SRv6 Network Programming

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Introduction

"SRv6 network programming" refers to the capability for an application to encode any complex program as a set of individual functions distributed through the SRv6 network.

Introduction (2)

➢ This draft is the "key" SRv6 document that describes SRv6 network programming concepts, its various functions, and their use cases:

- Local-SID Functions, Transit Behavior

- Control Plane

- Counters, Security

- Use case illustrations

➢ Status:

- Larger community support (from vendors and operators)

- Multiple interoperable implementations

  - Open Software Projects: http://www.segment-routing.net/open-software/ (VPP 17.04 and Linux Kernel 4.10)

Local SID

➢ A local SID has a specific instruction bound to it.

➢ An SRv6-capable node N maintains a table containing all the local SRv6 segments explicitly instantiated at node N.

▪ N is the parent node for these SIDs.

➢ A local SID of N could be routed to N but it does not have to be. Most often, it is routed to N via a shorter-mask prefix.

Local SID (2)

➢ SRv6 local SID is represented as LOC:FUNCT

- LOC is the L most significant bits

- FUNCT is the (128-L) least significant bits.

- L is called the locator length and is flexible:

  - no assumption on size/length

➢ Most often the LOC part of the SID is routable and leads to the node which owns that SID.

➢ The FUNCT part of the SID is an opaque identification of a local function bound to the SID. Hence the name SRv6 "Local" SID.

- LOC:FUNCT:ARGS if function requires argument(s)

Local SID Functions

➢ This draft defines a set of well-known functions that can be associated with a local SID.

  ▪ For each function, packet processing algorithm is also documented at a high level

Local SID Functions (2)

Name	Forwarding	Use case
End *	Lookup	Prefix SID
End.X *	L3 Xconnect	Adj SID
End.T *	Lookup in table T	Multi-table operation in the core
End.DT6	Decap and IPv6 table T lookup	IPv6 L3VPN - Per-VRF
End.DT4	Decap and IPv4 table T lookup	IPv4 L3VPN - Per-VRF
End.DX6	Decap and IPv6 Xconn	IPv6 L3VPN - Per-CE
End.DX4	Decap and IPv4 Xconn	IPv4 L3VPN - Per-CE
End.DX2	Decap and L2 Xconn	L2VPN

*: With variants

Local SID Functions (3)

Name	Forwarding	Use case
End.B6	SRv6 policy	Binding SID
End.B6.Encaps	SRv6 policy (with encap)	Binding SID
End.BM	SR-MPLS policy	Binding SID
End.S	Search of a target (Locally forward or END behavior)	ICN
End.AS	Remove Outer IPv6 header and SRH, forward to interface	Service Chaining via an SR-unaware App
End.AM	Update Outer IPv6 header DA with LAST SID and forward to interface	Service Chaining via an SR-unaware App (with masquerade)

SRH Pop

➢ "SRH Pop" refers to removal (pop) of the "top" SRH in a received SRv6 packet at an endpoint.

➢ We define SRH popping for the following functions:

    ▪ End, End.X, and End.T

➢ Flavors:

    ▪ Two variants:

        • **Ultimate Segment Pop** (USP) : SRH Popped at last segment

        • **Penultimate Segment Pop** (PSP): SRH Popped at penultimate segment

    ▪ For each of the above End functions, these variants can be enabled or disabled either individually or together.

Transit Behaviors

➢ Transit node: A node that receives an IPv6/SRv6 packet whose DA is neither local address nor local SID

Namen	Behavior
T	Pure Transit
T.Insert	Insert an SRv6 policy
T.Encaps	Encap an SRv6 policy
T.Encaps.L2	Encap an SRv6 policy on L2 frame

Control Plane

➢ The following table summarizes which SID would be signaled in which signaling protocol

Name	IGP	BGP-IP/VPN	BGP-LS
End	X		X
End.X	X		X
End.T	X		X
End.DT6		X	X
End.DT4		X	X
End.DX6		X	X
End.DX4		X	X
End.DX2		X	X
End.BM			X
End.S			X
End.AS			X
End.AM			X
T			X
T.Insert			X
T.Encaps			X
T.Encaps.L2			X

Counters and Security

- Counters:
  - Local SID - Matched and processed correctly/incorrectly
  - SR policy – Steered into and processed correctly/incorrectly

- Security:
  - "How a domain of trust can operate SRv6-based services for internal traffic while preventing any external traffic from accessing these internal SRv6-based services."
  - Some mechanisms:
    - ACL on the external interface to drop any traffic with SA or DA in the internal SID space
    - ACL to prevent access to local SIDs from outside the operator's infrastructure
    - An SRv6 router MUST only implement the End behavior on a local IPv6 address if that address has been explicitly enabled as a segment (local SID)
    - Support Unicast-RPF on source address on external interface

Use Case Illustrations

- ➢ Basic Security

- ➢ SR-L3VPN

- ➢ SR-L2VPN-VPWS

- ➢ SRTE for Underlay SLAs
  - ▪ Policy @ ingress PE
  - ▪ Policy @ mid

- ➢ End-to-end SRTE policy

- ➢ TI-LFA

- ➢ SRTE for Service Chaining

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Draft: Next Steps

➢ Seeking WG input and feedback

➢ Comments and suggestions are welcomed !!!

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