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RG-S3250

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RGOS 10.2(4)

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⁋ à à à à à è à è ⁋
Â

à 
à RGOS® à RGNOS® à


à Red-Giant® à


à 锐捷® Ὼ ᛘ Ἇ
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ЎĄ ў ий' RGOS®10.2(3) Â

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' ҳ ^ ҳ ҳ ǂ ~

[ ] ' [ ] ĭ ˘ ҳ ۷ Â

{ x | y | ... }' ÿ ч ۷ У Â

[x | y | ...]' ÿ ч ۷ У a Â

//' ۷ ѝ Â **509C2F0TJTT13.22 Tc Gc 128 Td M8x2βx2.10 d Tf0 Tc 0.56**

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ϡ **no default**

CLI

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CLI

CLI

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ϡ Ю ∕ˀ ˆ ?˜ ˧ Л∪ ϡ ϡ Â

У ˘ ″I

ˆ User EXEC ˜ ˘ ˧ Л∪ ϡ Â Ю˘ ˀ ˧ Л∪

ϡ˘ з ϡ ╥ ≠ ˧ У ˘ show ϡ Â

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ϡ˘ ″I ˆ Privileged EXEC ˜ Â ˘

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˧ ѝ “Ruijie” Â

ϡ '

User EXEC		Ruijie>	**exit**	
Privileged EXEC	**enable**	Ruijie#	**disable** **configure**	
Global configuration	**configure**	Ruijie(config)#	**exit** **end** Ctrl+C **interface** **interface** VLAN **vlan** vlan_id	
Interface configuration	**interface**	Ruijie(config-if)#	**end** Ctrl+C **exit** **interface**	
Config-vlan	**vlan** *vlan_id*	Ruijie(config-vlan)#	**end** Ctrl+C **exit**	VLAN

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ϟ ЛЪ ϟ ϗ ϗ Â Ю '

ϗ	
Help	ϗ Ю ╟ Â
abbreviated-command-entry?	ϟ ϗ Â ' Ruijie# **di**? dir disable
abbreviated-command-entry<Tab>	ϗ Â ' Ruijie# **show conf<Tab>** Ruijie# **show configuration**
?	ϗ ЮУ Â ' Ruijie# **show ?**
command keyword ?	ЮУ ϟ Â ' Ruijie(config)# **snmp-server community ?** WORD SNMP community string

---

˜

ϗ˘ word/string Ю˘ . ˝I ϧ
˘ έ ℼ Â '

Ruijie(config)#aaa domain ?
WORD Specific domain configure
default Default domain configure
enable Domain enable configure

˘ aaa domain d ϗ˘ . ˝I ϧ defaultˇ ϗ
aaa domain default Â

ϗ

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У ϗ . ϟ Â

show configuration ʒ ˩ Л∪ '

```
Ruijie# show conf
```

ʒ no default

ʒ **no** Â ˘ **no** ╖ ˘
б ʒ ˥ Â ˤ ʒ **no shutdown** ˤ ʒ
shutdown ˥ ˘ . ˤ Â a **no**
Â

ʒ **default** ˘ ʒ **default** ʒ й Â
ʒ ╖ ˘ Ю **default** **no**
˩ Â ↑ ʒ ╖ ˘ Ю˘ **default**
no ˥ Â **default** ʒ ╖ ˘ ˩
й Â

CLI

Ю CLI ˩ Â

CLI '

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Ctrl-P Э ↓	↓ ʒ У ʒ Â ÿ У ˇ ↓ Л Â
Ctrl-N Ю ↓	Ctrl-P Э ↓ Лˇ ↓ ʒ У ʒ Â ↓ Л Â

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	Ctrl-E	″I ʒ Â
Â	Backspace	″I У Â
	Delete	″I Â
╟ У У Â	Return	↓ Э ╟ У ˇ Ю У ˇ Â
	Space	↓ Э ╟ У ˇ Ю У ˇ Â

ʒ ╟ ʌ

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ʒ ″I ╟ Ю '

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″I	Ctrl-A
″I ɻ ɻ У	ɻ ɻ Ctrl-F
″I ╟	Ctrl-E

ɻ 4 ɻ ʒ **mac-address-table static** ɻ У
Â ″I У ˘ ʒ ɻ ╟

ɻ ϡ ϡ ϡ ϡ ˘
Ю˝ **alias ?** ɻЛυ ɻЛυ ɻ ϡ '

```
Ruijie(config)#alias ?
aaa-gs              AAA server group mode
acl                 acl configure mode
bgp                 Configure bgp Protocol
config              globle configure mode
......
```

ϡ ɻ ╠ ˘ ɻ У Л^ *˜ ˘ з ЛυЮ
'

**command-alias=original-command*

˘ EXEC Ю˝ ϡ ɻ ”s” ”show” Â ‡ ”s?” ɻЛυ
ɻ ’s’ ɻ ╠ '

```
Ruijie#s?
*s=show  show  start-chat  start-terminal-service
```

ɻ ϡ ϡ a У ˘ ‡ Л ϡ Â ˘
EXEC Ю ɻ ”sv” ϡ ϡ ”show version”˝ ‡'

```
Ruijie#s?
*s=show  *sv=”show version” show  start-chat
start-terminal-service
```

ɻ ÿ ϡ У ˘ a Â Э ˘
ϡ ˘ a ɻ'

```
Ruijie# s?
show  start-chat  start-terminal-service
```

ϡ ɻ ≠ ɻЛυ ɻ ϡ ╠ ˘ Л Ю ϡ
ɻ ”ia” ϡ ”ip address”˝ ‡ Л Ю'

```
Ruijie(config-if)#ia ?
A.B.C.D  IP address
dhcp     IP Address via DHCP

Ruijie(config-if)#ip address
```

”**ip address**” ϡ Л ˘ з ɻ ϡ Â

ϡ ɻ ˘ ‡ a Â

show aliases ϡ ɻЛυ ɻ Â

CLI

CLI ˘ У PC Â ╟ ˘
˚ ˚ Л Л┘ CLI Â Л
Л^ Console˜ ˘ й ^ Outband˜ Â
Л˘ Л┘ Telnet Â ч
Л┘ ʒ Â

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TFTP˜ ˘ ﾍ ﾇ Â ﾍ ﾇ ˚ ╗
˘ ﾍ ﾇ ﾉ ﾍ ﾇ Â ﾇ **enable secret**
╗ Â

ﾍ ﾇ

ﾍ ﾇ˘ 15 Â

ﾉ ﾍ ﾇ

ﾊ ﾈ Ю ﾇ ﾉ ﾍ ﾇ Â

ﾇ	
Ruijie(config)# **enable password** [**level** *level*] {*password* | *encryption-type encrypted-password*}	ﾍ ﾇ Â ﾉ 15 ﾍ ﾇ˘ з ﾉ ﾍ ﾇ Ю Â 15 ﾍ ﾇ˘ У ˘ ╟ й ﾍ ﾇ Â 15 ﾍ ﾇ 15 ﾍ ﾇ ﾉ˘ У Â
Ruijie(config)# **enable secret** [**level** *level*] {*encryption-type encrypted-password*}	ﾍ ﾇ˘ ╗ б ﾍ ﾇ ﾉ˘ ﾍ ﾇ ╗ Â й ˘ ﾍ ﾇ Â
Ruijie# **enable** [*level*] Ruijie# **disable** [*level*]	┌ ˘ ÿ æ ┌ ﾍ ﾇ Â

ﾍ ﾇ ˘ **level** ˘ ‡ й ﾈ ﾍ ﾇ Â
ﾍ ﾇ ﾊ˘ ﾍ ﾇ ﾉ Â

Ю˘ ﾉ ч ﾉ ﾍ ﾇ ' ^ 1 ˜
^ 15 ˜ Â ﾉ Л Ъ й ﾇ ┤ 16 Â
a ﾉ ﾍ ﾇ˘ ﾉ Л Ъ a ﾉ a ﾉ ﾇ Â

ﾍ ﾇ Ю˘ Ң a ﾍ ﾇ Â й
˘ й ﾍ ﾇ Â

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’ ꝛ У ˘ ‡ ⅃ Л∪ ꝛ
Â

⅃ Л∪ Ю ꝛ ꝛ '

ꝛ	
Ruijie# **configure terminal**	
Ruijie(config)# **privilege mode** [**all**] {**level** *level* | **reset**} *command-string*	ꝛ ˛ Â mode · ꝛ CLI ꝛ ˘ ' **config** ’ **exec** ꝛ ˘ **interface** ∧ Â all · ꝛ ꝛ ˘ ⅃ и ⅃ Â **level** *level* · ˘ ÿ 0 15 Â **level** 1 ˘ **level** 15 ˘ ˛ ⅃ Л∪ **enable/disable** ꝛ Â *command-string* · ꝛ Â

У ꝛ ˘ ⅃ Л∪ Ю **no privilege mode** [**all**] **level** *level command* ꝛ Â

ꝛ

Ю **reload** ꝛ ∧ è ꝛ 1 з 1 и ^ ∧ ꝛ и ”**test**”˜ '

```
Ruijie# configure terminal
Ruijie(config)# privilege exec all level 1 reload
Ruijie(config)# enable secret level 1 0 test
Ruijie(config)# end
```

1 ˘ ⅃ Л∪ ꝛ ꝛ'

```
Ruijie# disable 1
Ruijie> reload ?
at                  reload at a specific time/date
cancel               cancel pending reload scheme
in                  reload after a time interval
```

<cr>

Ю reload ҳ ⊣ è ҳ й '

```
Ruijie# configure terminal
Ruijie(config)# privilege exec all reset reload
Ruijie(config)# end
```

1 ˘ ҳ '

```
Ruijie# disable 1
Ruijie> reload ?
% Unrecognized command.
```

^ line˜ ∧ ҳ

∧ н ^ TELNET˜ ∧ ҳ ˘ **line** ∧ ҳ ˘ **line** Ю ЛЬЮ ҳ'

ҳ	
Ruijie(config-line)# **password** *password*	**line** ∧ ҳ

Ruijie(config-line)# **login**ie(config-line.0>Tj/TT5 1 Tf0.0017 Tc 2.251 0 Td(line)Tj/C2_0 1 Tf0 Tc 1.9

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AAA ‡
RADIUS
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RADIUS a
RADIUS
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' Л Ю AAA Ю Â
Ю é ЛЮ

Ruijie(config)# **username** *name* [**password** *password* | **password** *encryption-type encrypted password*]	
Ruijie(config)# **username** *name* [**privilege** *level*]	

Ю é ЛЮ

Ruijie(config-line)# **login local**	AAA Ю
Ruijie(config-line)# **login authentication** {**default** | *list-name*}	AAA Ю AAA Â AAA Radius à à Â

AAA à Radius Л ˇ AAA
Â

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Ю

Ю **show clock**

```
Ruijie# sh clock                              //
05:54:43 CHN-BJ Wed 2008-01-30
```

У calendar a
Ю ≠ Â
a Â

Ю **clock update-calendar**
Â

Ruijie# **clock update-calendar**	

Ю

```
Ruijie# clock update-calendar
```

reload [modifiers] scheme Ю( ) Â modifers **reload** У modifiers **in** à **at** à **cancel** Â Ю

1. **reload in** *mmm* | *hh:mm* [*string*]

У Â *mmm* *hhh:mm* *string* У 10 **reload in** *10 test* Â

2. **reload at** *hh:mm month day year* [*string*]

Â Â

year ˩ , ˇ ‡ ˇ

a 31 ˇ Лυ У ˇ 1 1

11 30 ˇ ‡ Â ˇ ѝ 12

ˇ ˩ з 1 ˇ

Ю˘ 1 a ӭ 1

ˇ ˇ ‡ ѝ ӭ 1 ˇ ÿ Â string

˩ Э Â 2005-01-10 14:31˘ Э

ˇ ˩ Лυ **reload at** *08:30 11 1 newday* Â

2005-12-10 14:31˘ 2006-01-01 12:00 ˇ ˩ Лυ

reload at *12:00 1 1 2006 newyear* Â

3. **reload cancel**

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ˇ **reload cancel** ˥˘ Â

at ˇ ‡ æ

```
Reload reason: midday
```

⅄ ⅁

ѝ ˘ ⅃Ⅼѝ У ⅄ ⅄ (System Name)
Â ⅄ ѝ CLI ⅁ ˘ ‡ ⅄ ˆ ⅄
32 ˘ ‡ ⅄ è 32 ~ ѝ ⅁ ˘
⅄ ⅃ ⅃ Â ЮˇЛυ έ ⅄ ѝ ⅄ ˘
”S2924G” à ”R2692” Â

⅄

⅄ ң Ю ⅁ ⅄ '

⅁	
Ruijie(Config)# **hostname** *name*	⅄ ˘ ⅄ ⅃ ˘ a . 255 Â

⅃Ⅼ Ю **no hostname** ⅄ Æ ÂЮ ⅄ RGOS'

```
Ruijie# configure terminal                    //
Ruijie(config)# hostname RGOS      //          ⅄ ѝ RGOS
RGOS(config)#                                  //⅄
```

⅁

⅁ ˘ ‡ ⅄ ˆ ⅄ 32 ˘ ‡ ⅃
è 32 ~ ѝ ˘ ⅄ ⅃ ⅃ Â ⅃
Лυ Ю **prompt** ⅁ ⅁ ˘ ⅁ ⅃ EXEC
Â

⅁	
Ruijie# **prompt** *string*	⅁ ˘ ⅄ ⅃ . ˘ 32 ˘ ‡ ⅃ è 32 Â

⅃Ⅼ Ю **no prompt** ⅁ ѝ Â

˘ ⅃ У Â ⅃ Л
Â ⅃ Л… ч ^ banner˜ '
Â ˘ ˘
"I Э Â ˘ ⅃ Л У ѝ ^
˜ Â ⅄˘ ў
У Â Ю˘ Â

⅃ Л… У ˘ ˘
Â ⅃ Л ЛЮ ҂ '

҂	
Ruijie(config)# **banner motd** *c message c*	(message of the day) Â c ↑ ˘ ↑ ⅃ Л ('&') Â ↑ ⅄˘ ⅄ ˘ ⅃ Л ˘ ˘ ↑ ↑ ⅄ Ÿ ˘ ‡ Â ˘ a ѝ↑ ˘ a 255 Â

⅃ Л Ю **no banner motd** Â
Ю У ˘ (#) ѝ↑ ˘
ѝ “Notice: system will shutdown on July 6th.” Ю'

```
Ruijie(config)# banner motd #                    //   ↑
Enter TEXT message.  End with the character '#'.
Notice: system will shutdown on July 6th.#       //   ↑
Ruijie(config)#
```

⅃ Л ЛЮ ҂ '

҂	

Ruijie(config)# **banner login** *c message c*	Â *c* ˇ ˇ ˩ Л Ъ (’&’) Â ˇ ˅˘ ˅ ˘ ˩ Л Ъ ˘ ˇ ˘ ˇ ‡ Â ˘ a й ˘ a 255 Â

˩ Л Ъ Ю **no banner login** Â

Ю У ˘ (#) й ˘

й “Access for authorized users only. Please enter your password.”

Ю

```
Ruijie(config)# banner login #                    //   ˇ
Enter TEXT message.  End with the character '#'.
Access for authorized users only. Please enter your password.
#                                                      //   ˇ
Ruijie(config)#  ï “Âccess fd. or âthorie  usèrs onl  Plea enter  ur13pssword.
```

٨

Ю˘ ٦Л Л Л Ю ٪ ٨ '

٪	
Ruijie(config-line)# **speed** *speed*	٨ ˘ Æ bps Â ٨˘ ٦ й 9600 à 19200 à 38400 à 57600 à 115200 У ˘ 9600 Â

Ю ٨ й 57600 bps˙

```
Ruijie# configure terminal                    //
Ruijie(config)# line console 0          //        ٨
Ruijie(config-line)# speed 57600        //        ٨     й 57600
Ruijie(config-line)# end                          //
Ruijie# show line console 0                    //        ٨
CON     Type    speed   Overruns
* 0     CON     57600   0
Line 0, Location: "", Type: "vt100"
Length: 25 lines, Width: 80 columns
Special Chars: Escape  Disconnect  Activation
            ^^x     none       ^M
Timeouts:      Idle EXEC    Idle Session
            never       never
History is enabled, history size is 10.
Total input: 22 bytes
Total output:  115 bytes
Data overflow:  0 bytes
stop rx interrupt:  0 times
Modem: READY
```

Э telnet

Telnet TCP/IP ˘

٦ Â Telnet Client Ь й Э

Telnet Client Э è

Ь Â Юفي Э Telnet б

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1 في

Telnet Client

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ʒ	
Ruijie# **telnet** *host-ip-address*	**telnet** ˘ ـ Л Ъ ў ـ IP Â

Ю **Telnet** ˘ ip 192.168.65.119'

```
Ruijie# telnet 192.168.65.119     //              telnet
Trying 192.168.65.119 ... Open
User Access Verification              //
Password:
```

ـ Л Ъ ˘ ^ ـ ˘ Л Ч ~˘ ˘ ˘ Â

ـ ˘ ˘ ˘ Ь Â

line_rcms_script.text **Telnet**

```
configure terminal
line tty 1 16
transport input all
no exec
end
```

```
Ruijie# execute flash:line_rcms_script.text
executing script file line_rcms_script.text ......
executing done
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# line vty 1 16
Ruijie(config-line)# transport input all
Ruijie(config-line)# no exec
Ruijie(config-line)# end
```

PC TFTP Flash CLI

```
Ruijie# configure terminal                    //
Ruijie(config)# enable service ssh-server     //    SSH Server
```

HTTP

Web ˘ ˧Л è HTTP ˘
˘ ˧ ˘ Â

ʒ	
Ruijie(Config)# **ip http port** *number*	HTTP ˘ ˧˘ 80
Ruijie(Config)# **ip http authentication** { **enable** | **local** }	web ˘ й enable Â **enable** ' enable password enable secret ʒ ˧ ʒ ˘ ˧ ʒ 15 ' **local** ' username ʒ ˫ ˧ ʒ ˘ 15 '

˧Л Ю˘ Л Э ʒ **no** ˘ й ÂЛЮ Э Http Server˘ ˘ ˧ й 8080˘ ˫ '

```
Ruijie# configure terminal                    //
Ruijie(config)# enable service web-server     //    Web Server
Ruijie(config)# username name password pass   //
Ruijie(config)# username name privilege 15    //
Ruijie(config)# ip http port 8080             //      ˘ ˧
Ruijie(config)# ip http authentication local //
```

LINE

LINE

˘

ˇ ˺ Ю ў CTRL ˇ ˙ Э Ю ˇ ч ˡ У TFTP ˥ ˇ ˇ ˩ У Xmodem ˥ ˇ Â

˘

ÿ ЉЮ ˇ ˙

TFTP ˙

XMODEM ˙

TFTP ˙

У ÿ ў Ю ˙ ˇ ˩ У ÿ Э ˙ ў Â

CLI ˺ Ю̆ Ю ˙ Ю ˡ

Ю ˇ ˝l ў TFTP Server ˙ ’ ˩ Ю ˙ ’ ˩ ˇ Ю ЉЮ ˺Ю ˙ ˇ Location ‡ TFTP Server IP Â

˺	
Ruijie# **copy tftp:** *//location/ filename* **flash:** *filename*	Ю ў URL ˙ *filename*

XMODEM

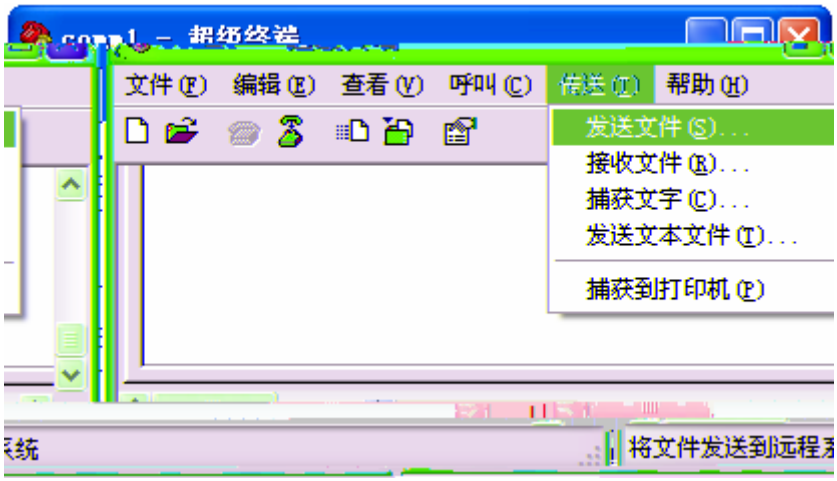
У ÿ ў Ю ˚ ˘ ⁄ У ÿ Э ˚ ў Â

CLI ʒ Ю˘ Ю ˚ Ю '

Ю ˘ ”I Windows ' Л

Ю ЛЬЮ ʒ Ю ˚ ' Л ў Windows ˘ “

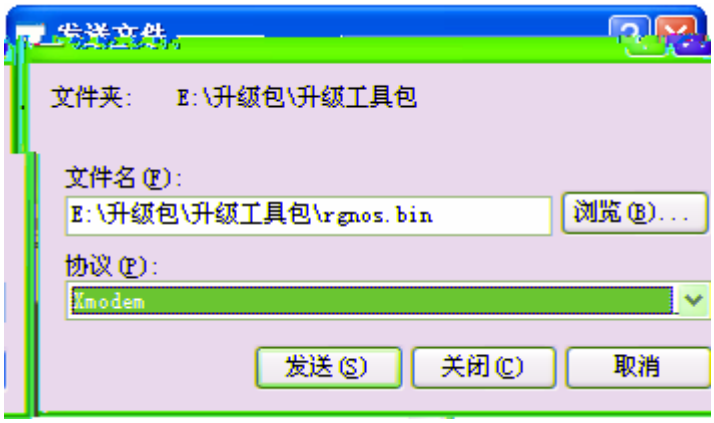
” “ ˚ ”Ш ˘ في 1 '



في 1

˚ Л ў Ю ˚ ˘ “Xmodem”

“ ” ‡ Windows ЛЬ ⁄ Â في 2 '



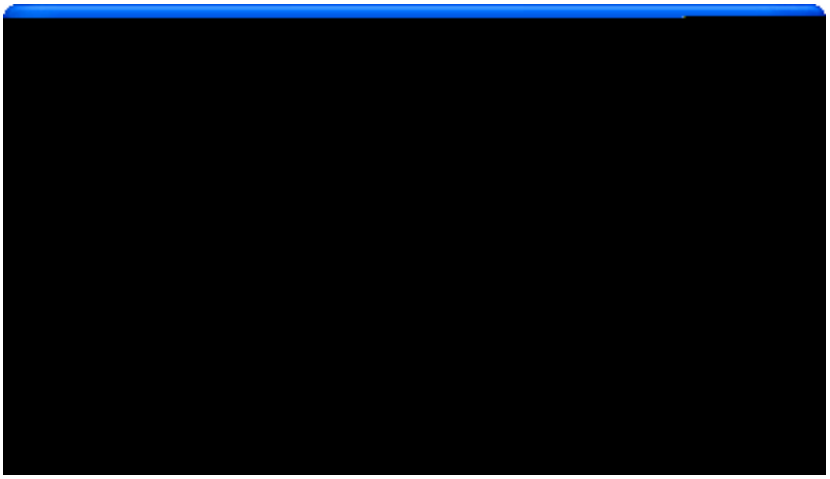
في 2

ʒ	
Ruijie# **copy xmodem flash**:*filename*	ÿ ў Ю ˚ Л и *filename* Â

CLI ʒ Ю˘ Ю ˚ Э '

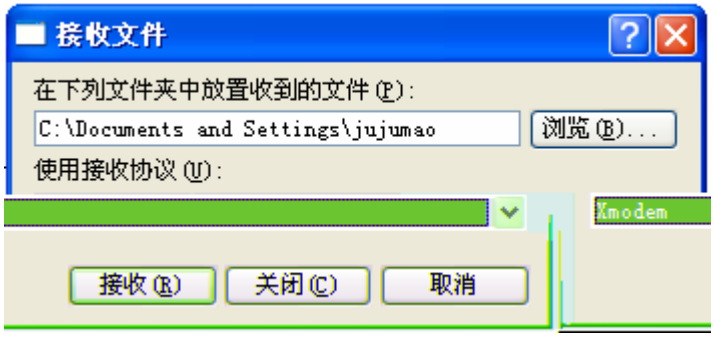
Э ˘ ”I Windows ' Л

Ю ЛЬЮ ʒ Э ˚ ' Л ў Windows ˘ “
” “ ˚ ”╖ Â في 3 '



في 3

Э ˚ Æ ˘ “Xmodem”˘ “
”˘ у ˚ ɻ ˘ “ ” Л
˚ Â في 4 '



في 4

ʒ	
Ruijie# **copy flash**:*filename* **xmodem**	ÿ Э ˚ *filename* ў

a ˘ ɻЛь Э tftp xmodem ˘
˚ Э Â ╖ Л˘ ╠ ˘ ˘ ˚ ╠

˘ ˘ a ȳ Â

˘ ˚ Э ˘ ╟ a ⅄'

1˜ ˘ ⅄ ˘ ˘ ˘ ˘ ╟ Æ˘
Ї Ą ╟ Â

2˜ ˘ ´ Л Ч Ь´ ˘ У ˘ ˚
˘ Â ″І ˘ ˘ Æ Â Ї Ą ╟ ˘
╟ ⅄ ╥ ╟ ˘ ´ Ь´ ˘ Â

╟ ˘ ╥ ' ў У ╥ ˘ ÿ ˘
´ Ь´ У ˘ ў
a У ˘ ˘ ˚ ˘ ˘ ˘ Л
У Â

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˘ ў ˘ ⅄ ˘ ÿ ˘ ÿ У
Â ˘ ´ ´ ⅄ ˘ Â ˘
a ⅄ ˘ ‡ ⅄ ˘ Â
˘ ˘ ⅄ **show version** ´ ˚
б ˘ У ˘ ˘ a ў ⁋ ^
' **redundancy force-switchover**˜ ˘ ‡ ˘ Â

˘ ˚ ˘ '

1˜ ˘ ˚ ˚ ⅄ й **RGOS.bin**

2˜ Э **copy** ҂˘ ˚ Ю Э

3˜ Э ÿ ˘ ў ÿ ў ˘ ╥˘ ╥
Ю '

```
Upgrade Slave CM MAIN successful!!
Upgrade CM MAIN successful!!
```

1˜ У Æ

2˜ Ї Ą ╟ Л˘ ˘ ˚ ˘ Ю '

```
Installing is in process ......
Do not restart your machine before finish !!!!!!
......
```

3˜ ˘ Л˘ Ю '

```
Installing process finished ......
Restart machine operation is permited now !!!!!!
```

4˜ ˘ ˙ ⅃ ╟ Æ˘ Ю ˈ

```
System restarting, for reason 'Upgrade product !'.
```

5˜ Ά ╟ ⅃˘ ˘ ˘ ⅃ ╗ ˘ ˙ ˘ 5 6 ˘ a 7 ˘ ⅃ ǯ ˈ

```
System load main program from install package ......
```

ÿ ˘ ˙ ╗ ў

6˜ ў ⅃˘ ╟ ˘ ╗ ╟˘ ÿ ἐ Ю ˈ

```
A new card is found in slot [1].
System is doing version synchronization checking ......
Current software version in slot [1] is synchronous.
System needn't to do version synchronization for this card ......
```

Ю ˈ

```
System is doing version synchronization checking ......
Card in slot [3] need to do version synchronization ......
```

ἐ .

```
Version synchronization begain ......
Keep power on, don't draw out the card and don't restart your
machine before finished !!!!!!
```

ἐ .

```
Transmission is OK, now, card in slot [3] need restart ...
Software installation of card in slot [3] is in process ......
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!
Software installation of card in slot [3] has finished
successfully ......
The version synchronization of card in slot [3] get finished
successfully.
```

Э ч У ˘ ˊ ⅃ a Ά ╟ ˘ ˘ ⅃ У ˊ ˘ ╟ ˘ ˘ ⅃ ˘ Â

ÿ У Э Â

6 ط

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˘ ╟ ˘ ˘ a ˘ y ˘ Ł
a Æ ˘ ≠ a è Â

˙ ╟ ˘ Â

˘ ˚ ˘ ˛

˘ ˧ Э 1˙ 7˙ ˥ Æ ˥
Â

έ

Ping

ὴ ˘ Echo ˘ У
˘ Л ˘
Echo ˘ Л Л ὰ Л ˘ RGOS
Ping έ˘ Л Л ╠ ὰ Æ Â

Ping ϟ Ю˘ Ю˘ Л
Ping ╖ ˘ Ю˘ Л Л Ping ╖ Â

ϟ	
Ruijie# **ping** [*ip*] [*address* [**length** *length*] [**ntimes** *times*] [**data** *data*][**source** *source*] [**timeout** *seconds*]]	**Ping**ˈ έ

Ping ╖ ˘ Л Л Ю ˘ 5
ὴ 100Byte IP ˘ ^ ὴ 2 ~ ˘
б ┐ ^ ┼ a ˘ Л Ώ ┼ ┐
~˘ ‡ ¦ ! Ľ Л’ б a ┐ ˘ ‡ ¦ C Ľ Л’
˘ ‡ ¦ . Ľ Л Â Л У ÂЛЮ ὴ ping
ˈ

```
Ruijie# ping 192.168.5.1
Sending 5, 100-byte ICMP Echoes to 192.168.5.1, timeout is 2
seconds:
< press Ctrl+C to break >
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/10
ms
```

Ping ╖ ˘ Л Ю Â Ping ˘ Л Л
ὰ ὰ Â Ping ╖ У ˘ Л ≠ У
˘ ЛЮ ὴ У Ping ˈ

```
Ruijie# ping 192.168.5.197 length 1500 ntimes 100 data ffff source
192.168.4.190 timeout 3
Sending 100, 1000-byte ICMP Echoes to 192.168.5.197, timeout
is 3 seconds:
  < press Ctrl+C to break >
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
```

```
Success rate is 100 percent (100/100), round-trip min/avg/max
= 2/2/3 ms
Ruijie#
```

Traceroute

Traceroute ʒ˘ ˩Л Ъ ÿ ˘
Â **Traceroute** ʒ ў ˘ ˘
Æ Æ Â

‡ ˘ У У ˘ TTL
1 Â TTL й 0 ˘ ˘ У
a ˩ Â ‡˘ Traceroute ʒ '
″I У TTL й 1 ˘ У У ICMP
˘ Л Ъ a ˘ й TTL ˘ ˥ TTL ╗ 1
˥ ˘ ˩ ў TTL ˘ У Ю ˘
˘ У ICMP TTL ˘ Ю
ÿ ˘ IP Â

Traceroute ʒ ˩Л Ъ Ю ˘ έ ʒ
Ю'

ʒ	╖
Ruijie# **traceroute** [*protocol*] [*destination* [**probe** *probe*] [**ttl** *minimum maximum*] [**source** *source*] [**timeout** *seconds*]]	

ЛЪЮ й Traceroute ч ˘ У й ˘ У й
a Â

1¨ Traceroute '

```
Ruijie# traceroute 61.154.22.36
  < press Ctrl+C to break >
Tracing the route to 61.154.22.36

1     192.168.12.1       0 msec  0 msec  0 msec
2     192.168.9.2        4 msec  4 msec 4 msec
3     192.168.9.1        8 msec  8 msec  4 msec
4     192.168.0.10       4 msec  28 msec  12 msec
5     202.101.143.130    4 msec  16 msec  8 msec
6     202.101.143.154   12 msec  8 msec  24 msec
7     61.154.22.36       12 msec  8 msec  22 msec
```

ÿ Э ˩Л Ъ ˘ ÿ IP й 61.154.22.36 ў ˘
^ 1¨ 6˜ ˘ ˩ ˘
ĭ ˘ Â

2˙ a Traceroute '

```
Ruijie# traceroute 202.108.37.42
< press Ctrl+C to break >
Tracing the route to 202.108.37.42
1     192.168.12.1      0 msec  0 msec  0 msec
2     192.168.9.2       0 msec  4 msec 4 msec
3     192.168.110.1    16 msec  12 msec  16 msec
4     *  *  *
5     61.154.8.129      12 msec  28 msec  12 msec
6     61.154.8.17        8 msec  12 msec  16 msec
7     61.154.8.250      12 msec  12 msec  12 msec
8     218.85.157.222    12 msec  12 msec  12 msec
9     218.85.157.130    16 msec  16 msec  16 msec
10    218.85.157.77     16 msec  48 msec  16 msec
11    202.97.40.65      76 msec  24 msec  24 msec
12    202.97.37.65      32 msec  24 msec  24 msec
13    202.97.38.162     52 msec  52 msec  224 msec
14    202.96.12.38      84 msec  52 msec  52 msec
15    202.106.192.226   88 msec  52 msec  52 msec
16    202.106.192.174   52 msec  52 msec  88 msec
17    210.74.176.158   100 msec  52 msec  84 msec
18    202.108.37.42     48 msec  48 msec  52 msec
```

ÿ Э ⅃Л ˘ ÿ IP ѝ 202.108.37.42 ў
˘ ˆ 1˙ 17˜ ˘ з 4 Â

ㅓ

ㅓ

ў ㅓ ĭ ˘ ㅓ ㅾ Â
ㅓ ㅢĭ ѝ ЛЬЮ ч '

ү ㅓ (L2 interface)

Ь ㅓ (L3 interface) (Ь)

ү ㅓ (L2 interface)

ў ү ㅓ ㅓ ㅾ ㅢĭ ѝ ЛЬЮ

Switch Port

L2 Aggregate Port

Switch Port

Switch Port Э ㅓ ˘ ㅓ ү ╗ Â ㅓ ㅢ Лъ У
Access Port У Trunk Portў ㅢ Лъ Switch Port ㅓ ʒ˘ У
ㅓ ѝ У Access Port Trunk Port Â Switch Port ㅓ
б ү ˘ з а Â

Access Port

Access Port ㅓ У VLAN, ㅓ VLAN Â У
Â

VLAN

Access Port ㅓ У VLANў Лъ VLAN VLANў
ㅢ Лъ а Â

б

Access Port а TAG ˘ з ㅓ ЛЬЮ Ь '

Untagged

VID ѝ Access Port VLAN Tagged

VID й 0 Tagged

Untagged

Access Port a TAG ˇ й TAG ╗ VLAN TAG Â ˇ ╗ TAG˜ ”Ą Â

Tagged

Access ㄐ TAG ˇ ЛЬЮ ˚ '

TAG VIDˆ VLAN ID˜ б VLAN ID ㄴ ˇ ˇ TAG Л Â

TAG VIDˆ VLAN ID˜ й 0 ˇ Â TAG ˇ VID 0 . ”I Â

TAG VIDˆ VLAN ID˜ б VLAN ID a ㄴ з a й 0 ˇ Â

Trunk Port

Trunk port ㄴ Лъ VLAN˙ VLAN ˇ У ˇ ≠ ㄴ Лъ Â

VLAN

й Trunk Port ㄴ Лъ VLAN˙ Лъ У Native vlan й VLAN Â Ю Trunk port VLAN ˇ й ˇ ˇ ㄴ VLAN ㄴ Trunk port VLAN Â

~

Trunk ㄐ native vlan Trunk ㄐ native vlan й У ˇ ‡ ㄐ ㄴ Â

б

Trunk port ㄴ Untagged ㄐ VLAN tagged Â Trunk Port

Trunk port TAG ˘ ЛЬЮ ˚ '

Trunk Port TAG VID Trunk port Native vlan ˘ , ˘ TAG Л Ї Â

Trunk Port TAG VID a Trunk port Native vlaň VID ㅓ VLAN ID ˘ , ˘ TAG Â

Trunk Port TAG VID a Trunk port Native vlaň з VID ㅓ a VLAN ID ˘ Â

Untagged Ethernet ˘ PC ´ ㄴЛ ' TAG ㄴ MAC MAC Л˘ ╗ Э 4bytes VLAN ˘ ≠ VLAN TAG Â

Hybrid ㅓ

Hybrid ㅓ ㄴЛ VLAN˝ ㄴЛ VLAN ˘ ㄴЛ ˘ ≠ ㄴЛ Â Hybrid ㅓ Trunk ㅓ a Л Hybrid ㅓ ㄴЛ VLAN a ˘ Trunk ㅓ ㄴ VLAN a , ' Hybrid ㅓ ╗ VLAN Â

L2 Aggregate Port

Aggregate port ㅓ Â ㄴЛ У У ˘ й У Aggregate Port˝ ЛЬЮ AP ˜ Â

γ AP У Switch port˝ ㄴЛ ㅓ ╗ ˘ Â ˘ L2 Aggregate port L2 Aggregate port ㅓ Э ˘ AP У ˘ L2 Aggregate port ╠ Э è Э˘ ㄴ Â

~

L2 Aggregate Port ㅓ ㄴЛ й Access port Trunk Port˝ Л У AP ㅓ й Л У ˘ ж Access Port˝ ж Trunk port Â

Ь ٴ (L3 interface)

ў Ь ٴ ٴ ЊЖ ٸ ̀ ЛЮ

SVI (Switch virtual interface)

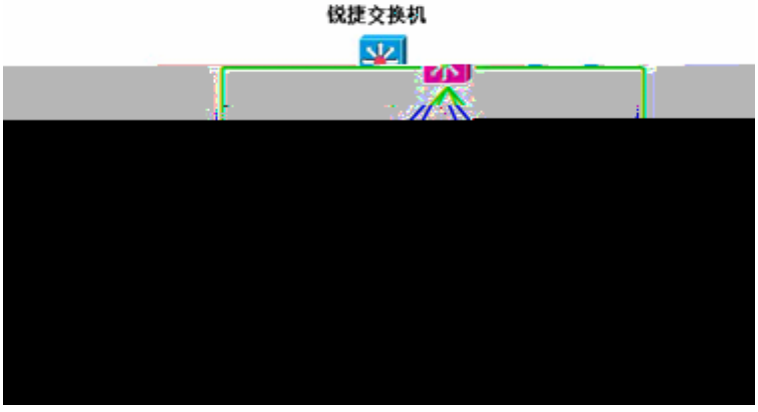
Routed Port

L3 Aggregate Port

SVI(Switch virtual interface)

SVI ٴ˘ Ь ٴ Â SVI ٸ Л̀ ̀
ٴ˘ ٴ ٸ Â ≠ ٸ Л̀… SVI ̀ У ٴ˘
VLAN ٴ˘ ٸ Ь VLAN
Â… У SVI ˘ ٸ **interface vlan** ٴ ʒ … SVĭ
Ѓ SVI ̀ IP VLAN Â

ف˘ VLAN20 ў ٸ ˘ Ь ˘
VLAN20 ў A VLAN30 ў B VLAN20 SVI1
VLAN30 SVI2 Â



ف 1

Routed Port

У Routed Port У ٴ˘ ٸ Ь Э У ٴ˘ У Ь
Â Ь Э˘ ٸ Л̀ ٴ ̀ Routed portĭ ̀
Ь ٴ Â У Routed Port б У Vlan ˘ ̀
У ٴ Â Routed port a έ γ ╗ Â ٸ **no switchport**

ٓ У γ ٰ Switch port ٗ ٙ Routed port, ٘ Routed port ٚ IP
Â ˘ **no switchport** ٰ ٓ ˘ ٰ
˘ ٰ γ Â

~

У ٰ L2 Aggregate Port ٰ ˘ a **switchport/ no switchport** ٓ ٛ Â

L3 Aggregate Port

L3 Aggregate port ٗ L2 Aggregate Port У ˘ ≠ ٰ
У Э ٰ Â ٰ ٙ ٗ Ь ٰ Â Ь
˘ AP ٙ Ь ٰ˘ ٗ У
ô=¤ ´Á €=@Ý Ç

Aggregate Portﾞ è ﾊ ù 1˙ Aggregate Port Â

SVIﾞ è ﾊ SVI VLAN VID Â

~

Э ﾊ ù Oﾞ ╟ (┘ ´) ﾊ ÿ 1 Â

ﾍ ｷ

┘ Ю **interface** ｷ ﾍ Â

ｷ	
Ruijie(config)# **interface** *ﾍ ID*	Ю **interface** ｷˇ ﾍ Â ≠ ┘ Л∪ Ю **interface range interface range macro** ｷ У ﾍ Â ╪ж У ﾍ ┘ é ┘

Ю Gigabitethernet 2/1 ﾍ '

```
Ruijie(config)# interface gigabitethernet 2/1
Ruijie(config-if)#
```

ﾍ Ю ┘ ﾍ Â

interface range ｷ

У ﾍ

┘ Л∪ Ю **interface range** ｷ ┘ ﾍ Â **interface range** ˘ ﾍ Â

ｷ	
Ruijie(config)# **interface range** {*port-range* | **macro** *macro_name*}	ｳ ﾍ Â **interface range** ｷ ﾉ Ո Â macro ﾉ Ո ﾍ Â ﾉ Ո ﾊ ˜ Â ﾉ ｳ ｷ ﾍ ﾉ Â

interface range ｷ ˘ range '

ﾍ '

vlan *vlan-ID - vlan-ID*, VLAN ID 1 4094'

Fastethernet *slot/{ ｳ port} - { ﾉ ｳ port}*'

Gigabitethernet *slot/{ ｳ port} - { ﾉ ｳ port}*'

TenGigabitethernet *slot/{ ｳ port} - { ﾉ ｳ port}*'

Aggregate Port Aggregate *port ﾊ - Aggregate port ﾊ*, 1 MAX'

ｳ **interface range** ﾍ ﾉ ˘ . fastetherneť gigabitethernet Aggregate Porť SVI Â

ﾐ ﾐ **interface range** ｷ'

```
Ruijie# configure terminal
Ruijie(config)# interface range fastethernet 1/1 - 10
Ruijie(config-if-range)# no shutdown
Ruijie(config-if-range)#
```

ﾐ ˛ ﾊ ˜ range'

```
Ruijie# configure terminal
Ruijie(config)# interface range fastethernet 1/1-5, 1/7-8
Ruijie(config-if-range)# no shutdown
Ruijie(config-if-range)#
```

ﾍ ﾊ

ﾉ Ո ﾊ ｳ ﾉ ｳ ｷ ﾍ Â **interface range** ｷ **macro** ˘ ˝I ﾐ **define interface-range** ｷ ﾊ Â

ｷ	
Ruijie(config)# **define interface-range** *macro_name interface-range*	ﾐﾎ ﾍ ﾐﾎ Â macro_name ﾐﾎ ﾉ ˇ a 32 Â ﾐﾎ ﾉ Л∪ Â ﾉ У ﾐﾎ ﾍ ﾉ Â
Ruijie(config)# **interface range macro** *macro_name*	ﾐﾎ ˇ **interface range** ｷ ˇ ﾉ Л∪ ﾐﾎ ﾉ ﾍ ｷ ﾍ Â

Ю **no define interface-range macro_name** ｷ ﾐﾎ Â

define interface-range ｷ ﾐﾎ ﾍ ˇ '

ﾍ '

– **vlan** *vlan-ID* - *vlan-ID*, VLAN ID 1 4094’
– **fastethernet** *slot*/{ У *port*} - 1.56 0 Td(/{)TjTj/TT1 1 Tf6(32)Tj/ TfE

```
Ruijie# configure terminal
Ruijie(config)# no define interface-range ports1to2N5to7
Ruijie# end
```

ㄟ ӯ

ㄟˇ ㄐЛ ӯ Â ㄐЛ ὲ У ӯ Â У
ӯ ˇ ㄟ à à ㄐ à ӯ
ˇ ㄐ ӯ ˇ ӯ ˇ ㄐ
Л Â

```
Ruijie(config-if)# description PortForUser A
Ruijie(config-if)# end
```

Ю˘ ㄐ ㄏ Â ㄐЛ ㄏ

У ㄏ Â У ㄏ˘ ‡ ㄏ Э a ˘

ㄏ ㄏ ╖ Â ≠ ㄐЛ

У ㄏ Â ㄏ ч ' Up Down˘ ㄏ

˘ ㄏ ѝ

```
Ruijie(config-if)# end
```

~

IEEE ˇ ”I ㄟ ㄟ Master Slave .

S3250 ˇ a ˇ Â

S3250 ˇ ”I ㄱ Â

ㄟ MTU

ㄟ ㅓ ˇ ㄴ Л∪ ˇ ㅕ jumbo Â ㄴ Л∪ ㄟ MTU ㄟ Â

MTU ˇ a Л∪ Â

ㄟ MTU ㄴ Â a MTU Â ㄟ ˇ MTU˝ Â

MTU ㅕ 64~9216 ˇ ㅕ 4 ˇ ㅕ 1500 Â

ㄱ ㄴ ㄟ Â SVI ㄟ a MTU Â

ㄱ	
Ruijie(config-if)# **Mtu** *num*	ㄟ MTU Num' <64-9216>

ЮО ㄟ Gigabitethernet 1/1 MTU'

```
Ruijie# config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 1/1
Ruijie(config-if)# mtu 64
Ruijie(config-if)# end
```

γ ㄟ

ЮО γ ㄟ ˇ VLAN ㄱ ㄟ ľ VLAN Ŀ ľ ㄟ Ŀ Â

γ ㄟ Ю '

	γ
Switch port	access port
VLAN	VLAN 1 4094
VLAN˜ access port	VLAN 1
Native VLAN˜ trunk port	VLAN 1
ȳ	copper
ㄟ	Up
ㄟ	
ㄣ	
Aggregate port	
ㄟ	
ㄟ	

Switch Port

access/trunk port

ў Switchport (access/trunk port)

```
Ruijie(config)# interface gigabitethernet 1/2
Ruijie(config-if)# switchport mode access
Ruijie(config-if)# end
```

?ㄱ	
Ruijie(config-if)# **switchport access vlan** *vlan-id*	access port VLAN Â

ЮO access port gigabitethernet 2/1 vlan и 100 Â

```
Ruijie# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 2/1
Ruijie(config-if)# switchport access vlan 100
Ruijie(config-if)# end
```

trunk port native VLAN

?ㄱ	
Ruijie(config-if)# **switchport trunk native vlan** *vlan-id*	trunk port NATIVE VLAN Â

ЮO Trunk Port Gigabitethernet 2/1 Native vlan и 10 Â

```
Ruijie# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 2/1
Ruijie(config-if)# switchport trunk native vlan 10
Ruijie(config-if)# end
```

ㄴ ㄴ ˇ ㄴ ľ ㄴ
Ľ'

?ㄱ	
Ruijie(config-if)# **switchport port-security**	ㄴ ㄴ Â

ЮO Gigabitethernet 2/1 ㄴ Â Â

```
Ruijie# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 2/1
Ruijie(config-if)# switchport port-security
Ruijie(config-if)# end
```

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ЮO Gigabitethernet 2/1 и access port VLAN и 100

ˇ ㄱ ˇ ὶ ˇ ㅅ '

```
Ruijie# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 2/1
Ruijie(config-if)# switchport access vlan 100
Ruijie(config-if)# speed auto
Ruijie(config-if)# duplex auto
Ruijie(config-if)# flowcontrol auto
Ruijie(config-if)# switchport port-security
Ruijie(config-if)# end
```

Hybrid ㅅ

ㄱ Л Л Ю Hybrid ㅅ'

ʒ	
configure terminal	
interface <*interface*>	ㅅ ˇl , ˇlˇ ˇl
switchport mode hybrid	ὶ ㅅ ὶ hybrid ㅅ
no switchport mode	ㅅ
switchport hybrid native vlan *id*	hybrid ㅅ VLAN
switchport hybrid allowed vlan [[**add**] [**tagged** | **untaged**]] |**remove**] **vlist**	ㅅ ‡

```
Ruijie# configure terminal
Ruijie(config)# interface g 0/1
Ruijie(config-if)# switchport mode hybrid
Ruijie(config-if)# switchport hybrid native vlan 3
Ruijie(config-if)# switchport hybrid allowed vlan untagged
20-30
Ruijie(config-if)# end
Ruijie# show running interface g 0/1
```

L2 Aggregate Port

ў … L2 Aggregate Port ㄱ L2 Aggregate Port У Â

ㄱ Л Л ㅅ Ю **aggregateport** … L2 Aggregate Portˇ é l' Aggregate Port Ŀ Â

```
Ruijie(config-if)# end
```

SVI

ў … SVI ㄱ SVI У Â

ㄴ **interface vlan** *vlan-id* … У SVI У SVI Â

SVI '

३	
Ruijie(config)# **interface vlan** *vlan-id*	SVI ㄴ Â

ㄲ ㄴ SVI ˘ Ľ IP Ŀ Â

Ю ㄴ ˘ з SVI 100ǂ IP '

```
Ruijie# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface vlan 100
Ruijie(config-if)# ip address 192.168.1.1 255.255.255.0
Ruijie(config-if)# end
```

Routed port

… Routed Port ㄱ Routed Port У Â

ㄴ ㄴ Ю˘ ㄴ ㄲ˘ **no switchport** … Routed port Â

… У Routed port Routed portǂ IP '

३	
Ruijie(config-if)# **no switchport**	ㄴ Shut Down Ь
Ruijie(config-if)# **ip address** *ip_address subnet_mask*	IP Â

~

У ㄴ L2 Aggregate Port ㄴ ˘ a **switchport/ no switchport** ३ ǀ Â

Ю У ɣ ㄴ Routed Port з ㄴǂ IP '

ㅓ	a 3 ㅓ' ㅣ 3 ㅓˇ ' 2 ㅓˇ й Â	a ap' ╗ ㅅ ˘ ap ㅅ' ㅓ ╗ ap Â
	a ㅣ	╗ APˇ AP ' APˇ ㅓ Â
arp check	a ㅣ	╗ APˇ AP ' APˇ ㅓ Â
	a ㅣ	╗ APˇ AP ' APˇ ㅓ Â
Ip	a 2 ㅓ' ㅣ 2 ㅓˇ ip ' 3 ㅓˇ й ip '	╗ APˇ AP ' APˇ ㅓ Â
shutdown	a ㅣ	╗ APˇ AP ' APˇ ㅓ Â

2 ㅓ a ╗ 3 apˇ 3 ㅓ a ╗ 2 ap' 2 ㅓˇ 3 ㅓˇ 2 apˇ 3

ㅓ

ㅓ ˘ Â ㅣ Ю **show** ㄋ ㅣ
ㅓ Â Ю ㅣ ЛЬЮ ㄋ ㅓ '

ㄋ	

Ruijie# **show interfaces**
[*interface-id*] ㅅ ㅓ ㅓ Â

```
Mtu         : 1500
PhysAddress   :
LastChange    : 0:0h:0m:0s
AdminDuplex   : Auto
OperDuplex    : Unknown
AdminSpeed    : 1000M
OperSpeed     : Unknown
FlowControlAdminStatus : Enabled
FlowControlOperStatus : Disabled
Priority    : 1
```

ЛЬЮ ѝ ﻧ SVI 5 ﻧ '

```
Ruijie# show interfaces vlan 5
VLAN   : V5
Description          : SVI 5
AdminStatus         : up
OperStatus          : down
Primary Internet address     :  192.168.65.230/24
Broadcast address         :  192.168.65.255
PhysAddress         : 00d0.f800.0001
LastChange          : 0:0h:0m:5s
```

ЛЬЮ ѝ ﻧ Aggregate Port 3 ﻧ '

```
Ruijie# show interfaces aggregateport 3
Interface   : AggreatePort 3
Description :
AdminStatus : up
OperStatus  : down
Hardware    : -
Mtu        : 1500
LastChange  : 0d:0h:0m:0s
AdminDuplex : Auto
OperDuplex  : Unknown
AdminSpeed  : Auto
OperSpeed   : Unknown
FlowControlAdminStatus : Autonego
FlowControlOperStatus  : Disabled
Priority    : 0
```

ЛЬЮ ﻧ GigabitEthernet 1/1 ﻧ '

```
Ruijie# show interfaces gigabitEthernet 1/1 switchport
Interface  Switchport Mode     Access    Native    Protected
VLAN lists
---------- ---------- --------- --------- --------- ---------
------------
gigabitethernet 1/1       Enabled  Access       1          1
```

```
Enabled   All
```

ЛьЮ ὶй ㄟ Gigabitethernet 2/1 ㄟ '

```
Ruijie# show interfaces gigabitethernet 1/2 description
Interface          Status     Administrative    Description
------------  ---------      -----------    ----------------
gigabitethernet 2/1     down       down        Gi 2/1
```

ЛьЮ ὶй ㄟ

```
Ruijie# show interfaces gigabitethernet 1/2 counters
Interface : gigabitethernet 1/2
5 minute input rate ' 9144 bits/sec, 9 packets/sec
5 minute output rate ' 1280 bits/sec, 1 packets/sec
InOctets           : 17310045
InUcastPkts         : 37488
InMulticastPkts     : 28139
InBroadcastPkts     : 32472
OutOctets          : 1282535
OutUcastPkts        : 17284
OutMulticastPkts    : 249
OutBroadcastPkts    : 336
Undersize packets   : 0
Oversize packets    : 0
collisions         : 0
Fragments          : 0
Jabbers            : 0
CRC alignment errors : 0
AlignmentErrors     : 0
FCSErrors          : 0
dropped packet events (due to lack of resources): 0
packets received of length (in octets):
64:46264, 65-127: 47427, 128-255: 3478,
256-511: 658, 512-1023: 18016, 1024-1518: 125
```

LinkTrap

ㄐЛь ㄟ ㄟ LinkTrapˇ ╖ ˇ
ㄟ Link ㄐ ˇ SNMP LinkTrap, ㄑ ‡ a Â Юˇ ╖
Â

ʒ

ʒ	

Ruijie(config-if)# [**no**] **snmp trap link-status**	ㄐ link trap ㄇ .

Ю ㄐ ὶ a Link trap:

```
Ruijie(config)# interface gigabitEthernet 1/1
Ruijie(config-if)# no snmp trap link-status
```

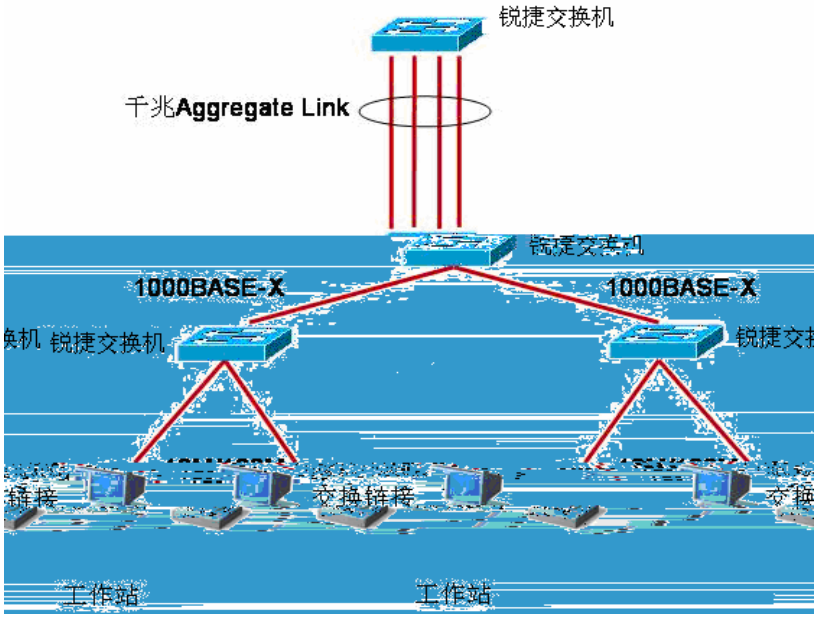
Aggregate Port

Э Aggregate Port Â

Aggregate Port

ل Л∪ У У ˘
ŕ Aggregate Poît ЛЬЮ AP˜ Â AP ╖ IEEE802.3ad
˘ ل Л∪ ˘ ل Â

AP У ˘ ╟ ↑ AP
è Э ÂAP У ˘ a
è Э Â



في 1 ŕ AP

AP ل Л∪ MAC à MAC ˘ MAC + MAC
à IP ˘ IP Л∪ ل IP + IP
↑ AP Â ل Л∪ **aggregateport load-balance** ↑

Â

MAC MAC ↑ AP
Â a ↓ MAC ˘ a ↓˘ ↓ MAC ˘ ÿ ↓ У
Â

MAC MAC ↑ AP
Â ↓ MAC ˘ ÿ ↓ У ˘ a ↓ MAC
˘ ÿ a ↓ Â

MAC+ MAC MAC MAC
↑ AP Â έ a ↓ MAC+ MAC ↓
↑ ↓ У AP Â

IP IP IP IP ↑ Â a ↓
IP IP a ↓ ˘ ↓ IP IP ‡
↓ Â Ь ˘
Ю γ ˘ ‡ ╟ γ MAC MAC
Â

IP + IP IP IP ↑ Â
Ь ˘ Ю γ ˘ ‡ ╟
γ MAC Â έ a ↓ IP+ IP ↓ ↑
↓ У AP Â

a ↓ ↑ ˘ Л∪ ↑
Э˘ Ї↑ Â

Юفي ˘ У AP б ˘ ^ فهي
Э 4 Л РС ~ Л∪ й ˘ ^ فهي Ю 2 Л РС ~
MAC MAC ˘ й б è ў
è ↑ ˘ й MAC ’
˘ ‡ й MAC Â

في 2 AP في

Aggregate Port

Aggregate Port

AP Ю '

γ AP ∧	
Ь AP ∧	
	MAC ¦ Â

Aggregate Port

γ ٨ ٧ ╗ γ AP˘ Ь ٨ ٧ ╗ Ь AP Â

AP a ٨ ╗ Â

٨ ╗ У a AP ˘ AP ╠… Â

У ٨ ╗ AP˘ ٨ AP ٧ Ʒ Â

У ٨ ÿ AP ˘ ‡ ٨ й è ╗ AP Â

~

У ٨ ╗ AP Л , a ٨ Э , ٨ AP.

Aggregate Port

٨ Ю˘ Ю ٨ ╗ AP'

Ʒ	
Ruijie(config-if-range)# **port-group** *port-group-number*	٨ ╗ У AP(AP a ˘ ‡ ٫ … AP) Â

٨ Ю **no port-group** Ʒ У ٨ AP Â

Ю γ Лυ ٨ 0/1 γ AP 5 '

```
Ruijie# configure terminal
Ruijie(config)# interface range gigabitEthernet 0/1
Ruijie(config-if-range)# port-group 5
Ruijie(config-if-range)# end
```

٫ Лυ Ю Ʒ Ruijie(config)# **interface aggregateport** *n* (n й AP Л) … У AP(AP n a) Â

Ь Aggregate Port

Ю˘ У Aggregate Port У γ AP˘ У Ь AP˘ Ю Â

Ю У Ь AP ٨ˆ AP 3˜ ˘ з IP ˆ 192.168.1.1˜ '

```
Ruijie# configure terminal
Ruijie(config)# interface aggretegateport 3
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 192.168.1.1 255.255.255.0
```

```
Ruijie(config-if)# end
```

Aggregate Port

ЮЎ Ю AP '

٩	
Ruijie(config)# **aggregateport load-balance** {**dst-mac** | **src-mac** | **src-dst-mac** | **dst-ip** | **src-ip** | **ip** }	AP ˘ ' **dst-mac'** MAC ˆ Â AP ˘ MAC ٧ ٧ ˘ MAC a ٧ ˆ a ٧ **src-mac'** MAC ˆ Â AP ˘ a ٧ MAC ˆ a ٧ ˘ ٧ MAC ٧ **ip'** IP б IP ˆ Â a ٧ IP—— IP a ٧ ˘ ٧ У IP—— IP ٧ Â **dst-ip'** IP ˆ Â AP ˘ IP ٧ ٧ ˘ IP a ٧ ˆ a ٧ **src-ip'** IP ˆ Â AP ˘ a ٧ IP ˆ a ٧ ˘ ٧ IP ٧ **src-dst-mac'** MAC б MAC ˆ Â a ٧ MAC—— MAC a ٧ ˘ ٧ У MAC—— MAC ٧ Â

AP ˘ ٧Ло Ю '

no aggregateport load-balance ٩ Â

Aggregate Port

ЮЎ Ю AP Â

٩	
Ruijie# **show aggregateport** [*port-number*]{**load-balance | summary**}	AP Â

```
Ruijie# show aggregateport load-balance
```

```
Load-balance : Source MAC address

Ruijie#show aggregateport 1 summary

AggregatePort MaxPorts SwitchPort Mode   Ports
------------- -------- ---------- ------
Ag1           8        Enabled    ACCESS
```

VLAN

IEEE802.1q VLAN

VLAN ˆ Virtual Local Area Networkˇ ˘ У
Э ¦ Â ISO γ Â

VLAN

ң VLAN IEEE802.1Q ˘ 4094 VLAN(VLAN ID 1-4094) è VLAN 1 a ┘ VLAN Â

VLAN

┘ Л Ъ У ∧ VLAN ˘ ∧ ˘ Л Ъ
┤ ∧ ┘ Л Ъ VLAN Â VLAN ˘ Ю
'

VLAN	VLAN ∧

VLAN State	Active	Active˘ Inactive

… à У VLAN

Ю˘ ˩ Л… У VLAN˝

ʒ	
Ruijie(config)# **vlan** *vlan-id*	У VLAN ID Â У VLAN ID˘ ‡ … У VLAN˘ VLAN ID˘ ‡ VLAN Â
Ruijie(config)# **name** *vlan-name*	ˆ ˩ ˜ й VLAN ˩ У ˧ Â У ˘ ‡ ╟ й У ˧ VLAN xxxx˘ è xxxx 0 Æ VLAN ID Л Â ˘ VLAN 0004 VLAN 4 ˧ Â

VLAN ˧ ˧ ˘ ˩ **no name** ʒ. ˩ Â

Ю У … VLAN 888˘ ˧ й Test888˘ з ˚ '

```
Ruijie# configure terminal
Ruijie(config)# vlan 888
Ruijie(config-vlan)# name test888
Ruijie(config-vlan)# end
```

У VLAN

a VLAN˙ VLAN 1˜ Â

Ю У VLAN˝

ʒ	
Ruijie(config)# **no vlan** *vlan-id*	У VLAN ID˘ Â

˧ VLAN¦ Access ˩

У ˩¦ У a VLAN˘ ѫ VLAN ╟ … Â

Ю˘ У ˩¦ У VLAN˝

ֽ	
Ruijie(config-if)# **switchport mode access**	׀ ˄ VLAN ˆ ˥ ACCESS ˄˜
Ruijie(config-if)# **switchport access vlan** *vlan-id*	˄† ˯ VLAN


锐捷交换机
trunk
trunk
trunk
trunk

ֽ	
Ruijie(config-if)# **switchport mode trunk**	᎒ ᐧ ᙆ γ Trunk ᐧ
Ruijie(config-if)# **switchport trunk native vlan** *vlan-id*	ᙆ ᐧ У Native VLAN

У Trunk ᐧ Trunk Æ ˘ **no switchport trunk** ᐧ ֽ Â

᎒ Trunk ᐧ ┘ VLAN

У Trunk ᐧ ┘Ո VLANˆ 1˙ 4094˜
≠ ┘Ո Trunk ᐧ ┘ VLAN VLAN a
Trunk ᐧ Â

Ю˝ ┘Ո У Trunk ᐧ ┘ VLAN Â

ֽ	
	ˆ ┘ ˜ Trunk ᐧ ┘ VLAN Â *vlan-list* ┘Ո У VLANˆ ≠ ┘Ո У VLANˆ Ո VLAN ID ˘ Ո VLAN ID ȳ ú

Ruijie(config-if)# **switchport trunk allowed vlan** {**all** | [**add** | **remove** | **except**] } *vlan-list*

```
1,3-4094
```

Native VLAN

У Trunk ㄟ TAG UNTAG 802.1Q Â è UNTAG Native VLAN Â Native VLAN VLAN 1 Â

ЮЎ ㄱЛЪ ѝ У Trunk ㄟ Native VLAN Â

҈	
Ruijie(config-if)# **switchport trunk native vlan** *vlan-id*	Native VLAN

Trunk Native VLAN VLAN 1Ў **no switchport trunk native vlan** ㄟ ҈ Â

У Native VLAN VLAN IDЎ Trunk ㄟ ˘ ╟ TAG Â

У ㄟ Native VLAN ѝ У a VLAN ˘ a ╟… VLAN Â ˘ У ㄟ Native VLAN ㄱЛЪ a ㄟ ㄱ VLAN Â ˘ Native VLAN a ㄟ Â

VLAN

ЮЎ ㄱЛЪ VLAN Â VLAN VID à VLAN à VLAN ㄟЛЪㄱ VLAN ÂЛЪЮ ҈'

҈	
show vlan [**id** *vlan-id*]	VLAN

Ю У VLAN '

```
Ruijie# show vlan
VLAN[1] "VLAN0001"
GigabitEthernet 3/1
GigabitEthernet 3/2
GigabitEthernet 3/3
GigabitEthernet 3/4
GigabitEthernet 3/5
GigabitEthernet 3/6
GigabitEthernet 3/7
GigabitEthernet 3/8
GigabitEthernet 3/9
GigabitEthernet 3/10
```

```
GigabitEthernet 3/11
GigabitEthernet 3/12
VLAN[6] "VLAN0006"
GigabitEthernet 3/1

Ruijie# show vlan  id 1
VLAN[1] "VLAN0001"
GigabitEthernet 3/1
GigabitEthernet 3/2
GigabitEthernet 3/3
GigabitEthernet 3/4
GigabitEthernet 3/5
GigabitEthernet 3/6
GigabitEthernet 3/7
GigabitEthernet 3/8
GigabitEthernet 3/9
GigabitEthernet 3/10
GigabitEthernet 3/11
GigabitEthernet 3/12
```

VLAN

Э ي ˘ ∫ и VLAN 10 à VLAN 20 à VLAN 30 Л
2 ' 3 VLAN IP ∫ и 192.168.10.0/24 à 192.168.20.0/24 à
192.168.30.0/24 3 VLAN 3 IP Â

Л 1 Л BÀÁÂÃÄÅÆÇÈÉÊËÌÍÎÏÐÑÒÓÔÕÖ×ØÙÚÛÜÝÞßà Â Ю

```
#        ╗      ∧      ⅃ vlan ѝ 10 à 20
Ruijie(config-if)#switchport trunk allowed vlan add 10,20
#        ∧ Gi 0/3
Ruijie(config-if)#interface GigabitEthernet 0/3
#      m ▨ n      ⊥      vlan ѝ
                        Ruijie(config-if)#                                    Ru
```

```
Gi0/3     enabled   TRUNK    1      1     Disabled  10,20,30
```

```
#       Gi 0/4    vlan
Ruijie#show interface GigabitEthernet 0/4 switchport
Interface Switchport Mode  Access Native Protected VLAN lists
--------- ---------- -----  ------ ------ --------- ----------
Gi0/4     enabled   TRUNK    1      1     Disabled  20,30
```

```
           ...   SVI          IP
#
Ruijie#configure terminal
# ...   SVI 10
Ruijie(config)#interface vlan 10
#     SVI 10    IP
Ruijie(config-if)#ip address 192.168.10.1 255.255.255.0
# ...   SVI 20
Ruijie(config-if)#interface vlan 20
#     SVI 20    IP
Ruijie(config-if)#ip address 192.168.20.1 255.255.255.0
# ...   SVI 30
Ruijie(config-if)#interface vlan 30
#     SVI 30    IP
Ruijie(config-if)#ip address 192.168.30.1 255.255.255.0
#
Ruijie(config-if)#exit
```

Switch A

```
           ...   VLAN
#
Ruijie#configure terminal
# ...   VLAN 10
Ruijie(config)#vlan 10
# ...   VLAN 20
Ruijie(config-vlan)#vlan 20
#
Ruijie(config-vlan)#exit
```

```
           VLAN      Access
#       Gi 0/2-12
Ruijie(config)#interface range GigabitEthernet 0/2-12
#     Gi 0/2-12       Access
Ruijie(config-if)#switchport mode access
#     Gi 0/2-12        VLAN 10
Ruijie(config-if)#switchport access vlan 10
#       Gi 0/13-24
```

```
Ruijie(config-if)#interface range GigabitEthernet 0/13-24
#     ٨ Gi 0/13-24     ٭ Access ٨
Ruijie(config-if)#switchport mode access
#     ٨ Gi 0/13-24¶      VLAN 20
Ruijie(config-if)#switchport access vlan 20
#
Ruijie(config-if)#exit
```

Э trunk ٨

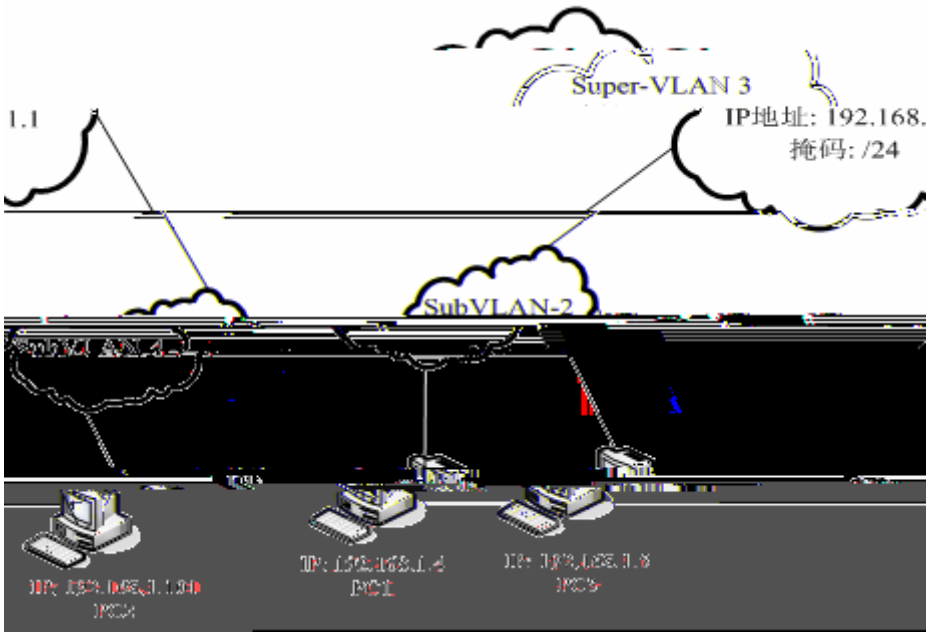
```
#       ٨ Gi 0/1
Ruijie(config)#interface GigabitEthernet 0/1
#         ٨ Gi 0/1    ٭ trunk ٨
Ruijie(config-if)#switchport mode trunk
#
Ruijie(config-if)#exit
```

Super VLAN

Super VLAN

Super VLAN VLAN ¦ У Â Super VLAN ٧ ѝ VLAN ˘ У ж . IP Â è У IP¦ a ٯ VLAN(Sub VLAN)˘ Sub VLAN ٯ У Super VLAN Â У Sub VLAN ˘ a ٯ Sub VLAN ү Â Sub VLAN Ь ˘ Super VLAN ٧ IP ѝ ˘ VLAN У IP ˘ ÿ IP Â ٯ ˘ ѝ a ٯ Sub VLAN Ь ٦ Sub VLAN б è ˘ ARP Ʒ ╖ Â ARP Ʒ ٯ Ƨ ARP б ˘ ÿ ү ٧ Ь Â Ю˘ Super VLAN Sub VLAN ARP Ʒ ╖ Â

Super VLAN ٯ Ƨ IP ˘ ٧ Sub VLAN Super VLAN¦ У IP ˘ ٧ Â



في 1

Ю У Ю VLAN Ю˘ ч Sub-VLAN ˘ Э في '

Sub VLAN2 Sub VLAN4 Super VLAN3˘ ѝ Super VLAN3¦ У IP

˘ Sub VLAN2 Sub VLAN4 æ Â Sub VLAN2 У ˊ ў PC1 б ˊ У ˊ ў PC2 ˘ PC1 б ˋ У ˘ ‡ IP ARP Â ж Ь ARP ˊ˘ è Sub VLAN2 ץ ˘ У ARP ˘ ARP ″I ARP IP a Sub-VLAN2 ˘ ˘ й PC1 ˋ У ˘ ж ў PC1’ a SuperVLAN3 MAC PC1˘ ARP Ç Â PC1 PC2 ARP Ç ˘ PC1 PC2 ’ PC1 PC3 ‡ Â

'

Super VLAN a ˊ˘ ˊ Sub VLAN˘ Sub VLAN ˊ Â

Super VLAN a й è Super VLAN Sub VLAN Â

Super VLAN a 1Q vlan Â

VLan 1 a й SuperVLAN Â

Sub VLAN a й ˊ˘ a IP Â

SVLAN a VRRP˘ a Â

Super VLAN ˊ ACL QOS a Sub VLAN Â

Super VLAN

ˋ Л Ю Ç Super VLAN Â

Ç	
Ruijie# **configure**	
Ruijie(config)# **vlan** *vlan-id*	VLAN
Ruijie(config-vlan)# **supervlan**	SuperVLAN ╖
Ruijie(config-vlan)# **end**	

Ю˘ Super VLAN ╖ ˘ **no supervlan** ˋ Л supervlan ╖ Â

Super VLAN Sub VLAN

й SuperVLAN SubVLAN˘ SuperVLAN Нж Â

ˋ Л Ю Ç У VLAN Super VLAN SubVLAN Â

~

┘ a SubVLAN

?	
Ruijie# **configure**	

Super VLAN ٨

Sub VLAN Ь , ″I … SuperVLAN
Ь ٨ Â

SuperVLAN SVI й ٨

Ю Ю Â

ٹ	
Ruijie# **configure**	
Ruijie(config)# **interface vlan** *vlan-id*	SVI
Ruijie(config-vlan)# **ip address** *ip mask*	٨ IP
Ruijie(config-vlan)# **end**	
Ruijie# **show run**	

VLAN ٹ ARP ٦

٦ Л Ю ٹ VLAN ٹ ARP ٦ ˘ ÿ SubVLAN
Â Ю ٦ Â

Ю Ю Â

ٹ	
Ruijie# **configure**	
Ruijie(config)# **vlan** *vlan-id*	VLAN
Ruijie(config-vlan)# **proxy-arp**	VLAN ARP ٹ ٦
Ruijie(config-vlan)# **end**	
Ruijie# **show run**	

no proxy-arp Vlan ٹ ARP ٦ Â

supervlan

٦ Л Ю ٹ SuperVLAN

ٹ	
Ruijie# **show supervlan**	supervlan

Super VLAN

```
switchport access vlan 4
!
```

… SuperVLAN Ь ٨

```
interface Vlan 3
ip address 192.168.1.1 255.255.255.0
```

Protocol VLAN

Protocol VLAN

ﾍ ˘ VLAN ｷ ˘ У У VLAN˘ ЛЬЮ Ь ┘ '

1. VLAN ID ^ UNTAG Priority ~ ˘ ﾍ VLAN｣ ˘ ╗ TAG VLAN ID ﾍ PVID Â
2. VLAN ID ^ UNTAG Priority ~ ˘ VLAN｣ ˘ ╗ TAG VLAN ID ÿ ﾍ Э VLAN ID ┘˘ б ﾍ Э a ˘ ﾍ VLAN｣ ｷ VLAN ID Â
3. TAG ˘ è VLAN｣ TAG VLAN ID ã Â

Protocol VLAN VLAN｣ ˘ è ┘Л У VLAN ID ｷ ┘ У VLAN Â

Protocol VLAN ┘ Trunk ﾍ ˘ Access ﾍ Â

ﾉﾍ ң IP VLAN｣ ﾍ Э Л VLAN｣ ч VLAN｣ Â

IP VLAN｣ ˘ IP VLAN｣ ˘ è Trunk ﾍ Э Â

1. ỳй VLAN ID , з IP ┐ IP ˘ ｷ VLAN Â
2. ỳй VLAN ID , з Л ┐ ﾍ Э Л ˘ ｷ VLAN Â

IP VLAN｣ . ˝I Л VLAN｣ ˘ Л ┘ IP Л ┤ Л VLAN ｷ ˘ з ┘ ч ˘ IP VLAN｣ Â

VLAN à ﾍ Trunk à Access AP ┘˘ ЇĄ Protocol VLAN˘ Trunk ﾍ Э Protocol VLAN˘ ѫ Trunk ﾍ ┘ VLAN Protocol VLAN VLAN

Protocol VLAN

Protocol VLAN

Ю Protocol VLAN

Л profile

Ю Л

?	
configure terminal	
protocol-vlan profile *id* **frame-type** [*type*] **ether-type** [*type*]	Л profile
no protocol-vlan profile *id*	profile
no protocol-vlan profile	profile
end	VLAN
show protocol-vlan profile	profile
show protocol-vlan profile *id*	profile

Ю

```
Ruijie# configure terminal
Ruijie(config)# protocol-vlan  profile 1 frame-type  ETHERII
ether-type EHTER_AARP
Ruijie(config)# protocol-vlan  profile 2 frame-type  SNAP
ether-type 0x809b
Ruijie(config-vlan)# end
Ruijie# show protocol-vlan profile
profile         frame-type  ether-type       Interfaces|vid
-------     ---------   ----------        -----------
1           ETHERII     EHTER_AARP       NULL|NULL
2           SNAP         ETHER_APPLETALK  NULL|NULL
```

1. Profile Л

2. Profile ˘ ˝I Profile˘ Ą Profile
3. a ˩ ң Profile a ˩˘ S3250 7 profile Â

profile

˩ Л Ю :

҂	
configure terminal	
interface [˄ *ID*]	˄
protocol-vlan profile *id* **vlan** *vid*	profile ˄
no protocol-vlan profile	˄ Э profile
no protocol-vlan profile *id*	˄ Э profile
end	˄

Ю profile 1 profile 2 3 GE ˄ 1,VLAN† й VLAN 101 102:

```
Ruijie# configure terminal
Ruijie(config)# interface gi 3/1
Ruijie(config-if)# protocol-vlan profile 1 vlan 101
Ruijie(config-if)# protocol-vlan profile 2 vlan 102
Ruijie(config-if)# end
Ruijie# show protocol-vlan profile
profile          frame-type  ether-type     Interfaces|vid
-------      ---------   ----------     --------------
1            ETHERII     EHTER_AARP     gi3/1|101
2            SNAP         ETHER_APPLETALK  gi3/1|102
```

˄ Э ˩ Л profile

˩ profile a ˩ ˄ Э ˩ Л a ˩ vid

a ˩ ң ˩ Л a ˩ VID Â

Protocol VLAN

ٸ Л Лю Protocol VLAN

Private VLAN

Private VLAN

Ь У VLANˇ ‡ У Л VLAN Н
4096 Ь ' Ь Эˇ VLAN ↑
У У ˇ IP ˇ У ¤
Private VLAN Â

VLAN(Private VLAN) У VLAN ү ↑ ˇ
У VLAN ' ў VLAN(Primary VLAN) ╠ VLAN(Secondary VLAN) Â

У VLAN Л Љ VLAN ˇ У VLAN Ҙ У
Â У VLAN VLAN Л У ў VLAN Â
╠ VLAN ID a Л Â

У VLAN Н У ў VLANˇ ╠ VLAN Л У VLAN
ү ˇ ч ╠ VLANˇ

VLAN(Isolated VLAN)ˇ Л У VLAN Н a ү
Â У VLAN Н У VLAN Â

VLAN(Community VLAN)ˇ Л У VLAN Н Л Љ ү
ˇ a б è VLAN Н ү Â У VLAN
Л Љ VLAN Â

Н Promiscuous Portˇ ˇ ў VLAN Нˇ Л Љ б Н ˇ
Л У VLAN ╠ VLAN Н Н Â

Н (Isolated Port)ˇ VLAN Нˇ Л б Н Â

Н (Community port)ˇ VLAN Нˇ Л У VLAN
Н Л Љ ˇ ≠ Л Љ б Â a б è VLAN Н Н
VLAN Н Â

VLAN ˇ Л ў VLAN Л Љ… SVI Нˇ ╠ VLAN a Л Љ… SVI Â

VLAN Н Л Љ й SPAN Нˇ a Л Љ й Н Â

Private VLAN

Private VLAN

Ю Private VLAN

VLAN й VLAN

Ю ҙ

ҙ	
configure terminal	
vlan *vid*	VLAN
private-vlan{**community	isolated**	**primary**}	VLAN
no private-vlan{**community**	**isolated**	**primary**}	VLAN
end	VLAN
show vlan private-vlan [*type*]	VLAN

```
Ruijie# configure terminal
Ruijie(config)# vlan 404
Ruijie(config-vlan)# private-vlan isolated
Ruijie(config-vlan)# end
Ruijie# show vlan private-vlan
VLAN Type  Status    Routed   Interface   Associated VLANs
--- ----   --------  ------   ---------   ------------------
303 comm  inactive  Disabled             no association
404 isol  inactive  Disabled             no association
```

Secondary VLAN Primary VLAN

ЮO Secondary VLAN Primary VLAN'

?	
configure terminal	
vlan *p_vid*	Primary VLAN
private-vlan association {*svlist* | **add** *svlist* | **remove** *svlist*}	Secondary VLAN
no private-vlan association	б Secondary VLAN
end	VLAN
show vlan private-vlan [*type*]	VLAN

ЮO'

```
Ruijie# configure terminal
Ruijie(config)# vlan 202
Ruijie(config-vlan)# private-vlan association 303-307,309,440
Ruijie(config-vlan)# end
Ruijie# show vlan private-vlan
VLAN Type  Status    Routed   Interface   Associated VLANs
--- ----   --------  ------   ---------   ------------------
202 prim  inactive  Disabled             303-307,309,440
303 comm  inactive  Disabled             202
304 comm  inactive  Disabled             202
305 comm  inactive  Disabled             202
306 comm  inactive  Disabled             202
307 comm  inactive  Disabled             202
309 comm  inactive  Disabled             202
440 comm  inactive  Disabled             202
```

й Primary VLAN VLAN Â

Secondary VLAN Primary VLAN Ь ٨

┘Л Ю '

ٹ	
configure terminal	
interface vlan *p_vid*	Primary VLAN ٨
private-vlan mapping {*svlist* | **add** *svlist* | **remove** *svlist*}	Secondary VLAN Primary VLAN SVI Ь Â
end	٨

Ю Secondary VLAN '

```
Ruijie# configure terminal
Ruijie(config)# interface vlan 202
Ruijie(config-if)# private-vlan mapping add 303-307,309,440
Ruijie(config-if)# end
Ruijie#
```

Primary VLAN Secondary VLAN Â

٨ й VLAN ў ٨

ЛЬЮ γ ٨ й VLAN ў ٨ (Host Port)' **ăĘQDN6SIQ4bà.28B%AFÕ**

switchport mode private-vlan host й γ

Ю '

```
Ruijie# configure terminal
Ruijie(config)# interface gigabitEthernet 0/2
Ruijie(config-if)# switchport mode private-vlan promiscuous
Ruijie(config-if)# switchport private-vlan mapping 202 add 203
Ruijie(config-if)# end
Ruijie#
```

Primary VLAN Secondary VLAN

Private VLAN

private VLAN

↓Л∪ ЛUЮ Private VLAN '

?	
show vlan private-vlan [*type*]	private VLAN

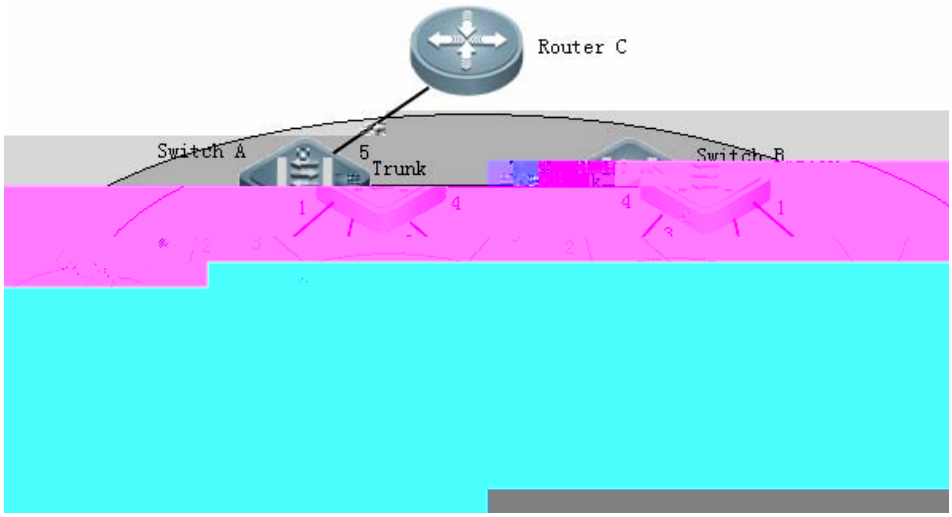
```
Ruijie# show vlan private-vlan
VLAN Type  Status    Routed   Interface   Associated VLANs
---- ----  --------  ------   ---------   ------------------
202  prim  active    Enabled   Gi0/1      303-307,309,440
303  comm  active    Disabled  Gi0/2      202
304  comm  active    Disabled  Gi0/3      202
305  comm  active    Disabled  Gi0/4      202
306  comm  active    Disabled             202
307  comm  active    Disabled             202
309  comm  active    Disabled             202
440  comm  active    Enabled   Gi0/5      202
```

Private VLAN ή

⅄ Э Private VLAN

ч ⅄ Э Private VLAN ˘ … У Primary VLAN˝ У Community VLAN˝ У Isolated VLAN. ⅄ У Community VLAN ў ⅄Ль ү ˘ Isoated VLAN ў б è ў а ˘ Private VLAN ў б Â

˘ S86 à S5750 ң а PVLAN˝ . Ю ⅄ S86 S5750 Â



… VLAN 99 й Primary VLAN˝ … VLAN 100 й Community VLAN˝ … VLAN 101 й Isolated VLAN˝ ў VLAN Â

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#vlan 99
```

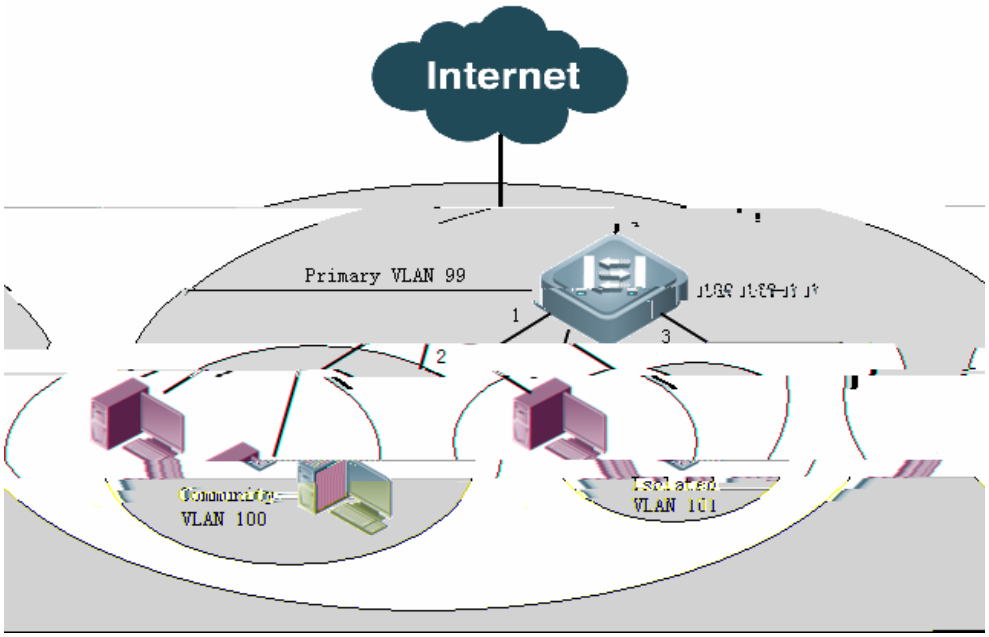
```
Ruijie(config-vlan)#private-vlan primary
Ruijie(config-vlan)#exit
Ruijie(config)#vlan 100
Ruijie(config-vlan)#private-vlan community
Ruijie(config-vlan)#exit
Ruijie(config)#vlan 101
Ruijie(config-vlan)#private-vlan isolated
Ruijie(config-vlan)#exit
Ruijie(config)#vlan 99
Ruijie(config-vlan)#private-vlan association 100,101
Ruijie(config-vlan)#exit
```

ٰ 1 2 Community VLAN 100, 0/3 Isolated VLAN 101, 0/4 Promiscuous Port

```
Ruijie(config)#interface gigabitEthernet 0/1
Ruijie(config-if)#switchport mode private-vlan host
Ruijie(config-if)#switchport private-vlan host-association 99
100
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/2
Ruijie(config-if)#switchport mode private-vlan host
Ruijie(config-if)#switchport private-vlan host-association 99
100
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/3
Ruijie(config-if)#switchport mode private-vlan host
Ruijie(config-if)#switchport private-vlan host-association 99
101
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/4
Ruijie(config-if)#switchport mode trunk
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/5
Ruijie(config-if)#switchport mode private-vlan promiscuous
Ruijie(config-if)#switchport private-vlan mapping 99 add
100-101
Ruijie(config-if)#show vlan private-vlan
VLAN    Type              Status      Routed      Ports
Associated VLANs
----- ---------- -------- -------- -------------------------
99       primary       active     Disabled  Gi0/4,  Gi0/5
100-101
100  community  active  Disabled Gi0/1, Gi0/2, Gi0/4      99
101  isolated   active  Disabled Gi0/3, Gi0/4            99
```

⅄ Ь Э Private VLAN

Private VLAN Ь Э˘ ⅃ Л ѝ Private VLAN У SVI. У Private VLAN Ю VLAN˘ Primary VLAN б Secondary VLAN˘ ⅃ Л ⅃ У SVI .⅄ Э Э˘ ѝ Primary VLAN У IP , Secondary VLAN ⅄ Primary VLAN Ь . ⅃ Â



Э У ˘ … VLAN 99 ѝ Primary VLAN˘ … VLAN 100 ѝ Community VLAN˘ … VLAN 101 ѝ Isolated VLAN˘ ў VLAN Â

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#vlan 100
Ruijie(config-vlan)#private-vlan community
Ruijie(config-vlan)#exit
Ruijie(config)#vlan 101
Ruijie(config-vlan)#private-vlan isolated
```

```
Ruijie(config-vlan)#exit
Ruijie(config)#vlan 99
Ruijie(config-vlan)#private-vlan primary
Ruijie(config-vlan)#private-vlan association 100,101
Ruijie(config-vlan)#exit
```

ٴ Ỏ 1 Ỏ 2 Community VLAN 100ˇ ٴ 0/3 Isolated VLAN 101ˇ ٴ 0/4 ٸ Promiscuous Port Â

```
Ruijie(config)#interface gigabitEthernet 0/1
Ruijie(config-if)#switchport mode private-vlan host
Ruijie(config-if)#switchport private-vlan host-association 99
100
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/2
Ruijie(config-if)#switchport mode private-vlan host
Ruijie(config-if)#switchport private-vlan host-association 99
100
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/3
Ruijie(config-if)#switchport mode private-vlan host
Ruijie(config-if)#switchport private-vlan host-association 99
101
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/4
Ruijie(config-if)#switchport mode private-vlan promiscuous
Ruijie(config-if)#switchport private-vlan mapping 99 add
100-101
Ruijie(config-if)#exit
```

ٸ Primary VLAN У SVI (192.168.1.1)ˇ Л٦ٴ Secondary VLAN Primary VLAN Ь ٴ Â

```
Ruijie(config)#interface vlan 99 config-if)#exit
```

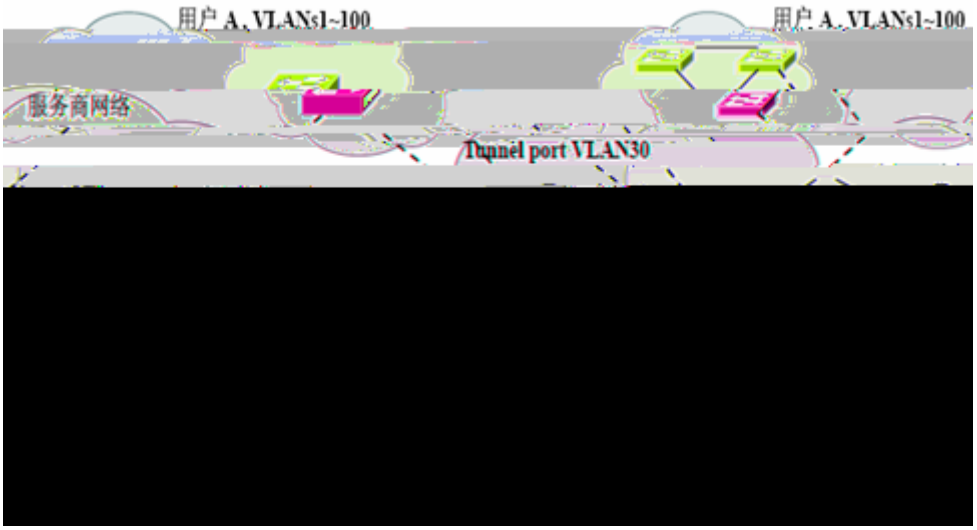
802.1Q tunneling

802.1Q tunneling

ㄴ VLAN ㄱ VLAN ID
Â ㅅ У ㄴ VLAN ㅅ ˇ з a ㅅ ㄴ
ㅅ У Â У VLAN
ˇ з VLAN ㄲ 802.1Q ㅾ 4096 Â

IEEE 802.1Q Tunneling( )╖ ˇ ㄴ ㅅ Л∪ У VLAN(ㄴ VLAN)
VLAN Â VLAN ˇ .
ㄴ a ㅅ VLAN ㅅˇ ≠ ㄴ ⍭ Â
ㄱ Tag VLAN ˇ У IEEE 802.1Q Tunneling( )
ㄱ й ㄱ (Tunnel Port) Â ˇ ㅅ Л∪ ㄱ У VLAN
й ж VLAN Â ˇ У ㄴ VLANˇ
ㄴ ㄴ VLAN ㄱ Tag ˇ Л∪ ㄴ VLAN
Â

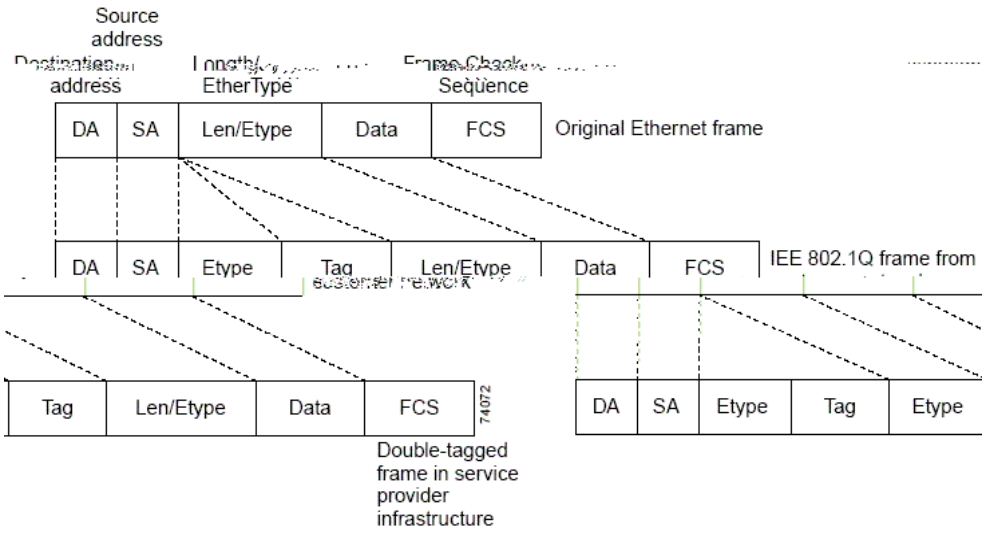
ÿ è У TRUNK ㄱˇ 802.1Q TAG ㄴ
У ㄱ Â ㄴ й (Asymmetric Linkˇ й У У Trunk Portˇ ㄲ У . У Tunnel Port Â a ㅅ
Tunnel Port a ㅅ VLAN Â Ю في'



في 1

ÿ Trunk Port ㄴ ㄱ У
Vlan ID IEEE 802.1Q Tag Â ㄱ ㄲˇ ╗ У
802.1Q Tag (й ㄴ Tagˇ ㄲ У VLAN IDˇ VLAN ID

a ⅃ Â TAG Â ⊾
Э ⅂ Tag˘ ⊾ Tag VID˘ Tag ‡
VID Â Юفي⅁ Tag ╗



Tag . ″I

802.1Q tunneling

ЮЎ 802.1Q ╖ '

802.1Q tunneling

802.1Q ˇ 802.1Q У (Asymmetric Link)ˇ ж У VLAN Â ⅄ Native VLAN Â

Native Vlan ' У 802.1Q ˇ 802.1Q Trunk ∧ У ∧ Â Ь ˇ ⅄ 802.1Q Trunk, Trunk ∧ Â TRUNK ˇ Э TRUNK ∧ Native VLAN б Tunnel port ACCESS VLAN a ⅄ˇ й Vid й Native VLAN ÿ Trunk ∧ ˇ Tag Â

' й 802.1Q Tunneling ∧ ╖ 4 Ь VLAN Tagˇ ÿ 1518 ╖ 1522 Â

Uplink ∧' Up-link ∧ è Ь Э ∧ Â Э ﻲ 1 Ь Trunk Portsˇ Uplink ∧ è У Trunk ∧ˇ a ⅄ ˇ ÿ Uplink ∧ Tag Â ÿ Trunk Port ˇ Native VLAN ˇ ‡ a tag Â

Tag . ″I ' ⅂ TAG ЮЎ Tag(Tag) . ″I Tag(Ь Tag) Â

802.1Q tunneling

802.1Q tunneling Ю '

∧ a й Tunnel Port

Ap ∧ ⅄Л Tunnel Port

й Tunnel ∧ a ″Ą 802.1x ╖ Â

й Tunnel ∧ Э a Â

й Tunnel ∧ Э a ╖ STP Â

й Tunnel ∧ Э a GVRP Â

й Tunnel ∧ System-guard Â

У 802.1Q tunneling ^

Ю Interface ? ^ Â Ю Tunnel Port '

?	
configure terminal	
interface <*interface*>	^
switchport access vlan <*vid*>	Access VLAN Â Access VLAN a ˩

```
Ruijie(config-if)# switchport mode up-link
Ruijie(config)# end
```

Tag TPID

Interface

configure terminal	
interface <*interface*>	
frame-tag tpid <*tpid*>	tag TPID 0x9100 frame-tag tpid 9100 16
end	
show frame-tag tpid	tpid

TPID

```
Ruijie(config)# interface gigabitethernet 0/1
Ruijie(config-if)# frame-tag tpid 9100
Ruijie(config)# end
Ruijie# show frame-tag tpid interface gigabitethernet 0/1
Port   tpid
------- -------------
Gi0/1  0x9100
```

Tag

Interface

Ю Tag . ″I '

```
Ruijie(config)# interface gigabitethernet 0/1
Ruijie(config-if)# inner-priority-trust enable
Ruijie(config)# end
Ruijie# show inner-priority-trust interface gigabitethernet 0/1
Port   inner-priority-trust
------   -------------------
Gi0/1  enable
```

MAC

MAC

MAC ﾍ Â MAC ╠ à
à Ь ˘ ÿ ЛЮ MAC Â

╠

╠ ╠ ˉ MAC Â У ﾍ У
˘ ﾍ ˘ ˘
a ˉ Â

У ˘ MAC ˉ ╠ ˘ ‡
б MAC ﾍ Э˘ ‡˘ ﾉ ﾍ
Â

ˉ a ¨Ą a è ╠ Â
У ˘ (ā) Лυ
ŕ ˘ ‡ Â ﾉ Лυ ﾉ ╠
Â ˘
ŕ ˘ ¨Ą Лυ ŕ
˘ ﾉ VLAN è ﾍ ˘ У a
Â ˘ ‡ ˘ ´ Â
╗ ﾉ˘ a ˉ ˘ ˉ ˘
У ˘ Лυ ŕ ˘ ﾉ
ﾉ VLAN è ﾍ ˘ ≠ У a Â

Æ ﾉ˘ ˉ ╠ ˘ ˉ
Â

Ю˘ ÿ ˉ ў ˘
ﾉ ÿ ˘ ‡ ÿ a ˉ ˘ ÿ mac ŕ
Э mac ˘ ﾍ Â

~

Ю ﾉ a ﾉ , ¨Ą╗ Э hash ă ﾉ

, Ю, , з ⅃
a Â Ю:

A B , A и ў . A B ⅃ .
, A B , a ⅃ .
⅃ B Э У mac1+vid1+Bport , A Э .
≠ . .

mac1 (pc) ÿ B Bport A Aport ,
mac1+vid1 ˝ , A , з ″I a
mac1+vid1 , Л Ъ , ∀ B, B
mac1+vid1 , B mac1+vid1+Aport
mac1+vid1+Bport . mac1+vid1+Bport
, B mac1+vid1+Aport . , .
, mac1+vid1+Bport ≠ a .
╟ , ҙ clear mac-address-table dynamic.

╗ MAC Â ╟ ╗ ⅃˘ a ╟
˘ ∀ (a ˝)˘ ⅃ Л Ъ
˚ ˘ . Æ˘ ≠ a Â

╗ MAC Â Л Ъ и
Â a ˘ ∀ ˘ ⅃ Л Ъ
˚ ˘ . Æ˘ ≠ a Â

У ˘ ⅃ Л Ъ MAC и
˘ б Â

MAC VLAN

MAC VLAN ˘ ⅃ MAC ⅃ Л Ъ VLAN
˘ a ⅃ VLAN ⅃ Л Ъ a ⅃ ∀ Â VLAN
Э У Â У VLAN ˝ MAC ˘ è VLAN ⅃
˘ ÿ ˝ Â

MAC

MAC

Ю '

	300
╟	╟ ⁻

~

б У ˘ a 2 Â

Ю й '

⅋	
Ruijie(config)# **mac-address-table aging-time** [*0* |*10-1000000*]	У ⁻ Л ╟ ˘ Æ ˘ 10˙ 1000000 ˘ й 300 Â й 0 ˘ ╖ ˘ ⁻ a Â

┘Л∪ Ю ⅋ **no mac-address-table aging-time**
й Â

╟

Ю˘ ┘Л∪ ⅋ **clear mac-address-table dynamic** Э
╟ ' ┘Л∪ ⅋ **clear mac-address-table dynamic address**
mac-address У MAC ' ┘ Л∪ ⅋ **clear**

MAC

ل Л Ю ٩ **no mac-address-table filtering mac-addr vlan** *vlan-id* У Â

Ю VLAN 1 MAC й 00d0.f800.073c

```
Ruijie(config)# mac-address-table filtering 00d0.f800.073c
vlan 1
```

MAC

MAC

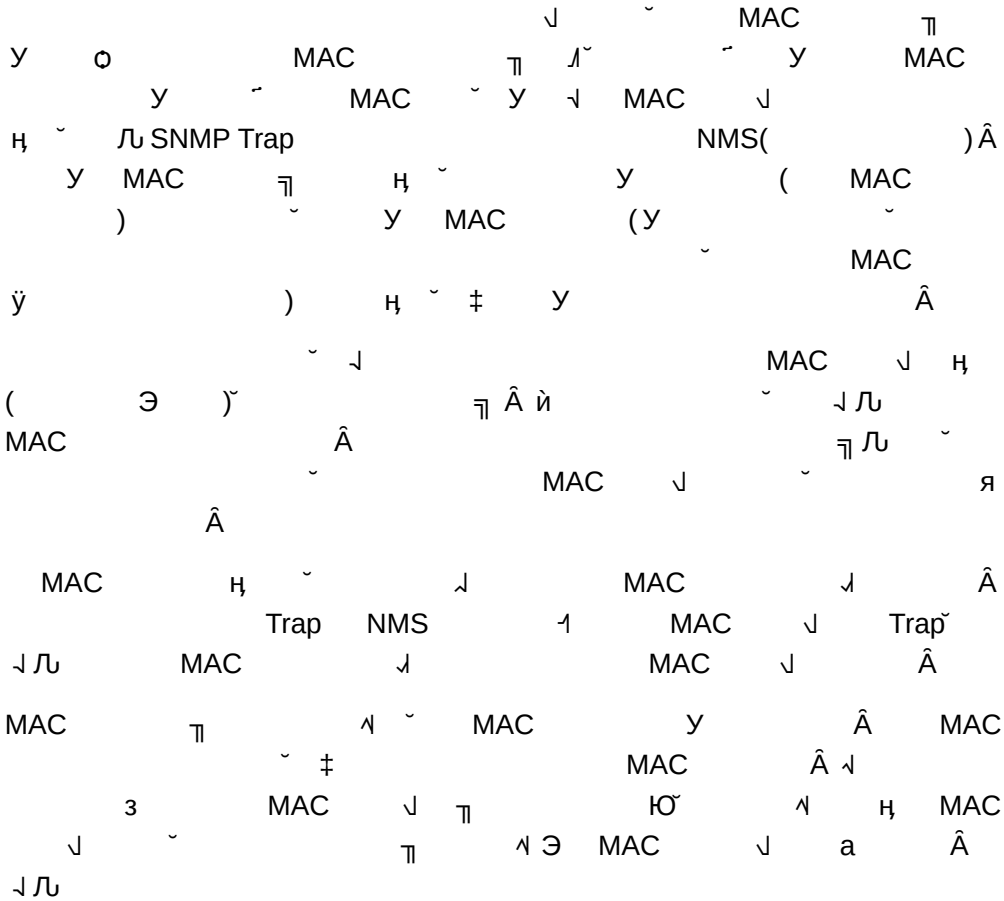
٩	

Ruijie# **show mac-address-table**

```
Total Mac Address Space Available: 8159


Ruijie# show mac-address-table aging-time
Aging time    : 300
```

MAC



~

MAC ╟ ˇ ┘ a ң
Â

MAC

Ю˜ Ю Ю MAC

MAC

ㄴЛЪ Ю **show address-bin**d [ip-address *ip* | mac-address *mac*]
ʒ IP/MAC Â

```
Ruijie# show address-bind ip-address 3.3.3.3
IP Address      Binding MAC Addr
-----------     -----------------
3.3.3.3         00d0.f811.1112
```

ㄴЛЪ Ю **show address-bind summary** ʒ
ЛЪㄱ

```
Ruijie# show address-bind summary
Total Bind Addresses in System : 0
Max Bind Addresses limit in System : 1000
System Address bind status:SUCCESS
```

~

System Address bind status Ь ' SUCCESS˝
ʒ address-bind install ʒ ╖ ' FAIL˘
ʒ address-bind install ʒ˘ ˚ a Л Ъ ˘
Л Ъ ˘ a ˘ ㄴЛЪ ˫
Ạ ' Uninstall˝ ˘
a Â

IP

˫ й ˘ ˘ ш Ь ˘ й ш Â ε
‡˘ Ю

	Ipv4 ‡	**IPV6 ‡**
ш	ㄴ IPV4+MAC ˚ a ipv6 Â	

३	

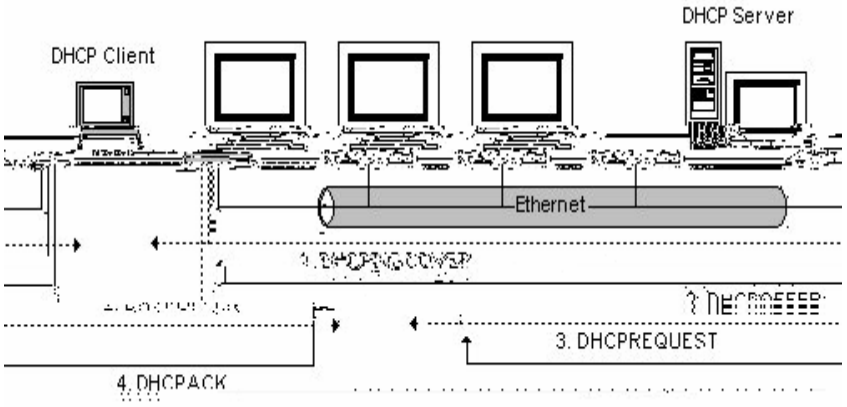
Ruijie# **configure terminal**

DHCP Snooping

DHCP Snooping Ӯ

DHCP

DHCP ╟ ↑ ┘ ˘ IP Â У ή
DHCP ┘ IP Ю '



1 ف

DHCP Client DHCP DISCOVER DHCP Server˘ Client У
Ь ˘ ‡ DHCP DISCOVER Â

DHCP Server DHCP DISCOVER ˅˘ У Client↑
(IP)˘ ˅ DHCP OFFER Â

DHCP Client DHCP OFFER ˅˘ DHCP REQUEST ˘
┘ Ь ˘ è Ь ┘ Ь ↑ Â

Ь DHCP REQUEST ˘ ┘Л↑ ˘ ┘Л↑ ˘ ‡
DHCP ACK ' a ┘↑ ˘ ‡ DHCP NAK Â DHCP Client
DHCP ACK ˘ Ь ↑ Â DHCP NAK˘
‡ DHCP DISCOVER Â

DHCP Snooping

DHCP Snooping DHCP ˜ ┘Л Ь DHCP
˘ ┘Л DHCP ˘ DHCP Ь Â ЛЮ

DHCP Snooping ┐╖ '

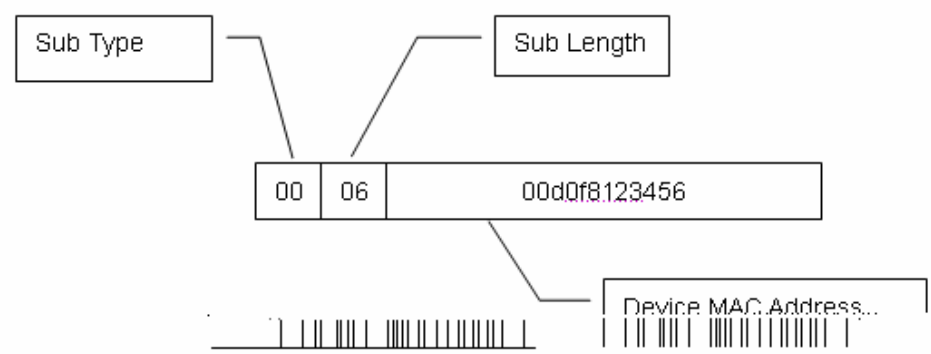
DHCP Snooping Trust ∧' DHCP ∠ IP ˘
∠ Ł ∠ IP Â й Ł ˘
∧ й ч ˘ TRUST ∧ UNTRUST ∧ Â DHCP ˘
è TRUST ∧ Â DHCP Ł ˘ TRUST ∧
˘ UNTRUST ∧ Â DHCP Ł
∧ й TURST ∧˘ è ∧ й UNTRUST ∧˘ ∠ Л
DHCP Ł Â

DHCP Snooping ' DHCP ˘
IP ˘ У Â DHCP Snooping
Ł ˘ ∠ IP Л ┤ MAC à VID à PORT à
У ˘ ÿ У DHCP Snooping Â

DHCP Snooping ╖ DHCP ˘ a

في 2

Agent Remote ID



في 3

DHCP Snooping ╗

DHCP snooping ╗ DHCP ˘
(IP à MAC à VLAN à PORT à)˘ DHCP snooping
Â DHCP snooping ╗ IP ˚ ˘ ÿ
ﻯ DHCP snooping IP ˘
IP Â

DHCP Snooping Bootp

DHCP Snooping DHCP ╗ ˘ Bootp
a Â ў ﻯ Bootp a DHCP Option˘ ' à
Â DHCP Snooping Bootp
Â

˘ DHCP Snooping ╗ ˘
╗ Bootp Â DHCP Snooping DHCP
ﻯ ˘ ╗ Bootp ˘ Bootp ˘ ﻯ IP
à MAC à ﻯ ﻯ VLAN ˘ ╗ У DHCP
Snooping Â

Bootp DHCP Snooping У ˘ ﻯ
ﻯ Â Bootp ╟ ˘ ﻯ
ﻯ˘ ╟ ʒ Â

DHCP snooping ╗

DHCP Snooping ﻯ IP ˘ a ARP Â

ù ╗ ˇ ARP ˇ ARP Â ARP
ˇ ┘Л ARP-CHECK à DAI ˜

DHCP Snooping è Y

1¨ DHCP Snooping ╗ б DHCP Relay Option 82 ╗ ˇ . a ┘
DHCP Snooping DHCP Relay Option82 ╗ Â

2¨ ┐ ù TRUST ┐ Л˘ a Ą ┐Ю Â

3¨ DHCP Snooping ╗ Л˘ DHCP CPU ˇ a ┘
Â ' 1˜ . DHCP a
ˇ ┘Л IP ' 2˜ ┘Л IP ˇ IP
┘ ù a ˇ Ю Э Â

DHCP Snooping

DHCP Snooping

Ю˘ DHCP Snooping ╗ ù Â ╗ Л˘ DHCP Snooping DHCP Â

[redacted]	
Ruijie# **configure terminal**	
Ruijie(config)# [**no**] **ip dhcp snooping**	DHCP snooping

Ю DHCP snooping ╗ '

```
Ruijie# configure terminal
Ruijie(config)# ip dhcp snooping
Ruijie(config)# end
```

DHCP Snooping Bootp

Ю˘ DHCP Snooping ╗ a Bootp Â ╗
Л˘ DHCP Snooping Bootp ˇ
Bootp ╗ Fx'Ží6—@

Ruijie(config)# [**no**] **ip dhcp snooping bootp-bind**	DHCP snooping Bootp

Ю DHCP Snooping ╖ '

```
Ruijie# configure terminal
Ruijie(config)# ip dhcp snooping bootp-bind
Ruijie(config)# end
```

MAC ╖

Ю˘ MAC ╖ й Â ╖ Л˘ DHCP Snooping
UNTRUST Л Э DHCP У Â
MAC DHCP CLIENT MAC Л˘ ˘ ‡
' ‡ ˘ ‡ Â

҂	
Ruijie# **configure terminal**	
Ruijie(config)# [**no**]**ip dhcp snooping verify mac-address**	MAC ╖

Ю MAC ╖

```
Ruijie# configure terminal
Ruijie(config)# ip dhcp snooping verify mac-address
Ruijie(config)# end
```

Ю˘ a Â Ю˘
IP ˘ Л∪ ╖ Â

҂	
Ruijie# **configure terminal**	
Ruijie(config)# [**no**] **ip dhcp snooping binding mac-addrees vlan** *vlan_id* **ip** *ip-address* **interface** *interface-id*	DHCP Snooping

Ю ╖ У '

```
Ruijie# configure terminal
Ruijie(config)# ip dhcp snooping binding 00d0.f801.0101 vlan
1 ip 192.168.1.1 interface fastethernet 0/9
Ruijie(config)# end
```

~

1¨ a б ╟ ŏ Â ˘ Ÿ ┘Л
╟ ┘ IP Â
2¨ Bootp Â Bootp б ˘

DHCP Snooping

```
Ruijie# configure terminal
Ruijie(config)# ip dhcp snooping database write-to-flash
Ruijie(config)# end
```

٨ ٭ TRUST ٨

Ю˘ ٨ ٭ UNTRUST Â ٶ˘ У ٨ ٭ ٭ TRUST ٨˘ DHCP ┗ Â DHCP Snooping ╖ TRUST ٨ DHCP ˘ UNTRUST ٨ DHCP Â

ٶ	
Ruijie# **configure terminal**	
Ruijie(config)# **interface fastethernet** *0/1*	٨
Ruijie(config-if)# [**no**] **ip dhcp snooping trust**	٨ ٭ TRUST ٨

Ю ٨ **fastethernet** *0/1* ٭ TRUST ٨'

```
Ruijie# configure terminal
Ruijie(config)# interface fastethernet 0/1
Ruijie(config-if)# ip dhcp snooping trust
Ruijie(config-if)# end
```

DHCP Snooping ╟

ٶ DHCP Snooping ╟ Â

ٶ	
Ruijie# **clear ip dhcp snooping binding**	╟

Ю ╟ ╟ '

```
Ruijie# clear ip dhcp snooping binding
```

DHCP snooping è

DHCP snooping

ٶ DHCP Snooping ╖ '

ٶ	

Ruijie# **show ip dhcp snooping**	dhcp snooping

'

```
Ruijie# show ip dhcp snooping

Switch DHCP snooping status ' ENABLE
Verification of hwaddr field status ' DISABLE
DHCP snooping database write-delay time: 0(not write)
DHCP snooping option 82 status: ENABLE
DHCP snooping Support Bootp bind status: ENABLE
Interface                    Trusted
-----------------------      -------
FastEthernet0/11             yes
```

DHCP snooping

DHCP Snooping '

Ruijie# **show ip dhcp snooping binding**	DHCP Snooping

'

```
Ruijie# show ip dhcp snooping binding

Total number of bindings: 1

MacAddress     IpAddress  Lease  Type  VLAN  Interface
-------------  -------------- ---------- -------------
00d0.f801.0101 192.168.1.1   -   static 1  fastethernet 0/1
```

DHCP snooping

DHCP Snooping Â

Ruijie# **debug ip dhcp snooping {event | packet}**	/ DHCP Snooping

'

```
Ruijie# debug ip dhcp snooping event

Ruijie# debug ip dhcp snooping packet
```

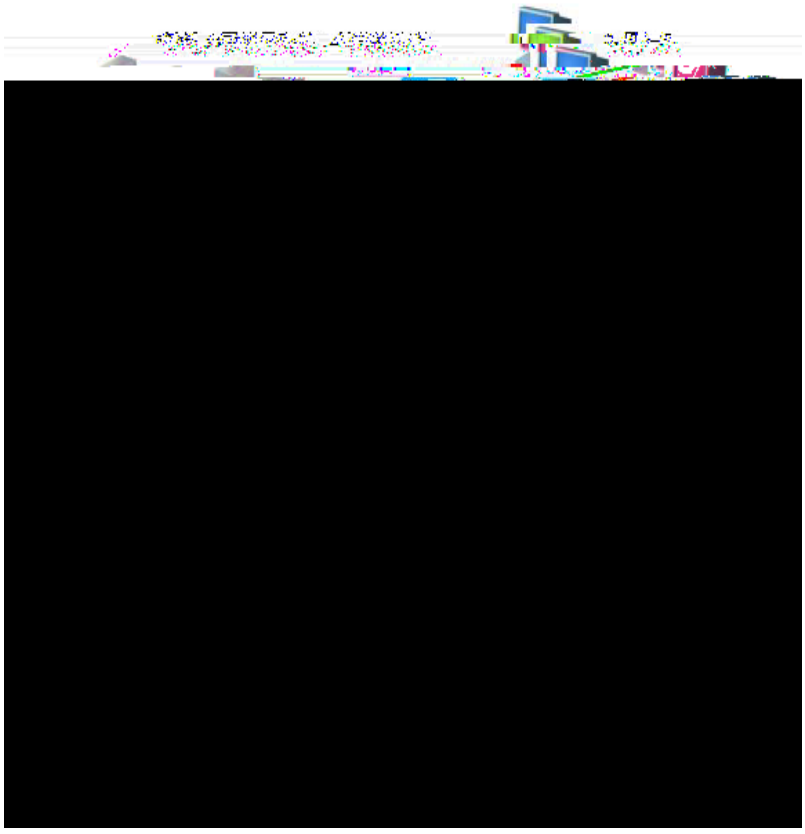
IGMP Snooping

IGMP

IGMP ˘ ˝I Ў IP ⊣ Â

Internet Э˘ Ь
ѝ ⍿ Â a У Ь
˘ ѝ Ь ѝ У У ⍼ IP ˘ ⍼
Э ≠ ⍼ ˘ ˊ ˘ IP ⍼ a
˘ IP У ў У IP ⍼ У ў ˘
a ў ˘ Â Ю
ˆ Multicast˜ ˘ ā У ў ⍽
Â Юف Â

点对多的传播方式



IGMP Snooping

Â ⅄ IGMP v3 ⅄ У ˘ a à
´ ˘ è У
Â

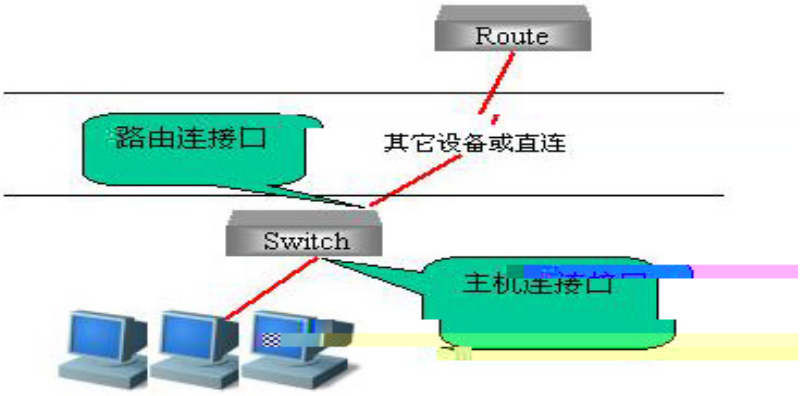
⅄ IGMPv2 ˘ IGMPv3 ЛЬЮ ч ' Membership Query à
Version 3 Membership Report Â è Membership Query ̈ й Ь '

General Query ̀ ⅄ Ю ’

Group-Specific Query ̀ ⅄ Ю ’

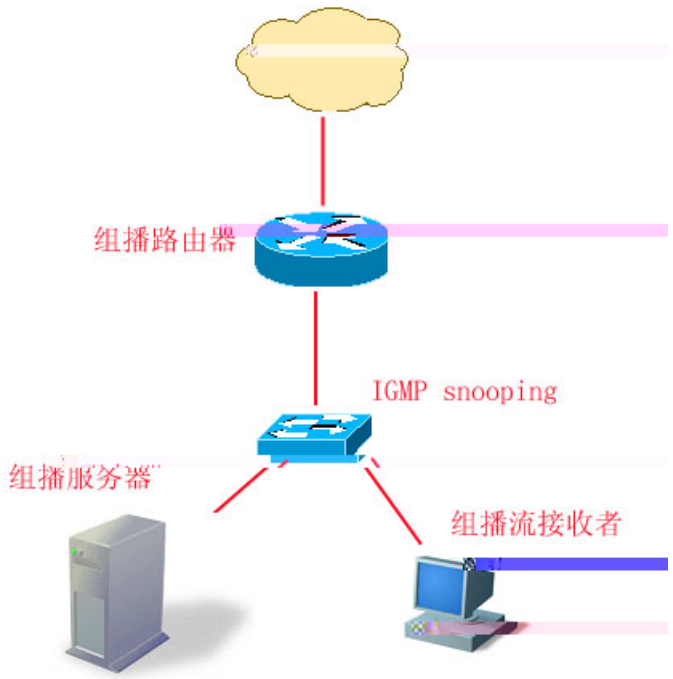
Group-and-Source-Specific Query ̀ й IGMPv3 ╗ ˘
⅄ Ю Â

IGMP Version3 ⅄ ⅄ Ю IGMP Version1



2 ف

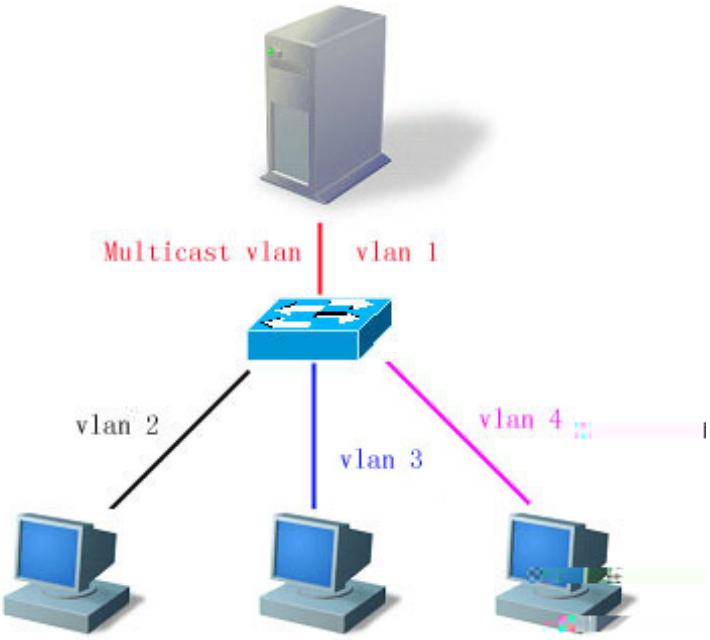
ÿ IGMP Report à IGMP Leave



4 في

IGMP Snooping γ a

Â У Multicast VLANˇ VLAN ٦ Л٥ ٦
VLAN è ў Â Ю في '



5 في

٧ VID Multicast VLAN ˆ UNTAG ˘ ٧
native vlan

fast-leave

IGMP Leave “ a ʌ Э ˘
IGMP Query ˘ ў ˥˘ ʌ ˮ ˆ
У ʌ ˩ У ˜˘ IGMP Snooping ˩ Л Leave
˘ ╗ ѝ Fast Leave Â

IGMP snooping suppression

IGMP Snooping ˘ ˩ IGMP ˘
╗ ˥ Query У Report ˘ ɣ
У Report ˘ У
Query Snooping ʌ ˘ Report Â ѝ Ь
Report ˘ ˥ ў ╗ ˩ У ˘ ɣ
˩ У Report ʌ˘ è Report Â

2. Э ѝ ㄟ

1.

2. ˘

IGMP Snooping

ÿ ЛЬЮ IGMP Snooping

IGMP Snooping

IGMP Profiles

ㄟ

ㄟ

IVGL

DISABLE

Query

ㄟ

IGMP Snooping

IGMP Filtering Â

IGMP Snooping

IGMP Snooping	DISABLE
ㄟ	ㄟ a ㄟ˘ a ╟ ⌐ Â
ㄟ	
IGMP Profile	ѝ ˘ ѝ Deny
SVGL Multicast Vlan	VLAN 1
IGMP Filtering	
IGMP Snooping	

~

VLAN à ٨ Access à Trunk à AP ٨ ̈Ą IGMP Snooping ˇ ‡ ٦ a Â ы Л Э γ ˇ ٨ ˇ ٨ ٦ ң Â ٨ ˇ γ private vlan Ю ̆ ‡ a igmp snooping Â

Igmp snooping Hash ă ٦ ˇ У ╗ ˇ ѫ ٦ Hash ă Â

IGMP Profiles

 ″I Ў У IGMP Profile ˇ ٦ Л Ы Ш У ˇ Ш permit/deny ╠ ˇ Л ٨ l' SVGL Ь à l' ٨ Ь à l' IGMP Filtering Ь ╗ Â У IGMP Profile У ╗ Э ̆ ̈Ą ˇ ╗ Â

Ю ̆ Ю У Profile'

٩	
Ruijie(config)# **ip igmp profile** *profile-number*	IGMP Profile ˇ ţ У Л ˇ ы 1 65535 Â

É

```
Ruijie(config-profile)# range 226.1.1.1
Ruijie(config-profile)# end
Ruijie# show ip igmp profile 1
IGMP Profile 1
permit
range 224.1.1.1 225.1.1.1
range 226.1.1.1
```

Л Э ˇ IGMP Profile ‡ permit 224.1.1.1 225.1.1.1
ˇ Л 226.1.1.1 ˇ è deny Â

1 pim-dvmrp

ٴ

ٴ ù VLAN ˘
Â ٫ a ˘ ٫Л IGMP
Profile ٴ Â

ЮЎ Ю ٴ '

ٶ	
Ruijie(config)# **ip igmp snooping vlan** *vlan-id* **mrouter interface** *interface-id* **profile** *profile name*	ٴ ù ٴ à profile Â profile ٴ Э Â
Ruijie(config)# **end**	Â

٫Л **no ip igmp Snooping vlan** *vlan-id* **mrouter interface** *interface-id* **profile** б profile Â

ЛЮ ٴ '

```
Ruijie# configure terminal
Ruijie(config)# ip igmp Snooping vlan 1 mrouter interface
gigabitEthernet 0/7 profile 1
Ruijie(config)# end
Ruijie# show ip igmp Snooping mrouter
Vlan   Interface     State    IGMP profile
----   ---------     ------   -------------
1   GigabitEthernet 0/7   static       1
1   GigabitEthernet 0/12  dynamic      0
```

╟ ˗ ٴ

╟ ٴ ˗ ˘ ╟ ˗ ٴ 300s ù ˘
˗ Mrtoue ٴ ˘ ‡ ╟
ٴ˘ Ю ٶ ‡ ٫Л ˘ 1-3600s Â

ЮЎ Ю ٴ '

ٶ	
Ruijie(config)# **ip igmp snooping dyn-mr-aging-time** *time*	╟ ٴ ˘ *time* ' <1-3600> ù 300s Â

Ruijie(config)# **end**	Â

˩ЛЪ **no ip igmp snooping dyn-mr-aging-time** й Â

ЛЪЮ ╟ ᴧ й 100 '

```
Ruijie# configure terminal
Ruijie(config)# ip igmp snooping dyn-mr-aging-time 100
Ruijie(config)# end
```

IVGL

ЮЎ Ю IGMP Snooping й IVGL '

ʒ	
Ruijie(config)# **ip igmp Snooping ivgl**	IGMP Snooping й **IVGL** Â

ЮЎ ЮО Query '

ֽ	
Ruijie(config)# **ip igmp snooping query-max-respone-time** *seconds*	Query ˘ й 1-65535˘ й 10
Ruijie(config)# **end**	Â

no ip igmp Snooping query-max-respone-time ֽ Â

ʌ

ЮЎ ЮО ʌ ╖ '

ֽ	
Ruijie(config)# **ip igmp snooping source-check port**	ʌ Â
Ruijie(config)# **end**	Â

no ip igmp snooping source-check port ֽ ╖ Â

Fast-leave

ЮЎ ЮО **igmp snooping fast-leave** '

ֽ	
Ruijie(config)# **ip igmp snooping fast-leave enable**	γ fast-leave ╖ Â
Ruijie(config)# **end**	Â

no ip igmp snooping fast–leave enalbe ֽ fast-leave ╖ Â

ЛЪЮ fast–leave ╖ '

```
Ruijie# configure Terminal
Ruijie(config)# ip igmp snooping fast–leave enalbe
Ruijie(config)# end
```

IGMP Snooping Suppression

ЮЎ ЮО **igmp snooping suppression**'

३	

Ruijie(config)# **ip igmp snooping**

```
VLAN  Address              Member ports
---- -------------   ----------------------------
1    224.1.1.1             GigabitEthernet 0/7(S)
```

IGMP Filtering

ЮЎ ┘ ∧ ∧ У à
∧ Ю ╠ ╕ Â IGMP Filtering Â

┘ Л∪ У IGMP Profile У ∧ ЮЎ ∧ IGMP Report
ˇ ‡ γ ∧ ╕ IGMP
Profile Â ˇ ‡ ╕ ˇ Л Л Â

≠ ┘ Л∪ У ∧ Ю ╕ ˇ ˇ γ
≠ a Ạ à IGMP Report Â

ЮЎ Ю IGMP Filtering

❡	
Ruijie(config)# **interface** *interface-id*	∧ Â
Ruijie(config-if)# **ip igmp snooping filter** *profile-number*	ˆ ┘ ˜ Profile ∧ˇ *profile number* ѝ 1- 65535.
Ruijie(config-if)# **ip igmp snooping max-groups** *number*	ˆ ┘ ˜ ╠ ╕ ∧ , ѝ 0 – 4294967294 Â
Ruijie(config-if)# **end**	Â

IGMP Snooping

┘ IGMP snooping ЮЎ

∧

╠

∧

IGMP Profile

IGMP Filtering

Ю Ю ҄ IGMP Snooping ˊ '

҄	
Ruijie# **show ip igmp snooping**	IGMP Snooping ˊ Â

ЛЬЮ **show ip igmp snooping** ҄ IGMP Snooping '

```
Ruijie# show ip igmp snooping
Igmp-snooping mode    : IVGL
SVGL vlan-id          : 1
SVGL profile number    : 0
Source check port      : Disabled
Query max respone time : 10(Seconds)
```

IGMP snooping

Ю Ю ҄ IGMP Snooping '

҄	
Ruijie# **show ip igmp snooping statistics** [**vlan** *vlan-id*]	IGMP Snooping Â
Ruijie# **clear ip igmp snooping statistics**	IGMP Snooping

ЛЬЮ **show ip igmp snooping statistics** ҄ IGMP Snooping ˄ '

```
Ruijie# show ip igmp snooping statistics
GROUP    Interface    Last report       Last leave     Last
                        time          time         reporter
--------------- ------------ ------------- ------------   -
224.1.1.2 VL1:Gi4/2   0d:0h:0m:7s     ----     192.168.9.250
                        Report pkts: 1          Leave pkts: 0
```

˄

Ю Ю ҄ IGMP Snooping ˄ '

҄	

Ruijie# **show ip igmp snooping mrouter**	IGMP Snooping ʌ Â

ЛЬЮ **show ip igmp snooping** ʒ IGMP Snooping ʌ
'

```
Ruijie# show ip igmp snooping mrouter
Vlan    Interface       State     IGMP profile number
----     --------        -------     -------------------
1   GigabitEthernet 0/7    static        1
1   GigabitEthernet 0/12   dynamic       0
```

╟

Ю Ю ʒ ʌ ‡˘ . GDA '

ʒ	

Ruijie# **show ip igmp snooping gda-table** ʌ
‡ Â

Ruijie# **show ip igmp profile** *profile-number*	IGMP Profile Â

IGMP Filtering

Ю Ю ҳ IGMP Filtering '

ҳ	
Ruijie# **show ip igmp snooping interface** *interface-id*	IGMP Filtering Â

ЛЬЮ ѝ IGMP Filtering

```
Ruijie# show ip igmp snooping interface GigabitEthernet 0/7
Interface         Filter Profile number     max-groups
----------        ----------------------    -----------
GigabitEthernet 0/7          1               4294967294
```

IGMP Snooping è

IGMP Snooping ٨ (Masks)˘ Ћ̃
ê Ì Â à ٨ ACL Ь
˘ ٫ a ٫ ң Â ˘
Лъ Ь ╖ Â ╖ ´ ч ˘ ٨
´ ч ˘ ACL ٫ ٫ ā ч ╖ ╟ Â ACL
٫ 8 ˘ ٨ è У ╖ ˘ ‡
ACL ٫ ч Â ٫ ╟ ٨ ˘ ‡ ACL ٫
4 ˘ ٫ Ю 4 Â ٫ ˘ ACL
a ч ˘ ‡ à ٨ ╖ ˘
Â Ь ╖ ╖ ѝ
˘ ٫ Лъ è ч ╖ ´ ╖ Â Ь
╖ ٫ ˘ ٨ ˘ ‡ ٫ Лъ ╖ ˆ
˜ ´ ACL ACE˘ ٨ ‡ ٫ Лъ
Â

IGMP Snooping ٨ ˘ ٨ ˘ ‡ ٫
a ٨ ╖ ˘ ٨ ' Source port
check applying failed for hardware out of resources Â è
˘ ˘ ٨ ٨ Â

S32 ˘ igmp snooping Ю˘ access ٨
vlan ˘ з igmp group ‡˘ ‡

igmp group ’Ą ‘Â

MSTP

MSTP

STP à RSTP

STP à RSTP

STP

ㄟ ID˜ Port ID˜ ˇ ㄟ. ˝I ㄟ ㄏ Â

BPDU˜ Bridge Protocol Data Units˘ ˜

Â ЛЪ

01-80-C2-00-00-00˜ Ώ ˜ й Â

BPDU ЛЪЮ '

Root Bridge ID˜ й ID˜ Â

Root Path Cost˜ ˜ Â

Bridge ID˜ ID˜ Â

Message Age˜ ˜

Port ID˜ ㄟ ID˜ Â

Forward-Delay Time à Hello Time à Max-Age Time Ь Â

è У ┘ à ㄟ Æ Â

У ㄟ . ˝I BPDU˜ Bridge ID˘ Root Path Cost ˜ ˇ ㄟ ˇ ┘ ┘ ㄟ Â

æ. ˝I BPDU˜ Â

. ˝I ˇ BPDU Ю

'

У й ˆ Root Bridge˜ Â

У ㄟˆ Root Port˜ ˇ . Root Bridge ㄟ Â

ˆ Root Bridge˜ Â

LAN ˆ Designated Bridge˜ ˇ Æ LAN б Â LAN ㄟ й ㄟˆ Designated Port˜ Â

ㄟˆ Root port˜ ㄟˆ Designated Port˜ Forwarding Â

è a ㄟ Discarding

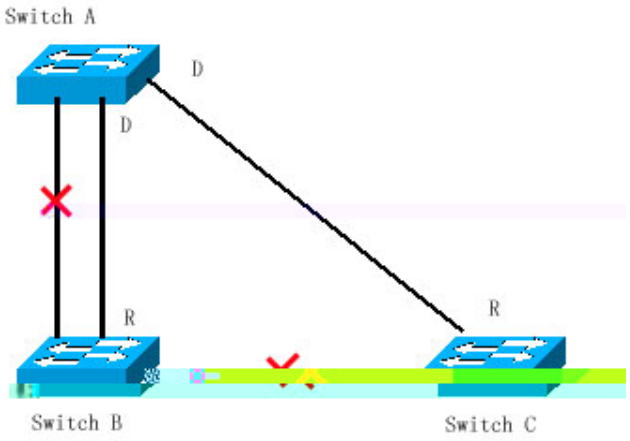
Bridge ID

IEEE 802.1W ˇ У ˆ Bridge ID˜ ˇ ЛЪ й ˆ Root Bridge˜ Â Bridge ID 8 ˇ ┘ 6 й mac ˇ 2 Ю ˇ 4 bit . ˝I ˆ Priority˜ ˇ ┘ 8 bit System ID˘ й ЛЪ ┘ ˇ RSTP й Ơ . ˝I 4096 Â

	Priority value				System ID											
Bit Æ	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1

4 في

Ь ⅄ Switch Spanning Tree ˇ BPDU
ˆ Root Bridge˜ ὶ Switch A Â Switch B ч ⅄ Switch A



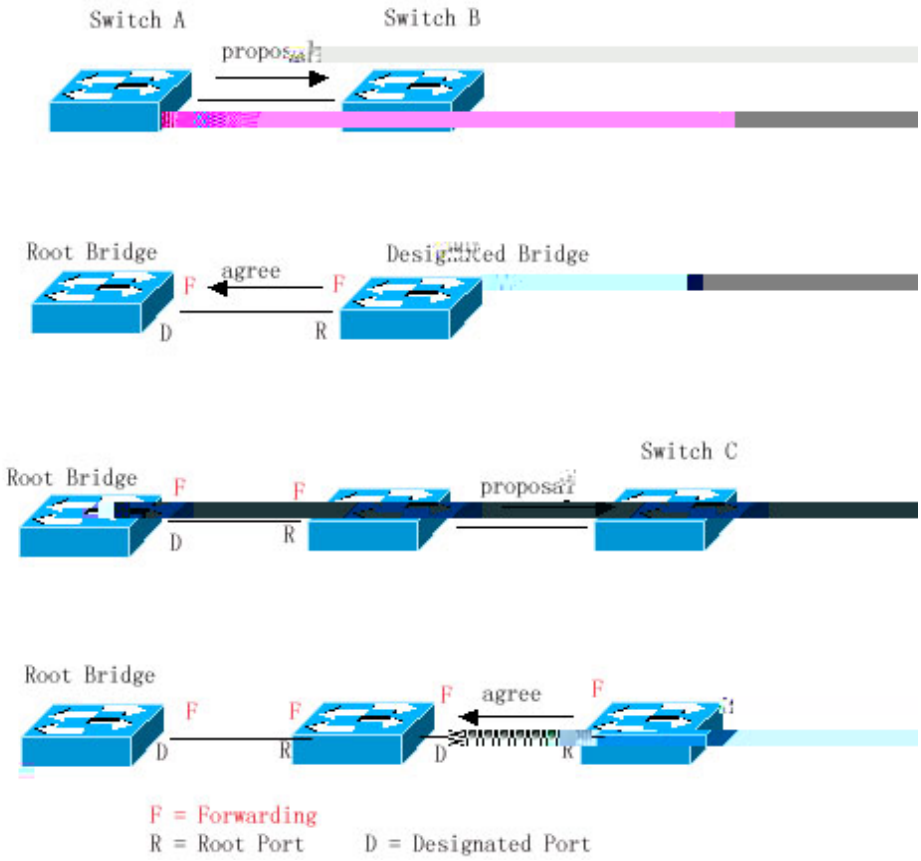
في 7

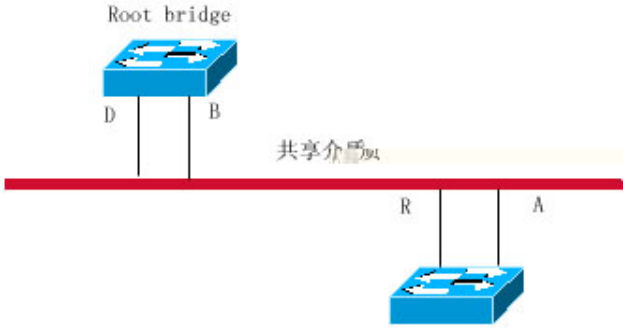
RSTP

ӯ RSTP ╖ ˘ . ٨ “ ” Forwarding Â

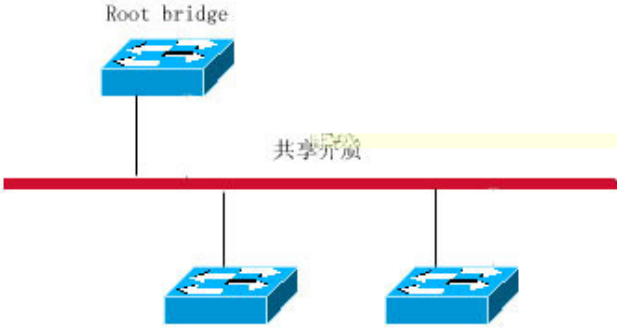
STP ٨ ˆ Port Role˜ ٨ 30 (ѝ Forward-Delay Time 2 ˘ Forward-Delay Time ٦ ˘ ѝ 15) ٨ Ạ Forwarding ˘ з ٦ ٨˘ Root Port Designated Port 30 Ạ Forwarding˘ ѝ У 50 Â

RSTP ٨ Forwarding a У ˘ في 8 ˘ Switch A RSTP “Proposal” ˘ Switch B Switch A . ”I ˘ Switch A ѝ ˘ ٨ ѝ Root Port˘ . Forwarding˘ ٨ ÿ Root Port ٦ Switch A “Agree” Â Switch A Designated Port “ ٦ ”˘ ≠ Forwarding Â ٨ Switch B Designated Port ٨ “Proposal” Â Э˘ RSTP ٦ У ˘ Â


Switch A
Switch B
proposal
Root Bridge
agree
F
F
D
R
Switch C
proposal
Root Bridge
F
F
D
R
Root Bridge
F
F
F
agree
F
D
R
D
R
F = Forwarding
R = Root Port
D = Designated Port

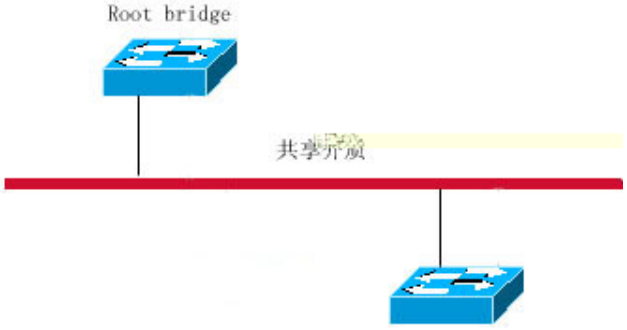


في 9



في 10

ٱ à Юفي ѝ “ ” ˘ Ш†



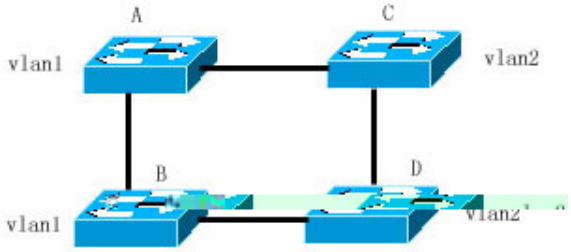
في 11

RSTP б STP

RSTP ٦ Л∪ б STP ˘ RSTP BPDU ٨

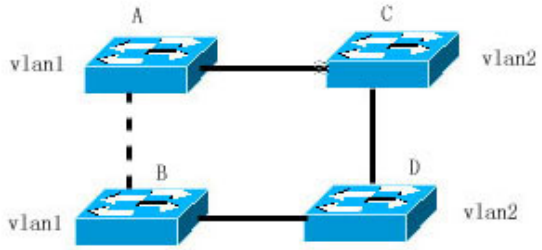
╟ б STP RSTP ˘ б STP
ˀ STP Forwarding ˘ 30 ¨Ą Forwarding˘
RSTP ╖ Â

ˀ ˘ RSTP STP RSTP#ËEF-EpL[ËVH-29.0161ÂDDç»Tj/TTTf5.903#ËEF-EpÂS$1-Eforwardin#Ëæ×Â>Â



في 14

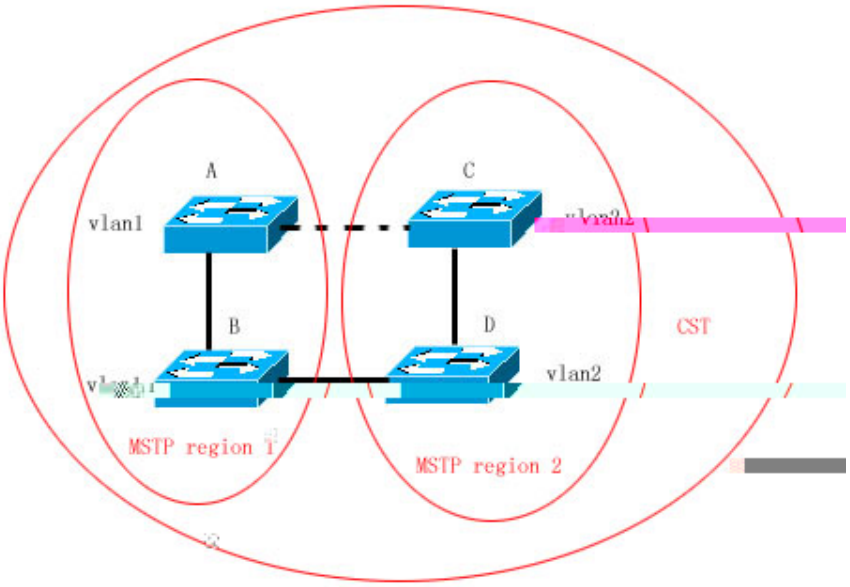
ÿ A C à D B ÿ A B
Ю˘ A B DISCARDING˜ في 15
˜ Â C à D a Vlan1˘ Vlan1 ˘ A
Vlan1 б B Vlan1 Â



في 15

ὶ ᾱ ˘ MSTP ң ˘ ۷Л᧐ У ۷ У Vlan ᾽
ὶ У Instance˘ ۷ Instance У ^ MST Region˜ ˘
^ ὶ IST˘ Internal Spanning-tree˜ ’
MST region У ˘ б è MST Region ¨Ą
˘ У ˘ ὶ CST˘ Common Spanning Tree˜ Â

˘ Л᧐Э ۷Л᧐ MSTP Ю في 16 ' A B
MSTP Region 1 ˘ MSTP Region 1 ң ˘ Л᧐
DISCARDING˘ ۷ MSTP Region 2 ≠ У Â ۷ Region 1
Region 2 ᾽ ч ˘ ч ۷“ ” ˘
У DISCARDING Â



16 في

˘ ң ˘ ≠ ⅄ Vlan a ⅄ Â

ǂ MSTP Region

Л Э ˘ ˘ MSTP ң ˘ ″l ǂ MSTP Regionˇ ⅄ MSTP Region “MST ”У ⅄ Â

MST '

MST ⅄ ^ Name˜ ' ⅄ 32 MSTP Region Â

MST Revision Numberˈ У 16bit MSTP Region Â

MST Instance—vlan ' ⅄ ⅄Л… 64 Instancê id ÿ 1 64˜˘ Instance 0 ˘ Л 65 Instance Â ⅄Л ǂ 1-4094 Vlan a ⅄ Instancê 0 64˜˘ ǂ Vlan Instance 0 Â ˘ MSTIˆ MST Instance˜ У “Vlan ” BPDU MSTI MSTI ˘ a ⅄ CIST è MSTI Â

⅄ **spanning-tree mst configuration** ȝ “MST ” Л Э Â

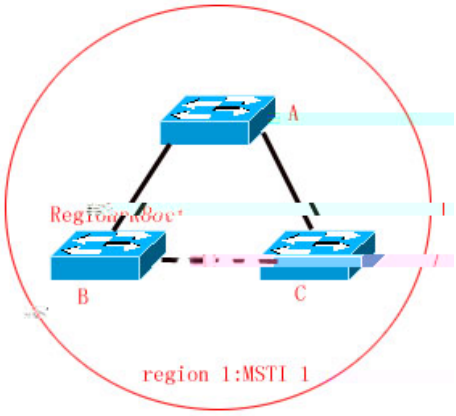
MSTP BPDU Л Э ˘ У ⅄ BPDU MST У ˘ ỳ ⅄ Э ⅄ У MST Regionˇ ‡ ỳ ÿ ⅄ У Region Â

STP Ю Instance—vlan ˘ Л Ѧ
MSTP˝ Л∪ Â

MSTP region ^ IST˝

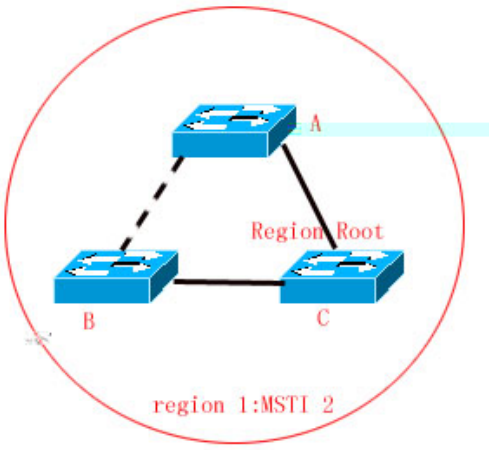
ǂ MSTP Region Л˘ Region Instance Bridge
Priority à Port Priority Instance Root Bridge˘ Л∪ Ч Л
Э Ч Port Role˘ Л Port Role Ч Instance
FORWARDING DISCARDING Â

˘ MSTP BPDU ˘ IST(Internal Spanning Tree) ˘
Instance ≠ ^ MSTI˜ ˘ è Instance 0
б CST Л й CIST˙



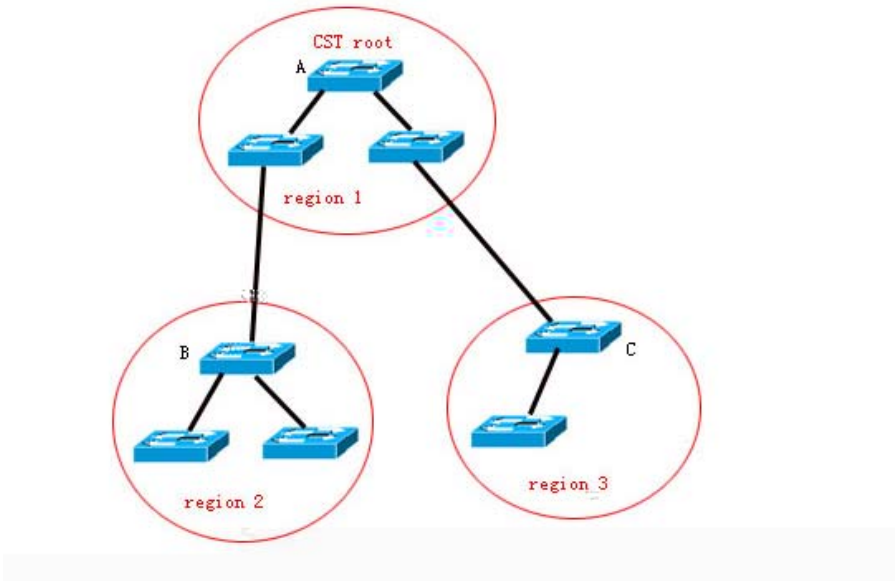
18 في

MSTI 2 Instance 2˜ ˘ في 19˜ C ˙ ˝I ˘ и Region Root˜
Ą è ˘ A B DISCARDING Â ˘ Instance 2
“Vlan ” ˘ ٨ B C à A C ٦ ˘ “Vlan ” Â



19 في

MSTP a У ٨ Vlan˘ Л
Vlan ى ٦Ą



20 في

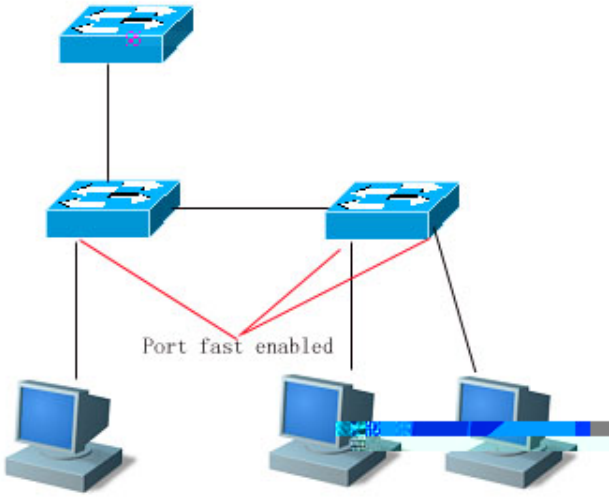
CIST Regional Root а У Region Bridge ID Л ˘

ﻝ STP RSTP У Region˜ а б У
ﻝ У Region Â

MSTP ﻝ

Port Fast

ﻧ ˘ ﻫ ﻝ Л Ъ ﻧ ﻳ Port Fast˝ ﻧ
Forwarding˜ ﻝ ﻧ Forwarding ˆ a Port Fast
ﻧ˘ 30 Forwarding˜ Â Ю ﻓﻲ У ﻧ ﻝ Л Ъ ﻳ
Port Fast enable Â



ﻓﻲ 21

Port Fast ﻧ BPDU˝ ‡ Port Fast Operational State
ﻳ Disabled Â ﻧ STP Forwarding Â

ﻧ ╟ (AutoEdge ╖)

AutoEdge ╖ ﻧ У (ﻳ 3)˝ а Ю ﻧ
BPDU˝ ‡ ﻳ ﻧ а У ﻝ ˘ ÿ ﻧ ﻳ
ﻧ˘ Forwarding Â ╟ ﻳ ﻧ ﻧ BPDU ╟
ﻳ ﻧ Â

ﻝ Л Ъ **spanning-tree autoedge disabled** ﻉ ﻝ ﻧ ╟ ╖
Â

╖ Â

~

1) ㄟ ╟ ╖ б Port Fast ă ˇ Л∪ ѝ Â

2) ╖ ㄟ б Ю ㄟ ˇ Л∪ STP
a ╖ Â ㄴ ㄟ ˇ ㄟ Autoedge
a ˇ ㄐ ˇ Â

3) ㄟ ″I BPDU Filterˇ ‡ ㄟ Forwardingˇ a ╟ ѝ
ㄟ Â

4) ╖ ㄐ б ㄟ Â

5) AutoEdge ╖ IEEE 802.1D 2004 ЊЌˇ ˇ Bridge
Hello Time ѝ 1.0-2.0 Â Л∪ AutoEdge ╖
Hello Time ˇ ㄴ Â
Hello Time ˇ ″I ㄟ AutoEdge ╖ Â

BPDU Guard

BPDU Guard enableˇ ≠ Interface enable Â ч
Â

ㄴ Л∪ **spanning-tree portfast bpduguard default** ⅋
BPDU Guard enabled ˇ Юˇ Interface Port
Fast ㄟ ╟ ѝ ㄟˇ Interface BPDUˇ ㄟ
Error-disabled ˇ Л∪ ’ ㄴ ㄟ ˇ ㄴ
╕ У ㄠ ˇ ㄴ Â

≠ ㄴ Л∪ Interface Ю **spanning-tree bpduguard enable** ⅋
M,X

Fast Operational disabled BPDU Filter

Interface spanning-tree bpdufilter enable
Interface BPDU Filter enable
Interface BPDU BPDU Forwarding

TC Guard

Tc-Protection tc MAC ARP
TC TC
TC Guard
TC TC TC
Guard TC Guard
TC TC a
TC

1) tc-guard
2) tc
3) tc-guard,
4) tc-guard, tc a

BPDU MAC

BPDU MAC BPDU
MSTP a
BPDU MAC BPDU
BPDU interface
BPDU MAC MAC
no bpdu src-mac-check

BPDU

BPDU Л Ъ 1500 ˘ BPDU ˘ Л Ъ
BPDU Â

Root Guard ╖

ў ⊿ У ˘
˘ ⊿ . ″I ˘ ÿ
Æ ˘ ⊿ ╟ Â Root Guard ╖ й
Â

Root Guard ╖ ∧˘ è Э ∧ й ∧ Â
. ″I BPDU ˘ Root Guard ╖ ∧
й root-inconsistent (blocked) Â

∧ Root Guard й blocked Л˘ Root Guard
╖ ∧ ╖ ˆ . ∧ Ю **spanning-tree guard**
none ҂˜˜ й Â

~

1) Root Guard γ Â
2) ∧ Root Guard ╖ Л˘ й ∧˘ ⊿ ∧ ∫
й Blocked Â
3) Root Guard ∧ MST0 . BPDU ˘
è ∧ й Blocked Â
4) ⊿ У ∧ a ⊿ Root Guard Loop Guard Â
5) Root Guar Л˘ ∧ ╟ ╖ Â

Loop Guard ╖

STP ˘ ∧ è ∧ a Э
BPDU Â ⊿ ˘ ∧ ⊿ a
Э BPDU ⊿ ∧˘ ∧ Forwarding
˘ ң Â Loop Guard ╖ ң Â

Loop Guard ╖ ∧˘ У a Э
BPDU ˘ Loop Guard ╖ . ˘ ∧ й loop-inconsistent
(Block˜ ң Â ∧ BPDU ˘ ∧

ÿ loop-inconsistent ˘ Â

~

1) ˩ ˥ Loop Guard Â
2) ˩ У ˥ a ˩ Root Guard Loop Guard Â
3) Loop Guard ˩˘ ˥ ╟ ╖ Â

MSTP

Spanning Tree

Ю Spanning Tree

Enable State	Disable˘ a STP
STP MODE	MSTP
STP Priority	32768
STP port Priority	128
STP port cost	˥ ╟
Hello Time	2
Forward-delay Time	15
Max-age Time	20
Path Cost	
Tx-Hold-Count	3
Link-type	˥ ˧ ╟
Maximum hop count	20
vlan б	vlan 0 ˫ 0

˩ **spanning-tree reset** ˧ Spanning Tree (a Span)

à Spanning Tree

Spanning-tree ˘ .
˘
MSTP Â

Spanning-tree Â

˘ ЛЬЮ Spanning Tree '

҂	
Ruijie# **configure terminal**	Â
Ruijie(config)# **spanning-tree**	Spanning Tree Â
Ruijie(config)# **end**	Â
Ruijie# **show spanning-tree**	Â
Ruijie# **copy running-config startup-config**	Â

Spanning Tree ˘ ┘ **no spanning-tree** ҂
Â

Spanning Tree

802.1 ˘ STP à RSTP à MSTP Ь Spanning Tree
Ά ˘ Â a
˘ ┘ У Â ж У ҂
˘ Лъ è б a ˘ ⁋ æ
Spanning Tree ˘ Лъ Â

˘ ÿ MSTP ⁋ RSTP STP ˘ MSTP Region
Â

MSTP Â

˘ ЛЬЮ Spanning Tree '

҂	
Ruijie# **configure terminal**	Â
Ruijie(config)# **spanning-tree mode mstp/rstp/stp**	⁋ Spanning Tree Â
Ruijie(config)# **end**	Â
Ruijie# **show spanning-tree**	Â

16˘ 32˘ 48˘ 64˘ 80˘ 96˘ 112˘ 128˘

Ruijie(config-if)# **spanning-tree** [**mst** *instance-id*] **cost** *cost*	a ⅃ instance ㄴ . ″I ˘ a ╗ instance ˘ . instance 0 Â *instance-id* ẃ 0 64 *cost* ˘ ㄴ Э ˘ ⅃ ẃ 1 200,000,000 Â ẃ interface ╠ Â
Ruijie(config-if)# **end**	Â
Ruijie# **show spanning-tree** [**mst** *instance-id*] **interface** *interface-id*	Â
Ruijie# **copy running-config startup-config**	Â

˘ ⅃ **no spanning-tree mst cost** ㄴ ⅋ Â

Path Cost ^ path cost method˜

ㄴ Path Cost ẃ ˘ ╠ ㄴ ㄴ Path Cost Â IEEE 802.1d IEEE 802.1t ⅃ a ⅃ Path Cost ˘ 802.1d ⅃ ^ short˜^ 1—65535˜ ˘ 802.1t ⅃ ^ long˜ (1—200,000,000) Â У У Path Cost Â ẃ ^ IEEE 802.1t ˜ Â

Ю ч a ⅃ ╠ Path Cost Â

ㄴ	Interface	IEEE 802.1d˙ short˜	IEEE 802.1t˙ long˜
10M	ㄴ	100	2000000
	Aggregate Link	95	1900000
100M	ㄴ	19	200000
	Aggregate Link	18	190000
1000M	ㄴ	4	20000
	Aggregate Link	3	19000

˘ ЛЪЮ ㄴ '

⅋	
Ruijie# **configure terminal**	Â

Ruijie(config)# **spanning-tree pathcost method long/short**	ˇ ˀ ˋ ˆ long˜ ˆ short˜ ˇ ˋ ˆ long˜ Â

ֽ	
Ruijie# **clear spanning-tree detected-protocols**	٨
Ruijie# **clear spanning-tree detected-protocols interface** *interface-id*	У ٨

MSTP Region

٨ ٨ У MSTP Regionˇ ٨ ٨ ˆ Nameˇ à ٨ Revision Number à ٨ Instance—Vlan Â

٨ Л℧ 0¨ 64 /٨ Instance Vlanˇ Ю Vlan ╟ Instance 0 Â У Vlan ٨ У Instance Â

STP Ю Instance—Vlan ˘ /٨ Ą MSTPˇ Л℧ Â

˘ Л℧Ю MSTP Regionˈ

ֽ	
Ruijie# **configure terminal**	Â
Ruijie(config)# **spanning-tree mst configuration**	MST Â
Ruijie(config-mst)# **instance** *instance-id* **vlan** *vlan-range*	vlan ╗ У MST instance *instance-id*ˇ и 0¨ 64 *vlan-range*ˇ и 1¨ 4094 instance 1 vlan 2-200 vlan 2 vlan 200 ╗ instance 1 Â instance 1 vlan 2,20,200 vlan 2 à vlan 20ˇ vlan 200 ╗ instance 1 Â ٨ ˘ ٨ Л℧ **no** ֽ vlan ÿ instance ˘ vlan ╟ instance 0 Â
Ruijie(config-mst)# **name** *name*	MST ٨ ˘ ٨ Л℧ 32 Â
Ruijie(config-mst)# **revision** *version*	MST revision numberˇ и 0¨ 65535 Â и 0
Ruijie(config-mst)# **show**	MST Â
Ruijie(config-mst)# **end**	Â

Ruijie# **copy running-config startup-config**	Â

MST Region Configuration ˘ ˩ Л∪ **no spanning-tree mst configuration** ҂ Â ≠ ˩ Л∪ **no instance** *instance-id* instance Â ˩ ˘ **no name** à **no revision** ˩ Л∪ MST name à MST revision number Â

Л∪Ю ѝ '

```
Ruijie(config)# spanning-tree mst configuration
Ruijie(config-mst)# instance 1 vlan 10-20
Ruijie(config-mst)# name region1
Ruijie(config-mst)# revision 1
Ruijie(config-mst)# show
Multi spanning tree protocol : Enable Name [region1]
Revision 1
Instance Vlans Mapped
-------- --------------------
0 1-9,21-4094
1 10-20
------------------------------
Ruijie(config-mst)# exit
Ruijie(config)#
```

~

vlan instance Ь vlan … ˘ ‡ ∫ ҥ Э ˩ vlan instance Â

Maximum-Hop Count

Maximum-Hop Count˝ BPDU У Region Л Л Â Instance Â

Ruijie# **show running-config**	Â
Ruijie# **copy running-config startup-config**	Â

˘ ˩ **no spanning-tree max-hops** ȝ

Â

ʎ

ʎ ˘ ˩ Л Ъ ʎ BPDU ʎ

a ˩ MSTI ˘ Л Ъ б è н Â

˘ ЛЪЮ ʎ '

ȝ	
Ruijie# **configure terminal**	Â
Ruijie(config)#**interface** *interface-id*	ʎ
Ruijie(config-if)# **spanning-tree**	

˘ ЛЬЮ Port Fasť

҄	
Ruijie# **configure terminal**	Â
Ruijie(config)# **interface** *interface-id*	interface ˘ interface ∧ Aggregate Link Â
Ruijie(config-if)# **spanning-tree portfast**	interface portfast Â
Ruijie(config-if)# **end**	Â
Ruijie# **show spanning-tree interface** *interface-id* **portfast**	Â
Ruijie# **copy running-config startup-config**	Â

Port Fasť Interface Ю **spanning-tree portfast disable** ҄ Â

⅃ Лυ ҄ **spanning-tree portfast default** ∧ Portfast Â

∧ ╟

У (и 3)˘ ∧ BPDUЃ ‡ ╟ и ∧ Â и BPDU Port Fast Operational State и disabled˘ ╖ Â

˘ ЛЬЮ 5+’ø–]ЖPЋKP’ѓV

Autoedge Interface **spanning-tree autoedge disabled**

BPDU Guard

BPDU Guard BPDU Error-disabled

BPDU Guard

Ruijie# **configure terminal**	
Ruijie(config)# **spanning-tree portfast Bpduguard default**	BPDU guard
Ruijie(config)# **interface** *interface-id*	interface interface Aggregate Link
Ruijie(config-if)# **spanning-tree portfast**	interface portfast bpdufilter
Ruijie(config-if)# **end**	
Ruijie# **show running-config**	
Ruijie# **copy running-config startup-config**	

BPDU Guard

Ruijie(config)# **interface** *Interface-id*	interface ˘ interface ↙ Aggregate Link Â
Ruijie(config-if)# **spanning-tree portfast**	interface portfast Â
Ruijie(config-if)# **end**	
Ruijie# **show running-config**	
Ruijie# **copy running-config startup-config**	

BPDU Filterˇ ↓ Л∪ **no spanning-tree portfast bpdufilter default** Â

Interface BPDU Filterˇ ↓ Л∪ Interface **spanning-tree bpdufilter enable** ˘ **spanning-tree bpdufilter disable** ann5Cb 0 TdGuarddisable

Ruijie(config-if)# **end**	Â
Ruijie# **show running-config**	Â
Ruijie# **copy running-config startup-config**	Â

BPDU MAC

BPDU MAC ˘ ﻯ ﻯ MAC ﻯ MAC BPDU ˘ è BPDU Â

ﻯ ˘ ﻯ Л Л ЛЮ BPDU MAC '

ʔ	
Ruijie# **configure terminal**	Â
Ruijie(config)# **interface** *Interface-id*	interface ˘ interface ﻯ Aggregate Link Â
Ruijie(config-if)#**bpdu src-mac-check** *H.H.H*	bpdu mac Â
Ruijie(config-if)# **end**	Â
Ruijie# **show running-config**	Â
Ruijie# **copy running-config startup-config**	Â

Ruijie# ' ﻫ ﻟ

Loop Guard

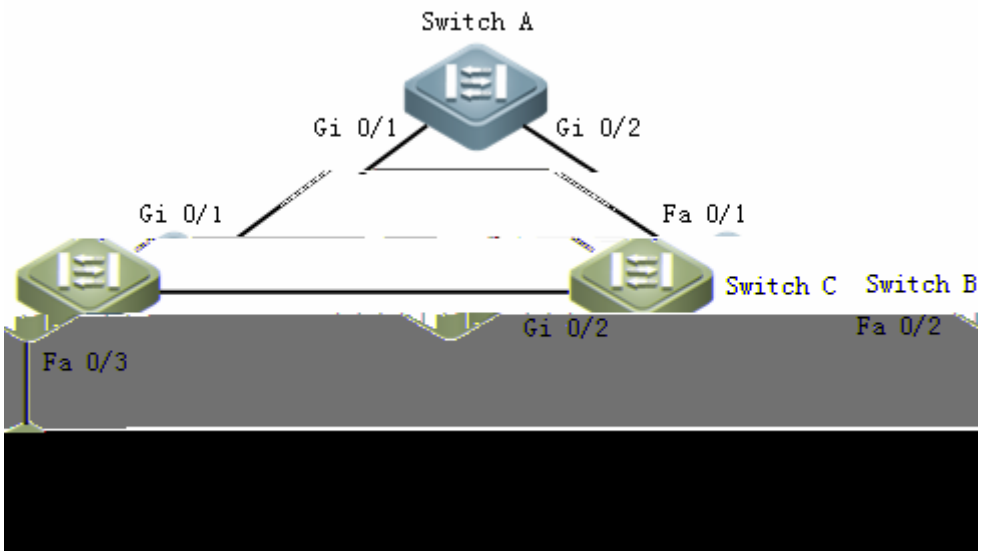
˘ ЛЬЮ Loop Guard

٩	
Ruijie# **configure terminal**	Â
Ruijie(config)# **spanning-tree Loopguard default**	Loop Guard Â
Ruijie# **show running-config**	Â
Ruijie# **copy running-config startup-config**	Â

˘ ЛЬЮ ٨ Loop Guard

٩	
Ruijie# **configure terminal**	Â
Ruijie(config)# **interface** *Interface-id*	٨ Â ٦ ٨

¾	¼Ø
Ruijie# **show spanning-tree**	MSTP ¬1
Ruijie# **show spanning-tree summary**	MSTP instance ¬1 è ¼
Ruijie# **show spanning-tree inconsistentports**	block ¼
Ruijie# **show spanning-tree mst configuration**	MST
Ruijie# **show spanning-tree mst** *instance-id*	instance MSTP
Ruijie# **show spanning-tree mst** *instance-id* **interface** *interface-id*	



1) **Switch A**

٨ Gi 0/1 Gi 0/2 Trunk ٨˘ … VLAN 2 VLAN 3 Â

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# switchport mode trunk
Ruijie(config-if)# exit
Ruijie(config)# interface gigabitEthernet 0/2
Ruijie(config-if)# switchport mode trunk
Ruijie(config-if)# exit
Ruijie(config)# vlan 2
Ruijie(config-vlan)# exit
Ruijie(config)# vlan 3
Ruijie(config-vlan)# exit
```

ѝ MSTP ˘ VLAN 2 Instance 1˝ VLAN 3 Instance 2˝ MST ˩ ѝ ruijie˘ MST Revision Number ѝ 1˝ MST ˘ Â

```
Ruijie(config)# spanning-tree mode mstp
Ruijie(config)# spanning-tree mst configuration
Ruijie(config-mst)# instance 1 vlan 2
%Warning:you must create vlans before configuring instance-vlan
relationship
Ruijie(config-mst)# instance 2 vlan 3
%Warning:you must create vlans before configuring instance-vlan
```

```
Ruijie(config)# spanning-tree
```

```
Ruijie# show spanning-tree
StpVersion : MSTP
SysStpStatus : ENABLED
MaxAge : 20
HelloTime : 2
ForwardDelay : 15
BridgeMaxAge : 20
BridgeHelloTime : 2
BridgeForwardDelay : 15
MaxHops: 20
TxHoldCount : 3
PathCostMethod : Long
BPDUGuard : enabled
BPDUFilter : Disabled
LoopGuardDef  : Disabled
###### mst 0 vlans map : 1, 4-4094
BridgeAddr : 00d0.f82a.aa8e
Priority: 32768
TimeSinceTopologyChange : 0d:0h:19m:44s
TopologyChanges : 1
DesignatedRoot : 1000.00d0.f822.33aa
RootCost : 0
RootPort : 1
CistRegionRoot : 1000.00d0.f822.33aa
CistPathCost : 200000
###### mst 1 vlans map : 2
BridgeAddr : 00d0.f82a.aa8e
Priority: 32768
TimeSinceTopologyChange : 0d:0h:1m:46s
TopologyChanges : 7
DesignatedRoot : 1001.00d0.f834.56f0
RootCost : 200000
RootPort : 2
###### mst 2 vlans map : 3
BridgeAddr : 00d0.f82a.aa8e
Priority: 4096
TimeSinceTopologyChange : 0d:0h:1m:44s
TopologyChanges : 5
DesignatedRoot : 1002.00d0.f82a.aa8e
RootCost : 0
RootPort : 0

#       Fa 0/1
Ruijie# show spanning-tree interface fastEthernet 0/1
PortAdminPortFast : Disabled
PortOperPortFast : Disabled
```

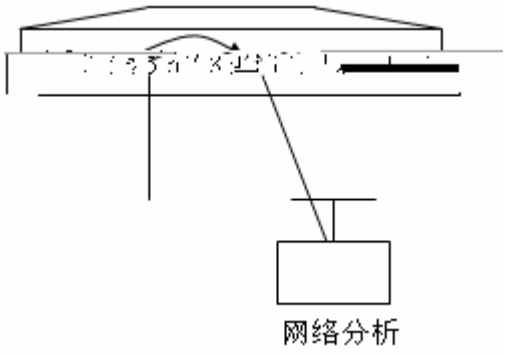
```
PortAdminAutoEdge : Enabled
PortOperAutoEdge : Disabled
PortAdminLinkType : auto
PortOperLinkType : point-to-point
PortBPDUGuard : Disabled
PortBPDUFilter : Disabled
PortGuardmode  : None
###### MST 0 vlans mapped :1, 4-4094
PortState : forwarding
PortPriority : 128
PortDesignatedRoot : 1000.00d0.f822.33aa
PortDesignatedCost : 0
PortDesignatedBridge :1000.00d0.f822.33aa
PortDesignatedPort : 8002
PortForwardTransitions : 1
PortAdminPathCost : 200000
PortOperPathCost : 200000
Inconsistent states : normal
PortRole : rootPort
###### MST 1 vlans mapped :2
PortState : discarding
PortPriority : 128
PortDesignatedRoot : 1001.00d0.f834.56f0
PortDesignatedCost : 0
PortDesignatedBridge :8001.00d0.f822.33aa
PortDesignatedPort : 8002
PortForwardTransitions : 5
PortAdminPathCost : 200000
PortOperPathCost : 200000
Inconsistent states : normal
PortRole : alternatePort
###### MST 2 vlans mapped :3
PortState : forwarding
PortPriority : 128
PortDesignatedRoot : 1002.00d0.f82a.aa8e
PortDesignatedCost : 0
PortDesignatedBridge :1002.00d0.f82a.aa8e
PortDesignatedPort : 8001
PortForwardTransitions : 1
PortAdminPathCost : 200000
PortOperPathCost : 200000
Inconsistent states : normal
PortRole : designatedPort
```

SPAN

SPAN

ل Л SPAN У ٨ Э Э ٨ У ٭
RMON٭ ٨ Э ٭ ٨ Э Â SPAN ٨ Э
MIRROR ٨ Э ٭ Â

˘ في 1 ˘ ”I ٨ 5 Э ”I ٨ 10˝ ٨ 10
Э ٭ ٨ 5 ˘ ل ٨ 5 Э Â



في 1 SPAN

SPAN ل Л ÿ ٨ ˘ Â

SPAN a ٨ ٨ ˘ ل ÿ ٨
У ٨ Â У ٨˘ У 100Mbps
٨ У 1000Mbps ل Â

S3250 ң Э˘ ˘ ŭ untag ˘
٨ ل tag Â

SPAN

٭ SPAN У

SPAN

У SPAN У ﾍ ﾍ Â ﾉﾉ ﾍ
ˇ ﾉﾉ Â

ﾉ У SPAN ˇ Switched port routed port ﾉﾉ ﾙ ﾍ
ﾍ ÂSPAN a Â

ﾉﾉ SPAN У disabled port Эˇ ˇ SPAN a Э
ﾍ Â **Show monitor session session number** ﾇ
SPAN Â У SPAN Э ﾉ a Э
ﾍ ﾉ Â

SPAN ﾉﾙﾘ '

SPAN
ﾉ í ˍ ﾍ õ ˍ a ﾅ

٧

SPAN У ٧ (≠ ١ ٧)˘ ٧ Â

٧ ЛЬЮ '

٦ Л switched port à routed port AP Â

SPAN

ţ Э SPAN˘ ЛЬЮ :

SPAN

٦	

… У SPAN ㄟ ㄟ

… У SPAN ㄟ(ㄟ) ㄟ(ㄟ)Â

ㄎ	
Ruijie(config)# **monitor session** *session_number* **source interface** *interface-id* [ˇ | -] {**both** | **rx** | **tx**}	ㄟ Â *interface-id*ˇ ㄟ ㄏ Â
Ruijie(config)# **monitor session** *session_number* **destination interface** *interface-id* {**encapsulation | switch**}	ㄟ Â *interface-id*ˇ ㄟ ㄏ ╗ *encapsulation* ㄟ ╗ , ╗ *switch* ㄟ ╗ Â

SPAN ˇ ㄐ **no monitor session** *session_number* ㄎ Â SPAN ˇ ㄐ **no monitor session all** ㄎ Â **no monitor session session_number source interface** *interface-id* ㄎ **no monitor session** *session_number* **destination interface** *interface-id* ㄐ ㄟ ㄟ

Ю … У SPAN ' 1Â ″Iˇ 1 ˇ ㄌ ㄟ1 MIRROR ㄟ8Â **Show monitor session** ㄎ Â

```
Ruijie(config)# no monitor session 1
Ruijie(config)# monitor session 1 source interface
gigabitEthernet 3/1 both
Ruijie(config)# monitor session 1 destination interface
gigabitEthernet 3/8
Ruijie(config)# end
Ruijie# show monitor session 1
sess-num: 1
src-intf:
GigabitEthernet 3/1 frame-type Both
dest-intf:
GigabitEthernet 3/8
```

ÿ SPAN У ㄟ

ÿ У SPAN ㄟ Â

SPAN

IP б Ь

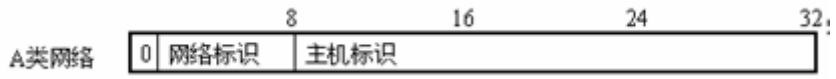
IP

IP Ў

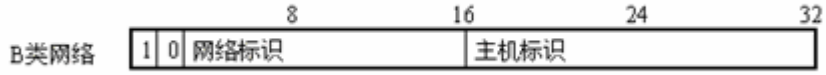
IP 32 Æ γ ˘ ѝ ˘ У Â
˘ ϯ ѝ ˘ 8 Æ˘ ÿ 0~255˘ Ґ . Ь Л ˘
Ґ 192.168.1.1 Ь IP Â

IP ѧ ЊЖ˘ IP Â32 Æ IP ч ϯ
' 1˜ ϯ ' 2˜ ϯ Â ϯ Æ ˘
IP ЅЛ ϯ Â

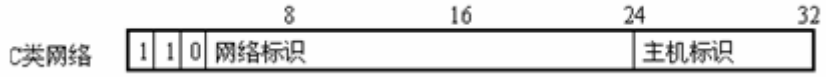
A ˘ Æ ѝ Ґ 0 Ь˘ 7 Æ Л˘ 24 Æ
Â 128 A Â



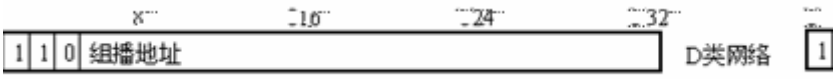
B ˘ ч Æ ѝ Ґ 10 Ь˘ 14 Æ Л˘ 16 Æ
Â 16,348 B Â



C ˘ Ь Æ ѝ Ґ 110 Ь˘ 22 Æ Л˘ 8 Æ
Â 2,097,152 C Â



D ˘ Æ ѝ Ґ 1110 Ь˘ è Æ ѝ Â



Æ ѝ Ґ 1111 Ь а ў ˘ ѝ E ˘
Â

˘ IP ˘ У IP
ў Â б ˘ ‡ ў IP
Â ىف Ш Л Ль Л ىف ^ CNNIC˜ ˘ IP ў
ѝ ىف Л б Л ў Ώ Л ^ ICANN,Internet Corporation for Assigned Names and Numbers˜

C	192.168.0.0~192.168.255.255	256 C

IP à TCP/UDP ʌ ʅ è ˚ ˘ RFC 1166 Â

IP Ł

IP Ł ЛЮ ˘ ʌ У ˘ è Ł ɻ Л
é ã Â

ʌ IP ˆ ~

ˆ ARP˜ ˆ ɻ ~

IP ˆ ɻ ~

IP ˆ ɻ ~

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У ʌ IP ˘ ɻ Л IP ˘ ʌ IP
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MAC ˘ ˝ Э й MAC ˘ MAC

Э Ъ IP ' 2˜ ˘ Э Ъ IP ˘ ⅄

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Э ч ⅄ IP ˘ 48 MAC Â

IP MAC й ˆ ARP˜ Â MAC

IP й ⅁ ⅄ ˆ RAÛRR m Â ⅄ Ȯ Ď

ARP

ARP ѵ Ethernet II ˘ Л ң ≠ ѝ ARPA Â

ARP

ARP ѵ ╟ ˜ IP MAC Â
˘ ARP ă ˘ ARP ≠ ˘
Лъ Â ˘ ‡ У a ARP Â

ARP ˘ ѵ ЛъЮ ҄ '

҄	
Ruijie(config-if)# **arp timeout** *seconds*	ARP ˘ 0-2147483˜ è 0 a
Ruijie(config-if)# **no arp timeout**	

Ю˜ ѝ 3600 ˘ . 1 Â

IP

IP ╖ Ю ╟ ˘ a IP ╖ ˘ ‡ a
Â IP ˘ з ╖ Â

IP ╖ ˘ ЛъЮ ҄ '

҄	
Ruijie(config)# **no ip routing**	IP ╖
Ruijie(config)# **ip routing**	╟ IP ╖

ѝ Э ў Â Л ң ч
' 1˜ ┘ ˘ ѝ У ў ˘ ў
† ѝ Ґ 1 Ь ’ 2˜ ˘ ѝ ў ˘
32 Æ ѝ Ґ 1 Ь Â У IP ˘ è †
IP Â Лъ У Â

IP ˘ ˩ ˘ ш
˘ ѝ Â У ╕

Â

255.255.255.255 ˘ ٧ ЛЬЮ ٶ'

ٶ	
Ruijie(config-if)# **ip broadcast-address** *ip-address*	…
Ruijie(config-if)# **no ip broadcast-address**	٧

IP

˘ ЛЬЮ Ь ˘ Â

ă

ă

٦ Л Ў ă à à ˘ ў Ь '

1) ARP ă'

2) ў ٫ IP '

3) Â

ٶ	
Ruijie# **clear arp-cache**	ARP ă
Ruijie# **clear ip route** {*network* [*mask*] | *}	IP

٦ Л IP à ă à ˘
ٹ ╠ Â ٦ ˘ ٦ Л
٫ Â

˘ ЛЬЮ ٶ'

ٶ	
Ruijie# **show arp**	ARP ă

Ruijie# **show ip arp**	IP ARP ă
Ruijie# **show ip interface** [*interface-type interface-number*]	٨ IP
Ruijie# **show ip route** [*network* [*mask*]]	
Ruijie#**show ip route**	
Ruijie# **ping** *ip-address* [**length** *bytes*] [**ntimes** *times*] [**timeout** *seconds*]	٦

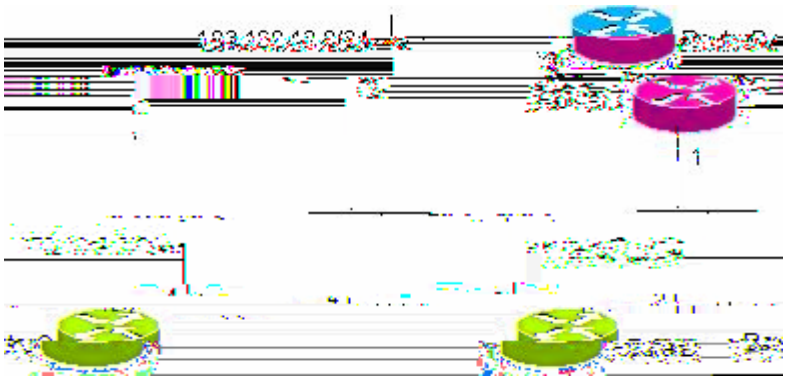
IP

ЛЬЮ IP

IP

IP

IP ĵ في في 1 Â



A B 192.168.12.0/24 Э У 172.16.3.0/24
ч Â ЛЮ ы A B Â

A '

```
interface FastEthernet 0/0
ip address 172.16.3.1 255.255.255.0 secondary
ip address 192.168.12.1 255.255.255.0
!
interface FastEthernet 0/1
ip address 172.16.1.1 255.255.255.0
!
router rip
network 172.16.0.0
network 192.168.12.0
```

B :

```
interface FastEthernet 0/0
ip address 172.16.3.2 255.255.255.0 secondary
ip address 192.168.12.2 255.255.255.0
!
interface FastEthernet 0/1
ip address 172.16.2.1 255.255.255.0
!
router rip
network 172.16.0.0
network 192.168.12.0
```

IP Ь

IP Ь Ь

IP Ь ъ ЛЮ Ьъ ЛЮ Ь ы Ьъ ы Л

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IP

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҄ʼ	
ip default-gateway *ip-address*	

˘ Ю ҄ʼ Â

҄ʼ	
show ip redirects	

҄ʼ ˩ γ Э Â

IP

IP Ь IP ˘ ICMP
Ь Â ˘ Ь ICMP ў è
Â ICMP ЊЖ RFC 792 Â

IP ˘ ˩ ЛЪЮ Ь'

ICMP a ˩

ICMP ˩

ICMP

IP MTU

IP

ICMP a ˩

й ˘ a IP
˘ ˩ ICMP a ˩ Â ˧ ˘ a
a ˘ ≠ ICMP ў a ˩ Â
Â

ICMP a ˩ ˘ ˧ ЛЪЮ ҄ʼ'

҄ʼ	
Ruijie(config-if)# **ip unreachables**	ICMP a ˩ ў a ˩

IP MTU ˘ ʌ ЛЬЮ ʒ'

ʒ	
Ruijie(config-if)# **ip mtu** *bytes*	MTU ˘ 68~1500
Ruijie(config-if)# **no ip mtu**	

IP

ʌ ң IP Â IP ˘ IP ш
ȁ ȁ ˘ RFC 791
Â ѐ У ˘ ╠ '
˘ У ICMP ˘ ʌ
Â ʌ ң Ю IP Â

IP ˘ ЛЬЮ ʒ'

ʒ	
Ruijie(config)# **ip source-route**	IP
Ruijie(config)# **no ip source-route**	IP

DHCP

DHCP Ӯ

DHCP(Dynamic Host Configuration Protocol ╟ ў) RFC 2131
ˇ DHCP й Э ў Â DHCP
Client/Server ˇ DHCP Ł й ╟ ў ↑ IP
ў Â

DHCP Ь ↑ IP '

1) ╟↑ ˇ DHCP ↑ IP ’

2) ╟ ↑ ˇ DHCP ↑ У IP ^ ┘
Лυ ў ╟ ~ ’

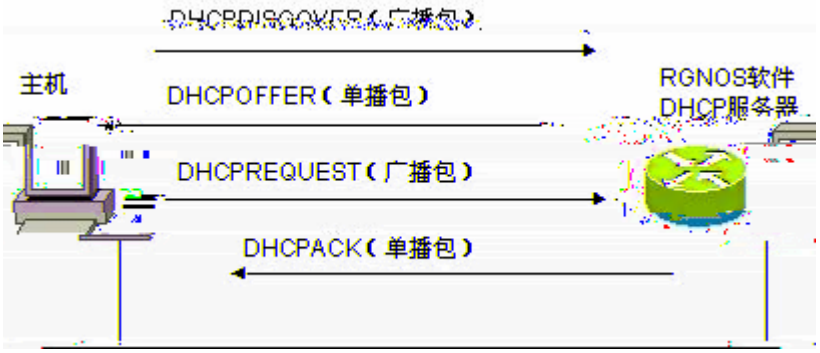
3) ˇ IP Â ┘Лυ DHCP
IP Â

Ь ↑ ˇ ┘ ╟ ↑ ┘Лυ a Ά Â

DHCP BOOTP(Bootstrap Protocol) ˇ
έ BOOTP Ϟ ╥ ˇ б BOOTP DHCP Ł
Â BOOTP Ϟ ╥ ˇ У DHCP
Ł Â RFC 951 RFC 1542 DHCP Â

DHCP Ł Ӯ

Л ң DHCP Ł RFC 2131 ˇ ў ╥ й ў ↑
IP Â DHCP في 3-1 Â



في 1 DHCP

DHCP IP Ю

1) ў DHCPDISCOVER Э DHCP Ь ’

2) DHCP Ь Л ў DHCPOFFER ˘ IP à MAC à Л Љ ч ’

3) ў DHCPREQUEST ˘ Л Ь ќ IP ’

4) DHCP Ь Л ў DHCPACK ˘ ў Â

DHCP ч Љ DHCP Ь DHCPOFFER Ü 1f Ńf ‡Pc 4 ¹)y ú 9 Ѵ È Q Ø Ö ð "Ò D ÑÁ ч ч У DHCPOFFER ˘ ч ч У DHCPOFFER Â ч ˘ DHCP Ь DHCPOFFER a У ў ќ ˘ Ю˘ DHCP Ь - ´A•À s iÒƒ@ -!´A•À !Ôd à Â

ㄴЛЪ IP ǂ Â

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ㅅ ㅂ ЛЪ ㅅЛЪㄱ FR ӕPPP ӕHDLC ㅅ Э DHCP Â

DHCP Ɂ Ӯ

DHCP Ɂ ˇ DHCP Ь DHCP Â
DHCP б Ь a ㄴ У Эˇ DHCP Ɂ
DHCP Â DHCP Ɂ ˇ б a ㄴ
ˇ ˇ У a IP Â
DHCP Ɂ DHCP ㅅˇ У DHCP ˇ ㅅ
Â

DHCP ˇ DHCP Ɂ DHCP Ь ' DHCP Ь
ˇ DHCP Ɂ DHCP Â

DHCP

DHCPˇ Ю Ь ˇ ὲ Ь Ь Â

DHCP Ь б Ɂ ˆ ~

ֽ	
Ruijie(config)# **service dhcp**	DHCP Ь DHCP ֽ ֿ
Ruijie(config)# **no service dhcp**	DHCP Ь ֽ ֿ

DHCP

˘ DHCP Ь ف ﷺ ׀
DHCP Â ˘ У a ׀ ˘ ׀ Ь
˘ ﷺ a ׀ Â

a ׀ ˘ ЛЮ ֽ'

ֽ	
Ruijie(config)# **ip dhcp excluded-address** *low-ip-address* [*high-ip-address*]	ﷺ IP ˘ DHCP a ׀
Ruijie(config)# **no ip dhcp excluded-address** *low-ip-address* [*high-ip-address*]	ﻯ

DHCP Ь ˘ У ׀ a DHCP
׀ ˘ ﻯ Л ч ' 1˜ a ă ' 2˜ DHCP ׀ ˘
˘ ÿ DHCP׀ Â

DHCP

DHCP ׀ Л ﻯ DHCP ˘ DHCP
ﷺ Â DHCP ˘ . DHCP Ь ˘ ≠ a
׀ ' DHCP Ь ˘ a DHCP
˘ DHCP ֽ Â

ﻯ Л DHCP ﷺ à ﻯ ˘ ﻯ
Â ﻯ ң ﻯ Л ﷺ ˘ DHCP ֽ IP
ă ׀ Â

DHCP ֽ IP ˘ ׀ б DHCP
ﻯ IP ﻯ У Â ﷺ ˘
׀ '

DHCP ֽ IP ˘ ׀ б ﻯ У
Â ﷺ ˘ ׀ Â

DHCP ˘ ЛЮ Ь˘ è Ь Ь
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NetBIOS WINS └ ^ ┘ ~

NetBIOS ^ ┘ ~

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┘ ˘ ЛЮ ҂'

҂	
Ruijie(config)# **ip dhcp pool** *dhcp-pool*	┘

й “Ruijie(dhcp-config)#” Â

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DHCP Ю Â

╟ ˚ ˘ ЛЮ ҂'

҂	
Ruijie (dhcp-config)# **bootfile** *filename*	╟ ˚ ┘

˘ й └ † Â

IP б DHCP IP ┘ У Â

˘ ЛЮ ҂'

҂	
Ruijie(dhcp-config)# **default-router** *address* [*address2…address8*]	

DHCP Ь ў ˘ Ю й 1 Â
˘ ‡ Л a Â

˘ ЛЮ ҄ʼ

҄	
Ruijie(dhcp-config)# **lease** {*days* [*hours]* [*minutes*]	**infinite**}	

Л

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Л ╟╬ Э Л Л ў Л Â

Л˘ ЛЮ ҄ʼ

҄	
Ruijie(dhcp-config)# **domain-name** *domain*	Л

Л Ь

ў Л ˘ DNS Ь Л Â
DHCP Л Л Ь ˘ ЛЮ ҄ʼ

ЛЪЮ ҳ'

ҳ	
Ruijie(dhcp-config)# **netbios-name-server** *address* [*address2…address8*]	DNS Ь

NetBIOS

DHCP NetBIOS ' 1˜ Broadcasť ˘
NetBIOS ɻ ' 2˜ Peer-to-peeř ˘
WINS Ь NetBIOS ɻ ' 3˜ Mixeď ˘ ″I
ɻ ˘ ɻ б WINS Ь ɻ ' 4˜ Hybriď
˘ ″I WINS Ь NetBIOS ɻ ˘ ˘
NetBIOS ɻ Â

Ю˘ й Â
WINS Ь ˘ й ' WINS Ь ˘ ὶ Â

DHCP NetBIOS ˘ ЛЪЮ ҳ'

ҳ	
Ruijie(dhcp-config)# **netbios-node-type** *type*	NetBIOS

DHCP Л

╟ ˘ ч è ˘ й DHCP Ь
У ┘† Â ˘ ‡
┘ † ÂDHCP † ˘
˘ DHCP
˘ ЮУ ˘ † У Â

˘ ЛЪЮ ҳ:

ҳ	
Ruijie(dhcp-config)# **network** *network-number mask*	DHCP Л

Л ң DHCP ╟ ˘ † Лъ ID
ὶ ˘ DHCP ╟ а ┘ ┘ ч '
Ь Э [┘Лъ

˘ ⅄ ≠ ⅄ Л Ь Ь] Ь ↑ ˘
⅄ ↑ ’

˘ ѝ Э ˘ ˘ è ˘
˘ Ь Â

IP MAC Â ч ' 1˜
˘ DHCP Ь ˘ ЊЖ IP MAC
˘ è У ’ 2˜ ╟ ˘ DHCP Ь
DHCP ˘ ╟ ÿ ↑ IP ˘ ? ѧ я

Ping ˘ ЛЮ ҄ʼ

҄	
Ruijie(config)# **ip dhcp ping packets** *number*	DHCP Ł ŧ Ping ˘ ѝ 0 ‡ a Ping ˘ ѝ 2 Â

Ping

Ю˘ DHCP Ł Ping 500 ˘ ѝ IP ў Â ˩ Л Ping ˘ ˩ Ł Ping Â

Ping ˘ ЛЮ ҄ʼ

҄	
Ruijie(config)# **ip dhcp ping timeout** *milliseconds*	DHCP Ł Ping ˘ ѝ 500ms Â

Л ʎ DHCP

ʎ ң Л ʎ DHCP ╟ ŧ IP Â Л ʎ DHCP ˘ ʎ ЛЮ ҄ʼ

҄	
Ruijie(config-if)# **ip address dhcp**	DHCP IP

PPP Э DHCP

ʎ ң ppp ʎ DHCP ╟ ŧ IP Â DHCP ˘ ʎ ЛЮ ҄ʼ

҄	
Ruijie(config-if)# **ip address dhcp**	DHCP IP

FR Э DHCP

ʎ ң FR ʎ DHCP ╟ ŧ IP Â DHCP ˘ ʎ ЛЮ ҄ʼ

ȝ	
Ruijie(config-if)# **ip address dhcp**	DHCP IP

HDLC Э DHCP

ʌ ң HDLC ʌ DHCP ╟ ǐ IP Â
DHCP ˘ ʌ ЛЬЮ ȝ'

ȝ	
Ruijie(config-if)# **ip address dhcp**	DHCP IP

ʌ 10.1 ǐ ң Э˘ PPP àHDLC àFR
ЭЛЬ dhcp IP Â

DHCP Ł

DHCP Ł Ь ȝ'

1˜ ȝ˘ ˩Ль DHCP à ă à Ł ’

2˜ ˆ debug˜ ȝ˘ ˘ ў ’

3˜ ȝ˘

٦	
Ruijie# **debug ip dhcp server** [**events** | **packet**]	DHCP Ł

DHCP Ł ˘ ٦ ЛЬЮ ٦'

٦	
Ruijie# **show ip dhcp binding** [**address**]	DHCP
Ruijie# **show ip dhcp conflict**	DHCP ă
Ruijie# **show ip dhcp server statistics**	DHCP Ł

DHCP

DHCP ч ٦˘ ┘Л Э ЛЬЮ '

1˜ ˆ debug˜ ٦˘ ˘ ў .

2˜ ٦˘ DHCP Â

DHCP ˘ ٦ ЛЬЮ ٦'

٦	
Ruijie# **debug ip dhcp client**	DHCP

DHCP ˘ ٦ ЛЬЮ ٦'

٦	
Ruijie# **show dhcp lease**	DHCP

3 '

DHCP

ЛЬЮ ˘ Ьѫ У net172˝ й 172.16.1.0/24˝
й 172.16.16.254˝ ˩ й rg.com˘ ˩ Ь й 172.16.1.253˝ WINS Ь
й 172.16.1.252˝ NetBIOS й ˘ й 30 Â
172.16.1.2~172.16.1.100 ˘ è й ˩† Â

```
ip dhcp excluded-address 172.16.1.2 172.16.1.100
!
ip dhcp pool net172
network 172.16.1.0 255.255.255.0
default-router 172.16.1.254
domain-name rg.com
dns-server 172.16.1.253
netbios-name-server 172.16.1.252
netbios-node-type h-node
lease 30
```

ЛЬЮ ˘ MAC й 00d0.df34.32a3 DHCP † IP й
172.16.1.101˘ й 255.255.255.0˘ ў ˩ й Billy.rg.com˘ й
172.16.1.254˝ WINS Ь й 172.16.1.252˝ NetBIOS й Â

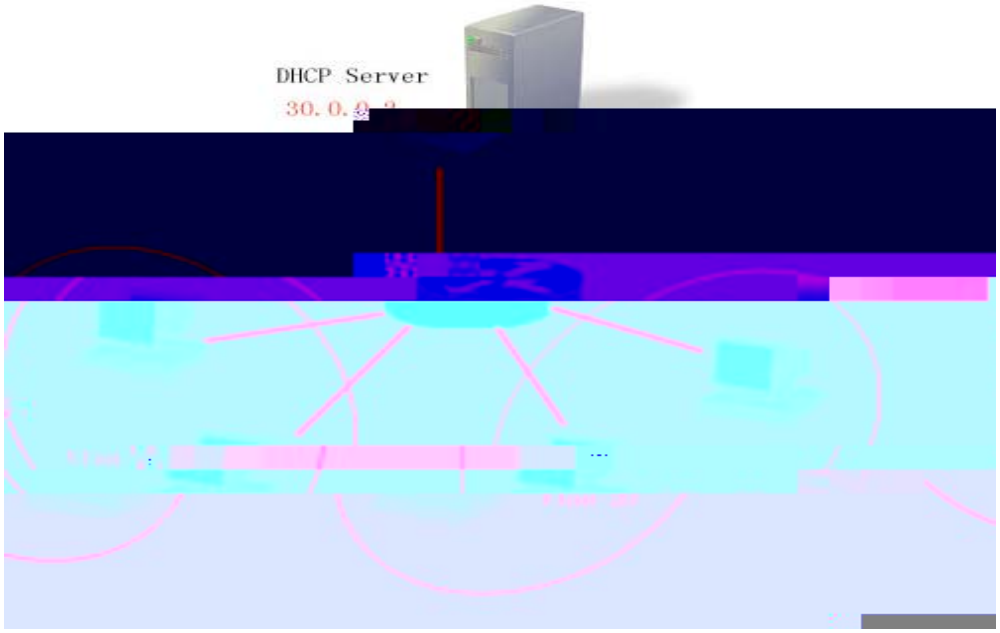
```
ip dhcp pool Billy
host 172.16.1.101 255.255.255.0
hardware-address 00d0.df34.32a3 ethernet
client-name Billy
default-router 172.16.1.254
domain-name rg.com
dns-server 172.16.1.253
netbios-name-server 172.16.1.252
netbios-node-type h-node
```

DHCP

ЛЬЮ ˘ й ٨ FastEthernet 0/0 DHCP ╟† Â

```
interface FastEthernet0/0
ip address dhcp
```

DHCP Relay



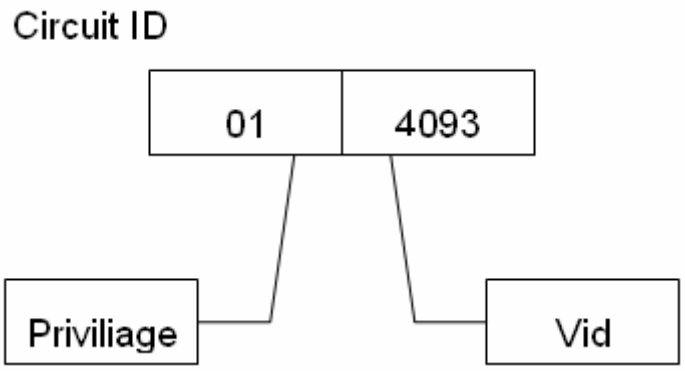
1 في

VLAN 10 VLAN 20 ↑ 10.0.0.1/16 20.0.0.1/16 ˘ DHCP Server 30.0.0.1/16 Э˘ 30.0.0.2 DHCP Server 10.0.0.1/16 20.0.0.1/16 ╠ IP ˘ ↓ ѝ Э DHCP Relay Agent˘ DHCP Server IP ѝ 30.0.0.2 ↓ Л

DHCP Relay Agent Information(option 82)

RFC3046 Ђ˘ DHCP relay ˘ ↓ Л ╗ У option DHCP client У ˘ ÿ Ь ↓ Л ↑ a ↓ IP˘ RFC3046 Ђ˘ option Л ѝ 82˘ ≠ option82˘ option ↓ Л ↑ ˘ Circuit ID Remote ID Â Ѽ Л relay agent information ч ˘ У б 802.1x/SAM relay agent information option dot1x˘ Л У Л vid˘ slot˘ port˘ Л Л mac relay agent information option82˘ Ю ч option Л Л Л У ђ У '

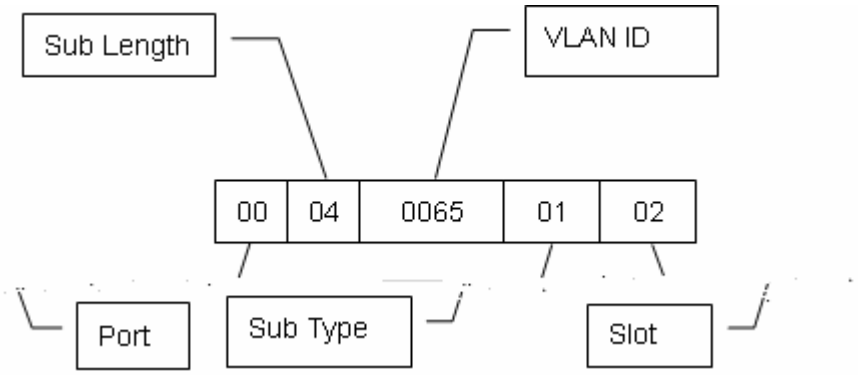
1. relay agent information option dot1x˘ 802.1x Л Л Л ң RG-SAM Â RG-SAM 802.1x Ю a ↓ IP ˘ DHCP client vid Circuit ID Â DHCP relay Э DHCP server ˘ DHCP server ˘ ↓ Л a ↓ ↑ a ↓ IP Â Circuit ID Ю˘ è priviliage vid ´ ч '



2

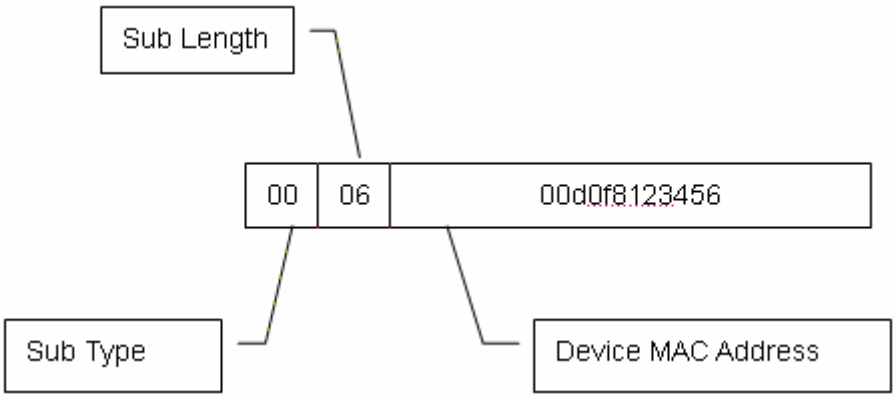
2. relay agent information option82 option a è
ˇ DHCP relay ˇ DHCP ˇ
ˇ option82 option

Agent Circuit ID



3

Agent Remote ID



4

DHCP relay Check Server-id ╖

DHCP ˘ й У DHCP Ь ˘ ÿ ˘
й У Л Ь a Â DHCP Л
˘ DHCP client DHCP REQUEST Ь ˘
У server-id option ˘ й
Ь ˘ relay ˘ Л
serverˇ a У DHCP serverˇ Э DHCP
check server-id ╖

DHCP

DHCP Ъ┐

Ю˘ Ю DHCP Ъ┐ '

Ъ┐	
Ruijie (config)# **service dhcp**	DHCP Ъ┐
Ruijie(config)# **no service dhcp**	DHCP Ъ┐ Â

Ruijie(config)# **no IP helper-address** *A.B.C.D*	У DHCP Ь
Ruijie(config-if)# **no IP helper-address** *A.B.C.D*	У ∧ DHCP Ь

DHCP option dot1x

DHCP Relay Agent Information ⅃ ˘
a ⅃ ⍞ a ⅃ IP ˘ ⅃Ло **ip dhcp relay information option dot1x** DHCP relay option dot1x ╗ ˘
╗ ˘ relay 802.1x ╗ option Ь
˘ ╗ dot1x ╗ Â

Ю˘ Ю DHCP option dot1x'

⅋	
Ruijie(config)# **ip dhcp relay information option dot1x**	DHCP option dot1x ╗
Ruijie(config)# **no ip dhcp relay information option dot1x**	DHCP option dot1x ╗ Â

DHCP option dot1x access-group

option dot1x ˘ æ IP ∧
У IP ˘ Ло ∧ æ ˘ ⅃Ло
⅋ **ip dhcp relay information option dot1x access-group** *acl-name*
˘ *acl-name* ЊЖ ACL ″I ˘ Ло ˘ ў
Â ∧ ˘ ACL
∧ Э˘ з ACL ACE˘ б è ∧ ACL ă
˘ ⍞

ѝ У IP ˘ ѝ 192.168.3.2-192.168.3.254˘
192.168.4.2-192.168.4.254˘ 192.168.5.2-192.168.5.254' ∧ 192.168.3.1 à
192.168.4.1 à 192.168.5.1 ѝ ˘ a⍞ Â ‡
192.168.3.x-5.x web ЛЬЮ ˙ Â
Э Ю'

```
Ruijie# config
Ruijie(config)# ip access-list extended DenyAccessEachOther
OfUnauthrize
Ruijie(config-ext-nacl)# permit ip any host 192.168.3.1
//
Ruijie(config-ext-nacl)# permit ip any host 192.168.4.1
```

```
Ruijie(config-ext-nacl)# permit ip any host 192.168.5.1
Ruijie(config-ext-nacl)# permit ip host 192.168.3.1 any
//      IP      ѝ
Ruijie(config-ext-nacl)# permit ip host 192.168.4.1 any
Ruijie(config-ext-nacl)# permit ip host 192.168.5.1 any
Ruijie(config-ext-nacl)# deny ip 192.168.3.0 0.0.0.255 192.1
68.3.0 0.0.0.255
//
Ruijie(config-ext-nacl)# deny ip 192.168.3.0  0.0.0.255  192.
168.4.0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.3.0  0.0.0.255  192.
168.5.0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.4.0  0.0.0.255  192.
168.4.0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.4.0  0.0.0.255  192.
168.5.0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.5.0  0.0.0.255  192.
168.5.0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.5.0  0.0.0.255  192.
168.3.0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.5.0  0.0.0.255  192.
168.4.0  0.0.0.255
Ruijie(config-ext-nacl)# exit
```

ѧ ̈Ą ҂ **ip dhcp relay information option dot1x access-group** *DenyAccessEachOtherOfUnauthrize* ҂ ѧ Э

Ю̆ Ю **DHCP option dot1x access-group** R uijie(config)#43( )]TJ -0.

```
Ruijie(config)# ip helper-address192.18.100.2      //
Ruijie(config)# interface GigabitEthernet 0/3
Ruijie(config-if)# ip helper-address 192.18.200.1  //
Ruijie(config-if)# ip helper-address 192.18.200.2  //
Ruijie(config-if)# end
```

DHCP relay

```
ip dhcp relay information option dot1x
interface GigabitEthernet 0/1
interface GigabitEthernet 0/2
interface GigabitEthernet 0/3
no switchport
ip helper-address 192.168.200.1
ip helper-address 192.168.200.2
interface VLAN 1
ip address 192.168.193.91 255.255.255.0
line con 0
exec-timeout 0 0
line vty 0
exec-timeout 0 0
login
password 7 0137
line vty 1 2
login
password 7 0137
line vty 3 4
login
end
```

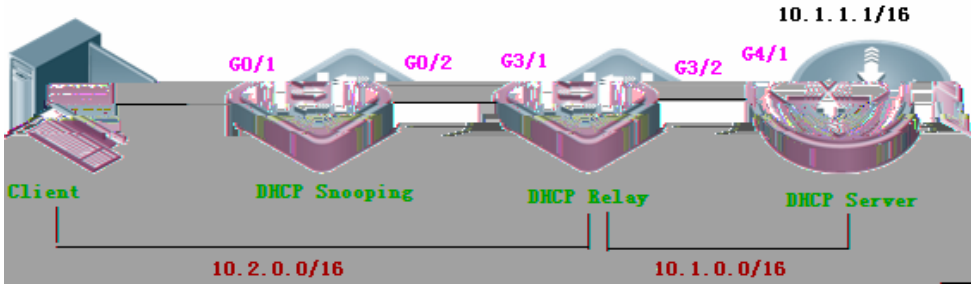
DHCP ή

IP Э

1 à ↓Л↓ IP Э ’

2 à IP Э Â

في



أ

DHCP Snooping б DHCP Relay ٧ access ٧˘
Client ٦ Л∪ ╟ ٧ IP Э ˘ DHCP Relay
Â IP Э ч ' У Ю
DAΓ ╟ ARP ╥ ˜ ˘ ٦ У ٧ Ю ٧ ˘
arp-check ╥ Э Â У Â

Э في ˘ Ю '

DHCP Snooping '

```
#       DHCP Snooping ╥
Ruijie(config)# ip dhcp snooping

#      б  Ь        Gi0/2 ѝ ٦     ٧
Ruijie(config)# interface gigabitEthernet 0/2
Ruijie(config-if)# ip dhcp snooping trust

#      Gi0/2 ѝ ARP         ٧
Ruijie(config-if)# ip arp inspection trust
Ruijie(config-if)# exit

#          VLAN    DAI          ╥
Ruijie(config)# ip arp inspection vlan 1

#           IP     ^  SVI1˜
Ruijie(config)# interface vlan 1
Ruijie(config-if)# ip address 10.2.0.1 255.255.0.0
# Ruijie(config)#
```

DHCP Relay

```
#      DHCP      ?¦
Ruijie(config)# server dhcp

#    ╗ У         DHCP    ╘
Ruijie(config)# ip helper-address 10.1.1.1

#      б Snooping              ∧    IP
Ruijie(config)# interface gigabitEthernet 3/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 10.2.1.1 255.255.0.0

#      б Server              ∧    IP
Ruijie(config)# interface gigabitEthernet 3/2
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 10.1.0.1 255.255.0.0
```

DHCP Server Э ¦

```
# ù      Relay          ∧      IP
Ruijie(config)# interface gigabitEthernet 4/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 10.1.1.1 255.255.0.0

#      DHCP    ╘
Ruijie(config)# service dhcp

#      DHCP          ˘           a     ¦
Ruijie(config)# ip dhcp excluded-address 10.1.1.1 10.1.1.10

#           ┘
Ruijie(config)# ip dhcp pool star

#
Ruijie(dhcp-config)# default-router 10.2.1.1

#      DHCP             /
Ruijie(dhcp-config)# network 10.2.0.0  255.255.0.0

#       ∧ У       ^  10.2.0.0/16˜
Ruijie(config)# ip route 10.2.0.0  255.255.0.0  10.1.0.1
```

DNS

DNS

IP ˩Л᧐ У ў ˩˘ ў ˩ У ˘
Â ў ˩˘ a ˩ IP IP ˘ ˩ в
Ижк ў ˩ Â DNS ╖ Â

ў ˩ IP ч ' 1˜ ˘ ˩ Э ў IP
˘ ˘ з ˩ ’ 2˜ ╟
˘ У ˩ ^ DNS˜ ˘ ˩ ж DNS Ь Э ў IP
˘ Э ў ˩ ˘ ˝I DNS Ь ў
IP Â

ў ˩˘ ў ˩ IP ˩ ˩ ^ ў ˩
˜ Â ў ˩ ˘ ≠ DNS ˩ Â
˩ ˘ ˩Л᧐ ˝I ˩ ˘ ˩ a ╖˘ ¨Ą
╟ ˩ Â ˩Л᧐ У ˩ ˩ ˘
˩Л᧐ ˩ Â

Ruijie(config)# **ip Domain-lookup**	DNS

NTP

NTP

Network Time Protocol NTP

LAN

WAN

NTP

UTC NTP UTC

Internet

(Authentication)

SNTP NTP SNTP

SNTP

NTP

NTP

NTP

NTP

NTP ID

NTP

NTP

NTP

NTP

NTP

NTP

NTP ╗ б Ь ╡ ч ' У˘ NTP
Л∪ ч ' у˘ Ь '
NTP У ˘ б Ь ╗
˘ Ь Â

Ю˘ a Â ‡ a
╗ Â ˘ a Ъ У ╗
Ь б ˘ ѐ Ь ╗
┘ Ь ╗ Â

˘ ЛЮ Ъ'

Ъ	
ntp authenticate	NTP Â
no ntp authenticate	NTP Â

ntp authentication-key à ntp trusted-key
Â

NTP

NTP ˘ Ю Â

˘ У У key-id ˘ ┘ Л∪ **ntp trusted-key** key-id й Â

˘ ЛЮ Ъ'

Ъ	
ntp authentication-key *key-id* **md5** *key-string* [*enc-type*]	NTP Â key-id' 1-4294967295 key-string' enc-type' 0 7 ч Â
no ntp authentication-key *key-id* **md5** *key-string* [*enc-type*]	NTP Â

a У ˘
й Â

~

Л ┘ 1024 ˘ Ь У У
Â

NTP ID

Л У ˘ У
Â ˘ ↓Л ╗ Â
˘ ЛЮ ?'

?	
ntp trusted-key *key-id*	NTP ID Â
no ntp trusted-key *key-id*	NTP ID Â

Л Э Ь У ˘ б Ь
╗ Ь Â

~

˘ ‡ ≠ Â

NTP Ь

Ю˘ NTP Ь Â ↓ б 20
NTP Ь ˘ ^ Л 1 Л˜ ↓Л й У Ь
У ˘ б Ь ╗ Â
б Ь й NTP З˘ ↓ ↓Л NTP ↑˘
↑ ↑ Э Ь NTP Â
У NTP Ь ˘ Ю ЛЮ ?'

?	
ntp server *ip-addr* [**version** *version*][**source** *if-name number*][**key** *keyid*][**prefer**]	NTP Ь version^ NTP Л˜ ' 1-3 if-name^ ↑ ˜ ' Aggregateport à Dialer GigabitEthernet à Loopback à Multilink à Null à Tunnel à Virtual-ppp à Virtual-template à Vlan Â keyid' 1-4294967295
no ntp server *ip-addr*	NTP Ь

↑ Л 1 ˘ Ь

˘ Ł ╗ ˘ ╗ Ł ┘
Â

∧ NTP

ϟ ╗ ∧ Э NTP Â

ЮЎ ∧ Э NTP ┘Л˘ ˘
╗ ˘ ┘Л˘ ∧ Э NTP Â

~

╗ ϟ ∧ IP ∧˘ è ∧
Э ϟ Â

∧ Ю ЛЮ ϟ˘ ∧ NTP '

ϟ	
interface *interface-type number*	∧
ntp disable	∧ NTP ╗ Â

∧ NTP ╗ ˘ ∧ Ю **no ntp disable** ϟ

NTP ╗

no ntp ϟ ╗ NTP ┘ Ł˘ ┘ ˘ ┘ NTP
Â

ЮЎ NTP ╗ ˘ ∧ NTP Ł NTP
˘ NTP ╗ Â

NTP˘ Ю ЛЮ ϟ'

ϟ	
no ntp	NTP ╗ Â
ntp authenticate **ntp server** *ip-addr* [**version** *version*][**source** *if-name number*][**key** *keyid*][**prefer**]	NTP ╗

NTP ⅄

ὶй ˘ У Ь 8
˘ Ю ⅄ ˘ NTP ⅄ ὶй 1ᛏ ˘ . ⅄
╟ Ю У ⅄ ˘ ╟ ⅄ ⅄ Л
ⵖ Â

NTP ⅄ ˘ Ю ЛЮ ⵖ'

ⵖ	
ntp synchronize	⅄
no ntp synchronize	⅄

ὶй ⅄ ⅄ 30ᛏ Ю У ⅄ ˘ ╗
Ь ≠ ⅄ ˘ NTP ⅄ ⵖ ≠
⅄ ˘ ⅄ ⵖ a Â

⅄ ⵖ NTP ⵖ ⅄ Л ⅄ ˆ ⅄ ~
⅄ ╗ ˆ ⅄ ~˘ a ⅄ ˘ NTP ⵖ a NTP ⅄
╗ ˘ з NTP Â

NTP

NTP

NTP ╗ ˘ ⅄ Л ⵖ ˘
Â

NTP ╗ ˘ Ю ЛЮ ⵖ'

ⵖ	
debug ntp	╗ Â
no debug ntp	╗ Â

NTP

Ю˘ ⅄ Л **show ntp status** ⵖ NTP Â

NTP ˘ Ю ЛЮ ⵖ'

ֽ	
show ntp status	NTP

ٸ ٹ ٻ ֽ . Â

```
Ruijie# show ntp status
Clock is synchronized, stratum 9, reference is 192.168.217.100
nominal freq is 250.0000 Hz, actual freq is 250.0000 Hz, precision
is 2**18
reference time is AF3CF6AE.3BF8CB56 (20:55:10.000 UTC Mon Mar
1 1993)
clock offset is 32.97540 sec, root delay is 0.00000 sec
root dispersion is 0.00003 msec, peer dispersion is 0.00003 msec
```

' starum ֽ ˇ reference ٸ ٹ ٻ frep ˇ precision ٸ ˇ reference time ٸ ٹ ٻ UTC ˇ clock offset ٸ ˇ root delay ٸ ˇ root dispersion ٸ ٻ ˇ peer dispersion ٸ ٹ ٻ Â

ЛъЮ ˇ У ٸ master NTP ٻ ˇ ˇ У key-id ٸ 6 â key-string ٸ wooooop ˇ ٸ ٻ ' ٸ ٹЛъ Э NTP ٻ ٹ ˇ Ю ˇ ╟ ˇ У NTP ٻ У ˇ ٻ ٹ ٻ ٸ Э NTP ٻ ˇ ٹ Â

```
Ruijie(config)# no ntp
Ruijie(config)# ntp authentication-key 6 md5 wooooop
Ruijie(config)# ntp authenticate
Ruijie(config)# ntp trusted-key 6
Ruijie(config)# ntp server 192.168.210.222 key 6
Ruijie(config)# ntp synchronize
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# ntp disable
Ruijie(config-if)# no ntp disable
```

UDP-Helper

UDP-Helper

UDP-Helper ӯ

UDP-Helper ў ╖ UDP Â
Ь ˘ UDP ⁄ Ь ˘
Â

UDP-Helper ╖ ⁄ˇ UDP ∧ ∧ ˘
UDP ∧ ∧ б ∧ ∧ ┐ ˘ IP
ѝ Ь IP ˘ Л Ь Â

UDP-Helper ╖ ⁄ˇ 69 à 53 à 37 à 137 à 138 à 49 ∧
Â

:

BOOTP/DHCP DHCP Relay UDP ∧ 67 à 68
˘ ∧ 67 à 68 a UDP-Helper ∧ Â

UDP-Helper

UDP-Helper

╖	
UDP ∧ ∧	UDP-Helper ╖ ⁄ 69 à 53 à 37 à 137 à 138 à 49 ∧ UDP Â
Ь	

╠ UDP-Helper ╖

¦	╖
Ruijie(config)# **udp-helper enable**	**udp-helper enable** ¦ ╠ UDP ╖ Â UDP

no udp-helper enable ¦ UDP ╖ Â

:

1) Ю ╖ Â

2) ╠ UDP ╖ ˘ ‡ 69 à 53 à 37 à 137 à 138 à 49 UDP ∧ Â

3) DUP ╖ ⁄˘ UDP ∧ ∨ ˘ ∧ Â

Ł

¦	╖
Ruijie(config-if)# **ip helper-address** *IP-address*	UDP Ł Â Ю Ł Â

no ip helper-address ¦ Ł Â

:

1) У ∧ 20 Ł

2) Ł ∧ Э ˘ ╠ UDP-Helper ╖ ⁄˘ ÿ ∧ UDP ∧ ˘ Л∪ ∧ Ł Э Â

UDP ∧

¾	¶
Ruijie(config)# **ip forward-protocol udp** *ID*	UDP ˆ Â ˆ UDP ˇ ‡ ˆ ˇ ‡ Â UDP-Helper ¶ ˇ 69 à 53 à 37 à 137 à 138 à 49 ˆ

no ip forward-protocol udp port ¾ UDP ˆ Â

:

ˆ UDP-Helper ¶ ˇ
UDP ˆ Â ‡ˇ Â

╟ UDP ¶ ˇ 69 à 53 à 37 à 137 à 138 à 49 ˆ
UDP ¶ . ╟ˇ a Ä Â

256 UDP ˆ Â

ˆ ч ˇ **ip forward-protocol udp domain ip forward-protocol udp** *53* ˇ Â

SNMP

SNMP

SNMP Simple Network Manger Protocôl ~ ˘ 1988 8 ỳ У RFC1157 Â ˘ ˘ SNMP ỳ Y Э ˘ Â SNMP ˘ ⅃ Л Э à à Æ à ˘ SNMP ╖ Â

SNMP У ˘ ỳ / Ь ˘ Ь ' '

SNMP

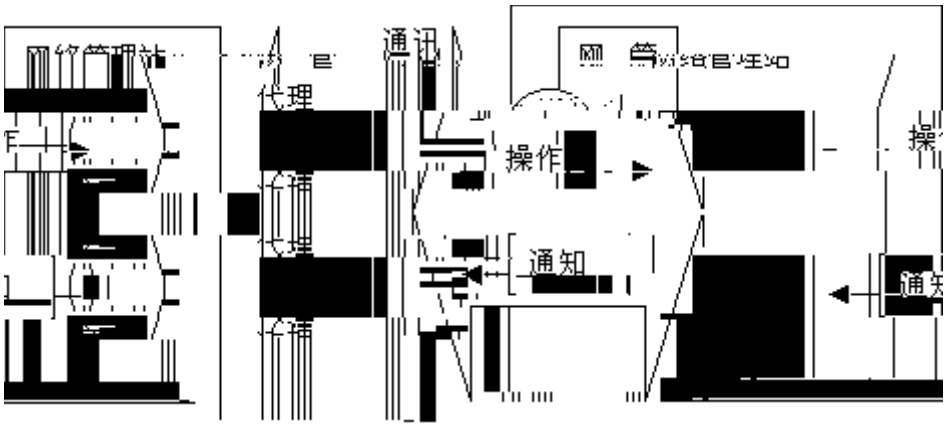
SNMP Ҷ

MIB

SNMP ˘ SNMP ˘ ≠ ỳ NMS (Network Management System) Â NMS Э ⅄ HP OpenView à CiscoView à CiscoWorks 2000˝ ˘ У ˚ · · Star View Â ˚ ⅃ Л Â

SNMP Ҷ ˆ SNMP Agent˜ Э ˚ ˘ ⅃ à з NMS ˘ ≠ ⅃ Л ў ╠ У NMS Â

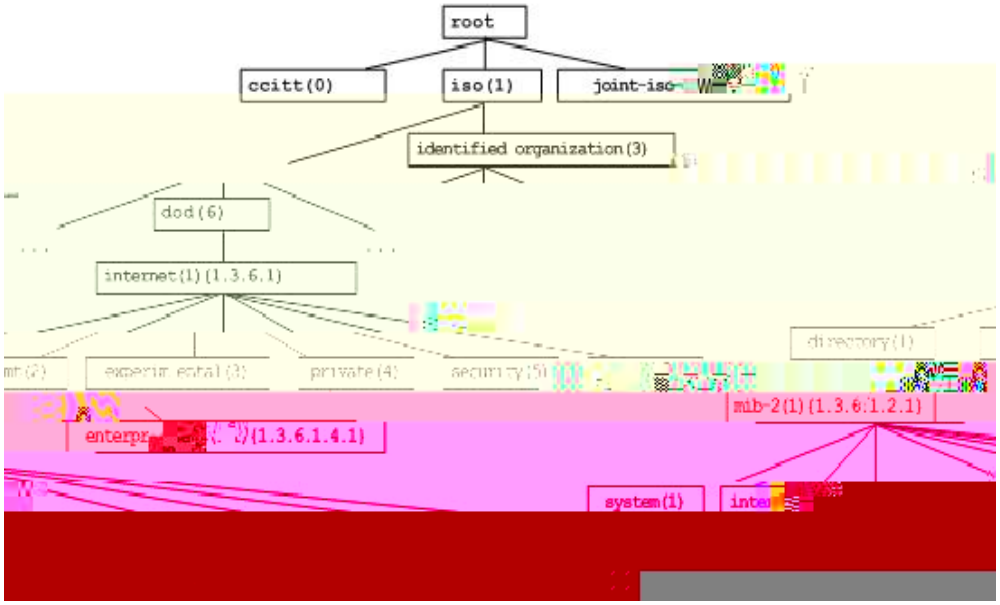
NMS Agent ⅃ Л Ю في '



في 1 ˆ NMS˜ б Ҷ ˆ Agent˜ في

MIB˜ Management Information Base˜ У Â

˘ ŕ SNMP У
˘ MIB Â
Â Юفي MIB ل ˘ ŕ У
System˜ ل Лυ У ˘ {1.3.6.1.2.1.1} У . ŕ
Object Identifier^ ˜ ˘ MIB ‡
Â



في 2 MIB

SNMP

SNMP ЛυЮ '

SNMPv1 ' У ˘ RFC1157 ЬЖ Â

SNMPv2C' ل ^ Community-Based˜ SNMPv2 ,
RFC1901 ЬЖ У Â

SNMPv3 ' ╗ ˘ ЛυЮ '

1. a '
2. ÿ '
3. ╗ ˘ '

SNMPv1 SNMPv2C ل ^ Community-based˜ Â
ЬЖ ў Лυ ٦ ل (Community String) Ҁ MIB
Â

SNMPv2C ╗ Get-bulk з ╗
Â Get-bulk У ٧ ٧

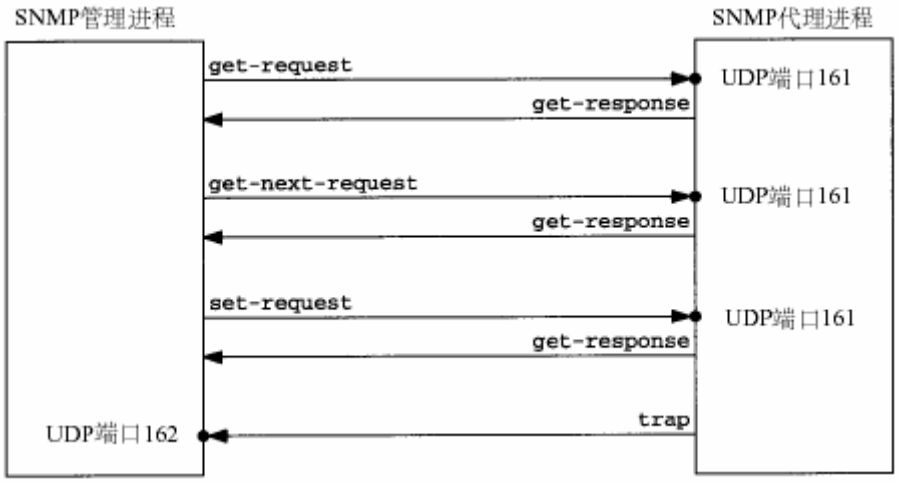
˘ ÿ - Â SNMPv2C ˙I
Ɂ ՃѾ a ɻ ˘ SNMPv1 У Ɂ Â
Ɂ ɻՃѾ Â Ɔ ɻ ɻ SNMPv1
SNMPv2C ˘ SNMP Ɂ SNMPv1 SNMPv2C
˘ ɜ Â

SNMP

SNMP NMS Agent ˘ Ⱶ 6 '

1. Get-request ' NMS ÿ Agent ɻ У Â
2. Get-next-request ' NMS ÿ Agent ɻ У ЮУ Â
3. Get-bulk ' NMS ÿ Agent ɻ '
4. Set-request ' NMS Agent У Â
5. Get-response ' Agent У ˘ Agent NMS 3 Â
6. Trap ' Agent ў ╟ ˘ NMS Y Â

4 NMS ɹ Agent ˘ ɻ ч Agent NMS ˆ ' SNMPv1 a Get-bulk ˜ Â Юفي Â



فى 3 SNMP

NMS ɹ Agent 3 Agent UDP 161 ʌ Â
Agent Trap UDP 162 ʌ Â

SNMP

SNMPv1 SNMPv2 ɻ MIB Â ŷ
˘ (NMS) ɻ ɻ ЬѪ ɻ У Â

У ɻ ɻ Л Л Ю :

ɻ (Read-only)' ŷ MIB ɻ Â
(Read-write)' ŷ MIB ɻ Â

SNMPv2 Э˘ SNMPv Л ɬ
' ɻ Ь ' SNMPv1 à
SNMPv2C à SNMPv3 Â

Ю ŷ ɻ Л ɬ

			₹	
SNMPv1	noAuthNoPriv	ɻ		ɻ
SNMPv2c	noAuthNoPriv	ɻ		ɻ
SNMPv3	noAuthNoPriv	ɻ		ɻ

SNMPv3 authNoPriv MD5 ŗ Ƶ ɬ

4' ˘ 27 ˘ ЬЖ Â

5' 16 ˘ 27 ˘ ЬЖ Â

6-127' Â

128-255' Â

SNMP

SNMP Ю ˘ SNMP ˘
¨I Â

⅄ ⊣

SNMPv1/SNMPv2C ⅄ ^ Community-based˜ ˘ SNMP
Ϛ ⅄ ⅄ ⅄ ⅄^ Community-String˜ ˘ б
⅄ a SNMP a ˘ Â ⅄ NMS Agent
Â

⅄ Л Ъ ˘ ⅄ IP NMS ⅄ Л Ъ '

⅄ Л Ъ ⅄ ˘ ReadOnly ⅄ ˜ ReadWrite ˜'

ففي ⅄ ˘ ففي Â ففي˘ .
MIB '

⅄ Л Ъ ⅄ IP Â a ˘ ‡ a
⅄ IP Â й a ⅄ IP '

SNMP ⅄˘ Ю Ю Ϛ'

Ϛ	
Ruijie(config)# **snmp-server community** *string* [**view** *view-name*] [**ro** | **rw**] [**host** *host-ip*] [*num*]	⅄ Â

ل Л ы У ل في ل في'

SNMPv3 ˘ ل Л ы è ˘
à ╗ '

MIB في ˘ Ю Ю ٹ'

ٹ	
Ruijie(config)# **snmp-server view** *view-name oid-tree* {**include** | **exclude**}	… У MIB في˘ MIB Â
Ruijie(config)# **snmp-server group** *groupname* {**v1** | **v2c** |**v3** {**auth** | **noauth** | **priv**}} [**read** *readview*] [**write** *writeview*] [**access** {*num* | *name*}]	… У ˘ في Â

no snmp-server view *view-name* ٹ У في˘ **no snmp-server view** *view-name oid-tree* ٹ У في У Â ≠ ل Л
no snmp-server group *groupname* ٹ У Â

SNMP

ل Л NMS ل ˘ Y ″I

SNMPv3 ˘ ل Л à ^ MD5 SHA пà ٨ ٹ à ╗ ^ ل DES п

SNMP ˘ Ю Ю ٹ'

֧	
Ruijie(config)# **snmp-server host** *host-addr* **traps** [**version** {**1**|**2c** |**3** [**auth**	**noauth**	**priv**]}] *community-string* [*udp-port port-num*] [**type**]	SNMP ў ˘ ў ˄˘ ˘ ˩ˆ SNMPv3 Ю ˩˜ à ˆ SNMPv3 ˜

SNMP ֧

˩ Л Ъ SNMP Agent ˘ à Æ à ˄ ˘ NMS ˘ ˩ Л Ъ ˘ Æ Â

SNMP ֧ ˘ Ю˘ Ю ֧'

֧	
Ruijie(config)# **snmp-server contact** *text*	
Ruijie(config)# **snmp-server location** *text*	Æ
Ruijie(config)# **snmp-server chassis-id** *number*	

Ьѫ SNMP ֧

ѝ ˘ ˩ Л Ъ Ьѫ SNMP ֧ Â

Ю˘ Ю ֧'

SNMP ⅋

a ⅄ ⅋˘ ⅄ ⅎ snmp ⅋ ⅋˘ ⅋ snmp
⊾˘ a ⅋ ' SNMP ⅋ ⊾˘
Ю˘ Ю ⅋'

⅋	
Ruijie(config)# **no enable service snmp-agent**	SNMP ⅋ ⊾

Agent ў ╟ ⅄ NMS Trap

Trap Agent a ў ╟ ⅄ NMS ˘ У Y
˚ Â a Agent ў ╟ Trap ˘ ˘
Ю˘ Ю ⅋'

⅋	
Ruijie(config)# **snmp-server enable traps** [*type*] [*option*]	Agent ў ╟ Trap
Ruijie(config)# **no snmp-server enable traps** [*type*] [*option*]	Agent ў ╟ Trap

Link Trap

⅄ Л℧ ⅄ ⅄ LinkTrap˘ ╖ ˘
⅄ Link ⅄ ˘ SNMP LinkTrap, ⅄ ‡ a Â Ю˘ ╖
Â

⅋	
Ruijie(config)# **interface** *interface-id*	⅄
Ruijie(config-if)# [**no**] **snmp trap link-status**	⅄ link trap ╖ .

Ю ⅄ ѝ a Link trap:

```
Ruijie(config)# interface gigabitEthernet 1/1
Ruijie(config-if)# no snmp trap link-status
```

ㄱ Ⅱ Agent Trap

```
SNMP logging: enabled
SNMP agent: enabled
.
```

Э Ю '

```
entPhysicalContainsEntry
entPhysicalContainsEntry.entPhysicalChildIndex
entLastChangeTime
```

SNMP

ЮЎ **show snmp user** Ъ Э SNMP Â

```
Ruijie# show snmp user

User name: test
Engine ID: 800013110300000000000
storage-type: permanent    active
Security level: auth priv
Auth protocol: SHA
Priv protocol: DES
Group-name: g1
```

SNMP في

ЮЎ **show snmp group** Ъ Э Â

```
Ruijie# show snmp group
groupname: g1
securityModel: v3
securityLevel:authPriv
readview: default
writeview: default
notifyview:
groupname: public
securityModel: v1
securityLevel:noAuthNoPriv
readview: default
writeview: default
notifyview:
groupname: public
securityModel: v2c
securityLevel:noAuthNoPriv
readview: default
writeview: default
notifyview:
```

ЮЎ **show snmp view** Ъ Э في Â

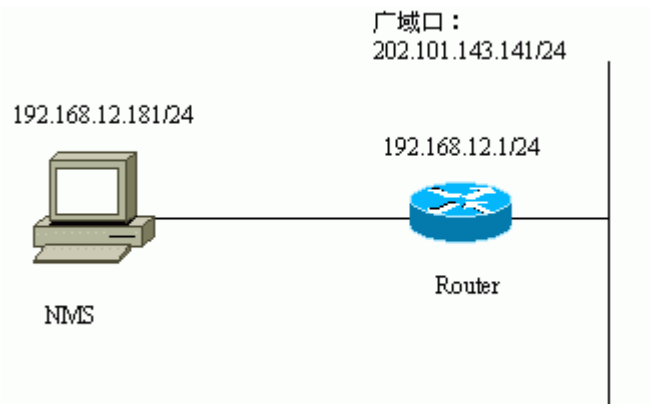
```
Ruijie# show snmp view
```

```
default(include) 1.3.6.1
test-view(include) 1.3.6.1.2.1
```

SNMP

ή

ي˘ NMS Л υ ˘ NMS IP й
192.168.12.181˘ IP й 192.168.12.1˘ Э
˚ ^ Л υ HP OpenView й ~ Â



ي 5 SNMP ή ي

έ

╠ SNMP Ʒ Ь'

```
Ruijie(config)# snmp-server community public RO
```

٧ Ю˘ Л υ Э Ʒ˘ ╠ SNMP Ʒ Ь ╖
˘ NMS ٦ Л υ SNMP ˘ a ٧ ٧
˘ a ˘ ٧ Â è ٦ Â

╖ ˘ ٦ Л υ Ю '

```
Ruijie(config)# snmp-server community private RW
```

Л υ Ю SNMP У Ʒ ˘ NMS ٦ Л υ
У ˘ й ٦ '

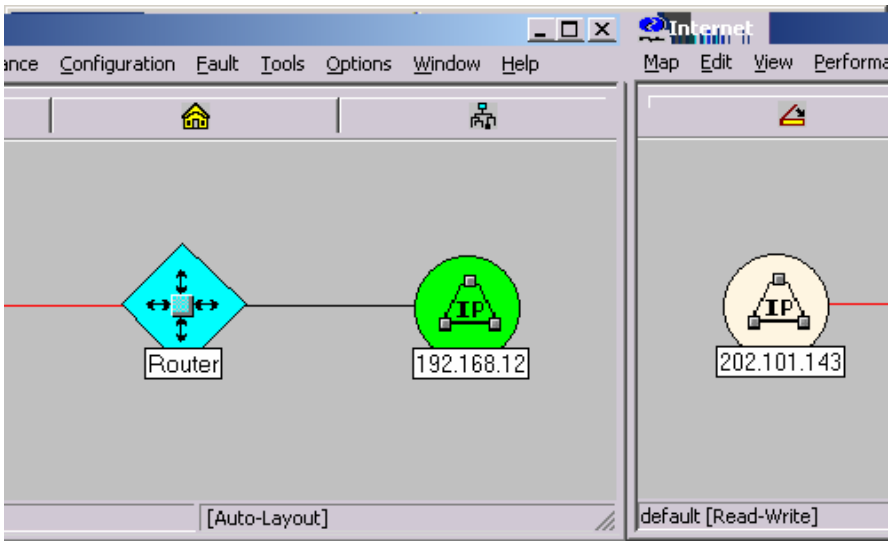
```
Ruijie(config)# snmp-server location fuzhou
Ruijie(config)# snmp-server contact wugb@i-net.com.cn
Ruijie(config)# snmp-server chassis-id 1234567890
0987654321
```

ЛЬЮ ˘ ў ╟ ┘ NMS У Trap ˘ ѝ ┤

```
Ruijie(config)# snmp-server enable traps
Ruijie(config)# snmp-server host 192.168.12.181 public
```

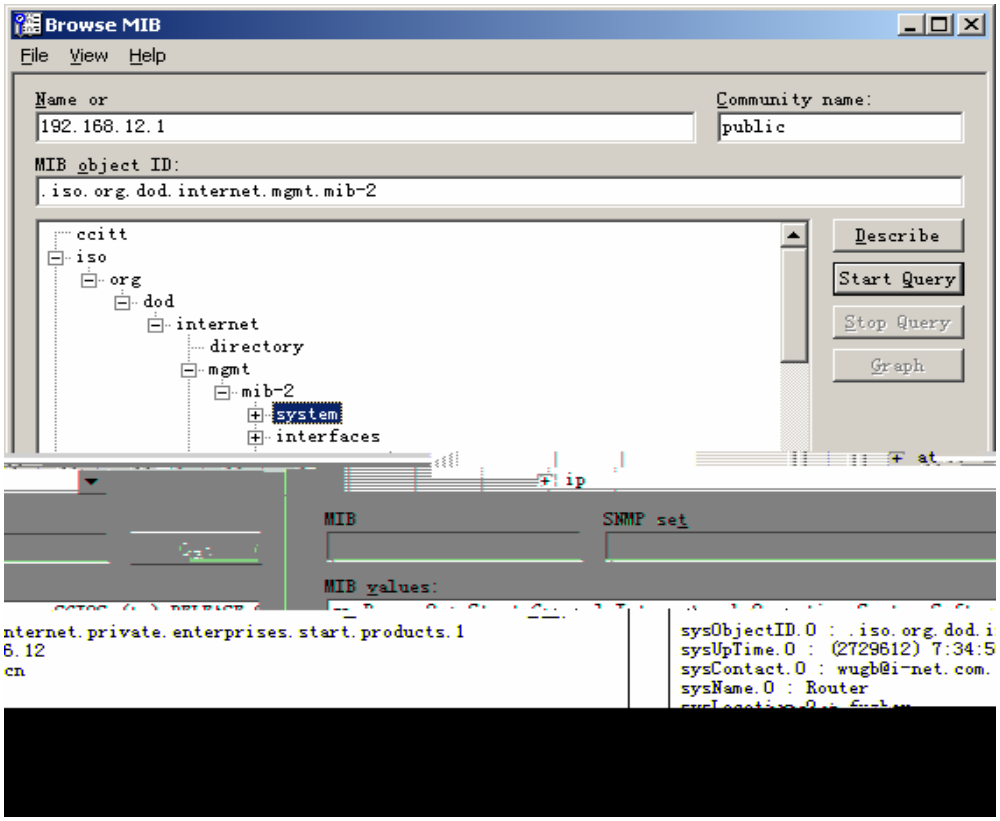
Э ˘ SNMP Ъ ˘ NMS ┤Л

˘ Л HP OpenView ѝ ˘ ┤Л ң ف˘ Юف'



ف 6

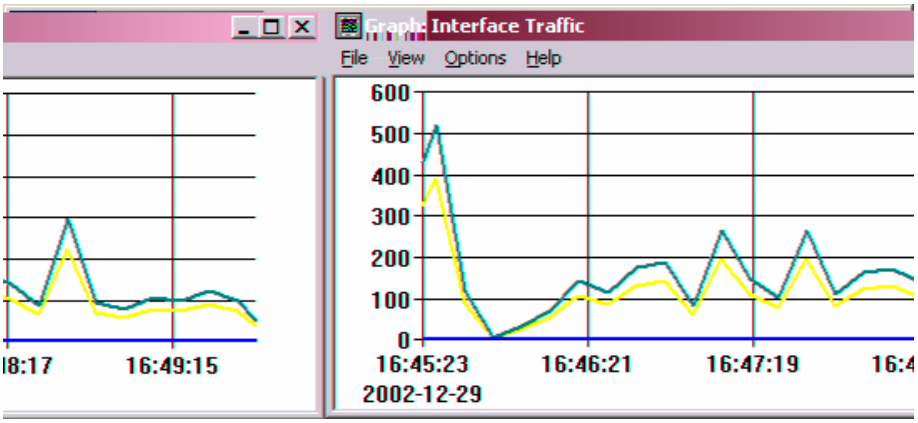
┤Л ˘ HP OpenView TOOL->SNMP MIB Brower ˘ Ю ˘ Name IP 192.168.12.1˘ Community Name Public˘ MIB é ˘ Юف System Â Start Query˘ MIB ˘ é



ف 7 MIB

HP OpenView ٦ ˘ ˘ ٦ ل ف ٨

ˇف è é SNMP ٦ ˘ ˚ ˘ a



ف 8 ٨ ف

SNMP

٨ ҥ ل ∩ ˘ ٨ NMS ل ∩

SNMP Agent ˘ NMS ˘ SNMP

Â

Ю

```
Ruijie(config)# access-list 1 permit 192.168.12.181
Ruijie(config)# snmp-server community public RO 1
```

Э ˇ ﾍ IP й 192.168.12.181 ў SNMP
Â

SNMPv3

ЛЪЮ SNMPv3 ¯ ╗ ﾉ v3user
MIB-2(1.3.6.1.2.1) Ю ﾚ Â й MD5˜
й MD5-Authˇ DES ╗ ˇ ╗ й DES-Priv Â ﾉ
ﾉ 192.168.65.199 Лъ SNMPv3 Trap Â Trap ﾉ й v3user,
¯ ╗ ˇ й MD5˜ й
MD5-Authˇ DES ╗ ˇ ╗ й DES-Priv Â

```
Ruijie(config)# snmp-server view v3userview 1.3.6.1.2.1 include
Ruijie (config)# snmp-server group v3usergroup v3 priv read
v3userview write v3userview
Ruijie (config)# snmp-server user v3user v3usergroup v3 auth
md5 md5-auth priv des56 des-priv
Ruijie (config)# snmp-server host 192.168.65.199 traps version
3 priv v3user
```

RMON

RMON˄ Remote Monitoring˅ ˜ IETF(Internet Engineering Task Force˅ Internet ж) ˅ ˩ Л
˩ Â RMON Э ˅

~

Л Н Л Л Â 1-65535 Л Л
10 Â

Bucket-number à Â Ш
У Â Ю Bucket-number
Â Bucket-number Л
1-65535 10 Â

Interval Â 1800 Л 1-3600 Â

Y

Л Л Ю

Ruijie(config)# **rmon alarm** *number variable interval* {**absolute** | **delta**} **rising-threshold** *value* [*event-number*] **falling-threshold** *value* [*event-number*] [**owner** *ownername*]	У Л
Ruijie(config)# **rmon event** *number* [**log**] [**trap** *community*] [**description** *description-string*]	У Y
Ruijie(config)# **no rmon alarm** *number*	У
Ruijie(config)# **no rmon event** *number*	У Y

number (Y) 1-65535 Â

variable Л Â Л Â

interval Â <1-4294967295>

Absolute Э à Ю Delta
Э Э à Ю Â

value Э à Ю Â

event-number Э Ю Y й Event-number
Y Â

Log Y

Trap Y Л Trap Â

community Trap Л Â

description-string Y

RMON

ֽ	
Ruijie(config)# **show rmon alarm**	
Ruijie(config)# **show rmon event**	Y ˇ
Ruijie(config)# **show rmon history**	ﻝ
Ruijie(config)# **show rmon statistics**	

RMON

Л∪ ﻥ З˝ Ю ֽ'

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

ﻝ

10ﾌ Л∪ ﻥ 3 ﻝ ˘ Ю ֽ'

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

Y ˇ

У ﻝ MIB ﻝ ╗ Â Ю
MIB-II IfEntry ifInNUcastPkts.6(ﻥ 6 Э ˘
й 1.3.6.1.2.1.2.2.1.12.6) ╗ Â έ ╗ й'
30 ﻥ 6 Э ﻝ ˘
Э (30) ╗ 20 20 Л∪Э˘ Э ﻥ ╗ 10
10 Л∪Ю˘ ‡ ˘ ﻝ Y ˇ 1 (
˘ ﻝ й Ŀ rmon Ŀ Trap˘ Y ˇ й ľ ifInNUcastPkts is too
much Ŀ) Â Y ˇ й zhangsan Â

```
Ruijie(config)# rmon alarm 10 1.3.6.1.2.1.2.2.1.12.6 30 delta
rising-threshold 20 1 falling-threshold 10 1 owner zhangsan
```

```
Ruijie(config)# rmon event 1 log trap rmon description "ifIn
NUcastPkts is too much " owner zhangsan
```

rmon

show rmon alarm

```
Ruijie# show rmon alarm
Alarm : 1
Interval : 1
Variable : 1.3.6.1.2.1.4.2.0
Sample type : absolute
Last value : 64
Startup alarm : 3
Rising threshold : 10
Falling threshold : 22
Rising event : 0
Falling event : 0
Owner : zhangsan
```

show rmon event

```
Ruijie# show rmon event
Event : 1
Description : firstevent
Event type : log-and-trap
Community : public
Last time sent : 0d:0h:0m:0s
Owner : zhangsan
Log : 1
Log time : 0d:0h:37m:47s
Log description : ipttl
Log : 2
Log time : 0d:0h:38m:56s
Log description : ipttl
```

show rmon history

```
Ruijie# show rmon history
Entry : 1
Data source : Gi1/1
Buckets requested : 65535
```

```
Buckets granted : 10
Interval : 1
Owner : zhangsan
Sample : 198
Interval start : 0d:0h:15m:0s
DropEvents : 0
Octets : 67988
Pkts : 726
BroadcastPkts : 502
MulticastPkts : 189
CRCAlignErrors : 0
UndersizePkts : 0
OversizePkts : 0
Fragments : 0
Jabbers : 0
Collisions : 0
Utilization : 0
```

show rmon statistics

```
Ruijie#  show rmon statistics
Statistics : 1
Data source : Gi1/1
DropEvents : 0
Octets : 1884085
Pkts : 3096
BroadcastPkts : 161
MulticastPkts : 97
CRCAlignErrors : 0
UndersizePkts : 0
OversizePkts : 1200
Fragments : 0
Jabbers : 0
Collisions : 0
Pkts64Octets : 128
Pkts65to127Octets : 336
Pkts128to255Octets : 229
Pkts256to511Octets : 3
Pkts512to1023Octets : 0
Pkts1024to1518Octets : 1200
Owner : zhangsan
```

RIP

RIP Ӯ

RIP (Routing Information Protocol) У ʌ ˘ Лъ ʇ ˩ Ӯ
У Â RIP ˩ ˘ У
˩ Â RIP RFC 1058 Ⱨ Â

RIP UDP ˘ UDP ʌ ʌ ̀ й 520 Â Ю RIPv1 ̀ й
’ RIPv2 ̀ й ˘ ̀ й 224.0.0.9 Â RIP 30 ˩
У Â 180 R —ЮЙ^Û=ÂP ü!f P

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RIP ㄱ ˩ ˜

╟ ˆ ˩ ˜

RIP ˆ ˩ ˜

RIP ˆ ˩ ˜

RIP ˥ ˆ ˩ ˜

ЛЬЮ ў ˇ ê IP “ ” Ì Â

RIP

VLSMs ˩ ˩ ˆ RIPv2˜

… RIP

RIP ˇ ″I … RIP ˇ ㄱ б RIP
Â

… RIP ˇ ЛЬЮ ҳ'

ҳ	
Ruijie(config)# **router rip**	… RIP
Ruijie(config-router)# **network** *network-number*	ㄱ

Network ҳ ㄱ ч '

1˜ RIP ˥ ’

2˜ RIP ˥ ˩ ˥ Â

RIP

RIP й ˇ RIP ˇ ‡
ˇ ЛЬ RIP Â

RIP ˇ RIP ЛЬЮ ҳ'

ҳ	
Ruijie(conf-router)# **neighbor** *ip-address*	RIP

ꢀ ꢁ ꢂ ꢃ ꢄ RIP ꢅ ꢆ
ꢇ ꢈ
passive-interface ꢀ Â ꢅ ê IP “
” Ì “ ” Â

FR à X.25 ꢅ Broadcast ꢅ ‡
neighbor Â **Neighbor** ꢀ Э Â

Ì

Ä IP Э˘ ꢇ Ä ꢅ
Ì Ъ Â Ì ꢃ Ъ
ÿ ˝ ꢇ ꢅ й.
Â

ˆ à X.25 ˜ ˘ Ì Ä Ì
˝ a Â Ю˘ Ä Ì Â У
ꢇ IP ˘ ≠ Ì Â

Ì ˘ ꢇ ЪЮ ꢀ'

ꢀ	
Ruijie(config-if)# **no ip split-horizon**	Ì
Ruijie(config-if)# **ip split-horizon**	Ì

ꢇ й й Ì Â

ЫЖ RIP

Л ң RIP 1 2˝ RIPv2 Ä Ъ à à à
CIDR VLSMs Â è à VLSMs ê IP “ ”
Ì Â

Ю˘ Л ң Ä Ъ RIPv1 RIPv2 ˘ Ä RIPv1
Â Ä Ъ ˘ Ä RIPv1 ˘ ≠ Ä Ъ Ä
RIPv2 Â

˚ Ä ˘ ЪЮ
ꢀ'

ֽ	
Ruijie(config-router)# **version** {**1** | **2**}	ЊЖ RIP

Л Э ֽ ˚ Ю ٨ ˇ ٦ Л
٨ й Â

٨ ٨ ˇ ٨ ЛЮ ֽ'

ֽ	
Ruijie(config-if)# **ip rip send version 1**	٨ RIPv1
Ruijie(config-if)# **ip rip send version 2**	٨ RIPv2
Ruijie(config-if)# **ip rip send version 1 2**	٨ RIPv1 RIPv2

٨ ٨ ˇ ٨ ЛЮ ֽ'

ֽ	
Ruijie(config-if)# **ip rip receive version 1**	٨ RIPv1
Ruijie(config-if)# **ip rip receive version 2**	٨ RIPv2
Ruijie(config-if)# **ip rip receive version 1 2**	٨ RIPv1 RIPv2

╟

RIP ╟ ˇ ˇ ╟
Â RIPv2 Ю ╟ ˇ RIPv1 a ╖ Â

RIPv2 ╟ ╖ ˇ Â
ˇ a ˇ ٦ Л
Â

ˇ ў ЛЮ '

RIP ˇ ″I '

RIP ˇ ˇ Â

٦ é ˇ a ٨ Л ˇ
╟ ╖ Â

╟ ˇ RIP ЛЮ ֽ'

ֽ	
Ruijie(config-router)# **no auto-summary**	╟

Ruijie(config-router)# **auto-summary**	╟

╟ ˇ ˩ Л ˩ ˇ ˩ Ю
ˇ ˩ Ю ЛЮ ⅋'

⅋	
Ruijie(config-if)# **ip summary-address rip** *ip-address ip-network-mask*	˩
Ruijie(config-if)# **no ip summary-address rip** *ip-address ip-network-mask*	↓ ˩

RIP

RIPv1 a ˇ RIPv2 ˇ ˩ Л ˩
Â

Ⱶ ˩ ˩ ˇ ˇ . ˩
ˇ ≠ a ̀ Â

˩ ң ч RIP ' MD5 Â ̀
Â

RIP ˇ ˩ ЛЮ ⅋'

⅋	
Ruijie(config-if)# **ip rip authentication key-chain** *key-chain-name*	ˇ RIP
Ruijie(config-if)# **ip rip authentication mode** {**text**	**md5**}	˩ RIP ' MD5

ˇ ê IP “ ” Ì “
” Â

RIP

RIP ╗ ˇ ˩ Л é ˇ RIP
Â ˩ Л ЛЮ '

' Л ˇ Ⱶ ,

' Л ˇ Ⱶ ˩ ̀ ,

' Л ˇ ˇ ,

Л Э ˇ ˩ ╗ Л ˥ Â
RIP ˇ RIP ЛЮ ⅋'

ʒ	
Ruijie(config-router)# **timers basic** *update invalid flush*	RIP

Ю˘ й 30 ˘ й 180 ˘ й 120 Â

л У Э ˘ RIP У У Â

RIP

Ю˘ RIP ˘ ˘
RIP Â ˘ IP б л IP
л Â л IP л˘ a Â

˘ RIP ЛЬЮ ʒ'

ʒ	
Ruijie(config-router)# **no validate-update-source**	
Ruijie(config-router)# **validate-update-source**	╟

RIP л

Ю˘ RIP ˘ ¯ RIP ˘
a RIP ˘ л Л ╟ л' л
˘ ‡ л Л ʒ л RIP Â

л й ╟ ˘ RIP ЛЬЮ ʒ'

ʒ	
Ruijie(config-router)# **passive-interface** {**default** | *interface-type interface-num*}	╟ л
Ruijie(config-router)#**no passive-interface** {**default** | *interface-type interface-num*}	л ╟ л

╟ л RIP Л˘ a ' RIP˘ ~
Л˘ ˘ й Â

ﾍ RIP ˇ ﾍ ЛЬЮ ﾇ

ﾇ	
Ruijie(config-if)# **no ip rip receive enable**	ﾍ RIP
Ruijie(config-if)# **ip rip receive enable**	ﾍ RIP

ﾍ RIP ˇ ﾍ ЛЬЮ ﾇ

ﾇ

في 1 RIP ƚ

ЛЬЮ '

1˜ RIP ’

2˜ RouterB à RouterC ’ 3˜ RouterE 192.168.12.0/24 Â

έ

˘ ѝ ˘ RouterA RouterD У ƚ ℸ Â ‡ RouterA a RouterB RouterC˘ RouterD ≠ a 192.168.12.0 RouterE Â ЛЬЮ ѝ ⁄ έ Â

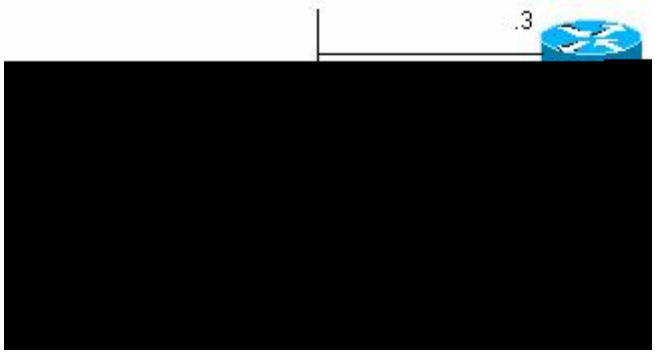
A '

```
#     Л      ⁄
interface FastEthernet0/0
ip address 192.168.12.1 255.255.255.0

#           ⁄
interface Serial1/0
ip address 192.168.123.1 255.255.255.0
encapsulation frame-relay
no ip split-horizon

#     RIP
router rip
version 2
network 192.168.12.0
network 192.168.123.0
```

B '

```
#     Л      ⁄
interface FastEthernet0/0
ip address 172.16.20.1 255.255.255.0

#           ⁄
interface Serial1/0
ip address 192.168.123.2 255.255.255.0
encapsulation frame-relay

#     RIP
router rip
version 2
network 172.16.0.0
network 192.168.123.0
no auto-summary
```

C



في 2 RIP

Router A RIP ѝ Keyaˇ ↲ ѝ Keya à Keyb RIP ' Router B RIP ѝ Keybˇ ↲ ѝ Keya à Keyb RIP Â

É

A '

```
#
key chain ripkey
key 1
key-string keya
accept-lifetime 00:00:00 Dec 3 2000 infinite
send-lifetime 00:00:00 Dec 4 2000 infinite
key 2
key-string keyb
accept-lifetime 00:00:00 Dec 3 2000 infinite
send-lifetime 00:00:00 Dec 4 2000 infinite

#    Л      ↰
interface FastEthernet0/0
ip address 192.168.12.1 255.255.255.0
ip rip authentication mode md5
ip rip authentication key-chain ripkey

#    RIP
router rip
version 2
network 192.168.12.0
```

B :

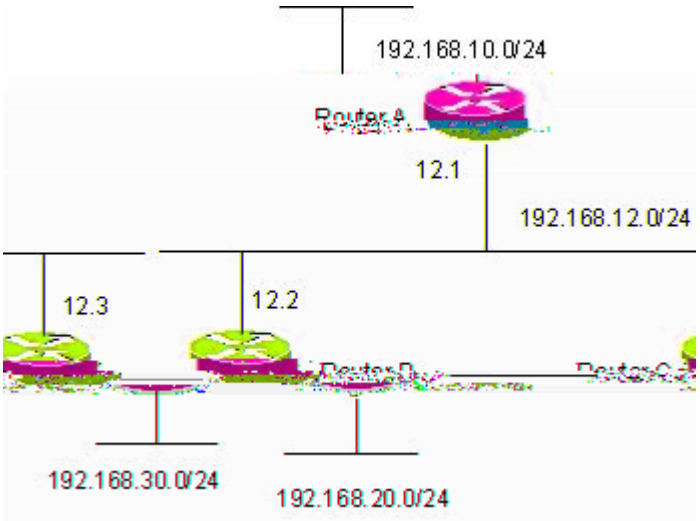
```
#
key chain ripkey
key 1
key-string keyb
accept-lifetime 00:00:00 Dec 3 2000 infinite
send-lifetime 00:00:00 Dec 4 2000 00:00:00 Dec 5 2000
```

```
key 2
key-string keya
accept-lifetime 00:00:00 Dec 3 2000 infinite
send-lifetime 00:00:00 Dec 4 2000 infinite

#     Л      Ы
interface FastEthernet0/0
ip address 192.168.12.2 255.255.255.0
ip rip authentication mode md5
ip rip authentication key-chain ripkey

#     RIP
router rip
version 2
network 192.168.12.0
```

RIP

Ь Ы Э˜ з RIP Â IP ‡

في في 3 Â



في 3 RIP

RIP ˘ ЛЬЮ '

1˜ Router A Ы Л Router C '

2˜ Router C a Router A Â

ε

ѝ Л Э ˘ A RIP Â

A '

```
#    Ո      ٨
interface FastEthernet0/0
ip address 192.168.12.1 255.255.255.0

#          ٨
interface Loopback0
ip address 192.168.10.1 255.255.255.0

#     RIP
router rip
version 2
network 192.168.12.0
network 192.168.10.0
passive-interface FastEthernet0/0
neighbor 192.168.12.2
```

B '

```
#    Ո      ٨
interface FastEthernet0/0
ip address 192.168.12.2 255.255.255.0

#          ٨
interface Loopback0
ip address 192.168.20.1 255.255.255.0

#     RIP
router rip
version 2
network 192.168.12.0
network 192.168.20.0
```

C '

```
#    Ո      ٨
interface FastEthernet0/0
ip address 192.168.12.3 255.255.255.0

#          ٨
interface Loopback0
ip address 192.168.30.1 255.255.255.0

#     RIP
router rip
version 2
network 192.168.12.0
network 192.168.30.0
```

IP

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ɻ Л Ъ ĺ Â

˘ ЛЪЮ ȝ'

ȝ	
Ruijie(config)# **ip route** [**vrf** *vrf_name*] *network mask* {*ip-address* | *interface-type interface-number* [*ip-address*] } [*distance*] [**tag** *tag*] [**permanent**] [**weight** *weight*]	
Ruijie(config)# **no ip route** *network mask*	
Ruijie(config)# **ip static route-limit** *number*	
Ruijie(config)# **no ip static route-limit**	

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'

	0
	1
OSPF	110
RIP	120
a ɻ	255

ɹ ʌ ˘ ɻ Л Ъ RIP à OSPF ╟ ˘ a

ˇ Â ЛЏ ┘ЛЏ ╟
ˇ ┘ ∧ и ∧ ˇ ÿ и
Â ┘ Ня ┘ ∧ ˇ
Network ҂ Ня ˇ ╟ a ˇ ˀ
҂ Â

У ∧ ľ down Ŀ ˇ ┘ ∧ ÿ
Â ∧ ˇ ∧ ң a ЮУ ˇ ≠
ÿ Â

VRF ╗ VRF ˇ ┘ ∧ˇ ∧
VRF VRF a ˇ a ╗ ╗ˇ VRF ‡ ╗
Â

и 1ˇ ┘ЛЏ **show ip route weight** ҂
Â weight WCMP ╗ ˇ ┘
ˇ ˀ ˇ weight

default-network ң ۷ ЛЮ ˚ . ۷. a
۷ ˘ ۷ Â
۸ ˚ Ю˘ RIP ≠ ۷Л˘ ˘ RIP ۷ У
╕ ˘ ˘ è 0.0.0.0/0
Â

˘ a ╟ ‑ ң ˘
show ip route ҳ ˘ ľ gateway of last resort Ŀ ۸
Â У ۷ й ˘ ۷
й ľ gateway of last resort Ŀ Â

ǂ

╖ ˘ ۷Л˘ ǂ ˘ ǂ .
a ۸ ۷ У Â ۷ У ǂ ˘ ۷ У ۷
У ˘ ‡ ۷ ╖ Â
ǂ ˘ ЛЮ ҳ˘ ҳ no й
ǂ

ҳ	
maximum-paths [*number*]	ǂ (1-32)

ǂ

ǂ

й ˘ ۸ ң ÿ У
ǂ ۷ У ╖ Â ۷Л˘ OSPF
ǂ ۸ RIP ˘ ≠ ۷Л˘ RIP ǂ ۸
OSPF Â ǂ ۷Л˘ IP Â

ǂ ˘ ڤي route maps˜ ˘ ч
ǂ ˚ Â

ЛЮ ǂ Ь ˘ Ьǂ й ǂ '

1. Ңѫ ǂ ڤي˘ У ڤي ۷Л˘ ˘ ۸
˘ ۷ ˘ ڤي ,

2. ⊮ في ך ‡ ˚ ’

3. ⊮ ך ‡ ⊿˘ ’

4. في Â في б “ ” ˘ a ⊿ ˘ è ⊿ **match** б **set** ʒ ⊿ a ⊿ Â

⊮ ⊺ في˘ ЛЬЮ ʒ'

ʒ	
Ruijie(config)# **route-map** *route-map-name* [**permit**	**deny**] *sequence*	⊮ في *sequence* ' 0-65535
Ruijie(config)# **no route-map** *route-map-name* {[**permit**	**deny**] *sequence*}	في

У في ‡ ˘ ⊿Л 1 **match** ʒ 1 **set** ʒ Â **match** ʒ˘ ‡ ך ’ **set** ʒ˘ ‡ a Â

⊮ ‡ ך ˚ ˘ في ЛЬЮ ʒ'

ʒ	
Ruijie(config-route-map)# **match interface** *interface-type interface-number*	ך Ю У ∧ *interface-type*' Aggregateport à Dialer à GigabitEthernet à Loopback à Multilink à Null à Tunnel à Virtual-ppp à Virtual-template à Vlan
Ruijie(config-route-map)# **match ip address** *Access-list-number* […*access-list-number*]	ך *Access-list-number* ’ *1-199 à 1300-2699*
Ruijie(config-route-map)# **match ip next-hop** *access-list-number* […*access-list-number*]	ך Ю У *access-list-number* ' 1-199
Ruijie(config-route-map)# **match ip route-source** *access-list-number* […*access-list-number*]	ך
Ruijie(config-route-map)# **match metric** *Metric*	ך *Metric* ' 0—4294967295
Ruijie(config-route-map)# **match route-type** {**local**	**internal**	**external** [**level-1**	**level-2**]}	ך local **I**

ϡ	
Ruijie(config-route-map)# **set level** {**stub-area** | **backbone** | **level-1** | **level-1-2** | **level-2**}	ш
Ruijie(config-route-map)# **set metric** *metric*	ϯ
Ruijie(config-route-map)# **set metric** [+ *metric-value* | **-** *metric-value* | *metric-value*]	ϯ
Ruijie(config-route-map)# **set metric-type** {**type-1** | **type-2 | external** | **internal**}	ϯ
Ruijie(config-route-map)# **set tag** *tag*	ϯ
Ruijie(config-route-map)# **set next-hop** *next-hop*	ϯ ЮУ *next-hop'* ЮУ IP

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ϡ	
Ruijie(config-router)# **redistribute** *protocol* [**metric** *metric*] [**route-map** *route-map-name*]	ϯ *protocol* ~ ' bgp à connected à isis à ospf à static

ϯ
n ^ [T

Ruijie(config-router)# **default-metric** *metric*

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Ruijie(config-router)# **distribute-list** {[*access-list-number* | *access-list-name*] **prefix** *prefix-list-name* [**gateway** *prefix-list-name*] | **gateway** *prefix-list-name*} **out** [*interface-type interface-number*]

prefix^ 2 Л

˘ ЛЬЮ ϧ'

ϧ	
Ruijie(config-router)# **distribute-list** {[*access-list-number* | *access-list-name*] | **prefix** *prefix-list-name* [**gateway** *prefix-list-name*] | **gateway** *prefix-list-name*} **in** [*interface-type interface-number*]	‡˘ ϯ Â **prefix'** , ⊀ ip prefix-list Â **gateway'** ϯ Â
Ruijie(config-router)# **no distribute-list** {[*access-list-number* | *name*] | **prefix** *prefix-list-name* [**gateway** *prefix-list-name*] | **gateway** *prefix-list-name* } **in** [*interface-type interface-number*]	⊀

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У ⊀ ˘ RIP б è ˘ ⊀ З ˘ ⊀
RIP ϯ 172.16.1.0/24 à 192.168.1.0/24 ч Â

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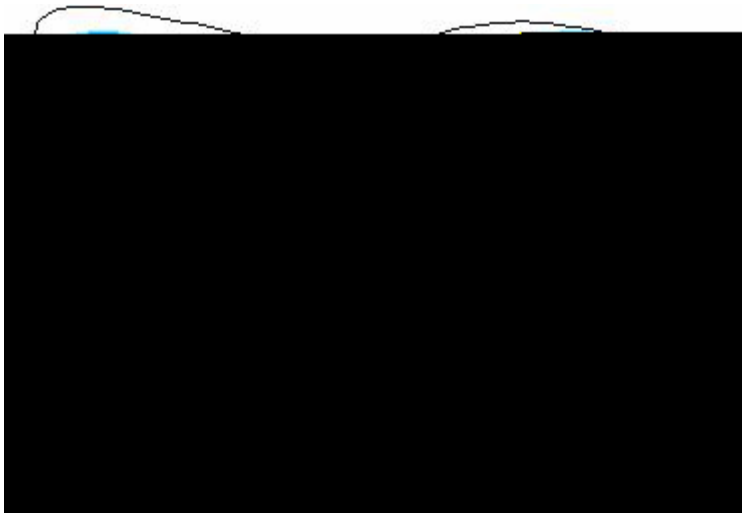
˘ RIP ╟ϯ Â RIP б ╟
˘ ὶ 172.16.1.0/24 ˘ RIP
˘ ″I ˘ з a 172.16.0.0/16
Â

```
Ruijie(config)# ip route 172.16.1.0 255.255.255.0 172.200.1.2
Ruijie(config)# ip route 192.168.1.0 255.255.255.0 172.200.1.2
Ruijie(config)# ip route 192.168.2.0 255.255.255.0 172.200.1.4
!
Ruijie(config)# router rip
Ruijie(config-router)# version 2
Ruijie(config-router)# redistribute static
Ruijie(config-router)# network 192.168.34.0
Ruijie(config-router)# distribute-list 10 out static
```

```
Ruijie(config-router)# no auto-summary
!
Ruijie(config)# access-list 10 permit 192.168.1.0
Ruijie(config)# access-list 10 permit 172.16.1.0
```

RIP&OSPF ‡

Ь ⊀ ˘ في 1 Â A OSPF ˘ C RIP ˘ B ч Â A 192.168.10.0/24 à 192.168.100.1/32 ч ˘ C 200.168.3.0/24 à 200.168.30.0/24 Â



في 1 RIP&OSPF ‡

OSPF ⊀ ‡ RIP ˘ й Type-1’ RIP ⊀ ‡ OSPF 192.168.10.0/24 У ˘ з й 3 Â

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A '

```
Ruijie(config)# interface gigabitEthernet 0/0
Ruijie(config-if)# ip address 192.168.10.1 255.255.255.0
Ruijie(config)# interface loopback 1
Ruijie(config-if)# ip address 192.168.100.1 255.255.255.0
Ruijie(config-if)# no ip directed-broadcast
```

```
!
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# ip address 192.168.12.55 255.255.255.0
!
Ruijie(config)# router ospf 1
Ruijie(config-router)# network 192.168.10.0 0.0.0.255 area 0
Ruijie(config-router)# network 192.168.12.0 0.0.0.255 area 0
Ruijie(config-router)# network 192.168.100.0 0.0.0.255 area 0
```

B '

```
Ruijie(config)# interface gigabitEthernet 0/0
Ruijie(config-if)# ip address 192.168.12.5 255.255.255.0
!
Ruijie(config)# interface Serial 1/0
Ruijie(config-if)# ip address 200.168.23.2 255.255.255.0
```

OSPF ˝ ˛

```
Ruijie(config)# router ospf
Ruijie(config-router)# redistribute
```

A OSPF :

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à ɻ ˘ ʎ
˘ ˘ ˘ ÿ
LAN Â

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ʒ	
Ruijie(config-if)# **storm-control** {**broadcast** | **multicast** | **unicast**} [{ **level** *percent* | **pps** *packets* | *rate-bps*]	**broadcast** ╗ **multicast** ɻ ╗ **level** *percent'* ɅƱ ɻ 20 ʎ ỳ 20% Â **pps** *packet'* ɅƱ ỳ Æ . packets per second' Â *Rate-bps'* ɅƱ bit ỳ Æ ˘ . Kbits per second, Â

ɻ ɅƱ ʎ Ю ʒ **no storm-control broadcast ,no storm-control multicast , no storm-control unicast** ʎ
╗ Â

Ю GigabitEthernet 0/1 Э ╗ ˘ ʒ
ỳ 4M Â

```
Ruijie# configure terminal
Ruijie(config)# interface GigabitEthernet 0/1
Ruijie(config-if)# storm-control multicast 4096
Ruijie(config-if)# end
```

~

ЮЎ S32 ╖ ˘ ɻ
╖ ˘ ѝ ʎ ŕ У Â
level ˘ ʎ
˘ a ʎ Â
╖ ˘ storm-control broadcasť
˘ ѝ ʎ ŕ У Â

ʎ '

ϟ	
Ruijie# **show storm-control** [*interface-id*]	Â

Ю ѝ ʎ Gi0/3 ╖ '

```
Ruijie# show storm-control gigabitEthernet 0/3
Interface   Broadcast Control   Multicast Control   Unicast
Control action
GigabitEthernet 0/3 Disabled  Disabled   Disabled    none
```

≠ ɻ Л∪ У ʎ ╖ '

```
Ruijie# show storm-control
Interface   Broadcast Control   Multicast Control   Unicast
Control Action
---------   ------------------   ------------------   -------
------- ------
GigabitEthernet 0/1   Disabled   Disabled   Disabled   none
GigabitEthernet 0/2   Disabled   Disabled   Disabled   none
GigabitEthernet 0/3   Disabled   Disabled   Disabled   none
GigabitEthernet 0/4   Disabled   Disabled   Disabled   none
GigabitEthernet 0/5   Disabled   Disabled   Disabled   none
GigabitEthernet 0/6   Disabled   Disabled   Disabled   none
GigabitEthernet 0/7   Disabled   Disabled   Disabled   none
GigabitEthernet 0/8   Disabled   Disabled   Disabled   none
```

```
GigabitEthernet 0/9   Disabled   Disabled   Disabled   none
GigabitEthernet 0/10  Disabled   Disabled   Disabled   none
GigabitEthernet 0/11  Disabled   Disabled   Disabled   none
GigabitEthernet 0/12  Disabled   Disabled   Disabled   none
GigabitEthernet 0/13  Disabled   Disabled   Disabled   none
GigabitEthernet 0/14  Disabled   Disabled   Disabled   none
GigabitEthernet 0/15  Disabled   Disabled   Disabled   none
GigabitEthernet 0/16  Disabled   Disabled   Disabled   none
GigabitEthernet 0/17  Disabled   Disabled   Disabled   none
GigabitEthernet 0/18  Disabled   Disabled   Disabled   none
GigabitEthernet 0/19  Disabled   Disabled   Disabled   none
GigabitEthernet 0/20  Disabled   Disabled   Disabled   none
GigabitEthernet 0/21  Disabled   Disabled   Disabled   none
GigabitEthernet 0/22  Disabled   Disabled   Disabled   none
GigabitEthernet 0/23  Disabled   Disabled   Disabled   none
GigabitEthernet 0/24  Disabled   Disabled   Disabled   none
```

Protected Port

ʒ	
Ruijie(config-if)# **switchport protected**	ʌ ỳ ʌ

ɻ Л∪ ʒ **no switchport protected** ʌ ʒ У ʌ ỳ ʌ Â

Ю Gigabitethernet 0/3 ỳ ʌ

```
Ruijie# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 0/3
Ruijie(config-if)# switchport protected
Ruijie(config-if)# end
```

Protected Port

ʒ	
Ruijie(config-if)# **show interfaces switchport**	ʌ

ɻ Л∪ ʒ **show interfaces switchport** ʌ 218.82f-0.000e(c 1 Tf-0.60ew4n ie(confi

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˘ Â ˘ ╟ ⌐ a IP

˘ У ㅓ Э˘ IP ˘ ‡ a Ạ

У ㅓㅓ У Access Port

802.1x ㅠ ㅓ ㅠ Â802.1x ㅠ ㅓ ㅠ ㅓ
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ㅓ IP+MAC IP б ACLs ˚ ˇ
У ㅓЭ ACLs ‡ ㅓЭ IP+MAC
IP Â

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IP ˇ ж a IP Â У
ㅓㅓ ч ˇ ‡ a IP (
IP . ″I) Â

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```
Ruijie(config-if)# switchport port-security
Ruijie(config-if)# switchport port-security maximum 8
Ruijie(config-if)# switchport port-security violation protect
Ruijie(config-if)# end
```

---

1. ʎ Э Ip Ip+Mac ˘ ʎ ⌐ Mac ˘ a ң Y ˙ Â
2. ʎ ʎ ң trap ⊣ log Â
3. γ ʎ ң 1 Â

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ʎ Э

ʎ Ю˘ Ю ʂ й ʎ ╗ '

ʂ	
Ruijie(config-if)# **switchport port-security mac-address** *mac-address* [**ip-address** *ip-address*]	ʎ Э Â **ip-address**(⊿)' й IP Â

ʎ Ю˘ ⊿ Л∪ ʂ **no switchport port-security mac-address** *mac-address* ʎ Â

Ю й ʎ gigabitethernet 0/3 У ' 00d0.f800.073c˘ й è У IP ' 192.168.12.202 Â

```
Ruijie# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 0/3
Ruijie(config-if)# switchport mode access
Ruijie(config-if)# switchport port-security
Ruijie(config-if)#  switchport  port-security  mac-address
```

```
00d0.f800.073c  ip-address 192.168.12.202
Ruijie(config-if)# end
```

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Â
ﻧ ﻮ ﻮ ﻍ '

ﻍ	
Ruijie(config-if)#**switchport port-security aging**{**static** | **time** *time* }	**static**' ﻗ Ə ˘ ﻝ ‡ ﻧ ﻗ ⌐ Â **Time** ' ﻧ Ə ˘ 0 1440 ˘ Æ ﻑ Â ﻯ 0 ˘ ‡ ﻣ Ə Â ˘ ≠ ﻭ ﻯ ﻭ ﻧ ﻝ ˘

ﺭ	
Ruijie#**show port-security interface** [*interface-id*]	ﻧ ﻧ Â
Ruijie#**show port-security address**	Â
Ruijie# **show port-security address** [*interface-id*]	ﻧ Э
Ruijie# **show port-security**	ﻧ ˘ ˘ Л ﻧ Â

Ю ﻧ Gigabitethernet 0/3 Э ﻧ '

```
Ruijie# show port-security interface gigabitethernet 0/3
Interface : Gi0/3
Port Security: Enabled
Port status : down
Violation mode:Shutdown
Maximum MAC Addresses:8
Total MAC Addresses:0
Configured MAC Addresses:0
Aging time : 8 mins
SecureStatic address aging : Enabled
```

Ю

```
Ruijie# show port-security address
Vlan Mac Address IP Address Type Port Remaining Age(mins)
-----------------------------------------------------------------
1  00d0.f800.073c   192.168.12.202    Configured   Gi0/3    8
1  00d0.f800.3cc9   192.168.12.5     Configured   Gi0/1    7
```

≠ ﻝ Л ﻧ У ﻧ Э ˘ Ю ﻧ gigabitstethernet 0/3 Э

```
Ruijie# show port-security address interface gigabitethernet 0/3
Vlan Mac Address IP Address Type Port Remaining Age(mins)
---- --------------- ---------- ------ ------------------
1    00d0.f800.073c  192.168.12.202 Configured Gi0/3    8
```

Ю ﻧ

```
Ruijie# show port-security
Secure Port MaxSecureAddr(count) CurrentAddr(count) Security
Action
----------  ------------------  -----------------  -------
Gi0/1       128                 1                Restrict
Gi0/2       128                 0                Restrict
```

Gi0/3 8 1 Protect

ARP-CHECK

ARP ˆ ARP-CHECK˜ ʎ Э MAC+IP ╖ ˘
DHCP Snooping˘ ʎ Â
ARP ARP˘ ˈI IP Ь
˜ ˘ Â

ARP-CHECK Ь ' ˘ ╟ ˘ й ╟ Â

Ю˘ ʎ Э ARP Â ʎ Э
˘ ‡ ʎ arp Â

Ю˘ a ʎ Э ARP Â

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Ю˘ ARP Â

ARP '

1. ʎ ARP ʎ IP
У Â

2. ʎ ARP a Â
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ARP ˘ è ˚ Â
˚ a ˘ ɻ ǂ ARP a Â

3. MAC+IP ˘ ARP Check Cpu˘ CPU
, æ CPU Â

ARP-CHECK

ÿ Ю ARP-CHECK

ʕ	
Ruijie# **configure t**	
Ruijie(config)#**interface** *interface-id*	ʎ
Ruijie(config-if)# **arp-check**	arp

Ruijie(config-if)# **no arp-check**	arp
Ruijie(config-if)# **arp-check auto**	

802.1X

AAA Â 802.1x

802.1x

802.1x

802.1x k Access Control Tf0 Tc 3.413 0 Td<00 T962297j/C2_842 51C21>8Dj0BFE/TT

CLI

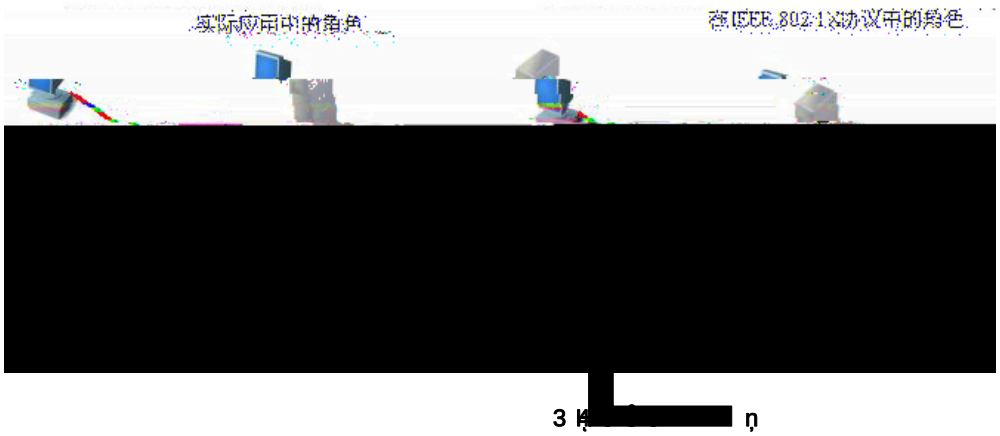
Authentication

Authorization

Accounting

802.1x

IEEE802.1x Client (network access server NAS) Radius-Server



ч ٧' ٧ ٧^ controlled Port˜ ٧
٧^ uncontrolled Port˜ Â ٧ ٧ ٧
' ٧ ٧ ٧ Л Л Â
٧ ٧ Э˘ ٧ Л Л ' ٧ ٧ ў
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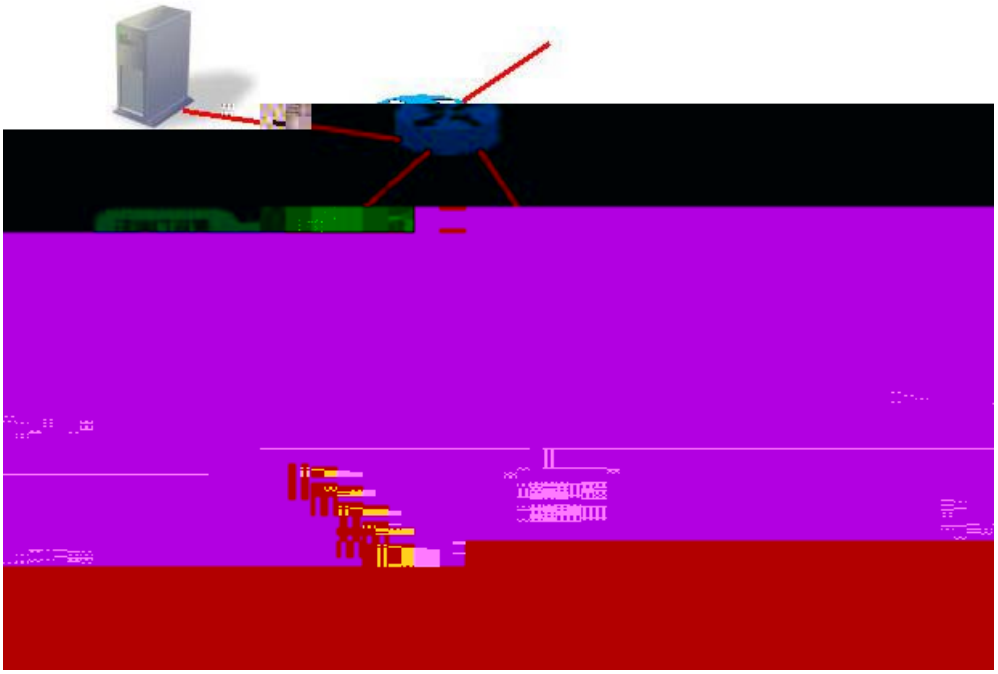
Ь

Ь й RADIUS Ь ˘ б ˘ й
Ь Â Ь ٧ ٧ ˘ Л Л ٧ ˘ У ٧ Ь ٧ Л Л
٧ Ь˘ ٧ Л Л Â Ь
ў Â Ω ٧ 802.1x
Radius Server˘ MicroSoft win2000 Server Radius Server
٧ Linux Ю Free Radius Server Â

٧

EAPOL ˘ Ь
RADIUS ˘ ÂE



في 4

1. 802.1x 802.1x windowXp Star-supplicant è IEEE802.1x Â
2. IEEE 802.1x (EAPOL)
3. 802.1x
4. RADIUS ù

1. б Radius Server Э б Ъ Л Э
2. б ù Л Л Â

1. Ю a Â
2. Radius Server Э Э
3. Л Л EAPOL
4. a

802.1X

ЛЬЮ 802.1x

802.1x

802.1x Y

б RADIUS SERVER

802.1X

/ У Л

/ Л supplicant ╖

┘ QUIET

Server-timeout

ў ╟ 802.1x

802.1x

IP

Л Ю ┘ ў

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б IP

Л

Л VLAN ╟ ┤

Ъ Ь Л

EAPOL TAG

802.1x

Ю 802.1x У

Authentication	DISABLE
Accounting	DISABLE
Ь (Radius Server) * Ь IP (ServerIp) * UDP ٨ * (Key)	* *1812 *
Ь (Accounting Server) * Ь IP * UDP ٨	* *1813
٨	٦ ٨^ ٨ ٦ ~
re-authentication	
reauth_period	3600
Л ЎĄ	10
	3
	3
	3 ˘ ѝ
Ь	5 ˘ Ь ˘ ѝ
٨ Ю ٦ ў	

802.1X Y

٦ 802.1x ң ˘ ЛЬЮ Â

802.1x ٦ Л Ь ү Ю ٨ ٦ Л Ь Ь Ю Â

Ў Ь IP ˘ radius server ٦ Л Ь Â

٨ ٨ a 1X Â

Aggregate Port a 1X Â

٦ У ٨ 1x ╖ ˘ ٨ 1x cpu Â

802.1X

б Radius Server ㄟ ㄣ ㄟ

802.1X

802.1x ˘ ў ╟ ㄣ ㄟ Э ў ˘
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ЮЎ Ю 1x '

҂	
configure terminal	
aaa new-model	AAA
radius-server host *ip-address* [**auth-port** *port*] [**acct-port** *port*]	RADIUS Ł
Radius-server key string	RADIUS Key
aaa authentication dot1x *auth* **group radius**	dot1x
dot1x authentication *auth*	dot1x
end	
write	
show running-config	

~

ㄡ AAA Ł ЮЎ ≠. ҂ **aaa domain enable** ˘
dot1x authentication ҂ a ˘
Â ε ľ ㄡ AAA Ł Ł Â

ЛЪЮ 802.1x '

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
Ruijie(config)# radius-server host 192.168.217.64
Ruijie(config)# radius-server key starnet
Ruijie(config)# aaa authentication dot1x authen group radius
Ruijie(config)# dot1x authentication authen
Ruijie(config)# end
Ruijie# show running-config
!
aaa new-model
!
aaa authentication dot1x authen group radius
```

```
!
username ruijie password 0 starnet
!
radius-server host 192.168.217.64
radius-server key 7 072d172e071c2211
!
!
!
dot1x authentication authen
!
interface VLAN 1
ip address 192.168.217.222 255.255.255.0
no shutdown
!
!
line con 0
line vty 0 4
!
end
```

802.1x RADIUS ˇ ″l Radius Server IP ˇ

6 Radius Server

ҳ **no dot1x port-control** ҳ ٧ ╖ Â ЛЬЮ
Л Ь ٧ 1/1 й ↓ ٧'

```
Ruijie# configure terminal
Ruijie(config)# interface f 1/1
Ruijie(config-if)# dot1x port-control auto
Ruijie(config)# end
```

٧ й ↓ ٧ ˘ ↓ EAP ˘ CPU ≠ ↓
Â

~

cpu a ↓ ٧ EAP ˘ ↓ Л Ь й
vlan˘ б vlan¦ Â

802.1x ў ╟ ˘ ↓ Л Ь a è
˘ ↓ Л Ь ˘ Â ↓ Л Ь
˘ ↓ Л Ь Ю Â 3600 Â
Ю˘ é ˘
У ٧ ↓ Â

Ю˘ Ю / ˘ з Â

ҳ	
configure terminal	
dot1x re-authentication	╖
dot1x timeout re-authperiod *seconds*	
End	
Write	
show dot1x	dot1x

no dot1x re-authentication ҳ ╖ ˘ **no dot1x timeout re-authperiod** ҳ й Â

ЛЬЮ ╖ ˘ й 1000 '

```
Ruijie# configure terminal
```

```
Ruijie(config)# dot1x re-authentication
Ruijie(config)# dot1x timeout re-authperiod 1000
Ruijie(config)# end
Ruijie# show dot1x
802.1X Status:       Disabled
Authentication Mode:  EAP-MD5
Authed User Number:   0
Re-authen Enabled:    Enabled
Re-authen Period:     1000 sec
Quiet Timer Period:   10 sec
Tx Timer Period:      3 sec
Supplicant Timeout:   3 sec
Server Timeout:       5 sec
Re-authen Max:        3 times
Maximum Request:      3 times
Filter Non-RG Supp:   Disabled
Client Oline Probe:   Disabled
Eapol Tag Enable:     Disabled
Authorization Mode:   Disabled
```

˘ Â é Â

/ Л supplicant ╖

Л supplicant н╕ ╣и 802.1x ˘ ╛ ≠ è У 802.1x (WindowsXP 802.1x ╖) ‡ ╛ Â

╛Л╚ ╖ ˘ Л supplicant 802.1x ˘ supplicant a ╛ è 802.1x Â Ю ╖ Â

Ю Ю à ╖ '

╕	
configure terminal	
dot1x private-supplicant-only	╖

```
Ruijie(config)# dot1x private-supplicant-only
Ruijie(config)# end
Ruijie# show dot1x
802.1X Status:       enable
Authentication Mode:  eap-md5
Total User Number:   0(exclude dynamic user)
Authed User Number:  0(exclude dynamic user)
Dynamic User Number:  0
Re-authen Enabled:   enable
Re-authen Period:    2 sec
Quiet Timer Period:  10 sec
Tx Timer Period:     3 sec
Supplicant Timeout:  3 sec
Server Timeout:      5 sec
Re-authen Max:       3 times
Maximum Request:     3 times
Private supplicant only:  enable
Client Online Probe:  disable
Eapol Tag Enable:    disable
Authorization Mode:  disable
```

no dot1x private-supplicant-only ʕ ℸ Â

↓ QUIET

˘ У ˥˘ Ѝ Â Quiet Period

Ѝ Â ↓ Â

Quiet Period и 10 ˘

↓ Л Quiet Period ↓ Л Ѝ Â

Ю˘ Ю Quiet Period

ʕ	
configure terminal	7

no dot1x max-req ٪ ù Â ЛЪЮ
ù 5 '

```
Ruijie# configure terminal
Ruijie(config)# dot1x max-req 5
Ruijie(config)# end
```

Л˘ ЎД б Â
Л˘ ù ˘ Â
3 ˘ ↓Л Â

Ю˘ Ю '

٪	
configure terminal	
dot1x reauth-max *count*	
end	
write	
show dot1x	dot1x

no dot1x reauth-max ٪ ù Â ЛЪЮ
ù 3 '

```
Ruijie# configure terminal
Ruijie(config)# dot1x reauth-max 3
Ruijie(config)# end
Ruijie#
```

Server-timeout

Radius Server ˘ ˘
Radius Server ˘ ù Â

Ю˘ Ю Server-timeout â ù

٪	
configure terminal	
dot1x timeout server-timeout *seconds*	Ь ˘ ٪ no è ù
end	

write	
show dot1x	dot1x

dot1x auto-req	ў ╟ ╥ Â ╥ Ю
end	
write	
show dot1x	dot1x

ʒ **no** ┘Л ╥ ˘ ┘ ╥ Ю˘ Л ˘ ў ╟ ˘ ┘Л ў ╟ ˘ ┘ Â ˘ ЛЮ '

```
group acct-use
Ruijie(config)# dot1x accounting acct-list
Ruijie(config)# end
Ruijie# write memory
Ruijie# show running-config
```

~

1) б Radius Server б ⁄

2) AAA Ю

3) 802.1X ⁄

4) 802.1x ╖ Ю

5) Radius Server

6) ⁄ AAA ╞ Ю˘ ≠. ϧ **aaa domain enable** ˘ **dot1x accounting** ϧ a ˘
Â ε ľ ⁄ AAA ╞ Ŀ Â

⁄ ╖ ˘ NAS Э ⁄˘ NAS
. ⁄ Radius Server ˘ Radius Server Э ⁄ Л
Ю˘ Ō ش ł Z ◊

ЛЪЮ й н ╖ '

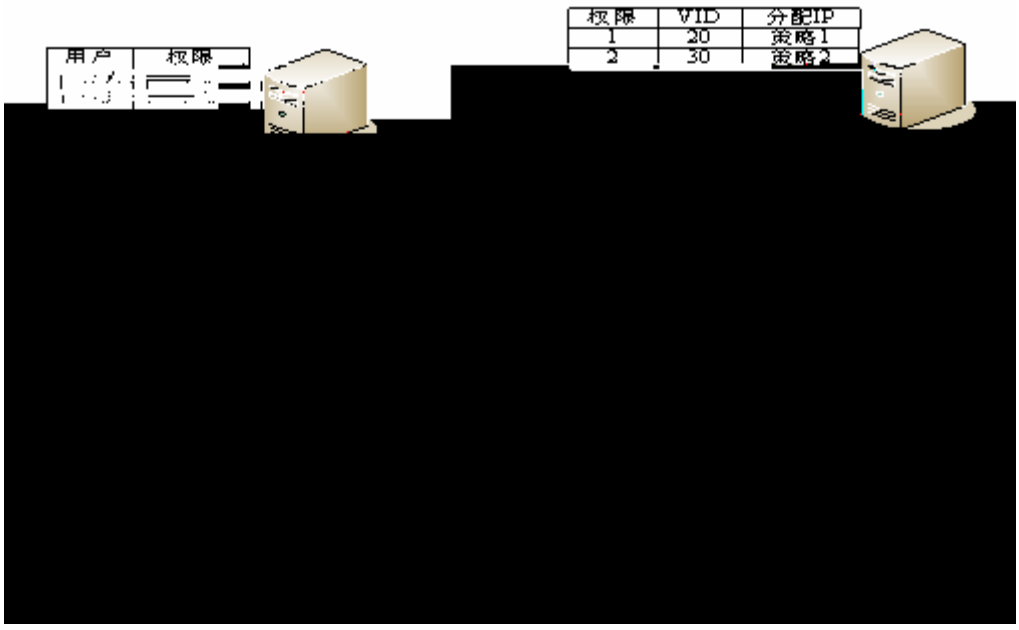
й ┤ è ˘ 802.1x ╖
Э ^ Э˘ б IEEE 802.1x a
˜ Â

IP

802.1x˘ ┘Л Ъ IP Â
IP IP Â IP '
DISABLE à DHCP SERVER à RADIUS SERVER à
SUPPLICANT Â Ю ¦ Ў '

DISABLE ^ ˜ ' Ю˘ a IP ˘ ┤
┘Л Ъ Â

DHCP SERVER ' IP DHCP SERVER ˘ ┤
DHCP SERVER ¦ IP IP˘ DHCP ┘Л Ъ DHCP
relay option82 802.1X й IP¦ Â ђ في Ю'



في 5

DHCP Client IP ˘ é dhcp relay option82
SAM Ь Э ˘ option82 DHCP ˘
option82 ľ vid + Ь Â DHCP Server option82 a ┘
¦ Â

Ю DHCP Relay ┤ option82 ˘ DHCP relay
╖ ˘ option82 ˘ DHCP Relay ҂ Â

RADIUS SERVER ' IP RADIUS SERVER Â ٧
RADIUS SERVER IP Â

SUPPLICANT ' IP ѝ SUPPLICANT PC IP Â
Л˘ ٧ IP ˘ a ٦ IP Â

Ю '

DISABLE ' a IP Â ٧ ٦Л
Â

DHCP SERVER ' PC DHCP IP ˘
DHCP RELAY DHCP SERVER˘ ˘ ٧
DHCP SERVER ↑ IP Â

RADIUS SERVER ' PC IP˘ RADIUS SERVER
< —IP> ˘ RADIUS Framed-IP-Address
˘ ٧ IP Â

SUPPLICANT ' PC IP˘ SUPPLICANT
˘ ٧ IP Â

~

↱ Ю ˘ Лυ
Â

Ю˘ Ю IP '

٣	
configure terminal	
aaa new-model	AAA ╗
aaa authorization ip-auth-mode {disabled | dhcp-server | radius-server | supplicant }	IP
end	
write	
show running-config	

ЛυЮ IP ѝ

```
r
Ruijie(config)# end
Ruijie# show running-config
!
aaa new-model
!
aaa authorization ip-auth-mode radius-server
!
Ruijie# write memory
```

802.1x Radius Server Reply-Message
802.1x
Star-Supplicant Э У Â

У a
Â

HTML http://XXX.XXX.XX
Â

1) Radius Server Reply Message
2) r-supplicant a a
3)

ЮЙ ў

й 802.1x a IEEE 802.1x Э
ЙЛ Ў У ЮЙ ў й
‡ ’ ў a й ћЙ ў
Â ў MAC Â

У ЮЙ ў à У ЮЙ ў

ќ	
configure terminal	
dot1x auth-address-table address *mac-addr* **interface** *interface*	ў
end	
write	

show running-config	

~

ў й ˇ ∧ ў Â

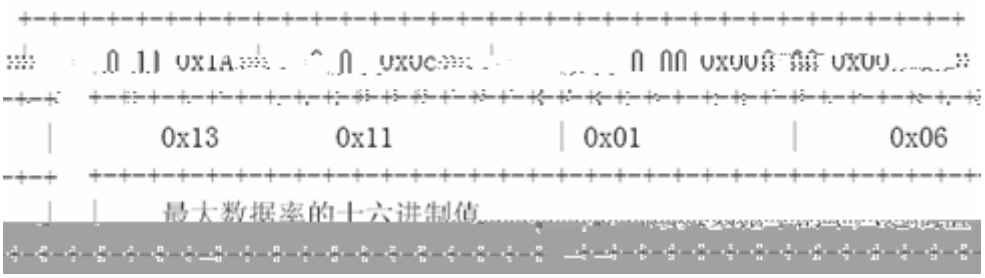
й ˇ ∧ ң ⅃Л∪ a ⅃ a ⅃ Ь˘ '
a ⅃ Â Radius Server Э˘ a
⅃ Â

Radius Â ∧ Ⱨ
Â

Ⱨ Ю'

ف 6

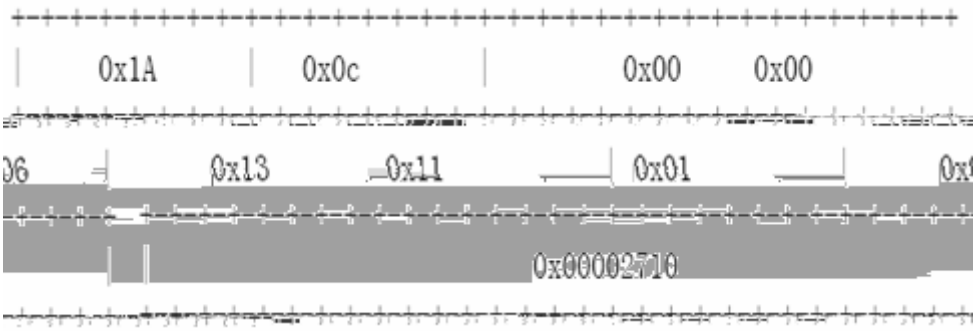
Ю'



ف 7

Æ' kbps

й 10M Ю'



8 في

ЬЖ Л Э ˘ ѝ

```
Authentication Mode:  CHAP
Authed User Number:   0
Re-authen Enabled:    Disabled
Re-authen Period:     3600 sec
Quiet Timer Period:   10 sec
Tx Timer Period:      3 sec
Supplicant Timeout:   3 sec
Server Timeout:       5 sec
Re-authen Max:        3 times
Maximum Request:      3 times
Filter Non-RG Supp:   Disabled
Client Oline Probe:   Disabled
Eapol Tag Enable:     Disabled
Authorization Mode:   Group Server
```

Ł

Л 802.1x ˇ ЛЛυ Ł Â ў Ł

Лˇ ╟ Л Ł ЮУ Ł Â

ЮˇЮ Ł Â

ʒ	
configure terminal	
aaa new-model	aaa
aaa group server radius *gs-name*	Ł
server sever	Ł
server server-backup	Ł
end	
write	
show dot1x	

ЛυЮ 192.168.4.12 й Ł '

```
Ruijie# configure terminal
Ruijie# aaa new-model
Ruijie(config)# aaa group server radius auth-ll
Ruijie(config-gs-radius)# server 192.168.4.1
Ruijie(config-gs-radius)# server 192.168.4.12
Ruijie(config-gs-radius)# end
Ruijie#
```

SNMP

SNMP

б IP

Radius Server

б IP

Radius Server

VLAN

VLAN RADIUS

RADIUs vlan

VLAN

show dot1x summary

VLAN **show dot1x user id** RADIUS

RADIUS

VLAN

RADIUS RADIUS

VLAN

RADIUS

26 RADIUS ID 0x00001311

radius attribute 4 vendor-type *type*

vlan

RADIUS

Ң ⅃ RADIUS

AAA é ï AAA Ļ Â

2˝ RADIUS Ļ

¾	
configure terminal	
radius-server host *host-ip*	RADIUS Ļ IP
radius-server key *text*	6 RADIUS Ļ

AAA é ï AAA Ļ Â

3˝

¾	
configure terminal	
aaa authentication dot1x *list1* **group radius**	AAA dot1x list1
aaa accounting network *list2* **start-stop group radius**	AAA list2

AAA é ï AAA Ļ Â

4˝ 802.1X AAA Ļ

¾	
configure terminal	
dot1x authentication *list1*	˝I dot1x list1

interface *interface_id*	∧
dot1x dynamic-vlan enable	VLAN ╟ ╖

~

VLAN ╟ ╖ ˘
RADIUS Ю VLAN

7 ╟ VLAN ╟

⅃ Л Ъ Ю ҁ ╟ VLAN ╟

ҁ	
show dot1x user id *session_id*	˘ ∕∧ ѝ *session_id* ╟ VLAN ╟ Â
show dot1x summary	∧ VLAN

Y ľ 802.1X è Y Ŀ Â

ҁ Ŀ ∕∧

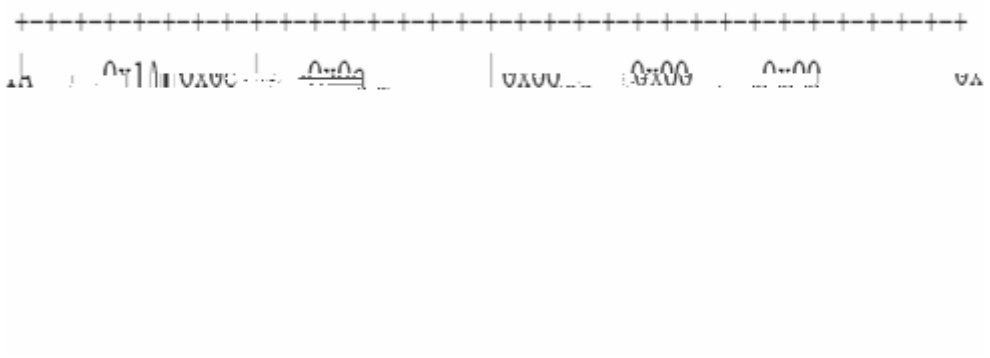
ҁ Ŀ Л Ъ ⅃ Л Ѧ ∕∧ Э ˘
ч Â ҁ Ŀ ∕∧ ╖ Â

╖ a ˘ ⅃ RADIUS Ŀ Â
Radius ˘ ⅃ Ⱨ
Â Ⱨ У Â

ҁ Ŀ ╖ Ⱨ Vendor Type ѝ 0x20 ∕∧ ╖ Ⱨ Vendor Type ѝ 0x21 Â

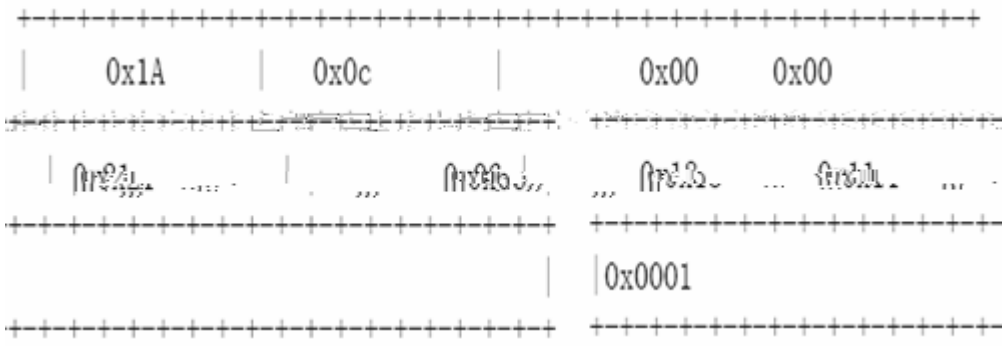
Attribute-Specific ѝ Ⱨ ˘ Ⱨ ҁ Ŀ
Э ∕∧ Э ѝ ⅃ ╟ . 0x0000 ˘ a ,
0x0001 Â

ҁ Ŀ Э ˘ Ю '



في 9

Л Э ˘ Ю '



في 10

ѝ ˘ У

Â ˘

RADIUS Ь б˘ ´

RADIUS Ь Â ѝ ´ Э

ير

Interval Â

ЮЎ ┘Л└ ЛЬЮ ╖ :

╕	
configure terminal	
dot1x client-probe enable	╖
dot1x probe-timer interval *interval*	Hello Interval
dot1x probe-timer alive interval	Alive Interval
end	
write	
show dot1x	

EAPOL TAG

IEEE 802.1x EAPOL a ╕ VLAN TAGЎ ┘ ˘
˘ ˘ Trunk Port
‡ TAG Â

ђ 802.1x ˘ ľ ђ
Ł Â

ЮЎ ┘Л└ ЛЬЮ EAPOL TAG Â

╕	
configure terminal	
dot1x eapol-tag	EAPOL TAG ╖ Â ╖
end	
write	
show dot1x	

┘Л└ **no dot1x eapol-tag** ╕ ╖ Â

╣

802.1x Ю MAC ˘ ╣
˘ è ┘У ╣ ˘ ╣
┤ У ╣ У ˘ ╣ ┘

٧

ٮ ЛЪ ٧ ٧ ٮ Â ٧
MAC ˘ ٧ ٮ ˘ ٧
˘ , ٧ ˘
٧ Л ╟ ˘ ٧ ╟ Л˘
٧ a ╟ Â
٧ ˘ ÿ ˘ ЛЪЮ Â

٦	
configure terminal	
interface <*interface-id*>	٧
dot1x port-control auto	ٮ ╖
dot1x default-user-limit <*1-4000*>	٧
End	
Write	
show dot1x port-control	٧ 802.1X

ڸ

1X

Radius ؎

show radius server ڀ Radius Server ˇ **show aaa user**

```
Ruijie# sh radius server
Server IP:       192.168.5.11
Accounting Port:  1813
Authen  Port:    1812
Server State:    Ready
```

Ѝ ؍ 802.1X ڸ Л ч ˇ У ˇ ү
Â ˆ ₸ ~ ’
ˇ Â

Ю ؎ ˇ 1x ˇ
show dot1x Â

ЛЮ 802.1x '

```
Ruijie# show dot1x
802.1X Status:       Disabled
Authentication Mode:  EAP-MD5
Authed User Number:   0
Re-authen Enabled:    Disabled
Re-authen Period:     3600 sec
Quiet Timer Period:   10 sec
Tx Timer Period:      3 sec
Supplicant Timeout:   3 sec
Server Timeout:       5 sec
Re-authen Max:        3 times
Maximum Request:      3 times
Filter Non-RG Supp:   Disabled
Client Oline Probe:   Disabled
Eapol Tag Enable:     Disabled
Authorization Mode:   Disabled
```

┘

Ὼ ᾀ 802.1x˘ ╖ ˘ ┘Л┐ ᾀ Э ┘ ў
┘Л┐ Â ┘ ў ╖ ˘ ┘Л┐ Â

ЮЎ Ю ┘ ў

⅋	
configure terminal	
dot1x auth-address-table address *mac-addr* **interface** *interface*	┘ ў
end	
write	
show dot1x auth-address-table	┘ ў

no dot1x auth-address-table address ⅋ ┘ ў Â
ЛЬЮ ┘ ў '

```
Ruijie# show dot1x auth-address-table
interface:g3/1
-----------------------------------
mac addr: 00D0.F800.0001
```

┘Л┐ ˘ Â

ЮЎ Ю

⅋	
show dot1x summary	

ЛЬЮ '

```
Ruijie# show dot1x summary
ID   MAC         Interface  VLAN  Auth-State  Backend-State
Port-Status
---- ----------- --------- ----  ----------  ------------
-----------
1    00d0f8000001  Gi3/1        1    Authenticated   IDLE
Authed
```

1x

Ю˘ Ю 1x

ʒ	
show dot1x probe-timer	1x

ЛЮ 1x :

```
Ruijie# show dot1x probe-timer
Hello Interval: 20 Seconds
Hello Alive: 250 Seconds
Ruijie#
```

802.1x è Y

1. IP ˘ ⁄ 10000 Â

2. 1X ACL ⁄

IP Ю˘ У ∧ 802.1x ╗ ˘ ∧ У ACL У ∧ Â ‡ ACL MAC Э Â ≠ ˘ ∧ MAC й MAC ACL ˘ è MAC ˘ ACL ∧ MAC Э Â

˘ MAC й 00d0.f800.0001˘ ‡ MAC й 00d0.f800.0001 ⁄Л Â ∧ ¨Ą ACL˘ ‡ ACL Э У Â MAC й ICMP Â

IP Ю˘ a ⁄ ∧ Э ACL˘ й ACL ¨I ˘ IP+MAC a Â ∧ ч '

1' mac: 00d0.f800.0001 ip: 192.168.65.100

2' mac: 00d0.f800.0002 ip: 192.168.65.101

⁄ ∧ Э У ACL˘ Ю'

ip access-list extended ip_acl:

deny icmp any any

й ˘ з ⁄ ICMP Â ACL ¨I IP + MAC ˘ ACL ⁄ У ACE **deny any any˘** Л Ъ ≠ Â

IP_acl ⁄ ╗ У **permit any any˘** ‡ IP ⁄ Ў ⁄Л ˘ a IP + MAC У У Â Л Ъ a IP ¯ ACL

AAA

ㅓ Л Ъ ㅏ Л Ъ ㅓ Э ㅓ Л Ъ
ㅏ Â à ^ AAA˜ У ў Â

AAA

AAA Authentication Authorization and Accounting à ˜ ˘
à ╖ У ˘ ң
AAA Â

AAA Л Ъ Л ЪЮ ㅏ'

' ㅓ ˘ ㅓ RADIUS àTACACS+
Local ˜ Â ㅏ è
У Â

' ㅓ ㅏ Â AAA Ж У
˘ Â ㅓ Л Ъ
Э˘ ≠ ㅓ Л Ъ ㅏ Э Â

' Â AAA ˘
Л Ъ ㅓ ㅏ Â
Л Ъ ˘ ㅏ Э˘ ㅓ Л Ъ ж ˚
ㅓ ˘ ÿ à à Â

ў ң AAA ╖ Â ㅓ ң ˘ ㅓ Л Ъ ㅓ
Ὼ ∧ Â

AAA ў ˘ ∧ ң ㅓ ≠ AAA
˘ ㅓ à Â a ㅓ
a У ˘ AAA Â

AAA Л ЪЮ ˙ '

ㅓ

ㅓ 'I

AAA

AAA ˩ Л Ъ ˆ ˜ Ь ╟ à Л Ъ ˥
Â … Ѭ à à ˇ ˩
Ь ˥ Â

à ˩ Л Ъ a ˩ ˇ
Ѭ У a ˩ à ˩ Â ˩ Л Ъ
Ѭ У ˇ ˩ Л Ъ У ˇ ˩ Â
˥ ң У ˇ ˇ ‡ ң ˇ
Â ╖ ˇ ‡

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ˇ ˇ ‡ ˇ a ̈Ạ

ف 1 AAA ف

в ف У ң AAA ˇ ԁ ˩ Ь ' R1 R2
RADIUS Ь Â

Ѭ У ˇ ˇ ˇ R1 ″I ˩
ˇ ˩ R2 ˩ Ь в ˩ Â У PC
ف ˥ ˇ Ь ″I ˩ R1 ˇ
R1 R1 ACCEPT ˇ
. Â R1 REJECT ˇ ‡ ˇ

Â R1 ˘ Ь TIMEOUT˘ ┘ R2
Â У Ю Ю ˘
ѣ Â TIMEOUT˘ ‡ ˘
Â

~

REJECT a ┘ TIMEOUT Â REJECT a ┘
˘ ÿ ˘ Â TIMEOUT ‡
Ь ˘ У TIMEOUT ˘ AAA
Ю У Â

AAA

˝І ᾱ ᾱ ˘ з
˘ Â ˘ ┘ Ю˘
AAA Â

AAA

AAA ˘ AAA Â Э
AAA Ю˙

1) AAA˘ ϟ **aaa new-model** Â
2) ᾱ Ь ˘ ˘ RADIUS Â
3) Ю ˘ **aaa authentication** ϟ Â
4) ˘ ┘ ∧ Â

~

˘ ┘ ˘ ‡
Â
˘ a ˘ ‡ Â

ʒ ˘ ʒ Â

AAA

AAA ˘ ”I AAA Â

AAA˘ Ю ЛьЮ ʒ'

ʒ	

aaa new-model

ЊЖ AAA

AAA ˘ ″I ЊЖ У ⅄ ˘ ⅄
ЊЖ Â ЊЖ Â
ЊЖ ˘ Â У
Â Â

ЊЖ à У Â
У ˘ У
Ю˝ ⅃ Л Â ⅄ ң У
˘ ˘ Ю У Â У
Ю ˘ б ℸ Â
ℸ ˘ ‡ Â

~

⅃ У Ю˝ ⅄ ң Ю У Â
˘ ˘ ‡ ˘ a ″Ą è
Â

ὴ AAA ـفي ˘ 2 Ь ' R1 R2 RADIUS Ь Â
У ā ˘ NAS У
Telnet ' ″I R1 ˘ ˘ ‡
R2 ’ R1 à R2 ˘ ‡ Ь
˘ Л Э ˘ ЛЮ ʒ'

ʒ	
configure terminal	
aaa authentication login default group radius local	У ˘ è ľ default Ь ⅄ Â ˘ ⅄ ⅄ Â й Â

У Login ˘ … У
⅄ ˘ ⅄ Â Ю
2'

ʒ	

configure terminal	
aaa new-model	AAA
aaa authentication login *test* **group radius local**	Ю˘ Ня У ﻝ ﻭ ľ test Ł Â
line vty *2*	2
login authentication *test*	line Ю˘ ﻝ ﻭ ľ test Ł Â

PC في Telnet (NAS)˘ NAS ˝I ﻝ R1
˘ R1 ˘ R1 ﻝ NAS У ACCEPT ˘
. Â R1 REJECT Ă ˘

AAA

AAA ˇ طي بج گّ

line vty *line-num*	AAA Â
login authentication {**default** | *list-name*}	Â

list-name … *method* Â ERROR FAIL( ) a Â **none** RADIUS (TIMEOUT)

aaa authentication login default group radius none

---

none

none **none**

---

local	
none	a
group radius	RADIUS
group tacacs+	TACACS+

AAA Login Â

Login

Login

configure terminal	
username *name* [**password** *password*]	

end	
show running-config	

Login

configure terminal	
aaa new-model	AAA
aaa authentication login {**default** | *list-name*} **local**	
end	
show aaa method-list	
configure terminal	
line vty *line-num*	
login authentication {**default** | *list-name*}	
end	
show running-config	

RADIUS Login

RADIUS Login RADIUS RADIUS

configure terminal	
aaa new-model	AAA
radius-server host *ip-address* [**auth-port** *port*] [**acct-port** *port*]	RADIUS
end	
show radius server	RADIUS

RADIUS RADIUS RADIUS RADIUS RADIUS

RADIUS

configure terminal	
aaa new-model	AAA
aaa authentication login {**default** | *list-name*} **group radius**	RADIUS
end	
show aaa method-list	
configure terminal	
line vty *line-num*	
login authentication {**default** | *list-name*}	
end	
show running-config	

AAA Enable

AAA Enable

Telnet (NAS)

CLI 0~15 a

show privilege

enable Enable

AAA Enable

configure terminal	
aaa new-model	AAA
aaa authentication enable default *method1* [*method2*...]	Enable RADIUS

Enable *method* ERROR FAIL( ) a

Enable **none** **enable**

˘ ⁋ ˘ ‡ Â ⁋
˘ ‡ ⁋ ˘ a Â

~

CLI Login ˆ **none** ~~
˩ Â ˘ Enable ˘ a ¨Ą ˩˘
б Login ˩ ˩ ˘ ٨ ٹ б ٦ Â

CLI Login ˘ Login **none**
˘ a ˩ Â ˘ Enable ˘
˩ Â ˩ a ˘ Enable Â

У ˘ ˧ Л∪ Â ˘ ˘
˘ Â Ь
Ⅱ
˘ ‡ Â ⁋
˘ ‡ Enable Ⅱ˘ ⁋ ’
⁋ ˘ ‡ Enable ˘ ˘
Ь a ˘ ‡ a ˘ ˧ Л∪⁋ Â

~

˧ RADIUS ˘ ˧ ч
˘ è ‡ a Â

Enable

Enable ˘ ˧ Л∪ ˘ й
Â ˘ ‡ й 1 Â Enable
˘ ”I ˘ й ˘
Ю˜ é ЛЮ ٹ'

ٹ	
configure terminal	
username *name* [**password** *password*]	˘ ٨ ٹ
username *name* [**privilege** *level*]	й ˆ ˩ ~
end	

AAA

PPP AAA

PPP Э У Â
Ю˜ ISDN /I NAS˜ Ł ~ ˘ У
˘ ╟ PPP ˘ й ˘ PPP
/I Â

é Ū /I ң AAA PPP ˘ AAA PPP
˘ Ю ЛЬЮ ҂'

҂	
configure terminal	
aaa new-model	AAA Â
aaa authentication ppp {**default** | *list-name*} *method1* [*method2*...]	Ђ У PPP ˘ ┘Л ˘ RADIUS TACACS+ ˘ Л ┤ Â
interface *interface-type interface-number*	AAA ISDN /I Â
ppp authentication {**chap** | **pap**} {**default** | *list-name*}	ISDN /I Â

PPP é ľ PPP à MP Ł Â

802.1x AAA

IEEE802.1x˜ Port-Based Network Access Control˜ У /I ┘
˘ й LAN ˘ У
Â

é Ū /I ң 802.1x ˘ 802.1x
˘ Ю ЛЬЮ ҂'

҂	
configure terminal	
aaa new-model	AAA Â
aaa authentication dot1x {**default** | *list-name*} *method1* [*method2*...]	Ђ У IEEE802.1x ˘ ┘Л ˘ RADIUS

	˘ Л Ч Â
dot1x authentication *list-name*	802.1x Â

IEEE802.1x é ľ 802.1x Ł Â

Ю ˘ ľ RADIUS+ Ł Â

```
Ruijie(config)# aaa new-model
Ruijie(config)# username Ruijie password starnet
Ruijie(config)# radius-server host 192.168.217.64
Ruijie(config)# radius-server key test
Ruijie(config)# aaa authentication login test group radius local
Ruijie(config)# line vty 0
Ruijie(config-line)# login authentication test
Ruijie(config-line)# end
Ruijie# show running-config
!
aaa new-model
!
!
aaa authentication login test group radius local
username Ruijie password 0 starnet
!
radius-server host 192.168.217.64
radius-server key 7 093b100133
!
line con 0
line vty 0
login authentication test
line vty 1 4
!
!
```

Э ˘ Ł RADIUS Ł ^ IP й 192.168.217.64˜
˘ RADIUS Ł ˘ ‡
Â

AAA

```
line vty 0 4
login authentication test
!
!
```

Э ˘ Ь RADIUS Ь ^ IP ѝ 192.168.217.64˜
˘ RADIUS Ь ˘ ‡
Â tty 1-4 ѝ Ь ˘ a ˘ è tty
vty Â

AAA ۷ Ь Â AAA Ь
Л۷ ˘ Ь ˚
Â Л۷ ˘ ۷ ˚ Ь ۷ é ۷
Â

Л ң ЛЮ AAA '

Exec
Command ҄ ҃˜
Network ˜

è Exec NAS Э CLI ˘
^ ҅ ѝ 0~15 ˜' ҃ NAS Э CLI
Л۷ ˘ é ҃ ' Э
۷ Ь Â

҃ ҇ TACACS+ ˘ é ľ TACACS+ Ŀ Â

AAA Л۷ ˘ Ю Ь'

AAA Ь Â AAA Ь˘ ľ AAA Ŀ Â

ˆ ˩ ˜ AAA Â У ˅
Ю˜ ≠ ˩Л Â AAA ˇ Ґ
Ь Â

ˆ ˩ ˜ Â ˇ
Â ˅ ң Network RADIUS ˇ Exec RADIUS
TACACS+ ˇ RADIUS ˇ Ґ RADIUS Ь
TACACS+ ˇ Ґ TACACS+ Ь Â

ˆ ˩ ˜ ˇ ‡ **username** ҳ ҂
Â

AAA ˇ Ю ЛЮ ҳ'

ҳ	
configure terminal	
aaa new-model	AAA
aaa authorization exec {**default** | *list-name*} *method1* [*method2*|…]	҂ AAA Exec
aaa authorization network{**default** | *list-name*} *method1* [*method2*|…]	҂ AAA Network

AAA Exec

˅ ң Ь ˆ NAS˜ ˇ è ҳ
ˇ . Exec Â й NAS CLI ˆ Telnet˜˜
é ˆ ℸ ˅˜ ˩Л **show privilege** ҳ ˜ Â

a ā Exec ˇ ˅ **aaa authorization exec** ҳ
҂У Exec ˇ Exec
˩Л Â

AAA Exec ˇ Ю ЛЮ ҳ'

ҳ	
configure terminal	
aaa new-model	AAA Â
aaa authorization exec {**default** | *list-name*} *method1* [*method2*...]	҂У ˇ ҂ ˇ ҳ Â
line vty *line-num*	AAA Exec

	Â
authorization exec {**default** | *list-name*}	Â

list-name ⅄ … ˘ ⅃ Ո ’
method Â ERROR˜ ~ ˘
⅄ ὲ ’

username *name* [**privilege** *level*]	й ^ ┘ ~
end	
show running-config	

ЬЖ Exec ˇ ┘ ЛЬЮ ҂'

҂	
configure terminal	
aaa new-model	AAA
aaa authorization exec {**default** | *list-name*} **local**	ЬЖ
end	
show aaa method-list	
configure terminal	
line vty *line-num*	
authorization exec {**default** | *list-name*}	
end	
show running-config	

RADIUS Exec

RADIUS Ь Exec ˇ ″I RADIUS Ь ˇ RADIUS Ь ˇ Ї' RADIUS Ь Â

RADIUS Ь Лˇ ┘Лu RADIUS Ь ˇ Ю ЛЬЮ ҂'

҂	
configure terminal	
aaa new-model	AAA
aaa authorization exec {**default** | *list-name*} **group radius**	ЬЖ RADIUS
end	
show aaa method-list	
configure terminal	
line vty *line-num*	

authorization exec {**default** | *list-name*}	
end	
show running-config	

Exec

Ю Exec Â VTY 0~4 Э Login ˘ з Exec Â è Login ˘ Exec ″I RADIUS à ⅃ Л Â RADIUS Ь й 192.168.217.64˝ й test ⅃ й ruijie˘ ∧ ҷ й ruijie˘ 6 Â Ю

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
Ruijie(config)# radius-server host 192.168.217.64
Ruijie(config)# radius-server key test
Ruijie(config)# username ruijie password ruijie
Ruijie(config)# username ruijie privilege 6
Ruijie(config)# aaa authentication login mlist1 local
Ruijie(config)# aaa authorization exec mlist2 group radius local
Ruijie(config)# line vty 0 4
Ruijie(config-line)# login authentication mlist1
Ruijie(config-line)# authorization exec mlist2
Ruijie(config)# end
Ruijie# show running-config
aaa new-model
!
aaa authorization exec mlist2 group radius local
aaa authentication login mlist1 local
!
username ruijie password ruijie
username ruijie privilege 6
!
radius-server host 192.168.217.64
radius-server key 7 093b100133
!
line con 0
line vty 0 4
 authorization exec mlist2
 login authentication mlist1
!
end
```

AAA Network

Л ң PPP à SLIP Network^ ~ ˘
Network ˘ ˩ Л∪ à à Ł Â Network
RADIUS ˘ Ł Ю RADIUS
˘ a ˩ ˘ Ł Ю ˩ a ˩ Â

~

a 802.1X AAA ˘ 802.1X Л ҄ ˘ έ
ľ 802.1X ŁÂ

AAA Network ˘ Ю ЛυЮ ҄'

҄	
configure terminal	
aaa new-model	AAA Â

Ҍ У ˘

aaa authorization network {**default** | *list-name*} *method1* [*method2*...]

aaa authorization network {**default** | *list-name*} **group radius**	RADIUS

Network

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
Ruijie(config)# radius-server host 192.168.217.64
Ruijie(config)# radius-server key test
Ruijie(config)# aaa authorization network test group radius none
Ruijie(config)# end
Ruijie# show running-config
aaa new-model
!
aaa authorization network test group radius none
!
radius-server host 192.168.217.64
radius-server key 7 093b100133
!
```

AAA

Exec

Command

Network

Exec NAS CLI

NAS CLI

ʒ ℸ TACACS+ ˘ έ ľ TACACS+ Ł·Â

AAA Л∪ ˘ Л∪Ю Ł'

AAA Ł Â AAA ˘ ľ AAA Ł· Â

Ⱳ Â ˘ Â Л ң Network
RADIUS ’ Exec RADIUS TACACS+ ’
Command TACACS+ Â RADIUS ˘ ľ
RADIUS Ł TACACS+ ˘ ľ TACACS+ Ł· Â

ˆ ˩ ˜ AAA Â Л ˆ
Exec ˜ ˘ è Ю˝ ≠ ˩ Л∪ Â AAA
˘ ľ Ł·Â

AAA Exec

Exec NAS ˘ ˩ Л∪ è CLI
Â NAS CLI ˘ ˩ Ł У
ˆ Start˜ ˘ CLI ˘ ˩ Ł У ˆ Stop˜
Â

~

˩ NAS Login ˘ Exec Â
Login ˘ none ˘ ‡ a Exec Â
˩ У ˘ Start ˘ ≠ a
Stop Â

AAA Exec ˘ Ю Л∪Ю ʒ'

ʒ	
configure terminal	
aaa new-model	AAA Â

aaa accounting exec

show running-config	

Exec

Ю Exec Â VTY 0~4 Э Login
˘ з Exec Â ε Login ˘ Exec
RADIUS Â RADIUS Ь й 192.168.217.64˝ й test Â
л й ruijie˘ Л ҙ й ruijie Â Ю

```
Ruijie# config
Ruijie(config)# aaa new-model
Ruijie(config)# radius-server host 192.168.217.64
Ruijie(config)# radius-server key test
Ruijie(config)# .6 0 Td(us-server hosuec 2.40 Td(Tj/T3 1 r8 0 Td(testTj.C2_
```

AAA Network

Network˜ ~ ˘ ˥
à IP à ˩ Â Network ˧ RADIUS Â

:

RADIUS a ˩ RADIUS Ł ˩ Â
˩ ˥ ɳ a ˩ ˩ Â

AAA Network ˘ Ю ЛЮ ʒ'

ʒ	
configure terminal	
aaa new-model	AAA Â
aaa accounting network {**default** | *list-name*} **start-stop** *method1* [*method2*...]	Ҍ У ˘ Ҍ ˘ ʒ Â

list-name ˩ … ˘ ˧ Л Ъ ’
method Â ERROR˜ ~ ˘
˥ è ’ FAIL( )˘ ‡ a è
Â ѝ ˥ ˥ ˘ . ˘ ˧ Л Ъ ʒ
none ѝ ˥ У Â

RADIUS Network

RADIUS Ł Network ˘ ˝I RADIUS Ł ˘
RADIUS Ł ˘ ľ RADIUS Ł Â

RADIUS Ł ˥˘ ˧ Л Ъ RADIUS Ł ˘
Ю ЛЮ ʒ'

ʒ	
configure terminal	
aaa new-model	AAA
aaa accounting network {**default** | *list-name*} **start-stop group radius**	Ҍ RADIUS Â

Network

ЛЬЮ RADIUS Network У '

```
Ruijie# config
Ruijie(config)# aaa new-model
Ruijie(config)# radius-server host 192.168.217.64
Ruijie(config)# radius-server key test
Ruijie(config)# aaa accounting network acct start-stop group
radius
Ruijie(config)# end
Ruijie# show running-config
!
aaa new-model
!
aaa accounting network acct start-stop group radius
!
username Ruijie password 0 starnet
username Ruijie privilege 6
!
radius-server host 192.168.217.64
radius-server key 7 093b100133
```

AAA

˘ Ю ҳ'

ҳ	
show aaa user { *id* | **all** }	AAA

VRF AAA

Virtual Private Networks (VPNs) й У ISP Э Â У VPN. Â У Ч Ь ˘ VPN ≠ ɨ VPN routing/forwarding (VRF) table˘ AAA ɻ Лъ й Ьж Ь VRF Â

AAA VRF˘ Ю ЛЬЮ ҳ'

ҳ	

configure terminal	
aaa new-model	AAA
aaa group server radius *gs_name*	RADIUS Ł Ł
ip vrf forwarding *vrf_name*	й vrf

:

Ң vrf ╖

Login

Login ˘ й Login ˘ ҳ
, ˘ a Â

Login ˘ Ю ЛЪЮ ҳ'

ҳ	
configure terminal	
aaa new-model	AAA
aaa local authentication attempts *num*	login ˘
aaa local authentication lockout-time *num*	login ˘ ˘ ^ ~
end	
show aaa user lockout {**all** | **user-name** *name-string*}	
clear aaa local user lockout {**all** | **user-name** *name-string* }	

ﻝ AAA ﻠ

ﻝ AAA ﻠ ˘ Ю '

ﻝ AAA ﻠ ﻠ
ﻝ AAA ﻠ Y

~

ﻝ AAA ﻠ˘ IEEE802.1x ﻠ˘ IEEE802.1x
é ľ 802.1x Ł Â

:

ң ЛЪЮ ﻝ
1. userid@domain-name
2. domain-name\userid
3. userid.domain-name
4. userid

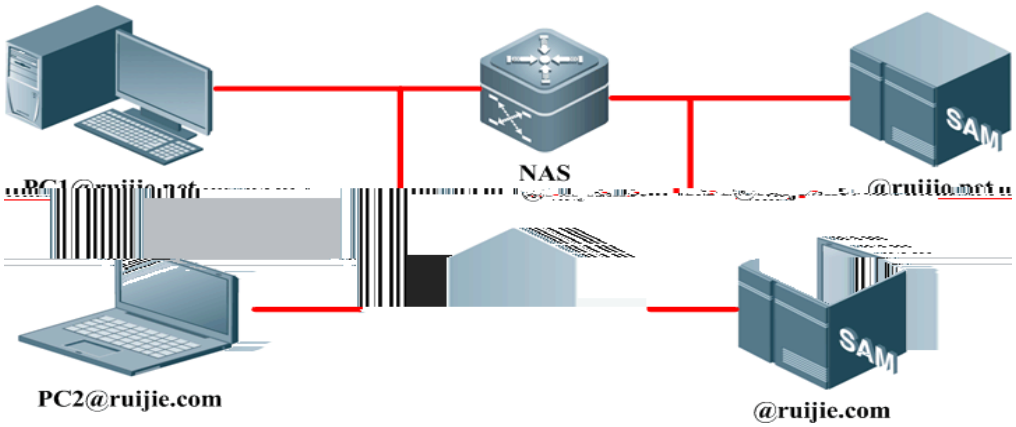
4 a domain-name ﻝˆ . ЛЪЭ 4 ' userid˜˜ ѝ è
ﻝ ѝ default˝ . ѝ ﻝ Â

Ю˘ ﻝ У ﻝ NAS˘ Network Access Switch˜ ﻝ ѝ a ﻝ
AAA ﻠ˘ ˆ ﻝ ﻧ ầ ﻠ ầ ˜ ﻝ
a ﻝ˘ Ψ˙ ˘ ѝ RĐ

:

Э У ˘ AAA Ь

ЛЮ ђ في'



في 2 ђ في

Ј AAA Ь

Ю Ј AAA Ь'

1. AAA Ь
2. Ьж AAA Ь
3. Ј AAA Ь
4. …
5.
6.

:

32 Â

AAA

ʔ	

configure terminal	
aaa new-model	AAA

३	
configure terminal	
aaa domain *domain-name*	… ˙ ɻ ѝ *domain-name*

:

ɻ AAA Ŀ 64 ɻ˘ a Ш† Â

Ю˘ й ˘ AAA Ŀ '

३	
authentication dot1x {**default** | *list-name*}	Ю˘
accounting network {**default** | *list-name*}	Ю˘
authorization network {**default** | *list-name*}	Ю˘

'

state {**block** | **active**}	Ю˘

ɻ ɻ '

Q, ३	0ti
username-format {**without-domain** | **with-domain**}	Ю˘ NAS б Ŀ ɻ ɻ

'

:

1. ЮЎ AAA Ь ˘

RADIUS

RADIUS

RADIUS Л ╘(Remote Authentication Dial-In User Service)
˘ У ┼ / ╘ ˘ б AAA في
˘ Â RGOS ˘ RADIUS
╘ ^ NAS˜ Э˘ Л RADIUS ╘ ˘
╘ ╘ Â

RADIUS У ˘ UNIX à WINDOWS 2000
RADIUS ╘ й У ˚ ˘ RADIUS
╘ Â

RADIUS Ю'

Л Â

Л ╕ RADIUS ╘ Â

RADIUS Ю У'

ACCEPT' Â

REJECT' ˘ Л Â

RADIUS

23	login privilige	42
24	limit to user number	50

ID '

ID	╖	TYPE

ЛЬЮ é '

```
Ruijie# show radius vendor-specific
id    vendor-specific     type-value
----- -------------------- ----------
1     max down-rate       76
2     qos                77
3     user ip             3
4     vlan id             4
5     version to client    5
6     net ip             6
7     user name           7
8     password            8
9     file-diractory       9
10    file-count          10
11    file-name-0         11
12    file-name-1         12
13    file-name-2         13
14    file-name-3         14
15    file-name-4         15
16    max up-rate         75
17    version to server    17
18    flux-max-high32      18
19    flux-max-low32       19
20    proxy-avoid         20
21    dailup-avoid        21
22    ip privilige        22
23    login privilige      42
24    limit to user number 50

Ruijie# configure
Ruijie(config)# radius attribute 24 vendor-type 67
Ruijie(config)# show radius vendor-specific
id    vendor-specific     type-value
----- -------------------- ----------
1     max down-rate       76
2     qos                77
3     user ip             3
4     vlan id             4
5     version to client    5
6     net ip             6
7     user name           7
8     password            8
9     file-diractory       9
10    file-count          10
11    file-name-0         11
12    file-name-1         12
```

```
13    file-name-2         13
14    file-name-3         14
15    file-name-4         15
16    max up-rate         75
17    version to server    17
18    flux-max-high32      18
19    flux-max-low32       19
20    proxy-avoid         20
21    dailup-avoid        21
22    ip privilige        22
23    login privilige      42
24    limit to user number 50
Ruijie(config)#
Ruijie(config)#
```

RADIUS

RADIUS˜ ЛЬЮ ҄'

҄	
debug radius event	RADIUS ˘ RADIUS Â

RADIUS

ὴ RADIUS ﻲ ˘ RADIUS ᶣ ˘ ὶ
ℸ ˘ ᶣ Â

RADIUS ᶣ ⅃Л Windows 2000/2003 Serveî IAS˜ à UNIX ˚ ,
≠ ⅃Л У ж ᶣ ˚ Â

ЛЬЮ RADIUS ἑ '

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
Ruijie(config)# radius-server host 192.168.12.219
auth-port 1645 acct-port 1646
Ruijie(config)# radius-server key aaa
Ruijie(config)# aaa authentication login test group radius
Ruijie(config)# end
```

```
Ruijie# show radius server
Server IP:       192.168.12.219
Accounting Port: 1646
Authen  Port:    1645
Server State:    Ready

Ruijie# configure terminal
Ruijie(config)# line vty 0
Ruijie(config-line)# login authentication test
Ruijie(config-line)# end
Ruijie# show running-config
!
aaa new-model
!
!
aaa authentication login test group radius
!
username ruijie password 0 starnet
!
radius-server host 192.168.12.219 auth-port 1645 acct-port 1646
!
line con 0
line vty 0
login authentication test
line vty 1 4
!
```

TACACS+

TACACS+

TACACS+ TACACS RFC 1492 Terminal Access Controller Access Control System˜˜ Э ╖ Â ў Client-Server б TACACS Ь AAA ╖ ˘ ┘ à ˘ TACACS+ Ь ˘ ″I TACACS+ Ь Â

TACACS+ à ˘ . ┘Л У ⅄ Ь ˘ ⅄ ⅄ ⅄ У ⅄ Ь ˘ ⅄ ⅄ Ь ┘Л ˘ ┘Л à Â

TACACS+ Ю'

4	8	16	24	32 bit
Major	Minor	Packet type	Sequence no.	Flags
Session ID				
Length				

1 في

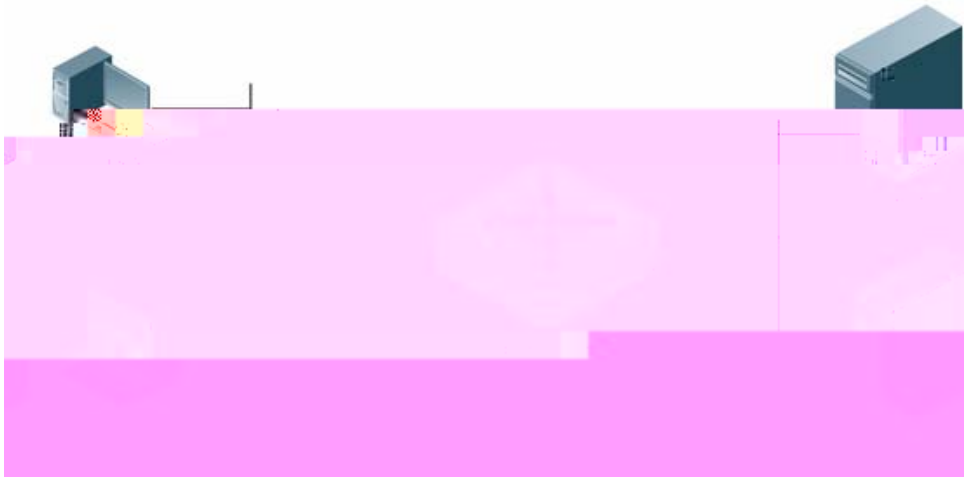
Major Version — ў TACACS+ ⅄ Â

Minor Version — TACACS+ ⅄ Â

Packet Typeˆ

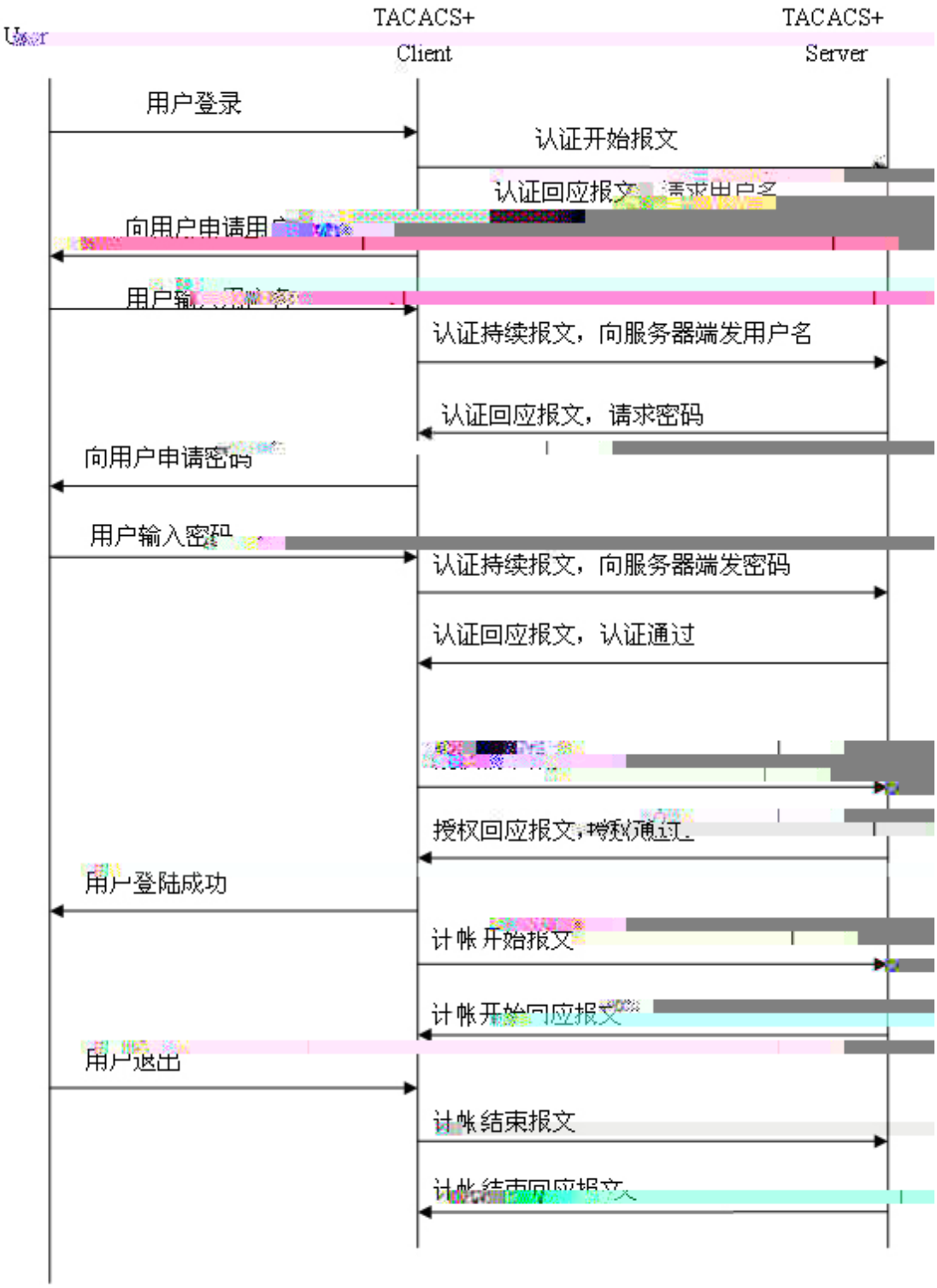
TACACS+

TACACS+ ή ϊ ˘ ˆ Telnet
˜˜ ˆ ˜ ϊ TACACS+ ˘ ɻ
TACACS+ Ɬ ˘ ɻ ɻ Ʌ
Э Â ف 2 '



ف 2

Ю Ʌ à TACACS+
'



3 في

1.

1˜ Â

2˜ TACACS+ Ù˜ Ù

3˜ TACACS+ Ł ˘ ɻ Â

4˜ TACACS+ ˘ ɻ ɻ Â

5˜ ɻ Â

6˜ TACACS+ ɻ ɻ˘ ɻ TACACS+ Ł ˘ è ɻ Â

7˜ TACACS+ Ł ˘ Â

8˜ TACACS+ ˘ ɻ Â

9˜ Â

10˜ TACACS+ ɻ˘ ɻ TACACS+ Ł ˘ è Â

11˜ TACACS+ Ł ˘ Â

2. **ɻ** '

1˜ TACACS+ ɻ TACACS+ Ł Â

2˜ TACACS+ Ł ˘ Â

3˜ TACACS+ ╖ ˘ ɻ Â

3. **ɻ˘** ˘ '

1˜ TACACS+ ɻ TACACS+ Ł Â

2˜ TACACS+ Ł ˘ Â

3˜ Â

4˜ TACACS+ ɻ TACACS+ Ł Â

5˜ TACACS+ Ł ˘ Â

TACACS+ Ł

Э TACACS+˘ ˝I ЛЪЮ Ł'

aaa new-mode ҁ AAA Â TACACS+ ˝I AAA˘ f́ ŋ ∃ σ ˝I Ȯ ɔ◌ AAA

Â **aaa authorization** ҳ ӍӜ ˘ Ї
Ŀ Â

˘ **aaa accounting** ҳ ӍӜ TACACS+
Â **aaa accounting** ҳ ӍӜ ˘ Ї
Ŀ Â

Э ӍӜ ˘ ‡ Â

έ TACACS+ ˘ ЛЬЮ '
TACACS+ Ł ў

ѝ TACACS+ Ь ˘ ‡ Ь ˘
TACACS+ Â

TACACS+

TACACS+ ˘ ЛЮ ҙ'

ҙ	
configure terminal	Â
tacacs-server key *string*	TACACS+ Ь ˘ ў ˘ ‡ Â

~

TACACS+˘ Â з Э TACACS+
Ь Э У Â

AAA Ь

Э AAA Ь ˘ ˩ Л Ъ У Ь ў ˚
˘ Ь У ˘ ѐ У Ь
ˆ Login ˜ Â

Ь ˩ Л Ъ Ь ˘ Ь ў ╗ ″І ˥ ˘
Ь ў Â Ь ╗ Ь ˘ ‡ ″І ╗ ˘ ˥ ╗
Ь ѝ У Ь ˘ У Ь ˘ Ю
У Ь Â

AAA Ь ˘ ЛЮ ҙ'

ҙ	
configure terminal	Â
tacacs-server host *ip-address* [**port** *integer*] [**timeout** *integer*] [**key** *string*]	TACACS+ Ь ў ˘ Ь TACACS+ Ь ў Ь Â

aaa group server {**radius** | **tacacs+**} *group-name*	Ѭ AAA Ь ˘ ѝ У ɻ Â У Ь ˩ ˆ RADIUS TACACS+˜ Â ȝ AAA Ь Â ' TACACS+ Ь **tacacs+** Â
server *ip-address*	Ь ╗ TACACS+ Ь ў ˘ ˩ Ʌ Ъ ╗ Ь ў Â ' ╗ Ь Ь ў ˘ Y ˝I **tacacs-server host** ȝ Ѭ Â
ip vrf forwarding *vrf-name*	ˆ ˩ ˜ TACACS+ Ь vrf ɻ (VRF ȝ)

TACACS+

TACACS+ Ь ʌ˘ ѝ TACACS+ Ѭ ˘ TACACS+ Â ѝ TACACS+ AAA ˘ **aaa authentication** ȝ TACACS+ Ѭ ѝ Â TACACS+ Login Enable Â

Loginˀ ˜ NAS Â Login ЛЪЮ ȝ'

ȝ	
configure terminal	Â
aaa authentication login {**default** | *list-name*} **group** {**tacacs+** | *group-name*}	Login TACACS+ Â
line [**aux** | **console** | **tty** | **vty**] *line-number* [*ending-line-number*]	line ˘ Login Â
login authentication {**default** | *list-name*}	Login Э Â

˘ ȝ ˆ CLIˆ ˘ У = ƙ ˘ ѝ ˘ ˘ ѝ Enable Â Enable ЛЪЮ ȝ'

ȝ	

configure terminal	Â
aaa authentication enable default group {**tacacs+** | *group-name*}	Enable TACACS+ Â

TACACS+

TACACS+ ┗ TACACS+ ﻝˇ ﺴﺨﻲ
TACACS+TACACS+
TACACS+ Â Ò

no aaa authorization config-commands Command

aaa accounting commands *level* {**default** | *list-name*} **start-stop group** {**tacacs+** | *group-name*}	Exec TACACS+ Â *level* Â-Ì 0 15 Â
line [**aux** | **console** | **tty** | **vty**] *line-number* [*ending-line-number*]	line ˘ Exec Â
accounting commands *level* {**default** | *list-name*}	Exec Э Â *level* Â-Ì 0 15 Â

TACACS+

Э TACACS+ ˘ ѝ TACACS+ Ь Â Ì TACACS+ ˘ ЛЬЮ ҙ'

ҙ	
configure terminal	
tacacs-server timeout *seconds*	Лυ ˆ ѝ 5 ˜˜ ў ˘ ‡ Â
Ip tacacs source-interface *interface*	tacacs+ Ь IP˝ ѝ a

TACACS+ à à

ѝ TACACS+ ف ˘ TACACS+ Ь à ˘ Ю ¦ Login à Enable à Exec Command ˘ TACACS+ à Â

Login TACACS+ '

1. ″I aaa'

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
```

2. Л tacacs+ server '

```
Ruijie(config)# tacacs-server host 192.168.12.219
```

```
Ruijie(config)# tacacs-server key aaa
```

3. ʌ tacacs+ '

```
Ruijie(config)# aaa authentication login test group tacacs+
```

4. ʌ Э :

```
Ruijie(config)# line vty 0 4
Ruijie(config-line)# login authentication test
```

ЛЪЭ login tacacs+ ˘ ЮÂ

```
Ruijie#show running-config
!
aaa new-model
!
aaa authentication login test group tacacs+
!
tacacs-server host 192.168.12.219
tacacs-server key aaa
!
line con 0
line vty 0 4
login authentication test
!
```

Enable TACACS+ '

1. ″I aaa'

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
```

2. ʌ tacacs+ server '

```
Ruijie(config)# tacacs-server host 192.168.12.219
Ruijie(config)# tacacs-server host 192.168.12.218
Ruijie(config)# tacacs-server host 192.168.12.217
Ruijie(config)# tacacs-server key aaa
```

3. tacacs+ server group Ь У ¦ Ь '

```
Ruijie(config)#aaa group server tacacs+ tacgroup1
Ruijie(config-gs-tacacs)#server 192.168.12.219
Ruijie(config-gs-tacacs)#server 192.168.12.218
```

4. ʌ tacgroup1 '

```
Ruijie(config)# aaa authentication enable default group
tacgroup1
```

Л Э enable tacacs+ Ю Â

```
Ruijie#show running-config
!
aaa new-model
!
!
aaa group server tacacs+ tacgroup1
server 192.168.12.219
server 192.168.12.218
!
aaa authentication enable default group tacgroup1
!
!
tacacs-server host 192.168.12.219
tacacs-server host 192.168.12.218
tacacs-server host 192.168.12.217
tacacs-server key aaa
!
line con 0
line vty 0 4
!
```

Exec TACACS+

1. aaa

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
```

2. tacacs+ server

```
Ruijie(config)# tacacs-server host 192.168.12.219
Ruijie(config)# tacacs-server key aaa
```

3. tacacs+

```
Ruijie(config)# aaa authorization exec test group tacacs+
```

4. Э :

```
Ruijie(config)# line vty 0 4
Ruijie(config-line)#authorization exec test
```

Л Э tacacs+ Ю Â

```
Ruijie#show running-config
!
aaa new-model
```

```
!
!
aaa authorization exec test group tacacs+
!
tacacs-server host 192.168.12.219
tacacs-server key aaa
!
line con 0
line vty 0
authorization exec test
!
```

15 Commans TACACS+ '

1. ″I aaa'

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
```

2.

!

SSH ┗

SSH Ў

SSH Secure Shell Â SSH ╖ У Telnet
ˇ б Telnet a ┘ ╗ Â У a
ˇ SSH ┘ Л
╖ ˇ Л a ┘ IP à ┘ Â

SSH

	SSH1	SSH2
┘	RSA	RSA à DSA
	RSA Ώ ╗ Â	KEX_DH_GEX_SHA1 KEX_DH_GRP1_SHA1 KEX_DH_GRP14_SHA1
╖	DES à 3DES à Blowfish	DES à 3DES à AES-128 à AES-192 à AES-256
	^ ?	^ ?
	a	MD5 à SHA1 à SHA1-96 à MD5-96
	NONE ~	NONE ~

SSH

~ ю N Td<677 T5326/C2_0 1 Tf0 Tc 2 Tr 2.3 0 Td. 0.D5>Tj

SSH Server

SSH Server Ю **no enable service ssh-server**
SSH Server DISABLE

configure terminal	
no enable service ssh-server	SSH Server

SSH server

Ю SSH Server 1 2 ЛЬЮ SSH

configure terminal	
ip ssh version {**1	2**}	SSH
no ip ssh version	SSH SSHv1 б SSHv2

SSH

Ю SSH Server 120
SSH

configure terminal	
ip ssh time-out *time*	SSH 1-120sec

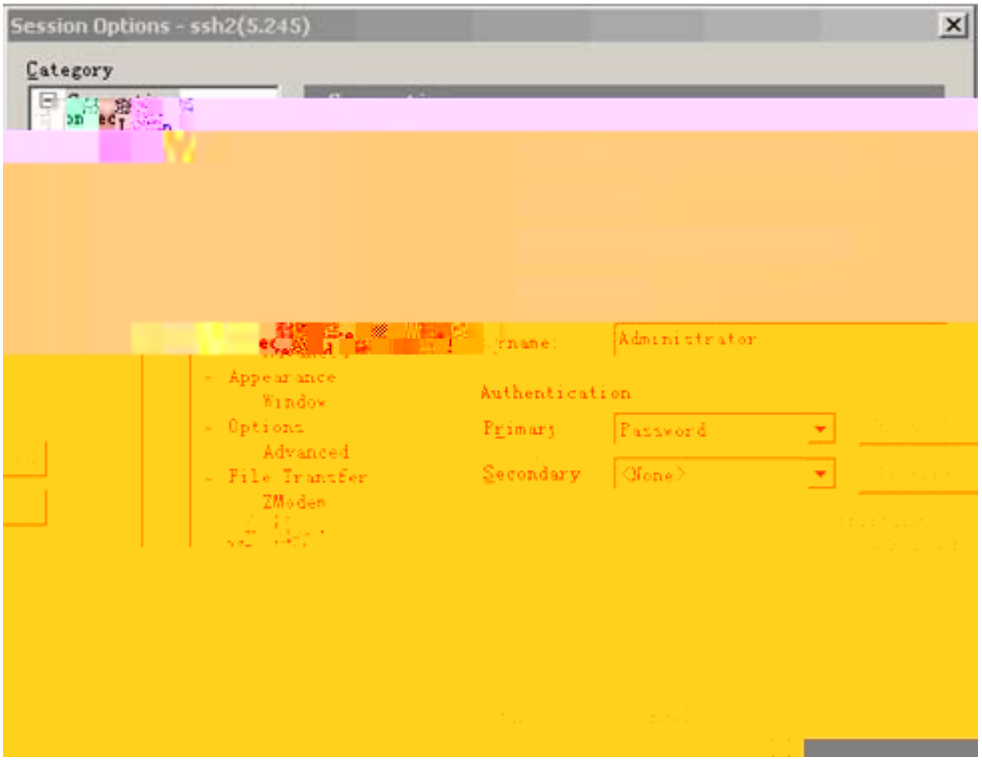
no ip ssh time-out

ع	
configure terminal	
ip ssh authentication-retries *retry times*	SSH ˆ 0-5˜
no ip ssh authentication-retries	SSH ы 3 '

' Э ع é [SSH ع ¨Ą] Â

SSH

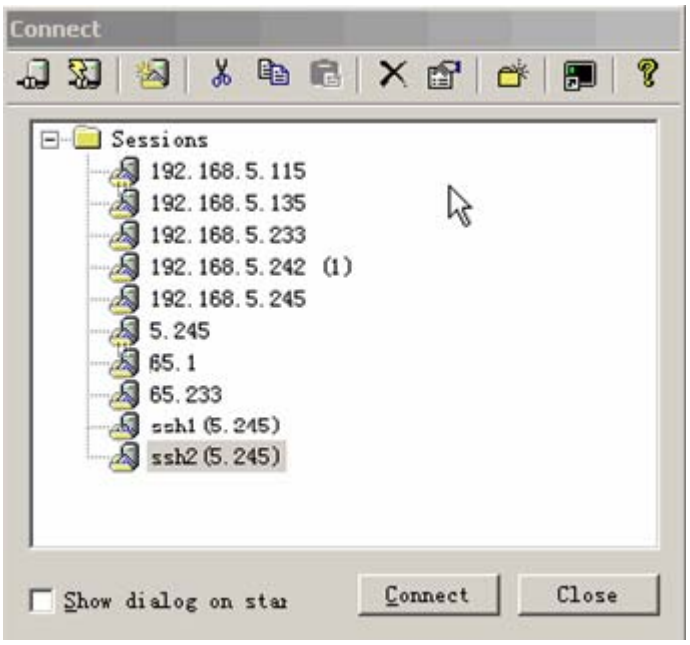
ل Л SSH ˘ SSH Server ╖ ˘
Ю ╖ Â Windows Telnet ˚ a SSH˝
Ь ˚ ˘ ' Putty˘ Linux˘
SecureCRT Â Ю Л ˚ SecureCRT ы У SSH ˘
Юفي'



في 1

في 1 2 ˘ Protocol SSH2˝ Hostname
ў IP ˘ ы 192.168.5.245˝ ٨ ы 22 . SSH ٨
٨˘ Username ы ل˘ ٨ ˘ ل a ˘
Authentication ы ˘ ٨ ل Â
Telnet У Â

ل OK˝ ЛЮ '


Connect
Sessions
192.168.5.115
192.168.5.135
192.168.5.233
192.168.5.242 (1)
192.168.5.245
5.245
65.1
65.233
ssh1 (5.245)
ssh2 (5.245)
Show dialog on star
Connect
Close

2 في

Connect

ˇ ⅄ Ь ╟ ˇ Ь
ˇ ╟ Ф Â
Ь У╒ ╟ Л˘ ЇĄ
Л ˇ ˇ
Л ˇ
Â

ѝ ᾱ У ╒ ˇ ÿ Л Э
ˇ з ˇ Â

GSN

Ю˝ GSN

[**no**] **security V**

interface *interface*	٨
[**no**] **security address-bind enable**	٨

~

٨ GSN ٦ 3 ٨ ٨ ٦ Â ٨
˘ ٦ 802.1x IP ٦ ˘ ‡
Â

GSN

smp server

٦Л Л∪ЮО smp sverver

٩	
show smp-server	smp server

'

```
Ruijie# show smp-server
SMP-Server IP:192.168.217.220
```

security event interval

٦Л Л∪ЮО policy-map

٩	
show security event interval	Y ˇ

'

```
Ruijie# show security event interval
Event sending interval(Seconds):5
```

GSN Y

GSN

GSN ˚ ˘ ˚ ˘ Л∪ GSN
ң a ⅄ a ⅄˘ ⅄ GSN
˚ ⅄ è ´ ˘ Л∪ ╖ ˆ ⅄ ARP
╖ ~ ≠ ⅄ ˘ GSN ≠ Â ѝ
╟ ˘ GSN ˘ Л∪ GSN a
è ˚ ╖ Â

б GSN ă У ╖

GSN ˘ GSN б Ю У ╖ Э ă ˘
╗ Л∪ ˘ ⅄ ╖ Â

1) GSN a б 1x ip Â
2) GSN a ⅄ ⅄ Â
3) GSN a AP ⅄ Э ˘ ⅄ a ╗ AP ⅄˘
GSN ⅄ ╗ AP ⅄ ⅄ ⅄ ╖
˘ У ⅄ ╗ AP ⅄ ″I ⅄ Э
Â

GSN è Y

GSN ˚ ˘ Л∪ Ю У
⅄ GSN '

IP+MAC ' IP+MAC ⅄˘ MAC
˘ GSN ⅄ MAC ˘ IP+MAC
˘ ÿ GSN ⅄ Â

ACL' ACL б GSN Ю ă ≠ GSN ╖
˘ GSN a ACL Â

╟ ARP

DAI

DAI Dynamic ARP Inspection, ɹ ŷ ╟ ARP Â
ARP Â a arp

ARP

ARP ˘ ARP a ARP
Â ARP Â è ˘ ŋ

MACC), B ARP (IPA, MACC). A B C A B C

DAI ARP

DAI ARP DAI VLAN ARP DHCP ARP

ARP DHCP snooping binding DHCP snooping

ARP

Э ARP DAI ARP ARP DAI

ip arp inspection trust, show ip arp inspection interface

ARP

DAI CPU ARP ARP DAI 15

ip arp inspection limit-rate

ip arp inspection limit-rate show ip arp inspection interface

DAI

DAI **ARP**

ARP

DAI

VLAN DAI

ARP

ARP

DHCP snooping database

VLAN DAI

VLAN DAI

VLAN vid DAI vlan-id = vid ARP DAI a ARP

show ip arp inspection vlan VLAN DAI

VLAN DAI

Ruijie(config)# **ip arp inspection vlan** *vlan-id*	VLAN *vlan-id* DAI
Ruijie(config)# **no ip arp inspection vlan** [*vlan-id*]	VLAN *vlan-id* DAI *vlan-id* VLAN DAI

ARP

SVI ARP

ARP DHCP snooping ARP

ARP

arp

γ Э˘ Ю arp vlan ˘
arp Â

arp A arp mac ˘ ﻝ
У vlan B ≠ arp ˘ B ﻝ Л∪ arp ˘
ip й ip˘ mac й mac Â A arp
Л˘ й B ˘ A
B˘ A Э ﻝ ˘ arp Â

ﻝ Л∪ γ Э arp arp Â
arp Л˘ ﻝ Л∪ ﻟ Э arp ip
ip˘ ˘ ‡ ˘ arp Â ﻝ
Э Ю ARP ˘ ὲ pc a arp
Â

arp

arp

Â

arp

arp '

ʒ	
Ruijie(config-if)#**anti-arp-spoofing ip** *ip-address*	ﻟ Ю arp ˘ ip й ip Â

ﻝ Л∪ ﻟ Ю ʒ **no anti-arp-spoofing ip** *ip-address*
arp Â

~

Э ㄟ Э a arp Â

arp arp check ㄐˇ ipv6 acl a ¨Ą ˇ ㄣ Ң Â

arp

arp '

३	
Ruijie #**show anti-arp-spoofing**	ㄟ Ю arp

ѝ ѧ ą ā У ˇ
ℸ Â ѧ ą ЛЮ '

IP

IP

MAC

MAC

Expert

˩ Л∪ é a ˩ Â

ӯ

ACLs ѝ (Access Control Lists)˘ ≠ ѝ ˆ Access Lists˜ ˘ ѝ ˘ ѝ Â ACLs ЊЖ У ‡ ѧ Э ' Â è ˘ ˩ Л∪ˇ ѝ ACLs QoS ACLs Â

˩ Л∪ ˘
Â ACLs è ˇ ÿ ѧ ˘ ך ˚ (Conditions) ā è (Permit) (Deny) Â

˘ ACLs ÿ ˘ Qos . ″I ˇ Â

ACLs У ˘ ѝ (Access Control Entry˙ ACE) Â ך ˚ ч ѝ Â

‡ ˩ Л∪ à à Э ˘ ѡ Â

ѝ Ж

˘ ў ЛЮ У '

' Ж ˘ ˩ Ж Â

' ѝ ˘ ⅎ ‡˘ ⅃ Л У

ᒡ ⅃ WWW ˚ ᒡ˘ ὲ ᒡ TELNET ‡ ~ ˘

ѧ ш ѧ ˘ ÿ У ѧ
˘ У У ˚ ѧ ˥ ˘ ѫ ѧ ѧ
˘ a ¨Ą Â

/ ACL à ч ‡

ACL ѧ ˘ б ѧ ACL У
ACE ˥ ’ ACL ÿ У ѧ ˘ б
ѧ ACL У ACE ˥ Â

a ѯ ‡ ˘ ‡ ѯ ѯ ˘ ≠ ѯ ѧ è Â
ѧ ACE¯ ACE Ѭ (Permit Deny) Â ACL
ACE Л∪ Л∪ ˘ ’

γ (Layer 2 Fields)ˈ

48 Æ MAC (48 Æ)

48 Æ MAC (48 Æ)

16 Æ γ

Ь (Layer 3 Fields)ˈ

IP (ѯ Л∪ IP ˘ Ѭ Ѭ У
)

IP (ѯ Л∪ IP ˘ Ѭ
Ѭ У)

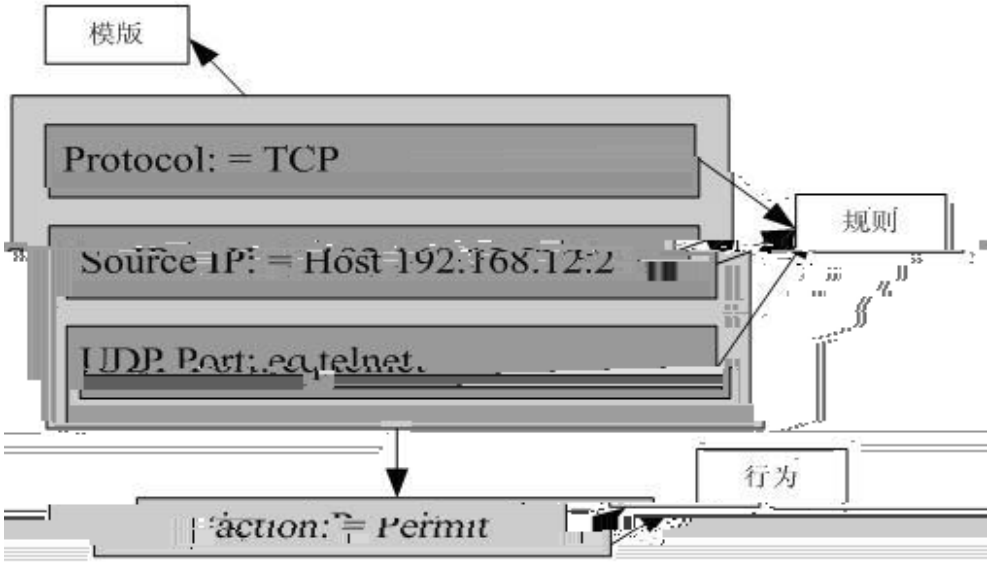
(Layer 4 Fields)ˈ

ѯ Л∪ У TCP ѧ à ѧ

ѯ Л∪ У UDP ѧ à ѧ

У ACE ˘ Л∪
à˥ Â ь ѥ ˘ ѡ У

ÆCE à˥



في 2 ACE' permit tcp host 192.168.12.2 any eq telnet ‡

ل ل ь (Layer 3 Field) (Layer 4 Field)
ˇ ≠ ل ل γ (Layer 2 Field) ˇ б ACL
a γ ь à γ à γ ь à Â
γ à ь à ˇ ل ل Expert ˆ Expert
ACLs˜ Â

IP

Э ˇ ѝ У У ɻ ⁄ˇ
ل ل У Â Ю ل ل ⁄ˇ
ل ل ل ل ⁄ˇ Â

б ‡ ٦ ā ţ Â

˘ ⅏ ṅ ‡ ў

ЛЬЮ

Э

ѡ

IP Л й 1 - 99 1300 - 1999 ў IP

ţ ˘ IP Л й 100 – 199 2000 - 2699 Лъ Э

ţ Â è ʒ

ţ Â

У ˘ ⅃ Лъ Л ⅏ ‡˘

¦Å≠Ю>3/C2_0 1 Tf10.0018 T210 Tc .83w 2.554[(permit ho)5(st)B040E>]TJ/TT1 1 Tf21 Tf

Ruijie (config-xxx-nacl)# [*sn*] { **permit** | **deny** } {src *src-wildcard* | **host** *src* | **any** } [**time-range** *tm-rng-name*]	ѝ ACL ╕ , έ ϛ
Ruijie(config-xxx-nacl)# **exit** Ruijie(config)# **interface** *interface*	˘ ∧
Ruijie(config-if)# **ip access-group** *id* { **in** | **out** }	∧

У ∢ ACL ˘ γ ∢ Л∪ ∤ ACL ˘ ∢ Л∪
. ″I (ACE . ″I) Â

IP

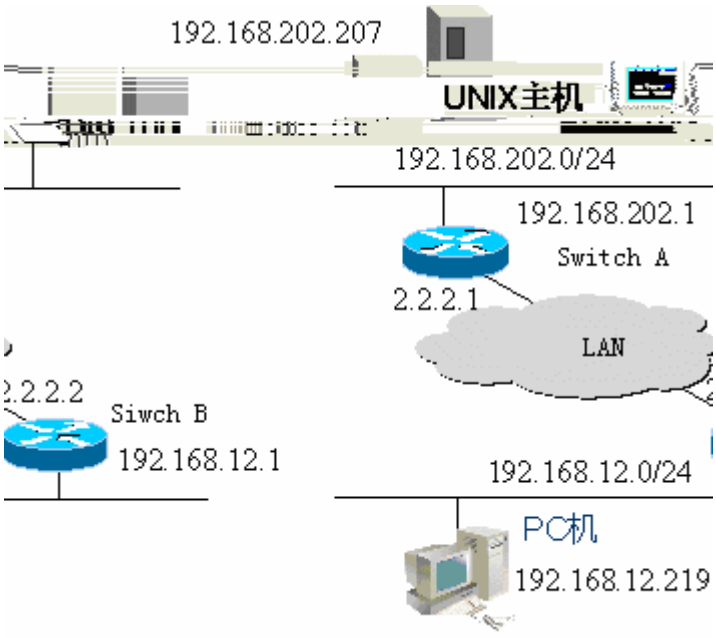
˘ ЛЬЮ ϛ'

Ruijie# **show access-lists** [*id* | *name*]

ϛ ∢ Л∪

IP

ч ∢ Switch A Switch B˝ في 1-3˝



Switch B Э ˘ ЛЬЮ ╖ '

192.168.12.0/24 ў ↓ Э UNIX ў TELNET ┺˘ PING ┺Â

Switch B ↓ Э a 192.168.202.0/24 ў ┺Â

ЛЬЭ ˘ . ↓ ↑ Э ў ў ˘ a Э ў Â

Switch B '

```
Ruijie(config)# interface GigabitEthernet 0/1
Ruijie(config-if)# ip address 192.168.12.1 255.255.255.0
Ruijie(config-if)# exit
Ruijie(config)# interface GigabitEthernet 0/2
Ruijie(config-if)# ip address 2.2.2.2 255.255.255.0
Ruijie(config-if)# ip access-group 101 in
Ruijie(config-if)# ip access-group 101 out
```

˘ У Л и 101

```
Ruijie(config)# access-list 101 permit tcp 192.168.12.0
 [192.168.12.0)6(Tc 0 -27w 4.177 -1.446 Td0.0.0.(Tj/TT6 1 5c 2.4 0 Tdany (T
```

```
Ruijie(config)# interface GigabitEthernet 0/1
Ruijie(config-if)# ip address 192.168.202.1 255.255.255.0
Ruijie(config)# interface GigabitEthernet 0/2
Ruijie(config-if)# ip address 2.2.2.1 255.255.255.0
```

MAC

Э MAC ˘ У У ɻ
ʃˇ Л Ю ɻ Л ʃ
MAC ʃ Â

	ʃ
MAC	700-799

MAC

… MAC ˘ Ⱨ ‡ ɻ Л ʅ ˘ ʅ
б ‡ ɔ ɑ ʅ Â

MAC Ⱨ ɳ ‡ ў ЛЮ

MAC

MAC

Л

Ш

MAC ˆ ʃ 700 -799˜ ў MAC
ʅ , ≠ ɻ Л Л ɔ Â

У MAC ˘ ɻ Л ɻ Ⱨ
‡ˇ è ɻ ɻ У ʃ ɻ ˇ Л ɻ ɻ У
Â

MAC

MAC ЛЮ ч '

1. Ⱨ MAC

2. ɻ

MAC ˘ ЛЮ ч '

У Ю ЛЮ ʒ'

Л υ ∧ˇ Л υ ∧ Э 101, Л υ ∧ Э

```
Ruijie> enable
Ruijie# configure terminal
Ruijie(config)# mac access-list extended mac-list
Ruijie(config-mac-nacl)# deny host 0013.2049.8272 any ipx
Ruijie(config-mac-nacl)# permit any any
Ruijie(config-mac-nacl)# exit
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# mac access-group mac-list in
Ruijie(config-if)# end
Ruijie# show access-lists
mac access-list extended mac-list
deny host 0013.2049.8272 any ipx
permit any any
Ruijie#
```

∧ permit any any a a ˇ й Л У

‡ ∧ Â

S3250 ң Эˇ permit any any ↓Л υ a Â

Expert

Э Expert ˇ У У ↓

Л ˇ Л У ÂЮ Expert

Л Â =)A“KÑPÑÍÑWp=AÉ@Ñ+<,X4ÐÛ¼4“CÀ@=Pr2cCH6ŽÞÅ£)KÑPÓ‰wÐ3"1ý=ÑMA“KÂ“CA

У ㄴ ACL ’ γ ㄴЛυ ㄹ ACL ˘
. ”I ˘ ㄴЛυ . ”I (⅋ [sn]) Â

s3250 ㅂ Ip acl ㄴ Лυ“eq” tcp,udp 4 ㄲ ㄱ

Expert

˘ ЛυЮ ⅋'

Ruijie # **show access-lists** [*id* | *name*]

ㄴЛυ Expert

Expert

Expert ˘ ЛυЮ ℸ '

VLAN20 0013.2049.8272 ў Giga 0/1 ㄲ Â

è a

```
Ruijie> enable
Ruijie# config terminal
Ruijie(config)# expert access-list extended expert-list
Ruijie(config-exp-nacl)# permit ip vid 20 any host
0013.2049.8272 any any
Ruijie(config-exp-nacl)# deny any any any any
Ruijie(config-exp-nacl)# exit
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# expert access-group expert-list in
Ruijie(config-if)# end
Ruijie# show access-lists
expert access-list extended expert-list
petmit ip vid 20 any host 0013.2049.8272 any any
deny any any
Ruijie#
```

ACL80

ACL80 ≠ ㅓ ㅐ ˘ ㅐ ㄱ 80 ˘

Â У ˘ ACL80 ˩Л∪ 80
16 ^ bit˜ Æ ٦ Â

---

16 a ЛЬЮ '
SMAC, DMAC,SIP, DIP,ETYPE,PROTOCOL,L4_SPORT, L4_DPORT,VID.
٦ Э ≠ ˩Л∪˥ ٦ 16 Â

У 16 ˘ ˩Л∪ bit б a Â
≠ ˘ 16 У ѝ 0 1Â
У ˘ ч ' ‡ ˘ γ Æ
У У Â ‡ ˘ ‡
^ 1 ٦ ‡ Æ˘ 0 a ٦ ˜ ˘ Л∪
٦ ˘ ѝ ѝ 1Â
Æ ѝ 0˝ ‡ Æ ѫ˘ a ٦ Â
'

```
Ruijie(config)# expert access-list advanced name
Ruijie(config-exp-dacl)# permit 00d0f8123456 ffffffffffff 0
Ruijie(config-exp-dacl)# deny 00d0f8654321 ffffffffffff 6
```

Ѭ Ѭ γ 80
٦ ˘ Â Ѭ
γ Â Юفي ѝ γ 64
في^ ٦ У 16 ˘ ч ٦ У ˜ Â

AA AA AA AA AA AA BB BB BB BB BB BB CC CC DD DD

DD DD EE FF GG HH HH HH II II JJ KK LL LL MM MM

NN NN OO PP QQ QQ RR RR RR RR SS SS SS SS TT TT

UU UU VV VV VV VV WW WW WW WW XY ZZ aa aa bb bb

Эفي ˘ Ѭ˥ ˩ Ю '

	Ѭ			Ѭ	
A	MAC	0	O	TTL	34
B	MAC	6	P	/\	35
C	VLAN tag	12	Q	IP	36
D		16	R	ip	38
E	DSAP( )	18	S	ip	42

```
Ruijie# configure terminal
Ruijie(config)#
```

3) ACL

```
Ruijie(config)# ip access-list extended test-tcp-flag
Ruijie(config-ext-nacl)#
```

4) ╗ ACL

```
Ruijie(config-ext-nacl)# permit tcp any any match-all rst
```

5) ╗ deny

```
Ruijie(config-ext-nacl)# deny tcp any any match-all fin
```

6) ╗ ˘

7) end

```
Ruijie(config-ext-nacl)# end
```

8)

```
Ruijie# show access-list test-tcp-flag
ip access-lists extended test-tcp-flag
10 permit tcp any any match-all rst
20 deny tcp any any match-all fin
```

”I ACL

ѝ ACE . ”I ˘ ACL ˘ Л∪ ACL Ю ACE ˘ Л - ˘ έ Ю'

ACE Л∪ Л ’

Л∪ Л ˘ a Л Л∪ У ACE Л ѝ Л∪ Â

Л ACE Л∪ ˘ ч ACE ACE Â

ACL Л Л Â

ip access-list resequence {*acl-id*| *acl-name*} *sn-start sn-inc* ϟ˘ ϟ ϟ Â

Л∪Э ϟ˘ ACL list Ю ace ˘ ⅄ ѝ tst_acl ACL Ю ace Л ѝ'

```
ace1: 10
ace2: 20
ace3: 30
```

ip access-list resequence *tst_acl 100 3*, ACE Л Ю

```
Ruijie(config)# ip access-list resequence tst_acl 100 3
ace1: 100
ace2: 103
ace3: 106
```

a sn-num ╗ ace4 ˇ Л Ю

```
Ruijie(config-std-nacl)# permit Â Â Â
ace1: 100
ace2: 103
ace3: 106
ace4: 109
```

seq-num = 105 ╗ ace5 ˇ Л Ю

```
Ruijie(config-std-nacl)# 105 permit Â Â Â
ace1: 100
ace2: 103
ace5: 105
ace3: 106
ace4: 109
```

Л й 4 ″I ╗ ace Â

ACE

```
Ruijie(config-std-nacl)# no 106
ace1: 100
ace2: 103
ace5: 105
ace4: 109
```

Э Л ≠ ┘Л ACE Â

ѿ ACL

┘Л ACL ˇ ACL У Â

й ˇ ″I У Time-Range Â

Time-Range

Â ▓ ↄ Ш ↑ ŋ Ɛ ▒

Ruijie(config)# **time-range** time-range-name	У Ьѫ ѝ ѧ У
Ruijie(config-time-range)# **absolute** [**start** *time date*] **end** *time date*	ѽ (˩)˘ έ ˩ time range
Ruijie(config-time-range)# **periodic** *day-of-the-week time* **to** [*day-of-the-week*] **time**	(˩)˘ έ ˩ time range
Ruijie# **show time-range**	
Ruijie# **copy running-config** *startup-config*	
Ruijie(config)# **ip access-list extended** *101*	ACL
Ruijie(config-ext-nacl)# **permit ip any** *any* **time-range** *time-range-name*	ѽ ACE

Time Range ѧ ѝ 1 32 ˘ a
ѽ ˩ У a ˘ Time Range
ѽ
˩Л У Â ѝ Time Range
У ѽ ˘ ‡ ѽ

Ю Л ѽ ACL ѝ ˘ HTTP

```
Ruijie(config)# time-range no-http
Ruijie(config-time-range)# periodic weekdays 8:00 to 18:00
Ruijie(config)# end
Ruijie(config)# ip access-list extended limit-udp
Ruijie(config-ext-nacl)# deny tcp any any eq www time-range no-http
Ruijie(config-ext-nacl)# exit
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# ip access-group no-http in
Ruijie(config)# end
```

Ю ѝ Time Range :

```
Ruijie# show time-range
time-range entry: no-http(inactive)
periodic Weekdays 8:00 to 18:00
```

```
time-range entry: no-udp
periodic Tuesday 15:30 to 16:30
```

ACL ˘ ACL У ˘ ≠ У
˘ У ACL ∧ portmap ˘ ⅃Л
∧ ˘ б У ACL a ⅃ . ″I Э˘ . ″I
∧ (∧ Ю IP/IP+MAC)˘ 802.1X ACL ˘ .
ך Э ACL ˘ a ″Ą 802.1X˘
ACL ∧ ˚ ’ a ך ACL ˘ ѫ ″Ą
ך ∧ à 802.1X ACL ˚ ˘
∧ ˘ ∧ ὶй ∧ Â

1. permit deny Â
2. ∧ a
3. ∧ . ″I
4. IP Ю˘ 802.1x ˘
й ˘ IP Ю У Â
5. &Ø@

ㄟЮ ˇ ″I ㄣ ˇ ″Ą ㄟ ὶй ㄟ Â

ÿ ˇ ㄣЛυ ЛυЮ ㄟЮ

₹	₸
Ruijie# **configure terminal**	Â
Ruijie(config)#**interface** *idx*	ㄟ
Ruijie(config-if)#**security access-group** *1*	ㄟЮ

ㄟЮ ㄟˇ ″I ㄣ ㄟ ˇ ″Ą ㄟ

Ю Лυ ὶй '

ㄟ 4 ὶй ㄟˇ IP+MAC

```
Ruijie(config)#interface FastEthernet 0/4
Ruijie(config-if)#switchport port-security
Ruijie(config-if)#switchport port-security mac-address
0000.0000.0011 ip-address 192.168.6.3
```

ㄟ IP й 192.168.6.3 з MAC й 0000.0000.0011 ÿ
ㄟ 4 Э ˇ ѫ ㄟ IPX ㄣЛυ
У ˇ IPX ˇ Ю

```
Ruijie #configure
Ruijie (config)#expert access-list extended safe_channel
Ruijie (config-exp-nacl)#permit ipx any any
Ruijie (config-exp-nacl)#exit
Ruijie (config)#security global access-group safe_channel
```

≠ ㄣЛυ У ㄟ

```
Ruijie #configure
Ruijie (config-if)#expert access-list extended safe_channel
Ruijie (config-exp-nacl)#permit ipx any any
Ruijie (config-exp-nacl)#exit
Ruijie(config)#interface FastEthernet 0/4
Ruijie (config-if)#security access-group safe_channel
```

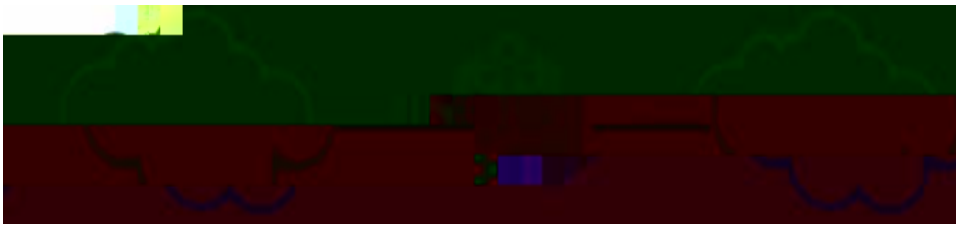
Ю ㄟ Ю˘ “safe_channel”˘ ㄟ 4
IPX Â

TCP ┘

TCP Flag ┘ ACL ╖ Â

й У Э А ˘ ↙ А ў ┘ В ў
TCP ˘ а В ў А TCP
Â

في



4 في

Э في ˘ Ь ч ˘ А б G3/1 ↙ ˘
В б G3/2 ↙ Â

Ÿ

В ў А TCP ˘ ↙ ÿ В
G3/2 ↙ TCP . ┘ Â† TCP ┘
˘ TCP TCP SYN Æ з ACK Æ й 0 Â
˘ ┘ Л Match-all ˘ G3/2 ↙ ↙
┘˘ TCP SYN Æ 1 з ACK Æ й 0 ˘ . ┘
А ┘ В Â

1) ⊮

```
#
Ruijie# configure terminal
#          Ю…              ACL101
Ruijie(config)# ip access-list extended 101
#     TCP Flag   SYN=1˜  з è  ˆ      ACK     Æ˜      Æ и 0
Ruijie(config-ext-nacl)# deny tcp any any match-all syn
#     è   IP
Ruijie(config-ext-nacl)# permit ip any any
```

2) **ʎ Э**

```
#
Ruijie(config-ext-nacl)# exit
#                    ʎ G3/2
Ruijie(config)# interface gigabitEthernet 3/2
#    ACL 101       G3/2      ɹ
Ruijie(config-if)# ip access-group 101 in
```

3)

```
#          Ю˘      show   ʒ     ACL
Ruijie# show access-lists 101
ip access-list extended 101
10 deny tcp any any match-all syn
20 permit ip any any
```

QOS

QOS

Internet Internet Э
У a л a л Ь
“ й”
a ÂQOS Â

QOS Quality of Service Ь ~ Ь Â
й Ь QOS QOS
Â QOS й à ╠ à
Ь Â

QoS

a QoS ╗ a έ Ь л
a У л Â Ї
л Â Ь й
Ї Â

QoS ╗ Ь Â л Л
й Ї
Ї à й Ь Â
QoS ╗ л
╗ Â

QoS Л IETF Internet Engineering Task Force DiffServ
Differentiated Servece Mode Ь ~ й ÂDiffServ
У a л IP
DiffServ IPv4 TOS Type Of Service Ipv6
Traffic Class 6 Â
≠ л Л Э Â У

802.1Q Tag Control Information 3
8 Ї Ь й User Priority bits Â

IPv4 TOS IPv6 Traffic Class
3 IPprecedence value IPv4 TOS
IPv6 Traffic Class 6 Differentiated Services
Code Point (DSCP) value Â

DiffServ ˘ ﻝ↑ ﻯ ﻝ

ﻠ ˘ a ﻝ↑ ﻯ a ﻝ ﻠ Â ↑

ﻝ ﻤ Э ў à è Â ﻝ ﻤ a ﻝ

″I ∧ . ″I Â

Э Ь ‡ ⅃ ⅃ У ∧ Э Â Ю˘ Э Ь
‡ 3 à 2 à 1 . ″I Â. ″I ACLs ˘ Ю˘
⅃ ‡ 2 à 1˘ ˘ ∧ QoS ˘ ‡
‡ 2 1 ÿ ÿ ∧ Э QoS ’ ∧ QoS
˘ ѫ DSCP 0 Â

IP ˘ ⅃ Л∪ ЛЮ ‡ '

∧ ѝ Trust ip-precedence˘ ‡ ÿ IP Ip precedence ^ 3 ~ ∨ ˘ ′I CoS ^ 3 ~ Â

∧ ѝ Trust cos˘ ‡ CoS ^ 3 ~ ∨ Ip Precedence ^ 3 ~ Â ч ˘ У γ a User Priority bits˘ ѫ ⅃ Л∪ ∧ CoS CoS Â ∧ У γ User Priority bits˘ ‡ ÿ ∨ CoS Â

∧ Policy-map Ip access-list (Extended) ACLs ˘ ѫ ∧ Э˘ ∨ IP à IP à Protocol à Л∪ ∧ TCP/UDP ∧ ٦ ACLs˘ Л∪ DSCP Â ˘ ∧ Policy-map˘ ∧ ѝ ѐ DSCP ˘ ‡ ‡ 1 à 2 . ″I Â

IP ‡ У ˘ Л∪ Э ‡ ⅃ ⅃ Л∪ ⅃ У ∧ Э Â Ю˘ Э ‡ 3 à 2 à 1 . ″I Â

Э CoS-to-DSCP map à IP-precedence-to-DSCP map ⅄ Â

Policing

Policing . ˘ ↑ ⅄˘ ↑ ´ Â Policing ╟ У ˘ Police ˘ ѫ ˘ ˘ ∧ DSCP Â

QoS ˘ Policing ╟ ⅃ Â Policing ╟ ˘ ѫ ↑ DSCP a ˘ ≠ a Marking ╟ Â

Marking

Marking˛ ˘ Classifying Policing ╟ Л˘ ѝ ї
DSCP Э Ю У ˘ Marking ╟ ѝ
QoS ˘ ↓Л Ъ QoS ACLs ↓ QoS ˘ ≠ ↓Л Ъ
Trust QoS ˘ ˘ Trust DSCP ÿ IP
DSCP Â

Queueing

Queueing˛ ˘ Ч ˘ Ч
a ↓ a ↓ Ь Â

У Ч Э 8 ˘ Э DSCP-to-CoS Map
Cos-to-Queue Map ч DSCP Л˘ Ъ
Â

Scheduling

Scheduling˛ ˘ ѝ QoS Л У Â Ч a ↓
Э Л˘ WRR è 8 Â

↓Л Ъ WRR ´
, ÿ Â DRR
´ , ÿ
Â

QOS

QOS

QoS ˘ QoS ˘ Ю'

У Ч 1 Policy-map

У Policy-map ↓Л Ъ Class-map

У Class-map 1 ACL˘ ACL ACE é ↓

У Ч Э ACE ÿ ľ ACL Ь

Ю˘ QoS Ń

╗ . Â ∧ QoS ╗ ˘ ┘Л ∧ Policy Map ˘ ∧ ѝ Off . ┘ Â ЛЬЮ ѝ QOS '

CoS	0
	8
	WRR
QueueWeight	1:1:1:1:1:1:1:1
WRR Weight Range	1:15
	No Trust

Cos

CoS	0	1	2	3	4	5	6	7
	1	2	3	4	5	6	7	8

CoS to DSCP

CoS	0	1	2	3	4	5	6	7
DSCP	0	8	16	24	32	40	48	56

IP-Precedence to DSCP

IP-Precedence	0	1	2	3	4	5	6	7
DSCP	0	8	16	24	32	40	48	56

DSCP to CoS

.

DSCP 0 8 16 24 32 40 48 56

ЛЬЮ ҙ ٨ **interface** GigabitEthernet 0/4 ѝ DSCP'

```
Ruijie(config)# interface gigabitEthernet 0/4
Ruijie(config-if)# mls qos trust dscp
Ruijie(config-if)# end
Ruijie# show mls qos interface g0/4
Interface: GigabitEthernet 0/4
Attached input  policy-map:
Default COS: trust dscp
Default COS: 0
Ruijie#
```

٨ CoS

ٸЛЬ ЮО У ٨ CoS

ЮЎ ٨ CoS ѝ 0

ҙ	
configure terminal	
interface *interface*	٨
mls qos cos default-cos	٨ CoS , default-cos

Ȯ

ƙ Ń У

ֽ	
configure terminal	
ip access-list extended {*id* | *name*} **…** **ip access-list standard** {*id* | *name*} **…** **mac access-list extended** {*id* | *name*} **…** **expert access-list extended** {*id* | *name*} **…** **ipv6 access-list extended** *name* **…** **access-list** *id* [**…**]	… ACL ACL
[**no**] **class-map class-map-name**	… class map ,class-map-name … class map ɻ no У class map
[**no**] **match access-group** {*acl-num* | *acl-name* }	֊ ACL, acl-name ẁ … ACL ɻ ˘ acl-num ẁ … ACL idˇ no ֊

˘ ЛЬЮ … У ɻ ẁ Class1 Class-mapˇ У
ACL:acl_1Â Class-map ʈ ʌ ʌ ẁ 80 TCP

```
Ruijie(config)# ip access-list extended acl_1
Ruijie(config-ext-nacl)# permit tcp any any eq 80
Ruijie(config-ext-nacl)# exit
Ruijie(config)# class-map class1
Ruijie(config-cmap)# match access-group acl_1
Ruijie(config-cmap)# end
```

Policy Maps

ɹ ЛЬ Ю … Policy Maps

ֽ	
configure terminal	
	… policymap

[**no**] **policy-map policy-map-name**

[**no**] **class class-map-name**	… ‡ ˘ class-map-name … class map ⅄ no ‡
[**no**]**set ip dscp new-dscp**	ὶ IP ip dscp ’ IP ˘ a ’ new-dscp DSCP ˘ ↓ ң a ⅄ a ⅄
police rate-bps burst-byte [**exceed-action** {**drop**	**dscp dscp-value**}] **no police**	ὶ ‡ ╟ ˘ rate-bps (kbps)˘ burst-byte (Kbyte)˘ drop ‡ ˘ dscp dscp-value ‡ DSCP ˘ dscp-value ↓ ң a ⅄ a ⅄

⅄ У Policy Maps ↓ Э˘ ‡ è police ↓ Â У ↓ ´ Policy Maps police ˘ ⅄ У ↓ У Policy Maps˘ ↓ Policy Maps ⅄ б è а У ˘ è Class ⅄ Л Ь è У ˜ Â

˘ Л Ь Ю … У ⅄ ὶ Policy1 Policy-map˘ Policy-map ↓ Gigabitethernet 1/1

```
Ruijie(config)# policy-map policy1
Ruijie(config-pmap)# class class1
Ruijie(config-pmap-c)# set ip dscp 48
Ruijie(config-pmap-c)# exit
Ruijie(config-pmap)# exit
Ruijie(config)# interface gigabitethernet 1/1
Ruijie(config-if)# switchport mode trunk
Ruijie(config-if)# mls qos trust cos
Ruijie(config-if)# service-policy input policy1
```

↓ Policy Maps

⅄ Л Ь Ю Policy Maps ↓ Э

?	
configure terminal	
interface *interface*	٨
[**no**] **service-policy input policy-map-name**	… Policy Map ٨ Э' policy-map-name … policy map ˇ input й

˧ЛЪ й ٨ ' WRRˇ SPˇ RR DRRˇ Юˇ й WRRˇ)

˧ЛЪ ЛЪЮ ٨ ˝I , QOS Â

?	
configure terminal	
mls qos scheduler {**sp** | **rr** | **wrr** | **drr** | **wfq**}	٨ ˝I ˇ **sp** й ˝I ˇ **rr** й ˇ **wrr** й ˇ **drr** й
no mls qos scheduler	й **wrr**

S3250 ң a DRR

S3250 ң Эˇ WRR ˇ ˇ ٨ й 128Kbps Â ж ˧ ˫ Â

ˇ ЛЪЮ ٨ SPˇ

```
Ruijie# configure terminal
Ruijie(config)# mls qos scheduler sp
Ruijie(config)# end
Ruijie# show mls qos scheduler
```

```
Global Multi-Layer Switching scheduling
Strict Priority
Ruijie#
```


```
7   8
Ruijie(config)#
```

Cos-Map

┘Л Cos-Map ˘ Cos-Map QOS

?	
configure terminal	
priority qid *cos0* [*cos1* [*cos2* [*cos3* [*cos4* [*cos5* [*cos6* [*cos7*]]]]]]]	qid ѝ id,cos0..cos7 ѝ CoS Â
no priority	Cos-Map

Ю CoS Map

```
Ruijie# configure terminal
Ruijie(config)# priority la9ue Cos-Map 1 2 4 6 7 5
Ruijie(config)# end
Ruijie# show mls qos qa9ueing
Cos la9ue map:
cos qid
--- ---
0   1
1   2
2   1
3   4
4   1
5   1
6   1
7   1

wrr bandwidth weights:
qid weights
--- -------
0   1
1   2
2   3
3   4
4   5
5   6
6   7
7   8
```

CoS-to-DSCP Map

CoS-to-DSCP Map CoS DSCP , ┘Л ЛЮ
CoS-to-DSCP Map ,CoS-to-DSCP Map
QOS

╕	
configure terminal	
mls qos map cos-dscp *dscp1...dscp8* **no mls qos map cos-dscp**	CoS-to-DSCP Map ,dscp1...dscp8 CoS 0 7 DSCP ,DSCP ┘ ц a ┘ a ┘

Ю '

```
Ruijie# configure terminal
Ruijie(config)# mls qos map cos-dscp 56 48 46 40 34 32 26 24
Ruijie(config)# end
Ruijie# show mls qos maps cos-dscp
cos dscp
--- ----
0   56
1   48
2   46
3   40
4   34
5   32
6   26
7   24
```

DSCP-to-CoS Map

DSCP-to-CoS DSCP CoS ˘ Л й

DSCP-to-CoS Map QOS , ┘Л ЛЮ
DSCP-to-CoS Map :

╕	
configure terminal	

mls qos map dscp-cos *dscp-list* **to** *cos*	DSCP to COS Map˘ *dscp-list*: DSCP ˘ DSCP ĭ ˘ ↓ ң a ↓ a ↓ ;*cos*: DSCP CoS ˘ ↓ ὶ' 0 7ʼ
no mls qos map dscp-cos	ὶ

˘ ЛЪЮ DSCP 0 à 32 à 56 6ʼ

```
Ruijie# configure terminal
Ruijie(config)# mls qos map dscp-cos 0 32 56 to 6
Ruijie(config)# show mls qos maps dscp-cos
dscp cos    dscp cos    dscp cos    dscp cos
---- ---    ---- ---    ---- ---    ---- ---
 0   6      1   0      2   0      3   0
 4   0      5   0      6   0      7   0
 8   1      9   1     10   1     11   1
12   1     13   1     14   1     15   1
16   2     17   2     18   2     19   2
20   2     21   2     22   2     23   2
24   3     25   3     26   3     27   3
28   3     29   3     30   3     31   3
32   6     33   4     34   4     35   4
36   4     37   4     38   4     39   4
40   5     41   5     42   5     43   5
44   5     45   5     46   5     47   5
48   6     49   6     50   6     51   6
52   6     53   6     54   6     55   6
56   6     57   7     58   7     59   7
60   7     61   7     62   7     63   7
```

↓

↓ Л Ъ ЛЪЮ ↓

ʒ	
configure terminal	
interface *interface*	↓

rate-limit { **input** | **output** }
bps *burst-size*

no rate-limit	↓ ↑

```
Ruijie# configure terminal
Ruijie(config)# interface gigabitEthernet 0/4
Ruijie(config-if)# rate-limit input 100 100
Ruijie(config-if)# end
Ruijie#
```

IPpre to DSCP Map

IPpre-to-Dscp IPpre DSCP , IPpre-to-DSCP Map QOS , ↓ ∏ ∏ЬЮ IPpre-to-Dscp Map

QOS

class-map

ل Л Ъ Л Ъ Ю class-map

ٹ	
show class-map [*class-name*]	class map

'

```
Ruijie# show class-map
Class Map cc
Match access-group 1
Ruijie#
```

policy-map

ل Л Ъ Л Ъ Ю Policy-map

ٹ	
show policy-map [*policy-name* [**class** *class-name*]]	QoS policy map˘ policy-name ѝ policy map ل˘ class class-name policy map class map Â

'

```
Ruijie# show policy-map
Policy Map pp
Class cc
Ruijie#
```

mls qos interface

ل Л Ъ Л Ъ Ю ٨ qos

ٹ	
show mls qos interface [*interface* | *policers*]	٨ QoS , Policers ٨ Policy map

ˈ

```
Ruijie# show mls qos interface gigabitEthernet 0/4
Interface: GigabitEthernet 0/4
Attached input  policy-map: pp
Default COS: trust dscp
Default COS: 6
Ruijie#show mls qos interface policers
Interface: GigabitEthernet 0/4
Attached input  policy-map: pp
Ruijie#
```

mls qos queueing

˩ᏁᏅ ᏁᏅЮ qos

٦	
show mls qos queueing	QoS , CoS-to-queue map˘ wrr weight ˧ drr weight;

Юʻ

```
Ruijie# show mls qos queueing
Cos-queue map:
cos qid
--- ---
0   1
1   2
2   1
3   4
4   1
5   1
6   1
7   1
wrr bandwidth weights:
qid weights
--- -------
0   1
1   2
2   3
3   4
4   5
5   6
6   7
```

7 8

mls qos scheduler

G!5ЭВЛu ЛuЮ

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

```
Ruijie# show mls qos maps ip-prec-dscp
ip-precedence dscp
------------- ----
0     56
1     48
2     46
3     40
4     34
5     32
6     26
7     24
```

mls qos rate-limit

ل Л ЛЮ ٨

٩	
show mls qos rate-limit [**interface** *interface*]	[٨]

```
Ruijie# show mls qos rate-limit
Interface: GigabitEthernet 0/4
rate limit input bps = 100 burst = 100
```

show policy-map interface

ل Л ЛЮ ٨ policymap

?	
show policy-map interface *interface*	[^] policymap

```
Ruijie# show policy-map interface f0/1
FastEthernet 0/1  input (tc policy): pp
Class cc
set ip dscp 22
mark count 0
```

a mark count

QOS

ЛЬЮ ч б QOS ACL ђ

```
#
Ruijie#configure
Enter configuration commands, one per line.  End with CNTL/Z.
#  Њ Ј й salary_acl       ACL
Ruijie(config)#ip access-list standard salary_acl
#  Њ  ‡ў          Ь
Ruijie(config-std-nacl)#permit host 192.168.217.223
#
Ruijie(config-std-nacl)#exit
#…  Ј й salaryclass   class mapў      class-map
Ruijie(config)#class-map salaryclass
#  Њ ђ      ‡
Ruijie(config-cmap)#match access-group salary_acl
#
Ruijie(config-cmap)#exit
#…  Ј й salarypolicy      ў      policy-map
Ruijie(config)#policy-map salarypolicy
#             ¦      ‡ й salaryclass
Ruijie(config-pmap)#class salaryclass
#             Ь  Л              a     512Kbpsў             й
32 Kbyteў     з                  Â
Ruijie(config-pmap-c)#police 512 32  exceed-action drop
#      class-map
Ruijie(config-pmap-c)#exit
#
```

```
Ruijie(config-pmap)#exit

#    G0/2    ٨

Ruijie(config)#interface gigabitEthernet 0/2

#  salarypolicy          G0/2 ٨     ٨   ٫

Ruijie(config-if)#service-policy input salarypolicy

#

Ruijie(config-if)#end

#        Ю  show   ٤

Ruijie#show mls qos interface policers
Interface: GigabitEthernet 0/2
Attached input  policy-map: salarypolicy
Ruijie#show policy-map salarypolicy
 Policy Map salarypolicy
    Class salaryclass
      police 512 32 exceed-action drop

Ruijie#show class-map salaryclass
 Class Map salaryclass
```

RLDP

RLDP

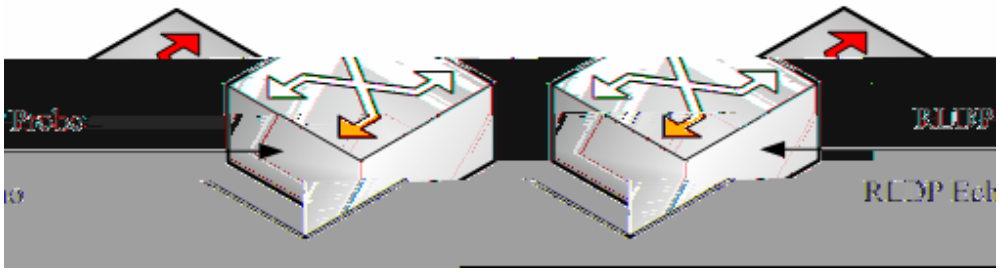
RLDP

RLDP Rapid Link Detection Protocol ʎ ў У
Л Â

У Л ɻ ˘ ╟
Â У ˘ У Ю
ѝ ɻ ˘ ″I ʎ Э ″I ˘ ″I
˘ ɻ Э linkup ˘ ɣ .
Â ″Ą ч ɻ Л У ˘
˘ ˘ ɻ Â

RLDP ɻ Л Л ˘ ɻ
à ɻ ɻ à Â

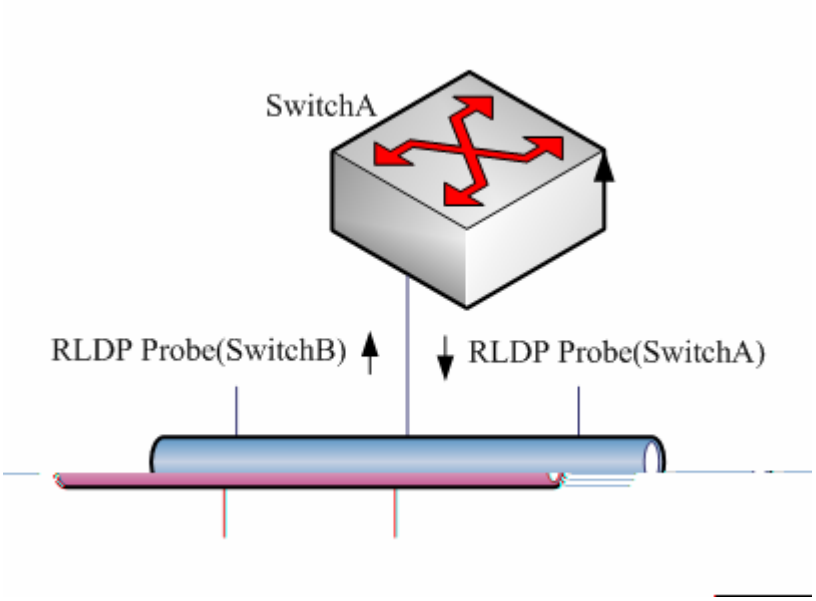
RLDP ч RLDP ˘ Юفي '



1 في

RLDP Ѭ ч ' (Probe) (Echo).RLDP
RLDP з linkup ʎ ʎ Probe ˘
ʎ ˘ ɻ ≠ ʎ ≠ Probe Â
У Э ˘ ѫ У ʎ ʎ
Л ɻ ʎ Â ‡ Â

RLDP



لـ 3 في

ˆ لا لا لا لـ

RLDP ˇ في Э Â ˜ لـ لـ لـ ˝I

ˆ سخ قى

ч У RLDP ≠ ѝ ↰ ⅄ ⅄ ˘
↰ ⅄ ⅄ ч RLDP˘ Л∪
Â

RLDP

ÿ ЛЬЮ RLDP

RLDP

RLDP

↰ RLDP

Ű

ù

ȟ ∪ ьь ά ¸

~

RLDP ㄴ ㄴ(AP) ㄴ Â

RLDP untag Â

RLDP block ╖ STP Â ≠
ㄴ ù blcok ‡ stp ‡ STP ㅣ
ˇ ㅣ STP ㄴ ˇ RLDP. ㄴ block Â

RLDP

ㄴ RLDP ˇ ㄴ RLDP Â

ЮˇЮ RLDP'

ʒ	
Ruijie(config)# **rldp enable**	RLDP ╖ Â
Ruijie(config)# **end**	Â

RLDP ʒ **no** Â

ㄴ RLDP

RLDP ㄴ ˇ ㄴ RLDP Â ㄱ
ㄴ RLDP ˇ ㅣ ㄴ ЛЬ ㄱ Â
' unidirection-detecf ㅣ ~ à bidirection-detecf ㄱ ㅣ
~ à loop-detecf ~ Â ' warning ~ à block
ˆ ㄴ ~ à shutdown-porf ㄴ ~ à shutdown-svi
ㄴ svi~ Â

ЮˇЮ ㄴ RLDP ╖ '

ʒ	
Ruijie(config)# **interface** *interface-id*	ㄴ
Ruijie(config-if)# **rldp port** {**unidirection-detect** | **bidirection-detect** | **loop-detect** } {**warning** | **shutdown-svi** | **shutdown-port** | **block**}	ㄴ RLDP ㅣ Â

Ruijie(config-if)# **end**	

ㄴ RLDP ̃ ʒ **no** У Â

ЛЬЮ GigabitEthernet 0/5 Э RLDP

```
Ruijie# configure terminal
Ruijie(config)# interface gigabitEthernet 0/5
Ruijie(config-if)# rldp port unidirection-detect shutdown-svi
Ruijie(config-if)# rldp port bidirection-detect warning
Ruijie(config-if)# rldp port loop-detect block
Ruijie(config-if)# end
Ruijie# show rldp interface gigabitEthernet 0/5
port state     : normal
local bridge   : 00d0.f822.33ac
neighbor bridge : 0000.0000.0000
neighbor port  :
unidirection detect information:
action : shutdown svi
state  :  normal
bidirection detect information :
action : warnning
state  :  normal
loop detect  information    :
action : block
state  :  normal
```

ㄴ

ㄴ a shutdown-svi ˘ ㄴ a Â

ㄴЮ a RLDP ˘ ‡ ㄴ Â

aggregate port Э block з ㄴ ˘ ‡ ㄴ a ㄱ aggregate port ㄴ ˘ ‡ ㄴ a У Â

RLDP ˘ ‡ Â ㄱЛЬ log ╖ log Ь ˘ log ㄱЛЬ 3 Â

ㄱ ˚ ˘ ң block ㄴЎ cpu, й block ˘ ㄴ block ˘ Ў cpu, ˘ Лb shutdown-port Â

Ю˜ Ю 小 RLDP '

```
-----------------------------------------------
interface GigabitEthernet 0/1
port state:normal
neighbor bridge : 00d0.f800.41b0
neighbor port   : GigabitEthernet 0/2
unidirection detect information:
action : shutdown svi
state  : normal
interface GigabitEthernet 0/24
port state:error
neighbor bridge : 0000.0000.0000
neighbor port   :
bidirection detect information :
action : warnning
state  : error
```

ÿ Э ˩ Л Ъ ˇ ˄ GigabitEthernet 0/1 ˫ ˇ ɜ ˇ ˄ ѝ (normal) Â ˄ GigabitEthernet 0/24 ˩ ˫ ˇ ɜ ˩ ˫ Â

˄ RLDP

Ю Ю ɂ ˄ RLDP '

ɂ	
Ruijie# **show rldp interface** *interface-id*	*interface-id* rldp Â

ЛЪЮ **show rldp interface GigabitEthernet** *0/1* ɂ fas0/1 ˄ rldp '

```
Ruijie# show rldp int GigabitEthernet 0/1
port state     :error
local bridge   : 00d0.f8a6.0134
neighbor bridge : 00d0.f822.57b0
neighbor port  : GigabitEthernet 0/1
unidirection detect information:
action: shutdown svi
state :  normal
bidirection detect information :
action : warnning
state :  normal
loop detect  information   :
action: shutdown svi
state :  error
```

ÿ Э ㄴ Л ˇ ㄲ GigabitEthernet 0/1 Ь ˈ ㄱ
à ㄱ ㄱ à , ˆ й ㄲ svi à ң
à ㄲ svĭ è ˇ ㄲ й
errorˇ ˇ ㄲ svi ≠ shutdown Â

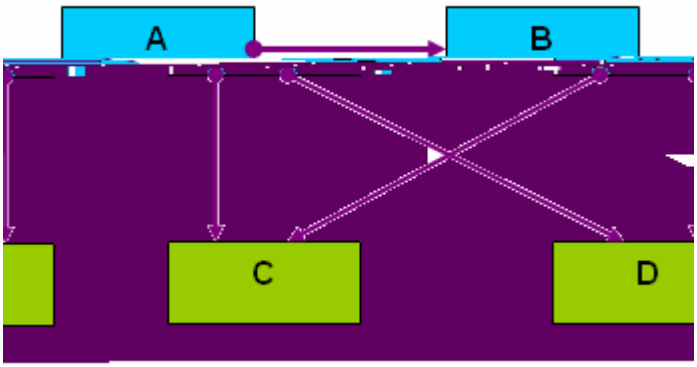
TPP

TPP

TPP(Topology Protection Protocol) У Â
˘ ˘ ˩ CPU
à ˘ Â ў
ˆ CPU à ă ~
Â б
˘ ╖ . ”I ˘ ˩ Л
Â

TPP

ў MSTP VRRP Л ч è ǂ ˩
ң Â MSTP VRRP ╟
˘ ╟ ˩ Â ≠ ˩ ˘ ˩
ѝ ˘ CPU ˘ ˩
˘ ÿ ˘
~ Â ╖ ѝ а ˘ б
è ǂ ˆ MSTP à VRRP ~ ˩ ˘ ÿ ╕ à ˩ Â



في 1

Э في ч ˘ في A à B ѝ Ь ˘ C à D ѝ ү Â A ѝ
MSTP ˘ ╖ Â

Ь A ˩ CPU à Ѝ.A’Û И ó ╖

D B ˘ Â

B ↓ CPU ˘ a ˘
↓˘ ↓ Â A ↓˘
˘ è ˘ a У Â Ю γ C à D
↓˘ è ˘ У ˘ ÿ
Â

TPP

TPP ╥ ∧╥ Â ╥
╥ ˘ Ю˘ ╥ ˘
˘ ң Â a a ↓
Â ∧╥ ∧ ╥ ˘ ∧ ╥
˘ ˘
˘ ∧ Â Ю˘ ∧ ╥
Â

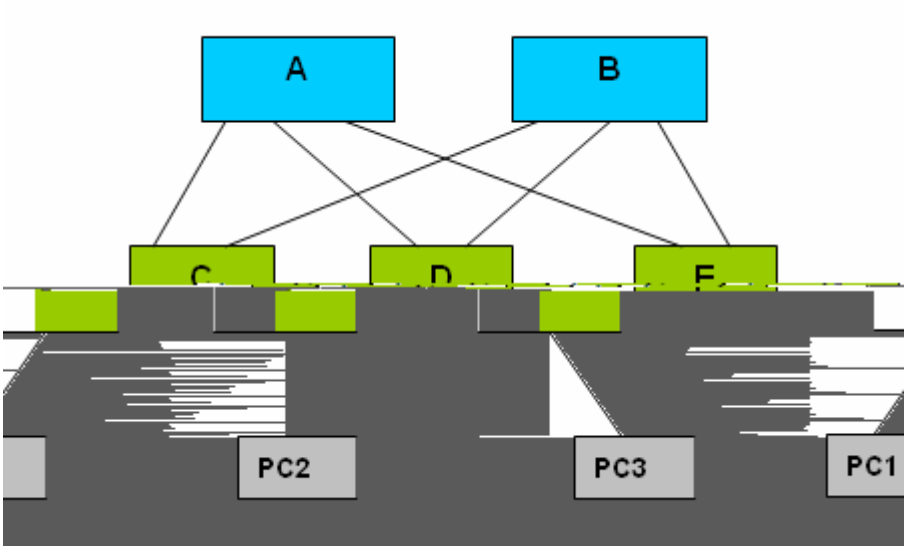
╥ ˘ з ╥
Â ∧ ˘ TPP ╥ ˘ cpu topology-limit ҁ cup
˘ cpu ˘ ң Â
У Э Æ ˘ 50-70, TPP й
Â æ˘ ‡ ↓ ⁋
TPP a⁋ ˘ ˘ ‡ ↓ ң TPP
˘ TPP ╥ Â

╥ Â ҁ **no** Â
ҁ Ю˙

ҁ	
Ruijie> **enable**	ҁ
Ruijie# config terminal	
Ruijie(config)# **topology guard**	
Ruijie(config)# **end**	ҁ

no topology guard

Ruijie> **enable**	



2 في

في A à B ù Ь ˘ C à D E ù γ Â

Ь A à B γ C à D E MSTP ˙ ч ˙ Ь
VRRP Â ╗ MSTP VRRP ╗ ˘
a Â

Ь A à B ╗ ˘ ˙ ˄
╗ Â ˙ γ C à D E ╗ Â

TPP

˙ TPP Ю'

TPP ˥

TTP ˥

Ю Ю ʒ TTP ˥ '

ʒ	
Ruijie# show tpp	TPP ˥ Â

```
Ruijie #show tpp
tpp state        : enable
tpp local bridge  : 00d0.f822.35ad
----------------------------------
```

˚

~

flash Э˘ ˚ a 128M ’

‡˘ ╟ ˘ ∧ ˘ Ю ˚ ҂

dir Â ˘ ˚ ∧˘ ╟ У

˚ Â

⁋

ÿ ⁋ Â

Ю˘ Ю ҂'

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Ю Ю

Ruijie# **rename flash:** *old_filename* **flash:** *new_filename*	*old_filename* *new_filename*

Ruijie# **pwd**	

˘ ⅄ UP à DOWN ˘ У Ү˚
à Â ⁄ ң У ˘ ⅄
Ү˚ ˘ ╟ ^ ~ ˘ ⅄ Л∪
⁄ˆ ⁄ à VTY ~ Э ӯˆ ŭ ш à FLASH˜ Э
Э У Ь Э˘ ǂ Æ Â ⅄ ѝ
⁄ ˘ ⅄ Л∪ Э ⁄˘
. ″I ǂ Â

⁄ ң Ю'

<priority> seq no: timestamp sysname

%ModuleName-severity-MNEMONIC: description

' < ″I > ⁄ ⅃ ⅃-ш - '
. ″I ¯ 8¯ ш
'

```
<189> 226:Mar  5 02:09:10 S3250 %SYS-5-CONFIG_I: Configured from console
by console
```

~

⁄ . a . ″I ˘ . ″I ⅄
Syslog Server Â

Ю ˘ ˘ a ⁄ .
˘ a Syslog Ь ˘ ≠ a
ӯˆ ŭ ш à FLASH˜ Э Â

˘ Ю ЛЬЮ ҂'

҂	
Ruijie(config)# **logging on**	
Ruijie(config)# **no logging on**	

~

У Ю˘ a ˘ . ˘ ‡ ⅃ ЛЬ a ⅄ . Â

ЛЬ ⅄˘ a ⅃ ЛЬ ⅄ Э ˘ ≠ ⅃ ЛЬ a ⅄ Â

a ⅄ ˘ Ю ЛЬЮ ҂'

҂	
Ruijie(config)# **logging buffered** [*buffer-size* | *level*]	ă ш
Ruijie# **termninal monitor**	VTY ⅄ Э
Ruijie(config)# **logging** *host*	Э Syslog Sever
Ruijie(config)# **logging file flash:***filename* [*max-file-size*] [*level*]	FLASH Э

Logging Buffere ă ш Â ă ш ˘ . ă ш ЛЬ ⅄˘ Â ă ш ˘ ҂ **show logging** Â ă ш ˘ ҂ **clear logging** Â

Termninal Monitor VTY(Telnet ⅄) Э Â Logging Host Syslog Server ˘ ⅄ ң 5 Syslog Server Â ⅄ ↑ Syslog Server Â

Ю Ъ a Â ╗ Э Ы Ъ
Ю ЛЬЮ ʒ'

ʒ	

ٹ	
Ruijie(config)# **logging console** *level*	٨ Э
Ruijie(config)# **logging monitor** *level*	VTY ٨(telnet ٨) Э
Ruijie(config)# **logging buffered** [*buffer-size* | *level*]	ă ש
Ruijie(config)# **logging file flash:***filename* [*max-file-size*] [*level*]	FLASH Э
Ruijie(config)# **logging trap** *level*	Syslog Server

٨ ң ٭ ŕ ЛЪЮ 8 '

Emergencies	0	˘ a
Alerts	1	. ٨
Critical	2	
Errors	3	
warnings	4	
Notifications	5	˘ a
informational	6	
Debugging	7	

˘ ˘ . 0 Â

Л Л˘ æ

Â ٹ **logging console *6*** Л Л˘ й 6

6 ٨ Э Â

٨ й 7 Â

VTY ٨ й 7 Â

Syslog Server й 6 Â

ă ש й 7 Â

FLASH й 6 Â

٦ Л ٹ **show logging** a ٦ Э

Â

Syslog Server . ″I У ↑ ˘ ң

Â

˘ Ю ЛЪЮ ʒ'

ʒ	
Ruijie(config)# **logging facility** *facility-type*	
Ruijie(config)# **no logging facility** *facility-type*	ѝ Â

Ю Ѭ'

Numerical Code	Facility
0	kernel messages
1	user-level messages
2	mail system
3	system daemons
4	security/authorization messages
5	messages generated internally by syslogd
6	line printer subsystem
7	network news subsystem
8	UUCP subsystem
9	clock daemon
10	security/authorization messages
11	FTP daemon
12	NTP subsystem
13	log audit
14	log alert
15	clock daemon
16	local use 0 (local0)
17	local use 1 (local1)
18	local use 2 (local2)
19	local use 3 (local3)
20	local use 4 (local4)
21	local use 5 (local5)
22	local use 6 (local6)
23	local use 7 (local7)

Л ң ѝ 23 Â

Ю Syslog Server й ˇ
Â

Log IP ˇ Log Â

ˇ Ю ЮЮ '

Ruijie(config)# **logging source interface** *interface-type interface-number*	
Ruijie(config)# **logging source ip** *A.B.C.D*	ip

LOG

Ю б ˇ a LOG Â
/ LOG ˇ LOG Â
Ю ЮЮ '

Ruijie(config)# **logging userinfo**	/ LOG '
Ruijie(config)# **logging userinfo command-log**	ˇ LOG

й ˇ Ю ЮЮ '

Ruijie# **show logging**	ˇ
Ruijie# **show logging count**	
Ruijie# **clear logging**	
Ruijie# **more flash:***filename*	FLASH

~

show logging count

ЛЬЮ У ℸ У ὴ

```
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# ip address 192.168.200.42 255.255.255.0
Ruijie(config-if)# exit
Ruijie(config)# service sequence-numbers          //
Ruijie(config)# service timestamps debug datetime   //     debug

Ruijie(config)# service timestamps log datetime  //     log

Ruijie(config)# logging 192.168.200.2    //     syslog server
Ruijie(config)# logging trap debugging        //
                                                    syslog server
Ruijie(config)# end
```

POE

POE Power Over Ethernet PD IP Phone WLAN AP Network Camera 45V~-57V PD

PSE Power Sourcing Equipment 3/5 1 3 2 6 100m

POE 80 POE 60 POE

S3250 S3250P POE

POE

/

POE

POE

POE PD

PD Â

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à POE à POE à
à Â

1-1

POE	/ ì		·
	ì ¶	15.4	·
	POE	45	·
	POE	57	·
		╟	—
		AC	·
PD	POE ì	.	.

/ ì

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```
Ruijie(config-if)# poe enable
Ruijie(config-if)# no poe enable
Ruijie(config-if)# end
Ruijie#
```

POE

˘ POE Л∪ ∧ ⅃ ѝ 45V Â
⅃Л∪ ∧ ˘ 45 ~47
Â æ ˘ ╟ ∧
Â

⅃Л∪ Ю ҙ ∧ Â Ю Ю
Â

1-3 POE

ҙ	
configure	
poe-power lower *lower* | **no poe-power lower**	POE / ѝ
end	
show run	
copy running-config startup-config	▫

Ю˘ ∧ ╖ ѝ 45 Â
˘ ╖ ѝ 46

```
Ruijie#
Ruijie# configure
Ruijie(config)# poe-power lower 46
Ruijie(config)# end
Ruijie#
```

POE

POE Â Л∪⅃Л∪ ∧ ⅃ ѝ
˘ 55 ~57

POE

ㄴㄩ Â

1-5

ʒ	
configure	
poe disconnect-mode {ac | dc} | no poe disconnect-mode	/ ѝ
end	
show run	
copy running-config startup-config	˚

Ю˘ ѝ AC Â

˘ ѝ DC

```
Ruijie#
Ruijie# configure
Ruijie(config)# poe-disconnect-mode dc
Ruijie(config-if)# end
Ruijie#
```

ㄟ/

POE ㄟㄩㄐ POE ˘

Ю ˘ ㄩ Â ㄴㄩ Ю show ʒ ㄴ ㄟ Â

ʒ	
show poe interfaces gigabitEthernet [*interface-id*]	ㄟ
show poe interfaces	POE ㄟˆ POE 24 ㄟ˜
show poe powersupply	POE
show running-config interface [*interface-id*]	ㄟ .

' ㄟ gigabitethernet 0/2 '

```
Interface               : Gi0/2
Port Power Enabled      : ENABLE
Port connect status     : ON
Port Max Power          : 15.4 W
```

```
Port Current Power     : 15.4 W
Port Peak Power        : 15.4 W
Port current icut      : 12 mA
Port trouble cause     : normal
Port Pd Class          : 1
Port voltage           : 48 V
```

' Port trouble cause Ю ˘ é Ю'

Port trouble cause	
normal	ˆ ˜ à AC/DC ( ) à Disableˆ ˜
overload during start-up	˘ ( )
port off due to overload event	PD ( )
short circuit event	PD ( )
voltage is out of established bounds	( )
temperature rise too high	( )
power overload	ℸ ( )

ЛЪЮ й POE '

```
Ruijie# show poe powersupply
PSE Total Power :1200.0 W
PSE Total Power Consumption : 0 W
PSE Available Power : 1200.0 W
PSE Peak Value : 0 W
PSE Min Allow Voltage : 45 V
PSE Max Allow Voltage : 57 V
PSE Disconnect Sense Mode : ac
```

S7600P-48GT й PSE˝ ЛЪЮ й S7600 ң POE '

```
External Power Mangement: auto
External PSE Total Power: 1200.0 W
External PSE Total Power Consumption : 0 W
External PSE Total Remain Power Consumption : 1200.0 W
External PSE Peak Value : 0 W
External PSE Min Allow Voltage : 45V
External PSE Max Allow Voltage : 57V
External PSE SYS Voltage: 48 V
External PSE Disconnect Sense Mode : ac
```

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	SWITCH

/I

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ў ˘ . ″I У ˘ ‡ MAC ˘ MAC
ѝ ў Â . ″I Л Â

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ѝ ў Â . ″I ÿ æ ѝ 1-10˝ ѝ 1˝
. ″I Â ╟ **show member** ҳ ˘ ┘
Љ MAC Љ ┤ Â

ÿ N Л Э ‡
Љ Â

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˘ è . ″I Ю ѝ ˘ Л ˘
ѝ ў Â

. ″I

Ю, Ю ҳ :

ֽ	
Ruijie# **show version devices**	
Ruijie# **show version slots**	
Ruijie# **show version**	
Ruijie# **show member** [*member*]	*member*: ؍ 1-MAX,

:

```
Ruijie#show version devices

Device  Slots  Description
------  -----  --------------------
1       3      RG-S5750-24GT/12SFP
2       3      RG-S5750-48GT/4SFP
3       3      RG-S5750-24GT/12SFP
4       3      RG-S5750-24GT/12SFP
5       3      RG-S5750-24GT/12SFP
6       3      RG-S5750-24GT/12SFP
7       3      RG-S5750-24GT/12SFP
8       3      RG-S5750-48GT/4SFP
```

```
Ruijie#show version slots

Device  Slot  Ports  Max Ports  Module
------  ----  -----  -----  --------------------
1        0     24      24    M5750-24GT/12SFP_Static_Module
1        1     1      1       M5700_STACK_IB4X
1        2     0      1
2        0     48     48     M5750-48GT/4SFP_Static_Module
2       1     1      1         M5700_STACK_IB4X
2       2     1      1         M5700_STACK_IB4X
3       0      24     24      M5750-24GT/12SFP_Static_Module
3       1     1      1         M5700_STACK_IB4X
3       2     1      1         M5700_STACK_IB4X
4       0    24       24     M5750-24GT/12SFP_Static_Module
4       1     1      1         M5700_STACK_IB4X
4       2     1      1         M5700_STACK_IB4X
5       0     24   24         M5750-24GT/12SFP_Static_Module
5       1     1      1         M5700_STACK_IB4X
5       2     1      1         M5700_STACK_IB4X
6       0     24     24       M5750-24GT/12SFP_Static_Module
6       1     1      1         M5700_STACK_IB4X
6       2     0      1
7       0     24     24       M5750-24GT/12SFP_Static_Module
7       1     1      1         M5700_STACK_IB4X
```

```
7       2     1     1          M5700_STACK_IB4X
8       0     48    48         M5750-48GT/4SFP_Static_Module
8       1     1     1          M5700_STACK_IB4X
8       2     1     1          M5700_STACK_IB4X
```

Ruijie#**show version**

```
System description : Red-Giant 10G Routing
Switch(RG-S5750-24GT/12SFP) By Ruijie Network
System start time       : 2007-4-23 17:39:11
System hardware version : 1.0
System software version : RGOS 10.1.00(2), Release(12889)
System BOOT version     : 10.1.11330
System CTRL version     : 10.1.11330
System Serial Number    : 1234942570002
Device information:
Device-1
Hardware version : 1.0
Software version : RGOS 10.1.00(2), Release(12889)
BOOT version     : 10.1.11330
CTRL version     : 10.1.11330
Serial Number    : 1234942570002
Device-2
Hardware version : 1.0
Software version : RGOS 10.1.00(2), Release(12889)
BOOT version     : 10.1.11330
CTRL version     : 10.1.11330
Serial Number    : 1234942570001
Device-3
Hardware version : 1.0
Software version : RGOS 10.1.00(2), Release(12889)
BOOT version     : 10.1.11330
CTRL version     : 10.1.11330
Serial Number    : 1234942570003
Device-4
Hardware version : 1.0
Software version : RGOS 10.1.00(2), Release(12889)
BOOT version     : 10.1.11330
CTRL version     : 10.1.11330
Serial Number    : 1234942570004
Device-5
Hardware version : 1.0
Software version : RGOS 10.1.00(2), Release(12889)
BOOT version     : 10.1.11330
CTRL version     : 10.1.11330
Serial Number    : 1234942570005
Device-6
```

```
Hardware version : 1.0
Software version : RGOS 10.1.00(2), Release(12889)
BOOT version     : 10.1.11330
CTRL version     : 10.1.11330
Serial Number    : 1234942570006
Device-7
Hardware version : 1.0
Software version : RGOS 10.1.00(2), Release(12889)
BOOT version     : 10.1.11330
CTRL version     : 10.1.11330
Serial Number    : 1234942570007
Device-8
Hardware version : 1.0
Software version : RGOS 10.1.00(2), Release(12889)
BOOT version     : 10.1.11330
CTRL version     : 10.1.11330
Serial Number    : 1234942570008
```

Ruijie#**show member**

```
Member     Mac Address     Priority Software Version
Hardware          Version   Description
------     -------------   ------------------------
----------------------------
1        00d0.f810.3323  1        RGOS 10.1.00(2),
Release(12889)  1.0        SWITCH
2        00d0.f822.33aa  1        RGOS 10.1.00(2),
Release(12889)  1.0        SWITCH
3        00d0.f822.33ae  1        RGOS 10.1.00(2),
Release(12889)  1.0        SWITCH
4        00d0.f822.33b0  1        RGOS 10.1.00(2),
Release(12889)  1.0        SWITCH
5        00d0.f822.33b2  1        RGOS 10.1.00(2),
Release(12889)  1.0        SWITCH
6        00d0.f824.23b4  1        RGOS 10.1.00(2),
Release(12889)  1.0        SWITCH
7        00d0.f833.44b4  1        RGOS 10.1.00(2),
Release(12889)  1.0       SWITCH
8        00d0.f855.33ae  1        RGOS 10.1.00(2),
Release(12889)  1.0        SWITCH
```