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A Thesaurus for the Terminology used in Multiprotocol Label Switching Transport Profile (MPLS-TP) drafts/RFCs and ITU-T's Transport Network Recommendations.

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Abstract

MPLS-TP is based on a profile of the MPLS and PW procedures as specified in the MPLS-TE and (MS-)PW architectures developed by the IETF. The ITU-T has specified a Transport Network architecture.

This document provides a thesaurus for the interpretation of MPLS-TP terminology within the context of the ITU-T Transport Network recommendations.

It is important to note that MPLS-TP is applicable in a wider set of contexts than just Transport Networks. The definitions presented in this document do not provide exclusive nor complete interpretations of MPLS-TP concepts. This document simply allows the MPLS-TP terms to be applied within the Transport Network context.

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1. Introduction

Multiprotocol Label Switching - Transport Profile (MPLS-TP) has been developed by the IETF to facilitate the Operation, Administration and Management of Label Switched Paths (LSPs) in a Transport Network environment as defined by the ITU-T.

The ITU-T has specified a Transport Network architecture for the transfer of signals from different technologies. This architecture forms the basis of many Recommendations within the ITU-T.

Because of the difference in historic background of MPLS, and inherently MPLS-TP (the Internet) and the Transport Network (ITU telecommunication Sector), the terminology used is different.

This document provides a thesaurus for the interpretation of ITU-T Transport Network terminology within the context of the MPLS-TP. This allows MPLS-TP documents to be generally understood by those familiar with MPLS RFCs. The definitions presented in this document do not provide exclusive or complete interpretations of the ITU-T Transport Network concepts.

1.1. Contributing Authors

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1.2. Abbreviations

CC   Communications Channel

CE   Customer Edge

DCN Data Communication Network

ECC Embedded Communication Channel

EMF Equipment Management Function

MCC Management Communication Channel

MCN Management Communication Network

ME Maintenance Entity

MEG Maintenance Entity Group

MEP Maintenance Entity Group End Point

MIP Maintenance Entity Group Intermediate Point

MPLS Multiprotocol Label Switching

MPLS-TP MPLS Transport Profile

NE Network Element

OAM Operations, Administration and Maintenance

PST Path Segment Tunnel

SCC Signaling Communication Channel

SCN Signaling Communication Network

SPME Sub-Path Maintenance Element

TCM Tandem Connection Monitoring

2. Terminology

2.1. MPLS-TP Terminology Sources

MPLS-TP terminology is principally defined in [RFC3031]. Other documents provide further key definitions including [RFC4397].

2.2. ITU-T Transport Network Terminology Sources

The ITU-T Transport Network is specified in a number of recommendations: generic functional architectures and requirements are specified in [ITU-T_G.805], [ITU-T_G.806], and [ITU-T_G.872]. ITU-T Recommendation [ITU-T_G.8101] contains an overview of the Terms and Definitions for transport MPLS.

2.3. Common Terminology Sources

The work in this document builds on the shared view of MPLS requirements.

The following sources are used:
IETF framework and requirements RFCs: [RFC6371], [RFC6372], [RFC5654], [RFC5921], [RFC5860], [RFC5951], [RFC3031] and [RFC4397].
ITU-T architecture and requirements Recommendations: [ITU-T_G.8101], [ITU-T_G.805], [ITU-T_G.806], [ITU-T_G.872], [ITU-T G.7710] and [ITU-T Y.2611].

3. Thesaurus

3.1. Associated bidirectional path:

A path that supports traffic flow in both directions but that is constructed from a pair of unidirectional paths (one for each direction) that are associated with one another at the path's ingress/egress points. The forward and backward directions are setup, monitored, and protected independently. As a consequence, they may or may not follow the same route (links and nodes) across the network.

3.2. Bidirectional path:

A path that supports traffic flow in two opposite directions, i.e. the forward and backward direction.

3.3. Client layer network:

In a client/server relationship (see [ITU-T_G.805]), the client layer network receives a (transport) service from the lower server layer network (usually the layer network under consideration).

3.4. Communication Channel (CC):

A logical channel between network elements (NEs) that can be used - e.g. - for management plane application or control plane applications. The physical channel supporting the CC is technology specific. See [RFC5951] APPENDIX A.

3.5. Concatenated Segment:

A serial-compound link connection as defined in [ITU-T_G.805]. A concatenated segment is a contiguous part of an LSP or multi-segment PW that comprises a set of segments and their interconnecting nodes in sequence. See also "Segment".

3.6. Control Plane:

Within the scope of [RFC5654], the control plane performs transport path control functions. Through signalling, the control plane sets up, modifies and releases transport paths, and may recover a transport path in case of a failure. The control plane also performs other functions in support of transport path control, such as routing information dissemination.

3.7. Co-routed bidirectional path:

A path where the forward and backward directions follow the same route (links and nodes) across the network. Both directions are setup, monitored and protected as a single entity. A transport network path is typically co-routed.

3.8. Data Communication Network (DCN):

A network that supports Layer 1 (physical layer), Layer 2 (data-link layer), and Layer 3 (network layer) functionality for distributed management communications related to the management plane, for distributed signaling communications related to the control plane, and other operations communications (e.g., order-wire/voice communications, software downloads, etc.).

3.9. Defect:

The situation for which the density of anomalies has reached a level where the ability to perform a required function has been interrupted. Defects are used as input for PM, the control of consequent actions, and the determination of fault cause. See also [ITU-T_G.806].

3.10. Domain:

A domain represents a collection of entities (for example network elements) that are grouped for a particular purpose, examples of which are administrative and/or managerial responsibilities, trust relationships, addressing schemes, infrastructure capabilities, aggregation, survivability techniques, distributions of control

functionality, etc. Examples of such domains include IGP areas and Autonomous Systems.

3.11. Embedded Communication Channel (ECC):

A logical operations channel between network elements (NEs) that can be utilized by multiple applications (e.g., management plane applications, control plane applications, etc.). The physical channel supporting the ECC is technology specific. An example of physical channels supporting the ECC is a DCC channel within SDH.

3.12. Equipment Management Function (EMF):

The management functions within an NE. See [ITU-T G.7710].

3.13. Failure:

The fault cause persisted long enough to consider the ability of an item to perform a required function to be terminated. The item may be considered as failed; a fault has now been detected. See also [ITU-T_G.806].

3.14. Fault:

A Fault is the inability of a function to perform a required action. This does not include an inability due to preventive maintenance, lack of external resources, or planned actions. See also [ITU-T_G.806].

3.15. Layer network:

Layer network is defined in [ITU-T_G.805]. A layer network provides for the transfer of client information and independent operation of the client OAM. A layer network may be described in a service context as follows: one layer network may provide a (transport) service to a higher client layer network and may, in turn, be a client to a lower-layer network. A layer network is a logical construction somewhat independent of arrangement or composition of physical network elements. A particular physical network element may topologically belong to more than one layer network, depending on the actions it takes on the encapsulation associated with the logical layers (e.g., the label stack), and thus could be modeled as multiple logical elements. A layer network may consist of one or more sublayers. For additional explanation of how layer networks relate to the OSI concept of layering, see Appendix I of [ITU-T Y.2611].

3.16. Link:

A physical or logical connection between a pair of LSRs that are adjacent at the (sub)layer network under consideration. A link may carry zero, one or more LSPs or PWs. A packet entering a link will emerge with the same label stack entry values.

A link as defined in [ITU-T_G.805] is used to describe a fixed relationship between two ports.

3.17. Maintenance Entity (ME):

A Maintenance Entity (ME) can be viewed as the association of two (or more) Maintenance Entity Group End Points (MEPs), that should be configured and managed in order to bound the OAM responsibilities of an OAM flow across a network or sub-network, i.e. a transport path or segment, in the specific layer network that is being monitored and managed. See also [RFC6371] section 3.1 and [ITU-T G.8113.1], [ITU-T G.8113.2] clause 6.1.

A Maintenance Entity may be defined to monitor and manage bidirectional or unidirectional point-to-point connectivity or point-to-multipoint connectivity in an MPLS-TP layer network.

Therefore, in the context of MPLS-TP LSP or PW Maintenance Entity (defined below) LERs and T-PEs can be MEPs while LSRs and S-PEs can be MIPs. In the case of Tandem Connection Maintenance Entity (defined below), LSRs and S-PEs can be either MEPs or MIPs.

The following properties apply to all MPLS-TP MEs:

- o OAM entities can be nested but not overlapped.
- o Each OAM flow is associated to a unique Maintenance Entity.
- o OAM packets are subject to the same forwarding treatment as the data traffic, but they are distinct from the data traffic.

3.18. Maintenance Entity Group (MEG):

A Maintenance Entity Group is defined, for the purpose of connection monitoring, between a set of connection points within a connection. This set of connection points may be located at the boundary of one administrative domain or a protection domain, or the boundaries of two adjacent administrative domains. The MEG may consist of one or more Maintenance Entities (ME). See also [RFC6371] section 3.1 and [ITU-T G.8113.1], [ITU-T G.8113.2] clause 6.2.

In an MPLS-TP layer network a MEG consists of only one ME.

3.19. Maintenance Entity Group End Point (MEP):

Maintenance Entity Group End Points (MEPs) are the end points of a pre-configured (through the management or control planes) ME. MEPs are responsible for activating and controlling all of the OAM functionality for the ME. A source MEP may initiate an OAM packet to be transferred to its corresponding peer or sink MEP, or to an intermediate MIP that is part of the ME. See also [RFC6371] section 3.3 and [ITU-T G.8113.1], [ITU-T G.8113.2] clause 6.3.

A sink MEP terminates all the OAM packets that it receives corresponding to its ME and does not forward them further along the path.

All OAM packets coming into a source MEP are tunnelled via label stacking and are not processed within the ME as they belong either to the client network layers or to an higher TCM level.

A MEP in a tandem connection is not coincident with the termination of the MPLS-TP transport path (LSP or PW), though it can monitor its connectivity (e.g. count packets). A MEP of an MPLS-TP network transport path is coincident with transport path termination and monitors its connectivity (e.g. count packets).

An MPLS-TP sink MEP can notify a fault condition to its MPLS-TP client layer network.

3.20. Maintenance Entity Group Intermediate Point (MIP):

A Maintenance Entity Group Intermediate Point (MIP) is a point between the two MEPs in an ME and is capable of responding to some OAM packets and forwarding all OAM packets while ensuring fate sharing with data plane packets. A MIP responds only to OAM packets that are sent on the ME it belongs to and that are addressed to the MIP, it does not initiate OAM messages. See also [RFC6371] section 3.4 and [ITU-T G.8113.1], [ITU-T G.8113.2] clause 6.4.

3.21. Management Communication Channel (MCC):

A CC dedicated for management plane communications.

3.22. Management Communication Network (MCN):

A DCN supporting management plane communication is referred to as a Management Communication Network (MCN).

3.23. Monitoring

Monitoring is applying OAM functionality to verify and to maintain the performance and the quality guarantees of a transport path. There is a need to not only monitor the whole transport path (e.g. LSP or MS-PW), but also arbitrary parts of transport paths. The connection between any two arbitrary points along a transport path is described in three ways:

- as a Path Segment Tunnel,
- as a Sub-Path Maintenance Element, and
- as a Tandem Connections.

3.23.1. Path Segment Tunnel (PST):

A path segment is either a segment or a concatenated segment. Path Segment Tunnels (PSTs) are instantiated to provide monitoring of a portion of a set of co-routed transport paths (LSPs or MS-PWs). Path segment tunnels can also be employed to meet the requirement to provide Tandem Connection Monitoring, see Tandem Connection.

3.23.2. Sub-Path Maintenance Element (SMPE):

To monitor, protect, and manage a portion (i.e., segment or concatenated segment) of an LSP, a hierarchical LSP [RFC3031] can be instantiated. A hierarchical LSP instantiated for this purpose is called a Sub-Path Maintenance Element (SPME). Note that by definition an SPME does not carry user traffic as a direct client.

An SPME is defined between the edges of the portion of the LSP that needs to be monitored, protected or managed. The SPME forms a MPLS-TP Section that carries the original LSP over this portion of the network as a client. OAM messages can be initiated at the edge of the SPME and sent to the peer edge of the SPME or to a MIP along the SPME. A P router only pushes or pops a label if it is at the end of a SPME. In this mode, it is an LER for the SPME.

3.23.3. Tandem Connection:

A tandem connection is an arbitrary part of a transport path that can be monitored (via OAM) independently from the end-to-end monitoring (OAM). It may be a monitored segment, a monitored concatenated segment or any other monitored ordered sequence of contiguous hops and/or segments (and their interconnecting nodes) of a transport path.

Tandem Connection Monitoring (TCM) for a given path segment of a transport path is implemented by creating a path segment tunnel that

has a 1:1 association with the path segment of the transport path that is to be uniquely monitored. This means that the PST used to provide TCM can carry one and only one transport path thus allowing direct correlation between all fault management and performance monitoring information gathered for the PST and the monitored path segment of the end-to-end transport path. The PST is monitored using normal LSP monitoring. See also [RFC6371] section 3.2 and [ITU-T G.8113.1], [ITU-T G.8113.2] clause 6.2.1.

3.24. MPLS Section:

A network segment between two LSRs that are immediately adjacent at the MPLS layer.

3.25. MPLS Transport Profile (MPLS-TP):

The set of MPLS functions used to support packet transport services and network operations.

3.26. MPLS-TP NE:

A network element (NE) that supports MPLS-TP functions.

3.27. MPLS-TP network:

A network in which MPLS-TP NEs are deployed.

3.28. MPLS-TP Recovery:

3.28.1. End-to-end recovery:

MPLS-TP End-to-end recovery refers to the recovery of an entire LSP, from its ingress to its egress node.

3.28.2. Link recovery:

MPLS-TP link recovery refers to the recovery of an individual link (and hence all or a subset of the LSPs routed over the link) between two MPLS-TP nodes. For example, link recovery may be provided by server layer recovery.

3.28.3. Segment recovery:

MPLS-TP Segment recovery refers to the recovery of an LSP segment (i.e., segment and concatenated segment in the language of [RFC5654]) between two nodes and is used to recover from the failure of one or more links or nodes.

3.29. MPLS-TP Ring Topology:

In an MPLS-TP ring topology, each LSR is connected to exactly two other LSRs, each via a single point-to-point bidirectional MPLS-TP capable link. A ring may also be constructed from only two LSRs where there are also exactly two links. Rings may be connected to other LSRs to form a larger network. Traffic originating or terminating outside the ring may be carried over the ring. Client network nodes (such as Customer Edges (CEs)) may be connected directly to an LSR in the ring.

3.29.1. MPLS-TP Logical Ring:

An MPLS-TP logical ring is constructed from a set of LSRs and logical data links (such as MPLS-TP LSP tunnels or MSPL-TP pseudowires) and physical data links that form a ring topology.

3.29.2. MPLS-TP Physical Ring:

An MPLS-TP physical ring is constructed from a set of LSRs and physical data links that form a ring topology.

3.30. OAM flow:

An OAM flow is the set of all OAM packets originating with a specific source MEP that instrument one direction of a MEG (or possibly both in the special case of data plane loopback).

3.31. Operations System (OS):

A system that performs the functions that support processing of information related to operations, administration, maintenance, and provisioning (OAM&P) for the networks, including surveillance and testing functions to support customer access maintenance.

3.32. Path:

See Transport path.

3.33. Protection priority:

Fault conditions (e.g., signal failed), external commands (e.g, forced switch, manual switch) and protection states (e.g., no request) are defined to have a relative priority with respect to each other. Priority is applied to these conditions/command/states locally at each endpoint and between the two endpoints.

3.34. Section Layer Network:

A section layer is a server layer (which may be MPLS-TP or a different technology) that provides for the transfer of the section-layer client information between adjacent nodes in the transport-path layer or transport-service layer. A section layer may provide for aggregation of multiple MPLS-TP clients. Note that [ITU-T_G.805] defines the section layer as one of the two layer networks in a transmission-media layer network. The other layer network is the physical-media layer network.

Section layer networks are concerned with all the functions which provide for the transfer of information between locations in path layer networks.

Physical media layer networks are concerned with the actual fibres, metallic wires or radio frequency channels which support a section layer network.

3.35. Segment:

A link connection as defined in [ITU-T_G.805]. A segment is the part of an LSP that traverses a single link or the part of a PW that traverses a single link (i.e., that connects a pair of adjacent {Switching|Terminating} Provider Edges). See also "Concatenated Segment".

3.36. Server layer:

A service layer is a layer network in which transport paths are used to carry a customer's (individual or bundled) service (may be point-to-point, point-to-multipoint or multipoint-to-multipoint services).

In a client/server relationship (see [ITU-T_G.805]) the server layer network provides a (transport) service to the higher client layer network (usually the layer network under consideration).

3.37. Server MEPs:

A server MEP is a MEP of an ME that is defined in a layer network below the MPLS-TP layer network being referenced. A server MEP coincides with either a MIP or a MEP in the client (MPLS-TP) layer network. See also [RFC6371] section 3.5 and [ITU-T G.8113.1] clause 6.5.

For example, a server MEP can be either:

- A termination point of a physical link (e.g. IEEE 802.3), an SDH VC or OTH ODU for the MPLS-TP Section layer network, defined in [RFC6371] section 3.1.;

- An MPLS-TP Section MEP for MPLS-TP LSPs, defined in [RFC6371] section 3.2.;

- An MPLS-TP LSP MEP for MPLS-TP PWs, defined in [RFC6371] section 3.4.;

- An MPLS-TP TCM MEP for higher-level TCMs, defined in [RFC6371] sections 3.3. and 3.5.

The server MEP can run appropriate OAM functions for fault detection, and notifies a fault indication to the MPLS-TP layer network.

3.38. Signaling Communication Channel (SCC):

A CC dedicated for control plane communications. The SCC may be used for GMPLS/ASON signaling and/or other control plane messages (e.g., routing messages).

3.39. Signaling Communication Network (SCN):

A DCN supporting control plane communication is referred to as a Signaling Communication Network (SCN).

3.40. Span:

A span is synonymous with a link.

3.41. Sublayer:

Sublayer is defined in [ITU-T_G.805]. The distinction between a layer network and a sublayer is that a sublayer is not directly accessible to clients outside of its encapsulating layer network and offers no direct transport service for a higher layer (client) network.

3.42. Transport Entity:

A "Transport Entity" is a node, link, transport path segment, concatenated transport path segment, or entire transport path.

3.42.1. Working Entity:

A "Working Entity" is a transport entity that carries traffic during normal network operation.

3.42.2. Protection Entity:

A "Protection Entity" is a transport entity that is pre-allocated and used to protect and transport traffic when the working entity fails.

3.42.3. Recovery entity:

A "Recovery Entity" is a transport entity that is used to recover and transport traffic when the working entity fails.

3.43. Transmission media layer:

A layer network, consisting of a section layer network and a physical layer network as defined in [ITU-T_G.805], that provides sections (two-port point-to-point connections) to carry the aggregate of network-transport path or network-service layers on various physical media.

3.44. Transport Network:

A Transport Network provides transmission of traffic between attached client devices by establishing and maintaining point-to-point or point-to-multipoint connections between such devices. A Transport Network is independent of any higher-layer network that may exist between clients, except to the extent required to supply this transmission service. In addition to client traffic, a Transport Network may carry traffic to facilitate its own operation, such as that required to support connection control, network management, and Operations, Administration and Maintenance (OAM) functions.

3.45. Transport path:

A network connection as defined in [ITU-T_G.805]. In an MPLS-TP environment a transport path corresponds to an LSP or a PW.

3.46. Transport path layer:

A (sub)layer network that provides point-to-point or point-to-multipoint transport paths. It provides OAM that is independent of the clients that it is transporting.

3.47. Transport service layer:

A layer network in which transport paths are used to carry a customer's (individual or bundled) service (may be point-to-point, point-to-multipoint or multipoint-to-multipoint services).

3.48. Unidirectional path:

A Unidirectional Path is a path that supports traffic flow in only one direction.

4. Guidance on the Application of this Thesaurus

As discussed in the introduction to this document, this thesaurus is intended to bring the concepts and terms associated with MPLS-TP into the context of the ITU-T's Transport Network architecture. Thus, it should help those familiar with MPLS to see how they may use the features and functions of the Transport Network in order to meet the requirements of MPLS-TP.

This lexicography should not be used in order to obtain or derive definitive definitions of GMPLS terms. To obtain definitions of GMPLS terms that are applicable across all GMPLS architectural models, the reader should refer to the RFCs listed in the references sections of this document. [RFC3945] provides an overview of the GMPLS architecture and should be read first.

5. Management Considerations

The MPLS-TP based network requires management. The MPLS-TP specifications described in [RFC5654], [RFC5860], [RFC5921], [RFC5951], [RFC6371], [RFC6372], [ITU-T G.8110.1] and [ITU-T G.7710], include considerable efforts to provide operator control and monitoring, as well as Operations, Administration and Maintenance (OAM) functionality.

These concepts are, however, out of scope of this document.

6. Security Considerations

Security is a significant requirement of MPLS-TP. See for more information [SECURITY].

However, this informational document is intended only to provide lexicography, and the security concerns are, therefore, out of scope.

7. IANA Considerations

There are no IANA actions resulting from this document.

8. Acknowledgments

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