

IPv6 Routing

Achmad Husni Thamrin
SOI-ASIA OW 2004

Outline

- IPv6 Routing
- OSPFv3
- Zebra

IPv6 Routing

- Similar to IPv4 routing
- Router doesn't fragment packets
- Router has to advertise itself
 - Router Advertisement

Steps to Build IPv6 Router

- Enable IPv6 forwarding
- Assign site-local and/or global unicast address
- Activate router advertisement
 - Usually only to downstream
- Populate routing table
 - Static
 - Routing protocol

Routing Protocols

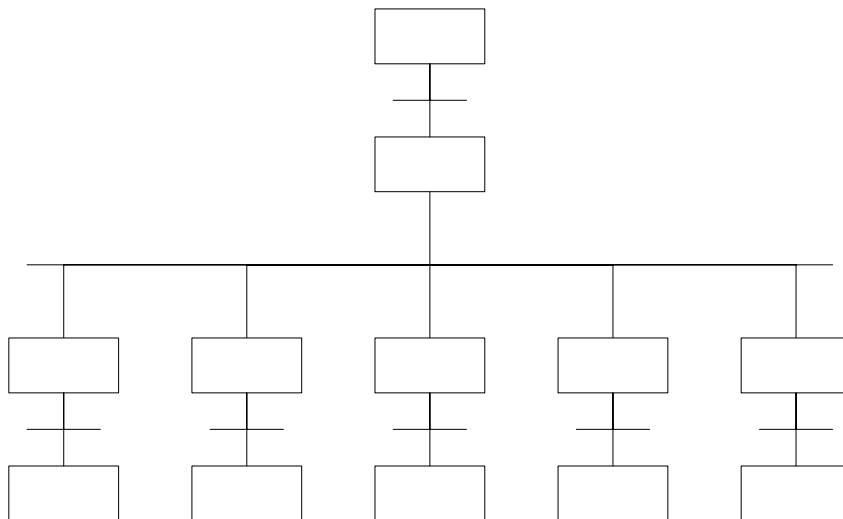
- IGP
 - RIPng
 - OSPFv3
- EGP
 - BGP 4+

RIPng

- Routing Information Protocol next generation
- Bellman-Ford algorithm
- Scalability and convergence problems
- Good for small network
 - Virtually no special configuration when using route6d

LAB WORK

Exercise 1



OSPFv3

- OSPF for IPv6
- Link-state routing protocol in a single AS
- LSA: who connects to who
- Routers exchange Link State Advertisements
 - hop-by-hop
 - LSA flooding
- Routers know the topology of the whole network
- Calculate paths using Dijkstra Algorithm

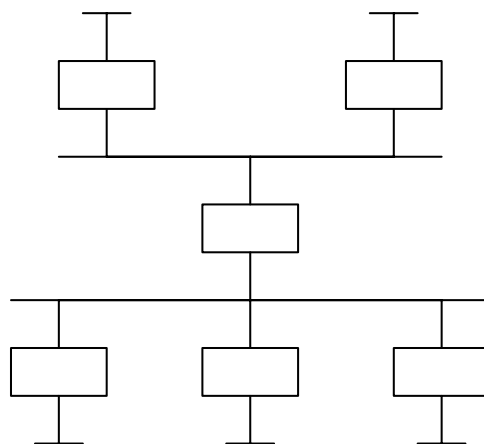
OSPF Features

- Scalability
 - Large network may be divided into areas
- Full-subnetting support
- TOS routing
- Equal-cost multi path
 - Depend on the underlying system
 - FreeBSD doesn't support this

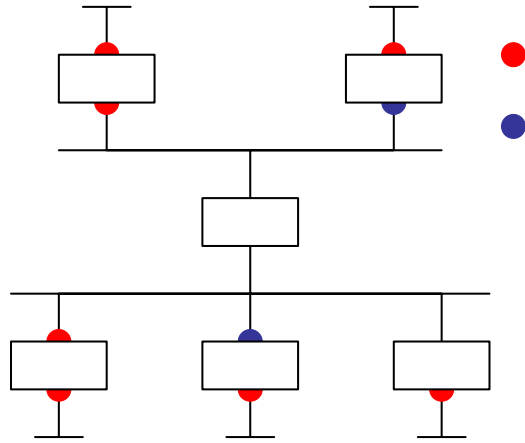
OSPFv3 Basic Process

- Exchange Hello messages
- Elect DR and BDR
- Synchronize LSDB with DR and BDR
- LSA Flooding
- Calculate SPF

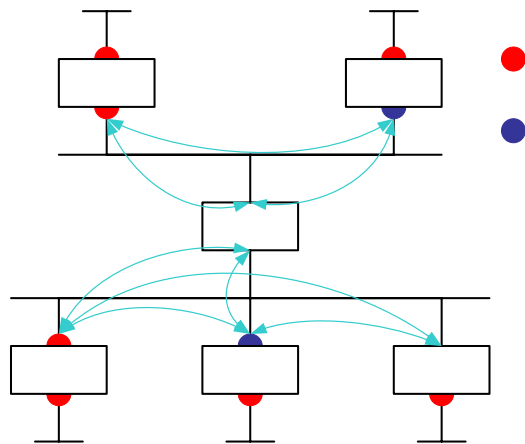
Sample Network



Hello Exchange

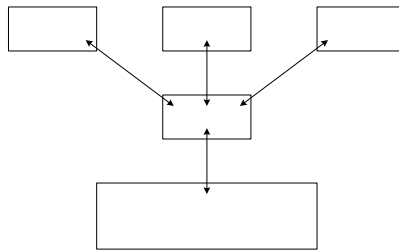


LSA Flooding



Zebra

- Open source routing package
- GNU License
- Runs on *nix, including FreeBSD
- Cisco-like CLI



LAB WORK

Exercise 2

Configuring Zebra

- Configuration file: `/usr/local/etc/zebra.conf`
- Contents:
 - General
 - Interface definition
 - Static route definition
 - Access control

`/usr/local/etc/zebra.conf (1)`

```
!  
hostname Router  
password 8 bJ0xh87QLi Lbl  
log syslog  
service password-encryption
```

`/usr/local/etc/zebra.conf (2)`

```
interface fxp0
description Ethernet to Upstream
multicast
ipv6 nd suppress-ra
!
interface fxp1
description Another Ethernet
multicast
ipv6 nd suppress-ra
```

`/usr/local/etc/zebra.conf (3)`

```
ipv6 route ::/0 fe80::280:c8ff:feb9:4491 fxp0
```

`/usr/local/etc/zebra.conf (4)`

```
access-list vty-access permit 127.0.0.1/32
access-list vty-access deny any
!
ipv6 access-list vty-access permit ::1/128
ipv6 access-list vty-access deny any
!
line vty
access-class vty-access
ipv6 access-class vty-access
exec-timeout 0 0
```

Configuring ospf6d

- Config file: `/usr/local/etc/ospf6d.conf`
- Contents:
 - General
 - Interface config
 - OSPF config
 - Route-map
 - Access control

`/usr/local/etc/ospf6d.conf (1)`

```
hostname ospf6router
password zebra
enable password zebra
log syslog
```

`/usr/local/etc/ospf6d.conf (2)`

```
interface fxp0
  ipv6 ospf6 cost 1
  ipv6 ospf6 hello-interval 10
  ipv6 ospf6 dead-interval 40
  ipv6 ospf6 priority 10
!
interface fxp1
!
```

`/usr/local/etc/ospf6d.conf (3)`

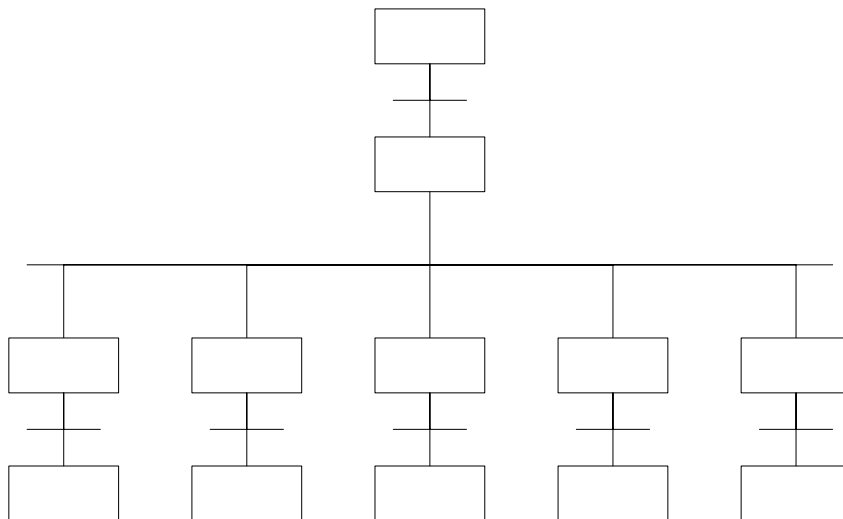
```
router ospf6
router-id 0.1.2.3
interface fxp0 area 0.0.0.0
interface fxp1 area 0.0.0.0
!
```

Secure Your Zebra

- Config file readable-writable by root only
- Use encryption
- Access to Zebra CLI from localhost only

LAB WORK

Exercise 3



Operating Zebra

- telnet localhost <zebra beast>
- Input password
- Press ? to get available commands
- Press TAB to complete command

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Exercise 4

LAB WORK

Exercise 5

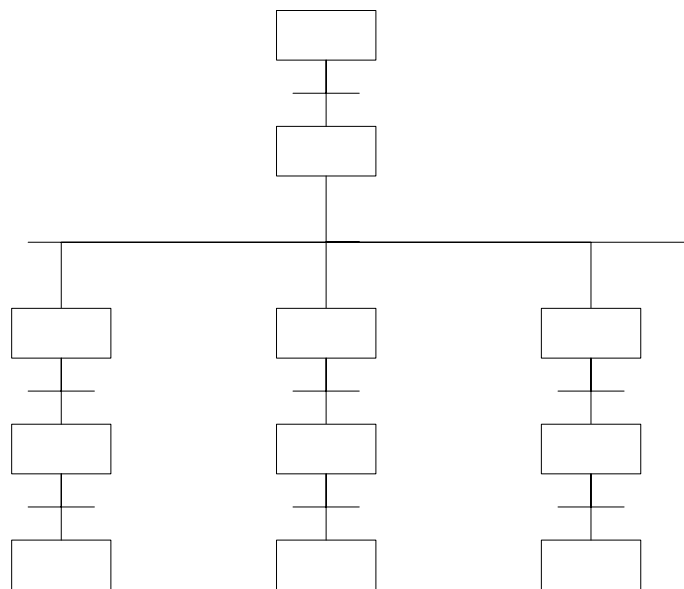
LAB WORK

Exercise 6

LAB WORK

(Topology II)

Exercise 3-5



Troubleshooting

Foundation for Troubleshooting

- Technical knowledge of routing protocol
- Familiar with router commands (e.g. Zebra)
- Experience

Possible Causes

- Mis-configuration
- Filtering
- MTU
- Packet loss
- Bug
 - O/S
 - Zebra beast
- Interoperability problem

General Zebra Debugging Procedure

- Direct log to a file
- Turn on debugging related to the problem
- Watch the log file

- Remember to disable logging and debug afterwards , otherwise the log file eats up your disk

OSPFv3 LSA

- Router-LSA
- Network-LSA
- Inter-Area-Prefix-LSA
- Inter-Area-Router-LSA
- AS-External-LSA
- Link-LSA
- Intra-Area-Prefix-LSA

Some Symptoms

- Routes in kernel != routes in Zebra
- OSPF neighbor state does not advance to FULL
- Missing routes

LAB WORK: TROUBLESHOOTING

Exercise 1 Interpreting zebra log and ospf6d output

Display Debug Messages

- Log on to ospf6d CLI, go to configuration mode
#telnet localhost ospf6d
en
conf term
- Redirect log to /home/admin/log.ospf6d
log file /home/admin/log.ospf6d
- Start debug messages
debug ospf6 all
- Let's interpret the messages!

Stop Debug Messages

- Stop debugging messages
no debug
- Stop logging to file
no log file

LAB WORK: TROUBLESHOOTING

Exercise 2

What Would Happen If MTUs are different?

