Cátedra: Internetworking

Práctica 10

OSPF

2003
Ejercicio 1
A partir de las consultas a un router que se listan a continuación diagrame la red OSPF.

router#sh ip ospf
Routing Process "ospf 65501" with ID 172.16.11.1
Supports only single TOS(TOS0) routes
It is an autonomous system boundary router
External Link update interval is 00:30:00 and the update due in 00:14:57
Redistributing External Routes from,
    connected, includes subnets in redistribution
eigrp 65500, includes subnets in redistribution
SPF schedule delay 5 secs, Hold time between two SPF's 10 secs
Number of DCbitless external LSA 1
Number of DoNotAge external LSA 0
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Area BACKBONE(0)
    Number of interfaces in this area is 1
    Area has no authentication
    SPF algorithm executed 14 times
    Area ranges are
    Link State Update Interval is 00:30:00 and due in 00:00:41
    Link State Age Interval is 00:20:00 and due in 00:04:57
    Number of DCbitless LSA 2
    Number of indication LSA 0
    Number of DoNotAge LSA 0

router#sh ip ospf border-routers
OSPF Process 65501 internal Routing Table
Codes: i - Intra-area route, I - Inter-area route
i 172.16.11.2 [10] via 172.16.11.2, Ethernet0/0, ASBR, Area 0, SPF 14

router#sh ip ospf interface
Ethernet0/0 is up, line protocol is up
    Internet Address 172.16.11.1/24, Area 0
    Process ID 65501, Router ID 172.16.11.1, Network Type BROADCAST, Cost: 10
    Transmit Delay is 1 sec, State BDR, Priority 1
    Designated Router (ID) 172.16.11.2, Interface address 172.16.11.2
    Backup Designated router (ID) 172.16.11.1, Interface address 172.16.11.1
    Timer intervals configured, Hello 10, Dead 40, Wait 40, Retransmit 5
    Hello due in 00:00:05
    Neighbor Count is 1, Adjacent neighbor count is 1
    Adjacent with neighbor 172.16.11.2 (Designated Router)
    Suppress hello for 0 neighbor(s)
Ethernet0/0.1 is up, line protocol is up
    OSPF not enabled on this interface
Serial1/0 is up, line protocol is up
    OSPF not enabled on this interface
Serial1/1 is up, line protocol is up
    OSPF not enabled on this interface
Serial1/2 is up, line protocol is up
    OSPF not enabled on this interface
Serial1/3 is up, line protocol is up
  OSPF not enabled on this interface
Serial1/4 is up, line protocol is up
  OSPF not enabled on this interface
Serial1/5 is up, line protocol is up
  OSPF not enabled on this interface
Serial1/6 is up, line protocol is up
  OSPF not enabled on this interface
Serial1/7 is up, line protocol is up
  OSPF not enabled on this interface
Serial2/0 is up, line protocol is up
  OSPF not enabled on this interface
Serial2/1 is administratively down, line protocol is down
  OSPF not enabled on this interface
Serial2/2 is down, line protocol is down
  OSPF not enabled on this interface
Serial2/3 is down, line protocol is down
  OSPF not enabled on this interface
Serial2/4 is up, line protocol is up
  OSPF not enabled on this interface
Serial2/5 is down, line protocol is down
  OSPF not enabled on this interface
Serial2/6 is up, line protocol is up
  OSPF not enabled on this interface
Serial2/7 is administratively down, line protocol is down
  OSPF not enabled on this interface

router#sh ip ospf neighbor

Neighbor ID  Pri  State           Dead Time   Address         Interface
172.16.11.2  1   FULL/DR         00:00:35    172.16.11.2    Ethernet0/0

router#sh ip ospf neighbor detail
Neighbor 172.16.11.2, interface address 172.16.11.2
  In the area 0 via interface Ethernet0/0
  Neighbor priority is 1, State is FULL
  Options 2
  Dead timer due in 00:00:31

router#sh ip ospf request-list 172.16.11.2 e0/0
Neighbor 172.16.11.2, interface Ethernet0/0 address 172.16.11.2

Type  LS ID           ADV RTR         Seq NO      Age    Checksum

router#sh ip ospf retransmission-list 172.16.11.2 e0/0
Neighbor 172.16.11.2, interface Ethernet0/0 address 172.16.11.2

router#sh ip ospf summary-address
OSPF Process 65501, Summary-address
  Not configured
router#sh ip ospf virtual-links
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```
router# sh ip ospf database

OSPF Router with ID (172.16.11.1) (Process ID 65501)

Router Link States (Area 0)

<table>
<thead>
<tr>
<th>Link ID</th>
<th>ADV Router</th>
<th>Age</th>
<th>Seq#</th>
<th>Checksum Link count</th>
</tr>
</thead>
<tbody>
<tr>
<td>172.16.11.1</td>
<td>172.16.11.1</td>
<td>571</td>
<td>0x8000050F</td>
<td>0xA499 1</td>
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<tr>
<td>172.16.11.2</td>
<td>172.16.11.2</td>
<td>567</td>
<td>0x8000050C</td>
<td>0xF7F8 2</td>
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</tbody>
</table>

Net Link States (Area 0)

<table>
<thead>
<tr>
<th>Link ID</th>
<th>ADV Router</th>
<th>Age</th>
<th>Seq#</th>
<th>Checksum</th>
</tr>
</thead>
<tbody>
<tr>
<td>172.16.11.2</td>
<td>172.16.11.2</td>
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<td>0xAB53</td>
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Type-5 AS External Link States

<table>
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<tr>
<th>Link ID</th>
<th>ADV Router</th>
<th>Age</th>
<th>Seq#</th>
<th>Checksum</th>
<th>Tag</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.0.0.0</td>
<td>172.16.11.2</td>
<td>446</td>
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<td>0xB683</td>
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<td>172.16.10.0</td>
<td>172.16.11.1</td>
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<td>0</td>
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<tr>
<td>172.16.10.4</td>
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<td>1515</td>
<td>0x8000034</td>
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<tr>
<td>172.16.10.8</td>
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<td>0x21A0</td>
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<td>172.16.10.20</td>
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```

```
router# sh ip ospf database asbr-summary internal

OSPF Router with ID (172.16.11.1) (Process ID 65501)

router# sh ip ospf database asbr-summary

OSPF Router with ID (172.16.11.1) (Process ID 65501)

router# sh ip ospf database database-summary
```
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OSPF Router with ID (172.16.11.1) (Process ID 65501)

<table>
<thead>
<tr>
<th>Area ID</th>
<th>Router</th>
<th>Network</th>
<th>S-Net</th>
<th>S-ASBR</th>
<th>Type-7</th>
<th>Subtotal</th>
<th>Delete</th>
<th>Maxage</th>
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</table>

**router#show ip database external**

OSPF Router with ID (172.16.11.1) (Process ID 65501)

Type-5 AS External Link States

Routing Bit Set on this LSA
Options: (No TOS-capability, No DC)
LS Type: AS External Link
Link State ID: 10.0.0.0 (External Network Number)
Advertising Router: 172.16.11.2
LS Seq Number: 80000500
Checksum: 0xB683
Length: 36
Network Mask: /8
Metric Type: 2 (Larger than any link state path)
TOS: 0
Metric: 20
Forward Address: 0.0.0.0
External Route Tag: 0

LS age: 657
Options: (No TOS-capability, No DC)
LS Type: AS External Link
Link State ID: 172.16.10.0 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 80000505
Checksum: 0x515D
Length: 36
Network Mask: /24
Metric Type: 2 (Larger than any link state path)
TOS: 0
Metric: 20
Forward Address: 0.0.0.0
External Route Tag: 0

LS age: 1726
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.10.4 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 80000034
Checksum: 0xC7BB
Length: 36
Network Mask: /30
Metric Type: 2 (Larger than any link state path)
TOS: 0
Metric: 20
Forward Address: 0.0.0.0
External Route Tag: 0

LS age: 1745
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.10.8 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 800003EE
Checksum: 0x21A0
Length: 36
Network Mask: /30
  Metric Type: 2 (Larger than any link state path)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0

LS age: 1747
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.10.12 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 80000009
Checksum: 0xCDDB8
Length: 36
Network Mask: /30
  Metric Type: 2 (Larger than any link state path)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0

LS age: 1748
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.10.16 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 80000019
Checksum: 0x850D
Length: 36
Network Mask: /30
  Metric Type: 2 (Larger than any link state path)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0

LS age: 1757
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.10.20 (External Network Number)
Advertising Router: 172.16.11.1
<table>
<thead>
<tr>
<th>LS Seq Number</th>
<th>Checksum</th>
<th>Length</th>
<th>Network Mask</th>
<th>Metric Type</th>
<th>TOS</th>
<th>Metric</th>
<th>Forward Address</th>
<th>External Route Tag</th>
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<tbody>
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<td>8000002A</td>
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</tbody>
</table>
LS age: 1777
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.10.36 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 8000003A
Checksum: 0x7AE2
Length: 36
Network Mask: /30
   Metric Type: 2 (Larger than any link state path)
   TOS: 0
   Metric: 20
   Forward Address: 0.0.0.0
   External Route Tag: 0

LS age: 1799
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.10.40 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 8000000B
Checksum: 0xB0D7
Length: 36
Network Mask: /30
   Metric Type: 2 (Larger than any link state path)
   TOS: 0
   Metric: 20
   Forward Address: 0.0.0.0
   External Route Tag: 0

LS age: 1
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.10.52 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 80000506
Checksum: 0x3349
Length: 36
Network Mask: /30
   Metric Type: 2 (Larger than any link state path)
   TOS: 0
   Metric: 20
   Forward Address: 0.0.0.0
   External Route Tag: 0

LS age: 2
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.11.0 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 80000508
Checksum: 0x406A
Length: 36
Network Mask: /24
   Metric Type: 2 (Larger than any link state path)
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TOS: 0
Metric: 20
Forward Address: 0.0.0.0
External Route Tag: 0

LS age: 91
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.12.0 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 8000000B
Checksum: 0x3E6D
Length: 36
Network Mask: /24
  Metric Type: 2 (Larger than any link state path)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0

LS age: 92
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.13.0 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 8000000C
Checksum: 0x3178
Length: 36
Network Mask: /24
  Metric Type: 2 (Larger than any link state path)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0

LS age: 94
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.14.0 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 80000004
Checksum: 0x367A
Length: 36
Network Mask: /24
  Metric Type: 2 (Larger than any link state path)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0

LS age: 110
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.15.0 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 80000006
Checksum: 0x2786
Length: 36
Network Mask: /24
  Metric Type: 2 (Larger than any link state path)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0

LS age: 112
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.16.0 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 8000000A
Checksum: 0x1494
Length: 36
Network Mask: /24
  Metric Type: 2 (Larger than any link state path)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0

LS age: 113
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.17.0 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 8000000B
Checksum: 0x79F
Length: 36
Network Mask: /24
  Metric Type: 2 (Larger than any link state path)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0

LS age: 124
Options: (No TOS-capability, DC)
LS Type: AS External Link
Link State ID: 172.16.18.0 (External Network Number)
Advertising Router: 172.16.11.1
LS Seq Number: 80000004
Checksum: 0xAA2
Length: 36
Network Mask: /24
  Metric Type: 2 (Larger than any link state path)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0
LS age: 125  
Options: (No TOS-capability, DC)  
LS Type: AS External Link  
Link State ID: 172.16.19.0 (External Network Number)  
Advertising Router: 172.16.11.1  
LS Seq Number: 8000000A  
Checksum: 0xF2B2  
Length: 36  
Network Mask: /24  
  Metric Type: 2 (Larger than any link state path)  
    TOS: 0  
    Metric: 20  
    Forward Address: 0.0.0.0  
    External Route Tag: 0

LS age: 127  
Options: (No TOS-capability, DC)  
LS Type: AS External Link  
Link State ID: 172.16.20.0 (External Network Number)  
Advertising Router: 172.16.11.1  
LS Seq Number: 8000000E  
Checksum: 0xDFC0  
Length: 36  
Network Mask: /24  
  Metric Type: 2 (Larger than any link state path)  
    TOS: 0  
    Metric: 20  
    Forward Address: 0.0.0.0  
    External Route Tag: 0

LS age: 137  
Options: (No TOS-capability, DC)  
LS Type: AS External Link  
Link State ID: 172.16.21.0 (External Network Number)  
Advertising Router: 172.16.11.1  
LS Seq Number: 80000009  
Checksum: 0xDEC5  
Length: 36  
Network Mask: /24  
  Metric Type: 2 (Larger than any link state path)  
    TOS: 0  
    Metric: 20  
    Forward Address: 0.0.0.0  
    External Route Tag: 0

router#sh ip ospf database network

OSPF Router with ID (172.16.11.1) (Process ID 65501)

Net Link States (Area 0)

Routing Bit Set on this LSA  
LS age: 1018  
Options: (No TOS-capability, No DC)
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LS Type: Network Links
Link State ID: 172.16.11.2 (address of Designated Router)
Advertising Router: 172.16.11.2
LS Seq Number: 80000083
Checksum: 0xAB53
Length: 32
Network Mask: /24
    Attached Router: 172.16.11.1
    Attached Router: 172.16.11.2

router#sh ip ospf database nssa-external

OSPF Router with ID (172.16.11.1) (Process ID 65501)

router#sh ip ospf database router

OSPF Router with ID (172.16.11.1) (Process ID 65501)

    Router Link States (Area 0)

    LS age: 1068
    Options: (No TOS-capability, DC)
    LS Type: Router Links
    Link State ID: 172.16.11.1
    Advertising Router: 172.16.11.1
    LS Seq Number: 8000050F
    Checksum: 0xA499
    Length: 36
    AS Boundary Router
    Number of Links: 1

        Link connected to: a Transit Network
            (Link ID) Designated Router address: 172.16.11.2
            (Link Data) Router Interface address: 172.16.11.1
            Number of TOS metrics: 0
            TOS 0 Metrics: 10

    Routing Bit Set on this LSA
    LS age: 1065
    Options: (No TOS-capability, No DC)
    LS Type: Router Links
    Link State ID: 172.16.11.2
    Advertising Router: 172.16.11.2
    LS Seq Number: 8000050C
    Checksum: 0xF7F8
    Length: 48
    AS Boundary Router
    Number of Links: 2

        Link connected to: a Transit Network
            (Link ID) Designated Router address: 172.16.11.2
            (Link Data) Router Interface address: 172.16.11.2
            Number of TOS metrics: 0

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TOS 0 Metrics: 10

Link connected to: a Stub Network
(Link ID) Network/subnet number: 192.168.88.0
(Link Data) Network Mask: 255.255.255.0
Number of TOS metrics: 0
TOS 0 Metrics: 10

router#sh ip ospf database summary

OSPF Router with ID (172.16.11.1) (Process ID 65501)

Ejercicio 2
Luego de cambiar el tipo de métrica de 10.0.0.0/8 a Tipo 1 la salida es la siguiente. ¿Qué diferencia hay con el Ejercicio 1?

router#sh ip ospf database external 10.0.0.0

OSPF Router with ID (172.16.11.1) (Process ID 65501)

Type-5 AS External Link States
Routing Bit Set on this LSA
LS age: 233
Options: (No TOS-capability, No DC)
LS Type: AS External Link
Link State ID: 10.0.0.0 (External Network Number )
Advertising Router: 172.16.11.2
LS Seq Number: 80000501
Checksum: 0x3188
Length: 36
Network Mask: /8
  Metric Type: 1 (Comparable directly to link state metric)
  TOS: 0
  Metric: 20
  Forward Address: 0.0.0.0
  External Route Tag: 0

Ejercicio 3
La siguiente salida se produce luego de cambiar la interfaz de la red 192.168.88.0/24 en el router 172.16.11.2 al area 1. Diagrame la red del Ejercicio 1 con este cambio.

router#sh ip ospf database summary 192.168.88.0

OSPF Router with ID (172.16.11.1) (Process ID 65501)

Summary Net Link States (Area 0)
Routing Bit Set on this LSA
LS age: 56
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Options: (No TOS-capability, No DC)
LS Type: Summary Links (Network)
Link State ID: 192.168.88.0 (summary Network Number)
Advertising Router: 172.16.11.2
LS Seq Number: 80000001
Checksum: 0xD0B8
Length: 28
Network Mask: /24
  TOS: 0  Metric: 10

router# sh ip ospf database router 172.16.11.2

OSPF Router with ID (172.16.11.1) (Process ID 65501)

  Router Link States (Area 0)

Routing Bit Set on this LSA
LS age: 154
Options: (No TOS-capability, No DC)
LS Type: Router Links
Link State ID: 172.16.11.2
Advertising Router: 172.16.11.2
LS Seq Number: 8000050E
Checksum: 0x89D1
Length: 36
Area Border Router
AS Boundary Router
  Number of Links: 1

  Link connected to: a Transit Network
  (Link ID) Designated Router address: 172.16.11.2
  (Link Data) Router Interface address: 172.16.11.2
  Number of TOS metrics: 0
  TOS 0 Metrics: 10