Intra-domain SAVNET method

draft-lin-savnet-intra-domain-method-00

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Background

- **[draft-li-savnet-intra-domain-problem-statement-00]**

  describes the current problems of SAV in the domain and the requirements for solutions.

- **This draft proposes a method:**

  By extending IGP, SAV information is calculated independently by each router.

  SAV information can be used to verify the legitimacy of the packet source address.

Terminology in draft

For convenience, the terms in this draft are described as follows：

- **SAV Information**

  Binding entries Independently calculated by the router that enables SAV function.

  Its contexts include:

  ✓ Prefix (protected prefix)

  ✓ Incoming interfaces

- **Protected prefix**

  The source prefix participating in SAV information calculation.

  Protected prefix is usually the subnet on the user side.

- **Redirected forwarding policy**

  Such as PBR or QoS.

  The forwarding path of the packets processed by these policies may be inconsistent with the routing table.

Overview

Distribute the protected prefix through IGP, and calculate SAV information through the received protected prefix.

- **Advertising protected prefix**

  When the router advertises prefixes, it identifies the protected prefixes. This is Extension for IGP①.

  Other routers can calculate SAV information only for the protected prefixes.

- **Calculating SAV Information**

  uRPF rely Local Routing table to SAV. However the local route is used to guide the packet how to leave the router, it is unable to reflect how the packet arrives at the router.

  Calculating SAV information should depend on the routing table of other routers.

Calculating Logic

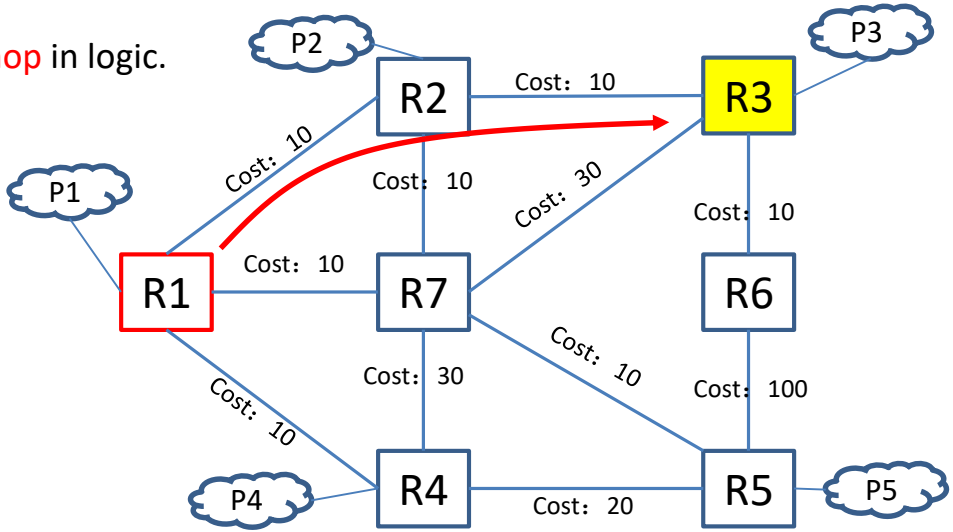
Take R3 as an example, **how to determine which interface the packet from a source prefix will arrive at R3** ?

The received packets of R3 should be the following three cases:

- ✓ The destination address of the packet is R3 or the subnet prefix (P3) accessed by R3
- ✓ R3 as a ABR or ASBR, packet goes out of the AS or area
- ✓ The packet passes through R3 and goes to the downstream node of R3 on its forwarding path

To sum up, R3 is the next hop or intermediate hop in logic.

R3 needs to calculate the shortest path tree with R1 as the root (Tree-R1) to calculate SAV information.

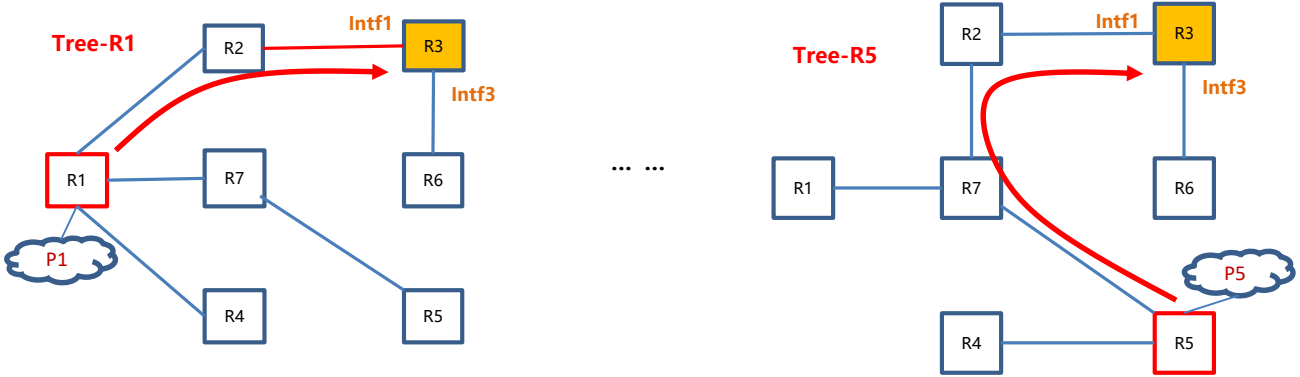


Calculating Logic (Cont.)

Calculation process of R3:

1. Calculate the shortest path tree with R3 itself as the root (Tree-R3).
2. Take other routers who advertised the protected prefix as the root to calculate the shortest path tree, Such as Tree-R1…Tree-R5.
   - Calculate the legal incoming interface for prefix P1 based on Tree-R1.
   - On Tree-R1, Intf1 is connected to the upstream node of R3, so Intf1 is the legal incoming interface of P1.

   Using the same method, the legal incoming interface of prefix P5 calculated based on Tree-R5 is Intf1.



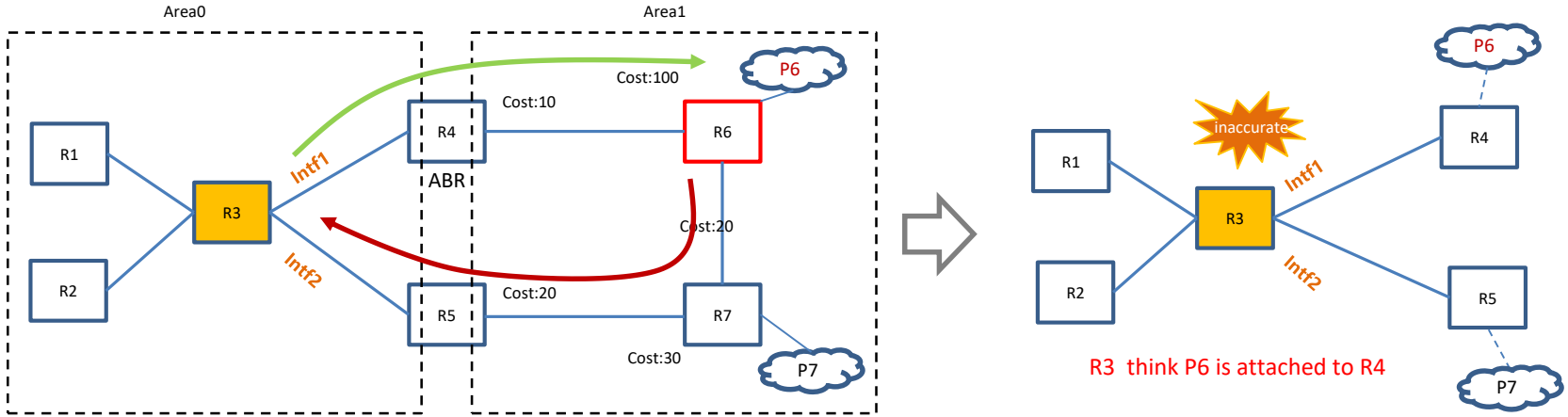
Scenario of Inter-area

- **Inaccurate calculation**

Due to the inter-area advertising of route, R3 cannot be aware the specific cost of the link in Area1.

According to the route information, R3 will calculate that the legal incoming interface of the packet from the prefix P6 is **intf1.** (**This is wrong**)

Based on the actual cost of the link, the packet from P6 will reach R3 through R5. **The real incoming interface is intf2**.



- **How to solve it ?**

Extend IGP ②to carry the total cost of prefix to ABR when ABR advertises inter-area routes to R3.

Protocol Extension ①

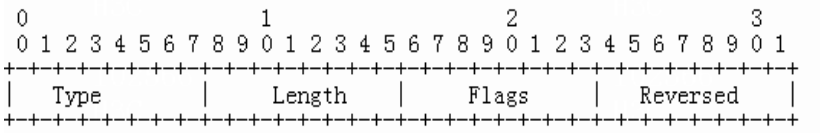
■ Prefix-SAV SUB-TLV

Used to Identify protected prefixes.

✓ IS-IS

The Prefix-SAV sub-TLV is a sub-TLV of the following IS-IS TLVs:

- TLV-135 (Extended IPv4 reachability).
- TLV-235 (Multi-topology IPv4 Reachability).
- TLV-236 (IPv6 IP Reachability).
- TLV-237 (Multi-topology IPv6 IP Reachability).



Type: TBD for IS-IS

Length: 2 octets

Flags: Reserved flag field

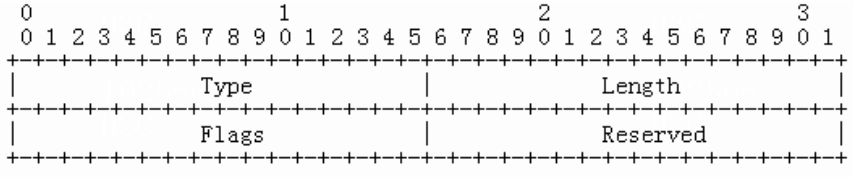
✓ OSPFv2

When the Route Type of OSPFv2 Extended Prefix TLV is Inter-Area (3), Prefix-Reverse-cost sub-TLV can be used.

✓ OSPFv3

The Prefix-SAV sub-TLV is a sub-TLV of the following OSPFv3 TLVs as defined in [RFC8362] :

- Intra-Area Prefix TLV
- Inter-Area Prefix TLV



Type: TBD respectively for OSPFv2 and OSPFv3

Length: 4 octets

Flags: Reserved flag field

Protocol Extension ②

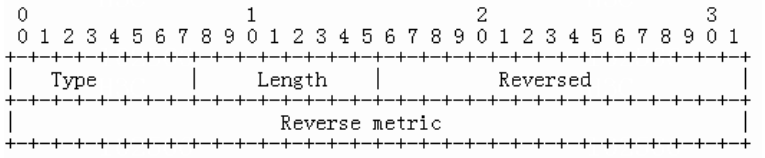
■ Prefix-Reverse-cost SUB-TLV

Used to carry the total costs from the router where the prefix is located to reach ABR.

✓ IS-IS

When the level 2 router leaks routes through the above TLVs, Prefix-Reverse-cost sub-TLV can be used to carry reverse total cost, as the sub-TLV of the following IS-IS TLVs:

- TLV-135 (Extended IPv4 reachability).
- TLV-235 (Multi-topology IPv4 Reachability).
- TLV-236 (IPv6 IP Reachability).
- TLV-237 (Multi-topology IPv6 IP Reachability).



Type: TBD for IS-IS
Length: 2 octets
Reverse metric: Total cost value from the router where the prefix is located to ABR.

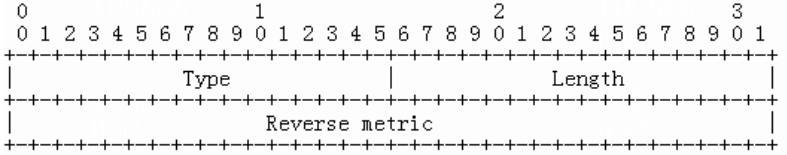
✓ OSPFv2

Prefix-Reverse-cost sub-TLV can be used when the Route Type of OSPFv2 Extended Prefix TLV is Inter-Area (3).

✓ OSPFv3

The Prefix-Reverse-cost sub-TLV is a sub-TLV of the following OSPFv3 TLVs:

- Inter-Area Prefix TLV



Type: TBD respectively for OSPFv2 and OSPFv3

Length: 4 octets

Flags: Reserved flag field

Consideration for Redirected forwarding Policy

Influence of redirection policy on SAV information calculation

- In the actual deployment, some redirected forwarding policies may be used, such as PBR and QoS.
- The Policy's forwarding path maybe different with IP routing Path resulting in additional incoming interface.

Abstraction of redirected forwarding policy

The redirected forwarding policy can specify the packet characteristics and redirection information.

Redirection information includes: next hop and outbound interface

Packet characteristics can be divided into the following categories

- (Src, dest, M),
- (*, dest, M)
- (Src, *, M)
- (*, *, M)

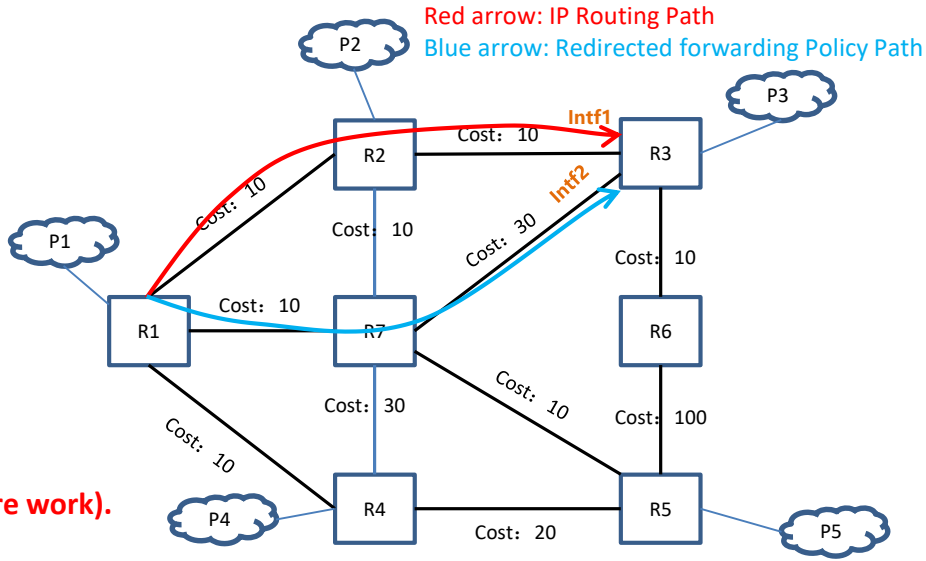
Src: source address of packet

Dest: destination address of packet

*: means to match all source addresses, that is, there is no restriction

M: True or false. Whether other non-address fields are specified

Policies can be advertised to other routers by extending IGP (future work).



Example for Redirected forwarding Policy

- **R1 and R7 are configured with redirection policies as follows, Dst1 is the route prefix advertised by R3.**

  The policy is advertised by IGP to other routers.

  - R1：(*, dst1, Yes, nexthop = R7)
  - R7：(*, dst1, Yes, nexthop = R3)

- **R3 calculates the redirected forwarding Path**

  Racket from R1 to dst1 is redirected to R7.

  - **case1(red line)**:

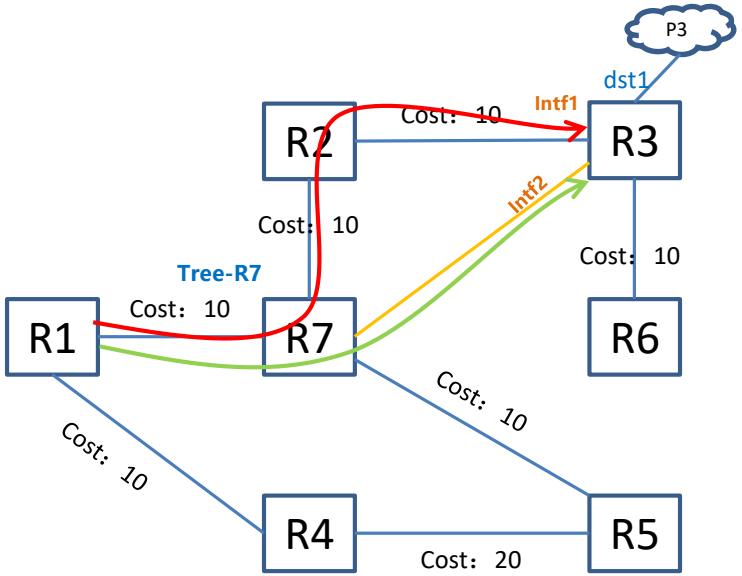
  There is no matching redirected forwarding policy on R7, calculating SAV based on Tree-R7.

  According to Tree-R7, packets arrives R3 through **intf1** form R2.

  - **case2(green line):**

  There is a matching redirected forwarding policy on R7, the redirected path reaches R3 through intf2.

  Then **intf2** of R3 also needs to be the valid incoming interface of the packet from R1.



Next Steps

- Further analysis on redirected forwarding policy and protocol extension
- Further analysis about backup path
- Keep the terminology consistent with other drafts
- Any questions or comments are Welcomed
- Seeking for feedback