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UGRV 4316+7b44,

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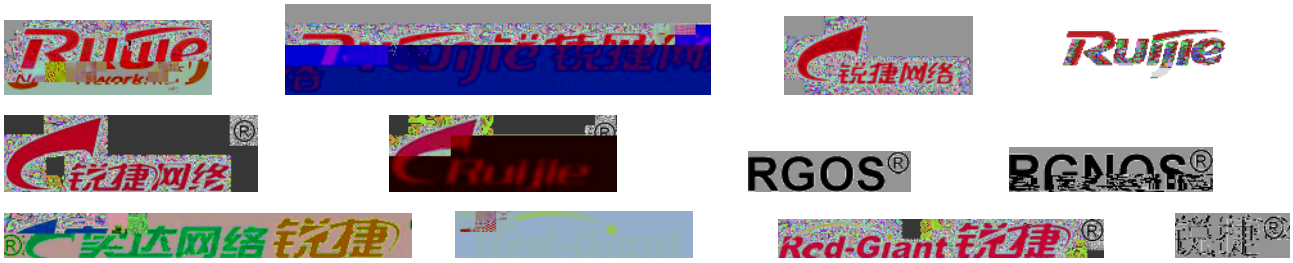
©2014



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1)

[ ] [ ]

{ x | y | ... }

[x | y | ...]

//

2)

3)

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5 HTTP

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CLI

CLI

CLI

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?

User EXEC

show

Privileged EXEC

“Ruijie”

User
EXEC

	Ruijie# ? dir disable
	Ruijie# Ruijie#
	Ruijie#
	Ruijie(config)# WORD SNMP community string

show configuration

Ruijie# **show conf**

CLI

CLI

% Ambiguous command: "show c"		
% Incomplete command.		
% Invalid input detected at ‘^’ marker.	^	

Ctrl-P	
Ctrl-N	Ctrl-P

VT100

80

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Ruijie# *any-command regular-expression*	show

1)

2)

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

”|”

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

”　　”

Φ

CLI　　PC

CLI　　Console

Outband　　Telnet

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

Ruijie(config)# *mode* [ ] { *level* | } *command-string*	*mode* CLI *level* 0 15 *command-string*

mode [ ]

level command

1 1

” ”

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

1

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

reload

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

1

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

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TELNET

Ruijie(config-line)# [|] *line*	0 7 Line
Ruijie(config-line)#	

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EXEC

Ruijie(config-line)#	
Ruijie#	

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AAA

RADIUS

RADIUS

RADIUS

web ePortal

ePortal

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AAA

AAA

web

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

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/

csv txt csv excel csv excel

aaa	aaa
bbb	bbb
ccc	ccc

Txt :

```
aaa,aaa
bbb,bbb
ccc,ccc
```

web CLI CLI

Ruijie# *filename*	flash flash

Ruijie#

Ruijie#

Ruijie# hh:mm:ss month day year	

2003-6-20 10:10:12

```
Ruijie# clock set 10:10:12 6 20 2003      //
Ruijie# show clock                        //
clock: 2003-6-20 10:10:54
```

```
Ruijie# show clock                                //
clock: 2003-5-20 11:11:34
```

calendar

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↑ ß

[modifiers] scheme

( )

modifers

modifiers

mmm | *hhh:mm* [*string*]

mmm *hhh:mm*

string

10 *10* *test*

hh:mm month day year [string]

year

,

31 1 1 11 30

12

1

1 1

1 string 2005-01-10

14:31 *08:30 11 1*

newday 2005-12-10 14:31 2006-01-01

12:00 *12:00 1 1 2006* *newyear*

reload cancel

8 30

31

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

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

```
Ruijie# reload at 12:00 1 11 2005 midday//
Ruijie# show reload                    //
Reload scheduled in 16581 seconds.
At 2005-01-11 12:00
Reload reason: midday
```

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

125 (2005-01-10 12:00)

```
Ruijie# reload in 125 test              //

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

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Ruijie#	

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(System Name)

CLI 32

32

“ Ruijie ”

ف ۱ ۱ ۱ ª ´

Ruijie(Config)# *name*	32

RGOS

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

ف ۱ ΠЂ˝Y ˆ ¨

32 32

EXEC

Ruijie# *string*	32 32

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banner

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Ruijie(config)# *c message c*	(message of the day) c ('&') 255

(#)

“Notice: system will shutdown on July 6th.”

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

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Ruijie(config)# *c message c*	*c* ('&') 255

(#)

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

```
Ruijie(config)# banner login #                    //
Enter TEXT message.  End with the character '#'.
Access for authorized users only. Please enter your password.
#                                                  //
Ruijie(config)#
```

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

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

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Console

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

57600 bps

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

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Telnet TCP/IP

Telnet Client

Ruijie#	Telnet Server IPV4

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	LINE
Ruijie(config-line)# *minutes* [ ]	*minutes*

LINE

	PC TFTP Flash CLI

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SNMP

Server/SSH Server/Telnet Server/Web Server

Ruijie(Config)#	SNMP Server
Ruijie(Config)#	SSH Server
Ruijie(Config)#	Telnet Server
Ruijie(Config)#	Http Server https server

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

http

```
Ruijie(config)# enable service web-server http
```

https

```
Ruijie(config)# enable service web-server https
```

	enable service web-server 3 enable service web-server [http | https | all] all http https http http https https
	https ,https httpd_cert.crt httpd_key.pem tftp

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Web HTTP

Ruijie(Config)#	*number*	HTTP	80

http https http https , http https http https http

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Flash

Flash

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4096

flash 128M

BAK

```
Ruijie# mkdir bak
```

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Ruijie# *old_filename* *new_filename*	*old_filename* *new_filename*

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Ruijie#	

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Ruijie# [ ] *filename*	
Ruijie# [ ] *filename*	

MNT large.c

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

aaa

```
Ruijie# delete recursive aaa
```

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```
Ruijie# rmdir mnt
```

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TFTP Xmodem

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TFTP

XMODEM

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//localtion/filename ”filename” [vrfname]

CLI

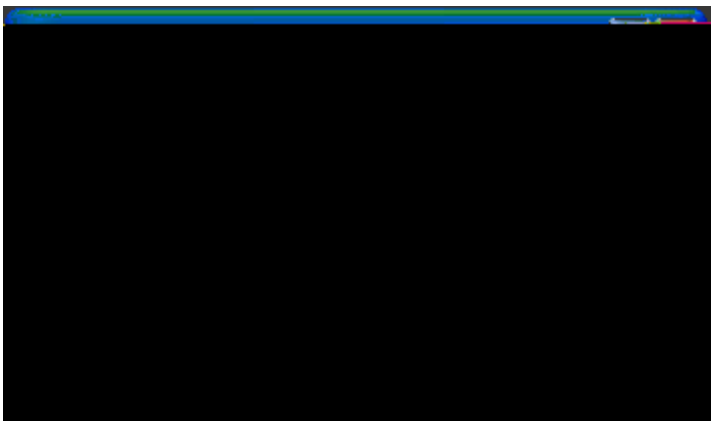
Windows

Windows “ ” “ ”

1

“Xmodem” “ ”

Windows 2



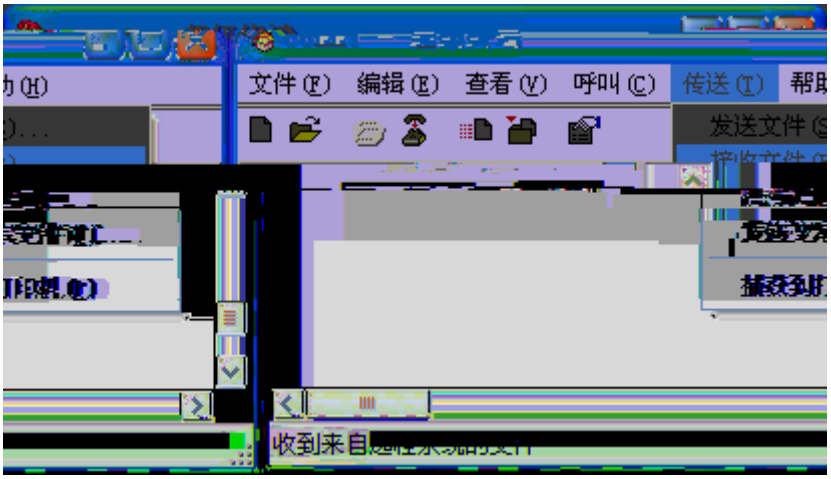
Ruijie# :*filename*	*filename*

CLI

Windows

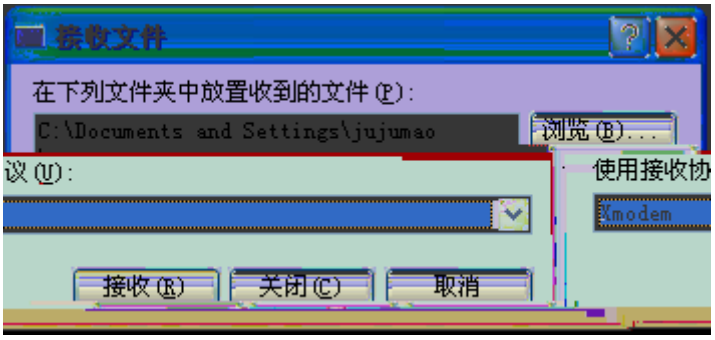
Windows “ ” “ ”

3



“Xmodem” “ ”

“ ” 4



Ruijie# :*filename*	*filename*

”filename” ”filename”

tftp xmodem

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2

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

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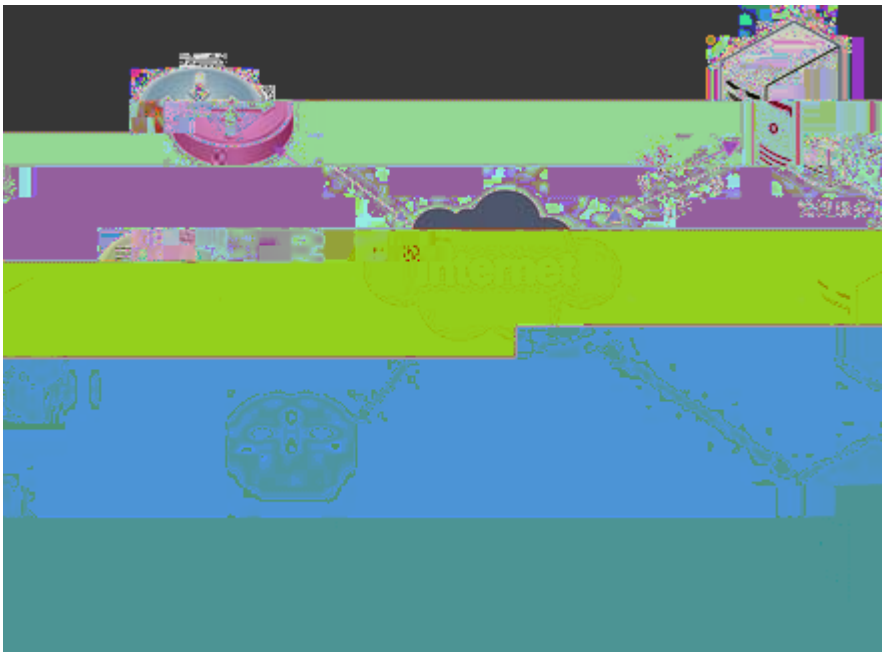
HTTP HTTP HTTP

HTTP HTTP

HTTP HTTP WEB á—Ð[å



HTTP WEB

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RFC1945 - Hypertext Transfer Protocol -- HTTP/1.0

RFC2616 - Hypertext Transfer Protocol -- HTTP/1.1

RFC1867 - Form-based File Upload in HTML

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Foxmail Outlook User File System
Sender-SMTP

HTTP

HTTP HTTP POST FORM

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RFC1945 - Hypertext Transfer Protocol -- HTTP/1.0

RFC2616 - Hypertext Transfer Protocol -- HTTP/1.1

RFC1867 - Form-based File Upload in HTML

RFC821 - Simple Mail Transfer Protocol -- SMTP

RFC822 – Standard for the format of arpa internet text messages -- MIME

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HTTP

	0.0.0.0
	80

HTTP POST	

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HTTP

Ruijie#	
Ruijie# { | *string*}	

HTTP

```
Ruijie# http check-version
files need to be updated: web, config, character-db, normal.
bin:
support identification of 31 kinds of popular games.
Ruijie# http update web character-db //    WEB
updating files, please wait...
update success!
```

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HTTP 0.0.0 80

Ruijie#	
Ruijie(config)# *host* [*port-value*]	
Ruijie#	

#

```
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
```

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HTTP

Ruijie#	
Ruijie(config)#	
Ruijie#	

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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HTTP

Ruijie#	
Ruijie(config)#	
Ruijie(config)# *string*	
Ruijie(config)#	
Ruijie#	

3 HTTP

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# http update time daily 03:00
Ruijie(config)# exit
```

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HTTP


```
Ruijie# feedback update
```

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```
Ruijie(config)# feedback user-info organization
industry-type IT     contact-info 021-61300160
Ruijie(config)# end
Ruijie# show running
```

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Ruijie#	
Ruijie#	
Ruijie(config)# *number*	
Ruijie(config)#	
Ruijie#	

#

```
Ruijie#show feedback items
no.  name      ignore
---------------------------------
1,   no memory,  NO
2,   no flash,   NO
3,   high cpu,   NO
Ruijie# configure terminal
Ruijie(config)# feedback ignore-item 2
Ruijie(config)# end
Ruijie#show feedback items
no.  name      ignore
---------------------------------
1,   no memory,  NO
2,   no flash,   YES
3,   high cpu,   NO
```

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# no mail-service enable
Ruijie(config)# end
```

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SMTP

Ruijie#	
Ruijie(config)# [*value*]	*host*

mail-client username test@qq.com password 093b10013

...

Ruijie#

Connect to SMTP server. OK!

Login to SMTP server. OK!

Send a test mail. OK!

Check SMTP OK!

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6 LINE

7

8

9 Aggregate Port

ف ٦ Ü

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Ruijie

Dialer NULL Loopback

Ruijie

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

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Ruijie(config)# *interface-type interface-number*	
Ruijie(config)# *interface-type interface-number*	

0 0

```
Ruijie# config terminal
Ruijie(config)# interface GigabitEthernet 0/0
```

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NULL IP

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

IP IP

ف ۱ ü ¨Yپ

Ruijie(config-if)# *interface-description*	80
Ruijie(config-if)#	

ف ۱ ˜ ƶ ˳

MTU IP 64 65535

Ruijie(config-if)# *bytes*	MTU
Ruijie(config-if)#	MTU

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BandWidth OSPF RSVP

Ruijie(config-if)# *kilobits*	Bandwidth
Ruijie(config-if)#	Bandwidth

0/0

```
Ruijie# show interface gigabitEthernet0/0
```

ف ۱ ۔ Ҏ Ü

VLAN

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IP

v Γb

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

range

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

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

TenGigabitethernet

```
Ruijie# configure terminal
Ruijie(config)# interface range GigabitEthernet 0/1 - 7
Ruijie(config-if-range)# no shutdown
Ruijie(config-if-range)#
```

, range

```
Ruijie# configure terminal
Ruijie(config)# interface range GigabitEthernet 0/1-5, 0/6-7
Ruijie(config-if-range)# no shutdown
Ruijie(config-if-range)#
```

interface range

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

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

GigabitEthernet0/1-4

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

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

ports1to2N5to7

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

ports1to2N5to7

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

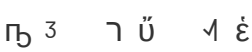
ف ٦ ڑ ٹ

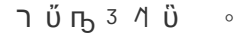
IP

Ruijie (Config-if)#
ip-address ip-mask

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
```





Ruijie#

```
0 output errors, 0 collisions, 3 interface resets
Link Mode: 1000M/Full-Duplex, media-type is twisted-pair.
Output flowcontrol is off;Input flowcontrol is off.
```

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Ruijie# *interface-number*	

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LinkTrap Link SNMP LinkTrap,

ف ㄱ ┐ƃ

Ruijie(config-if)# [ ]	link trap .

ف ㄱ

Link trap:

```
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# no snmp trap link-status
```

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IP

```
Ruijie# config terminal
Ruijie(config)# interface gigabitEthernet 0/0
Ruijie(config-if)# ip address 192.168.12.1 255.255.255.0
Ruijie(config-if)# no shutdown
```

1 ف

VLAN Virtual Local Area Network

ISO IEEE 1999 VLAN

802.1Q

VLAN LAN LAN

VLAN VLAN LAN

VLAN

LAN VLAN

ʜ ȳ VLANQ_01 Tf0 Tc 2.943 0 3d[<02C5>91<316B1DB620TJC5803E1018D0

VLAN Identified VLAN ID 12 VLAN ID 4096
802.1Q VLAN

Canonical Format Indicator C T-R

Priority P 12 8

VLAN VLAN

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VLAN

VLAN

IP

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VLAN

Ruijie(config)# *Sub_interface_number*	802.1Q
Ruijie((config-subif))# *VlanID*	802.1Q VLAN ID VLANID VLANID

VLANID 1 4085

VLAN native

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VLAN VLAN IP
IP

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

802.1Q IP VLAN VLAN

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VLAN

Ruijie# [*VlanID*]	VLAN
Ruijie# [*VlanID*]	VLAN

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VLAN VLAN

1. VLAN 192.168.0.0/24 VLAN 192.168.1.0/24

2. 802.1Q VLAN

```
hostname "Ruijie"
!
interface gigabitEthernet 0/0
no ip address
!
interface gigabitEthernet 0/0.20
encapsulation dot1Q 20            //    802.1Q      VlANID   20
ip addr 192.168.0.1 255.255.255.0          //          IP
!
interface GigabitEthernet0/0.21
encapsulation dot1Q 21            //    802.1Q      VlANID   21
ip addr 192.168.1.1 255.255.255.0          //          IP
!
interface GigabitEthernet0/1
no ip address
shutdown
!
end
```

ف ١ ذ ـ ٱ

Loopback( ) NULL( )
Dialer( )

ف ١ ٱ

Loopback( ) UP Loopback
Loopback IP OSPF
Telnet Telnet Loopback

Ruijie(config)# *loopback-interface-number*	loopback
Ruijie(config)# *loopback-interface-number*	loopback

loopback-interface-number Loopback
Loopback (IP)

Loopback
loopback-interface-number Loopback
loopback-interface-number Loopback

Ruijie# *loopback-interface-number*	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;
```

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IP

Ruijie(config)# *slot-number/interface-number.subinterface-number*	
Ruijie(config)# *slot-number /interface-number.subinterface-number*	

Slot-number/Interface-number / Subinterface-number
“.”

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“ ”

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NPE

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2 IP NAT

3 MGMT

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ف ٧ ٧ ⁴ ẩ ƛ Ậ

IP NAT

Ruijie#	
Ruijie(config)#	
Ruijie(config)#	

Ruijie(config-bridge-map)# *vlan-id num*	native vlan-id vlan-id native vlan-id vlan
Ruijie(config-bridge-map)#	
Ruijie#	

0 GigabitEthernet 0/0

GigabitEthernet 0/1 native vlan-id 100

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# bridge-map 0        Step 6
```

```
Ruijie(config-bridge-map)# link-mode GigabitEthernet 0/0 GigabitEthernet 0/1
receive-only
Ruijie(config-bridge-map)# lan-ip 192.168.0.0 255.255.255.0
Ruijie(config-bridge-map)# lan-ip 10.10.10.0 255.255.255.0
Ruijie(config-bridge-map))# end
```

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Ruijie#	
Ruijie(config)# *interface-name* { *lan* | *wan*}	*interface-name* *lan* *wan:*
Ruijie(config)#	
Ruijie#	

	show sys-mode dialer

Ruijie#	
Ruijie(config)# **bypass couple** *couple-num*	bypass bypass *couple-num* bypass
Ruijie(config)#	
Ruijie#	

1 bypass

```
Ruijie(config)#bypass couple 0
Couple 0 bypass started.
```

2 bypass

```
Ruijie(config)#no bypass couple 0
Couple 0 bypass stoped.
```

NPE50E NPE60E

NPE50E NPE60E bypass GigabitEthernet 0/0 GigabitEthernet 0/1 GigabitEthernet 0/2 GigabitEthernet 0/3 couple 0 couple 1

NPE50E NPE60E bypass

Ruijie#	

```
Ruijie(config)#bypass copper couple 0
```

```
              2             1                    receive-only
       100.100.100.0/24       IP      Ruijie#show bridge-map 1 lan-ip
           IP add            mask add
           100.100.100.0      255.255.255.0
```

3

```
Ruijie#show sys-mode
System is gateway mode.
LAN: GigabitEthernet 0/0 GigabitEthernet 0/3 GigabitEthernet 0/5
```

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

4 NPE60E

```
NPE60E:
Ruijie#sh environment
---environment information---
CPU Temperature is 34
fan works in high speed mode.

FAN 1 is OK!
FAN 2 is OK!
FAN 3 is OK!
FAN 4 is OK!

POWER 1 is not present!
```

POWER 2 is not present!

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NPE40 NPE60

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Console

MGMT Management

MGMT

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MGMT

Console MGMT 100M vs 115200bps

MGMT

MGMT ,XS*ƀ%ƈ<u)ƀƀ‰ƈ°…T”?U"ƀ0Ñ–ƈÂ

duplex	auto
speed	auto
flowcontrol	enable

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MGMT IP

MGMT

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MGMT IP MGMT IP

Ruijie#	
Ruijie(config)#	
Ruijie(config-if-Mgmt 0)# *ip-address subnet-mask*	IP

	MGMT LAN LAN

MGMT IP

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
```

NPE40 NPE60

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Ruijie#	
Ruijie(config)#	
Ruijie(config-if-Mgmt 0)# *A.B.C.D*	
Ruijie(config-if-Mgmt 0)# *mtu-value*	MTU

Ruijie(te01 02 T 01 00 10 T [(25 u) -5 [(g 1 4 0 3 (v -8 (e) -5 (0) 2 4 (0 5 6 2 10 T 0 2 / T 5 6 0 3 0 T 0 4 0 E 5 3 T 1 2 8 (.7) 3 C F 0 1 T 8 7 4 [(

- ping oob
- traceroute oob
- telnet oob
- sntp enable oob

ping oob

Ruijie# *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# *host*	

MGMT

```
Ruijie# traceroute oob 192.168.9.1
Tracing route to 192.168.9.1 over a maximum of 30 hops
  1   <10 ms   <10 ms   <10 ms  192.167.201.1
  2     1 ms     1 ms     1 ms  192.168.201.1
  3     1 ms   <10 ms   <10 ms  10.10.24.1
  4   <10 ms   <10 ms   <10 ms  192.168.9.1
```

telnet oob

Ruijie#	*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
```

	NPE40 NPE60

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LINE

LINE

/ LINE VTY

LINE

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LINE LINE LINE

LINE

Ruijie(config)# [| | |] *first-line* [*last-line*]	LINE

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LINE VTY 5 LINE VTY VTY

36

LINE VTY VTY

show users

VTY 7 telnet VTY 7

CLI “ no line vty 6 ” VTY VTY 7

Ruijie(config)# *line-number*	LINE VTY
Ruijie(config)# *line-number*	LINE VTY

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LINE VTY

TTY

line number	Line
{ | | | }	Line
	LINE
	LINE

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LINE Line

line number	Line
access-list-number { }	Line
access-list-number { }	Line

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DLDP

Ruijie(config-if)# *pool-number*	(, pppoe)

Ruijie(config-if)#	, (, pppoe)

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

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PPPOE PPP PPPOE

Ruijie(config)# *dialer-number*	
Ruijie(config-if)#	
Ruijie(config-if)# *pool-number*	
Ruijie(config-if)# *seconds*	
Ruijie(config-if)#	PPP PPPOE PPP
Ruijie(config-if)# *1488*	1488
Ruijie(config-if)# *dialer-group-number*	dialer-list

Ruijie(config-if)#

MTU

1488

PPPoE IP

PPPoE

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PPPOE

PPPOE NAT

Ruijie(config)# *number dialer-group protocol-name* { | | *access-list-number* | *access-group*}	

IP

Ruijie# { | }	tunnel session
Ruijie# *dialer-number*	IP
Ruijie# { | | | }	PPPOE

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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
access-list 1 permit any
ip route 0.0.0.0 0.0.0.0 Dialer1
!
dialer-list 1 protocol ip permit
!
line con 0
line aux 0
line vty 0 4
login
!
end
```

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Aggregate Port AP
AP IEEE802.3ad

AP AP AP
AP AP

NPE40/NPE50E/NPE60E

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IP L4 L4 L4 +L4 IP+L4 IP+L4
IP+L4 IP+L4 IP+L4 +L4 IP+L4 +L4
IP+ IP+L4 IP+ IP+L4 IP+ IP+L4 +L4
AP

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MAC

MAC MAC AP MAC
MAC MAC

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IP IP IP IP IP IP IP
IP IP IP

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IP+ IP IP+

IP IP+ IP

L4 L4 L4 L4

L4

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L4 +L4 L4 L4

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+L4 L4 +L4

IP+L4 IP L4

IP+L4

IP+L4

IP+L4 IP L4

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IP+L4 +L4

AP

MAC MAC

MAC + MAC IP IP IP + IP L4 L4 L4

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IP+L4 +L4 IP+L4 +L4 IP+ IP+L4 IP+

IP+L4 IP+ IP+L4 +L4

IP

WAN AP AP LAN

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AP AP AP
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4) AP

AP

Ruijie(config)# *ap-number*	AP

16 AP

ap-number AP

AP 10

```
Ruijie# configure terminal
Ruijie(config)# interface aggregateport 10
```

5) AP

AP

Ruijie(config)# *interface-name*	
Ruijie(config-if)# *ap-number*	AP

AP 8

AP AP AP

AP

Gi0/1 AP 5 AP 5

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

AP AP
AP AP

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AP

ف ۱ ۳

6) AP LinkTrap

AP LinkTrap AP Link LinkTrap

Ruijie(config-if-AggregatePort *ap_number*)#	AP LinkTrap

AP AP LinkTrap

AP 5 LinkTrap

```
Ruijie(config)# interface aggregateport 5
Ruijie(config-if-AggregatePort 5)# no snmp trap link-status
```

AP LinkTrap

7) AP LinkTrap

AP LinkTrap

AP LinkTrap

Ruijie(config)#	AP LinkTrap

AP LinkTrap

AP LinkTrap

```
Ruijie# configure terminal
Ruijie(config)# aggregateport member linktrap
```

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AP


```
Index(dec):25 (hex):19
AggregatePort 1 is DOWN  , line protocol is DOWN
Hardware is Aggregate Link AggregatePort, address is 00d0.f822.334a (bia 00d0.f822.334a)
Interface address is: no ip address
ARP type: ARPA,ARP Timeout: 3600 seconds
  MTU 1500 bytes, BW 1000000 Kbit
  Encapsulation protocol is Ethernet-II, loopback not set
  Keepalive interval is 10 sec , 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
  Link Mode: Down.
Aggregate Port Informations:
       Aggregate Number: 1
       Name: "AggregatePort 1"
       Refs: 2
       Members: (count=1)
       GigabitEthernet 0/1             Link Status: Down
  30 seconds input rate 0 bits/sec, 0 packets/sec
  30 seconds output rate 0 bits/sec, 0 packets/sec
    0 packets input, 0 bytes, 0 no buffer, 0 dropped
    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 dropped
    0 output errors, 0 collisions, 0 interface resets
```

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AP AP

Ruijie# { [*ap_number*] }	AP

AP 1

```
Ruijie# show aggregateport 1 summary
AggregatePort MaxPorts  Ports
------------- --------  ---------------------------------
Ag1           8         Gi0/1
```

AP

```
Ruijie# show aggregateport load-balance
Load-balance : Source MAC address
```

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IP

1 IP

2 IPv4

3

4 NAT

5

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

IP IP 32 IP 1
2 IP

A “ 0 ” 7 24
128 A

B “ 10 ” 14 16
16,348 B

C “ 110 ” 22 8
2,097,152 C

D “ 1110 ”

“ 1111 ” E

IP IP

IP

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IP

IP

ARP

IP

IP

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IP IP IP

IP

IP

Ruijie(config-if)# *ip-address mask*	IP
Ruijie(config-if)#	IP

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IP IP IP
IP IP IP IP
IP IP
C 254
254 C C
IP
IP
IP IP
IP

IP IP IP
IP IP

IP

Ruijie(config-if)# *ip-address mask*	IP
Ruijie(config-if)# *ip-address mask*	IP

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IP 1
MAC
MAC MAC IP 2
IP
IP 48 MAC IP
MAC ARP MAC IP
RARP 1 ARP 2 Proxy ARP ARP Proxy ARP RARP RFC 826 RFC 1027 RFC 903

ARP MAC IP IP ARP MAC
MAC IP MAC ARP
MAC IP
IP ARP Ethernet II SNAP

RARP ARP RARP MAC IP
RARP

ARP

ARP

ARP

ARP IP MAC
ARP IP ARP

ARP

Ruijie(config)# *ip-address mac-address arp-type*	ARP arp-type arpa
Ruijie(config)# *ip-address*	ARP

IP
ARP IP

1 IP IP IP

2 IP

IP ARP
ARP ( ) ARP

1 ARP MAC Ã *ü IPARP 1

Ruijie(config)#	
Ruijie(config-if-GigabitEthernet 0/0)#	anyip
Ruijie(config-if-GigabitEthernet 0/0)#	anyip

anyip

AnyIP ARP
ARP VRRP ARP AnyIP ARP
AnyIP

ARP Ethernet II ARPA

ARP IP MAC ARP
ARP
ARP

ARP

Ruijie(config-if)# *seconds*	ARP 0-2147483 0
Ruijie(config-if)#	

3600 1

ARP ARP arp arp
ARP ARP
ARP ARP

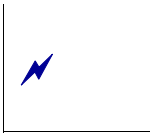
Ruijie(config-if)#
arp

UP UP IP

Ruijie(config-if)# *start-ip-address* *end-ip-address*	ARP

ARP

1 ARP IP
2



ARP

ip ARP

ARP ARP

arp trusted aging

Ruijie(config)#	ARP

ARP *number*

Ruijie(config)# *number*	ARP *number* NPE40 NPE50E NPE60 NPE60E <10-7168> 4096

1 ARP

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1
“ 1 ” 2
32 “ 1 ”
IP IP

IP

IP

RFC 919 RFC 922

IP

IP IP IP 172.16.16.255

IP

IP “ 1 ”

Ruijie(config-if)#	

“ 1 ” 255.255.255.255

255.255.255.255

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

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1) ARP

2) IP

3)

Ruijie#	ARP

Ruijie#

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IP

Ruijie#	ARP
Ruijie#	IP ARP
Ruijie# [*interface-type interface-number*]	IP
Ruijie# [*network* [*mask*]]	
Ruijie#	

Ruijie#

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
```

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IP

IP

Ruijie(config-if)#	ICMP

ICMP

ICMP

ICMP

Ruijie(config-if)#	ICMP
Ruijie(config-if)#	ICMP

ICMP ICMP

ICMP

ICMP

Ruijie(config-if)#	
Ruijie(config-if)#	

MTU MTU

MTU MTU IP MTU IP MTU

MTU IP MTU MTU

MTU

IP MTU

Ruijie(config-if)# *bytes*	MTU 68~1500
Ruijie(config-if)#	

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IP IP IP
RFC 791
ICMP
IP IP

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(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

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RDF

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IP REF

IP/MASK

IP IP

1. IP IP IP

2. IP IP IP IP IP

3. IP IP IP

IP

Ruijie(config)#	IP + IP
Ruijie(config)#	IP + IP
Ruijie(config)#	IP 6$1w 0@ bu@ Pc],Â

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REF

Ruijie# [ ]	/ REF

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Ruijie# [| | *ip* | (*interface_type interface_number*) |]	IP

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IP IP IP
IP IP
CPU

Ruijie# [vrf_name] source-ipaddress dest_ipaddress	

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Ruijie# [*vrf_name*] [| (*ip mask*) |	0

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Ruijie# [*ip_protocol_number urce_ip source_ip_mask_len dest_ip dest_ip_mask_len*]	

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Ruijie#	

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Ruijie#	

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Ruijie#	

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ip session timeout

Ruijie# {	
10 } *num*	

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	10s
	10s
	10s
	10s
	300s

ip session timeout tcp-fin-wait 10

ip session timeout tcp-syn-sent 5

ip session timeout tcp-time-wait 5

UDP udp-connected udp-closed udp-connected

ip session timeout udp-closed 5

ip session timeout udp-connected 600

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NAT( )

NAT
NAPT
NAT
TCP

NAT IP IP
NAT

NAT NAT

ce-type

'66 T1

Ruijie(config-if)#	

NAPT

Ruijie(config-if)#	
Ruijie(config)# *interface-type interface-number*	
Ruijie(config-if)#	

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TCP TCP

NAT TCP

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TCP

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NAT Net200

200.168.12.2~200.168.12.100 1 NAT

```
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
```

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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 0/1
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
```

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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 0/1
ip address 200.198.12.1 255.255.255.0
ip nat outside
```

```
Ruijie# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
#     WAN0
Ruijie(config)#interface GigabitEthernet 0/1
#     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 0/1, changed state to up
%LINE PROTOCOL CHANGE: Interface GigabitEthernet 0/1, 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 0/1 218.5.19.1
#     NAT
Ruijie(config)# access-list 1 permit any
#
```

```
Ruijie(config)#ip nat inside source list 1 interface GigabitEthernet 0/1
#     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        A“K‡ z“K‡ z‡ ]@ A@> ¼pK€
```

```
specify interface GigabitEthernet 0/1 wan
!
```

!
ip nat inside source static 192.168.12.0 200.198.12.0 netmask 255.255.255.0

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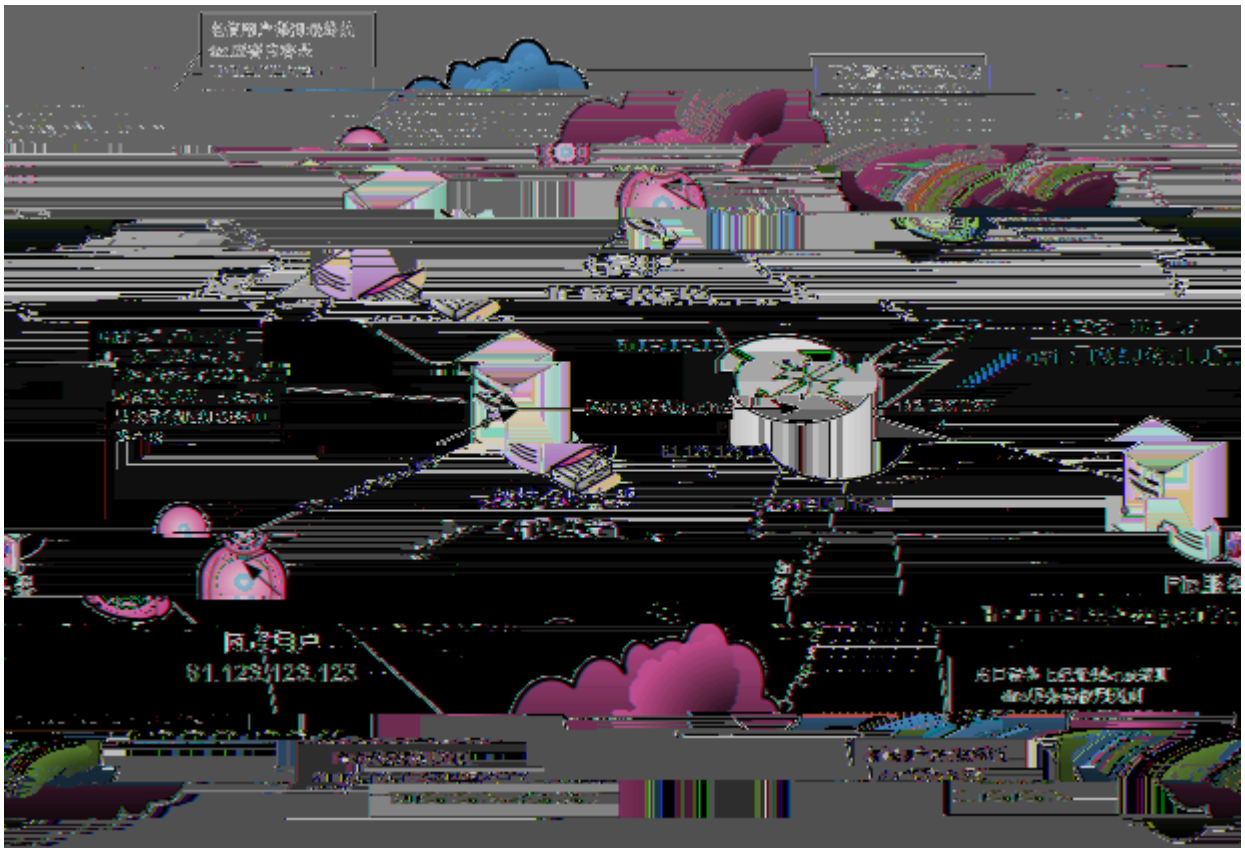
NAT dns alg dns DNS
ISP
DNS

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 192.168.1.1 10.123.123.123
 /*                    */
 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
```

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ص ⊦

ECMP

10.3(4b8)	ECMP 10.3(4b8) ECMP ECMP

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(session) IP IP VRF

	VPN VPN VPN VPN

	ecmp nexthop

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Ruijie#	
Ruijie(config)#	
Ruijie(config)#	

#

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

#

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

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Ruijie#		
Ruijie(config)#	*interface-name*	
Ruijie(config-if)#	*kilobits*	
Ruijie(config-if)#		

1M

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface fastEthernet 0/1
Ruijie(config-if)# bandwidth 1000
```

#

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

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Ruijie#	
Ruijie(config)# { | }	/
Ruijie(config)#	

bandwidth

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

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IP

IP

mllb policy bandwidth

IP

Ruijie#	
Ruijie(config)#	IP
Ruijie(config)#	IP IP

IP

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# mllb load-sharing original
```

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Ruijie#	
Ruijie(config)# *interface-type interface-number*	
Ruijie(config)#	

gi0/1

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# mllb first-choice gi0/1
```

Mllb 10.3(4b8) ECMP Mllb first-choice

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Ruijie#	
Ruijie(config)# { | }	
Ruijie(config)#	

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#load-monitor uplink
```

#

Ruijie#	
Ruijie(config)# *percent*	*percent* 90
Ruijie(config)#	

80

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#over-load-protect threshold 80
```

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Ruijie (config)#	

show running-config

```
Ruijie# show mllb config
multi-link load balance configure:
multi-link load balance state: enabled
multi-link load balance policy: load
multi-link load balance load-interval: 5
multi-link load balance threshold: 90 lower: 90
multi-link load balance load-monitor: down-link
multi-link load balance first-choice set to GigabitEthernet 0/5 is up
multi-link load balance load-sharing original
```

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Ruijie (config)#	

#

```
Ruijie# show over-load-protect configure
>Over-load-protect configure
------------------------------------------------------------------
over-load-protect state: disable
interface-group: 1, 2, 19
load-interval: 5
threshold: 90
```

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Ruijie (config)#	

#

```
Ruijie(config)#show load-monitor configure
>Load-monitor: down-link
```

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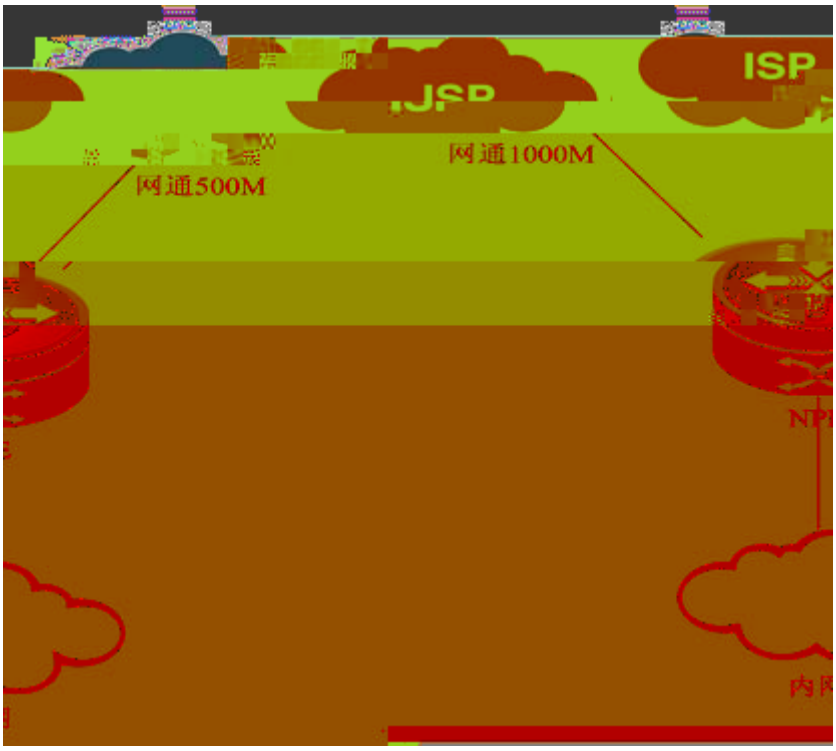
ISP

2 gi0/2 gi0/3 1000M 500M



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1000M *gigabitEthernet 0/1* *gigabitEthernet 0/2*

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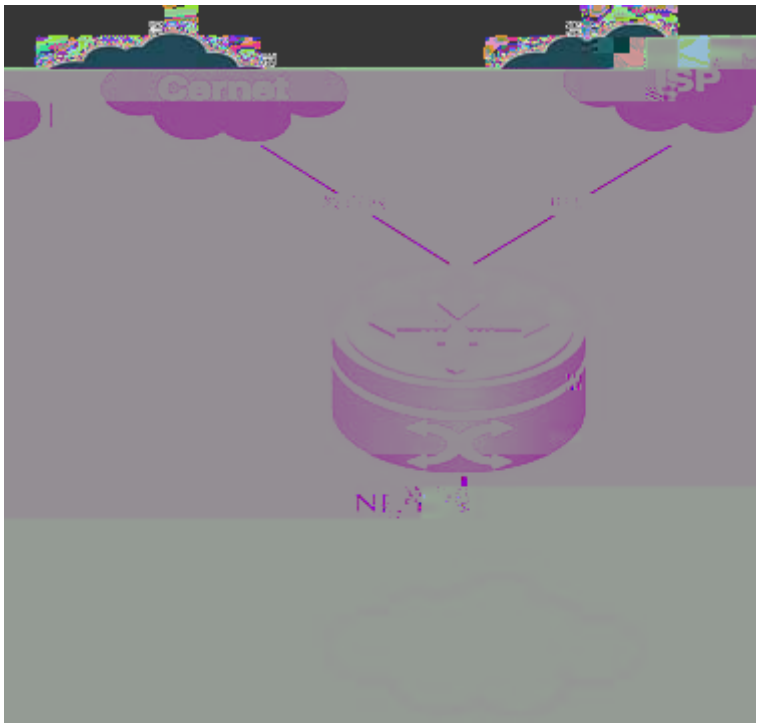

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1 1

#

```
Router(config)#interface-group 1
Router(config-intf-group)# interface gi 0/1
Router(config-intf-group)# interface gi 0/2
Router(config-intf-group)# exit
```

2

```
Ruijie(config)#over-load-protect enable

3                1
Ruijie(config)#over-load-protect interface-group 1
```

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IP

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```
Ruijie(config)#user-route enable
#
Ruijie(config)#no user-route enable
```

NPE

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SAM

Ruijie#con	
Ruijie(config)# *user-group-name*	user-group-name 30
Ruijie(config)#	

SAM

```
Ruijie(config)#no link-sam enable
```

	SAM SAM3.90 SAM SAM

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SAM SAM 3.90 SAM3.90
3.90

Ruijie#con	
Ruijie(config)#	SAM 3.90
Ruijie(config)#	SAM3.90

#

SAM3.90

```
Ruijie(config)#link-sam protocol old
```

SAM3.90

```
Ruijie(config)#no link-sam protocol
```

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“ ”

Ruijie#con	
Ruijie(config)# *user-group-name*	
Ruijie(config-user-group)# *interface-name*	“ ” 32
Ruijie(config-user-group)#no *interface-name*	“ ”

#

“ ” gi0/1 gi0/2

```
Ruijie(config)#user-route user-group cnii
Ruijie(config-user-group)#prior-line interface gigabitEthernet 0/1
```

```
Ruijie(config-user-group)#prior-line interface gigabitEthernet 0/2
```

“ ” gi0/1 gi0/2

```
Ruijie(config-user-group)#no prior-line interface gigabitEthernet 0/1
Ruijie(config-user-group)#no prior-line interface gigabitEthernet 0/2
```

nexthop

NPE

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“ ” “ ”

Ruijie#con	
Ruijie(config)# *user-group-name*	
Ruijie(config-user-group)# *interface-name*	“ ” 32
Ruijie(config-user-group)# *interface-name*	“ ”

#

“ ” gi0/3 gi0/4

```
Ruijie(config)#user-route user-group cnii
Ruijie(config-user-group)#posterior-line interface gigabitEthernet 0/3
Ruijie(config-user-group)#posterior-line interface gigabitEthernet 0/4
```

“ ” gi0/3 gi0/4

```
Ruijie(config-user-group)#no posterior-line interface gigabitEthernet 0/3
Ruijie(config-user-group)#no posterior-line interface gigabitEthernet 0/4
```

nexthop

NPE

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“ ”

Ruijie#con	
Ruijie(config)#	“ ”
Ruijie(config)#	“ ”

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ACE ACE

“ ”

Ruijie#con	
Ruijie(config)# *user-group-name*	
Ruijie(config-user-group)#	“ ”
Ruijie(config)#	

#

“ ”

```
Ruijie(config)#user-route user-group intranet
Ruijie(config-user-group)#deny others
```

#

```
Ruijie(config)#user-route load-sharinig original
```

NPE

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SAM TCP

Ruijie#con	
Ruijie(config)# *port*	SAM TCP 2012
Ruijie(config)#	SAM

#

SAM TCP 2015

```
Ruijie(config)#link-sam port 2015
```

SAM

```
Ruijie(config)#no link-sam port
```

	1. SAM TCP SAM
	2. NAT NAT

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SAM SAM SAM
SAM
SAM NPE SAM
SAM SAM NPE

```
>Total user-group counts: 4
>User-route load-sharing original
>User-route posterior-line load-balance enable
------------------------------------------------------------------
User-group: cnii
  State: Active
  Prior-line: GigabitEthernet 0/1, GigabitEthernet 0/2
  Posterior-line: GigabitEthernet 0/7, GigabitEthernet 0/8
  Deny others: No

User-group: cnc
  State: Active
  Prior-line: GigabitEthernet 0/3, GigabitEthernet 0/4
  Posterior-line: GigabitEthernet 0/7, GigabitEthernet 0/8
  Deny others: No

User-group: cmii
  State: Inactive
  Prior-line: GigabitEthernet 0/5, GigabitEthernet 0/6
  Posterior-line: GigabitEthernet 0/7, GigabitEthernet 0/8
  Deny others: No

User-group: intranet
  State: Active
  Prior-line:
  Posterior-line:
  Deny others: Yes
```

cnii

```
Ruijie#show user-route user-group cnii configure
User-group: cnii
  State: Inactive
  Prior-line: GigabitEthernet 0/1, GigabitEthernet 0/2
  Posterior-line: GigabitEthernet 0/7, GigabitEthernet 0/8
  Deny others: No
```

NPE

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show link-sam statistics SAM

Ruijie#	SAM

```
#

#
Ruijie#show link-sam statistics
>Link-sam run state: enable
>Link-sam connect port: 2012
>Link-sam connect timeout minutes: 20
>Current SAM connections: 2
>Count of SAM connections: 2
>Count of SAM disconnections: 0
----------------------------------------------------------------
SAM's ip: 192.168.1.1
  Received packets: 2650
  Received user online messages: 530
  Received user offline messages: 0
  Received user synchronization messages: 2120
  Received user ip update messages: 0
  Received exception messages: 0
  Received invalid segments: 0

SAM's ip:192.168.10.1
  Received packets: 2400
  Received user online messages: 480
  Received user offline messages: 0
  Received user synchronization messages: 1920
  Received user ip update messages: 0
  Received exception messages: 0
  Received invalid segments: 0
```

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1. SAM SAM
2. “ ”

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1

4 gi0/1,gi0/2 gi0/3 gi0/4

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1. “ ” “ ” “ ”
   “ ”
2. “ ”
3. (nexthop)
4. SAM
5. SAM

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1

“ ”

```
Ruijie# con
Ruijie(config)# route-auto-choose cernet gi0/4 219.243.240.5
```

2

#

```
Ruijie(config-if-GigabitEthernet 0/1)#nexthop 120.35.31.101
Ruijie(config-if-GigabitEthernet 0/2)#nexthop 120.35.31.108
Ruijie(config-if-GigabitEthernet 0/3)#nexthop 58.22.122.110
Ruijie(config-if-GigabitEthernet 0/4)#nexthop 219.243.240.5
```

3

#

```
Ruijie(config)#user-route user-group cnii
#       “       ”
Ruijie(config-user-group)#prior-line gi0/1
Ruijie(config-user-group)#prior-line gi0/2
#    “       ”
Ruijie(config-user-group)#posterior-line gi0/4
```

#

```
Ruijie(config)#user-route user-group cnc
#       “       ”
Ruijie(config-user-group)#prior-line gi0/3
#    “       ”
Ruijie(config-user-group)#posterior-line gi0/4
```

4

#

```
Ruijie(config)#user-route enable
```

4 SAM

SAM

```
Ruijie(config)#link-sam enable
```

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#

```
Ruijie#show user-route configure
>User-route run state: enable
>Total user-group counts: 2
>User-route load-sharing original
>User-route posterior-line load-balance enable
-------------------------------------------------------------------
User-group: cnii
  State: Active
  Prior-line: GigabitEthernet 0/1, GigabitEthernet 0/2
  Posterior-line: GigabitEthernet 0/4
  Deny others: No

User-group: cnc
  State: Active
  Prior-line: GigabitEthernet 0/3
  Posterior-line: GigabitEthernet 0/4
  Deny others: No
```

show link-sam statistics

```
Ruijie#show link-sam statistics
>Link-sam run state: enable
>Link-sam connect port: 2012
>Link-sam connect timeout minutes: 20
>Current SAM connections: 1
>Count of SAM connections: 1
>Count of SAM disconnections: 0
-------------------------------------------------------------------
SAM's ip: 192.168.1.1
  Received packets: 2650
  Received user online messages: 530
  Received user offline messages: 0
  Received user synchronization messages: 2120
  Received user ip update messages: 0
  Received exception messages: 0
         Received invalid segments: 0
```

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vlan IP IP

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vlan tag IP IP

vlan

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ip mac

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Ruijie#	
Ruijie(config)#	
Ruijie(config)#	
Ruijie#	

```
#
Ruijie#configure terminal
```

Ruijie#	
Ruijie(config)#	
Ruijie(config)#	
Ruijie#	

#

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

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vlan

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vlan vlan

Ruijie#	
Ruijie(config)# *name* *vid-list*	vlan
Ruijie(config)#	
Ruijie#	

name

vlan tag vlan

vlan vlan id vlan id vlan id

vlan “ - ” vlan id vlan id vlan id

vlan “ any ” vlan id
vlan vlan “ any ”

vlan “ vlan-group1 ” vlan 1 vlan 3 vlan7 vlan8 vlan9

```
Ruijie#
Ruijie(config)#vlan-group vlan-group1 vlan 1,3,7-9
Ruijie(config)#end
```

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

vlan

Ruijie#show vlan-group

vlan-group	police_flow	police_url	flow	vlan id
any	9	0	0	
vlan1	0	0	0	1
vlan2	0	0	0	3-5
vlan3	0	0	0	7,9

Ruijie#	

Ruijie(config)# *name parent* [[*ip-addr*] [*mac-addr*] *subnet mask start end*] [*pwd_str* { *two-way-bind* | *single-way-bind*}]	
Ruijie(config)#	

Ruijie#

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Ruijie# [|] *filename*	

“ userfile ”

Ruijie# userfile

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Ruijie#**subscriber rename** *oldname newname*	

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xx yy

Ruijie#**subscriber rename** *xx yy*

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Ruijie#**subscriber** *xx* **move to parent** *yy*	

5

:

xx yy

Ruijie# **subscriber** *xx* **move to parent** *yy*

“ baidu ” ip “ 192.168.196.156 ” “ 1 ” “ 1 ”
“ ”

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#network-group name baidu parent /  /  1 ip-host
192.168.196.156
Ruijie(config)#end
```

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Ruijie# [|] *filename*	
Ruijie# | name	

“ .txt ”

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Ruijie# [|] *filename*	

“ userfile ”

Ruijie# userfile

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Ruijie# | name	show network-group

#

Ruijie#show network-group all

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

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Ruijie#**network-group rename** *oldname newname*	

:

xx yy

Ruijie#**network-group rename** *xx yy*

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Ruijie#**network-group** *xx* **move to parent** *yy*	

5

:

xx yy

Ruijie# **network-group** *xx* **move to parent** *yy*

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sam sam

Ruijie# *time* Ruijie# *time}*	Sam Sam

:

1 sam 30 sam

Ruijie#config

Ruijie(config)# sam-online recycle 30

Ruijie(config)# sam-offline recycle off

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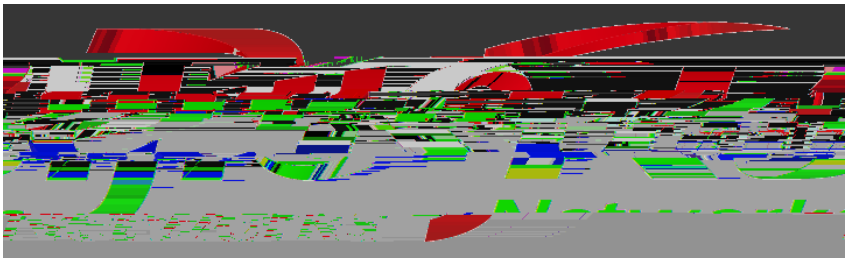
Ruijie# | name	show auth-subs

#

Ruijie#show auth-subs all

name	mac	flow	fc	url	dir	dym ip
/	0000.0000.0000	16	0	1	1	0
smp_root	0000.0000.0000	0	0	0	1	0
webauth_root	0000.0000.0000	0	0	0	1	0



2012-11-5			
2012-11-20			

.....0
.....0
.....0
.....0
.....3
.....3
.....4
.....5
.....5
.....6
.....6
.....7
.....8

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Ruijie(config)#	
Ruijie#	

#

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

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Ruijie#	

Ruijie#	
Ruijie(config)#	
Ruijie(config)#	
Ruijie#	

#

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


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Ruijie(config)#	
Ruijie(config)#	
Ruijie#	

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P2P P2P

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Ruijie(config)#	
Ruijie#	

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DFI P2P

Ruijie#	
Ruijie(config)#	DFI P2P
Ruijie(config)#	
Ruijie#	

DFI P2P

DFI P2P

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

	P2P DPI P2P DPI P2P P2P P2P “ P2P ” “ ”

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DFI

Ruijie#	
Ruijie(config)#	DFI
Ruijie(config)#	
Ruijie#	

DFI

DFI

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

	DFI P2P

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Ruijie#	
Ruijie(config)#	
Ruijie(config)#	
Ruijie#	

#

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

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Ruijie#	
Ruijie(config)# *app-name class-name sport-low sport-high dport-low dport-high* [*sip-low sip-high dip-low dip-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 sip-low sip-high dip-low dip-high sport dport
Ruijie(config)#	
Ruijie#	

app-name class-name sport-low sport-high dport-low dport-high [*sip-low sip-high dip-low dip-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 sip any any dip 100.1.1.1 10.1.1.10
Ruijie#end
Ruijie#*Jan 11 17:25:29: %SYS-5-CONFIG_I: Configured from console by console
Ruijie#show identify-application custom-rule
TYPE  NAME               CLASS              SPL    SPH    DPL    DPH  SIPL
SIPH  DIPL       DIPH

TCP                                          1      10      1      100  any
any   100.1.1.1  10.1.1.10
```

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# identify-application custom name myqq class           udp
sport 1 10 dport any any sip 192.168.1.2 192.168.1.2 dip 66.12.11.34
66.12.11.36
Ruijie#end
Ruijie#*Jan 11 17:25:29: %SYS-5-CONFIG_I: Configured from console by console
Ruijie#show identify-application custom-rule
TYPE  NAME               CLASS              SPL    SPH    DPL    DPH  SIPL
SIPH    DIPL    DIPH

TCP                          1     10    1     100   any          any   100.1.1.1
10.1.1.10

UDP  myqq                     1     10     any  any  192.168.1.2 192.168.1.2
66.12.11.34  66.12.11.36
```

show identify-application class

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app-group *app-name*

MYQQ QQ MYQQ

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

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Ruijie#	
Ruijie(config)#	
Ruijie(config)#	
Ruijie#	

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HTTP

Ruijie#	
Ruijie(config)#	HTTP
Ruijie(config)#	
Ruijie#	

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Ruijie#	
Ruijie(config)#	ŝ

```
Ruijie#show identify-application custom-rule
TYPE  NAME     CLASS        SPL  SPH   DPL   DPH   SIPL        SIPH
DIPL        DIPH
TCP                         1    10    1     100   any         any
100.1.1.1   10.1.1.10
UDP   myxunlei  myp2p       18    18     any  any  192.168.1.2 192.168.1.2
66.12.11.34  66.12.11.36
#
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        5-0-0-0
        6-0-0-0
HTTP     7-0-0-0
             8-0-0-0
           9-0-0-0
      10-0-0-0
           11-0-0-0
        12-0-0-0
        13-0-0-0
           14-0-0-0
        15-0-0-0
RFC 16-0-0-0
         248-0-0-0
```

MSN

#

Ruijie#**show identity-application proto-expect**

protocol expectation state: on //

protocol expectation timeout: 180 // 3

#

Ruijie#**show identity-application route enhance**

identify-application route enhance: on

identify-application http route enhance: on

#

Ruijie#**show identify-application route enhance table**

..route enhance enable application list..

4-0-0-0

PPFilm 4-14-0-0

PPTV|PP 4-15-0-0

PPSTREAM 4-16-0-0

| Web 4-17-0-0

UUSEE_PC|IPad 4-33-0-0

QVOD 4-48-0-0

4-50-0-0

4-52-0-0

4-71-0-0

4-73-0-0

P2P 5-0-0-0

BITTORRENT 5-3-0-0

5-5-0-0

QQ	5-22-0-0
	5-28-0-0
FLASHGET	5-34-0-0
P2P-FTP	5-50-0-0
P2P-HTTP	5-51-0-0
	5-52-0-0

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Ruijie#	
Ruijie(config)#	

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IP IP

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P2P

ADSL

	NPE40 NPE50E NPE60E

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“ ”
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” “ ” “ ” “ ”
“ ”

“ ” “ ” “ ” “ ”
“ ” “ ”
“ ” “ ” “ ” “ HTTP
” “ HTTP ” “ HTTP ” “ ” “
” “ HTTP ” “ HTTP
” “ ”
“ ” “ ” “ ”

P2P	(all)	(all)	Y
	(all)	(all)	Y
	(all)	(all)	Y
HTTP			
	HTTP	(all)	Y
	(all)	(all)	Y
	(all)	(all)	Y
(IM)	(all)	(all)	Y

“ HTTP ” “ HTTP ”

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IP

(set ip next-hop) > > IP > (set ip default next-hop) >

2

IP

NAT IP

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Ruijie>	
Ruijie#	

Ruijie(config)#	

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Ruijie(config-intf-group)# { | }	
Ruijie(config-if)#	

interface-group-name

interface-name

IP hash

“ inhibitive_intf_group ” “ dialer 1 ” “ dialer 2 ” “ dialer 3 ”
“ ”

Router(config)#interface-group inhibitive_intf_group

Router(config-intf-group)#interface-member dialer 1

Router(config-intf-group)#interface-member dialer 2

Router(config-intf-group)#interface-member dialer 3;

Router(config-intf-group)#load-balance policy load

Router(config-intf-group)#exit

	WAN dialer WAN WAN LAN

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WAN

Ruijie>	
Ruijie#	
Ruijie(config)# *type number*	
Ruijie(config-if)# *ip-address*	
Ruijie(config-if)#	

GigabitEthernet 0/1 100.0.0.1

Router(config)#interface gi 0/1

Router(config-if-GigabitEthernet 0/1)# nexthop 100.0.0.1

	WAN WAN LAN

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[| *app-name* [ ]]	

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1 ADSL ADSL
HTTP

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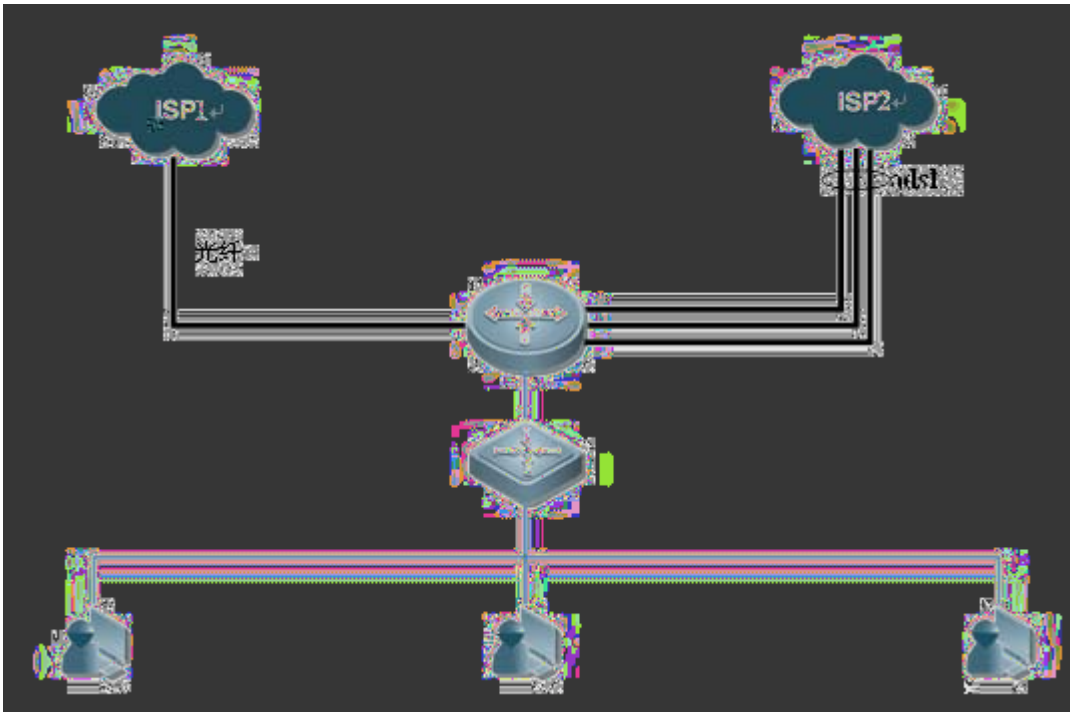

3 + ADSL

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#

Router(config)#ip route 0.0.0.0 0.0.0.0 202.100.12.5

2

dialer 1,2,3

```
Router(config)#interface-group inhibitive_intf_group
Router(config-intf-group)# interface-member dialer 1
Router(config-intf-group)# interface-member dialer 2
Router(config-intf-group)# interface-member dialer 3
```

#

```
Router(config-intf-group)# load-balance policy load
Router(config-intf-group)#exit
```

3

```
Router(config)#time-range no_midnight
Router (config-time-range)#periodic daily 9:00 to 23:00
Router (config-time-range)#exit
```

4

#

```
Router(config)#app route enable
```

http

```
Router(config)#app route P2P        interface-group inhibitive_intf_group
Router(config)#app route            interface-group inhibitive_intf_group
time-range no_midnight
Router(config)#app route HTTP       interface-group inhibitive_intf_group
time-range no_midnight
Router(config)#app route          interface-group inhibitive_intf_group
Router(config)#app route       interface-group inhibitive_intf_group
Router(config)#app route            interface-group inhibitive_intf_group
```

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Router#show app route

CLASS INTERFACE(GRPUP) time-range state

---------- ---------- ---------- -----

P2P inhibitive_intf_group(group) e3v3.( )ÿ@ ëà0Ê inhibitive_intf_grÿ+ÊCÇ 0.225

STATE	

2

Router#show app route statistics

CLASS INTERFACE(GROUP)

HIT DATA(byte) HIT RATE(Mb/s)

SUM DATA(byte) SUM RATE(Mb/s)

---------- ----------

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---------- ----------

HTTP inhibitive_intf_group(group)

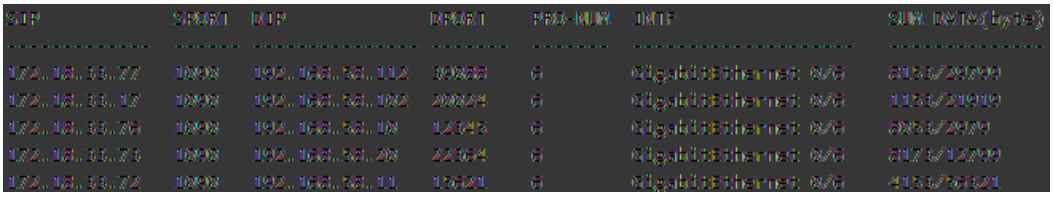
81535/297997 0.5/3.75

101918/342496 0.6/4.68

CLASS	(/ / /)
INTERFACE(GROUP)	/
HIT DATA(byte)	/
HIT RATE(Mb/s)	= / /
SUM DATA(byte)	= + /
SUM RATE(Mb/s)	= / /

3 “ HTTP ”

Router#show app route HTTP session



SIP	IP
SPORT	
DIP	IP
DPORT	
SUM DATA(byte)	/

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3 ADSL
88.0.0.0/8 80
ADSL

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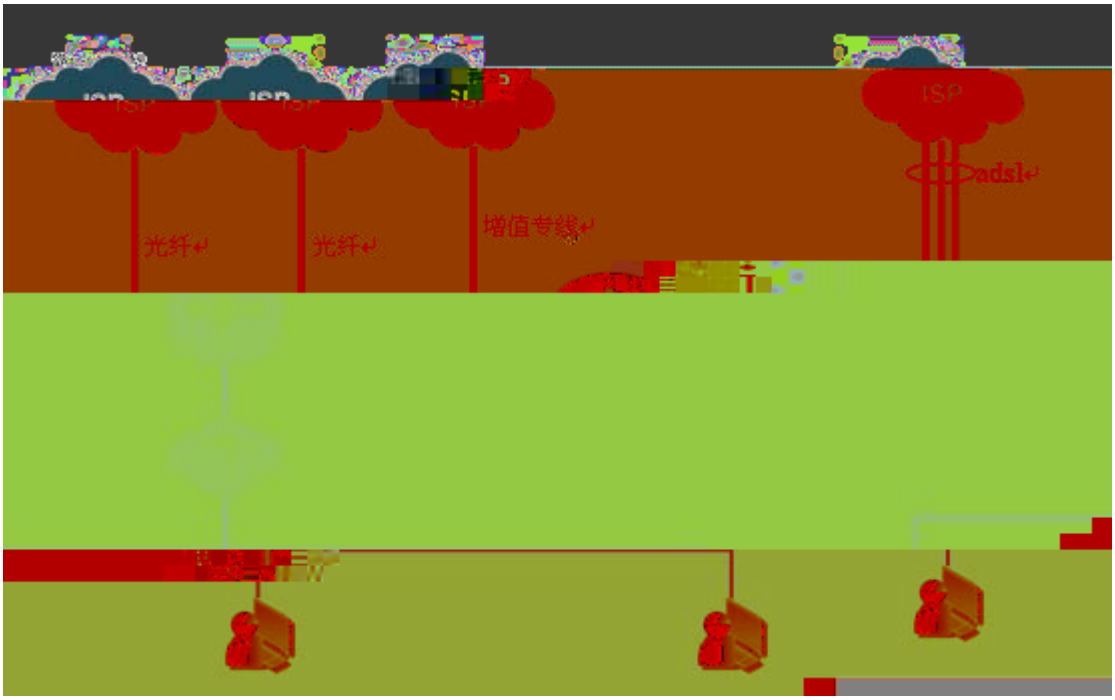

4 + ADSL

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ecmp

Router(config)#ip route 0.0.0.0 0.0.0.0 gi0/1 202.100.12.51

Router(config)#ip route 0.0.0.0 0.0.0.0 gi0/2 202.96.128.86

2

gi0/1 gi0/2

Router(config)#route-auto-choose cnii gi0/1 202.100.12.51

Router(config)#route-auto-choose cnii gi0/1 202.100.12.51

```
Router(config-intf-group)# interface-member dialer 1
Router(config-intf-group)# interface-member dialer 2
Router(config-intf-group)# interface-member dialer 3
#
Router(config-intf-group)# load-balance policy load
Router(config-intf-group)#exit
```

3

```
Router(config)#time-range no_midnight
Router (config-time-range)#periodic daily 9:00 to 23:00
Router (config-time-range)#exit
```

4

```
#
Router(config)#app route enable
#
Router(config)#app route P2P        interface-group inhibitive_intf_group
Router(config)#app route            interface-group inhibitive_intf_group
time-range no_midnight
Router(config)#app route          interface-group inhibitive_intf_group
?Ne#f'ECÊ
```

2

Router#show app route statistics

CLASS INTERFACE(GROUP)

HIT DATA(byte) HIT RATE(Mb/s)

SUM DATA(byte) SUM RATE(Mb/s)

---------- ----------

---------- ----------

---------- ----------

P2P inhibitive_intf_group(group)

92333/297997 0.6/3.75

202918/342496 0.7/4.68

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#

Router(config)#ip route 0.0.0.0 0.0.0.0 202.100.12.51

2

```
Router(config)#time-range no_midnight
Router (config-time-range)#periodic daily 9:00 to 23:00
Router (config-time-range)#exit
```

3 DNS

DNS

```
Router(config)#interface gi 0/1
Router(config-if-GigabitEthernet 0/1)#dns 202.96.199.133
Router(config-if-GigabitEthernet 0/1)#exit
Router(config)#interface gi 0/2
Router(config-if-GigabitEthernet 0/2)#dns 58.240.57.33
Router(config-if-GigabitEthernet 0/2)#exit
```

DNS

```
Router(config)#dns-proxy enable
```

4

```
Router(config)#interface gi 0/2
Router(config-if-GigabitEthernet 0/1)#nexthop 61.61.61.1
```

5

#

```
Router(config)#app route enable
```

http

```
Router(config)#app route P2P GigabitEthernet 0/2
Router(config)#app route GigabitEthernet 0/2 time-range
no_midnight
Router(config)#app route HTTP GigabitEthernet 0/2 time-range
no_midnight
```

```
Router(config)#app route            GigabitEthernet 0/2
Router(config)#app route         GigabitEthernet 0/2
Router(config)#app route               GigabitEthernet 0/2
```

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1

Router#show app route

CLASS INTERFACE(GRPUP) time-range state

---------- ---------- ---------- -----

P2P GigabitEthernet 0/2(interface) NA UP

GigabitEthernet 0/2(interface) no_midnight UP

HTTP GigabitEthernet 0/2(interface) no_midnight UP

GigabitEthernet 0/2(interface) NA UP

GigabitEthernet 0/2(interface) NA UP

GigabitEthernet 0/2(interface) NA UP

2

Router#show app route statistics

CLASS INTERFACE(GROUP)

HIT DATA(byte) HIT RATE(Mb/s)

SUM DATA(byte) SUM RATE(Mb/s)

---------- ----------

---------- ----------

---------- ----------

P2P inhibitive_intf_group(group)

92333/297997 0.6/3.75

202918/342496 0.7/4.68

inhibitive_intf_group(group)

31030/101901 0.2/1.75

401189/212002 0.3/2.61

inhibitive_intf_group(group)

10120/201331 0.1/2.57

100121/204691 0.2/2.98

inhibitive_intf_group(group)

41035/97997 0.3/1.01

60168/91067 0.1/1.41

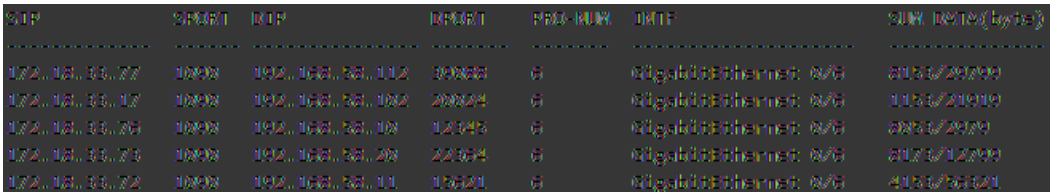
inhibitive_intf_group(group)

20136/40359 0.1/0.98

21031/60594 0.2/2.01

3 “ HTTP ”

Router#show app route HTTP session



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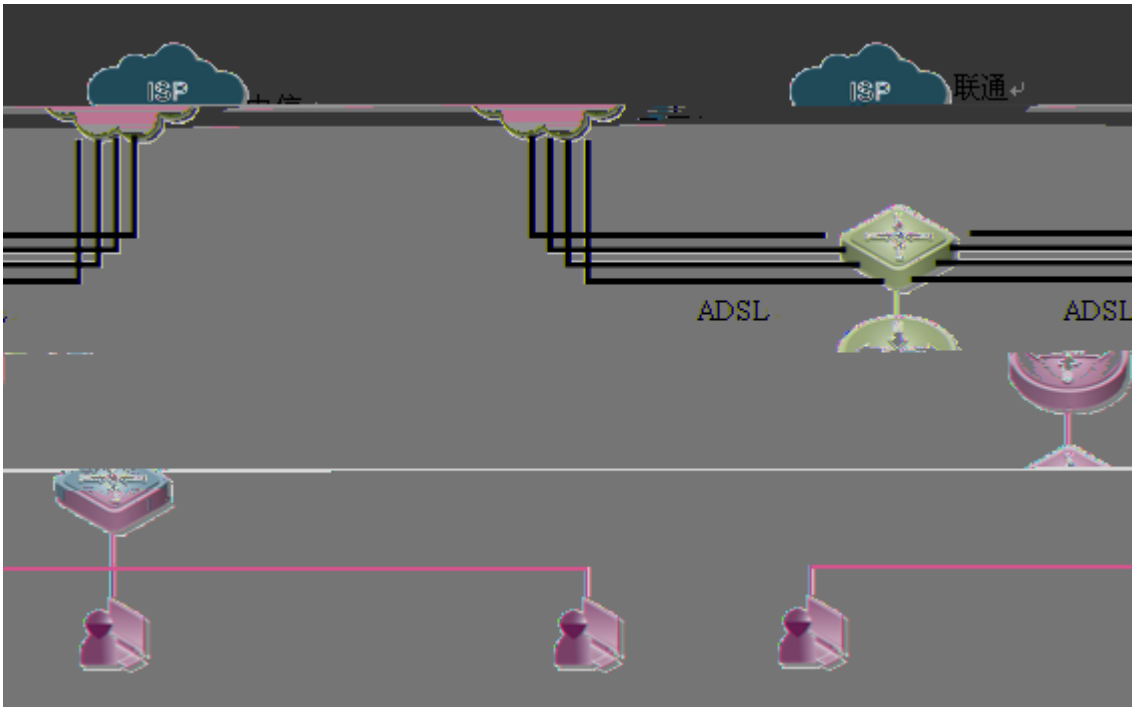

6 ADSL

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20 ADSL

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 30

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 31

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 32

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 33

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 34

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 35

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 36

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 37

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 38

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 39

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 40

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 41

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 42

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 43

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 44

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 45

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 46

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 47

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 48

Router(config)#ip route 0.0.0.0 0.0.0.0 dialer 49

2

ADSL dialer 1-30

```
Router(config-intf-group)# interface-member dialer 26
Router(config-intf-group)# interface-member dialer 27
Router(config-intf-group)# interface-member dialer 28
Router(config-intf-group)# interface-member dialer 29
Router(config-intf-group)# interface-member dialer 30
```

#

```
Router(config-intf-group)# load-balance policy load
Router(config-intf-group)#exit
```

3

```
Router(config)#time-range no_midnight
Router (config-time-range)#periodic daily 9:00 to 23:00
Router (config-time-range)#exit
```

4

#

```
Router(config)#app route enable
```

http

```
Router(config)#app route P2P        interface-group inhibitive_intf_group
Router(config)#app route
```

HTTP inhibitive_intf_group(group) no_midnight UP

inhibitive_intf_group(group) NA UP

inhibitive_intf_group(group) NA UP

inhibitive_intf_group(group) NA UP

2

Router#show app route statistics

CLASS INTERFACE(GROUP)

HIT DATA(byte) HIT RATE(Mb/s)

SUM DATA(byte) SUM RATE(Mb/s)

---------- ----------

---------- ----------

---------- ----------

P2P inhibitive_intf_group(group)

92333/297997 0.6/3.75

202918/342496 0.7/4.68

inhibitive_intf_group(group)

31030/101901 0.2/1.75

401189/212002 0.3/2.61

inhibitive_intf_group(group)

10120/201331 0.1/2.57

100121/204691 0.2/2.98

inhibitive_intf_group(group)

41035/97997 0.3/1.01

60168/91067 0.1/1.41

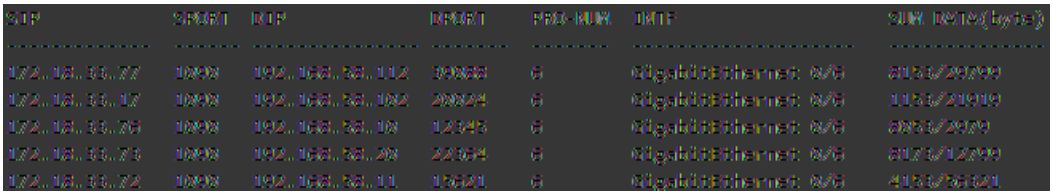
inhibitive_intf_group(group)

20136/40359 0.1/0.98

21031/60594 0.2/2.01

3 “HTTP ”

Router#show app route HTTP session



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VOIP Voice Over Internet Protocol P2P Peer-to-Peer
P2P

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QOS

2 / /
/

a) P2P /

b) PC

c)

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Ruijie(config)#	

no flow-pre-mgr enable

#

Ruijie# configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Ruijie(config)# no flow-pre-mgr enable

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Ruijie(config)# *limit-number*	limit-number 0

no flow-pre-mgr total-limit

1

Ruijie(config)# *rule-id* *subs_name* *total-limit-number* *per-limit-number*	/ block by-pass trust rule-id 1~50 subs_name total-limit-number / 0 per-limit-number / IP *total-limit-number* 0

no flow-pre-mgr *id*

	1 2 action block by-pass trust / IP

	1 2

“ UserGroupA ” 5000 “ UserGroupA ” IP 300

Ruijie# configure terminal

Enter configuration commands, one

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Ruijie#	
Ruijie# [*ip-address*]	IP IP ip-address IP IP

#

Ruijie#show flow-pre-mgr rule-info

flow-pre-mgr total-limit 200000

(active)flow-pre-mgr 1 subscriber UserGroupA action trust total-limit 5000 per-ip-limit 300 (446 flows)

(inactive)flow-pre-mgr 2 access-list 120 action block (0 flows)

Ruijie#

IP IP

Ruijie#

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IP 500

IP 1000

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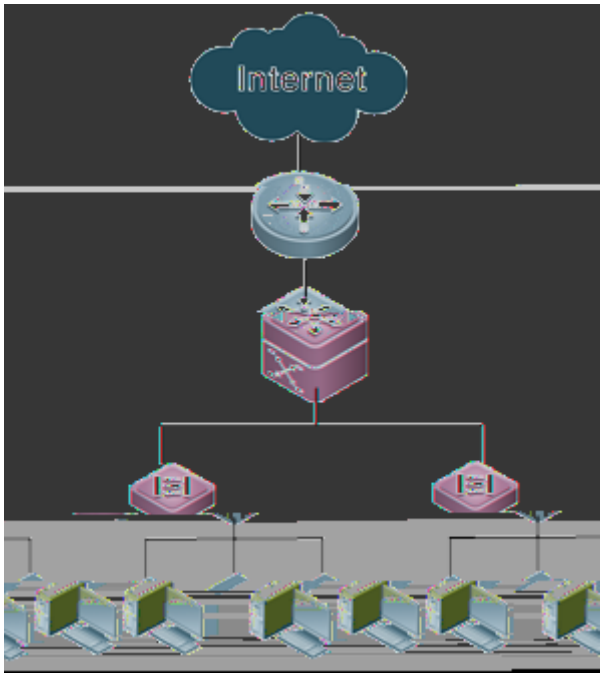

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#

Ruijie# configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

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(Flow Control)

P2P

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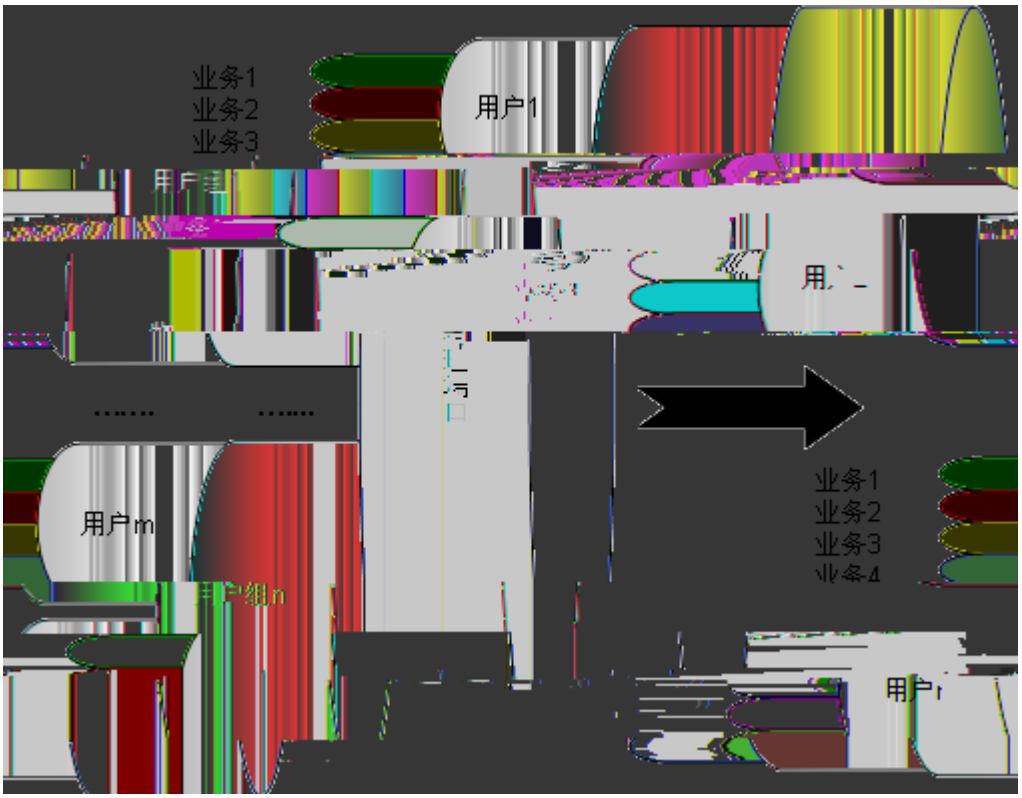

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Normal

Per-IP

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VID

IP

IP

VPDN

( )

1.
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Flow-control

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1		Gi0/1	8M	

flow-template copy *tpl-ibar Gi0/1* bandwith *8000 8000*

2	Gi0/1	Gi0/6	16M	tpl-ibar Gi0/1

ف ۱ ژ گ ّ ۱

Ruijie#	
Ruijie(config)# *Name*	
Ruijie#	

Ruijie(config-if-GigabitEthernet 0/1)# *Name*	Gi 0/1
Ruijie(config-if-GigabitEthernet 0/1)#	
Ruijie#	

	WAN Dialer pppoe dialer wan dialer

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# flow-control DianXin
Ruijie(config-flow-control)# exit
Ruijie(config)#interface Gi 0/1
Ruijie(config-if-GigabitEthernet 0/1)# flow-policy DianXin
Ruijie(config-if-GigabitEthernet 0/1)#end
```

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Ruijie#	
Ruijie(config)# *Name*	
Ruijie(config-flow-control)#	
Ruijie(config-channel-tree)#	
Ruijie(config-flow-control)#	
Ruijie(config-channel-tree)#	
Ruijie#	

flow-control no channel-tree {inbound | outbound}

#

```
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
```

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Ruijie#	
Ruijie(config)# *Name*	
Ruijie(config-flow-control)#	
Ruijie(config-channel-tree)# *name* { | *parent_name*} *cir_num* *pir_num* [*pri_num*] [{ | | *mask* *pcir_num* *ppir_num* *limit_num* [*session_limit_num*] [ ] [ ]}]	
Ruijie(config-channel-tree)#	
Ruijie#	

channel-tree no channel-group *Name*

1.
2.
3.
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#

```
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
```

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Ruijie#	
Ruijie(config)# *Name*	
Ruijie(config-flow-control)#	
Ruijie(config-channel-tree)# *channel*	
Ruijie(config-channel-tree)#	
Ruijie#	

channel-tree no channel-default

depart1

```
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-default depart1
Ruijie(config-channel-tree)# end
```

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Ruijie#	
Ruijie(config)# *Name*	
Ruijie(config-flow-control)# *num* *vlan-group-name* *subscriber-name* *auth-group-name* *network-group-name* *app-group-name* *time-rang-name*	
Ruijie(config-flow-control)# *num* *session-num* | | *in-channel-name* *out-channel-name* *string*	
Ruijie(config-flow-control)#	
Ruijie#	

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
```

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Ruijie#	
Ruijie(config)# *Name*	
Ruijie(config-flow-control)# *rule1-pri-num* *rule2-pri-num*	Name 1 2
Ruijie(config-flow-control)#	
Ruijie#	

	show flow-control-policy rule Pri_num

1 2 1 2 1 2

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# flow-control DianXin
Ruijie(config-flow-control)# change-priority rule1 1 rule2 2
Ruijie(config-flow-control)# end
```

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Ruijie(config)# *Name* [*channel-name*]	

#

```
Ruijie#show flow-control test inbound channel-group root
group-name                     cir     pir     pri  schedule
------------------------------ -------- -------- ---- --------
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
```

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Ruijie(config)# *group*	

#

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

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10M 3 department1 department 2 department 3 192.168.1.0/24 192.168.2.0/24 192.168.3.0/24 5M 3M 2M

Ruijie(config-flow-control)# *3* *0* *department3* *department3*

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

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Internet

P2p

192.168.10.0/24 P2p

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Time-range any

time-range any

periodic Daily *0:00* to *23:59*

subscriber static name *DP-test* parent / ip-subnet *192.168.10.0 255.255.255.0*

flow-control global

flow-rule *1* vlan-group *any* subscriber *any* network-group *any* app-group *P2P* time-rang *any*

flow-rule *1* session-limit *0* action drop

flow-rule *2* vlan-group *any* subscriber *DP-test* network-group *any* app-group *any* time-rang *any*

flow-rule *2* session-limit *0* action pass

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IP IP

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	60
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/ /	3

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VPN

Ruijie#	
Ruijie(config)#	VPN inside-ip IP outside-ip IP .
Ruijie(config-if)#	
Ruijie#	

flow-audit vpn outside-ip

VPN VPN IP

Ruijie# configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Ruijie(config)# flow-audit vpn outside-ip

VPN VPN IP

Ruijie# configure terminal

Enter configuration commands, one per line. End with CNTL/Z.

Ruijie(config)# flow-audit vpn inside-ip

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Ruijie# { | *interface-name* *bridge-name*} [{ [start-record { record-num}] *hour* *begin-year begin-month begin-day begin-hour:begin-minute end-year end-month end-day end-hour:end-minute* [*begin-year begin-month begin-day begin-hour end-year end-month end-day end-hour* | *begin-year begin-month begin-day* [*begin-hour1 end-hour1* [*begin-hour2 end-hour2*]]}]	hour IP NPE minute-interval time-interval recent day month week hour-interval

Ruijie# { | *interface-name* *bridge-name*} [[*subscriber-name*] [*subscriber-group*] [ ] | { } [*auth-group-name*] [*auth-name*]]] [*ip-address*] [{ *begin-year begin-month begin-day begin-hour: begin-minute end-year end-month end-day end-hour:end-minute* {[|] *begin-year begin-month begin-day end-year end-month end-day* | *begin-year begin-month begin-day*} [*begin-hour end-hour* [*begin-hour2 end-hour2*]]}] [{{ | } { | } | | | | } { | }[n]]	IP IP NPE minute-interval day-interval day month week hour-interval ey |]]}] [ressload

Ruijie# { |]]}] [sub 0 Td ( )Tj /TT2 1 T08 0.0022714w 3.823 09

Ruijie# [*channel-group*] [*begin-year begin-month begin-day begin-hour:begin-minute end-year end-month end-day end-hour:end-minute* | {[ ] *begin-year begin-month begin-day end-year end-month end-day* | *begin-year begin-month begin-day*} [*begin-hour end-hour* [*begin-hour2 end-hour2*]]] [{ | } { | }[*n*]]

Ruijie# *channel-name* [*channel-group*] [{ | } { | }[*n*] | { *hour begin-year begin-month begin-day begin-hour:begin-minute end-year end-month end-day end-hour:end-minute* [

Ruijie# { | {
interface-name *bridge-name*} [ ]}
[*subscriber-group* |
[[*subscriber-group*]
[*subscriber-name*] [ ] | { }
[*auth-group-name*]
[*auth-name*]] [*ip-address*]
[*application-name*]
[*application-group*]
[*application-type*]] [{ *hour*
begin-year *begin-month*
begin-day *begin-hour:begin-minute* *end-year*
end-month *end-day* *end-hour:* *end-minute* |
{[|] *begin-year*
begin-month *begin-day* *end-year* *end-month*
end-day | *begin-year* *begin-month* *begin-day*}
[*begin-hour1* *end-hour1*
[*begin-hour2* *end-hour2*]]}] [{{ |
} { | } |
| |
| } { | }[
n [ ]]] [{

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URL Uniform Resource Locator

URL

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Ruijie#	
Ruijie(config)# *policy-name*	policy-name
Ruijie(cont-plcy-config)#	
Ruijie#	

policy-name

policyA

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# content-policy policyA
Ruijie(cont-plcy-config)# end
```

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URL URL URL

Ruijie#	
Ruijie(config)# *class-name*	URL class-name URL
Ruijie(url-cls-config)# *url-string*	URL URL
Ruijie(url-cls-config)#	
Ruijie#	

URL *url-string*

URL

1 URL
URL “ ietf.org/2006 ” “ ietf.org/2006 ”

2 URL ♂

Ruijie#	

URL

URL	URL

URL “CLASSA”

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# url-class CLASSA
Ruijie(url-cls-config)# comment “comment for CLASSA”
Ruijie(url-cls-config)# end
```

Ruijie#	*[class-name]*

comment:comment for CLASSA

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URL URL URL

Ruijie#	
Ruijie(config)# *obj-name*	URL obj-name URL
Ruijie(url-obj-config)# *url-regexp*	URL URL
Ruijie(url-obj-config)#	
Ruijie#	

URL *url*

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URL URL URL

Ruijie#	
Ruijie(config)# *obj-name*	URL obj-name URL
Ruijie(url-obj-config)# *class-name*	URL URL
Ruijie(url-obj-config)#	
Ruijie#	

Step<3F

URL

	URL URL

URL “ OBJA ”

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# url-object OBJA
Ruijie(url-obj-config)# comment “comment for OBJA”
Ruijie(url-obj-config)# end
```

Ruijie(config-if)# *[obj-name]*	show url-obj URL

URL

Ruijie#show url-object

url-object: (inactive)OBJA

regexp: .*ieft.*

url-class:CLASSA

comment: comment for OBJA

url-object: (active)OBJB

regexp: .*w3c.*

url-class:CLASSB

comment: comment for OBJB

	active URL URL inactive URL URL URL

URL

Ruijie#show url-object OBJA

url-object: (inactive)OBJA

regexp: .*ieft.*

comment: comment for OBJA

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URL

Ruijie#	
Ruijie(config)# *policy-name*	policy-name
Ruijie(cont-plcy-config)#	URL
Ruijie(cont-plcy-config)#	
Ruijie#	

	URL URL URL

“ POLICYA ” URL

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# content-policy POLICYA
Ruijie(cont-plcy-config)# url-rule audit-default-enable
Ruijie(cont-plcy-config)# end
```

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URL

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# content-policy POLICYA
Ruijie(cont-plcy-config)# url-rule 2 subscriber USERA url-object OBJA
  time-range any action deny audit
Ruijie(cont-plcy-config)# end
```

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URL

Ruijie#	
Ruijie(config)# *policy-name*	policy-name
Ruijie(cont-plcy-config)# *rule-id1 rule-id2*	URL
Ruijie(cont-plcy-config)#	
Ruijie#	

	URL show running URL show running

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HTTP GET

Ruijie#	
Ruijie(config)#	HTTP

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URL

URL

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# url-filter-notice display
Ruijie(config)# end
```

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URL referer

Ruijie#	
Ruijie(config)#	url referrer URL
Ruijie(config)#	
Ruijie#	

1	url-rule apply-referer no
2	URL URL URL referer URL

URL

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1

2 DHCP

3 DHCP Relay

4 DNS

5 NTP

6 SNTP

7 UDP-Helper

8 DDNS

9 DDNS

10 DNS

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Echo

Echo

RGOS Ping

Ping Ping

Ping

Ruijie# [*ip*] [*address* [*length*] [*times*] [*data*][*source*] [*seconds*]]	

Ping 5 100Byte

IP 2 ‘ ! ’

‘ . ’ ping

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

Ping Ping

Ping

Ping

```
Ruijie# ping 192.168.5.197 length 1500 ntimes 100 data ffff source
192.168.4.190 timeout 3
Sending 100, 1000-byte ICMP Echoes to 192.168.5.197, timeout is 3 seconds:
  < press Ctrl+C to break >
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
!!!!!!!!!!!!!!!!!!!!!!!!!!!!!!
Success rate is 100 percent (100/100), round-trip min/avg/max = 2/2/3 ms
Ruijie#
```

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TTL 1

TTL 0 TTL

Traceroute TTL 1

ICMP TTL

TTL 1 TTL

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```
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

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DHCP(Dynamic Host Configuration Protocol) RFC 2131
DHCP

FR PPP HDLC DHCP

DHCP DHCP DHCP DHCP
DHCP DHCP DHCP

IP DHCP DHCP DHCP

DHCP DHCP DHCP DHCP DHCP
DHCP

DHCP

10.1 DHCP DHCP
DHCP

10.1 10.1

10.1 DHCP

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DHCP DHCP

Ruijie(config)# *low-ip-address* [*high-ip-address*]	IP DHCP
Ruijie(config)# *low-ip-address* [*high-ip-address*]	

DHCP DHCP
1 2 DHCP
DHCP

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DHCP DHCP DHCP
DHCP DHCP
DHCP DHCP DHCP

DHCP
DHCP IP

DHCP IP DHCP IP

DHCP IP

DHCP

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DHCP

1

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

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Ruijie(dhcp-config)# *domain*	

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DNS DHCP

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

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

DHCP NetBIOS WINS

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

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DHCP NetBIOS 1 Broadcast
NetBIOS 2 Peer-to-peer WINS NetBIOS
3 Mixed WINS
4 Hybrid WINS NetBIOS
NetBIOS

WINS

WINS

DHCP NetBIOS

Ruijie(dhcp-config)# *type*	NetBIOS

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DHCP

DHCP ٥

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DHCP ARP DHCP DHCP
MAC ARP ARP
ARP ARP

DHCP ARP

Ruijie(dhcp-config)#	DHCP ARP

DHCP ARP ARP DHCP
DHCP ARP

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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(config)# *name*	DHCP
Ruijie(dhcp-config)# *address*	IP

Ruijie(dhcp-config)#

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DHCP IP Ping
( ) Ping DHCP
DHCP Ping DHCP
DHCP

Ping

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FR DHCP IP DHCP

Ruijie(config-if)#	DHCP IP

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HDLC DHCP IP DHCP

Ruijie(config-if)#	DHCP IP

10.1 PPP HDLC FR dhcp
IP

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DHCP

1 DHCP

2 debug

3 DHCP

Ruijie# { *address* | *}	DHCP
Ruijie# { *address* | *}	DHCP
Ruijie#	DHCP

DHCP

Ruijie# [|]	DHCP

DHCP

Ruijie# DHCP صي DHCP 8d(packet)T1 1 Tf-0.0014 Tc (ev2 Tw 32,1CE1087(address 1 Tf0.0022	

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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

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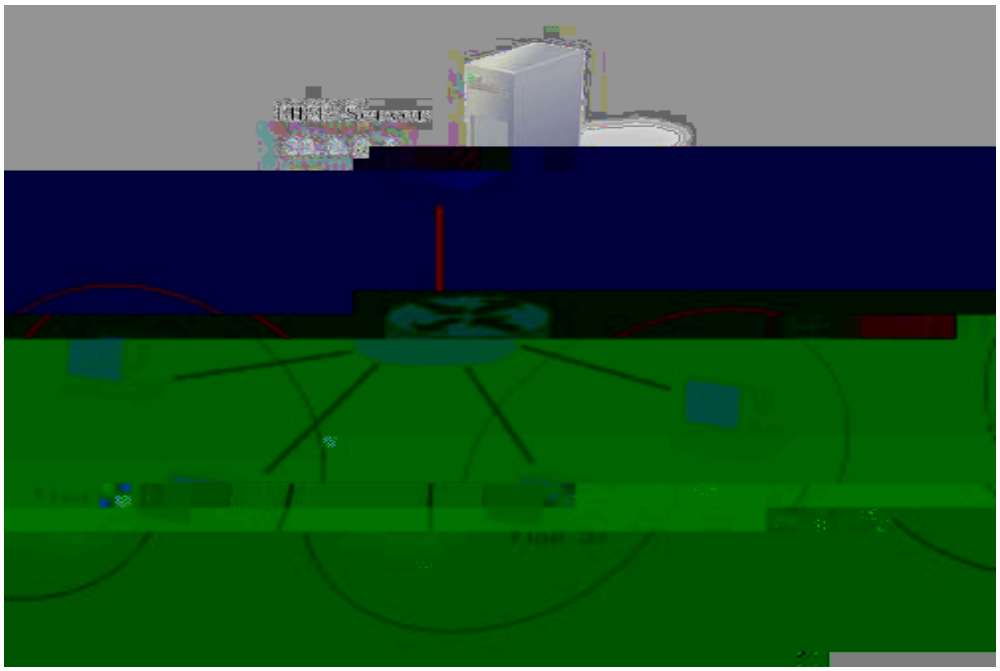
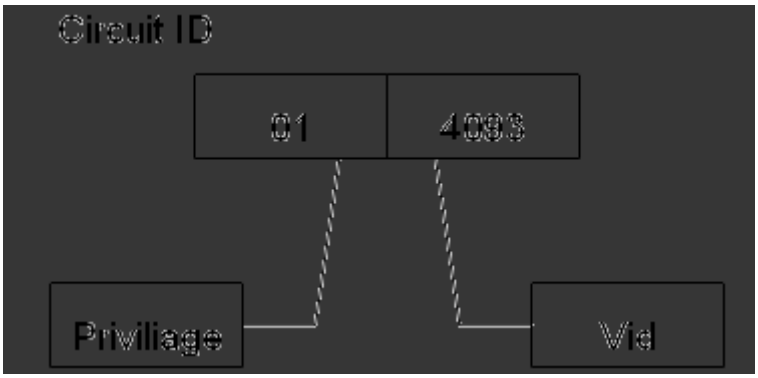
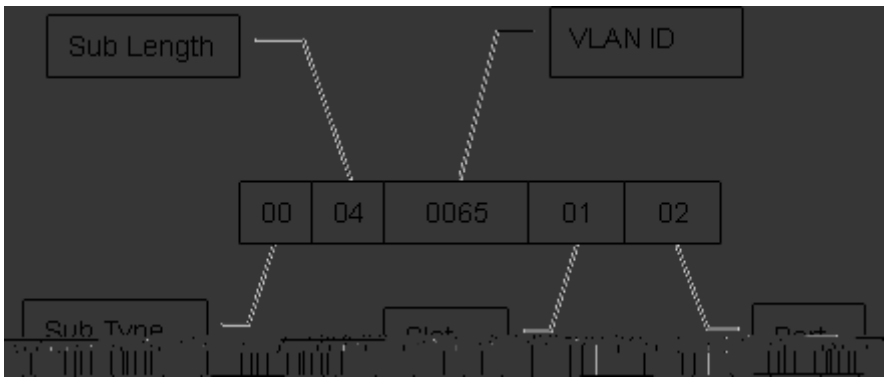
DHCP IP 255.255.255.255 IP DHCP Relay Agent DHCP IP DHCP Server DHCP DHCP Client DHCP Relay Agent DHCP Client DHCP Server DHCP Server IP Client—Relay Agent—Server DHCP IP

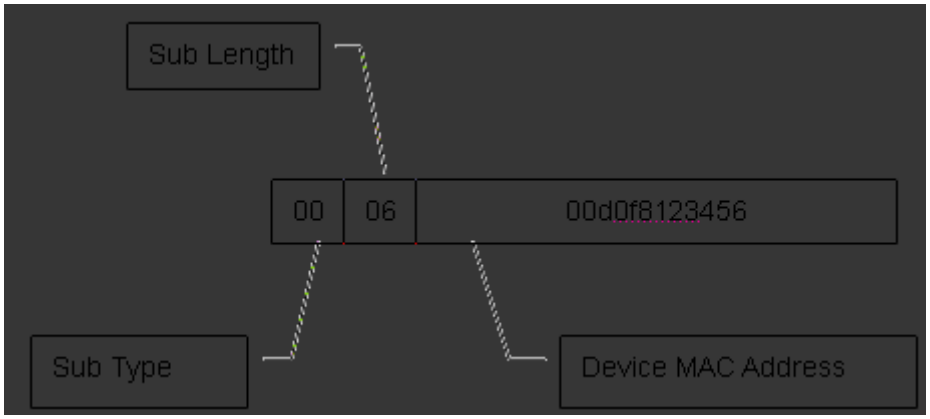


VLAN 10 VLAN 20 10.0.0.1/16 20.0.0.1/16 DHCP Server 30.0.0.1/16 30.0.0.2



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





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DHCP DHCP

DHCP DHCP client

DHCP REQUEST > ¯ ServesQUESe]TJ /C2_1 1 Tf 0.0002 Tc 0 [(D8.623 0 7 71318C20A5

ف 1

DHCP Relay Agent Information
IP
DHCP relay option dot1x relay 802.1x
option dot1x

DHCP option dot1x

Ruijie(config)#	DHCP option dot1x
Ruijie(config)#	DHCP option dot1x

ف 1

option dot1x IP IP

acl-name *acl-name* ACL

ACL ACL ACE
ACL

IP 192.168.3.2-192.168.3.254
192.168.4.2-192.168.4.254 192.168.5.2-192.168.5.254 192.168.3.1 192.168.4.1
192.168.5.1 192.168.3.x-5.x
web portal

```
Ruijie# config
Ruijie(config)# ip access-list extended DenyAccessEachOtherOfUnauthrize
Ruijie(config-ext-nacl)# permit ip any host 192.168.3.1
//
Ruijie(config-ext-nacl)# permit ip any host 192.168.4.1
Ruijie(config-ext-nacl)# permit ip any host 192.168.5.1
Ruijie(config-ext-nacl)# permit ip host 192.168.3.1 any
//      IP
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
//
```

ف ا

server-id DHCP relay DHCP SERVER-ID option server

server-id

Ruijie(config)#	DHCP relay check server-di
Ruijie(config)#	DHCP relay check server-id

ف ا

DHCP realy suppression DHCP relay

Ruijie(config-if)#	DHCP relay suppresson
Ruijie(config-if)#	DHCP relay suppresson

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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
```

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vlan relay option dot1x
option82 vlan relay

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1. AAA/802.1x

```
login
password 7 0137
line vty 1 2
login
password 7 0137
line vty 3 4
login
end
```

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1 IP

2 IP

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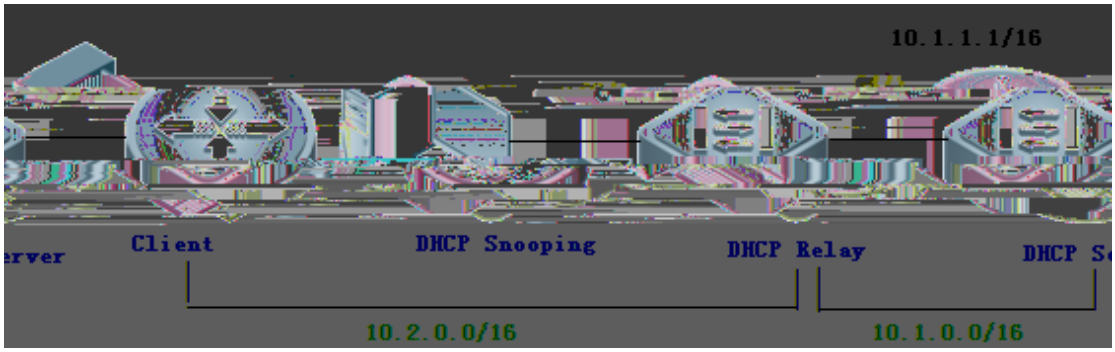

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DHCP Snooping DHCP Relay access Client IP DHCP Relay IP DAI ARP arp-check

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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
```

```
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
```

ف ۱

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IP

IP IP

DNS

IP 1 IP

2

DNS DNS IP

DNS IP

IP

DNS

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DNS

DNS	
DNS IP	

DNS

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

ف ۱

DNS DNS

DNS [*ip-address*]

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

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IP

Ruijie	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
```

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```
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
```

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Network Time Protocol NTP

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NTP UTC NTP

UTC Internet

NTP (Authentication)

NTP

Server

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NTP

NTP

NTP

NTP ID

NTP

NTP

NTP

NTP

NTP

NTP

NTP

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NTP Щ

NTP NTP

NTP

	NTP
	NTP

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key-id	NTP ID
key-id	NTP ID

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NTP 20 NTP

NTP 3 NTP
NTP

NTP

ip-addr [*version*][*if-name number*][*keyid*][ ]	NTP version NTP 1-3 if-name Aggregateport Dialer GigabitEthernet Loopback Multilink Null Tunnel Virtual-ppp Virtual-template Vlan keyid 1-4294967295
ip-addr	NTP

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NTP

NTP

NTP

IP

NTP

interface-type number	

NTP

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8

NTP 1

NTP

30

NTP

NTP

NTP NTP

NTP

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NTP

NTP NTP

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NTP

NTP “ stratum ” “ hops ”
1 2 1
3 2 ……

NTP

[*stratum*]	NTP 1 15 8
	NTP

12

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

ntp NTP

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NTP NTP

NTP

NTP

{ } *access-list-number|access-list-name*	
{ } *access-list-number|access-list-name*	

NTP

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NTP

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NTP

NTP

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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 gigabitEthernet 0/1
Ruijie(config-if)# ntp disable
Ruijie(config-if)# no ntp disable
```

IPv6

```
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 10::4 key 6
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# ntp disable
Ruijie(config-if)# no ntp disable
```

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NTP Network Time Protocol--
NTP SNTP Simple Network Time Protocol

NTP
1-50 ms NTP NTP

SNTP NTP
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SNTP NTP SNTP Client NTP Server

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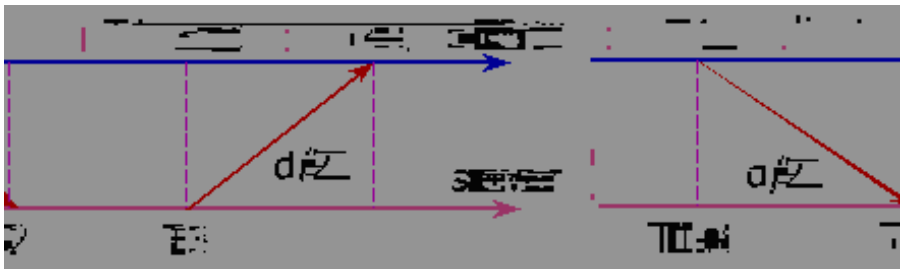
SNTP / GPS



Originate Timestamp	T1	time request sent by client
Receive Timestamp	T2	time request received at server
Transmit Timestamp	T3	time reply sent by server
Destination Timestamp	T4	time reply received at client

T1 ( ) Originate Timestamp

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

ف ۱

SNTP

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SNTP

SNTP	Disable SNTP
NTP Server IP	0
SNTP	1800s
	+8

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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 SNTP

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SNTP NTP SNTP Client NTP Server
NTP Server NTP
Server

NTP server http://www.time.edu.cn/ http://www.ntp.org/
192.43.244.18(time.nist.gov)

SNTP Server IP

1)

```
Ruijie# config
```

2) SNTP Server IP

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

3)

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

4)

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

5)

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

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SNTP Client NTP Server
NTP Server

1)

```
Ruijie# config
```

2) 60 -65535 1800

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

3)

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

4)

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

5)

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

---

sntp enable

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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
```

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1) SNTP

```
Ruijie# show sntp
```

2)

```
Ruijie# show sntp
SNTP state              : ENABLE            //SNTP
SNTP server             : 192.168.4.12        //NTP Server
SNTP sync interval      : 60            //
Time zone            : +8                       //
```

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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

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UDP	UDP-Helper 69 53 37 137 138 49 UDP

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Ruijie(config)#	UDP UDP

UDP

1)

2) UDP 69 53 37 137 138 49 UDP

3) DUP UDP

ف ا ح ن ي أ ي ز ط

Ruijie(config-if)# *IP-Address*	UDP

1) 20

2) UDP-Helper
UDP

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

UDP

UDP-Helper
UDP

UDP 69 53 37 137 138 49 UDP

256 UDP

53

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↑ ب

DDNS Dynamic Domain Name Server

```
#
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# peanut username test password test
Ruijie(config)#
```

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DNS PC DNS

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DNS

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IP	

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DNS

IP

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DNS

Ruijie#	
Ruijie(config)#	DNS
Ruijie(config)#	
Ruijie#	

DNS

DNS

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

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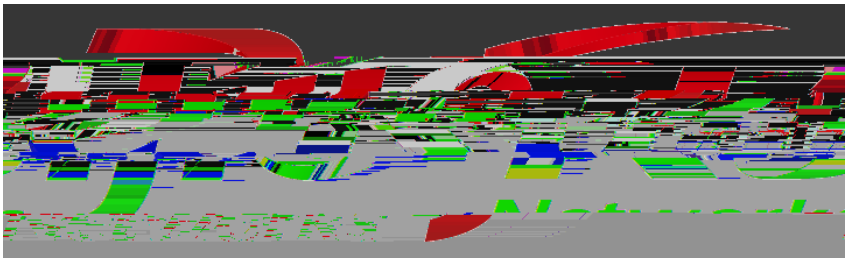
IP

Ruijie#	
Ruijie(config)# *X.X.X.X*	*A.B.C.D interface* IP
Ruijie(config)#	
Ruijie#	

A.B.C.D interface *X.X.X.X*

IP 192.168.1.100 gigabitethernet 0/1 202.101.99.55 gigabitethernet 0/2 58.66.101.33

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# smartdns 192.168.1.100 gigabitethernet 0/1 map 202.101.99.55
Ruijie(config)#                    gigabitethernet 0/1 map 58.66.101.33
Ruijie(config)#
```



dns DNS-Proxy

2011-11-09			
2012-01-14			
2012-02-06			
2012-02-23			
2012-06-12			“ ” “ ” “ ”
2012-07-05			DNS-Proxy

2012—8-24		DNS	“ ” “ DNS ” PPP DHCP DNS “ ” nexthop
2013-03-12		dns-proxy	dns-proxy nat dns

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IP IP
DNS
IP IP DNS DNS
DNS IP DNS

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DNS DNS
DNS DNS DNS
DNS DNS DNS DNS
DNS

DNS TCP DNS

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DNS-Proxy PC DNS DNS
DNS-Proxy

2. any dns

DNS-Proxy DNS IP DNS
DNS dns-proxy
dns dns
DNS any dns

3. dns

DNS DNS
DNS

4. DNS

DNS-Proxy DNS
IP IP DNS IP IP

1. DNS DNS any dns
dns-prxoy DNS
“ dns ”> “
” “ any dns ”

2. DNS

Ruijie(config-if-GigabitEthernet 0/1)# *ip-address* *id*	dns track 4 dns
Ruijie(config-if-GigabitEthernet 0/1)# *ip-address*	dns

gi0/1 dns

```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#int gi0/1
Ruijie(config-if-GigabitEthernet 0/1)#ip name-server 218.85.157.99 track 1
```

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dns-proxy dns-proxy dns-proxy

Ruijie#	
Ruijie(config)#	dns-proxy
Ruijie(config-dns-proxy)#	dns-proxy

dns-proxy

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

#

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dns-proxy dns-proxy

```
Ruijie(config-dns-proxy)#load-balance bandwidth
```

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DNS IP dns-proxy
DNS

dns dns-proxy

Ruijie#	
Ruijie(config)#	dns-proxy
Ruijie(config)# *start-ip* [*end-ip*]} |{ *ip*} *num*	dns DNS IP nameserver IP increase decrease 10

dns
```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)#dns-proxy
```
dns-proxy IP 192.168.1.1-192.168.1.10
```
Ruijie(config-dns-proxy)#dns-proxy whitelist source-ip 192.168.1.1
192.168.1.10
```
dns-proxy dns 8.8.8.8
```
Ruijie(config-dns-proxy)#dns-proxy whitelist name-server 8.8.8.8
```

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DNS DNS IP
IP Dns DNS IP
dns-proxy DNS IP dns
dns-proxy

Ruijie#	
Ruijie(config)#	dns-proxy
Ruijie(config-dns-proxy)# *start-ip [end-ip]*	dns IP IP IP 10

dns-proxy IP 202.112.14.1-202.114.14.10
```
Ruijie#configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
```

```
------------------------------------------------------------------------
-----------
Interface          Dns-server   TrackId  State  Description
-------------------------  -----------------  ---------  -----
-----------
GigabitEthernet 0/0  8.8.8.8              up    static
GigabitEthernet 0/1  202.85.157.99  1     up    static
                202.85.159.99  2     up    static
                8.8.8.8             up    static
                8.8.4.4             up    static
GigabitEthernet 0/2  58.22.99.66          up    dynamic
                58.22.96.66         up    dynamic
```

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dns-proxy

Ruijie#	dns-proxy

```
#     dns-proxy
Ruijie(config)#show dns-proxy configure whitelist
>Dns-proxy whitelist
------------------------------------------------------------------
Type: source-ip
Source-ip: 192.168.1.1 192.168.1.10

Type: name-server
Name-server: 8.8.8.8
```

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dns

Ruijie#	dns

```
#     dns
Ruijie#show dns-proxy configure blacklist
>Dns-proxy blacklist
------------------------------------------------------------------
```

```
Start-ip              End-ip
--------------------  --------------
202.112.112.114   220.112.112.120
114.110.211.1       114.110.211.100
121.244.10.1        121.244.10.255
```

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dns-proxy

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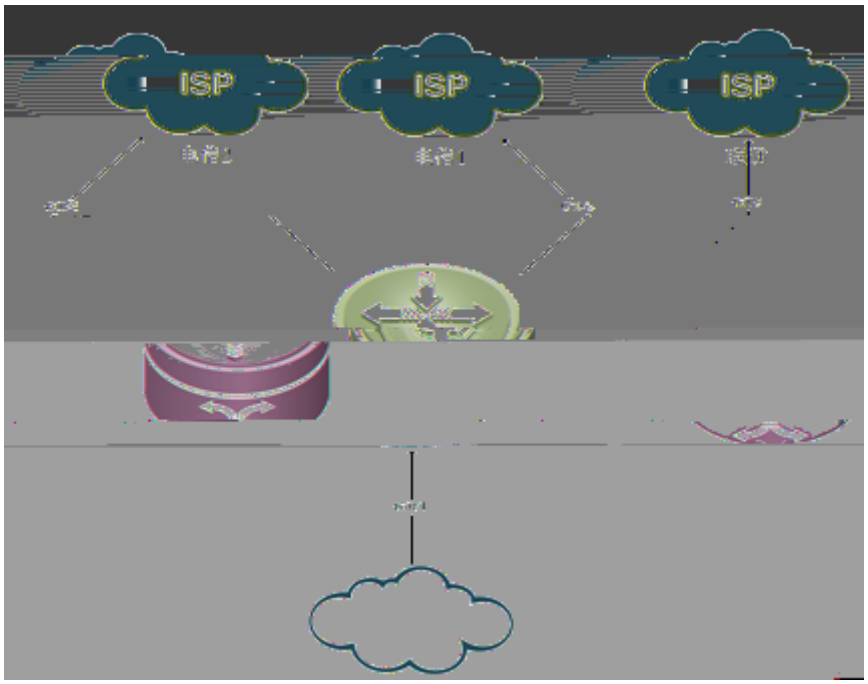

2 dns

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1. dns-proxy dns-proxy dns-proxy
DNS LAN gi0/1

2. dns-proxy DNS dns-proxy
dns gi0/4 DNS gi0/2
DNS gi0/3 DNS

3. DNS-Proxy
DNS-Proxy

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1) gi0/1 `dns-proxy`

```
Ruijie#configure terminal

Ruijie(config)#int gi0/1
```

```
Ruijie(config-track)#exit
Ruijie(config)#ip rns 3
Ruijie(config-ip-rns)#icmp-echo 58.22.96.66
Ruijie(config-ip-rns)#exit
Ruijie(config)#track 3 rns 3
Ruijie(config-track)#exit
Ruijie(config)#ip rns 4
Ruijie(config-ip-rns)#icmp-echo 218.104.128.106
Ruijie(config-ip-rns)#exit
Ruijie(config)#track 4 rns 4
Ruijie(config-track)#exit
Ruijie(config)#ip rns 5
Ruijie(config-ip-rns)#icmp-echo 218.85.157.99
Ruijie(config-ip-rns)#exit
Ruijie(config)#track 5 rns 5
Ruijie(config-track)#exit
Ruijie(config)#ip rns 6
Ruijie(config-ip-rns)#icmp-echo 218.85.152.99
Ruijie(config-ip-rns)#exit
Ruijie(config)#track 6 rns 6
Ruijie(config-track)#exit
```

4) dns-proxy

```
Ruijie(config)#dns-proxy
```

5) dns

```
Ruijie(config-dns-proxy)#whitelist name-server 192.168.58.110
Ruijie(config-dns-proxy)#exit
```

6) gi0/2 gi0/3

```
Router(config)#interface gi 0/2
```

```
Router(config-if-GigabitEthernet 0/2)# nexthop 218.85.157.5

Router(config-if-GigabitEthernet 0/2)# exit

 Router(config)#interface gi 0/3

Router(config-if-GigabitEthernet 0/3)# nexthop 58.22.96.5

Router(config-if-GigabitEthernet 0/3)# exit
```

7) gi0/2 gi0/3

```
Ruijie(config)# route-auto-choose cnii gigabitEthernet 0/2 218.85.157.5

Ruijie(config)# route-auto-choose cnc gigabitEthernet 0/3 58.22.96.5
```

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#

```
Ruijie#show dns-proxy configure
>Dns-proxy load-balance: load
-------------------------------------------------------------------

>Dns-proxy whitelist
-------------------------------------------------------------------
Type:name-server
Host-name: 192.168.58.110

>Dns-proxy blacklist
-------------------------------------------------------------------
Start-ip     End-ip
---------------  ---------------
```

	rns track TRACK&RNS

show dns-proxy name-server dns

```
Ruijie#show dns-proxy name-server
>Dns-proxy name-server
-------------------------------------------------------------------------
Interface          Dns-server    TrackId  State  Description
-------------------------  --------------------  ---------  -----
-----------
GigabitEthernet 0/2  218.85.157.99   1       up    static
```

```
                218.85.152.99    2       up     static
GigabitEthernet 0/3  58.22.96.66      3       up     dynamic
                218.104.128.106  4       up     dynamic
```

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gi0/1 1000M *gigabitEthernet 0/2* 1 100M *gigabitEthernet 0/3* PPP 10M *gigabitEthernet 0/4* DNS DNS 218.85.157.99 DNS 218.85.152.99 DNS DNS 58.22.96.66 DNS 218.104.128.106

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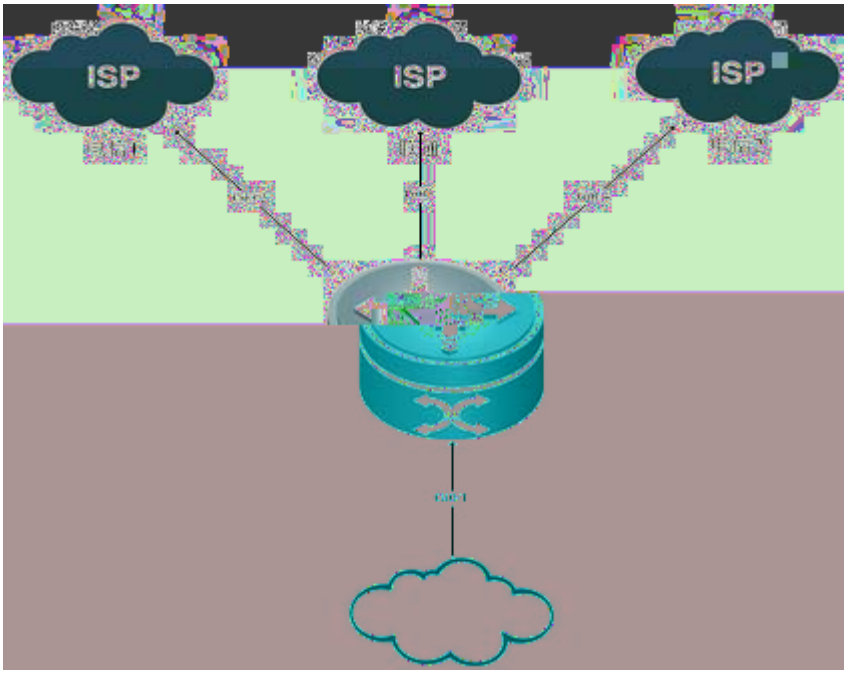

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dns-proxy dns

Ruijie(config)#**dns-proxy**

Ruijie(config-dns-proxy)#**blacklist domain-ip** 202.112.14.1

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show dns-proxy configure blacklist dns

```
Ruijie#show dns-proxy configure blacklist
>Dns-proxy blacklist
-----------------------------------------------------------------
Start-ip     End-ip
---------------  ---------------
202.112.14.1
```

1

2

3 RIP

4 OSPF

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IP

1

:

1.

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Ruijie(config-route-map)# *ip-address* [*weight*][*ip-address*[*weight*]]	IP
Ruijie(config-route-map)# *intf_name*	
Ruijie(config-route-map)# *intf_name*	
Ruijie(config-route-map)#	IP
Ruijie(config-route-map)#	IP TOS
Ruijie(config-route-map)#	IP DSCP

4.

x

Ruijie(config)# { | }	
Ruijie(config)#	

WCMP(Weighted Cost Multiple Path) 4 ECMP(Equal Cost Multiple Path) 32

WCMP 4 ECMP 32

route-map

1.

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3. ACL , ACL ACL

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ISP

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Ruijie#	
Ruijie(config)#	gigabitEthernet 0/1 202.100.102.5
Ruijie(config)#	
Ruijie#	

no route-auto-choose cnii gigabitEthernet 0/1 202.100.102.5

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# route-auto-choose cnii gigabitEthernet 0/1 202.100.102.5
Ruijie(config)#
```

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Ruijie#	
Ruijie(config)#	

Ruijie(config)#	

#

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# route-auto-choose update
Ruijie(config)#
```

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RIP (Routing Information Protocol)
RIP RIPv1
RFC 1058 RIPv2 RFC 2453 RGOS

RIP UDP UDP 520 RIPv1
RIPv2 224.0.0.9 RIP 30
180
120

RIP RIP
0 1
16

RIP

RIP RIP
RIP RIPv1 RIPv2 RIPv2
MD5

RIP Split Horizon

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RIP

RIP

RIP

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RIP RIP

RIP

RIP RIP

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

RIP

“ ”

FR X.25 Broadcast

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IP

X.25

IP

Ruijie(config-if)#	
Ruijie(config-if)#	

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RIP 1 2 RIPv2 CIDR
VLSMs VLSMs

RIPv1 RIPv2 RIPv1
RIPv1 RIPv2

Ruijie(config-router)# { | }	RIP

Ruijie(config-if)#	RIPv1
Ruijie(config-if)#	RIPv2
Ruijie(config-if)#	RIPv1 RIPv2

Ruijie(config-if)#	RIPv1
Ruijie(config-if)#	RIPv2
Ruijie(config-if)#	RIPv1 RIPv2

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RIP
RIPv2 RIPv1

RIPv2

RIP

RIP

RIP

Ruijie(config-router)#	
Ruijie(config-router)#	

Ruijie(config-if)# *ip-address ip-network-mask*	
Ruijie(config-if)# *ip-address ip-network-mask*	

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RIPv1 RIPv2

RIPv2 MD5

ip rip authentication text-password

MD5 MD5

MD5

key chain

RIP

RIP

Ruijie(config-if)# *key-chain-name*	

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RIP RIP

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RIP RIP

RIP

Ruijie(config-if)# [*metric-value*]	
Ruijie(config-if)#	

0.0.0.0/0 ,

RIP

Ruijie(config-if)# [*metric-value*]	
Ruijie(config-if)#	

RIP

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RIP VRF RIP RIP VRF
RIP VRF RIP VRF
RIP VRF

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

VRF RIP RIP

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

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4 RIP

RIP

RIP

RIP

RIP VRF

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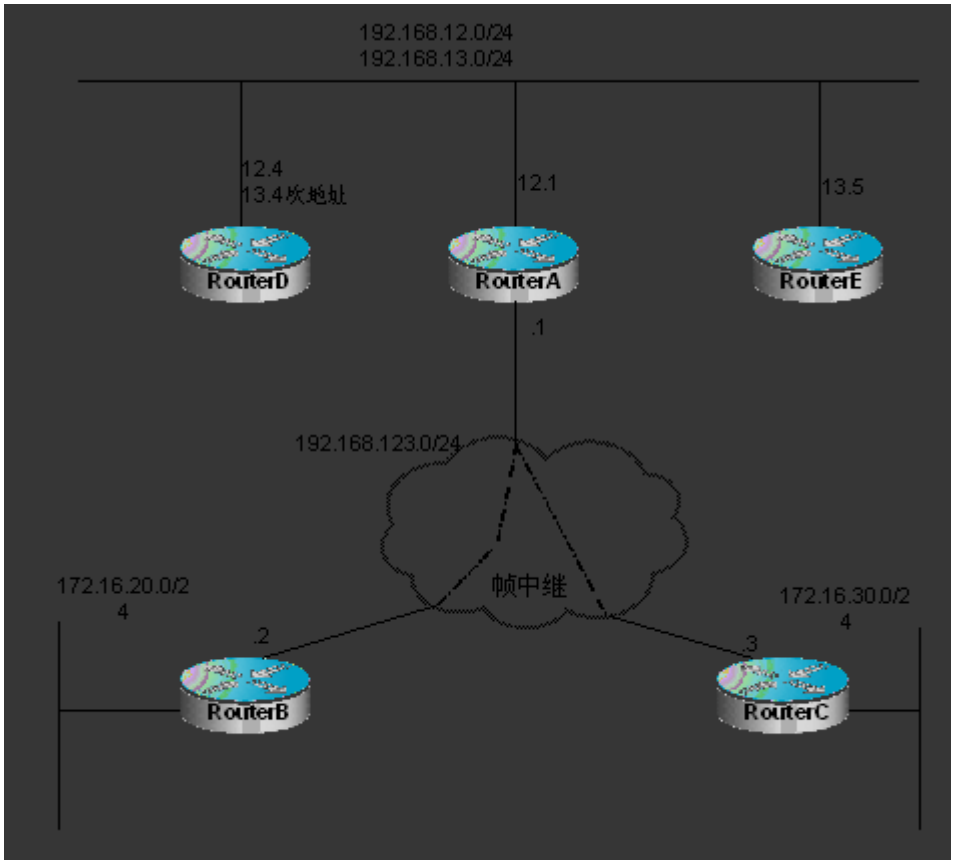
RouterA RouterD RouterE RouterA RouterB RouterC IP 1 RouterD



1 RIP

```
#
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
```

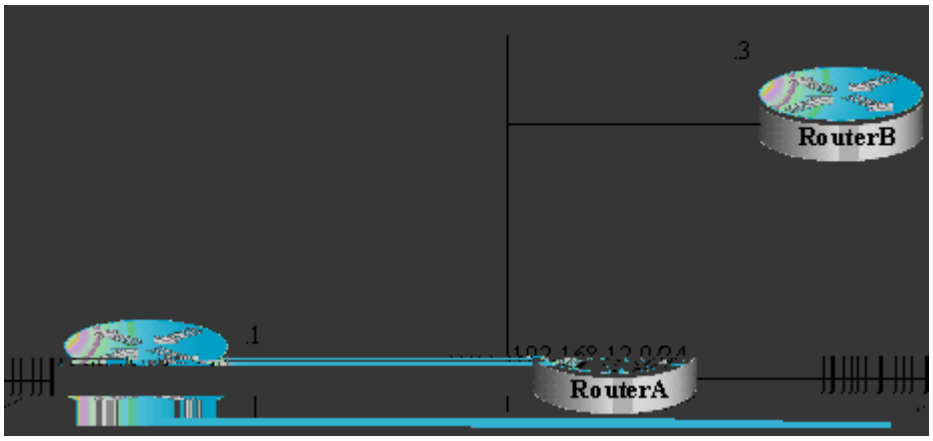
E

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

#     RIP
router rip
version 2
network 192.168.13.0
```

RIP MD5

IP 2



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

#     RIP
router rip
version 2
network 192.168.12.0
```

B :

```
#
key chain ripkey
key 1
key-string keyb
```

```
#
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
```

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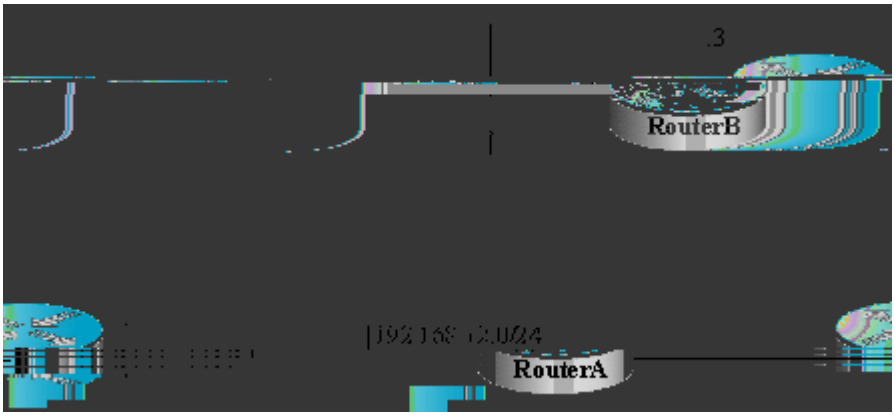
RIP IP 4



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
```

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

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

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1) OSPF RFC 1793

2) OSPF

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OSPF

OSPF OSPF

OSPF

OSPF (

OSPF

OSPF

OSPF

OSPF NSSA

OSPF

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OSPF OSPF IP IP
OSPF OSPF IP OSPF
64 OSPF

OSPF

Ruijie #	
Ruijie (config)#	( )
Ruijie (config)# *process_id* [*vrf-name*]	OSPF OSPF

authentication-key ip ospf message-digest-key

OSPF

Ruijie #	
Ruijie (config)#	( )
Ruijie (config)# *interface-id*	
Ruijie (config-if)# *cost-value*	
Ruijie (config-if)# *seconds*	
Ruijie (config-if)# *seconds*	
Ruijie (config-if)# *seconds*	hello
Ruijie (config-if)# *seconds*	
Ruijie (config-if)# *number*	DR BDR
Ruijie (config-if)# [|]	
Ruijie (config-if)# *key*	
Ruijie (config-if)# *keyid* *key*	MD5
Ruijie (config-if)#	OSPF LSA LSA
Ruijie (config-if)#	
Ruijie # [*process-id*] [*interface-id*]	
Ruijie #	

no

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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)# { | | | { [ ]} }	OSPF

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PPP SLIP X.25
NBMA (non-broadcast)
X.25

FULL

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X.25
OSPF

neighbor

Ruijie(config-if)#	
Ruijie(config-if)#	
Ruijie(config)# *1* Ruijie(config-router)# *cost*	

NBMA :

Ruijie (config-if)#	NBMA
Ruijie (config-if)#	
Ruijie (config)# *1*	
Ruijie(config-router)# *ip-address* [*priority number*] [*poll-interval seconds*]	, hello

ospf

ip ospf cost . ,
neighbor ,

,

Ruijie (config-if)#	
Ruijie (config-if)#	
Ruijie (config)# *1*	
Ruijie(config-router)# *ip-address* [*cost number*]	,

4 ip ospf cost

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OSPF DR,Designated Router BDR
Backup Designated Router

OSPF

OSPF

HELLO

:

Ruijie (config-if)#	
Ruijie (config-if)# *priority*	

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OSPF OSPF

Stub Area

1 2 3

Stub LSA

(no-summary) 1

2 OSPF

(area

default-cost)

STUB

STUB STUB

STUB

Stub ASBR

OSPF

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

Type-7 LSA nssa ABR
ASBR ABR Type-7 LSA
ASBR (ABR) Type-7 LSA

no-redistribution ASBR OSPF redistribute
NSSA NSSA ASBR ABR
nssa

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

area default-cost NSSA ABR
NSSA NSSA
1

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(Area Border Routers)
OSPF

Ruijie (config-router)# *area-id* *ip-address mask* [|] [*cost*]	

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OSPF

( )

hello-interval,dead-interval

“ ” ABR OSPF

IP ABR ABR
type3 LSA

Ruijie (config-router) *area-id* *router-id* [[*seconds*]| [*seconds*] |[*seconds*]|[*seconds*]| [[ ] |[[*key* | *keyid* *key*]]]	

router-id

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OSPF IP IP
,OSPF

Loopback Loopback IP
Loopback IP
Loopback

Loopback

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

OSPF IP loopback
OSPF

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0~255

OSPF 110

OSPF

Ruijie(config-router)# {*distance* { *distance* *distance* *distance* }}	OSPF

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OSPF SPF

SPF

OSPF

Ruijie (config-router)# *spf-delay spf-holdtime*	

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LSA (LSA age) LSA LSA

CPU CPU LSA

4

LSA 10000

LSA 40~100 10~20

Ruijie #	
Ruijie (config)# *1*	OSPF OSPF
Ruijie (config-router)# *seconds*	
Ruijie (config-router)#	
Ruijie #	

Ruijie #

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OSPF Cost Cost
OSPF

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

10

Ruijie #	
Ruijie (config)# *1*	OSPF OSPF
Ruijie(config-router)# *ref-bw*	ref-bw
Ruijie (config-router)#	
Ruijie #	

Ruijie #

Ruijie (config-if)#	MTU

MTU .

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OSPF

Ruijie #	
Ruijie (config)# *1*	
Ruijie (config-router)# *interface-name*	( )
Ruijie (config-router)#	( )
Ruijie (config-router)#	
Ruijie#	

OSPF
interface-id default

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OSPF OVERFLOW OVERFLOW
OSPF
LSA LSA LSA
LSA
LSA
LSA LSA

OSPF NULL
OVERFLOW

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

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OSPF


```
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

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```
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
```

```
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
External LSA database is unlimited.
Number of LSA originated 0
Number of LSA received 0
Log Neighbor Adjency Changes : Enabled
Number of areas attached to this router: 0
```

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8 OSPF

OSPF NBMA

OSPF

OSPF

OSPF

OSPF ABR ASBR

OSPF

OSPF

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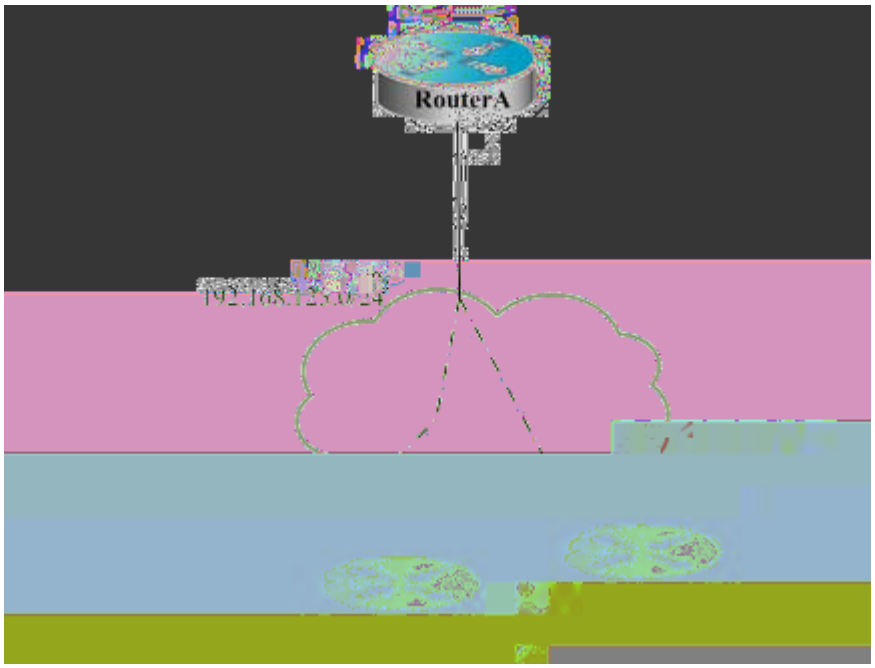
PVC IP



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
```

```
neighbor 192.168.123.1 10
neighbor 192.168.123.2 5
timers spf 500 1000 10000
```

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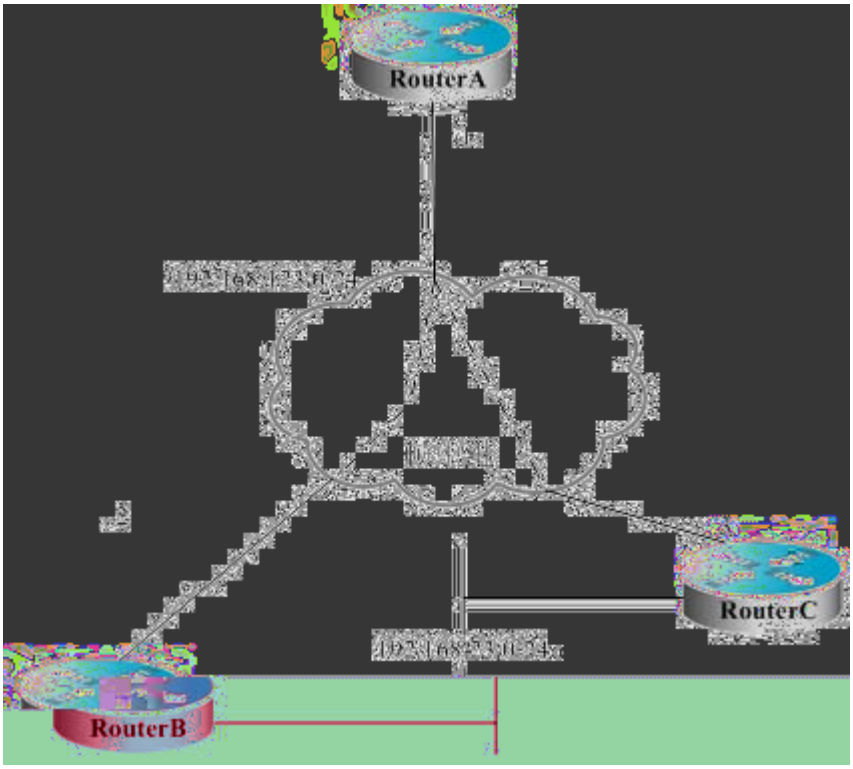
PVC

IP



1 A B C

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
encapsulation frame-relay
ip ospf network point-to-multipoint
```

OSPF

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

:

A 192.168.23.0/24 B

.

A :

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

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OSPF MD5

IP

OSPF

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```
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
```

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IP

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

A

```
interface GigabitEthernet0/0
ip address 192.168.12.1 255.255.255.0
```

2

```
interface GigabitEthernet1/0
ip address 172.16.1.1 255.255.255.0
interface GigabitEthernet1/1
ip address 172.16.2.1 255.255.255.0
```

OSPF

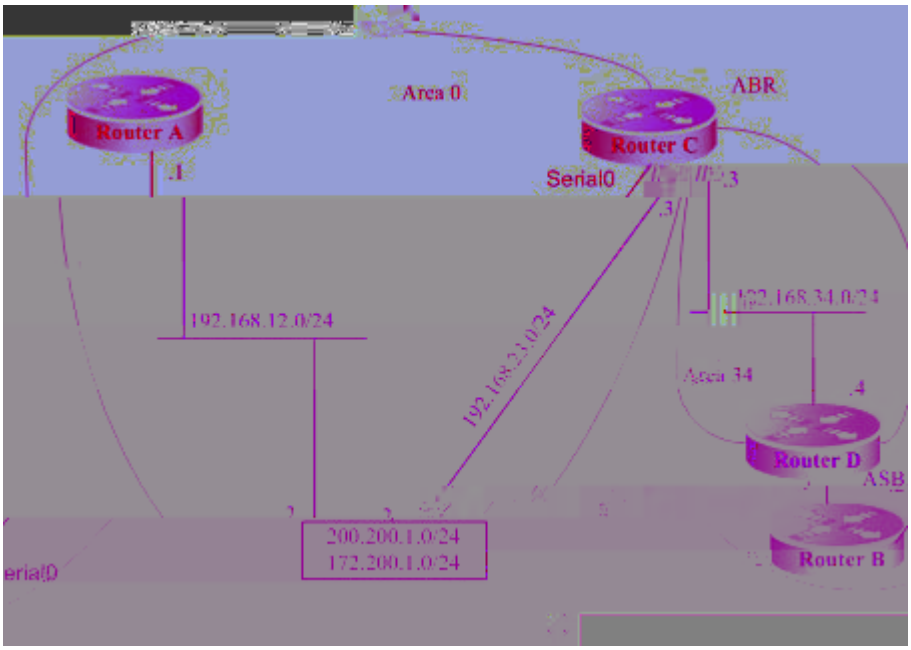
```
router ospf 1
network 192.168.12.0 0.0.0.255 area 0
network 172.16.1.0 0.0.0.255 area 10
network 172.16.2.0 0.0.0.255 area 10
no discard-route internal
area 10 range 172.16.0.0 255.255.252.0 cost 20
```

B

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

OSPF

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



A B C D

200.200.1.0/24 172.200.1.0/24 OSPF

OSPF , “34” I

OSPF II

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 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
```

OSPF

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

D

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


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

OSPF RIP

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

RIP

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

B ospf “E1”

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

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

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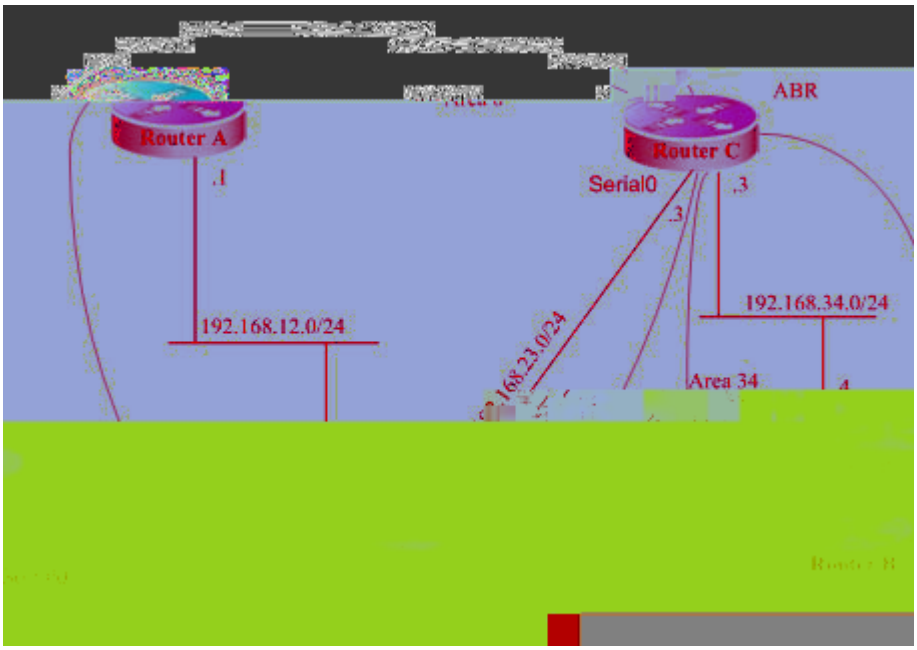
OSPF 192.168.12.0/24 192.168.23.0/24 0 192.168.34.0/24 34 IP



OSPF

RouterD OSPF

D C

192.168.30.0/24

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
```

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 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


interface Dialer10
ip address 192.168.30.1 255.255.255.0
```

OSPF

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

D

```
interface 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
```

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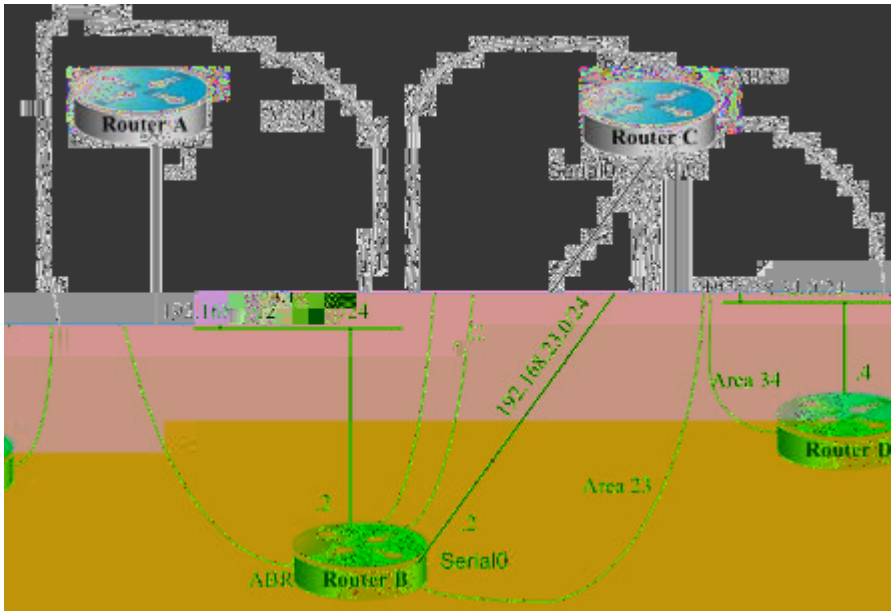
OSPF 192.168.12.0/24 0
192.168.23.0/24 23 192.168.34.0/24 34 IP



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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
```

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Ruijie(config)# [*vrf_name*] *network mask* {*ip-address* | *interface-type interface-number* [*ip-address*]} [*distance*] [*tag*] [ ] [*weight*] [*object-number*]	
Ruijie(config)# *network mask*	
Ruijie(config)# *number*	
Ruijie(config)#	

“ ”

	0
	1
OSPF	110
ISIS	115
RIP	120

	255

RIP OSPF

“ down ”

VRF VRF VRF
VRF VRF

1
weight WCMP
weight
WCMP 32
WCMP

WCMP
WCMP 8

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

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

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

1000

IP IP RPI

distance/tag/weight

distance

100

ip route 20.0.0.0 255.0.0.0 Loopback 1 10.0.0.2 tag 5 weight 2

ip route 20.0.0.0 255.0.0.0 Loopback 1 100

ip route 20.0.0.0 255.0.0.0 Loopback 1 10.0.0.2 tag 5 weight 2

ip route 20.0.0.0 255.0.0.0 10.0.0.2 100

ip route 20.0.0.0 255.0.0.0 10.0.0.2

ip route 20.0.0.0 255.0.0.0 Loopback 1 100

ip route 20.0.0.0 255.0.0.0 Loopback 1 10.0.0.2 200

/ / /

http://www.ruijie.com.cn

Ruijie(config)# network	
Ruijie(config)# network	

RIP RIP

0.0.0.0/0

“ gateway of last resort ”

“ gateway of last resort ”

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( )

Ruijie(config)# *route-map-name* [|	

Ruijie(config-route-map)# *Metric*	*Metric* 0-4294967295
Ruijie(config-route-map)# { | | }	
Ruijie(config-route-map)# { | | [|]}	
Ruijie(config-route-map)# *tag*	*tag* 0-4294967295

Ruijie(config-route-map)# *as-num ip_addr*	AS

Ruijie(config-route-map)# [+ *metric-value*	*metric-value*	*metric-value*]	
Ruijie(config-route-map)# { | | }	
Ruijie(config-route-map)# *next-hop*	*next-hop* IP
Ruijie(config-route-map)# { | | }	
Ruijie(config-route-map)# *ip-addr*	
Ruijie(config-route-map)# *tag*	
Ruijie(config-route-map)# *number*	BGP

“ ”

(PBR)

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OSPF

Ruijie(config-router)#

[ ]

[*metric*] [*type*

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

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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

#     OSPF
Ruijie(config)# router ospf 1
Ruijie(config-router)# redistribute rip subnets route-map redrip

% ospf redistribute rip not support match length
% ospf redistribute rip not support match route-type
% ospf redistribute rip not support set level backbone
```

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RIP 3 RIP
172.16.1.0/24 192.168.1.0/24

RIP

RIP
172.16.1.0/24 RIP
172.16.0.0/16

```
#
Ruijie(config)# ip route 172.16.1.0 255.255.255.0 172.200.1.2
Ruijie(config)# ip route 192.168.1.0 255.255.255.0 172.200.1.2
Ruijie(config)# ip route 192.168.2.0 255.255.255.0 172.200.1.4

#     RIP
Ruijie(config)# router rip
Ruijie(config-router)# version 2
Ruijie(config-router)# redistribute static
Ruijie(config-router)# network 192.168.34.0
Ruijie(config-router)# distribute-list EXT_ACL out static
Ruijie(config-router)# no auto-summary

#        ACL
Ruijie(config)# ip access-list extended EXT_ACL
Ruijie(config-ext-nacl)#10 permit 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
```

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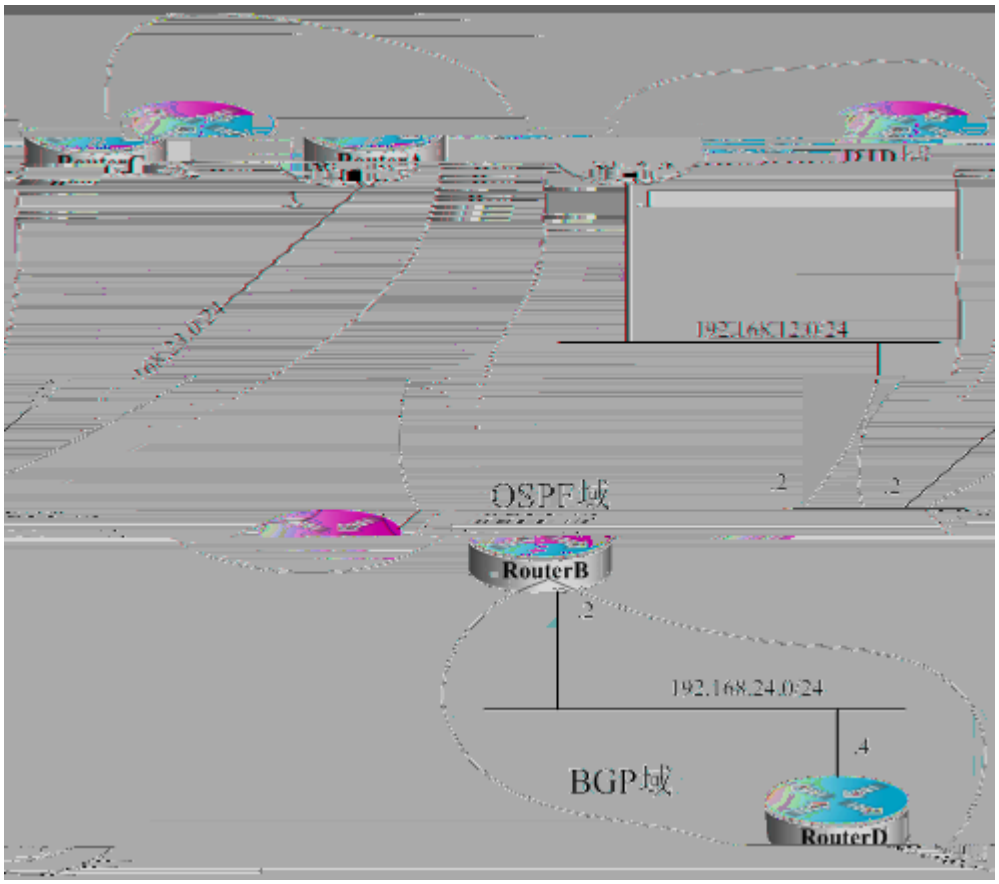
1 A OSPF C RIP D BGP B A

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



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

#         ج     Пђ  نھ   i              قھ        ئم
```

```
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
```

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1

2 RPL

3

4

5

6 VPDN

7 PPTP

8 L2TP

9 Tunnel

10 IPSec

11

12 AAA

13 RADIUS

14 TACACS+

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

ACLs
(Conditions) (Permit) (Deny)
ACLs Qos

ACLs (Access Control Entry ACE)

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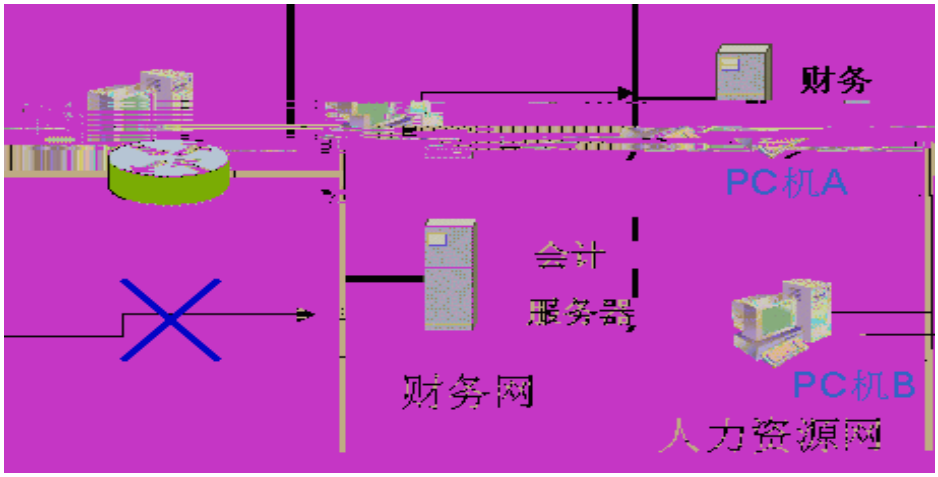
WWW TELNET

A B



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IPSEC

INTERNET

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ACL ACL ACE
ACL ACL
ACE

ACE ACE (Permit Deny) ACL ACE

(Layer 2 Fields)

48 MAC (48)

48 MAC (48)

16

(Layer 3 Fields)

IP (IP)

IP (IP
)

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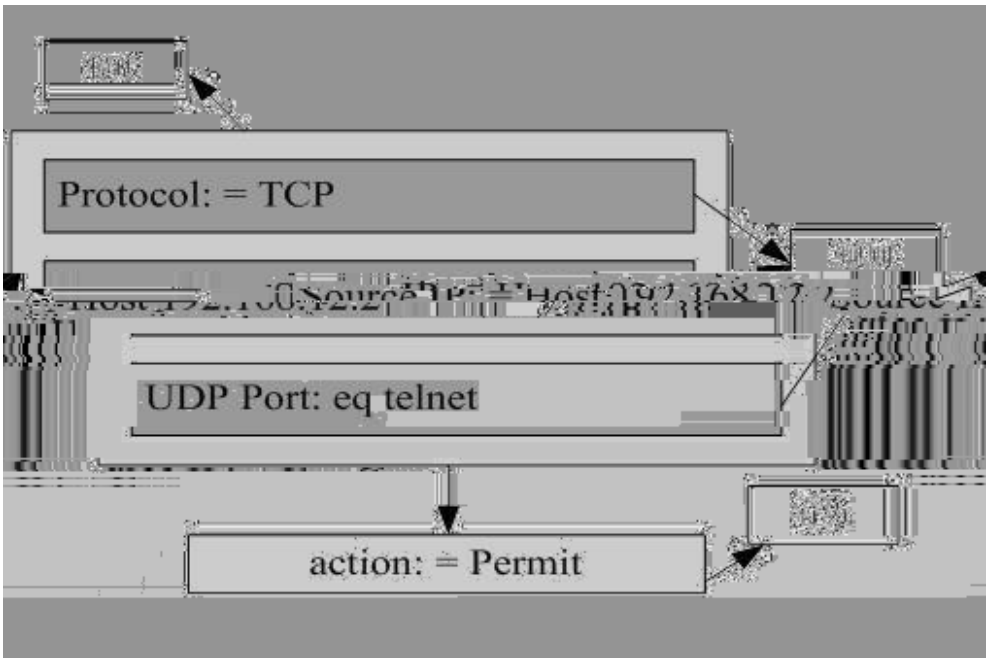

(Layer 3 Field) (Layer 4 Field)
(Layer 2 Field) ACL

Expert Expert ACLs

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

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- 101
- 101 192.168.12.0 0.0.0.255

IP 192.168.12.0/24 Telnet

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1.
2.

Ruijie(config)# *id* { | } {src *src-wildcard* | *src* | } [*tm-rng-name*]	
Ruijie(config)# *interface*	
Ruijie(config-if)# *id* { | } [ ]	

ACL

Ruijie(config)# { | } { *id* | *name* }	

Ruijie (config-xxx-nacl)# [*sn*] { | } {src *src-wildcard* | *src* | } [*tm-rng-name*]	ACL ,
Ruijie(config-xxx-nacl)# Ruijie(config)# *interface*	
Ruijie(config-if)# *id* { | } [|]	

ACL ACL

(ACE)

IP ACL ACL reflect ACL

ACL a.

, protocol source-IP ,

destination-IP source-port,destination-port b.

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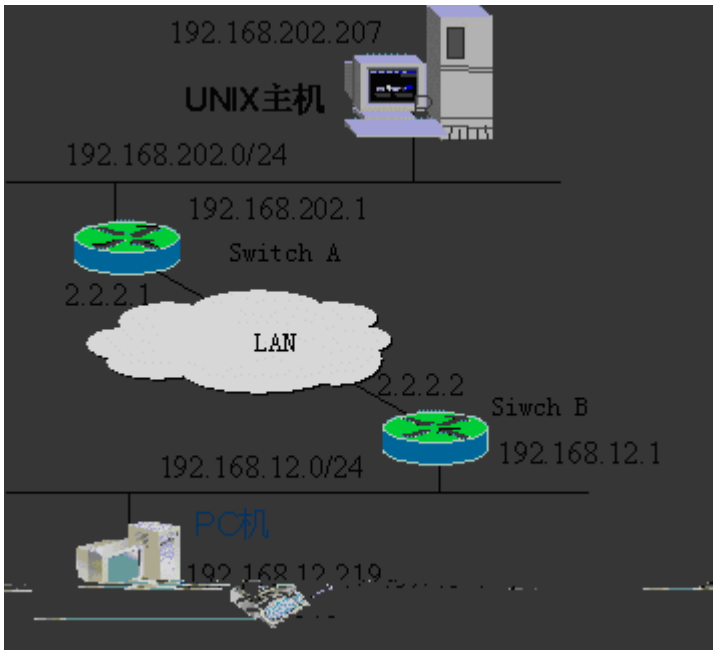

Switch B

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
```

VLAN ID

Expert 2700 -2899 MAC

VLAN ID

Expert

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Expert

1. Expert

2. ( )

Expert

Ruijie (config)# *id* { | } [*prot* | {[*ethernet-type*] [*cos*]}] [*vid*] {src *src-wildcard* | *src* } { *src-mac-addr* | } {dst *dst-wildcard* | *dst* | }{ *dst-mac-addr* | }] [*precedence*] [*tos*] [*dscp*] [ ] [*tm-rng-name*]	,
Ruijie(config)# *interface*	

Ruijie(config-if)# *id* { \| } [ ]

```
Ruijie(config-exp-nacl)# deny any any any any
Ruijie(config-exp-nacl)# exit
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# expert access-group expert-list in
Ruijie(config-if)# end
Ruijie# show access-lists
expert access-list extended expert-list
petmit ip vid 20 any host 0013.2049.8272 any any
deny any any
Ruijie#
```

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

TCP Flag RST 0

ACL ACL TCP MAC
IP

Ruijie(config-if)# {*id* | *name*} { | }	

ACE ACE

ACE

ACL

{*acl-id*| *acl-name*} *sn-start sn-inc*

ACL list ace tst_acl ACL ace

```
ace1: 10
ace2: 20
ace3: 30
```

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
```

ACE

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ACL ACL
Time-Range

Time-Range

Time-Range

Ruijie# **configure terminal**	
Ruijie(config)# **time-range** *time-range-name*	
Ruijie(config-time-range)# **absolute** [**start time** *date*] **end time** *date*	( ) time range
Ruijie(config-time-range)# **periodic** *day-of-the-week time* **to** [*day-of-the-week*] *time*	( )

```
Ruijie#
```

```
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
```

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TCP Flag ACL

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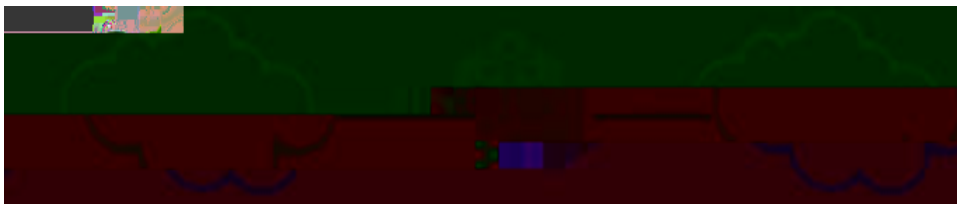
A A B
TCP B A TCP

1.7.1.2 ή Ữ ƒ



A G3/1 B
G3/2

1.7.1.3 ˬ ѽ

B P è TCP

1.7.1.4 ف ۱ ۹ ۳

```
#
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

#
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

#                              ACL
Ruijie# show access-lists 101
ip access-list extended 101
10 deny tcp any any match-all syn
20 permit ip any any
```

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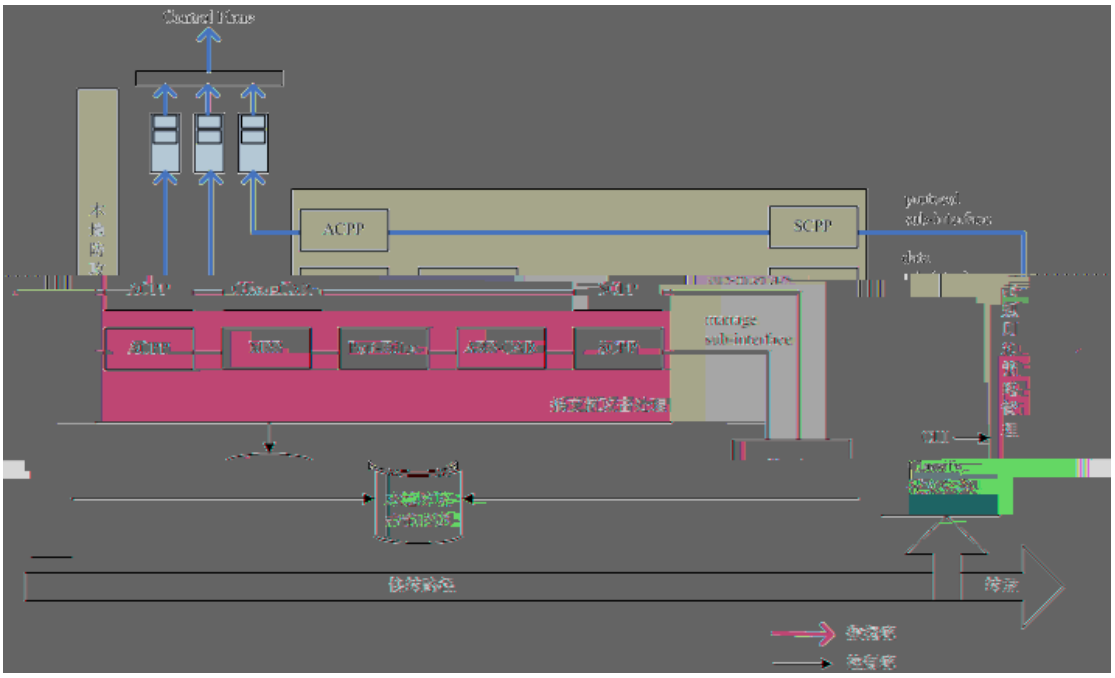
1 CPU

2 CLI

3

4



protocol

(manage) (data)

Classify

ftp telnet snmp

arp

icmp

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control-plane

SCPP

Glean-CAR

ARP-CAR

Port-Filter

MPP

ACPP

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

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control-plane control-plane

Ruijie(config)# { | | }	control-plane

control-plane exit

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SCPP

SCPP

Ruijie(config-cp)# *acl_no* { bw-rate *bw-burst-rate* }	acl_no SCPP pps acl_no acl scpp bw-rate pps bw-burst-rate pps
Ruijie(config-cp)# acl_no	SCPP

SCPP

SCPP SCPP

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IP Glean-CAR

Ruijie(config-cp)# *packet_rate_per_group*	Glean *packet_rate_per_group* pps
Ruijie(config-cp)#	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-CAR

ف 1

ARP ARP-CAR

Ruijie(config-cp)# *packet_rate_per_group*	ARP *packet_rate_per_group* pps
Ruijie(config-cp)#	ARP-CAR

ARP-CAR manage

N N

ARP-CAR ARP A
192.168.52.57 B 192.168.60.57
192.168.52.1 ARP arp-car 5 A B
5 ARP

ARP-CAR ARP-CAR

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Port-Filter

Ruijie(config-cp)#	Port-Filter
Ruijie(config-cp)#	Port-Filter

MPP

MPP MPP

ف ۱

ping web

Ruijie(config-cp)#security deny lan-ping | lan-web | wan-ping | wan-web	ping web
Ruijie(config-cp)# security deny lan-ping | lan-web | wan-ping | wan-web	ping web

ف ۱

security deny web IP
web web permit ip IP
IP web deny
IP

Ruijie(config-cp)# security web permit *low-ip-address* [*high-ip-address*]	web IP *low-ip-address* IP IP *high-ip-address* IP

Ruijie(config-cp)# *rate* *burst-rate*	ACPP *rate* pps *burst-rate* pps
Ruijie(config-cp)#	ACPP

ACPP

ACPP ACPP

ف ۱

ARP ARP
ARP ARP ARP (10s
200 ARP) MAC IP ARP
MAC MAC

no ARP

Ruijie(config-cp)#anti-arp-spoof	ARP
Ruijie(config-cp)# no anti-arp-spoof	ARP

ف ۱

pps

Ruijie(config-cp)#attack threshold 500	

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control-plane

Ruijie(config-cp)#	
Ruijie(config-cp)#	

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Ruijie#	
Ruijie(config)#	
Ruijie(config)# *time*	
Ruijie(config)# *value1* *value2*	IP
Ruijie#	
Ruijie# *ip-addr time*	IP
Ruijie# clear [*ip-addr*]	IP IP IP

Ruijie# //

Ruijie(config)#

Ruijie(config)# *180* // 3

Ruijie(config)# *10000* //
10000 kbps ip

Ruijie(config)# *5000* //
5000 pps ip

Ruijie#

Ruijie# *1.1.1.1 300* // IP 1.1.1.1 5

	1. IP

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Ruijie# { | | - | - | - | | }	

show ef-rnfp {acpp | scpp | glean-car | arp-car | port-filter | mpp}

show ef-rnfp all

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Ruijie# attack-info history	

attack-info history

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ARP

Ruijie# show arp-suspect	ARP

show arp-suspect ARP

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Ruijie# show attack-block	IP

1 IP

Ruijie#show attack-block

Blocking IP Addr(s): 2

IP Manual Timeout(sec) Drop(Kbps) Drop(pps)

==========

1.1.1.11 Y 523 0 0

3.3.3.55 N 0 6168 5263

Blocking IP Addr(s): IP

IP ip

Manual

Timeout(sec)

Drop(Kbps)　IP　kbps

Drop(pps)　IP　pps

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```
Ruijie# config
//    control-plane    protocol
Ruijie(config)# control-plane protocol
//    ACPP  protocol    500pps    600pps
Ruijie(config-cp)# acpp bw-rate 500 bw-burst-rate 600
//    control-plane    data
Ruijie(config)# control-plane data
//    ACPP  data    500pps    600pps
Ruijie(config-cp)# acpp bw-rate 500 bw-burst-rate 600
//    Glean-CAR    10    glean
Ruijie(config-cp)# glean-car 10
//    control-plane    manage
Ruijie(config)# control-plane manage
//    ACPP  manage    500pps    600pps
Ruijie(config-cp)# acpp bw-rate 500 bw-burst-rate 600
//    ARP-CAR    10  ARP
Ruijie(config-cp)# arp-car 10
//    Port-Filter
Ruijie(config-cp)# port-filter
//    MPP    gi0/0    telnet  snmp
Ruijie(config-cp)# management-interface gi0/0 allow telnet snmp
```

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“ ”

ACL

ACL

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DoS Denial of Service

DoS SYN Flo

od Fraggle

ICMP TCP

ICMP PING

TCP UDP

IP
Ping of Death Teardrop

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1 Land

Land TCP SYN IP
SYN-ACK ACK
Land
UNIX Windows NT

2 Smurf

Smurf ICMP
ICMP
Smurf ICMP

Smurf Fraggle

3 Winnuke

WinNuke Windows NetBIOS 139 OOB
out-of-band NetBIOS

4 SYN Flood

TCP/IP TCP SYN Flood
SYN1CDD4C2403FE>Tj/TT0 1 Tf0.0239 Tc 0.2e211534BWinnuÈÞÖ[ø4Xu]<C

7 Ping of Death

Ping of Death ICMP IP
16 IP 65535 ICMP
65507 ICMP IP (20) ICMP
8 > 65535

P2.[(P1P)-5( )]TJg/TT1j/T30.0454 T450.577 0 B5407>6<4D009AD08FE B1509B4F07CF>T1/TT0 1 Tf0

ICMP	
	IP

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Ruijie (config)#	
Ruijie (config)#	

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SYN

Ruijie (config)#	SYN
Ruijie (config)#	SYN

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SYN Flood “ ”

SYN Flood IP SYN
IP SYN

Ruijie(config)# *acl-number* | *acl-name*} *rate-num*	SYN Flood TCP-Proxy *acl-number:* acl 1-99 *acl-name:* acl acl ip *rate-num* pps
Ruijie(config)# *acl-number* | *acl-name*} *rate-num*	SYN Flood *acl-number:* acl 1-99 *acl-name:* acl acl ip *rate-num* pps

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UDP Flood “ ”

Ruijie(config)# *acl-number* | *acl-name*} *rate-num*	UDP Flood *acl-number:* acl 1-99 *acl-name:* acl acl ip *rate-num* pps
Ruijie(config)# *acl-number* | *acl-name*} *rate-num*	UDP Flood *acl-number:* acl 1-99 *acl-name:* acl acl ip *rate-num* pps

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ICMP Flood “ ”

Ruijie(config)# *acl-number* | *acl-name*} *rate-num*	ICMP Flood *acl-number:* acl 1-99 *acl-name:* acl acl ip *rate-num* pps
Ruijie(config)# *acl-number* | *acl-name*} *rate-num*	ICMP Flood *acl-number:* acl 1-99 *acl-name:* acl acl ip *rate-num* pps

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IP teardrop UDP
jolt2 (IP) (DoS)
flood
CPU “ ”

Ruijie(config)# *rate-num*	IP Flood *rate-num* pps
Ruijie(config)# *rate-num*	IP Flood *rate-num* pps

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ICMP ICMP
ICMP

IP

Ruijie(config)#	ICMP icmp
Ruijie(config)#	ICMP

ف ۱ ۔ ۓ

WinNuke “ ”
139 URG 1 WinNuke Windows
TCP OOB
OOB
Windows

Ruijie(config)#	Winnuke
Ruijie(config)#	Winnuke

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IP IP
IP

IP R1 R2 R3
IP
R1 R2 R3 IP

IP

Ruijie(config)#	IP
Ruijie(config)#	IP

ف ۱ ṽ ص ۲ Ч Ẹ ج گ ۔ ۂ ۄ ۱

IP IP

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3

Ruijie(config)#

icmp|*ip*|*tcp*|*udp*

high|*low*|*medium*

con-num *pri-num* *ip-num*

port-num

protocol	*icmp*|*ip*|*tcp*|*udp*
sense-level	*high*|*low*|*medium*
con-num	0 2000 0
pri-num	0~2000 0
ip-num	ip 1 2000
port-num	1 2000

con-num ip-num

```
high
        connection count is:50
        priority count is:3
        ip count is:3
        port count is:10

udp scan default config:
low
        connection count is:0
        priority count is:100
        ip count is:30
        port count is:50
medium
        connection count is:50
        priority count is:10
        ip count is:5
        port count is:20
high
        connection count is:50
        priority count is:3
        ip count is:3
        port count is:10

icmp scan default config:
low
        connection count is:0
        priority count is:30
        ip count is:50
medium
        connection count is:20
        priority count is:10
        ip count is:5
high
        connection count is:10
        priority count is:3
        ip count is:3

ip scan default config:
low
        connection count is:0
        priority count is:100
        ip count is:50
```

```
        protocol count is:50
medium
        connection count is:30
        priority count is:15
        ip count is:15
        protocol count is:15
high
        connection count is:30
        priority count is:3
        ip count is:3
        protocol count is:7
```

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ICMP “ ”

Ruijie(config)# [*icmp-length*]	ICMP *icmp-length* 28-65499 *icmp-length* 4000.
Ruijie(config)# [*icmp-length*]	ICMP *icmp-length* 28-65499 *icmp-length* 4000.

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IP ACL

IP ip

IP

IP

Ruijie(config)#	*sour-addr*	sour-addr ip
Ruijie(config)#	*sour-addr*	sour-addr ip

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Ruijie#	IP

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Ruijie(config)#	ICMP Flood
Ruijie(config)#	ICMP Flood

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Ruijie(config)#	IP
Ruijie(config)#	IP

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interface vlan 2/3

ICMP FLOOD interface Vlan3

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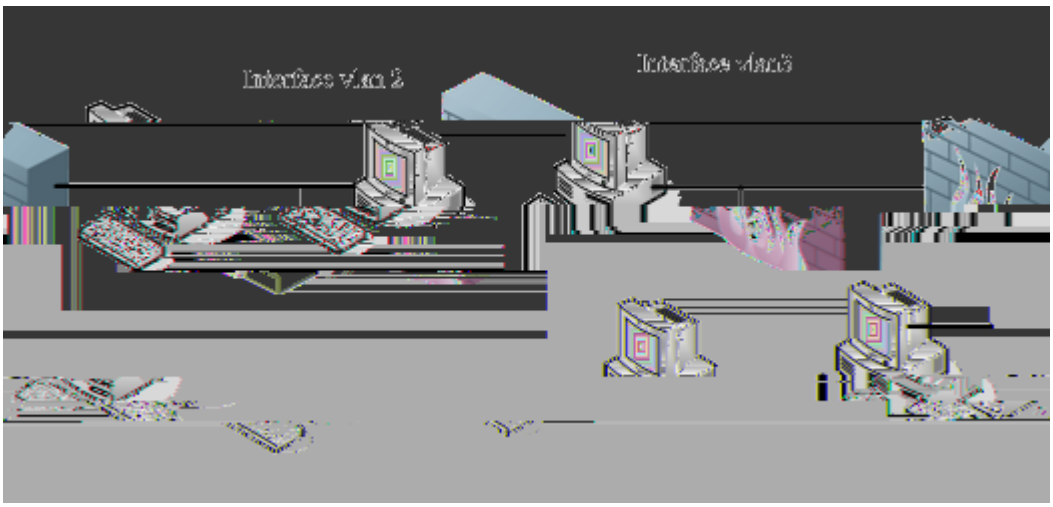

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ftp mms h.323

acl

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MMS H.323 SIP FTP RTSP TFTP

Ruijie(config)#	

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ب ↑

VPDN L2TP PPTP

L2TP(Layer Two Tunneling Protocol)

PPTP(Point-to-Point Tunneling Protocol)

VPDN

PPTP MicroSoft Windows L2TP Cisco

L2TP Windows 2000/XP

ف ٦

ب ↑

IP

Ruijie(config)# *poolname first-ip* [*last-ip*]	/
Ruijie(config)# *poolname*	

poolname / *first-ip* *last-ip*

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PPTP PPTP

Ruijie(config)# *user-name* *password*	
Ruijie(config)# *user-name*	

user-name *password* ( )

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PPTP VPDN VPDN

/ VPDN

VPDN

VPDN

VPDN

/ VPDN VPDN

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VPDN

PPTP PPTP VPDN

Ruijie(config)#	VPDN
Ruijie(config)#	VPDN

VPDN PPTP

PPTP

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VPDN ( ) VPDN

PPTP

Ruijie(config)#	*ip-address*	VPDN
Ruijie(config)#		VPDN

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VPDN

VPDN

Ruijie(config)#	*sessions*	VPDN
Ruijie(config)#		VPDN

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VPDN

Ruijie(config)#	
Ruijie(config)#	VPDN

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VPDN

Ruijie(config)#	
Ruijie(config)#	

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VPDN VPDN

Ruijie(config)# *rate_num*	*rate_num* 5 100
Ruijie(config)#	

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PPTP PPTP

Virtual-access Virtual-template

Virtual-template ( )

IP ( )

( )

IP ( )

IP IP

Ü

Virtual-template

Ruijie(config)# *number*	/ Virtual -template
Ruijie(config)# *number*	Virtual- template

number Virtual-template Virtual-template
PPTP Virtual-access

ف

PPTP VPDN-group
VPDN-group

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

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VPDN-group

Ruijie(config)#	*name*	/ VPDN-group
Ruijie(config)#	*name*	VPDN-group

name VPDN-group VPDN-group

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Ruijie (config-vpdn)#	
Ruijie (config-vpdn)#	

PNS

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Ruijie(config-vpdn-acc-in)# { | | }	
Ruijie(config-vpdn-acc-in)#	

PNS

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VPDN-group

Ruijie(config-vpdn-acc-in)# *number*	
Ruijie(config-vpdn-acc-in)#	

VPDN-group

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

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

name

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

name

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VPDN-group
VPDN-group

Ruijie(config-vpdn)# *src-ip*	VPDN-group
Ruijie(config-vpdn)#	VPDN-group

src-ip VPDN-group

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PPTP

Ruijie(config-vpdn)# *winsize*	PPTP 1—64
Ruijie(config-vpdn)#	PPTP PAC 16 PNS 64
Ruijie(config-vpdn)# *interval*	PPTP ACK 100—5000
Ruijie(config-vpdn)#	PPTP ACK 1500

winsize PPTP *interval* ACK

Ruijie(config-vpdn)# domain-name	

domain-name vrf-name vrf

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vpdn-domain

vpdn

PPP

virtual-template

Ruijie(config-vpdn)# *domain-name* *vrf-name* Ruijie(config-vpdn-doamin)# *pool-name*	pool
Ruijie(config-vpdn-domain)#	

domain-name vrf-name vrf pool-name

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PPP DNS

vpdn-domain vpdn

PPP DNS PPP DNS

virtual-template PPP DNS

Ruijie(config-vpdn)# *domain-name* *vrf-name* Ruijie(config-vpdn-doamin)# *A.B.C.D* *A.B.C.D*	PPP DNS
Ruijie(config-vpdn-domain)#	dns

domain-name vrf-name vrf *A.B.C.D* dns

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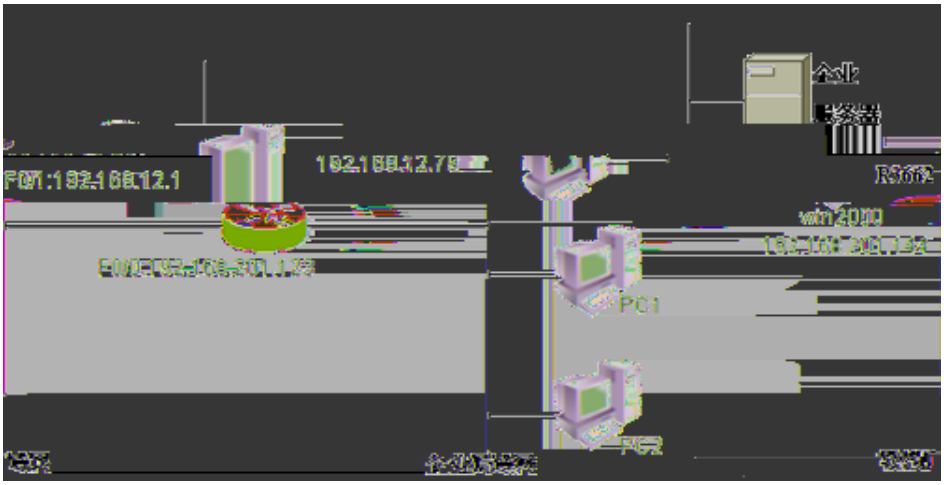
1 RUIJIE PPTP

VPDN Win2000 PC VPDN RUIJIE

PPTP

RUIJIE IP IP



8 PPTP

RUIJIE Windows 2000

1)RUIJIE

```
RUIJIE# show running-config
Building configuration...
Current configuration : 1053 bytes
!
hostname Ruijie
enable password  1
!
vpdn enable
!
vpdn-group pptp
! Default PPTP VPDN group
accept-dialin
```

```
duplex auto
speed auto
!
interface Virtual-Template 1
```

PPTP

```
IP Routing Enabled. . . . . . . . : Yes
WINS Proxy Enabled. . . . . . . . : No
Ethernet adapter        :
Connection-specific DNS Suffix  . :
Description . . . . . . . . . . . : STAR 901 Family Fast Ethernet Adapte
ng EnabDT*HCP . . abDT*HCP
```

```
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


RUIJIE#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
```

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

show vpdn tunnel pptp *locid*

```
RUIJIE# show vpdn tunnel pptp 1
PPTP tunnel id 1 is up, remote id is 0, 1 active session
  Tunnel state is estbed
  Remote tunnel name is
    Internet Address 192.168.201.144, port 1436
  Local tunnel name is
Internet Address 192.168.201.123
```

IP hostname
IP

Ruijie# [[|] [*remote name*]]	

remote name

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

PPTP
PPP

Ruijie# { | | }	VPDN Error Event Packet

Debug

PPTP

```
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

```
PPTP: I Start-Control-Connection-Request len 156 Magic Cookie 0x1A2B3C4D
Protocol Version 0x100
Framing Type 0x1
Bearer Type 0x1
Maximum Channels 0x0
Firmware Revision 0x893
Host Name:
Vendor String: Microsoft Windows NT
PPTP: O Start-Control-Connection-Reply len 156 Magic Cookie 0x1A2B3C4D
Protocol Version 0x100
Framing Type 0x2
Bearer Type 0x3
Maximum Channels 0x0
Firmware Revision 0x100
Host Name: Dingjs
Vendor String: Ret-Giant Network Operating System
PPTP: I Outgoing-Call-Request len 168 Magic Cookie 0x1A2B3C4D
Call Id 0x4000
```

```
Call Serial Number 0x96A5
Min BPS 0x12C
Max BPS 0x5F5E100
Bearer Type 0x3
Framing Type 0x3
Rec Window Size 0x40
Proc Delay 0x0
Phone Number Length 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
Vi1 VPDN PROCESS Into tunnel: Sending 54 byte pak
Vi1 VPDN PROCESS Into tunnel: Sending 64 byte pak
Vi1 VPDN PROCESS Into tunnel: Sending 50 byte pak
PPTP: I Set-Link-Info len 24 Magic Cookie 0x1A2B3C4D
Peer Call Id 0x1
Send ACCM 0xFFFFFFFF
Recv ACCM 0xFFFFFFFF
Vi1 VPDN PROCESS Into tunnel: Sending 45 byte pak
Vi1 VPDN PROCESS Into tunnel: Sending 46 byte pak
Vi1 VPDN PROCESS Into tunnel: Sending 187 byte pak
Vi1 VPDN PROCESS Into tunnel: Sending 56 byte pak
Vi1 VPDN PROCESS Into tunnel: Sending 64 byte pak
Vi1 VPDN PROCESS Into tunnel: Sending 50 byte pak
Vi1 VPDN PROCESS Into tunnel: Sending 50 byte pak
Vi1 VPDN PROCESS Into tunnel: Sending 52 byte pak
```

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Layer 2 Tunnel Protocol(L2TP) Internet Engineering Task Force(IETF)
Cisco Layer 2 Forwarding(L2F) Point-to-Point
Tunneling Protoool 3(e(PP(L2TP))]TJ/C2_0 1 Tf0.04 Tc 0 Td[<0923435E0FA1>-9A4182>-7CE-6<203

L2TP-class

L2TP

L2TP

L2TP

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L2TP L2TP-class

Ruijie(config)#	*l2tp-class-name*	/	L2TP-class
Ruijie(config)#	*l2tp-class-name*	L2TP-class	

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

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L2TP

Ruijie(config-l2tp-class)#	

*timeou*t 1
8 *seconds* (Tunnel) 120

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L2TP (Tunnel)

Ruijie(config-l2tp-class)#	
Ruijie(config-l2tp-class)#	
Ruijie(config-l2tp-class)#	
Ruijie(config-l2tp-class)# *host-name*	
Ruijie(config-l2tp-class)# *pass-words*	
Ruijie(config-l2tp-class)#	

]

L2TP IP

L2TP

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L2TP

Ruijie(config)#	/
pseudowire- class-name	Pseudowire-class
Ruijie(config)# *pseudowire- class-name*	Pseudowire-class

pseudowire-class-name /

Peudowire

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L2TP

Ruijie (config-pw-class)#	

L2TP

Peudowire-class L2TP L2TP

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L2TP IP

Ruijie (config-pw-class)#		
Ruijie (config-pw-class)#		
Ruijie (config-pw-class)#	*ttl-value*	IP TTL
Ruijie (config-pw-class)#		TTL
Ruijie (config-pw-class)# *interface-name*		( )

Ruijie(config-pw-class)# *interface-name*	( )

L2TP IP L2TP UDP IP
TTL 255
( )

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L2TP

Ruijie(config-pw-class)# [*l2tp-class-name*]	L2TP
Ruijie(config-pw-class)#	

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

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L2TP ή L2TP
Virtual-ppp
Virtual-ppp
IP

Pseudowire λ
IP

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L2TP Virtual-ppp

Ruijie(config)# *number*	/ Virtual-ppp
Ruijie(config)# *number*	Virtual-ppp

”Branch” (NAT) virtual-ppp 1
”Headquarters” L2TP Tunnel ”Branch”
(NAT) interface FastEthernet 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. . . . . . . . . : 00-10-97 Broadcast
IP Routing Enabled. . c(icr c c(i5C.2lCPN)6(o)D000b :)6ed2000 Compatible
Physio. c(icr c c(i5. )6(. 0)6(0- Tw 11B)6(roa)6(dcas)6(t )]TJT*[(I)6(P R)6(


IP Routioutiouti/C26( .)6( . )6(3 . )6(. )6lCPNo00 Compatible
Physio. c(icr c( . )6(. . )6(. )6(. 0)6(0- Tw 11B)6(roa)6(dcas)6(t )]TJT*[(I
IP Routing E]TJ.5 TJ2.5 TJ2.TJ.J]TJ.5 . .i5C.2(fD000ul(0.)6Ga45B2>ws)6.ycast
```

```
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 IP
) ” ” ” ”
” ” L2TP L2TP

Windows 2000/XP L2TP IPSec/IKE
L2TP (Cisco Quidway)
L2TP IPSec/IKE Windows 2000/XP L2TP

Windows 2000/XP ” ”
” ” ”regedit”
“HKEY_LOCAL_MACHINE/ SYSTEM / CurrentControlSet / Services / RasMan
/
Parameters” ” ProhibitIpSec”
1 F5 Windows 2000
L2TP IPSec/IKE
Windows 2000/XP L2TP
IPSec/IKE

”Branch” ” DENGL-NECBOOK” Internet
”Headquarters”

```
icrosoft Windows 2000 [Version 5.00.2195]
(C)        1985-2000 Microsoft Corp.
C:\WINNT\system32>ipconfig /all
Windows 2000 IP Configuration
Host Name . . . . . . . . . . . . : DENGL-NECBOOK
Primary DNS Suffix  . . . . . . . :
Node Type . . . . . . . . . . . . : Hybrid
IP Routing Enabled. . . . . . . . : No
WINS Proxy Enabled. . . . . . . . : No
Ethernet adapter        :
Connection-specific DNS Suffix  . :
Description . . . . . : Realtek RTL8139(A)-based PCI Fast Ethernet Adapter
Physical Address. . . . . . . . . : 00-10-60-75-BD-7A
DHCP Enabled. . . . . . . . . . . : No
IP Address. . . . . . . . . . . . : 192.168.201.78
Subnet Mask . . . . . . . . . . . : 255.255.255.0
Default Gateway . . . . . . . . . : 192.168.201.1
DNS Servers . . . . . . . . . . . : 202.101.143.141
                                    202.101.98.55
C:\WINNT\system32>route print
===========================================================Interface
List
0x1 ........................... MS TCP Loopback interface
0x1000003 ...00 10 60 75 bd 7a ...... NDIS 5.0 driver
===========================================================Active
Routes:
Network Destination       Netmask         Gateway      Interface
Metric
0.0.0.0    0.0.0.0    192.168.201.1  192.168.201.78    1
127.0.0.0    255.0.0.0    127.0.0.1     127.0.0.1     1
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>
```

v

```
C    192.168.12.0/24 is directly connected, FastEthernet0/1
C    192.168.201.0/24 is directly connected, FastEthernet0/0
S*   0.0.0.0/0 [1/0] via 192.168.12.1, FastEthernet0/1
RUIJIE#
```

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

10 Cisco 2620(LNS)

```
!
!
interface serial 1/0
encapsulation PPP
ip address 202.101.93.21 255.255.255.192
ip nat outside
!
interface serial 1/1
clock rate 64000
!
interface serial 1/2
clock rate 64000
!
interface serial 1/3
clock rate 64000
!
interface FastEthernet 0/0
ip address 192.168.201.1 255.255.255.0
ip nat inside
duplex auto
speed auto
!
interface FastEthernet 0/1
duplex auto
speed auto
!
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
RUIJIE#
```

”Branch” ( ) Virtual-ppp 1 ”Headquarters” L2TP Tunnel ”Branch” (NAT) interface Serial 0 Internet FastEthernet 0 (ADSL WAN) NAT Serial 0 ARP

```
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 0.0.0.0 to network 0.0.0.0
     192.168.103.0/32 is subnetted, 2 subnets
C       192.168.103.3 is directly connected, Virtual-PPP1
C       192.168.103.2 is directly connected, Virtual-PPP1
S    192.168.19.0/24 is directly connected, Virtual-PPP1
C    192.168.201.0/24 is directly connected, FastEthernet0/0
     202.101.93.0/24 is variably subnetted, 2 subnets, 2 masks
C       202.101.93.23/32 is directly connected, Serial1/0
C       202.101.93.0/26 is directly connected, Serial1/0
S*   0.0.0.0/0 is directly connected, Serial1/0
RUIJIE#show arp
Protocol  Address         Age (min)  Hardware Addr   Type   Interface
Internet  192.168.201.213        3   0010.8801.a5c3  ARPA
FastEthernet0/0
Internet  192.168.201.1          -   00d0.f8fb.126e  ARPA
FastEthernet0/0
RUIJIE#
```

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
l2tp tunnel password 7 0832444F1B1C
!
call rsvp-sync
!
interface FastEthernet0/0
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
```

```
i - IS-IS, 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 static route
Gateway of last resort is not set
O   192.168.201.0/24 [110/20] via 192.168.103.3, 00:06:26,
Virtual-Access1
192.168.103.0/24 is variably subnetted, 2 subnets, 2 masks
C      192.168.103.3/32 is directly connected, Virtual-Access1
C      192.168.103.0/24 is directly connected, Virtual-Access1
202.101.93.0/24 is variably subnetted, 2 subnets, 2 masks
C      202.101.93.21/32 is directly connected, Serial0/0
C      202.101.93.0/26 is directly connected, Serial0/0
C   192.168.19.0/24 is directly connected, FastEthernet0/0
Cisco2620#
```

”Branch” ” BLIZZARD” Internet ”Headquarters”

```
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. . . . . . . . . . . . : 192.168.201.213
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.
===========================================================
```

```
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 (192.168.201.213) 192.168.201.1 NAT

```
RUIJIE# show ip nat translations
Pro Inside global     Inside local      Outside local      Outside
global
icmp 202.101.93.21:1024 192.168.201.213:1024 202.101.93.23:1024
202.101.93.23:1024
RUIJIE#
```

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Ruijie Windows 2000 PC PC windows 2000

PC hostname DNS Ruijie DNS client Ruijie ping DNS

Ruijie LAC

```
l2tp-class 1
!
pseudowire-class 1
 encapsulation l2tpv2
!
no service password-encryption
!
ip name-server 192.168.5.119
ip name-server 61.154.22.41
!
no ip ref load-sharing original
!
interface FastEthernet 0/0
```

```
 ip ref
 ip address 192.168.52.90 255.255.255.0
 duplex auto
 speed auto
!
interface FastEthernet 0/1
 duplex auto
 speed auto
!
interface Virtual-ppp 1
 pseudowire hostname mm.hxs.meibu.com 1 encapsulation l2tpv2
 ppp pap sent-username user1 password  11
 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
```

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VPDN ( )

Virtual-template ( )

Vpdn-group( )

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L2TP LNS

L2TP VPN IP

IP IP

Ruijie(config)# *poolname first-ip* [*last-ip*]	/
Ruijie(config)# *poolname*	

poolname / *first-ip* *last-ip*

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L2TP

L2TP

Ruijie(config)# *user-name password*	
Ruijie(config)# *user-name*	

user-name *password*

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L2TP VPDN

VPDN

/ VPDN

VPDN

VPDN

VPDN

VPDN

, / VPDN VPDN

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VPDN

L2TP L2TP VPDN

Ruijie(config)#	VPDN
Ruijie(config)#	VPDN

VPDN / VPDN

L2TP

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VPDN ( ) VPDN

L2TP

Ruijie(config)#	*ip-address*	VPDN
Ruijie(config)#		VPDN

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VPDN

VPDN ,

Ruijie(config)#	*sessions*	VPDN
Ruijie(config)#		VPDN

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VPDN

Ruijie(config)#	
Ruijie(config)#	VPDN

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VPDN

Ruijie(config)#	
Ruijie(config)#	

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L2TP L2TP

Virtual-access Virtual-template

Virtual-template ( )

IP ( )

( )

IP ( )

IP IP

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Virtual-template

Ruijie(config)# *number*	/ Virtual -template
Ruijie(config)# *number*	Virtual-template

number Virtual-template Virtual-template

L2TP Virtual-access

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L2TP VPDN-group

VPDN-group

VPDN-group( )

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VPDN-group ( )

L2TP ( )

L2TP ( )

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PPP ( )

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VPDN-group

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VPDN-group

Ruijie(config-vpdn-acc-in)# *number*	
Ruijie(config-vpdn-acc-in)#	

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VPDN-group

VPDN-group

Ruijie(config-vpdn)# *src-ip*	VPDN-group
Ruijie(config-vpdn)#	VPDN-group

src-ip VPDN-group

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L2TP

Ruijie(config-vpdn)#	
Ruijie(config-vpdn)#	
Ruijie(config-vpdn)# *interval*	Hello
Ruijie(config-vpdn)#	Hello
Ruijie(config-vpdn)# *pass-word*	
Ruijie(config-vpdn)#	
Ruijie(config-vpdn)# *size*	
Ruijie(config-vpdn)#	
Ruijie(config-vpdn)# { *number* | { | } *seconds*}	
Ruijie(config-vpdn)# { | { | }}	
Ruijie(config-vpdn)# { | } *seconds*	/
Ruijie(config-vpdn)# { | }	/
Ruijie(config-vpdn)#	VPDN

Ruijie(config-vpdn)#	
Ruijie(config-vpdn)#	RFC2661 AVP Hidden
Ruijie(config-vpdn)#	Cisco AVP Hidden

L2TP (Cisco)
Hello 60 4
5 1
8 600
300 L2TP L2TP
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l2tp vrf VT

ip vrf forward vrf

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

vrf-name vrf

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vpdn group

group

Ruijie(config-vpdn)# *domain-name* *vrf-name*	vrf
Ruijie(config-vpdn)# domain-name	

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PPP DNS
vpdn-domain vpdn
PPP DNS PPP DNS
virtual-template PPP DNS

Ruijie(config-vpdn)# *domain-name* *vrf-name* Ruijie(config-vpdn-doamin)# *A.B.C.D* *A.B.C.D*	PPP DNS
Ruijie(config-vpdn-domain)#	dns

domain-name vrf-name vrf *A.B.C.D* dns

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PPP Client LAC LAC
LNS Client L2TP Client
LNS

Ruijie(config-vpdn)#	PPP
Ruijie(config-vpdn)#	PPP

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RFC L2TP

Ruijie(config-vpdn)#	
Ruijie(config-vpdn)#	RFC

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

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```
!
username rgnos password 7 04251F083110
!
ip local pool vpdnusers 192.168.101.3 192.168.101.253
!
interface FastEthernet 0/0
ip address 192.168.201.1 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet 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 address pool vpdnusers
!
!
line con 0
line aux 0
line vty 0 4
!
!
end
RUIJIE#
```

2)Windows 2000

```
Microsoft Windows 2000 [Version 5.00.2195]
(C)         1985-2000 Microsoft Corp.
C:\>ipconfig /all
```

```
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
C:\>route print
===========================================================
Interface List
0x1 ........................... MS TCP Loopback interface
0x2000003 ...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
192.168.12.255  255.255.255.255   192.168.12.213
192.168.12.213      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:\>
```

” ” ” ” ” Internet ” LNS RUIJIE 192.168.12.217 ” ” ” ( )” ” ” ” ” ( )” ” (PAP)” ” ”

```
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
0.0.0.0    0.0.0.0    192.168.101.8   192.168.101.8     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
```

```
192.168.101.2  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 192.168.0uround trip times in milli-seconds:
Minimum = 0ms, MmumN6(168ytes(= 4)61( 19)6(2.16)6(8.)6(101)6(.2: )6(by)6(tes)6(=
P= 4om 192.168.101.2: bytes=32 titime<10ms TTL=255
P= 4om 192.168.101.2: bytes4time<10ms TTL=255
P= 4om 192.168.101.2: bytes4time<10ms TTL=255
P= 4om 192.168.101.2: bytes4time<ping6(ack)6(ets:)6( S)6(ent)6( = 4)6(, )6(Rec)6
Minimum = 0ms, Maximum =  0ms-sege =  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:\>
```

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RUIJIE# Cisco 3640

1)RUIJIE

```
RUIJIE# show running-config
Building configuration...
Current configuration : 766 bytes
!
hostname Ruijie
!
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 FastEthernet 0/0
ip address 192.168.201.1 255.255.255.0
duplex auto
speed auto
!
interface FastEthernet 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 address pool vpdnusers
!
!
line con 0
line aux 0
line vty 0 4
!
!
end
RUIJIE#
```

2)Cisco3640

```
C3640# show running-config
Building configuration...
Current configuration : 2096 bytes
!
version 12.3
```

```
service timestamps debug uptime
service timestamps log uptime
no service password-encryption
no service dhcp
!
hostname C3640
!
!
ip subnet-zero
!
l2tp-class l2x
authentication
password 0 share
!
pseudowire-class pw
encapsulation l2tpv2
protocol l2tpv2 l2x
ip local interface FastEthernet2/0
!
no mpls ldp logging neighbor-changes
no scripting tcl init
no scripting tcl encdir
!
no voice hpi capture buffer
no voice hpi capture destination
!
controller E1 3/0
channel-group 1 timeslots 1-2
!
!
!
interface Loopback0
ip address 132.11.10.2 255.255.255.0
!
interface FastEthernet2/0
ip address 192.168.12.242 255.255.255.0
speed auto
duplex auto
!
interface FastEthernet2/1
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 FastEthernet2/0 192.168.12.1
!
!
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)RUIJIE

```
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       192.168.101.9/32 is directly connected, Virtual-Access1
C       192.168.101.0/24 is directly connected, Loopback1
C    192.168.12.0/24 is directly connected, FastEthernet0/1
C    192.168.201.0/24 is directly connected, FastEthernet0/0
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
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
RUIJIE#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
RUIJIE#
```

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 static route
Gateway of last resort is 192.168.12.1 to network 0.0.0.0
C    192.168.12.0/24 is directly connected, FastEthernet2/0
     132.11.0.0/24 is subnetted, 1 subnets
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
C       192.168.101.2 is directly connected, Virtual-PPP1
S*   0.0.0.0/0 [1/0] via 192.168.12.1, FastEthernet2/0
C3640# show vpdn
```

```
%No active L2F tunnels
L2TP Tunnel and Session Information Total tunnels 1 sessions 1
LocID RemID Remote Name  State  Remote Address  Port  Sessions L2TP
Class/
                                                    VPDN Group
21511 9    R3660      est    192.168.12.217  1701  1     l2x
LocID      RemID      TunID      Username, Intf/      State  Last Chg Uniq
ID
                              Vcid, Circuit
14     1      21511      11, Vp1      est    00:23:58   2
%No active PPTP tunnels
C3640# ping 192.168.101.2
Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 192.168.101.2, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 1/2/4 ms
C3640#
```

Cisco 3640 L2TP

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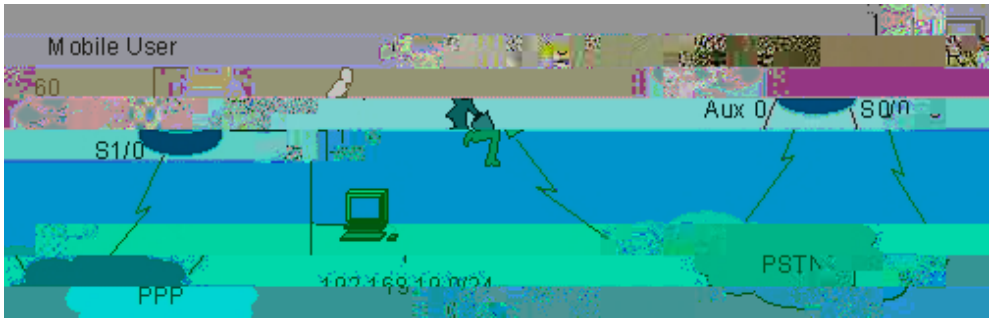
Ruijie Cisco 2620 L2TP 6
Cisco2620 (Access Server AS) LAC
ISP Cisco AS5300 Cisco AS5800
Cisco 2620 L2TP
L2TP Cisco 2620 RUIJIE PPP /
(Mobile User) RUIJIE Mobile User
L2TP
L2TP
Mobile User



13 Cisco 2620(LAC) L2TP

RUIJIE Cisco 2620

1)RUIJIE

```
RUIJIE# show running-config
Building configuration...
Current configuration : 989 bytes
!
hostname Ruijie
!
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 FastEthernet 0/0
duplex auto
speed auto
```

```
!
interface FastEthernet 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
RUIJIE#
```

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 FastEthernet0/0
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
exi65 754.700gim-l
lial
```

```
ip vrf vrf2
!
vpdn enable
vpdn domain-delimiter @/%#-\ suffix
vpdn authorize domain split
!
vpdn-group 1
! Default L2TP VPDN group
accept-dialin
  protocol l2tp
  virtual-template 1
domain bangong vrf vrf1   /*       */
domain shiyan vrf vrf2   /*       */
!
!
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 FastEthernet 0/1
ip address 192.168.19.1 255.255.255.0
duplex auto
speed auto
!
interface Loopback 1
ip vrf forward vrf1
ip address 192.168.101.2 255.255.255.0
!
interface Loopback 2
ip vrf forward vrf2
ip address 192.168.101.2 255.255.255.0
!
interface Null 0
!
interface Virtual-Template 1
ppp authentication pap
```

```
line aux 0
line vty 0 4
!
!
end
```

LNS VP
VRF VP VP
LNS VA VRF
VRF LNS VP VP
LNS ping
ping

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L2TP

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L2TP

Ruijie# [[*locid*]]	vpdn id
Ruijie> [[*locid*]]	
Ruijie#	vpdn error
Ruijie#	vpdn error
Ruijie#	vpdn event
Ruijie#	vpdn event
Ruijie#	vpdn packet
Ruijie#	vpdn packet
Ruijie#	vpdn l2x-data
Ruijie#	vpdn l2x-data
Ruijie#	vpdn l2x-errors
Ruijie#	vpdn l2x-errors
Ruijie#	vpdn l2x-events

Ruijie#	vpdn l2x-events
Ruijie#	vpdn l2x-packets
Ruijie#	vpdn l2x-events

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L2TP (

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```
Ruijie# show vpdn tunnel
L2TP Tunnel Information Total tunnels 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
%No active PPTP tunnels
Ruijie# show vpdn session
L2TP Session Information Total sessions 1
LocID     RemID     TunID     Username, Intf/     State
Last Chg
                           Vcid, Circuit
1         1261      1         rgnos,Vi1              est
01:04:42
%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#
Ruijie# show vpdn tunnel l2tp 1
L2TP tunnel locid 1 is up,remote id is 35390, 1 active sessions
```

```
Tunnel state is est
Tunnel transport is UDP
Remote tunnel name is C3640
  Internet Address 192.168.12.242, port 1701
Local tunnel name is Ruijie
  Internet Address 192.168.12. 217, port 1701
```

```
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
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      192.168.101.5/32 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, FastEthernet0
C    192.168.201.0/24 is directly connected, Ethernet0
Ruijie#
```

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L2TP L2TP
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#
```

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M**no debug all** ę ά Λ
All possible debugging has been turned off
R35jie#
u p 2 3 . 5 8 d a t a

```
Ruijie# no debug all
All possible debugging has been turned off
Ruijie#
```

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L2TP

LNS (

)

```
%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, FastEthernet0
C    192.168.201.0/24 is directly connected, Ethernet0
Ruijie# show vpdn
```

```
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#
```

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L2TP L2TP

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
Tnl 22 L2TP: O ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 18889, ns 2,
nr 3
        C8 02 00 0C 49 C9 00 00 00 02 00 03
Tnl/Sn 22/1 L2TP: I ICCN from C3640 tnl 18889, cl 1280
Tnl/Sn 22/1 L2TP: Parse  AVP 0, len 8, flag 0x8000 (M)
Tnl/Sn 22/1 L2TP: Parse ICCN
Vi1 Tnl/Sn 22/1 L2TP: Parse  AVP 24, len 10, flag 0x8000 (M)
Vi1 Tnl/Sn 22/1 L2TP: Connect Speed 0
Vi1 Tnl/Sn 22/1 L2TP: Parse  AVP 19, len 10, flag 0x8000 (M)
```

```
Vi1 Tnl/Sn 22/1 L2TP: Framing Type 1
Tnl/Sn 22/1 L2TP: No missing AVPs in ICCN
Tnl/Sn 22/1 L2TP: I ICCN, flg TLS, ver 2, len 48, tnl 22, lsid 1, rsid
1280, ns 3, nr 2 contiguous pak, size 48
C8 02 00 30 00 16 00 01 00 03 00 02 80 08 00 00
00 00 00 0C 80 0A 00 00 00 18 00 00 00 00 80 0A
00 00 00 13 00 00 00 01 00 08 00 00 00 1D 00 04
Tnl 22 L2TP: O ZLB ctrl ack, flg TLS, ver 2, len 12, tnl 18889, ns 2,
nr 4
C8 02 00 0C 49 C9 00 00 00 02 00 04
```

```
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
```

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 ”

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Tunnel Tunnel

Tunnel

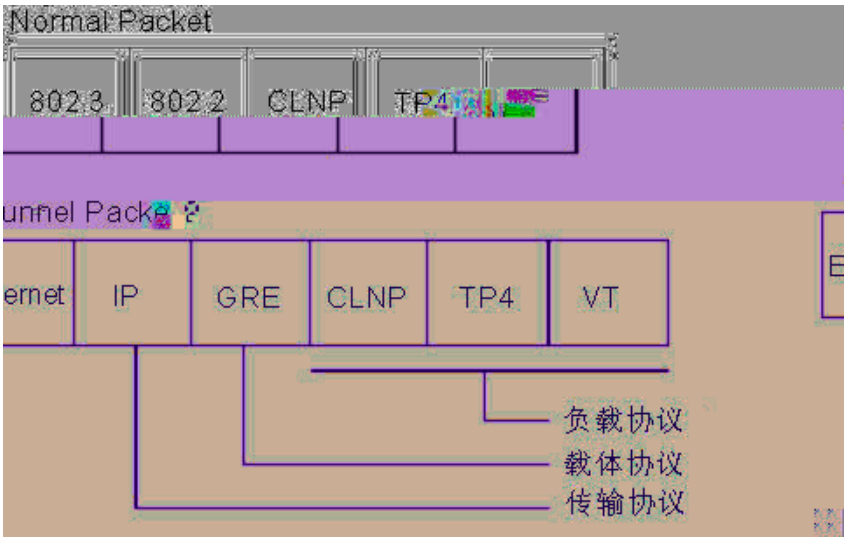
Tunnel

Tunnel ( ) Tunnel
IP

Tunnel

gre ipip

IP



14 Tunnel

GRE IP Tunnel

Tunnel

Tunnel

IP (IP) Tunnel

Tunnel (IP)

(IP)

VPN (virtual private network)

Tunnel

Tunnel hop
Tunnel Tunnel

Tunnel (ACL)
(MTU)

Tunnel (IP
)

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Tunnel :

- Tunnel
- Tunnel
- Tunnel
- Tunnel
- Tunnel
- Tunnel Key
- Tunnel
- Tunnel TOS
- Tunnel TTL
- Tunnel PMTUD
- Tunnel

Tunnel VRF

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Tunnel

Ruijie(config)# *tunnel-number*	Tunnel
Ruijie(config)# *tunnel-number*	Tunnel

Tunnel Tunnel

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Tunnel
Loopback tunnel

Tunnel tunnel

Ruijie(config-if)# {*ip-address*	*interface-number*}	Tunnel
Ruijie(config-if)#	Tunnel

Tunnel Tunnel

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tunnel tunnel

Ruijie(config-if)# { *ip-address* }	Tunnel
Ruijie(config-if)#	Tunnel

Tunnel

Tunnel

Tunnel

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Tunnel Tunnel Tunnel GRE
Tunnel

Ruijie(config-if)# { | }	Tunnel
Ruijie(config-if)#	Tunnel

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Tunnel

Ruijie(config-if)#	Tunnel
Ruijie(config-if)#	Tunnel

Tunnel

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Tunnel Key Tunnel

Ruijie(config-if)#	*key-value*	Tunnel Key
Ruijie(config-if)#		Tunnel Key

Tunnel GRE Tunnel Key
GRE Tunnel Key

	(1) Tunnel Key (2) GRE GRE Key Key (3)

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Tunnel

Ruijie(config-if)#	Tunnel
Ruijie(config-if)#	Tunnel

IPv4 IPv4 tos
IPv4 IPv4 tos

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MTU
IP DF Don't Fragment
PMTU mtu(IP)Tj/C2_0 1 Tf0.04 T6<3.463 0 Td-6<0EFB11E3>-6<02A141E61D

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UP

Ruijie(config-if)# [*seconds* [*retries*]]	Tunnel
Ruijie(config-if)#	Tunnel
	tunnel vrf ip vrf forward

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IPv4 VRF

Ruijie(config-if)# *vrf-name*	Tunnel VRF
Ruijie(config-if)#	Tunnel VRF

IPv4 VRF IP
IP VRF VRF IP
down

	tunnel vrf IPv4 over IPv4 GRE

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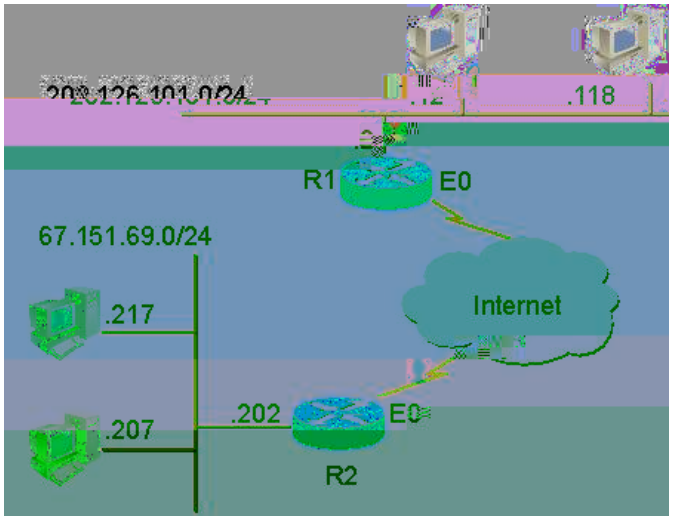
4.2



15 Tunnel

R1 R2 Tunnel R1 R2 3 R2 202.126.101.0/24 R2 67.151.69.0/24 R1 R2 Tunnel R

```
ip address 67.151.69.202 255.255.255.0
!
```

R1 R2 f0/0 Tunnel f0/1

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show interfaces tunnel debug [gre/ip | ipip]

Ruijie# *tunnel-number*	Tunnel
Ruijie#	GRE
Ruijie#	Tunnel
Ruijie#	Tunnel

show interfaces tunnel debug

show interfaces tunnel

```
Ruijie# show interfaces tunnel 1
Tunnel 1 is UP  , line protocol is UP
Hardware is  Tunnel
Interface address is: 1.1.1.1/24
MTU 1500 bytes, BW 9 Kbit
Encapsulation protocol is Tunnel, loopback not set
Keepalive interval is 0 sec , no set
Carrier delay is 0 sec
RXload is 1 ,Txload is 1
Tunnel source 192.168.200.200 (FastEthernet 0/0), destination
192.168.200.100
Tunnel protocol/transport GRE/IP, key 0xea
Order sequence numbers 0/0 (tx/rx)
Checksumming of packets enabled  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
```

Tunnel IP
MTU Bandwidth

debug

```
Ruijie# debug gre/ip
Ruijie#
GRE: to decaps 192.168.200.100->192.168.200.200(len=132
ttl=255) 112
```

(192.168.200.100) GRE/IP
GRE IP

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Tunnel

Tunnel Tunnel
Tunnel ( ) Tunnel
( )

Tunnel Tunnel
Tunnel

Tunnel GRE Tunnel

GRE Tunnel Tunnel Key

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sniffer

IPSec IKE

IPSec IETF IPSec
IPSec IP

IKE IPSec IKE UDP
IPSec IKE IPSec

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IPSec IPSec

AH
ESP
DES 64bits 56bits
3DES 192bits 168bits
AES AES 128 128 AES

SM1 128 SM1
CBC

NULL:

MD5-HMAC 5 HASH

HH

IPSec

IPSec

IPSec

IPSec IPSec IPSec

IPSec SNMP IPSec

IPSec mib

	IKE UDP 500 IPSec ESP AH 50 51 IPSec IPSec 50 51 UDP 500

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Ruijie(config)# *seconds*	IPSec SA
Ruijie(config)# *kilobytes*	IPSec SA IPSec KB
Ruijie#	
Ruijie#	{*ip-address* | *peer-name*}
Ruijie#	*map-name*

	SA peer map SA

1 3600 4,608,000KB 10

1

IKE IPSec

IPSec IKE IPSec

seconds

kilobytes

ipsec-manual

30

256K

IPSec

DF bit 0 1

IP DF bit 1 0
IPsec IPSec
ip DF bit ip DF bit

DF bit

Ruijie(config)# [| |]	ip DF bit

DF bit FastEthernet0/0 DF bit
FastEthernet0/0 mtu
FastEthernet0/0 IP DF bit

```
crypto isakmp policy 1
hash md5
authentication pre-share
crypto isakmp key 0 DELaware address 192.168.10.66
crypto isakmp key 0 Key-What-Key address 192.168.11.19
!
!
crypto ipsec transform-set BearMama ah-md5-hmac esp-des
crypto ipsec df-bit clear
!
!
```

```
crypto map armadillo 1 ipsec-isakmp
set peer 192.168.10.66
set transform-set BearMama
match address 101
!
crypto map basilisk 1 ipsec-isakmp
set peer 192.168.11.19
set transform-set BearMama
match address 102
!
!
interface FastEthernet0/0
ip address 192.168.10.38 255.255.255.0
ip broadcast-address 0.0.0.0
crypto map armadillo
crypto ipsec df-bit copy
!
interface FastEthernet0/1
ip address 192.168.11.75 255.255.255.0
ip broadcast-address 0.0.0.0
crypto map basilisk
!
```

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A 192.168.202.0/24 B 192.168.12.0/24 IP 120 A B IP 101

access-list 120 permit ip 192.168.12.0 0.0.0.255 192.168.202.0 0.0.0.255

access-list 101 permit ip host 2.2.2.2 host 2.2.2.1

IPSec

IPSec permit=

IPSec

permit

IPSec

IPSec IKE IPSec ipsec-isakmp

Ruijie(config)#
access-list-number { | } *protocol*
source source-wildcard destination
destination-wildcard [ ]

Ruijie(config)# *transform-set-name transform1* [*transform2* [*tr Tdsnsfor*]]*Tdm3*	transform

ah-md5-hmac esp-des esp-sha-hmac	AH ESP HMAC	MD5 HMAC DES	 SHA
ah-md5-hmac esp-null esp-sha-hmac	AH ESP HMAC	MD5 HMAC	 SHA
ah-sha-hmac esp-des esp-md5-hmac	AH ESP HMAC	SHA HMAC DES	 MD5
ah-sha-hmac esp-null esp-md5-hmac	AH ESP HMAC	SHA HMAC	 MD5
ah-sha-hmac esp-des esp-sha-hmac	AH ESP HMAC	SHA HMAC DES	 SHA
ah-sha-hmac esp-null sp-sha-hmac	AH ESP HMAC	SHA HMAC	 SHA
esp-des esp-md5-hmac	ESP HMAC	DES	MD5
esp-null esp-md5-hmac	ESP		MD5 HMAC
esp-des esp-sha-hmac	ESP HMAC	DES	SHA
esp-null esp-sha-hmac	ESP		SHA HMAC
esp-3des	ESP	3DES	
esp-3des esp-sha	ESP HMAC	3DES	SHA
esp-3des esp-md5	ESP HMAC	3DES	MD5
ah-md5-hmac esp-des	AH ESP	MD5 HMAC 3DES	
ah-sha-hmac esp-des	AH ESP	SHA HMAC 3DES	
ah-md5-hmac esp-3des esp-sha	AH ESP HMAC	MD5 HMAC 3DES	 SHA
ah-sha-hmac esp-3des esp-sha	AH ESP HMAC	SHA HMAC 3DES	 SHA
ah-md5-hmac esp-3des esp-md5	AH ESP HMAC	MD5 HMAC 3DES	 MD5
ah-sha-hmac esp-3des esp-md5	AH ESP	SHA HMAC 3DES	

	esp-des esp-des esp-md5-hmac esp-des esp-sha-hmac

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IPSec mib IPSec
IPsec mib IPSec
mib CLI IPSec MIB

Ruijie(config)#	ipsec mib

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ACL IPSec
IPSec

Ruijie(config)#	

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IPSec
IPSec IPSec
IPSec IPSec

IPSec

IKE

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IP
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IPSec

IPSec/IKE IPSec/

seq- num seq-num

IPSec

IPSec

Ruijie(config)# *map-name seq-num*	
Ruijie(config-crypto-map)# *access-list-id*	IPSec IPSec
Ruijie(config-crypto-map)# {*hostname* | *ip-address*}	IPSec IPSec ike peer

Ruijie(config-crypto-map)# *spi hex-key-data*	AH AH SPIs spi spi
Ruijie(config-crypto-map)#	*spi hex-key-data*
Ruijie(config-crypto-map)# *spi hex-key-data* [*hex-key-data*]	ESP ESP ESP ESP spi spi
Or Ruijie(config-crypto-map)# [*hex-key-data*]	*spi hex-key-data*
Ruijie(config-crypto-map)# *length*	
Ruijie(config-crypto-map)#	

```
set session-key inbound esp 300 cipher abcdef1234567890
set session-key outbound esp 301 cipher abcdef1234567890
set transform-set myset
match address 101
!
access-list 101 permit ip 192.168.202.0 0.0.0.255 192.168.12.0 0.0.0.255
```

IPSec MD5 SHA

	Ruijie17config01#
Ruijie(config)#	

Ruijie(config-crypto-map)# *access-list-id*	IPSec IPSec
Ruijie(config-crypto-map)# {*hostname* | *ip-address*}	IPSec IPSec peer
Ruijie(config-crypto-map)# *transform-set-name1* [*transform-set-name2…transform-set-name6*]	
Ruijie(config-crypto-map)# *seconds*	
Or Ruijie(config-crypto-map)#	*kilobytes*
Ruijie(config-crypto-map)# *main* | *aggressive*	
Ruijie(config-crypto-map)# *group1* | *group2*	Diffie-Hellman
Ruijie(config-crypto-map)# *length*	
Ruijie(config-crypto-map)#	

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#

```
crypto map mymap 3 ipsec-isakmp
set peer 2.2.2.1
set transform-set myset
match address 101
!
access-list 101 permit ip 192.168.202.0 0.0.0.255 192.168.12.0 0.0.0.255
```

	IKE

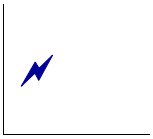
	IKE des des IKE

ike ip

ip

ip ike

access list permit SA
SA SA
SA



permit any permit
deny IPSec

Ruijie(config)# *dynamic-map-name dynamic-seq-num*	
Ruijie(config-crypto-map)# *transform-set-name1* [*transform-set-name2...transform-set-name6*]	

Ruijie(config-crypto-map)#

Ruijie (config)# *map-name* *seq-num* *dynamic-map-name*	

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Ruijie(config-if)#	

Ruijie(config-crypto-map)#	

IKE

A

```
#              myset
crypto ipsec transform-set myset esp-des
#            IKE                      profile-name
crypto ipsec profile profile-name
  set transform-set myset
```

B

```
#              myset
crypto ipsec transform-set myset  esp-des
#            IKE                      mymap
crypto ipsec profile profile-name
  set transform-set myset
```

	IPV6 IPSEC-IPV4 IPSEC-IPV6 profile-name match any match any Profile map IPIP IPV6 Tunnel

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Profile Tunnel

Ruijie(config-if-Tunnel 1)#	IPIP

	Profile Tunnel Tunnel GRE IPIP IPV6 Tunnel Profile match any IPIP IPV6 Tunnel

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IPSec

IPSec

IPSec

Ruijie#	
Ruijie# {*ip-address* | *peer-name*}	
Ruijie# *map-name*	
Ruijie# *destionation-address* { | } *spi*	< SPI>

IPSec

Ruijie#	
Ruijie# [*map-name*]	
Ruijie#	IPSec
Ruijie# [*tag* *map-name*]	
Ruijie#	ipsec debug
Ruijie#	ipsec debug

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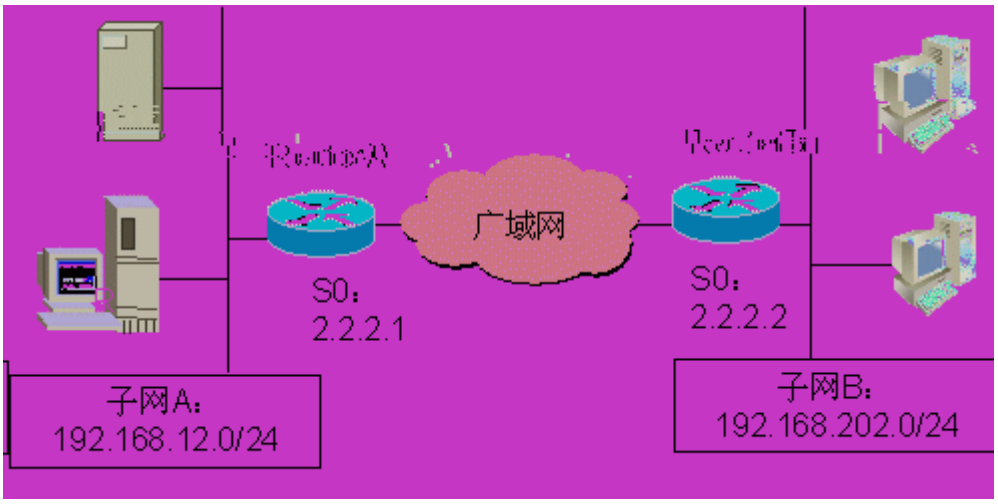
2 A 192.168.12.0/24 B 192.168.202.0/24 IP
RouterA 192.168.12.1 RouterB
192.168.202.1 ESP-DES-SHA



17 IPSec

IP
IKE RouterA RouterB RouterA
IKE ”IKE “

RouterA

```
#
access-list 101 permit ip 192.168.12.0 0.0.0.255 192.168.202.0 0.0.0.255
#
crypto ipsec transform-set myset esp-des esp-sha-hmac
#          IPSec                                                    .
crypto map mymap 10 ipsec-manual
match address 101
set transform-set myset
set session-key inbound esp 301 cipher 0123456789abcdef authenticator
00001111222233334444555566667777788889999
```

```
set session-key outbound esp 300 cipher 0123456789abcdef authenticator
55556666777788889999000011112222333344444
set peer 2.2.2.2
!
interface Fastethernet 0
ip address 192.168.12.1 255.255.255.0
#
interface Serial 0
ip address 2.2.2.1 255.255.255.0
crypto map mymap
!
```

IKE

IKE

IKE

IKE ID

IKE

IKE

DPD on-demand periodic

nat-t udp nat nat
keepalive udp

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IKE SM1

IKE IKE

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IKE IKE IPSec

IPSec

IKE

Ruijie(config)#

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IKE UDP UDP 500

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IKE IKE IKE #

IKE

DES-

56 DES-CBC,168 3DES-CBC,128 AES-CBC 128
SM1-CBC
SHA-1 MD5 MD5 SHA-1
MD5 IKE HMAC
MD5
RGOS

Diffie-Hellman 768 1024 Diffie-Hellman 1024
Diffie-Hellman CPU
IKE IPSec IKE

IKE IPSec

IKE
1 10000 1

HASH Diffie-Hellman

Ruijie(config)# *Priority*	
Ruijie(config-isakmp)#	
Ruijie(config-isakmp)# { | }	HASH
Ruijie(config-isakmp)# { }	
Ruijie(config-isakmp)# { | }	Diffie-Hellman
Ruijie(config-isakmp)# *seconds*	IKE
Ruijie(config-isakmp)#	

IKE

Ruijie#	IKE

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IKE

Ruijie(config)# *map-name seq-num*	
Ruijie(config-crypto-map)# { | }	ike

Ruijie(config)#	

ike

Ruijie#	IKE

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Ruijie(config)# | | *identity*	Address IP Fqdn User-fqdn @

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Ruijie(config)#	

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Router(config)#	IKE

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IKE

IKE

Ruijie#	IKE
Ruijie# [*connection-id*]	IKE connection-id IKE
Ruijie#	IKE

IKE

IKE

Ruijie#	IKE

Ruijie#
Ruijie#

```
group 1
lifetime 1000


Ruijie# show crypto isakmp policy
Protection suite of priority 4
encryption algorithm:   3DES - Data Encryption Standard (56 bit keys).
hash algorithm:         Secure Hash Standard
authentication method:  Rsa-Sig
Diffie-Hellman group:   #1 (1024 bit)
lifetime:               1000 seconds
Protection suite of priority 5
encryption algorithm:   DES - Data Encryption Standard (56 bit keys).
hash algorithm:         Secure Hash Standard
authentication method:  Pre-Shared Key
Diffie-Hellman group:   #2 (1024 bit)
lifetime:               1000 seconds
Protection suite of priority 6
encryption algorithm:   DES - Data Encryption Standard (56 bit keys).
hash algorithm:         Secure Hash Standard
authentication method:  Rsa-Sig
Diffie-Hellman group:   #1 (768 bit)
lifetime:             1000 seconds
Default protection suite
encryption algorithm:   DES - Data Encryption Standard (56 bit keys).
hash algorithm:         Secure Hash Standard
authentication method:       Rsa-Sig
Diffie-Hellman group:   #1 (768 bit)
lifetime:               86400 seconds
```

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IP Cisco A

B

3des

ESP-DES-MD5

Cisco 3:

18 IPSec

RouterA IKE

Cisco

IKE

RouterA

```
!
hostname "RouterA"
#     IKE
crypto isakmp enable
crypto isakmp policy 1
authentication pre-share
encrytiong 3des
!
#
crypto isakmp key 0 preword address 2.2.2.1
crypto ipsec transform-set myset  esp-des esp-md5-hmac
#
crypto map mymap 5 ipsec-isakmp
set peer 2.2.2.1
set transform-set myset
match address 101
!
```

```
interface FastEthernet0
ip address 192.168.202.1 255.255.255.0
#
interface Serial0
ip address 2.2.2.2 255.255.255.0
encapsulation ppp
crypto map mymap
!
ip route 0.0.0.0 0.0.0.0 Serial0
#                    192.168.202.0/24    192.168.12.0/24            IP

access-list 101 permit ip 192.168.202.0 0.0.0.255 192.168.12.0 0.0.0.255
!
end
```

Cisco

```
!
hostname Cisco
#     IkE
crypto isakmp policy 1
authentication pre-share
encryption 3des
#
crypto isakmp key 0 preword address 2.2.2.2
#
crypto ipsec transform-set myset esp-des esp-md5-hmac
#
crypto map mymap 5 ipsec-isakmp
set peer 2.2.2.2
set transform-set myset
match address 101
!
interface FastEthernet0/0
ip address 192.168.12.1 255.255.255.0
#
interface Serial0
ip address 2.2.2.1 255.255.255.0
encapsulation ppp
crypto map mymap
```

```
!
ip route 192.168.202.0 255.255.255.0 Serial0
#                  192.168.12.0/24   192.168.202.0/24          IP

access-list 101 permit ip 192.168.12.0 0.0.0.255 192.168.202.0 0.0.0.255
!
end
```

RouterA

```
!
hostname "RouterA"
#
crypto ipsec transform-set myset  esp-des esp-md5-hmac
#
crypto map mymap 5 ipsec-manual
set peer 2.2.2.1
set session-key inbound esp 300 cipher abcdef1234567890
authenticator abcdef1234567890abcdef1234567890  //
set session-key outbound esp 301 cipher abcdef1234567890
authenticator abcdef1234567890abcdef1234567890  //
set transform-set myset
match address 101
!
interface FastEthernet0
ip address 192.168.202.1 255.255.255.0
#
interface Serial0
ip address 2.2.2.2 255.255.255.0
encapsulation ppp
crypto map mymap
!
ip route 0.0.0.0 0.0.0.0 Serial0
#                    192.168.202.0/24    192.168.12.0/24           IP

access-list 101 permit ip 192.168.202.0 0.0.0.255 192.168.12.0 0.0.0.255
!
end
```

Cisco

```
!
hostname Cisco
#
crypto ipsec transform-set myset esp-des esp-md5-hmac
#
crypto map mymap 5 ipsec-manual
set peer 2.2.2.2
 n ± x ö%   "|      e40ŒjÌfc a ™n`)•)‘– † ` ™   V ™ ahb ` ™  &U`Á & "nm   E| p      %…l ,¥ { `€  S*üÐ a• #C
```

```
#
Get acquire: 192.168.202.0/0.0.0.255 -> 192.168.12.0/0.0.0.255 , prot
0, port 0/0
Acquire negotiate with 2.2.2.1
(36) Beginning Quick Mode exchange, M-ID of 4445127
(36) sending packet to 2.2.2.1 (I) QM_SI1_WR1
ipsec_output:423, get item acclist 101
ipsec_output:429, match  3
(36) received packet from 2.2.2.1 (I) QM_SI1_WR1
payload format: <Hdr>,<hash> <sa> <nonce> <id>
(36) processing SA payload. message ID = 4445127
(36) Creating IPSec SAs.
inbound SA has spi 4445127
protocol esp, DES_CBC
auth MD5
outbound SA has spi 275385850
protocol esp, DES_CBC
auth MD5
lifetime of 3600 seconds, soft 3570 seconds
lifetime of 4608000 kilobytes, soft 256 kilobytes
ipsec_output:423, get item acclist 101
ipsec_output:429, match  3
(36) sending packet to 2.2.2.1 (I) QM_IDLE
(36) Phase_2 negotiate complete!
```

IKE IPSec

```
RouterA# show crypto isakmp sa
destination    source         state                conn-id
lifetime(second)
2.2.2.1         2.2.2.2         QM_IDLE              36
5013
```

IKE

```
RouterA# show crypto ipsec sa
Interface: Serial0
Crypto map tag:mymap, local addr  2.2.2.2  //               mymap
         2.2.2.2
media mtu 1500
local  ident (addr/mask/prot/port): (192.168.202.0/0.0.0.255/0/0))
remote  ident (addr/mask/prot/port): (192.168.12.0/0.0.0.255/0/0))
PERMIT            //    192.168.202.0/24   192.168.12.0/24
current_peer: 2.2.2.1                  //             2.2.2.1
#pkts encaps: 3, #pkts encrypt: 3, #pkts digest 3
```

```
#pkts decaps: 3, #pkts decrypt: 3, #pkts verify 3
#send errors 0, #recv errors 0
//

inbound esp sas:                //                          ESP
spi:0x43D3C7 (4445127)                        //spi      4445127
transform: esp-des esp-md5-hmac          //          esp-des-md5
in use settings={Tunnel,}                               //
sa timing: remaining key lifetime (k/sec): (4607999/3578)
//                          4607999      /3578
IV size: 8 bytes                                    //IV          8
Replay detection support:Y                             //
outbound esp sas:                //                          ESP
spi:0x106A0DFA (275385850)                  //spi      275385850
transform: esp-des esp-md5-hmac         //          esp-des-md5
in use settings={Tunnel,}                               //
sa timing: remaining key lifetime (k/sec): (4607999/3577)
//                          4607999      /3577
IV size: 8 bytes                                    //IV          8
Replay detection support:Y                             //
```

IPSec

```
RouterA# show crypto ipsec sa
Interface: Serial0
Crypto map tag:mymap, local addr  2.2.2.2  //                mymap
         2.2.2.2
media mtu 1500
local  ident (addr/mask/prot/port): (192.168.202.0/0.0.0.255/0/0))
remote  ident (addr/mask/prot/port): (192.168.12.0/0.0.0.255/0/0))
PERMIT             //    192.168.202.0/24   192.168.12.0/24
current_peer: 2.2.2.1                     //              2.2.2.1
#pkts encaps: 8, #pkts encrypt: 8, #pkts digest 8
#pkts decaps: 8, #pkts decrypt: 8, #pkts verify 8
#send errors 0, #recv errors 0
//

inbound esp sas:                //
```

```
transform: esp-des esp-md5-hmac          //          esp-des-md5
in use settings={Tunnel,}                              //
no sa timing                                          //
IV size: 8 bytes                                    //IV          8
Replay detection support:N                           //
outbound esp sas:                //                          ESP
spi: 0x12D (301)                                     //spi       301
transform: esp-des esp-md5-hmac          //          esp-des-md5
in use settings={Tunnel,}                             //
no sa timing                                          //
IV size: 8 bytes                                    //IV          8
Replay detection support:N                           //
```

IPSec

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IP A

A B B 4

ESP-DES-MD5

A ip :202.1.1.2/24 Internet

B ADSL pppoe Internet ip ISP

IKE

19 IPSec

RouterB RouterA

RouterB

```
!
hostname "RouterB"
#     IKE
crypto isakmp enable
#
crypto isakmp policy 1
authentication pre-share
crypto isakmp key 0 preword address 202.1.1.2
crypto ipsec transform-set myset  esp-des esp-md5-hmac
#
crypto map mymap 5 ipsec-isakmp
set peer 202.1.1.2
set transform-set myset
match address 101
!
interface FastEthernet0
ip address 192.168.12.1 255.255.255.0
```

```
interface FastEthernet1
no ip addrsss
pppoe enable
pppoe-client 1 dial-pool-number 1 dial-on-demand
#
interface Dialer0
mtu 1488
ip address negotiate
encapsulation ppp
ppp pap sent-username xxx password xxx
crypto map mymap
dialer idle-timeout 2400
dialer pool 1
dialer-group 1
!
dialer-list protocol ip permit
ip route 0.0.0.0 0.0.0.0 Dialer0 permanent
#                   192.168.12.0/24   192.168.1.0/24          IP
access-list 101 permit ip 192.168.12.0 0.0.0.255 192.168.1.0 0.0.0.255
!
end
```

RouterA

```
!
hostname “RouterA”
#     IkE
crypto isakmp policy 1
authentication pre-share
#                              ip

crypto isakmp key 0 preword address 0.0.0.0 0.0.0.0
#
crypto ipsec transform-set myset esp-des esp-md5-hmac
#
crypto dynamic-map dymymap 5
set transform-set myset
match address 101
!
```

```
#
crypto map mymap 10 ipsec-isakmp dynamic  dymymap
!
interface FastEthernet0/0
ip address 192.168.1.1 255.255.255.0
#
interface Serial0
ip address 202.1.1.2 255.255.255.0
encapsulation ppp
crypto map mymap
!
ip route 0.0.0.0 0.0.0.0  Serial0
#                    192.168.1.0/24   192.168.12.0/24          IP
access-list 101 permit ip 192.168.1.0 0.0.0.255 192.168.12.0 0.0.0.255
!
end
```

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RouterB RouterA

RouterB

```
!
hostname "RouterB"
#     IKE
crypto isakmp enable
#
self-identity fqdn www.google.com
#
crypto isakmp key 0 preword address 202.1.1.2
crypto ipsec transform-set myset  esp-des esp-md5-hmac
#
```

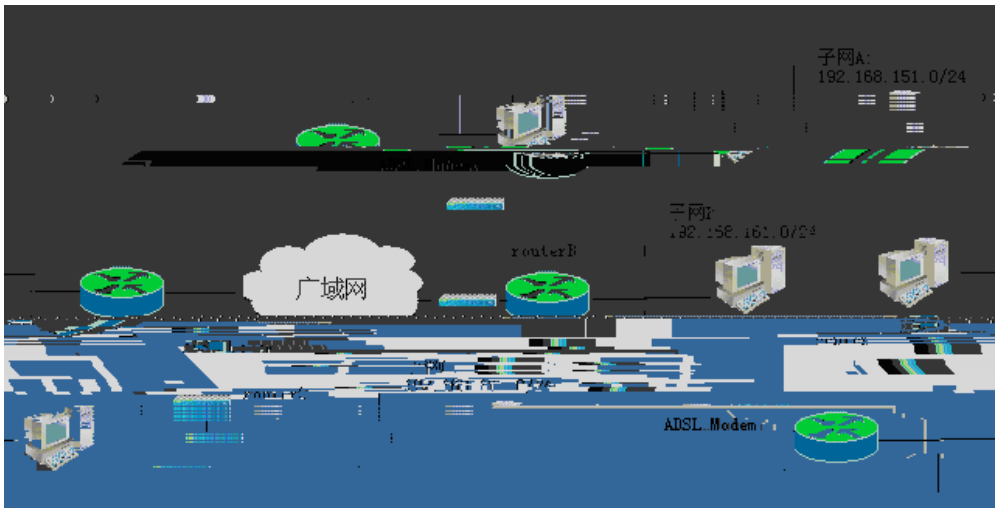
```
no ip addrsss
pppoe enable
pppoe-client 1 dial-pool-number 1 dial-on-demand
#
interface Dialer0
mtu 1488
ip address negotiate
encapsulation ppp
ppp pap sent-username xxx password xxx
crypto map mymap
dialer idle-timeout 2400
dialer pool 1
dialer-group 1
!
dialer-list protocol ip permit
ip route 0.0.0.0 0.0.0.0 Dialer0 permanent
#                   192.168.12.0/24   192.168.1.0/24          IP
access-list 101 permit ip 192.168.12.0 0.0.0.255 192.168.1.0 0.0.0.255
!
end
```

RouterA

```
!
hostname “RouterA”
#     IkE
crypto isakmp policy 1
authentication pre-share
#                                ip                      hostname

crypto isakmp key 0 preword hostname www.google.com
#
crypto isakmp mode-detect
#
crypto ipsec transform-set myset esp-des esp-md5-hmac
#
crypto dynamic-map dymymap 5
set transform-set myset
match address 101
```

```
!
#
crypto map mymap 10 ipsec-isakmp dynamic  dymymap
!
interface FastEthernet0/0
ip address 192.168.1.1 255.255.255.0
#
interface Serial0
ip address 202.1.1.2 255.255.255.0
```



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Center

```
hostname center
!
!
route-map static-ospf permit 10
 match ip address 1
!
access-list 1 permit 0.0.0.0 255.255.255.0
!
vpdn enable
!
vpdn-group 1
! Default L2TP VPDN group
accept-dialin
protocol l2tp
virtual-template 1
l2tp tunnel force_ipsec
source-ip 63.23.12.212
!
username RGOS password 0 RGOS
!
#
crypto pki certificate chain
certificate ca 56AE073C10A17E8C45AE8D3F15523357
3082032E 308202D8 A0030201 02021056 AE073C10 A17E8C45 AE8D3F15 52335730
0D06092A 864886F7 0D010105 05003081 AC312130 1F06092A 864886F7 0D010901
16126469 6E676A73 40737461 722D6E65 742E636E 310B3009 06035504 06130243
4E310F30 0D060355 04081306 46754A69 616E310F 300D0603 55040713 0646755A
```

686F7531 20301E06 0355040A 13175265 6769616E 74204E65 74776F72 6B20436F
2E204C74 64311D30 1B060355 040B1314 52657365 61726368 20417061 72746D65
6E742035 31173015 06035504 03130E43 41207465 73742073 65727665 72301E17
0D303530 32323530 38343630 325A170D 30373033 30313032 33363233 5A3081AC
3121301F 06092A86 4886F70D 01090116 1264696E 676A7340 73746172 2D6E6574
2E636E31 0B300906 03550406 1302434E 310F300D 06035504 08130646 754A6961
6E310F30 0D060355 04071306 46755A68 6F753120 301E0603 55040A13 17526567
69616E74 204E6574 776F726B 20436F2E 204C7464 311D301B 06035504 0B131452
65736561 72636820 41706172 746D656E 74203531 17301506 03550403 130E4341
20746573 74207365 72766572 305C300D 06092A86 4886F70D 01010105 00034B00
30480241 00D91F1A C60EF951 924CDC96 4D4443FA DABE53F2 DDF513B6 34B5A6A1
9FFD57A1 6C6F7AF4 A113C159 3D0C4C3E 8E62DE76 D8A24CF2 2CF8DA82 AA17D3E8
CC80C295 8F020301 0001A381 D33081D0 300B0603 551D0F04 04030201 C6300F06
03551D13 0101FF04 05300301 01FF301D 0603551D 0E041604 14724384 1C2B0345
2D8258F5 844377F5 21AA4B2C 21307F06 03551D1F 04783076 3038A036 A0348632
68747470 3A2F2F7A 6A2D726F 75746572 2F436572 74456E72 6F6C6C2F 43412532
30746573 74253230 73657276 65722E63 726C303A A038A036 86346669 6C653A2F
2F5C5C7A 6A2D726F 75746572 5C436572 74456E72 6F6C6C5C 43412532 30746573
74253230 73657276 65722E63 726C3010 06092B06 01040182 37150104 03020101
300D0609 2A864886 F70D0101 05050003 41007F2E 7D1676B5 560EDD1E D80B4205
3B39A742 B8E06813 786E9992 2E4C5860 AB4AF193 63A34170 50BD756A AEA7086A
7A9FC2AC D1D8A3A0 CC6779D0 76CE7D1A 7F4C
quit
!
certificate 1FFC97F0000100000029
308204B3 3082045D A0030201 02020A1F FC97F000 01000000 29300D06 092A8648
86F70D01 01050500 3081AC31 21301F06 092A8648 86F70D01 09011612 64696E67
6A734073 7461722D 6E65742E 636E310B 30090603 55040613 02434E31 0F300D06
03550408 13064675 4A69616E 310F300D 06035504 07130646 755A686F 75312030
1E060355 040A1317 52656769 616E7420 4E657477 6F726B20 436F2E20 4C746431
1D301B06 0355040B 13145265 73656172 63682041 70617274 6D656E74 20353117
30150603 55040313 0E434120 74657374 20736572 76657230 1E170D30 35303332
31303632 3335395A 170D3036 30333231 30363333 35395A30 81A63122 30200609
2A864886 F70D0109 0116137A 68616F6A 756E4073 7461722D 6E65742E 636E310B
30090603 55040613 02434E31 0F300D06 03550408 13064675 4A69616E 310F300D
06035504 07130646 755A686F 75312030 1E060355 040A1317 52656769 616E7420
4E657477 6F726B20 436F2E20 4C746431 1D301B06 0355040B 13145265 73656172
63682041 70617274 6D656E74 20353110 300E0603 55040313 077A6861 6F6A756E
305C300D 06092A86 4886F70D 01010105 00034B00 30480241 00BB70FF 351D18F5
7735FE4F C890AF42 8E8744BA D946C4B8 61F046DF 614E4A37 D8A3BA80 7003D7E1
BC5394F3 58DDE033 4ABA82D1 AEAD4C10 3135C2AE BB58FA2F 75020301 0001A382
02633082 025F300E 0603551D 0F0101FF 04040302 06C03013 0603551D 25040C30

```
0A06082B 06010505 08020230 1D060355 1D0E0416 0414420E 87E0F7C1 B744AFE3
2C1EFD64 E03E2144 844C3081 E8060355 1D230481 E03081DD 80147243 841C2B03
452D8258 F5844377 F521AA4B 2C21A181 B2A481AF 3081AC31 21301F06 092A8648
86F70D01 09011612 64696E67 6A734073 7461722D 6E65742E 636E310B 30090603
55040613 02434E31 0F300D06 03550408 13064675 4A69616E 310F300D 06035504
07130646 755A686F 75312030 1E060355 040A1317 52656769 616E7420 4E657477
6F726B20 436F2E20 4C746431 1D301B06 0355040B 13145265 73656172 63682041
70617274 6D656E74 20353117 30150603 55040313 0E434120 74657374 20736572
76657282 1056AE07 3C10A17E 8C45AE8D 3F155233 57307F06 03551D1F 04783076
3038A036 A0348632 68747470 3A2F2F7A 6A2D726F 75746572 2F436572 74456E72
6F6C6C2F 43412532 30746573 74253230 73657276 65722E63 726C303A A038A036
86346669 6C653A2F 2F5C5C7A 6A2D726F 75746572 5C436572 74456E72 6F6C6C5C
43412532 30746573 74253230 73657276 65722E63 726C3081 AC06082B 06010505
07010104 819F3081 9C304B06 082B0601 05050730 02863F68 7474703A 2F2F7A6A
2D726F75 7465722F 43657274 456E726F 6C6C2F7A 6A2D726F 75746572 5F434125
32307465 73742532 30736572 76657228 31292E63 7274304D 06082B06 01050507
30028641 66696C65 3A2F2F5C 5C7A6A2D 726F7574 65725C43 65727445 6E726F6C
6C5C7A6A 2D726F75 7465725F 43412532 30746573 74253230 73657276 65722831
292E6372 74300D06 092A8648 86F70D01 01050500 034100AF 173B4A23 E95C8042
ED4F2F97 0D869C1E 715800E6 F64F505F 1A6F291C 4B8C95C8 2FE04F9C CA81778F
07A2DE20 C9640A8B DD36BCC0 359C26BB D5A5E434 B5F46B
quit
!
!
# IKE
!
#
crypto ipsec transform-set myset  esp-des
#
crypto dynamic-map dy 1
set transform-set myset
!
!
crypto map mymap 1 ipsec-isakmp dynamic dy
!
interface FastEthernet 0/0
ip address 63.23.12.212 255.255.255.248
crypto map mymap
duplex auto
speed auto
```

```
!
interface FastEthernet 0/1
ip address 192.168.216.1 255.255.255.0
ip address 192.168.217.1 255.255.255.0 secondary
ip address 192.168.218.1 255.255.255.0 secondary
ip address 192.168.219.1 255.255.255.0 secondary
duplex auto
speed auto
!
interface Null 0
!
interface Virtual-Template 1
mtu 1400
ip ospf mtu-ignore
ip unnumbered FastEthernet 0/1
ip mtu 1360
!
!
router ospf
redistribute static subnets route-map static-ospf
network 192.168.216.0 0.0.0.255 area 0.0.0.0
network 192.168.217.0 0.0.0.255 area 0.0.0.0
network 192.168.218.0 0.0.0.255 area 0.0.0.0
network 192.168.219.0 0.0.0.255 area 0.0.0.0
!
line con 0
exec-timeout 0 0
line aux 0
disconnect-character 240
line vty 0 4
exec-timeout 0 0
privilege level 15
no login
!
!
end
```

routerA

```
hostname routerA
!
#
```

```
access-list 177 deny icmp any any unreachable
access-list 177 permit ip any any
dialer-list 1 protocol ip permit
!
l2tp-class l2x
hostname rg36_1
!
pseudowire-class pw
encapsulation l2tpv2
protocol l2tpv2 l2x
```

```
7A9FC2AC D1D8A3A0 CC6779D0 76CE7D1A 7F4C
quit
!
certificate 11F7C51700010000003E
308204B1 3082045B A0030201 02020A11 F7C51700 01000000 3E300D06 092A8648
86F70D01 01050500 3081AC31 21301F06 092A8648 86F70D01 09011612 64696E67
6A734073 7461722D 6E65742E 636E310B 30090603 55040613 02434E31 0F300D06
03550408 13064675 4A69616E 310F300D 06035504 07130646 755A686F 75312030
1E060355 040A1317 52656769 616E7420 4E657477 6F726B20 436F2E20 4C746431
1D301B06 0355040B 13145265 73656172 63682041 70617274 6D656E74 20353117
30150603 55040313 0E434120 74657374 20736572 76657230 1E170D30 35303431
32303932 3935335A 170D3036 30343132 30393339 35335A30 81A43121 301F0609
2A864886 F70D0109 01161264 696E676A 73407374 61722D6E 65742E63 6E310B30
09060355 04061302 434E310F 300D0603 55040813 0646754A 69616E31 0F300D06
03550407 13064675 5A686F75 3120301E 06035504 0A131752 65676961 6E74204E
6574776F 726B2043 6F2E204C 7464311D 301B0603 55040B13 14526573 65617263
68204170 6172746D 656E7420 35310F30 0D060355 04031306 64696E67 6A73305C
300D0609 2A864886 F70D0101 01050003 4B003048 024100CD 2C3B2981 FF9BF7E6
F9DFFCF9 495FE6AA 6691FD76 BB5EBEC3 5A1E48F8 8B75DD68 9E79AC5A 36C0B4F4
AA959323 49EEEB7F 24B546B8 74421F17 401033AE EC3F4102 03010001 A3820263
3082025F 300E0603 551D0F01 01FF0404 030204F0 30130603 551D2504 0C300A06
082B0601 05050802 02301D06 03551D0E 04160414 216567F3 E72263B2 4990E14D
ECC22471 1596A71F 3081E806 03551D23 0481E030 81DD8014 7243841C 2B03452D
8258F584 4377F521 AA4B2C21 A181B2A4 81AF3081 AC312130 1F06092A 864886F7
0D010901 16126469 6E676A73 40737461 722D6E65 742E636E 310B3009 06035504
06130243 4E310F30 0D060355 04081306 46754A69 616E310F 300D0603 55040713
0646755A 686F7531 20301E06 0355040A 13175265 6769616E 74204E65 74776F72
6B20436F 2E204C74 64311D30 1B060355 040B1314 52657365 61726368 20417061
72746D65 6E742035 31173015 06035504 03130E43 41207465 73742073 65727665
72821056 AE073C10 A17E8C45 AE8D3F15 52335730 7F060355 1D1F0478 30763038
A036A034 86326874 74703A2F 2F7A6A2D 726F7574 65722F43 65727445 6E726F6C
6C2F4341 25323074 65737425 32307365 72766572 2E63726C 303AA038 A0368634
66696C65 3A2F2F5C 5C7A6A2D 726F7574 65725C43 65727445 6E726F6C 6C5C4341
25323074 65737425 32307365 72766572 2E63726C 3081AC06 082B0601 05050701
0104819F 30819C30 4B06082B 06010505 07300286 3F687474 703A2F2F 7A6A2D72
6F757465 722F4365 7274456E 726F6C6C 2F7A6A2D 726F7574 65725F43 41253230
74657374 25323073 65727665 72283129 2E637274 304D0608 2B060105 05073002
86416669 6C653A2F 2F5C5C7A 6A2D726F 75746572 5C436572 74456E72 6F6C6C5C
7A6A2D72 6F757465 725F4341 25323074 65737425 32307365 72766572 2831292E
63727430 0D06092A 864886F7 0D010105 05000341 00148479 89448BB7 E6D3A7A7
34376464 C8D857C2 D9075263 9E278FC3 2D6C5041 036B66C7 F59ADCA5 39C9F824
A40A4C57 05373965 66671538 921FF39C B95C90F4 3F
```

```
quit
!
crypto pki revocation-check none
!
#
```

```
!
interface Null 0
!
interface Virtual-ppp 1
pseudowire 63.23.12.212 20 encapsulation l2tpv2 pw-class pw
mtu 1400
ppp pap sent-username RGOS password 0 RGOS
ip ospf mtu-ignore
no ip route-cache policy
ip unnumbered FastEthernet 0/1
ip mtu 1360
!
!
router ospf
network 192.168.161.0 0.0.0.255 area 0.0.0.0
!
ip route 0.0.0.0 0.0.0.0 dialer 0
!
!
line con 0
line aux 0
line vty 0 4
exec-timeout 0 0
privilege level 15
no login
!
!
end
```

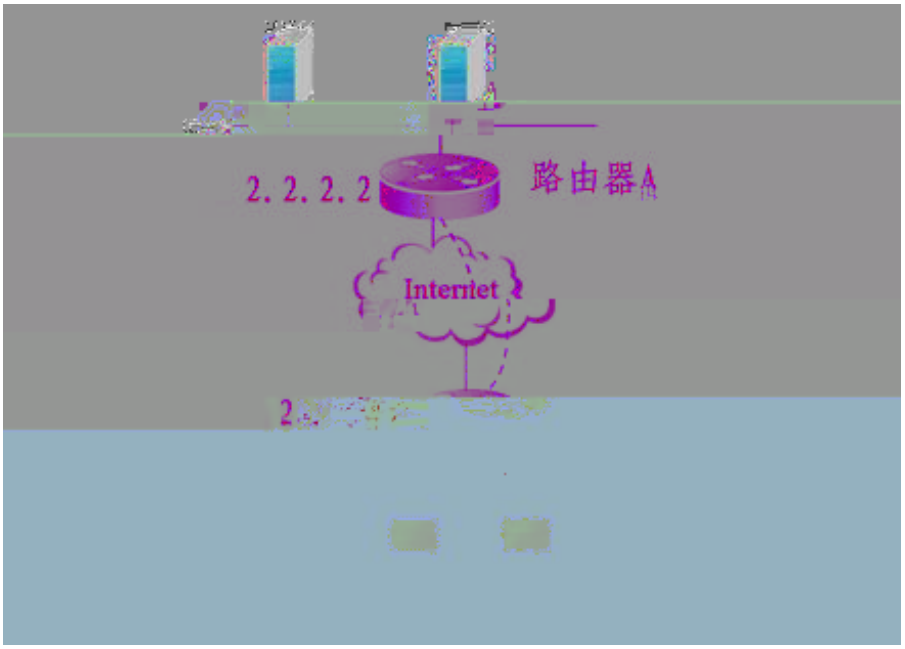
routerB routerC routerA

IP A

B 5

3des

esp-3des 5:



A

```
ip host peerhost 2.2.2.2
ip access-list extended 110
  10 permit ip host 2.2.2.3 host 2.2.2.2
crypto isakmp policy 1
  authentication pre-share
!
!
crypto isakmp key 7 01334b46391e033004 address 0.0.0.0 0.0.0.0
crypto ipsec transform-set myset    esp-3des
crypto dynamic-map dymap 100
  set transform-set myset
  reverse-route
  match address 111
!
```

!

interface FastEthernet 0/1

 ip address 200.1.1.10 255.255.255.0

 duplex auto

 speed auto

end

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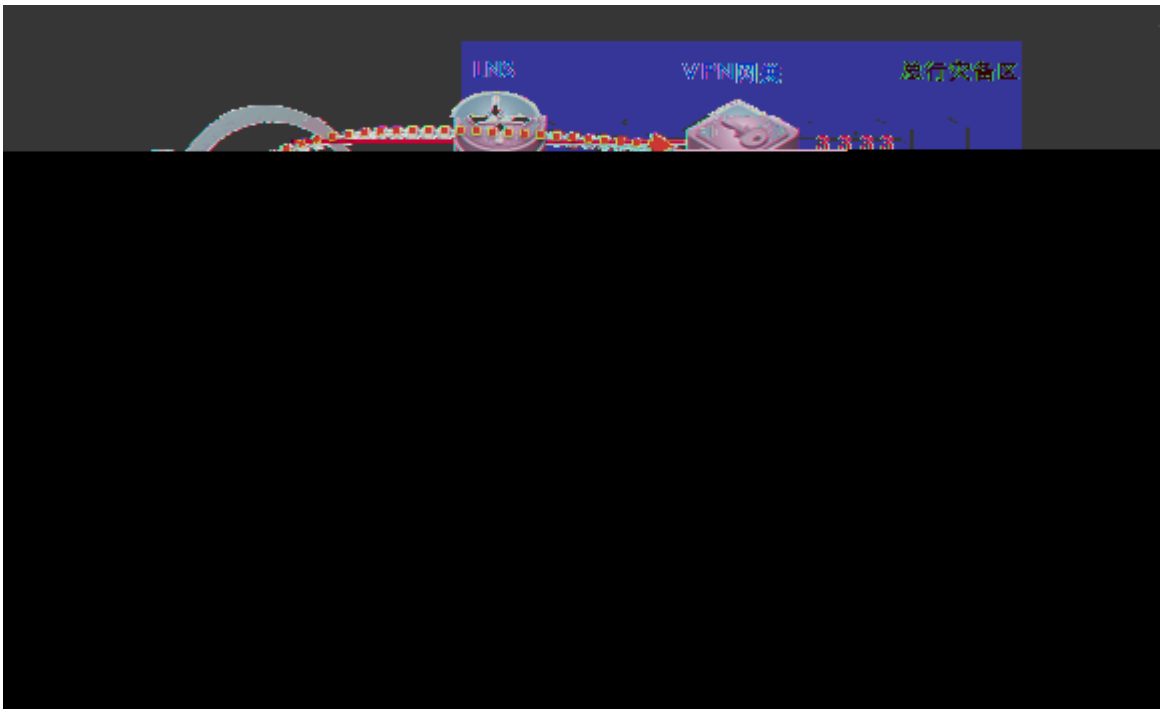
peer

6



6

vpn

A

// policy

```
!
crypto ipsec transform-set myset    esp-3des
crypto dynamic-map dymap 100
 set transform-set myset
 reverse-route
!
!
crypto map mymap 7 ipsec-isakmp dynamic dymap
interface GigabitEthernet 1/0/0
 ip ref
 ip address 2.2.2.3 255.255.255.0
 crypto map mymap
 duplex auto
 speed auto
end
                B
//              policy
!
crypto ipsec transform-set myset    esp-3des
crypto dynamic-map dymap 100
 set transform-set myset
 reverse-route
!
!
crypto map mymap 7 ipsec-isakmp dynamic dymap
interface GigabitEthernet 1/0/0
```

```
 ip ref
 ip address 2.2.2.2 255.255.255.0
 crypto map mymap
 duplex auto
 speed auto
end
                A

ip access-list extended 110
 10 permit ip host 2.2.2.1 any
!
//              policy
//       dpd
crypto isakmp keepalive 10 2 periodic
//       3des تم
crypto ipsec transform-set myset    esp-3des
!
crypto map mymap 7 ipsec-isakmp
set peer 2.2.2.2 //
set peer 2.2.2.3 trustpoint backup
set transform-set myset
match address 100

interface GigabitEthernet 1/0/0
 ip ref
 ip address 2.2.2.1 255.255.255.0
```

crypto map mymap

duplex auto

speed auto

end

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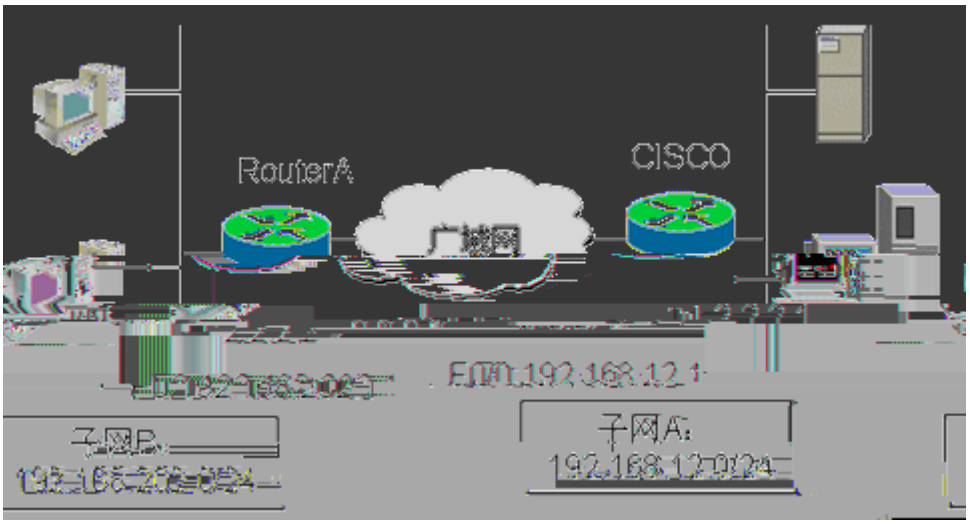
IP Cisco A

B

3des

ESP-DES-MD5

Cisco 7:



7

8

```
  crypto isakmp policy 1
  authentication pre-share
  encrytiong 3des
#
crypto isakmp key 0 123 address 192.168.12.1
crypto ipsec transform-set t1  esp-des esp-md5-hmac
  mode transport
#
crypto ipsec profile profi-map
  set transform-set t1
  match any
!
interface FastEthernet0
  ip address 192.168.202.1 255.255.255.0
#               GRE   Tunnel
interface tunnel 1
  tunnel mode ipip
  tunnel source  192.168.202.1
  tunnel destination 192.168.12.1
  tunnel protection ipsec profile profile-map
  ip address 2.2.2.2 255.255.255.0
!
ip route 0.0.0.0 0.0.0.0 tunnel 1
```

Cisco

```
!
hostname Cisco
#     IkE
crypto isakmp policy 1
  authentication pre-share
  encryption 3des
#
crypto isakmp key 0 123 address 192.168.202.1
#
crypto ipsec transform-set t1 esp-des esp-md5-hmac
  mode transport
#
```

```
  tunnel source  1111:1111::2
  tunnel destination 1111:1111::1
  tunnel protection ipsec profile profile-map
  ipv6 address 2222:2222::2/96
!
ipv6 route ::/0 tunnel 1
```

Cisco

```
!
hostname Cisco
#     IkE
crypto isakmp policy 1
  authentication pre-share
  encryption 3des
  #
crypto isakmp key 0 123 ipv6  ::/0
crypto ipsec transform-set t1  esp-des esp-md5-hmac
  mode transport
#
crypto ipsec profile profi-map
  set transform-set t1
!
interface FastEthernet0
  ipv6 address 1111:1111::1/96
#               GRE   Tunnel
interface tunnel 1
  tunnel mode ipv6
  tunnel source  1111:1111::1
  tunnel destination 1111:1111::2
```

```
#     IKE
crypto isakmp enable
  crypto isakmp policy 1
  authentication pre-share
  encrytiong 3des
#
crypto isakmp key 0 123 address 192.168.12.1
crypto ipsec transform-set t1  esp-des esp-md5-hmac
  mode transport
#
crypto ipsec profile profi-map
  set transform-set t1
!
interface FastEthernet0
  ip address 192.168.202.1 255.255.255.0
#               GRE   Tunnel
interface tunnel 1
   tunnel mode ipip
  tunnel source  192.168.202.1
  tunnel destination 192.168.12.1
  tunnel protection ipsec profile profile-map
  ip address 2.2.2.2 255.255.255.0
!
ip route 0.0.0.0 0.0.0.0 tunnel 1
```

NAT

```
hostname "NAT"
```

#NAT ACL

ip access standard 1

10 permit any

Router A

interface FastEthernet 0/0

ip address 192.168.202.2 255.255.255.0

ip nat inside

!

Router B

interface FastEthernet0/1

ip add 192.168.12.2 255.255.255.0

ip nat outside

!

#NAT F0/0 IP F0/1

ip nat inside source list 1 interface fastEthernet 0/1

!

Cisco

```
!
hostname Cisco
#     IkE
crypto isakmp policy 1
  authentication pre-share
  encryption 3des
#
crypto isakmp key 0 123 address 192.168.202.1
#
crypto ipsec transform-set t1 esp-des esp-md5-hmac
  mode transport
#
crypto ipsec profile profile-name
  set transform-set t1
!
interface FastEthernet0/0
  ip address 192.168.12.1 255.255.255.0
#                Tunnel
```

```
  tunnel protection ipsec profile profile-map
  ip address 2.2.2.1 255.255.255.0
!
```

RouterA

```
!
hostname "RouterA"
#     IKE
crypto isakmp enable
  crypto isakmp policy 1
  authentication pre-share
  encrytiong 3des
#
crypto isakmp key 0 123 address 192.168.12.1
crypto ipsec transform-set t1  esp-des esp-md5-hmac
  mode transport
#
crypto ipsec profile profi-map
  set transform-set t1
  match any
!
interface FastEthernet0
  ip address 192.168.202.1 255.255.255.0
#               GRE   Tunnel
interface tunnel 1
   tunnel mode ipip
  tunnel source  192.168.202.1
  tunnel destination 192.168.12.1
  tunnel protection ipsec profile profile-map
  ip address 2.2.2.2 255.255.255.0
!
ip route 0.0.0.0 0.0.0.0 tunnel 1
```

NAT

```
hostname "NAT"
#NAT                ACL
ip access standard 1
10 permit any
```

```
crypto ipsec transform-set t1 esp-des esp-md5-hmac
  mode transport
#
crypto ipsec profile profile-name
  set transform-set t1
!
interface FastEthernet0/0
  ip address 192.168.12.1 255.255.255.0
#               Tunnel
interface tunnel 1
  tunnel mode ipsec ipv4
  tunnel source  192.168.12.1
  tunnel destination 192.168.12.2
  tunnel protection ipsec profile profile-map
  ip address 2.2.2.1 255.255.255.0
!
```

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PKI

CA Certificate Authority
CA

CA

X.509 PGP X.509

IPSec IKE SSL IPSec IKE

X.509 SCEP SCEP

SCEP PKCS7

CA SCEP

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PKI Public-Key Infrastructure

X.509 ITU-T PKI

CA CA

X.509 X.509 ,

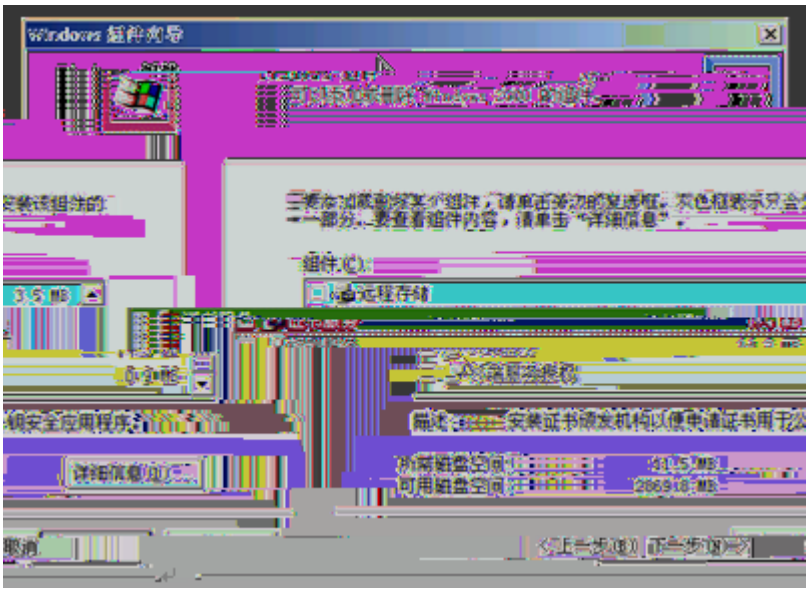
CA ( )
ITUT X.509

CA

rfc 1421-rfc1424 base64 ,
,

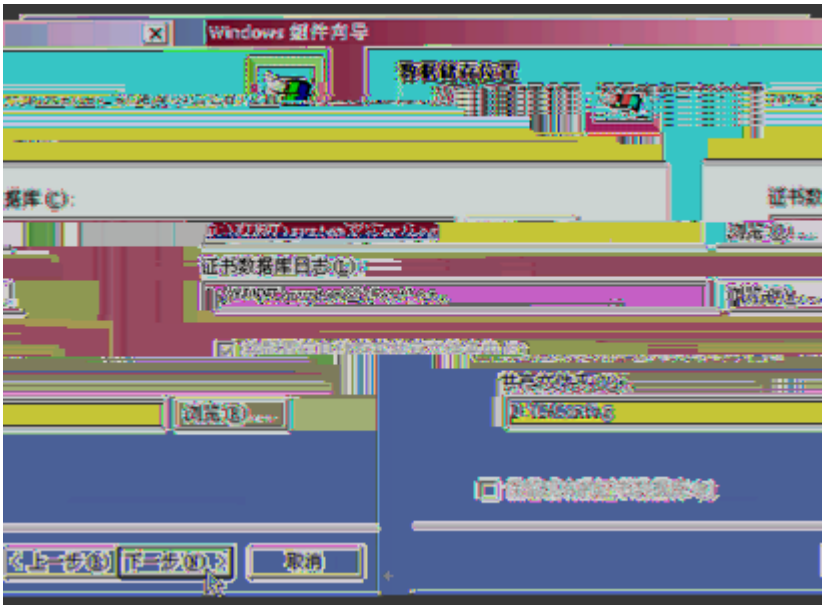
RSA ,
PKCS#1 RSA , PKCS#7 ,
PKCS#12 (PKCS12 , ,
) PKCS DER
PEM

CA
Internet X.509
PKIX CRL
CRL طفح



CA

CA



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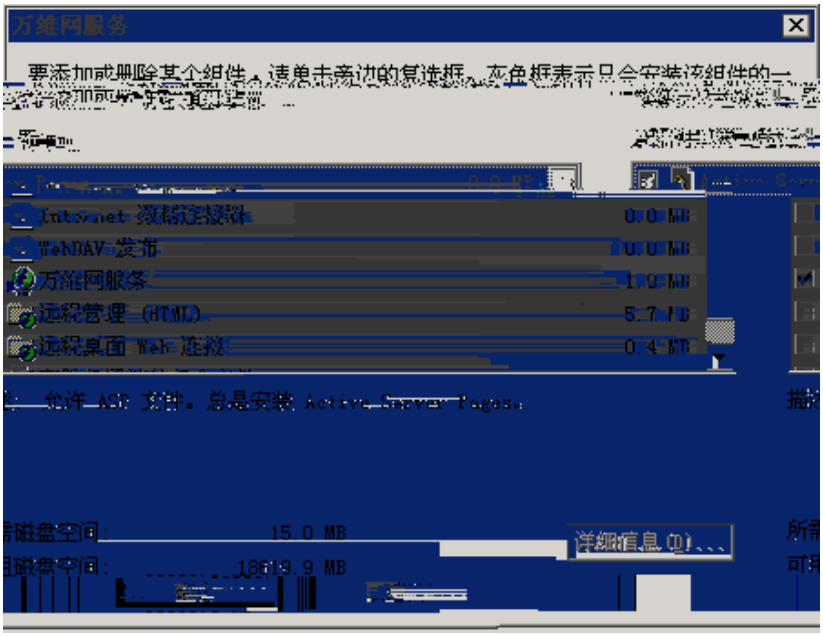
“ / ” “ / Windows ”

“ ” “ ”

“Active Server Pages” “ ”

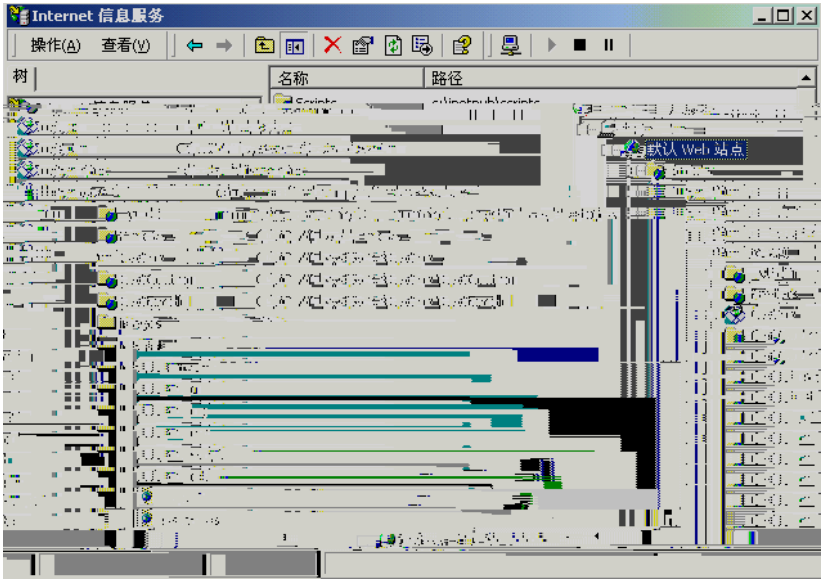
“ ” “ ” “ ” “Internet

”

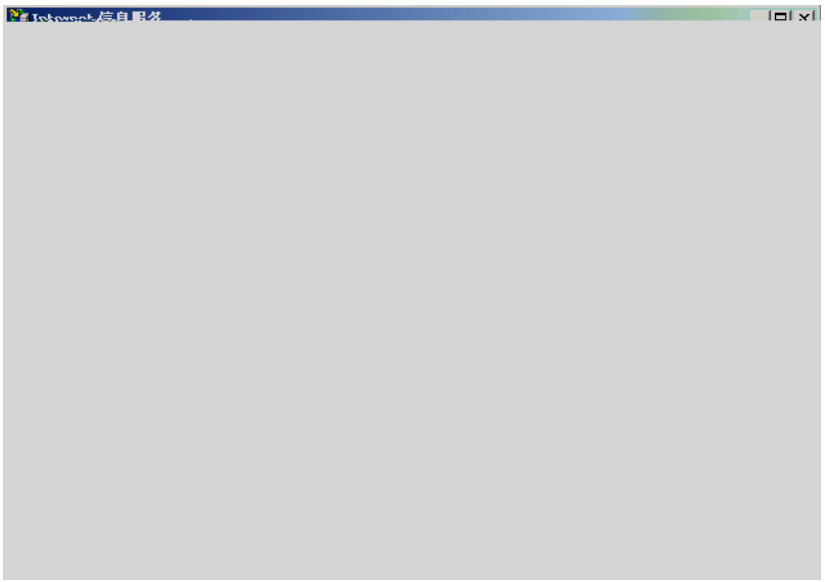


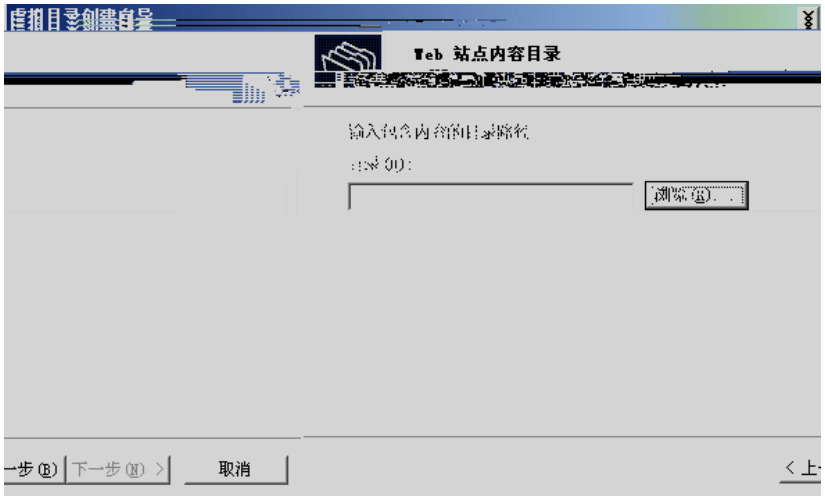
“ ”

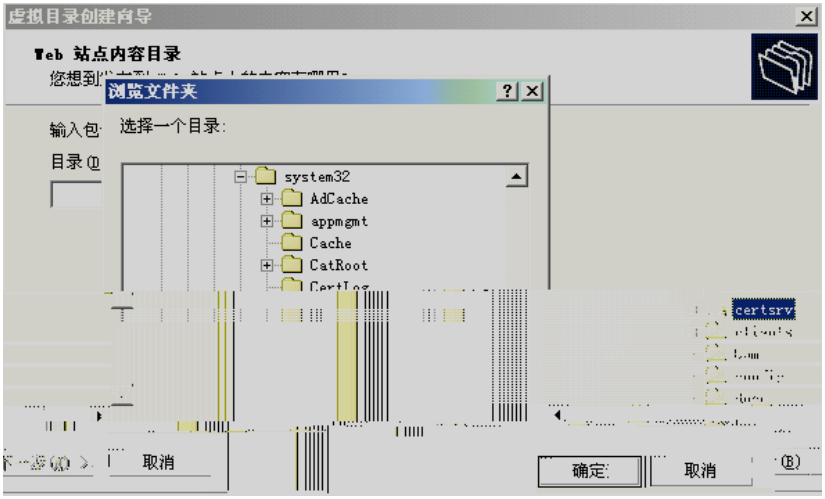
Internet



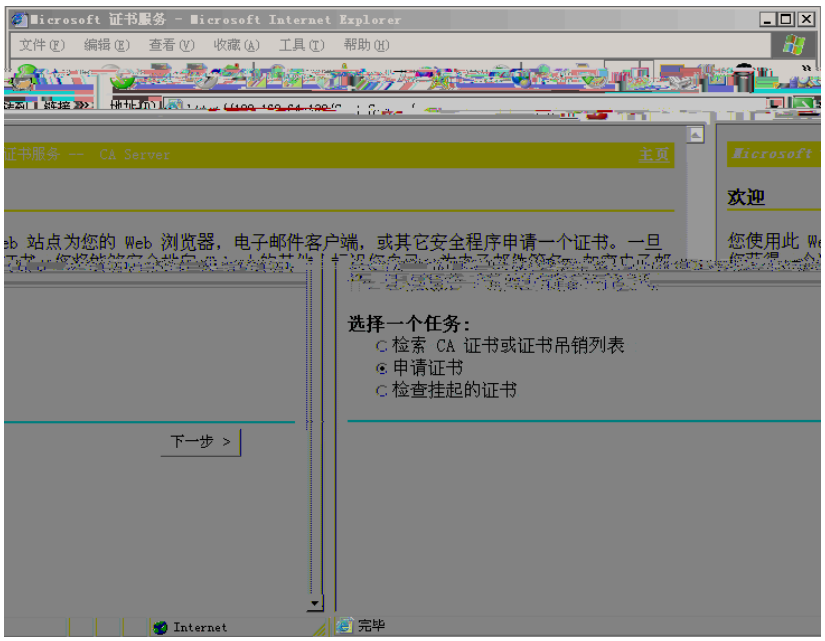
Web

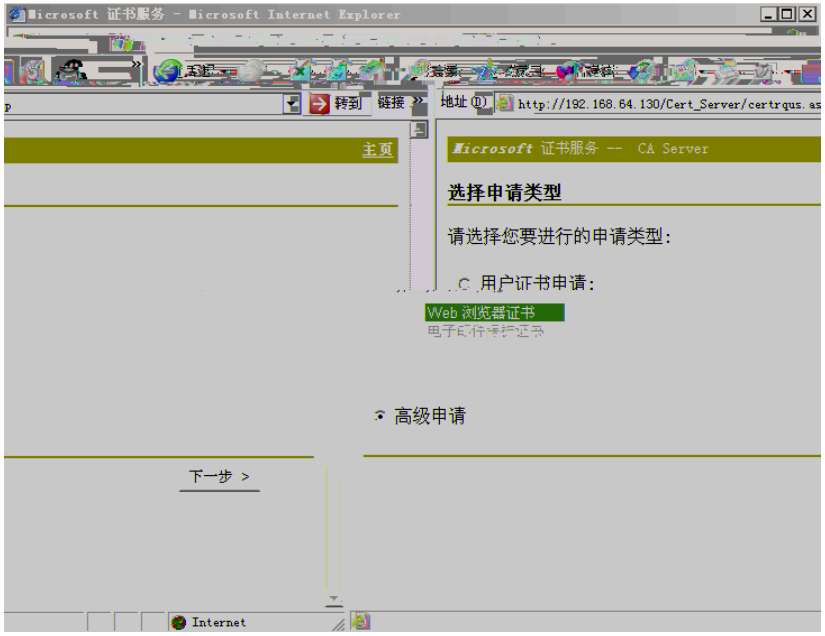


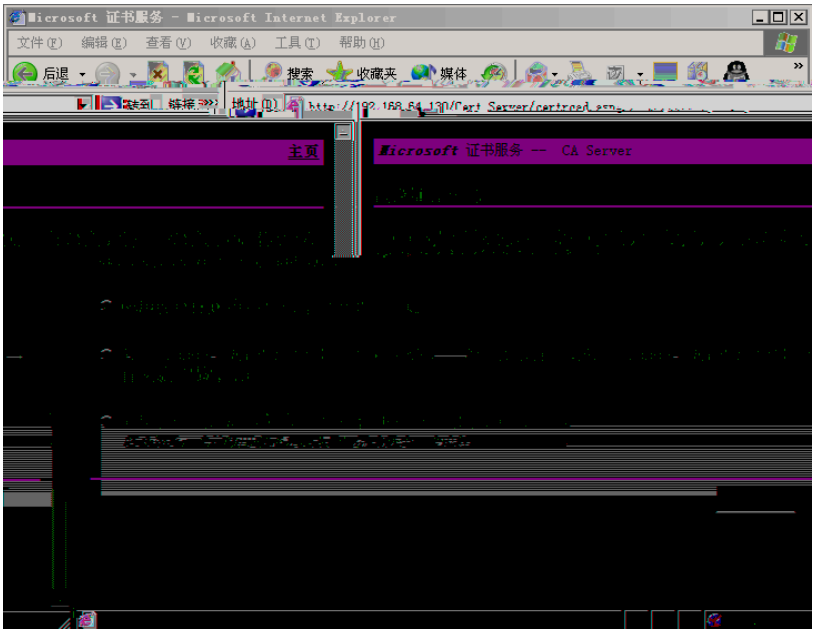

Web 站点内容目录
取消


虚拟目录创建向导
Web 站点内容目录
浏览文件夹
选择一个目录:
system32
AdCache
appmgmt
Cache
CatRoot
certsrv
取消
确定
取消

win2003

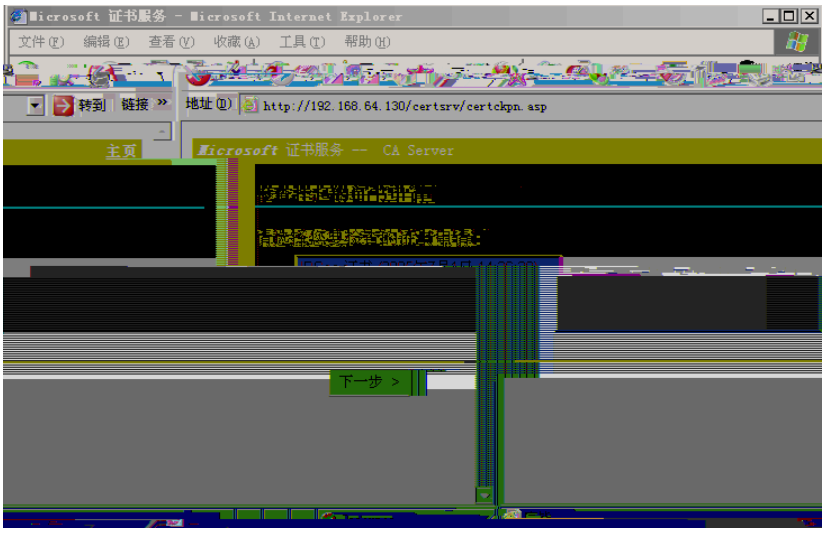

文件(F) 编辑(E) 查看(V) 收藏(A) 工具(T) 帮助(H)
主页
欢迎
选择一个任务:
检索 CA 证书或证书吊销列表
申请证书
检查挂起的证书
下一步 >
Internet
完毕

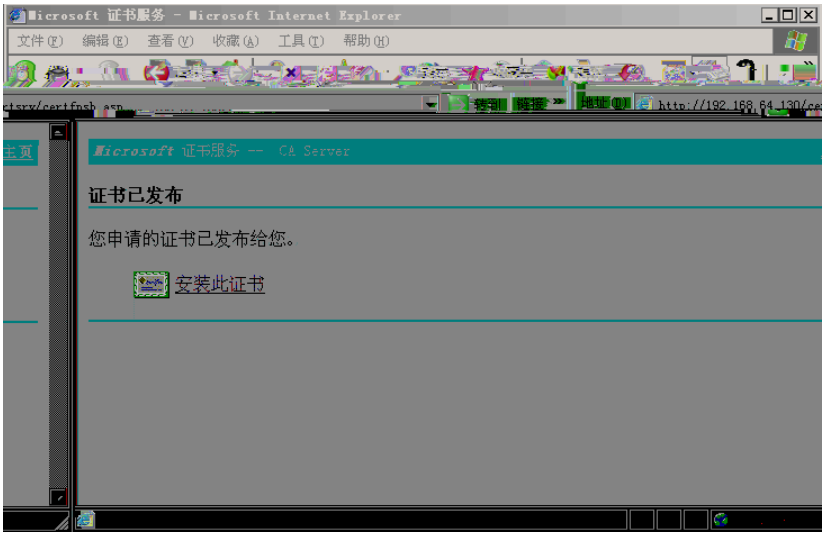

转到
链接
地址
http://192.168.64.130/Cert_Server/certrqus.as
主页
Microsoft 证书服务 -- CA Server
选择申请类型
请选择您要进行的申请类型:
用户证书申请:
Web 浏览器证书
高级申请
下一步 >
Internet

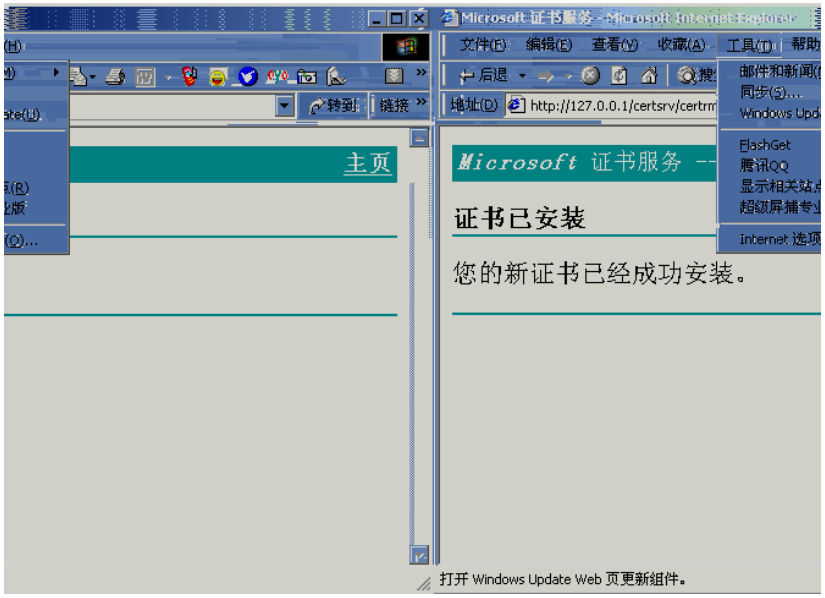


RSA CA server

CA

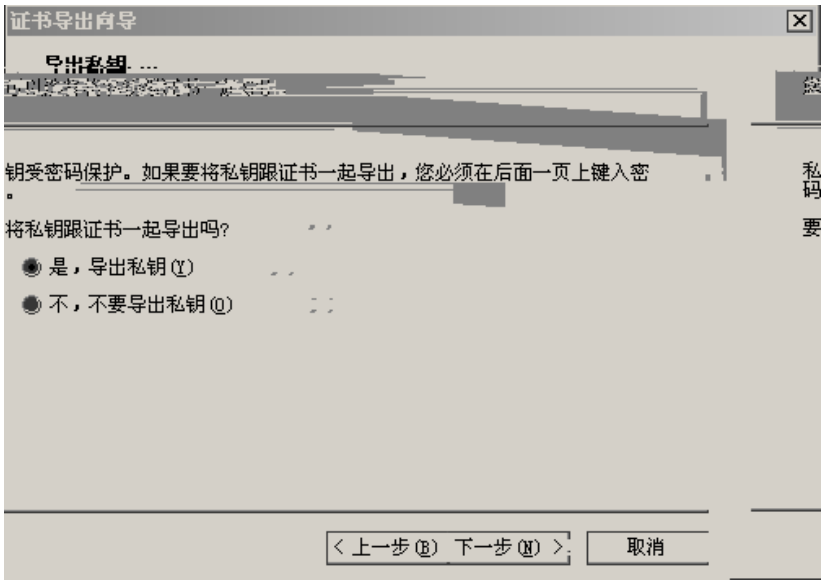

Microsoft 证书服务 - Microsoft Internet Explorer
文件(F) 编辑(E) 查看(V) 收藏(A) 工具(T) 帮助(H)
转到 链接
地址(D) http://192.168.64.130/certsrv/certckpn.asp
主页
Microsoft 证书服务 -- CA Server
下一步 >

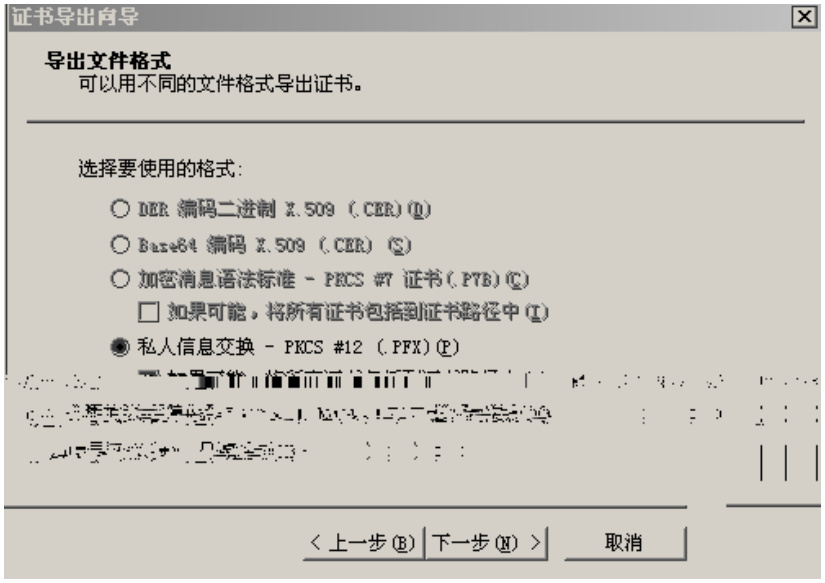

Microsoft 证书服务 - Microsoft Internet Explorer
文件(F) 编辑(E) 查看(V) 收藏(A) 工具(T) 帮助(H)
主页
Microsoft 证书服务 -- CA Server
证书已发布
您申请的证书已发布给您。
安装此证书


Microsoft 证书服务 -- Microsoft Internet Explorer
文件(F) 编辑(E) 查看(V) 收藏(A) 工具(T) 帮助
后退
地址(D) http://127.0.0.1/certsrv/certrm
转到
链接
主页
Microsoft 证书服务 --
证书已安装
您的新证书已经成功安装。
打开 Windows Update Web 页更新组件。

Internet

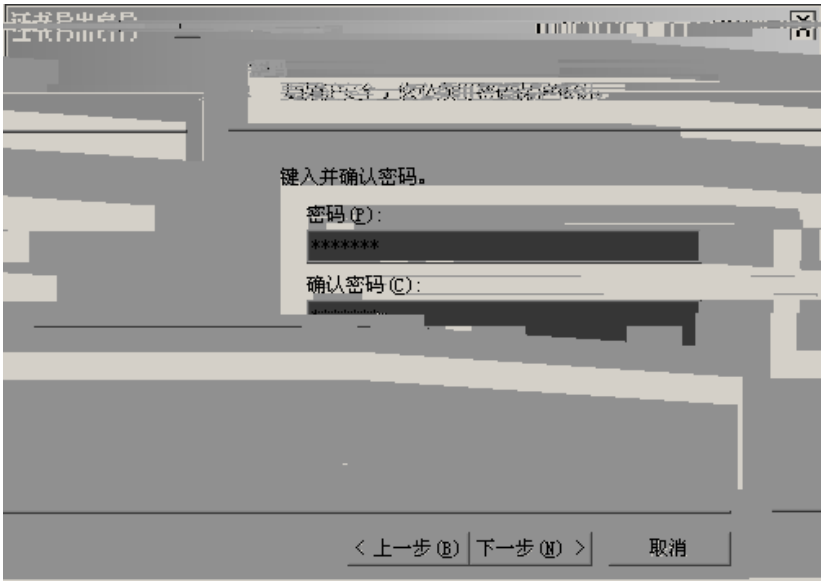
Internet 选项
常规
安全
隐私
内容
连接
程序
高级
分级审查
确定
取消
应用(A)

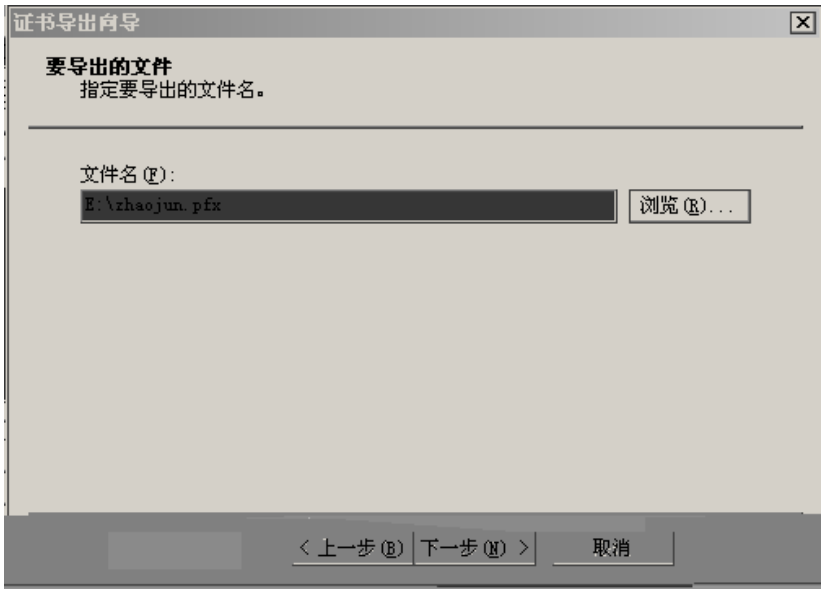

证书导出向导
导出私钥
钥受密码保护。如果要将私钥跟证书一起导出，您必须在后面一页上键入密
。
将私钥跟证书一起导出吗?
是，导出私钥(Y)
不，不要导出私钥(O)
< 上一步(B)
下一步(N) >
取消


证书导出向导
导出文件格式
可以用不同的文件格式导出证书。
选择要使用的格式:
DER 编码二进制 X.509 (.CER)(D)
Base64 编码 X.509 (.CER) (S)
加密消息语法标准 - PKCS #7 证书(.P7B)(C)
如果可能，将所有证书包括到证书路径中(I)
私人信息交换 - PKCS #12 (.PFX)(P)
< 上一步(B)
下一步(N) >
取消

“ ”

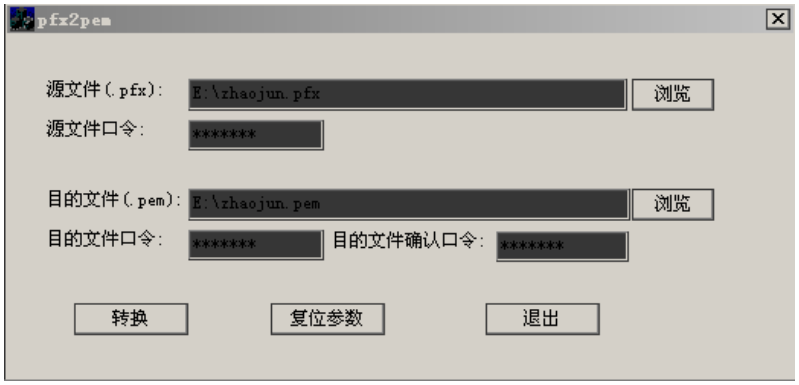
CA


键入并确认密码。
密码(P):
******
确认密码(C):
< 上一步(B)
下一步(N) >
取消


证书导出向导
要导出的文件
指定要导出的文件名。
文件名(F):
E:\zhaojun.pfx
浏览(R)...
< 上一步(B)
下一步(N) >
取消

pfx pem

pfx2pem



pem Windows

pem

IE

6.3.1.1

ا ف ا

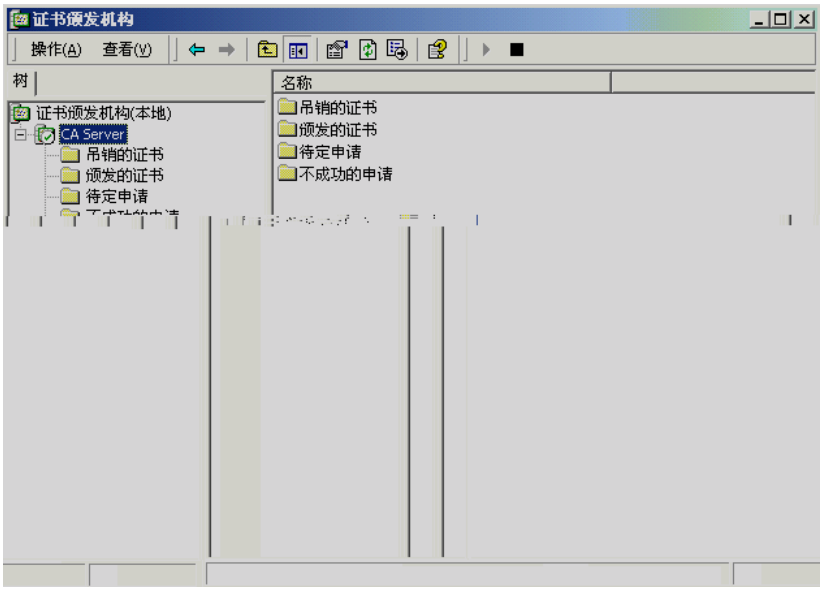
crl

http://%SERVER_DNS_NAME%/CertEnroll/%CA_NAME%%CRL_SUFFIX%.crl

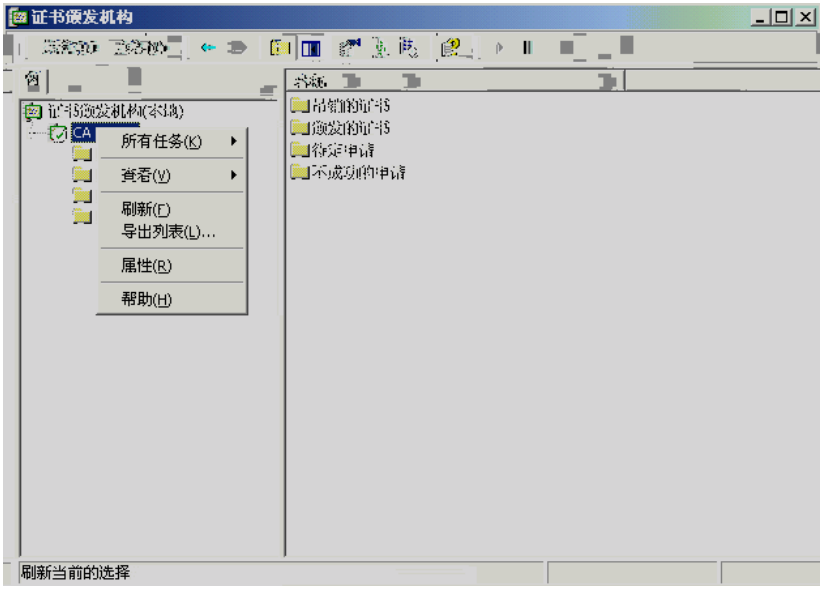
file://\\%SERVER_DNS_NAME%\CertEnroll\%CA_NAME%%CRL_SUFFIX%.crl

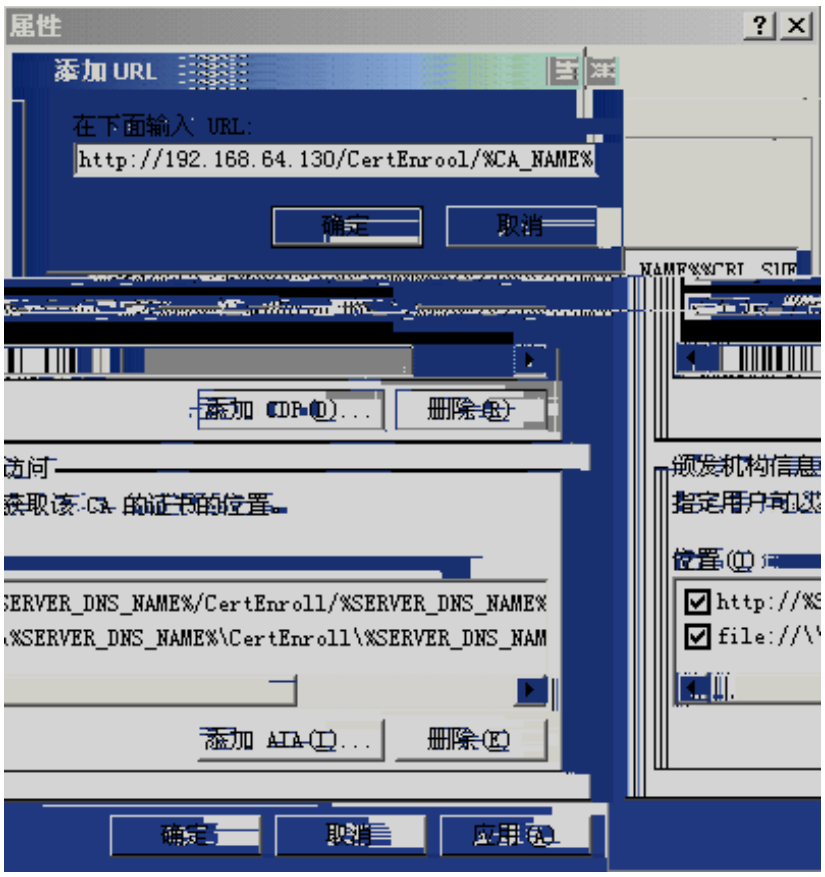
%SERVER_DNS_NAME% ip

ip CA server



CA Server





CRL

ip

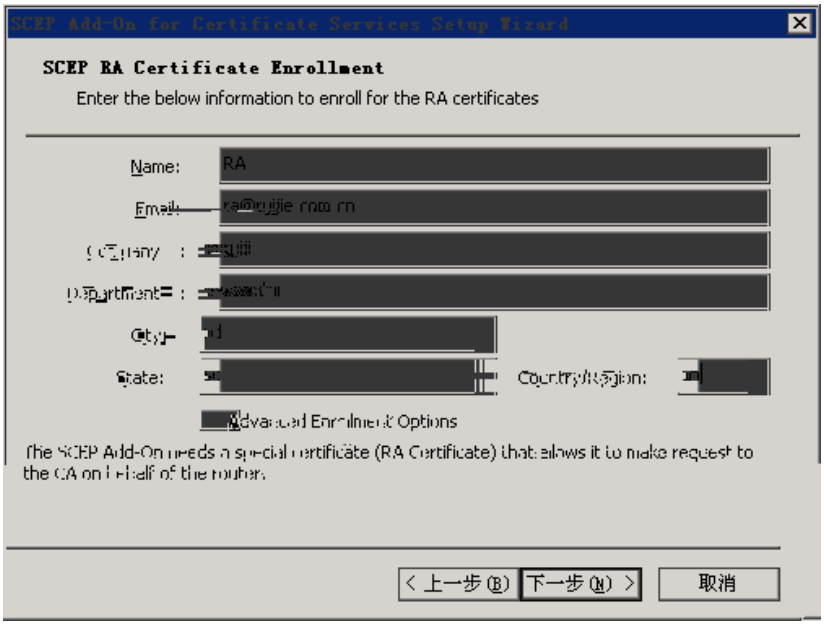
http://192.168.64.130/CertEnroll/%CA_NAME%%CRL_SUFFIX%.crl

file:\\192.168.64.130\CertEnroll\%CA_NAME%%CRL_SUFFIX%.crl

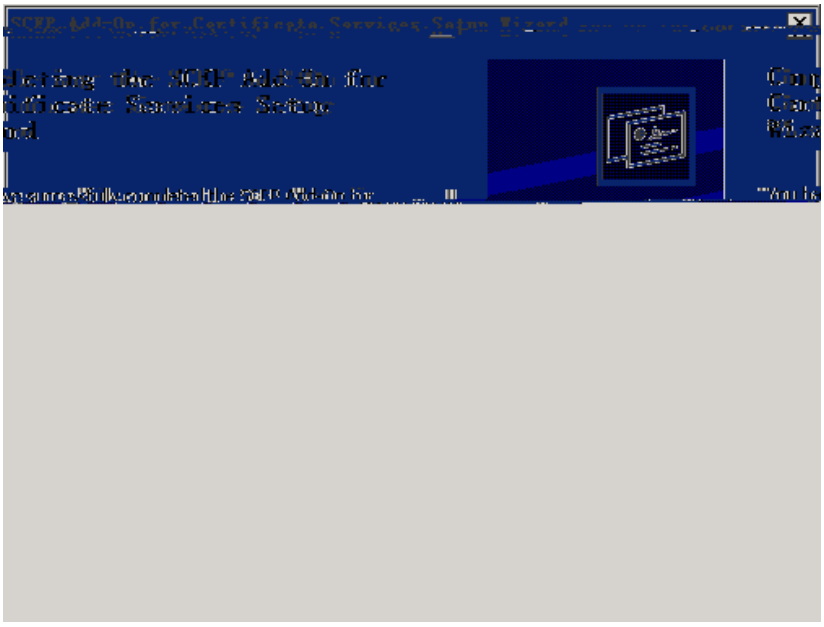
http://www.ruijie.com.cn/CertEnroll/%CA_NAME%%CRL_SUFFIX%.crl

file://\\www.ruijie.com.cn\CertEnroll\%CA_NAME%%CRL_SUFFIX%.crl

CRL http


SCEP Add-On for Certificate Services Setup Wizard
SCEP RA Certificate Enrollment
Enter the below information to enroll for the RA certificates
Name:
RA
Email:
Advanced Enrollment Options
The SCEP Add-On needs a special certificate (RA Certificate) that allows it to make request to the CA on behalf of the router.
< 上一步(B)
下一步(N) >
取消

“ ”



SCEP URL

SCEP Add-On for Certificate Services Setup Wizard
Setup Successful. URL to use for SCEP enrollment is http://ruijieca/certsrv/mscep/mscep.dll.

```
aCBBcGFydG1lbnQgNTEPMA0GA1UEAxMGZGluZ2pzMFwwDQYJKoZIhvcNAQEBBQAD
SwAwSAJBAM0sOymB/5v35vnf/PlJX+aqZpH9drtevsNaHkj4i3XdaJ55rFo2wLT0
qpWTI0nu638ktUa4dEIfF0AQM67sP0ECAwEAAaOCAmMwggJfMA4GA1UdDwEB/wQE
AwIE8DATBgNVHSUEDDAKBggrBgEFBQgCAjAdBgNVHQ4EFgQUIWVn8+ciY7JJkOFN
7MIkcRWWpx8wgegGA1UdIwSB4DCB3YAUckOEHCsDRS2CWPWEQ3f1IapLLCGhgbKk
ga8wgawxITAfBgkqhkiG9w0BCQEWEmRpbmdqc0BzdGFyLW5ldC5jbjELMAkGA1UE
BhMCQ04xDzANBgNVBAgTBkZ1SmlhbjEPMA0GA1UEBxMGRnVaaG91MSAwHgYDVQQK
ExdSZWdpYW50IE5ldHdvcmsgQ28uIEx0ZDEdMBsGA1UECxMUUmVzZWFyY2ggQXBh
cnRtZW50IDUxFzAVBgNVBAMTDkNBIHRlc3Qgc2VydmVyghBWrgc8EKF+jEWujT8V
UjNXMH8GA1UdHwR4MHYwOKA2oDSGMmh0dHA6Ly96ai1yb3V0ZXIvQ2VydEVucm9s
bC9DQSUyMHRlc3QlMjBzZXJ2ZXIuY3JsMDqgOKA2hjRmaWxlOi8vXFx6ai1yb3V0
ZXJcQ2VydEVucm9sbFxDQSUyMHRlc3QlMjBzZXJ2ZXIuY3JsMIGsBggrBgEFBQcB
AQSBnzCBnDBLBggrBgEFBQcwAoY/aHR0cDovL3pqLXJvdXRlci9DZXJ0RW5yb2xs
L3pqLXJvdXRlcl9DQSUyMHRlc3QlMjBzZXJ2ZXIoMSkuY3J0ME0GCCsGAQUFBzAC
hkFmaWxlOi8vXFx6ai1yb3V0ZXJcQ2VydEVucm9sbFx6ai1yb3V0ZXJfQ0ElMjB0
ZXN0JTIwc2VydmVyKDEpLmNydDANBgkqhkiG9w0BAQUFAANBABSEeYlEi7fm06en
NDdkZMjYV8LZB1JjniePwy1sUEEDa2bH9ZrcpTnJ+CSkCkxXBTc5ZWZnFTiSH/Oc
uVyQ9D8=
-----END CERTIFICATE-----
Bag Attributes: <Empty Attributes>
subject=/Email=dingjs@star-net.cn/C=CN/ST=FuJian/L=FuZhou/O=Regiant
```

```
f0w=
-----END CERTIFICATE-----
```

```
BgkrBgEEAYI3FQEEAwIBATANBgkqhkiG9w0BAQUFAANBAH8ufRZ2tVYO3R7YC0IF
OzmnQrjgaBN4bpmSLkxYYKtK8ZNjo0FwUL11aq6nCGp6n8Ks0dijoMxnedB2zn0a
f0w=
-----END CERTIFICATE-----
quit
Certificate has the following attributes:
Fingerprint: B286A3F4 4930D46D 81D4A544 885D611C   CA
% Do you accept this certificate? [yes/no]: yes
% Certificate successfully imported
% Enter PEM-formatted encrypted private key.         PEM
% End with "quit" on a line by itself.        “quit”
```

Â•š"ñ!9Px 1

3vueTIHmTurHvvdLIytYjQOFM4Bu 6U8Qi.21KDCL2w1sAk.623 c (4)6(Sa)6(nSa)6(qI)6(jB[(u-quit

```
Proc-Type: 4,ENCRYPTED
DEK-Info: DES-EDE3-CBC,251F9D955610C376
GDG2s1mbs/MJCpo5w2bu972jK1OZYtv3RQunH4I29c9H5uq3LtyvNA9RwrlpRQ3t
iUmkvQrU3/6SBp4Rqx1EU2UWgv1KRqqYwRVbdPdBZYVJLrso3Ov/9eaS4TiD+4Dl
NfJ1sAA4OONdVKDCLcGZIB43Wq5rAlqzsyjcF6tx3fWsSankVjQfroTv7UvP+ijj
uGndmJwbXEiATxlt+Smvt2/CGjr8nIC55T1W+tW0itkBdZhnvBJekOFM4BdgoLZc
3vueTIHmTurHvvdLIytYjQOFM4Bu 6U8Qi.21KDCL2w1sAk.623 c (4)6(Sa)6(nSa)6(qI)6(jB[(u
```

```
AwIE8DATBgNVHSUEDDAKBggrBgEFBQgCAjAdBgNVHQ4EFgQUIWVn8+ciY7JJkOFN
7MIkcRWWpx8wgegGA1UdIwSB4DCB3YAUckOEHCsDRS2CWPWEQ3f1IapLLCGhgbKk
ga8wgawxITAfBgkqhkiG9w0BCQEWEmRpbmdqc0BzdGFyLW5ldC5jbjELMAkGA1UE
BhMCQ04xDzANBgNVBAgTBkZ1SmlhbjEPMA0GA1UEBxMGRnVaaG91MSAwHgYDVQQK
ExdSZWdpYW50IE5ldHdvcmsgQ28uIEx0ZDEdMBsGA1UECxMUUmVzZWFyY2ggQXBh
cnRtZW50IDUxFzAVBgNVBAMTDkNBIHRlc3Qgc2VydmVyghBWrgc8EKF+jEWujT8V
UjNXMH8GA1UdHwR4MHYwOKA2oDSGMmh0dHA6Ly96ai1yb3V0ZXIvQ2VydEVucm9s
bC9DQSUyMHRlc3QlMjBzZXJ2ZXIuY3JsMDqgOKA2hjRmaWxlOi8vXFx6ai1yb3V0
ZXJcQ2VydEVucm9sbFxDQSUyMHRlc3QlMjBzZXJ2ZXIuY3JsMIGsBggrBgEFBQcB
AQSBnzCBnDBLBggrBgEFBQcwAoY/aHR0cDovL3pqLXJvdXRlci9DZXJ0RW5yb2xs
L3pqLXJvdXRlcl9DQSUyMHRlc3QlMjBzZXJ2ZXIoMSkuY3J0ME0GCCsGAQUFBzAC
hkFmaWxlOi8vXFx6ai1yb3V0ZXJcQ2VydEVucm9sbFx6ai1yb3V0ZXJfQ0ElMjB0
ZXN0JTIwc2VydmVyKDEpLmNydDANBgkqhkiG9w0BAQUFAANBABSEeYlEi7fm06en
NDdkZMjYV8LZB1JjniePwy1sUEEDa2bH9ZrcpTnJ+CSkCkxXBTc5ZWZnFTiSH/Oc
uVyQ9D8=
-----END CERTIFICATE-----
quit
% Certificate successfully imported
Ruijie (config)#
```

CA

Ruijie (config)# *CA_name*	trustpoint *CA_name* CA Win2003 server IIS “ CA C ”
Ruijie (ca-trustpoint)# *http://192.168.50.203/certsrv/mscep/mscep.dll*	URL SCEP URL URL ip ip

```
router(config)#
```

4. CA trustpoint

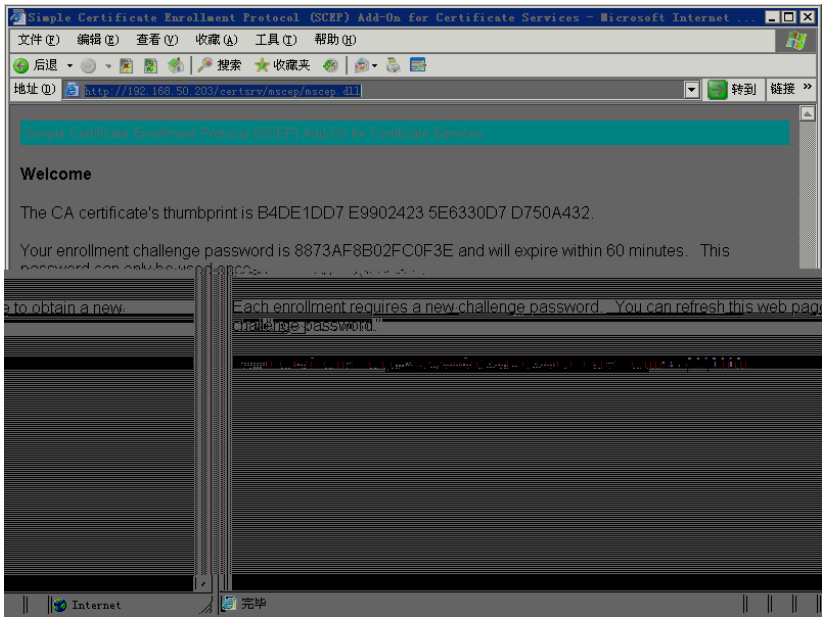
```
router(config)#crypto pki trustpoint CA
router(ca-trustpoint)#enrollment url
http://192.168.50.203/certsrv/mscep/mscep.dll //enroll   url
router(ca-trustpoint)#exit
```

5. CA

```
router(config)#crypto pki authenticate CA
Certificate has the following attributes:
MD5 fingerprint: B4DE1DD7 E9902423 5E6330D7 D750A432
SHA1 fingerprint: AD070162 672A7C57 BD5EE522 A95AAFA1 351524D0
% Do you accept this certificate?[yes/no]:yes    //    yes    CA
Trustpoint CA certificate accepted.
```

6. http://ca-ip-address/certsrv/mscep/mscep.dll

7.



8. CA

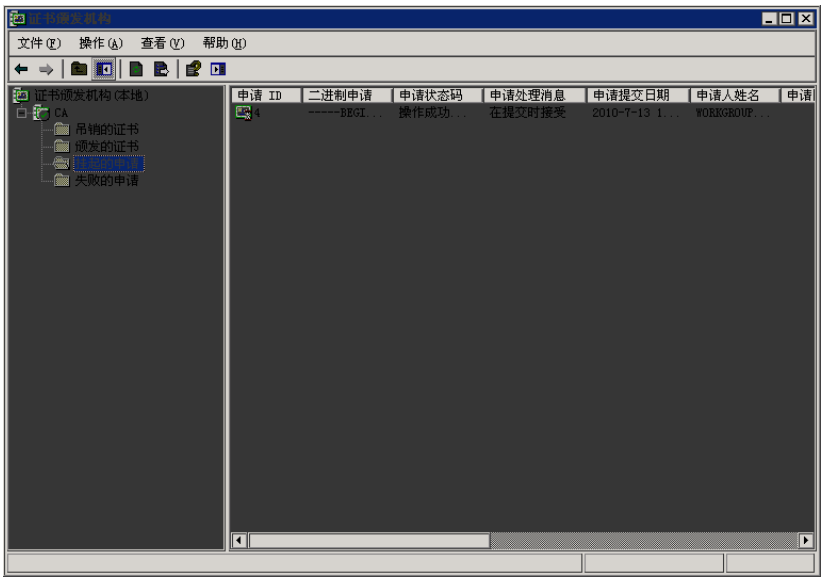
```
router(config)#crypto pki enroll CA
%
%Start certificate enrollment ..
%Create a challenge password. You will need to verbally provide this
   password to the CA Administrator in order to revoke your certificate.
   For security reasons your password will not
```

```
Re-enter password:F4EEE4FEB3766007
%The subject name in the certificate will include: router
```

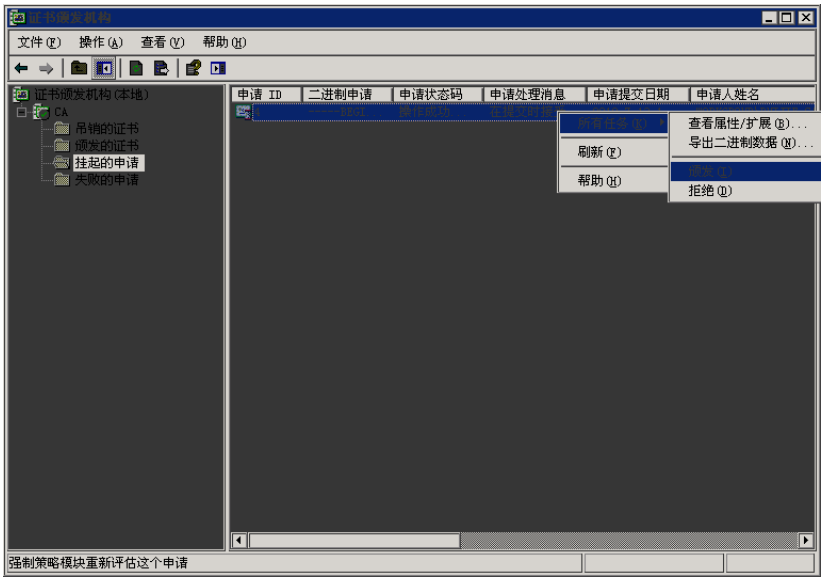
9. trustpoint

```
router(config)#show crypto pki trustpoints CA status
Trustpoint CA Status:
  Issuing CA certificate configured:
    Subject Name:
      /CN=CA
    Fingerprint MD5: B4DE1DD7 E9902423 5E6330D7 D750A432
    Fingerprint SHA1: AD070162 672A7C57 BD5EE522 A95AAFA1 351524D0
  Router General Purpose certificate pending:    Requested Subject Name:
      /unstructuredName=router
    Request Fingerprint MD5: E8F50E2A 1FB46B00 52C6A9DB CC20AA42
Request Fingerprint SHA1: B1031204 E7A2D547 CC48F0A6 2BAE8420 829637D8
    Enrollment polling: 2 times (58 left)
  Last enrollment status: Pending    //    pending
  State:
    Keys generated ..... Generated
    Issuing CA authenticated ..... Yes
Certificate request(s) ..... Pending
```

10. “certificate requests pending” CA “ ” 10 15



11. “ ” “ ”



12. “ ” trustpoint

router(config)#show crypto pki trustpoints CA status

```
Trustpoint CA Status:
  Issuing CA certificate configured:
    Subject Name:
      /CN=CA
    Fingerprint MD5: B4DE1DD7E 99024235 E6330D7D 750A432
    Fingerprint SHA1: AD070162 672A7C57 BD5EE522 A95AAFA1 351524D0
  Router General Purpose certificate configured:
    Subject Name:
      /unstructuredName=router
    Fingerprint MD5: 7FFF7F4C 225850A3 D0D39EA3 EFAD8D5A
    Fingerprint SHA1: 84E3678C F2DE94DD 63397145 87CDC9C6 1010A82F
  Last enrollment status: Granted   //
  State:
    Keys generated ..... Generated
    Issuing CA authenticated ..... Yes
    Certificate request(s) ..... Yes
```

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Ruijie (config)# *CA_name*	trustpoint *CA_name* CA Win2003 server IIS “ CA C ”
Ruijie (ca-trustpoint)#	

EwJTQzELMAkGA1UEBhMCQ04wgZ8wDQYJKoZIhvcNAQEBBQADgY0AMIGJAoGBANep
/WFrf0uBBp7ZIPMC7Dq22mUtzc3xWrT3V5sk/P98+KTXlKYy7aYCKZqhgCw/5XHP
6fAV9d7kKcs9ynptjbagjdFpeWSRpRzJ0U+fYg1muJf7U3ZuyFMBOQgwOvofwcOa
sJ53RhmadZqdAHzPDtQT9XVbl4tSNYckGiOm3My3AgMBAAGgADANBgkqhkiG9w0B
AQQFAAOBgQBFAC/oAVXrKpVvks0Mvk+84bKIR0tY2opqyRo9Ax26rZM8hK4oULQS
n3Ar7O3pBoWt1YbX0ZpUpEgu1IRCm0PwIeQ6uN6KwnO3a6A3AMLgWrwQ29rn7kQG
JbsHZ+Okk80CzZu6s8OBtasB6VU4LFCGwBAtbL83Syp973c8cYGPWg==
-----END CERTIFICATE REQUEST-----
// -----BEGIN CERTIFICATE REQUEST----- -----END CERTIFICATE REQUEST-----
PKCS10 CA

% Enter PEM-formatted CA certificate.
% End with a blank line or "quit" on a line by itself.
// PEM CA % fwi0Am.022poerJ 0ed8f0uBBp7ZIs8OBta(matte8 CA certificat7.)]TJ 0.02127Tc
// ┼PEM CA

Ruijie(config-pubkey)# *308202E6 30820290 A0030201 0202107F FFBB3997 39B4814B E16B4FF9 067A4B30*	

quit

exit Ctrl^Z

Ruijie(config-pubkey)#	

1.

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```
Ruijie(config-pubkey)# 301E170D 30353036 32323035 34363332 5A170D30
37303632 32303535 3434355A
Ruijie(config-pubkey)# 30818F31 23302106 092A8648 86F70D01 09011614
776C6370 796A7762 40737461
Ruijie(config-pubkey)# 722D6E65 742E636E 310B3009 06035504 06130243
4E310B30 09060355 04081302
Ruijie(config-pubkey)# 666A310F 300D0603 55040713 0666757A 686F7531
12301006 0355040A 13095265
Ruijie(config-pubkey)# 64204769 616E7431 15301306 0355040B 130C4465
70617274 6D656E74 20353112
Ruijie(config-pubkey)# 30100603 55040313 09434120 53657276 6572305C
300D0609 2A864886 F70D0101
Ruijie(config-pubkey)# 01050003 4B003048 024100BE D1E81427 7A302B5E
11CA43FD 2F2B7EA9 8A0796A2
Ruijie(config-pubkey)# CFFE9DB7 D3DA54C3 034AA844 B3F011DC 8ABB7253
9758B13F DF6B8A9E 5F46D300
Ruijie(config-pubkey)# 402E24D3 85A74142 55F77502 03010001 A381C530
81C2300B 0603551D 0F040403
Ruijie(config-pubkey)# 0201C630 0F060355 1D130101 FF040530 030101FF
301D0603 551D0E04 16041464
Ruijie(config-pubkey)# 4612C027 A49E010C 65DAF86E E7FEC656 ECADD430
71060355 1D1F046A 30683031
Ruijie(config-pubkey)# A02FA02D 862B6874 74703A2F 2F7A6A2D 726F7574
65722F43 65727445 6E726F6C
Ruijie(config-pubkey)# 6C2F4341 25323053 65727665 722E6372 6C3033A0
31A02F86 2D66696C 653A2F2F
Ruijie(config-pubkey)# 5C5C7A6A 2D726F75 7465725C 43657274 456E726F
6C6C5C43 41253230 53657276
Ruijie(config-pubkey)# 65722E63 726C3010 06092B06 01040182 37150104
03020100 300D0609 2A864886
Ruijie(config-pubkey)# F70D0101 05050003 4100342F 8D936843 607B685F
F07E910C 5CE35898 7C5395AE
```

no

Ruijie(ca-trustpoint)#	CRL

	IKE CRL

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( ) CRL RGOS CRL
1M http CRL URL

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```
ref parameter 50 400
line con 0
line aux 0
line vty 0 4
 login
!
!
end
```

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Ruijie# *CA_name* [ ]	CA

show crypto pki certificates

Ruijie# show crypto pki certificates *test*

```
%CA certificate info:                          //CA
Certificate:
Data:
Version: 3 (0x2)                             //X.509 v3
Serial Number:                                 //
```

```
64:46:12:C0:27:A4:9E:01:0C:65:DA:F8:6E:E7:FE:C6:56:EC:AD:D4
X509v3 CRL Distribution Points:                //CRL
URI:http://zj-router/CertEnroll/CA%20Server.crl
URI:file://\\zj-router\CertEnroll\CA%20Server.crl
1.3.6.1.4.1.311.21.1:
...
Signature Algorithm: sha1WithRSAEncryption          //
34:2f:8d:93:68:43:60:7b:68:5f:f0:7e:91:0c:5c:e3:58:98:
7c:53:95:ae:c2:b8:1c:ff:82:a4:ae:95:a8:81:a8:8a:ff:f9:
6f:92:72:3e:fa:6f:84:7d:83:47:93:0f:85:76:48:ae:68:b9:
5a:72:cf:09:50:be:1b:a7:e1:87                       //
%Router certificate info:                  //
Certificate:
Data:
Version: 3 (0x2)                               //X.509 v3
Serial Number:                                    //
16:2a:7a:1d:00:00:00:00:00:02
Signature Algorithm: sha1WithRSAEncryption         //
Issuer: emailAddress=wlcpyjwb@star-net.cn, C=CN, ST=fj, L=fuzhou, O=Red
Giant, OU=Department 5, CN=CA Server  //      DN
Validity                                           //
Not Before: Jun 22 05:50:48 2005 GMT      //         UTC
Not After : Jun 22 06:00:48 2006 GMT      //         UTC
Subject: emailAddress=zhaojun, C=CN, ST=fj, L=fuzhou, O=Red Giant, OU=De
partment 5, CN=zhaojun           //       DN
Subject Public Key Info:                          //
Public Key Algorithm: rsaEncryption      //       :  RSA
RSA Public Key: (2048 bit)                  //2048    RSA
Modulus (2048 bit):
00:c6:e2:7a:e8:8d:6d:d8:bb:56:a8:9c:03:62:14:
e5:2e:23:e5:a5:26:31:3d:b2:24:65:b1:f2:cc:07:
e3:ef:cc:02:3c:d0:6e:00:8d:fc:ce:3a:b6:45:7a:
cb:a0:87:94:1f:c3:92:43:36:6a:b2:7c:9c:d5:ca:
7e:83:ba:76:49:7f:be:f4:1f:4a:a1:0b:98:22:96:
e2:79:54:a0:ed:1c:62:30:b7:ee:6a:6e:cb:72:e9:
9c:d9:e8:b0:dc:f5:c6:19:8f:2b:2a:85:fa:bf:ff:
08:40:7e:f2:a1:df:d1:8b:ef:68:32:1e:1a:45:fa:
16:de:33:b0:62:90:bd:9c:8e:ec:7c:6e:49:48:75:
e6:5c:ce:b1:8e:1c:80:f3:5b:79:6c:a1:31:b2:a9:
48:37:9f:ed:45:95:85:ba:98:0f:42:c5:78:4c:3d:
a2:45:73:90:3d:0b:1a:7c:53:b5:97:1a:a6:43:2f:
44:54:0f:a1:51:3a:0e:9f:8b:2e:d1:70:cb:36:99:
```

```
91:57:d2:b7:9d:7c:ee:07:cf:4a:c7:cd:71:dc:ce:
72:dc:75:a0:03:b2:36:be:8e:af:ca:99:46:03:83:
27:d3:ff:24:1e:4c:0c:21:99:b4:fe:5a:4d:61:b5:
e9:b4:38:dc:59:2c:37:f3:93:02:fc:09:88:02:1b:
```

```
Last Update: Jun 22 06:10:27 2005 GMT    //         UTC
Next Update: Jun 29 18:30:27 2005 GMT  //         UTC          CRL

Revoked Certificates:                        //
Serial Number: 162A7A1D000000000002           //
Revocation Date: Jun 22 06:19:53 2005 GMT          //


Ruijie# sh crypto pki crls test detail
Certificate Revocation List (CRL):
Version 2 (0x1)                              //X.509V2   CRL
Signature Algorithm: sha1WithRSAEncryption          //
Issuer: /emailAddress=wlcpyjwb@star-net.cn/C=CN/ST=fj/L=fuzhou/O=Red
Giant/OU=Department 5/CN=CA Server                //      DN
Last Update: Jun 22 06:10:27 2005 GMT    //         UTC
Next Update: Jun 29 18:30:27 2005 GMT  //         UTC          CRL

CRL extensions:                             //      CRL
X509v3 Authority Key Identifier:          //
keyid:64:46:12:C0:27:A4:9E:01:0C:65:DA:F8:6E:E7:FE:C6:56:EC:AD:D4
1.3.6.1.4.1.311.21.1:
...
Revoked Certificates:                        //
Serial Number: 162A7A1D000000000002           //
Revocation Date: Jun 22 06:19:53 2005 GMT          //
CRL entry extensions:                          //CRL
X509v3 CRL Reason Code:                       //CRL
Key Compromise                                      //
Serial Number: 1635E5E3000000000003
Revocation Date: Jun 22 06:19:53 2005 GMT
CRL entry extensions:
X509v3 CRL Reason Code:
Key Compromise                                      //
Signature Algorithm: sha1WithRSAEncryption         //
5d:a2:ab:07:ff:7e:0e:9a:af:b2:25:11:7f:31:86:aa:21:48:
37:e7:22:99:e3:b2:15:e0:f9:80:63:66:5e:2f:f2:d6:c0:ea:
ef:46:7e:d1:c1:b2:66:0e:0b:d3:74:d1:55:bc:5c:13:46:e8:
56:ec:40:83:7b:1b:75:f2:68:87                        //
Ruijie#
```

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AAA

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AAA Authentication Authorization and Accounting

AAA

AAA

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AAA

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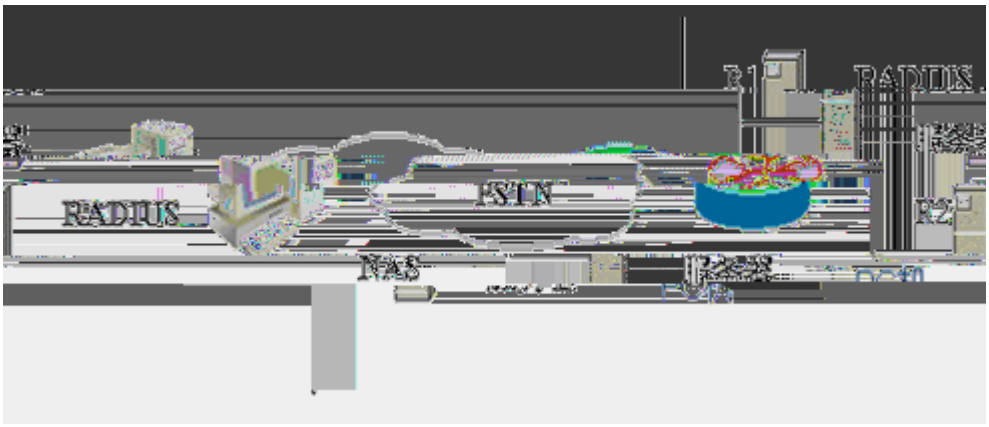

TIMEOUT

REJECT TIMEOUT REJECT TIMEOUT TIMEOUT AAA

AAA RADIUS TACACS+ “ TACACS+ ”

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RADIUS	2	RADIUS
(Login)	3	
	4	
	5	
RADIUS	6	
RADIUS	7	

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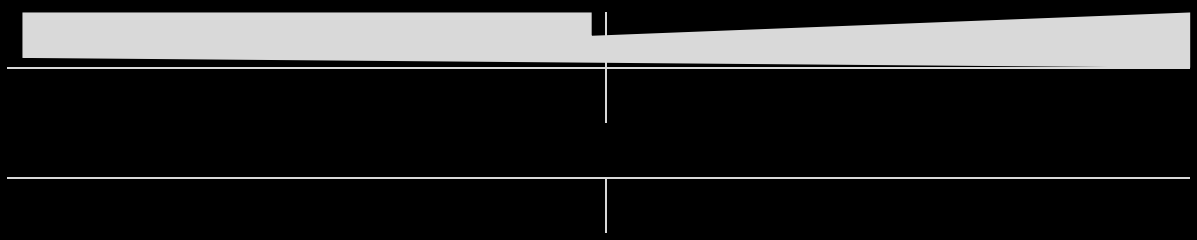

	AAA
ip-address [*port*] [*port*]	RADIUS
	RADIUS

RADIUS RADIUS RADIUS RADIUS “ RADIUS ”

RADIUS

	AAA
{ | *list-name*}	RADIUS
line-num	
{ | *list-name*}	

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AAA Enable

Telnet (NAS) CLI CLI 0~15 “ ”

enable

Enable

AAA Enable

	AAA
method1 [*method2*...]	Enable RADIUS

Enable

method T

Step	configure	
	name [*password*]	
Step	*name* [	

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PPP
ISDN NAS
PPP PPP

AAA PPP AAA PPP

	AAA
{ *list-name*} *method1* [*method2*...]	PPP RADIUS TACACS+
interface-type interface-number	AAA ISDN
{chap | pap} {default ***list-name***}	ISDN

PPP “ PPP MP ”

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IEEE802.1x Port-Based Network Access Control
LAN

802.1x 802.1x Ó,Q(cÓR ‘(cÓ

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Web

web web

	AAA
{ | *list-name*} *method1* [*method2*...]	web RADIUS

Web “ web ”

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IP IP

Ruijie#	
Ruijie(config)#	
Ruijie(config)#	Web

( )

```
Ruijie# configure terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# aaa local user allow public account
Ruijie(config)# show web-auth local-portal
```

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“ RADIUS+ ”

```
Ruijie(config)# aaa new-model
Ruijie(config)# username Ruijie password starnet
Ruijie(config)# radius-server host 192.168.217.64
```

```
Ruijie(config)# radius-server key test
Ruijie(config)# aaa authentication login test group radius local
Ruijie(config)# aaa authentication web portal group radius local
Ruijie(config)# web-auth authentication  portal

Ruijie(config)# line vty 0
Ruijie(config-line)# login authentication test
Ruijie(config-line)# end
Ruijie# show running-config
!
aaa new-model
!
!
aaa authentication login test group radius local
aaa authentication web portal group radius local
aaa local user allow public account
username Ruijie password 0 starnet
!
radius-server host 192.168.217.64
radius-server key 7 093b100133
!
web-auth authentication  portal

line con 0
line vty 0
login authentication test
line vty 1 4
!
!
```

web RADIUS IP 192.168.217.64
RADIUS

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IP

AAA

Login

none

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AAA

Exec

Command

Network

Exec NAS CLI
0~15 NAS CLI

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AAA

AAA AAA “ AAA ”

AAA

AAA “ ”

Network RADIUS TACACS+ Exec RADIUS
TACACS+ RADIUS “ RADIUS ” TACACS+
“ TACACS+ ”

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AAA

	Exec
	RADIUS Exec
	TACACS+ Exec

AAA Exec

Exec Login Login Exec Exec Login CLI

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Exec

1

name [*password*]	
name [*level*]	

Exec

	AAA
{ | *list-name*}	
line-num	
{ | *list-name*}	

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RADIUS Exec RADIUS RADIUS

```
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
```

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PPP SLIP Network

Network Network

RADIUS TACACS+ RADIUS TACACS+

802.1X AAA 802.1X

“ 802.1X ”

AAA Network

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RADIUS Network RADIUS RADIUS
“ RADIUS ”

RADIUS RADIUS

	AAA
{ | *list-name*}	RADIUS

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```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
Ruijie(config)# radius-server host 192.168.217.64
Ruijie(config)# radius-server key test
Ruijie(config)# aaa authorization network te ius-f0 (ƫj/TT1 2TT1 2TT1 2T gg1714
```

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Exec

Command

Network

Exec NAS CLI

NAS CLI

TACACS+ “ TACACS+ ”

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AAA

AAA AAA “ AAA ”

Network

RADIUS TACACS+ Exec RADIUS TACACS+

Command TACACS+ RADIUS “

RADIUS ” TACACS+ “ TACACS+ ”

AAA Exec

AAA “

”

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Exec NAS CLI

NAS CLI Start

CLI Stop

NAS Login Exec

Login none Exec

Start

Stop

AAA Exec

	AAA
{ | *list-name*} *method1* [*method2*...]	
line-num	AAA Exec
{ | *list-name*}	

list-name *method*

ERROR

FAIL( )

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RADIUS Exec RADIUS RADIUS

“ RADIUS ”

RADIUS RADIUS

	AAA
{ | *list-name*}	RADIUS
{ | *list-name*}	
	Step10 show r5

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Exec VTY 0~4 Login Exec Login Exec RADIUS RADIUS 192.168.217.64 test ruijie ruijie

```
Ruijie# config
Ruijie(config)# aaa new-model
Ruijie(config)# radius-server host 192.168.217.64
Ruijie(config)# radius-server key test
Ruijie(config)# username ruijie password ruijie
Ruijie(config)# aaa authentication login auth local
Ruijie(config)# aaa accounting exec acct start-stop group radius
Ruijie(config)# line vty 0 4
Ruijie(config-line)# login authentication auth
Ruijie(config-line)# accounting exec acct
Ruijie(config)# end
Ruijie# show running-config
!
aaa new-model
!
aaa accounting exec acct start-stop group radius
aaa authentication login auth local
!
username ruijie password ruijie
!
radius-server host 192.168.217.64
radius-server key 7 093b100133
!
line con 0
line vty 0 4
 accounting exec acct
 login authentication auth
!
end
```

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Network IP Network RADIUS

RADIUS	RADIUS

AAA Network


```
!
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
```

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{ *id*	}	AAA

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

AAA VRF

	AAA
gs_name	RADIUS
vrf_name	vrf

	vrf

AAA

1. AAA
2. AAA
3. AAA
4.
5.
6.

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	AAA

“ AAA ”

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{ | *list-name*} *method1* [*method2*...]	IEEE802.1x
{ | *list-name*} *method1* [*method2*...]	Network
{ | *list-name*} *method1* [*method2*...]	Network

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	AAA

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a@b@c@d

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AAA

{	*list-name*}	
{	*list-name*}	
{	*list-name*}	

{	}	

{	}	NAS

num	802.1x

1. AAA AAA
2. default AAA AAA
3.

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AAA

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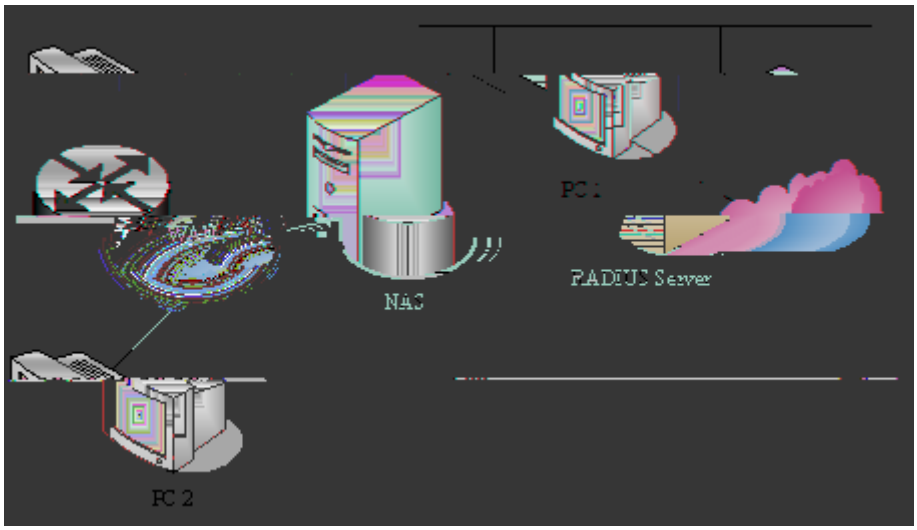
RADIUS (Remote Authentication Dial-In User Service)
/ AAA
RGOS RADIUS
NAS RADIUS

RADIUS UNIX WINDOWS 2000 RADIUS
RADIUS

RADIUS

RADIUS

RADIUS
ACCEPT
REJECT
CHALLENGE RADIUS
ACCEPT
RADIUS



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RADIUS

AAA AAA “AAA ”

RADIUS

“ ”

“ ”

RADIUS RADIUS

RADIUS

RADIUS

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RADIUS RADIUS RADIUS

ip-address [*port*] [*port*]	RADIUS IP
string	RADIUS
retries	RADIUS 3
seconds *minutes*	2 5minutes

RADIUS RADIUS Key RADIUS

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RADIUS RADIUS RADIUS
RADIUS AAA
RADIUS
AAA

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1	max down-rate	1
2	qos	2
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-directory	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	16
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

ID

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)#
```

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RADIUS

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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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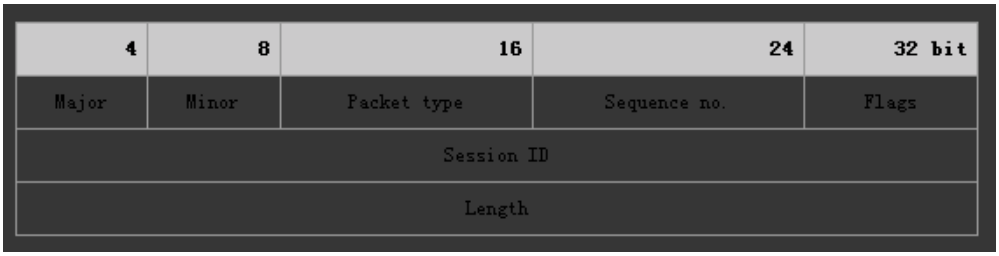
TACACS+ TACACS RFC 1492 Terminal Access Controller Access Control System Client-Server TACACS AAA

TACACS+ TACACS+

TACACS+

TACACS+



Major Version — TACACS+

Minor Version — TACACS+

Packet Type —

TAC_PLUS_AUTHEN = 0x01

TAC_PLUS_AUTHOR = 0x02

TAC_PLUS_ACCT = 0x03

Sequence Number — TACACS+

1 1

TACACS+ Daemon

Flags — flag Flag

Session ID — TACACS+ ID

Length — TACACS+

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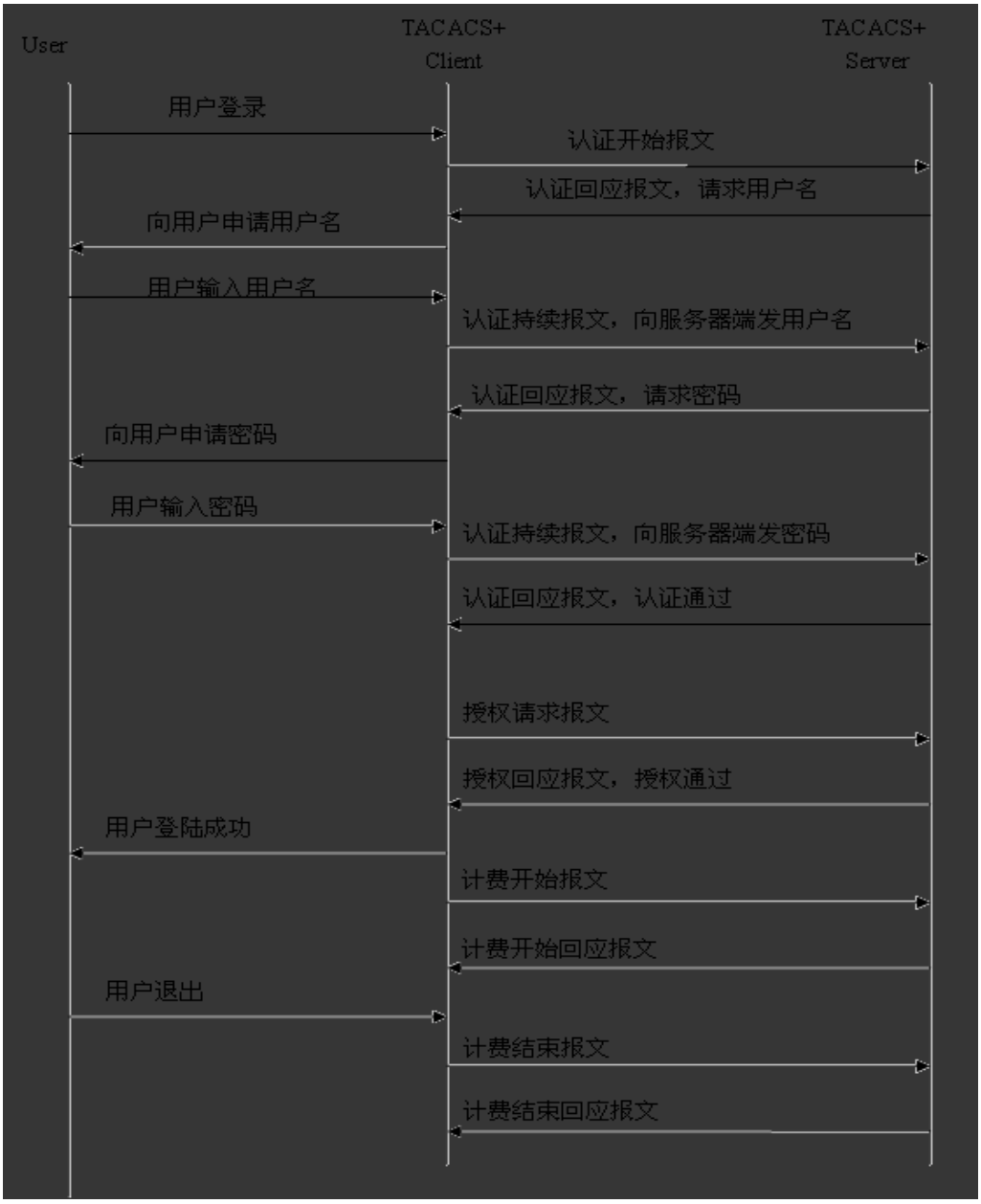
TACACS+ TACACS+

TACACS+

login TACACS+



1.

1)

2) TACACS+ TACACS+

3) TACACS+

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6) TACACS+ TACACS+

7) TACACS+

8) TACACS+

9)

10) TACACS+ TACACS+

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1) TACACS+ TACACS+

2) TACACS+

3) TACACS+

3.

1) TACACS+ TACACS+

2) TACACS+

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4) TACACS+ TACACS+

5) ACACS+

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TACACS+

AAA TACACS+ AAA

“AAA ”

tacacs+

key

TACACS+

a “ ”

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“ ”

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TACACS+ TACACS+

TACACS+


```
!
```

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1) aaa

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
```

2) tacacs+ server

```
Ruijie(config)# tacacs-server host 192.168.12.219
Ruijie(config)# tacacs-server host 192.168.12.218
Ruijie(config)# tacacs-server host 192.168.12.217
Ruijie(config)# tacacs-server key aaa
```

3) tacacs+ server group

```
Ruijie(config)#aaa group server tacacs+ tacgroup1
Ruijie(config-gs-tacacs)#server 192.168.12.219
Ruijie(config-gs-tacacs)#server 192.168.12.218
```

4) tacgroup1

```
Ruijie(config)# aaa authentication enable default group tacgroup1
```

5) enable tacacs+

```
Ruijie#show running-config
!
aaa new-model
!
!
aaa group server tacacs+ tacgroup1
server 192.168.12.219
server 192.168.12.218
!
aaa authentication enable default group tacgroup1
!
!
tacacs-server host 192.168.12.219
tacacs-server host 192.168.12.218
tacacs-server host 192.168.12.217
tacacs-server key aaa
!
line con 0
line vty 0 4
```

!

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1) aaa

```
Ruijie# configure terminal
Ruijie(config)# aaa new-model
```

2) tacacs+ server

```
Ruijie(config)# tacacs-server host 192.168.12.219
Ruijie(config)# tacacs-server key aaa
```

3) tacacs+

```
Ruijie(config)# aaa authorization exec test group tacacs+
```

4) :

```
Ruijie(config)#
```

```
Ruijie(config)# tacacs-server host 192.168.12.219
Ruijie(config)# tacacs-server key aaa
```

3) tacacs+

```
Ruijie(config)# aaa accounting commands 15 test start-stop group tacacs+
```

4) :

```
Ruijie(config)# line vty 0 4
Ruijie(config-line)# accounting commands 15 test
```

5) enable tacacs+

```
Ruijie#show running-config
!
aaa new-model
!
!
aaa accounting commands 15 test start-stop group tacacs+
!
!
tacacs-server host 192.168.12.219
tacacs-server key aaa
!
line con 0
line vty 0 4
accounting commands 15 test
!
```

Ruffle

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VRRP (Virtual Router Redundancy Protocol)

VRRP

VRRP

VRRP

RFC 2338 VRRP IP VRRP

VRRP IP

IP

VRRP

VRRP RFC 2338

VRRP VRRP

VRRP

Master IP IP

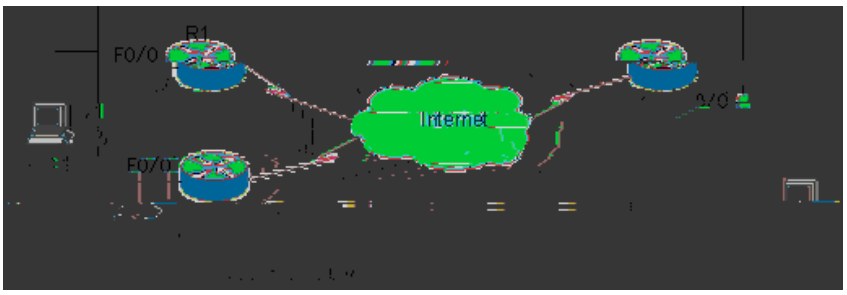
(Backup)

VRRP

VRRP

Master Master 1)

VRRP



VRRP

1 1 R1 R2

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

VRRP IP

VRRP VRRP

PC 1

PC 2 PC 1 PC 2

VRRP PC 2

PC 1

R1 R2 VRRP R1 R2

VRRP

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VRRP 2

2 A B C

3 1 A Fa0/0
IP 192.168.12.1 IP A
B 2 B Fa0/0
IP 192.168.12.2 IP B
A 1 2 1 IP
192.168.12.1 3 4 2 IP
192.168.12.2 VRRP A B

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IP

VRRP

Ruijie(config-if)# *group*	VRRP

VRRP VRRP
VRRP VRRP
1

VRRP VRRP VRRP
VRRP

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VRRP Master
VRRP VRRP
Master VRRP
VRRP IP VRRP
VRRP

Ruijie(config-if)# *group* [*seconds*]	VRRP
Ruijie(config-if)# group [ ]	VRRP

Delay Seconds VRRP
Master 0 VRRP VRRP

Ⱶ ㄱ ص ⱶ Ⱶ ∫ ŋ ∫ VRRP 0 Td(VRRP)Tj/C250 1 Tf0 Tc 0 Tw 117EACD5F9341FF514E3>

Ruijie(config-if)# *group* *level*	VRRP
Ruijie(config-if)# *group*	VRRP

Level 1~254 VRRP IP IP
VRRP 255 VRRP

Ruijie(config-if)# *group ip-address* [*interval-value*] [*timeout-value*] [*retry-value*][*priority*]	VRRP IP
Ruijie(config-if)# *group ip-address*	VRRP

VRRP interval-value
1~3600 3 timeoute-value
1~60 1
interval-value retry-value 1~60
3 priority 1~255 10

Ruijie(config-if)# *group text*	VRRP
Ruijie(config-if)# *group*	VRRP

VRRP VRRP

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VRRP ” “ ” ” ” ”

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VRRP

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Ruijie(config-if)# { *min-seconds* | *reload-seconds* }	VRRP
Ruijie(config-if)#	VRRP

VRRP VRRP

0~60

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Show Vrrp Debug Vrrp VRRP
VRRP Debug Vrrp VRRP
VRRP VRRP

VRRP

Ruijie# [| *group*]	VRRP
Ruijie# *type* *number* [ ]	VRRP

1.

```
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 interval is 3 sec
Master Down interval is 9 sec
GigabitEthernet 0/0 - Group 2
State is Master
Virtual IP address is 192.168.201.2 configured
Virtual MAC address is 0000.5e00.0102
Advertisement interval is 3 sec
Preemption is enabled
min delay is 0 sec
Priority is 120
Master Router is 192.168.201.217 (local), priority is 120
Master Advertisement interval is 3 sec
Master Down interval is 9 sec
```

VRRP

VRRP IP MAC Master IP Master

Master Master VRRP

2.

```
Ruijie# show vrrp brief
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.

```
Ruijie# show vrrp interface GigabitEthernet 0/0
GigabitEthernet 0/0 - Group 1
State is Backup
Virtuaa6 -1.549 TDr5>9a9 Tdre B  -6<. 67(016)7(219 TDr5>e)]Tonfgaunet edVirt
Virtuaa6
```

Master Master Master
VRRP

VRRP

Ruijie#	VRRP
Ruijie#	VRRP
Ruijie#	VRRP
Ruijie#	VRRP
Ruijie#	VRRP
Ruijie#	VRRP
Ruijie#	VRRP
Ruijie#	VRRP
Ruijie#	VRRP
Ruijie#	VRRP

1.

```
Ruijie# debug vrrp
Ruijie#
VRRP: Grp 1 Advertisement priority 120, ipaddr 192.168.201.213
VRRP: Grp 1-6(Gr)6(t99r)6]TJ-]TJAd(t99rr6]TJhy 12ghy 1er o )]T-6(Gequ6(Gal p
```

```
%VRRP-6-STATECHANGE: GigabitEthernet 0/0 Grp 2 state Backup -> Master
Ruijie# config terminal
Enter configuration commands, one per line.  End with CNTL/Z.
Ruijie(config)# interface GigabitEthernet 0/0
Ruijie(config-if)# no shutdown
Ruijie(config-if)# end
Ruijie#
%VRRP-6-STATECHANGE: GigabitEthernet 0/0 Grp 2 state Master -> Init
Ruijie#
```

GigabitEthernet 0/0 VRRP Master Backup Init

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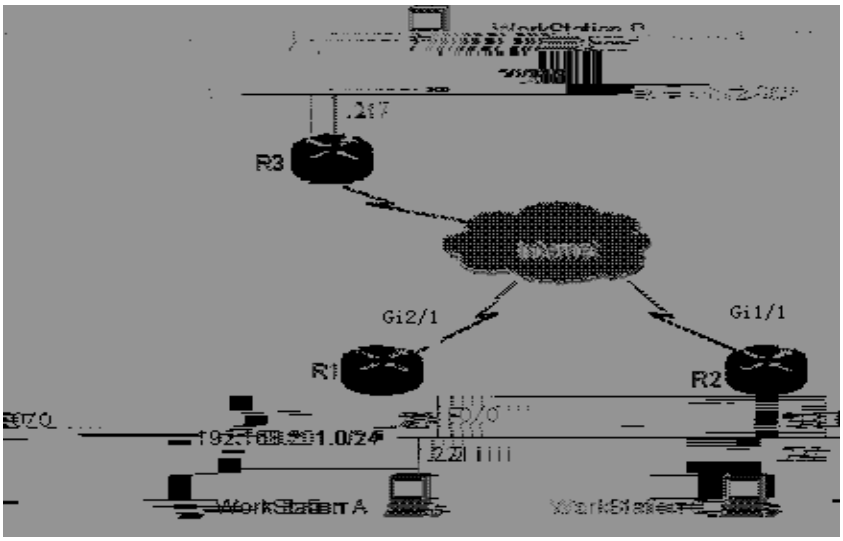
4 R1 R2 VRRP 192.168.201.0 /24 VRRP R3 VRRP R1 R2 VRRP



R3 R3

```
!
!
hostname "R3"
!
!
!
interface GigabitEthernet 0/0
```

```
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 VRRP Master

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4 (192.168.201.0/24)
R1 R2 IP
192.168.201.1 192.168.201.1 (
192.168.12.0/24) R1 VRRP Master
R1 VRRP GigabitEthernet 2/1
R1 (192.168.201.1)
R1 R2 (
192.168.201.1) R1
GigabitEthernet 2/1 R1 VRRP
R2
(192.168.201.1) R1 GigabitEthernet 2/1
R1 VRRP
R1 R2

R1

```
!
!
hostname "R1"
!
!
interface 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
R1 VRRP 30 90 R2 Master
R1 GigabitEthernet 2/1
VRRP 30 120 R1

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VRRP

4 (192.168.201.0/24)
R1 R2 (A) 1 IP

192.168.201.1 (C) 2 IP
192.168.201.2 R1 2 1
R2 2 1
R1 R2

R1

```
!
!
hostname "R1"
!
interface GigabitEthernet 0/0
no switchport
ip address 192.168.201.217 255.255.255.0
vrrp 1 timers advertise 3
vrrp 1 ip 192.168.201.1
vrrp 2 priority 120
vrrp 2 timers advertise 3
vrrp 2 ip 192.168.201.2
vrrp 2 track GigabitEthernet 2/1 30
!
interface GigabitEthernet 2/1
no switchport
ip address 202.101.90.63 255.255.255.0
!
router ospf
network 202.101.90.0 0.0.0.255 area 10
network 192.168.201.0 0.0.0.255 area 10
!
!
end
```

R2

```
!
!
hostname "R2"
!
!
interface Loopback 0
ip address 20.20.20.5 255.255.255.0
!
interface 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
network 60.154.101.0 0.0.0.255 area 10
network 192.168.201.0 0.0.0.255 area 10
!
!
!
end
```

R2 R2 VRRP 1 2

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VRRP

IP Ping

Ping IP : VRRP
VRRP

ARP
IP ARP

IP

VRRP Master

VRRP VRRP

VRRP VRRP

VRRP

VRRP VRRP

VRRP VRRP IP

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MULTI-LDP ICMP DNS TCP
ARP ICMP DNS TCP

MULTI-LDP

1 ICMP/DNS/TCP
MULTI-LDP ARP ARP
DOWN ARP
ICMP/DNS/TCP

2 UP ICMP
ICMP DNS

DOWN

3 MULTI-LDP

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RFC792 INTERNET CONTROL MESSAGE PROTOCOL

RFC1034 DOMAIN NAMES - CONCEPTS AND FACILITIES

RFC1035 DOMAIN NAMES - IMPLEMENTATION AND SPECIFICATION

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MULTI-LDP

MULTI-LDP	-

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MULTI-LDP

MULTI-LDP

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Ruijie>	
Ruijie#	
Ruijie(config) *interface-type number*	
Ruijie(config-if)# *dest-ip1* [*next-hop*] [*dest-ip2*] [*dest-ip3* [*port-value*]] [*value1*] [*value2*] [*value3*]	multi-ldp

end	

dldp

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Ruijie>

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DOWN

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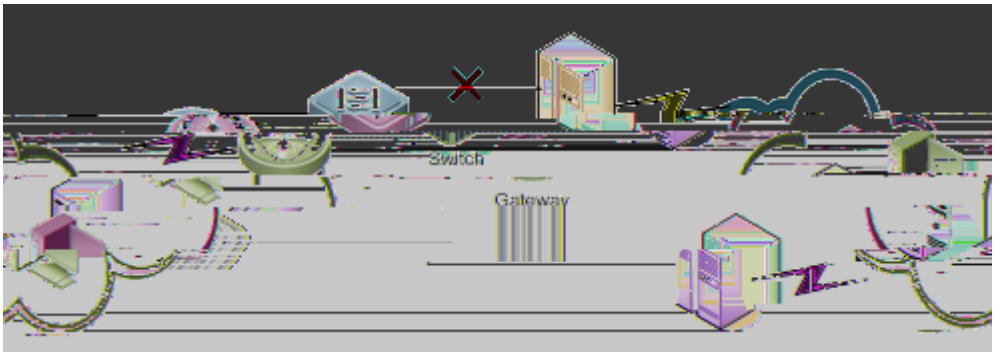

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1 ICMP IP IP next-hop

2 retry resume

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0/1 icmp
192.168.20.1 dns 192.168.5.110 tcp 192.168.6.66
10tick 3 UP DOWN 2
DOWN UP

Ruijie#

Ruijie(config)#interface gigabitEthernet 0/1

Ruijie(config-if-GigabitEthernet 0/1)# 192.168.20.1 192.168.5.110
192.168.6.66 10 3 2

1

2

3

4 USB

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NPE	syslog

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CPU

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CPU

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```
2009-12-18 04:57:10    61%
2009-12-18 05:02:10    61%
2009-12-18 05:07:10    61%
2009-12-18 05:12:10    61%
2009-12-18 05:17:10    61%
2009-12-18 05:22:10    61%
2009-12-18 05:27:10    61%
2009-12-18 13:32:10    61%
2009-12-18 13:37:10    61%
2009-12-18 13:42:10    64%
2009-12-18 13:47:10    64%
2009-12-18 14:02:29    61%
2009-12-18 14:07:29    61%
2009-12-18 14:18:45    61%
2009-12-18 14:23:45    61%
2009-12-18 14:28:45    61%
2009-12-18 14:33:45    61%
2009-12-18 14:38:45    61%
2009-12-18 14:43:45    61%
2009-12-18 14:48:45    61%
2009-12-18 14:53:45    61%
2009-12-18 14:58:45    61%
```

2 CPU

```
Ruijie#show dev-audit cpu from 2010 1 14 12:00:00
Date & Time           CPU
2010-01-14 12:03:16    0%
2010-01-14 12:08:16    0%
2010-01-14 12:13:16    0%
2010-01-14 12:18:16    0%
2010-01-14 12:23:16    0%
2010-01-14 12:28:16    0%
2010-01-14 12:33:16    0%
2010-01-14 12:38:16    0%
```

```
2010-01-14 12:43:16    0%
2010-01-14 12:48:16    0%
2010-01-14 12:53:16    0%
2010-01-14 12:58:16    0%
2010-01-14 13:03:16    0%
2010-01-14 13:08:16    0%
2010-01-14 13:13:16    0%
2010-01-14 13:18:16    0%
2010-01-14 13:23:16    0%
2010-01-14 13:28:16    0%
2010-01-14 13:33:16    0%
2010-01-14 13:38:16    0%
2010-01-14 13:43:16    0%
2010-01-14 13:48:16    0%
2010-01-14 13:53:16    0%
2010-01-14 13:58:16    0%
2010-01-14 14:03:16    0%
2010-01-14 14:08:16    0%
2010-01-14 14:13:16    8%
```

3

```
Ruijie#show dev-audit flash from 2010 1 14
Date & Time                    FLASH(KB)          SATA(MB)
                            Total Available    Total Available
2010-01-14 01:13:16        523776    470152    163746    163451
2010-01-14 02:13:16        523776    470152    163746    163449
2010-01-14 03:13:16        523776    470152    163746    163448
2010-01-14 04:13:16        523776    470152    163746    163447
2010-01-14 05:13:16        523776    470152    163746    163445
2010-01-14 06:13:16        523776    470152    163746    163444
2010-01-14 07:13:16        523776    470152    163746    163442
```

```
2010-01-14 11:13:16       523776   470152   163746   163430
2010-01-14 12:13:16       523776   470152   163746   163421
2010-01-14 13:13:16       523776   470152   163746   163416
2010-01-14 14:13:16       523776   470112   163746   163409
```

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CPU

CPU

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CPU CPU

Ruijie#	CPU

Ruijie

```
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 seco NO287251029 Tw 0 ormation ormaLIc   R3(
```

```
 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
78    0%    0%    0%    uart_debug_file_task
79    0%    0%    0%    ssp_init_task
80    0%    0%    0%    rl_listen
81    0%    0%    0%    ikl_msg_operate_thread
82    0%    0%    0%    bcmDPC
83    0%    0%    0%    bcmL2X.0
84    3%    3%    3%    bcmL2X.0
85    0%    0%    0%    bcmCNTR.0
86    0%    0%    0%    bcmTX
87    0%    0%    0%    bcmXGS3AsyncTX
88    0%    2%    1%    bcmLINK.0
89    0%    0%    0%    bcmRX
90    0%    0%    0%    mngpkt_rcv_thread
91    0%    0%    0%    mngpkt_recycle_thread
92    0%    0%    0%    stack_task
```

```
 93     0%     0%     0%    stack_disc_task
 94     0%     0%     0%    redun_sync_task
 95     0%     0%     0%    conf_dispatch_task
 96     0%     0%     0%    devprob_task
 97     0%     0%     0%    rdp_snd_thread
 98     0%     0%     0%    rdp_rcv_thread
 99     0%     0%     0%    rdp_slot_change_thread
100     4%     2%     1%    datapkt_rcv_thread
101     0%     0%     0%    keepalive_link_notify
102     0%     0%     0%    rerp_msg_recv_thread
103     0%     0%     0%    ip_scan_guard_task
104     0%     0%     0%    ssp_ipmc_hit_task
105     0%     0%     0%    ssp_ipmc_trap_task
106     0%     0%     0%    hw_err_snd_task
107     0%     0%     0%    rerp_packet_send_task
108     0%     0%     0%    idle_vlan_proc_thread
109     0%     0%     0%    cmic_pause_detect
110     1%     1%     1%    stat_get_and_send
111     0%     1%     0%    rl_con
112    75%    80%    90%    idle
```

3 5 1 5

CPU LISR HISR CPU

No

5Sec 5 CPU

1Min 1 CPU

5Min 5 CPU

Process

2 LISR CPU HISR CPU z

100% 90%

CPU 70% 80%

```
Ruijie# configure terminal                    //
Ruijie(config)# cpu-log log-limit 70 80    //    CPU
```

CPU 80% 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% 70% , ,,

```
Oct 20 15:47:01 %SYSCHECK-5-CPU_USING_RATE: CPU utilization in one
minute :68%  Using most cpu's task is ktimer : 60%
Oct 20 15:47:01 %SYSCHECK-5-CPU_USING_RATE: The CPU using rate has
down!
```

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Threshold CPU

CLI

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.

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CPU	90	100
	90	100
	90	100

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Ruijie#	
Ruijie(config)# *n* | *n warning_value critical_value*	CPU 1~100

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Ruijie#	

Ruijie(config)# *n* | *n warning_value critical_value*	1~100

no threshold set memory

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Ruijie(config)#threshold set cpu member 1 80 90

Ruijie(config)#threshold set temperature member 1 60 80

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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

lower	**memory-lack exit-policy**
low	OVERFLOW
high	OVERFLOW

3.

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lower

BGP OSPF RIP PIM-SM

[| | |

Ruijie(config)# [| | |	

lower

lower (show memory lower)

BGP

BGP

Ruijie#	

```
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

RGOS SCSI U SCSI
USB U USB U

U /SD FAT U /SD PC FAT

RGOS USB USB-HDD

U copy FS
syslog SYSLOG

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makefs

Ruijie# *dev_file* *fs_name*	*dev_file* *fs_name*

U

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

U fat32

U vfat

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Ruijie#	usb

CLI

```
Ruijie# sh usb
Device: USB Mass Storage Device :
ID: 778
Lun 0:
Disk Partitions:
1: /dev/uba/disc0/part1 --> /mnt/uba
size : 131072000B(125MB)
```

0:1:2:34 Ruijie: USB-3-OHCI_ERR: USB1.0 controller is not available now.

USB 1.0 2.0 U

U

0:1:3:29 Ruijie: USB-3-EHCI_ERR: USB2.0 controller is not available now.

USB 2.0 1.0 U

U

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1

2 RLOG

3 SNMP

4 MIB

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UP DOWN

VTY

FLASH

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

Syslog

Server

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Syslog

FLASH

Syslog Server

Syslog Server

Logging File Flash FLASH

TXT

More Flash Filename Flash

FLASH FLASH FLASH

FLASH FLASH

Ruijie(config)# *message-type* [|]	
Ruijie(config)# *message-type*	

(Uptime) (Datetime)

Log Debug Log 0 6 Debug

7

Ruijie(config)#	
Ruijie(config)#	

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Ruijie(config)#	
Ruijie(config)#	

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Ruijie(config)#	
Ruijie(config)#	

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Ruijie(config-line)#	
Ruijie(config)#	

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	3	
	4	
	5	
	6	
	7	

0

6 6 6

7

VTY 7
6
6 6

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

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Syslog Server

Log IP Log

Ruijie(config)# *interface-type interface-number*	
Ruijie(config)# *A.B.C.D*	ip

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LOG

/ LOG LOG

Ruijie(config)#	/ LOG
Ruijie(config)#	LOG

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Ruijie#	
Ruijie#	
Ruijie#	
Ruijie# *filename*	FLASH

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```
Ruijie(config)# interface gigabitEthernet 0/1
Ruijie(config-if)# ip address 192.168.200.42 255.255.255.0
Ruijie(config-if)# exit
Ruijie(config)# service sequence-numbers          //
```

```
Ruijie(config)# service timestamps debug datetime   //     debug

Ruijie(config)# service timestamps log datetime  //     log

Ruijie(config)# logging 192.168.200.2    //      syslog server
Ruijie(config)# logging trap debugging         //
                                                 syslog server
Ruijie(config)# end
```

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rlog

rlog nat

web

/NAT

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udp

Ruijie(config)# [*vrf-name*	] [*port-num*]	ip VRF 20000
Ruijie(config)# *server-ip*	

IP	26
	27
telnet	28
web	29
web bbs	30
im	31
FTP	32
Web	33
	0-7
XLOG_PRIORITY_EMER, XLOG_PRIORITY_ALERT, XLOG_PRIORITY_ERR, XLOG_PRIORITY_WARN, XLOG_PRIORITY_NOTICE, XLOG_PRIORITY_INFO, XLOG_PRIORITY_DEBUG,	

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Ruijie(config)#	

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/NAT

Ruijie(config)#	
Ruijie(config)#	

Ruijie(config)# nat

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Ruijie#	
Ruijie#	*server-ip*

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SNMP Simple Network Manger Protocol 1988 8
RFC1157 SNMP
SNMP

SNMP

SNMP /

SNMP

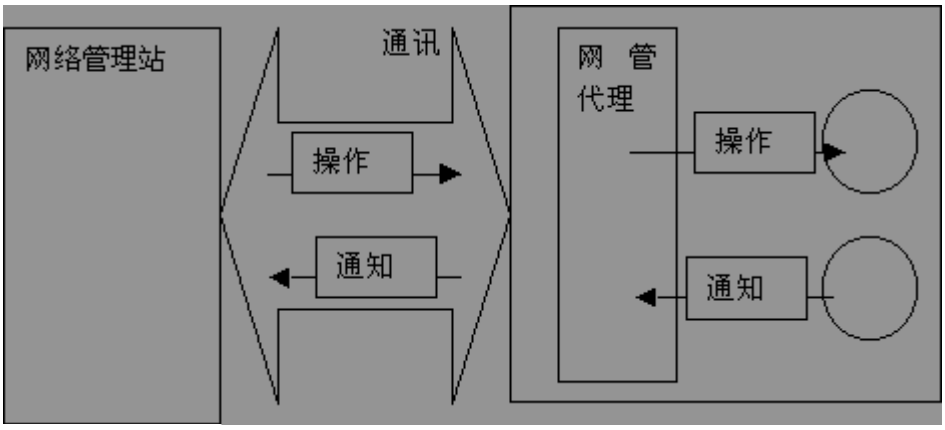
SNMP

MIB

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

SNMP SNMP Agent
NMS NMS

NMS Agent



MIB Management Information Base

SNMPv2C Get-bulk
Get-bulk

- SNMPv2C
SNMPv1
SNMPv1 SNMPv2C
SNMP SNMPv1 SNMPv2C

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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

NMS Agent 3 Agent UDP 161 Agent
Trap UDP 162

0

1 4 Ipv4

2 16 Ipv6

3 6 MAC

4 27

5 16 27

6-127

128-255

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SNMPv3

MIB

username groupname

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Agent NMS Agent NMS

Ruijie(config)# { *host-addr* | ipv6-addr} [*vrfname*] [{ | | [| |]}] *community-string* [*udp-port port-num*] [ ]	SNMP vrf SNMPv3 SNMPv3

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SNMP Agent
NMS

SNMP

Ruijie(config)#

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SNMP

snmp snmp

Ruijie(config)#	SNMP

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snmp snmp
SNMP

Ruijie(config)#	SNMP

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Trap Agent NMS
Agent Trap

Ruijie(config)# [*type*] [*option*]	Agent Trap
Ruijie(config)# [*type*] [*option*]	Agent Trap

Ruijie(config)# *interface-id*	
Ruijie(config-if)# [ ]	link trap .

Link trap:

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

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Agent Trap

Ruijie(config)# *interface*	Trap
Ruijie(config)# *length*	Trap
Ruijie(config)# *seconds*	Trap

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Ruijie(config)#	

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

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SNMP SNMP SNMP
SNMP
SNMP

```
Ruijie# show snmp
Chassis: 1234567890 0987654321
Contact: wugb@i-net.com.cn
Location: fuzhou
2381 SNMP packets input
5 Bad SNMP version errors
6 Unknown community name
0 Illegal operation for community name supplied
0 Encoding errors
9325 Number of requested variables
0 Number of altered variables
31 Get-request PDUs
2339 Get-next PDUs
0 Set-request PDUs
2406 SNMP packets output
0 Too big errors (Maximum packet size 1500)
4 No such name errors
0 Bad values errors
0 General errors
2370 Get-response PDUs
36 SNMP trap PDUs
SNMP globqune3(0)6( ToFs)6(qbled)6( )]TJT*[(S)6(NMP)6( log)6(gi)6(ng3(0)6en)
```

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	
Bad values errors	
General errors	
Get-response PDUs	Get-response
SNMP trap PDUs	SNMP trap

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MIB

```
Ruijie# show snmp mib
sysDescr
sysObjectID
sysUpTime
sysContact
sysName
sysLocation
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
entPhysicalEntry.entPhysicalSoftwareRev
entPhysicalEntry.entPhysicalSerialNum
entPhysicalEntry.entPhysicalMfgName
entPhysicalEntry.entPhysicalModelName
entPhysicalEntry.entPhysicalAlias
entPhysicalEntry.entPhysicalAssetID
entPhysicalEntry.entPhysicalIsFRU
entPhysicalContainsEntry
entPhysicalContainsEntry.entPhysicalChildIndex
entLastChangeTime

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SNMP

```
Ruijie# show snmp user

User name: test
Engine ID: 8000131103000000000000
storage-type: permanent    active
Security level: auth priv
Auth protocol: SHA
Priv protocol: DES
Group-name: g1
```

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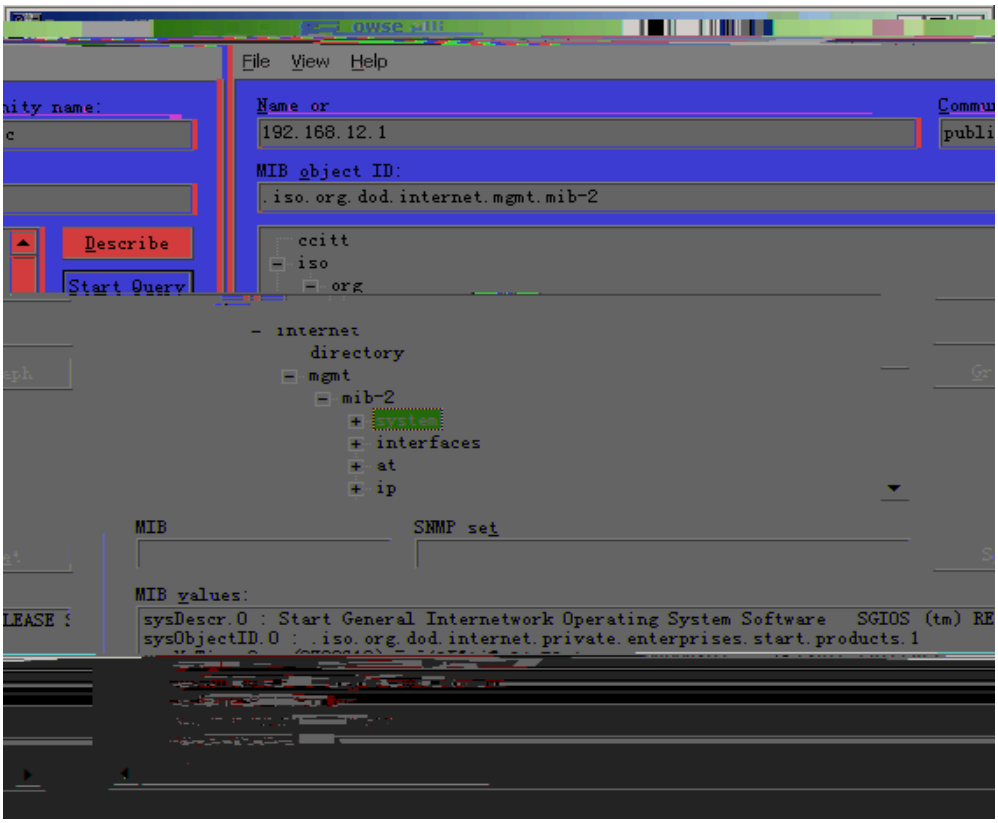
```
Ruijie# show snmp group
groupname: g1
securityModel: v3
securityLevel:authPriv
readview: default
writeview: default
notifyview:
groupname: public
securityModel: v1
securityLevel:noAuthNoPriv
readview: default
writeview: default
notifyview:
groupname: public
securityModel: v2c
securityLevel:noAuthNoPriv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

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

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

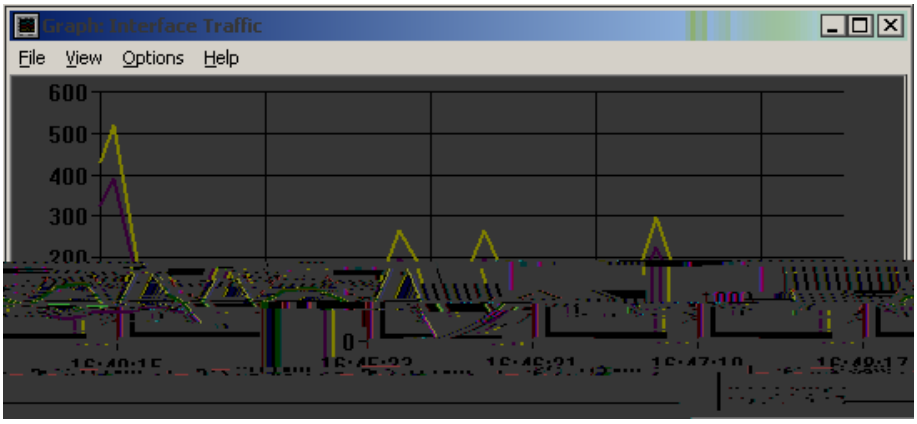
SNMP NMS
HP OpenView

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



HP OpenView

SNMP



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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

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MIB

MIB

MIB

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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

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
......
```

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

MIB