Path Computation Extension 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 $N*10\text{Mbps}$ 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

- The number of fine-grain TDM channels will significantly increase 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.

Figure: Example of packet clients over fgOTN connections
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

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

Figure 1: Scenario of E2E fine-grain connection
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!