GEP-2650

26-Port Web Smart Gigabit PoE Switch

802.3at PoE+,

24 PoE Outputs, 370W, 2 x SFP

User Manual

V1.0

Digital Data Communications Asia Co., Ltd.

http://www.level1.com

Introduction

Reader object

This book is suitable for the following personnel to read

- Network Engineer
- Technology promotion personnel
- Network administrator

Relevant information

Manual name	Description
Product installation manual	This manual describes some characteristics of the products in the functional and physical, provides procedures, hardware installation troubleshooting, module specifications of equipment, as well as the cable and connector specifications and standards.
Product manual commands	This manual does a detailed description of the product support configuration command. Including a description of the command mode, parameters and using the guidelines, and equipped with specific examples.
The product WEB management manual	This manual supports various functional products' WEB interface and describiation, and a detailed configuration example.

The book agreed…

the command line format conventions

By using the Arial command line font，The following specific correlation scheme:

Bold：Command keywords (unchanged must according to lose part of command) is represented by bold font.

Italic：The command line parameters (the actual value for replacement parts must be ordered in the italicized)

[ ] ：Represented by [] the enclosed part, in command configuration is optional.

{ x | y | ... }：Select one of the two or more options.

[x | y | ...]：Said to choose a or not selected from two or more options.

//：Started by the double slash line expressed as comments..

1) general format conventions

2) Terminal information display format：英文用 Courier New ，Chinese with Song typeface, font size 5, representing the output information screen. The user with information from the terminal input information, represented by the **bold** font.

3) various types of marks

The book also expressed in the operating process should pay special attention to place the various eye-catching signs, these signs meaning：

⚡	Note, warning, remind the precautions during operation.
📖	Instructions, tips, tricks, the operation content descriptions are necessary supplement.

- Statement:
- It illustrates the port type part with the actual might be inconsistent, needs to be configured according to the port types supported by the product of the actual operation.
- This manual section for example display may contain other products information content (such as product type, description), specific display information please refer to the actual use of the equipment information shall prevail.
- router and router icon mentioned in this manual, on behalf of the general meaning of the router, and run a three layer switch routing protocol.

Table of contens

This section introduces the configuration guide related content, including the following：

1. Configuration command line interface
2. Configuration management
3. Configuration interface
4. Configure access/trunk port
5. Configure Link-aggregation Port
6. Configure VLAN
7. Configure MAC address
8. Configuration of POE
9. configuration IGMP Snooping
10. Configure SNMP
11. Configure SPAN
12. Configure the flow control based port
13. Anti-illegal DHCP Server
14. Anti-ARP-Spoofing
15. Port Rate Limit
16. Loopback Detection
17. Access Control
18. File system Configuration

1. Configuration command line interface

This section describes methods to use the command line interface, you can manage the network equipment by using the command line interface

1.1. Command mode

Device management interface is divided into a number of different models, the user the command mode determines the commands that you can use.

Enter a question mark button at the command prompt (?) can list every command mode to support the use of command. When a user and network equipment management interface, a new session is connected, the user first in the user model (User EXEC model)，You can use the user mode command. In user mode, can only use a small amount of commands, and command functions also have some limitations, such as the show command. User mode command operating results will not be saved.

To use all of the commands, you must first enter privilege mode (Privileged EXEC).Usually, enter privilege mode password must enter privilege mode. In privileged mode, the user can use all the privileges of command, and can enter global configuration mode.

Use the configuration mode (global configuration mode, interface configuration mode) command, will have an impact on the current running configuration. If the user to save the configuration information, these commands will be preserved, and perform again at system restart. To enter configuration mode, you must first enter global configuration mode. Starting from the global configuration mode, can enter interface configuration mode and other configuration sub model.

The following table lists the command mode, how to access each mode, mode of prompt, how to leave mode. The assumption here network device name for the default "Switch”

Command mode.：

Command mode	Access method	Prompt	To leave or access mode	About the model
User EXEC(user mode)	First entered the access network equipment.	Switch>	Enter the exit command to leave the mode. To enter privilege mode, enter the enable command.	To carry out the test, this model is used to display system information
Privileged EXEC(privileged mode)	In user mode, use the enable command to enter this mode.	Switch#	To return to user mode, enter the disable command.	To verify the results of using the set command mode. This mode is protected with a password.

Command mode	Access method	Prompt	To leave or access mode	About the model
Global configuration(global configuration mode)	In privileged mode, use the configure command to enter this mode	Switch(config)#	To enter global configuration mode, enter the configure command. To return to the privileged mode, enter the exit command or the end command, or type Ctrl+Z	Using the mode command to configure the network to set global parameters.
Interface configuration（The interface configuration mode）	In global configuration mode, use the interface gigabitEthernet_id command to enter this mode	Switch(config-if-GigabitEthernet-0/1)#	To enter the interface configuration mode, enter the interface gigabitEthernet_id command. To return to the privileged mode, enter the end command, or type the Ctrl+Z key combination.	Various interfaces using the mode configuration of network devices.
Config-vlan（The VLAN configuration mode)	In global configuration mode, use the VLAN vlan_id command to enter this mode	Switch(config-vlan)#	To enter the VLAN configuration mode, enter the VLAN vlan_id command. To return to the privileged mode, enter the end command, or type the Ctrl+Z key combination.	This model is used to configure VLAN Parameters.

1.2. get help

The user can enter a question mark button at the command prompt (?) lists the support each command mode command. The user can also list the parameter information of the same command keywords or each command. See the table below:

Command	Function
Help	Get the help system description information in any Command mode.

Command	Function
abbreviated-command-entry?	To obtain the command key string the same beginning. Example： Switch# **di?** disable Turn off privileged commands display Show something for debug purpose
abbreviated-command-entry<Tab>	The command key integrity Example： Switch# show star<Tab> Switch# show startup-config ?
?	Listed under the command of an associated keywords. Example： Switch# **show?**
command keyword ?	The command key integrity. Example： Switch(config)# snmp-server community ? <WORD> Community name

1.3. command

If you want to abbreviate command, only need to enter the command key part of a character, as long as this part of the character recognition only enough command keyword.

For example **show running-config** The command can be written as：

```
Switch# show runn
```

1.4. The command can be written as

Almost all commands are no options. Usually, use the no option to disable certain features or functions, or the executive and the command itself opposite operation. For example, interface configuration command no shutdown performs the inverse operation interface off shutdown commands, namely open interface. Used without no option keyword open characteristics are closed or opened by default is closed.

Prompt information to understand CLI

The following table lists the user may be encountered in the use of CLI network management device error messages.

CLI error information common：

Error message	Meaning	How to get help
% Ambiguous command: "show c"	The user does not have enough input character, network equipment cannot recognize the unique command.	Re enter the command, followed by a ambiguous words enter a question mark. May the entered keyword will be displayed.
Type "speed ?" for a list of subcommands	The user does not enter the command must be the key word or variable parameters.	Re enter the command, input space and then enter a question mark. May be variable parameter input keyword or will be displayed.
% Invalid input detected at '^' marker	The user input command error, symbol (^) indicates the error word position.	Command mode prompt on the seat under the input of a question mark, this mode allows the command key will be displayed.

1.5. Use the history command

The system provides the user input command records. The characteristics in the input again long and complex command will be very useful. From the command history records re call input commands, perform actions in the following table: ：

Operation	Result
Ctrl-P Or up arrow	Browse before a command in the command history table. From the beginning of last record, repeated use of the operation can query the earlier records.
Ctrl-N Or down arrow key	After using Ctrl-P or the key operational direction, using the operation back to a command closer in history command table. Use again the operation can query the more recent record.

Tip ： the terminal supports standard keys.

1.6. Use the edit properties

The possibility of using this section describes the command line editing editing functions.

1.6.1. Edit shortcuts

Listed in the following table editing shortcuts：

Function	Operation	Result
Move the cursor in the edit line.	Left arrow or Ctrl-B	Move the cursor to a character to the left.
	Left arrow or Ctrl-B	Move the cursor to a character on the right.
	Ctrl-A	Move the cursor to the first command line.
	Ctrl-E	Move the cursor to the first command line
Delete the input character.	Backspace	A character to delete from the cursor to the left of the
	Delete key	A character to delete from the cursor to the left of the
©	Return key	When the contents are displayed by enter key will output the contents to the rolling line, showing a line of content, using only the output is not the end.
	Space key	When the contents are displayed using the space bar will output the contents to scrolling a page, the next page content, only in the output content does not end use.

1.7. Visit CLI

Before using CLI, users need to use a terminal or PC and network equipment connection. To start the network equipment, network software and hardware initialization can be used after CLI. in network equipment used for the first time only when using the serial port (Console) connected network device, called out of band (Outband) management.

2. Configuration management

2.1. Login authentication control

2.1.1. Summary

Through the authentication control can prevent illegal user access switch.

2.1.2. To configure the local user

To establish a user identity authentication, please in global configuration mode, according to specific needs, execute the following command：

Command	Function
Switch(config)# **user** name [**password** password **|** **password** encryption-type encrypted password]	Use encrypted password based user authentication

2.1.3. Configuration line login authentication

To build the line login authentication, please in line configuration mode, according to specific needs, execute the following command：

	Command	Function
Step 1	Switch(config-line)# **login local**	Set line login authentication local

2.2. System configuration

2.2.1. Summary

Each network device has its own system clock, the clock to provide specific date (year, month, day) and time (time, minutes, seconds) and other information. For a network device, when the first time you first need to manually configure the network equipment system clock for the current date and time. Of course you can also, according to the need, the system clock correction at any time. The system clock network equipment is mainly used for system log to record events.

2.2.2. Set the system time

You can set the network equipment on time by manual way. When you set the clock network equipment, network equipment clock will you set the time is running down, even if the network equipment, network equipment clock continues to run. So the network equipment clock settings once in principle, do not need to be provided, unless you need to fix network equipment on time.

But for the network equipment do not provide the hardware clock, manually set the network equipment on time is actually set the software clock, it only on the effective operation, when the network equipment of electric, manual setting time to failure.

command	Function
Switch# **clock** Year Month Day Hour Minute	Date and set the clock system.

Such as the system time into 2003-6-20，10:10:12

```
Switch# clock 2003 6 20 10 10 12
Switch# show clock
FRI JUN 20 10:10:15 2003
```

2.2.3. View the system time

You can use the show clock in privileged mode command to display the system time information, display format as follows： Switch# **show clock** // Display the current system time

```
FRI JUN 20 10:10:15 2003
```

2.2.4. Set the clock synchronization

In setting the clock synchronization, can be better to view the system of log time, web operating time, convenient track record.

command	Function
Switch(config)#**ntp server** *ip-address* **version** [1-3]	Open the clock synchronization, the clock server configuration and version of IP.
Switch(config)#**ntp synchronize**	Clock synchronization.
Switch(config)#ntp update-calendar	The hardware clock.
Switch#show ntp status	Check the NTP clock.

2.3. The system name and a command prompt

2.3.1. summary

In Command to facilitate the management of, you can for a network device configuration system name (System Name) to identify it. At the same time if you are not configured for the CLI command prompt, then the system name (if the system name exceeds 32 characters, interception

The first 32 characters) will be the default command prompt, prompt will change with the name of the default system.

2.3.2. Set system name

products provide global configuration mode command to configure the system name: ：

	command	Function
Step 1	Switch(Config)# **hostname** *name*	Set system name, name must be composed of printable characters, not longer than 63 bytes.

The following example will name network equipment intoSwitch1 ：

Switch# **configure terminal** // Enter global configuration mode Switch(config)# **hostname Switch1** // Set the network device name Switch1 Switch1(config)# // The name has changed

2.4. Check the information system

2.4.1. Summary

You can check some information in the command line to display, including the version information system, equipment information system and so on..

2.4.2. View the system, version information

Including the system describes the system information, system power on time, system hardware, system software version, Ctrl version of the software system layer, Boot layer software version of the system. You can know the general situation of the network system through the information. You can in privileged mode using the following table command display the system information：

	command	Function
Step 1	Switch# show version	Display system, version information

2.5. Console rate allocation

2.5.1. Summary

Network equipment have a console interface (Console), through the console interface, can be on the network equipment management. When the network equipment used for the first time, must use the configure it through the console port. You may need to change according to the rate of network equipment serial. Note, used for network management equipment terminal rate setting must and network equipment console rate.

2.5.2. Set console rate

On line configuration mode, rate, you can use the following command to set the console: ：

	Command	Function
Step 1	Switch(config-line)# **speed** *speed*	The transmission rate set console, in units of bps. for serial interface, you can only the transmission rate is set to 9600, A 19200, 38400, 115200, 4800, 2400, 9600 is the default rate

2.6. Connection timeout

2.6.1. Summary

Through the connection timeout configuration of equipment, connection control the equipment has been established (including has accepted the connection, and the device to a remote terminal session), when the idle time exceeds the set value, without any input and output information, interrupt this connection.

2.6.2. Connection timeout

The connection is currently accepted, within the specified time, without any input information, the server will interrupt this connection. Ruijie products provide LINE configuration mode command to configure the connection timeout:

Command	Function
Switch(config-line)# **exec-timeout** *minutes* [seconds]	The configuration of LINE, has accepted the connection timeout, when over allocation of time, do not have any input, will break the connection. Minutes: the number of minutes the timeout specified; seconds: the specified number of seconds timeout;

You can use the no exec-timeout command in the LINE configuration mode, cancel the timeout connected LINE.

Switch# **configure terminal** // Enter global configuration mode Switch#
line vty *0* // Enter the LINE configuration mode Switch(config-line)#
exec-timeout *20* // Set the timeout period for the 20min

2.7. The configuration of LINE model

2.7.1. Summary

This chapter describes some of the operation of LINE：

Enter the LINE configuration mode
Increase / decrease in the number of LINE VTY

2.7.2. To enter LINE mode

Through access to the specified LINE mode, can be in LINE mode, the configuration of the specific LINE. To enter to the specified LINE mode, execute the following command：

Command	Function
Switch(config)# **line** [**console** | **vty**] first-line [last-line]	Access to the specified LINE model

2.7.3. Configure user authentication local

By default, the user can directly through the console port or telnet directly connected to the switch, can be connected to the switch by allowing the user to enter the username and password

Command	Function
Switch(config)# user Switch password 0 Switch	Configure user name and password ：Switch
Switch(config)# **line vty** *0 12*	Enter the VTY configuration mode
Switch(config)# **login local**	Start the local authentication configuration

2.7.4. Configure the WEB user login timeout

The default user five minutes without operation switch, system automatically disconnect the related connected this time can be modified according to the needs of users

Command	Function
Switch(config)# **line vty** *0 12*	Enter the VTY configuration mode
Switch(config-line)# **exec-timeout** *10*	The configuration is not the action timeout time is 10 minutes, 0 never timeout

3. Configuration interface

3.1. Interface type Summary

This chapter mainly to Ruijie equipment interface types are divided, and a detailed definition of each interface type interface type Ruijie equipment can be divided into the following two categories：

(L2 interface)

(L3 interface) (Layer three device support)

3.1.1. This section describes the type two layer interface and the related definition, can be divided into the following types (L2 interface)

This section describes the type two layer interface and the related definition, can be divided into the following types

Switch Port

Link-aggregation Port

3.1.2. Switch Port

Switch Port consists of a single physical port on the device, only the two layer switching function. The port can be a Access Port, Hybrid Port or a Trunk Port, you can use the Switch Port interface configuration command, a port configured as a Access Port, Hybrid Port or Trunk Port.Switch Port is used to manage the physical interface and the second related protocols, and does not handle routing and bridging.

3.1.3. Access Port

Each Access Port can only belong to one VLAN, it only belongs to the VLAN transmission frame is generally used to connect computers..

The default VLAN:

Each Access Port belongs to only one VLAN, so the default VLAN it is the VLAN, can not use the settings.

Computer

Receiving and sending frames

Access Port sends out the data frame is not with the TAG, and it can only receive the following three forms of frame：

Untagged Frame

VID IS Access Port VLAN Tagged Frame

Untagged Frame

The Access Port to receive frames without the TAG ,And for the without TAG frame add default VLAN TAG, Before sending to remove add TAG, send again.

Tagged Frame

The received data frame to the Access port with TAG, will be in accordance with the following conditions for processing:

When the TAG VID (VLAN ID) the same with the default VLAN ID, receiving the data frame, and removed when it is sent

The TAG sign and send.

When the TAG VID (VLAN ID) as the default VLAN ID, receiving the data frame. In TAG, VID = default VLAN ID for the identification of priority.

When the TAG VID (VLAN ID) and the VLAN ID is not at the same time, drop the frame.

3.1.4. Trunk Port

Trunk port can belong to multiple VLAN, capable of receiving and transmitting belong to more than one VLAN frame, generally used for connection between devices, can also be used to connect the user's computer.

The default VLAN

Because Trunk Port can belong to more than one VLAN, so we need to set up a Native VLAN as the default VLAN. when switching Trunk port received no VLAN tag with the frame to the frame, it increases the Native VLAN label, the frame belongs to Native VLAN; when Trunk port sends frame, if the frame of VLAN and Native same as VLAN, will remove the VLAN label.

Tip	Recommend the end device Trunk port of the native VLAN and the end Trunk port of the native VLAN configuration is consistent, otherwise may not be the correct port forwarding packets.

Receiving and sending frames

Trunk port can receive Untagged frame and tagged frame.Trunk port allows Port to send VLAN range of non Native VLAN frame are TAG, sending Native VLAN frame without TAG.

Untagged Frame

If the received Trunk port frame without IEEE802.1Q TAG, then the frame in the interface of the Native VLAN transmission.

Tagged Frame

If the received frame is Trunk port TAG, will be in accordance with the following conditions for processing:

when receiving a Trunk Port frame with TAG VID equal to the Trunk port Native VLAN, allows the receiving the data frame; in sending the frame, remove and send TAG.

when receiving a Trunk Port frame with TAG VID is not equal to the Trunk port Native VLAN, but VID

Tip	The Untagged message is ordinary Ethernet message, the PC card can identify this message communication; change of the TAG message structure is in the source MAC address and a destination MAC address, plus the 4bytes VLAN information, namely VLAN TAG head.

3.1.5. Hybrid port

Hybrid type of port can belong to multiple VLAN, can message receiving and transmitting a plurality of VLAN, can be used for the connection between devices, can also be used for different user computer.Hybrid port and the Trunk port is sending Hybrid port allows multiple VLAN message without a label, and only allowed to send the default Trunk port VLAN message without a label, the need to pay attention to is: Hybrid port with VLAN must already exist.

3.1.6. Link-aggregation Port

Link-aggregation Port is formed by multiple physical member port aggregation. We can take multiple physical links tied together to form a simple logical link, link, the logic we call a Link-aggregation Port.

For the two layer switch AP is like a high bandwidth Switch port, it allows multiple port bandwidth stacking up,,,,,,,,, expanding the bandwidth. In addition, through the Link-aggregation, Port frames transmitted will be in the Link-aggregation Port member port on flow balance, if a member link in AP failure, Link-aggregation Port will automatically transfer the link traffic to other effective members of the link, improve the reliability of the connection.

3.1.7. (L3 interface)

This section describes the type three layer interface and the related definition, can be divided into the following types

SVI (Switch virtual interface)

The SVI is switched virtual interface, to achieve the three layer switch interface to.SVI logic can be used as a management interface of the machine, through the management interface, administrators can manage the equipment.

You can through the interface VLAN interface configuration command to create a SVI, and then to the SVI IP address assigned to the establishment of VLAN

Routing between.

3.2. Configuration interface

This section describes the default configuration, interface configuration guide, configuration steps, configuration example

3.2.1. Interface ID rules

For Switch Port, the numbers start at 1.

For Link-aggregation Port, the number of the number of AP support the 116 equipment. For SVI, its number is the SVI corresponding VLAN VID.

3.2.2. Using the interface configuration command

You can be in the global configuration mode. Use the Interface command to enter interface configuration mode..

command	Function
Switch(config)# Interface gigabitEthernet *port- ID*	Enter the Interface gigabitEthernet _ID command in global configuration mode, enter interface configuration mode.

Under the given into the Gigabitethernet 0/1 interface example：

```
Switch(config)# interface gigabitEthernet 0/1
Switch(config-if-gigabitEthernet-0/1)#
```

In interface configuration mode you can attribute configuration interface.

You can use interface in global configuration mode command into the SVI interface configuration mode.

Command	Function
Switch(config)# **interface vlan** vlan*ID*	Enter the interface command in global configuration mode, enter the SVI interface configuration mode.

Under the given into the interface vlan1 interface example：

```
Switch(config)# interface vlan 1
Switch(config-if-vlan1)#
```

In the SVI interface configuration mode you can configure the IP address of the interface.

3.2.3. Select the interface media type

Some of these interfaces, can have a variety of media types for the user to choose. You can choose one kind of medium. Once you have selected the medium type, connection status, speed, duplex, fluidic attribute interface all refer to the properties of the medium type, if you change the media type, the new media types of these properties will use the default values, you can according to need to set these properties.

This configuration command only to the physical port.Link-aggregation Port and the SVI interface is not supported media type setting. This configuration command only for media port.

Configuration for the Link-aggregation Port member export port, the medium type must be consistent, otherwise cannot be added to the AP.

The Link-aggregation port type Port members and can not be changed.

3.2.4. Configuration interface description and management state

In Command to help you remember an interface function for each interface, you can come up with a name that identifies this interface, also is the description of the interface (Description). You can set the interface according to the specific name, to express the meaning of such as: you want to put the Gigabitethernet 0/1 assigned to the user A special use, you can use this interface description is set to "User A”.

Command	Function
Switch(config-if-gigabitEthernet-0/2)# **description** *string*	Set interface description, up to a maximum of 240 characters.

The following example shows how to set the interface Gigabitethernet 0/1 description：

```
Switch# config terminal
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-gigabitEthernet-0/1)#description User A
```

In some cases, may need to disable an interface. By setting the interface management state to close the corresponding interface. If you close an interface, the interface will not receive and transmit any frames, all functions will lose the interface corresponding to. Also by setting up the management state to re open the closed interface interface management state has two types: Up and Down, when the interface is closed, interface management state is down, otherwise up

Command	Function
Switch(config-if-gigabitEthernet-0/1)# {**shutdown|no shutdown}**	Close an interface or open an interface

The following example describes how to close the interface 0/1：

```
Switch# config terminal
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-gigabitEthernet-0/1)# shutdown
```

The following example describes how to enable the interface 0/1:

```
Switch# config terminal
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-gigabitEthernet-0/1)#no shutdown
```

3.2.5. This section describes how to configure the interface speed, duplex mode.

This section describes how to configure the interface speed, duplex mode..

	Command	Function
Step 1	Switch(config-if-gigabitEthernet-0/1)# **speed** {**10 | 100 | 1000 |auto** }	The rate parameter setting interface, or set t auto: 1000 only to Gigabit mouth;
Step 2	Switch(config-if-gigabitEthernet-0/1)# **duplex** {**auto | full | half** }	Duplex mode interface. Be careful. Gigabit ports can only be set to Full mode;

3.2.6. The configuration interface MTU

When a port for high throughput data exchange, may encounter greater than Ethernet frame length frame, this frame is called

Jumbo frame. The user can set the port MTU to control the maximum frame the port allows the transceiver. MTU is the effective data frame length, not including Ethernet encapsulation overhead. Port received or forwarding of frames, if the length is more than the MTU, will be discarded.

MTU allows setting for 64~10240 bytes, 1518 bytes by default.

This configuration command only to the physical port.SVI interface does not support the MTU setting.

Command	Function

Switch(config-if-gigabitEthernet-0/1)# **Mtu** *num*	Set port MTU Num：<64-10240>

The following example shows how to set the interface Gigabitethernet 0/1 MTU:

```
Switch# config terminal
Enter configuration commands, one per line. End with CTRL+Z. Switch(config)# interface gigabitEthernet   0/1
Switch(config-if-gigabitEthernet-0/1)# Mtu 64
```

3.2.7. Two layer interface configuration

The following table shows the default configuration of two layer interface, please refer to the "VLAN" and "VLAN and port configuration

The port based on flow control ".

The default configuration of two layer interface are given in the following table：

Attribute	The default settings
Working mode	L2 swith
Switch port mode	access port
Allow VLAN range	VLAN 1～4094
The default VLAN (for access port)	VLAN 1
Native VLAN（TO trunk port ）	VLAN 1
Interface management state	Enable
Interface description	Empty
Speed	Auto negotiation
Duplex mode	Auto negotiation
Link-aggregation Port	None
Storm control	closed
To protect the port	closed
Port security	closed

4. Configure access/trunk port

This section mainly shows how to configure the Switch Operation mode (access/trunk port) and relevant configuration in each mode. You can configure the relevant attributes of Switch port by switch under port configuration mode or other Commands.

Commands	Function

Switch(config-if-GigabitEthernet-0/1)# **switch mode** {**access** |**trunk** | **hybrid**}	Configuration port operation mode.

Below is the example how to configure gigabitethernet 0/2 into access port operation mode.

```
Switch# configure terminal
Switch(config)# interface gigabitEthernet  0/2
Switch(config-if-GigabitEthernet-0/2)# switch mode access
```

Command	Function
Switch(config-if-GigabitEthernet-0/2)# **switch access vlan** *vlan-id*	Configuration port operation mode.

Below is the example how to configure the belonged VLAN of access port gigabit ethernet 0/2 to be 100。

```
Switch# configure terminal
Switch(config)# interface gigabitEthernet  0/2
Switch(config-if-GigabitEthernet-0/2)# switch access vlan 100
```

Configure the trunk port's native VLAN

Command	Function
Switch(config-if-GigabitEthernet-0/2)# **switch trunk native vlan** *vlan-id*	Configure the trunk port's NATIVE VLAN。

Below is the example to configure Trunk Port Gigabitethernet 0/2's Native vlan to be10。

```
Switch# configure terminal
Switch(config)# interface gigabitEthernet 0/2
Switch(config-if-GigabitEthernet-0/2)# switch mode trunk
Switch(config-if-GigabitEthernet-0/2)# switch trunk native vlan 10
```

Please refer to "Configure port rate,Duplex, fluid control" to configure the port rate ,duplex, fluid control.

Below is the example to configure Gigabitethernet 0/2 to be access port , belonged VlAN to be 100，Rate，Duplex，fluid control to be self-negotiation model，port safe to be open：

```
 Switch# configure terminal
 :
```

```
Switch# configure terminal
Enter configuration commands, one per line. End with CTRL+Z. Switch(config)# interface gigabitEthernet 0/2
Switch(config-if-GigabitEthernet-0/2)# onfigure the Hybrid port.
```

```
 switch access vlan 100
Switch(config-if-GigabitEthernet-0/2)# speed auto
Switch(config-if-GigabitEthernet-0/2)# duplex auto
```

4.1.1. port

You can confirgure the Hy bid port by below steps：

	Command	Function
S t	configure terminal	Enter the configuration pattern
e p	Interface gigabitEthernet <*portnumber*>	Enter the port configuration pattern 100M,1000M,10000M
1	switchport mode hybrid	Configure port to be hybrid port
S	switchport hybrid native vlan *id*	Configure the default port to be VLAN
	switchport hybrid vlan *id* [[tagged | untaged]]	Congfigure the port output rule.

```
Switch# configure terminal
Switch(config)# interface gigabitEthernet 0/2
Switch(config-if-GigabitEthernet-0/2)# switch mode hybrid
Switch(config-if-GigabitEthernet-0/2)# switch hybrid native vlan 3
Switch(config-if-GigabitEthernet-0/2)# switch hybrid vlan 20 untagged
```

4.1.2. Configure the Link-aggregation port

This section mainly shows how to create Link-aggregation Port and some configurations of Link-aggregation Port。 You can creat Link-aggregation Port in the port configuration pattern by using Link-aggregation Port，Specific configuration process ,please refer to “Configure Link-aggregation Port”。

4.1.3. Clear the port statistics .

Clear the port statistics by “Clear” Command in the privileged mode

Command	Function
Switch# clear counters [all | gigabitEthernet] [*id*]	Clear the port statistics。

You can check the port statistics by Command: **show interface GigabitEthernet** *0/1* **statistics** in the privileged mode .You can clear the statistics by Command: **clear counters GigabitEthernet 0/1** in the privileged mode。

Below is the example to show how to clear the Gigabitethernet 0/1 counters：

```
Switch# clear counters   GigabitEthernet 0/1
```

4.1.4. Configure SVI

This section mainly show how to describle SVI and some configurations of SVI .

Create a SVI or revise an exsited SVI by interface vlan.

SVI configuration：

Command	Function
Switch(config)# **interface vlan** *vlan-id*	Enter SVI port configuration mode.

Below example will show how to enter the port configuration mode and assign IP address to SVI1.：

```
Switch# configure terminal
Enter configuration commands, one per line. End with CTRL+Z. Switch(config)# interface vlan 1
Switch(config-if-vlan1)# ip address 192.168.1.1 255.255.255.0
```

4.2. Show the port configuration and Status

This section describles the port's display content and display examples.You can chec the port status by "Show" Command in the privileged mode.You can also check the port status by using below Commands in the privileged mode.：

Command	Function
Switch# show interface GigabitEthernet [*id*]	Show the specficed interface's all status and configuration information
Switch# show interface GigabitEthernet [*id*] configuration	Show the configuration information of the port.
Switch# show interface GigabitEthernet [*id*] media	Show the specificed port's physical attribute。
Switch# show interface GigabitEthernet [*id*] statistics	Show the specificed port's statistics information may contain the rate . Random error 0.5%。

Below is the example how to show the port status of Gigabitethernet 0/3：

```
Switch#show interface GigabitEthernet 0/3

interface gigabitEthernet 0/3 configuration information
        Description          :
        Status                 : Enabled
        Link                   : Down
        Set Speed             : Auto
        Act Speed             : Unkown
        Set Duplex            : Auto
        Act Duplex            : Unkown
        Set Flow Control : Off
        Act Flow Control : Off
        Mdix                    : Auto
        Mtu                     : 1518
        Link Delay           : 1
        Storm Control       : Unicast Disabled
        Storm Control       : Broadcast Disabled
        Storm Control       : Multicast Disabled
        Storm Action         : None
        native vlan          : 40
```

Below is the example to show the port physical attribute.：

```
Switch#show interface gigabitEthernet 0/9 media
Gi  0/9: media: fiber（optical interface）

Switch#show interface gigabitEthernet 0/3 media
Gi 0/3: media: copper（electrical port）
```

Below example shows the port’s statistics.

```
Switch#show interface gigabitEthernet 0/9 statistics
  interface gigabitEthernet 0/9 statistics information:
        5 minutes input  rate      : 1656 bits/sec ,19 packets/sec
        5 minutes output rate      : 190 bits/sec ,2 packets/sec
        RxOctets                       : 1327408
        RxUcastPkts                    : 2406
        RxMulticastPkts              : 2172
        RxBroadcastPkts               : 6843
        TxOctets                       : 2705325
        TxUcastPkts                    : 3023
        TxMulticastPkts              : 35638
        TxBroadcastPkts               : 410
        CRCErrors                       : 0
        DropPacketEvents              : 0
        TotalOctets                   : 4032733
```

```
TotalPkts                     : 50492
TotalUcastPkts                : 5429
TotalBroadcastPkts            : 7253
TotalMulticastPkts          : 37810
TotalSymbolErrors             : 0
TotalAlignmetErrors         : 0
TotalUndersizePkts            : 0
TotalOversizePkts             : 0
TotalFragments                 : 0
TotalJabbers                  : 0
TotalCollisions             : 0
TotalPkts64Octets             : 43300
TotalPkts65to127Octets        : 5005
TotalPkts128to255Octets       : 1125
TotalPkts256to511Octets       : 695
TotalPkts512to1023Octets : 244
TotalPkts1024to1518Octets: 123
```

5. Configure Link-aggregation Port

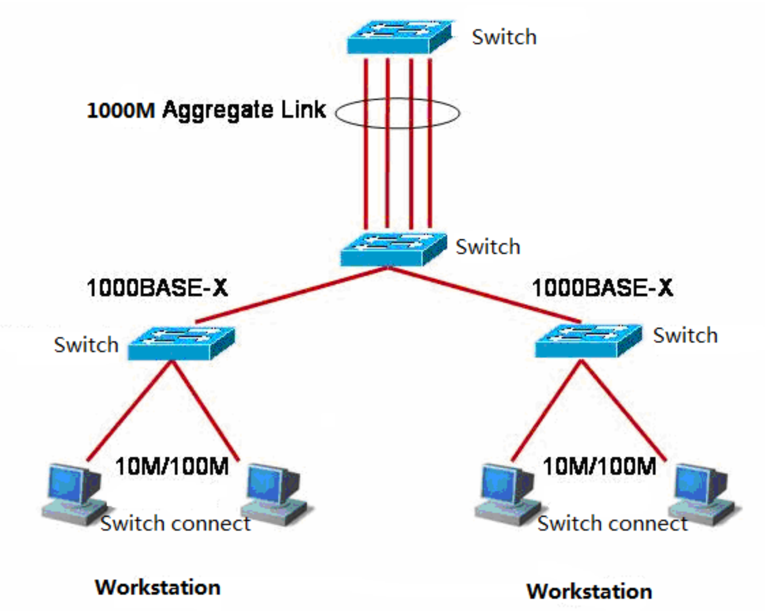
This section will descirbls how to configure Link-aggregation Port based on the Ruijie equipment。

5.1. Summarize

5.1.1. Understand Link-aggregation Port

We can bind many physical links into a logistical links，We call this logistical links Link-aggregation Port（AP）。AP offered by Ruijie compliant with IEEE802.3，It can be used to enlarge the link barndwidth to provide higher connection reliability。

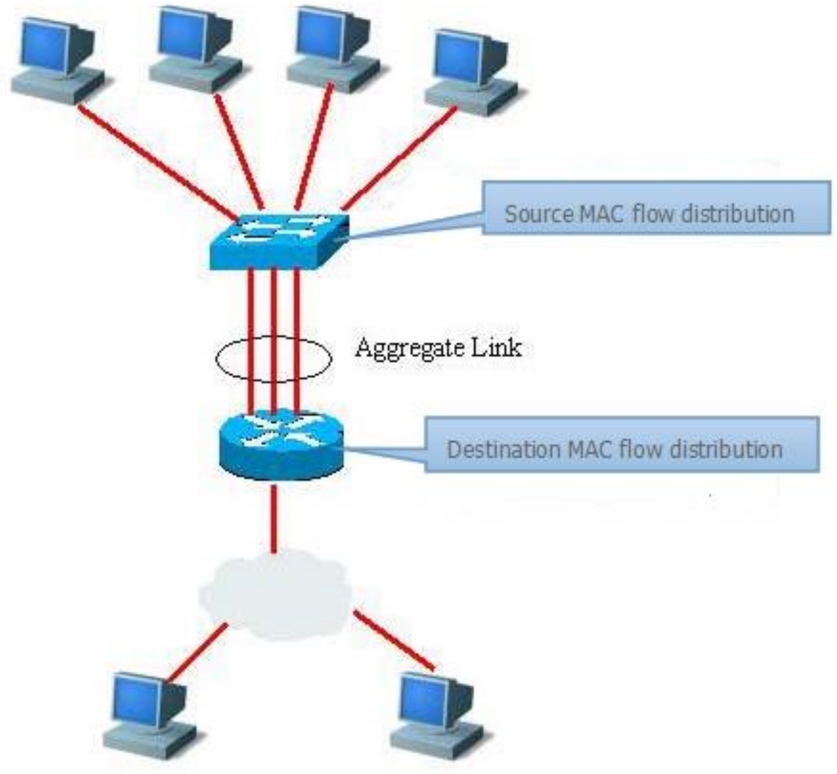
AP supports flow balance, it can assign flow to each link evenly. AP realize the linke backup.When one of the link in the AP disconnected，syestem will assign this link's flow to the other effective links automaticly。One broadcast or more broadcasts received by one link in the AP will not be transmitted to other links.



Typical **AP** configuration.

Tip

When Flow balance mode is configured as source IP,destination IP, Source IP+destination IP, it should balance the flow by using the equipment's default mode to 2 layer packets. Default model can be gotten by Command **"show link-aggregation group** *AP_id"* when the equipment has not been configured **link-aggregation load-balance.**


Source MAC flow distribution
Aggregate Link
Destination MAC flow distribution

AP flow balance diagram

5.2. Configure Link-aggregation Port instructor

5.2.1. Default Link-aggregation Port configuration

AP default configurations as follow ：

Feature	Default
Two layer AP port	N/A
Flow Balance	Assign the flow according the input packets source MAC address.

5.2.2. Link-aggregation Port configuration Instructor

AP members ports' rate, status,duplex, transmission media must be the same. 成

Two layer port can only join two layer AP,the port contains the member is forbidden to change the two layer attribute.

A port join the AP, the port attribute will be replaced by the AP's attribute.

A port removed from the AP, its attribute can recover to the attribute before it joined.

Tip	Once a port join an AP, any configuration can be set on the port until the port exit the AP.

5.2.3. Creat Link-aggregation Port

First creat the Link aggregation group, then let the port join the AP as follow stepsinthe port configuration mode.：

Command	Function
Switch(config)# link-aggregation [*ap-id*] mode {lacp | manual}	Creat an AP group (AP group has lacp and manual two modes，the AP mode should be the same between two switches.
Switch(config-port-range)# link-aggregation [*ap-id*] {active | passive | manual}	Join this port into the created AP group. (If the AP group is lacp mode, the port should be confired to active or passive mode.If the AP group is manual mode the port needs to be configured to be manual mode.

Using the Command **no link-aggregation** [*ap-id*] to exit a physical port in the port configuration mode.

Below is the example to configure two layer Ethernet port 0/1 and 0/3 to be one memberoftow layer AP.

```
Switch# configure terminal
Switch(config)#link-aggregation 1 mode manual
Switch(config)#port 0/1,0/3
Switch(config-if-GigabitEthernet-range)# link-aggregation 1 manual
```

You can use the Command “Switch(config)# **link-aggregation***n”* (n means AP number) to enter the AP Congiguration mode in the global configuration mode.(if AP n is not exsit ,using **link-aggregation** [*ap-id*] **mode {lacp | manual} to create.**)

Tip	When two switches AP group configured to LACP mode,related AP group physical port attribute need to be active mode at least a section. If both ports are passive mode, it can not communicate.

5.2.4. Configure Link-aggregation Port flow balance.

In the congiguration mode, plase configure AP flow balance as follow steps：

Command	function
Switch(config)# link-aggregation [*ap-id*] load-balance {mac | ip-mac | ip}	Configure AP flow balance,choose the way of algorithm.： mac：According to the input packets' source MAC address to assign. ip-mac：According to input packtes' resource packets' MAC address to assign flow. ip：According input packets resource IP address to assign flow.

5.3. show Link-aggregation Port

In the privileged mode, please show the AP configuration as follow steps.

Command	Function
Switch# show link-aggregation group [*ap-id*]	Show AP configuration。

```
Switch#show link-aggregation group 1
 Link Aggregation 1
  Mode: Manual     Description:
  Load balance method: mac
  Number of ports in total: 1
  Number of ports attached: 1
  Gi 0/1: DETACHED
  Gi 0/3: ATTACHED
```

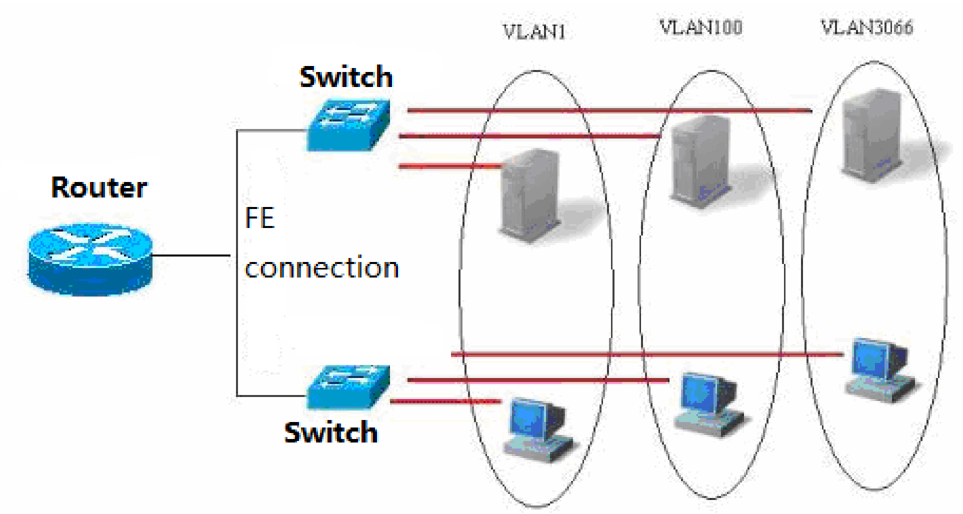
6. Configure VLAN

This section describles how to configure IEEE802.1Q VLAN

6.1. Summarize

VLAN is the abbreviation of Virtual Local Area Network，it is a logical net divided from a physical network.This network corresponds to the second layer of the ISO mode. How to divide the VLAN is not limited by the actual physical position of the network port.的划分不受网。VLAN has the same attribute with the common physical network. It is the same as the common LAN except that it doesn't have the limitation of physical position. The unicasting and broadcasting and multicasting in the second layer transimit and spread in a VLAN,will not enter other VLAN.So if a host wants to communicate with other host which is not in the same VLAN. It needs a 3 layers equipment.see figure below。

A port can be defined as a member of a VLAN. All of the terminals connected to this port are a part of virtual network, The entire network can support more than one VLAN.There is no need to adjust the network configuration from the physical when add, remove and revise the user.



Normally like the same as a phosical network, VLAN is connected with a subnet IP。A typical example, All the hosts in a same IP subnet belong to the same VLAN, VLANs must communicate with each other by 3 layers equipment.The Ruijie equipment can configure the SVI of the IP router between the VLAN by using the SVI interfaces. About the configuration of the SVI, please refer to the port management and IP unicast router configuration.

6.1.1. Supported VLAN

Products supported VLAN abides to IEEE802.1Q，most support 4094 VLAN(VLAN ID 1-4094)，VLAN 1 can not be removed default VLAN。

Tip	License configuration VLAN ID in the range of 1-4094 When the hardware lacks of resources, system will return the failed to create a VLAN information

6.1.2. VLAN member type

By configuring a port's VLAN member type to make sure this port will pas which kind of frame and how many VLAN can this port belong to. Please refer to the follow table to see the VLAN member type's detailed type.

Command	Function
Access	An Access port can only belong to a VLAN，and assign VLAN by Manual Setup.
Trunk	A Trunk port can configure more than on VLAN but only native VLAN can without VLAN mark.
Hybrid	A Hybrid port can figure to be belonged to more than one VLAN ,It also can configure if VLAN has VLAN MARK or not accord ing to customer's requirements。

6.2. VLAN Configuration

A VLAN is identified by VLAN ID。In the equipment，you can add ,remove, revise VLAN 2-4094，but VLAN 1 is created by the device automatic and can not be removed.

You can configure a port's VLAN member type or add，rmove a VLAN in port configurationmode.

6.2.1. Save VLAN configuration information

When you type the Command "Write"in the privileged mode,the configuration informationofthe VLAN will be saved in configuration file.You can use Command "Show vlan" to check VLAN configuration information.

6.2.2. Default VLAN configuration

Parameter	Default	Range
VLAN ID	1	1－4094
description	VLAN xxxx	

6.2.3. Create, amend a VLAN

In the global configuration mode, you can create or amend a VLAN

	Command	Function
Step 1	Switch(config)# **vlan** *vlan-id*	Input a VLAN ID。If you input a new one the queipment will create a VLAN.if you input an exsited one,it will amend specific VLAN，
Step 2	Switch(config-vlan888)# **description** *vlan-name*	（Optional）Name for a VLAN,If you do not do this step,it will name for it as VLAN xxxx automaic，xxxx is started with 0 which has four numbers of VLAN ID number。For example，VLAN 0004 is VLAN 4's default name。

If you want to change the name of VLAN back to its default name, just type "no description".

Below is an example to create VLAN888 and name it as VLAN888：

```
Switch# configure terminal
Switch(config)# vlan 888
Switch(config-vlan 888)# description test888
```

6.2.4. Remove a VLAN

Default VLAN（VLAN 1）is not allowed to delete。 Delete an existed VLAN in the global configuration mode：

Command	Function
Switch(config)# **no vlan** *vlan-id*	Input a VLAN ID and delete it。

6.2.5. Assign access port to VLAN

Assign a port to a VLAN in the interface configuration mode.：

Command	Function
Switch(config-if-GigabitEthernet-0/1)# **switch mode access**	Identiy the member type of the VLAN 2 layers ACCESs）
Switch(config-if-GigabitEthernet-0/1)# **switch access vlan** *vlan-id*	Assign this port to a VLAN.

Below is the example to take GigabitEthernet 0/1 as Access port to join VLAN20：

```
Switch# configure terminal
Switch(config)# interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)# switch mode access
Switch(config-if-GigabitEthernet-0/1)# switch access vlan 20
Switch(config-if-GigabitEthernet-0/1)# end
```

Below is the example to show how to check if the configuration information is right or not .：

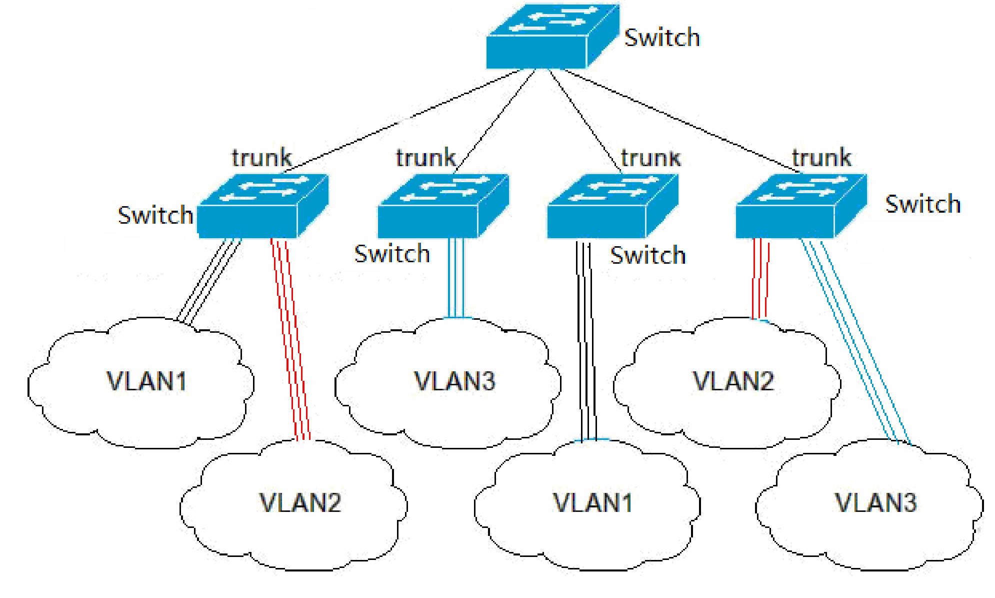
```
Switch#show vlan 20
1      20     VLAN0020
----[Untag Port]----
       Gi 0/1
----[Tag Port]----
```

6.3. Configure Trunk VlAN

6.3.1. Trunking Summarize.

A Trunk is a point-to-point link which connect one or more ethernet exchange port with other network equipment (Router or Switch)，A Trunk link can transmit more than one VLAN flow.

Ruijie’s Trunk take 802.1Q standard to seal。Below picture shows a network uses Trunk connection。



You can set a common Ethernet port or a link-aggregation port as a Trunk port.（Please refer to link-aggregation port for link-aggregation port deatils.

Use switch mode Command to switch a port between access mode and truck mode.

Command	Function
Switch(config-if-GigabitEthernet-0/1)# **switch mode access**	Set a port to be Access mode.
Switch(config-if-GigabitEthernet-0/1# **switch mode trunk**	Set a port to be Trunk mode.

Must assigned a Native VLAN for Trunk port. So called Native VLAN is received and sent by this port. UNTAG packets are belonged to this VLAN. ◦Obvious ›the default VLAN ID of this port 这个(PVID of IEEE 802.1Q is Native VLAN’s VLAN ID ›transmit frame belonged to Native VLAN on the trunk must take UNTAG method. Each Trunk’s default Native VLAN is VLAN1.When configure the Trunk link, please confirm the ports on the link two sides are using the same native vlan.

6.3.2. Configure a Trunkport

In the interface configuration mode,you can configure a port to be a Trunk port.

	Command	Function
Step 1	Switch(config-if-GigabitEthernet-0/1)# **switch mode trunk**	Identify the port type to be 2 layers Trunk port
Step 2	Switch(config-if-GigabitEthernet-0/1)# **switch trunk native vlan** *vlan-id*	Specify a Native VLAN for this interface Native VLAN

If you want to recovery a Trunk port’s all trunk attributes to default, please use the Command **switch mode access** 。

6.3.3. Identiy Trunk’s permission VLAN list.

You can limit some flow of VLAN can pass this Trunk port or not by configuring Truck port’s permission VLAN list.

At the interface configuration mode, you can amend a Trunk port’s permission WLAN list.

Command	Function
Switch(config-if-GigabitEthernet-0/1)# **switch trunk allowed vlan** {**all** | *vlan-list* }	Can choose to configure this Trunk’s permission VLAN list. Parameter can be a VLAn, ， “all “ means permission VLAN list contains all supported VLAN.

Below is an example to remove a VLAN 2 from GigabitEthernet 0/1 permission list.

```
Switch(config)# interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)# no switch trunk allowed vlan 2
Switch(config-if-GigabitEthernet-0/1)# end
```

6.3.4. Configure Native VLAN

A Trunk can receive and send TAG or UNTAG 802.1Q frame. 。UNTAG frame used to transmit Native.
VLAN flow 。 Default Native VLAN is VLAN 1 。

In the port configuration mode, can configure Native VLAN fro a Trunk port.

	Command	Function
Step 1	Switch(config-if-GigabitEthernet-0/1)# **switch trunk native vlan** *vlan-id*	Configure Native VLAN

If you want to change Trunk’s Native VLAN list back to the default VLAN 1, please use **no switch trunk native vlan Command .**

6.4. Configure Hybrid Vlan

6.4.1. Hybrid OverView

Hybrid Vlan’s usage scenario is similar with Trunk Vlan，The only difference is that Hybrid Vlani is assigned the packets sent from related ports whether print the specificed VLAN mark or not by user manual.

6.4.2. Configure a Hyhrid port

In the port configuration mode can configure a port to be a hybrid port.

	Command	Function
Step 1	Switch(config-if-GigabitEthernet-0/1)# **switch mode hybrid**	Define the port type to be a 2 layer hybrid port.
Step 2	Switch(config-if-GigabitEthernet-0/1)# **switch hybrid native vlan** *vlan-id*	Assign a Native VLAN for this port.

6.4.3. Define Hybrid permission VLAN list.

In port configuration mode can amend a HYBRID port's permission VLAN list.

Command	Function
Switch(config-if-GigabitEthernet-0/1) # **switch hybrid vlan** *vlan-list* {**tagged** | **untagged** }	Choose to configure this Hybrid port's permission VLAN lsit. Parameter "tagged" means the packets transmitted from this VLAN with "VLAN" Mark. Parameter "untagged" means the packets transmitted from tthis VLAN without"VLAN" mark.

Below is an example to remove a VLAN 2 from GigabitEthernet 0/1 port's permission list.

```
Switch(config)# interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)# no switch hybrid vlan 2 untagged
```

6.4.4. Configure Native VLAN

Native vlan in the hybrid port confirm to recive without vlan marked packet and confirmitis transmitted in that vlan.

In the port configuration can configure Native VLAN for a Hybrid.◦

	Command	Function
Step 1	Switch(config-if-GigabitEthernet-0/1)# **switch hybrid native vlan** *vlan-id*	Configure Native VLAN

If you want to change Trunk's Native VLAN list back to default VLAN1, please use Command**no switch hybrid native vlan** to configure.◦

6.5. Show VLAN

Only In the privilege mode can check the VLAN information.The information includes VLAN VID、VLAN status、VLAN member port and VLAN configuration information.

Related show Commands are as follow:

Command	Function
show vlan [*vlan-id*]	Show all or specificed VLAN parameters.

Below is the example to show the VLAN.

```
Switch#show vlan
vlan total num --------------- 4------------------------------ --------------------
NO.   VID   VLAN-Name                                  Interface-Name
---- ---- ------------------------------- -----------------------------------------
1       1       DEFAULT
----[Untag Port]----
        Gi 0/5                    Gi 0/9                    link-aggregation 1
----[Tag Port]----

2       40      VLAN0040
----[Untag Port]----
        Gi 0/4                    Gi 0/7                    Gi 0/8
----[Tag Port]----

3       60      VLAN0060
----[Untag Port]----
        Gi 0/2
----[Tag Port]----

4       90      VLAN0090
----[Untag Port]----
        Gi 0/6
----[Tag Port]----
        Gi 0/5
```

7. Configure MAC address

Ethernet switches through the MAC address table in the data link layer to forward packets, this article is description of configuration method of MAC address.

7.1. Understand MAC address table

7.1.1. Overview

By identifying the data link layer information to forward packet is main functions of the Ethernet switch(Referred to as forward capability on the second floor) through purpose of the MAC address carried by the message, Ethernet switches forward the message to the corresponding ports, and purpose of the MAC address and port information when using MAC address table to storage and forward packet.

All MAC address in MAC address table of Ethernet switch is associated with the VLAN.Each VLAN will maintain its own logic address table. A MAC address that has been learned by VLAN, still be unknown by other VLANs.

The MAC address of the Ethernet switch consists of the following information:

User MAC	Port	Port Method	VLAN

MAC address table

User MAC ：MAC address information in table

Port：MAC address corresponding to the port information

Port Method：It marks dynamic address, static address or filtering address.

VLAN：VLAN belonging to MAC address

Ethernet switch MAC address table update and maintain by following two ways:

Dynamic address learning

Manual configuration address

Ethernet switches in the forwarded message through the message MAC address, and message belonging to a VLAN ID information in the MAC address table to find the corresponding forward output port, according to the search results to forward packets in unicast, multicast or broadcast.

Unicast forwarding: Ethernet switch can check it MAC address and corresponding tables of VLAN ID,and table output port is only one, and message output directly from a table item of the corresponding port

Multicast forwarding: Ethernet switch can check message's purpose MAC address and tables that is correspond to VLAN ID, then forward message from multicast ports.

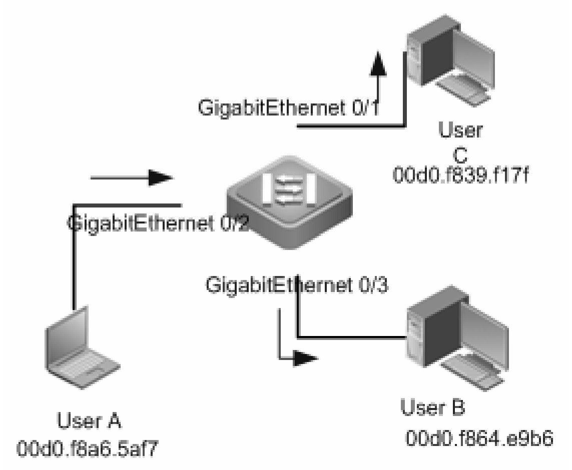
Broadcasting forwards: Ethernet switches received message of destination address to FFFF. FFFF. FFFF or in the MAC address table, you can't find the corresponding item, the message from under their VLAN all ports (in addition to receiving port) will be forwarded.

7.1.2. Dynamic address learning

MAC address produced by automatic address learning process of Ethernet switch is called dynamic address, only dynamic address will be deleted by aging mechanism of address table.

Normally the MAC address table maintenance is conducted by means of dynamic address learning, its working principle is as following:

In condition of MAC address of Ethernet switch is empty, UserA will communicate with UserB, UserA first send message to Gigabit port of switch. Then Ethernet switch will learn MAC address of UserA to MAC address table. As there is no source MAC address of UserB in the address table, then Ethernet switch will send message in broadcasting method all ports except for UserA, and UserC can receive message from UserA, that does not belong to it.

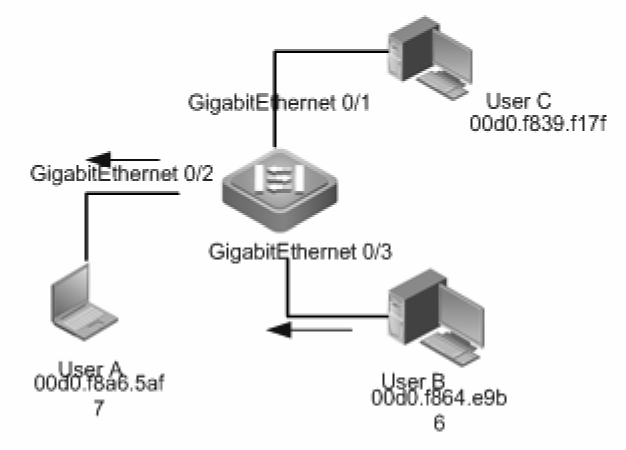


Step one of learning dynamic address

User MAC	Port	Port Method	VLAN
00d0.f8a6.5af7	2	Dynamic	1

Table one of Ethernet switch MAC address

UserB after receiving the message will reply message through Ethernet switch Gigabit port Ethernet 0/3 send UserA, at this point in the Ethernet switch MAC address table has been in existence UserA's MAC address, so the message is in the form of unicast forwarding to Gigabit Ethernet 0/2 ports, Ethernet switches at the same time will learn UserB MAC address, and the difference from the step 1is that UserC don’t receive message that UserB sent to UserA.



Dynamic address learning step two

User MAC	Port	Port Method	VLAN
00d0.f8a6.5af7	2	Dynamic	1
00d0.f864.e9b6	3	Dynamic	1

Ethernet switch MAC address table 2

3. Through UserA and UserB after an interactive process, Ethernet switches learn to UserA and UserB source MAC address, after UserA and UserB message interaction forward in unicast way, then UserC will no longer receive the interaction between the UserA and UserB message.

7.1.3. Address aging

Ethernet switch MAC address table has a capacity limitation, Ethernet switch address table aging mechanism will eliminate inactive item address table.

Ethernet switches at the same time of learning to a new address to launch the address of the aging time, before reaching the aging time, if the Ethernet switches does not receive the address as the source MAC address of the message, that the address will be deleted from the MAC address table when reaching to aging time.

7.1.4. Filter addresses

Manual configuration of the MAC address table entries for discarded in the Ethernet switch to the configured MAC address for the source or destination address of the packet, such address only by manual configuration to add and delete, restart after saving the configuration equipment , filtering to address will not be lost.

Through manual configuring illegal users access to the source MAC address for the filtering ways of implementation method of filtering the illegal user access.

7.2. Default Configuration

Function Performance	Default Value
Dynamic address aging time	300 seconds
Port MAC address learning ability	Open
MAC Address change notifications	Close

7.3. Dynamic address configuration

7.3.1. Check configuration

Command	Function
Switch#show mac-address all	Check all address information on device
Switch#show mac-address dynamic	Check all dynamic address information on device
Switch#show mac-address interface gigabitEthernet *port-id* {all | dynamic | static}	Check address information for ports
Switch#show mac-address link-aggregation *ap-id* {all | dynamic | static}	check the address information of link together group
Switch#show mac-address vlan *vlan-id* {all | dynamic | static}	Check address information for Vlan
Switch#show mac-address aging-time	Check MAC address aging time
Switch# show mac-address count	Check the address table statistics

The following example illustrates how to view the equipment on the physical interface Gigabi t Ethernet 0/9 of all dynamic VLAN

```
Switch#show mac-address all
 VLAN      MAC            TYPE       interface             STATE       index
 ----    --------------   -------   --------------------   --------   ------
 1        0000.0000.0000    DYNAMIC    Gi 0/1                FWD        4
 1        0009.E8F3.F817    DYNAMIC    Gi 0/1                FWD        216
 1        0287.4500.000D    DYNAMIC    Gi 0/1                FWD        444
 1        C860.00E0.2BCC    DYNAMIC    Gi 0/1                FWD        1184
 1        3883.45EE.7332    DYNAMIC    Gi 0/1                FWD        1576
 1        C860.00E0.2B80    DYNAMIC    Gi 0/1                FWD        2080
```

The following example illustrates how to view on the device address table statistics

```
Switch#show mac-address count
 Static Mac Address Count          : 0
 Drop Mac Address Count            : 0
 Dynamic Mac Address Count         : 20
 Total Mac Addresses               : 20
```

7.4. Dynamic Address Aging Time Configuration

7.4.1. Aging Time Configuration

Command	Function
Switch(config)# **mac-address agint-time** [10 | 893]	set the time span of an address kept in dynamic address table after being learned. The unit is second.

Switch(config)#on mac-address agint-time	Resume address aging time to default value.

The following example illustrates how to set the aging time of the equipment to be 180 seconds:

Switch#configure terminal

Enter configuration commands, one per line. End with CTRL+Z. Switch(config)#**mac-address aging-time** 180

The following example illustrates how to view the time configuration of address in the equipment:

Switch#show mac-address aging-time

Aging time : 180 s

7.5. Static Address Configuration

7.5.1. Static Address Management

Command	Function
Switch(config)# mac-address static *mac-address* vlan *vlan-id* {interface gigabitEthernet *port-id*|link-aggregation *ap-id* | drop }	mac-address the destination MAC address corresponding to specified table item. vlan-id：specify VLAN the address belongs to. port-id：the interface that package forwards to. ap-id：the link aggregation interface that package forwards to. drop：discarded data package
Switch(config)# no mac-address static *mac-address* vlan *vlan-id* {interface gigabitEthernet *port-id* | link-aggregation *ap-id* | drop }	Delete static address list item, the parameter is the same with the added command.

The following example illustrates how to add a static IP address 00d0.f800.073c. when the received destination address in VLAN 4 is the message of the address, the message will be forwarded to the specified interface Gigabit Ethernet 0/3.

Switch#configure terminal

Enter configuration commands, one per line. End with CTRL+Z. Switch(config)# **mac-address static** 00d0.f800.073c **vlan** 4 **interface GigabitEthernet** 0/3

The following example illustrates how to delete the added static address 00d0.f800.073c in the previous example:

Switch#configure terminal

Enter configuration commands, one per line. End with CTRL+Z. Switch(config)#**no mac-address static** 00d0.f800.073c **vlan** 4 **interface GigabitEthernet** 0/3

7.5.2. View Configuration

Command	Function
Switch#show mac-address static	View all the information of static address.

The following example illustrates how to view all the information of static address:

```
Switch#show mac-address static
 VLAN              MAC               TYPE          interface                    STATE          index
 ----        --------------       -------       --------------------       --------       ------
 1           1212.1212.1202      STATIC         Gi 0/9                         FWD                -----
```

7.6. Filtering Address Configuration

7.6.1. Filtering Address Management

Command	Function
Switch(config)# **mac-address static** *mac-address* **vlan** *vlan-id* **drop**	mac-address：the corresponding MAC address of the specified table item. vlan-id：specified the VLAN that the address belonged to. when the equipment receives the message with address specified by mac-address as source address or destination address from the specified VLAN of vlan-id of the equipment, the message will be discarded.
Switch(config)# **no mac-address static** *mac-address* **vlan** *vlan-id* **drop**	Delete filtering address list item, the parameter is the same with the added command.

The following example illustrates how to add a filtering address 00d0.f800.073c, when the received source address or destination address in VLAN 1 is the message of the address, the message will be discarded.

```
Switch#configure terminal
Enter configuration commands, one per line. End with CTRL+Z. Switch(config)# mac-address static
00d0.f800.073c vlan 1 drop
```

The following example illustrates how to delete the static address 00d0.f800.073c in the previous example:

```
Switch#configure terminal
Enter configuration commands, one per line. End with CTRL+Z. Switch(config)#no mac-address
static 00d0.f800.073c vlan 1 drop
```

7.6.2. View Configuration

Command	Function
Switch#show mac-address drop	View all filtering address information.

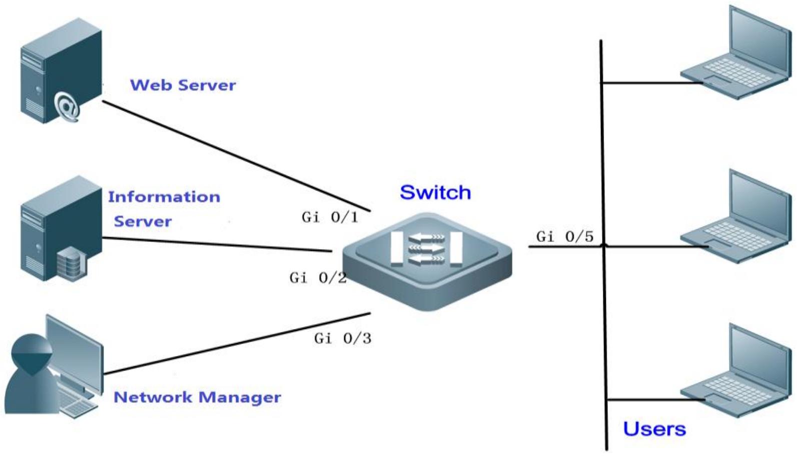
The following example illustrates how to view all the information of static address:

```
Switch#show mac-address drop
 VLAN          MAC             TYPE        interface                  STATE        index
 ----      --------------     -------     --------------------     --------     ------
 VLAN          MAC             TYPE        interface        STATE              index
------     --------------     -------     -----------     --------        -------
 40        0012.2131.1211     DROP            -----             ---
```

7.7. Example of the Typical Configuration of MAC Address Table Management

7.7.1. Topological Diagram

Below is a network diagram for an information system. Web server, database server is connected to the Ethernet switch respectively through Gi0/1 and Gi0/2 , server administrators connected to the Ethernet switch through Gi0/3 , other normal users access to the Web server through the Ethernet switch Gi0/5 port . All the data are forwarded in the VLAN 10.



Static MAC address use network topology

7.7.2. Application Requirements

For the information security of interaction between a WEB server and database information and interaction between server administrator and server, assuring the data forwarding between WEB server and database server, between administrator and each server is adopted unicast way by configuring static address. This can effectively avoid the data is forwarded to the general users to in the form of broadcast.

7.7.3. Point of Configuration

Configure static MAC address table entries, make sure the following three elements:
1, destination MAC address the specified table item corresponding to.
2, specify the VLAN that the address belonging to(VLAN id)
3, interface ID (port - ID)

When the switch receives the message with Mac-address as its destination address from the Vlan-id specified VLAN of the switch, the message will be forwarded to the interface specified by port-id.

The corresponding relationship of MAC address between VLAN, interface in the example is shown in the table below:

Role	MAC Address	VLAN ID	Interface ID
Web Server	00d0.3232.0001	VLAN10	Gi 0/1
Information Server	00d0.3232.0002	VLAN10	Gi 0/2
Network Administrator	00d0.3232.1000	VLAN10	Gi 0/3

7.7.4. Configuration Steps

！enter the global configuration mode of the switch:

```
Switch>en
Switch#configure terminal
Enter configuration commands, one per line. End with CTRL+Z.
```

！Add static MAC address (indicates the belonging VLAN, interface)

```
Switch(config)#mac-address static 00d0.3232.0001 vlan 10 interface GigabitEthernet 0/1
Switch(config)#mac-address static 00d0.3232.0002 vlan 10 interface GigabitEthernet 0/2
Switch(config)#mac-address static 00d0.3232.1000 vlan 10 interface GigabitEthernet 0/3
```

7.7.5. Configuration Verification

Add static MAC address (indicates the belonging VLAN, interface):

```
Switch#show mac-address static
 VLAN          MAC            TYPE        interface       STATE       index
------   --------------   -------   -----------   --------   -------
 10       00D0.3232.0002   STATIC     Gi 0/2           FWD          ----
 10       00D0.3232.0001   STATIC     Gi 0/1           FWD          ----
 10       00D0.3232.1000   STATIC     Gi 0/3           FWD          ----
```

8. Configuration of POE

8.1. Overview

Power over Ethernet，Referred to as PoE，Is a technology that it can through in the Ethernet twisted-pair cable to transmit power and data to the device. With the technology including network telephone, WIFI AP, network camera, hubs, computer and other devices can get power directly from the twisted-pair cable.

8.1.1. Basic concepts

In the use of PoE switches build PoE system, PoE switches play PoE power supply and the combination of PSE. Users of electrical equipment, such as WLAN wireless AP, VoIP phone, etc., can be called the PD. PoE switch power supply in accordance with the standards for the longest distance of 100 m. Support PoE switches can statistical each port and the whole equipment power supply, and is displayed by a query command.

PoE system consists of three parts:

PoE power supply

PoE power for the whole of PoE power supply system ,the PoE system is divided into two types, that is, external power supply and Internal power supply. In our products, Cassette PoE switches generally have internal power supply, some products also supports external power supply, external power supply is called the RPS.

PSE

PSE（Power Sourcing Equipment）◦PSE on PoE interface circuit to find and detect PD, PD for grading, and to the power supply.When detected PD uproot, PSE stop power supply.

PD

PD is accept PSE power supply equipment. Divided into standard PD and non-standard PD, Standard PD refers to comply with the IEEE 802.3 af and 802.3 at standard of PD equipment. PD equipment in PoE power supply at the same time, allowed to connect other power supply, power supply redundancy backup.

8.1.2. The related protocol specification

At present there are IEEE 802.3 af and IEEE 802.3 at PoE tandard, the main features and the difference between these two standard shown in the table below:

Parameters	802.3af	802.3at
PD Available power	12.95W	25.50W
PSE provide maximum power	15.4W	30W
PSE Voltage range	44.0-57.0V	50.0-57.0V
PD Voltage range	37.0-57.0V	42.5-57.0V
The largest cable impedance	20 Ω	12.5 Ω
Power management ways	To divide the power level when the line is initialized	When line initialization is divided into four levels or using 0.1W as a unit to Dynamic adjustment.
Support Cable	CAT3 or CAT5	CAT5

Tip

According to the standard of the IEEE 802.3 af, PoE switches can use twisted-pair idle line to supply power , can also use the twisted pair Signal line to supply power , PD equipment shall supply power at the same time support the free line of power supply and signal lines in two ways.

IEEE 802.3 at switches provide backward compatibility ability, support at 802.3 PoE switches can use only support on the IEEE 802.3 af of PD equipment.

8.2. POE Configuration

8.2.1. Set port POE function

The user can enable or close port PoE function. By default, the access layer switch port of PoE function is enable, the core switches PoE function is closed.Please configure the following at the interface mode.

Command	Function
Switch# configure terminal	Enter global configuration mode
Switch(config)# interface gigabitEthernet *port-id*	Enter interface configuration mode, specified to configure the physical port
Switch(config-if-GigabitEthernet-0/1)# **poe enable**	Enable remote power supply of the port
Switch(config-if-GigabitEthernet-0/1)# **no poe enable**	Close port of the remote power supply
Switch(config)# **end**	Back in privileged mode
Switch# write	Save Settings to parameter file

Tip

If you use interface range command batch configuration port PoE function,Due to the range command is configuration interfaces one by one, a port PoE function were switched on or off, will affect the equipment global supply management. So maybe can appear in the process of configuration interface to electricity up and down phenomenon, which belongs to the normal phenomenon.

8.2.2. Set the power management mode

Power supply management mode is refers to the equipment connection of PD for power distribution. PoE switches support power management model includes Auto mode 、Energy-saving mode and Static mode.

Auto mode, according to detect the type of port PD grading to allocate power. About PD of class0 ~ 3 the equipment allocate the power in the following relations: Class0 - 15.4 W, Class1 - 4W ，Class2 - 7W ，Class3 - 15.4W ，Class4 - 30W 。In this mode, such as there is a distribution to Class3 equipment, even if the consumption of only 11 W, PoE power supply equipment will be in accordance with the power for port distribution power of 15.4 W.Auto mode for PoE switch power supply management mode by default.

Energy-saving mode, the actual consumption of equipment in accordance with the PD adjustment of dynamic power allocation. Set to this mode, PoE power supply equipment for more PD equipment power supply, but also may be due to partial PD power fluctuations affect other PD equipment of power supply. Optional modes of energy saving mode for PoE switches, if the switch does not support the pattern, will output the corresponding message in the configuration.

Static mode, the distribution of power, according to the user's configuration each port must be assigned to power supply. When switch to static mode, if all the port is not set up distribution power (through POE alloc - power configuration), the system will automatically for port power distribution. If the power distribution of power is not enough to all ports, so part of the port from small allocation in Command to supply power allocation is finished.

PoE switch power supply management mode of comparison

Mode\Features	Auto Mode	Energy-saving Mode	Static Mode
Power calculation basis	PD equipment classification power	PD current consumed power of the equipment	User's configuration
Whether the default mode	Default mode	Optional mode	Optional mode

Command	Function
Switch# configure terminal	Enter global configuration mode
Switch(config)# poe mode { auto | energy-saving | static }	Set the PoE system of power supply management mode to automatic mode, energy-saving mode or static mode.

y

default, the equipment of the power supply management mode to auto mode.

For example, set up the equipment of power supply management mode of energy - saving mode:

```
Switch# configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)# poe mode energy-saving
```

Tip

Switching power supply management mode, all PoE port under electricity, ports in accordance with the new management model of power supply to electricity.

When switch to static mode, if there is no port assignments power set, the system automatically port configuration for power distribution, support only 802.3 af equipment distribution of each port 15.4 W, support at 802.3 equipment, distribution of each port 30 W.

8.2.3. The POE port power priority

The user can configure the PoE switch port power supply priority.Priority from high to low in turn is:Critical、High 、Intermediate and Low。In automatic mode and energy-saving mode, high priority as well as power supply port.At the time of PoE switch machine power shortage, low priority port first off electricity, under the condition of the same priority, actual consumption power will be out of electricity.The default priority of the interface are all low.

Same priority port, the new insert port, will not affect the already in the state of the power supply of PD equipment power supply.Different priority of ports is not affected by this feature, high-priority ports can preempt the low
priority.

Command	Function
Switch# configure terminal	Enter global configuration mode
Switch(config)# **interface gigabitEthernet** *interface-id*	Enter interface configuration mode, specified to configure the physical port
Switch(config-if-GigabitEthernet-0/1)# **poe priority** *{ low* **|** *high* **|** *critical }*	Set port power supply priority
Switch(config-if-GigabitEthernet-0/1)# **no poe priority**	Restore power to port as the default priority

For example, Set port 1 remote power supply for Critical priority, and close the POE priority, restore the port priority as the default mode.

```
Switch# configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)# interface gigabitEthernet 0/1
Switch(config-if-gigabitEthernet-0/1)#poe priority critical
Switch(config-if-gigabitEthernet-0/1)#no poe priority
Switch(config-if-gigabitEthernet-0/1)#end
```

Tip	This command at the time of power supply management model for the static model is meaningless, because in the static mode of port power according to the user configuration force distribution, the switch can't be selected automatically, so the command is not effective in the static mode.If before the switch to static mode ports have configured the priority, then the command will be displayed, but do not take effect.

8.2.4. Set port maximum power

Users can configure port maximum power, to limit the maximum output power

In automatic mode and energy-saving mode, set the maximum power can limit the maximum output power of the port, when the port's power more than setting the maximum power of a certain time, port power supply stopped, electrical port on the device. After 10 seconds, the port will once again be on the electricity, the power still exceed the maximum power, if the port port will once again be the electric cycle and the process.

If the user doesn't configure port maximum power, then the port on the examination of the maximum power.

Command	Function
Switch# configure terminal	Enter global configuration mode
Switch(config)# interface gigabitEthernet *port-id*	Enter interface configuration mode, specified to configure the physical port
Switch(config-if-GigabitEthernet-0/1)# **poe max-power** *int*	Sets the maximum power at the port, the range of 0 to 30, the unit is watt, support setting up to three decimal places.
Switch(config-if-GigabitEthernet-0/1)# **no poe max-power**	Close port maximum power Settings

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-gigabitEthernet-0/1)#poe max-power 17
Switch(config-if-gigabitEthernet-0/1)#poe enable
Switch(config-if-gigabitEthernet-0/1)#end
```

Tip	The command is in effect only in automatic mode and energy-saving mode. If in automatic mode and energy-saving mode, the Max - power is set to 0, port off electricity, and no longer on the electricity. Support only 802.3 af PoE switches, Max - power configuration in the range of < 0-15.4 > If the power supply management mode in automatic mode, and configured with Max - power command, so the power supply according to user's Max - power management algorithm configuration commands to calculate the distribution of the port power.

8.2.5. Set port’s distribution power

Users can configure the porti's distribution power, to setting output value of the port in the static mode.

When the power supply management model for the static mode, the command is used to power the distribution of the specified port.When switch to static mode for the first time, if the user has no port configuration for power distribution, on the support only 802.3 af POE switches, the distribution of the system will configuration for each port 15.4 W power, on the support 802.3at POE switches, the distribution of the system configuration for each port 30 W power.If the system power is not enough to assigned to all ports, the port number assigned small port

Command	Function
Switch# configure terminal	Enter global configuration mode
Switch(config)# interface gigabitEthernet *port-id*	Enter interface configuration mode, specified to configure the physical port
Switch(config-if-GigabitEthernet-0/1)# **poe alloc-power** *int*	Sets the maximum power at the port, the range of 0 to 30, the unit is watt, support setting up to three decimal places.
Switch(config-if-GigabitEthernet-0/1)# **no poe alloc-power**	Cancel the port assignments power set, if in the static mode, the ports of the power supply will stop.

For example, in the static mode setting port of the maximum power of 20 w, then can make port PoE function.

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-gigabitEthernet-0/1)# poe alloc-power 20
Switch(config-if-gigabitEthernet-0/1)#poe enable
Switch(config-if-gigabitEthernet-0/1)#end
```

Tip	When the power supply management model for static mode, you must configure port‘s distribution power, Port to the power supply. This command takes effect only in the static mode. If in the static mode, will alloc - power is set to 0, port off electricity, and no longer on the electricity.

8.2.6. Set system’s Reserve power

When using energy-saving mode, PoE switches according to the actual consumption of PD equipment power to calculate the power consumption of the system.If there is a PD device in this mode consumed power fluctuation is very big, will lead to damage of PoE switches under the heavy load PoE equipment.

PoE switches provide Settings PoE system reserved power command to protect PoE switch power has always been "surplus", the current consumption of power will not exceed the limit of PoE switch itself.

System’s preserving power default is 0%.

Command	Function
Switch# configure terminal	Enter global configuration mode
Switch(config)# **poe reserve-power** *int*	Set to retain power of the percentage of the total power of system, the range of 0% to 50%.
Switch(config)# no poe reserve-power	Restore the reserved power as the default value, the default is 0%

For example, set up the system for the power of retention of 20%.

Switch#configure terminal

Enter configuration commands, one per line. End with CTRL+Z.

Switch(config)# **poe reserve-power** 20

Switch(config)# no poe reserve-power

Tip

Set up command system to retain power, only in the current PoE switch power supply management mode to save energy when.

In energy-saving mode to retain power, it may lead to port under electric has access to electricity.

8.2.7. Use hot start uninterrupted power supply function

If you need to restart the switch in practical applications, such as restart the PoE switches after upgrade PoE switche's management software,But this time there are many PD equipment is in the normal power supply on the PoE switch,If restart directly, may cause the working PD equipment off the electricityand then to electricity，PD equipment work there will be a period of time interrupt.

The switch provides the hot start uninterrupted power supply,At the time of system restart, has been in a state of power supply of PD equipment in the process of hot start PoE switches will not off electricity.Hot start is completed, the system back to save the configuration file in the state.

Command	Function
Switch# configure terminal	Enter global configuration mode
Switch(config)#poe uninterruptible-power	Enable the hot start uninterrupted power supply function
Switch(config)# **end**	Return to the global model
Switch#**write**	Save the configuration, to ensure effective at the time of the next start
Switch(config)# no poe uninterruptible-power	Closed hot start uninterrupted power supply function

For example, Enable and disenable the hot start uninterrupted power supply function

```
Switch#configure terminal
Enter configuration commands, one per line.    End with CTRL+Z.
Switch(config)# poe uninterruptible-power
Switch(config)# no poe uninterruptible-power
Switch(config)#end
```

Tip

After enable and disenable this function must to save the configuration to ensure effective in the reduction of the next. If the user forgot to save the configuration, or to save the configuration and then change the POE configuration, system will prompt the user to save the configuration.

8.2.8. Set the power recovery mode

If power supply equipment off electricity in actual application, can be set up port recovery mode to restore power,there are auto and manual in two ways,In auto mode,Power supply equipment to restore power, connection of PD equipment automatically restore power,in manual mode, through the user manual to restore power, the default configuration for manual. Also can sets the recovery interval time by recover - time, the default is 60 seconds, can be installed range 5-3600 seconds.

Command	Function
Switch# configure terminal	Enter global configuration mode
Switch(config)#**poe recover-time** *{Time range(s)}*	Sets the restore clearance time
Switch(config)# no poe recover-time	Restore clearance for the default 60 s
Switch(config)# interface gigabitEthernet *port-id*	Enter interface configuration mode, specified to configure the physical port
Switch(config-if-gigabitEthernet-0/1) #**poe recover** *[auto*|*manual]*	Set the recovery mode Auto,Power supply equipment to restore power, PD device automatically restore power Manual, Power supply equipment to restore power, through the user Settings to restore power
Switch(config-if-gigabitEthernet-0/1) #**no poe recover**	Close the auto mode, revert to the default manual
Switch(config-if-gigabitEthernet-0/1) #**end**	Return to the privileged mode

For example,Set power supply recovery clearance time is 30 s and revert to the default interval of time.

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#poe recover-time 30
Switch(config)#no poe recover-time
```

For example,Enter interface configuration mode, set the power supply recovery mode for auto and revert to the default manual.

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-gigabitEthernet-0/1)#poe recover auto
Switch(config-if-gigabitEthernet-0/1)#no poe recover
```

8.2.9. Set port's PD descriptor

In practice it is often necessary to record specified PoE port access PD name,In RFC3621 provides pethPsePortType item to set port of PD.

Switches also provides the CLI Settings to set this value.

Command	Function
Switch# configure terminal	Enter global configuration mode
Switch(config)# interface gigabitEthernet *port-id*	Enter interface configuration mode, specified to configure the physical port
Switch(config-if-GigabitEthernet-0/1)#**poe pd-description** pd-name	PD descriptor configuration interface, parameter as a string, the maximum support 32 characters
Switch(config)# **end**	Return to the global model
Switch#**write**	Save the configuration, to ensure effective at the time of the next start

For example, set gigabitEthernet 0/1 interface of PD descriptors.

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-gigabitEthernet-0/1)# poe pd-description test
Switch(config-if-gigabitEthernet-0/1)#end
```

8.3. Display POE Status

8.3.1. POE port status display

The user can in privileged mode through the show command to view the interface state.

Command	Function
Switch# show poe interface gigabitEthernet [*port-id*]	Display power supply state about designated port
Switch# show poe interfaces status	Show all PoE port state of power supply （8 ports can rely on PoE power supply system）
Switch# show poe interfaces configuration	Show all PoE port configuration information（8 ports can rely on PoE power supply system）

,
display the single port fastEthernet 0/1 state of power supply:

```
Switch#show poe interface gigabitEthernet 0/1
Interface                    : Gi0/1
Pd Description               : test
```

```
Power control              : Normal
Power status                : Detecting
Max power                     : 29.123 W
Allocate power             : 19.124 W
Current power               : 0 W
Average power                : 0 W
Peak power                   : 0 W
Voltage                            : 0 V
Current                            : 0 mA
PD class                     : NO PD Devices
Trouble cause               : None
Priority                          : Low
Trouble Recover Mode             : manual
Power management                  : Auto
```

The meaning of the information displayed is:

Display Item	Instructions
Interface	The interface number.
Power control	Whether have enable the PoE function.
Power status	Whether the PoE has already started to power supply. 。
Max power	Port to support maximum power.
Allocate power	Port’s distribution power
Current power	Port’s consumed power.
Average power	Port’s current average power After power on port "port current consumed power" of the sample average.
Peak Power	Port’s peak power
Voltage	The current voltage of the port.
Current	The current electricity of the port.
PD class	Port's level, according to the regulations of the 802.3af/802.3at, PD equipment is divided into four levels.
Trouble cause	The cause of the problem of none said there is no system failure.
Priority	The port priority: low，Low priority, the default priority for port; high，High priority, requires the user to configure; critical，The highest priority, the user configuration is required.
Trouble Recover Mode	Power recovery mode: Auto，Automatically restore power Manual，Requires the user to manually restore power

Power management	Power supply management mode:
	auto，Automatic mode;
	energy-saving，Energy-saving mode;
	static，The static model.

Trouble cause Said the electricity

	Port trouble cause	Instructions
	None	Normal power supply
	Overload During Startup	Detection stage, found that the current is too big and disconnect
	Power Overload due to Icut	PD equipment overload and disconnect the power
	Short Circuit Detected	PD equipment short circuit and broken
	Thermal Powerdown	High temperature protection and shut down
	Power Management	Shut down power management
	VEE UVLO	Hardware fault and shut down

Users can not enter the port number,through the show poe interfaces status command to display all port state of POE power supply,can show poe interface configuration command to display all the ports of POE configuration information.

Show all PoE port state of power supply:

```
Switch#show poe interfaces status
Interface  Power    Power      Curr     Avg      Peak     Curr     Trouble  PD
            Control  Status    Power    Power    Power    Current  Cause     Class
------------------------------------------------------------------------------------------
*    Gi0/1   Normal   Powering    2.138W   2.217W    2.296W      40mA        0        3
*    Gi0/2   Normal   Powering   17.106W 17.186W   17.267W     320mA        0        4
     Gi0/3   Normal   Detecting       0W       0W        0W       0mA       0      N/A
     Gi0/4   Normal   Detecting       0W       0W        0W       0mA       0      N/A
     Gi0/5   Normal   Detecting       0W       0W        0W       0mA       0      N/A
     Gi0/6   Normal   Detecting       0W       0W        0W       0mA       0      N/A
     Gi0/7   Normal   Detecting       0W       0W        0W       0mA       0      N/A
     Gi0/8   Normal   Detecting       0W       0W        0W       0mA       0      N/A
```

Display all POE port configuration information:

```
Switch#show poe interfaces configuration
Interface  Power    Power      Max      Alloc    Port     Port
            Control  Status    Power    Power    Priority  Legacy
-----------------------------------------------------------------
*    Gi0/1   Normal   Powering      30W       20W      High      N/A
*    Gi0/2   Normal   Powering      30W       30W      High      N/A
     Gi0/3   Normal   Detecting    15.123W 30W    Critical    N/A
     Gi0/4   Normal   Detecting    30W       30W     Critical    N/A
     Gi0/5   Normal   Detecting    30W        0W       Low       N/A
     Gi0/6   Normal   Detecting    30W        0W       Low       N/A
     Gi0/7   Normal   Detecting    30W        0W       Low       N/A
     Gi0/8   Normal   Detecting    30W        0W       Low       N/A
```

8.3.2. Display POE status

The user can in privileged mode by the show command to view the system state of PoE.

Command	Function
Switch#show poe powersupply	Display POE power supply state of the whole system

The following example to show the PoE system state of power supply:

```
Switch#show poe powersupply
Power-Over-Ethernet System power status:
  Powerring Port List :   Gi0/1，  Gi0/2，
  Power Management Method         : Auto
  Poe uninterruptible power      : Disable
  Error Recover Interval          : 60s
  System Total Power                : 400 W
  Power Consumption                  : 15.4 W
  Available power                   : 384.6 W [96%]
  PSE reserve power                  : 0%
```

The meaning of the information displayed is:

Display Item	Instructions
Powerring Port List	Currently in power supply port

Power management	Power supply management mode:
	auto，Automatic mode;
	energy-saving，Energy-saving mode;
	static，The static model.

Poe uninterruptible power	Whether to enable hot start not power down mode, the default for the disable
Error Recover Interval	Recovery time, the default 60 s, range: 5-3600 - s
System Total Power	This system can support the maximum power.
power consumption	The current system power consumption.
Available power	The current system of power distribution, in different power supply management mode, the system of distribution of power is different.
PSE reserve power	The percentage of the system to retain power.

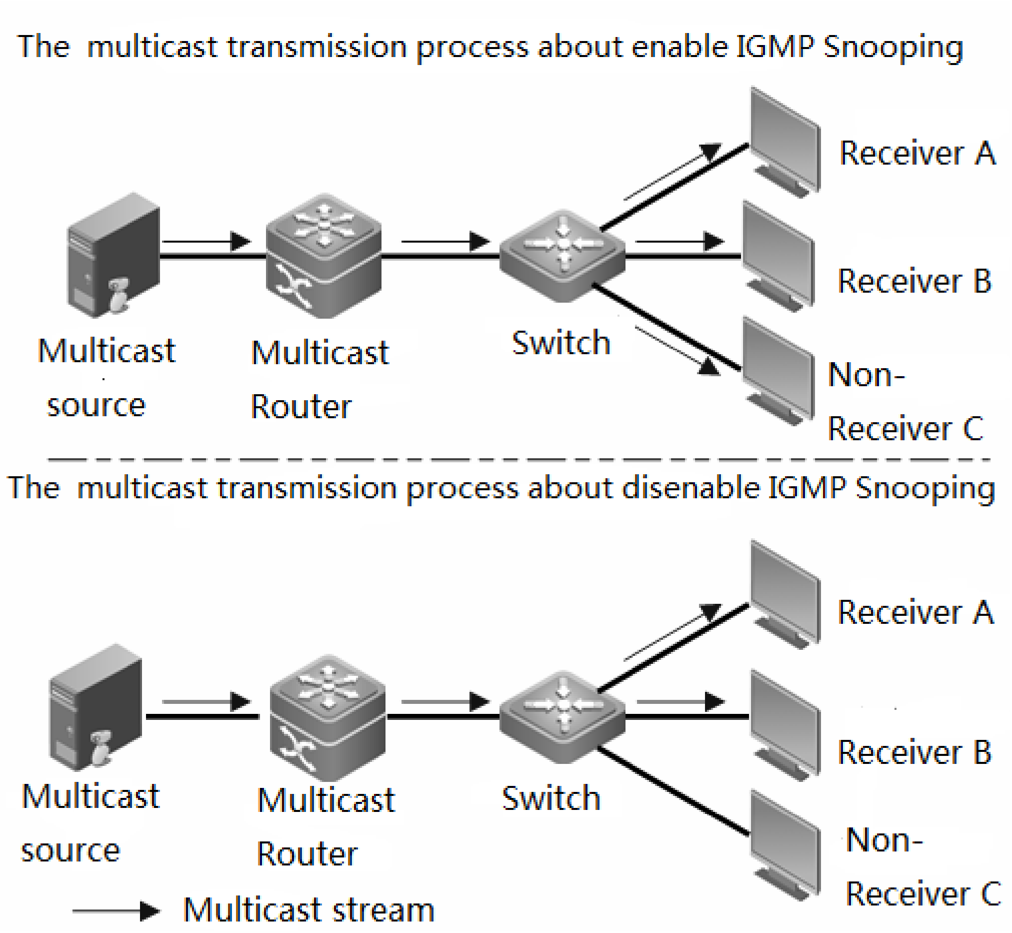
9. configuration IGMP Snooping

9.1. Overview

9.1.1. Understand the working principle of IGMP Snooping

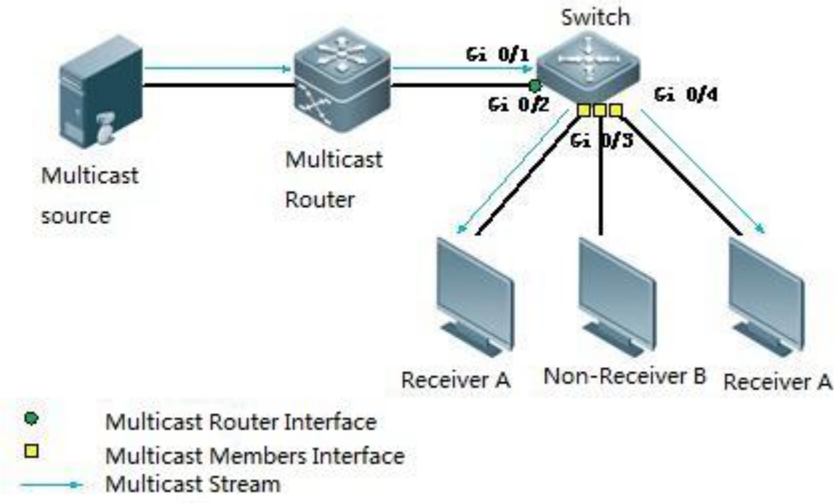
IGMP Snooping is short for Internet Group Management Protocol.It is to run on the VLAN IP multicast constraint mechanism,Used to manage and control the IP multicast flow within the VLAN forwarding,Belong to the second layer of multicast functionality.IGMP Snooping function described below,Is carried out within the VLAN, related port is refers to the internal members of the VLAN.

Run the IGMP Snooping devices through analyze the IGMP packets received,For port and multicast address set up mapping relationship,and according to the mapping relationship of such forwarding IP multicast data packets.As shown in the figure below,When the switch is not running IGMP Snooping, IP multicast data packets within a VLAN is broadcast;After the switch to run the IGMP Snooping, known IP multicast group's multicast data packets not within a VLAN is broadcast, but sent to the designated recipient.



9.1.2. Understand the two types of IGMP Snooping port

As shown in the figure below, the Router connection multicast source, run in the Switch A IGMP Snooping, Host A and Host C for receiver Host (i.e., IP multicast group members).



Two types of IGMP Snooping port

Multicast Router Port：Switches connected multicast router(three layer multicast equipment)，Such as the Switch of A Gi 0/1 port.Switches connect all routing of this device ports (including dynamic and static ports) are recorded in the routing connection list.Router connection by default is corresponding to the receiver of multicast data within a VLAN can be added to the IGMP Snooping in turn.

Member Port：Short for IP multicast group members port,Also known as the Listener Port,Said switch connection port of the IP multicast group side,Such as the SwitchA of Gi 0/2、Gi 0/3 and Gi 0/4 port。Switch to all members of the ports on the device (including dynamic and static port) is recorded in the IGMP Snooping in turn.

9.1.3. Understanding the dynamic aging timer of the port

IGMP Snooping Dynamic port of aging timer

Type	Description	Start the event triggered a timer	Timeout after the switch
Aging timer dynamic routing connection port	Switch for each dynamic routing connections are starting a timer aging time, thetimeout is the dynamic routing connection port	IGMP group received query message or PIM Hello message	The port is removed from the routing connections list
Aging timer dyna mic member port	Switch to the port starts a timer, the timeout is dynamic state members port aging time	IGMP queries received message	The port is removed from the IGMP Snooping multicast group

9.1.4. Understand the working mechanism of IGMP Snooping

Conventional query and specific queries

IGMP will send all the hosts and routers in the network common set of query message,In Command to query the network segment what IP multicast address is 224.0.0.1 multicast groups.After receiving the IGMP universal set is the query message, switch the query message to the all port forwarding out within a VLAN, and receiving port of the newspaper article to do the following:

If the port is already in routing connection port list, timer is reset to its aging.

If the port is not in routing connections list, then add it to the list of routing connectors, and start the aging time.

After receive IGMP‘s common set of query message, multicast equipment will be switched to all members of the port their aging timer,timer for configuration of IGMP query message to the longest response time,When the timer timeout, argues that the port no more members to receive multicast stream,multicast equipment will turn the port from the IGMP Snooping published.

Report the membership

The following case,The host will report to the IGMP inquirers IGMP membership to send a message:

When IP multicast group members of the host after receiving the IGMP query message,IGMP membership report will reply message.

If the host IP to join a multicast group,It will take the initiative to send IGMP inquirers IGMP membership report message to declare to join the IP multicast group.

IGMP membership after receiving the report message,Switch it to all routing within a VLAN connection port forwarding to go out,

From the analysis of the message in the host IP multicast group address to join,and receiving port of the newspaper article to do the following:

If there is no corresponding turned this IP multicast group published items,create the forwarding table entries,add the port as members of the dynamic port to a port in the list,and start the aging timer;

If there are corresponding to the IP multicast forwarding table entries,but the output port does not contain the list of ports,then the port as a dynamic member port is added to the list of ports,and start the aging timer;

If there are corresponding to the IP multicast forwarding table entries,And the dynamic member port already contains the list of ports,then aging timer is reset.

9.1.5. Leave the multicast group

For the IGMP V2,when the host left the IP multicast group, IGMP leave group by sending a message,in Command to inform the multicast router left an IP multicast group.When the switch from one port on dynamic members receive IGMP leave group message,Switches will deal with it according to whether launched immediately leave accordingly.If the switch opens the leave immediately, the port is removed from the multicast table,If does not start to leave immediately, send a specific set of query message,If have not received the report within the timeout message, will be the port is removed from the multicast table.If you remove the port after the multicast group members have no port, switch to routing port forwarding to leave a message.

9.1.6. Understand IGMP Profiles

IGMP Profiles is actually a set of filters,It can be defined as a series of multicast address range,and the definition of the multicast address access permit or deny action,For later "routing connection filtering of multicast data range", "IGMP Filtering" using the features.

9.2. Configure IGMP Snooping

We will from the following sections describe how to configure the IGMP Snooping:

9.2.1. Enable IGMP Snooping

	Command	Function
Step 1	Switch(config)# **ip igmp snooping**	Enable and set the IGMP Snooping, lack of provincial situation, IGMP Snooping in the closed state.
Step 2	Switch(config)# ip igmp snooping version ｛1**|** *2* **|** *3*｝	Configuration IGMP version 1, 2, 3;The default configuration version 2.
Step 3	Switch(config)# no ip igmp snooping	IGMP Snooping global shutdown function.

The following example is Enable and set up IGMP Snooping and configure IGMPv2

```
Switch# configure terminal Switch(config)# ip igmp snooping
Switch(config)#end
Switch# show ip igmp snooping
Global IGMP Snooping configuration:
 -----------------------------
 IGMP Snooping                : Enabled
 Report Suppression           : Enabled
 TCN solicit query            : Disabled
 TCN flood query count        : 2
 Last Member Query Interval : 1000
 IGMP version                 : 2
 ProtoStatus                  : Enabled
 Router-port aging time       : 255
 Report-port aging time       : 260

 Vlan ID:1
 -----------
 IGMP Snooping                : Enabled
 IGMPv2 immediate leave       : Disabled
 Last Member Query Interval : 1000
 Router-port aging time       : 255
 Report-port aging time       : 260

 Vlan ID:2
 -----------
```

```
IGMP Snooping                      : Enabled
IGMPv2 immediate leave           :Disabled
Last Member Query Interval   : 1000
Router-port aging time          : 255
Report-port aging time          : 260
```

9.2.2. Close the IGMP Snooping

In the global mode, follow these steps to close the IGMP Snooping:

Command	Function
Switch(config)# no ip igmp snooping	Close the IGMP Snooping, by default, the IGMP Snooping in the closed state.
Switch(config)# show ip igmp snooping	If confirm the configuration take effect.

9.2.3. Based on the VLAN start IGMP Snooping

By default, when the global open IGMP Snooping, all VLAN will automatically open the IGMP Snooping function.If you need to specific VLAN off the IGMP Snooping function, can use the following command.

In the global mode, follow these steps to close the IGMP Snooping:

Command	Function
Switch(config)# no ip igmp snooping vlan *num*	Close the VLAN num IGMP Snooping, by default, VLAN num of IGMP Snooping in the open state.
Switch(config)# ip igmp snooping vlan *num*	Open the VLAN num IGMP Snooping function.

The following example is close the vlan 3 IGMP Snooping:

```
Switch# configure terminal
Switch(config)# no ip igmp snooping vlan 3
```

9.2.4. Aging timer configuration of router's connection port

For dynamic routing connection port,before the aging time timeout not received the IGMP query message,switch will turn the port is removed from the list of router port.

In the global mode, press the following steps to configure the dynamic port aging timer:

Command	Function

Switch(config)# ip igmp snooping timer router-port expiry *time*	Configure dynamic routing connection port aging time, time:<60-300> the default value is 255s.
Switch(config)# no ip igmp snooping timer router-port expiry	The aging time to recover dynamic routing connection port as the default, the default value is 255s.

The following is a dynamic routing configuration joint aging time of 100 s instance:

```
Switch# configure terminal
Switch(config)# ip igmp snooping timer router-port expiry 100
```

9.2.5. Configure the aging timer of member port

For member port, if the aging time timeout did not receive IGMP join message,the switch will remove the port from the list of member port.

In the global mode, follow these steps to configure the aging timer of member port

Command	Function
Switch(config)# ip igmp snooping timer report-port expiry *time*	Member connecting port aging time, time:60-300, the default value is 260s.
Switch(config)# no ip igmp snooping timer report-port expiry	The aging time recovery member interface as the default, the default value is 260s.

The following is a member of the aging time of 100s interface configuration example:

```
Switch# configure terminal
Switch(config)# ip igmp snooping timer report-port expiry 100
```

9.2.6. Configure IGMP Profiles

IGMP Profiles is actually a set of filters,For the following "routing connection filtering multicast data range", "IGMP Filtering" using the features.

In the global mode, follow these steps to set up a Profile:

	Command	Function
Step 1	Switch(config)# **ip igmp profile** *profile-number*	Enter the IGMP Profile model, assign a number for logos, the number range of 1-1024, by default, did not match any Profile.
Step 2	Switch (config-igmp-profile)# **permit | deny**	(optional) configured to permit or deny that a batch of multicast address range, the default value is deny.This behavior: enable / disable the following range within the multicast address, multicast address and ban / allow other.
Step 3	Switch(config-igmp-profile)# **range** *low-address high_address*	Adding the multicast address range, the value can be a single IP group address can also be a group address interval (in front of the low IP group address, behind the high IP group address), also can configure multiple rangerange.
Step 4	Switch(config)# **end**	Return to the privileged mode.

If you want to delete one of the IGMP profile, you can use the no IP IGMP profile profile number to execute.

Which of the following is an example says the Profile of the configuration process:

```
Switch(config)# ip igmp profile 1
Switch(config-profile)# permit
Switch(config-profile)# range 224.0.1.0 239.255.255.255
Switch(config-profile)# end
Switch# show ip igmp profile 1
IGMP profile 1:
  ----------------
           Permit
range 224.0.1.0, 239.255.255.255
```

According to the above configuration,The rules of the IGMP Profile is a multicast address to permit 224.0.1.0 -239.255.255.255 , other multicast address is deny.

9.2.7. Configure the routing connections

By default, VLAN will be undertaken within the dynamic routing link learning,

You can configure the closed dynamic multicast routing connection of the function of learning,With the corresponding **no** option ordered closed dynamic learning,And empty all dynamically learned routing connectors.

Also can through the command connect the switch port configuration as the static routing.

In the global mode, press the following steps to configure the router connection:

Command	Function
Switch(config)# **ip igmp snooping vlan** *vlan-id* mrouter {interface gig *port-id* | link-aggregation *ap-id}*	Set the interface to the static routing joint.
Switch(config)# no ip igmp snooping vlan *vlan-id* mrouter {interface gig *port-id* | link-aggregation *ap-id}*	Cancel the interface for static routing connections.

The following example is set Ethernet interface 0/1 to VLAN1 static routing connection

```
Switch# configure terminal
Switch(config)# ip igmp snooping vlan 1 mrouter interface GigabitEthernet 0/1
Switch(config)# end
Switch#show ip igmp snooping mrouter
 Vlan           SourceAddr            Interface
 ----          ---------           --------
 1              0.0.0.0              Gi 0/1(static)
```

9.2.8. Configure port IGMP Filtering

In some cases, you may need to control a certain ports can only receive a number of specific multicast data flow, under the control of the port allows dynamic most how many groups to join.IGMP Filtering to meet the demand.

You can put a IGMP Profile application in a port,if the port receives a IGMP Report message, the two layer multicast device will find this port to join the multicast address is in the allowable range of IGMP Profile.If yes, are allowed to join, only after the subsequent processing.

You can also count on a port configuration allows up to join the group,Over the range, two layer multicast equipment is no longer receiving, processing the IGMP Report message.

In the global mode,According to the following steps to configure the IGMP Filtering:

	Command	Function
Step 1	Switch(config)# interface GigabitEthernet *id*	Enter the configuration interface.
	Switch(config-if-GigabitEthernet-0/1)# **ip igmp filter** profile-number	(optional) Profile is applied to the port, the Profile number range 1-1024.By default, a port is not associated with any profile.
Step 2	Switch(config-if-GigabitEthernet-0/1)# **no ip igmp filter**	(optional) delete associated profile on interface, the interface will be allowed by all groups.
	Switch(config-if-GigabitEthernet-0/1)# **ip igmp max-groups** *number*	(optional) allows for up to a few dynamic group of the port, and the number range of 0-500.By default, 500.

The following is the example of IGMP Filtering configuration:

```
Switch# configure terminal
Switch(config)#link-aggregation 1
Switch(config-link-aggregation1)#ip igmp snooping filter 1
```

9.3. Check the IGMP Snooping information

We offer to view the IGMP snooping related information is as follows:

9.3.1. View the current mode

IGMP Snooping in privileged mode using the following command to view the current working mode and global configuration:

Command	Function
Switch# show ip igmp snooping	Check the IGMP Snooping current work mode and global configuration.

The following example uses the **show ip igmp snooping** to viewIGMP Snooping configuration information:

```
Switch# show ip igmp snooping
 Global IGMP Snooping configuration:
 -----------------------------
 IGMP Snooping                             : Enabled
 Report Suppression                      : Enabled
 TCN solicit query                     : Disabled
 TCN flood query count                  : 2
 Last Member Query Interval             : 1000
 IGMP version                             : 2
 ProtoStatus                             : Enabled
 Router-port aging time                 : 255
 Report-port aging time                 : 260

 Vlan ID:1
 -----------
 IGMP Snooping                             : Enabled
 IGMPv2 immediate leave                   : Disabled
 Last Member Query Interval             : 1000
 Router-port aging time                 : 255
 Report-port aging time                 : 260
```

9.3.2. Check the IGMP Snooping statistics

In privileged mode using the following command to view IGMP Snooping statistics information:

Command	Function
Switch# show ip igmp snooping interface GigabitEthernetstatistics	Check the IGMP Snooping statistics.

The following example uses show ip igmp snooping interface statistics command to view IGMP Snooping routing connection information:

```
Switch#show ip igmp snooping interface GigabitEthernet statistics
 interface                                  GrpNum
 -----                                     -------
 Gi 0/1                                      0
 Gi 0/2                                      0
 Gi 0/3                                      0
 Gi 0/4                                      0
 Gi 0/5                                      0
 Gi 0/6                                      0
 Gi 0/7                                      0
 Gi 0/8                                      0
 Gi 0/9                                      0
 link-aggregation 1                        0
```

9.3.3. View the routing connection information

In privileged mode using the following command to check the IGMP Snooping routing connection mouth information:

Command	Function
Switch# show ip igmp snooping mrouter	Check the IGMP Snooping routing connection information.

The following example uses the**show ip igmp snooping** command to view IGMP Snooping routing connection mouth information:

```
Switch#show ip igmp snooping mrouter
 Vlan           SourceAddr              Interface
 ----          ---------             --------
 1              0.0.0.0                Gi 0/1(static)
 1              0.0.0.0                link-aggregation 1(static)
```

9.3.4. View the forwarding table

In privileged mode using the following command to view the port forwarding rules in the multicast Group, namely view Group Destination Address GDA (Group Destination Address) table:

command	Function
Switch# show ip igmp snooping groups	Check the port in the multicast forwarding rule table.

The following example is to check the GDA table of each group multicast group information, and all the members of a multicast group port information:

```
Switch#show ip igmp snooping groups
 Vlan Group              Version Interface             Status
 ---- --------------- ------- ------------------- --------------
 1     239.255.255.250 3          Gi 0/3                V2 members
```

9.3.5. View the IGMP Profile

In privileged mode using the following command to check the IGMP Profile information:

Command	Function
Switch# **show ip igmp profile** *profile-number*	View the IGMP Profile information

The following to view the IGMP Profile information:

```
Switch#show ip igmp profile
 IGMP profile 11:
 ----------------
         permit
         range 224.1.1.1 224.1.1.100
```

10. Configure SNMP

10.1. SNMP relevant knowledge

10.1.1. Overview

SNMP s the abbreviation of Simple Network Management Protocol,In August 1988, it became the network management standards RFC1157 .Up to now, because of many manufacturers support for the deal,SNMP has become the de facto standard of network management,Network equipment by using SNMP protocol,The network administrator can for hosts on the network information query,network configuration, fault location, capacity planning, network monitoring and management is the basic function of SNMP.

SNMP is an application layer protocol for the client/server mode, including three parts:

SNMP Network Manager

SNMP Agent

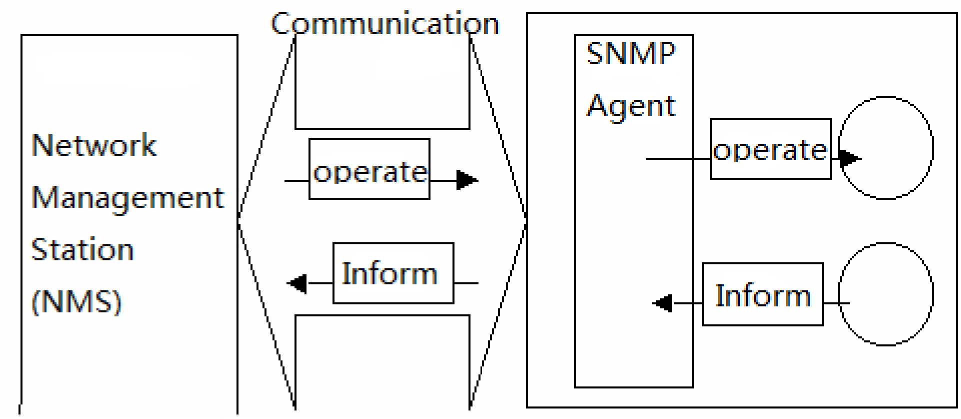
MIB Management Informatio Bbase

SNMP Network Manager，is using SNMP to control and monitor network system, also known as NMS (Network Management System).

SNMP Agent is running on the managed devices software, data acquisition board is responsible for accepting and processing and response from NMS monitor and control the message, also can take the initiative to send some to trap the alarm information to the NMS.

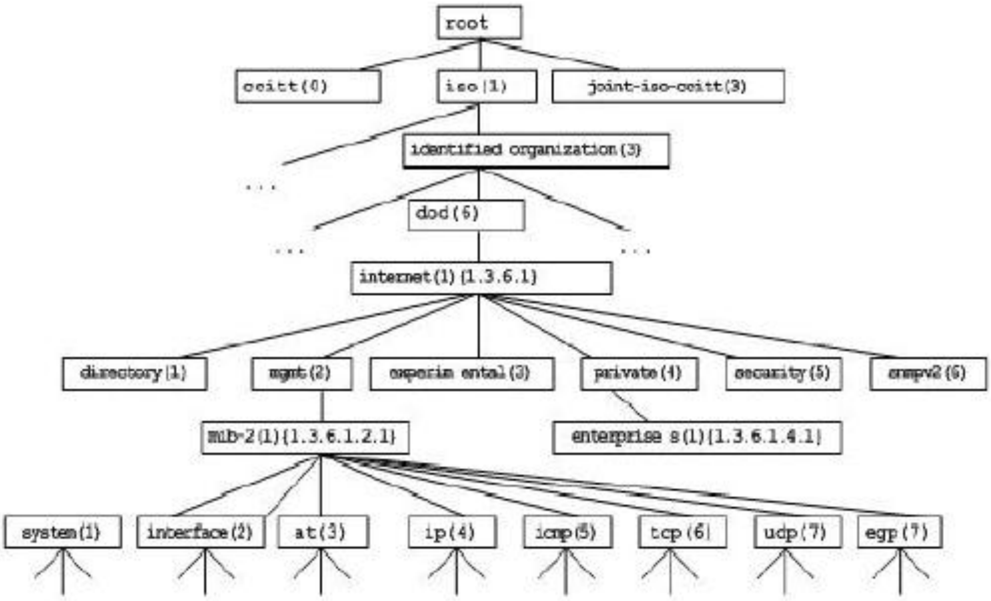
NMS and Agent relationship can be represented in the following figure:

Fig. 1-1 NMS and Agent relationship



MIB（Management Information Base）Is a virtual network management information base.Managed network device contains a large amount of information,in order to be able to in the SNMP message uniquely identifies a particular management unit,MIB with tree like hierarchical structure to describe the management unit in the network equipment.The tree node represents a specific management unit.The diagram below MIB object named tree,For a management unit System uniquely identifies the network equipment in the,A list of Numbers can be used to represent such as {1.3.6.1.2.1.1},this string of Numbers is the management unit of the Object Identifier,MIB is a collection of network equipment unit identifier.

Figure 1-2 MIB tree hierarchy



10.1.2. SNMP Protocol Version

The SNMP version supports the following:

SNMPv1 ：The first official version of the simple network management protocol, defined in RFC1157.

SNMPv2C：SNMPv2 management structure of Community-Based, defined in RFC1901 an experimental protocol.

SNMPv1 and SNMPv2C are the security architecture of Community-based.By the definition of the host address and authentication name (CommunityString) is defined to proxy MIB operation manager.

SNMPv2C increased the Get-bulk operating mechanism and it can return an error message type more detailed of the management workstation.Get-bulk operation can obtain all information in the form or access to large amounts of data,to reduce the number of the request response.SNMPv2C error handling ability improvement including expansion of error code to distinguish between different types of errors,in SNMPv1 these errors only an error code.Now through the error code can distinguish wrong type.Because the Internet may exist support SNMPv1 and SNMPv2C management workstation,so the SNMP agent must be able to identify SNMPv1 and SNMPv2C message, and can return the corresponding version of the message.

10.1.3. SNMP Management Operations

The interactive information between SNMP protocol NMS and Agent, defines 6 types of operations:

Get-request operation：NMS extracted one or more parameter values from the Agent.

Get-next-request operation：NMS extracted from one or more parameters from Agent under a parameter value.Get-bulk Operation: NMS extracted from Agent batch parameter values;

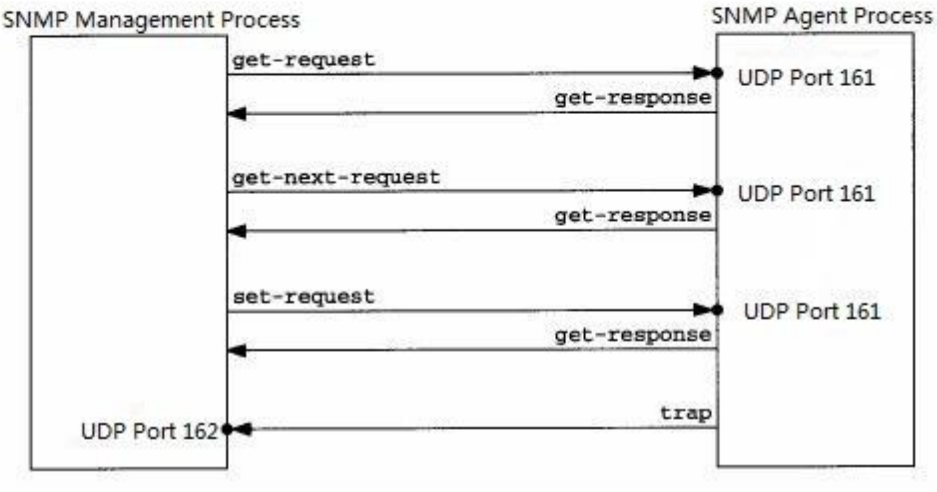
Set-request Operation: NMS set one or more of the parameters of the Agent.

Get-response Operation: the Agent returns one or more parameter values, is the Agent of NMS front three response operation of the operation.

Trap Operation: the Agent unsolicited message, notify the NMS is what will happen.

In front of the four message are sent from the NMS to Agent,Behind the two is the Agent to NMS(note: SNMPv1 version does not support the Get - bulk operations).

Below describes the kinds of operations.



NMS to Agent in the front of the three kinds of operation and the response Agent operation using UDP port 161.Agent of the Trap operation using UDP port 162.

10.1.4. SNMP Security

SNMPv1 and SNMPv2 version use certification name used to identify whether has the right to use the MIB object.In order to be able to manage equipment, network management system (NMS) certification name must be in accordance with defined in an equipment name.

A certification name can have the following properties:

Read-only：Provide authorized management workstation to all read access to the MIB variables.

Read-write：For the authorized management workstation provides read and write access to all MIB variables.

Currently available security model there are two categories:SNMPv1、SNMPv2C。

The table below for the currently available security model and security level

Security model	Security level	Identify	Encryption	Instructions
SNMPv1	noAuthNoPriv	Certificate name	none	Through the certification confirmed data validity
SNMPv2c	noAuthNoPriv	Certificate name	none	Through the certification confirmed data validity

10.2. Configure SNMP

Configuration of SNMP is completed in the global configuration mode of network equipment, in the SNMP configuration, please enter global configuration mode.

10.2.1. Set authentication name and access permissions

The security scheme of Community-based SNMPv1/SNMPv2C.The SNMP agent only accept from the same authentication name (Community-String) management operations,SNMP packets and network equipment certification name does not match will not be response, discarded directly.Certification name equivalent to between NMS and Agent password.

Can set the access list, only the specified IP address NMS can manage;

Can set permissions of operation of the community, it is ReadOnly or ReadWrite.

Specify the name for the view, view based management.The default does not specify a view, which allows access to all MIB objects;

You can specify to use the certification of management IP. If not specified, were not limiting the use of the certification of management of IP address.The default is not to limit the use of the certification of management of IP address;

To configure SNMP authentication, execute the following command in the global configuration mode:

Command	Function
Switch#configure terminal	Enter the global model
Switch(config)#snmp-server start	Enable SNMP
Switch(config)# **snmp-server community** *Community name* **[ro | r w|]** *IP access list number [1-1000]*	Set authentication and authority.

can configure one or more specified, to specify a number of different community name,Allows network devices to NMS for different permissions management,To delete the community name and permissions, in global configuration mode,execute no snmp-server community Community name command.

10.2.2. Configure SNMP host address

The Agent in certain cases,also will send a message to the NMS,to configure the Agent actively send messages NMS host address,In global configuration mode, perform the following command:

Command	Function
Switch#configure terminal	Enter the global model
Switch(config)#snmp-server start	Enable SNMP
Switch(config)# **snmp-server host** { *host-addr* [**traps**] *community name* [**version** { **1 | 2**}	Set the SNMP host address
Switch(config)# **no snmp-server host** *community name*	Delete the existing host, the use of the community name removed

10.2.3. Set the SNMP agent parameters

The basic parameters of SNMP Agent configuration,Set equipment contact network elements, equipment of coded information, equipment, location information, serial number,NMS through access device of these parameters,can be told of the contact device, device information such as the physical location.

To configure SNMP agent parameters in global configuration mode, perform the following command:

Command	Function
Switch(config)# **snmp-server contact** text	Set up the system's contact information
Switch(config)# snmp-server location text	Sets the position of system

10.2.4. Close the SNMP agent

To close the SNMP agent services in global configuration mode, perform the following command:

Command	Function
Switch(config)# no snmp-server start	Close the SNMP agent

10.2.5. Configuration agent take the initiative to send NMS sends the Trap message

The Trap is Agent without request to take the initiative to send messages to the NMS,Used to report some urgent and important event.The default is not to allow Agent to send Trap messages,If you want to permit, in global configuration mode, perform the following command:

Command	Function
Switch(config)# **snmp-server enable traps** [*type*] [*option*]	Permit active Agent sends the Trap message

Switch(config)# no snmp-server enable traps [*type*] [option]	Deny active Agent sends the Trap message

10.2.6. Configure the link the trap strategy

In the equipment can be based on the interface configuration LinkTrap whether to send the interface,When the function is enabled, if the interface changes state of the Link, the SNMP will send LinkTrap,don't send conversely.By default, this function enable. Need to come into force in the open Trap alarm function.

Command	Function
Switch#configure terminal	Enter the global model
Switch(config)#interface gigabitEthernet *port id*	Enter interface mode
Switch(config-if-gigabitEthernet-0/1)#**snmp-trap -link-status**	Enable send the interface link trap function
Switch(config-if-gigabitEthernet-0/1)#**no snmp-trap-link-status**	Close send the interface link trap function

10.3. The SNMP monitoring and maintenance

10.3.1. View the current SNMP Open state

In privileged user mode, execute show snmp-status to view the current SNMP open state

```
Switch#show snmp-status
SNMP          ON
SNMP Trap     OFF
```

10.3.2. View the current state of SNMP

In privileged user mode, execute show snmp-server to view the current state of SNMP.

```
Switch#show snmp-server
0 SNMP packets input:
        0 Bad SNMP version errors
        0 Unknown community name
        0 Illegal operation for community name supplied
        0 Encoding errors
        0 Number of requested variables
        0 Number of altered variables
        0 Get-request PDUs
        0 Get-next PDUs
        0 Set-request PDUs
18 SNMP packets output:
        0 Too big errors
        0 No such name errors
```

```
   0 Bad values errors
   0 General errors
   0 Response PDUs
  18 Trap PDUs
```

10.3.3. View the current state of SNMP community

In privileged user mode, execute show community to view the current state of the SNMP community.

```
Switch#show community
---------------------------------------------------
|      Community              |              Read/Write             |
---------------------------------------------------
        private                      RW
        publice                      RW
---------------------------------------------------
```

10.3.4. View user configuration information of host

In privileged user mode, execute show snmp-server Host to view the current proxy user configuration information of host.

```
Switch#show snmp-server Host
Trap destination    Community                                    Trap-Switch    Informs-Switch Version
============================================================================
192.168.100.72       public                                       ON              OFF            Ver 2
```

10.4. RMON

10.4.1. Overview

RMON（Remote Monitoring）is IETF(Internet Engineering Task Force)standard monitoring specification,The specification can make between various network monitors and console systems network monitoring data.Place the RMON detector in the network nodes,network management platform decided what information these detectors,Such as statistical information is monitored, collecting historical information to use time etc..For example, switches and routers and other network equipment, at the network is a network node, through the RMON function, can monitor the node location information.

The development of RMON has experienced three stages, the first stage is the Ethernet Remote Monitoring; second stage has been added to the token ring function, called token ring remote monitor module; the third stage is known as RMON2, so that the higher level of RMON function to monitor the development agreement.

The first phase of the RMON (hereinafter referred to as RMON1) contains ninegroup, all groups are optional (but not mandatory), but some groups must have other group support.

Switch to achieve one of the 1, 2, 3, 9 groups of content: statistics group, history group, Alarm group, event group.

10.4.1.1. Statistics group

Statistics group was first in group RMON, each sub network basic statistical information statistics statistical monitoring.At present, only the network equipment’s interface interface can be monitoring, statistics. The group contains an Ethernet statistics, statistical content including discarded packets, broadcast packets, CRC error, size block, conflicts, etc.

10.4.1.2. History group

The history group is the second group in the RMON, historical groups regularly collecting network statistics, and recorded for later processing. It contains two group:

HistoryControl Group：Used to set the sampling interval, sampling the data source control information.

EthernetHistory Group：Provides network traffic, packet error, broadcast packets, utilization and the number of collisions and other statistical information of historical data for the administrator.

10.4.1.3. Alarm group

The alarm group is the third groups in the RMON,At specified time intervals to monitor a specific MIB(Management Information Base)object，When the MIB object value exceeds the upper limit of a set or below the lower limit value of a set, will trigger the alarm.Alerts are treated as events to handle, the handling of events to log or sending SNMP Trap.

10.4.1.4. Event group

The event group is the ninth groups in the RMON,determine the result of the alarm events, processing behavior is to produce a log record or an SNMP Trap.

10.4.2. Configure RMON

10.4.2.1. Configure event group

You can use the following command to add a table statistics.

Command	Function
Switch(config-if)# **rmon collection stats** *index* [**owner** ownername]	Add a covariance item
Switch(config-if-gigabitEthernet-0/1)# **no rmon collection stats** *index*	Delete a covariance item

Tip	Statistics of the series of products the current version only supports Ethernet interface. The index value should be an integer between 1-65535.

10.4.2.2. Configuration history control group

You can use the following command to add a history control table:

Command	Function
Switch(config-if-gigabitEthernet-0/1)# **rmon collection history** *index* [**owner** ownername] [**buckets** bucket-number] [**interval** *seconds*]	Add a history control table
Switch(config-if-gigabitEthernet-0/1)# **no rmon collection history** *index*	To delete a history control table

Tip

Statistics of the series of products the current version only supports Ethernet interface.

The index value should be an integer between 1-65535.

Bucket-number： Control specifies the data source, time interval.Each sampling interval, are a sampling.Sampling results preserved,Bucket-number A specifies the maximum number of sampling save, when sampling record peak, covering the earliest records.Bucket-number value range is 1-65535, the default value is 10.

Interval： Sampling interval.The default value is 1800 seconds, value between 1-3600.

10.4.2.3. Configure alarm and event groups

You can use the following command to configure warning table:

Command	Function
Switch(config)# **rmon alarm** *number variable interval* {absolute **|** delta} rising-threshold *value* [*event-number*] **falling-threshold** *value* [event-number] [**owner** ownername]	Add an alarm table
Switch(config)# **rmon event** *number* [**log**] [**trap** community] [**description** description-string] [**owner** ownername]	Add an event group table
Switch(config)# **no rmon alarm** *number*	Delete an alarm group
Switch(config)# **no rmon event** *number*	Delete an event group

number： Alarm table index (event), range 1-65535.

variable： The alarm table monitoring variables.Variables must be an integer type.

interval： Sampling interval.Range of <1-4294967295>

Keyword Absolute said with each sampled value and upper, lower comparison,Keywords Delta utilization and last sampling and upper limit, lower limit of difference comparison.

Value defines the upper limit, lower limit value.

Event-number： When more than the upper limit or lower limit, the triggering event group index for Event-number events.

Keyword Log said event trigger action is: the record of events

Keywords Trap represents the event triggered action is: send Trap message to the management station.

Community： When sending Trap certification name.

Description-string： The description of the event.

Ownername： Alarm or event group owner.

10.4.2.4. Display RMON status

Command	Function
Switch#show rmon alarm	Display alarm group
Switch#show rmon event	Display event group
Switch#show rmon	Display history group
Switch#show rmon statistics ethernet	Display statistics group

10.4.3. RMON configuration instance

10.4.3.1. Statistical group instance configuration

If you want to statistics Ethernet port 3, using the following commands:

```
Switch(config)# interface gigabitEthernet 0/3
Switch(config-if-gigabitEthernet-0/13)# rmon collection stats 1 owner zhangsan
```

10.4.3.2. History group instance configuration

If you want the 500 historical information every 10 minutes and statistics third Ethernet ports, use the following command:

```
Switch(config)# interface gigabitEthernet 0/3
Switch(config-if-gigabitEthernet-0/3)#rmon collection history control 1 500 interval 600 owner zhangsan
```

10.4.3.3. Alarm and Event groups instance configuration

If you want to configure for a statistical MIB variables alarm function.In the following example illustrates thMIB-II IfEntry Table instance ifInNUcastPkts. 6 (port 6 received on the number of unicast frame, for instance identifier 1.3.6.1.2.1.2.2.1.12.6)set alarm function.Specific functions as follows:

Switches every 30 seconds to check port 6 received on the change of the number of unicast frame,If received a unicast frame number than the last time check (30 seconds ago) increased by 20 or more than 20,or more than the last time only 10 or 10 below, the alarm is triggered,at the same time, the alarm will trigger event 1 for the corresponding operation(logged in, and send the certification called rmon "Trap", the description of the event as "ifInNUcastPkts is too much").Alarm and event owners are zhangsan item table.

```
Switch(config)# rmon alarm 10 1.3.6.1.2.1.2.2.1.12.6 30 delta risingthreshold 20 1 fallingthreshold 10 1 owner zhangsan
Switch(config)#rmon event 1 log 200 trap rmon description "ifInNUcastPktsistoomuch" owner zhangsan
```

10.4.3.4. Rmon status display instance

Show rmon alarm

```
Switch#show rmon alarm
Alarm 10 is active, owned by zhangsan
Monitoring variable: ifInNUcastPkts.6,    Sample interval: 30 second(s)
Taking samples type: delta,         last value was 0
Rising threshold :      20,             assigned to event: 1
```

```
Falling threshold :    10,              assigned to event: 1
```

show rmon event

```
Switch#show rmon event
Event 1 is active, owned by zhangsan
Description : "ifInNUcastPktsistoomuch"
Event firing causes: log, last fired at 00:20:35

Current log entries:
            logIndex                logTime                    Description
-----------------------------------------------------------------
                  1                   00:19:35            "ifInNUcastPktsistoomuch"
                  2                   00:20:05            "ifInNUcastPktsistoomuch"
                  3                   00:20:35            "ifInNUcastPktsistoomuch"
```

show rmon history control

```
Switch#show rmon history control
----------------------------------
RMON history control entry index: 1
            Data source: IfIndex.3
            Buckets request: 500
            Buckets granted: 1
            Interval: 600
            Owner: zhangsan
            Entry status: Valid
```

show rmon statistics ethernet

```
Switch#show rmon statistics ethernet
-------------------------------
Ethernet statistics table information:
              Index: 1
              Data Source: ifIndex.3
              Owner: zhangsan
              Status: Valid
------------------------------
  ifIndex.3 statistics information:
------------------------------
  DropEvents:0
  Octets: 8257011
  Pkts:100635
  BroadcastPkts:377
  MulticastPkts:288
  CRCAlignErrors:0
  UndersizePkts:0
  OversizePkts:0
  Fragments:0
  Jabbers:0
  Collisions:0
  Pkts64Octets:218
  Pkts65to127Octets:100334
```

```
Pkts128to255Octets:76
Pkts256to511Octets:7
Pkts512to1023Octets:0
Pkts1024to1518Octets:0
```

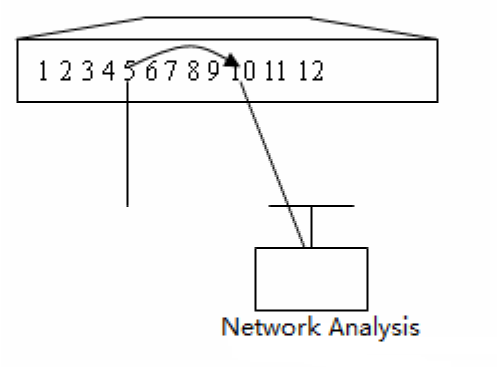
11. Configure SPAN

11.1. Overview

11.1.1. Learning SPAN

The user can use the port mirroring (SPAN) provides the function, the Design-Port packet is copied to the switch on another connected with network monitoring equipment port, for network monitoring and troubleshooting.

Through the SPAN can monitor all incoming and output message from the source port.For example, in the following figure,Port 5 on all the packets are mapped to the port 10,Connected on port 10 of the network analyzer although not direct connected with port 5, but can be received by all the packets on port 5.



SPAN configuration instance

SPAN does not affect the message source and destination ports exchange,just from the source port all input and output message copying a to the port of destination.When the image flow of source port more than the destination port's bandwidth,For example, the 100Mbps destination port monitoring 1000Mbps source port traffic, may cause packet is discarded.

11.2. SPAN concepts and terminology

11.2.1. SPAN Session

SPAN session is to mirror the flow of data between source port and destination port,can monitor a single or multiple ports of input, output, two-way message.Interface and AP type of port can be configured to SPAN session source port and destination port..Port after joining SPAN session does not affect the normal operation of the switch.

The user can in the shutdown port configuration SPAN session,But the SPAN session is inactive, only the relevant port is opened, the SPAN session will become active.In addition, the SPAN session on the switch power does not take effect immediately,until the destination port in an operational state, the SPAN session is only active.Operation users can view the SPAN session through the command **show monitor session .**

11.2.2. Image data flow

11.2.2.1. Data flow direction

The SPAN session consists of the following three direction of data flow:

The input data stream：All of the source port receives the message will be copied to the port of destination.In a SPAN session, users can monitor one or more source port input message.For some reason (e.g., port security), from the source port input message may be discarded, but this does not affect the function of SPAN, the newspaper article will still be the mirror to the port of destination.

The output data stream： All messages sent from the source port will be a copy to the destination port.In a SPAN session, users can monitor one or more source port output message.If for some reason, a message sent to the source port from other port may be discarded,similarly, the packet will not send to the port of destination.For some reason from the source port output message format may change,for example, the source port output after routing message,the message of the source MAC, destination MAC, VLAN ID and TTL changes,as well, the format of the message copy to the destination port will also change.

Bidirectional data flow： Including the above two kinds of data flow.In a SPAN session, the user can monitor one or more of the source port of the direction of the input and output data stream.

11.2.2.2. SPAN Traffic

Using SPAN can monitor all communications, including multicast frames, BPDU frame, etc.

11.2.3. Source port

Source port, also known as being monitored, the SPAN session, the data flow on the source port be monitored,for network analysis and troubleshooting.In a single SPAN session, the user can monitor the input, output, and bidirectional data flow, and the source port there is no limit to the number of the big 。

Source port has the following features:

The source port is not AP.

The source port cannot at the same time as the destination port.

Source and destination ports can belong to the same VLAN, can also belong to different VLAN.

11.2.4. Destination port

SPAN session has a destination port (also known as a monitoring port), for message receiving source port copy. The destination port has the following features:

The destination port is not AP port.

The destination port cannot at the same time as the source port.

11.3. Configure SPAN

11.3.1. SPAN default state

Features	Default value
SPAN status	close

11.3.2. Create the SPAN session and specify the destination port and port

Users can create the SPAN session according to the following steps and specify the destination port (monitor port) and port (by monitoring port):

Command	Function
Switch(config)# monitor session *session_num* source iUsers can create the SPAN session according to the following steps and specify the destination port (monitor port) and port (by monitoring port):nterface Gigabitethernet *id* {both | rx | tx}	Specified Source port.For **Gigabitethernet** *id*, please specify the corresponding slogans.
Switch(config)# monitor session *session_num* destination interface Gigabitethernet *id*	Specified destination port.For **Gigabitethernet** *id*, please specify the corresponding slogans.

If you want to remove the SPAN session, you can use the **no monitor session** *session_num* global configuration command.

Use the**no monitor session** *session_num* **source interface Gigabitethernet** *port-id* command can delete the source port.

Use no monitor session *session_num* destination interface Gigabitethernet *port-id c*an delete the destination port.

The following example shows how to create a SPAN session:Session 1, first of all, will be clear of the current session 1 configuration,then set the port gigabitEthernet 0/1 message to the mirror port gigabitEthernet 0/8. Show monitor session privilege commands are used to confirm the configuration was successful.

```
Switch(config)# no monitor session 1
Switch(config)# monitor session 1 source interface Gigabitethernet 0/1 both
Switch(config)# monitor session 1 destination interface Gigabitethernet 0/8
Switch(config)# end
Switch#show monitor session
--------------
Session :1
Type       : Local Session
Source interface:     Gi 0/1
BOTH      :Gi 0/1
Destination interface:    Gi 0/8
```

11.3.3. Delete the SPAN session

Users can follow the steps below to remove from a SPAN session.

	Command	Function
Step 1	Switch(config)# **no monitor session** *session_num*	Delete the specified SPAN session.

Use the no monitor session session_num global configuration command to delete from the specified SPAN group.The following example shows how to delete SPAN 1 and confirm the configuration was successful.

```
Switch(config)# no monitor session 1
Switch(config)# end
Switch#show monitor session
```

11.4. Display SPAN status

The use of show monitor privilege command can display the current SPAN configuration state,The following example illustrates how to command displays the current state of SPAN session by show monitor privileges.

```
Switch#show monitor session
--------------
Session :1
Type       : Local Session
Source interface:     Gi 0/1
BOTH     :Gi 0/1
Destination interface:    Gi 0/8
```

12. Configure the flow control based port

12.1. Storm Control

12.1.1. Overview

When there is an excess of broadcast, multicast or unknown unicast data flows in LAN,lead to the decline of the network performance, and even network paralysis,in this case we call the LAN storm.

We can respectively for broadcast and multicast storm and unknown unicast data flow executive storm control.When the switch port receives the broadcast and multicast or unicast unknown data flow rate is more than the bandwidth of the set,equipment will only be allowed through set with wide data flow,beyond the bandwidth of data flow will be discarded, until the data flow back to normal,to avoid excessive flood data flow into the LAN formed in the storm.

12.1.2. Configure Storm Control

In interface configuration mode, please use the following command to configure the storm control:

	Command	Function
t e p 1	Switch(config-if-GigabitEthernet-0/1)# storm-control {broadcast | multicast | unicast| brd_multi | uni_brd | uni_brd_multi | uni_multi } [kbps *rate-kbps*]	**broadcast** Enable to the control function of the broadcast storm. **multicast** Enable Open to the unknown multicast storm control functions. **unicast** Enable to the unknown unicast storm control function. **brd_multi**：Enable the control function of broadcast and multicast storm. **uni_brd**：Enable to the unknown unicast and broadcast storm control function. **uni_brd_multi**：Enable to the unknown unicast, broadcast and multicast storm control functions. **uni_multi**：Enable to the unknown unicast and multicast storm control function. *Rate-bps*[illegible]

Interface configuration mode by the command **no storm-control** to close the storm interface and corresponding control function.

The following example opens the broadcast storm on port GigabitEthernet 0/1 control function, and is set to 64K.

```
Switch# configure terminal
Switch(config)# interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)# storm-control multicast bps 64
Switch(config-if-GigabitEthernet-0/1)# end
```

12.1.3. Show storm control enable state

Show storm control enable state

	Command	Function
Step 1	Switch# show storm-control	Show storm control information.

The following example to show the state of storm control function enable state

```
Switch#show storm-control
interface   unicast    broadcast   multicast   action
Gi 0/1        enable      enable        disable       none
Gi 0/2     disable    disable    disable    none
Gi 0/3     disable    disable    disable    none
Gi 0/4     disable    disable    disable    none
Gi 0/5     disable    disable    disable    none
Gi 0/6     disable    disable    disable    none
Gi 0/7     disable    disable    disable    none
Gi 0/8     disable    disable    disable    none
Gi 0/9     disable    disable    disable    none
```

12.2. Isolate Port

12.2.1. Overview

Some application environment, require the part between ports on a switch can't communicate,Can set some Port to Isolate port to achieve a goal.

After the port is set as the isolated port, isolation between ports cannot communicate each other,The isolate port between the non isolated port can be normal communication.When the two protection port to a SPAN port, SPAN port to send or receive a frame can still image into the SPAN destination port.

Equipment support **link-aggregation** *Port* is set to the isolation port,When a **link-aggregation** *Port* is set to the isolation port, all members of the l**ink-aggregation** *Port* is set to isolation port..

12.2.2. Configuration Isolate Port

Set interface for the protection of port：

Command	Function
Switch(config-if-GigabitEthernet-0/1)#**isolate-port** {**link-aggregation** *ap-id*| **interface** *port-id*}	The interface and related interface segregation

Through the **no switch isolate-port** {**link-aggregation** *ap-id*| **interface** *port-id*} interface configuration command to a port reset to protect the mouth.

The following example illustrates how the Gigabitethernet 0/1 and Gigabitethernet 0/2 set to isolate Port.

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)#isolate-port interface GigabitEthernet 0/2
```

12.2.3. Display Isolate Port configuration

	Command	Function
Step 1	Switch# show isolate-port	Show the separation configuration

Through the **show isolate-port** command to view the protection port settings

```
Switch#show isolate-port
Gi 0/1 : Gi 0/2
Gi 0/2 : Gi 0/1
Gi 0/3 :
Gi 0/4 :
Gi 0/5 :
Gi 0/6 :
Gi 0/7 :
Gi 0/8 :
Gi 0/9 :
link-aggregation 1 :
```

12.3. Port Security

12.3.1. Overview

Port security function through the source MAC address message to define whether packet can enter the switch port,You can set a specific static MAC addresses or learn to limit the number of dynamic MAC address to control the message whether can enter the port.Enable port security port called port security.Only the source MAC address is the port security address table configuration or has to learn the MAC address message,before they can enter the exchange communication,other packets will be dropped.You can also set the port security address bind IP+MAC+PORT to port security address used to limit must be consistent with the binding for the source MAC address of the packet to switch the communication;In accordance with ARP message IP+MAC+PORT can enter the switch,Does not conform to the IP+MAC+PORT message binding will be dropped.

Port security also supports the function of the Sticky MAC address,by enable the function,Can be dynamically learned to address the safety of the conversion for static configurationIn show running-config, can be seen in the configuration,Save the configuration after the restart, without having to learn these dynamic security address,And if this feature is not enabled, then the dynamic learning into the safety of the MAC address on the switch after the restart to learn again.You can secure address for each security port configured maximum security address number,maximum security address number refers to the total number of static configuration and dynamic learning security address,when the security port security address does not reach the maximum number of safety,security port can dynamically learn new dynamic security address,when security address number reaches maximum number,Safe port will no longer study dynamic security address,If there are new user access security port, will produce a security violation.You can handle security violation according to the following three ways:

protect：When the number of address is full, safe port will discard all new user data access flow.The processing mode as the default for violation processing mode.

12.3.2. The default configuration of port security

The following table shows the default configuration of port security:

Features	Default value
Port safety switch	All ports are closed port security function
Security address	None

Safe way of address binding	None
Dynamic MAC addresses learning	Enable

12.3.3. Configure port security

In interface configuration mode, please configure port security and exception processing mode uses the following commands:

Command	Function
Switch(config-if-GigabitEthernet-0/3)#port-security enable default [deny|permit]	Enable the port security functions of the interface:Deny:Unbound port refused Permit:Unbound port permit
Switch(config-if-GigabitEthernet-0/3)# port-security disable	Close the port security functions of the interface.

The following example illustrates the enable port security function interface on gigabitethernet0/3.Binding method for IPMAC

Switch# configure terminal

Enter configuration commands, one per line. End with CTRL+Z.

Switch(config-if-GigabitEthernet-0/3)#**port-security add ip-address** 1.1.1.1 mac-address 0000.0000.0001 Description xxxx

12.3.4. configure Security address of security port .

In the port mode, please use the following command added security for safe port address:

Command	Function
Switch(config-if-GigabitEthernet-0/1)# **port-security add ip-address** *X.X.X.X* mac-address *XXXX.XXXX.XXXX* Description xxxx	In configuration mode, the port to allow access to the host's IP address and MAC and port.

In the port mode, use the command**port-security move ip-address** *X.X.X.X* **mac-address** *XXXX.XXXX.XXXX* to delete the address table configuration.

The following example shows how to configure port security binding and access mode

Switch# configure terminal

```
Switch(config-if-GigabitEthernet-0/1)#port-security add ip-address 1.1.1.1 mac-address 0000.0000.0001
Switch(config-if-GigabitEthernet-0/1)#port-security visitor ip-address 1.1.1.3 mac-address 0000.0000.0002 times 5 Description xxx
```

Tip	When the host match permit rule, which is to permit the host biggest quantity is full can also access the network; When refused to host matching rules, which is to allow the host biggest quantity under cannot access the network.

12.3.5. View port security information

In privileged mode, through the following command to check port security information:

Command	Function
Switch#show port-security active-table	View the current port security is not binding information
Switch#show port-security all	View the current port security all information
Switch#show port-security default	View the current port security unbounded port is granted or denied
Switch#show port-security rule	View the current port security binding information
Switch#show port-security visitor	View the current port security visitor information

The following example shows the port security of all address table information:

```
Switch#show port-security all
IP address          MAC address         interface-name        bind-code            age-t(m)    out-t(m)
description
---- ---- ------------------------------- -----------------------------------------
192.168.10.11       0012.1102.1133      Gi 0/1                IPMACPORT                   0
----
```

The following example shows the port security not binding IP and MAC:

```
Switch#show port-security active-table
IP address          MAC address       interface-name      bind-code        age-t(m)    out-t(m)
description
---- ---- ------------------------------- -----------------------------------------
192.168.100.7       0086.302A.05E1      link-aggregation 1    ACTIVE(UNBIND)     10       9
192.168.100.24      0800.27A1.3A4C      link-aggregation 1    ACTIVE(UNBIND)     10       9
192.168.100.61      80C1.6EDF.AF7F         Gi 0/5             ACTIVE(UNBIND)     10       9
```

The following example shows the port security unbounded port is granted or denied:

```
Switch#show port-security default
IP address          MAC address         interface-name        bind-code            age-t(m)    out-t(m)
description
---- ---- ------------------------------- -----------------------------------------
-----               ----                ----                  PERMIT(DEFAULT)     0            ----        ----
```

The following example shows the current port security binding information:

```
Switch#show port-security rule
IP address          MAC address         interface-name        bind-code            age-t(m)    out-t(m)
description
---- ---- ------------------------------- -----------------------------------------
192.168.10.11       0012.1102.1133      Gi 0/1                IPMACPORT                  0
----
```

The following example shows the current port security visitor information:

```
Switch#show port-security visitor
IP address        MAC address       interface-name      bind-code          age-t(m)    out-t(m)
description
---- ---- ------------------------------- -----------------------------------------
192.164.1.2       0012.0001.0002      Gi 0/5            VISITOR          50            49
```

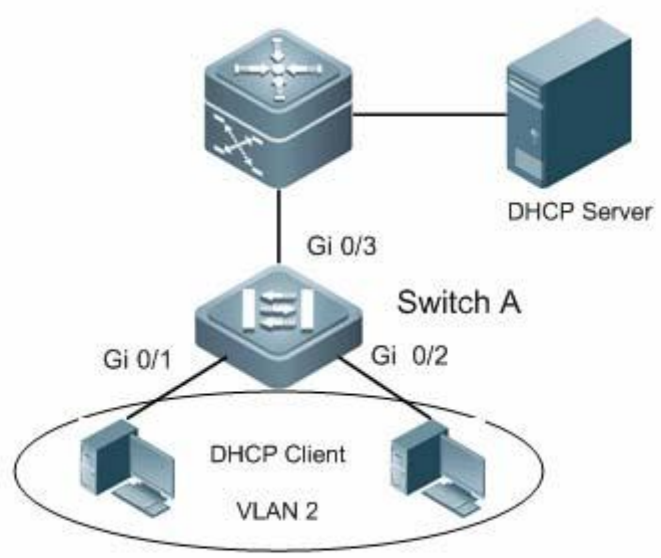
13. Anti-illegal DHCP Server

13.1. Summary

DHCP is a dynamic protocol to assign IP addresses to the PC client dynamically. It can be used for users or internal network administrator as central management to all the computers.

DHCP Snooping technique is DHCP security features, its main effect is filtering untrusted DHCP information through configuring untrusted port. The information refers to the DHCP information from untrusted port. The following are some of the explanation of the concept of DHCP Snooping:

DHCP Snooping TRUST port: DHCP Snooping divided the ports into two types, TRUST port and UNTRUST port, equipment only forwards the DHCP Offer message TRUST port received, But discards all the DHCP Offer message from UNTRUST port, then we set legal DHCP Server connected port as TRUST port, and the other port set as UNTRUST port, this can realize the shielding of illegal DHCP Server.



1-1

As shown in diagram 1-1 network environment. The Client obtain IP address and surf the Internet through legal DHCP Server. Set the switch port connected by client as untrust port according to the requirement, set the switch port connected by DHCP Server as trust port. So we can put an end to the affect to other user that private set up illegal DHCP Server user caused.

13.2. DHCP Snooping Configuration

13.2.1. Enabling DHCP Snooping

Only after enabling the DHCP Snooping, DHCP Snooping function will take effect, the configured trusted port and untrusted port can work properly.

Command	Function
Switch(config)# **dhcp-snooping**	Enable DHCP Snooping, DHCP Snooping is disabled by default.

Enabling DHCP Snooping in global configuration mode:

```
Switch# configure terminal
Switch(config)#dhcp-snooping
  Global DHCP mode:   enable
```

13.2.2. Trusted Port Configuration

Use the following command to configure DHCP Snooping trusted port in interface configuration mode:

Command	Function
Switch(config-if-GigabitEthernet-0/1)# **dhcp-snooping trust**	set the port as DHCP Snooping trusted port.
Switch(config-if-GigabitEthernet-0/1)# **no dhcp-snooping trust**	delete the port from trusted port, that is, to set it as untrusted port.
Switch(config-link-aggregation1)#**dhcp-snooping trust**	set the link aggregation group as DHCP Snooping trusted link aggregation group(the link aggregation group must has
Switch(config-link-aggregation1)#**no dhcp-snooping trust**	delete the link aggregation group from trusted link aggregation group, that is, to set it as untrusted port.

The following example is to configure DHCP Snooping trusted port:

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)#dhcp-snooping trust
```

The following example is to configure DHCP Snooping untrusted port:

```
:
Switch(config-if-GigabitEthernet-0/1)#no dhcp-snooping trust
```

The following example is to configure DHCP Snooping trusted AP port:

```
          Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#link-aggregation 1
Switch(config-link-aggregation1)#dhcp-snooping trust
```

The following example is to configure DHCP Snooping untrusted AP port:

```
Switch(config-link-aggregation1)#no dhcp-snooping trust
```

13.2.3. Disable DHCP Snooping

Command	Function

Switch(config)#no dhcp-snooping	Disable DHCP Snooping

The following example is to disable global DHCP Snooping.

```
Switch# configure terminal
Switch(config)#no dhcp-snooping
  Global DHCP mode:   disable
```

13.3. View DHCP Snooping Information

Use the following command to view DHCP Snooping information in privileged mode:

Command	Function
Switch#show dhcp-snooping	Display DHCP Snooping information.

The following example is to display DHCP Snooping information:

```
Switch#show dhcp-snooping
        dhcp-snooping configuration information:
        dhcp-snooping status:enable
        dhcp-snooping port   information :
----------------------------------------------------
        interface                 trust-status
        Gi 0/1                       trust
        Gi 0/2                       untrust
        Gi 0/3                       untrust
        Gi 0/4                       untrust
        Gi 0/5                       untrust
        Gi 0/6                       untrust
        Gi 0/7                       untrust
        Gi 0/8                       untrust
        Gi 0/9                       untrust
        link-agg 1                  trust
```

14. Anti-ARP-Spoofing

14.1. Summary

According to the design of the ARP protocol, in order to reduce the excessive ARP data communication in the network, a host, even if received ARP reply is not requested itself, it also can insert it into the ARP cache table, but the ARP protocol itself does not check the validity of ARP message it received. It will cause attackers using leaky agreement and forged IP address and MAC address for ARP spoofing attacks.

In addition to cause the user privacy disclosure, ARP spoofing can also cause a network failure, network impassability,etc.

Anti-ARP spoofing function will filter the possible ARP spoofing attacks by the establishment of anti spoofing sheet, record suspicious attack source.

14.2. Anti-ARP-Spoofing Configuration

14.2.1. Enable Anti-ARP-Spoofing

Please use the following command to configure Anti-ARP-Spoofing in interface configuration mode:

Command	Function
Switch(config-if-GigabitEthernet-0/1) #**arp-inspection**	Enable Anti-ARP-Spoofing function of the port
Switch(config-link-aggregation1)#**arp-inspection**	Enable Anti-ARP-Spoofing function of the link aggregation group.

The following example is to enable Anti-ARP-Spoofing function:

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)# arp-inspection

Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#link-aggregation 1
Switch(config-link-aggregation1)# arp-inspection
```

14.2.2. Disable Anti-ARP-Spoofing

Please use the following command to configure Anti-ARP-Spoofing in interface configuration mode:

Command	Function
Switch(config-if-GigabitEthernet-0/1)# **no arp-inspection**	Disable Anti-ARP-Spoofing function of the port
Switch(config-link-aggregation1)#**no arp-inspection**	Disable Anti-ARP-Spoofing function of the link aggregation group.

The following example is to disable Anti-ARP-Spoofing function:

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)#no arp-inspection

Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#link-aggregation 1
Switch(config-link-aggregation1)#no arp-inspection
```

14.3. View information of Anti-ARP-Spoofing

Use the following command to view Anti-ARP-Spoofing information in Privileged mode：

Command	Function
Switch#show arp-inspection config	Display the configuration information of Anti-ARP-Spoofing function
Switch#show arp-inspection status	Display the list item information of Anti-ARP-Spoofing function.

The following example is to view the configuration information of Anti-ARP-Spoofing function:

```
Switch#show arp-inspection config
interface-name          status
---- ---- -------------------------------
  Gi 0/1              arp-inspection: disable
  Gi 0/2              arp-inspection: enable
  Gi 0/3              arp-inspection: enable
  Gi 0/4              arp-inspection: enable
  Gi 0/5              arp-inspection: enable
  Gi 0/6              arp-inspection: enable
  Gi 0/7              arp-inspection: enable
```

```
 Gi 0/8              arp-inspection: enable
 Gi 0/9              arp-inspection: enable
 link-aggregation 1 arp-inspection: enable
```

Notes: enable:enable Anti-ARP-Spoofing   disable:disable Anti-ARP-Spoofing

The following example is to view the list item information of Anti-ARP-Spoofing function:

```
Switch#show arp-inspection status
VID          MAC address              IP address               interface-name         tbl-status    ---- ----
------------------------------- -----------------------------------------
40              0001.7AD2.4D8C       192.168.100.1        Gi 0/4                        AFFIRM          40
DDCC.BBAA.4B79       0.0.0.1                  Gi 0/4                        ATTACK           40
0087.2380.9EA7       192.168.1.137         Gi 0/4                        AFFIRM           40
C860.00E0.2B80       192.168.100.51       Gi 0/4                        ATTACK
40              7427.EA36.DD67       192.168.0.145        Gi 0/4                        AFFIRM
40              7427.EA36.DE14       10.10.10.5            Gi 0/4                        AFFIRM
```

Notes:

Vid：the vlan where the port is;   MAC address：MAC Address

IP address：IP address   interface-name：port name

tbl-status：the status of Anti-ARP-Spoofing table, AFFIRM refers to normal,

ATTACK refers to the member is attacking.

15. Port Rate Limit

15.1. Overview

With the rapid development of the Internet, there are more and more needs to transmit multimedia stream on the Internet. Generally speaking, Users ask different service quality for different multimedia application. It needs the network can allocate and schedule the resource according to the users' needs. Therefore, the network administrator need to limit the rate of corresponding ports.

15.2. Configure port rate limit

Enter the interface pattern to configure the Upstream Rate limitation.

Command	Function

Switch(config-if-GigabitEthernet-0/1)#**rate-limit** {Rate}
{ Committed Burst size} { Excess Burst size}
	Configure the port rate limitation
	rate:
	Committed Burst size：
	Excess Burst size：

Below is the example to configure the Upstream Rate limitation：

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)#rate-limit 10000 100000 100000
```

Enter the interface pattern to configure the Downstream Rate limitation.

Command	Function

Switch(config-if-GigabitEthernet-0/1)#**traffic-shape** {Rate} { Committed Burst size}
{ Excess Burst size}
	Configure the port rate limitation
	rate:
	Excess Burst size：

Below is the example to configure the port Rate limitation Switch#**configure terminal**

```
Enter configuration commands, one per line.  End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
      Switch(config-if-GigabitEthernet-0/1)#traffic-shape  64  1
```

15.3. Close the port rate limitation

Enter the interface pattern to close the Rate limitation.

Command	Function
Switch(config-if-GigabitEthernet-0/1)#**no rate-limit**	Close the port Upstream Rate Limitation
Switch(config-if-GigabitEthernet-0/1)#**no traffic-shape**	Close the port Downstream Rate Limitation

Below is the example to close the port upstream Rate limitation：

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)#no rate-limit
```

Below is the example to close the port Downstream Rate limitation：

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)#no traffic-shap
```

15.4 Check the port upstream rate limitation information

Enter the privileged pattern, check the port upstream limitation information by below Commands.

Command	Function
Switch#show rate-limit [*interface*]	Show the upstream rate limitation information.

Below is the example to show the port upstream Rate limitation information：

```
Switch#show rate-limit
Gi 0/1
 rate-limit 64 12000 120000
```

64：Rate

12000：Excess Burst size

120000：Excess Burst size

15.4. Check the port Downstream rate limitation information

In the privileged pattern, check the port Downstream limitation information by below Commands.

Command	Function
Switch#show traffic-shape [*interface*]	Show the downstream rate limitation information.

Below is the example to show the port Downstream Rate limitation information：

```
Switch#show traffic-shape
Gi 0/1
  traffic-shape 128 1000
Gi 0/2
  The traffic shape is not configured
Gi 0/3
  The traffic shape is not configured
Gi 0/4
  The traffic shape is not configured
Gi 0/5
  The traffic shape is not configured
Gi 0/6
  The traffic shape is not configured
Gi 0/7
  The traffic shape is not configured
Gi 0/8
  The traffic shape is not configured
Gi 0/9
  The traffic shape is not configured
```

16. Loopback Detection

16.1. Overview

Loopback-detection bases on the port configuration, it monitors if the Ethernet frame transmitted from the port comes back to the equipment through the same port. Judge if the port TX-RX self-loop or the network exists loop.

16.2. Configure loop detection.

Enter global patterns to configure loop detection.

Command	Function
Switch(config)#**loopback-detection** **[***enable*|*interval*|*errdisable***]**	Configure loop detection,enable: Open detection （default on） Interval:Set loop detection time.（2-15secs，Default3s） Errdisable：Port recovery time（30-86400S Default 60s）

Below is the example that configuration port open loop detection and set the detection time slot：

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CTRL+Z.
Switch(config)#loopback-detection enable
Switch(config)#loopback-detection interval 2
Switch(config)#loopback-detection errdisable recover 30
```

```
 Switch#configure terminal
Enter configuration commands, one per line.  End with CTRL+Z.
Switch(config)#loopback-detection enable
Switch(config)#loopback-detection interval 2
Switch(config)#loopback-detection errdisable recover 30
```

16.3. loop detection processing mechanism

Processing mechanism when Enter the port patterns to revise the loop

Command	Function
Switch(config-if-GigabitEthernet-0/1)#**loopback-detection** control	processing mechanism: Close the port
Switch(config-if-GigabitEthernet-0/1)#**noloopback-detection** control	processing mechanism :Warning

Below is the example to revise the port loop processing mechanism function.

```
Switch#configure terminal
Enter configuration commands, one per line.  End with CTRL+Z.
Switch(config)#interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)#loopback-detection control
Switch(config-if-GigabitEthernet-0/1)#no loopback-detection control.
```

Notes: Revise the link aggregation loop processing mechanism, Similarly

16.4. Check loopback detection

Enter the privileged pattern to check the loopback-detection.

Command	Function
Switch#show loopback-detection	Check loopback detection and configuration：

Below is the example to check loopback detection.

```
Switch#show loopback-detection
  Loopback detection is Runing on!
  Detection interval time is 2 seconds
  Error Disable recover time is 60 seconds
Interface                    Action          State
--------------------     ----------     -----------
  Gi 0/5                     WARNING         LINK_DOWN
  Gi 0/6                     CONTROL         LINK_DOWN
  Gi 0/7                     CONTROL         LINK_DOWN
  Gi 0/8                     CONTROL         LINK_DOWN
  link-aggregation 1       CONTROL         NORMAL
  link-aggregation 2       CONTROL         LINK_DOWN
```

16.5. close loopback detection.

Enter the global patterns to close loopback detection.

Command	Function
Switch(config)#no loopback-detection	Close loopback detection.

Below is the example to close loopback detection：

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
```

```
Switch(config)#no loopback-detection enable
```

17. Access Control

17.1. Overview

Information between port and port and communication inside and outside is essential business requirements of enterprise internet. To ensure security of the network, it needs safety strategy to ensure unauthorized users can only access specific network resources to reach and control visits.
In brief, ACL can filter network traffic and is a type of internet technology of access control.

17.2. configure access control

Enter into global mode and configure access control：

Step 1

Command	Function
Switch(config)#ip access-list [standard|extended]（0-9|10-19）	Configuration list of access control： Standard：it can configure table 0-9 Extended：it can configure table 10-19
Switch(config)#mac access-list extended （20-25）	Access-list extended：extended mac access control list can configure table 20-25

Step 2

Enter into standard IPSwitch(config)#ip access-list standard 9 and configure

Command	Function
Switch(config-std-ip-nacl)#0 [permit|deny][any|host|sip]	Rule of configuration: Permit：Allow matching rules of IP data flow Deny：Refuse matching rules of IP data flow

Enter into extended IP Switch(config)#ip access-list extended 10and configure

Command	Function
Switch(config-ext-ip-nacl)#0 [permit|deny] [any|host|sip]	Rule of configuration: Permit: Allow matching rules of IP data flow Deny: Refuse matching rules of IP data flow

Enter into extended MAC Switch(config)#mac access-list extended 20 and configure

Command	Function
Switch(config-ext-mac-nacl)# 0 [permit|deny] [any|host]	Rule of configuration: Permit: Allow matching rules of MAC data flow Deny:Refuse matching rules of MAC data flow

Step 3

Enter into standard IP rule table Switch(config)#ip access-list standard 9 and configure

Command	Function
Switch(config-std-ip-nacl)#0 permit [any|host|sip]	Rule of configuration access list: Any: Any source IP address Host: specified source IP Sip: specified source IP and mask

Enter into extended IP rule table Switch(config)#ip access-list extended 10and configure

Command	Function
Switch(config-std-ip-nacl)#0 permit ip [any|host|sip]	Rule of configuration access list: specified protocol type:igmp、ip、tcp、udp Any :Any source IP address,parameter (any|host|dip) host：specified source IP(any|host|dip) sip： specified source IP, mask and parameter (any|host|dip)

Enter into extended MAC Switch(config)#mac access-list extended 20and configure

Command	Function
Switch(config-ext-mac-nacl)# 0 deny [any|host]	Rule of configuration access list: Any：Any source mac address, objective MAC parameters (any|host) host：specified source mac, objective MAC parameters (any|host) Protocol: <0x0000-0xffff> optional

After the success of the configuration rules into port under application configuration

Command	Function
Switch(config-if-GigabitEthernet-0/1)#mac access-list 20 commit	Application of list rule in ports

Following example for configure standard IP, extended IP, extended MAC：

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#ip access-list standard 0
Switch(config-std-ip-nacl)#0 deny host 1.1.1.1
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#ip access-list extended 10
Switch(config-ext-ip-nacl)#0 permit ip sip 1.1.1.3 255.255.255.0 host 1.1.2.1

Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#mac access-list extended 20
Switch(config-ext-mac-nacl)# 0 deny host 0000.0000.0001 host 0000.1111.1111
```

17.3. Configure access control of closing the command

Enter port cancel the configuration access control：

Command	Function
Switch(config-if-GigabitEthernet-0/3)#**no ip access-list**（0-9|10-19）	Cancel configuration access control list: 0-9：cancel standard IP access control list on ports from 0-9 table 10-19：cancel extended IP access control list on ports from 10-19 table
Switch(config-if-GigabitEthernet-0/3)#**no mac access-list** （20-25）	Configure access control list: cancel port extended mac access control list from 20-25

Enter into global mode and delete access control list:

Command	Function
Switch(config)#**no access-list**（0-9|10-19|20-25）	Cancel configuration access control list: 0-9: cancel standard IP access control list from table0-9 10-19: cancel extended IP access control list from table10-19 20-25: cancel extended mac access control list from table 20-25

Enter rule table Switch(config)#ip access-list extended 10 and delete access control table:

Command	Function
Switch(config-ext-ip-nacl)#**no [0-9]**	Cancel configure access control list: 0-9：delete extended IP access control list rule to configure table 0-9(standard IP, extended MAC, same command)

Following example is to close access control from ports, delete rule tables, and rules:

Close access control from ports

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)# interface gigabitEthernet 0/1
Switch(config-if-GigabitEthernet-0/1)#no ip access-list 10
```

Delete rule tables

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
```

```
Switch(config)#no access-list 9
```

Delete rules

```
Switch#configure terminal
Enter configuration commands, one per line.   End with CTRL+Z.
Switch(config)#ip access-list extended 10
Switch(config-ext-ip-nacl)#no 9
```

17.4. Check access control list

Enter into privilege mode and check access-list:

Command	Function
Switch#show access-list	Check access-list all information

Following is to check access control function:

```
Switch#show access-list
ip access-list standard 9
0 permit host 192.168.1.23
ip access-list extended 10
1 deny tcp any any
mac access-list extended 20
mac access-list extended 21
3 deny host 0012.0012.0012 any
```

18. File system Configuration

18.1. Overview

Switch files containing several types, The main file types for the IOS image file and the configuration file. The configuration file is divided into:

1·Startup-config：Boot for the first time, will read and parse the file, and perform the configuration file.

2·Running-config：This file is a copy of the current state of the use of the command, the file is dynamic, and will be updated after each configuration commands.

18.2. Filesystem operation

Enter file configuration mode, the implementation of file system basic operation command:

Command	Function
Switch#configure filesystem	Enter the file configuration mode
Switch(config-fs)#**dir**	Dir command to display the directory file, the default directory is usually Flash file systems.
Switch(config-fs)#**dir** {word}	Display files in the specified directory, word: directory name
Switch(config-fs)#**copy tftp** {Server IP} {The file name on the server }{Save the file name on	Switches through the TFTP download file
Switch(config-fs)#**mkdir** {word}	Create adirectory, word: directory name
Switch(config-fs)#**cd** {word}	Enter directory, word: directory name

The following example for input dir the default display:

```
Switch#configure filesystem
Switch(config-fs)#dir
  size            date         time         name
--------        ------      ------     --------
0             JAN-01-1980   00:00:04    config              <DIR>
0             JAN-01-1980   00:00:04    script             <DIR>
0             JAN-01-1980   00:00:28    more                 <DIR>
0             JAN-01-1980   00:00:00    log                 <DIR>
0             JAN-01-1980   00:00:04    flash               <DIR>
```

The following example for download files via TFTP Server:

```
Switch#configure filesystem
Switch(config-fs)#copy tftp 192.168.100.83 1.txt 192.168.100.93
```

The following example for creating and into the err directory, then delete the err directory:

```
Switch(config-fs)#mkdir test
Switch(config-fs)#cd test
Switch(config-fs)#rmdir test
WARNING:
```

```
The Data of this dir will be lost! if OS is deleted,the system will hangup!

Please confirm to continue?(Yes/No)y
Switch(config-fs)#
```