

OSPF

- ▶ OSPF stand for Open Shortest path first
- ▶ It's a link state protocol
- ▶ Standard protocol
- ▶ It uses SPF (shortest path first) or dijkistra algorithm
- ▶ Unlimited hop count
- ▶ Metric is cost (cost= $10^{8/B.W.}$)
- ▶ Administrative distance is 110
- ▶ It is a classless routing protocol (carry subnet-mask information & supports VLSM)
- ▶ Supports equal cost load balancing.

Basic OSPF process

Seven stages

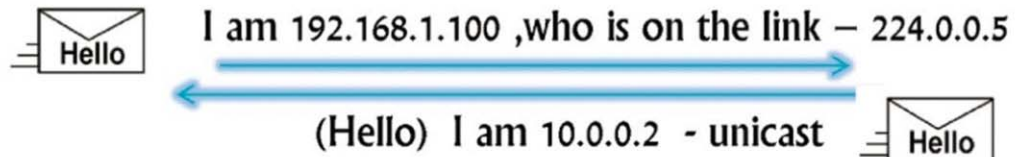
1. Down
2. Init
3. 2 way
4. Exstart
5. Exchange
6. Loading
7. Full

OSPF Basic process – seven stages



Down stage

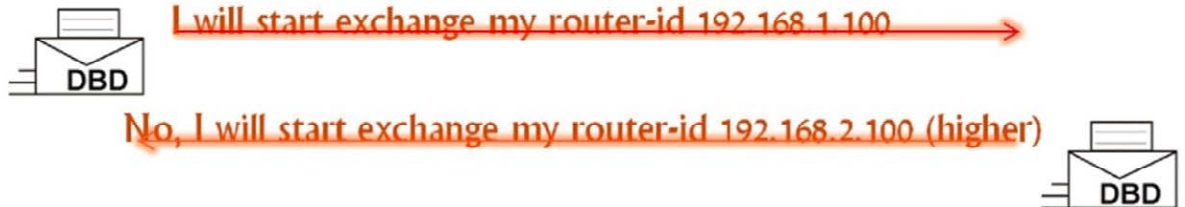
Init stage



Two-way stage

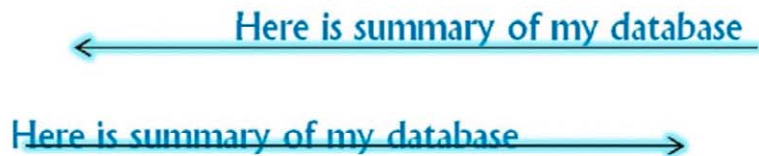
They become neighbors, built **neighbor table**

Exstart stage

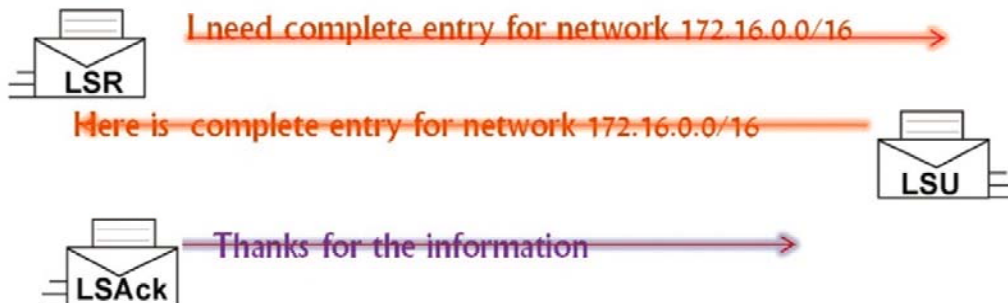


No, I will start exchange my router-id 192.168.2.100 (higher)

Exchange stage



Loading stage



Here is complete entry for network 172.16.0.0/16

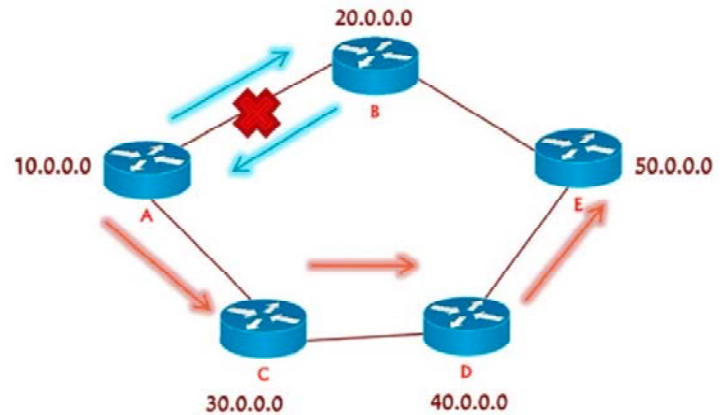


Full stage

Routers have synchronized database

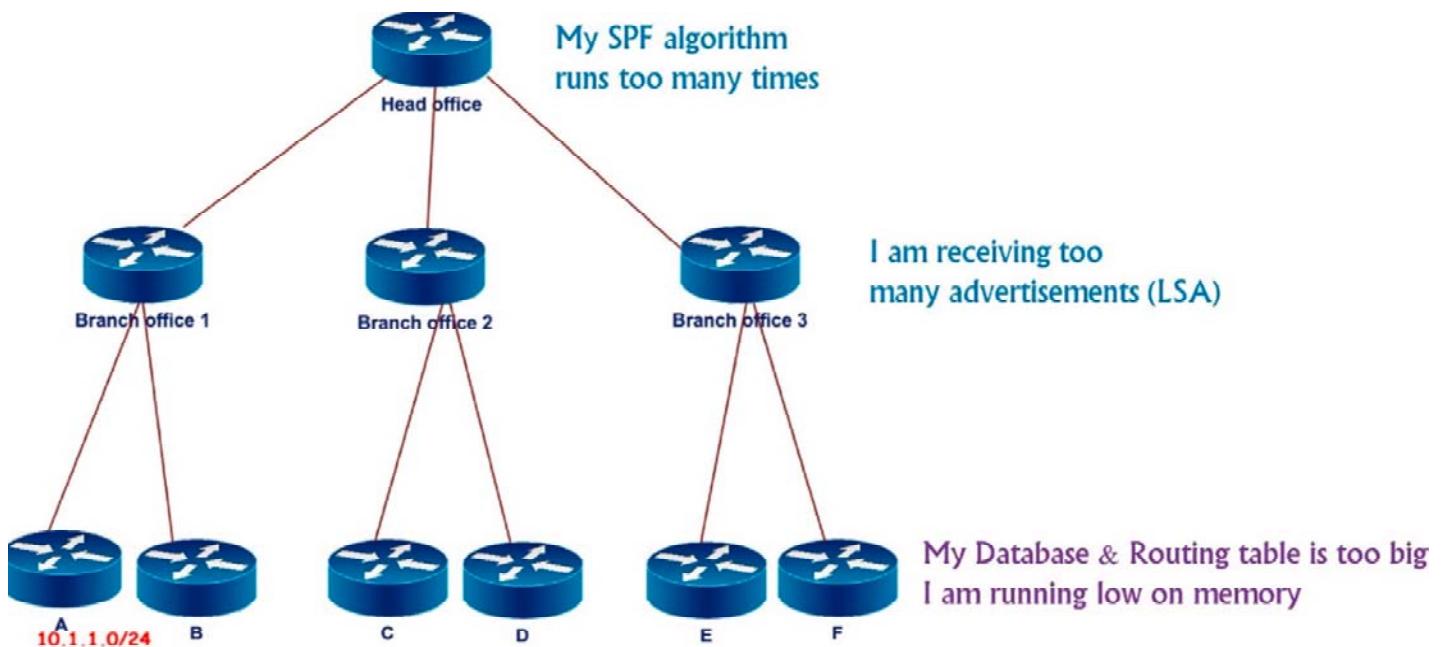
Calculate the best route ($10^8/BW$)

OSPF Convergence



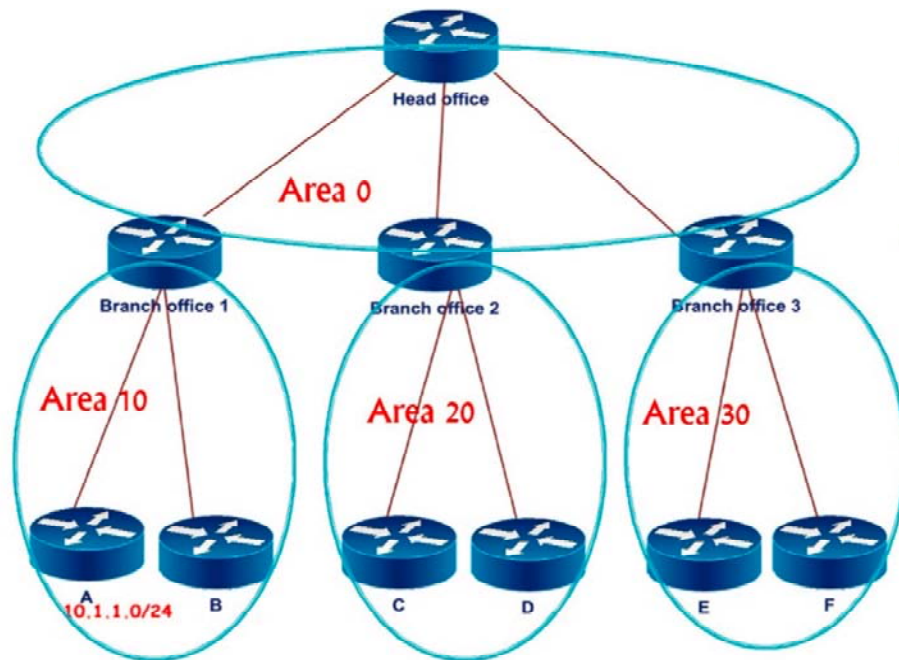
- ▶ Incremental updates
- ▶ Periodically send hello packets are sent every 10 seconds (dead – 40 sec)
- ▶ Convergence rate is fast (40 sec)

Issues with Maintaining a Large OSPF Network



- All the routers must have the same database.
- Any change in the database advertised to all routers.

Issues with Maintaining a Large OSPF Network



Solution : OSPF areas

Area is logical grouping of Routers.

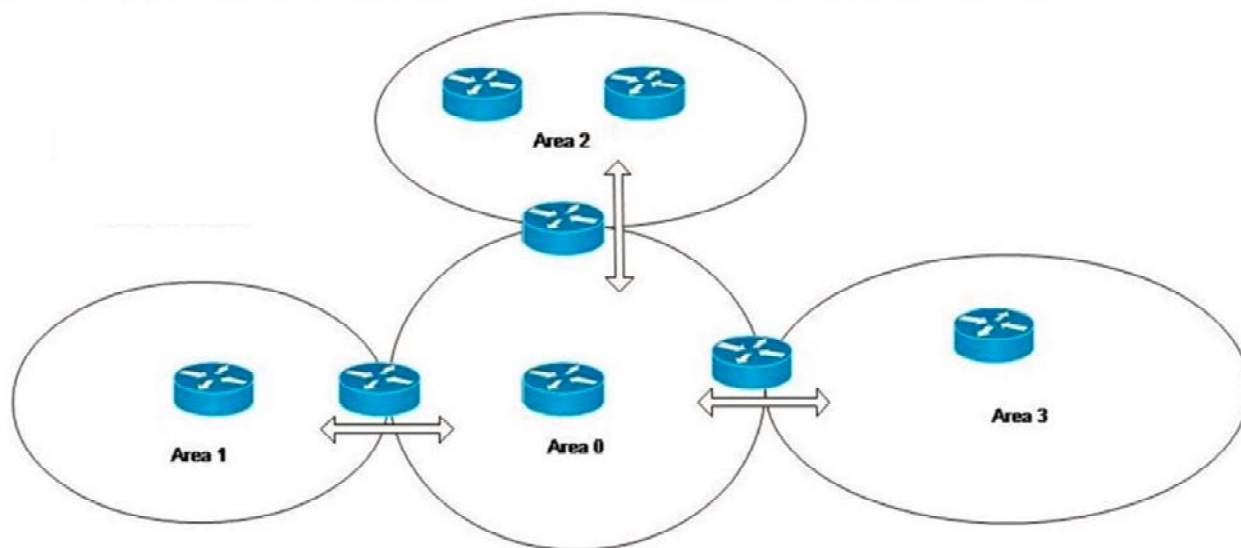
- All the routers must have the same database with in area
- Any change in the database advertised to all routers with in area

Concept of areas

- ▶ Area is logical grouping of Routers .
- ▶ All the routers maintain same database with in the same Area.
- ▶ Any change impact all the routers with the same area.
- ▶ Minimizes size of database
- ▶ Restrict any changes with in that area. (not flood outside area)
- ▶ Routers with in the same area participate in Algorithm

OSPF area design Rules

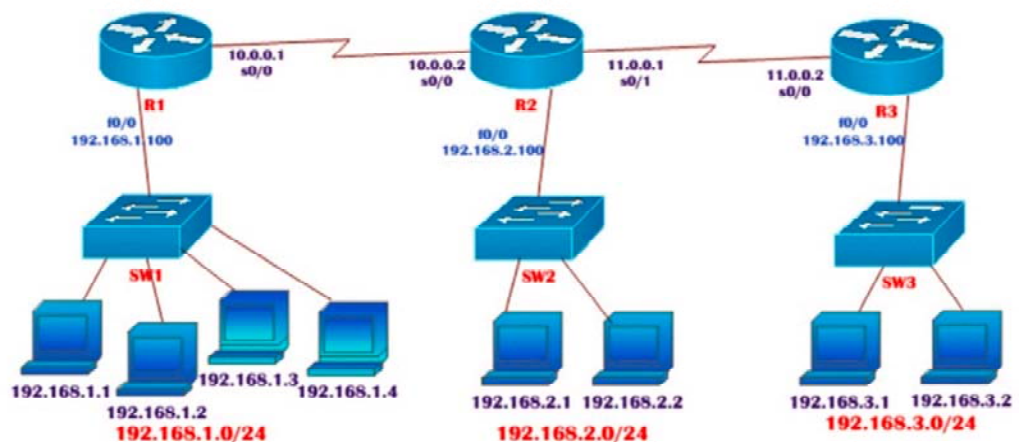
- ▶ Must have one area called as area 0 (its backbone area)
- ▶ All the non-backbone areas must connect to area 0. (Area 0 must be transit area)
- ▶ At least one Area Border Router (connecting two or more areas) .
- ▶ Interfaces of both routers facing must be in the same Area.



Configuring OSPF

(config)# **router ospf** <process ID>

(config-router)# **network** <Network ID> <wildcard mask> **area** <area id>



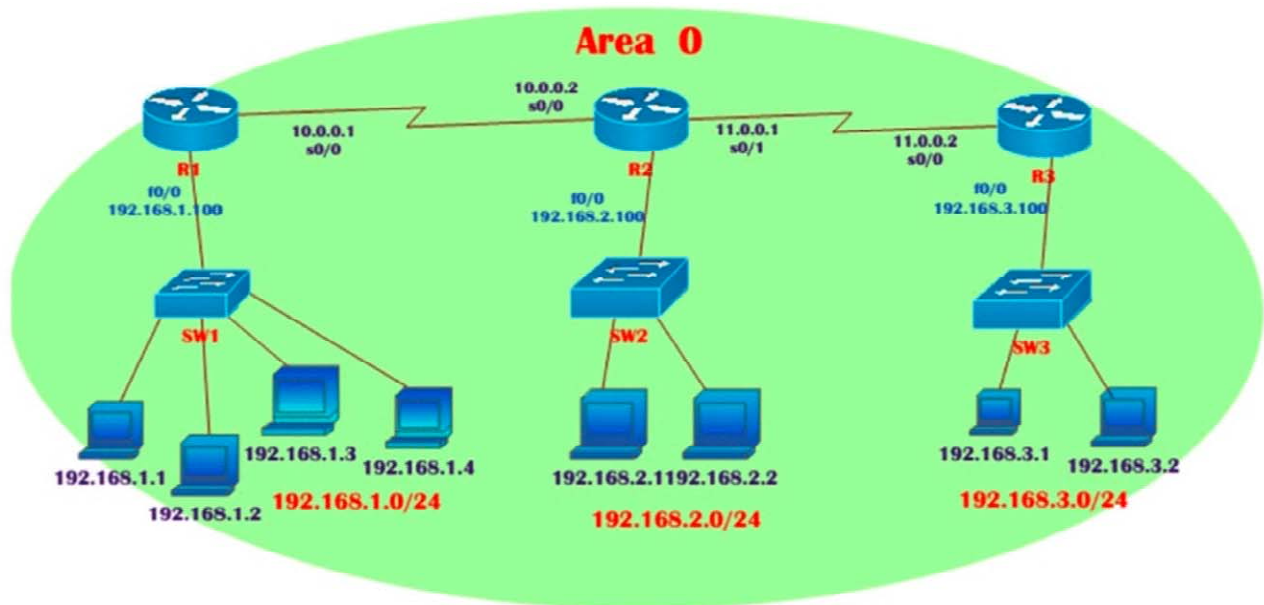
- Process ID is a number used to identify an OSPF routing process on the router.
- Multiple OSPF processes can be started on the same router.
- The number can be any value between 1 and 65,535.

LAB: OSPF Single Area

R-1(config)#router ospf 1

R-1(config-router)#network 192.168.1.0 0.0.0.255 area 0

R-1(config-router)#network 10.0.0.0 0.255.255.255 area 0



R-2(config)#router ospf 1

R-2(config-router)#network 192.168.2.0 0.0.0.255 area 0

R-2(config-router)#network 11.0.0.0 0.255.255.255 area 0

R-2(config-router)#network 10.0.0.0 0.255.255.255 area 0

R-3(config)#router ospf 1

R-3(config-router)#network 192.168.3.0 0.0.0.255 area 0

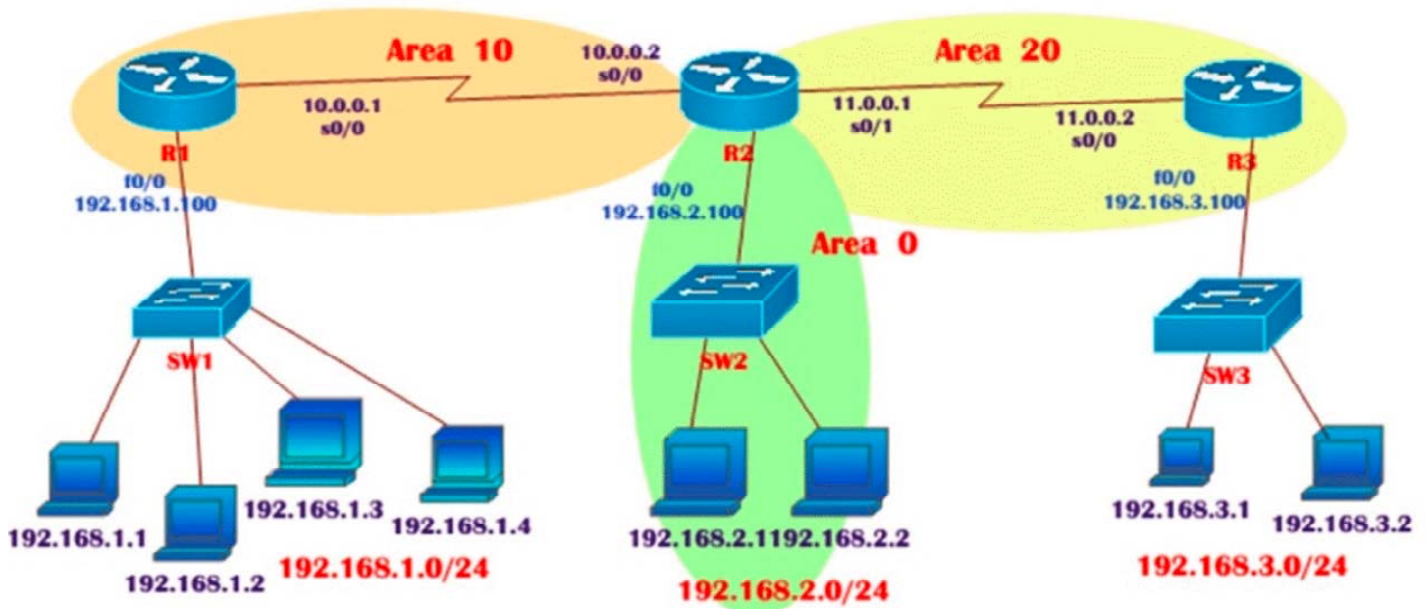
R-3(config-router)#network 11.0.0.0 0.255.255.255 area 0

LAB: OSPF using Multiple Areas

```
R-1(config)#router ospf 1
```

```
R-1(config-router)#network 192.168.1.0 0.0.0.255 area 10
```

```
R-1(config-router)#network 10.0.0.0 0.255.255.255 area 10
```



```
R-2(config)#router ospf 1
```

```
R-2(config-router)#network 192.168.2.0 0.0.0.255 area 0
```

```
R-2(config-router)#network 11.0.0.0 0.255.255.255 area 20
```

```
R-2(config-router)#network 10.0.0.0 0.255.255.255 area 10
```

```
R-3(config)#router ospf 1
```

```
R-3(config-router)#network 192.168.3.0 0.0.0.255 area 20
```

```
R-3(config-router)#network 11.0.0.0 0.255.255.255 area 20
```

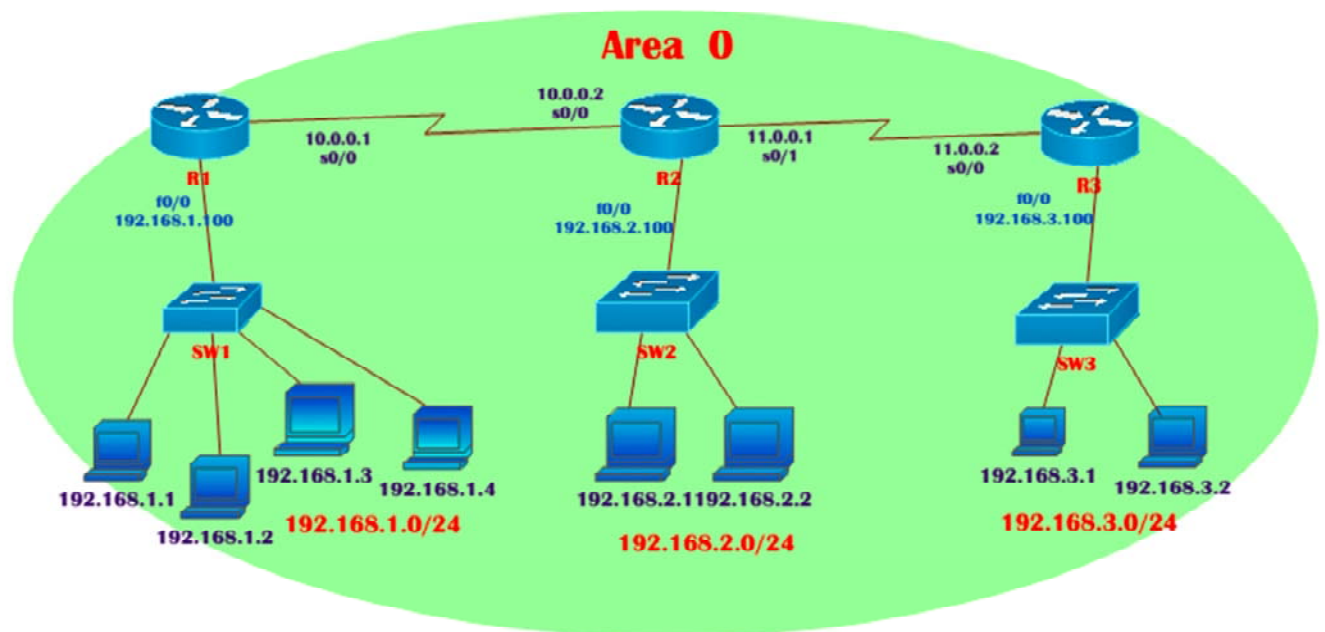

Advantages of OSPF

- Open standard
- No hop count limitations
- Faster convergence

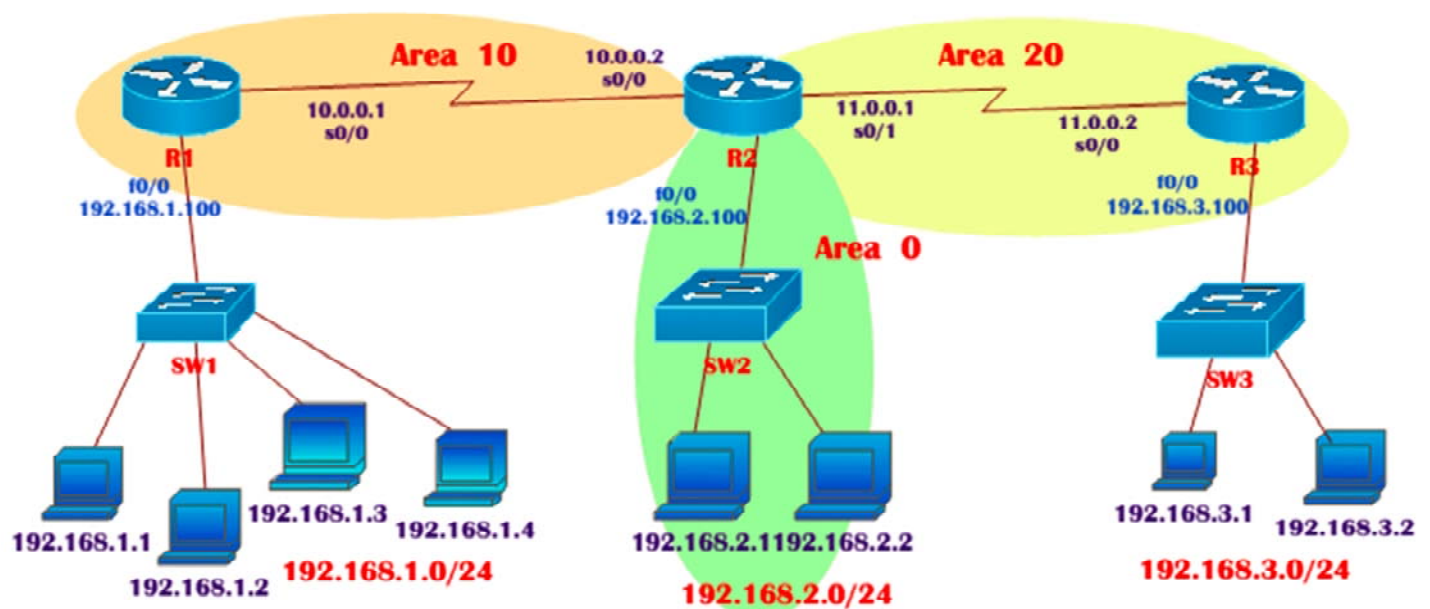
Disadvantages of OSPF

- Consume more CPU resources.
- Complex design rules

LAB: DYNAMIC ROUTING USING OSPF IN SINGLE AREA



LAB: DYNAMIC ROUTING USING OSPF MULTIPLE AREA



LAB: ospf multi- area – Redundant links

