IETF 106 – Singapore
6man Working Group

Deployments With Insertion of IPv6 Segment Routing Headers

draft-voyer-6man-extension-header-insertion-08

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Formerly:

Insertion of IPv6 Segment Routing Header in a Controlled Domain

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Changes

- Revision 7
  - Standards Track
  - Normative text for performing SRH insertion and removal within an SR Domain.
- Revision 8
  - Informational
  - Describes current deployments and implementations performing SRH insertion and removal within an SR Domain.

Who deploys SRv6 with SRH insertion? 6 publicly reported operators

- Softbank
- China Telecom
- Iliad
- China Unicom
- CERNET2
- MTN Uganda

Who supports SRH insertion and removal?
18 platforms, multiple vendors and open source

Cisco ASR 9000
Cisco NCS 5500
Cisco NCS 560
Cisco NCS 540
Cisco ASR1000

Broadcom Jericho 1
Broadcom Jericho 1+
Broadcom Jericho 2

Huawei ATN
Huawei CX600
Huawei NE40E
Huawei ME60
Huawei NE5000E
Huawei NE9000
Huawei NG-OLT MA5800

Marvell Prestera Falcon CX 8500 family

Linux kernel

FD.io VPP

Intel PAC N3000

SR Domains Encapsulate

All intra SR Domain packets are of the SR Domain. The IPv6 header is originated by a node of the SR Domain, and is destined to a node of the SR Domain.

All inter domain packets are encapsulated for the part of the packet journey that is within the SR Domain. The outer IPv6 header is originated by a node of the SR Domain, and is destined to a node of the SR Domain.

In other words, all packets within the SR domain have a source and destination address within the SR Domain.

But is the SR Domain Protected? Yes, we did that

```
The SR domain is secured as per Section 5.1 of
[I-D.ietf-6man-segment-routing-header] and no external packet can
enter the domain with a destination address equal to a segment of the
domain.
```

In other words, no node outside the SR domain may send packets to, nor make direct use of, segments within the SR domain.

The IP header of traffic traversing the SR Domain is not modified by the SR Domain

```
        + * * * * * * * * * * * * * * * * * * * +

        *                                       *
[1]----[3]--------[5]----------------[6]---------[4]---[2]
        *          |                  |           *
                   |                  |
        *          |                  |           *
                 [7]----------------[8]
        *                                       *

        + * * * * * * *  SR Domain  * * * * * * * +
```

A packet sent from 1 and destined to 2 is encapsulated in an outer IPv6 header between nodes 3 and 4.

Choosing an SRv6 SID Block

- For Example, obtain a GUA
  - e.g PPPP:PPP0::/28)
- Sub-allocate a block for SID allocation
  - e.g. PPPP:PPPB:BB00::/40
- Allocate a /64 SID locator to each node in the domain that needs to provide network instruction
  - e.g. node 4 gets PPPP:PPPB:BB00:0004::/64 as a SID locator

- We have experience automating this process

Protect the SR Domain

- Draft-ietf-6man-segment-routing-header defines how.
- filter external traffic entering the SR domain.
  - At ingress edge apply an ingress ACL
  - eg. drop DA in PPPP:PPPB:BB00::/40
- filter internal traffic.
  - On internal interfaces apply an ingress ACL
  - eg. drop DA in PPPP:PPPB:BB00:0004::/64 and SA not in PPPP:PPP0::/28

- We have experience automating this process

VPN Service

```
        + * * * * * * * * * * * * * * * * * * * +

        *                                       *
[1]----[3]--------[5]----------------[6]---------[4]---[2]
        *          |                  |           *
                   |                  |
        *          |                  |           *
                  [7]----------------[8]
        *                                       *

        + * * * * * * *  SR Domain  * * * * * * * +
```

- Node 3 – ingress PE
- Node 4 – egress PE
- Node 3 performs IPv6 encapsulation with a SID that will decapsulate the outer IP header (END.DX/DT)

TILFA

- SRH insertion
- The penultimate SID of the inserted SRH removes the SRH

SRH Insertion

- Where does SRH insertion occur?
  - At any node within the SR Domain
  - Insertion only occurs on the outer IPv6 header
  - Source and destination address are within the SR Domain

SRH Removal

- Where does SRH removal occur?
  - As per RFC8200
  - Always before leaving the SRH domain

MTU Planning

- Just like MPLS for the past 20 years

Conclusion

- SRH Insertion within an SR Domain is widely deployed.
  - Widely supported by vendor, custom and merchant silicon
- Deployments are expected to keep growing within the next few months.

Thank you