PCE Working Group   D. Dhody
Internet-Draft   Q. Wu
Intended status: Standards Track   Huawei
Expires: September 7, 2015   March 6, 2015

        PCEP Extensions for service segment used in Segment Routing
                 draft-dw-pce-service-segment-routing-01

Abstract

   Segment Routing (SR) technology leverages the source routing and
   tunneling paradigms where a source node can choose a path without
   relying on hop-by-hop signaling.

   This document specifies extensions to the Path Computation Element
   Protocol (PCEP) that allow a stateful PCE to compute and instantiate
   SR-TE paths that also have a local service segments involved.

Status of This Memo

   This Internet-Draft is submitted in full conformance with the
   provisions of BCP 78 and BCP 79.

   Internet-Drafts are working documents of the Internet Engineering
   Task Force (IETF). Note that other groups may also distribute
   working documents as Internet-Drafts. The list of current Internet-
   Drafts is at http://datatracker.ietf.org/drafts/current/.

   Internet-Drafts are draft documents valid for a maximum of six months
   and may be updated, replaced, or obsoleted by other documents at any
   time. It is inappropriate to use Internet-Drafts as reference
   material or to cite them other than as "work in progress."

   This Internet-Draft will expire on September 7, 2015.

Table of Contents

1. **Introduction**

   Segment Routing (SR) enables Traffic Engineering (TE) without relying
   on a hop-by-hop signaling. It depends only on "segments" that are
   advertised by Interior Gateway Protocols (IGPs). These segments made
   by -

   o Node Segment

   o Adjacency Segment

   o Anycast Segment

   o IGP-Prefix Segment

   Further to this list, a segment may also be identify a particular
   value added service or service function (SF).
   [I-D.filsfils-spring-segment-routing-use-cases] describes using local
   Service-Segment to stand for a BGP-VPN service in an example. A
   service-segment may also be used to represent specific treatment
   offered by SR enabled node(s) in the path, a combination of node-
   segment and service-segment can be used. The service segment is
   local to the SR enabled node.

A stateful PCE can be used for computing one or more SR-TE paths
taking into account various constraints and objective functions.
Once a path is chosen, the stateful PCE can instantiate an SR-TE path
on a PCC using PCEP extensions specified in
[I-D.ietf-pce-segment-routing].

An SR-TE path is defined as a path that consists of one or more
SID(s) where each SID is associated with the identifier that
represents the node or adjacency corresponding to the SID. This
document extends the SR-TE path to use Service-SID(s) in the path as
well.

The means by which the PCE learns about the Service-SID (e.g., learnt
over a management interface or through a variety of other mechanisms)
is beyond scope of this document.

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 [RFC2119].

2.1. Terminology

The following terminologies are used in this document:

ERO: Explicit Route Object

IGP: Interior Gateway Protocol

LSR: Label Switching Router

PCC: Path Computation Client

PCE: Path Computation Element

PCEP: Path Computation Element Protocol

SF: Service Function

SFC: Service Function Chaining

SID: Segment Identifier

SR: Segment Routing

SR-ERO: Segment Routed Explicit Route Object

SR Path: Segment Routed Path

SR-TE: Segment Routed Traffic Engineering

[3](). Overview of PCEP Operation in SR Networks for Service Chaining

In SR networks, an ingress node of an SR path appends all outgoing packets with an SR header consisting of a list of Segment IDs (SIDs). The header has all necessary information to guide the packets from the ingress node to the egress node of the path, and hence there is no need for any signaling protocol. In the [I-D.ietf-pce-segment-routing], an SID represents either a nodal segment representing a path to a node or adjacency segment representing path over a specific adjacency. In this document,we allow SID also can represent a service segment representing a specific treatment or SF.

In a PCEP session, path information is carried in the Explicit Route Object (ERO), which consists of a sequence of subobjects. In this document, a PCE needs to specify EROs containing SID of service segments (or service-SID), and a PCC needs to be capable of processing such ERO sub-objects.

The SR-ERO Subobject defined in the [I-D.ietf-pce-segment-routing] can be used to carry SID of service segment. An SR-ERO containing SID of service segment can be included in the same PCEP messages specified in the [I-D.ietf-pce-segment-routing].

When a PCEP session between a PCC and a PCE is established, the corresponding PCEP operation is same as defined in the [I-D.ietf-pce-segment-routing].

[4](). Object Formats

In the [I-D.ietf-pce-segment-routing], an SR-TE path is defined as a path that consists of one or more SID(s) where each SID is associated with the identifier that represents the node or adjacency corresponding to the SID. In this document, we allow the SR-TE path to include one or more SID of service segments (called service-SID) that are inserted along with node segments in SR-TE path. A service-segment may also be used to represent a set of SF instances. The service-SID is local to the node where the service resides, thus a combination of node-segment and service-segment are used together.

4.1. The SR-ERO Subobject extension for service segment support

   The SR-ERO Subobject is defined in section 5.3.1 of
   [I-D.ietf-pce-segment-routing] and as an mandatory subobject used to
   advertise SID and NAI ('Node or Adjacency Identifier') associated
   with SID. In this document, we extend the existing SR-ERO Subobject
   as specified in section 5.3.1 of [I-D.ietf-pce-segment-routing] to
   represent service-SID of the service segment.

   The SR-ERO Subobject as described in [I-D.ietf-pce-segment-routing]:

```
 0                   1                   2                   3
 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|L|    Type     |     Length    | ST    |     Flags     |F|S|C|M|
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                              SID                              |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
//                         NAI (variable)                      //
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

   L

      The L bit SHOULD NOT be set, so that the subobject represents a
      strict hop in the explicit route in case of service-segment.

   Type

      The Type is as per [I-D.ietf-pce-segment-routing].

   Length

      The Length is as per [I-D.ietf-pce-segment-routing].

   ST

      The ST (SID Type) field is set to specify service-SID. A new SID-
      Type values is to be assigned.

   Flags

      All flags (M, C, S, F bit) are as per
      [I-D.ietf-pce-segment-routing].

SID

    The SID value represents an service segment as described in
[I-D.filsfils-spring-segment-routing-use-cases].

NAI

    The NAI for service-segment may be defined in future based on the
service.

4.2. Service Segment SR-ERO Processing

When the SID represents a service segment (as per the SID Type - ST
field), its value is local to node segment offering the service.
Thus Service-SID MUST be associated with a node-SID preceding it in
the SR-ERO. Note that multiple services may be offered by the same
node, and in this case node-SID maybe followed by multiple Service-
SID. NAI value for service-SID may be defined in future.

If a service segment (or service-SID) cannot be associated with a
node segment (or node-SID), PCEP speaker MUST send a PCE error with
Error-Type = "Reception of an invalid object" and Error-Value
="Segment List Order Error".

The rest of the processing rules are as per
[I-D.ietf-pce-segment-routing].

5. Backward Compatibility

Backward Compatibility consideration described in section 8 of
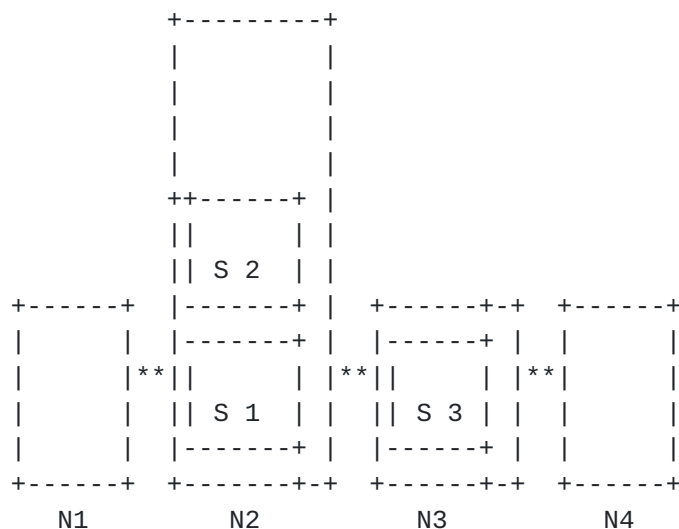[I-D.ietf-pce-segment-routing] can be applied for service segment
support as well.

6. Management Considerations

Management consideration described in section 9 of
[I-D.ietf-pce-segment-routing] can be applied to service segment
support as well.

7. Security Considerations

The security considerations described in [RFC5440] and
[I-D.ietf-pce-segment-routing] apply.

8. IANA Considerations

   TBD.

9. References

9.1. Normative References

   [I-D.ietf-pce-segment-routing]
              Sivabalan, S., Medved, J., Filsfils, C., Crabbe, E.,
              Raszuk, R., Lopez, V., and J. Tantsura, "PCEP Extensions
              for Segment Routing", draft-ietf-pce-segment-routing-00
              (work in progress), October 2014.

   [RFC2119] Bradner, S., "Key words for use in RFCs to Indicate
              Requirement Levels", BCP 14, RFC 2119, March 1997.

9.2. Informative References

   [I-D.filsfils-spring-segment-routing-use-cases]
              Filsfils, C., Francois, P., Previdi, S., Decraene, B.,
              Litkowski, S., Horneffer, M., Milojevic, I., Shakir, R.,
              Ytti, S., Henderickx, W., Tantsura, J., Kini, S., and E.
              Crabbe, "Segment Routing Use Cases", draft-filsfils-
              spring-segment-routing-use-cases-01 (work in progress),
              October 2014.

Appendix A. Examples

   Consider the below example-

```
            +---------+
            |         |
            |         |
            |         |
            |         |
           ++------+  |
           ||      |  |
           || S 2  |  |
   +------+ |------+ |   +------+-+  +------+
   |      | |------+ |   |------+ |  |      |
   |      |**||      | |**||      | |**|      |
   |      | || S 1  | | || S 3 | |  |      |
   |      | |------+ |   |------+ |  |      |
   +------+  +------+-+  +------+-+  +------+
      N1         N2         N3         N4
```

   o N1 is Ingress;

   o N4 is Egress;

   o N2 has two services hosted identified as S1 and S2;

   o N3 hase one service hosted identified as S3.

   The SR-ERO for the SR-TE path including the service segment would be
   -

   [{SID_N2, SID_S1, SID_S2}, {SID_N3, SID_S3}, {SID_N4}]

Authors' Addresses

   Dhruv Dhody
   Huawei
   Divyashree Techno Park, Whitefield
   Bangalore, Karnataka 560037
   India

   Email: dhruv.ietf@gmail.com

   Qin Wu
   Huawei
   101 Software Avenue, Yuhua District
   Nanjing, Jiangsu 210012
   China

   Email: bill.wu@huawei.com