

PCE Working Group
Internet-Draft
Intended status: Standards Track
Expires: 2 September 2026

L. Han
H. Huang
M. Wang
CMCC
J. Zhou
ZTE
L. Zhang
Huawei
1 March 2026

Path Computation Element Communication Protocol (PCEP) Extension for
Fine Granularity Metro Transport Network (fgMTN) Path Setup
draft-han-pce-fgmtn-setup-00

Abstract

This document focuses on the PCEP extension for G.8312 fine granularity metro transport network. It provides the PCEP considerations on the path setup requirements of PCEP extension in fgMTNP.

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 <https://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 2 September 2026.

Copyright Notice

Copyright (c) 2026 IETF Trust and the persons identified as the document authors. All rights reserved.

This document is subject to BCP 78 and the IETF Trust's Legal Provisions Relating to IETF Documents (<https://trustee.ietf.org/license-info>) in effect on the date of publication of this document. Please review these documents carefully, as they describe your rights

and restrictions with respect to this document. Code Components extracted from this document must include Revised BSD License text as described in Section 4.e of the Trust Legal Provisions and are provided without warranty as described in the Revised BSD License.

Table of Contents

1. Introduction	2
2. Requirements Language	3
3. Terminology	3
4. Overview of PCEP Extension in fgMTNP Network	3
5. Object Formats	4
5.1. The OPEN Object	4
5.1.1. The Path Setup Type Capability TLV	4
5.1.2. The fgMTN PCE Capability Sub-TLV	5
5.2. The RP/SRP Object	5
5.3. The LSP Object	5
5.4. The ERO Object	6
5.4.1. FgMTN-ERO Subobject	6
5.5. The BANDWIDTH Object	6
6. Deployment Considerations	7
7. Security Considerations	7
8. IANA Considerations	7
9. Acknowledgments	7
10. Normative References	7
Authors' Addresses	9

1. Introduction

With the development of transport networks, TDM-based Metro transport network (MTN) is being extended to fine granularity, enabling the provisioning of flexible N*10 Mbps bandwidths for clients.

ITU-T published a series of fgMTN Recommendations which includes the fgMTN overview [ITU-T_G.8312.20], the fgMTN layer architecture defined in [ITU-T_G.8310], fgMTN interface defined in [ITU-T_G.8312], fgMTN equipment defined in [ITU-T_G.8321]. The fgMTNP serves as a client of the MTN Path layer, providing sub-1G services for Ethernet MAC frames and CBR clients. Compared to conventional MTNP (N*5Gbps) bandwidth, fgMTNP significantly increases the number of LSPs in metro network.

Managing such a massive number of fine-grained channels presents major control and management challenges, especially in efficiently establishing and maintaining numerous LSPs. A PCE-based path computation mechanism help to address these issues.

This document specifies a set of extensions to carry the fgMTNP path information in PCEP message.

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. Terminology

fgCS:

Fine Grain Calendar Slot

fgMTNP:

Fine Granularity Metro Transport Network Path Layer

MTN:

Metro Transport Network

4. Overview of PCEP Extension in fgMTNP Network

As described in [I-D.han-pce-path-computation-fg-transport], to address the massive fgMTN path computation issues, it's necessary to hybrid centralized control and distributed control architecture. The centralized control PCE is used to calculate the routing and left the resource allocation to device itself. The path computation results are delivered to ingress node to let distributed control protocols between devices to perform operations of resource (e.g. fine grain calendar slots) allocation and cross connection configuration.

[RFC5440] describes the Path Computation Element Communication Protocol (PCEP) for communication between a Path Computation Client (PCC) and a Path Computation Element (PCE). A PCE computes paths based on various constraints and optimization criteria. [RFC8231] specifies PcrPt and PCUpd messages to enable stateful control of TE LSPs, whereby LSPs are configured on the PCC and control over them is delegated to the PCE. [RFC8281] introduces the PCInitiated message which a PCE can send to a PCC to request the initiation or deletion of an LSP. All of the PCEP mechanism can be applied to path computation of fgMTNP layer network.

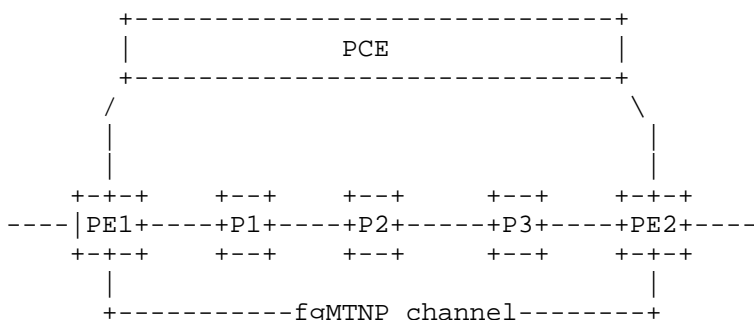


Figure 1: Scenario of fgMTNP channel

As shown in Figure 1, the PCE communication protocol can be extended to meet the communication between PCE and PCC according to [RFC4655]. The path calculation is in a centralized way and sends path information to the PE1. At the same time, fgMTN LSP routing information is carried by the explicit route object (ERO) in the PCEP message. The ERO consists of a series of sub-objects.

Then, the fgMTNP channel is established between devices through control signaling. The topology and fgCS resource information of devices are collected and reported to PCE through traditional IGP protocols, BGP-LS, or centralized PCEP-LS.

For the fgCS resource allocation, since there may be as many as 480 or 960 serices or 480 or 960 fgCSs for one fgMTNP, centralized PCE resource allocation would be inefficient. Moreover, given the flexibility of fgMTN channel, it may be frequently created, deleted, or modified. The mechanism of device itself allocation may be appropriate for the fgCSs allocation.

The extensions specified in this document complement the existing PCEP specifications to support fgMTN paths. As such, the PCEP messages (e.g., PCReq, PCRep, PCRpt, PCUpd, PCInitiate, etc.) are formatted according to [RFC5440], [RFC8231], [RFC8281], and any other applicable PCEP specifications.

5. Object Formats

5.1. The OPEN Object

5.1.1. The Path Setup Type Capability TLV

[RFC8408] defines the PATH-SETUP-TYPE-CAPABILITY TLV for use in the OPEN object. The fgMTN paths computed by a PCE can be represented in an ENO as an ordered sets of adjacency identity.

5.1.2. The fgMTN PCE Capability Sub-TLV

This document defines a new Path Setup Type (PST) for fgMTNP, as follows:

PST = TBD1: Traffic-engineering path is set up for fgMTN LSP.

A PCEP speaker SHOULD indicate its support of the function described in this document by sending a PATH-SETUP-TYPE-CAPABILITY TLV in the OPEN object with this new PT included in the PST list.

5.2. The RP/SRP Object

To set up an fgMTN LSP, the RP or SRP object MUST include the PATH-SETUP-TYPE TLV, specified in [RFC8408], with the PST set to TBD1.

5.3. The LSP Object

The LSP object specified in [RFC8231] can be used for fgMTN LSP. The 12bits Flags are reused for fgMTN. IPV4-LSP-IDENTIFIER TLV and IPV6-LSP-IDENTIFIER TLV describes the fgMTN channel which includes the IPv4 or IPv6 Tunnel Sender Address indicating the ingress node of fgMTN channel, Extended Tunnel ID which is unique in the source node, and the IPv4 or IPv6 Tunnel Endpoint Address indicating the egress node of fgMTN channel. These three tuple identifies an fgMTN channel.

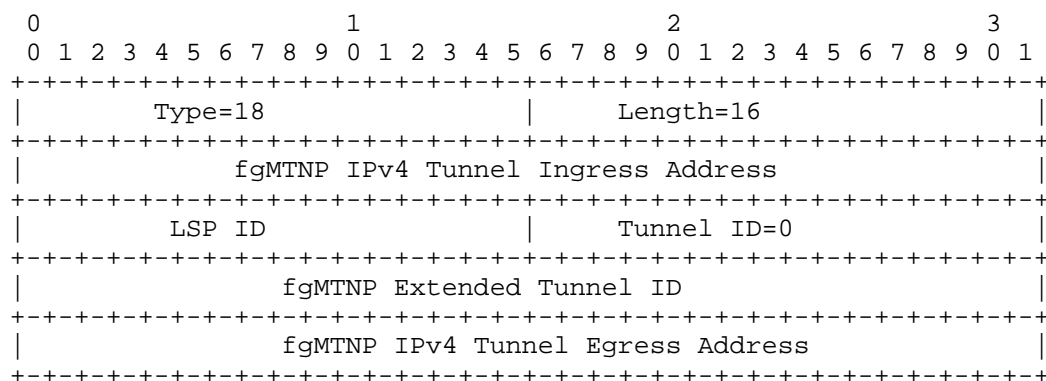


Figure 2: IPV4-LSP-IDENTIFIERS TLV Format

As shown in Figure 2, this is an example of IPV4-LSP-IDENTIFIERS TLV format. The IPV6-LSP-IDENTIFIERS TLV format follows the IPV6-LSP-IDENTIFIERS TLV format of Figure 13 in [RFC8231]

5.4. The ERO Object

During the path calculation of each fgMTN path, the server layer port for each fgMTN is clearly defined. The 5Gbps port of MTN layer can be configured either statically through network management or via other approach. Regardless of the configuration method deployed, the server layer 5Gbps port supporting fine granularity mode is unique and unambiguous within a node.

In PCEP messages, fgMTN LSP route information is carried in the Explicit Route Object (ERO), which consists of a strictly sequence of subobjects. The fgMTNP paths computed by a PCE is represented in an ERO as an strict ordered set of ports id, without IP addresses. The "fgMTN-ERO subobject" that is capable of carrying an unique adjacency id.

5.4.1. FgMTN-ERO Subobject

The ERO content is defined in [RFC5440] to support the fgMTN LSPs. Each Label ERO subobject is defined in [RFC3473] represents each hop of MTN client id for the fgMTN LSP.

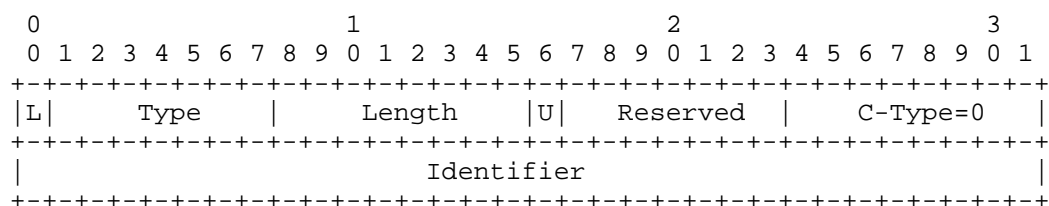


Figure 3: fgMTN-ERO Subobject Format

The L bit flag is 0 because fgMTNP is a strict path. The C-Type is not used.

The identifier is a unique identifier for server layer port (5Gbps MTN port or 10GE interface) that is enabled in fine grain mode.

5.5. The BANDWIDTH Object

The BANDWIDTH object defined in [RFC8779] can be applied to fgMTN. The Bw Spec Type field determines which type of bandwidth is represented by the object.

This document defines a new Bw Spec Type for MTN-TDM:

Bw Spec Type = TBD2: MTN-TDM

In the BANDWIDTH object body, the 32bits "Generalized bandwidth" field can be reused to describe the Bw Spec. The format of the Bw Spec is shown as follows:

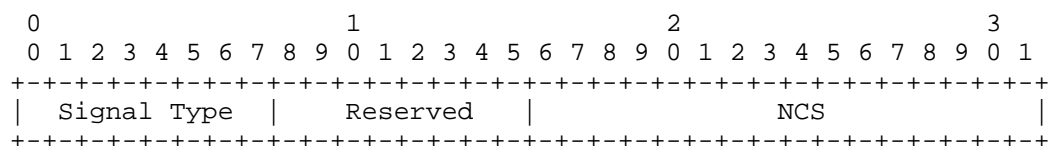


Figure 4: Bw Spec Format

Signal Type : 8 bits This value indicates the fgMTN LSP.

NCS (Number of Calendar Slots): 16 bits This field indicates the number of fgCSs of this fgMTNP.

6. Deployment Considerations

7. Security Considerations

8. IANA Considerations

This document requests IANA to make the following allocations from this sub-registry.

Value	Description	Reference
TBD1	Path Setup Type (PST) for fgMTNP	This document
TBD2	Bw Spec Type for MTN-TDM	This document

Table 1: IANA Considerations

9. Acknowledgments

TBD.

10. Normative References

- [ITU-T_G.8312.20]
 ITU-T, "ITU-T G.8312.20:Overview of fine grain MTN;
 01/2024", <https://www.itu.int/rec/T-REC-G.8312.20>,
 January 2024.

[ITU-T_G.8310]

ITU-T, "ITU-T G.8310: Architecture of the metro transport network; 01/2024", <https://www.itu.int/rec/T-REC-G.8310>, March 2025.

[ITU-T_G.8312]

ITU-T, "ITU-T G.8312: Interfaces for metro transport networks; 01/2024", <https://www.itu.int/rec/T-REC-G.8312>, January 2024.

[ITU-T_G.8321]

ITU-T, "ITU-T G.8321: Characteristics of metro transport network equipment functional blocks;", <https://www.itu.int/rec/T-REC-G.8321>.

[RFC4655] Farrel, A., Vasseur, J.-P., and J. Ash, "A Path Computation Element (PCE)-Based Architecture", RFC 4655, DOI 10.17487/RFC4655, August 2006, <<https://www.rfc-editor.org/info/rfc4655>>.

[RFC5440] Vasseur, JP., Ed. and JL. Le Roux, Ed., "Path Computation Element (PCE) Communication Protocol (PCEP)", RFC 5440, DOI 10.17487/RFC5440, March 2009, <<https://www.rfc-editor.org/info/rfc5440>>.

[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>>.

[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>>.

[RFC8231] Crabbe, E., Minei, I., Medved, J., and R. Varga, "Path Computation Element Communication Protocol (PCEP) Extensions for Stateful PCE", RFC 8231, DOI 10.17487/RFC8231, September 2017, <<https://www.rfc-editor.org/info/rfc8231>>.

[RFC8281] Crabbe, E., Minei, I., Sivabalan, S., and R. Varga, "Path Computation Element Communication Protocol (PCEP) Extensions for PCE-Initiated LSP Setup in a Stateful PCE Model", RFC 8281, DOI 10.17487/RFC8281, December 2017, <<https://www.rfc-editor.org/info/rfc8281>>.

- [RFC8408] Sivabalan, S., Tantsura, J., Minei, I., Varga, R., and J. Hardwick, "Conveying Path Setup Type in PCE Communication Protocol (PCEP) Messages", RFC 8408, DOI 10.17487/RFC8408, July 2018, <<https://www.rfc-editor.org/info/rfc8408>>.
- [RFC3473] Berger, L., Ed., "Generalized Multi-Protocol Label Switching (GMPLS) Signaling Resource ReserVation Protocol-Traffic Engineering (RSVP-TE) Extensions", RFC 3473, DOI 10.17487/RFC3473, January 2003, <<https://www.rfc-editor.org/info/rfc3473>>.
- [RFC8779] Margaria, C., Ed., Gonzalez de Dios, O., Ed., and F. Zhang, Ed., "Path Computation Element Communication Protocol (PCEP) Extensions for GMPLS", RFC 8779, DOI 10.17487/RFC8779, July 2020, <<https://www.rfc-editor.org/info/rfc8779>>.
- [I-D.han-pce-path-computation-fg-transport]
Han, L., Zheng, H., Wang, M., and Y. Zhao, "Path Computation and Control Extention Requirements for Fine-Granularity Transport Network", Work in Progress, Internet-Draft, draft-han-pce-path-computation-fg-transport-01, 4 March 2024, <<https://datatracker.ietf.org/doc/html/draft-han-pce-path-computation-fg-transport-01>>.

Authors' Addresses

Liuyan Han
China Mobile
No.32 Xuanwumen west street
Beijing
100053
China
Email: hanliuyan@chinamobile.com

Haibin Huang
China Mobile
No.32 Xuanwumen west street
Beijing
100053
China
Email: huanghaibin@chinamobile.com

Minxue Wang
China Mobile
No.32 Xuanwumen west street
Beijing
100053
China
Email: wangminxue@chinamobile.com

Jin Zhou
ZTE Corporation
Shenzhen
China
Email: zhou.jin6@zte.com.cn

Li Zhang
Huawei
Beiqing Road
Beijing
China
Email: zhangli344@huawei.com