

RSR04E/08E

A

2005-8

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“A” RSR JUNOS 7.3 RSR JUNOS
↓
JUNOS documentation CD

RSR JUNOS

JUNOS Configuration Guides

Feature Guide

JUNOS-FIPS

MPLS Applications

Multicast

Network Interfaces and Class of Service

Network Management

Policy Framework

Routing and Routing Protocols

Services Interfaces

System Basics

VPNs

1 JUNOS

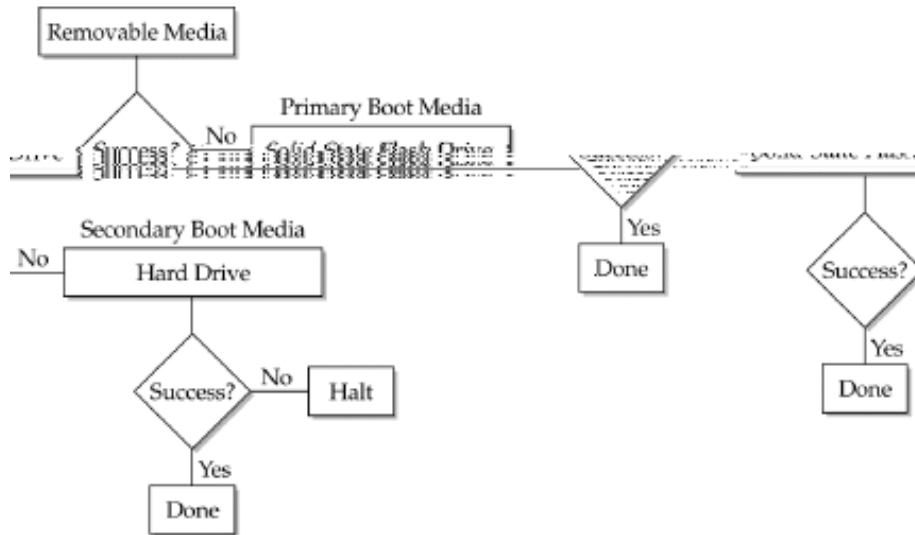
Junos FreeBSD
MPLS 卅 Å

IPv6 à

1-1

1.1

卅 PC-card PCMCIA Å
Flash Disk Å
b, IDE Å



1-2

RSR ↓ IDE flash disk pc-card ↓ IDE ~ || Â

1.2

1.2.1 RSR

*** FINAL System shutdown message from root ***

System going down IMMEDIATELY

Shutdown NOW!

[pid 4050]

The operating system has halted.

Please press any key to reboot.

```
1,      "The operating system has halted. "      ↵  ␣
2              ||- Å| Please press any key to reboot. ␣
```

(2) ␣

root>**request system reboot**

Reboot the system ? [yes,no] (no)y

1.2.3

```
Junos      .tgz      Å      ↵      ' jinstall-7.1r1.4-domestic.taz
^ 1~      FTP      ⊖      RSR      /var/home/admin/IO
è  admin      ↵ Å
^ 2~      ⌘ request system software add <path-and-name-for-package>      Å
␣ ||      Å
admin@rsr04e>request system software add jinstall-7.1r1.4-domestic.taz
installing package '/var/home/admin/ jinstall-7.1r1.4-domestic.taz' ....
....
Restarting cli
cli
```

1.3 junos

admin@rsr04E> **help reference | topic**

example: admin@1> **help topic interfaces lo0**

Configuring the Loopback Interface

On the routing platform, you can configure one physical loopback interface, lo0, and one or more addresses on the interface. To do this, include the following statements at the [:

⌘ ' RSR04/08E Å

⌘

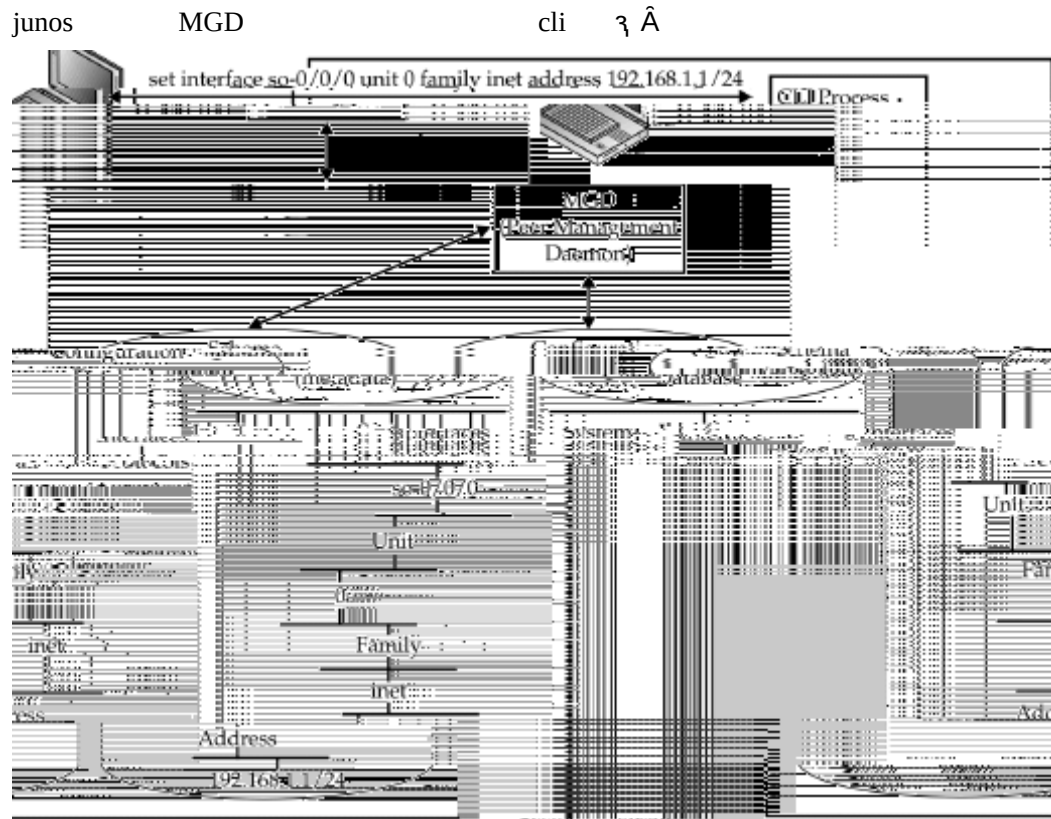
```
[edit interfaces]
lo0 {
    unit 0 {
        family inet {
            address loopback-address;
            address <loopback-address2>;
            ...
        }
    }
}
```

When do not include a destination prefix.

Also, in most cases, do not specify a loopback address on any unit other than unit 0.

```
+-----+
|       | NOTE: For Layer 3 you can       |
|       | configure multiple logical units for the loopback interface.   |
---(more)---
```

2. JUNOS CLI



2-1

Example

```
set interfaces fe-0/0/0 unit 0 family inet address 192.168.1.1/24
delete interfaces fe-0/0/0 unit 0 family inet address 192.168.1.1/24
```

2.1 CLI

1

à Â

2

test@lab2>

' interface à à à à Â

test@lab2> configure

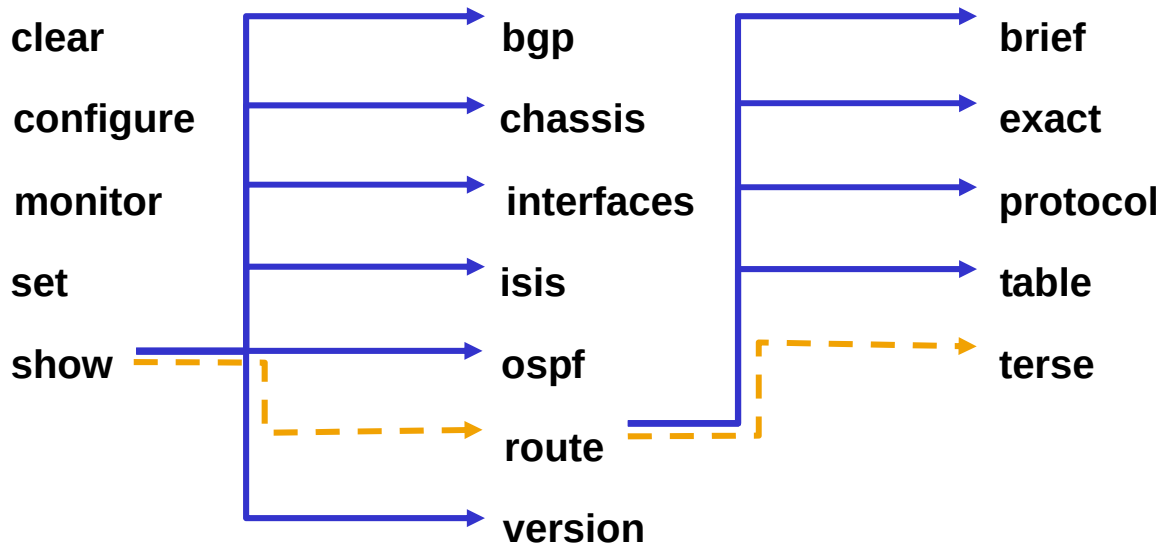
[edit]

test@lab2#

2.1.1 CLI

^ 1 ~ 3

tu



2-2

^ 2 ~ 3

admin@RSR> ?

Possible completions:

clear	Clear information in the system
configure	Manipulate software configuration information
file	Perform file operations
help	Provide help information
monitor	Show real-time debugging information
mtrace	Trace multicast path from source to receiver
ping	Ping remote target
quit	Exit the management session
request	Make system-level requests
restart	Restart software process
set	Set CLI properties, date/time, craft interface message
show	Show system information
ssh	Start secure shell on another host
start	Start shell

telnet	Telnet to another host
test	Perform diagnostic debugging
tracert	Trace route to remote host

^ 3~ ↓ 几 Ю / |
|compare à| count à| display à| except à| find à| hold à| match à| no-more à| resolve à| save à| trim

^ 4~ set cli 3 cli

admin@HBLF-PA-RT01> **set cli ?**

Possible completions:

complete-on-space	Toggle word completion on space
directory	Set the CLI's working directory
idle-timeout	Set the CLI maximum idle time
prompt	Set the CLI command prompt string
restart-on-upgrade	Set CLI to prompt for restart after a software upgrade
screen-length	Set number of lines on screen
screen-width	Set number of characters on a line
terminal	Set terminal type

^ 5~ VT-100

Ctrl+P	Displays the previous line in the CLI history buffer and is equivalent to the Up arrow key.
Ctrl+N	Displays the next line in the CLI history buffer and is equivalent to the Down arrow key.
Ctrl+B	Moves the cursor back one character and is equivalent to the Left arrow key.
Ctrl+F	Moves the cursor forward one character and is equivalent to the Right arrow key.
Esc+B	Moves the cursor back one word at a time. The Esc key must be released and re-pressed for each keystroke.
Esc+F	Moves the cursor forward one word at a time. The Esc key must be released and re-pressed for each keystroke.
Ctrl+A	Moves the cursor to the beginning of the current command line.
Ctrl+E	Moves the cursor to the end of the current command line.
Ctrl+W	Deletes the word to the left of the cursor.
Ctrl+X	Deletes the entire current command line.
Ctrl+L	Redraws the current command line

^ 6~ ¶

```
root@lab2> sh<space>ow i<space>
'i' is ambiguous.
```

Possible completions:

igmp	Show information about IGMP
interfaces	Show interface information
isis	Show information about IS-IS

```
root@lab2> show i
```

^ 7~ ¶ 3

```
lab@omaha> ?
```

Possible completions:

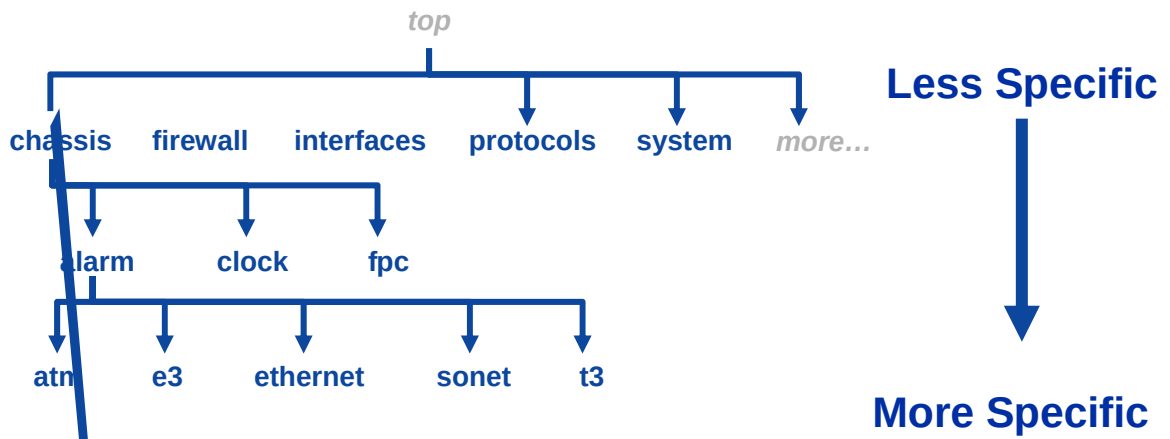
clear	Clear information in the system
configure	Manipulate software configuration information
file	Perform file operations
help	Provide help information
...	

2.1.2

^ 1~

```
root@lab2> configure
Entering configuration mode
[edit]
```

^ 2~



2 -3

^ 3~

edit { cd }

2-4

edit chassis alarm ethernet ↵

ethernet

a

set chassis alarm ethernet

^ 4~

up top }

user@host# **up**
[edit chassis alarm]
user@host# **top**
[edit]

2-5


```
sonet {  
+      lol red  
      los red;  
-      pll yellow;  
      }  
}  
,  
     ě  
user@host# s2i*D26(o | compa(r)11( )TJ/T30 1 Tf0.0006 Tc 0 Tw76.086 0 Td[filens)8ame
```

^ 9~

commit
ser@host#commit
and-quit
at
check

rollback

commit
a commit

3

L

3.1 Root

3.1.1

```

router root
login: root
Password:

--- JUNOS 7.3B1.1 built 2005-04-22 22:04:30 UTC
Terminal type? [vt100]

root% cli
root>

root> configure
Entering configuration mode

[edit]
Root#
```

3.1.2 root

```

(1)
root# set root-authentication plain-text-password
root# new password : star
root# retype new password: star
(2)
root# show
root-authentication {
  encrypted-password "$1$xavDeUe6$fNM6olGU.8.M7B62u05D6."; # SECRET-DATA
}
^ 3~  é  7  7  root  user  Â
root# set root-authentication encrypted-password character-string
  7  a  Â
```

3.2 user

Junos user 网络 用户 网络 用户

3.2.1 user

```
root# set login user robert
```

```
root# set login user robert authentication plain-text-password
```

routing	Can view routing configuration
routing-control	Can modify routing configuration
secret	Can view secret configuration
secret-control	Can modify secret configuration
security	Can view security configuration
security-control	Can modify security configuration
shell	Can start a local shell
snmp figuration	
snmp-control	Can modify SNMP configuration
system	Can view system configuration
system-control	Can modify system configuration
trace	Can view trace file settings
trace-control	view Can view current values and statistics
view-configuration	Can view all configuration (not including secrets)

[edit system]

Example : root@RSR04E-1# **set login class test permissions** [*clear network reset trace view configure interface-control*]

2 配置 3 class

root@RSR04E-1#**set login class test permissions** [*clear network reset trace view configure interface-control*] **allow-commands** “system request reboot” **deny-commands** “(show system | show chassis | show version)”

3, session timeout

root@RSR04E-1# **set login class** class-name **idle-timeout** minutes;

4, ≠ ↓ √ RADIUS TACACS+ Å

3.3 services and processes

3.3.1 host name à dns à domain-name

配置 Hostname

root@RSR04E# set system host-name RSR04E-1

[edit]

root@RSR04E# commit

commit complete

[edit]

root@RSR04E-1#

4 ' RSR04/08E Å

4

[edit]

2 ssh ↵

2

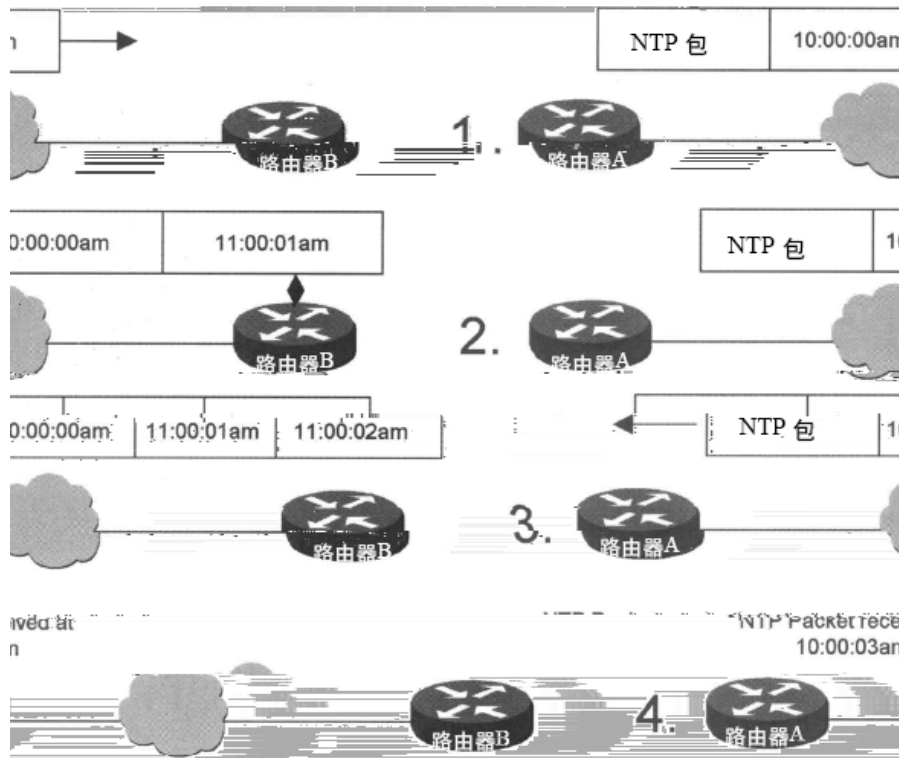
ssh

1

2 a

^

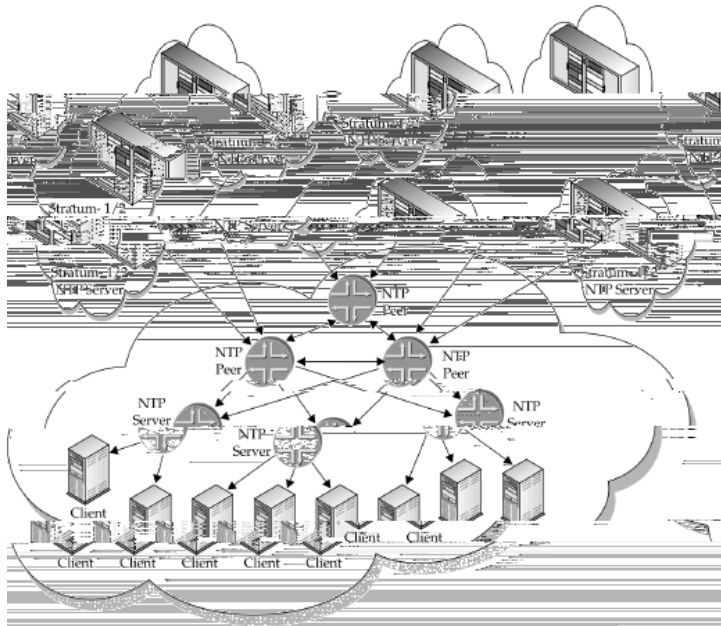
root@RSR04E-1#



3-4

- 1) A NTP B A 10:00:00 a.m. Â
 - 2) NTP B B 11:00:01 a.m. Â
 - 3) NTP B B 11:00:02 a.m. Â
 - 4) A 10:00:03 a.m. Â
- NTP
- A B Â
- A 6 B Â
- ↓ NTP RFC1305 NTP
- ↓ Â

NTP ^ JUNOS RFC 1305⁸ version3~



3 - 4

- (1) JUNOS NTP
 - Configuring the NTP Boot Server
 - Specifying a Source Address for an NTP Server
 - Configuring the NTP Time Server and Time Services
 - Configuring NTP Authentication Keys
 - Configuring the Router to Listen for Broadcast Messages
 - Configuring the Router to Listen for Multicast Messages

(2) Syntax

[edit system]

Syntax

ntp {

Syntax

server address <key key-number> <version value> <prefer>;

authentication-key key number type type value password;

boot-server address;

trusted-key [key-numbers];

example :

[edit system ntp]

authentication-key 1 type md5 value "\$9\$EgfcvX7VY4ZEcwgoHjkP5Q3CuREyv87";

boot-server 10.1.1.1;

server 10.1.1.1 key 1 prefer;

trusted-key 1;

^ 4~ Symmetric Active

symmetric active router system ↵ ⌘ ⌘

[edit system ntp]

peer address <key key-number> <version value> <prefer>

^ 5~ NTP server

router ntp server

Syntax

[edit system ntp]

authentication-key key number type type value password;

server address <key key-number> <version value> <prefer>;

trusted-key [key-numbers];

example

[edit system ntp]

authentication-key 1 type md5 value "\$9\$tXERuBEreWx-wtuLNdboaUjH.T3AtOESe";

server 172.17.17.27.46 prefer;

trusted-key 1;

^ 6~ NTP

Lab@RSR> show ntp status

Lab@RSR>show ntp associations

⌘ ⌘ ⌘ ntp services ↵ ⌘

3.3.4 SNMP

JUNOS SNMP version 3

(1) SNMP Agent 配置

Syntax

```
community community-name {
    authorization authorization;
    clients {
        address restrict;
    }
    view view-name;
}
```

Example:

admin@RSR04E-1# **set snmp community tester authorization read-only clients 192.168.0.1/24**

admin@RSR04E-1# **set snmp community tester authorization read-only clients 10.10.10.0/24 restrict**

```
snmp {
    community tester {
        authorization read-only;
        clients {
            192.168.0.1/24;
            10.10.10.0/24 restrict' /**** a 10.10.10.0/24 只 router snmp ****/
        }
    }
}
```

(2) SNMP trap-group

Syntax

```
trap-group group-name {
    categories [ categories ]; /**** trap ****/
    destination-port <port-number>;
    targets {
        address; /**** ****/
    }
    version (all | v1 | v2); /**** *****/
}
```

Example:

```
Snmp{
    trap-group tester {
        categories {
```

```
link;      /***      ŷ || trap      ŷ      ***/  
}
```


Junos 几 syslog console 几 ~ - 几 Â

, facilities and Severity levels

JUNOS system logging Facilities (logging 几)

Facility Type of Event or Error

Syntax :

```
syslog {
    archive {
        files number;
        size size;
        (world-readable | no-world-readable);
    }
    console {
        facility severity;
    }
    file filerity;
        explicit-priority;
        match "regular-expression";
        archive {
            files number;
            size size;
            (world-readable | no-world-readable);
        }
    }
    host (hostname | other-routing-engine | scc-master) {
        facility severity;
        explicit-priority;
        facility-overrde facility;
        log-prefix string;
        match "regular-expression";
    }
    ce-address;
        time-format (year | millisecond | year millisecond);
        user (username | *) {
            facility severity;
            match "regular-expression";
        }
    }
```

Syslog Files

```

admin@RSR04E-1# edit system

[edit system]
admin@RSR04E-1# set syslog file messages any notice
log
log 128k 10
admin@RSR04E-1# edit system

[edit system]
admin@RSR04E-1# set syslog archive size 1m files 20
1M 20
syslog server udp 514
[edit system]
admin@RSR04E-1# set syslog host 192.168.0.1 any alert
localX facility name
admin@RSR04E-1# set syslog host 192.168.0.1 facility-override local0

```

4 Traceoptions

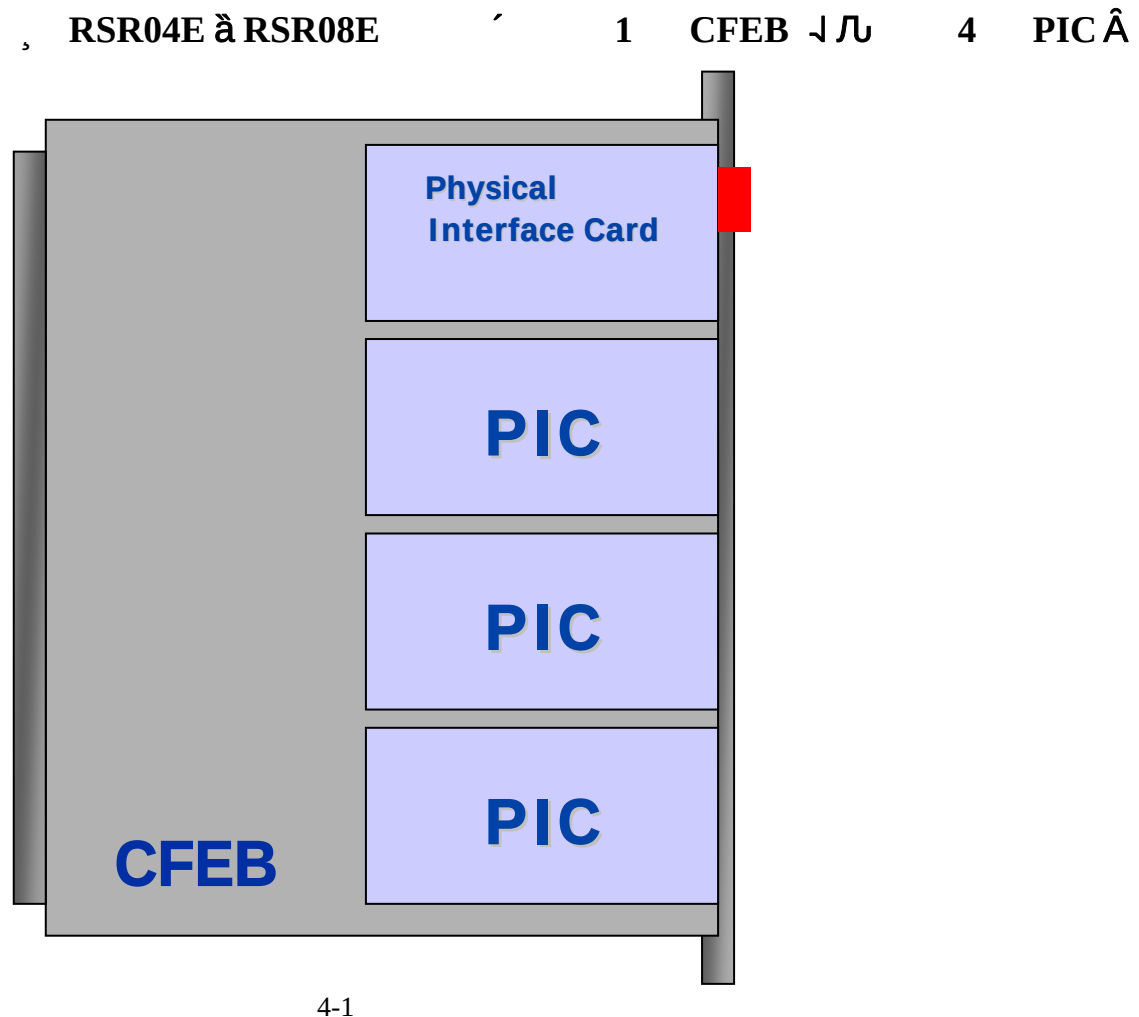
```

admin@RSR04E-1# set traceoptions file interface.log size 1m files 10
admin@RSR04E-1# set traceoptions flag change-events
example
interfaces {
    traceoptions {
        file interface.log size 1m files 10;
        flag change-events;
    }
}
admin@RSR04E-1>Show log

```

Log /var/log/

4 interface



4.1

show interfaces terse 几 Â

Interface type-CFEB # / PIC Slot Port #

Interface Media Type

Â at—ATM over SONET/SDH ports

Â e1—E1 ports

Â e3—E3 ports

Â fe—Fast Ethernet ports

- ^ so—SONET/SDH ports
- ^ t1—T1 ports
- ^ t3—DS-3 ports
- ^ ge—Gigabit Ethernet ports
- ^ ae—Aggregated Ethernet ports

CFEB slot number

RSR 04E CFEB CFEB number 0
RSR 08E CFEB 0 1

0
1

4-2

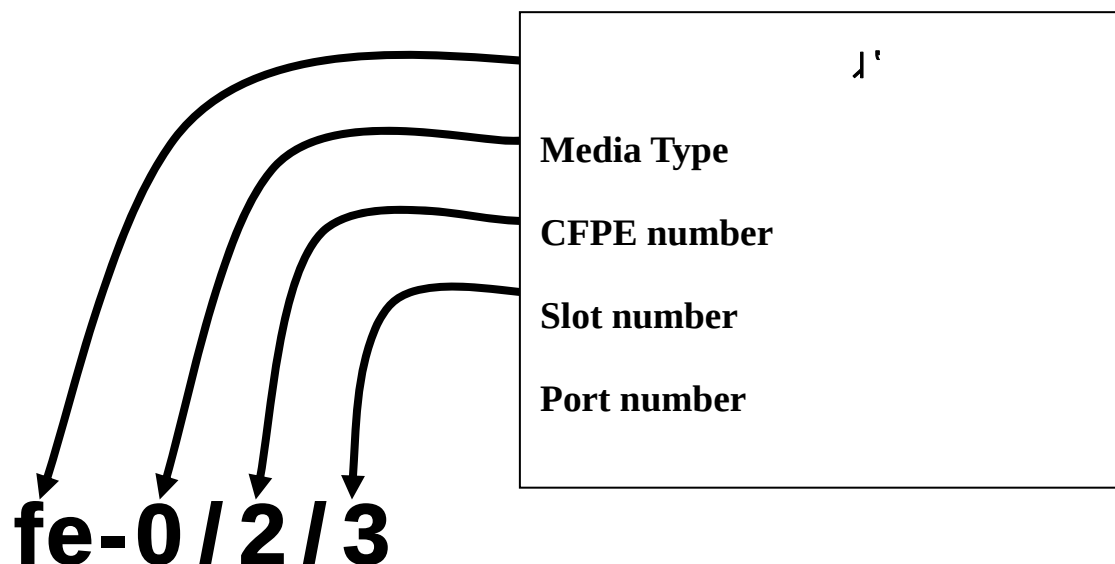
PIC slot number

3	2	1	0
---	---	---	---



4-3

Interface name



4-4


```

>
admin@RSR04E-1> configure
Entering configuration mode
admin@RSR04E-1# set interfaces fe-0/0/0 mtu 1514

[edit]
admin@RSR04E-1# commit
commit complete

[edit]

>
    ↑      à      Â
admin@RSR04E-1# set fe-0/0/0 unit 0 family inet address 192.168.11.1/24

>
    unit number
1
    unit 1
    1  3  4  ATM vc à frame- rely DLCI 1
2
    4  4  unit 1  10 unit 1  0
3
    unit 1
  
```

4.2 Ethernet interface : GE and FE

RSR GE à FE à VLAN tagging à MTU

4.4.1 MAC

1024	16	ÀÈ	16
------	----	----	----

Public count	1008
Private base address	00:12:1e:01:33:f0
Private count	16

4.4.2 VLAN Tagging

RSR 802.1Q VLAN tagging. Vlan IDs 0 4095

Example:

1, RSR04E 6 RG—6806E trunk 802.1Q FE trunk

(1) RSR config

```
interfaces {
    fe-0/0/0 {
        description to-RG6808-4/5;
        vlan-tagging;
        unit 11 {
            vlan-id 11;
            family inet {
                address 10.10.11.2/24;
            }
        }
        unit 12 {
            vlan-id 12;
            family inet {
                address 10.10.12.2/24;
            }
        }
    }
}
```

(2) RG-6806E

```
interface GigabitEthernet 4/5
    speed 100
    duplex full
    description "to-RSR04E-fe-0/0/0"
    switchport mode trunk
```

2, RSR04E 6 RG—6806E trunk 802.1Q GE trunk

^ 1~ RG-6806E

```
interface GigabitEthernet 4/9
H ' RSR04/08E "A
```

H


```
medium-type fiber
speed 1000
description "to-RSR04E-ge-1/3/0"
switchport mode trunk
```

(2) RSR04E

```
interfaces {
  ge-1/3/0 {
    description to-RG-6808E;
    vlan-tagging;
    unit 13 {
      vlan-id 13;
      family inet {
        address 10.10.13.2/24;
      }
    }
    unit 14 {
      vlan-id 14;
      family inet {
        address 10.10.14.2/24;
      }
    }
  }
}
```

4.2.3 Source Filtering

mac

```
interfaces {
  ge-1/3/0 {
    description to-RG-6808E;
    vlan-tagging;
    gigether-options {
      source-filtering;          /****          *****/
      source-address-filter {
        00:90:69:6e:b8:01;      /*****      0      *****/
      }
    }
  }
}
```



```
}
virtual-address [ addresses ];
}
```

Exaple'

Router A

```
fe-0/0/1 {
  unit 0 {
    family inet {
      address 10.10.11.2/24 {
        vrrp-group 10 {
          virtual-address 10.10.11.1;
          priority 105;
          accept-data;
        }
      }
    }
  }
}
```

Router B

4 -6

admin@RouterA # **show vrrp detail**

Physical interface: fe-0/0/1, Unit: 0, Address: 10.10.11.2/24
 Index: 65, SNMP ifIndex: 31, VRRP-Traps: disabled
 Interface state: up, Group: 10, State: **backup**
 Priority: 105, Advertisement interval: 1, Authentication type: none
 Preempt: yes, Accept-data mode: yes, VIP count: 1, VIP: **10.10.11.1**
 Dead timer: 2.921s, Master priority: 150, Master router: 10.10.11.3
 Virtual router uptime: 00:21:53
 Tracking: disabled

admin@RouterB>**show vrrp detail**

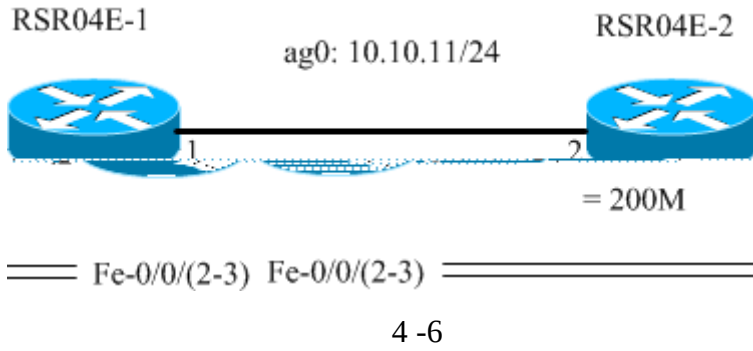
Physical interface: fe-0/0/1, Unit: 0, Address: 10.10.11.3/24
 Index: 65, SNMP ifIndex: 25, VRRP-Traps: disabled
 Interface state: up, Group: 10, State: **master**
 Priority: 150, Advertisement interval: 1, Authentication type: none
 Preempt: yes, Accept-data mode: no, VIP count: 1, VIP: **10.10.11.1**
 Advertisement timer: 0.779s, Master router: 10.10.11.3
 Virtual router uptime: 00:20:41, Master router uptime: 00:20:37
 Virtual MAC: 00:00:5e:00:01:0a
 Tracking: disabled

```

  1  accept-data          vip  ICMP  ^
  2  ^                    clear vrrp  vrrp ^
  3  ^
```

4.4 Aggregated Interfaces

Junos Ethernet full-duplex mode with VLAN tagging Sonet
 ^



RSR04E-1

[edit]

admin@RSR04E-1> show

chassis {


```
port-group 1
speed 100
duplex full
!
interface GigabitEthernet 4/2
port-group 1
speed 100
duplex full
!
interface Vlan 100
ip address 10.10.11.2 255.255.255.0
!
```

4.5 Troubleshooting interface

4.5.1 monitor interface

```
↓ ∪      monitor interface <interface>    ||
↓ ∪      monitor traffic interface
```

Example:

```
dmin@RSR04E-1> monitor traffic interface fe-0/0/1
verbose output suppressed, use <detail> or <extensive> for full protocol decode
Listening on fe-0/0/1, capture size 96 bytes
```

```
08:32:23.253227 In IP 10.10.11.3 > 224.0.0.18: VRRPv2-advertisement 20: vrid=10 prio=150 authtype=simple intvl=1
08:32:24.583251 In IP 10.10.11.3 > 224.0.0.18: VRRPv2-advertisement 20: vrid=10 prio=150 authtype=simple intvl=1
08:32:26.073227 In IP 10.10.11.3 > 224.0.0.18: VRRPv2-advertisement 20: vrid=10 prio=150 authtype=simple intvl=1
^C
3 packets received by filter
0 packets dropped by kernel
```

4.5.1 show interfaces fe-0/0/0 extensive

⌘

4.5.2 E-1 Loopback

admin@RSR# set loopback ?

possible completions:

local	local loopback
remote	remote loopback

5. protocol-Independent Routing

5.1

```

,      7
,      10
,      11      routing-options

```

Syntax

```

[edit]
routing-options {
    static {
        defaults {
            static-options;
        }
        route destination-prefix {
            next-hop next-hop;
            qualified-next-hop address {
                metric metric;
                preference preference;
            }
            static-options;
        }
    }
}

```

Example:

```

[edit]
user@host# show
routing-options {
    static {
        route 0.0.0.0/0 next-hop 192.168.0.1;
    }
}

```

```

,      Discard → Reject
      cisco 10      null 0      a 1      Reject      ICMP
! Destination Host Unreachable L      A Discard      ICMP
      routing-options {
          static {
              route 143.172.0.0/6 discard;
          }
      }

```


Syntax

[edit]

```
routing-options {
  generate {
    defaults {
      generate-options;
    }
    route destination-prefix {
      policy policy-name;
      generate-options;
    }
  }
}
```

Example

```
routing-options {
  generate {
    defaults {
      metric 5;
    }
    route 172.16.64.0/20;
    route 172.16.80.0/20 discard;
  }
}
```

5.3 Martian Routes

Assigned Numbers Authority (IANA). 互联网

<http://www.iana.org/assignments/ipv4-address-space>.

The default list of martian routes in the JUNOS software is:

- Prefix bits of 0.0.0.0 /8 and more specific routes
- Prefix bits of 127.0.0.0 /8 and more specific routes
- Prefix bits of 128.0.0.0 /16 and more specific routes
- Prefix bits of 191.255.0.0 /16 and more specific routes
- Prefix bits of 192.0.0.0 /24 and more specific routes
- Prefix bits of 223.255.255.0 /24 and more specific routes
- Prefix bits of 240.0.0.0 /4 and more specific routes

Junos a 1 2 A 1 2 A

Syntax

```
routing-options {
  martians {
    prefix/prefix-length match-type allow;
  }
}
```

Match-type **exact** | **longer** | **orlonger** | **prefix-length-range** | **through** | **upto**

user@Riesling> **show route martians**

```
inet.0:
    0.0.0.0/0 exact -- allowed
    0.0.0.0/8 orlonger -- disallowed
    127.0.0.0/8 orlonger -- disallowed
    128.0.0.0/16 orlonger -- disallowed
    191.255.0.0/16 orlonger -- disallowed
    192.0.0.0/24 orlonger -- disallowed
    223.255.255.0/24 orlonger -- disallowed
    240.0.0.0/4 orlonger -- disallowed
```

5.4 JUNOS

junos

↓

↓

- inet.0 - store IPv4 unicast routes
- inet.1 - store IPv4 multicast routes
- inet.2 - store IPv4 multicast routes Routes in the inet.2 table are used by multicast routing protocols to prevent routing loops
- inet.3 - The *inet.3*

5.5 JUNOS software Preference Values

JUNOS	preference	cisco	Â	
Source or Protocol Name Meaning				Preference Value

5.6

```
[edit]
routing-options {
  rib fbf-north.inet.0 {
    static {
      route 0.0.0.0/0 next-hop 172.16.1.1;
    }
  }
  rib fbf-south.inet.0 {
    static {
      route 0.0.0.0/0 next-hop 172.16.2.1;
    }
  }
  static {
    route 0.0.0.0/0 next-hop 192.168.0.1;
  }
}
```

Rib-groups

inet.0 inet.2 ospf-rib ospf ^

Example:

```
routing-options {
  rib-groups {
    ospf-rib {
      import-rib [ inet.0 inet.2 ];
    }
  }
}
protocols {
  ospf {
    rib-group ospf-rib;
  }
}
```

5.7 Load Balancing

JUNOS Load Balancing

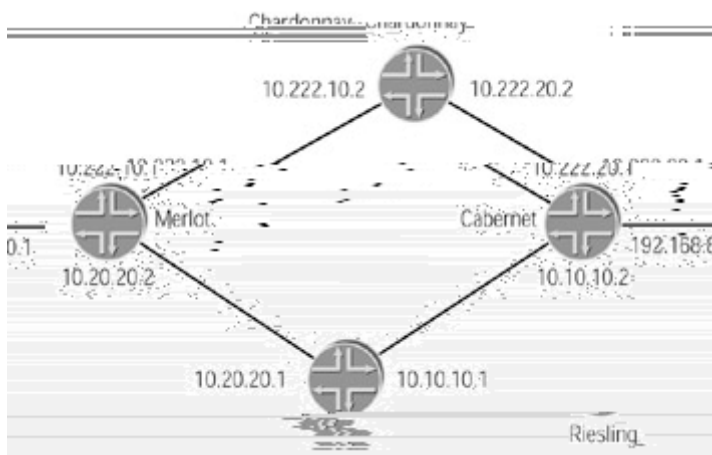
Example:

```
routing-options {
  forwarding-table {
    export load-balance;
```

```

}
}
policy-options {
  policy-statement load-balance {
    then {
      load-balance per-packet;
      accept;
    }
  }
}

```



(1)

```
user@Merlot> show route 192.168.80/24 terse
```

inet.0: 4 destinations, 4 routes (4 active, 0 holddown, 0 hidden)

+ = Active Route, - = Last Active, * = Both

A Destination	P	Prf	Metric 1	Metric 2	Next hop	AS path
* 192.168.80.1/32	I	18	20		10.222.10.2 >10.20.20.1	

(2)

```
user@Merlot> show route forwarding-table matching 192.168.80/24
```

Routing table:: inet

Internet:

Destination	Type	RtRef	Nexthop	Type	Index	NhRef	Netif
192.168.80.1/32	user	0	10.20.20.0	ucst	26	30	so-0/0/3.0

^ 3 ~

[edit]

```
user@Riesling# show
```

```

policy-options {
  policy-statement please-load-balance-traffic {
    then {
      load-balance per-packet;
    }
  }
}

```


}

, Autonomous system number

BGP

[edit]

routing-options {

autonomous-system 65001;

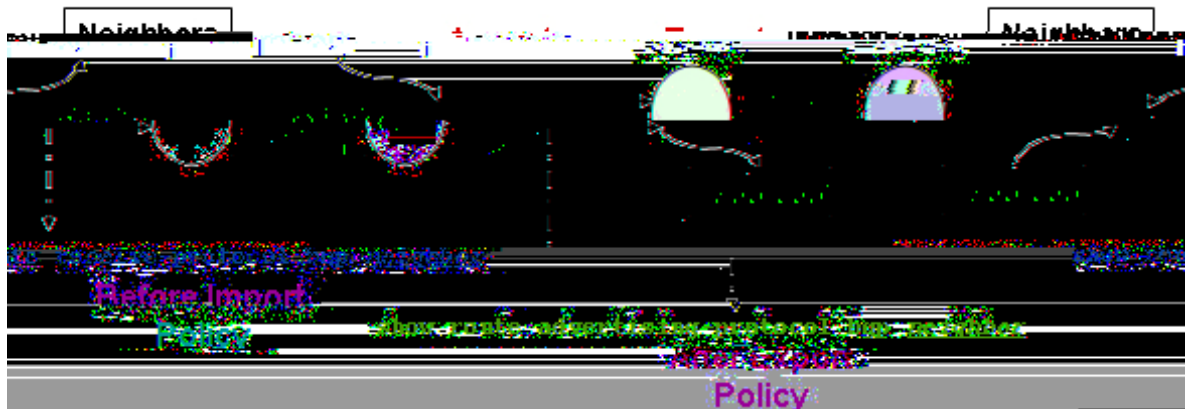
}



$\hat{A}$ BGP $\hat{A}$
 $\hat{A}$

6.4

show route receive-protocol show route receive-protocol
^



6-2

6.5

6.5.1

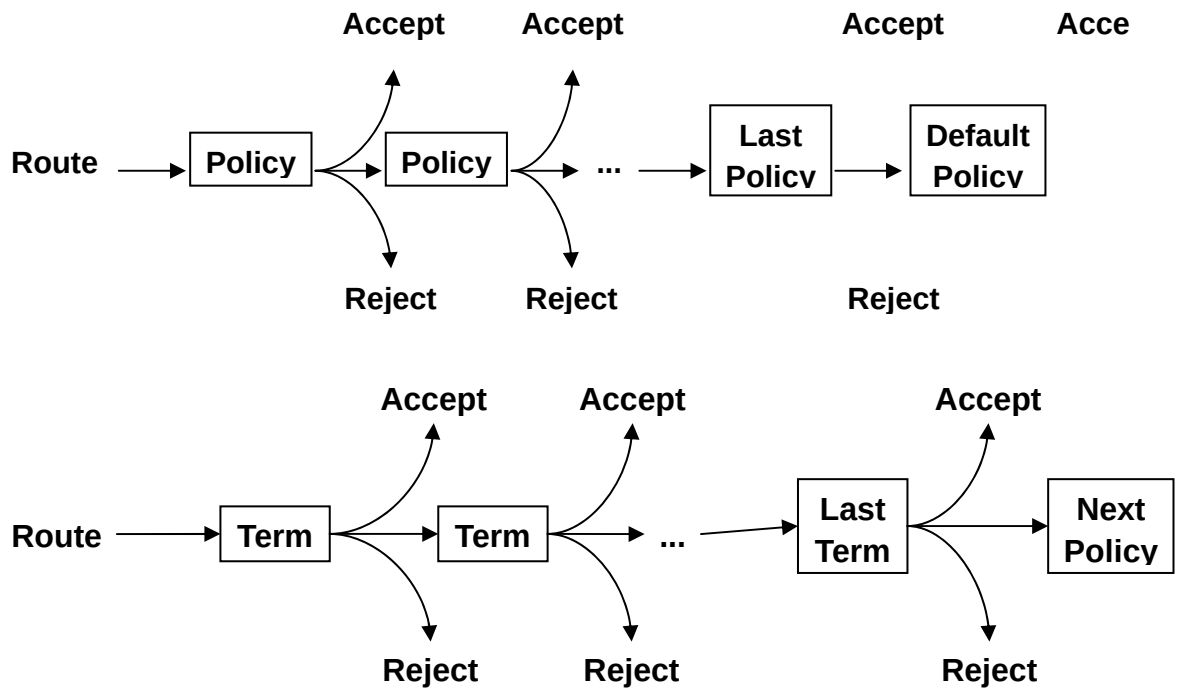
↓ ∪

Syntax

```
policy-options {
  policy-statement policy-name {
    term term-name {
      from {
        match-conditions;  /***  ***/
      }
      then {
        action;           /***  ||  ***/
      }
    }
    term term-name {
      from {
        match-conditions;
      }
      then {
        action;
      }
    }
  }
}
```

}
}

Routing Policy Flow



6-3

6.6

, 7
, 7

1. Neighbor address
2. Protocol (source of information)
 - BGP, direct, DVMRP, IS-IS, local, MPLS, OSPF,
 - PIM, RIP, static, aggregate
3. Routing protocol information
 - OSPF area ID
 - IS-IS level number
 - BGP attributes

, From and To

— From 7 ' area area-id àas-path name àcommunity [names] àlevel level
à local-preference value à metric metric à neighbor address à next-hop address
à origin value à preference preference à protocol protocol à rib routing-table

to `level level ãrib routing-table`

Example:

```
policy-options {
  policy-statement isis-export {
    term sending-to-neighborA {
      to level 2;
      then accept;
    }
  }
}
```

6.7

Actions:

- **Terminate**
 - Á **Accept route**
 - Á **Reject (or suppress) route**
- **Flow control**
 - Á **Skip to next policy**
 - Á **Skip to next term**
- **Modify attributes**
 - Á **Metric**
 - Á **Preference**
 - Á **Color**
 - Á **Next-hop address**

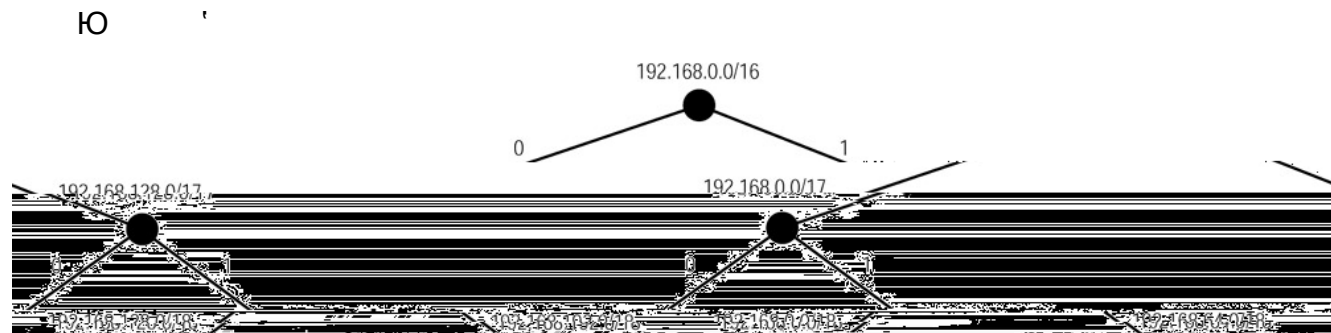
6.8 default policy

- **IS—IS**
 - Á **Import all routes**
 - Á **Export all routes learned by that protocol and all interface routes on which the protocol is configured explicitly (except RIP)**
- **BGP**
 - Á **Import all routes learned from BGP neighbors**
 - Á **Export all active routes learned from BGP neighbors to all BGP neighbors**
 - **EBGP-learned routes are exported to all BGP peers**
 - **IBGP-learned routes are exported to all EBGP peers (logical full-mesh)**

6.9 Route Filters

配置命令: `cisco ip prefix-list`

Syntax: `route-filter prefix/prefix-length match-type actions;`



6 - 4

— Exact

`route-filter 192.168.0.0/16 exact;`

— orlonger;

`route-filter 192.168.0.0/16 orlonger;`

— longer

`route-filter 192.168.0.0/16 longer;`

— upto

`route-filter 192.168.0.0/16 upto /18;`

— prefix-length-range

`route-filter 192.168.0.0/16 prefix-length-range /17-/18;`

— through

`route-filter 192.168.0.0/16 through 192.168.128.0/19;`


```
policy-options {
    policy-statement hbm-export {
```

Ö 6-6

6.11 Applying Routing Policies

z RIP Policy Application

```
SURWRFROV ^
  ULS ^
    LPSR$R O L $R O L F \ @
    JURXS WHVW ^
      H[SR$R O L $R O L F \ @
      QHLJKERU IH ^
        LPSR$R O L $R O L F \ @
      ,
    ,
  ,
,
```

z Link-State IGP Policy Application

```
SURWRFROV ^
  LVLV ^
    H[SR$R O L $R O L F \ @
  ,
  RVSI ^
    H[SR$R O L $R O L F \ @
  ,
,
```


6.12 BGP Policy Application

```
! 配置 BGP 策略应用
!
protocols {
    bgp {
        import [ policy1 policy2 ...];
        export [ policy1 policy2 ...];
        group external-peers {
            type external;
            import [ policy1 policy2 ...];
            export [ policy1 policy2 ...];
            peer-as 65521;
            neighbor 1.1.1.1 {
                import [ policy1 policy2 ...];
                export [ policy1 policy2 ...];
            }
        }
    }
}
```

7 Routing Information Protocol ^ RIP~

7.1 RIP

RIP ^ UNPDATES) (REQUESTS) ^
 RIP ^ 30 UDP 520 6 ^
 ^
 ^ RIP ^ IP 6 ^
 ^ RIP ^



7-1 RIP

RIP ^
 ^ 1~ ^ 8 - 1 C C ^
 B 152.1.0.0 ^ 1^6
 B A^ B A6152.1.0.
 0 ^ 1 à2 ^ 8 - 1
 ^ ^
 ^ 8- 2 ^ A B RIP 56 KB P S
 a 1.5 M b p s ^ ^ 1 56 KB P S ^ 2 1.5 M
 b p s ^



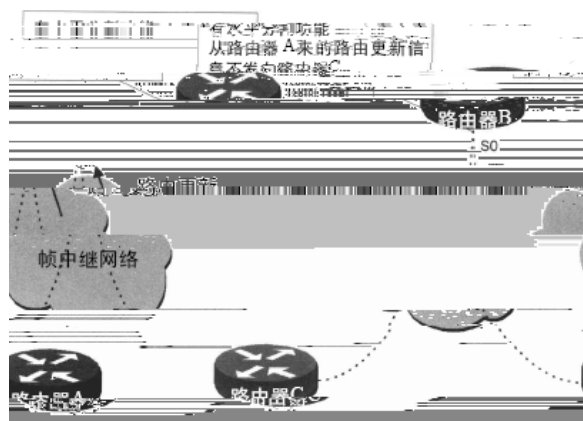
$\begin{array}{ccccccc} & & R & I & P & & \\ & & & & & a & \hat{A} \\ \downarrow & & & & & & \\ \downarrow & & \hat{A} & & & & \mathfrak{A} \\ & & & & & a & \mathfrak{H} \hat{A} R I P \end{array}$

3 a 2
 ă ı ă ă ă ă

$$R \mid P \quad \hat{y} \mid 1.5 \hat{A} \quad 1.5 \quad \hat{y} \mid a \mid \hat{A}$$

1) $\begin{matrix} \text{Л} & & \text{А} \\ \neq & & \text{А} \\ & 8 - 3 & \text{А} \\ & & \text{Ю} \\ \text{Л} & & \text{Л} \text{ и} & & \text{А} \\ & \text{В} & & \text{С} \text{А} \\ & \text{В} & & \text{С} & & \text{А} \text{ а} \text{ "А"} \end{matrix}$

$$\begin{array}{ccccccc}
 & A & & \hat{A} & & & \\
 B & & \hat{\sim} & C & P & U & \hat{a} & \sim \\
 & & & C & \hat{A} & & C & \ddot{y} \\
 & A & & & \hat{A} & & & \\
 2) & & B & \ddot{y} & & & & A
 \end{array}$$


$$A \cup 2 \quad \downarrow \quad \hat{A}$$

	С		й		$A\hat{A}$
3)	С		А	л 3	$A\hat{A}$
4)	А		В	л 4	$A\hat{A}$

 $H,$

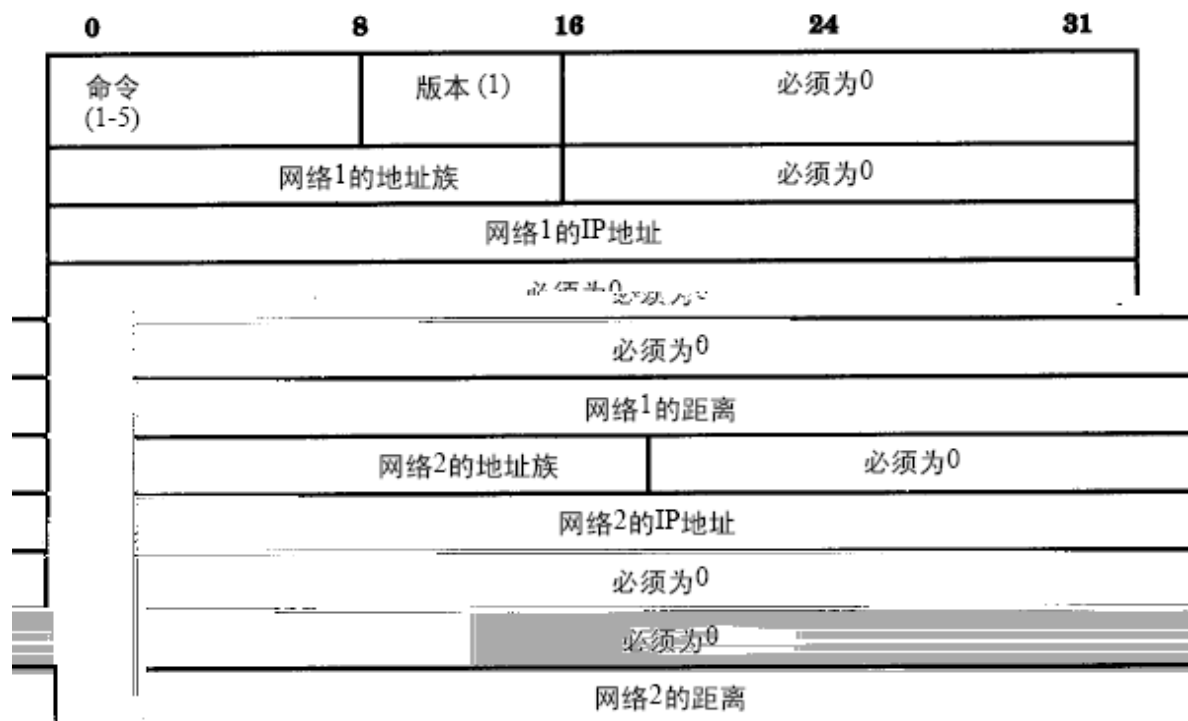
5)

$\dot{y}$ R I P $\dot{y}$ 16 $\hat{A}$
 $a \downarrow$ $\ddot{y}$ $\hat{A}$
 $\ddot{y}$

∇ $\hat{A}$ $i \propto$ $m N$ $\hat{A}$ $a \theta$ l $\propto$

7.2.2 RIP

8 - 5 的 RIP 的 3 2 的 1 的 的
IP 的 Commands (3) : 的
3 的 RIP 的 1 的 RIP 的 2 的 3 4 的 a
3 5 Sun Microsystems 的 Version 的
的 的 RIP 的 Address Family Identifier 的
RIP 的 的 IP
2 的 IP Address 的 IP 的 IP 的 4 的
Must Be Zero 的 RIP 的 1 2 的 IP 的 1 2
4 的 8 的 Distance to Net 的 :
的 a 的 1 6 的



7-5 RIP

的 RFC

- RFC 1058, "Routing Information Protocol"
- RFC 2082, "RIP-2 MD5 Authentication"
- RFC 2453, "RIP Version 2"

7.3 RIP

```

—      RIP
      [edit protocol]
      protocols {
        rip {
          group group-name {
            neighbor interface-name;
          }
        }
      }

```

```

—      RIP      Export
      policy-options {
        policy-statement statics-to-rip {
          from protocol static;
          then accept;
        }
      }

```

```

—
      protocols {
        rip {
          group rip-neighbors {
            export statics-to-rip;
            neighbor fe-0/0/0.0;
            neighbor fe-0/0/1.0;
          }
        }
      }

```

7.3 Monitoring RIP

7.3.1 RIP

```
user@Cabernet> show rip neighbor
```

Neighbor	State	Source Address	Destination Address	Send Mode	Receive Mode	In Met
H ' RSR04/08E	"A				H	

fe-0/0/0.0	Up	172.16.1.2	224.0.0.9	mcast	both	1
fe-0/0/1.0	Up	172.16.2.1	224.0.0.9	mcast	both	1

7.3.2 RIP

user@Riesling> show route protocol rip

inet.0: 27 destinations, 27 routes (27 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

```
172.16.2.0/24      *[RIP/100] 00:07:25, metric 2
                   > to 172.16.1.2 via fe-0/0/0.0
192.168.8.1/32    *[RIP/100] 00:07:25, metric 2
                   > to 172.16.1.2 via fe-0/0/0.0
192.168.24.1/32   *[RIP/100] 00:00:25, metric 3
                   > to 172.16.1.2 via fe-0/0/0.0
```

7.3.3 RIP

lab@sf-pe> show route advertising-protocol rip 10.0.21.1

inet.0: 12 destinations, 12 routes (11 active, 1 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

```
3.0.0.0/8          *[Static/5] 00:10:56
                   Reject
30.0.0.0/16        *[Static/5] 00:12:20
                   Reject
```

7.3.4 RIP

lab@p1> show route receive-protocol rip 10.100.3.2

inet.0: 17 destinations, 18 routes (17 active, 0 holddown, 0 hidden)
+ = Active Route, - = Last Active, * = Both

```
172.20.4.0/24      *[RIP/100] 00:01:01, metric 2
                   > to 10.100.3.2 via fe-0/0/0.0
192.168.28.0/24    *[RIP/100] 00:01:01, metric 2
                   > to 10.100.3.2 via so-0/0/0.0
```

7.3.5 RIP statistics

lab@sf-pe> **show rip statistics**

RIP info: port 520; update interval 30s; holddown 180s; timeout 120s.

rts learned	rts held down	rqsts dropped	resps dropped
1	1	0	0

fe-0/0/0.0: 1 routes learned; 3 routes advertised

Counter	Total	Last 5 min	Last minute
-----	-----	-----	-----
Updates Sent	28	11	2
Triggered Updates Sent	1	0	0
Responses Sent	0	0	0
Bad Messages	0	0	0
RIPv1 Updates Received	0	0	0
RIPv1 Bad Route Entries	0	0	0
RIPv1 Updates Ignored	0	0	0
RIPv2 Updates Received	14	11	3
RIPv2 Bad Route Entries	0	0	0
RIPv2 Updates Ignored	0	0	0
Authentication Failures	0	0	0
RIP Requests Received	0	0	0
RIP Requests Ignored	0	0	0

7.3.5 RIP log

— Log file-related configuration options

[edit protocols rip]

```

traceoptions {
    file name <replace> <size size> <files number> <no-stamp>
}

```

[edit protocols rip]

lab@p1# show traceoptions file ?

Possible completions:

<[Enter]>	Execute this command
files	Maximum number of trace files (2..1000)
no-stamp	Don't timestamp trace file
no-world-readable	Don't allow any user to read the log file

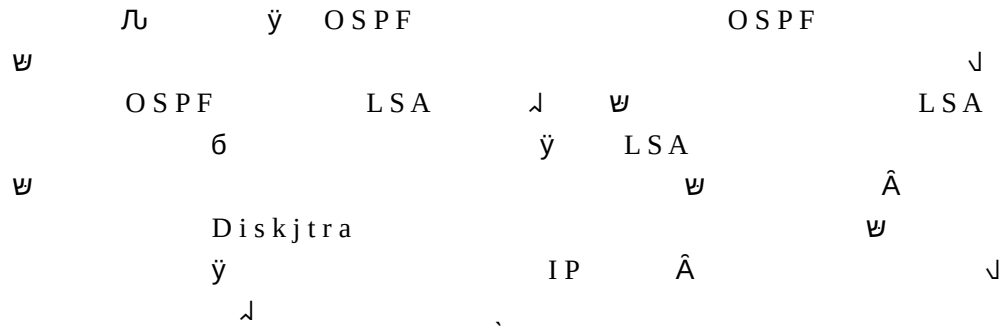
```
neighbor fe-0/0/1.0;
neighbor fe-0/0/0.0;
}
}
admin@RSR04E-1# run show rip neighbor
```

Neighbor	State	Source Address	Destination Address	Send Mode	Receive Mode	In Met
ge-1/3/0.0	Up	192.168.100.5	224.0.0.9	mcast	both	1
fe-0/0/1.0	Up	192.168.100.1	224.0.0.9	mcast	both	1

```
admin@RSR04E-2> show rip neighbor
```

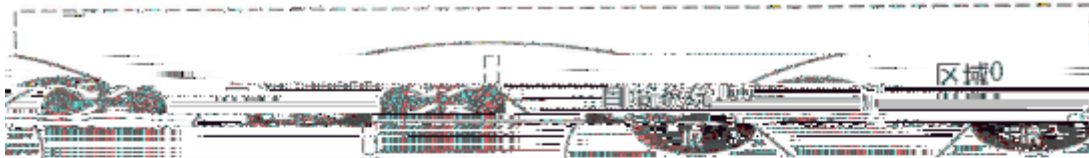
Neighbor	State	Source Address	Destination Address	Send Mode	Receive Mode	In Met
fe-0/0/0.0	Up	192.168.100.13	224.0.0.9	mcast	both	1
fe-0/0/1.0	Up	192.168.100.2	224.0.0.9	mcast	both	1

8.2 OSPF



8.2.4

OSPF 网络 AS 域 9-1 LSA 类型
网络 域 æ 域
网络 域 域 域 域
网络 域 a 域 a 域 域 域 域
网络 域 域 域 域 域 域 域 域
网络 域 (ABR) 域 域 域 域 域 域 域 域
网络 域 域 (ASBR) 域 域 域 域 域 域 域 域



8-1 OSPF

8.2.5

OSPF 网络 域 域 域 域 域 域 域 域
网络 域 域 域 域 域 域 域 域
网络 域 域 域 域 域 域 域 域
网络 域 域 域 域 域 域 域 域
网络 域 域 域 域 域 域 域 域

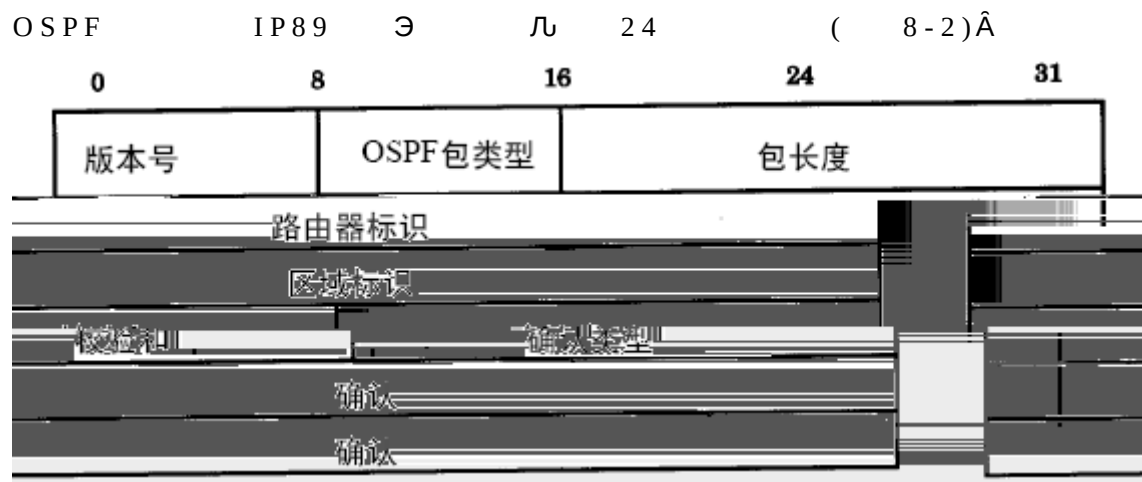
8.2.6

DR 域 DR

域 域 OSPF

6 è Â DR
 ^ ÿ ↓ H ~ H N-1
 Â ↓ ↓ DR BDR ↓ D
 R 儿 ↓ H H Â DR
 DR 3 Â ≠ 儿
 ÂDR Hello DR
 Hello Â ÿ DR Â IP
 3 æ IP Â ip ospf priority 3 ↓ 儿
 Â
 DR a DR è
 3 DR Â DR ‡ DR Â

8.2.7 OSPF



9-2 OSPF

5 OSPF (9-3) Â

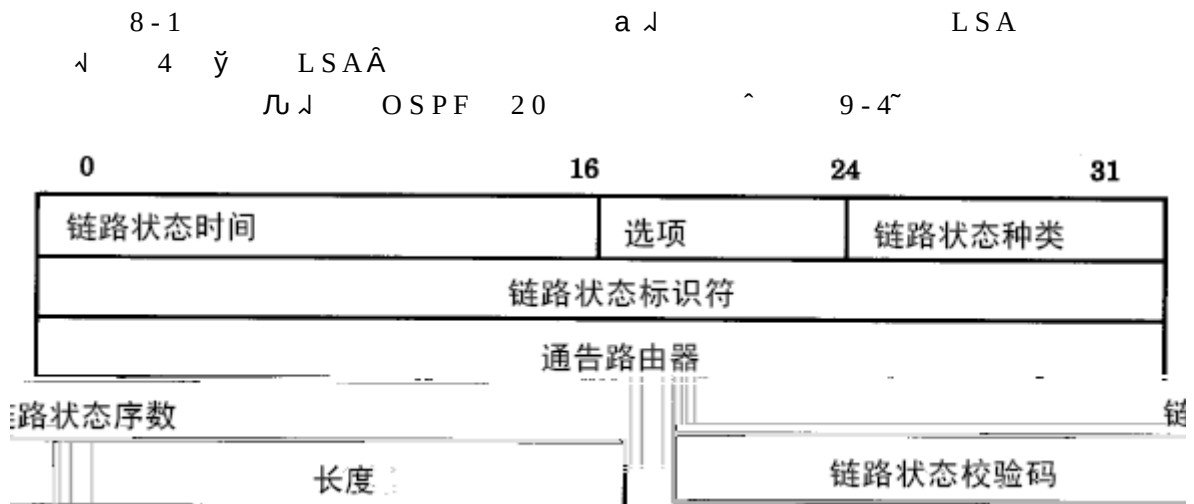
类型	包名称	协议功能
	1 Hello	发现并维持邻居
2	数据库描述	概括数据库容量
3	数据库请求	请求数据库信息

9-3 OSPF

1) Hello ' Hello Â Hello
 儿 ÿ Â Hello DR ÂDR æ
 Â
 H ' RSR04/08E A H

- 2) OSPF L
- 3) OSPF Б
- 4) OSPF
- 5) OSPF LSA

8.2.8



9-4

LSA

20

1.

LSA 1 LSA

LSA

2.

RSR04/08E



```

user@Chardonnay> show ospf neighbor
  Address          Interface          State      ID              Pri
Dead
10.0.1.46         at-0/1/0.100      Full      10.0.1.103      128    36
10.0.1.1          so-0/0/3.0        Full      10.0.1.23       128    39

```



1. OSPF 4 ^ à à ~ a
 ↳ OSPF ≠ a ↳ OSPF ③

2. LAN ③ Â

3. ③ Â

? o 8 u ' 8

```
[edit]
user@host# show protocols ospf
ospf {
    area 0.0.0.0 {
        interface ge-0/0/0.0;
    }
}
```

8.3.2 OSPF 配置

```
[edit]
user@host# show protocols ospf
ospf {
    area 0.0.0.0 {
        interface ge-0/0/0.0;
    }
}
```

```
[edit]
user@host# set protocols ospf area 1 interface at-0/1/1.100
[edit]
user@host# show protocols ospf
ospf {
    area 0.0.0.0 {
        interface ge-0/0/0.0;
    }
    area 0.0.0.1 {
        interface at-0/1/1.100;
    }
}
```

8.3.2 配置 Stub Area

```
[edit protocols ospf area area-id ]
stub <default-metric metric> <(no-summaries | summaries)>;
```

8.3.3 配置 Not-So-Stubby Area

```
[edit protocols ospf area area-id ]
nssa {
```

```
area-range network/mask-length <restrict>;
default-lsa {
default-metric metric;
metric-type type;
type-7;
}
(no-summaries | summaries);
}
```

8.4.4 OSPF Virtual Link

3 area virtual Link

[edit protocols ospf area 0.0.0.0]

virtual-link neighbor-id *router-id* transit-area *area-id*;

8.3.5 OSPF Router Interfaces

Configuring an Interface on a Broadcast or Point-to-Point Network

[edit protocols ospf area *area-id*]

interface *interface-name*;

Configuring an Interface on a Point-to-Multipoint Network

[edit protocols ospf area 0.0.0.0]

interface *interface-name* {

neighbor *address*;

}

Configuring an Interface on a Nonbroadcast, Multiaccess Network

[edit protocols ospf area 0]

interface *interface-name* {

interface-type nbma;

neighbor *address* <eligible>;

poll-interval *seconds*;

}

8.3.6

simple MD5

[edit protocols ospf area *area-id*]

authentication-type authentication;

```
[edit protocols ospf area area-id interface interface-name]
authentication {
md5 key-id {
key [ key-values ];
}
simple-password key-id;
}
```

8.4 JUNOS Troubleshooting

8.4.1 6 OSPF show ospf interface

user@Chardonmay> show ospf interface

Interface	State	Area	DR ID	BDR ID	Nbrs
at-0/1/0.100	PtToPt	0.0.0.0	0.0.0.0	0.0.0.0	1
so-0/0/1.0	PtToPt	0.0.0.0	0.0.0.0	0.0.0.0	1
so-0/0/0.0	PtToPt	0.0.0.10	0.0.0.0	0.0.0.0	1
so-0/0/2.0	PtToPt	0.0.0.10	0.0.0.0	0.0.0.0	1
so-0/0/3.0	PtToPt	0.0.0.10	0.0.0.0	0.0.0.0	1

Area — This field displays the current area ID assigned to the interface.

DR ID — The router ID of the current designated router is displayed in this column. Point-to-point interfaces use a value of 0.0.0.0.

BDR ID — The router ID of the current backup designated router is displayed in this column. Point-to-point interfaces use a value of 0.0.0.0.

Nbrs — The value in this column represents the total number of OSPF neighbors discovered across this interface.

8.4.2 OSPF

user@Chardonmay> show ospf neighbor

Address	Interface	State	ID	Pri	Dead
10.0.1.46	at-0/1/0.100	Full	10.0.1.103	128	36
10.0.1.34	so-0/0/1.0	Full	10.0.1.102	128	35
10.0.1.9	so-0/0/0.0	Full	10.0.1.21	128	38
H ' RSR04/08E	^A				H

- Router-Type 1 router LSA
- Network-Type 2 network LSA
- Summary-Type 3 network summary LSA
- ASBRSum-Type 4 ASBR summary LSA
- Extern-Type 5 AS external LSA
- NSSA-Type 7 NSSA external LSA

ID This field shows the Link-State ID field from the LSA. This value is used to provide uniqueness for each LSA. Entries marked with an asterisk (*) are LSAs generated by the local router.

Adv Rtr The router ID of the originating router for each LSA is displayed in this field.

Seq The sequence number assists the router to determine the most recent version of the LSA.

Age This field displays the current age of the LSA. All LSAs begin with a lifetime of 0 and increment to a defined MaxAge of 3600 seconds. Each LSA must be refreshed before the MaxAge value is reached.

Opt The Options field from the OSPF header is displayed in this column. The possible bit values are discussed in the "Hello Packet" section earlier in this chapter.

Cksum The calculated checksum value of the LSA is stored in this field. Each router calculates a new checksum when the LSA is received and verifies the value against the received value to ensure packet integrity.

Len This field displays the total length of the LSA.

8.4.3 OSPF

clear ospf database

```
user@Shiraz> clear ospf database purge
```

OSPF floods Â

Last instance of each event type

When	Type	Elapsed
00:17:29	SPF	0.000073
00:17:29	Stub	0.000067
00:17:29	Interarea	0.000025
00:17:29	External	0.000003
00:17:29	NSSA	0.000003
00:17:29	Cleanup	0.000083

Maximum length of each event type

When	Type	Elapsed
01:17:57	SPF	0.000116
00:22:41	Stub	0.000365
20:00:18	Interarea	0.000132
01:19:43	External	0.000042
19:17:29	NSSA	0.000014
19:17:29	Cleanup	0.000715

Last 100 events

When	Type	Elapsed
01:19:48	Total	0.000182
01:19:43	SPF	0.000090
01:19:43	Stub	0.000086
01:19:43	Interarea	0.000030
01:19:43	External	0.000042
01:19:43	NSSA	0.000004

...[output truncated]

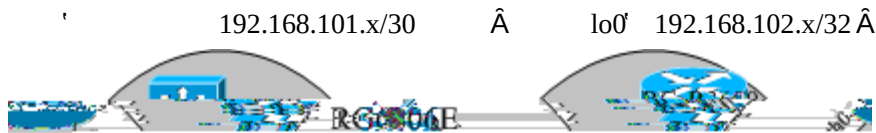
8.4.6 OSPF statistics

user@Shiraz> show ospf statistics

Packet type	Total		Last 5 seconds	
	Sent	Received	Sent	Received
Hello	24	45	0	0
DbD	24	16	0	0
LSReq	6	7	0	0
LSUpdate	375	2260	0	0
LSAck	2236	368	0	0
...				



8.5 OSPF



8 - 6

RSR04E-1

```

interfaces {
  fe-0/0/0 {
    description to-RSR04E-2-fe-0/0/0;
    unit 0 {
      family inet {
        address 192.168.101.5/30;
      }
    }
  }
  fe-0/0/1 {
    description to-RG-R3600-eth0;
    unit 0 {
      family inet {
        address 192.168.101.9/30;
      }
    }
  }
}

```

H ' RSR04/08E "A

H

```
}  
}  
fe-0/0/2 {  
    description "to-RG-S3550-fa 0/25";  
    unit 0 {  
        family inet {  
            address 192.168.101.13/30;  
        }  
    }  
}  
ge-1/3/0 {  
    description to-RG-S6806E-g4/9;  
    unit 0 {  
        family inet {  
            address 192.168.101.1/30;  
        }  
    }  
}  
lo0 {  
    description RID;  
    unit 0 {  
        family inet {  
            address 192.168.102.1/32;  
        }  
    }  
}  
routing-options {  
    router-id 192.168.102.1;  
}  
protocols {  
    ospf {  
        area 0.0.0.0 {  
            interface lo0.0 {  
                passive;  
            }  
            interface ge-1/3/0.0;  
            interface fe-0/0/0.0;  
        }  
        area 0.0.0.1 {  
            interface fe-0/0/1.0;  
            interface fe-0/0/2.0;  
        }  
    }  
}
```

}

RSR04E-2

```
interfaces {
    fe-0/0/0 {
        description to-RSR04E-1-fe-0/0/0;
        speed 100m;
        link-mode full-duplex;
        unit 0 {
            family inet {
                address 192.168.101.6/30;
            }
        }
    }
    fe-0/0/1 {
        description to-RG6806E-g4/1;
        unit 0 {
            family inet {
                address 192.168.101.17/30;
            }
        }
    }
    lo0 {
        description RID;
        unit 0 {
            family inet {
                address 192.168.102.2/32;
            }
        }
    }
}
routing-options {
    router-id 192.168.102.2;
}
protocols {
    ospf {
        area 0.0.0.0 {
            interface lo0.0 {
                passive;
            }
        }
    }
}
```

```
interface fe-0/0/0.0;
interface fe-0/0/1.0;
}
}
}
```

RG-6806E

```
interface GigabitEthernet 4/1
no switchport
description "to-RSR04E-2-fe-0/0/1"
ip address 192.168.101.18 255.255.255.252
!
interface GigabitEthernet 4/9
medium-type fiber
no switchport
speed 1000
description "to-RSR04E-ge-1/3/0"
ip address 192.168.101.2 255.255.255.252
!
interface Loopback 0
description "RID"
ip address 192.168.102.5 255.255.255.255
!
router ospf
area 0.0.0.0
network 192.168.101.0 255.255.255.252 area 0.0.0.0
network 192.168.101.16 255.255.255.252 area 0.0.0.0
network 192.168.102.5 255.255.255.255 area 0.0.0.0
!
End
```

RG3660

```
!
interface FastEthernet 0/0
ip address 192.168.101.10 255.255.255.252
duplex auto
speed auto
description to-RSR04E-1-fe-0/0/1
!
interface FastEthernet 0/1
ip address 192.168.101.22 255.255.255.252
duplex auto
speed auto
```

```
no keepalive
description to-RG-S3550-fa-0/25
!
interface Loopback 0
 ip address 192.168.102.3 255.255.255.255
 description RID
!
router ospf
 passive-interface Loopback 0
 network 192.168.101.8 0.0.0.3 area 0.0.0.1
 network 192.168.101.20 0.0.0.3 area 0.0.0.1
 network 192.168.102.3 0.0.0.0 area 0.0.0.1
!
```

RG-S3550

```
interface FastEthernet 0/25
 no switchport
 description "to-RSR04E-1-fe-0/0/2"
 ip address 192.168.101.14 255.255.255.252
!
interface FastEthernet 0/26
 no switchport
 description "to-RG-R3600-fa0/1"
 ip address 192.168.101.21 255.255.255.252
!
interface Loopback 0
 description "RID"
 ip address 192.168.102.4 255.255.255.255
!
router ospf
 area 0.0.0.1
 network 192.168.101.12 255.255.255.252 area 0.0.0.1
 network 192.168.101.20 255.255.255.252 area 0.0.0.1
 network 192.168.102.4 255.255.255.255 area 0.0.0.1
!
End
```

8.5.1 RSR ospf

```
admin@RSR04E-1> show route protocol ospf
```

```
inet.0: 18 destinations, 18 routes (18 active, 0 holddown, 0 hidden)
```

```
  H   ' RSR04/08E      A
```

```
  H
```

+ = Active Route, - = Last Active, * = Both

```

192.168.101.16/30  *[OSPF/10] 00:35:03, metric 2
                    > to 192.168.101.6 via fe-0/0/0.0
                    to 192.168.101.2 via ge-1/3/0.0
192.168.101.20/30  *[OSPF/10] 00:27:05, metric 2
                    > to 192.168.101.10 via fe-0/0/1.0
                    to 192.168.101.14 via fe-0/0/2.0
192.168.102.2/32   *[OSPF/10] 00:35:03, metric 1
                    > to 192.168.101.6 via fe-0/0/0.0
192.168.102.3/32   *[OSPF/10] 00:27:05, metric 2
                    > to 192.168.101.10 via fe-0/0/1.0
192.168.102.4/32   *[OSPF/10] 00:46:39, metric 2
                    > to 192.168.101.14 via fe-0/0/2.0
192.168.102.5/32   *[OSPF/10] 00:46:50, metric 2
                    > to 192.168.101.2 via ge-1/3/0.0
224.0.0.5/32       *[OSPF/10] 01:13:33, metric 1
                    MultiRecv

```

8.5.2 OSPF

admin@RSR04E-1> **show ospf neighbor**

Address	Interface	State	ID	Pri	Dead
192.168.101.6	fe-0/0/0.0	Full	192.168.102.2	128	35
192.168.101.2	ge-1/3/0.0	Full	192.168.102.5	1	39
192.168.101.10	fe-0/0/1.0	Full	192.168.102.3	1	30
192.168.101.14	fe-0/0/2.0	Full	192.168.102.4	1	30

8.5.3 6 ospf

admin@RSR04E-1> **show ospf interface**

Interface	State	Area	DR ID	BDR ID	Nbrs
fe-0/0/0.0	DR	0.0.0.0	192.168.102.1	192.168.102.2	1
ge-1/3/0.0	DR	0.0.0.0	192.168.102.1	192.168.102.5	1
lo0.0	DRother	0.0.0.0	0.0.0.0	0.0.0.0	0
fe-0/0/1.0	BDR	0.0.0.1	192.168.102.3	192.168.102.1	1
fe-0/0/2.0	BDR	0.0.0.1	192.168.102.4	192.168.102.1	1

8.5.4

admin@RSR04E-1> **show route protocol ospf | match /32**

```
192.168.102.2/32    *[OSPF/10] 00:55:06, metric 1
192.168.102.3/32    *[OSPF/10] 00:55:06, metric 2
192.168.102.4/32    *[OSPF/10] 00:55:06, metric 2
192.168.102.5/32    *[OSPF/10] 00:55:06, metric 2
224.0.0.5/32        *[OSPF/10] 02:31:34, metric 1
```

8.5.5

admin@RSR04E-1> **show route forwarding-table destination 192.168.101.16/30**

Routing table: inet

Internet:

Destination	Type	RtRef	Next hop	Type	Index	NhRef	Netif
192.168.101.16/30	user	0	192.168.101.6	ucst	341	3	fe-0/0/0.0

jun.e1 Tf0.0003 Tc 0.67600006 [<54AC4178>6<1C0322751CDD2C5897C809C304B9199768 797C85(30)4(08214D

8.5.7 OSPF Authentication

， JUNOS MD5 Simple ^

Example:

```
' 8.5-1 Area 0 MD5 ^ Area 1 ^
dmin@RSR04E-1# show
ospf {
  area 0.0.0.0 {
    authentication-type md5;
    interface lo0.0 {
      passive;
    }
    interface ge-1/3/0.0 {
      authentication {
        md5 10 key "$9$nj7z9tOhSeX7V1R7VwYZG69A"; ## SECRET-DATA
      }
    }
    interface fe-0/0/0.0 {
      authentication-type simple;
      authentication {
        md5 10 key "$9$tXIZ01hevLVwgSrwgoJHkp0B"; ## SECRET-DATA
      }
    }
  }
  area 0.0.0.1 {
    interface fe-0/0/1.0 {
      authentication {
        simple-password "$9$WlEXNb4aU.PQaZ6A"; ## SECRET-DATA
      }
    }
    interface fe-0/0/2.0 {
      authentication {
        simple-password "$9$ZSDHmz39O1h36lM"; ## SECRET-DATA
      }
    }
  }
}
```

RG-6806E#show run

Building configuration...

Current configuration : 1005 bytes

!
H ' RSR04/08E ^

H

```
version 1.0
install 4 12sfp/gt
ip routing algorithm CRC32_UPPER
!
hostname RG-6806E
enable secret level 1 5 $2lowNq&3h`@IOrJ4imLMp]KQknAxB^"
enable secret level 15 5 $2,1u_;C3&-8U0<D4'.tj9=GQ+/7R:>H
!
interface GigabitEthernet 4/1
no switchport
description "to-RSR04E-2-fe-0/0/1"
ip address 192.168.101.18 255.255.255.252
ip ospf authentication message-digest
ip ospf message-digest-key 10 md5 juniper
!
interface GigabitEthernet 4/9
medium-type fiber
no switchport
speed 1000
description "to-RSR04E-ge-1/3/0"
ip address 192.168.101.2 255.255.255.252
ip ospf authentication message-digest
ip ospf message-digest-key 10 md5 juniper
!
interface Loopback 0
description "RID"
ip address 192.168.105ft-.105ft-.255.25per
```

enable password 7 1316064b1f

!

interface FastEthernet 0/0

ip ospf authentication-key junos

ip address 192.168.101.10 255.255.255.252

duplex auto

1 T4eedauto

Listening on fe-0/0/1.0, capture size 96 bytes

07:12:19.423729 In (tos 0xc0, ttl 1, id 16641, offset 0, flags [none], proto: OSPF (89), length: 68)

192.168.101.10 > 224.0.0.5: OSPFv2, Hello (1), length: 48

Router-ID: 192.168.102.3, Area 0.0.0.1, **Authentication Type:** unknown (1)junos^@^@^@"

Options: [External]

Hello Timer: 10s, Dead Timer 40s, Mask: 255.255.255.252, Priority: 1

Designated Router 192.168.101.9, Backup Designated Router 192.168.101.10

Neighbor List:

192.168.102.1

07:12:20.892801 Out 0:12:1e:1:30:1 1:0:5e:0:0:5 ip 82: (tos 0xc0, ttl2(1)5168.101 18(fse5(Prio4Pri3-6((101 21 0.0

8-7

RSR04E-1 200.0.0.0/24 ospf 7 ospf LSA 5 type 2

```
admin@RSR04E-1# set routing-options static route 200.0.0.0/24 reject
[edit]
7
policy-options {
  policy-statement static {
    term static {
      from {
        protocol static;
        route-filter 200.0.0.0/24 exact;
      }
      then {
        metric 111;
        external {
          type 2;
        }
        accept;
      }
    }
    term deny-any {
      then reject;
    }
  }
}
```

RG-R2600-2# show ip route

Codes: C - connected, S - static, R - RIP

O - OSPF, IA - OSPF inter area

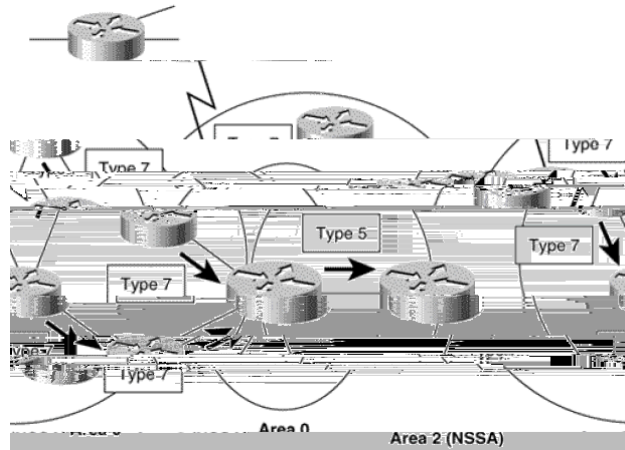
E1 - OSPF external type 1, E2 - OSPF external type 2

Gateway of last resort is 192.168.101.26 to network 0.0.0.0

192.168.101.0/30 is subnetted, 10 subnets

8.7 Not-So-Stubby Areas (NSSA)

No type 5 or type 3 LSAs in area 0
NSSA ABR can inject LSA type 7 into area 0
Type 7 LSA is converted to Type 5 LSA by ABR



8-8

```

NSSA
edit protocols ospf area 0.0.0.10]
admin@RSR04E-2#show
nssa {
  default-lsa {
    default-metric <value>;
    metric-type <value>;
    type-7;
  }
  no-summaries;
}
interface <interface-name>;
}
    
```

8.8 Virtual Links

Virtual Links — 虚拟链路
用于连接两个不连续的 OSPF 区域，通常用于连接 backbone 区域和末梢区域。
配置示例：在 RSR04E-2 和 RSR04E-1 之间配置虚拟链路，连接 area 0 和 area 1。
命令：
area 0 virtual-link 1.1.1.1
area 1 virtual-link 1.1.1.1
8.8-1 8.8-2

Syntax:

area <area-id> virtual-link <neighbor-ip>


```
authentication-type md5;
virtual-link neighbor-id 192.168.102.5 transit-area 0.0.0.10 {
    authentication {
        md5 10 key "$9$FFE56CuRhr8X-O1X-VwaJ369"; ## SECRET-DATA
    }
}
interface lo0.0 {
    passive;
}
interface fe-0/0/0.0 {
    authentication {
        md5 10 key "$9$0GZDk5Qnp0I.P0IEcvMaZU"; ## SECRET-DATA
    }
}
}
area 0.0.0.10 {
    interface fe-0/0/2.0;
    interface fe-0/0/1.0;
}
}
```

RG-R6806E

```
admin@RSR04E-1# run telnet 192.168.102.5
Trying 192.168.102.5...
Connected to 192.168.102.5.
Escape character is '^'.
```

User Access Verification

Password:

RG-6806E>en

Password:

RG-6806E#sho run

Building configuration...

Current configuration : 1501 bytes

!

version 1.0

install 4 12sfp/gt

ip routing algorithm CRC32_UPPER

!

hostname RG-6806E

H ' RSR04/08E "A

H

enable secret level 1 5 \$2-aeh`@31'dfimL4t{bcknAQ7zyglow

End

⊖ backbone ^ AREA 0~ MD5 7 Virtual Links ≠ MD5
7 Â

, Virtual Links

admin@RSR04E-2> show ospf interface

Interface	State	Area	DR ID	BDR ID	Nbrs
fe-0/0/0.0	DR	0.0.0.0	192.168.102.2	192.168.102.1	1
lo0.0	DRother	0.0.0.0	0.0.0.0	0.0.0.0	0
vl-192.168.102.5	PtToPt	0.0.0.0	0.0.0.0	0.0.0.0	1
fe-0/0/1.0	DR	0.0.0.10	192.168.102.2	192.168.102.5	1
fe-0/0/2.0	DR	0.0.0.10	192.168.102.2	192.168.102.6	1

admin@RSR04E-2> show ospf neighbor

Address	Interface	State	ID	Pri	Dead
192.168.101.5	fe-0/0/0.0	Full	192.168.102.1	128	38
192.168.101.18	vl-192.168.102.5	Full	192.168.102.5	1	35
192.168.101.18	fe-0/0/1.0	Full	192.168.102.5	1	36
192.168.101.37	fe-0/0/2.0	Full	192.168.102.6	1	36

, Disable Â

admin@RSR04E-2> set interfaces fe-0/0/0.0 disable

, ospf

admin@RSR04E-2> show ospf neighbor

Address	Interface	State	ID	Pri	Dead
192.168.101.18	vl-192.168.102.5	Full	192.168.102.5	1	30
192.168.101.18	fe-0/0/1.0	Full	192.168.102.5	1	30
192.168.101.37	fe-0/0/2.0	Full	192.168.102.6	1	31

9. Firewall Filters

Route policy

firewall filters

9.1 firewall Filters Overview

↓

3 ~ 4

9.2

9.2.2 $\vdash$

```
term implicit-rule {
  then {
    discard;
  }
}
```

9.2.3 ר

Page 112 of 131


```

        protocol 6;
        port 23;
      }
      then {
        reject;
      }
    }
  }
, Well-known /

```

```

[edit firewall family inet]
user@Shiraz# show
filter example-filter-1 {
  term deny-telnet {
    from {
      protocol tcp;
      port telnet;
    }
    then {
      reject;
    }
  }
}
,

```

```

[edit firewall family inet]
user@Shiraz# show
filter example-filter-2 {
  term allow-telnet {
    from {
      protocol tcp;
      port telnet;
    }
    then accept;
  }
  term allow-mail {
    from {
      protocol tcp;
      port smtp;
    }
  }
}

```

```

    then accept;
  }
}
,
[edit firewall family inet]
user@Shiraz# shp x      Я  D f ® D Ъ  D " X  m. m'  D f ® D Ъ'  "
    }  thb@mac1 î a      a      ba
    , , , ,
    }  t      t `@otoeolthc `;
    }  t      t `?@pf[thb ö t]tcit `}};
    }  t
    }      then accept;
    }

```

Match Condition	Description
	also listed):The Expedited Forwarding RFC defines one codepoint: ef (46).The Assured Forwarding RFC defines 4 classes, with 3 drop precedences in each class, for a total of 12 codepoints: af11 (10), af12 (12), af13 (14), af21 (18), af22 (20), af23 (22), af31 (26), af32 (28), af33 (30), af41 (34), af42 (36), or af43 (38).
fragment-offset <i>number</i>	The fragment offset field.
icmp-code <i>number</i>	The ICMP code field. This value or keyword provides more specific information than the icmp-type condition. Because the value's meaning depends on the associated icmp-type, it must also be specified along with the icmp-code.

icmp-type *number*
p"

The ICMP packet type field. Normally, you specify this match in conjunction with the protocol match condition to determine which protocol is being used on the port. In place of the numeric jŷ \$~ ' 0 1 'D 'ε s D q f

```

    }
    then {
        reject;
    }
}
}

```

Match Condition	Description
address <i>prefix</i>	The IP source or destination address field. You cannot specify both the address and the destination-address or source-address match conditions in the same term.
destination-address <i>prefix</i>	The IP destination address field. You cannot specify the destination-address and address match conditions in the same term.
destination-prefix-list <i>prefix-list</i>	The IP destination prefix list field. You cannot specify the destination-prefix-list and prefix-list match conditions in the same term.
prefix-list <i>prefix-list</i>	The IP source or destination prefix list field. You cannot specify both the prefix-list and the destination-prefix-list or source-prefix-list match conditions in the same term.
source-address <i>prefix</i>	The IP source address field. You cannot specify the source-address and address match conditions in the same rule.
source-prefix-list <i>prefix-list</i>	The IP source prefix list field. You cannot specify the source-prefix-list and prefix-list match conditions in the same term.

9.2.4

terminating, flow-control, and action modifiers

9.2.4.1 terminating Actions

accept, discard, and reject

RSR04/08E

A

H

9.2.4.2 Flow-Control Actions

Flow-Control Actions next term

|| ^

```

10
^ 1~ ^ log ^
[edit firewall family inet]
user@Shiraz# show
filter example-filter-9{
    term log-all-packets {
        then log;
    }
    term deny-telnet {
        from {
            protocol tcp;
            port telnet;
        }
        then {
            reject;
        }
    }
    term accept-everything-else {
        then accept;
    }
}
^ 2~ log ^ 10 term ^
[edit firewall family inet]
user@Shiraz# show
filter example-filter-9{
    term log-all-packets {
        then {
            log;
            next term;
        }
    }
    term deny-telnet {
        from {
            protocol tcp;
            port telnet;
        }
        then {
            reject;
        }
    }
    term accept-everything-else {
        then accept;
    }
}

```

```
}
}
```

9.2.4.2 Action Modifiers

```
count ' 10.0.0/24 ^
[edit firewall family inet]
user@Shiraz# show
filter inbound-from-peer {
    term count-traffic {
        from {
            source-address {
                10.0.0/24;
            }
        }
        then {
            count traffic-counter;
            accept;
        }
    }
}
```

```
Log' memory-resident buffer that is 500 lines ^ show firewall log ^
[edit firewall family inet]
user@Shiraz# show
filter log-tcp-flow-start {
    term count-syn {
        from {
            protocol tcp;
            tcp-initial;
        }
        then {
            log;
            accept;
        }
    }
}
```

```
Sample' ^
[edit firewall family inet]
user@Shiraz# show
filter sample-peer-traffic {
    term peer-connections {
        from {
            source-address {
                10.10.0.0/16;
                172.30.45.0/24;
            }
        }
    }
}
```

```

192.168.164.0/20;
    }
}
then {
    sample;
    accept;
}
}
}
}

```

Syslog

```

log
[edit firewall family inet]
user@Shiraz# show
filter log-tcp-flow-start {
    term count-syn {
        from {
            protocol tcp;
            tcp-initial;
        }
        then {
            syslog;
            accept;
        }
    }
}
}

```

9.2.3 Applying Firewall Filters

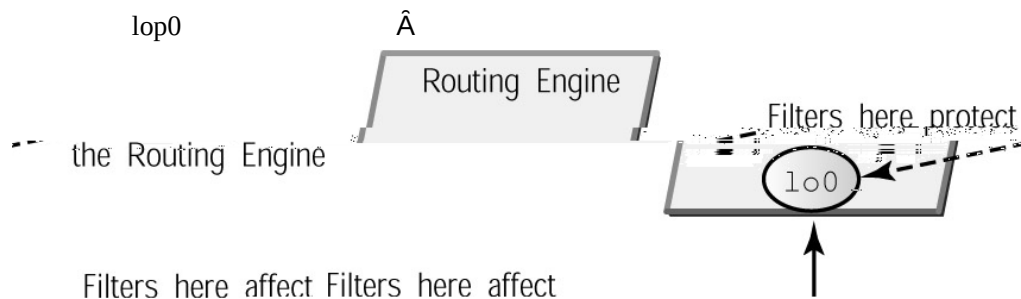
```

firewall filters to interface'
[edit interfaces fe-0/0/0]
user@Shiraz# show
description "Connection to AS 65000";
unit 0 {
    family inet {
        filter {
            input AS65000-inbound-filter;
            output AS65000-outbound-filter;
        }
        address 10.10.10.1/24;
    }
}

```


}

9.3 Protecting the Routing Engine



9-1

```
edit interfaces lo0]
user@Shiraz# show
unit 0 {
    family inet {
        filter {
            input protect-routing-engine;
        }
        address 192.168.1.1/32;
    }
}
```

9.4 Rate Limits

bandwidth-limit burst-size-limit,

```

    policer policer-1 {
        if-exceeding {
            bandwidth-limit 400k; /**          **/
            burst-size-limit 100k; /**        1          **/
        }
        then discard; /**          500k 1          ***/
    }
    term ftp {
        from {
            source-address {
                10.2.3/24;
            }
            protocol tcp;
            destination-port [ftp ftp-data];
        }
        then {
            policer policer-1; /**          FTP **/
            accept;
        }
    }
    term accept-all {
        then accept;
    }
}

```

```

interface
[edit firewall]
user@Shiraz# show
policer police-all-traffic {
    if-exceeding {
        bandwidth-limit 10m;
        burst-size-limit 100k;
    }
    then {
        discard;
    }
}
[edit interfaces fe-0/0/0]
user@Shiraz# show
description "Connection to Customer-A";
unit 0 {
    family inet {
        policer {
            input police-all-traffic;

```


23 (2 packets)

9.5.3 show interfaces filters

user@Shiraz> show interfaces filters

Interface	Admin	Link	Proto	Input Filter	Output Filter
fe-0/0/0	up	up			
fe-0/0/0.0	up	up	inet	filter-1	
				filter-2	
fe-0/0/1	up	up			
fe-0/0/1.0	up	up	inet	filter-3	
				filter-4	
fe-0/0/2	up	down			
fe-0/0/3	up	down			

user@Shiraz> show interfaces policers

Interface	Admin	Link	Proto	Input Policar	Output Policar
fe-0/0/0	up	up			
fe-0/0/0.0	up	up	inet	fe-0/0/0.0-in-policar	
				fe-0/0/0.0-out-policar	
fe-0/0/1	up	up			
fe-0/0/1.0	up	up	inet	fe-0/0/1.0-in-policar	
				fe-0/0/1.0-out-policar	
fe-0/0/2	up	down			
fe-0/0/3	up	down			

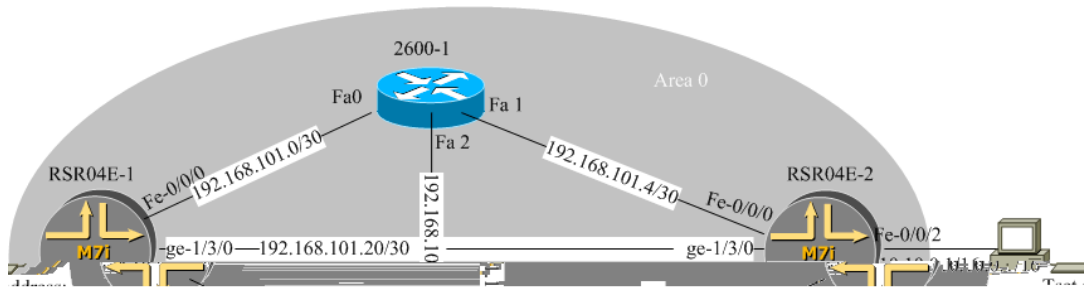
user@Shiraz> show policar

```

Policar: so-2/2/0.0-in-policar
          so-2/2/0.0-in-policar
                        0 packets
Policar: so-2/2/0.0-out-policar
          so-2/2/0.0-out-policar
                        238 packets
  
```

9.6 Configuring Filter-Based Forwarding

Â IO Â



9-2

```

10'
RSR04E-2
1          10.10.0.2          RSR04E-1 lookback
          193.1.1.1 RSR04E-2 2600-2 192.168.101.9
2          10.10.0.3          RSR04E-1 lookback
          193.1.1.1 RSR04E-2 2600-1 192.168.101.5
3  ε          ||          Å ≠          RSR04E-1 ge-1/3/0
          192.168.101.20 Å
          π          RSR04  IO
1 routing-instances
routing-instances {
  route-source-filter1 {          /***  Å          ***/
    instance-type forwarding;          /***          ***/
    routing-options {
      static {
        route 0.0.0.0/0 next-hop 192.168.101.9;
      }
    }
  }
  route-source-filter2 {          /***  Å          ***/
    instance-type forwarding;          /***          Å          ***/
    routing-options {
      static {
        route 0.0.0.0/0 next-hop 192.168.101.5;
      }
    }
  }
}

routing-options {
  Å ' RSR04/08E          Å

```

```

interface-routes {
    rib-group inet source-filter;
}
rib-groups {
    source-filter {
        import-rib [ route-source-filter1.inet.0
                    route-source-filter2.inet.0 inet.0 ];
    }
}
}
2, 网 ,
firewall {
    family inet {
        filter classify-source {
            term isp1 {
                from {
                    source-address {
                        10.10.0.2/32;
                    }
                }
                then routing-instance route-source-filter1;
            }
            term isp2 {
                from {
                    source-address {
                        10.10.0.3/32;
                    }
                }
                then routing-instance route-source-filter2;
            }
            term default {
                then accept;
            }
        }
    }
}
4 网 ,
interfaces {
    fe-0/0/2 {
        unit 0 {
            description to-3550-fa0/48;
            family inet {
                filter {
                    input classify-source;

```

```

    }
    address 10.10.0.1/16;
  }
}
5      traceroute

```

```

5.1 凡      10.10.0.2  traceroute
RG-S3550#traceroute 193.1.1.1
  1   12ms   1ms   1ms   10.10.0.1
  2    1ms   4ms   1ms   192.168.101.9
  3    1ms   2ms   1ms   193.1.1.1
Trace complete successfully.

```

```

5.2 凡      10.10.0.3  traceroute
RG-S3550#traceroute 193.1.1.1
  1   29ms   1ms   1ms   10.10.0.1
  2    1ms   1ms   1ms   192.168.101.5
  3    2ms   1ms   4ms   193.1.1.1
Trace complete successfully.

```

```

5.3 凡      10.10.0.3  traceroute
RG-S3550#traceroute 193.1.1.1
  1    3ms   1ms   1ms   10.10.0.1
  2    1ms   1ms   3ms   193.1.1.1
Trace complete successfully.

```

```

RSR04E-2
admin@RSR04E-2# show
version 7.3B1.1;
system {
  host-name RSR04E-2;
  root-authentication {
    encrypted-password "$1$4lSSr3rQ$dwkAWDsD6HZnsgdH7l.Zv1"; ##
  SECRET-DATA
  }
  login {
    user admin {
      uid 2004;
      class super-user;
    }
  }
}

```

```
}
ge-1/3/0 {
    description to-RSR04E-1-ge-1/3/0;
    unit 0 {
        family inet {
            address 192.168.101.22/30;
        }
    }
}
fxp0 {
    description IMG;
    unit 0 {
        family inet {
            address 192.168.0.12/24;
        }
    }
}
lo0 {
    description RID;
    unit 0 {
        family inet {
            address 192.168.102.2/32;
        }
    }
}
}
routing-options {
    interface-routes {
        rib-group inet source-filter;
    }
    rib-groups {
        source-filter {
            import-rib [ route-source-filter1.inet.0
route-source-filter2.inet.0 inet.0 ];
        }
    }
    router-id 192.168.102.2;
}
protocols {
    ospf {
        area 0.0.0.0 {
            interface fe-0/0/0.0;
            interface fe-0/0/1.0;
            interface lo0.0 {
```

```
        passive;
    }
    interface fe-0/0/2.0 {
        passive;
    }
    interface ge-1/3/0.0;
}
}
}
firewall {
    family inet {
        filter classify-source {
            term isp1 {
                from {
                    source-address {
                        10.10.0.2/32;
                    }
                }
                then routing-instance route-source-filter1;
            }
            term isp2 {
                from {
                    source-address {
                        10.10.0.3/32;
                    }
                }
                then routing-instance route-source-filter2;
            }
            term default {
                then accept;
            }
        }
    }
}
routing-instances {
    route-source-filter1 {
        instance-type forwarding;
        routing-options {
            static {
                route 0.0.0.0/0 next-hop 192.168.101.9;
            }
        }
    }
    route-source-filter2 {
```

