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Requirements for Generalized MPLS (GMPLS) Routing for Automatically Switched Optical Network (ASON)

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Status of this Memo

Abstract

The Generalized MPLS (GMPLS) suite of protocols has been defined to control different switching technologies as well as different applications. These include support for requesting TDM connections including SONET/SDH and Optical Transport Networks (OTNs).

This document concentrates on the routing requirements on the GMPLS suite of protocols to support the capabilities and functionalities of an Automatically Switched Optical Network (ASON).

*** This draft is in an early stage and propose only a template to be further developed ***

1. Contributors

This document is the result of the CCAMP Working Group ASON Routing Requirements design team joint effort.

2. 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.

The reader is also assumed to be familiar with the terminology used in [G.8080] and [G.7715].

3. Introduction

The GMPLS suite of protocol provides support for controlling different switching technologies as well as different applications. These include support for requesting TDM connections including SONET/SDH (see ANSI T1.105 and ITU-T G.707, respectively) as well as Optical Transport Networks (see ITU-T G.709). However, there are certain capabilities that are needed to support Automatically Switched Optical Networks (ASON) control planes. Therefore, it is desirable to understand the corresponding requirements for the GMPLS protocol suite. ASON control plane architecture is defined in [G.8080] and ASON routing requirements are identified in [G.7715]. Also, the SG15/Q.14 is working on refining these requirements.

This document focuses on the routing requirements for the GMPLS suite of protocols to support the capabilities and functionalities of ASON control planes. It discusses the requirements for GMPLS routing that MAY subsequently lead to additional backward compatible extensions to support the capabilities specified in the above referenced document. A description of backward compatibility considerations is provided in Section 5. Nonetheless, any protocol (in particular, routing) design or suggested protocol extensions is strictly outside the scope of this document. A terminology section (that may be further completed) is provided in the Appendix.

The ASON model distinguishes reference points (representing points of protocol information exchange) defined (1) between an administrative domain and a user a.k.a. user-network interface (UNI), (2) between (and when needed within) administrative domains a.k.a. external network-network interface (E-NNI) and, (3) between areas of the same administrative domain and when needed between control components (or simply controllers) within areas a.k.a. internal network-network interface (I-NNI).

The ASON routing architectural model is based on the following assumptions:

- The information exchanged between routing controllers is subject

  to policy constraints imposed at reference points (E-NNI and I-NNI)

- The routing information exchanged between routing domains (i.e. inter-domain) is independent of intra-domain routing protocol

- The routing information exchanged between routing domains is independent of intra-domain control distribution choices, e.g. centralized, fully distributed

- The routing adjacency topology and transport network topology shall not be assumed to be congruent

- Each routing area shall be uniquely identifiable within a carrier's network (constituted by several routing domains)

The following functionality is to be supported by GMPLS routing to instantiate ASON routing realization:
- support multiple hierarchical levels
- support hierarchical routing information dissemination including summarized routing information
- support for multiple links between nodes (and allow for link and node diversity)
- support architectural evolution in terms of the number of levels of hierarchies, aggregation and segmentation of (control ?) domains
- support routing information divided between attributes pertaining to links and nodes (representing either a routing area or sub-network)

In addition the behaviour of GMPLS routing is expected to be such that:
- it is scalable with respect to the number of links, nodes and

routing area hierarchical levels. - what does this means ? is it
routing areas and hierarchical levels ? or hierarchical levels of
routing areas -

- in response to a routing event (e.g. topology update, reachability update), it delivers convergence and damping against flapping
- it fulfils the operational security objectives where required

4. ASON Requirements for GMPLS Routing

The next sections detail the requirements for GMPLS routing to support the following ASON routing functions:

- supporting multiple hierarchical levels
- support hierarchical routing information dissemination including summarized routing information
- support for multiple links between nodes (and allow for link and node diversity)
- support architectural evolution in terms of the number of levels of hierarchies, aggregation and segmentation of (control ?) domains

- support of routing attributes for links and nodes

4.1 Multiple Hierarchical Levels

TBD.

4.2 Hierarchical Routing Information Dissemination

TBD.

4.3 Multiple Links between Nodes

TBD.

4.4 Evolution

TBD.

4.5 Routing Attributes

TBD.

4.5.1 Link Attributes

TBD.

4.5.2 Node Attributes

TBD.

5. Backward Compatibility

TBD.

6. Security Considerations

TBD.

7. Acknowledgements

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8. References

[RFC 2026] S.Bradner, "The Internet Standards Process -- Revision 3", BCP 9, RFC 2026, October 1996.

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

[G.7715] ITU-T Rec. G.7715/Y.1306, "Architecture and

Requirements for the Automatically Switched Optical Network (ASON)," June 2002.

[G.8080] ITU-T Rec. G.8080/Y.1304, "Architecture for the Automatically Switched Optical Network (ASON)," November 2001 (and Revision, January 2003).

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Appendix - Terminology

This document makes use of the following terms:

Administrative domain: See Recommendation G.805.

Control plane: performs the call control and connection control functions. Through signaling, the control plane sets up and releases connections, and may restore a connection in case of a failure.

(Control) Domain: represents a collection of entities that are grouped for a particular purpose. G.8080 applies this G.805 recommendation concept (that defines two particular forms, the administrative domain and the management domain) to the control plane in the form of a control domain. The entities that are grouped in a control domain are components of the control plane.

External NNI (E-NNI): interfaces are located between protocol controllers between control domains.

Internal NNI (I-NNI): interfaces are located between protocol controllers within control domains.

Link: See Recommendation G.805.

Management plane: performs management functions for the Transport Plane, the control plane and the system as a whole. It also provides coordination between all the planes. The following management functional areas are performed in the management plane: performance, fault, configuration, accounting and security management

Management domain: See Recommendation G.805.

Transport plane: provides bi-directional or unidirectional transfer of user information, from one location to another. It can also provide transfer of some control and network management information. The Transport Plane is layered; it is equivalent to the Transport Network defined in G.805.

User Network Interface (UNI): interfaces are located between protocol controllers between a user and a control domain.

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