OSPF外部路径选择：外部类型2 (E2) VS NSSA类型2 (N2)

目录

简介

本文目的将展示开放最短路径优先(OSPF)路径选择行为，当路由器接收Type-5链路状态广播(LSA)时和一个给的外部网络的Type-7 LSA。 当再分配在非NSSA区域进行， OSPF将注入Type-5 LSA OSPF域。再分配到NSSA区域里创建指Type-7 LSA特殊类型，能在NSSA区域只存在。

先决条件

参考在图1的网络图，您使用本文：

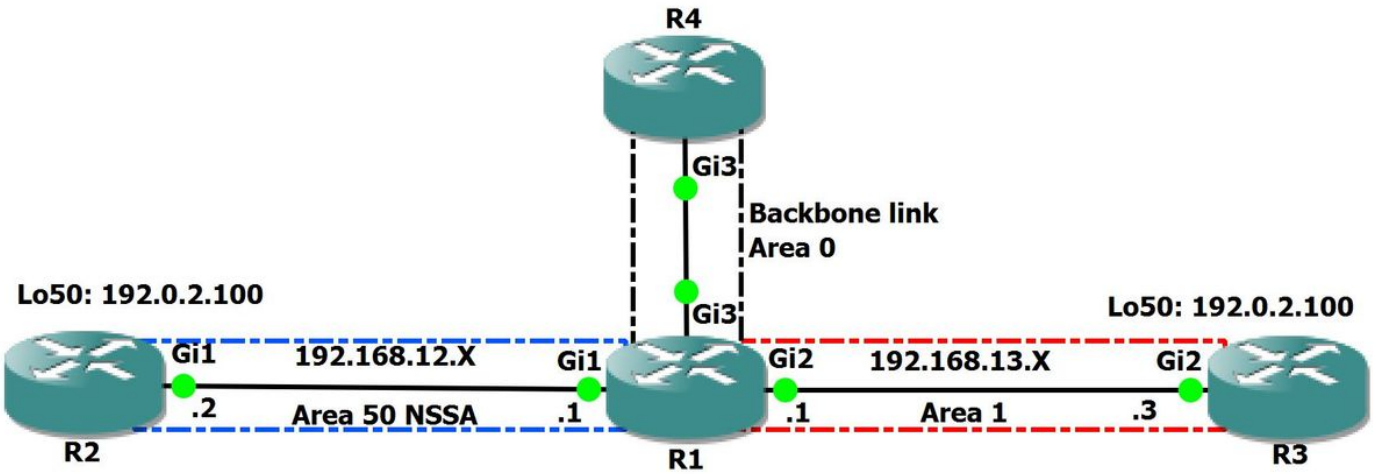

图 1

在网络图中，有非骨干区域1和NSSA区域50连接对R1。R1是区域边界路由器(ABR)连接对骨干区域0。R2和R3对重新分配同一个前缀192.0.2.100/32负责到OSPF域。

要求

思科建议您有OSPF协议的知识。

使用的组件

本文档中的信息基于以下软件版本：

- Cisco CSR1000V版本16.4.1

背景信息

Cisco IOS XE外部路径计算的设备支持RFC 3101。RFC 1587是已废弃的由RFC 3101，但是RFC 1587特定行为可能通过配置仍然启用。在Cisco IOS版本15.1(2)S和以上版本中，输出show ip ospf命令显示设备是否使用RFC 3101或RFC 1587。

从RFC 3101部分2.5提取

```
(e) If the current LSA is functionally the same as an
 installed LSA (i.e., same destination, cost and non-zero
 forwarding address) then apply the following priorities in
 deciding which LSA is preferred:

1. A Type-7 LSA with the P-bit set.
2. A Type-5 LSA.
3. The LSA with the higher router ID.
```

从RFC 1587部分3.5提取

```
5. Otherwise, compare the cost of this new AS external path
         to the ones present in the table. Note that type-5 and
         type-7 routes are directly comparable. Type-1 external
         paths are always shorter than Type-2 external paths.
         Type-1 external paths are compared by looking at the sum
         of the distance to the forwarding address/ASBR and the
         advertised Type-1 paths (X+Y). Type-2 external paths are
         compared by looking at the advertised Type-2 metrics,
         and then if necessary, the distance to the forwarding
         address/ASBR.
         When a type-5 LSA and a type-7 LSA are found to have the
         same type and an equal distance, the following priorities
         apply (listed from highest to lowest) for breaking the tie.

                 a. Any type 5 LSA.
                 b. A type-7 LSA with the P-bit set and the forwarding
                    address non-zero.
                 c. Any other type-7 LSA.

         If the new path is shorter, it replaces the present paths
         in the routing table entry. If the new path is the same
         cost, it is added to the routing table entry's list of
         paths
```

场景 1

网络图

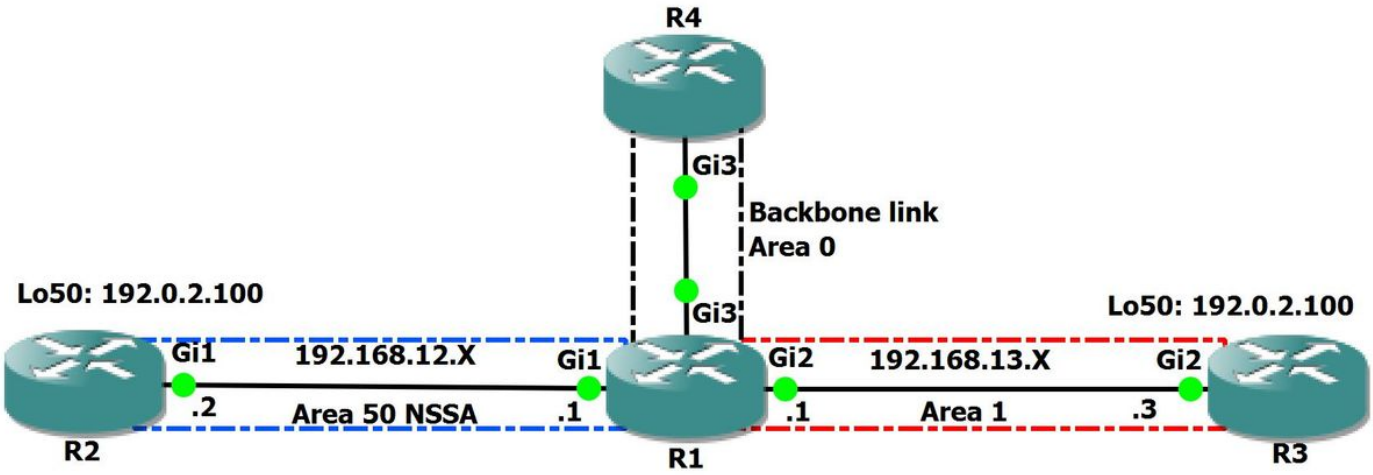

图 2

在此方案中，我们查看什么行为被观察，当曾经RFC 3101外部路径计算时。我们将是对在R3和R2重新分配的前缀192.0.2.100/32感兴趣。

从R1的类型1 LSA在下面的输出中：

```
R1#show ip ospf database router 1.1.1.1

            OSPF Router with ID (1.1.1.1) (Process ID 1)

                Router Link States (Area 0)

  LS age: 51
  Options: (No TOS-capability, DC)
  LS Type: Router Links
  Link State ID: 1.1.1.1
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000007
  Checksum: 0x3BD6
  Length: 48
  Area Border Router
  AS Boundary Router
  Number of Links: 2

    Link connected to: another Router (point-to-point)
     (Link ID) Neighboring Router ID: 4.4.4.4
     (Link Data) Router Interface address: 192.168.14.1
      Number of MTID metrics: 0
       TOS 0 Metrics: 1

    Link connected to: a Stub Network
     (Link ID) Network/subnet number: 192.168.14.0
     (Link Data) Network Mask: 255.255.255.0
      Number of MTID metrics: 0
       TOS 0 Metrics: 1
```

```
                Router Link States (Area 1)

  LS age: 562
  Options: (No TOS-capability, DC)
  LS Type: Router Links
  Link State ID: 1.1.1.1
  Advertising Router: 1.1.1.1
  LS Seq Number: 8000000C
  Checksum: 0xEC26
  Length: 48
  Area Border Router
  AS Boundary Router
  Number of Links: 2

    Link connected to: another Router (point-to-point)
     (Link ID) Neighboring Router ID: 3.3.3.3
     (Link Data) Router Interface address: 192.168.13.1
      Number of MTID metrics: 0
       TOS 0 Metrics: 1

    Link connected to: a Stub Network
     (Link ID) Network/subnet number: 192.168.13.0
     (Link Data) Network Mask: 255.255.255.0
      Number of MTID metrics: 0
       TOS 0 Metrics: 1



                Router Link States (Area 50)

  LS age: 562
  Options: (No TOS-capability, DC)
  LS Type: Router Links
  Link State ID: 1.1.1.1
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000012
  Checksum: 0x42CA
  Length: 48
  Area Border Router
  AS Boundary Router
  Number of Links: 2

    Link connected to: another Router (point-to-point)
     (Link ID) Neighboring Router ID: 2.2.2.2
     (Link Data) Router Interface address: 192.168.12.1
      Number of MTID metrics: 0
       TOS 0 Metrics: 1

    Link connected to: a Stub Network
     (Link ID) Network/subnet number: 192.168.12.0
     (Link Data) Network Mask: 255.255.255.0
      Number of MTID metrics: 0
       TOS 0 Metrics: 1
```

在R1我们有以下外部LSA在我们的数据库：

```
R1#show ip ospf database external

            OSPF Router with ID (1.1.1.1) (Process ID 1)
                Type-5 AS External Link States
```

```
  LS age: 706
  Options: (No TOS-capability, DC, Upward)
  LS Type: AS External Link
  Link State ID: 192.0.2.100 (External Network Number )
  Advertising Router: 1.1.1.1
  LS Seq Number: 80000001
  Checksum: 0xE617
  Length: 36
  Network Mask: /32
        Metric Type: 2 (Larger than any link state path)
        MTID: 0
        Metric: 20
        Forward Address: 192.168.12.2
        External Route Tag: 0

  LS age: 600
  Options: (No TOS-capability, DC, Upward)
  LS Type: AS External Link
  Link State ID: 192.0.2.100 (External Network Number )
  Advertising Router: 3.3.3.3
  LS Seq Number: 80000002
  Checksum: 0xBFAC
  Length: 36
  Network Mask: /32
        Metric Type: 2 (Larger than any link state path)
        MTID: 0
        Metric: 20
        Forward Address: 0.0.0.0
        External Route Tag: 0


R1#show ip ospf database nssa-external

            OSPF Router with ID (1.1.1.1) (Process ID 1)
                Type-7 AS External Link States (Area 50)

  LS age: 865
  Options: (No TOS-capability, Type 7/5 translation, DC, Upward)
  LS Type: AS External Link
  Link State ID: 192.0.2.100 (External Network Number )
  Advertising Router: 2.2.2.2
  LS Seq Number: 80000002
  Checksum: 0x32BC
  Length: 36
  Network Mask: /32
        Metric Type: 2 (Larger than any link state path)
        MTID: 0
        Metric: 20
        Forward Address: 192.168.12.2
        External Route Tag: 0
```

现在让检查什么LSA在R1更喜欢：

```
R1#show ip ospf rib 192.0.2.100

            OSPF Router with ID (1.1.1.1) (Process ID 1)
                Base Topology (MTID 0)
```

```
OSPF local RIB
Codes: * - Best, > - Installed in global RIB
LSA: type/LSID/originator

*>  192.0.2.100/32, NSSA2, cost 20, fwd cost 1, tag 0, area 50
     SPF Instance 38, age 00:04:51
      contributing LSA: 7/192.0.2.100/2.2.2.2 (area 50)
      contributing LSA: 5/192.0.2.100/3.3.3.3
     Flags: RIB, HiPrio, ViaFwAddr, IntraNonBB, NSSA P-bit
      via 192.168.12.2, GigabitEthernet1 label 1048578
       Flags: RIB
       LSA: 7/192.0.2.100/2.2.2.2
```

我们在上述输出中能看到， R1更喜欢从R2的LSA Type-7。这是因为我们跟随RFC 3101，有以下路径计算首选

1. 与P位集的Type-7 LSA。
2.Type-5 LSA。
3.与更高的路由器ID的LSA。

注意：请注意以下路径计算首选是可适用的，如果当前LSA功能上是相同的象已安装LSA。我们能验证两个LSA的转发量度是查看R1的类型1 LSA相同的。

现在，如果我们清除在NSSA Type-7 LSA的P位从R2我们看到我们将更喜欢从R3的Type-5 LSA ：

从RFC 3101部分2.4提取

```
R1#show ip ospf rib 192.0.2.100

            OSPF Router with ID (1.1.1.1) (Process ID 1)
                Base Topology (MTID 0)

OSPF local RIB
Codes: * - Best, > - Installed in global RIB
LSA: type/LSID/originator

*>  192.0.2.100/32, NSSA2, cost 20, fwd cost 1, tag 0, area 50
     SPF Instance 38, age 00:04:51
      contributing LSA: 7/192.0.2.100/2.2.2.2 (area 50)
      contributing LSA: 5/192.0.2.100/3.3.3.3
     Flags: RIB, HiPrio, ViaFwAddr, IntraNonBB, NSSA P-bit
      via 192.168.12.2, GigabitEthernet1 label 1048578
       Flags: RIB
       LSA: 7/192.0.2.100/2.2.2.2
```

在我们继续进行清洁在R2前的P位，这是type-7从R2的LSA输出

```
R2#show ip ospf database nssa-external

            OSPF Router with ID (2.2.2.2) (Process ID 1)

                Type-7 AS External Link States (Area 50)

  LS age: 1215
  Options: (No TOS-capability, Type 7/5 translation, DC, Upward)
  LS Type: AS External Link
  Link State ID: 192.0.2.100 (External Network Number )
  Advertising Router: 2.2.2.2
```

```
  LS Seq Number: 80000002
  Checksum: 0x32BC
  Length: 36
  Network Mask: /32
        Metric Type: 2 (Larger than any link state path)
        MTID: 0
        Metric: 20
        Forward Address: 192.168.12.2
        External Route Tag: 0
```

P位，当NSSA边界路由器产生Type-5 LSA和Type-7 LSA同一网络的时，可以清除。

```
R2#show ip ospf database nssa-external

            OSPF Router with ID (2.2.2.2) (Process ID 1)

                Type-7 AS External Link States (Area 50)

  LS age: 44
  Options: (No TOS-capability, No Type 7/5 translation, DC, Upward)
  LS Type: AS External Link
  Link State ID: 192.0.2.100 (External Network Number )
  Advertising Router: 2.2.2.2
  LS Seq Number: 80000003
  Checksum: 0xBFAD
  Length: 36
  Network Mask: /32
        Metric Type: 2 (Larger than any link state path)
        MTID: 0
        Metric: 20
        Forward Address: 0.0.0.0
        External Route Tag: 0
```

这是关于如下所述的上述输出的某些重要特性：

- 位 P — 此位用于告知 NSSA ABR 是否将类型 7 转换为类型 5。
- 无类型 7/5 转换表示位 P = 0。
- 类型 7/5 转换表示位 P = 1。
- 如果位P = 0，那么NSSA ABR不能将此LSA翻译成第5类。当 NSSA ASBR 也作为 NSSA ABR 时，会发生这种情况。
- 如果位 P = 1，则 NSSA ABR 必须将此类型 7 LSA 转换为类型 5 LSA。如果有多个NSSA ABR，那个与最高的路由器ID执行此。

现在，当我们检查R1时我们看到我们更喜欢在Type-7 LSA的Type-5。

```
R1#show ip ospf rib 192.0.2.100

            OSPF Router with ID (1.1.1.1) (Process ID 1)

                Base Topology (MTID 0)

OSPF local RIB
Codes: * - Best, > - Installed in global RIB
LSA: type/LSID/originator

*>  192.0.2.100/32, Ext2, cost 20, fwd cost 1, tag 0
     SPF Instance 39, age 00:03:32
      contributing LSA: 7/192.0.2.100/2.2.2.2 (area 50)
```

```
     contributing LSA: 5/192.0.2.100/3.3.3.3
    Flags: RIB, HiPrio, IntraNonBB
     via 192.168.13.3, GigabitEthernet2 label 1048578
      Flags: RIB
      LSA: 5/192.0.2.100/3.3.3.3
```

场景 2

网络图

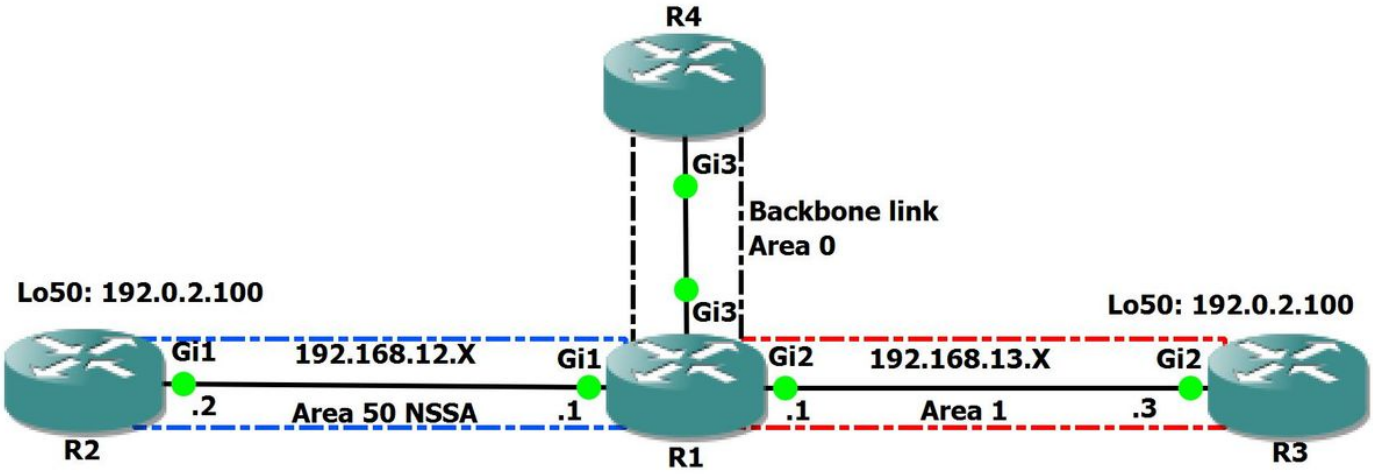

图 3

在此方案中，我们查看什么行为被观察，当曾经RFC 1587外部路径计算时。RFC 3101标准在IOS-XE设备自动地启用。用路由选择的RFC 1587兼容性要替换RFC 3101兼容性在次未节区域(NSSA)区域边界路由器(ABR)，请使用**compatiblerfc1587** in命令路由器配置模式或地址家族配置模式。要恢复RFC 3101兼容性，请使用此命令**no表示**。

我们将是对在R3和R2重新分配的前缀192.0.2.100/32感兴趣。首先我们必须启用在R1的RFC 1587兼容性

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#compatible rfc1587

R1#show ip ospf  | in RFC
 Supports NSSA (compatible with RFC 1587)
```

一旦我们启用在R1的兼容性RFC 1587我们能检查什么路径在我们的数据库，并且什么LSA更喜欢：

```
R1#conf t
Enter configuration commands, one per line.  End with CNTL/Z.
R1(config)#router ospf 1
R1(config-router)#compatible rfc1587

R1#show ip ospf  | in RFC
 Supports NSSA (compatible with RFC 1587)
```

现在让检查什么LSA在R1更喜欢：

```
R1#show ip ospf rib 192.0.2.100

            OSPF Router with ID (1.1.1.1) (Process ID 1)
                Base Topology (MTID 0)

OSPF local RIB
Codes: * - Best, > - Installed in global RIB
LSA: type/LSID/originator

*>  192.0.2.100/32, Ext2, cost 20, fwd cost 1, tag 0
     SPF Instance 44, age 00:01:56
      contributing LSA: 7/192.0.2.100/2.2.2.2 (area 50)
      contributing LSA: 5/192.0.2.100/3.3.3.3
     Flags: RIB, HiPrio, IntraNonBB, PartialSPF
      via 192.168.13.3, GigabitEthernet2 label 1048578
       Flags: RIB
       LSA: 5/192.0.2.100/3.3.3.3
```

Type-5 LSA更喜欢。

在上述输出中，您也许也已经注意R1不翻译Type-7对Type-5，这是，因为被添加了到路由表仅的Type-7路由是转换的候选。

相关信息

- 技术支持 - Cisco Systems
- RFC 3101
- RFC 1587