RG-S3760

RGOS 10.3(5b1)

RGOS®10.3(5b1)

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،

،

1.

5

Courier New 5

2.

Arial

[] []

{ x | y | ... }

[x | y | ...]

//

3.

~

&

&

1

-
-
-
- **no** **default**
- CLI
-
-
- CLI
- CLI

1.1

?

User EXEC

show

Privileged EXEC

User EXEC		Ruijie>	**exit** **enable**	
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**	

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

1.3

show configuration

```
Ruijie# show conf
```

1.4 no default

no **no**

no shutdown

shutdown **no**

default **default**

default **no**

default

no **default**

1.5 CLI

CLI

CLI

% Ambiguous command "show c"		
% Incomplete command		
% Invalid input detected at '^' marker	^	

1.6

Ctrl-P	
Ctrl-N	Ctrl-P

~

VT100

1.7

›

›

1.7.1

	Ctrl-E

mac-address-table static

20

$ 20

```
mac-address-table  static  00d0.f800.0c0c  vlan  1
interface
$tatic  00d0.f800.0c0c  vlan  1  interface  fastEthernet
$tatic  00d0.f800.0c0c  vlan  1  interface  fastEthernet  0/1
```

Ctrl-A

$

```
-address-table  static  00d0.f800.0c0c  vlan  1 interface  $
```

~

80

1.8 CLI

1.8.1 Show

show

Ruijie# **show** *any-command* **|**
begin *regular-expression*

K,XS!k

Ruijie# **show** *any-command* | **exclude** *regular-expression*	show

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

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

”ia” ”ip address”

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

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

”**ip address**”

show aliases

1.9.1 CLI

CLI

2

2.1

-
-
-
-
-
-
-
-
-
- telnet
-
-
-

&

CLI

2.2

2.2.1

TFTP

enable secret

2.2.2

15

2.2.3

15

Ruijie(config)# **enable password**
[**level** *level*] {*password* | *encryption-type encrypted-password*}

2.2.4.1

Ruijie# **configure terminal**	
Ruijie(config)# **privilege mode** [**all**] {**level** *level* | **reset**} *command-string*	mode CLI **config** **exec** **interface** all **level** *level* 0 15 **level** 1 **level** 15 **enable/disable** *command-string*

no privilege mode [**all**]

level *level command*

2.2.4.2

reload 1 1
test

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

1

```
Ruijie# disable 1
Ruijie> reload ?
at                  reload at a specific time/date
```

```
cancel              cancel pending reload scheme
in                  reload after a time interval
<cr>
```

reload

```
Ruijie# configure 5.8ejnal
Ruijie(config)# privilege exec all reset reload
Ruijie(config)# end
```

1

2.3

2.3.1

AAA

RADIUS

RADIUS

RADIUS

2.3.2

AAA

AAA

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

2.3.3

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

&

AAA Radius AAA

2.4

2.4.1

( ) (

)

2.4.4

calendar

clock update-calendar

Ruijie# **clock update-calendar**	

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

2.5

2.5.1

reload [modifiers] scheme
( )
modifers **reload**
modifiers **in at cancel**

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

mmm *hhh:mm*
string

10 **reload in** *10 test*

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

200 string 2005-01-10
14:31 **reload at** *08:30 11 1*
2005 newday 2005-12-10 14:31
2006-01-01 12:00 **reload at** *12:00 1 1 2006 newyear*

3. **reload cancel**

8 30

reload cancel

&

at

200

,

2.5.2

Ruijie# **reload at** *hh:mm month day year* [*reload-reason*]	year month day hh mm reload reload reload-reason ( )

2005 1 11 12:00 (
2005 1 11 8:30)

```
Ruijie# reload at 12:00 1 11 2005 midday//

Ruijie# show reload                    //
Reload scheduled in 16581 seconds.
At 2005-01-11 12:00
Reload reason: midday
```

2.5.3

Ruijie# **reload in** *mmm* [*reload-reason*]	*mmm* **reload** **reload** *reload-reason*( )
Ruijie# **reload in** *hhh:mm* [*reload-reason*]	*hhh* *mm* **reload** **reload** *reload-reason*( )

125 **reload** (2005-01-10 12:00)

```
Ruijie# reload in 125 test                    //

Ruijie# reload in 2:5 test                    //
Ruijie# show reload                          //
System will reload in 7485 seconds.
```

2.5.4

reload

reload

2.5.5

Ruijie# **reload cancel**	

2.6

2.6.1

(System Name)

CLI 32

32

S2924G R2692

2.6.2

Ruijie(Config)# **hostname** *name*	255

no hostname

RGOS

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

2.6.3

32

32

prompt EXEC

Ruijie# **prompt** *string*	32 32

no prompt

2.7

2.7.1

banner

2.7.2

Bp}¢² X + Bp

2.7.4

```
C:\>telnet 192.168.65.236
 Notice:  system will shutdown on July 6th.
 Access for authorized users only. Please enter your password.
 User Access Verification
 Password:
```

Notice: system will shutdown on July 6th. Access for authorized users only. Please enter your password.

2.8

2.8.1

2.8.2

Ctrl Boot

Ruijie# **show version**	

2.8.3

Ruijie# **show version devices**	

Ruijie# **show version slots**	

2.9

2.9.1

Console

2.9.2

Ruijie(config-line)# **speed** *speed*	bps 9600 19200 38400 57600 115200 9600

57600 bps

```
Ruijie# configure terminal                    //
Ruijie(config)# line console 0          //
Ruijie(config-line)# speed 57600        //              57600
Ruijie(config-line)# end                          //
Ruijie# show line console 0                     //
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
```

2.10 telnet

2.10.1

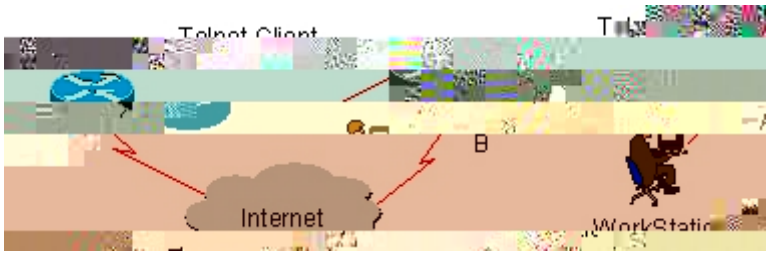
Telnet TCP/IP

Telnet Client

Telnet Client

Telnet

A telnet B



1

2.10.2 Telnet Client

telnet

Ruijie# **telnet** *host-ip-address*	**telnet** IP

Telnet ip

```
  192.168.65.119
```

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

2.11

2.11.1

2.11.2

LINE

Ruijie(config-line)# **exec-timeout** *20*	LINE

LINE **no exec-timeout** LINE

```
Ruijie# configure terminal                    //
Ruijie# line vty 0                            //    LINE
Ruijie(config-line)# exec-timeout 20          //              20min
```

2.11.3

LINE

LINE

Ruijie(config-line)# **session-timeout** *20*	LINE

LINE **no exec-timeout** LINE

```
Ruijie# configure terminal                    //
```

Ruijie(config)# **line vty** *0* // LINE
Ruijie(config-line)# **session-timeout** *20* // 20min

2.12

CLI

Ruijie# **execute** {[**flash:**] *filename*}	

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

2.13

SSH Server/Telnet Server/Web Server

Ruijie(Config)# **enable service ssh-sesrver**	SSH Server
Ruijie(Config)# **enable service telnet-server**	Telnet Server
Ruijie(Config)# **enable service web-server**	Http Server

3 LINE

configure terminal	
Line vty *line number*	Line
transport input {**all** | **ssh** | **telnet** | **none**}	Line
no transport input	LINE
default transport input	LINE

3.2.4 Line

LINE

Line

configure terminal	
Line vty *line number*	Line
access-class *access-list-number* {**in | out**}	Line
no access-class *access-list-number* {**in |out**}	Line

4

4.1

CTRL

TFTP

Xmodem

4.2

¸ TFTP

¸ XMODEM

4.2.1 TFTP

CLI

TFTP Server

Location TFTP Server IP

Ruijie# **copy tftp:** *//location/ filename* **flash:** *filename* [**vrf** vrfname]	URL *filename*

CLI

TFTP Server

Ruijie# **copy flash:** *filename* **tftp:** *//loca tion/filename* [**vrf** vrfname]	*filename* URL

~

tftp

copy tftp:"//localtion/filename" **flash:**filename [**vrf** vrfname]

copy tftp://localtion/filename **flash:**”filename” [**vrf** vrfname]

4.2.2 XMODEM

4.2.3

tftp xmodem

1

2

~

show version

redundancy force-switchover

，

1 **rgos.bin**

2 **copy**

3

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

1

2

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

```
......

3

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

4

System restarting, for reason 'Upgrade product !'.

5
                    5   6                       7


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



6


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 ......


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


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


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.
```

~

&

1 7

5

5.1 Ping

Echo

Echo

RGOS Ping

Ping

Ping Ping

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

Ping 5

100Byte IP 2

‘ ! ’ ‘ . ’

ping

```
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 Ping

Ping

Ping

```
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
```

5.2 Traceroute

Traceroute

Traceroute

TTL

1 TTL 0

Traceroute

TTL 1 ICMP

TTL TTL 1

TTL

ICMP TTL

IP

Traceroute

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

Traceroute

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
```

IP 61.154.22.36

1 6

2 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
```

IP 202.108.37.42

1 17 4

6

6.1

¸ (L2 interface)

¸ (L3 interface) ( )

6.1.1 (L2 interface)

¸ Switch Port

¸ L2 Aggregate Port

6.1.1.1 Switch Port

Switch Port

Access Port Trunk Port Switch Port

Access Port Trunk Port Switch Port

6.1.1.1.1 Access Port

Access Port VLAN, VLAN

VLAN

Access VLAN VLAN VLAN

Access Port TAG

¸ Untagged

¸ VID Access Port VLAN Tagged

¸ VID 0 Tagged

Untagged

Access Port TAG TAG VLAN TAG TAG

Tagged

Access TAG

¸ TAG VID VLAN ID VLAN ID TAG

¸ TAG VID VLAN ID 0 TAG VID 0

¸ TAG VID VLAN ID VLAN ID 0

6.1.1.1.2 Trunk Port

Trunk port VLAN VLAN

VLAN

Trunk Port VLAN Native vlan VLAN Trunk port VLAN VLAN Trunk port VLAN

~

Trunk native vlan Trunk native vlan

Trunk port Untagged VLAN tagged Trunk Port Native vlan TAG Native vlan TAG

Untagged

Trunk port IEEE802.1Q TAG Native VLAN

Tagged

Trunk port TAG

¸ Trunk Port TAG VID Trunk port Native vlan TAG

- Routed Port
- L3 Aggregate Port

6.1.2.3 L3 Aggregate Port

L3 Aggregate port L2 Aggregate Port

AP

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6.2.2

interface

Ruijie(config)# **interface** *ID*	interface interface range interface range macro

Gigabitethernet 2/1

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

6.2.3 interface range

6.2.3.1

interface range

interface range

Ruijie(config)# **interface range** {*port-range* | **macro** *macro_name*}	**interface range** macro ,

interface range range

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

Fastethernet *slot/*{ *port*} - { *port*}

Gigabitethernet *slot/*{ *port*} - { *port*}

TenGigabitethernet *slot*/{ *port*} - { *port*}

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

interface range fastethernet

gigabitethe 0 21.6.36.1714 0 TD0 TcD-4 1 Tf1 0 TD( )D0 Tc803 Tm-0.e 0 e Tf-34.5543 -1.4857 TD-0

– **gigabitethernet** *slot*/{ *port*} - { *port*}

– **Aggregate Port** *Aggregate port* - *Aggregate port* , 1 MAX

interface range switch port

Aggregate Port SVI

define interface-range fastethernet0/1-4

```
Ruijie# configure terminal
Ruijie(config)# define interface-range resource
fastethernet 0/1-4
Ruijie(config)# end
```

```
Ruijie# configure terminal
Ruijie(config)# define interface-range ports1to2N5to7
fastethernet 0/1-2, 1/5-7
Ruijie(config)# end
```

ports1to2N5to7

```
Ruijie# configure terminal
Ruijie(config)# interface range macro ports1to2N5to7
Ruijie(config-if-range)#
```

ports1to2N5to7

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

6.2.4

Gigabitethernet 1/1

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

6.2.6

Switch Port,Routed Port

Ruijie(config-if)# **speed** {**10** | **100** | **1000** | **auto** }	auto 1000 1000M
Ruijie(config-if)# **duplex** {**auto** | **full** | **half** }	
Ruijie(config-if)# **flowcontrol** {**auto** | **on** | **off** }	speed,duplex,flowcontrol auto

no speed **no duplex** **no flowcontrol**

Gigabitethernet 1/1 1000M

```
Ruijie# configure terminal
Ruijie(config)# interface gigabitethernet 1/1
Ruijie(config-if)# speed 1000
Ruijie(config-if)# duplex full
Ruijie(config-if)# flowcontrol off
Ruijie(config-if)# end
```

~

S3760

link up

6.2.7 MTU

jumbo MTU

MTU

MTU MTU

MTU

Aggregate port	

6.2.8.1 Switch Port

6.2.8.1.1 access/trunk port

Switchport (access/trunk port)

switchport Switch Port

Ruijie(config-if)#

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

Trunk Port Gigabitethernet 2/1 Native vlan 10

```
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
```

“ ”

Ruijie(config-if)# **switchport port-security**	

interface <*interface*>	,
switchport mode hybrid	hybrid
no switchport mode	
switchport hybrid native vlan *id*	hybrid VLAN
switchport hybrid allowed vlan [[**add**] [**tagged** | **untaged**]] |**remove**] **vlist**	

```
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
```

6.2.8.2 L2 Aggregate Port

L2 Aggregate Port L2 Aggregate Port

aggregateport L2 Aggregate Port
“ Aggregate Port ”

6.2.8.3

clear
Switch Port,L2 Aggregrate port ,Routed port,L3 Aggregate port
clear

Ruijie# **clear counters** [*interface-id*]	
Ruijie# **clear interrface** *interface-id*	

show interfaces

clear counters
L2

Gigabitethernet 1/1

```
Ruijie# clear counters gigabitethernet 1/1
```

6.2.9

Ruijie(config-if)# **no switchport**	Shut Down Switch Port L2 Aggregrate port
Ruijie(config-if)# **ip address** *ip_address subnet_mask*{[**secondary**|**tertiary**|**quartus**][**broadcast**]}	IP

IP **no ip address**

L2 Aggregate Port **no switchport**

Routed Port IP

```
Ruijie# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 2/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 192.20.135.21 255.255.255.0
Ruijie(config-if)# no shutdown
Ruijie(config-if)# end
```

6.2.9.1 SVI

SVI SVI

interface vlan *vlan-id* SVI SVI

SVI

Ruijie(config)# **interface vlan** *vlan-id*	SVI

SVI “ IP ”

SVI 100 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
```

6.2.9.2 Routed port

Routed Port Routed Port

no switchport Routed port

Routed port Routed port IP

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

~

L2 Aggregate Port **switchport/ no switchport**

Routed Port IP

```
Ruijie# configure terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface fastethernet 0/6
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 192.168.1.1 255.255.255.0
Ruijie(config-if)# no shutdown
Ruijie(config-if)# end
```

6.2.9.3 L3 Aggregate Port

L3 Aggregate Port

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

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

SVI 5

```
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
```

Aggregate Port 3

```
Ruijie# show interfaces aggregateport 3
Interface   : AggreatePort 3
/unFlowControlAd  : : Disabled
```

Gigabitethernet 2/1

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


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
```

6.4 LinkTrap

LinkTrap

Link SNMP LinkTrap,

6.4.1

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

6.4.2

Ų اکبر

7 Aggregate Port

Aggregate Port

7.1

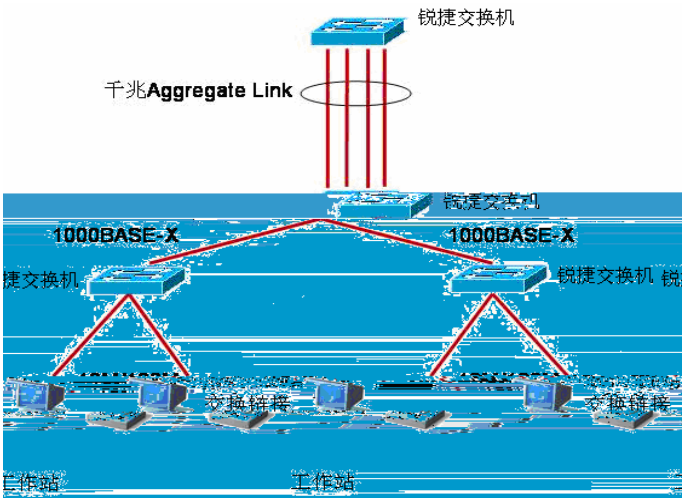
7.1.1 Aggregate Port

Aggregate Port AP AP IEEE802.3ad

AP AP

AP

AP AP



1 AP

&

S3760 AP

7.1.2

AP

4 PC 2 PC

MAC MAC

MAC

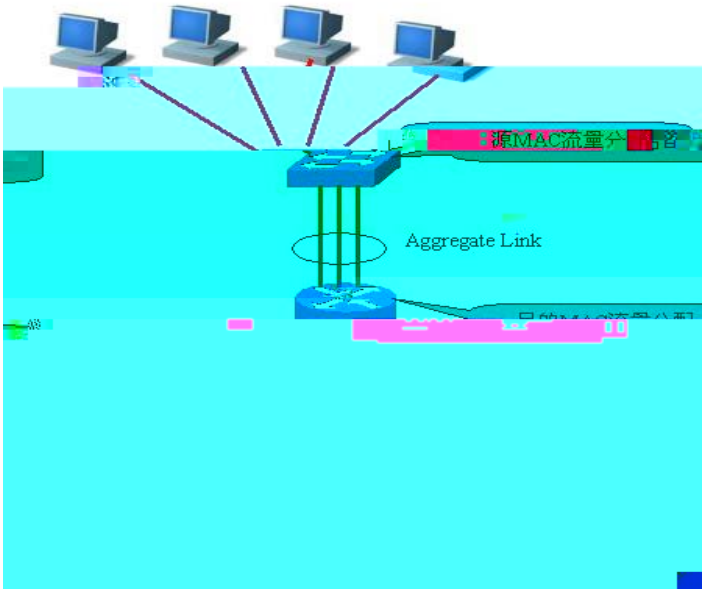
MAC

&

IP IP IP IP 2

aggregateport load-balance

show aggregateport load-balance



2 AP

7.2 Aggregate Port

7.2.1 Aggregate Port

AP

AP	
AP	

	MAC

7.2.2 Aggregate Port

- AP
- AP AP AP
  /
- AP
- AP AP
- AP AP

~

AP AP

7.2.3 Aggregate Port

AP

Ruijie(config-if-range)# **port-group** *port-group-number*	AP(ئو طد

7.3 Aggregate Port

AP

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

```
Ruijie# show aggregateport load-balance
Load-balance : Source MAC address
Ruijie#show aggregateport 1 summary
AggregatePort MaxPorts SwitchPort Mode   Ports
------------- -------- ---------- ------
Ag1           8        Enabled    ACCESS
```

8 (LACP)

8.1

IEEE 802.3ad LACP(Link Aggregation Control Protocol,
) LACPDU(Link Aggregation
Control Protocol Data Unit,)

LACP LACPDU
MAC key

8.2

LACP (Active) ą

8.4

8.4.1 LACP ID

LACP LACP
ID LACP MAC
ID MAC
MAC ID ID

8.4.2 LACP ID

LACP ID LACP
ID
ID

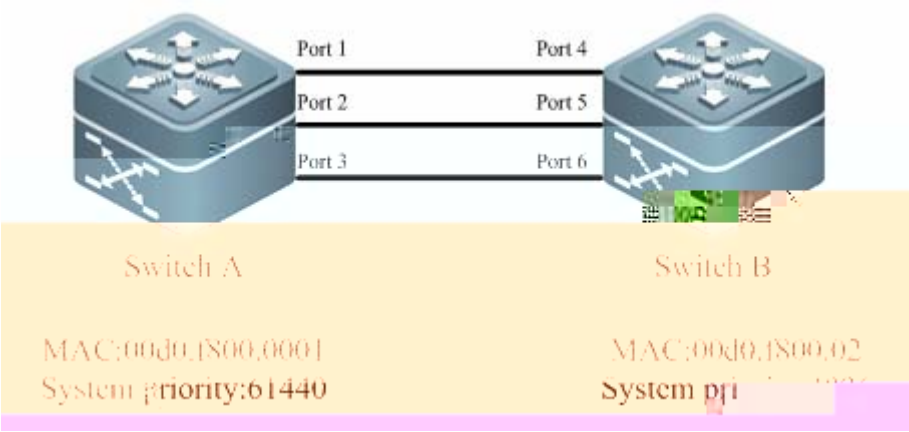
8.4.3 LACP

up LACP
ID
LACP
LACP

8.4.4 LACP

LACP ID ID
ID

LACP



1 LACP

1 A B 3
A 61440 B 4096 A
B 3 LACP 3
3 32768

LACP B ID (
B A) ID (
) 4 5 6
A B LACP ID
1 2 3

8.5

LACP

1. key
2.
3. UP LACP
(Active)

8.6 (LACP)

LACP key
LACP

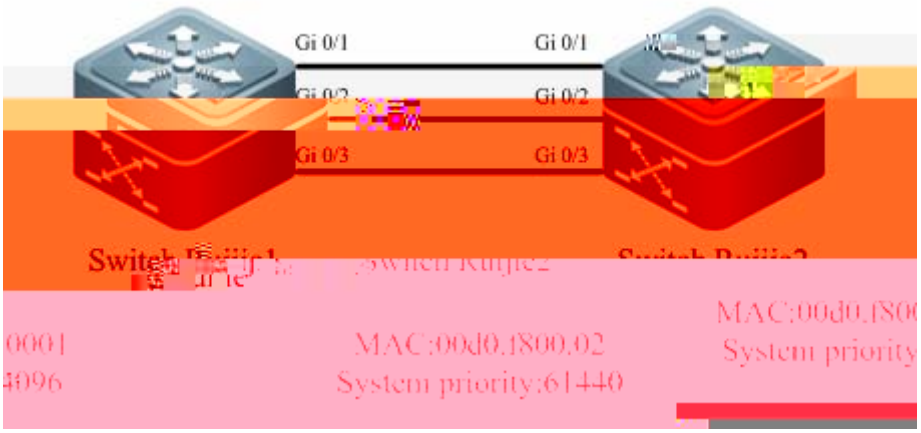
,

Ruijie# **configure**	
Ruijie(config)# **lacp system-priority** *system-priority*	( ) LACP 0-65535 32768
Ruijie(config)# **interface** *interface-id*	
Ruijie(config-if)# **lacp port-priority** *port-priority*	( ) , 0-65535, 32768
Ruijie(config-if)# **port-group** *key* **mode active | passive**	key key key active|passive
Ruijie(config-if)# **end**	

8.6.1

Ruijie# **show lacp summary**	LACP .

8.7 LACP



2 LACP

2 Ruijie1 LACP 4096, Gi 0/1 Gi 0/2 Gi 0/3 LACP 4096

```
Ruijie1# configure terminal
Ruijie1(config)# lacp system-priority 4096
Ruijie1(config)# interface range GigabitEthernet 0/1-3
Ruijie1(config-if-range)# lacp port-priority 4096
Ruijie1(config-if-range)# port-group 3 mode active
Ruijie1(config-if-range)# end
```

Ruijie2 LACP 61440 **Gi 0/1 Gi 0/2 Gi 0/3** LACP 61440

```
Ruijie2# configure terminal
Ruijie1(config)# lacp system-priority 61440
Ruijie2(config)# interface range GigabitEthernet 0/1-3
Ruijie2(config-if-range)# lacp port-priority 61440
Ruijie2(config-if-range)# port-group 3 mode active
Ruijie2(config-if-range)#end
```

LACP log

```
*Feb 25 17:11:31: %LACP-5-BUNDLE: Interface Gi0/1 joined
AggregatePort 3.
*Feb 25 17:11:32: %LACP-5-BUNDLE: Interface Gi0/2 joined
AggregatePort 3.
*Feb 25 17:11:32: %LACP-5-BUNDLE: Interface Gi0/3 joined
AggregatePort 3.
*Feb 25 17:11:32: %LINEPROTO-5-UPDOWN: Line protocol on Interface
AggregatePort 3, changed state to up
```

Gi 0/1 Gi 0/2 Gi 0/3 3 Ruijie1

```
Ruijie(config)#show LACP summary
Flags:  S - Device is sending Slow LACPDUs
        F - Device is sending fast LACPDUs.
A - Device is in active mode.       P - Device is in passive mode.

Aggregate port 3:

Local information:
                           LACP port      Oper    Port     Port
Port     Flags     State    Priority       Key     Number   State
-------------------------------------------------------------------
Gi0/1    SA        bndl       4096          0x3     0x1      0x3d
```

```
Gi0/2     SA       bndl       4096          0x3     0x2      0x3d
Gi0/3     SA       bndl       4096          0x3     0x3      0x3d


Partner information:
                  LACP port                Oper    Port     Port
Port     Flags    Priority     Dev ID      Key     Number   State
-------------------------------------------------------------------
Gi0/1     SA       61440     00d0.f800.0002   0x3     0x1     0x3d
Gi0/2     SA       61440     00d0.f800.0002   0x3     0x2     0x3d
Gi0/3     SA       61440     00d0.f800.0002   0x3     0x3     0x3d
```

“ Local information ” LACP

“ Port ” ID

“ Flags ” ‘ S’ LACP
LACPPDU ’A’

“ State ” “ bndl ”
“ LACP ”

“ LACP Port Priority ” LACP

“ Oper Key ” Key

“ Port Number ”

“ Port State ” LACP

“ Partner infomation ” LACP

“ Dev ID ” MAC

9 VLAN

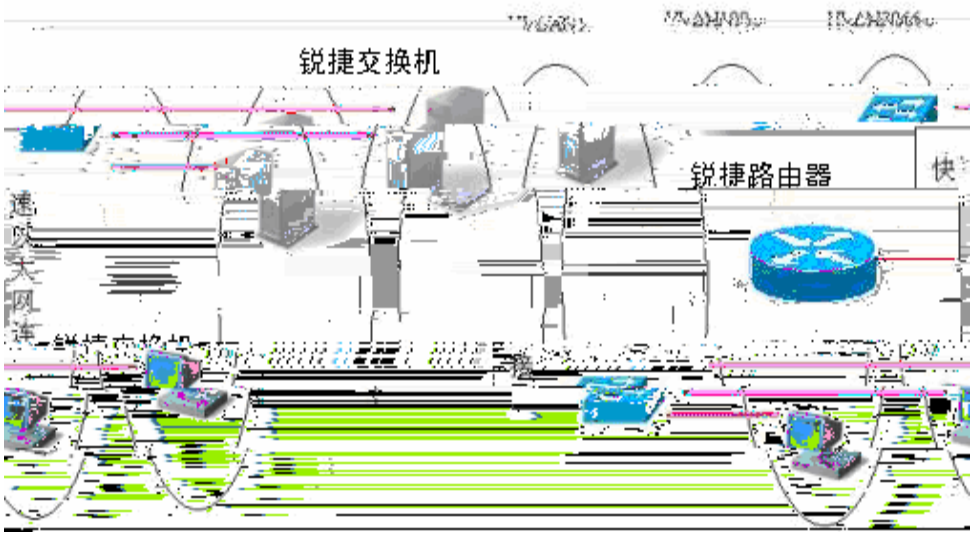
IEEE802.1q VLAN

9.1

VLAN Virtual Local Area Network
ISO VLAN
VLAN

VLAN VLAN
VLAN

VLAN
VLAN VLAN



1

VLAN IP
IP VLAN VLAN
SVI Switch Virtual Interfaces
VLAN IP SVI IP

9.1.1 VLAN

VLAN IEEE802.1Q 4094 VLAN(VLAN ID

VLAN ID	1	1 4094
VLAN Name	VLAN xxxx xxxx VLAN ID	
VLAN State	Active	Active Inactive

9.2.3 VLAN

VLAN

Ruijie(config)# **vlan** *vlan-id*	VLAN ID VLAN ID VLAN VLAN ID VLAN
Ruijie(config)# **name** *vlan-name*	VLAN VLAN xxxx xxxx 0 VLAN ID VLAN 0004 VLAN 4

VLAN **no name**

VLAN 888 Test888

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

9.2.4 VLAN

VLAN VLAN 1

VLAN

Ruijie(config)# **no vlan** *vlan-id*	VLAN ID

9.2.5 VLAN Access

VLAN VLAN

VLAN

Ruijie(config-if)# **switchport mode access**	VLAN ACCESS
Ruijie(config-if)# **switchport access vlan** *vlan-id*	VLAN

fastEthernet 0/10 Access VLAN20

```
Ruijie# configure terminal
Ruijie(config)# interface fastethernet 1/10
Ruijie(config-if)# switchport mode access
Ruijie(config-if)# switchport access vlan 20
Ruijie(config-if)# end
```

```
Ruijie(config)# show interfaces fastEthernet 0/1 switchport
Switchport is enabled
Mode is access port
Acsess vlan is 1,Native vlan is 1
Protected is disabled
Vlan lists is ALL
```

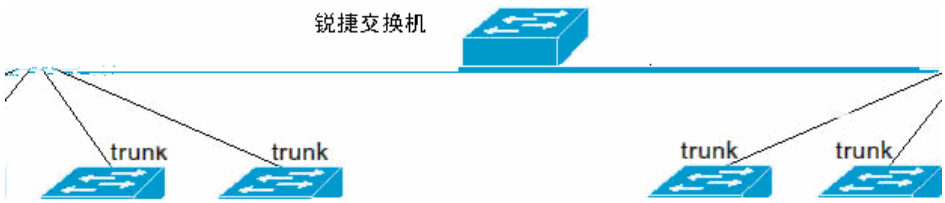
9.3 VLAN Trunks

9.3.1 Trunking

Trunk

Trunk VLAN

Trunk 802.1Q Trunk



2

Aggregate Port Trunk
Aggregate Port Aggregate Port

ACCESS TRUNK **switchport mode**

Ruijie(config-if)# **switchport mode access**	Access
Ruijie(config-if)# **switchport mode trunk**	Trunk

Trunk Native VLAN Native VLAN
UNTAG VLAN VLAN
ID IEEE 802.1Q PVID Native VLAN VLAN ID E- ðÐÀ!10h`Ô "W ~î€! Qõ

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

Trunk Trunk

10 Super VLAN

Super VLAN

10.1 Sub VLAN

Super VLAN VLAN Super VLAN VLAN
IP VLAN) IP VLAN(Sub
VLAN) Sub VLAN Super VLAN Sub VLAN
Sub VLAN Sub VLAN
S IP Super VLAN IP
VLAN IP IP Sub VLAN
Sub VLAN ARP
ARP ARP
لها ضر Q n لم

PC1 PC2 PC1
IP ARP ARP
Sub VLAN2 ARP
ARP ARP IP
Sub-VLAN2 PC1
PC1 SuperVLAN3 MAC
PC1 ARP PC1 PC2 ARP
PC1 PC2 PC1 PC3

- Super VLAN Sub VLAN Sub VLAN
- Super VLAN Super VLAN Sub VLAN
- Super VLAN 1Q vlan
- VLan 1 SuperVLAN
- Sub VLAN IP
- Super VLAN VRRP IGMP Snooping PIM Snooping
- Super VLAN ACL QOS Sub VLAN

10.2 Super VLAN

Super VLAN

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

Super VLAN **no supervlan** supervlan

10.3 Super VLAN Sub VLAN

SuperVLAN SubVLAN SuperVLAN
VLAN Super VLAN SubVLAN

~

SubVLAN

Ruijie# **configure**	
Ruijie(config)# **vlan** *vlan-id*	VLAN
Ruijie(config-vlan)# **supervlan**	vlan SuperVLAN
Ruijie(config-vlan)# **subvlan** *vlan-id-list*	sub vlan supervlan
Ruijie(config-vlan)# **exit**	

no subvlan [*vlan-id-list*] SuperVLAN SubVLAN

~

no vlan SubVLAN VLAN

10.4 Sub VLAN

SubVLAN IP SubVLAN. SuperVLAN SubVLAN .

Ruijie# **configure**	
Ruijie(config)# **vlan** *vlan-id*	vlan
Ruijie(config-vlan)# **subvlan-address-range** *start-ip end-ip*	VLAN start-ip SubVLAN IP end-ip SubVLAN IP
Ruijie(config-vlan)# **end**	
Ruijie# **show run**	

~

no subvlan-address-range

10.5 Super VLAN

Sub VLAN , SuperVLAN

SuperVLAN SVI

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

10.6 VLAN ARP

VLAN ARP SubVLAN

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

no proxy-arp Vlan ARP

10.7 supervlan

SuperVLAN

Ruijie# **show supervlan**	supervlan

10.8 Super VLAN

10.8.1

- Super-VLAN VLAN 2 Sub-VLAN VLAN 3 VLAN
- Sub-VLAN 3 192.168.196.51~192.168.196.100 Sub-VLAN 4

```
  Ruijie(config-vlan)# exit
#     VLAN 3
  Ruijie(config)# vlan 3
#
  Ruijie(config-vlan)# exit
#     VLAN 4
  Ruijie(config)# vlan 4
#
  Ruijie(config-vlan)# exit
#     VLAN 2                VLAN 3    VLAN 4    Super VLAN 2
Sub-VLAN
  Ruijie(config)# vlan 2
  Ruijie(config-vlan)# subvlan 3,4
#                   VLAN 3                VLAN 3
192.168.196.51~192.168.196.100
  Ruijie(config-vlan)# exit
  Ruijie(config)# vlan 3
  Ruijie(config-vlan)# subvlan-address-range 192.168.196.51
  192.168.196.100
#                   VLAN 4                VLAN 4
192.168.196.101~192.168.196.150
  Ruijie(config-vlan)# exit
  Ruijie(config)# vlan 4
  Ruijie(config-vlan)# subvlan-address-range 192.168.196.101
  192.168.196.150
#
  Ruijie(config-vlan)# exit
#     SVI
  Ruijie(config)# interface vlan 2
#   VLAN 2            IP       192.168.96.1            255.255.255.0
  Ruijie(config-if)# ip address 192.168.196.1 255.255.255.0
#                   VLAN 2                ARP
```

```
Ruijie(config-if)# exit
Ruijie(config)# vlan 2
Ruijie(config-vlan)# proxy-arp
```

#

11 Protocol VLAN

11.1 Protocol VLAN

VLAN VLAN

1) VLAN ID UNTAG Priority
VLAN TAG VLAN ID PVID

2) VLAN ID UNTAG Priority
VLAN TAG VLAN ID
VLAN ID
VLAN
VLAN ID

3) TAG VLAN TAG VLAN ID

Protocol VLAN VLAN
VLAN ID VLAN

Protocol VLAN Trunk Hybrid Access

IP VLAN
VLAN VLAN

IP VLAN IP VLAN
Trunk Hybrid

1) VLAN ID , IP IP
VLAN

2) VLAN ID ,

VLAN

IP VLAN VLAN
IP VLAN
IP VLAN

VLAN Trunk Hybrid Access AP
Protocol VLAN Trunk Hybrid Protocol VLAN
Trunk Hybrid VLAN Ω † þ Z

11.2 Protocol VLAN

11.2.1 Protocol VLAN

Protocol VLAN

11.2.2 profile

3 Profile S3760 11 profile

4 S3760 0x0806 ARP

11.2.3 profile

:

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

profile 1 profile 2 3 GE 1,VLAN 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
```

&

1 profile

2 profile vid

3 VID S3760 4094 VLAN

11.3 Protocol VLAN

Protocol VLAN

show protocol-vlan	Protocol VLAN

```
Ruijie# show protocol-vlan
```

12 Private VLAN

12.1 Private VLAN

VLAN VLAN
4096 VLAN
IP
Private VLAN

VLAN(Private VLAN) VLAN
VLAN VLAN(Primary VLAN) VLAN(Secondary
VLAN)

VLAN VLAN VLAN
VLAN VLAN VLAN
VLAN ID

VLAN VLAN VLAN VLAN
VLAN

¸ VLAN(Isolated VLAN) VLAN
VLAN VLAN

¸ VLAN(Community VLAN) VLAN
VLAN VLAN
VLAN

Promiscuous Port VLAN
VLAN VLAN

(Isolated Port) VLAN
Trunk Port Trunk Port vid VLAN

TRUNK Isolated Trunk Port VLAN
PVLAN VLAN VLAN
VLAN VLAN
802.1Q TRUNK VLAN ID
Trunk Port Trunk Port vid VLAN

TRUNK TAG VID VLAN ID
VLAN VID

(Community port) VLAN VLAN

				TRUNK VLAN	TRUNK VLAN

VLAN SPAN

12.2

S3760 MAC

S3760 Isolate Trunk Port TAG VID PVLAN VLAN ID VLAN ID

S3760 VLAN TAG

				TRUNK VLAN	TRUNK VLAN
				VLAN ID TAG	VLAN ID TAG
		NA	NA	NA	VLAN ID TAG
		NA		VLAN ID TAG	VLAN ID TAG
TRUNK VLAN	VLAN TAG	NA	VLAN TAG	VLAN	
TRUNK VLAN	VLAN TAG	NA	VLAN TAG	**VLAN**	
CPU	Untag	Untag	Untag	**VLAN ID TAG**	VLAN ID TAG

12.3 Private VLAN

12.3.1 Private VLAN

Private VLAN

12.3.2 VLAN VLAN

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

&

802.1Q Vlan VLAN VLAN 1
VLAN Trunk Uplink 802.1Q VLAN VLAN
VLAN Private VLAN ACTIVE

1) Priamry VLAN

2) Secondary VLAN

3) Secondary VLAN Primary VLAN

802.1Q VLAN Private VLAN

```
Ruijie# configure terminal
Ruijie(config)# vlan 303
Ruijie(config-vlan)# private-vlan community
Ruijie(config-vlan)# end
Ruijie# show vlan private-vlan community
VLAN Type  Status    Routed   Interface   Associated VLANs
--- ----   --------  ------   ---------   ------------------
303 comm   inactive  Disabled             no association
Ruijie# configure terminal
Ruijie(config)# vlan 404
Ruijie(config-vlan)# private-vlan community - Tc( )Tj-15.6 munity  config)#.6 0 TD(end )Tj/TT14
```

12.3.3 Secondary VLAN Primary VLAN

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	Secondary VLAN
end	VLAN
show vlan private-vlan [*type*]	VLAN

```
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
```

&

Primary VLAN VLAN

12.3.4 Secondary VLAN Primary VLAN

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

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

12.3.5 VLAN

VLAN (Host Port)

configure terminal	
interface <*interface*>	*fastethernet*, *gigabitethernet*, *tengigabitethernet*
switchport mode private-vlan host	
no switchport mode	VLAN
end	SVI
switchport private-vlan host-association *p_vid s_vid*	VLAN
no switchport private-vlan host-association	

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

&

Primary VLAN Secondary VLAN

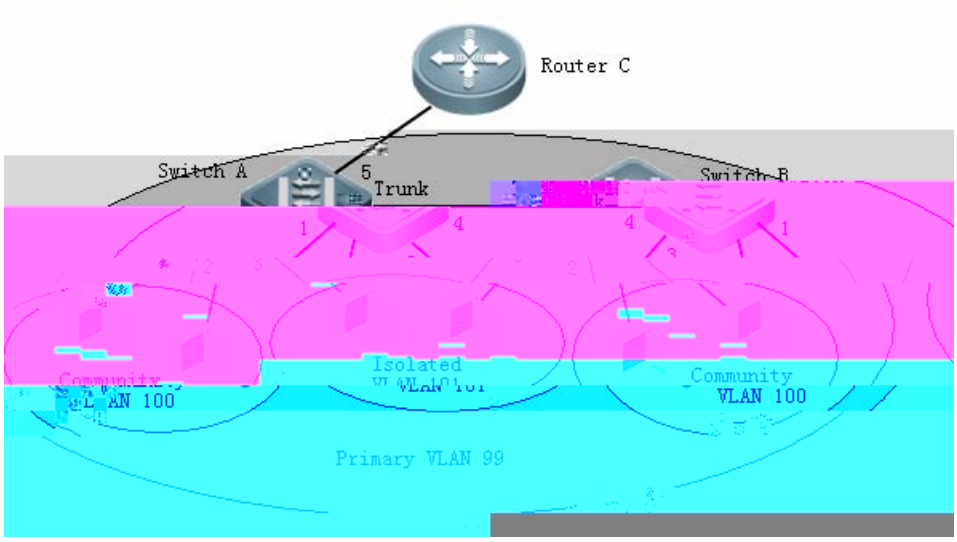
12.3.6 PVLAN TRUNK

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config-if)# **interface** <*interface*>	*fastethernet*, *gigabitethernet*, *tengigabitethernet*
Step 3	Ruijie(config-if)# **switchport mode trunk**	trunk

Step 6	Ruijie(config-if)# **switchport trunk native vlan** *vlan-id*	Native VLAN Trunk Native VLAN VLAN 1 **no switchport trunk native vlan**

```
Ruijie# configure terminal
Ruijie(config)# interface
```

12.5.1.2



12.5.1.3

VLAN 99 Primary VLAN VLAN 100 Community VLAN VLAN 101 Isolated VLAN VLAN

```
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
```

0 1 0 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
```

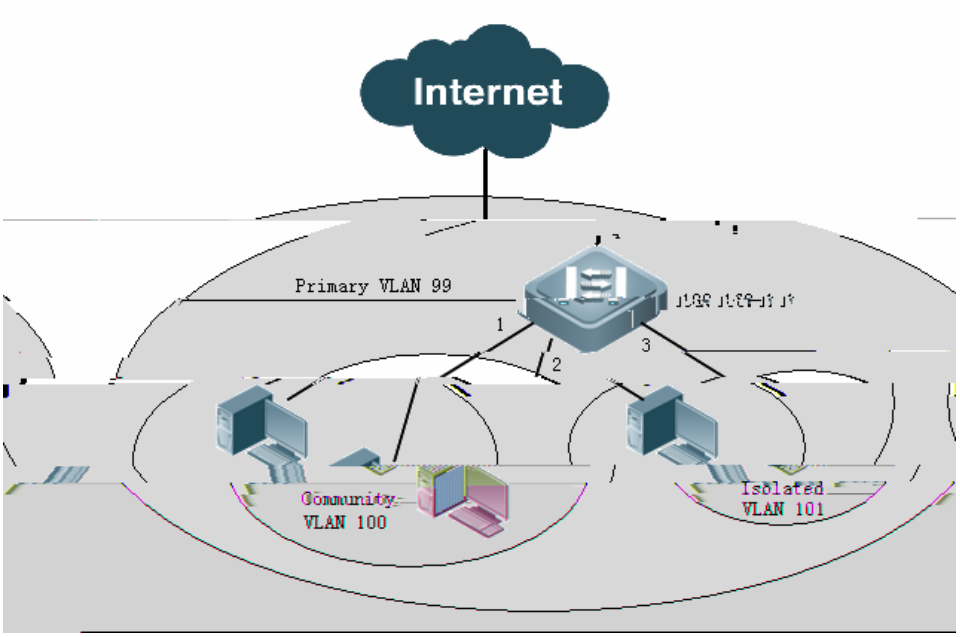
```
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/2
Ruijie(config-if)#switchport mode private-vlan host
Ruijie(config-if)#switchport private-vlan host-association 99
100
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/3
Ruijie(config-if)#switchport mode private-vlan 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
```

12.5.2 Private VLAN

12.5.2.1

Private VLAN Private VLAN SVI Private VLAN VLAN Primary VLAN Secondary VLAN SVI Primary VLAN IP Secondary VLAN Primary VLAN

12.5.2.2



12.5.2.3

VLAN 99 Primary VLAN VLAN 100 Community VLAN VLAN 101 Isolated VLAN VLAN

```
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
```

0 1 0 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 private-vlan promiscuous
Ruijie(config-if)#switchport private-vlan mapping 99 add
100-101
Ruijie(config-if)#exit
```

Primary VLAN SVI (192.168.1.1) Secondary VLAN Primary VLAN

```
Ruijie(config)#interface vlan 99
Ruijie(config-if)#ip address 192.168.1.1 255.255.255.0
Ruijie(config-if)#private-vlan mapping 100-101
Ruijie(config-if)#show vlan private-vlan
VLAN     Type                Status       Routed       Ports
Associated VLANs
-----  ----------  --------  --------  -------------------------
99          primary          active        Enabled     Gi0/4
100-101
100   community  active   Enabled  Gi0/1, Gi0/2        99
101   isolated   active   Enabled  Gi0/3               99
```

12.5.3 Private VLAN

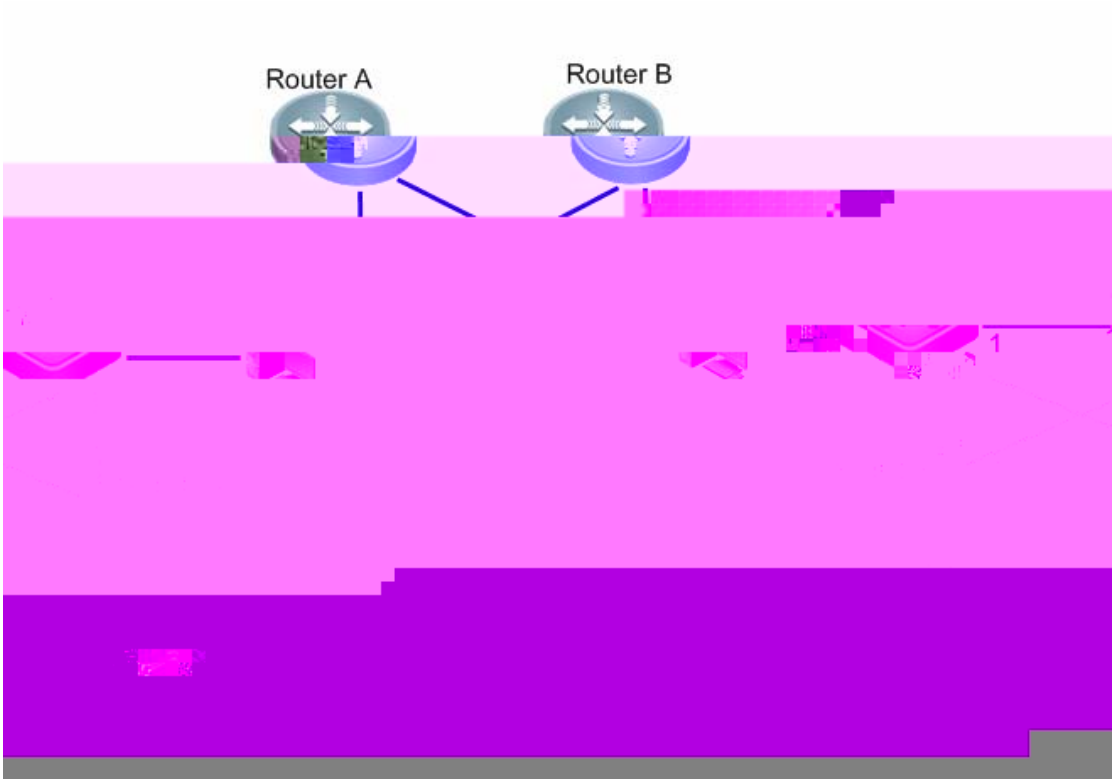
12.5.3.1

Private VLAN

Private VLAN Isolate

Trunk Port Trunk Port 1-3

12.5.3.2



12.5.3.3

Switch Switch B VLAN 99 Primary VLAN VLAN 101 Isolated VLAN VLAN

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

Switch A Switch B 0 1 Trunk Port 0 2 0 3 Isolated Trunk Port 0 4 Isolated VLAN 101

```
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)#switchport private-vlan association trunk
99 101
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/3
Ruijie(config-if)#switchport mode trunk
Ruijie(config-if)#switchport private-vlan association trunk
99 101
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/4
Ruijie(config-if)#switchport mode private-vlan host
Ruijie(config-if)#switchport private-vlan host-association 99
101
Ruijie(config-if)#exit
```

#Switch C Switch D Vlan 101 0 1 0 2 0 3 Trunk Port

```
Ruijie(config)#vlan 101
Ruijie(config-vlan)#exit
Ruijie(config)#interface gigabitEthernet 0/1
Ruijie(config-if)#switchport protected
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/2
Ruijie(config-if)#switchport mode trunk
Ruijie(config-if)#exit
Ruijie(config)#interface gigabitEthernet 0/3
Ruijie(config-if)#switchport mode trunk
Ruijie(config-if)#exit
```

13 MAC

MAC

MAC

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MAC VLAN ID
MAC

Â MAC MAC
VLAN ID

Â MAC MAC
VLAN ID

Â ffff.ffff.ffff MAC
VLAN

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IGMP Snooping

13.1.2

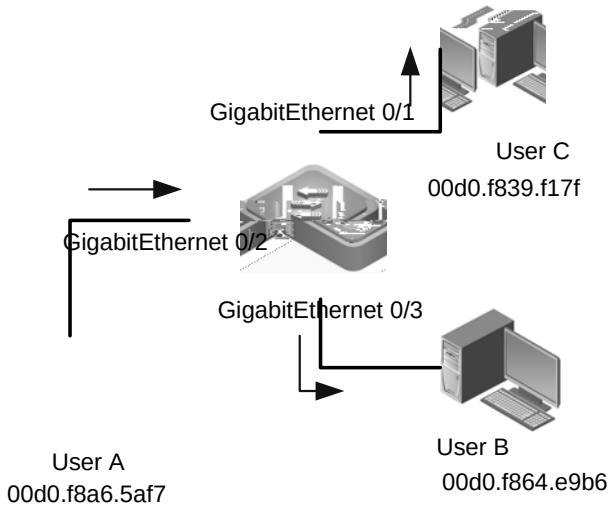
13.1.2.1

MAC

13.1.2.2

MAC

1. MAC UserA UserB
UserA GigabitEthernet 0/2
UserA MAC MAC
UserB MAC
UserA User B User C
UserC UserA

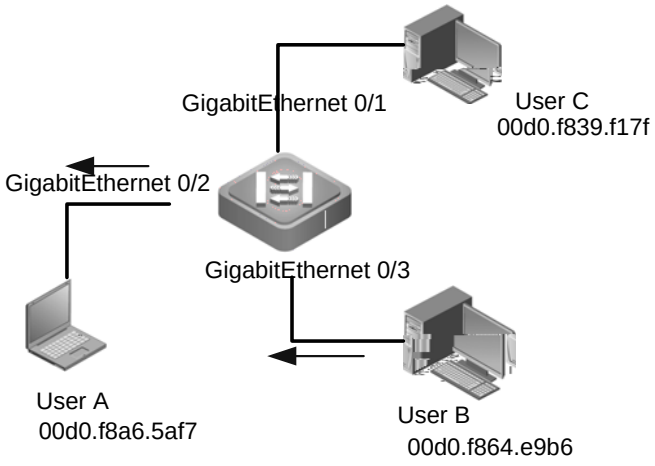


4

Status	VLAN	MAC	
	1	00d0.f8a6.5af7	GigabitEthernet 0/2

5 MAC

2. UserB GigabitEthernet 0/3
UserA MAC UserA MAC
GigabitEthernet 0/2
UserB MAC 1 UserC
UserB UserA



6

Status	VLAN	MAC	
	1	00d0.f8a6.5af7	GigabitEthernet 0/2
	1	00d0.f864.e9b6	GigabitEthernet 0/3

7 MAC

3. UserA UserB UserA
UserB MAC UserA UserB
UserC UserA UserB

13.1.2.3

MAC

MAC
MAC

13.1.3

MAC MAC

MAC
MAC

13.1.4

MAC MAC

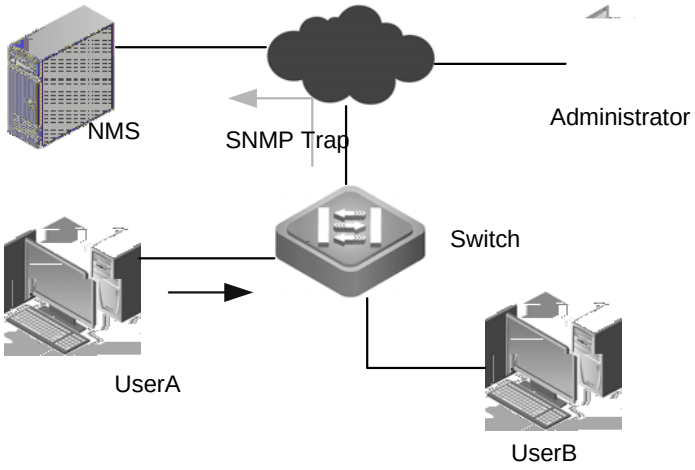
MAC

~

CPU ARP MAC
ARP CPU

13.1.5 MAC

MAC NMS



8

MAC MAC
MAC MAC
SNMP Trap NMS( )

MAC MAC
MAC

MAC
MAC

MAC

MAC MAC
Trap NMS MAC
MAC

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MAC

13.1.6 IP MAC

13.1.6.1

IP MAC IP MAC
IP MAC
IP MAC IP IP

13.3

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13.3.1

Ruijie#**clear mac-address-table dynamic**	
Ruijie#**clear mac-address-table dynamic address** *mac-address* **vlan** *vlan-id*	MAC mac-address MAC vlan-id MAC VLAN
Ruijie#**clear mac-address-table dynamic interface** *interface-id* [**vlan** *vlan-id*]	Aggregate Port VLAN interface-id Aggregate Port vlan-id VLAN
Ruijie#**clear mac-address-table dynamic vlan** vlan-id	VLAN vlan-id VLAN

GigabitEthernet 0/1 VLAN 1

```
Ruijie#clear mac-address-table dynamic interface GigabitEthernet
0/1 vlan 1
```

13.3.2

Ruijie#**show mac-address-table dynamic**	
Ruijie#**show mac-address-table dynamic address** *mac-address* [**vlan** *vlan-id*]	MAC mac-address MAC vlan-id VLAN MAC

Ruijie#**show mac-address-table dynamic interface** *interface-id* [**vlan** *vlan-id*]	Aggregate Port vlan-id VLAN
Ruijie#**show mac-address-table dynamic vlan** *vlan-id*	VLAN vlan-id VLAN
Ruijie# **show mac-address-table count**	

GigabitEthernet 0/1 VLAN

MAC

```
Ruijie#show mac-address-table dynamic interface gigabitEthernet
0/1 vlan 1
Vlan        MAC Address         Type     Interface
----------  ------------------- -------- ------------------
  1         0000.5e00.010c      DYNAMIC  GigabitEthernet 0/1
  1         00d0.f822.33aa      DYNAMIC  GigabitEthernet 0/1
  1         00d0.f822.a219      DYNAMIC  GigabitEthernet 0/1
  1         00d0.f8a6.5af7      DYNAMIC  GigabitEthernet 0/1
```

```
Ruijie# show mac-address-table count
```

Ruijie(config)# **mac-address-table agint-time** [0 |10-1000000]	
Ruijie(config)#**on mac-address-table agint-time**	

180

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#mac-address-tabsle aging-time 180
```

13.4.2

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

```
Ruijie#show mac-address-table aging-time
Aging time    : 180 seconds
```

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2

S3760 10 – 630

13.5

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13.5.1

Ruijie(config)# **mac-address-table static** *mac-address* **vlan** *vlan-id* **interface** *interface-id*	mac-address MAC vlan-id VLAN interface-id (Aggregate Port) vlan-id VLAN mac- address interface-id
Ruijie(config)# **no mac-address-table static** *mac-address* **vlan** *vlan-id* **interface** *interface-id*	

00d0.f800.073c VLAN 4

Gigabitethernet 0/3

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# mac-address-table static 00d0.f800.073c vlan 4
interface gigabitethernet 0/3
```

00d0.f800.073c

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#no mac-address-table static 00d0.f800.073c vlan 4
interface gigabitethernet 0/3
```

13.5.2

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

```
Vlan        MAC Address          Type      Interface
----------  -------------------- --------  -------------------
    4       00d0.f800.073c       STATIC    GigabitEthernet 0/3
```

13.6

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13.6.1

Ruijie(config)# **mac-address-table filtering** *mac-address* **vlan** *vlan-id*	mac-address MAC vlan-id VLAN vlan-id VLAN mac- address

13.7.1 MAC

MAC MAC

MAC

Ruijie(config)# **snmp-server host** *host-addr* **traps** [**version** {**1**|**2c** |**3** [**auth**	**noauth**	**priv**]}] *community-string*	MAC NMS host-addr IP version snmp trap v3
Ruijie (config)#**snmp-server enable traps**	trap
Ruijie(config)#**mac-address-table notification**	MAC
Ruijie(config)#**mac-address-table notification** {**interval** *value* | **history-size** *value*}	MAC interval value MAC ( ) 1 3600 1 history-size value MAC 1 200 50
Ruijie(config-if)# **snmp trap mac-notification** {**added** |**removed**}	MAC added E¡¿MAC¢ç¿Ø

```
Ruijie(config-if)#snmp trap mac-notification added
Ruijie(config-if)#snmp trap mac-notification removed
```

13.7.2

MAC

Ruijie#show mac-address-table notification	MAC
Ruijie#show mac-address-table notification interface	MAC
Ruijie#show mac-address-table notification history	MAC

MAC

MAC

```
Ruijie#show mac-address-table notification
MAC Notification Feature : Enabled
Interval(Sec): 2
Maximum History Size : 154
Current History Size : 2
Ruijie# show mac-address-table notification interface
Interface         MAC Added Trap  MAC Removed Trap
----------------- -------------- ----------------
Gi0/1              Disabled       Enabled
Gi0/2              Disabled       Disabled
Gi0/3              Enabled        Enabled
Gi0/4              Disabled       Disabled
Gi0/5              Disabled       Disabled
Gi0/6              Disabled       Disabled

Ruijie#show mac-address-table notification history
History Index:1
Entry Timestamp: 15091
MAC Changed Message :
Operation   VLAN  MAC Address    Interface
----------- ---- -------------- --------------------
Added        1    00d0.f808.3cc9  Gi0/1
Removed     1     00d0.f808.0c0c  Gi0/1
History Index:2
Entry Timestamp: 21891
MAC Changed Message :
Operation   VLAN  MAC Address    Interface
----------- ---- -------------- --------------------
```

```
Added      1      00d0.f80d.1083 Gi0/1
```

13.8 IP MAC

13.8.1 IP MAC

Ruijie(config)# **address-bind** *ip-address mac-address*	IP MAC ip-address IP mac-address MAC
Ruijie(config)# **address-bind install**	IP MAC

no address-bind *ip-address mac-address* IP MAC

no address-bind install

IP MAC

```
Ruijie#configure terminal
```

~

IPV6 **DHCP Snooping** MAC+IP MAC+IP IPV6 IPV6

	Ipv4	IPV6
	IPV4+MAC	IPV6 IPV6
	IPV4+MAC	IPV6
	IPV4+MAC	MAC MAC IPV6 IPV6

13.8.3

Ruijie(config)#**address-bind uplink** *interface-id*	interface-id Aggregate Port

GigabitEthernet 0/1

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#address-bind uplink GigabitEthernet 0/1
```

13.8.4

IP MAC

Ruijie#**show address-bind**	IP MAC

IP MAC

```
Ruijie#show address-bind
Total Bind Addresses in System : 1

IP Address        Binding MAC Addr
---------------    ----------------
   192.168.5.1    00d0.f800.0001
```

13.9

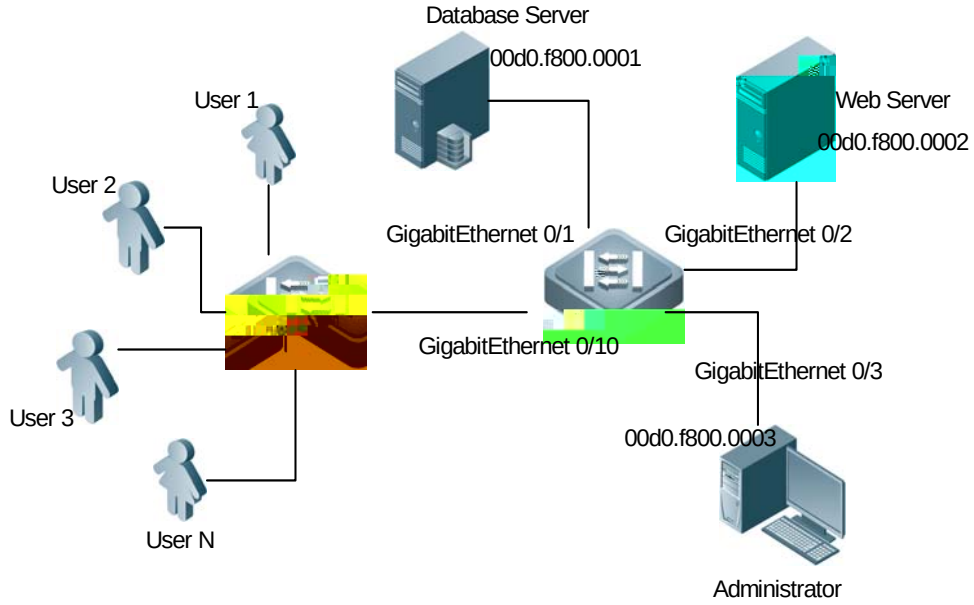
13.9.1

GigabitEthernet0/1 WEB
GigabitEthernet 0/2 GigabitEthernet 0/3
GigabitEthernet 0/10

WEB VLAN 1

WEB

WEB



9

13.9.2

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#mac-address-table static 00d0.fBT0T14 1 Tf-5.039000R7016BT0T14ig
```

```
Ruijie(config)#mac-address-table static 00d0.f800.0003 vlan 1
interface GigabitEthernet 0/3


Ruijie#show mac-address-table static
```

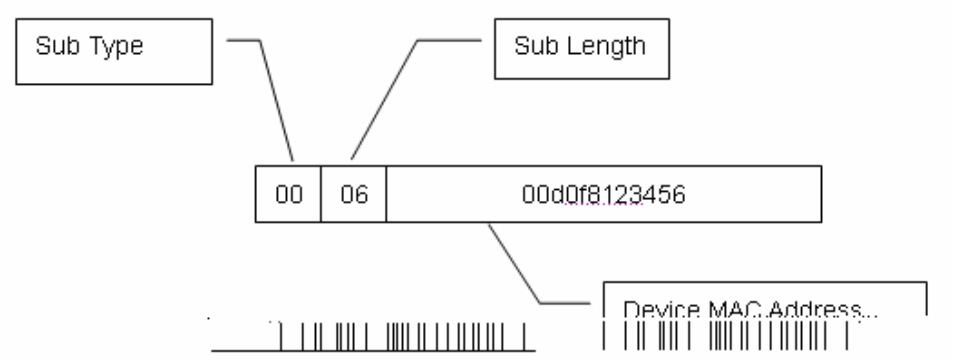
14 DHCP Snooping

14.1 DHCP Snooping

14.1.1 DHCP

DHCP

DHCP Snooping



3

14.1.4 DHCP Snooping

DHCP snooping DHCP
(IP MAC VLAN PORT) DHCP snooping
DHCP snooping IP
DHCP snooping IP
IP

14.1.5 DHCP Snooping Bootp

DHCP Snooping DHCP Bootp
Bootp DHCP Option
DHCP Snooping Bootp

DHCP Snooping
Bootp DHCP Snooping DHCP
Bootp Bootp IP
MAC VLAN DHCP
Snooping

Bootp DHCP Snooping
Bootp

14.1.6 DHCP snooping

DHCP Snooping IP ARP
ARP ARP DHCP Snooping
ARP ARP ARP-CHECK
DAI

```
Ruijie(config)# end
```

14.2.3 DHCP Snooping Bootp

DHCP Snooping Bootp
DHCP Snooping Bootp Bootp
DHCP Snooping

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

DHCP Snooping Bootp

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

14.2.4 MAC

MAC DHCP Snooping
UNTRUST DHCP
MAC DHCP CLIENT MAC

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

MAC

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

14.2.5 DHCP snooping information option

DHCP Snooping
DHCP option82 DHCP
option82

Ruijie# **configure terminal**	
Ruijie(config)# [**no**] **ip dhcp snooping Information option**	DHCP snooping information option

DHCP Snooping information option

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

~

DHCP relay option82

14.2.6 DHCP Snooping Flash

DHCP Snooping

DHCP Snooping

Flash

14.2.7 DHCP Snooping Flash

DHCP Snooping

Flash

Ruijie# **configure terminal**	
Ruijie(config)# **ip dhcp snooping database write-to-flash**	DHCP snooping flash

DHCP Snooping Flash

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

14.2.8 suppression

suppression

DHCP

Ruijie# **configure terminal**	
Ruijie(config)# **interface***interface-id*	
Ruijie(config-if)# [**no**] **ip dhcp snooping suppression**	suppression

fastethernet *0/2* suppression

```
Ruijie# configure terminal
Ruijie(config)# interface fastethernet 0/2
Ruijie(config-if)# ip dhcp snooping suppression
Ruijie(config-if)# end
```

14.2.9 TRUST

UNTRUST

TRUST DHCP DHCP Snooping TRUST DHCP UNTRUST DHCP

Ruijie# **configure terminal**	
Ruijie(config)# **interface** *interface-id*	

Ruijie(config-if)# [**no**] **ip dhcp snooping trust**	TRUST

fastethernet *0/1* TRUST

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

14.2.10 DHCP

DHCP

DHCP

Ruijie# **configure terminal**	
Ruijie(config)# **interface fastethernet** *0/1*	
Ruijie(config-if)# [**no**] **ip dhcp snooping limitrate** *rate-value*	DHCP

fastethernet *0/1* DHCP 100pps

```
Ruijie# configure terminal
Ruijie(config)# interface fastethernet 0/1
Ruijie(config-if)# ip dhcp snooping limit rate 100
Ruijie(config-if)# end
Ruijie# show ip dhcp snooping
Switch DHCP snooping status   ENABLE
(confher98efBTer98e89 Tf196.20 0 10./TT14  re2. 1  hwaddr040bTf3fTr0 Tcw u
```

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

14.3 DHCP Snooping

14.3.1 DHCP Snooping

DHCP Snooping

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 seconds
DHCP snooping option 82 status: ENABLE
DHCP snooping Support Bootp bind status: ENABLE
Interface                Trusted    Rate limit (pps)
-----------------------  -------    ------------
FastEthernet0/1           NO         100
```

14.3.2 DHCP Snooping

DHCP Snooping

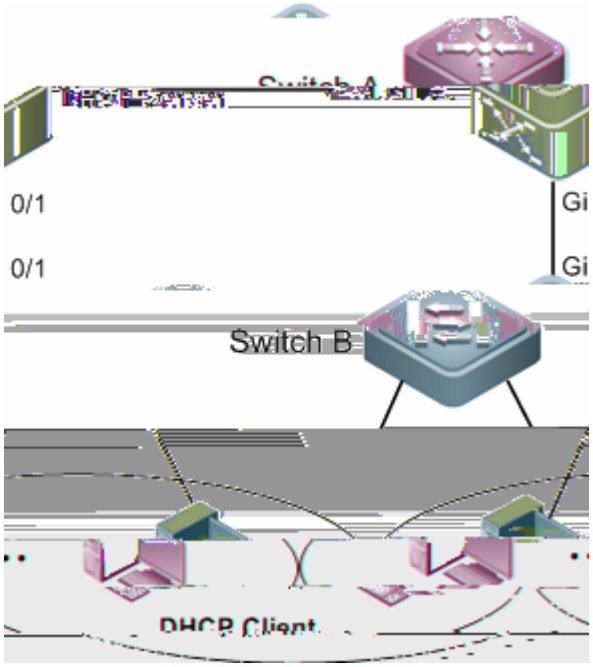
Ruijie# **show ip dhcp snooping binding**	DHCP?8Q?@E}Bg,X*Q

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

```
Ruijie# debug ip dhcp snooping event
Ruijie# debug ip dhcp snooping packet
```

14.4 DHCP Snooping

14.4.1



10

14.4.2

1. DHCP DHCP IP
2. DHCP

14.4.3

1. Switch B DHCP Snooping Gi 0/1

14.4.4

， Switch B

DHCP Snooping

```
Ruijie#configure terminal
```

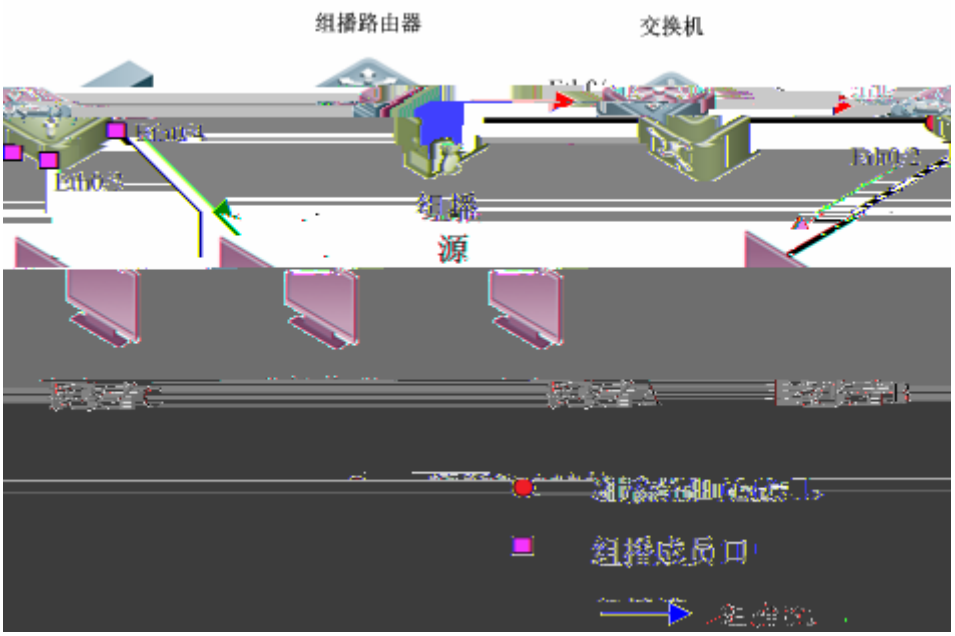
15 IGMP Snooping

15.1

15.1.1 IGMP Snooping

15.1.2 IGMP Snooping

1-2 Router Switch A IGMP Snooping Host A Host C IP



、 IP

15.1.4.3

IP IGMP
IP IGMP

15.1.5 IGMP Profiles

IGMP Profiles
permit deny “ SVGL
” “ ” “ IGMP Filtering ”

15.1.6 IGMP Snooping

DISABLE IGMP Snooping
VLAN “ ” IGMP VLAN

IVGL (Independent VLAN Group Learning) VLAN
VLAN
VLAN VLAN

15.2 IGMP Snooping

IGMP Snooping

IGMP Snooping	IGMP Snooping	
	IGMP	
IGMP Snooping		

	IGMP	
IP	IP	

15.2.1 IGMP Snooping

IGMP Snooping IGMP Snooping
IVGL

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private vlan IGMP snooping

15.2.2 IVGL

IGMP Snooping IVGL

Ruijie(config)# **ip igmp snooping ivgl**	IGMP Snooping IVGL IGMP Snooping
Ruijie(config)# **show ip igmp snooping**	
Ruijie(config)#**no ip igmp snooping**	IGMP Snooping

IGMP Snooping IVGL

```
Ruijie# configure terminal
Ruijie(config)# ip igmp snooping ivgl
Ruijie(config)# show ip igmp snooping
IGMP Snooping running mode: IVGL
SVGL vlan: 1
SVGL profile number: 0
Source port check: Disable
Source ip check: Disable
IGMP Fast-Leave: Disable
IGMP Report suppress: Disable
```

15.2.3 IGMP Snooping

IGMP Snooping

， IGMP

Ruijie(config)# **ip igmp snooping query-max-response-time** *time*	IGMP 1-65535 10s
Ruijie(config)# **no ip igmp snooping query-max-response-time**	IGMP 10s

IGMP 15s

```
Ruijie# configure terminal
Ruijie(config)# ip igmp snooping query-max-response-time 15
```

15.2.6

VLAN

no

Ruijie(config)# **ip igmp snooping vlan** *vlan-id* **mrouter interface** *interface-id*	
Ruijie(config)# **no ip igmp snooping vlan** *vlan-id* **mrouter interface** *interface-id*	
Ruijie(config)# **ip igmp snooping vlan** *vlan-id* **mrouter learn pim-dvmrp**	VLAN
Ruijie(config)# **no ip igmp snooping vlan** *vlan-id* **mrouter learn pim-dvmrp**	

1/1j/TT7 5.429 00.480n102d79 1 Tf92#ÞHouCBGÊADEpCDp@

{ 04c6N Ä

```
Ruijie# show ip igmp snooping mrouter
Vlan    Interface         State
----    ---------         ------
1   GigabitEthernet 1/1    static
1   GigabitEthernet 0/2    dynamic
Ruijie# show ip igmp snooping mrouter learn
Vlan    learn method
----    ------------------
1       pim-dvmrp
```

15.2.7

IP IP

IP

IGMP Snooping

Ruijie(config)# **ip igmp snooping ivgl**	IGMP Snooping IVGL

vlan-id **static** *ip-addr* **interface** ping ivgl

Ruijie(config)# **ip igmp snooping** *interface-id*
vlan *vlan-id* **static** *ip-addr* **interface**
interface-id

```
1    233.3.3.4        GigabitEthernet 0/7(S)
```

15.2.8

IP IGMP

IGMP snooping

Ruijie(config)# **ip igmp snooping fast-leave enable**	
Ruijie(config)# **no ip igmp snooping fast-leave enable**	

no ip igmp snooping fast–leave enalbe

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

15.2.9 IGMP Snooping

VLAN IP IGMP
VLAN
IP Report IGMP

IGMP VLAN
IP IGMP
IGMP

IGMP snooping suppression

Ruijie(config)# **ip igmp snooping suppression enable**	Report
Ruijie(config)# **no ip igmp snooping suppression enable**	Report

Suppression

```
Ruijie# configure terminal
Ruijie(config)# ip igmp snooping suppression enable
```

15.2.10 IGMP Profiles

IGMP Profiles “ SVGL ” “ ” “ IGMP Filtering ”

Profile

Ruijie(config)# **ip igmp profile** *profile-number*	IGMP Profile 1 1024 profile
Ruijie (config-profile)# **permit** | **deny**	(permit deny deny / range /
Ruijie(config-profile)# **range** *low-address high_address*	IP IP IP range
Ruijie(config)# **end**	

IGMP profile **no ip igmp profile profile number** profile range **no range ip multicast address**

Profile

```
Ruijie(config)# ip igmp profile 1
Ruijie(config-profile)# permit
Ruijie(config-profile)# range 224.0.1.0 239.255.255.255
Ruijie(config-profile)# end
Ruijie# show ip igmp profile 1
Profile    1
       Permit
       range 224.0.1.0,   239.255.255.255
```

IGMP Profile permit 224.0.1.0 239.255.255.255 deny

15.2.11 IGMP Filtering

IGMP Filtering

IGMP Profile IGMP Report
IGMP Profile

IGMP Report

IGMP Filtering

Ruijie(config)# **interface** *interface-id*	
Ruijie(config-if)# **ip igmp snooping filter** *profile-number*	Profile *profile number*

IGMP Snooping

```
Ruijie# show ip igmp snooping statistics
Current number of Gda-table entries: 1
Configured Statistics database limit: 1024
Current number of IGMP Query packet received : 1957
Current number of IGMPv1/v2 Report packet received: 5
Current number of IGMPv3 Report packet received: 4
Current number of IGMP Leave packet received: 1

 GROUP  Interface   Last      Last       Report  Leave
                 report time reporter    pkts    pkts
------   -------- ---------- ---------- ---- -- -------- ----
233.3.3.3 gi1/1   00:02:40   1.1.1.1     3       1
```

15.2.15

IGMP Snooping

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

show ip igmp snooping IGMP Snooping

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

15.2.16

GDA Group Destination Address

Ruijie# **show ip igmp snooping gda-table**	

GDA

```
Ruijie# show ip igmp snooping gda-table
Abbr: M - mrouter
```

```
     D - dynamic
     S - static
VLAN  Address            Member ports
------------------------------------------------------------
1      233.3.3.3          GigabitEthernet 0/7(S)
```

15.2.17

GDA Group Destination Address

Ruijie# **clear ip igmp snooping statistics**	

GDA

```
Ruijie# clear ip igmp snooping statistics
```

15.2.18

IGMP Snooping

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

```
Ruijie(config)# show ip igmp snooping
IGMP-snooping mode        :IVGL
SVGL vlan-id             :1
SVGL profile number      :0
Source check port        :Disable
IGMP Fast-Leave: Disable
IGMP Report suppress: Disable
```

15.2.19 IGMP Profile

IGMP Profile

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

IGMP Profile

```
Ruijie# show ip igmp profile 1
Profile    1
       Permit
       range 224.0.1.0,   239.255.255.255
```

15.2.20 IGMP Filtering

IGMP Filtering

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

IGMP Filtering

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

16 MSTP

16.1 MSTP

16.1.1 STP RSTP

16.1.1.1 STP RSTP

STP RSTP IEEE 802.1D IEEE 802.1w

STP

LAN

STP

,

,

RSTP 802.1D STP STP

“ ”

RSTP

1 STP 50

~

S3760 buffer fc

16.1.1.2 Bridge Protocol Data Units(BPDU)

- ID Bridge ID Mac
- Root Path Cost
  Ş 1T/
- ID Port ID

4sUƀ ضم ï I C

Root Bridge Bridge ID 8
6 mac 2 4 bit
Priority 12 bit System ID RSTP
0 4096

	Priority value				System ID											
Bit	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
	32768	16384	8192	4096	2048	1024	512	256	128	64	32	16	8	4	2	1

16.1.1.4 Spanning-Tree Timers

- Hello timer BPDU
- Forward-Delay timer RSTP STP Listening Learning Learning Forwarding
- Max-Age timer BPDU

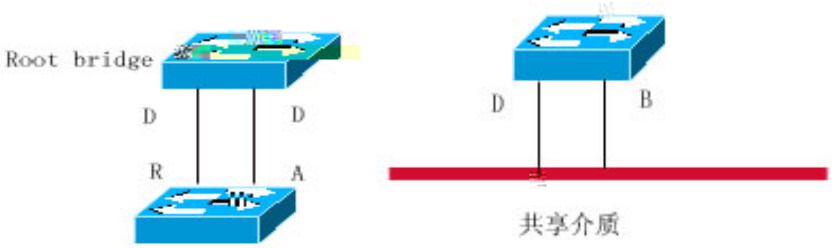
16.1.1.5 Port Roles and Port States

Port Role

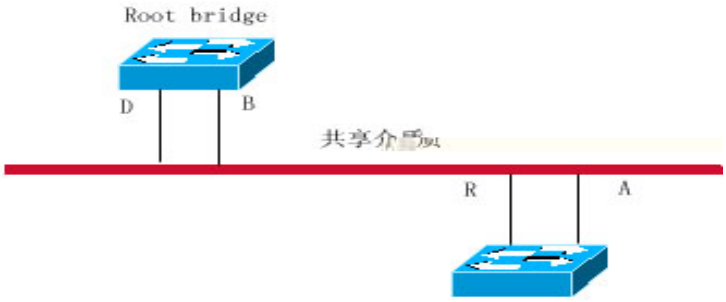
- Root port Root Bridge
- Designated port LAN
- Alternate port
- Backup port Designated Port LAN Designated Port Backup Port
- Disable port Operation State Down

1 2 3

R = Root Port D = Designated Port A = Alternate Port B = Backup Port



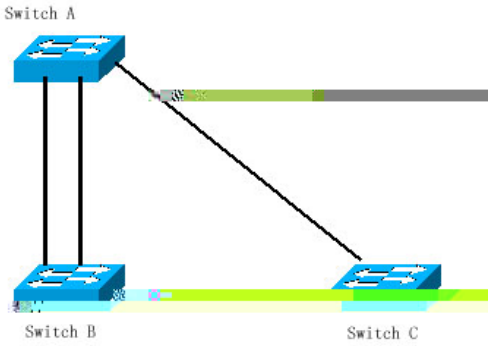
1 **2**



3

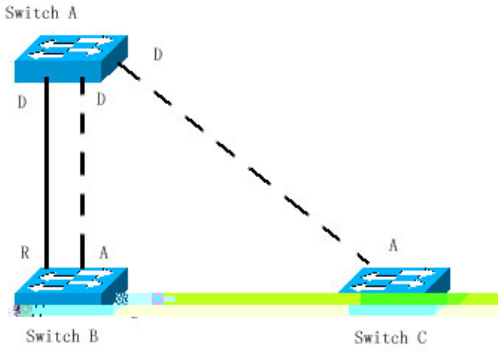
Port State

, Discarding



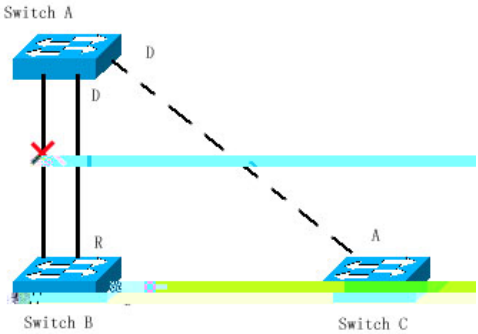
4

Switch Spanning Tree BPDU
Root Bridge Switch A Switch B Switch A
Root Port Alternate Port
Switch C B A A
B A Path Cost A
Switch C B Root port A
Alternate port Port Role
5



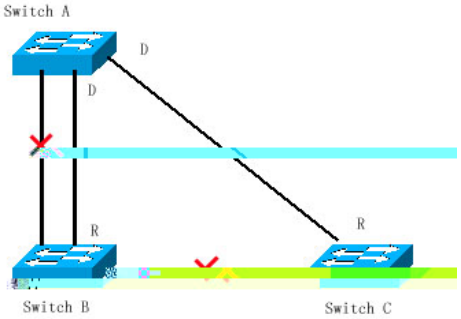
5

Switch A Switch B
6



6

Switch B Switch C Switch C Alternate port Root port 7



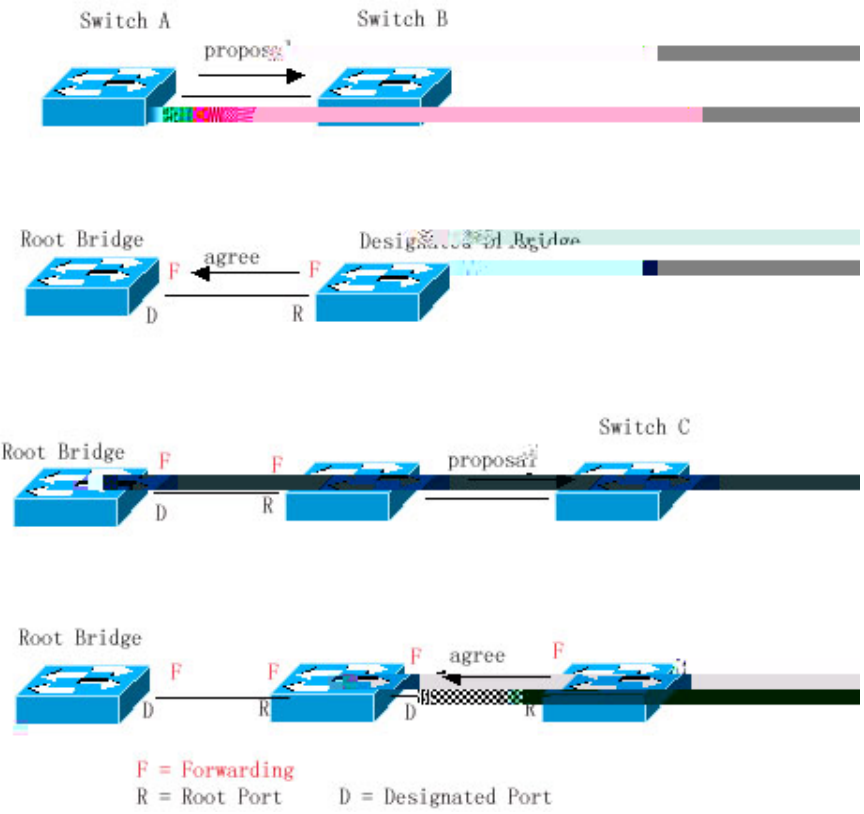
7

16.1.1.7 RSTP

RSTP “ ” Forwarding

STP Port Role 30 (Forward-Delay Time 2 Forward-Delay Time 15) Forwarding Root Port Designated Port 30 Forwarding 50

RSTP Forwarding 8 Switch A RSTP “Proposal” Switch B



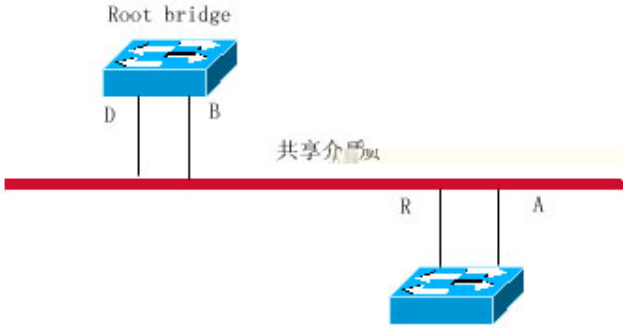
8

~

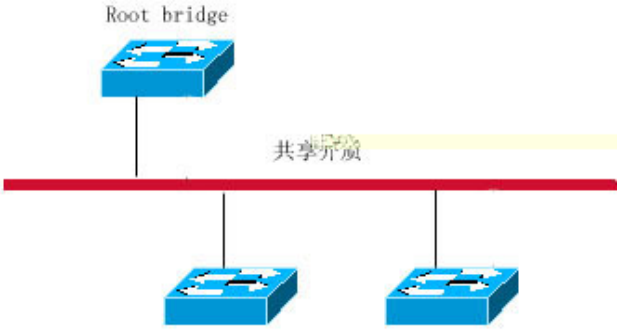
“ ” “Point-to-point Connect

”

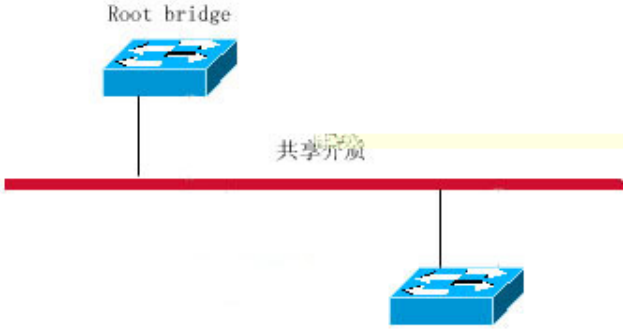
9 “ ” “ ”



9



10



11

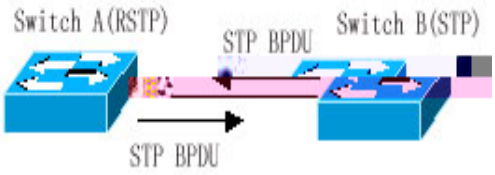
16.1.1.8 RSTP STP

RSTP STP RSTP BPDU
STP RSTP STP
STP Forwarding 30 Forwarding
RSTP

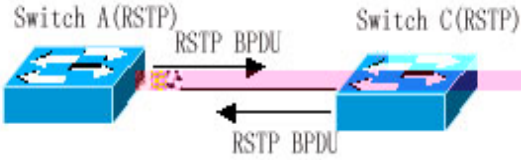
RSTP STP 12 Switch A
RSTP Switch B STP Switch A
STP STP BPDU Switch C
RSTP Switch A STP BPDU Switch C
STP RSTP STP

RSTP Protocol-migration

Protocol Migration



12



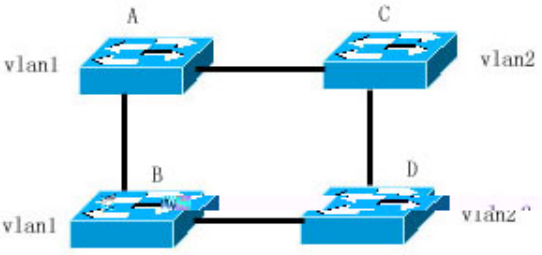
13

16.1.2 MSTP

MSTP MSTP STP RSTP
RSTP FORWARDING

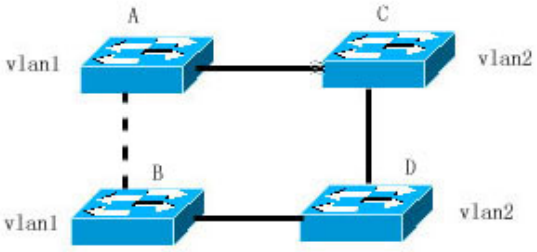
Vlan

14 A B Vlan1 C D Vlan2



14

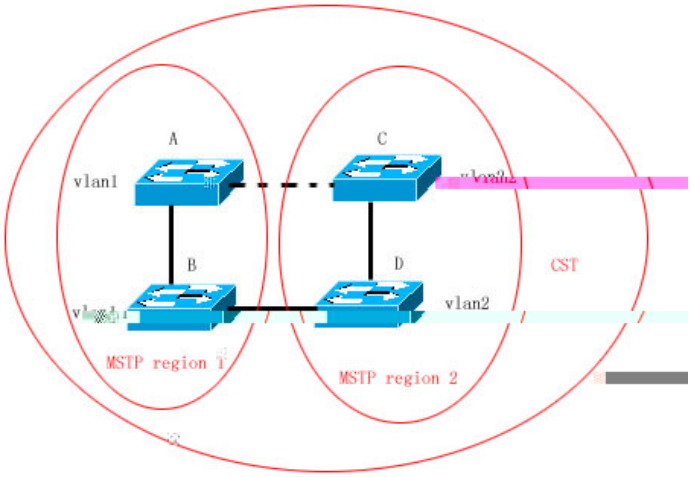
A C D B A B
A B DISCARDING 15
C D Vlan1 Vlan1 A Vlan1
B Vlan1



15

MSTP Vlan
Instance Instance MST Region
IST Internal Spanning-tree
MST region MST Region
CST Common Spanning Tree

MSTP 16 A B
MSTP Region 1 MSTP Region 1
DISCARDING MSTP Region 2 Region 1 Region
2 “ ”
DISCARDING



16

Vlan

16.1.2.1 MSTP Region

MSTP MSTP
Region MSTP Region “MST ”

MST

， MST Name 32 MSTP Region

¸ MST Revision Number 16bit MSTP Region

¸ MST Instance—vlan 64 Instance id
1 64 Instance 0 65 Instance
1-4094 Vlan Instance 0 64
Vlan Instance 0 MSTI MST Instance
“Vlan ” BPDU MSTI MSTI
CIST MSTI

spanning-tree mst configuration “MST ”

MSTP BPDU BPDU MST
MST Region
Region

&

STP Instance—vlan
MSTP

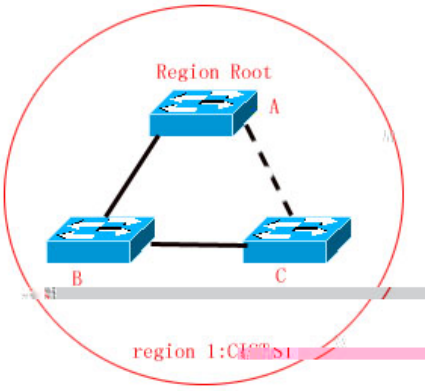
16.1.2.2 MSTP region IST

MSTP Region Region Instance Bridge Priority Port Priority Instance Root Bridge
Port Role Port Role Instance
FORWARDING DISCARDING

MSTP BPDU IST(Internal Spanning Tree)
Instance MSTI Instance 0
CST CIST Common Instance Spanning Tree
Instance “vlan ”

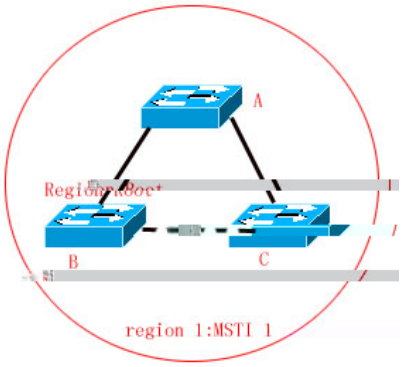
Region 1 A B C

CIST Instance 0 17 A Region Root
A C DISCARDING Instance 0 “Vlan
” A B B C “Vlan ”



17

MSTI 1 Instance 1 18 B Region Root B C DISCARDING Instance 1 “Vlan ” A B A C “Vlan ”



18

MSTI 2 Instance 2 19 C Region Root A B DISCARDING Instance 2 “Vlan ” B C A C “Vlan ”

MSTP

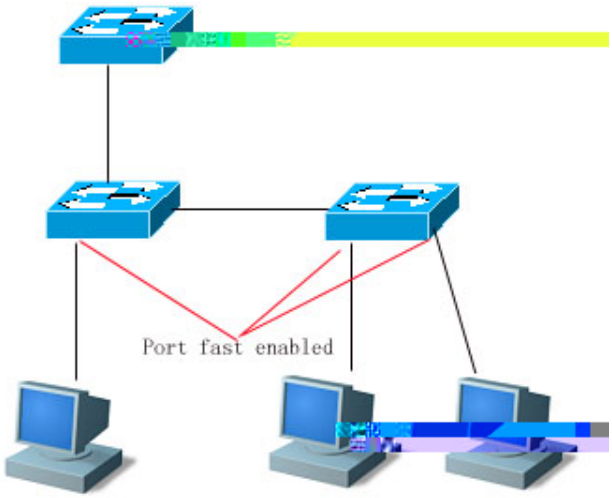
CIST Regional Root Region Bridge ID
Region CST Root Root Path Cost

CIST Regional Root Root Port MSTI Port Role
“Master port” Instance “ ” Instance
FORWARDING Region CST Root “
” Region !

16.1.2.4 Hop Count

IST MSTI Message Age Max Age BPDU
IP TTL Hop Count

spanning-tree max-hops Region Region
Root Bridge Hop Count 1 0 BPDU
Hops BPDU ß&4 •„ ò% Qð3 Ð †AW \f•=JÎQò † O b,X2 pß=@œBO



21

Port Fast BPDU Port Fast Operational State
Disabled STP Forwarding

16.2.2 (AutoEdge)

AutoEdge (3)
BPDU
Forwarding BPDU

spanning-tree autoedge disabled

~

1) Port Fast

2) STP
Autoedge

3) BPDU Filter Forwarding

4)

5) AutoEdge IEEE 802.1D 200 1 1 T4.251 Tf5.2514 0 TD0 280f5d000c03d837 Tc[<422

Hello Time	AutoEdge

16.2.3 BPDU Guard

BPDU Guard enable Interface enable

spanning-tree portfast bpduguard default

BPDU Guard enabled Interface Port Fast Interface BPDU Error-disabled

Interface **spanning-tree bpduguard enable**

Interface BPDU Guard

Interface BPDU Error-disabled

16.2.4 BPDU Filter

BPDU Filter enable Interface enable

spanning-tree portfast bpdufilter default

BPDU Filter enabled Interface Port Fast BPDU BPDU BPDU BPDU Port Fast Operational disabled BPDU Filter

Interface spanning-tree bpdufilter enable

Interface BPDU Filter enable

Interface BPDU BPDU Forwarding

16.2.5 Tc-protection

TC-BPDU TC BPDU MAC ARP TC-BPDU TC-protection

Tc-protection

TC-BPDU 4 TC-BPDU TC-BPDU

16.2.6 TC Guard

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

~

1) tc-guard

2) tc

3) tc-guard, tc

4) tc-guard, tc

16.2.7 BPDU MAC

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

16.2.8 BPDU

BPDU 1500 BPDU
BPDU

16.2.9 ROOT Guard

Root Guard

Root Guard

16.3 MSTP

16.3.1 Spanning Tree

Spanning Tree

Enable State	Disable 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

Ruijie# **show spanning-tree**	
Ruijie# **copy running-config startup-config**	

Spanning Tree **no spanning-tree**

16.3.3 Spanning Tree

802.1 STP RSTP MSTP Spanning Tree

Spanning Tree

MSTP RSTP STP MSTP Region

MSTP

Spanning Tree

Ruijie# **configure terminal**	
Ruijie(config)# **spanning-tree mode mstp/rstp/stp**	Spanning Tree
Ruijie(config)# **end**	
Ruijie# **show spanning-tree**	
Ruijie# **copy running-config startup-config**	

Spanning Tree **no spanning-tree mode**

16.3.4 Switch Priority

Instance Instance

Region CIST

Instance 0

Bridge ID	16	4096

Ruijie(config-if)# **spanning-tree** [**mst** *instance-id*] **port-priority** *priority*	instance instance instance 0 *instance-id* 0 64 *priority* interface 0 240 16 128
Ruijie(config-if)# **end**	
Ruijie# **show spanning-tree** [**mst** *instance-id*] **interface** *interface-id*	
Ruijie# **copy running-config startup-config**	

no spanning-tree mst *instance-id* **port-priority**

16.3.6 Path Cost

Root Bridge Path Cost Root Port
Port Path Cost Root Port Interface
The Media Speed
Path Cost
Instance Instance

Ruijie# **configure terminal**	
Ruijie(config)# **interface** *interface-id*	interface interface Aggregate Link
Ruijie(config-if)# **spanning-tree** [**mst** *instance-id*] **cost** *cost*	instance instance instance 0 *instance-id* 0 64 *cost* 1 200,000,000 interface
Ruijie(config-if)# **end**	

Ruijie# **show spanning-tree** [**mst** *instance-id*] **interface** *interface-id*	
Ruijie# **copy running-config startup-config**	

no spanning-tree mst cost

16.3.7 Path Cost path cost method

Path Cost Path Cost IEEE 802.1d IEEE 802.1t Path Cost 802.1d short 1—65535 802.1t long (1—200,000,000) Path Cost IEEE 802.1t

Path Cost

	Interface	IEEE 802.1d short	IEEE 802.1t long

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

no spanning-tree pathcost method

16.3.8 Hello Time

BPDU 2

Hello Time

Ruijie# **configure terminal**	
Ruijie(config)# **spanning-tree hello-time** *seconds*	hello_time 1 10 2
Ruijie(config)# **end**	
Ruijie# **show running-config**	
Ruijie# **copy running-config startup-config**	

no spanning-tree hello-time

16.3.9 Forward-Delay Time

15

Forward-Delay Time

Ruijie# **configure terminal**	
Ruijie(config)# **spanning-tree forward-time** *seconds*	forward delay time 4 30 15
Ruijie(config)# **end**	

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

no spanning-tree forward-time

16.3.10 Max-Age Time

BPDU 20

Max-Age Time

Ruijie# **configure terminal**	
Ruijie(config)# **spanning-tree max-age** *seconds*	max age time 6 40 20
Ruijie(config)# **end**	
Ruijie# **show running-config**	
Ruijie# **copy running-config startup-config**	

no spanning-tree max-age

~

Hello Time Forward-Delay Time Max-Age Time

2*(Hello Time + 1.0 seconds) <= Max-Age Time <= 2*(Forward-Delay – 1.0seconds)

16.3.11 Tx-Hold-Count

BPDU 3

Tx-Hold-Count

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

16.3.14 MSTP Region

MSTP Region

Name Revision Number Instance Vlan

0 64 Instance Vlan Vlan Instance 0 Vlan Instance

STP Instance Vlan MSTP

MSTP Region

Ruijie(config-mst)# **end**	
Ruijie# **copy running-config startup-config**	

MST Region Configuration **no spanning-tree mst configuration** **no instance** *instance-id* instance **no name**

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

no spanning-tree max-hops

16.3.16

BPDU

MSTI

Ruijie# **configure terminal**	

Ruijie(config)#

Operational State disabled STP Forwarding

Port Fast

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

Port Fast Interface **spanning-tree portfast disable**

spanning-tree portfast default

Portfast

16.4.3

(3) DU

DU Port Fast Operational State disabled

Ruijie# **configure terminal**	
Ruijie(config)# **spanning-tree portfast bpdufilter default**	BPDU filter
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**(confil)]TJ/TT4 1 Tf989771 0 TD0 Tc0 Tw( )Tj/TT5 1 TfG5BBÒ#Ä
[AT0@
confil

Ruijie# **configure terminal**	
Ruijie(config)# **spanning-tree tc-protection tc-guard**	TC Guard
Ruijie(config)# **end**	
Ruijie# **show running-config**	

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

bpdu mac

Ruijie(config)# **interface**
Interface-id

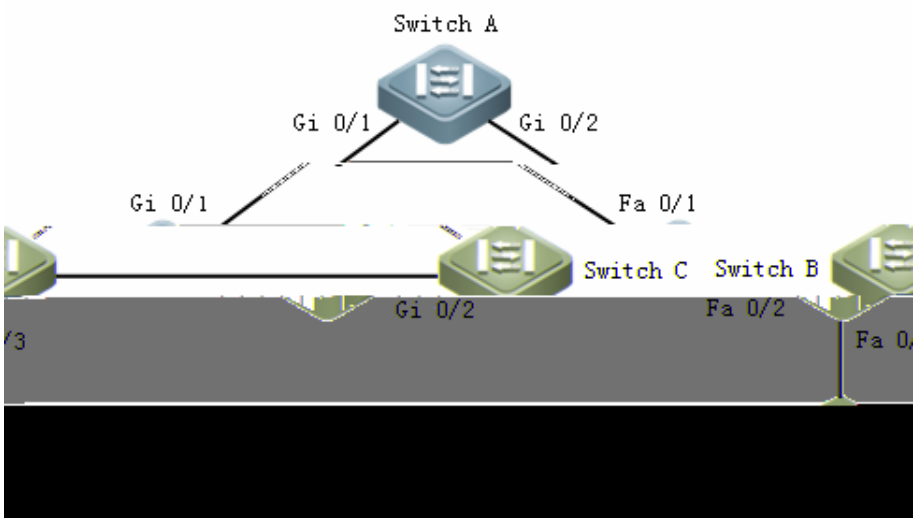
Ruijie# **show spanning-tree mst** *instance-id* **interface** *interface-id*	interface instance MSTP
Ruijie# **show spanning-tree interface** *interface-id*	interface instance MSTP
Ruijie# **show spanning-tree forward-time**	forward-time
Ruijie# **show spanning-tree Hello time**	Hello time
Ruijie# **show spanning-tree max-hops**	max-hops
Ruijie# **show spanning-tree tx-hold-count**	tx-hold-count
Ruijie# **show spanning-tree pathcost method**	pathcost method

16.6 MSTP

16.6.1

1) MSTP
2) Vlan-Instance MST MST Revision Number
3) MSTP
4) BPDU Guard PC Port Fast

16.6.2



16.6.3

1) **Switch A**

Gi 0/1 Gi 0/2 Trunk VLAN 2 VLAN 3

```
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
```

MSTP VLAN 2 Instance 1 VLAN 3 Instance 2 MST ruijie MST Revision Number 1 MST

```
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 relationship
Ruijie(config-mst)# name ruijie
Ruijie(config-mst)# revision 1
Ruijie(config-mst)# show
Multi spanning tree protocol : Enable
Name    : ruijie
Revision : 1
Instance  Vlans Mapped
-------- ---------------------------------------------
0       : 1, 4-4094
1       : 2
2       : 3
---------------------------------------------------
Ruijie(config-mst)# exit
Ruijie(config)# spanning-tree
Enable spanning-tree.
```

Instance 0 4096

```
Ruijie(config)# spanning-tree mst 0 priority 4096
```

2) **Switch B**

Gi 0/1 Gi 0/2 Trunk VLAN 2 VLAN 3

```
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
```

MSTP VLAN 2 Instance 1 VLAN 3 Instance 2 MST ruijie MST Revision Number 1

```
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 relationship
Ruijie(config-mst)# name ruijie
Ruijie(config-mst)# revision 1
Ruijie(config-mst)# exit
Ruijie(config)# spanning-tree
Enable spanning-tree.
```

Instance1 4096

```
Ruijie(config)# spanning-tree mst 1 priority 4096
```

3) Switch C

Fa 0/1 Fa 0/2 Trunk VLAN 2 VLAN 3

```
Ruijie(config)# interface fastEthernet 0/1
Ruijie(config-if)# switchport mode trunk
Ruijie(config-if)# exit
Ruijie(config)# interface fastEthernet 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
```

```
#                MSTP             VLAN 2          Instance 1      VLAN 3
Instance 2        MST              ruijie    MST Revision Number     1
```

```
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 relationship
Ruijie(config-mst)# name ruijie
Ruijie(config-mst)# revision 1
Ruijie(config-mst)# exit
Ruijie(config)# spanning-tree
Enable spanning-tree.
```

```
#                Instance 2
```

```
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
```

17 SPAN

17.1

17.1.1 SPAN

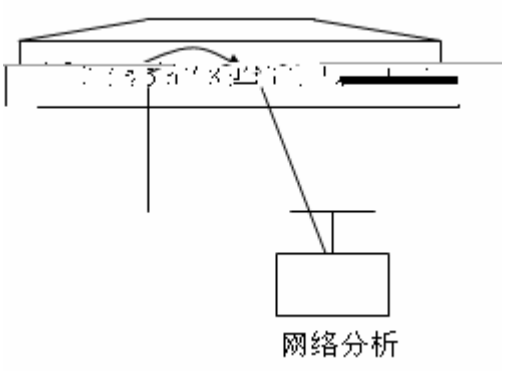
SPAN

RMON SPAN

MIRROR

1 5 10 10

5 5



1 SPAN

SPAN

SPAN

100Mbps

1000Mbps

17.2 SPAN

SPAN

17.2.1 SPAN

SPAN disabled port SPAN

Show monitor session *session number*

SPAN SPAN

17.2.2

SPAN

~

S3760 ٦ ط

2) VLAN

3) SPAN

4) AP SPAN

17.3.3 SPAN

SPAN ( ) ( )

Ruijie(config)# **monitor session** *session_number*
source interface *interface-id*

~

S3760

17.3.4 SPAN

SPAN

Ruijie(config)#

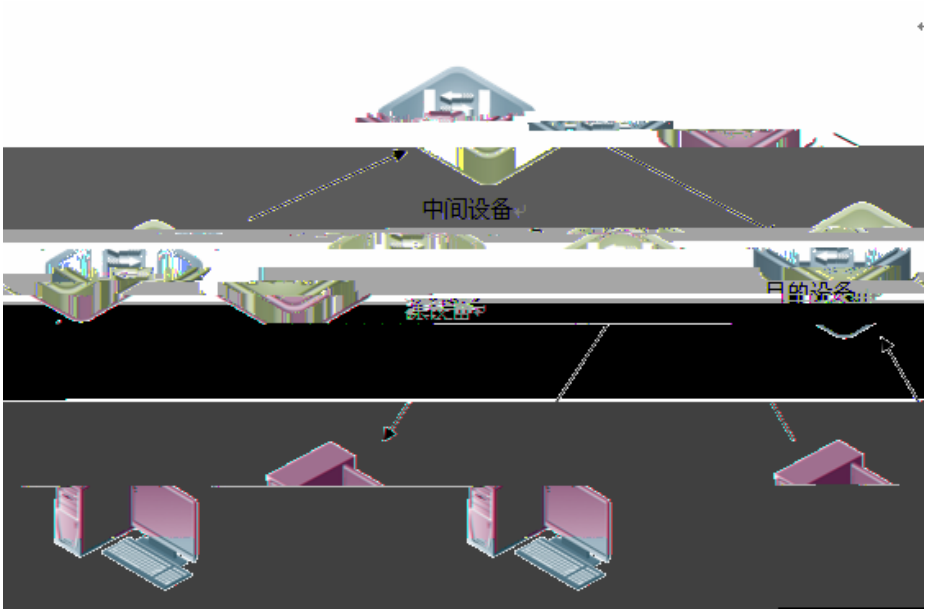
18 RSPAN

RSpan

18.1

RSPAN SPAN RSPAN Session
RSPAN Vlan

RSPAN RSPAN Vlan



1

， Remote VLAN

， Remote
VLAN

， Remote VLAN

-
- Remote VLAN

18.2.2

Ruijie# **configure terminal**	
Ruijie(config)# **vlan** *vlan-id*	Vlan
Ruijie(config-van)# **remote-span**	Vlan remote-span Vlan
Ruijie(config-vlan)# **exit**	
Ruijie(config)#	

tag

、 S3760 CPU RLDP DHCP

18.2.3

Ruijie# **configure**	
Ruijie(config)# **vlan** *vlan-id*	Vlan
Ruijie(config-vlan)# **remote-span**	Vlan remote-span Vlan
Ruijie(config-vlan)# **exit**	

18.2.4

Ruijie# **configure**	
Ruijie(config)# **vlan** *vlan-id*	Vlan
Ruijie(config-vlan)# **remote-span**	Vlan remote-span Vlan
Ruijie(config-vlan)# **exit**	
Ruijie(config)# **monitor session** *session_num* **remote-destination**	
Ruijie(config)# **monitor session** *session-num* **destination remote vlan** *vlan-id* **interface** *interface-name* [**switch**]	Remote VLAN

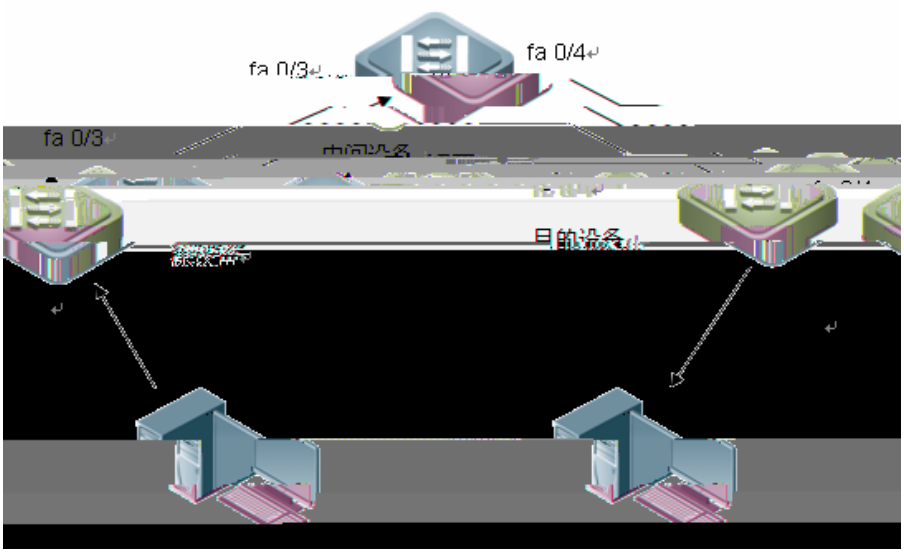
interface *interface-name* [**switch**])

18.3 RSPAN

Ruijie# **show monitor**	

```
Ruijie# show monitor
sess-num: 1
src-intf:
GigabitEthernet 0/4 frame-type Both
dest-intf:
GigabitEthernet 0/6
remote vlan 3
```

18.4



2

```
Ruijie# configure
Ruijie(config)# vlan 7
Ruijie(config-vlan)# remote-span
Ruijie(config-vlan)# exit
```

```
Ruijie(config)#Interface fastEthernet 0/3
Ruijie(config-if)#switchport mode trunk
Ruijie(config-if)#switchport trunk allowed vlan add 7
Ruijie(config-if)# exit
Ruijie(config)# monitor session 1 remote-source
Ruijie(config)# monitor session 1 source interface
fastEthernet 0/2
Ruijie(config)#Interface fastEthernet 0/1
Ruijie(config-if)#switchport access vlan 7
Ruijie(config)#monitor session 1 destination remote vlan 7
reflector-port interface fastEthernet 0/1 switch
```

```
Ruijie# configure
Ruijie(config)# vlan 7
Ruijie(config-vlan)# remote-span
Ruijie(config-vlan)# exit
Ruijie(config)#Interface  fastEthernet 0/3
Ruijie(config-if)#switchport mode trunk
Ruijie(config-if)#switchport trunk allowed vlan add 7
Ruijie(config-if)#exit
Ruijie(config)#Interface  fastEthernet 0/4
Ruijie(config-if)#switchport mode trunk
Ruijie(config-if)#switchport trunk allowed vlan add 7
```

```
Ruijie# configure
Ruijie(config)# vlan 7
Ruijie(config-vlan)# remote-span
Ruijie(config-vlan)# exit
Ruijie(config)#Interface fastEthernet 0/4
Ruijie(config-if)#switchport mode trunk
Ruijie(config-if)#switchport trunk allowed vlan add 7
Ruijie(config-if)# exit
Ruijie(config)# monitor session 1 remote- destination
Ruijie(config)#monitor session 1 destination remote vlan 7
interface fastEthernet 0/1 switch
```

19 IP

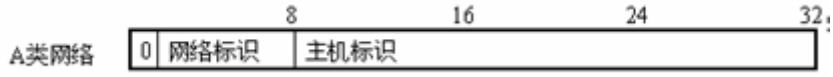
19.1 IP

19.1.1 IP

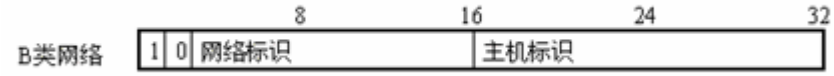
IP 32
8 0~255 “ . ” “ 192.168.1.1 ”
IP

IP IP 32 IP
1 2
IP

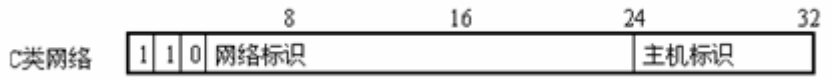
A “ 0 ” 7 24
128 A



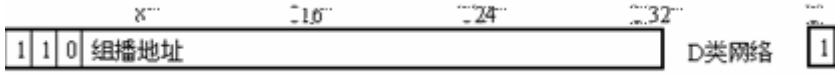
B “ 10 ” 14 16
16,348 B



C “ 110 ” 22 8
2,097,152 C



D “ 1110 ”



&

“ 1111 ” E

IP IP

IP

CNNIC IP

ICANN,Internet Corporation for Assigned Names and Numbers CNNIC

- IP
- ARP
- IP
- IP
-

19.1.2.1 IP

IP IP IP
IP

IP

Ruijie(config-if)# **ip address** *ip-address mask*	IP
Ruijie(config-if)# **no ip address**	IP

32 IP
“1” IP “0”
IP A
“255.0.0.0”

&

IP

-

19.1.2.1.1 IP

IP IP
IP IP IP IP
IP IP
IP

C

254 254 C

C

IP

IP

IP

IP

II

19.1.2.3 IP

IP IP

IP

IP

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

19.1.2.4

1

“ 1 ” 2

32 “ 1 ” IP

IP

IP

IP

RFC 919 RFC 922

，

， IP

19.1.2.4.1

IP IP IP

172.16.16.255

IP

IP “ 1 ”

Ruijie(config-if)# **ip directed-broadcast** [*access-list-number*]	
Ruijie(config-if)# **no ip directed-broadcast**	

19.1.2.4.2 IP

“ 1 ” 255.255.255.255

255.255.255.255

Ruijie(config-if)# **ip broadcast-address**	

19.1.3.2

IP

RIP RIPv1 C
172.16.2.0/24 D 172.16.1.0/24

，

RIPv1
172.16.1.0/24 172.16.2.0/24 C 192.168.12.0/24
C D
RIP

A B 192.168.12.0/24 172.16.3.0/24
A B

A

```
interface FastEthernet 0/1
ip address 172.16.3.1 255.255.255.0 secondary
ip address 192.168.12.1 255.255.255.0
!
interface FastEthernet 0/2
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 0/1
ip address 172.16.3.2 255.255.255.0 secondary
ip address 192.168.12.2 255.255.255.0
!
interface FastEthernet 0/2
ip address 172.16.2.1 255.255.255.0
!
router rip
network 172.16.0.0
network 192.168.12.0
```

19.2 IP

19.2.1 IP

IP IP ICMP
ICMP
ICMP RFC 792

IP

- ICMP
- ICMP
- ICMP
- IP MTU
- IP

19.2.1.1 ICMP

IP

ICMP

ICMP

ICMP

Ruijie(config-if)# **ip unreachables**	ICMP
Ruijie(config-if)# **no ip unreachables**	ICMP

19.2.1.2 ICMP

ICMP

5

ICMP

Ruijie(config-if)# **ip redirects**	ICMP
Ruijie(config-if)# **no ip redirects**	ICMP

19.2.1.3 ICMP

ICMP ICMP

ICMP

ICMP

Ruijie(config-if)# **ip mask-reply**	
Ruijie(config-if)# **no ip mask-reply**	

19.2.1.4 IP MTU

MTU MTU

MTU MTU IP MTU IP MTU MTU IP MTU MTU

MTU

MTU

IP MTU

Ruijie(config-if)# **ip mtu** *bytes*	

20 DHCP

20.1 DHCP

DHCP(Dynamic Host Configuration Protocol) RFC 2131
DHCP DHCP Client/Server
DHCP IP

DHCP IP

， DHCP IP

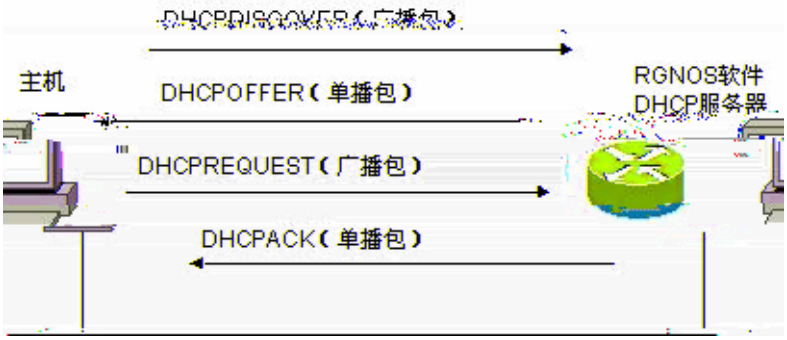
， DHCP IP

， IP DHCP
IP

DHCP BOOTP(Bootstrap Protocol)
BOOTP BOOTP DHCP
BOOTP DHCP
RFC 951 RFC 1542 DHCP

20.2 DHCP

DHCP RFC 2131
IP DHCP 3-1



1 DHCP

DHCP IP

1) DHCPDISCOVER DHCP

2) DHCP DHCPOFFER IP MAC

3) DHCPREQUEST

20.4 DHCP

DHCP DHCP DHCP DHCP
DHCP DHCP
DHCP
IP DHCP
DHCP DHCP

DHCP DHCP DHCP DHCP
DHCP DHCP

20.5 DHCP

DHCP

- DHCP
- DHCP
- DHCP
- DHCP NAK
- Ping
- Ping
- DHCP

20.5.1 DHCP

DHCP

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

20.5.2 DHCP

DHCP
DHCP

Ruijie(config)# **ip dhcp excluded-address** *low-ip-address* [*high-ip-address*]	IP DHCP
Ruijie(config)# **no ip dhcp excluded-address** *low-ip-address* [*high-ip-address*]	

DHCP DHCP

1 2 DHCP

DHCP

304w44a8D(p)Tjw ess1288/TT5 1 Tf2-1.4286 T1.32 0 T2234.88 661.2803 Tm<

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

“Ruijie(dhcp-config)#”

20.5.3.2

DHCP

Ruijie (dhcp-config)# **bootfile***filename*	

20.5.3.3

IP DHCP IP

Ruijie(dhcp-config)# *address* [*address2…address8*]s	

20.5.3.4

DHCP

Ruijie(dhcp-config)# **lease** { [[*minutes*] |**infinite**	

20.5.3.5

20.5.3.9 DHCP

DHCP

DHCP

DHCP

:

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

&

DHCP ID

DHCP

[

]

20.5.4 DHCP NAK

RFC2131 DHCP Request

NAK

IP Request IP

IP

DHCP NAK DHCP

DHCP

DHCP

NAK DHCP Request IP

IP DHCP

DHCP

NAK IP

DHCP NAK

Ruijie(dhcp-config)# **ip dhcp force-send-nak**	DHCP NAK

&

1

2 DHCP DHCP NAK

20.5.5

Ping ( ) Ping DHCP
DHCP Ping DHCP
DHCP

Ping

Ruijie(config)# **ip dhcp ping packets** *number*	DHCP Ping 0 Ping 2

-
-
- DHCP

20.7.1

21 DHCP Relay

21.1

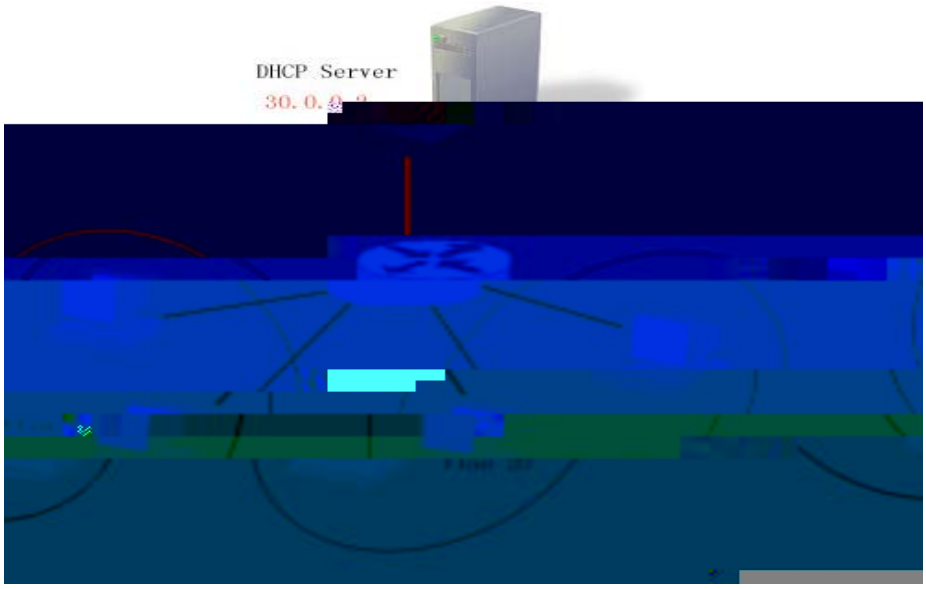
21.1.1 DHCP

DHCP IP

DHCP Client DHCP DISCOVER DHCP Server DHCP Server DHCP DISCOVER Client , IP DHCP OFFER DHCP Client DHCP OFFER DHCP REQUEST DHCP DISCOVER DHCP REQUEST IP DHCP ACK DHCP NAK DHCP Client DHCP ACK DHCP NAK DHCP DISCOVER IP

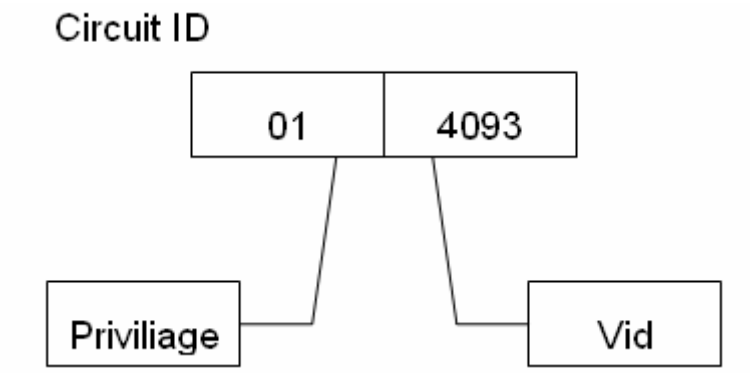
21.1.2 DHCP DHCP Relay Agent

DHCP IP 255.255.255.255



1

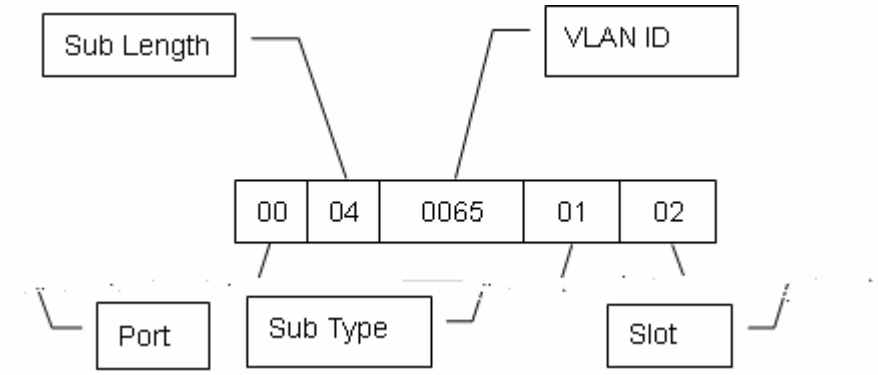
VLAN 10 VLAN 20 10.0.0.1/16 20.0.0.1/16 DHCP Server 30.0.0.1/16 30.0.0.2



2

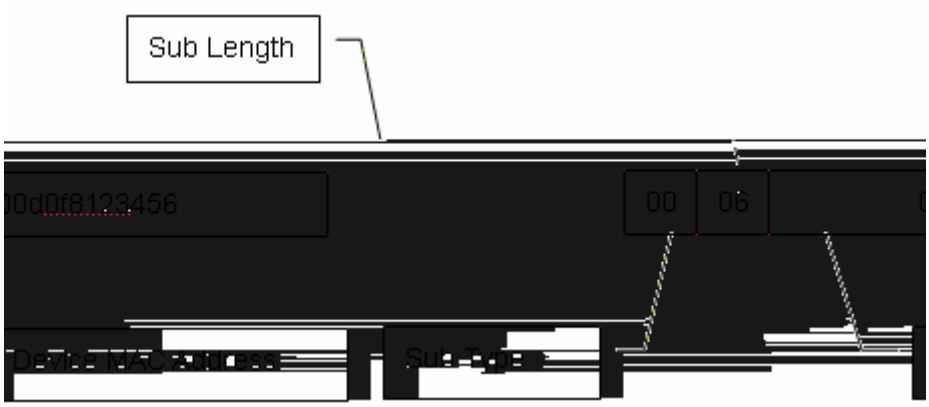
2. relay agent information option82 option
DHCP relay DHCP
option82 option

Agent Circuit ID



3

Agent Remote ID



4

21.1.4 DHCP relay Check Server-id

DHCP DHCP
DHCP
DHCP client DHCP REQUEST

Ruijie(config-if)# **no IP helper-address** [**vrf**]

Ruijie(config)# **ip dhcp relay check** *server-id*	DHCP relay check server-id

21.3.1 DHCP option dot1x

1. AAA/802.1x
2. 802.1x DHCP IP
3. **dhcp option82**
4. 802.1x DHCP IP MAC + IP DHCP

21.3.2 DHCP option82

DHCP option82 **dhcp option dot1x**

21.4 DHCP

show running-config DHCP

```
Ruijie# show running-config
Building configuration...
Current configuration : 1464 bytes
version RGOS 10.1.00(1), Release(11758)(Fri Mar 30 12:53:11 CST
2007 -nprd
hostname Ruijie
vlan 1
ip helper-address 192.18.100.1
ip helper-address 192.18.100.2
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
```

22 DNS

22.1 DNS

IP

IP IP

DNS

IP 1 IP

2

DNS DNS IP

DNS

IP

IP

DNS

22.2

22.2.1 DNS

DNS

DNS

Ruijie# **show hosts**	DNS

```
Ruijie# show hosts
DNS name server    :
192.168.5.134    static
    host               type         address
www.163.com            static       192.168.5.243
www.ruijie.com         dynamic      192.168.5.123
```

22.2.7

Ping

```
Ruijie# ping www.ietf.org
Resolving host[www.ietf.org]
Sending 5,100-byte ICMP Echos to 192.168.5.123,
timeout is 2000 milliseconds.
!!!!!
Success rate is 100 percent(5/5)
Minimum = 1ms Maximum = 1ms, Average = 1ms
```

23 (SNTP)

23.1

Timestamp

T3 ( ) Transmit Timestamp

T4 ( ) Destination Timestamp

T

d

T2 = T1 + t + d / 2;

T2 - T1 = t + d / 2;

T4 = T3 – t + d / 2;

T3 - T4 = t – d / 2;

d = (T4 - T1) - (T3 - T2);

t = ((T2 - T1) + (T3 - T4)) / 2;

t d SNTP Client

T4 + t

23.2 SNTP

SNTP

23.2.1 SNTP

SNTP

SNTP	Disable SNTP
NTP Server IP	0

SNTP	1800s
	+8

23.2.2 SNTP

SNTP

```
Ruijie# config
```

SNTP “ ”
“ ”

5

```
Ruijie(config)# sntp enable
```

```
Ruijie(config)# end
```

```
Ruijie# show running-config
```

```
Ruijie# copy running-config startup-config
```

SNT **no sntp enable** SNTP

23.2.3 NTP Server

SNTP NTP SNTP Client
NTP Server NTP Server
NTP Server

NTP server http://www.time.edu.cn/ http://www.ntp.org/

192.43.244.18(time.nist.gov)

SNTP Server IP

1)

```
Ruijie# config
```

2) SNTP Server IP

```
Ruijie(config)# sntp server <ip-addr>
```

3)

```
Ruijie(config)# end
```

4)

```
Ruijie# show running-config
```

5)

```
Ruijie# copy running-config startup-config
```

23.2.4 SNTP

SNTP Client NTP Server
NTP Server

1)

```
Ruijie# config
```

2) 60 -65535 1800

```
Ruijie(config)# sntp interval <seconds>
```

3)

```
Ruijie(config)# End
```

4)

```
Ruijie# show running-config
```

5)

```
Ruijie# copy running-config startup-config
```

~

sntp enable

23.2.5

SNTP (GMT)

1

```
Ruijie# config
```

2 -23 23 8
-8 8 0

Ruijie(config)# **clock timezone** <*timezone*>

3

Ruijie(config)# **End**

4

Ruijie# **show running-config**

5

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

no clock timezone

23.3 SNTP

1) SNTP

Ruijie# **show sntp**

2) **show sntp**

```
Ruijie# show sntp
SNTP state              : ENABLE            SNTP
SNTP server             : 192.168.4.12        NTP Server
SNTP sync interval      : 60
Time zone            : 8(east)
```

24 NTP

24.2.1 NTP

NTP

NTP NTP

NTP

ntp authenticate	NTP
no ntp authenticate	NTP

ntp authentication-key **ntp trusted-key**

24.2.2 NTP

NTP

key-id **ntp**

trusted-key key-id

uthentication-key *key-id* **md5** *tring* [*enc-type*]	NTP key-id 1-4294967295 key-string enc-type 0 7
p authentication-key *key-id* **md5** *tring* [*enc-type*]	NTP

~

1024

24.2.3 NTP ID

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

~

24.2.4 NTP

NTP 20

NTP

NTP L;QHIQGCDa<PAC08

ntp server *ip-addr* [**version** *version*][**source** *if-name number*][**key** *keyid*][**prefer**]	NTP version NTP 1-3 if-name Aggregateport Dialer GigabitEthernet Loopback Multilink Null Tunnel Virtual-ppp Virtual-template Vlan keyid 1-4294967295
no ntp server *ip-addr*	NTP

24.2.5 NTP

NTP

NTP

NTP

~

IP

NTP

interface *interface-type number*

NTP

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

NTP

ntp master [*stratum*]	NTP 1 15 8
no ntp master	NTP

12

```
Ruijie(config)# ntp master 12
```

~

ntp NTP

24.2.9 NTP

NTP
NTP NTP

NTP

ntp access-group { **peer | serve | serve-only | query-only** } *access-list-number*|*access-list-name*	
no ntp access-group { **peer | serve | serve-only | query-only** } *access-list-number*|*access-list-name*	

, **peer** NTP

NTP

debug ntp	
no debug ntp	

24.3.2 NTP

show ntp status NTP

NTP

show ntp status	NTP

```
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 reference frep precision reference time UTC clock offset root delay root dispersion peer dispersion

24.4

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

25 UDP-Helper

25.1 UDP-Helper

25.1.1 UDP-Helper

UDP-Helper UDP
UDP

UDP-Helper UDP
UDP IP
IP

UDP-Helper 69 53 37 137 138 49

& :

BOOTP/DHCP DHCP Relay UDP 67 68
67 68 UDP-Helper

Ruijie(config)# **udp-helper enable**	**udp-helper enable** UDP UDP

no udp-helper enable UDP

& :

1)

2) UDP 69 53 37 137

no ip forward-protocol udp port UDP

& :

¸ UDP-Helper
UDP

¸ UDP 69 53 37 137 138 49
UDP

¸ 256 UDP

¸ **ip forward-protocol udp domain ip forward-protocol udp** *53*

26 SNMP

26.1 SNMP

26.1.1

SNMP Simple Network Manger Protocol 1988
8 RFC1157
SNMP
SNMP
SNMP

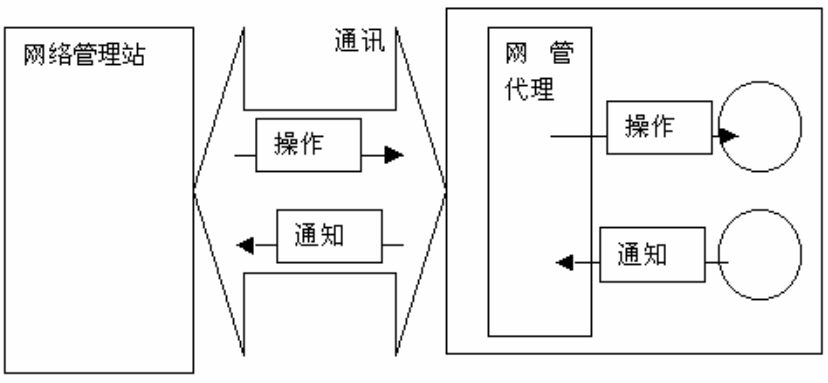
SNMP /

¸ SNMP
¸ SNMP
¸ MIB

SNMP SNMP NMS
(Network Management System) NMS HP
OpenView CiscoView CiscoWorks 2000
Star View

SNMP SNMP Agent
NMS NMS

NMS Agent



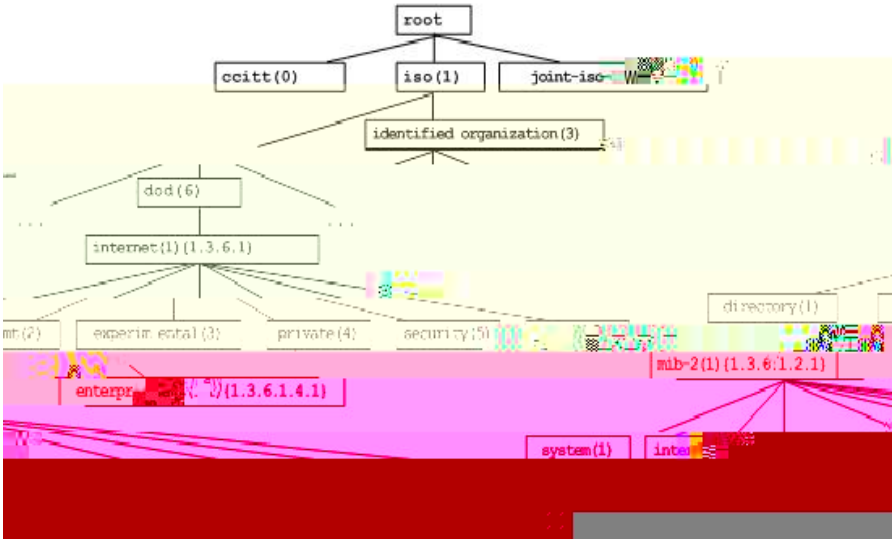
1 NMS Agent

MIB Management Information Base
SNMP
MIB

MIB

System {1.3.6.1.2.1.1}

Object Identifier MIB



2 MIB

26.1.2 SNMP

SNMP

， SNMPv1 RFC1157

， SNMPv2C Community-Based SNMPv2 ，
RFC1901

， SNMPv3

1.

2.

3.

SNMPv1 SNMPv2C Community-based
(Commumity String) MIB

SNMPv2C Get-bulk

SNMPv3

SNMPv1	noAuthNoPriv			
SNMPv2c	noAuthNoPriv			
SNMPv3	noAuthNoPriv			
SNMPv3	authNoPriv	MD5 SHA		HMAC-MD5 HMAC-SHA
SNMPv3	authPriv	MD5 SHA	DES	HMAC-MD5 HMAC-SHA CBC-DES

26.1.5 SNMP

SNMP SNMP SNMP
SNMP
SNMPv3 SnmpEngineID

OCTET STRING 5 32 RFC3411
:

、 4 IANA HEX

、 5

0

1 4 Ipv4

2 16 Ipv6

3 6 MAC

4 27

5 16 27

6-127

128-255

26.2 SNMP

SNMP SNMP

26.2.1

SNMPv1/SNMPv2C Community-based SNMP
Community-String
SNMP NMS Agent

- IP NMS
- ReadOnly ReadWrite
- MIB
- IP
  IP IP

SNMP

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

no snmp-server community

Ruijie(config)# **snmp-server group** *groupname* {**v1**|**v2c** |**v3**{**auth**|**noauth**|**priv**}}[**read** *readview*][**write** *writeview*][**access**{*num*|*name*}]	

no snmp-server view *view-name* **no snmp-server view** *view-name oid-tree*

no snmp-server group *groupname*

26.2.3 SNMP

NMS

SNMPv3 MD5 SHA DES

SNMP

Ruijie(config)# **snmp-server user** *username roupname* {**v1** | **v2** | **v3** [**encrypted**] [**auth** { **md5**|**sha** } *auth-password*] [**priv des56** *priv-password*] } [**access** {*num* | *name*}]	

no snmp-server user *username groupname*

26.2.4 SNMP

Agent NMS Agent NMS

Ruijie(config)# **snmp-server host**{ *host-addr* | **ipv6** ipv6-addr} [**vrf** *vrfname*] [**traps**] [**version**{**1**|**2c**|**3**[**auth**|**noauth**|**priv**]}]*community-string* [**udp-port** *port-num*] [**type**]	SNMP vrf SNMPv3 SNMPv3

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

26.2.6 SNMP

SNMP

Ruijie(config)# **snmp-server packetsize** *byte-count*	

26.2.7 SNMP

SNMP

snmp snmp

Ruijie(config)# **no snmp-server**	SNMP

26.2.8 SNMP

snmp snmp

SNMP

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

26.2.9 Agent NMS Trap

Trap Agent NMS

Ruijie(config)# **snmp-server enable traps** [*type*] [*option*]	Agent	Trap

Ruijie(config)#

no snmp-server if-index persist

```
Ruijie(config)# snmp-server if-index persist
```

26.3 SNMP

26.3.1 SNMP

SNMP SNMP SNMP
SNMP

show snmp SNMP

```
Ruijie# show snmp
Chassis: 1234567890 0987654321
Contact: wugb@i-net.com.cn
Location: fuzhou
2381 SNMP packets input
5 Bad SNMP version errors
6 Unknown community name
0 Illegal operation for community name supplied
0 Encoding errors
9325 Number of requested variables
0 Number of altered variables
31 Get-request PDUs
2339 Get-next PDUs
0 Set-request PDUs
2406 SNMP packets output
0 Too big errors (Maximum packet size 1500)
4 No such name errors
0 Bad values errors
0 General errors
2370 Get-response PDUs
36 SNMP trap PDUs
SNMP global trap: disabled
SNMP logging: enabled
SNMP agent: enabled
.
```

Bad SNMP version errors	SNMP

Unknown community name	
No such name	errors

26.3.2 MIB

show snmp mib MIB

```
Ruijie# show snmp mib sysDescr
```

```
snmpInGetNexts
snmpInSetRequests
snmpInGetResponses
snmpInTraps
snmpOutTooBigs
snmpOutNoSuchNames
snmpOutBadValues
snmpOutGenErrs
snmpOutGetRequests
snmpOutGetNexts
snmpOutSetRequests
snmpOutGetResponses
snmpOutTraps
snmpEnableAuthenTraps
snmpSilentDrops
snmpProxyDrops
entPhysicalEntry
entPhysicalEntry.entPhysicalIndex
entPhysicalEntry.entPhysicalDescr
entPhysicalEntry.entPhysicalVendorType
entPhysicalEntry.entPhysicalContainedIn
entPhysicalEntry.entPhysicalClass
entPhysicalEntry.entPhysicalParentRelPos
entPhysicalEntry.entPhysicalName
entPhysicalEntry.entPhysicalHardwareRev
entPhysicalEntry.entPhysicalFirmwareRev
entPhysicalEntry.entPhysicalSoftwareRev
entPhysicalEntry.entPhysicalSerialNum
entPhysicalEntry.entPhysicalMfgName
entPhysicalEntry.entPhysicalModelName
entPhysicalEntry.entPhysicalAlias
entPhysicalEntry.entPhysicalAssetID
entPhysicalEntry.entPhysicalIsFRU
entPhysicalContainsEntry
entPhysicalContainsEntry.entPhysicalChildIndex
entLastChangeTime
```

26.3.3 SNMP

show snmp user SNMP

```
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
```

26.3.4 SNMP

show snmp group

```
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:
```

show snmp view

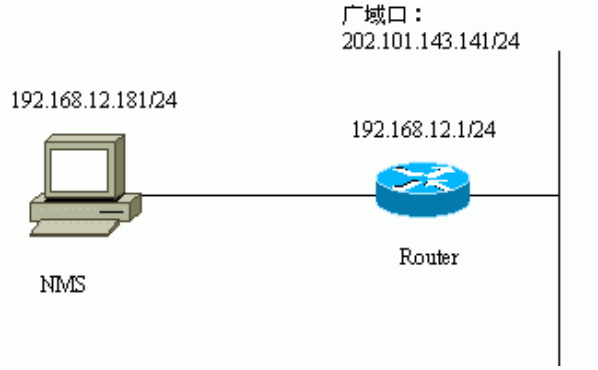
```
Ruijie# show snmp view
default(include) 1.3.6.1
test-view(include) 1.3.6.1.2.1
```

26.4 SNMP

26.4.1

，

NMS NMS IP 192.168.12.181 IP 192.168.12.1 HP OpenView



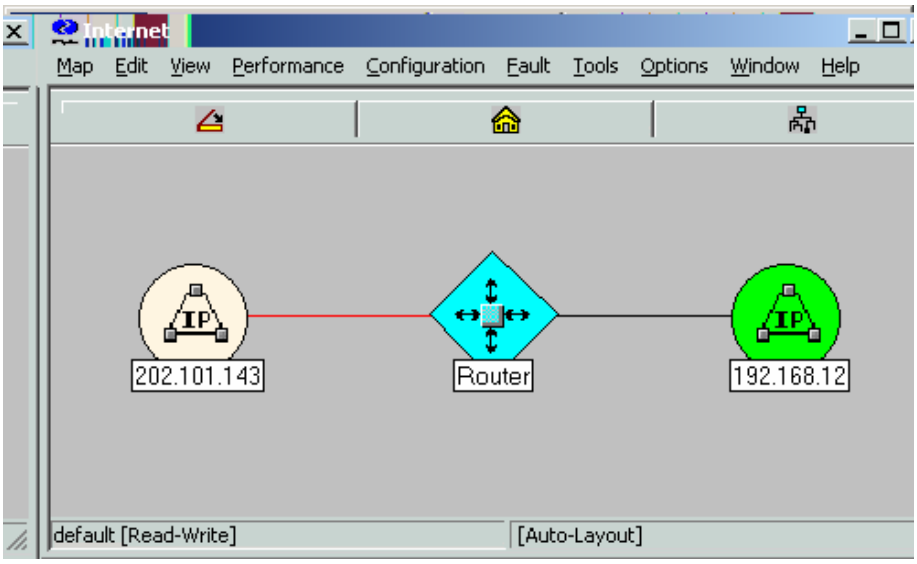
5 SNMP

，

SNMP

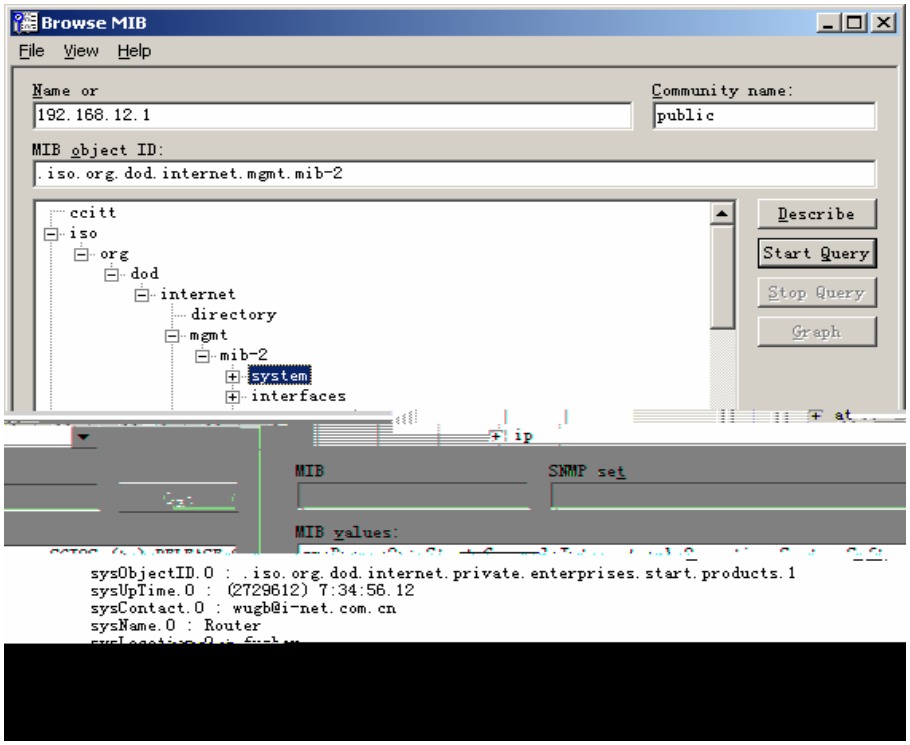
```
Ruijie(config)# snmp-server community public RO
```

* p4.6933 0 TD0.0.5193a1ce1087502<9b0c160 T2c8T1T9475051996>0eT9c



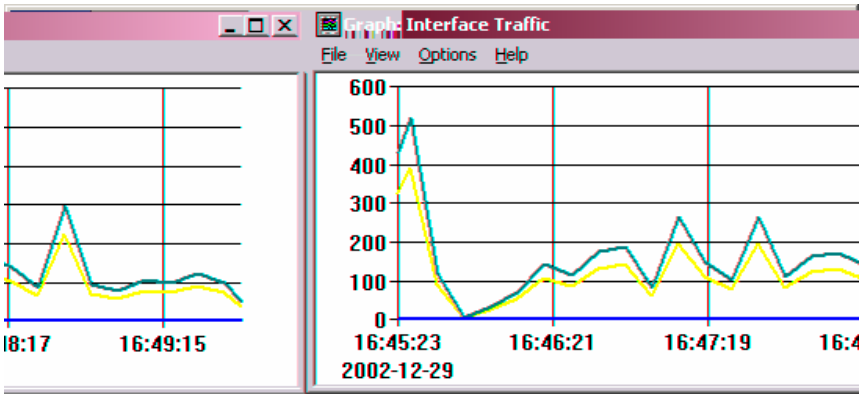
6

HP OpenView TOOL->SNMP MIB Brower Name IP 192.168.12.1 Community Name Public MIB System Start Query MIB MIB Values



7 MIB

HP OpenView SNMP



8

26.4.2 SNMP

NMS

27 RMON

27.1

RMON Remote Monitoring IETF(Internet Engineering Task Force Internet)

RMON

RMON

RMON

RMON2 RMON

RMON RMON1

1 2 3 9

27.1.1

RMON 1

CRC

27.1.2

(History) RMON 2

1. HistoryControl
2. EthernetHistory

27.1.3

(Alarm) RMON 3
MIB(Management Information Base) MIB

SNMP Trap

27.1.4

(Event) RMON 9
SNMP Trap

27.2 RMON

27.2.1

Ruijie(config-if)# **rmon collection stats** *index* [**owner** *ownername*]	
Ruijie(config-if)# **no rmon collection stats** *index*	

~

Ù ظ j †

Bucket-number

Bucket-number

Bucket-number

1-65535 10

Interval 1800 1-3600

27.2.3

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

number ( ) 1-65535

variable

interval <1-4294967295>

Absolute Delta

value

event-number Event-number

Log

Trap Trap

community Trap

description-string

27.2.4 RMON

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

27.3 RMON

27.3.1

3

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

27.3.2

10 3

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

27.3.3

MIB
MIB-II IfEntry ifInNUcastPkts.6(6
1.3.6.1.2.1.2.2.1.12.6) 30
6
(30) 20 20 10 10
1 (
” rmon ” Trap “ ifInNUcastPkts is too much ”)
zhangsan

```
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

```
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
```

27.3.4.4 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
```

~

S3760 **show rmon statistics**

28 VRF

pÈQ%žm%…0Ø ì((ÔQ¼apÈQ%èC95B%€n-Ä4!2*CÃ;!5Ä¼r99€-4Ã8f!-cQ1„?ÔÃ&D3

28.1 VRF

VRF(Virtual Routing Forwarding)

VRF

28.1 VEÄ

28.2.3 VRP

Ruijie(config)# **ip route vrf** *vrf-name* **network** *mask* **interface nexthop**	
Ruijie(config)# **no ip route vrf** *vrf-name* **network** *mask*	

28.3 VRF

VRF

29 RIP

29.1 RIP

RIP (Routing Information Protocol)

RIP

RIPv1 RFC 1058 RIPv2 RFC 2453 RGOS

RIP UDP UDP 520 RIPv1

RIPv2 224.0.0.9 RIP 30

180

120

RIP RIP

0 1

16

RIP

default-information originate

¸ **ip default-network**

¸

RIP RIP

RIP RIPv1 RIPv2 RIPv2

MD5

RIP Split Horizon

29.2 RIP

RIP

¸ RIP

¸ RIP

¸

¸ RIP

¸

¸ RIP

¸ RIP

- RIP
- RIP
- RIP VRF ( )

IP “ ”

-
-
-

29.2.1 RIP

RIP RIP RIP

RIP

Ruijie(config)# **router rip**	RIP
Ruijie(config-router)# **network** *network-number* *wildcard*	

network-number *wildcard*
RIP

wildcard RGOS
RIP

&

network

1 RIP

2 RIP

29.2.2 RIP

RIP RIP
RIP

RIP RIP

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

RIP

passive-interface

“ ”

&

FR X.25 Broadcast

neighbor Neighbor

29.2.3

IP

X.25

IP

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

29.2.4 RIP

RIP 1 2 RIPv2
CIDR VLSMs VLSMs

RIPv1 RIPv2 RIPv1
RIPv1

RIPv2

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

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

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

29.2.5

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

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*	

29.2.6 RIP

RIPv1 RIPv2

RIPv2 MD5

ip rip authentication text-password

MD5 MD5

MD5

RIP

Ruijie(config-if)# **ip rip authentication mode** {**text**	**md5**}	RIP **text** **md5** MD5
Ruijie(config-if)# **ip rip authentication text-password** *password-string*	1 16
Ruijie(config-if)# **ip rip authentication key-chain** *key-chain-name*	

29.2.7 RIP

RIP RIP

RIP RIP

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

30 180 120

&

RIP

29.2.8 RIP

RIP

RIP IP IP

IP

RIP

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

29.2.9 RIP

RIP RIP

RIP

RIP

RIP

Ruijie(config-router)# **passive-interface default** *interface-type interface-num*	

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

&

RIP RIP

RIP

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

RIP

Ruijie(config-if)# **no ip rip send enable**	RIP
Ruijie(config-if)# **ip rip send enable**	RIP

29.2.10 RIP

0.0.0.0/0 ,

Ruijie(config-if)# **ip rip default-information originate** [**metric** *metric-value*]	
Ruijie(config-if)# **no ip rip default-information**	

0.0.0.0/0 ,

RIP

Ruijie(config-if)# **ip rip default-information only** [**metric** *metric-value*]	
Ruijie(config-if)# **no ip rip default-information**	

&

ip rip default-information RIP **default-information originate**

29.2.11 RIP VRF

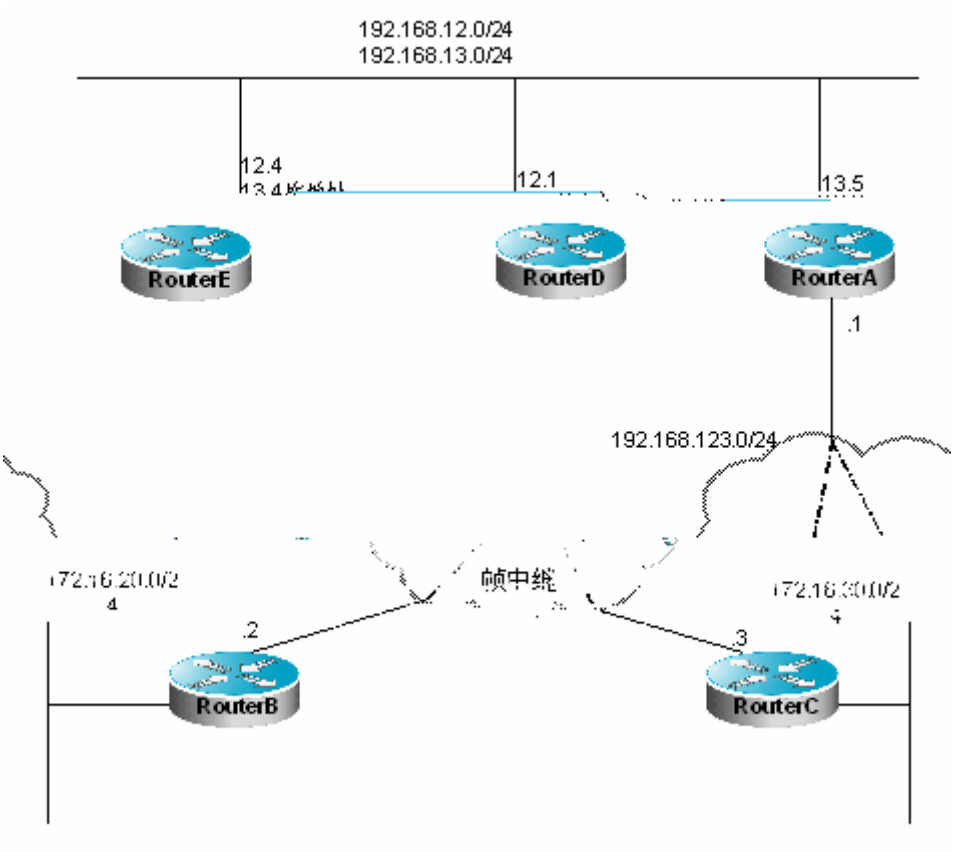
RIP VRF RIP RIP VRF
RIP VRF
RIP VRF RIP VRF

address-family
(config-router-af)# VRF RIP VRF
RIP VRF RIP RIP

VRF

Ч z

RouterB RouterC IP 1
RouterD



1 RIP

1 RIP

2 RouterB RouterC 3 RouterE
192.168.12.0/24

，

RouterA RouterD
RouterA RouterB RouterC RouterD
192.168.12.0 RouterE

A

```
#
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

```
#
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

```
#
interface FastEthernet0/0
ip address 172.16.30.1 255.255.255.0

#
interface Serial1/0
ip address 192.168.123.3 255.255.255.0
encapsulation frame-relay

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

    D

```
#
interface FastEthernet0/0
ip address 192.168.12.4 255.255.255.0
ip address 192.168.13.4 255.255.255.0 secondary
no ip split-horizon
```

```
#     RIP
router rip
version 2
network 192.168.12.0
network 192.168.13.0
```

    E

```
#
interface FastEthernet0/0
ip address 192.168.13.5 255.255.255.0
```

```
#     RIP
router rip
version 2
network 192.168.13.0
```

29.3.2 RIP

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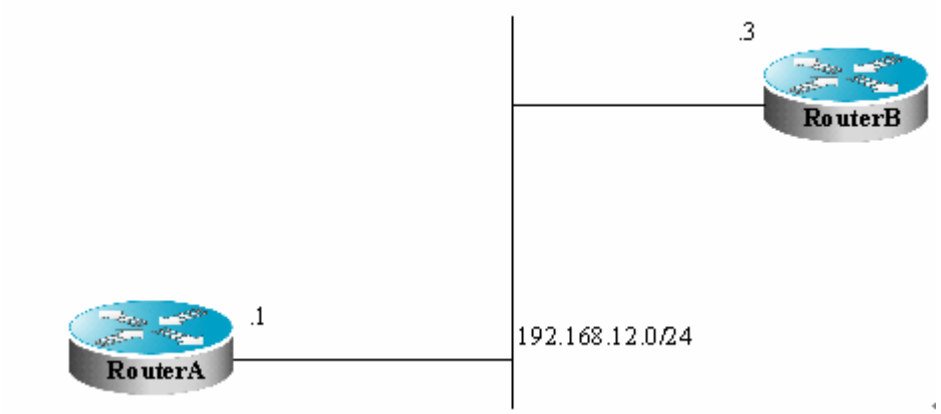
RIP MD5
IP 2



2 RIP

Router A RIP Keya Keya Keyb
RIP Router B RIP Keyb Keya
Keyb RIP

，

    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

#
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   :

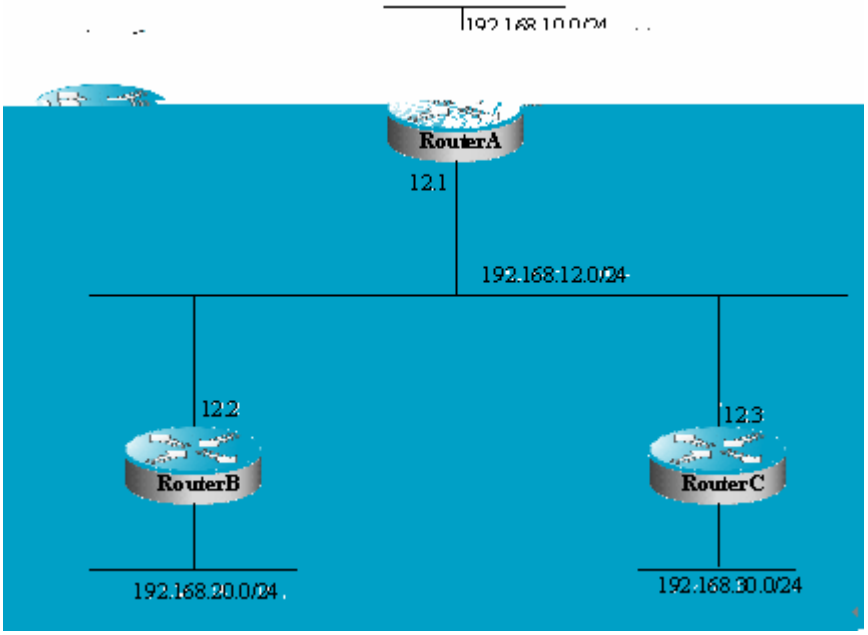
```
#
key chain ripkey
key 1
key-string keyb
accept-lifetime 00:00:00 Dec 3 2000 infinite
send-lifetime 00:00:00 Dec 4 2000 00:00:00 Dec 5 2000
key 2
key-string keya
accept-lifetime 00:00:00 Dec 3 2000 infinite
send-lifetime 00:00:00 Dec 4 2000 infinite

#
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
```

29.3.3 RIP

，

RIP IP

3



3 RIP

RIP

1 Router A Router C

2 Router C Router A

，

A RIP

A

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

#
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

```
#
interface FastEthernet0/0
```

```
ip address 192.168.12.2 255.255.255.0

#
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

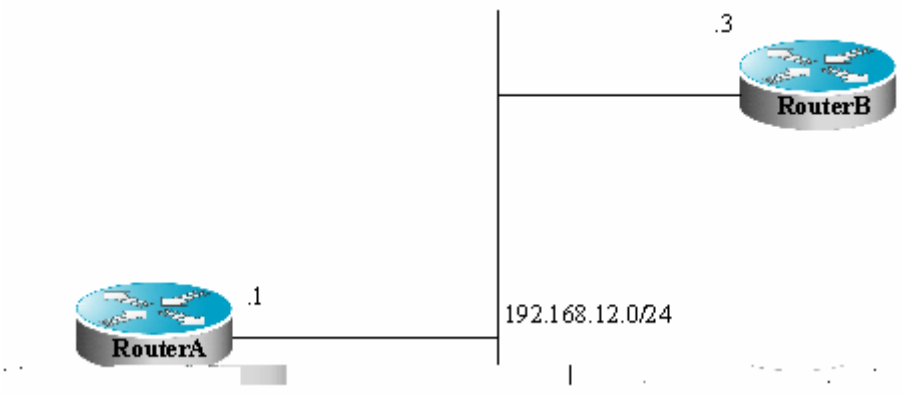
```
#
interface FastEthernet0/0
ip address 192.168.12.3 255.255.255.0

#
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
```

29.3.4 RIP VRF

，

RIP IP

4



4 RIP VRF

RIP Router A redvpn VRF Router B bluevpn VRF

，

A

```
#     VRF
ip vrf redvpn

#         VRF
interface FastEthernet 1/0
ip vrf forwarding redvpn
ip address 192.168.12.1 255.255.255.0

#     RIP             RIP
router rip
address-family ipv4 vrf redvpn
network 192.168.12.0
exit-address-family
```

B :

```
#     VRF
ip vrf   bluevpn

#         VRF
interface FastEthernet 1/0
ip vrf forwarding bluevpn
ip address 192.168.12.3 255.255.255.0

#     RIP             RIP
router rip
address-family ipv4 vrf bluevpn
network 192.168.12.0
exit-address-family
```

30 OSPF

30.1 OSPF

OSPF Open Shortest Path First IETF OSPF
OSPF IP IP
89 OSPF 224.0.0.5 OSPF
224.0.0.6

RIP OSPF
RIP OSPF
VLSMs( ) RIPv2
RIP
1 2 16 OSPF
RIP IGP

OSPF

，

，

， Dijkstra
IP

OSPF
OSPF
Dijkstra

OSPF OSPF
IGP
BGP
IGP

OSPF OSPF
AREA

OSPF

1)

2) ABR Area Border Routers ,

3) ASBR Autonomous System Boundary Routers , OSPF

OSPF RFC 2328 OSPF v2 OSPF

1) OSPF 64 OSPF

2) VRF VRF OSPF

3) ——

4) —— RIP BGP

5) —— MD5

6) ——

7) VLSMs

8)

9) NSSA Not So Stubby Area RFC 3101

10) Graceful Restart RFC 3623

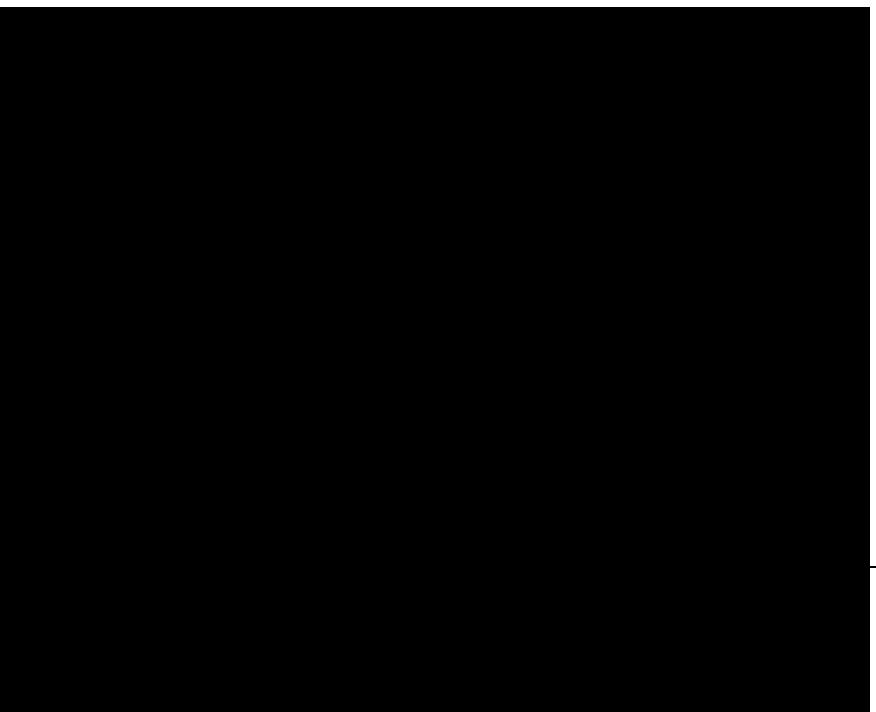
30.2 OSPF

OSPF

OSPF OSPF OSPF

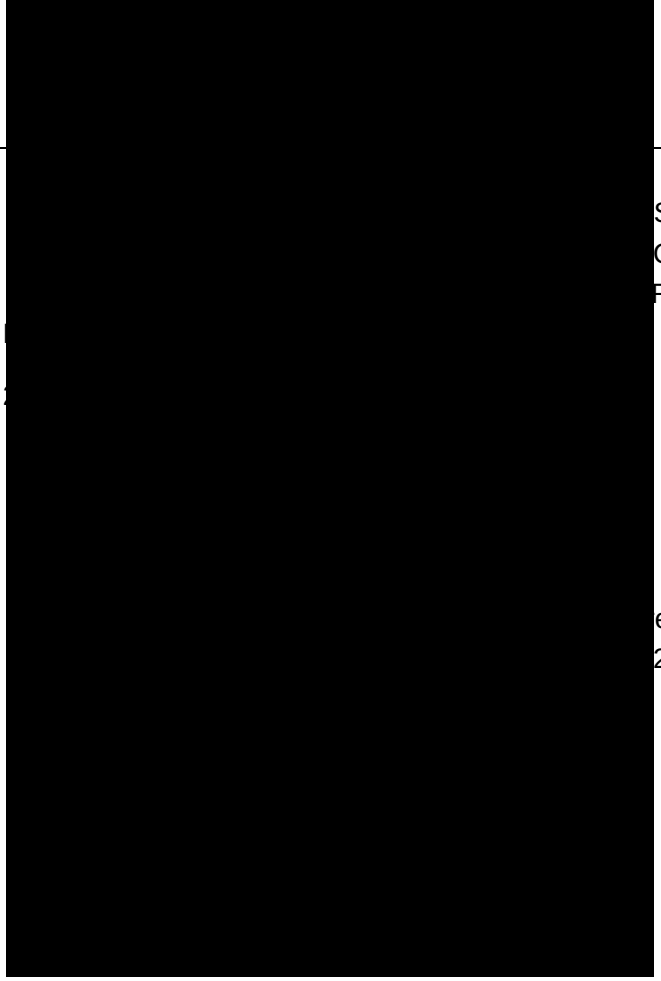
¸ OSPF (
¸ OSPF
¸ OSPF
¸ OSPF
¸ OSPF NSSA
¸ OSPF
¸
¸
¸ Loopback

- OSPF
-
-
- OSPF
- ÆÅ
  - ๆ
    - OSPF
      -



```
Ruijie (config)#
```

OSPF



SVC X.25
OSPF NBMA
Router

OSPF
OSPF

OSPF
elay map X.25
25

OSPF
NBMA

Ruijie(config-if)#p

neighbor

Ruijie(config-if)# **ip ospf network point-to-multipoint**	
Ruijie(config-if)# **exit**	
Ruijie(config)# **router ospf** *1*	
Ruijie(config-router)# **neighbor ip-address cost** *cost*	

&

OSPF X.25

30.2.3.2

ospf NBMA
ospf

NBMA

1.

2. NBMA

NBMA

NBMA :

Ruijie (config-if)# **ip ospf network non-broadcast**	NBMA
Ruijie (config-if)# **exit**	
Ruijie (config)# **router ospf** *1*	

Ruijie(config-router)# **neighbor** *ip-address* [*priority number*] [*poll-interval seconds*]	, hello

ospf

ip ospf cost . ,
neighbor ,

,

Ruijie (config-if)# **ip ospf network point-to-multipoint non-broadcast**	

Ruijie (config-if)#**ip ospf network broadcast**	
Ruijie (config-if)#**ip ospf priority** *priority*	

30.2.4 OSPF

OSPF OSPF

Stub Area

1 2 3

Stub

LSA (no-summary

) 1 2

OSPF

(

area default-cost)

STUB

, STUB STUB

Ruijie (config-router)#**area** *area-id*

default-information-originate Type-7 LSA nssa
ABR ASBR ABR
Type-7 LSA ASBR (ABR)
Type-7 LSA

no-redistribution ASBR OSPF redistribute
NSSA NSSA ASBR ABR
nssa

NSSA LSA ABR
no-summary ABR NSSA summary LSAs Type-3
LSA

area default-cost NSSA ABR
NSSA NSSA
1

30.2.6 OSPF

30.2.6.1

(Area Border Routers)
OSPF

Ruijie (config-router)# **area** *area-id* **range** *ip-address mask* [**advertise** | **not-advertise**] [**cost** *cost*]	

&

30.2.6.2

OSPF

OSPF

Ruijie (config-router)# **summary-address** *ip-address mask* {**not-advertise | tag** *tag-id*]

IP ABR
ABR type3 LSA

Ruijie

30.2.9 Loopback

OSPF IP
IP ,OSPF

Loopback Loopback IP
Loopback IP
Loopback

Loopback

Ruijie (config)# **interface loopback** *1*	Loopback
Ruijie (config-if)# **ip address** *ip-address mask*	Loopback IP

&

OSPF IP
loopback OSPF

30.2.10 OSPF

0~255

OSPF 110

OSPF

Ruijie(config-router)# **distance** {*distance* **|** **ospf** { **intra-area** *distance* **| inter-area** *distance* **| external** *distance* }}	OSPF

30.2.11

OSPF SPF

SPF

OSPF

Ruijie (config-router)# **timers throttle spf** *spf-delay spf-holdtime spf-max-waittime*	

&

"

30.2.12

LSA (LSA age) LSA
LSA CPU CPU
LSA

4
LSA
10000 LSA 40~100
10~20

Ruijie # **configure terminal**	
Ruijie (config)# **router ospf** *1*	OSPF OSPF
Ruijie (config-router)# **timers lsa-group-pacing** *seconds*	
Ruijie (config-router)# **end**	
Ruijie # **show running-config**	
Ruijie # **write**	

no timers lsa-group-pacing

30.2.13 OSPF

OSPF Cost Cost
OSPF

ip ospf cost

100Mbps 10Mbps 100/10 + 0.5
≈ 10

10

Ruijie # **configure terminal**	
Ruijieconfig)# **router ospf** *1*	OSPF OSPF
Ruijie(config-router)# **aut-cost reference-bandith** *ref-bw*	ref-b
Ruijieconfig-router **en**	
Ruijie # **showip protoc**	

Ruijie # **write/]TJ/TT4 1 Tf2.3429 0 TD0 Tc( )Tj/TT5 1 Tf14.3486 0.0171 TD<02c409c345dd0**

30.2.14 MTU

OSPF MTU MTU
MTU MTU,
, MTU .
MTU

OSPF

no passive-interface *interface-id*

default

30.2.16 OSPF

OSPF OVERFLOW OVERFLOW

OSPF

¸ LSA LSA LSA

LSA

LSA

¸ LSA LSA

¸

OVERFLOW

OSPF OVERFLOW

30.2.17 OSPF

30.2.17.1 OSPFv2 MIB

OSPFv2 MIB OSPFv2 SNMP OSPFv2 OSPFv2 MIB OSPFv2

SNMP OSPFv2 OSPFv2 MIB

Ruijie (config-router)#**enable mib-binding**	OSPFv2 MIB OSPFv2

30.2.17.2 OSPFv2 TRAP

OSPFv2 TRAP OSPFv2 OSPFv2 TRAP OSPFv2 MIB TRAP

Ruijie # **configure terminal**	
Ruijie (config)# **snmp-server host** *host-ip* **version** *version-no string* [**ospf**]	TRAP snmp-server host-ip server version-no server snmp string snmp public ospf snmp-server OSPF TRAP server TRAP
Ruijie (config)#**snmp-server enable traps ospf**	OSPF TRAP
Ruijie (config)#**router ospf** *process_id* [**vrf** *vrf-name*]	OSPF OSPF

Ruijie (config-router)# **enable traps** [**error**

[**ifauthfailure | ifconfigerror |**

ifrxbadpacket | virtifauthfailure |

virtifconfigerror |

virtifrxbadpacket] |

lsa [**lsdbapproachoverflow |**

lsdboverflow | maxagelsa |

originatelsa] |

Dead

```
Ruijie#sh ip ospf interface fastEthernet 1/0
FastEthernet 1/0 is up, line protocol is up
Internet Address 192.168.1.1/24, Ifindex: 2 Area 0.0.0.0, MTU
1500
Matching network config: 192.168.1.0/24
Process ID 1, Router ID 192.168.1.1, Network Type BROADCAST,
Cost: 1
Transmit Delay is 1 sec, State DR, Priority 1
Designated Router (ID) 192.168.1.1, Interface Address
192.168.1.1
Backup Designated Router (ID) 192.168.1.2, Interface Address
192.168.1.2
Timer intervals configured, Hello 10, Dead 40, Wait 40,
Retransmit 5
Hello due in 00:00:04
Neighbor Count is 1, Adjacent neighbor count is 1
Crypt Sequence Number is 30
Hello received 972 sent 990, DD received 3 sent 4
LS-Req received 1 sent 1, LS-Upd received 10 sent 26
LS-Ack received 25 sent 7, Discarded 0
```

3 OSPF

, ,

```
Ruijie# show ip ospf
Routing Process "ospf 1" with ID 1.1.1.1
Process uptime is 4 minutes
Process bound to VRF default
Conforms to RFC2328, and RFC1583Compatibility flag is enabled
Supports only single TOS(TOS0) routes
Supports opaque LSA
This router is an ASBR (injecting external routing information)
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
LsaGroupPacing: 240 secs
Number of incomming current DD exchange neighbors 0/5
Number of outgoing current DD exchange neighbors 0/5
Number of external LSA 4. Checksum 0x0278E0
Number of opaque AS LSA 0. Checksum 0x000000
Number of nonphtTr of external 278E0
Numbernal, PgiDesignent 26
Numbernal-Ack recei00000 Log  TD(Neigs 1 SeySA  excs : En-5.7d )101 Ts
```

```
Number of interfaces in this area is 1(1)
Number of fully adjacent neighbors in this area is 1
Area has no authentication
SPF algorithm last executed 00:01:26.640 ago
SPF algorithm executed 4 times
Number of LSA 3. Checksum 0x0204bf

Routing Process "ospf 20" with ID 2.2.2.2
Process uptime is 4 minutes
Process bound to VRF default
Conforms to RFC2328, and RFC1583Compatibility flag is enabled
Supports only single TOS(TOS0) routes
Supports opaque LSA
SPF schedule delay 5 secs, Hold time between two SPFs 10 secs
LsaGroupPacing: 240 secs
Number of incomming current DD exchange neighbors 0/5
Number of outgoing current DD exchange neighbors 0/5
Number of external LSA 0. Checksum 0x000000
Number of opaque AS LSA 0. Checksum 0x000000
Number of non-default external LSA 0
External LSA database is unlimited.
Number of LSA originated 0
Number of LSA received 0
Log Neighbor Adjency Changes : Enabled
Number of areas attached to this router: 0
```

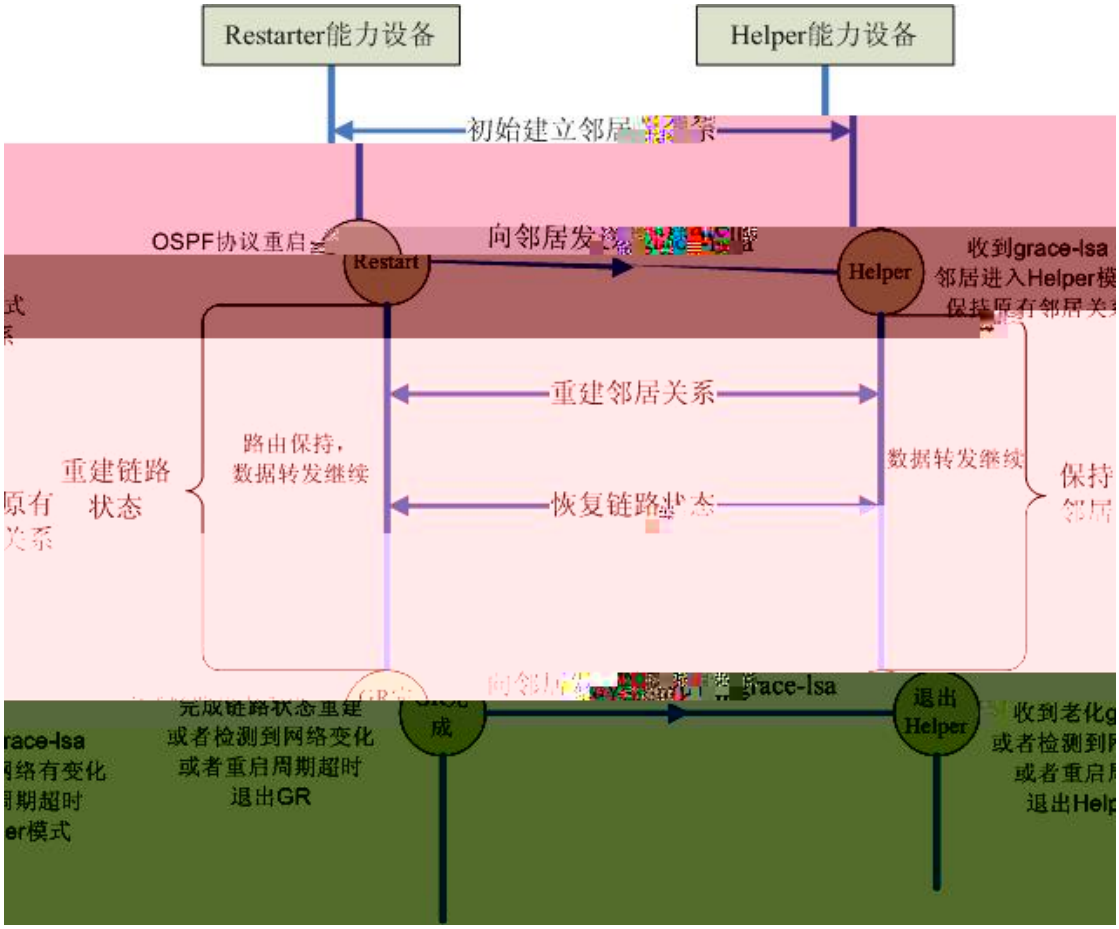
30.3.1 OSPF GR

GR Graceful Restart

GR

OSPF GR GR Restart GR Help GR Restart GR Help Grace-LSA

GR Restart GR GR Restarter GR Help GR Restarter GR GR Helper GR Restarter Grace LSA Grace LSA Helper Restarter Restarter



1 OSPF GR

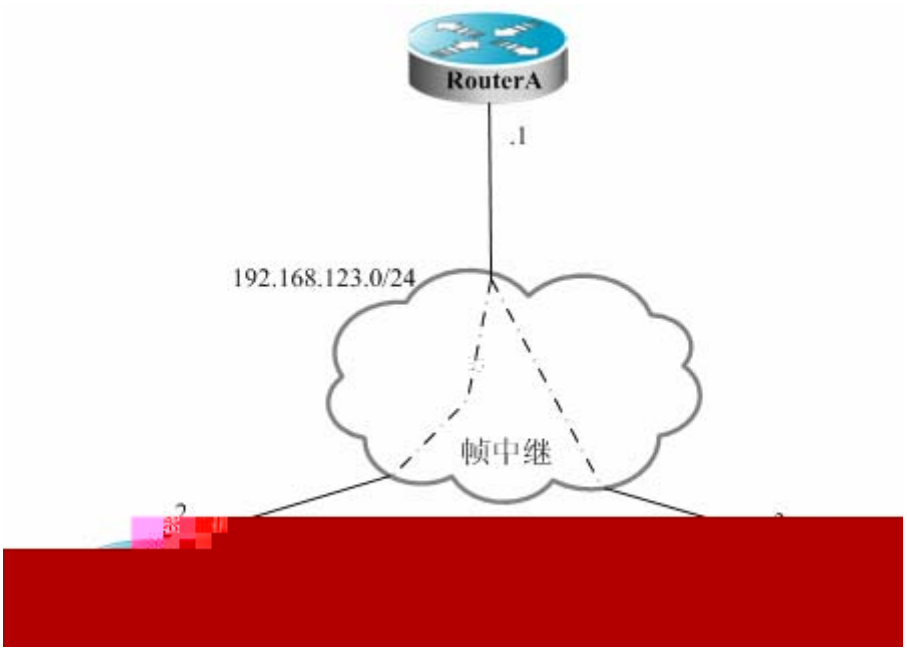
OSPF GR “ ” Restarter GR

30.3.1.2 OSPF GR helper

GR Helper GR Helper Helper GR Helper

Helper

Step 1	Ruijie # **configure terminal**	
Step 2	Ruijie (config)# **router ospf** *1*	OSPF OSPF
Step 3	Ruijie (config-router)# **graceful-restart helper disable**	OSPF GR Helper GR
Step 4	Ruijie (config-router)# **no graceful-restart helper disable**	OSPF GR Helper



OSPF NBMA

1 A B C NBMA

2 A B

3

4

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OSPF NBMA

OSPF IP

SPF

A

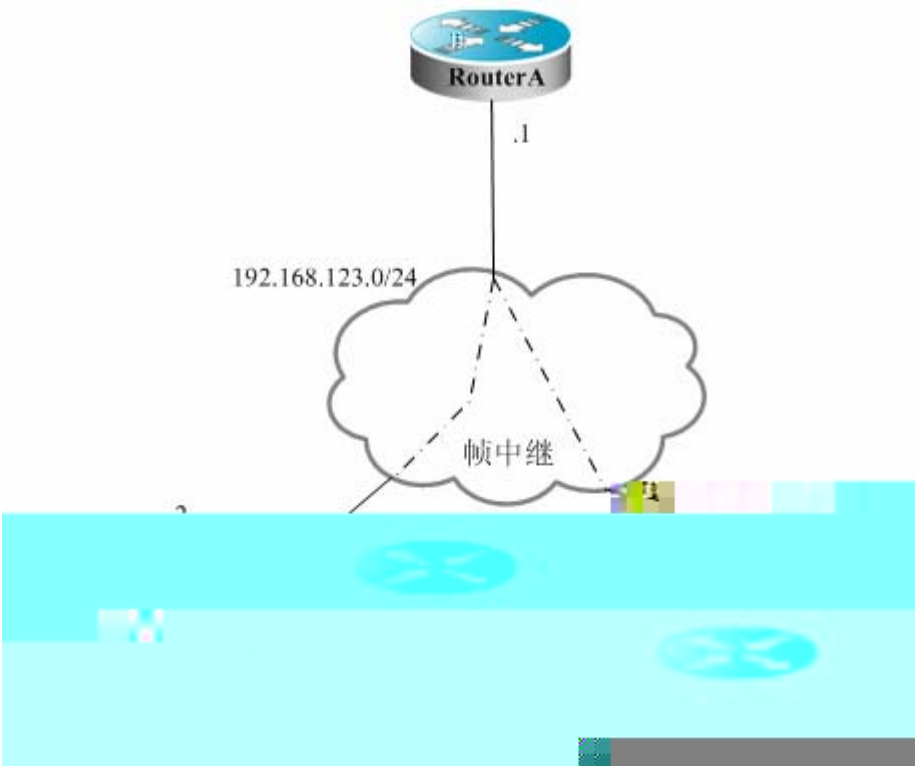
B

```
interface Serial 1/0
ip address 192.168.123.2 255.255.255.0
encapsulation frame-relay
ip ospf network non-broadcast
ip ospf priority 5
```

OSPF

```
router ospf 1
network 192.168.123.0 0.0.0.255 area 0
neighbor 192.168.123.1 priority 10
neighbor 192.168.123.3
timers spf 500 1000 10000
```

C



OSPF

1 A B C

，

OSPF

A

```
interface FastEthernet 0/0
ip address 192.168.12.1 255.255.255.0


interface Serial 1/0
ip address 192.168.123.1 255.255.255.0
encapsulation frame-relay
ip ospf network point-to-multipoint
```

OSPF

```
router ospf 1
network 192.168.23.0 0.0.0.255 area 0
network 192.168.123.0 0.0.0.255 area 0
```

B

```
interface FastEthernet 0/0
ip address 192.168.23.2 255.255.255.0


interface Serial 1/0
ip address 192.168.123.2 255.255.255.0
encapsulation frame-relay
ip ospf network point-to-multipoint
```

OSPF

```
router ospf 1
network 192.168.23.0 0.0.0.255 area 0
network 192.168.123.0 0.0.0.255 area 0
```

C

```
interface FastEthernet 0/0
ip address 192.168.23.3 255.255.255.0


interface Serial 1/0
ip address 192.168.123.3 255.255.255.0
encapsulation frame-relay
ip ospf network point-to-multipoint
```

OSPF

```
router ospf 1
network 192.168.23.0 0.0.0.255 area 0
network 192.168.123.0 0.0.0.255 area 0
```

:

A 192.168.23.0/24 B

.

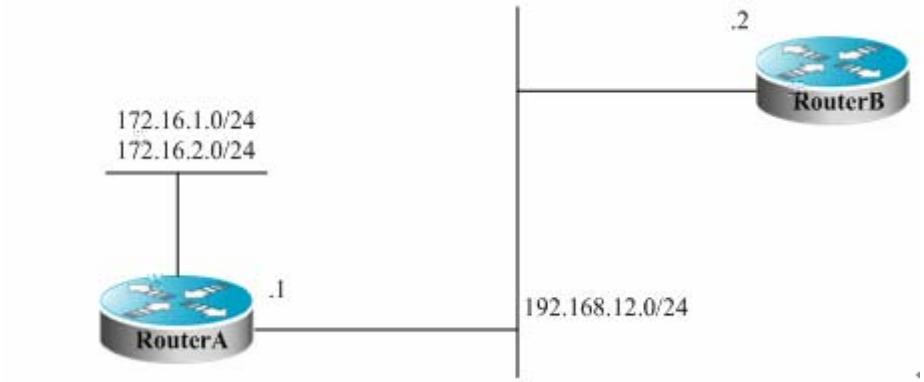
A :

```
router ospf 1
neighbor 192.168.123.2 cost 100
neighbor 192.168.123.3 cost 200
```

30.4.3 OSPF

OSPF MD5

IP 3



OSPF

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OSPF

1

2

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OSPF

```
network 172.16.1.0 0.0.0.255 area 10
network 172.16.2.0 0.0.0.255 area 10
no discard-route internal
area 10 range 172.16.0.0 255.255.252.0 cost 20
```

B

```
interface FastEthernet0/0
ip address 192.168.12.2 255.255.255.0
```

OSPF II

A

```
interface FastEthernet0/0
ip address 192.168.12.1 255.255.255.0
```

OSPF

```
router ospf 1
network 192.168.12.0 0.0.0.255 area 0
```

B

```
interface FastEthernet0/0
ip address 192.168.12.2 255.255.255.0

interface Serial 1/0
ip address 192.168.23.2 255.255.255.0
```

OSPF

```
router ospf 1
network 192.168.12.0 0.0.0.255 area 0
network 192.168.23.0 0.0.0.255 area 0
```

C

```
interface FastEthernet 0/0
ip address 192.168.34.3 255.255.255.0

interface Serial 1/0
ip address 192.168.23.3 255.255.255.0
```

OSPF

```
router ospf 1
network 192.168.23.0 0.0.0.255 area 0
network 192.168.34.0 0.0.0.255 area 34
```

D

```
interface FastEthernet 0/0
ip address 192.168.34.4 255.255.255.0
```

```
interface FastEthernet 1/0
ip address 200.200.1.1 255.255.255.0
interface FastEthernet 1/1
ip address 172.200.1.1 255.255.255.0
```

OSPF RIP

```
router ospf 1
network 192.168.34.0 0.0.0.255 area 34
redistribute rip metric-type 1 subnets tag 34
```

RIP

```
router rip
network 200.200.1.0
network 172.200.0.0
```

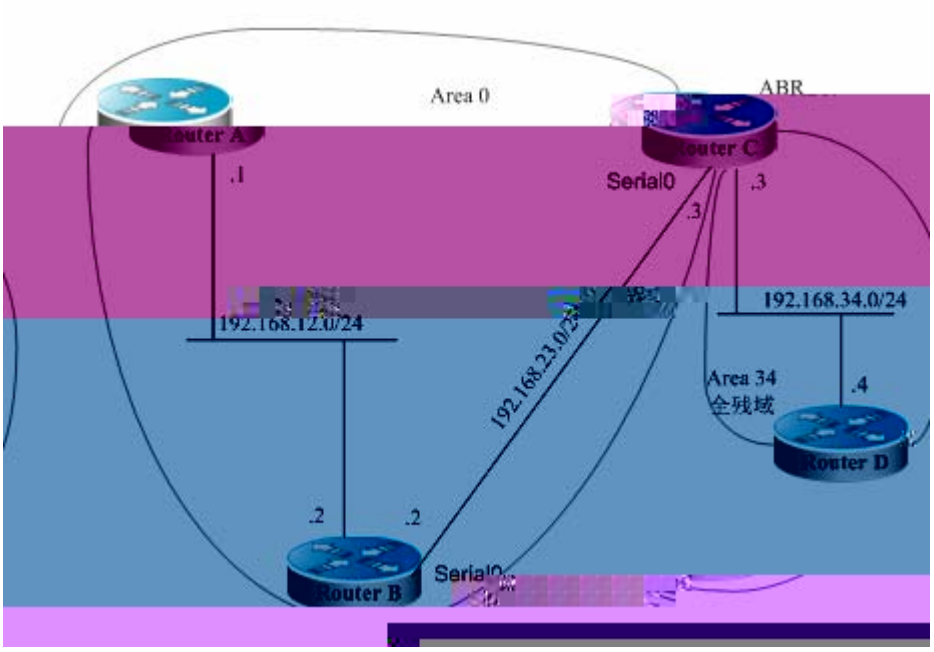
B ospf “E1”

```
O E1 200.200.1.0/24 [110/85] via 192.168.23.3, 00:00:33,
Serial1/0
O IA 192.168.34.0/24 [110/65] via 192.168.23.3, 00:00:33,
Serial1/0
O E1   172.200.1.0 [110/85] via 192.168.23.3, 00:00:33,
Serial1/0
```

30.4.6 OSPF

，

OSPF 192.168.12.0/24 192.168.23.0/24
0 192.168.34.0/24 34 IP
6



OSPF

RouterD OSPF

，

D

C 192.168.30.0/24

A

```
interface FastEthernet0/0
ip address 192.168.12.1 255.255.255.0
```

OSPF

```
router ospf 1
network 192.168.12.0 0.0.0.255 area 0
```

B

```
interface FastEthernet0/0
ip address 192.168.12.2 255.255.255.0


interface Serial1/0
ip address 192.168.23.2 255.255.255.0
```

OSPF

```
router ospf 1
network 192.168.12.0 0.0.0.255 area 0
network 192.168.23.0 0.0.0.255 area 0
```

C

```
interface FastEthernet0/0
ip address 192.168.34.3 255.255.255.0


interface Serial1/0
ip address 192.168.23.3 255.255.255.0


interface Dialer10
ip address 192.168.30.1 255.255.255.0
```

OSPF

```
router ospf 1
network 192.168.23.0 0.0.0.255 area 0
network 192.168.34.0 0.0.0.255 area 34
network 192.168.30.0 0.0.0.255 area 34
area 34 stub no-summary
```

D

```
interface FastEthernet0/0
ip address 192.168.34.4 255.255.255.0
```

OSPF

```
router ospf 1
network 192.168.34.0 0.0.0.255 area 34
area 34 stub
```

D ospf

```
O 192.168.30.0/24 [110/1786] via 192.168.34.3, 00:00:03,
FastEthernet0/0
O*IA 0.0.0.0/0 [110/2] via 192.168.34.3, 00:00:03,
FastEthernet0/0
```

30.4.7 OSPF

、

OSPF

```
ip address 192.168.23.2 255.255.255.0
```

IP OSPF

```
interface Loopback2
ip address 2.2.2.2 255.255.255.0
```

OSPF

```
router ospf 1
network 192.168.12.0 0.0.0.255 area 0
network 192.168.23.0 0.0.0.255 area 23
area 23 virtual-link 3.3.3.3
```

C

```
interface FastEthernet0/0
ip address 192.168.34.3 255.255.255.0


interface Serial1/0
ip address 192.168.23.3 255.255.255.0
```

IP OSPF

```
interface Loopback2
ip address 3.3.3.3 255.255.255.0
```

OSPF

```
router ospf 1
network 192.168.23.0 0.0.0.255 area 23
network 192.168.34.0 0.0.0.255 area 34
area 23 virtual-link 2.2.2.2
```

D

```
interface FastEthernet0/0
ip address 192.168.34.4 255.255.255.0
```

OSPF

```
router ospf 1
network 192.168.34.0 0.0.0.255 area 34
```

D ospf

```
O IA 192.168.12.0/24 [110/66] via 192.168.34.3, 00:00:10,
FastEthernet0/0
O IA 192.168.23.0/24 [110/65] via 192.168.34.3, 00:00:25,
FastEthernet0/0
```

31

31.1 IP

31.1.1

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

“ ”

	0
	1
OSPF	110
ISIS	115
RIP	120
	255

&

RIP OSPF

“ down ”

VRF VRF
VRF VRF VRF

1 **show ip route weight**
weight WCMP
weight
WCMP
32 WCMP

WCMP
WCMP 8

```
Ruijie(config)#ip route 10.0.0.0 255.0.0.0 172.0.1.2 weight 6
Ruijie(config)#ip route 10.0.0.0 255.0.0.0 172.0.1.4 weight 6
Ruijie(config)#show ip route 10.0.0.0

Routing entry for 10.0.0.0/8
  Distance 1, metric 0
  Routing Descriptor Blocks:
  *172.0.1.2, generated by "static"
Ruijie(config)#show ip route weight

------------[distance/metric/weight]-----------
S    10.0.0.0/8 [1/0/6] via 172.0.1.2
```

1000

IP **show ip route** IP
RPI

31.1.2

1 “
” 2

RIP
RIP RIP “ 0.0.0.0 ” OSPF
“ OSPF ”

Ruijie(config)# **ip default-network** network	
Ruijie(config)# **no ip default-network** network	

&

default-network

RIP RIP
0.0.0.0/0

show ip route “ gateway of last resort ”

“ gateway of last resort ”

31.1.3

no

ipv4 ipv6 ipv4
ipv6
∂ ¬ ŕ ← ס

Ruijie(config-route-map)# **match ipv6 next-hop** { *access-list-name* | **prefix-list** *prefix-list-name* }	
Ruijie(config-route-map)# **match ipv6 route-source** { *access-list-name* | **prefix-list** *prefix-list-name* }	
Ruijie(config-route-map)# **match metric** *Metric*	*Metric* 0-4294967295

Ruijie(config-route-map)# **match origin** {**egp** | **igp** | **incomplete**

Ruijie(config-route-map)# **set ip next-hop**

31.3

31.3.1

OSPF

RIP RIP OSPF

IP

route maps

Ruijie(config-router)#

Ruijie(config-router)# **default-information originate** [**always**] [**metric** *metric*] [**metric-type** *type*] [**route-map** *map-name*]	**always( )** **metric( )** metric **metric-type( )** OSPF **route-map( )**
Ruijie(config-router)# **no default-information originate** [**always**] [**metric** *metric*] [**metric-type** *type*] [**route-map** *map-name*]	

31.3.3

31.3.3.1

:

Ruijie(config-router)# **distribute-list** {[*access-list-number* | *access-list-name*] **prefix** *prefix-list-name*} **out** [*interface-type interface-number*]	″E ɣ ھ õ

```
Ruijie(config-router)# network 192.168.12.0 0.0.0.255 area 0
#
Ruijie(config)# access-list 20 permit 200.168.23.0
#
Ruijie(config)# route-map redrip permit 10
Ruijie(config-route-map)# match metric 4
Ruijie(config-route-map)# set metric 40
Ruijie(config-route-map)# set metric-type type-1
Ruijie(config-route-map)# set tag 40
```

RIP OSPF 10 OSPF 10

```
#     RIP
Ruijie(config)# router rip
Ruijie(config-router)# version
```

RIP 3 RIP
172.16.1.0/24 192.168.1.0/24

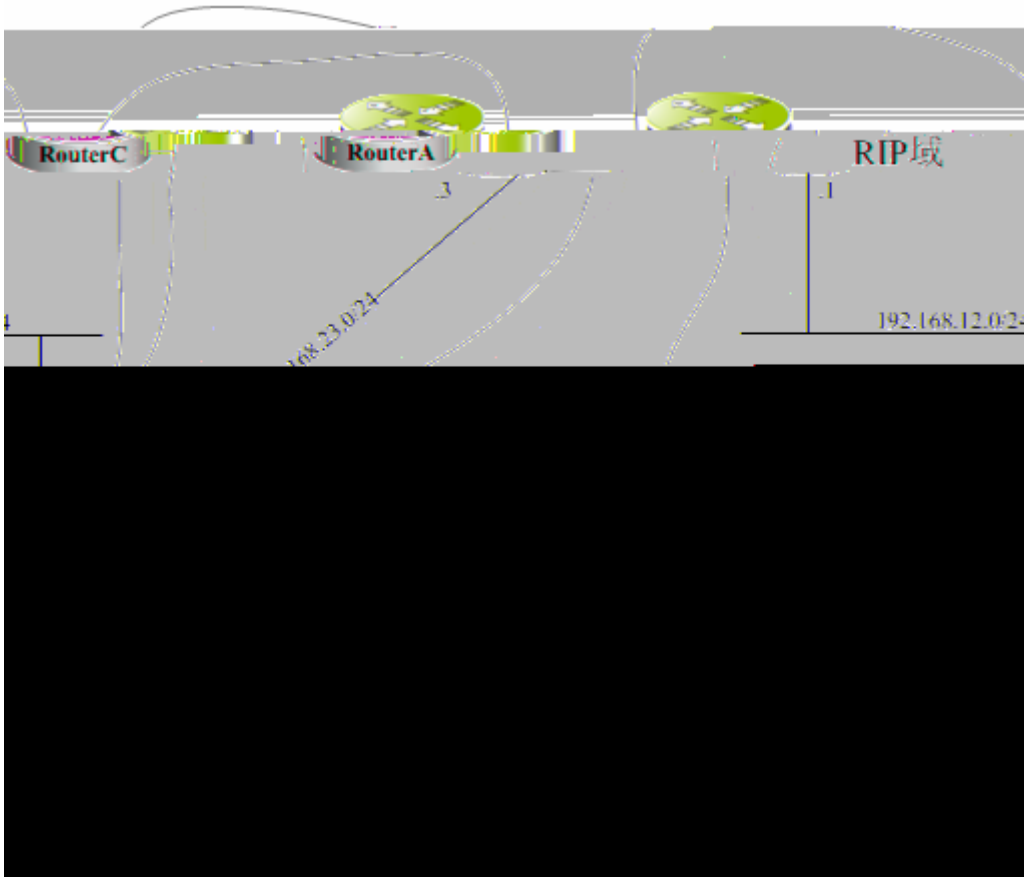
、

RIP RIP
172.16.1.0/24 RIP
172.16.0.0/16

```
#
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

#     RIP
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 EXT_ACL out static
Ruijie(config-router)# no auto-summary

#         ACL
Ruijie(config)# ip access-list extended EXT_ACL
Ruijie(config-ext-nacl)#10 permit T4 1fa(configTD(ipe05static)Tj1)# Ruijie
```



1

Router B OSPF RIP Type-1 BGP 11:11 BGP RIP OSPF 192.168.10.0/24 3 RIP

，

BGP

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
```

```
#     OSPF
Ruijie(config)# router ospf 12
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 192.168.23.2 255.255.255.0

#     OSPF
Ruijie(config)# router ospf 12
Ruijie(config-router)# redistribute rip metric 100 metric-type
1 subnets
Ruijie(config-router)# redistribute bgp route-map ospfrm
subnets
Ruijie(config-router)# network 192.168.12.0 0.0.0.255 area 0

#     RIP
Ruijie(config)# router rip
Ruijie(config-router)# redistribute ospf 12 metric 2
Ruijie(config-router)# network 192.168.23.0
Ruijie(config-router)# distribute-list 10 out ospf
Ruijie(config-router)# default-information originate always
Ruijie(config-router)# no auto-summary

#     BGP
Ruijie(config)# router bgp 2
Ruijie(config-router)# neighbor 192.168.24.4 remote-as 4
Ruijie(config-router)# address-family ipv4
Ruijie(config-router-af)# neighbor 192.168.24.4 activate
Ruijie(config-router-af)# neighbor 192.168.24.4
 send-community

#
Ruijie(config)# route-map ospfrm
Ruijie(config-route-map)# match community cl_110

#
Ruijie(config)# access-list 10 permit 192.168.10.0

#     community
Ruijie(config)# ip community-list standard cl_110 permit 11:11
```

C

```
#
```

```
Ruijie(config)# interface gigabitEthernet 0/0
Ruijie(config-if)# ip address 192.168.30.1 255.255.255.0
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# ip address 192.168.3.1 255.255.255.0
Ruijie(config)# interface Serial 1/0
Ruijie(config-if)# ip address 192.168.23.3 255.255.255.0

#    RIP
Ruijie(config)# router rip
Ruijie(config-router)# network 192.168.23.0
Ruijie(config-router)# network 192.168.3.0
Ruijie(config-router)# network 192.168.30.0
```

31.5 ECMP/WCMP

ECMP/WCMP

hash hash

&

S3760
weight

*Aug 24 11:20:39: %7: Warning: Because hardware resource is not enough, route:
*Aug 24 11:20:39: %7: 191.168.200.120/32 191.168.200.120
*Aug 24 11:20:39: %7: were deleted

31.5.1 Hash

S3760 hash

- MAC SA [5:0]
- MAC DA [5:0]
- SIP [22:16] [6:0]
- DIP [22:16] [6:0]

S3760

31.5.2 Hash

S3760 hash

31.5.3

Ruijie(config)# **aggregateport** **load-balance** { **src-dst-mac |** **src-dst-ip** }	ECMP/WCMP **src-dst-ip** IP IP IP—— IP IP—— IP **src-dst-mac** MAC MAC MAC—— MAC MAC—— MAC

31.6

hash ip

```
Ruijie(config)# aggregateport load-balance src-dst-ip
```

32

IP

1

Ruijie(config)# **route-map** *route-map-name* [**permit** | **deny**] *sequence*	
Ruijie(config)# **no route-map** *route-map-name* {[**permit** | **deny**] *sequence*}	

Ruijie(config-route-map)# **match ip address** *access-list-number*	
Ruijie(config-route-map)# **match length** *min max*	

Ruijie(config-route-map)# **set ip default**	

Ruijie(config-route-map)# **set ip next-hop** *ip-address* [*weight*][*ip-address*[*weight*]]	IP

Ruijie(config-if)# **ip policy route-map** *name*	route-map

3. **set ip next-hop**

4. **set ip default next-hop**

~

1. (route-map sequence) ACL ACL

2. nexthop ACL ACL nexthop ACL nexthop,

3. ACL , ACL ACL ACL ACL ACE ACL

4. IP deny ACE IP deny any any ACE ACL deny any any ACE IP deny ACE ACL ACL ACL ACL permit ACE set ACL

5. IP PBR ACL ”deny IP ” ACE

6. nexthop nexthop drop nexthop

33 IPv6

33.1 IPv6

Internet IPv4 IPv4
Internet Protocol Next Generation - IPng
Internet (IETF) IPng IPng
"IP 6" IPv6 RFC2460

IPv6

IPv6 IPv6 Authentication Header AH

33.1.1 IPv6

IPv6 X : X : X : X : X : X : X : X 4
(16) 4 4
8 128 IPv6

2001:ABCD:1234:5678:AAAA:BBBB:1200:2100
800 : 0 : 0 :0 : 0 : 0 : 0 : 1
1080 : 0 : 0 : 0 : 8 : 800 : 200C : 417A

A F 10 15
0 IPv6 0 (
) “ ”
0 800 : 0 : 0 : 0 : 0 : 0 : 0 : 1 800 :: 1

128
16 0

IPv4 IPv6 IPv6 32
IPv4 X : X : X : X : X :
X : d . d . d . d X 1 6 d 8
0 : 0 : 0 : 0 : 0 : 0 : 192 .168 . 20 : 1 IPv6
: : 192 .168 . 20 . 1

IPv6 CIDR

( ) IPv6 IPv6
12AB::CD30:0:0:0:0/60
60

33.1.2 IPv6

RFC2373 IPv6

¸ (Unicast)

¸ (Anycast)
(“ ”)

¸ (Multicast) ( )

~

IPv6

33.1.2.1 Unicast Addresses

IPv6

¸

¸

¸

¸ IPv4 IPv6

1.

```
| 3 |   13 | 8  |    24      |    16      |              64 bits                  |
+--+-----+---+--------+--------+-------------------------------+
|FP| TLA |RES|   NLA    |  SLA    |            Interface ID               |
|  | ID  |    |   ID      |  ID      |                                       |
+--+-----+-----+-----------+-----------+---------------------------------------+
```

¸ FP (Format Prefix)

IPv6 3 IPv6
’ 0 0 1’

¸ TLA ID (Top-Level Aggregation Identifier)

1 3 8192

¸ RES (Reserved for future use)

8

¸ NLA ID (Next-Level Aggregation Identifier)

24
(ISP)
24 ISP 2 4
22 (ISP)

¸ SLA ID (Site-Level Aggregation Identifier)

IPv4
16
65535 8

255 255

, (Interface Identifier)

64 IEEE EUI-64 64

2.

| 10 |

| bits | 54 bits | 64 bits |
+----------+----------+----------+

|1111111010| 0 | interface ID |

+----------+----------+----------+

10

54 0 64
2 64 1

3.

| 10 |

| bits | 38 bits | 16 bits | 64 bits |
+----------+----------+----------+----------+

|1111111011| 0 | subnet ID | interface ID |

+----------+----------+----------+----------+

internet
10 10
38 0 16 64
IEEE EUI-64

4. IPv4 IPv6

RFC2373 2 IPv4 IPv6

IPv4 IPv6 IPv4-compatible IPv6 address

| 80 bits | 16 | 32 bits |
+----------+----+----------+

|0000.....0000|0000| IPv4 address |

+----------+----+----------+

IPv4 IPv6 IPv4-mapped IPv6 address

| 80 bits | 16 | 32 bits |
+----------+----+----------+
|0000.....0000|ffff| IPv4 address |
+----------+----+----------+

IPv4 IPv6 IPv4 IPv6
IPv4 IPv6 IPv4 IPv6 IPv4
IPv6 IP6 IPv4 IPv4/IPv6
IPv6 (IPv4)
IPv4 IPv6 IPv6

33.1.2.2 Multicast Addresses

IPv6

| 8 | 4 | 4 | 112 bits |
+----------+----+----+----------+
|11111111|flgs|scop| group ID |
+----------+----+----+----------+

1 “1”

- 4 4 Internet

“0” “1”
3

- 4
IPv6

- 112

IPv6 FF00::/8 IPv6

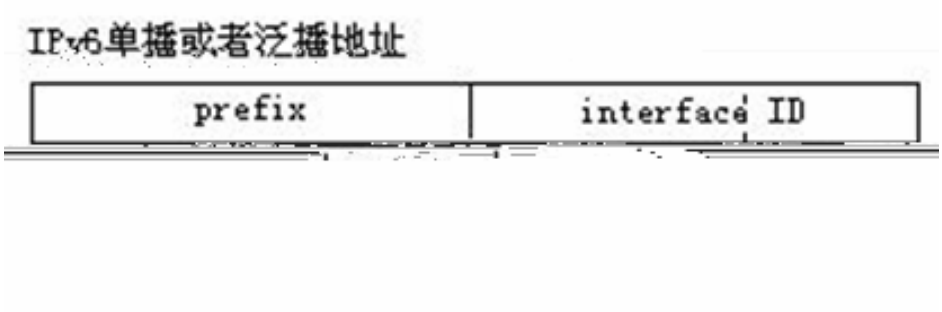
( )

- FF02::1
- FF02:0:0:0:0:1:FF00:0000/104
FF02::2

IPv6 (unicast) (anycast) IPv6

FF02:0:0:0:0:1:FF00:0000/104 24
24
FE80::2AA:FF:FE21:1234 FF02::1:FF21:1234

(NS)



1

33.1.2.3 Anycast Addresses

I P v 6

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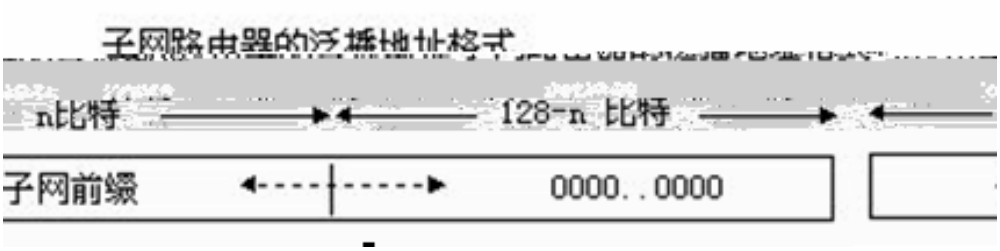
RFC2373

0(

)

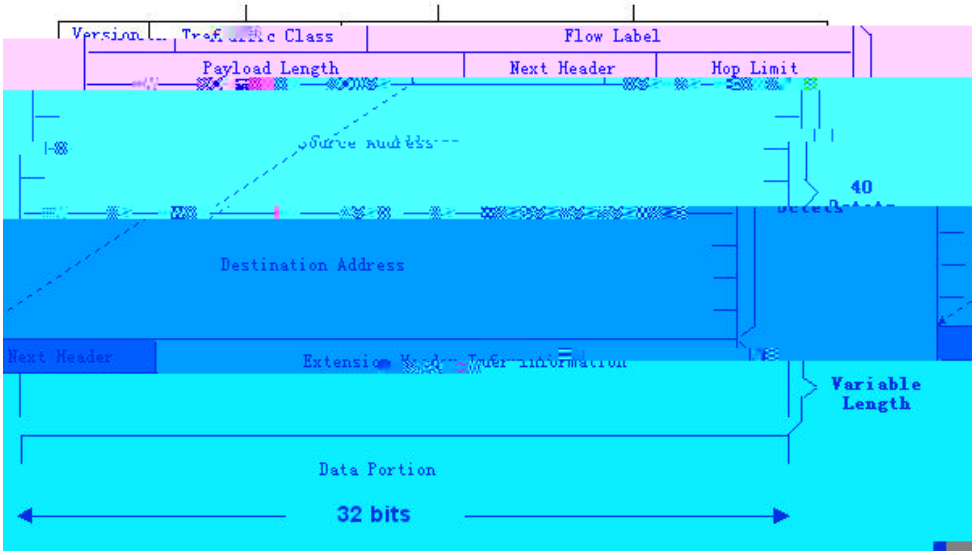
( )



2

33.1.3 IPv6

IPv6



3

IPv4 4 IP v 6 8
40 IPv6

¸ (Next Header)

IPv6 IPv4
TCP UDP IPv6

¸ (Hop Limit)

8 1
0 IPv4

¸ (Source Address)

128 IPv6

¸ (Destination Address)

128 IPv6

IPv6 IPv6

¸ (Hop-by-Hop Options)

IPv6

¸ Routing Type 0

IPv6
IPv6

¸ Fragment

MTU

¸ Destination Options

IPv4
6 4 8

¸ (Upper-layer header)

TCP(6) UDP(17)

(Authentication) (Encapsulating Security Payload) IPSec IPv6 IPSec

33.1.4 IPv6 MTU

IPv4 MTU IPv6 MTU

MTU

MTU

IPv6 IPv6

~

IPv4

( )

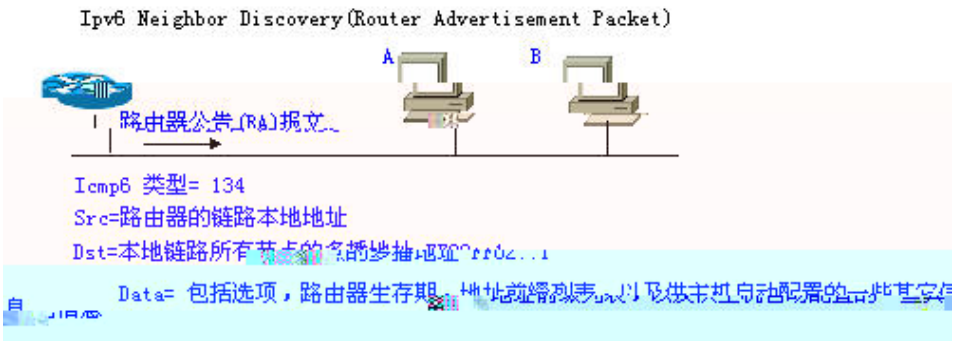
NUD(Neighbor Unreachability Detection),

NUD

(: :)

33.1.5.2 (Router Advertisement)

(RA)



5

- IPv6
- IPv6
- ( )
- ( )
- MTU

(RS)

(RA)

(0:0:0:0:0:0:0:0)

(FF02::2)

(RS) (RA)
(
FF02::1)

Ra-interval

Ra-lifetime

Prefix IPv6

Rs-initerval

Reachabletime

IPv6

~

1)
no ipv6 nd suppress-ra

2)
64

33.2 IPv6

IPv6

33.2.1 IPv6

IPv6 IPv6

~

IPv6 UP
IPv6 (Anycast)

IPv6

configure terminal	
interface *interface-id*	
ipv6 enable	IPv6 IPv6 IPv6
ipv6 address *ipv6-prefix/prefix-length* [**eui-64**]	IPv6 Eui-64 ipv6 64 ID eui-64 (+ ID/) IPv6 IPv6 **no ipv6 enable** IPv6
end	
show ipv6 interface *interface-id*	IPv6
copy running-config startup-config	

```
ND advertised reachable time is 0 milliseconds
ND retransmit interval is 1000 milliseconds
ND advertised retransmit interval is 0 milliseconds
ND router advertisements are sent every 200 seconds<160--240>
ND router advertisements live for 1800 seconds
```

33.2.2 ICMPv6

ICMPv6 IPv6

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，

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，

~

configure terminal	
interface vlan *1*	SVI 1
ipv6 redirects	IPv6
end	
show ipv6 interface vlan *1*	
copy running-config startup-config	

no ipv6 redirects

```
Ruijie(config)# interface vlan 1
Ruijie (config-if)# ipv6 redirects
Ruijie (config-if)# end
```

```
Ruijie # show ipv6 interface vlan 1
Interface vlan 1 is Up, ifindex: 2001
address(es):
Mac Address: 00:d0:f8:00:00:01
INET6: fe80::2d0:f8ff:fe00:1 , subnet is fe80::/64
INET6: fec0:0:0:1::1 , subnet is fec0:0:0:1::/64
Joined group address(es):
ff01:1::1
ff02:1::1
ff02:1::2
ff02:1::1:ff00:1
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
ND DAD is enabled, number of DAD attempts: 1
ND reachable time is 30000 milliseconds
ND advertised reachable time is 0 milliseconds
ND retransmit interval is 1000 milliseconds
ND advertised retransmit interval is 0 milliseconds
ND router advertisements are sent every 200 seconds<160--240>
ND router advertisements live for 1800 seconds
```

33.2.3

(NDP)

configure terminal	
ipv6 neighbor *ipv6-address interface-id hardware-address*	

end

```
00d0.f811.1234
Ruijie (config)# end
Ruijie# show ipv6 neighbors verbose fec0:0:0:1::100
IPv6 Address       Linklayer Addr   InH2cnace
fec0:0:0:1::100    00d0.f811.1234   vlan 1
State: REACH/H Age: - asked: 0
```

33.2.4

2

0

Donw Up

configure H2cminal	
inH2cnace vlan *1*	SVI 1
ipv6 nd dad attempts *attempts*	0
end	
show ipv6 inH2cnace vlan *1*	SVI 1 IPv6
copy running-config startup-config	

no ipv6 nd dad attempts SVI1

(NS)

```
Ruijie(config)# inH2cnace vlan 1
Ruijie(config-if)# ipv6 nd dad attempts 3
Ruijie(config-if)# end
Ruijie# show ipv6 inH2cnace vlan 1
InH2cnace vlan 1 is Up, ifindex: 2001
address(es):
Mac Address: 00:d0:f8:00:00:01
INET6: fe80::2d0:f8ff:fe00:1 , subnet is fe80::/64
```

```
INET6: fec0:0:0:1::1 , subnet is fec0:0:0:1::/64
Joined group address(es):
ff01:1::1
ff02:1::1
ff02:1::2
ff02:1::1:ff00:1
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
ND DAD is enabled, number of DAD attempts: 3
ND reachable time is 30000 milliseconds
ND advertised reachable time is 0 milliseconds
ND retransmit interval is 1000 milliseconds
ND advertised retransmit interval is 0 milliseconds
ND router advertisements are sent every 200 seconds<160--240>
ND router advertisements live for 1800 seconds
```

33.2.5

IPv6 2

configure terminal	
interface *interface-id*	
ipv6 enable	IPv6
ipv6 nd ns-interval *milliseconds*	
ipv6 nd reachable-time *milliseconds*	RFC4861 0.5 1.5
ipv6 nd prefix *ipv6-prefix/prefix-length* | **default** [[*valid-lifetime preferred-lifetime*] | [**at** *valid-date preferred-date*] | **infinite** | **no-advertise**]]	(RA)

(RA)

ipv6 nd ra-lifetime

seconds	0

```
address(es):
Mac Address: 00:d0:f8:00:00:01
INET6: fe80::2d0:f8ff:fe00:1 , subnet is fe80::/64
INET6: fec0:1:1:1::1 , subnet is fec0:1:1:1::/64
Joined group address(es):
ff01:1::1
ff02:1::1
ff02:1::2
ff02:1::1:ff00:1
MTU is 1500 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
ND DAD is enabled, number of DAD attempts: 1
ND reachable time is 30000 milliseconds
ND advertised reachable time is 0 milliseconds
ND retransmit interval is 1000 milliseconds
ND advertised retransmit interval is 0 milliseconds
ND router advertisements are sent every 200 seconds<160--240>
ND router advertisements live for 1800 seconds
```

2)

```
Ruijie# show ipv6 interface ra-info
vlan 1: DOWN
RA timer is stopped
waits: 0, initcount: 3
statistics: RA(out/in/inconsistent): 4/0/0, RS(input): 0
Link-layer address: 00:00:00:00:00:01
Physical MTU: 1500
ND router advertisements live for 1800 seconds
ND router advertisements are sent every 200 seconds<160--240>
Flags: !M!O, Adv MTU: 1500
ND advertised reachable time is 0 milliseconds
ND advertised retransmit time is 0 milliseconds
ND advertised CurHopLimit is 64
Prefixes: (total: 1)
fec0:1:1:1::/64(Def, Auto, vltime: 2592000, pltime: 604800,
flags: LA)
```

3) IPv6

```
Ruijie# show ipv6 neighbors
IPv6 Address              Linklayer Addr  Interface
fe80::200:ff:fe00:1      0000.0000.0001 vlan 1
State: REACH/H Age: - asked: 0
fec0:1:1:1::1            0000.0000.0001 vlan 1
State: REACH/H Age: - asked: 0
```

34 IPv6

34.1

IPv6 IPv4 IPv4 IPv6
IPv6 IPv4
IPv4 IPv6 IPv4

1) IPv6 IPv4
2) IPv6 IPv4

Tunnel 1 2 NAT-PT
-

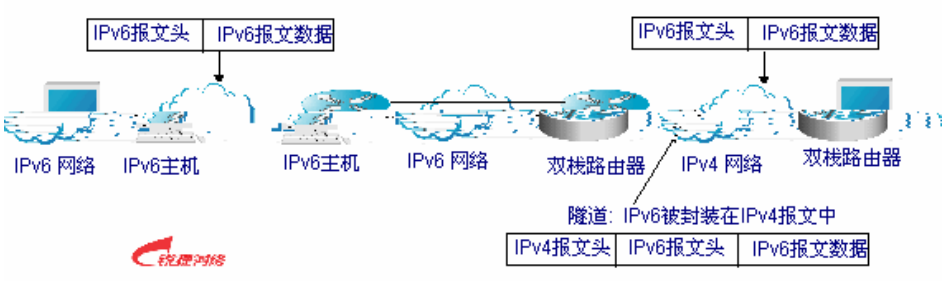
IPv6 IPv6 IPv4 IPv6 IPv4
IPv6 IPv6
IPv4 IPv4 IPv6

IPv4 IPv6 :

Manually Config Tunnel	RFC2893
automatic 6to4 Tunnel	RFC3056
Intra-Site Automatic Tunnel Addressing Protocol(ISATAP)	draft-ietf-ngtrans-isatap-22

~

IPv6 =



1

34.1.1 (IPv6 Manually Configured Tunnel)

I P v 4 IPv6 *6* IPv6 *[5 3 7 b*

6to4 IPv4 211.1.1.1
D301:0101 1 2e0:ddff:fee0:e0e1
6to4

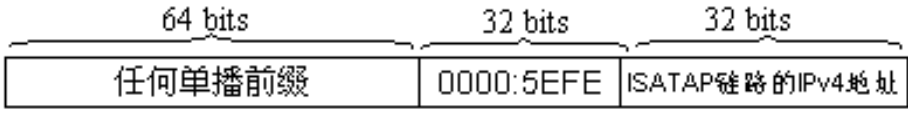
2002: D301:0101:1: 2e0:ddff:fee0:e0e1

~

ISATAP 64 IPv6 64
64 EUI-64
32 0000:5EFE ISATAP

， ISATAP

ISATAP ISATAP
ISATAP



IPv6 ISATAP 地址格式

3

IPv4 IPv4

IPv6 2001::/64 IPv4 192.168.1.1 ISATAP
IPv4 C0A8:0101 ISATAP

2001::0000:5EFE:C0A8:0101

34.2 IPv6

34.2.1 IPv6

IPv6
IPv4 (IPv6
IPv4)

~

Tunnel Source Tunnel Destination

```
config terminal
interface tunnel tunnel-num
tunnel mode ipv6ip
ipv6 enable
tunnel source {ip-address | type num}
```

```
tunnel destination ip-address
end
```

configure terminal	
interface tunnel *tunnel-num*	
tunnel mode ipv6ip	
ipv6 enable	IPv6 IPv6 IPv6
tunnel source {*ip-address* | *type num*}	IPv4 IPv4
tunnel destination *ip-address*	
end	
copy running-config startup-config	

“ IPv6 ”

34.2.2 6to4

6to4

6to4 6to4 IPv6 IPv4 6to4
IPv4 IPv6

~

6to4 6to4 IPv4
6to4

```
config terminal
interface tunnel tunnel-num
tunnel mode ipv6ip 6to4
ipv6 enable
```

```
tunnel source {ip-address | type num}
exit
ipv6 route 2002::/16 tunnel tunnel-number
end
```

configure terminal	
interface tunnel *tunnel-num*	
tunnel mode ipv6ip 6to4	

ISATAP ISATAP

```
config terminal
interface tunnel tunnel-num
tunnel mode ipv6ip isatap
ipv6 address ipv6-prefix/prefix-length eui-64
tunnel source interface-type num
no ipv6 nd suppress-ra
end
```

configure terminal	
interface tunnel *tunnel-num*	
tunnel mode ipv6ip isatap	ISATAP
ipv6 address *ipv6-prefix*/*prefix-length* [**eui-64**]	IPv6 ISATAP , eui-64 ISATAP ISATAP ISATAP
tunnel source *type num*	, IPv4
no ipv6 nd suppress-ra	, ISATAP
end	
copy running-config startup-config	

“ IPv6 ”

34.3 IPv6

IPv6

```
enable
show interface tunnel number
```

```
show ipv6 interface tunnel mumber
ping protocol destination
show ip route
show ipv6 route
```

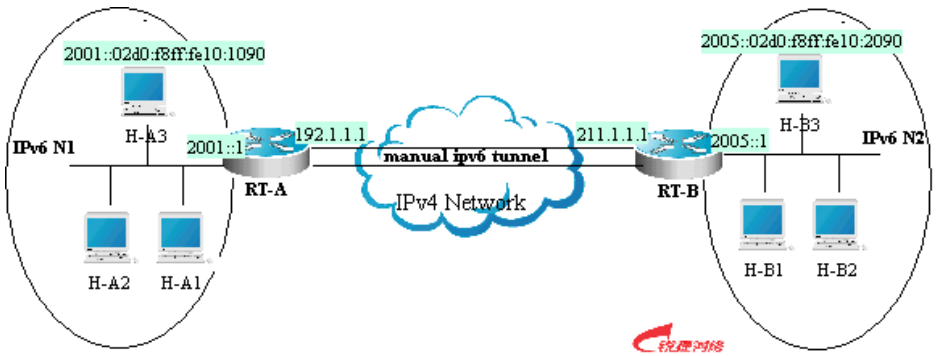
enable	
show interface tunnel *tunnel-num* **show ipv6 interface tunnel** *tunnel-numtunnel*	tunnel .

```
ff02::1
ff02::1:ff00:1
MTU is 1480 bytes
ICMP error messages limited to one every 100 milliseconds
ICMP redirects are enabled
ND DAD is enabled, number of DAD attempts: 1
ND reachable time is 30000 milliseconds
ND advertised reachable time is 0 milliseconds
ND retransmit interval is 1000 milliseconds
ND advertised retransmit interval is 0 milliseconds
ND router advertisements are sent every 200 seconds<160--240>
ND router advertisements live for 1800 seconds
```

34.4 IPv6

- IPv6
-
- 6to4
- ISATAP
- ISATAP 6to4

34.4.1 IPv6



4

IPv6 N1 N2 IPv4
N1 H-A3 N2 H-B3

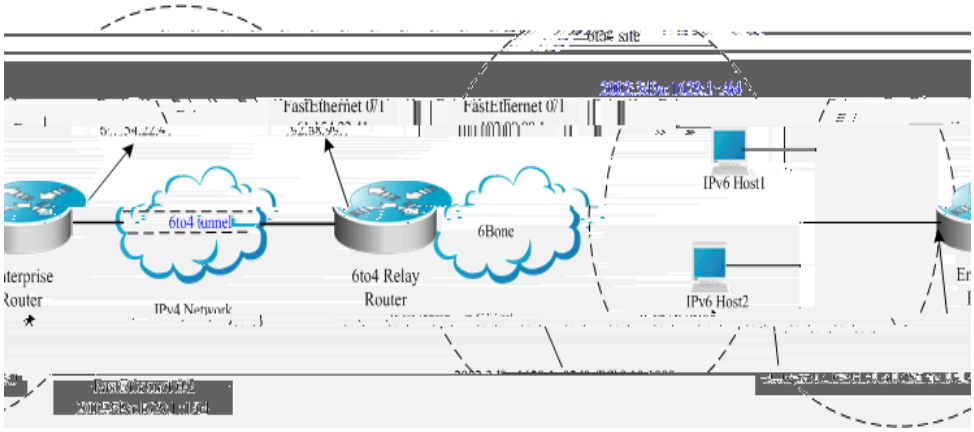
RT-A RT-B IPv4 IPv6 N1 N2
(RT-A RT-B) RT-A
RT-B

IPv4 IPv4

RT-A

```
#     IPv4
interface FastEthernet 2/1
no switchport
ip address 192.1.1.1 255.255.255.0

#     IPv6
interface FastEthernet 2/2
no switchport
ipv6 address 2001::1/64
```

34.4.2 6to4



5

IPv6 (6to4) 6to4 6to4 IPv6 (6bone)

6to4 IPv6 6to4 IPv6 6to4 IPv6 IPv4 6to4 6to4

61.154.22.41 3d9a:1629

192.88.99.1 c058:6301

~

6to4 IPv4 6to4

---

2 IPv4 IPv4

Enterprise Router

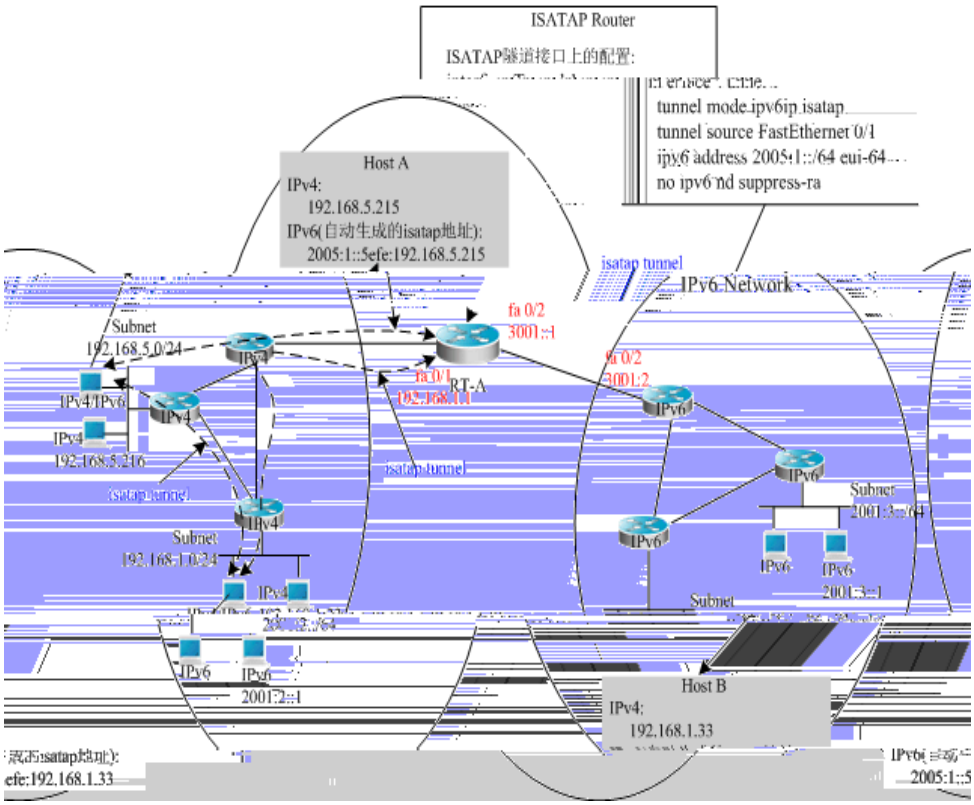
```
#      IPv4
interface FastEthernet 0/1
no switchport
ip address 61.154.22.41 255.255.255.128

#      IPv6
interface FastEthernet 0/2
no switchport
ipv6 address 2002:3d9a:1629:1::1/64
no ipv6 nd suppress-ra
```

```
#     6to4
interface Tunnel 1
tunnel mode ipv6ip 6to4
ipv6 enable
tunnel source FastEthernet 0/1

#
ipv6 route 2002::/16 Tunnel 1

#       6to4                ,           6bone
ipv6 route ::/0 2002:c058:6301::1
```

ISP 6to4 Relay Router

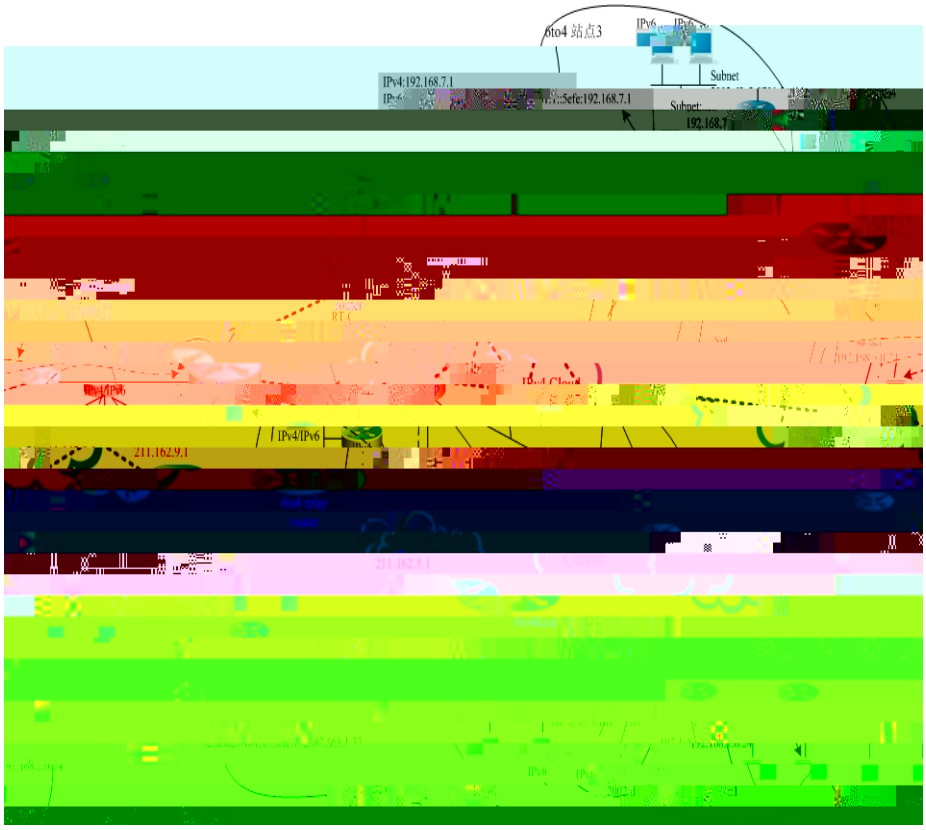
```
#     IPv4
interface FastEthernet 0/1


#     ⅝           ⅋
interface Fannel1 6tunnel mode 2002::/16 Tunnel 6to4 1 tunnel source FastEthernet 0/1 #
```

34.4.3 ISATAP


ISATAP Router
tunnel mode ipv6ip isatap
tunnel source FastEthernet 0/1
ipv6 address 2005:1::/64 eui-64
no ipv6 nd suppress-ra
Host A
IPv4:
192.168.5.215
IPv6(自动生成的isatap地址):
2005:1::5efe:192.168.5.215
isatap tunnel
IPv6 Network
Subnet
192.168.5.0/24
fa 0/2
3001::1
fa 0/1
192.168.1.1
RT-A
fa 0/2
3001::2
IPv4/IPv6
IPv4
192.168.5.216
IPv6
Subnet
2001:3::/64
Subnet
192.168.10.0/24
IPv6
2001:2::1
Host B
IPv4:
192.168.1.33
efe:192.168.1.33
2005:1::5

```
tunnel mode ipv6ip isatap
tunnel source FastEthernet 0/1
ipv6 address 2005:1::/64 eui-64
no ipv6 nd suppress-ra

#     IPv6
interface FastEthernet  0/2
no switchport
ipv6 address 3001::1/64

#       IPv6
ipv6 route 2001::/64 3001::2
```

34.4.4 ISATAP 6to4



7

&

6to4 ISATAP 6to4
6to4 **6to4 relay router** 6to4 Cernet
6to4 ISATAP IPv4 IPv6
ISATAP IPv6

~

IP 6to4 Relay
IP 6to4 Relay
6to4 Relay

6to4

RT-A

```
#     Internet
interface GigabitEthernet 0/1
no switchport
ip address 211.162.1.1 255.255.255.0

#             IPv4
interface FastEthernet  0/1
no switchport
ip address 192.168.0.1 255.255.255.0

#     ISATAP
interface Tunnel 1
tunnel mode ipv6ip isatap
tunnel source FastEthernet 0/1
ipv6 address 2002:d3a2:0101:1::/64 eui-64
no ipv6 nd suppress-ra

#     IPv6         1
interface FastEthernet 0/2
no switchport
2002:d3a2:0101:10::1/64

#     IPv6         2
interface FastEthernet  0/2
no switchport
2002:d3a2:0101:20::1/64

#     6to4
interface Tunnel 2
tunnel mode ipv6ip 6to4
ipv6 enable
tunnel source GigabitEthernet 0/1

#      6to4
ipv6 route 2002::/16 Tunnel 2
```

```
#       6to4          RT-D      ,           Cernet
ipv6 route ::/0 2002:d3a2::0901::1
```

RT-B

```
#     Internet
interface GigabitEthernet 0/1
no switchport
ip address 211.162.5.1 255.255.255.0

#             IPv4         1
interface FastEthernet  0/1
no switchport
ip address 192.168.10.1 255.255.255.0

#             IPv4         2
interface FastEthernet  0/2
no switchport
ip address 192.168.20.1 255.255.255.0

#     ISATAP
interface Tunnel 1
tunnel mode ipv6ip isatap
tunnel source FastEthernet 0/1
ipv6 address 2002:d3a2:0501:1::/64 eui-64
no ipv6 nd suppress-ra

#     6to4
interface Tunnel 2
tunnel mode ipv6ip 6to4
ipv6 enable
tunnel source GigabitEthernet 0/1

#      6to4
ipv6 route 2002::/16 Tunnel 2

#      6to4          RT-D      ,           Cernet
ipv6 route ::/0 2002:d3a2::0901::1
```

RT-C

```
#     Internet
interface GigabitEthernet 0/1
no switchport
ip address 211.162.7.1 255.255.255.0

#             IPv4
interface FastEthernet 0/1
no switchport
ip address 192.168.0.1 255.255.255.0

#     ISATAP
```

```
interface Tunnel 1
tunnel mode ipv6ip isatap
tunnel source FastEthernet 0/1
ipv6 address 2002:d3a2:0701:1::/64 eui-64
no ipv6 nd suppress-ra

#     IPv6
interface FastEthernet 0/2
no switchport
2002:d3a2:0701:10::1/64

#     6to4
interface Tunnel 2
tunnel mode ipv6ip 6to4
ipv6 enable
tunnel source GigabitEthernet 0/1

#       6to4
ipv6 route 2002::/16 Tunnel 2

#       6to4          RT-D                  Cernet
ipv6 route ::/0 2002:d3a2::0901::1
```

RT-D(6to4 Relay)

```
#     Internet
interface GigabitEthernet 0/1
no switchport
ip address 211.162.9.1 255.255.255.0

#     IPv6
interface FastEthernet 0/1
no switchport
2001::1/64
no ipv6 nd suppress-ra

#     6to4
interface Tunnel 1
tunnel mode ipv6ip 6to4
ipv6 address 2002:d3a2::0901::1/64
tunnel source GigabitEthernet 0/1

#       6to4
ipv6 route 2002::/16 Tunnel 1
```

35 OSPFv3

OSPF 2 RFC2328 OSPFv2 IPv4 RFC2740 OSPF 3 OSPFv3 OSPFv2 IPv6 OSPFv3 OSPFv3

~

OSPFv2 OSPFv3 OSPFv2 OSPFv2

35.1 OSPFv3

OSPF Interior Gateway Protocol IGP AS

OSPF link-state advertisements(LSAs) Dijkstra algorithm OSPF

OSPFv3 RFC2740 IPv6 OSPFv2 OSPFv3

35.1.1 LSA

OSPF LSA LSA IPv4 IPv6 128 IP LSA LSA

¸ Router-LSAs (Type 1)

OSPFv2 OSPFv3 Router-LSAs router LSA OSPFv2 Router-LSA OSPFv3 Router-LSAs SPF Router-LSAs Router-LSAs Network-LSAs

~

Router-LSAs router area border

router(ABR) AS boundary routers (ASBR
) irtual link( )

Netw -LSAs NBMA R( )
routers outer-LSAs

Netw -LSAs
Netw -LSAs

OSPFv3 OSPFv2

OSPFv2

LSA

LSA

LSA

OSPFv3 LSA LSA header

LSA

35.1.1.1

OSPFv3

1. OSPFv3 OSPFv2
   OSPF network
2. OSPFv3 IPv6
   OSPFv2 **network**
3. OSPFv3

10
hello
1
5
1

		110
		110
		100 Mbps
		240
		SPF 5 10

OSPFv3

configure terminal	
ipv6 router ospf *process-id*	OSPFv3 OSPFv3
router-id *router-id*	OSPFv3 Router ID
interface *interface-id*	
ipv6 ospf *process-id* **area** *area-id* [**instance** *instance-id*]	OSPFv3 instance-id OSPFv3 OSPFv3
copy running-config startup-config	3229 2 ref203.82 2924 0.6 0.47998 1.9 ref203.82 294

OSPFv3

ipv6 ospf *process-id* **area** *area-id* [**instance** *instance-id*]	OSPFv3
ipv6 ospf network {**broadcast** |**non-broadcast** | **point-to-point** |**point-to-multipoint** [**non-broadcast**]} [**instance** *instance-id*]	
ipv6 ospf cost *cost* [**instance** *instance-id*]	( )
ipv6 ospf hello-interval *seconds* [**instance** *instance-id*]	( ) Hello
ipv6 ospf dead-interval *seconds* [**instance** *instance-id*]	( )
ipv6 ospf transmit-delay *seconds* [**instance** *instance-id*]	( )
ipv6 ospf retransmit-interval *seconds* [**instance** *instance-id*]	( ) LSA
ipv6 ospf priority *number* [**instance** *instance-id*]	( ) DR BDR

no

~

instance hello-interval dead-interval

35.1.4 OSPFv3

OSPF “ ” “ ” “ (Area)” “ ” “ ” 0(0.0.0.0)

OSPF

, stub

stub

stub AS (type 5 LSAs)
stub
OSPF

stub

area *area-id* **virtual-link** *router-id* [**hello-interval** *seconds*] [**dead-interval** *seconds*] [**transmit-delay** *seconds*] [**retransmit-interval** *seconds*] [**instance** *instance-id*]	

no

~

1. stub NSSA

2.

instance hello-interval dead-interval

35.1.6 OSPFv3

35.1.6.1

OSPF ABR

ABR

OSPFv3

area *area-id* **range** *ipv6-prefix*/*prefix-length* [**advertise**	**not-advertise**]	

no area *area-id* **range** *ipv6-prefix* /*prefix-length*

35.1.7 OSPFv3

OSPF

100 Mbps 10Mbps

100/10 = 10

100 Mbps

OSPFv3 OSPFv3

auto-cost [**reference-bandwidth** *ref-bw*]	

~

ipv6 ospf cost *cost-value*

35.1.8 OSPFv3

OSPF

OSPFv3 Stub Type 3 LSA

Type5 LSA

OSPF OSPFv3

default-information originate [**always**] [**metric** *metric-value*] [**metric-type** *type-value*] [**route-map** *map-name*]	

no default-information originate

~

1) Stub

2) ASBR

35.1.9 OSPFv3

OSPF OSPF SPF

SPF

SPF

OSPFv3

timers spf *delay holdtime*	SPF SPF

35.1.10 G ! 5 B E ¯ 0 W

show ipv6 ospf [*process- id*] **neighbor** [*interface-type interface-number* [**detail**]| *neighbor-id* |**detail**]	OSPFv3

36 IPv4

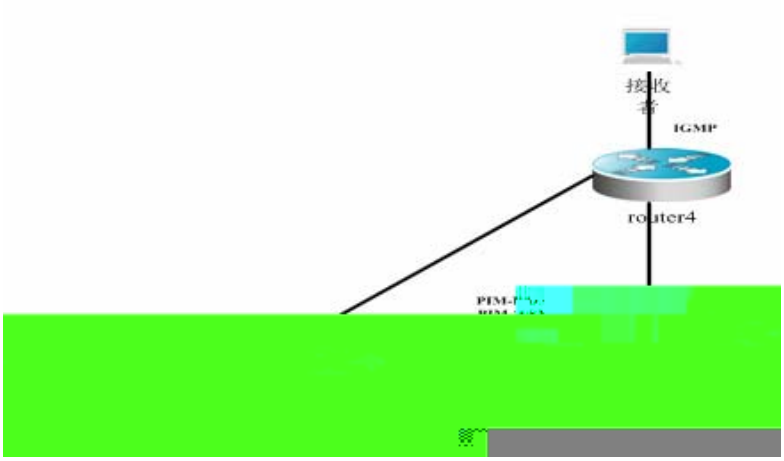
36.1

IPV4

4,ŘÁSÁSK@Ø˜…ÍÐ)Eî ÀW Þ …d\@

IANA D D 1110
224.0.0.0 239.255.255.255
224.0.0.1 224.0.0.255 q Á Ɑ
224.0.0.1 224.0.0.2

UDP TCP



1 IPV4

36.1.2 IGMP

IPV4 IGMP
IGMP

IGMP IGMPv1 IGMPv2 IGMPv3 IGMPv2 IGMPv1
IGMP

36.1.2.1 IGMPV1

1

- Membership query
- Membership report

report query

36.1.2.2 IGMPV2

2

1) Membership query
2) Version 1 membership report
3) Version 2 membership report
4) Leave group

2 1 2
leave Query

IGMP
IGMP
IP IGMPv1 IP
IGMPv2/IGMPv3 IP
IGMP

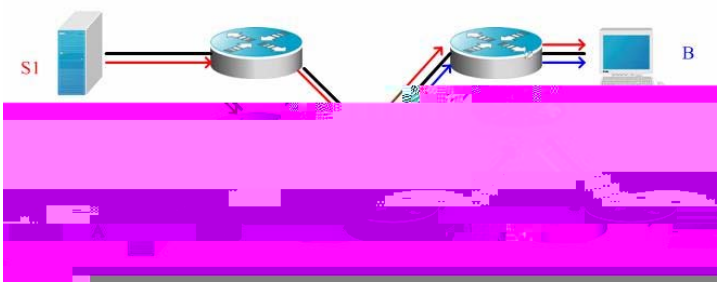
36.1.2.3 IGMPV3

IGMPv1 v2 :

¸

¸ Ő Ư ú ę z

” S1 S2
G S1 S2 G
A S1 S2



2

IGMP v3 A S1 join G include S1

- IS_EX EXCLUDE

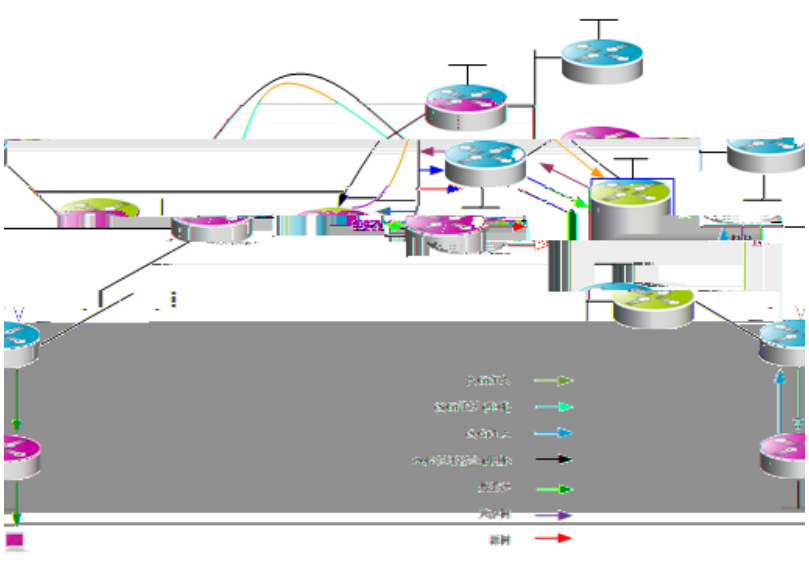
- TO_IN EXCLUDE
  INCLUDE
- TO_EX INCLUDE
  EXCLUDE
- ALLOW
  INCLUDE
  EXCLUDE
- BLOCK
  INCLUDE
  EXCLUDE

IGMPv3 IGMPv1/IGMPv2

36.1.3 PIM-SM

PIM(Protocol Independent Multicast) IDMR
PIM
RPF
PIM PIM
PIM Internet SPT
PIM
(Dense-Mode) Sparse-Mode

PIM-SM(Protocol Independent Multicast Sparse Mode)
PIM-SM PIM-SM Hello
PIM-SM DR
DR “ / ”



5 pim-sm

PIM-SM
G RP (Shared Tree) (Shortest Path Tree) PIM-SM /
DR report G
RP (*.G)
RP
RP
S G

PIM-SM
SPT SPT
RP

PIM-SM SPT

PIM RP
RP
DR
RP

PIMv2 BSR group-to-RP
RP BSR hop-by-hop BSR
BSR STP root-bridge
BSR BSR
IP BSR BSR BSR
all-PIM-routers multicast group (224.0.0.13) TTL 1 PIMv2
TTL 1 BSR
BSR IP BSR
RP RP RP
RP BSR RP BSP
RP PIM

36.1.4 PIM-DM

PIM-DM Protocol Independent Multicast-Dense Mode
PIM-DM
Protocol
Independent PIM-DM RFC 3973

PIM-DM Hello PIM-DM
PIM-DM Hello Hello
Hello Hold Time
Hello Hello

PIM-DM flood and prune PIM-DM

RPF Reverse Path
Forwarding RPF
RPF S, G
S, G

RPF S,
G

Pruned

PIM-DM Assert

Ruijie(config)# **ip multicast-routing**	
Ruijie(config)# **no ip multicast-routing**	

~

36.3.1 TTL

ttl TTL

36.3.4 IPV4

RPF

RPF

Ruijie(config) # **ip mroute** *source-address mask* [**bgp | isis | ospf | static**] { *v4rpf-address* |*interface-type interface-number*} [*distance*]	Distance <1-255>

&

ip

36.3.5

Ruijie(config) # **ip multicast static** *source-address group-address interface-type interface-number*	

PIM-DM PIM-SM

36.3.6

v4

Ruijie# **show ip mroute** [*v4group-address*] [*v4 source-address*] [**dense**|**sparse**][**summary**|**count**]	v4

v4

Ruijie# **clear ip mroute** {* | *v4group-address* [*v4source -address*]}	

Ruijie# **debug nsm mcast vif**	v4

v4

Ruijie# **debug nsm mcast stats**	v4

36.4 IGMP

IGMP

- IGMP
- IGMP
- join-group( )
- static-group( )
- IGMP
- IGMP PROXY-SERVICE
- IGMP MROUTE-PROXY
- IGMP SSM-MAP
- IGMP SSM-MAP STATIC
- IGMP
- IGMP
- IGMP
- IGMP SSM-MAP
- IGMP

， IGMP

36.4.1 IGMP

IGMP	2
	10
	125
	255
	2
	1s
	2
IGMP	

36.4.2 IGMP

IGMP

Ruijie(config-if) # **ip pim** {**sparse-mode**| **dense-mode**}	IGMP
Ruijie(config-if) # **no ip pim** {**sparse-mode**|**dense-mode**}	IGMP

&

IGMP

Ruijie(config-if) # **no ip igmp version**	IGMP

36.4.4

10(

0.1s)

:

Ruijie(config-if) # **ip igmp last-member-query-interval** *interval*	*interval* <1-255> 0.1s
Ruijie(config-if) # **no ip igmp last-member-query-interval**	

36.4.5

1.

Ruijie(config-if) # **ip igmp last-member-query-count** *count*	2-7 2
Ruijie(config-if) # **no ip igmp last-member-query-count**	

36.4.6

all-hosts

224.0.0.1 TTL 1 125

Ruijie(config-if) # **ip igmp query-interval** *seconds*	125s 1~18000

Ruijie(config-if) # **no ip igmp query-interval**	

36.4.7

10

Ruijie(config-if)# **ip igmp query-max-response-time** *seconds*	10s <1-25> s
Ruijie(config-if)# **no ip igmp query-max-response-time**	

Ruijie (config) # **access-list** *access-list-num* **permit** *A.B.C.D A.B.C.D*	
Ruijie (config)# **interface** *interface-id*	
Ruijie (config-if) # **ip igmp access-group** *access-list-name*	*access-list-name*
Ruijie (config-if) # **no ip igmp access-group**	

36.4.10

IGMP version2

Ruijie # **config terminal**	
Ruijie(config)# **access-list** *access-list-num* **permit** *A.B.C.D A.B.C.D*	.
Ruijie (config)# **interface** *interface-id*	
Ruijie(config-if)# **ip igmp immediate-leave group-list** *access-list-name*	*access-list-name*
Ruijie (config-if) # **exit**	

no ip igmp join-group *group-address*

36.4.12 static-group

no

Ruijie # **config terminal**	
Ruijie (config)# **interface** *interface-id*	
Ruijie(config-if)# **ip igmp static-group** *group-address*	
Ruijie (config-if) **# exit**	

Ruijie(config-if # **ip igmp proxy-service**	proxy-service

36.4.15 IGMP MROUTE - PROXY

proxy-service igmp

Ruijie(config-if # **ip igmp mroute-proxy** *interfacename*	*Interfname*

36.4.16 IGMP SSM-MAP

ip igmp ssm-map static

Ruijie(config # **ip igmp ssm-map enable**	ssm-map

36.4.17 IGMP SSM-MAP STATIC

ip igmp ssm-map enable v3

Ruijie(config # **ip igmp ssm-map static** *11 192.168.2.2*	acl 11 192.168.2.2

36.4.18 IGMP

Ruijie# **clear ip igmp group**	IGMP igmp group

36.4.19 IGMP

IGMP

36.4.22 IGMP SSM-MAP

IGMP SSM-MAP

Ruijie# **show ip igmp ssm-mapping**	IGMP SSM-MAP
Ruijie# **show ip igmp ssm-mapping** *233.3.3.3*	IGMP SSM-MAP 233.3.3.3

36.4.23 IGMP

IGMP

Ruijie# **show debugging**	IGMP

36.4.24 IGMP IGMP

IGMP IGMP

Ruijie# **debug ip igmp all**	IGMP
Ruijie# **debug ip igmp decode**	IGMP
Ruijie# **debug ip igmp encode**	IGMP
Ruijie# **debug ip igmp events**	IGMP
Ruijie# **debug ip igmp fsm**	IGMP
Ruijie# **debug ip igmp tib**	IGMP
Ruijie# **debug ip igmp warning**	IGMP

- DR
- RP
- BSR
- RP-SET RP
- RP
- RP
- RP
-
- cisco
-
-
- RP KAT
- Join/Prune
-
- dense-mode mib
-
- PIM-SM
- PIM-SM ( )

36.5.1 PIM-SM

PIM-SM PIM-SM
PIM-SM

PIM-SM

Ruijie(config-if # **ip pim sparse-mode**	PIM-SM
Ruijie(config-if # **no ip pim sparse-mode**	PIM-SM

~

PIM-SM

“ Failed to enable PIM-SM on < >, resource temporarily unavailable, please try again ”

“ PIM-SM Configure failed! VIF limit exceeded in NSM!!! ”

PIM-SM PIM-SM PIM-DM

/ v4

36.5.2 Hello

PIM-SM Hello
Hello

Hello

Ruijie(config-if # **ip pim query-interval** *interval-seconds*	Hello *interval-seconds* <1-65535>
Ruijie(config-if # **no ip pim query-interval**	Hello

Hello 30

&

Hello Hello
Hello Hello 3.5 Hello
* 3.5 > 65535 Hello 65535

36.5.3 PIM-SM

PIM-SM c

PIM

&

ip pim neighbor-filter

ACL PIM ACL

PIM

36.5.4 DR

Ruijie(config-if # **ip pim dr-priority** *priority-value*	*priority-value* <0-4294967294>
Ruijie(config-if # **no ip pim dr-priority** *priority-value*	1

36.5.5 RP

RP PIM-SM

- ACL 0.0.0.0/0
  224/4
- RP RP
  RP IP

PIM-SM RP

Ruijie(config # **ip pim rp-candidate** *interface-type interface-number* [**priority** *priority-value*] [**interval** *interval-seconds*] [**group-list** *access-list*]	RP **priority** *priority-value* 192 *priority-value* <0-255> **interval** *interval-seconds* 60s *interval-seconds* <1-16383> **group-list** *access-list* 224/4
Ruijie(config # **no ip pim rp-candidate** *interface-type interface-number*	RP

&

RP acl
permit ace deny ace

~

ace

36.5.9 RP

DR RP RP
DR RP
RP RP

Ruijie(config # **ip pim register-rp-reachability**	RP
Ruijie(config # **no ip pim register-rp-reachability**	

36.5.10 RP

RP

RP

ACL

Ruijie(config # **ip pim accept-register list** *access-list*	
Ruijie(config # **no ip pim accept-register**	

36.5.11

DR S G

Ruijie(config # **ip pim register-rate-limit** *rate*	*rate* <1-65535>
Ruijie(config # **no ip pim register-rate-limit**	

36.5.12 cisco

cisco

Ruijie(config # **ip pim cisco-register-checksum** [**group-list** *access-list*]	cisco **group-list** *access-list*

Ruijie(config # **no ip pim cisco-register-checksum** [**group-list** *access-list*]	cisco **group-list** *access-list*

36.5.13

DR

no DR

Ruijie(config # **no ip pim rp-register-kat**	KAT

~

DR * 3 +
RP DR (S,G)

36.5.16 Join/Prune

Join/Prune 60s
Join/Prune 60s

Ruijie(config # **ip pim jp-timer** *interval-seconds*	Join/Prune interval-seconds	<1-65535> и

Ruijie#**show ip pim sparse-mode rp-hash** *group-address*	*group-address* RP
Ruijie#**show ip pim sparse-mode rp mapping**	RP

36.5.21 PIM-SM

PIM-SM

Ruijie# **clear ip mroute** {*** |** ***group_address*** [***source_address***] }	
Ruijie# **clear ip mroute statistics** {*** |** ***group_address*** [***source_address***] }	
Ruijie#**clear ip pim sparse-mode bsr rp-set ***	RP-SET

36.6 PIM-DM

PIM-DM

- PIM-DM
- Hello
- PIM
- PIM
- PIM
- PIM-DM

36.6.1 PIM-DM

PIM-DM PIM-DM

PIM-DM

PIM-DM

Ruijie(config-if #**ip pim dense-mode**	PIM-DM
Ruijie(config-if #**no ip pim dense-mode**	PIM-DM

GabitEthernet 0/3 PIM

```
Ruijie(config)# ip multicast-routing
Ruijie(config)# interface  gabitEthernet 0/3
Ruijie(config-if)# ip address 192.168.194.2 255.255.255.0
Ruijie(config-if)# ip pim dense-mode
```

~

PIM-DM

“Failed to enable PIM-DM on < >, resource temporarily unavailable, please try again”

“PIM-DM Configure failed!

36.6.5 PIM

PIM-DM

PIM

PIM

Ruijie(config-if #**ip pim state-refresh origination-interval** *interval-seconds*	PIM *interval-seconds*

show ip pim dense-mode interface detail

```
Ruijie# show ip pim dense-mode interface detail
FastEthernet 0/45 (vif-id: 3):
Address 10.10.10.10
Hello period 30 seconds, Next Hello in 15 seconds
Over-ride interval 2500 milli-seconds
Propagation-delay 500 milli-seconds
Neighbors:
10.10.10.1
VLAN 4 (vif-id: 2):
Address 50.50.50.50
Hello period 30 seconds, Next Hello in 2 seconds
Over-ride interval 2500 milli-seconds
Propagation-delay 500 milli-seconds
Neighbors:
50.50.50.1
```

FastEthernet 0/45 IP 10.10.10.10 Hello 30 Hello 15 10.10.10.1 VLAN 4 FastEthernet 0/45

show ip pim dense-mode neighbor

```
Ruijie# show ip pim dense-mode neighbor
Neighbor-Address Interface            Uptime/Expires    Ver
```

```
RPF Neighbor: 50.50.50.1, Nexthop: 50.50.50.1, VLAN 4
Upstream IF: VLAN 4
Upstream State: Pruned, PLT:200
Assert State: NoInfo
Downstream IF List:
FastEthernet 0/45:
Downstream State: NoInfo
Assert State: Loser, AT:170
```

(1.1.1.111, 229.1.1.1) MRT 205
RPF 50.50.50.1 50.50.50.1 VLAN4
VLAN4 Pruned
FastEthernet 0/45 NoInfo Assert
Loser FastEthernet 0/45

36.7

36.7.1 PIM-DM

36.7.1.1

36.7.1.2

1 PIM-DM 2 3 1

```
Ruijie# configure terminal
Ruijie(config)# ip multicast-routing
```

2 eth0 PIM-DM

```
Ruijie(config)# interface eth 0
Ruijie(config-if)# ip pim dense-mode
Ruijie(config-if)# exit
```

3 eth1 PIM-DM

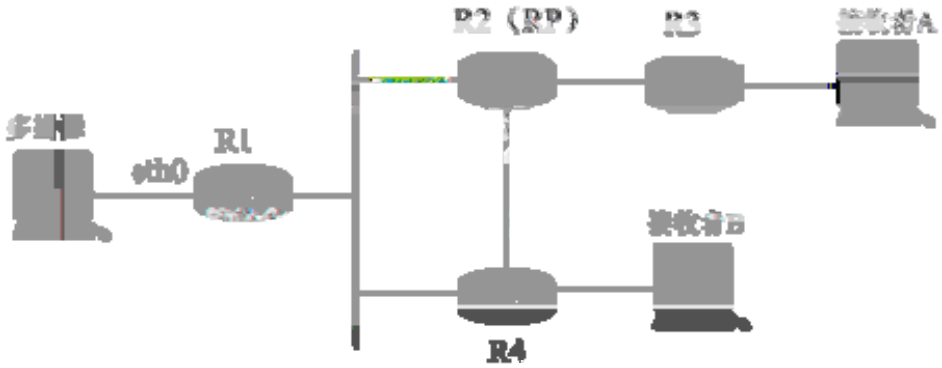
```
Ruijie(config)# interface eth 1
Ruijie(config-if)# ip pim dense-mode
Ruijie(config-if)# end
```

2 3 1
PIM-DM

36.7.2 PIM-SM

36.7.2.1

2 R1 R2 RP R3
A R4 B
IP IP



7 PIM-SM

36.7.2.2

R1 IPV4 R2 R3 R4

```
Ruijie# configure terminal
Ruijie(config)# ip multicast-routing
```

2 PIM-SM

R1 eth0 PIM-SM R1 R2 R3 R4

```
Ruijie(config)# interface eth
```

37

37.1

37.1.1

LAN

LAN

LAN

37.1.2

Ruijie(config-if)# **storm-control** {**broadcast** | **multicast** | **unicast**} [{ **level** *percent* | **pps** *packets* | *rate-bps*]	**broadcast** **multicast** **unicast** **level** *percent* 20 20% **pps** *packet* packets per second *Rate-bps* bit Kbits per second,

~

1. level

2. storm-control broadcast

3. S3760
(level,pps,kbps)
1 level 2 pps
3 AP

AP

37.1.3

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

Gi0/3

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


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
```

37.2 Protected Port

37.2.1

(Protected Port)

3

3

SPAN SPAN

SPAN SPAN SPAN

( )

Aggregated Port Aggregated Port

Aggregated Port

37.3

37.3.1

MAC MAC+ IP IP

MAC IP+MAC
IP MAC
MAC
IP+MAC IP
MAC
MAC IP
MAC IP

、

、
IP
IP

、

protect

restrict Trap

shutdown Trap

37.3.2

37.3.2.1

	128
	(protect)

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

&

S3760 IP+MAC IP

S3760 IP IP
mac **show mac-address-table** mac

37.3.3

Ruijie#**show port-security interface** [*interface-id*]	
Ruijie#**show port-security address**	
Ruijie# **show port-security address** [*interface-id*]	
Ruijie# **show port-security**	

Gigabitethernet 0/3

```
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


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
```

```
Secure Port MaxSecureAddr(count) CurrentAddr(count) Security
Action
----------  ------------------  -----------------  -------
Gi0/1       128                 1                  Restrict
Gi0/2       128                 0                  Restrict
Gi0/3       8                    1                  Protect
```

37.4 ARP-CHECK

37.4.1

ARP ARP-CHECK MAC+IP
DHCP Snooping ARP
ARP IP

ARP-CHECK

ARP
arp

ARP

ARP
ARP

ARP

1. ARP IP

2. ARP
ARP

ARP

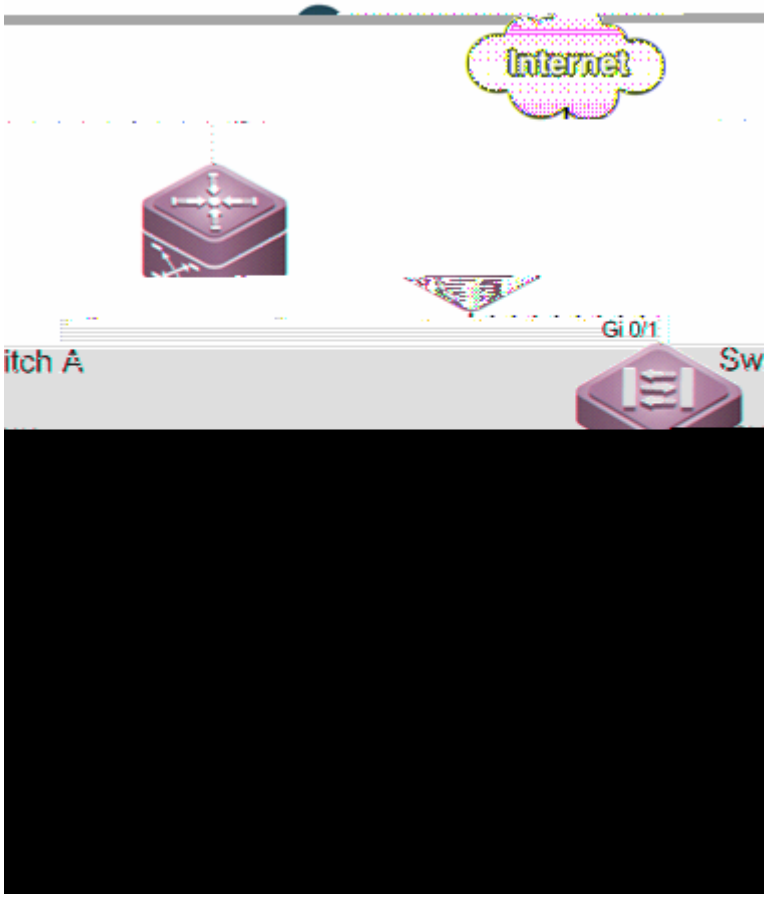
3. MAC+IP ARP Check Cpu CPU
, CPU

~

S3760 CPU ARP ARP

37.5

37.5.1



11

37.5.2

Switch A IP/MAC
IP/MAC IP,/ MAC

Switch B
ARP DOS

37.5.3

,

1. Switch A Switch B

2. Switch A Gi 0/5 Gi 0/9

3. Switch B

，

IP/MAC ARP CHECK

IP/MAC ARP

37.5.4

ü **Switch A**

VLAN

VLAN 2

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#vlan 2
Ruijie(config-vlan)#exit

Ruijie(config)#interface gigabitEthernet 0/5
Ruijie(config-if-GigabitEthernet 0/5)#switchport access vlan 2
Ruijie(config-if-GigabitEthernet 0/5)#exit
Ruijie(config)#interface gigabitEthernet 0/9
Ruijie(config-if-GigabitEthernet 0/9)#switchport access vlan 2
Ruijie(config-if-GigabitEthernet 0/9)#exit
Ruijie(config)#interface gigabitEthernet 0/1
Ruijie(config-if-GigabitEthernet 0/1)#switchport mode trunk
Ruijie(config-if-GigabitEthernet 0/1)#exit
Ruijie(config)#interface gigabitEthernet 0/13
Ruijie(config-if-GigabitEthernet 0/13)#switchport mode trunk
Ruijie(config-if-GigabitEthernet 0/13)#exit

Ruijie(config)#interface range gigabitEthernet 0/1,0/5,0/9,0/13
Ruijie(config-if-range)#storm-control broadcast
Ruijie(config-if-range)#storm-control multicast
Ruijie(config-if-range)#storm-control unicast
Ruijie(config-if-range)#exit
```

IP MAC

IP 1.1.1.1 /MAC 0000.0000.0001

```
Ruijie(config)#interface gigabitEthernet 0/5
Ruijie(config-if-GigabitEthernet 0/5)#switchport port-security
```

```
Ruijie(config-if-GigabitEthernet 0/5)#switchport port-security
mac-address 0000.0000.0001 ip-address 1.1.1.1
Ruijie(config-if-GigabitEthernet 0/5)#exit
```

IP 1.1.1.2 /MAC 0000.0000.0002

```
Ruijie(config)#interface gigabitEthernet 0/9
Ruijie(config-if-GigabitEthernet 0/9)#switchport port-security
Ruijie(config-if-GigabitEthernet 0/9)#switchport port-security
mac-address 0000.0000.0002 ip-address 1.1.1.2
Ruijie(config-if-GigabitEthernet 0/9)#exit
```

ü **Switch B**

VLAN

VLAN 3

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#vlan 3
Ruijie(config-vlan)#exit
Ruijie(config)#interface gigabitEthernet 0/5
Ruijie(config-if-GigabitEthernet 0/5)#switchport access vlan 3
Ruijie(config-if-GigabitEthernet 0/5)#exit
Ruijie(config)#interface gigabitEthernet 0/9
Ruijie(config-if-GigabitEthernet 0/9)#switchport access vlan 3
Ruijie(config-if-GigabitEthernet 0/9)#exit
Ruijie(config)#interface gigabitEthernet 0/1
Ruijie(config-if-GigabitEthernet 0/1)#switchport mode trunk
Ruijie(config-if-GigabitEthernet 0/1)#exit


Ruijie(config)#interface range gigabitEthernet 0/1,0/5,0/9
Ruijie(config-if-range)#storm-control broadcast
Ruijie(config-if-range)#storm-control multicast
Ruijie(config-if-range)#storm-control unicast
Ruijie(config-if-range)#exit


Ruijie(config)#interface gigabitEthernet 0/5
Ruijie(config-if-GigabitEthernet 0/5)#switchport protected
Ruijie(config-if-GigabitEthernet 0/5)#exit
Ruijie(config)#interface gigabitEthernet 0/9
Ruijie(config-if-GigabitEthernet 0/9)#switchport protected
Ruijie(config-if-GigabitEthernet 0/9)#exit
```

37.5.5

Switch A

IP+MAC

```
Ruijie#show running-config
vlan 2
!
interface GigabitEthernet 0/1
 switchport mode trunk
 storm-control broadcast
 storm-control multicast
 storm-control unicast
!
interface GigabitEthernet 0/5
 switchport access vlan 2
 switchport port-security mac-address 0000.0000.0001 ip-address
1.1.1.1
 switchport port-security
 storm-control broadcast
 storm-control multicast
 storm-control unicast
!
interface GigabitEthernet 0/9
 switchport access vlan 2
 switchport port-security mac-address 0000.0000.0002 ip-address
1.1.1.2
 switchport port-security
 storm-control broadcast
 storm-control multicast
 storm-control unicast
!
interface GigabitEthernet 0/13
 switchport mode trunk
 storm-control broadcast
 storm-control multicast
 storm-control unicast
```

Switch B

```
Ruijie#show running-config
vlan 3
!
interface GigabitEthernet 0/1
 switchport mode trunk
 storm-control broadcast
 storm-control multicast
 storm-control unicast
!
interface GigabitEthernet 0/5
```

```
 switchport access vlan 3
 switchport protected
 storm-control broadcast
 storm-control multicast
 storm-control unicast
!
interface GigabitEthernet 0/9
 switchport access vlan 3
 switchport protected
 storm-control broadcast
 storm-control multicast
 storm-control unicast
```

Switch A ARP CHECK

```
Ruijie#show port-security all
Vlan Port  Arp-Check  Mac Address IP Address  Type remaining Age
(mins)
---- -------- ---------- -------------- --------------
2    Gi0/5 Enabled  0000.0000.0001 1.1.1.1   Configured      -
2    Gi0/9 Enabled  0000.0000.0002 1.1.1.2   Configured      -
```

Switch B GigabitEthernet 0/5

```
Ruijie#show interfaces gigabitEthernet 0/5 switchport
Interface   Switchport Mode    Access Native Protected VLAN lists
----------------------- ---------- --------- ------ ------
GigabitEthernet0/5 enabled ACCESS   3   1    Enabled   ALL
```

38 802.1X

AAA 802.1x

，

， 802.1x

， 802.1x

， 802.1x

&

CLI 802.1X

38.1

IEEE 802 LAN

IEEE 802.1x

IEEE802.1x Port-Based Network Access Control
LAN IEEE
IEEE 802 LAN

IEEE 802.1x “ —— ” Client-Server

EAPOL Extensible Authentication Protocol over LAN

802.1x Authentication Authorization and Accounting AAA

， Authentication

- Authorization
- Accounting

802.1x

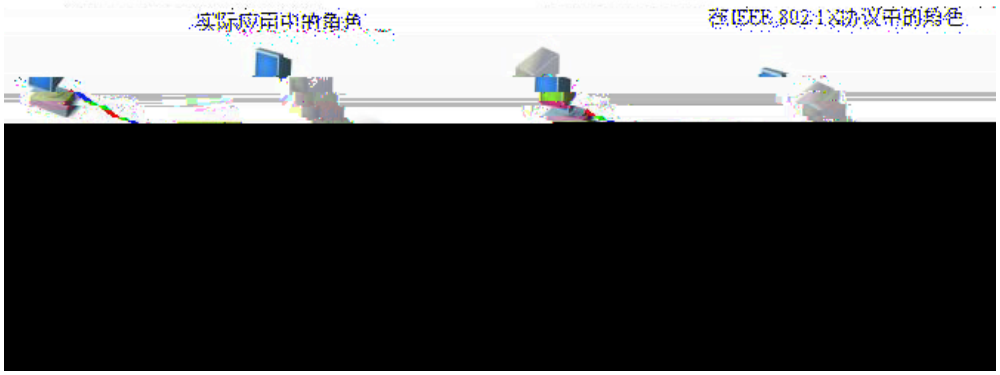
-
-
-
-

38.1.1

IEEE802.1x

Client (network access server NAS)

Radius-Server



1

-

PC

IEEE 802.1x

WindowsXP IEEE802.1x

STAR Supplicant

-

IEEE802.1x RADIUS Client

network access server(NAS)

RADIUS RADIUS Server RADIUS Server À

，

RADIUS

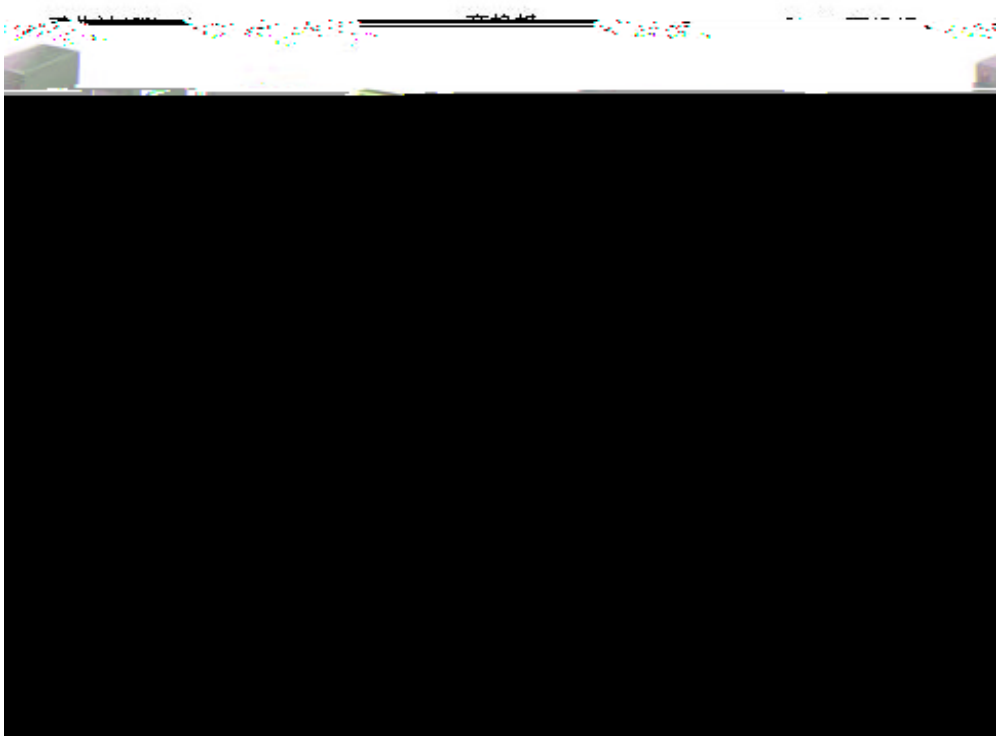
802.1x

Radius Server MicroSoft win2000 Server Radius Server Linux Free Radius Server

38.1.2

EAPOL

RADIUS EAPOL MAC 0x888E MAC 01-80-C2-00-00-03



2

38.1.3

802.1x
802.1X

Authorized
unauthorized
authorized

802.1x

unauthorized

802.1x 802.1x
EAPOL-START EAPOL-START

802.1x

RADIUS Server
(authorized)
RADIUS
server unauthorized

EAPOL-LOGOFF (authorized)
(unauthorized)

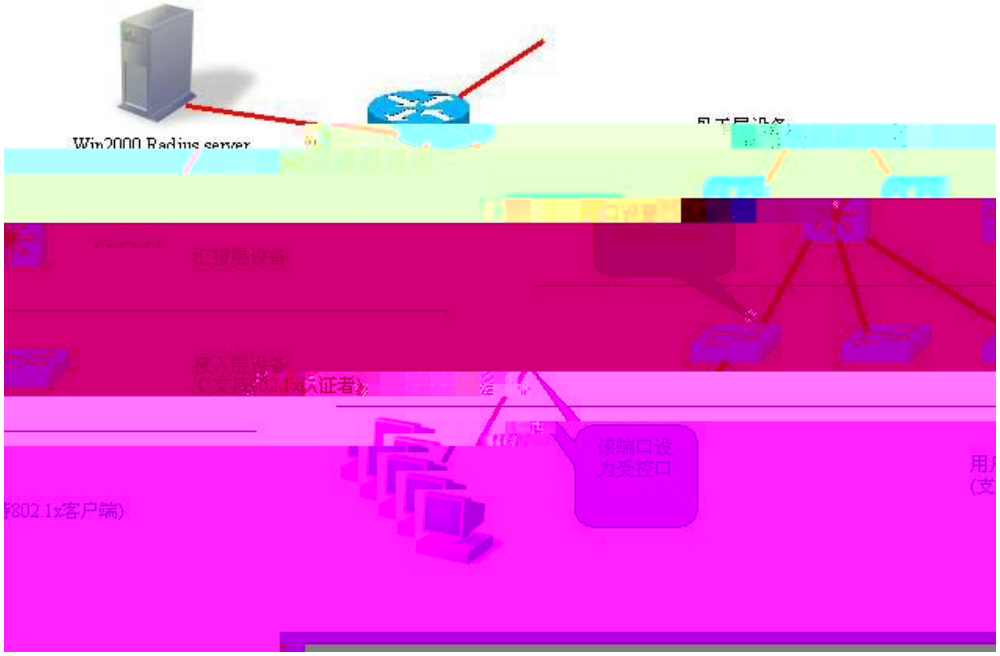
LINK-DOWN
(unauthorized)

(unauthorized)

MAC

38.1.4

A 802.1x



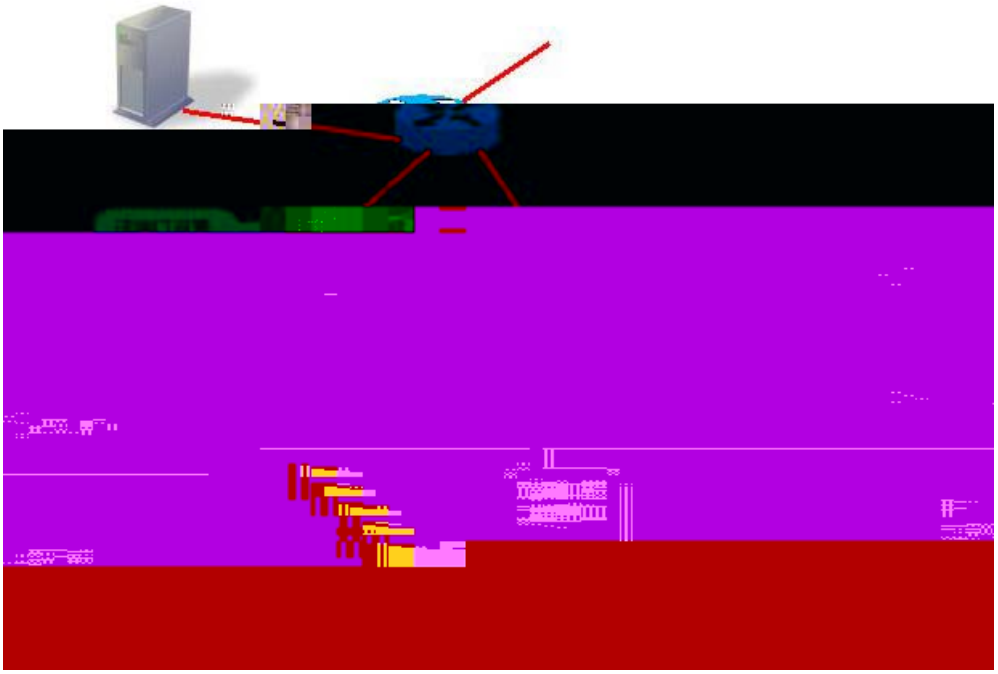
3

，

1. 802.1x 802.1x windowXp Star-supplicant IEEE802.1x
2. IEEE 802.1x
3. RADIUS

，

1. Radius Server



4

،

1. 802.1x 802.1x windowXp

38.2 802.1X

802.1x

- 802.1x
- 802.1x
- RADIUS SERVER
- 802.1X
- /
-
- / supplicant
- QUIET
-
-
-
- Server-timeout
- 802.1x
- 802.1x
- IP
-
-
-
-
-
-
- IP
-
- VLAN
- GUEST VLAN
-
-
- EAPOL TAG
-
-

，
，MAC MAC
，MAC
，MAC MAC
，VLAN
，VLAN VLAN

38.2.1 802.1x

802.1x

Authentication	DISABLE
Accounting	DISABLE
(Radius Server) * IP (ServerIp) * UDP * (Key)	* *1812 *
(Accounting Server) * IP * UDP	* *1813
re-authentication	
reauth_period	3600
	10
	3
	3
	3
	5

38.2.2 802.1X

，802.1x

802.1X

```
Ruijie(config)# radius-server host 192.168.4.12 auth-port 600
Ruijie(config)# radius-server key MsdadShaAdasdj878dajL6g6g
a
Ruijie(config)# end
```

- UDP 1812
- UDP 1813
- Radius Server 16
- Radius Server

38.2.4 802.1X

802.1x

1x

```
!
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 Radius Server IP Radius Server Radius Server Radius Server

38.2.5 /

802.1x

1/1

```
Ruijie# configure terminal
Ruijie(config)# interface f 1/1
Ruijie(config-if)# dot1x port-control auto
Ruijie(config)# end
```

~

S3760 CPU EAP
arp ping
cpu EAP
vlan vlan

38.2.6

802.1x

3600

/

configure terminal	
dot1x re-authentication	
dot1x timeout re-authperiod *seconds*	
End	
Write	
show dot1x	dot1x

no dot1x re-authentication **no dot1x timeout re-authperiod**

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
```

38.2.7 / supplicant

supplicant 802.1x
802.1x (WindowsXP 802.1x
)

supplicant 802.1x
supplicant 802.1x

configure terminal	
dot1x private-supplicant-only	
end	

write

```
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

38.2.8 QUIET

```
Ruijie (config)# dot1x timeout quiet-period 500
Ruijie(config)# end
```

38.2.9

EAP-request/identity

3

end	
write	
show dot1x	dot1x

38.2.13 802.1x

802.1x

EAPOL-START

“ ”

linkdown linkup

802.1x

WindowsXP 802.1x

EAP-request/identity

802.1x

/

configure terminal	
dot1x auto-req	
end	
write	
show dot1x	dot1x

no

configure terminal	
dot1x auto-req packet-num *num*	num 802.1x , num 0 0
end	
write	
show dot1x auto-req	

no

configure terminal	
dot1x auto-req req-interval *interval*	
end	
write	
show dot1x auto-req	

no

(

)

configure terminal	
dot1x auto-req user-detect	
end	
write	
show dot1x auto-req	

no

	1	2	3
supplicant			
	dot1x auto-req	**dot1x auto-req** **dot1x auto-req packet-num** *num* **dot1x auto-req req-interval** *interval* **dot1x auto-req user-detect**	**dot1x auto-req** **dot1x auto-req packet-num** *0* **dot1x auto-req req-interval** *interval* **no dot1x auto-req user-detect**

38.2.14 802.1x

802.1x 802.1x

802.1x

1. Radius Server Radius Client
2. IP
3. UDP
4. 802.1x

configure terminal	
aaa new-model	AAA
aaa group server radius *gs*	
server *192.168.4.12* **acct-port** *11*	
exit	
aaa accounting network *acct* **start-stop group** *gs*	
dot1x accounting *acct*	802.1X
end	
write	
show running-config	

no aaa accounting network **no dot1x accounting** dot1x IP 192.168.4.12 IP 192.168.4.13 UDP 1200 802.1x

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
Ruijie(config)# aaa group server radius acct-use
Ruijie(config-gs-radius)# server 192.168.4.12 acct-port 1200
Ruijie(config-gs-radius)# server 192.168.4.13 acct-port 1200
Ruijie(config-gs-radius)# exit
Ruijie(config)# aaa accounting network acct-list start-stop
group acct-use
Ruijie(config)# dot1x accounting acct-list
Ruijie(config)# end
Ruijie# write memory
Ruijie# show running-config
```

3) 802.1X

4) 802.1x

5) Radius Server

NAS NAS
Radius Server Radius Server
NAS
NAS Radius Server

configure terminal	
aaa new-model	AAA
aaa accounting update	
end	
write	
show running-config	

no aaa accounting update

```
Ruijie# configure terminal
Ruijie(config)# aaa accounting update
Ruijie(config)# end
Ruijie# write memory
Ruijie# show running-config
```

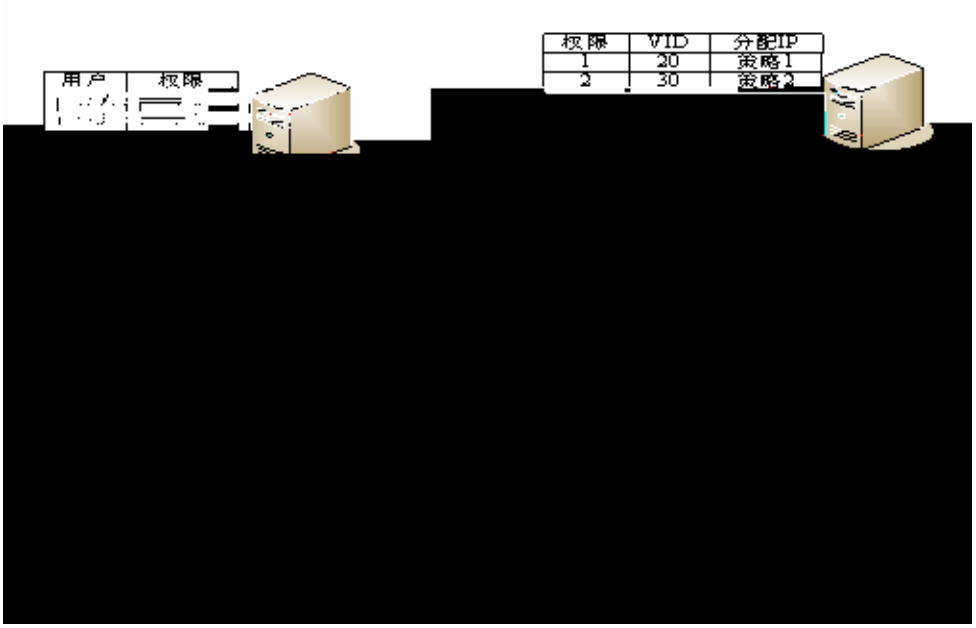
802.1x
IEEE 802.1x

38.2.15 IP

802.1x IP
IP IP IP DISABLE
DHCP SERVER RADIUS SERVER SUPPLICANT

DISABLE IP

DHCP SERVER IP DHCP SERVER
DHCP SERVER IP IP DHCP DHCP
relay option82 802.1X IP



5

DHCP Client IP dhcp relay option82
SAM option82 DHCP option82
“ vid + ” DHCP Server option82

DHCP Relay option82 DHCP relay
option82 DHCP Relay

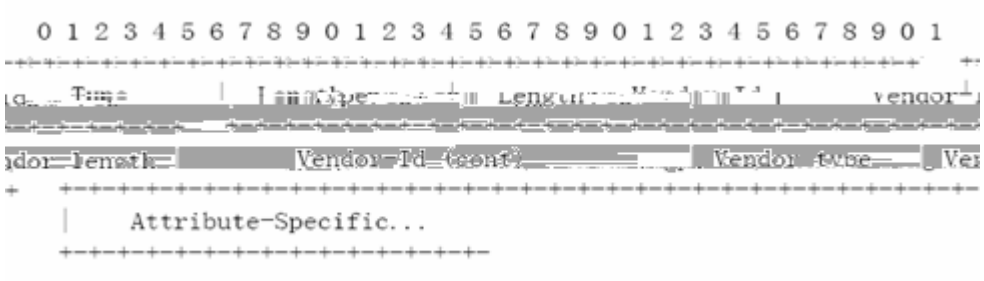
RADIUS SERVER IP RADIUS SERVER
RADIUS SERVER IP

d08 1.1 135(PLICANT)1w [7 TD -0D 0 Tc 0 Tw 7623525>5.7<34b0078001TT4 1 1bca

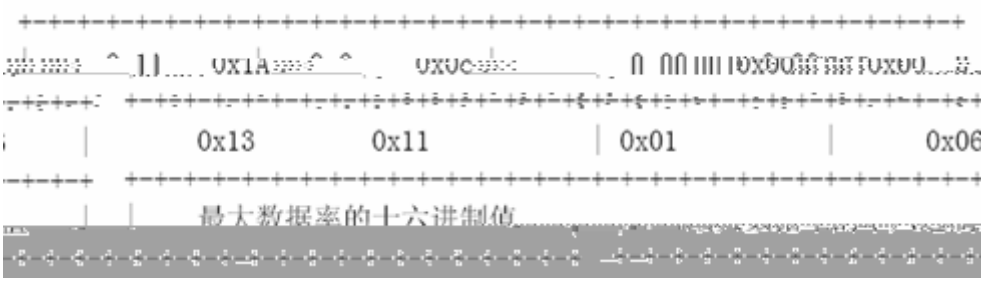
~

IP

configure terminal



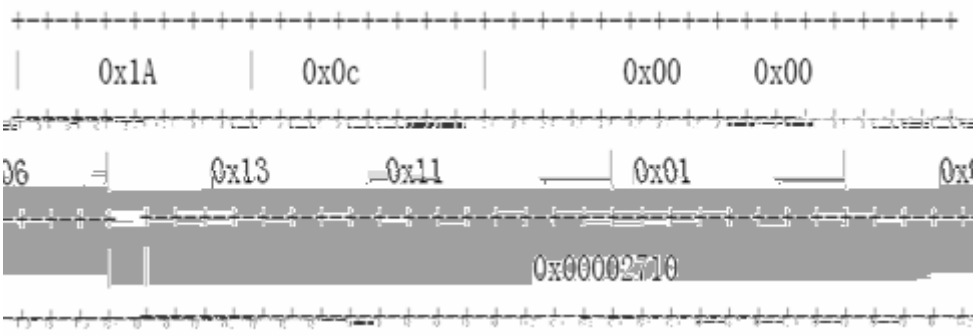
6



7

kbps

10M



8

10M 10000kbsp 16 0x00002710

~

S3760 dscp rate-limit

38.2.20

ACCESS TRUNK 802.1X
VLAN ACCESS TRUNK
VLAN

1 ACCESS VLAN

VLAN VLAN VLAN ID
ID VLAN VLAN VLAN
VLAN

VLAN VLAN
ACCESS VLAN
VLAN ACCESS VLAN
VLAN

ACCESS VLAN

¸ VLAN
¸ Remote VLAN
¸ Super VLAN

2 TRUNK Native VLAN

TRUNK VLAN Native VLAN

VLAN VLAN VLAN ID
Native VLAN VLAN VLAN VLAN

VLAN VLAN TRUNK
VLAN( )
VLAN TRUNK VLAN
Native VLAN VLAN

TRUNK VLAN

¸ VLAN
¸ Remote VLAN
¸ Super VLAN

VLAN

AAA

Step 2	**radius-server host** *host-ip*	RADIUS
Step 3	**radius-server key** *text*	RADIUS

“ RADIUS ”

Step 1	**configure terminal**	
Step 2	**aaa authentication dot1x** *list1* **group radius**	list1
Step 3	**aaa accounting network** *list2* **start-stop group radius**	list2

“ AAA ”

802.1X

Step 1	**configure terminal**	
Step 2	**dot1x authentication** *list1*	list1 list1 3
Step 3	**dot1x accounting** *list2*	list2 list2 3

802.1X

Step 1	**configure terminal**	
Step 2	**interface** *interface_id*	*interface_id*
Step 3	**dot1x port-control auto**	802.1X

VLAN

Step 1	**configure terminal**	
Step 2	**interface** *interface_id*	*interface_id*
Step 3	**dot1x dynamic-vlan enable**	VLAN

~

VLAN

dot1x dynamic-vlan enable VLAN RADIUS

dot1x dynamic-vlan enable **dot1x port-control auto**

no dot1x port-control auto VLAN

vlan private vlan private vlan dot1x vlan

VLAN

VLAN

.

Step 1	**show dot1x user id** *session_id*	*session_id* VLAN
Step 2	**show dot1x summary**	VLAN

VLAN “

802.1X ”

38.2.25 GUEST VLAN

guest vlan

guest vlan

4 Trunk guest vlan vlan
802.1X Access guest vlan

5 guest vlan private vlan private vlan dot1x
guest vlan

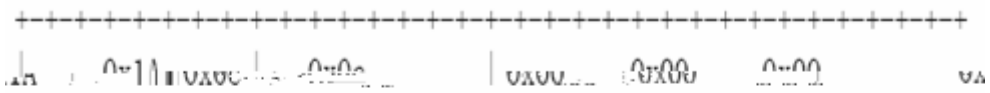
38.2.26

RADIUS

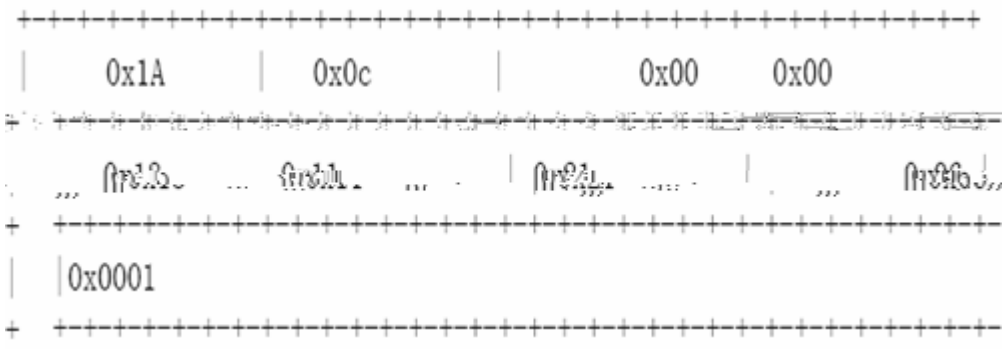
Radius

Vendor Type 0x20 Vendor
Type 0x21

Attribute-Specific
. 0x0000 ,
0x0001



9



10

38.2.27

RADIUS

RADIUS

(

)

)e1>12 0 0 12 5

write	
show dot1x	

38.2.28 EAPOL TAG

IEEE 802.1x EAPOL VLAN TAG

Trunk Port

TAG

802.1x “ ”

EAPOL TAG

configure terminal	
dot1x eapol-tag	EAPOL TAG
end	

write

end	

write

configure terminal	
interface *interface-id*	
dot1x port-control auto	
dot1x port-control-mode port-based single-host	
end	
write	
show dot1x port-control	802.1X
show running-config	

no dot1x port-control-mode

```
Ruijie#configure terminal
Ruijie(config)#interface fastEthernet 0/4
Ruijie(config-if)#dot1x port-control-mode port-based
single-host
```

~

single-host 802.1x show dot1x port-control port-based show running-config dot1x port-control-mode port-based single-host

single-host default-user-limit single-host single-host default-user-limit single-host

configure terminal	

Write	

38.2.31 acl

802.1x acl acl acl
acl acl

acl mac-based
ACL

~

single-host acl
acl acl

mac-based ACL, acl
, acl, acl, acl

acl acl

acl

```
Ruijie#configure terminal
Ruijie(config)# radius vendor-specific extend
```

38.2.32 MAC

GUEST VLAN 802.1X

802.1X
MAC (MAC Authentication Bypass, MAB)

802.1X MAB 802.1x
tx-period*reauth-max
802.1x MAC MAC
MAC

MAB

Step 1	**configure terminal**	

Step 2	**interface** <*interface-id*>	
Step 3	**dot1x mac-auth-bypass**	
Step 4	**end**	
Step 5	**Write**	
Step6	**show running-config**	

MAB

```
Ruijie# configure terminal
Ruijie(config)# interface fa 0/1
Ruijie(config-if)# dot1x port-control auto
Ruijie(config-if)#
```

MAB

Step 1	**configure terminal**	
Step 2	**nterface** <*interface-id*>	
Step 3	**dot1x mac-auth-bypass timeout-activity <value>**	MAB , 1-65535
Step 4	**end**	
Step 5	**Write**	
Step 6	**show running-config**	

MAB

```
Ruijie# configure terminal
Ruijie(config)# interface fa 0/1
Ruijie(config)# dot1x mac-auth-bypass timeout-activity  3600
```

&	Â mac timeout-activity Â guest vlan guest vlan MAB guest vlan

38.2.34 MAC

MAC MAB

MAB

MAC MAB MAB

MAB 1 MAC

MAB

Step 1	**configure terminal**	
Step 2	**nterface** <*interface-id*>	

```
Ruijie# configure terminal
Ruijie(config)# interface fa 0/1
Ruijie(config)# dot1x mac-auth-bypass violation
```

&	Â MAB errdisable recover Â private vlan MAC VLAN , private vlan MAB MAB

38.2.35 VLAN

vlan

vlan

vlan

Step 1	**configure terminal**	
Step 2	**interface** <*interface-id*>	EQ(V3N,ÑÆJQA-ÆGTÀ

Step 1	**configure terminal**	
Step 2	**dot1x auth-fail max-attemp<value>**	vlan 3 , 1-3
Step 3	**end**	
Step 4	**Write**	
Step5	**show running-config**	

VLAN

```
Ruijie# configure terminal
        Ruijie(config)# dot1x auth-fail max-attemp   2
```

38.3 802.1x

802.1X

- Radius
-
-
-
- 1X

38.3.1 Radius

show radius server Radius Server **show aaa user**

```
Ruijie# sh radius server
Server IP:       192.168.5.11
Accounting Port:  1813
Authen  Port:    1812
Server State:    Ready
```

38.3.2

802.1X

1x

show dot1x

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
```

38.3.3

802.1x

38.3.4

show dot1x summary	

```
Ruijie# show dot1x summary
ID    MAC         Interface  VLAN  Auth-State  Backend-State
Port-Status
---- ----------- --------- ----  ----------  ------------
1     00d0f8000001  Gi3/1          1     Authenticated   IDLE
Authed
```

38.3.5 1x

1x

show dot1x probe-timer	1x

1x :

```
Ruijie# show dot1x probe-timer
Hello Interval: 20 Seconds
Hello Alive: 250 Seconds
Ruijie#
```

38.3.6 802.1x

1 1X ACL

IP 802.1x ACL
ACL MAC MAC
MAC ACL MAC
ACL MAC

MAC 00d0.f800.0001 MAC
00d0.f800.0001 ACL ACL
MAC ICMP

2

- switchport mode trunk
- ACCESS Access VLAN
- TRUNK Allowed VLAN Native VLAN

3 VLAN

- VLAN
- VLAN private-vlan primary

4

- VLAN VLAN VLAN
- VLAN VLAN
- VLAN
- VLAN VLAN

5 GVRP VLAN

6 VLAN 802.1X VLAN ACCESS , TRUNK TRUNK VLAN

802.1x IP+MAC

39 AAA

AAA

39.1 AAA

AAA Authentication Authorization and Accounting

AAA

AAA

RADIUS TACACS+
Local

AAA

39.1.1 AAA

AAA

39.1.2

~

1 AAA

AAA R1 R2 RADIUS

R1 R2 PC R1 R1 R1 ACCEPT R1 REJECT

R1 TIMEOUT R2

TIMEOUT

~

REJECT TIMEOUT REJECT

TIMEOUT

TIMEOUT AAA

&

AAA RADIUS

TACACS+ “ TACACS+ ”

39.2 AAA

AAA

39.2.1 AAA

AAA AAA

AAA

1) AAA **aaa new-model**

2) RADIUS

3) **aaa authentication**

4)

~

39.3.1 AAA

AAA

configure terminal	

39.3.4 AAA

AAA

- **aaa new-model** AAA
- RADIUS TACACS+
  “ RADIUS ” “ TACACS+ ”
- **aaa authentication**
-

~

DOT1X TACACS+

39.3.5 AAA Login

AAA Login

~

aaa new-model AAA AAA
“ AAA ”

Telnet (NAS)
NAS

AAA Login
Login **aaa authentication login**
Login

AAA Login

configure	terminal
aaa new-model	AAA
aaa authentication login {**default** | *list-name*} *method1* [*method2*...]	

line vty *line-num*	AAA
login authentication {**default** | *list-name*}	

list-name

method ERROR

FAIL( )

none

RADIUS (TIMEOUT)

aaa authentication login default group radius none ,UHg7]%0

username

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	

39.3.6 AAA Enable

AAA Enable

Telnet (NAS)

CLI CLI

0~15 **show**

privilege “ ”

enable

Enable

AAA Enable

configure terminal	
aaa new-model	AAA
aaa authentication enable default *method1* [*method2*...]	Enable RADIUS

Enable

method ERROR

FAIL( )

none

Enable **enable**

~

CLI Login **none**
Enable
Login

CLI Login Login **none**
Enable
Enable

Enable
Enable

~

RADIUS

39.3.6.1 Enable

Enable
1 Enable

configure terminal	
username *name* [**password** *password*]	
username *name* [**privilege** *level*]	

end	
show running-config	

Enable

configure terminal	
aaa new-model	AAA
aaa authentication enable default local	
end	
show aaa method-list	
show running-config	

39.3.6.2 RADIUS Enable

RADIUS Service-Type 6
1 15 RADIUS SAM
42 0~15 RADIUS
“ RADIUS ” “ RADIUS ”

RADIUS RADIUS RADIUS

39.3.7 PPP AAA

PPP

ISDN NAS

PPP PPP

AAA PPP AAA PPP

configure terminal	
aaa new-model	AAA
aaa authentication ppp {**default** | *list-name*} *method1* [*method2*...]	PPP RADIUS TACACS+

AAA

interface *interface-type interface-number*

dot1x authentication *list-name*	802.1x

IEEE802.1x “ 802.1x ”

39.3.9

“ RADIUS+ ”

```
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
!
!
```

RADIUS IP 192.168.217.64
RADIUS

39.3.10 " א Ŏ

```
login authentication test
line vty 0 4
login authentication test
!
!
```

RADIUS IP 192.168.217.64
RADIUS
tty 1-4 tty vty

39.4

AAA AAA

39.4.1

AAA

Exec

z نۆ نۆ J ل

、 AAA

AAA “ ”

、

Network RADIUS Exec RADIUS

TACACS+ RADIUS “ RADIUS ”

TACACS+ “ TACACS+ ”

、 **username**

39.4.3

AAA

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

39.4.4 AAA Exec

NAS

Exec NAS CLI Telnet

show privilege

Exec **aaa authorization exec**

Exec Exec

AAA Exec

configure terminal	
aaa new-model	AAA
aaa authorization exec {**default** | *list-name*} *method1* [*method2*...]	
line vty *line-num*	AAA Exec

authorization exec {**default** | *list-name*}	

list-name *method*

ERROR

FAIL( )

none

RADIUS (TIMEOUT) Exec

aaa authorization exec default group radius none

local	Exec
none	Exec
group radius	RADIUS Exec
group tacacs+	TACACS+ Exec

AAA Exec

~

Exec Login Login

Exec

Exec Login CLI

39.4.4.1 Exec

Exec

1

configure terminal	
username *name* [**password** *password*]	
username *name* [**privilege** *level*]	

end	
show running-config	

Exec

configure terminal	
aaa new-model	AAA
aaa authorization exec {**default** | *list-name*} **local**	
end	
show aaa method-list	
configure terminal	
line vty *line-num*	
authorization exec {**default** | *list-name*}	
end	
show running-config	

39.4.4.2 RADIUS Exec

RADIUS Exec RADIUS
RADIUS “ RADIUS ”

RADIUS RADIUS

configure terminal	
aaa new-model	AAA
aaa authorization exec {**default** | *list-name*} **group radius**	RADIUS
end	
show aaa method-list	
configure terminal	
line vty *line-num*	
authorization exec {**default** | *list-name*}	
end	

show running-config	

39.4.4.3 Exec

Exec VTY 0~4 Login Exec Login Exec RADIUS RADIUS 192.168.217.64 test ruijie ruijie 6

```
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
```

39.4.5 AAA Network

PPP SLIP Network
Network Network
RADIUS RADIUS

~

802.1X AAA 802.1X
“ 802.1X ”

AAA Network

configure terminal	
aaa new-model	AAA
aaa authorization network {**default** | *list-name*} *method1* [*method2*...]	

list-name *method*
ERROR
FAIL( )
none

39.4.5.1 RADIUS Network

RADIUS Network RADIUS
RADIUS “ RADIUS ”

RADIUS RADIUS

configure terminal	
aaa new-model	AAA
aaa authorization network {**default** |	RADIUS

list-name} **group radius**	

39.4.5.2 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
!
```

39.5

AAA

39.5.1

- Exec
- Command
- Network

Exec NAS CLI
NAS CLI

&

TACACS+ “ TACACS+ ”

39.5.2

AAA

, AAA AAA “ AAA ”

, Network
RADIUS Exec RADIUS TACACS+
Command TACACS+ RADIUS “
RADIUS ” TACACS+ “ TACACS+ ”

, AAA Exec
AAA
“ ”

39.5.3 AAA Exec

Exec NAS CLI
NAS CLI
Start CLI Stop

~

NAS Login Exec
Login none Exec
Start
Stop

AAA Exec

configure terminal	
aaa new-model	AAA
aaa accounting exec {**default** | *list-name*}	

start-stop *method1* [*method2*...] **line vty** *line-num* **accounting exec** {**default** | *list-name*}	AAA Exec

list-name *method*

ERROR

FAIL( )

none

& :

start-stop

39.5.3.1 RADIUS Exec

RADIUS Exec RADIUS

RADIUS “ RADIUS ”

RADIUS RADIUS

configure terminal	
aaa new-model	AAA
aaa accounting exec {**default** | *list-name*} **start-stop group radius**	RADIUS
end	
show aaa method-list	
configure terminal	
line vty line-num	
accounting exec {**default |** *list-name*}	
end	

show running-config

39.5.3.2 Exec

Exec VTY 0~4 Login Exec Login Exec RADIUS RADIUS 192.168.217.64 test ruijie ruijie

```
Ruijie# config
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)# aaa authentication login auth local
Ruijie(config)# aaa accounting exec acct start-stop group
radius
Ruijie(config)# line vty 0 4
Ruijie(config-line)# login authentication auth
Ruijie(config-line)# accounting exec acct
Ruijie(config)# end
Ruijie# show running-config
!
aaa new-model
!
aaa accounting exec acct start-stop group radius
aaa authentication login auth local
!
username ruijie password ruijie
!
radius-server host 192.168.217.64
radius-server key 7 093b100133
!
line con 0
line vty 0 4
 accounting exec acct
 login authentication auth
!
end
```

39.5.4 AAA Network

Network

IP Network RADIUS

& :

RADIUS RADIUS

```
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
```

39.6 AAA

show aaa user { *id* | **all** } AAA

AAA

40 RADIUS

40.1 RADIUS

RADIUS (Remote Authentication Dial-In User Service)
/ AAA
RGOS RADIUS
NAS RADIUS

RADIUS UNIX WINDOWS 2000
.

40.2 RADIUS

RADIUS

¸ AAA AAA “AAA ”

¸ **aaa authentication** RADIUS **aaa authentication** “ ”

¸ “ ”

RADIUS RADIUS

¸ RADIUS

¸ RADIUS

40.2.1 RADIUS

RADIUS RADIUS
RADIUS

configure terminal	
radius-server host *ip-address* [**auth-port** *port*] [**acct-port** *port*]	RADIUS IP
radius-server key *string*	RADIUS
radius-server retransmit *retries*	RADIUS 3
radius-server timeout *seconds* **radius-server deadtime** *minutes*	2 5minutes

~

RADIUS RADIUS Key RADIUS

40.2.2 RADIUS

RADIUS RADIUS RADIUS
RADIUS AAA
aaa authentication
RADIUS AAA

40.2.3 RADIUS

RADIUS Calling-Station-ID
31

40.2.3.1 Calling-Station-ID

RADIUS Calling-Station-ID NAS RADIUS Server
NAS Calling-Station-ID
NAS NAS MAC
MAC

ietf	IETF RFC3580 ‘ - ’ 00-D0-F8-33-22-AC
normal	MAC ‘ . ’ 00d0.f833.22ac
unformatted	00d0f83322ac

```
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)#
```

40.3 RADIUS

RADIUS

debug radius event	RADIUS RADIUS

40.4 RADIUS

RADIUS RADIUS

&

RADIUS Windows 2000/2003 Server IAS UNIX ,

RADIUS

```
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
!
```

41 TACACS+

41.1 TACACS+

TACACS+ TACACS RFC 1492 Terminal Access Controller Access Control System Client-Server TACACS AAA TACACS+ TACACS+

TACACS+

TACACS+

4	8	16	24	32 bit
Major	Minor	Packet type	Sequence no.	Flags
Session ID				
Length				

1

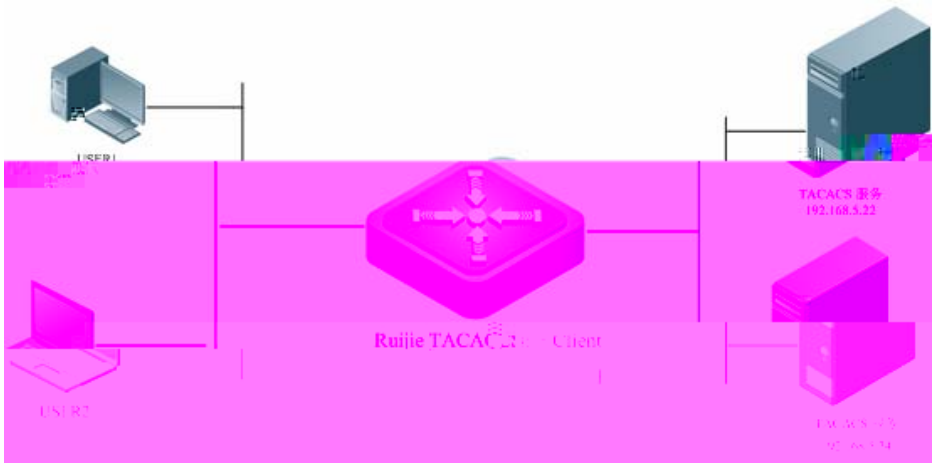
- Major Version — TACACS+
- Minor Version — TACACS+
- Packet Type —
  - TAC_PLUS_AUTHEN = 0x01
  - TAC_PLUS_AUTHOR = 0x02
  - TAC_PLUS_ACCT = 0x03
- Sequence Number — TACACS+ 1 1

41.2 TACACS+

TACACS+ TACACS+

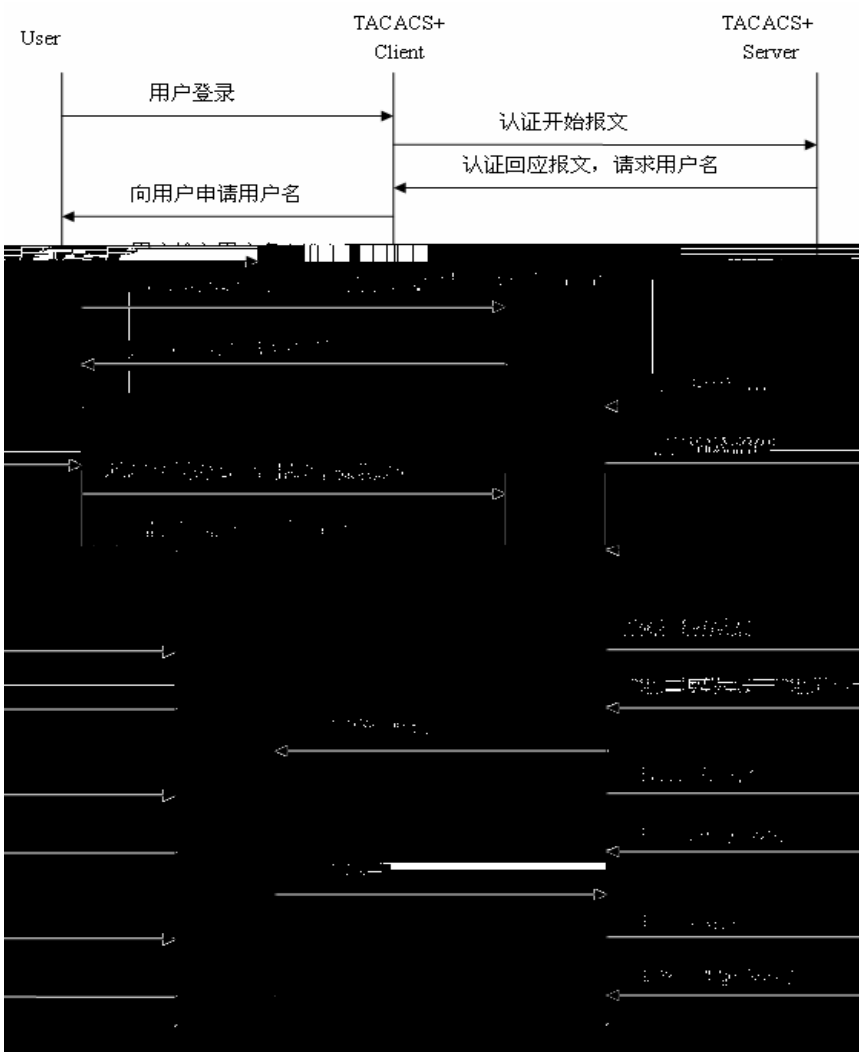
TACACS+

1



2

login TACACS+



3

1.

1

2 TACACS+ TACACS+

3 TACACS+

4 TACACS+

5

6 TACACS+ TACACS+

7 TACACS+

8 TACACS+

9

10 TACACS+ TACACS+

11 TACACS+

2

1 TACACS+ TACACS+

2 TACACS+

3 TACACS+

3

1 TACACS+ TACACS+

2 TACACS+

3

4 TACACS+ TACACS+

5 ACACS+

41.3 TACACS+

TACACS+

- **aaa new-mode** AAA TACACS+ AAA **aaa new-mode** “AAA ”
- **tacacs-server host** tacacs+
- **tacacs-server key** NAS key
- **tacacs-server timeout**
- **aaa authentication** TACACS+ a**aa authentication** “ ”
- **aaa authorization** TACACS+ **aaa authorization** “ ”
- **aaa accounting** TACACS+ **aaa accounting** “ ”

41.3.1 TACACS+

TACACS+ TACACS+ TACACS+

configure terminal	
aaa group server tacacs+ *group-name*	TACACS+ TACACS+
server *ip-address*	TACACS+
ip vrf forwarding *vrf-name*	TACACS+ vrf (VRF)
tacacs-server host *ip-address* [**port** *integer*] [**timeout** *integer*] **key** [**0** | **7**]*string* []	TACACS+ IP 、 *ip-address* 、 **port** *intege* [ ] 49 1 65535 、 **timeout** *integer* [ ] 5s 1 1000s 、 **key** *string* [ ] ip
tacacs-server key [**0** | **7**]*string*	TACACS+ key
tacacs-server timeout *seconds*	5

ip tacacs source-interface *interface* 5 є

41.4.1 Login 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 authentication login test group tacacs+
```

4. :

```
Ruijie(config)# line vty 0 4
Ruijie (config-line)# login authentication test
```

login tacacs+

```
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
login authentication test
line vty 1 4
login authentication test
!
```

41.4.2 ENABLE 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 host 192.168.12.218
```

```
Ruijie(config)# tacacs-server host 192.168.12.217
Ruijie(config)# tacacs-server key aaa
```

3. tacacs+ server group

```
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. tacgroup1

```
Ruijie(config)# aaa authentication enable default group
tacgroup1
```

enable tacacs+

```
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
line vty 1 4
!
```

41.4.3 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 exex test group tacacs+
```

4.

```
Ruijie(config)# line vty 0 4
Ruijie (config-line)#authorization exec test
```

tacacs+

```
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
line vty 1 4
 authorization exec test
!
```

41.4.4 15 Commans 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 accounting commands 15 test
```

```
Ruijie#show running-config
!
aaa new-model
!
!
aaa accounting commands 15 default group tacacs+
!
!
tacacs-server host 192.168.12.219
tacacs-server key aaa
!
line con 0
line vty 0 4
 accounting commands 15 test
```

42 SSH

42.1 SSH

SSH Secure Shell SSH Telnet
Telnet

42.4 SSH

42.4.1 SSH

SSH	
SSH	1 2
SSH	120s
SSH	3

42.4.2

1. SSH
   Telnet
2. (Username) (Password)

42.4.3 SSH Server

SSH Server SSH Server
enable service ssh-server SSH SSH Server ENABLE

configure terminal	
enable service ssh-server	SSH Server
crypto key generate {**rsa**|**dsa**}	

~

[**no**] **crypto key generate** **crypto key zeroize**

42.4.4 SSH Server

SSH Server **no enable service ssh-server**

SSH Server DISABLE

configure terminal	
no enable service ssh-server	SSH Server

42.4.5 SSH server

SSH Server 1 2 SSH

configure terminal	
ip ssh version {**1	2**}	SSH
no ip ssh version	SSH SSHv1 SSHv2

42.4.6 SSH

SSH Server 120 SSH

configure terminal	
ip ssh time-out *time*	SSH 1-120sec
no ip ssh time-out	SSH 120

42.4.7 SSH

SSH
SSH Server 3
SSH

configure terminal	
ip ssh authentication-retries *retry times*	SSH 0-5
no ip ssh authentication-retries	SSH 3

[SSH]

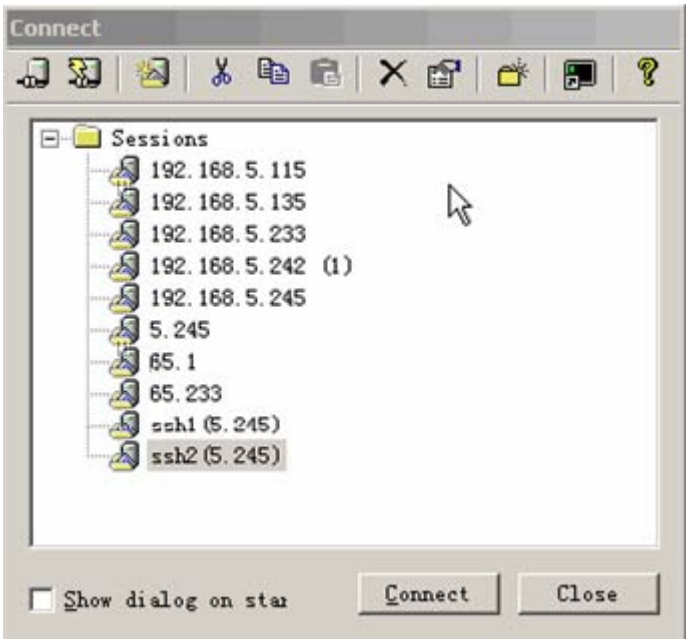
42.5 SSH

SSH SSH Server
Windows Telnet SSH
Putty Linux SecureCRT
SecureCRT SSH

1

1 2 Protocol SSH2 Hostname
IP 192.168.5.245 22 SSH
Username
Authentication
Telnet

OK



2

Connect ẓ ¼ ˚ S

4

Telnet Telnet

5

CPU

Queuing

Queuing

CPU 8 Queuing

，

43.2.1 CPU Protect

CPU

CPU

S3760

BPDU	6
ARP	5
IGMP	3
802.1X	3
GVRP	3
DHCP	2
Error_TTL	0
Unicast	4
Multicast	1
Broadcast	0
error_ttl	0
route	5
route-local	7
route6-local	7
ripv1	7
ipv4-ctrl	7
other	0

	(kbps)
7	1000
6	1000
5	1000
4	1000
3	1000

2	1000
1	1000
0	1000
CPU	3000

43.2.2 CPU Protect

~

S3760 GVRP 802.1X GVRP
802.1X GVRP 802.1X
802.1X GVRP

S3760 CPU 651
kbps 651(kbps)

S3760 SVI CPU ARP 0
ARP

43.2.3

Ruijie(config)# **cpu-protect type** { **bpdu** | **arp** | **igmp** | **dot1x** | **gvrp** | **dhcp** | **unicast** | **multicast** | **broadcast** | **error_ttl** | **other** } **traffic-class** *traffic-class-num*	*traffic-class-num* 0 7

no cpu-protect type { **bpdu** \| **arp** \| **igmp** \| **dot1x** \| **gvrp** \| **dhcp** \| **unicast** \| **multicast** \| **broadcast** \| **error_ttl** \| **other** } **traffic-class**

```
Ruijie(config)#
```

```
%cpu port bandwidth: 2000(kpbs)
```

43.3 CPU Protect

کی

Ruijie# **show cpu-protect traffic-class id** *id_num*	id_num 0 7
Ruijie# **show cpu-protect traffic-class all**	

show cpu-protect traffic-class all

```
Ruijie# show cpu-protect traffic-class all
%*********traffic class     bandwidth(kbps)**********
            0                1000
            1                1000
            2                1000
            3                1000
            4                1000
            5                1000
            6                1000
            7                100000
```

43.3.3 CPU

Ruijie# **show cpu-protect cpu**	CPU

CPU

```
Ruijie# show cpu-protect cpu
%cpu port bandwidth: 100000(kbps)
```

44

44.1

“ ”

CPU

1) IP “ Scan Dest Ip Attack ”

2) IP “ Same Dest Ip Attack ” CPU IP CPU IP CPU CPU

Interface Range

44.2

44.2.1 IP

，

， IP

， IP IP

， IP

， IP

， IP

,

44.2.2

configure terminal	
interface *interface-id*	**interface** **interface**
system-guard enable	
end	
show system-guard	
copy running-config startup-config	

no system-guard

44.2.3 IP

IP

IP

configure terminal	
interface *interface-id*	**interface** **interface**
system-guard isolate-time *seconds*	30 3600 120
end	
show system-guard	
copy running-config startup-config	

no system-guard

isolation-time

LOG

LOG

44.2.5 IP

“

20 ”

configure terminal	
system-guard detect-maxnum *number*	1-500 100
end	
show system-guard	
copy running-config startup-config	

~

IP “ Chip Resource Full ”

U m j ACL

no IP

no **all-eip** IP

ip

```
Ruijie(config)# no system-guard exception-ip all-eip
```

ip

```
Ruijie(config)# no system-guard exception-ip 192.168.5.145/32
```

~

IP IP IP IP

IP CPU **clear system-guard** IP

S3760 IP IP 127.0.0.0

44.2.7 IP

clear system-guard [**interface** *interface-id* [**ip-address** *ip-address*]]	**clear system-guard** **clear system-guard interface** *interface-id* **clear system-guard interface** *interface-id* **ip-address** *ip-address* IP

44.2.8

44.2.8.1

show system-guard

show system-guard [**interface** *interface-id*]	

```
Ruijie# show system-guard
detect-maxnum number   : 100           //
isolated host number   : 11              //
inteface  state   isolate time  same-attack-pkts
scan-attack-pkts
-----------------  --------------------   --------------
Fa 0/1    ENABLE    120             20                 10
Fa 0/2    DISABLE   110             21                 11
……
Ruijie# show system-guard interface Fa 0/1
detect-maxnum number   : 100           //
isolated host number   : 11              //
intefacestate solate time ame-attack-pkts   scan-attack-pkts
-----------------   -----------------   ---------------
Fa 0/1    ENABLE     120         20                 10
```

44.2.8.2 IP

show system-guard isolate-ip [**interface** *interface-id*]	IP IP

```
Ruijie# show system-guard isolated-ip

interface ip-address    isolate reason   remain-time(second)
-----------------   -----------------  -----------------
Fa 0/1    192.168.5.119   scan ip attack     110
Fa 0/1    192.168.5.109   same ip attack     61
```

IP IP

44.2.8.3

show system-guard detect-ip [**interface** *interface-id*]	IP

```
Ruijie# show system-guard detect-ip
interface ip-address ame ip attack packets  scan ip attack
packets
------------------   ------------------  ----------------
Fa 0/1    192.168.5.118        0             8
```

```
Fa 0/1    192.168.5.108        12              2
```

44.2.8.4 IP

IP

show system-guard exception-ip	IP

```
Ruijie# show system-guard exception-ip
Exception IP Address    Exception Mask
--------------------    ---------------
192.168.5.145           255.255.255.0
192.168.4.11             255.255.255.0
```

45 GSN

45.1 GSN

1) RG Security policy Management Platform
2) RG Security Agent
3) RG Restore System
4) RG Security Switch

45.1.1 RG SMP

45.1.2

45.1.3

“ ”

Windows

~

security v3 user , SNMP v3 user

45.2.3

45.3 GSN

45.3.1 smp server

smp sverver

show smp-server	smp server

```
Ruijie# show smp-server
SMP-Server IP:192.168.217.220
```

45.3.2 security event interval

policy-map

1) GSN 1x ip

2) GSN

3) GSN AP AP
GSN AP
AP

45.4.3 GSN

GSN
GSN

IP+MAC IP+MAC MAC
GSN MAC IP+MAC
GSN

ACL ACL GSN GSN
GSN ACL

46 ARP

46.1 DAI

DAI Dynamic ARP Inspection, ARP
ARP arp

46.1.1 ARP

46.2 DAI

DAI **ARP**
ARP

DAI

- VLAN DAI
-
- ARP
- DHCP snooping database

46.2.1 VLAN DAI

VLAN DAI

VLAN vid DAI vlan-id = vid ARP
DAI 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

46.2.2

46.2.3 ARP

SVI

ARP 15 ARP

1 ARP

show ip arp inspection interface

ARP

Ruijie(config-if)# **ip arp inspection limit-rate**{ *<1-2048>* **| none**}	ARP / **none**
Ruijie(config-if)# **no ip arp inspection limit-rate**	

46.2.4 DHCP snooping database

DHCP Snooping

DHCP Snooping database ARP

46.3 DAI

46.3.1 VLAN DAI

VLAN

Ruijie(config)# **show ip arp inspection vlan**	VLAN

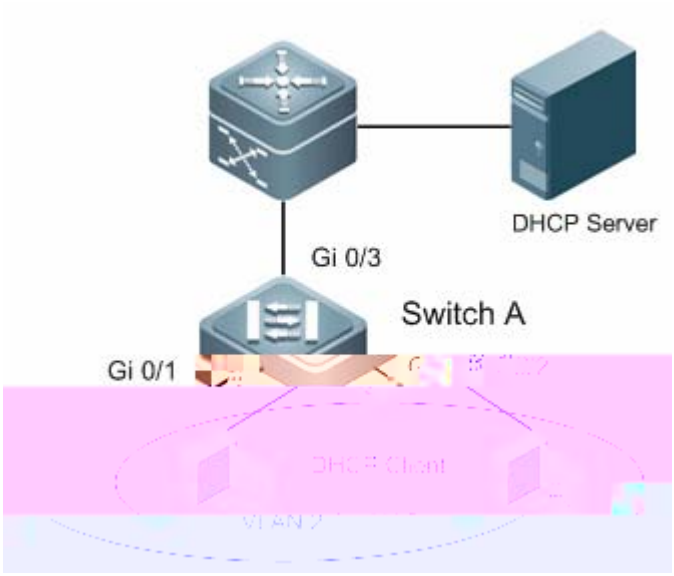
46.3.2 DAI

DAI

Ruijie(config)# **show ip arp inspection interface**	DAI

46.4 DAI

46.4.1.1



12 DHCP

46.4.1.2

PC IP DHCP

1. PC DHCP IP DHCP
2. PC DHCP IP IP

46.4.1.3

、

1. Switch A DHCP Snooping DHCP GigabitEthernet 0/3

2. Switch A DHCP Snooping DAI

，

1 PC DHCP DHCP Snooping

2 Switch A GigabitEthernet 0/3

```
!
interface GigabitEthernet 0/1
 switchport access vlan 2
!
interface GigabitEthernet 0/2
 switchport access vlan 2
!
interface GigabitEthernet 0/3
 switchport mode trunk
 ip dhcp snooping trust
 ip arp inspection trust
```

DHCP SNOOPING

```
Ruijie#show ip dhcp snooping
Switch DHCP snooping  status                    :   ENABLE
DHCP snooping  Verification of hwaddr status    :   DISABLE
DHCP snooping database write-delay time         :   0 seconds
DHCP snooping option 82 status                  :   DISABLE
DHCP snooping Support bootp bind status         :   DISABLE
Interface                    Trusted      Rate limit (pps)
------------------------      -------      ----------------
GigabitEthernet 0/3           YES          unlimited
```

DAI VLAN

```
Ruijie#show ip arp inspection vlan
Vlan    Configuration
----    -------------
2       Enable
Ruijie#show ip arp inspection interface
      Interface        Trust State
---------------------    -----------
GigabitEthernet 0/1     Untrusted
GigabitEthernet 0/2     Untrusted
GigabitEthernet 0/3     Trusted
```

DHCP Snooping **show ip dhcp snooping binding**

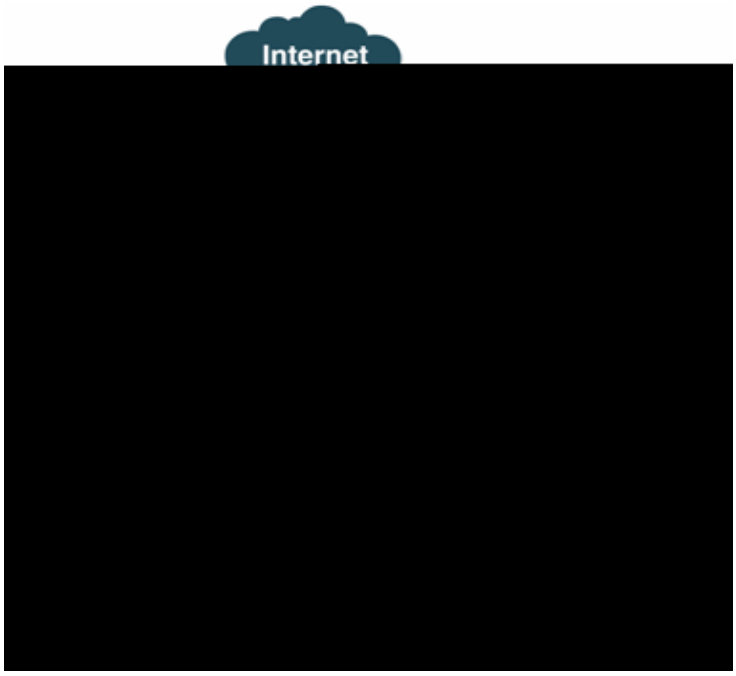
arp arp check ipv6 acl

47.3 arp

arp

Ruijie #**show anti-arp-spoofing**	arp

47.3.1



1

47.3.2

PC Switch A
IP

IP ARP

ü ARP

47.3.3

¸

Switch A PC (Gi 0/3, Gi 0/4)

¸

47.3.4

¸ SwitchA

```
SwitchA# configure terminal
Enter configuration commands, one per line.  End with
CNTL/Z.
SwitchA(config)#interface range gigabitEthernet 0/2-4
SwitchA(config-if-range)# anti-arp-spoofing ip
192.168.1.1
SwitchA(config-if-range)# anti-arp-spoofing ip
192.168.1.254
```

47.3.5

```
SwitchA (config-if)#show running-config
interface GigabitEthernet 0/1
!
interface GigabitEthernet 0/2
 anti-arp-spoofing ip 192.168.1.1
 anti-arp-spoofing ip 192.168.1.254
!
interface GigabitEthernet 0/3
 anti-arp-spoofing ip 192.168.1.1
```

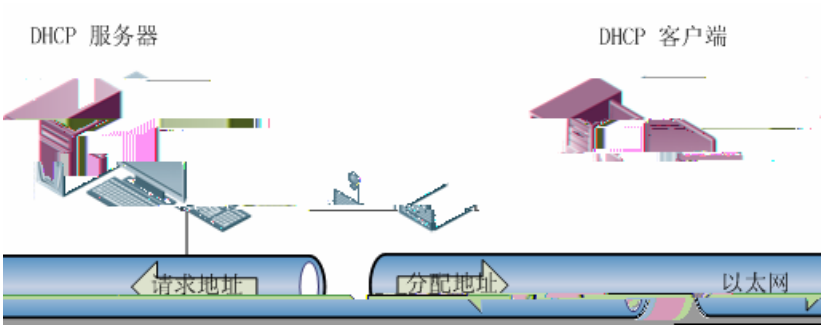
```
 anti-arp-spoofing ip 192.168.1.254
!
interface GigabitEthernet 0/4
 anti-arp-spoofing ip 192.168.1.1
 anti-arp-spoofing ip 192.168.1.254
!


SwitchA#show anti-arp-spoofing
Anti-arp-spoofing
port          ip
-------       -------
Gi 0/2        192.168.1.1
Gi 0/2        192.168.1.254
Gi 0/3        192.168.1.1
Gi 0/3        192.168.1.254
Gi 0/4        192.168.1.1
Gi 0/4        192.168.1.254
```

48 IP Source Guard

48.1 IP Source Guard

48.1.1 DHCP

DHCP DHCP
DHCP DHCP



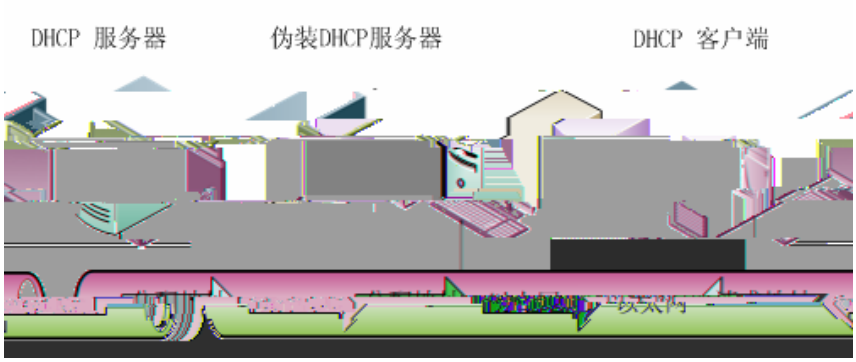
1 DHCP

/

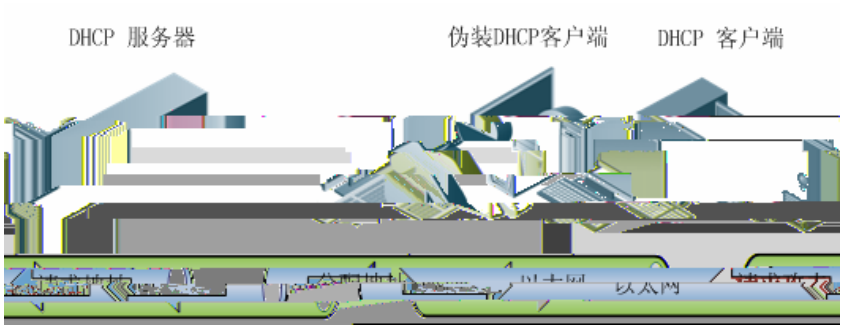
2

3 DHCP

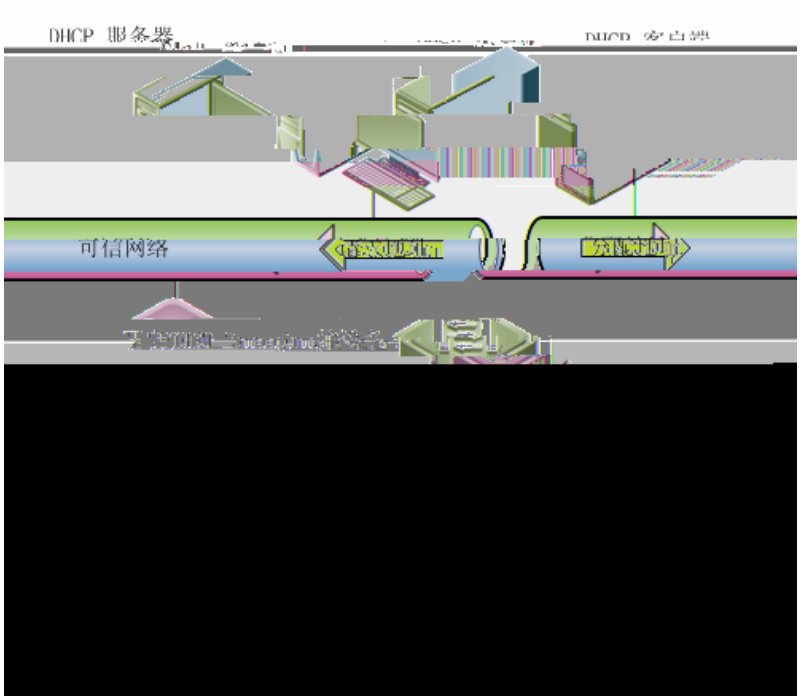
DHCP Snooping DHCP
DHCP Snooping DHCP
DHCP Snooping DHCP



2 DHCP



3 DHCP



4 DHCP Snooping

DHCP Snooping DHCP
IP DHCP IP
DHCP
IP IP Source
Guard IP Source Guard DHCP Snooping DHCP
DHCP IP

48.1.2 IP Source Guard

IP Source Guard IP IP
IP
IP

IP Source Guard DHCP IP
IP DHCP Snooping

IP Source Guard DHCP Snooping IP Source Guard IP IP Source Guard DHCP Snooping IP ó א ¢

48.2.2

IP

Ruijie# **configure terminal**	
Ruijie(config)# [**no**] **ip source binding mac-addrees vlan** *vlan_id ip-address* **interface** *interface-id*	

```
Ruijie# configure terminal
Ruijie(config)# ip source binding 00d0.f801.0101 vlan 1
192.168.4.243 interface FastEthernet 0/9
Ruijie(config)# end
```

48.3 IP Source Guard

48.3.1 IP Source Guard

IP Source Guard

Ruijie# **show ip verify source** [**interface** *interface*]	IP Source Guard

```
Ruijie # show ip verify source

Interface  Filter-type Filter-mode Ip-address  Mac-address

VLAN

-------------------- ----------- ----------- ---------------
FastEthernet    0/1    ip    active     192.168.4.243
00d0.f801.0101 1
```

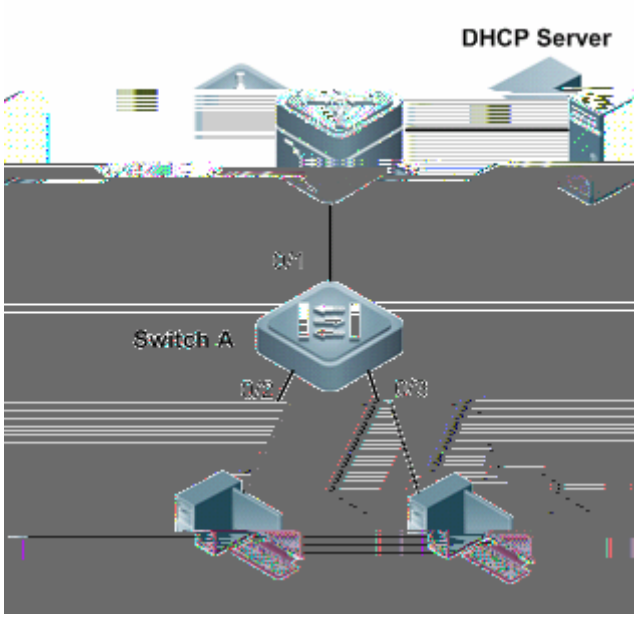
48.3.2 IP

IP

Ruijie# **show ip source binding**
[*ip-address*] [*mac-address*]
[

48.4 IP Source Guard

48.4.1



13 DHCP

48.4.2

1 DHCP IP
IP IP IP

48.4.3

Switch A IP Source Guard DHCP Snooping

1 GigabitEthernet 0/1 DHCP

2 PC GigabitEthernet 0/2 GigabitEthernet 0/3
IP Source Guard

3 IP IP Source Guard
IP 192.168.216.4 MAC 0000.0000.0001

48.4.4

ü **Swtich A**

DHCP Snooping

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

```
MacAddress        IpAddress      Lease(sec)   Type          VLAN
Interface
------------------ --------------- ------------ -------------
0013.2049.9014    192.168.216.4   86233       dhcp-snooping 1
GigabitEthernet 0/3
00e0.4c70.b7e2    192.168.216.3   86228       dhcp-snooping 1
GigabitEthernet 0/2
```

49

49.1

- IP
- IP
- MAC
- MAC
- Expert
- IPV6

49.1.1

ACLs (Access Control Lists) Access Lists ACLs

ACLs QoS ACLs

ACLs

(Conditions)

(Permit) (Deny)

ACLs Qos

ACLs (Access Control Entry ACE)

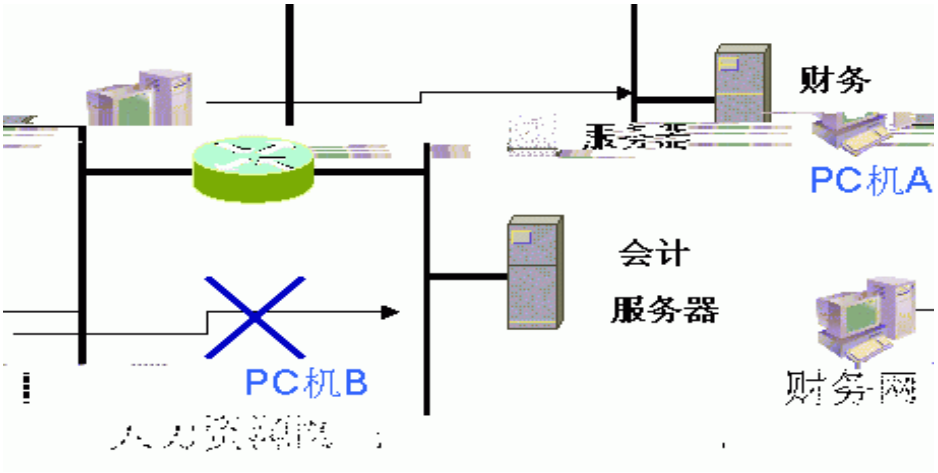
49.1.2

，

WWW TELNET

1 A B

1



1

49.1.3

&

IPSEC

，INTERNET

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49.1.4 / ACL

ACL ACL
ACE ACL
ACL ACE

ACE ACE (Permit Deny) ACL ACE

(Layer 2 Fields)

¸ 48 MAC (48)

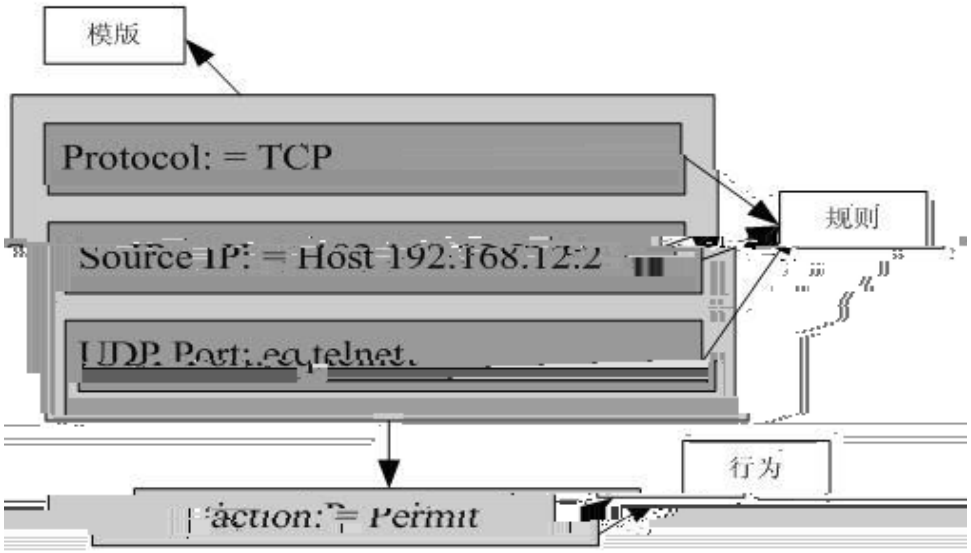
¸ 48 MAC (48)

¸ 16

(Layer 3 Fields) ' Å¥ ÀÐ@Ñ@

z

Fields) ' Æ¢



2 ACE permit tcp host 192.168.12.2 any eq telnet

&

(Layer 3 Field) (Layer 4 Field)
(Layer 2 Field) ACL

Expert Expert ACLs

~

S3760 ACL private vlan SVI community vlan isolate vlan

IP	100-199 2000 - 2699

49.2.1 IP

-
-
-
-

IP 1 - 99 1300 - 1999 IP
IP 100 – 199 2000 - 2699

” “ ” “
”

49.2.1.2

```
access-list 101 deny ip any any
access-list 101 permit tcp 192.168.12.0 0.0.0.255  eq  telnet
any
```

IP 192.168.12.0/24
Telnet

49.2.2 IP

1.

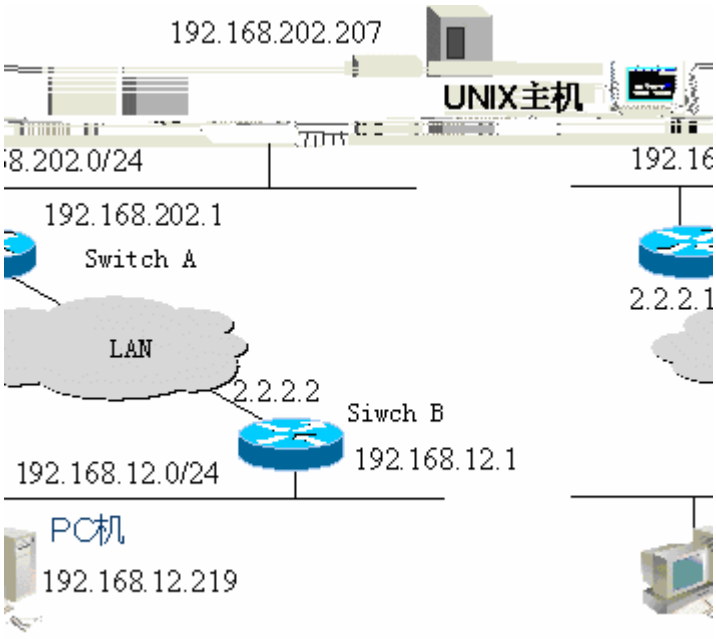
2.

Ruijie(config)# **access-list** *id* {**deny** | **permit**} {src *src-wildcard* | **host** *src* | **any** } [**time-range** *tm-rng-name*]	

Ruijie(config)# **interface** *003 Tm0.0003 Tc[Ruij5.b3e2004b9f0.28 0 LT9f(6.31 0 0 L TD40022 Tc0 Tv*

Ruijie(config)# **ip access-list**
{ **standard** | **extended** } {

4 . 8 7 . 1 - 6 .



3

Switch B

1. 192.168.12.0/24

```
Ruijie(config)# access-list 101 deny ip 2.2.2.0 0.0.0.255 any
Ruijie(config)# access-list 101 deny ip any any
```

Time-Range

```
Ruijie(config)# time-range check
Ruijie(config-time-range)# periodic weekdays 8:30 to 17:30
```

&

101 access-list 101 deny ip any any

Switch A

```
Ruijie(config)# hostname Ruijie
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
```

49.3 MAC

MAC

MAC

MAC	700-799

49.3.1 MAC

MAC

MAC

、 MAC

、 MAC

、

、

MAC 700 -799 MAC

,

MAC

49.3.2 MAC

MAC

1. MAC

2.

MAC

Ruijie(config)# **access-list** *id* {**deny** | **permit**}{**any** | **host** *src-mac-addr*} {**any** | **host** *dst-mac-addr*} [*ethernet-type*] [**cos** *cos*]	,
Ruijie(config)# **interface** *interface*	
Ruijie(config-if)# **mac access-group** *id* **in**	

ACL

Ruijie(config)# **mac access-list extended** {*id* | *name*}	
Ruijie (config-mac-nacl)# [*sn*] { **permit** | **deny** }{**any** | **host** *src-mac-addr*} {**any** | **host** *dst-mac-addr*} [*ethernet-type*] [**cos** *cos*]	ACL ,
Ruijie(config-mac-nacl)# **exit** Ruijie(config)# **interface** *interface*	
Ruijie(config-if)# **mac access-group** {*id* | *name*} **in**	

&

ACL ACL

49.3.3 MAC

Ruijie# **show access-lists** [*id* | *name*]

49.3.4 MAC

MAC

1. IPX 0013.2049.8272 giga 0/1

2.

101,

```
Ruijie> enable
Ruijie# configure terminal
Ruijie(config)# mac access-list                    enable-list  (          e          n
```

Expert	2700-2899

49.4.1 Expert

expert

Expert

， MAC

， VLAN ID

Expert 2700 -2899 MAC VLAN ID

Expert

49.4.2 Expert

Expert

1. Expert

2. ( )

Expert

```
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#
```

49.5 IPv6

49.5.1 IPv6

IPv6

1. IPv6

2. ( )

ACL

Ruijie(config)# **ipv6 access-list** *name*	
Ruijie (config-ipv6-nacl)# [*sn*] {**permit** | **deny** }*prot* {*src-ipv6-prefix/prefix-len* | **host** *src-ipv6-addr* | **any**} {*dst-ipv6-pfix/pfix-len* | **any** | **host** *dst-ipv6-addr*} [**dscp** *dscp*] [**flow-label** *flow-label*] [**fragments**] [**time-range** *tm-rng-name*]	ACL ,
Ruijie(config-exp-nacl)# **exit** Ruijie(config)# **interface** *interface*	
Ruijie(config-if)# **ipv6 traffic-filter** *name* **in**	

MAC IP

TCP Flag

Ruijie(config)# **ip access-list**

```
ip access-lists extended test-tcp-flag
10 permit tcp any any match-all rst
20 deny tcp any any match-all fin
```

49.7 ACL

ACE ACL ACL ACE
-

- ACE
- ACE
- ACE ACE
  ACE
- ACL

ip access-list resequence {*acl-id*| *acl-name*} *sn-start sn-inc*

ACL list ace tst_acl ACL
ace

```
ace1: 10
ace2: 20
ace3: 30
```

ip access-list resequence *tst_acl 100 3*, ACE

```
Ruijie(config)# ip access-list resequence tst_acl 100 3
ace1: 100
ace2: 103
ace3: 106
```

sn-num ace4

```
Ruijie(config-std-nacl)# permit
ace1: 100
ace2: 103
ace3: 106
ace4: 109
```

seq-num = 105 ace5

```
Ruijie(config-std-nacl)# 105 permit
```

4 ace

ACE

```
Ruijie(config-std-nacl)# no 106
ace1: 100
ace2: 103
ace5: 105
ace4: 109
```

ACE

49.8 ACL

ACL ACL

Time-Range

Time-Range

Time-Range

Ruijie# **configure terminal**	
Ruijie(config)# **time-range** *time-range-name*	
Ruijie(config-time-range)# **absolute** [**start time** *date*] **end time** *date*	( ) time range
Ruijie(config-time-range)# **periodic** *day-of-the-week time* **to** [*day-of-the-week*] *time*	( ) 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*	ACE

Time Range

ACL 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
```

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
```

49.9

ACL ACL ACL ACE

&

- ACL 1 ACL 2048 ACE
- 100
- ACE

ACL

Ruijie# **configure terminal**	
Ruijie(config)# **ip access-list standard** *id*	ACL (ACL)
Ruijie(config-std-nacl)# **list-remark** *comment*	ACL

ACL

Ruijie# **configure terminal**	
Ruijie(config)# **access-list** *id* **list-remark** *comment*	ACL (ACL)

ACE

Ruijie# **configure terminal**	
Ruijie(config)# **ip access-list standard** *id*	ACL (ACL)
Ruijie(config-std-nacl)# **remark** *comment*	ACL ACE

ACE

Ruijie# **configure terminal**	
Ruijie(config)# **access-list** *id* **remark** *comment*	ACL ACE (ACL)

ACL ACE

```
Ruijie(config)#ip access-list standard 1
Ruijie(config-std-nacl)#remark ace_remark_permit_62_start
Ruijie(config-std-nacl)#permit 192.168.197.62 0.0.0.0
Ruijie(config-std-nacl)#remark ace_remark_permit_62_end
Ruijie(config-std-nacl)#list-remark acl_remark_foo
Ruijie(config-std-nacl)#end
Ruijie#write
Ruijie#show access-lists 1
ip access-list standard 1
 remark ace_remark_permit_62_start
 10 permit host 192.168.197.62
 remark ace_remark_permit_62_end
list-remark acl_remark_foo
Ruijie#
```

49.10

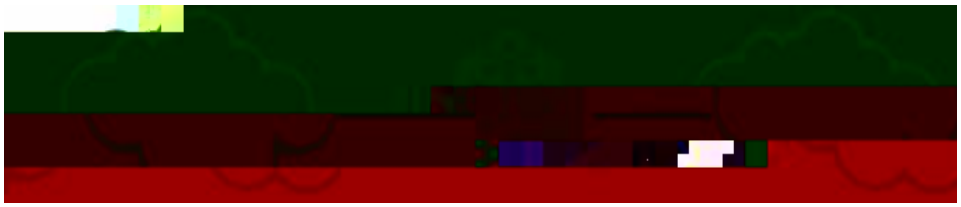
49.10.1 TCP

TCP Flag ACL

49.10.1.1

A A B
TCP B A TCP

49.10.1.2



4

A G3/1
B G3/2

49.10.1.3

B A TCP B
G3/2 TCP TCP
TCP TCP SYN ACK 0
Match-all G3/2
TCP SYN 1 ACK 0
A B

49.10.1.4

1)

#

```
Ruijie# configure terminal
```

ACL101

```
Ruijie(config)#
```

49.10.2 ACL

49.10.2.1

1 ACL

SwitchC PC (trunk)

SwitchB VLAN VLAN (trunk)

SwitchA FTP HTTP Internet

49.10.2.2

ACL

1 Internet

2 PC PC

3 PC PC PC PC

4 9:00~18:00 QQ MSN

49.10.2.3

1. SwitchA Router G2/1
   ACL

2. PC PC
   IP ACL SwitchA
   G2/2 /SVI 2

3. IP ACL
   SwitchB G0/22 G0/23 IP ACL

4. IP ACL QQ/MSN
   SwichB SVI2 IP ACL

49.10.2.4

, **SwitchA**

Virus_Defence

udp/69 tftp IP IP TCP 136 445 593 1025 5554 9995 9996 UDP 136 445 593 1433 1434 UDP/TCP 135 137 138 139 TCP/4444 tftp

```
SwitchA#configure terminal
SwitchA(config)#ip access-list extended Virus_Defence
!                                TCP
SwitchA(config-ext-nacl)#deny tcp any any eq 135
```

```
SwitchA(config-ext-nacl)#deny tcp any eq 135 any
SwitchA(config-ext-nacl)#deny tcp any any eq 136
SwitchA(config-ext-nacl)#deny tcp any eq 136 any
SwitchA(config-ext-nacl)#deny tcp any any eq 137
SwitchA(config-ext-nacl)#deny tcp any eq 137 any
……!
SwitchA(config-ext-nacl)#deny tcp any any eq 9996
SwitchA(config-ext-nacl)#deny tcp any eq 9996 any

! UDP
SwitchA(config-ext-nacl)#deny udp any any eq 69
SwitchA(config-ext-nacl)#deny udp any eq 69 any
SwitchA(config-ext-nacl)#deny udp any any eq 135
SwitchA(config-ext-nacl)#deny udp any eq 135 any
SwitchA(config-ext-nacl)#deny udp any any eq 137
SwitchA(config-ext-nacl)#deny udp any eq 137 any
……!
SwitchA(config-ext-nacl)#deny udp any any eq 1434
SwitchA(config-ext-nacl)#deny udp any eq 1434 any

! ICMP
SwitchA(config-ext-nacl)#deny icmp any any

! ip
SwitchA(config-ext-nacl)#permit ip any any

SwitchA(config-ext-nacl)#exit
```

Virus_Defence **Router**

```
SwitchA(config)#interface gigabitEthernet 2/1
SwitchA(config-if)#no switchport
SwitchA(config-if)#ip address 192.168.5.1 255.255.255.0

! ACL Virus_Defence G2/1
SwitchA(config-if)#ip access-group Virus_Defence in

SwitchA(config-if)#exit
```

PC ***access_server***

```
SwitchA(config)#ip access-list extended access_server

! IP PC (IP 192.168.4.100)
SwitchA(config-ext-nacl)#permit ip 192.168.2.0 0.0.0.255 host
192.168.4.100
SwitchA(config-ext-nacl)#permit ip 192.168.1.0 0.0.0.255 host
192.168.4.100
SwitchA(config-ext-nacl)#permit ip 192.168.3.0 0.0.0.255 host
192.168.4.100
SwitchA(config-ext-nacl)#deny ip any any
```

```
SwitchA(config)#interface gigabitEthernet 2/2
SwitchA(config-if)#switch mode trunk

!
SwitchA(config-if)#ip access-group access_server in
SwitchA(config-if)#exit

!     vlan
SwitchA(config)#vlan 2
SwitchA(config-vlan)#exit
SwitchA(config)#interface gigabitEthernet 2/48

!               G2/48     vlan2
SwitchA(config-if)#switch access vlan 2
SwitchA(config-if)#exit


SwitchA(config)#interface vlan 2
SwitchA(config-if-VLAN 2)# ip access-group access_server in
SwitchA(config-if-VLAN    2)#    ip    address    192.168.4.2
255.255.255.0
SwitchA(config-ext-nacl)#end
```

、 **SwitcB**

vlan2-4

```
SwitchB#configure terminal

!     vlan2-4
SwitchB(config)#vlan range 2-4
SwitchB(config-vlan-range)#exit


!     IP     ACL  vlan_access1   vlan_access2
SwitchB(config)#ip access-list extended vlan_access1
!
SwitchB(config-ext-nacl)#deny   ip   192.168.2.0   0.0.0.255
192.168.1.0 0.0.0.255
SwitchB(config-ext-nacl)#deny   ip   192.168.3.0   0.0.0.255
192.168.1.0 0.0.0.255
SwitchB(config-ext-nacl)#permit ip any any
SwitchB(config)#ip access-list extended vlan_access2
!
SwitchB(config-ext-nacl)#deny   ip   192.168.1.0   0.0.0.255
192.168.2.0 0.0.0.255
SwitchB(config-ext-nacl)#deny   ip   192.168.3.0   0.0.0.255
```

```
192.168.2.0 0.0.0.255
SwitchB(config-ext-nacl)#permit ip any any
SwitchB(config-ext-nacl)#exit
```

(vlan_access1 vlan_access2)

```
!     G0/22     trunk          vlan_access1
SwitchB(config)#interface GigabitEthernet 0/22
SwitchB(config-if)#switchport mode trunk
SwitchB(config-if)#ip access-group vlan_access1 in

!     G0/23     trunk          vlan_access2
SwitchB(config)# interface GigabitEthernet 0/23
SwitchB(config-if)# switchport mode trunk
SwitchB(config-if)# ip access-group vlan_access2 in

!     G0/24    trunk
SwitchB(config)#interface GigabitEthernet 0/24
SwitchB(config-if)#switchport mode trunk

!     SVI2   IP
SwitchB(config)#interface vlan 2
SwitchB(config-if)#ip address 192.168.1.100 255.255.255.0

!     SVI3   IP
SwitchB(config)#interface vlan 3
SwitchB(config-if)#ip address 192.168.2.100 255.255.255.0

!     SVI4   IP
SwitchB(config)#interface vlan 4
SwitchB(config-if)#ip address 192.168.4.1 255.255.255.0


!               9  00~18  00
SwitchB#configure terminal
SwitchB(config)#time-range worktime
SwitchB(config-time-range)#periodic weekdays 9:00 to 18:00


SwitchB#configure terminal

!                          ACL yanfa
SwitchB(config)#ip access-list extended
```

```
SwitchB(config-ext-nacl)#deny tcp 192.168.1.0 0.0.0.255 eq 443
any time-range worktime
SwitchB(config-ext-nacl)#deny tcp 192.168.1.0 0.0.0.255 eq
1863 any time-range worktime
SwitchB(config-ext-nacl)#deny tcp 192.168.1.0 0.0.0.255 eq
4000 any time-range worktime
SwitchB(config-ext-nacl)#deny udp 192.168.1.0 0.0.0.255 eq
8000 any time-range worktime
SwitchB(config-ext-nacl)#deny udp 192.168.1.0 0.0.0.255 eq
1429 any time-range worktime
SwitchB(config-ext-nacl)#deny udp 192.168.1.0 0.0.0.255 eq
6000 any time-range worktime
SwitchB(config-ext-nacl)#deny udp 192.168.1.0 0.0.0.255 eq
6001 any time-range worktime
SwitchB(config-ext-nacl)#deny udp 192.168.1.0 0.0.0.255 eq
6002 any time-range worktime
SwitchB(config-ext-nacl)#deny udp 192.168.1.0 0.0.0.255 eq
6003 any time-range worktime
SwitchB(config-ext-nacl)#deny udp 192.168.1.0 0.0.0.255 eq
6004 any time-range worktime

!        IP
SwitchB(config-ext-nacl)#permit ip any any

!            SVI2
SwitchB(config)#interface vlan 2
SwitchB(config-if)#ip access-group yanfa in
```

49.10.2.5

ACE

```
SwitchA#show access-lists

ip access-list extended Virus_Defence
 10 deny tcp any any eq 135
 20 deny tcp any eq 135 any
 30 deny tcp any eq 4444 any
 40 deny tcp any any eq 5554
 50 deny tcp any eq 5554 any
 60 deny tcp any any eq 9995
 70 deny tcp any eq 9995 any
 80 deny tcp any any eq 9996
 90 deny tcp any eq 9996 any
 100 deny udp any any eq tftp
 110 deny udp any eq tftp any
```

```
 120 deny udp any any eq 135
 130 deny udp any eq 135 any
 140 deny udp any any eq netbios-ns
 150 deny udp any eq netbios-ns any
 160 deny udp any any eq netbios-dgm
 170 deny udp any eq netbios-dgm any
 180 deny udp any any eq netbios-ss
 190 deny udp any eq netbios-ss any
 200 deny udp any any eq 445
 210 deny udp any eq 445 any
 220 deny udp any any eq 593
 230 deny udp any eq 593 any
 240 deny udp any any eq 1433
 250 deny udp any eq 1433 any
 260 deny udp any any eq 1434
 270 deny udp any eq 1434 any
 280 deny tcp any any eq 136
 290 deny tcp any eq 136 any
 300 deny tcp any any eq 137
 310 deny tcp any eq 137 any
 320 deny tcp any any eq 138
 330 deny tcp any eq 138 any
 340 deny tcp any any eq 139
 350 deny tcp any eq 139 any
 360 deny tcp any any eq 445
 370 deny tcp any eq 445 any
 380 deny tcp any any eq 593
 390 deny tcp any eq 593 any
 400 deny tcp any eq 1025 any
 410 deny tcp any any eq 4444
 420 deny icmp any any
 430 permit tcp any any
 440 permit udp any any
 450 permit ip any any

ip access-list extended access_server
 10 permit ip 192.168.2.0 0.0.0.255 host 192.168.4.100
 20 permit ip 192.168.1.0 0.0.0.255 host 192.168.4.100
 30 permit ip 192.168.3.0 0.0.0.255 host 192.168.4.100
 40 deny ip any any

SwitchB#show access-lists 20 permit ip 192.16
```

```
ip access-list extended vlan_access2
 10 deny ip 192.168.1.0 0.0.0.255 192.168.2.0 0.0.0.255
 20 deny ip 192.168.3.0 0.0.0.255 192.168.2.0 0.0.0.255
 30 permit ip any any

ip access-list extended yanfa
 10 deny tcp 192.168.1.0 0.0.0.255 eq 8000 any time-range
worktime (active)
 20 deny tcp 192.168.1.0 0.0.0.255 eq 8001 any time-range
worktime (active)
 30 deny tcp 192.168.1.0 0.0.0.255 eq 443 any time-range
worktime (active)
 40 deny tcp 192.168.1.0 0.0.0.255 eq 1863 any time-range
worktime (active)
 50 deny tcp 192.168.1.0 0.0.0.255 eq 4000 any time-range
worktime (active)
 60 deny udp 192.168.1.0 0.0.0.255 eq 8000 any time-range
worktime (active)
 70 deny udp 192.168.1.0 0.0.0.255 eq 1429 any time-range
worktime (active)
 80 deny udp 192.168.1.0 0.0.0.255 eq 6000 any time-range
worktime (active)
 90 deny udp 192.168.1.0 0.0.0.255 eq 6001 any time-range
worktime (active)
 100 deny udp 192.168.1.0 0.0.0.255 eq 6002 any time-range
worktime (active)
 110 deny udp 192.168.1.0 0.0.0.255 eq 6003 any time-range
worktime (active)
 120 deny udp 192.168.1.0 0.0.0.255 eq 6004 any time-range
worktime (active)
```

ACL ACL

SwitchA

```
SwitchA#show run
interface GigabitEthernet 2/1
 no switchport
 no ip proxy-arp
 ip access-group Virus_Defence in
 ip address 192.168.5.1 255.255.255.0
!
interface GigabitEthernet 2/2
 switchport mode trunk
 ip access-group access_server in
```

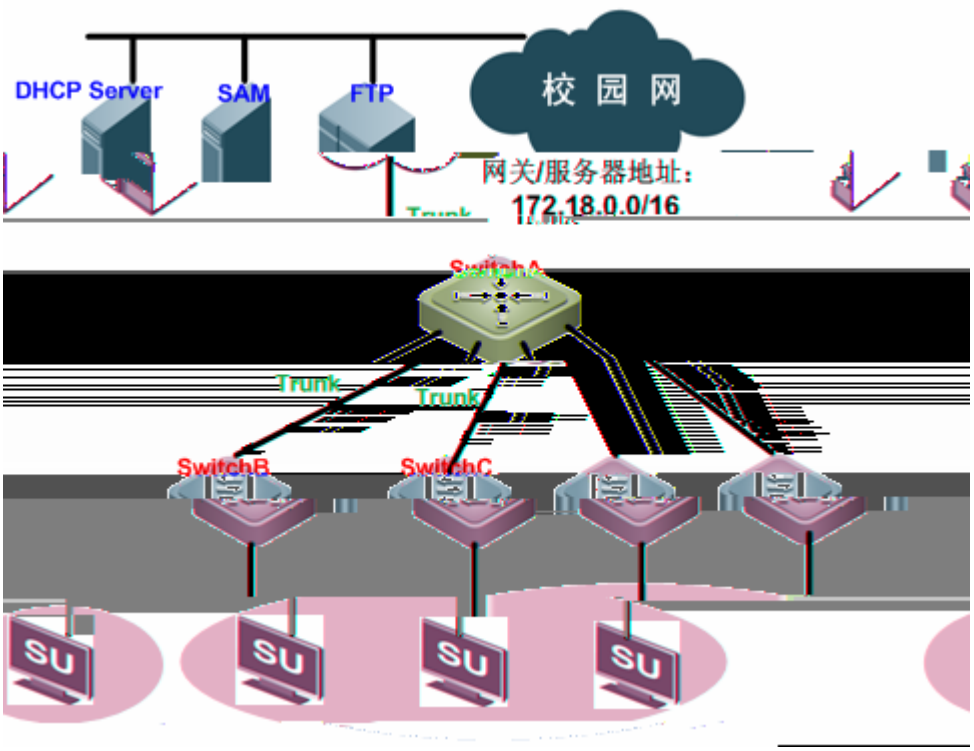
```
!
interface VLAN 2
 no ip proxy-arp
 ip access-group access_server in
 ip address 192.168.4.2 255.255.255.0
```

SwitchB

```
SwitchB#show run
!
interface GigabitEthernet 0/22
 switchport mode trunk
 ip access-group vlan_access1 in
!
interface GigabitEthernet 0/23
 switchport mode trunk
 ip access-group vlan_access2 in
!
interface VLAN 2
 no ip proxy-arp
 ip access-group yanfa in
 ip address 192.168.1.100 255.255.255.0
```

49.10.3 ACL&ACL80

49.10.3.1



2 ACL&ACL80

SwitchA VLAN VLAN
(trunk)

SwitchB SwitchC PC (trunk)

PC SU 802.1x

49.10.3.2

SU windows PC SU
PC 802.1x

1) / 172.18.0.0/16 IP ARP
PC
2) DHCP (UDP 67/68) PC IP

49.10.3.3

SwitchB/SwitchC ACL80 ACL

SwitchB ACL80 SwitchC ACL

49.10.3.4

、 **SwitchB**

	80 64
	bit
	1 0

```
SwitchB#configure terminal
!       tongdao
SwitchB(config)#expert access-list advanced tongdao
!       IP ARP        IP          40   172.18.0.0          ac12
         ARP    (      0806         24)
SwitchB(config-exp-dacl)#permit 0806 ffff 24 ac12 ffff 40
!       IP  IP        IP          38   172.18.0.0          ac12
         IP    (      0800         24)
SwitchB(config-exp-dacl)#permit 0800 ffff 24 ac12 ffff 38
!      UDP         67  Bootstrap Protocol Server   68  Bootstrap
Protocol Client    DHCP                    35          11
  UDP              46          43/44            67  68
SwitchB(config-exp-dacl)# permit 11 ff 35 00440043 ffffffff 46
SwitchB(config-exp-dacl)#exit
```

ACL

```
!               ACL tongdao
SwitchB(config)# security global access-group tongdao
```

、 **SwitchC**

```
SwitchC#configure terminal
!                   tongdao1
```

```
SwitchC(config)#expert access-list extended tongdao1
```

```
!       IP    172.18.0.0          IP
SwitchC(config-exp-dacl)#permit ip 172.18.0.0 0.0.255.255 any
any any
```

```
!     udp        67 Bootstrap Protocol Server   68 Bootstrap Protocol
Client
SwitchC(config-exp-dacl)# permit udp any any eq bootpc any any
eq bootps
SwitchC(config-exp-dacl)#exit
```

ACL

```
!                ACL tongdao1
SwitchC(config)# security global access-group tongdao1
```

49.10.3.5

ACE

```
SwitchB# show access-lists
expert access-list advanced tongdao
 10 permit 0806 FFFF 24 AC12 FFFF 40
 20 permit 0800 FFFF 24 AC12 FFFF 38
 30 permit 11 FF 35 00440043 FFFFFFFF 46
```

```
SwitchC# show access-lists
expert access-list extended tongdao1
 10 permit ip 172.18.0.0 0.0.255.255 any any any
 20 permit udp any any eq bootpc any any eq bootps
```

ACE

ACL ACL

```
SwitchB#show run
```

```
expert access-list advanced tongdao
!
security global access-group tongdao
!
SwitchC#show run
```

```
!
expert access-list advanced tongdao1
!
security global access-group tongdao1
!
```

50 QOS

50.1 QOS

Internet Internet

“ ”

QOS

QOS Quality of Service

QOS QOS

QOS

50.1.1 QoS

QoS

QoS

QoS

QoS IETF Internet Engineering Task Force DiffServ Differentiated Servece Mode DiffServ IP DiffServ IPv4 TOS Type Of Service Ipv6 Traffic Class 6

¸ 802.1Q Tag Control Information 3 8 User Priority bits

¸ IPv4 TOS IPv6 Traffic Class 3 IPprecedence value IPv4 TOS IPv6 Traffic Class 6 Differentiated Services Code Point (DSCP) value

DiffServ

DiffServ B [

&

3 2 1 ACLs

2 1 QoS

50.1.2.3 Marking

Marking Classifying Policing
DSCP Marking
QoS QoS ACLs QoS Trust
QoS Trust DSCP IP
DSCP

50.1.2.4 Queueing

Queueing

8 DSCP-to-CoS Map
Cos-to-Queue Map DSCP

50.1.2.5 Scheduling

Scheduling QoS
WRR 8
WRR
, DRR
,

50.1.3 buffer

802.3x flow-control
flow-control
QoS HOL

buffer
802.3xflow-control
QoS HOL

flow-control

QoS

Pause

QoS buffer
802.3xflow-control QoS buffer QoS
QOS

1000m
100m QOS
100m
FC
QoS QoS QoS
flow-control
Police (QoS) buffer
QOS
flow-control

50.1.4

&

1. 8

Â S3760-48

2. Buffer Qos

3. AP

4.

50.1.5 QOS

QOS AP

Policy-map QOS

Policy-map

~

Aggregate Port

128

50.2 QOS

CoS	0
	8
	WRR
QueueWeight	1:1:1:1:1:1:1:1
WRR Weight Range	1:15
DRR 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	32555	C16	u56.42	516.74	

```
Ruijie# show mls qos interface g0/4
Interface: GigabitEthernet 0/4
Attached input  policy-map:
Default COS: trust dscp
Default COS: 0
Ruijie#
```

50.2.3 CoS

CoS

CoS 0

configure terminal	
interface *interface*	
mls qos cos default-cos	CoS , default-cos CoS , 0 7
no mls qos cos	CoS

Interface g0/4 CoS 6

```
Ruijie# configure terminal
Ruijie(config)# interface g 0/4
Ruijie(config-if)# mls qos cos 6
Ruijie(config-if)# end
Ruijie# show mls qos interface g 0/4
Interface: GigabitEthernet 0/4
Attached input  policy-map:
Default COS: trust dscp
Default COS: 6
Ruijie#
```

50.2.4

Ruijie(config-if)#
[no] **virtual-group** *virtual-group-number*
virtual-group-number

no virtual-group *virtual-group-number*

0/1 5

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

50.2.5 Class Maps

Class Maps

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* |*.4457 T3[(ist1.0022 Tc0 Tw(Tj/TT19 1 Tf0.6114 d6(andard)TJ/TT4*	

50.2.6 Policy Maps

Policy Maps

configure terminal	
[**no**] **policy-map** *policy-map-name*	policymap policy-map-name policymap no policy map
[**no**] **class** *class-map-name*	class-map-name class map no
[**no**]**set ip dscp** *new-dscp*	IP ip dscp IP new-dscp DSCP
police *rate-bps burst-byte* [**exceed-action** {**drop** | **dscp** *dscp-value*}] **no police**	rate-bps (kbps) burst-byte (Kbyte) drop dscp dscp-value DSCP dscp-value

&

S3760 Police Policy Maps police Policy Maps police Policy Maps Policy Maps Class

S3760 DSCP S3760

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
```

50.2.7 Policy Maps

Policy Maps

configure terminal	
interface *interface*	
[**no**] **service-policy** {**input** | **output**} **policy-map-name**	Policy Map policy-map-name policy map input ,output

50.2.8 Policy Maps

Policy Maps

configure terminal	
virtual-group *virtual-group-number*	
[**no**] **service-policy** {**input** | **output**} **policy-map-name**	Policy Map policy-map-name policy map input ,output

&

50.2.10

configure terminal	
{**wrr-queue** | **drr-queue**} **bandwidth** **weight1...weightn**	weight1...weightn QOS
no {**wrr-queue** | **drr-queue**} **bandwidth**	no

wrr 1:2:3:4:5:6:7:8

```
Ruijie# configure terminal
Ruijie(config)# wrr-queue bandwidth 1 2 3 4 5 6 7 8
Ruijie(config)# end
Ruijie# show mls qos queueing
```

QOS

DSCP 0 32 56 6

```
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
```

50.2.14

configure terminal	
interface *interface*	
rate-limit output bps *burst-size*	output bps (kbps) burst-size (Kbyte)
no rate-limit	

```
Ruijie# configure terminal
Ruijie(config)# interface gigabitEthernet 0/4
Ruijie(config-if)# rate-limit output 64 1024
Ruijie(config-if)# end
Ruijie#
```

50.2.15 IPpre to DSCP Map

IPpre-to-Dscp IPpre DSCP , IPpre-to-DSCP Map QOS , IPpre-to-Dscp Map :

configure terminal	
mls qos map ip-precedence-dscp *dscp1...dscp8*	IP-Precedence-to-Dscp Map ,dscp1...dscp8 IP-Precedence 0 7 DSCP
no mls qos map ip-prec-dscp	

```
Ruijie# configure terminal
Ruijie(config)# mls qos map ip-precedence-dscp 56 48 46 40 34
32 26 24
Ruijie(config)# end
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
```

50.2.16 buffer

buffer 802.3x flow-control QoS

configure terminal	
buffer management { **fc** | **qos** }	buffer FC 802.3xflow-control QoS QoS
no buffer management	

50.3 QOS

50.3.1 class-map

class-map

show class-map [*class-name*]	class map

```
Ruijie# show class-map
Class Map cc
Match access-group 1
Ruijie#
```

50.3.2 policy-map

Policy-map

show policy-map [*policy-name* [**class** *class-name*]]	QoS policy map policy-name policy map class class-name policy map class map

```
Ruijie# show policy-map
Policy Map pp
Class cc
Ruijie#
```

50.3.3 mls qos interface

qos

show mls qos interface [*interface* | *policers*]	QoS , Policers Policy map

```
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#
```

50.3.4 mls qos virtual-group

qos

show mls qos virtual-group [*virtual-group-number* | **policers**]	police Policers police

```
Ruijie# show mls qos virtual-group 1
Virtual-group: 1
Attached input  policy-map: pp
Ruijie# show mls qos virtual-group policers
Virtual-group: 1
Attached input  policy-map: pp
Ruijie#
```

50.3.5 mls qos queueing

qos

show mls qos queueing	QoS , CoS-to-queue map wrr weight drr weight;

```
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
```

50.3.6 mls qos scheduler

QOS

show mls qos scheduler	

```
Ruijie# show mls qos scheduler
Global Multi-Layer Switching scheduling
Strict Priority
Ruijie#
```

50.3.7 mls qos maps

mls qos maps

show mls qos maps [**cos-dscp** |**dscp-cos**|**ip-prec-dscp**]	**dscp-cos maps** **dscp-cos maps** **ip-prec-dscp maps**

```
Ruijie# show mls qos maps cos-dscp
cos dscp
--- ----
0   0
1   8
2   16
3   24
4   32
5   40
6   48
7   56

Ruijie# 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

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
```

50.3.8 mls qos rate-limit

show mls qos rate-limit [**interface** *interface*]	[ ]

```
Ruijie# show mls qos rate-limit
Interface: GigabitEthernet 0/4
rate limit input bps = 100 burst = 100
```

50.3.9 show policy-map interface

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
```

&

mark count

50.3.10 buffer

buffer

show buffer management nput (tc4	

50.3.11

show buffer management qos queue	

```
Ruijie#show buffer management qos queue

Interface             Status  Queue

-------------------------------------

FastEthernet    0/1   Auto   8

FastEthernet    0/2   Admin  8

....

GigabitEthernet 0/52  Auto   8
```

50.3.12 virtual-group

virtual-group

show virtual-group [*virtual-group-number* | **summary**]	

```
Ruijie#show virtual-group 1
  virtual-group       member
  -------------       -------------------------
  1                   Gi0/2 Gi0/3 Gi0/4 Gi0/5
                      Gi0/6 Gi0/7 Gi0/8 Gi0/9 Gi0/10
Ruijie#show virtual-group summary
  virtual-group       member
  -------------       -------------------------
  1                   Gi0/1 Gi0/2 Gi0/3 Gi0/4
                      Gi0/5 Gi0/6 Gi0/7 Gi0/8 Gi0/9
  2                   Gi0/11 Gi0/12 Gi0/13 Gi0/14
              Gi0/15 Gi0/16 Gi0/17 Gi0/18 Gi0/19
```

50.4 QOS

50.4.1

50.4.1.1

```
#
Ruijie(config-std-nacl)#exit
#       salaryclass    class map       class-map
Ruijie(config)#class-map salaryclass
#
Ruijie(config-cmap)#match access-group salary_acl
#
Ruijie(config-cmap)#exit
#       salarypolicy             policy-map
Ruijie(config)#policy-map salarypolicy
#                        salaryclass
Ruijie(config-pmap)#class salaryclass
#                                        512Kbps                32
Kbyte
Ruijie(config-pmap-c)#police 512 32  exceed-action drop
#      class-map
Ruijie(config-pmap-c)#exit
#
Ruijie(config-pmap)#exit
#    G0/2
Ruijie(config)#interface gigabitEthernet 0/2
#   salarypolicy           G0/2
Ruijie(config-if)#service-policy input salarypolicy
#
Ruijie(config-if)#end
#            show
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
   Match access-group salary_acl

Ruijie#show access-lists salary_acl
ip access-list standard salary_acl
 10 permit host 192.168.217.223
```

51 VRRP

51.1

VRRP (Virtual Router Redundancy Protocol)

VRRP

VRRP

VRRP

RFC 2338

1 VRRP

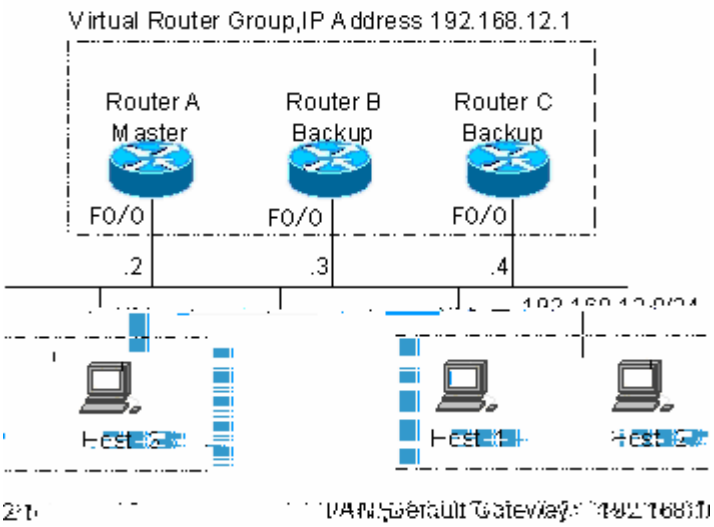
VRRP
1 1 R1 R2
Fa0/0 192.168.12.0/24 R1 R2 Fa0/0
VRRP VRRP IP
VRRP
VRRP
PC 1 PC 2 PC 1
PC 2 VRRP
PC 2 PC 1
R1
R2 VRRP R1 R2

51.2 VRRP

VRRP

51.2.1

VRRP 2



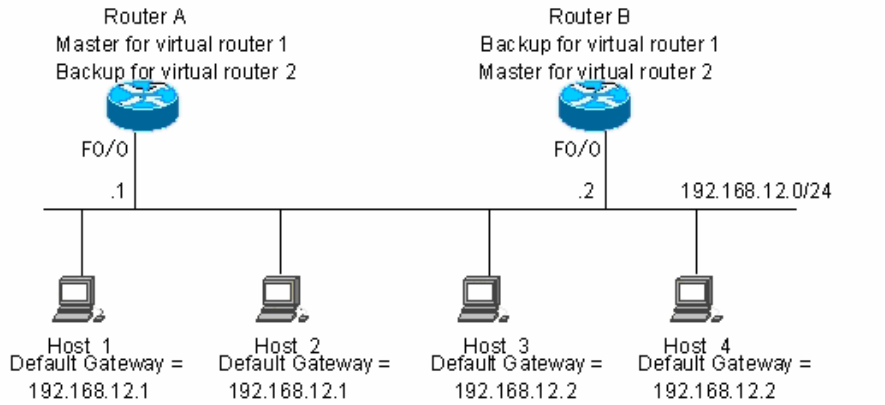
2 VRRP

2 A B C
Ů VRRP VRRP VRRP
IP 192.168.12.1 A VRRP
B C 1 2 3 IP
192.168.12.1
(2-2 A) A

B C

51.2.2

VRRP 3



3 VRRP

3 1 A
Fa0/0 IP 192.168.12.1 IP A
B 2
B Fa0/0 IP 192.168.12.2 IP
B A
1 2 1 IP 192.168.12.1
3 4 2 IP 192.168.12.2
VRRP A B

51.3 VRRP

51.3.1 VRRP

VRRP VRRP

- VRRP ( )
- VRRP ( )
- VRRP ( )
- VRRP ( )
- VRRP ( )
- VRRP ( )

- VRRP IP ( )
- VRRP ( )
- VRRP ( )
- VRRP ( )

VRRP

51.3.2 VRRP

IP
VRRP

Ruijie(config-if)# **vrrp** *group* **ip** *ipaddress* [**secondary**]	VRRP
Ruijie(config-if)# **no vrrp** *group* **ip** *ipaddress* [**secondary**]	VRRP

Group 1~255 IP
VRRP Secondary IP
IP

&

VRRP IP (Primary Secondary) IP
(Primary Secondary) VRRP (Own)
IP VRRP 255
VRRP Master

NMX-2GEH 14 VRRP VRRP
14

51.3.3 VRRP

VRRP VRRP
VRRP VRRP
VRRP

/ VRRP

Ruijie(config-if)# **vrrp** *group* **authentication** *string*	VRRP
Ruijie(config-if)# **no vrrp** *group* **authentication**	VRRP

VRRP
8

51.3.4 VRRP

Ruijie(config-if)# **vrrp** *group* **timers advertise** *interval*	VRRP
Ruijie(config-if)# **no vrrp** *group* **timers advertise**	VRRP

VRRP VRRP
VRRP
VRRP 1

&

VRRP VRRP
VRRP VRRP

51.3.5 VRRP

VRRP Master
VRRP VRRP
Master
VRRP VRRP IP
VRRP VRRP

Ruijie(config-if)# **vrrp** *group* **preempt** [	

Ruijie(config-if)# **no vrrp** group **preempt** [**delay**]	VRRP

&

(Routed Port SVI Loopback Tunnel)

51.3.8 VRRP IP

VRRP IP

IP ping

VRRP

VRRP ( )

interval

timeout

Ruijie(config-if)# **vrrp** *group* **track** *ip-address* [[[**interval** *interval-value*] **timeout** *timeout-value*] *priority*]	VRRP IP
Ruijie(config-if)# **no vrrp** *group* **track** *ip-address*	VRRP

VRRP interval-value

1~3600

&

VRRP VRRP

VRRP

VRRP VRRP VRRP

VRRP

VRRP

```
State is Master
Virtual IP address is 192.168.201.2 configured
Virtual MAC address is 0000.5e00.0102
Advertisement interval is 3 sec
Preemption is enabled
min delay is 0 sec
Priority is 120
Master Router is 192.168.201.217 (local), priority is 120
Master Advertisement interval is 3 sec
Master Down interval is 9 sec
```

VRRP

VRRP IP MAC Master IP Master Master Master VRRP

2. **show vrrp brief**

```
Ruijie# show vrrp brief
Interface      Grp Pri Time Own Pre State   Master addr     Group addr
FastEthernet0/0 1  100  -    -    P  Backup 192.168.201.213 192.168.201.1
FastEthernet0/0 2  120  -    -   P  Master  192.168.201.217 192.168.201.2
```

VRRP IP Master IP

3. **show vrrp interface**

```
Ruijie# show vrrp interface FastEthernet 0/0
FastEthernet 0/0 - Group 1
State is Backup
Virtual IP address is 192.168.201.1 configured
Virtual MAC address is 0000.5e00.0101
Advertisement interval is 3 sec
Preemption is enabled
min delay is 0 sec
Priority is 100
Master Router is 192.168.201.213 , pritority is 120
Master Advertisement interval is 3 sec
Master Down interval is 9 sec
FastEthernet 0/0 - Group 2
State is Master
Virtual IP address is 192.168.201.2 configured
Virtual MAC address is 0000.5e00.0102
Advertisement interval is 3 sec
Preemption is enabled
```

```
min delay is 0 sec
Priority is 120
Master Router is 192.168.201.217 (local), priority is 120
Master Advertisement interval is 3 sec
Master Down interval is 9 sec
Ruijie#
```

VRRP

VRRP IP MAC Master IP Master Master Master VRRP

```
VRRP: Grp 1 Advertisement from 192.168.201.213 has invalid
virtual address 192.168.1.1
%VRRP-6-STATECHANGE: FastEthernet 0/0 Grp 1 state Backup ->
Master
Ruijie#
```

debug vrrp debug vrrp errors debug vrrp events
debug vrrp packets debug vrrp state

2. **debug vrrp errors**

```
Ruijie# debug vrrp errors
Ruijie#
VRRP: Grp 1 Advertisement from 192.168.201.213 has invalid
virtual address 192.168.1.1
VRRP: Grp 1 Advertisement from 192.168.201.213 has invalid
virtual address 192.168.1.1
VRRP: Grp 1 Advertisement from 192.168.201.213 has invalid
virtual address 192.168.1.1
```

192.168.201.213 VRRP 1 VRRP
IP 192.168.1.1 VRRP 1

3. **debug vrrp events**

```
Ruijie# debug vrrp events
Ruijie#
VRRP: Grp 1 Event - Advert higher or equal priority
VRRP: Grp 1 Event - Advert higher or equal priority
VRRP: Grp 1 Event - Advert higher or equal priority
Ruijie#
```

VRRP VRRP (Advertisement)

4. **debug vrrp packets**

```
Ruijie# debug vrrp packets
Ruijie#
VRRP: Grp 2 sending Advertisement checksum DD4D
VRRP: Grp 2 sending Advertisement checksum DD4D
VRRP: Grp 2 sending Advertisement checksum DD4D
```

VRRP 2 VRRP VRRP
0XDD4D

```
Ruijie# debug vrrp packets
Ruijie#
VRRP: Grp 1 Advertisement priority 120, ipaddr 192.168.201.213
VRRP: Grp 1 Advertisement priority 120, ipaddr 192.168.201.213
VRRP: Grp 1 Advertisement priority 120, ipaddr 192.168.201.213
```

192.168.201.213 VRRP 1 VRRP 120

5. **debug vrrp state**

```
Ruijie# debug vrrp state
VRRP State debugging is on
Ruijie#
%VRRP-6-STATECHANGE: FastEthernet 0/0 Grp 2 state Master ->
Backup
%VRRP-6-STATECHANGE: FastEthernet 0/0 Grp 2 state Backup ->
Master
Ruijie# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface fastethernet 0/0
Ruijie(config-if)# no shutdown
Ruijie(config-if)# end
Ruijie#
%VRRP-6-STATECHANGE: FastEthernet 0/0 Grp 2 state Master ->
Init
Ruijie#
```

Fastethernet 0/0 VRRP Master 120

R3 R3

```
!
!
hostname "R3"
!
!
!
interface FastEthernet 0/0
no switchport
ip address 192.168.12.217 255.255.255.0
!
interface GigabitEthernet 1/1
no switchport
ip address 60.154.101.5 255.255.255.0
!
interface GigabitEthernet 2/1
no switchport
ip address 202.101.90.61 255.255.255.0
!
router ospf
network 202.101.90.0 0.0.0.255 area 10
network 192.168.12.0 0.0.0.255 area 10
network 60.154.101.0 0.0.0.255 area 10
!
!
!
end
```

51.5.1 VRRP

4 (192.168.201.0/24)
R1 R2
IP 192.168.201.1 192.168.201.1
(192.168.12.0 /24) R1 VRRP Master
R1 (192.168.201.)
R1 VR3 ‵Ω R1 + b B

```
!
interface FastEthernet 0/0
no switchport
ip address 192.168.201.217 255.255.255.0
vrrp 1 priority 120
vrrp 1 timers advertise 3
vrrp 1 ip 192.168.201.1
!
interface GigabitEthernet 2/1
no switchport
ip address 202.101.90.63 255.255.255.0
!
router ospf
network 202.101.90.0 0.0.0.255 area 10
network 192.168.201.0 0.0.0.255 area 10
!
```

R2

```
!
hostname "R2"
!
interface FastEthernet 0/0
no switchport
ip address 192.168.201.213 255.255.255.0
vrrp 1 ip 192.168.201.1
vrrp 1 timers advertise 3
!
interface GigabitEthernet 1/1
no switchport
ip address 60.154.101.3 255.255.255.0
!
!
router ospf
network 60.154.101.0 0.0.0.255 area 10
network 192.168.201.0 0.0.0.255 area 10
!
!
end
```

R1 R2 VRRP 1

IP (192.168.201.1) VRRP R1

VRRP 120 R2 VRRP 100

R1 VRRP Master

51.5.2 VRRP

4 (192.168.201.0/24)
R1 R2
IP 192.168.201.1 192.168.201.1
(192.168.12.0/24) R1 VRRP Master
R1 VRRP
GigabitEthernet 2/1 R1
(192.168.201.1) R1
R2 (
192.168.201.1) R1
GigabitEthernet 2/1 R1 VRRP
R2
(192.168.201.1) R1 GigabitEthernet
2/1 R1 VRRP
R1 R2

R1

```
!
!
hostname "R1"
!
!
interface FastEthernet 0/0
no switchport
ip address 192.168.201.217 255.255.255.0
vrrp 1 priority 120
vrrp 1 timers advertise 3
vrrp 1 ip 192.168.201.1
vrrp 1 track GigabitEthernet 2/1 30
!

interface GigabitEthernet 2/1
no switchport
ip address 202.101.90.63 255.255.255.0
!
router ospf
network 202.101.90.0 0.0.0.255 area 10
network 192.168.201.0 0.0.0.255 area 10
!
!
end
```

R2

```
!
```

```
!
hostname "R2"
!
interface FastEthernet 0/0
no switchport
ip address 192.168.201.213 255.255.255.0
vrrp 1 ip 192.168.201.1
vrrp 1 timers advertise 3
!
interface GigabitEthernet 1/1
no switchport
ip address 60.154.101.3 255.255.255.0
!
router ospf
network 60.154.101.0 0.0.0.255 area 10
network 192.168.201.0 0.0.0.255 area 10
!
!
end
```

R1 R2 VRRP 1 VRRP ( ) IP (192.168.201.1) VRRP R2 R2 VRRP (Advertisement) 3 R1 VRRP 120 R2 VRRP 100 R1 Master R1 Master GigabitEthernet 2/1 R1 VRRP 30 90 R2 Master R1 GigabitEthernet 2/1 VRRP 30 120 R1

51.5.3 VRRP

VRRP

4 (192.168.201.0/24) R1 R2 (A) 1 IP 192.168.201.1 (C) 2 IP 192.168.201.2 R1 2 1 R2 2 1 R1 R2

R1

```
!
!
hostname "R1"
!
interface FastEthernet 0/0
no switchport
ip address 192.168.201.217 255.255.255.0
vrrp 1 timers advertise 3
vrrp 1 ip 192.168.201.1
vrrp 2 priority 120
vrrp 2 timers advertise 3
vrrp 2 ip 192.168.201.2
vrrp 2 track GigabitEthernet 2/1 30
!
interface GigabitEthernet 2/1
no switchport
ip address 202.101.90.63 255.255.255.0
!
router ospf
network 202.101.90.0 0.0.0.255 area 10
network 192.168.201.0 0.0.0.255 area 10
!
!
end
```

R2

```
!
!
hostname "R2"
!
!
interface Loopback 0
ip address 20.20.20.5 255.255.255.0
!
interface FastEthernet 0/0
no switchport
ip address 192.168.201.213 255.255.255.0
vrrp 1 ip 192.168.201.1
vrrp 1 timers advertise 3
vrrp 1 priority 120
vrrp 2 ip 192.168.201.2
vrrp 2 timers advertise 3
!
interface GigabitEthernet 1/1
no switchport
ip address 60.154.101.3 255.255.255.0
```

```
!
router ospf
network 60.154.101.0 0.0.0.255 area 10
network 192.168.201.0 0.0.0.255 area 10
!
!
!
end
```

R2 R2 VRRP 1 2

51.6 VRRP

VRRP

IP Ping

，

， Ping IP :
VRRP **show vrrp** VRRP

，
ARP IP ARP

，
IP
VRRP Master

， VRRP VRRP

， VRRP VRRP

， VRRP

， VRRP VRRP

， VRRP VRRP IP

52 BFD

52.1 BFD

52.1.1 BFD

BFD(Bidirectional Forwarding Detection)

52.1.2 BFD

BFD BFD

(0 1) BFD

1 0 0

show bfd neighbors 1

1

2BFD

¸ Vers BFD 1

¸ Diags UP :

0—

1—

2—

3— Down

4—

5—

6—

7— Down

- Sta BFD 0 AdminDown 1 Down 2 Init 3 Up
- P BFD
- F P F
- C / BFD OSPF OSPF /GR BFD
- A
- D
- M 0
- Detect Mult
- Length
- My Discreaminator BFD
- Your Discreaminator BFD
- Desired Min Tx Interval BFD
- Required Min RX Interval BFD
- Required Min Echo RX Interval Echo Echo 0
- Auth Type ( )

Simple Password

Keyed MD5

Meticulous Keyed MD5

Keyed SHA1

Meticulous Keyed SHA1

- Auth Length
- Authentication Data

RGOS 10.3(4b3) 1 0

~ 1 0

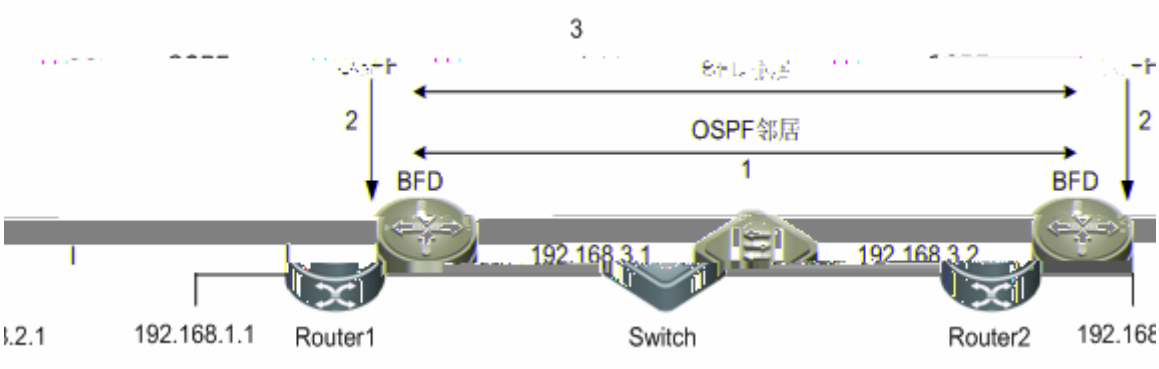
0

52.1.3 BFD

BFD

OSPF BGP RIP BFD

BFD



3BFD

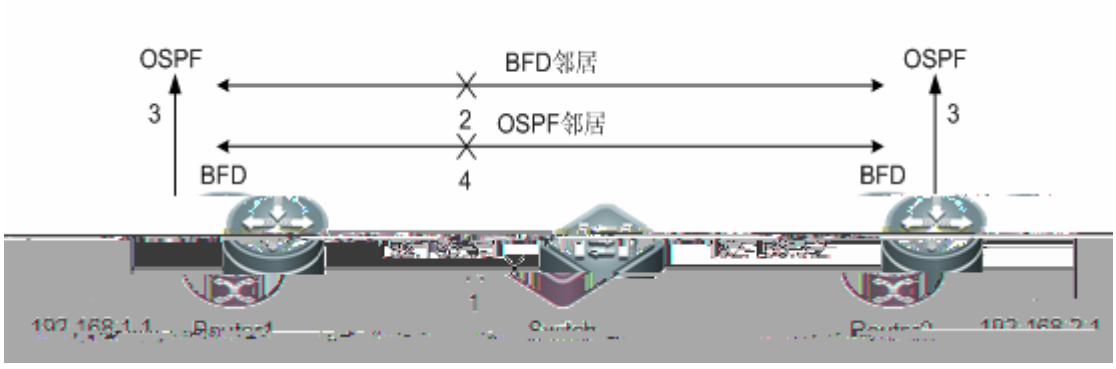
2

OSPF BFD BFD :

1 :OSPF

2 :OSPF BFD

3 :BFD



4BFD

3 BFD :

1 :Router1 Switch

2 :Router1 Router2 BFD

3 :BFD OSPF

4 :OSPF Down

52.1.4

BFD

,

52.2.1.2 BFD

BFD

1.

BFD

BFD Down

2.

3. Meticulous Keyed MD5
4. Keyed SHA1
5. Meticulous Keyed SHA1

~ RGOS10.3(5) BFD

52.2.4 BFD

BFD BFD “HEELO”

1 RGOS10.3(5)

1. RIPv1 RIPV2
2. OSPFv2
3. BGP

52.2.5 BFD

BFD

BFD
BFD BFD
RIB
BFD BFD BFD
BFD
BFD

BFD BFD BFD
Down

~ 10.3(5) BFD IPv4

52.2.6 BFD

BFD

BFD

BFD BFD BFD
BFD
BFD
BFD BFD BFD
Down

~	10.3(5) BFD IPv4

52.2.7 BFD VRRP

VRRP BFD VRRP “HEELO”

1

VRRP VRRP BFD BFD
BFD
VRRP BFD
VRRP BFD BFD
VRRP
BFD

52.2.8 BFD VRF

BFD VRF VPN Routing and Forwarding VPN BFD
PE(provider edge) CE(customer edge)

52.2.9 BFD

BFD Routed Port SVI L3 AP

BFD ATM POS CPOS
E1 ATM CPOS MPPP

52.3 BFD

BFD

Step 5	Ruijie(config-if)# **end**	

BFD **no bfd interval**

Routed Port FastEthernet 0/2 BFD

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface fastEthernet 0/2
Ruijie(config-if)# bfd interval 100 min_rx 100 multiplier 3
```

~	BFD L3 AP

52.3.3 BFD

BFD BFD

BFD

Step 1	Ruijie>**enable**	
Step 2	Ruijie# **configure terminal**	
Step 3	Ruijie(config)# **interface** *type number*	
Step 4	Ruijie(config-if)# **bfd echo**	
Step 5	Ruijie(config-if)# **end**	

BFD **no bfd echo**

Routed Port FastEthernet 0/2 BFD Echo

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface fastEthernet 0/2
Ruijie(config-if)# bfd echo
```

BFD ECHO BFD

Step 1	Ruijie>**enable**	

Step 2	Ruijie# **configure terminal**	
Step 3	Ruijie(config)#**bfd slow-timer** [*milliseconds*]	

52.3.5 BFD

BFD BFD : Ping
BFD BFD
BFD
BFD BFD
BFD
BFD

Step 1	Ruijie>**enable**	
Step 2	Ruijie# **configure terminal**	
Step 3	Ruijie(config)#**bfd cpp**	BFD
Step 5	Ruijie(config-if)# **end**	

no bfd cpp Ó

Step 5	Ruijie(config-router)# **exit**	( ) Router
Step 6	Ruijie(config)# **interface** *type number*	( )
Step 7	Ruijie(config-if)#**ip rip bfd** [**disable**]	( ) RIP BFD
Step 8	Ruijie(config-if)#**end**	( )
Step 9	Ruijie#**show bfd neighbors** [**details**]	( ) BFD RIP

RIP BFD Router **no bfd all-interfaces**

FastEthernet 0/2 RIP BFD

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# router rip
Ruijie(config-router)# bfd all-interfaces
Ruijie(config-router)# exit
Ruijie(config)# interface FastEthernet 0/2
Ruijie(config-if)# ip rip bfd disable
Ruijie(config-if)#end
```

	RIP BFD RIP (RIP) BFD RIP BFD BFD
~	unnumbered , BFD IP BFD BFD BFD BFD

52.3.7 OSPF BFD

OSPF Hello OSPF BFD FULL BFD BFD BFD OSPF 120

bfd all-interfaces OSPF BFD

ip ospf bfd [disable]

OSPF BFD

Step 1	Ruijie>**enable**	
Step 2	Ruijie# **configure terminal**	
Step 3	Ruijie(config)# **router ospf** *process-id*	Router
Step 4	Ruijie(config-router)# **bfd all-interfaces**	OSPF BFD no RIP BFD
Step 5	Ruijie(config-router)# **exit**	( ) Router
Step 6	Ruijie(config)# **interface** *type number*	( )
Step7	Ruijie(config-if)#**ip rip bfd** [**disable**]	( ) OSPF BFD
Step8	Ruijie(config-if)#**end**	( )
Step9	Ruijie#**show bfd neighbors** [**details**]	( ) BFD OSPF
Step10	Ruijie#**show ip ospf**	( ) OSPF

OSPF BFD Router **no bfd all-interfaces**

FastEthernet 0/2 OSPF BFD

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# router ospf 123
Ruijie(config-router)# bfd all-interfaces
Ruijie(config-router)# exit
Ruijie(config)# interface FastEthernet 0/2
Ruijie(config-if)# ip ospf bfd disable
Ruijie(config-if)#end
```

	10.3(5) OSPFv3 BFD OSPF BFD BFD IP BFD BFD ~ . BFD BFD 0SPFv2/0SPFv3 BFD

```
Ruijie(config-if)# bfd interval 50 min_rx 50 multiplier 3
Ruijie(config-if)# ip route static bfd FastEthernet 0/1 172.16.0.2
Ruijie(config-if)# ip route 10.0.0.0 255.0.0.0 FastEthernet 0/1
172.16.0.2
Ruijie(config-if)# end
```

52.3.9 BFD

BFD

Step 1	Ruijie>**enable**	
Step 2	Ruijie# **configure terminal**	

```
Ruijie(config-route-map)# match ip address 1
Ruijie(config-route-map)# set ip precedence priority
Ruijie(config-route-map)#set ip next-hop verify-availability
172.16.0.2 bfd FastEthernet 0/1 172.16.0.2
Ruijie(config-route-map)#end
Ruijie(config)#interface FastEthernet 0/1
Ruijie(config-if)#no switchport
Ruijie(config-if)#ip address 172.16.0.1 255.255.255.0
Ruijie(config-if)#bfd interval 50 min_rx 50 multiplier 3
Ruijie(config-if)#ip policy route-map Example1
Ruijie(config-if)#exit
```

~	10.3(5)	PBRv6	BFD

```
Ruijie(config-if)#bfd interval 50 min_rx 50 multiplier 3
Ruijie(config-if)#vrrp 1 priority 120
Ruijie(config-if)#vrrp 1 ip 192.168.201.1
Ruijie(config-if)#vrrp 1 bfd 192.168.201.12
Ruijie(config-if)#end
```

VRRP BFD IP

Step 1	Ruijie>**enable**	
Step 2	Ruijie# **configure terminal**	
Step 3	Ruijie(config)# **interface** *type number*	
Step 4	Ruijie(config-if)#**vrrp** *group-number* **ip** [*ip-address*[**secondary**]]	VRRP IP
Step 5	Ruijie(config-if)# **vrrp** *group-number* **track bfd** *interface-type interface-number ip-addess* [*priority*]	VRRP BFD IP no
Step 6	Ruijie(config)# **end**	
Step 7	Ruijie#**show bfd neighbors** [**details**]	( ) BFD VRRP
Step 8	Ruijie#**show vrrp**	( ) VRRP BFD IP

VRRP BFD IP no **vrrp** *group-number* **track bfd** *interface-type interface-number ip-addess*

.

:

VRRP BFD 192.168.1.3

```
Ruijie#configure terminal
```

52.3.11 BFD

BFD

show bfd neighbors [**vrf** *vrf-name*] [**ipv4** *ip-addess* [**details**]| **ipv6** *ipv6-addess* [**details**] |**client** {**bgp**|**ospf**|**rip**|**vrrp**|**static-route**|**pbr**} **[ipv4** *ip-address* [**details**]	**ipv6** *ipv6-addess* [**details**]| **details**]]	BFD , , 4
show vrrp	VRRP BFD
show route-map	BFD
show ip static route	BFD
show ip ospf	OSPF BFD
show ip rip database	RIP BFD

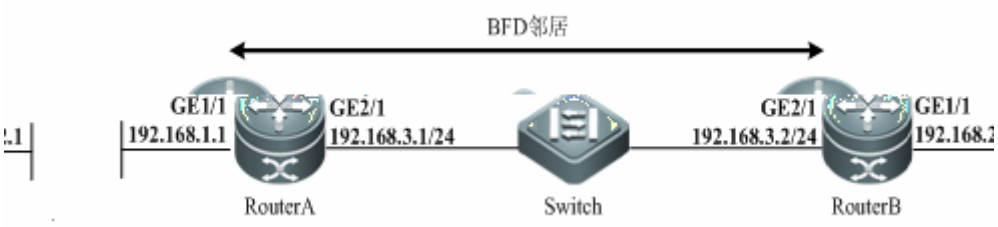
&

52.4 RIP BFD

52.4.1.1

Router A Router B switch RIP
RIP BFD Router B
swicth BFD RIP

52.4.1.2



14 RIP BFD

52.4.1.3

1) RouterA

RouterA Routed Port ge2/1 IP BFD

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface GigabitEthernet2/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 192.168.3.1 255.255.255.0
Ruijie(config-if)# bfd interval 200 min_rx 200 multiplier 5

Ruijie(config-if)# exit
Ruijie(config)# interface GigabitEthernet1/1
Ruijie(config-if)# no switchport
Ruijie(config)# ip address 192.168.1.1 255.255.255.0
```

RIP RIP BFD 192.168.3.2

```
Ruijie(config-if)# exit
Ruijie(config-router)# router rip
Ruijie(config-router)# version 2
Ruijie(config-router)# network 192.168.3.0
Ruijie(config-router)# network 192.168.1.0
Ruijie(config-router)# passive-interface GigabitEthernet 2/1
Ruijie(config-router)# bfd all-interfaces
```

2) RouterB

RouterA Routed Port IP BFD

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface GigabitEthernet 2/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 192.168.3.2 255.255.255.0
Ruijie(config-if)# bfd interval 50 min_rx 50 multiplier 3

Ruijie(config-if)# exit
Ruijie(config)# interface GigabitEthernet1/1
Ruijie(config-if)# no switchport
Ruijie(config)# ip address 192.168.2.1 255.255.255.0
```

RIP RIP BFD 192.168.3.1

```
Ruijie(config-if)# exit
f2.25J--0.0013 c(Ruijie(config-if)#)52 0 Dmultiplier)J/I4 13628000.005 -1.5(m
```

```
Ruijie(config-router)# network 192.168.3.0
Ruijie(config-router)# network 192.168.2.0
Ruijie(config-router)# passive-interface GigabitEthernet 2/1
Ruijie(config-router)# bfd all-interfaces
Ruijie(config-router)# end
Ruijie#
```

52.4.1.4

1) RouterA BFD

Ruijie# **show bfd neighbors details**

OurAddr	NeighAddr	LD/RD	RH	Holdown(mult)	State	Int
192.168.3.1	192.168.3.2	1/2	1	532 (3)	Up	Ge2/1

Local Diag: 0, Demand mode: 0, Poll bit: 0

MinTxInt: 200000, MinRxInt: 200000, Multiplier: 5

Received MinRxInt: 50000, Received Multiplier: 3

Holdown (hits): 600(22), Hello (hits): 200(84453)

Rx Count: 49824, Rx Interval (ms) min/max/avg: 208/440/332

Tx Count: 84488, Tx Interval (ms) min/max/avg: 152/248/196

Registered protocols: RIP

Uptime: 02:18:49

Last packet: **Version: 1** - Diagnostic: 0

I Hear You bit: 1 - Demand bit: 0

Poll bit: 0 - Final bit: 0

Multiplier: 3 - Length: 24

My Discr.: 2 - Your Discr.: 1

Min tx interval: 50000 - Min rx interval: 50000

Min Echo interval: 0

	IP
	IP
	hello

	echo echo (Echo)
	hello
	BFD
	BFD
	UP
	BFD

5

2) RouterB BFD

Ruijie# **show bfd neighbors details**

OurAddr NeighAddr LD/RD RH Holdown(mult) State Int

192.168.3.2 192.168.3.1 2/1 1 532 (5) Up Ge2/1

Local Diag: 0, Demand mode: 0, Poll bit: 0

MinTxInt: 50000, MinRxInt: 50000, Multiplier: 3

Received MinRxInt: 200000, Received Multiplier: 5

Holdown (hits): 600(22), Hello (hits): 200(84453)

Rx Count: 49824, Rx Interval (ms) min/max/avg: 209/440/332

Tx Count: 84488, Tx Interval (ms) min/max/avg: 153/249/197

Registered protocols: RIP

Uptime: 02:18:49

Last packet: **Version: 1** - Diagnostic: 0

I Hear You bit: 1 - Demand bit: 0

Poll bit: 0 - Final bit: 0

Multiplier: 5 - Length: 24

My Discr.: 1 - Your Discr.: 2

Min tx interval: 200000 - Min rx interval: 200000

Min Echo interval: 0

52.5 OSPF BFD

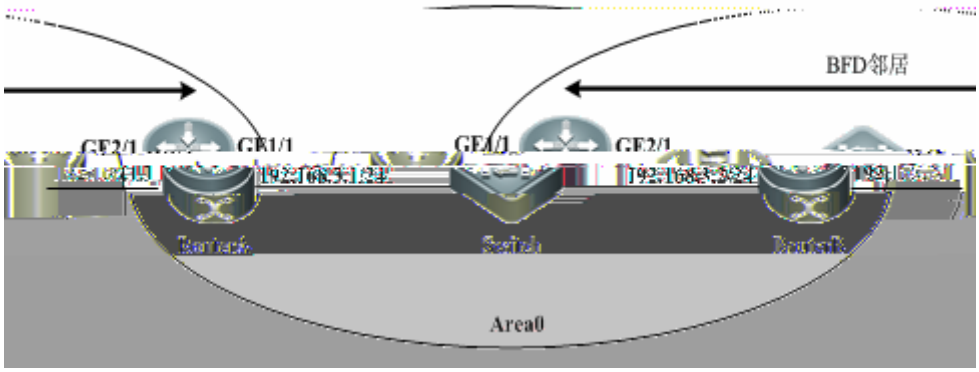
52.5.1.1

Router A Router B switch OSPF

OSPF BFD Router B

swicth BFD OSPF

52.5.1.2



15 OSPF BFD

52.5.1.3

1) RouterA

RouterA Routed Port IP BFD

```
Ruijie# configure terminal
```

```
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface GigabitEthernet2/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 192.168.3.1 255.255.255.0
Ruijie(config-if)# bfd interval 200 min_rx 200 multiplier 5

Ruijie(config-if)# exit
Ruijie(config)# interface GigabitEthernet1/1
Ruijie(config-if)# no switchport
Ruijie(config)# ip address 192.168.1.1 255.255.255.0
#    OSPF        BFD       192.168.3.2
Ruijie(config-if)# exit
Ruijie(config-router)# router ospf 123
Ruijie(config-router)# log-adjacency-changes detail
Ruijie(config-router)# network 192.168.3.0 0.0.0.255 area 0
Ruijie(config-router)# network 192.168.1.0 0.0.0.255 area 0
Ruijie(config-router)# bfd all-interfaces
Ruijie(config-router)# end
Ruijie#
```

2) RouterB

```
#  RouterA      Routed Port          BFD
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface GigabitEthernet 2/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 192.168.3.2 255.255.255.0
Ruijie(config-if)# bfd interval 50 min_rx 50 multiplier 3

Ruijie(config-if)# exit
Ruijie(config)# interface GigabitEthernet1/1
Ruijie(config-if)# no switchport
Ruijie(config)# ip address 192.168.2.1 255.255.255.0
#    OSPF        BFD       192.168.3.1
Ruijie(config-if)# exit
Ruijie(config-router)# router ospf 123
Ruijie(config-router)# log-adjacency-changes detail
Ruijie(config-router)# network 192.168.3.0 0.0.0.255 area 0
Ruijie(config-router)# network 192.168.2.0 0.0.0.255 area 0
Ruijie(config-router)# bfd all-interfaces
Ruijie(config-router)# end
```

52.5.1.4

3) RouterA BFD

`Ruijie#` **show bfd neighbors details**

OurAddr NeighAddr LD/RD RH Holdown(mult) State Int

192.168.3.1 192.168.3.2 1/2 1 532 (3) Up Ge2/1

Local Diag: 0, Demand mode: 0, Poll bit: 0

MinTxInt: 200000, MinRxInt: 200000, Multiplier: 5

Received MinRxInt: 50000, Received Multiplier: 3

Holdown (hits): 600(22), Hello (hits): 200(84453)

Rx Count: 49824, Rx Interval (ms) min/max/avg: 208/440/332

Tx Count: 84488, Tx Interval (ms) min/max/avg: 152/248/196

Registered protocols: OSPF

Uptime: 02:18:49

Last packet: **Version: 1** - Diagnostic: 0

I Hear You bit: 1 - Demand bit: 0

Poll bit: 0 - Final bit: 0

Multiplier: 3 - Length: 24

My Discr.: 2 - Your Discr.: 1

Min tx interval: 50000 - Min rx interval: 50000

Min Echo interval: 0

4) RouterB BFD

`Ruijie#` **show bfd neighbors details**

OurAddr NeighAddr LD/RD RH Holdown(mult) State Int

192.168.3.2 192.168.3.1 2/1 1 532 (5) Up Ge2/1

Local Diag: 0, Demand mode: 0, Poll bit: 0

MinTxInt: 50000, MinRxInt: 50000, Multiplier: 3

Received MinRxInt: 200000, Received Multiplier: 5

Holdown (hits): 600(22), Hello (hits): 200(84453)

Rx Count: 49824, Rx Interval (ms) min/max/avg: 209/440/332 last: 66 ms ago

Tx Count: 84488, Tx Interval (ms) min/max/avg: 153/249/197 last: 190 ms ago

Registered protocols: OSPF

Uptime: 02:18:49

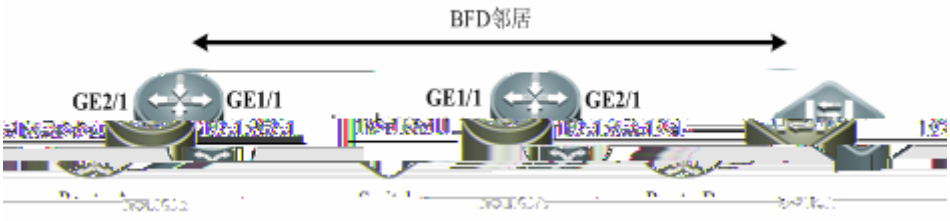
Last packet: **Version: 1** - Diagnostic: 0
I Hear You bit: 1 - Demand bit: 0
Poll bit: 0 - Final bit: 0
Multiplier: 5 - Length: 24
My Discr.: 1 - Your Discr.: 2
Min tx interval: 200000 - Min rx interval: 200000
Min Echo interval: 0

52.6 BFD

52.6.1.1

Router A Router B switch
BFD Router B
swicth BFD
RIB

52.6.1.2



16 **BFD**

52.6.1.3

```
Ruijie(config-if)# bfd interval 200 min_rx 200 multiplier 5

Ruijie(config-if)# exit
Ruijie(config)# interface GigabitEthernet1/1
Ruijie(config-if)# no switchport
Ruijie(config)# ip address 192.168.1.1 255.255.255.0
#                BFD       192.168.3.2
Ruijie(config-if)# exit
Ruijie(config)# ip route static bfd GigabitEthernet 2/1 192.168.3.2
Ruijie(config)# ip route 192.168.2.0 255.255.255.0 GigabitEthernet 2/1
192.168.3.2
Ruijie(config)# end
Ruijie#
```

2) RouterB

```
#   RouterA      Routed Port          IP          BFD
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface GigabitEthernet 2/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 192.168.3.2 255.255.255.0
Ruijie(config-if)# bfd interval 50 min_rx 50 multiplier 3

Ruijie(config-if)# exit
Ruijie(config)# interface GigabitEthernet1/1
Ruijie(config-if)# no switchport
Ruijie(config)# ip address 192.168.2.1 255.255.255.0
#                BFD       192.168.3.1
Ruijie(config-if)# exit
Ruijie(config)# ip route static bfd GigabitEthernet 2/1
192.168.3.1
Ruijie(config)# ip route 192.168.1.0 255.255.255.0
GigabitEthernet 2/1 192.168.3.1
Ruijie(config)# end
Ruijie#
```

52.6.1.4

1) RouterA BFD

```
Ruijie# show bfd neighbors details

OurAddr         NeighAddr       LD/RD  RH  Holdown(mult)   State    Int
```

192.168.3.1 192.168.3.2 1/2 1 532 (3) Up Ge2/1

Local Diag: 0, Demand mode: 0, Poll bit: 0

MinTxInt: 200000, MinRxInt: 200000, Multiplier: 5

Received MinRxInt: 50000, Received Multiplier: 3

Holdown (hits): 600(22), Hello (hits): 200(84453)

Rx Count: 49824, Rx Interval (ms) min/max/avg: 208/440/332

Tx Count: 84488, Tx Interval (ms) min/max/avg: 152/248/196

Registered protocols: STATIC ROUTE

Uptime: 02:18:49

Last packet: Version: 1 - Diagnostic: 0

I Hear You bit: 1 - Demand bit: 0

Poll bit: 0 - Final bit: 0

Multiplier: 3 - Length: 24

My Discr.: 2 - Your Discr.: 1

Min tx interval: 50000 - Min rx interval: 50000

Min Echo interval: 0

2) RouterB BFD

`Ruijie#` **show bfd neighbors details**

OurAddr NeighAddr LD/RD RH Holdown(mult) State Int

192.168.3.2 192.168.3.1 2/1 1 532 (5) Up Ge2/1

Local Diag: 0, Demand mode: 0, Poll bit: 0

MinTxInt: 50000, MinRxInt: 50000, Multiplier: 3

Received MinRxInt: 200000, Received Multiplier: 5

Holdown (hits): 600(22), Hello (hits): 200(84453)

Rx Count: 49824, Rx Interval (ms) min/max/avg: 209/440/332 last: 66 ms ago

Tx Count: 84488, Tx Interval (ms) min/max/avg: 153/249/197 last: 190 ms ago/max/avg:209/440/332 l

Min tx interval: 200000 - Min rx interval: 200000

Min Echo interval: 0

52.7 BFD

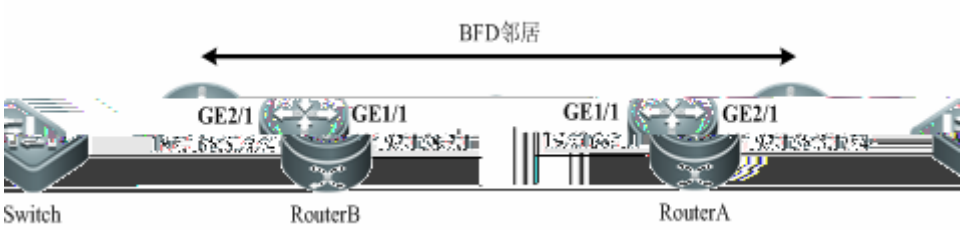
52.7.1.1

Router A Router B switch

l BFD Router B

swicth BFD

52.7.1.2



17 BFD

52.7.1.3

1) RouterA

RouterA Routed Port ge2/1 IP BFD

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface GigabitEthernet2/1
```

```
Ruijie(config-ext-nacl)# deny ip any any
Ruijie(config-ext-nacl)# exit
Ruijie(config)# route-map Example1 permit 10
Ruijie(config-route-map)# match ip address 100
Ruijie(config-route-map)# set ip precedence priority
Ruijie(config-route-map)#set ip next-hop verify-availability
192.168.3.2 bfd GigabitEthernet 0/1 192.168.3.2
Ruijie(config)# end
Ruijie#
```

2) RouterB

RouterA Routed Port IP BFD

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface GigabitEthernet 2/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 192.168.3.2 255.255.255.0
Ruijie(config-if)# bfd interval 50 min_rx 50 multiplier 3

Ruijie(config-if)# exit
Ruijie(config)# interface GigabitEthernet1/1
Ruijie(config-if)# no switchport
Ruijie(config)# ip address 192.168.2.1 255.255.255.0
```

BFD 192.168.3.1

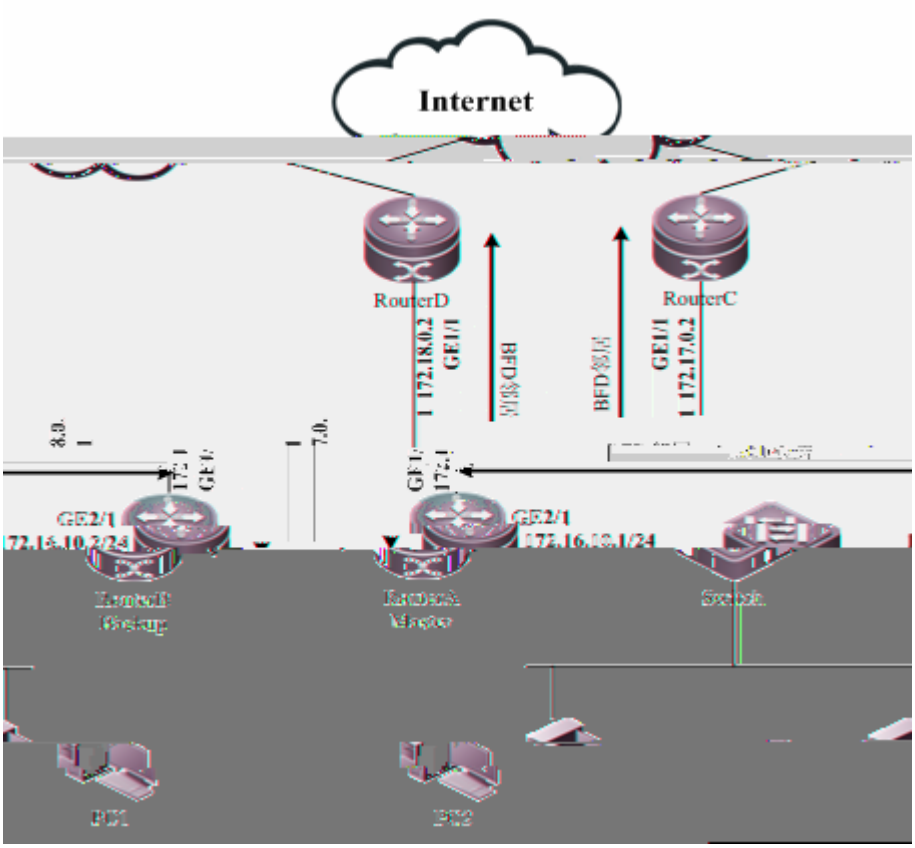
```
Ruijie(config)# ip access-list extended 100
Ruijie(config-ext-nacl)# permit ip any 10.10.11.0 0.0.0.255
Ruijie(config-ext-nacl)# deny ip any any
Ruijie(config-ext-nacl)# exit
Ruijie(config)# route-map Example1 permit 10
Ruijie(config-route-map)# match ip address 100
Ruijie(config-route-map)# set ip precedence priority
Ruijie(config-route-map)#set ip next-hop verify-availability
192.168.3.1 bfd GigabitEthernet 2/1 192.168.3.1
Ruijie(config)# end
Ruijie#
```

52.7.1.4

3)

Last packet: Version: 1

52.8.1.2



18 VRRP BFD

52.8.1.3

1) RouterC .

2) RouterD .

3) RouterA

RouterA Routed Port IP BFD

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface GigabitEthernet2/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 172.16.10.1 255.255.255.0
Ruijie(config-if)# bfd interval 200 min_rx 200 multiplier 5

Ruijie(config-if)# exit
Ruijie(config)# interface GigabitEthernet1/1
Ruijie(config-if)# no switchport
Ruijie(config-if)# ip address 172.17.0.1 255.255.255.0
```

```
Ruijie(config-if)# bfd interval 200 min_rx 200 multiplier 5
#     VRRP          VRRP         BFD       172.16.10.2
  BFD
```

```
Ruijie(config)# end
Ruijie#
```

52.8.1.4

1) RouterA BFD

```
Ruijie# show bfd neighbors details
```

OurAddr	NeighAddr	LD/RD	RH	Holdown(mult)	State	Int
172.16.10.1	172.16.10.2	1/2	1	532 (3)	Up	Ge2/1

Local Diag: 0, Demand mode: 0, Poll bit: 0

MinTxInt: 200000, MinRxInt: 200000, Multiplier: 5

Received MinRxInt: 50000, Received Multiplier: 3

Holdown (hits): 600(22), Hello (hits): 200(84453)

Rx Count: 49824, Rx Interval (ms) min/max/avg: 208/440/332

Tx Count: 84488, Tx Interval (ms) min/max/avg: 152/248/196

Registered protocols: VRRP

Uptime: 02:18:49

Last packet: **Version: 1** - Diagnostic: 0

I Hear You bit: 1 - Demand bit: 0

Poll bit: 0 - Final bit: 0

Multiplier: 3 - Length: 24

Registered protocols: VRRP,STATIC ROUTE

Uptime: 02:18:49

Last packet: **Version: 1** - Diagnostic: 0

I Hear You bit: 1 - Demand bit: 0

Poll bit: 0 - Final bit: 0

Multiplier: 3 - Length: 24

My Discr.: 2 - Your Discr.: 1

Min tx interval: 50000 - Min rx interval: 50000

Min Echo interval: 0

1) RouterB BFD

`Ruijie#` **show bfd neighbors details**

OurAddr	NeighAddr	LD/RD	RH	Holdown(mult)	State	Int
172.16.10.2	172.16.10.1	2/1	1	532 (3)	Up	Ge2/1

Local Diag: 0, Demand mode: 0, Poll bit: 0

MinTxInt: 50000, MinRxInt: 50000, Multiplier: 3

Received MinRxInt: 200000, Received Multiplier: 5

Holdown (hits): 600(22), Hello (hits): 200(84453)

Rx Count: 49824, Rx Interval (ms) min/max/avg: 208/440/332 last: 68 ms ago

Tx Count: 84488, Tx Interval (ms) min/max/avg: 152/248/196 last: 192 ms ago

Registered protocols: VRRP

Uptime: 02:18:49

Last packet: **Version: 1** - Diagnostic: 0

I Hear You bit: 1 - Demand bit: 0

Poll bit: 0 - Final bit: 0

Multiplier: 3 - Length: 24

My Discr.: 1 - Your Discr.: 2

Min tx interval: 200000 - Min rx interval: 200000

Min Echo interval: 0

OurAddr	NeighAddr	LD/RD	RH	Holdown(mult)	State	Int
172.18.0.1	172.18.0.2	1/3	1	532 (3)	Up	Ge2/1

Local Diag: 0, Demand mode: 0, Poll bit: 0

MinTxInt: 200000, MinRxInt: 200000, Multiplier: 5

53 RLDP

53.1 RLDP

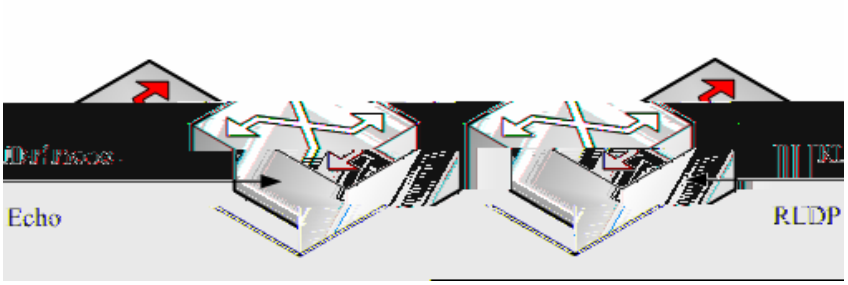
53.1.1 RLDP

RLDP Rapid Link Detection Protocol

linkup

RLDP

RLDP RLDP



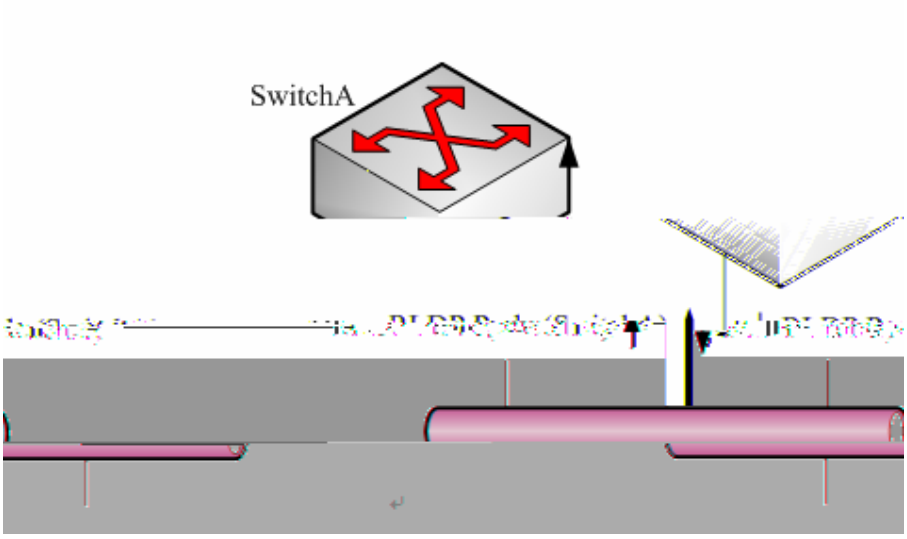
1

RLDP (Probe) (Echo).RLDP
RLDP linkup Probe
Probe

&

RLDP
RLDP RLDP RLDP

53.1.2



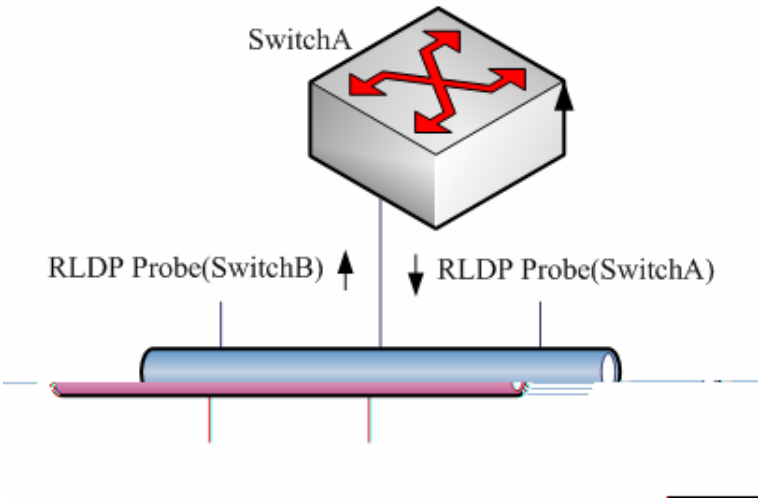
2

RLDP

RLDP

RLDP

svi



3

RLDP

RLDP

RLDP

53.2.1 RLDP

RLDP	DISABLE
RLDP	DISABLE
	2S
	3

RLDP **no**

~

53.2.3 RLDP

RLDP RLDP
RLDP
unidirection-detect bidirection-detect
loop-detect warning block
shutdown-port shutdown-svi
svi

RLDP

Ruijie(config)# **interface** *interface-id*	
Ruijie(config-if)# **rldp port** {**unidirection-detect** | **bidirection-detect** | **loop-detect** } {**warning** | **shutdown-svi** | **shutdown-port** | **block**}	RLDP
Ruijie(config-if)# **end**	

RLDP **no**

GigabitEthernet 0/5 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
```

,

```
Ruijie(config)#
```

rldp (shutdown-port
) RLDP rldp
errdisable revover interval
rldp **errdisable recover interval**
detect-interval* detect-max **errdisable recover**
interval ,

53.3 RLDP

RLDP

RLDP

RLDP

53.3.1 RLDP

RLDP rldp

Ruijie# **show rldp**	RLDP rldp

show rldp rldp

```
Ruijie# show rldp
rldp state       : enable
rldp hello interval  : 2
rldp max hello    : 3
rldp local bridge   : 00d0.f8a6.0134
------------------------------------------------
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
```

GigabitEthernet 0/1
(normal) GigabitEthernet 0/24

53.3.2 RLDP

RLDP

54 DLDP

54.1 DLDP

54.1.1 DLDP

DLDP

&

~

54.1.2.2 DLDP

DLDP ICMP echo

54.1.2.4 DLDP

PING
DLDP UP DOWN

“ ” 3 PING
3 UP

54.1.3

54.2

DLDP

configure terminal	
interface *interface-name*	
Ruijie(config-if)# **dldp** *ip-address* [**next-hop** *ipv4-address*] [**interval** *tick*] [**retry** retry-num] [**resume** resume-num]	IP next-hop IP interval retry interval 1-6000 tick 1 tick =10 retry 1-3600 DOWN UP DLDP resume resume 1-200
Ruijie(config-if)#**end**	
show running	

no dldp

K	10.3(5)

54.4 DLDP

show dldp interface *interface-name* **statistic**	

```
Ruijie#show dldp
Interface  Type        Ip          Next-hop    Interval Retry
Resume State
---------    -------   -------------------
--------------------   --------- ------- ----------- --------
Vl2      Passive 192.168.6.3    192.168.2.2    10      5   3
Up
Vl3      Passive 192.168.7.3                10      5   3
Up
Vl4      Passive 192.168.3.3    192.168.4.2    10      5   3
Up
```

54.5 DLDP

clear dldp interface *interface-name ip*	

55 TPP

55.1 TPP

TPP(Topology Protection Protocol)

CPU

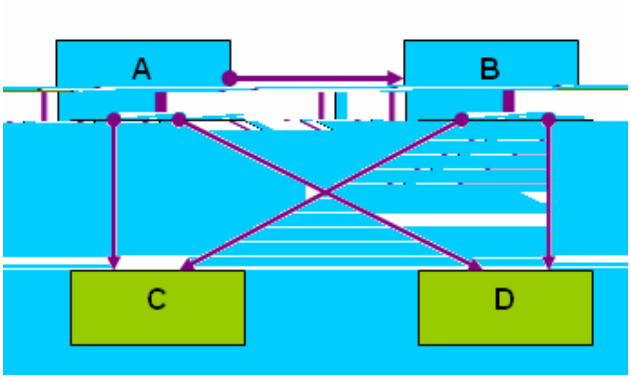
CPU

55.2 TPP

MSTP VRRP
MSTP VRRP

CPU

MSTP VRRP



1

A B C D A
MSTP

A CPU BPDU

C D B C D
B

B CPU

A

C D

55.3 TPP

TPP

&

TPP cpu topology-limit cup

cpu

50-70, TPP

T P P c p u Ù

VRRP MSTP VRRP

A B

C D E

55.5 TPP

TPP

TPP

55.5.1 TTP

TTP

Ruijie# **show tpp**	TPP

```
Ruijie #show tpp
tpp state        : enable
tpp local bridge  : 00d0.f822.35ad
-----------------------------------
```

56

56.1

Flash

Flash

56.2

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、
、
、
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、
、
、
、

56.2.1

4096

~

flash flash 32M
512K flash
USB flash USB
flash 512K

flash flash 512M
4M flash
USB flash USB
flash 4M

flash 110%

10MB flash 10MB
flash 11MB

56.2.2

Ruijie# **cd** *directroy*	directory
Ruijie# **cd** *../*	
Ruijie# **cd** *./*	

MNT Document

```
Ruijie# cd mnt/document
```

MNT/Document

56.2.3

copy

Ruijie# **copy flash:** *filename* **flash:** *directoryname*	
Ruijie# **copy flash:** *filename* **sour** *directoryname*	

```
Ruijie# copy flash:config.tex flash:tmp/
Ruijie# copy flash:con_bak.txt flash:config.text
```

56.2.4

Ruijie# **dir**	
Ruijie# **dir** *directory*	

```
Ruijie# dir
Ruijie# dir ../bak
```

56.2.5

56.2.7

Ruijie# **rename flash:** *old_filename* **flash:**

57

CPU

、 CPU

、 CPU

CPU

show cpu CPU CPU

Ruijie# **show cpu**	CPU

Ruijie

show cpu

```
Ruijie# show cpu
=======================================
    CPU Using Rate Information
CPU utilization in five seconds: 25%
CPU utilization in one minute  : 20%
CPU utilization in five minutes: 10%
  NO   5Sec   1Min   5Min   Process
  0     0%     0%     0%    LISR INT
```

```
13    0%    0%    0%    kswapd
14    0%    0%    0%    bdflush
15    0%    0%    0%    kupdate
16    0%    3%    1%    ll_mt
17    0%    0%    0%    ll main process
18    0%    0%    0%    bridge_relay
19    0%    0%    0%    d1x_task
20    0%    0%    0%    secu_policy_task
21    0%    0%    0%    dhcpa_task
22    0%    0%    0%    dhcpsnp_task
23    0%    0%    0%    igmp_snp
24    0%    0%    0%    mstp_event
25    0%    0%    0%    GVRP_EVENT
26    0%    0%    0%    rldp_task
27    0%    2%    1%    rerp_task
28    0%    0%    0%    reup_event_handler
29    0%    0%    0%    tpp_task
30    0%    0%    0%    ip6timer
31    0%    0%    0%    rtadvd
32    0%    0%    0%    tnet6
33    2%    0%    0%    tnet
34    0%    0%    0%    Tarptime
35    0%    0%    0%    gra_arp
36    0%    0%    0%    Ttcptimer
37    8%    1%    0%    ef_res
38    0%    0%    0%    ef_rcv_msg
39    0%    0%    0%    ef_inconsistent_daemon
40    0%    0%    0%    ip6_tunnel_rcv_pkt
41    0%    0%    0%    res6t
42    0%    0%    0%    tunrt6
43    0%    0%    0%    ef6_rcv_msg
44    0%    0%    0%    ef6_inconsistent_daemon
45    0%    0%    0%    imid
46    0%    0%    0%    nsmd
47    0%    0%    0%    ripd
48    0%    0%    0%    ripngd
49    0%    0%    0%    ospfd
50    0%    0%    0%    ospf6d
51    0%    0%    0%    bgpd
52    0%    0%    0%    pimd
53    0%    0%    0%    pim6d
54    0%    0%    0%    pdmd
55    0%    0%    0%    dvmrpd
56    0%    0%    0%    vty_connect
57    0%    0%    0%    aaa_task
58    0%    0%    0%    Tlogtrap
```

59	0%	0%	0%	dhcp6c
60	0%	0%	0%	sntp_recv_task
61	0%	0%	0%	ntp_task
62	0%	0%	0%	sla_deamon
63	0%	3%	1%	track_daemon
64	0%	0%	0%	pbr_guard
65	0%	0%	0%	vrrpd
66	0%	0%	0%	psnpd
67	0%	0%	0%	igsnpd
68	0%	0%	0%	coa_recv
69	0%	0%	0%	co_oper
70	0%	0%	0%	co_mac
71	0%	0%	0%	radius_task
72	0%	0%	0%	tac+_acct_task
73	0%	0%	0%	tac+_task
74	0%	0%	0%	dhcpd_task
75	0%	0%	0%	dhcps_task
76	0%	0%	0%	dhcpping_task
77	0%	0%	0%	dhcpc_task
78	0%	0%	0%	uart_debug_file_task
79	0%	0%	0%	ssp_init_task
80	0%	0%	0%	rl_listen
81	0%	0%	0%	ikl_msg_operate_thread
82	0%	0%	0%	bcmDPC
83	0%	0%	0%	bcmL2X.0
84	3%	3%	3%	bcmL2X.0
85	0%	0%	0%	bcmCNTR.0
86	0%	0%	0%	bcmTX
87	0%	0%	0%	bcmXGS3AsyncTX
88	0%	2%	1%	bcmLINK.0
89	0%	0%	0%	bcmRX
90	0%	0%	0%	mngpkt_rcv_thread
91	0%	0%	0%	mngpkt_recycle_thread
92	0%	0%	0%	stack_task
93	0%	0%	0%	stack_disc_task
94	0%	0%	0%	redun_sync_task
95	0%	0%	0%	conf_dispatch_task
96	0%	0%	0%	devprob_task
97	0%	0%	0%	rdp_snd_thread
98	0%	0%	0%	rdp_rcv_thread
99	0%	0%	0%	rdp_slot_change_thread
100	4%	2%	1%	datapkt_rcv_thread
101	0%	0%	0%	keepalive_link_notify
102	0%	0%	0%	rerp_msg_recv_thread
103	0%	0%	0%	ip_scan_guard_task
104	0%	0%	0%	ssp_ipmc_hit_task

```
105     0%     0%     0%    ssp_ipmc_trap_task
106     0%     0%     0%    hw_err_snd_task
107     0%     0%     0%    rerp_packet_send_task
108     0%     0%     0%    idle_vlan_proc_thread
109     0%     0%     0%    cmic_pause_detect
110     1%     1%     1%    stat_get_and_send
111     0%     1%     0%    rl_con
112    75%    80%    90%    idle
```

3 5 1 5
CPU LISR HISR CPU

- No
- 5Sec 5 CPU
- 1Min 1 CPU
- 5Min 5 CPU
- Process

2 LISR CPU HISR CPU
3 CPU idle
CPU Windows “ System Idle Process ”
idle 5 CPU 75% CPU
75%

CPU

CPU , cpu-log
CPU

cpu-log log-limit *low_num high_num*	CPU

100% 90%

CPU 70% 80%

```
Ruijie# configure terminal                    //
Ruijie(config)# cpu-log log-limit 70 80    //     CPU
```

CPU 80%

```
Oct 20 15:47:01 %SYSCHECK-5-CPU_USING_RATE: CPU utilization in
one minute : 95%  Using most cpu's task is ktimer : 94%
```

CPU 70%

```
Oct 20 15:47:01 %SYSCHECK-5-CPU_USING_RATE: CPU utilization in
one minute :68%  Using most cpu's task is ktimer : 60%
```

```
Oct 20 15:47:01 %SYSCHECK-5-CPU_USING_RATE: The CPU using rate has
down!
```

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show memory

Ruijie# **show memory**	

Ruijie

show memory

```
Ruijie#show memory
Buddy System info ( Active: 4, inactive: 2, free: 19958 ) :
Zone : DMA
watermarks : min 429, low 1716, high 2574
watermarks : min 0, low 0, high 0
watermarks : min 0, low 0, high 0
Totalpages : 25780(103120KB), freepages : 19958(79832KB)
System Memory Statistic:
Total Objects : 89128, Objects Using size 20428KB.
System Total Memory : 128MB, Current Free Memory : 81066KB
slabinfo - (statistics)
============================================================
cache                  |objects                       |slabs
|statistics
------------------------------------------------------------
memory-cache-name   |active   number   size    |active number
order |high   alloc  grown  reaped error
============================================================
kmem_cache        86       87       132      3      3      1
86    86    3     0     0
ssp_rx_packet_pool   2044    2044    2048    1022   1022   1
2044   2044   1022   0     0
ssp_emergen_mem     0       1024    512     0     128    1
```

```
1024   1024   128    0     0
tcp_tw_bucket        0        0        224      0      0      1
0      0      0      0      0
tcp_bind_bucket      1        59       32       1      1      1
1      1      1      0      0
tcp_open_request     0        0        96       0      0      1
0      0      0      0      0
ip_mrt_cache         0        0        576      0      0      1
0      0      0      0      0
tuncache             0        0        132      0      0      1
0      0      0      0      0
tsfnpool             0        0        12       0      0      1
0      0      0      0      0
ARP table            0        0        132      0      0      1
0      0      0      0      0
bst_pool             9        72       20       1      1      1
9      9      1      0      0
sock                 91       91       1184     7      7      4
91     131    7      0      0
clipri               0        0        32       0      0      1
0      0      0      0      0
clieol               1        5        3072     1      1      4
2      81     1      0      0
clipsr               0        8        512      0      1      1
6      37864  1      0      0
waitqueue_block      0        0        20       0      0      1
0      0      0      0      0
hookbait_pool        140      177      32       3      3      1
140    140    3      0      0
skb_head             34       45       224      3      3      1
34     34     3      0      0
long_sk_data         0        0        10048    0      0      4
0      0      0      0      0
sk_data              1        3        2432     1      1      2
1      1      1      0      0
blkdev_requests      1024     1050     96       35     35     1
1024   1024   35     0      0
jffs2_inode_cache    37       67       24       1      1      1
37     37     1      0      0
jffs2_node_frag      3598     3654     28       58     58     1
3603   3611   58     0      0
jffs2_raw_node_ref   7445     7488     16       96     96     1
7445   7445   96     0      0
jffs2_tmp_dnode      0        3640     36       0      65     1
3601   3635   65     0      0
jffs2_raw_inode      0        39       68       0      1      1
```

```
1     11    1     0     0
jffs2_raw_dirent     0       53       40       0      1      1
1     3     1     0     0
jffs2_full_dnode     3602     3666     16       47     47     1
3611   3637   47     0     0
jffs2_i              9       10       768      2      2      1
10    11    2     0     0
devfsd_event         0       0        20       0      0      1
0     0     0     0     0
file_lock_cache      0       0        88       0      0      1
0     0     0     0     0
dnotify_cache        0       0        20       0      0      1
0     0     0     0     0
kiobuf               0       0        64       0      0      1
0     0     0     0     0
cdev_cache           0       0        160      0      0      1
0     0     0     0     0
bdev_cache           1       20       160      1      1      1
1     1     1     0     0
mnt_cache            9       40       64       1      1      1
9     11    1     0     0
inode_cache          128     132      640      22     22     1
128    153    22     0     0
dentry_cache         141     144      128      6      6      1
141    168    6     0     0
filp                 101     120      128      5      5      1
101    101    5     0     0
names_cache          0       2        4096     0      2      1
2     69    2     0     0
buffer_head          0       0        96       0      0      1
0     0     0     0     0
fs_cache             87      118      32       2      2      1
93    96    2     0     0
files_cache          87      99       416      11     11     1
93    96    11    0     0
mc_bitmap            176     180      128      6      6      1
176    176    6     0     0
mdbg_cache           2883    3030     16       15     15     1
2883   6492   15    0     0
size-33554432(DMA)   0          0          33554432 0       0
8192   0     0     0     0     0
size-33554432        0          0          33554432 0       0
8192   0     0     0     0     0
size-16777216(DMA)   0          0          16777216 0       0
4096   0     0     0     0     0
size-16777216        0          0          16777216 0       0
```

```
4096   0     0     0     0     0
size-8388608(DMA)     0          0          8388608   0       0
2048   0     0     0     0     0
size-8388608          0          0          8388608   0       0
2048   0     0     0     0     0
size-4194304(DMA)     0          0          4194304   0       0
1024   0     0     0     0     0
size-4194304          0          0          4194304   0       0
1024   0     0     0     0     0
size-2097152(DMA)     0          0          2097152   0       0
512    0     0     0     0     0
size-2097152          0          0          2097152   0       0       512
0      0     0     0     0
size-1048576(DMA)     0          0          1048576   0       0
256    0     0     0     0     0
size-1048576          0          0          1048576   0       0       256
0      0     0     0     0
size-524288(DMA)      0          0          524288    0       0       128
0      0     0     0     0
size-524288           0          1          524288    0       1       128
1      1     1     0     0
size-262144(DMA)      0          0          262144    0       0       64
0      0     0     0     0
size-262144           7          7          262144    7       7       64
7      7     7     0     0
size-131072(DMA)      0          0          131072    0       0       32
0      0     0     0     0
size-131072           18         18         131072    18      18      32
18     18    18    0     0
size-65536(DMA)       0          0          65536     0       0       16
0      0     0     0     0
size-65536            34         39         65536     34      39      16
39     44    39    0     0
size-32768(DMA)       0          0          32768     0       0       8
0      0     0     0     0
size-32768            56         57         32768     56      57      8
57     64    57    0     0
size-16384(DMA)       0          0          16384     0       0       4
0      0     0     0     0
size-16384            72         74         16384     72      74      4
74     77    74    0     0
size-8192(DMA)        0          0          8192      0       0       2
0      0     0     0     0
size-8192             24         24         8192      24      24      2
24     34    24    0     0
size-4096(DMA)        0          0          4096      0       0       1
```

```
0     0     0     0     0
size-4096           148      148      4096     148    148    1
148    2962   148    0     0
size-2048(DMA)       0        0        2048     0      0      1
0     0     0     0     0
size-2048           63       64       2048     32     32     1
63     403    32     0     0
size-1024(DMA)       0        0        1024     0      0      1
0     0     0     0     0
size-1024           188      188      1024     47     47     1
188    473    47     0     0
size-512(DMA)        0        0        512      0      0      1
0     0     0     0     0
size-512            160      161      512      23     23     1
160    440    23     0     0
size-256(DMA)        0        0        256      0      0      1
0     0     0     0     0
size-256            92       104      256      8      8      1
95     1244   8      0     0
size-128(DMA)        0        0        128      0      0      1
0     0     0     0     0
size-128            248      288      128      11     12     1
272    787    12     0     0
size-64(DMA)         0        0        64       0      0      1
0     0     0     0     0
size-64             16519    16560    64       414    414    1
16534  17990  414    0     0
size-32(DMA)         0        0        32       0      0      1
0     0     0     0     0
size-32             49854    49914    32       845    846    1
49866  90468  846    0     0
============================================================
```

1. Buddy System

Active	
Inactive	
Free	
Zone	DMA Normal 256M DMA
Zone watermasks 1	DMA DMA

DMA		min low high
	watermasks 2	DMA DMA
	watermasks 3	
	watermasks 1	Normal

cs	Alloc	
	Grown	slab
	Reaped	slab
	Error	

Threshold CPU

CLI MIB

57.1.1

57.1.1.1 CPU

CPU CPU MIB
log

57.1.1.2

MIB

log

CPU	90	100
	90	100

CPU

CPU

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **threshold set cpu [M1 | M2 | slot** *n* | **member** *n***]** *warning_value critical_value*	CPU 1~100

no threshold set cpu

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **threshold set memory [M1 | M2 | slot** *n* | **member** *n***]** *warning_value critical_value*	1~100

no threshold set memory

show threshold cpu	CPU
show threshold memory	

&

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#threshold set cpu member  1 80 90
Ruijie(config)#threshold set temperature member 1 60 80
```

```
Ruijie#show threshold  cpu
Device       Warning     Critical
Member 1:        80          90
Ruijie#show threshold memory
Device       Warning     Critical
Member 1:        90         100
Ruijie#show threshold temperature
Device       Warning     Critical
Member 1:        60          80
```

58

58.1

UP DOWN

VTY FLASH

58.1.1

<priority> seq no: timestamp sysname
%ModuleName-severity-MNEMONIC: description

< > - -
8

```
<189> 226:Mar  5 02:09:10 S3760 %SYS-5-CONFIG_I: Configured
from console by console
```

~

Syslog Server

58.2

58.2.1

Syslog
FLASH

Ruijie(config)# **logging on**	
Ruijie(config)# **no logging on**	

~

58.2.2

Ruijie(config)# **logging buffered** [*buffer-size* | *level*]	
Ruijie# **termninal monitor**	VTY
Ruijie(config)# **logging** *host*	Syslog Sever
Ruijie(config)# **logging file flash:***filename* [*max-file-size*] [*level*]	FLASH

Logging Buffere

show logging
clear logging

Termninal Monitor VTY(Telnet)
Logging Host Syslog Server
5 Syslog Server Syslog Server

~

Syslog Server
Syslog Server

Logging File Flash FLASH
TXT

More Flash Filename Flash

~

FLASH FLASH
FLASH FLASH FLASH

58.2.3

Ruijie(config)# **service timestamps** *message-type* [**uptime**	**datetime**]	
Ruijie(config)# **no service timestamps** *message-type*	

(Uptime) (Datetime)

Log Debug Log 0 6
Debug 7

~

RTC

58.2.4

Ruijie(config)# **no service sysname**	

Ruijie(config)# **service sysname**	

Ruijie(config)# **logging rate-limit** *rate*	
Ruijie(config)# **no logging rate-limit**	

58.2.9

Ruijie(config)# **logging console** *level*	
Ruijie(config)# **logging monitor** *level*	VTY ? **logging mon2tor**

logging console *6* 6

6

7

VTY 7

Syslog Server 6

~ سخي

```
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)
```

23

58.2.11

Syslog Server

Log IP Log

Ruijie(config)# **logging source interface** *interface-type interface-number*	
Ruijie(config)# **logging source ip** *A.B.C.D*	ip

58.2.12 LOG

LOG

/ LOG LOG

Ruijie(config)# **logging userinfo**	/ LOG

Ruijie(config)# **logging userinfo** LOG

command-log 6-0 Tc[<05b51643>-5.7<010 TD-cf 7]TJ/8b51643197

Ruijie# **show logging reverse**	
Ruijie# **clear logging**	
Ruijie# **more flash:***filename*	FLASH

~

show logging count

58.3.1

```
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
```