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Amendment 2
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Linear protection switching for MPLS transport
profile

Amendment 2

Recommendation ITU-T G.8131/Y.1382 (2014) –
Amendment 2

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Recommendation ITU-T G.8131/Y.1382

Linear protection switching for MPLS transport profile

Amendment 2

Summary

Recommendation ITU-T G.8131/Y.1382 provides architecture and mechanisms for subnetwork connection (SNC) protection switching for MPLS transport profile (MPLS-TP) networks. It describes the SNC protection architectures type, the uni- and bidirectional switching types and the revertive/non-revertive operation types. It defines an automatic protection coordination protocol used to coordinate both ends of the protected domain.

Amendment 1 provided the format of APC specific information, and descriptions about management (MI) signals and trail protection architecture.

Amendment 2 to Recommendation ITU-T G.8131/Y.1382 (2014) provides:

- Support for pseudowire (PW) protection.
- Modifications to the references of terms related to new Recommendation ITU-T G.808

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APC, APS, PSC, bridge, selector, SNC protection, MPLS-TP.

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Recommendation ITU-T G.8131/Y.1382

Linear protection switching for MPLS transport profile

Amendment 2

Editorial note: This is a complete-text publication. Modifications introduced by this amendment are shown in revision marks relative to Recommendation ITU-T G.8131/Y.1382 (2014) plus its Amendment 1 (2016).

1 Scope

This Recommendation provides architecture and mechanisms for linear protection switching for MPLS transport profile (MPLS-TP) networks.

The automatic protection coordination protocol, and 1+1 and 1:1 protection architecture are defined in this Recommendation. Other protection architecture types are for further study.

This Recommendation describes the protection switching functionality for point-to-point connections using the automatic protection switching (APS) mode defined in [IETF RFC 7271].

This Recommendation provides a representation of the MPLS-TP technology using the methodologies that have been used for other transport technologies (e.g., synchronous digital hierarchy (SDH), optical transport network (OTN) and Ethernet).¹

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.

- [ITU-T G.780] Recommendation ITU-T G.780/Y.1351 (2010), *Terms and definitions for synchronous digital hierarchy (SDH) networks*.
- [ITU-T G.805] Recommendation ITU-T G.805 (2000), *Generic functional architecture of transport networks*.
- [ITU-T G.806] Recommendation ITU-T G.806 (2012), *Characteristics of transport equipment – Description methodology and generic functionality*.
- [\[ITU-T G.808\] Recommendation ITU-T G.808 \(2016\), *Terms and definitions for network protection and restoration*.](#)
- [ITU-T G.808.1] Recommendation ITU-T G.808.1 (2014), *Generic protection switching – Linear trail and subnetwork protection*.
- [\[ITU-T G.870\] Recommendation ITU-T G.870/Y.1352 \(2012\), *Terms and definitions for optical transport networks*.](#)

¹ This ITU-T Recommendation is intended to be aligned with the IETF MPLS RFCs normatively referenced by this Recommendation.

- [ITU-T G.8031] Recommendation ITU-T G.8031/Y.1342 (2011), *Ethernet linear protection switching*.
- [ITU-T G.8110.1] Recommendation ITU-T G.8110.1/Y.1370.1 (2011), *Architecture of the Multi-Protocol Label Switching transport profile layer network*.
- [ITU-T G.8121] Recommendation ITU-T G.8121/Y.1381 (2013), *Characteristics of MPLS-TP equipment functional blocks*.
- [IETF RFC 5586] IETF RFC 5586 (2009), *MPLS Generic Associated Channel*
- [IETF RFC 6378] IETF RFC 6378 (2011), *MPLS Transport Profile (MPLS-TP) Linear Protection*.
- [IETF RFC 7271] IETF RFC 7271 (2014), *MPLS Transport Profile (MPLS-TP) Linear Protection to Match the Operational Expectations of Synchronous Digital Hierarchy, Optical Transport Network, and Ethernet Transport Network Operators*.
- [\[IETF RFC 7771-A\] IETF RFC 7771 \(2016\), Switching Provider Edge \(S-PE\) Protection for MPLS and MPLS Transport Profile \(MPLS-TP\) Static Multi-Segment Pseudowires; Appendix A – Optional Linear Protection Approach.](#)

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

- ~~3.1.1 — 1+1 protection architecture [ITU-T G.870]~~
- ~~3.1.2 — 1:n protection architecture [ITU-T G.870]~~
- ~~3.1.3 — 1 phase [ITU-T G.870]~~
- ~~3.1.4 — 2 phase [ITU-T G.870]~~
- ~~3.1.5 — 3 phase [ITU-T G.870]~~
- ~~3.1.6 — active transport entity [ITU-T G.870]~~
- ~~3.1.7 — APS protocol [ITU-T G.870]~~
- ~~3.1.8 — architecture [ITU-T G.870]~~
- ~~3.1.9 — bidirectional protection switching [ITU-T G.780]~~
- ~~3.1.10 — bridge [ITU-T G.870]~~
- ~~3.1.11 — defect [ITU-T G.806]~~
- ~~3.1.12 — failure [ITU-T G.806]~~
- ~~3.1.13 — forced switch [ITU-T G.870]~~
- ~~3.1.14 — hold-off time [ITU-T G.870]~~
- ~~3.1.15 — manual switch [ITU-T G.870]~~
- ~~3.1.16 — non-revertive (protection) operation [ITU-T G.870]~~
- ~~3.1.17 — normal traffic signal [ITU-T G.870]~~
- ~~3.1.18 — permanent bridge [ITU-T G.870]~~
- ~~3.1.19 — protected domain [ITU-T G.870]~~

~~3.1.20 protection [ITU-T G.870]~~
~~3.1.21 protection group [ITU-T G.870]~~
~~3.1.22 protection transport entity [ITU-T G.870]~~
~~3.1.23 revertive (protection) operation [ITU-T G.870]~~
~~3.1.24 selector [ITU-T G.870]~~
~~3.1.25 selector bridge [ITU-T G.870]~~
~~3.1.26 signal [ITU-T G.870]~~
~~3.1.27 signal degrade (SD) [ITU-T G.806]~~
~~3.1.28 signal fail (SF) [ITU-T G.806]~~
~~3.1.29 standby transport entity [ITU-T G.870]~~
~~3.1.30 subnetwork connection protection [ITU-T G.870]~~
~~3.1.31 switch [ITU-T G.870]~~
~~3.1.32 traffic signal [ITU-T G.870]~~
~~3.1.33 trail [ITU-T G.805]~~
~~3.1.34 trail protection [ITU-T G.870]~~
~~3.1.35 transport entities [ITU-T G.870]~~
~~3.1.36 unidirectional protection switching [ITU-T G.780]~~
~~3.1.37 wait to restore time [ITU-T G.870]~~
~~3.1.38 working transport entity [ITU-T G.870]~~
3.1.1 1+1 protection architecture [ITU-T G.808]
3.1.2 1:n protection architecture [ITU-T G.808]
3.1.3 1-phase [ITU-T G.808]
3.1.4 2-phase [ITU-T G.808]
3.1.5 3-phase [ITU-T G.808]
3.1.6 active transport entity [ITU-T G.808]
3.1.6 APS protocol [ITU-T G.808]
3.1.7 bidirectional protection switching [ITU-T G.780]
3.1.8 bridge [ITU-T G.808]
3.1.9 defect [ITU-T G.806]
3.1.10 failure [ITU-T G.806]
3.1.11 forced switch [ITU-T G.808]
3.1.12 hold-off time [ITU-T G.880]
3.1.13 manual switch [ITU-T G.808]
3.1.14 non-revertive (protection) operation [ITU-T G.808]
3.1.15 normal traffic signal [ITU-T G.808]
3.1.16 permanent bridge [ITU-T G.808]
3.1.17 protected domain [ITU-T G.808]

- [3.1.18 protection \[ITU-T G.808\]](#)
- [3.1.19 protection group \[ITU-T G.808\]](#)
- [3.1.20 protection transport entity \[ITU-T G.808\]](#)
- [3.1.21 revertive \(protection\) operation \[ITU-T G.808\]](#)
- [3.1.22 selector \[ITU-T G.808\]](#)
- [3.1.23 selector bridge \[ITU-T G.808\]](#)
- [3.1.24 signal degrade \(SD\) \[ITU-T G.806\]](#)
- [3.1.25 signal fail \(SF\) \[ITU-T G.806\]](#)
- [3.1.26 standby transport entity \[ITU-T G.808\]](#)
- [3.1.27 subnetwork connection protection \[ITU-T G.808\]](#)
- [3.1.28 switch \[ITU-T G.808\]](#)
- [3.1.29 trail \[ITU-T G.805\]](#)
- [3.1.30 trail protection \[ITU-T G.807\]](#)
- [3.1.31 transport entity \[ITU-T G.805\]](#)
- [3.1.32 unidirectional protection switching \[ITU-T G.780\]](#)
- [3.1.33 wait-to-restore time \[ITU-T G.808\]](#)
- [3.1.34 working transport entity \[ITU-T G.808\]](#)

3.2 Terms defined in this Recommendation

This Recommendation defines the following term:

3.2.1 PSC protocol: A means to coordinate the two ends of the protected domain via the exchange of a single message as defined in [IETF RFC 6378].

4 Abbreviations and acronyms

This Recommendation uses the following abbreviations and acronyms:

ACH	Associated Channel Header
APC	Automatic Protection Coordination
APS	Automatic Protection Switching
dFOP	Failure of Protocol defect
DNR	Do-not-Revert
DPath	Data Path
EXER	Exercise
FPath	Fault Path
FS	Forced Switch
G-ACh	Generic Associated Channel
LO	Lockout of protection
LSP	Label Switched Path
MPLS-TP	MPLS Transport Profile

MS	Manual Switch
MS-P	Manual Switch to Protection transport entity
MS-PW	Multi-Segment Pseudowire
MS-W	Manual Switch to Working transport entity
MT_C	MPLS-TP Connection
MT_CP	MPLS-TP Connection Point
MT_TT_Sk	MPLS-TP Trail Termination Sink
NR	No Request
OAM	Operations, Administration and Maintenance
OC	Operator Clear
OTN	Optical Transport Network
PDU	Protocol Data Unit
PSC	Protection State Coordination
PT	Protection Type
PW	Pseudowire
RR	Reverse Request
SD	Signal Degrade
SDH	Synchronous Digital Hierarchy
SD-P	Signal Degrade on Protection transport entity
SD-W	Signal Degrade on Working transport entity
SF	Signal Fail
SF-P	Signal Fail on Protection transport entity
S-PE	Switching Provider Edge
SF-W	Signal Fail on Working transport entity
SNC	Subnetwork Connection
SNCP	Subnetwork Connection Protection
SNC/S	SNCP with Sublayer monitoring
SS-PW	Single-Segment Pseudowire
TLV	Type Length Value
T-PE	Terminating Provider Edge
WTR	Wait-to-Restore

5 Conventions

In this Recommendation, the term automatic protection coordination (APC) protocol is used to describe the means to coordinate the two ends of the protected domain via the exchange of a single message and represents the protection state coordination (PSC) protocol in automatic protection switching (APS) mode as defined in [IETF RFC 7271]. This protocol is developed to provide the same operator control and experience of APS protocol by modifying and enhancing the PSC protocol as described in [IETF RFC 6378].

6 Protection architecture and characteristics

Protection switching is a fully allocated protection mechanism that can be used on any topology. It is fully allocated in the sense that the route and bandwidth of the protection connection is reserved for a selected working connection. To be effective under all possible failures of the working connection however, the protection connection must be known to have complete physical diversity over all common-failure modes. This may not always be possible. Also, this might require the working connection not to follow its shortest path.

This version of the Recommendation describes the MPLS-TP subnetwork connection protection with sublayer monitoring (SNC/S) protection architecture for both LSP and PW sublayers. It also supports MPLS-TP trail protection architecture for both LSP and PW sublayers. Other types (~~e.g., trail protection for the PW sublayer~~) are for further study.

6.1 MPLS-TP protection architecture

6.1.1 MPLS-TP SNC protection

MPLS-TP subnetwork connection protection (SNCP) is used to protect a section of a connection (e.g., that section where two separate routes are available) within an operator's network or multiple operators' networks. Two independent subnetwork connections exist, which act as working and protection transport entities for the (protected) normal traffic signal.

6.1.1.1 SNC/S protection

The MPLS-TP sublayer trail termination functions (i.e., tandem connection termination functions) generate/insert and monitor/extract the MPLS-TP operations, administration and maintenance (OAM) information to determine the status of the working and protection MPLS-TP sublayer trails. See also [ITU-T G.8110.1]. Automatic protection coordination (APC) protocol information is transported over the protection subnetwork connection (SNC). The 1+1 unidirectional protection can work with or without APC protocol.

6.1.2 MPLS-TP trail protection

MPLS-TP trail protection is used to protect a MPLS-TP trail within an operator's network or multiple operators' networks. It is a dedicated end-to-end protection architecture. The MT trail termination functions generate/insert and monitor/extract the end-to-end MPLS-TP OAM information to determine the status of the working and protection transport entities. See also [ITU-T G.8110.1]. APC information is transported over the protection trail except for the case of 1+1 unidirectional switching without APC communication.

The details of the atomic functions for APC processing are described in [ITU-T G.8121].

6.2 Switching types

The protection switching types can be a unidirectional switching type or a bidirectional switching type.

6.2.1 Unidirectional switching type

In unidirectional switching, only the affected direction of the connection is switched to protection; the selectors at each end are independent. This type is applicable for 1+1 MPLS-TP SNC/S protection. Unidirectional switching can protect two unidirectional failures or degradations in opposite directions on different entities.

6.2.2 Bidirectional switching type

In bidirectional switching, both directions of the connection, including the affected direction and the unaffected direction, are switched to protection. For bidirectional switching, APC protocol is required to coordinate the two endpoints.