了解OSPFv3 AS外部LSA路由计算

目录

简介

本文描述开放最短路径第一版本3 (OSPFv3)自治系统(AS)外部链路状态广告(LSA)类型5路由选择机制。它提交与配置的一网络环境如何的能选择从一自治系统边界路由器接收的路由(ASBR)在别的。

先决条件

要求

思科建议您有知识OSPFv3和IPv6路由。

使用的组件

本文档不限于特定的软件和硬件版本。

本文档中的信息都是基于特定实验室环境中的设备编写的。本文档中使用的所有设备最初均采用原始（默认）配置。如果您使用的是真实网络，请确保您已经了解所有命令的潜在影响。

背景信息

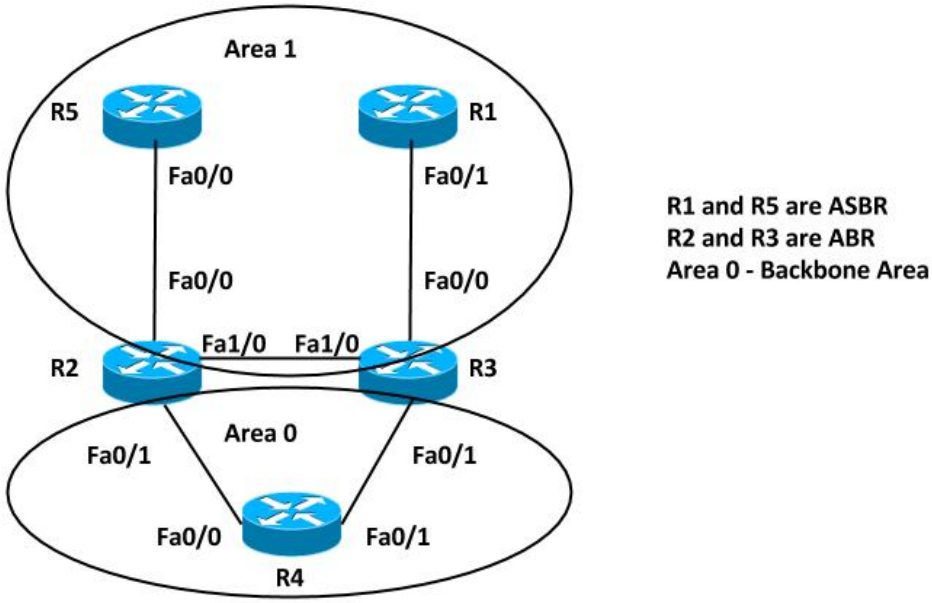
如果路由再分布到OSPFv3从其他IPv6路由协议或从IPv6静态路由，默认情况下这些路由变为OSPF和外部路由。这些和外部路由属于两个类别、外部类型1 (O E1)和外部类型2 (O E2)。

两个之间的差异就象开销的(量度)路由计算。类型 2 路由的成本始终为外部成本，与到达该路由的内部成本无关。 类型1路由的开销是用于的外部费用和内部费用的新增内容到达该路由。对于同一目标，类型 1 路由始终优先于类型 2 路由。

配置

网络图

考虑下面的网络拓扑检查在起源于ASBRs于区域1. R2和R3是区域边界路由器的Area 0的R4 5接收的AS-external LSA (ABR)。



配置

为了简化，此配置再分布在ASBRs的IPv6静态路由在区域1路由器R5和R1。

```
R5#
ipv6 route FD00:AAAA:BBBB:CCCC::/64 Null0
!
interface FastEthernet0/0
 ipv6 address FD00:AAAA:BBBB:25::5/64
 ipv6 ospf 10 area 1
!
ipv6 router ospf 10
 router-id 192.168.1.5
 redistribute static

R1#

ipv6 route FD00:AAAA:BBBB:CCCC::/64 Null0
!
interface FastEthernet0/1
```

```
 ipv6 address FD00:AAAA:BBBB:13::1/64
 ipv6 ospf 10 area 1
!
ipv6 router ospf 10
 router-id 192.168.1.1
 redistribute static
```

Note: 如果量度没有指定， OSPFv3放置默认值为20，当再分布从所有协议的路由除了边界网关协议(BGP)路由时，接收量度1。

验证

您能使用这些命令为了验证再分配：

```
R5#show ipv6 ospf
 Routing Process "ospfv3 10" with ID 192.168.1.5
 Event-log enabled, Maximum number of events: 1000, Mode: cyclic
 It is an autonomous system boundary router
 Redistributing External Routes from,
   static
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 2. Checksum Sum 0x0100D4
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Graceful restart helper support enabled
 Reference bandwidth unit is 100 mbps
 RFC1583 compatibility enabled
   Area 1
       Number of interfaces in this area is 1
       SPF algorithm executed 5 times
       Number of LSA 16. Checksum Sum 0x08011B
       Number of DCbitless LSA 0
       Number of indication LSA 0
       Number of DoNotAge LSA 0
       Flood list length 0

R1#show ipv6 ospf
 Routing Process "ospfv3 10" with ID 192.168.1.1
 Event-log enabled, Maximum number of events: 1000, Mode: cyclic
 It is an autonomous system boundary router
 Redistributing External Routes from,
   static
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 2. Checksum Sum 0x0100D4
```

```
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Graceful restart helper support enabled
Reference bandwidth unit is 100 mbps
RFC1583 compatibility enabled
  Area 1
      Number of interfaces in this area is 1
      SPF algorithm executed 6 times
      Number of LSA 16. Checksum Sum 0x08AD19
      Number of DCbitless LSA 0
      Number of indication LSA 0
      Number of DoNotAge LSA 0
      Flood list length 0
```

因此，两个ASBR路由器、R5和R1再分布IPv6静态路由。为了检查在路由表和OSPFv3数据库的被重新分配的路由在路由器R4前缀FD00:AAAA:BBBB:CCCC::/64，请输入此命令：

```
R4#show ipv6 route FD00:AAAA:BBBB:CCCC::/64
Routing entry for FD00:AAAA:BBBB:CCCC::/64
  Known via "ospf 10", distance 110, metric 20, type extern 2
  Route count is 2/2, share count 0
  Routing paths:
      FE80::C801:37FF:FE2C:6, FastEthernet0/0
      Last updated 00:04:17 ago
      FE80::C802:BFF:FEB4:6, FastEthernet0/1
      Last updated 00:04:17 ago
```

- Both the LSAs are installed in the Routing Table

```
R4#show ipv6 ospf database external FD00:AAAA:BBBB:CCCC::/64

            OSPFv3 Router with ID (192.168.1.4) (Process ID 10)

            Type-5 AS External Link States

  Routing Bit Set on this LSA
  LS age: 285
  LS Type: AS External Link
  Link State ID: 0
  Advertising Router: 192.168.1.1
  LS Seq Number: 80000001
  Checksum: 0x8C60
  Length: 36
  Prefix Address: FD00:AAAA:BBBB:CCCC::
  Prefix Length: 64, Options: None
  Metric Type: 2 (Larger than any link state path)
  Metric: 20

  Routing Bit Set on this LSA
  LS age: 288
  LS Type: AS External Link
  Link State ID: 0
  Advertising Router: 192.168.1.5
  LS Seq Number: 80000001
  Checksum: 0x7474
  Length: 36
  Prefix Address: FD00:AAAA:BBBB:CCCC::
  Prefix Length: 64, Options: None
  Metric Type: 2 (Larger than any link state path)
  Metric: 20
```

- Advertising Routers are R1 (192.168.1.1) and R5 (192.168.1.5)
- OSPF External type 2 routes - OE2
- Metric is 20

重新分配的量度

当路由再分布到OSPFv3时，默认情况下如前面提到，度量值设置到20。其次，请定义值10，当您在ASBR 192.168.1.1 (R1)时重新分配并且检查在Router4的输出。

这是在R1实现的更改：

```
R1#show ipv6 ospf
 Routing Process "ospfv3 10" with ID 192.168.1.1
 Event-log enabled, Maximum number of events: 1000, Mode: cyclic
 It is an autonomous system boundary router
```

```
Redistributing External Routes from,
  static
Router is not originating router-LSAs with maximum metric
Initial SPF schedule delay 5000 msecs
Minimum hold time between two consecutive SPFs 10000 msecs
Maximum wait time between two consecutive SPFs 10000 msecs
Minimum LSA interval 5 secs
Minimum LSA arrival 1000 msecs
LSA group pacing timer 240 secs
Interface flood pacing timer 33 msecs
Retransmission pacing timer 66 msecs
Number of external LSA 2. Checksum Sum 0x0100D4
Number of areas in this router is 1. 1 normal 0 stub 0 nssa
Graceful restart helper support enabled
Reference bandwidth unit is 100 mbps
RFC1583 compatibility enabled
  Area 1
      Number of interfaces in this area is 1
      SPF algorithm executed 6 times
      Number of LSA 16. Checksum Sum 0x08AD19
      Number of DCbitless LSA 0
      Number of indication LSA 0
      Number of DoNotAge LSA 0
      Flood list length 0
```

路由表在IPv6路由表里只当前显示一个条目。进一步检查OSPF数据库此AS-external LSA ：

```
R4#show ipv6 route FD00:AAAA:BBBB:CCCC::/64
Routing entry for FD00:AAAA:BBBB:CCCC::/64
  Known via "ospf 10", distance 110, metric 10, type extern 2
  Route count is 1/1, share count 0
  Routing paths:
      FE80::C802:BFF:FEB4:6, FastEthernet0/1
      Last updated 00:00:19 ago
```

- Only the LSA with lower metric 10 is installed in the Routing Table

```
R4#show ipv6 ospf database external FD00:AAAA:BBBB:CCCC::/64

            OSPFv3 Router with ID (192.168.1.4) (Process ID 10)

            Type-5 AS External Link States

  Routing Bit Set on this LSA
  LS age: 34
  LS Type: AS External Link
  Link State ID: 0
  Advertising Router: 192.168.1.1
  LS Seq Number: 80000002
  Checksum: 0x4EA7
  Length: 36
  Prefix Address: FD00:AAAA:BBBB:CCCC::
  Prefix Length: 64, Options: None
  Metric Type: 2 (Larger than any link state path)
  Metric: 10

  LS age: 382
  LS Type: AS External Link
  Link State ID: 0
  Advertising Router: 192.168.1.5
  LS Seq Number: 80000001
  Checksum: 0x7474
  Length: 36
  Prefix Address: FD00:AAAA:BBBB:CCCC::
  Prefix Length: 64, Options: None
  Metric Type: 2 (Larger than any link state path)
  Metric: 20
```

- Advertising Routers are R1 (192.168.1.1) and R5 (192.168.1.5)
- OSPF External type 2 routes - OE2

转发量度

向前量度是到达从路由器的ASBR的开销。这可以用这些命令检查：

```
R1#show ipv6 ospf
 Routing Process "ospfv3 10" with ID 192.168.1.1
 Event-log enabled, Maximum number of events: 1000, Mode: cyclic
 It is an autonomous system boundary router
 Redistributing External Routes from,
   static
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 2. Checksum Sum 0x0100D4
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Graceful restart helper support enabled
 Reference bandwidth unit is 100 mbps
 RFC1583 compatibility enabled
   Area 1
       Number of interfaces in this area is 1
       SPF algorithm executed 6 times
       Number of LSA 16. Checksum Sum 0x08AD19
       Number of DCbitless LSA 0
       Number of indication LSA 0
       Number of DoNotAge LSA 0
       Flood list length 0
```

在此输出中，到达ASBRs的开销(R1和R5)是2从路由器R4。默认情况下，快速以太网接口的开销在OSPFv3是1。 那么在这种情况下，开销是2从到达R1或R5的R4 ：到达ABR的向前量度=路由器开销(1) +到达ASBR的ABR开销(1) = 2。

更改再分配量度到10在R5，因此两个路由在IPv6路由表里再安装。

这是在R5实现的更改：

```
R1#show ipv6 ospf
 Routing Process "ospfv3 10" with ID 192.168.1.1
 Event-log enabled, Maximum number of events: 1000, Mode: cyclic
 It is an autonomous system boundary router
 Redistributing External Routes from,
   static
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 2. Checksum Sum 0x0100D4
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Graceful restart helper support enabled
 Reference bandwidth unit is 100 mbps
 RFC1583 compatibility enabled
   Area 1
```

```
       Number of interfaces in this area is 1
       SPF algorithm executed 6 times
       Number of LSA 16. Checksum Sum 0x08AD19
       Number of DCbitless LSA 0
       Number of indication LSA 0
       Number of DoNotAge LSA 0
       Flood list length 0
```

在R4的IPv6路由表和OSPFv3 RIB显示：

```
R1#show ipv6 ospf
 Routing Process "ospfv3 10" with ID 192.168.1.1
 Event-log enabled, Maximum number of events: 1000, Mode: cyclic
 It is an autonomous system boundary router
 Redistributing External Routes from,
   static
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 2. Checksum Sum 0x0100D4
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Graceful restart helper support enabled
 Reference bandwidth unit is 100 mbps
 RFC1583 compatibility enabled
   Area 1
       Number of interfaces in this area is 1
       SPF algorithm executed 6 times
       Number of LSA 16. Checksum Sum 0x08AD19
       Number of DCbitless LSA 0
       Number of indication LSA 0
       Number of DoNotAge LSA 0
       Flood list length 0
```

现在让更改开销到达一ASBRs，但是与同样再分配量度和检查同一输出。

增加在路由器的R4 fa0/1开销的OSPFv3 ：

```
R1#show ipv6 ospf
 Routing Process "ospfv3 10" with ID 192.168.1.1
 Event-log enabled, Maximum number of events: 1000, Mode: cyclic
 It is an autonomous system boundary router
 Redistributing External Routes from,
   static
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 2. Checksum Sum 0x0100D4
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Graceful restart helper support enabled
 Reference bandwidth unit is 100 mbps
```

```
 RFC1583 compatibility enabled
   Area 1
        Number of interfaces in this area is 1
        SPF algorithm executed 6 times
        Number of LSA 16. Checksum Sum 0x08AD19
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0
```

检查向前量度。它显示当前到达的开销ASBR R1是11从Fa0/1接口：

```
R1#show ipv6 ospf
 Routing Process "ospfv3 10" with ID 192.168.1.1
 Event-log enabled, Maximum number of events: 1000, Mode: cyclic
 It is an autonomous system boundary router
 Redistributing External Routes from,
   static
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 2. Checksum Sum 0x0100D4
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Graceful restart helper support enabled
 Reference bandwidth unit is 100 mbps
 RFC1583 compatibility enabled
   Area 1
        Number of interfaces in this area is 1
        SPF algorithm executed 6 times
        Number of LSA 16. Checksum Sum 0x08AD19
        Number of DCbitless LSA 0
        Number of indication LSA 0
        Number of DoNotAge LSA 0
        Flood list length 0
```

现在R4的IPv6路由表和OSPFv3 RIB显示：

```
R1#show ipv6 ospf
 Routing Process "ospfv3 10" with ID 192.168.1.1
 Event-log enabled, Maximum number of events: 1000, Mode: cyclic
 It is an autonomous system boundary router
 Redistributing External Routes from,
   static
 Router is not originating router-LSAs with maximum metric
 Initial SPF schedule delay 5000 msecs
 Minimum hold time between two consecutive SPFs 10000 msecs
 Maximum wait time between two consecutive SPFs 10000 msecs
 Minimum LSA interval 5 secs
 Minimum LSA arrival 1000 msecs
 LSA group pacing timer 240 secs
 Interface flood pacing timer 33 msecs
 Retransmission pacing timer 66 msecs
 Number of external LSA 2. Checksum Sum 0x0100D4
 Number of areas in this router is 1. 1 normal 0 stub 0 nssa
 Graceful restart helper support enabled
 Reference bandwidth unit is 100 mbps
```

```
 RFC1583 compatibility enabled
   Area 1
       Number of interfaces in this area is 1
       SPF algorithm executed 6 times
       Number of LSA 16. Checksum Sum 0x08AD19
       Number of DCbitless LSA 0
       Number of indication LSA 0
       Number of DoNotAge LSA 0
       Flood list length 0
```

因此有更低向前量度的路由在IPv6路由表里安装。

总之，当您有AS-external LSA的时多个条目，第一个首选给对量度(重新分配的量度)。有低度量值的路由在IPv6路由表里安装。如果重新分配的量度是同样，第二个首选给对向前量度。有更低向前量度的路由在IPv6路由表里安装。