

Post 18

Thursday, January 24, 2019 11:16 PM

OSPF P2

Router OSPF Config Mode

router ospf *process-id* [*global config*] OSPFv2 enable: Process-id = # between 1-65,535

- Locally significant: Doesn't have to be same value on other routers to establish adjacencies

Router IDs: Every router requires a r-ID to participate in OSPF domain: Defined by admin/auto assigned by router

Used by the OSPF-enabled router to:

Unique ID router	Used to ID each router w/in OSPF domain/all packets that originate from them
Participate in election of DR	In multiaccess LAN: Election of DR occurs during establishment of OSPF network <ul style="list-style-type: none">• When links become active: r-device config w/highest priority elected DR• Assuming no priority config/tie: Router w/highest r-ID elected DR• R-device w/2nd highest r-ID elected BDR

Cisco r-ID based on 1 of 3 criteria:

1. router-id [*config mode*] Any 32-bit value expressed as IPv4 address
2. If r-ID not config: Router chooses highest IPv4 address of any loopback ints
3. If no loopback ints: Router chooses highest IPv4 address of any physical ints

If router uses highest IPv4 for r-ID: Int doesn't need to be OSPF-enabled

Config OSPF R-ID

show ip protocols Verify router ID

If r-ID same on 2 neighbors: Displays error: %OSPF-4-DUP_RTRID1: Detected router w/duplicate r-ID

Modifying R-ID: Active OSPF router doesn't allow r-ID changed until router reloaded/OSPF cleared
clear ip ospf process [*priv EXEC*] Forces OSPF to transition to Down/Init states

- Adjacency msgs from full to down/loading to full

show ip protocols Verifies r-ID change

Loopback Int as R-ID

- IPv4 of loopback int should be config using 32-bit mask: 255.255.255.255: Creates host

Enabling OSPF on Ints

network Determines which ints participate in r-process for area

- Any ints that match network address enabled to send/receive OSPF packets

network *network-address* wildcard-mask area *area-id*

- Single-area OSPF: network must be config w/same area-id value on all routers

Wildcard Mask	v2: Uses arg combo of network-address/wildcard-mask to enable OSPF on ints Classless: Wildcard always needed When ID'ing ints in r-process Wildcard mask is inverse of subnet mask config on that int Wildcard mask: String of 32 binary digits used by r-to determine which bits of address to examine for match <ol style="list-style-type: none">1. Wildcard mask bit 0: Matches corresponding bit value in address2. Wildcard mask bit 1: Ignores corresponding bit value in address Easiest calc: Subtract network subnet mask from 255.255.255.255
----------------------	---

network intf-ip-address 0.0.0.0 area *area-id* [*config mode*] OSPFv2 enable

- v2 uses int address/subnet mask to determine network to advertise

Passive Int: Default: OSPF msgs fwded out all OSPF-enabled ints: Only need ints connecting other OSPF-routers

Sending out unneeded msgs affects network?

Bad use of BW	BW consumed: Msgs multicasted: Switches also fwd msgs out all ports
Bad use of Resources	All devices on LAN must process/discard msg
Security Risk	Advert updates on broadcast network: Security risk

- Msgs can be intercepted w/packet sniffer
- Updates can be mod/sent back: Corrupting table w/false metrics: Misdirects traffic

Config Passive Int

passive-interface [*config mode*] Prevent transmission of r-msgs through r-int: Still allow advertise to other routers

- Cmd stops msgs from being sent out specified int: Network specified int belongs to: Still advertises
- Neighbor adjacency can't be formed over passive int: Link-state packets can't be sent/acknowledged

show ip protocols Verify settings: v2/v3 support passive-int: All ints can be made passive
no passive-interface Not passive can be re-enabled

OSPF Metric = Cost: Lower cost indicates better path

- Cost of int is inversely proportional to BW of int
- Higher bw indicates lower cost: A 10Mb Eth0 has higher cost than 100Mb Eth0

Formula: Cost = reference BW/int BW

auto-cost reference-bandwidth [router config] Must be config on every router in OSPF domain

show ip ospf interface s0/0/0 Verify current OSPF cost assigned

- All ints have default BW values assigned to them: Int BW values don't affect speed/capacity of link

show interfaces View int BW settings

ip ospf cost value [*int config*]

Cost setting the int BW:

Advantage	Router doesn't have to calc metric when cost is manually config
Disadvantage	When int BW config: Router must calc OSPF cost based on BW

ip ospf cost Calculate OSPF costs

Verify Neighbors:

show ip ospf neighbor Verify router has formed an adjacency w/neighbor routers

- r-ID of neighbor not displayed/doesn't show as being in FULL state

For each neighbor: cmd displays following output:

Neighbor ID	r-ID of neighbor
Pri	OSPF priority of int: Value used in DR/BDR election
State	State of int: <ul style="list-style-type: none"> • FULL state: Router/neighbor have identical OSPF LSDBs • On multiaccess networks: 2 routers that are adjacent may have states displayed as 2WAY • Dash: No DR/BDR required b/c of network type
Dead Time	Amt of time remaining that router waits to receive OSPF Hello packet from neighbor before declaring it down <ul style="list-style-type: none"> • Value reset when int receives Hello packet
Address	IPv4 address of neighbor's int: Router directly connected
Interface	Int router formed adjacency with

2 routers may not form OSPF adjacency if:

- Subnet masks don't match: Causes routers to be on separate networks
- Hello/Dead Timers don't match
- Network Types don't match
- Missing/incorrect OSPF network cmd

Verify OSPF Protocol Settings

show ip protocols Quick way to verify OSPF config info

Includes: OSPF process ID | router ID | router is advertising | neighbors router is receiving updates from | default AD [110: OSPF]

Verify Process Info

show ip ospf Examine process ID/r-ID/area info/last time SPF alg was calc

Verify Int Settings

show ip ospf interface Detailed list for every OSPF-enabled int/determine network statements correct

show ip ospf interface brief Summary of OSPF-enabled ints

OSPFv3

- IPv6: Network address referred to as prefix/subnet mask is called prefix-length
- v3: Same function as v2: Uses IPv6 as network layer transport: Communicating w/v3 peers/advertising routes

- OSPFv2/v3: Have separate adjacency tables | OSPF topology tables | IP r-tables

Similarities: OSPFv2/OSPFv3

Link-state	Both classless link-state r-protocols
R-alg	Both use SPF alg
Metric	RFCs for both define metric as cost of sending packets out int <ul style="list-style-type: none"> • Both can mod using auto-cost reference-bandwidth ref-bw [config mode] • Cmd only influences metric where it was config
Areas	Both use same concept of multiple areas
Packet types	v3 uses same 5 basic packet types as v2 [Hello/DBD/LSR/LSU/LSAck]
Neighbor discovery mechanism	Neighbor state machine: Includes list of neighbor states/events remains unchanged <ul style="list-style-type: none"> • Both use Hello mechanism to learn about neighbors/form adjacencies • v3: No requirement for matching subnets to form neighbor adjacencies • B/C neighbor adjacencies are formed using link-local addresses (not global unicast)
DR/BDR election process	DR/BDR election process remains unchanged
Router ID	Both use a 32-bit # for r-ID represented in decimal: Typically IPv4 address. <ul style="list-style-type: none"> • router-id cmd must be used to config router ID

Differences: OSPFv2/OSPFv3

Advertises	v2 advertises IPv4 routes v3 advertises IPv6 routes
Source address	v2 Msgs sourced from IPv4 address of exit int v3 Msgs sourced using link-local address of exit int
All OSPF router multicast addresses	v2 uses 224.0.0.5 v3 uses FF02::5
DR/BDR multicast address	v2 uses 224.0.0.6 v3 uses FF02::6.
Advertise networks	v2 advertises networks using network r-config v3 uses <code>ipv6 ospf process-id area area-id [int config]</code>
IP unicast routing	IPv4: Enabled by default IPv6: <code>ipv6 unicast-routing [global config]</code> must be config
Authentication	v2 uses plaintext/MD5 authentication v3 uses IPv6 authentication

Link-Local Addresses

- Routers running dynamic r-protocol [OSPF] exchange msgs between neighbors on same subnet/link
- Routers only need to send/receive r-protocol msgs w/directly connected neighbors
- These msgs always sent from source IPv4 address of router doing fwding

IPv6 link-local addresses:

- IPv6 link-local address enables device to communicate w/other IPv6-enabled devices on same link/only on link (subnet)
- Packets w/source/destination link-local address can't be routed beyond link from where packet originated

OSPFv3 messages sent using:

Source IPv6 address	IPv6 link-local address of exit int
Destination IPv6 address	v3 packets can be sent to unicast address using neighbor IPv6 link-local address Can also be sent using multicast address FF02::5 address is all OSPF router address FF02::6 is DR/BDR multicast

- Link-local addresses auto created when IPv6 global unicast address assigned to int
- Global unicast addresses not required on an int: IPv6 link-local addresses are

Cisco routers create link-local address using FE80::/10 prefix and EUI-64

- EUI-64 involves using 48-bit Eth0 MAC: Inserting FFFE in middle/flipping 7th bit
- For serial ints: Cisco uses MAC address of Eth0 int

Assigning Link-Local Addresses

- Link-local addresses created using EUI-64 fmt/random int IDs, make it difficult to recognize/remember those addresses

ipv6 router ospf process-id [*global config*] Enter router config mode: IPv6 router config mode prompt is diff than IPv4

- IPv6 router confirmation mode to config global OSPFv3 params
- IPv6 routing protocols are enabled on an int: Not from router config mode like IPv4
- Network IPv4 router config mode cmd doesn't exist in IPv6: process-id value: 1-65,535

Requires 32-bit r-ID to be assigned before OSPF can be enabled on an int

Like v2: v3 uses	Explicitly config r-ID 1st <ul style="list-style-type: none"> • If none config: router uses highest config IPv4 address of loopback int • If none config: router uses highest config IPv4 address of active int • If no sources of IPv4: Router displays console msg to config r-ID manually
------------------	---

Modifying OSPFv3 R-ID

- R-IDs sometimes must change: After v3 r-establishes r-ID, that ID can't be changed until r-reloaded/OSPF process cleared

clear ipv6 ospf process [*priv EXEC*] Forces OSPF to renegotiate neighbor adjacencies using new r-ID

Enabling OSPFv3 on Ints

- Uses diff method to enable an int for OSPF: Instead of network r-config mode cmd to specify matching int addresses
- OSPFv3 is config directly on the int

ipv6 ospf *process id* area *area-id* [*int config*] Enable OSPFv3 on an int

process-id	ID's specific r-process/must be same as process ID used to create r-process in ipv6 router ospf process-id cmd
area-id	Area associated w/int: Any value could be config: 0 selected: b/c 0 is backbone area all other areas must attach

ipv6 ospf 10 area 0 OSPFv3 enabled on ints

Verify OSPFv3 Neighbors

show ipv6 ospf neighbor Verify adjacency w/neighbors: If r-ID of neighbor no display/no state FULL: Haven't formed adjacency

- If 2 routers don't establish adjacency: Link-state info not exchanged
- Incomplete LSDBs can cause inaccurate SPF trees/r-tables: Routes may not exist/may not be optimal

For each neighbor: Cmd displays:

Neighbor ID	R-ID of neighbor
Pri	Priority of int: Value used in DR/BDR election
State	State of int: FULL: Means router/neighbor have identical OSPF LSDBs <ul style="list-style-type: none"> • Multiaccess networks (Eth0): 2 routers adjacent may have states displayed as 2WAY • Dash indicates no DR/BDR required b/c of network type
Dead Time	Amt of time remaining router waits to receive Hello packet from neighbor before declaring it down <ul style="list-style-type: none"> • Value reset when int receives Hello packet
Interface ID	Int ID/link ID
Interface	Int router formed adjacency with

Verify OSPFv3 Protocol Settings

show ipv6 protocols Verify vital config info: Process ID/r-ID/ints enabled for OSPFv3

show ipv6 ospf Examine process ID/r-ID/area info/last time SPF alg was calc

Verify OSPFv3 Ints

show ipv6 ospf interface Detailed list for every OSPF-enabled int

show ipv6 ospf interface brief View summary of OSPFv3-enabled ints

show ipv6 route ospf Provides specifics about OSPF routes in r-table