PCE Working Group   Zafar Ali
Internet Draft   Siva Sivabalan
Intended status: Standard Track   Clarence Filsfils
Expires: April 20, 2014   Cisco Systems
                                                   Robert Varga
                                          Pantheon Technologies
                                                   Victor Lopez
                                        Oscar Gonzalez de Dios
                                                 Telefonica I+D
                                                     Xian Zhang
                                                         Huawei
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          Path Computation Element Communication Protocol (PCEP)
                Extensions for remote-initiated LSP Usage
             draft-ali-pce-remote-initiated-lsp-usage-00.txt

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Abstract

When active stateful PCE is used for managing PCE-initiated LSP,
PCC may not be aware of the intended usage of the LSP (e.g., in a
multi-layer network). PCEP Extensions for PCE-initiated MPLS and
GMPLS LSP Setup specifications do not address this requirement.
This draft addresses the requirement to specify on how PCC should
use the remote initiated LSPs.

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 RFC 2119
[RFC2119].

Table of Contents

1. Introduction

   [I-D. draft-crabbe-pce-pce-initiated-lsp] and [I-D. draft-ali-
   pce-remote-initiated-gmpls-lsp] describe the setup and teardown
   of PCE-initiated MPLS and GMPLS LSPs under the active stateful
   PCE model, without the need for local configuration on the PCC,
   thus allowing for a dynamic network that is centrally controlled
   and deployed. However, when an active stateful PCE is used for
   managing remote-initiated MPLS or GMPLS LSP, the PCC may not be
   aware of the intended usage of the remote-initiated LSP. For
   example, the PCC may not know the target IGP instance in which
   the remote-initiated LSP is to be used. These requirements are
   outlined in Section 3.

   This draft addresses the requirement to specify on how PCC
   should use the PCEP initiated LSPs. This is achieved by using
   LSP_TUNNEL_INTERFACE_ID Object defined in [RFC6107] in PCEP, as
   detailed in Section 4. PCEP extensions specified in this
   document are equally applicable to PCEP initiated MPLS as well
   as GMPLS LSPs.

2. Use Cases

2.1. Bandwidth-on-demand

   This use case assumes there is a multi-layer network composed by
   routers and optical equipment. In this scenario, there is an
   entity, which decides it needs extra bandwidth between two
   routers. This certain moment a GMPLS LSP connecting both routers
   via the optical network can be established on-the-fly. This
   entity can be a router, an active stateful PCE or even the NMS
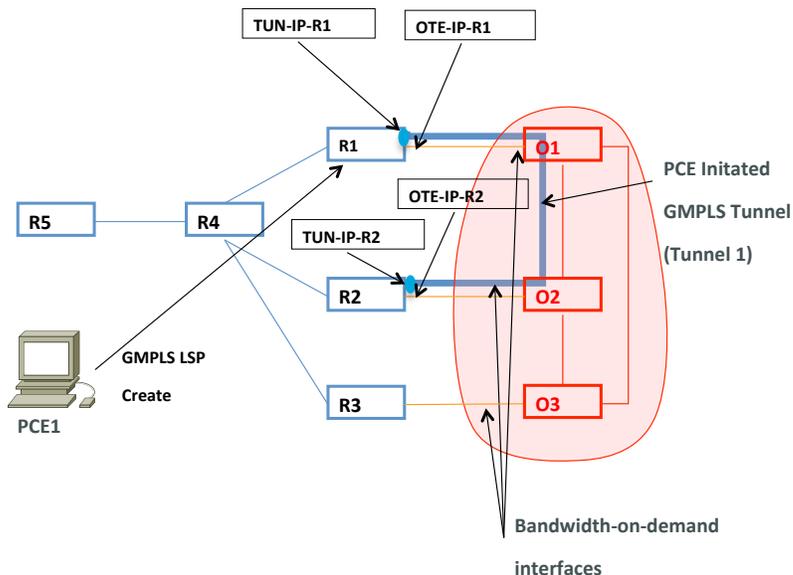   (with or without human intervention).

Figure 1. Bandwidth on demand use case

It is important to note that the bandwidth-on-demand interfaces
and spare bandwidth in the optical network could be shared to
cover many under capacity scenarios in the L3 network. For
example, in this use-case, if we assume all interfaces are 10G
and there is 10G of spare bandwidth available in the optical
network, the spare bandwidth in the optical network can be used
to connect any router, depending on bandwidth demand of the
router network. For example, if there are three routers, it is
not known a priori if the demand will make bandwidth-on-demand
interface at R1 to be connected to bandwidth-on-demand interface
at R2 or R3. For this reason, bandwidth-on-demand interfaces
cannot be pre-provisioned with the IP services that are expected
to carry. Furthermore, in this example, as active stateful PCE
is used for managing PCE-initiated LSP, PCC may not be aware of
the intended usage of the PCE-initiated LSP. Specifically, when
the PCE1 initiated GMPLS tunnel1, PCC does not know the IGP
instance whose demand leads to establishment of the GMPLS
tunnel1 and hence does not know the IGP instance in which the
GMPLS tunnel1 needs to be advertised. Similarly, the PCC does
not know IP address that should be assigned to the GMPLS
tunnel1. In the above example, this IP address is labeled as
TUN-IP-R1 (tunnel IP address at R1). The PCC also does not know
if the tunnel needs to be advertised as forwarding and/ or
routing adjacency and/or to be locally used by the target IGP
instance. Similarly, egress node for GMPLS signaling (R2 node in
this example) may not know the intended usage of the tunnel
(tunnel1 in this example). For example, the R2 node does not
know IP address that should be assigned to the GMPLS tunnel1. In
the above example, this IP address is labeled as TUN-IP-R2

   (tunnel IP address at R2). Section 4 of this draft addresses the
   requirement to specify on how PCC and egress node for signaling
   should use the remote initiated LSPs.

3. Remote Initiated LSP Usage Requirement

   The requirement to specify usage of the LSP to the PCC includes
   but not limited to specification of the following information.

   - The target IGP instance for the Remote-initiated LSP needs to
      be specified.

   - In the target IGP instance, should the PCE-initiated LSP be
      advertised as a forwarding adjacency and/ or routing adjacency
      and/ or to be used locally by the PCC?

   - Should the as Remote-initiated LSP be advertised an IPv4 FA/
      RA, IPv6 FA/ RA or as unnumbered FA/ RA.

   - If Remote-initiated LSP is to be advertised an IPv4 FA/ RA,
      IPv6 FA/ RA, what is the local and remote IP address is to be
      used for the advertisement.

4. PCEP extension for PCEP Initiated LSP Usage Specification

   The requirement to specify on how PCC should use the PCEP
   initiated LSPs in outlined in Section 2. This subsection
   specifies PCEP extension used to satisfy this requirement.

4.1. LSP_TUNNEL_INTERFACE_ID Object in LSP Initiate Message

   [RFC6107] defines LSP_TUNNEL_INTERFACE_ID Object for
   communicating usage of the forwarding or routing adjacency from
   the ingress node to the egress node. This document extends the
   LSP Initiate (PCInitiate) Message to include
   LSP_TUNNEL_INTERFACE_ID object defined in [RFC6107]. Object
   class and type for the LSP_TUNNEL_INTERFACE_ID object are as
   follows:

   Object Name: LSP_TUNNEL_INTERFACE_ID

   Object-Class Value: TBA by Iana (suggested value: 40)

   Object-type: 1

   The contents of this object are identical in encoding to the
   contents of the RSVP-TE LSP_TUNNEL_INTERFACE_ID object defined
   in [RFC6107] and [RFC3477]. The following TLVs of RSVP-TE
   LSP_TUNNEL_INTERFACE_ID object are acceptable in this object.
   The PCEP LSP_TUNNEL_INTERFACE_ID object's TLV types correspond
   to RSVP-TE LSP_TUNNEL_INTERFACE_ID object's TLV types. Please

note that use of TLV type 1 defined in [RFC3477] is not
specified by this document.

```
TLV   TLV
Type  Description                                         Reference
--    -------------------------------------------------- ----------
2   IPv4 interface identifier with target IGP instance [RFC6107]

3   IPv6 interface identifier with target IGP instance [RFC6107]

4   Unnumbered interface with target IGP instance      [RFC6107]
```

The meanings of the fields of PCEP LSP_TUNNEL_INTERFACE_ID
object are identical to those defined for the RSVP-TE
LSP_TUNNEL_INTERFACE_ID object. Similarly, meanings of the
fields of PCEP LSP_TUNNEL_INTERFACE_ID object's supported TLV
are identical to those defined for the corresponding RSVP-TE
LSP_TUNNEL_INTERFACE_ID object's TLVs. The following fields have
slightly different usage.

-   IPv4 Interface Address field in IPv4 interface identifier
    with target IGP instance TLV: This field indicates the local
    IPv4 address to be assigned to the tunnel at the PCC (ingress
    node for RSVP-TE signaling). In the example use case of
    Section 2, IP address TUN-IP-R1 (tunnel IP address at R1) is
    carried in this field (if TUN-IP-R1 is a v4 address).

-   IPv6 Interface Address field in IPv4 interface identifier
    with target IGP instance TLV: This field indicates the local
    IPv6 address to be assigned to the tunnel at the PCC (ingress
    node for RSVP-TE signaling).

-   LSR's Router ID field in Unnumbered interface with target IGP
    instance: The PCC SHOULD use the LSR's Router ID in Unnumbered
    interface with target IGP instance in advertising the LSP
    being initiated by the PCE.

-   Interface ID (32 bits) field in unnumbered interface with
    target IGP instance: All bits of this field MUST be set to 0
    by the PCE server and MUST be ignored by PCC. PCC SHOULD
    allocate an Interface ID that fulfills Interface ID
    requirements specified in [RFC3477].

When the Ingress PCC receives an LPS Request Message with
LSP_TUNNEL_INTERFACE_ID TLV, it uses the information contained
in the TLV to drive the IGP instance, treatment of the LSP being
initiated in the target IGP instance (e.g., FA, RA or local
usage), the local IPv4 or IPv6 address or router-id for
unnumbered case to be used for advertisement of the LSP being
instantiated.

4.2. Communicating LSP usage to Egress node

   PCE does not need to send LSP Initiate message to egress node to
   communicate LSP usage information. Instead PCC (Ingres signaling
   node) uses RSVP-TE signaling mechanism specified in [RFC6107] to
   send the LSP usage to Egress node. Specifically, when the
   Ingress PCC receives an LPS Request Message with
   LSP_TUNNEL_INTERFACE_ID TLV, it SHOULD add
   LSP_TUNNEL_INTERFACE_ID object in RSVP TE Path message. For this
   purpose, it is RECOMMENDED that the ingress PCC use content of
   the LSP_TUNNEL_INTERFACE_ID TLV in LSP Initiate Message in PCEP
   to drive LSP_TUNNEL_INTERFACE_ID object in RSVP-TE. This
   document does not modify usage of LSP_TUNNEL_INTERFACE_ID Object
   in RSVP-TE signaling as specified in [RFC6107].

   The egress node uses information contained in the
   LSP_TUNNEL_INTERFACE_ID object in RSVP-TE Path message to drive
   the IGP instance, treatment of the LSP being initiated in the
   target IGP instance (e.g., FA, RA or local usage), the local
   IPv4 or IPv6 address or router-id for unnumbered case to be used
   for advertisement of the LSP being instantiated.

5. Security Considerations

   To be added in future revision of this document.

6. IANA Considerations

6.1. END-POINT Object

   This document extends the LSP Initiate Message to include
   LSP_TUNNEL_INTERFACE_ID object defined in [RFC6107]. Object
   class and type for the LSP_TUNNEL_INTERFACE_ID object are as
   follows:

Name	Class value	Type
LSP_TUNNEL_INTERFACE_ID	TBA by Iana (Suggested:40)	1

7. Acknowledgments

   The authors would like to thank George Swallow and Jan Medved
   for their comments.

8. References

8.1. Normative References

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[RFC3477] Kompella, K. and Y. Rekhter, "Signalling Unnumbered
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8.2. Informative References

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Authors' Addresses

    Zafar Ali
    Cisco Systems
    Email: zali@cisco.com

    Siva Sivabalan
    Cisco Systems
    Email: msiva@cisco.com

    Clarence Filsfils
    Cisco Systems
    Email: cfilsfil@cisco.com

    Robert Varga
    Pantheon Technologies

    Victor Lopez
    Telefonica I+D
    Email: vlopez@tid.es

    Oscar Gonzalez de Dios

   Telefonica I+D
   Email: ogondio@tid.es

   Xian Zhang
   Huawei Technologies
   Email: zhang.xian@huawei.com