Path Computation Extention Requirements for Fine-Granularity Transport Network

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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). Data plane recommendations are expected to consent in December.

- This document focuses on the requirements for path computation and control of the fine-grain transport network. PCE needs to be extended to meet the fine-grain transport requirements. The detailed extension will be produced in future separate documents.

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.

- The fgOTN overview is defined in [ITU-T_G.709.20] and the fgOTN layer architecture is defined in [ITU-T_G.872].
- The fgMTN overview is defined in[ITU-T_G.8312.20] and the fgMTN layer architecture is defined in [ITU-T_G.8310].

- 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 Challenges for Fine-grain Transport

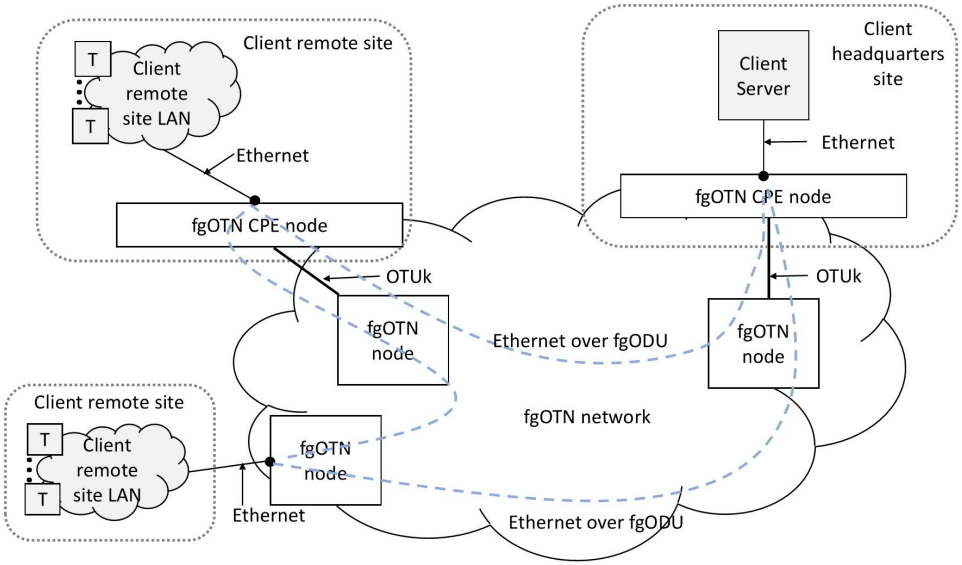

Figure: Example of packet clients over fgOTN connections

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

- One ODU2 channel can support up to 952 fgOTN connections.
- One 5Gbps MTN channel can support up to 480 fgMTN 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 Challenges 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 start 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 massive, faster, and more flexible path set-up, deletion and update capabilities.

The centralized computation model of PCE architecture and the protocol (PCEP) is suitable for the fine-grain transport network.

Use Cases of Fine-grain Path Computation

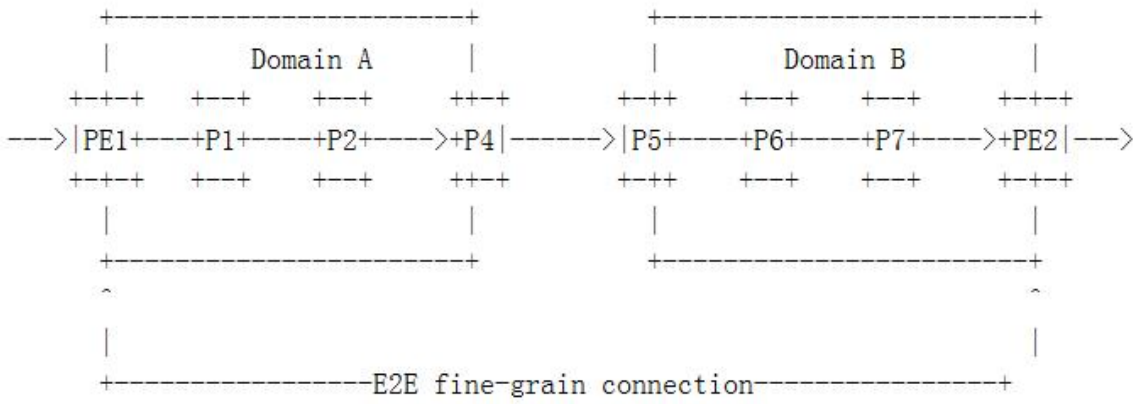

Figure 1: Scenario of E2E fine-grain connection

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 needs to be extended to meet the fine-grain transport requirements.
- The path calculation request/reply/update/report message should consider to 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
  - ……
- The protocol and signaling should support the application of fine-grain path set-up/update/removal and resource management etc.

Next Step

- This draft mainly proposed the requirements to extend PCEP for the fine-grain transport network.
- The specific extentions will continue to submit in the future.

- Comments welcome, open to collaboration.

Thank you!