

Router Configuration



Cisco Router Configuration

- Rule #1: What would v4 do?
 - Enable routing
 - ipv6 unicast-routing
 - Configure interfaces
 - ipv6 address
 - Configure routing protocols

Cisco Configs

- LAN Interface

```
interface Ethernet0/0  
  ip address 192.168.1.254 255.255.255.0  
  ipv6 address 2001:468:123:1::2/64
```

Cisco Configs

- Tunnel Interface

```
interface Tunnell
  description IPv6 to Abilene
  no ip address
  no ip redirects
  no ip proxy-arp
  ipv6 address 3FFE:3700:FF:105::2/64
  tunnel source ATM2/0.1
  tunnel destination 192.168.193.14
  tunnel mode gre
```

Cisco Configs

- ATM PVC

```
interface ATM2/0.3 point-to-point
description My GigaPoP
no ip redirects
no ip proxy-arp
pvc MyGigaPoP 3/66
    ubr 155000
    encapsulation aal5snap
!
ipv6 address 2001:468:FF:555::1/64
```

Cisco Configs

- IGP - OSPFv3, IS-IS, EIGRPv6
- Static

```
ipv6 route <prefix> <nexthop>
```

Cisco Configs

```
router BGP <AS-NUMBER>  
    <generic config>  
address-family ipv6 unicast  
    <ipv6 config>  
address-family ipv4 unicast  
    <ipv4 config>  
address-family ipv4 multicast  
    <ipv4 multicast config>
```

Cisco Configs

- BGP - added to your existing IPv4 BGP config

```
router bgp 64555
  bgp router-id 192.168.2.1
  neighbor 2001:468:1::2 remote-as 11537
```

- router-id
 - only a 32-bit number, not an IPv4 address
 - only has to be unique within the AS

Cisco Configs

- BGP continued. . .

```
address-family ipv6 unicast
  neighbor 2001:468:2::1 activate
  neighbor 2001:468:2::1 soft-reconfiguration in
  neighbor 2001:468:2::1 prefix-list to-Abilene-v6 out
network 2001:468:4ff::/48
exit-address-family
```



Cisco Configs

- BGP continued. . .

```
ipv6 route 2001:468:4ff::/48 Null0
```

```
!
```

```
ipv6 prefix-list to-Abilene-v6 seq 10 permit  
2001:468:4ff::/48
```

Cisco Configs

- OSPF interface config

```
! For each internal (intra-pod) interface - including  
! loopback0
```

```
interface FastEthernet0/0  
  ipv6 ospf <process> area 0
```

process is an arbitrary number, must be consistent on the router but
can be different between routers

- OSPF router config

```
ipv6 router ospf <process>
```

```
! For any external (inter-pod) interfaces  
  passive-interface <interface>
```

Cisco Configs

- Securing Console Access

```
ipv6 access-list V6VTY permit  
  2001:468:4ff::/48 any
```

```
. . .
```

```
!
```

```
line vty 0 4
```

```
  ipv6 access-class V6VTY in
```

JunOS config editor commands for Cisco users

- "set" command to enter configuration, e.g.
set protocol bgp local-as 65500
- "edit" command to change config context
 - In Junos, the prompt is your context:
 - [edit]% edit protocol bgp
 - [edit protocol bgp]%
- "delete" command to remove lines
- "run" command to execute show commands while in configuration mode
- "commit" command to save and execute changes —
"commit" check verifies config

Juniper Router Configuration

- Rule #1: What would v4 do?
 - Enable routing — already there. . .
 - Configure interfaces
 - family inet6 address
 - Configure routing protocols and RIBs

Juniper Configs

- Interface (physical)

```
interfaces {
    fe-0/1/0 {
        unit 0 {
            family inet6 {
                address 2001:468:123::1/64;
            }
        }
    }
}
```

Juniper Configs

- Interface (tunnel)

```
interfaces {
  gr-0/3/0 {
    unit 0 {
      tunnel {
        source 192.168.2.2;
        destination 192.168.45.2;
      }
      family inet6 {
        mtu 1514; /* note Cisco vs. Juniper
        address 2001:468:123::1/64;
      }
    }
  }
}
```

Juniper Configs

- Router Advertisement - not enabled by default

```
protocols {  
    router-advertisement {  
        interface fe-0/3/0.0 {  
            prefix 2001:468:123::/64;  
        }  
    }  
}
```

Juniper Configs

- Static Routing in Routing-Options

```
rib inet6.0 {  
    static {  
        route 2001:468::/32 {  
            reject;  
            install;  
            readvertise;  
        }  
    }  
}
```

```
router-id 192.168.2.1
```

Juniper Configs

- BGP

```
protocols {
  bgp {
    group Abilene-v6 {
      type external;
      family inet6 {
        unicast;
      }
      export to-Abilene-v6;
      peer-as 11537;
      neighbor 2001:468:555:200::6;
    }
  }
}
```

Juniper Configs

- BGP continued. . .

```
policy-options {
  policy-statement to-Abilene-v6 {
    term accept-aggregate {
      from {
        route-filter 2001:468:4ff::/48 exact;
      }
      then accept;
    }
    term reject {
      then reject;
    }
  }
}
```

Cisco Show Commands

- show bgp
- show bgp summary
- show bgp ipv6 unicast neighbor <addr> routes
- show bgp ipv6 unicast neighbor <addr> advertised
- show ipv6 route
- show ipv6 interface
- show ipv6 neighbors

Juniper Show Commands

- `show bgp summary`
- `show route advert bgp <addr>`
- `show route rece bgp <addr>`
- `show route table inet6.0 (terse)`
- `show interfaces`
- `show ipv6 neighbors`

IGPs

IS-IS and OSPFv3



Engineering Workshops

IGP – IS/IS

- Distance Vector IGPs
 - RIP
 - RIP2
 - IGRP
 - EIGRP

- Link State IGPs
 - OSPF
 - IS/IS

IGP – IS/IS

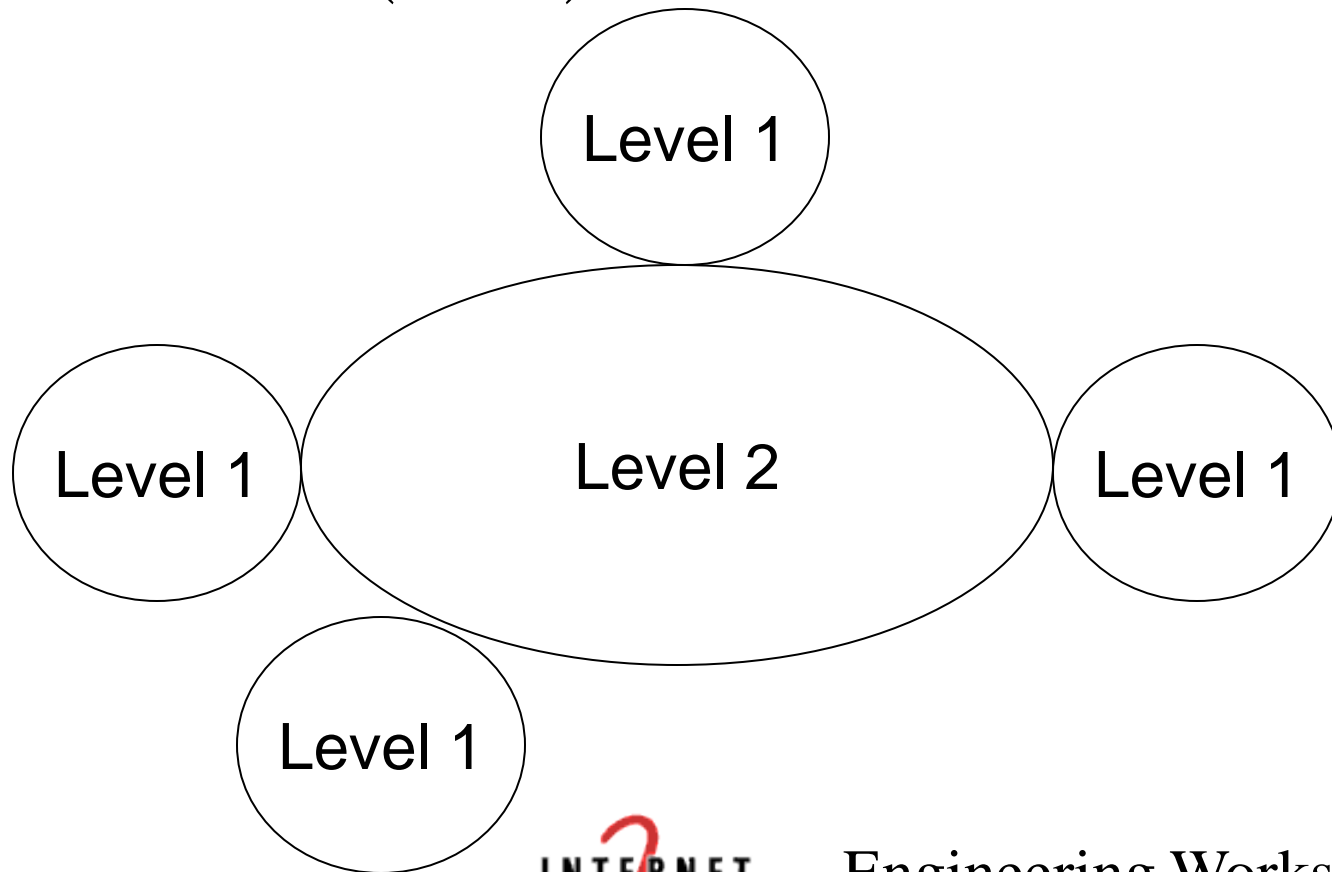
- OSI-developed
- In the magic OSI fantasy world everything is either an End System (ES) or an Intermediate System (IS)
- ES=Hosts
- IS=Routers
- IS/IS: A protocol to let Intermediate Systems talk to other Intermediate Systems, i.e. Router to Router, i.e. Routing

IGP – IS/IS

- IS/IS carries routing information for the OSI protocols.
- It is also VERY easy to modify to carry other protocols, like IPv4 and IPv6.
- The language is different, but the concepts are the same as in OSPF. (Well, not really, but close enough.)
- OSPF Areas = IS/IS Levels
- OSPF Neighbors = IS/IS Adjacencies

IGP – IS/IS

- Only two levels allowed: Level Two (backbone) and Level One (stub.)



IGP – IS/IS

- Always use Wide Metrics.
- Always set your metrics.
- Always disable Level 1 and force Level 2.
- OSI MTU must be ≤ 1500 .
- You need one unique OSI address per router.
- An ES-IS state means something is wrong.
- Don't forget: It needs OSI/CLNS to work.

IGP – IS/IS – Cisco Interface Config

```
interface POS0/0
  description BACKBONE: OC48 to IPLSng
  mtu 9180
  ip router isis
  ipv6 router isis
  clns mtu 1497
```

IGP – IS/IS Cisco Routing

```
router isis
 redistribute connected metric-type external
 redistribute static ip
 !
 address-family ipv6
   redistribute connected
 exit-address-family
 net 49.0000.0000.0000.0006.00
 is-type level-2-only
 metric-style wide
```

IGP – IS/IS Cisco Commands

```
ipls-gsr#show clns neighbor
```

System Id	Interface	SNPA	State	Holdtime	Type	Protocol
clev-gsr	PO2/0	*HDLC*	Up	21	L2	IS-IS
IPLSng	PO0/0	*HDLC*	Up	26	L2	IS-IS



IGP – IS/IS – Cisco Commands

```
ipls-gsr#sh isis topology
```

```
IS-IS paths to level-2 routers
```

System Id	Metric	Next-Hop	Interface	SNPA
atla-gsr	588	IPLSng-re0	P00/0	*HDLC*
chin-gsr	262	IPLSng-re0	P00/0	*HDLC*
clev-gsr	324	clev-gsr	P02/0	*HDLC*
dnvr-gsr	1194	IPLSng-re0	P00/0	*HDLC*
hstn-gsr	1457	IPLSng-re0	P00/0	*HDLC*
ipls-gsr	--			
kscy-gsr	550	IPLSng-re0	P00/0	*HDLC*
losa-gsr	2850	IPLSng-re0	P00/0	*HDLC*



IGP – IS/IS Juniper Interface Config

```
interface {  
    so-0/0/0 {  
        unit 0 {  
            family iso {  
                mtu 1497;}}  
        }  
    }  
    lo0 {  
        unit 0 {  
            family iso {  
                address  
                49.0000.0000.0000.0018.00;}}  
        }  
    }  
}
```

IGP – IS/IS – Juniper Routing

```
protocols{
  isis{
    level 2 wide-metrics-only
    interface so-0/0/0.0 {
      level 1 disable;
      level 2 metric 548; }}}
  interface so-0/1/0.0 {
    level 2 metric 260;
    level 1 disable; }
```

IGP – IS/IS Juniper Commands

```
gcbrowni@IPLSng-re0> show isis adjacency
```

Interface	System	L State	Hold (secs)
so-0/0/0.0	KSCYng-re0	2 Up	24
so-0/1/0.0	CHINng-re0	2 Up	25
so-1/1/0.0	atla-gsr	2 Up	24
so-1/2/1.0	ipls-7200-6	2 Up	25
so-1/3/0.0	ipls-gsr	2 Up	23

IGP – IS/IS Juniper Commands

```
gcbrowni@IPLSng-re0> show isis database
```

```
IS-IS level 1 link-state database:
```

LSP ID	Sequence	Checksum	Lifetime	Attributes
IPLSng-re0.00-00	0xf65	0xa1fc	400	L1 L2

```
1 LSPs
```

```
IS-IS level 2 link-state database:
```

LSP ID	Sequence	Checksum	Lifetime	Attributes
atla-gsr.00-00	0x60a2	0x7cae	1068	L1 L2
chin-gsr.00-00	0x5eac	0xc1d9	1110	L1 L2
chin-gsr.01-00	0x1a15	0x99ed	525	L1 L2
clev-gsr.00-00	0x62a2	0xcf0e	584	L1 L2
dnvr-gsr.00-00	0x5ca7	0x332e	1019	L1 L2



IGP – OSPF for IPv6

It *is* pretty much your father's OSPF!

OSPF for IPv6

- Published as RFC 2740 (80 pages!)
 - Protocol version 3
 - Link-state IGP (additive interface costs)
 - Same basic structure as OSPF for IPv4
 - IPv4/IPv6 OSPF run as “ships in the night”
- Assumption: Most campuses run OSPF as their IGP \Rightarrow Familiarity

Changes from OSPF for IPv4

- Protocol processing per-link, not per-subnet
 - “Interfaces” connect to “links”
 - Nodes without common subnet can talk over link
- Removal of addressing semantics
 - IP addresses only in payloads
 - 32-bit router ID
 - Protocol-independent core

Changes from OSPF for IPv4

- Addition of flooding scope
 - Link-local
 - Area
 - AS
- Support for multiple instances per link
 - Sort of like VLAN tagging but for OSPF
 - *E.g.*, OSPF on shared DMZ

Changes from OSPF for IPv4

- Use of link-local addresses
 - Used for next hop
 - Link-local destination not forwarded
- Authentication changes
 - Remove authentication-related fields
 - Rely on AH, ESP
 - Use normal IP checksum

Changes from OSPF for IPv4

- Packet format changes
 - R-bit, V6-bit
- LSA format changes
- Handling unknown LSA types
- Stub area support
- Identifying neighbors by router ID

Cisco Interface Config

```
interface Vlan257
  ip address 128.254.1.12 255.255.255.0
  load-interval 30
  ipv6 address 2001:FFE8:1:1::C/64
  ipv6 enable
  ipv6 ospf network broadcast
  ipv6 ospf 1 area 0.0.0.0
```



Cisco Routing Config

```
ipv6 router ospf 1
  log-adjacency-changes
  passive-interface default
  no passive-interface Vlan58
  no passive-interface Vlan257
  no passive-interface Vlan61
  no passive-interface Vlan62
  no passive-interface Vlan60
  no passive-interface Vlan63
  no passive-interface Vlan948
  redistribute connected metric-type 1
```



Cisco Commands

```
cephus#show ipv6 ospf neighbor
```

Neighbor ID	Pri	State	Dead Time	Interface ID	Interface
128.254.1.17	1	FULL/BDR	00:00:33	7	Vlan257
128.254.1.18	1	FULL/DROTHER	00:00:31	7	Vlan257



Cisco Commands

```
cepheus#show ipv6 ospf database
```

```
OSPFv3 Router with ID (128.254.58.2) (Process ID 1)
```

```
Router Link States (Area 0.0.0.0)
```

ADV Router	Age	Seq#	Fragment ID	Link count	Bits
128.254.1.17	1136	0x800007A9	0	1	E
128.254.1.18	1121	0x800007A7	0	1	E
128.254.58.2	138	0x8000054F	0	1	E

```
Net Link States (Area 0.0.0.0)
```

ADV Router	Age	Seq#	Link ID	Rtr count
128.254.58.2	138	0x8000053C	231	3

```
Link (Type-8) Link States (Area 0.0.0.0)
```

ADV Router	Age	Seq#	Link ID	Interface
128.254.1.17	1236	0x800007A2	7	Vl257



Juniper Routing Config

```
protocols {  
    ospf3 {  
        area 0 {  
            interface interface-name;  
        }  
    }  
}
```

Juniper Commands

- `show ospf3 neighbor`
- `show ospf3 database`

OSPF Lab

- Configure routing and interface addresses
- Bring up OSPFv3 on the internal campus pod networks
- Verify that the interface routes are propagated as expected
- Originate and redistribute a default route from router C
- Verify that the internal routers are seeing the proper default route