Kardan University
BCS
Open Shortest Path First
OSPF

Outline

- OSPF Characteristics
- Router ID
- DR & BDR
- OSPF Area
- OSPF Neighborship
- LSA, LSR & LSU
- OSPF Configuration

OSPF Characteristics

- Its an open standard (can be used by no-Cisco Routers)
- It’s a link state protocol
- It uses the Dijkstra Algorithm
- Faster convergence
- Its Administrative Distance is 110
- It support VLSM and both of IPv4 and IPv6
- OSPF uses the areas to separate a large network into small one for better management

OSPF Characteristics

- OSPF has unlimited hop count
- It uses areas and Process ID numbers
- The first area must be the backbone or area Zero
- ABR (Area Border Router)
- ASBR (Autonomous System Border Router)
- The OSPF uses the Cost as a Metric to determine the best path (less Cost means best path)
- OSPF has unlimited hop count

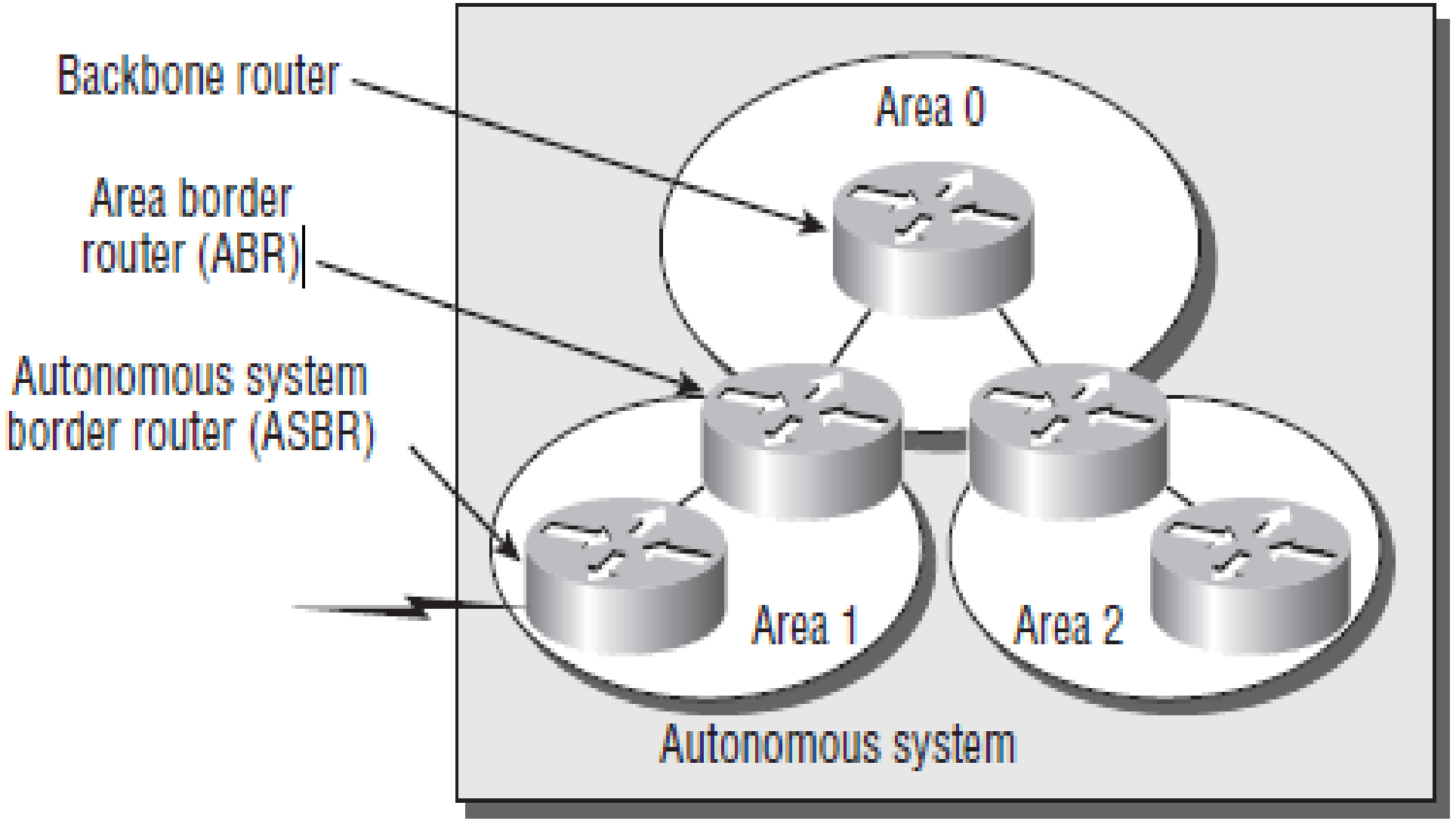
OSPF Cost

- OSPF cost is calculated from the link bandwidth using the formula:
- Cost=100/BW (in Mbps)
- Some common cost values:
  - Serial T1 link: cost= 65
  - Ethernet Link: Cost=10
  - Fast Ethernet Link: Cost=1
  - Gigabit Ethernet Link: Cost=1
  - 10GigabitEthernet Link: Cost=1
  - 40GigabitEthernet Link: Cost=1
  - 100GigabitEthernet Link: Cost=1

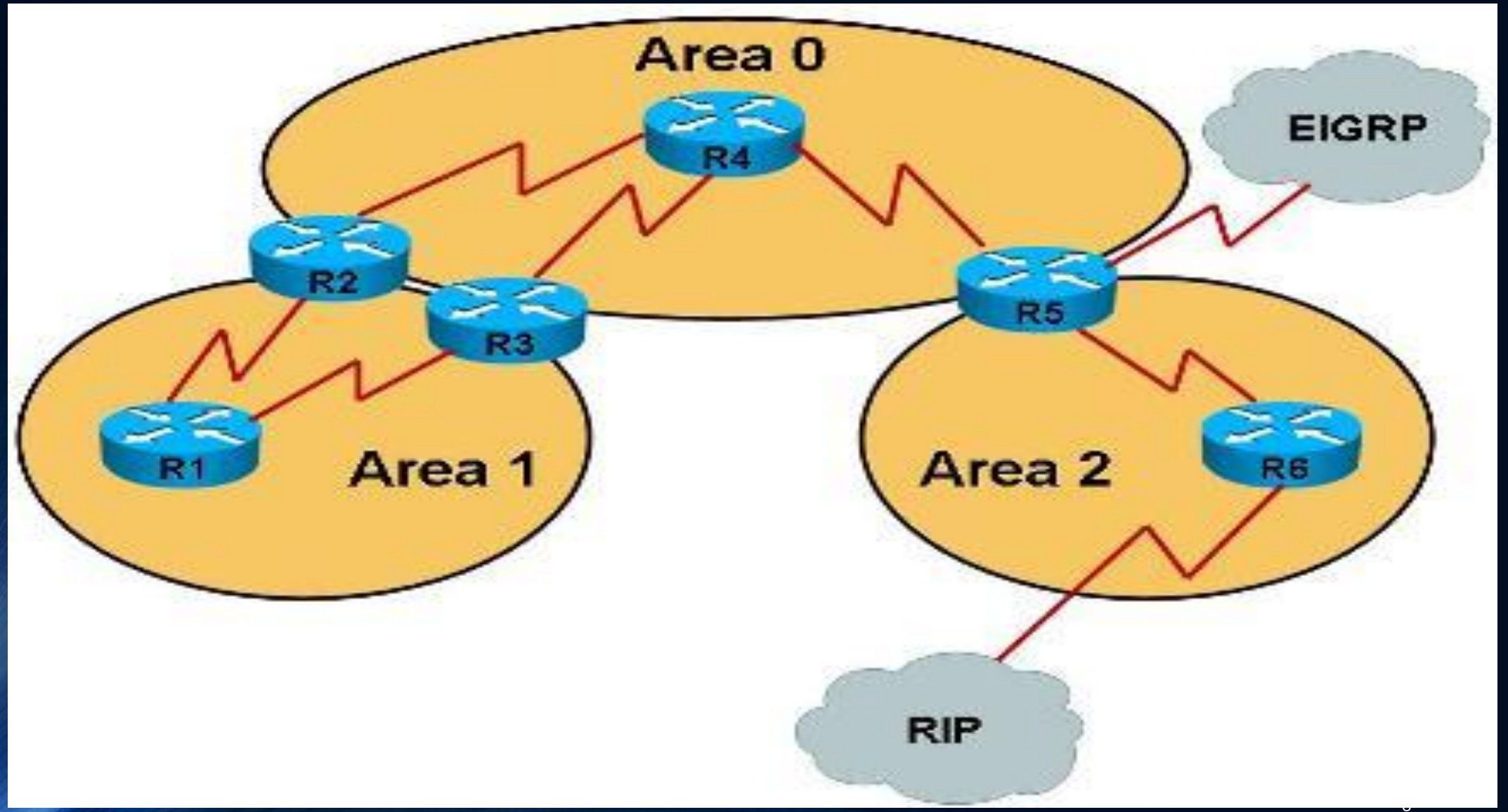
OSPF Characteristics

- Support Equal cost load balancing
- Each OSFP router then runs SPF algorithm to calculate the best routes
- Uses multicast addresses 224.0.0.5 and 224.0.0.6 for routing updates.
- Each OSPF router stores routing and topology information in three tables:
  - Neighbor table – stores information about OSPF neighbors
  - Topology table – stores the topology structure of a network
  - Routing table – stores the best routes

FIGURE 7.4 OSPF design example



ASBR



OSPF Terminologies

- **Router ID (RID):**
  - Its an IP Address that identifies a Router
  - To determine the RID:
    - Using the router-id command under the OSPF process.
    - Using the highest IP address of the router's loopback interfaces.
    - Using the highest IP address of the router's physical interfaces.
    - (show ip ospf)

OSPF Terminologies

- **Topology Database:**
  - Have info about the neighbor Routers
  - The Routers use the Topology database to determine the best path
- **Link State Advertisement:**
  - The OSPF Routers advertise the LSA packets to all their adjacent Routers which contains routing info

DR (Designated Router)

- **DR is a Router which is elected so that it receives that routing info from all Routers and share it with the rest of the routers**
- **Electing DR:**
  - Highest Priority (It's a number between 0-255)
  - R(config-if)# ip ospf priority <0-255>
  - If the priority of all routers is the same, then the RID is considers for the electing of the DR
  - Non-DR routers send packets to DR using 224.0.0.5
  - DR sends packets to Non-DR using 224.0.06

BDR (Backup Designated Router)

- It’s the backup of the DR, it receives the LSA packets from all the Routers but does not flood it
- When the DR fails then the BDR become the DR
- DR and BDR are elected in each broadcast multi-access network .
- Broadcast multi-access network is a network which allows multiple devices to access the network and give them the ability to send the broadcast messages

OSPF Area

- OSPF area is a logical group of Routers and Networks
- All routers in the same area have the same area ID
- Each are must be connected to backbone area (area 0)
- A Router can be the member of more than one Area
- Area ID is associated to a specific interface
- All Routers in the same area have the same topology table but they don’t know about the routers in other areas.
- The areas reduce routing updates and size of routing table as well as the topology table.

OSPF Area

- The role of an ABR is to advertise address summaries to neighboring areas.
- The role of an ASBR is to connect an OSPF routing domain to another external network (e.g. Internet, EIGRP network…).

OSPF Neighbor & Adjacent

- OSPF routers need to establish a neighbor relationship before exchanging routing updates.
- OSPF neighbors are dynamically discovered by sending Hello packets out each OSPF-enabled interface on a router.
- Hello packets are sent every 10 seconds to the multicast IP address of 224.0.0.5.
- A dead timer is four times the value of the hello interval i.e. 4x10=40 seconds

OSPF Neighbor & Adjacent

- For two routers to become neighbors, the following fields must match:
  - Subnet
  - Area id
  - Hello and dead interval timers
  - Authentication
  - MTU 1500 bytes

OSPF Neighbor & Adjacent

- **Neighbors:**
  - Are the router who exchange the Hello packets ,
  - Neighbor Routers must have the same area ID

- **Adjacent:**
  - Are the routers who exchange the LSA packets and routing information
  - Routers must be Neighbors so they can become Adjacent

OSPF Configuration

- R# conf t
- R(config)# router ospf 10
- Here the 10 above is the process id which is locally important for each router, it ranges from 1-65536.
- R(config)# network 10.1.1.0 0.255.255.255 area 0
- Here , instead of subnet mask, we use the wildcard which is the reverse of the subnet mask.
- Subnet mask ->> 255.255.255.0
- Wildcard ---->>> 0.255.255.255

OSPF Verification

- R# show ip ospf
- R# sh ip route
- R# sh ip ospf database
- R# sh ip ospf interface fast Ethernet 0/1
- R# show ip ospf neighbors
- R# show ip protocols

OSPF Debug

- R# debug ip ospf packets
- R# debug ip ospf hello
- R# debug ip ospf adjacent
- R#debug ip packets
- To configure routers ID :
  - R# conf t
  - R#router ospf 10
  - R#router – id 172.168.10.10

loopback Interface

- R# conf t
  - Interface loopback 0
  - Ip address 192.168.10.1 255.255.255.0

- NOTE
- Every router on a network segment will establish a full neighbor relationship with the DR and BDR. Non-DR and non-BDR routers will establish a two way neighbor relationship between themselves.

REFERENCES

- https://study-ccna.com/ospf-overview/
- https://www.youtube.com/watch?v=dQRx6ucmwpU

THANK YOU