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# Requirements for MPLS-TE/GMPLS interworking

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## Status of this Memo



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## Abstract

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This document describes Service Provider requirements for MPLS-TE/GMPLS interworking.

The main objective is to allow the operation of an MPLS-TE network as a client network over a GMPLS network. The GMPLS network may be a packet or non-packet network.

Specification of solutions is out of scope for this document.

Conventions used in this document

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC-2119.

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## 1. Introduction

Recently, the deployment of a GMPLS network is planned or under investigation among many service providers, and some of very advanced





research networks have already been operated based on GMPLS technology. GMPLS is developed as an extension of MPLS-TE and allows control a transport network consisting of TDM cross-connect, optical/lambda switches, and fibers. By introducing GMPLS technology, some service providers expect that MPLS-TE network connectivity is effectively and reliably established over the GMPLS network. If MPLS-TE and GMPLS protocols can interwork with each other, the introduction of GMPLS would be more beneficial for service providers, because this is expected to improve the resource utilization, network resiliency and manageability all over the network, less impacting the existing MPLS-TE networks.

Currently, there is no clear definition and standardization work to interwork between MPLS-TE routers and GMPLS routers or switches, i.e. , between MPLS-TE networks and GMPLS networks. In order to accelerate the deployment of GMPLS technology, MPLS-TE/GMPLS interworking is a key.

In order to create the definition of MPLS-TE/GMPLS interworking technology, the concrete requirement is preferably defined from the point of operational experience of MPLS-TE/GMPLS networks and future view on these technologies by collecting the input and requirements from various service providers.

Considering such environment, this document focuses on the requirement of MPLS-TE/GMPLS interworking especially in support of GMPLS deployment.

## 2. Terminology

LSP: Label Switched Path

MPLS-TE LSP: Multi Protocol Label Switching Traffic Engineering LSP

PSC: Packet Switch Capable

LSC: Lambda Switch Capable

Head-end LSR: ingress LSR

Tail-end LSR: egress LSR

LSR: Label Switching Router

## 3. Problem Statement

GMPLS technology is deployed or will be deployed in various forms to provide a highly efficient transport for existing MPLS-TE networks, depending on the deployment choices of each service provider. A GMPLS



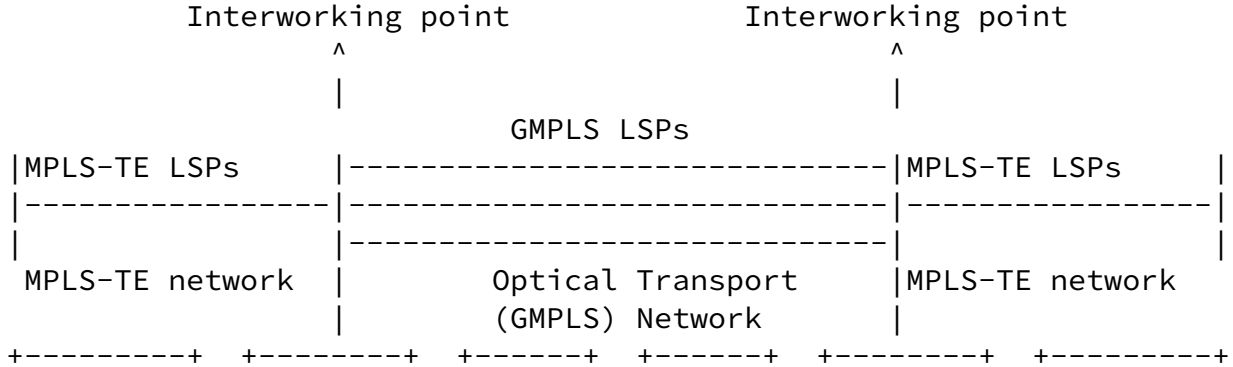


network may provide connectivity in terms of LSPs that are used as TE links by the MPLS-TE network to support MPLS-TE LSPs.

In terms of MPLS-TE/GMPLS signaling, although GMPLS LSPs may be set up triggered by the signaling of MPLS-TE LSPs, the clear mechanism of how to interwork has not yet been defined. Feature richness of MPLS-TE and GMPLS technology allows service providers to use a set of options on how GMPLS services can be used by MPLS-TE networks. In this document, the requirement for MPLS-TE/GMPLS interworking is presented with some operations considerations associated with use of GMPLS services by MPLS-TE networks.

## 4. Reference model

The reference model used in this document is shown in Figure 1. As indicated in [RFC3945], the optical transport network consists of, for example, GMPLS controlled OXCs and GMPLS-enabled MPLS-TE routers.



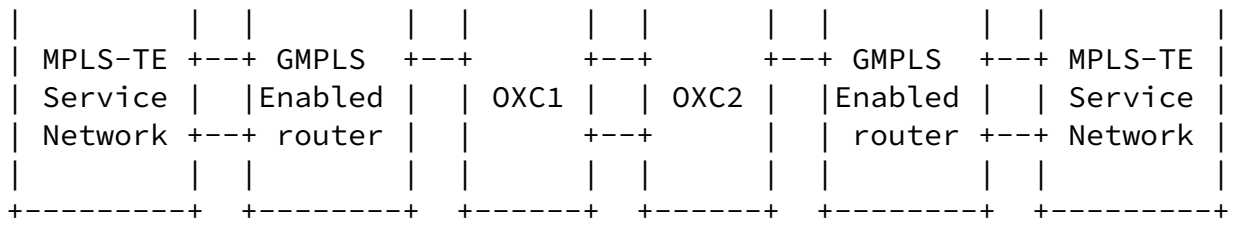



Figure 1. Reference model of MPLS-TE/GMPLS interworking

MPLS-TE network connectivity is provided through a GMPLS LSP which is created between GMPLS routers. This document defines the requirements for how the MPLS-TE network and the GMPLS network are interworked in order to effectively operate the entire network and smoothly deploy the GMPLS network.

## 5. Detailed Requirements

This section describes detailed requirements for MPLS-TE/GMPLS interworking in support of GMPLS deployment.





### 5.1 Use of GMPLS optical network resources in MPLS-TE networks

The solution SHOULD provide the ability to make effective use of GMPLS optical network resources (e.g. bandwidth, protection & recovery) by the MPLS-TE service networks.

The GMPLS network MUST be able to support more than one MPLS-TE network. Most of service providers have different networks for various services; their GMPLS deployment plans are to have these service networks use a common GMPLS controlled optical network as a core network of various services.

### 5.2 Mapping signaling information between MPLS-TE and GMPLS

The solution SHOULD provide the ability to map signaling information between MPLS-TE and GMPLS. From an MPLS-TE signaling point of view, the routers in MPLS-TE domain should be able to signal over GMPLS optical domain. In this case, an interworking between MPLS-TE and GMPLS protocol is required.

### 5.3 Establishment of GMPLS LSPs triggered by end-to-end MPLS-TE LSPs

signaling

The solution SHOULD provide the ability to establish end-to-end MPLS-TE LSPs over a GMPLS optical network. GMPLS LSPs SHOULD be set up triggered by the signaling of MPLS-TE LSP.

5.4 Establishment of end-to-end MPLS-TE LSPs having diverse paths over GMPLS optical network

The solution SHOULD provide the ability to establish end-to-end MPLS-TE LSPs having diverse paths including diverse GMPLS LSPs corresponding to the request of the head-end MPLS LSR for protection of MPLS-TE LSPs. The GMPLS optical network SHOULD assure the diversity of GMPLS LSPs, even if their ingress nodes in GMPLS optical network are different.

5.5 Advertisement of TE information via GMPLS optical domain

The solution SHOULD provide the ability to control advertisements of TE information belonging to MPLS-TE service networks across the GMPLS optical network.
The TE information within the same MPLS-TE service networks needs to be exchanged in order that a head end LSR of the MPLS-TE network can compute an LSP to a tail end LSR that is reached over the GMPLS optical network.
On the other hand, the TE information belonging to one MPLS-TE service network MUST NOT be advertised to other MPLS-TE service





networks to preserve confidentiality and security, and in order to avoid establishing undesirable LSPs.

5.6 Selective advertisement of TE information via a border node

The solution SHOULD provide the ability to distribute TE reachability information from the GMPLS optical network to MPLS-TE networks selectively, which are useful for the head-end MPLS routers to compute MPLS-TE LSPs.

5.7 Interworking of MPLS-TE and GMPLS protection

The solution SHOULD provide the ability to select GMPLS protection types for the GMPLS LSPs according to protection options defined for

the protected MPLS-TE LSPs.
If MPLS-TE LSPs are protected using MPLS FRR [RFC4090], then when an FRR protected packet LSP is signaled, we SHOULD be able to select protected GMPLS LSPs in the GMPLS optical network. In terms of MPLS protection, the MPLS-TE Path message can include some flags in the FAST REROUTE object and SESSION_ATTRIBUTE object. In terms of GMPLS protection, there are both signaling aspects [RFC3471] [RFC3473] and routing aspects [RFC4202].

## 5.8 Failure recovery

The solution SHOULD provide failure recovery in the GMPLS optical domain without impacting MPLS-TE domain and vice versa.
In case that failure in the GMPLS optical domain associates with MPLS-TE domain, some kind of notification of the failure may be transmitted to MPLS-TE domain and vice versa.

## 5.9 Complexity and Risks

The solution SHOULD NOT introduce unnecessary complexity to the current operating network to such a degree that it would affect the stability and diminish the benefits of deploying such a solution over service provider networks.

## 5.10 Scalability consideration

The solution MUST have a minimum impact on network scalability for deploying GMPLS technology in the existing MPLS-TE networks.
Scalability of GMPLS deployment in the existing MPLS-TE networks MUST address the following consideration.

- the number of GMPLS capable nodes (e.g. the number of non-PSC GMPLS capable nodes)
- the number of MPLS-TE capable nodes
- the number of GMPLS LSPs





- the number of MPLS-TE LSPs

## 5.11 Performance consideration

The solution SHOULD be evaluated with regard to the following criteria.

- Failure and restoration time
- Impact and scalability of the control plane due to added overheads and so on
- Impact and scalability of the data/forwarding plane due to added overheads and so on

## 5.12 Management consideration

Manageability of MPLS-TE/GMPLS interworking MUST addresses the following consideration.

- need for a MIB module for control plane and monitoring
- need for diagnostic tools

MIB for an interworking between MPLS-TE and GMPLS protocol SHOULD be implemented.
In case that an interworking between MPLS-TE and GMPLS protocol is done, a failure between them MUST be detected.

# 6. Security Considerations

We will write security considerations in next version.

# 7. IANA Considerations

This requirement document makes no requests for IANA action.

# 8. Normative References


[RFC2119] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

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[RFC3471] Berger, L., "Generalized Multi-Protocol Label Switching (GMPLS) Signaling Functional Description", RFC3471, January 2003.

[RFC3473] Berger, L., "Generalized Multi-Protocol Label Switching (GMPLS) Signaling Resource ReserVation Protocol-Traffic Engineering (RSVP-TE) Extensions ", RFC 3473, January 2003.

[RFC4202] Kompella, K., Rekhter, Y., "Routing Extensions in Support of Generalized Multi-Protocol Label Switching (GMPLS)", RFC4202, October 2005.

## 9 .Acknowledgments

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