Υλοποίηση Δικτυακών Υποδομών και Υπηρεσιών: OSPF Cost

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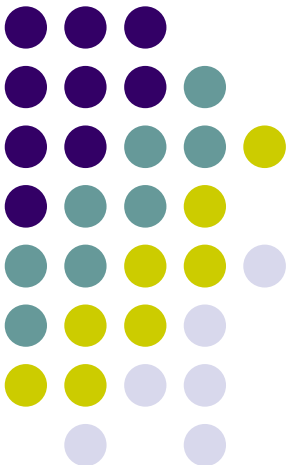
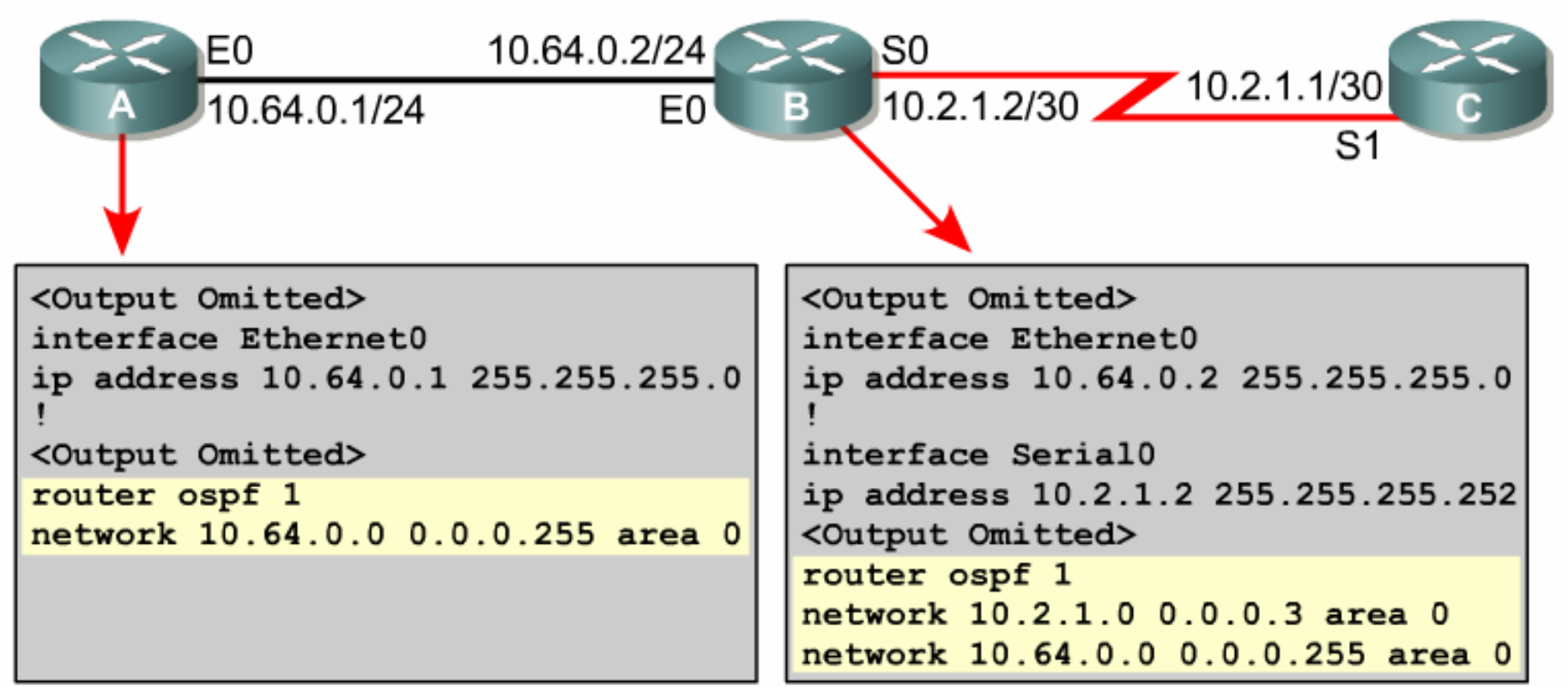


Basic OSPF Configuration




```
<Output Omitted>
interface Ethernet0
ip address 10.64.0.1 255.255.255.0
!
<Output Omitted>
router ospf 1
network 10.64.0.0 0.0.0.255 area 0
```

```
<Output Omitted>
interface Ethernet0
ip address 10.64.0.2 255.255.255.0
!
interface Serial0
ip address 10.2.1.2 255.255.255.252
<Output Omitted>
router ospf 1
network 10.2.1.0 0.0.0.3 area 0
network 10.64.0.0 0.0.0.255 area 0
```

Basic OSPF Configuration

Network Area Command	Description
address	This can be the network address, subnet, or address of the interface. It tells routers which links to listen to advertisements on and which links and networks to advertise.
wildcard-mask	This is an inverse mask that is used to determine how an address is read. The mask has wildcard bits where 0 is a match and 1 is not important. For example, 0.0.255.255 indicates a match in the first two bytes. The equivalent subnet mask would be a 16-bit mask of 255.255.0.0. The wildcard mask 0.0.0.0 is used to specify an interface address.
area-id	This value specifies the area to be associated with an address. It can be a number or can be similar to an IP address. For a backbone area, the ID must equal 0.

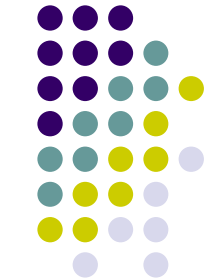
Setting OSPF Priority

```
Sydney1(config)#interface fastethernet 0/0
Sydney1(config-if)#ip ospf priority 50
Sydney1(config-if)#end
Sydney1#
00:21:57: %SYS-5-CONFIG_I: Configured from console
by console
```

The hello packet sent on the Fast Ethernet interface will have the Router Priority field set to 50.

The priorities can be set to any value from 0 to 255. A value of 0 prevents that router from being elected. A router with the highest OSPF priority will win the election for transmission.

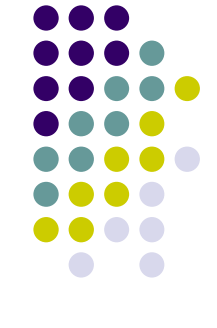
Modifying OSPF cost (1)



- The *auto-cost reference-bandwidth* command allows you to change the reference bandwidth that OSPF uses to calculate its metrics:

RouterA#**configure terminal**
Enter configuration commands, one per line. End with CNTL/Z.
RouterA(config)#**router ospf *87***
RouterA(config-router)#**auto-cost reference-bandwidth *1000***
RouterA(config-router)#**exit**
RouterA(config)#**end**
RouterA#

Modifying OSPF cost (2)



- You can also adjust the OSPF cost of a single interface with the *ip ospf cost* configuration command:

RouterA#**configure terminal**
Enter configuration commands, one per line. End with CNTL/Z.
RouterA(config)#**interface *Ethernet0***
RouterA(config-if)#**ip ospf cost *31***
RouterA(config-if)# **exit**
RouterA(config)#**end**
RouterA#

Reference bandwidth (1)

- The custom in OSPF networks is to make the link cost inversely proportional to the bandwidth of a link.
- This is the default behavior for Cisco routers.
- The reference bandwidth defines the link speed that has an OSPF cost of 1.
- In Cisco routers, by default, the reference bandwidth is 100 Mbps

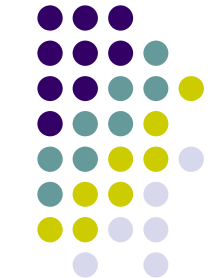
Reference bandwidth (2)

- If he have faster links in the network, such as gigabit Ethernet or OC-3 connections, OSPF can't give these links a better cost than 1.
- So you should set the reference bandwidth to at least as high as the fastest link in your network.
- In fact, you may want to set this value higher than the bandwidth of your fastest link to ensure that you don't have to reconfigure your whole network when you eventually upgrade some of your core links.

Reference bandwidth (3)

- It is important to set the same reference bandwidth on all routers in an area, and preferably throughout the entire network.
- Suppose you set the reference bandwidth differently on two routers, so that they advertise different link costs for their Ethernet interfaces.
  - This could cause seriously strange routing patterns as OSPF will try to avoid using the higher cost links.
    - It may decide, for example, that a FastEthernet interface on one router is faster than a Gigabit Ethernet interface on the other router.

Calculate cost from reference bandwidth (1)



- Each interface has an associated cost. It is computed as follows:

  reference bandwidth / configured bandwidth of interface in kbps

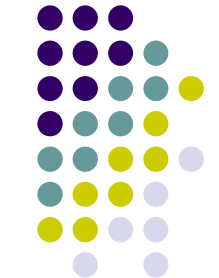
- On Cisco routers, the reference bandwidth defaults to 100000.
  - So, a DS-3 interface, with a configured bandwidth of 45000, has a cost of:

    100000000 / 45000 = 2222

- The interface bandwidth must be explicitly configured. If not, the router will probably get it wrong. It is configured using the following syntax:

  int h1/0
  bandwidth 45000

Calculate cost from reference bandwidth (2)



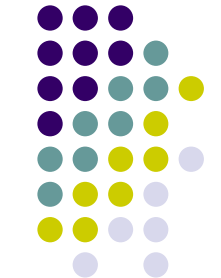
- Different manufacturers use different reference bandwidths.
- It is therefore common practice for every router to have it's OSPF reference bandwidth set. Many sysadmins set it to 10000(k) using the following syntax:

  router ospf 100 auto-cost reference-bandwidth 10000

This reference bandwidth should be the same on all of your routers. Once this is done, our DS-3 interface will have a cost of:

10000000 / 45000 = 222

Problem in Reference bandwidth (1)

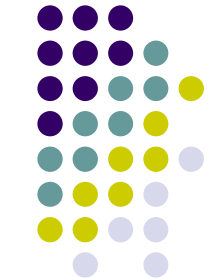


- The OSPF metric is only 16 bits long, giving it a maximum per-link cost value of 65,535.
- If the fastest links use 10 Gbps Ethernet, and you set the cost of this link to 1, then
  - a relatively common 56 kbps serial link would need to have a cost of 178,571
  - a 128 kbps circuit would cost 78,125.
    - Since this is not possible, OSPF would use the maximum link cost of 65,535 for both of these low-speed links. This could cause some very poor routing patterns.

Problem in Reference bandwidth (2)

- The cost of a link doesn't actually have to be 10 times as high just because the link is 1/10 as fast.
- In fact, this default behavior implies that it is better to go through a succession of 10 FastEthernet links rather than use a single Ethernet, which is probably not true in most cases.
- So a useful alternative strategy is to use the square root of the bandwidth instead of the bandwidth when calculating the link cost.

Problem in Reference bandwidth (3)



Suggested OSPF costs for different media				
Medium	**Nominal bandwidth**	**Default cost**	**Changing reference bandwidth**	**Cost with 1/square root model**
9.6 kbps line	9.6 kbps	10,416	1,041,666	1,020
56 kbps line	56 kbps	1,785	178,571	422
64 kbps line	64 kbps	1,562	156,250	395
T1 circuit	1.544 Mbps	64	6,476	80
E1 circuit	2.048 Mbps	48	4,882	69
T3 circuit	45 Mbps	2	222	14
Ethernet	10 Mbps	10	1,000	31
Fast Ethernet	100 Mbps	1	100	10
Gigabit Ethernet	1 Gbps	1	10	3
10 Gigabit Ethernet	10 Gbps	1	1	1
4 Mbps Token Ring	4 Mbps	25	2,500	50
16 Mbps Token Ring	16 Mbps	6	625	25

Modifying OSPF cost (3)

Medium	Cost
56 kbps serial link	1785
T1 (1.544 Mbps serial link)	64
E1 (2.048 Mbps serial link)	48
4 Mbps Token Ring	25
Ethernet	10
16 Mbps Token Ring	6
100 Mbps Fast Ethernet, FDDI	1

```
Sydney2(config-if)#ip ospf cost ?
  <1-65535>  Cost
Sydney2(config-if)#ip ospf cost 1
```

Configuring OSPF Timers

Cisco

```
Sydney1(config-if)#ip ospf hello-interval 5
Sydney1(config-if)#ip ospf dead-interval 20
```

OSPF timers are configured on the interface.

Verifying OSPF Configuration

- `show ip protocol`
- `show ip route`
- `show ip ospf interface`
- `shop ip ospf`
- `show ip ospf neighbor detail`
- `show ip ospf database`

The debug and clear Commands for OSPF Verification

Command	Description
`clear ip route *`	Clear all routes in routing table
`clear ip route a.b.c.d`	Clear route to a.b.c.d in routing table
`debug ip ospf events`	Report all OSPF events
`debug ip ospf adj`	Report OSPF adjacency events