OSPF Configuration – Process ID

```
R1(config)#router ospf 1
```

- Different interfaces on a router can run in different instances of OSPF.

- Different instances have different Link State Databases

- Only one instance is typically configured on OSPF routers – multiple Process IDs are very rarely used

- The Process ID is locally significant. It does not have to match on the neighbour router to form an adjacency
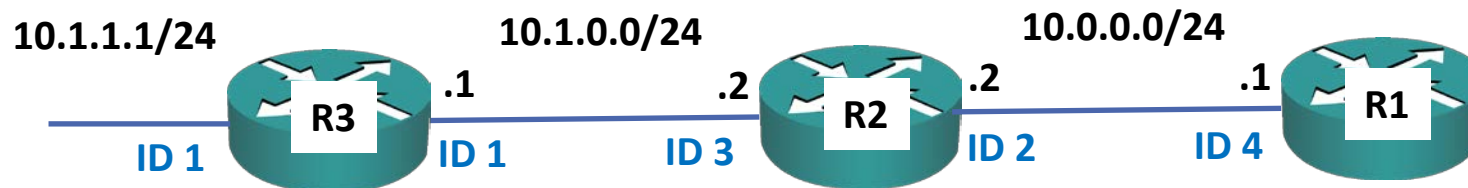
OSPF Configuration – Process ID

- In the example below, R2 will form adjacencies with both R1 and R3 (even though the Process ID does not match on both sides)
- R1 and R3 will not learn each others routes because they are in different Process IDs on R2
- **This is NOT a normal configuration**

```
R2(config)#router ospf 2
R2(config-router)#network 10.0.0.0 0.0.0.255 area 0
R2(config)#router ospf 3
R2(config-router)#network 10.1.0.0 0.0.0.255 area 0
```


10.1.1.1/24   10.1.0.0/24   10.0.0.0/24

R3   .1   .2   R2   .2   .1   R1

ID 1   ID 1   ID 3   ID 2   ID 4

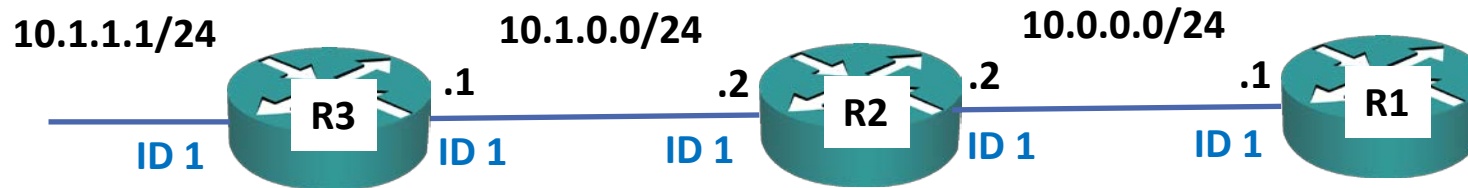# OSPF Configuration – Process ID

- This is a normal configuration. All routers will learn all routes

```
R2(config)#router ospf 1
R2(config-router)#network 10.0.0.0 0.0.0.255 area 0
R2(config-router)#network 10.1.0.0 0.0.0.255 area 0
```


10.1.1.1/24

10.1.0.0/24

10.0.0.0/24

R3   .1   .2   R2   .2   .1   R1

ID 1   ID 1   ID 1   ID 1   ID 1

OSPF Configuration - network

```
R1(config)#router ospf 1
R1(config-router)#network 10.0.0.0 0.0.255.255 area 0
```

- The network command uses a wildcard mask which is the inverse of a subnet mask.

- Subtract each octet in the subnet mask from 255 to calculate the wildcard mask

- A subnet mask of 255.255.0.0 equals a wildcard mask of 0.0.255.255

- A subnet mask of 255.255.255.252 equals a wildcard mask of 0.0.0.3

```
R1(config)#router ospf 1
R1(config-router)#network 10.0.0.0
% Incomplete command.
```

- The command does not default to using the classful boundary
- You must enter a wildcard mask

OSPF Configuration - network

`R1(config-router)# network 10.0.0.0 0.0.255.255 area 0`

- The network command means:
  - Look for interfaces with an IP address which falls within this range.
  - Enable OSPF on those interfaces – send out and listen for OSPF hello messages, and peer with adjacent OSPF routers.
  - Advertise the network and mask which is configured on those interfaces.

OSPF Configuration Example - network

`R1(config-router)# network 10.0.0.0 0.0.255.255 area 0`

- Interface FE1/0 and FE2/0 fall within this range, FE0/0 does not
- OSPF will be enabled on FE1/0 and FE2/0 and the router will peer with adjacent OSPF routers
- Networks advertised:
  - 10.0.1.0/24
  - 10.0.2.0/24
  - 10.1.0.0/24 is NOT advertised
  - 10.0.0.0/16 is NOT advertised

FE1/0
10.0.1.1/24

FE0/0
10.1.0.1/24

R1

FE2/0
10.0.2.1/24
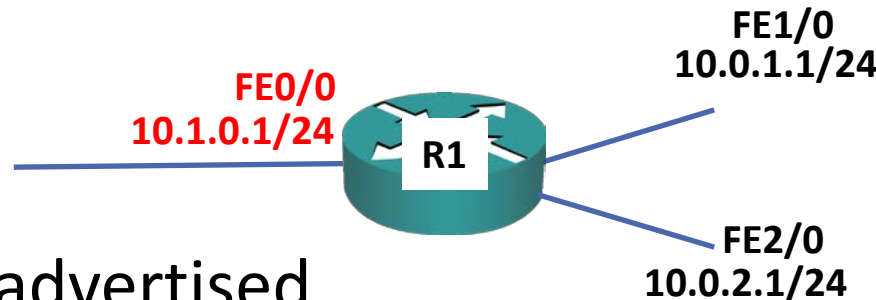
```
R1#sh run | section ospf
router ospf 1
 network 10.0.0.0 0.255.255.255 area 0
```

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```
R1#show ip protocols
*** IP Routing is NSF aware ***

Routing Protocol is "ospf 1"
  Outgoing update filter list for all interfaces is not set
  Incoming update filter list for all interfaces is not set
  Router ID 10.0.3.1
  Number of areas in this router is 1. 1 normal 0 stub 0 nssa
  Maximum path: 4
  Routing for Networks:
    10.0.0.0 0.0.255.255 area 0
  Routing Information Sources:
    Gateway            Distance       Last Update
    10.1.1.2                 110       00:00:33
    10.1.0.2                 110       00:01:12
    10.1.3.2                 110       00:00:21
    203.0.113.1              110       00:00:11
  Distance: (default is 110)
```

OSPF Verification – show ip ospf interface brief

```
R2#show ip ospf interface brief
Interface     PID    Area                 IP Address/Mask     Cost  State Nbrs
F/C
Fa0/0         1      0                    10.0.0.2/24         1     DR    1/1
```
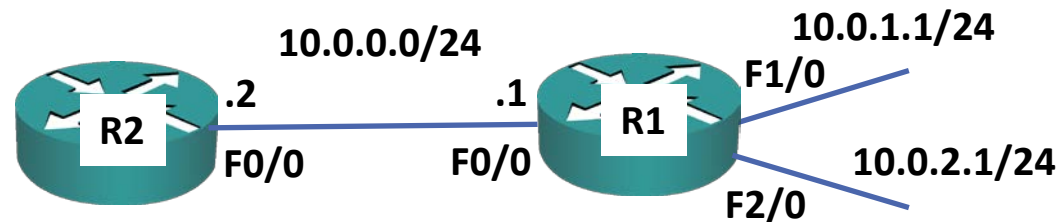
OSPF Operations

1. **Discover neighbours**
2. **Form adjacencies**
3. Flood Link State Database (LSDB)
4. Compute Shortest Path
5. Install best routes in routing table
6. Respond to network changes

OSPF Verification - show ip ospf neighbor

```
R2#show ip ospf neighbor

Neighbor ID       Pri   State             Dead Time    Address         Interface
10.0.2.1            1   FULL/BDR          00:00:35     10.0.0.1        FastEthernet0/0
```

OSPF Operations

1. Discover neighbours
2. Form adjacencies
3. **Flood Link State Database (LSDB)**
4. Compute Shortest Path
5. Install best routes in routing table
6. Respond to network changes

OSPF Verification - show ip ospf database

```
R2#show ip ospf database

           OSPF Router with ID (10.1.0.2) (Process ID 1)

           Router Link States (Area 0)

Link ID          ADV Router       Age        Seq#        Checksum Link count
10.0.3.1         10.0.3.1         102        0x80000004 0x009015 4
10.1.0.2         10.1.0.2         109        0x80000004 0x00AA37 2
203.0.113.1      203.0.113.1      463        0x80000003 0x000846 3

           Net Link States (Area 0)

Link ID          ADV Router       Age        Seq#        Checksum
10.0.0.2         10.1.0.2         550        0x80000001 0x00A065
10.1.1.1         203.0.113.1      495        0x80000001 0x00EEB3
10.1.3.1         203.0.113.1      463        0x80000001 0x00F2AB
```

OSPF Operations

1. Discover neighbours
2. Form adjacencies
3. Flood Link State Database (LSDB)
4. **Compute Shortest Path**
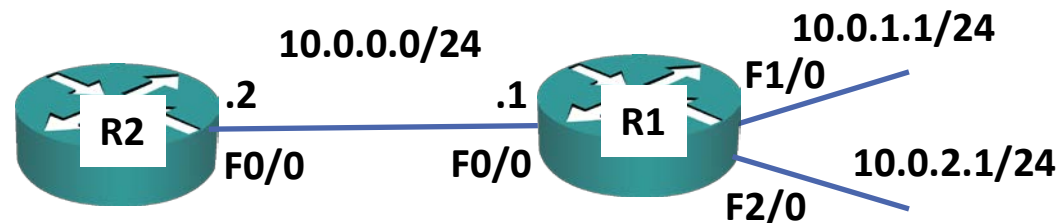5. **Install best routes in routing table**
6. Respond to network changes

OSPF Verification - show ip route

```
R2#show ip route
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route, H - NHRP, l - LISP
       + - replicated route, % - next hop override


Gateway of last resort is not set


      10.0.0.0/8 is variably subnetted, 7 subnets, 2 masks
C        10.0.0.0/24 is directly connected, FastEthernet0/0
L        10.0.0.2/32 is directly connected, FastEthernet0/0
O        10.0.1.0/24 [110/2] via 10.0.0.1, 00:07:11, FastEthernet0/0
O        10.0.2.0/24 [110/2] via 10.0.0.1, 00:07:11, FastEthernet0/0
```


R2 — .2 — F0/0 — 10.0.0.0/24 — .1 — F0/0 — R1 — F1/0 — 10.0.1.1/24 — F2/0 — 10.0.2.1/24

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