RG-NPE

RGOS 10.3(4b7)

RGOS®10.3(4b7)

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-

1.

//

3.

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1

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

1.1

?

User

EXEC

show

Privileged EXEC

“Ruijie”

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** **interface**	
Config-vlan VLAN	**vlan** *vlan_id*	Ruijie(config-vlan)#	**end** Ctrl+C **exit**	VLAN

1.2

?

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-B	
	Ctrl-F	
	Ctrl-A	
	Ctrl-E	
	Backspace	
	Delete	
	Return	
	Space	

1.7.2

20

1) **Show**

2)

show

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

show ”|”

1.9

"mygateway"

"ip route 0.0.0.0 0.0.0.0 192.1.1.1"

```
......
```

*

command-alias=original-command

EXEC ”s” ”show” ”s?” ’s’

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

EXEC

”sv” ”show version”

```
Ruijie#s?
*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 PC

CLI

Console Outband

Telnet

2

2.1

Flash

USB flash USB
flash 512K
flash flash 512M 4M
flash
USB flash USB
flash 4M
flash 110%

10MB flash 10MB
flash 11MB

2.2.2

Ruijie# **cd** *directroy*	directory
Ruijie# **cd** *../*	
Ruijie# **cd** *./*	

MNT Document

```
Ruijie# cd mnt/document
```

MNT/Document

2.2.3

copy

Ruijie# **copy flash:** *filename* **flash:** *directoryname*	
Ruijie# **copy flash:** *filename* **sour** *directoryname*	

Ruijie# **pwd**	

2.2.8

Ruijie# **del** *filename*	

MNT large.c

```
Ruijie# del mnt/large.c
```

2.2.9

Red-Giant# **rmdir** *directoryname*	

MNT

```
Ruijie# rmdir mnt
```

3

3.1

CTRL

TFTP Xmodem

3.2

- TFTP
- XMODEM

3.2.1 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:** *//location/filename* [**vrf** vrfname]	*filename* URL

tftp

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

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

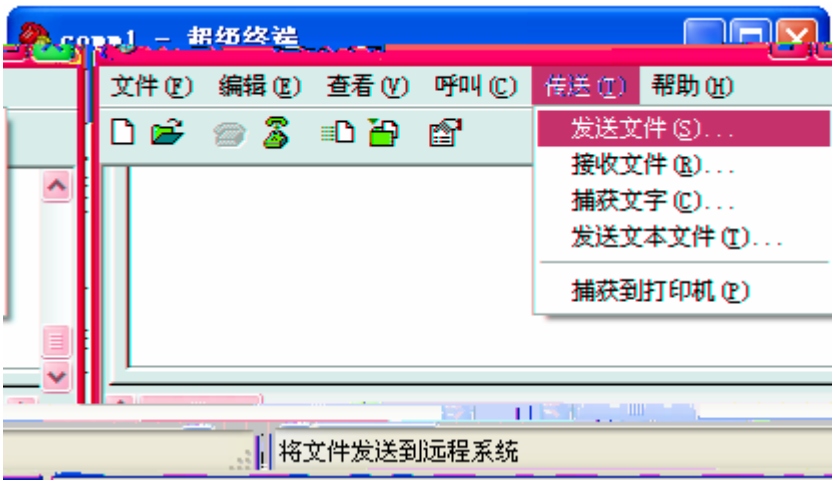
3.2.2 XMODEM

CLI

Windows

Windows “ ” “

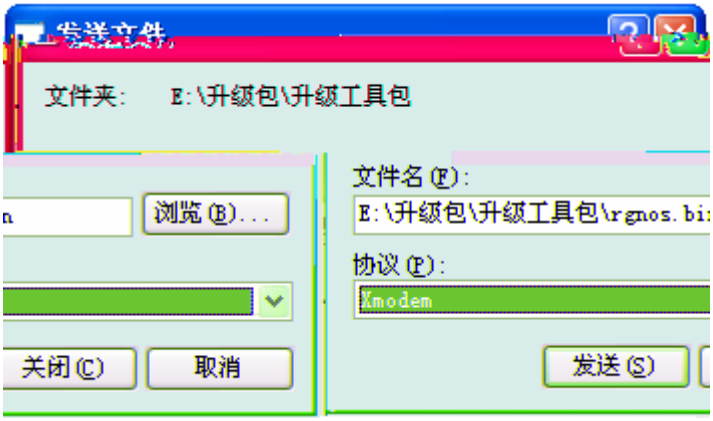
” 1



1

“Xmodem” “ ”

Windows 2



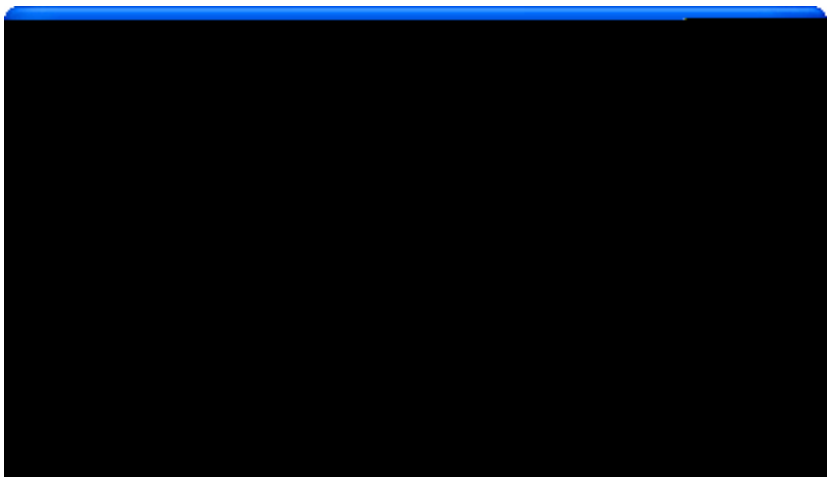
2

Ruijie# **copy xmodem flash**:*filename*	*filename*

CLI

Windows

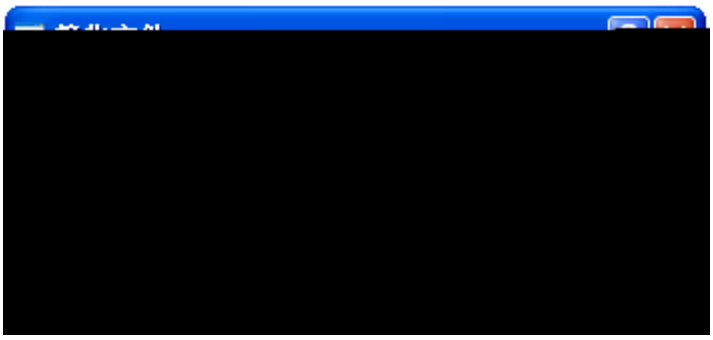
Windows “ ” “ ” 3



3

“Xmodem” “ ”

“ ” 4



4

filename

Ruijie# **copy flash**:*filename* **xmodem**

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

4 HTTP

4.1 HTTP

4.1.1 HTTP

HTTP HTTP HTTP

HTTP

4.2

HTTP

	0.0.0.0
	80
	8 ā ṗ Ь ü = Ń

```
Ruijie# http update web character-db //    WEB
updating files, please wait...
update success!
```

4.3.2

HTTP 0.0.0.0 80

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **http update server** *host* [**port** *port-value*]	
Step 3	Ruijie# **show running**	

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# http update server 10.83.132.1
Ruijie(config)# exit
```

4.4 HTTP

- _____

4.4.1

HTTP

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **http update set oob**	
Step 3	Ruijie# **show running**	

no http update set oob

HTTP

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# http update set oob
Ruijie(config)# exit
```

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5

5.1

Ruijie

Dialer NULL Loopback

Ruijie

	GigabitEthernet tenGigabitEthernet	IEEE802.3 RFC894
Dialer	dialer	—
Loopback	Loopback	—
NULL	NULL	—
	GigabitEthernet 0/0.10( )	—

5.2

5.2.1

Ruijie(config)# **interface** *interface-type interface-number*	
Ruijie(config)# **no interface** *interface-type interface-number*	

0 0

5.2.2 IP

NULL IP IP

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

IP IP

5.2.3

Ruijie(config-if)# **description** *interface-description*	80
Ruijie(config-if)# **no description**	

5.2.4 MTU

MTU IP 64 65535

Ruijie(config-if)# **mtu** *bytes*	MTU
Ruijie(config-if)# **no mtu**	MTU

5.2.5 Bandwidth

BandWidth OSPF RSVP

Ruijie(config-if)# **bandwidth** *kilobits*	Bandwidth
Ruijie(config-if)# **no bandwidth**	Bandwidth

5.2.6

Hold-Queue

Ruijie(config-if)# **Hold-Queue** *Length* {**in** | **out**}	
Ruijie(config-if)# **no Hold-Queue**	

5.3

-
-
-

5.3.1

Ruijie# **Show interface** [**GigabitEthernet**] |…	

Ruijie# **Clear counters** [**GigabitEthernet**]…	**show interface** 0
Ruijie# **Clear interface** [**GigabitEthernet**]…	

clear counter **show interface gigabitEthernet***1/0*

```
Ruijie# show interface gigabitEthernet 1/0
gigabitEthernet 1/0 is DOWN  , line protocol is DOWN
Interface address is: 192.168.10.10/24
MTU 1500 bytes, BW 2000 Kbit
Keepalive interval is 10 sec , set
Carrier delay is 2 sec
RXload is 1 ,Txload is 1
Queueing strategy: WFQ
```

5.4.2

```
Ruijie(config)# Interface gigabitEthernet 0/0
Ruijie(config-if)# shutdown
```

6 LAN

LAN(Local Aare Network)

6.1

6.1.1

-
- IP
- MAC

6.1.1.1 ώ Ո ሃ

Ruijie(Config)# **Interface GigabitEthernet** *interface-number*	(R26 R36)
Ruijie(Config)# **Interface GIgabitethernet** *interface-number*	(R37)

6.1.1.2 IP فخ سم

IP

Ruijie (Config-if)# **ip address** *ip-address ip-mask* [**secondary**]	IP
Ruijie (Config-if)# **no ip address** *ip-address ip-mask* [**secondary**]	IP

IP Secondary IP IP

6.1.1.3

VLAN LAN LAN
VLAN VLAN LAN
VLAN
LAN
VLAN VLAN

Canonical Format Indicator C T-R

Priority P 12 8

VLAN VLAN

6.2.2 VLAN

VLAN

- VLAN
- IP
- Vlan LAN

6.2.2.1 VLAN

VLAN

Ruijie(config)# **interface GigabitEthernet** *Sub_interface_number*	802.1Q
Ruijie((config-subif))# **encapsulation dot1Q** *VlanID*	802.1Q VLAN ID VLANID VLANID

●	●
Ruijie((config-subif))# **ip address** *ip-address mask*	IP

802.1Q IP VLAN VLAN

6.2.3 VLAN

VLAN **debug show**

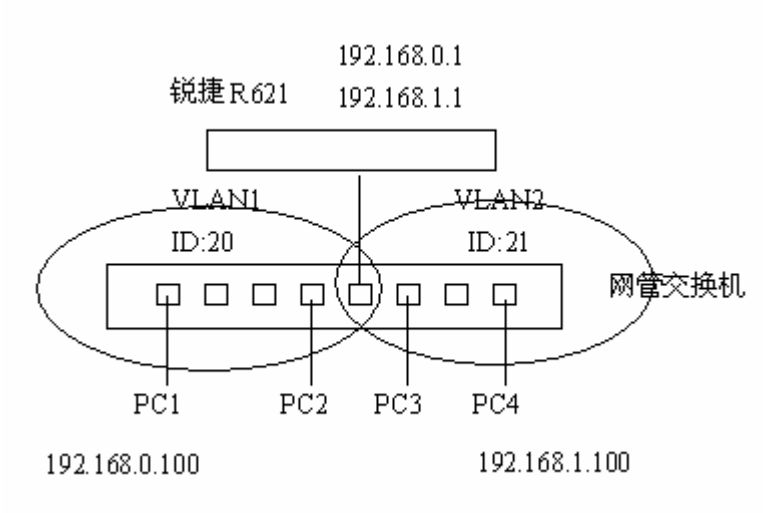
Ruijie# **debug vlan**	vlan
Ruijie# **no debug vlan**	vlan
Ruijie# **show vlans** [*VlanID*]	VLAN
Ruijie# **clear vlan** [*VlanID*]	VLAN

6.2.4 VLAN

●

VLAN VLAN

1. VLAN 192.168.0.0/24 VLAN 192.168.1.0/24
2. ş ẃ Ŗ



3

-

```
hostname "Ruijie"
!
interface gigabitEthernet 0/0
```

7

Loopback( ) NULL( )
Dialer( )

7.1 Loopback

Loopback( ) UP
Loopback Loopback IP
OSPF Telnet Telnet
Loopback

Ruijie(config)# **interface loopback** *loopback-interface-number*	loopback
Ruijie(config)# **no interface loopback** *loopback-interface-number*	loopback

interface loopback *loopback-interface-number*
Loopback Loopback (IP)

Loopback **no interface loopback** *loopback-interface-number* Loopback
show interfaces loopback *loopback-interface-number* Loopback

Ruijie# **show interfaces loopback** *loopback-interface-number*	loopback

show interfaces loopback

```
Ruijie# show interfaces loopback 0
Loopback 0 is UP  , line protocol is UP
Hardware is  Loopback
```

```
Interface address is: no ip address
MTU 1500 bytes, BW 8000000 Kbit
Encapsulation protocol is LOOPBACK, loopback not set
Keepalive interval is 0 sec , no set
Carrier delay is 2 sec
RXload is 1 ,Txload is 1
Queueing strategy: FIFO
Output queue 0/40, 0 drops;
Input queue 0/75, 0 drops
5 minutes input rate 0 bits/sec, 0 packets/sec
5 minutes output rate 0 bits/sec, 0 packets/sec
0 packets input, 0 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 abort
0 packets output, 0 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
```

Loopback IP

MTU Bandwidth

7.2 NULL

NULL( )

NULL( ) UP NULL

NULL

NULL **help** **exit**

NULL

NULL

Ruijie(config)#**ip route** *127.0.0.0 255.0.0.0* **null** *0*

NULL

Ruijie(config)# **interface null** *0*	NULL

NULL “ ” **no interface null** NULL

7.3 Dialer

7.3.1 Dialer

Dialer

Dialer DDR( ) Dialer

Dialer (DDR)

7.3.2 Dialer

interface dialer Dialer

Dialer Dialer **no interface dialer** Dialer Dialer

Ruijie(config)# **nterface dialer** *dialer-number*	Dialer
Ruijie(config)# **no interface dialer** *dialer-number*	Dialer

7.3.3 Dialer

show interfaces dialer Dialer Dialer

Debug

R2501+# **show interfaces dialer** *dialer-number*	Dialer

show interfaces dialer

```
Ruijie# show interfaces dialer 1
dialer 1 is UP  (spoofing) , line protocol is UP  (spoofing)
Hardware is  dialer
Interface address is: 192.168.20.1/24
MTU 1500 bytes, BW 56 Kbit
Encapsulation protocol is SLIP, loopback not set
Keepalive interval is 0 sec , set
Carrier delay is 2 sec
RXload is 1 ,Txload is 1
Queueing strategy: WFQ
```

```
5 minutes input rate 0 bits/sec, 0 packets/sec
5 minutes output rate 0 bits/sec, 0 packets/sec
0 packets input, 0 bytes, 0 no buffer
Received 0 broadcasts, 0 runts, 0 giants
0 input errors, 0 CRC, 0 frame, 0 overrun, 0 abort
0 packets output, 0 bytes, 0 underruns
0 output errors, 0 collisions, 0 interface resets
```

Dialer IP

MTU Bandwidth

7.4

7.4.1

1)

7.4.2

7.4.2.1 ㅅ ㆍ ㄴ "

●

7.4.2.2 ㄲ ㅅ ㅅ

interface gigabitEthernet

no interface gigabitEthernet

IP

Ruijie(config)# **interface gigabitEthernet** *slot-number/interface-number.subinterface-number*	
Ruijie(config)# **no interface gigabitEthernet** *slot-number /interface-number.subinterface-number*	

Slot-number /Interface-number / Subinterface-number

“.”

7.4.3

show interfaces

debug

8

8.1

8.1.1

interface

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

Gigabitethernet 0/1

```
Ruijie(config)# interface gigabitethernet 0/1
Ruijie(config-if)#
```

8.1.2 interface range

8.1.2.1 У ىن ٨

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

GigabitEthernet *slot/*{ *port*} - { *port*}

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

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

< ‰# v â "l K–D Ïî¡ð< b F Þ‰ 2 X W !I Y v ìò "l # X # g‰îíð< b F 5 œ R ØK W # X ` Q xô Ò‰ t O éc %

Ruijie(config)# **define interface-range** *macro_name interface-range*	macro_name 32
Ruijie(config)# **interface range macro** *macro_name*	**interface range**

no define interface-range macro_name

define interface-range

- **vlan** *vlan-ID* - *vlan-ID*, VLAN ID 1 4094
- **GigabitEthernet** *slot*/{ *port*} - { *port*}
- **gigabitethernet** *slot*/{ *port*} - { *port*}

interface range

define interface-range GigabitEthernet1/1-4

```
Ruijie# configure terminal
Ruijie(config)# define interface-range resource
GigabitEthernet 1/1-4
Ruijie(config)# end     T3 1 Tf 0.0228 Tc -2.08 -2.2 Td [(R)6(uiji)6(e# )]TJ /TT4 1 Tf 4.966 0 Td [(c
```

ports1to2N5to7

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

8.1.3

Ruijie(config-if)# **medium-type** { **fiber** | **copper** }	

Gigabitethernet 0/1

```
Ruijie# config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 0/1
Ruijie(config-if)# medium-type fiber
Ruijie(config-if)# end
```

8.1.4

(Description)

Gigabitethernet 1/1 A

“ Port for User A ”

Ruijie(config-if)# **description** *string*	32

Gigabitethernet 0/1

```
Ruijie# config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 0/1
Ruijie(config-if)# description PortForUser A
```

```
Ruijie(config-if)# speed 1000
Ruijie(config-if)# duplex full
Ruijie(config-if)# flowcontrol off
Ruijie(config-if)# end
```

IEEE Master Slave ..

8.1.6 MTU

jumbo MTU

MTU

MTU MTU
MTU

MTU 64~1500 4 1500

SVI MTU

Ruijie(config-if)# **Mtu** *num*	MTU Num <64-1500>

Gigabitethernet 0/1 MTU

```
Ruijie# config terminal
Enter configuration commands, one per line. End with CNTL/Z.
Ruijie(config)# interface gigabitethernet 0/1
Ruijie(config-if)# mtu 64
Ruijie(config-if)# end
```

8.2

show

Ruijie# **show interfaces** [*interface-id*]	
Ruijie# **show interfaces** *interface-id* **status**	
Ruijie# **show interfaces** [*interface-id*] **description**	
[redacted]**rfaces** [redacted]**nters**	0.5%

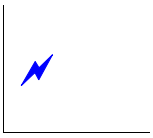
8.3 LinkTrap0.M(0.J []0 d Tf0.0132 Tc 03.0073 503 -20

9

9.1

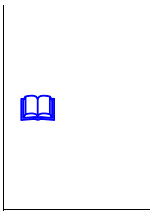
9.1.1

NPE



9.1.2.2 ˜Ω Ю ɔ ⁋

- ✧ Forward forward
- ✧ Sniffer sniffer
- ✧ Bypass bypass



1

2

9.1.2.3 ∧ ϕ̈ Ո ⁋

NPE MGMT

B . 9 ʊ b LJ b א

Step 2	Ruijie(config)# **specify interface** *interface-name* { *lan* | *wan*}	*interface-name* *lan* *wan:*
Step 4	Ruijie(config-if)#**end**	
Step 5	Ruijie# **show running**	

	show sys-mode

1 GigabitEthernet 0/0

```
Ruijie(config)#speranethe.21r6.21eTf.21/00CCCla6.21 10.02 0 3.427 10.02 30.ter1Ö
Ruijie(config)#speranethe.21r6.21eTf.21/00CCCwa6.21 10.02 0 3.427 10.02 30.ter1Ö!5BGigabi
```

	8 4 1 show run xaui-mode slot 0 xaui-mode slot 1 8 2

1 4 1

```
Ruijie(config)#xaui-mode slot 0
Please save the config, and reload NPE60 to take effect!
```

2 4 1

```
Ruijie(config)#no xaui-mode slot 0
Please save the config, and reload NPE60 to take effect!
```

	10.3(4b7) NPE60 V1.0

9.4

Ruijie# **show bridge-map** [*bridge-num*]	
Ruijie# **show sys-mode**	

1 Δ U

LAN: GigabitEthernet 0/0 GigabitEthernet 0/3 GigabitEthernet 0/5

WAN: GigabitEthernet 0/1 GigabitEthernet 0/2 GigabitEthernet 0/4

10

10.1

10.1.1

® NPE40 NPE60

“ ”

Console

MGMT Management

MGMT

10.1.2

MGMT

Console MGMT 100M vs 115200bps

MGMT

MGMT

1 MGMT Telnet

2 MGMT TCP/IPv4 Ethernet II

3 MGMT

IP

10.2

MGMT

ip ref	enable

duplex	auto
speed	auto
flowcontrol	enable

10.3 MGMT

- MGMT IP
- MGMT
-
-

10.3.1 MGMT IP

MGMT IP MGMT IP

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)#**interface mgmt 0**	
Step 3	Ruijie(config-if-Mgmt 0)#**ip address** *ip-address subnet-mask*	IP

MGMT LAN

LAN

MGMT IP

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#interface mgmt 0
Ruijie(config-if-Mgmt 0)#ip address 192.168.1.1 255.255.255.0
```

10.3.2 MGMT

Step 1	Ruijie#**configure terminal**	
Step 2	Ruijie(config)#**interface mgmt 0**	
Step 3	Ruijie(config-if-Mgmt 0)#**gateway** *A.B.C.D*	
Step 4	Ruijie(config-if-Mgmt 0)# **mtu** *mtu-value*	MTU
Step 5	Ruijie(config-if-Mgmt 0)# **speed** {**10** | **100** | **1000** | **auto**}	speed auto
Step 6	Ruijie(config-if-Mgmt 0)# **duplex** { **full** | **half** | **auto** }	duplex auto
Step 7	Ruijie(config-if-Mgmt 0)# **flowcontrol**	enable
Step 8	Ruijie(config-if-Mgmt 0)# **description** *text*	
Step 9	Ruijie(config-if-Mgmt 0)#**shutdown**	MGMT

- **ping oob**

Ruijie#**ping oob** *host*	ICMP echo request

```
#          MGMT                192.168.1.2
Ruijie# ping oob 192.168.1.2
Sending 5, 100-byte ICMP Echos to 192.168.1.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent, round-trip min/avg/max = 4/4/4 ms
```

- **traceroute oob**

Ruijie#**traceroute oob** *host*	

```
Password:
```

- **sntp enable oob**

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **sntp enable oob**	SNTP

```
#              SNTP
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#sntp enable oob
```

10.3.4

copy *url* **tftp** TFTP **oob_tftp**

Ruijie#**copy** *source-url destination-url*	*source-url* *destination-rul*

```
#
Ruijie#copy oob_tftp://192.168.1.2/ngsa-compress.bin flash:file.bin
Accessing tftp://192.168.1.2/ngsa-compress.bin...
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!
Success : Transmission success,file length 1183856
```

11 LINE

11.1

LINE

- LINE
- / LINE VTY
- LINE

11.2 LINE

11.2.1 LINE

LINE LINE LINE

LINE

Ruijie(config)# **line** [**aux** | **console** | **tty** | **vty**]

firsyTf0.04 TTc0 Tr 2.060213 Tc 0.57 0 Td[(t)6(y)18(p)7(e)]TJ/TT0 1 Tf0.0202 Tc 1.57 0 Td[(g14 TE13 Tc 0.57

LINE

VTY TTY

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

11.2.4 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

12

12.1

DLDP

DLDP

arp

mac شج شج mac

mac شج

ICMP echo

UP echo

ذَ

DLDP / arp icmp echo

icmp echo ذَ dldp

12.2

12.2.1

-
- ip
- interval

- retry

12.2.2

Ruijie(config-if)#**dldp ip [nexthopip]**	

---

1) ICMP ECHO ICMP

2) up

3) down

4) ip

12.2.3 interval

Ruijie(config-if)# **dldp ip interval val**	

12.3 retry

Ruijie(config-if)# **dldp ip retry val**	

12.4 /

Ruijie(config-if)# **dldp passive**	

13

13.1 PPPOE

13.1.1 PPPOE

PPP(PPPOE PPP over Ethernet) DDR

DDR

PPPOE DDR(DDR Profiles)

13.1.2 PPPOE

PPPOE PPPOE

-
-
-

13.1.2.1 Л∪ ∧

- PPPOE
-

no shutdown

PPPOE

Ruijie(config-if)# **pppoe enable**	PPPOE

PPPOE DDR Profiles

DDR Profiles

Ruijie(config-if)# **pppoe-client dial-pool-number** *pool-number* **dial-on-demand**	(, pppoe)

Ruijie(config-if)# **pppoe-client dial-pool-number pool-number no-ddr**	, (, pppoe)

dail-on-demand no-ddr dail-on-demand PPPOE DDR
, DDR
no-ddr pppoe , pppoe .

13.1.2.2 ٨

PPPOE PPP PPPOE

Ruijie(config)# **interface dialer** *dialer-number*	
Ruijie(config-if)# **ip address negotiate**	
Ruijie(config-if)# **dialer pool** *pool-number*	
Ruijie(config-if)# **dialer idle-timeout** *seconds*	
Ruijie(config-if)# **encapsulation ppp**	PPP PPPOE PPP
Ruijie(config-if)# **mtu** *1488*	 1488
Ruijie(config-if)# **dialer-group** *dialer-group-number*	dialer-list

Ruijie(config-if)# **ppp pap sent-username** *username* **password** *password*	

MTU

1488

PPPoE IP

clear pppoe tunnel PPPoE

13.1.2.3 ώ ٧

PPPOE

-
-

PPPOE NAT

13.1.3 PPPOE

PPPOE, EXEC

Ruijie# **show pppoe** {**tunnel** | **session**}	tunnel session
Ruijie# **show interfaces dialer** *dialer-number*	IP
Ruijie# **debug pppoe** {**datas**|**errors**|**events**|**packets** }	PPPOE

13.1.4 PPPOE

-

PPPOE

1. 5 5
2. pppoe pppoe
3. NAT 192.168.0.0/24

-

```
!
hostname "Ruijie"
!
ip subnet-zero
#     PPPOE,                  10
interface GigabitEthernet0/0
no ip address
duplex auto
pppoe enable
pppoe-client dial-pool-number 10 dial-on-demand
```

```
#
interface GigabitEthernet0/1
ip address 192.168.0.1 255.255.255.0
ip nat inside
ip mtu 1488
duplex auto
speed auto

#
interface Dialer1
ip address negotiate
mtu 1488
encapsulation ppp
ip nat outside
dialer pool 10                                  //          10
dialer-group 1
dialer idle-timeout 300                                 //5
ppp pap sent-username pppoe password 0 pppoe
!
ip nat inside source list 1 interface Dialer1
3CT*m4alet(1 )6plertarn
ip(ro)6(nte)6 100.0(0.)6( Dd)6(ia)6(le(1 1096( )]TJ0.017 Tc 0 -1.543 TD(! )T



!
```

Ь ᛙ ᛚ IP سم فخ ᑎ ᒪ

14 IP

14.1 IP

14.1.1 IP

IP 32

8 0~255 “ . ” “ 192.168.1.1 ”

IP

IP IP 32

“ 1111 ” E

IP IP

IP

IP

B	172.16.0.0~172.31.255.255	16 B
C	192.168.0.0~192.168.255.255	256 C

IP TCP/UDP RFC 1166

14.1.2 IP

IP

- IP
- ARP
- IP ..

IP

14.1.2.2 فذ سم ~ ^ ARP~

IP 1

MAC MAC MAC IP
2 IP

14.1.2.2.2 ARP

ARP Ethernet II ARPA

14.1.2.2.3 ARP

ARP IP MAC
ARP ARP
ARP

ARP

Ruijie(config-if)# **arp timeout** *seconds*	ARP 0-2147483 0
Ruijie(config-if)# **no arp timeout**	

3600 1

14.1.2.3 Ω IP

IP IP
IP

IP

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

14.1.2.4

1
“ 1 ”

IP

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

14.1.3 IP

-
-

14.1.3.1 ă Ո ą̈

1) ARP

2) IP

3)

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

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

14.1.4 IP

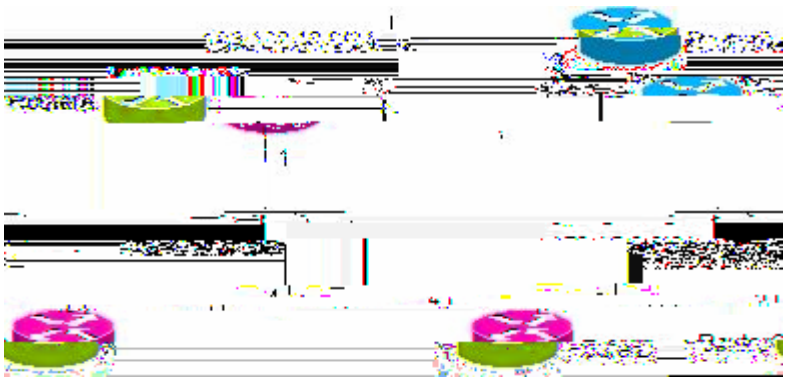
IP

- IP

14.1.4.1 IP فخ سم R

-

IP 1



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

B :

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

14.2 IP

14.2.1 IP

IP

- IP

14.2.2 IP

IP IP ICMP
ICMP ICMP
RFC 792

IP

- ICMP
- ICMP
- ICMP
- IP MTU
- IP

14.2.2.1 ŭ ICMP a ⅃

IP

14.2.2.3 ǔ ICMP

ICMP ICMP

ICMP

ICMP

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

14.2.2.4 IP MTU

MTU MTU

MTU MTU IP MTU IP MTU
MTU IP MTU MTU

MTU

IP MTU

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

14.2.2.5 IP

IP IP IP
RFC 791

ICMP IP

IP

15 IPv4

15.1 IPv4

15.1.1 IPv4

(Prefix Tree+Adjacency) Ruijie Express Forwarding REF REF Cache CPU Cache CPU

REF

- Prefix Tree

IP

Prefix Tree Radix Tree M-Tries Tree M-Tries Tree Prefix Tree Radix Tree Prefix

- Adjacency

REF

1) REF

2) Prefix Tree

3)

15.2

NPE

15.3

IP REF

IP/MASK

IP

IP

1. IP IP IP

2. IP IP IP IP IP

3. IP IP IP

IP

REF

Ruijie# **show ip ref packet-statistic** [**clear**]	/ REF

15.4.2

Ruijie# **show ip ref adjacency** [**glean** | **local** | *ip* | (**interface** *interface_type interface_number*) | **statistic**]	IP

15.4.3

IP IP IP
IP IP
CPU

Ruijie# **show ip ref exact-route** [**vrf** vrf_name] source-ipaddress dest_ipaddress	

15.4.4

Ruijie# **show ip ref route** [**vrf** *vrf_name*] [**default** | (*ip mask*) | **statistic]**	0

16 NAT

16.1 NAT

NAT( )

- NAT
- NAPT
- NAT
- TCP
- NAT
- NAT
- NAT

16.1.1 NAT

NAT IP
IP NAT
NAT
NAT
NAT NAT

Inside outside

NAT

NAT

Step 1	Ruijie(config)# **ip nat pool** *address-pool start-address end-address* {**netmask** *mask* | **prefix-length** *prefix-length*}	IP
Step 2	Ruijie(config)# **access-list** *access-list-number* **permit** *ip-address wildcard*	
Step 3	Ruijie(config)# **ip nat inside source list** *access-list-number* **pool** *address-pool* [**vrf** vrf_*name*]	
Step 4	Ruijie(config)# **interface** *interface-type interface-number*	
Step 5	Ruijie(config-if)# **ip nat inside**	
Step 6	Ruijie(config)# **interface** *interface-type interface-number*	
Step 7	Ruijie(config-if)# **ip nat outside**	

16.1.2 NAPT

NAT

NAPT( )

NAPT NAPT NAPT NAPT

Step 1 Ruijie(config)# **ip nat inside source static** {**UDP** | **TCP**} *local-address port global-address port* [**permit**-**inside**] [**vrf** vrf_*name*]

IP

IP

NAT

NAT

NAT 1)

2)

NAT NAT

NAT

Step 1	Ruijie(config)# **ip nat outside source static** *global-address local-address* [vrf vrf_*name*]	
Step 2	Ruijie(config)# **interface** *interface-type interface-number*	
Step 3	Ruijie(config-if)# **ip nat inside**	
Step 4	Ruijie(config)# **interface** *interface-type interface-number*	
Step 5	Ruijie(config-if)# **ip nat outside**	

16.1.4 TCP

TCP TCP

NAT TCP NAT TCP

Ruijie(config)# **ip nat pool** *address-pool start-address end-address* {**netmask** *mask* | **prefix-length** *prefix-length*}	IP
Ruijie(config)# **access-list** *access-list-number* *permit ip-address* **wildcard**	IP ACL
Ruijie(config)# **ip nat inside destination list** *access-list-number* **pool** *address-pool* [**vrf** vrf_*name*]	

Ruijie(config)# **interface** *interface-type interface-number*	
Ruijie(config-if)# **ip nat inside**	
Ruijie(config)# **interface** *interface-type interface-number*	
Ruijie(config-if)# **ip nat outside**	

16.1.5

NAT NAT

Ruijie(config)# **ip nat translation dns-timeout** *seconds*	DNS 60
Ruijie(config)# **ip nat translation finrst-timeout** *seconds*	TCP FIN RESET 60 NPE80
Ruijie(config)# **ip nat translation icmp-timeout** *seconds*	ICMP 60

Ruijie(config)# **ip nat translation**

16.1.6.1 ╟ ϙ فخسم R

NAT Net200
200.168.12.2~200.168.12.100 1 NAT

```
!
interface GigabitEthernet 0/0
ip address 192.168.12.1 255.255.255.0
ip nat inside
!
interface GigabitEthernet 1/0
ip address 200.168.12.1 255.255.255.0
ip nat outside
!
ip nat pool net200 200.168.12.2 200.168.12.100 netmask 255.255.255.0
ip nat inside source list 1 pool net200
!
access-list 1 permit 192.168.12.0 0.0.0.255
```

16.1.6.2 ϙ ώ فخسم R

NAPT 8.1 NAT
NAPT NAT Net200
200.168.12.200 IP 1
NAT

```
!
interface GigabitEthernet 0/0
ip address 192.168.12.1 255.255.255.0
ip nat inside
!
interface GigabitEthernet 1/0
ip address 200.168.12.200 255.255.255.0
ip nat outside
!
ip nat pool net200 200.168.12.200 200.168.12.200 netmask 255.255.255.0
ip nat inside source list 1 pool net200
access-list 1 permit 192.168.12.0 0.0.0.255
```

NAT

```
Ruijie# show ip nat translations
```

```
Pro Inside global     Inside local      Outside local     Outside
global
tcp 200.168.12.200:2063 192.168.12.65:2063 168.168.12.1:23
168.168.12.1:23
```

16.1.6.3 ϙ فذسم NAPT R

NAPT NAT

NAPT

WEB 192.168.12.3 IP200.198.12.1 80

```
!
interface GigabitEthernet 0/0
ip address 192.168.12.1 255.255.255.0
ip nat inside
!
interface GigabitEthernet 1/0
ip address 200.198.12.1 255.255.255.0
ip nat outside
!
ip nat inside source static tcp 192.168.12.3 80 200.198.12.1 80
```

16.1.6.4 TCP ك R

TCP

Realhosts

1

TCP NAT ACL

IP ACL

```
!
interface GigabitEthernet 0/0
ip address 10.10.10.1 255.255.255.0
ip nat inside
!
interface GigabitEthernet 1/0
ip address 200.198.12.1 255.255.255.0
ip nat outside
!
```

```
ip nat pool realhosts 10.10.10.2 10.10.10.3 netmask 255.255.255.0 type
rotary
ip nat inside destination list 100 pool realhosts
!
access-list 100 permit ip any host 10.10.10.100
!
```

NAT

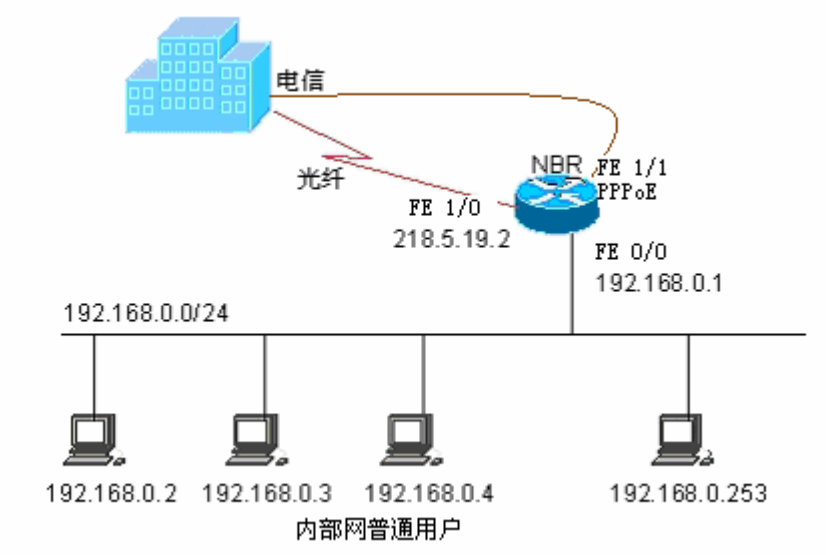
```
Ruijie# sh ip nat translations
Pro Inside global   Inside local    Outside local          Outside global
tcp 10.10.10.100:23 10.10.10.2:23  100.100.100.100:1178
100.100.100.100:1178
tcp 10.10.10.100:23 10.10.10.3:23  200.200.200.200:1024
200.200.200.200:1024
```

16.1.6.5 NAT э outside ∧ ⅋ R

WAN NAT Outside WAN
WAN

NAT **ip default-route balance by-source**
Outside NBR1000 WAN
NBR1000

1. Interface GigabitEthernet 1/0 100M IP
2. Interface GigabitEthernet 1/1 1M ADSL PPPoE



1

```
dialer idle-timeout 1200
dialer-group 1
#     1M      Kbits
bandwidth 1000
!
#     NAT            NAT       Outside       Outside      GigabitEthernet 1/0
      218.5.19.2           Outside      Dialer 1    PPPoE                Dialer

ip nat pool nbr_setup_build_pool prefix-length 24
address 218.5.19.2 218.5.19.2 match interface GigabitEthernet 1/0
address interface dialer 1 match interface dialer 1
#     NAT
ip nat inside source list 99 pool nbr_setup_build_pool
#                WAN
ip route 0.0.0.0 0.0.0.0 GigabitEthernet 1/0 202.101.98.1
ip route 0.0.0.0 0.0.0.0 dialer 1
!
```

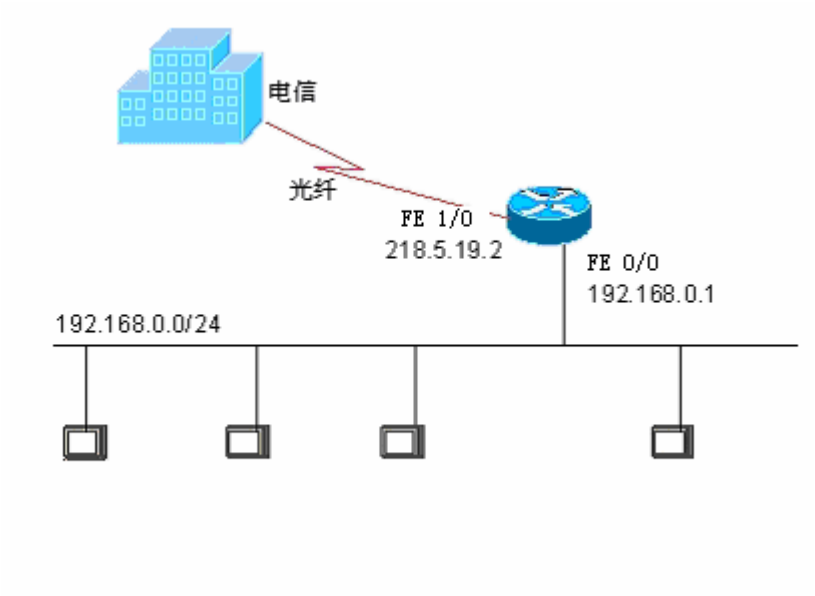
16.1.6.6 سم لا R

2 (FTP

WEB E-MAIL)

Internet

NAT NAT



2

NAT

```
#
Ruijie> enable
#
Ruijie# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
#     WAN0
Ruijie(config)#interface GigabitEthernet 1/0
#     WAN
Ruijie(config-if)# ip address 218.5.19.2 255.255.255.0
#     WAN              Internet
Ruijie(config-if)# ip nat outside
#     WAN
Ruijie(config-if)# no shut
#
Ruijie(config-if)# end
Ruijie#
#                          WAN          UP     (          ).
%LINK CHANGED: Interface GigabitEthernet 1/0, changed state to up
```

```
%LINE PROTOCOL CHANGE: Interface GigabitEthernet 1/0, changed state to
UPRuijie# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
#     LAN
Ruijie(config)# interface GigabitEthernet 0/0
#     LAN
Ruijie(config-if)# ip address 192.168.0.1 255.255.255.0
#     LAN              Intranet
Ruijie(config-if)# ip nat inside
#     LAN
Ruijie(config-if)# no shut
Ruijie(config-if)# end
Ruijie#
%LINK CHANGED: Interface GigabitEthernet 0/0, changed state to up
%LINE PROTOCOL CHANGE: Interface GigabitEthernet 0/0, changed state to
UP
Ruijie# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
#                  Internet
Ruijie(config)# ip route 0.0.0.0 0.0.0.0 GigabitEthernet 1/0 218.5.19.1
#     NAT
Ruijie(config)# access-list 1 permit any
#
Ruijie(config)#ip nat inside source list 1 interface GigabitEthernet 1/0
#     FTP
Ruijie(config)# ip nat inside source static tcp 192.168.0.2 20 218.5.19.2
20
Ruijie(config)# ip nat inside source static tcp 192.168.0.2 21 218.5.19.2
21
#     WEB
Ruijie(config)# ip nat inside source static tcp 192.168.0.3 80 218.5.19.2
80
#     EMAIL
Ruijie(config)# ip nat inside source static tcp 192.168.0.4 25 218.5.19.2
25
```

```
Ruijie(config)# ip nat inside source static tcp 192.168.0.4 110
218.5.19.2 110
Ruijie(config)# end
Ruijie#
Ruijie# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
```

Telnet

```
Ruijie(config)# line vty 0 4
Ruijie(config-line)# password remoteuser
Ruijie(config-line)# end
Ruijie#
Ruijie# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# enable secret private
```

#

```
Ruijie(config)# host NBR
RUIJIE(config)# end
RUIJIE#
```

#

```
RUIJIE# write
Building configuration...
[OK]
RUIJIE#
```

#

```
RUIJIE# show running-config
Building configuration...
Current configuration:
!
!
hostname NBR
!
!
!
access-list 1 permit any
!
!
interface GigabitEthernet 0/0
ip address 192.168.0.1 255.255.255.0
ip nat inside
```

```
!
interface GigabitEthernet 1/0
ip address 218.5.19.2 255.255.255.0
ip nat outside
!
ip nat inside source list 1 interface GigabitEthernet 1/0
ip nat inside source static tcp 192.168.0.4 110 218.5.19.2 110
ip nat inside source static tcp 192.168.0.4 25 218.5.19.2 25
ip nat inside source static tcp 192.168.0.3 80 218.5.19.2 80
ip nat inside source static tcp 192.168.0.2 21 218.5.19.2 21
ip nat inside source static tcp 192.168.0.2 20 218.5.19.2 20
!
ip route 0.0.0.0 0.0.0.0 GigabitEthernet 1/0 218.5.19.1
!
line con 0
line vty 0 4
password remoteuser
login
!
end
RUIJIE#
```

16.1.6.7 vrf Ю nat

vrf nat vrf

nat vrf

```
access-list 1 permit 192.168.12.0 0.0.0.255

ip vrf 1

ip vrf 2

interface GigabitEthernet 0/0
ip vrf forward 1
ip address 192.168.12.1 255.255.255.0
ip nat inside
!
interface GigabitEthernet 0/1
ip vrf forward 1
ip address 100.168.12.200 255.255.255.0
ip nat outside
```

```
!
interface GigabitEthernet 1/0
ip vrf forward 2
ip address 192.168.12.1 255.255.255.0
ip nat inside
!
interface GigabitEthernet 1/1
ip vrf forward 2
ip address 200.168.12.200 255.255.255.0
ip nat outside
!
ip nat pool net100 100.168.12.200 100.168.12.200 netmask 255.255.255.0
ip nat pool net200 200.168.12.200 200.168.12.200 netmask 255.255.255.0

ip nat inside source list 1 pool net100 vrf 1
ip nat inside source list 1 pool net200 vrf 2
```

NAT

```
Ruijie# show ip nat translations vrf 1
Pro Inside global     Inside local      Outside local     Outside
global
tcp 100.168.12.200:2063 192.168.12.65:2063 168.168.12.1:23
168.168.12.1:23
Ruijie# show ip nat translations vrf 2
Pro Inside global     Inside local      Outside local     Outside
global
tcp 200.168.12.200:2063 192.168.12.65:2063 168.168.12.1:23
168.168.12.1:23
```

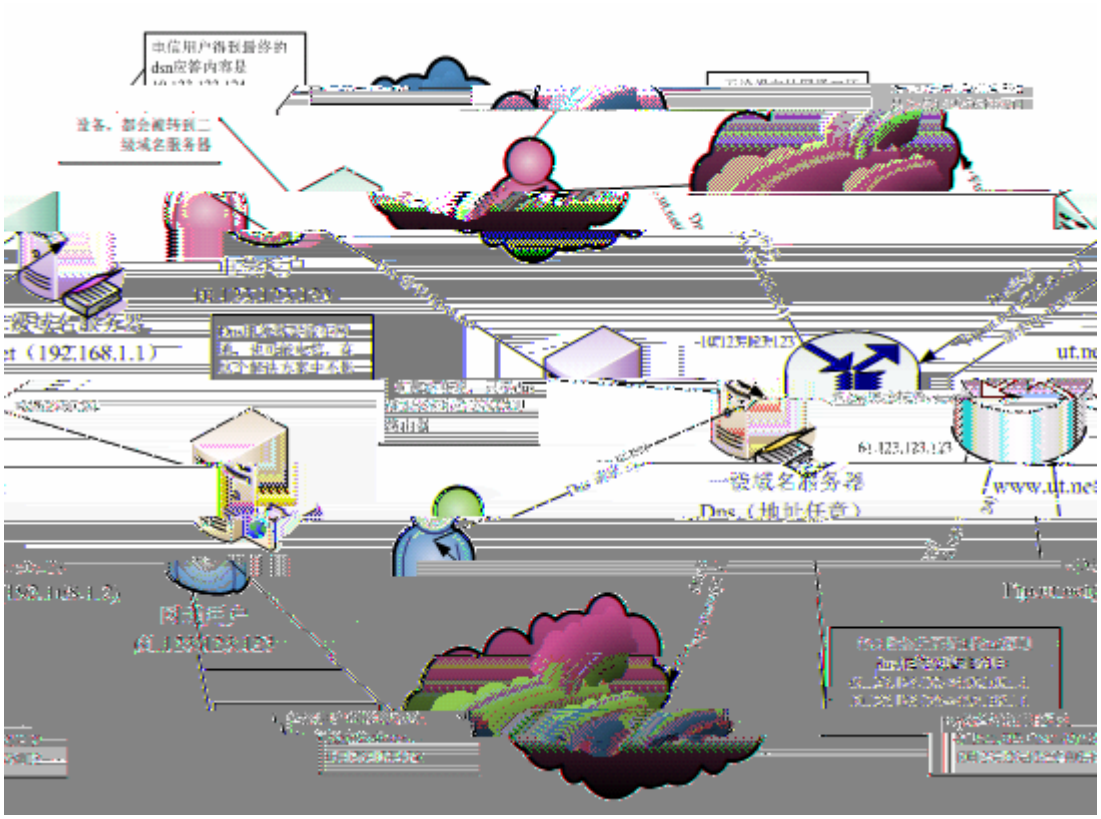
16.1.6.8 ϙ فذسم NAT R

```
ip nat outside
!
ip nat inside source static 192.168.12.0 200.198.12.0 netmask
255.255.255.0
```

16.1.6.9 NAT DNS

NAT dns alg dns DNS
ISP
DNS

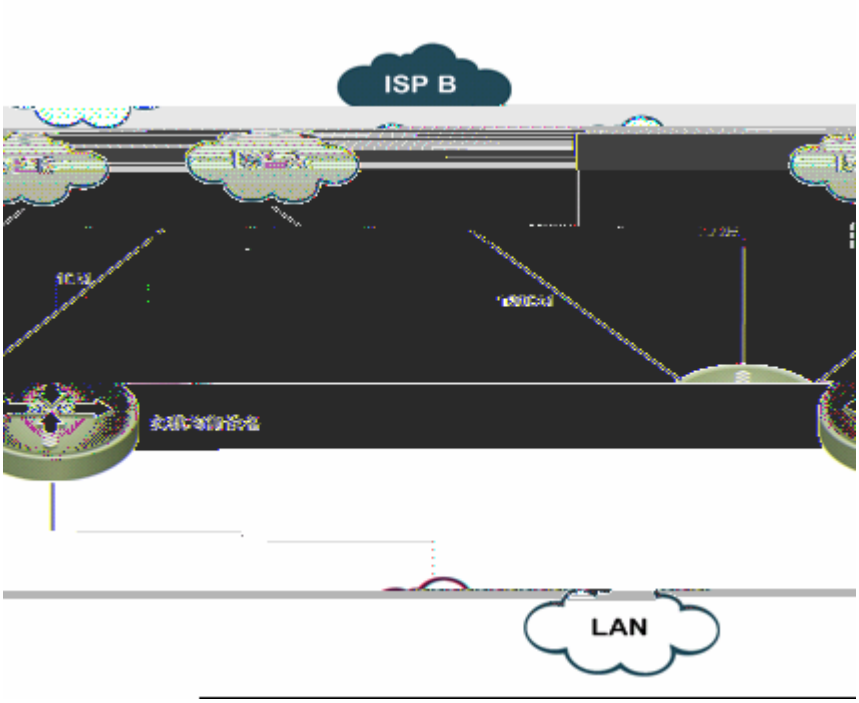
1. ftp
2. dns
3. DNS
4. DNS
5. DNS



```
interface GigabitEthernet 0/0
 ip address 10.123.123.123 255.255.255.0
 ip nat outside
 duplex auto
 speed auto
 description
interface GigabitEthernet 0/1
 ip address 61.123.123.123 255.255.255.0
 ip nat outside
 duplex auto
 speed auto
 description
interface GigabitEthernet 0/2
 ip address 192.168.1.254 255.255.255.0
 ip nat inside
 duplex auto
 speed auto
 description
 /*dns          */
 ip nat inside source static 192.168.1.1 61.123.123.123
 /*                    */
 ip nat inside source static 192.168.1.2 10.123.123.124 match gigabitEthernet 0/0
 /*                    */
 ip nat inside source static 192.168.1.2 61.123.123.124 match gigabitEthernet 0/1
```

17

17.1



1.

17.1.1

2 /

17.1.2

17.1.2.1

17.1.2.2

17.1.2.3

/

17.1.2.4 ⅋

17.1.3

WCMP

17.2

17.3

- /
-
-
-
-
- IP

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface fastEthernet 0/1
Ruijie(config-if)# no bandwidth
```

17.3.3

1 100.

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **mllb threshold** *percent*	*percent* 1-100
	Ruijie(config)# **no mllb threshold**	100

95

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# mllb threshold 95
```

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# no mllb threshold
```

17.3.4

4

.

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **mllb policy** { **bandwidth** | **latency** | **load** | **intelligent** }	/ / /
	Ruijie(config)# **no mllb policy**	

bandwidth

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

17.3.5

intelligent

IP

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **mllb load-sharing original**	IP
	Ruijie(config)# **no mllb load-sharing original**	

```
Ruijie# exit
#       2
Ruijie(config)# interface gigabitEthernet 0/3
Ruijie(config-if)# bandwidth 10000
Ruijie# exit
3
#                  bandwidth
Ruijie(config)#mllb policy bandwidth
4
#               95
Ruijie(config)# mllb threshold 95
```

Й ˈ ǂ ني

18

18.1

18.1.1

vlan IP IP

18.1.2

vlan tag IP

IP vlan

18.1.2.1 vlan

ﺱ ٚ ﻟ

18.1.2.3

ip

18.2

18.3

-

18.3.1

Ruijie# **configure terminal**	
Ruijie(config)# **layer23 classify enable**	
Ruijie(config)#**end**	
Ruijie# **show running**	

no layer23 classify enable

#

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#layer23 classify enable
Ruijie(config)#end
```

18.4 vlan

- vlan

18.4.1 vlan

vlan vlan

vlan-group	police_flow	police_url	flow	vlan id
any	9	0	0	

ip mac

/group1 user3 192.168.199.1 00-d0-f8-21-da-29

“ userfile ”

Ruijie# **subscriber import txt** userfile

18.6.3

18.8

- _____

18.8.1

Step 1	Ruijie#**configure terminal**	
Step 2	Ruijie(config)# **network-group name** *name* **{ip-host** *ip-addr* **| ip-subnet** *subnet mask* **| ip-range** *start end***] }**	
Step 3	Ruijie(config)#**end**	
Step 4	Ruijie#**show network-group**	

no network-group *name*

ip ip ip ip

“ / ”

ip

“ / ”

ip network1 192.168.196.0

```
Ruijie#configure terminal
Ruijie(config)# network-group name network1 ip-subnet 192.168.196.0
255.255.255.0
Ruijie(config)#end
```

18.9

Ruijie# **show network-group** [*name*]	show network-group

#

```
Ruijie#show network-group
network-group police_flow police_url    flow          ip
------------          -------          --------       ------       ----------
/                     9                0              351
network1              0                2              0            192.168.197.3
network2              0                0              0            192.168.197.1
network3              0                0              0            192.168.197.2
```

19

19.1

19.1.1

19.1.2

19.1.2.1

17 17 “ ” “ "IP
” “ ” “ ” “ P2P ” “ ”
“ ” “ ” “ ” “ ” “ ”
“ ” “ ” “ ” “ RFC ” “ HTTP ” “
”

show identify-application group-state

1

QQ QQ

QQ

QQ

Q= “ ض / & & .48B2-228BT /C20 1 Tf 10.02 0.5 0 0 10.0

19.3.1

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **identify-application enable**	
Step 4	Ruijie(config)#**end**	
Step 5	Ruijie#**show running**	

no identity-application enable

#

19.3.3

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **identify-application custom name** *app-name* **class** *class-name* **{tcp|udp} sport** *sport-low sport-high* **dport** *dport-low dport-high*	app-name class-name class-name app-name sport-low 0-65535 any sport-high 0-65535 any dport-low 0-65535 any dport-high 0-65535 any sport-low sport-high dport-low dport-high sport sport dport dport
Step 4	Ruijie(config)#**end**	
Step 5	Ruijie#**show identify-application userdef-rule**	

no identify-application custom name *app-name* **class** *class-name* **{tcp|udp} sport** *sport-low sport-high* **dport** *dport-low dport-high*

1	app-name app-class
2	app-name app-class

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# identify-application custom name        class
   tcp sport 1 10 dport 1 100
Ruijie#end
Ruijie#*Jan 11 17:25:29: %SYS-5-CONFIG_I: Configured from console by
console
```

```
Ruijie#show identify-application userdef-rule
TYPE  NAME              CLASS             SPL    SPH    DPL    DPH
TCP                                       1      10      1      100


#
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# identify-application custom name myqq class im  udp
sport 1 10 dport any any
Ruijie#end
Ruijie#*Jan 11 17:25:29: %SYS-5-CONFIG_I: Configured from console by
console
Ruijie#show identify-application userdef-rule
TYPE  NAME              CLASS             SPL    SPH    DPL    DPH
TCP                                       1      10     1      100
UDP   myqq
```

tunnel	Tunnel software
video	Video software

db
email
file-trans
game
http-app HTTP
im
ipphone IP
network-management
other
p2p P2P
remote-access
rfc RFC
route
security
stock
tunnel
video

19.3.4

no identity-application key *app-name*

FTP

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# identify-application key FTP
Ruijie(config)#
```

19.3.5

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **identify-application inhibitive** *app-name*	app-name
Step 4	Ruijie(config)#**end**	
Step 5	Ruijie#**show identity-application inhibitive**	

no identity-application inhibitive *app-name*

QQ

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# identify-application key QQ
Ruijie(config)#
```

19.3.6

show identify-application version	
show identity-application userdef-rule	
show identity-application	

show identity-application key	
show identity-application inhibitive	
show identity-application class	
show identity-application group-state	

```
#
Ruijie# show identify-application custom version
 Version  1.0
Date  2010-1-8
#
Ruijie#show identify-application userdef-rule
TYPE  NAME              CLASS             SPL    SPH    DPL    DPH
TCP                                       1      10     1      100
UDP   myqq                                1      10     any    any
#
Ruijie#show identity-application
any 255-4095-63-48
              1-0-0-0
              1-1-0-0
       MSN 1-6-0-0
           MSN-CHAT 1-6-1-0
           MSN-AUDIO 1-6-2-0
           MSN-FILE 1-6-3-0
           MSN-    1-6-4-0
           MSN-    1-6-5-0
          QQ 1-7-0-0
           QQ-CHAT 1-7-1-0
           QQ-    1-7-2-0
           QQ-        1-7-3-0
           QQ-        1-7-4-0
           QQ-    1-7-5-0
           QQ-    1-7-14-0
       WEBIM 1-9-0-0
           MSN-WEBIM 1-9-1-0
           YAHOO-WEBIM 1-9-2-0
```

```
#
Ruijie#show identity-application key
IP
    QQ
MSN
FTP
#
Ruijie#show identity-application inhibitive




#
Ruijie#show identity-application class
           1-0-0-0
IP        2-0-0-0
           3-0-0-0
             4-0-0-0
P2P
                                                                    14 4-0-0
```

```
app group state: on  //on
```

19.4

20

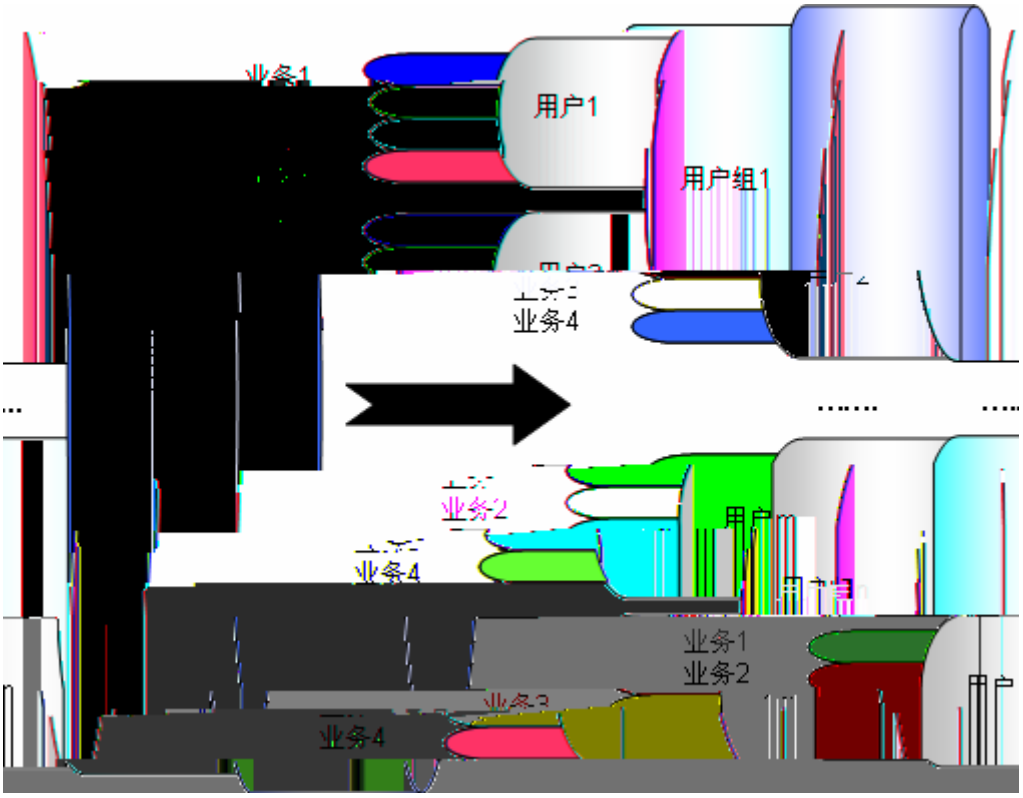
20.1

20.1.1

(Flow Control)

P2P

20.1.2



20.1.2.1 [8]

20.1.2.1.1

1.
2.

20.1.2.1.2

cir **pir** **pir** **cir**
cir **pir** **pir**
cir

SFQ Per-net

Per-net

SFQ 128

- _____
- _____

20.3.1

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)#**flow-control** *Name*	
Step 3	Ruijie# **show running**	

no flow-control *Name*

🕮	10

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# flow-control DianXin
Ruijie(config-flow-control))# end
```

20.3.2

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **flow-control** *Name*	
Step 3	Ruijie(config-flow-control)# **exit**	**flow-control**
Step 4	Ruijie(config)#**interface Gi** *0/1*	
Step 5	Ruijie(config-if-GigabitEthernet 0/1)# **flow-policy** *Name*	Gi 0/1
Step 6	Ruijie(config-if-GigabitEthernet 0/1)# **end**	
Step 7	Ruijie# **show running**	

ض

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# flow-control DianXin
Ruijie(config-flow-control)# channel-tree inbound
Ruijie(config-channel-tree)#exit
Ruijie(config-flow-control)# channel-tree outbound
Ruijie(config-channel-tree)#end
```

20.3.4

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)#**flow-control** *Name*	
Step 3	Ruijie(config-flow-control)# **channel-tree inbound**	
Step 4	Ruijie(config-channel-tree)# **channel-group** *name* **parent** {**NULL** | *parent_name*} **cir** *cir_num* **pir** *pir_num* [**pri** *pri_num*] [**schedule-type** {**fifo** | **sfq** | **per-net per-mask** *mask* **per-cir** *pcir_num* **per-pir** *ppir_num* **limit** *limit_num*}]	
Step 6	Ruijie(config-channel-tree)#**end**	
Step 7	Ruijie# **show running**	

channel-tree **no channel-group** *Name*

1. **cir** **pir**
2. **cir** **cir** **cir** **cir** **pir** **pir** **pir**
3. **sfq** **per-net**
4. **per-net** **limit** **per-net** **limit**

root

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# flow-control DianXin
Ruijie(config-flow-control)# channel-tree inbound
Ruijie(config-channel-tree)# channel-group root parent null cir 100000
pir 100000 pri 4 schedule-type fifo
Ruijie(config-channel-tree)# end
```

20.3.5

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)#**flow-control** *Name*	
Step 3	Ruijie(config-flow-control)# **channel-tree inbound**	
Step 4	Ruijie(config-channel-tree)# **channel-default** *channel*	
Step 6	Ruijie(config-channel-tree)#**end**	
Step 7	Ruijie# **show running**	

channel-tree **no channel-default**

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)#**flow-control** *Name*	
Step 3	Ruijie(config-flow-control)# **flow-rule** *num* **vlan-group** *vlan-group-name* **subscriber** *subscriber-name* **network-group** *network-group-name* **app-group** *app-group-name* **time-range** *time-rang-name*	
Step 4	Ruijie(config-flow-control)# **flow-rule** *num* **session-limit** *session-num* **action {drop | log-drop | pass [in-channel** *in-channel-name***] [out-channel** *out-channel-name***]} [commet** *string***]**	
Step 6	Ruijie(config-flow-control)#**end**	
Step 7	Ruijie# **show running**	

flowl-control **no flow-rule** *num*

3M 300

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# flow-control DianXin
Ruijie(config-flow-control)# flow-rule 1 vlan-group any subscriber
        network-group any time-range any
Ruijie(config-flow-control)# flow-rule 1 session-limit 300 action pass
out-channel          3M
Ruijie(config-flow-control)# end
```

20.3.7

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)#**flow-control** *Name*	
Step 3	Ruijie(config-flow-control)# **change-priority rule1** *rule1-pri-num* **rule2** *rule2-pri-num*	Name 1 2
Step 4	Ruijie(config-flow-control)#**end**	
Step 5	Ruijie# **show running**	

show flow-control-policy rule

Pri_num

1 2 1 2

1 2

```
Ruijie# configure terminal
```

```
root                              1000000   1000000   4     fifo

#
Ruijie#show flow-control test inbound
group-name                        cir      pir      pri  schedule
--------------------------------- -------- -------- ---- --------
root                             1000000  1000000  4    fifo
part1                            700000   1000000  4    fifo
part2                            200000   1000000  4    fifo
part3                            100000   1000000  4    fifo
```

20.5

Ruijie(config)# **show flow-control-policy** *group*	

```
#
Ruijie#show flow-control-policy group
group_name                        group_id  apply_ifx    policy_entries
group1                            0         6            14
group2                            1         0            4
```

20.6

Ruijie(config)# **show flow-control-policy rule [group** *name***]**	

```
#
Ruijie#show flow-control-policy rule
Pri_num grp_id rule_num ifx   vlan_id    subs_id    net_wk_id  app_id
ichl_id ochl_id ses_num ses_lim effec
1       0       1         0      0          814695740   0          0
NA      2       0        2000    0
```

```
2       0       2         0     18661884    18577704    18577496   0
1       NA      0        2000     0
3       1      3           6       18661884      18577704     18577496
4294967290
1       1       0        2000     1
#
Ruijie#show flow-control-policy rule group DianXin
Pri_num grp_id rule_num ifx   vlan_id    subs_id    net_wk_id  app_id
ichl_id ochl_id ses_num ses_lim effec
1       0       1         0      0          814695740   0          0
NA      2       0        2000     0
2       0       2         0     18661884    18577704    18577496   0
1       NA      0        2000     0
```

20.7

```
#
Ruijie(config)# flow-control Corp
#
Ruijie(config-flow-control)# channel-tree inbound
Ruijie(config-channel-tree)# channel-group root parent null cir 10000
pir 10000 pri 4 schedule-type fifo
Ruijie(config-channel-tree)# channel-group department1 parent root cir
5000 pir 10000 pri 4 schedule-type fifo
Ruijie(config-channel-tree)# channel-group department2 parent root cir
3000 pir 10000 pri 4 schedule-type fifo
Ruijie(config-channel-tree)# channel-group department3 parent root cir
2000 pir 10000 pri 4 schedule-type fifo
Ruijie(config-channel-tree)# exit
#
Ruijie(config-flow-control)# channel-tree outbound
Ruijie(config-channel-tree)# channel-group root parent null cir 10000
pir 10000 pri 4 schedule-type fifo
Ruijie(config-channel-tree)# channel-group department1 parent root cir
5000 pir 10000 pri 4 schedule-type fifo
Ruijie(config-channel-tree)# channel-group department2 parent root cir
3000 pir 10000 pri 4 schedule-type fifo
Ruijie(config-channel-tree)# channel-group department3 parent root cir
2000 pir 10000 pri 4 schedule-type fifo
Ruijie(config-channel-tree)# exit
Ruijie(config-flow-control)# exit
```

2

```
Ruijie# configure terminal
#
Ruijie(config)# identify-application enable
#
Ruijie(config)# subscriber static name department1 parent / ip-subnet
192.168.1.0 255.255.255.0
Ruijie(config)# subscriber static name department2 parent / ip-subnet
192.168.2.0 255.255.255.0
Ruijie(config)# subscriber static name department3 parent / ip-subnet
192.168.3.0 255.255.255.0
#             any              any
Ruijie(config)# time-range any
Ruijie(config-time-range)# periodic Daily 0:00 to 23:59
```

3

```
Ruijie# configure terminal
Ruijie(config)# flow-control Corp
#     1  2  3              department1  department2  department3
Ruijie(config-flow-control)# flow-rule 1 vlan-group any subscriber department1 network-group any app-group any time-rang any
Ruijie(config-flow-control)# flow-rule 1 session-limit 0 action pass in-channel department1 out-channel department1
Ruijie(config-flow-control)# flow-rule 2 vlan-group any subscriber department2 network-group any app-group any time-rang any
Ruijie(config-flow-control)# flow-rule 2 session-limit 0 action pass in-channel department2 out-channel department2
Ruijie(config-flow-control)# flow-rule 3 vlan-group any subscriber department3 network-group any app-group any time-rang any
Ruijie(config-flow-control)# flow-rule 3 session-limit 0 action pass in-channel department3 out-channel department3
```

4

```
Ruijie# configure terminal
Ruijie(config)# interface GigabitEthernet 0/1
Ruijie(config-if-GigabitEthernet 0/1)# flow-policy Corp
```

21

21.1

21.1.1

IP IP IP

21.1.2

IP IP

21.2

	60

21.3

- _____
- _____
- _____

21.3.1

Step 1	Ruijie# **configure terminal**	
Step 2	Ruijie(config)# **flow-audit enable**	
Step 3	Ruijie(config-if)#**end**	
Step 4	Ruijie# **show running**	

no flow-audit enable

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# flow-audit enable
```

21.3.2

60

Ruijie# **show online statistics**{**interface** *interface-name* **| bridge** *bridge-name*} [{**detail|recent** *hour* **| time-interval** *begin-year begin-month begin-day begin-hour* **to** *end-year end-month end-day end-hour*}]	hour

show flowrate channel [**channel-name** *channel-name*] [**channel-group** *channel-group*] [{**recent** *hour* **| time-interval** *begin-year begin-month begin-day begin-hour* **to** *end-year end-month end-day end-hour*} | **day-interval** *begin-year begin-month begin-day* **to** *end-year end-month end-day* [**hour-interval** *begin-hour* **to** *end-hour begin-hour2* **to** *end-hour2*]] [**order-by** {{**pass** | **drop**} {**upload** | **download**} } {**desc** | **asc**}[**top** *n*]]	
show flowrate interface *interface-name* [{**recent** *hour* **| time-interval** *begin-year begin-month begin-day begin-hour* **to** *end-year end-month end-day end-hour*} [**detail**]]	
show flowrate ip {**interface** *interface-name* **| bridge** *bridge-name*} [**subscriber-group** *subscriber-group*] {[**by-group**] |[**subscriber** *subscriber-name*] [**ip** *ip-address*] [**application** *application-name*] [**application-group** *application-group*] [**application-type** *application-type*] }[**day-interval** *begin-year begin-month begin-day* **to** *end-year end-month end-day* [**hour-interval** *begin-hour1* **to** *end-hour1 begin-hour2* **to** *end-hour2*] [**order-by** {{**pass** | **drop**} {**upload** | **download**} | **ip** | **subscriber**} {**desc** | **asc**}[**top** *n*] [**detail**]] **show flowrate application** {**interface** *interface-name* **| bridge** *bridge-name*} [**subscriber-group** *subscriber-group*] [**subscriber** *subscriber-name*] [**ip**	

show flowrate ip-application {**interface** *interface-name* **| bridge** *bridge-name*} []TJ-}

/User_groupC/User_nameC

153986 0 2022024 0

0 0 0 0

gigabitEthernet 0/1

Ruijie#show flowrate application interface gigabitEthernet 0/1

path:GigabitEthernet 0/1

Application Subscriber-num

PASS: Upload(bps) Download(bps) Upload(pps) Download(pps)

DROP: Upload(bps) Download(bps) Upload(pps) Download(pps)

App1 46

62597 65955 15 17

0 0 0 0

bridge 0

Ruijie# show flowrate application bridge 0 by-group

path:bridge-map 0

Application_group

PASS: Upload(bps) Download(bps) Upload(pps) Download(pps)

DROP: Upload(bps) Download(bps) Upload(pps) Download(pps)

App_group1

211 249 0 0

0 0 0 0

bridge 0 2010 1 9 2010 1 9

Ruijie# show flowrate application bridge 0 by-group day-interval 2010 1 9 to 2010 1 9

path:bridge-map 0

day-interval: 2010-1-9 ~ 2010-1-9

Application_group

PASS: Upload(KB) Download(KB) Upload(packets) Download(packets)

DROP: Upload(KB) Download(KB) Upload(packets) Download(packets)

P2P

0 6 24 24

0 0 0 0

/HTTP

5229 116742 59983 89151

0 0 0 0

/ QQ

220 135 1349 1290

0 0 0 0

27684236 159994 363431164 226927

0 0 0 0

gigabitEthernet 0/1 IP

Ruijie#show flowrate ip-application interface gigabitEthernet 0/1

path:GigabitEthernet 0/1

Subscriber Application

PASS Upload(bps) Download(bps) Upload(pps) Download(pps)

DROP: Upload(bps) Download(bps) Upload(pps) Download(pps)

/user_groupA/user_nameA applicationA

46003 2093107 93 173

0 0 0 0

/user_groupB/user_nameB applicationB

46001 2093102 193 173

0 0 0 0

/user_groupC/user_nameC applicationC

4003 1093107 63 73

0 0 0 0

bridge 0 2010 1 9

Ruijie# show flowrate ip-application bridge 0 day-interval 2010 1 9 to 2010 1 9

path:bridge-map 0

day-interval: 2010-1-9 ~ 2010-1-9

Կ ↟ ՝ ~

22

22.1 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

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

22.2 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

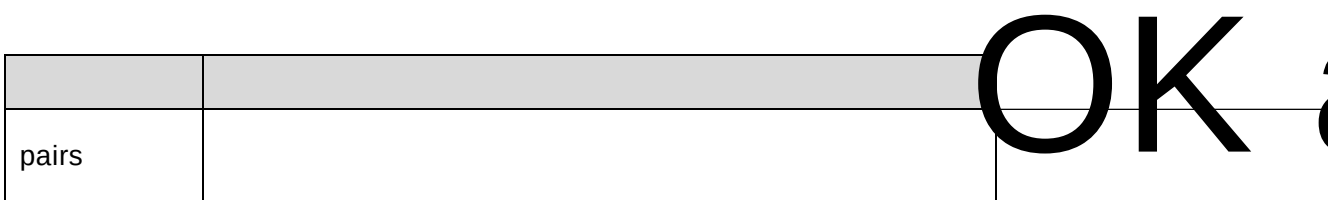
1 17 4

22.3 line-detect

Ruijie(config)# **interface** *interface*	
Ruijie(config-if)# **line-detect**	

AP

```
Ruijie(config)#int gigabitEthernet 3/1
Ruijie(config-if)#line-detect
start cable-diagnoses,please wait...
cable-daignoses end!this is result:
4 pairs
pair state     length(meters)
---- ---------- --------------
A     Ok          2
B     Ok          1
C     Short        1
D     Short        1
```



OK Short

State Open A B OK

C D } BC D

23 DHCP

23.1 DHCP

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

DHCP IP

1) DHCP IP

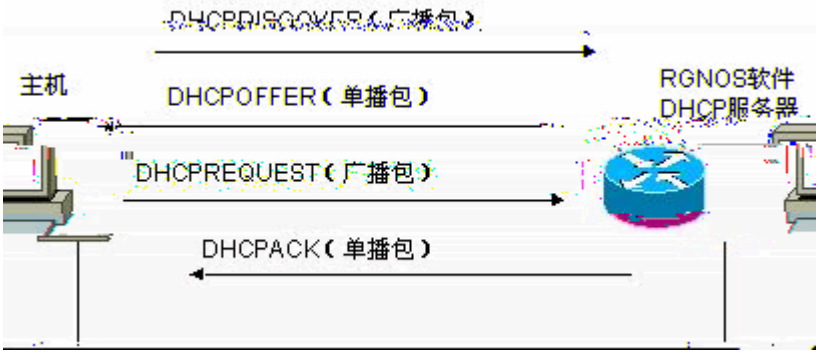
2) DHCP IP

3) IP DHCP IP

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

23.2 DHCP

DHCP RFC 2131
IP DHCP 3-1



1 DHCP

DHCP IP

1) DHCPDISCOVER DHCP

2) DHCP DHCPOFFER IP MAC

3) DHCPREQUEST IP

4) DHCP DHCPACK

DHCP DHCP DHCPOFFER
DHCPOFFER DHCPOFFER
DFER

FR PPP HDLC DHCP

23.4 DHCP

DHCP DHCP DHCP DHCP
DHCP DHCP
DHCP
IP DHCP DHCP
DHCP

DHCP DHCP DHCP DHCP DHCP
DHCP

23.5 DHCP

DHCP

- DHCP
- DHCP
- DHCP
-

Ruijie(conf	DHCP DHCP
Ruijie(conf	DHCP

10 CP DHCP **service dhcp**
DHCP

10.1
se

10.1 CP

23.5.2 DHCP

DHCP

DHCP IP

- DHCP IP DHCP IP
- DHCP IP

DHCP

-
-
-
-
-
-
- NetBIOS WINS
- NetBIOS

23.5.3.1 فخ سم ﻻ ώ è

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

“Ruijie(dhcp-config)#”

23.5.3.2 ΰ ╠ ˚

DHCP

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

23.5.3.3 Ω

IP

DHCP IP

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

23.5.3.4 ڀ ڻ

Ruijie(dhcp-config)# **dns-server** *address* [*address2…address8*]	DNS

23.5.3.7 NetBIOS WINS

WINS TCP/IP NetNBIOS IP WINS
Windows NT WINS WINS
WINS WINS
WINS

DHCP NetBIOS WINS

DHCP

:

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

DHCP ID
DHCP
[
]

23.5.4

IP MAC 1
DHCP IP MAC
2 DHCP DHCP
IP IP MAC

DHCP
IP MAC
MAC MAC
RFC 1700 “Address Resolution Protocol Parameters” “01”

Ruijie(dhcp-config)# **hardware-address** *hardware-address type* Ruijie(dhcp-config)# **client-identifier** *unique-identifier*	aabb.bbbb.bb88 01aa.bbbb.bbbb.88
Ruijie(dhcp-config)# **client-name** *name*	ASCII mary mary.rg.com

23.5.5 Ping

DHCP IP Ping
( ) Ping DHCP
DHCP Ping DHCP
DHCP

Ping

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

23.5.6 Ping

DHCP Ping 500 IP
Ping Ping

Ping

Ruijie(config)# **ip dhcp ping timeout** *milliseconds*	DHCP Ping 500ms

23.5.7 DHCP

DHCP IP DHCP

MAC 00d0.df34.32a3 DHCP IP 172.16.1.101 255.255.255.0 Billy.rg.com 172.16.1.254 WINS 172.16.1.252 NetBIOS

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

23.7.3 DHCP

GigabitEthernet 0/0 DHCP

```
interface GigabitEthernet0/0
ip address dhcp
```

24 DHCP Relay

24.1

24.1.1 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

24.1.2 DHCP DHCP Relay Agent

DHCP IP 255.255.255.255

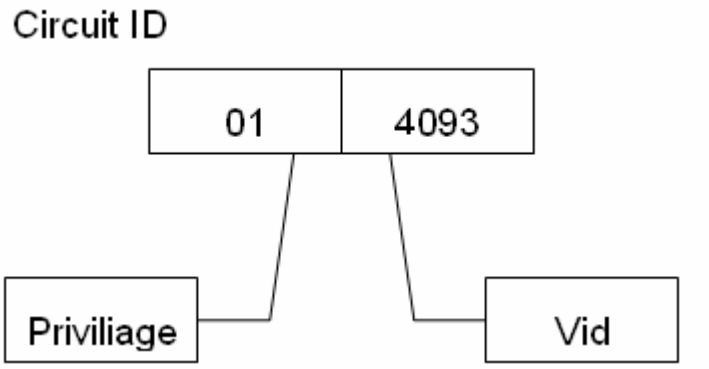
IP DHCP

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 DHCP Server 10.0.0.1/16 20.0.0.1/16 IP DHCP Relay Agent DHCP Server IP 30.0.0.2

24.1.3 DHCP Relay Agent Information(option 82)

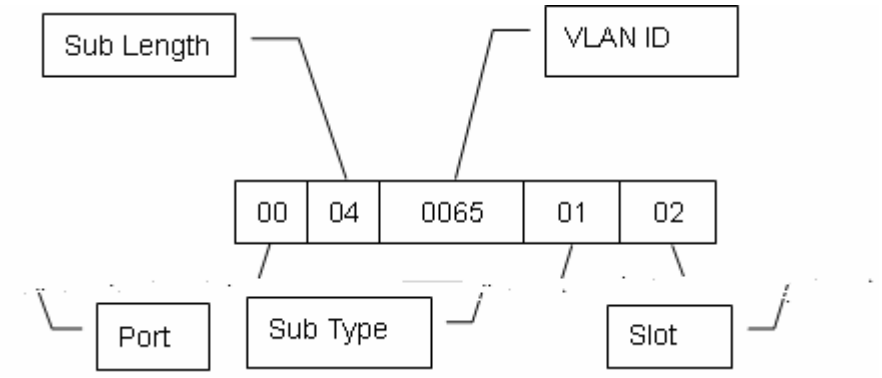
RFC3046 DHCP relay option DHCP client IP RFC3046 option 82 option82l ` R e m o t



2

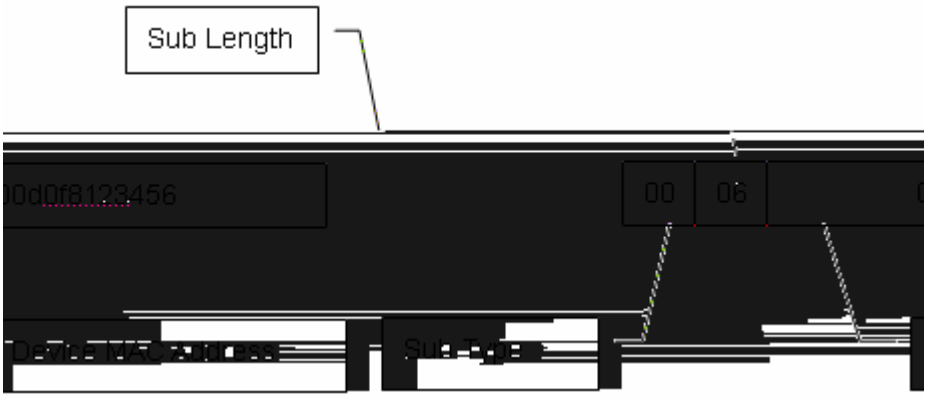
2. relay agent information option82 option
DHCP relay DHCP
option82 option

Agent Circuit ID



3

Agent Remote ID



4

24.1.4 DHCP relay Check Server-id

DHCP DHCP
DHCP
DHCP client DHCP REQUEST
server-id option
relay server
DHCP server DHCP check server-id

24.2 DHCP

24.2.1 DHCP

DHCP

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

24.2.2 DHCP Server IP

DHCP Server IP DHCP
Server DHCP Client

DHCP server
20 DHCP
DHCP DHCP

DHCP vrf vrf
DHCP

Ruijie(config)# **IP helper-address** [**vrf**] *A.B.C.D*	DHCP
Ruijie(config-if)# **IP helper-address** [**vrf**] *A.B.C.D*	DHCP
Ruijie(config)# **no IP helper-address** [**vrf**] *A.B.C.D*	DHCP

Ruijie(config-if)# **no IP helper-address** [**vrf**] *A.B.C.D*	DHCP

24.2.3 DHCP option dot1x

DHCP Relay Agent Information

```
Ruijie(config-ext-nacl)# permit ip any host 192.168.5.1
Ruijie(config-ext-nacl)# permit ip host 192.168.3.1 any
//      IP
Ruijie(config-ext-nacl)# permit ip host 192.168.4.1 any
Ruijie(config-ext-nacl)# permit ip host 192.168.5.1 any
Ruijie(config-ext-nacl)# deny ip 192.168.3.0 0.0.0.255 192.168.3.0
 0.0.0.255
//
Ruijie(config-ext-nacl)# deny ip 192.168.3.0  0.0.0.255  192.168.4.
0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.3.0  0.0.0.255  192.168.5.
0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.4.0  0.0.0.255  192.168.4.
0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.4.0  0.0.0.255  192.168.5.
0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.5.0  0.0.0.255  192.168.5.
0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.5.0  0.0.0.255  192.168.3.
0  0.0.0.255
Ruijie(config-ext-nacl)# deny ip 192.168.5.0  0.0.0.255  192.168.4.
0  0.0.0.255
Ruijie(config-ext-nacl)# exit
```

ip dhcp relay information option dot1x access-group

DenyAccessEachOtherOfUnauthrize

DHCP option dot1x access-group e

DHCP option82

Ruijie(config)# **ip dhcp relay information option82**	DHCP option82
Ruijie(config)# **no ip dhcp relay information option82**	DHCP option82

24.2.6 DHCP relay check server-id

ip dhcp relay check *server-id* DHCP relay DHCP SERVER-ID option server

DHCP relay check *server-id*

Ruijie(config)# **ip dhcp relay check server-id**	DHCP relay check server-di
Ruijie(config)# **no ip dhcp relay check server-id**	DHCP relay check server-id

24.2.7 DHCP relay suppression

ip dhcp relay suppression DHCP realy suppression DHCP relay

Ruijie(config-if)# **ip dhcp relay suppresson**	DHCP relay suppresson
Ruijie(config-if)# **no ip dhcp relay suppresson**	DHCP relay suppresson

24.2.8 DHCP

dhcp relay

```
Ruijie# configure terminal
Ruijie(config)# service dhcp                    //      dhcp relay
Ruijie(config)# ip helper-address 192.18.100.1  //
Ruijie(config)# ip helper-address192.18.100.2       //
Ruijie(config)# interface GigabitEthernet 0/3
Ruijie(config-if)# ip helper-address 192.18.200.1  //

Ruijie(config-if)# ip helper-address 192.18.200.2  //

Ruijie(config-if)# end
```

24.3 DHCP relay

vlan relay option dot1x option82 vlan relay

24.3.1 DHCP option dot1x

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

24.3.2 DHCP option82

DHCP option82 **dhcp option dot1x**

24.4 DHCP

show running-config DHCP

```
Ruijie# show running-config
Building configuration...
Current configuration : 1464 bytes
version RG0S 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
```

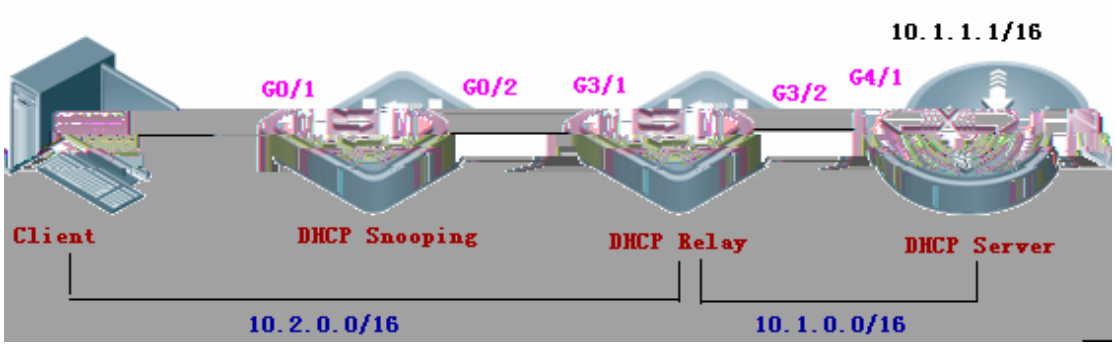
24.5 DHCP

24.5.1 IP

24.5.1.1

1	IP
2	IP

24.5.1.2 في



24.5.1.3 †

DHCP Snooping DHCP Relay access Client
IP DHCP Relay
IP DAI ARP
arp-check

24.5.1.4

- DHCP Snooping

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

#                   Gi0/2
Ruijie(config)# interface gigabitEthernet 0/2
Ruijie(config-if)# ip dhcp snooping trust

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

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

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

#                   10.1.0.0/16
```

```
Ruijie(config)# ip route 10.1.0.0 255.255.0.0 10.2.1.1
```

- DHCP Relay

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

#             DHCP
Ruijie(config)# ip helper-address 10.1.1.1

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

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

- DHCP Server

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

#     DHCP
Ruijie(config)# service dhcp

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

#
Ruijie(config)# ip dhcp pool linwei

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

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

#                10.2.0.0/16
Ruijie(config)# ip route 10.2.0.0  255.255.0.0  10.1.0.1
```

25 DNS

25.1 DNS

IP

IP IP

DNS

IP 1 IP

2

DNS DNS IP

DNS IP

IP

DNS

25.2

25.2.1 DNS

DNS

DNS	
DNS IP	
DNS	6

25.2.2 DNS

DNS

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

no ip domain-lookup DNS

```
Ruijie(config)# ip domain-lookup
```

25.2.3 DNS Server

DNS DNS

DNS **no ip name-server** [*ip-address*]

ip-address

Ruijie(config)# **ip name-server** *ip-address*	DNS Server IP DNS Server Server Server DNS 6

25.2.4 IP

Ruijie# **clear host** [*word*]	

25.2.6

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
```

25.2.7

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
```

26 NTP

26.1 NTP

Network Time Protocol NTP

LAN

1 WAN

NTP UTC NTP

UTC Internet

NTP (Authentication)

NTP

Server

26.2 NTP

NTP

- NTP
- NTP
- NTP ID
- NTP
- NTP
- NTP
- NTP
- NTP
- NTP
- NTP
- NTP

26.2.1 NTP

1024

26.2.3 NTP ID

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

26.2.4 NTP

NTP 20 NTP

NTP 3 NTP
NTP

NTP

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

26.2.5 NTP

NTP

NTP

NTP

IP

NTP

NTP

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

26.2.7 NTP

8

NTP 1

NTP

	p 549 6 -9.609( )-5 c -9.hroT-5 [iz4 -1e 2

no ntp update-calendar	

NTP NTP

26.2.9 NTP

NTP

NTP “ stratum ” “ hops ”
1 2
1 3 2 ……

NTP

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

12

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

---

ntp NTP

26.2.10 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
- **serve** NTP
- **serve-only** NTP
- **query-only** NTP
- *access-list-number* IP 1 99 1300 1999 IP
- *access-list-name* IP IP

NTP

peer serve serve-only query-only

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

26.4

master NTP
key-id 6 key-string wooooop
NTP
NTP
NTP

IPv4

```
Ruijie(config)# no ntp
Ruijie(config)# ntp authentication-key 6 md5 wooooop
Ruijie(config)# ntp authenticate
Ruijie(config)# ntp trusted-key 6
Ruijie(config)# ntp server 192.168.210.222 key 6
Ruijie(config)# interface git6(e(c)6(on)6(.23 0 t0228 Tf00tf0 c 9.314 0 d( -
```

27 (SNTP)

27.1

T2 ( ) Receive 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

27.2 SNTP

SNTP

27.2.1 SNTP

SNTP

SNTP	Disable SNTP

NTP Server IP	0
SNTP	1800s
	+8

27.2.2 SNTP

SNTP

1)

```
Ruijie# config
```

2) SNTP “ ”
(“ ” 5)

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

3)

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

4)

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

5)

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

SNTP **no sntp enable** SNTP

2) SNTP Server IP

SNTP (GMT)

1

```
Ruijie# config
```

2 -23 23 8 -8
8 0

```
Ruijie(config)# clock time-zone <time-zone>
```

3

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

4

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

5

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

no clock time-zone

27.3 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                     //
```

28 SSH

28.1 SSH

SSH Secure Shell SSH Telnet
Telnet
SSH
IP

28.2 SSH

	SSH1	SSH2
	RSA	RSA DSA
	RSA	KEX_DH_GEX_SHA1 KEX_DH_GRP1_SHA1 KEX_DH_GRP14_SHA1
	DES 3DES Blowfish	DES 3DES AES-128 AES-192 AES-256
		MD5 SHA1 SHA1-96 MD5-96
	NONE	NONE

28.3 SSH

SSH SSHv1 SSHv2 SSH

28.4 SSH

28.4.1 SSH

SSH	
SSH	1 2
SSH	120s
SSH	3

28.4.2

1. SSH
   Telnet
2. (Username) (Password)

28.4.3 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**

28.4.4 SSH Server

SSH Server **no enable service ssh-server**
SSH Server DISABLE

configure terminal	
no enable service ssh-server	SSH Server

28.4.5 SSH server

SSH Server 1 2 SSH

configure terminal	
ip ssh version {**1	2**}	SSH
no ip ssh version	SSH SSHv1 SSHv2

28.4.6 SSH

SSH Server 120 SSH

configure terminal	
ip ssh time-out *time*	SSH 1-120sec
no ip ssh time-out	SSH 120

28.4.7 SSH

SSH

SSH Server 3

SSH

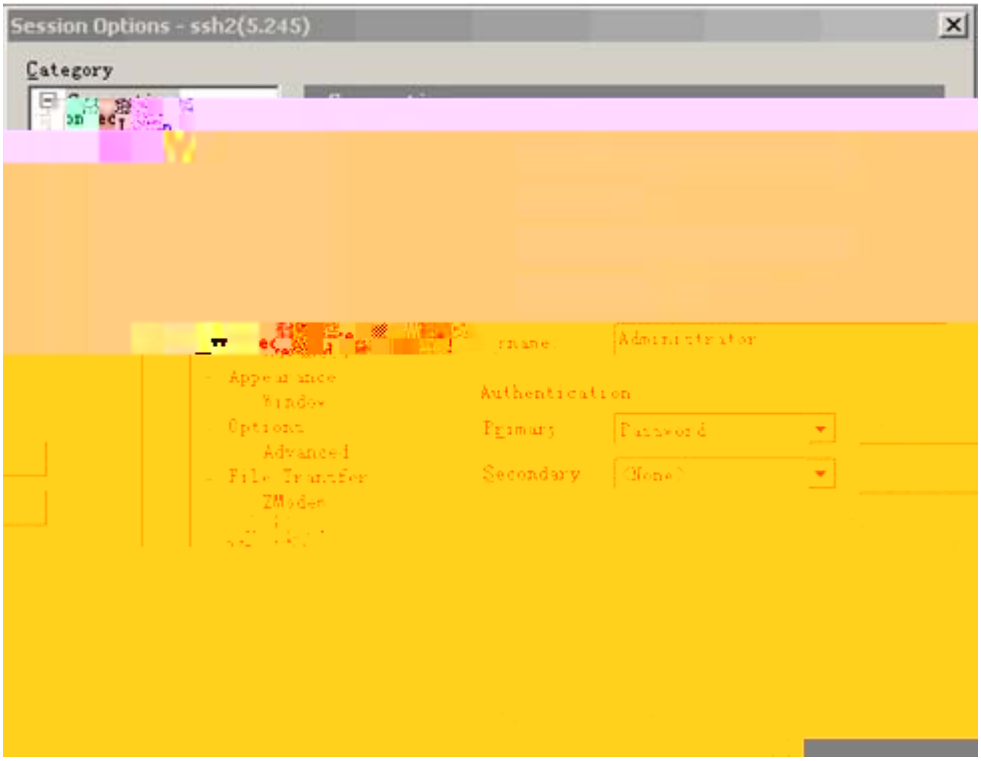
configure terminal	

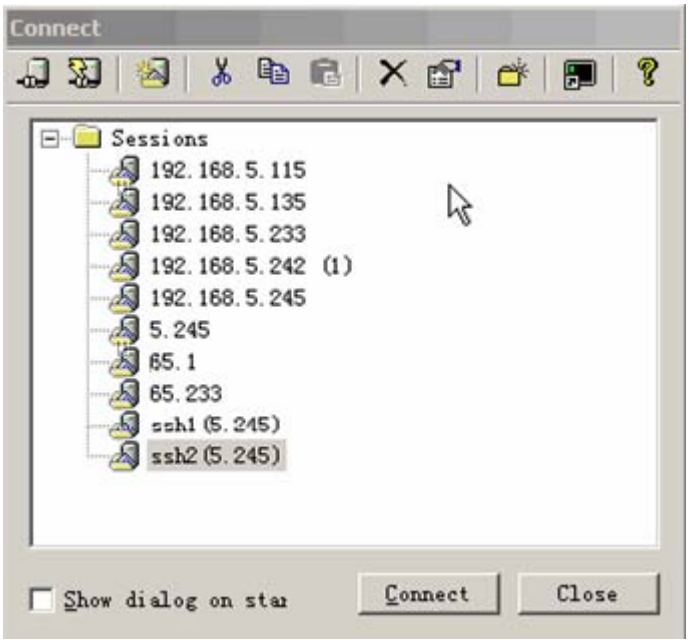
ip ssh authentication-retries *retry times*	SSH 0-5
no ip ssh authentication-retries	SSH 3

[SSH]

28.5 SSH

SSH SSH Server
Windows Telnet SSH
Putty Linux SecureCRT
SecureCRT SSH





2

Connect

3

я . Ї

4

Telnet Telnet

5

29 UDP-Helper

29.1 UDP-Helper

29.1.1 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

29.2 UDP-Helper

29.2.1 UDP-Helper

UDP	UDP-Helper 69 53 37 137 138 49 UDP

29.2.2 UDP-Helper

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

no udp-helper enable UDP

1)

2) UDP 69 53 37 137 138 49 UDP

3) DUP UDP

29.2.3

Ruijie(config-if)# **ip helper-address** *IP-Address*	UDP

no ip helper-address

1) 20

2) UDP-Helper

UDP

29.2.4 UDP

Ruijie(config)# **ip forward-protocol udp** *ID*	UDP UDP UDP-Helper 69 53 37 137 138 49

no ip forward-protocol udp port UDP
4

- UDP-Helper
  UDP SyYź+Sàw L@ñÔ

Ω ↑ '

30

IP

1

:

1.

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

2.

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

3.

Ruijie(config-route-map)# **set ip default next-hop** *ip-address*[*weight*][*ip-address*[*weight*]]	IP
Ruijie(config-route-map)# **set ip next-hop** *ip-address* [*weight*][*ip-address*[*weight*]]	IP
Ruijie(config-route-map)# **set interface** *intf_name*	
Ruijie(config-route-map)# **set default interface** *intf_name*	
Ruijie(config-route-map)# **set ip precedence**	IP
Ruijie(config-route-map)# **set ip tos**	IP TOS
Ruijie(config-route-map)# **set ip dscp**	IP DSCP

4.

, :

Ruijie(config-if)# **ip policy route-map** *name*	route-map
Ruijie(config-if)# **no ip policy route-map**	route-map

5.

Ruijie(config-if)# **ip local policy route-map** [*name*]	route-map
Ruijie(config-if)# **no ip local policy route-map**	

:

GigabitEthernet 0/0 ,
192.168.5.5

```
Ruijie(config)# access-list 1 permit any
```

```
Ruijie(config)# route-map name
Ruijie(config-route-map)# match ip address 1
Ruijie(config-route-map)# set ip next-hop 192.168.5.5
Ruijie(config-route-map)# int GigabitEthernet 0/0
Ruijie(config-if)# ip policy route-map name
```

Ruijie(config)# **ip policy** {**load-balance** | **Redundance**}	

Ruijie(config)# **no ip**

31

31.1

31.1.1

31.1.2

ISP

IP

IP IP

31.3

31.3.1

#

32 RIP

32.1 RIP

RIP (Routing Information Protocol)

RIP RIPv1

RFC 1058

-
- RIP
- RIP
- RIP
- RIP
- RIP VRF ( )

  IP “ ”
-
-
-

32.2.1 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

RIP RIP

RIP

RIP RIP

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

RIP

passive-interface

“ ”

FR X.25 Broadcast **neighbor**

Neighbor

32.2.3

IP

X.25

IP

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

32.2.4 RIP

RIP 1 2 RIPv2 CIDR

VLSMs VLSMs

RIP

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

32.2.6 RIP

RIPv1 RIPv2

RIPv2 MD5

ip rip authentication text-password

MD5 MD5

Ruijie(config-if)# **ip rip authentication key-chain** *key-chain-name*	

32.2.7 RIP

RIP RIP

RIP

RIP

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

30 180 120

RIP

32.2.8 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

32.2.10 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**

32.2.11 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 RIP

exit-address-family **exit** VRF RIP RIP

Ruijie(config-router)# **address-family ipv4 vrf** *vrf-name*	*vrf-name* VRF RIP

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 GigabitEthernet0/0
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 GigabitEthernet0/0
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 GigabitEthernet0/0
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 GigabitEthernet0/0
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

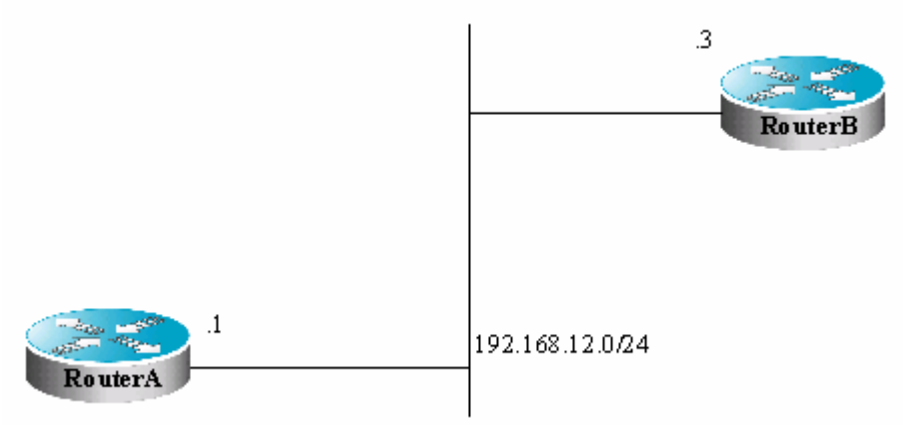
```
#
interface GigabitEthernet0/0
ip address 192.168.13.5 255.255.255.0

#     RIP
router rip
version 2
network 192.168.13.0
```

32.3.2 RIP

-

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 GigabitEthernet0/0
ip address 192.168.12.1 255.255.255.0
ip rip authentication mode md5
ip rip authentication key-chain ripkey
```

B :

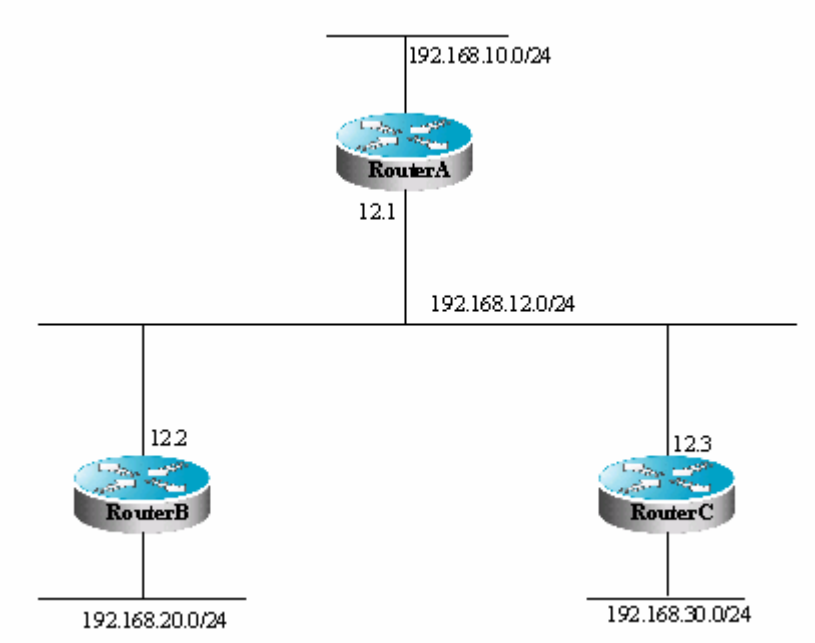
```
#
key chain ripkey
key 1
key-string keyb
accept-lifetime 00:00:00 Dec 3 2000 infinite
send-lifetime 00:00:00 Dec 4 2000 00:00:00 Dec 5 2000
key 2
key-string keya
accept-lifetime 00:00:00 Dec 3 2000 infinite
send-lifetime 00:00:00 Dec 4 2000 infinite

#
interface GigabitEthernet0/0
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
```

32.3.3 RIP

-

RIP IP

3



3 RIP

RIP

1 Router A Router C

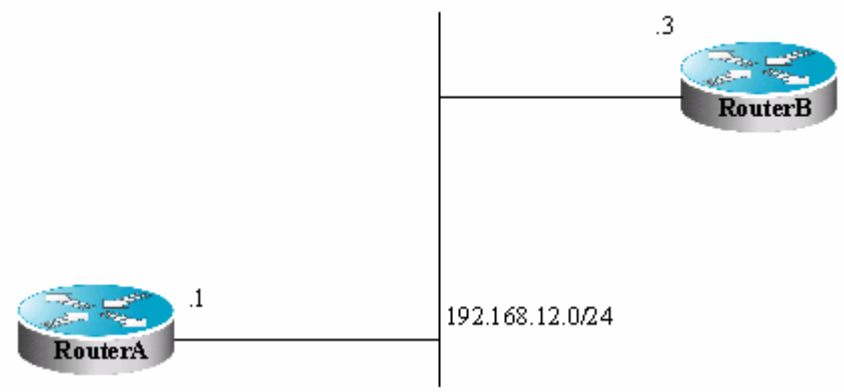
```
#
interface GigabitEthernet0/0
ip address 192.168.12.2 255.255.255.0

#
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 GigabitEthernet0/0
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
```

32.3.4 RIP VRF

- RIP IP 4



4 RIP VRF

RIP Router A redvpn VRF Router B bluevpn VRF

-

A

```
#     VRF
ip vrf redvpn

#        VRF
interface GigabitEthernet 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 GigabitEthernet 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
```

33 OSPF

33.1 OSPF

OSPF Open Shortest Path First IETF 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

---

1) OSPF RFC 1793

2) OSPF

33.2 OSPF

OSPF

OSPF OSPF
OSPF

- OSPF (
- OSPF
- OSPF
- OSPF
- OSPF NSSA
- OSPF
-
-
- Loopback
- OSPF
-
-
- OSPF
- MTU
- OSPF
- OSPF
- OSPF BFD

-
-

OSPF

	: LSA :5 LSA :1 hello :10 (30) : hello 1 0 ( )
	0( ) Stub NSSA : 1 (STUB): (NSSA):

	: LSA :5 LSA :1 hello :10 : hello
	100 Mbps
	metric 1 type-2
metric (Default metric)	metric
	110 110 110
	LSA

OSPFv2 TRAP	

33.2.1 OSPF

OSPF OSPF IP IP
OSPF OSPF IP OSPF
64 OSPF

OSPF

Ruijie # **configure terminal**	
Ruijie (config)# **ip routing**	( )
Ruijie (config)# **router ospf** *process_id* [**vrf** *vrf-name*]	OSPF OSPF
Ruijie (config-router)# **network** *address wildcard-mask* **area** *area-id*	
Ruijie (config-router)# **end**	
Ruijie # **show ip protocols**	
Ruijie # **write**	

vrf vrf-name OSPF vrf OSPF
VRF OSPF VRF **Networ**k 32 “ ”
“1” “0”
network IP
OSPF **network**
IP OSPF

no router ospf *process-id* OSPF OSPF

```
Ruijie(config)# router ospf 1
Ruijie(config-router)# network 192.168.0.0 0.0.0.255 area 0
Ruijie(config-router)# end
```

33.2.2 OSPF

OSPF

ip ospf hello-interval, ip ospf dead-interval, ip ospf authentication ip ospf authentication-key ip ospf message-digest-key

OSPF

Ruijie # **configure terminal**	
Ruijie (config)# **ip routing**	( )

Ruijie (config)# **interface**

Ruijie (config-if)# **ip ospf database-filter all out**	OSPF LSA LSA
Ruijie (config-if)# **end**	
Ruijie # **show ip ospf** [*process-id*] **interface** [*interface-id*]	
Ruijie # **write**	

no

33.2.3 OSPF

OSPF

- FDDI
- X.25
- HDLC PPP SLIP

OSPF

1. (NBMA) NBMA
   SVC X.25 PVC
   OSPF NBMA
   Designated Router NBMA

2. OSPF
   OSPF

X.25 OSPF
X.25 map Frame-relay map X.25
OSPF X.25

OSPF
NBMA

-
-

Ruijie(config-if)# **ip ospf network** {**broadcast** | **non-broadcast** | **point-to-point** | {**point-to-multipoint** [**non-broadcast**]} }	OSPF

,

-

PPP SLIP X.25

- NBMA (non-broadcast)

X.25

-

-

FULL

33.2.3.1 ↑

X.25

OSPF

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

33.2.3.2

ospf NBMA
ospf

NBMA

1.
2. NBMA
щ Ď ’ Ȯ ŋ È

Ruijie (config)# **router ospf** *1*

(no-summary) 1
2 OSPF

(area
default-cost)

STUB

- STUB STUB
- STUB
- Stub ASBR

OSPF

Ruijie (config-router)#**area** *area-id* **authentication**	
Ruijie (config-router)#**area** *area-id* **authentication message-digest**	MD5
Ruijie (config-router)#**area** *area-id* **stub** [**no-summary**]	, **no-summary:** Stub ABR summary-LSAs stub
Ruijie (config-router)#**area** *area-id* **default-cost** *cost*	STUB

“ OSPF ”

33.2.5 OSPF NSSA

NSSA(Not-So-Stubby Area) OSPF STUB ,NSSA 5
LSA(AS-external-LSA) NSSA , STUB
NSSA OSPF .

NSSA 7 NSSA , 7
LSA NSSA 5 LSA

NSSA

-

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

discard

33.2.7

OSPF OSPF ,

ABR ABR
Stub Area NSSA
ABR , ABR
router-id
Transit Area

( )

hello-interval,dead-interval

“ ” ABR OSPF

IP ABR ABR
type3 LSA

Ruijie (config-router)# **area** *area-id* **virtual-link** *router-id* [[**hello-interval** *seconds*]| [**retransmit-interval** *seconds*] |[**transmit-delay** *seconds*]|[**dead-interval** *seconds*]| [**authentication** [**message-digest	null**] |[[**authentication-key** *key*	**message-digest-key** *keyid* **md5** *key*]]]	

router-id OSPF router-id **show ip ospf** **show ip ospf neighbor** router-id

33.2.8

(ASBR) OSPF
ASBR ASBR

ASBR

●	
Ruijie (config-router)# **default-information originate** [**always**] [**metric** *metric-value*] [**metric-type** *type-value*] [**route-map** *map-name*]	

33.2.9 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

33.2.10 OSPF

0~255

OSPF 110

OSPF

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

33.2.11

OSPF SPF

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

33.2.13 OSPF

OSPF Cost Cost
OSPF

ip ospf cost
100Mbps
10Mbps 100/10 + 0.5 ≈ 10

10

Ruijie(config-router)# **auto-cost reference-bandwidth** *ref-bw*	ref-bw
Ruijie (config-router)# **end**	
Ruijie # **show ip protocols**	
Ruijie # **write**	

Ruijie# **write**	

OSPF

no passive-interface *interface-id* default

33.2.16 OSPF

33.2.16.1 OSPFv2 MIB

OSPFv2 MIB OSPFv2 SNMP OSPFv2
OSPFv2 MIB OSPFv2

SNMP OSPFv2
OSPFv2 MIB

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

33.2.16.2 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**] | **retransmit** [**iftxretransmit | virtiftxretransmit**] | **state-change** [**ifstatechange | nbrstatechange | virtifstatechange | virtnbrstatechange**]]	OSPF TRAP
Ruijie (config)# **end**	
Ruijie# **write**	

33.3 OSPF

OSPF

Ruijie# **show ip ospf** [*process-id*]	OSPF
Ruijie# **show ip ospf** [*process-id area-id*] **database** [**adv-router** *ip-address* | {**asbr-summary** | **external** | **network** | **nssa-external | opaque-area | opaque-as | opaque-link | router** | **summary**} [*link-state-id*] [{**adv-router** *ip-address* | **self-originate}**] | **database-summary** | **max-age** | **self-originate**]	OSPF LSA
Ruijie# **show ip ospf** [*process-id*] **border-routers**	ABR ASBR
Ruijie# **show ip ospf interface** [*interface-name*]	ospf
Ruijie# **show ip ospf** [*process-id*] **neighbor**[*interface-name*] [*neighbor-id*] [**detail**]	interface-name neighbor neighbor-id: neighbor ID
Ruijie# **show ip ospf** [*process-id*] **virtual-links** *ip-address*	
Ruijie# **show ip ospf** [*process-id*] **route** [**count**]	OSPF

OSPF

1 OSPF

show ip ospf [*process-id*] **neighbor** OSPF IP

```
Ruijie # show ip ospf neighbor
OSPF process 1:
Neighbor ID  Pri State    Dead Time    Address   Interface
10.10.10.50 1 Full/DR 00:00:38     10.10.10.50  eth0/0
OSPF process 100:
Neighbor ID  Pri State       Dead Time    Address Interface
10.10.11.50 1 Full/Backup    00:00:31  10.10.11.50  eth0/1
```

```
Ruijie # show ip ospf 1 neighbor
OSPF process 1:
Neighbor ID  Pri State       Dead Time    Address      Interface
10.10.10.50 1 Full/DR    00:00:38     10.10.10.50  eth0
Ruijie # show ip ospf 100 neighbor
OSPF process 100:
Neighbor ID  Pri State       Dead Time    Address      Interface
10.10.11.50 1   Full/Backup  00:00:31     10.10.11.50  eth1
```

2 OSPF

F0/1 OSPF 0 172.16.120.1
“BROADCAST”— Area Netwrok Type Hello Dead

```
Ruijie#sh ip ospf interface GigabitEthernet 1/0
GigabitEthernet 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 non-default external LSA 4
External LSA database is unlimited.
Number of LSA originated 6
Number of LSA received 2
Log Neighbor Adjency Changes : Enabled
Number of areas attached to this router: 1
Area 0 (BACKBONE)
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
```

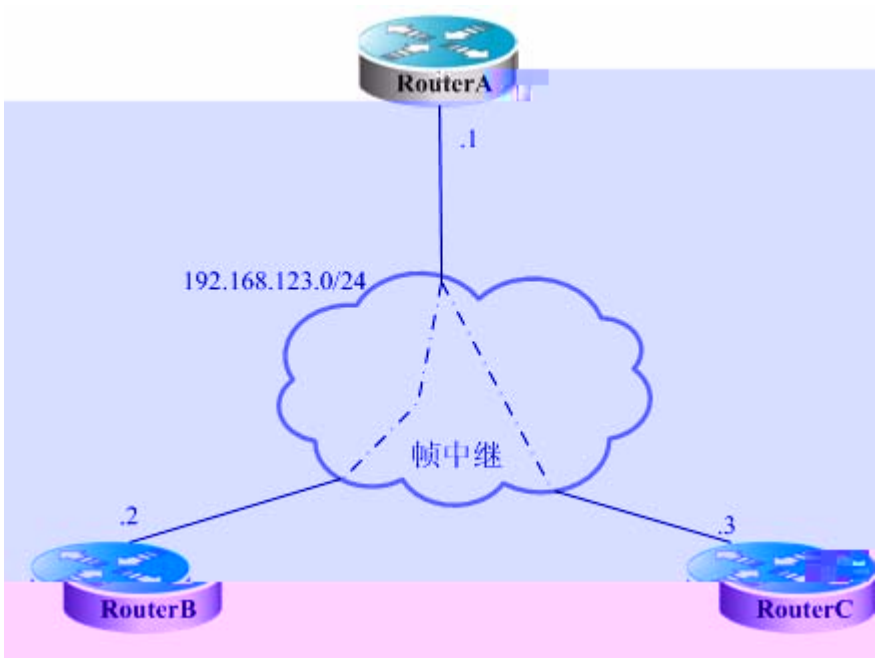
8 OSPF

- OSPF NBMA
- OSPF
- OSPF
- OSPF
- OSPF ABR ASBR
- OSPF
- OSPF

33.4.1 OSPF NBMA

-

PVC IP 1



3. OSPF NBMA

1 A B C NBMA

2 A B

3

4

●

OSPF NBMA
OSPF IP
SPF

A

```
interface Serial 1/0
ip address 192.168.123.1 255.255.255.0
encapsulation frame-relay
ip ospf network non-broadcast
ip ospf priority 10
```

OSPF B

```
router ospf 1
network 192.168.123.0 0.0.0.255 area 0
neighbor 192.168.123.2 priority 5
neighbor 192.168.123.3
timers spf 500 1000 10000
```

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

```
interface Serial 1/0
ip address 192.168.123.3 255.255.255.0
```

```
encapsulation frame-relay
ip ospf network non-broadcast
```

OSPF

```
router ospf 1
network 192.168.123.0 0.0.0.255 area 0
neighbor 192.168.123.1 10
neighbor 192.168.123.2 5
timers spf 500 1000 10000
```

33.4.2 OSPF

-

A

```
interface GigabitEthernet 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 GigabitEthernet 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 GigabitEthernet 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
```

A

```
interface GigabitEthernet0/0
ip address 192.168.12.1 255.255.255.0
ip ospf message-digest-key 1 md5 hello
```

OSPF

```
router ospf 1
network 192.168.12.0 0.0.0.255 area 0
area 0 authentication message-digest
```

B

```
interface GigabitEthernet0/0
ip address 192.168.12.2 255.255.255.0
ip ospf message-digest-key 1 md5 hello
```

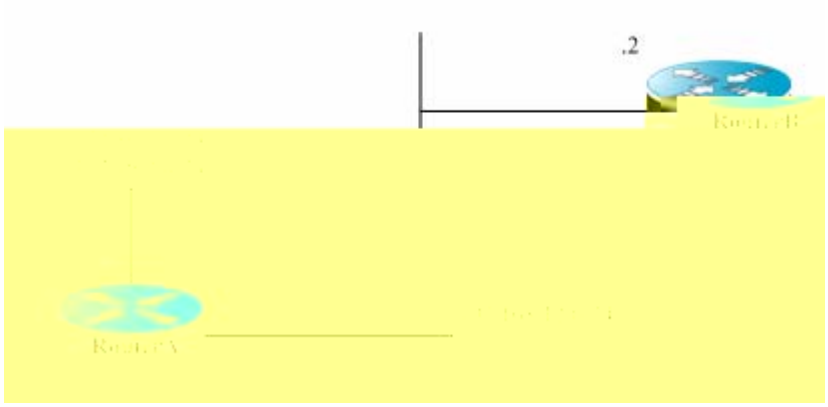
OSPF

```
router ospf 1
network 192.168.12.0 0.0.0.255 area 0
area 0 authentication message-digest
```

33.4.4 OSPF

-

IP 4



6. OSPF

1 OSPF 192.168.12.0/24 0 172.16.1.0/24 172.16.2.0/24 10

2 Router A A 172.16.0.0/22 172.16.1.0/24 172.16.2.0/24

3 Router A A 20 discard

- Router A OSPF

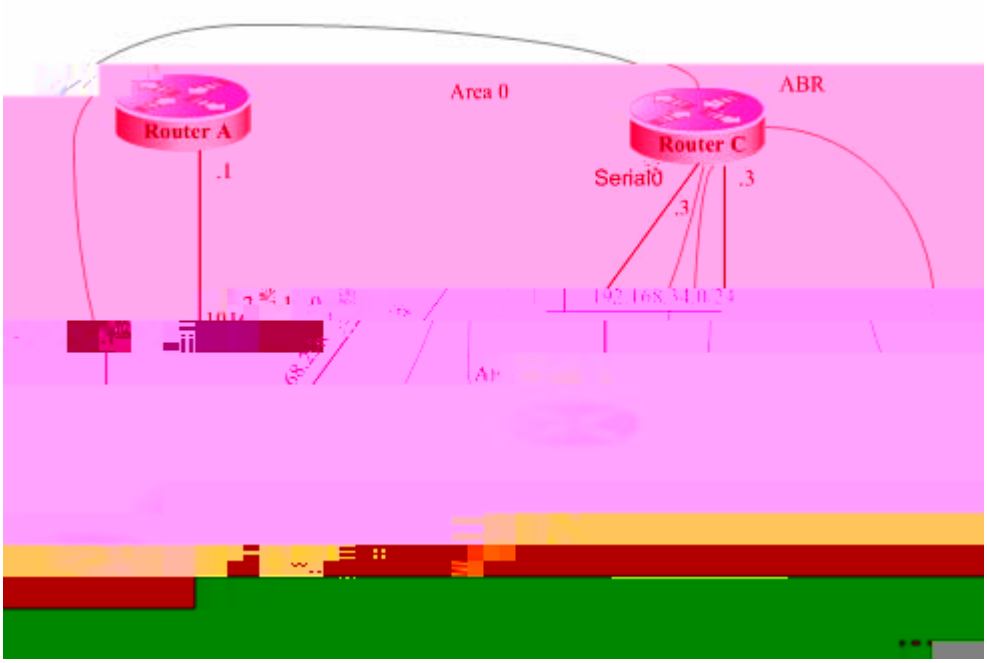
2 OSPF ز A

```
network 192.168.12.0 0.0.0.255 area 0
```

33.4.5 OSPF ABR ASBR

-

OSPF 192.168.12.0/24 192.168.23.0/24
0 192.168.34.0/24 34 IP 5



7. OSPF ABR ASBR

A B C D
200.200.1.0/24

B

```
interface GigabitEthernet0/0
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 GigabitEthernet 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
```

#

```
router orea 0
network 192.168.23.0 0.0.0.2r ospf 1
nessrk 192.168.23.0 0.5.255.255 Tc89
```

A’ Û C

```
interface GigabitEthernet 0/0
ip addre4s 192.168.23.2 255.255.255.0


interface Gi(nter[(r)6(oute)6eri)6(al 1/)6(0)6( )]TJ0 Tw T*7216
```

OSPF5%0ÊV%V%V, ÀÔ

```
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
```

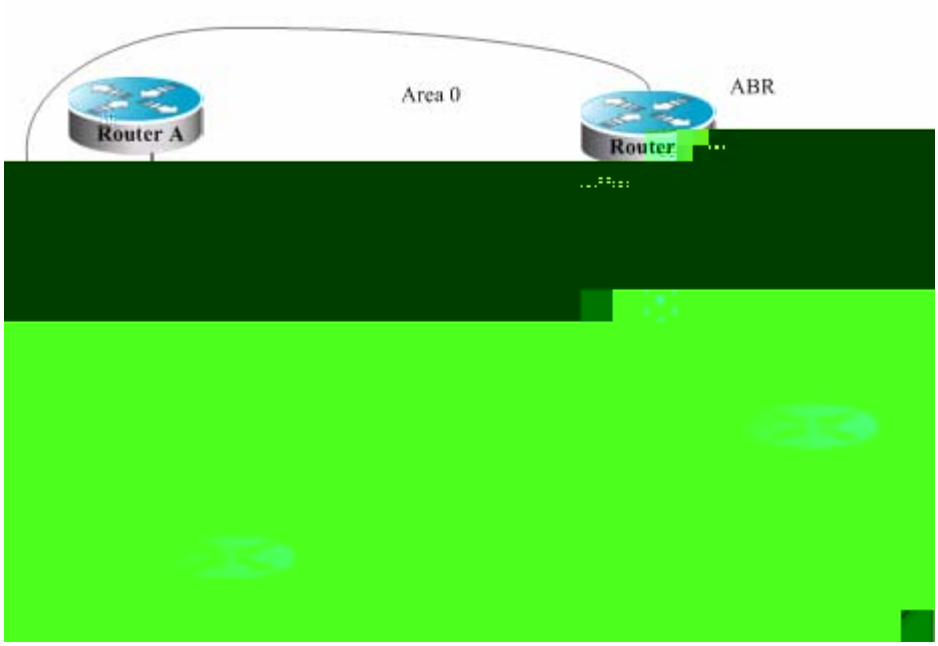
B ospf “ E1 ”

```
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
```

33.4.6 OSPF

- 192.168.12.0/24192.168.23.0/24

6



8OSPF

RouterD OSPF

D C

192.168.30.0/24

```
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 GigabitEthernet0/0
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,
GigabitEthernet0/0
O*IA 0.0.0.0/0 [110/2] via 192.168.34.3, 00:00:03,
GigabitEthernet0/0
```

33.4.7 OSPF

- OSPF 192.168.12.0/24 0 192.168.23.0/24 23 192.168.34.0/24 34 IP 7

9. OSPF

D 192.168.12.0/24 192.168.23.0/24

-

OSPF area 0

ABR

A

```
interface GigabitEthernet0/0
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 GigabitEthernet0/0
ip address 192.168.12.2 255.255.255.0


interface Serial1/0
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 GigabitEthernet0/0
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 GigabitEthernet0/0
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,
GigabitEthernet0/0
```

```
O IA 192.168.23.0/24 [110/65] via 192.168.34.3, 00:00:25,
GigabitEthernet0/0
```

34

34.1 IP

34.1.1

Ruijie(config)# **ip route** [**vrf** *vrf_name*] *network mask* {*ip-address*	

	255

RIP OSPF

“ down ”

VRF VRF VRF
VRF VRF

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

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

34.1.2

1 “
” 2

RIP RIP RIP
“ 0.0.0.0 ” OSPF
“ OSPF ”

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

ƍ

maximum-paths [*number*]	32

34.2

(**route-map**)

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

match **set**

match **set**

Ruijie(config-route-map)# **match community** {*standard-list-number* | *expanded-list-number* | *community-list-name*}	BGP
Ruijie(config-route-map)# **match interface** *interface-type interface-number*	
Ruijie(config-route-map)# **match ip address** *Access-list-number* [*…access-list-number*]	
Ruijie(config-route-map)# **match ip next-hop** *access-list-number* [*…access-list-number*]	
Ruijie(config-route-map)# **match ip route-source** *access-list-number* [*…access-list-number*]	

Ruijie(config-route-map)# **match ipv6 address** { *access-list-name* | **prefix-list** *prefix-list-name* }	IPv6
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)# **match route-type** {**local** | **internal** | **external** [**level-1** | **level-2**]}	
Ruijie(config-route-map)# **match tag** *tag*	*tag* 0-4294967295

Ruijie(config-route-map)# **set aggregator as** *as-num ip_addr*	AS
Ruijie(config-route-map)# **set as-path prepend** *as-number*	AS_PATH
Ruijie(config-route-map)# **set comm-list** *community-list-number* | *community-list-name* **delete**	COMMUNITY_LIST community
Ruijie(config-route-map)# **set community** {*community-number*[*community-number …*] **additive** | **none**}	COMMUNITY
Ruijie(config-route-map)# **set dampening** *half-life reuse suppress max-suppress-time*	

Ruijie(config-route-map)# **set extcommunity** {**rt** *extend-community-value* | **soo** *extend-community-value*}	
Ruijie(config-route-map)# **set interface** *interface-type interface-number*	
Ruijie(config-route-map)# **set ip default next-hop** *ip-address*	IP
Ruijie(config-route-map)# **set ip next-hop** *ip-address*	IP
Ruijie(config-route-map)# **set ip next-hop verify-availability** *ip-address* **track** *track-object-num*	IP
Ruijie(config-route-map)# **set level** {**stub-area** | **backbone** | **level-1** | **level-1-2** | **level-2**}	
Ruijie(config-route-map)# **set local-preference** *number*	LOCAL_PREFERENCE
Ruijie(config-route-map)# **set metric** *metric*	
Ruijie(config-route-map)# **set metric** [+ *metric-value* | **-** *metric-value* | *metric-value*]	
Ruijie(config-route-map)# **set metric-type** {**type-1** | **type-2 | external** | **internal**}	
Ruijie(config-route-map)# **set next-hop** *next-hop*	*next-hop* IP
Ruijie(config-route-map)# **set origin** {**egp** | **igp** | **incomplete**}	
Ruijie(config-route-map)#**set originator-id** *ip-addr*	
Ruijie(config-route-map)# **set tag** *tag*	
Ruijie(config-route-map)# **set weight** *number*	BGP

match set

match set

- **route-map** **route-map** **match** **set**

- **route-map** **match** **set** **route-map**
  route-map **match** **set**

“ ”

(PBR)

OSPF 20

Type-2 OSPF

34.3.2

OSPF

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

34.4

34.4.1

OSPF RIP 4 RIP OSPF type-1 40 40

```
#     OSPF
Ruijie(config)# router ospf 1
Ruijie(config-router)# redistribute rip subnets route-map redrip
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 2
Ruijie(config-router)# redistribute ospf 1 route-map redospf
Ruijie(config-router)# network 200.168.23.0

#
Ruijie(config)# route-map redospf permit 10
Ruijie(config-route-map)# match tag 10
Ruijie(config-route-map)# set metric 10
```

OSPF RIP

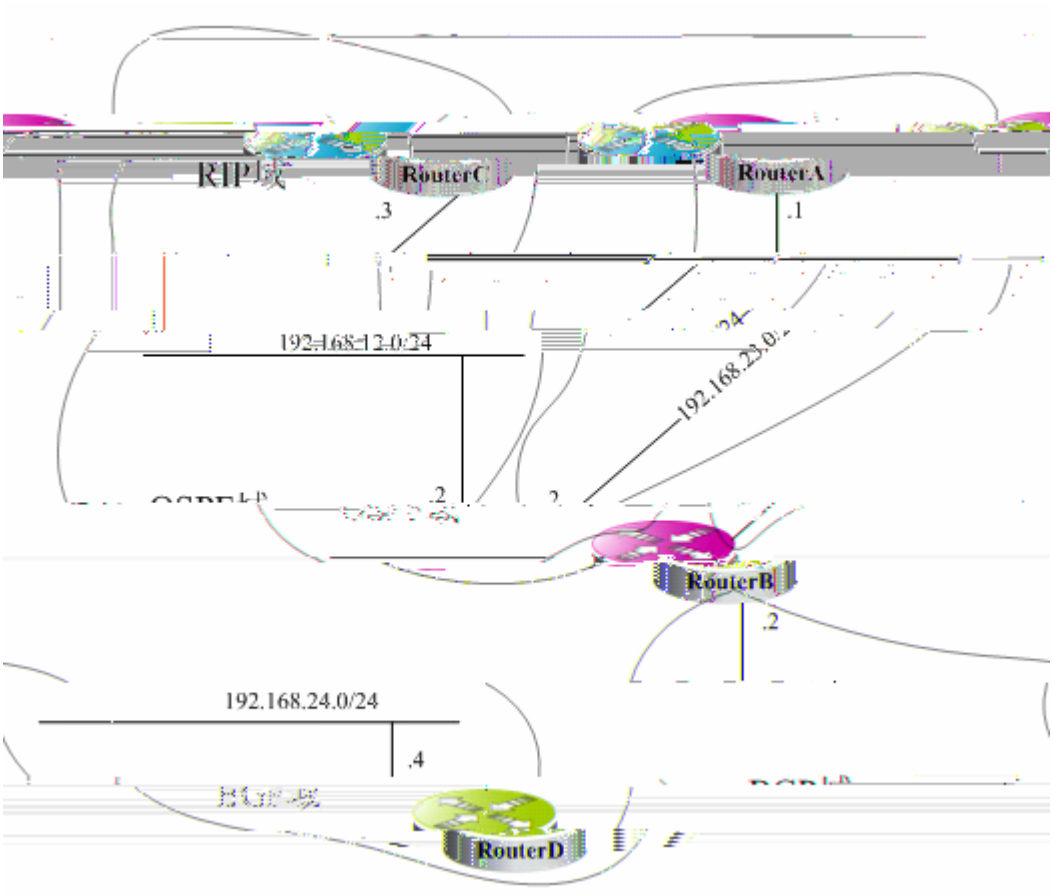
```
#
Ruijie(config)# route-map redrip permit 10
Ruijie(config-route-map)# match length 1 3
Ruijie(config-route-map)# match route-type external
Ruijie(config-route-map)# set level backbone
#
```

```
Ruijie(config)# ip access-list extended EXT_ACL
Ruijie(config-ext-nacl)#10 permit ip 192.168.1.0 0.0.0.255
any
Ruijie(config-ext-nacl)#10 permit ip 172.16.1.0 0.0.0.255 any
```

34.4.3

-

1 A OSPF C RIP D BGP B A 192.168.10.0/24 192.168.100.1/32 C 192.168.3.0/24 192.168.30.0/24 D 192.168.4.0/24 192.168.40.0/24



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
```

D

```
#
Ruijie(config)# interface gigabitEthernet 0/0
Ruijie(config-if)# ip address 192.168.40.1 255.255.255.0
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# ip address 192.168.4.1 255.255.255.0
Ruijie(config)# interface gigabitEthernet 1/0
Ruijie(config-if)# ip address 192.168.24.4 255.255.255.0

#     BGP
Ruijie(config)# router bgp 4
Ruijie(config-router)# neighbor 192.168.24.2 remote-as 2
```

```
Ruijie(config-router)# redistribute connected route-map bgprm
Ruijie(config-router)# address-family ipv4
Ruijie(config-router-af)# neighbor 192.168.24.2 activate
Ruijie(config-router-af)# neighbor 192.168.24.2
 send-community

#
Ruijie(config)# route-map bgprm
Ruijie(config-route-map)# set community 22:22
```

A OSPF :

```
O  E1  192.168.30.0/24  [110/101]  via  192.168.12.5,  00:04:07,
GigabitEthernet0/1
O  E1  192.168.3.0/24  [110/101]  via  192.168.12.5,  00:04:07,
GigabitEthernet0/1
```

C RIP

```
R   0.0.0.0/0 [120/1] via 200.168.23.2, 00:00:00, Serial1/0
R   192.168.10.0/24 [120/2] via 200.168.23.2, 00:00:00,
Serial1/0
```

35

35.1

RGDG

- IP
- IP
- MAC
- MAC
- Expert
- IPV6

35.1.1

ACLs (Access Control Lists) Access Lists
ACLs
ACLs
QoS ACLs

ACLs
(Conditions) (Permit)ACLs Ò¨E Qs 1*+s‘EÕ

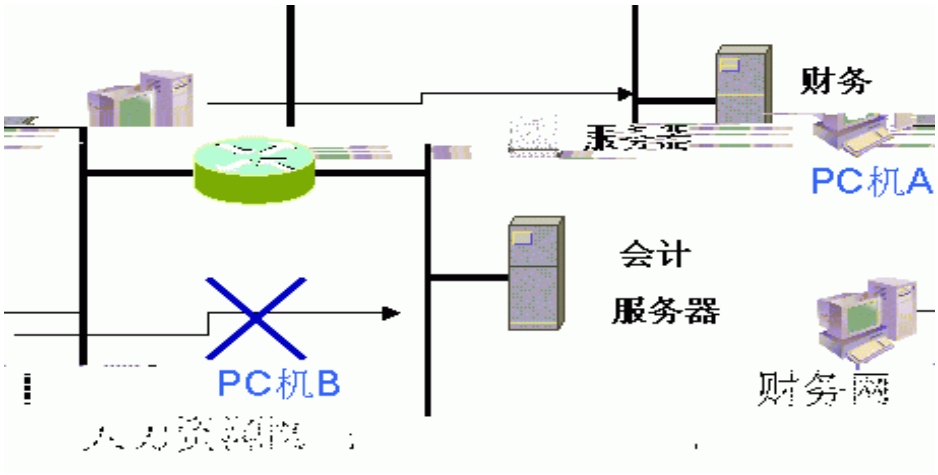
-

-

WWW TELNET

1 A B

1



1

35.1.3

IPSEC

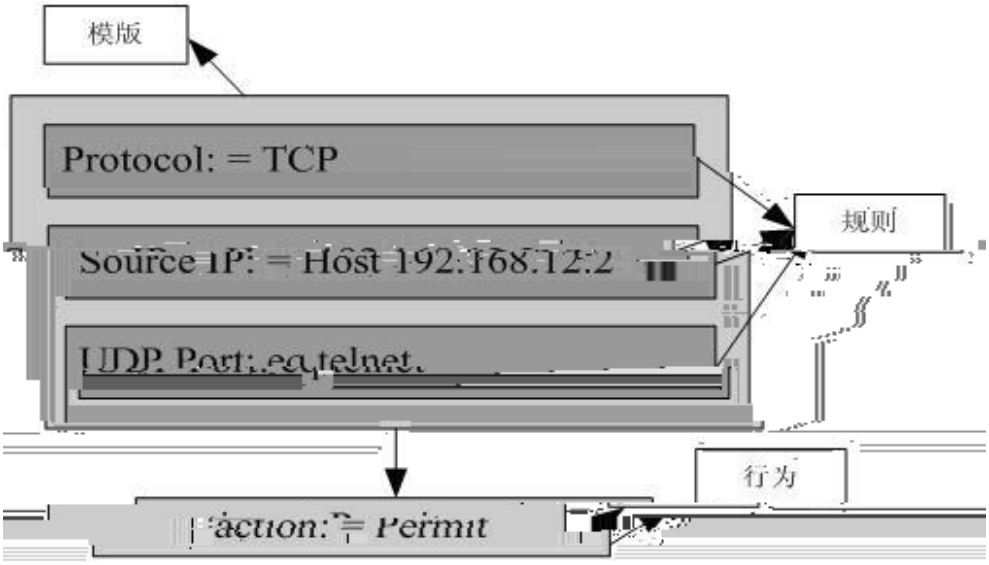
- INTERNET

-

- .

35.1.4 / ACL

ACL ACL ACE
ACL L9è7,Xê



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

35.2 IP

IP	1-99 1300 - 1999
IP	100-199 2000 - 2699

35.2.1 IP

-
-
-
-

IP 1 - 99 1300 - 1999 IP
IP 100 – 199 2000 - 2699

35.2.1.1 ŭ ľ Ł ‡ ⁄

“ ”

access-list 1 **permit host** 192.168.4.12

192.168.4.12
access-list 1 deny any

Access-list 1 **deny host** 192.168.4.12

“ ”

35.2.1.2 ώ ‡ ٨

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

35.2.2 IP

1.

2.

Ruijie (config-xxx-nacl)# [*sn*] { **permit** | **deny** } {src *src-wildcard* | **host** *src* | **any** } [**time-range** *tm-rng-name*]	ACL ,
Ruijie(config-xxx-nacl)# **exit** Ruijie(config)# **interface** *interface*	
Ruijie(config-if)# **ip access-group** *id* { **in** | **out** } [**unreflect**]	

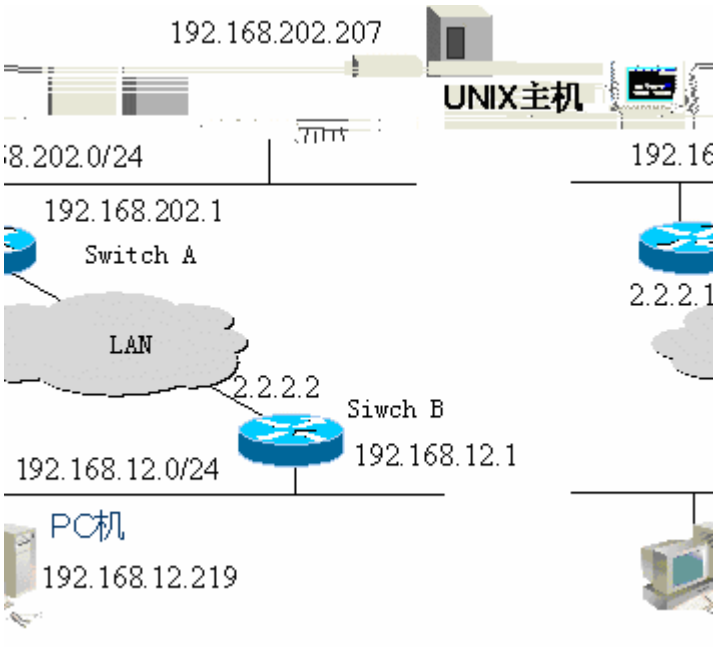
ACL ACL
(ACE)
IP ACL ACL unreflect ACL
ACL a.
, protocol source-IP ,
destination-IP source-port,destination-port b.

35.2.3 IP

Ruijie# **show access-lists** [*id* | *name*]

35.2.4 IP

- Switch A Switch B 1-3



3

Switch B

1. 192.168.12.0/24 UNIX TELNET PING
2. Switch B 192.168.202.0/24

-

Switch B

```
Ruijie(config)# interface GigabitEthernet 0/1
Ruijie(config-if)# ip address 192.168.12.1 255.255.255.0
Ruijie(config-if)# exit
Ruijie(config)# interface GigabitEthernet 0/2
Ruijie(config-if)# ip address 2.2.2.2 255.255.255.0
Ruijie(config-if)# ip access-group 101 in
Ruijie(config-if)# ip access-group 101 out
```

101

```
Ruijie(config)# access-list 101 permit tcp 192.168.12.0 0.0.0.255 any
eq telnet time-range check
```

```
Ruijie(config)# access-list 101 deny icmp 192.168.12.0 0.0.0.255
```

- VLAN ID

Expert 2700 -2899 MAC
VLAN ID

Expert

35.3.2 Expert

Expert

1. Expert
2. ( )

Expert

```
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#
```

35.4 TCP Flag

TCP Flag TCP Flag Match-All
TCP Flag ACL TCP Flag ACL
TCP Flag TCP Flag

permit tcp any any match-all rst

TCP Flag RST 0

ACL ACL TCP MAC
IP
NPE80

TCP Flag

Ruijie(config)# **ip access-list extended** { *id* | *name* }	
Ruijie(config-ext-nacl)# [*sn*] [**permit** | **deny**] **tcp** *source source-wildcard* [**operator port** [*port*]] *destination destination-wildcard* [**operator port** [*port*]] [**match-all** *flag-name*][**precedence** *precedence*]	ACL ,

Ruijie(config-exp-nacl)# **exit** Ruijie(config)# **interface** *interface*	
Ruijie(config-if)# **ip access-group** {*id* | *name*} {**in** | **out**}	

TCP Flag

1) enable

```
Ruijie> enable
Ruijie#
```

2)

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

3) ACL

```
Ruijie(config)# ip access-list extended test-tcp-flag
Ruijie(config-ext-nacl)#
```

4) ACL

```
Ruijie(config-ext-nacl)# permit tcp any any match-all rst
```

5) deny

```
Ruijie(config-ext-nacl)# deny tcp any any match-all fin
```

6)

7) end

```
Ruijie(config-ext-nacl)# end
```

8) 8

```
Ruijie# show access-list test-tcp-flag
ip access-lists extended test-tcp-flag
10 permit tcp any any match-all rst
20 deny tcp any any match-all fin
```

35.5 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
ace1: 100
ace2: 103
ace5: 105
ace3: 106
ace4: 109
```

4 ace

ACE

```
Ruijie(config-std-nacl)# no 106
ace1: 100
ace2: 103
ace5: 105
```

```
ace4: 109
```

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
```

35.7

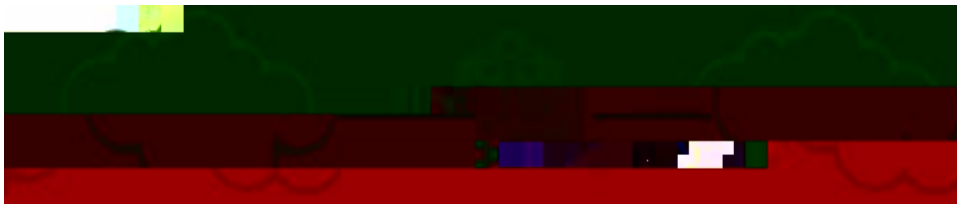
35.7.1 TCP

TCP Flag ACL

35.7.1.1

A A B
TCP B A TCP

35.7.1.2 في



4

A G3/1 B G3/2

35.7.1.3 ¦

B A TCP B G3/2 TCP TCP TCP TCP SYN ACK 0 Match-all G3/2 TCP SYN 1 ACK 0 A B

35.7.1.4

1)

#

```
Ruijie# configure terminal
```

ACL101

```
Ruijie(config)# ip access-list extended 101
```

TCP Flag SYN=1 ACK 0

```
Ruijie(config-ext-nacl)# deny tcp any any match-all syn
```

IP

```
Ruijie(config-ext-nacl)# permit ip any any
```

2)

#

```
Ruijie(config-ext-nacl)# exit
```

G3/2

```
Ruijie(config)# interface gigabitEthernet 3/2
```

ACL 101 G3/2

```
Ruijie(config-if)# ip access-group 101 in
```

3)

show ACL

```
Ruijie# show access-lists 101

ip access-list extended 101
10 deny tcp any any match-all syn
20 permit ip any any
```

36 RPL

36.1 RPL

36.1.1 RPL

RPL reverse path limited

37

37.1

1 CPU

2 CLI

3

E 1T 0$ RSFAyX&0$ RSC 5B

Classify

1. **protocol sub-interface**

2. **manage sub-interface** ftp telnet snmp arp

3. **data sub-interface** icmp

SCPP Segregate Control Plane Protection

Glean-CAR

- Glean-CAR
- ARP-CAR
- Port-Filter
- MPP
- ACPP
-

	SCPP Glean-CAR ARP-CAR Port-Filter MPP ACPP

37.2.2 control-plane

control-plane control-plane

Ruijie(config)# **control-plane** {**protocol** | **manage** | **data**}	control-plane

control-plane exit

37.2.3 SCPP

SCPP

SCPP

Ruijie(config-cp)# **scpp list** *acl_no* {**bw-rate** bw-rate **bw-burst-rate** *bw-burst-rate* | **conn-total** *conn-num* | **conn-create-rate** conn-*create-rate* **conn-create-burst-rate** *conn-create-burst-rate*}	acl_no SCPP pps acl_no acl scpp bw-rate pps bw-burst-rate pps conn-num conn-create-rate /s conn-create-burst-rate /s

Ruijie(config-cp)# **no scpp list** acl_no	SCPP

SCPP

SCPP SCPP

37.2.4 Glean-CAR

IP Glean-CAR

Ruijie(config-cp)# **glean-car** *packet_rate_per_group*	Glean *packet_rate_per_group* pps
Ruijie(config-cp)# **no glean-car**	Glean-CAR

Glean-CAR data

N N

Glean-CAR Glean
A 192.168.52.57 B 192.168.60.57
C 172.16.0.5 172.16.0.5 ARP
glean-car 5 A B 5
IP ARP

Glean-CAR Glean
5pps

37.2.5 ARP-CAR

ARP ARP-CAR

Ruijie(config-cp)# **arp-car** *packet_rate_per_group*	ARP *packet_rate_per_group* pps
Ruijie(config-cp)# **no arp-car**	ARP-CAR

ARP-CAR manage

N N

ARP-CAR ARP A

Ruijie(config-cp)# **acpp bw-rate** *rate* **bw-burst-rate** *burst-rate*	ACPP *rate* pps *burst-rate* pps
Ruijie(config-cp)# **no acpp**	ACPP

ACPP

ACPP

37.2.9

control-plane بج ش / - ؟

```
Ruijie(config-cp)# port-filter
//     MPP          gi0/0                              telnet  snmp
Ruijie(config-cp)# management-interface gi0/0 allow telnet snmp
```

38

38.1 ip-mac

38.1.1 ip-mac

IP/MAC

IP ض IP

38.2.2

38.2.2.1 ŏ ώ ϟ

П

ip ingress-filter

```
Ruijie(config-if)# ip ingress-filter log
```

ip ingress-filter no

```
Ruijie(config-if)# no ip ingress-filter log
```

38.2.2.2 ώ ϟ ҉

ip-mac **show ip ingress-filter**

```
Ruijie(config)# show ip ingress-filter
Firewall Network-ingress-filter is enable, blocked 0 flowsInterface
GigabitEthernet 1/0: log is on, blocked 0 flows
```

38.3 TCP SYN

38.3.1 TCP SYN

SYN SYN Flood SYN flood TCP
TCP SYN , TCP
TCP SYN ACK TCP ACK 3
TCP
SYN /

38.3.2 TCP SYN

38.3.2.1 ŭ TCP SYN ʔ ╖

TCP SYN TCP SYN
acl TCP SYN

```
Ruijie(config)# access-list 100 permit ip 192.168.52.0 0.0.0.255 any
```

ip tcp-intercept list in|out acl
TCP SYN

```
Ruijie(config)# interface gigabitEthernet 0/0
Ruijie(config-if)# ip tcp-intercept list 100 in log
```

gi 0/0 acl 100 TCP SYN
TCP SYN

ip tcp-intercept list in|out no

```
Ruijie(config)# interface gigabitEthernet 0/0
Ruijie(config-if)# no ip tcp-intercept list 100 in log
```

38.3.2.2 TCP SYN ʔ ə

TCP SYN show ip tcp-intercept

```
Ruijie(config-if)# show ip tcp-intercept
Intercepting new connections using access-list 100 at
```

38.4.2

config

P !ÜAPB2CÃB

```
mms
```

```
Ruijie(config)# interface gigabitEthernet 0/0
Ruijie(config-if)# ip inspect abc in
Ruijie(config)# show ip inspect all
Inspection Rule Configuration
Inspection name abc
ftp
mms
Inspection name 123
mms
h323

Interface Configurationn
Interface gigabitEthernet 0/0
Inbound inspection rule is abc
ftp
mms

Ruijie(config)# interface gigabitEthernet 0/0
Ruijie(config-if)# ip inspect 123 in
Ruijie(config)# show ip inspect all
Inspection Rule Configuration
Inspection name abc
ftp
mms
Inspection name 123
mms
h323

Interface Configurationn
Interface gigabitEthernet 0/0
Inbound inspection rule is 123
mms
h323
```

38.5 TCP

38.5.1 TCP

TCP TCP TCP

38.5.2 TCP

38.5.2.1 TCP /I ℸ

gi0/0 in

```
----------------------------------------------------------------------------------------------------
Output
no session-limit access-group 1 rate 12 concurrent 123
out log
==[Show Cmd to del the rule on the gigabitEthernet 0/0's end]=
```

38.6.3.3 show session-limit statistics

```
Ruijie(config-if)# show session-limit statistics

=========[Show gigabitEthernet 0/0's Statistics]========
Input
matches access-group  : 1
[Configure]:  new_session_rate : 12 , concurren : 123
[Statistics]:  conformed 2247 sessions, blocked 0 sessions

matches access-group  : 12
[Configure]:  new_session_rate : 20 , concurren : 100
[Statistics]:  conformed 0 sessions, blocked 0 sessions

matches access-group  : 13
[Configure]:  new_session_rate : 20 , concurren : 100
[Statistics]:  conformed 0 sessions, blocked 0 sessions

matches access-group  : 14
[Configure]:  new_session_rate : 20 , concurren : 100
[Statistics]:  conformed 0 sessions, blocked 0 sessions

----------------------------------------------------------------------------------------------------
Output
matches access-group  : 1
[Configure]:  new_session_rate : 12 , concurren : 123
[Statistics]:  conformed 0 sessions, blocked 0 sessions

=========[Show gigabitEthernet 0/0's Statistics End ]=======
```

38.7

38.7.1

icmp flood udp flood

TCP ICMP
TCP SYN ICMP
ip session track-state-strictly

ip session track-state-strictly FW
TCP
TCP telnet ftp

39 VPDN

39.1 VPDN

VPDN L2TP PPTP

- L2TP(Layer Two Tunneling Protocol)
- PPTP(Point-to-Point Tunneling Protocol)

VPDN PPTP
MicroSoft Windows L2TP Cisco
L2TP Windows 2000/XP

┘

40 PPTP

40.1 PPTP

Point-to-Point-Tunneling Protocol (PPTP) VPN
Microsoft Windows NT® Workstation Windows® 95 Windows® 98
Windows® 2000 PPP ISP Internet
RFC 2637 Microsoft
Internet Engineering Task Force(IETF)

PPTP IP PPP PPP
PPP
PPTP Network Access Servers NAS PNS PPTP Network
Server PAC(PPTP Access Concentrator) PNS
TCP/IP IP PAC PSTN ISDN
PPP

PNS PPTP
PPTP

40.2 PPTP

40.2.1

- ( )
- ( )
- VPDN ( )
- Virtual-template ( )
- VPDN-group( )

40.2.2

PPTP PNS PPTP
VPN IP IP
IP

40.2.5.1 virtual-template ㅓ

Virtual-template

Ruijie(config)# **interface virtual-template** *number*	/ Virtual -template
Ruijie(config)# **no interface virtual-template** *number*	Virtual- template

number Virtual-template Virtual-template PPTP Vrtual-access

40.2.6 VPDN-group

PPTP VPDN-group VPDN-group

- VPDN-group( )
- ( )
- ( )
- ( )
- ( )
- ( )
- VPDN-group ( )
- PPTP ( )
- PPTP ( )

40.2.6.1 VPDN-group

VPDN-group

Ruijie(config)# **vpdn-group** *name*	/ VPDN-group
Ruijie(config)# **no vpdn-group** *name*	VPDN-group

name VPDN-group VPDN-group

40.2.6.2

Ruijie (config-vpdn)# **accept-dialin**	
Ruijie (config-vpdn)# **no accept-dialin**	

PNS

40.2.6.3 ~

Ruijie(config-vpdn-acc-in)# **protocol** {**any** | **l2tp** | **[illegible]tp**}	
Ruijie(config-vpdn-acc-in)# **no protocol**	

} ‘c~™rH B‘G•2! @ …)—$ax' IdC~ R H„cd& P& @ …, E|! R$XFq‡ %ĀQ ¸ ‘a ãqˆH ˜) y„ˆ" a .. PNS

40.2.6.5 ﻝ

VPDN-group
VPDN-group VPDN-group VPDN
VPDN-group
VPDN-group

Ruijie(config-vpdn)# **terminate-from hostname** *name*	
Ruijie(config-vpdn)# **no terminate-from hostname**	

name

ﻝ

Ruijie(config-vpdn)# **local name** *name*	
Ruijie(config-vpdn)# **no local** *name*	

name

40.2.6.6 VPDN-group فخ سم

VPDN-group
VPDN-group

Ruijie(config-vpdn)# **source-ip** *src-ip*	VPDN-group
Ruijie(config-vpdn)# **no source-ip**	VPDN-group

src-ip VPDN-group

40.2.6.7 PPTP ٧

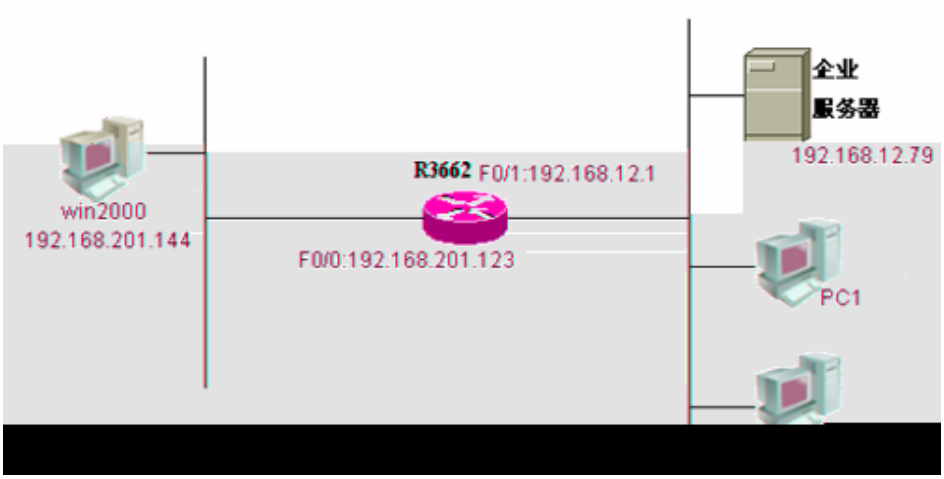
PPTP

Ruijie(config-vpdn)# **pptp flow-control receive-window winsize**	PPTP 1—64
Ruijie(config-vpdn)# **no pptp flow-control receive-window**	PPTP PAC 16 PNS 64
Ruijie(config-vpdn)# **pptp flow-control** *static-rtt interval*	PPTP ACK 100—5000

Ruijie(config-vpdn)# **no pptp**

PPTP R3660

IP IP



1 PPTP

R3660

```
Description . . . . . . . . . . . : STAR 901 Family Fast Ethernet
r (ACPI)
Physical Address. . . . . . . . . : 00-D0-F8-00-68-E5
DHCP Enabled. . . . . . . . . . . : No
IP Address. . . . . . . . . . . . : 192.168.201.144
Subnet Mask . . . . . . . . . . . : 255.255.255.0
Default Gateway . . . . . . . . . : 192.168.201.123
DNS Servers . . . . . . . . . . . : 202.101.143.141
Primary WINS Server . . . . . . . : 192.168.9.7
F:\>route print
===========================================================
Interface List
0x1 ........................... MS TCP Loopback interface
0x2 ...00 d0 f8 00 68 e5 ...... PCI Bus Master Adapter
===========================================================Active
Routes:
Network Destination  Netmask   Gateway      Interface  Metric
0.0.0.0    0.0.0.0  192.168.201.123  192.168.201.144     1
127.0.0.0  255.0.0.0       127.0.0.1      127.0.0.1      1
192.168.201.0  255.255.255.0  192.168.201.144 192.168.201.144
1
192.168.201.144  255.255.255.255 127.0.0.1   127.0.0.1    1
192.168.201.255  255.255.255.255  192.168.201.144  192.168.201.144
1
224.0.0.0  224.0.0.0  192.168.201.144  192.168.201.144  1
255.255.255.255  255.255.255.255  192.168.201.144  192.168.201.144
1
Default Gateway:   192.168.201.123
===========================================================
Persistent Routes:
None
```

Win2000 “ ” “ ” “ Internet ” “ ” “ ” 192.168.201.123 Vpdnconnect Vpdnconnect VPDN PPTP PAP

PC 1111

Win2000 192.168.12.79

```
F:\>ipconfig /all
Windows 2000 IP Configuration
Host Name . . . . . . . . . . . . : testpc
```

PPTP

```
192.168.201.123  255.255.255.255  192.168.201.144  192.168.201.144
1
192.168.201.144  255.255.255.255       127.0.0.1      127.0.0.1
1
192.168.201.200  255.255.255.255  192.168.201.100  192.168.201.144
1
192.168.201.255  255.255.255.255  192.168.201.144  192.168.201.144
1
224.0.0.0     224.0.0.0       1.1.1.4        1.1.1.4    1
224.0.0.0  224.0.0.0  192.168.201.144  192.168.201.144  1
255.255.255.255  255.255.255.255  192.168.201.144  192.168.201.144
1
Default Gateway:          192.168.12.1
===========================================================
Persistent Routes:
None
F:\>
F:\>ping 192.168.12.1
Pinging 192.168.12.1 with 32 bytes of data:
Reply from 192.168.12.1: bytes=32 time<10ms TTL=255
Reply from 192.168.12.1: bytes=32 time<10ms TTL=255
Reply from 192.168.12.1: bytes=32 time<10ms TTL=255
Reply from 192.168.12.1: bytes=32 time<10ms TTL=255
Ping statistics for 192.168.12.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  0ms, Average =  0ms
F:\>ping 192.168.12.79
Pinging 192.168.12.79 with 32 bytes of data:
Reply from 192.168.12.79: bytes=32 time=10ms TTL=127
Reply from 192.168.12.79: bytes=32 time<10ms TTL=127
Reply from 192.168.12.79: bytes=32 time<10ms TTL=127
Reply from 192.168.12.79: bytes=32 time<10ms TTL=127
Ping statistics for 192.168.12.79:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  10ms, Average =  2ms


R3660#sh ip route
Codes: C - connected, S - static,  R - RIP
O - OSPF, IA - OSPF inter area
```

```
E1 - OSPF external type 1, E2 - OSPF external type 2
Gateway of last resort is 0.0.0.0 to network 0.0.0.0
1.0.0.0/8 is variably subnetted, 2 subnets, 2 masks
C      1.1.1.0/24 is directly connected, Virtual-Access1
C      1.1.1.4/32 is directly connected, Virtual-Access1
C    192.168.12.0/24 is directly connected, GigabitEthernet0/1
C    192.168.201.0/24 is directly connected, GigabitEthernet0/0
S*   0.0.0.0/0 is directly connected, GigabitEthernet0/0
R3660#
```

VPDN

192.168.12.1

40.2.8 PPTP

40.2.8.1 PPTP

show vpdn

Ruijie# **show vpdn tunnel**	VPDN Tunnel
Ruijie# **show vpdn session**	VPDN Session
Ruijie# **show vpdn**	VPDN Tunnel Session

```
R3660# sh vpdn
%No active L2TP tunnels
PPTP Tunnel and Session Information Total tunnels 1 sessions 1
LocID Remote Name    State      Remote Address  Port  Sessions
1                    estbed     192.168.201.144 1436  1
LocID RemID TunID  Intf    Username     State     Last Chg
1     49152 1      Vi1     pc           connected  00:31:33
R3660#
```

L2TP PPTP

Total tunnels 1 sessions 1

ID LocID Remote Name State

IP Remote Address PPTP TCP Port

Sessions ID LocID ID RemID

ID TunID Virtual-Access Intf
Username (State) Last Chg

40.2.8.2 PPTP

clear vpdn

Ruijie# **clear vpdn tunnel** [[**l2tp** | **pptp**] [*remote name*]]	

remote name

clear vpdn tunnel pptp **clear vpdn tunnel**

```
R3660# show vpdn
%No active L2TP tunnels
%No active PPTP tunnels
```

debug vpdn PPTP
debug ppp PPP

Ruijie# **debug vpdn** [**error** | **event** | **packet**]	VPDN Error Event Packet

---

Debug

PPTP **debug vpdn event**

```
VPDN: Pptp recv start-control-connection-request from host
192.168.200.114
PPTP: New tunnel socket id =9
VPDN: Pptp get tunnel info for 192.168.200.114 ok!
VPDN: Pptp send start-control-connection-reply, ok
VPDN: Pptp tunnel id 0 state change: idle --> estbed
PPTP: Add send-echo-request timer, interval = 60
```

```
VPDN: Pptp tunnel id 0 recv outgoing-call-request!
Pptp: Tunnel to 192.168.200.114 get config para. from vpdn-group pptp!
VPDN: Must process using ACCEPT_DIALIN parameters
Pptp: Session va0 get config para. from vpdn-group pptp!
VPDN: Pptp session va0 state change: idle --> connected
PPTP: Receive outcall request,process ok!assign local call id = 1
VPDN: Pptp tunnel id 0 send out-call reply
%LINK CHANGED: Interface virtual-access 0, changed state to up
VPDN: Pptp tunnel to 192.168.200.114 peer callid 1 recv set-linkinfo
VPDN: Pptp tunnel to 192.168.200.114 peer callid 1 recv set-linkinfo
%LINE PROTOCOL CHANGE: Interface virtual-access 0, changed state to
UP
```

PPTP **debug vpdn packet**

```
PPTP: I Start-Control-Connection-Request len 156 Magic Cookie
0x1A2B3C4D
Protocol Version 0x100
Framing Type 0x1
Bearer Type 0x1
Maximum Channels 0x0
```

```
Phone Number:
Subaddress:

PPTP: O Outgoing-Call-Reply len 32 Magic Cookie 0x1A2B3C4D
Call Id 0x1
Peer Call Id 0x4000
Result Code 0x1
Error Code 0x0
Cause Code 0x0
Connect Speed 0xFA00
Rec Window Size 0x10
Physical Channel Id 0x0

PPTP: I Set-Link-Info len 24 Magic Cookie 0x1A2B3C4D
Peer Call Id 0x1
Send ACCM 0xFFFFFFFF
Recv ACCM 0xFFFFFFFF
%UPDOWN: Interface Virtual-Access1, changed state to up
```

```
VPDN: PPTP session Virtual-Access1 wait pak ack timeout(wait seq=39,
ack=36), de
crease send window to half of current = 8!
VPDN: PPTP session Virtual-Access1 adjust ATO to 400 ms!
VPDN: Pptp EGRE encap fail, err=-4!
VPDN: PPTP session Virtual-Access1 wait pak ack timeout(wait seq=40,
ack=36), de
crease send window to half of current = 4!
```

41 L2TP

41.1 L2TP

Layer 2 Tunnel Protocol(L2TP) Internet Engineering Task Force(IETF)
Cisco Layer 2 Forwarding(L2F) Point-to-Point Tunneling
Protocol (PPTP) RFC
2661

L2TP Point-to-Point Protocol(PPP) PPP
PPTP L2TP UDP

L2TP VPN

L2TP L2TP
L2TP-class

- L2TP-class
- L2TP
- L2TP
- L2TP

41.2.2.1 l2tp-class ´ ĩ

L2TP L2TP-class

Ruijie(config)# **l2tp-class** *l2tp-class-name*	/ L2TP-class
Ruijie(config)# **no l2tp-class** *l2tp-class-name*	! L2TP-class

L2TP-class-name / L2TP-class L2TP-class
Pseudowire-class

41.2.2.2 L2TP 8 ٧

L2TP

Ruijie(config-l2tp-class)# **receive-window** *size*	
Ruijie(config-l2tp-class)# **no receive-window**	

Ruijie(config-l2tp-class)# **retransmit** {**initial**
{**retries** *initial-retries* | **timeout** { *size* **{**

Ruijie(config-l2tp-class)# **timeout setup** *seconds*	
Ruijie(config-l2tp-class)# **no timeout setup**	

size 8 *initial-retries* SCCRQ
2 *initial-timeout* SCCRQ 1
8 *retries* 5 *timeou*t
1
8 *seconds* (Tunnel) 120

41.2.2.3 L2TP 8 ٧

L2TP (Tunnel)

Ruijie(config-l2tp-class)# **authentication**	
Ruijie(config-l2tp-class)# **no authentication**	
Ruijie(config-l2tp-class)# **no hostname**	
Ruijie(config-l2tp-class)# **hostname** *host-name*	
Ruijie(config-l2tp-class)# **password** *pass-words*	
Ruijie(config-l2tp-class)# **no password**	

host-name

pass-words

41.2.2.4 L2TP 8 ٧

(Tunnel)

Ruijie(config-l2tp-class)# **hello** *interval*	

41.2.3 pseudowire-class

L2TP L2TP

Ruijie (config-pw-class)# **ip dfbit set**	
Ruijie (config-pw-class)# **no ip dfbit set**	
Ruijie (config-pw-class)# **ip ttl** *ttl-value*	IP TTL
Ruijie (config-pw-class)# **no ip ttl**	TTL
Ruijie (config-pw-class)# **ip local interface** *interface-name*	( )
Ruijie(config-pw-class)# **no ip local interface** *interface-name*	( )

L2TP IP L2TP UDP IP
TTL 255
( )

41.2.3.4 L2TP 8 ٧

L2TP

Ruijie(config)# **protocol l2tpv2** [*l2tp-class-name*]	L2TP
Ruijie(config)# **no protocol**	

L2TPv2 RFC 2661 L2TP
L2TP-class-name L2TP-class
L2TP

41.2.4 virtual-ppp

L2TP L2TP
Virtual-ppp

- Virtual-ppp
- IP
-
- Pseudowire

IP

41.2.4.1 virtual-ppp ㅓ

L2TP Virtual-ppp

Ruijie (config-if)# **no pseudowire**	Pseudowire

virtual-ppp Pseudowire virtual-ppp

```
l2tp-class l2x
hostname branch
!
pseudowire-class pw
encapsulation l2tpv2
protocol l2tpv2 l2x
ip local interface Gig22Css pw
!
p(cal)6( i)6(Gig)6(22Css 6( )]TJ0 -1.1 -1.herrancet 0/pw)1Tc T*(! )tocol iTJ
```

```
!
!
end
```

”Branch” (NAT) virtual-ppp 1
”Headquarters” L2TP Tunnel ”Branch”
(NAT) interface GigabitEthernet 0/1 Internet
ACL(Access Control List)

2)Windows 2000 Server :

```
Microsoft Windows 2000 [Version 5.00.2195]
(C)        1985-2000 Microsoft Corp.
C:\>ipconfig /all
Windows 2000 IP Configuration
Host Name . . . . . . . . . . . . : BLIZZARD
Primary DNS Suffix  . . . . . . . :
Node Type . . . . . . . . . . . . : Broadcast
IP Routing Enabled. . . . . . . . : Yes
WINS Proxy Enabled. . . . . . . . : No

Ethernet adapter         2:
Connection-specific DNS Suffix  . :
Description . . . . . . . . . . . : NE2000 Compatible
Physical Address. . . . . . . . . : 00-10-88-01-A5-C3
DHCP Enabled. . . . . . . . . . . : No
IP Address. . . . . . . . . . . . : 192.168.12.213
Subnet Mask . . . . . . . . . . . : 255.255.255.0
Default Gateway . . . . . . . . . : 192.168.12.1
DNS Servers . . . . . . . . . . . : 202.101.143.141

PPP adapter RAS Server (Dial In) Interface:
Connection-specific DNS Suffix  . :
Description . . . . . . . . . . . : WAN (PPP/SLIP) Interface
Physical Address. . . . . . . . . : 00-53-45-00-00-00
DHCP Enabled. . . . . . . . . . . : No
IP Address. . . . . . . . . . . . : 192.168.103.2
Subnet Mask . . . . . . . . . . . : 255.255.255.255
Default Gateway . . . . . . . . . :
DNS Servers . . . . . . . . . . . :

C:\>route print
===========================================================
Interface List
0x1 ........................... MS TCP Loopback interface
```

```
0x1000002 ...00 53 45 00 00 00 ...... WAN (PPP/SLIP) Interface
0x1000003 ...00 10 88 01 a5 c3 ...... Novell 2000 Adapter.
===========================================================
Active Routes:
Network Destination       Netmask         Gateway      Interface
Metric
0.0.0.0    0.0.0.0    192.168.12.1  192.168.12.213    1
127.0.0.0    255.0.0.0     127.0.0.1    127.0.0.1    1
192.168.12.0    255.255.255.0   192.168.12.213  192.168.12.213
1
192.168.12.213  255.255.255.255       127.0.0.1      127.0.0.1
1
192.168.12.217  255.255.255.255   192.168.12.213  192.168.12.213
1
192.168.12.255  255.255.255.255   192.168.12.213  192.168.12.213
1
192.168.103.2  255.255.255.255       127.0.0.1      127.0.0.1
1
192.168.103.6  255.255.255.255    192.168.103.2   192.168.103.2
1
224.0.0.0  224.0.0.0  192.168.12.213  192.168.12.213  1
255.255.255.255  255.255.255.255   192.168.12.213  192.168.12.213
1
Default Gateway:     192.168.12.1
===========================================================
Persistent Routes:
None
C:\>
```

Windows 2000 Server ” ”

VPDN (ACL Ĥ ر t Ƈ

```
192.168.201.64  255.255.255.192   192.168.201.78  192.168.201.78
1
192.168.201.78  255.255.255.255       127.0.0.1      127.0.0.1
1
192.168.201.255  255.255.255.255   192.168.201.78  192.168.201.78
1
224.0.0.0   224.0.0.0   192.168.201.78  192.168.201.78   1
  255.255.255.255  255.255.255.255   192.168.201.78
192.168.201.78      1
Default Gateway:    192.168.201.1
===========================================================
Persistent Routes:
Network Address         Netmask  Gateway Address  Metric
192.168.2.0    255.255.255.0     192.168.1.1      1
192.168.9.0    255.255.255.0    192.168.12.1      1
61.154.22.0    255.255.255.0    192.168.12.1      1
C:\WINNT\system32>ping 192.168.12.1
Pinging 192.168.12.1 with 32 bytes of data:
Reply from 192.168.12.1: bytes=32 time=50ms TTL=254
Reply from 192.168.12.1: bytes=32 time=20ms TTL=254
Reply from 192.168.12.1: bytes=32 time<10ms TTL=254
Reply from 192.168.12.1: bytes=32 time=60ms TTL=254
Ping statistics for 192.168.12.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  60ms, Average =  32ms
C:\WINNT\system32>ping 192.168.103.2
Pinging 192.168.103.2 with 32 bytes of data:
Reply from 192.168.103.2: bytes=32 time<10ms TTL=128
Reply from 192.168.103.2: bytes=32 time<10ms TTL=128
Reply from 192.168.103.2: bytes=32 time<10ms TTL=128
Reply from 192.168.103.2: bytes=32 time<10ms TTL=128
Ping statistics for 192.168.103.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  0ms, Average =  0ms
C:\WINNT\system32>
```

”Branch” ”DENGL-NECBOOK” Internet

”Hea04 0 Td[(”Hea04 0 TE07FD2C58>-6<41934BC2>]TJ 1 66 -E1 Tf s.251 i2ne)8(t)]TJ/C2_

```
R3660# show ip nat translations
Pro Inside global     Inside local      Outside local     Outside
global
icmp 192.168.103.6:512 192.168.201.78:512 192.168.207.2:512
192.168.207.2:512
icmp 192.168.12.217:512 192.168.201.78:512 192.168.12.1:512
192.168.12.1:512
R3660# show ip route
Codes: C - connected, S - static,  R - RIP
O - OSPF, IA - OSPF inter area
E1 - OSPF external type 1, E2 - OSPF external type 2
Gateway of last resort is 192.168.12.1 to network 0.0.0.0
192.168.103.0/32 is subnetted, 2 subnets
C       192.168.103.6 is directly connected, Virtual-PPP1
C       192.168.103.2 is directly connected, Virtual-PPP1
C    192.168.12.0/24 is directly connected, GigabitEthernet0/1
C    192.168.201.0/24 is directly connected, GigabitEthernet0/0
S*   0.0.0.0/0 [1/0] via 192.168.12.1, GigabitEthernet0/1
R3660#
```

41.2.5.2 б Cisco 2620

Ruijie Cisco 2620 L2TP Cisco 2620 L2TP Network Server(LNS) 3

3 Cisco 2620(LNS) L2TP

R3660 Cisco2620

1)R3660

```
R3660# show running-config
Building configuration...
Current configuration : 1136 bytes
!
```

```
hostname R3660
access-list 1 permit any
!
l2tp-class l2x
authentication
hostname branch
password share
!
pseudowire-class pw
encapsulation l2tpv2
protocol l2tpv2 l2x
ip local interface serial1/0
!
!
!
!
!
!
interface serial 1/0
encapsulation PPP
ip address 202.101.93.21 255.255.255.192
```

```
interface Null 0
!
interface Virtual-ppp 1
pseudowire 202.101.93.23 7 pw-class pw
ppp pap sent-username rgnos password 7 072C04211A01
ip mtu 1460
ip address 192.168.103.3 255.255.255.0
!
router ospf
network 192.168.103.0 0.0.0.255 area 0.0.0.1
network 192.168.201.0 0.0.0.255 area 0.0.0.1
!
ip nat inside source list 1 interface Serial1/0 overload
ip route 0.0.0.0 0.0.0.0 serial 1/0
ip route 192.168.19.0 255.255.255.0 Virtual-ppp 1
!
line con 0
line aux 0
line vty 0 4
!
!
end
R3660#
```

”Branch” ( ) Virtual-ppp 1

”Headquarters” L2TP Tunnel ”Branch”

(0Å’|s6Ñ*ü ﻙ א Ŏ

```
C      202.101.93.0/26 is directly connected, Serial1/0
S*   0.0.0.0/0 is directly connected, Serial1/0
R3660#show arp
Protocol  Address         Age (min)  Hardware Addr   Type
Interface
Internet  192.168.201.213        3   0010.8801.a5c3  ARPA
GigabitEthernet0/0
Internet  192.168.201.1          -   00d0.f8fb.126e  ARPA
GigabitEthernet0/0
R3660#
```

2)Cisco2620

```
Cisco2620# show running-config
Building configuration...
Current configuration : 1212 bytes
!
version 12.2
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
!
hostname Cisco2620
!
!
username 163 password 0 163
username rgnos password 0 rgnos
username 263 password 0 263
ip subnet-zero
!
!
no ip domain-lookup
!
vpdn enable
!
vpdn-group 1
! Default L2TP VPDN group
accept-dialin
protocol l2tp
virtual-template 1

!
```

```
!
interface GigabitEthernet0/0
ip address 192.168.19.1 255.255.255.0
duplex auto
speed 10
!
interface Serial0/0
ip address 202.101.93.23 255.255.255.192
encapsulation ppp
fair-queue
clockrate 2000000
!
interface Serial0/1
no ip address
shutdown
!
interface Virtual-Template1
ip address 192.168.103.2 255.255.255.0
ppp authentication pap
!
router ospf 100
log-adjacency-changes
network 192.168.103.0 0.0.0.255 area 1
!
ip classless
ip http server
!
!
voice-port 1/0/0
!
voice-port 1/0/1
!
dial-peer cor custom
!
!
gatekeeper
shutdown
!
!
line con 0
exec-timeout 0 0
line aux 0
```

```
Primary DNS Suffix  . . . . . :
Node Type . . . . . . . . . . . . : Broadcast
IP Routing Enabled. . . . . . . . : No
WINS Proxy Enabled. . . . . . . . : No

Ethernet adapter         2:
Connection-specific DNS Suffix  . :
Description . . . . . . . . . . . : NE2000 Compatible
Physical Address. . . . . . . . . : 00-10-88-01-A5-C3
DHCP Enabled. . . . . . . . . . . : No
IP Address. . . . . . . . . . . . : 192.168.201.213
Subnet Mask . . . . . . . . . . . : 255.255.255.0
Default Gateway . . . . . . . . . : 192.168.201.1
DNS Servers . . . . . . . . . . . : 202.101.143.141

C:\>route print
===========================================================
Interface List
0x1 ........................... MS TCP Loopback interface
0x3000003 ...00 10 88 01 a5 c3 ...... Novell 2000 Adapter.
===========================================================
===========================================================Active
Routes:
Network Destination       Netmask         Gateway      Interface
Metric
0.0.0.0    0.0.0.0    192.168.201.1  192.168.201.213    1
127.0.0.0    255.0.0.0     127.0.0.1    127.0.0.1      1
192.168.201.0    255.255.255.0  192.168.201.213  192.168.201.213
1
192.168.201.213  255.255.255.255       127.0.0.1      127.0.0.1
1
192.168.201.255  255.255.255.255  192.168.201.213  192.168.201.213
1
224.0.0.0   224.0.0.0  192.168.201.213  192.168.201.213   1
255.255.255.255  255.255.255.255  192.168.201.213  192.168.201.213
1
Default Gateway:    192.168.201.1
===========================================================
Persistent Routes:
None
C:\>ping 192.168.103.2
Pinging 192.168.103.2 with 32 bytes of data:
Reply from 192.168.103.2: bytes=32 time=10ms TTL=0
```

```
Reply from 192.168.103.2: bytes=32 time<10ms TTL=0
Reply from 192.168.103.2: bytes=32 time<10ms TTL=0
Reply from 192.168.103.2: bytes=32 time<10ms TTL=0
Ping statistics for 192.168.103.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  10ms, Average =  2ms
C:\>ping 192.168.19.1
Pinging 192.168.19.1 with 32 bytes of data:
Reply from 192.168.19.1: bytes=32 time<10ms TTL=254
Reply from 192.168.19.1: bytes=32 time<10ms TTL=254
Reply from 192.168.19.1: bytes=32 time<10ms TTL=254
Reply from 192.168.19.1: bytes=32 time<10ms TTL=254
Ping statistics for 192.168.19.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  0ms, Average =  0ms
C:\>ping 202.101.93.23
Pinging 202.101.93.23 with 32 bytes of data:
Reply from 202.101.93.23: bytes=32 time<10ms TTL=254
Reply from 202.101.93.23: bytes=32 time<10ms TTL=254
Reply from 202.101.93.23: bytes=32 time<10ms TTL=254
Reply from 202.101.93.23: bytes=32 time<10ms TTL=254
Ping statistics for 202.101.93.23:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  0ms, Average =  0ms
C:\>
```

”Branch” ”BLIZZARD” Internet ”Headquarters” VPDN

41.2.5.3 б windows 2000 hostname

Ruijie Windows 2000 PC PC windows 2000

```
 ip address negotiate
!
ip route 0.0.0.0 0.0.0.0 192.168.52.1
!
ref parameter 75 400
line con 0
line aux 0
line vty 0 4
 login
```

41.3

41.3.1

- ( )
- ( )
- VPDN ( )
- Virtual-template ( )
- Vpdn-group( )

41.3.2

L2TP LNS
L2TP VPN IP
IP IP

Ruijie(config)# **ip local pool** *poolname first-ip* [*last-ip*]	/
Ruijie(config)# **no ip local pool** *poolname*	

poolname / *first-ip*
last-ip

41.3.3

L2TP

L2TP

Ruijie(config)# **username** *user-name* **password {0|7}** *password*	
Ruijie(config)# **no username** *user-name*	

user-name *password*
( )

41.3.4 VPDN

L2TP VPDN

VPDN

- / VPDN
- VPDN

, / VPDN VPDN

41.3.4.1 Ŭ / VPDN ╖

VPDN

L2TP L2TP VPDN

Ruijie(config)# **vpdn enable**	VPDN
Ruijie(config)# **no vpdn enable**	VPDN

VPDN / VPDN

L2TP

41.3.4.2 فخ سم VPDN

VPDN

L2TP VPDN-group
VPDN-group

- VPDN-group( )
- ( )
- ( )
- ( )
- ( )
- ( )
- VPDN-group ( )
- L2TP ( )
- L2TP ( )

41.3.6.1 VPDN-group

VPDN-group

/

Ruijie(config)# **vpdn-group** *name*

Ruijie(config-vpdn-acc-in)# **protocol** {**any** | **l2tp** | **pptp**}	
Ruijie(config-vpdn-acc-in)# **no protocol**	

41.3.6.4 G

VPDN-group

Ruijie(config-vpdn-acc-in)# **virtual-template** *number*	
Ruijie(config-vpdn-acc-in)# **no virtual-template** *number*	

VPDN-group

41.3.6.5 ⅄

VPDN-group q

Ruijie(config-vpdn)# **local name** *name*	
Ruijie(config-vpdn)# **no local name**	

name

41.3.6.7 VPDN-group فخ سم

VPDN-group

VPDN-group

Ruijie(config-vpdn)# **source-ip** *src-ip*	VPDN-group
Ruijie(config-vpdn)# **no source-ip**	VPDN-group

src-ip VPDN-group

41.3.6.8 L2TP 8 ٨

L2TP

Ruijie(config-vpdn)# **l2tp tunnel authentication**	
Ruijie(config-vpdn)# **no l2tp tunnel authentication**	
Ruijie(config-vpdn)# **l2tp tunnel hello** *interval*	Hello
Ruijie(config-vpdn)# **no l2tp tunnel hello**	Hello
Ruijie(config-vpdn)# **l2tp tunnel password** *pass-word*	
Ruijie(config-vpdn)# **no l2tp tunnel password**	
Ruijie(config-vpdn)# **l2tp tunnel receive-window** *size*	
Ruijie(config-vpdn)# **no l2tp tunnel receive- window**	

l2tp-class (config-vpdn)# **retransmit** {**retries** *number* | **timeout** {**min** | **max**} *seconds*}	
no l2tp-class (config-vpdn)# **retransmit** {**retries** | **timeout** {**min**|**max**}}	
l2tp-class (config-vpdn)# **timeout** {**no-session**| **setup**} *seconds*	/
no l2tp-class (config-vpdn)# **timeout** {**no-session** | **setup**}	/

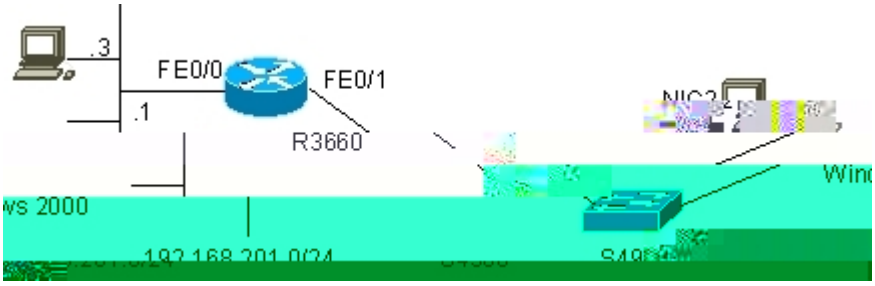
L2TP (Cisco)
Hello 60 4
5 1
8 600
ž č

41.3.7

Windows 2000 Server L2TP
Windows 2000 Server
Cisco 3640 L2TP Cisco 2620
L2TP

41.3.7.1 б Windows 2000

Ruijie R3660 Windows 2000 Server L2TP
4



4 Windows 2000(LAC) L2TP

R3660 Windows 2000 Server

1)R3660

```
R3660# show running-config
Building configuration...
Curre4.34i figo :.760
DefnL2TPVTP(rco)6up.
p. v0
```

```
!
ip local pool vpdnusers 192.168.101.3 192.168.101.253
!
```

1)R3660

```
R3660# show ip route
Codes: C - connected, S - static,  R - RIP
O - OSPF, IA - OSPF inter area
E1 - OSPF external type 1, E2 - OSPF external type 2
Gateway of last resort is not set
192.168.101.0/24 is variably subnetted, 2 subnets, 2 masks
C      192.168.101.8/32 is directly connected, Virtual-Access1
C      192.168.101.0/24 is directly connected, Loopback1
C    192.168.12.0/24 is directly connected, GigabitEthernet0/1
C    192.168.201.0/24 is directly connected, GigabitEthernet0/0
R3660#ping 192.168.101.8
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 192.168.101.8, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
R3660#show vpdn tunnel
L2TP Tunnel Information Total tunnels 1
LocID RemID Remote Name   State  Remote Address  Port  Sessions L2TP
Class/
                                                      VPDN Group
7    8    BLIZZARD     est    192.168.12.213  1701  1      1
%No active PPTP tunnels
R3660#
R3660# show vpdn session
L2TP Session Information Total sessions 1
LocID      RemID      TunID      Username, Intf/      State
Last Chg
                             Vcid, Circuit
1       1         7         ,Vi1             est    00:02:08
%No active PPTP tunnels
R3660#
```

2).Windows 2000:

```
Microsoft Windows 2000 [Version 5.00.2195]
(C)         1985-2000 Microsoft Corp.
C:\>ipconfig /all
Windows 2000 IP Configuration
Host Name . . . . . . . . . . . . : BLIZZARD
Primary DNS Suffix  . . . . . . . :
```

```
Node Type . . . . . . . . . . . . : Broadcast
IP Routing Enabled. . . . . . . . : No
WINS Proxy Enabled. . . . . . . . : No

Ethernet adapter         2:
Connection-specific DNS Suffix  . :
Description . . . . . . . . . . . : NE2000 Compatible
Physical Address. . . . . . . . . : 00-10-88-01-A5-C3
DHCP Enabled. . . . . . . . . . . : No
IP Address. . . . . . . . . . . . : 192.168.12.213
Subnet Mask . . . . . . . . . . . : 255.255.255.0
Default Gateway . . . . . . . . . : 192.168.12.1
DNS Servers . . . . . . . . . . . : 202.101.143.141
PPP adapter L2TP:
Connection-specific DNS Suffix  . :
Description . . . . . . . . . . . : WAN (PPP/SLIP) Interface
Physical Address. . . . . . . . . : 00-53-45-00-00-00
DHCP Enabled. . . . . . . . . . . : No
IP Address. . . . . . . . . . . . : 192.168.101.8
Subnet Mask . . . . . . . . . . . : 255.255.255.255
Default Gateway . . . . . . . . . : 192.168.101.8
DNS Servers . . . . . . . . . . . :
C:\>route print
===========================================================
Interface List
0x1 ........................... MS TCP Loopback interface
0x2000003 ...00 10 88 01 a5 c3 ...... Novell 2000 Adapter.
0xd000004 ...00 53 45 00 00 00 ...... WAN (PPP/SLIP) Interface
===========================================================
===========================================================
Active Routes:
Network Destination       Netmask         Gateway      Interface
Metric
0.0.0.0    0.0.0.0    192.168.12.1  192.168.12.213    2
```

```
192.168.12.255  255.255.255.255   192.168.12.213  192.168.12.213
1
192.168.101.2  255.255.255.255   192.168.101.8   192.168.101.8
1
192.168.101.8  255.255.255.255       127.0.0.1      127.0.0.1
1
192.168.101.255  255.255.255.255   192.168.101.8   192.168.101.8
1
224.0.0.0    224.0.0.0   192.168.12.213  192.168.12.213   1
224.0.0.0   224.0.0.0    192.168.101.8   192.168.101.8    1
255.255.255.255  255.255.255.255   192.168.12.213  192.168.12.213
1
Default Gateway:    192.168.101.8
===========================================================
Persistent Routes:
None
C:\>ping 192.168.101.2
Pinging 192.168.101.2 with 32 bytes of data:
Reply from 192.168.101.2: bytes=32 time<10ms TTL=255
Reply from 192.168.101.2: bytes=32 time<10ms TTL=255
Reply from 192.168.101.2: bytes=32 time<10ms TTL=255
Reply from 192.168.101.2: bytes=32 time<10ms TTL=255
Ping statistics for 192.168.101.2:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  0ms, Average =  0ms
C:\>ping 192.168.201.1
Pinging 192.168.201.1 with 32 bytes of data:
Reply from 192.168.201.1: bytes=32 time<10ms TTL=255
Reply from 192.168.201.1: bytes=32 time<10ms TTL=255
Reply from 192.168.201.1: bytes=32 time<10ms TTL=255
Reply from 192.168.201.1: bytes=32 time<10ms TTL=255
Ping statistics for 192.168.201.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  0ms, Average =  0ms
C:\>ping 192.168.201.3
Pinging 192.168.201.3 with 32 bytes of data:
Reply from 192.168.201.3: bytes=32 time<10ms TTL=254
Reply from 192.168.201.3: bytes=32 time<10ms TTL=254
Reply from 192.168.201.3: bytes=32 time<10ms TTL=254
Reply from 192.168.201.3: bytes=32 time<10ms TTL=254
```

```
Ping statistics for 192.168.201.3:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  0ms, Average =  0ms
C:\>ping 192.168.12.1
Pinging 192.168.12.1 with 32 bytes of data:
Reply from 192.168.12.1: bytes=32 time=10ms TTL=255
Reply from 192.168.12.1: bytes=32 time<10ms TTL=255
Reply from 192.168.12.1: bytes=32 time<10ms TTL=255
Reply from 192.168.12.1: bytes=32 time<10ms TTL=255
Ping statistics for 192.168.12.1:
Packets: Sent = 4, Received = 4, Lost = 0 (0% loss),
Approximate round trip times in milli-seconds:
Minimum = 0ms, Maximum =  10ms, Average =  2ms
C:\>
```

41.3.7.2 б Cisco 3640

Ruijie R3660 Cisco 3640 L2TP

5

5 Cisco 3640(LAC) L2TP

R3660 Cisco 3640

1)R3660

```
R3660# show running-config
Building configuration...
Current configuration : 766 bytes
!
hostname R3660
!
vpdn enable
!
vpdn-group 1
```

```
! Default L2TP VPDN group
accept-dialin
protocol l2tp
virtual-template 1
l2tp tunnel authentication
l2tp tunnel password share
!
!
!
username rgnos password 7 025144391715
!
ip local pool vpdnusers 192.168.101.3 192.168.101.253
!
interface GigabitEthernet 0/0
ip address 192.168.201.1 255.255.255.0
duplex auto
speed auto
!
interface GigabitEthernet 0/1
ip address 192.168.12.217 255.255.255.0
duplex auto
speed auto
!
interface Loopback 1
ip address 192.168.101.2 255.255.255.0
!
interface Null 0
!
interface Virtual-Template 1
ppp authentication pap
ip unnumbered Loopback 1
peer default ip addreGack 1
```

```
speed auto
duplex auto
!
interface GigabitEthernet2/1
ip address 192.168.203.1 255.255.255.0
duplex auto
speed auto
!
interface Serial3/0:1
ip address 192.168.1.2 255.255.255.0
!
interface Virtual-PPP1
ip address negotiated
no cdp enable
ppp pap sent-username rgnos password 0 rgnos
pseudowire 192.168.12.217 11 pw-class pw
!
no ip http server
ip classless
ip route 0.0.0.0 0.0.0.0 GigabitEthernet2/0 192.168.12.1
!
!
dial-peer cor custom
!
dial-peer voice 111 voip
session protocol sipv2
codec g711alaw
!
!
line con 0
exec-timeout 0 0
line aux 0
line vty 0 4
privilege level 15
no login
line vty 5 871
login
!
!
end
```

L2TP

1)R3660

```
R3660# show ip route
Codes: C - connected, S - static,  R - RIP
O - OSPF, IA - OSPF inter area
E1 - OSPF external type 1, E2 - OSPF external type 2
Gateway of last resort is not set
192.168.101.0/24 is variably subnetted, 2 subnets, 2 masks
C      192.168.101.9/32 is directly connected, Virtual-Access1
C      192.168.101.0/24 is directly connected, Loopback1
C   192.168.12.0/24 is directly connected, GigabitEthernet0/1
C   192.168.201.0/24 is directly connected, GigabitEthernet0/0
R3660# show vpdn
L2TP Tunnel and Session Information Total tunnels 1 sessions 1
LocID RemID Remote Name   State  Remote Address  Port  Sessions L2TP
Class/
                                                      VPDN Group
9    21511 C3640        est    192.168.12.242  1701  1       1
LocID     RemID     TunID     Username, Intf/     State  Last Chg
                            Vcid, Circuit
1      14        9         ,Vi1           est    00:18:06
%No active PPTP tunnels
R3660#ping 192.168.101.9
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echoes to 192.168.101.9, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
R3660#
```

L2TP

2)Cisco 3640

```
C3640# show ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
E1 - OSPF external type 1, E2 - OSPF external type 2
i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
ia - IS-IS inter area, * - candidate default, U - per-user static route
o - ODR, P - periodic downloaded typen  Remote

C    192.161192  conti  ga(ot)Eth pont1920/0
```

```
C       132.11.10.0 is directly connected, Loopback0
C    192.168.1.0/24 is directly connected, Serial3/0:1
192.168.101.0/32 is subnetted, 2 subnets
C       192.168.101.9 is directly connected, Virtual-PPP1
```

6 Cisco 2620(LAC) L2TP

R3660 Cisco 2620

1)R3660

```
R3660# show running-config
Building configuration...
Current configuration : 989 bytes
!
hostname R3660
!
vpdn enable
!
vpdn-group 1
! Default L2TP VPDN group
accept-dialin
protocol l2tp
virtual-template 1
l2tp tunnel authentication
l2tp tunnel password share
!
!
!
username rgnos password 7 025144391715
username pc@i-net.com.cn password 7 127654431B
!
ip local pool vpdnusers 192.168.101.3 192.168.101.253
!
interface serial 1/0
encapsulation PPP
ip address 202.101.93.21 255.255.255.0
!
interface serial 1/1
clock rate 64000
```

```
!
interface serial 1/2
clock rate 64000
!
interface serial 1/3
clock rate 64000
!
interface GigabitEthernet 0/0
duplex auto
speed auto
!
interface GigabitEthernet 0/1
ip address 192.168.19.1 255.255.255.0
duplex auto
speed auto
!
interface Loopback 1
ip address 192.168.101.2 255.255.255.0
!
interface Null 0
!
interface Virtual-Template 1
ppp authentication pap
ip unnumbered Loopback 1
peer default ip address pool vpdnusers
!
!
line con 0
line aux 0
line vty 0 4
!
!
end
R3660#
```

2)Cisco2620

```
Cisco2620# show running-config
Building configuration...
Current configuration : 1677 bytes
!
version 12.3
service timestamps debug uptime
```

```
service timestamps log uptime
no service password-encryption
no service dhcp
!
hostname Cisco2620
!
!
username pc password 0 1111
username 163 password 0 163
no aaa new-model
ip subnet-zero
!
!
!
vpdn enable
!
vpdn-group 1
request-dialin
protocol l2tp
domain i-net.com.cn
initiate-to ip 202.101.93.21
l2tp tunnel password 7 0832444F1B1C
!
interface GigabitEthernet0/0
ip address 192.168.7.1 255.255.255.0
duplex auto
speed 10
!
interface Serial0/0
ip address 202.101.93.23 255.255.255.0
encapsulation ppp
fair-queue
clockrate 2000000
!
interface Serial0/1
no ip address
shutdown
!
interface Async65
ip address 5.5.5.5 255.255.255.0
encapsulation ppp
dialer in-band
```

```
dialer idle-timeout 30000
dialer string 8435
dialer-group 1
async mode dedicated
peer default ip address 5.5.5.6
ppp authentication pap
!
no ip http server
ip classless
!
dialer-list 1 protocol ip permit
!
!
line con 0
exec-timeout 0 0
line aux 0
login local
modem InOut
transport input all
autoselect during-login
autoselect ppp
line vty 0 4
privilege level 15
no login
line vty 5 15
login
!
no scheduler allocate
end
Cisco2620#
```

Mobile User ”pc@i-net.com.cn” ”1111” L2TP R3660 192.168.19.0/24

Ruijie# **show vpdn** [**tunnel**|**session**] Ruijie> **show vpdn** [**tunnel**|**session**]	vpdn
Ruijie# **debug vpdn error**	vpdn error
Ruijie# **no debug vpdn error**	vpdn error
Ruijie# **debug vpdn event**	vpdn event
Ruijie# **no debug vpdn event**	vpdn event
Ruijie# **debug vpdn packet**	vpdn packet

RuijieDC1>Tj/TT39 Tf0.0209 Tc 0.0041 Tw 3.2 0 Td[2x-Tw 8 spdn erro

```
%No active PPTP tunnels
Ruijie# show vpdn
L2TP Tunnel and Session Information Total tunnels 1 sessions 1
LocID RemID Remote Name   State  Remote Address  Port  Sessions L2TP
Class/
                                                        VPDN Group
1    35390 C3640        est    192.168.12.242  1701  1       1
LocID     RemID     TunID     Username, Intf/     State  Last Chg
                             Vcid, Circuit
1         1261      1         rgnos,Vi1              est
01:04:45
%No active PPTP tunnels
Ruijie#
```

41.4.1.2 VPDN E

VPDN L2TP PPTP
LNS ( ) VPDN

```
Ruijie# debug vpdn error
vpdn protocol errors debugging is on
Ruijie# debug vpdn event
vpdn events debugging is on
Ruijie# debug vpdn packet
vpdn packet debugging is on
Ruijie# show debug
VPDN:
vpdn events debugging is on
vpdn protocol errors debugging is on
vpdn packet debugging is on
Ruijie#
VPDN PROCESS From tunnel: Received 158 byte pak
L2X: UDP socket write 168 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
L2X: UDP socket write 40 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
VPDN PROCESS From tunnel: Pak consumed
VPDN PROCESS From tunnel: Received 70 byte pak
L2X: UDP socket write 40 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
VPDN PROCESS From tunnel: Pak consumed
VPDN PROCESS From tunnel: Received 76 byte pak
```

```
Get virtual-access from free queue: Virtual-Access1
Clone virtual-access from interface Virtual-Template1
L2X: UDP socket write 56 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
L2X: UDP socket write 40 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
VPDN PROCESS From tunnel: Pak consumed
VPDN PROCESS From tunnel: Received 76 byte pak
L2X: UDP socket write 40 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
Vi1 Tnl/Sn 3/1 L2TP: Virtual interface created for unknown, bandwidth
1024 Kbps
Vi1 Tnl/Sn 3/1 L2TP: VPDN session up
VPDN PROCESS From tunnel: Pak consumed
VPDN PROCESS From tunnel: Received 50 byte pak
Vi1 VPDN PROCESS From tunnel: Queue 14 byte pak to ppp parse and iqueue
Vi1 VPDN PROCESS From tunnel: Pak send successful
%UPDOWN: Interface Virtual-Access1, changed state to up
Vi1 VPDN PROCESS Into tunnel: Sending 54 byte pak
L2X: UDP socket write 54 bytes, 255.255.255.255(1701) to
4.83.68.68(1701)
VPDN PROCESS From tunnel: Received 50 byte pak
Vi1 VPDN PROCESS From tunnel: Queue 14 byte pak to ppp parse and iqueue
Vi1 VPDN PROCESS From tunnel: Pak send successful
Vi1 VPDN PROCESS Into tunnel: Sending 50 byte pak
L2X: UDP socket write 50 bytes, 255.255.255.255(1701) to
4.83.68.68(1701)
Vi1 VPDN PROCESS Into tunnel: Sending 54 byte pak
L2X: UDP socket write 54 bytes, 255.255.255.255(1701) to
4.83.68.68(1701)
VPDN PROCESS From tunnel: Received 50 byte pak
Vi1 VPDN PROCESS From tunnel: Queue 14 byte pak to ppp parse and iqueue
Vi1 VPDN PROCESS From tunnel: Pak send successful
Vi1 VPDN PROCESS Into tunnel: Sending 50 byte pak
L2X: UDP socket write 50 bytes, 255.255.255.255(1701) to
4.83.68.68(1701)
Vi1 VPDN PROCESS Into tunnel: Sending 54 byte pak
L2X: UDP socket write 54 bytes, 255.255.255.255(1701) to
4.83.68.68(1701)
VPDN PROCESS From tunnel: Received 50 byte pak
Vi1 VPDN PROCESS From tunnel: Queue 14 byte pak to ppp parse and iqueue
Vi1 VPDN PROCESS From tunnel: Pak send successful
```

```
Vi1 VPDN PROCESS Into tunnel: Sending 50 byte pak
L2X: UDP socket write 50 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
Vi1 VPDN PROCESS Into tunnel: Sending 54 byte pak
L2X: UDP socket write 54 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
VPDN PROCESS From tunnel: Received 54 byte pak
Vi1 VPDN PROCESS From tunnel: Queue 18 byte pak to ppp parse and iqueue
Vi1 VPDN PROCESS From tunnel: Pak send successful
VPDN PROCESS From tunnel: Received 56 byte pak
Vi1 VPDN PROCESS From tunnel: Queue 20 byte pak to ppp parse and iqueue
Vi1 VPDN PROCESS From tunnel: Pak send successful
Vi1 VPDN PROCESS Into tunnel: Sending 45 byte pak
L2X: UDP socket write 45 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
Vi1 VPDN PROCESS Into tunnel: Sending 50 byte pak
L2X: UDP socket write 50 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
VPDN PROCESS From tunnel: Received 50 byte pak
Vi1 VPDN PROCESS From tunnel: Queue 14 byte pak to ppp parse and iqueue
Vi1 VPDN PROCESS From tunnel: Pak send successful
Vi1 VPDN PROCESS Into tunnel: Sending 50 byte pak
L2X: UDP socket write 50 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
VPDN PROCESS From tunnel: Received 50 byte pak
Vi1 VPDN PROCESS From tunnel: Queue 14 byte pak to ppp parse and iqueue
Vi1 VPDN PROCESS From tunnel: Pak send successful
VPDN PROCESS From tunnel: Received 50 byte pak
Vi1 VPDN PROCESS From tunnel: Queue 14 byte pak to ppp parse and iqueue
Vi1 VPDN PROCESS From tunnel: Pak send successful
Vi1 VPDN PROCESS Into tunnel: Sending 50 byte pak
L2X: UDP socket write 50 bytes, 192.168.12.217(1701) to
192.168.12.242(1701)
%UPDOWN: Line protocol on Interface Virtual-Access1, changed state
to up
Ruijie# show ip route
```

```
C      192.168.101.0/24 is directly connected, Virtual-Access1
C    192.168.12.0/24 is directly connected, GigabitEthernet0
C    192.168.201.0/24 is directly connected, Ethernet0
Ruijie#
```

41.4.1.3 L2TP

L2TP L2TP

l2x-data LNS ( ) L2TP

```
Ruijie# no debug all
All possible debugging has been turned off
Ruijie# debug vpdn l2x-data
L2X data packets debugging is on
Ruijie#
L2X: Punting to L2TP control message queue
L2X: Punting to L2TP control message queue
L2X: Punting to L2TP control message queue
L2X: Punting to L2TP control message queue
L2X: Punting to L2TP control message queue
L2X: Punting to L2TP control message queue
%UPDOWN: Interface Virtual-Access1, changed state to up
%UPDOWN: Line protocol on Interface Virtual-Access1, changed state
to up
Ruijie#
```

41.4.1.4 L2TP

l2x-erorrs ( )

```
Ruijie# no debug all
All possible debugging has been turned off
Ruijie# debug vpdn l2x-errors
L2X protocol errors debugging is on
Ruijie# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface virtual-ppp 1
```

```
Tnl 14 L2TP: Tunnel auth failed for BLIZZARD
Tnl 14 L2TP: Expected
9E 8D 7A 8E 78 EA 41 9F A1 74 01 21 DE 4F F3 F0
Tnl 14 L2TP: Got
84 E5 62 69 AE 46 A5 98 4E FE E2 38 EE F2 B7 E2
Ruijie# no debug all
All possible debugging has been turned off
Ruijie#
```

41.4.1.5 L2TP Y

l2x-events L2TP **l2x-evetns** LNS (
)

```
Ruijie# show vpdn tunnel
%No active L2TP tunnels
%No active PPTP tunnels
Ruijie# no debug all
All possible debugging has been turned off
Ruijie# debug vpdn l2x-events
```

```
ection-iccn
Vi1 Tnl/Sn 20/1 L2TP: Session state change from
wait-for-service-selection- iccn to established
%UPDOWN: Interface Virtual-Access1, changed state to up
%UPDOWN: Line protocol on Interface Virtual-Access1, changed state
to up
Ruijie# show ip route
Codes: C - connected, S - static,  R - RIP
O - OSPF, IA - OSPF inter area
E1 - OSPF external type 1, E2 - OSPF external type 2
Gateway of last resort is not set
192.168.101.0/24 is variably subnetted, 2 subnets, 2 masks
C      192.168.101.7/32 is directly connected, Virtual-Access1
C      192.168.101.0/24 is directly connected, Virtual-Access1
C    192.168.12.0/24 is directly connected, GigabitEthernet0
C    192.168.201.0/24 is directly connected, Ethernet0
Ruijie# show vpdn
L2TP Tunnel and Session Information Total tunnels 1 sessions 1
LocID RemID Remote Name   State  Remote Address  Port  Sessions L2TP
Class/
                                                        VPDN Group
20    26656 C3640      est    192.168.12.242  1701  1     1
LocID   RemID    TunID   Username, Intf/    State  Last Chg
                           Vcid, Circuit
1     1279      20        rgnos,Vi1       est    00:00:38
%No active PPTP tunnels
Ruijie#
```

l2x-evetns LAC L2TP Server

( )

```
Ruijie# no debug all
```

```
Tnl 21 L2TP: Control channel retransmit delay set to 1 seconds
Tnl 21 L2TP: Tunnel state change from idle to wait-ctl-reply
Tnl 21 L2TP: SM State wait-ctl-reply
Tnl 21 L2TP: O Resend SCCRQ, flg TLS, ver 2, len 96, tnl 0, ns 0, nr
0
Tnl 21 L2TP: Control channel retransmit delay set to 1 seconds
Tnl 21 L2TP: I SCCRP from
Tnl 21 L2TP: O SCCCN  to BLIZZARD tnlid 40
Tnl 21 L2TP: Control channel retransmit delay set to 1 seconds
Tnl 21 L2TP: Tunnel state change from wait-ctl-reply to established
Tnl 21 L2TP: SM State established
Vi1 Tnl/Sn 21/1 L2TP: O ICRQ to BLIZZARD 40/0
Vi1 Tnl/Sn 21/1 L2TP: Control channel retransmit delay set to 1 seconds
Vi1 Tnl/Sn 21/1 L2TP: Session state change from wait-for-tunnel to
wait-reply
Vi1 Tnl/Sn 21/1 L2TP: I ICRP from BLIZZARD
Vi1 Tnl/Sn 21/1 L2TP: O ICCN to BLIZZARD 40/1
Vi1 Tnl/Sn 21/1 L2TP: Control channel retransmit delay set to 1 seconds
Vi1 Tnl/Sn 21/1 L2TP: Session state change from wait-reply to
established
%UPDOWN: Interface Virtual-PPP1, changed state to up
%UPDOWN: Line protocol on Interface Virtual-PPP1, changed state to
up
Ruijie# show vpdn
L2TP Tunnel and Session Information Total tunnels 1 sessions 1
LocID RemID Remote Name   State  Remote Address  Port  Sessions L2TP
Class/
                                                          VPDN Group
21    40    BLIZZARD     est    192.168.12.213  1701  1
LocID    RemID   TunID    Username, Intf/    State  Last Chg
                             Vcid, Circuit
1      1         21        13,Vi1          est    00:00:27
%No active PPTP tunnels
Ruijie#
```

41.4.1.6 L2TP

L2TP **l2x-packets** L2TP **l2x-packets** LNS ( )

```
Ruijie# no debug all
```

```
All possible debugging has been turned off
Ruijie# debug vpdn l2x-packets
L2X control packets debugging is on
Ruijie# show vpdn
%No active L2TP tunnels
%No active PPTP tunnels
Ruijie#
L2TP: I SCCRQ from C3640 tnl 18889
L2X: Parse  AVP 0, len 8, flag 0x8000 (M)
L2X: Parse SCCRQ
L2X: Parse  AVP 2, len 8, flag 0x8000 (M)
L2X: Protocol Ver 1
L2X: Parse  AVP 6, len 8, flag 0x0
L2X: Firmware Ver 0x1130
L2X: Parse  AVP 7, len 11, flag 0x8000 (M)
L2X: Hostname C3640
L2X: Parse  AVP 8, len 25, flag 0x0
L2X: Vendor Name Cisco Systems, Inc.
L2X: Parse  AVP 10, len 8, flag 0x8000 (M)
L2X: Rx Window Size 800
L2X: Parse  AVP 11, len 22, flag 0x8000 (M)
L2X: Chlng
       98 20 4E 34 6A 4C E1 E7 FA CF 58 07 FF 4E 56 A3
L2X: Parse  AVP 9, len 8, flag 0x8000 (M)
L2X: Assigned Tunnel ID 18889
L2X: Parse  AVP 3, len 10, flag 0x8000 (M)
L2X: Framing Cap 0x3
L2X: Parse  AVP 4, len 10, flag 0x8000 (M)
L2X: Bearer Cap 0x3
L2X: No missing AVPs in SCCRQ
L2X: I SCCRQ, flg TLS, ver 2, len 130, tnl 0, ns 0, nr 0 contiguous
pak, size 130
C8 02 00 82 00 00 00 00 00 00 00 00 80 08 00 00
00 00 00 01 80 08 00 00 00 02 01 00 00 08 00 00
00 06 11 30 80 0B 00 00 00 07 43 33 36 34 30 00
19 00 00 00 08 43 69 73 63 6F 20 53 79 73 74 65
6D 73 2C 20 49 6E 63 2E ...

Tnl 22 L2TP: O SCCRP  to C3640 tnlid 18889
Tnl 22 L2TP: O SCCRP, flg TLS, ver 2, len 140, tnl 18889, ns 0, nr
1
C8 02 00 8C 49 C9 00 00 00 00 00 01 80 08 00 00
00 00 00 02 80 08 00 00 00 02 01 00 80 0A 00 00
```

```
00 03 00 00 00 01 80 0A 00 00 00 04 00 00 00 00
00 08 00 00 00 06 11 30 80 0A 00 00 00 07 52 36
32 31 00 0E 00 00 00 08 ...

Tnl 22 L2TP: O ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 18889, ns
1, nr 1
C8 02 00 0C 49 C9 00 00 00 01 00 01
Tnl 22 L2TP: Parse  AVP 0, len 8, flag 0x8000 (M)
Tnl 22 L2TP: Parse SCCCN
Tnl 22 L2TP: I SCCCN from C3640 tnl 18889
Tnl 22 L2TP: Parse  AVP 13, len 22, flag 0x8000 (M)
Tnl 22 L2TP: Chlng Resp
5C D5 A4 37 36 A6 7D 0F FE EF 22 48 B8 DF F5 12
Tnl 22 L2TP: No missing AVPs in SCCCN
Tnl 22 L2TP: I SCCCN, flg TLS, ver 2, len 42, tnl 22, ns 1, nr 1 contiguous
pak, size 42
C8 02 00 2A 00 16 00 00 00 01 00 01 80 08 00 00
00 00 00 03 80 16 00 00 00 0D 5C D5 A4 37 36 A6
7D 0F FE EF 22 48 B8 DF F5 12
Tnl 22 L2TP: O ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 18889, ns
1, nr 2
C8 02 00 0C 49 C9 00 00 00 01 00 02
Tnl 22 L2TP: Parse  AVP 0, len 8, flag 0x8000 (M)
Tnl 22 L2TP: Parse ICRQ
Tnl 22 L2TP: I ICRQ from C3640 tnl 18889
Tnl 22 L2TP: Parse  AVP 15, len 10, flag 0x8000 (M)
Tnl 22 L2TP: Serial Number -1714567290
Tnl 22 L2TP: Parse  AVP 14, len 8, flag 0x8000 (M)
Tnl 22 L2TP: Assigned Call ID 1280
Tnl 22 L2TP: Parse  AVP 18, len 10, flag 0x8000 (M)
Tnl 22 L2TP: Bearer Type 0
Tnl 22 L2TP: No missing AVPs in ICRQ
Tnl 22 L2TP: I ICRQ, flg TLS, ver 2, len 48, tnl 22, ns 2, nr 1 contiguous
pak,size 48
C8 02 00 30 00 16 00 00 00 02 00 01 80 08 00 00
00 00 00 0A 80 0A 00 00 00 0F 99 CD C7 86 80 08
00 00 00 0E 05 00 80 0A 00 00 00 12 00 00 00 00
Tnl/Sn 22/1 L2TP: O ICRP to C3640 18889/1280
Tnl/Sn 22/1 L2TP: O ICRP, flg TLS, ver 2, len 28, tnl 18889, lsid 1,
rsid 1280,ns 1, nr 3
C8 02 00 1C 49 C9 05 00 00 01 00 03 80 08 00 00
00 00 00 0B 80 08 00 00 00 0E 00 01
```

```
Ruijie#
```

l2x-packets LAC L2TP Server

( )

```
Ruijie# no debug all
All possible debugging has been turned off
Ruijie# debug vpdn l2x-packets
L2X control packets debugging is on
Ruijie# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface virtual-ppp 1
Ruijie(config-if)# no shutdown
Ruijie(config-if)# end
Ruijie#
Tnl 21 L2TP: O SCCRQ
Tnl 21 L2TP: O SCCRQ, flg TLS, ver 2, len 96, tnl 0, ns 0, nr 0
C8 02 00 60 00 00 00 00 00 00 00 00 80 08 00 00
00 00 00 01 80 08 00 00 00 02 01 00 80 0A 00 00
00 03 00 00 00 01 80 0A 00 00 00 04 00 00 00 00
00 08 00 00 00 06 11 30 80 0A 00 00 00 07 52 36
32 31 00 0E 00 00 00 08 ...
Tnl 21 L2TP: Parse  AVP 0, len 8, flag 0x8000 (M)
Tnl 21 L2TP: Parse SCCRP
Tnl 21 L2TP: Parse  AVP 2, len 8, flag 0x8000 (M)
Tnl 21 L2TP: Protocol Ver 1
Tnl 21 L2TP: Parse  AVP 3, len 10, flag 0x8000 (M)
Tnl 21 L2TP: Framing Cap 0x1
Tnl 21 L2TP: Parse  AVP 4, len 10, flag 0x8000 (M)
Tnl 21 L2TP: Bearer Cap 0x0
Tnl 21 L2TP: Parse  AVP 6, len 8, flag 0x0
Tnl 21 L2TP: Firmware Ver 0x500
Tnl 21 L2TP: Parse  AVP 7, len 14, flag 0x8000 (M)
Tnl 21 L2TP: Hostname BLIZZARD
Tnl 21 L2TP: Parse  AVP 8, len 15, flag 0x0
Tnl 21 L2TP: Vendor Name Microsoft
Tnl 21 L2TP: Parse  AVP 9, len 8, flag 0x8000 (M)
Tnl 21 L2TP: Assigned Tunnel ID 41
Tnl 21 L2TP: Parse  AVP 10, len 8, flag 0x8000 (M)
Tnl 21 L2TP: Rx Window Size 8
Tnl 21 L2TP: No missing AVPs in SCCRP
Tnl 21 L2TP: I SCCRP, flg TLS, ver 2, len 101, tnl 21, ns 0, nr 1
contiguous pak, size 101
```

```
C8 02 00 65 00 15 00 00 00 00 00 01 80 08 00 00
00 00 00 02 80 08 00 00 00 02 01 00 80 0A 00 00
00 03 00 00 00 01 80 0A 00 00 00 04 00 00 00 00
00 08 00 00 00 06 05 00 80 0E 00 00 00 07 42 4C
49 5A 5A 41 52 44 00 0F ...
Tnl 21 L2TP: O SCCCN  to BLIZZARD tnlid 41
Tnl 21 L2TP: O SCCCN, flg TLS, ver 2, len 20, tnl 41, ns 1, nr 1
C8 02 00 14 00 29 00 00 00 01 00 01 80 08 00 00
00 00 00 03
Vi1 Tnl/Sn 21/1 L2TP: O ICRQ to BLIZZARD 41/1
Vi1 Tnl/Sn 21/1 L2TP: O ICRQ, flg TLS, ver 2, len 48, tnl 41, lsid
1, rsid 1, ns 2, nr 1
C8 02 00 30 00 29 00 00 00 02 00 01 80 08 00 00
00 00 00 0A 80 08 00 00 00 0E 00 01 80 0A 00 00
00 0F 00 00 00 00 80 0A 00 00 00 12 00 00 00 02
Tnl 21 L2TP: O ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 41, ns 3,
nr 1
C8 02 00 0C 00 29 00 00 00 03 00 01
Tnl 21 L2TP: I ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 21, ns 1,
nr 2
Tnl 21 L2TP: I ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 21, ns 1,
nr 3
Vi1 Tnl/Sn 21/1 L2TP: Parse  AVP 0, len 8, flag 0x8000 (M)
Vi1 Tnl/Sn 21/1 L2TP: Parse ICRP
Vi1 Tnl/Sn 21/1 L2TP: Parse  AVP 14, len 8, flag 0x8000 (M)
Vi1 Tnl/Sn 21/1 L2TP: Assigned Call ID 1
Vi1 Tnl 21/1 L2TP: No missing AVPs in ICRP
Vi1 Tnl/Sn 21/1 L2TP: I ICRP, flg TLS, ver 2, len 28, tnl 21, lsid
1, rsid 1, ns 1, nr 3 contiguous pak, size 28
C8 02 00 1C 00 15 00 01 00 01 00 03 80 08 00 00
00 00 00 0B 80 08 00 00 00 0E 00 01
Vi1 Tnl/Sn 21/1 L2TP: O ICCN to BLIZZARD 41/1
Vi1 Tnl/Sn 21/1 L2TP: O ICCN, flg TLS, ver 2, len 40, tnl 41, lsid
1, rsid 1, ns 3, nr 2
C8 02 00 28 00 29 00 01 00 03 00 02 80 08 00 00
00 00 00 0C 80 0A 00 00 00 18 00 98 96 80 80 0A
00 00 00 13 00 00 00 01
Tnl 21 L2TP: O ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 41, ns 4,
nr 2
C8 02 00 0C 00 29 00 00 00 04 00 02
Tnl 21 L2TP: I ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 21, ns 2,
nr 4
```

```
%UPDOWN: Interface Virtual-PPP1, changed state to up
%UPDOWN: Line protocol on Interface Virtual-PPP1, changed state to
up
Ruijie# show vpdn
L2TP Tunnel and Session Information Total tunnels 1 sessions 1
LocID RemID Remote Name   State  Remote Address  Port  Sessions L2TP
Class/
                                                        VPDN Group
21    41    BLIZZARD     est    192.168.12.213  1701  1
LocID     RemID     TunID     Username, Intf/     State  Last Chg
                            Vcid, Circuit
1         1         21        13,Vi1              est    00:00:13
%No active PPTP tunnels
Ruijie#
```

41.4.2 L2TP

L2TP

Ruijie# **clear vpdn tunnel** [{ **pptp** | **l2tp**}
[*remote-host-name*

```
%CHANGED: Interface Virtual-Access1, changed state to
administratively down
Ruijie# show vpdn
%No active L2TP tunnels
%No active PPTP tunnels
Ruijie#
```

41.4.3

L2TP

- Windows L2TP MicroSoft Windows 2000 L2TP PPTP L2TP Windows 2000 Windows XP L2TP IPSec/ IKE Windows 2000/XP MicroSoft L2TP

- Windows L2TP ” ” ” ” (” Internet (V)”) ” ( )” PAP ” ” PAP CHAP

- Windows L2TP ” ” ” ” ” (A)” MS-CHAPv2 CHAP CHAP ” ” ” ” CHAP

- Windows L2TP Windows L2TP Ruijie L2TP Ruijie

- Cisco L2TP Cisco IOS Ruijie

- Cisco L2TP Ruijie LNS Cisco LAC L2TP Cisco2620(LAC) Cisco **ip domain-lookup** **ip cef** Cisco PPP

- L2TP

- Cisco (IOS 12.2 12.3) Windows 2000 L2TP

42 AAA

AAA

42.1 AAA

AAA Authentication Authorization and Accounting

AAA

AAA

- RADIUS TACACS+ Local

- AAA

- AAA

AAA

AAA AAA

AAA

AAA

-
-
-
-

42.1.1 AAA

AAA

42.1.2

1 AAA

AAA R1 R2 RADIUS

R1

R2 PC

R1 R1

R1 ACCEPT R1

REJECT R1

TIMEOUT R2

TIMEOUT

REJECT TIMEOUT REJECT

~ ’LGh1(Ä -

42.2.2 AAA

AAA AAA

AAA

aaa new-model	AAA

42.2.3 AAA

É ĩ ȯ ⊓ ɒ ∩

42.3.1 AAA

AAA

42.3.2

AAA 2 R1 R2 RADIUS
NAS Telnet
R1 R2 R1 R2

ER6XUGMQP

42.3.4 AAA

AAA

- **aaa new-model** AAA
- RADIUS TACACS+
  “ RADIUS ” “ TACACS+ ”
- **aaa authentication**
-

DOT1X TACACS+

42.3.5 AAA Login

AAA Login

aaa new-model AAA AAA
“ AAA ”

Telnet (NAS)
NAS

AAA Login
Login **aaa authentication login**
Login

AAA Login

login authentication {**default** | *list-name*}	

list-name *method*

ERROR

FAIL( )

none

RADIUS) ñ ÃÜ Ø Ó ì W< W 2GEr+

end	
show running-config	

Login

configure terminal	
aaa new-model	AAA
aaa authentication login {**default** | *list-name*} **local**	
end	
show aaa method-list	
configure terminal	
line vty *line-num*	
login authentication {**default** | *list-name*}	
end	

show runnuo

configure terminal	
aaa new-model	AAA
aaa authentication login {**default** | *list-name*} **group radius**	RADIUS
end	
show aaa method-list	
configure terminal	

FAIL( )

none

Enable **enable**

CLI Login **none**
Enable Login

CLI Login Login **none**
Enable
Enable

Enable Enable

RADIUS

42.3.6.1 G سم Enable

Enable
1 Enable

configure terminal	
username *name* [**password** *password*]	

username *name* [**privilege** *level*]	
end	
show running-config	

Enable

PPP

ISDN NAS

PPP O ㄴ ≠ ɔ

```
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

42.3.9

IP
AAA Login

none

```
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)# aaa authentication login terms none
Ruijie(config)# line tty 1 4
Ruijie(config-line)# login authentication terms
Ruijie(config-line)# exit
Ruijie(config)# line tty 5 16
Ruijie(config-line)# login authentication test
Ruijie(config-line)# exit
Ruijie(config)# line vty 0 4
Ruijie(config-line)# login authentication test
```

```
Ruijie(config-line)# end
Ruijie# show running-config
!
```

42.4.4 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

42.4.4.1 G سم Exec

Exec

42.4.4.2 G 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	

42.4.4.3 Exec R

Exec VTY

```
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
```

42.4.5 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*...]	

42.5

AAA

42.5.1

- Exec
- Command
- Network

Exec NAS CLI

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*...]	

AAA Exec

line vty *line-num*

RADIUS RADIUS

configure terminal	
aaa new-model	AAA

aaa accounting exec {**default** |

```
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
```

42.5.4 AAA Network

Network IP

Network RADIUS

RADIUS RADIUS ?UT

42.5.4.1 G RADIUS Network

RADIUS Network RADIUS RADIUS
“ RADIUS ”

RADIUS RADIUS

configure terminal	
aaa new-model	AAA
aaa accounting network {**default** | *list-name*} **start-stop group radius**	RADIUS

42.5.4.2 Network R

RADIUS Network

```
Ruijie# config
Ruijie(config)# aaa new-model
Ruijie(config)# radius-server host 192.168.217.64
Ruijie(config)# radius-server key test
Ruijie(config)# aaa accounting network acct start-stop group radius
Ruijie(config)# end
Ruijie# show running-config
!
aaa new-model
!
aaa accounting network acct start-stop group radius
!
username Ruijie password 0 starnet
username Ruijie privilege 6
!
radius-server host 192.168.217.64
radius-server key 7 093b100133
```

42.6 AAA

show aaa user { *id* | **all** }	AAA

42.7 VRF AAA

Virtual Private Networks (VPNs) ISP
VPN
VPN VPN routing/forwarding (VRF) table AAA
VRF

aaa local authentication lockout-time *num*	login
end	
show aaa user lockout {**all** | **user-name** *name-string*}	
clear aaa local user lockout {**all** | **user-name** *name-string* }	

Login 3 15

43 RADIUS

43.1 RADIUS

RADIUS (Remote Authentication Dial-In User Service)
/ AAA
RGOS RADIUS
NAS RADIUS

RADIUS UNIX WINDOWS 2000 RADIUS
RADIUS

RADIUS

-
- RADIUS
- RADIUS
- ACCEPT

43.2 RADIUS

RADIUS

- AAA AAA “AAA ”
- **aaa authentication** RADIUS **aaa authentication** “ ”
- “ ”

RADIUS RADIUS

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

ID

ID		TYPE
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# show radius vendor-specific
id    vendor-specific     type-value
----- -------------------- ----------
1     max down-rate        76
2     qos                 77
3     user ip              3
4     vlan id              4
5     version to client    5
6     net ip              6
7     user name            7
8     password            8
9     file-diractory       9
10    file-count          10
11    file-name-0          11
12    file-name-1          12
13    file-name-2          13
14    file-name-3          14
15    file-name-4          15
16    max up-rate          75
17    version to server    17
18    flux-max-high32      18
19    flux-max-low32       19
20    proxy-avoid          20
21    dailup-avoid         21
22    ip privilige         22
23    login privilige      42
24    limit to user number 50

Ruijie# configure
Ruijie(config)# radius attribute 24 vendor-type 67
Ruijie(config)# show radius vendor-specific
id    vendor-specific     type-value
----- -------------------- ----------
1     max down-rate        76
2     qos                 77
```

```
3     user ip             3
4     vlan id             4
5     version to client    5
6     net ip              6
7     user name           7
8     password            8
9     file-diractory       9
10    file-count          10
11    file-name-0          11
12    file-name-1          12
13    file-name-2          13
14    file-name-3          14
15    file-name-4          15
16    max up-rate          75
17    version to server    17
18    flux-max-high32      18
19    flux-max-low32       19
20    proxy-avoid          20
21    dailup-avoid         21
22    ip privilige         22
23    login privilige      42
24    limit to user number 50
Ruijie(config)#
Ruijie(config)#
```

43.3 RADIUS

RADIUS

debug radius event	RADIUS RADIUS

43.4 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
!
```

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44 VRRP

44.1

VRRP (Virtual Router Redundancy Protocol)

VRRP

VRRP

VRRP

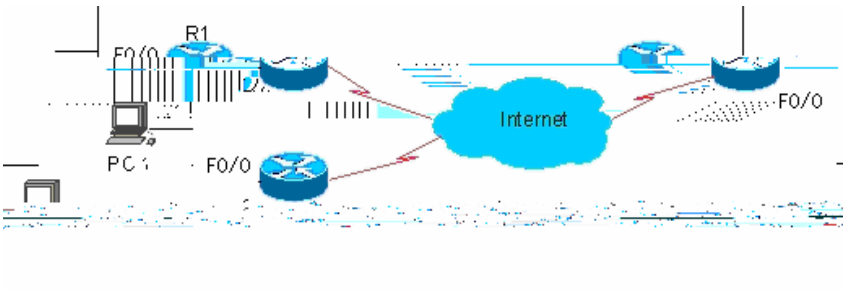
RFC 2338 VRRP IP VRRP

VRRP IP

IP

VRRP

VRRP Л



1 VRRP

VRRP

1 1 R1 R2

Fa0/0 192.168.12.0/24 R1 R2 Fa0/0 VRRP

VRRP IP

VRRP VRRP

VRRP

B

Ruijie(config-if)# **no vrrp** *group* **ip** *ipaddress* [**secondary**]	VRRP

Group 1~255 IP VRRP
Secondary IP IP

VRRP IP (Primary Secondary) 0 0 Tf0.004 Tc 4.894 0 Td [(1)]TJ 31 0 Td [(2)]TJ

VRRP VRRP
VRRP VRRP
1

VRRP VRRP VRRP
VRRP

Level 1~254 VRRP IP IP
VRRP 255 VRRP
VRRP Master ( )

44.3.7 VRRP

VRRP

VRRP
VRRP ( )

Ruijie(config-if)# **vrrp** *group* **track** *interface-type number* [*interface –priority*]	VRRP
Ruijie(config-if)# **no vrrp** *group* **track** *interface-type number*	VRRP

VRRP Interface -Priority
1~255 Interface -Priority 10

(Routed Port SVI Loopback Tunnel
)

44.3.8 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 3 timeoute-value
1~60 1
interval-value priority 1~255 10

44.3.9 VRRP

VRRP
VRRP VRRP
Master VRRP
Backup Master VRRP

Ruijie(config-if)# **vrrp** *group* **timers learn**	
Ruijie(config-if)# **no vrrp** *group* **timers learn**	

VRRP

VRRP VRRP
VRRP VRRP
VRRP VRRP VRRP
VRRP VRRP VRRP
VRRP Master

44.3.10 VRRP

VRRP VRRP

VRRP VRRP
80

VRRP ” “ ” ” ” ”

44.3.11 VRRP

VRRP

VRRP
VRRP VRRP
VRRP
VRRP
VRRP
VRRP
VRRP
VRRP VRRP VRRP

Ruijie(config-if)# **vrrp delay** { **minimum** *min-seconds* | **reload** *reload-seconds* }	VRRP
Ruijie(config-if)# **no vrrp delay**	VRRP

VRRP VRRP
0~60

44.4 VRRP

Show Vrrp Debug Vrrp VRRP **show vrrp**
VRRP Debug Vrrp VRRP
VRRP VRRP

44.4.1 show vrrp

show vrrp VRRP

Ruijie# **show vrrp** [**brief** | *group*]	VRRP
Ruijie# **show vrrp interface** *type number* [**brief**]	VRRP

1. **show vrrp**

```
Ruijie# show vrrp
GigabitEthernet 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 ii4.96652i69t is0
Masteshshn6(t ii4.96652i69t)6( is)9 rti0
GigabitEthernet 0/0 - Group 26(0)6( )]TJT*[(S)6(tate)6( is)[(M)6(aste)6(1)6(
Virtual MAC address is 0000.5e00.010
Advertisement interval is 3 sec
Preemption is enabled

Priority is 120
Master Router is 192.168.20176(0)(6(blocrtu)6),6(0)prPityss0120
Master Advertisement ii4.96652i69t is0
Masteshshn6(t ii4.96652i69t)6( is)9 rti0
```

```
Interface     Grp Pri Time Own Pre State   Master addr     Group addr
GigabitEthernet0/0 1  100  -    -    P  Backup 192.168.201.213 192.168.201.1
GigabitEthernet0/0 2  120  -    -   P  Master  192.168.201.217 192.168.201.2
```

VRRP

IP Master IP

3. **show vrrp interface**

```
Ruijie# show vrrp interface GigabitEthernet 0/0
GigabitEthernet 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
[(R)6(uiji)6(e# )]TJ/TT4 1 Tf4.966 0 Td[(sh)6(ow v)6(r653 )6(s9 T6(se)6(c)6(
```

Ruijie# **debug vrrp errors**	VRRP
Ruijie# **no debug vrrp errors**	VRRP
Ruijie# **debug vrrp events**	VRRP
Ruijie# **no debug vrrp events**	VRRP
Ruijie# **debug vrrp packets**	VRRP
Ruijie# **no debug vrrp packets**	VRRP
Ruijie# **debug vrrp state**	VRRP
Ruijie# **no debug vrrp state**	VRRP

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**

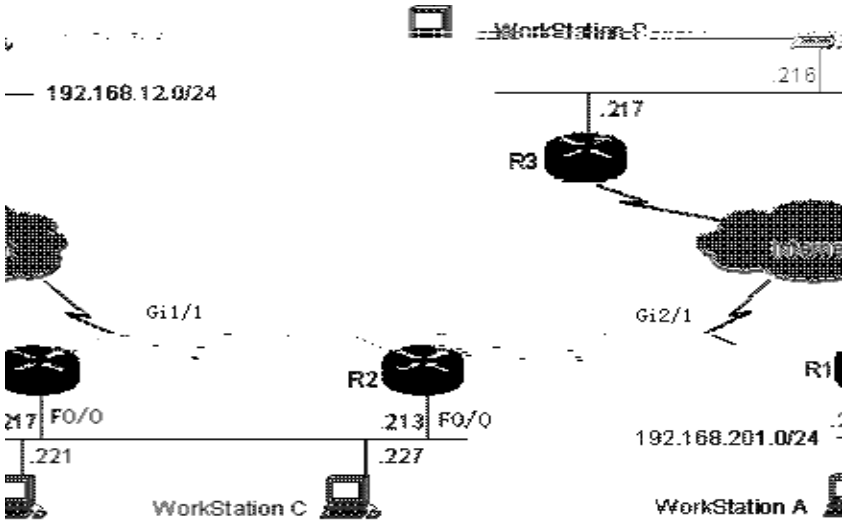
```
Ruijie# debug vrrp state
VRRP State debugging is on
Ruijie#
%VRRP-6-STATECHANGE: GigabitEthernet 0/0 Grp 2 state Master -> Backup
```

```
%VRRP-6-STATECHANGE: GigabitEthernet 0/0 Grp 2 state Master -> Init
Ruijie#
```

GigabitEthernet 0/0 VRRP Master Backup Init

44.5 VRRP

4 R1 R2 VRRP 192.168.201.0 /24 VRRP R3 VRRP R1 R2 VRRP



4 VRRP

R3 R3

```
!
!
hostname "R3"
!
!
!
interface GigabitEthernet 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
```

44.5.1 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
R2 (192.168.201.1)
R1 R2

R1

```
!
!
hostname "R1"
!
!
interface GigabitEthernet 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 GigabitEthernet 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

R2
(192.168.201.1) R1 GigabitEthernet 2/1
R1 VRRP
R1 R2

R1

```
!
!
hostname "R1"
!
!
interface GigabitEthernet 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 GigabitEthernet 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 n

```
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 GigabitEthernet 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
```

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45

45.1

45.1.1

- CPU
- CPU

45.1.2 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
  1     7%     2%     1%    HISR INT
  2     0%     0%     0%    ktimer
  3     0%     0%     0%    atimer
  4     0%     0%     0%    printk_task
  5     0%     0%     0%    waitqueue_process
  6     0%     0%     0%    tasklet_task
  7     0%     0%     0%    kevents
  8     0%     0%     0%    snmpd
  9     0%     0%     0%    snmp_trapd
 10     0%     0%     0%    mtdblock
```

```
11    0%    0%    0%    gc_task
12    0%    0%    0%    Context
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
7  0%   co_mac
```

```
 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
```

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!
```

46

46.1

46.1.1

Threshold CPU

CLI MIB

46.1.2

46.1.2.1 CPU ¯

CPU CPU MIB log

46.1.2.2 ¨ ¯

MIB log

46.1.2.3

normal condition
warning condition
alert condition

log log

log

%SYS-1-TEMP_STATE: System detected temperature is in warning condition.

log

%SYS-1-TEMP_STATE: System detected temperature is in alert condition.

log

%SYS-1-TEMP_STATE: System detected temperature is in normal condition.

46.2

CPU	90	100
	90	100
	90	100

46.3

- CPU
-
-

46.3.1 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

46.3.2

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

46.3.3

show threshold cpu	CPU
show threshold memory	

46.4

46.4.1

CPU 80 90 50 80

```
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
```

46.4.2

show threshold

```
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
```

CPU

	memory-lack exit-policy
low	OVERFLOW
high	OVERFLOW

3.

47.1.3

memory-lack exit-policy lower
BGP OSPF RIP PIM-SM

memory-lack exit-policy [**bgp**|**ospf**|**pim-sm**|**rip]**

Ruijie(config)#**memory-lack exit-policy** [**bgp**|**ospf**|**pim-sm**|**rip]**	

no memory-lack exit-policy lower

lower (show memory lower)

BGP

show memory protocol

Ruijie#**show memory protocols**	

show memory protocols

```
Ruijie# show memory protocols
=================================================
protocol      |memory(byte)
BGP            102000000
OSPF            24000000
RIP             10000000
PIM             50000000
LDP             20000000
Total           206000000
```

BGP OSPF

RIP LDP PIM ISIS

48 USB

48.1

usb U FAT U

U U

48.2

Usb usb

0:1:18:57 Ruijie: %5:USB Device Found ..... <USB Mass Storage Device>!

0:1:18:57 Ruijie: %5: Auto 1 T1Ab

Ruijie# **makefs dev** *dev_file* **fs** *fs_name*	*dev_file* *fs_name*

U

```
Ruijie# makefs dev /dev/uba/disc0/part1 fs vfat
```

U fat32

U vfat

48.2.3 USB

Ruijie# **show usb**	usb

CLI **show usb** USB

USB CLI

Ruijie# **usb remove** *Deviced0>6≈61 61 61 61 61 61 6 0 Tr 2.086 0 Td()TjET61 65EQc5h?ÄBaapkSIC*

49 SD

49.1 SD

49.1.1 SD

SD sd FAT32 sd

sd sd

49.1.2

sd sd

*Jan 14 15:43:06: %SD_CARD-5-INSERT: SD Card install successfully!

*Jan 14 15:43:06: %SD-5-SD_DISK_PARTITION: SD_DISK_PARTITION found, /dev/sd0/disc0/part1 to /mnt/sd0, size 1017643008B(970MB).

/dev/sd0/disc0/part1 /mnt/sd0 size
u 970MB

49.1.3

sd dir copy del sd
sd flash

Ruijie# cd /mnt/sd0 # sd
Ruijie# copy flash: a.txt flash: /b.txt # sd a.txt

dir / flash b.txt

sd

49.1.4 sd

Ruijie#

```
Now, you can drag out the sd card.
           sd
```

SD card is currently in use, You can't remove it, please try later.

49.2 SD

Ruijie(config-if)# **show sd**	showsd SD

```
Ruijie#show sd
Product name: SD
Product serial number: d72185e3
    Disk Partitions:
    1: /dev/sd0/disc0/part1 --> /mnt/sd0
    size 1017643008B(970MB).
```

50

50.1

UP DOWN

VTY

FLASH

50.1.1

<priority> seq no: timestamp sysname
%ModuleName-severity-MNEMONIC: description

< > - -

8

```
<189> 226:Mar  5 02:09:10 S3250 %SYS-5-CONFIG_I: Configured from console by
console
```

Syslog

Server

50.2

50.2.1

Syslog

FLASH

Ruijie(config)# **logging on**	
Ruijie(config)# **no logging on**	

50.2.2

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

Logging File Flash FLASH
TXT

More Flash Filename Flash

FLASH FLASH FLASH
FLASH FLASH

50.2.3

Ruijie(config)# **service timestamps** *message-type* [**uptime** | **datetime**]	

Ruijie(config)# **no service timestamps** *message-type*

Ruijie(config)# **service sysname**	

50.2.5

50.2.8

Ruijie(config)# **logging rate-limit** *number*	
Ruijie(config)# **no logging rate-limit**	

50.2.9

Ruijie(config)# **logging console** *level*	
Ruijie(config)# **logging monitor** *level*	VTY (telnet)
Ruijie(config)# **logging buffered** [*buffer-size* | *level*]	

Ruijie(config)# **logging file flash:***filename* [

3	system daemons
4	security/authorization messages
5	messages generated internally by syslogd
6	line printer subsystem
7	network news subsystem
8	UUCP subsystem
9	clock daemon
10	security/authorization messages
11	FTP daemon
12	NTP subsystem
13	log audit
14	log alert
15	clock daemon
16	local use 0 (local0)
17	local use 1 (local1)
18	local use 2 (local2)
19	local use 3 (local3)
20	local use 4 (local4)
21	local use 5 (local5)
22	local use 6 (local6)
23	local use 7 (local7)

23

50.2.11

Syslog Server

LOG

/ LOG

```
Ruijie(config)#
```

51 RLOG

51.1

rlog

rlog nat

web

51.2

51.2.1

udp

Ruijie(config)# **rlog server** *server-ip* [**vrf** *vrf-name*]	ip VRF
Ruijie(config)# **no rlog server**	

ip session log-on

51.2.2

Ruijie(config)# **rlog mtu** *number* Ruijie(config)# **no rlog mtu**	1500
Ruijie(config)# **rlog port** *number* Ruijie(config)# **no rlog port**	10000
Ruijie(config)# **rlog export-rate** *number* Ruijie(config)# **no rlog export-rate**	1000

51.2.3

Ruijie(config)# **rlog test**

0

web

web

51.4

web

52 SNMP

52.1 SNMP

52.1.1

SNMP Simple Network Manger Protocol 1988 8
RFC1157 SNMP
SNMP

SNMP

SNMP /

- SNMP
- SNMP
- MIB

SNMP SNMP NMS (Network Management System) NMS HP OpenView Cisco-4JP

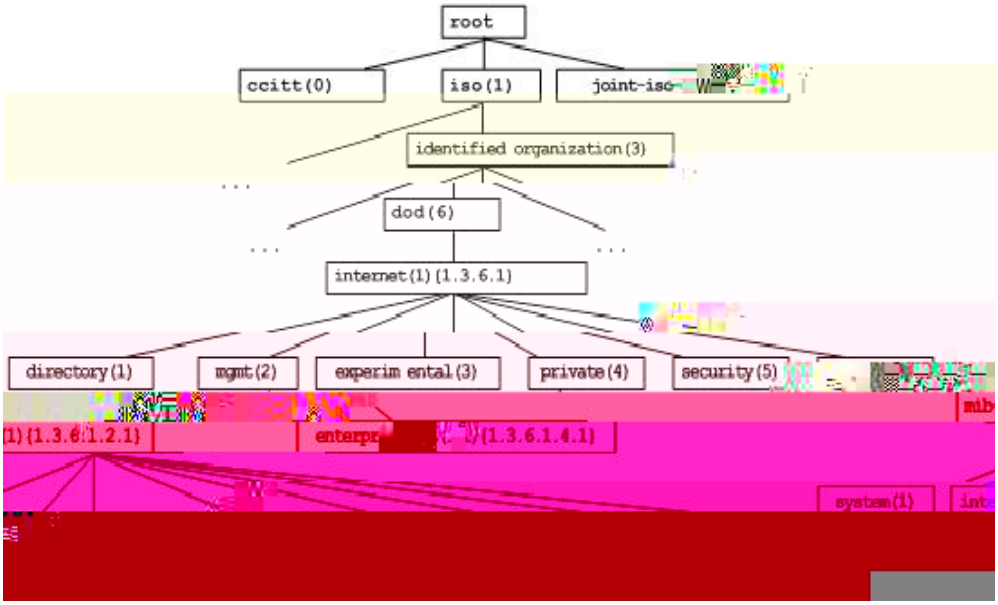
MIB Management Information Base

SNMP MIB

MIB System

{1.3.6.1.2.1.1} Object Identifier

MIB



2 MIB

52.1.2 SNMP

SNMP

- SNMPv1 RFC1157
- SNMPv2C Community-Based SNMPv2 , RFC1901

- SNMPv3

1.

2.

3.

SNMPv1 SNMPv2C Community-based

(Commumity String) MIB

SNMPv2C Get-bulk
Get-bulk

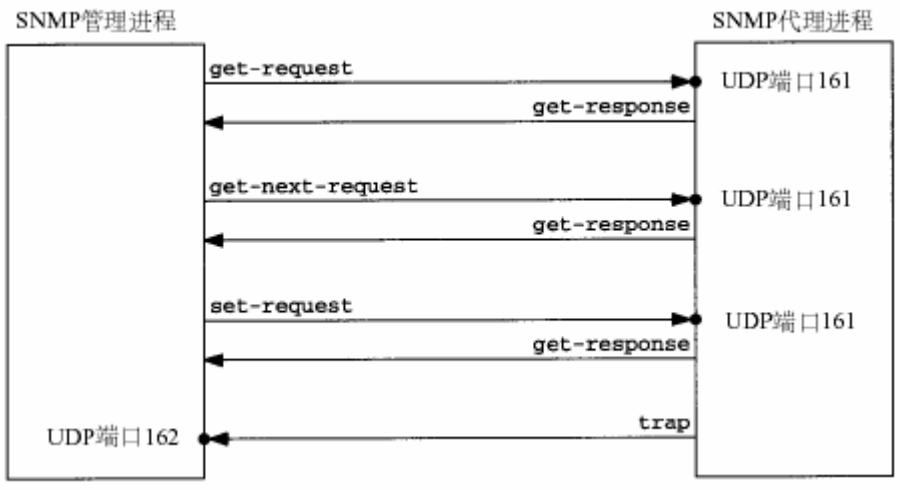
- SNMPv2C
SNMPv1
SNMPv1 SNMPv2C
SNMP SNMPv1 SNMPv2C

52.1.3 SNMP

SNMP NMS Agent 6

1. Get-request NMS Agent
2. Get-next-request NMS Agent
3. Get-bulk NMS Agent
4. Set-request NMS Agent
5. Get-response Agent Agent NMS 3
6. Trap Agent NMS

4 NMS Agent Agent NMS SNMPv1
Get-bulk



3 SNMP

NMS Agent 3 Agent UDP 161 Agent
Trap UDP 162

SNMP R2700 (NM2-24ESW/NM2-16ESW) NM2-16ESW
17~26 NM2-24ESW 25~26

52.1.4 SNMP

SNMPv1 SNMPv2 MIB
(NMS)

:

- (Read-only) MIB
- (Read-write) MIB

SNMPv2 SNMPv
SNMPv1 SNMPv2C SNMPv3

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

52.2 SNMP

SNMP SNMP

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

NMS **no snmp-server community**

52.2.2 MIB

-
-
- SNMPv3

MIB

Ruijie(config)# **snmp-server view** *view-name oid-tree* {**include**	**exclude**}	MIB MIB
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*

52.2.3 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*

52.2.4 SNMP

Agent NMS Agent NMS

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

52.2.6 SNMP

SNMP

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

52.2.7 SNMP

SNMP

snmp snmp

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

52.2.10 Link Trap

LinkTrap Link

SNMP LinkTrap,

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

Link trap:

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

52.2.11

Agent Trap

Ruijie(config)# **snmp-server trap-source** *interface*	

Ruijie(config)#

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

Bad SNMP version errors	SNMP
Unknown community name	
Illegal operation for community name supplied	
Encoding errors	
Get-request PDUs	Get-request
Get-next PDUs	Get-next
Set-request PDUs	Set-request
Too big errors (Maximum packet size 1500)	

No such name errors Unknown community na11 2C0CFC<1B5B8DB40(6<0EF8>-6317529D6<07FF92

```
sysServices
sysORLastChange
snmpInPkts
snmpOutPkts
snmpInBadVersions
snmpInBadCommunityNames
snmpInBadCommunityUses
snmpInASNParseErrs
snmpInTooBigs
snmpInNoSuchNames
snmpInBadValues
snmpInReadOnlys
snmpInGenErrs
snmpInTotalReqVars
snmpInTotalSetVars
snmpInGetRequests
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
```

```
groupname: public
securityModel: v2c
securityLevel:noAuthNoPriv
readview: default
writeview: default
notifyview:
```

show snmp view

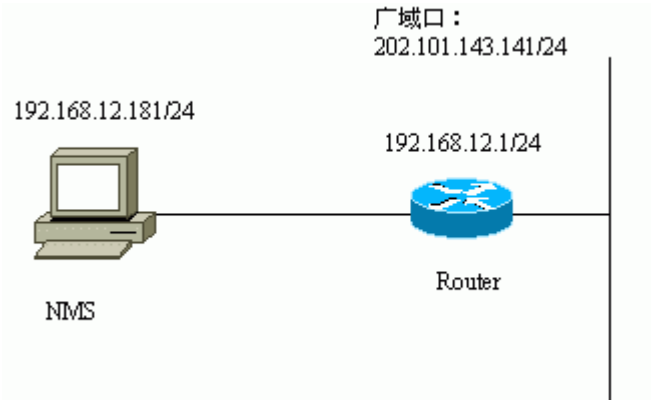
```
Ruijie# show snmp view
default(include) 1.3.6.1
test-view(include) 1.3.6.1.2.1
```

52.4 SNMP

52.4.1

-

NMS NMS IP 192.168.12.181 IP 192.168.12.1 HP OpenView



5 SNMP

-

SNMP

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

SNMP

NMS SNMP

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

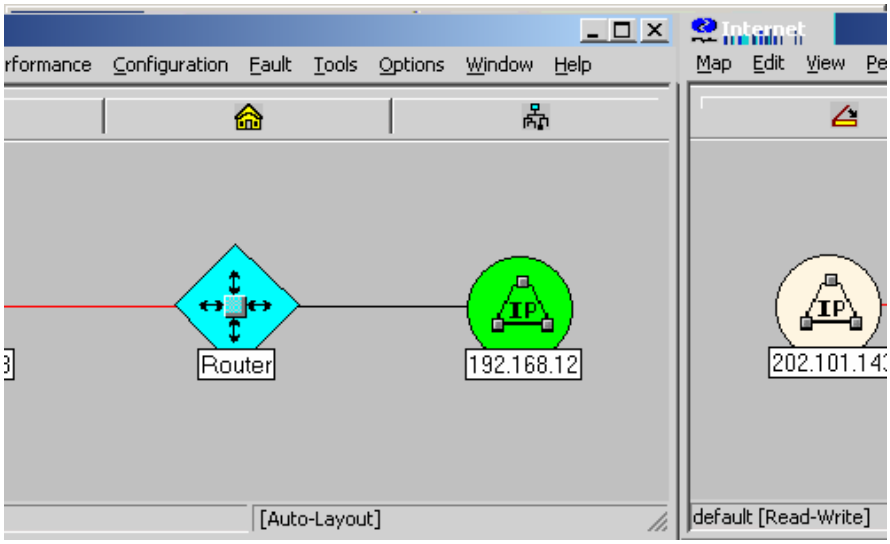
SNMP NMS

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

NMS Trap

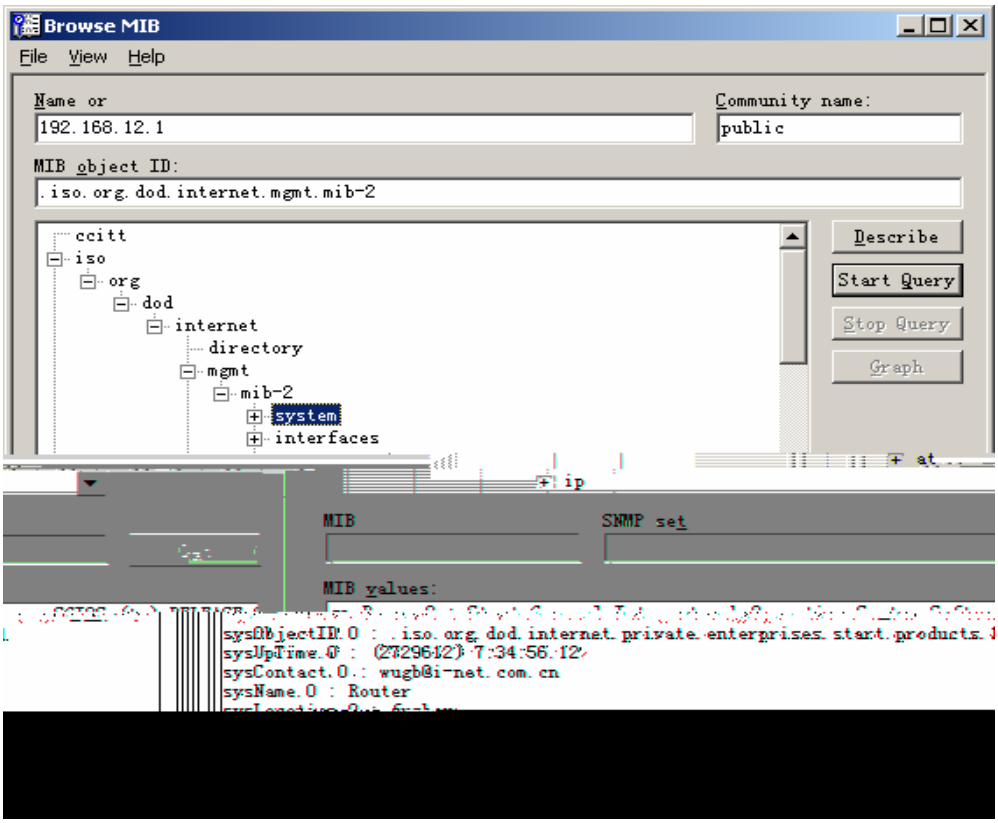
```
Ruijie(config)# snmp-server enable traps
Ruijie(config)# snmp-server host 192.168.12.181 public
```

SNMP NMS
HP OpenView



6

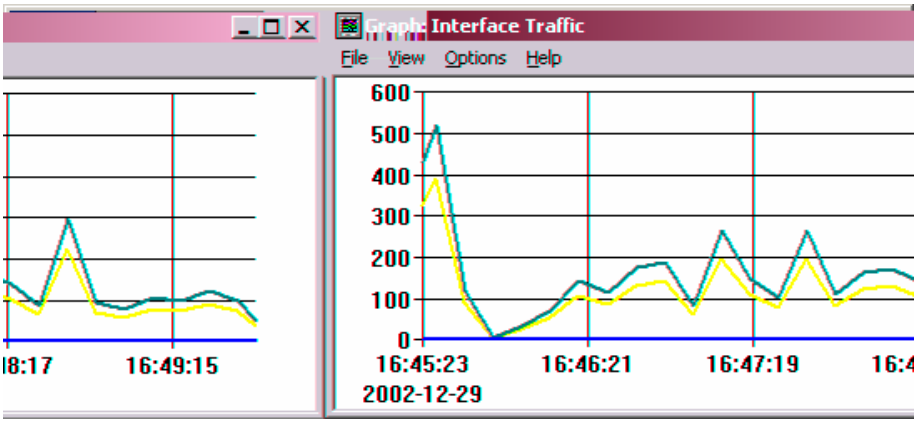
HP OpenView TOOL->SNMP MIB Brower Name IP 192.168.12.1 Community Name Public MIB System Start Query MIB MIB Values



7 MIB

HP OpenView

SNMP



8

52.4.2 SNMP

NMS SNMP

Agent NMS SNMP

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

IP 192.168.12.181 SNMP

52.4.3 SNMPv3

SNMPv3 v3user MIB-2(1.3.6.1.2.1) MD5 MD5-Auth DES DES-Priv 192.168.65.199 SNMPv3 Trap Trap v3user, MD5 MD5-Auth DES DES-Priv

```
Ruijie(config)# snmp-server view v3userview 1.3.6.1.2.1 include
Ruijie (config)# snmp-server group v3usergroup v3 priv read v3userview
write v3userview
```

53 MIB

MIB

MIB

MIB

53.1 MIB

MIB

- BRIDGE-MIB (RFC1493)
- EtherLike-MIB(RFC1643)
- IF-MIB(RFC2863)
- RFC1213-MIB
- RMON1-MIB RMON etherStats, etherHistory,alarms, events
- SNMPv2-MIB
- SNMPv3-MIB USM VACM

MIB

- RUIJIE-AAA-MIB
- RUIJIE -ENTITY-MIB
- RUIJIE -RIP-MIB
- RUIJIE -MEMORY-MIB

MIB

show snmp mib MIB

```
Ruijie# show snmp mib
sysDescr
sysObjectID
sysUpTime
sysContact
sysName
sysLocation
sysServices
sysORLastChange
```

```
ifNumber
ifEntry
ifEntry.ifIndex
ifEntry.ifDescr
ifEntry.ifType
ifEntry.ifMtu
ifEntry.ifSpeed
ifEntry.ifPhysAddress
ifEntry.ifAdminStatus
ifEntry.ifOperStatus
ifEntry.ifLastChange
ifEntry.ifInOctets
ifEntry.ifInUcastPkts
ifEntry.ifInNUcastPkts
ifEntry.ifInDiscards
ifEntry.ifInErrors
ifEntry.ifInUnknownProtos
ifEntry.ifOutOctets
ifEntry.ifOutUcastPkts
ifEntry.ifOutNUcastPkts
ifEntry.ifOutDiscards
ifEntry.ifOutErrors
ifEntry.ifOutQLen
ifEntry.ifSpecific
......
```

53.2 MIB

http://ietf.org/rfc.html MIB

MIB

54 RMON

54.1

RMON Remote Monitoring IETF(Internet Engineering Task Force
Internet)
RMON
RMON
Ÿ
RMO2tRMON خي
RMONRMO1t ل R

54.1.4

(Event) RMON 9
SNMP Trap

54.2 RMON

54.2.1

Bucket-number

Bucket-number

Bucket-number

1-65535 10

Interval 1800 1-3600

54.2.3

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

54.3.4.1 show rmon alarm

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

54.3.4.2 show rmon event

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

54.3.4.3 show rmon history

```
Ruijie# show rmon history
Entry : 1
Data source : Gi1/1
Buckets requested : 65535
Buckets granted : 10
Interval : 1
Owner : zhangsan
Sample : 198
Interval start : 0d:0h:15m:0s
DropEvents : 0
Octets : 67988
```

```
Pkts : 726
BroadcastPkts : 502
MulticastPkts : 189
CRCAlignErrors : 0
UndersizePkts : 0
OversizePkts : 0
Fragments : 0
Jabbers : 0
Collisions : 0
Utilization : 0
```

54.3.4.4 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
```

´ У ¦ ' IPv6

55 IPv6

55.1 IPv6

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

IPv6

-

IPv4 32 128 Ipv6 2^128-1 IPv6
Internet

-

IPv6
IPv6 IPv4
IPv4 IPv6 я в

IPSec IPv4 IPv6 IPv6
IPv6 IPv6 Authentication Header AH
Encapsulated Security Payload ESP IP

- QoS

IPv6 IPv6 Flow Label
IPv6

-

IPv6 Neighbor Discovery Protocol IPv6
ICMPv6
ARP ICMPv4

-

IPv6 IPv6 IPv4
40 IPv6 IPv6

IPv6

- IPv6
- IPv6
- IPv6
- ICMPv6
- IPv6
- MTU
- ICMPv6
-
- IPv6
- IPv6
- IPv6
- IPv6
- Ping IPv6

55.1.1 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 (v ŋ ﻫ

55.1.2.1 ´ سم فخ ˆ 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)

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

55.1.2.2 فخ سم Multicast Addresses˜

IPv6

| 8 | 4 | 4 | 112 bits |
+----------+----+----+----------+

|11111111|flgs|scop| group ID |

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

1 “1”

- 4 4 Internet
“0”
“1” 3

- 4
IPv6

-

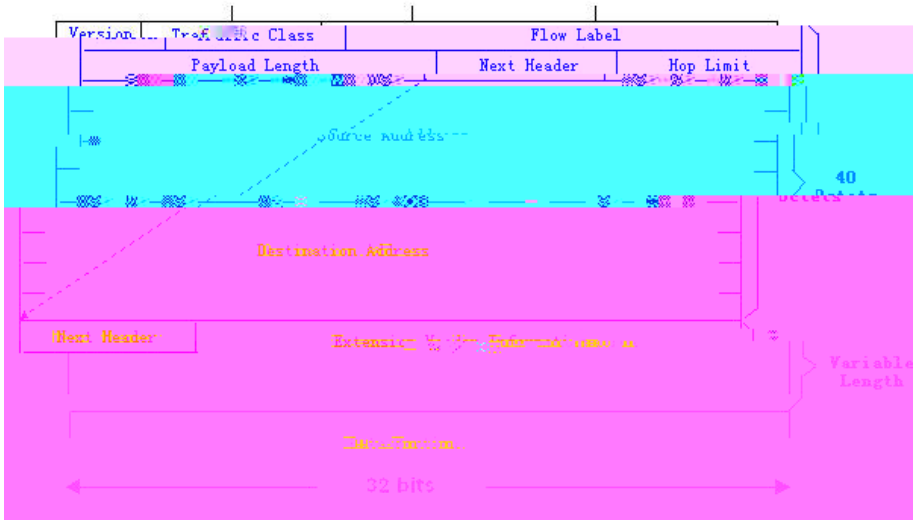
112

IPv6 FF00::/8 IPv6

2

55.1.3 IPv6

IPv6



3

IPv4 4 IP v 6 8
40 IPv6

- (Version)

  4 I P v 6 6

- (Traffic Class)

  8 IPv4 “TOS”

- (Flow Label)

  20

- (Payload Length)

16 IPv6 (
) IPv6 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

55.1.4 IPv6 MTU

IPv4 MTU IPv6 MTU
MTU
MTU
IPv6 IPv6

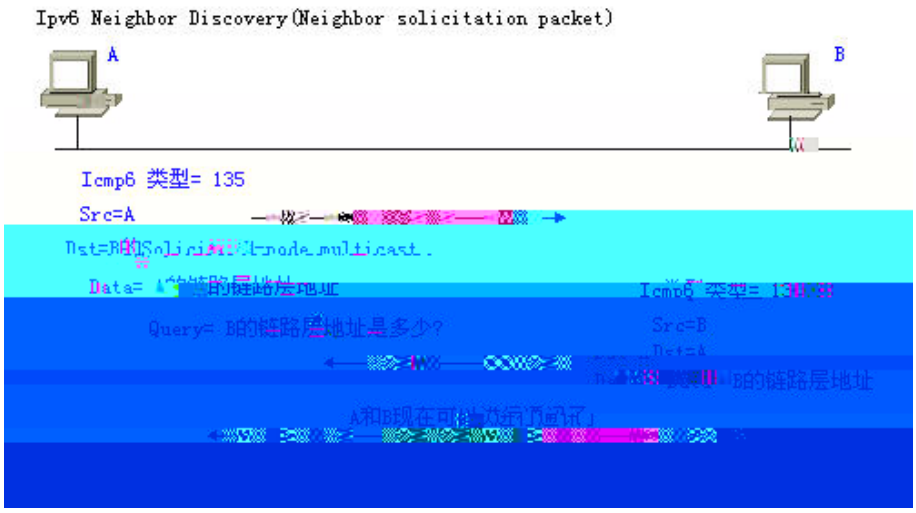
IPv4 MTU 68
68 MTU IPv6 MTU 1280 IPv6
1500 MTU

55.1.5 IPv6

IPv6 ICMPv6

55.1.5.1 ˆ Neighbor Solicitation˜

(NS) , IPv6
NS NS
(NA) NS



4

( )

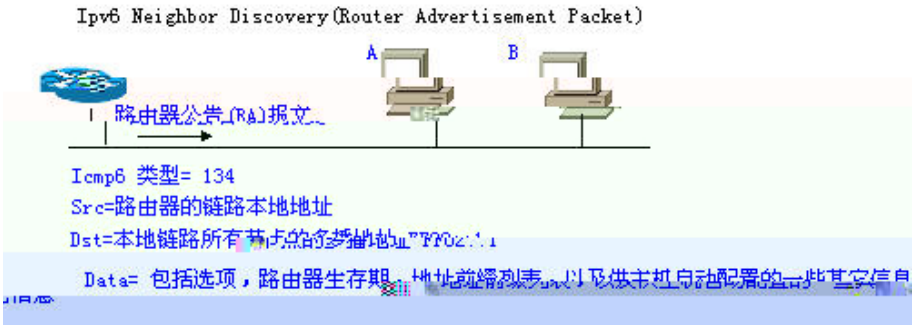
NUD(Neighbor Unreachability Detection),

NUD

(: :)

55.1.5.2 ʢ Ω (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

55.2 IPv6

IPv6

55.2.1 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 vlan 1	IPv6
copy running-config startup-config	

no ipv6 address *ipv6-prefix/prefix-length* [**eui-64**]

IPv6

```
Ruijie(config)# interface vlan 1
Ruijie(config-if)# ipv6 enable
Ruijie(config-if)# ipv6 address fec0:0:0:1::1/64
Ruijie(config-if)# end
Ruijie(config-if)# show ipv6 interface vlan 1
Interface vlan 1 is Up, ifindex: 2001
address(es):
Mac Address: 00:00:00:00:00:01
INET6: fe80::200:ff: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 10 milliseconds
ICMP redirects are enabled
ND DAD is enabled, number of DAD attempts: 1
```

160>

IPv6

```
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 10 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<240--160>
ND router advertisements live for 1800 seconds
```

55.2.3

(NDP)

no ipv6 neighbor SVI 1

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

55.2.4

2

- 0
-

Donw Up

configure terminal	
interface vlan *1*	SVI 1
ipv6 nd dad attempts *attempts*	0
End	
show ipv6 interface vlan *1*	SVI 1 IPv6
copy running-config startup-config	

no ipv6 nd dad attempts

```
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 10 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<240--160>
ND router advertisements live for 1800 seconds
```

55.2.5

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)
ipv6 nd ra-lifetime *seconds*	(RA) 0
ipv6 nd ra-interval *seconds*	(RA)
ipv6 nd managed-config-flag	(RA) “managed address configuration” ,

IPv6 IPv6

show ipv6 interface [*interface-id*] [**ra-info**]	IPv6
show ipv6 neighbors [**verbose**] [*interface-id*] [*ipv6-address*]	
show ipv6 route [**static**] [**local**] [**connected**]	IPv6

1) IPv6

```
Ruijie# show ipv6 interface
interface vlan 1 is Down, ifindex: 2001
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 10 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<240--160>
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
```

56 IPv6

56.1

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 IPv6 IPv6

1

56.1.1 (IPv6 Manually Configured Tunnel)

IPv6 IPv4

IPv6 IPv4 (Tunnel Source)
IPv4 (Tunnel Destination) IPv6 IPv4

6to4 6to4 IPv4
IPv4 IPv4
6ot4 IPv6 IPv4 6to4

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

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

6to4 IPv4 IPv4 10.0.0.0/8 172.16.0.0/12
192.168.0.0/16 IPv4

6to4

- 6to4 IPv6
IPv4 IPv4 Internet
J h

ISATAP

```
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 ”

56.2.2 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	6to4
ipv6 enable	IPv6 IPv6 IPv6
tunnel source {*ip-address* | *type num*}	IPv4 IPv4
Exit	
ipv6 route *2002::/16* **tunnel** *tunnel-number*	IPv6 6to4 2002::/16 (2)
End	
copy running-config startup-config	

“ IPv6 ”

56.2.3 ISATAP

ISATAP

ISATAP ISATAP IPv6 IPv6
ISATAP EUI-64 IPv6
32 (Tunnel Source) IPv4)
ISATAP

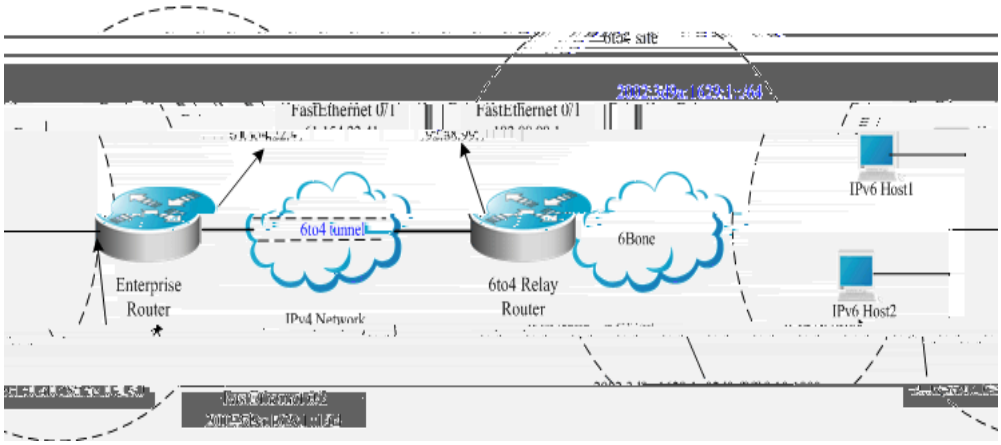
ISATAP ISATAP tunnel source
ISATAP ISATAP

```
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

```
interface GigabitEthernet 2/1
no switchport
ip address 211.1.1.1 255.255.255.0

#     IPv6
interface GigabitEthernet 2/2
no switchport
ipv6 address 2005::1/64
no ipv6 nd suppress-ra  (    )

#
interface Tunnel 1
tunnel mode ipv6ip
ipv6 enable
tunnel source GigabitEthernet 2/1
tunnel destination 192.1.1.1

#
ipv6 route 2001::/64 tunnel 1
```

56.4.2 6to4



192.88.99.1 c058:6301

6to4 IPv4 6to4

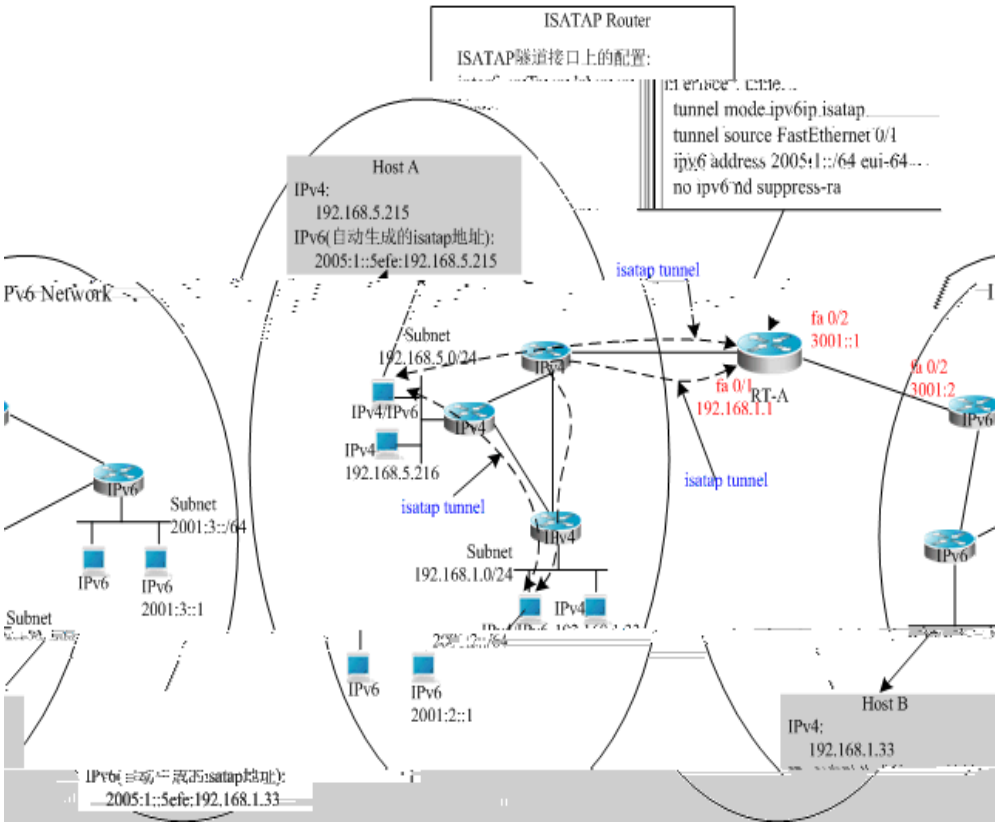
2 IPv4 IPv4

Enterprise Router

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

#     IPv6
interface GigabitEthernet 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 GigabitEthernet 0/1

#               tunt 0/1
```

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

56.4.3 ISATAP



6

ISATAP ISATAP IPv4 IPv4/IPv6 ISATAP ISATAP

2

- ISATAP ISATAP

- ISATAP IPv6

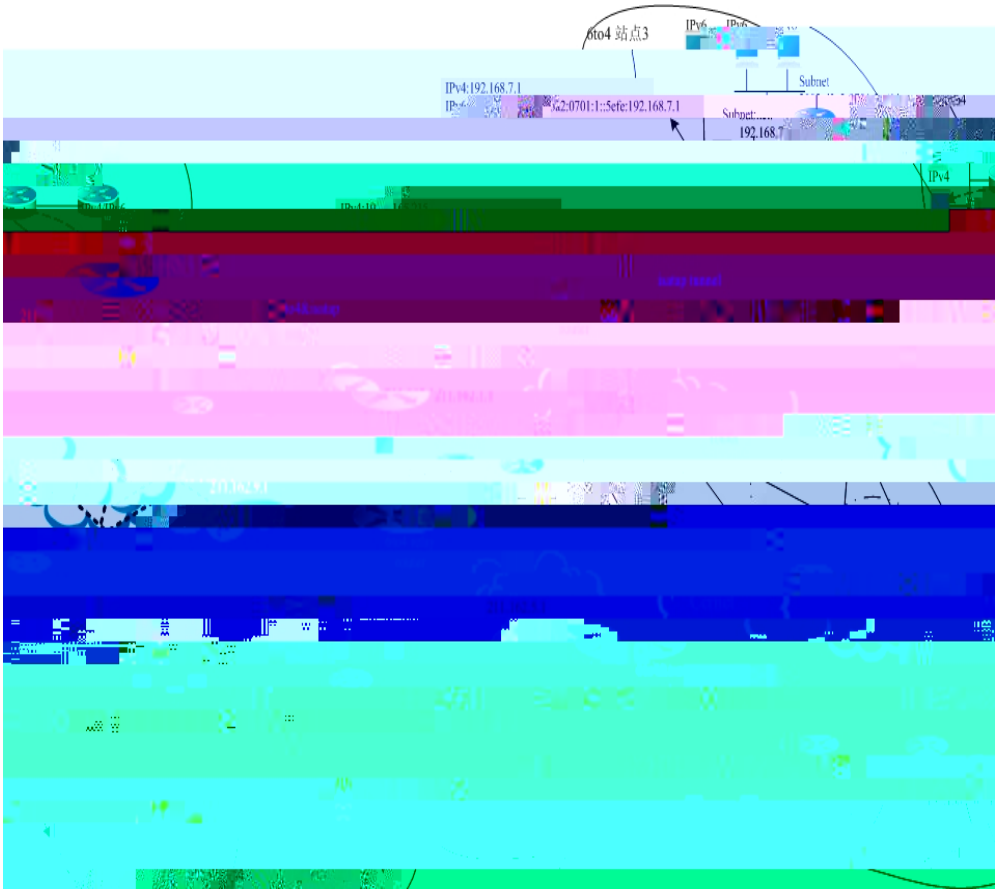
Host A Host B ISATAP Router ISATAP Router ISATAP Host A Host B IPv6 ISATAP Host A Host B IPv6 Host A ISATAP ISATAP RT-A RT-A IPv6

ISATAP Router RT-A

IPv4

```
interface GigabitEthernet 0/1
no switchport
ip address 192.168.1.1 255.255.255.0

#     ISATAP
interface Tunnel 1
tunnel mode ipv6ip isatap
tunnel source GigabitEthernet 0/1
ipv6 address 2005:1::/64 eui-64
no ipv6 nd suppress-ra

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

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

56.4.4 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 GigabitEthernet  0/1
no switchport
ip address 192.168.0.1 255.255.255.0

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

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

#     IPv6          2
interface GigabitEthernet  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 GigabitEthernet  0/1
no switchport
ip address 192.168.10.1 255.255.255.0

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

#     ISATAP
interface Tunnel 1
tunnel mode ipv6ip isatap
tunnel source GigabitEthernet 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 GigabitEthernet 0/1
no switchport
ip address 192.168.0.1 255.255.255.0

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

#     IPv6
interface GigabitEthernet 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 GigabitEthernet 0/1
```