PCE extension to support reporting of dynamic tunnels
draft-paul-pce-dynamic-tunnel-00

Abstract

In a SDN environment, path computation element protocol (PCEP) (RFC 5440) is used between a controller and the network devices, using which controller can setup and tear down Resource ReserVation Protocol (RSVP) based label switched paths (LSPs) in the network having Path Computation Client (PCC) as Label Switched Router (LSR). In an environment where dynamic tunnels are used to provide MPLS based customer services instead of a Label Switched Path, the specifications lack a method to report the Dynamic tunnels over PCEP session to PCE. This draft defines a method to advertise the dynamic tunnels via PCEP session to PCE.

This document proposes new object TLV that can be used to report dynamic tunnels to the PCE.

Status of This Memo

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

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This Internet-Draft will expire on March 8, 2018
1. Introduction

As described in [RFC5440], PCEP can be used to create, modify or delete LSPs between PCCs. PCEP can be used to create, modify and delete RSVP and segment routing LSPs between PCCs. This document specifies the way to report the dynamic nexthop based tunnels from PCC to PCE server. This is helpful for PCE to have complete visibility of the network and help take intelligent decisions based on the information available to it.
In this draft a method to report dynamic tunnels from PCC via PCEP is outlined. This document proposes one new pcep objects to carry the tunnels attributes for individual dynamic tunnels. Since only reporting of dynamic tunnels is outlined here, only dynamic tunnel object and well-known metric objects are being carried in PCRpt [RFC8231] of PCEP message in order to report the dynamic tunnel to PCE.

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].

3. Motivation

PCEP protocol lacks the capability to report dynamic-tunnels e.g, MPLS over UDP and MPLS over GRE to the PCE. In the SDN scenario where a controller uses the information provided by PCEP to gain network visibility, adding the report capability of dynamic-tunnel via PCEP helps controller gain additional insights about network tunnels.

4. Overview of Protocol Extensions

4.1. Capability Advertisement

During the PCEP session initialization phase, PCEP speakers (PCE or PCC) advertise their support of dynamic tunnel report capability. A PCEP speaker includes the "STATEFUL-PCE-CAPABILITY TLV", described in Section 7.1.1, in the OPEN object to advertise its support for PCEP
Stateful PCE extensions. The STATEFUL-PCE-CAPABILITY TLV includes the 'Dynamic Tunnel Report' flag that indicates whether the PCEP speaker supports Dynamic Tunnel report capability.

One new flag is added in this document:

D (DYNAMIC-TUNNEL-REPORT bit - TBD): if set to 1 by a PCC, the D Flag indicates that the PCC is willing to send Dynamic Tunnel State Reports whenever dynamic tunnel state changes.; if set to 1 by a PCE, the D Flag indicates that the PCE is interested in receiving Dynamic Tunnel State Reports whenever dynamic tunnel state changes. The DYNAMIC-TUNNEL-REPORT Flag must be advertised by both a PCC and a PCE for PCRpt messages DYNAMIC-TUNNEL-REPORT extension to be allowed on a PCEP session.

4.2 Dynamic-Tunnel Object

Path Computation State Report (PCRpt): a PCEP message sent by a PCC to a PCE to report the status of one or more LSPs. Each LSP State Report in a PCRpt message MAY contain the actual LSP’s path, bandwidth, operational and administrative status, etc. An LSP Status Report carried on a PCRpt message is also used in delegation or revocation of control of an LSP to/from a PCE. The PCRpt message is described in Section 6.1.

One new object is defined in order to report dynamic tunnels to PCE.

The Dynamic-Tunnel object MUST be present within PCRpt messages while reporting dynamic tunnel. The LSP object contains a set of fields used to specify the target LSP, the operation to be performed on the LSP, and LSP delegation. It also contains a flag indicating to a PCE that the LSP State Synchronization is in progress. This document focuses on MPLS Tunnels that run over UDP or GRE.

Dynamic tunnel Object-Class is TBD.

Dynamic tunnel Object-Type is TBD.
The format of the Dynamic-Tunnel object body is shown in Figure 1:

```
+---------------+---------------+---------------+---------------+
| Tunnel-ID     | Flag | O | R | S |
+---------------+---------------+---------------+---------------+
+---------------+---------------+---------------+---------------+
// TLVs         //
+---------------+---------------+---------------+---------------+
```

Figure 1: The LSP Object format

Tunnel-ID (20 bits): A PCEP-specific identifier for the Dynamic Tunnel. A PCC creates a unique Tunnel-ID for each dynamic tunnel that is constant for the lifetime of a PCEP session. The PCC will advertise the same Tunnel-ID on all PCEP sessions it maintains at a given time. There will not be any name associated with dynamic-tunnel, so no mapping between Tunnel-ID and tunnel name is maintained. If needed PCE can maintain mapping of Tunnel-ID with source and destination of dynamic tunnels.

All subsequent PCEP messages then address the LSP by the Tunnel-ID. The values of 0 and 0xFFFFF are reserved. Note that the Tunnel-ID is a value that is constant for the lifetime of the PCEP session.

Flags (12 bits), starting from the least significant bit:

S (SYNC - 1 bit): The S flag MUST be set to 1 on each PCRpt sent from a PCC during State Synchronization. The S flag MUST be set to 0 in other messages sent from the PCC.

R (Remove - 1 bit): On PCRpt messages, the R flag indicates that the Dynamic tunnel has been removed from the PCC and the PCE SHOULD remove all state from its database. Upon receiving an Dynamic tunnel State Report with the R flag set to 1 for a Dynamic tunnel, the PCE SHOULD remove all state for the path identified by the IPV4-TUNNEL-IDENTIFIERS
TLV from its database.

O (Operational - 3 bits): On PCRpt messages, the O field represents the operational status of the LSP.

The following values are defined:

0 - DOWN: not active.
1 - UP: signaled.
2 - ACTIVE: up and carrying traffic.
3-7 - Reserved: these values are reserved for future use.

Unassigned bits are reserved for future uses. They MUST be set to 0 on transmission.

TLVs that may be included in the Dynamic-Tunnel object are described in the following sections.

4.2.1 IPV4-TUNNEL-IDENTIFIERS TLV

The format of the IPV4-TUNNEL-IDENTIFIERS TLV is shown in the following figure:

```
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
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|           Type=[TBD]          |           Length=16           |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   IPv4 Tunnel Source Address                  |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                   IPv4 Tunnel Destination Address             |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
|                        Tunnel Type                            |
+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+-+
```

Figure 2: IPV4-TUNNEL-IDENTIFIERS TLV Format
The type of the TLV is to be assigned by IANA and it has a fixed length of 2 octets.

IPv4 Tunnel Source Address: contains the tunnel’s source IPv4 address

IPv4 Tunnel Destination Address: contains the tunnel’s destination IPv4 address

Tunnel Type: Defines the tunnel type. This draft assigns MPLSoUDP a numeric value of 1 and MPLSoGRE a numeric value of 2.

4.3 Metric Object

This object is already defined in [RFC5440]. It can be reused and metric type should be set to value 1 which signifies IGP metric.

5. Backward Compatibility Consideration

A PCE that does not support the new capability will not bring up the session during initialization phase.

6. Management Considerations

Not needed.

7. Security Considerations

This document raises no new security issues.

8. IANA Considerations

IANA is requested to allocate a Type for this new object to support dynamic tunnel reporting.
9. References

9.1. Normative References

[draft-crabbe-pce-pce-initiated-lsp] E. Crabbe, "PCEP Extensions for PCE-initiated LSP Setup in a Stateful PCE Model"

[draft-sivabalan-pce-segment-routing] E. Crabbe, "PCEP Extensions for Stateful PCE"

9.2. Informative References


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