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Segment Routing Transport Profile Use Case
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Abstract

This document discusses the use case and requirement of segment routing is used in MPLS-TP network.

Status of This Memo

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1. Introduction

With the wide spread adoption of virtualization and cloud computing, the east-west traffic is greatly increased in the current MPLS-TP network. This trend brought the new requirements for the MPLS-TP networks:

(1) The access layer nodes should be meshed to provide the east-west traffic forwarding capability.

(2) The access nodes should support signaling protocol and maintain large volume of state for traffic engineering and tunnel connection, which is very challenging for the access nodes in the current MPLS-TP networks.

Segment Routing(SR)[I-D.ietf-spring-segment-routing] allows a node to steer a packet through a controlled set of instructions, called segments, by prepending an SR header to the packet. The transit nodes forward the packet based on the segment list, and do not need to maintain the service status. There is no need to run signaling protocol in the traffic engineering network, which simplifies the network deployment and operation. The Segment Routing architecture can be directly applied to the MPLS dataplane with no change on the forwarding plane [I-D.ietf-spring-segment-routing-mpls]. It requires a minor extension to the existing link-state routing protocols.

If the segment routing technology is deployed in the current MPLS-TP network, the challenge for the access layer nodes could be addressed. The access layer nodes only need to support IGP protocol (ISIS, OSPF), and they do not need to support signaling protocol and

maintain traffic engineering status and tunnel information, which simplifies the access layer nodes. The segment routing technology being deployed in the MPLS-TP network is referred to as SRTP technology. This document discusses uses case and requirements for the SR-TP.

2. Conventions used in this document

2.1. Terminology

SRTP: segment routing transport profile. The segment routing is deployed in the packet-switched transport networks.

2.2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in BCP 14 [RFC2119] [RFC8174] when, and only when, they appear in all capitals, as shown here.

3. SRTP Requirement

The requirement of SRTP are as following:

(1) It is required to support bi-direction tunnel to fit for the requirement of packet-switched transport networks. The SR nodes are required to announce the related capability and parameters information to the centralized controller.

(2) It is required to support SRTP loose constraints traffic engineering path for packet-switched transport networks.

(3) It is required to support SRTP strict constraints traffic engineering path for packet-switched transport networks. The data forwarding path is usually maintained by centralized controller.

4. SRTP Use Case

4.1. SRTP Scenario

Figure 1 is a typical SRTP deployment scenario. The SR nodes run IGP protocol extension for segment routing ([I-D.ietf-isis-segment-routing-extensions] or [I-D.ietf-ospf-segment-routing-extensions]), and flood the SR parameters to the network. The nodes maintain local SR information, and receiving the other nodes' SR information through IGP protocol.

They create the RIB and SR label forwarding table for traffic forwarding. A centralized controller can be used to configure and manage the nodes in the transport network. The segment routing nodes report their topology information to the centralized controller, e.g. through [I-D.ietf-idr-bgp-ls-segment-routing-ext]. The centralized controller creates the RIB and synchronizes the forwarding table among segment routing nodes. The centralized controller also calculates the end to end SR paths, and creates the ordered segment list, then downloads it to the ingress segment routing nodes.

Both the loose constraints path and strict constraints path are support in the packet-switched transport networks. The SRTP loose constraints path is usually used in the access rings or access and aggregation rings for the east-west data flows (the synchronized data among eNodeB) in the packet-switched transport, and the SRTP strict constraints path is usually used for the south-north data flows (e.g., the data from eNodeB to core network).

```
                               ************************
                               *                      *
                               *    Controller        *
                               *                      *
                               ************************
                                       /    ^
                                      /       \
                                     /         \
                                    v           \
                      +---+        +---+     +----+       +----+
                      |SR2|--------|SR3|     |SR9 |-------|SR10|
                      +---+        +---+     +----+       +----+
                      /               \     /                \
                     /                 \   /                  \
        +---+      +---+              +---+                  +----+
        |BS1|------|SR1|              |SR4|                  |SR11|
        +---+      +---+              +---+                  +----+
                    |                   |                      |
                    |                   |                      |
        +---+      +---+              +---+                  +----+
        |BS2|------|SR8|              |SR5|                  |SR12|
        +---+      +---+              +---+                  +----+
                     \                  /  \                  /
                      \                /    \                /
                      +---+        +---+     +----+       +----+
                      |SR7|--------|SR6|     |SR14|-------|SR13|
                      +---+        +---+     +----+       +----+
```

Figure 1 SRTP Scenario

4.2. SRTP Loose Constraints Path

Figure 2 shows the typical SRTP loose constraints path application scenario. A and F is the ingress SR node and egress node respectively, and D is the gateway of the access ring. The data traffic will be forwarded to go across access ring and aggregation ring from A to F. The F node's Node SID and D's Node SID are flooded in the access ring and aggregation ring (The access ring and aggregation ring belong to the same IGP area). Node A encapsulates the SID D and SID F in the segment routing data packet. The data traffic is forwarded along the best path from A to D, and then is forwarded from D to F.

In the SRTP loose constraints path mechanism, the SR nodes in the IGP area are assigned a global unique node SID, and all the SR nodes should run IGP protocol(ISIS OR OSPF) to advertise their Node SIDs.

The SR packets forwarding is based on the best route to the destination SR nodes calculated at each node.

```
                 +-----------+        +-----------+
                 |     B     |        |    SR     |
                 +-----------+        +-----------+
                 /             \      /             \
                /               \    /               \
           +-----+              +----+                +-----+
           | A   |              | C  |                |SR11 |
           +-----+              +----+                +-----+
             |                    |                      |
             |                    |                      |
           +---+                +---+                 +-------+
           |SR |                | D |                 |   F   |
           +---+                +---+                 +-------+
              \                  /   \                 /
               \                /     \               /
                +-------------+        +------------+
                |     SR      |        |      E     |
                +-------------+        +------------+

       +--------+   +--------+
       | node D |   | node D |
           +--------+   +--------+   +--------+  +--------+
           | node E |   | node E |   | node E |  | node E |
           +--------+   +--------+   +--------+  +--------+  +--------+
           |payload |   |payload |   |payload |  |payload |  |payload |
           +--------+   +--------+   +--------+  +--------+  +--------+
```

Figure 2 SRTP Loose Constraints Path

4.3. SRTP Strict Constraints Path

Figure 3 shows the SRTP strict constraints path. The SR nodes are assigned the Adjacent SIDs(local SID) by the centralized controller. The centralized controller collects the global topology and TE information, and calculates the end-to-end path based on the service requirement and the routing policy (minimum hop count, minimum delay, load balancing, etc.) to form the strictly constrained path. The ingress SR nodes (PE nodes) push the SID list to encapsulate the SR packet. The transit SR nodes (P nodes) forward the SR packets based on the SID list. Egress SR nodes (PE nodes) decapsulate the SR packet and forwards to the destination.

Because there is no label or only the last label in the MPLS label stack when the packet reaches the egress node, the egress node cannot

determine from which ingress node or SR path the packet comes. A path segment is introduced to address this issue(Section 5 for details).

```
                             +-----------+       +-----------+
                 |     A     |        |    SR     |
                 +-----------+        +-----------+
                 /             \      /             \
                / adj A    adj B\    /               \
           +-----+              +----+                +-----+
           | PE1 |              |  B |                |SR11 |
           +-----+              +----+                +-----+
             |                    |                      |
             |           adj C    |                      |
           +---+                +---+                 +-----+
           |SR |                | C |                 | PE2 |
           +---+                +---+                 +-----+
              \                  /   \ adj D            /
               \                /     \               / adj E
                +-------------+        +------------+
                |     SR      |        |      D     |
                +-------------+        +------------+

           +--------+
           | adj A  |
           +--------+   +--------+
           | adj B  |   | adj B  |
           +--------+   +--------+   +--------+
           | adj C  |   | adj C  |   | adj C  |
           +--------+   +--------+   +--------+
           | adj D  |   | adj D  |   | adj D  |
           +--------+   +--------+   +--------+  +--------+
           | adj E  |   | adj E  |   | adj E  |  | adj E  |
           +--------+   +--------+   +--------+  +--------+  +--------+
           |path SID|   |path SID|   |path SID|  |path SID|  |path SID|
           +--------+   +--------+   +--------+  +--------+  +--------+
           |payload |   |payload |   |payload |  |payload |  |payload |
           +--------+   +--------+   +--------+  +--------+  +--------+
```

Figure 3 SRTP Strict Constraints Path

5. Bi-direction SRTP Tunnel Binding

It is required to establish the bi-direction tunnel, for some use cases, such as end-to-end 1+1 path protection, bidirectional path correlation or performance measurement (PM) in MPLS-TP network . But the SR is a one direction tunnel, so when deploying the SR to packet-

switched transport networks, it is necessary to binding two direction tunnel as a bi-direction tunnel to meet the requirement of MPLS-TP. [I-D.cheng-spring-mpls-path-segment] provides the solution to binding the bi-direction SRTP tunnel.

6. Security Considerations

7. Acknowledgements

8. IANA Considerations

9. Normative References

[I-D.cheng-spring-mpls-path-segment]
Cheng, W., Wang, L., Li, H., Chen, M., Zigler, R., and S. Zhan, "Path Segment in MPLS Based Sement Routing Network", draft-cheng-spring-mpls-path-segment-00 (work in progress), October 2017.

[I-D.ietf-idr-bgp-ls-segment-routing-ext]
Previdi, S., Talaulikar, K., Filsfils, C., Gredler, H., and M. Chen, "BGP Link-State extensions for Segment Routing", draft-ietf-idr-bgp-ls-segment-routing-ext-04 (work in progress), January 2018.

[I-D.ietf-isis-segment-routing-extensions]
Previdi, S., Ginsberg, L., Filsfils, C., Bashandy, A., Gredler, H., Litkowski, S., Decraene, B., and J. Tantsura, "IS-IS Extensions for Segment Routing", draft-ietf-isis-segment-routing-extensions-15 (work in progress), December 2017.

[I-D.ietf-ospf-segment-routing-extensions]
Psenak, P., Previdi, S., Filsfils, C., Gredler, H., Shakir, R., Henderickx, W., and J. Tantsura, "OSPF Extensions for Segment Routing", draft-ietf-ospf-segment-routing-extensions-24 (work in progress), December 2017.

[I-D.ietf-spring-segment-routing]
Filsfils, C., Previdi, S., Ginsberg, L., Decraene, B., Litkowski, S., and R. Shakir, "Segment Routing Architecture", draft-ietf-spring-segment-routing-15 (work in progress), January 2018.

[I-D.ietf-spring-segment-routing-mpls]
Bashandy, A., Filsfils, C., Previdi, S., Decraene, B., Litkowski, S., and R. Shakir, "Segment Routing with MPLS data plane", draft-ietf-spring-segment-routing-mpls-12 (work in progress), February 2018.

[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, DOI 10.17487/RFC2119, March 1997, <https://www.rfc-editor.org/info/rfc2119>.

[RFC5654] Niven-Jenkins, B., Ed., Brungard, D., Ed., Betts, M., Ed., Sprecher, N., and S. Ueno, "Requirements of an MPLS Transport Profile", RFC 5654, DOI 10.17487/RFC5654, September 2009, <https://www.rfc-editor.org/info/rfc5654>.

[RFC5921] Bocci, M., Ed., Bryant, S., Ed., Frost, D., Ed., Levrau, L., and L. Berger, "A Framework for MPLS in Transport Networks", RFC 5921, DOI 10.17487/RFC5921, July 2010, <https://www.rfc-editor.org/info/rfc5921>.

[RFC8174] Leiba, B., "Ambiguity of Uppercase vs Lowercase in RFC 2119 Key Words", BCP 14, RFC 8174, DOI 10.17487/RFC8174, May 2017, <https://www.rfc-editor.org/info/rfc8174>.

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