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INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS  
AND NEXT GENERATION NETWORKS

Internet protocol aspects – Operation, administration and  
maintenance

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## **Misbranching detection for MPLS networks**

ITU-T Recommendation Y.1713

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**GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT  
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# ITU-T Recommendation Y.1713

## Misbranching detection for MPLS networks

### Summary

This Recommendation provides mechanisms for user-plane OAM (Operation and Maintenance) functionality in MPLS networks to augment ITU-T Rec. Y.1711 according to the requirements and principles given in ITU-T Rec. Y.1710. The current version of this Recommendation is designed primarily to support point-to-point and multipoint-to-point LSPs independent of the method of establishment.

### Source

ITU-T Recommendation Y.1713 was approved on 15 March 2004 by ITU-T Study Group 13 (2001-2004) under the ITU-T Recommendation A.8 procedure.

### Keywords

Defect, failure, MPLS, OAM.

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# ITU-T Recommendation Y.1713

## Misbranching detection for MPLS networks

### 1 Scope

This Recommendation provides mechanisms for user-plane OAM (Operation and Maintenance) functionality in MPLS networks according to the requirements and principles given in ITU-T Rec. Y.1710. The current version of this Recommendation is designed primarily to support point-to-point and multipoint-to-point LSPs independent of the method of establishment.

The detection mechanism utilizes an additional OAM packet (known as FEC-CV) which uses protocol conventions in common with ITU-T Rec. Y.1711 (use of OAM alert label, the ITU-T Rec. Y.1711 administered PDU and code points). Usage and applicability is outlined in clause 6.

### 2 References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Recommendation. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Recommendation are therefore encouraged to investigate the possibility of applying the most recent edition of the Recommendations and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published. The reference to a document within this Recommendation does not give it, as a stand-alone document, the status of a Recommendation.

- [1] ITU-T Recommendation Y.1711 (2004), *Operation & Maintenance mechanism for MPLS networks*.
- [2] ITU-T Recommendation G.805 (2000), *Generic functional architecture of transport networks*.
- [3] ITU-T Recommendation M.20 (1992), *Maintenance philosophy for telecommunication networks*.
- [4] ITU-T Recommendation Y.1710 (2002), *Requirements for Operation & Maintenance functionality for MPLS networks*.
- [5] IETF RFC 3036 (2001), *LDP Specification*. Category: Standards Track.
- [6] IETF RFC 3209 (2001), *RSVP-TE: Extensions to RSVP for LSP Tunnels*. Category: Standards Track.
- [7] IETF RFC 3212 (2002), *Constraint-Based LSP Setup using LDP*. Category: Standards Track.
- [8] IETF RFC 3429 (2002), *Assignment of the 'OAM Alert Label' for Multiprotocol Label Switching Architecture (MPLS) Operation and Maintenance (OAM) Functions*. Category: Informational.

### 3 Bibliography

- [9] IETF RFC 2547 (1999), *BGP/MPLS VPNs*. Category: Informational.

## 4 Definitions

This Recommendation introduces some terminology, which is required to discuss the functional network components associated with OAM. These definitions are consistent with G.805 terminology.

**4.1 backward direction:** The backward direction is opposite to the forward direction.

**4.2 client/server (relationship between layer networks):** [2] A term referring to the transparent transport of a client (i.e., higher) layer link connection by a server (i.e., lower) layer network trail.

**4.3 defect:** [3] Interruption of the capability of a transport entity (e.g., network connection) to transfer user or OAM information. This Recommendation defines 2 types of defects and references defects defined in ITU-T Rec. Y.1711 (the detailed specifications are given later):

dLOCV: Loss of Connectivity Verification defect

dExcess: Receiving excess rate of CV

dServer: Server layer defect

Any server layer defect arising from a non-MPLS layer technology below the lowest MPLS layer network

dFECfilter\_Mismatch: FEC filter mismatch defect

dFECfilter\_Mismerge: FEC filter mismerge defect

dTSSI\_Mismatch: Trail Termination Source Identifier Mismatch defect

dTTSI\_Mismerge: Trail Termination Source Identifier Mismerge defect

dUnknown: Unknown defect in the MPLS network

dPeerME: Unspecified failure in a peer maintenance entity.

**4.4 failure:** [3] Termination of the capability of a transport entity to transfer user or OAM information. A failure can be caused by a persisting defect.

**4.5 forward direction:** The forward direction is the direction that traffic and the CV OAM packets flow on an LSP.

**4.6 link connection:** A partition of a layer N trail that exists between two logically adjacent switching points within the layer N network.

**4.7 subnetwork:** [2] A subnetwork is a contiguous topological region of a network delimited by its set of peripheral access points, and is characterized by the possible routing across the subnetwork between those access points. A network is the largest subnetwork and a node is the smallest subnetwork (at least in practical physical terms, though there are smaller subnetworks within nodes).

**4.8 trail:** [2] A generic transport entity at layer N which is composed of a payload field (which can carry a packet from a client higher layer N-1 trail entity) with specific overhead added to ensure the forwarding integrity of the trail transport entity at layer N.

**4.9 trail termination point:** [2] A source or sink point of a trail at layer N, at which the trail overhead is added or removed respectively. A trail termination point must have a unique means of identification within the layer network.

**4.10 user-plane:** This refers to the set of traffic forwarding components through which traffic flows. CV or FEC-CV OAM packets are periodically inserted into this traffic flow to monitor the health of those forwarding components. The user-plane is also sometimes called the data-plane (especially in IETF). Note that control-plane protocols (e.g., for signalling or routing) and management-plane protocols will require their own user-plane, and their user-plane may or may not be congruent (to varying degrees) with the traffic bearing user-plane.

## 5 Abbreviations

This Recommendation uses the following abbreviations:

|           |                                                            |
|-----------|------------------------------------------------------------|
| BDI       | Backward Defect Indication                                 |
| BIP       | Bit Interleaved Parity                                     |
| CR-LDP    | Constraint-based Routing using Label Distribution Protocol |
| CV        | Connectivity Verification                                  |
| CV Packet | Connectivity Verification Packet                           |
| DL        | Defect Location                                            |
| DoS       | Denial of Service                                          |
| DT        | Defect Type                                                |
| ECMP      | Equal Cost Multi-Path                                      |
| FDI       | Forward Defect Indication                                  |
| FEC       | Forwarding Equivalence Class                               |
| FFD       | Fast Failure Detection                                     |
| LSP       | Label Switched Path                                        |
| LSR       | Label Switching Router                                     |
| MPLS      | Multi-Protocol Label Switching                             |
| NMS       | Network Management System                                  |
| OAM       | Operations and Maintenance                                 |
| PHP       | Penultimate Hop Popping                                    |
| RSVP      | Resource Reservation Protocol                              |
| TTL       | Time to Live                                               |
| TTSI      | Trail Termination Source Identifier                        |

## 6 Applicability and overview of functionality

In addition to the potential of forwarding problems misdirecting traffic within a specific MPLS level, MPLS provides the ability to define arbitrary hierarchy, but does not necessarily provide for synchronization mechanisms to ensure all hierarchical dependencies are satisfied prior to insertion of traffic into an LSP. A common example would be any overlay on an LDP [5] network that used independent label distribution mode. In independent mode an LSR in the core of the network may advertise a label binding for an FEC immediately upon learning of the FEC via any means (typically via an IGP advertisement) and this may be prior to having a viable downstream label binding or having LDP properly configured on all links that would be expected to be traversed by the LSP. This means that MPLS connectivity to the network egress for the FEC that applications of the MPLS level may depend on does not necessarily exist. The result is that the LDP label is popped in the core of the network, and the popping LSR may attempt to forward the application label. This may be a transient situation but is indicative of the types of problems that may occur.

Therefore the ability to ubiquitously detect problems in the network requires the ability to detect misbranching independent of the specific application. Currently the Y.1711 CV PDU [1] permits this to be performed for p2p LSPs where the specific ingress is known, and FEC-CV PDU permits this to be performed for p2p and mp2p LSPs where the set of ingresses is not necessarily known.