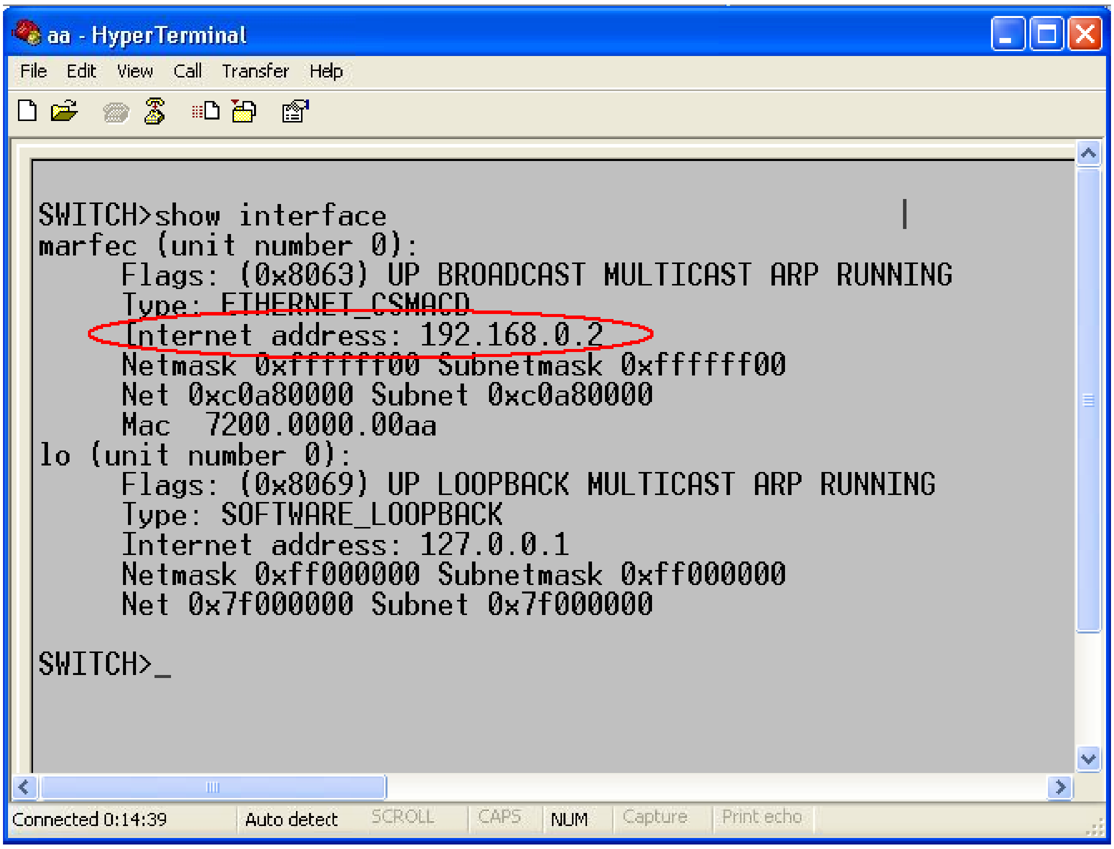
Figure 12: Port Statistics

5. Basic Configuration

5.1 IP Address

1. Show switch IP address by using Console port

Use Console port to log into switch command line interface, input "**show interface**" command in the user view to check the switch IP address. As Figure 13 shows, the IP address is circled in red.



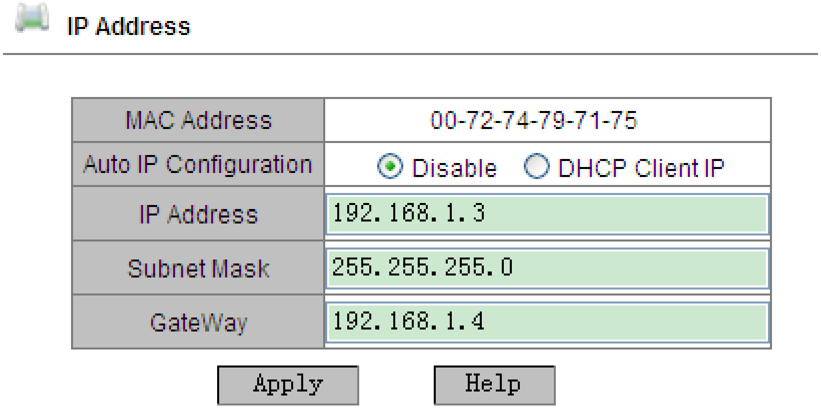
```
SWITCH>show interface
marfec (unit number 0):
     Flags: (0x8063) UP BROADCAST MULTICAST ARP RUNNING
     Type: ETHERNET_CSMACD
     Internet address: 192.168.0.2
     Netmask 0xffffff00 Subnetmask 0xffffff00
     Net 0xc0a80000 Subnet 0xc0a80000
     Mac  7200.0000.00aa
lo (unit number 0):
     Flags: (0x8069) UP LOOPBACK MULTICAST ARP RUNNING
     Type: SOFTWARE_LOOPBACK
     Internet address: 127.0.0.1
     Netmask 0xff000000 Subnetmask 0xff000000
     Net 0x7f000000 Subnet 0x7f000000

SWITCH>_
```

Figure 13: Show IP Address

2. IP address configuration

Switch IP address and gateway can be manually or automatically configured. As Figure 14 shows, when "Auto IP Configuration" is disabled, the switch IP address and gateway need to be manually configured; when "Auto IP Configuration" is enabled, switch can automatically obtain an IP address by DHCP protocol and there must be a DHCP Server in the network to assign IP addresses, subnet mask addresses and gateway addresses to clients. For more details, please refer to "22.1 DHCP Server Configuration".



IP Address

MAC Address	00-72-74-79-71-75
Auto IP Configuration	● Disable ○ DHCP Client IP
IP Address	192.168.1.3
Subnet Mask	255.255.255.0
GateWay	192.168.1.4

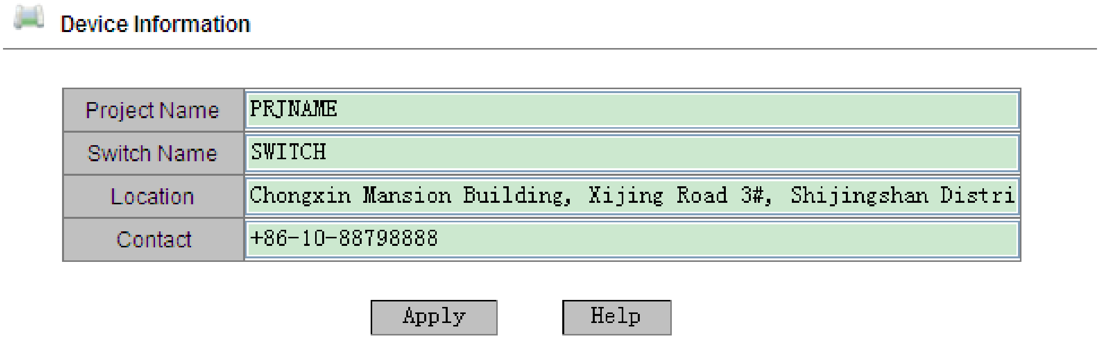
Figure 14: IP Address

Caution:

- ➢ IP address and gateway must be in the same segment, otherwise, the IP address cannot be modified.
- ➢ For this series switches, the change in IP address will take effect immediately after modification without the need of reboot.

5.2 Device Information

Device information includes the project name, switch name, location and contact, as shown in Figure 15.



Device Information

Project Name	PRJNAME
Switch Name	SWITCH
Location	Chongxin Mansion Building, Xijing Road 3#, Shijingshan Distri
Contact	+86-10-88798888

Figure 15: Device Information

Project Name

Configuration range: 1~64 characters

Switch Name

Configuration range: 1~32 characters

Location

Configuration options: character/Chinese character

Configuration range: 1~255 characters (One Chinese character occupies two characters)

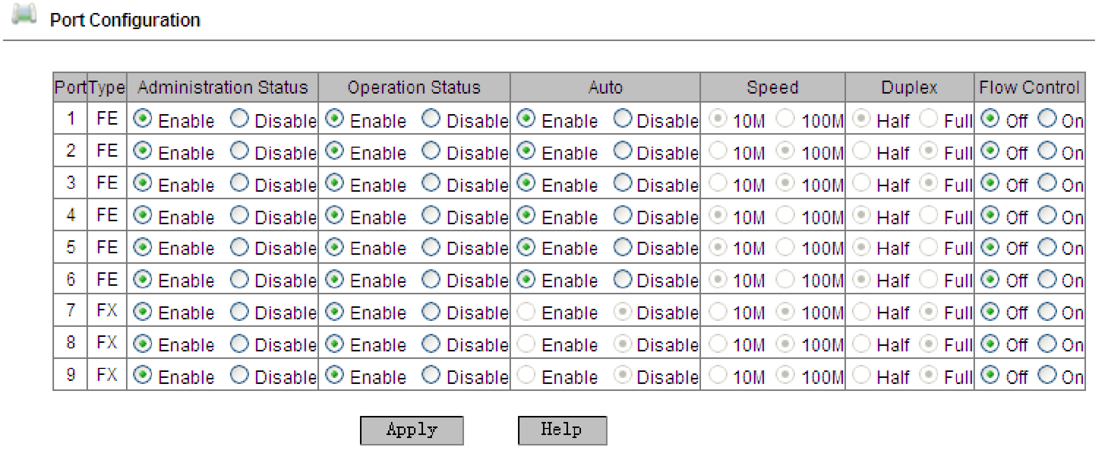
Contact

Configuration options: character/Chinese character

Configuration range: 1~32 characters (One Chinese character occupies two characters)

5.3 Port Configuration

Port configuration can configure port status, port speed, flow control and other information, as shown in Figure 16.



Port Configuration

Port	Type	Administration Status	Operation Status	Auto	Speed	Duplex	Flow Control
1	FE	● Enable ○ Disable	● Enable ○ Disable	● Enable ○ Disable	● 10M ○ 100M	● Half ○ Full	● Off ○ On
2	FE	● Enable ○ Disable	● Enable ○ Disable	● Enable ○ Disable	○ 10M ● 100M	○ Half ● Full	● Off ○ On
3	FE	● Enable ○ Disable	● Enable ○ Disable	● Enable ○ Disable	○ 10M ● 100M	○ Half ● Full	● Off ○ On
4	FE	● Enable ○ Disable	● Enable ○ Disable	● Enable ○ Disable	● 10M ○ 100M	● Half ○ Full	● Off ○ On
5	FE	● Enable ○ Disable	● Enable ○ Disable	● Enable ○ Disable	● 10M ○ 100M	● Half ○ Full	● Off ○ On
6	FE	● Enable ○ Disable	● Enable ○ Disable	● Enable ○ Disable	● 10M ○ 100M	● Half ○ Full	● Off ○ On
7	FX	● Enable ○ Disable	● Enable ○ Disable	○ Enable ● Disable	○ 10M ● 100M	○ Half ● Full	● Off ○ On
8	FX	● Enable ○ Disable	● Enable ○ Disable	○ Enable ● Disable	○ 10M ● 100M	○ Half ● Full	● Off ○ On
9	FX	● Enable ○ Disable	● Enable ○ Disable	○ Enable ● Disable	○ 10M ● 100M	○ Half ● Full	● Off ○ On

Figure 16: Port Configuration

Administration Status

Configuration options: Enable/Disable

Default: Enable

Function: Enable means that the port is open and permits data transmission; Disable means that the port is blocked without data transmission. This option can directly disable the port in hardware and trigger port alarms. When it is disabled, the port's operation state cannot be set.

Operation Status

Configuration options: Enable/Disable

Default: Enable

Function: configure the port operation state.

Explanation: The port is disabled by protocols.

Auto

Configuration options: Enable/Disable

Default: Enable

Function: configure the auto-negotiation status of ports

Function: When Auto is enabled, the port speed and duplex mode will be automatically negotiated according to port connection status; when Auto is disabled, the port speed and duplex mode can be configured by user.

CAUTION

Caution:

100Base-FX ports are forced to disable auto-negotiation

Speed

Configuration options: 10M/100M/1000M

Function: forced port speed

Explanation: When the Auto is disabled, the port speed can be configured by user.

Duplex

Configuration options: Half/Full

Function: configure the duplex mode of ports

Explanation: When the Auto is disabled, the port duplex mode can be configured by user.

Caution:

- 10/100Base-TX ports can be configured to auto-negotiation, 10M&full duplex, 10M&half duplex, 100M&full duplex, 100M&half duplex
- 100Base-FX ports are forced to 100M&full duplex
- 1000M electrical ports can be configured to auto-negotiation, 1000M&full duplex
- 1000M fiber ports can be configured to auto-negotiation, 1000M&full duplex

Users are advised to enable auto-negotiation for each port to avoid the connection problems caused by mismatched port configuration. If users would like to force port speed/duplex mode, please make sure the same speed/duplex mode configuration in the connected ports at both ends.

Flow Control

Configuration options: Off/On

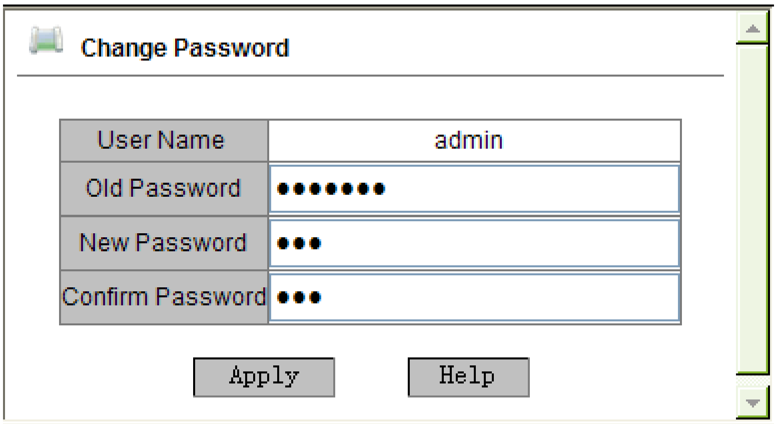
Default: Off

Function: Open/Close flow control function in the designated port.

Explanation: Once the flow control function is enabled, the port will inform the sender to slow the transmitting speed to avoid packet loss by algorithm or protocol when the port-received flow is bigger than the size of port cache. For the devices working in different duplex mode (half/full), their flow control is realized in different ways. For the device working in full duplex mode, the receiving end will send a special frame (Pause frame) to inform the sending end to stop sending messages, when the sender receives the Pause frame, it will stop sending messages for a period of "wait time" carried in the Pause frame and continue sending messages once the "wait time" ends. For the device working in the half duplex mode, it supports back pressure flow control. It is that the receiving end intentionally creates a conflict or a carrier signal, when the sender detects the conflict or the carrier wave, it will take Backoff to postpone the data transmission.

5.4 Change Password

Users can change the password for the "admin" account. The operation is shown in Figure 17.



Change Password

User Name	admin
Old Password	•••••••
New Password	•••
Confirm Password	•••

Figure 17: Change Password

5.5 Software Update

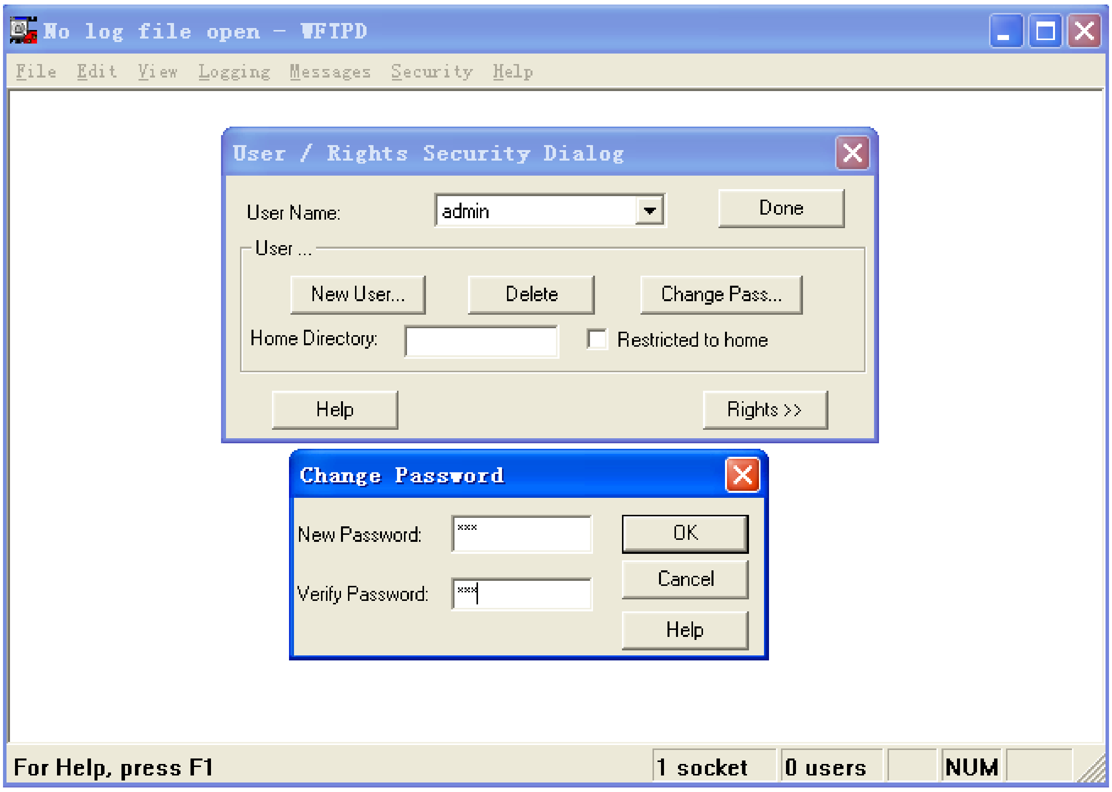
Switch can obtain more performances by software update. For this series switches, software updates contains BootROM software version update and system software version update. First, update the BootROM software version, and then update the system software version. If no change in the BootROM version, users can only update the system software version.

The software version update needs FTP/TFTP server.

5.5.1 Software Update by FTP

Install an FTP server. We will use WFTPD software as an example to introduce FTP server configuration and software update.

1. Click [Security]→[Users/rights] to open "Users/Rights Security Dialog"; Click <New User> button to create a new FTP user, as shown in Figure 18. Create a user name and password, for example, user name "admin", and password "123", click <OK>.



User Name: admin

Home Directory:

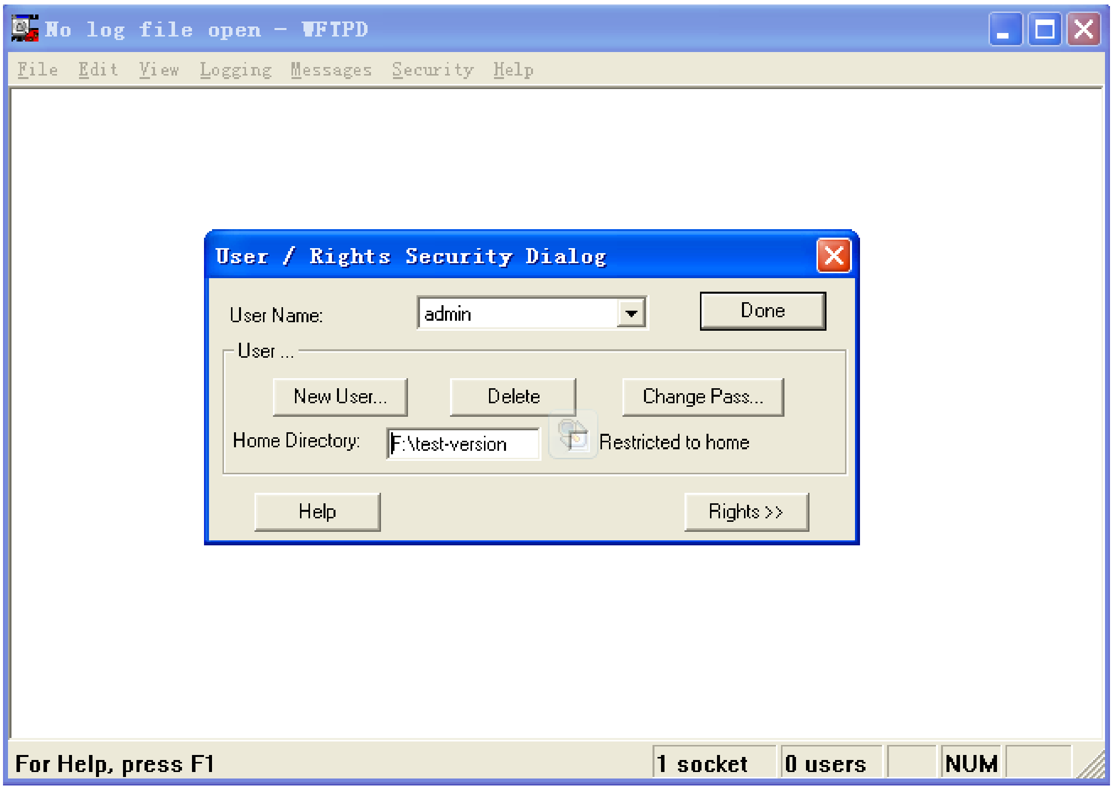
□ Restricted to home

New Password: ***

Verify Password: ***

Figure 18: Create a new FTP user

2. Input the storage path of the update file in the space of "Home Directory", as shown in Figure 19, click <Done>



User Name: admin

Home Directory: F:\test-version

Figure 19: File storage path

3. To update the BootROM software, input the following command in the management view.

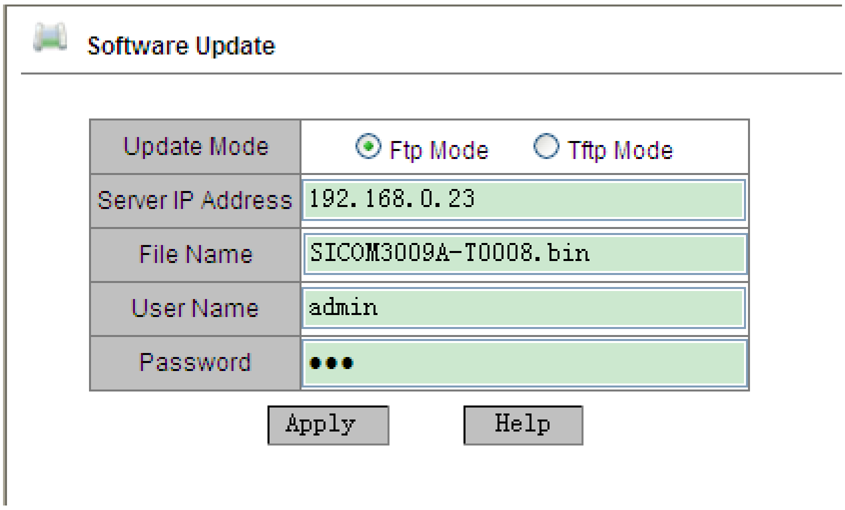
Switch#**update ftp-mode bootrom** *File_name Ftp_server_ip_address User_name Password*

Table 3 lists the parameter descriptions.

Table 3: Parameters for BootROM Update by FTP

Parameter	**Description**
File_name	Name of the BootROM version
Ftp_server_ip_address	IP address of the FTP server
User_name	Created FTP user name
Password	Created FTP password

4. Figure 20 shows the software update page. Enter the IP address of the FTP server, file name (on the server), FTP user name, and password. Click <Apply>.



Software Update

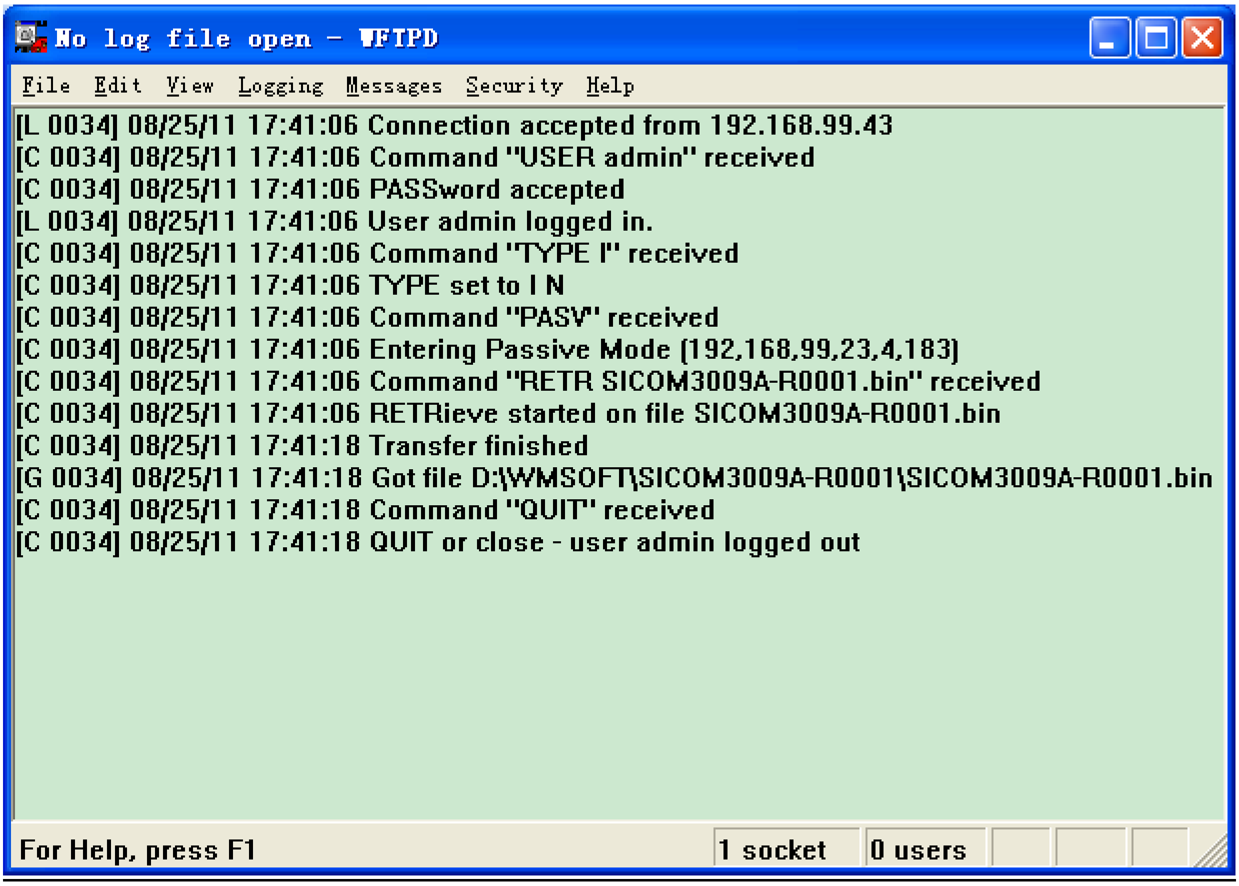
Update Mode	● Ftp Mode ○ Tftp Mode
Server IP Address	192.168.0.23
File Name	SICOM3009A-T0008.bin
User Name	admin
Password	•••

Figure 20 Software Update by FTP

Warning:

The file name must contain an extension. Otherwise, the update may fail.

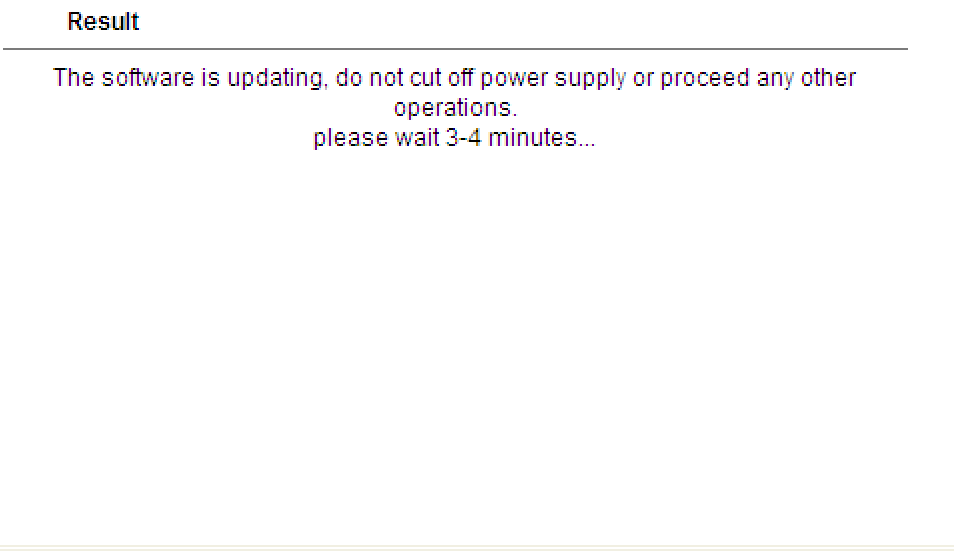
5. Make sure the normal communication of FTP server and switch, as shown in Figure 21.



```
[L 0034] 08/25/11 17:41:06 Connection accepted from 192.168.99.43
[C 0034] 08/25/11 17:41:06 Command "USER admin" received
[C 0034] 08/25/11 17:41:06 PASSword accepted
[L 0034] 08/25/11 17:41:06 User admin logged in.
[C 0034] 08/25/11 17:41:06 Command "TYPE I" received
[C 0034] 08/25/11 17:41:06 TYPE set to I N
[C 0034] 08/25/11 17:41:06 Command "PASV" received
[C 0034] 08/25/11 17:41:06 Entering Passive Mode (192,168,99,23,4,183)
[C 0034] 08/25/11 17:41:06 Command "RETR SICOM3009A-R0001.bin" received
[C 0034] 08/25/11 17:41:06 RETRieve started on file SICOM3009A-R0001.bin
[C 0034] 08/25/11 17:41:18 Transfer finished
[G 0034] 08/25/11 17:41:18 Got file D:\WMSOFT\SICOM3009A-R0001\SICOM3009A-R0001.bin
[C 0034] 08/25/11 17:41:18 Command "QUIT" received
[C 0034] 08/25/11 17:41:18 QUIT or close - user admin logged out
```

Figure 21: Normal communication of FTP server and switch

6. Wait for the update to complete, as shown in Figure 22.

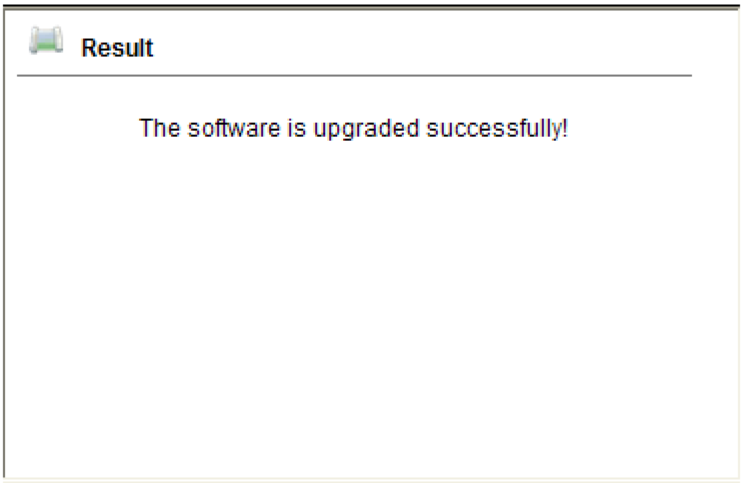


Result

The software is updating, do not cut off power supply or proceed any other operations.
please wait 3-4 minutes...

Figure 22: Wait for update to complete

7. When update completes as shown in Figure 23, please reboot the device and open the Basic Information to check if update succeeded and the new version is active.



Result

The software is upgraded successfully!

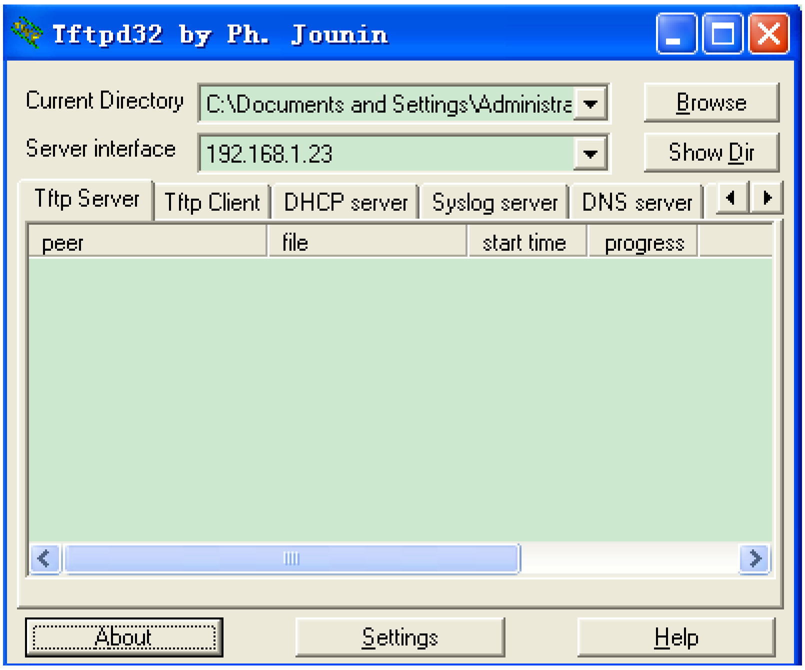
Figure 23: Successful software update by FTP

Warning:

- In the software update process, keep the FTP server software running
- When update completes, reboot the device to activate the new version
- If update fails, do not reboot the device to avoid the loss of software file and the switch cannot be started normally.

5.5.2 Software Update by TFTP

Install TFTP server. We will use TFTPD software in this example to introduce TFTP server configuration and software update, as shown in Figure 24.



Current Directory: C:\Documents and Settings\Administra

Server interface: 192.168.1.23

Figure 24: TFTP server configuration

1. In Current Directory, choose the storage path of the update file on server; input the server IP address in Server interface.
2. To update the BootROM software, input the following command in the management view.

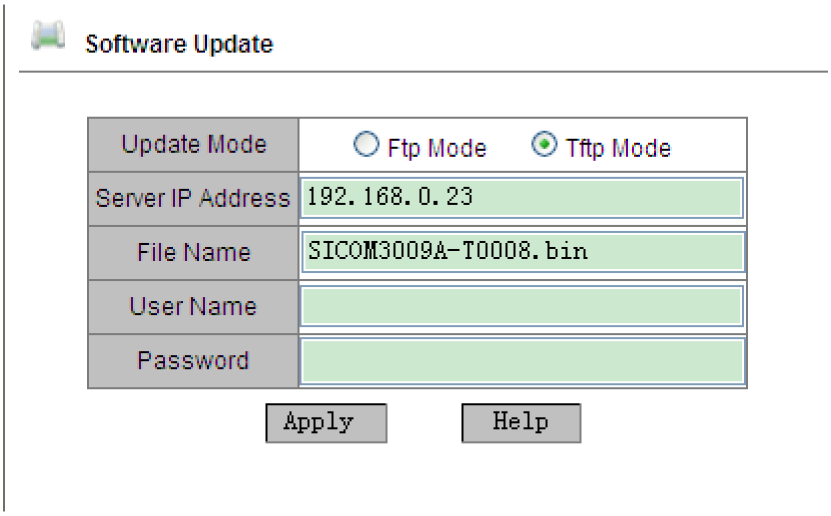
   Switch#**update tftp-mode bootrom** *File_name Ftp_server_ip_address*

   Table 4 lists the parameter descriptions.

Table 4: Parameters for BootROM Update by TFTP

Parameter	**Description**
File_name	Name of the BootROM version
Ftp_server_ip_address	IP address of the FTP server

3. As Figure 25 shows, input TFTP server IP address, file name on server, click <Apply> button, and wait for update to complete.



Software Update

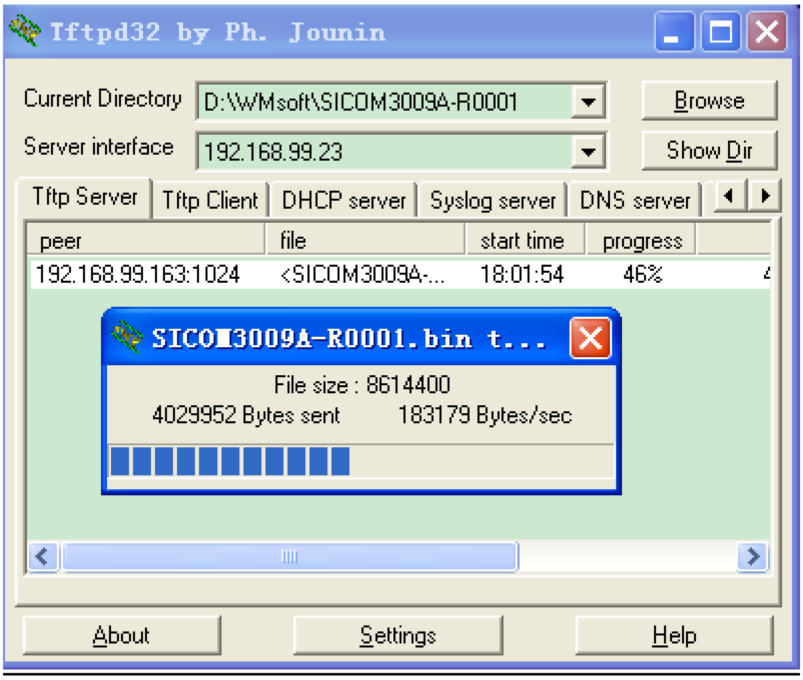
Update Mode	○ Ftp Mode ● Tftp Mode
Server IP Address	192.168.0.23
File Name	SICOM3009A-T0008.bin
User Name	
Password	

Figure 25: Software update by TFTP

Caution:

If software is updated by TFTP, there is no need of user name and password

4. Make sure the normal communication of TFTP server and switch, as shown in Figure 26.



Tftpd32 by Ph. Jounin

Current Directory: D:\WMsoft\SICOM3009A-R0001

Server interface: 192.168.99.23

peer	file	start time	progress
192.168.99.163:1024	<SICOM3009A-...	18:01:54	46%

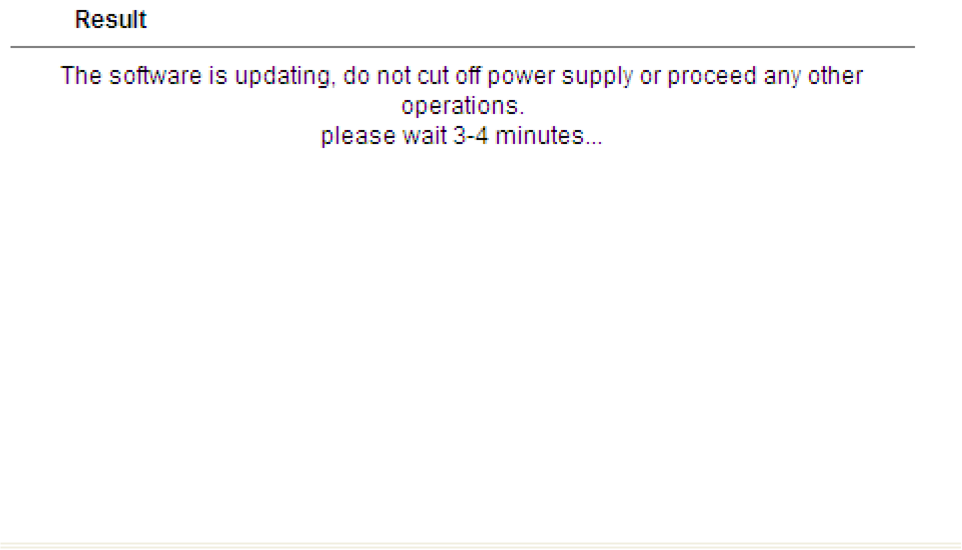
SICOM3009A-R0001.bin t...

File size : 8614400

4029952 Bytes sent 183179 Bytes/sec

Figure 26: Normal communication of TFTP server and switch

5. Wait for the update to complete, as shown in Figure 27.

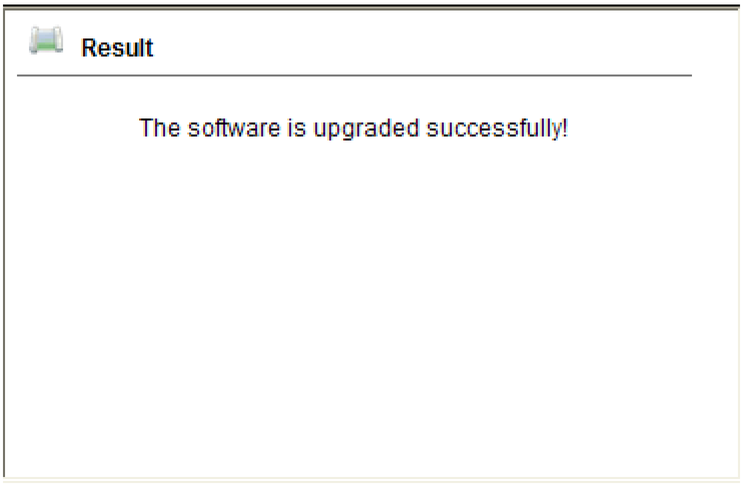


Result

The software is updating, do not cut off power supply or proceed any other operations.
please wait 3-4 minutes...

Figure 27: Wait for update

6. When update completes as shown in Figure 28, please reboot the device and open the Basic Information to check if update succeeded and the new version is active.



Result

The software is upgraded successfully!

Figure 28: Successful software update by TFTP

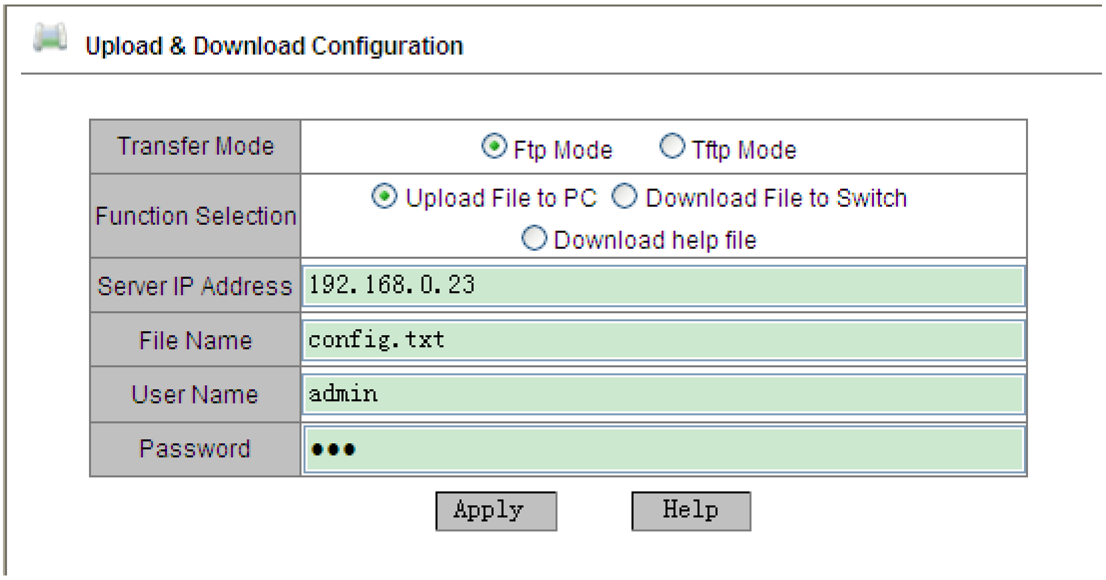
Warning:

- In the software update process, keep the TFTP server software running
- When update completes, reboot the device to activate the new version
- If update fails, do not reboot the device, so as to avoid the loss of software file and the switch cannot be started normally.

5.6 Upload & Download

Configuration backup function can save current switch configuration files on the server. When the switch configuration is changed, users can download the original configuration files from the server to switch by FTP/TFTP protocol.

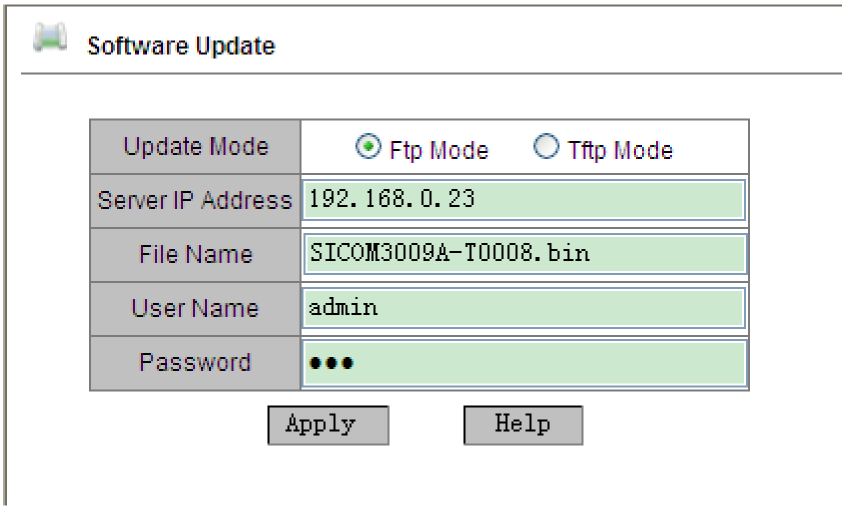
File uploading is to upload the switch configuration files to the server and save them to *.doc and *.txt files. File downloading is to download the saved configuration files from the server to switch, as shown in Figure 29 to Figure 32.



Upload & Download Configuration

Transfer Mode	● Ftp Mode ○ Tftp Mode
Function Selection	● Upload File to PC ○ Download File to Switch ○ Download help file
Server IP Address	192.168.0.23
File Name	config.txt
User Name	admin
Password	•••

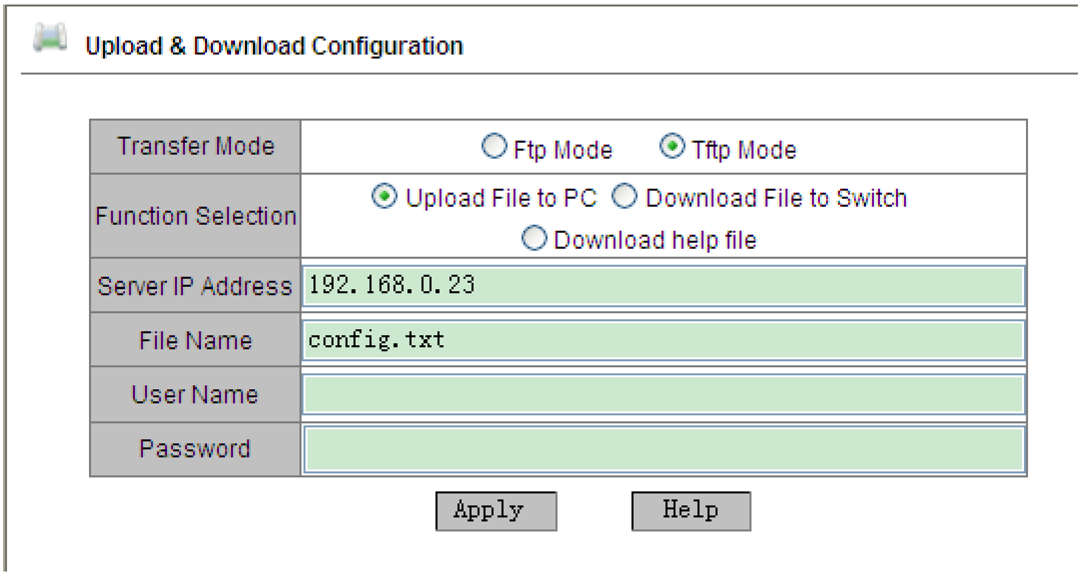
Figure 29: Configuration file upload in FTP mode



Software Update

Update Mode	● Ftp Mode ○ Tftp Mode
Server IP Address	192.168.0.23
File Name	SICOM3009A-T0008.bin
User Name	admin
Password	•••

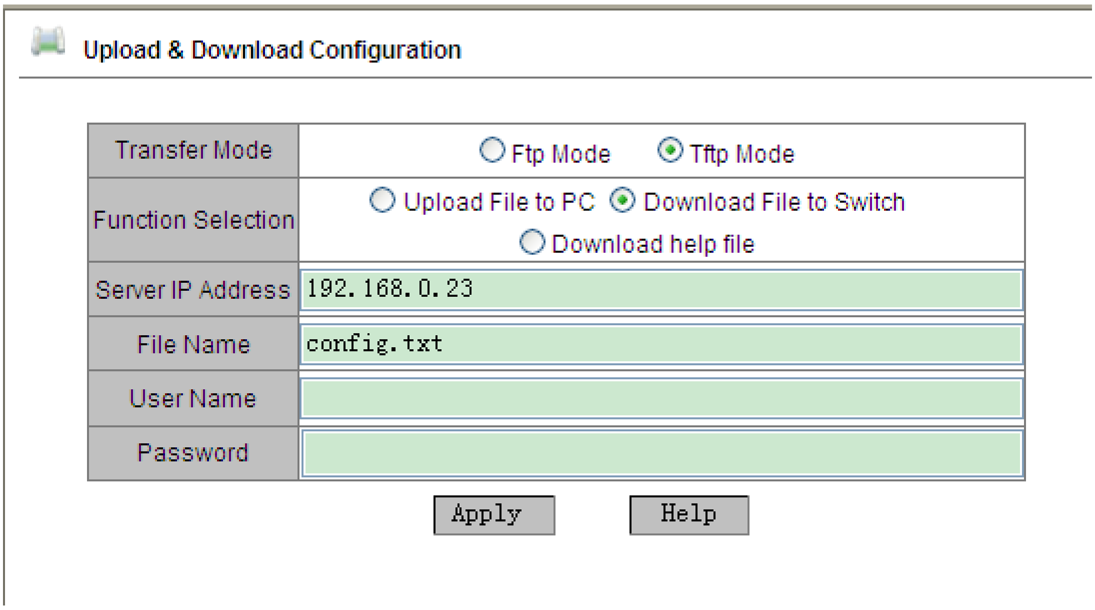
Figure 30: Configuration file download in FTP mode



Upload & Download Configuration

Transfer Mode	○ Ftp Mode ● Tftp Mode
Function Selection	● Upload File to PC ○ Download File to Switch ○ Download help file
Server IP Address	192.168.0.23
File Name	config.txt
User Name	
Password	

Figure 31: Configuration file upload in TFTP mode



Upload & Download Configuration

Transfer Mode	○ Ftp Mode ● Tftp Mode
Function Selection	○ Upload File to PC ● Download File to Switch ○ Download help file
Server IP Address	192.168.0.23
File Name	config.txt
User Name	
Password	

Figure 32: Configuration file download in TFTP mode

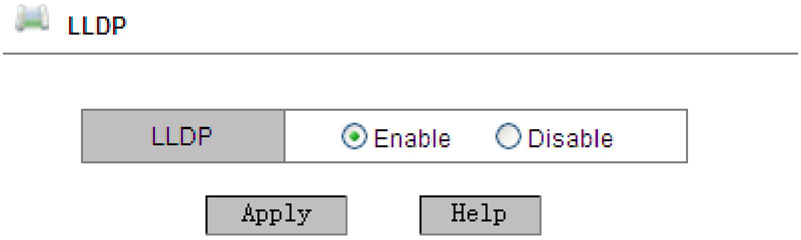
6. LLDP

6.1 Introduction

LLDP (Link Layer Discovery Protocol) provides a standard Link layer discovery method, which can encapsulate the main capabilities, management address, device identifier, interface identifier and other information of the local device into LLDPDU (Link Layer Discovery Protocol Data Unit), and then send the LLDPDU to its connected neighbors. Once the neighbors receive the information, they will save them in their MIB for the future query and link status judgment by the network management system.

6.2 Web Configuration

1. Enable LLDP protocol, as shown in Figure 33.



LLDP

LLDP ● Enable ○ Disable

Figure 33: Enable LLDP

LLDP

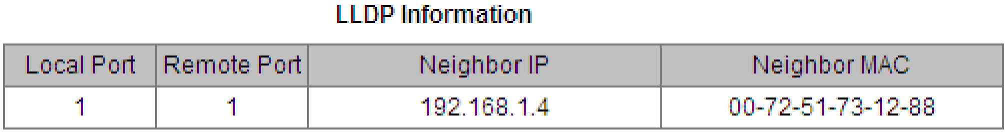
Configuration options: Enable/Disable

Default: Enable

Function: Enable/Disable LLDP protocol.

Explanation: If LLDP is enabled, the switch will send LLDP messages to its neighbor devices, meanwhile, receive and process the LLDP messages from the neighbor devices. If LLDP is disabled, the switch neither sends nor processes LLDP messages.

Once LLDP protocol is enabled, LLDP information can display the information of the neighbor device, including the connected local port on the switch and the remote port on the neighbor device, the IP address and the MAC address of the neighbor device, as shown in Figure 34.



LLDP Information

Local Port	Remote Port	Neighbor IP	Neighbor MAC
1	1	192.168.1.4	00-72-51-73-12-88

Figure 34: LLDP information

Caution:

LLDP information can be displayed only after LLDP protocol is enabled in both connected devices. This protocol is the link layer discovery protocol and it is enabled by default.

7. ARP

7.1 Introduction

ARP (Address Resolution Protocol) uses address request and response mechanism to resolve the mapping relationship of IP address and MAC address. The switch not only can dynamically learn the IP address-and-MAC address mapping relationships of other hosts that are in the same segment with the switch, but also can configure static ARP entries to specify the fixed mapping relationships of IP and MAC addresses. Dynamic ARP entries need periodic aging to ensure the consistency between entries and the practical applications.

This series switches not only provide layer 2 switching function, but also support ARP function to realize the IP address resolution of other hosts that are in the same segment with switches, achieving intercommunication with the network management system and other management hosts.

7.2 Explanation

ARP entries are divided to dynamic ARP entries and static ARP entries.

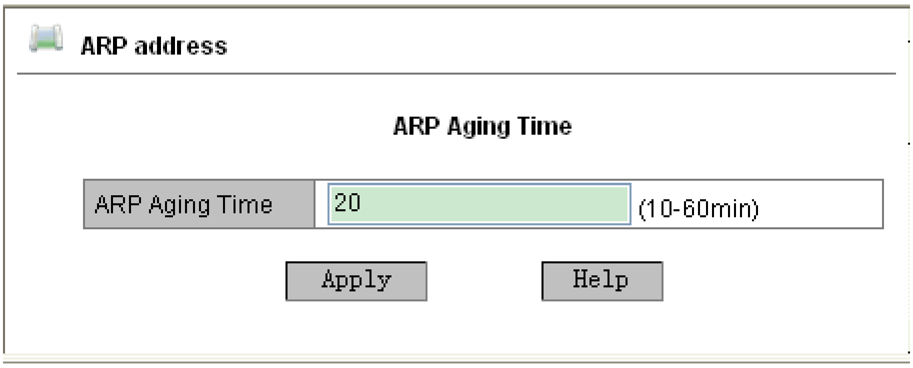
Dynamic entries are automatically generated and maintained by the exchange of ARP messages, and they can be aged and renewed by new ARP messages and covered by static ARP entries.

Static entries are manually configured and maintained, and cannot be aged and covered by dynamic ARP entries.

Max 512 ARP entries are supported, along with max 256 static entries. When the number of ARP entries exceeds 512, the new entry will cover the old dynamic entry.

7.3 Web Configuration

1. Configure ARP aging time, as shown in Figure 35.



ARP Aging Time	20 (10-60min)

Figure 35: Configure aging time

ARP Aging Time

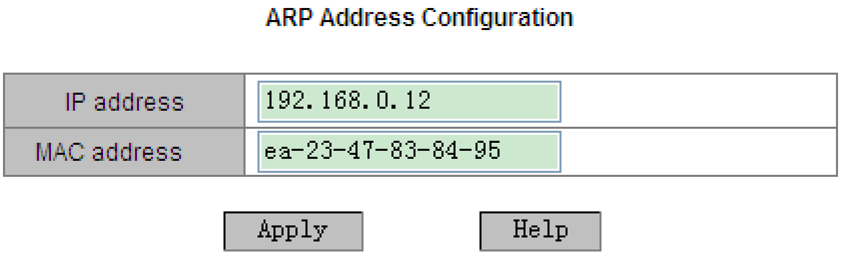
Configuration range: 10~60min

Default: 20min

Function: configure ARP aging time.

Explanation: The ARP aging time begins once a dynamic ARP entry adds into the address table. When the time ends, this dynamic entry will be deleted from the table.

2. Configure static ARP address entry, as shown in Figure 36.



IP address	192.168.0.12
MAC address	ea-23-47-83-84-95

Figure 36: Configure static ARP entry

ARP address

Group configuration: {IP address, MAC address}

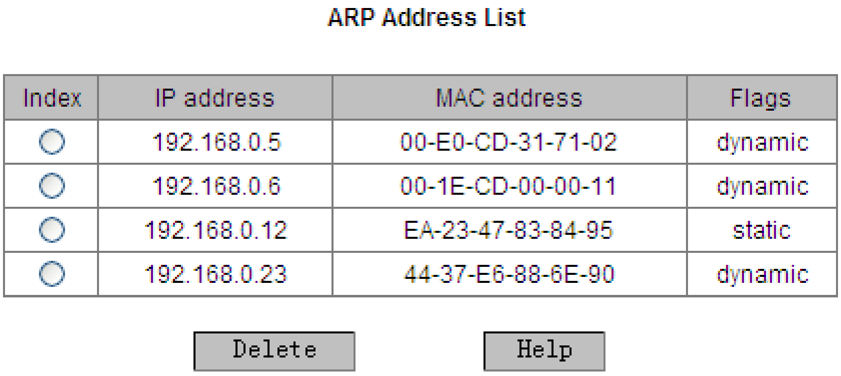
Configuration format: {A.B.C.D, HH-HH-HH-HH-HH-HH} (H is a hexadecimal number)

Function: configure static ARP address resolution entry

Caution:

- ➢ The IP address set in the static ARP entry must be in the same segment with the switch IP address.
- ➢ When the switch IP address is set in the static ARP entry, the system will automatically correspond to the switch MAC address.
- ➢ Generally, switch can automatically learn ARP entries without the need of static entry configuration by the administrator.

3. Show or delete ARP address entry, as shown in Figure 37.



ARP Address List

Index	IP address	MAC address	Flags
○	192.168.0.5	00-E0-CD-31-71-02	dynamic
○	192.168.0.6	00-1E-CD-00-00-11	dynamic
○	192.168.0.12	EA-23-47-83-84-95	static
○	192.168.0.23	44-37-E6-88-6E-90	dynamic

Figure 37: ARP address mapping table

ARP address

Group displaying: {IP address, MAC address, Flags}

Function: show ARP entries, including static and dynamic entries.

Method: Select a static entry and click <Delete> to delete this entry.

Caution:

Dynamic ARP entries cannot be deleted.

8. QoS Configuration

8.1 Introduction

QoS (Quality of Service) is a mechanism that utilizes flow control and resource allocation to offer different services to multi traffics that have different demands on the limited bandwidth in the IP network, according with the transmission features of different traffics as far as possible, reducing network congestion and minimizing the influence of network congestion on the high priority traffics. QoS mainly concerns traffic identification, congestion management and congestion avoidance. They mainly complete the following functions:

Traffic identification: identity objects according to certain matching rules, such as the priority identifier in the message, the remarked priority based on port and VLAN, and so on. Traffic identification is the premise of QoS.

Congestion management: an indispensable measure to solve resource competition. Generally, it is to put messages in queues for caching, and use certain scheduling algorithm to arrange the message forwarding sequence, so as to guarantee the top forwarding priority of key traffics.

Congestion avoidance: excessive congestion will damage network resources. Congestion avoidance supervises the usage of network resources. When it is found that the congestion has aggravated, the messages will be dropped to adjust flow, solving the network overload.

8.2 Principle

Each port of this series switches has 4 caching queues (0, 1, 2, and 3) and the priority gradually increases. When a frame arrives at a port, it will be stored in a queue according to the mapping relationship of the queue and the priority value in the Ethernet header of the frame.

This series switches support three types of queue mapping modes to identify the traffic priority: port, DSCP, and 802.1p.

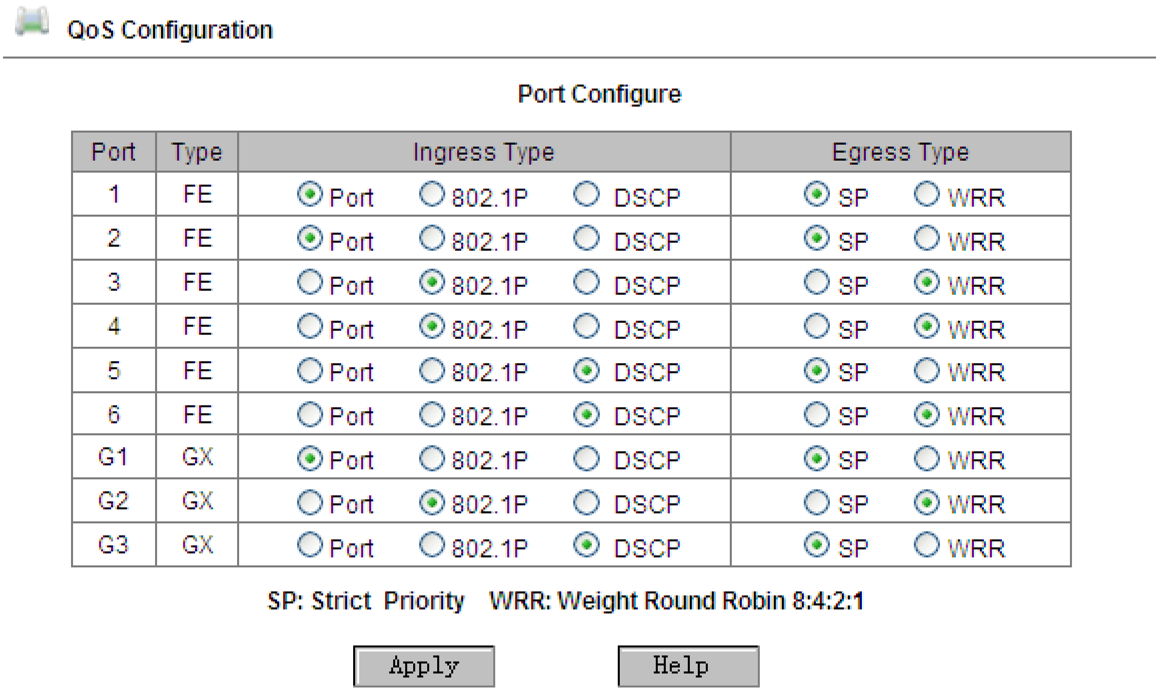
- If the Ingress Type of a port is set to Port, the port default priority determines a queue to save a message. The mapping relationship of port default priority and queue is consistent with that of 802.1p priority and queue.
- DSCP value depends on the ToS/DSCP part of the message. The mapping relationship of this priority and queue can be configured.
- If the message is a tagged message, 802.1p value depends on the priority of 802.1Q Tag in the message. When the message is an untagged message, 802.1p value depends on the port default priority. The mapping relationship of 802.1p priority and queue can be configured.

When ports forward data, the scheduling mode determines how to schedule data in four queues and bandwidth occupied by each queue. This series switches support two types of QoS queue scheduling modes: WRR (Weighted Round Robin) and SP (Strict Priority).

- WRR scheduling mode is to schedule data streams according to the weight ratio. The bandwidth is allocated to each queue according to the weight ratio and mode bandwidth is allocated to the queue with high weight ratio.
- SP mode can strictly guarantee the preferential forwarding of the high priority messages and mainly used for the transmission of sensitive signals. Once a frame adds into the high priority queue, the SP mechanism stops the scheduling of low priority queue and processes the data in the high priority queue. Only when the high priority queue is empty, it starts processing data in the lower priority queue in turn.

8.3 Web Configuration

1. QoS port configuration, as shown in Figure 38.



QoS Configuration

Port Configure

Port	Type	Ingress Type			Egress Type	
1	FE	● Port	○ 802.1P	○ DSCP	● SP	○ WRR
2	FE	● Port	○ 802.1P	○ DSCP	● SP	○ WRR
3	FE	○ Port	● 802.1P	○ DSCP	○ SP	● WRR
4	FE	○ Port	● 802.1P	○ DSCP	○ SP	● WRR
5	FE	○ Port	○ 802.1P	● DSCP	● SP	○ WRR
6	FE	○ Port	○ 802.1P	● DSCP	○ SP	● WRR
G1	GX	● Port	○ 802.1P	○ DSCP	● SP	○ WRR
G2	GX	○ Port	● 802.1P	○ DSCP	○ SP	● WRR
G3	GX	○ Port	○ 802.1P	● DSCP	● SP	○ WRR

SP: Strict Priority WRR: Weight Round Robin 8:4:2:1

Figure 38: QoS Port Configuration

Ingress Type

Configuration options: Port/802.1P/DSCP

Default: 802.1P

Function: configure the port-used priority mechanism.

Explanation: Select only one type of priority mechanism for each port.

Egress Type

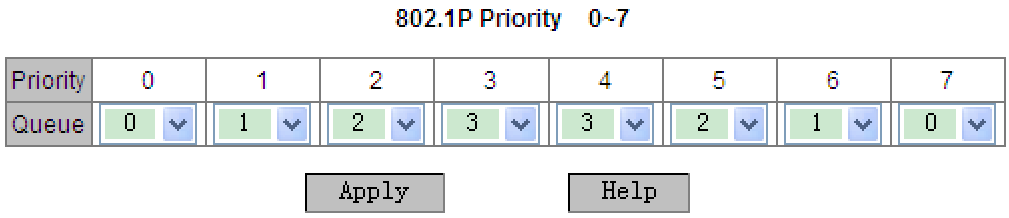
Configuration options: SP/WRR

Default: SP

Function: configure the bandwidth allocation mode for port.

Explanation: SP is to preferentially process the data in the high priority queue; WRR is that different queues have different weight configuration. This series switches adopts the fixed weight ratio: queue 3, 2, 1, 0 correspond to the weight ratio of 8:4:2:1.

2. Configure the mapping relationship of 802.1p priority/port priority to queue, as shown in Figure 39.



802.1P Priority 0~7

Priority	0	1	2	3	4	5	6	7
Queue	0	1	2	3	3	2	1	0

Figure 39: 802.1p priority-queue mapping table

802.1P Priority 0~7

Group configuration: {Priority, Queue}

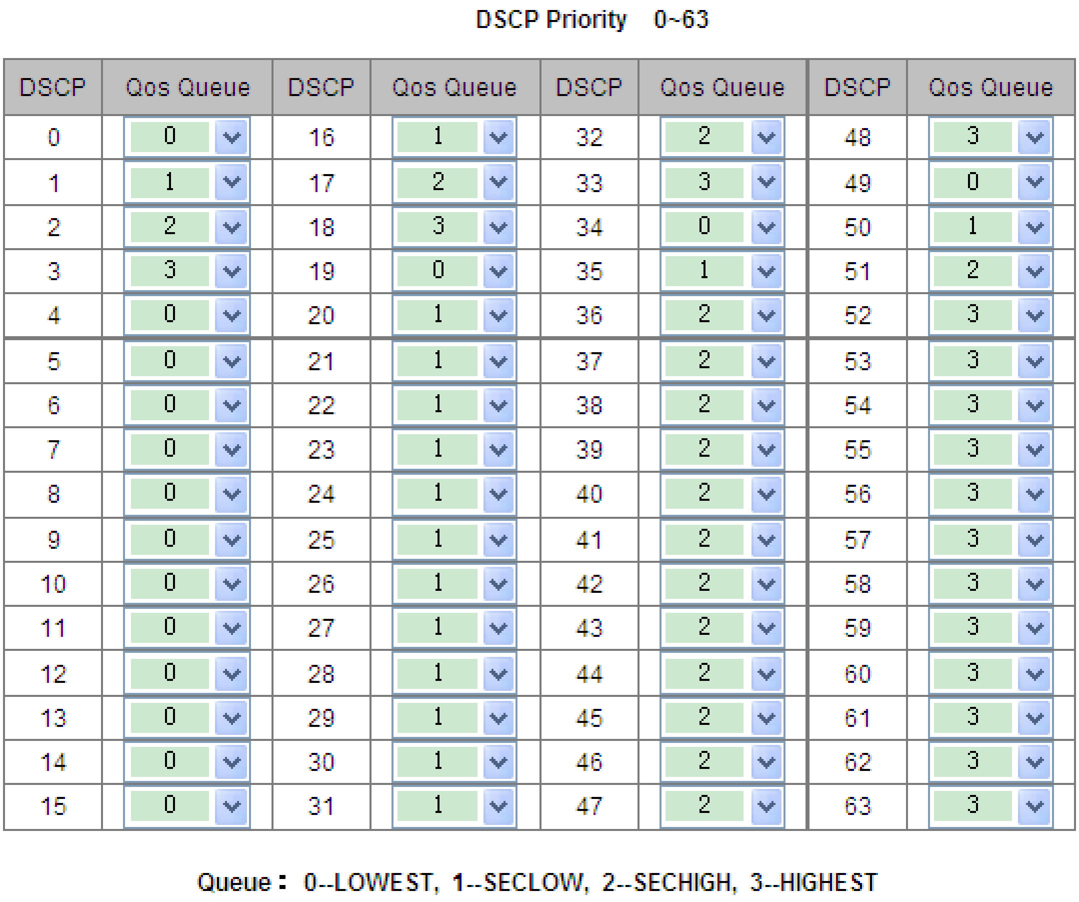
Configuration range: {0~7, 0~3}

Default: priority 0 and 1 map to queue 0; priority 2 and 3 map to queue 1;

priority 4 and 5 map to queue 2; priority 6 and 7 map to queue 3;

Function: Map 802.1P priority/port priority to queue

3. Configure the mapping relationship of DSCP priority to queue, as shown in Figure 40.



DSCP Priority 0~63

DSCP	Qos Queue	DSCP	Qos Queue	DSCP	Qos Queue	DSCP	Qos Queue
0	0	16	1	32	2	48	3
1	1	17	2	33	3	49	0
2	2	18	3	34	0	50	1
3	3	19	0	35	1	51	2
4	0	20	1	36	2	52	3
5	0	21	1	37	2	53	3
6	0	22	1	38	2	54	3
7	0	23	1	39	2	55	3
8	0	24	1	40	2	56	3
9	0	25	1	41	2	57	3
10	0	26	1	42	2	58	3
11	0	27	1	43	2	59	3
12	0	28	1	44	2	60	3
13	0	29	1	45	2	61	3
14	0	30	1	46	2	62	3
15	0	31	1	47	2	63	3

Queue： 0--LOWEST, 1--SECLOW, 2--SECHIGH, 3--HIGHEST

Figure 40: DSCP priority-queue mapping table

DSCP Priority 0~63

Group configuration: {Priority, Queue}

Configuration range: {0~63, 0~3}

Default: priority 0~15 maps to queue 0; priority 16~31 maps to queue 1;
priority 32~47 maps to queue 2; priority 48~63 maps to queue 3;

Function: Map DSCP priority to queue

8.4 Typical Configuration Example

As Figure 41 shows, port 1, 2, 3, 4 forward messages to port 5. Among them, the default priority of port 1 is 6 and the port 1 received messages are mapped to queue 3; the port 2 received messages carry an 802.1P priority of 2 and are mapped to queue 1; the port 3 received messages carry a 802.1P priority of 4 and are mapped to queue 2; the port 4 received messages carry a DSCP priority of 6 and are mapped to queue 3; port 5 adopts WRR bandwidth allocation mode.

Switch configuration steps:

1. Set the ingress type of port 1 to "Port", the ingress type of port 2 and port 3 to "802.1P" and the ingress type of port 4 to DSCP; set the egress type of port 5 to WRR, as shown in Figure 38.
2. Respectively map the 802.1P priority 2 and 4 to queue 1 and 2, as shown in Figure 39.
3. Map the DSCP priority 6 to queue 3, as shown in Figure 40.

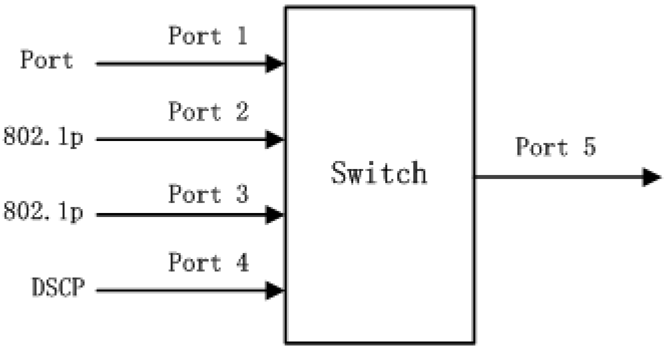


Figure 41: QoS configuration example

The messages from port 1 and port 4 add into the queue 3; the messages from port 2 add into the queue 1; and the messages from port 3 add into the queue 2. Then according to the corresponding relationship between queue and weight ratio, (the weight ratio of queue 1 is 2; the weight ratio of queue 2 is 4; the weight ratio of queue 3 is 8), we learn that the bandwidth ratio allocated to the messages in queue 1 is 2/(2+4+8); the bandwidth ratio allocated to the messages in queue 2 is 4/(2+4+8); the bandwidth ratio allocated to the messages in queue 3 is 8/(2+4+8). Besides, the messages from port 1 and port 4 all enter the queue 3, so they are forwarded based on the rule of "First come, First go", but certainly the total bandwidth ratio allocated to the messages from port 1 and port 4 must be 8/(2+4+8).

9. Port Trunk

9.1 Introduction

Port trunk is to bind a group of physical ports that have the same configuration to a logical port. The member ports in a Trunk group not only can share the flow to, but also can become a dynamic backup of each other to enhance the connection reliability.

9.2 Implementation

As Figure 42 shows, three ports in Switch A aggregate to a Trunk group and the bandwidth of the Trunk group is the total bandwidth of three ports.

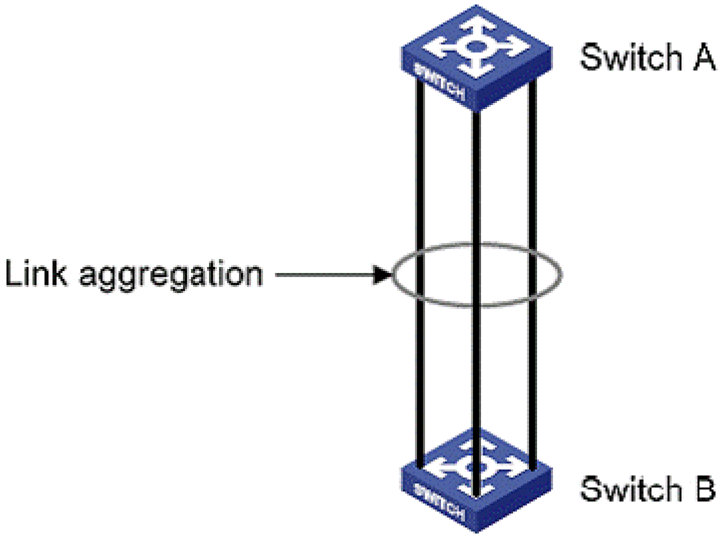


Figure 42: Port Trunk

When Switch A would like to transmit a flow to Switch B via the link aggregation, the trunk group in Switch A will conduct flow allocation algorithm according to the way of flow sharing, then one member port will be selected to transmit the flow according to the algorithm results. If a failed connection occurs in one port in the trunk group, the flow borne by this port will be allocated to other normally connected ports by flow allocation algorithm again.

9.3 Explanation

Port Trunk and the following port operations are mutually exclusive:

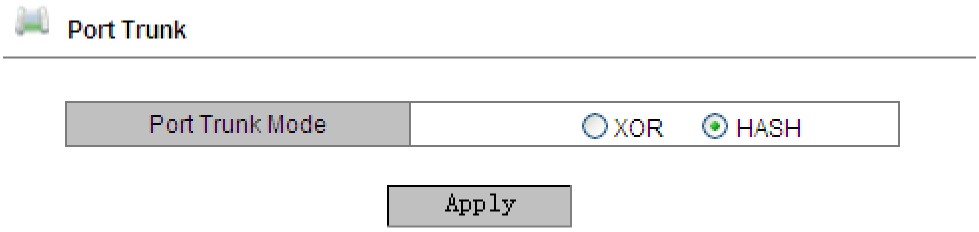
- The mutual exclusion of Port Trunk and port ring protocol. A port joining Trunk group cannot enable a ring protocol or be configured to a ring port, while a ring protocol-enabled port or a ring port cannot join a Trunk group.
- The mutual exclusion of Port Trunk and port multicast protocol. A port joining a Trunk group cannot enable a multicast protocol, while a multicast protocol-enabled port cannot join a Trunk group.
- The mutual exclusion of Port Trunk and port GVRP mode configuration. A port joining a Trunk group cannot enable GVRP mode, while a GVRP mode-enabled port cannot join a Trunk group.
- The mutual exclusion of Port Trunk and port static multicast/unicast configuration. A port joining a Trunk group cannot be added into a static multicast/unicast entry, while a port added into a static multicast/unicast entry cannot join a Trunk group.
- The mutual exclusion of Port Trunk and DHCP Snooping Trust-Port. A port joining Trunk group cannot be set to a Trust-Port, while a Trust-Port cannot join a Trunk group.
- The mutual exclusion of Port Trunk and Port mirroring. A port joining Trunk group cannot be set to a mirror source/destination port, while a mirror source/destination port cannot join a Trunk group.

Caution:

- Gigabit ports of the series switches do not support Port Trunk.
- A port can only join one Trunk group.

9.4 Web Configuration

1. Select the port trunk mode, as shown in Figure 43.



Port Trunk

Port Trunk Mode	○ XOR ● HASH

Figure 43: Port Trunk Mode Setting

Port Trunk Mode

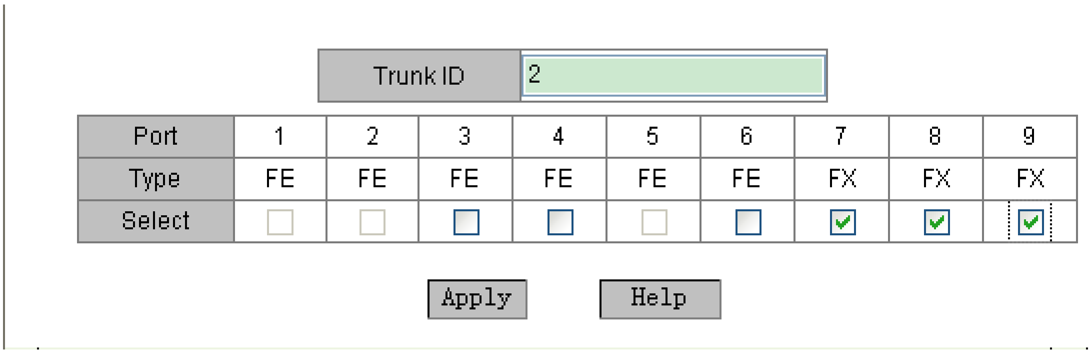
Configuration options: XOR/HASH

Default: HASH

Function: set port trunk mode

Explanation: Port Trunk Mode determines the way of flow sharing of Trunk Group.

2. Set Trunk group, as shown in Figure 44.



Trunk ID	2

Port	1	2	3	4	5	6	7	8	9
Type	FE	FE	FE	FE	FE	FE	FX	FX	FX
Select	☐	☐	☐	☐	☐	☐	☑	☑	☑

Figure 44: Trunk Group Configuration

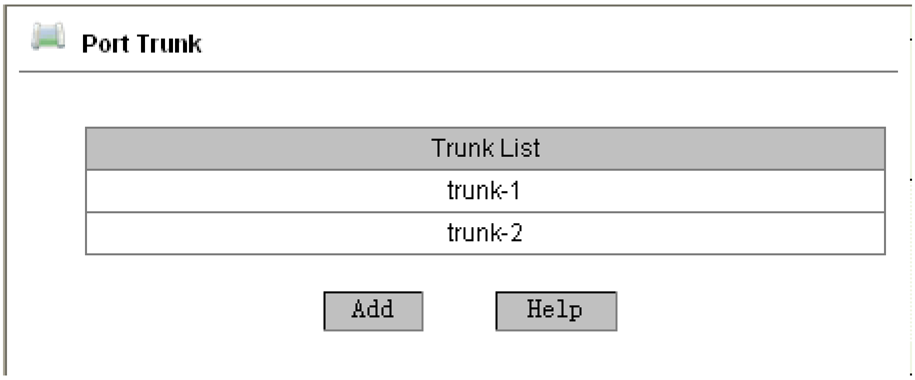
Trunk ID

Configuration range: 1 to 16

Function: Set the Trunk Group ID

Explanation: The series switches support max 16 trunk groups and each trunk group supports max four member ports.

3. Show Trunk group list, as shown in Figure 45.

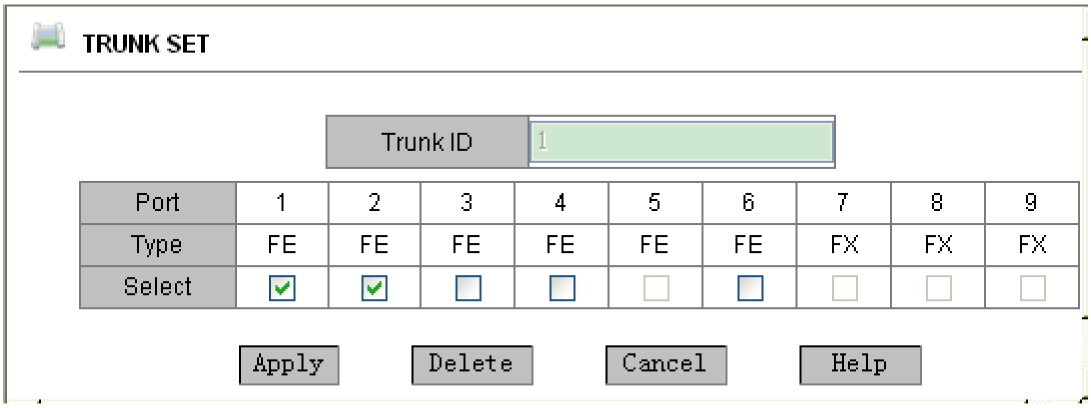


Port Trunk

Trunk List
trunk-1
trunk-2

Figure 45: Trunk Group List

Click a Trunk group in the list shown in Figure 45 to check group members, modify Trunk group configuration and delete Trunk group, as shown in Figure 46.



TRUNK SET

Trunk ID: 1

Port	1	2	3	4	5	6	7	8	9
Type	FE	FE	FE	FE	FE	FE	FX	FX	FX
Select	☑	☑	□	□	□	□	□	□	□

Figure 46: Detailed configuration of Trunk Group

Modify the members of Trunk group (Add new ports or delete the existing ports). Click <Apply> to activate the changes; click <Delete> to delete the Trunk group.

9.5 Typical Configuration Example

As Figure 42 shows, three ports (port 1, 2, 3) of Switch A respectively connect to three ports (port 1, 2, 3) of Switch B to form a Trunk Group 3, so as to realize the flow sharing between the ports.

Switch configuration steps:

1. Create Trunk Group 3 in Switch A and select port 1, 2 and 3 to be group members, as shown in Figure 44.
2. Create Trunk Group 3 in Switch B and select port 1, 2 and 3 to be group

members, as shown in Figure 44.

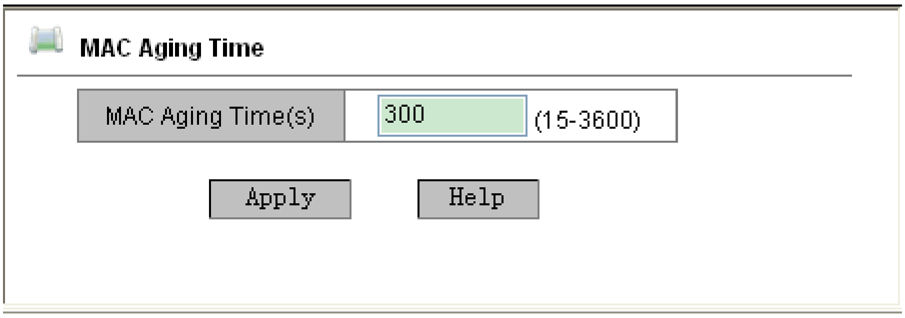
10. MAC Aging Time

10.1 Introduction

Each port of a switch has the function of auto-learning addresses. That is to learn the source address of the port-received frame, including source MAC address and switch port number, and store it in the address table. Aging time starts once the dynamic address adds into the address table. If all switch ports do not receive the frame with this source address within once to twice aging time, the address will be deleted from the dynamic forwarding address table. Static MAC address table is not affected by the aging time.

10.2 Web Configuration

Configure MAC Aging Time, as shown in Figure 47.



MAC Aging Time

MAC Aging Time(s): 300 (15-3600)

Figure 47: MAC Aging Time

MAC Aging Time

Configuration range: 15~3600s

Default: 300s

Explanation: this value must be a multiple of 15. Users can adjust the aging time according to the specific situation to effectively implement the MAC aging function.

11. Port Rate

11.1 Introduction

Port rate configuration is to limit the amount of port-received/transmitted messages and drop the data that is over the limitation. Ingress ports limit the rate of the selected messages, while egress ports limit the rate of all messages.

The rate limitation of five types of messages in ingress ports:

- Unknown Unicast Frame (UUF): the message whose destination MAC address has not been learned or has not been statically added
- Unknown Multicast Frame (UMF): the message whose destination MAC address has not been statically added or has not been learned by IGMP Snooping and GMRP.
- Broadcast Frame (BF): the message with the destination MAC address of FF:FF:FF:FF:FF:FF
- Multicast Frame (MF): the message whose destination MAC address has been statically added or has been learned by IGMP Snooping and GMRP.
- Unicast Frame (UF): the unicast message whose destination MAC address has been learned or been statically added.

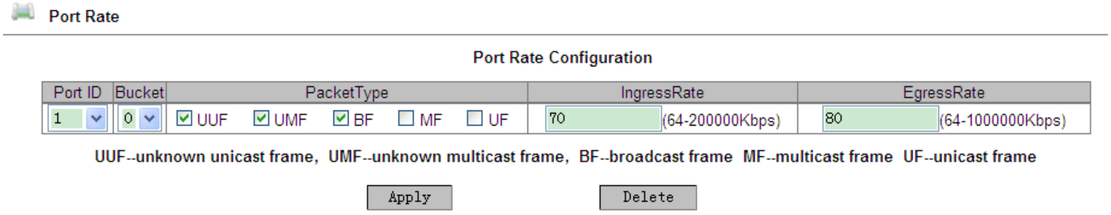
11.2 Implementation

Token bucket can be considered as a container to save a certain number of tokens. The mechanism puts tokens into the bucket at a predetermined rate and the bucket has a specified capacity. If the amount of tokens exceeds the capacity of the bucket, which will overflow, the mechanism will stop accumulating tokens. Each token allows sending a certain number of bits. When a packet is transmitted, a number of tokens that is equivalent to the length of the packet in bits are removed. If there are insufficient tokens in the bucket, the packet may be transmitted until there are sufficient tokens in the bucket or may be dropped.

Port rate configuration uses token buckets to control flow. If port rate is set in a port, the messages in this port will be processed by Token Bucket before forwarding. If there are sufficient tokens, the messages will be transmitted, or else they will be dropped.

11.3 Web Configuration

1. Add port rate configuration, as shown in Figure 48.



Port Rate

Port Rate Configuration

Port ID	Bucket	PacketType	IngressRate	EgressRate
1	0	☑ UUF ☑ UMF ☑ BF ☐ MF ☐ UF	70 (64-200000Kbps)	80 (64-1000000Kbps)

UUF--unknown unicast frame, UMF--unknown multicast frame, BF--broadcast frame MF--multicast frame UF--unicast frame

Figure 48: Port Rate Configuration

Port ID

Configuration options: all switch ports

Bucket

Configuration range: 0~4

Function: Set an index for a token bucket. Each port can set 5 different token buckets.

Packet Type

Configuration options: UUF/UMF/BF/MF/UF

Function: choose the types of packets that need to limit the rate in a token bucket. Multiple types of packets can be chosen at the same time

Ingress Rate

Configuration range: 64~200000Kbps

Function: limit the ingress rate of port-received packets and the packets that exceed the limitation will be dropped

Explanation: The ingress rate of Fast Ethernet port is in the range of

64~100000Kbps

The ingress rate of Gigabit Ethernet port is in the range of 64~200000Kbps

Egress Rate

Configuration range: 64~1000000Kbps

Function: limit the egress rate of port-transmitted packets and the egress rate is shared by 5 token buckets in a port.

Explanation: The egress rate of Fast Ethernet port is in the range of 64~100000Kbps

The egress rate of Gigabit Ethernet port is in the range of 64~1000000Kbps

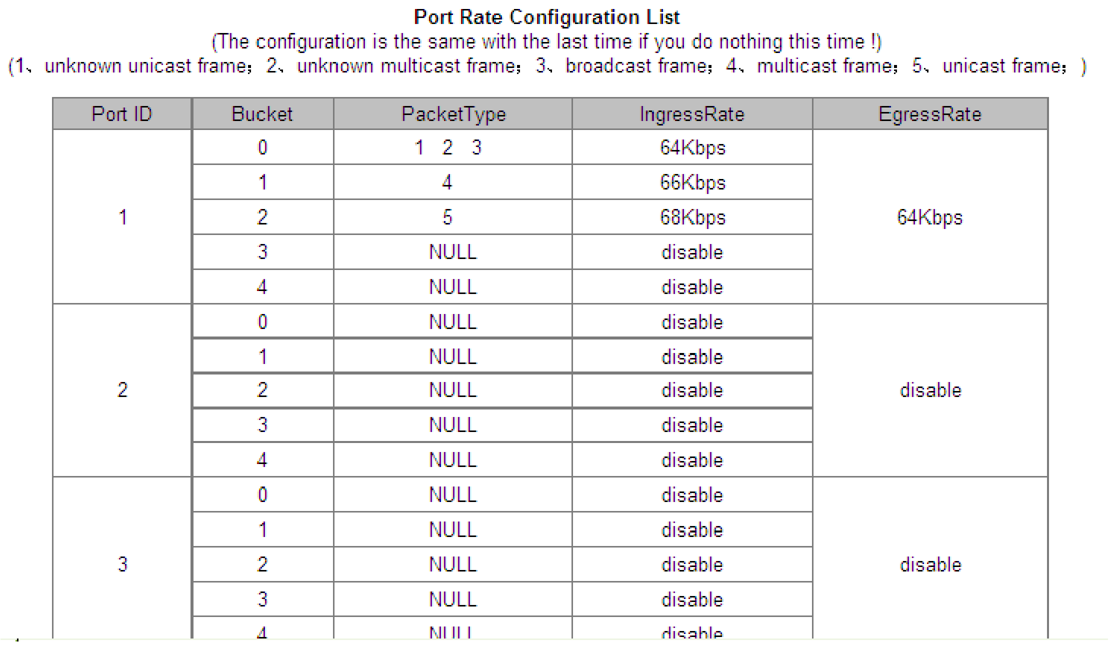
2. Delete port rate configuration.

Select an index of a Token bucket of the selected port shown in Figure 48, and click <Delete> to delete the packet rate limiting configuration of this bucket of the port.

Caution:

Once a packet ingress rate setting is deleted from a token bucket in a port, the port's egress rate setting is deleted as well. If other token buckets of this port need an egress rate, it needs to be reset.

3. Show port rate configuration list, as shown in Figure 49.



Port Rate Configuration List

(The configuration is the same with the last time if you do nothing this time !)

(1、unknown unicast frame; 2、unknown multicast frame; 3、broadcast frame; 4、multicast frame; 5、unicast frame;)

Port ID	Bucket	PacketType	IngressRate	EgressRate
1	0	1 2 3	64Kbps	64Kbps
	1	4	66Kbps	
	2	5	68Kbps	
	3	NULL	disable	
	4	NULL	disable	
2	0	NULL	disable	disable
	1	NULL	disable	
	2	NULL	disable	
	3	NULL	disable	
	4	NULL	disable	
3	0	NULL	disable	disable
	1	NULL	disable	
	2	NULL	disable	
	3	NULL	disable	
	4	NULL	disable	

Figure 49: Port rate configuration list

In the Packet Type, 1 means UUF (Unknown unicast frame), 2 means UMF (Unknown multicast frame, 3 means BF (Broadcast frame), 4 means MF (multicast frame), 5 means UF (Unicast frame).

11.4 Typical Configuration Example

Limit the ingress rate of UUF, UMF and BF in port 1 to 70Kbps and set the egress rate of port 1 to 80Kbps, and they are processed in the Token bucket 0. Configuration steps: select port 1, token bucket 0, and the packet types of UUF, UMF and BF; set the ingress rate to 70Kbps and the egress rate to 80Kbps, as shown in Figure 48.

12. Redundant

12.1 DT-Ring Configuration

12.1.1 Introduction

DT-Ring and DT-Ring+ are Kyland-proprietary redundancy protocols. They enable a network to recover within 50ms when a link fails, ensuring stable and reliable communication.

DT rings fall into two types: port-based (DT-Port-Ring) and VLAN-based (DT-VLAN-Ring).

- DT-Port-Ring: specifies a port to forward or block packets.
- DT-VLAN-Ring: specifies a port to forward or block the packets of a specific VLAN. This allows multiple VLANs on a tangent port, that is, one port is part of different redundant rings based on different VLANs.

DT-Port-Ring and DT-VLAN-Ring cannot be used together.

12.1.2 Concepts

- Master station: One ring has only one master station. The master station forwards DT-Ring packets and detects the current status of the ring.
- Master port: On the master station, the first port whose link status changes to up is called the master port. It is in forwarding state.
- Slave port: On the master station, the port whose link status changes to up later is called the slave port. When the ring is closed, the slave port is in blocking state. When a ring is open due to a link or port failure, the status of the slave port changes to forwarding.
- Slave station: A ring can include multiple slave stations. Slave stations listen to and forward DT-Ring packets and report fault information to the master station.
- Backup port: The port for communication between DT rings is called the

backup port.

- Master backup port: When a ring has two backup ports, the backup port with the larger MAC address is the master backup port. It is in forwarding state.
- Slave backup port: When a ring has two backup ports, the backup port with the smaller MAC address is the slave backup port. It is in blocking state.
- Forwarding state: If a port is in forwarding state, the port can both receive and send data.
- Blocking state: If a port is in blocking state, it can only receive data, but not send data.

12.1.3 Implementation

1. Implementation of DT-Ring

The master port on the master station periodically forwards DT-Ring packets to detect ring status. If the slave port of the master station receives the packets, the ring is closed; otherwise, the ring is open.

When a ring is closed, the master port of the master station is in forwarding state, the slave port in blocking state, and all ring ports of slave stations are in forwarding state.

A ring may be open in the following cases:

- The master port of the master station fails. The statuses of the slave port on the master station and all ring ports of slave stations change to forwarding.
- The slave port of the master station fails. The statuses of the master port on the master station and all ring ports of slave stations change to forwarding.
- Another port or link fails. The statuses of the two ports of the master station and all up ports of slave stations change to forwarding.

DT-Ring configurations should meet the following conditions:

- All switches in the same ring must have the same domain number.
- Each ring can have only one master station and multiple slave stations.
- Only two ports can be configured on each switch for a ring.
- For two connected rings, backup ports can be configured only in one ring.
- A maximum of two backup ports can be configured in one ring.
- On a switch, only one backup port can be configured for one ring.
- DT-Port-Ring and DT-VLAN-Ring cannot be configured on one switch at the same time.

As shown in Figure 50, the working process of Switch A, B, C, and D is as follows:

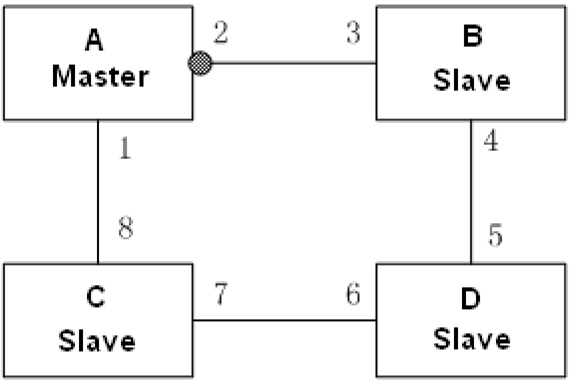


Figure 50 DT-Ring Topology

1. Configure Switch A as the master station and the other switches as salve stations.
2. Port 1, the first port whose link status changes to up on the master station is in forwarding state. Port 2 is in blocking state. The ring ports of the slave station are in forwarding state.
3. When link CD fails, the status of port 2 changes to forwarding, and the statuses of port 6 and port 7 change to blocking, as shown in Figure 51.

Caution:

The change of link status affects the role and status of ring ports.

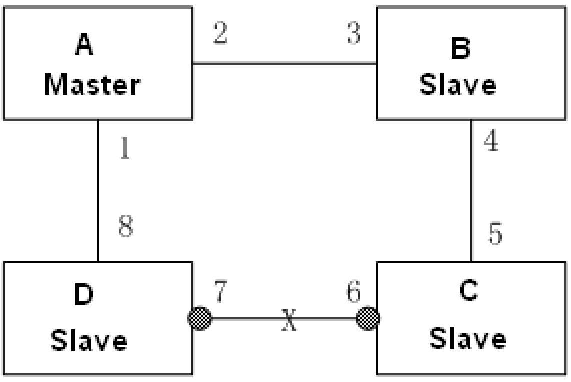


Figure 51 DT-Ring Recovery

2. Implementation of DT-Ring+

DT-Ring+ can provide backup for two DT rings, as shown in Figure 52. One backup port is configured respectively on Switch C and Switch D. Which port is the master backup port depends on the MAC addresses of the two ports. If the master backup port or its link fails, the slave backup port will forward packets, preventing loops and ensuring normal communication between redundant rings.

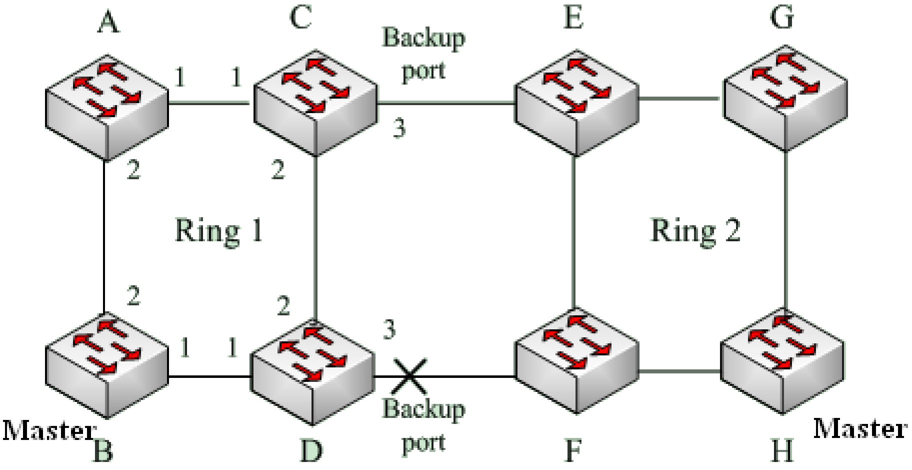


Figure 52 DT-Ring+ Topology

Caution:

The change of link status affects the status of backup ports.

3. Implementation of DT-VLAN-Ring

DT-VLAN-Ring allows the packets of different VLANs to be forwarded in different paths. Each forwarding path for a VLAN forms a DT-VLAN-Ring. Different DT-VLAN-Rings can have different master stations. As shown in Figure 53, two DT-VLAN-Rings are configured.

Ring links of DT-VLAN-Ring10: AB-BC-CD-DE-EA.

Ring links of DT-VLAN-Ring20: FB-BC-CD-DE-EF.

The two rings are tangent at link BC, CD, and DE. Switch C and Switch D share the same ports in the two rings, but use different logical links based on VLAN.

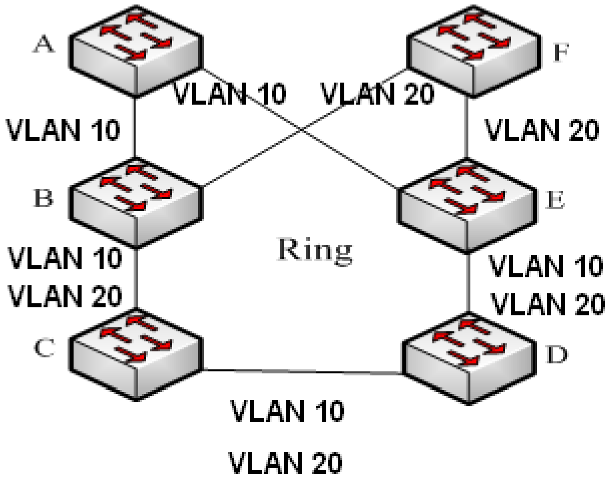
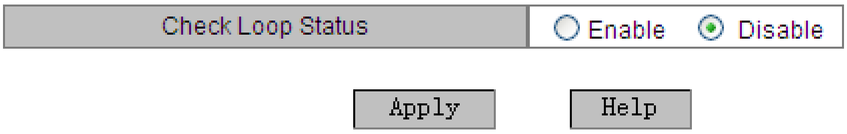


Figure 53 DT-VLAN-Ring

12.1.4 Web Configuration

1. Configure ring status detection, as shown in Figure 54.



Check Loop Status	○ Enable ● Disable

Figure 54 Configuring Ring Status Detection

Check Loop Status

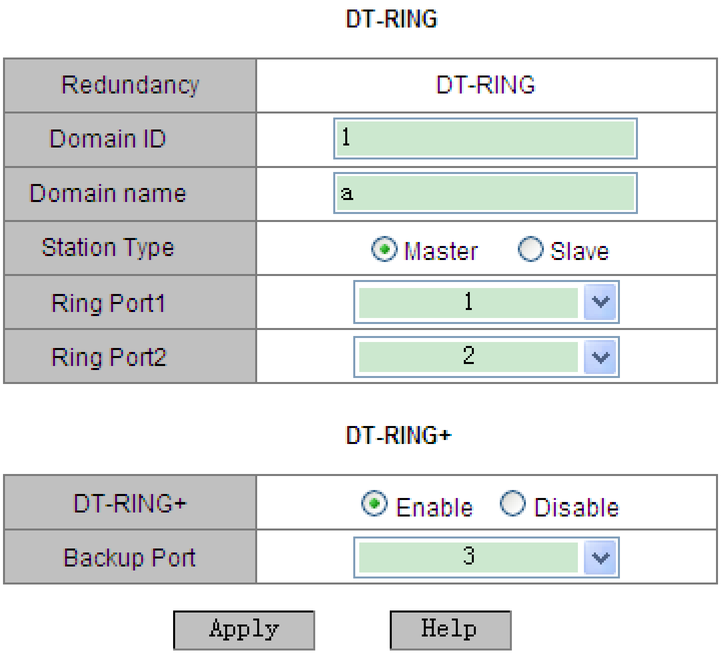
Options: Enable/Disable

Default: Disable

Function: Enable or disable ring status detection.

Description: After ring status detection is enabled, the switch automatically detects ring status. When a non-ring port receives DT-Ring packets, the port will be locked. Therefore, use the function with caution.

2. Create and configure a DT ring, as shown in Figure 55.



DT-RING

Redundancy	DT-RING
Domain ID	1
Domain name	a
Station Type	● Master ○ Slave
Ring Port1	1
Ring Port2	2

DT-RING+

DT-RING+	● Enable ○ Disable
Backup Port	3

Figure 55 DT-Ring Configuration

Redundancy

Forcible configuration: DT-RING

Domain ID

Range: 1~32

Function: Differentiate rings. A maximum of 16 port-based rings or 8 VLAN-based rings can be configured on one switch.

Domain name

Range: 1-31 characters

Function: Configure the domain name.

Station Type

Options: Master/Slave

Default: Master

Function: Select the role of the switch in the current ring.

Ring Port1/Ring Port2

Options: All ports of the switch

Function: Select two ring ports.

Caution:

Port trunk and ring are mutually exclusive. The ports added to a trunk group cannot be configured as a ring port, and a ring port cannot be added to a trunk group.

DT-Ring+

Options: Enable/Disable

Default: Disable

Function: Enable or disable the DT-Ring+ function.

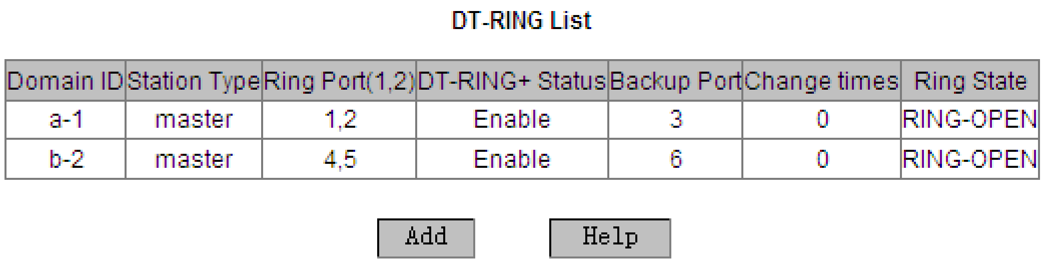
Backup Port

Options: All ports of the switch

Function: Select one port as the backup port.

Description: You can configure a backup port only after the DT-Ring+ function is enabled.

After the configurations are completed, created rings are listed in the DT-RING List, as shown in Figure 56.



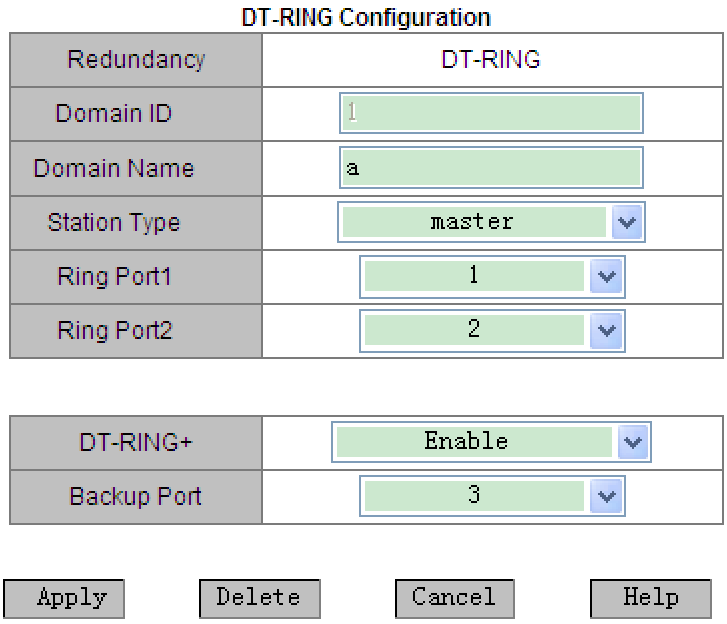
DT-RING List

Domain ID	Station Type	Ring Port(1,2)	DT-RING+ Status	Backup Port	Change times	Ring State
a-1	master	1,2	Enable	3	0	RING-OPEN
b-2	master	4,5	Enable	6	0	RING-OPEN

Figure 56 DT-Ring List

3. View and modify DT-Ring configuration.

Click the DT-Ring options in Figure 56. You can view and modify the configurations of the ring, as shown in Figure 57.



DT-RING Configuration

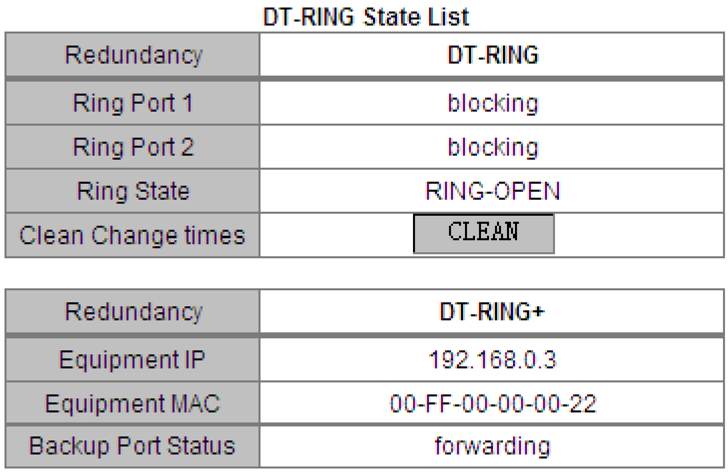
Redundancy	DT-RING
Domain ID	1
Domain Name	a
Station Type	master
Ring Port1	1
Ring Port2	2

DT-RING+	Enable
Backup Port	3

Figure 57 Viewing and Modifying DT-Ring Configuration

After modification is completed, click <Apply> to make the modification take effect. You can delete the DT-Ring configuration entry by clicking <Delete>.

4. View the status of DT-Ring and ports, as shown in Figure 58.



DT-RING State List

Redundancy	DT-RING
Ring Port 1	blocking
Ring Port 2	blocking
Ring State	RING-OPEN
Clean Change times	CLEAN

Redundancy	DT-RING+
Equipment IP	192.168.0.3
Equipment MAC	00-FF-00-00-00-22
Backup Port Status	forwarding

Figure 58 Viewing DT-Ring Status

12.1.5 Typical Configuration Example

As shown in Figure 52, Switch A, B, C, and D form Ring 1; Switch E, F, G, and H form Ring 2; CE and DF are the backup links of Ring 1 and Ring 2.

Configuration on Switch A:

1. Domain ID: 1; Domain name: Ring; Station Type: Slave; Ring Port 1 and 2; DT-Ring+: Disable; Backup Port: none, as shown in Figure 55.

Configuration on Switch B:

2. Domain ID: 1; Domain name: Ring; Station Type: Master; Ring Port 1 and 2; DT-Ring+: Disable; Backup Port: none, as shown in Figure 55.

Configuration on Switch C and Switch D:

3. Domain ID: 1; Domain name: Ring; Station Type: Slave; Ring Port 1 and 2; DT-Ring+: Enable; Backup Port: 3, as shown in Figure 55.

Configuration on Switch E and Switch F:

4. Domain ID: 2; Domain name: Ring; Station Type: Slave; Ring Port 1 and 2; DT-Ring+: Enable; Backup Port: 3, as shown in Figure 55.

Configuration on Switch G:

5. Domain ID: 2; Domain name: Ring; Station Type: Slave; Ring Port 1 and 2; DT-Ring+: Disable; Backup Port: none, as shown in Figure 55.

Configuration on Switch H:

6. Domain ID: 2; Domain name: Ring; Station Type: Master; Ring Port 1 and 2; DT-Ring+: Disable; Backup Port: none, as shown in Figure 55.

12.2 RSTP/STP Configuration

12.2.1 Introduction

STP (Spanning Tree Protocol) is based on IEEE802.1D standard and is a protocol of providing link backup to avoid loop and broadcast storm in LAN. The STP-enabled device selectively blocks some ports by mutual information exchange to prune the ring network to loop-free tree network, so as to avoid packet storm in the network. The disadvantage of STP is that it does not support rapid port state transition and ports must wait for twice Forward delay time before transiting to a forwarding state.

In order to solve this disadvantage, IEEE802.1w standard was launched as the supplement of 802.1D standard and defined RSTP (Rapid Spanning Tree Protocol). RSTP protocol made the following improvements based on STP protocol to improve the convergence rate: set an Alternate port for the root port and set a Backup port for the designated port; when the root port/designated port is out of running, its Alternate port/Backup port will enter forwarding state without delay.

12.2.2 Basic Concepts

- Root bridge: it works like a tree root in the tree network. There is one and only one root bridge in the entire network. The root bridge changes with the network topology and is not fixed. Root bridge periodically sends out configuration BPDU, and other devices forward this configuration BPDU to guarantee the topology stability.
- Root port: the optimum port for the data transmission from a non-root bridge to the root bridge, along with smallest path cost. It is responsible for the communication with the root bridge. There is only one root port on a non-root bridge and there is not root port on the root bridge.
- Designated bridge: a device that is in charge of forwarding configuration BPDU to other devices/LANs
- Designated port: a port on the designated bridge and it is responsible for forwarding configuration BPDU to other device or LAN. All ports in the root bridge are designated ports.
- Alternate port: the backup port of the root port. When the root port breaks down, the alternate port will become the new root port
- Backup port: the backup port of the designated port. When the designated port breaks down, the backup port will rapidly become the new designated

port and forward data without delay.

12.2.3 Configuration BPDU

In order to avoid loops in network, all bridges on LAN calculate a spanning tree together. They confirm the network topology by delivering BPDU messages between them, as shown in Table 5.

Table 5: BPDU Data

…	Root bridge ID	Root path cost	Designated bridge ID	Designated port ID	Message age	Max age	Hello time	Forward delay	…
…	8 bytes	4 bytes	8 bytes	2 bytes	2 bytes	2 bytes	2 bytes	2 bytes	…

Root bridge ID: 2 bytes of root bridge priority plus 6 bytes of root bridge MAC address

Root path cost: the cost of the shortest path to the root bridge

Designated bridge ID: 2 bytes of designated bridge priority plus 6 bytes of designated bridge MAC address

Designated port ID: port priority plus port number

Message age: age of the configuration BPDU while it propagates in the network

Max age: the maximum age of configuration BPDU maintained in the device. When Message Age > Max age, drop the BPDU

Hello time: the time interval of sending BPDU

Forward delay: the state transition delay (discarding→learning→forwarding)

12.2.4 Implementation

The specific process of spanning tree calculation by using BPDU message:

1. Initial state: each device port generates a BPDU with itself as the root bridge. Root bridge ID is the device ID, root path cost is 0, designated bridge ID is the device ID, and designated port is the local port
2. Select the optimum configuration BPDU. Each device sends out its

configuration BPDUs, meanwhile it also receives configuration BPDUs from other devices. Once receiving a configuration BPDU, each port will compare it with its own configuration BPDU.

- If the priority of the configuration BPDU generated by the local port is higher than its received configuration BPDU, the device does not perform any processing.
- If the priority of the configuration BPDU generated by the local port is lower than its received configuration BPDU, the device will replace the content of configuration BPDU generated by the local port with the content of the received configuration BPDU.

Device elects the optimum configuration BPDU after comparing the configuration BPDUs of all ports. The principles of BPDU comparison:

- The configuration BPDU with the smallest root bridge ID has the highest priority
- If the root bridge IDs are the same, compare the root path cost. The comparison method: the root path cost of the configuration BPDU plus the corresponding path cost of the port. The configuration BPDU with a smaller value has a higher priority.
- If the root path costs are the same, compare designated bridge ID, designated port ID, the ID of port that receives this configuration BPDU in turn. The configuration BPDU with a smaller value has a higher priority.

3. Select a root bridge. The root bridge of a spanning tree is the one with the smallest bridge ID.
4. Select root ports. The port that can receive the optimum configuration BPDU on the non-root bridge device is the root port.
5. Calculate a configuration BPDU of the designated port. According to the configuration BPDU and the path cost of the root port, the configuration BPDU of the designated port is calculated for each port

- Root bridge ID is replaced by that of the configuration BPDU of the root port

- ➢ Root path cost is replaced by that of the configuration BPDU of the root port plus the corresponding path cost of the root port
- ➢ Designated bridge ID is replaced by the device ID
- ➢ Designated port ID is replaced by the port ID

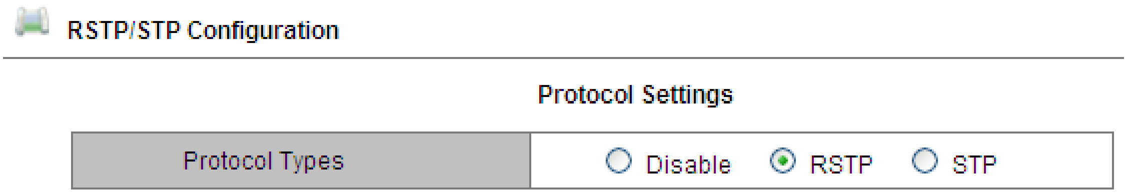
6. Select designated port

If the calculated configuration BPDU is superior, the device will elect this port to the designated port and the configuration BPDU of the designated port will be replaced by the calculated configuration BPDU that will be forwarded.

If the configuration BPDU of the port is superior, device won't renew the configuration BPDU of the port and block this port, so the port will only receive data, and no forward data.

12.2.5 Web Configuration

1. Enable global STP/RSTP protocol, as shown in Figure 59.



RSTP/STP Configuration

Protocol Settings

Protocol Types	○ Disable ● RSTP ○ STP

Figure 59: Enable RSTP/STP Protocol

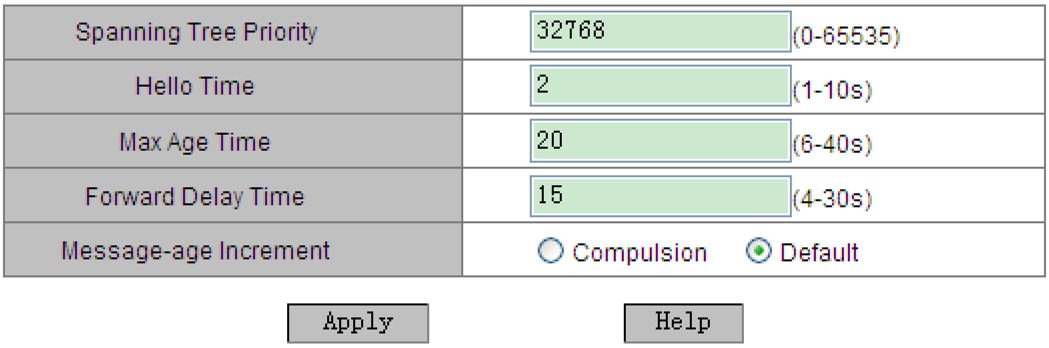
Protocol Types

Configuration options: Disable/RSTP/STP

Default: Disable

Function: enable/disable spanning tree protocol (RSTP or STP)

2. Configure the bridge BPDU, as shown in Figure 60.



Spanning Tree Priority	32768 (0-65535)
Hello Time	2 (1-10s)
Max Age Time	20 (6-40s)
Forward Delay Time	15 (4-30s)
Message-age Increment	○ Compulsion ● Default

Figure 60: Configure bridge BPDU

Spanning Tree Priority

Configuration range: 0~65535 with the step length of 4096

Default: 32768

Function: configure bridge priority

Explanation: the bridge priority is used to elect the root bridge. The smaller the value is, the higher the priority is.

Hello Time

Configuration range: 1~10s

Default: 2s

Function: set the time interval of sending configuration BPDU

Max Age Time

Configuration range: 6~40s

Default: 20s

Explanation: when the message age of BPDU is longer than the max age time, drop this BPDU.

Forward Delay Time

Configuration range: 4~30s

Default: 15s

Function: the time of state transition (Discarding--Learning---Forwarding)

Message-age Increment

Configuration options: Compulsion/Default

Default: Default

Function: set how to modify the message age when a BPDU passes through a bridge.

Explanation: On Compulsion mode, the message age plus one

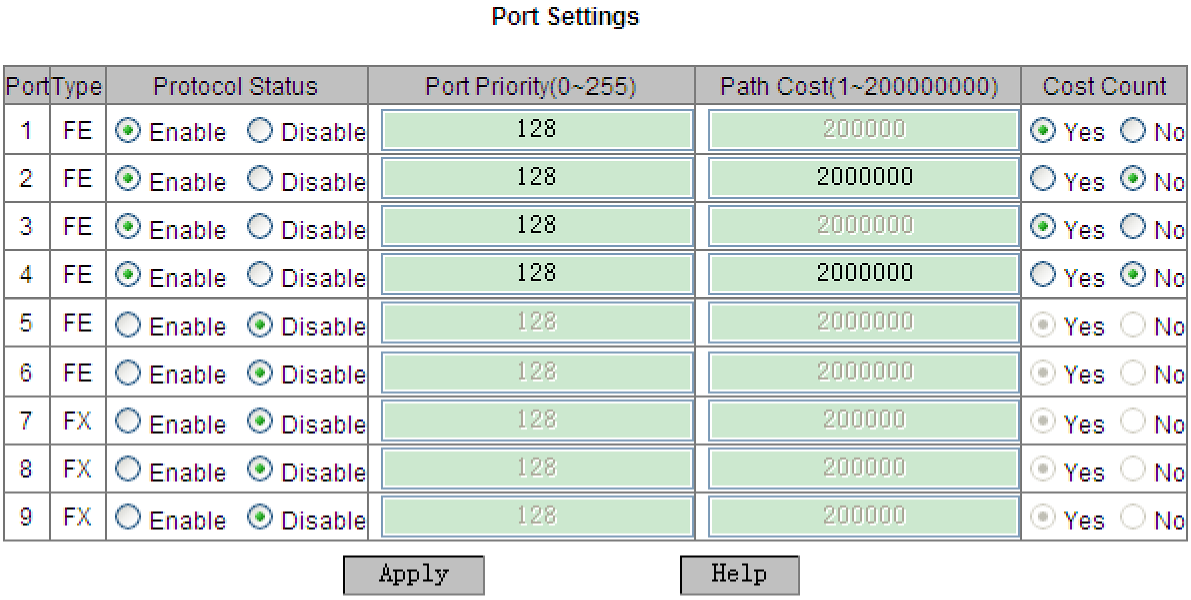
On Default mode, the message age plus max (max age time/16, 1)

Forward Delay Time, Max Age Time and Hello Time should accord to the following relationship:

2 x (Forward Delay Time—1.0 seconds) >= Max Age Time >= 2 x (Hello Time +

1.0 seconds).

3. Configure the RSTP protocol-enabled port, as shown in Figure 61.



Port Settings

Port	Type	Protocol Status	Port Priority(0~255)	Path Cost(1~200000000)	Cost Count
1	FE	● Enable ○ Disable	128	200000	● Yes ○ No
2	FE	● Enable ○ Disable	128	2000000	○ Yes ● No
3	FE	● Enable ○ Disable	128	2000000	● Yes ○ No
4	FE	● Enable ○ Disable	128	2000000	○ Yes ● No
5	FE	○ Enable ● Disable	128	2000000	● Yes ○ No
6	FE	○ Enable ● Disable	128	2000000	● Yes ○ No
7	FX	○ Enable ● Disable	128	200000	● Yes ○ No
8	FX	○ Enable ● Disable	128	200000	● Yes ○ No
9	FX	○ Enable ● Disable	128	200000	● Yes ○ No

Figure 61: Configure the RSTP protocol-enabled port

Protocol Status

Configuration options: Enable/Disable

Default: Disable

Function: Enable/Disable the spanning tree protocol in port

Caution:

- Port mirroring and Port ring protocol are mutually exclusive. The mirroring source/destination port cannot enable ring protocol, while the ring protocol-enabled port cannot be set to the mirroring source/destination port.
- Port Trunk and Port ring protocol are mutually exclusive. The port joining Trunk group cannot enable ring protocol, while the ring protocol-enabled port cannot join Trunk group.

Port Priority

Configuration range: 0~255 with the step length of 16

Default: 128

Function: Set the port priority to determine the port role

Path Cost

Configuration range: 1~200000000

Default: 2000000 (10M port), 200000 (100M port), 20000 (1000M port)

Explanation: port path cost is used to calculate the optimum path. This value is subject to the bandwidth. The more bandwidth, the lower the cost is. The transmission path from the local device to the root bridge can be changed by changing the port path cost, so as to change the port role. If users would like to change this value by themselves, please choose "No" in Cost Count.

Cost Count

Configuration range: Yes/No

Default: Yes

Explanation: if choose Yes, the port path cost adopts the default value; if choose No, users can configure the port path cost by themselves.

12.2.6 Typical Configuration Example

The priorities of Switch A, B C are 0, 4096, 8192 respectively, and the path costs of three links are 4, 5 and 10 respectively, as shown in Figure 62.

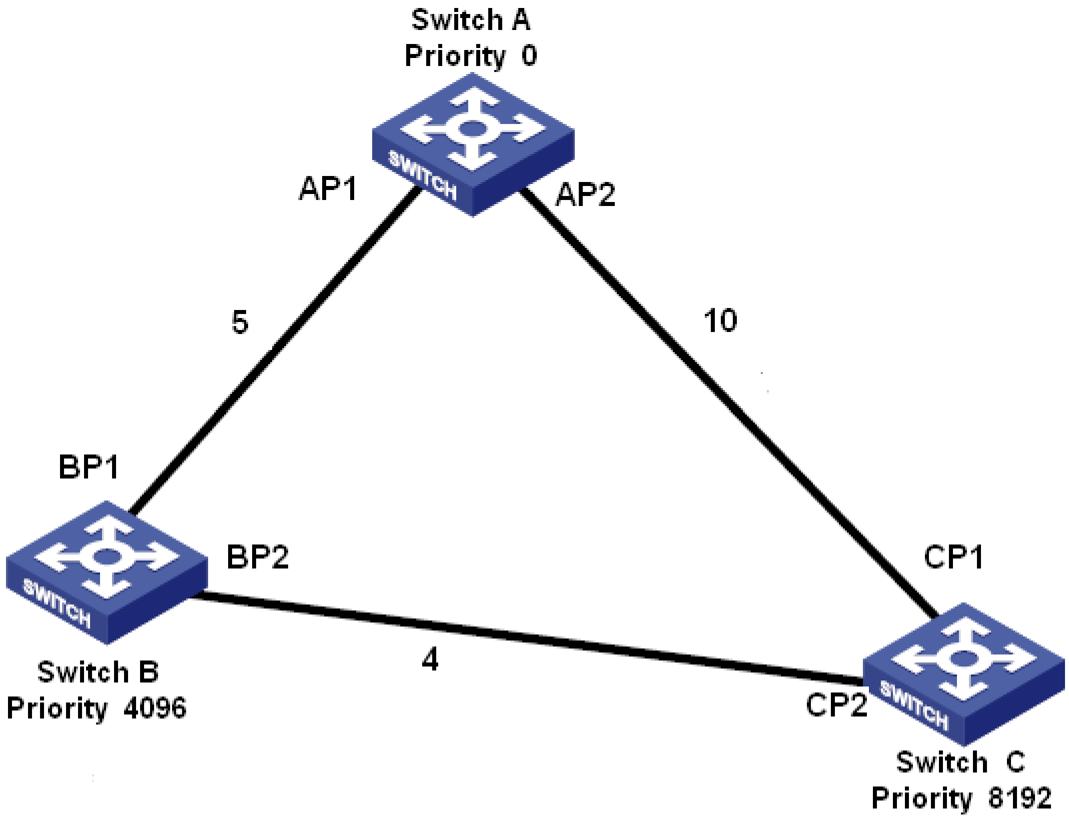


Figure 62: RSTP Example

Switch A Configuration:

1. Set the priority to 0 and the time parameters to the defaults, as shown in Figure 60.
2. Set the path cost of port 1 to 5, and the path cost of port 2 to 10, as shown in Figure 61.

Switch B Configuration:

1. Set the priority to 4096 and the time parameters to the defaults, as shown in Figure 60.
2. Set the path cost of port 1 to 5, and the path cost of port 2 to 4, as shown in Figure 61.

Switch C Configuration:

1. Set the priority to 8192 and the time parameters to the defaults, as shown in Figure 60.
2. Set the path cost of port 1 to 10, and the path cost of port 2 to 4, as shown

in Figure 61.

- The priority of Switch A is 0 and has the smallest bridge ID, so it is elected to the root bridge
- The path cost from AP1 to BP1 is 5, and the path cost from AP2 to BP2 is 14, so the BP1 is elected to the root port
- The path cost from AP1 to CP2 is 9, and the path cost from AP2 to CP1 is 10, so the CP2 is elected to the root port and BP2 is the designated port.

12.3 RSTP/STP Transparent Transmission

12.3.1 Introduction

RSTP protocol is compliant with IEEE standard and DRP/DT-Ring is the private redundant protection protocol of Kyland, but RSTP protocol and DRP/DT-Ring cannot coexist. In order to solve this problem, Kyland develops a RSTP/STP transparent transmission function that can retain other redundant protocols on the switch, meanwhile, transparently transmit RSTP protocol messages, meeting the industrial communication requirements.

When switches that run other redundant protocols enable RSTP transparent transmission function on their ports, they can receive and forward RSTP protocol messages. The RSTP transparent transmission function-enabled switches can be regarded as a transparent link.

In Figure 63, Switch A, B, C and D form a DRP ring network. After enabling port transparent transmission function in Switch A and B ports, Switch E and F can receive RSTP protocol messages from each other, detect loops and calculate spanning trees.

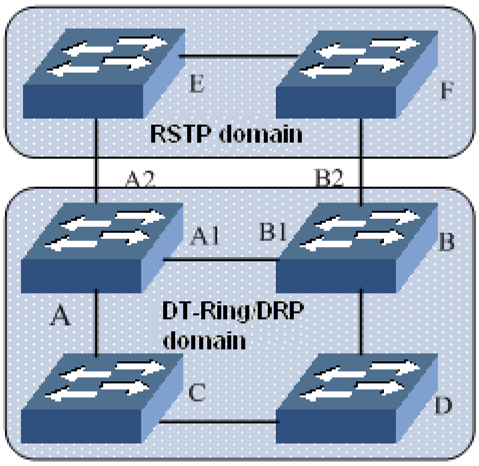
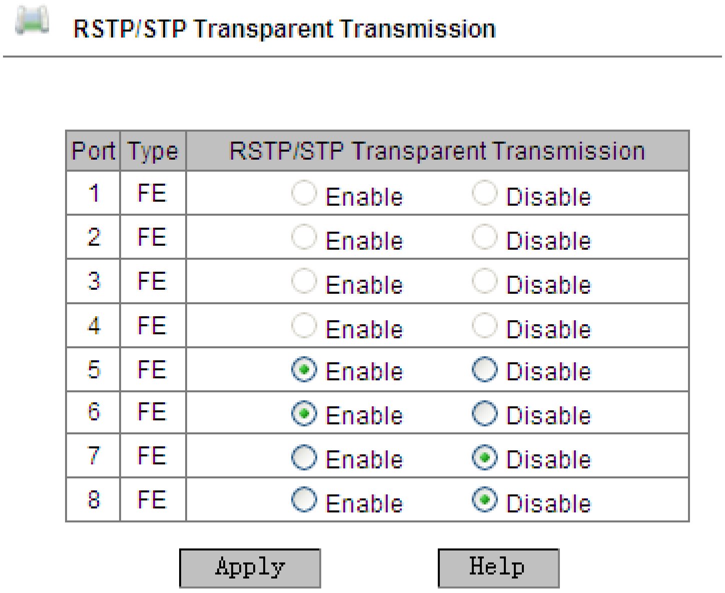


Figure 63: RSTP Transparent Transmission Application

12.3.2 Web Configuration

Configure the RSTP transparent transmission function on port, as shown in Figure 64.



RSTP/STP Transparent Transmission

Port	Type	RSTP/STP Transparent Transmission
1	FE	○ Enable ○ Disable
2	FE	○ Enable ○ Disable
3	FE	○ Enable ○ Disable
4	FE	○ Enable ○ Disable
5	FE	● Enable ○ Disable
6	FE	● Enable ○ Disable
7	FE	○ Enable ● Disable
8	FE	○ Enable ● Disable

Figure 64: RSTP Transparent Transmission Configuration

RSTP/STP Transparent Transmission

Configuration options: Enable/Disable

Default: Disable

Function: Enable RSTP transparent transmission function on port

Caution:

The RSTP protocol-enabled port cannot enable RSTP transparent transmission function.

12.3.3 Typical Configuration Example

As Figure 63 shows, Switch A, B, C and D form a DRP ring; Switch E and F forms a RSTP ring, in which Switch A and B form a transparent transmission link to transmit the RTSP protocol messages sent from Switch E or F.

- Switch A, B, C and D form a DRP redundant ring, and the configuration steps are introduced in the "DRP Configuration"
- Enable RSTP protocol in the corresponding ports in Switch E and F (See Figure 59 and Figure 61)
- Enable RSTP transparent transmission function in the A1, A2, B1, B2 ports in Switch A and B (See Figure 64)

12.4 DRP

12.4.1 Introduction

DRP is an IEC62439-6 standard compliant redundant ring protocol and Kyland has its proprietary intellectual property rights. It adopts distributed ring network protection solution. When link fails, the network can be rapidly recovered within 20ms to guarantee stable and reliable communication.

One switch can set multiple DRP rings.

12.4.2 Concepts

- INIT: the initial state of the switch
- Root: there is one and only one Root in the ring network. Root is elected by switches in the network after auto-learning. It changes with the network

topology and is not fixed. Root periodically sends out an Announce message and other devices forward this message to guarantee the topology stability.

- B-Root: The switch in which a ring port is Link-down, or a ring port deteriorates (it means the number of CRC messages exceeds the threshold)
- Normal: Except Root and B-Root, the rest are Normal switches in a normal communication ring network
- Backup port: the communication ports between DRP rings. Two or more than two backup ports can be configured. All backup ports must be in a same DRP ring. The backup port that links up first is the master backup port and is in Forward state, and other backup ports are slave backup ports and are in Block State.

12.4.3 Implementation

DRP protocol determines switch roles by forwarding Announce messages to guarantee a loop-free redundant network.

DRP configuration should meet the following conditions:

- All switches in a ring must have a same domain ID
- There is one and only one Root in a ring, but allows multiple B-Roots or Normals.
- There are only two ring ports in each switch in a ring
- For two connected rings, backup ports can only be set in one ring
- A ring allows multiple backup ports
- Each switch in a ring can only set one backup port

Figure 65 shows the working process of Switch A, B, C, D.

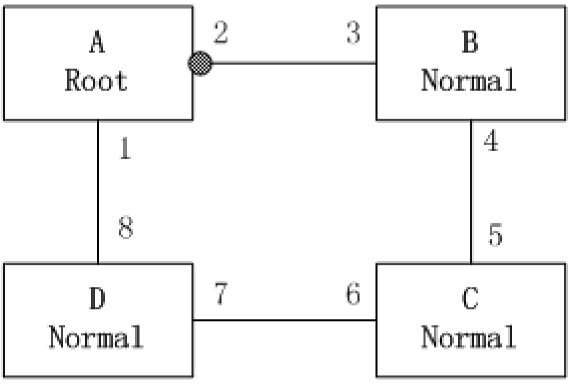


Figure 65: DRP Topology

1. In the initial state, all switch are in INIT state
2. In the ring network, switches compare the Announce message forwarded between them, and then elect Switch A to be Root due to its optimum configuration. The ring port 1 in Root that links up fist is the Forwarding port, while the ring port 2 is blocked. Other switches are B-Root or Normal. The two ring ports in B-Root/Normal are both in Forward state.
3. When the link CD (connected Switch C and D) fails, as shown in Figure 66, Switch A will change from Root to Normal right away and all devices re-elect Root. At this moment, Switch C or D will be elected to the new Root. If D is Root, C will be B-Root and port 6 and 7 are blocked.

Caution:

The change in link state affects the status of all ring ports.

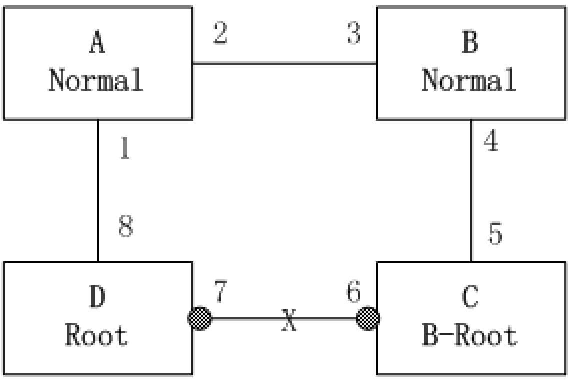


Figure 66: DRP recovery

DRP protocol can provide backup between two DRP rings. As Figure 67 shows, each switch can configure a backup port. The master backup port is the forwarding port, and the other backup ports are blocked. If the master backup port/link fails, the system will select a slave backup port to forward data, guaranteeing the normal communication between redundant rings.

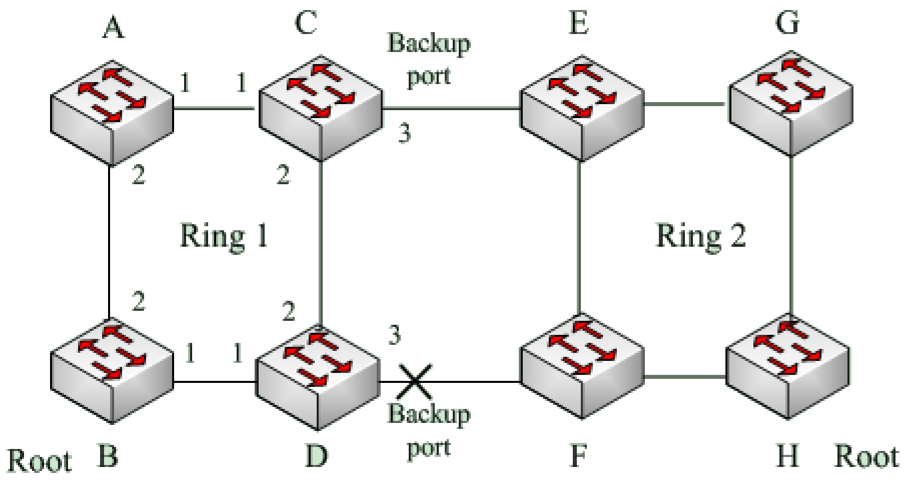


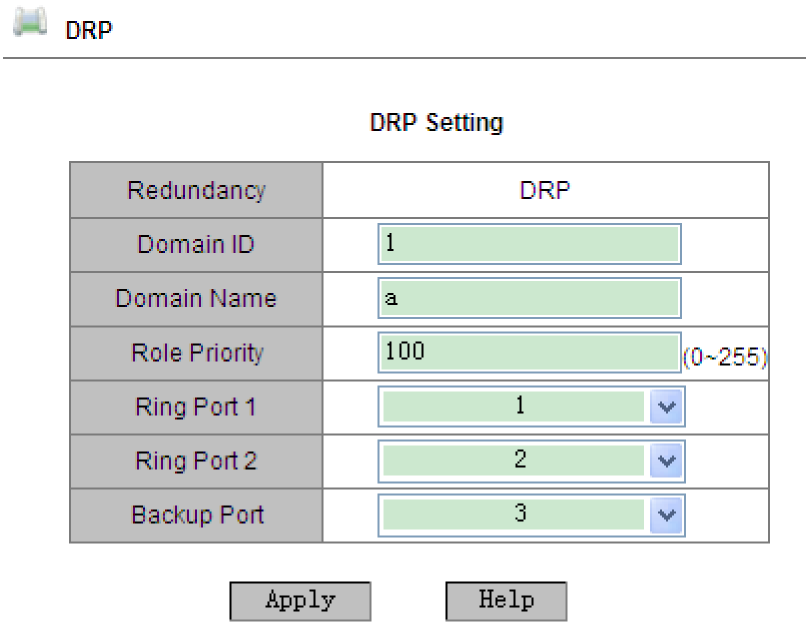
Figure 67: DRP Backup

Caution:

The change in link state affects the status of backup ports.

12.4.4 Web Configuration

1. DRP configuration, as shown in Figure 68.



DRP Setting

Redundancy	DRP
Domain ID	1
Domain Name	a
Role Priority	100 (0~255)
Ring Port 1	1
Ring Port 2	2
Backup Port	3

Figure 68: DRP Configuration

Redundancy

Forced configuration: DRP

Domain ID

Configuration range: 1~32

Function: Domain ID is used to distinguish different rings. One switch can set max 16 DRP rings.

Domain Name

Configuration range: 1~31 characters

Function: set the name of domain

Role Priority

Configuration range: 0~255

Default: 128

Function: configure switch priority

CRC Threshold

Configuration range: 25~65535

Default: 100

Function: Configure the CRR threshold

Ring Port 1/Ring Port 2

Configuration options: all switch ports

Function: Select two ring ports

Caution:

- Port mirroring and ring port configuration are mutually exclusive. The mirroring source/destination port cannot be configured to ring port, while the ring port cannot be set to the mirroring source/destination port.
- Port Trunk and ring port configuration are mutually exclusive. The port joining Trunk group cannot be ring port, while the ring port cannot join Trunk group.

Backup Port

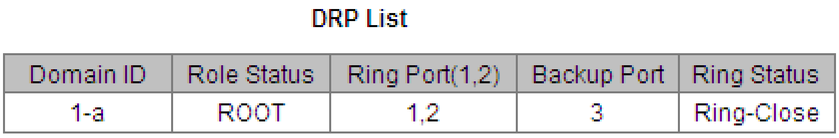
Configuration options: all switch ports

Function: configure backup port

Caution:

The backup port can be selected from ports other than ring ports.

After setting, the created ring is displayed in DRP list, as shown in Figure 69.

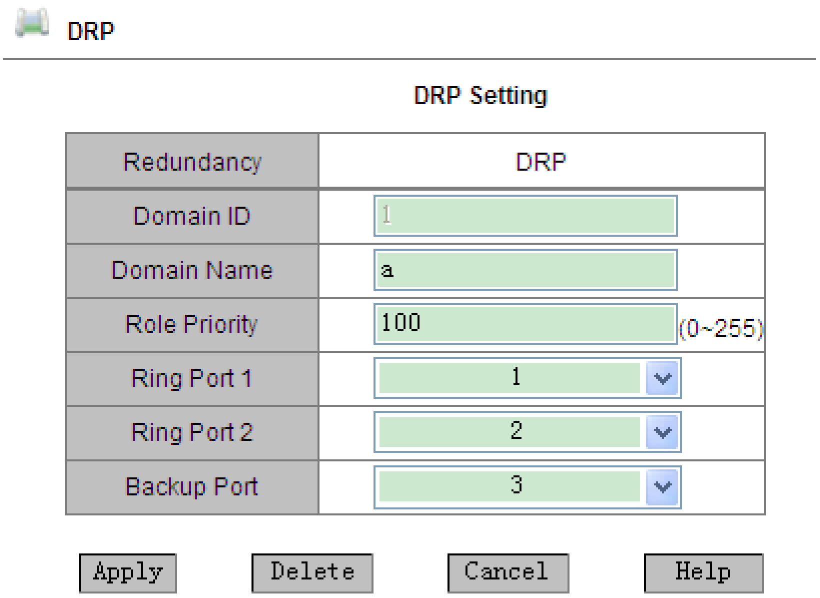


DRP List

Domain ID	Role Status	Ring Port(1,2)	Backup Port	Ring Status
1-a	ROOT	1,2	3	Ring-Close

Figure 69: DRP List

2. Click the domain ID in Figure 69 to show the detailed ring settings and it is able to modify it, as shown in Figure 70.



DRP

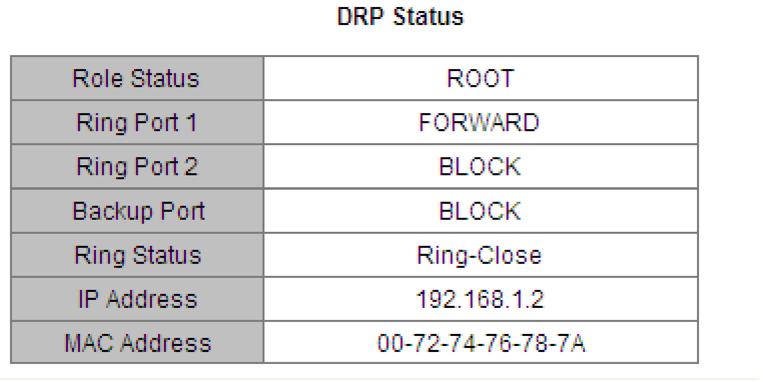
DRP Setting

Redundancy	DRP
Domain ID	1
Domain Name	a
Role Priority	100 (0~255)
Ring Port 1	1
Ring Port 2	2
Backup Port	3

Figure 70: Show and modify DRP configuration

After setting, click <Apply> to activate changes; click <Delete> to delete this DRP configuration entry.

3. Show the switch role and port status in DRP ring, as shown in Figure 71.



DRP Status

Role Status	ROOT
Ring Port 1	FORWARD
Ring Port 2	BLOCK
Backup Port	BLOCK
Ring Status	Ring-Close
IP Address	192.168.1.2
MAC Address	00-72-74-76-78-7A

Figure 71: DRP status

12.4.5 Typical Configuration Example

As Figure 67 shows, Switch A, B, C, D form Ring 1; Switch E, F, G, H form Ring 2. The links CE and DF are the backup links between Ring 1 and Ring 2.

➢ Switch A and Switch B configuration

Domain ID: 1; Domain name: Ring. The port priority is the default setting. Ring port: port 1 and port 2. Do not need to set the backup port, as shown in Figure 68.

➢ Switch C and Switch D configuration

Domain ID: 1; Domain name: Ring. The port priority is the default setting. Ring port: port 1 and port 2; Backup port: port 3, as shown in Figure 68.

- Switch E, F, G, H configuration

Domain ID: 2; Domain name: Ring. The port priority is the default setting. Ring port: port 1 and port 2. Do not need to set the backup port, as shown in Figure 68.

13. Multicast

13.1 GMRP

13.1.1 GARP Introduction

GARP (Generic Attribute Registration Protocol) is used to distribute, propagate and register certain information (such as VLAN, multicast address) between switches in a network. GARP application is divided to GVRP and GMRP. GVRP will be introduced in "17.3 GVRP".

Through GARP mechanism, the configuration information of a GARP member can be rapidly propagated in the entire switching network. The GARP member uses join/leave message to inform other GARP members to register or cancel its attribute information, meanwhile, it can register or cancel the attribute information of other members according to their join/leave messages.

There are three types of messages in GARP: Join, Leave, LeaveAll

- If a GARP-enabled switch wishes other switches to register its certain attribute information, it will send out a Join message. The Join message is divided to two types: Join Empty and Join In. Sending Join In message to declare a registered attribution and sending Join Empty message to declare a non-registered attribute.
- When a GARP-enabled switch wishes other switches to cancel its certain attribute information, it will send out a Leave message
- When a switch enables GARP, it starts a LeaveAll timer at the same time. When the timer times out, the switch will send out a LeaveAll message

GARP timers include Hold timer, Join timer, Leave timer, LeaveAll timer.

- Hold Timer: when a GARP-enabled switch receives a registration message, it starts s Hold timer rather than sending out the Join message immediately. When the Hold timer times out, it will put all registration information received during this time in a same Join message and send it out, reducing the message quantity for network stability.

- Join Timer: in order to guarantee that the Join message can be reliably transmitted to other switches, the GARP-enabled switch will wait for a time interval of a Join timer after sending the first Join message. If the switch does not receive a Join In message during this time, it will send out a Join message again, otherwise, it won't send the second message.
- Leave Timer: when a GARP-enabled switch wishes other switches to cancel its attribute information, it sends out a Leave message. Other GARP-enabled switches that receive this message will enable a Leave timer. If they do not receive a Join message until the timer times out, they will cancel this attribute information
- LeaveAll Timer: When a switch enables GARP, it starts a LeaveAll timer at the same time. When the timer times out, the switch will send a LeaveAll message to other GARP-Enabled switches and let them re-register their all attribute information, and then restart the LeaveAll timer to begin a new cycle.

13.1.2 GMRP Protocol

GMRP (GARP Multicast Registration Protocol) is a multicast registration protocol based on GARP and is used to maintain the multicast registration information of a switch. All GMRP-enabled switches can receive the multicast registration information from other switches, and dynamically renew the local multicast registration information; meanwhile, they can propagate the local multicast registration information to other switches. This information exchanging mechanism guarantees the consistency of the multicast information of all GMPR-supported switches in a same network.

Once a switch or a terminal registers or deregisters a multicast group, the GMPR-enabled port will broadcast this information to other ports in the same VLAN.

13.1.3 Explanation

Agent port: the port that enable GMRP function and agent function

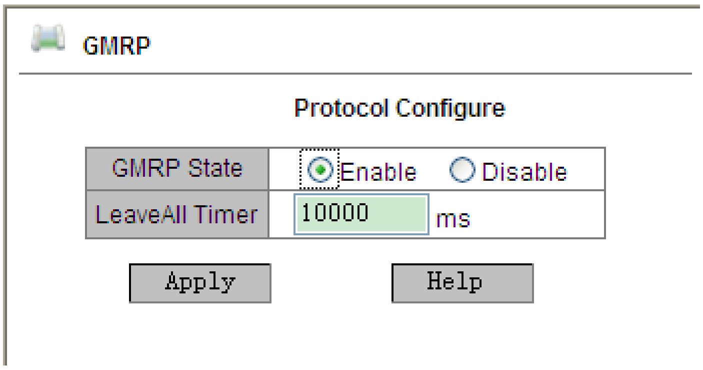
Propagation port: the port that only enables GMRP function, and does not enable agent function

GMRP application requires one or multiple agent ports. The agent entries in the device agent port will be propagated from the device propagation port to the propagation port of the next device.

All GMRP timers in the same network must keep consistent to avoid potential interference between them. The timers should follow the rule: hold timer < join timer, 2*join timer < leave timer, leave timer < leaveall timer.

13.1.4 Web Configuration

1. Enable global GMRP protocol, as shown in Figure 72.



GMRP

Protocol Configure

GMRP State	● Enable ○ Disable
LeaveAll Timer	10000 ms

Figure 72: GMRP Global Configuration

GMRP State

Configuration options: Enable/Disable

Default: Disable

Function: enable/disable global GMRP function. This function cannot be used with IGMP-Snooping function.

LeaveAll Timer

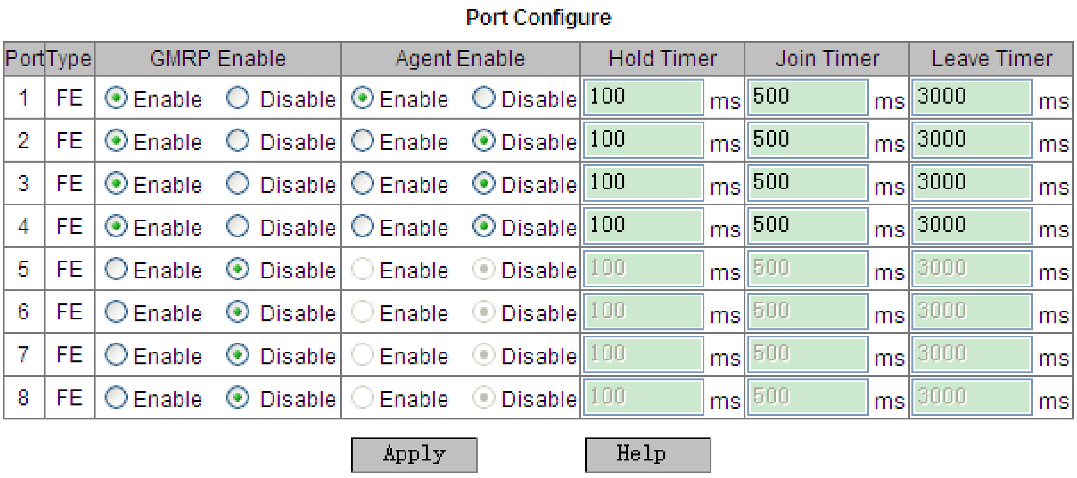
Configuration range: 100ms~327600ms

Default: 10000ms

Function: the time interval of sending leave all message. It must be a multiple of 100.

Explanation: if the LeaveAll timers of different devices time out at the same time, multiple LeaveAll messages will be sent out at the same time, which increases the message quantity. In order to avoid this problem, the actual running time of a LeaveAll timer is a random value, which is longer than the time of a LeaveAll timer, and less than 1.5 times of a LeaveAll timer.

2. Set GMRP function for each port, as shown in Figure 73.



Port Configure

Port	Type	GMRP Enable		Agent Enable		Hold Timer	Join Timer	Leave Timer
1	FE	● Enable	○ Disable	● Enable	○ Disable	100 ms	500 ms	3000 ms
2	FE	● Enable	○ Disable	○ Enable	● Disable	100 ms	500 ms	3000 ms
3	FE	● Enable	○ Disable	○ Enable	● Disable	100 ms	500 ms	3000 ms
4	FE	● Enable	○ Disable	○ Enable	● Disable	100 ms	500 ms	3000 ms
5	FE	○ Enable	● Disable	○ Enable	● Disable	100 ms	500 ms	3000 ms
6	FE	○ Enable	● Disable	○ Enable	● Disable	100 ms	500 ms	3000 ms
7	FE	○ Enable	● Disable	○ Enable	● Disable	100 ms	500 ms	3000 ms
8	FE	○ Enable	● Disable	○ Enable	● Disable	100 ms	500 ms	3000 ms

Figure 73: Port GMRP Configuration

GMRP Enable

Configuration options: Enable/Disable

Default: Disable

Function: Enable/Disable GMRP function on port

Agent Enable

Configuration options: Enable/Disable

Default: Disable

Function: Enable/Disable GMPR agent function on port

Caution:

- Agent ports cannot propagate agent entries.
- The premise of enabling GMRP agent function on port is to enable GMRP function on port.

Hold Timer

Configuration range: 100ms~327600ms

Default: 100ms

Explanation: This value must be a multiple of 100. It is better to set a same time of Hold timers for all GMRP-enabled ports

Join Timer

Configuration range: 100ms~327600ms

Default: 500ms

Explanation: This value must be a multiple of 100. It is better to set a same time of Join timers for all GMRP-enabled ports

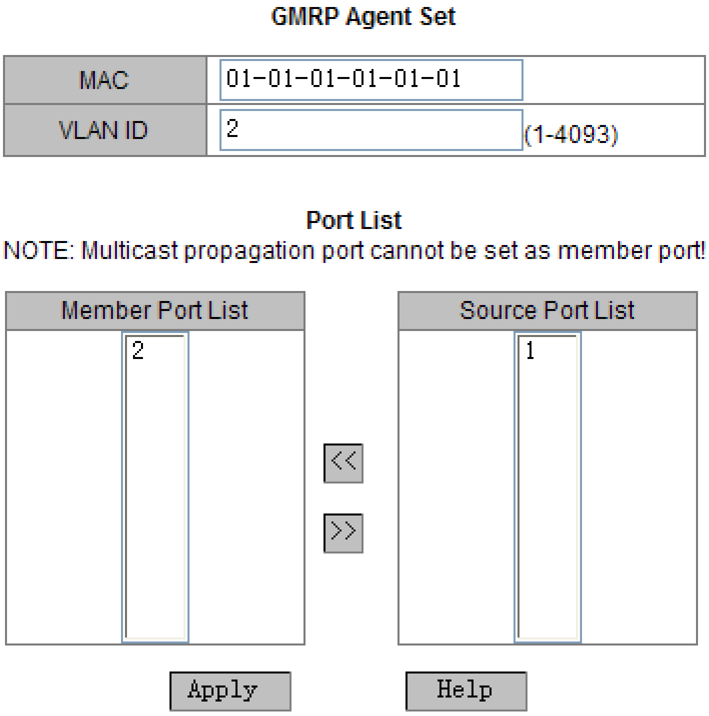
Leave Timer

Configuration range: 100ms~327600ms

Default: 3000ms

Explanation: This value must be a multiple of 100. It is better to set a same time of Leave timers for all GMRP-enabled ports

3. Add a GMRP agent entry, as shown in Figure 74.



GMRP Agent Set

MAC	01-01-01-01-01-01
VLAN ID	2 (1-4093)

Port List

NOTE: Multicast propagation port cannot be set as member port!

Member Port List	Source Port List
2	1

Figure 74: GMRP agent entry configuration

MAC

Configuration format: HH-HH-HH-HH- HH - HH (H is a hexadecimal number)

Function: configure the MAC address of the multicast group, and the lowest bit of the highest byte is 1.

VLAN ID

Configuration options: all existing VLAN IDs

Function: configure a VLAN ID for the GMRP agent entry

Explanation: GMRP agent entry can only be forwarded from the propagation port whose VLAN ID is the same as that of the agent entry. The VLAN ID of the agent entry is similar to the message VLAN ID. The propagation port on the other side can learn the agent entry or not depends on whether the VLAN ID of the agent entry is same as that of propagation ports at both sides.

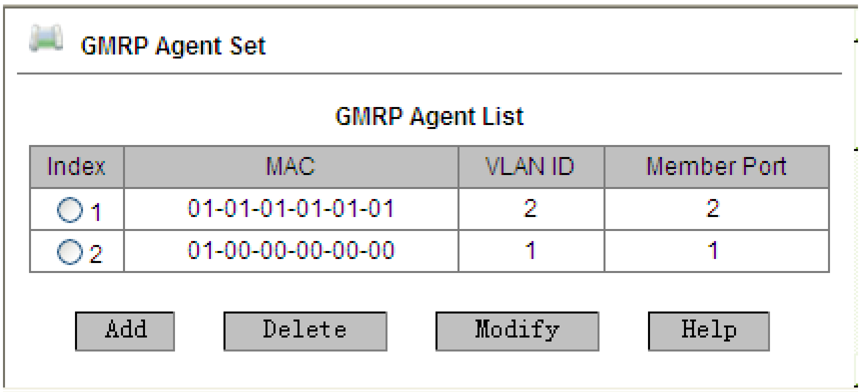
Member Port List

Select member ports for the agent entry and select from agent ports.

Source Port List

Configuration options: all GMRP Agent-enabled ports

4. Show, modify and delete GMRP agent entry, as shown in Figure 75.



GMRP Agent Set

GMRP Agent List

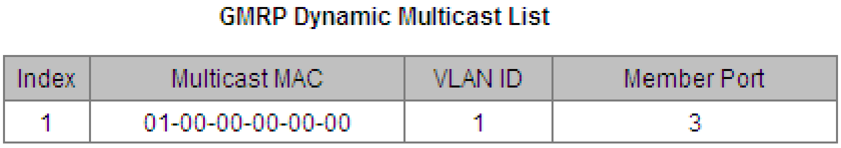
Index	MAC	VLAN ID	Member Port
○ 1	01-01-01-01-01-01	2	2
○ 2	01-00-00-00-00-00	1	1

Figure 75: GMRP agent entry operations

It displays the agent AMC address, VLAN ID, member ports. Choose an entry, click <Delete> button to delete the entry; click <Modify> to modify the member ports of the agent entry.

5. Check the multicast members of the agent entry in the connected neighbor device, as shown in Figure 76. But it should meet the following conditions:

- The connected devices both enable GMRP function
- The two ports that connect two devices must be propagation ports.



GMRP Dynamic Multicast List

Index	Multicast MAC	VLAN ID	Member Port
1	01-00-00-00-00-00	1	3

Figure 76: GMRP Dynamic multicast table

GMRP Dynamic Multicast List

Group displaying: {Index, Multicast MAC, VLAN ID, Member Port}

Function: show GMRP dynamic multicast entries

13.1.5 Typical Configuration Example

As Figure 77 shows, switch A and Switch B are connected by port 2. Port 1 of switch A is set to an agent port and contains two multicast entries:

- MAC address: 01-00-00-00-00-01, VLAN: 1
- MAC address: 01-00-00-00-00-02, VLAN: 2

Observe the dynamic registration between switches and multicast information update by setting different VLAN attribute for ports

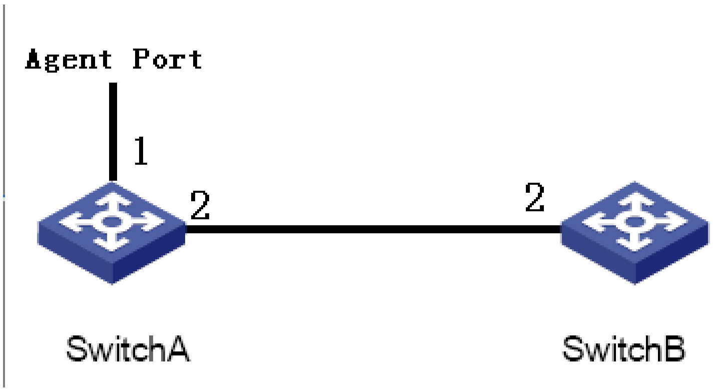


Figure 77: GMRP networking

Switch A configuration:

1. Enable global GMRP function in Switch A; LeaveAll timer uses the default value, as shown in Figure 72.
2. Enable GMRP function and agent function in port 1; only enable GMPR function in port 2; the timers all use default values, as shown in Figure 73.

3. Configure the agent multicast entry. <MAC address, VLAN ID, Member port> configure to {01-00-00-00-00-01, 1, 1> and {01-00-00-00-00-02, 2, 1}, as shown in Figure 74.

Switch B configuration:

1. Enable global GMRP function in switch B; LeaveAll timer uses the default value, as shown in Figure 72.
2. Enable GMPR function in port 2; the timers all use default values, as shown in Figure 73.

Dynamic GMRP multicast entries in Switch B are shown in Table 6.

Table 6: Dynamic Multicast Entries

Attribute of Switch A port 2	**Attribute of Switch B port 2**	**Switch B-received Multicast Entries**
Untag1	Untag1	MAC: 01-00-00-00-00-01 VLAN ID: 1 Member port: 2
Untag2	Untag2	MAC: 01-00-00-00-00-02 VLAN ID: 2 Member port: 2
Untag1	Untag2	MAC: 01-00-00-00-00-01 VLAN ID: 2 Member port: 2

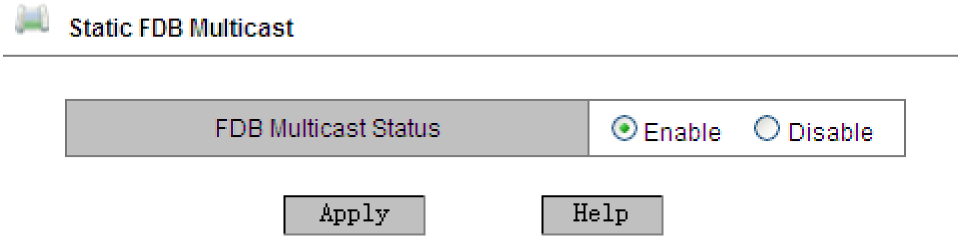
13.2 Static FDB Multicast

13.2.1 Introduction

Multicast address table can be statically configured. An entry is added into the multicast address table in the form of {Multicast MAC address, VLAN ID, Multicast member port}, and a multicast message will be forwarded to the corresponding member port according to the entry

13.2.2 Web Configuration

1. Enable static FDB multicast, as shown in Figure 78.



Static FDB Multicast

FDB Multicast Status	● Enable ○ Disable

Figure 78: Static FDB Multicast Table

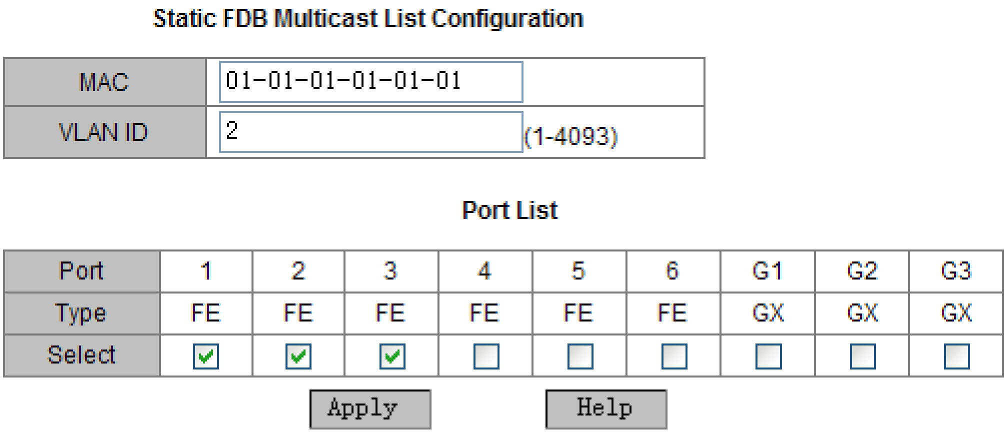
FDB Multicast Status

Configuration options: Enable/Disable

Default: Disable

Function: Enable/Disable static multicast address table

2. Add a static multicast entry, as shown in Figure 79.



Static FDB Multicast List Configuration

MAC	01-01-01-01-01-01
VLAN ID	2 (1-4093)

Port List

Port	1	2	3	4	5	6	G1	G2	G3
Type	FE	FE	FE	FE	FE	FE	GX	GX	GX
Select	☑	☑	☑	□	□	□	□	□	□

Figure 79: Add Static Multicast Address Entry

MAC

Configuration format: HH-HH-HH-HH-HH-HH (H is a hexadecimal number)

Function: configure multicast group address. The lowest bit of the highest byte is 1.

VLAN ID

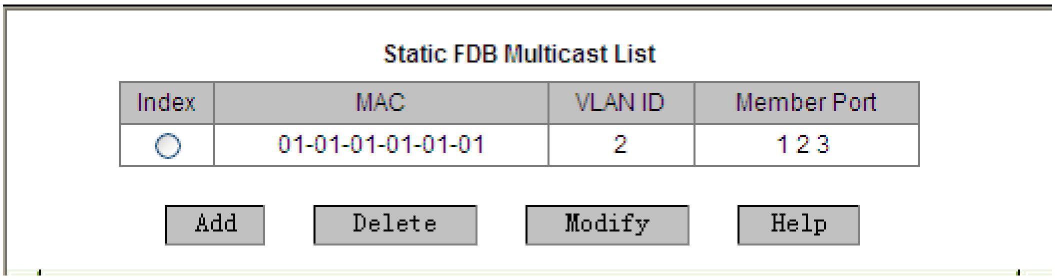
Configuration options: all existing VLAN IDs

Function: set the VLAN ID of the static multicast entry. Only VLAN member ports can forward this multicast message.

Port List

Function: choose the member ports of the multicast address. If a host connected to a port would like to receive a certain multicast group data, statically add this port into the multicast group and become a static member port.

Show, modify and delete static multicast entry, as shown in Figure 80.



Static FDB Multicast List

Index	MAC	VLAN ID	Member Port
○	01-01-01-01-01-01	2	1 2 3

Figure 80: Static Multicast Entry Operations

Static FDB multicast list displays MAC address, VLAN ID and member ports. Choose an entry, click <Delete> to delete the entry; click <Modify> to modify the member ports of the entry.

13.3 IGMP Snooping

13.3.1 Introduction

IGMP Snooping (Internet Group Management Protocol Snooping) is a multicast protocol running in data link layer and is used to manage and control multicast group. The IGMP Snooping-enabled switch analyzes the received IGMP message to establish mapping relationships of port and MAC multicast address, and forward multicast messages according to these mapping relationships.

13.3.2 Basic Concepts

- Querier: periodically sending general IGMP query messages to inquire whether multicast group members are active, so as to maintain multicast group information. If there are multiple queriers in network, they will automatically elect the one with the smallest IP address to be querier. Only the elected querier can periodically send out IGMP query messages, while other non-querier devices can receive and forward query messages, instead of sending out query messages.

- Router port: in IGMP-enabled device, the port that receives the IGMP query message from the querier is the router port. When an IGMP report arrives, the device need to create a multicast entry and the port that receives the IGMP report becomes a member port. In addition, if there is a router port, add it into the member port list. Meanwhile, the device will forward the IGMP report message from the router port to other devices, so as to establish a same multicast entry in other devices.

13.3.3 Principle

IGMP Snooping conducts management and maintenance of multicast group members through sending related messages between IGMP devices. It mainly contains following important messages:

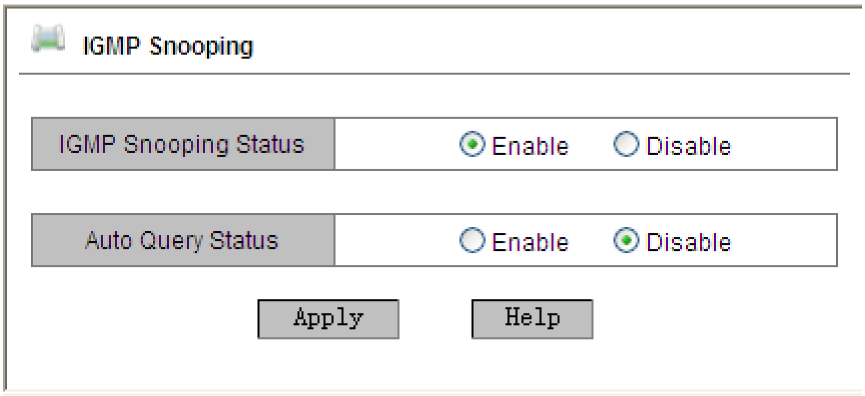
- General query message: the querier periodically sends out a general query message with the fixed destination IP address of 224.0.0.1 to confirm the existence of multicast group member ports. When the non-querier device receives the general query message, it also forwards the message to all connected ports.
- Specified query message: if a host wishes to leave a multicast group, it will send an IGMP leave message. When the querier receives this message, it will send out an IGMP specified query message (its destination IP is the IP address of the multicast group that the host wants to leave) to check whether there is other members in this multicast group.
- Member report message: if a host wishes to receive a certain multicast group data, it will respond to IGMP query message by sending IGMP member report message (its destination IP address is the IP address of the

multicast group that the host would like to join in).

- Leave group message: if a host wishes to leave a multicast group, it will send an IGMP leave message with the fixed destination IP address of 224.0.0.2.

13.3.4 Web Configuration

1. Enable IGMP Snooping protocol and enable Auto-query, as shown in Figure 81.



IGMP Snooping

IGMP Snooping Status ● Enable ○ Disable

Auto Query Status ○ Enable ● Disable

Figure 81: Enable IGMP Snooping

IGMP Snooping Status

Configuration options: Enable/Disable

Default: Disable

Function: enable/disable IGMP Snooping function. This function cannot use together with GMRP function.

Auto Query Status

Configuration options: Enable/Disable

Default: Disable

Function: the switch participates the querier election or not.

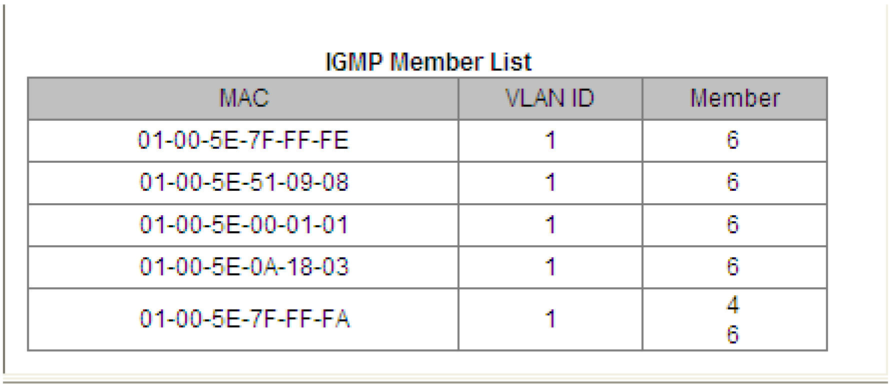
Explanation: Only when the IGMP Snooping is enabled can auto-query function be enabled.

CAUTION

Caution:

At least one switch enables auto-query function.

2. Show IGMP member list, as shown in Figure 82.



IGMP Member List

MAC	VLAN ID	Member
01-00-5E-7F-FF-FE	1	6
01-00-5E-51-09-08	1	6
01-00-5E-00-01-01	1	6
01-00-5E-0A-18-03	1	6
01-00-5E-7F-FF-FA	1	4 6

Figure 82: IGMP Snooping Member List

IGMP Member List

Group Displaying: {MAC, VLAN ID, Member}

Function: show the FDB multicast table that are dynamically learned by IGMP Snooping. VLAN ID is the VLAN ID of the member port.

13.3.5 Typical Application Example

As Figure 83 shows, enable IGMP Snooping function in Switch 1, Switch 2, Switch 3; switch 2 and switch 3 enable Auto Query. The IP address of Switch 2 is 192.168.1.2; the IP address of Switch 3 is 192.168.0.2, so Switch 3 is elected to the querier.

1. Enable IGMP Snooping function in Switch 1
2. Enable IGMP Snooping and auto-query functions in Switch 2
3. Enable IGMP Snooping and auto-query functions in Switch 3

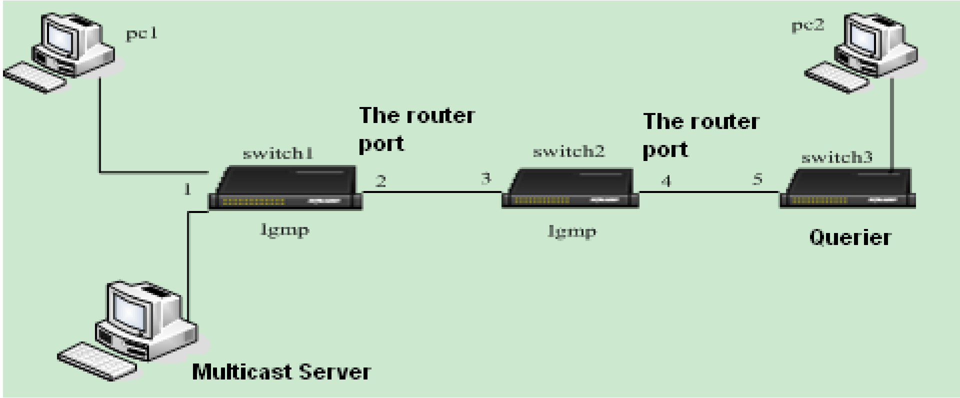


Figure 83: IGMP Snooping Application Example

- Because Switch 3 is elected to the querier, it will periodically send out a general query message, and then port 4 of Switch 2 will receive the query message, so it is elected to a router port, then the query message will be forwarded from the port 3 of Switch 2, and the port 2 of Switch 1 will receive the message and it will be elected to a router port.
- When PC 1 joins in the multicast group 225.1.1.1, it will send IGMP report messages of the multicast group to Switch 1, so port 1 and router port 2 of Switch 1 will also join in the multicast group 225.1.1.1; then, IGMP report messages will be forwarded to Switch 2 from the router port 2, so the port 3 and port 4 of Switch 2 will also join in multicast group 225.1.1.1, and then IGMP report messages will be forwarded to Switch 3 from the router port 4, so port 5 of Switch 3 will join in the multicast group 225.1.1.1 as well.
- When the multicast data from the multicast server reaches Switch 1, the data will be forwarded to pc1 by port 1; because router port 2 also enter the multicast group, so the multicast data will be forwarded from the router port 2. In this way, when the data reaches port 5 of Switch 3, the forwarding will stop because there is no receiver any more, but if pc2 also enter 255.1.1.1, the multicast data will be forwarded to pc2, too.

14. Diagnosis

14.1 Port Mirroring

14.1.1 Introduction

Port mirroring function is that the switch copies all received or transmitted data frames in a port (mirroring source port) to another port (mirroring destination port), and the mirroring destination port connects with a protocol analyzer or RMON monitor for network monitoring, management and fault diagnosis.

14.1.2 Explanation

A switch supports only one mirroring destination port, but there is no such restriction on mirroring source ports and it supports one or multiple source ports. Multiple source ports can be in the same VLAN, or in different VLANs. Mirroring source port and destination port can be in the same VLAN or in different VLANs.

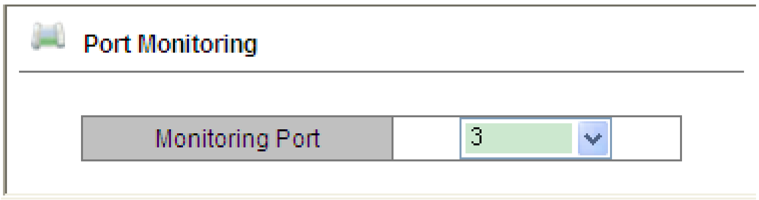
Source port and destination port cannot be the same port.

Caution:

- Port mirroring and Port Trunk are mutually exclusive. The mirroring source/destination port cannot be added into a Trunk group, while the ports joining a Trunk group cannot be set to a mirroring destination/source port
- Port mirroring and ring protocol configuration are mutually exclusive. The mirroring destination/source port can neither enable ring protocols nor be set to a ring port, while the ring protocol-enabled port and ring port cannot be set to a mirroring source/destination port.
- Port mirroring and DHCP Snooping Trust port configuration are mutually exclusive. The mirroring destination/source port cannot be set to a Trust port, while the Trust port cannot be set to a mirroring source/destination port.

14.1.3 Web Configuration

1. Select the mirroring destination port, as shown in Figure 84.



Port Monitoring

Monitoring Port	3

Figure 84: Mirroring Destination Port

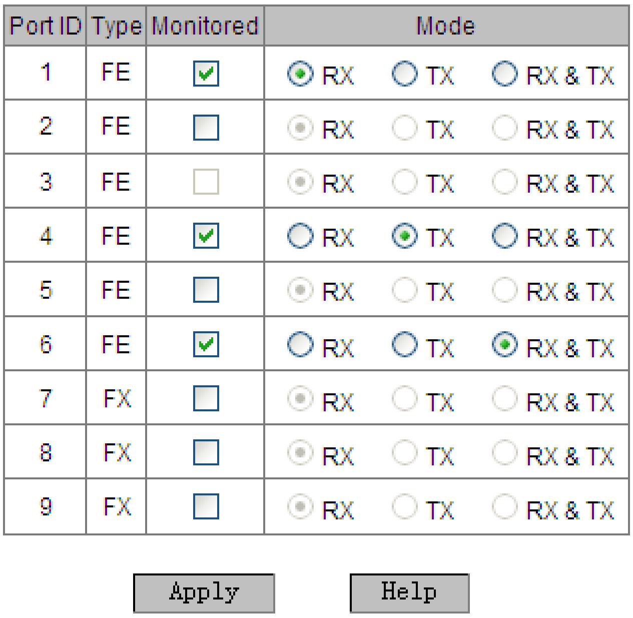
Monitoring Port

Configuration options: NULL/ one switch port

Default: NULL

Function: Select a port to be the mirroring destination port. There is one and only one mirroring destination port.

2. Select mirroring source ports and the mirroring mode, as shown in Figure 85.



Port ID	Type	Monitored	Mode		
1	FE	☑	● RX	○ TX	○ RX & TX
2	FE	□	● RX	○ TX	○ RX & TX
3	FE	□	● RX	○ TX	○ RX & TX
4	FE	☑	○ RX	● TX	○ RX & TX
5	FE	□	● RX	○ TX	○ RX & TX
6	FE	☑	○ RX	○ TX	● RX & TX
7	FX	□	● RX	○ TX	○ RX & TX
8	FX	□	● RX	○ TX	○ RX & TX
9	FX	□	● RX	○ TX	○ RX & TX

Figure 85: Mirroring Source Port

Mode

Configuration options: RX/TX/RX&TX

Function: Select the data to be mirrored.

TX only mirror the transmitted messages of the source port

RX only mirror the received messages of the source port

TX&RX mirror all messages of the source port

14.1.4 Typical Configuration Example

As Figure 86 shows, the mirroring destination port is port 2 and the mirroring source port is port 1. All messages on port 1 are mirrored to port 2

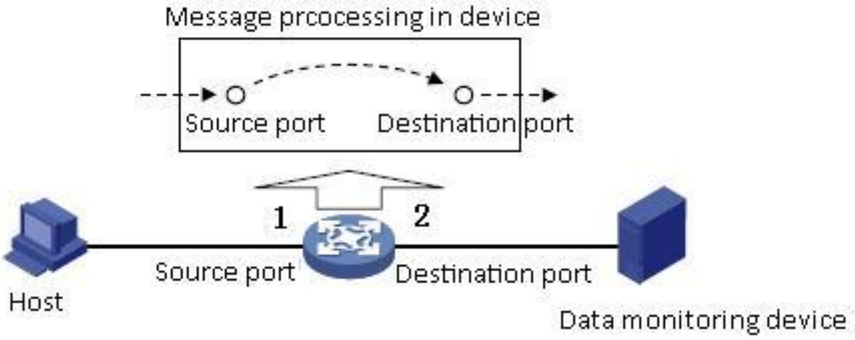


Figure 86: Port Mirroring Example

Configuration process:

1. Set port 2 to the mirroring destination port, as shown in Figure 84.
2. Set port 1 to the mirroring source port and the port mirroring mode is set to RX&TX, as shown in Figure 85.

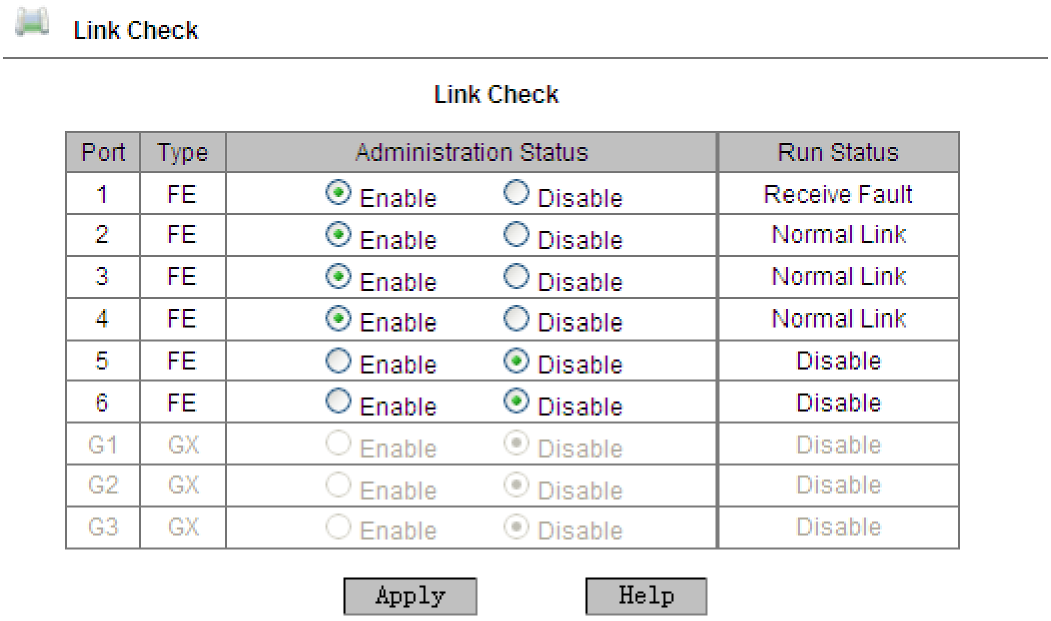
14.2 Link Check

14.2.1 Introduction

Link Check is to check whether the ports that enable ring protocols (STP/RSTP /DRP/DT-Ring) transmit data normally. When failover occurs, it can detect the problem and fix it in a timely manner.

14.2.2 Web Configuration

Link Check configuration, as shown in Figure 87.



Link Check

Link Check

Port	Type	Administration Status		Run Status
1	FE	● Enable	○ Disable	Receive Fault
2	FE	● Enable	○ Disable	Normal Link
3	FE	● Enable	○ Disable	Normal Link
4	FE	● Enable	○ Disable	Normal Link
5	FE	○ Enable	● Disable	Disable
6	FE	○ Enable	● Disable	Disable
G1	GX	○ Enable	● Disable	Disable
G2	GX	○ Enable	● Disable	Disable
G3	GX	○ Enable	● Disable	Disable

Figure 87: Link Check

Administration Status

Configuration options: Enable/Disable

Default: Enable

Explanation: only the ring protocol-enabled port can enable this function

Run Status

Configuration options: Normal Link/Receive Fault/Disable

Explanation: If a ring port enables the Link Check function, its run status is Normal when this port receives and transmits data properly, otherwise, its run status is Receive Fault; if the ring port does not enable Link Check, its run status is Disable.

14.3 Virtual Cable Tester

14.3.1 Introduction

Virtual Cable Tester (VCT) uses Time Domain Reflectometry (TDR) to detect Twisted-pair status. It transmits a pulse signal to the cable and detects the reflection of the pulse signal to detect the cable fault. If a failover occurs in the cable, parts of or all pulse energy will be reflected back to the sending source when the transmitted pulse signal reaches the end of the cable or the fault point, and VCT technology can measure the signal arrival time at the fault point and the time of getting back to the sending source, then calculates the distance according to the time.

14.3.2 Implementation

VCT technology can detect the media of link connecting the Ethernet copper ports and send back the detection result. VCT can detect the following types of cable faults:

Short: it means short circuit. It is that two or more wires are shorted.

Open: it means open circuit. There might be broken wires on the cable.

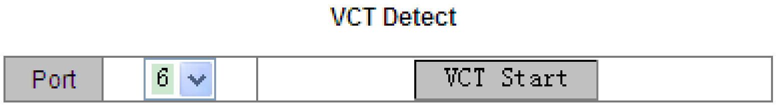
Normal: it means normal cable connection.

Imped: it means impedance mismatch. Because the impedance of the Cat.5 cable is 100 ohm, the impedance of the terminators at the both ends of the cable must be 100 ohm to avoid wave reflection and data error.

14.3.3 Web Configuration

1. Detect a cable whose length is known

   Select a cable whose length is known (such as 4m); connect one end of the cable to Ethernet copper port 1, and the other end of the cable is in open state; detect the cable connecting state of the port 1, as shown in Figure 88.



VCT Detect

Port: 6

Figure 88: VCT Detection

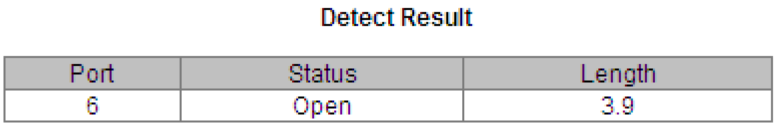
Port

Configuration options: all switch copper ports

Function: select a port that is connected by a cable and the cable length is known

Method: click <VCT Start> to detect the cable connecting state of the current port. Test multiple times to obtain an accurate and stable test result.

2. Compare the test result with the actual situation, as shown in Figure 89.



Detect Result

Port	Status	Length
6	Open	3.9

Figure 89: VCT Test Result

Status

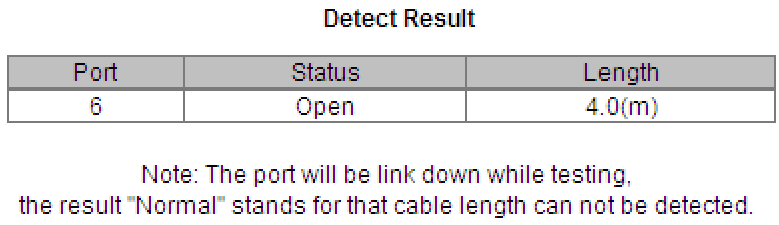
Displaying options: Open/Short/Normal/Imped

Function: show the cable connecting state of the current port, including open circuit, short circuit, normal connection, impedance mismatch.

Length

Function: Show the distance between the port and the fault point.

3. Set the port offset, as shown in Figure 90.



Detect Result

Port	Status	Length
6	Open	4.0(m)

Note: The port will be link down while testing,
the result "Normal" stands for that cable length can not be detected.

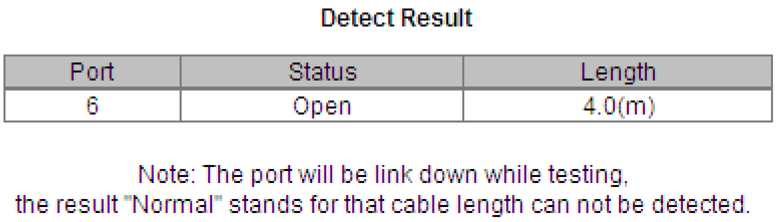
Figure 90: Offset Configuration

Offset

Configuration range: -10m ~10m

Default: 0

Function: Compare the cable length with the test result and input the offset. As Figure 89 shows, the length after test is 3.9m, but the actual cable length is 4m. In order to get a more accurate test result, input the offset of 10cm to adjust the test result to 4m, as shown in Figure 91, minimizing the test error.



Detect Result

Port	Status	Length
6	Open	4.0(m)

Note: The port will be link down while testing,
the result "Normal" stands for that cable length can not be detected.

Figure 91: Test Result after Adjustment

15. SNTP

15.1 Introduction

SNTP (Simple Network Time Protocol) calibrates time by requests and responses between servers and clients. Switches work as clients to calibrate time according to the messages from the server. Four SNTP servers are supported at the same time, but only one server is in active state.

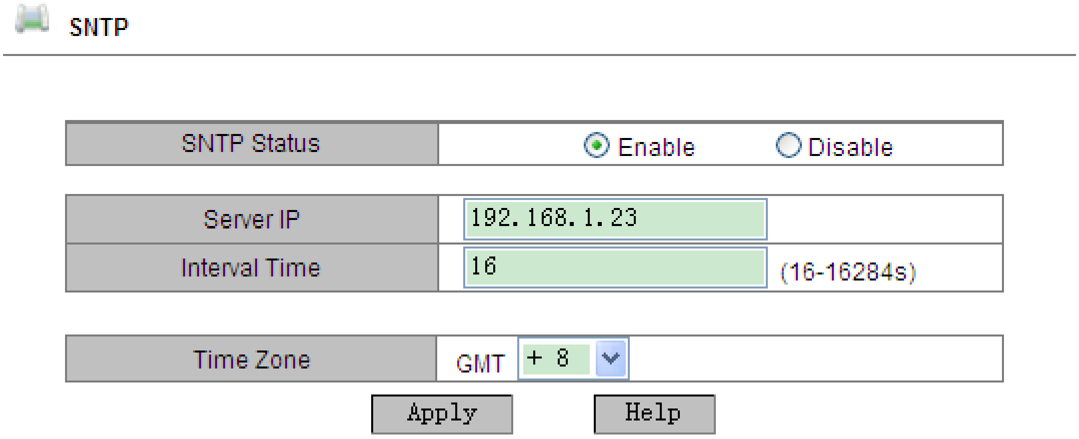
The request from the SNTP client is gradually sent to each server in the form of unicast, and the server that firstly responds will enter an active state, and other servers are in inactive state.

Caution:

- The switch cannot serve as the SNTP server.
- To synchronize time by SNTP, there must be an active SNTP server.

15.2 Web Configuration

1. Enable SNTP protocol and configure SNTP server, as shown in Figure 92.



SNTP Status	● Enable ○ Disable
Server IP	192.168.1.23
Interval Time	16 (16-16284s)
Time Zone	GMT + 8

Figure 92: SNTP Configuration

SNTP Status

Configuration options: Enable/Disable

Default: Disable

Function: enable/disable SNTP protocol

Server IP

Configuration format: A.B.C.D

Function: configure the IP address of the SNTP server and the client calibrates time according to the messages from this server

Interval Time

Configuration range: 16~16284s

Function: set the interval of the SNTP client sending a synchronous request to the SNTP server

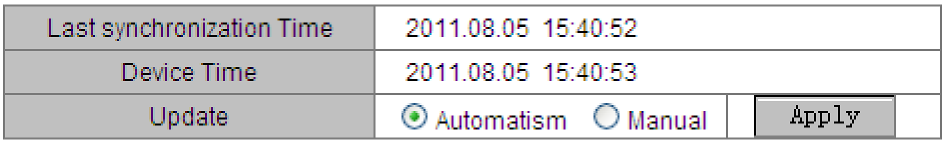
Time Zone

Configuration options: 0, +1, +2, +3, +4, +5, +6, +7, +8, +9, +10, +11, +12, -1, -2, -3, -4, -5, -6, -7, -8, -9, -10, -11

Default: 0

Function: choose the local time zone

2. Choose the client-and-server time synchronization form, as shown in Figure 93.



Last synchronization Time	2011.08.05 15:40:52	
Device Time	2011.08.05 15:40:53	
Update	● Automatism ○ Manual	Apply

Figure 93: Time Synchronization Form

Last synchronization time

Displaying format: yyyy.mm.dd hh.mm.ss

Default: 0000.00.00 00.00.00

Function: show the time obtained from the server

Device Time

Displaying format: yyyy.mm.dd hh.mm.ss

Function: show the local time of the device

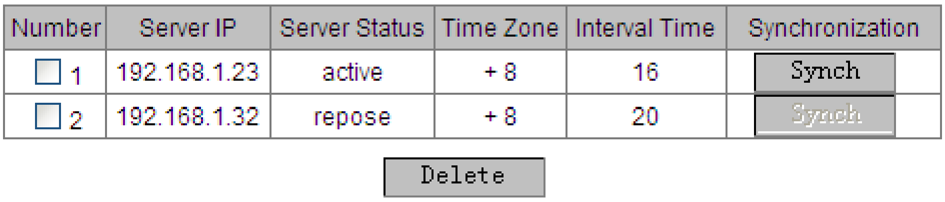
Update

Configuration options: Automatism/Manual

Default: Automatism

Function: choose the client-and-server time synchronization form

3. Show SNTP configuration information, as shown in Figure 94.



Number	Server IP	Server Status	Time Zone	Interval Time	Synchronization
□ 1	192.168.1.23	active	+ 8	16	Synch
□ 2	192.168.1.32	repose	+ 8	20	Synch

Figure 94: SNTP Configuration Information

Number

Select the number to delete the corresponding server configuration.

Server Status

Displaying options: active/repose

The server in active state provides SNTP time to the client. There is one and only one server that is in active state, and others are in repose at the same time.

Synchronization

Function: click <Synch> button in the "Manual" synchronization form

16. Security

16.1 SSH

16.1.1 Introduction

SSH (Secure Shell) is a network protocol for secure remote login. It encrypts all transmitted data to prevent information disclosure. When data is encrypted by SSH, users can only use command lines to configure switches.

This series switches support SSH server function and allow the connection of multiple SSH clients that can log into remote switches by SSH.

16.1.2 Secret Key

The unencrypted message is called plaintext, and the encrypted message is called cipher text. Encryption or decryption is under the control of the secret key. A secret key is a specific character string and is the only parameter to control the transformation between plain text and cipher text, working as a Key. Encryption can change plain text to cipher text, while decryption can change cipher text to plain text.

The key-based security authentication needs secret keys, and each end of the communication has a pair of secret keys, private key and public key. Public key is used to encrypt data, and the legal owner of private key can use the private key to decrypt the date to guarantee the data security.

16.1.3 Implementation

In order to realize the SSH secure connection in the communication process, the server and the client experience the following five stages:

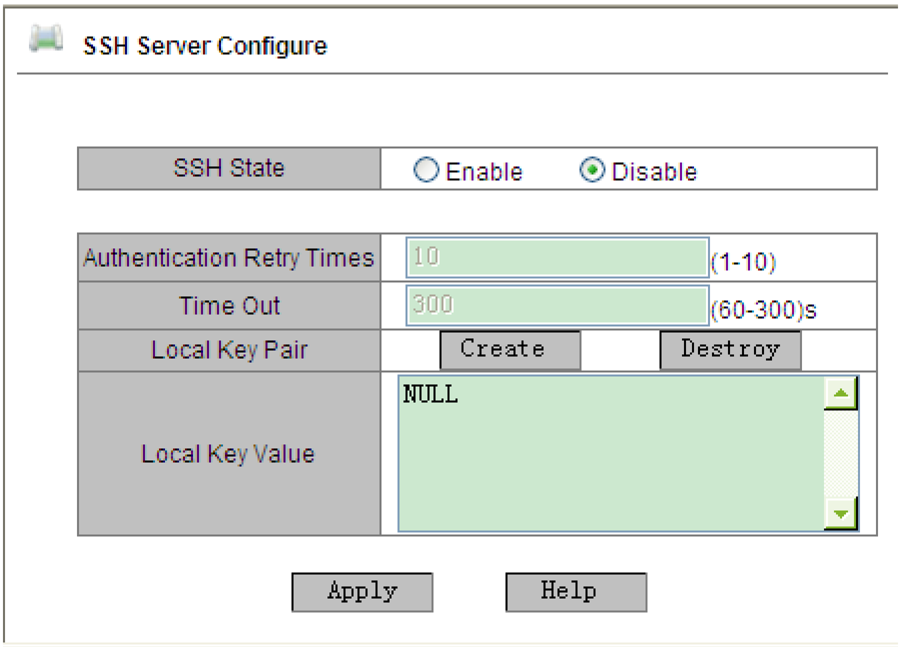
- Version negotiation stage: currently, SSH consists of two versions: SSH1 and SSH2. The two parties negotiate a version to use.

- Key and algorithm negotiation stage: SSH supports multiple types of encryption algorithms. The two parties negotiate an algorithm to use.
- Authentication state: the SSH client sends an authentication request to the server and the server authenticates the client.
- Session request stage: the client sends a session request to the server after passing the authentication.
- Session stage: the client and the server start communication after passing the session request

16.1.4 Web Configuration

- SSH server configuration steps:

1. Disable SSH Status
2. Click <Destroy> to destroy the old key pair, as shown in Figure 95.

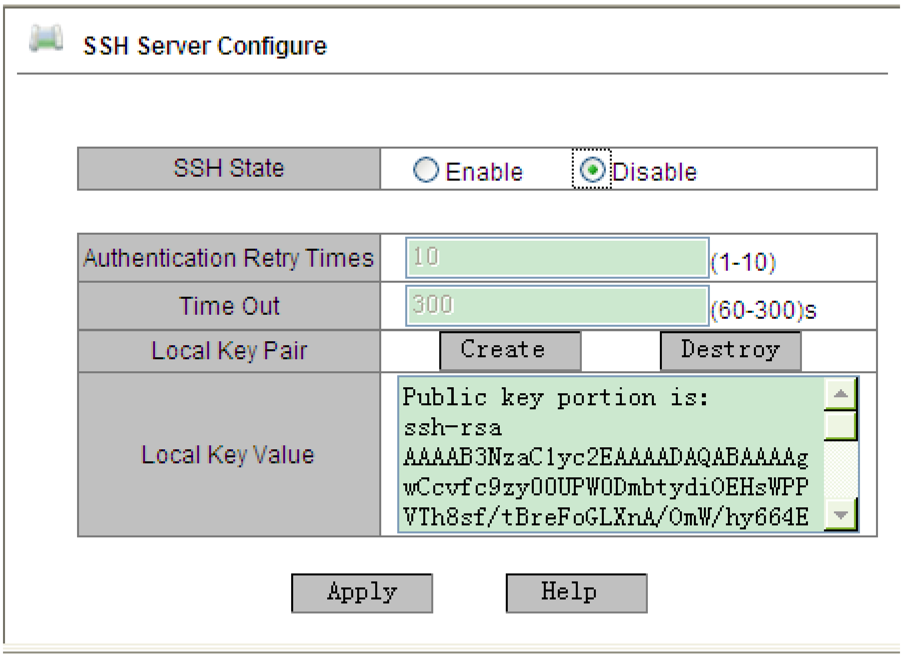


SSH Server Configure

SSH State	○ Enable ● Disable
Authentication Retry Times	10 (1-10)
Time Out	300 (60-300)s
Local Key Pair	Create Destroy
Local Key Value	NULL

Figure 95: Destroy the Old Key Pair

3. Click <Create> to create a new key pair, as shown in Figure 96.



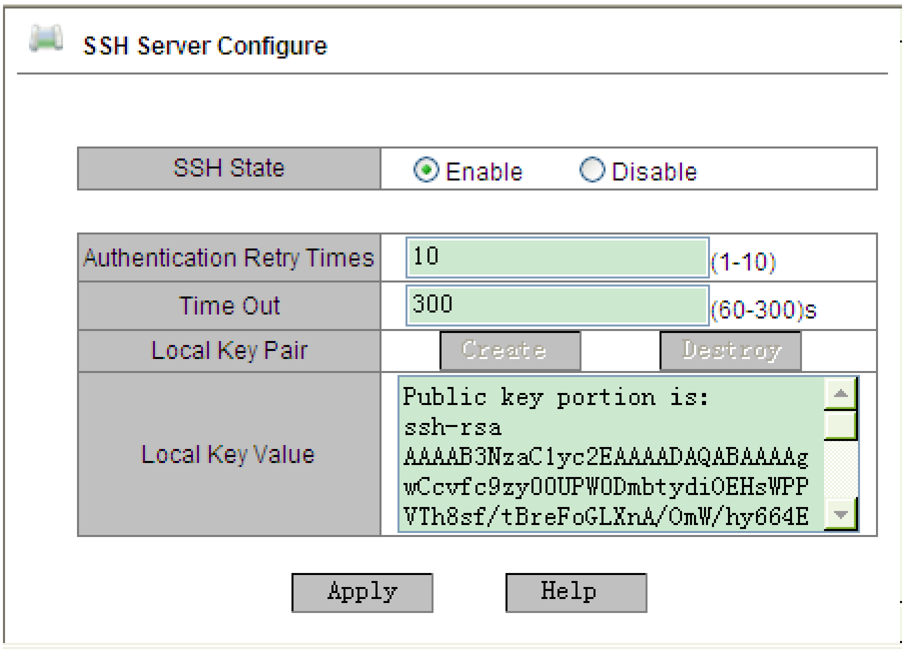
SSH Server Configure

SSH State	○ Enable ● Disable

Authentication Retry Times	10 (1-10)
Time Out	300 (60-300)s
Local Key Pair	Create Destroy
Local Key Value	Public key portion is: ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAAAg wCcvfc9zy0OUPWODmbtydiOEHsWPP VTh8sf/tBreFoGLXnA/OmW/hy664E

Figure 96: Create a new key pair

4. Enable SSH protocol and configure the SSH server, as shown in Figure 97.



SSH Server Configure

SSH State	● Enable ○ Disable

Authentication Retry Times	10 (1-10)
Time Out	300 (60-300)s
Local Key Pair	Create Destroy
Local Key Value	Public key portion is: ssh-rsa AAAAB3NzaC1yc2EAAAADAQABAAAAg wCcvfc9zy0OUPWODmbtydiOEHsWPP VTh8sf/tBreFoGLXnA/OmW/hy664E

Figure 97: SSH server configuration

SSH State

Configuration options: Enable/Disable

Default: Disable

Function: Enable/Disable SSH protocol. If it is enabled, the switch works as the

SSH server.

Authentication Retry Times

Configuration range: 1~10

Default: 10

Function: set the number of attempts to log into SSH server

Time Out

Configuration range: 60~300

Default: 300

Function: set the time that the SSH client connection lasts when there is no date transmission. When the time is out, the connection automatically disconnects.

Local Key Pair

Configuration options: Create/Destroy

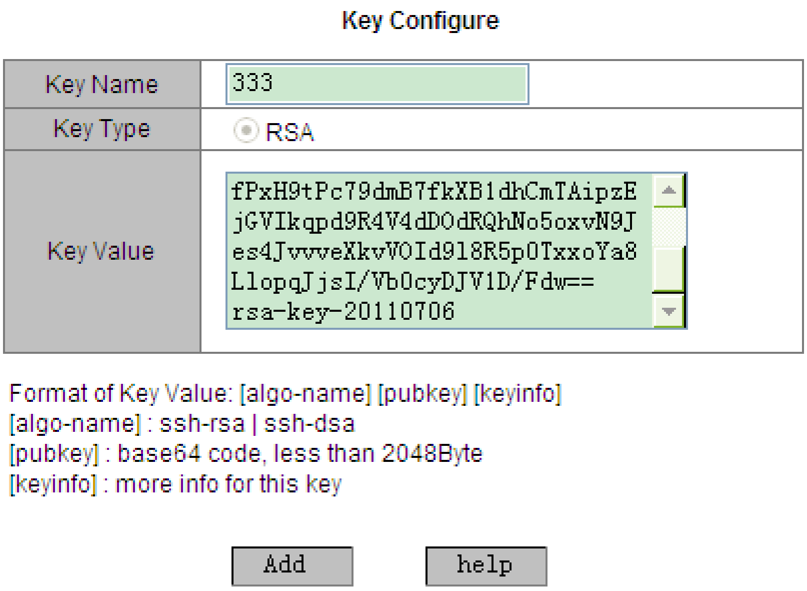
Function: create or destroy the local key pair of the SSH server. Please create a local key pair before enabling SSH server; destroy the old key pair before creating a new key pair.

Local Key Value

Function: show the local key value. Click <Create> to automatically generate the key value.

➢ SSH key configuration steps:

1. SSH key configuration, as shown in Figure 98.



Key Configure

Key Name	333
Key Type	● RSA
Key Value	fPxH9tPc79dmB7fkXB1dhCmTAipzE jGVIkqpd9R4V4dDOdRQhNo5oxvN9J es4JvvveXkvVOId918R5p0TxxoYa8 LlopqJjsI/Vb0cyDJV1D/Fdw== rsa-key-20110706

Format of Key Value: [algo-name] [pubkey] [keyinfo]
[algo-name] : ssh-rsa | ssh-dsa
[pubkey] : base64 code, less than 2048Byte
[keyinfo] : more info for this key

Figure 98: SSH key configuration

Key Name

Configuration range: 3~20 characters

Function: set the key name and support max 3 keys

Key Type

Fixed configuration: RSA

Explanation: this series switches only support RSA key algorithm

Key Value

Configuration format: {algorithm name, public key, key info}

Algorithm name: ssh-rsa | ssh-dsa

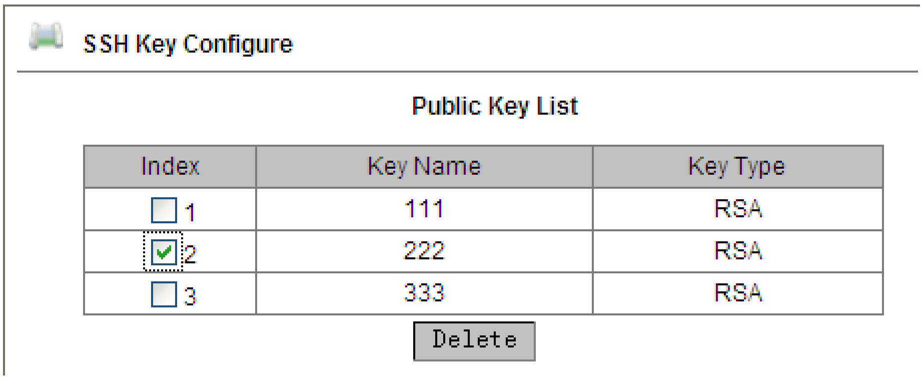
Public key: it is based on 64 codes and the length is less than 2048 bytes

Key info: more info for the key

Function: configure the public key corresponding to the client

Explanation: Generally, the public key is generated by Puttygen software and is copied to the key value of the server; the private key is saved in the client.

2. Show public key list and delete the selected key, as shown in Figure 99.



SSH Key Configure

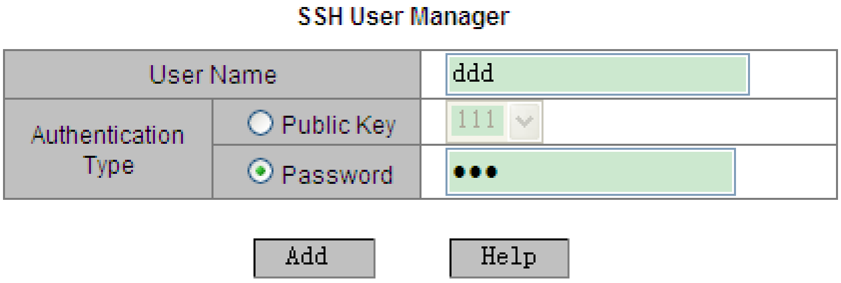
Public Key List

Index	Key Name	Key Type
□ 1	111	RSA
☑ 2	222	RSA
□ 3	333	RSA

Figure 99: Show key list

- ➢ SSH user configuration steps:

1. SSH user configuration, as shown in Figure 100.



SSH User Manager

User Name		ddd
Authentication Type	○ Public Key	111
	● Password	●●●

Figure 100: SSH user configuration

User Name

Configuration range: 3~20 characters

Function: create a user name and support max 4 users

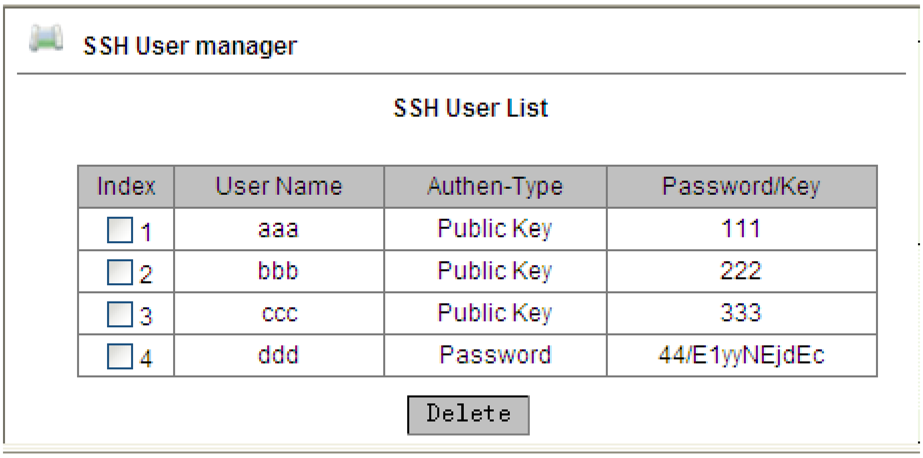
Authentication Type

Configuration options: Public Key/Password

Default: Public key

Function: set user authentication types. If choose "Public Key", choose one key from the public key list; if choose "Password", input 3~8 characters to be password.

2. Show SSH user list and delete the selected user, as shown in Figure 101.



SSH User manager

SSH User List

Index	User Name	Authen-Type	Password/Key
□ 1	aaa	Public Key	111
□ 2	bbb	Public Key	222
□ 3	ccc	Public Key	333
□ 4	ddd	Password	44/E1yyNEjdEc

Figure 101: Show User List

16.1.5 Typical Configuration Example

The Host works as the SSH client to establish a local connection with Switch, as shown in Figure 102.

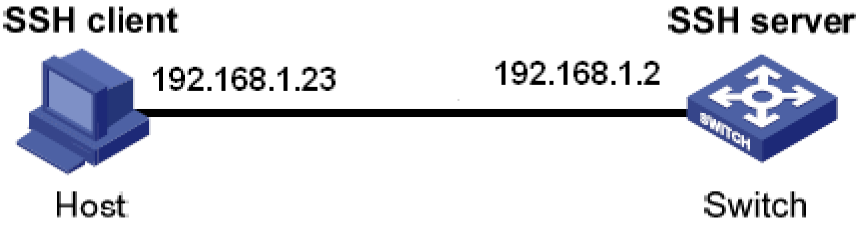
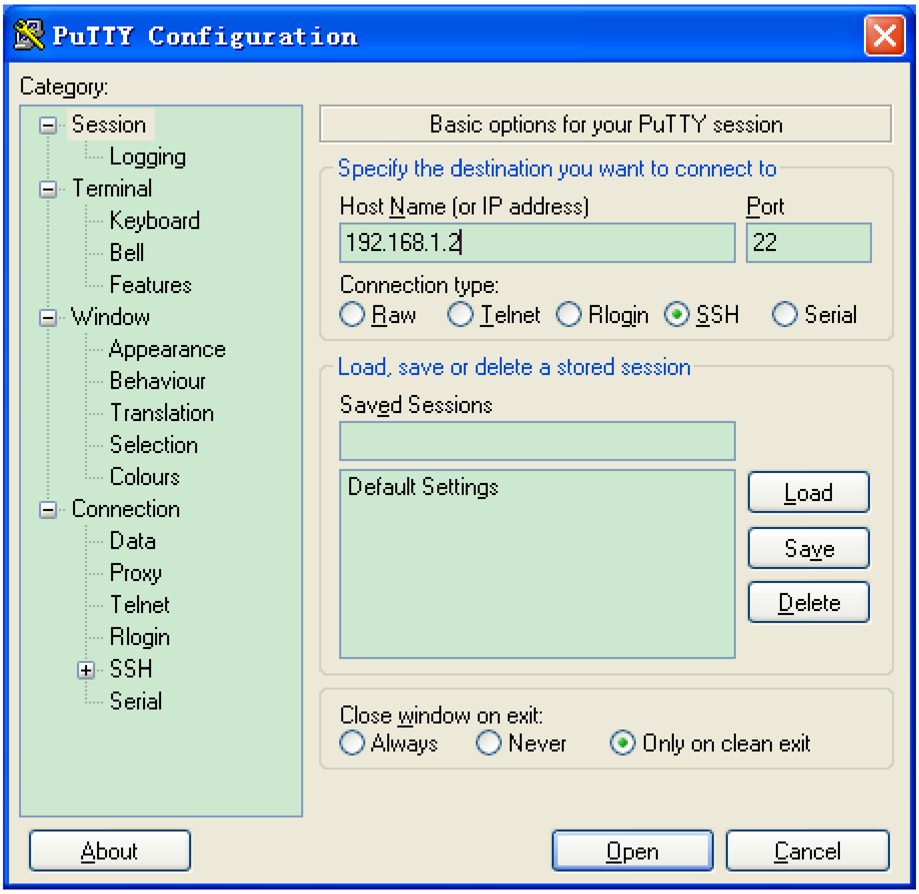


Figure 102: SSH configuration example

- ➢ SSH user chooses the authentication type of "Password":

1. Destroy the old key pair of the server, create a new key pair and start SSH server, see Figure 95, Figure 96, and Figure 97.
2. Set the SSH user name to ddd; choose the authentication type of "Password", set the password to 444, see Figure 100
3. Establish the connection with the SSH server. First, run the PuTTY.exe software, as shown in Figure 103; input the IP address of the SSH server "192. 168.1.2" in the space of Host Name (or IP address)



Host Name (or IP address): 192.168.1.2

Port: 22

Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

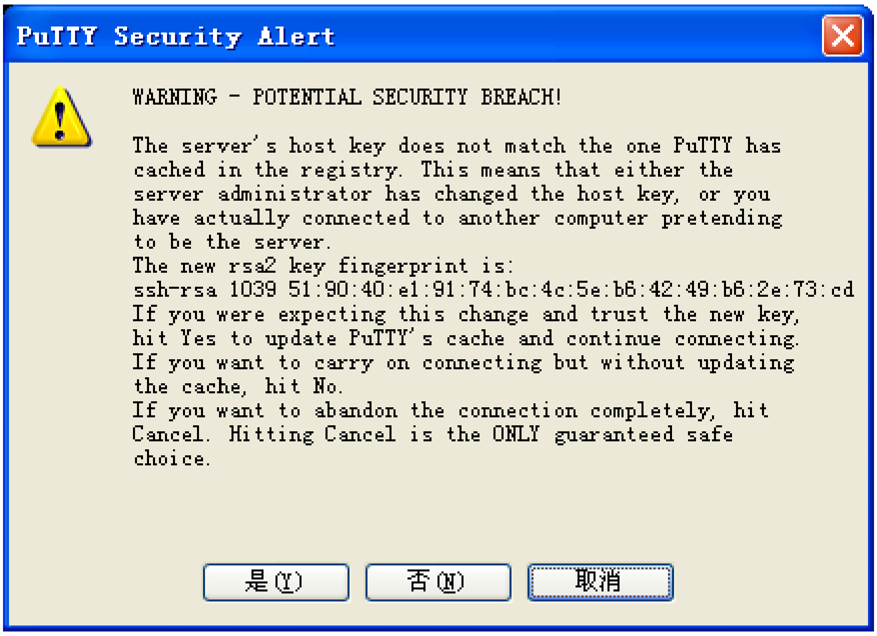
Saved Sessions:

Default Settings

Close window on exit: ○ Always ○ Never ● Only on clean exit

Figure 103: SSH client configuration

4. Click <Open> button and the following warning message appears shown in Figure 104, click the <是(Y)> button.

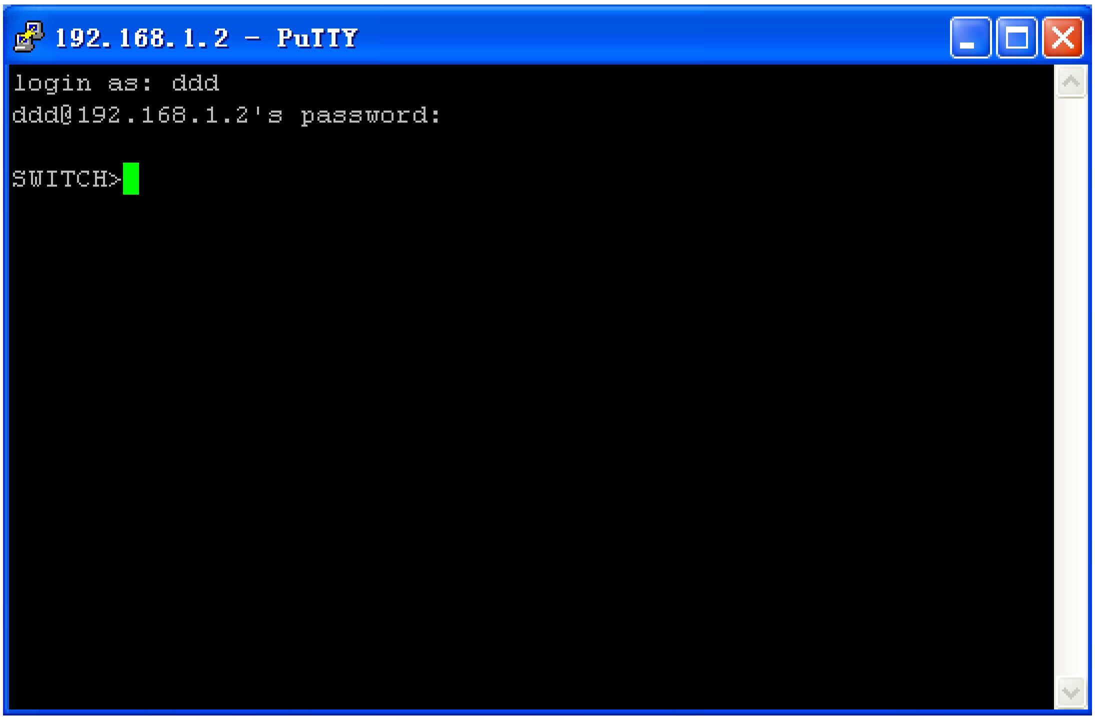


```
WARNING - POTENTIAL SECURITY BREACH!

The server's host key does not match the one PuTTY has
cached in the registry. This means that either the
server administrator has changed the host key, or you
have actually connected to another computer pretending
to be the server.
The new rsa2 key fingerprint is:
ssh-rsa 1039 51:90:40:e1:91:74:bc:4c:5e:b6:42:49:b6:2e:73:cd
If you were expecting this change and trust the new key,
hit Yes to update PuTTY's cache and continue connecting.
If you want to carry on connecting but without updating
the cache, hit No.
If you want to abandon the connection completely, hit
Cancel. Hitting Cancel is the ONLY guaranteed safe
choice.
```

Figure 104: Warning message

5. Input the user name "ddd" and the password "444" to enter the switch configuration interface, as shown in Figure 105.



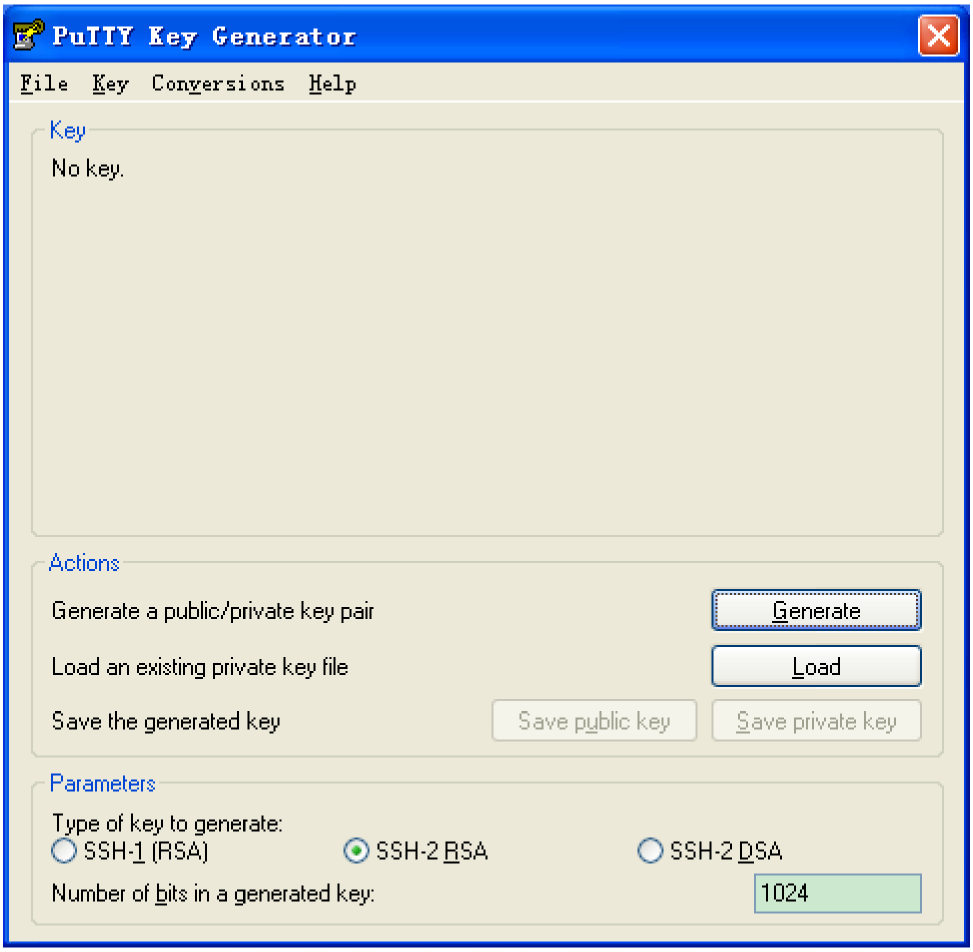
```
login as: ddd
ddd@192.168.1.2's password:

SWITCH>
```

Figure 105: Login interface of the SSH password authentication

➢ SSH user chooses the authentication type of "Public Key":

1. Destroy the old key pair of the server, create a new key pair and start the SSH server, see Figure 95, Figure 96 and Figure 97.
2. Configure SSH client, see Figure 98; run PuTTYGen.exe in the client, click <Generate> button to generate the client key pair, as shown in Figure 106.



No key.

Generate a public/private key pair

Load an existing private key file

Save the generated key

Type of key to generate:
○ SSH-1 (RSA) ● SSH-2 RSA ○ SSH-2 DSA

Number of bits in a generated key: 1024

Figure 106: Generate the client key

3. In the generation process, please move the mouse in the screen, otherwise, the progress bar does not move forward and the generation stops, as shown in Figure 107.

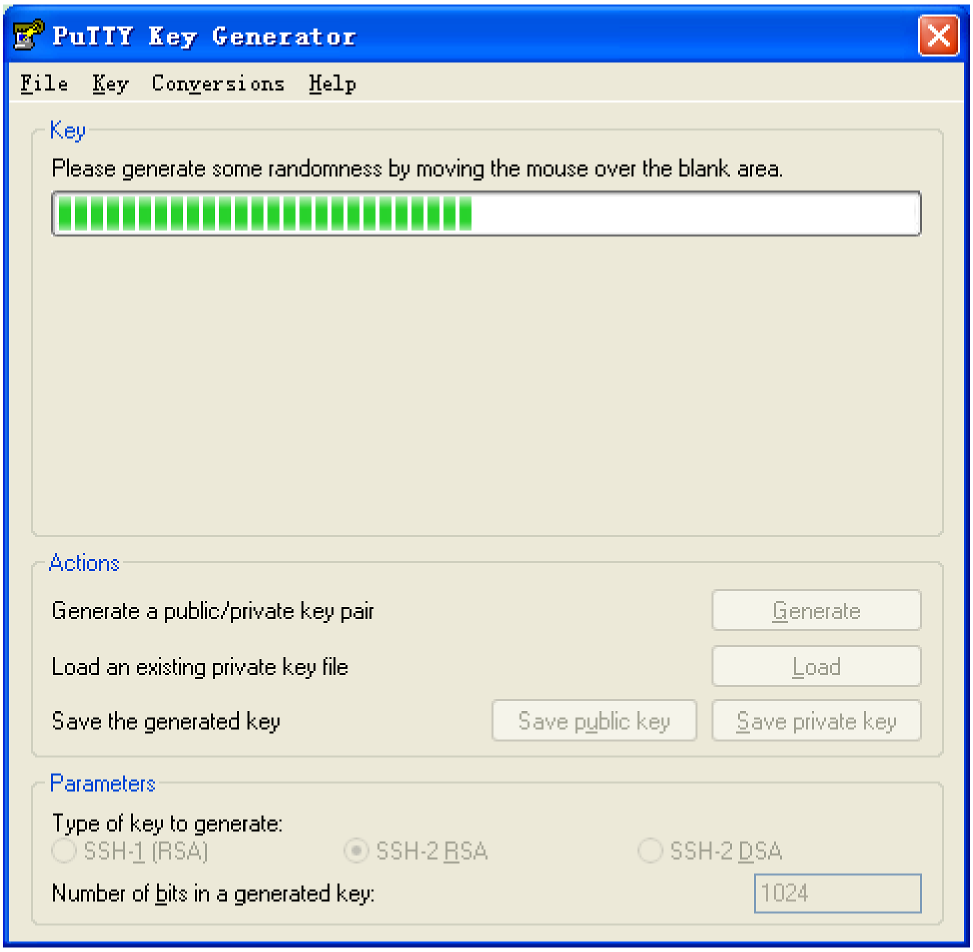
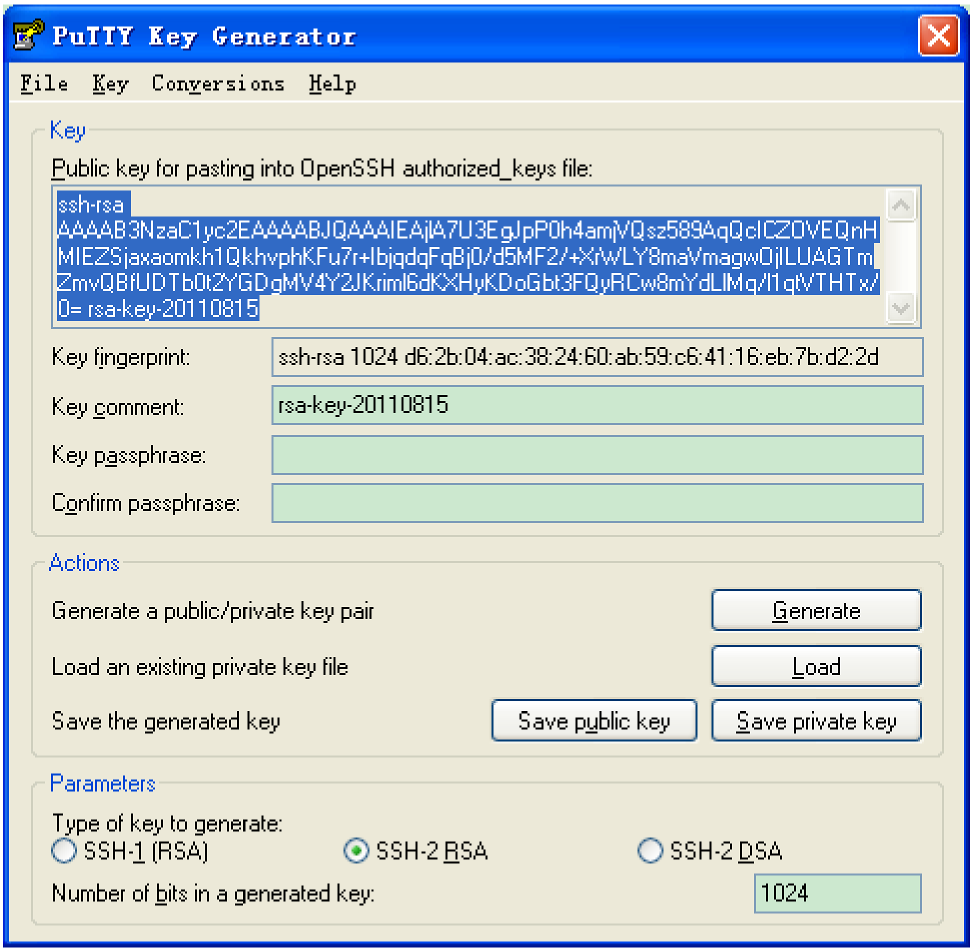

PuTTY Key Generator
File Key Conversions Help
Key
Please generate some randomness by moving the mouse over the blank area.
Actions
Generate a public/private key pair
Generate
Load an existing private key file
Load
Save the generated key
Save public key
Save private key
Parameters
Type of key to generate:
○ SSH-1 (RSA)
● SSH-2 RSA
○ SSH-2 DSA
Number of bits in a generated key:
1024

Figure 107: Key Generation

4. As Figure 108 shows, click <Save private key> to save the private key, and copy the public key to the space of Key Value in the SSH Key Configuration interface and input the key name, as shown in Figure 98.



Public key for pasting into OpenSSH authorized_keys file:

```
ssh-rsa
AAAAB3NzaC1yc2EAAAABJQAAAIEAjlA7U3EgJpP0h4amjVQsz589AqQclCZ0VEQnH
MIEZSjaxaomkh1QkhvphKFu7r+IbjqdqFqBj0/d5MF2/+XrWLY8maVmagw0jlLUAGTm
ZmvQBfUDTb0t2YGDgMV4Y2JKriml6dKXHyKDoGbt3FQyRCw8mYdLIMq/l1qtVTHTx/
0= rsa-key-20110815
```

Key fingerprint: ssh-rsa 1024 d6:2b:04:ac:38:24:60:ab:59:c6:41:16:eb:7b:d2:2d

Key comment: rsa-key-20110815

Key passphrase:

Confirm passphrase:

Generate a public/private key pair

Load an existing private key file

Save the generated key

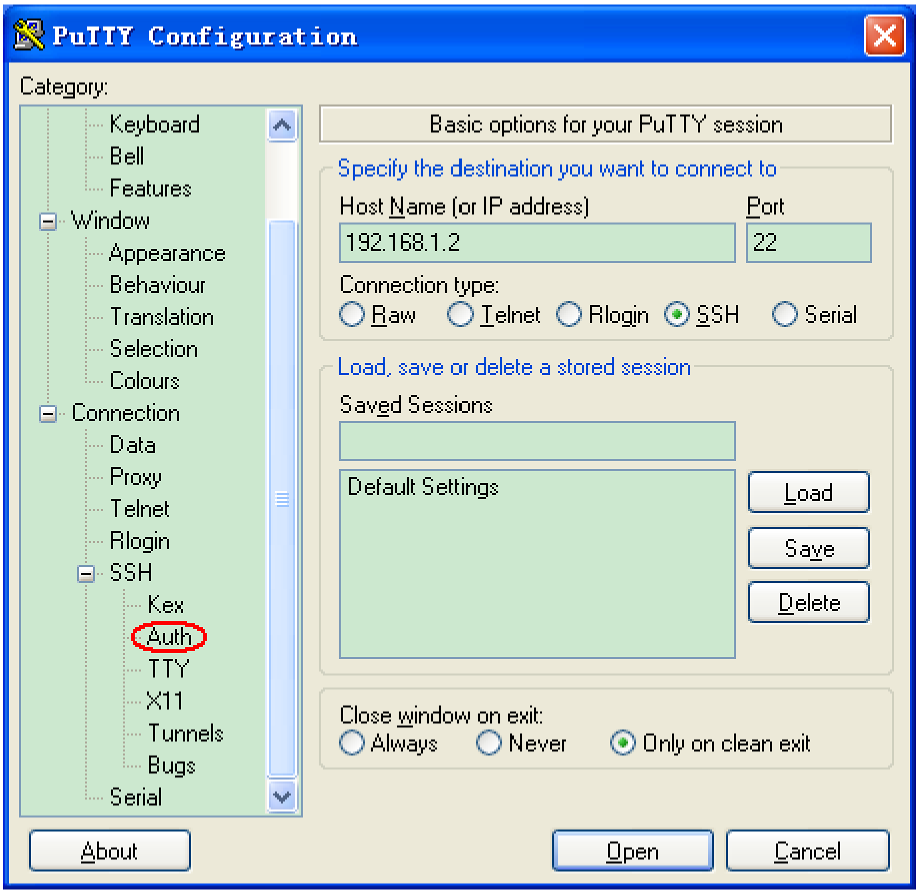
Type of key to generate:
○ SSH-1 (RSA) ● SSH-2 RSA ○ SSH-2 DSA

Number of bits in a generated key: 1024

Figure 108: Generate the key value

5. Configure the SSH user name to ddd, and select the authentication type of "Public Key", choose the corresponding key name, as shown in Figure 100.

6. Establish a connection with the SSH server. First, run the PuTTY.exe software, as shown in Figure 109; input the IP address of the SSH server "192.168.1.2" in the space of Host Name (or IP address)



Host Name (or IP address): 192.168.1.2
Port: 22

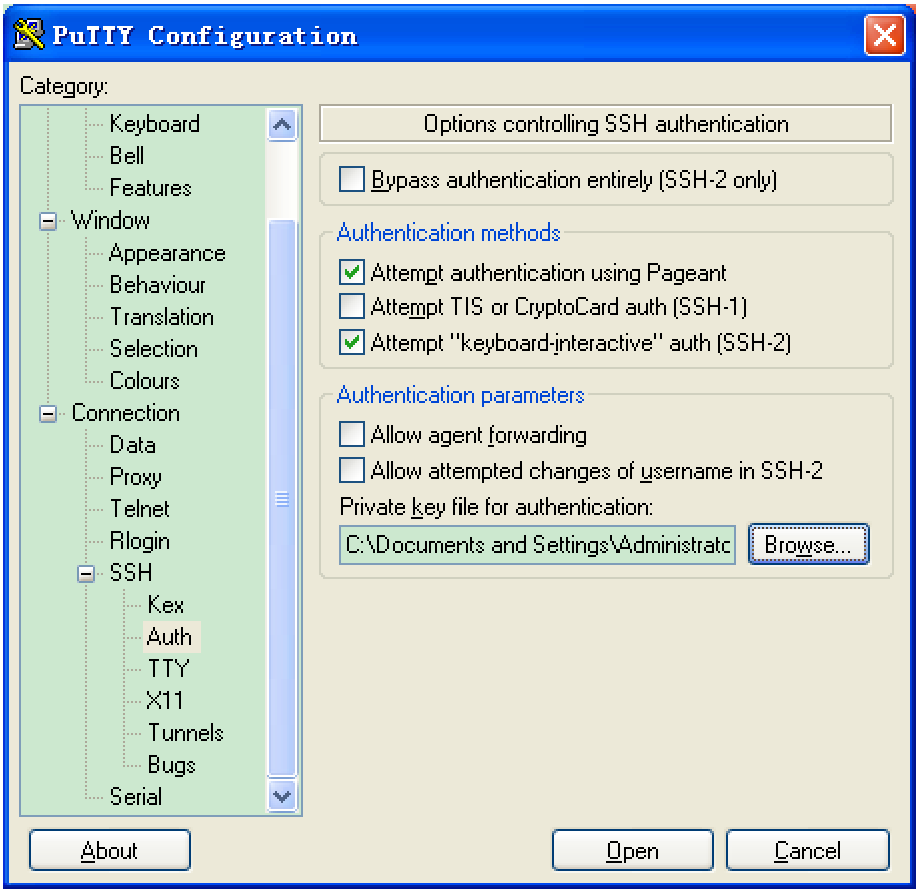
Connection type: ○ Raw ○ Telnet ○ Rlogin ● SSH ○ Serial

Default Settings

Close window on exit: ○ Always ○ Never ● Only on clean exit

Figure 109: SSH client configuration of the "Public Key" authentication

7. Click [SSH]→[Auth] in the left side of the Figure 109, and the screen shown in Figure 110 appears, click <Browse> and choose the private file saved in the step 4.



Options controlling SSH authentication

□ Bypass authentication entirely (SSH-2 only)

Authentication methods

☑ Attempt authentication using Pageant

□ Attempt TIS or CryptoCard auth (SSH-1)

☑ Attempt "keyboard-interactive" auth (SSH-2)

Authentication parameters

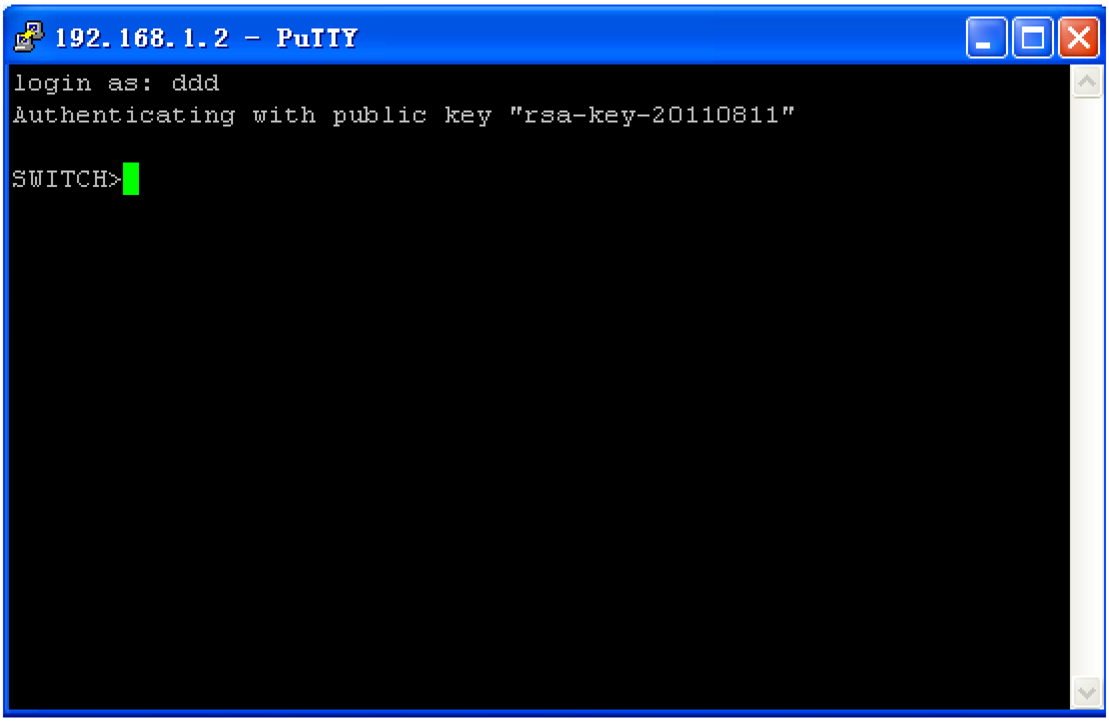
□ Allow agent forwarding

□ Allow attempted changes of username in SSH-2

Private key file for authentication: C:\Documents and Settings\Administratc

Figure 110: Choose the key file

8. Click <Open> button; input the user name to enter the switch configuration interface, as shown in Figure 111.



```
login as: ddd
Authenticating with public key "rsa-key-20110811"

SWITCH>
```

Figure 111: Login interface of the SSH public key authentication

16.2 Dot1x

16.2.1 Introduction

In order to solve the WLAN security problem, IEEE802LAN/WAN committee put forwarded the 802.1X protocol. IEEE802.1X protocol is used in Ethernet as a common access control mechanism, mainly solving authentication and security problems of Ethernet. 802.1X protocol is a kind of Port-Based Network Access Control protocol. Port-Based Network Access Control is to authenticate and control accessing devices on the port. The device connected to an 802.1X-enabled port can access the resources in LAN only after passing authentication. The 802.1X-enabled systems is a typical Client/Server structure. 802.1X application requires three elements:

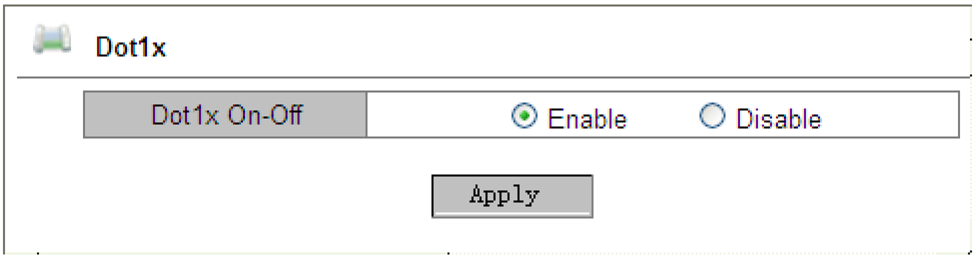
Client: generally, it is a user terminal device. When users want to get online, they need to activate the Client program and input the username and password, and then the client program will send out the request for connection.

Authenticator: in Ethernet system, it means the authentication switch that is mainly in charge of the transmission of authentication information and authentication result, and it can enable or disable ports according to authentication results.

Authentication server: it is to provide authentication services. It verifies identifiers (Username and password) sent from the client to judge whether the user has right to use the network services, and it will send Enable/Disable Port command to the switch according to the authentication result.

16.2.2 Web Configuration

1. Enable global Dot1x function, as shown in Figure 112.



Dot1x On-Off: ● Enable ○ Disable

Figure 112: Enable global Dot1x

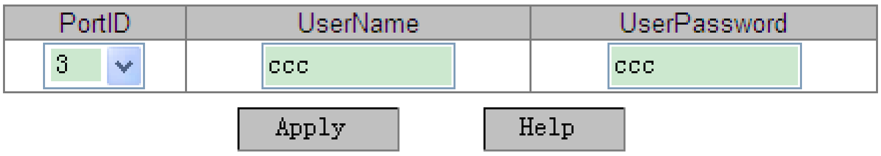
Dot1x On-Off

Configuration options: Enable/Disable

Default: Disable

Function: Enable/Disable global Dot1x security function

2. Dot1x information configuration on port, as shown in Figure 113.



PortID	UserName	UserPassword
3	ccc	ccc

Figure 113: Dot1x information

Port ID

Configuration options: all switch ports

Function: choose the port to enable Dot1x function

User Name

Configuration range: 1-16 characters

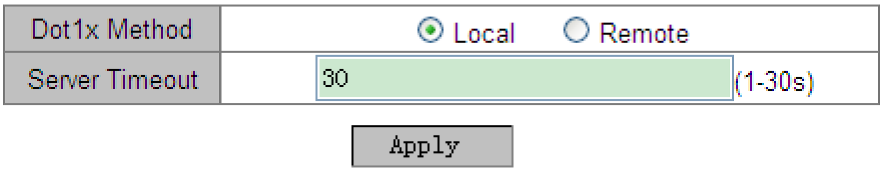
Function: configure the user name bound to the port

User Password

Configuration range: 1-16 characters

Function: configure the user password bound to the port

3. Configure authentication method and authentication timeout, as shown in Figure 114.



Dot1x Method	● Local ○ Remote
Server Timeout	30 (1-30s)

Figure 114: Configure authentication method and timeout

Dot1x Method

Configuration options: Local/Remote

Default: Local

Function: choose the Dot1x authentication method

Explanation: If choose Local, user needs to manually add authentication username and password on switch. If choose Remote, user needs to pass TACACS+ server authentication with the user name and password set on TACACS+ server.

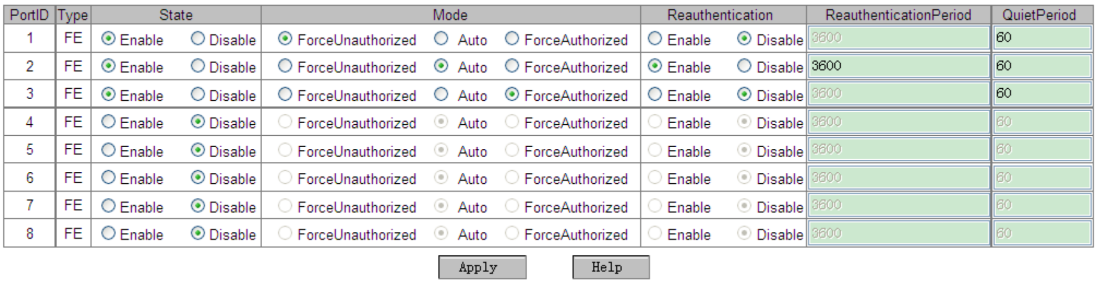
Server Timeout

Configuration range: 1-30s

Default: 30s

Function: configure the authentication timeout. If user does not pass the authentication within this time, it is assumed that the authentication fails and user enters the quiet state.

4. Configure Dot1x-enabled ports, as shown in Figure 115.



PortID	Type	State		Mode			Reauthentication		ReauthenticationPeriod	QuietPeriod
1	FE	● Enable	○ Disable	● ForceUnauthorized	○ Auto	○ ForceAuthorized	○ Enable	● Disable	3600	60
2	FE	● Enable	○ Disable	○ ForceUnauthorized	● Auto	○ ForceAuthorized	● Enable	○ Disable	3600	60
3	FE	● Enable	○ Disable	○ ForceUnauthorized	○ Auto	● ForceAuthorized	○ Enable	● Disable	3600	60
4	FE	○ Enable	● Disable	○ ForceUnauthorized	● Auto	○ ForceAuthorized	○ Enable	● Disable	3600	60
5	FE	○ Enable	● Disable	○ ForceUnauthorized	● Auto	○ ForceAuthorized	○ Enable	● Disable	3600	60
6	FE	○ Enable	● Disable	○ ForceUnauthorized	● Auto	○ ForceAuthorized	○ Enable	● Disable	3600	60
7	FE	○ Enable	● Disable	○ ForceUnauthorized	● Auto	○ ForceAuthorized	○ Enable	● Disable	3600	60
8	FE	○ Enable	● Disable	○ ForceUnauthorized	● Auto	○ ForceAuthorized	○ Enable	● Disable	3600	60

Figure 115: The Dot1x-enabled port configuration

State

Configuration options: Enable/Disable

Default: Disable

Function: Enable/Disable Dot1x protocol on port. When this function is enabled, user can log into switch from this port only after passing authentication.

Mode

Configuration options: ForceUnauthorized/Auto/ForceAuthorized

Default: Auto

Function: choose the authentication mode of the port

Explanation: ForceUnauthorized means that the port is always in an unauthorized state and does not allow user authentication and the authenticator does not offer the authentication service to clients that would like to access the network through this port; Auto means the initial state of the port is an unauthorized mode and the port does not allow users to access network resources, but if a user passes authentication, the port will be switched to the authorized state and allows user to access network resources. ForceAuthorized means that the port is always in an authorized state and allows user to access network resources without passing authentication.

Reauthentication

Configuration: Enable/Disable

Default: Disable

Function: When the authentication is passed, the periodical reauthentication is required or not.

Reauthentication Period

Configuration range: 60~7200s

Default: 3600s

Function: When the authentication is passed, set the time interval of reauthentication.

Quiet Period

Configuration range: 10~120s

Default: 60s

Function: when user fails in authentication and enters a quiet state, it will send the authentication request again when the Quiet period ends.

16.2.3 Typical Configuration Example

As Figure 116 shows, Dot1x client connects with switch port 3; enable Dot1x protocol in port 3 and choose Auto authentication mode; the local authentication username and password are both ccc and the remote authentication username and password are both ddd, other settings use the default values.

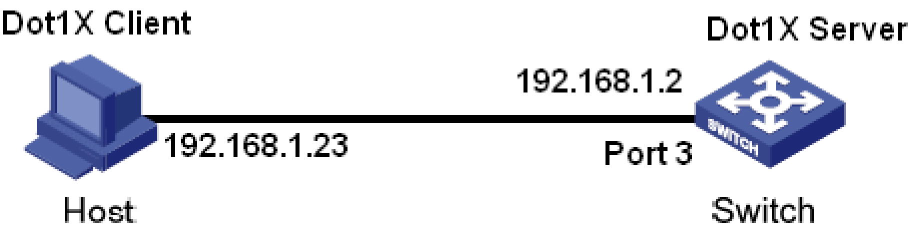


Figure 116: Dot1x configuration example

- Local authentication configuration

1. Enable global Dot1x protocol, as shown in Figure 112
2. Configure the username and password of port 3 to ccc, as shown in Figure 113
3. Choose the Dot1x method of Local, as shown in Figure 114
4. Enable Dot1x protocol in port 3, and the authentication mode is set to Auto, as shown in Figure 115
5. Install 802.1X authentication client software and run it, input username and password "ccc" to do authentication. User can access the switch after passing authentication.

- Remote authentication configuration

1. Enable global Dot1x protocol, as shown in Figure 112
2. Configure the username and password of port 3 to ccc, as shown in Figure 113
3. Choose the Dot1x method of Remote, as shown in Figure 114
4. Enable Dot1x protocol in port 3, and the authentication mode is set to Auto, as shown in Figure 115
5. Install 802.1X authentication client software and run it, input username and

password "ddd" to do authentication. User can access the switch after passing authentication.

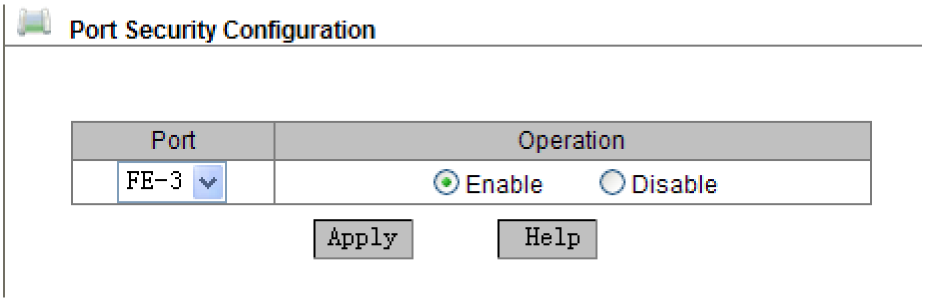
16.3 Port Security

16.3.1 Introduction

Port security is a MAC address-based security mechanism for network access control. This mechanism detects the source MAC addresses of the port-received frames to control the network access of unauthorized devices. The main function of port security is to let devices learn legal source MAC addresses by defining different types of port security modes.

16.3.2 Web Configuration

1. Select the port to enable Port Security function, as shown in Figure 117.



Port Security Configuration

Port	Operation
FE-3	● Enable ○ Disable

Figure 117: Enable Port Security

Port

Configuration options: all switch ports

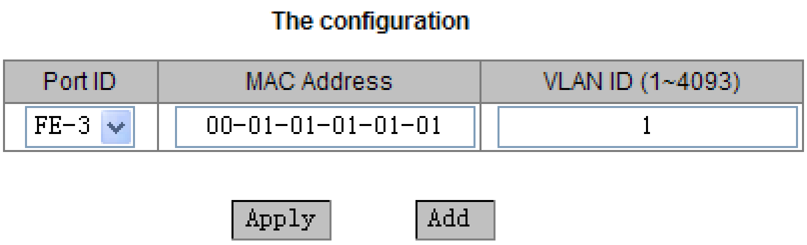
Operation

Configuration options: Enable/Disable

Default: Enable

Function: Enable/Disable port security function

2. Port security address configuration, as shown in Figure 118.



The configuration

Port ID	MAC Address	VLAN ID (1~4093)
FE-3	00-01-01-01-01-01	1

Figure 118: Port security address configuration

Port ID

Configuration options: the ports that enable port security function

Function: select the port to bind to the security address

MAC Address

Function: set the MAC address that is bound to the port. Only the message whose source MAC address is this binding address can pass through this port, otherwise the message is dropped.

VLAN ID

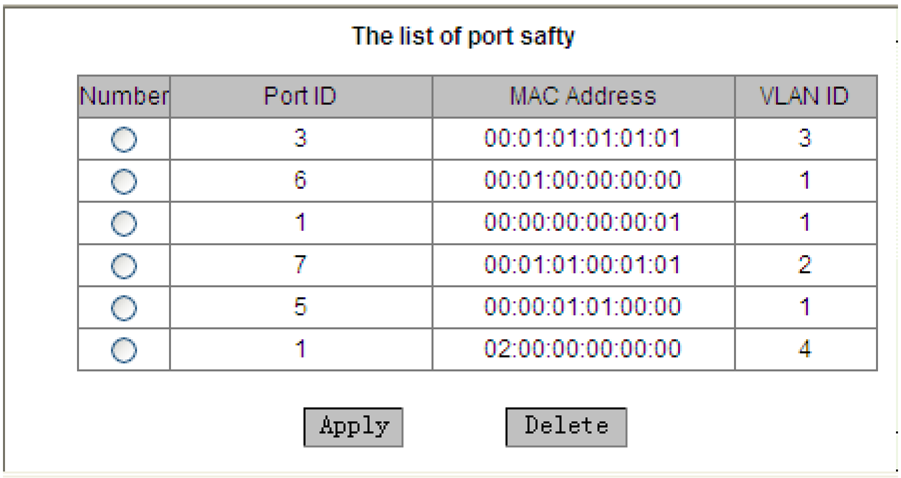
Configuration range: all existing VLANs

Function: set the VLAN ID of the port

Caution:

Each port of the series switches can configure max 32 port security entries.

3. Show the port security list and delete the selected port security configuration, as shown in Figure 119.



The list of port safty

Number	Port ID	MAC Address	VLAN ID
○	3	00:01:01:01:01:01	3
○	6	00:01:00:00:00:00	1
○	1	00:00:00:00:00:01	1
○	7	00:01:01:00:01:01	2
○	5	00:00:01:01:00:00	1
○	1	02:00:00:00:00:00	4

Figure 119: Port security list

16.3.3 Typical Configuration Example

Bind the MAC address of 0x000101010000 to the port 1 in VLAN 2, then only the message with the source MAC address of 0x000101010000 can pass through the port 1 in VLAN 2.

Configuration steps:

1. Enable port security function in port 1, as shown in Figure 117.
2. Set the MAC address of port 1 to 0x000101010000, and the VLAN ID to 2, as shown in Figure 118.

16.4 AAA Configure

16.4.1 Introduction

AAA (Authentication, Authorization, Accounting) is a management mechanism for network security, providing authentication, authorization and accounting functions.

Authentication: confirm the identity of the remote accessing user and judge whether it is a legal user

Authorization: grant different rights to different users and limit services that users can access to.

Accounting: record all operations performed by users when they use network services, including service type, start time, data flow. It is not only an accounting method, also the supervision of the network security.

16.4.2 Implementation

First, Authentication provides user authentication. It usually uses user name and password to verify user rights. The principle of authentication is that each user has a unique right to obtain a standard, and AAA server checks the standard with user standards in the database one by one. If there is conformity, the user passes the authentication; if there is not, the server refuses the network connection request.

Next, user obtains rights to operate corresponding tasks by Authorization. For example, user is likely to execute some commands for operation after logging into system, so the Authorization process will detect whether the user has rights to execute these commands. Simply put, authorization process includes the activity type or quality confirmation, the resources or services allocated to users. Authorization happens in the process of authentication. Once a user passes the authentication, the corresponding rights will be authorized to the user.

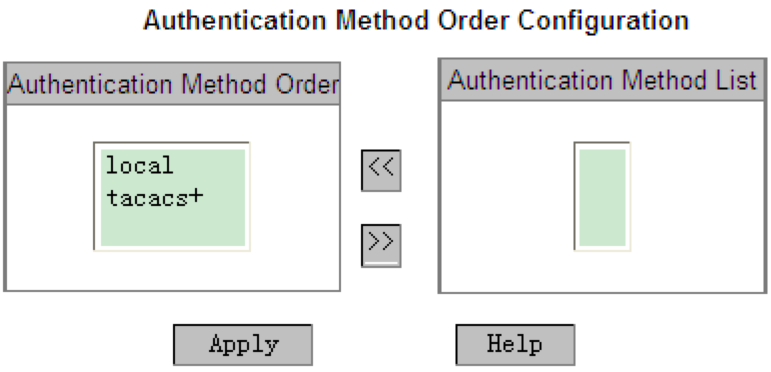
Last is Accounting. It is to account the number of resources that are consumed in the user connection process. These resources contain the connecting time or the transmitted and received data flow in the user connection process, and so on.

The Accounting process can be executed according to statistics logs in the connection process and the user information, and the authorization control, bill and trend analysis, resource utilization, and capacity planning.

Currently, the network connection server interface coordinating with AAA server is TACACS+ protocol.

16.4.3 Web Configuration

1. Authentication method order configuration, as shown in Figure 120.


Authentication Method Order Configuration

Authentication Method Order: local, tacacs+

Authentication Method List:

Figure 120: Configure authentication method

Authentication Method Order Configuration

Configuration options: local/tacacs+/local, tacacs+/tacacs+, local

Default: local

Function: choose the authentication order

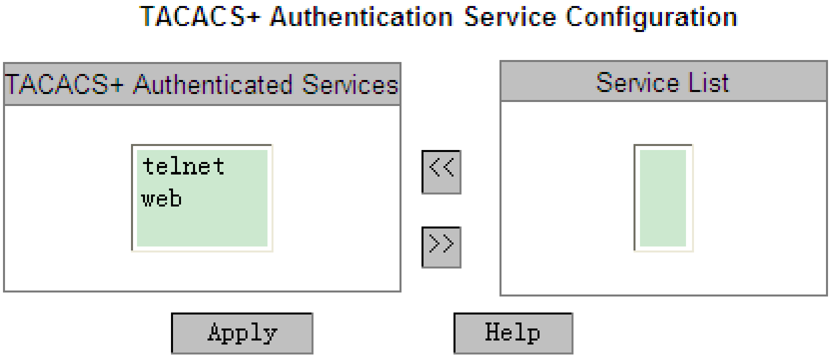
Explanation: local: take the local authentication, which uses the user name and password created on device to login.

tacacas+: take the TACACS+ authentication, which uses the user name and password set on TACACS+ server

local, tacacs+: take the local authentication first, if cannot pass the authentication, then take TACACS+ authentication.

tacacs+, local: take the TACACS+ authentication first, if cannot pass the authentication, then take the local authentication.

2. TACACS+ authentication service configuration, as shown in Figure 121.


TACACS+ Authentication Service Configuration

TACACS+ Authenticated Services: telnet, web

Service List:

Figure 121: TACACS+ authentication service configuration

TACACS+ Authentication Service Configuration

Configuration options: telnet/web

Function: choose the login method of TACACS+ authentication

16.5 TACACS+ Configure

16.5.1 Introduction

TACACS+ (Terminal Access Controller Access Control System) is a kind of application based on TCP transmission protocol and uses client/server mode to achieve the communication between NAS (Network Access Server) and TACACS+ server. Clients run on NAS and the server performs centralized management of user information. For users, NAS is a sever, but for TACACS+ server, NAS is a client. Figure 122 shows the structure.

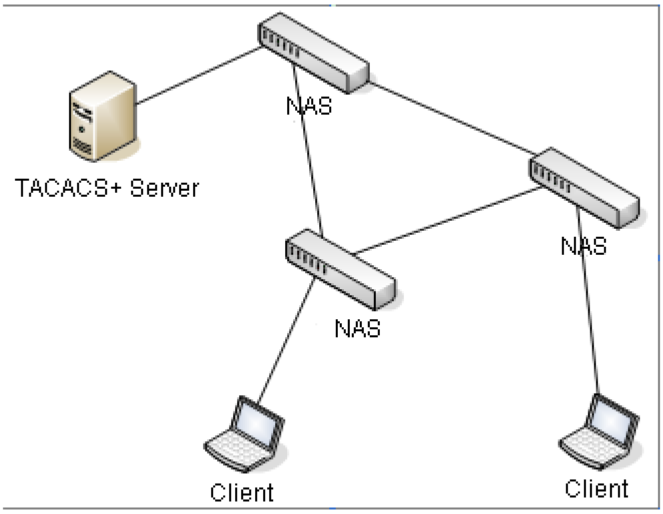
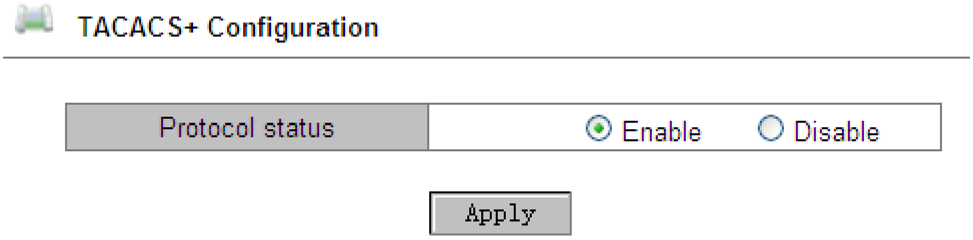


Figure 122: TACACS+ structure

This protocol is used to authenticate, authorize and charge the terminal user that would like to access the device to make operation. The device serves as a TACACS+ client, sending the username and password to the TACACS+ server for verification. The server establishes TCP connection with the client and responds to authentication requests, and verifies whether the user is a legal user. The user can log into the device to make operation only after it passed authentication and was authorized,

16.5.2 Web Configuration

1. Enable TACACS+ protocol, as shown in Figure 123.



TACACS+ Configuration

Protocol status	● Enable ○ Disable

Figure 123: Enable TACACS+ protocol

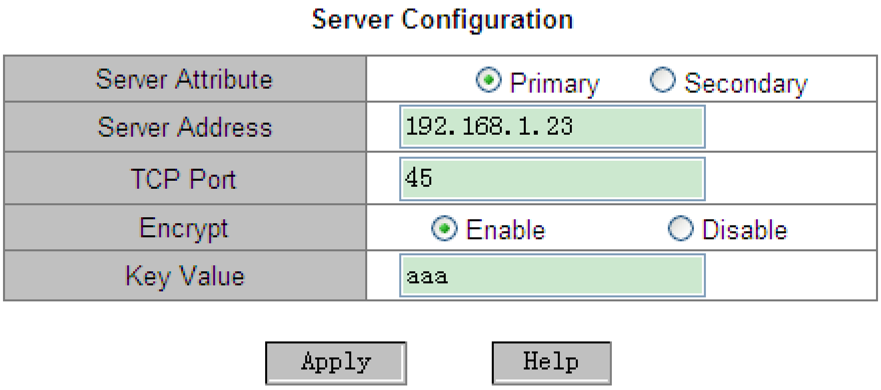
Protocol Status

Configuration options: Enable/Disable

Default: Disable

Function: Enable/Disable TACACS+ protocol

2. TACACS+ server configuration, as shown in Figure 124.



Server Configuration

Server Attribute	● Primary ○ Secondary
Server Address	192.168.1.23
TCP Port	45
Encrypt	● Enable ○ Disable
Key Value	aaa

Figure 124: TACACS+ server configuration

Server Attribute

Configuration options: Primary/Secondary

Default: Primary

Function: choose the server type

Server Address

Function: input the server IP address

TCP Port

Configuration range: 1~65535

Default: 49

Function: the number of the port that receives authentication requests from NAS

Encrypt

Configuration options: Enable/Disable

Default: Disable

Function: Encrypt messages or not. If it is enabled, it is required to input the key value.

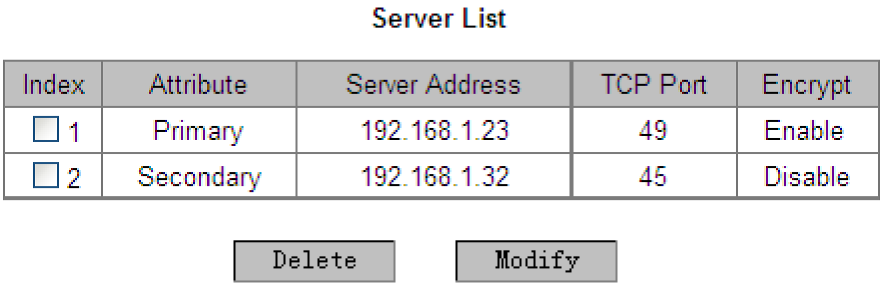
Key Value

Configuration range: 1~32 characters

Function: configure key value

Explanation: set the key value to improve the communication security between client and TACACS+ server. Two parties share the key to verify the message legality. Only when the keys are same can both parties receive messages from each other and respond to messages, so please make sure the key set on the client is same as the key on TACACS+ server.

3. Show server list, as shown in Figure 125.



Server List

Index	Attribute	Server Address	TCP Port	Encrypt
□ 1	Primary	192.168.1.23	49	Enable
□ 2	Secondary	192.168.1.32	45	Disable

Figure 125: Server list

Show TACACS+ server list. The selected server configuration can be deleted or be modified.

16.5.3 Typical Configuration Example

As Figure 126 shows, the TACACS+ server can authenticate and authorize the user by using switch. The server IP address is 192.168.1.23, the shared key for the switch and server exchanging messages is aaa.

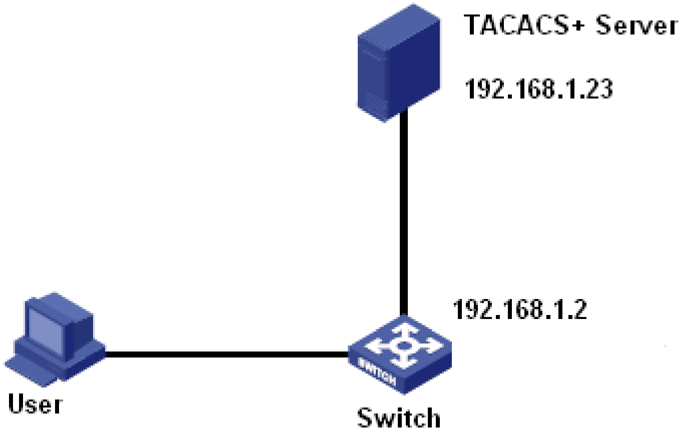


Figure 126: TACACS+ authentication example

1. Enable TACACS+ protocol, as shown in Figure 123.

2. Server configuration: IP address is 192.168.1.23, enable "Encrypt" and the Key Value is aaa, as shown in Figure 124. Web login uses Local authentication and Telnet login uses TACACS+ authentication, as shown in Figure 120 and Figure 121.
3. Configure the user name and password on TACACS+ server to bbb.
4. Input user name "admin" and password "123" and take local authentication to log into switch by Web.
5. Input user name and password "bbb" and take TACACS+ authentication to log into switch by Telnet.

16.6 SSL Configure

16.6.1 Introduction

SSL (Secure Socket Layer) is a security protocol and provides the security link for the TCP-based application layer protocol, such as HTTPS. SSL encrypts the network connection at the transport layer and uses the symmetric encryption algorithm to guarantee the data security, and uses the secret key authentication code to ensure the information reliability. This protocol is widely used in Web browser, receiving and sending emails, network fax, real time communication, and so on, providing an encryption protocol for the security transmission in the network.

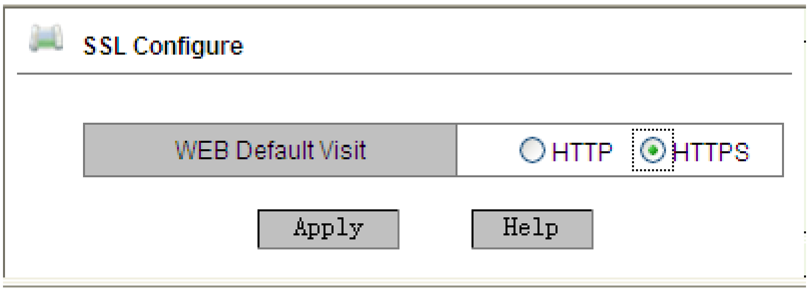
Once a switch enables SSL, users must use the secure link https, such as https://192.168.1.2, to access the switch.

Caution:

When using HTTPS protocol to access switch, please ensure SSL3.0 is used in the Internet options (open the browser, click [Tool]→[Internet Options]→[Advanced]→[Security], tick the "Use SSL3.0").

16.6.2 Web Configuration

1. Enable HTTPS protocol, as shown in Figure 127.



SSL Configure

WEB Default Visit ○ HTTP ● HTTPS

Figure 127: Enable HTTPS protocol

WEB Default Visit

Configuration options: HTTP/HTTPS

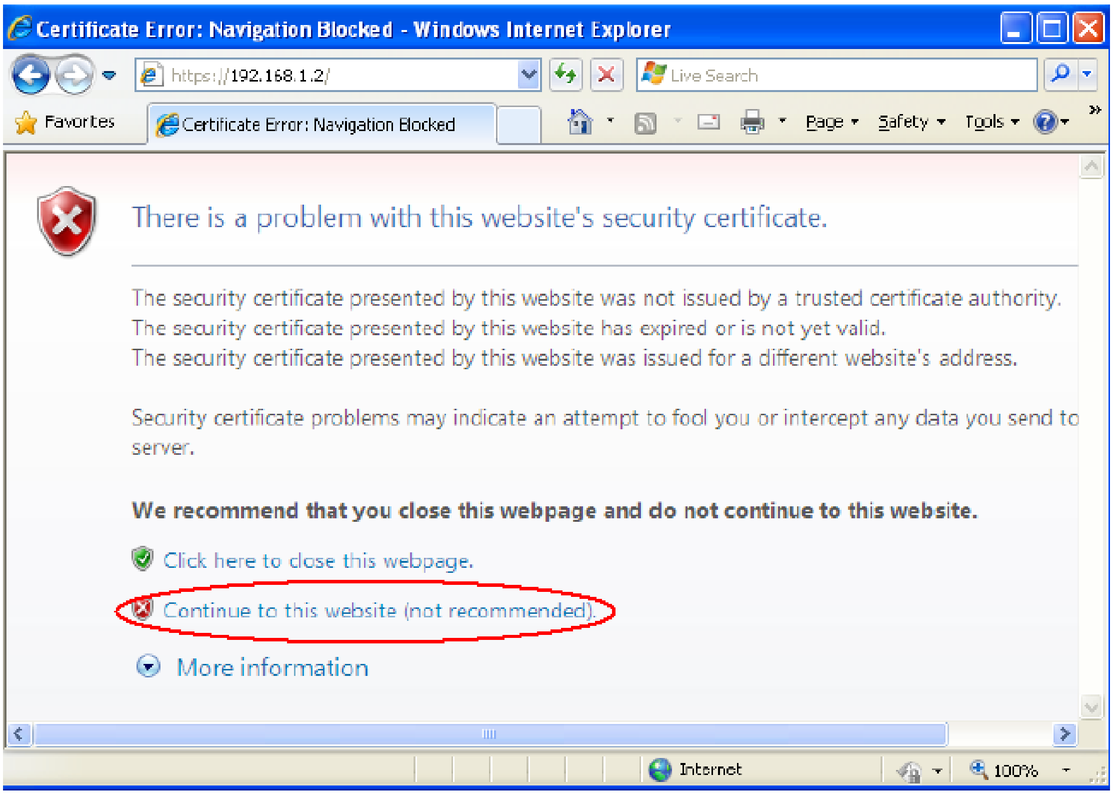
Default: HTTP

Function: choose the protocol to access Web browser.

Explanation: If choose HTTPS, use https://*ipaddress* to log into switch Web Interface.

2. Log into Web interface.

   When a warning about authentication appears, please choose "Continue browsing the website", as shown in Figure 128.



Certificate Error: Navigation Blocked - Windows Internet Explorer
https://192.168.1.2/
Live Search
Favorites
Certificate Error: Navigation Blocked
Page
Safety
Tools
Internet
100%

There is a problem with this website's security certificate.

The security certificate presented by this website was not issued by a trusted certificate authority.
The security certificate presented by this website has expired or is not yet valid.
The security certificate presented by this website was issued for a different website's address.

Security certificate problems may indicate an attempt to fool you or intercept any data you send to the server.

We recommend that you close this webpage and do not continue to this website.

Click here to close this webpage.

Continue to this website (not recommended).

More information

Figure 128: HTTPS logging interface

3. Input the username "admin" and password "123" to successfully log into switch through HTTPS.

17. VLAN

17.1 VLAN Configuration

17.1.1 Introduction

VLAN (Virtual Local Area Network) divides a LAN to multiple logic VLANs. The devices in a same VLAN can communicate to each other and the devices in different VLANs cannot conduct intercommunication, in this way, the broadcast messages are limited in a VLAN, highly improving LAN security.

VLAN partition is not restricted by the physical location. Each VLAN is regarded as a logical network. If a host in one VLAN would like to send data packets to a host in another VLAN, a router or a layer 3 device must be involved.

17.1.2 Principle

In order to let network devices distinguish different VLAN messages, it is needed to add a field into the message to identify VLAN. At present, the most common used protocol to identify VLAN is IEEE802.1Q protocol. The 802.1Q frame structure is shown in Table 7.

Table 7: 802.1Q Frame Structure

DA	SA	802.1Q Header				Length/Type	Data	FCS
		Type	PRI	CFI	VID			

A 4 bytes 802.1Q header is added into the traditional Ethernet data frame and it becomes the VLAN Tag.

Type: 16 bits, used to identify that the frame carries a VLAN Tag, and the value is 0x8100.

PRI: three bits, showing the 802.1p priority of the frame

CFI: one bit. 0 means Ethernet, 1 means token ring

VID: 12 bits, indicating VLAN ID and in the range of 1-4093. 0, 4094 and 4095 are reserved by protocol.

Note:

- VLAN 1 is the default VLAN and cannot be manually created and deleted by users.
- Reserved VLANs are reserved to realize specific functions by system and cannot be manually created and deleted by users.

The message containing 802.1Q header is a Tag message; if not, it is an Untag message. The messages in switch all carry an 802.1Q tag.

17.1.3 Port-based VLAN

VLAN partition consists of multiple types, such as port-based, MAC address-based. This series switches support the port-based VLAN partition. It defines VLAN members based on switch ports. It adds ports into the designated VLANs, and then the ports can forward the designated VLAN messages.

1. Port Type

According to the methods of port handling VLAN Tag during message forwarding, port can be divided to two types:

- Untag port: the messages forwarded from this type of port do not have a Tag. Generally, this type of port is used to connect with the terminal equipment that does not support 802.1Q protocol. At default, all switch ports are Untag ports and belong to VLAN1.
- Tag port: the messages forwarded from this type of port all carry a VLAN tag. This type of port is generally used to connect the network transmission devices.

2. PVID

Each port has a PVID attribute. When a port receives an Untag message, it will add a Tag into the message according to the PVID.

The port PVID is the VLAN ID of the Untag port. By default, all ports' PVID is VLAN 1.

After setting port type and PVID, there are several ways to process port-received and port-transmitted messages, as shown in Table 8.

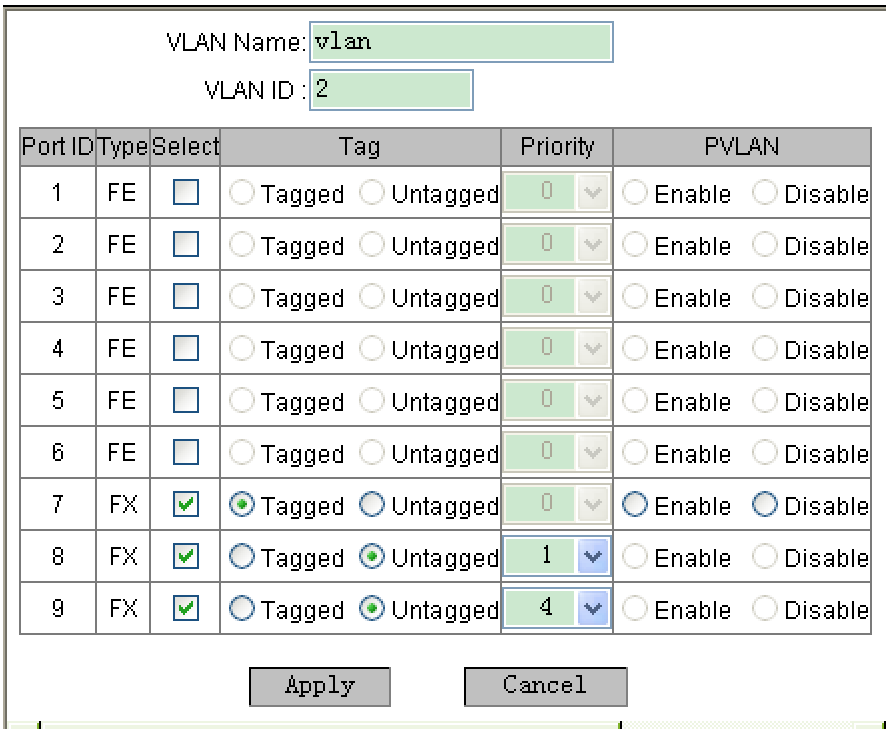
Table 8: Different Processing Modes for Packets

Processing Received Packets		Processing Packets to Be Forwarded	
Untagged packets	**Tagged packets**	**Port Type**	**Packet Processing**
Add PVID tags to untagged packets.	➢ If the VLAN ID in a packet is in the list of VLANs allowed through, accept the packet. ➢ If the VLAN ID in a packet is not in the list of VLANs allowed through, discard the packet.	Untag	Forward the packet after removing the tag.
		Tag	➢If the QoS priority of the ingress is set to port or 802.1p, keep the tag and forward the packet. ➢If the QoS priority of the ingress is set to DSCP, replace the original tag with the combination of the queue mapped by the DSCP priority and the lowest bit of the ingress priority, and forward the packet with the new tag.

17.1.4 Web Configuration

1. Create a VLAN

Select ports to add into VLAN and make corresponding port configuration, as shown in Figure 129.



VLAN Name: vlan

VLAN ID : 2

Port ID	Type	Select	Tag	Priority	PVLAN
1	FE	□	○ Tagged ○ Untagged	0	○ Enable ○ Disable
2	FE	□	○ Tagged ○ Untagged	0	○ Enable ○ Disable
3	FE	□	○ Tagged ○ Untagged	0	○ Enable ○ Disable
4	FE	□	○ Tagged ○ Untagged	0	○ Enable ○ Disable
5	FE	□	○ Tagged ○ Untagged	0	○ Enable ○ Disable
6	FE	□	○ Tagged ○ Untagged	0	○ Enable ○ Disable
7	FX	☑	● Tagged ○ Untagged	0	○ Enable ○ Disable
8	FX	☑	○ Tagged ● Untagged	1	○ Enable ○ Disable
9	FX	☑	○ Tagged ● Untagged	4	○ Enable ○ Disable

Figure 129: VLAN Configuration

VLAN Name

Configuration range: 1~31 characters

Function: set VLAN name

VLAN ID

Configuration range: a number in the range of 2~4093

Function: Configure VLAN ID

Explanation: VLAN ID is used to distinguish different VLANs. This series switches support max 256 VLANs.

Tag

Configuration options: Tagged/Untagged

Function: select the port type in VLAN

Priority

Configuration range: 0~7

Default: 0

Function: set the port default priority. When adding an 802.1Q Tag into an untagged message, the PRI field is this priority value.

PVLAN

Configuration options: Enable/Disable

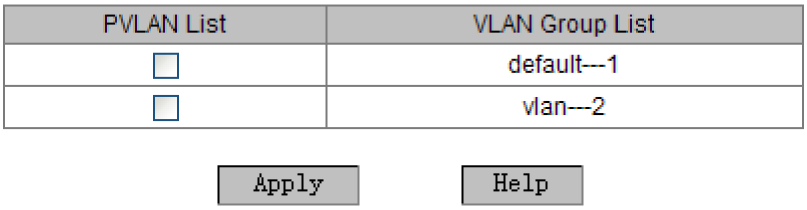
Default: Disable

Function: For Tag port, enable PVLAN or not. More information about PVLAN will be introduced in "17.2 PVLAN".

Caution:

An Untag port can join only one VLAN and its VLAN ID is the port PVID. By default, it is VLAN 1, but a tag port can join multiple VLANs.

2. Show VLAN list, as shown in Figure 130.



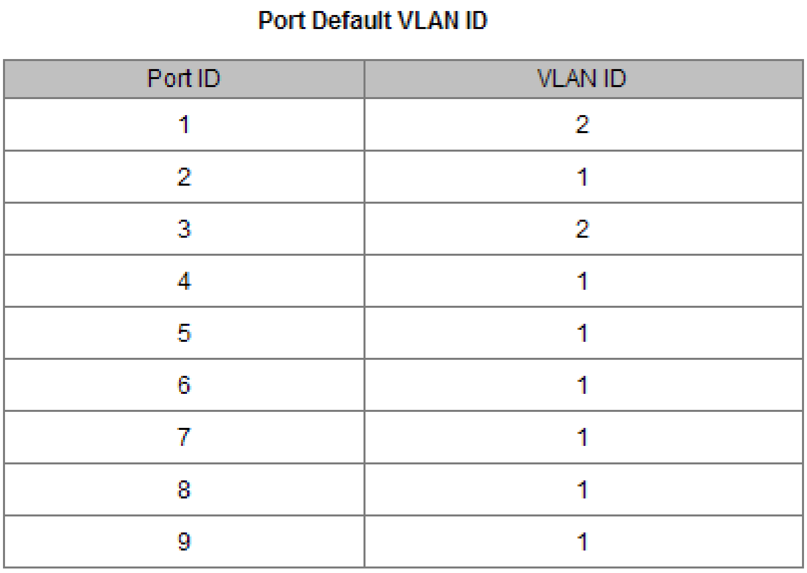
PVLAN List	VLAN Group List
□	default---1
□	vlan---2

Figure 130: Show VLAN List

PVLAN List

Function: If put a tick in the box, PVLAN function is enabled. More information will be introduced in "17.2 PVLAN".

3. Show the VLAN list of Untag ports and it is the port PVID, as shown in Figure 131.



Port Default VLAN ID

Port ID	VLAN ID
1	2
2	1
3	2
4	1
5	1
6	1
7	1
8	1
9	1

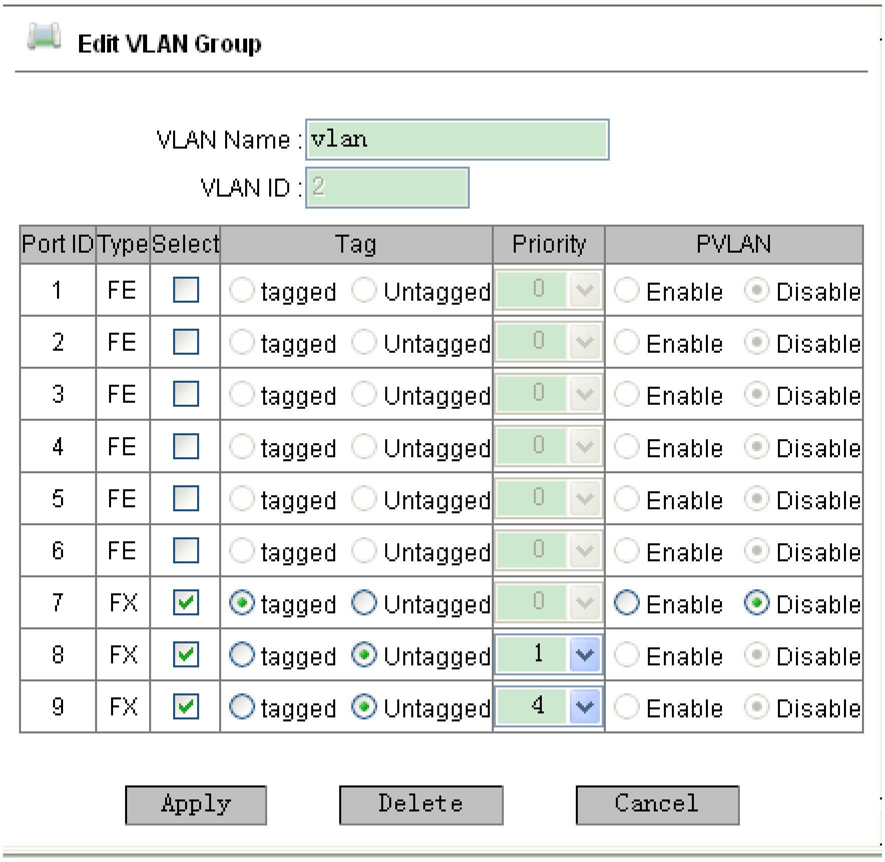
Figure 131: Port PVID List

Caution:

Each port must have an Untag attribute. If it is not set, the Untag port is default in VLAN 1.

4. Modify/Delete VLAN

Click a VLAN in the Figure 130 to enter the corresponding screen in which the VLAN can be deleted or modified. Click <Delete> to delete the selected VLAN, as shown in Figure 132.



VLAN Name : vlan

VLAN ID : 2

Port ID	Type	Select	Tag		Priority	PVLAN	
1	FE	□	○ tagged	○ Untagged	0	○ Enable	● Disable
2	FE	□	○ tagged	○ Untagged	0	○ Enable	● Disable
3	FE	□	○ tagged	○ Untagged	0	○ Enable	● Disable
4	FE	□	○ tagged	○ Untagged	0	○ Enable	● Disable
5	FE	□	○ tagged	○ Untagged	0	○ Enable	● Disable
6	FE	□	○ tagged	○ Untagged	0	○ Enable	● Disable
7	FX	☑	● tagged	○ Untagged	0	○ Enable	● Disable
8	FX	☑	○ tagged	● Untagged	1	○ Enable	● Disable
9	FX	☑	○ tagged	● Untagged	4	○ Enable	● Disable

Figure 132: Modify/Delete VLAN

17.1.5 Typical Configuration Example

As Figure 133 shows, the entire LAN is divided into 3 VLANs: VLAN2, VLAN100 and VLAN200. It is required that the devices in a same VLAN can communicate to each other, but different VLANs are isolated. The terminal PCs cannot distinguish Tag messages, so the ports on connecting Switch A and Switch B with PCs are set to Untag port. VLAN2, VLAN100 and VLAN200 messages need to be transmitted between Switch A and Switch B, so the ports connecting Switch A and Switch B should be set to Tag ports, permitting the messages of VLAN 2, VLAN 100 and VLAN 200 to pass through. Table 9 shows specific configuration.

Table 9: VLAN Configuration

VLAN	Configuration
VLAN2	Set Switch A and B's port 1 and port 2 to Untag ports, port 7 to Tag port

VLAN100	Set Switch A and B's port 3 and port 4 to Untag ports, port 7 to Tag port
VLAN200	Set Switch A and B's port 5 and port 6 to Untag ports, port 7 to Tag port

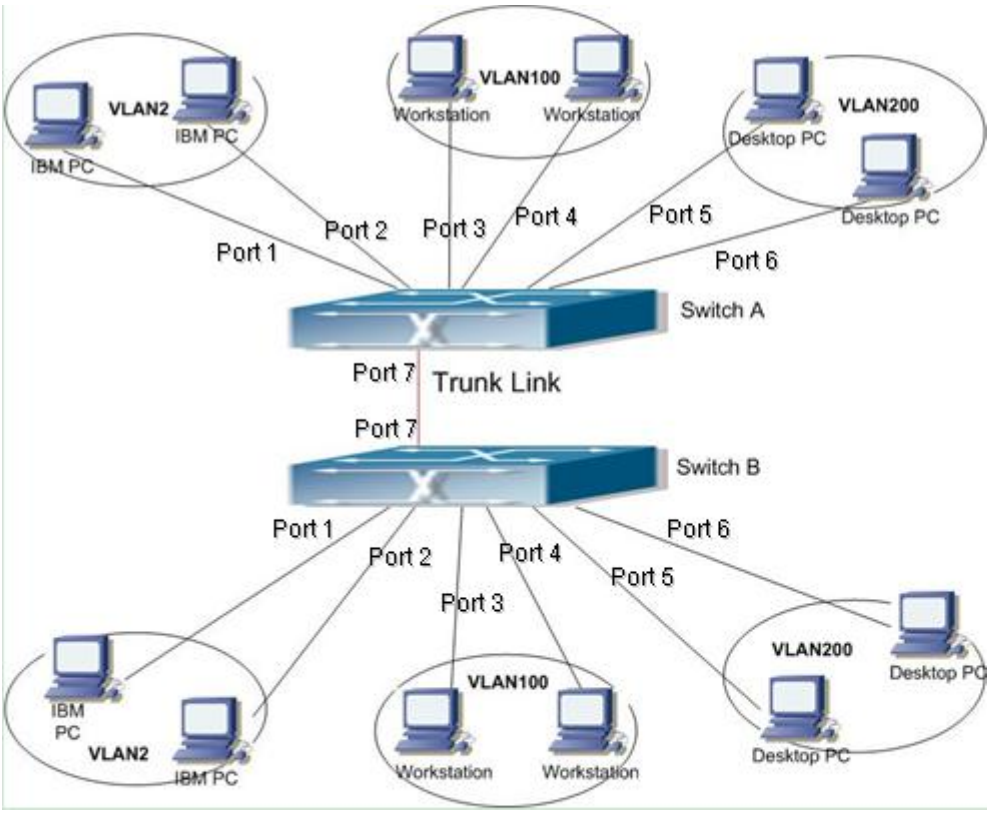


Figure 133: VLAN Application

Switch A and Switch B configuration are as follows:

1. Create VLAN 2, add port 1 and port 2 into VLAN 2 as Untag ports, and add port 7 into VLAN 2 as Tag port, as shown in Figure 129.
2. Create VLAN 100, add port 3 and port 4 into VLAN 100 as Untag ports, and add port 7 into VLAN 100 as Tag port, as shown in Figure 129.
3. Create VLAN 200, add port 5 and port 6 into VLAN 200 as Untag ports, and add port 7 into VLAN 200 as Tag port, as shown in Figure 129.

17.2 PVLAN

17.2.1 Introduction

PVLAN (Private VLAN) uses two layers isolation technologies to realize the complex port traffic isolation function, achieving network security and broadcast domain isolation.

The upper VLAN is a shared domain VLAN in which ports are uplink ports. The lower VLANs are isolation domains in which ports are downlink ports. Downlink ports can be assigned to different isolation domains and they can communicate with the uplink port at the same time. Isolation domains cannot communicate to each other.

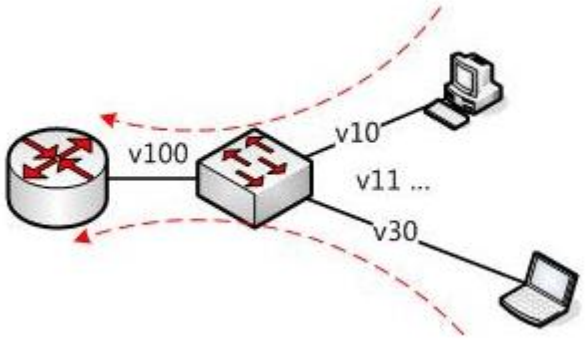


Figure 134: PVLAN Application

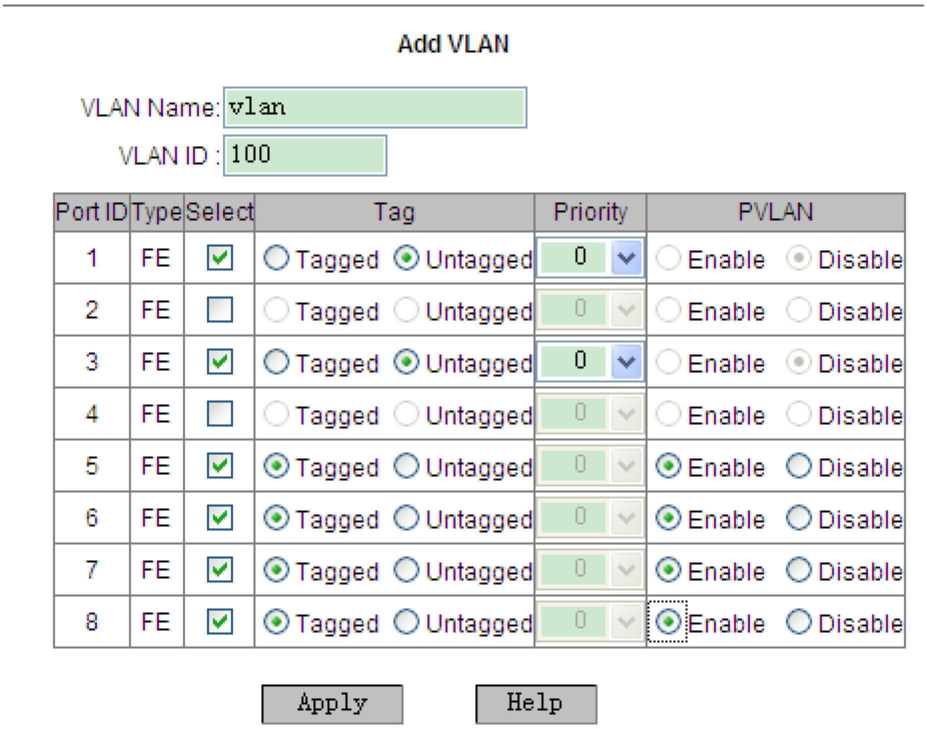
As Figure 134 shows, the shared domain is VLAN 100 and the isolation domains are VLAN 10 and VLAN 30; the devices in the isolation domains can communicate with the device in the shared domain, such as VLAN 10 can communicate with VLAN 100; VLAN 30 can also communicate with VLAN100, but the devices in different isolation domains cannot communicate to each other, such as VLAN 10 cannot communicate with VLAN 30.

Note:

When a PVLAN-enabled Tag port forwards a frame carrying a VLAN tag, the VLAN tag will be removed.

17.2.2 Web Configuration

1. Enable PVLAN function on port, as shown in Figure 135.



Add VLAN

VLAN Name: vlan

VLAN ID : 100

Port ID	Type	Select	Tag	Priority	PVLAN
1	FE	☑	○ Tagged ● Untagged	0	○ Enable ● Disable
2	FE	□	○ Tagged ○ Untagged	0	○ Enable ○ Disable
3	FE	☑	○ Tagged ● Untagged	0	○ Enable ● Disable
4	FE	□	○ Tagged ○ Untagged	0	○ Enable ○ Disable
5	FE	☑	● Tagged ○ Untagged	0	● Enable ○ Disable
6	FE	☑	● Tagged ○ Untagged	0	● Enable ○ Disable
7	FE	☑	● Tagged ○ Untagged	0	● Enable ○ Disable
8	FE	☑	● Tagged ○ Untagged	0	● Enable ○ Disable

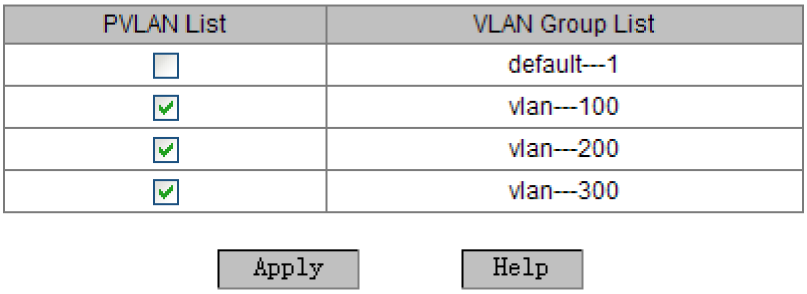
Figure 135: Enable PVLAN function

In VLAN configuration interface, Tag ports can enable PVLAN function.

If the VLAN is a shared domain, the uplink port should be set to untagged, and the downlink port should be set to tagged.

If the VLAN is an isolation domain, the downlink port should be set to untagged, and the uplink port should be set to tagged.

2. Select VLAN members for PVLAN, as shown in Figure 136.



PVLAN List	VLAN Group List
□	default---1
☑	vlan---100
☑	vlan---200
☑	vlan---300

Figure 136: PVLAN Member Configuration

PVLAN List

Configuration options: tick or not

Default: no tick

Function: Choose VLAN members for PVLAN

17.2.3 Typical Configuration Example

Figure 137 shows PVLAN application. VLAN300 is a shared domain and port 1 and port 2 are uplink ports; VLAN100 and VLAN200 are isolation domains and port 3, 4, 5 and 6 are downlink ports.

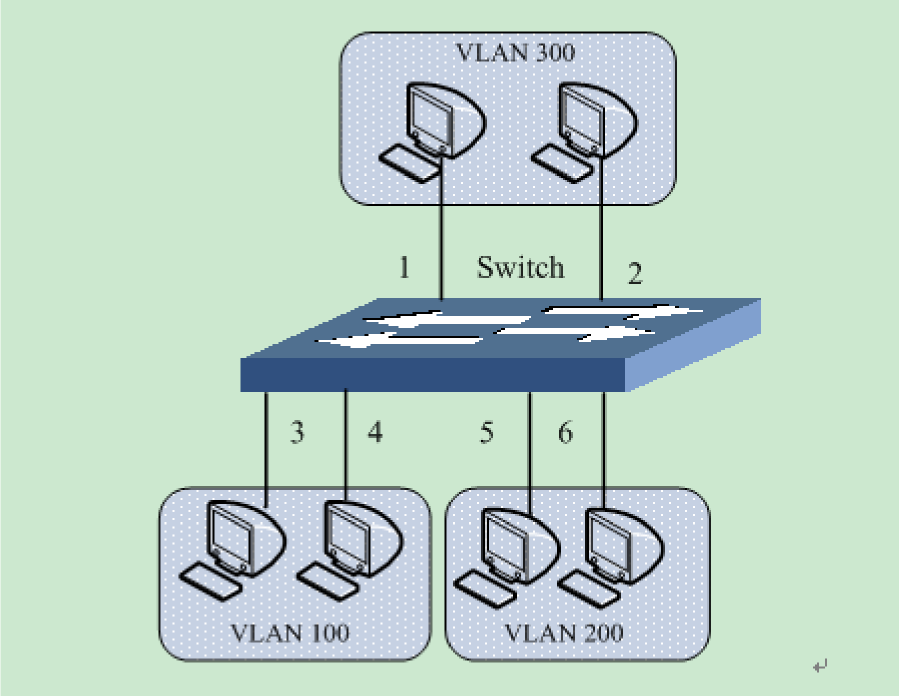


Figure 137: PVLAN Configuration Example

Switch Configuration:

1. Configure the shared domain of VLAN 300, as shown in Figure 135.

   Port 1 and port 2 are set to Untagged and are assigned to the shared domain of VLAN 300;

   Port 3 and port 4 are set to Tagged and are assigned to the shared domain of VLAN 300, and enable PVLAN;

   Port 5 and port 6 are set to Tagged and are assigned to the shared domain of VLAN 300, and enable PVLAN;

2. Configure the isolation domain of VLAN 100, as shown in Figure 135.

   Port 1 and port 2 are set to Tagged and are assigned to the isolation domain of VLAN 100, and enable PVLAN;

   Port 3 and port 4 are set to Untag ports and are assigned to the isolation domain of VLAN 100.

3. Configure the isolation domain of VLAN 200, as shown in Figure 135.

   Port 1 and port 2 are set to Tagged and are assigned to the isolation domain of VLAN 200, and enable PVLAN;

   Port 5 and port 6 are set to Untagged and are assigned to the isolation domain of VLAN 200.

4. Set VLAN300, VLAN100 and VLAN200 to PVLAN members, as shown in Figure 136.

17.3 GVRP

17.3.1 Introduction

GVRP (GARP VLAN Registration Protocol) is a GARP application and is based on the GARP working mechanism to maintain the VLAN dynamic registration information of the device and propagate the information to other devices.

The GVRP-enabled device can receive VLAN registration information from other devices and dynamically update the local VLAN registration information, and the device can propagate the local VLAN registration information to other devices, reaching the consistency of VLAN information in all devices in the same LAN. The VLAN registration information propagated by GVRP contains not only the manually configured local static registration information, but also the dynamic registration information from other devices.

17.3.2 Port Mode

There are three types of GVRP registration mode on a port: Normal, Fixed and Disable.

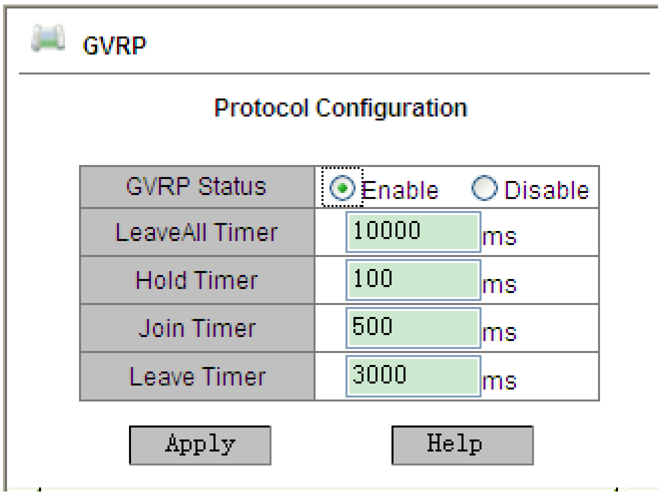
- Normal: allow the port to dynamically register or deregister VLAN attribute, and propagate dynamic and static VLAN information.
- Fixed: forbid the port dynamically registering or deregistering VLAN attribute, but allow the port to statically register or deregister VLAN information.
- Disable: forbid the port dynamically or statically registering or deregistering VLAN attribute and the port cannot propagate any VLAN information

Caution:

GVRP port and Port Trunk are mutually exclusive. The GVRP-enabled port cannot join a Trunk group, while the port joining a Trunk group cannot enable GVRP.

17.3.3 Web Configuration

1. Enable GVRP protocol and set the corresponding timers, as shown in Figure 138.



GVRP

Protocol Configuration

GVRP Status	● Enable ○ Disable	
LeaveAll Timer	10000	ms
Hold Timer	100	ms
Join Timer	500	ms
Leave Timer	3000	ms

Figure 138: GVRP Protocol Configuration

GVRP Status

Configuration options: Enable/Disable

Default: Disable

Function: Enable/Disable GVRP protocol

LeaveAll Timer

Configuration range: 100ms~327600ms

Default: 10000ms

Function: set the time interval of sending leave all message. It must be a multiple of 100.

Explanation: If LeaveAll timers of different devices time out at the same time, the devices will send out a LeaveAll message at the same time, which increases the message quantity. In order to avoid this, the actual running time of a LeaveAll timer is a random value and is longer than the time of one LeaveAll timer, and less than 1.5 times of a LeaveAll timer.

Hold Timer

Configuration range: 100ms~327600ms

Default: 100ms

Explanation: This value must be a multiple of 100. It is better to set a same value of Hold timers on all GVRP-enabled ports

Join Timer

Configuration range: 100ms~327600ms

Default: 500ms

Description: This value must be a multiple of 100. It is better to set a same value of Join timers on all GVRP-enabled ports

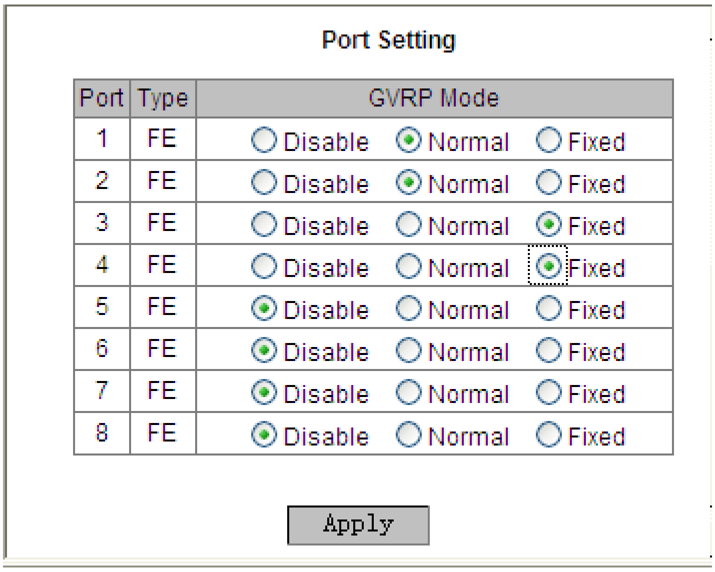
Leave Timer

Configuration range: 100ms~327600ms

Default: 3000ms

Description: This value must be a multiple of 100. It is better to set a same value of Leave timers on all GVRP-enabled ports

2. Port configuration, as shown in Figure 139.



Port Setting

Port	Type	GVRP Mode
1	FE	○ Disable ● Normal ○ Fixed
2	FE	○ Disable ● Normal ○ Fixed
3	FE	○ Disable ○ Normal ● Fixed
4	FE	○ Disable ○ Normal ● Fixed
5	FE	● Disable ○ Normal ○ Fixed
6	FE	● Disable ○ Normal ○ Fixed
7	FE	● Disable ○ Normal ○ Fixed
8	FE	● Disable ○ Normal ○ Fixed

Figure 139: GVRP Port Setting

GVRP Mode

Configuration options: Disable/Normal/Fixed

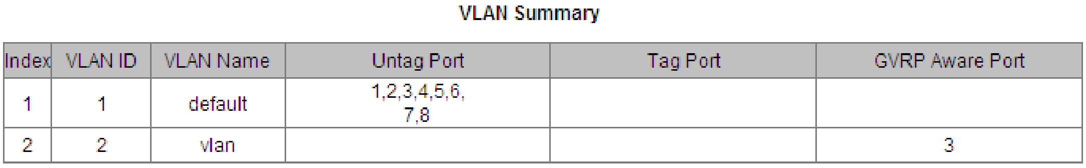
Default: Disable

Function: Set GVRP mode on port;

Caution:

- The port in Normal mode can only be set to Untagged and exist in the default VLAN (VLAN 1)
- Cannot carry on any VLAN operation on the port in Normal mode

3. Show statically configured and dynamically registered VLAN information, as shown in Figure 140.



VLAN Summary

Index	VLAN ID	VLAN Name	Untag Port	Tag Port	GVRP Aware Port
1	1	default	1,2,3,4,5,6, 7,8		
2	2	vlan			3

Figure 140: VLAN Information

17.3.4 Typical Configuration Example

As Figure 141 shows, switch A and Switch B are connected by port 2. Port 1 of

Switch A is set to Fixed mode to statically register VLAN information; port 2 is set to Normal mode and propagates the VLAN information of port 1. Port 2 of Switch B is set to Normal mode and registers the VLAN information of Switch A. In this way, port 2 of Switch B can register the same VLAN information as that in port 1 of Switch A.

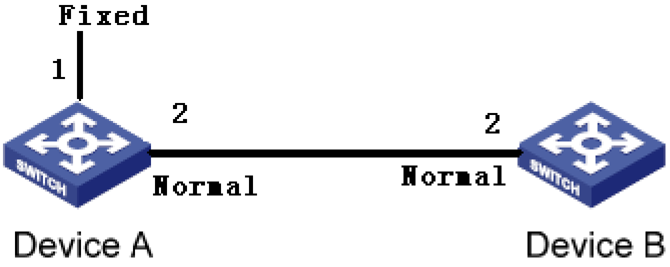


Figure 141: GVRP Configuration Example

Switch configuration are as follows:

1. Enable GVRP protocol on Switch A and Switch B, as shown in Figure 138.
2. Set the port 1 of Switch A to Fixed mode, and port 2 to Normal mode; set the port 2 of Switch B to Normal mode, as shown in Figure 139.
3. Port 2 of Switch B can register the same VLAN information as that of port 1 of Switch A.

18. RMON

18.1 Introduction

RMON (Remote Network Monitoring) is based on SNMP architecture and let network management devices more actively monitor and manage the managed devices. RMON includes NMS (Network Management Station) and Agent. NMS manages Agent and Agent can perform statistics of all kinds of traffic information on port.

RMON mainly realize statistics and alarm functions. Statistics function is that agent can periodically perform statistics of all kinds of traffic information on port, such as the amount of messages received in a certain network segment during a certain period. Alarm function is that agent can monitor the values of specified MIB variables. When a value reaches the alarm threshold (such as the amount of messages is up to the specified value), agent can automatically record alarm events in RMON log, or send a Trap message to the management device.

18.2 RMON Group

RMON (RFC2819) defines multiple RMON groups. This series devices support statistics group, history group, event group and alarm group of public MIB. Each group supports max 32 entries.

➢ Statistics Group

It is that the system can conduct statistics of all kinds of traffic information on port. The statistics information contains the number of network collisions, CRC error messages, undersized or oversized data messages, broadcast and multicast messages, received bytes, received messages, and so on. After successfully creating a statistics entry on a specified interface, the statistics group counts the number of messages on the current interface and the statistics result is a continuous accumulated value.

➢ History Group

History group stipulates that the system periodically take sampling of all kinds of traffic information on port and saves the sampling values in the history record table, so as that the management device can view them at any time. The history group counts statistics values of all kinds of data in the sampling interval.

the port-received messages in each cycle and the cycle can be configured.

➢ Event Group

Event group is used to define event indexes and event handing methods. Events defined in the event group is used in the configuration item of alarm group. Event is triggered when the monitored device meets the alarm condition. There are several ways to handle events:

Log: logging the event and related information in the event log table

Trap: sending Trap to NMS and inform the happening of event

Log-Trap: logging and sending Trap

None: No action

➢ Alarm Group

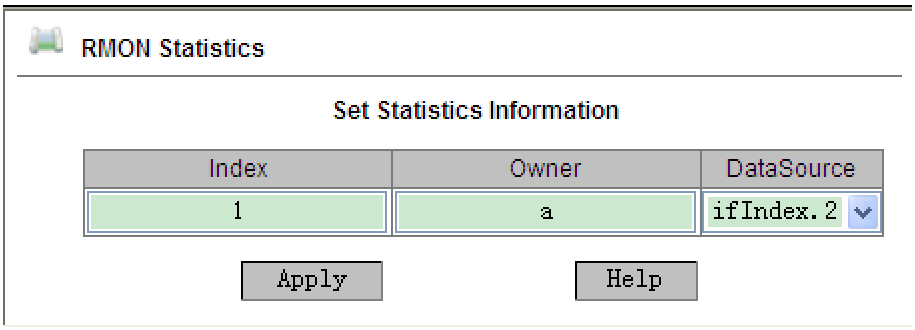
RMON alarm management can monitor the specified alarm variables. After users define alarm entries, the system will gain the values of monitored alarm variables in a defined period. When the value of the alarm variable is bigger than or equal to the upper threshold, an upper alarm event is triggered. When the value of the alarm variable is lower than or equal to the lower threshold, a lower alarm event is triggered. Alarms will be handled according to the event definition.

Caution:

If a sampled value of alarm variable exceeds the threshold multiple times in a same direction, only the first time can trigger alarm event. That means the rising alarm and falling alarm is alternate.

18.3 Web Configuration

1. Set statistics information, as shown in Figure 142.



RMON Statistics

Set Statistics Information

Index	Owner	DataSource
1	a	ifIndex.2

Figure 142: RMON Statistics Configuration

Index

Configuration range: 1~65535

Function: set a index of a statistics information entry

Owner

Configuration range: 1~32 characters

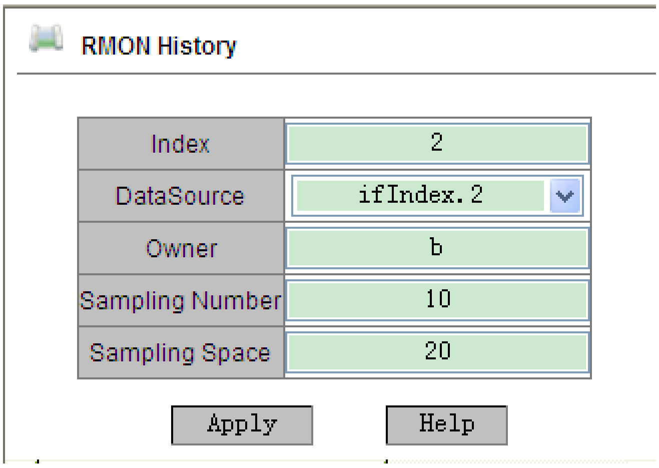
Function: set the name of a statistics information entry

Data Source

Configuration options: ifIndex.portid

Function: select the port to conduct statistics

2. History table configuration, as shown in Figure 143.



RMON History

Index	2
DataSource	ifIndex.2
Owner	b
Sampling Number	10
Sampling Space	20

Figure 143: RMON History Configuration

Index

Configuration range: 1~65535

Function: set the index of history control entry

Data Source

Configuration options: ifIndex.portid

Function: select the port to take sampling

Owner

Configuration range: 1~32 characters

Function: set the name of a history control entry

Sampling Number

Configuration range: 1~65535

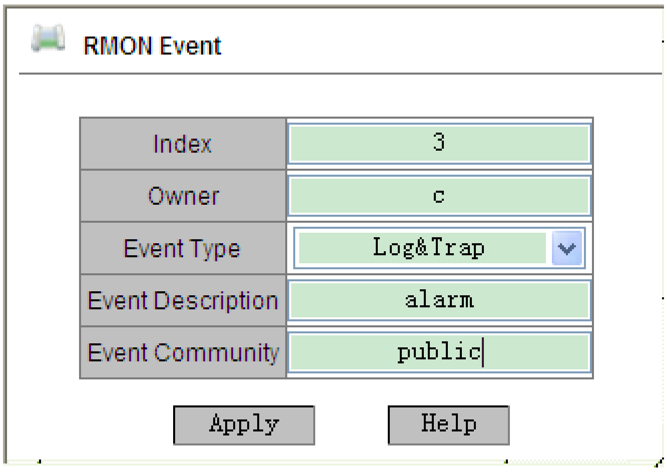
Function: set the times to take sampling

Sampling Space

Configuration range: 1~3600s

Function: set the interval to take sampling

3. Event control configuration, as shown in Figure 144.



RMON Event

Index	3
Owner	c
Event Type	Log&Trap
Event Description	alarm
Event Community	public

Figure 144: RMON Event Control Configuration

Index

Configuration range: 1~65535

Function: set the index of a event control entry

Owner

Configuration range: 1~32 characters

Function: set the name of a event control entry

Event Type

Configuration options: NONE/LOG/Snmp-trap/log&Trap

Default: NONE

Function: set the event type when alarm happens. It is the alarm handling method.

Event Description

Configuration range: 1~32 characters

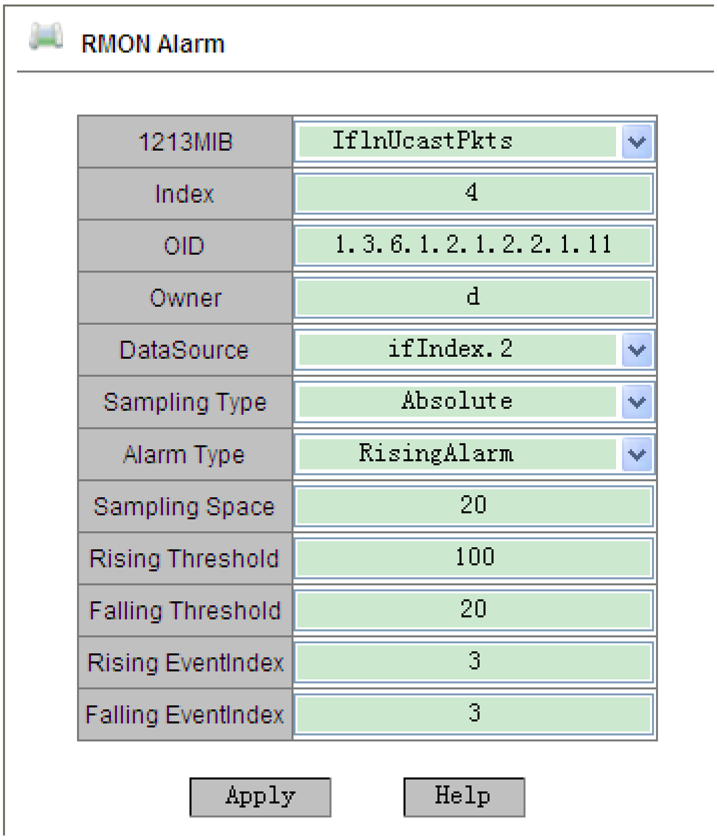
Function: set the event description

Event Community

Configuration range: 1~32 characters

Function: set the name of community sending trap events, which should be consistent with the community name of SNMP

4. Alarm control configuration, as shown in Figure 145.



RMON Alarm

1213MIB	IflnUcastPkts
Index	4
OID	1.3.6.1.2.1.2.2.1.11
Owner	d
DataSource	ifIndex.2
Sampling Type	Absolute
Alarm Type	RisingAlarm
Sampling Space	20
Rising Threshold	100
Falling Threshold	20
Rising EventIndex	3
Falling EventIndex	3

Figure 145: RMON alarm control configuration

MIB

Function: choose the MIB information to do statistics, such as the number of unicast message in the ingress port

Index

Configuration range: 1~65535

Function: set the index of a alarm control entry

OID

Function: set the OID number of the current MIB node

Owner

Configuration range: 1~32 characters

Function: set the name of a alarm control entry

Data Source

Configuration options: ifIndex.portid

Function: choose the port to monitor

Sampling Type

Configuration options: Absolute/Delta

Default: Absolute

Function: choose the method of comparing the sampling value and threshold.

Explanation: Absolute: directly compare each sampling value to threshold; Delta: the sampling value minus the previous sampling value, then use the difference to compare with threshold.

Alarm Type

Configuration options: RisingAlarm/FallingAlarm/RisOrFallAlarm

Default: RisingAlarm

Function: choose the alarm type

Sampling Space

Configuration range: 1~65535

Function: set the sampling period which is better to be same as the sampling space in History configuration

Rising Threshold

Configuration range: 1~65535

Function: set a rising threshold. When the sampling value exceeds the rising threshold and the alarm type is RisingAlarm or RisOrFallAlarm, the alarm will be triggered and the rising event index will be activated.

Falling Threshold

Configuration range: 1~65535

Function: set a falling threshold. When the sampling value is lower than the falling threshold and the alarm type is FallingAlarm or RisOrFallAlarm, the alarm will be triggered and the falling event index will be activated.

Rising Event Index

Configuration range: 0~65535

Explanation: set the index of a rising event. It is the handing method of a rising alarm

Falling Event Index

Configuration range: 0~65535

Explanation: set the index of a falling event. It is the handling method of a falling alarm

19. Unicast Configuration

19.1 Introduction

When a switch forwards a message, it searches in the MAC address table to confirm the destination port number corresponding to the destination MAC address of the message.

MAC address is divided into static MAC address and dynamic MAC address.

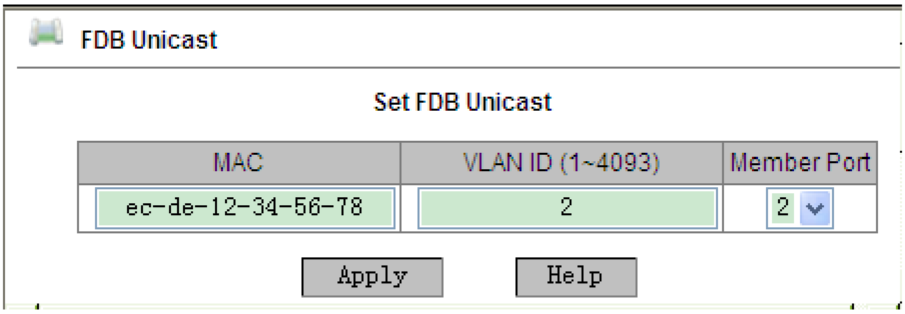
Static MAC address is configured by users and has the highest priority (cannot be covered by dynamic MAC address) and is permanently valid.

Dynamic MAC address is learned by switch in the process of forwarding data frames, and is valid in a limited time, and is renewed periodically. When a switch receives data frames that need to be forwarded, first, it learns the source MAC addresses of data frames, and establishes mapping relationships with sending ports, and then searches in the MAC address table according to their destination MAC addresses. If there are matched entries, the switch will forward data frames from the corresponding ports. Otherwise, the switch will broadcast data frames in its broadcast domain.

This series switches support max 256 static unicast entries.

19.2 Web Configuration

1. Add static MAC address entry, as shown in Figure 146.



FDB Unicast

Set FDB Unicast

MAC	VLAN ID (1~4093)	Member Port
ec-de-12-34-56-78	2	2

Figure 146: Add static unicast FDB entry

MAC

Configuration format: HH-HH-HH-HH-HH-HH (H means a hexadecimal number)

Function: configure unicast MAC address and the lowest bit in the highest byte is 0

VLAN ID

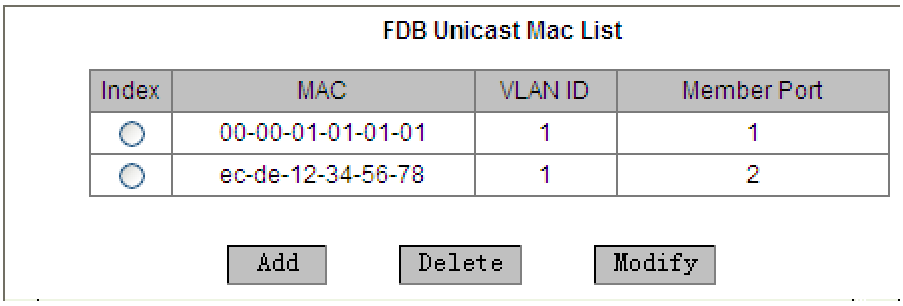
Function: set the VLAN ID of port

Member Port

Configuration options: all switch ports

Function: select a port to forward the message with this destination MAC address and the selects port must be in the above specified VLAN

2. Show static unicast MAC address list, as shown in Figure 147.



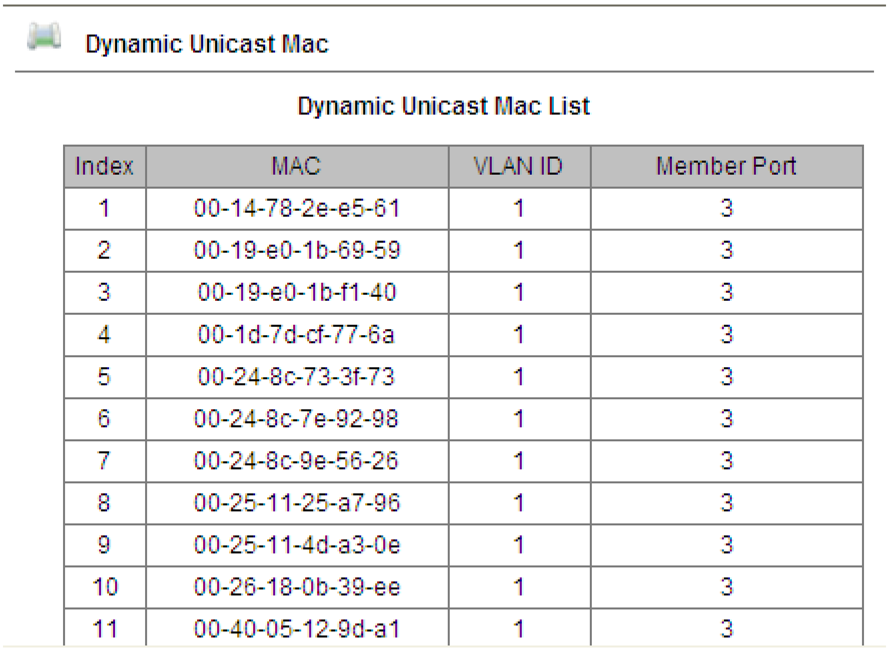
FDB Unicast Mac List

Index	MAC	VLAN ID	Member Port
○	00-00-01-01-01-01	1	1
○	ec-de-12-34-56-78	1	2

Figure 147: Show Static FDB Table

Select an entry to delete or modify this entry.

3. Show dynamic unicast MAC address list, as shown in Figure 148.



Dynamic Unicast Mac

Dynamic Unicast Mac List

Index	MAC	VLAN ID	Member Port
1	00-14-78-2e-e5-61	1	3
2	00-19-e0-1b-69-59	1	3
3	00-19-e0-1b-f1-40	1	3
4	00-1d-7d-cf-77-6a	1	3
5	00-24-8c-73-3f-73	1	3
6	00-24-8c-7e-92-98	1	3
7	00-24-8c-9e-56-26	1	3
8	00-25-11-25-a7-96	1	3
9	00-25-11-4d-a3-0e	1	3
10	00-26-18-0b-39-ee	1	3
11	00-40-05-12-9d-a1	1	3

Figure 148: Dynamic unicast FDB table

20. Alarm and Syslog

20.1 Alarm

20.1.1 Introduction

This series switches support three types of alarms. When an alarm is triggered, the Alarm LED in the front panel goes ON.

- Power alarm: if it is enabled, the alarm will be triggered for single power input
- Port alarm: if it is enabled, the alarm will be triggered for Link Down of port.
- Ring alarm: if it is enabled, the alarm will be triggered for an open ring.

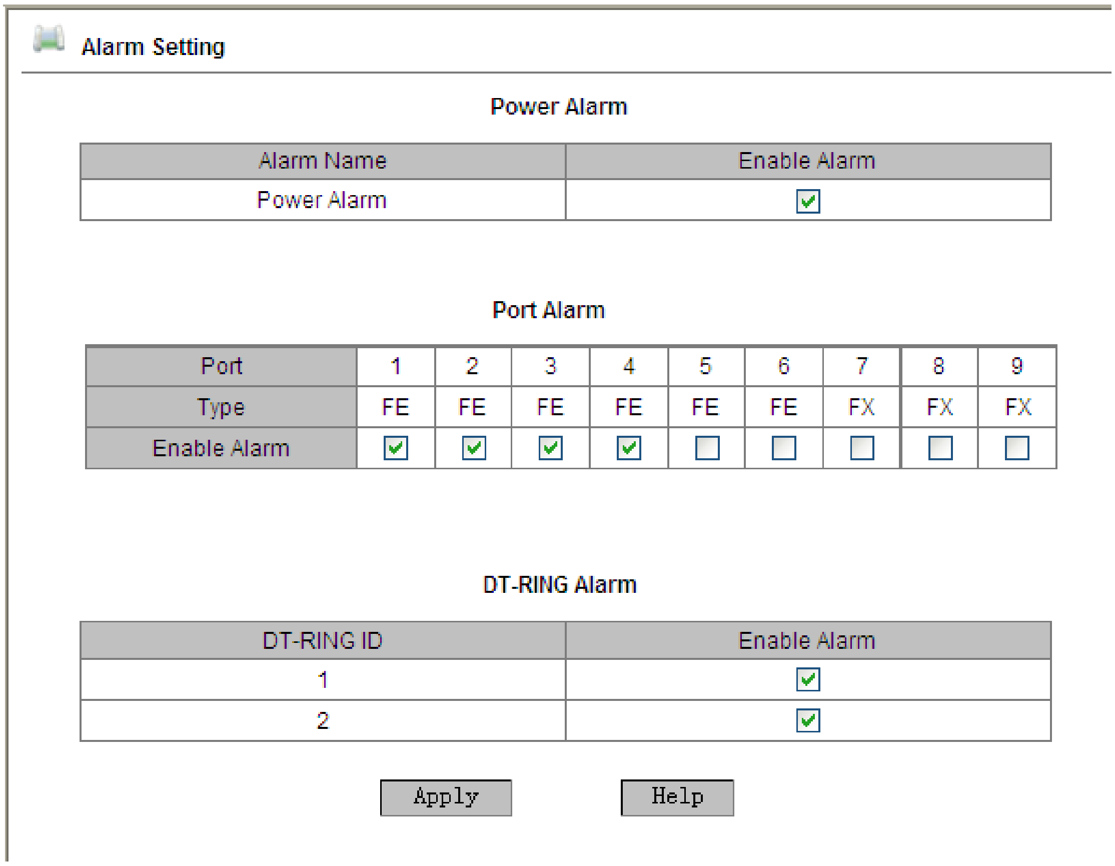
CAUTION

Caution:

Only the master station of a DT ring supports the ring alarm function.

20.1.2 Web Configuration

1. Alarm setting, as shown in Figure 149.



Alarm Setting

Power Alarm

Alarm Name	Enable Alarm
Power Alarm	☑

Port Alarm

Port	1	2	3	4	5	6	7	8	9
Type	FE	FE	FE	FE	FE	FE	FX	FX	FX
Enable Alarm	☑	☑	☑	☑	□	□	□	□	□

DT-RING Alarm

DT-RING ID	Enable Alarm
1	☑
2	☑

Figure 149: Alarm setting

Power Alarm

Options: Enable/Disable

Default: Disable

Function: Enable/disable power alarm

Port Alarm

Options: Enable/Disable

Default: Disable

Function: Enable/disable port alarm.

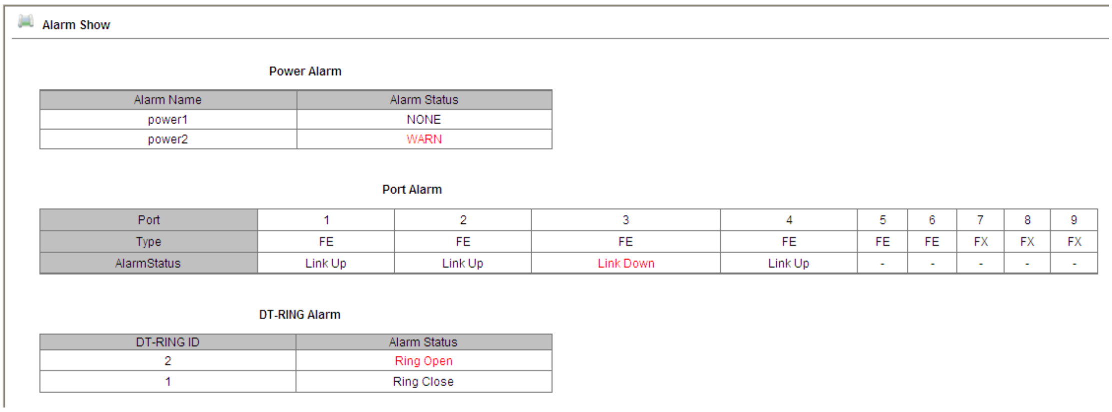
DT-RING Alarm

Options: Enable/Disable

Default: Disable

Function: Enable or disable the DT-Ring function.

2. Show alarm status after alarm functions are enabled, as shown in Figure 150.



Alarm Show

Power Alarm

Alarm Name	Alarm Status
power1	NONE
power2	WARN

Port Alarm

Port	1	2	3	4	5	6	7	8	9
Type	FE	FE	FE	FE	FE	FE	FX	FX	FX
AlarmStatus	Link Up	Link Up	Link Down	Link Up	-	-	-	-	-

DT-RING Alarm

DT-RING ID	Alarm Status
2	Ring Open
1	Ring Close

Figure 150: Show alarm status

Power Alarm Status

Options: NONE/WARN

Explanation: after the power alarm function is enabled, NONE is displayed for the power in power-on state, while WARN is displayed for the power in power-off state.

Port Alarm Status

Options: Link Up/Link Down

Explanation: after the port alarm function is enabled, Link Up is displayed for normal port connection, while Link Down displayed for port disconnection or abnormal connection.

DT-RING Alarm

Options: Ring Open/Ring Close

Explanation: after the port alarm function is enabled, Ring Open is displayed for an open ring, while Ring Close is displayed for a closed ring.

20.2 Syslog

20.2.1 Introduction

Logging function mainly records the switch system information and operation information for convenient fault location. It contains System log and Running log.

System log contains:

- Task suspension log
- Reboot caused by task suspension
- Reboot caused by pressing <Reset> button on switch front panel
- Reboot caused by Reboot command
- Reboot caused by clicking <Reboot> button on Web interface
- System reboot

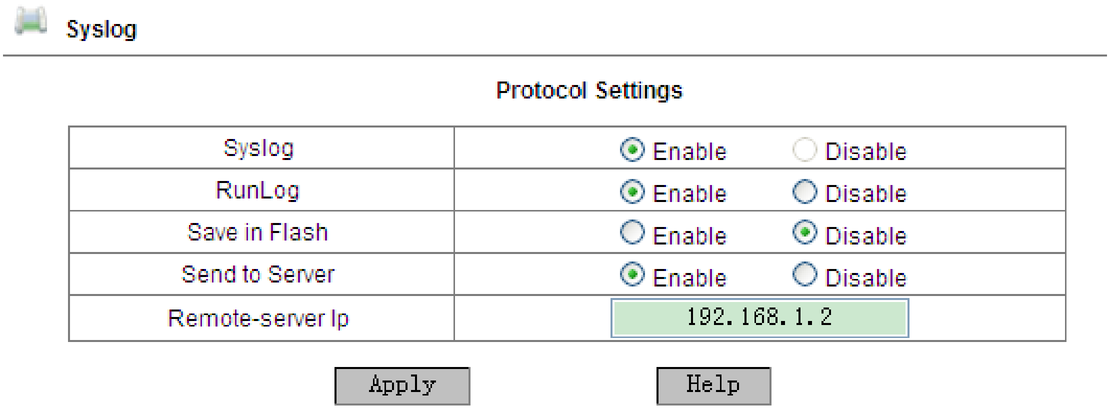
Running log contains:

- Port state change
- Power state change
- Reboot caused by Reboot command
- Reboot caused by clicking <Reboot> button on Web interface

Max 1024 logs are supported. When the number exceeds 1024, the new log will cover the old log.

20.2.2 Web Configuration

1. Logging function configuration, as shown in Figure 151.



Syslog

Protocol Settings

Syslog	● Enable ○ Disable
RunLog	● Enable ○ Disable
Save in Flash	○ Enable ● Disable
Send to Server	● Enable ○ Disable
Remote-server Ip	192.168.1.2

Figure 151: Log state configuration

Syslog

Configuration options: Enable/Disable

Default: Enable

Function: Enable/Disable syslog. Once it is enabled, syslog can be recorded.

RunLog

Configuration options: Enable/Disable

Default: Enable

Function: Enable/Disable RunLog. Once it is enabled, running log can be recorded.

Save in Flash

Configuration options: Enable/Disable

Default: Disable

Function: Save logs in Flash or not. Once it is enabled, the logs can be viewed on switch.

Send to Server

Configuration options: Enable/Disable

Default: Disable

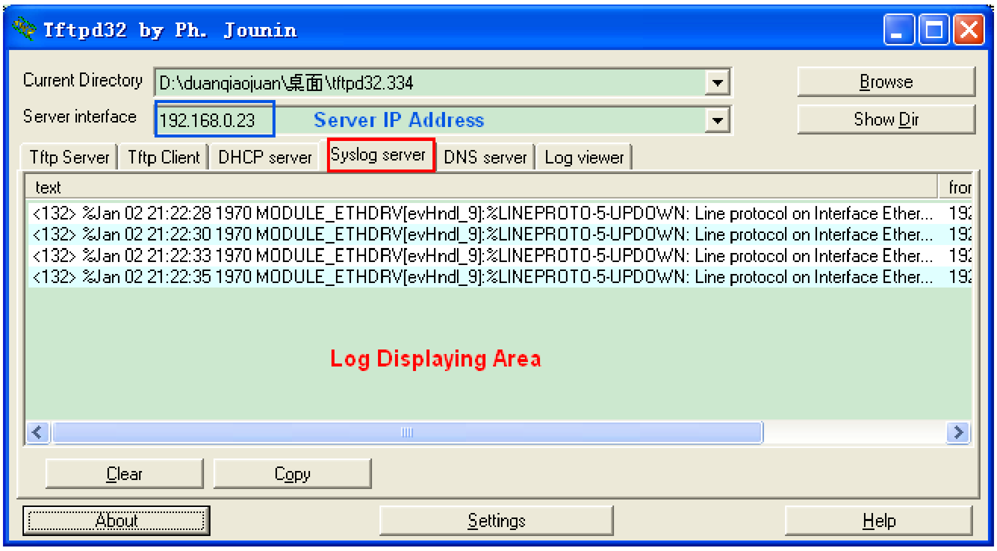
Function: Enable/Disable Send to Server

Explanation: Once it is enabled, switch logs can be uploaded to server by Syslog Server in real time.

Remote-server Ip

Configure the IP address of server to upload logs

Through Syslog Server (for example, Tftp32), users can view logs in a timely manner, as shown in Figure 152.



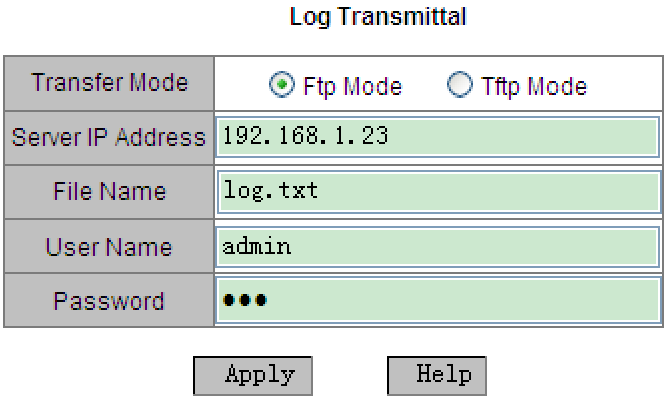
Current Directory D:\duanqiaojuan\桌面\tftpd32.334

Server interface 192.168.0.23

```
text                                                                                                    fror
<132> %Jan 02 21:22:28 1970 MODULE_ETHDRV[evHndl_9]:%LINEPROTO-5-UPDOWN: Line protocol on Interface Ether...   19:
<132> %Jan 02 21:22:30 1970 MODULE_ETHDRV[evHndl_9]:%LINEPROTO-5-UPDOWN: Line protocol on Interface Ether...   19:
<132> %Jan 02 21:22:33 1970 MODULE_ETHDRV[evHndl_9]:%LINEPROTO-5-UPDOWN: Line protocol on Interface Ether...   19:
<132> %Jan 02 21:22:35 1970 MODULE_ETHDRV[evHndl_9]:%LINEPROTO-5-UPDOWN: Line protocol on Interface Ether...   19:
```

Figure 152: Send logs to server

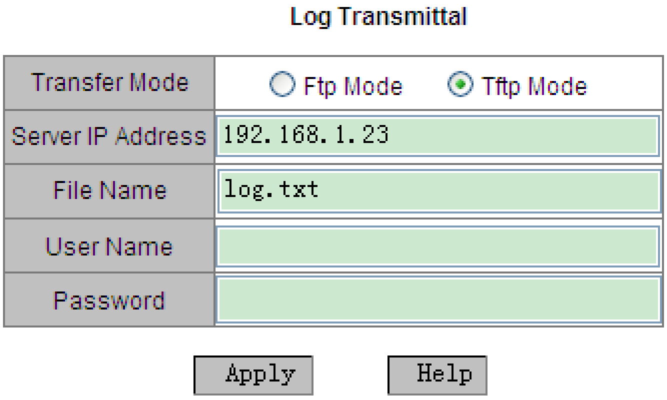
2. Log uploading, as shown in Figure 153 and Figure 154.



Log Transmittal

Transfer Mode	● Ftp Mode ○ Tftp Mode
Server IP Address	192.168.1.23
File Name	log.txt
User Name	admin
Password	●●●

Figure 153: Upload logs by FTP mode



Log Transmittal

Transfer Mode	○ Ftp Mode ● Tftp Mode
Server IP Address	192.168.1.23
File Name	log.txt
User Name	
Password	

Figure 154: Upload logs by TFTP mode

Transfer Mode

Configuration options: Ftp Mode/Tftp Mode

Default: Ftp Mode

Function: Choose the mode to upload logs to server

Server IP Address

Configuration format: A.B.C.D

Function: Set the IP address of FTP/TFTP server

File Name

Configuration range: 1~32 characters

Function: set the file name saved in server

User Name

Configuration range: 1~32 characters

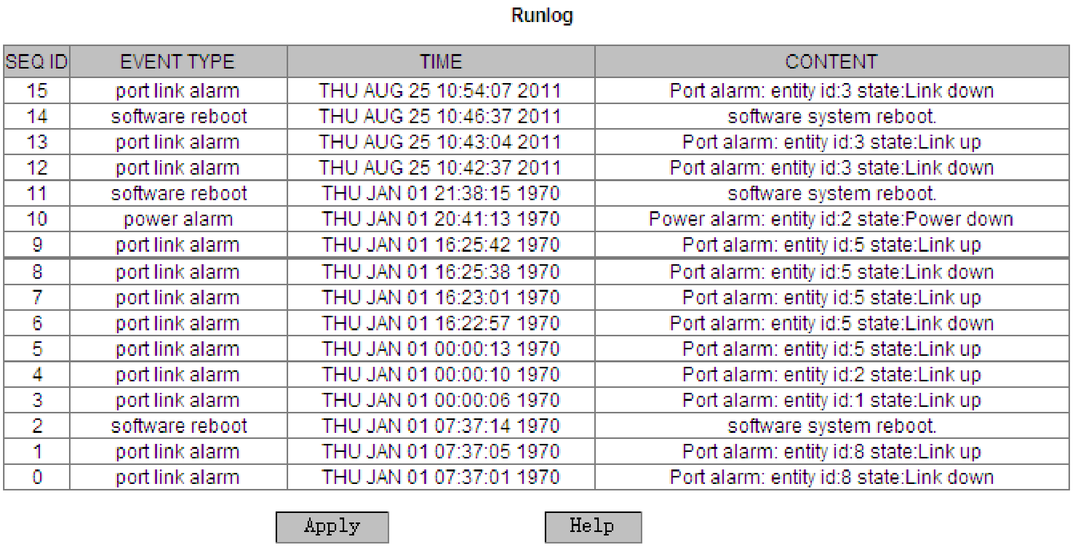
Function: Input FTP user name. There is no need to input user name when the file is uploaded by TFTP mode

Password

Configuration range: 1~32 characters

Function: Input FTP user password. There is no need to input password when the file is uploaded by TFTP mode

3. Show log, as shown in Figure 155.



Runlog

SEQ ID	EVENT TYPE	TIME	CONTENT
15	port link alarm	THU AUG 25 10:54:07 2011	Port alarm: entity id:3 state:Link down
14	software reboot	THU AUG 25 10:46:37 2011	software system reboot.
13	port link alarm	THU AUG 25 10:43:04 2011	Port alarm: entity id:3 state:Link up
12	port link alarm	THU AUG 25 10:42:37 2011	Port alarm: entity id:3 state:Link down
11	software reboot	THU JAN 01 21:38:15 1970	software system reboot.
10	power alarm	THU JAN 01 20:41:13 1970	Power alarm: entity id:2 state:Power down
9	port link alarm	THU JAN 01 16:25:42 1970	Port alarm: entity id:5 state:Link up
8	port link alarm	THU JAN 01 16:25:38 1970	Port alarm: entity id:5 state:Link down
7	port link alarm	THU JAN 01 16:23:01 1970	Port alarm: entity id:5 state:Link up
6	port link alarm	THU JAN 01 16:22:57 1970	Port alarm: entity id:5 state:Link down
5	port link alarm	THU JAN 01 00:00:13 1970	Port alarm: entity id:5 state:Link up
4	port link alarm	THU JAN 01 00:00:10 1970	Port alarm: entity id:2 state:Link up
3	port link alarm	THU JAN 01 00:00:06 1970	Port alarm: entity id:1 state:Link up
2	software reboot	THU JAN 01 07:37:14 1970	software system reboot.
1	port link alarm	THU JAN 01 07:37:05 1970	Port alarm: entity id:8 state:Link up
0	port link alarm	THU JAN 01 07:37:01 1970	Port alarm: entity id:8 state:Link down

Figure 155: Show Log

Log

Displaying portfolio: {SEQ ID, EVENT TYPE, TIME, CONTENT}

Function: show log records

Caution:

FTP/TFTP server must remain in online state when logs are uploading.

21. SNMP

21.1 SNMPv2

21.1.1 Introduction

SNMP (Simple Network Management Protocol) is a frame of using TCP/IP protocol suite to manage devices in a network. Network administrator can check device information, modify device parameters, monitor device status and locate network faults by SNMP function.

21.1.2 Implementation

SNMP protocol adopts manager/agent mode, so SNMP network contains NMS and Agent.

- NMS (Network Management Station) is a workstation running the SNMP-supported client network management software, playing a core role in SNMP network management.
- Agent is a program in the managed device. It is responsible for receiving, processing requests from NMS. When an alarm happens, Agent will automatically inform the NMS.

NMS manages SNMP network, while Agent is managed by SNMP network. The management information exchange between NMS and Agent is through SNMP protocol. SNMP provides 5 basic operations:

- Get-Request
- Get-Response
- Get-Next-Request
- Set-Request
- Trap

NMS sends query and configuration requests to Agent by Get-Request, Get-Next-Request and Set-Request messages. When Agent receives requests, it will send out Get-Response message as respond. When an alarm happens, Agent will automatically send Trap message to NMS to inform the occurrence of abnormal events.

21.1.3 Explanation

SNMP Agent of this series device supports SNMP v2 and SNMP v3 versions. SNMPv2 is compatible with SNMP v1.

SNMP v1 adopts Community Name Authentication. The community name works as a password and is used to restrict SNMP NMS accessing SNMP Agent. If the community name of the SNMP message cannot pass device authentication, this message will be dropped.

SNMP v2 also adopts community name authentication. It not only is compatible with SNMP v1, but also expands the functions of SNMP v1.

The precondition of mutual visiting of NMS and Agent is the matched SNMP version. Agent can be configured with multiple versions at the same time, and use different version to communicate with different NMS.

21.1.4 MIB Introduction

Any managed resource can be viewed as an object and it is called a managed object.

MIB (Management Information Base) is a collection of all managed objects. It defines the hierarchical relationships between managed objects and defines a series of attributes of objects, such as object name, access rights, data types, and so on. Each Agent has its own MIB. NMS can read or write objects in the MIB according to its rights. The relationship of NMS, Agent and MIB is shown in Figure 156.

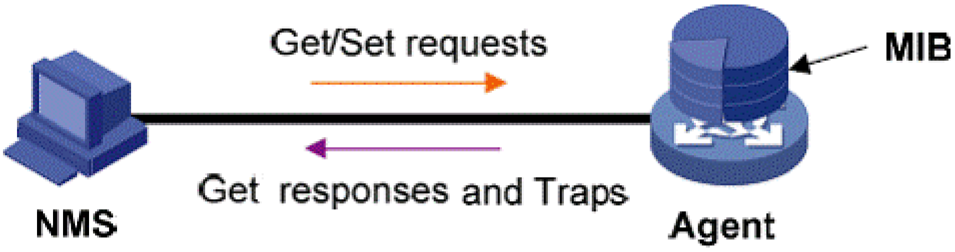


Figure 156: NMS, Agent and MIB relationship

MIB defines a tree structure and each tree node is a managed object. Each tree node contains an OID (Object Identifier) that can indicate the node position in the MIB tree structure. As Figure 157 shows, the OID of the managed object A is 1.2.1.1.

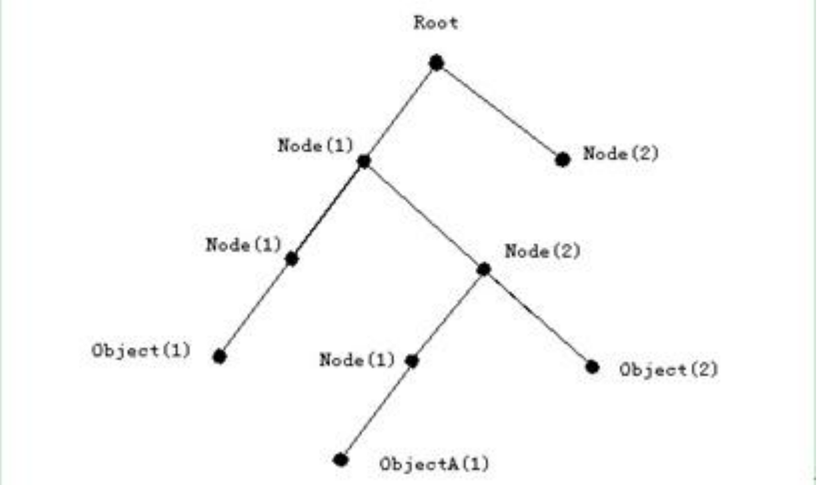
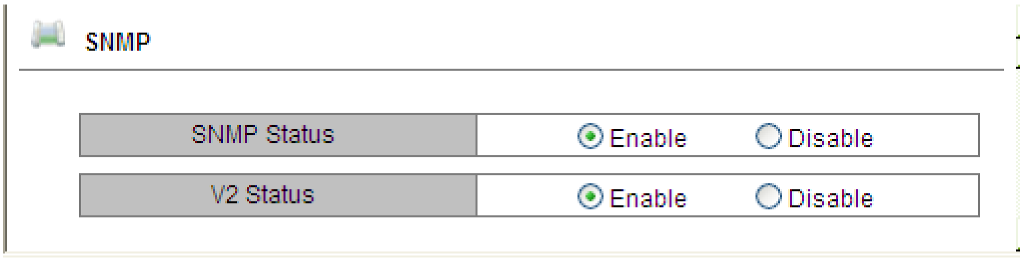


Figure 157: MIB tree structure

21.1.5 Web Configuration

1. Enable SNMP Protocol, as shown in Figure 158.



SNMP

SNMP Status	● Enable ○ Disable
V2 Status	● Enable ○ Disable

Figure 158: Enable SNMP and choose SNMP version

SNMP Status

Configuration options: Enable/Disable

Default: Enable

Function: Enable/Disable SNMP protocol

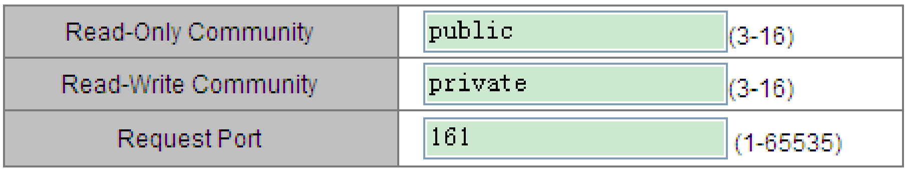
V2 Status

Configuration options: Enable/Disable

Default: Enable

Function: Enable SNMPv2 version that is compatible with SNMPv1

2. Configure access rights, as shown in Figure 159.



Read-Only Community	public (3-16)
Read-Write Community	private (3-16)
Request Port	161 (1-65535)

Figure 159: Access rights configuration

Read-Only Community

Configuration range: 3~16 characters

Default: public

Function: set the read-only community name.

Explanation: Only when the community name carried by the SNMP message sent from NMS is same as the community name set here can the NMS read MIB information.

Read-Write Community

Configuration range: 3~16 characters

Default: private

Function: set the read-write community name.

Description: Only when the community name carried by the SNMP message sent from NMS is same as the community name set here can the NMS read and write MIB information.

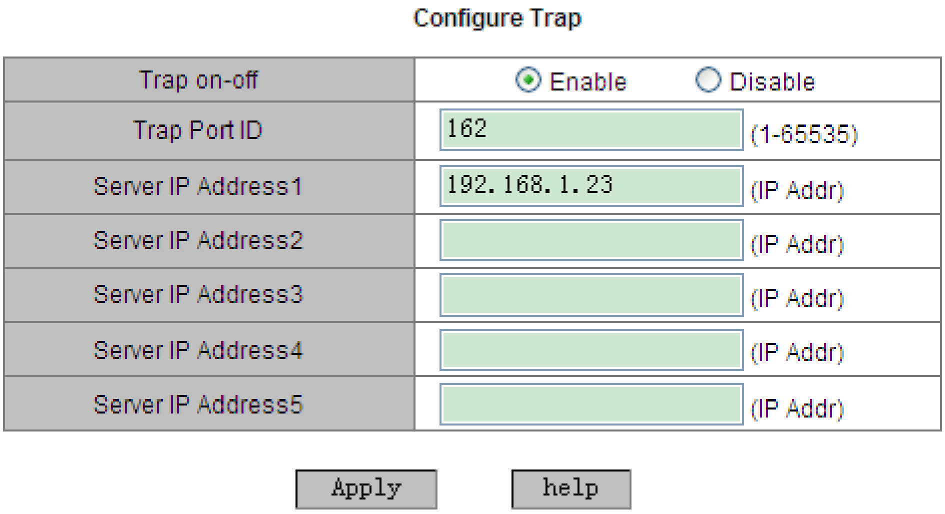
Request Port

Configuration range: 1~65535

Default: 161

Function: set the port to receive SNMP requests

3. Trap configuration, as shown in Figure 160.



Configure Trap

Trap on-off	● Enable ○ Disable
Trap Port ID	162 (1-65535)
Server IP Address1	192.168.1.23 (IP Addr)
Server IP Address2	(IP Addr)
Server IP Address3	(IP Addr)
Server IP Address4	(IP Addr)
Server IP Address5	(IP Addr)

Figure 160: Trap Configuration

Trap on-off

Configuration options: Enable/Disable

Default: Enable

Function: Enable/Disable the function of switch sending Trap messages

Trap Port ID

Configuration options: 1~65535

Default: 162

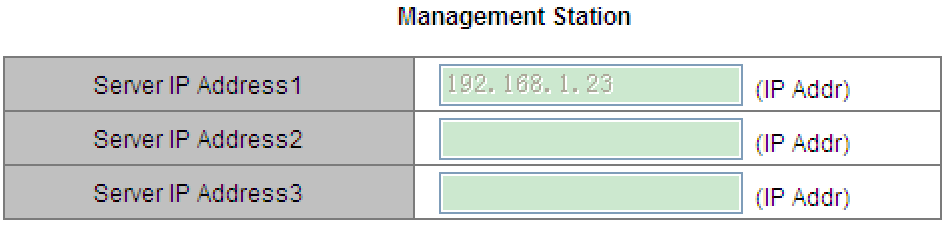
Function: Set the port ID of sending Trap messages

Server IP Address

Configuration format: A.B.C.D

Function: configure the server IP address of receiving Trap messages. Max 5 server IP addresses are supported.

4. Show management server IP address, as shown in Figure 161.



Management Station

Server IP Address1	192.168.1.23 (IP Addr)
Server IP Address2	(IP Addr)
Server IP Address3	(IP Addr)

Figure 161: Management server IP address

There is no need to manually set the server IP addresses. They will be automatically displayed as long as run the network management software on server and read & write device MIB node information.

21.1.6 Typical Configuration Example

SNMP NMS connects with the switch through Ethernet. The IP address of NMS is 192.168.1.23 and the switch IP address is 192.168.1.2. NMS monitors and manages Agent by using SNMPv2 and it can read and write MIB information of Agent, and the Agent will automatically send Trap messages to NMS when failover occurs in Agent, as shown in Figure 162.

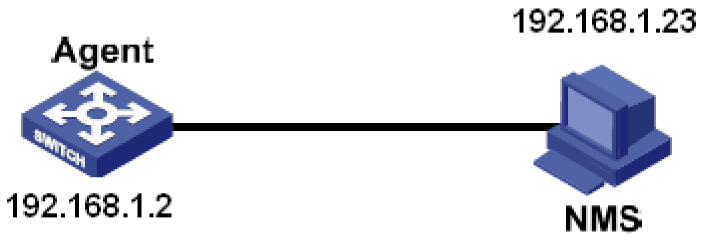


Figure 162: SNMPv2 Configuration Example

Agent configuration:

1. Enable SNMP protocol and v2 version, see Figure 158.
2. Configure access rights with the Read-Only community name "public" and Read-Write community name "private", and the request port is 161, as shown in Figure 159.
3. Enable Trap, the Trap port ID is set to 162 and the server IP address is 192.168.1.23, as shown in Figure 160.

If users would like to monitor and manage Agent, it is needed to run the corresponding management software, for example, Kyvision, in NMS.

Please refer to "Kyvision Management Software Operation Manual" to learn the specific operation of Kyvision software in NMS.

21.2 SNMPv3

21.2.1 Introduction

SNMPv3 provides a USM (User-Based Security Model) authentication mechanism. User can configure authentication and encryption functions. Authentication is used to verify the legality of the message sender to avoid the access from illegal users. Encryption is to encrypt the transmitted messages between NMS and Agent to avoid being eavesdropped. The combination of authentication and encryption improves the communication security between SNMP NMS and SNMP Agent.

21.2.2 Implementation

SNMPv3 has 4 configuration tables each of which can configure 16 entries. These tables codetermine whether the specified users based on context group can access MIB information.

User table is used to create users. Each user can use different security policies to realize user authentication, encryption and other security functions.

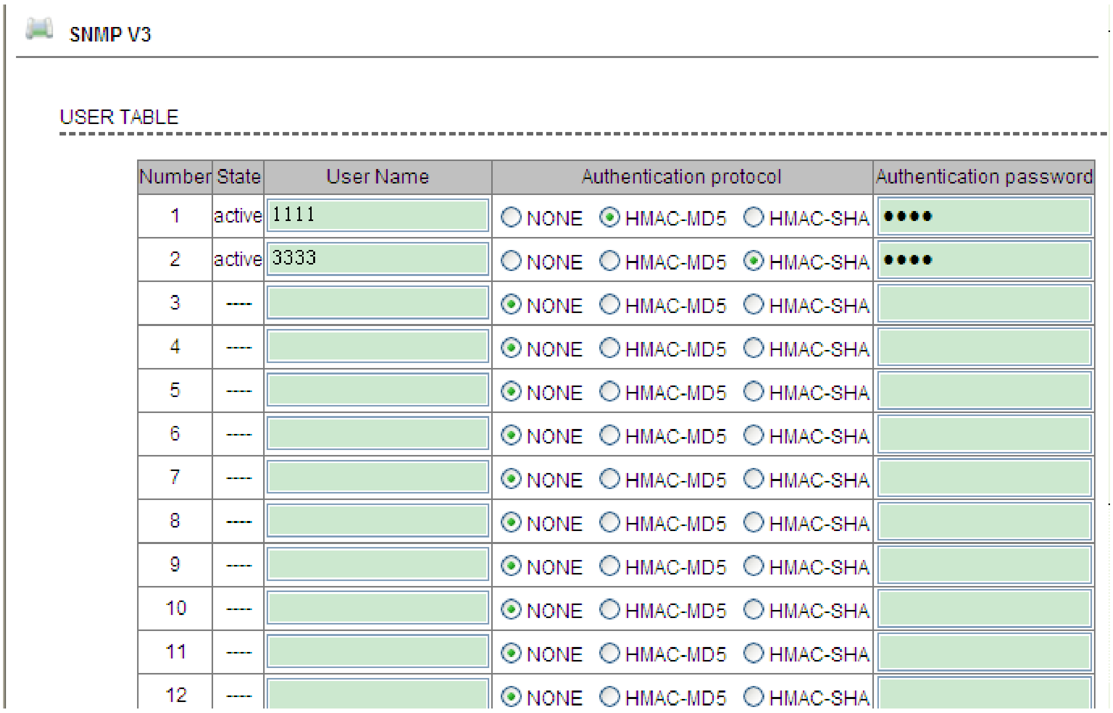
Access table can access MIB node information by matching group name, context name, and by setting security model, security level

Group table is a collection of multiple users. Access rights are subject to a user group, the access rights of a group are applicable for all users in the group.

Context table are readable character strings to identify users. It has nothing to do with the specific security model.

21.2.3 Web Configuration

1. User table configuration, as shown in Figure 163.



SNMP V3

USER TABLE

Number	State	User Name	Authentication protocol	Authentication password
1	active	1111	○ NONE ● HMAC-MD5 ○ HMAC-SHA	••••
2	active	3333	○ NONE ○ HMAC-MD5 ● HMAC-SHA	••••
3	----		● NONE ○ HMAC-MD5 ○ HMAC-SHA	
4	----		● NONE ○ HMAC-MD5 ○ HMAC-SHA	
5	----		● NONE ○ HMAC-MD5 ○ HMAC-SHA	
6	----		● NONE ○ HMAC-MD5 ○ HMAC-SHA	
7	----		● NONE ○ HMAC-MD5 ○ HMAC-SHA	
8	----		● NONE ○ HMAC-MD5 ○ HMAC-SHA	
9	----		● NONE ○ HMAC-MD5 ○ HMAC-SHA	
10	----		● NONE ○ HMAC-MD5 ○ HMAC-SHA	
11	----		● NONE ○ HMAC-MD5 ○ HMAC-SHA	
12	----		● NONE ○ HMAC-MD5 ○ HMAC-SHA	

Figure 163: SNMPv3 user table configuration

User Name

Configuration range: 4~16 characters

Function: create user name

Authentication Protocol

Configuration options: NONE/HMAC-MD5/HMAC-SHA

Default: NONE

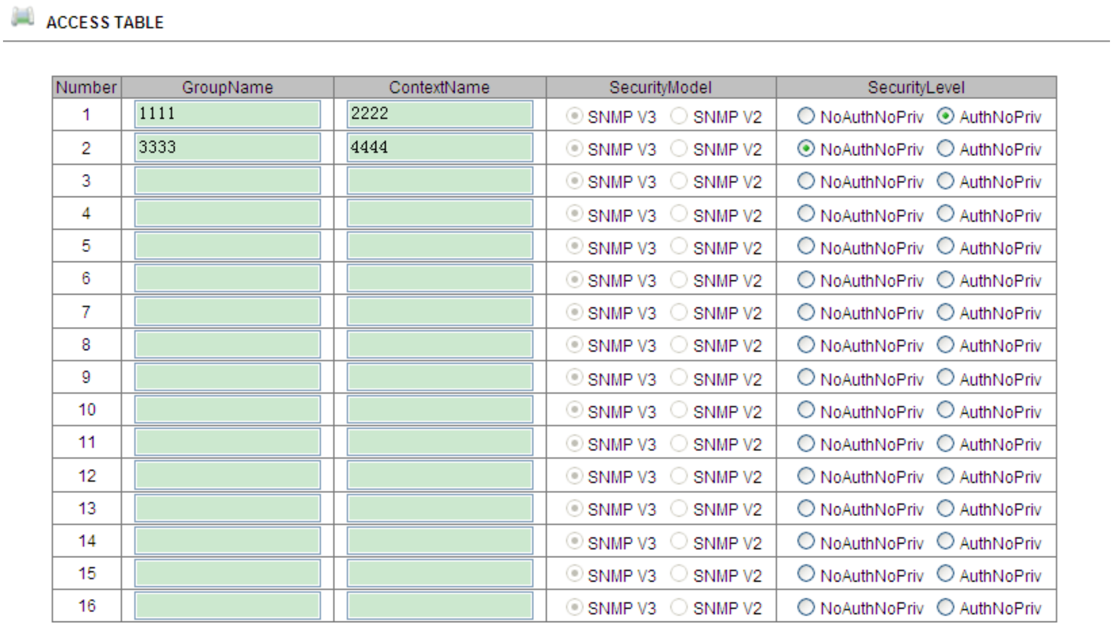
Function: choose a kind of authentication encryption algorithm

Authentication Password

Configuration range: 4~16 characters

Function: set a user password

2. Access table configuration, as shown in Figure 164.



ACCESS TABLE

Number	GroupName	ContextName	SecurityModel	SecurityLevel
1	1111	2222	● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ● AuthNoPriv
2	3333	4444	● SNMP V3 ○ SNMP V2	● NoAuthNoPriv ○ AuthNoPriv
3			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
4			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
5			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
6			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
7			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
8			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
9			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
10			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
11			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
12			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
13			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
14			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
15			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv
16			● SNMP V3 ○ SNMP V2	○ NoAuthNoPriv ○ AuthNoPriv

Figure 164: SNMPv3 access table configuration

Group Name

Configuration range: 4~16 characters

Function: set the name of group table. For this series switches, each group is only for a single user, so the group name must be the same as the user name set in the user table.

Context Name

Configuration range: 4~16 characters

Function: configure the context name

Security Model

Configuration range: SNMPv3/ SNMPv2

Explanation: SNMPv3 means using USM technology. SNMPv3 is selected forcibly.

Security Level

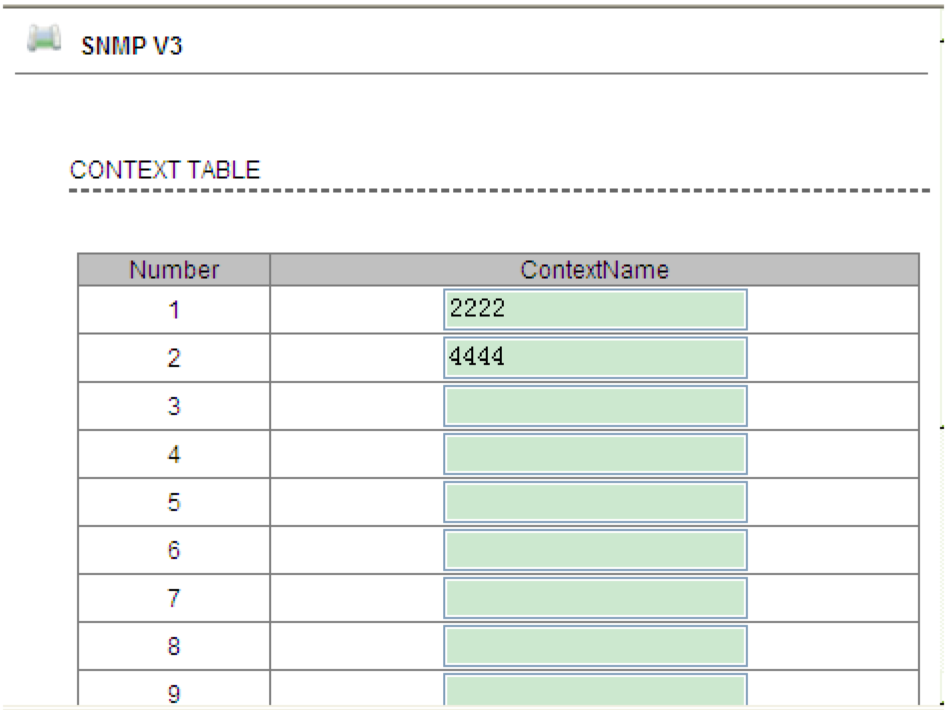
Configuration range: NoAuthNoPriv/AuthNoPriv

Default: NoAuthNoPriv

Function: authentication and encryption are needed or not when accessing MIB information.

Explanation: NoAuthNoPriv: needs neither authentication nor encryption; AuthNoPriv: need authentication, do not need encryption.

3. Context table configuration, as shown in Figure 165.



SNMP V3

CONTEXT TABLE

Number	ContextName
1	2222
2	4444
3	
4	
5	
6	
7	
8	
9	

Figure 165: SNMPv3 context table configuration

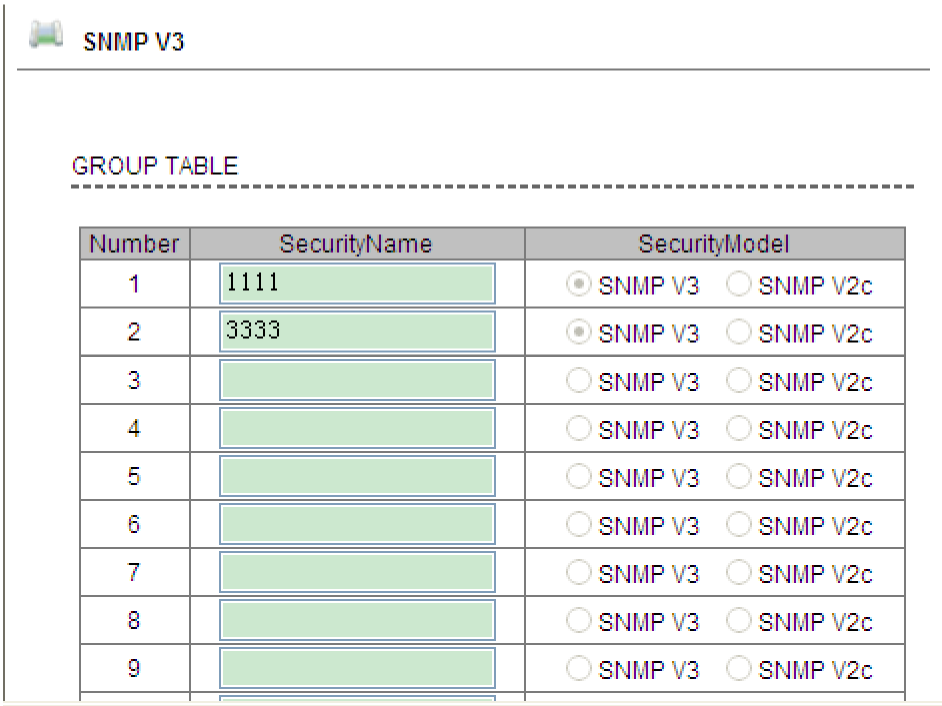
Context Name

Configuration range: 4~16 characters

Function: define a series of managed objects that can be accessed by SNMP.

This name must be the same as the context name set in access table.

4. Group table configuration, as shown in Figure 166.



SNMP V3

GROUP TABLE

Number	SecurityName	SecurityModel
1	1111	● SNMP V3 ○ SNMP V2c
2	3333	● SNMP V3 ○ SNMP V2c
3		○ SNMP V3 ○ SNMP V2c
4		○ SNMP V3 ○ SNMP V2c
5		○ SNMP V3 ○ SNMP V2c
6		○ SNMP V3 ○ SNMP V2c
7		○ SNMP V3 ○ SNMP V2c
8		○ SNMP V3 ○ SNMP V2c
9		○ SNMP V3 ○ SNMP V2c

Figure 166: SNMPv3 group table

Security Name

Configuration range: 4~16 characters

Function: set the name of group table. For this series switches, each group is only for a single user, so the security name must be the same as the user name set in user table.

Security Model

Configuration options: SNMPv3/SNMPv2

Default: SNMPv3

Explanation: SNMPv3 means using USM technology. Currently, this parameter is forced to SNMPv3 model.

21.2.4 Typical Configuration Example

As Figure 167 shows, SNMP NMS connects with the switch via Ethernet, and the IP address of NMS is 192.168.1.23, the switch IP address is 192.168.1.2. The user with the name of 111 monitors and manages the Agent by SNMPv3, and the authentication protocol is HMAC-MD5, the security level is AuthNoPriv.

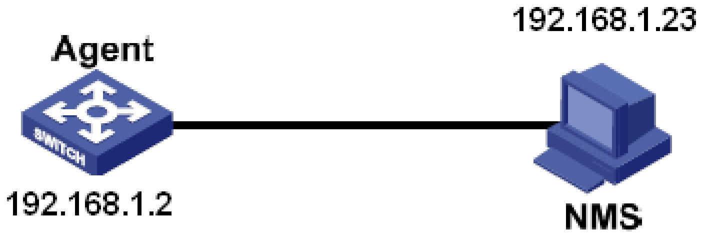


Figure 167: SNMPv3 configuration example

Agent Configuration:

1. Configure SNMPv3 user table. Set the user name to 111, choose the authentication protocol of HMAC-MD5, and set the authentication password to "aaaa", as shown in Figure 163.
2. Configure SNMPv3 access table. Set the group name to 1111 and the context name to 2222, choose the Security Level of AuthNoPriv, as shown in Figure 164.
3. Configure SNMPv3 context table. Set the context name to 2222, as shown in Figure 165.
4. Configure SNMPv3 group table. Set the security name to 1111, as shown in Figure 166.

If users would like to monitor and manage Agent, it is needed to run the corresponding management software in NMS.

Please refer to "Kyvision Management Software Operation Manual" to learn the specific operation of Kyvision software in NMS.

22. DHCP

With the continuous expansion of network scale and the growing of network complexity, under the conditions of the frequent movement of computers (such as laptops or wireless network) and the computers outnumbering the allocable IP addresses, the BOOTP protocol that is specially for the static host configuration has become increasingly unable to meet actual needs. For fast access and exit network and improving the utilization ratio of IP address resources, we do need to develop an automatic mechanism based on BOOTP to assign IP addresses. DHCP (Dynamic Host Configuration Protocol) was introduced to solve these problems.

DHCP employs a client-server communication model. The client sends a configuration request to the server, and then the server replies configuration parameters such as an IP address to the client, achieving the dynamic configuration of IP addresses. The structure of a DHCP typical application is shown in Figure 168.

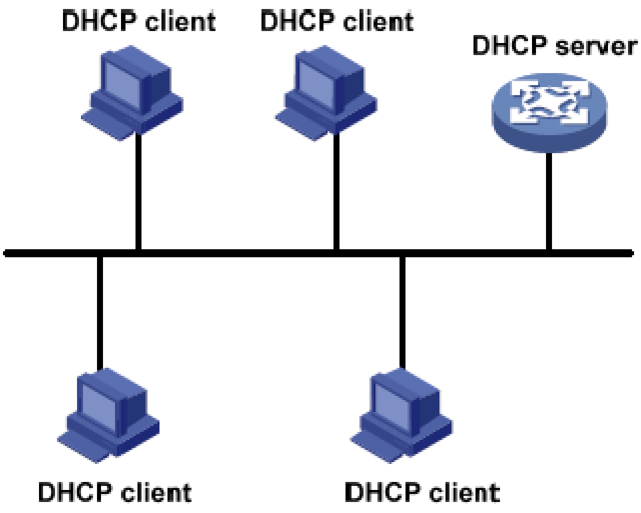


Figure 168: DHCP typical application

Caution:

In the process of dynamic obtainment of IP addresses, the messages are transmitted in the way of broadcast, so it is required that the DHCP client and the

DHCP server are in a same segment. If they are in the different segments, the client can communicate with the server via a DHCP relay to get IP addresses and other configuration parameters. This series switches do not support DHCP relay, so the client and the server must be in a same segment.

DHCP supports two types of IP address allocation mechanisms.

Static allocation: the network administrator statically binds fixed IP addresses to few specific clients such as a WWW server and sends the binding IP addresses to clients by DHCP. This allocation mechanism contains port IP address binding and MAC address binding.

Dynamic allocation: DHCP server dynamically allocates an IP address to a client. This allocation mechanism can allocate a permanent IP address or an IP address with a limited lease period to a client. When the lease expires, the client needs to reapply an IP address.

The network administrator can choose a DHCP allocation mechanism for each client.

22.1 DHCP Server Configuration

22.1.1 Introduction

DHCP server is a provider of DHCP services. It uses DHCP messages to communicate with DHCP client to allocate a suitable IP address to the client and assign other network parameters to the client as required. In the following conditions, the DHCP server generally is used to allocate IP addresses.

- Large network scale. The workload of manual configuration is heavy and it is hard to manage the entire network.
- The hosts outnumber the assignable IP addresses, and it is unable to allocate a fixed IP address to each host.
- Only a few hosts in the network need fixed IP addresses.

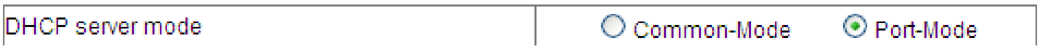
22.1.2 DHCP Address Pool

The DHCP server selects an IP address from an address pool and allocates it together with other parameters to the client. The IP address allocation sequence is as follows:

1. The IP address statically bound to the client MAC address or the port ID connecting to the server.
2. The IP address that is recorded in the DHCP server that it was ever allocated to the client
3. The IP address that is specified in the request message sent from the client
4. The first allocable IP address found in a address pool
5. If there is no available IP address, check the IP address whose lease expires and that had conflicts in order. If found, allocate the IP address. If not, no process.

22.1.3 Web Configuration

1. Enable DHCP server, as shown in Figure 169.



DHCP server mode	○ Common-Mode ● Port-Mode

Figure 169: DHCP server state

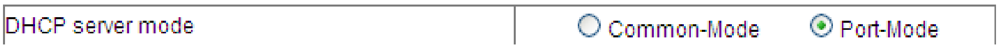
DHCP server status

Configuration options: Enable/Disable

Default: Disable

Function: select the current switch to the DHCP server to allocate an IP address to a client or not

2. Select the DHCP server mode, as shown in Figure 170.



DHCP server mode	○ Common-Mode ● Port-Mode

Figure 170: DHCP server mode

DHCP server mode

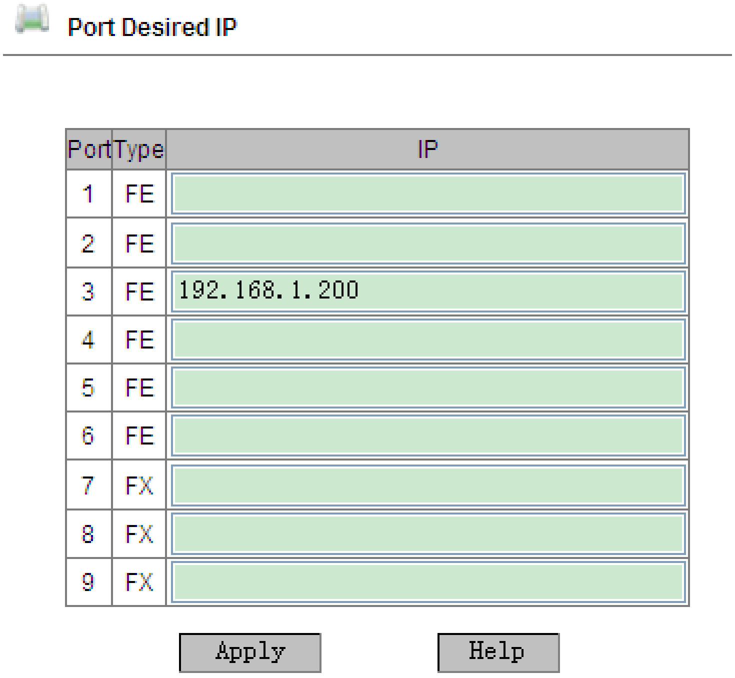
Configuration options: Common-mode/Port-mode

Default: Common mode

Explanation: Common mode contains dynamic IP address allocation and static MAC address binding. Port mode means the port desired IP setting.

3. Port-Mode configuration

When select Port-mode in the DHCP server mode, allocate static binding IP addresses to ports, as shown in Figure 171.



Port Desired IP

Port	Type	IP
1	FE	
2	FE	
3	FE	192.168.1.200
4	FE	
5	FE	
6	FE	
7	FX	
8	FX	
9	FX	

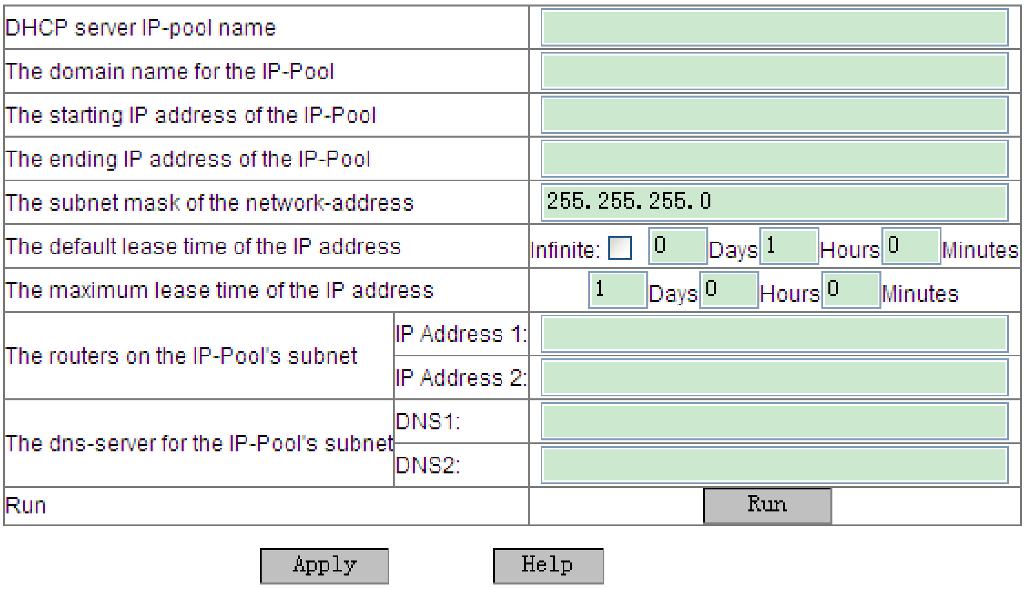
Figure 171: Port Desired IP Setting

Port desired IP setting is to statically configure an IP address to a port. When a port receives a request message from a client, the IP address bound to the port will be allocated to the client. This IP allocation mode has the highest priority and the lease period is 1000 days 23 hours and 59 minutes.

Caution:

The IP address bound to the port and the DHCP server must be in same segment.

When port mode is adopted for IP assignment, you need to configure the DHCP server, as shown in Figure 172.



DHCP server IP-pool name		
The domain name for the IP-Pool		
The starting IP address of the IP-Pool		
The ending IP address of the IP-Pool		
The subnet mask of the network-address		255.255.255.0
The default lease time of the IP address		Infinite: □ 0 Days 1 Hours 0 Minutes
The maximum lease time of the IP address		1 Days 0 Hours 0 Minutes
The routers on the IP-Pool's subnet	IP Address 1:	
	IP Address 2:	
The dns-server for the IP-Pool's subnet	DNS1:	
	DNS2:	
Run		Run

Figure 172: Port mode server configuration

The subnet mask of the network-address

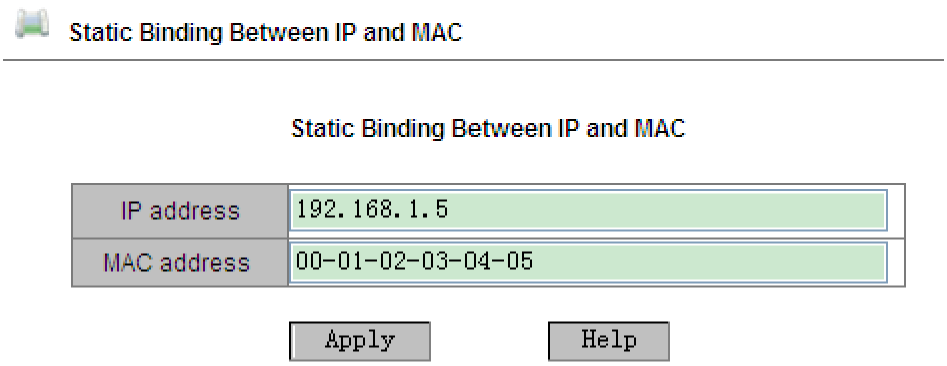
The subnet mask is a number with a length of 32 bits and consists of a string of 1 and a string of 0. "1" corresponds to network number fields and subnet number fields, while "0" corresponds to host number fields. It is generally configured to 255.255.255.0.

Caution:

After configuration, click <Run> button to allocate correct IP addresses to clients.

4. Common-Mode Configuration

When DHCP server mode is set to Common-Mode, it contains static MAC address binding and dynamic IP address allocation. In static MAC address binding, the system preferentially allocates the IP address bound to the MAC address, otherwise, dynamically allocate IP addresses in the address pool. The static MAC address binding configuration is shown in Figure 173 and Figure 174; dynamic IP address allocation configuration is shown in Figure 175.



Static Binding Between IP and MAC

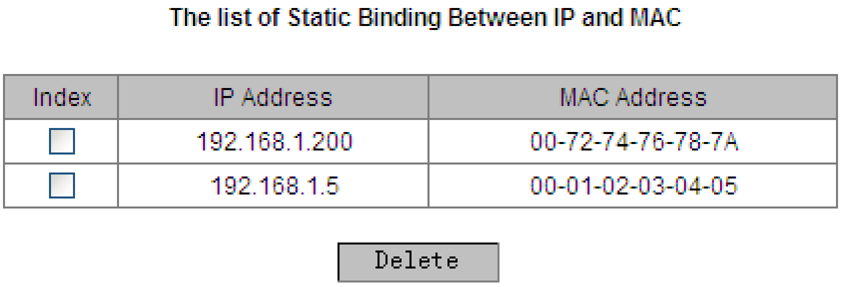
Static Binding Between IP and MAC

IP address	192.168.1.5
MAC address	00-01-02-03-04-05

Figure 173: Static MAC address binding

Static MAC address binding is to bind the client MAC address to IP address. When the server receives an IP address request message whose source MAC address is the MAC address set here, the IP address bound to this MAC address will be allocated to the client. This kind of IP allocation mode requires server configuration as shown in Figure 175.

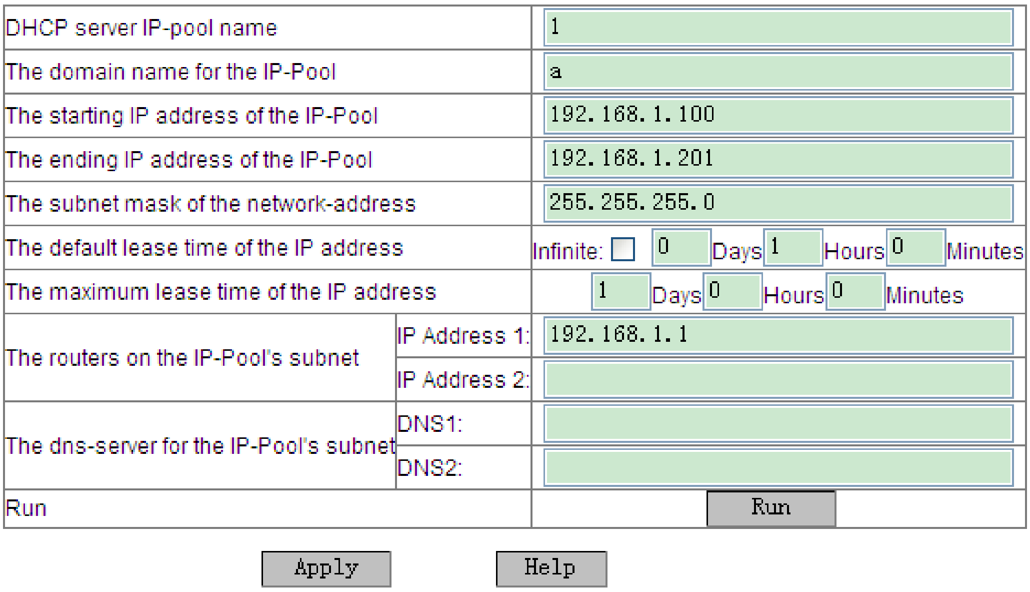
After configuration, the list of "Static Binding between IP and MAC" shows the statically-configured binding relationships of MAC addresses and IP addresses. Tick in the box of Index to delete the corresponding binding entry.



The list of Static Binding Between IP and MAC

Index	IP Address	MAC Address
☐	192.168.1.200	00-72-74-76-78-7A
☐	192.168.1.5	00-01-02-03-04-05

Figure 174: Static MAC address binding list



DHCP server IP-pool name		1
The domain name for the IP-Pool		a
The starting IP address of the IP-Pool		192.168.1.100
The ending IP address of the IP-Pool		192.168.1.201
The subnet mask of the network-address		255.255.255.0
The default lease time of the IP address		Infinite: □ 0 Days 1 Hours 0 Minutes
The maximum lease time of the IP address		1 Days 0 Hours 0 Minutes
The routers on the IP-Pool's subnet	IP Address 1:	192.168.1.1
	IP Address 2:	
The dns-server for the IP-Pool's subnet	DNS1:	
	DNS2:	
Run		Run

Figure 175: Common mode server configuration

DHCP server IP-pool name

Configuration range: 1-15 characters

Function: configure the name of the IP address pool

The domain name for the IP-Pool

Configuration range: 1-60 characters

Function: configure the domain name of the IP address pool

The starting IP address of the IP-Pool/The ending IP address of the IP-Pool

Configuration format: A.B.C.D (the starting IP address and the ending IP address must be in a same segment.

The subnet mask of the network-address

The subnet mask is a number with a length of 32 bits and consists of a string of 1 and a string of 0. "1" corresponds to network number fields and subnet number fields, while "0" corresponds to host number fields. It is generally configured to 255.255.255.0. In the dynamic address allocation, the range of the IP address pool need to be set and the address range is determined by the subnet mask.

The default lease time of the IP address

Configuration range: 0 Days 0 Hours 1 Minutes – 1000 Days 23 Hours 59 Minutes/Infinite

Default: 0 Days 1 Hours 0 Minutes

Explanation: If the IP address request message sent from the client does not contain a valid lease time, the lease time of the IP address the server allocates to the client is the default value.

The maximum lease time of the IP address

Configuration range: 0 Days 0 Hours 1 Minutes – 1000 Days 23 Hours 59 Minutes

Default: 1 Days 0 Hours 0 Minutes

Explanation: When the client sends an IP address request message to the server, the lease time of the message cannot be longer than the maximum lease time of the IP address. For different address pools, DHCP server can set different address lease time, but the addresses in the same DHCP address pool have the same lease time.

The routers on the IP-Pool's subnet

Configuration range: the addresses that are in the same segment as the address pool.

Explanation: when the DHCP client visits the host that is in the different segment, the data must be forwarded via gateways. When the DHCP server allocates IP addresses to clients, it can specify gateway addresses at the same time. DHCP address pool can configure max two gateway addresses.

The dns-server for the IP-Pool's subnet

When visiting the network host via a domain name, the domain name needs to be resolved to an IP address, which is realized by DNS. In order to let a DHCP client visit a network host via a domain name, when the DHCP server allocates IP addresses to clients, it can specify IP addresses of domain name servers at the same time. DHCP address pool can configure max two DNS addresses.

Caution:

After configuration, click <Run> button to allocate correct IP addresses to clients.

22.1.4 Typical Configuration Example

As Figure 176 shows, switch A works as a DHCP server and switch B works as a DHCP client. The port 3 of Switch A connects with the port 4 of Switch B. The client sends out IP address request messages and the server can allocate an IP address to the client in three ways.

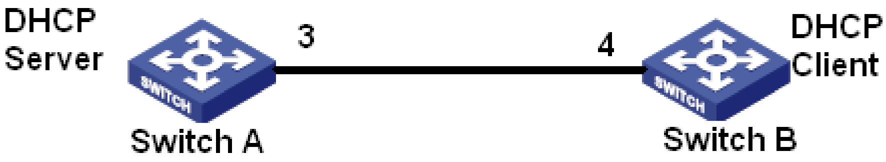


Figure 176: DHCP typical configuration example

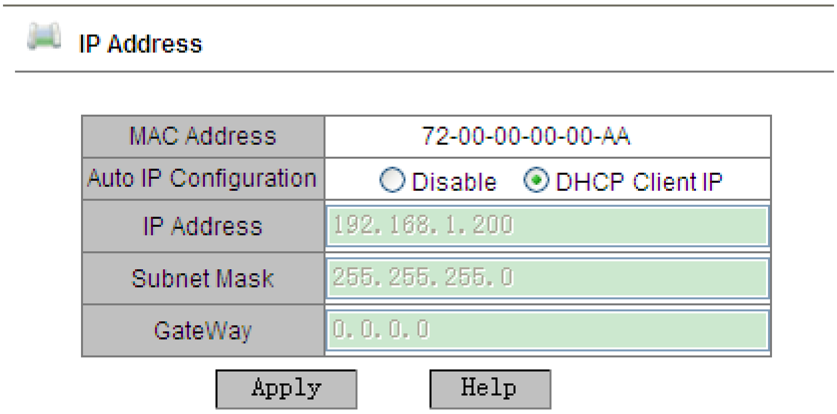
Port IP binding:

- Switch A Configuration:

1. Enable DHCP server status, as shown in Figure 169
2. Select Port-Mode in the DHCP server mode, as shown in Figure 170.
3. Set the subnet mask to 255.255.255.0, as shown in Figure 172.
4. Port 3 bind to the IP address of 192.168.1.200, as shown in Figure 171.
5. Click the <Run> button in the server configuration interface to run the server.

- Switch B configuration

1. Select DHCP Client IP in the IP address configuration of Switch B, as shown in Figure 14.
2. The switch B obtains the IP address of 192.168.1.200 and the subnet mask of 255.255.255.0 from the DHCP server, as shown in Figure 177.



IP Address

MAC Address	72-00-00-00-00-AA
Auto IP Configuration	○ Disable ● DHCP Client IP
IP Address	192. 168. 1. 200
Subnet Mask	255. 255. 255. 0
GateWay	0. 0. 0. 0

Figure 177: DHCP client obtain IP address-1

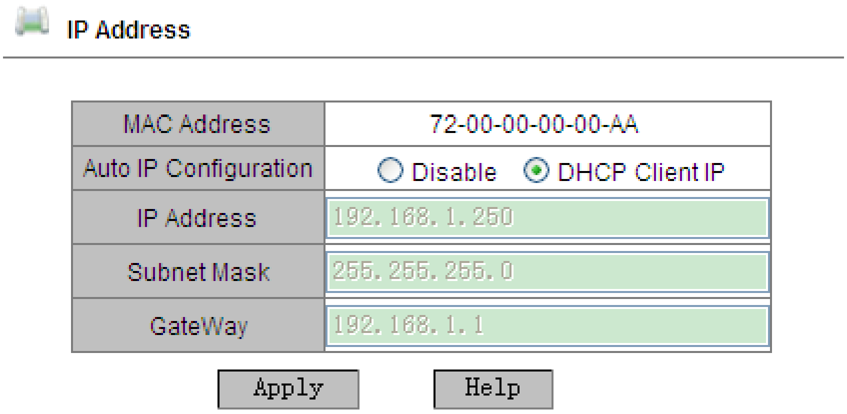
Static MAC address binding method

- ➢ Switch A configuration

1. Enable the DHCP server status, as shown in Figure 169
2. Select Common-Mode in the DHCP server mode, as shown in Figure 170.
3. Set the name of IP address pool to 1, set the domain name of the address pool to a, set the starting address of the address pool to 192.168.1.100 and the ending address to 192.168.1.200, set the subnet mask to 255.255.255.0 and the gateway address to 192.168.1.1 and the lease time uses the default value, as shown in Figure 172.
4. Bind the Switch B MAC address of 00-72-74-76-78-7a to the IP address of 192.168.1.250, as shown in Figure 173.
5. Click the <Run> button in the server configuration interface to run the server.

- ➢ Switch B configuration

1. Select DHCP Client IP in the IP address configuration of Switch B, as shown in Figure 14.
2. The switch B obtains the IP address of 192.168.1.250 and the subnet mask of 255.255.255.0 and the gateway address of 192.168.1.1 from the DHCP server, as shown in Figure 178



IP Address

MAC Address	72-00-00-00-00-AA
Auto IP Configuration	○ Disable ● DHCP Client IP
IP Address	192.168.1.250
Subnet Mask	255.255.255.0
GateWay	192.168.1.1

Figure 178: DHCP client obtain IP address-2

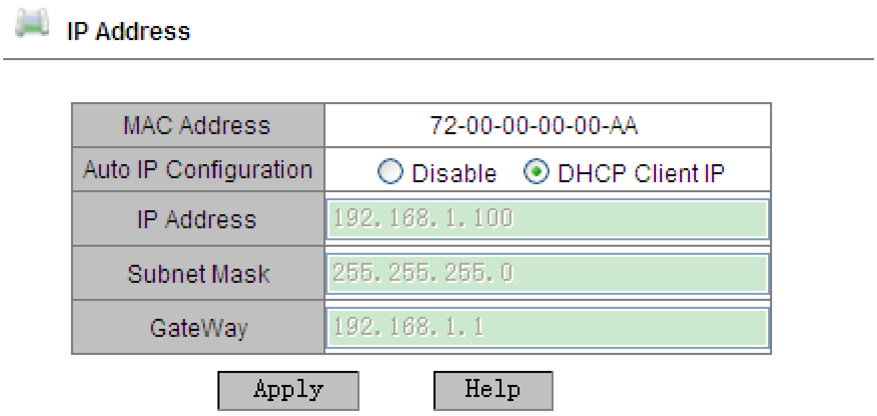
Dynamic obtainment of IP address in address pool

- Switch A configuration

1. Enable DHCP server status, as shown in Figure 169.
2. Select Common-Mode in the DHCP server mode, as shown in Figure 170.
3. Set the name of IP address pool to 1, set the domain name of address pool to a, set the starting address of the address pool to 192.168.1.100 and the ending address to 192.168.1.200, set the subnet mask to 255.255.255.0 and the gateway address to 192.168.1.1, and the lease time uses the default value, as shown in Figure 172.
4. Click the <Run> button in the server configuration screen to run the server.

- Switch B configuration

1. Select DHCP Client IP in the IP address configuration of Switch B, as shown in Figure 14.
2. DHCP server searches the assignable IP addresses in the address pool in order and allocates the first found assignable IP address and other network parameters to Switch B. The subnet mask is 255.255.255.0 and the gateway address is 192.168.1.1, as shown in Figure 179.



IP Address

MAC Address	72-00-00-00-00-AA
Auto IP Configuration	○ Disable ● DHCP Client IP
IP Address	192.168.1.100
Subnet Mask	255.255.255.0
GateWay	192.168.1.1

Figure 179: DHCP client obtain IP address-3

22.2 DHCP Snooping

22.2.1 Introduction

DHCP Snooping is a monitoring function of DHCP services on layer 2 and is a security feature of DHCP, ensuring the security of the client further. The DHCP Snooping security mechanism can control that only the trusted port can forward the request message of the DHCP client to the legal server, meanwhile, it can control the source of the response message of the DHCP server, ensuring the client to obtain an IP address from the valid server and preventing the fake or invalid DHCP server from allocating IP addresses or other configuration parameters to other hosts.

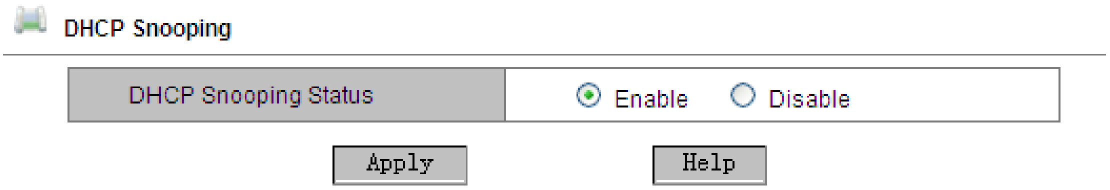
DHCP Snooping security mechanism divides port to trusted port and untrusted port.

Trusted port: it is the port that connects with the valid DHCP server directly or indirectly. Trusted port normally forwards the request messages of DHCP clients and the response messages of DHCP servers to guarantee that DHCP clients can obtain valid IP addresses.

Untrusted port: it is the port that connects with the invalid DHCP server. Untrusted port does not forward the request messages of DHCP clients and the response messages of DHCP servers to prevent DHCP clients from obtaining invalid IP addresses.

22.2.2 Web Configuration

1. Enable DHCP Snooping function, as shown in Figure 180.



DHCP Snooping

DHCP Snooping Status	● Enable ○ Disable

Figure 180: DHCP Snooping state

DHCP Snooping Status

Configuration options: Enable/Disable

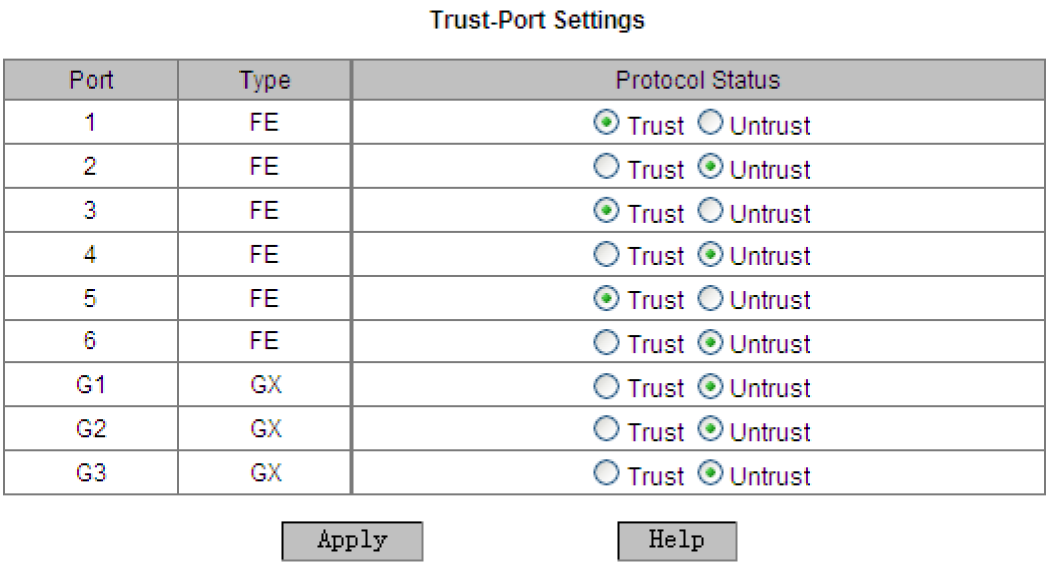
Default: Disable

Function: Enable/Disable switch DHCP Snooping function

Caution:

The switch working as DHCP server and client cannot enable DHCP Snooping function.

2. Configure trusted ports, as shown in Figure 181.



Trust-Port Settings

Port	Type	Protocol Status
1	FE	● Trust ○ Untrust
2	FE	○ Trust ● Untrust
3	FE	● Trust ○ Untrust
4	FE	○ Trust ● Untrust
5	FE	● Trust ○ Untrust
6	FE	○ Trust ● Untrust
G1	GX	○ Trust ● Untrust
G2	GX	○ Trust ● Untrust
G3	GX	○ Trust ● Untrust

Figure 181: Trusted port setting

Protocol Status

Configuration options: Trust/Untrust

Default: Untrust

Function: set the port to a trusted port or an untrusted port. The ports that connect with valid DHCP servers directly or indirectly are trusted ports.

Caution:

The trusted port configuration and Port Trunk is mutually exclusive. The port joining in a trunk group cannot be set to a trusted port. The trusted port cannot join in a trunk group.

22.2.3 Typical Configuration Example

As Figure 182 shows, the DHCP client requests an IP address from the DHCP server. An unauthorized DHCP server exists in the network. Set port 1 to a trusted port by DHCP Snooping to forward the request message of the DHCP client to the DHCP server and forward the response message of the DHCP server to the DHCP client. Set port 3 to an untrusted port that cannot forward the request message of the DHCP client and the response message of the unauthorized DHCP server, ensuring that the client can obtain a valid IP address from the valid DHCP server.

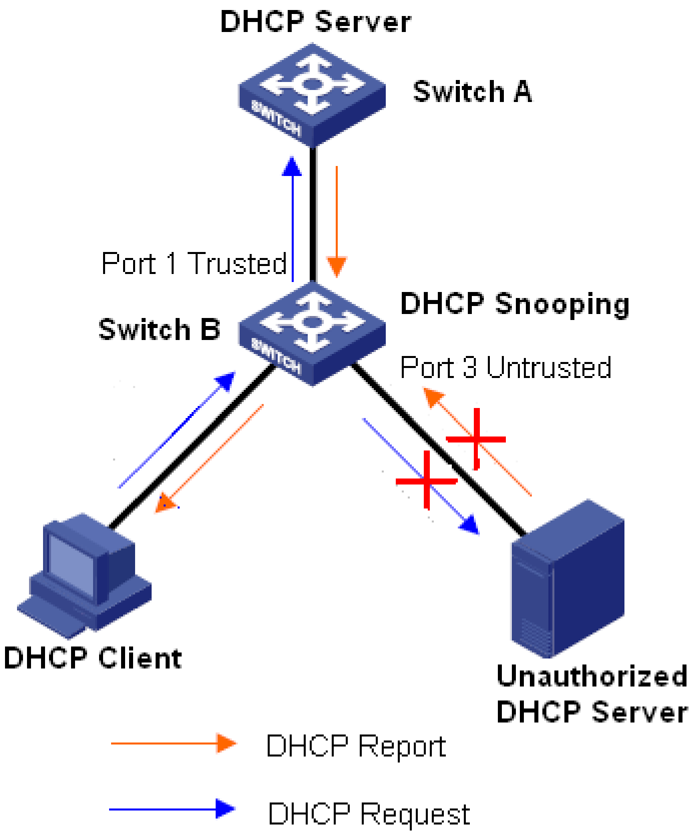


Figure 182: DHCP Snooping Typical Configuration Example

Switch B configuration:

- Enable DHCP Snooping function, as shown in Figure 180.
- Set the port 1 of switch B to a trusted port and set the port 3 to an untrusted port, as shown in Figure 181.

22.3 Option 82 Configuration

Option 82 (Relay Agent Information Entry) records the client information. When the Option 82 supported DHCP Snooping receives the request message from the DHCP client, it add the corresponding Option 82 field into the messages and then forward the message to the DHCP server. The server supporting Option 82 can flexibly allocate addresses according to the Option 82 message. Once Option 82 is enabled, the Option 82 field needs to be added into the message. The Option 82 field of this series switches contains two sub-options: sub-option 1 (Circuit ID) and sub-option 2 (Remote ID). The formats of two sub-options are shown below:

- Sub-option 1 contains the VLAN ID and number of the port that receives the request message from the DHCP client, as shown in Table 10.

Table 10: Sub-option 1 Field Format

Sub-option type (0x01)	Length (0x04)	VLAN ID	Port Number
One byte	One byte	Two bytes	Two bytes

Sub-option type: the type of the sub-option 1 is 1

Length: the number of bytes that VLAN ID and Port number occupy

VLAN ID: On DHCP Snooping device, the VLAN ID of the port that receives the request message from the DHCP client

Port number: On DHCP Snooping device, the number of the port that receives the request message from the DHCP client

- The content of Sub-option 2 is the MAC address of the DHCP Snooping device that receives the request message from the DHCP client, as shown in Table 11, or the character string configured by users, as shown in Table 12.

Table 11: Sub-option 2 Field Format-MAC Address

Sub-option type (0x02)	Length (0x06)	MAC Address
One byte	One byte	6 bytes

Table 12: Sub-option 2 Field Format-Character String

Sub-option type (0x02)	Length (0x10)	Character string
One byte	One byte	16 bytes

Sub-option type: the type of the sub-option 2 is 2

Length: the number of bytes that sub-option2 content occupies. MAC address occupies 6 bytes and character string occupies 16 bytes.

MAC address: the content of sub-option2 is the MAC address of the DHCP Snooping device that receives the request message from the DHCP client.

Character string: the content of Sub-option2 is 1~16 characters set by users.

(The character is indicated by ASCII code and each character occupies one byte). The length is fixed to 16. If the configured length of the character string is less than 16 bytes, fill in the missing characters by 0.

22.3.1 DHCP Snooping Supports Option 82 Function

1. Introduction

If DHCP Snooping device supports Option 82 function, when the DHCP Snooping receives a DHCP request message, it will process the request message according to whether the message contains Option 82 and the client policy, and then forward the processed message to the DHCP server. The specific processing method is shown in Table 13.

Table 13: Processing Modes for Request Messages (DHCP Snooping)

Receive the request message from the DHCP client	**Configuration policy**	**DHCP Snooping device processing the request message**
The request message contains Option 82	Drop	Drop the request message
	Keep	Keep the message format unchanged and forward the message
	Replace	Replace the Option 82 field in the message with the Option 82 field of the Snooping device and forward the new message
The request message does not contain Option 82	Drop/Keep/Replace	Add the Option 82 field of the Snooping device into the message and forward it

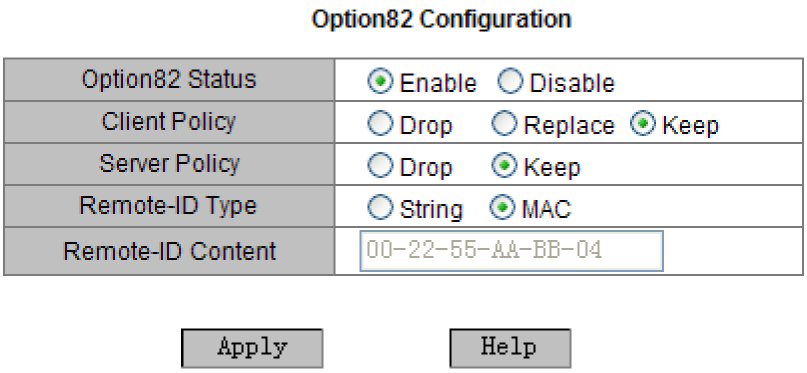
When the DHCP Snooping device receives the response message from the DHCP server, if the message contains Option 82 field, remove the Option 82 field and forward the message to the client; if the message does not contain Option 82 field, process the response message according to the server policy, as shown in Table 14.

Table 14: Processing Modes for Response Messages (DHCP Snooping)

Receive the response message from the DHCP server	**Configuration policy**	**DHCP Snooping device processing the response message**
The response message contains Option 82 field	Drop/Keep	Remove the Option 82 field in the response message and forward the message
The response message does not contains Option 82 field	Drop	Drop the response message
	Keep	Keep the message format unchanged and forward the message

2. Web Configuration

DHCP Snooping Option 82 configuration is shown in Figure 183.



Option82 Configuration

Option82 Status	● Enable ○ Disable
Client Policy	○ Drop ○ Replace ● Keep
Server Policy	○ Drop ● Keep
Remote-ID Type	○ String ● MAC
Remote-ID Content	00-22-55-AA-BB-04

Figure 183: DHCP Snooping Option 82 configuration

Option82 Status

Configuration options: Enable/Disable

Default: Disable

Function: Enable/Disable Option82 function on DHCP Snooping device

Client Policy

Configuration options: Drop/Replace/Keep

Default: Keep

Function: Configure client policy. The DHCP Snooping device processes the request message sent from the Client according to Client Policy, as shown in Table 13.

Server Policy

Configuration options: Drop/Keep

Default: Keep

Function: Configure server policy. The DHCP Snooping device processes the response message sent from the server according to Server Policy, as shown in Table 14.

Remote-ID Type

Configuration options: String/MAC

Default: MAC

Function: configure the content of Sub-option2.

Explanation: MAC means that the content of sub-option2 is the MAC address of the DHCP Snooping device that receives the request message from the client. String means the content of the sub-option2 is the character string defined by user.

Remote-ID Content

Configuration option: MAC address/1~16 characters

Default: MAC address

Explanation: when the remote ID type is set to MAC, the Remote ID content is forced to the MAC address of the current Snooping device. When the remote ID type is set to String, the Remote ID content is configured by user. The configuration content is 1~16 characters (Each character occupies one byte)

22.3.2 DHCP Server Supports Option 82 Function

1. Introduction

If the DHCP Server is set to support Option82 function, when the DHCP server receives the DHCP request message, it will provides different address allocation solution according to whether the message contains Option82 field and server configuration.

The DHCP server includes the following variables:

- Class: each DHCP server can configure 32 classes. Each class contains three variables: IP address range and Match-always and relay agent information option.
- Match the variable of relay agent information option to the Option 82 field. When the variable value is same as the Option82 field, it is assumed that they are matched, or else they are unmatched.
- If Match-always is enabled, it is assumed that the value of relay agent information option always matches to the Option82 filed without the need of judgment. If the Match-always is disabled, it is needed to judge whether the value of relay agent information option matches to the Option82 filed

According the configuration of the above variables, the server processes the request message as shown in Table 15.

Table 15: Processing Modes for Request Messages (Option82-enabled DHCP Server)

Receive the request message from the DHCP client	**Configuration Policy**		**DHCP server processing the request message**
The request message contains Option82 field	Enable Match-always		Add Option82 field into the response message, and allocate IP address and other parameters to the client
	Disable Match-always	Configure the value of relay agent information	➢ The value of relay agent information option is matched to the Option82

		option	field: Add Option82 field into the response message, and allocate IP address and other parameters to the client ➢ The value of relay agent information option is not matched to the Option82 field: the server does not allocate IP address to the client
		Do not configure the value of relay agent information option	The server does not allocate IP address to the client
The request message does not contain Option82 field	Enable Match-always		The response message does not contain Option82 field, allocate IP address and other parameters to the client
	Disable Match-always		The server does not allocate IP address to the client

If the DHCP server does not support Option82 function, when the DHCP server receives the message that contains Option82 field, the response message does not contain Option82 field, and the server can allocate IP address and other parameters to the client. Under this condition, the server processes the request message as shown in Table 16.

Table 16: Processing Modes for Request Messages (Option82-disabled DHCP Server)

Receive the request message from the DHCP client	**DHCP server processing the request message**

The request message contains Option82 field	The server does not allocate IP address and other parameters to the client
The request message does not contain Option82 field	The response message does not contain Option82 field, and the server allocate IP address and other parameter to the client

Appendix: Acronyms

Acronym	**Full Spelling**
AAA	Authentication, Authorization, Accounting
ARP	Address Resolution Protocol
BOOTP	Bootstrap Protocol
BPDU	Bridge Protocol Data Unit
CLI	Command Line Interface
CRC	Cyclic Redundancy Check
DHCP	Dynamic Host Configuration Protocol
DSCP	Differentiated Services Code Point
FTP	File Transfer Protocol
GARP	Generic Attribute Registration Protocol
GMRP	GARP Multicast Registration Protocol
GVRP	GARP VLAN Registration Protocol
HTTP	Hyper Text Transport Protocol
IGMP	Internet Group Management Protocol
IGMP Snooping	Internet Group Management Protocol Snooping
LLDP	Link Layer Discovery Protocol
MAC	Media Access Control
MIB	Management Information Base
NMS	Network Management Station
OID	Object Identifier
QoS	Quality of Service
RMON	Remote Network Monitoring
RSTP	Rapid Spanning Tree Protocol
SNMP	Simple Network Management Protocol
SNTP	Simple Network Time Protocol
SP	Strict Priority

STP	Spanning Tree Protocol
TACACS+	Terminal Access Controller Access Control System
TCP	Transmission Control Protocol
TFTP	Trivial File Transfer Protocol
ToS	Type of Service
UDP	User Datagram Protocol
USM	User-Based Security Model
VCT	Virtual Cable Tester
VLAN	Virtual Local Area Network
WRR	Weighted Round Robin