I n t e r n a t i o n a l   T e l e c o m m u n i c a t i o n   U n i o n

ITU-T

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

G.8121/Y.1381

(03/2006)

SERIES G: TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

Ethernet over Transport aspects – MPLS over Transport aspects

SERIES Y: GLOBAL INFORMATION INFRASTRUCTURE, INTERNET PROTOCOL ASPECTS AND NEXT-GENERATION NETWORKS

Internet protocol aspects – Transport

Characteristics of Transport MPLS equipment functional blocks

ITU-T Recommendation G.8121/Y.1381

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ITU-T G-SERIES RECOMMENDATIONS

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ITU-T Recommendation G.8121/Y.1381

Characteristics of Transport MPLS equipment functional blocks

Summary

This Recommendation specifies both the functional components and the methodology that should be used in order to specify Transport MPLS layer network functionality of network elements; it does not specify individual Transport MPLS network equipment as such.

Source

ITU-T Recommendation G.8121/Y.1381 was approved on 29 March 2006 by ITU-T Study Group 15 (2005-2008) under the ITU-T Recommendation A.8 procedure.

Keywords

Atomic functions, equipment functional blocks, Transport MPLS layer network, T-MPLS.

FOREWORD

The International Telecommunication Union (ITU) is the United Nations specialized agency in the field of telecommunications. The ITU Telecommunication Standardization Sector (ITU-T) is a permanent organ of ITU. ITU-T is responsible for studying technical, operating and tariff questions and issuing Recommendations on them with a view to standardizing telecommunications on a worldwide basis.

The World Telecommunication Standardization Assembly (WTSA), which meets every four years, establishes the topics for study by the ITU-T study groups which, in turn, produce Recommendations on these topics.

The approval of ITU-T Recommendations is covered by the procedure laid down in WTSA Resolution 1.

In some areas of information technology which fall within ITU-T's purview, the necessary standards are prepared on a collaborative basis with ISO and IEC.

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In this Recommendation, the expression "Administration" is used for conciseness to indicate both a telecommunication administration and a recognized operating agency.

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As of the date of approval of this Recommendation, ITU had not received notice of intellectual property, protected by patents, which may be required to implement this Recommendation. However, implementors are cautioned that this may not represent the latest information and are therefore strongly urged to consult the TSB patent database.

CONTENTS

ITU-T Recommendation G.8121/Y.1381

Characteristics of Transport MPLS equipment functional blocks

1 Scope

This Recommendation specifies both the functional components and the methodology that should be used in order to specify Transport MPLS layer network functionality of network elements; it does not specify individual Transport MPLS network equipment as such.

This Recommendation forms part of a suite of Recommendations covering the full functionality of network equipment. These Recommendations are ITU-T Recs G.806 (Conventions and Generic Equipment Functions), G.798 (OTN functions), G.783 (SDH functions), G.705 (PDH functions), G.781 (Synchronization functions), I.732 (ATM functions), G.8021/Y.1341 (ETH functions), G.7710/Y.1701, G.784 and G.874 (Management functions). This Recommendation also follows the principles defined in ITU-T Rec. G.805.

These Recommendations specify a library of basic building blocks and a set of rules by which they may be combined in order to describe digital transmission equipment. The library comprises the functional building blocks needed to specify completely the generic functional structure of the Transport MPLS layer network. In order to be compliant with this Recommendation, equipment needs to be describable as an interconnection of a subset of these functional blocks contained within this Recommendation. The interconnections of these blocks should obey the combination rules given.

Not every atomic function defined in this Recommendation is required for every application. Different subsets of atomic functions may be assembled in different ways according to the combination rules given in this Recommendation to provide a variety of different capabilities. Network operators and equipment suppliers may choose which functions must be implemented for each application.

Figure 1 presents the set of atomic functions associated with the traffic signal transport.

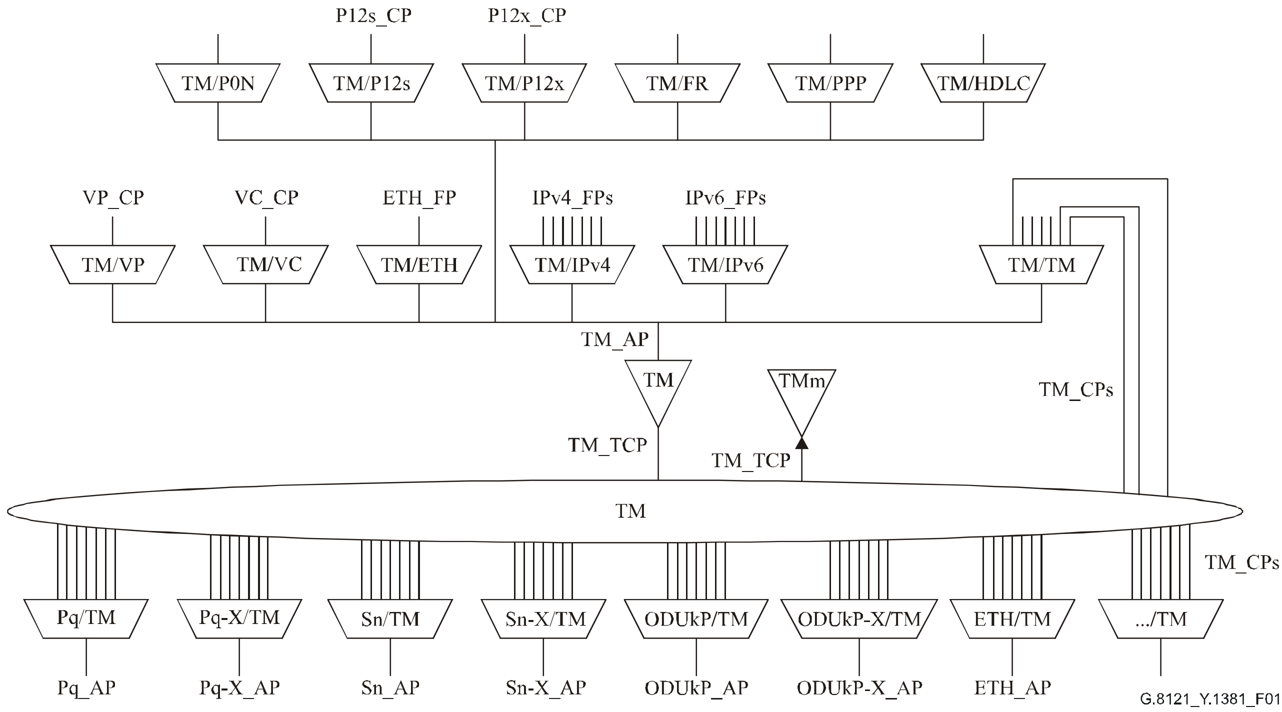

Figure 1/G.8121/Y.1381 – MPLS atomic functions

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 Recommendation G.705 (2000), *Characteristics of plesiochronous digital hierarchy (PDH) equipment functional blocks*.

– ITU-T Recommendation G.707/Y.1322 (2003), *Network node interface for the synchronous digital hierarchy (SDH).*

– ITU-T Recommendation G.709/Y.1331 (2003), *Interfaces for the Optical Transport Network (OTN).*

– ITU-T Recommendation G.780/Y.1351 (2004), *Terms and definitions for synchronous digital hierarchy (SDH) networks.*

– ITU-T Recommendation G.783 (2006), *Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks.*

– ITU-T Recommendation G.798 (2004), *Characteristics of optical transport network hierarchy equipment functional blocks.*

– ITU-T Recommendation G.805 (2000), *Generic functional architecture of transport networks.*

– ITU-T Recommendation G.806 (2006), *Characteristics of transport equipment – Description methodology and generic functionality.*

- ITU-T Recommendation G.808.1 (2006), *Generic protection switching – Linear trail and subnetwork protection.*
- ITU-T Recommendation G.809 (2003), *Functional architecture of connectionless layer networks*.
- ITU-T Recommendation G.870/Y.1352 (2004), *Terms and definitions for Optical Transport Networks (OTN).*
- ITU-T Recommendation G.8110/Y.1370 (2005), *MPLS layer network architecture*.
- ITU-T Recommendation G.8110.1/Y.1370.1 (2006), *Architecture of Transport MPLS (T-MPLS) layer network*.
- ITU-T Recommendation G.8112/Y.1371 (2006), *Interfaces for the Transport MPLS (T-MPLS) hierarchy.*
- ITU-T Recommendation G.7041/Y.1303 (2005), *Generic framing procedure (GFP)*.
- ITU-T Recommendation G.7042/Y.1305 (2006), *Link capacity adjustment scheme (LCAS) for virtual concatenated signals.*
- ITU-T Recommendation G.8021/Y.1341 (2004), *Characteristics of Ethernet transport network equipment functional blocks.*
- ITU-T Recommendation Y.1415 (2005), *Ethernet-MPLS network interworking – User plane interworking*.
- ITU-T Recommendation Y.1711 (2004), *Operation and maintenance mechanism for MPLS networks.*
- ITU-T Recommendation Y.1720 (2003), *Protection switching for MPLS networks.*
- IETF RFC 3031 (2001), *Multiprotocol label switching architecture.*
- IETF RFC 3032 (2001), *MPLS label stack encoding.*
- IETF RFC 3270 (2002), *Multi-Protocol Label Switching (MPLS) support of Differentiated Services.*
- IETF RFC 3443 (2003), *Time To Live (TTL) processing in Multi-Protocol Label Switching (MPLS) networks.*

3 Definitions

This Recommendation uses the following terms defined in ITU-T Rec. G.805:

3.1 access point

3.2 adapted information

3.3 characteristic information

3.4 client/server relationship

3.5 connection

3.6 connection point

3.7 layer network

3.8 matrix

3.9 network

3.10 network connection

3.11 reference point

3.12 subnetwork

3.13 subnetwork connection

3.14 termination connection point

3.15 trail

3.16 trail termination

3.17 transport

3.18 transport entity

3.19 transport processing function

3.20 unidirectional connection

3.21 unidirectional trail

This Recommendation uses the following terms defined in RFC 3031:

3.22 label

3.23 label stack

3.24 label switched path

This Recommendation uses the following terms defined in RFC 3032:

3.25 Bottom of Stack

3.26 Time To Live

3.27 Label value

This Recommendation uses the following terms defined in RFC 3270:

3.28 Per-Hop Behaviour

4 Abbreviations

This Recommendation uses the following abbreviations:

AI Adapted Information

AP Access Point

BDI Backward Defect Indication

BIP Bit Interleaved Parity

CI Characteristic Information

CII Common Interworking Indicator

CP Connection Point

CV Connectivity Verification

DL Defect Location

DT Defect Type

EXP Experimental Use

FDI Forward Defect Indication

FFD Fast Failure Detection

FP	Flow Point
FTP	Flow termination point
LSP	Label Switched Path
MPLS	Multi-Protocol Label Switching
OAM	Operation, Administration and Maintenance
PHB	Per Hop Behaviour
PSC	PHB Scheduling Class
S	Bottom of Stack
SCC	Signalling Communication Channel
TCP	Termination Connection Point
TFP	Termination Flow Point
T-MPLS	Transport MPLS
TM	Transport MPLS
TTL	Time-To-Live
TTSI	Trail Termination Source Identifier

5 Conventions

The diagrammatic convention for connection-oriented layer networks described in this Recommendation is that of ITU-T Rec. G.805.

6 Supervision

The generic supervision functions are defined in clause 6/G.806. Specific supervision functions for the Transport MPLS network are defined in this clause.

6.1 Defects

6.1.1 Nomenclature

The following terms are used in the criteria definition below:

- "expected packet":
  - in an LSP configured with CV: a CV packet with TTSI==ExTTSI
  - in an LSP configured with FFD: an FFD packet with TTSI==ExTTSI
- "unexpected FFD":
  - in an LSP configured with CV: any FFD packet
  - in an LSP configured with FFD: an FFD packet with TTSI≠ExTTSI
- "unexpected CV":
  - in an LSP configured with CV: a CV packet with TTSI≠ExTTSI
  - in an LSP configured with FFD: any CV packet
- "expected packet period":
  - in an LSP configured with CV: the CV period (one second)
  - in an LSP configured with FFD: the FFD period used by the sink function

- E: Number of "expected packets" received during the most recent three "expected packet periods"
- Uffd: Number of "unexpected FFD" received during the most recent three "expected packet periods"
- Ucv_3cv: Number of "unexpected CV" received during the most recent three CV periods (i.e. three seconds)

6.1.2 Summary of Defect Entry/Exit criteria

The defects shall be raised/cleared as per Table 1.

Table 1/G.8121/Y.1381 – Defect raise and clearing conditions

<table>
<tr><th>Defect</th><th>Raise condition</th><th>Clearing condition</th></tr>
<tr><td>dLOCV</td><td>(E==0)</td><td>(2<=E)</td></tr>
<tr><td>dMismatch</td><td>(E==0) && ((Ucv_3cv>0) || (Uffd>0))</td><td>(1<=E) || ((Ucv_3cv==0) && (Uffd==0))</td></tr>
<tr><td>dMismerge</td><td>(E>0) && ((Ucv_3cv>0) || (Uffd>0))</td><td>(E==0) || ((Ucv_3cv==0) && (Uffd==0))</td></tr>
<tr><td>dExcess</td><td>(E>=5)</td><td>(E<=4)</td></tr>
</table>

NOTE – It is a known fact that there is a possibility for toggling dMismerge situations. These can occur for mismerges of FFD LSPs of a certain FFD period with FFD LSPs with longer FFD periods. The recommended way of handling this situation is that network domains be operated with at most one FFD frequency (in addition to the basic CV frequency).

6.1.3 Continuity supervision

6.1.3.1 Loss of Connectivity Verification defect (dLOCV)

The Loss of Connectivity Verification defect is calculated at the T-MPLS layer. It monitors the presence of continuity in T-MPLS trails.

Its raise and clearing conditions are defined in Table 1.

6.1.4 Connectivity supervision

6.1.4.1 Trail Termination Source Identifier Mismatch defect (dMismatch)

The Trail Termination Source Identifier Mismatch defect is calculated at the T-MPLS layer. It monitors the connectivity to the specified source in T-MPLS trails.

Its raise and clearing conditions are defined in Table 1.

6.1.4.2 Trail Termination Source Identifier Mismerge defect (dMismerge)

The Trail Termination Source Identifier Mismerge defect is calculated at the T-MPLS layer. It monitors the absence of connectivity to sources other than the specified one in T-MPLS trails.

Its raise and clearing conditions are defined in Table 1.

6.1.4.3 Excessive CV/FFD OAM defect (dExcess)

The Excessive CV/FFD OAM defect is calculated at the T-MPLS layer. It monitors the rate of CV/FFD packets in T-MPLS trails.

Its raise and clearing conditions are defined in Table 1.

6.1.5 Maintenance signal supervision

6.1.5.1 Forward Defect Indicator defect (dFDI)

The Forward Defect Indicator defect is calculated at the T-MPLS layer. It monitors the presence of an FDI maintenance signal.

The dFDI defect is raised when a single FDI OAM packet is observed at the T-MPLS trail termination function.

The dFDI defect is cleared when in an aggregate period of 3 consecutive seconds no FDI OAM packets are observed at the T-MPLS trail termination function.

6.1.5.2 Backward Defect Indication defect (dBDI)

The Backward Defect Indicator defect is calculated at the T-MPLS layer. It monitors the presence of a BDI maintenance signal.

The dBDI defect is raised when a single BDI OAM packet is observed at the T-MPLS trail termination function.

The dBDI defect is cleared when in an aggregate period of 3 consecutive seconds no BDI OAM packets are observed at the T-MPLS trail termination function.

6.2 Consequent actions

For consequent actions, see ITU-T Rec. G.806 and the specific atomic functions.

6.3 Defect correlations

For the defect correlations, see the specific atomic functions.

6.4 Performance filters

Ffs.

7 Information flow across reference points

Information flow for T-MPLS functions is defined in clause 9. A generic description of information flow is defined in clause 7/G.806.

8 T-MPLS processes

This clause defines the specific processes for the Transport MPLS network. Generic processes are defined in clause 8/G.806.

8.1 CV/FFD processes

The defect detection processes take as their input the received CV/FFD frames and calculate from them the following defects: dLOCV, dMismatch, dMismerge, dExcess.

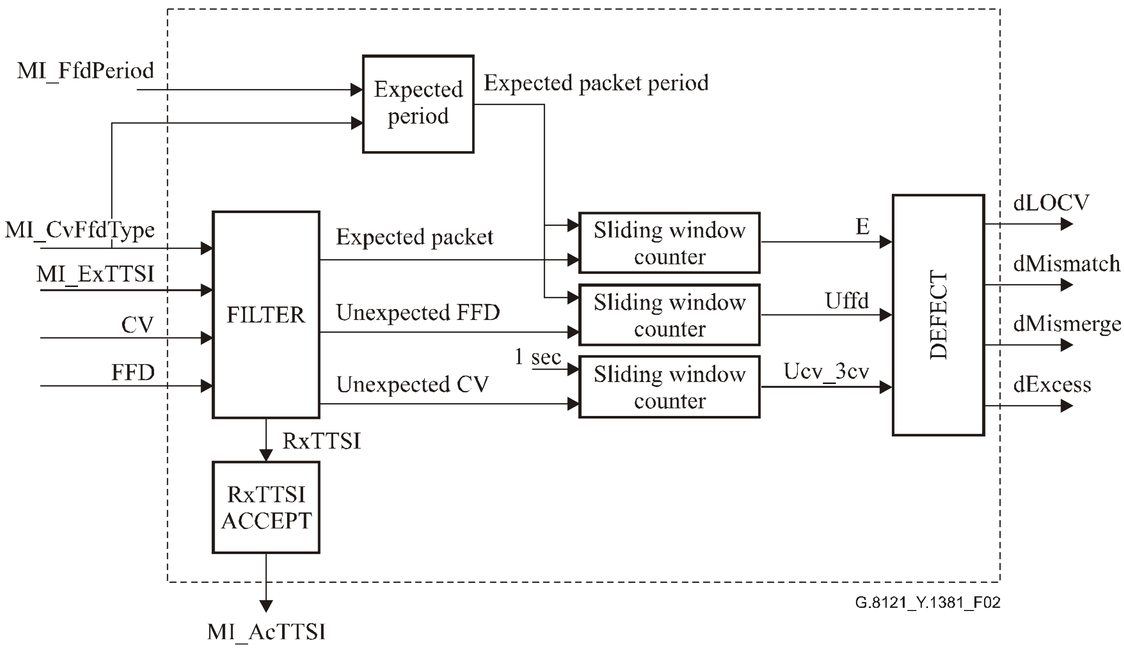

Figure 2/G.8121/Y.1381 – CV/FFD process block diagram

The Expected Period subprocess calculates the expected packet period as specified in Table 2.

Table 2/G.8121/Y.1381 – CV/FFD period

MI_CvFfdType	Period
CV	1 second
FFD	MI_FfdPeriod

The RxTTSI Accept subprocess copies the received TTSI (RxTTSI) of each received PDU into the AcTTSI.

NOTE – No persistency is applied in the TTSI Accept subprocess. This is because the PDU's validity is already verified by the BIP16.

The Filter, Sliding Window Counter and Defect subprocesses calculate the defects as per the definitions in 6.1.

8.2 EXP/Label processes

8.2.1 EXP/Label source processes

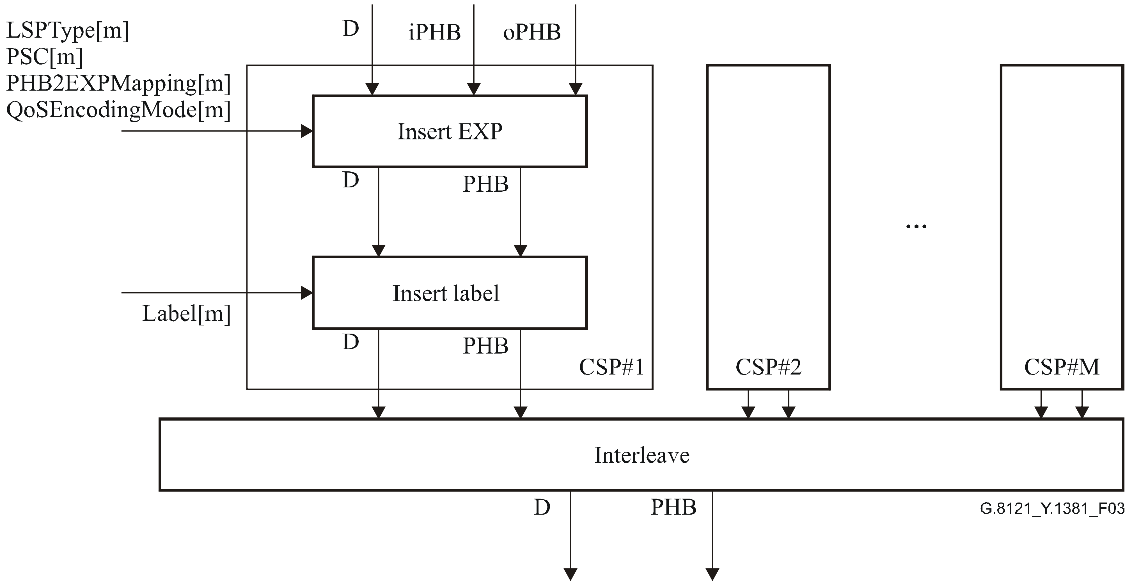

Figure 3/G.8121/Y.1381 – EXP/Label source processes

Figure 3 shows the EXP/Label source processes. These processes are performed on a frame-per-frame basis.

Client Specific Processes: The function supports M ($M \leq 2^N - 32$, with N = 20 for MPLS label) client specific processes (CSP#1 to CSP#M), each connected to a single T-MPLS connection point. CSP#m ($1 \leq m \leq M$) is active when Label[m] has a value in the range 32 to $2^N - 1$.

EXP Insertion process: Insert the EXP field encoding the PHB information according to the following rules:

- If LSPType[m] = L-LSP, the DP information is encoded into the EXP field according to RFC 3270 and PSC[m].
- If LSPType[m] = E-LSP, the PHB information is encoded into the EXP field according to the 1:1 mapping configured in the PHB2EXPMapping[m].

The PHB information to map into the EXP field is selected according to the following rules:

- If QoSEncodingMode[m] = A, the iPHB information is mapped into the EXP field.
- If QoSEncodingMode[m] = B, the oPHB information is mapped into the EXP field.

Label Insertion process: Insert the 20-bit MPLS Label field with the value provided via Label[m].

Interleave process: Interleave the T-MPLS traffic units from the client specific processes into a single stream.

8.2.2 EXP/Label Sink Processes

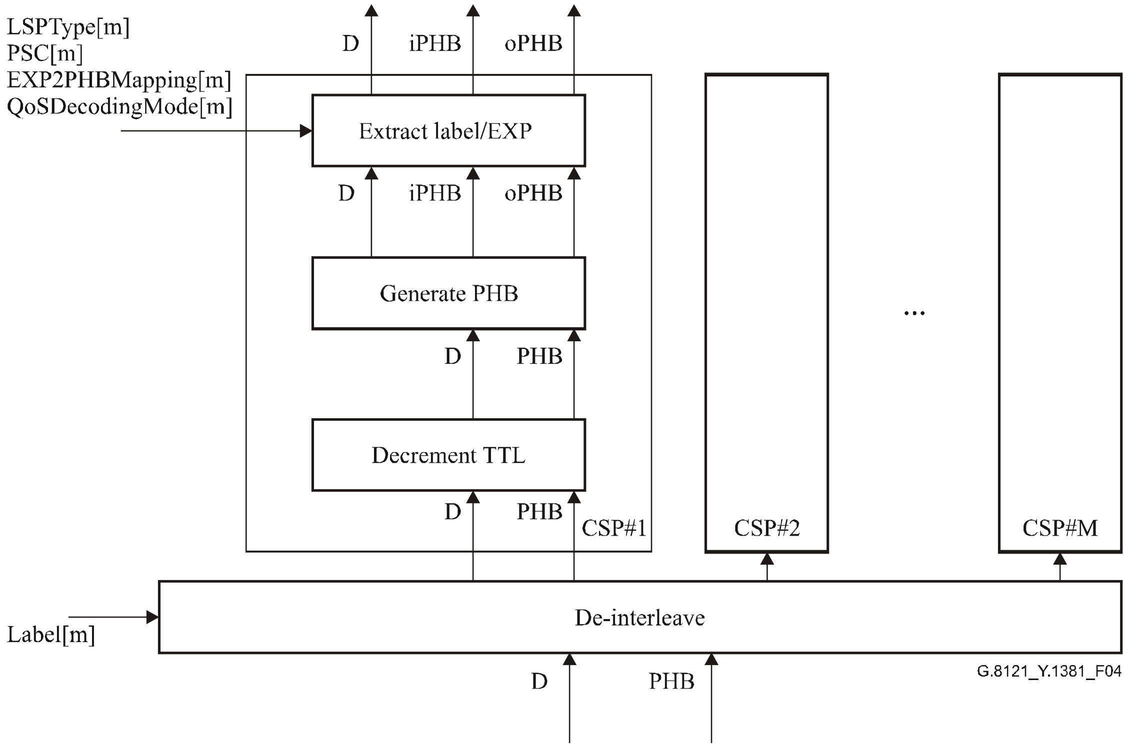

Figure 4/G.8121/Y.1381 – EXP/Label sink processes

Figure 4 shows the EXP/Label sink processes. These processes are performed on a frame-per-frame basis.

De-Interleave process: De-interleave the T-MPLS traffic units and forwards each of its Client Specific Process #m based on the value in the Label field of the traffic unit. Relation between CSP and MPLS label value is provided by Label[1..M].

Traffic units received with a label value identifying a non-active CSP are dropped.

Client Specific Processes: The function supports M ($M \leq 2^N - 32$, with N=20 for MPLS label) client specific processes (CSP#1 to CSP#M), each connected to a single T-MPLS connection point. CSP#m ($1 \leq m \leq M$) is active when Label[m] has a value in the range 32 to $2^N - 1$.

Label and EXP Extraction process: Extract the MPLS label and the EXP fields from the traffic unit.

TTL Decrement Process: Decrements the TTL. If the T-MPLS CP is not a TCP and the decremented TTL is less than or equal to zero, the traffic unit is dropped silently.

PHB Generation process: Processes the EXP field.

The iPHB signal is generated according to the following rules:

- If LSPType[m] = L-LSP, the PSC information is equal to the PSC[m] while the DP information is decoded from the EXP field according to RFC 3270 and the PSC[m].
- If LSPType[m] = E-LSP, the PHB information is decoded from the EXP field according to the 1:1 mapping configured in the EXP2PHBMapping[m].

The CI_oPHB is generated according to the following rule:

- If QoSDecodingMode = A, the oPHB is equal to the generated iPHB.
- If QoSDecodingMode = B, the oPHB is equal to the received PHB.

8.3 Queuing process

The queuing process buffers received MPLS packets for output according to the CI_oPHB. The details of the queuing process implementation are out of the scope of this Recommendation.

The queuing process is also responsible for dropping frames if their rate at the TM_CI is higher than the <Srv>_AI_D can accommodate. Performance monitor counters are *for further study*.

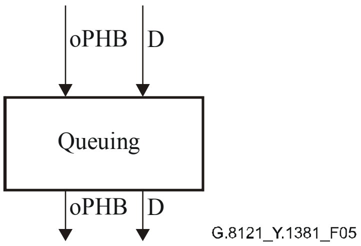

Figure 5/G.8121/Y.1381 – Queuing process

8.4 T-MPLS-specific GFP-F processes

8.4.1 T-MPLS-specific GFP-F source processes

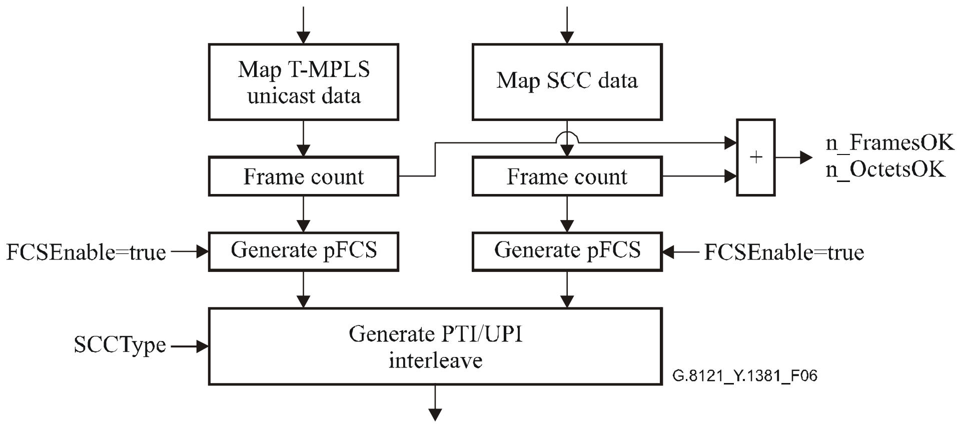

Figure 6/G.8121/Y.1381 – T-MPLS-specific GFP-F source process

Figure 6 shows the T-MPLS-specific GPF-F source processes. These processes are performed on a frame-per-frame basis.

Mapping of unicast T-MPLS data: The T-MPLS unicast frame is inserted into the client payload information field of the GFP frame as defined in 7.6/G.7041/Y.1303. One T-MPLS unicast frame results in one GFP frame.

NOTE 1 – Mapping of multicast T-MPLS data is for further study.

Mapping of SCC data: The SCC frame is inserted into the client payload information field of the GFP frame as defined in clause 7/G.7041/Y.1303. One SCC frame results in one GFP frame.

Frame Count: It counts the number of frames (n_FramesOK) and of octets (n_OctetsOK) that passes through.

pFCS generation: See 8.5.4.1.1/G.806. GFP FCS is always enabled (FCSEnable=true).

Generate PTI and UPI, Interleave: The PTI field of the GFP type header is set fixed to "000". The UPI field of the GFP type header is set to:

– the MPLS Unicast UPI (as defined in Table 6-3/G.7041/Y.1303), for frames coming from the Map MPLS Unicast data process;

– the SCC UPI according to SCCType for frames coming from the Map SCC data process.

The frames are then interleaved to form a single stream.

NOTE 2 – GFP Client Management frames are not defined for MPLS over GFP-F mapping.

8.4.2 T-MPLS-specific GFP-F sink processes

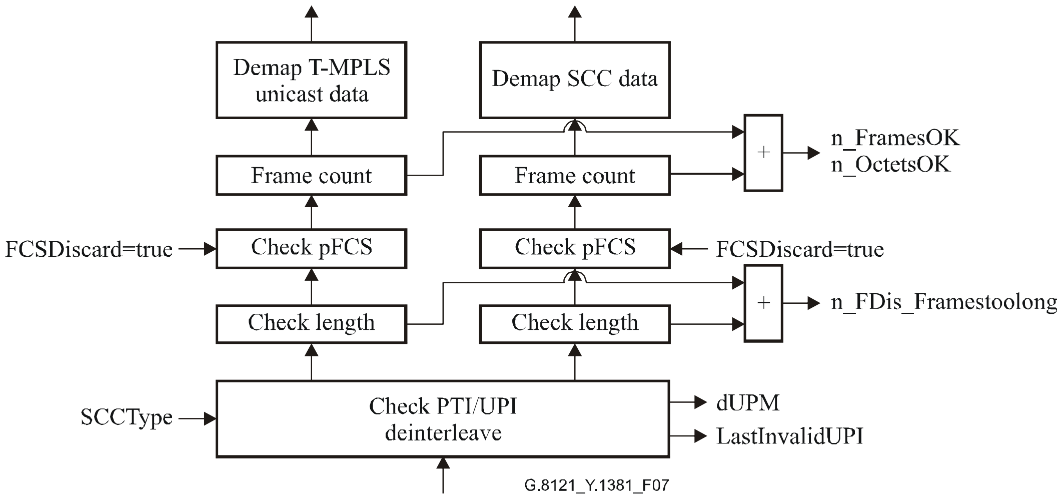

Figure 7/G.8121/Y.1381 – T-MPLS-specific GFP-F sink process

Figure 7 shows the T-MPLS-specific GPF-F sink processes. These processes are performed on a frame-per-frame basis.

Check PTI and UPI, Deinterleave: GFP frames with an accepted PTI (AcPTI, see 8.5.1.1/G.806) of "000" are client data frames. All GFP frames with an accepted PTI (AcPTI, see 8.5.1.1/G.806) value other than "000" shall be discarded.

The UPI of client data frames is checked to generate dUPM as follows:

– a "valid-UPI frame" is a frame with a UPI that equals either the MPLS Unicast UPI (as defined in Table 6-3/G.7041/Y.1303) or the SCC UPI according to SCCType. All other frames are "invalid-UPI frames".

– dUPM is raised as soon as one "invalid-UPI frame" is received.

– dUPM is cleared if no "invalid-UPI frames" have been received for the last Tclear seconds.

Tclear is ffs. If dUPM is active, the latest received invalid UPI is available at LastInvalidUPI. If dUPM is not active, LastInvalidUPI is "n/a".

The UPI of client data frames is further used to deinterleave the frames:

– "valid-UPI frames" with UPI equalling the MPLS Unicast UPI (as defined in Table 6-3/G.7041/Y.1303) are sent towards the Map MPLS Unicast data process.

– "valid-UPI frames" with UPI equalling the SCC UPI according to SCCType (as defined in Table 6-3/G.7041/Y.1303) are sent towards the Map SCC data process.

– "invalid-UPI frames" are discarded.

GFP-F frame length: It checks whether the length of the GFP-F frame is allowed. Frames longer than GFP_Length bytes are dropped and counted (n_FramesTooLong).

NOTE 1 – GFP_Length is for further study.

pFCS Supervision: See 8.5.4.1.2/G.806. The discarding of errored frames is always enabled (FCSdiscard=true). If the accepted PFI is 0, the frame is dropped and counted (n_FDis_PFI).

Frame Count: It counts the number of frames (n_FramesOK) and of octets (n_OctetsOK) that passes through.

Demapping of SCC data: The SCC frame is extracted from the client payload information field of the GFP frame as defined in clause 7/G.7041/Y.1303. One GFP frame results in one SCC frame.

Demapping of unicast T-MPLS data: The T-MPLS unicast frame is extracted from the client payload information field of the GFP frame as defined in 7.6/G.7041/Y.1303. One GFP frame results in one MPLS unicast frame.

NOTE 2 – Demapping of multicast T-MPLS data is for further study.

8.5 Common Interworking Indicators (CII) processes

This function performs the Common Interworking Indicator (CII) processing as described in ITU-T Rec. Y.1415.

8.5.1 CII source process

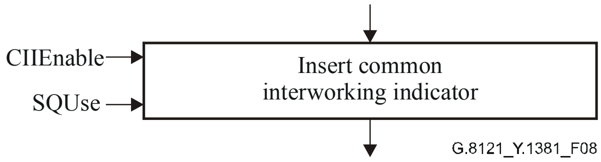

Figure 8/G.8121/Y.1381 – CII source process

This function should generate and insert the Common Interworking Indicator as described in ITU-T Rec. Y.1415, in case the indication CIIEnable is true. Otherwise no insertion should be performed. If the indication SQUse is false, the sequence number field should be set at all zeroes.

8.5.2 CII Sink Process

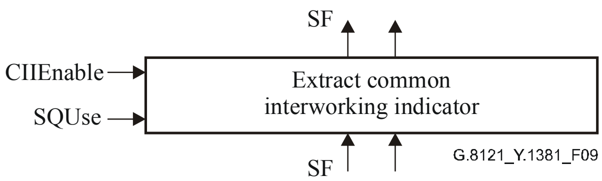

Figure 9/G.8121/Y.1381 – CII sink process

This function should process the Common Interworking Indicator as described in ITU-T Rec. Y.1415, in case the indication CIIEnable is true. In this case, if the indication SQUse is true, the sequence number field should be processed and out-of-sequence packets dropped (no reordering is performed by this process).

In addition, the SF indication is passed through unaltered to the next process.

9 T-MPLS layer functions

Figure 10 illustrates the T-MPLS layer network and server and client layer adaptation functions. The information crossing the T-MPLS connection point (TM_CP) is referred to as the T-MPLS characteristic information (TM_CI). The information crossing the T-MPLS access point (TM_AP) is referred to as the T-MPLS adapted information (TM_AI).

The T-MPLS layer network provides embedded hierarchy via the label stacking mechanism. This is represented in the model by T-MPLS Tunnel sublayers, which contain TM_TT and TM/TM_A functions. The figure shows a generic example for the connection of the T-MPLS Tunnel functions. It is not required to connect them via a TM_C function; they can be directly inserted without a connection function.

This mechanism (T-MPLS tunnel sublayers) is also used when sublayer (tandem connection) monitoring is required.

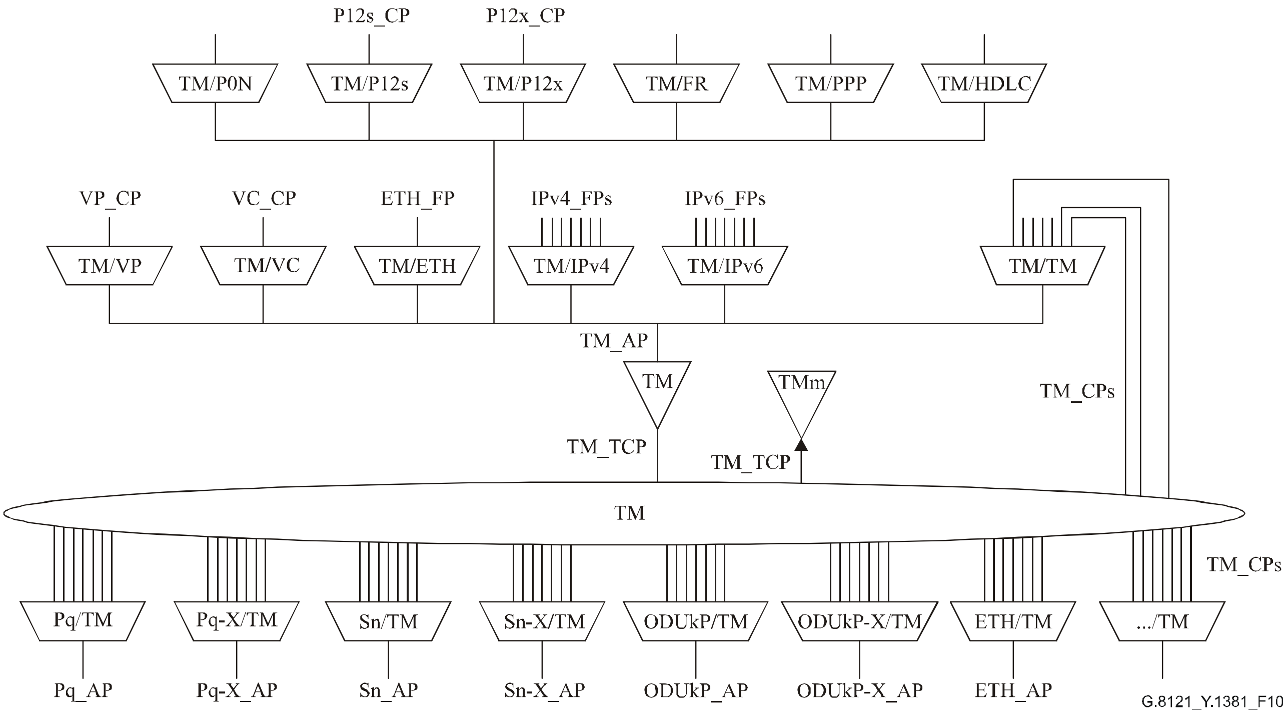

Figure 10/G.8121/Y.1381 – T-MPLS atomic functions

Figure 11 illustrates the T-MPLS sublayer stacking. A T-MPLS path level termination/adaptation function is connected to zero or more T-MPLS tunnel sublayer termination/adaptation functions that are deployed as tandem connection termination/adaptation functions[1] and have only a single TM_CP in use, which are then connected to zero or more T-MPLS tunnel sublayer termination/adaptation functions, each such sublayer with zero or more T-MPLS tunnel sublayer termination/adaptation functions underneath of it that act as T-MPLS tandem connection termination/adaptation functions. Note that this figure has left out possible intermediate T-MPLS subnetworks to present a maximum stacking view. One may expect that those sublayer functions are typically distributed over multiple network elements and interconnected via subnetwork connections.

[1] The definition of a dedicated TM/TM_A function with a single TM_CP, which just supports T-MPLS tandem connection monitoring, is for further study.

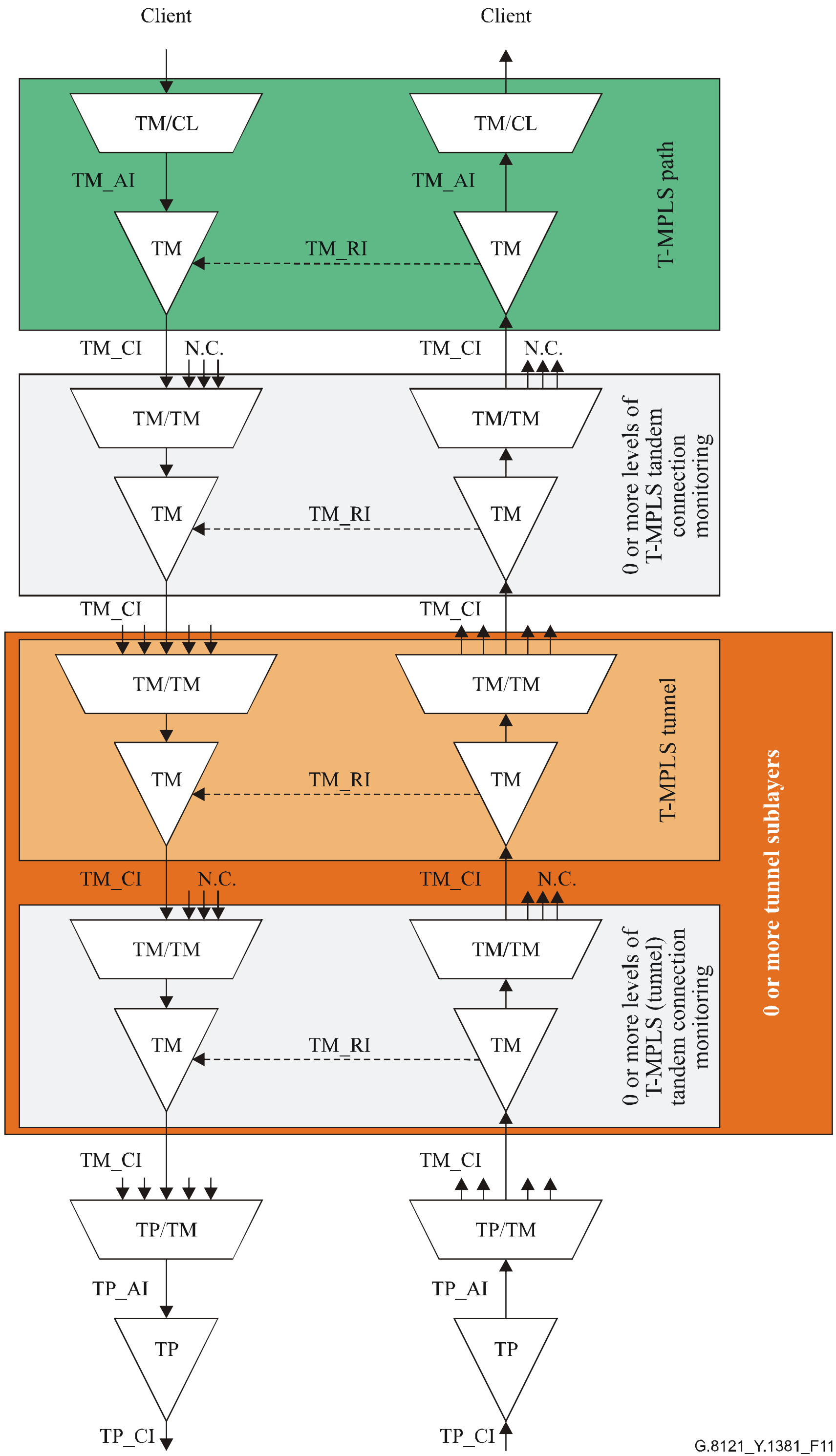

Figure 11/G.8121/Y.1381 – T-MPLS sublayer stacking example

Note that:

a) A network element need not support all depicted functions. A network element supporting the TP/TM_A (TP: Sn, Sn-X, etc.) function contains minimal T-MPLS functionality. A network element with TP/TM_A functions and a TM_C function is a T-MPLS switch/cross connect, etc.

b) A bidirectional T-MPLS path endpoint (Figure 12) can insert T-MPLS CV, FFD and BDI, and extract T-MPLS CV, FFD, FDI and BDI. A T-MPLS path endpoint source function adds a T-MPLS shim header to all incoming Client_CI. A T-MPLS path endpoint sink function extracts the top T-MPLS shim header from the incoming TM_CI traffic and OAM units before the rest of the signal is output. A T-MPLS path endpoint sink function inserts Client-AIS/FDI OAM during signal fail conditions (if such signal is defined).

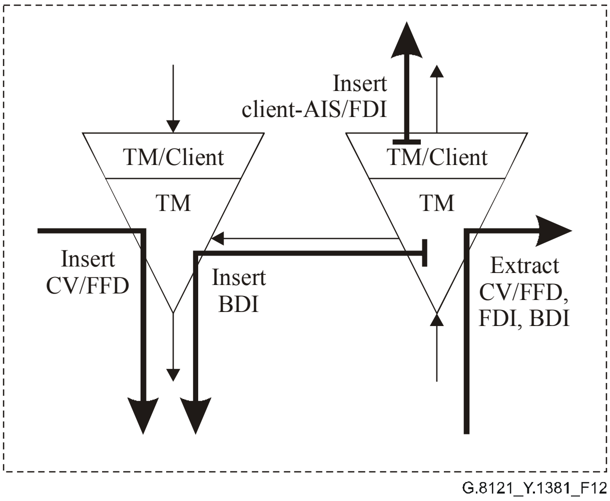

Figure 12/G.8121/Y.1381 – T-MPLS OAM insertion and extraction in MPLS path endpoint

c) A bidirectional T-MPLS tunnel endpoint (Figure 13) can insert T-MPLS CV, FFD and BDI, and extract T-MPLS CV, FFD, FDI and BDI OAM. A T-MPLS tunnel endpoint source function adds an MPLS shim header to all incoming TM_CI traffic and OAM units. A T-MPLS tunnel endpoint sink function extracts the top T-MPLS shim header from the incoming TM_CI traffic and OAM units before the rest of the T-MPLS signal is output. A T-MPLS tunnel endpoint sink function inserts T-MPLS FDI OAM during signal fail conditions.

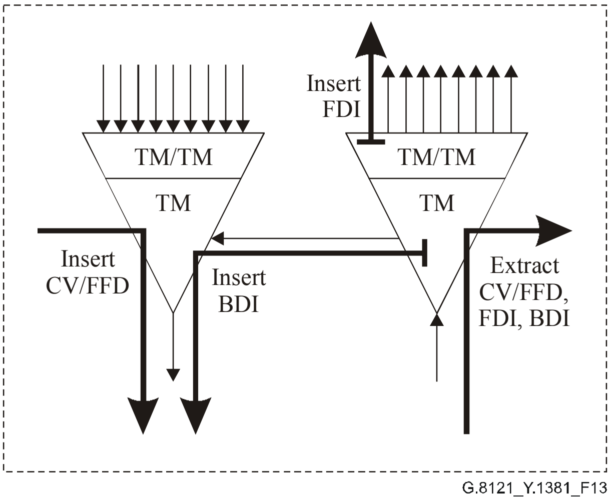

Figure 13/G.8121/Y.1381 – T-MPLS OAM insertion and extraction in T-MPLS tunnel endpoint

d) A bidirectional T-MPLS server layer endpoint (Figure 14) can insert server layer specific OAM/overhead and extract this server layer specific OAM/overhead. A T-MPLS server layer endpoint source function adds a server layer specific header to all incoming TM_CI traffic and OAM units. A T-MPLS server layer endpoint sink function extracts the server layer specific header from the incoming TM_CI traffic and OAM units before the rest of the T-MPLS signal is output. A T-MPLS server layer endpoint sink function inserts T-MPLS FDI OAM during signal fail conditions.

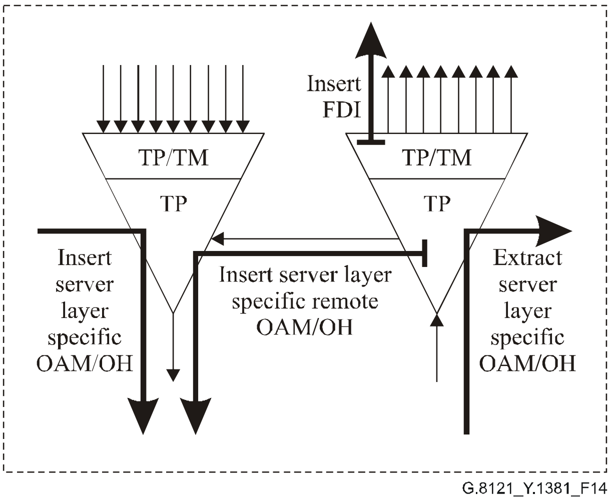

Figure 14/G.8121/Y.1381 – T-MPLS OAM insertion and extraction in T-MPLS server layer endpoint

e) A T-MPLS non-intrusive monitor function (Figure 15) can monitor T-MPLS CV, FFD, FDI and BDI OAM.

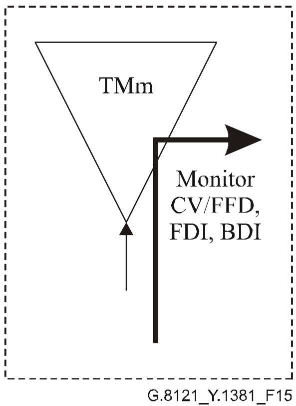

Figure 15/G.8121/Y.1381 – T-MPLS OAM monitoring in T-MPLS NIM

f) Fault Management-related signals in T-MPLS path endpoint functions are depicted in Figure 16. SSF and TSF signals communicate the signal fail condition detected in previous functions, help to suppress fault causes in equipment and are used to trigger protection switching. Fault causes (MI_cXXX) are determined and reported to the EMF. Remote Information (RI_XXX) is generated in the termination sink function and handed to the paired termination source function for insertion in the BDI OAM. Client-AIS/FDI OAM is inserted under control of the aAIS signal.

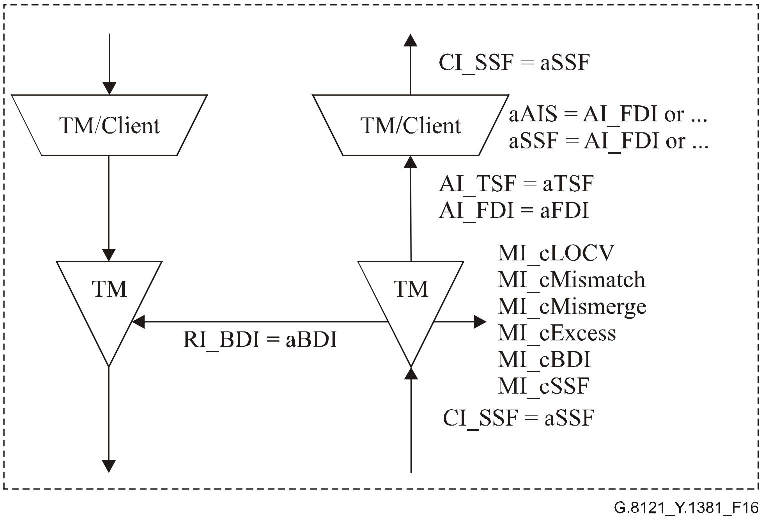

Figure 16/G.8121/Y.1381 – Fault Management in T-MPLS path endpoint function

g) Fault Management-related signals in T-MPLS tunnel endpoint functions are depicted in Figure 17. SSF and TSF signals communicate the signal fail condition detected in previous functions, help to suppress fault causes in equipment and are used to trigger protection switching. Fault causes (MI_cXXX) are determined and reported to the EMF. Remote Information (RI_XXX) is generated in the termination sink function and handed to the paired termination source function for insertion in the BDI OAM. FDI OAM is inserted under control of the aAIS signal.

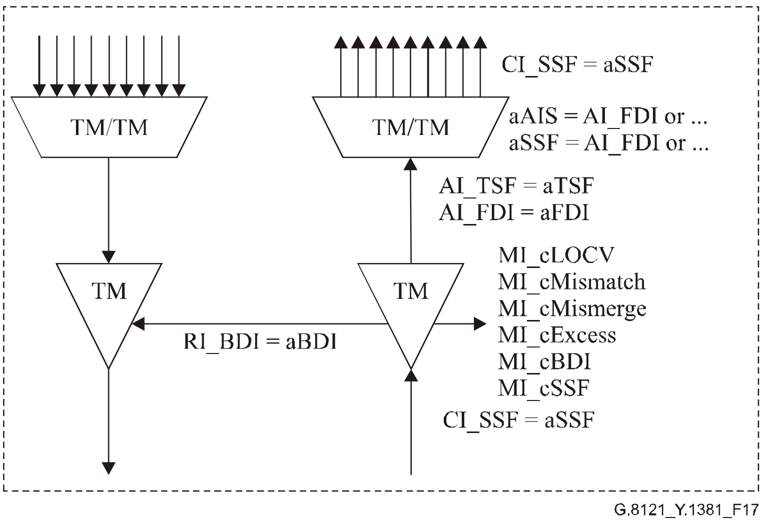

Figure 17/G.8121/Y.1381 – Fault Management in T-MPLS tunnel endpoint function

h) Fault Management-related signals in a T-MPLS non-intrusive monitor function are depicted in Figure 18. SSF and TSF signals communicate the signal fail condition detected in previous functions, help to suppress fault causes in equipment and are used to trigger protection switching. Fault causes (MI_cXXX) are determined and reported to the EMF.

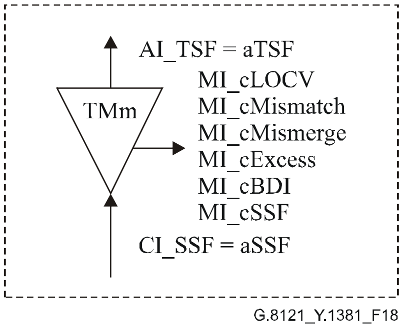

Figure 18/G.8121/Y.1381 – Fault Management in T-MPLS non-intrusive monitor function

T-MPLS characteristic information

The TM_CI is a stream of TM_CI traffic units (TM_CI_D) as illustrated in Figure 19 complemented with TM_CI_iPHB, TM_CI_oPHB and TM_CI_SSF signals. Each TM_CI traffic unit contains one or more MPLS shim headers, of which the outer one's Label and EXP fields have undefined values, and a payload or OAM field. A TM_CI traffic unit is identified ("visible") as an MPLS OAM unit if it contains two shim headers, of which the inner one has a label with value 14. Otherwise, MPLS OAM units are treated as a general traffic unit of which the OAM nature is hidden.

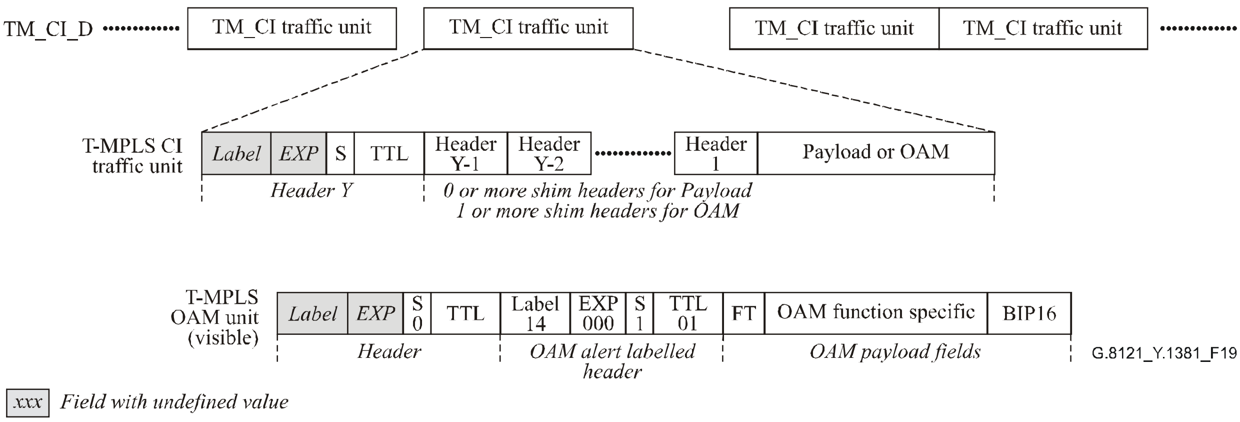

Figure 19/G.8121/Y.1381 – T-MPLS Characteristic Information Data (TM_CI_D)

Downstream of a signal fail location, the TM_CI contains the T-MPLS FDI OAM at a rate of one per second (Figure 20).

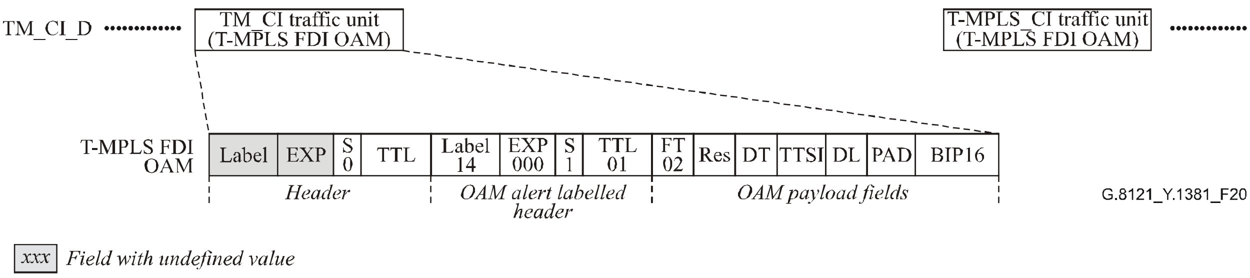

Figure 20/G.8121/Y.1381 – T-MPLS Characteristic Information Data (TM_CI_D) downstream of Signal Fail location

T-MPLS adapted information

The TM_AI is a stream of TM_AI traffic units (TM_AI_D) as illustrated in Figure 21 complemented with TM_AI_PHB and TM_AI_TSF signals. Each TM_AI traffic unit contains one or more MPLS shim headers, of which the outer one's Label, EXP and TTL fields have undefined values, and a payload or OAM field.

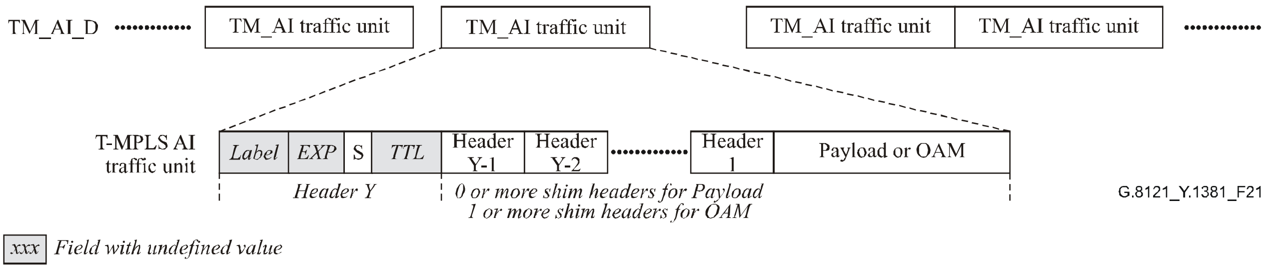

Figure 21/G.8121/Y.1381 – T-MPLS Adapted Information

The TM_AI traffic units may all be from one TM_CP, or may be from different TM_CPs (case of T-MPLS multiplexing in TM/TM_A). In the latter case, Header Y-1's Label field (Figure 21) identifies the TM_CP the traffic unit is associated with.

9.1 Connection Functions (TM_C)

TM_C is the function that assigns MPLS packets at its input ports to T-MPLS packets at its output ports.

The TM_C connection process is a unidirectional function as illustrated in Figure 22. The signal formats at the input and output ports of the function are similar, differing only in the logical sequence of the T-MPLS packets. As the process does not affect the nature of the characteristic information of the signal, the reference point on either side of the TM_C function is the same, as illustrated in Figure 22.

Incoming T-MPLS packets at the TM_CP are assigned to available outgoing T-MPLS capacity at the TM_CP.

• Symbol:

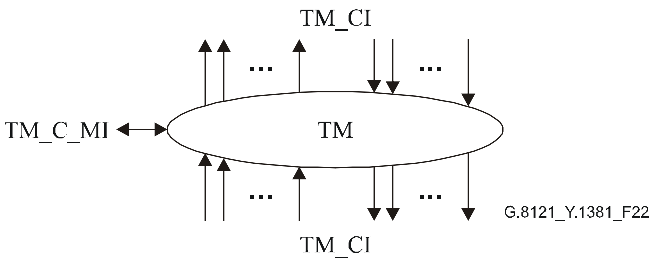

Figure 22/G.8121/Y.1381 – TM_C symbol

• **Interfaces:**

Table 3/G.8121/Y.1381 – TM_C input and output signals

Input(s)	Output(s)
Per TM_CP, n × for the function: TM_CI_D TM_CI_iPHB TM_CI_oPHB TM_CI_SSF TM_AI_TSF per input and output connection point: *for further study* per matrix connection: TM_C_MI_ConnectionType TM_C_MI_Return_CP_ID TM_C_MI_ConnectionPortIds per SNC protection group: *for further study*	per TM_CP, m × per function: TM_CI_D TM_CI_iPHB TM_CI_oPHB TM_CI_SSF

• **Processes:**

In the TM_C function T-MPLS Characteristic Information is routed between input (termination) connection points ((T)CPs) and output (T)CPs by means of matrix connections. (T)CPs may be allocated within a protection group.

NOTE – Neither the number of input/output signals to the connection function, nor the connectivity is specified in this Recommendation. That is a property of individual network elements.

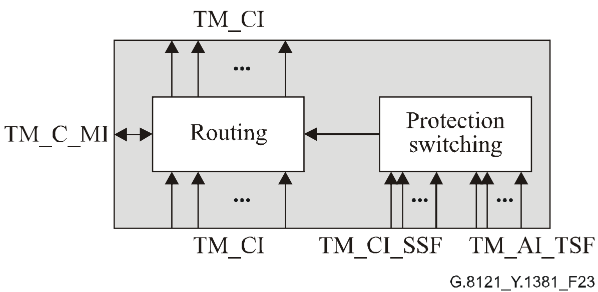

Figure 23/G.8121/Y.1381 – TM_C process diagram

– *Routing process:*

This process passes all the traffic units received from a specific input to the corresponding output according to the matrix connection between the specified input and output.

Each (matrix) connection in the TM_C function shall be characterized by the:

Type of connection (MI_ConnectionType):	unprotected, protected
Traffic direction (MI_Return_CP_ID):	Unidirectional if NULL, otherwise it identifies the CP of the return connection (Note)
Input and output connection points (MI_ConnectionPortIDs):	set of connection point identifiers
NOTE – Bidirectional LSPs are supported by associating two unidirectional LSPs in the data plane, as per ITU-T Rec. G.8110.1/Y.1370.1.	

– *Protection Switching process:*

For further study.

• Performance Monitoring:

None.

• Defects:

None.

• Consequent actions:

If an output of this function is not connected to one of its inputs, the connection function shall send no traffic units and SSF = false to the output.

• Defect correlations:

None.

9.1.1 Sub-network connection protection process

For further study.

9.2 Termination functions

9.2.1 MPLS Trail Termination function (TM_TT)

The TM_TT function terminates the MPLS OAM to determine the status of the MPLS (sub)layer trail. Figure 24 shows the combination of the unidirectional sink and source functions to form a bidirectional function.

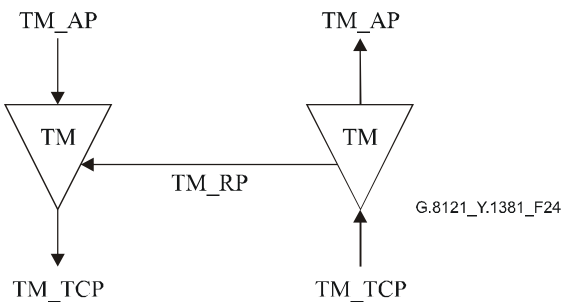

Figure 24/G.8121/Y.1381 – TM_TT

9.2.1.1 T-MPLS Trail Termination Source function (TM_TT_So)

The TM_TT_So function determines and inserts the TTL value in the shim header TTL field and adds T-MPLS OAM – including the CV, FFD and BDI signals – to the TM_AI signal at its TM_AP.

The information flow and processing of the TM_TT_So function is defined with reference to Figure 25.

• Symbol:

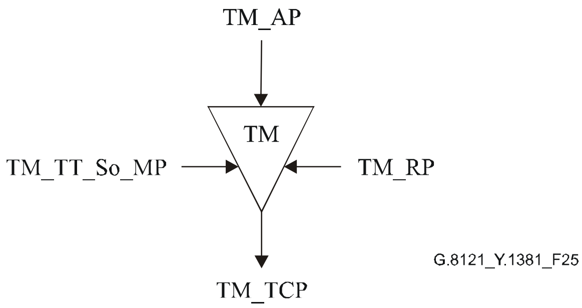

Figure 25/G.8121/Y.1381 – TM_TT_So function

• Interfaces:

Table 4/G.8121/Y.1381 – TM_TT_So inputs and outputs

Input(s)	Output(s)
TM_AP: TM_AI_D TM_AI_PHB **TM_RP:** TM_RI_BDI **TM_TT_So_MP:** TM_TT_So_MI_TxTTSI TM_TT_So_MI_CvFfdType TM_TT_So_MI_FfdFreq TM_TT_So_MI_TTLVALUE	**TM_CP:** TM_CI_D TM_CI_iPHB TM_CI_oPHB

• **Processes:**

The processes associated with the TM_TT_So function are as depicted in Figure 26.

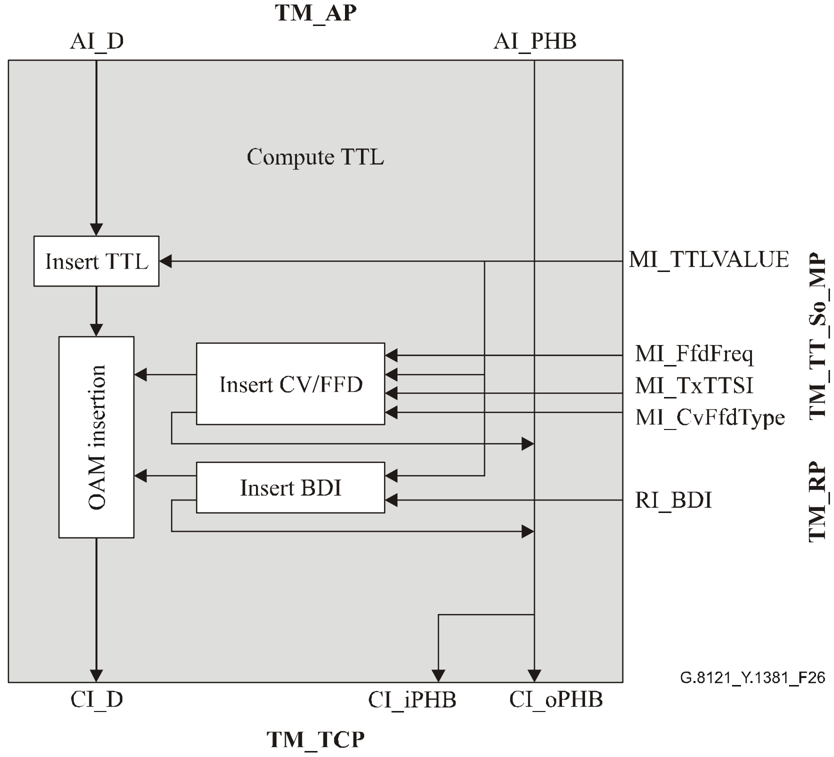

Figure 26/G.8121/Y.1381 – TM_TT_So process diagram

PHB: The AI_PHB signal is assigned to both the CI_iPHB and CI_oPHB signals at the TM_TCP reference point.

Insert TTL: The Time To Live (Figure 27)value is inserted in the outer shim header's TTL field within the TM_AI traffic unit (see Figure 21).

```
header.TTL = MI_TTLVALUE
```

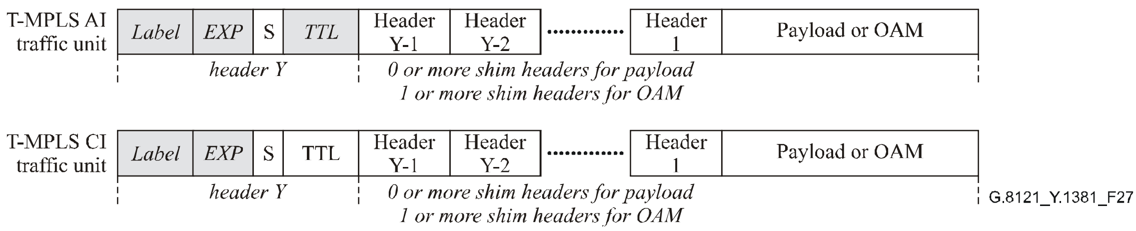

Figure 27/G.8121/Y.1381 – TTL value insertion

Insert CV/FFD: The connectivity verification (CV) or fast failure detection (FFD) OAM signal (depicted in Figures 28 and 29) is generated by the Insert CV/FFD process (as determined by MI_CvFfdType) and inserted into the traffic signal. The CV OAM signal is inserted once per second, the FFD OAM signal once per period derived from the MI_FREQ signal at reference point TM_TT_So_MP.

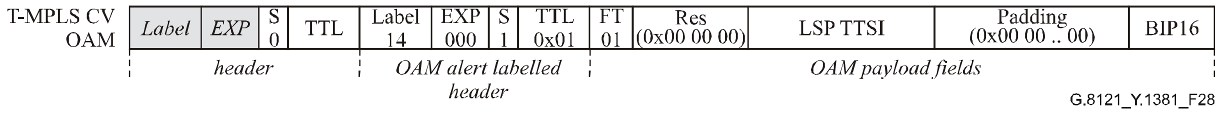

Figure 28/G.8121/Y.1381 – T-MPLS CV OAM at its TM_TCP

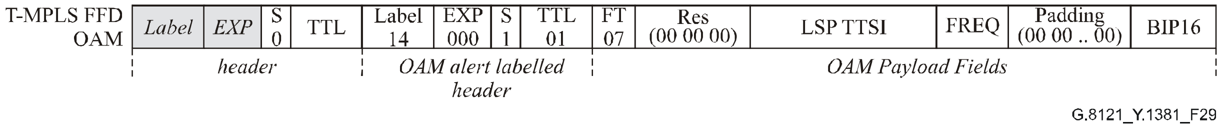

Figure 29/G.8121/Y.1381 – T-MPLS FFD OAM at its TM_TCP

The OAM Alert Labelled header field (Label, EXP, S, TTL) values are specified in ITU-T Rec. Y.1711 and illustrated in Figures 28 and 29. The function type (FT) field value for the CV and FFD OAM signals is specified in ITU-T Rec. Y.1711 and illustrated in Figures 28 and 29. The Reserved (Res) and Padding field values are specified in ITU-T Rec. Y.1711 and illustrated in Figures 28 and 29. The LSP TTSI structure is specified in ITU-T Rec. Y.1711. Its value is derived from the MI_TxTTSI signal at reference point TM_TT_So_MP. The frequency (FREQ) field values are specified in ITU-T Rec. Y.1711 and represent the repetition rate of the FFD OAM signal. The BIP16 field value is computed as specified in ITU-T Rec. Y.1711.

The TTL value in the header is derived from the MI_TTLVALUE signal at reference point TM_TT_So_MP as follows:

```
header.TTL = MI_TTLVALUE;
```

The CI_oPHB and CI_iPHB are to be set to the "minimum loss-probability PHB" as specified in ITU-T Rec. Y.1711.

Insert BDI: The backward defect indication (BDI) OAM signal depicted in Figure 30 is generated by the BDI process and once per second inserted into the traffic signal.

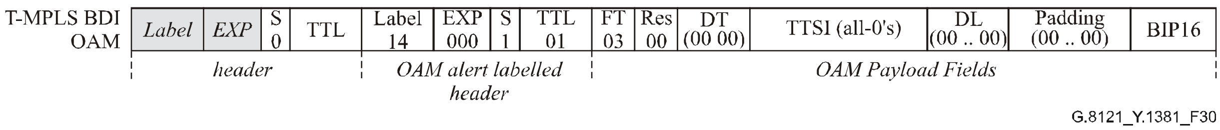

Figure 30/G.8121/Y.1381 – T-MPLS BDI OAM at its TM_TCP

The OAM Alert Labelled header field (Label, EXP, S, TTL) values are specified in ITU-T Rec. Y.1711 and illustrated in Figure 30. The function type (FT) field value for the BDI OAM signal is specified in ITU-T Rec. Y.1711 and illustrated in Figure 30. The Reserved (Res) and Padding field values are specified in ITU-T Rec. Y.1711 and illustrated in Figure 30. The BIP16 field value is computed as specified in ITU-T Rec. Y.1711.

The TTSI, defect type (DT) and defect location (DL) field values are set to all zeroes. Upon the declaration/clearing of aBDI at the termination sink function, the trail termination source function shall have inserted/removed the BDI indication within ffs ms.

The TTL value in the header is derived from the MI_TTLVALUE signal at reference point TM_TT_So_MP as follows:

```
header.TTL = MI_TTLVALUE;
```

The CI_ oPHB and CI_iPHB are to be set to the "minimum loss-probability PHB" as specified in ITU-T Rec. Y.1711.

• Defects:

None.

• Consequent actions:

None.

• Defect correlations:

None.

• Performance monitoring:

None.

9.2.1.2 T-MPLS Trail Termination Sink function (TM_TT_Sk)

The TM_TT_Sk function reports the state of the T-MPLS Trail (Path, Tandem Connection, Tunnel). It extracts T-MPLS trail OAM, including the CV, FFD, BDI and FDI signals, from the T-MPLS signal at its TM_TCP, detects for LOCV, Mismatch, Mismerge, Excess, BDI and FDI defects, counts during 1-second periods errors and defects to feed Performance Monitoring when connected, makes the TTSI available to network management and forwards the defect information as backward indications to the companion TM_TT_So function.

NOTE – The TM_TT_Sk function extracts and processes one level of T-MPLS OAM irrespective of the presence of more levels.

The information flow and processing of the TM_TT_Sk function is defined with reference to Figure 31.

• Symbol:

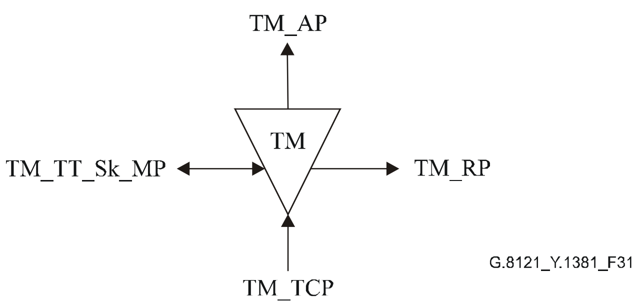

Figure 31/G.8121/Y.1381 – TM_TT_Sk function

• **Interfaces:**

Table 5/G.8121/Y.1381 – TM_TT_Sk inputs and outputs

Input(s)	Output(s)
TM_TCP: TM_CI_D TM_CI_iPHB TM_CI_oPHB TM_CI_SSF **TM_TT_Sk_MP:** TM_TT_Sk_MI_TxTTSI TM_TT_Sk_MI_ExTTSI TM_TT_Sk_MI_TIMActDis TM_TT_Sk_MI_CvFfdType TM_TT_Sk_MI_FfdPeriod TM_TT_Sk_MI_1second TM_TT_Sk_MI_SSF_Reported TM_TT_Sk_MI_BDI_Reported TM_TT_Sk_MI_TPmode	**TM_AP:** TM_AI_D TM_AI_PHB TM_AI_TSF TM_AI_FDI **TM_RP:** TM_RI_BDI **TM_TT_Sk_MP:** TM_TT_Sk_MI_AcTTSI TM_TT_Sk_MI_cLOCV TM_TT_Sk_MI_cMismatch TM_TT_Sk_MI_cMismerge TM_TT_Sk_MI_cExcess TM_TT_Sk_MI_cBDI TM_TT_Sk_MI_cSSF

• **Processes:**

The processes associated with the TM_TT_Sk function are as depicted in Figure 32.

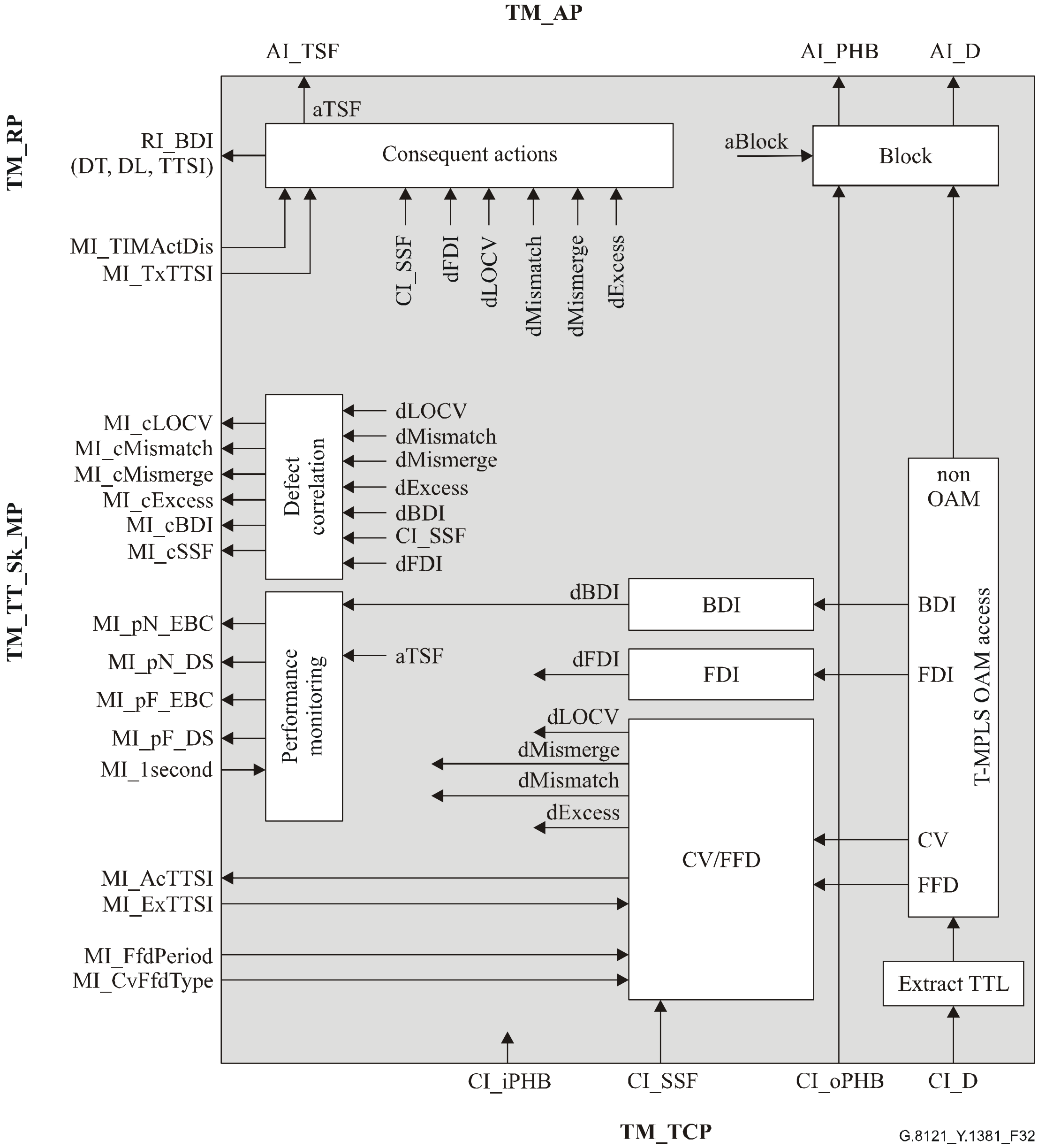

Figure 32/G.8121/Y.1381 – TM_TT_Sk process diagram

PHB: The CI_oPHB signal is assigned to the AI_PHB signal at the reference point TM_AP.

Note that the CI_iPHB signal is not used by any of the processes in the function.

Extract TTL: The Time To Live value is extracted from the outer shim header's TTL field within the TM_CI traffic unit (Figure 33).

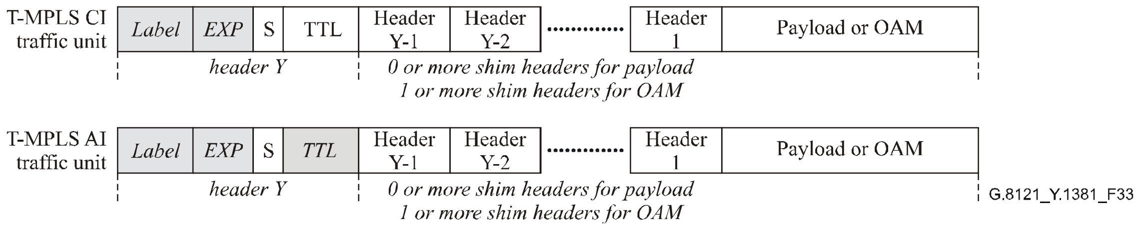

Figure 33/G.8121/Y.1381 – TTL value extraction

T-MPLS OAM access: TM_CI units at the input of the MPLS OAM access process are examined for the MPLS OAM signature (Figure 34) and OAM Function Type (FT) and then forwarded to the specific MPLS OAM process. Each MPLS_CI unit is classified as follows:

```
if (header1.S=0 AND header0.Label=14 AND header0.S=1)
then
  compute BIP16 over OAM Payload Fields as specified in 5.4/Y.1711;
  if computedBIP16 == payload.BIP16
  then
    switch(payload.FT) {
    case 0x01: MPLS-CV OAM unit
    case 0x02: MPLS-FDI OAM unit
    case 0x03: MPLS-BDI OAM unit
    case 0x07: MPLS-FFD OAM unit
    default: non OAM unit
    }
  else /*bit errors in OAM payload field*/
    discard OAM unit
  endif
else
  non-OAM unit;
endif;
```

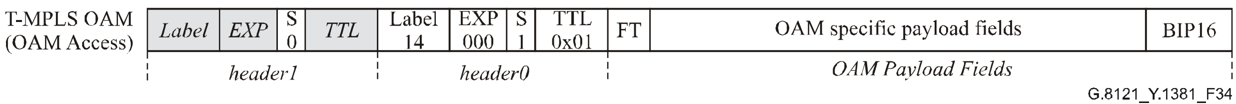

Figure 34/G.8121/Y.1381 – T-MPLS OAM

CV/FFD: See 8.1.

BDI: This process detects dBDI.

FDI: This process detects dFDI.

Block: When the aBlock consequent action is asserted, this process drops all traffic units arriving at its input.

• Defects:

The function shall detect for dLOCV, dMismatch, dMismerge, dExcess, dBDI and dFDI defects.

dLOCV, dMismatch, dMismerge, dExcess: see clauses 6.1.3.1, 6.1.4.1, 6.1.4.2 and 6.1.4.3, respectively.

dBDI: See 6.1.5.2.

dFDI: See 6.1.5.1.

• Consequent actions:

The function shall perform the following consequent actions:

aBDI ← CI_SSF or dLOCV or dMismatch or dMismerge or dExcess

aBlock ← dMismatch or dMismerge

The aBDI associated Defect Type (DT), Defect Location (DL) and TTSI fields are set to all zeroes.

aTSF ← CI_SSF or dLOCV or dMismatch or dMismerge or dExcess

• Defect correlations:

The function shall perform the following defect correlations to determine the most probable fault cause (see 6.4/G.806). This fault cause shall be reported to the EMF.

cMismatch ← dMismatch and (not CI_SSF) and MON

cMismerge ← dMismerge and (not dMismatch) and (not CI_SSF) and MON

cLOCV ← dLOCV and (not CI_SSF) and (not dFDI) and (not dMismatch) and (not dMismerge) and MON

cExcess ← dExcess and (not dMismatch) and (not dMismerge) and (not dLOCV) and (not CI_SSF) and MON

cBDI ← dBDI and (not CI_SSF) and BDI_Reported and MON

cSSF ← CI_SSF or dFDI and SSF_Reported and MON

• Performance monitoring:

Ffs.

9.2.2 T-MPLS non-intrusive monitor function (TM_TT_Sk)

Ffs.

9.3 Adaptation functions

9.3.1 T-MPLS to T-MPLS adaptation function (TM/TM_A)

9.3.1.1 T-MPLS to T-MPLS adaptation source function (TM/TM_A_So)

This function maps client TM_CI traffic units into server TM_AI traffic units.

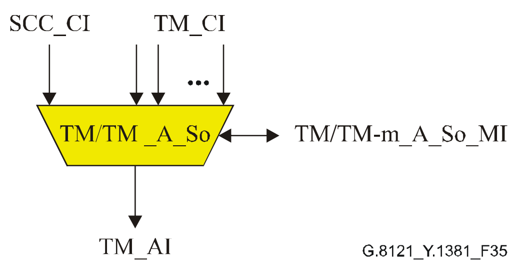

Figure 35/G.8121/Y.1381 – TM/TM_A_So function

• **Interfaces:**

Table 6/G.8121/Y.1381 – TM/TM_A_So interfaces

Inputs	Outputs
Each TM_CP: TM_CI_Data TM_CI_iPHB TM_CI_oPHB **SCC_CP:** SCC_CI_Data **TM/TM_A_So_MI:** TM/TM_A_So_MI_SCCType TM/TM_A_So_MI_Label[1…M] TM/TM_A_So_MI_LSPType[1…M] TM/TM_A_So_MI_PSC[1…M] TM/TM_A_So_MI_PHB2EXPMapping[1…M] TM/TM_A_So_MI_QoSEncodingMode[1…M]	**TM_AP:** TM_AI_Data TM_AI_PHB

• **Processes:**

A process diagram of this function is shown in Figure 36.

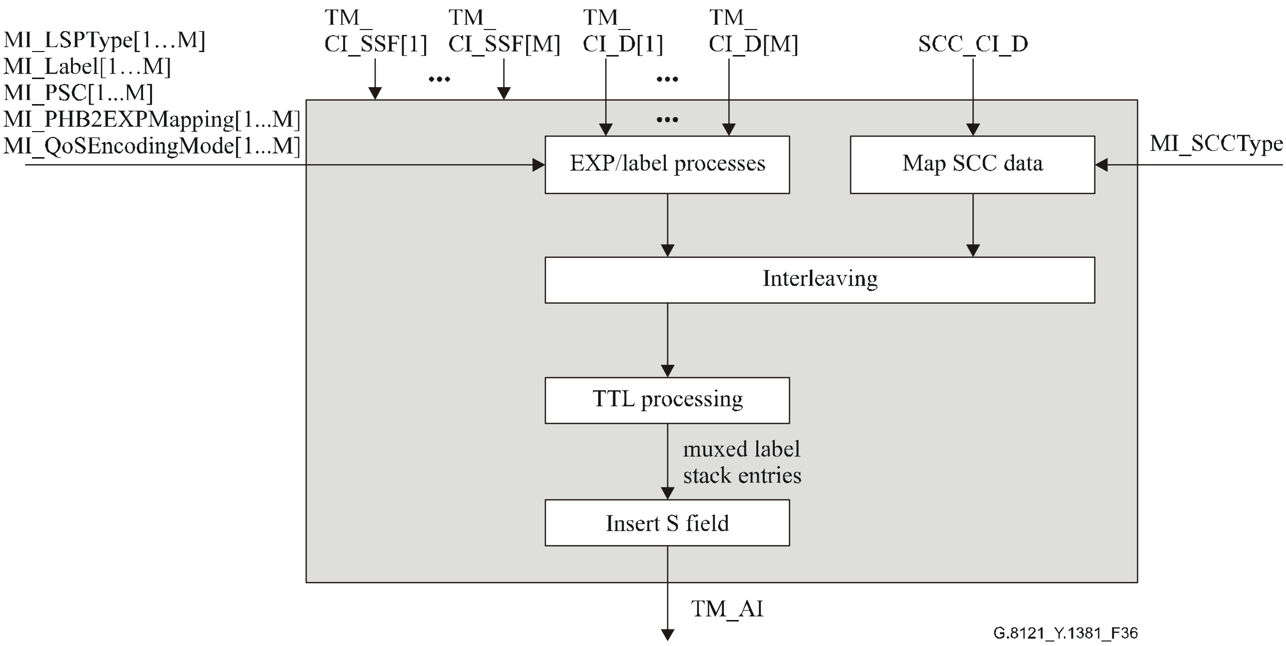

Figure 36/G.8121/Y.1381 – TM/TM_A_So process diagram

– *EXP/Label processes:*

See 8.2.1.

– *Map SCC Data:*

Ffs.

– *Interleave:*

Interleaves the traffic units from the client specific processes into a single stream.

Traffic units from the EXP/Label source processes are associated with S=0 (bottom of label stack is not reached) to indicate the client is MPLS.

Traffic units from the SSC_CI are associated with S=1 (bottom of label stack is reached) to indicate the client is SCC (and therefore not MPLS).

– *S Field Insertion:*

A 1-bit S Field set equal to the value generated by the interleave process.

• **Defects:**

None.

• **Consequent actions:**

None.

• **Defect correlations:**

None.

• **Performance monitoring:**

None.

9.3.1.2 T-MPLS to T-MPLS adaptation sink function (TM/TM_A_Sk)

This function retrieves client TM_CI traffic units from server TM_AI traffic units.

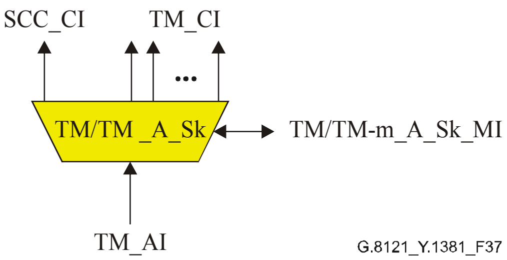

Figure 37/G.8121/Y.1381 – TM/TM_A_Sk function

• **Interfaces:**

Table 7/G.8121/Y.1381 – TM/TM_A_Sk interfaces

Inputs	Outputs
TM_AP: TM_AI_Data TM_AI_PHB TM_AI_TSF **TM/TM_A_Sk_MP:** TM/TM_A_Sk_MI_SCCType TM/TM_A_Sk_MI_Label[1…M] TM/TM_A_Sk_MI_LSPType[1…M] TM/TM_A_Sk_MI_PSC[1…M] TM/TM_A_Sk_MI_ EXP2PHBMapping[1…M] TM/TM_A_Sk_MI_QoSDecodingMode[1…M]	**Each TM_CP:** TM_CI_Data TM_CI_iPHB TM_CI_oPHB TM_CI_SSF **SCC_CP:** SCC_CI_Data SCC_CI_SSF

• **Processes:**

A process diagram of this function is shown in Figure 38.

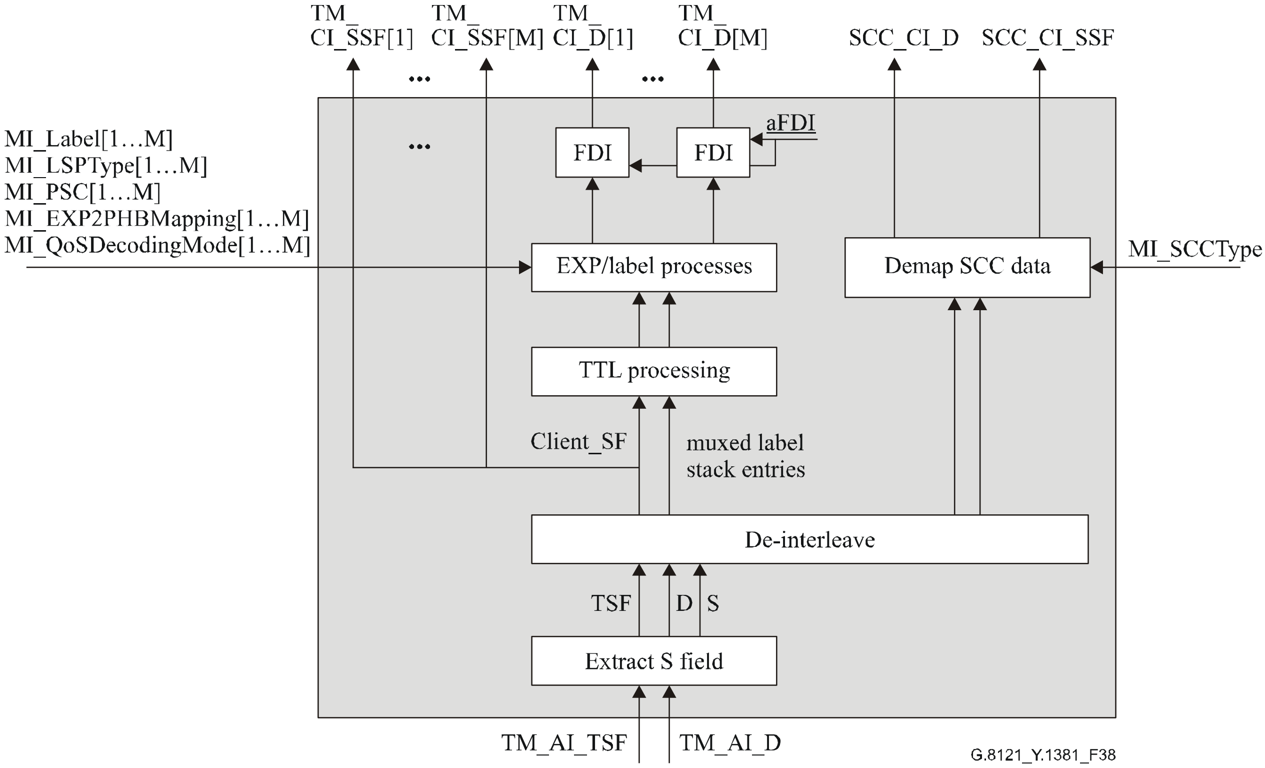

Figure 38/G.8121/Y.1381 – TM/TM_A_Sk process diagram

– *FDI process:*

This process inserts T-MPLS FDI OAM packets when consequent action aFDI is asserted.

– *EXP/Label processes:*

See 8.2.2.

– *Demap SCC data:*

Ffs.

– *S field extraction:*

Extract the 1-bit S Field and passes it to the De-interleave process.

– *De-interleave:*

De-interleaves the traffic units passing them to the client specific processes based on the S value associated with the traffic unit.

Traffic units with S=0 (bottom of label stack is not reached) indicating that the client is MPLS are sent to the EXP/Label sink processes.

Traffic units with S=1 (bottom of label stack is reached) indicating that the client is SCC (and therefore not MPLS) are sent to the SCC_CI.

• **Defects:**

None.

• **Consequent actions:**

The function shall perform the following consequent actions:

aSSF ← AI_TSF

aFDI ← AI_TSF

• **Defect correlations:**

None.

• **Performance monitoring:**

None.

9.3.2 T-MPLS to ETH adaptation function (TM/ETH_A)

9.3.2.1 T-MPLS to ETH adaptation source function (TM/ETH_A_So)

This function maps the ETH_CI information for transport in an TM_AI signal.

The information flow and processing of the TM/ETH_A_So function is defined with reference to Figure 39.

• **Symbol:**

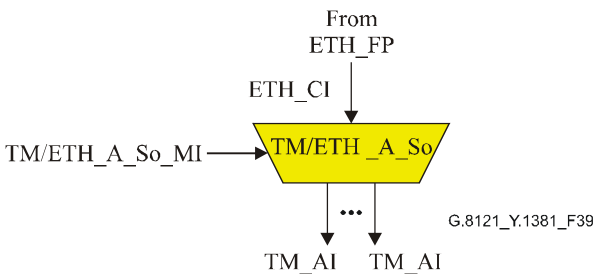

Figure 39/G.8121/Y.1381 – TM/ETH_A_So function

• **Interfaces:**

Table 8/G.8121/Y.1381 – TM/ETH_A_So Inputs and Outputs

Inputs	Outputs
ETH_FP: ETH_CI_Data ETH_CI_P ETH_CI_DE **TM/ETH_A_So_MP:** TM/ETH_A_So_MI_FCSEnable TM/ETH_A_So_MI_CIIEnable TM/ETH_A_So_MI_SQUse TM/ETH_A_So_MI_PRI2PSCMapping	**Each TM_AP:** TM_AI_Data TM_AI_PHB

• **Processes:**

The processes associated with the TM/ETH_A_So function are as depicted in Figure 40.

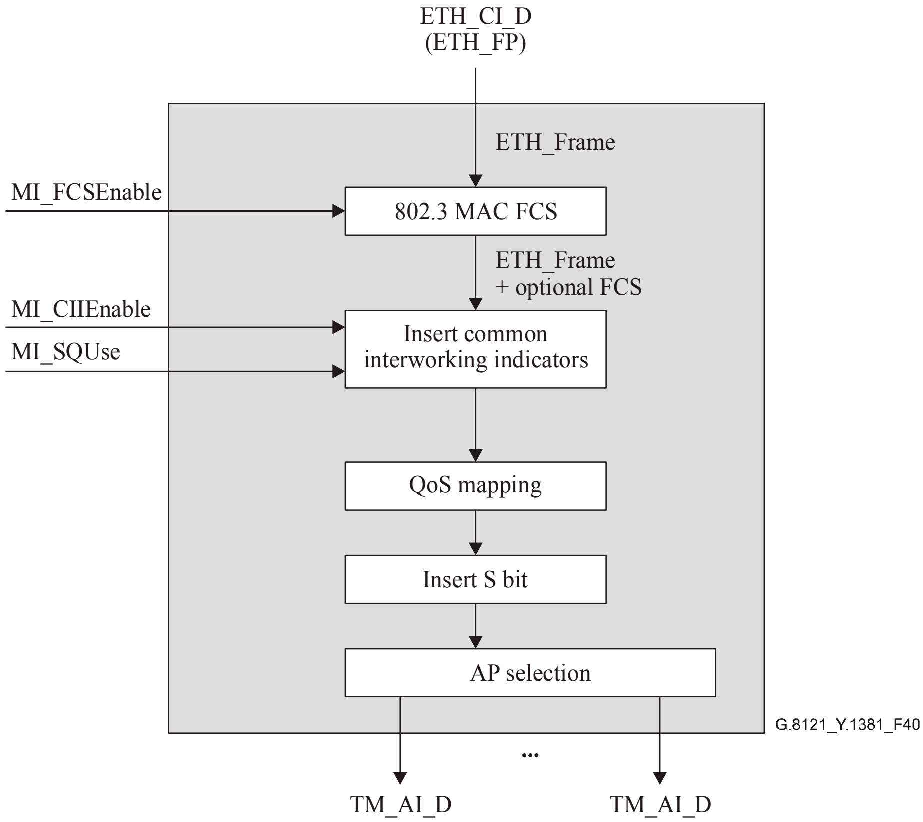

Figure 40/G.8121/Y.1381 – TM/ETH_A_So process diagram

– *802.3 MAC FCS generation:*

See 8.9.1/G.8021/Y.1341. MAC FCS generation is optional (see ITU-T Rec. Y.1415): MAC FCS is generated if MI_FCSEnabled is True.

– *Common interworking indicators insertion:*

See 8.5.1.

– *QoS mapping process:*

This process maps the Ethernet-based QoS signals into MPLS-based QoS signals.

The PSC part of the AI_PHB is generated by the received CI_P according to the 1:1 mapping configured by the MI_PRI2PSCMapping.

The DP part of the AI_PHB is generated by the received CI_DE according to the following rule:

```
If CI_DE = True
     DP(AI_PHB) = Yellow
Else
     DP(AI_PHB) = Green
```

– *S field insertion:*

A 1-bit S Field set to 1 (bottom of label stack) is inserted to indicate the client is not MPLS.

– *AP selection:*

Select the output TM_AP based on the packet's output PSC.

• **Defects:**

None.

• **Consequent actions:**

None.

• **Defect correlations:**

None.

• **Performance monitoring:**

None.

9.3.2.2 T-MPLS to ETH adaptation sink function (TM/ETH_A_Sk)

This function extracts the ETH_CI information from an TM_AI signal.

The information flow and processing of the TM/ETH_A_Sk function is defined with reference to Figure 41.

• **Symbol:**

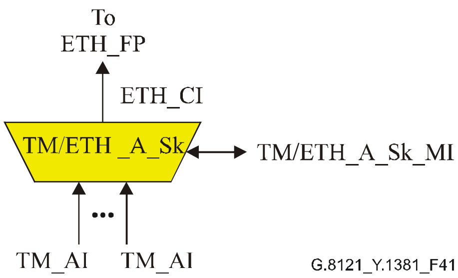

Figure 41/G.8121/Y.1381 – TM/ETH_A_Sk function

• **Interfaces:**

Table 9/G.8121/Y.1381 – TM/ETH_A_Sk Inputs and Outputs

Inputs	Outputs
Each TM_AP: TM_AI_Data TM_AI_PHB TM_AI_TSF **TM/ETH_A_Sk_MP:** TM/ETH_A_Sk_MI_FCSEnable TM/ETH_A_Sk_MI_CIIEnable TM/ETH_A_So_MI_SQUse TM/ETH_A_Sk_MI_PSC2PRIMapping	**ETH_FP:** ETH_CI_Data ETH_CI_P ETH_CI_DE ETH_CI_SSF

• Processes:

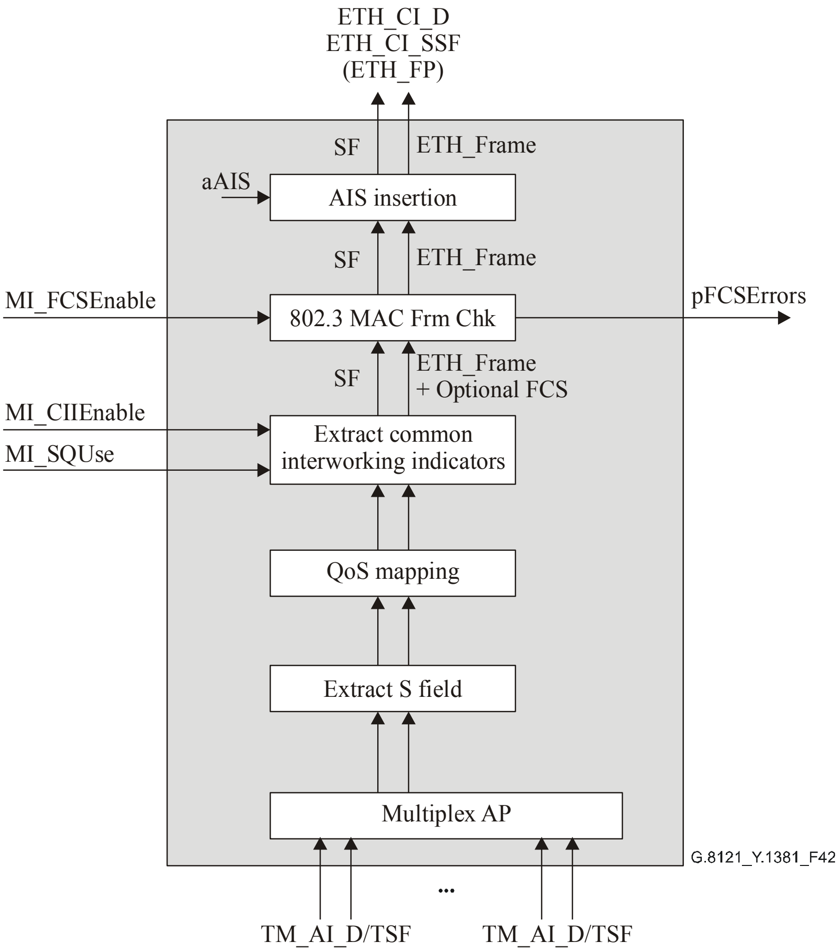

Figure 42/G.8121/Y.1381 – TM/ETH_A_Sk process diagram

– *AIS insertion:*

When aAIS is asserted, insert Ethernet AIS.

– *"802.3 MAC Frame Check" process:*

See 8.9.2/G.8021/Y.1341. MAC Frame Check is optional (see ITU-T Rec. Y.1415): MAC FCS is checked if MI_FCSEnabled is True.

– *Common interworking indicators extraction:*

See 8.5.2.

– *QoS mapping process:*

This process maps the MPLS-based QoS signals into Ethernet-based QoS signals.

The CI_P is generated by the received PSC part of the AI_PHB according to the 1:1 mapping configured by the MI_PSC2PRIMapping.

The CI_DE is generated by the received DP part of the AI_PHB according to the following rule:

```
If MI_QoSTransitMode = X
     If DP(AI_PHB) = Green
          CI_DE = False
     Else
          CI_DE = True
Else If MI_QoSTransitMode = Y
     CI_DE = False
```

– *S field extraction:*

Extract and process the 1-bit S Field: the retrieved S Field should have the value 1 (bottom of label stack) to indicate the client is not MPLS.

– *Multiplex AP:*

Multiplex the TM_AI traffic units coming from all the TM_APs.

• Defects:

None.

• Consequent actions:

The definitions of aAIS and aSSF are for further study.

• Defect correlations:

None.

• Performance monitoring:

Ffs.

9.3.2.3 T-MPLS to ETH multiplexing adaptation source function (TM/ETH-m_A_So)

Ffs.

9.3.2.4 T-MPLS to ETH multiplexing adaptation sink function (TM/ETH-m_A_Sk)

Ffs.

9.3.3 T-MPLS to IP adaptation function (TM/IP_A)

Ffs.

10 Non-T-MPLS Server to T-MPLS adaptation functions

10.1 SDH to T-MPLS adaptation function (S/TM_A)

10.1.1 VC-n to T-MPLS adaptation functions (S*n*/TM_A; *n*=3, 3-X, 4, 4-X)

10.1.1.1 VC-n to T-MPLS adaptation source function (S*n*/TM_A_So)

This function maps TM_CI information onto an Sn_AI signal (n=3, 3-X, 4, 4-X).

Data at the Sn_AP is a VC-n (n = 3, 3-X, 4, 4-X), having a payload as described in ITU-T Rec. G.707/Y.1322, but with indeterminate POH bytes: J1, B3, G1.

• Symbol:

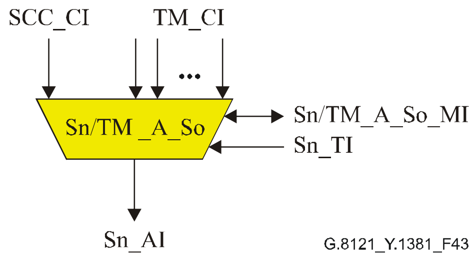

Figure 43/G.8121/Y.1381 – Sn/TM_A_So symbol

• Interfaces:

Table 10/G.8121/Y.1381 – Sn/TM_A_So interfaces

Inputs	Outputs
Each TM_CP: TM_CI_Data TM_CI_iPHB TM_CI_oPHB **SCC_CP:** SCC_CI_Data **Sn_TP:** Sn_TI_Clock Sn_TI_FrameStart **Sn/TM_A_So_MP:** Sn/TM_A_So_MI_SCCType Sn/TM_A_So_MI_Label[1…M] Sn/TM_A_So_MI_LSPType[1…M] Sn/TM_A_So_MI_PSC[1…M] Sn/TM_A_So_PHB2EXPMapping[1…M] Sn/TM_A_So_MI_QoSEncodingMode[1…M]	**Sn_AP:** Sn_AI_Data Sn_AI_Clock Sn_AI_FrameStart

• Processes:

A process diagram of this function is shown in Figure 44.

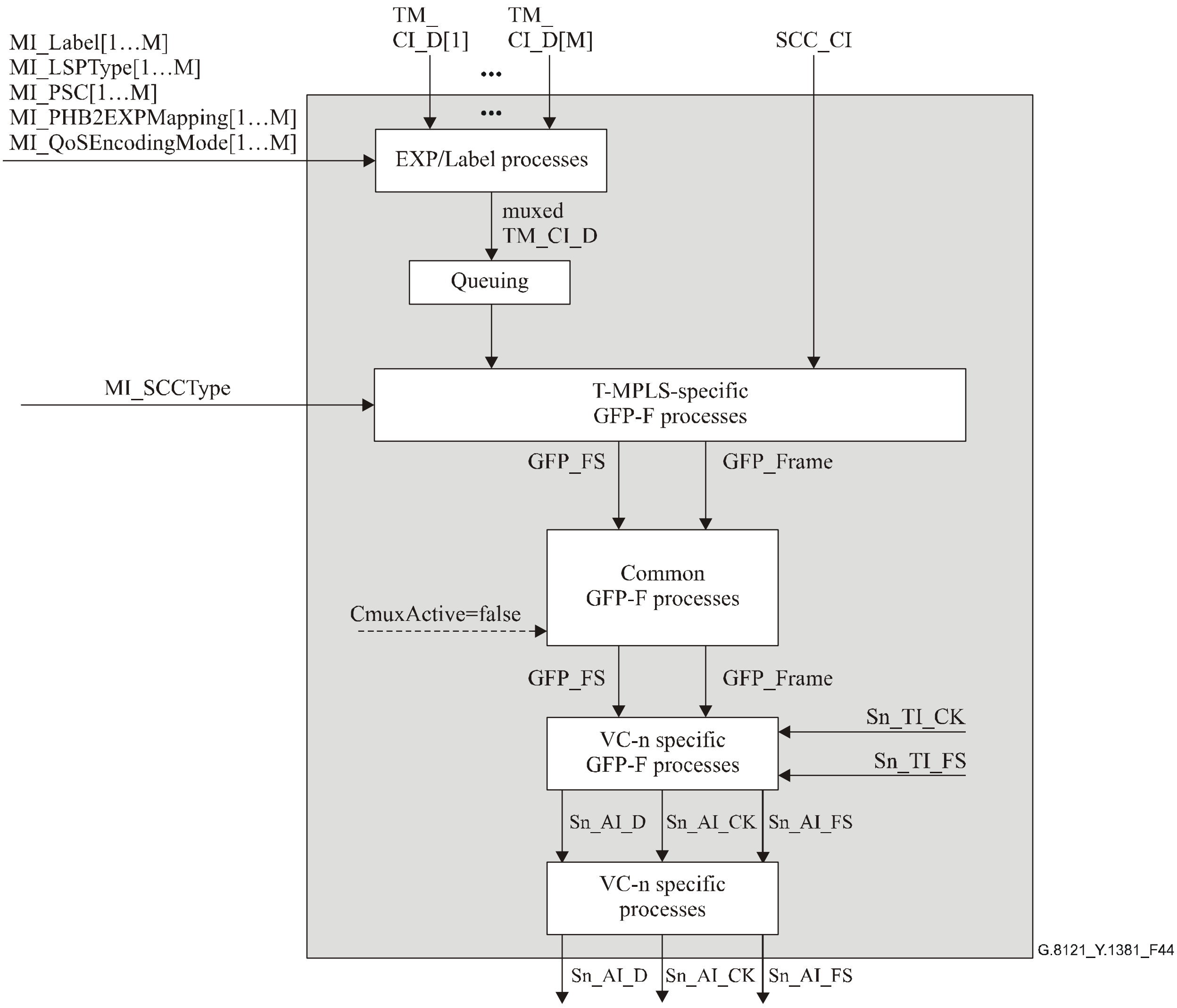

Figure 44/G.8121/Y.1381 – Sn/TM_A_So process diagram

– *EXP/Label processes:*

See 8.2.1.

– *Queuing process:*

See 8.3.

– *T-MPLS-specific GFP-F source process:*

See 8.4.1.

– *Common GFP source process:*

See 8.5.3.1/G.806. GFP channel multiplexing is not supported (CMuxActive=false).

– *VC-n specific GFP source process:*

See 8.5.2.1/G.806. The GFP frames are mapped into the VC-n payload area according to 10.6/G.707/Y.1322.

– *VC-n specific source process:*

C2: Signal label information is derived directly from the Adaptation function type. The value for "GFP mapping" in Table 9-11/G.707/Y.1322 is placed in the C2 byte position.

H4: For Sn/TM_A_So with n=3, 4, the H4 byte is sourced as all-zeros.

NOTE 1 – For Sn/TM_A_So with n=3-X, 4-X, the H4 byte is undefined at the Sn-X_AP output of this function (as per clause 12/G.783).

NOTE 2 – For Sn/TM_A_So with n=3, 4, 3-X, 4-X, the K3, F2, F3 bytes are undefined at the Sn-X_AP output of this function (as per clause 12/G.783).

• Defects:

None.

• Consequent actions:

None.

•Defect correlations:

None.

• Performance monitoring:

Ffs.

10.1.1.2 VC-n to T-MPLS adaptation sink function (S*n*/TM_A_Sk)

This function extracts TM_CI information from the Sn_AI signal (n=3, 3-X, 4, 4-X), delivering TM_CI.

Data at the Sn _AP is a VC-n (n=3, 3-X, 4, 4-X) but with indeterminate POH bytes J1, B3, G1, as per ITU-T Rec. G.707/Y.1322.

• Symbol:

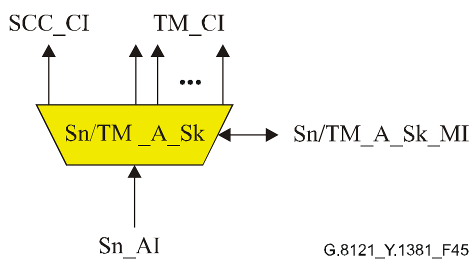

Figure 45/G.8121/Y.1381 – Sn/TM_A_Sk symbol

• **Interfaces:**

Table 11/G.8121/Y.1381 – Sn/TM_A_Sk interfaces

Inputs	Outputs
Sn_AP: Sn_AI_Data Sn_AI_ClocK Sn_AI_FrameStart Sn_AI_TSF **Sn/TM_A_Sk_MP:** Sn/TM_A_Sk_MI_SCCType Sn/TM_A_Sk_MI_Label[1…M] Sn/TM_A_Sk_MI_LSPType[1…M] Sn/TM_A_Sk_MI_PSC[1…M] Sn/TM_A_Sk_MI_EXP2PHBMapping[1…M] Sn/TM_A_Sk_MI_QoSDecodingMode[1…M]	**Each TM_CP:** TM_CI_Data TM_CI_iPHB TM_CI_oPHB TM_CI_SSF **SCC_CP:** SCC_CI_Data SCC_CI_SSF **Sn/TM_A_Sk_MP:** Sn/TM_A_Sk_MI_AcSL Sn/TM_A_Sk_MI_AcEXI Sn/TM_A_Sk_MI_LastValidUPI Sn/TM_A_Sk_MI_cPLM Sn/TM_A_Sk_MI_cLFD Sn/TM_A_Sk_MI_cEXM Sn/TM_A_Sk_MI_cUPM

• Processes:

A process diagram of this function is shown in Figure 46.

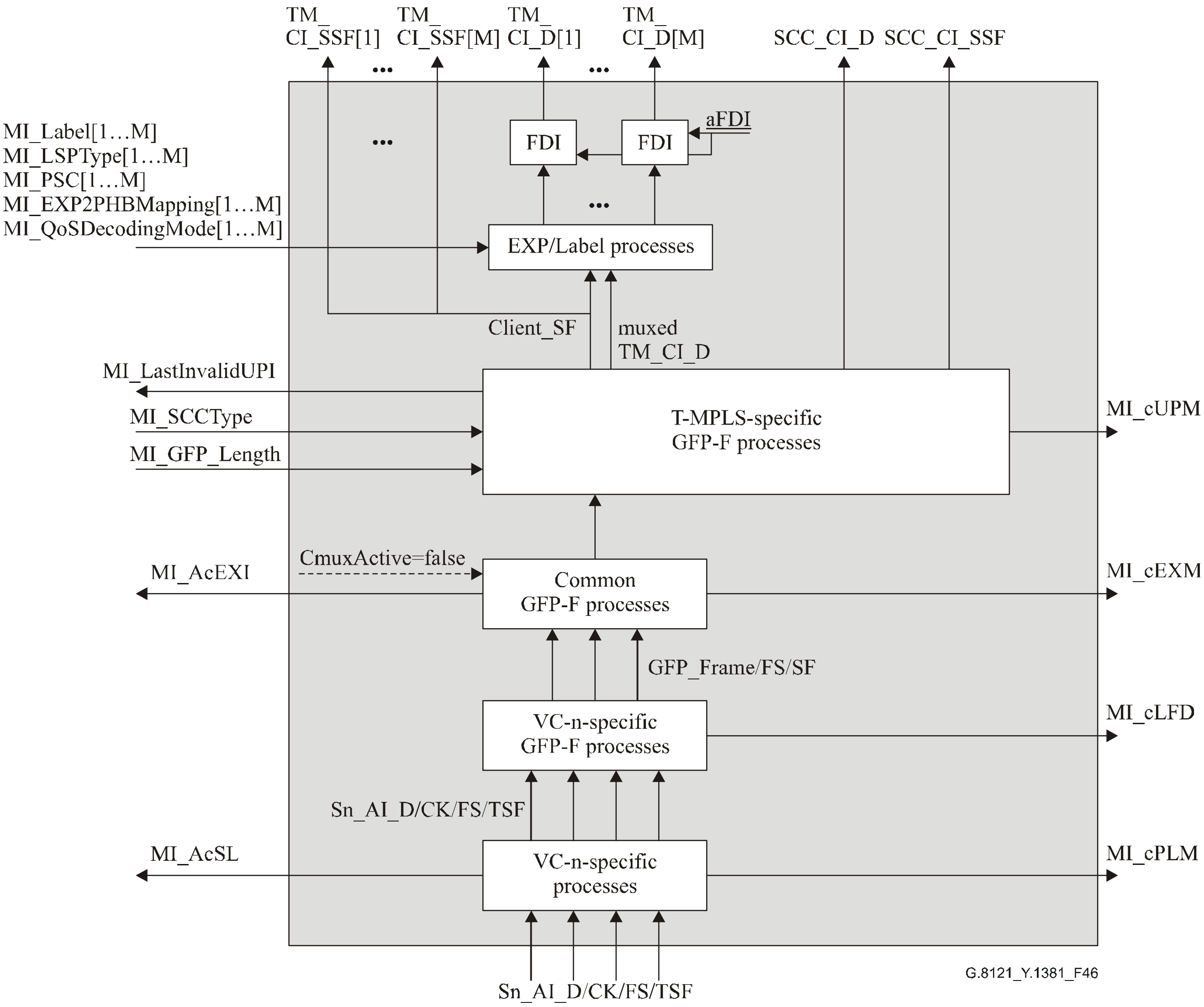

Figure 46/G.8121/Y.1381 – Sn/TM_A_Sk process diagram

– *FDI process:*

This process inserts T-MPLS FDI OAM packets when consequent action aFDI is asserted.

– *EXP/Label processes:*

See 8.2.2.

– *T-MPLS-specific GFP-F sink process:*

See 8.4.2.

– *Common GFP sink process:*

See 8.5.3.2/G.806. GFP channel multiplexing is not supported (CMuxActive=false).

– *VC-n specific GFP sink process:*

See 8.5.2.2/G.806. The GFP frames are demapped from the VC-n payload area according to 10.6/G.707/Y.1322.

– *VC-n-specific sink process:*

C2: The signal label is recovered from the C2 byte as per 6.2.4.2/G.806. The signal label for "GFP mapping" in Table 9-11/G.707/Y.1322 shall be expected. The accepted value of the signal label is also available at the Sn/TM_A_Sk_MP.

• Defects:

dPLM – See 6.2.4.2/G.806.

dLFD – See 6.2.5.2/G.806.

dEXM – See 6.2.4.4/G.806.

dUPM – See 8.4.2.

• Consequent actions:

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM

aFDI ← AI_TSF or dPLM or dLFD or dUPM or dEXM

• Defect correlations:

The function shall perform the following defect correlations to determine the most probable fault cause (see 6.4/G.806). This fault cause shall be reported to the EMF.

cPLM ← dPLM and (not AI_TSF)

cLFD ← dLFD and (not dPLM) and (not AI_TSF)

cEXM ← dEXM and (not dPLM) and (not dLFD) and (not AI_TSF)

cUPM ← dUPM and (not dEXM) and (not dPLM) and (not dLFD) and (not AI_TSF)

• Performance monitoring:

Ffs.

10.1.2 LCAS-capable VC-n to T-MPLS adaptation functions (S*n*-X-L/TM_A; *n*=3, 4)

10.1.2.1 LCAS-capable VC-n to T-MPLS adaptation source function (S*n*-X-L/TM_A_So)

This function maps TM_CI information onto an Sn-X-L_AI signal (n=3, 4).

Data at the Sn-X-L_AP is a VC-n-X (n = 3, 4), having a payload as described in ITU-T Rec. G.707/Y.1322, but with indeterminate POH bytes: J1, B3, G1.

• **Symbol:**

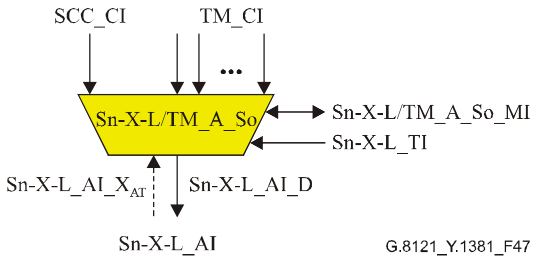

Figure 47/G.8121/Y.1381 – Sn-X-L/TM_A_So symbol

• **Interfaces:**

Table 12/G.8121/Y.1381 – Sn-X-L/TM_A_So interfaces

Inputs	Outputs
Each TM_CP: TM_CI_Data TM_CI_iPHB TM_CI_oPHB **SCC_CP:** SCC_CI_Data **Sn-X-L_AP:** Sn-X-L_AI_X$_{AT}$ **Sn-X-L_TP:** Sn-X-L_TI_Clock Sn-X-L_TI_FrameStart **Sn-X-L/TM_A_So_MP:** Sn-X-L/TM_A_So_MI_SCCType Sn-X-L/TM_A_So_MI_Label[1…M] Sn-X-L/TM_A_So_MI_LSPType[1…M] Sn-X-L/TM_A_So_MI_PSC[1…M] Sn-X-L/TM_A_So_PHB2EXPMapping[1…M] Sn-X-L/TM_A_So_MI_QoSEncodingMode[1…M]	**Sn-X-L_AP:** Sn-X-L_AI_Data Sn-X-L_AI_Clock Sn-X-L_AI_FrameStart

• **Processes:**

A process diagram of this function is shown in Figure 48.

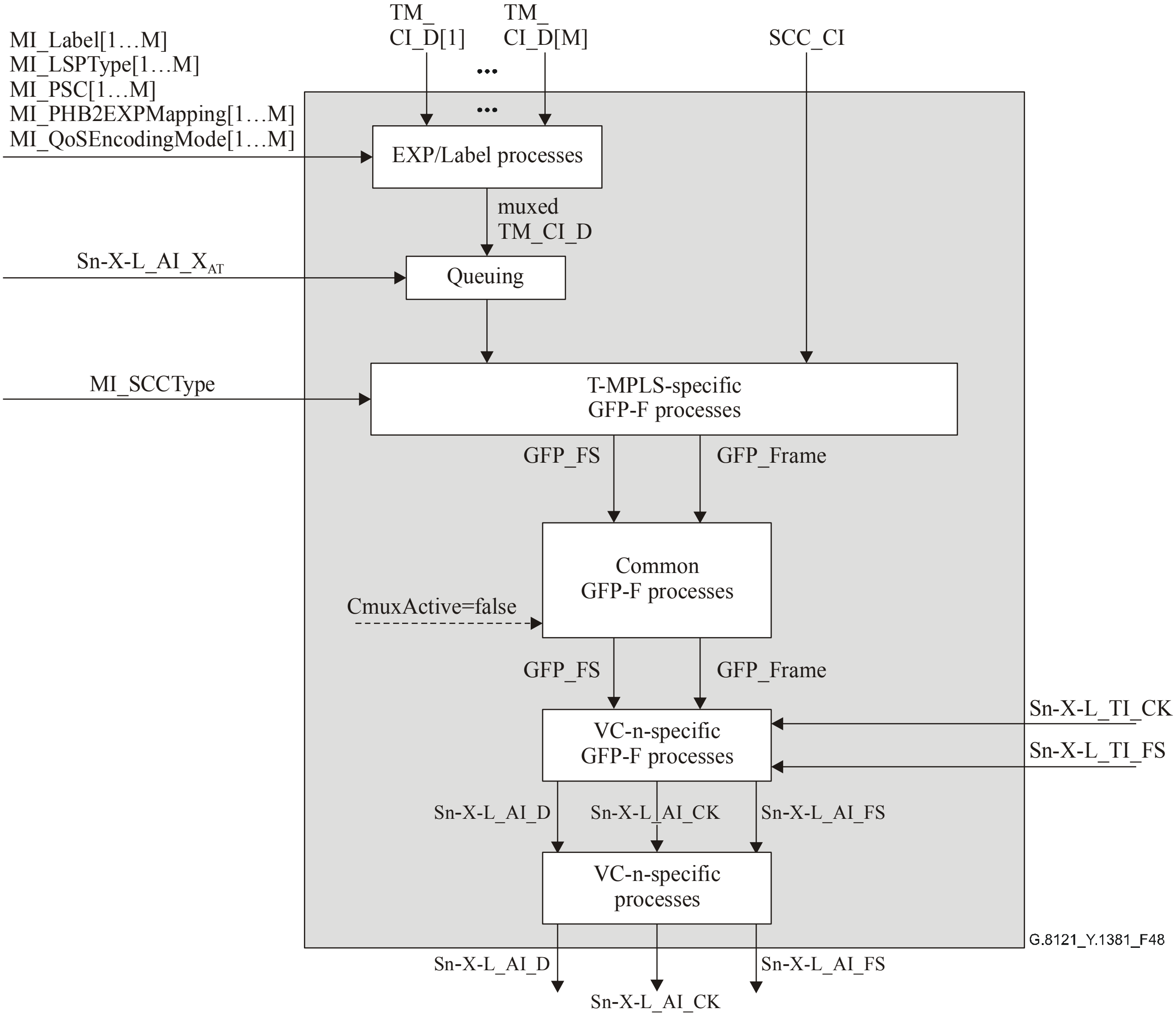

Figure 48/G.8121/Y.1381 – Sn-X-L/TM_A_So process diagram

The processes have the same definition as in 10.1.1.1.

• **Defects:**

None.

• **Consequent actions:**

None.

• **Defect correlations:**

None.

• **Performance monitoring:**

Ffs.

10.1.2.2 LCAS-capable VC-n to T-MPLS adaptation sink function (S*n*-X-L/TM_A_Sk)

This function extracts TM_CI information from the Sn-X-L_AI signal (n=3, 4), delivering TM_CI.

Data at the Sn-X-L_AP is a VC-n-Xv (n=3, 4) but with indeterminate POH bytes J1, B3, G1, as per ITU-T Rec. G.707/Y.1322.

• Symbol:

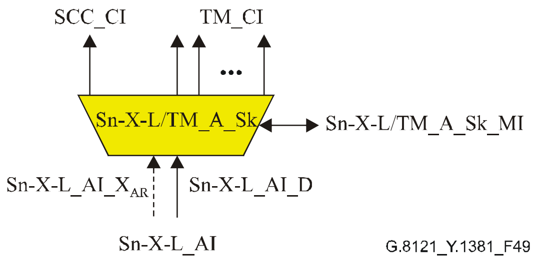

Figure 49/G.8121/Y.1381 – Sn-X-L/TM_A_Sk symbol

• Interfaces:

Table 13/G.8121/Y.1381 – Sn-X-L/TM_A_Sk interfaces

Inputs	Outputs
Sn-X-L_AP: Sn-X-L_AI_Data Sn-X-L_AI_ClocK Sn-X-L_AI_FrameStart Sn-X-L_AI_TSF Sn-X-L_AI_X$_{AR}$ **Sn-X-L/TM_A_Sk_MP:** Sn-X-L/TM_A_Sk_MI_SCCType Sn-X-L/TM_A_Sk_MI_Label[1…M] Sn-X-L/TM_A_Sk_MI_LSPType[1…M] Sn-X-L/TM_A_Sk_MI_PSC[1…M] Sn-X-L/TM_A_Sk_MI_EXP2PHBMapping[1…M] Sn-X-L/TM_A_Sk_MI_QoSDecodingMode[1…M]	**Each TM_CP:** TM_CI_Data TM_CI_iPHB TM_CI_oPHB TM_CI_SSF **SCC_CP:** SCC_CI_Data SCC_CI_SSF **Sn-X-L/TM_A_Sk_MP:** Sn-X-L/TM_A_Sk_MI_AcSL Sn-X-L/TM_A_Sk_MI_AcEXI Sn-X-L/TM_A_Sk_MI_LastValidUPI Sn-X-L/TM_A_Sk_MI_cPLM Sn-X-L/TM_A_Sk_MI_cLFD Sn-X-L/TM_A_Sk_MI_cEXM Sn-X-L/TM_A_Sk_MI_cUPM

• **Processes:**

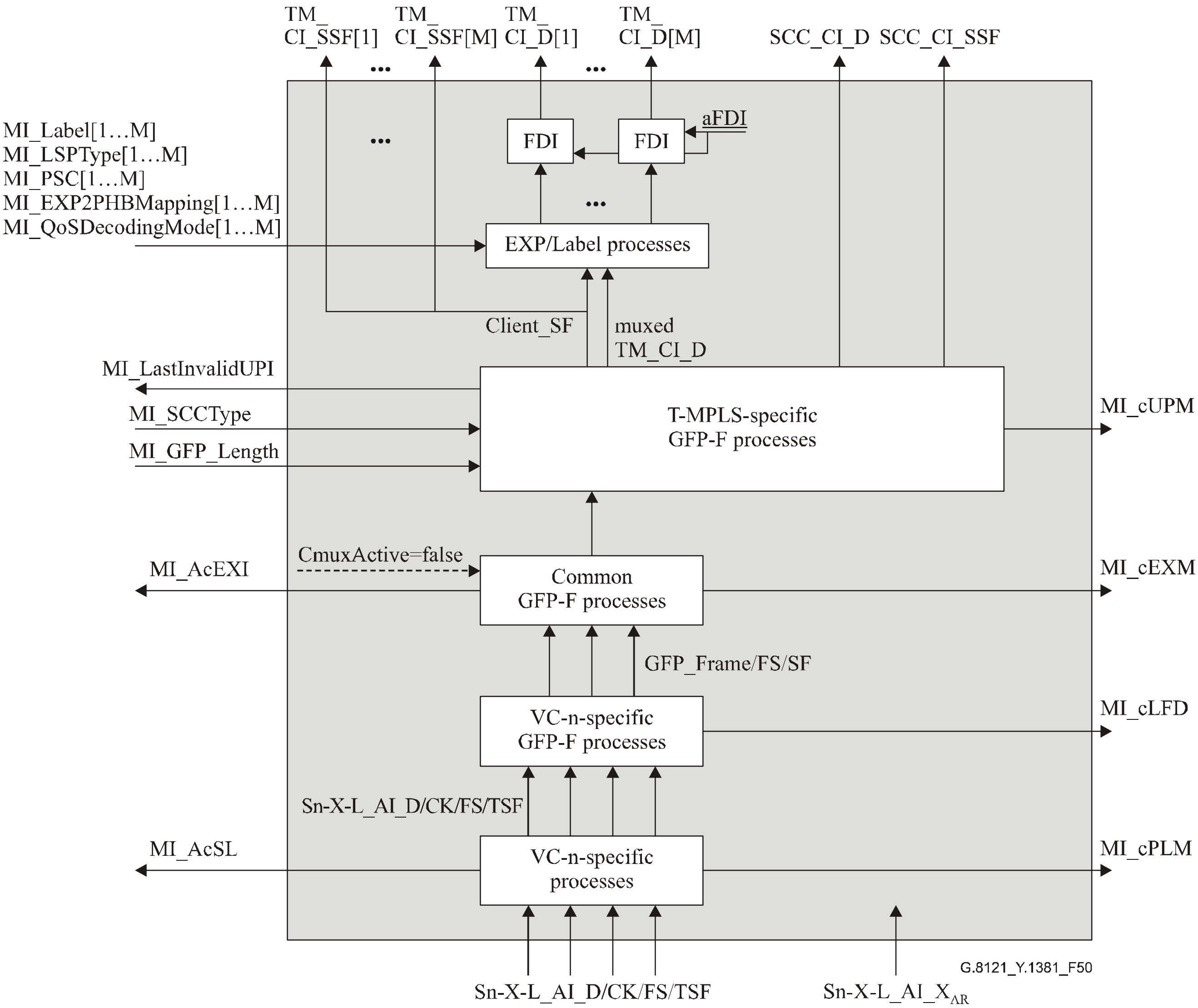

Figure 50/G.8121/Y.1381 – Sn-X-L/TM_A_Sk process diagram

See process diagram and process description in 10.1.1.2. The additional Sn-X-L_AI_X_{AR} interface is not connected to any of the internal processes.

• **Defects:**

dPLM – See 6.2.4.2/G.806.

dLFD – See 6.2.5.2/G.806.

dUPM – See 8.4.2.

dEXM – See 6.2.4.4/G.806.

• Consequent actions:

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM

aFDI ← AI_TSF or dPLM or dLFD or dUPM or dEXM

• Defect correlations:

The function shall perform the following defect correlations to determine the most probable fault cause (see 6.4/G.806). This fault cause shall be reported to the EMF.

cPLM ← dPLM and (not AI_TSF)

cLFD ← dLFD and (not dPLM) and (not AI_TSF)

cEXM ← dEXM and (not dPLM) and (not dLFD) and (not AI_TSF)

cUPM ← dUPM and (not dEXM) and (not dPLM) and (not dLFD) and (not AI_TSF)

• Performance monitoring:

Ffs.

10.1.3 VC-m to T-MPLS adaptation functions (S*m*/TM_A; *m*=11, 11-X, 12, 12-X)

10.1.3.1 VC-m to T-MPLS adaptation source function (S*m*/TM_A_So)

This function maps TM_CI information onto an Sm_AI signal (m=11, 11-X, 12, 12-X).

Data at the Sm_AP is a VC-m (m = 11, 11-X, 12, 12-X), having a payload as described in ITU-T Rec. G.707/Y.1322, but with indeterminate POH bytes: J2, V5[1-4], V5[8].

• Symbol:

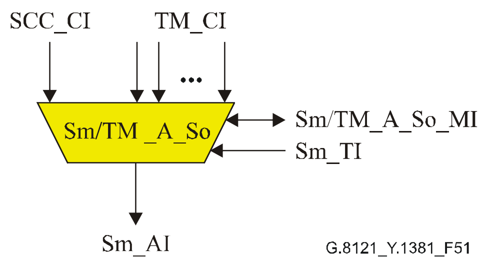

Figure 51/G.8121/Y.1381 – Sm/TM_A_So symbol

• **Interfaces:**

Table 14/G.8121/Y.1381 – Sm/TM_A_So interfaces

Inputs	Outputs
Each TM_CP: TM_CI_Data TM_CI_iPHB TM_CI_oPHB **SCC_CP:** SCC_CI_Data **Sm_TP:** Sm_TI_Clock Sm_TI_FrameStart **Sm/TM_A_So_MP:** Sm/TM_A_So_MI_SCCType Sm/TM_A_So_MI_Label[1…M] Sm/TM_A_So_MI_LSPType[1…M] Sm/TM_A_So_MI_PSC[1…M] Sm/TM_A_So_PHB2EXPMapping[1…M] Sm/TM_A_So_MI_QoSEncodingMode[1…M]	**Sm_AP:** Sm_AI_Data Sm_AI_Clock Sm_AI_FrameStart

• **Processes:**

A process diagram of this function is shown in Figure 52.

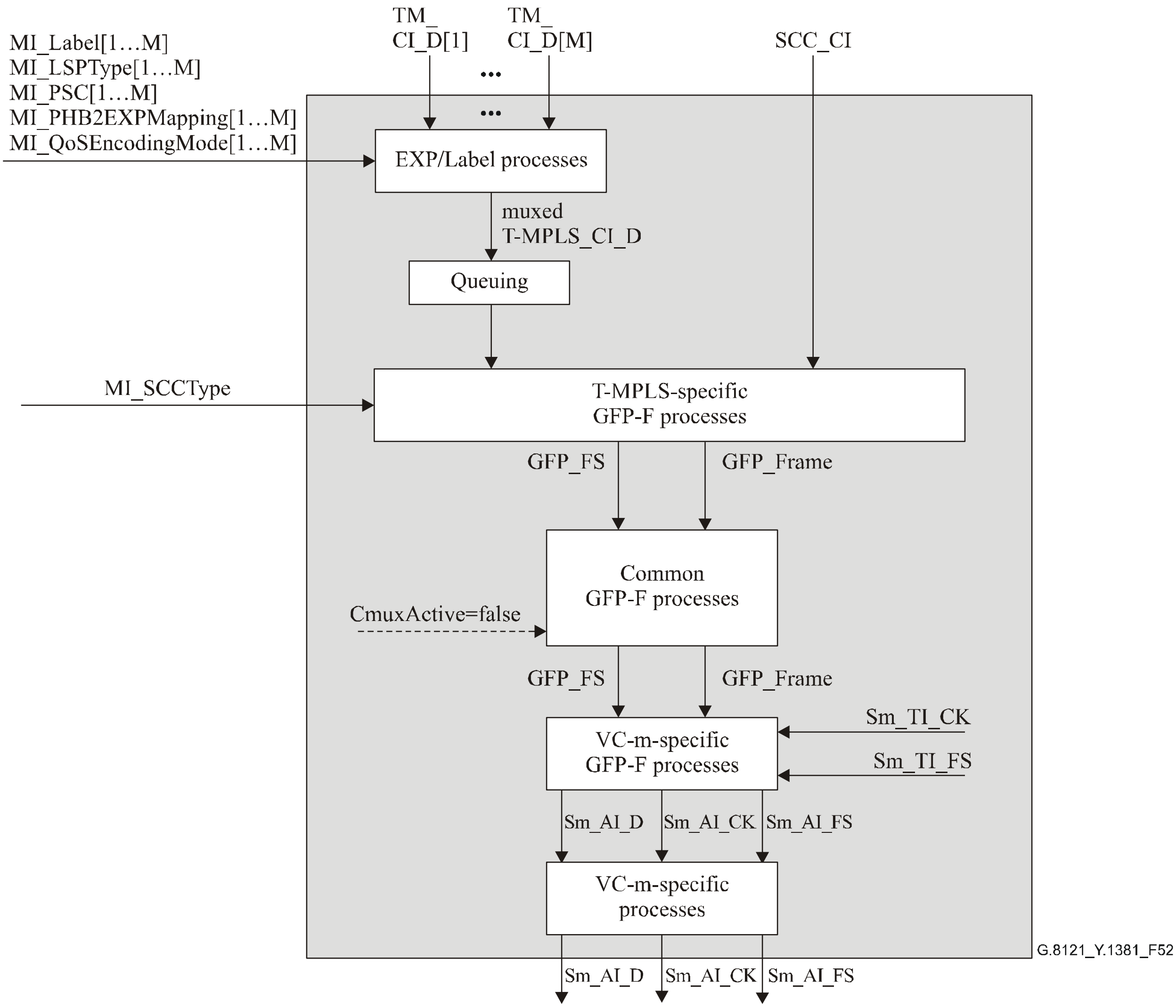

Figure 52/G.8121/Y.1381 – Sm/TM_A_So process diagram

– *EXP/Label processes:*

See 8.2.1.

– *Queuing process:*

See 8.3.

– *T-MPLS-specific GFP-F source process:*

See 8.4.1.

– *Common GFP source process:*

See 8.5.3.1/G.806. GFP channel multiplexing is not supported (CMuxActive=false).

– *VC-m-specific GFP source process:*

See 8.5.2.1/G.806. The GFP frames are mapped into the VC-m payload area according to 10.6/G.707/Y.1322.

– *VC-m-specific source process:*

V5[5-7] and K4[1]: Signal label information is derived directly from the Adaptation function type. The value for "GFP mapping" in Table 9-13/G.707/Y.1322 is placed in the K4[1] Extended Signal Label field as described in 8.2.3.2/G.783.

K4[2]: For Sm/TM_A_So with m = 11, 12, the K4[2] bit is sourced as all-zeros.

NOTE 1 – For Sm/TM_A_So with m = 11-X, 12-X, the K4[2] bit is undefined at the Sm-X_AP output of this function (as per clause 13/G.783).

NOTE 2 – For Sm/TM_A_So with m = 11, 11-X, 12, 12-X, 2, the K4[3-8], V5[1-4] and V5[8] bits are undefined at the Sm-X_AP output of this function (as per clause 13/G.783).

• Defects:

None.

• Consequent actions:

None.

• Defect correlations:

None.

• Performance monitoring:

Ffs.

10.1.3.2 VC-m to T-MPLS adaptation sink function (Sm/TM_A_Sk)

This function extracts TM_CI information from the Sm_AI signal (m=11, 11-X, 12, 12-X), delivering TM_CI.

Data at the Sm _AP is a VC-m (m=11, 11-X, 12, 12-X) but with indeterminate POH bytes J2, V5[1-4], V5[8], as per ITU-T Rec. G.707/Y.1322.

• Symbol:

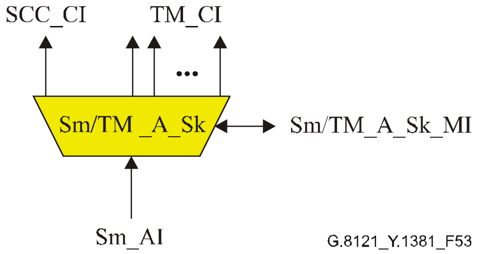

Figure 53/G.8121/Y.1381 – Sm/TM_A_Sk symbol

• Interfaces:

Table 15/G.8121/Y.1381 – Sm/TM_A_Sk interfaces

Inputs	Outputs
Sm_AP: Sm_AI_Data Sm_AI_ClocK Sm_AI_FrameStart Sm_AI_TSF **Sm/TM_A_Sk_MP:** Sm/TM_A_Sk_MI_SCCType Sm/TM_A_Sk_MI_Label[1…M] Sm/TM_A_Sk_MI_LSPType[1…M] Sm/TM_A_Sk_MI_PSC[1…M] Sm/TM_A_Sk_MI_EXP2PHBMapping[1…M] Sm/TM_A_Sk_MI_QoSDecodingMode[1…M]	**Each TM_CP:** TM_CI_Data TM_CI_iPHB TM_CI_oPHB TM_CI_SSF **SCC_CP:** SCC_CI_Data SCC_CI_SSF **Sm/TM_A_Sk_MP:** Sm/TM_A_Sk_MI_AcSL Sm/TM_A_Sk_MI_AcEXI Sm/TM_A_Sk_MI_LastValidUPI Sm/TM_A_Sk_MI_cPLM Sm/TM_A_Sk_MI_cLFD Sm/TM_A_Sk_MI_cEXM Sm/TM_A_Sk_MI_cUPM

• **Processes:**

A process diagram of this function is shown in Figure 54.

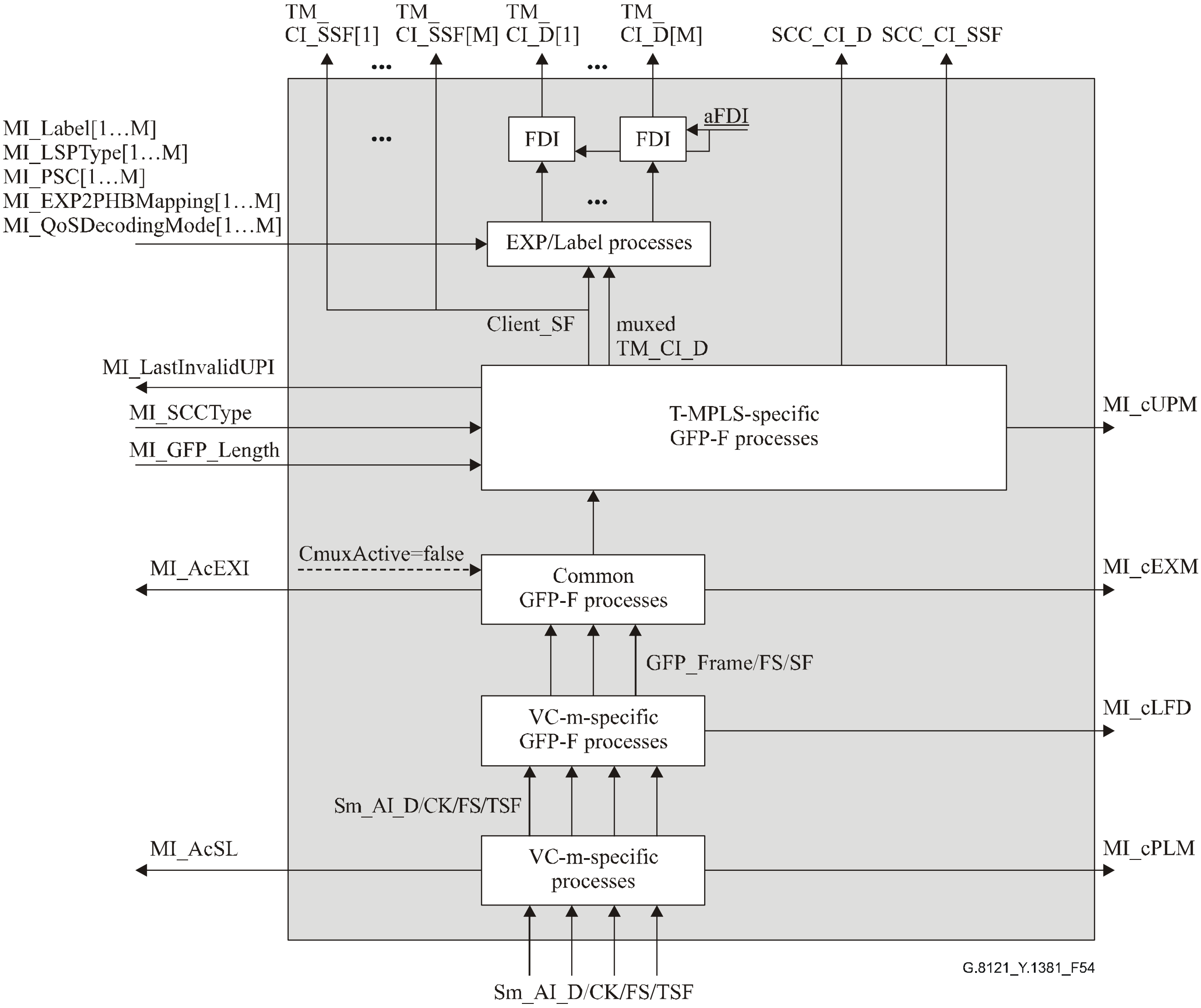

Figure 54/G.8121/Y.1381 – Sm/TM_A_Sk process diagram

– *FDI process:*

This process inserts T-MPLS FDI OAM packets when consequent action aFDI is asserted.

– *EXP/Label processes:*

See 8.2.2.

– *T-MPLS specific GFP-F sink process:*

See 8.4.2.

– *Common GFP sink process:*

See 8.5.3.2/G.806. GFP channel multiplexing is not supported (CMuxActive=false).

– *VC-m-specific GFP sink process:*

See 8.5.2.2/G.806. The GFP frames are demapped from the VC-m payload area according to 10.6/G.707/Y.1322.

– *VC-m-specific sink process:*

V5[5-7] and K4[1]: The signal label is recovered from the extended signal label position as described in 8.2.3.2/G.783 and 6.2.4.2/G.806. The signal label for "GFP mapping" in Table 9-13/G.707/Y.1322 shall be expected. The accepted value of the signal label is also available at the Sm/TM_A_Sk_MP.

• Defects:

dPLM – See 6.2.4.2/G.806.

dLFD – See 6.2.5.2/G.806.

dUPM – See 8.4.2.

dEXM – See 6.2.4.4/G.806.

• Consequent actions:

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM

aFDI ← AI_TSF or dPLM or dLFD or dUPM or dEXM

• Defect correlations:

The function shall perform the following defect correlations to determine the most probable fault cause (see 6.4/G.806). This fault cause shall be reported to the EMF.

cPLM ← dPLM and (not AI_TSF)

cLFD ← dLFD and (not dPLM) and (not AI_TSF)

cEXM ← dEXM and (not dPLM) and (not dLFD) and (not AI_TSF)

cUPM ← dUPM and (not dEXM) and (not dPLM) and (not dLFD) and (not AI_TSF)

• Performance monitoring:

Ffs.

10.1.4 LCAS-capable VC-m to T-MPLS adaptation functions (Sm-X-L/TM_A; *m*=11, 12)

10.1.4.1 LCAS-capable VC-m to T-MPLS Adaptation Source function (Sm-X-L/TM_A_So)

This function maps TM_CI information onto an Sm-X-L_AI signal (m=11, 12).

Data at the Sm-X-L_AP is a VC-m-X (m = 11, 12), having a payload as described in ITU-T Rec. G.707/Y.1322, but with indeterminate POH bytes: J2, V5[1-4], V5[8].

• Symbol:

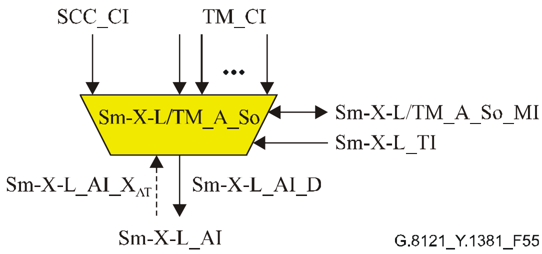

Figure 55/G.8121/Y.1381 – Sm-X-L/TM_A_So symbol

• Interfaces:

Table 16/G.8121/Y.1381 – Sm-X-L/TM_A_So interfaces

Inputs	Outputs
Each TM_CP: TM_CI_Data TM_CI_iPHB TM_CI_oPHB **SCC_CP:** SCC_CI_Data **Sm-X-L_AP:** Sm-X-L_AI_X_{AT} **Sm-X-L_TP:** Sm-X-L_TI_Clock Sm-X-L_TI_FrameStart **Sm-X-L/TM_A_So_MP:** Sm-X-L/TM_A_So_MI_SCCType Sm-X-L/TM_A_So_MI_Label[1…M] Sm-X-L/TM_A_So_MI_LSPType[1…M] Sm-X-L/TM_A_So_MI_PSC[1…M] Sm-X-L/TM_A_So_PHB2EXPMapping[1…M] Sm-X-L/TM_A_So_MI_QoSEncodingMode[1…M]	**Sm-X-L_AP:** Sm-X-L_AI_Data Sm-X-L_AI_Clock Sm-X-L_AI_FrameStart

• **Processes:**

A process diagram of this function is shown in Figure 56.

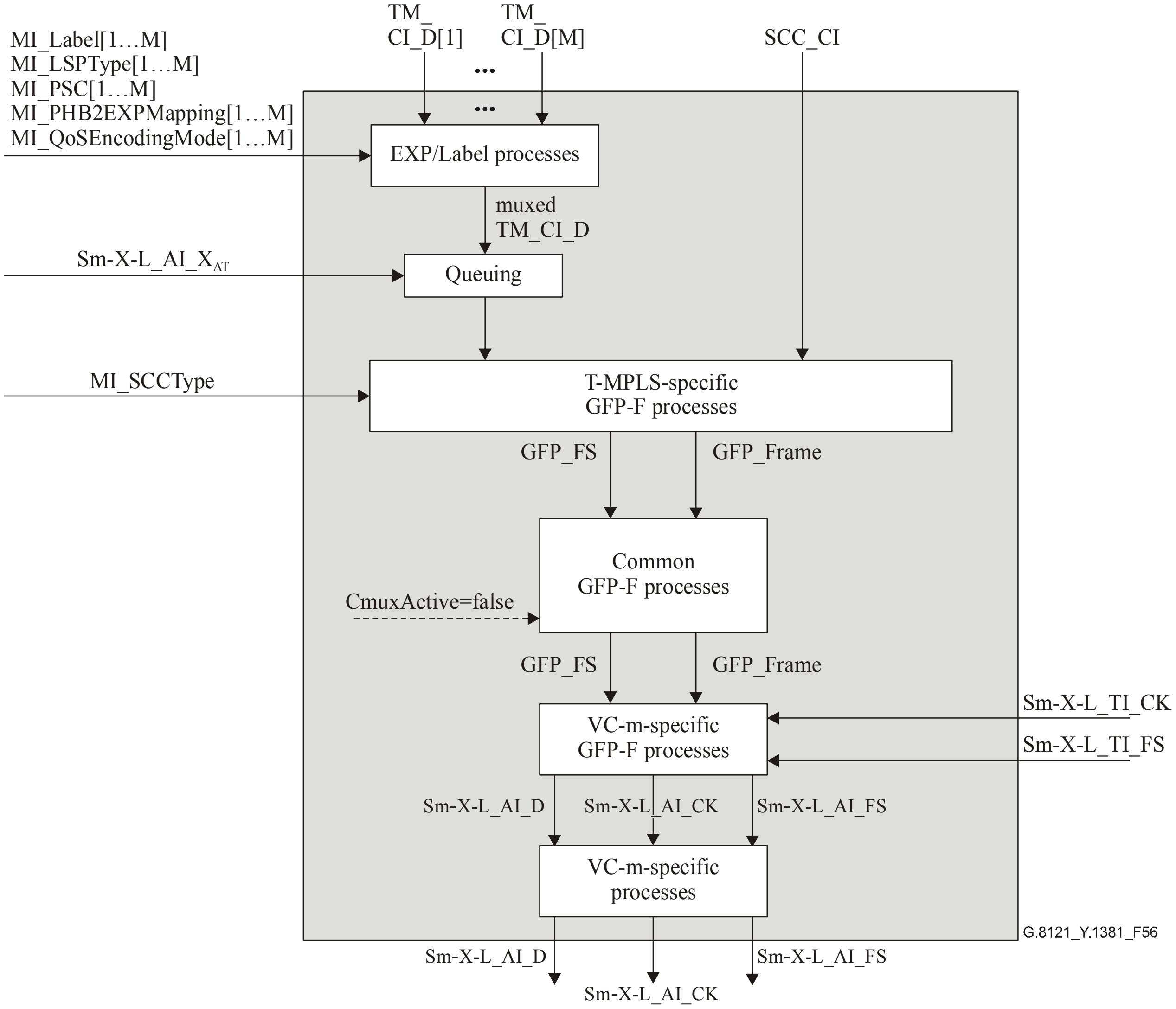

Figure 56/G.8121/Y.1381 – Sm-X-L/TM_A_So process diagram

The processes have the same definition as in 10.1.1.1.

• **Defects:**

None.

• **Consequent actions:**

None.

• **Defect correlations:**

None.

• **Performance monitoring:**

Ffs.

10.1.4.2 LCAS-capable VC-m to T-MPLS adaptation sink function (Sm-X-L/TM_A_Sk)

This function extracts TM_CI information from the Sm-X-L_AI signal (m=11, 12), delivering TM_CI.

Data at the Sm-X-L_AP is a VC-m-Xv (m=11, 12) but with indeterminate POH bytes J2, V5[1-4], V5[8], as per ITU-T Rec. G.707/Y.1322.

• Symbol:

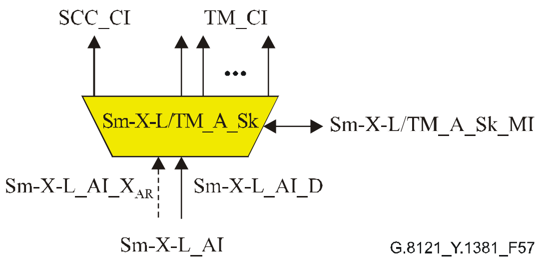

Figure 57/G.8121/Y.1381 – Sm-X-L/TM_A_Sk symbol

• Interfaces:

Table 17/G.8121/Y.1381 – Sm-X-L/TM_A_Sk interfaces

Inputs	Outputs
Sm-X-L_AP: Sm-X-L_AI_Data Sm-X-L_AI_ClocK Sm-X-L_AI_FrameStart Sm-X-L_AI_TSF Sm-X-L_AI_X_{AR} **Sm-X-L/TM_A_Sk_MP:** Sm-X-L/TM_A_Sk_MI_SCCType Sm-X-L/TM_A_Sk_MI_Label[1…M] Sm-X-L/TM_A_Sk_MI_LSPType[1…M] Sm-X-L/TM_A_Sk_MI_PSC[1…M] Sm-X-L/TM_A_Sk_MI_EXP2PHBMapping[1…M] Sm-X-L/TM_A_Sk_MI_QoSDecodingMode[1…M]	**Each TM_CP:** TM_CI_Data TM_CI_iPHB TM_CI_oPHB TM_CI_SSF **SCC_CP:** SCC_CI_Data SCC_CI_SSF **Sm-X-L/TM_A_Sk_MP:** Sm-X-L/TM_A_Sk_MI_AcSL Sm-X-L/TM_A_Sk_MI_AcEXI Sm-X-L/TM_A_Sk_MI_LastValidUPI Sm-X-L/TM_A_Sk_MI_cPLM Sm-X-L/TM_A_Sk_MI_cLFD Sm-X-L/TM_A_Sk_MI_cEXM Sm-X-L/TM_A_Sk_MI_cUPM

• **Processes:**

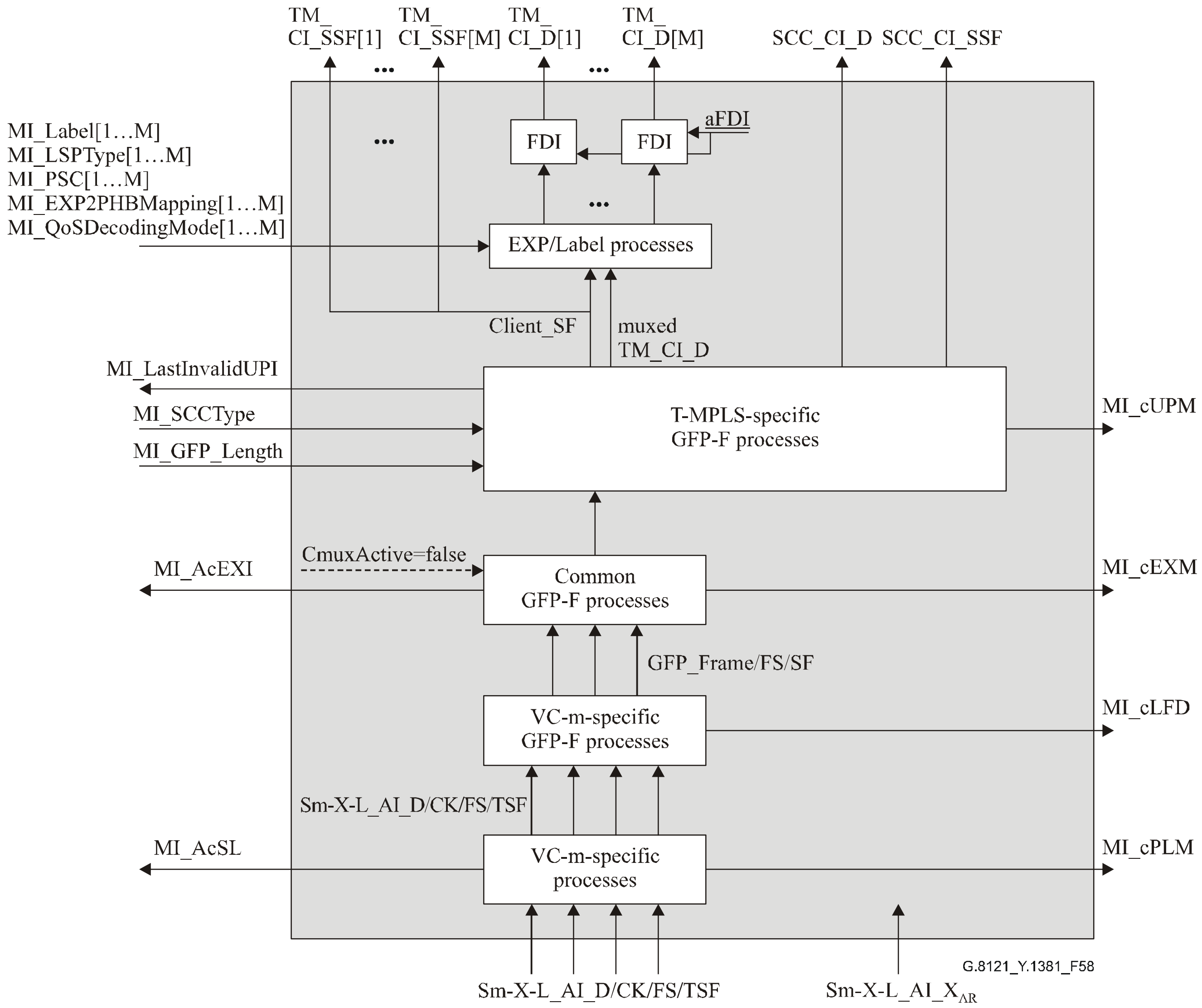

Figure 58/G.8121/Y.1381 – Sm-X-L/TM_A_Sk process diagram

See process diagram and process description in 10.1.1.2. The additional Sm-X-L_AI_X_{AR} interface is not connected to any of the internal processes.

• **Defects:**

dPLM – See 6.2.4.2/G.806.

dLFD – See 6.2.5.2/G.806.

dUPM – See 8.4.2.

dEXM – See 6.2.4.4/G.806.

• **Consequent actions:**

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM

aFDI ← AI_TSF or dPLM or dLFD or dUPM or dEXM

• Defect correlations:

The function shall perform the following defect correlations to determine the most probable fault cause (see 6.4/G.806). This fault cause shall be reported to the EMF.

cPLM ← dPLM and (not AI_TSF)

cLFD ← dLFD and (not dPLM) and (not AI_TSF)

cEXM ← dEXM and (not dPLM) and (not dLFD) and (not AI_TSF)

cUPM ← dUPM and (not dEXM) and (not dPLM) and (not dLFD) and (not AI_TSF)

• Performance monitoring:

Ffs.

10.2 OTH to T-MPLS adaptation function (O/TM_A)

10.2.1 ODU*k* to T-MPLS adaptation functions (ODU*k*P/TM_A; k=1,2,3)

Ffs.

10.2.2 LCAS-capable ODU*k* to T-MPLS adaptation functions (ODU*k*P-X-L/TM_A; k=1,2,3)

Ffs.

10.3 PDH to T-MPLS adaptation function (P/TM_A)

Ffs.

10.4 ETH to T-MPLS adaptation function (ETH/TM_A)

Ffs.

11 Interworking functions based on ITU-T Rec. G.805

Ffs.

ITU-T Y-SERIES RECOMMENDATIONS

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