Prefix Unreachable Announcement for SRv6 Fast Convergence
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Abstract

This document describes the mechanism that can be used to announce the unreachable prefixes for SRv6 fast convergence.

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1. Introduction

OSPF and IS-IS have the summary route and default route mechanism on area border router or L1L2 border router, which can be used to increase the scalability of these IGP protocols. Such summary mechanism can also reduce the SPF calculation time when the link oscillation occurs in another area.

The summary route and the default route may cover the host route or link prefixes of intra area or inter area. But in some situations, the router needs to know the exact reachability information about prefix in other area, especially when the prefix is unreachable but it is located within the summary range.

With the introduction of SRv6, more and more services are migrated from the MPLS data plane to the IPv6 data plane. The biggest difference between IPv6 and MPLS is that IPv6 has aggregation ability, so we need to reconsider how to know the prefix reachability in the case of aggregation.

This document introduces the mechanism that can be used in such situation, to announce the unreachable prefixes which are located in the summary address range.

2. Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].
3. Scenario Description

Figure 1 illustrates the topology scenario when OSPF is running in multi-area. R0-R4 are routers in backbone area, S1-S4, T1-T4 are internal routers in area 1 and area 2 respectively. R1 and R3 are area border routers between area 0 and area 1. R2 and R4 are area border routers between area 0 and area 2. Ps2 is the host address of S2 and Pt2 is the host address of T2.

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+---------------------+------+--------+-----+--------------+
| +--+        +--+   ++-+   ++-+    +-++   + -+        +--+|
| |S1+--------+S2+---+R1+---|R0+----+R2+---+T1+--------+T2||
| +-++     Ps2+-++   ++-+   +--+    +-++   ++++    Pt2 +-++|
|   |           |     |               |     ||           | |
|   |           |     |               |     ||           | |
|   |           |     |               |     ||           | |
|   |           |     |               |     ||           | |
| +-++        +-++   ++-+           +-++   ++-+        +--+|
| |S4+--------+S3+---+R3+-----------+R4+---+T3+--------+T4||
| +--+        +--+   ++-+           +-++   ++-+        +--+|
|                     |               |                    |
|                     |               |                    |
|         Area 1      |     Area 0    |      Area 2        |
+---------------------+---------------+--------------------+
```

Figure 1: OSPF Inter-Area Prefix Unreachable Announcement Scenario

If the area border router R1/R3 and R2/R4 does the summary action, then one summary address that cover the prefixes of area 0, area 1 and area 2 will be announced to area 1 and area 2, instead of the detail address. When the node S2 is down, Ps2 become unreachable. But there will be no change to the summary prefix. Except the border router R1/R3, the other routers within area 0 and area 2 do not know the unreachable status of this prefix. When these routers send traffic to prefix Ps2, the traffic will be dropped.

In another situation, assume the BGP session is built between Node S2 and T2, via Ps2 and Pt2 respectively. If Node S2 within area 1 become unreachable, the unreachable information can’t be advertised to Node T2 because the summary behaviour on border router R1/R3. The BGP session between S1 and T2 will be kept until the BGP keepalive timeout or other detection mechanism takes effect. During this period, the BGP traffic to Node S2 will be in black hole.

4. Inter-area prefix unreachable solution

[RFC7794] and [I-D.ietf-lsr-ospf-prefix-originator] both define one sub-TLV "Prefix Source Router ID" to announce the originator router information of one prefix. This TLV can be used to announce the prefix unreachable information when the link or node is down.
According to the procedure described in section 5 of [I-D.ietf-lsr-ospf-prefix-originator], the ABR has the responsibility to add the prefix originator information when it receives the type 1 LSA from other routers in the same area. When the ABR does the summary work and receives one updated LSA that omits the prefix belong to failed link which is within the range of summary address, the ABR should announce one new type 3 LSA, which includes the information about this prefix, but with the prefix originator set to NULL(all 0 address).

When one node in one area is down, the ABR has also the ability to detect the missing neighbor from the neighbor list. It should then announce one new type 3 LSA that includes the loopback addresses of this node, with the prefix originator set also to NULL(all 0 address).

For IS-IS, the above procedure is similar. The level-1/2 router will accomplish the above work when it judges that one prefix within the summary address range is missing.

These LSA will be transported via the traditional flooding procedure.

When the routers in other area receives such LSA, they will generate automatically one black-hole route, with the prefix as the destination, and the next hop be set to Null.

5. Intra-area prefix unreachable solution

In the intra-area scenario, like S1 illustrated in Figure 1, it will learn two types of prefixes, one is summary route, another is host route. When node S2 is down, S2 will withdraw the host route. But S1 can still match the summary route via the longest mask matching. For this scenario, when node S2 is down, S1 needs to keep the S2 host route for a period of time but updates S2 host route to black hole route. S1 will match the black hole route via the longest mask matching. Such mechanism can be used to trigger a SRv6 VPN for PE switching, or SRv6 TE mid-point protection.

The period for keeping the black hole route should be configured, to ensure the related protocols or services be converged.

6. Implementation Consideration

The above procedures will only be triggered under the following conditions:

1. The ABR or Level 1/2 router do the summary work.
2. The link prefix within the summary address range become unreachable.

3. The node whose loopback address is within the summary address become unreachable.

The Summary LSA that includes the unreachable prefix, with the prefix originator set to NULL value, will be announced across the ABR router, reach the routers in other areas. It’s behavior is still the same as that defined in OSPFv2 [RFC2328] or OSPFv3 [RFC5340].

7. Security Considerations

Security concerns for OSPF are addressed in [RFC5709].

Advertisement of the additional information defined in this document introduces no new security concerns.

8. IANA Considerations

TBD

9. Acknowledgement

TBD

10. Normative References

[I-D.ietf-lsr-ospf-prefix-originator]


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