

Path Computation Extention Requirements for Fine-Granularity Transport Network

draft-han-pce-path-computation-fg-transport-01

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CCAMP WG IETF-119 Meeting, March 2024

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.
- This document has been presented in the PCE working group, and this time it will be presented again at CCAMP, focusing on the fgOTN, fgMTN standard processes, and path computation requirement.

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). Six of the recommendations has been consented Dec 2023.

ITU-T fgOTN and fgMTN series

Topic	fgOTN	fgMTN
Support of sub1G clients overview	G.709.20 (consented)	G.8312.20 (consented)
fg Layer Architecture	G.872 Rev.6 (consented)	G.8310 Amd.1 (consented)
fg Interface	G.709 Amd.3 (consented)	G.8312 Amd.2 (consented)
Server/fg adaptation	G.709 Annex PT in main body	G.8312 Annex PT in main body
Protection	G.808.4	
Equipment	G.798 Annex	G.8321 Annex
Synchronization	G.8251 Annex	G.mtn-sync Annex
Management Requirements	G.874 Annex	G.8350 Annex
Protocol-neutral Information Model	G.875 Annex	G.8350 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

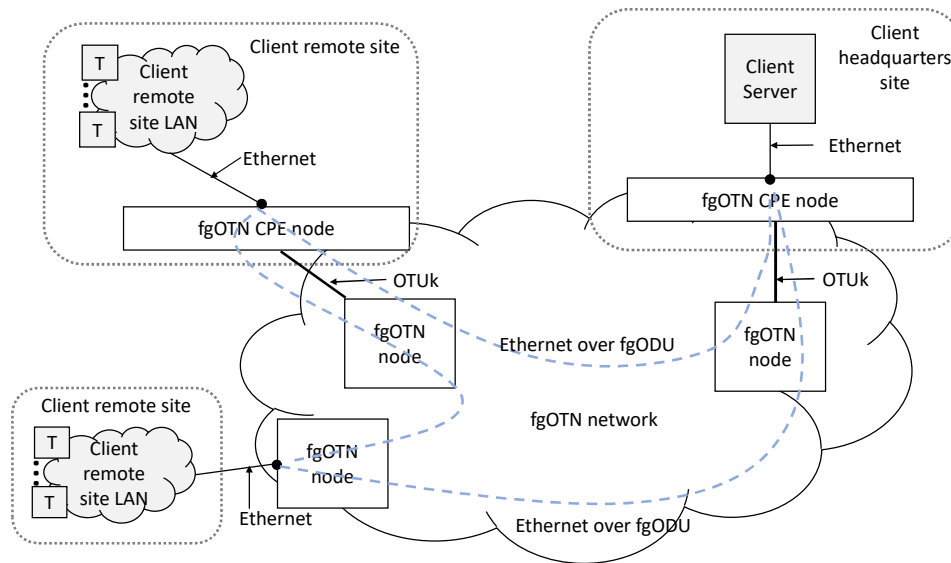


Figure: Example of packet clients over fgOTN connections

a) 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.

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

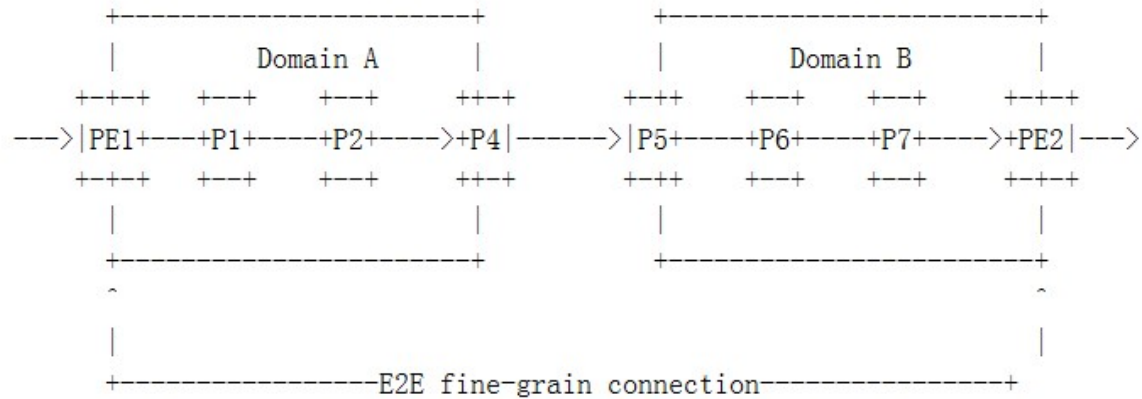


Figure 1: Scenario of E2E fine-grain connection

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 Control protocol Extension for Fine-grain Transport

- Control protocols needs to be extended to meet the fine-grain transport requirements.
- 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
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- 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 the protocols for the fine-grain transport network.
- The specific extensions will continue to apply in the future.
- Comments welcome.

Thank you!