Path Computation Extention Requirements for Fine-Granularity Transport Network

draft-han-pce-path-computation-fg-transport-02

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Discussions in previous meetings and plan in IETF 125

- IETF 118 in PCE
  - How much of this work has been discussed with CCAMP?
- IETF 119 in CCAMP
  - Some experts requested to coordinate with GMPLS and PCE.
- Updates from -00 to -02
  - Add coauthors, update ITU-T recommandations and add fgMTN network layer structure.
- IETF 125 in CCAMP&PCE
  - PCEP Extensions for fgOTN/fgMTN topology resource information reporting & path setup have been submitted to the PCE working group.
  - draft-lee-pce-pcep-ls-optical-17
  - draft-han-pce-ls-fgmtn-reporting-00
  - draft-han-pce-fgmtn-setup-00

Introduction

- With the proposal of new service demand, the transport technologies of Optical Transport Network (OTN) and Metro Transport Network (MTN) are both moving towards fine- grain hard slices.

- ITU-T has a series of recommendations for fgOTN (fine grain OTN) and fgMTN (fine grain MTN).

- This document focuses on the requirements for path computation and control of the fine-grain transport network. It is proposed to extend the PCE to meet the fine-grain transport requirements.

Development of Fine-Grain Transport

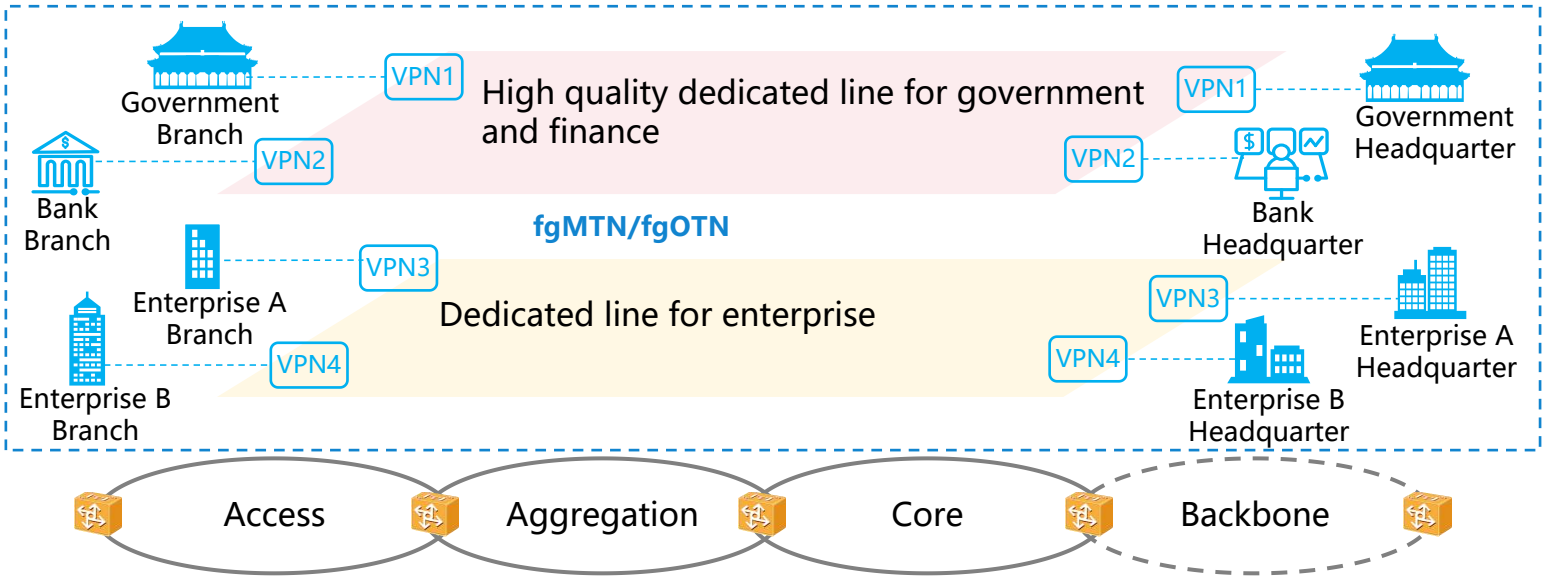
- Some vertical industries and dedicated line services have higher requirements on isolation, security and reliability but with smaller bandwidth. Fine-grain TDM technology can provide the **flexible N*10Mbps bandwidth** for the hard-isolation connections.
- ITU-T has a series of recommendations for fgOTN (fine grain OTN) and fgMTN (fine grain MTN).

ITU-T fgOTN and fgMTN series

Topic	fgOTN	fgMTN
Support of sub1G clients overview	G.709.20 Amd.1 (05/2025)	G.8312.20 Amd.2 (11/2025)
fg Layer Architecture	G.872 (03/2024)	G.8310 Amd.2 (05/2025)
fg Interface	G.709 Amd.4 (07/2025)	G.8312 Amd.4 (05/2025) Annex
Server/fg adaptation	G.709 Amd.4 (07/2025) Annex	G.8312 Amd.4 (05/2025) Annex
Protection	G.808.4 (08/2024)	
Equipment	G.798 (02/2026)	G.8321 Amd.2 (05/2025) Annex
Synchronization	G.8251 Amd. 1 (08/2024)	G.8371 (07/2025)
Management Requirements	G.874 Amd. 2 (01/2024) Annex	G.8350 Amd.2 (11/2025) Annex
Protocol-neutral Information Model	G.875 (12/2024) Annex	G.8350 Amd.2 (11/2025) Annex

- For the future massive fine-grain transport channel connections, **how to effectively perform end-to-end path computation and control** will be an important topic.

Path Computation Requirements for Fine-grain Transport



Use Cases for Fine Grain Transport Networks

a) **<u>The number of fine grain TDM channels will significantly increase</u>** compared to the traditional connections based on optical wavelength or ODUk/MTN with larger bandwidth.

- One 5Gbps MTN channel can support up to 480 fgMTN connections.
- One ODU2 channel can support up to 952 fgOTN connections.
- One device with a switching capacity of several Tbps can support fine-grain channel connections of tens of thousands or even tens of thousands.

Path Computation Requirements for Fine-grain Transport

b) **According to service requirements, fine-grain paths may change frequently and dynamically**.

- One fine-grain channel can carry and correspond to a certain CBR or Ethernet service, rather than serving as a large optical channel.
- When the services appear or end, or its bandwidth changes, or the destination address changes, they will cause changes in fine-grain channels.

- Compared to traditional optical networks, fine-grain transport networks require more quantity, faster, and more flexible path set-up and removing capabilities.
- The centralized computation model of PCE architecture seems to be suitable for the fine-grain transport network.

Use Cases of Fine-grain Path Computation

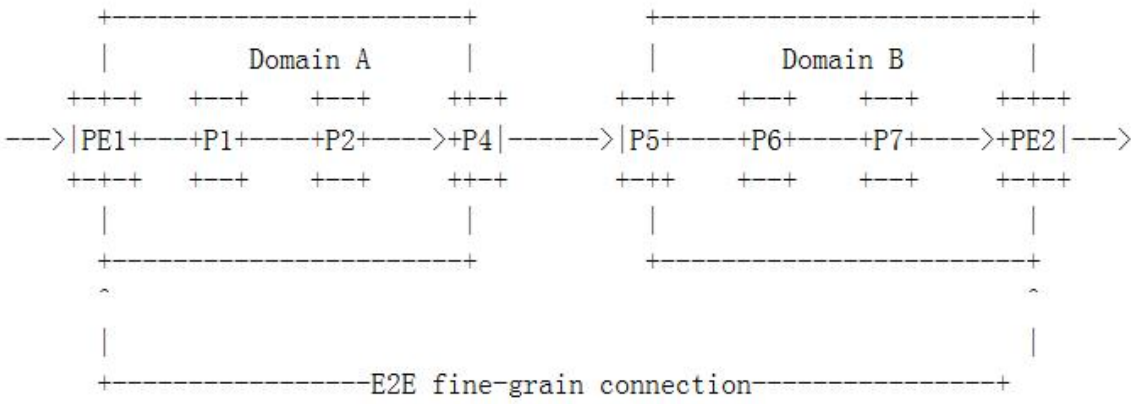


Figure 1: Scenario of E2E fine-grain connection

1. Fine-grain path set-up
2. Fine-grain resource management
3. Fine-grain path update (e.g. hitless bandwidth adjustment)
4. Fine-grain path removal
5. Service awareness and mapping at the PE nodes

Requirements of PCE Extension for Fine-grain Transport

- PCEP-LS is required to be extended to enable the collection of link-state and TE information from TE networks and sharing with PCE.
- The path calculation request/reply message must contain the information specifying appropriate fine-grain channel attributes, including:
  - e.g. fine-grain switching capability/type
  - fine-grain server layer type
  - fine-grain time slots
  - fine-grain client ID
  - end-to-end fine-granularity path protection type
  - ……

Next Step

- We believed the path computation of fine grain transport network is required for industry and dedicated line services.
- This draft mainly proposed the requirements to extend PCEP for the fine grain transport network.
- The specific extentions will continue to apply in the future.
- Comments welcome.

Thank you!