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A.1 Overview of the-166(3ie)-1bPae-166(ProTco)27(ct)-1((I)]TJ/54110.9091Tf80.359510Td[(.)-166(.)-176





# 1 Overview

## 1.2 System Architecture



## 1.5 How to get Quagga



'--enable-snmp'

Enable SNMP support. By default, SNMP support is disabled.

'--enable-opaque-lsa'

Enable support for Opaque LSAs (RFC2370) in ospfd.

'--disable-ospfapi'

'--enable-vty-group=*group*'

Create Unix Vty sockets (for use with vtysh) with group ownership set to *group*





## 3 Basic commands



the severity level is not included in logged messages. Note: some versions of syslogd including Solaris can be configured to include the facility and level in the messages emitted.

<code>service password-encryption</code> Encrypt password.	[Command]
<code>service advanced-vty</code> Enableanced mode	[Command]
<code>service terminal -length &lt;0-512&gt;</code> Set system wide line configuration. This configuration command applies to all VTY interfaces.	[Command]
<code>line vty</code> Enter vty configuration mode.	[Command]
<code>banner motd default</code> Set default motd	[Command]
<code>no banner motd</code> No motder string will beinted.	[Command]
<code>exec-timeout <i>minute</i></code>	[Lineand]
<code>exec-timeout <i>minute second</i></code>	[Lineand]

password zebra!password

'-i *file*'

'--pid\_*file=**file*'

Upon startup the process identifier of the daemon is written to a file, typically in `'/var/run`

```
% telnet localhost 2601
Trying 127.0.0.1...
Connected to localhost.
Escape character is '^]'.
```

### 3.4.3.1 CLI Movement Commands

These commands are used for moving the CLI cursor. The `↵`





## 4 Zebra

zebra





show ipv6forward

[Command]

## 5

RIP – Routing Information Protocol is widely deployed interior gateway protocol.

links. Quagga ripd does not support the non-sequential netmasks that are included in RIP Version 2.

In a case of similar information with the same prefix and metric, the old information will be suppressed. Ripd does not currently support equal cost multipath routing.

## 5.2 RIP Configuration

router rip [Command]

The router rip command is necessary to enable RIP. To disable RIP, use the no

```
passive-interface (IFNAME | default) [RIP command]
no passive-interface IFNAME [RIP command]
```

This command sets the specified interface to passive mode. On passive mode interface,







di stance <1-255> A. B. C. D/M  
no di stance <1-255> A. B. C. D/M

[RIP command]

[RIP command]



```
interface eth1
 ip rip authentication mode md5
 ip rip authentication key-chain test
!
```

## 5.10 RIP Timers

```
timers basic update timeout garbage [RIP command]
```

RIP protocol has several timers. User can configure those timers' value by `timers basic`

```
ripd> show ip protocols
Routing Protocol is "rip"
  Sending updates every 30 seconds with +/-50%, next due in 35 seconds
```











Note that areas with fully-adjacent virtual-links are considered to be "transit capable" and can always be used to route backbone traffic, and hence are unaffected by this setting (see [\[OSPF virtual-link\]](#), page 37).

More information regarding the behaviour controlled by this command can be found in *RFC 3509, Alternative Implementations of OSPF Area Border Routers*, and *draft-ietf-ospf-shortcut-abr-02.txt*.

Quote: "Though the definition of the ABR (Area Border Router) in the OSPF specification does not require a router with multiple attached areas to have a backbone connection, it is actually necessary to provide successful routing to the inter-area and external destinations. If this requirement is not met, all traffic destined for the areas not connected to such an ABR or out of the OSPF domain, is dropped. This document describes alternative ABR behaviors implemented in Cisco and IBM routers."

`ospf rfc1583compatibility` [OSPF Command]

`no ospf rfc1583compatibility` [OSPF Command]

*RFC2328*, the successor to *RFC1583*, suggests according to section G.2 (changes) in section 16.4 a change to the path preference algorithm that prevents possible routing loops that were possible in the old version of OSPFv2. More specifically it demands that inter-area paths and intra-area path are now of equal preference but still both preferred to external paths.

This command should NOT be set normally.

`log-adjacency-changes [detail]` [OSPF Command]

`no log-adjacency-changes [detail]` [OSPF Command]



(i.e. a link of bandwidth 100Mbit/s or higher will have a cost of 1. Cost of lower bandwidth links will be scaled with reference to this cost).

This configuration setting **MUST** be consistent across all routers within the OSPF domain.

```
network a.b.c.d/m area a.b.c.d [OSPF Command]
```



```
router ospf
 network 192.168.1.0/24 area 0.0.0.0
 network 10.0.0.0/8 area 0.0.0.10
 area 0.0.0.10 export-list foo
!
access-list foo permit 10.10.0.0/16
access-list foo deny any
```

With example above any intra-area paths from area 0.0.0.10 and from range

## 7.4 OSPF interface

```
ip ospf authentication-key AUTH_KEY [Interface Command]
no ip ospf authentication-key [Interface Command]
    Set OSPF authentication key to a simple password. After setting AUTH_KEY
```





```
redistribute (kernel |connected|static|rip|bgp) [OSPF Command]
    metric-type (1|2) metric <0-16777214> route- word
no redistribute (kernel |connected|static|rip|bgp) [OSPF Command]
```





```
!  
password ABCDEF  
log file /var/log/quagga/ospfd.log  
service advanced-vty  
!  
interface eth0  
 ip ospf authentication message-digest  
 ip ospf message-digest-key 1 md5 ABCDEFGHIJK  
!  
interface ppp0  
!  
interface br0  
 ip ospf authentication message-digest  
 ip ospf message-digest-key 2 md5 XYZ12345  
!  
router ospf  
 ospf router-id 192.168.0.1  
 redistribute connected  
 passive interface ppp0  
 network 192.168.0.0/24 area 0.0.0.0  
 network 10.0.0.0/16 area 0.0.0.0  
 network 192.168.1.0/24 area 0.0.0.1  
 area 0.0.0.0 authentication message-digest  
 area 0.0.0.0 range 10.0.0.0/16  
 area 0.0.0.0 range 192.168.0.0/24  
 area 0.0.0.1 authentication message-digest  
 area 0.0.0.1 range 10.2.0.0/16  
!
```

## 8 OSPFv3

ospf6d

## 8.5 Showing OSPF6 information

- `show ipv6 ospf6 [INSTANCE_ID]` [Command]  
INSTANCE\_ID is an optional OSPF instance ID. To see router ID and OSPF instance ID, simply type "show ipv6 ospf6 <cr>".
- `show ipv6 ospf6 database` [Command]  
This command shows LSA database summary. You can specify the type of LSA.
- `show ipv6 ospf6 interface` [Command]  
To see OSPF interface configuration like costs.
- `show ipv6 ospf6 neighbor` [Command]  
Shows state and chosen (Backup) DR of neighbor.
- `show ipv6 ospf6 request-list A.B.C.D` [Command]  
Shows requestlist of neighbor.
- `show ipv6 route ospf6` [Command]  
This command shows internal routing table.

## 8.6 OSPF6 Configuration Examples



`di stance <1-255> A. B. C. D/M`

[BGP]

`di stance <1-255> A. B. C. D/M word`

[BGP]

This command set distance value to



redistribute connected [BGP]  
Redistribute connected route to BGP process.

redistribute rip [BGP]  
Redistribute RIP route to BGP process.

[BGP]

`neighbor peer interface ifname` [BGP]

`no neighbor peer interface ifname` [BGP]

When you connect to a BGP peer over an IPv6 link-local address, you have to specify the *ifname* of the interface used for the connection. To specify IPv4 session addresses, see the `neighbor peer update-source` command below.

This command is deprecated and may be removed in a future release. Its use should be avoided.

`neighbor peer next-hop-self` [BGP]

`no neighbor peer next-hop-self` [BGP]

This command specifies an announced route's nexthop as being equivalent to the address of the bgp router.

`neighbor peer update-source <ifname|address>` [BGP]

`no neighbor peer update-source` [BGP]

Specify the IPv4 source address to use for the BGP session to this neighbour, may be specified 4(b)292(e)-1(i)1(ther)-291(4n)-291(l)-1(P)1(v4)-291(4dd)1(res)-1(s)-292(d)1(irec)-1(tl)1(y)-292

[BGP]





### 9.8.1 BGP Community Lists

BGP community list is a user defined BGP communities attribute list. BGP community list can be used for matching or manipulating BGP communities attribute in updates.



set comm-list *word* delete

[Route Map]

This command remove communities value from BGP communities attribute. The

~~This command remove communities value from BGP communities attribute. The~~

```
    set local-preference 80
!
route-map RMAP permit 30
  match community 90
  set local-preference 90
```





[Command]



## 9.11 Capability Negotiation

When adding IPv6 routing information exchange feature to BGP. There were some proposals. IETF

neighbor *peer* override-capability  
no neighbor *peer* override-capability

[BGP]  
[BGP]





## 9.14 How to set up a 6-Bone connection

zebra configuration

=====

!



`dump bgp all path interval`  
Dump all BGP packet and events to *path*

[Command]

```
neighbor 10.1.1.1 peer-group upstream
neighbor 10.2.1.1 remote-as 64516
neighbor 10.2.1.1 peer-group upstream
neighbor 10.3.1.1 remote-as 64517
neighbor 10.3.1.1 peer-group cust-d2fault
neighbor 10.3.1.1 description customer1
neighbor 10.3.1.1 prefix-list pl-cust1-network in
neighbor 10.4.1.1 remote-as 64518
neighbor 10.4.1.1 peer-group cust
neighbor 10.4.1.1 prefix-list pl-cust2-network in
neighbor 10.4.1.1 description customer2
neighbor 10.5.1.1 remote-as 64517ras 64517raso0/1or description cust
neighbor 10.4.1.1 prefix-list plx2-list plx2-list plx2-listprefix-l6T6T6T6T6T6T6T6T6T
neighbor 10.4.6.1 prefix-list plx2-list plx2-TJ0--5.727313.1507Td[(ne!ist)-525(plx2-l
```

```

! 100 - blackhole the prefix
! 200 - set no_export
! 300 - advertise only to other customers
! 400 - advertise only to upstreams
! 500 - set no_export when advertising to upstreams
! 2X00 - set local_preference to X00
!
! blackhole the prefix of the route
ip community-list standard cm-blackhole permit 64512:100
!
! set no-export community before advertising
ip community-list standard cm-set-no-export permit 64512:200
!
! advertise only to other customers
ip community-list standard cm-cust-only permit 64512:300
!
! advertise only to upstreams
ip community-list standard cm-upstream-only permit 64512:400
!
! advertise to upstreams with no-export
ip community-list standard cm-upstream-noexport permit 64512:500
!
! set local-pref to least significant 3 digits of the community
ip community-list standard cm-prefmod-100 permit 64512:2100
ip community-list standard cm-prefmod-200 permit 64512:2200
ip community-list standard cm-prefmod-300 permit 64512:2300
ip community-list standard cm-prefmod-400 permit 64512:2400
ip community-list expanded cme-prefmod-range permit 64512:2...
!
! Informational communities
!
! 3000 - learned from upstream
! 3100 - learned from customer
! 3200 - learned from peer
!
ip community-list standard cm-learnt-upstream permit 64512:3000
ip community-list standard cm-learnt-cust permit 64512:3100
ip community-list standard cm-learnt-peer permit 64512:3200
!
! #####
! Utility route-maps
!
! These utility route-maps generally should not used to permit/deny

```

```
route-map rm-no-export permit 10
  set community additive no-export
route-map rm-no-export permit 20
!
route-map rm-blackhole permit 10
  description blackhole, up-pref and ensure it cant escape this AS
  set ip next-hop 127.0.0.1
  set local-preference 10
  set community additive no-export
route-map rm-blackhole permit 20
!
! Set local-pref as requested
route-map rm-prefmod permit 10
  match community cm-prefmod-100
  set local-preference 100
route-map rm-prefmod permit 20
  match community cm-prefmod-200
```

```

    match community cm-cust-only
route-map rm-community-filt-to-upstream 477! it 20
!
! Deny customer routes to other customers with upstream-only set.
route-map rm-community-filt-to-cust deny 10
    match community cm-learned-cust
    match community cm-upstream-only
route-map rm-community-filt-to-cust 477! it 20
!
! #####
! The top-level route-maps applied to sessions. Further entries could
! be added obviously..
!
! Customers
route-map rm-cust-in 477! it 10
    call rm-community-in
    on-match next
route-map rm-cust-in 477! it 20
    set community additive 64512:3100
route-map rm-cust-in 477! it 30
!
route-map rm-cust-out 477! it 10
    call rm-community-filt-to-cust
    on-match next
route-map rm-cust-out 477! it 20
!
! Upstream transit ASes
route-map rm-upstream-out 477! it 10
    description filter customer 4refixes which are marked cust-only
    call rm-community-filt-to-upstream
    on-match next
route-map rm-upstream-out 477! it 20
    description only customer routes are provided to upstreams/peers
    match community cm-learned-cust
!
! Peer ASes
! outbound policy is same as for upstream
route-map rm-peer-out 477! it 10
    call rm-upstream-out
!
route-map rm-peer-in 477! it 10
    set community additive 64512:3200

```



## 10 Configuring Quagga as a Route Server











Figure 10.4: Announcement processing model implemented by the Route Server

## 10.2 Commands for configuring a Route Server

Now we will describe the commands that have been added to quagga in order to support the route server features.

```
neighbor peer-group route-server-client [Route-Server]
```













route-map for client RA in the route server, simply add route-map entries following this scheme:

```
route-map <NAME> permit 10
  match peer <Peer Address>
  call <In Route-Map for this Peer>
route-map <NAME> permit 20
  match peer <Another Peer Address>
  call <In Route-Map for this Peer>
```

This is exactly the process that has been followed to generate the route-map

```
route-map RSCLIENT-A-IMPORT permit 10
  match peer 2001:ODB8::B
  call A-IMPORT-FROM-B
...
...
!
route-map A-IMPORT-FROM-B permit 1
  match ipv6 address prefix-list LIST-1
  match as-path LIST-2
  on-match goto 10
route-map A-IMPORT-FROM-B deny 2
route-map A-IMPORT-FROM-B permit 10
  match ipv6 address prefix-list COMMON-PREFIXES
  set local-preference 100
route-map A-IMPORT-FROM-B permit 20
  match ipv6 address prefix-list PEER-B-PREFIXES
  set community 65001:11111
!
...
...
```









show ip prefix-list

[Command]





## 13 Route Map

	Match	No Match
<i>Permit</i>	action	cont
<i>Deny</i>	deny	cont

'action'

- Apply *set* statements
- If *call* is present, call given route-map. If that returns a 'deny', finish processing and return 'deny'.
- If 'Exit Policy' is *next*, goto next route-map entry
- If 'Exit Policy' is *goto*, goto first entry whose order in the li60(fir)1(s)-1373129J5/F5110.90 deny'BT576510.9091Tf-1

### 13.3 Route Map Set Command

`set ip next-hop ipv4_address` [Route-map Command]  
Set the BGP nexthop address.

`set local-preference local_pref` [Route-map Command]  
Set the BGP local preference.

`set weight weight` [Route-map Command]

[Route-map Command]set wei g

[p





[Interface Command]







## 15 Kernel Interface

There are several different methods for reading kernel routing table information, updating kernel routing tables, and for looking up interfaces.

'ioctl' The 'ioctl



## 16 SNMP Support

SNMP (Simple Network Managing Protocol) is a widely implemented feature for collecting network information from router and/or host. Quagga itself does not support SNMP agent (server daemon) functionality but is able to connect to a SNMP agent using the SMUX protocol (*RFC1227*) and make the routing protocol MIBs available to MIBs.





```
# if peer address is in $WARN_PEER, the email should also
# be sent to $EMAILADDR_WARN
for ip in $WARN_PEERS; do
    if [ "$ip" == "$peer" ]; then
        EMAILADDR="$EMAILADDR,$EMAILADDR_WARN"
        TYPE="WARNING"
        break
    fi
done
```

```
# convert peer state
case "$peerstate" in
    1) peerstate="Idle" ;;
    2) peerstate="Connect. 1tf[tate="Idle" ;;2)al soemConnect. 1tf[x2TE7f1GuTJ0613. 1507Td[(2))-52E0
```

```
# convererrorcodeer state
ca0013. 15ate
```









'Version' Version number of the Zserv message. Clients should not continue processing messages past the version field for versions they do not recognise. Not present in version 0 messages.

'Command' The Zebra Protocol command.

#### A.2.4 Zebra Protocol Commands

Command  
ZEBRA

Value

## Appendix B Packet Binary Dump Format

Quagga can dump routing protocol packet into file with a binary format (see

0										1										2										3									
0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9	0	1	2	3	4	5	6	7	8	9
Source AS number										Destination AS number																													
Interface Index										Address Family																													
Source IP address																																							
Source IP address (Cont'd)																																							
Source IP address (Cont'd)																																							
Source IP address (Cont'd)																																							
Destination IP address																																							
Destination IP address (Cont'd)																																							
Destination IP address (Cont'd)																																							
Destination IP address (Cont'd)																																							
Old State										New State																													

If 'type' is PROTOCOL





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no ip as-path access-lip2 <i>word</i> .....	52
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no router zebra ..... 41  
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no smux peer *oid* .....

```
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..... 55,  
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show ip community-list name .....
```







