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

Packet over Transport aspects – Ethernet over Transport aspects

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Internet protocol aspects – Transport

Characteristics of Ethernet transport network equipment functional blocks

Recommendation ITU-T G.8021/Y.1341

ITU-T G-SERIES RECOMMENDATIONS

TRANSMISSION SYSTEMS AND MEDIA, DIGITAL SYSTEMS AND NETWORKS

INTERNATIONAL TELEPHONE CONNECTIONS AND CIRCUITS	G.100–G.199
GENERAL CHARACTERISTICS COMMON TO ALL ANALOGUE CARRIER-TRANSMISSION SYSTEMS	G.200–G.299
INDIVIDUAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON METALLIC LINES	G.300–G.399
GENERAL CHARACTERISTICS OF INTERNATIONAL CARRIER TELEPHONE SYSTEMS ON RADIO-RELAY OR SATELLITE LINKS AND INTERCONNECTION WITH METALLIC LINES	G.400–G.449
COORDINATION OF RADIOTELEPHONY AND LINE TELEPHONY	G.450–G.499
TRANSMISSION MEDIA AND OPTICAL SYSTEMS CHARACTERISTICS	G.600–G.699
DIGITAL TERMINAL EQUIPMENTS	G.700–G.799
DIGITAL NETWORKS	G.800–G.899
DIGITAL SECTIONS AND DIGITAL LINE SYSTEM	G.900–G.999
QUALITY OF SERVICE AND PERFORMANCE – GENERIC AND USER-RELATED ASPECTS	G.1000–G.1999
TRANSMISSION MEDIA CHARACTERISTICS	G.6000–G.6999
DATA OVER TRANSPORT – GENERIC ASPECTS	G.7000–G.7999
PACKET OVER TRANSPORT ASPECTS	G.8000–G.8999
Ethernet over Transport aspects	**G.8000–G.8099**
MPLS over Transport aspects	G.8100–G.8199
Quality and availability targets	G.8200–G.8299
Service Management	G.8600–G.8699
ACCESS NETWORKS	G.9000–G.9999

For further details, please refer to the list of ITU-T Recommendations.

Recommendation ITU-T G.8021/Y.1341

Characteristics of Ethernet transport network equipment functional blocks

Summary

Recommendation ITU-T G.8021/Y.1341 specifies both the functional components and the methodology that should be used in order to specify Ethernet transport network functionality of network elements; it does not specify individual Ethernet transport network equipment as such.

Source

Recommendation ITU-T G.8021/Y.1341 was approved on 22 December 2007 by ITU-T Study Group 15 (2005-2008) under Recommendation ITU-T A.8 procedures.

Keywords

Atomic functions, equipment functional blocks, Ethernet transport network.

FOREWORD

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CONTENTS

Introduction

This Recommendation forms part of a suite of ITU-T Recommendations covering the full functionality of Ethernet transport network architecture and equipment (e.g., Recommendations ITU-T G.8010/Y.1306 and ITU-T G.8012/Y.1308) and follows the principals defined in Recommendation ITU-T G.805.

This Recommendation specifies a library of basic building blocks and a set of rules by which they may be combined in order to describe equipment used in an Ethernet transport network. The building blocks are based on atomic modelling functions defined in Recommendations ITU-T G.806 and ITU-T G.809. The library comprises the functional building blocks needed to specify completely the generic functional structure of the Ethernet transport network. In order to be compliant with this Recommendation, the Ethernet functionality of any equipment which processes at least one of the Ethernet transport layers 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.

The specification method is based on functional decomposition of the equipment into atomic and compound functions. The equipment is then described by its equipment functional specification (EFS) which lists the constituent atomic and compound functions, their interconnection and any overall performance objectives (e.g., transfer delay, availability, etc.).

Recommendation ITU-T G.8021/Y.1341

Characteristics of Ethernet transport network equipment functional blocks

1 Scope

This Recommendation covers the functional requirements of Ethernet functionality within Ethernet transport equipment.

This Recommendation uses the specification methodology defined in [ITU-T G.806] in general for transport network equipment and is based on the architecture of Ethernet layer networks defined in [ITU-T G.8010], the interfaces for Ethernet transport networks defined in [ITU-T G.8012], and in support of services defined in the ITU-T G.8011.x series of Recommendations. It also provides processes for Ethernet OAM based on [ITU-T Y.1731]. The description is generic and no particular physical partitioning of functions is implied. The input/output information flows associated with the functional blocks serve for defining the functions of the blocks and are considered to be conceptual, not physical.

The functionality defined in this Recommendation can be applied at user-to-network interfaces (UNIs) and network-to-network interfaces (NNIs) of the Ethernet transport network.

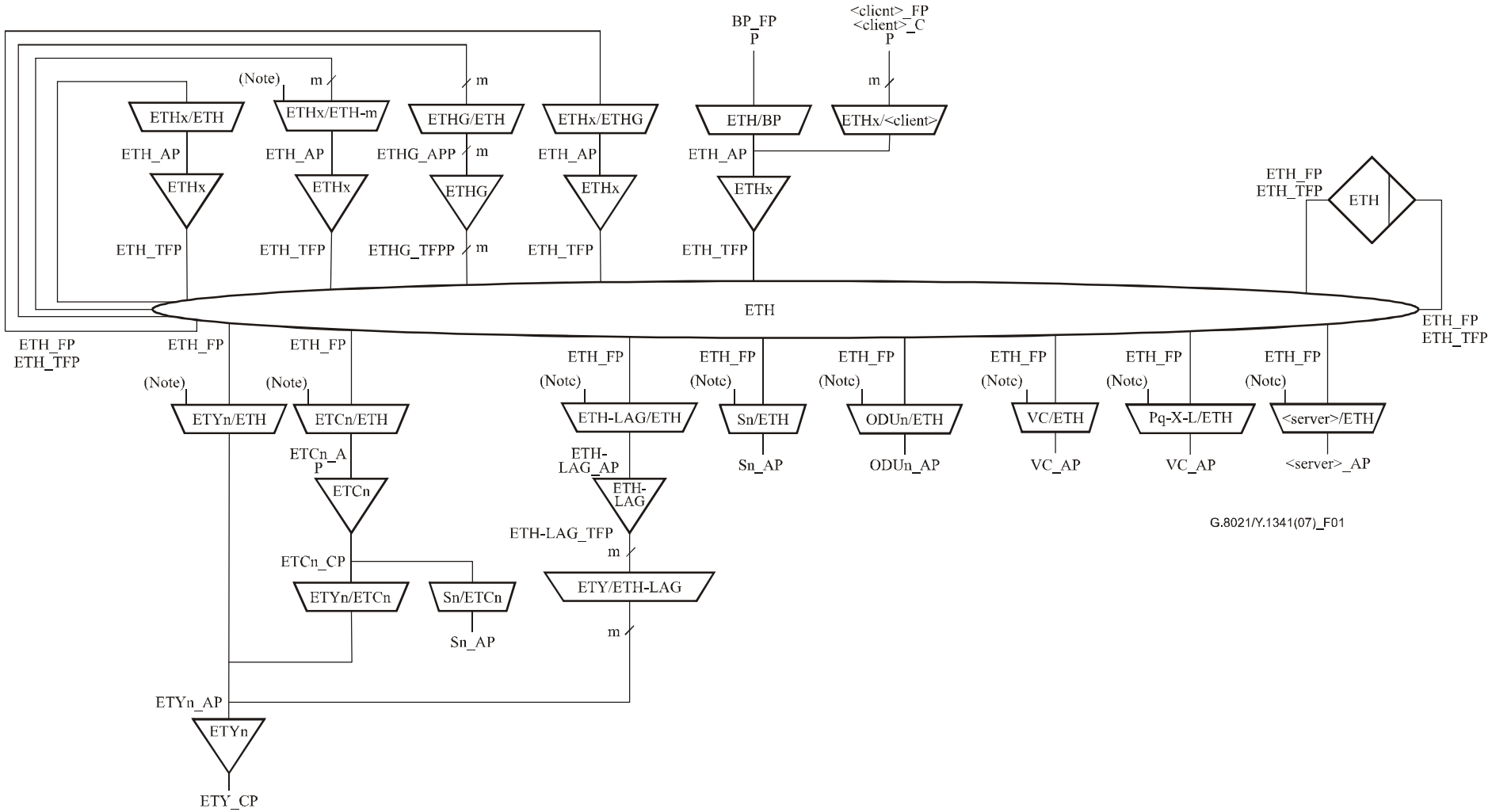
Not every functional block defined in this Recommendation is required for every application. Different subsets of functional blocks from this Recommendation and others (e.g., [ITU-T G.783], [ITU-T G.798], [ITU-T G.806] and [b-ITU-T I.732]) may be assembled in different ways according to the combination rules given in these Recommendations (e.g., [ITU-T G.806]) to provide a variety of different capabilities. Network operators and equipment suppliers may choose which functions must be implemented for each application.

The internal structure of the implementation of this functionality (equipment design) need not be identical to the structure of the functional model, as long as all the details of the externally observable behaviour comply with the equipment functional specification (EFS).

Equipment developed prior to the production of this Recommendation may not comply in all details with this Recommendation.

The equipment requirements described in this Recommendation are generic and no particular physical partitioning of functions is implied. The input/output information flows associated with the functional blocks define the functions of the blocks and are considered to be conceptual, not physical.

Figure 1-1 presents a summary illustration of the set of atomic functions associated with the Ethernet signal transport. These atomic functions may be combined in various ways to support a variety of Ethernet services, some of which are illustrated in Appendix I. The functions for the processing of management communication channels (e.g., SDH DCC or OTH COMMS) are not shown in these figures in order to reduce their complexity. For DCC or COMMS functions, refer to the specific layer network descriptions.



NOTE – ETH_TFP interface of adaptation functions towards the ETH_FT functions connects to logical link control. See [ITU-T G.8010] and function definition for details.

Figure 1-1 – Overview of G.8021/Y.1341 atomic model 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 G.707] Recommendation ITU-T G.707/Y.1322 (2003), *Network node interface for the synchronous digital hierarchy (SDH)*.

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

[ITU-T G.783] Recommendation ITU-T G.783 (2004), *Characteristics of synchronous digital hierarchy (SDH) equipment functional blocks*.

[ITU-T G.798] Recommendation ITU-T G.798 (2006), *Characteristics of optical transport network hierarchy equipment functional blocks.*

[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 (2006), *Characteristics of transport equipment – Description methodology and generic functionality*.

[ITU-T G.809] Recommendation ITU-T G.809 (2003), *Functional architecture of connectionless layer networks*.

[ITU-T G.831] Recommendation ITU-T G.831 (2000), *Management capabilities of transport networks based on the synchronous digital hierarchy (SDH).*

[ITU-T G.832] Recommendation ITU-T G.832 (1998), *Transport of SDH elements on PDH networks – Frame and multiplexing structures.*

[ITU-T G.841] Recommendation ITU-T G.841 (1998), *Types and characteristics of SDH network protection architectures*.

[ITU-T G.874] Recommendation ITU-T G.874 (2001), *Management aspects of the optical transport network element*.

[ITU-T G.957] Recommendation ITU-T G.957 (1999), *Optical interfaces for equipments and systems relating to the synchronous digital hierarchy*.

[ITU-T G.959.1] Recommendation ITU-T G.959.1 (2003), *Optical transport network physical layer interfaces*.

[ITU-T G.7041] Recommendation ITU-T G.7041/Y.1303 (2008), *Generic framing procedure (GFP)*.

[ITU-T G.7042] Recommendation ITU-T G.7042/Y.1305 (2004), *Link capacity adjustment scheme (LCAS) for virtual concatenated signals*.

[ITU-T G.7043] Recommendation ITU-T G.7043/Y.1343 (2004), *Virtual concatenation of plesiochronous digital hierarchy (PDH) signals.*

[ITU-T G.8001] Recommendation ITU-T G.8001/Y.1354 (2008), *Terms and definitions for Ethernet frames over Transport (EoT).*

[ITU-T G.8010] Recommendation ITU-T G.8010/Y.1306 (2004), *Architecture of Ethernet layer networks*.

[ITU-T G.8011] Recommendation ITU-T G.8011/Y.1307 (2004), *Ethernet over Transport – Ethernet services framework*.

[ITU-T G.8011.1] Recommendation ITU-T G.8011.1/Y.1307.1 (2004), *Ethernet private line service*.

[ITU-T G.8011.2] Recommendation ITU-T G.8011.2/Y.1307.2 (2005), *Ethernet virtual private line service*.

[ITU-T G.8012] Recommendation ITU-T G.8012/Y.1308 (2004), *Ethernet UNI and Ethernet NNI*.

[ITU-T G.8031] Recommendation ITU-T G.8031/Y.1342 (2006), *Ethernet linear protection switching.*

[ITU-T G.8040] Recommendation ITU-T G.8040/Y.1340 (2005), *GFP frame mapping into Plesiochronous Digital Hierarchy (PDH).*

[ITU-T G.8251] Recommendation ITU-T G.8251 (2001), *The control of jitter and wander within the optical transport network (OTN).*

[ITU-T M.3208.1] Recommendation ITU-T M.3208.1 (1997), *TMN management services for dedicated and reconfigurable circuits network: Leased circuit services.*

[ITU-T Y.1731] Recommendation ITU-T Y.1731 (2006), *OAM functions and mechanisms for Ethernet based networks.*

[IEEE 802] IEEE 802 (2001), *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and Metropolitan Area Networks: IEEE Standard: Overview and Architecture.* <http://standards.ieee.org/getieee802/>

[IEEE 802.1AB] IEEE 802.1AB (2005), *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and Metropolitan Area Networks: Station and Media Access Control Connectivity Discovery.* <http://ieeexplore.ieee.org/servlet/opac?punumber=9971>

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[IEEE 802.1X] IEEE 802.1X (2004), *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and Metropolitan Area Networks: Port-Based Network Access Control*. <http://ieeexplore.ieee.org/servlet/opac?punumber=9828>

[IEEE 802.3 2002] IEEE 802.3 (2002), *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and Metropolitan Area Networks: Specific requirements Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*.
<http://ieeexplore.ieee.org/servlet/opac?punumber=7754>

[IEEE 802.3 2005] IEEE 802.3 (2005), *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and Metropolitan Area Networks: Specific requirements Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications*.
<http://ieeexplore.ieee.org/servlet/opac?punumber=10531>

[MEF 10.1] Metro Ethernet Forum Technical Specification 10.1 (2006), *Ethernet Service Attributes Phase 2*.
<http://metroethernetforum.org/PDF_Documents/MEF10-1.pdf>

3 Definitions

3.1 Terms defined elsewhere

This Recommendation uses the following terms defined elsewhere:

3.1.1 8B/10B transmission code: [IEEE 802.3 2005]

3.1.2 10BASE-F: [IEEE 802.3 2005]

3.1.3 10BASE-T: [IEEE 802.3 2005]

3.1.4 100BASE-FX: [IEEE 802.3 2005]

3.1.5 100BASE-T: [IEEE 802.3 2005]

3.1.6 100BASE-TX: [IEEE 802.3 2005]

3.1.7 100BASE-X: [IEEE 802.3 2005]

3.1.8 1000BASE-CX: [IEEE 802.3 2005]

3.1.9 1000BASE-LX: [IEEE 802.3 2005]

3.1.10 1000BASE-SX: [IEEE 802.3 2005]

3.1.11 1000BASE-T: [IEEE 802.3 2005]

3.1.12 1000BASE-X: [IEEE 802.3 2005]

3.1.13 access point: [ITU-T G.805] [ITU-T G.809]

3.1.14 adaptation: [ITU-T G.809]

3.1.15 adapted information: [ITU-T G.809]

3.1.16 auto-negotiation: [IEEE 802.3 2005]

3.1.17 characteristic information: [ITU-T G.809]

3.1.18 client/server relationship: [ITU-T G.809]

3.1.19 code-group: [IEEE 802.3 2005]

3.1.20 comma: [IEEE 802.3 2005]

3.1.21 connection point: [ITU-T G.805]

3.1.22 connectionless trail: [ITU-T G.809]

3.1.23 consequent actions: [ITU-T G.806]

3.1.24 defect correlations: [ITU-T G.806]

3.1.25 defects: [ITU-T G.806]

3.1.26 Ethernet flow replication point (ETHF_PP): [ITU-T G.8001]

3.1.27 Ethernet replicated information (ETH_PI): [ITU-T G.8001]

3.1.28 Ethernet termination flow replication point (ETHTF_PP): [ITU-T G.8001]

3.1.29 flow: [ITU-T G.809]

3.1.30 flow domain: [ITU-T G.809]

3.1.31 flow domain flow: [ITU-T G.809]

3.1.32 flow point: [ITU-T G.809]

3.1.33 flow point pool: [ITU-T G.809]

3.1.34 flow termination: [ITU-T G.809]

3.1.35 flow termination sink: [ITU-T G.809]

3.1.36 flow termination source: [ITU-T G.809]

3.1.37 full duplex: [IEEE 802.3 2005]

3.1.38 generic framing procedure (GFP): [ITU-T G.7041]

3.1.39 jabber: [IEEE 802.3 2005]

3.1.40 layer network: [ITU-T G.809]

3.1.41 link: [ITU-T G.805]

3.1.42 link connection: [ITU-T G.805]

3.1.43 link flow: [ITU-T G.809]

3.1.44 media access control (MAC): [IEEE 802.3 2005]

3.1.45 medium attachment unit (MAU): [IEEE 802.3 2005]

3.1.46 network: [ITU-T G.809]

3.1.47 network connection: [ITU-T G.805]

3.1.48 network flow: [ITU-T G.809]

3.1.49 network operator: [ITU-T M.3208.1]

3.1.50 network-to-network interface (NNI): [ITU-T G.8001]

3.1.51 non-return-to-zero, invert on ones (NRZI): [IEEE 802.3 2005]

3.1.52 ordered set: [IEEE 802.3 2005]

3.1.53 performance filters: [ITU-T G.806]

3.1.54 physical coding sublayer (PCS): [IEEE 802.3 2005]

3.1.55 physical layer entity (PHY): [IEEE 802.3 2005]

3.1.56 physical medium attachment (PMA) sublayer: [IEEE 802.3 2005]

3.1.57 physical medium dependent (PMD) sublayer: [IEEE 802.3 2005]

3.1.58 physical signalling sublayer (PLS): [IEEE 802.3 2005]

3.1.59 port: [ITU-T G.809]

3.1.60 QTag prefix: [IEEE 802.3 2005]

3.1.61 reconciliation sublayer (RS): [IEEE 802.3 2005]

3.1.62 reference point: [ITU-T G.805] [ITU-T G.809]

3.1.63 reference points: [ITU-T G.806]

3.1.64 service provider: [ITU-T M.3208.1]

3.1.65 tagged MAC frame: [IEEE 802.3 2005]

3.1.66 termination connection point: [ITU-T G.805]

3.1.67 termination flow point: [ITU-T G.809]

3.1.68 termination flow point pool: [ITU-T G.809]

3.1.69 traffic conditioning function: [ITU-T G.8001]

3.1.70 traffic unit: [ITU-T G.809]

3.1.71 trail: [ITU-T G.805]

3.1.72 trail termination: [ITU-T G.805]

3.1.73 transport: [ITU-T G.809]

3.1.74 transport entity: [ITU-T G.809]

3.1.75 transport processing function: [ITU-T G.809]

3.1.76 twisted pair: [IEEE 802.3 2005]

3.1.77 user-to-network interface (UNI): [ITU-T G.8001]

4 Acronyms and abbreviations

This Recommendation uses the following abbreviations:

AI	Adapted Information
AIS	Alarm Indication Signal
AP	Access Point
APS	Automatic Protection Switching
ATM	Asynchronous Transfer Mode
BER	Bit Error Ratio
BP-FP	Bridge Protocol Flow Point
BS	Bad Second
CC	Continuity Check
CCM	Continuity Check Message
CI	Characteristic Information
COMMS	Communications Channel
CP	Connection Point
DA	Destination Address
DCC	Data Communication Channel

DE Drop Eligibility
DEG Degraded
DEGM Degraded M
DEGTHR Degraded Threshold
DM Delay Measurement
EC Ethernet Connection
EFS Equipment Functional Specification
EoA Ethernet over Asynchronous Transfer Mode
EoM Ethernet over Multi-Protocol Label Switching
EoO Ethernet over Optical Transport Hierarchy
EoP Ethernet over Plesiochronous Digital Hierarchy
EoR Ethernet over Resilient Packet Ring
EoS Ethernet over Synchronous Digital Hierarchy
EoT Ethernet over Transport
EPL Ethernet Private Line
EPLAN Ethernet Private Local Area Network
ETC Ethernet Coding
ETH Ethernet Media Access Control layer network
ETH_CI Ethernet Media Access Control Characteristic Information
ETY Ethernet Physical layer
ETYn Ethernet Physical layer network of type *n*
EVC Ethernet Virtual Connection
EVPL Ethernet Virtual Private Line
EVPLAN Ethernet Virtual Private Local Area Network
EXM Extension Header Mismatch
FCS Frame Check Sequence
FD Flow Domain
FDF Flow Domain Flow
FOP Failure Of protocol
FP Flow Point
FT Flow Termination
GFP Generic Framing Procedure
GFP-F Generic Framing Procedure – Frame mapped
GFP-T Generic Framing Procedure – Transparent mapped
LAN Local Area Network
LAPS Link Access Procedure – Synchronous Digital Hierarchy
LB LoopBack

LBM	LoopBack Message
LBR	LoopBack Reply
LCAS	Link Capacity Adjustment Scheme
LCK	Locked
LFD	Loss of Frame Delineation
LLC	Logical Link Control
LM	Loss Measurement
LMM	Loss Measurement Message
LMR	Loss Measurement Reply
LOC	Loss Of Continuity
LOS	Loss Of Signal
M_SDU	Media Access Control Service Data Unit
MAC	Media Access Control
MAU	Management Attachment Unit
MEF	Metro Ethernet Forum
ME	Maintenance Entity
MEG	Maintenance Entity Group
MEL	Maintenance Entity Group Level
MEP	Maintenance Entity Group End Point
MI	Management Information
MIP	Maintenance Entity Group Intermediate Point
MMG	Mismerge
MPLS	Multi-Protocol Label Switching
NNI	Network-to-Network Interface
NT	Network Termination
OAM	Operations, Administration and Maintenance
ODU	Optical Channel Data Unit
ODUj	Optical Channel Data Unit – order j
ODUj-Xv	Virtual concatenated Optical Channel Data Unit – order j
ODUk	Optical Channel Data Unit – order k
ODUk-Xv	Virtual concatenated Optical Channel Data Unit – order k
OTH	Optical Transport Hierarchy
P	Priority
P11s	1544 kbit/s PDH path layer with synchronous 125 μs frame structure according to Recommendation ITU-T G.704
P12s	2048 kbit/s PDH path layer with synchronous 125 μs frame structure according to Recommendation ITU-T G.704

P31s	34 368 kbit/s PDH path layer with synchronous 125 μs frame structure according to [ITU-T G.832]
P4s	139 264 kbit/s PDH path layer with synchronous 125 μs frame structure according to [ITU-T G.832]
PA	(Ethernet) Preamble
PCS	Physical Convergence Sublayer
PDH	Plesiochronous Digital Hierarchy
PDU	Protocol Data Unit
PHY	Physical Layer Entity
PLM	Payload Mismatch
PLS	Physical Layer Signalling
PMA	Physical Medium Attachment sublayer
PMD	Physical Medium Dependent sublayer
POH	Path OverHead
QTag	IEEE 802.1Q tag
RDI	Remote Defect Indication
REC	Received
RFC	Request for Comments
RPR	Resilient Packet Ring
RxFCf	Received Frame Count Far end
RxFCl	Received Frame Count Local
SA	Source Address
SDH	Synchronous Digital Hierarchy
SDU	Service Data Unit
SFD	Start of Frame Delimiter
SSF	Server Signal Fail
STM-N	Synchronous Transport Module – level N
TF	Transmitted Frame
TFP	Termination Flow Point
TID	Transaction Identifier
TLV	Type, Length, Value
TSF	Trail Signal Fail
TST	Test
TxFCf	Transmitted Frame Count Far end
TxFCl	Transmitted Frame Count Local
UNI	User-to-Network Interface
UNL	Unexpected Maintenance Entity Group Level

UNP Unexpected Period

UNPr Unexpected Priority

UPI (Generic Framing Procedure) User Payload Identifier

UPM User Payload Mismatch

VC Virtual Channel (asynchronous transfer mode) or Virtual Container (synchronous digital hierarchy)

VCAT Virtual ConCATenation

VC-m Lower Order Virtual Channel – order m

VC-n Higher Order Virtual Channel – order n

VC-n-Xc Contiguous concatenated Virtual Channel – order n

VC-n-Xv Virtual concatenated Virtual Channel – order n

VLAN Virtual Local Area Network

5 Methodology

For the basic methodology to describe transport network functionality of network elements, refer to clause 5 of [ITU-T G.806]. For Ethernet-specific extensions to the methodology, see clause 5 of [ITU-T G.8010].

6 Supervision

The generic supervision functions are defined in clause 6 of [ITU-T G.806]. Specific supervision functions for the Ethernet transport network are defined in this clause.

6.1 Defects

6.1.1 Summary of detection and clearance conditions for defects

The defect detection and clearance conditions are based on events. Occurrence or absence of specific events may detect or clear specific defects.

In the following:

Valid means a received value is ***equal*** to the value configured via the MI input interface(s).

Invalid means a received value is ***not equal*** to the value configured via the MI input interface(s).

The events defined for this Recommendation are summarized in Table 6-1. The events are generated by processes in the ETHx_FT_Sk function as defined in clause 9.2.1.2. These processes define the exact conditions for these events; Table 6-1 only provides a quick overview.

Table 6-1 – Overview of events

Event	Meaning
unexpMEL	Reception of a CCM frame with an invalid MEL.
unexpMEG	Reception of a CCM frame with an invalid MEG value.
unexpMEP	Reception of a CCM frame with an invalid MEP, but with a valid MEG.
unexpPeriod	Reception of a CCM frame with an invalid Periodicity, but valid MEG and MEP values.
unexpPriority	Reception of a CCM frame with an invalid Priority, but valid MEG and MEP values.
expCCM[i]	Reception of a CCM frame with valid MEL, MEG and MEP values.
RDI[i]=x	Reception of a CCM frame for a MEP indexed by 'i' with the RDI flag set to x; where x = 0 (remote defect clear) and x = 1 (remote defect set).
LCK	Reception of a LCK frame.
AIS	Reception of an AIS frame.
BS	Bad second, a second in which the lost frame ratio exceeds the bad second threshold (BS_THR).
expAPS	Reception of a valid APS frame.
APSw	Reception of an APS frame from the working transport entity.
APSb	Reception of an APS frame with incompatible "B" bit value.
APSr	Reception of an APS frame with incompatible "requested signal" value.

The occurrence or absence of these events may detect or clear a defect. An overview of the conditions is given in Table 6-2. The notation "#event=x (K*period)" is used to indicate the occurrence of x events within the period as specified between the brackets; $3.25 \leq K \leq 3.5$.

Table 6-2 gives a quick overview of the detection and clearance conditions for the various defects; in the following clauses 6.1.2, 6.1.3, 6.1.4 and 6.1.5 the precise conditions are specified using SDL diagrams.

Table 6-2 – Overview of defect detection and clearance

Defect	Defect detection	Defect clearance
dLOC[]	#expCCM[]==0 (K*CCM_Period)	expCCM[]
dUNL	unexpMEL	#unexpMEL==0 (K*CCM_Period)
dUNPr	unexpPriority	#unexpPriority==0 (K*CCM_Period)
dMMG	unexpMEG	#unexpMEG==0 (K*CCM_Period)
dUNM	unexpMEP	#unexpMEP==0 (K*CCM_Period)
dUNP	unexpPeriod	#unexpPeriod==0 (K*CCM_Period)
dRDI[]	RDI[]==1	RDI[]==0
dAIS	AIS	#AIS==0 (K*AIS_Period)
dLCK	LCK	#LCK==0 (K*LCK Period)
dDEG	#BS==DEGM (DEGM*1second)	#BS==0 (M*1second)
dFOP-CM	APSw	#APSw == 0 (K*normal APS Period)
dFOP-PM	APSb	expAPS
dFOP-NR	APSr continues more than 50 ms	expAPS

Note that for the case of CCM_Period, AIS_Period and LCK_Period the values for the CCM, AIS and LCK periods are based on the periodicity as indicated in the CCM, AIS or LCK frame that triggered the timer to be started.

For dUNL, dUNV, dUNPr, dMMG, dUNM, dUNP there may be multiple frames received detecting the same defect but carrying a different periodicity. In that case, the longest received period will be used, see the detailed descriptions below.

6.1.2 Continuity supervision

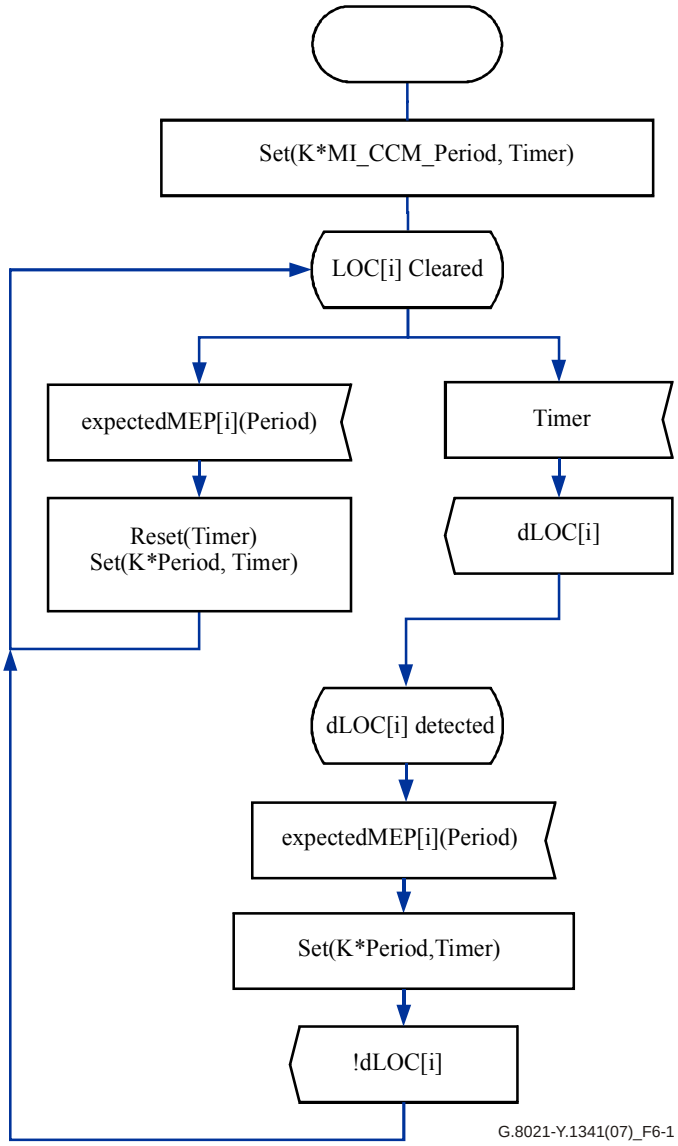

Figure 6-1 – dLOC[i] detection and clearance process

6.1.2.1 Loss of continuity defect (dLOC[i])

The loss of continuity verification defect is calculated at the ETH layer. It monitors the presence of continuity in ETH trails.

Its detection and clearance are defined in Figure 6-1. The 'period' in Figure 6-1 is the period as carried in the CCM frame triggering the expectedMEP[i] event. Furthermore, in Figure 6-1, K>=3.

6.1.3 Connectivity supervision

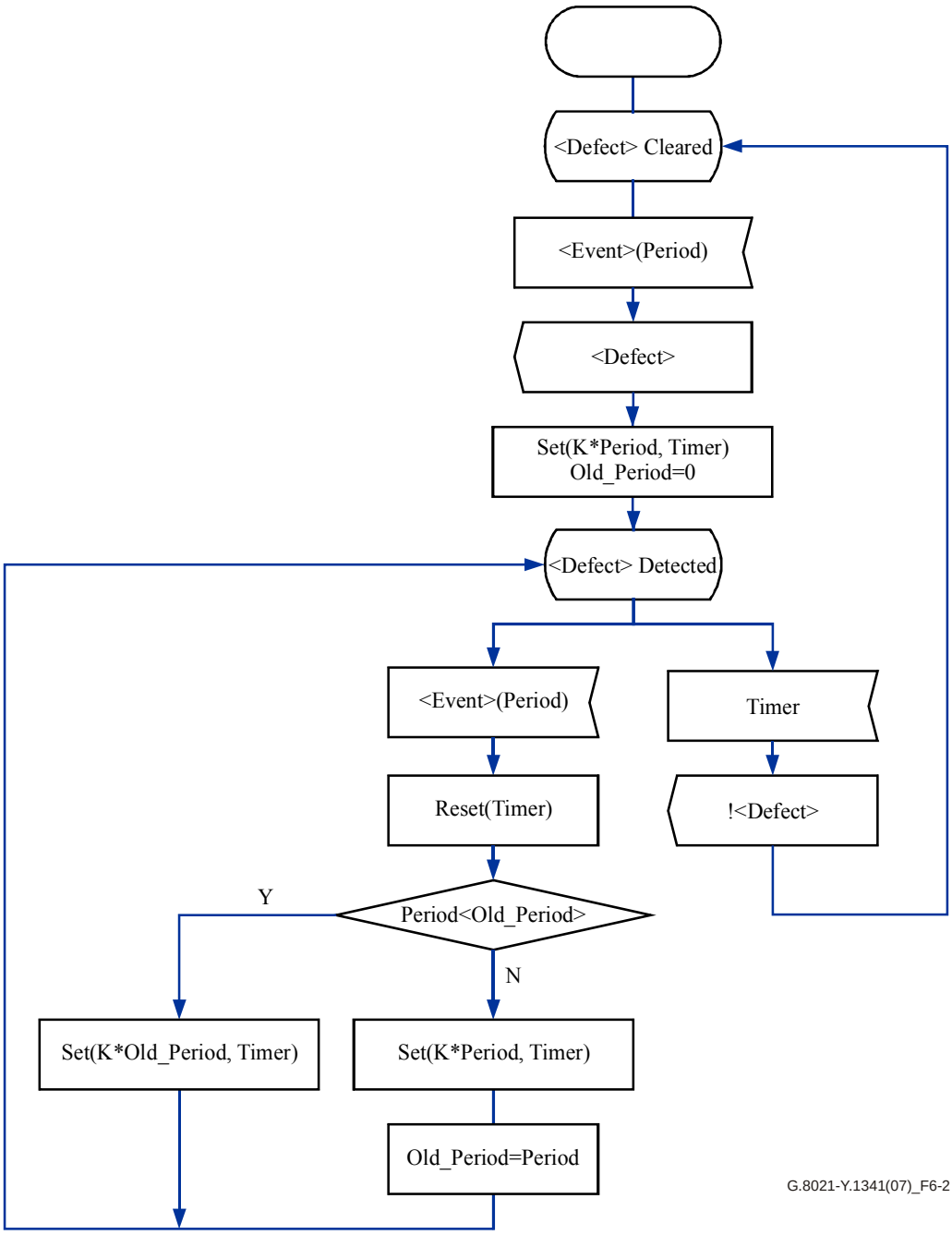

Figure 6-2 – Defect detection and clearance process for dUNL, dUNP, dMMG, dUNM, dUNPr, dAIS, dLCK

Figure 6-2 shows a generic state diagram that is used to detect and clear the dUNL, dUNP, dMMG, dUNM, dUNPr, dAIS, dLCK defects. In this diagram, <Defect> needs to be replaced with the specific defect and <Event> with the specific event related to this defect. Furthermore, in Figure 6-2, K>=3.

Figure 6-2 shows that the timer is set based on the last received period value, unless an earlier CCM frame triggering <Event> (and therefore the detection of <Defect>) carried a longer period. As a consequence, clearing certain defects may take more time than necessary.

6.1.3.1 Unexpected MEL defect (dUNL)

The unexpected MEL defect is calculated at the ETH layer. It monitors the connectivity in a maintenance entity group.

Its detection and clearance are defined Figure 6-2. The <Defect> in Figure 6-2 is dUNL. The <Event> in Figure 6-2 is the unexpMEL event (generated by the CCM reception process in clause 8.1.7.3) and the period is the period carried in the CCM frame that triggered this event.

Figure 6-2 shows that the timer is set based on the last received period value; unless an earlier CCM frame triggering an unexpMEL event carried a longer period.

6.1.3.2 Mismerge defect (dMMG)

The mismerge defect is calculated at the ETH layer. It monitors the connectivity in a maintenance entity group.

Its detection and clearance are defined in Figure 6-2. The <Defect> in Figure 6-2 is dMMG. The <Event> in Figure 6-2 is the unexpMEG event (as generated by the CCM reception process in clause 8.1.7.3) and the period is the period carried in the CCM frame that triggered the event, unless an earlier CCM frame triggering an unexpMEG event carried a greater period.

6.1.3.3 Unexpected MEP defect (dUNM)

The unexpected MEP defect is calculated at the ETH layer. It monitors the connectivity in a maintenance entity group.

Its detection and clearance are defined in Figure 6-2. The <Defect> in Figure 6-2 is dUNM. The <Event> in Figure 6-2 is the unexpMEP event (as generated by the CCM reception process in clause 8.1.7.3) and the period is the period carried in the CCM frame that triggered the event, unless an earlier CCM frame triggering an unexpMEP event carried a greater period.

6.1.3.4 Degraded signal defect (dDEG)

This defect is only defined for ptp ETH connections.

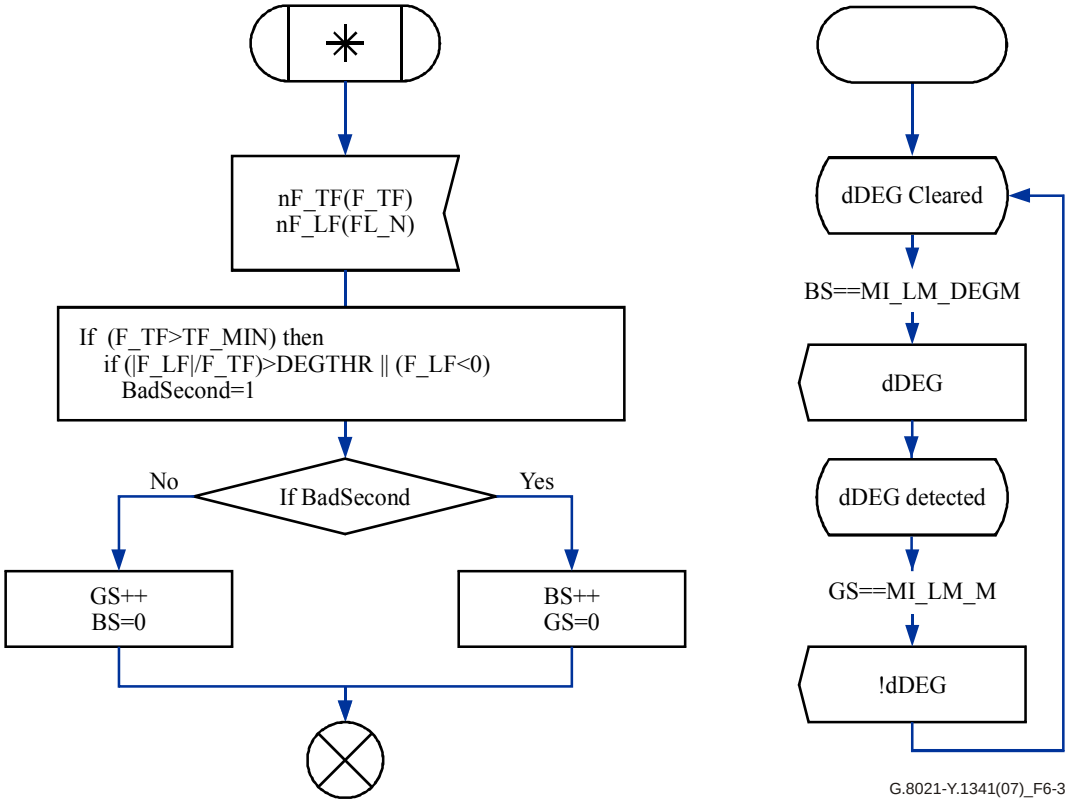

Figure 6-3 – dDEG detection and clearance process

The degraded signal defect is calculated at the ETH layer. It monitors the connectivity of an ETH trail.

Its detection and clearance are defined in Figure 6-3.

Every second, the state machine receives the one-second counters for far-end received and transmitted frames and determines whether the second was a bad second. The defect is detected if there are MI_LM_DEGM consecutive bad seconds and cleared if there are MI_LM_M consecutive good seconds.

In order to declare a bad second, the number of transmitted frames must exceed a threshold (TF_MIN). If this is true then a bad second is declared if either the frame loss is negative (i.e., there are more frames received than transmitted) or the frame loss ratio (lost frames/transmitted frames) is greater than MI_LM_DEGTHR.

6.1.4 Protocol supervision

6.1.4.1 Unexpected periodicity defect (dUNP)

The unexpected periodicity defect is calculated at the ETH layer. It detects the configuration of different periodicities at different MEPs belonging to the same MEG.

Its detection and clearance conditions are defined in Figure 6-2. The <Defect> in Figure 6-2 is dUNP. The <Event> in Figure 6-2 is the unexpPeriod event (generated by the CCM reception process in clause 8.1.7.3) and the period is the period carried in the CCM frame that triggered the event, unless an earlier CCM frame triggering an unexpPeriod event carried a greater period.

6.1.4.2 Unexpected priority defect (dUNPr)

The unexpected priority defect is calculated at the ETH layer. It detects the configuration of different priorities for CCM at different MEPs belonging to the same MEG.

Its detection and clearance are defined in Figure 6-2. The <Defect> in Figure 6-2 is dUNPr. The <Event> in Figure 6-2 is the unexpPriority event (generated by the CCM reception process in clause 8.1.7.3) and the period is the period carried in the CCM frame that triggered the event, unless an earlier CCM frame triggering an unexpPriority event carried a greater period.

6.1.4.3 Protection protocol supervision

6.1.4.3.1 Linear protection failure of protocol provisioning mismatch (dFOP-PM)

The failure of protocol provisioning mismatch defect is calculated at the ETH layer. It monitors provisioning mismatch by comparing B bits of the transmitted and the received APS protocol.

Its detection and clearance are defined in Table 6-2. dFOP-PM is detected on receipt of an APSb event and cleared on receipt of an expAPS event. These events are generated by the subnetwork connection protection process (clause 9.1.3).

6.1.4.3.2 Linear protection failure of protocol no response (dFOP-NR)

The failure of protocol no response defect is calculated at the ETH layer. It monitors incompletion of protection switching by comparing the transmitted "requested signal" values and the received "bridged signal" in the APS protocol.

Its detection and clearance are defined in Table 6-2. dFOP-NR is detected when APSr event continues more than 50 ms and it is cleared on receipt of the expAPS event. These events are generated by the subnetwork connection protection process (clause 9.1.3).

6.1.4.3.3 Linear protection failure of protocol configuration mismatch (dFOP-CM)

The failure of protocol configuration mismatch defect is calculated at the ETH layer. It monitors working and protection configuration mismatch by detecting the reception of APS protocol from the working transport entity.

Its detection and clearance are defined in Table 6-2. dFOP-CM is detected on receipt of an APSw events and cleared on receipt of no APSw event during K times the normal APS transmission period defined in [ITU-T G.8031], where K>=3. These events are generated by the subnetwork connection protection process (clause 9.1.3).

6.1.5 Maintenance signal supervision

6.1.5.1 Remote defect indicator defect (dRDI[])

The remote defect indicator defect is calculated at the ETH layer. It monitors the presence of an RDI maintenance signal.

dRDI is detected on receipt of the RDI[]=1 event and cleared on receipt of the RDI[]=0 event. These events are generated by the CCM reception process.

6.1.5.2 Alarm indication signal defect (dAIS)

The alarm indication signal defect is calculated at the ETH layer. It monitors the presence of an AIS maintenance signal.

Its detection and clearance conditions are defined in Figure 6-2. The <Defect> in Figure 6-2 is dAIS. The <Event> in Figure 6-2 is the AIS event (as generated by the AIS reception process in clause 9.2.1.2) and the period is the period carried in the AIS frame that triggered the event, unless an earlier AIS frame carried a greater period.

6.1.5.3 Locked defect (dLCK)

The locked defect is calculated at the ETH layer. It monitors the presence of a locked maintenance signal.

Its detection and clearance conditions are defined in Figure 6-2. The <Defect> in Figure 6-2 is dLCK. The <Event> in Figure 6-2 is the LCK event (as generated by the LCK reception process in clause 9.2.1.2) and the period is the period carried in the LCK frame that triggered the event, unless an earlier LCK frame carried a greater period.

6.2 Consequent actions

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

6.3 Defect correlations

For the defect correlations, see the specific atomic functions.

6.4 Performance filters

6.4.1 One-second performance monitoring filters associated with counts

For further study.

6.4.2 Performance monitoring filters associated with gauges

For further study.

7 Information flow across reference points

See clause 7 of [ITU-T G.806] for the generic description of information flow. For Ethernet-specific information flow, see the description of the functions in clause 9.

8 Generic processes for Ethernet equipment

This clause defines processes specific to equipment supporting the Ethernet transport network.

8.1 OAM-related processes

8.1.1 OAM MEL filter

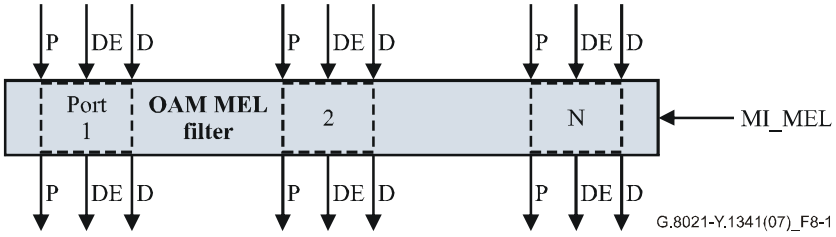

Figure 8-1 – OAM MEL filter process

The OAM MEL filter process filters incoming ETH OAM traffic units based on the MEL they carry. All traffic units with an MEL equal to or lower than the MEL provided by the MI_MEL signal are discarded.

The criteria for filtering depend on the values of the fields in the M_SDU field of the ETH_CI_D signal.

The ETH OAM traffic unit and complementing P and DE signals will be filtered, if:

- Length/type field = OAM Ethertype (89-02 as defined in [IEEE 802.1ag]); and
- MEL field <= MI_MEL

Figure 8-1 shows the OAM MEL filter process for multiple ports. Figure 8-2 shows the filtering process that is running per port.

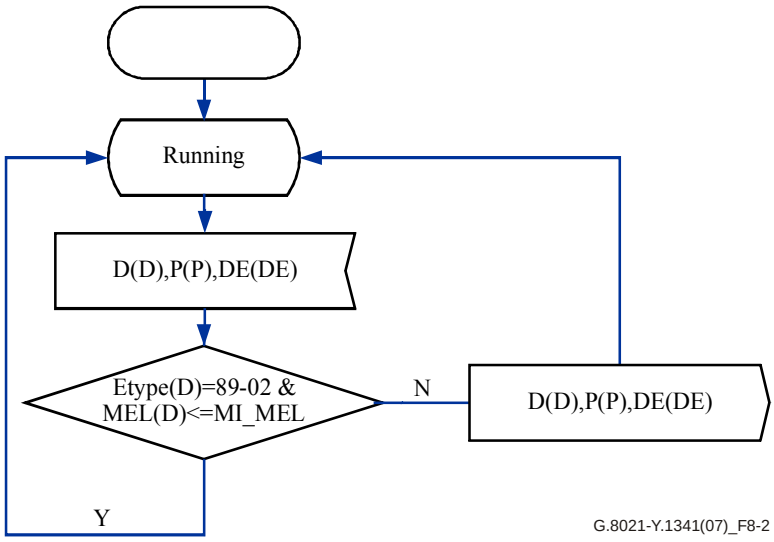

Figure 8-2 – OAM MEL filter behaviour

8.1.2 LCK generate process

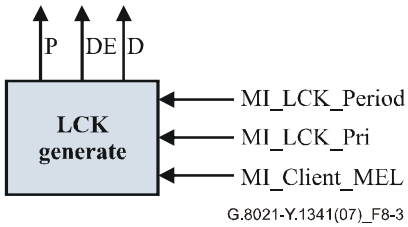

Figure 8-3 – LCK generate process

The LCK generate process generates ETH_CI traffic units where the ETH_CI_D signal contains the LCK signal. Figure 8-4 defines the behaviour of the LCK generate process.

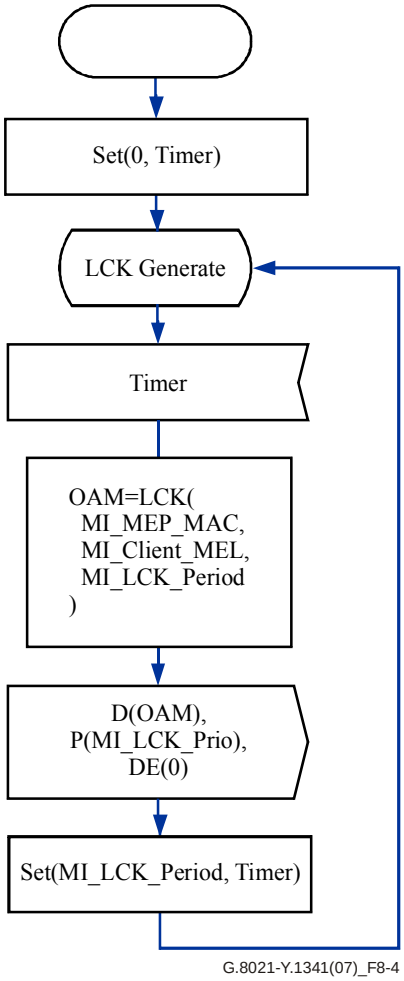

Figure 8-4 – LCK generate behaviour

The LCK generate process continuously generates LCK traffic units; every time the timer expires, a LCK traffic unit will be generated. The period between two consecutive traffic units is determined by the MI_LCK_Period input signal. Allowed values are defined in Table 8-1.

Table 8-1 – LCK period values

3-bits	Period value	Comments
000-011	Invalid value	Invalid value for AIS/LCK PDUs
100	1 s	1 frame per second
101	Invalid value	Invalid value for AIS/LCK PDUs
110	1 min	1 frame per minute
111	Invalid value	Invalid value for AIS/LCK PDUs

The ETH_CI_D signal contains a source and destination address field and an M_SDU field. The format of the M_SDU field is defined in clauses 9.1 and 9.8 of [ITU-T Y.1731]. The MEL in the M_SDU field is determined by the MI_Client_MEL input parameter.

The values of the source and destination address fields in the M_SDU field are determined by the local MAC address (SA) and the multicast class 1 DA as described in [ITU-T Y.1731] (DA). The value of the multicast class 1 DA is 01-80-C2-00-00-3y, where y is equal to MI_Client_MEL as defined in [IEEE 802.1ag]. The value of MI_MEP_MAC should be a valid unicast MAC address.

The periodicity (as defined by MI_LCK_Period) is encoded in the three least significant bits of the flags field in the LCK PDU using the values from Table 8-1.

The LCK (SA, Client_MEL and period) function generates an LCK traffic unit with the SA, MEL and period fields defined by the values of the parameters. Figure 8-5 below shows the M_SDU signal format, resulting from the function call from Figure 8-4:

LCK(
    MI_MEP_MAC,
    MI_Client_MEL,
    MI_LCK_Period
)

SA=MI_MEP_MAC

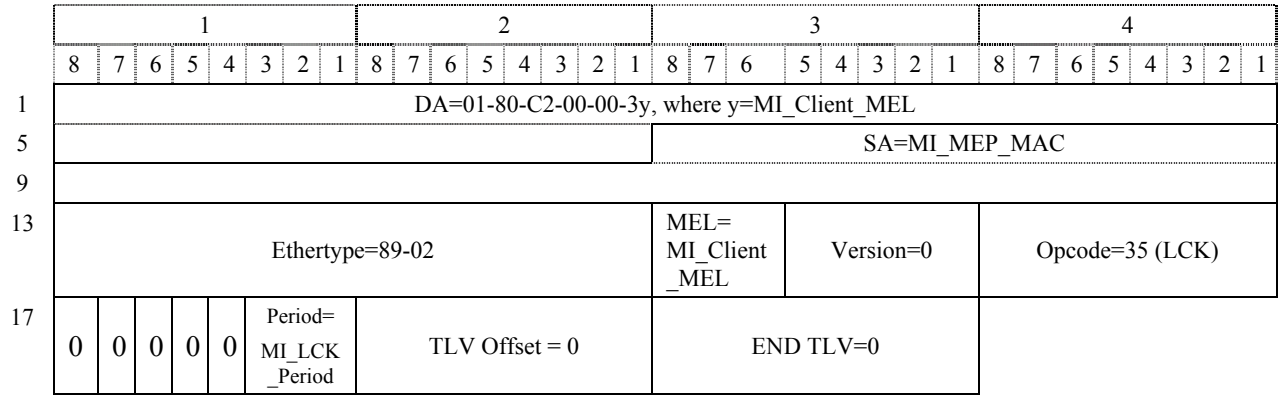

Figure 8-5 – LCK traffic unit format

The value of the ETH_CI_P signal associated with the generated LCK traffic unit is defined by the MI_LCK_Pri input parameter; valid values are in the range 0-7.

The value of the ETH_CI_DE signal associated with the generated LCK traffic units is always set to drop ineligible.

8.1.3 Selector process

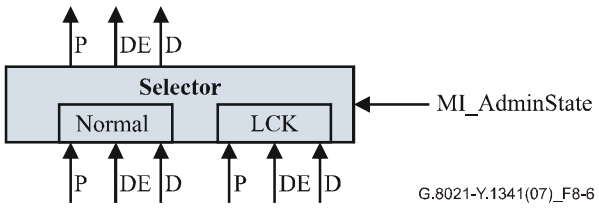

Figure 8-6 – Selector process

The selector process may replace the normal ETH_CI signal by the ETH_CI LCK signal (as generated by the LCK generate process). The normal signal is replaced if MI_Admin_State is LOCKED. The behaviour is defined in Figure 8-7.

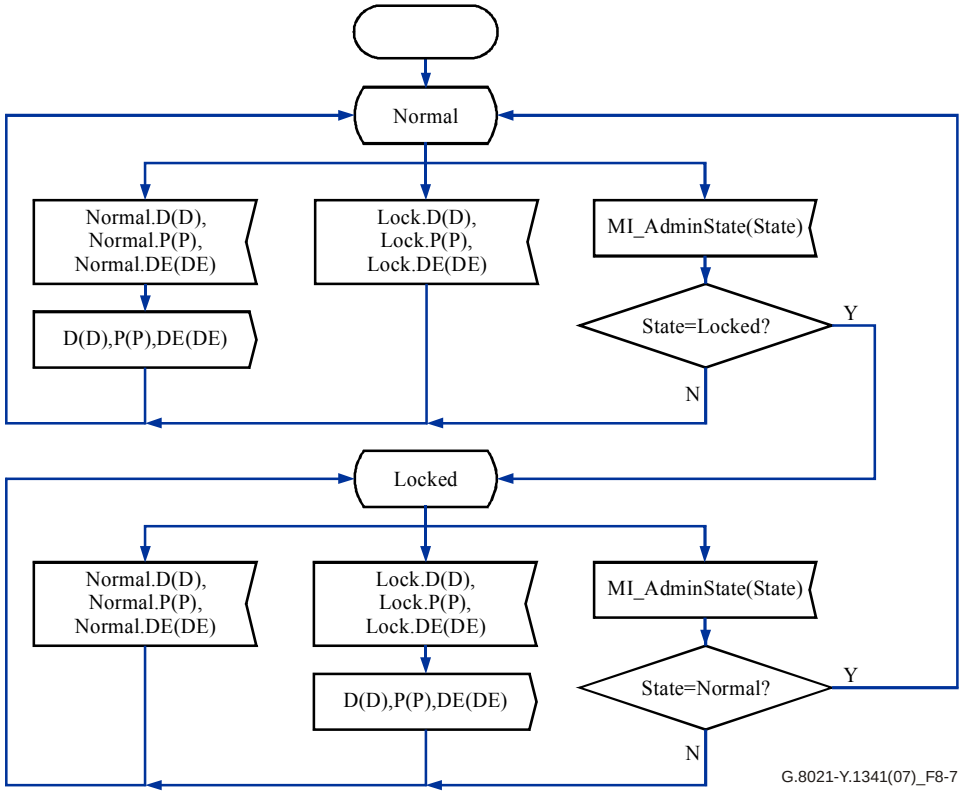

Figure 8-7 – Selector behaviour

8.1.4 AIS insert process

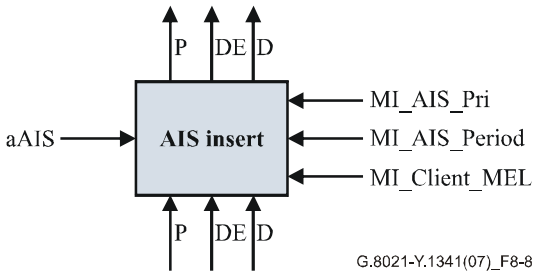

Figure 8-8 – AIS insert process

Figure 8-8 shows the AIS insert process symbol and Figure 8-9 defines the behaviour. If the aAIS signal is true, the AIS insert process continuously generates ETH_CI traffic units where the ETH_CI_D signal contains the AIS signal until the aAIS signal is false. The generated AIS traffic units are inserted in the incoming stream, i.e., the output stream contains the incoming traffic units and the generated AIS traffic units.

The period between consecutive AIS traffic units is determined by the MI_AIS_Period parameter. Allowed values are once per second and once per minute; the encoding of these values is defined in Table 8-2. Note that these encoding are the same as for the LCK generation process.

Table 8-2 – AIS period values

3 -bits	Period value	Comments
000-011	Invalid value	Invalid value for AIS PDUs
100	1 s	1 frame per second
101	Invalid value	Invalid value for AIS PDUs
110	1 min	1 frame per minute
111	Invalid value	Invalid value for AIS PDUs

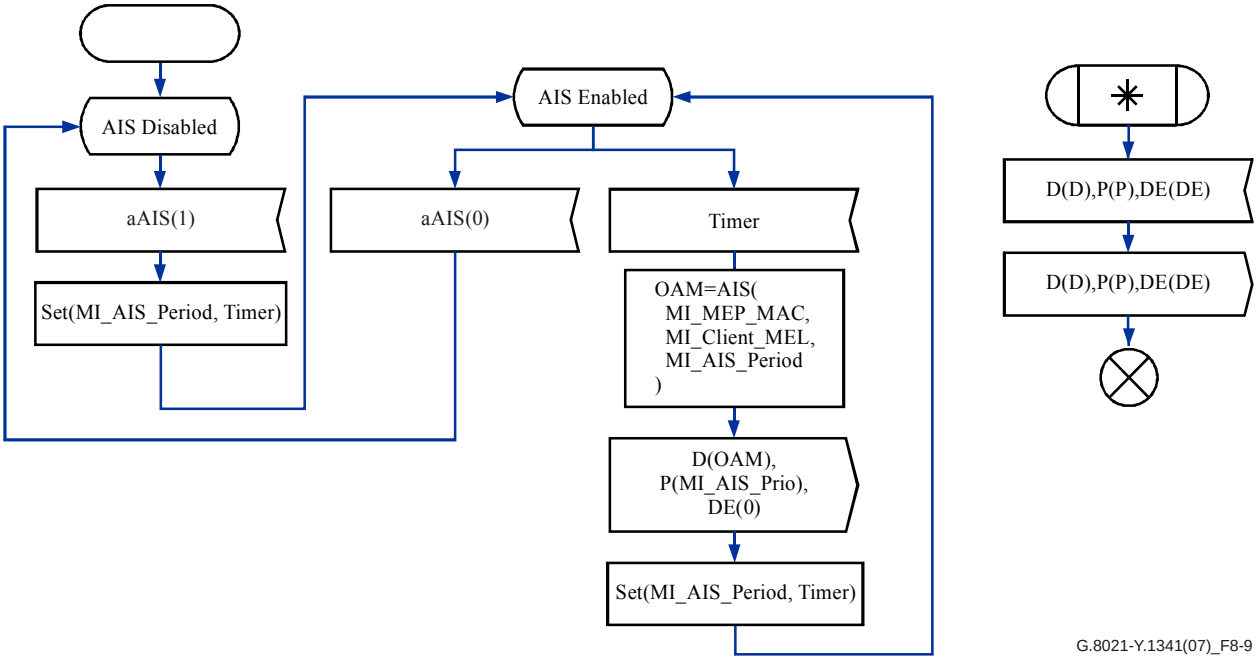

Figure 8-9 – AIS generate behaviour

The ETH_CI_D signal contains a source and destination address field and an M_SDU field. The format of the M_SDU field for AIS traffic units is defined in clauses 9.1 and 9.7 of [ITU-T Y.1731]. The MEL in the M_SDU field is determined by the MI_Client_MEL input parameter.

The values of the source and destination address fields in the M_SDU field are determined by the local MAC address (SA) and the multicast class 1 DA as described in [ITU-T Y.1731] (DA). The value of the multicast class 1 DA is 01-80-C2-00-00-3y, where y is equal to MI_Client_MEL as defined in [IEEE 802.1ag]. The value of MI_MEP_MAC should be a valid unicast MAC address.

The periodicity (as defined by MI_AIS_Period) is encoded in the three least significant bits of the flags field in the AIS PDU using the values from Table 8-2.

The AIS(SA, Client_MEL, Period) function generates an AIS traffic unit with the SA, MEL and period fields defined by the values of the parameters. Figure 8-10 below shows the M_SDU signal format resulting from the function call from Figure 8-9.

AIS(
    MI_MEP_MAC,
    MI_Client_MEL,
    MI_AIS_Period
)

	1								2								3								4							
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	DA=01-80-C2-00-00-3y, where y=MI_Client_MEL																															
5	SA=MI_MEP_MAC																															
9																																
13	Ethertype=89-02																MEL= MI_Client _MEL				Version=0				Opcode=33 (AIS)							
17	0	0	0	0	0	Period= MI_AIS _Period			TLV Offset = 0								END TLV=0															

Figure 8-10 – AIS traffic unit format

The value of the ETH_CI_P signal associated with the generated AIS traffic units is defined by the MI_AIS_Pri input parameter. Allowed values are 0-7.

The value of the ETH_CI_DE signal associated with the generated AIS traffic units is always set to drop ineligible.

8.1.5 APS insert process

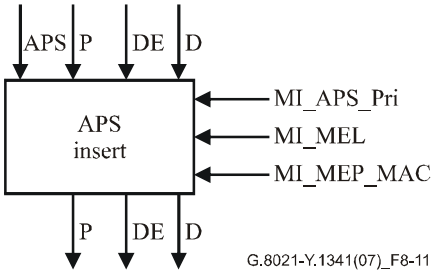

Figure 8-11 – APS insert process

The APS insert process encodes the ETH_CI_APS (APS input signal in Figure 8-11) signal into the ETH_CI_D signal of an ETH_CI traffic unit; the resulting APS traffic unit is inserted into the stream of incoming traffic units, i.e., the outgoing stream consists of the incoming traffic units and the inserted APS traffic units. The ETH_CI_APS signal contains the APS-specific information as defined in clause 11.1 of [ITU-T G.8031] (APS Format). The behaviour is defined in Figure 8-12.

The ETH_CI_D signal contains a source and destination address field and an M_SDU field. The format of the M_SDU field for APS traffic units is defined in clauses 9.1 and 9.10 of [ITU-T Y.1731]. The MEL in the M_SDU field is determined by the MI_MEL input parameter.

The values of the source and destination address fields in the M_SDU field are determined by the local MAC address (SA) and the multicast class 1 DA or unicast address as described in [ITU-T Y.1731] (DA). The value of the multicast class 1 DA is 01-80-C2-00-00-3y, where y is equal to MI_MEL as defined in [IEEE 802.1ag]. The value of MI_MEP_MAC should be a valid unicast MAC address.

The value of the ETH_CI_P signal associated with the generated APS traffic units is determined by the MI_APS_Pri input parameter.

The value of the ETH_CI_DE signal associated with the generated APS traffic units is set to drop ineligible.

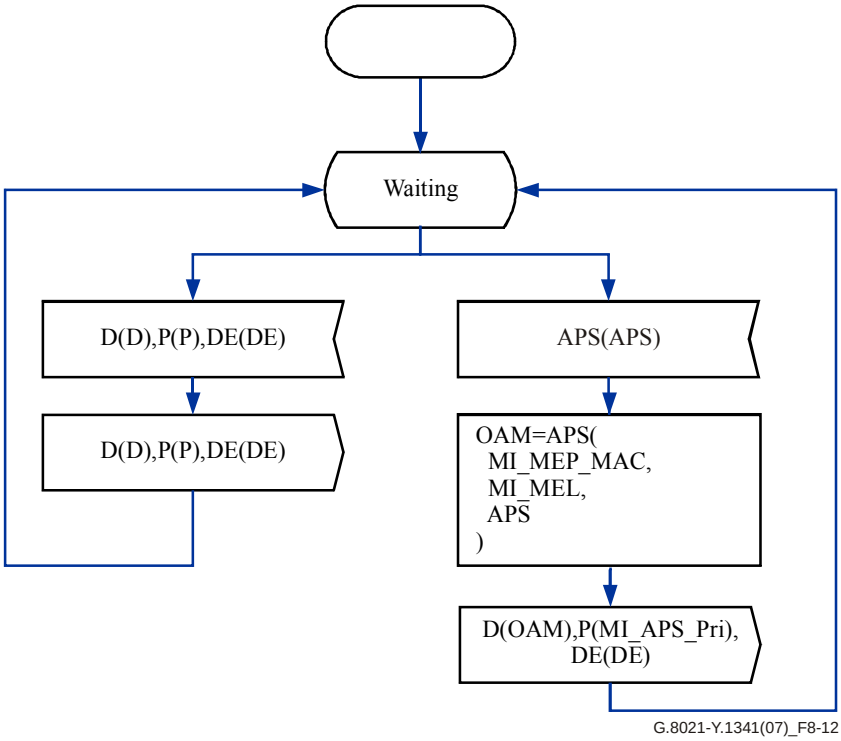

Figure 8-12 – APS insert behaviour

The APS(MEL, APS) function generates an APS traffic unit with the MEL and APS fields defined by the values of the parameters. Figure 8-13 below shows the M_SDU signal format, resulting from the function call from Figure 8-12.

APS(
    MI_MEP_MAC,
    MI_MEL,
    APS
)

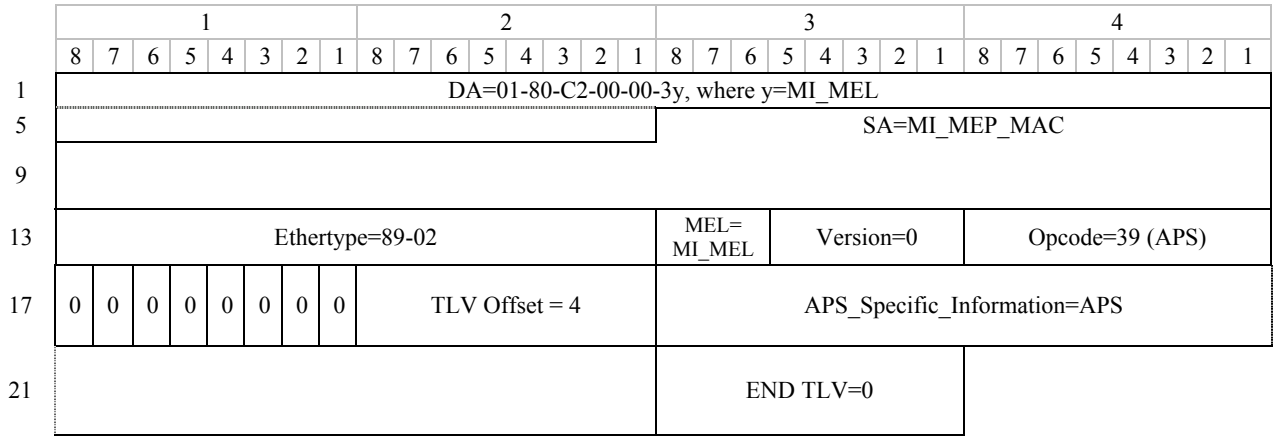

Figure 8-13 – APS traffic unit format

8.1.6 APS extract process

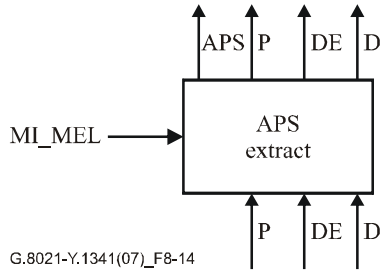

Figure 8-14 – APS extract process

The APS extract process extracts ETH_CI_APS signals from the incoming stream of ETH_CI traffic units. ETH_CI_APS signals are only extracted if they belong to the MEL as defined by the MI_MEL input parameter.

If an incoming traffic unit is an APS traffic unit belonging to the MEL defined by MI_MEL, the ETH_CI_APS signal will be extracted from this traffic unit and the traffic unit will be filtered. The ETH_CI_APS is the APS-specific information contained in the received traffic unit. All other traffic units will be transparently forwarded. The encoding of the ETH_CI_D signal for APS frames is defined in clause 9.10 of [ITU-T Y.1731].

The criteria for filtering are based on the values of the fields within the M_SDU field of the ETH_CI_D signal:

- length/type field equals the OAM Ethertype (89-02); and
- MEL field equals MI_MEL; and
- OAM type equals APS (39), as defined in clause 9.1 of [ITU-T Y.1731].

This is defined in Figure 8-15. The function APS(D) extracts the APS specific information from the received traffic unit.

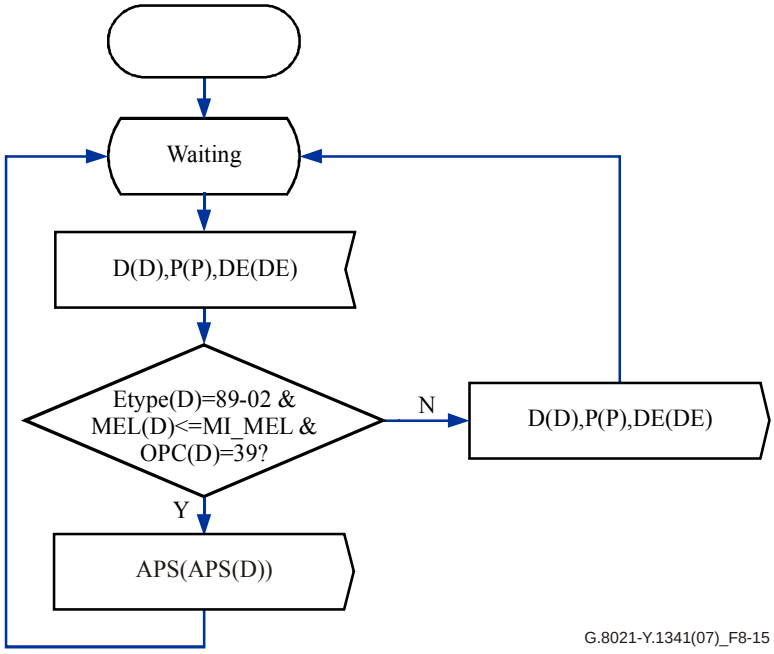

Figure 8-15 – APS extract behaviour

8.1.7 Continuity check (CC) processes

8.1.7.1 ETH CC overview

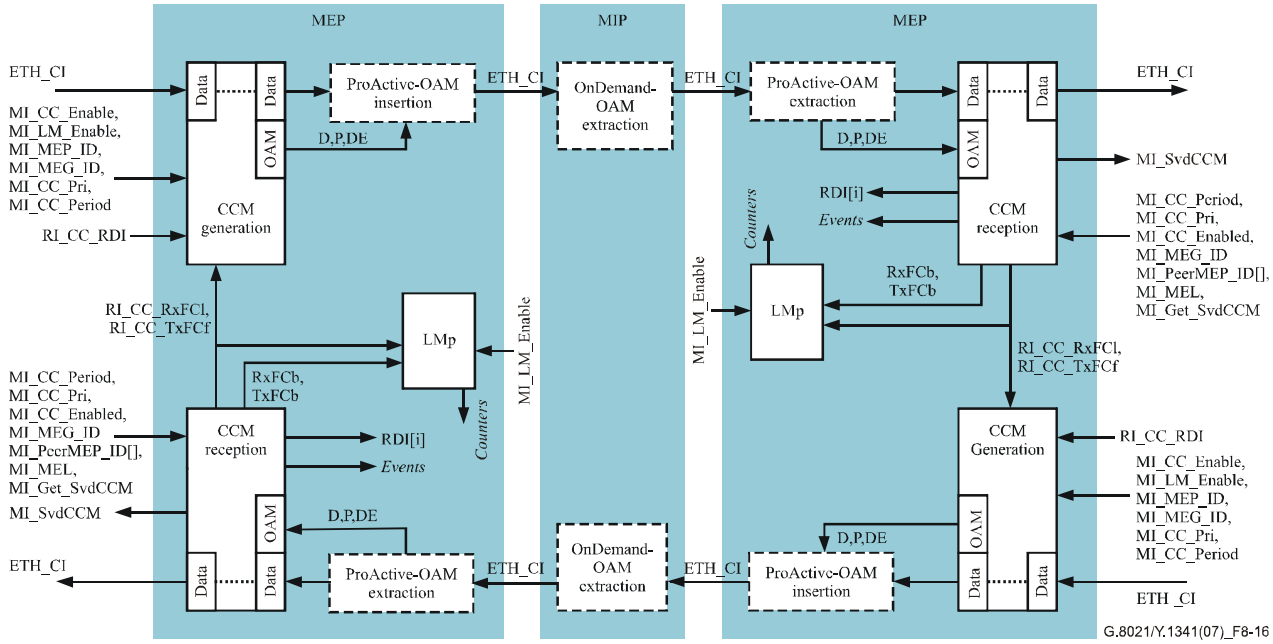

Figure 8-16 – CC overview

Figure 8-16 gives an overview of the processes involved in the CC. The CCM generation process generates the CCM frames if MI_CC_Enable is true. The MI_MEG_ID and MI_MEP_ID are the MEG and MEP IDs of the MEP itself and these IDs are carried in the CCM frame. The CCM frames are generated with a periodicity determined by MI_CC_Period and with a priority determined by MI_CC_Pri. If MI_LM_Enable is set, the CCM frames will also carry loss measurement information. The generated CCM traffic units are inserted in the flow of ETH_CI by the OAM MEP source insertion process.

The CCM frames pass transparently through MIPs.

The OAM MEP sink extraction process extracts the CCM unit from the flow of ETH_CI and the CC reception process processes the received CCM traffic unit. It compares the received MEG ID with the provisioned MI_MEG_ID, and the received MEP_ID with the provisioned MI_PeerMEP_ID[], that contains the list of all expected peer MEPs in the MEG. Based on the processing of this frame, one or more events may be generated that serve as input for the defect detection process (not shown in Figure 8-16).

RDI information is carried in the CCM frame based upon the RI_CC_RDI input. It is extracted in the CCM reception process.

8.1.7.2 CCM generation process

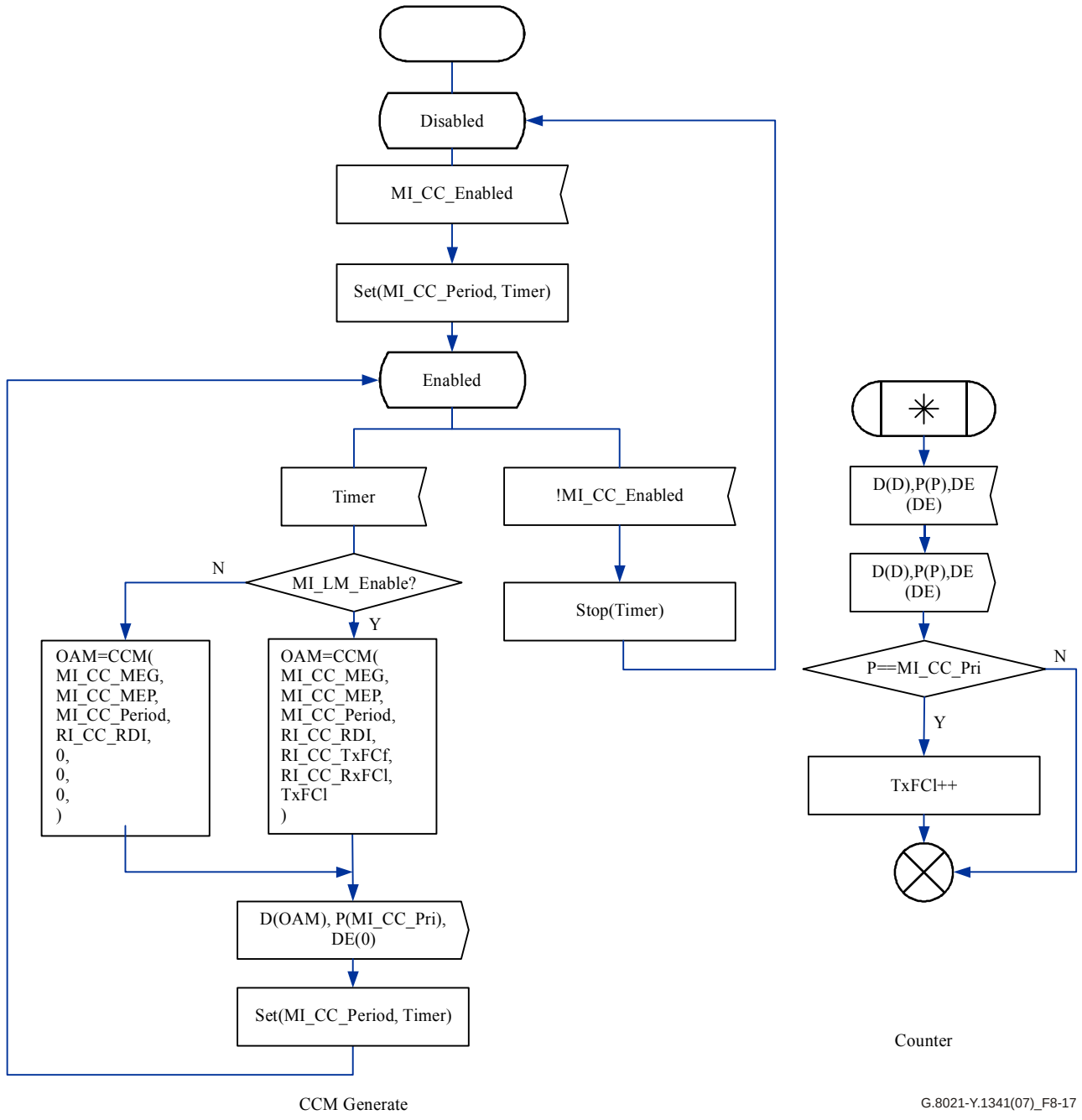

Figure 8-17 – CCM generation behaviour

Figure 8-17 shows the state diagram for the CCM generation process. The CCM generation process can be enabled and disabled using the MI_CCM_Enable signal.

In the enabled state there are two main parts:

– counter part that is triggered by the receipt of a data frame;

– CCM generate part that is triggered by the expiration of the timer.

Counter part

The CCM generation process forwards data frames and counts all frames with priority equal to MI_CCM_Pri that it forwards (TxFCl). The D, P and DE signals are forwarded unchanged as indicated by the dotted lines in Figure 8-16.

CCM generate part

The CCM generate part generates and transmits an OAM frame every MI_CC_Period. The allowed values for MI_CC_Period are defined in Table 8-3.

Table 8-3 – CCM period values

3-bits	Period value	Comments
000	Invalid value	Invalid value for CCM PDUs
001	3.33 ms	300 frames per second
010	10 ms	100 frames per second
011	100 ms	10 frames per second
100	1 s	1 frame per second
101	10 s	6 frames per minute
110	1 min	1 frame per minute
111	10 min	6 frame per hour

The ETH_CI_D signal contains a source and destination address field and an M_SDU field. The format of the M_SDU field is defined in clauses 9.1 and 9.8 of [ITU-T Y.1731].

The value of the destination address field (DA) is the multicast class 1 DA as described in [ITU-T Y.1731]. The value of the multicast class 1 DA is 01-80-C2-00-00-3y, where y is equal to MI_MEL as defined in [IEEE 802.1ag]. This y will be filled in later by the OAM MEP insertion process and will be undefined in this process.

The value of the source address will be filled in later by the OAM MEP insertion process and will be undefined in this process.

The M_SDU field contains a CCM PDU. Figure 8-18 below shows the M_SDU field where the CCM-specific values are shown. It shows the traffic unit resulting from the function call in Figure 8-17 (CCM generate part):

```
OAM=CCM(
  MI_CCM_MEG,
  MI_CCM_MEP,
  MI_CCM_Period,
  RI_CCM_RDI,
  RI_CCM_TxFCf,
  RI_CCM_RxFCl,
  TxFCl
)
```

If MI_LM_Enabled, or if !MI_LM_Enabled:

OAM=CCM(
  MI_CCM_MEG,
  MI_CCM_MEP,
  MI_CCM_Period,
  RI_CCM_RDI,
  0,
  0,
  0
)

The value of the ETH_CI_P signal associated with the generated CCM traffic unit is defined by the MI_CCM_Pri input parameter; valid values are in the range 0-7.

The value of the ETH_CI_DE signal associated with the generated CCM traffic units is always set to drop ineligible (0).

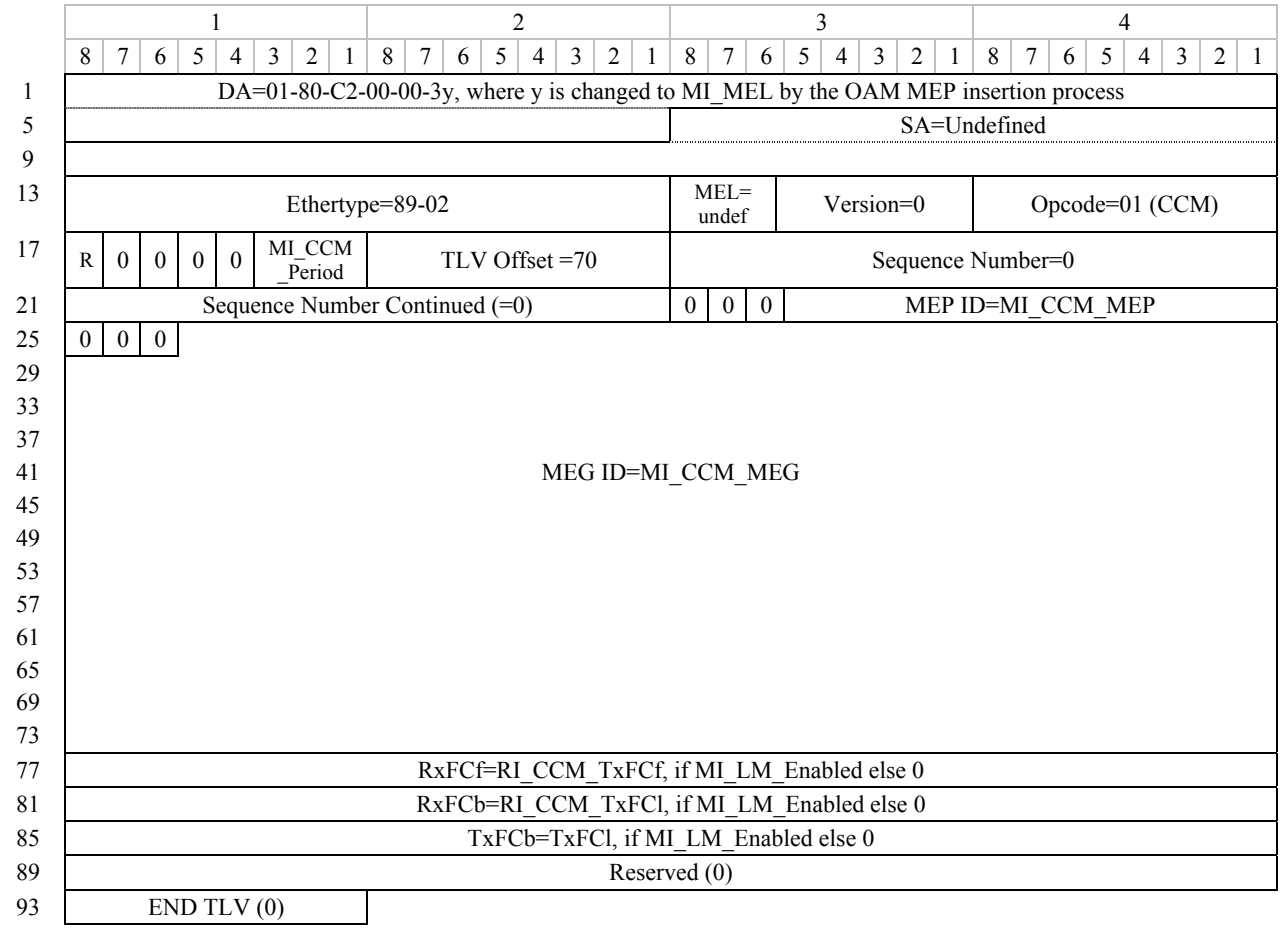

Figure 8-18 – CCM traffic unit

8.1.7.3 CCM reception process

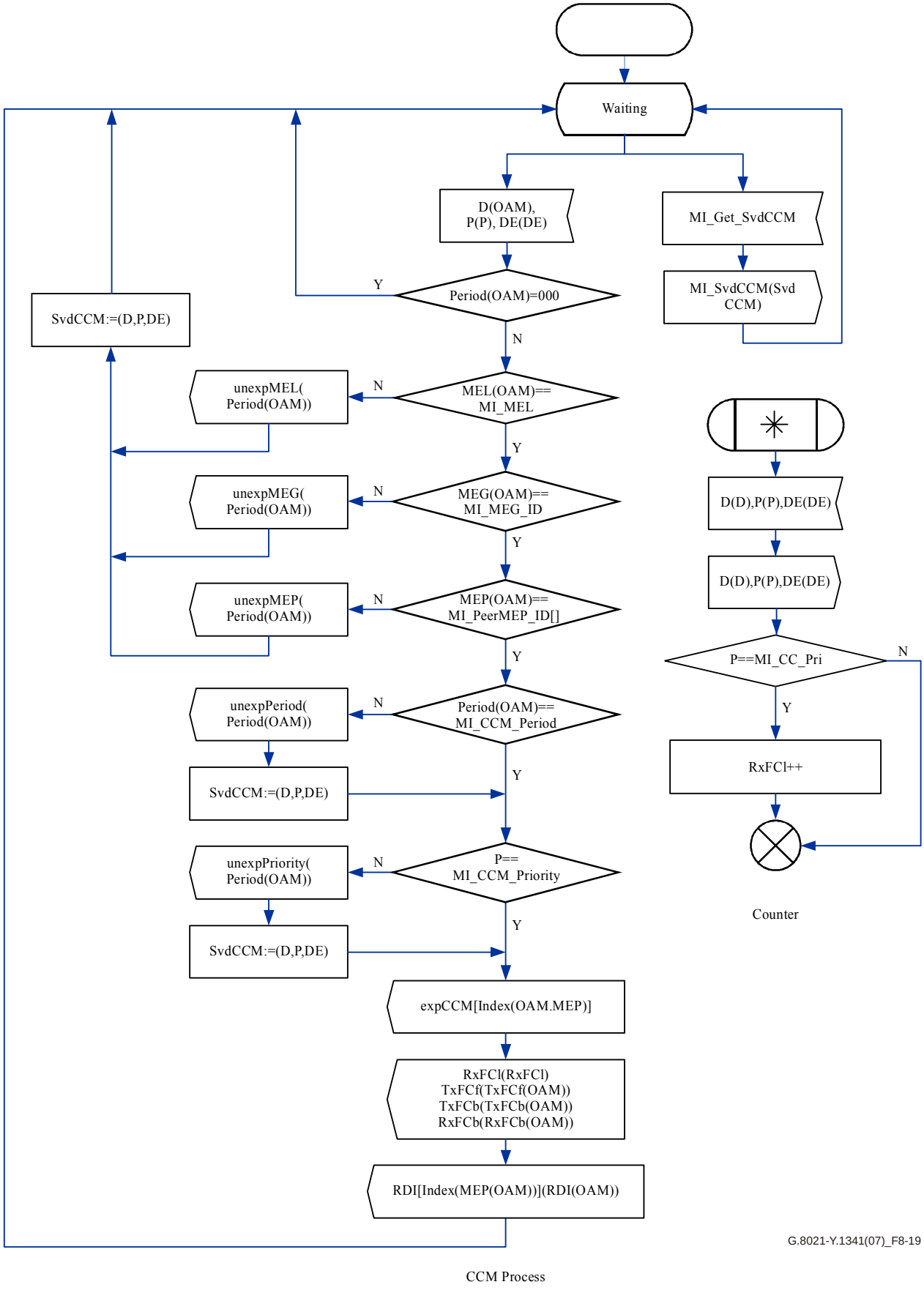

Figure 8-19 – CCM reception behaviour

The CCM reception process consists of two parts: counter and CCM process.

Counter part

The counter part of the CCM reception process forwards the data frames and counts all data frames that have priority equal to MI_CC_Pri.

CCM process part

The CCM process part of the CCM reception process processes CCM OAM frames. It checks the various fields of the frames and generates the corresponding events (as defined in clause 6). If the version, MEL, MEG and MEP are valid, the values of the frame counters are sent to the performance counter process.

Note that unexpPriority and unexpPeriod events do not prevent the CCM from being processed, since the MEL, MEG and MEP are as expected.

8.1.7.4 Proactive loss measurement (LMp) process

This process calculates the number of transmitted and lost frames per second.

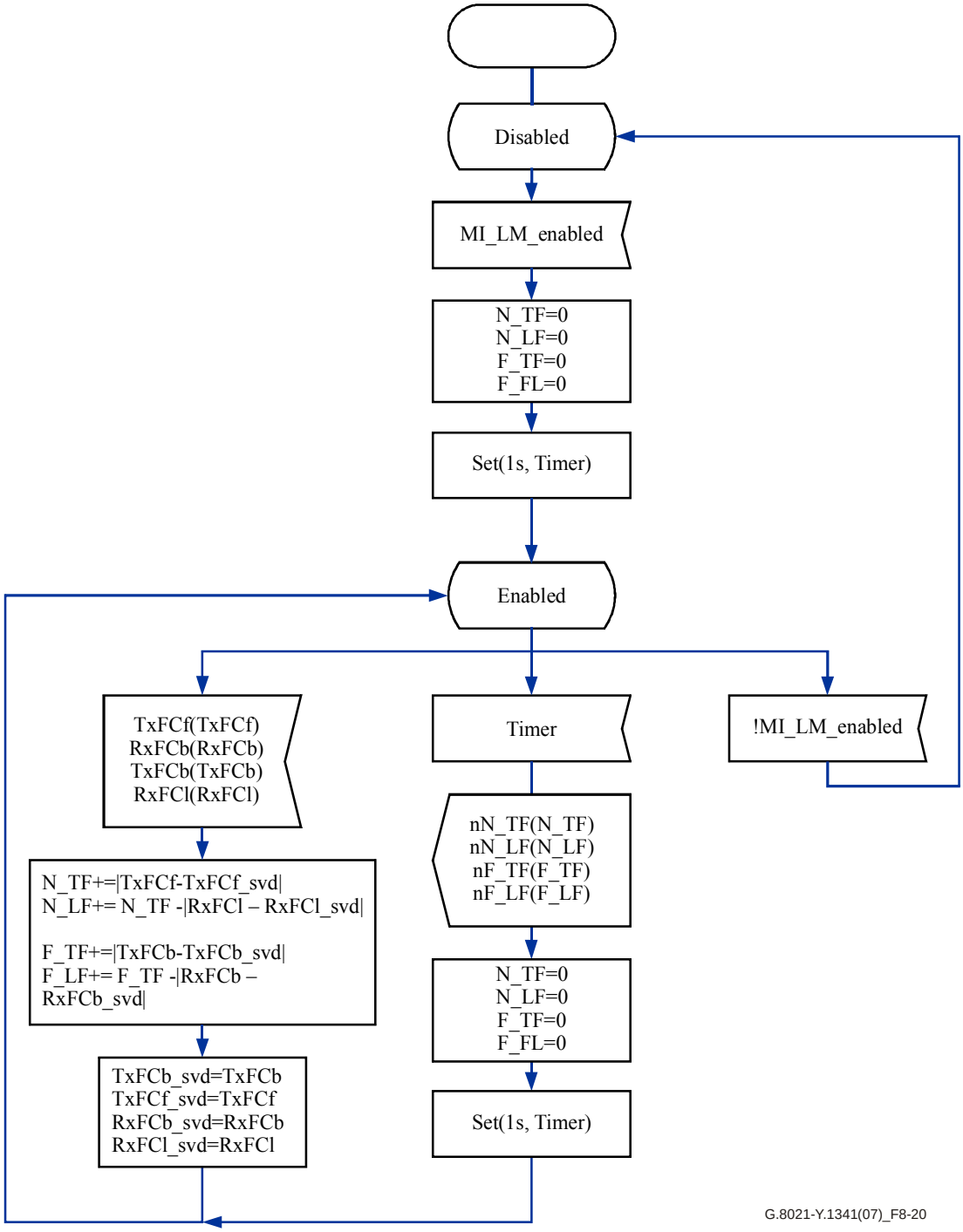

Figure 8-20 – LM process behaviour

It processes the TxFCf, RxFCb, TxFCb, RxFCl values and determines the number of transmitted frames and the number of lost frames. Every second, the number of transmitted and lost frames, in that second, are sent to the performance monitoring and defect generation processes.

8.1.8 Ethernet loopback (LB) processes

8.1.8.1 LB overview

Figure 8-21 shows the different processes inside MEPs and MIPs that are involved in the loopback protocol.

The MEP OnDemand-OAM source insertion process is defined in clause 9.4.1.1, the MEP OnDemand-OAM sink extraction process in clause 9.4.1.2, the MIP OnDemand-OAM sink extraction process in clause 9.4.2.2 and the MIP OnDemand-OAM source insertion process in clause 9.4.2.1. In summary, they insert and extract ETH_CI OAM signals into and from the stream of ETH_CI_D traffic units and the complementing P and D signals going through an MEP and MIP; the extraction is based on MEL and Opcode. Furthermore, the insertion process inserts the correct MEL and SA values into the OAM traffic units. The other processes are defined in this clause.

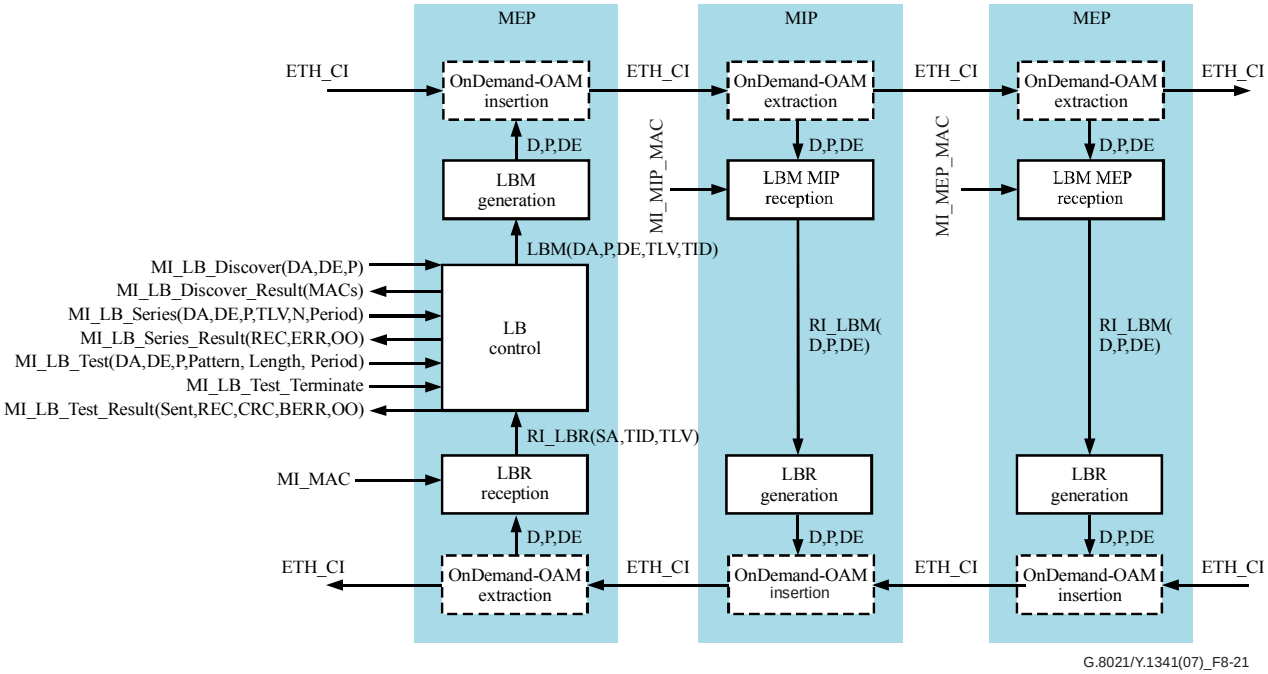

Figure 8-21 – Overview of processes involved with loopback

The LBM protocol is controlled by the LB control process. There are three possible MI signals that can trigger the LB protocol:

- MI_LB_Discover(DA,DE,P): To discover the MAC addresses of the other MEPs in the same MEG;
- MI_LB_Series(DA,DE,P,N,Period): To send a series of N LB messages to a particular MEP;
- MI_LB_Test(DA,DE,P,Pattern,Length,Period): To send a series of LB messages carrying a test pattern to a particular MEP; these LB messages are generated every period until the MI_LB_Test_Terminate signal is received.

The details are described later in this clause.

The LBM control protocol triggers the LBM generation process to generate an LBM traffic unit that is received and forwarded by MIPs and received by MEPs in the same MEG. The LBM control process controls the number of LBM generated and the period between consecutive LBM traffic units.

The LBM MIP/MEP reception processes process the received LBM traffic units and, as a result, the LBR generation process may generate an LBR traffic unit in response. The LBR reception process receives and processes the LBR traffic units. The source address (SA), transaction ID (TID) and TLV values are given to the LBM control process.

The LBM control process processes these received values to determine the result of the requested LB operation. The result is communicated back using the following MI signals:

- MI_LB_Discover_Result(MACs): Reports back the MACs that have responded with a valid LBR.
- MI_LB_Series_Result(REC,OO): Reports back the total number of received LBR frames (REC), as well as counts of specific errors:
  - OO: The number of LBR traffic units that were received out of order (OO).
- MI_LB_Test_Result(Sent,REC,CRC,BERR,OO): Reports back the total number of LBM frames sent (Sent) as well as the total number of LBR frames received (REC); for the latter counts of specific errors are reported:
  - CRC: Number of LBR frames where the CRC in the pattern failed.
  - BERR: Number of LBR frames where there was a bit error in the pattern.
  - OO: Number of LBR frames that where received out of order.

The detailed functionality of the various processes is defined below.

8.1.8.2 LB control process

The LB control process can receive several MI signals to trigger the LB protocol; this is shown in Figure 8-22.

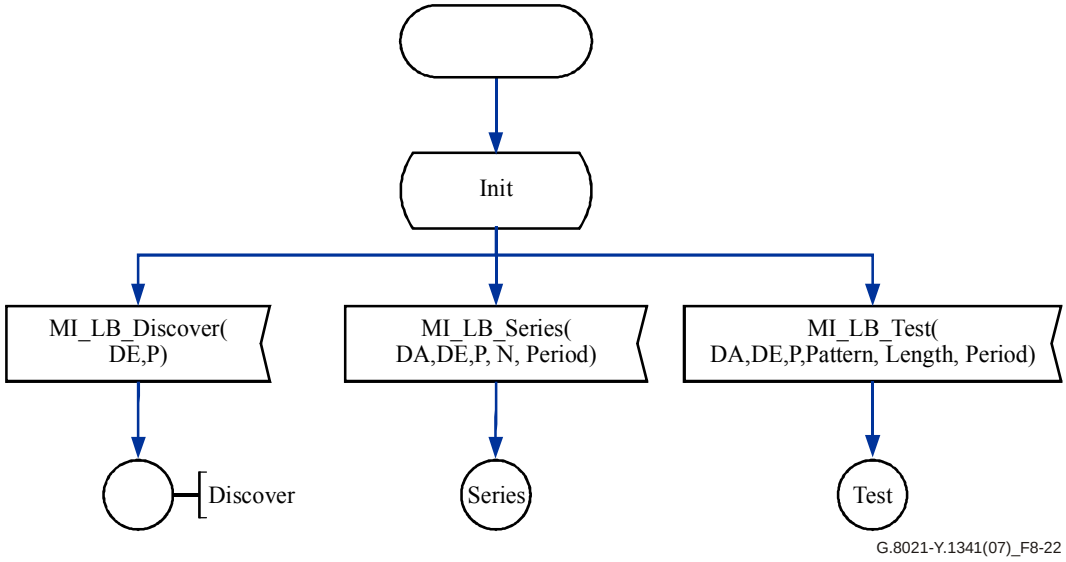

Figure 8-22 – MEP LB control behaviour

Figure 8-23 shows the behaviour if the MI_LB_Discover signal is received.

Figure 8-24 shows the behaviour if the MI_LB_Series signal is received.

Figure 8-25 shows the behaviour if the MI_LB_Test signal is received.

NOTE – The state machine (Figure 8-22 combined with Figures 8-23, 8-24 and 8-25) shows that the LB_Discover, LB_Series and LB_Test actions are mutually exclusive. Furthermore a 'new' instantiation of any of these actions cannot be initiated until the current action is finished.

MI_LB_Discover behaviour

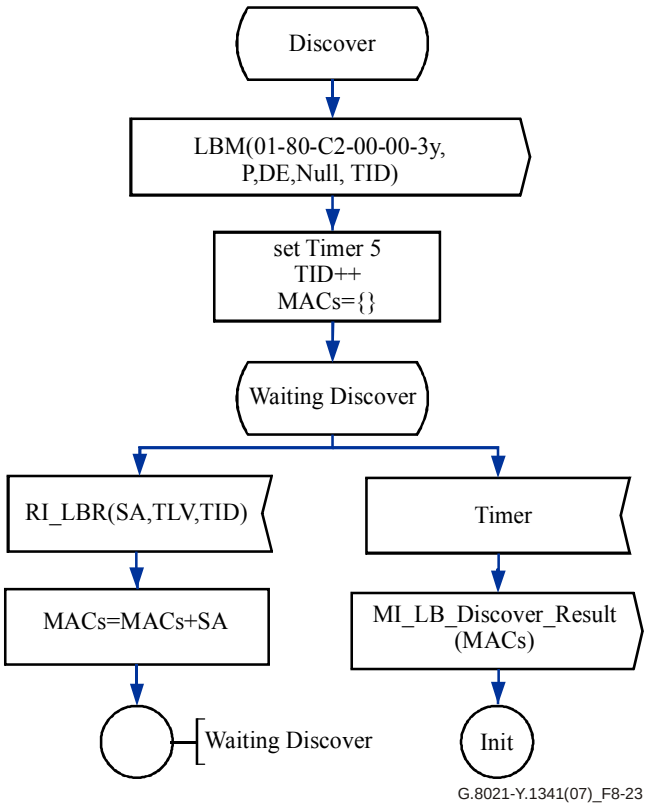

Figure 8-23 – LB control process discover behaviour

Figure 8-23 shows the behaviour when an MI_LB_Discover(DE,P) signal is received.

First the LBM generation process is requested to generate an LBM frame by sending the LBM(01-80-c2-00-00-3y,P,DE,Null,TID) signal to the LBM generation process. The DA is set to the class 1 multicast address as defined in [ITU-T Y.1731], where the last part (y) will be overwritten with MEL by the OAM MEP insertion process. There are no TLVs included, hence the TLV parameter is set to null.

After triggering the transmission of the LBM frame, received RI_LBR is processed for 5 seconds (as governed by the timer). Every time the RI_LBR(SA,TLV,TID) is received, the SA is stored in the set of received MACs.

After 5 seconds all the received SAs are reported back using the MI_LB_Discover_Result(MACs) signal and the LBM control process returns to the Init state.

MI_LB_Series behaviour

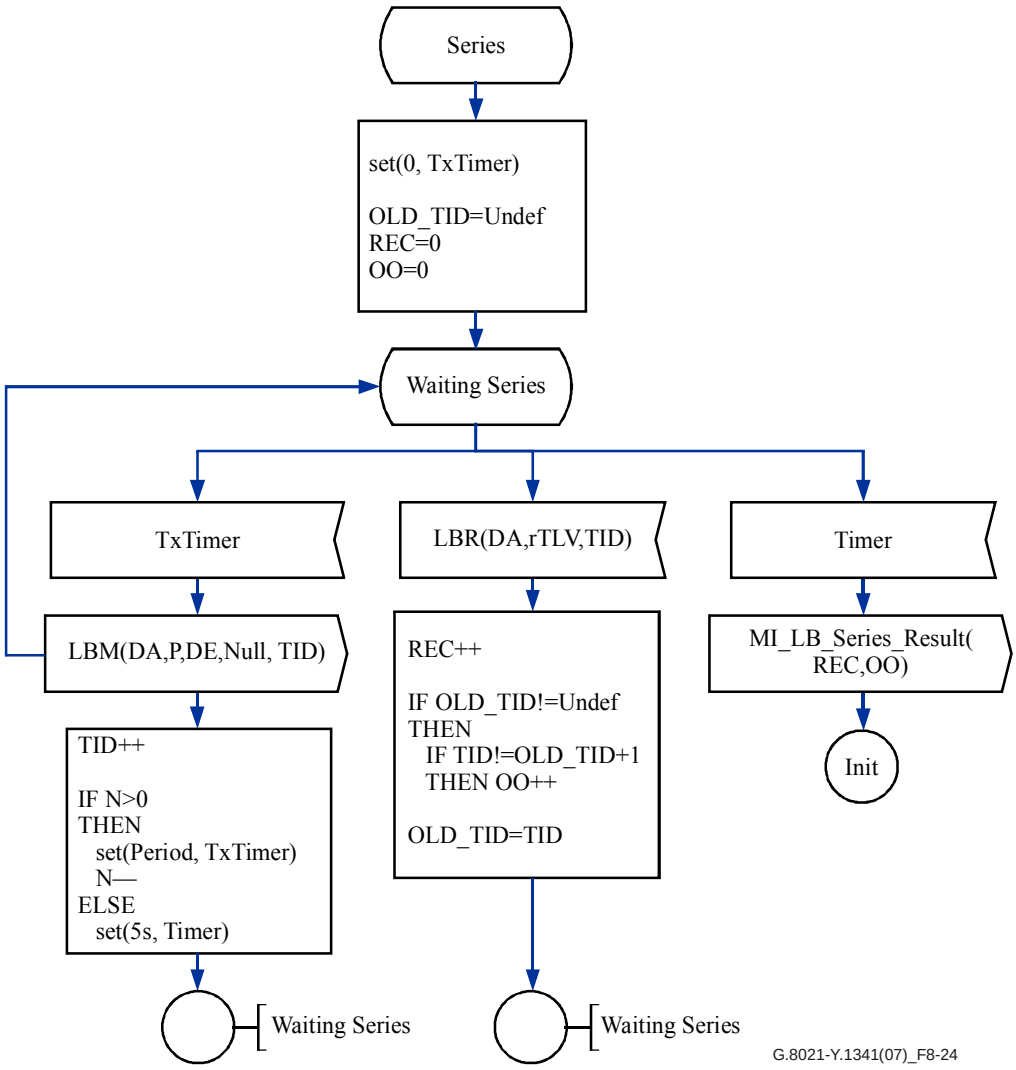

Figure 8-24 – LB control series behaviour

Figure 8-24 defines the behaviour of the LB control process after the reception of the MI_LB_Series(DA,DE,P,N,Period) signal.

After the receipt of the MI_LB_Series signal, the LBM generation process is requested N times to generate an LBM frame (where period determines the interval between two LBM frames); this is done by issuing the LBM(DA,P,DE,Null,TID) signal. Since there are no TLVs included, the TLV parameter is set to null.

Whenever an RI_LBR(DA,rTLV,TID) signal is received, the number of received LBR frames is increased (REC++). If the TID value from the RI_LBR signal does not consecutively follow the last received TID value, the counter for out of order frames is incremented by one (OO++).

Five seconds after sending the last LBM frame (i.e., after sending the Nth LBM frame) the REC and OO counters are reported back in the MI_LB_Series_Result signal.

MI_LB_Test behaviour

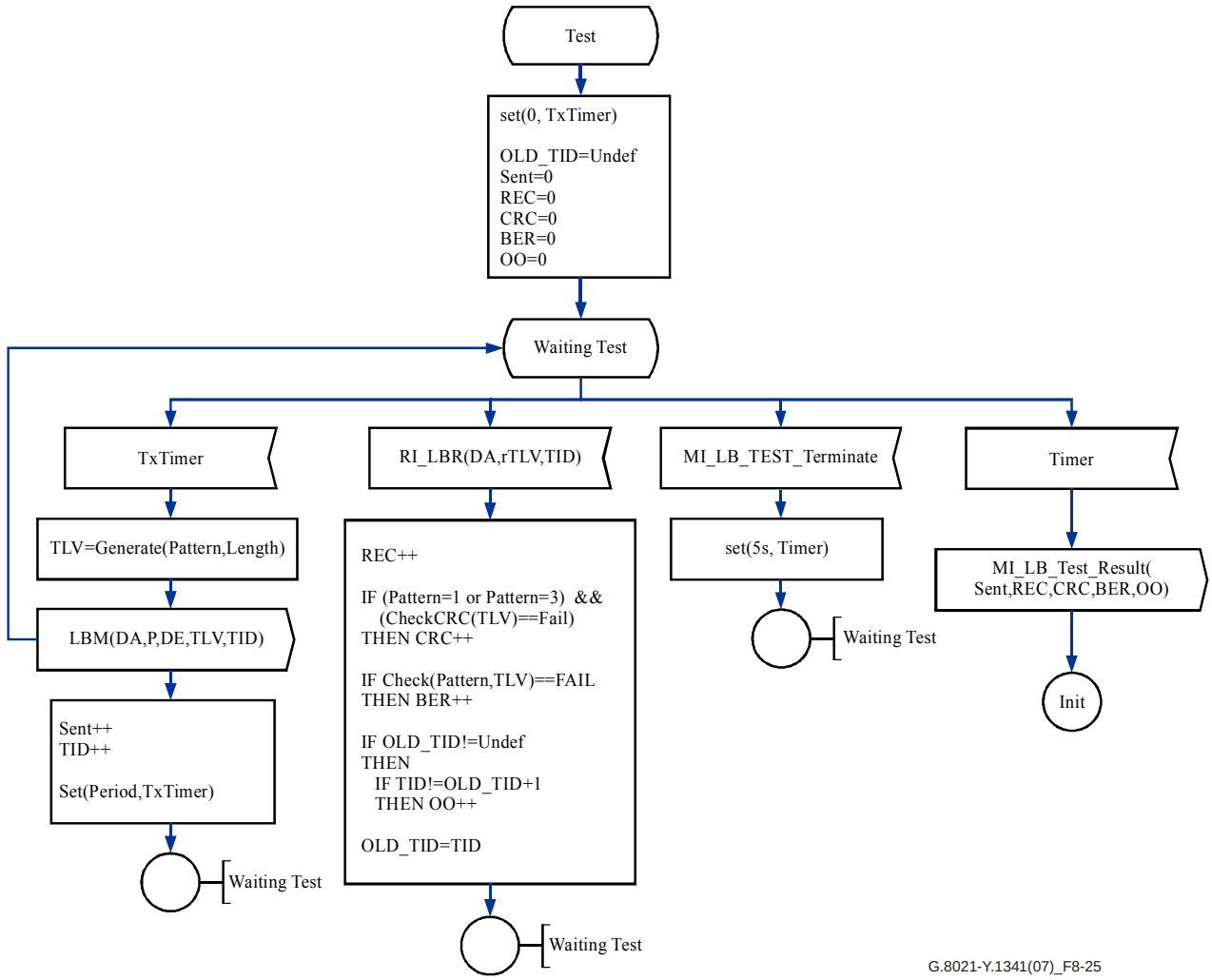

Figure 8-25 – LB control test behaviour

Figure 8-25 defines the behaviour of the LB control process after the reception of the MI_LB_Test(DA,DE,P,Pattern,Length,Period) signal.

Every period, an LBM frame is generated until the MI_LB_Test_Terminate signal is received. Five seconds after receiving this MI_LB_Test_Terminate signal the Sent, REC, CRC, BER and OO counters are reported back using the MI_LB_Test_Result signal.

The TLV field of the LBM frames is determined by the generate (Pattern, Length) function. For pattern, the following types are defined:

0: "Null signal without CRC-32".

1: "Null signal with CRC-32".

2: "PRBS 2^31-1 without CRC-32".

3: "PRBS 2^31-1 with CRC-32".

The length parameter determines the length of the generated TLV.

Generate (Pattern, Length) generates a Test TLV with length 'Length' to be included in the LBM frame. Therefore, this TLV is passed using the LBM(DA,P,DE,TLV,TID) signal to the LBM generation process.

Upon receipt of the RI_LBR(SA,rTLV,TID) remote information, the received LBR counter is incremented by one (REC++).

If the TLV contains a CRC (pattern 1 or 3), the CRC counter is incremented by one if the CRC check fails.

The function Check(Pattern, TLV) compares the received test pattern with the expected test pattern. If there is a mismatch, the BERR counter is increased.

If the TID value from the RI_LBR signal does not follow the last received TID value, the counter for out of order frames is incremented by one (OO++).

8.1.8.3 LBM generation process

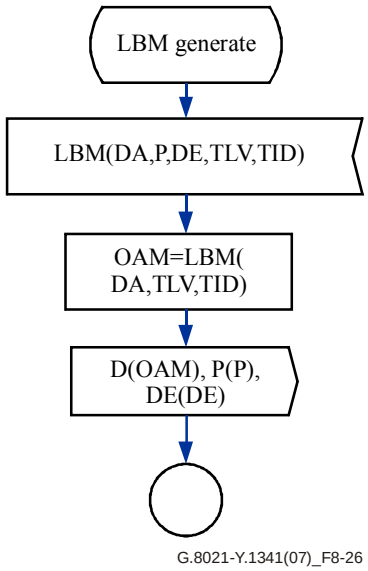

Figure 8-26 – LBM generation behaviour

The LBM generation process generates a *single* LBM OAM traffic unit (ETH_CI_D) complemented with ETH_CI_P and ETH_CI_DE signals on receipt of the LBM(DA,P,DE,TLV,TID) signal. The process is defined in Figure 8-26.

From the LBM(DA,P,DE,TLV,TID) signal, the P field determines the value of the ETH_CI_P signal, the DE field determines the value of the ETH_CI_DE signal. The DA, TLV and TID fields are used in the construction of the ETH_CI_D signal that carries the LBM traffic unit.

The format of the LBM traffic unit and the values are shown in Figure 8-27.

The values of the SA and MEL fields will be determined by the OAM MEP insertion process, as well as the last part (y) of the DA if the DA is set to 01-80-c2-00-00-3y.

	1								2								3								4							
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	DA=LBM(DA)																															
5																	SA=Undefined															
9																																
13	Ethertype=89-02																MEL= undef				Version=0				Opcode=03 (LBM)							
17	Flags=0								TLV Offset = 4								Transaction ID= LBM(TID)															
21	Transaction ID continued																TLV=LBM(TLV)															
25																																
29																																
33																																
:																																
Last																									END TLV (0)							

Figure 8-27 – LBM traffic unit

8.1.8.4 LBM MIP reception process

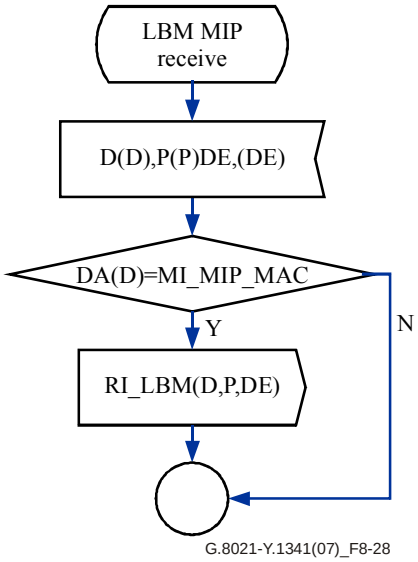

Figure 8-28 – MIP LBM reception behaviour

The MIP LBM reception process receives ETH_CI traffic units containing LBM PDUs complemented by the P and D signals.

The behaviour is defined in Figure 8-28. If the DA field in the traffic unit (D signal) equal the local MAC address (MI_MIP_MAC), the loopback is intended for this MIP and the information is forwarded to the loopback reply generation process using the RI_LBM(D,P,DE) signal; otherwise the information is ignored and no action is taken.

Note that a MIP therefore does not reply to LBM traffic units that have a class 1 multicast address.

8.1.8.5 LBM MEP reception process

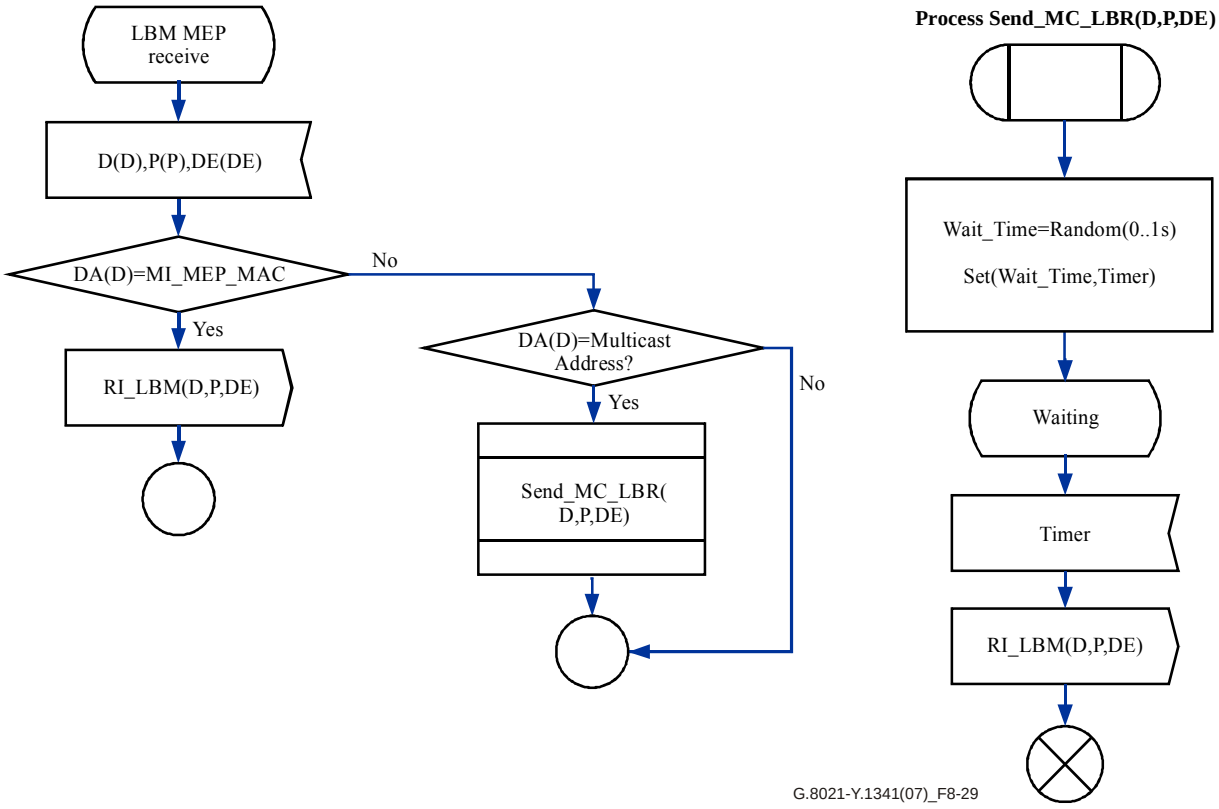

Figure 8-29 – MEP LBM reception behaviour

The MEP LBM reception process receives ETH_CI traffic units containing LBM PDUs complemented by the P and D signals.

The behaviour is defined in Figure 8-29.

If the DA field in the LBM traffic unit (D signal) equals the local MAC address (MI_MEP_MAC), the loopback is intended for this MEP, and the information is forwarded to the loopback reply generation process (RI_LBM(D,P,DE)).

If the DA field in the LBM traffic unit (D signal) is a multicast address, a LBR traffic unit must be generated after a random delay between 0 and 1 second. This is specified by instantiating a separate process, the Send_MC_LBR process. This process chooses a random waiting time between 0 and 1 second and, after waiting for the chosen period of time, the D, P and DE information is forwarded to the loopback reply process (RI_LBM(D,P,DE)). Finally, this process instance is terminated.

Since the 0 to 1 second waiting time is performed in a separate process, it does not block the reception and processing of other LBM frames within that waiting period.

8.1.8.6 LBR generation process

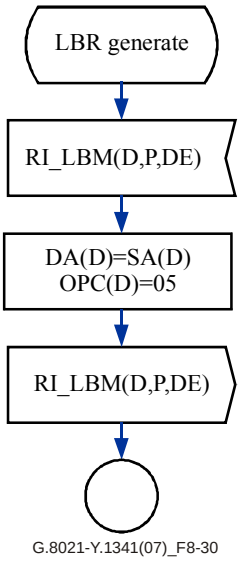

Figure 8-30 – LBR generation behaviour

Note that the LBR generation process is the same for MEPs and MIPs.

Upon receipt of the LBM traffic unit and accompanying signals (RI_LBM(D,P,DE)) from the LBM reception process, the LBR generation process generates an LBR traffic unit together with the complementing P and DE signals.

The behaviour is specified in Figure 8-30. The generated traffic unit is the same as the received RI_LBM(D) traffic unit except:

- the DA of the generated LBR traffic unit is the SA of the received LBM traffic unit; and
- the Opcode is set to LBR Opcode.

NOTE – In the generated LBR, in the OAM (MEP) insertion process, the SA will be overwritten with the local MAC address, and the MEL will be overwritten with MI_MEL.

The resulting LBR traffic unit format is shown in Figure 8-31.

	1								2								3								4							
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	DA=SA(RI_LBM(D))																															
5																	SA=Undefined															
9																																
13	Ethertype=For further study																MEL=Undef								Version=Version (RI_LBM(D))							
17	Flags=Flags(RI_LBM(D))								TLV offset TLV_Offset(RI_LBM(D))								Transaction ID=Transaction ID(RI_LBM(D))															
21	Transaction ID continued																TLV=TLV(RI_LBM(D))															
25																																
29																																
33																																
:																																
Last																									END TLV (0)							

Figure 8-31 – LBR traffic unit

8.1.8.7 LBR reception process

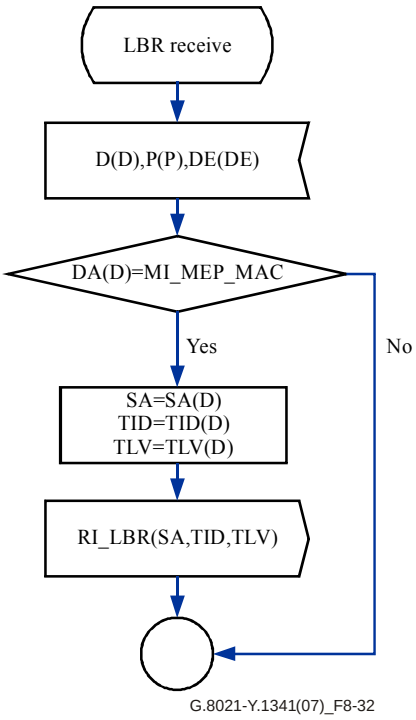

Figure 8-32 – LBR reception behaviour

The LBR reception process receives LBR traffic units (D signal) together with the complementing P and DE signals. The LBR reception process will inspect the DA field in the received traffic unit; if the DA equals the local MAC address (MI_MEP_MAC) the SA, TID and TLV values will be extracted from the LBR PDU and signalled to the LB control process using the RI_LBR(SA,TID,TLV) signal. The behaviour is defined in Figure 8-32.

8.1.9 Loss measurement

8.1.9.1 Overview

Figure 8-33 shows the different processes inside MEPs and MIPs that are involved in the loss measurement protocol.

The MEP OnDemand-OAM source insertion process is defined in clause 9.4.1.1, the MEP OnDemand-OAM sink extraction process in clause 9.4.1.2, the MIP OnDemand-OAM sink extraction process in clause 9.4.2.2 and the MIP OnDemand-OAM source insertion process in clause 9.4.2.1. In summary, they insert and extract ETH_CI OAM signals into and from the stream of ETH_CI_D traffic units together with the complementing P and D signals going through a MEP and MIP; the extraction is based on MEL and Opcode. Furthermore, the insertion process inserts the correct MEL and SA values into the OAM traffic units.

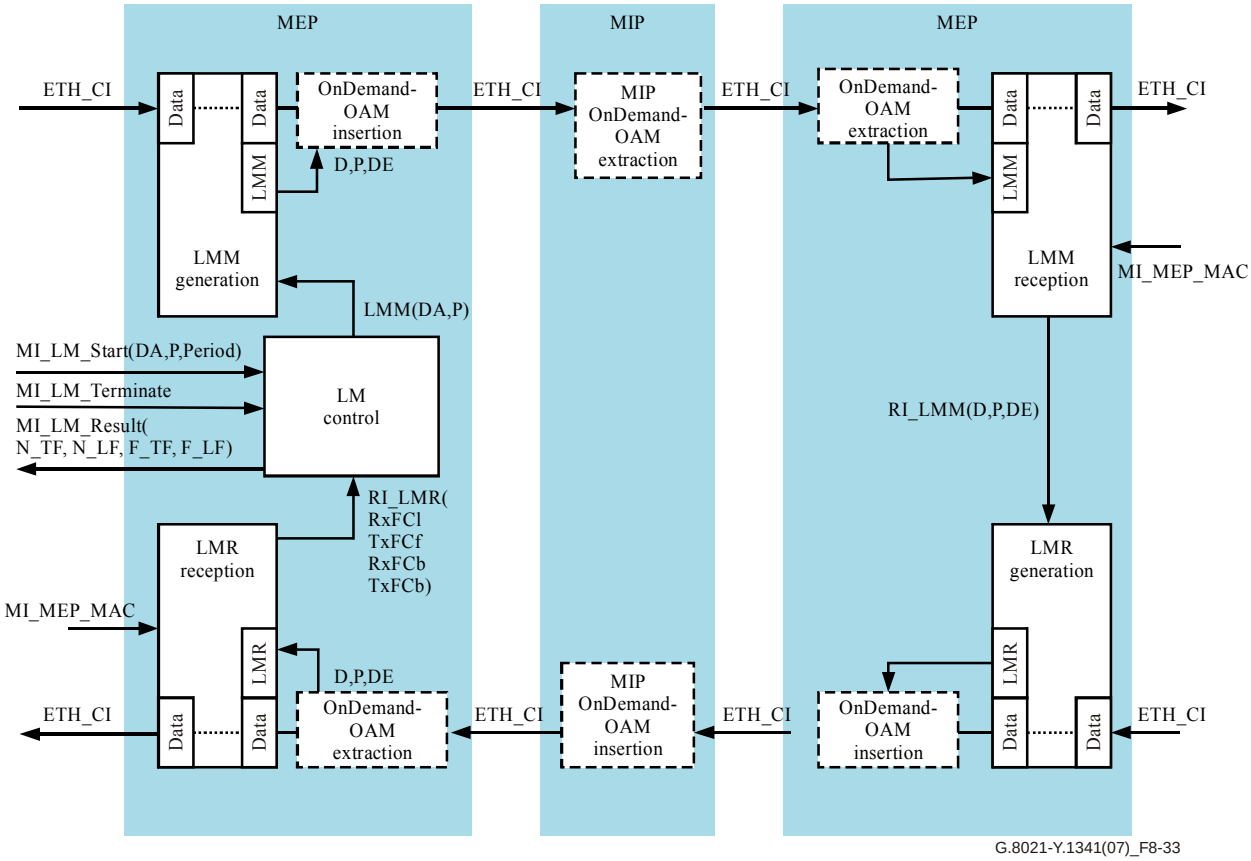

Figure 8-33 – Overview of processes involved with loss measurement protocol

The LM control process controls the LM protocol. The protocol is activated upon receipt of the MI_LM_Start(DA,P,Period) signal and remains activated until the MI_LM_Terminate signal is received.

The result is communicated via the MI_LM_Result(N_TF, N_LF, F_TF, F_LF) signal.

The LMM generation protocol generates an LMM traffic unit that passes transparently through MIPs, but that will be processed by the LMM reception process in MEPs. The LMR generation process may generate an LMR traffic unit in response to the receipt of an LMM traffic unit. The LMR reception process receives and processes the LMR traffic units.

The behaviour of the processes is defined below.

Note that the LMM generation and LMR generation process are both part of the LMx generation process. Similarly, the LMM reception and the LMR reception process are both part of the LMx reception process.

8.1.9.2 LM control process

The behaviour of the LM control process is defined in Figure 8-34.

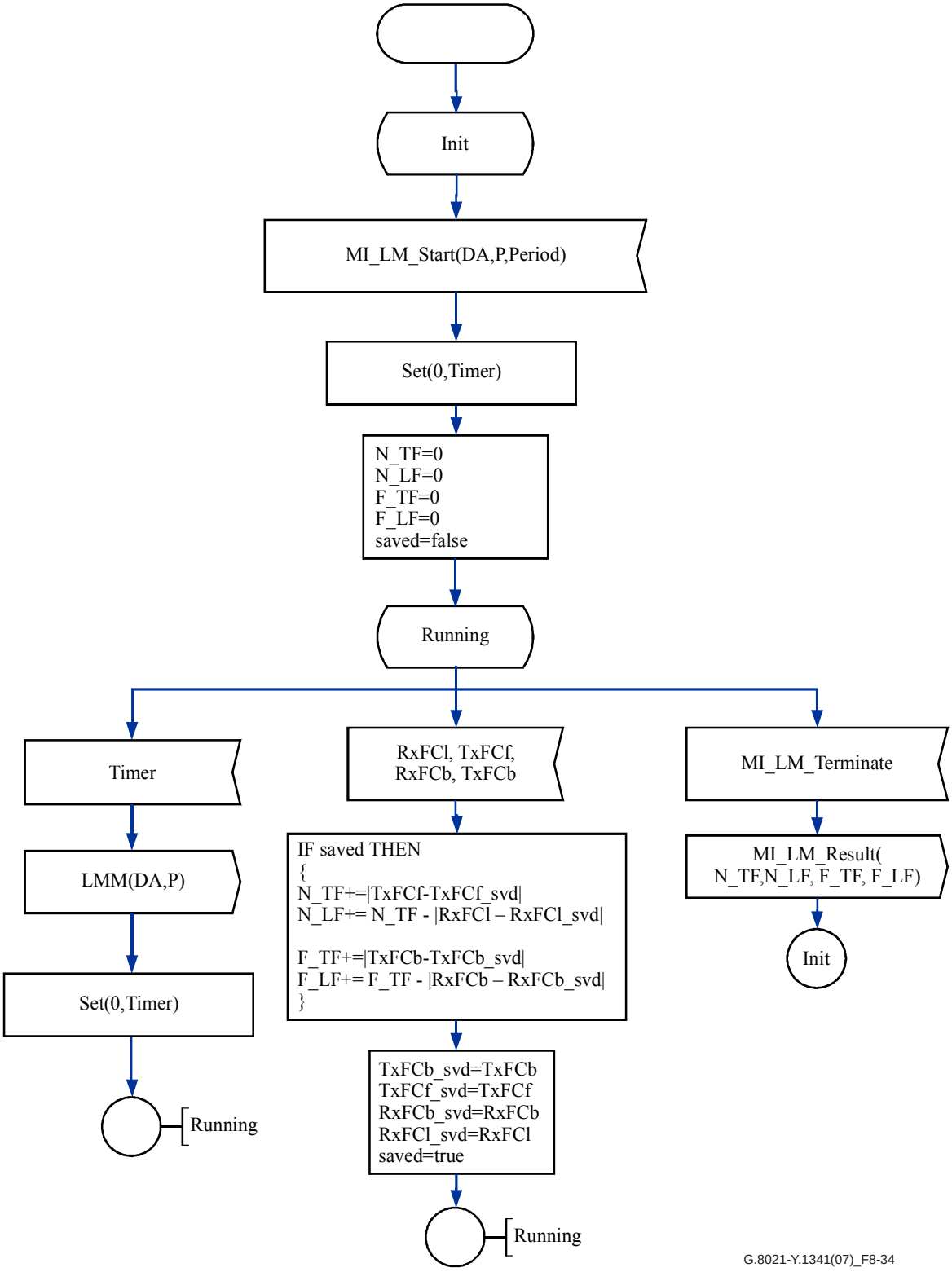

Figure 8-34 – LM control behaviour

Upon receipt of the MI_LM_Start(DA,P,Period), the LM protocol is started. Every period the generation of an LMM frame is triggered (using the LMM(DA,P) signal), until the MI_LM_Terminate signal is received.

The received counters are used to count the near-end and far-end transmitted and lost frames. This result is reported using the MI_LM_Result(N_TF, N_LF, F_TF, F_LF) signal after the receipt of the MI_LM_Terminate signal.

8.1.9.3 LMx generation process

The LMx generation process contains both the LMM generation and LMR generation functionality. Figure 8-35 shows the LMx generation process.

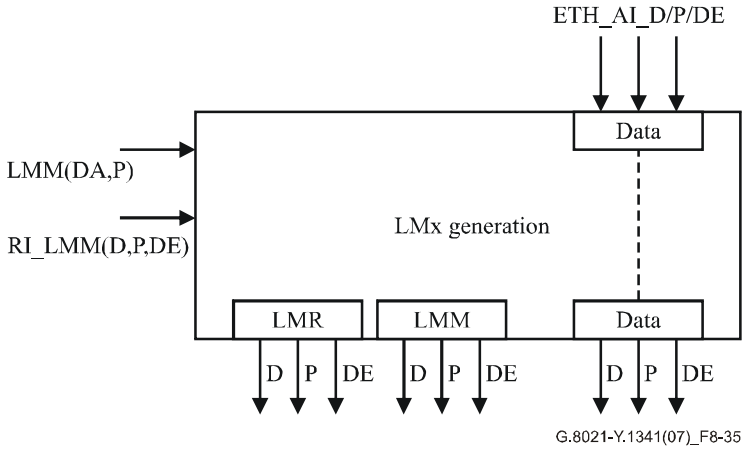

Figure 8-35 – LMx generation process

Figure 8-36 defines the behaviour of the LMx process. The behaviour consists of three parts:

– LMM generation part that is triggered by the receipt of the LMM(DA,P) signal;

– LMR generation part that is triggered by the receipt of RI_LMM(D,P,DE) signals;

– counter part that is triggered by the receipt of a normal data signal.

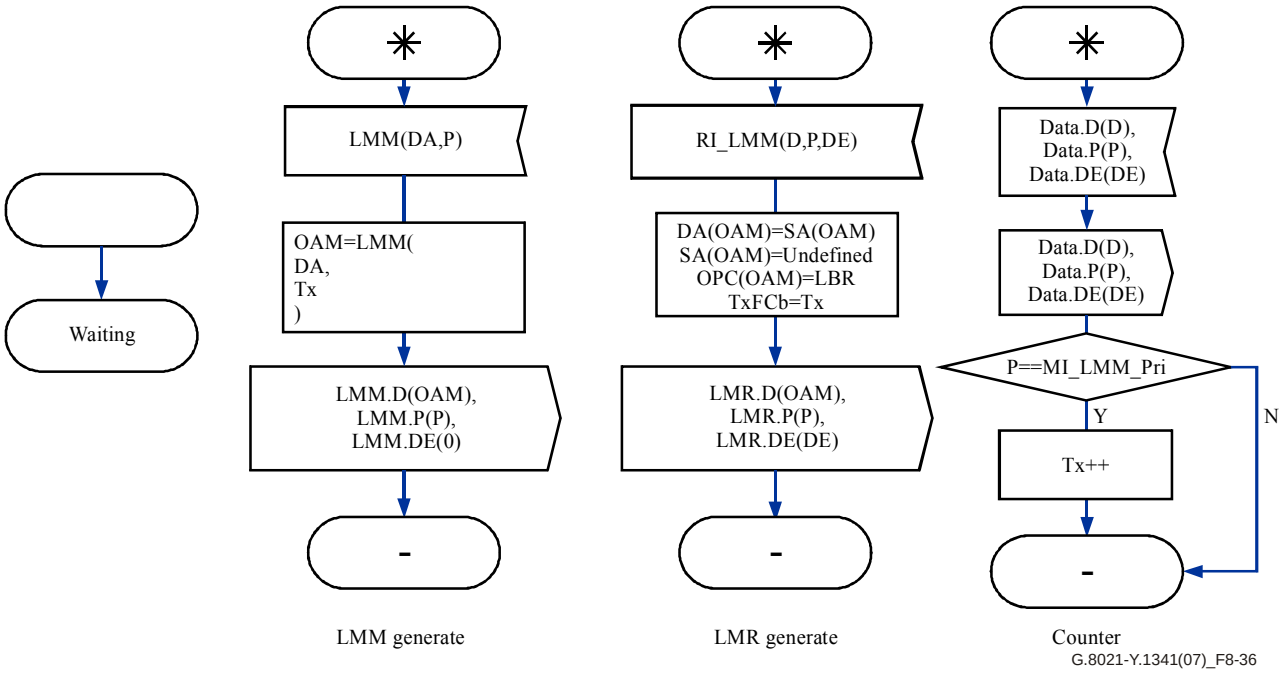

Figure 8-36 – LMx generation behaviour

Counter part

This part receives ETH_CI and forwards it. It counts the number of ETH_CI traffic units received with ETH_CI_P signal equal to MI_LMM_Pri.

LMM generate

This part generates an LMM traffic unit on receipt of the LMM(DA,P) signal.

The LMM traffic unit contains a source and destination address field and an M_SDU field. The format of the M_SDU field for LMM traffic units is defined in clauses 9.1 and 9.12 of [ITU-T Y.1731].

The LMM traffic unit is generated by the LMM generate function in Figure 8-36. Figure 8-37 shows the resultant LMM traffic unit.

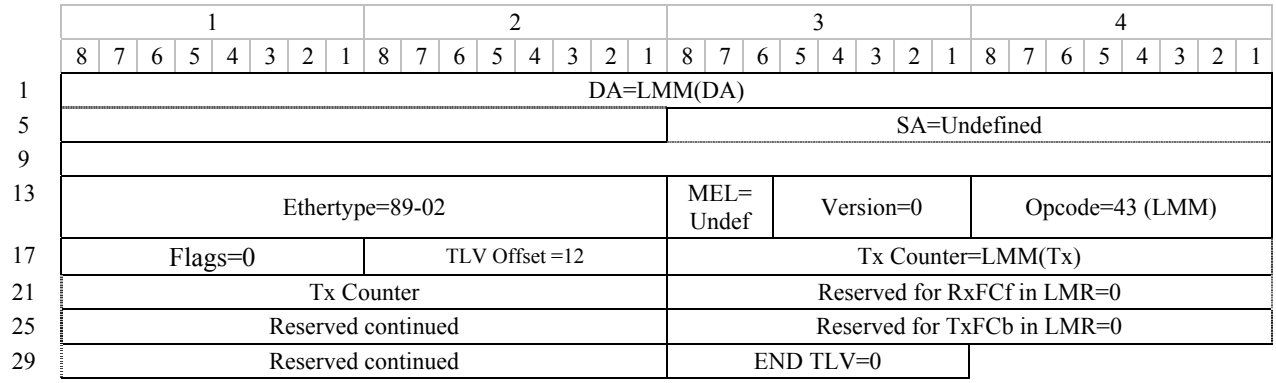

Figure 8-37 – LMM traffic unit

LMR generate

The LMR generate part generates an LMR traffic unit on receipt of RI_LMM signals. The LMR traffic unit is based on the received LMM traffic unit (as conveyed in the RI_LMM_D signal), however:

- the SA of the LMM traffic unit becomes the DA of the LMR traffic unit;
- the Opcode is set to LMR;
- the TxFCb field is assigned the value of the Tx counter.

NOTE – In the generated LMR, in the OAM (MEP) insertion process, the SA will be overwritten with the local MAC address, and the MEL will be overwritten with MI_MEL.

Note that the RxFCf field is already assigned a value by the LMM reception process.

Figure 8-38 shows the resultant LMR traffic unit.

	1								2								3								4							
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	DA=SA(RI_LMM(D))																															
5																	SA=Undefined															
9																																
13	Ethertype=89-02																MEL= Undef				Version=Version (RI_LMM(D))				Opcode=44 (LMR)							
17	Flags=0								TLV Offset =12								TxFCf=TxFCf(RI_LMM(D))															
21	TxFCf continued																RxFCf=RxFCf(RI_LMM(D))															
25	RxFCf continued																TxFCb=Tx Counter															
29	TxFCb continued																END TLV=0															

Figure 8-38 – LMR traffic unit

8.1.9.4 LMx reception process

The LMx reception process contains both the LMM reception and LMR reception functionality. Figure 8-39 shows the LMx reception process.

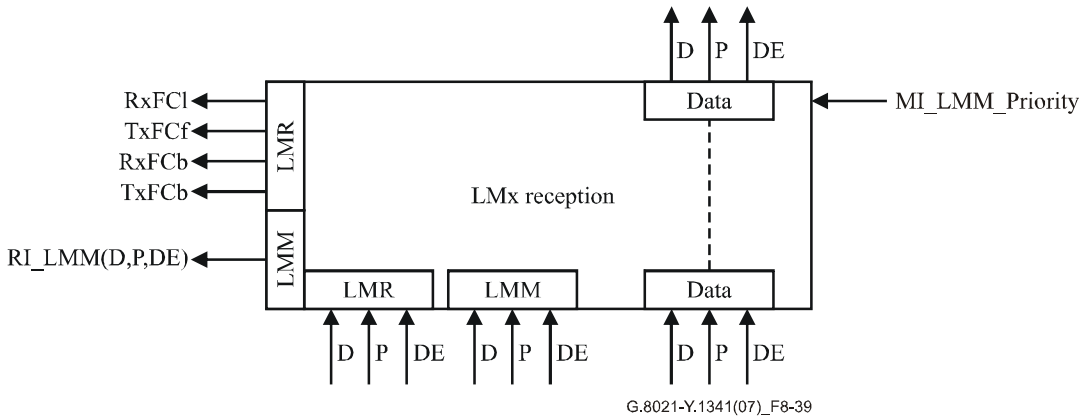

Figure 8-39 – LMx reception process

Figure 8-40 defines the behaviour of the LMx reception process. The behaviour consists of three parts:

– LMM reception part that is triggered by the receipt of an LMM traffic unit;

– LMR reception part that is triggered by the receipt of an LMR traffic unit;

– counter part that is triggered by the receipt of a normal data signal.

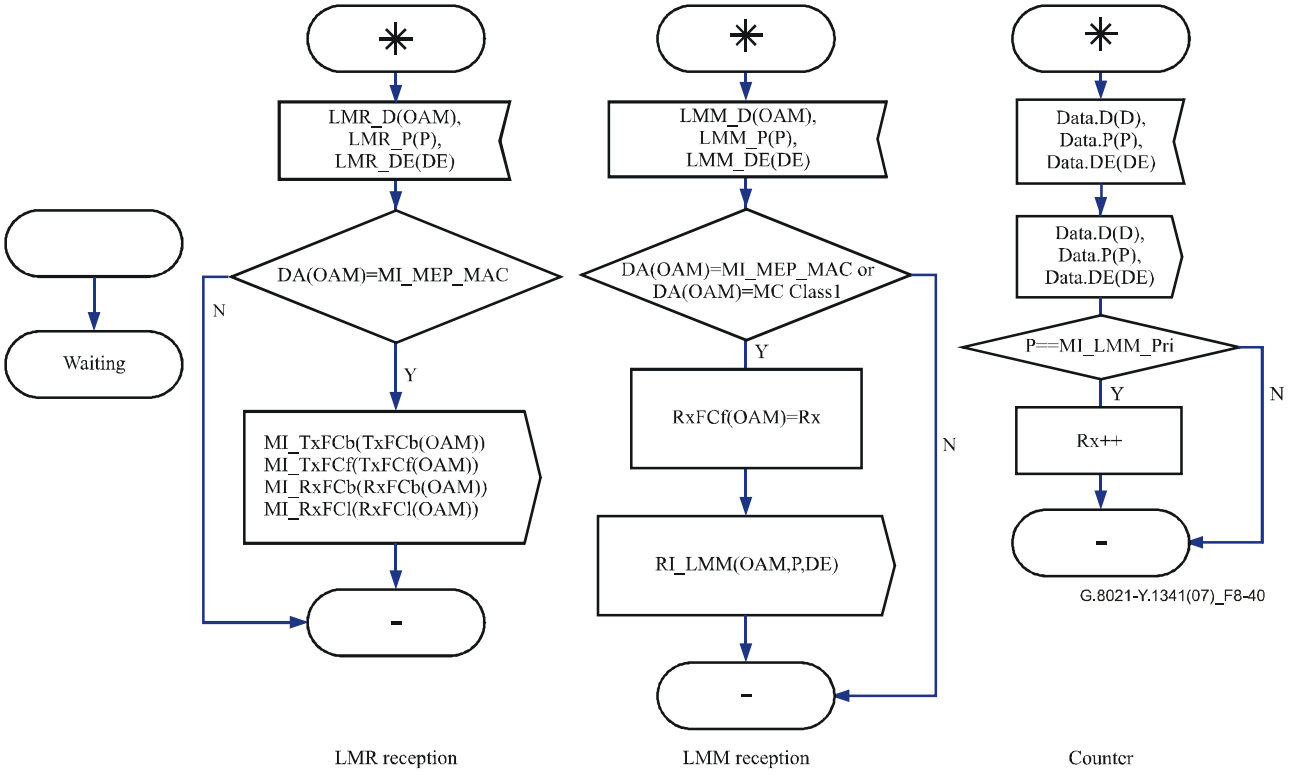

Figure 8-40 – LMx reception behaviour

Counter part

This part receives ETH_CI and forwards it. It counts the number of ETH_CI instances received with ETH_CI_P signal equal to MI_LMM_Pri.

LMM reception part

This part processes received LMM traffic units. It checks the destination address, the DA must be either the local MAC address or it should be a multicast class 1 destination address. If this is the case, the LMM reception process writes the Rx counter value to the received traffic unit in the RxFCf field and forwards the received traffic unit and complementing P and DE signals as remote information to the LMR generation process.

LMR reception part

This part processes received LMR traffic units. If the DA equals the local MAC address, it extracts the counter values TxFCb, TxFCf, RxFCb from the received traffic unit as well as the SA field. These values together with the value of the Rx counter are forwarded as MI signals.

8.1.10 Delay measurement protocol

8.1.10.1 Overview

Figure 8-41 shows the different processes inside MEPs and MIPs that are involved in the delay measurement protocol.

The MEP OnDemand-OAM source insertion process is defined in clause 9.4.1.1, the MEP OnDemand-OAM sink extraction process in clause 9.4.1.2, the MIP OnDemand-OAM sink extraction process in clause 9.4.2.2, and the MIP OnDemand-OAM source insertion process in clause 9.4.2.1. In summary, they insert and extract ETH_CI OAM signals into and from the stream of ETH_C_D traffic units and the complementing P and D signals going through a MEP and MIP;

the extraction is based on MEL and Opcode. Furthermore, the insertion process inserts the correct MEL and SA values into the OAM traffic units.

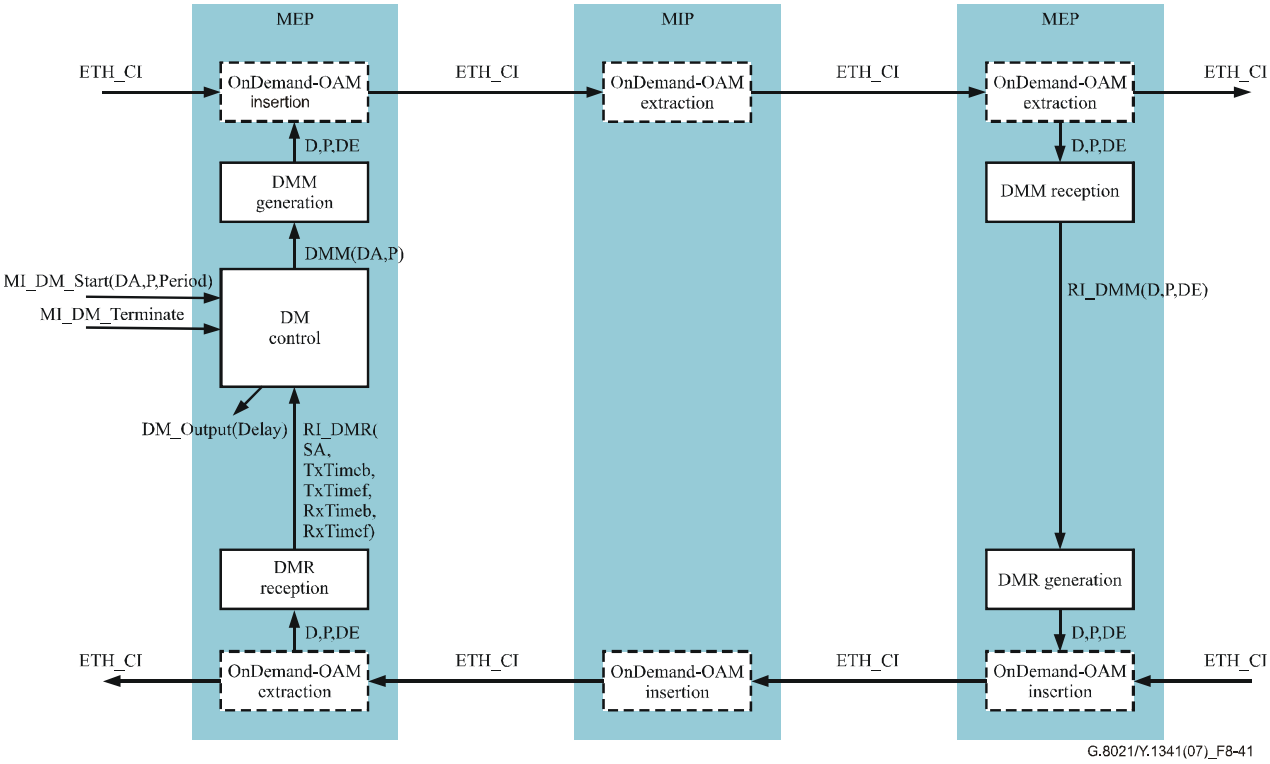

Figure 8-41 – Overview of processes involved with delay measurement protocol

The DM control process controls the DM protocol. The protocol is activated upon receipt of the MI_DM_Start(DA,P,Period) signal and remains activated until the MI_DM_Terminate signal is received.

The measured delay values are output via the DM_Output(delay) signal.

Note that the processing of the delay values is for further study.

The DMM generation process generates DMM traffic units that pass through MIPs transparently, but are received and processed by DMM reception processes in MEPs. The DMR generation process may generate a DMR traffic unit in response. This DMR traffic unit also passes transparently through MIPs, but is received and processed by DMR reception processes in MEPs.

The behaviour of the processes is defined below. Note that it is for further study whether we need to define with which bit of the frame the timestamp is associated.

8.1.10.2 DM control process

The behaviour of the DM control process is defined in Figure 8-42.

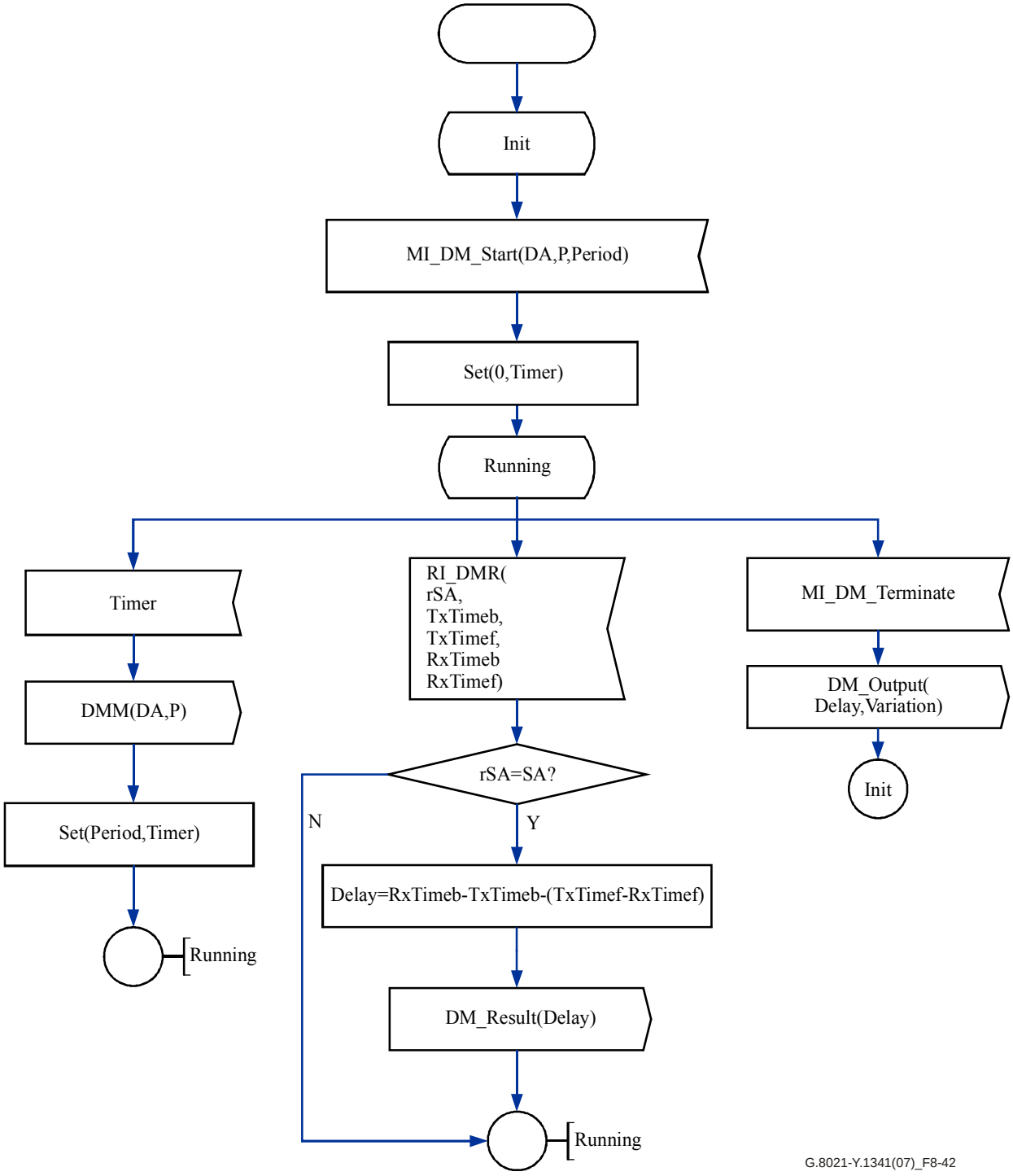

Figure 8-42 – DM control behaviour

Upon receipt of the MI_DM_Start(DA,P,Period), the DM protocol is started. Every period the generation of a DMM frame is triggered (using the DMM(DA,P) signal), until the MI_DM_Terminate signal is received.

Upon receipt of a DMR traffic unit, the delay value recorded by this particular DMR traffic unit is calculated and communicated via the DM_Output(delay) signal.

8.1.10.3 DMM generation process

The behaviour of the DMM generation process is defined in Figure 8-43.

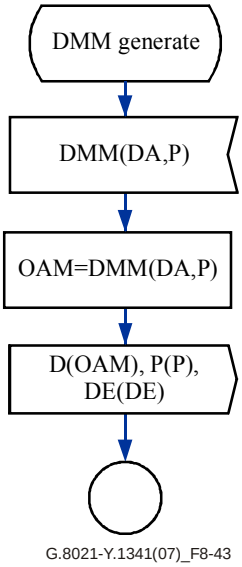

Figure 8-43 – DMM generation behaviour

Upon receiving the DMM(DA,P), a single DMM traffic unit is generated together with the complementing P and DE signals. The DA of the generated traffic unit is determined by the DMM(DA) signal. The TxTimeStampf field is assigned the value of the local time.

The P signal value is defined by DMM(P).

	1								2								3								4							
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	DA=DMM(DA)																															
5																	SA=Undefined															
9																																
13	Ethertype=89-02																MEL= Undef				Version=0				Opcode=47 (DMM)							
17	Flags=0								TLV Offset =32								TxTimeStampf=Local Time															
21																																
25																	RxTimeStampf=0															
29																	Used by DMM reception process															
33																	0 (reserved for DMR)															
37																																
41																	0 (reserved for DMR receiving equipment)															
45																																
49																	END TLV=0															

Figure 8-44 – DMM traffic unit

8.1.10.4 DMM reception process

The DMM reception process processes the received DMM traffic units and the complementing P and DE signals. The behaviour is defined in Figure 8-45.

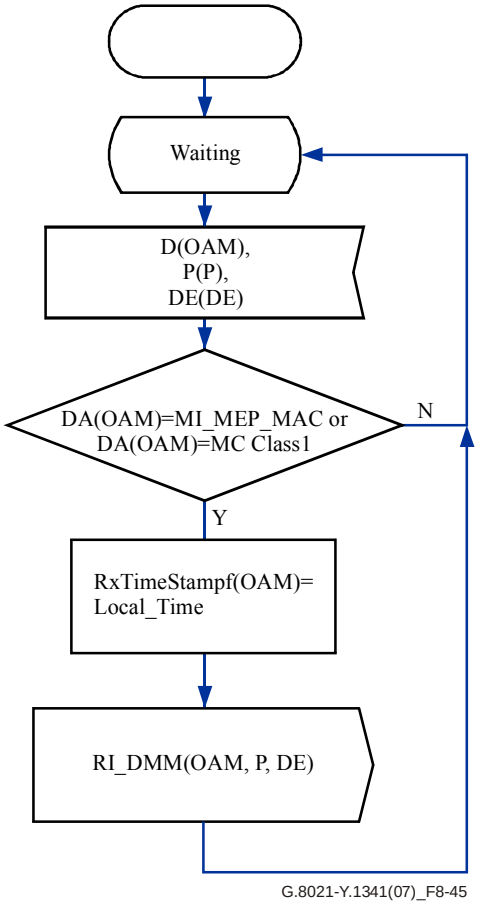

Figure 8-45 – DMM reception behaviour

First the DA is checked, it should be the local MAC address or a multicast class 1 address, otherwise the frame is ignored.

If the DA is the local MAC or a multicast class 1 address, the RxTimeStampf field is assigned the value of the local time and traffic unit and the complementing P and DE signals are forwarded as remote information to the DMR generation process.

8.1.10.5 DMR generation process

The DMR generation process generates a DMR traffic unit and its complementing P and DE signals. The behaviour is defined in Figure 8-46.

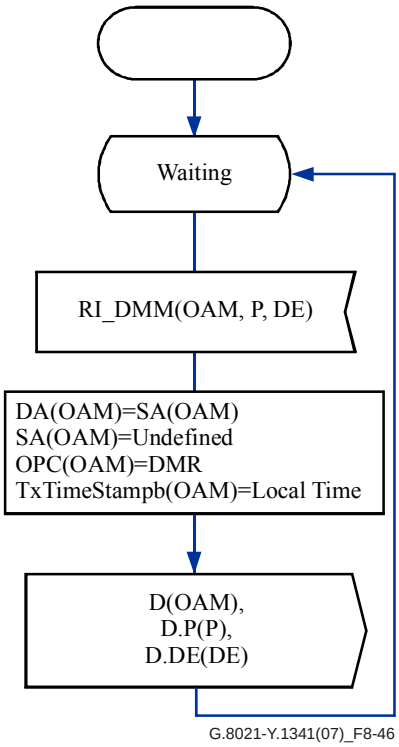

Figure 8-46 – DMR generation behaviour

Upon the receipt of remote information containing a DMM traffic unit, the DMR generation process generates a DMR traffic unit and forwards it to the OAM insertion process.

As part of the DMR generation the:

– DA of the DMR traffic unit is the SA of the original DMM traffic unit;

– The Opcode is changed into DMR Opcode;

– The TxTimeStampb field is assigned the value of the local time.

The resulting DMR traffic unit is shown in Figure 8-47.

NOTE – In the generated DMR, in the OAM (MEP) insertion process, the SA will be overwritten with the local MAC address, and the MEL will be overwritten with MI_MEL.

	1								2								3								4							
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	DA=SA(RI_DMM(D))																															
5																	SA=Undefined															
9																																
13	Ethertype=For further study																MEL= Undef				Version=0				Opcode=48 (DMR)							
17	Flags=0								TLV Offset =32								TxTimeStampf=TxTimeStampf(RI_DMM(D))															
21																																
25																	RxTimeStampf=RxTimeStampf(RI_DMM(D))															
29																																
33																	TxTimeStampb=Local Time															
37																																
41																	0 (reserved for DMR reception process)															
45																																
49																	END TLV=0															

Figure 8-47 – DMR traffic unit

8.1.10.6 DMR reception process

The DMR reception process processes the received DMR traffic units and the complementing P and DE signals. The behaviour is defined in Figure 8-48.

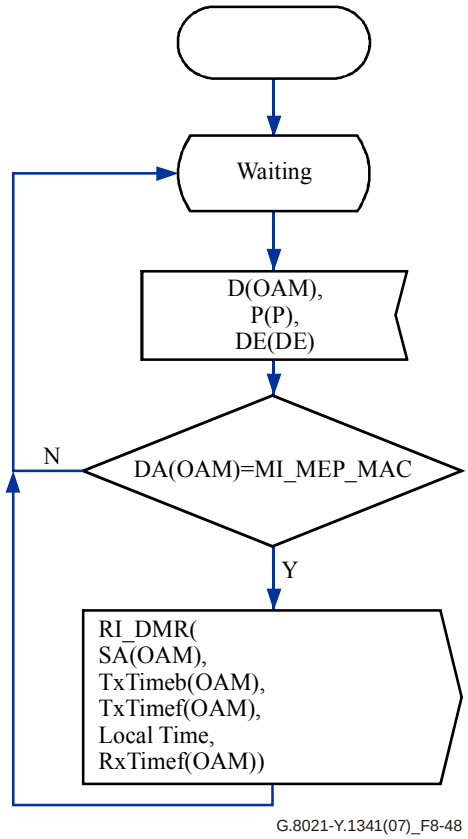

Figure 8-48 – DMR reception behaviour

Upon receipt of a DMR traffic unit, the DA field of the traffic unit is checked. If the DA field equals the local MAC address, the DMR traffic unit is processed further, otherwise it is ignored.

If the DMR traffic unit is processed, the TxTimeStampb, TxTimeStampf, RxTimeStampf are extracted from the traffic unit and signalled using the TimeStamps signal together with the local time.

8.1.11 One way delay measurement protocol

8.1.11.1 Overview

Figure 8-49 shows the different processes inside MEPs and MIPs that are involved in the one way delay measurement protocol.

The MEP OnDemand-OAM source insertion process is defined in clause 9.4.1.1, the MEP OnDemand-OAM sink extraction process in clause 9.4.1.2, the MIP OnDemand-OAM sink extraction process in clause 9.4.2.2, and the MIP OnDemand-OAM source insertion process in clause 9.4.2.1. In summary, they insert and extract ETH_CI OAM signals into and from the stream of ETH_CI_D traffic units and the complementing P and DE signals going through a MEP and MIP; the extraction is based on MEL and Opcode. Furthermore, the insertion process inserts the correct MEL and SA values into the OAM traffic units.

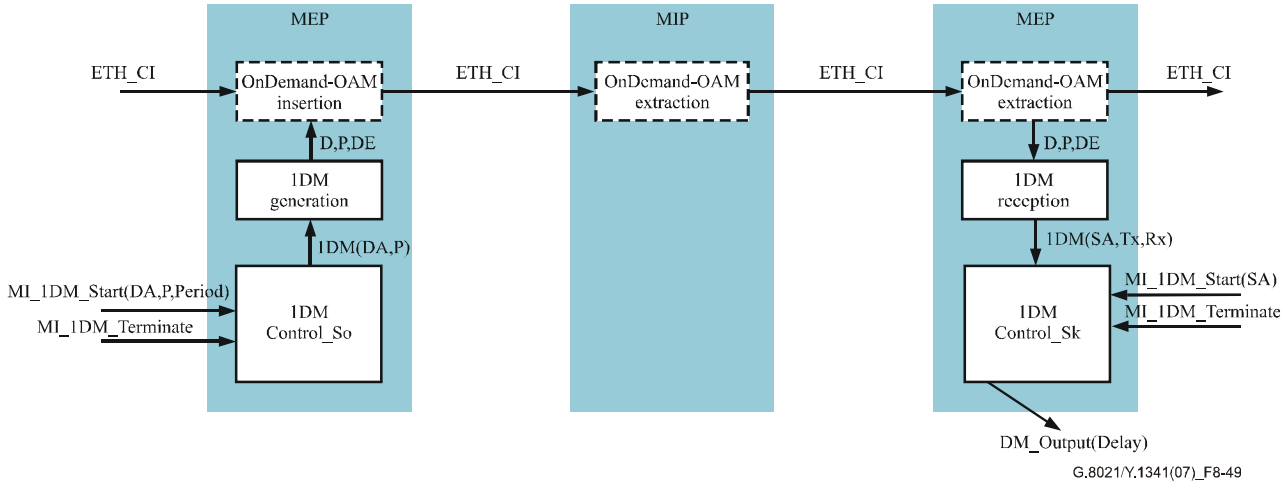

Figure 8-49 – Overview of processes involved with one way delay measurement

The 1DM protocol is controlled by the DM control_So and DM control_Sk processes. The DM control_So process triggers the generation of DMM traffic units upon the receipt of an MI_DM_Start(DA,P,Period) signal. The DM control_Sk process processes the information from received 1DM traffic units after receiving the MI_DM_Start(SA) signal.

The 1DM generation process generates 1DM messages that pass transparently through MIPs and are received and processed by the 1DM reception process in MEPs.

The processes are defined below. Note that it is for further study whether we need to define with which bit of the frame the timestamp is associated.

8.1.11.2 1DM control_So process

Figure 8-50 shows the behaviour of the 1DM control_So process. Upon receipt of the MI_1DM_Start(DA,P,Period) signal, the 1DM protocol is started. The protocol will run until the receipt of the MI_1DM_Terminate signal.

If the DM protocol is running every period (as specified in the MI_1DM_Start signal) the generation of a 1DM message is triggered by generating the 1DM(DA,P) signal towards the 1DM generation process.

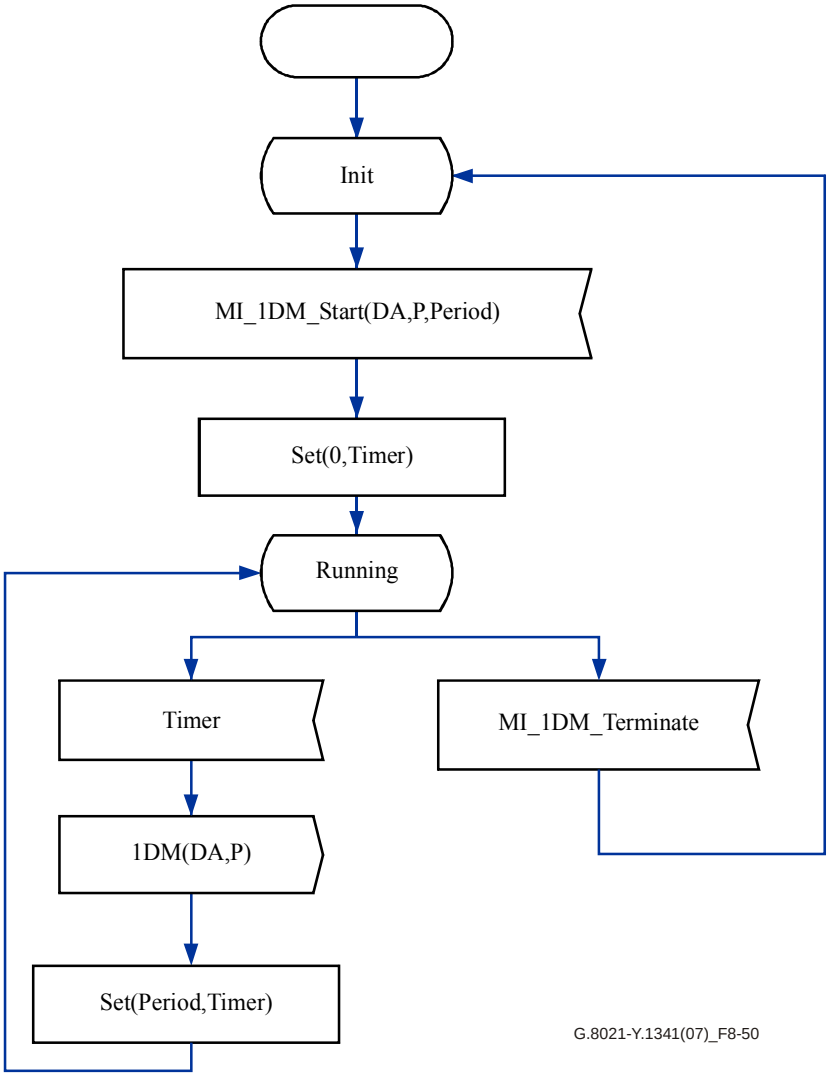

Figure 8-50 – 1DM control_So behaviour

8.1.11.3 1DM generation process

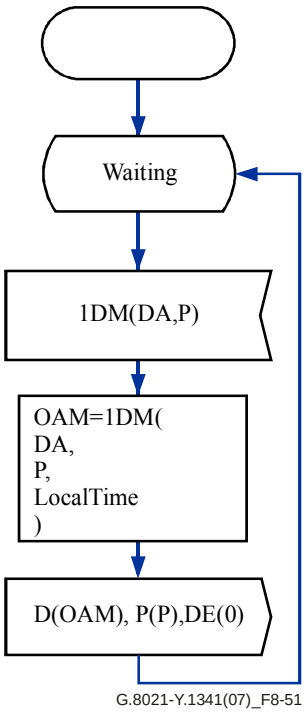

Figure 8-51 – 1DM generation behaviour

Figure 8-51 shows the 1DM generation process. Upon receiving the 1DM(DA,P) signal, a single 1DM traffic unit is generated by the OAM=1DM (DA,P,LocalTime) call.

Together with this 1DM traffic unit, the complementing P and DE signals are generated. The DA of the generated 1DM traffic unit is determined by the 1DM(DA) signal. The TxTimeStampf field is assigned the value of the local time. The value of the P signal is determined by the 1DM(P) signal. The DE signal is set to 0.

The resulting traffic unit is shown in Figure 8-52.

NOTE – In the generated 1DM traffic unit, in the OAM (MEP) insertion process, the SA will be assigned the local MAC address, and the MEL will be assigned by MI_MEL.

	1								2								3								4							
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	DA=1DM(DA)																															
5																	SA=Undefined															
9																																
13	Ethertype=89-02																MEL= Undef				Version=0				Opcode=45(1DM)							
17	Flags=0								TLV Offset =16								TxTimeStampf=Local Time															
21																																
25																	RxTimeStampf=0															
29																	Used by 1DM reception process															
33																	END TLV=0															

Figure 8-52 – 1DM traffic unit

8.1.11.4 1DM reception process

The 1DM reception process processes the received 1DM traffic units and the complementing P and DE signals. The behaviour is defined in Figure 8-53.

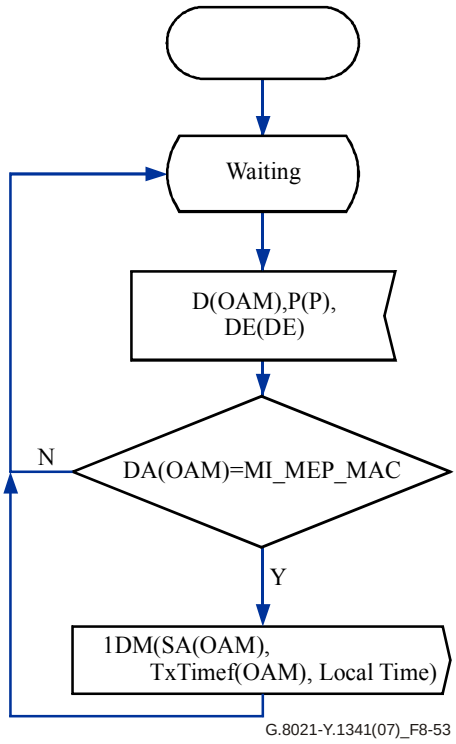

Figure 8-53 – 1DM reception behaviour

Upon receipt of an 1DM traffic unit, the DA field is checked. The 1DM traffic unit is processed if the DA is equal to the local MAC address and ignored otherwise.

If the 1DM traffic unit is processed, the SA and TxTimeStampf fields are extracted and forwarded to the 1DM control_Sk process together with the local time using the 1DM(SA,Tx,Rx) signal.

8.1.11.5 1DM control_Sk process

Figure 8-54 shows the behaviour of the 1DM control_Sk process. The MI_1DM_Start (SA) signal starts the processing of 1DM messages coming from a MEP with SA as MAC address. The protocol runs until the receipt of the MI_1DM_Terminate signal.

While running, the process processes the received 1DM(rSA,Tx,Rx) information. First, the rSA is compared with the SA from the MI_1DM_Start (SA) signal. If the rSA is not equal to this SA, the information is ignored. Otherwise, the delay from the single received 1DM traffic unit is calculated and communicated via the 1DM_Output(delay) signal.

Note that the further processing of the measured delay values is for further study.

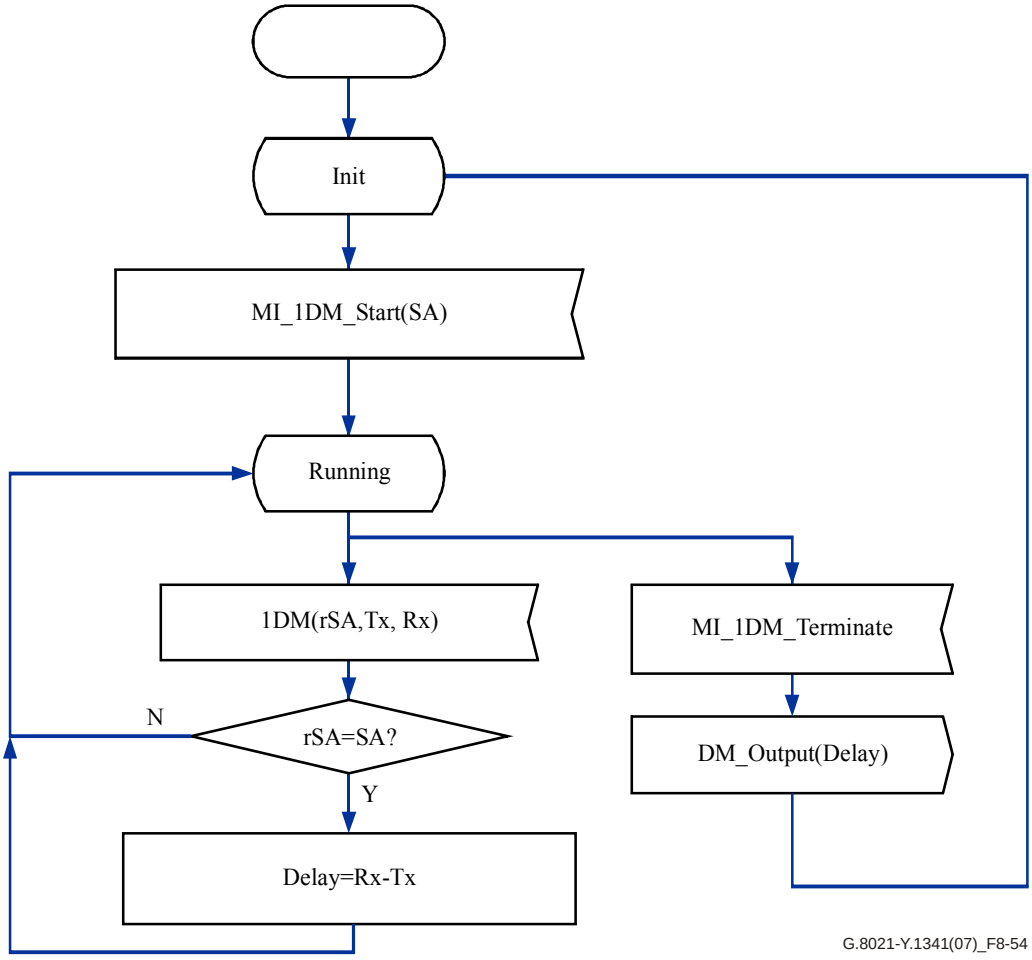

Figure 8-54 – 1DM control_Sk process

8.1.12 Test protocol

8.1.12.1 Overview

Figure 8-55 shows the different processes inside MEPs and MIPs that are involved in the test protocol.

The MEP OnDemand-OAM source insertion process is defined in clause 9.4.1.1, the MEP OnDemand-OAM sink extraction process in clause 9.4.1.2, the MIP OnDemand-OAM sink extraction process in clause 9.4.2.2, and the MIP OnDemand-OAM source insertion process in clause 9.4.2.1. In summary, they insert and extract ETH_CI OAM signals into and from the stream of ETH_CI_D traffic units together with the complementing P and DE signals going through an MEP and MIP; the extraction is based on MEL and Opcode. Furthermore, the insertion process inserts the correct MEL and SA values in the OAM traffic units.

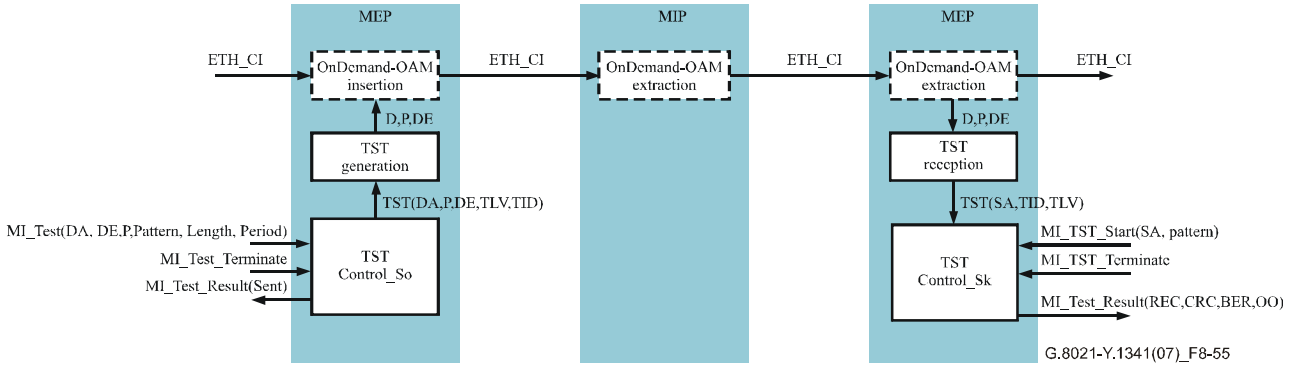

Figure 8-55 – Overview of processes involved with test protocol

The TST protocol is controlled by the TST control_So and TST control_Sk processes. The TST control_So process triggers the generation of TST traffic units after the receipt of an MI_TST_Start(DA,DE,P,Pattern,Length,Period) signal. The TST control_Sk process processes the information from received TST traffic units after receiving the MI_TST_Start(SA,Pattern) signal.

The TST generation process generates TST messages that pass transparently through MIPs and are received and processed by the TST reception process in MEPs.

The processes are defined below.

8.1.12.2 TST control_So process

Figure 8-56 defines the behaviour of the TST control_So process. This process triggers the transmission of TST traffic units after receiving the MI_Test(DA,DE,P,Pattern,Length,Period) signal. The transmission of TST traffic units is triggered by the generation of the TST(DA,P,DE,TLV,TID) signal. This is continued until the receipt of the MI_Test_Terminate signal. After receiving this signal, the number of triggered TST traffic units is reported back using the MI_Test_Result(Sent) signal.

The TLV field of the TST frames is determined by the generate (Pattern, Length) function. For pattern, the following types are defined:

0: "Null signal without CRC-32".

1: "Null signal with CRC-32".

2: "PRBS 2^31-1 without CRC-32".

3: "PRBS 2^31-1 with CRC-32".

The length parameter determines the length of the generated TLV.

Generate(Pattern, Length) generates a test TLV with length 'Length' to be included in the TST frame. Therefore, this TLV is passed using the TST(DA,P,DE,TLV,TID) signal to the TST generation process.

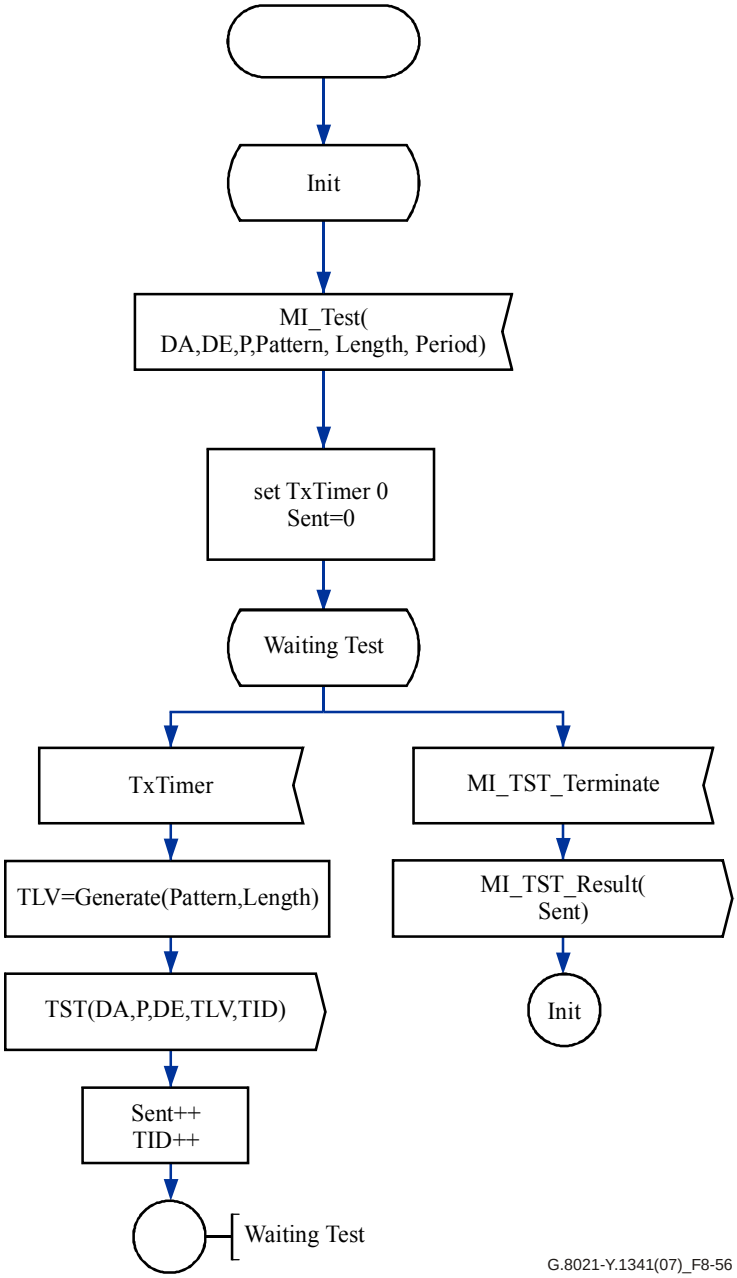

Figure 8-56 – TST control_So behaviour

8.1.12.3 TST generation process

Figure 8-57 defines the behaviour of the TST generation process.

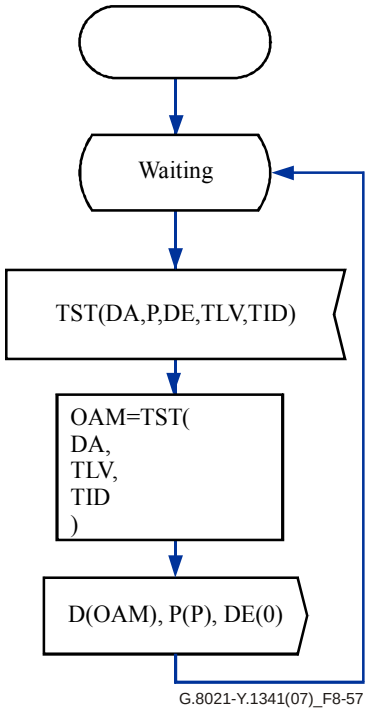

Figure 8-57 – TST generation behaviour

Upon receiving the TST(DA,P,DE,TLV,TID), a single TST traffic unit is generated together with the complementing P and DE signals. The TST traffic unit is generated by:

OAM=TST(DA,TLV,TID).

The DA of the generated TST traffic unit is determined by the TST(DA) signal. The transaction identifier field gets the value of TST(TID); the TLV field is populated with TST(TLV). The resulting TST traffic unit is shown in Figure 8-58.

NOTE – In the generated TST traffic unit, in the OAM (MEP) insertion process, the SA will be assigned the local MAC address, and the MEL will be assigned by MI_MEL.

The P signal is determined by the TST(P) signal.

The DE signal is set to 0.

	1								2								3								4							
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	DA=TST(DA)																															
5																	SA=Undefined															
9																																
13	Ethertype=89-02																MEL= Undef				Version=0				Opcode=37(TST)							
17	Flags=0								TLV Offset =4								Transaction Identifier=TST(TID)															
21	Transaction identifier continued																TST(TLV)															
25																																
29																																
33																	END TLV=0															

Figure 8-58 – TST traffic unit

8.1.12.4 TST reception process

Figure 8-59 defines the behaviour of the TST reception process.

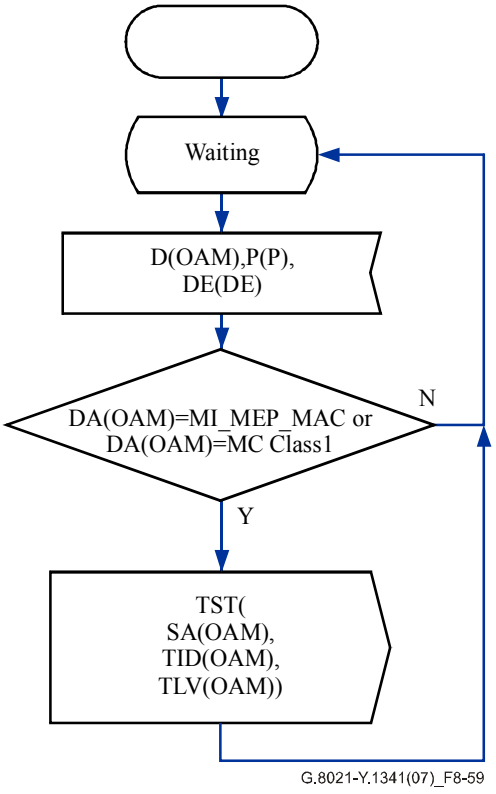

Figure 8-59 – TST reception behaviour

First the DA is checked, it should be the local MAC address (as configured via MI_MEP_MAC) or a multicast class 1 address, otherwise the frame is ignored.

If the DA is the local MAC or a multicast class 1 address, the SA, TID and TLV fields from the TST traffic unit are forwarded using the TST signal.

8.1.12.5 TST control_Sk process

Figure 8-60 shows the behaviour of the TST control_Sk process. The MI_ TST_Start (SA) signal starts the processing of TST messages coming from a MEP with SA as MAC address. The protocol runs until the receipt of the MI_TST_Terminate signal.

While running, the process processes the received TST(rSA,rTLV,TID) information. First, the rSA is compared with the SA from the MI_ TST_Start (SA) signal. If the rSA is not equal to this SA, the information is ignored. Otherwise the received information is processed.

First, the received TST counter is incremented by one (REC++). Furthermore, if the TLV contains a CRC (pattern 1 or 3), the CRC counter is incremented by one (CRC++) if the CRC check fails. The function Check(Pattern, TLV) compares the received test pattern with the expected test pattern. If there is a mismatch, the BERR counter is incremented by one. If the TID value from the RI_LBR signal does not follow the last received TID value, the counter for out of order frames is incremented by one (OO++).

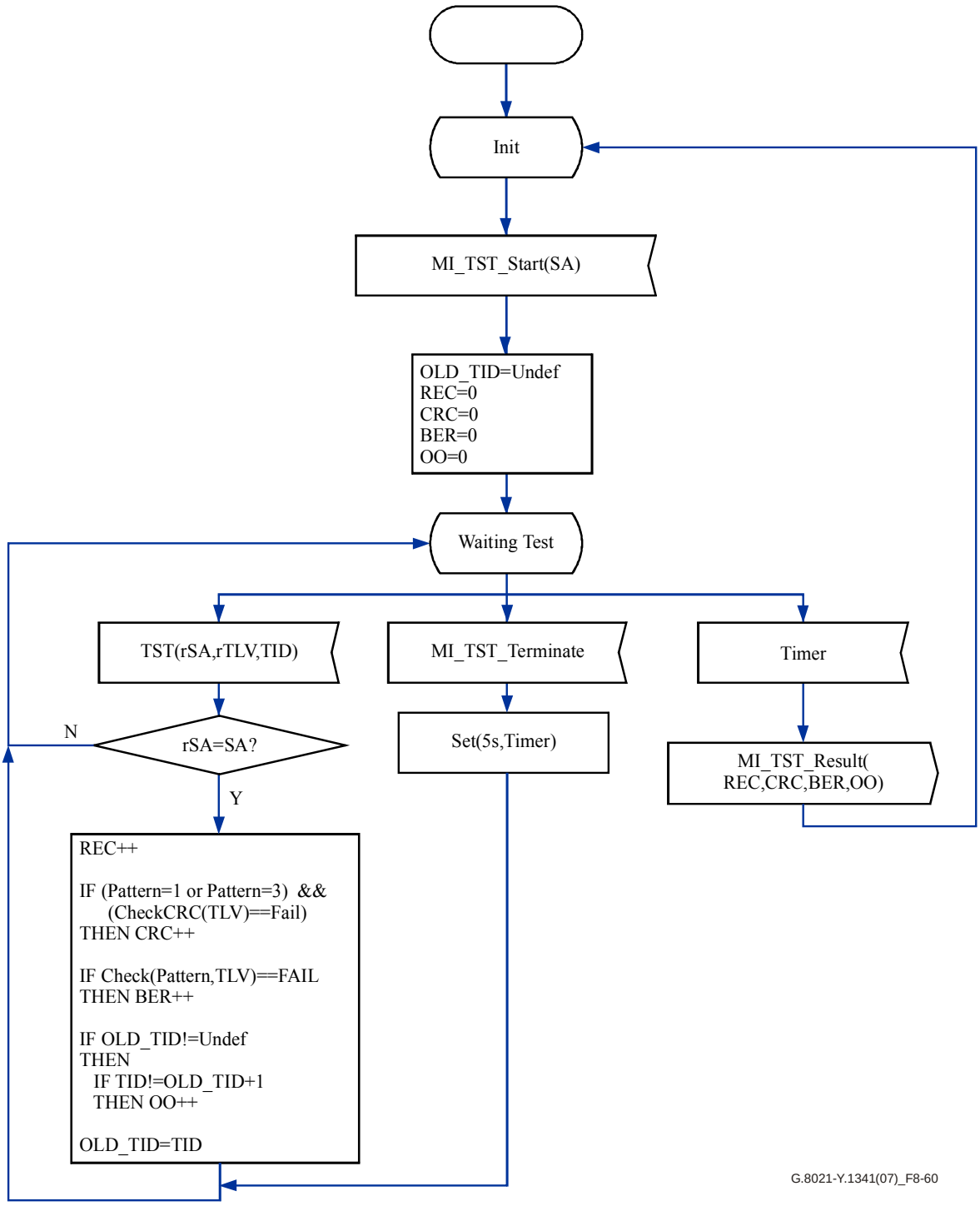

Figure 8-60 – TST control_Sk behaviour

8.1.13 Link trace protocol

8.1.13.1 Overview

Figure 8-61 shows the different processes involved in the link trace protocol.

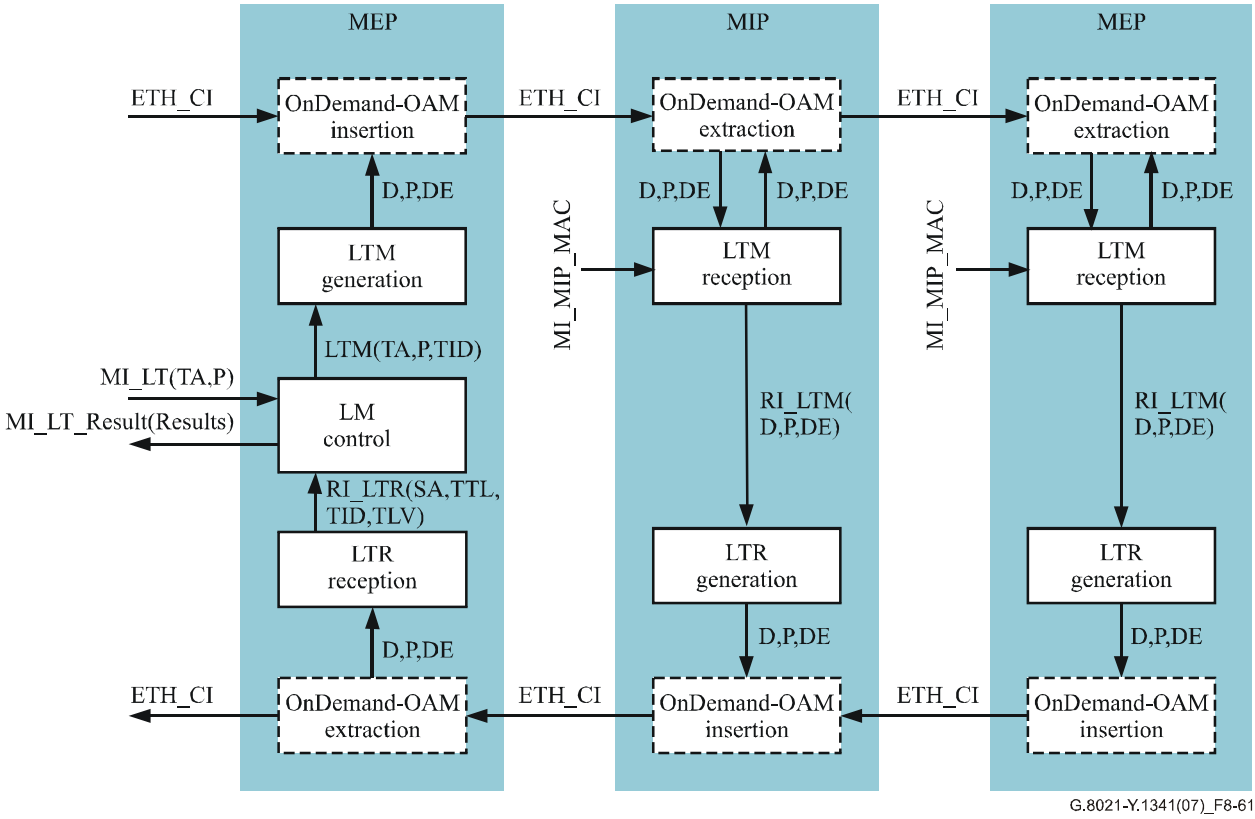

Figure 8-61 – LT protocol overview

The link trace protocol is started upon receipt of an MI_LT(TA,P) signal. The result of the process will be communicated back via the MI_LT_Result(Results) signal.

The LM control will trigger the transmission of an LTM traffic unit and then wait for the LTR traffic units that are sent in reply to this LTM traffic unit.

The LTM traffic unit is processed by LTM MIP reception processes and by LTM MEP reception processes. Depending on the DA given in the MI_LT(TA,P) signal, these processes may decide to trigger the transmission of an LTR traffic unit back to the source of the LTM traffic unit.

8.1.13.2 LT control process

Figure 8-62 shows the behaviour of the LT control process.

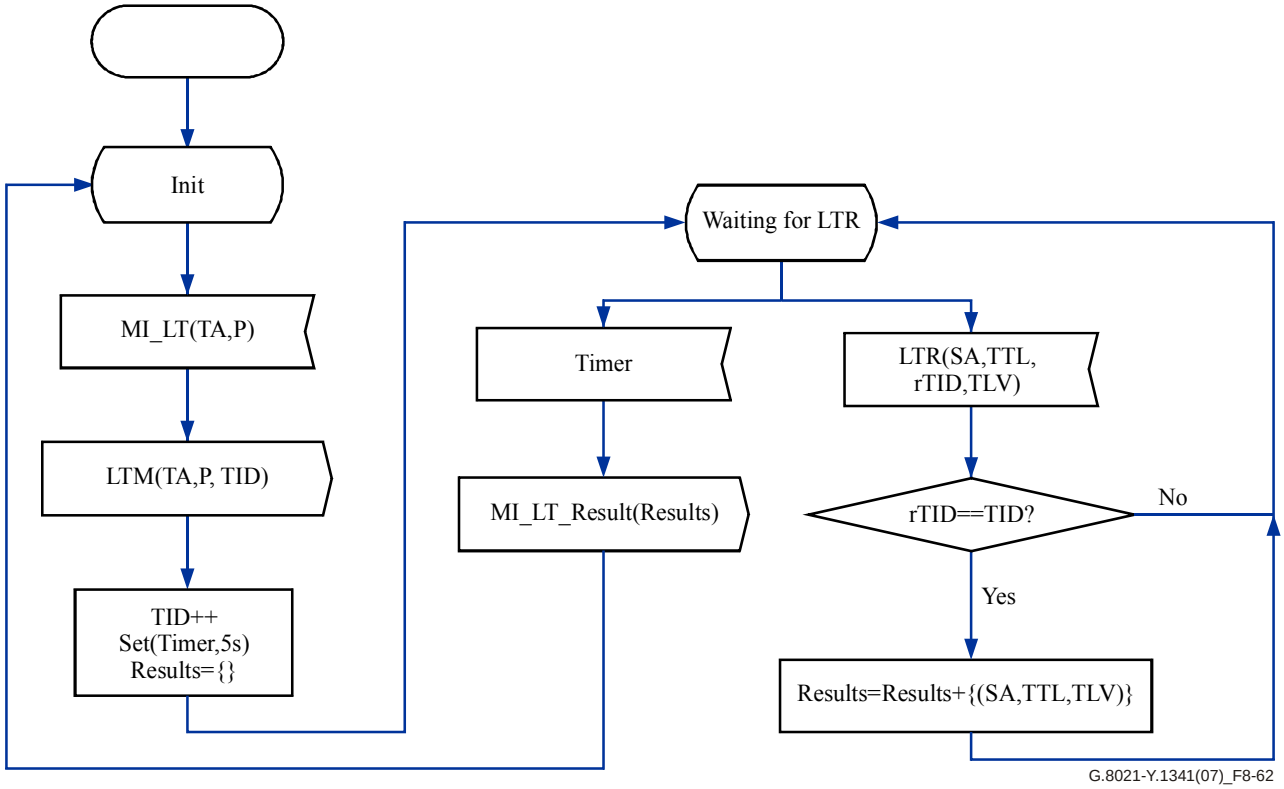

Figure 8-62 – LT control behaviour

After receiving the MI_LT(TA,P) input signal, the transmission of an LTM traffic unit is triggered. In the "waiting for LTR" state, the LTM control process waits for the LTR traffic units that will be sent in response. The waiting period is five seconds. For each received LTR traffic unit, the TID value in the received LTR traffic unit is compared with the one that was sent in the LTM traffic unit. If they are equal, the SA, TTL and TLV values are stored in the results. These results are communicated back using the MI_LT_Results signal after the five second waiting period is over.

8.1.13.3 LTM generation process

Figure 8-63 shows the behaviour of the LTM generation process.

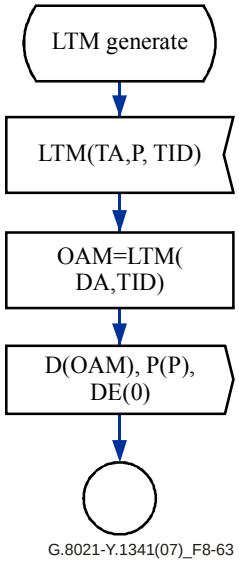

Figure 8-63 – LTM generation behaviour

The LTM generation process generates an LTM traffic unit with the function:

OAM=LTM(TA,TID) and the result is shown in Figure 8-64.

NOTE – In the generated LTM traffic unit, in the OAM (MEP) insertion process, the SA will be assigned the local MAC address, and the MEL will be assigned by MI_MEL. The value of the multicast class 1 DA is 01-80-C2-00-00-3y, where y is equal to MI_MEL as defined in [IEEE 802.1ag].

	1								2								3								4							
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	DA = 01-80-C2-00-00-3y where y is changed to MI_MEL by the OAM MIP insertion process.																															
5																	SA=Undefined															
9																																
13	Ethertype=(89-02)																MEL= undefined				Version=0				Opcode=03 (LTM)							
17	1	0	0	0	0	0	0	0	TLV Offset =17								Transaction ID=TID															
21	Transaction ID continued																MI_LTM_TTL=255								Orig. MAC							
25	Originating MAC = MI_MEP_MAC																															
29	Orig. MAC																Target MAC = TA															
33	Target MAC continued																								END TLV=0							

Figure 8-64 – LTM traffic unit

8.1.13.4 LTM reception process

Figure 8-65 shows the behaviour of the LTM reception process.

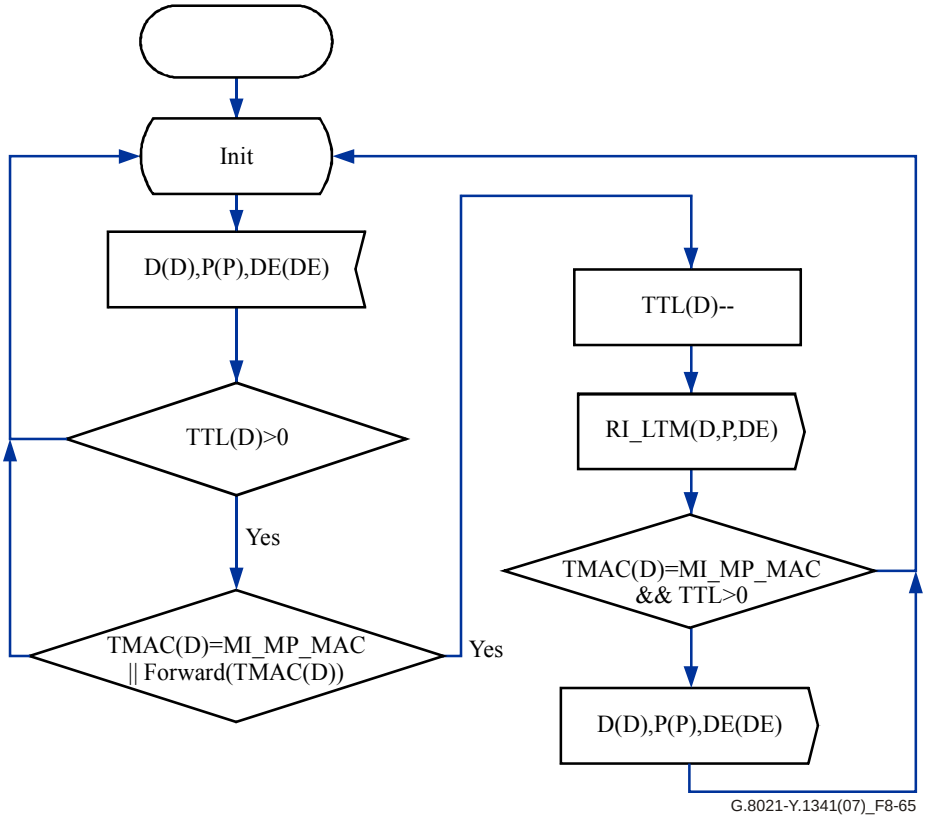

Figure 8-65 – LTM reception behaviour

Upon receipt of an LTM traffic unit, first the TTL is checked, only LTM traffic units with a TTL>0 are processed. Thereafter, the target MAC (TMAC) of the LTM traffic unit is checked.

There are two reasons to send back an LTR traffic unit. The first is if the TMAC in the LTM traffic unit is the MAC address of the MIP or MEP itself.

The second reason is summarized in Figure 8-65 as Forward(TMAC(D)). This function returns true if:

- the network element that the LTM reception process resides in would forward a normal data traffic unit with its DA equal to the TMAC on a single port; and
- the LTM reception process resides in this port (LTM in egress port), or the LTM traffic unit will be forwarded to that port (LTM in ingress port).

Furthermore, after triggering the transmission of an LTR traffic unit, the LTM traffic unit is forwarded if the TMAC was not the MAC of the MEP or MIP and if the TTL>0.

8.1.13.5 LTR generation process

Figure 8-66 shows the behaviour of the LTR generation process.

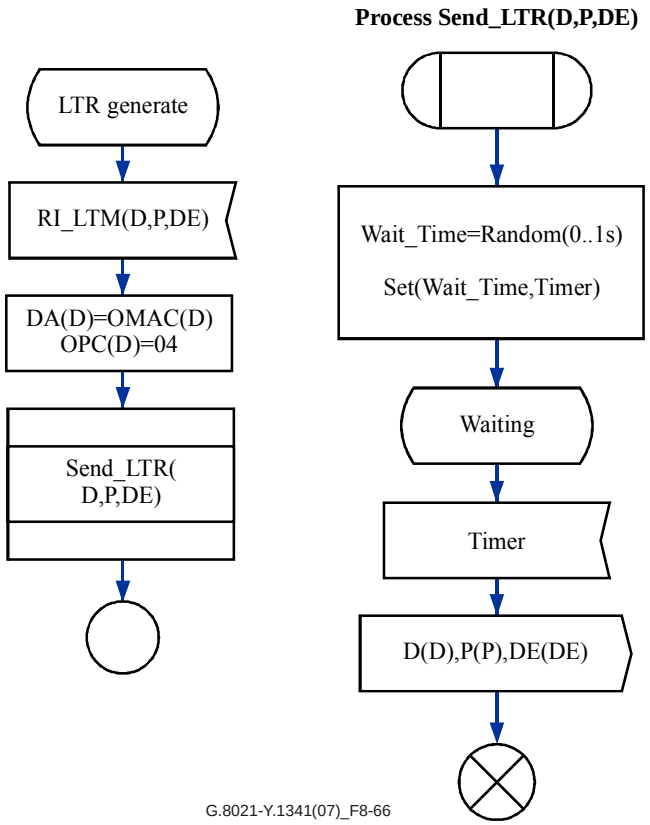

Figure 8-66 – LTR generation behaviour

The LTR generation process generates the LTR traffic unit to be sent back, based on the LTM traffic unit. The DA of the LTR traffic unit is the originating MAC (orig MAC) as contained in the LTM traffic unit. The Opcode is the LTR Opcode. The resulting LTR traffic unit is shown in Figure 8-67. The SA and MEL will be overwritten by the OAM insertion process. The LTR traffic unit is sent back after a random delay between 0 and 1 second.

NOTE – In the generated LTR, in the OAM (MEP) insertion process, the SA will be overwritten with the local MAC address, and the MEL will be overwritten with MI_MEL.

	1								2								3								4							
	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1	8	7	6	5	4	3	2	1
1	DA = Orig MAC(D)																															
5																	SA															
9																																
13	Ethertype=89-02																MI_MEL								Version=0							
17	Flags=MI_LTR_Flags								TLV Offset =6								Transaction ID=MI_LTR_TID															
21	Transaction ID continued																TTL=MI_LTR_TTL								0 (reserved for IEEE)							
25	END TLV=0																															

Figure 8-67 – LTR traffic unit

8.1.13.6 LTR reception process

Figure 8-68 shows the behaviour of the LTR reception process.

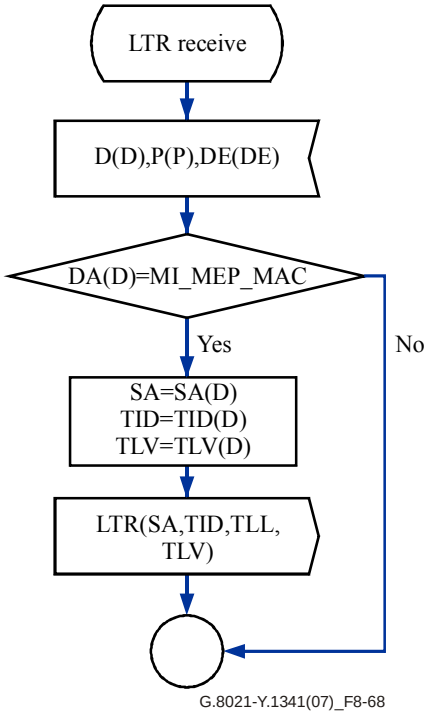

Figure 8-68 – LTR reception behaviour

The LTR reception process checks the DA of the received LTR traffic unit and passes the SA, TID, TLL and TLV fields from the LTR traffic unit to the LT control process.

8.2 Queuing process

The queuing process buffers the received ETH_CI_D for output (see Figure 8-69). The queuing process is also responsible for discarding frames if their rate at the ETH_CI_D is higher than the <server>_AI_D can accommodate, as well as maintaining PM counters for discarded frames. Additional performance monitor counters (MI_PM_count) per [IEEE 802.1Q] are for further study.

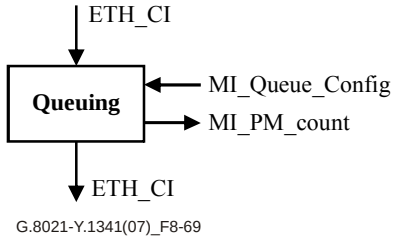

Figure 8-69 – Queuing process

The queuing process is configured using the MI_Queue_Config input parameter. This parameter specifies the mapping of ETH_CI_D into the available queues based on the value of the ETH_CI_P signal.

Furthermore, it specifies whether the value of the ETH_CI_DE signal should be taken into account when discarding frames. If this needs to be taken into account, ETH_CI with ETH_CI_DE set to drop eligible should have a higher probability of being discarded than ETH_CI with ETH_CI_DE set to drop ineligible.

8.3 Filter process

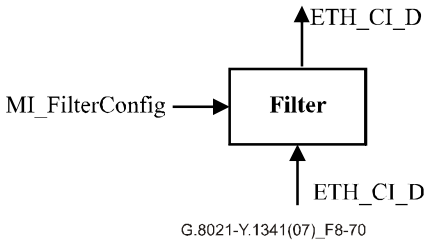

Figure 8-70 – Filter process

The filter process maintains the filter action for each of the 33 group MAC addresses indicating control frames as defined in clause 6.3 of [ITU-T G.8012]. Valid filter actions are "pass" and "block". The filter action for these 33 MAC addresses can be configured separately. If the destination address of the incoming ETH_CI_D matches one of the above addresses, the filter process shall perform the corresponding configured filter action:

- Block: The frame is discarded by the filter process;
- Pass: The frame is passed unchanged through the filter process.

If none of the above addresses match, the ETH_CI_D is passed.

Valid filter actions for specific services are indicated in the ITU-T G.8011.x-series of Recommendations for services supported by those Recommendations. The default filter action value shall be "pass" for all frames with the exception of MAC control frames for which the default value shall be "block".

8.4 Replicate process

See Figure 8-71.

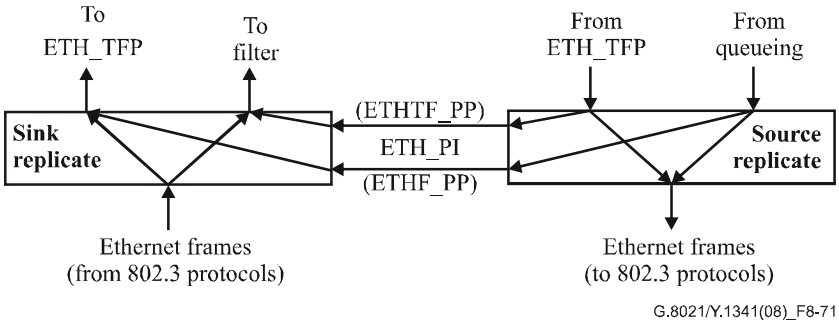

Figure 8-71 – Replicate processes

The <Srv>/ETH_A_So replicate process shall:

- replicate ETH_CI traffic units received on the input from the queuing process and deliver them as ETH_PI to the ETHF_PP interface and the 802.3 protocols process;
- replicate ETH_CI traffic units received on the input from the ETH_TFP and deliver them as ETH_PI to the ETHTF_PP interface and 802.3 protocols process.

The <Srv>/ETH_A_Sk replicate process shall:

- replicate ETH_CI traffic units received on the input from the 802.3 protocols process and deliver them to the ETH_TFP and to the filter process;

- deliver ETH_PI traffic units received on the input from the ETHF_PP interface to the ETH_TFP;
- deliver ETH_PI traffic units received on the input from the ETHTF_PP to the filter process.

8.5 802.3 protocols processes

802.3 protocols processes include source and sink handling of MAC control and optionally IEEE 802.3 slow protocols, as shown in Figure 8-72. The following subclauses specify processes for each of the illustrated process blocks.

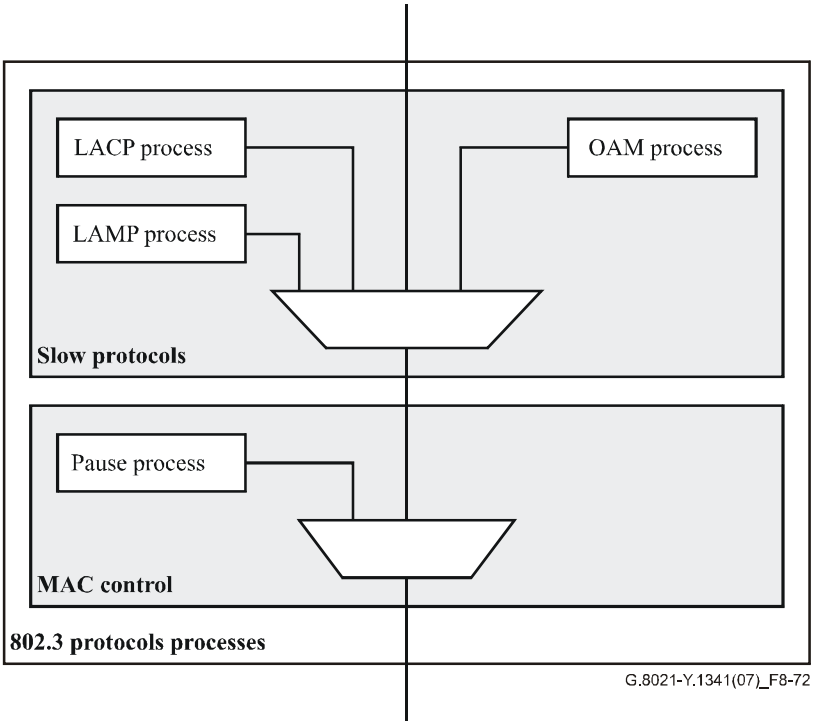

Figure 8-72 – 802.3 protocols processes

8.5.1 MAC control process

The Ethernet MAC control function specified in clause 31 of [IEEE 802.3 2002] shall be implemented in all interfaces conforming to this Recommendation.

The process intercepts all MAC control frames, other frames are passed through unchanged. MAC control frames are characterized by the length/type value that is used (88-08). Every MAC control frame contains an Opcode. MAC control frames are handled based on the value of the Opcode. If the Opcode is not supported, the frame is discarded. If the Opcode is supported, the frame is processed by the corresponding MAC control function. In Annex 31A of [IEEE 802.3 2002] the Opcode assignment is defined.

8.5.1.1 802.3 pause processes

The pause process handles MAC control frames with the Opcode value 00-01, as described in Annex 31B of [IEEE 802.3 2005]. There are two kinds of pause processes: Pause transmit process and pause receive process.

8.5.1.1.1 Pause transmit process

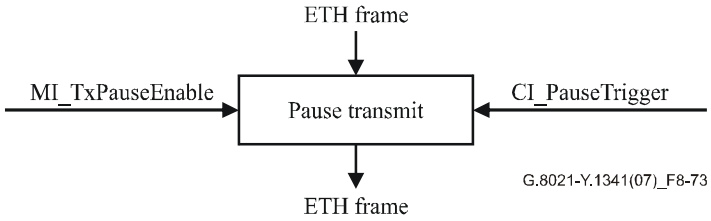

Figure 8-73 – Pause transmit process

If enabled (MI_TxPauseEnable = true), this optional process generates pause frames according to clause 31 and Annexes 31A and 31B of [IEEE 802.3 2005].

The generation of the pause frame is triggered as soon as a CI_PauseTrigger is received. The CI_PauseTrigger primitive that has triggered the pause frame generation conveys the pause_time parameter used in the generated pause frame.

The CI_PauseTrigger is generated as a result of the 802.3 service interface signal MA_CONTROL.request described in clause 2.3.3 of [IEEE 802.3 2002]. The generation of the MA_CONTROL.request is outside of the scope of this Recommendation.

8.5.1.1.2 Pause receive process

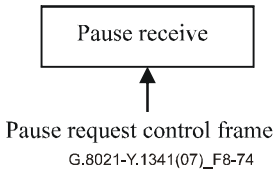

Figure 8-74 – Pause receive process

On receipt of a pause request control frame, no action shall be performed (i.e., the pause request control frame shall be silently discarded).

8.5.2 802.3 slow protocols process

This optional process inspects all slow protocol frames, other frames are passed through unchanged. Slow protocol frames are characterized by the length/type value that is used (88-09). Every slow protocol frame contains a subtype field that distinguishes between different slow protocols. Table 43B-3 of [IEEE 802.3 2002] defines the assignment of subtypes to protocols. The processing of the slow protocol frames depends on the value of the subtype field. There are three options:

- Illegal: The subtype field contains an illegal value (>10) and is discarded.
- Unsupported: The subtype field indicates a protocol that is not supported and the frame is passed through.
- Supported: The subtype field indicates a protocol that is supported, the frame is processed by the corresponding protocol function.

8.5.2.1 LACP process

The LACP process inserts and extracts LACP PDUs. LACP PDUs have a subtype=1. The LACP PDUs are processed and generated by the aggregation control process in the ETY-Np/ETH-LAG-Na_A adaptation function (clause 9.7.1.1, see Figures 9-53 and 9-55).

8.5.2.2 LAMP process

The LAMP process inserts and extracts LAMP PDUs. LAMP PDUs have a subtype=2. The LAMP PDUs are processed and generated by the aggregation control process in the ETY-Np/ETH-LAG-Na_A adaptation function (clause 9.7.1.1, see Figures 9-53 and 9-55).

8.5.2.3 OAM process

The OAM process generates and processes OAM frames according to clause 57 of [IEEE 802.3 2005]. The OAM PDUs have subtype=3.

8.6 MAC length check

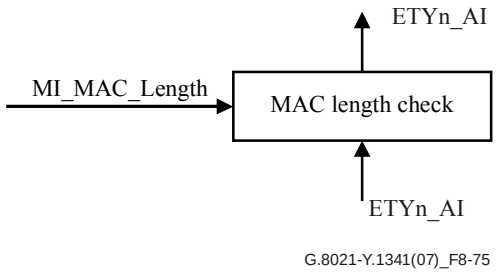

Figure 8-75 – MAC length check function

This process checks whether the length of the MAC frame is allowed. When the processed signal is ETYn_AI frames shorter than 64 bytes are discarded. Frames longer than MI_MAC_Length are passed.

Note that frames shorter than 64 bytes are only foreseen on non-ETYn interfaces in connection with removal of VLAN tags. Such frames must be padded to a length of 64 bytes according to clause 4 of [IEEE 802.3 2005].

Table 8-4 shows the values corresponding to the IEEE-defined frame lengths.

Table 8-4 – IEEE 802.3 MI_MAC_Length values

Frame type	MI_MAC_Length
Basic	1518
Q-tagged	1522
Envelope	2000

8.7 MAC frame counter

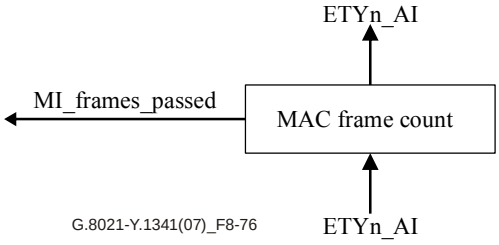

Figure 8-76 – MAC frame count function

This process passes MAC frames and counts the number of frames that are passed.

8.8 "Server-specific" common processes

For some server signals, MAC FCS generation is not supported. This will be defined in the server-specific adaptation functions.

8.8.1 MAC FCS generation

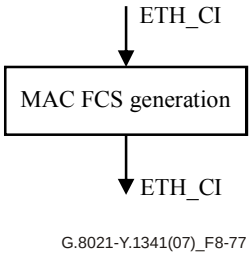

Figure 8-77 – MAC FCS generation process

The MAC FCS is calculated over the ETH_CI traffic unit and is inserted into the MAC FCS fields of the frame as defined in clause 4.2.3.1.2 of [IEEE 802.3 2005].

8.8.2 MAC FCS check

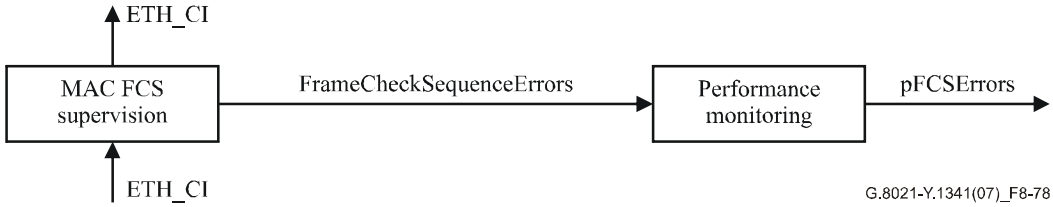

Figure 8-78 – MAC FCS check process

The MAC FCS is calculated over the ETH_CI traffic unit and checked as specified in clause 4.2.4.1.2 of [IEEE 802.3 2005]. If errors are detected, the frame is discarded. Errored frames are indicated by FrameCheckSequenceErrors.

8.8.3 802.1AB/X protocols processes

802.1AB/X protocols processes include source and sink handling of 802.1AB and 802.1X protocols, as shown in Figures 8-80 and 8-79. These processes are used in ETYn/ETH_A functions.

The following clauses specify processes for each of the illustrated process blocks.

8.8.3.1 802.1X protocol

The 802.1X protocol block implements the port-based network access control as per [IEEE 802.1X].

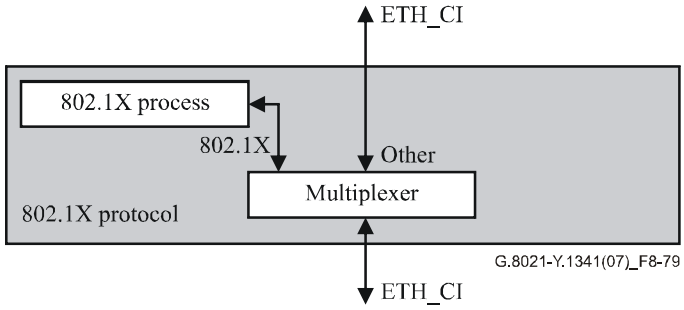

Figure 8-79 – 802.1X protocol processes

In the sink direction, the multiplexer separates the 802.1X PDUs from the rest of the frames based on MAC address 01-80-C2-00-00-03. The former are delivered to the 802.1X process, the latter are passed on in the sink direction. In the source direction, 802.1X PDUs are multiplexed with the rest of the frames.

In the function descriptions in which it appears, the 802.1X process is optional.

8.8.3.2 802.1AB protocol

The 802.1AB protocol block implements the link layer discovery protocol as per [IEEE 802.1AB].

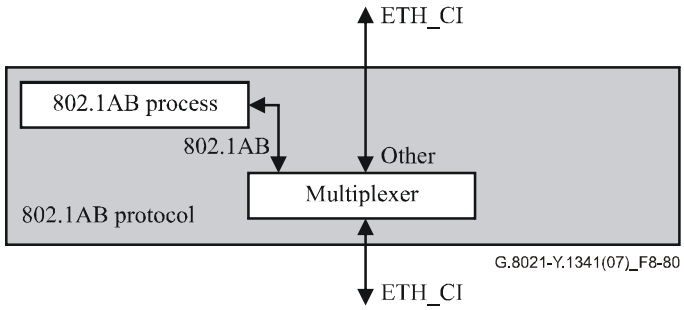

Figure 8-80 – 802.1AB protocol processes

In the sink direction, the multiplexer separates the 802.1AB PDUs from the rest of the frames. The former are delivered to the 802.1AB process, the latter are passed on in the sink direction. In the source direction, 802.1AB PDUs are multiplexed with the rest of the frames. Frames are defined by: MAC address 01-80-C2-00-00-0E, Ethertype 88-CC.

In the function description in which it appears, the 802.1AB process is optional.

8.8.4 Link quality supervision

Counts of transmitted and received octets and frames are maintained in <Srv>/ETH_A functions per the requirements of clause 30 of [IEEE 802.3 2005]. Discarded jabber frames are counted in ETYn/ETH_A_So functions.

Additional link quality performance monitors per clause 30 of [IEEE 802.3 2002] are for further study.

8.8.5 FDI/BDI generation and detection

For further study.

8.9 QoS-related processes

8.9.1 Queue

The queue process stores received ETH_CI traffic units and associated signals, and forwards a traffic unit if requested to do so by the connected process.

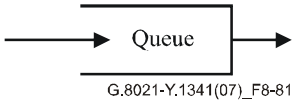

Figure 8-81 – Queue process

There are several parameters on the queue:

- Queue depth: The maximum size of the queue in bytes. An incoming ETH_CI traffic unit is dropped if there is insufficient space to hold the whole unit.
- Dropping threshold: If the queue is filled beyond this threshold, incoming ETH_CI traffic units accompanied by the ETH_CI_DE signal set are dropped.

8.9.2 Priority splitter

The priority splitter process forwards received ETH_CI onto different output ports depending on the value of the ETH_CI_P signal.

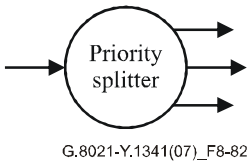

Figure 8-82 – Priority splitter function

The mapping of ETH_CI_P values to output ports of the priority splitter function needs to be configured.

8.9.3 Priority merger

The priority merger process forwards received ETH_CI on one of its input ports to a single output port.

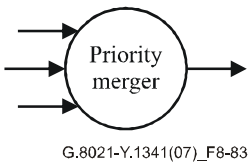

Figure 8-83 – Priority merger function

Nothing has to be configured on this process.

8.9.4 Conditioner

The conditioner determines the conformance of the incoming ETH_CI traffic units. The level of conformance is expressed as one of three colours; green, yellow or red.

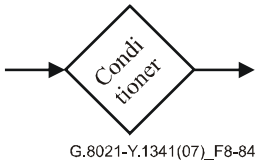

Figure 8-84 – Conditioner process

Red conformance means that the ETH_CI traffic unit is discarded; Yellow conformance means that for the ETH_CI traffic units the associated ETH_CI_DE signal is set to True; Green conformance means that the ETH_CI traffic unit is forwarded unchanged and the ETH_CI_DE signal is set to false.

Compliance for a bandwidth profile is described by 4 parameters. The parameters are:

1) Committed information rate (CIR) expressed as bits per second. CIR must be ≥ 0.
2) Committed burst size (CBS) expressed as bytes. When CIR > 0, CBS must be ≥ maximum transmission unit size allowed to enter the function.
3) Excess information rate (EIR) expressed as bits per second. EIR must be ≥ 0.
4) Excess burst size (EBS) expressed as bytes. When EIR > 0, EBS must be ≥ maximum Ethernet frame allowed to enter the network.

Two additional parameters are used to determine the behaviour of the bandwidth profile algorithm. The algorithm is said to be in colour-aware mode when each incoming Ethernet frame already has a level of conformance colour associated with it and that colour is taken into account in determining the level of conformance to the bandwidth profile parameters. The bandwidth profile algorithm is said to be in colour-blind mode when the level of conformance colour (if any), already associated with each incoming Ethernet frame, is ignored in determining the level of conformance. Colour-blind mode support is required at the UNI. Colour-aware mode is optional at the UNI.

1) Coupling flag (CF) must have only one of two possible values, 0 or 1.
2) Colour mode (CM) must have only one of two possible values, "colour-blind" and "colour-aware".

All these parameters have to be configured at the conditioner function. The conformance algorithm is defined in [MEF 10.1].

8.9.5 Scheduler

The scheduler process forwards ETH_CI from its input ports to the corresponding output ports of the scheduler function according to a specified scheduling algorithm.

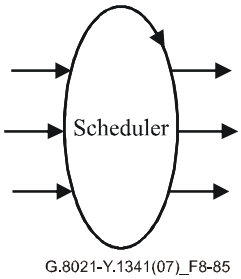

Figure 8-85 – Scheduler process

The scheduling algorithm and its parameters must be configured.

The scheduling algorithms are for further study.

9 Ethernet MAC layer (ETH) functions

Figure 1-1 illustrates all the ETH layer network, server and client adaptation functions. The information crossing the ETH flow point (ETH_FP) is referred to as the ETH characteristic information (ETH_CI). The information crossing the ETH access point (ETH_AP) is referred to as ETH adapted information (ETH_AI).

ETH sublayers can be created by expanding an ETH_FP as illustrated in Figure 9-1.

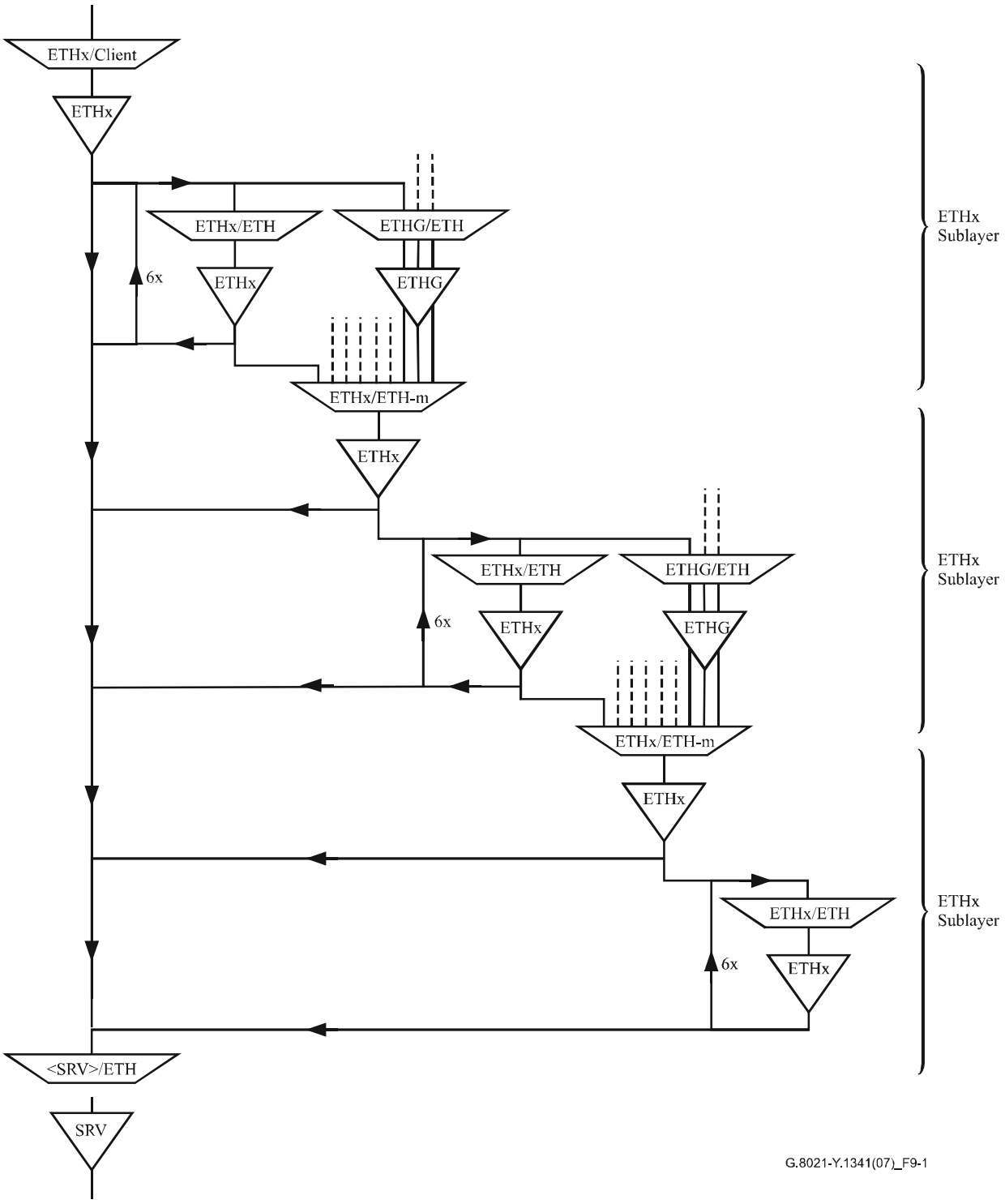

Figure 9-1 – ETH sublayering

Figure 9-1 illustrates the basic flow termination and adaptation functions involved and the possible ordering of these functions. The ETHx/ETH-m functions multiplex ETH_CI streams. The ETHx and ETHG flow termination functions insert and extract the pro-active Y.1731 OAM information (e.g., CCM). The ETHDy flow termination functions insert and extract the on-demand Y.1731 OAM information (e.g., LBM, LTM). The ETHx/ETH adaptation functions insert and extract the administrative and management Y.1731 OAM information (e.g., LCK, APS).

Any combination that can be constructed by following the directions in the figure is allowed. Some recursion is allowed as indicated by the arrows upwards; the number next to the arrow defines the number of recursions allowed.

Note that the ETHx sublayers in Figure 9-1 correspond to the ETH0 (top), ETH1 (middle) and ETH2 (bottom) in Figure 7-5 of [ITU-T G.8010].

ETH characteristic information

The ETH_CI is a stream of ETH_CI traffic units complemented with ETH_CI_P, ETH_CI_DE and ETH_CI_SSF signals. An ETH_CI traffic unit defines the ETH_CI_D signal as illustrated in Figure 9-2. Each ETH_CI traffic unit contains a source address (SA) field, a destination address (DA) field and an M_SDU field, this can be further decomposed into a length/type field and a payload field; the payload field may be padded.

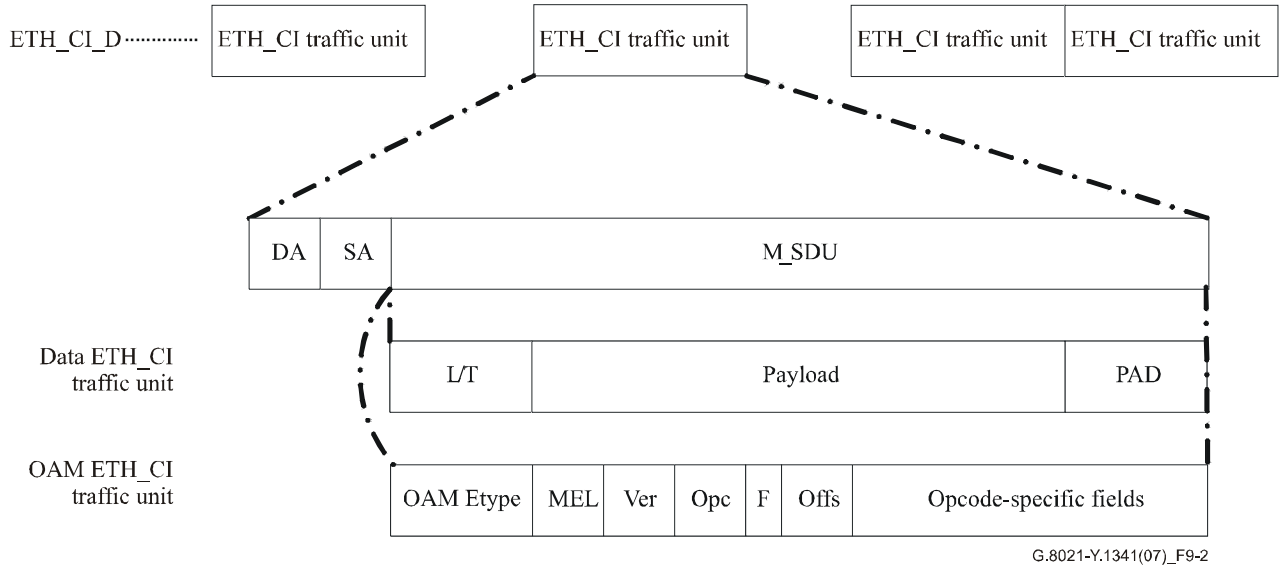

Figure 9-2 – ETH characteristic information

The SA and DA field contain 48-byte MAC addresses as defined in [IEEE 802.3 2005].

There are two types of ETH_CI traffic units: Data traffic units and OAM traffic units. If the L/T field equals the OAM Etype value (for further study, see Note 2), the ETH_CI traffic unit is an ETH_CI OAM traffic unit, otherwise it is an ETH_CI data traffic unit.

The payload field of an ETH_CI OAM traffic unit can be decomposed into the maintenance entity group level field (MEL), the version field (Ver), the Opcode field (Opc), the Flags field (F), the TLV offset field (Offs) and Opcode-specific fields. This structure of ETH_CI OAM traffic units is defined in clause 9 of [ITU-T Y.1731].

Functions for traffic units

The following functions are used in this Recommendation to indicate the various fields of a traffic unit:

- SA(Traffic_Unit): Returns the value of the SA field in the traffic unit.
- DA(Traffic_Unit): Returns the value of the DA field in the traffic unit.
- Etype(Traffic_Unit): Returns the value of the Ethertype field in the traffic unit.
- OPC(OAM Traffic_Unit): Returns the value of the Opcode field in the OAM traffic unit; returns undefined value if the traffic unit is not an OAM traffic unit.

- MEL(OAM Traffic_Unit): Returns the value of the maintenance entity group level field in the OAM traffic unit; returns undefined value if the traffic unit is not an OAM traffic unit.
- Flags(OAM Traffic_Unit): Returns the value of flags field in the OAM traffic unit; returns an undefined value if the traffic unit is not an OAM traffic unit.

NOTE 1 – The ETH_CI contains no VID field as the ETH_CI is defined per VLAN.

ETH adapted information

The ETH_AI is a stream of ETH_AI traffic units complemented with the following signals: ETH_AI_P, ETH_AI_DE and ETH_AI_TSF. The ETH_AI traffic units define the ETH_AI_D signal. The ETH_AI traffic unit structure is shown in Figure 9-3.

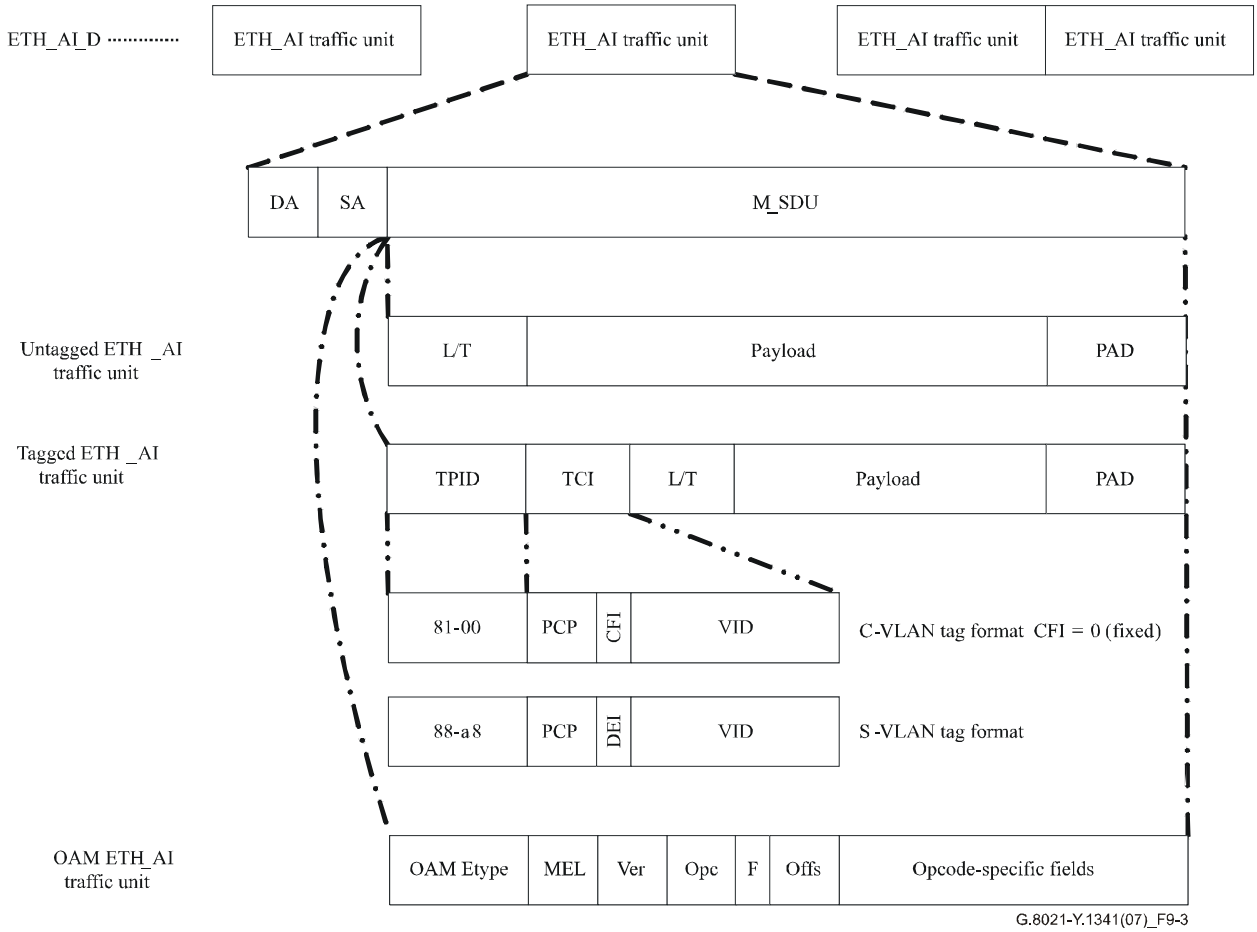

Figure 9-3 – ETH adapted information

The ETH_AI traffic unit contains the M_SDU and the DA and SA fields. The M_SDU field can be further decomposed into L/T, payload and PAD fields. These fields are the same as in ETH_CI traffic units.

There are three types of ETH_AI traffic units: Tagged, untagged and OAM traffic units. The tagged and untagged types are defined in [IEEE 802.1Q] and [IEEE 802.1ad]. The OAM traffic units are defined in [ITU-T Y.1731].

The L/T field determines the type of the ETH_AI traffic unit:

- If the L/T field contains the OAM Ethertype value (for further study, see Note 2), the traffic unit is an OAM traffic unit; otherwise.

- If the L/T field contains one of the tag protocol identifier values indicated in Figure 9-3, the traffic unit is a tagged traffic unit; otherwise.
- The traffic unit is an untagged traffic unit.

NOTE 2 – The OAM Ethertype is assigned as defined in [IEEE 802.1ag].

The payload field of an ETH_CI OAM traffic unit can be decomposed into the maintenance entity group level field (MEL), the version field (Ver), the Opcode field (Opc), the flags field (F), TLV offset field (Offs) and Opcode-specific fields, as for the ETH_CI OAM traffic units. This structure of ETH_CI OAM traffic units is defined in clause 9 of [ITU-T Y.1731].

There are two types of tagged traffic units: C-VLAN tagged and S-VLAN tagged. Each of these types has its own TPI value, 81-00 for C-VLAN tagged and 88-a8 for S-VLAN tagged, as defined in [IEEE 802.1Q] and [IEEE 802.1ad], respectively.

In a tagged frame (C-VLAN and S-VLAN tagged), a tag control information (TCI) field follows the TPI field. This field consists of a priority code point (PCP), VLAN ID (VID) and canonical format identifier (CFI) for C-VLAN tagged, or drop eligible indicator (DEI) field for S-VLAN tagged traffic units.

The PCP field may be used to carry the ETH_CI_P and ETH_CI_DE signal values from an ETH_FP. The DEI field may be used to carry the ETH_CI_DE signal from an ETH_FP.

All ETH_AI traffic units may come from one ETH_FP or from different ETH_FPs (in the case of multiplexing in ETHx/ETH-m_A Function). In the latter case, the VID field value is used to identify the ETH_FP that the traffic unit is associated with.

Note that because of the stacking of ETH sublayers, ETH_CI of a client ETH sublayer is encapsulated in ETH_AI to be transferred via a server ETH sublayer. Figure 9-4 shows an ETH_CI OAM traffic unit encapsulated in an ETH_AI data traffic unit. The grey fields constitute the original ETH_CI OAM traffic unit. The encapsulating traffic unit is no longer an OAM traffic unit, but a tagged traffic unit. Adding a VLAN tag hides the OAM information, and transforms an OAM ETH_CI traffic unit into an ETH_AI tagged traffic unit.

Figure 9-4 – Tagged ETH_AI carrying ETH_CI OAM

This ETH_AI tagged traffic unit will be transformed into an ETH_CI data traffic unit by the ETHx_FT source function, resulting in an ETH_CI data traffic unit carrying a client layer ETH_CI OAM traffic unit.

9.1 Connection functions

9.1.1 ETH flow forwarding function (ETH_FF)

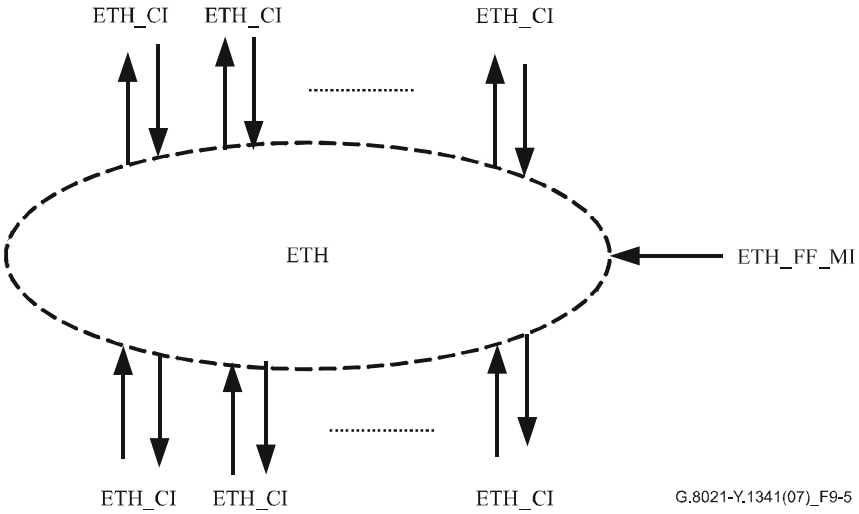

Figure 9-5 – ETH flow forwarding function

The ETH flow forwarding function, as shown in Figure 9-5, forwards ETH_CI signals at its input ports to its output ports. The forwarding may take into account the value of the SA field of the ETH_CI traffic unit.

Interfaces

Table 9-1 – ETH_FF interfaces

Inputs	Outputs
Per ETH_FP, n x for the function: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_FF_MP: MI_Flush_Learned MI_Flush_Config MI_Group_Default MI_ETH_FF MI_Ageing MI_Learning MI_STP_Learning_State[]	Per ETH_FP, n x for the function: ETH_CI_D ETH_CI_P ETH_CI_DE

Processes

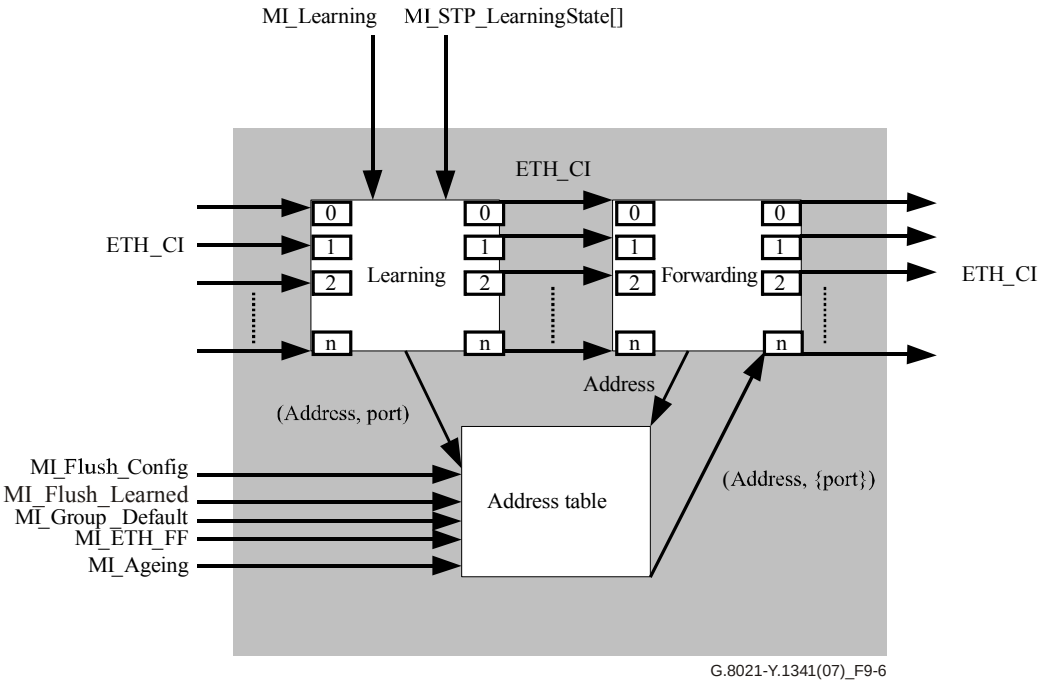

Figure 9-6 – ETH flow forwarding process

Figure 9-6 shows the ETH_FF in case of individual VLAN learning (IVL) mode. In this mode, each ETH_FF has its own address table. Figure 9-7 shows the process for the case of shared VLAN learning (SVL) mode. In this mode, two or more ETH_FF share the address table process.

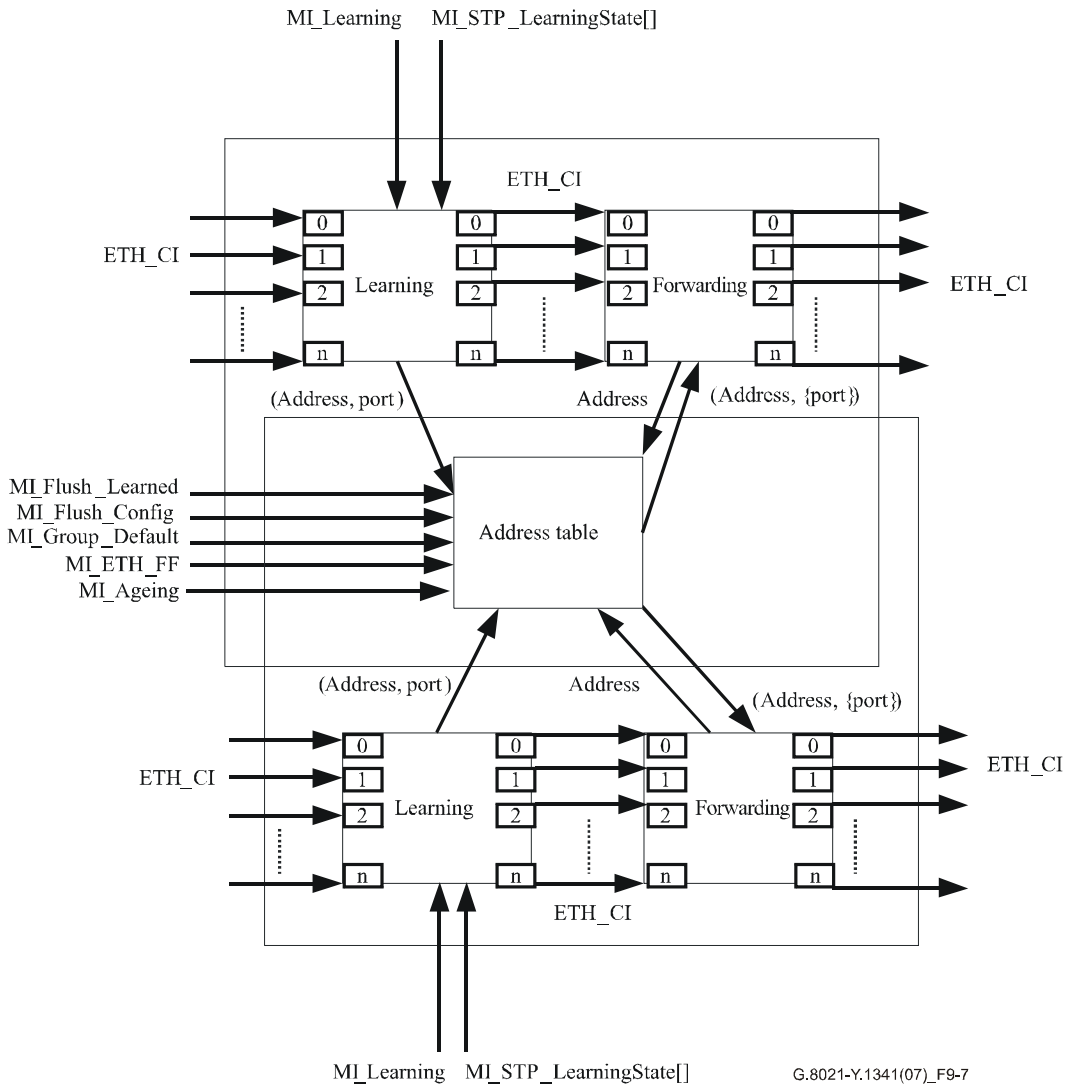

Figure 9-7 – ETH flow forwarding process in SVL mode

Address table process

The address table process maintains a list of tuples (address, {ports}). This list may be configured using ETH_FF_MI input signal and by the learning process.

A tuple received from the learning process is only stored in the address table process if there is no entry present for that MAC address that has been configured by the MI_ETH_FF input signal.

The MI_Ageing is used to provision the ageing time period for entries configured from the learning process. Entries received from the learning process are removed from the address table ageing time period after it was received. If, before the ageing time period has expired, a new entry for the same MAC address is received, the ageing time period starts again.

There is one specific value of MI_Ageing: "never". This means that the entries received from the learning process are never removed.

All the tuples received from the learning process can be cleared using the MI_Flush_Learned command.

All the tuples that are entered via the MI_ETH_FF can be cleared using the MI_Flush_Config command. Individual entries are removed via the MI_ETH_FF signal.

The address table process processes address requests from the Forwarding process, and responds with the tuple (address, {port}) for the specified address. For unicast MAC addresses, if the tuple does not exist, the port set ({port}) is empty. For multicast MAC addresses, if the tuple does not exist, the port set ({port}) contains the ports as configured using the MI_Group_Default input signal.

Learning process

If the value of MI_Learning is enabled, the learning process reads the SA field of the incoming ETH_CI traffic unit and forwards a tuple (address, {port}) to the address table process. The address contains the value of the SA field of the ETH_CI traffic unit, and the port is the port on which the traffic unit was received.

If the value of MI_Learning is disabled, the learning process does not submit information to the address table process.

In both cases, the ETH_CI itself is forwarded unchanged to the output of the learning process.

Forwarding process

The MI_STP_LearningState input signal can be used to configure a specific port to be in the learning state. If a port is in the learning state, this means that all frames received on that port will be discarded by the learning process, and therefore not forwarded to the forwarding process; however the (address, {port}) tuple may be submitted to the address table process before the frame is dropped (depending on the value of MI_Learning).

The forwarding process reads the DA field of the incoming ETH_CI traffic unit and sends this to the address table process, the address table will send a tuple (Address, {port}) back in response. It will forward the ETH_CI on all ports listed in the port set field of the tuple. If the port set is empty, the ETH_CI will be forwarded on all ports (flooding). In all cases, the ETH_CI is never forwarded on the same port as it was received on.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.1.2 ETH connection function (ETH_C)

Symbol

The ETH connection function as shown in Figure 9-8 forward ETH_CI signals at its input ports to its output ports.

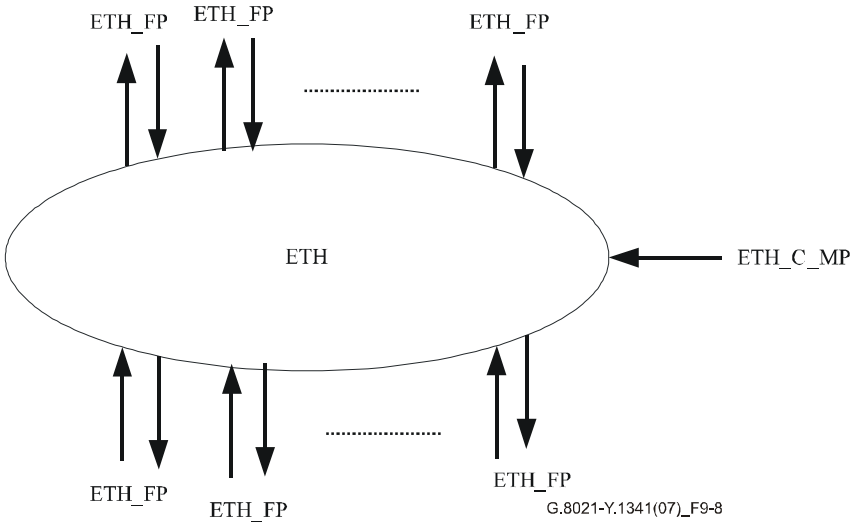

Figure 9-8 – ETH connection function

The actual forwarding is performed using ETH_FF functions interconnecting the input and output ports. Figure 9-9 shows an ETH connection function with several ETH_FF functions inside it.

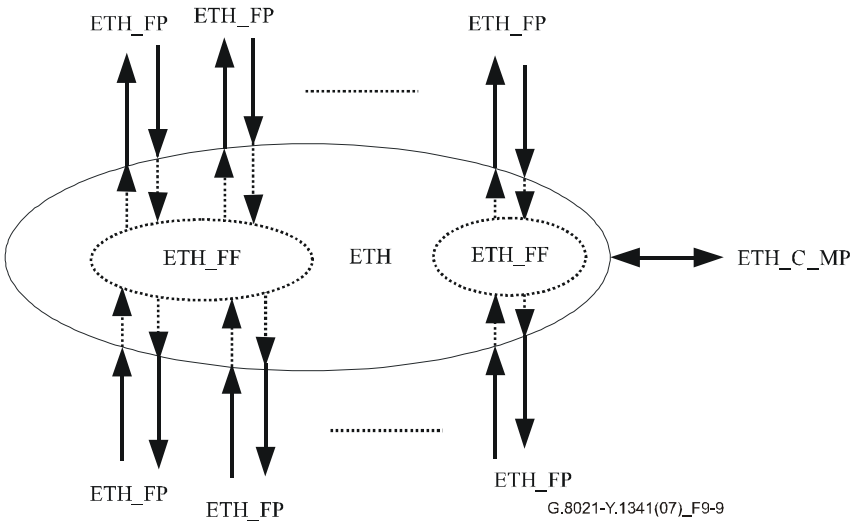

Figure 9-9 – ETH connection function with ETH_FF inside

Interfaces

Table 9-2 – ETH_C interfaces

Inputs	Outputs
Per ETH_FP, n x for the function: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_APS ETH_CI_SSF ETH_C_MP: ETH_C_Create_FF ETH_C_MP per ETH_FF: ETH_C_FF_Set_PortIds ETH_C_FF_ConnectionType	Per ETH_FP, n x for the function: ETH_CI_D ETH_CI_P ETH_CI_DE

Processes

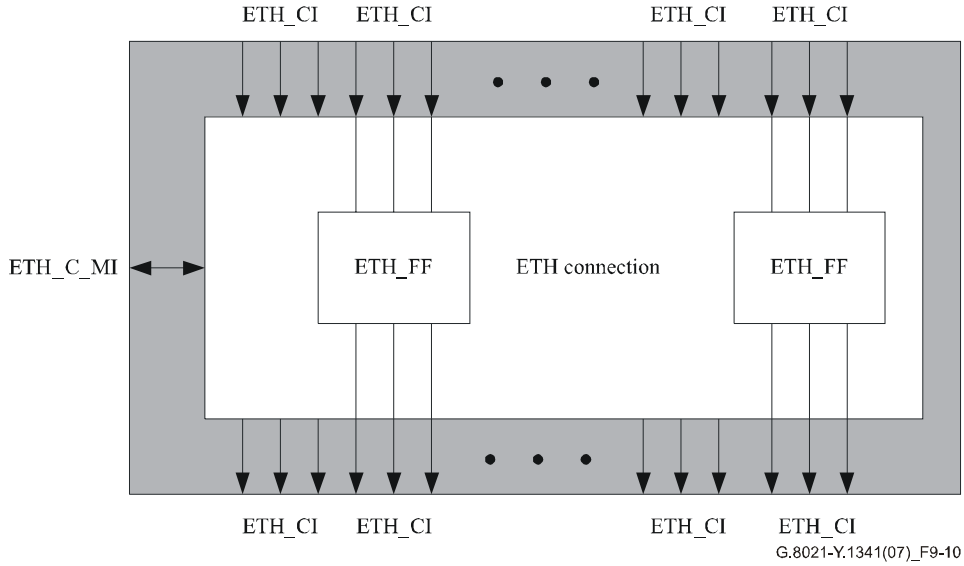

Figure 9-10 – ETH connection function process

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.1.3 Subnetwork connection protection process

SNC protection with sublayer monitoring based on TCM is supported.

Figure 9-11 shows the involved atomic functions in SNC/S. The ETH_FT_Sk provides the TSF protection switching criterion via the ETH/ETH_A_Sk function (SSF).

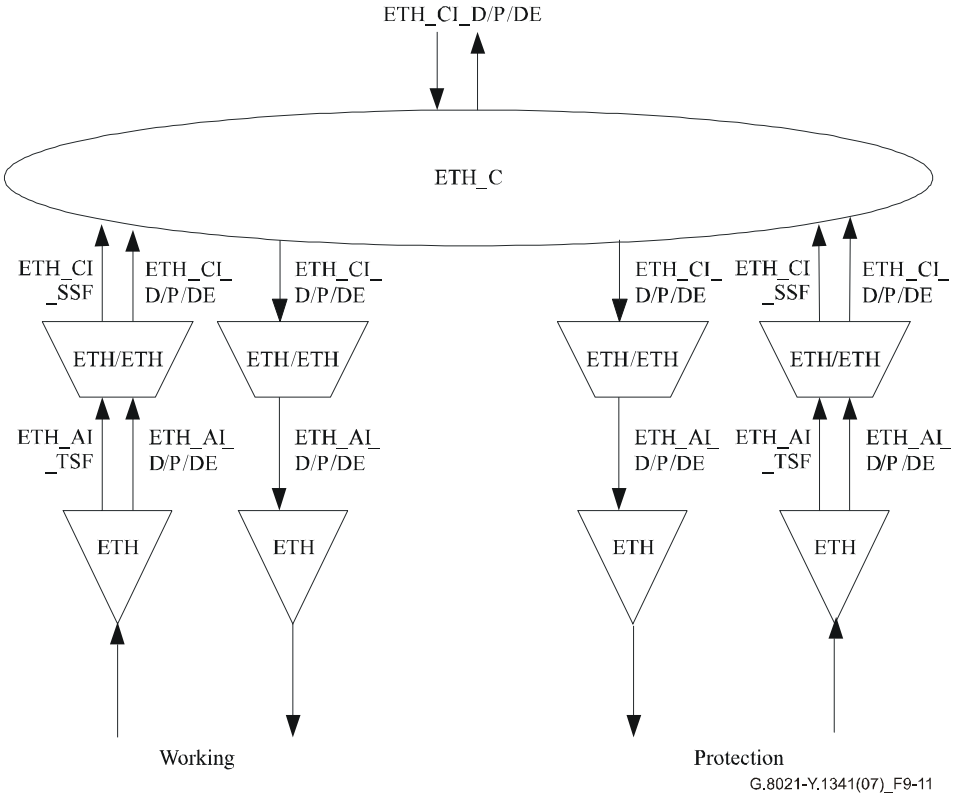

Figure 9-11 – SNC/S atomic functions

The protection functions at both ends operate the same way, by monitoring the working and protection subnetwork connections for defects, evaluating the system status taking into consideration the priorities of defect conditions and of external switch requests, and switching the appropriate subnetwork flow point (i.e., working or protection) to the protected (sub)network flow point.

The signal flows associated with the ETH_C SNC protection process are described with reference to Figure 9-12. The protection process receives control parameters and external switch requests at the MP reference point. The report of status information at the MP reference point is for further study.

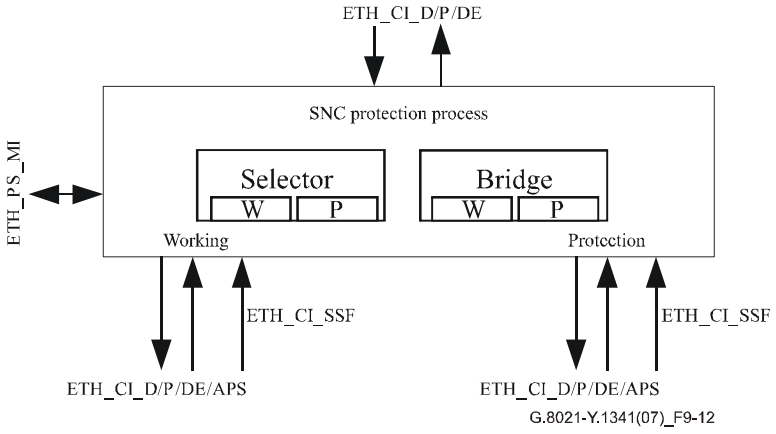

Figure 9-12 – SNC/S protection process

Source direction

For a 1+1 architecture, the CI coming from the normal (protected) ETH_FP is bridged permanently to both the working and protection ETH_FP.

For a 1:1 architecture, the CI coming from the normal (protected) ETH_FP is switched to either the working or the protection ETH_FP. A switch-over from working to protection ETH_FP or vice versa is initiated by the switch initiation criteria defined below.

Sink direction

For a 1+1 or 1:1 architecture, the CI coming from either the working or protection ETH_FP is switched to the normal (protected) ETH_FP. A switch-over from working to protection ETH_FP or vice versa is initiated by the switch initiation criteria defined below.

Switch initiation criteria

Automatic protection switching is based on the defect conditions of the working and protection (sub)network connections, for SNC/S protection server signal fail (SSF).

In order to allow interworking between nested protection schemes, a hold-off timer is provided. The hold-off timer delays switch initiation, in case of signal fail, in order to allow a nested protection to react and clear the fault condition. The hold-off timer is started by the activation of signal fail and runs for the hold-off time. Protection switching is only initiated if signal fail is still present at the end of the hold-off time. The hold-off time shall be provisionable between 0 and 10 s in steps of 100 ms; this is defined in clause 11.12 of [ITU-T G.8031].

Protection switching can also be initiated by external switch commands received via the MP or a request from the far end via the received ETH_CI_APS. Depending on the mode of operation, internal states (e.g., wait-to-restore) may also affect a switch-over.

See the switching algorithm described in [ITU-T G.8031].

Switching time

Refer to [ITU-T G.8031].

Switch restoration

In the revertive mode of operation, the protected signal shall be switched back from the protection (sub)network connection to the working (sub)network connection when the working (sub)network connection has recovered from the fault.

To prevent frequent operation of the protection switch due to an intermittent fault, a failed working (sub)network connection must become fault-free for a certain period of time before it is used again. This period, called the wait-to-restore (WTR) period, should be of the order of 5-12 minutes and should be capable of being set. The WTR is defined in clause 11.13 of [ITU-T G.8031].

In the non-revertive mode of operation, no switch back to the working (sub)network connection is performed when it has recovered from the fault.

Configuration

The following configuration parameters are defined in [ITU-T G.8031]:

ETH_MI_PS_Enable enables the protection switching.

ETH_MI_PS_setWorkingPortId configures the working port.

ETH_MI_PS_setProtectionPortId configures the protection port.

ETH_MI_PS_ProtType configures the protection type.

ETH_MI_PS_OperType configures to be in revertive mode.

ETH_MI_PS_HoTime configures the HoldOffTimer.

ETH_MI_PS_WTR configures the wait-to-restore timer.

ETH_MI_PS_ExtCmd configures the protection group command.

ETH_MI_PS_StateChange reports a state change.

Defects

The function detects dFOP-PM, dFOP-CM and dFOP-NR defects in case the APS protocol is used.

9.1.4 ETH split horizon flow forwarding function (ETH_SH_FF)

For further study.

9.2 Termination functions

9.2.1 ETHx flow termination functions (ETHx_FT)

The bidirectional ETH flow termination (ETHx_FT) function is performed by a co-located pair of ETH flow termination source (ETHx_FT_So) and sink (ETHx_FT_Sk) functions.

9.2.1.1 ETHx flow termination source function (ETHx_FT_So)

Symbol

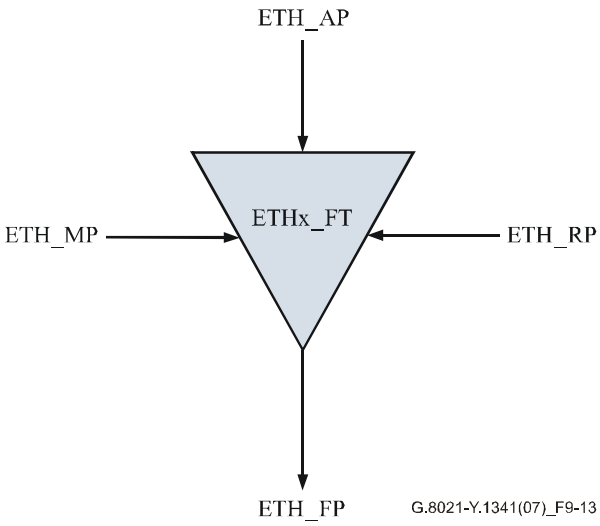

Figure 9-13 – ETHx_FT_So symbol

Interfaces

Table 9-3 – ETHx_FT_So interfaces

Inputs	Outputs
ETHx_AP: ETHx_AI_D ETHx_AI_P ETHx_AI_DE ETHx_MP: ETHx_MI_MEL ETHx_MI_CC_Enable ETHx_MI_LM_Enable ETHx_MI_MEG_ID ETHx_MI_MEP_ID ETHx_MI_CC_Priority ETHx_MI_CC_Period ETHx_RP: ETHx_RI_CC_TxFCl ETHx_RI_CC_RxFCf ETHx_RI_CC_RDI ETHx_RI_CC_Blk	ETHx_FP: ETHx_CI_D ETHx_CI_P ETHx_CI_DE

Processes

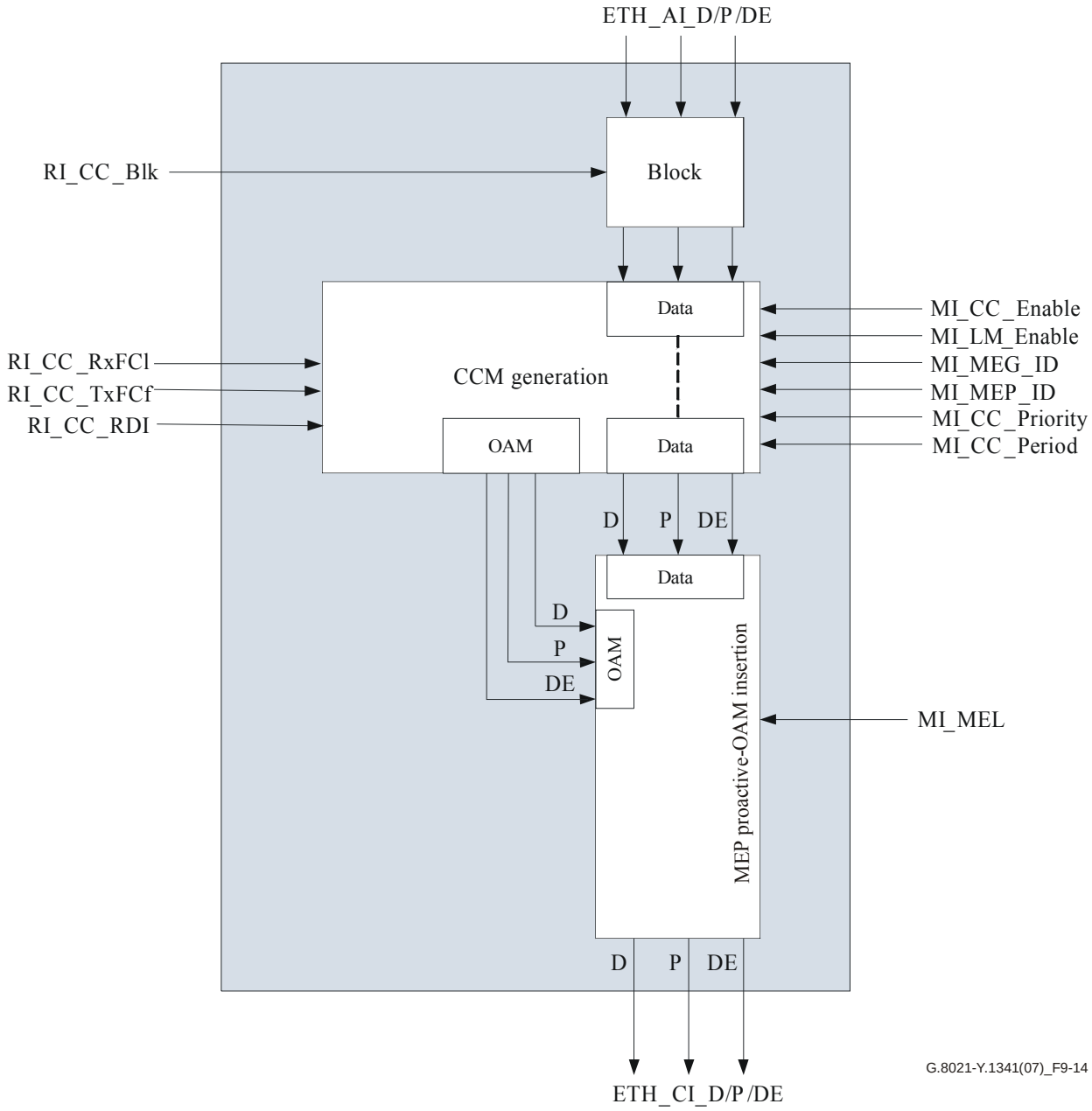

Figure 9-14 – ETHx_FT_So processes

MEP proactive-OAM insertion process

This process inserts the OAM traffic units in the stream of ETH_CI and sets the MEL field to MI_MEL.

If the DA of the OAM traffic unit is a class 1 multicast DA, the OAM insertion process updates the DA to reflect the correct MEL.

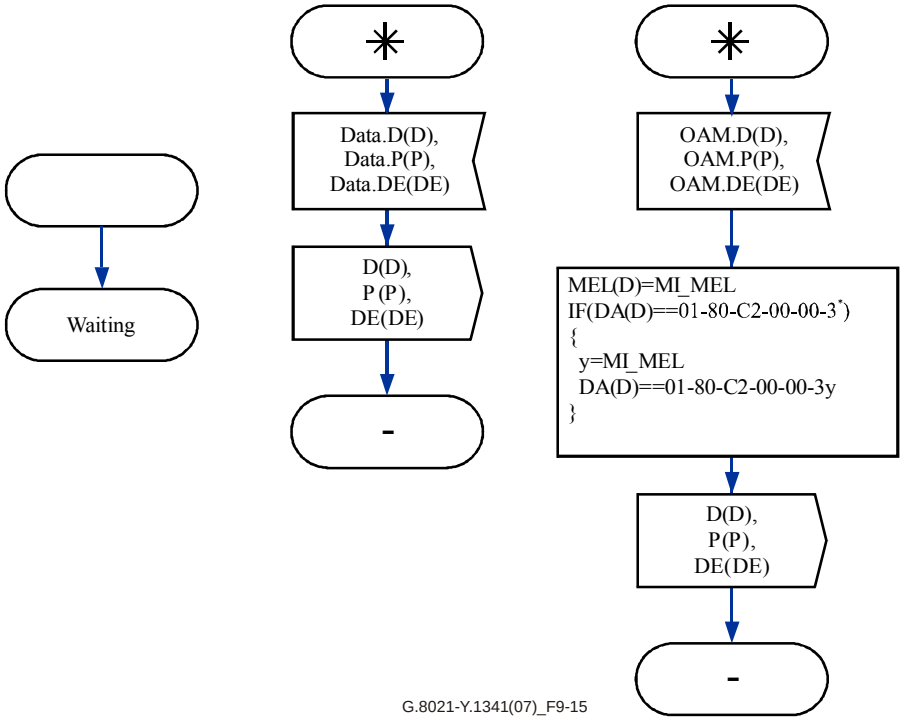

Figure 9-15 – OAM MEP insertion behaviour

CCM generation process

This process is defined in clause 8.1.7 where the CC protocol is defined. Clause 8.1.7.2 defines the CCM generation process.

Block process

When aBlk is raised, the block process will discard all ETH_CI information it receives. If aBLK is cleared, the received ETH_CI information will be passed to the output port.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.2.1.2 ETHx flow termination sink function (ETHx_FT_Sk)

The ETHx_FT_Sk process diagram is shown in Figure 9-16.

Symbol

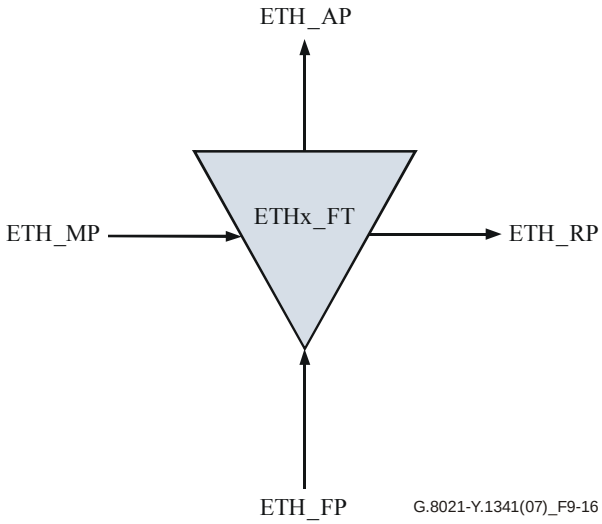

Figure 9-16 – ETHx_FT_Sk function

Interfaces

Table 9-4 – ETHx_FT_Sk interfaces

Inputs	Outputs
ETHx_FP: ETHx_CI_D ETHx_CI_P ETHx_CI_DE ETHx_MP: ETHx_FT_Sk_MI_LM_Enabled ETHx_FT_Sk_MI_1Second ETHx_FT_Sk_MI_LM_DEGM ETHx_FT_Sk_MI_LM_M ETHx_FT_Sk_MI_LM_DEGTHR ETHx_FT_Sk_MI_CC_Period ETHx_FT_Sk_MI_CC_Pri ETHx_FT_Sk_MI_MEG_ID ETHx_FT_Sk_MI_PeerMEP_ID[] ETHx_FT_Sk_MI_GetSvdCCM ETHx_FT_Sk_MI_MEL ETHx_FT_Sk_MI_CC_Enable	ETHx_AP: ETHx_AI_D ETHx_AI_P ETHx_AI_DE ETHx_AI_TSF ETHx_AI_AIS ETHx_AI_TSD ETHx_RP: ETHx_FT_Sk_RI_CC_RxFCf ETHx_FT_Sk_RI_CC_TxFCl ETHx_FT_Sk_RI_CC_RDI ETHx_FT_Sk_RI_CC_Blk ETHx_MP: ETHx_FT_Sk_MI_cSSF ETHx_FT_Sk_MI_cLCK ETHx_FT_Sk_MI_cLOC[i] ETHx_FT_Sk_MI_cMMG ETHx_FT_Sk_MI_cUNM ETHx_FT_Sk_MI_cUNP ETHx_FT_Sk_MI_cUNPr ETHx_FT_Sk_MI_cUNL ETHx_FT_Sk_MI_cRDI[i] ETHx_FT_Sk_MI_SvdCCM ETHx_FT_Sk_MI_pN_FL ETHx_FT_Sk_MI_pN_TF ETHx_FT_Sk_MI_pF_FL ETHx_FT_Sk_MI_pF_TF ETHx_FT_Sk_MI_pF_DS ETHx_FT_Sk_MI_pN_DS

Processes

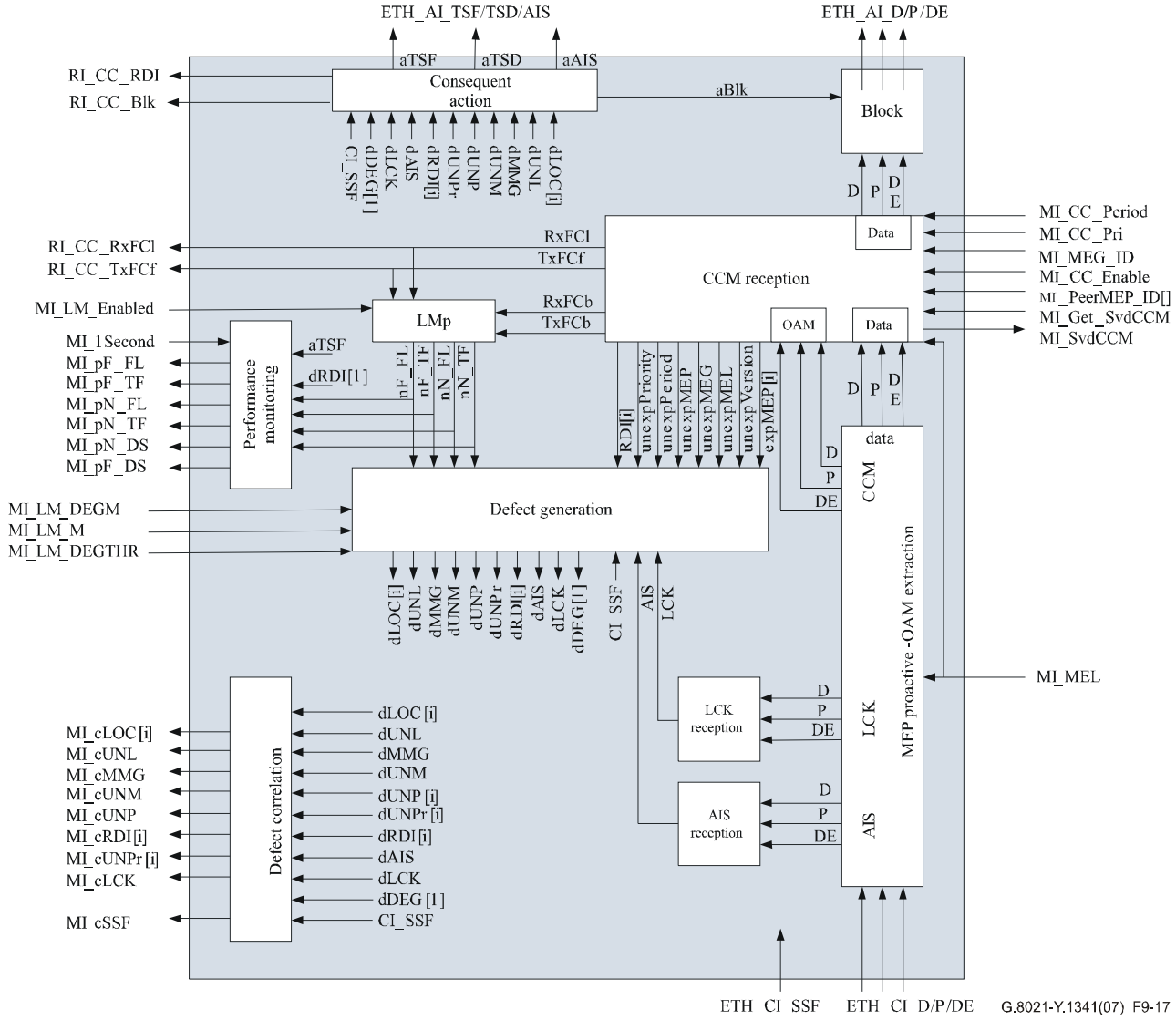

Figure 9-17 – ETHx_FT_Sk processes

MEP proactive-OAM extraction

The MEP proactive-OAM extraction process extracts OAM traffic units that are processed in the ETHx_FT_Sk process from the stream of traffic units according to the following pseudo code:

```
if (TYPE=<ETHOAM>) and (MEL=MI_MEL) then
  switch(OPC) {
  case <CCM>: extract ETH-CCM OAM traffic unit and forward to CCM port
  case <AIS>: extract ETH-AIS OAM traffic unit and forward to AIS port
  case <LCK>: extract ETH-LCK OAM traffic unit and forward to LCK port
  default: forward ETH_CI traffic unit to other output
  }
elseif (TYPE=<ETH0AM>) and (MEL<MI_MEL) and (OPC=CCM) then
  extract ETH-CCM OAM traffic unit and forward to CCM port
else
  forward traffic unit to Data port
endif
```

ETH_AIS reception process

This process generates the AIS event upon the receipt of the AIS traffic unit from the OAM MEP extraction process.

ETH_LCK reception process

This process generates the LCK event upon receipt of the LCK traffic unit from the OAM MEP extraction process.

Block process

When aBlk is raised, the block process will discard all ETH_CI information it receives. If aBLK is cleared, the received ETH_CI information will be passed to the output port.

LMp process

This process is defined in clause 8.1.7.4.

Defect generation process

This process detects and clears the defects (dLOC[i], dRDI[i], dLCK, dAIS, dUNL, dMMG, dUNM, dUNP, dUNPr) as defined in clause 6.

CCM reception process

This process is defined in clause 8.1.7.3.

Defects

This function detects dLOC[i], dRDI[i], dLCK, dAIS, dUNL, dMMG, dUNM, dUNP, dUNPr.

Consequent actions

aBLK ← (dUNL or dMMG or dUNM)

Note that dUNP, dUNPr and dUNV does not contribute to aBLK because a mismatch of periodicity is not considered to be a security issue.

aTSF ← (dLOC[1..n] and MI_CC_Enable) or (dAIS and not(MI_CC_Enable)) or dUNL or dMMG or dUNM or CI_SSF

aTSD ← dDEG[1] and (not aTSF)

aAIS ← aTSF

aRDI ← aTSF

Defect correlations

cLOC[i] ← dLOC[i] and (not dAIS) and (not dLCK) and (not CI_SSF) and (MI_CC_Enable)

cMMG ← dMMG

cUNM ← dUNM

cUNP ← dUNP

cUNL ← dUNL

cUNPr ← dUNPr

cRDI ← (dRDI[1..n]) and (MI_CC_Enable)

cSSF ← CI_SSF or dAIS

cLCK ← dLCK and (not dAIS)

cDEG[1] ← dDEG[1] and (not dAIS) and (not CI_SSF) and (not (dLOC[1..n] or dUNL or dMMG or dUNM)) and (MI_CC_Enable)

Performance monitoring

pN_FLC ← N_LF

pN_TFC ← N_TF

pF_FLC ← F_LF

pF_NTC ← F_TF

pN_DS ← aTSF

pF_DS ← aRDI[1]

9.3 Adaptation functions

9.3.1 ETH to client adaptation functions (ETH/<client>_A)

For further study.

9.3.2 ETH to ETH adaptation function (ETHx/ETH_A)

9.3.2.1 ETH to ETH adaptation source function (ETHx/ETH_A_So)

This function maps client ETH_CI traffic units into server ETH_AI traffic units.

Symbol

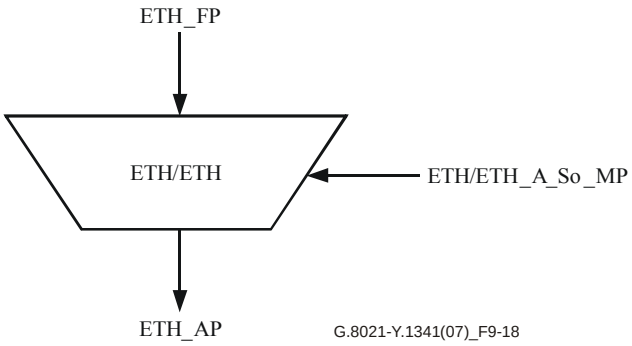

Figure 9-18 – ETHx/ETH_A_So function

Interfaces

Table 9-5 – ETHx/ETH_A_So input and outputs

Inputs	Outputs
ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_APS ETHx/ETH_A_So_MP: ETHx/ETH_A_So_MI_MEL ETHx/ETH_A_So_MI_LCK_Period ETHx/ETH_A_So_MI_LCK_Pri ETHx/ETH_A_So_MI_Client_MEL ETHx/ETH_A_So_MI_Admin_State ETHx/ETH_A_So_APS_Pri	ETH_AP: ETH_AI_D ETH_AI_P ETH_AI_DE

Processes

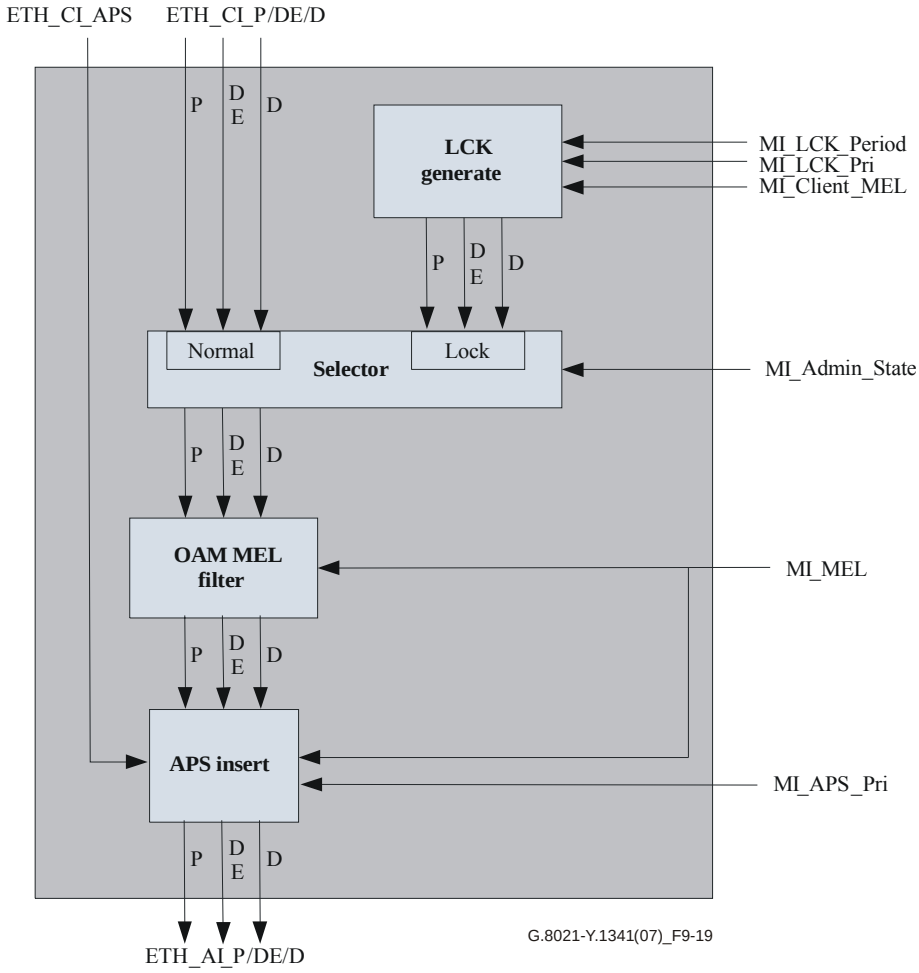

Figure 9-19 – Source direction ETHx/ETH_So process

LCK generate process

As defined in clause 8.1.2.

Selector process

As defined in clause 8.1.3.

OAM MEL filter process

As defined in clause 8.1.1.

APS insert process

As defined in clause 8.1.5.

When activated, LCK admin state shall be unlocked (see clause 7.5.2.2 of [ITU-T G.8010]).

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.3.2.2 ETH to ETH adaptation sink function (ETHx/ETH_A_Sk)

This function retrieves client ETH_CI traffic units from server ETH_AI traffic units.

Symbol

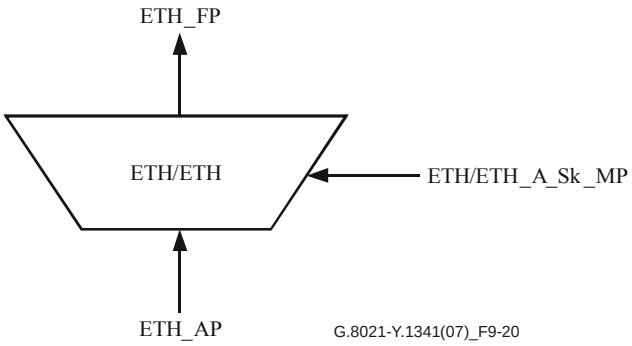

Figure 9-20 – ETHx/ETH_A_Sk function

Interfaces

Table 9-6 – ETHx/ETH_A_Sk input and outputs

Inputs	Outputs
ETH_AP: ETH_AI_D ETH_AI_P ETH_AI_DE ETH_AI_TSF ETH_AI_AIS ETHx/ETH_A_Sk_MP: ETHx/ETH_A_Sk_MI_Admin_State ETHx/ETH_A_Sk_MI_LCK_Period ETHx/ETH_A_Sk_MI_LCK_Pri ETHx/ETH_A_Sk_MI_Client_MEL ETHx/ETH_A_Sk_MI_AIS_Pri ETHx/ETH_A_Sk_MI_AIS_Period ETHx/ETH_A_Sk_MI_MEL	ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_APS ETH_CI_SSF

Processes

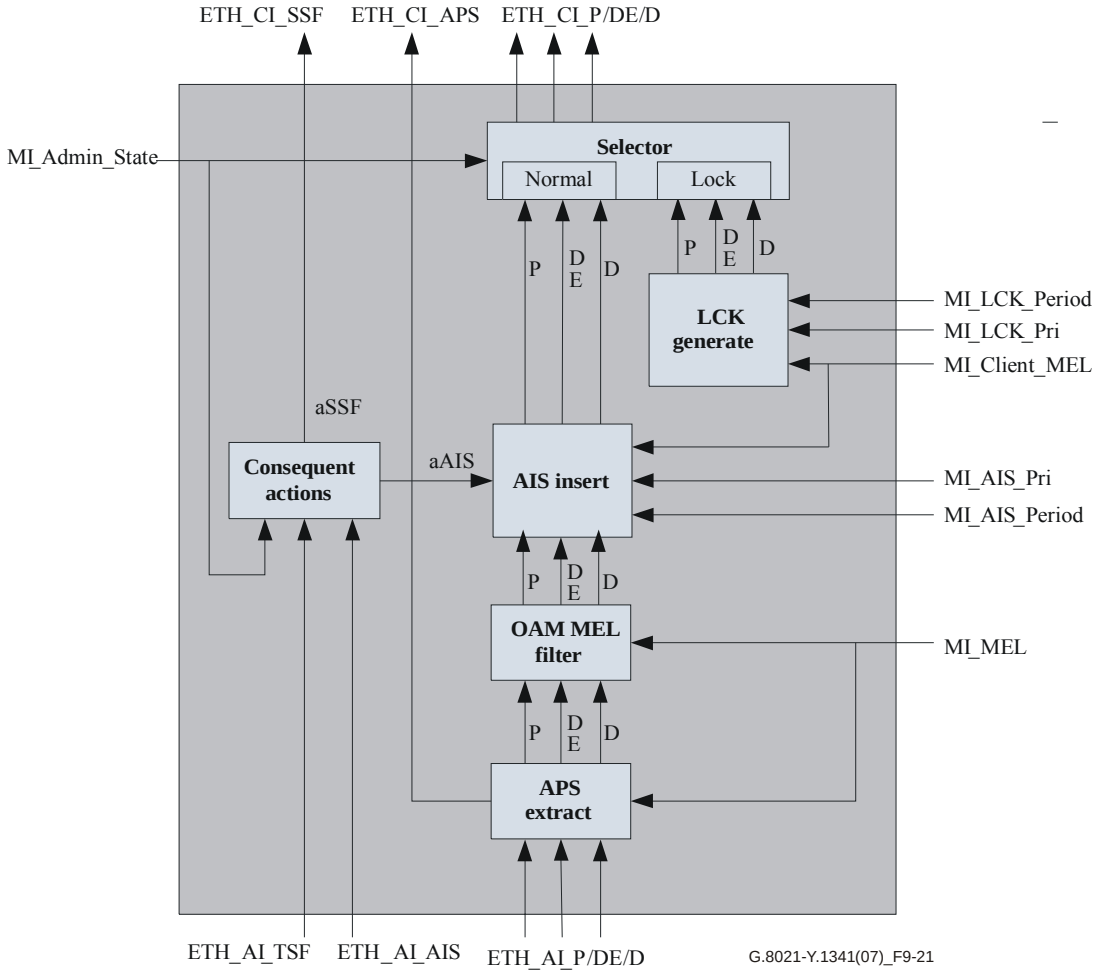

Figure 9-21 – Sink direction ETHx/ETH_A_Sk process

APS extract process

As defined in clause 8.1.6.

OAM MEL filter process

As defined in clause 8.1.1.

AIS insert process

As defined in clause 8.1.4.

LCK generate process

As defined in clause 8.1.2.

Selector process

As defined in clause 8.1.3.

Defects None.

Consequent actions

aSSF ← AI_TSF and (not MI_Admin_State == Locked)

aAIS ← AI_TSF and (not MI_Admin_State == Locked)

Defect correlations None.

Performance monitoring None.

9.3.3 ETH to ETH multiplexing adaptation function (ETHx/ETH-m_A)

This adaptation function multiplexes different ETH_CI streams into a single ETH_AI stream in the source direction and demultiplexes the ETH_AI stream into individual ETH_CI streams.

Symbol

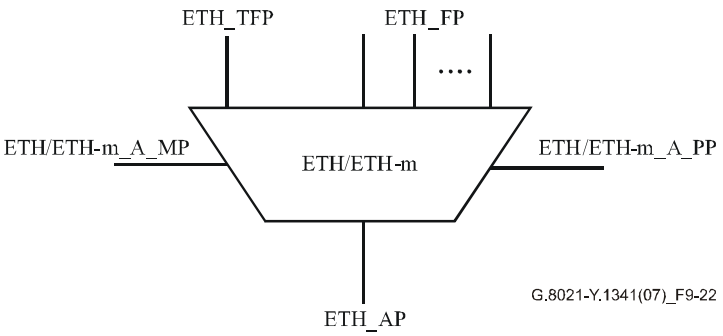

Figure 9-22 – ETHx/ETH-m_A function

The ETHx/ETH-m_A (Figure 9-22) function is further decomposed into separate source and sink adaptation functions that are interconnected as shown in Figure 9-23.

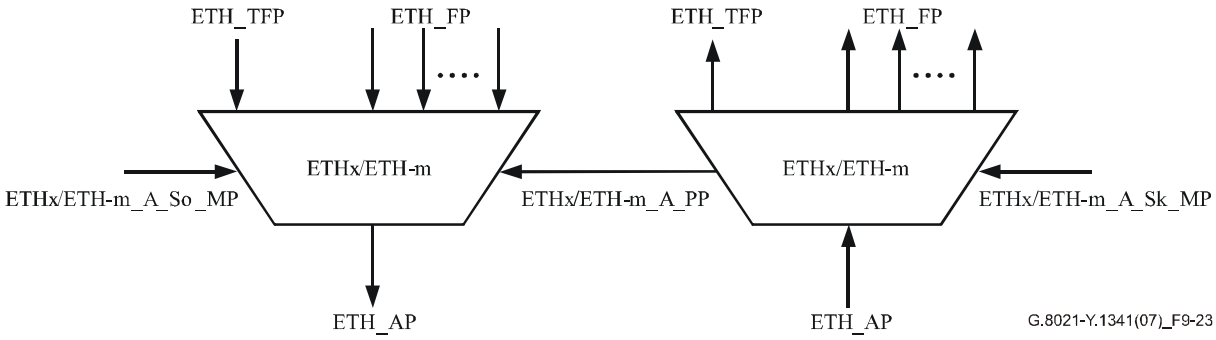

Figure 9-23 – ETHx/ETH-m_A source and sink functions

9.3.3.1 ETH to ETH multiplexing adaptation source function (ETHx/ETH-m_A_So)

This function multiplexes individual ETH_CI streams into a single ETH_AI stream.

Symbol

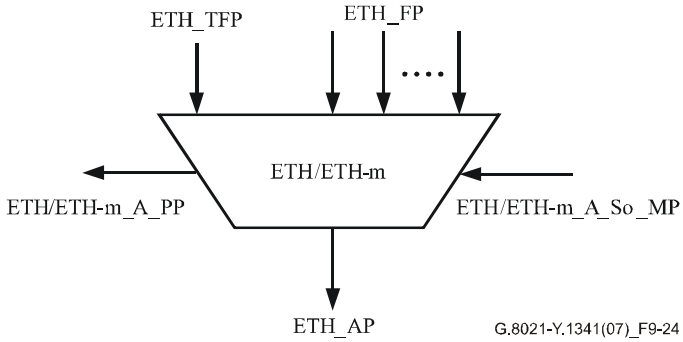

Figure 9-24 – ETHx/ETH-m_A_So function

Interfaces

Table 9-7 – ETHx/ETH-m_A_So interfaces

Inputs	Outputs
ETH_FP: ETH_CI_D[1...M] ETH_CI_P[1...M] ETH_CI_DE[1...M] ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE ETHx/ETH-m_A_So_MP: ETHx/ETH-m_A_So_MI_MEL[1…M] ETHx/ETH-m_A_So_MI_LCK_Period[1…M] ETHx/ETH-m_A_So_MI_LCK_Pri[1…M] ETHx/ETH-m_A_So_MI_Client_MEL[1…M] ETHx/ETH-m_A_So_MI_Admin_State ETHx/ETH-m_A_So_MI_Vlan_Config ETHx/ETH-m_A_So_MI_Etype ETHx/ETH-m_A_So_MI_PCP_Config ETHx/ETH-m_A_So_Queue_Config	ETH_AP: ETH_AI_D ETH_AI_P ETH_AI_DE ETHx/ETH-m_A_PP: ETH_PI_P ETH_PI_DE ETH_PI_D

Processes

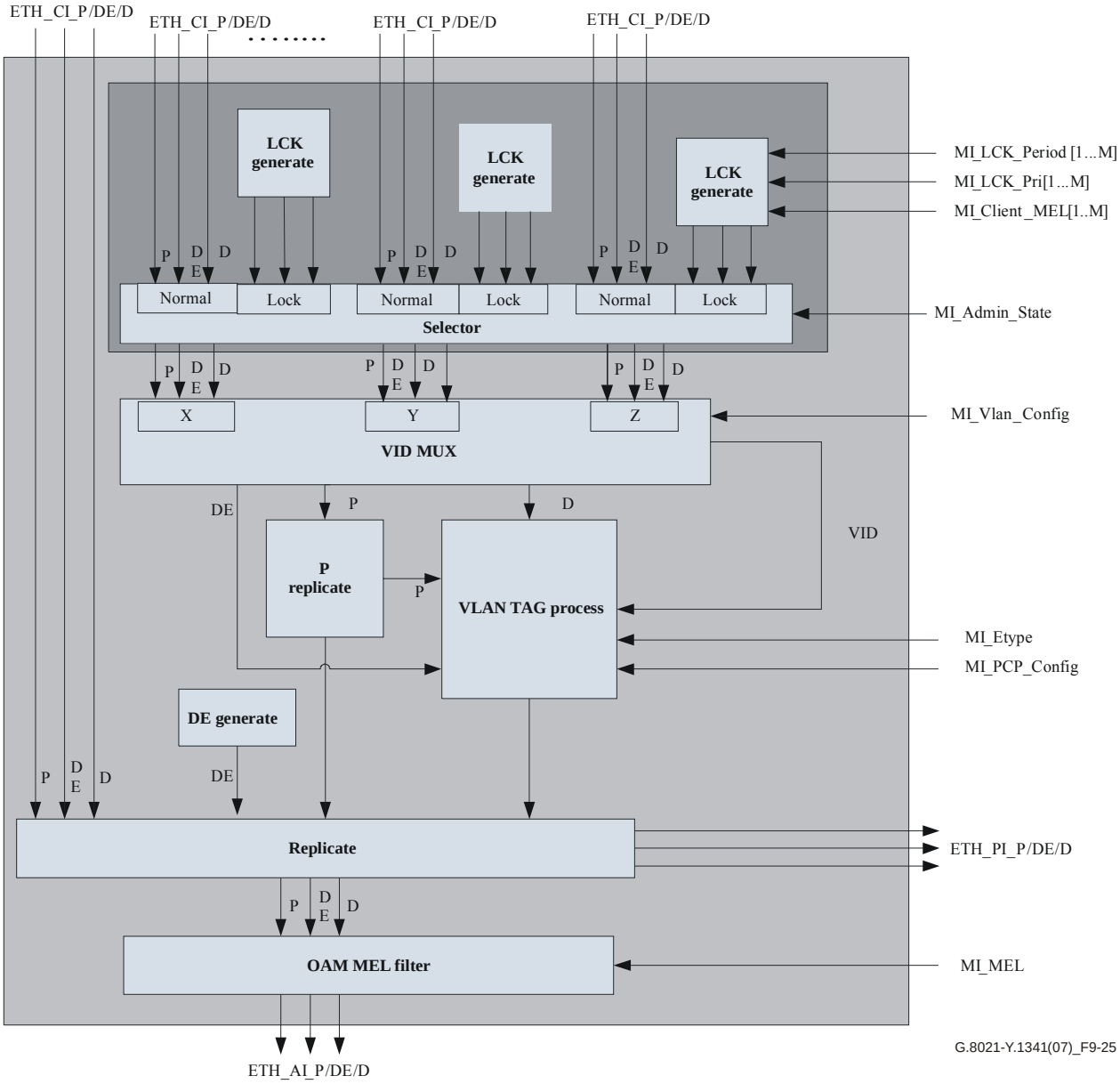

Figure 9-25 – ETHx/ETH-m_A_So process

LCK generate process

As defined in clause 8.1.2. Each FP has its LCK generate process.

Selector process

As defined in clause 8.1.3. Replaces the normal CI by the individual lock CI if Admin_State = LOCKED.

VID mux process

The VID mux process interleaves the signal sets (P, D, DE) from the input ports (X, Y, Z). For each incoming signal set on forwarding the signal set, a VID signal is generated. The value of the VID signal is based on the port on which the signal set is received and the configuration from the MI_VLAN_Config input parameter.

The MI_VLAN_Config input parameter determines for every input port the associated VID value. The allowed values for the VID signal are untagged, priority tagged and 1-4094. The following restriction applies to the allowed MI_VLAN_Config values:

- Every VID value is only used once.

Note that IEEE 802.1 standards do not allow IEEE bridges to generate priority tagged frames. Priority tagged frames are only generated by end stations. However a C-VLAN bridge may create S-VLAN priority tagged frames.

VLAN tag process

This process inserts a VLAN tag into the M_SDU field of the incoming D signal. The Ethertype used is determined by the value of the MI_Etype input parameter. The MI_PCP_Config signal determines the encoding of the P and DE signals in the VLAN tag. This parameter defines a mapping from P value to PCP value in the case of C-VLAN tags, and from P value to PCP and DEI value in the case of S-VLAN tags.

The VID signal determines the VID value in the VLAN tag. If the VID signal equals priority tagged, the VID value used is 0. If the VID signal equals untagged, no VLAN tag is inserted in the M_SDU field.

P replicate process

The P replicate process replicates the incoming P signal to both output ports, without changing the value of the signal.

DE generate process

The DE generate process generates a DE signal with the value drop ineligible.

Replicate process

As defined in clause 8.4.

OAM MEL filter process

As defined in clause 8.1.1.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.3.3.2 ETH to ETH multiplexing adaptation sink function (ETHx/ETH-m_A_Sk)

Symbol

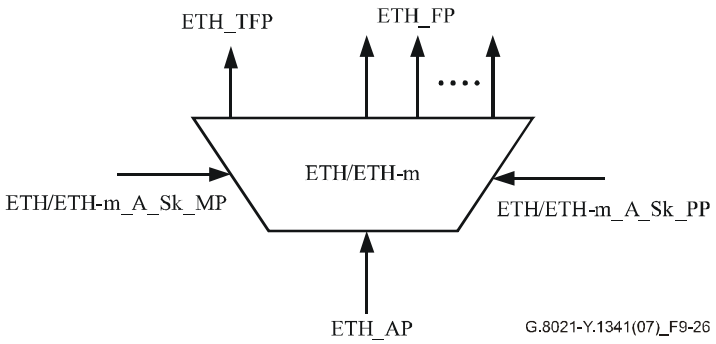

Figure 9-26 – ETHx/ETH-m_A_Sk function

Interfaces

Table 9-8 – ETHx/ETH-m_A_Sk interfaces

Inputs	Outputs
ETH_AP: ETH_AI_D ETH_AI_P ETH_AI_DE ETH_AI_TSF ETH_AI_AIS ETHx/ETH-m_A_Sk_PP: ETH_PI_D ETH_PI_P ETH_PI_DE ETHx/ETH-m_A_Sk_MP: ETHx/ETH-m_A_Sk_MI_Admin_State ETHx/ETH-m_A_Sk_MI_LCK/AIS_Period[1…M] ETHx/ETH-m_A_Sk_MI_LCK/AIS_Pri[1…M] ETHx/ETH-m_A_Sk_MI_Client_MEL[1…M] ETHx/ETH-m_A_Sk_MI_VLAN_Config ETHx/ETH-m_A_Sk_MI_P_Regenerate ETHx/ETH-m _A_Sk_MI_PVID ETHx/ETH-m_A_Sk_MI_PCP_Config ETHx/ETH-m_A_Sk_MI_Etype ETHx/ETH-m_A_Sk_MI_MEL ETHx/ETH-m_A_Sk_MI_frametype_Config ETHx/ETH-m_A_Sk_MI_Filter_Config	ETH_FP: ETH_CI_P[1...M] ETH_CI_DE[1...M] ETH_CI_D[1...M] ETH_CI_SSF[1...M] ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE

Processes

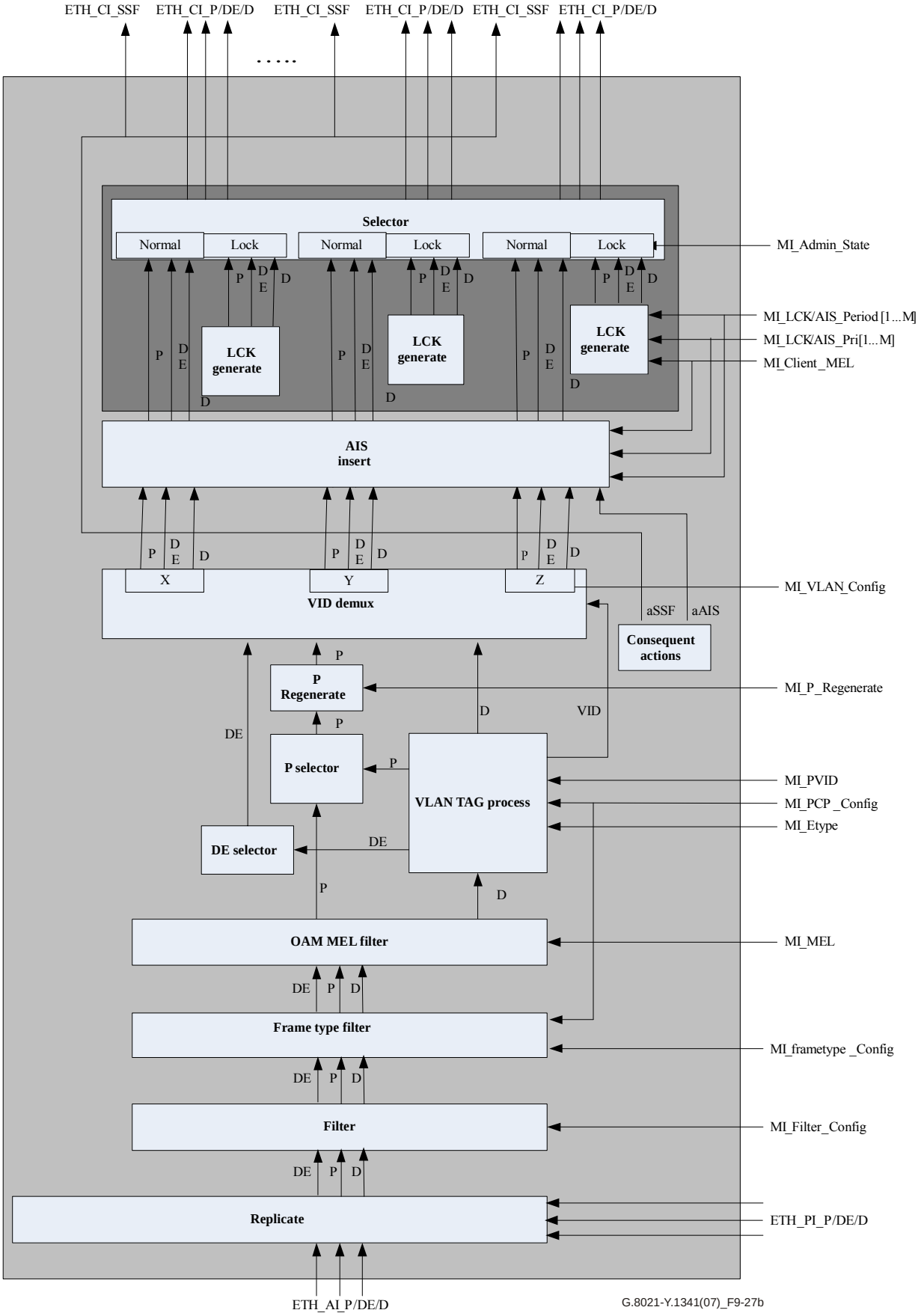

Figure 9-27 – ETHx/ETH-m_A_Sk process

Replicate process

As defined in clause 8.4.

Filter process

As defined in clause 8.3.

Frame type filter process

The frame type filter process filters the ETH_CI depending on the value of the MI_frametype_Config input parameter. There are three possible values for this parameter:

- All frames;
- Only VLAN-tagged;
- Only untagged and priority tagged.

If the value of MI_frametype_Config equals all frames, all ETH_CI is passed through. For the other two values, the process inspects the M_SDU field of the ETH_CI_D signal. It inspects the length/type field and, if applicable, the VID field.

If MI_frametype_Config is set to only untagged and priority tagged, all frames with L/T equals MI_Etype and VID in the range 1…4094 are filtered.

If MI_frametype_Config is set to only VLAN tagged, all frames with L/T not equal to MI_Etype and all frames with L/T equal to MI_Etype and VID equal to zero are filtered.

OAM MEL filter process

As defined in clause 8.1.1.

VLAN tag process

The VLAN tag process inspects the incoming D signal; if the value in the L/T field is equal to the value provisioned by the MI_Etype input parameter, a VLAN tag is present in the D signal.

If there is no VLAN tag present, the VID signal gets the value presented by the MI_PVID input parameter.

If there is a VLAN tag present, the VLAN tag process extracts the P, DE and VID information from this VLAN tag. The VID value is taken from the VID field in the VLAN tag. The P and DE values are decoded from the PCP field of the VLAN tag (C-VLAN) or from the PCP and DEI fields of the VLAN tag (S-VLAN), using the decoding information presented via the MI_PCP_Config input parameter. The P value is presented to the P selector process and the DE value is presented to the DE selector process.

DE selector process

This process forwards the incoming DE signal. If there is no incoming DE signal present, it generates a DE signal with value drop ineligible.

P selector process

This process forwards the P signal coming from the VLAN tag process. If this signal is not present, the P signal coming from the OAM MEL process is forwarded.

P regenerate process

This process regenerates the incoming P signal, based on the MI_P_Regenerate input signal. The MI_P_Regenerate signal specifies a mapping table from P value to P value.

VID demux process

The VID demux process deinterleaves the incoming signal set (DE, P, D) to the different ports (X, Y, Z in Figure 9-27). The VID signal determines the port to be selected, based on the MI_Vlan_Config input parameter.

The MI_Vlan_Config parameter specifies the possible VID values for the ports to be used. If there is no port assigned to a specific VID value, and this VID value is used, the VID demux process will filter the incoming signal set.

AIS insert process

As defined in clause 8.1.4.

LCK generate process

As defined in clause 8.1.2. Each FP has its own LCK generate process.

Selector process

As defined in clause 8.1.3. Replaces the normal CI by the individual lock CI if Admin_State = LOCKED.

Defects None.

Consequent actions

aSSF ← AI_TSF and (not MI_Admin_State == Locked)

aAIS ← AI_TSF and (not MI_Admin_State == Locked)

Defect correlations None.

Performance monitoring None.

9.3.4 ETH group to ETH adaptation function (ETHG/ETH)

9.3.4.1 ETH group to ETH adaptation source function (ETHG/ETH_A_So)

Symbol

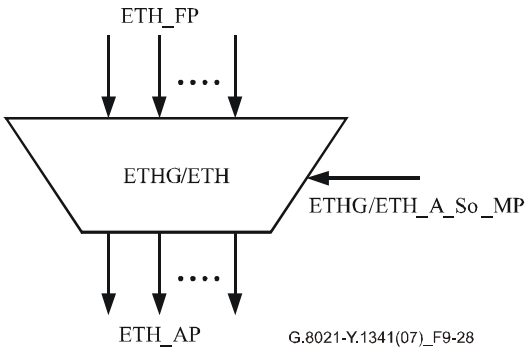

Figure 9-28 – ETHG/ETH_A_So function

Interfaces

Table 9-9 – ETHG/ETH_A_So interfaces

Inputs	Outputs
ETH_FP: ETH_CI_D[1…M] ETH_CI_P[1…M] ETH_CI_DE[1…M] ETH_CI_APS ETHG/ETH_A_So_MP: ETHG/ETH_A_So_MI_MEL ETHG/ETH_A_So_MI_LCK_Period[1…M] ETHG/ETH_A_So_MI_LCK_Pri[1…M] ETHG/ETH_A_So_MI_Client_MEL ETHG/ETH_A_So_MI_Admin_State ETHG/ETH_A_So_MI_APS_Pri	ETH_AP: ETH_AI_D[1...M] ETH_AI_P[1...M] ETH_AI_DE[1...M]

Processes

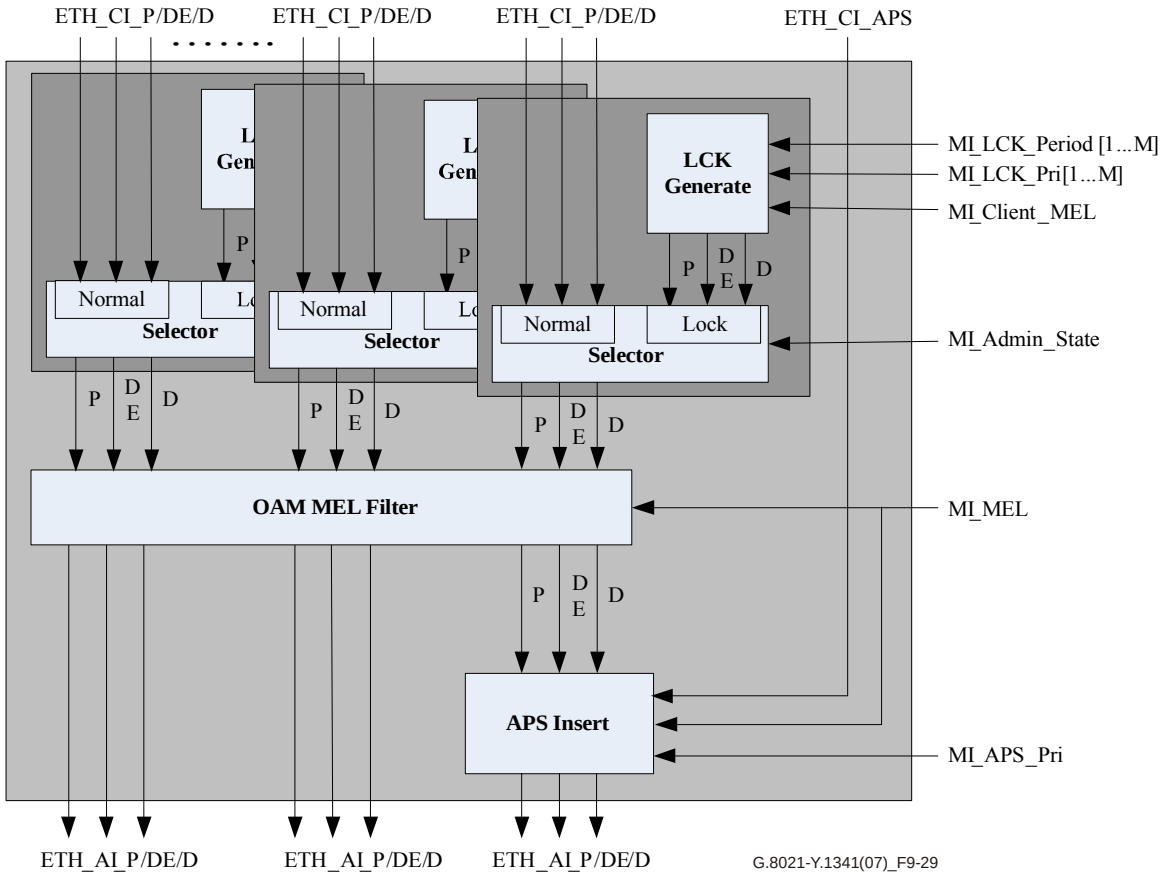

Figure 9-29 – ETHG/ETH_A_So process

LCK generate process

As defined in clause 8.1.2. There is a single LCK generate process for each ETH.

Selector process

As defined in clause 8.1.3. Replaces the normal CI of each input by the lock CI if Admin_State = LOCKED.

OAM MEL filter process

As defined in clause 8.1.1.

APS insert process

As defined in clause 8.1.5.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.3.4.2 ETH group to ETH adaptation sink function (ETHG/ETH_A_Sk)

Symbol

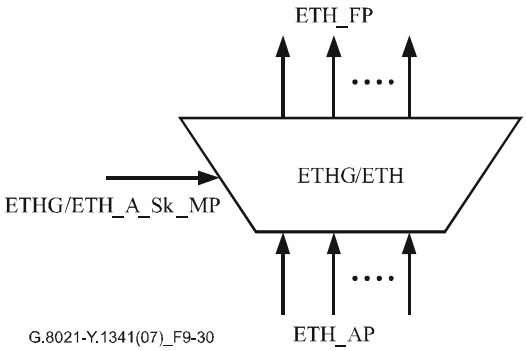

Figure 9-30 – ETHG/ETH_A_Sk function

Interfaces

Table 9-10 – ETHG/ETH_A_Sk interfaces

Inputs	Outputs
ETH_AP: ETH_AI_D[1...M] ETH_AI_P[1...M] ETH_AI_DE[1...M] ETH_AI_TSF ETH_AI_AIS ETHG/ETH_A_Sk_MP: ETHG/ETH_A_Sk_MI_Admin_State ETHG/ETH_A_Sk_MI_LCK/AIS_Period[1…M] ETHG/ETH_A_Sk_MI_LCK/AIS_Pri[1…M] ETHG/ETH_A_Sk_MI_Client_MEL ETHG/ETH_A_Sk_MI_MEL	ETH_FP: ETH_CI_D[1…M] ETH_CI_P[1…M] ETH_CI_DE[1…M] ETH_CI_APS ETH_CI_SSF[1…M]

Processes

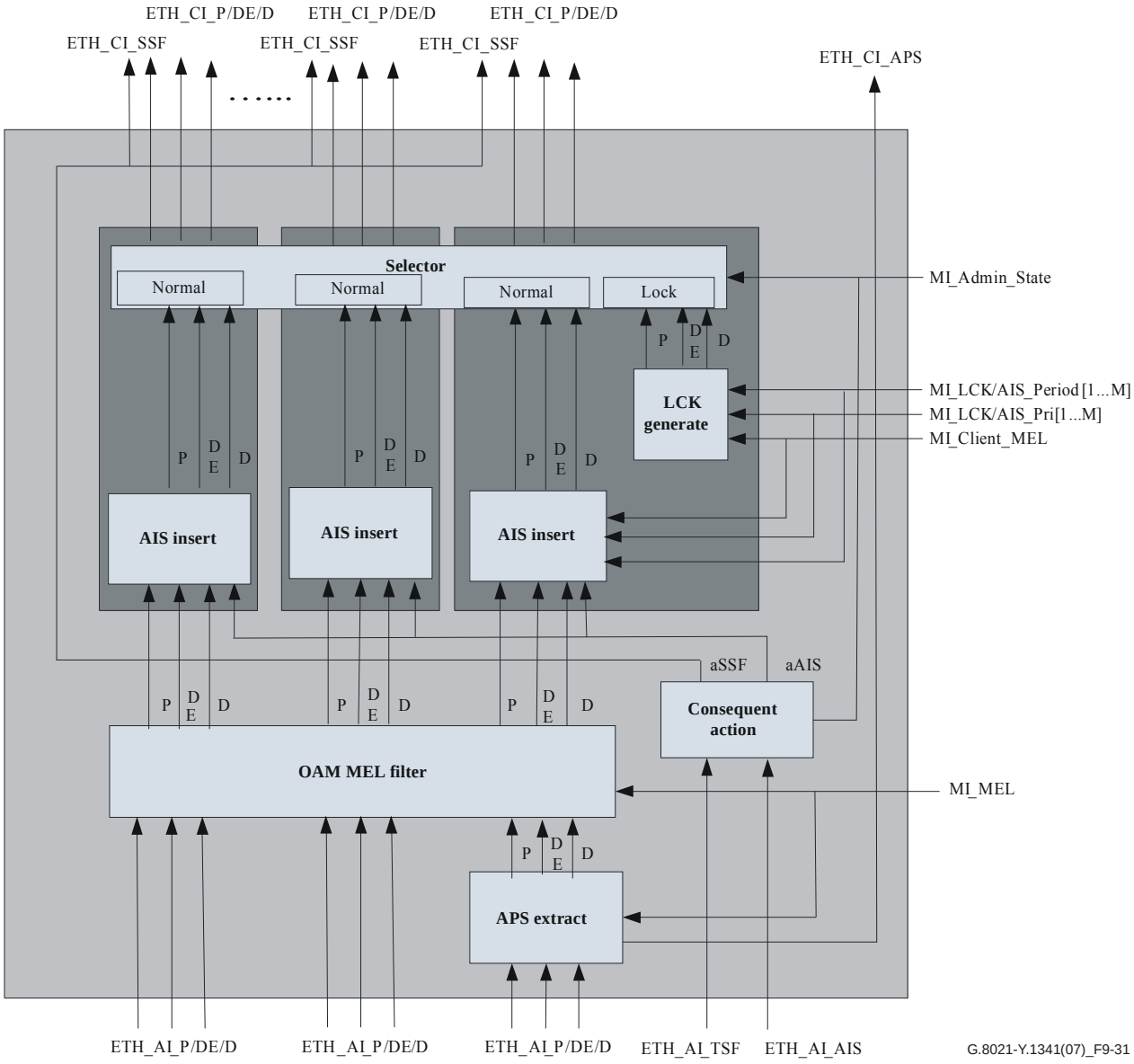

Figure 9-31 – ETHG/ETH_A_Sk process

APS extract process

As defined in clause 8.1.6.

OAM MEL filter process

As defined in clause 8.1.1.

AIS insert process

As defined in clause 8.1.4. There is a single AIS insert process for each ETH.

LCK generate process

As defined in clause 8.1.2. There is a single LCK generate process for each ETH.

Selector process

As defined in clause 8.1.3. Replaces the normal CI of each input by the lock CI if Admin_State = LOCKED.

Defects None.

Consequent actions

aSSF ← AI_TSF and (not MI_Admin_State == Locked)

aAIS ← AI_TSF and (not MI_Admin_State == Locked)

Defect correlations None.

Performance monitoring None.

9.3.5 ETHx to ETHG adaptation function

For further study.

9.4 ETH diagnostic functions

9.4.1 ETH diagnostic flow termination function for MEPs (ETHDe_FT)

The bidirectional ETHDe flow termination (ETHDe_FT) function is performed by a co-located pair of ETHDe flow termination source (ETHDe_FT_So) and sink (ETHDe_FT_Sk) functions.

9.4.1.1 ETH diagnostic flow termination source function for MEPs (ETHDe_FT_So)

The ETHDe_FT_So process diagram is shown in Figure 9-32.

Symbol

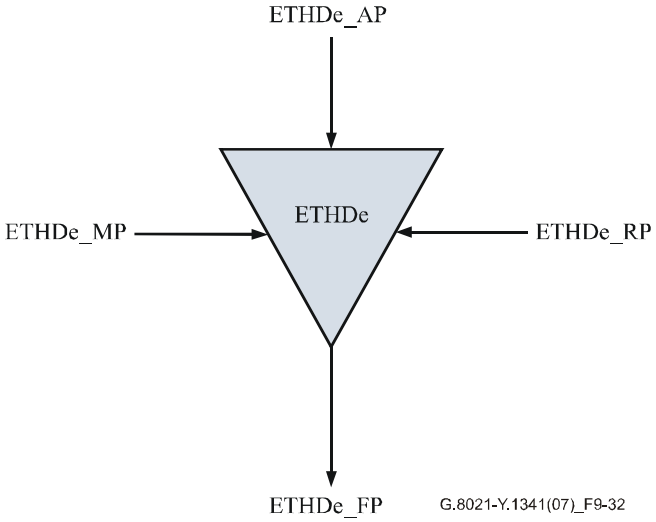

Figure 9-32 – ETHDe_FT_So function

Interfaces

Table 9-11 – ETHDe_FT_So interfaces

Inputs	Outputs
ETHDe_AP: ETHDe_AI_D ETHDe_AI_P ETHDe_AI_DE ETHDe_MP: ETHDe_FT_So_MI_LM_Start(DA,P,Period) ETHDe_FT_So_MI_LM_Terminate ETHDe_FT_So_MI_LB_Discover(DA,DE,P) ETHDe_FT_So_MI_LB_Series(DA,DE,P, TLV,N,Period) ETHDe_FT_So_MI_LB_Test(DA,DE,P, Pattern,Length, Period) ETHDe_FT_So_MI_LB_Test_Terminate ETHDe_FT_So_MI_DM_Start(DA,P,Period) ETHDe_FT_So_MI_DM_Terminate ETHDe_FT_So_MI_1DM_Start(DA,P,Period) ETHDe_FT_So_MI_1DM_Terminate ETHDe_FT_So_MI_Test(DA,DE,P,Pattern, Length, Period) ETHDe_FT_So_MI_Test_Terminate ETHDe_FT_So_MI_LT(TA,P) ETHDe_FT_So_MI_MEP_MAC ETHDe_FT_So_MI_MEL ETHDe_RP: ETHDe_RI_LMM(D,P,DE) ETHDe_RI_DMM(D,P,DE) ETHDe_RI_LBM(D,P,DE) ETHDe_RI_LBR(SA,TID,TLV) ETHDe_RI_LTM(D,P,DE) ETHDe_RI_LTR(SA,TTL,TID,TLV)	ETHDe_FP: ETHDe_CI_D ETHDe_CI_P ETHDe_CI_DE ETHDe_MP: ETHDe_FT_So_MI_LM_Result(N_TF, N_LF, F_TF, F_LF) ETHDe_FT_So_MI_LB_Discover_Result(MACs) ETHDe_FT_So_MI_LB_Series_Result(REC, ERR,OO) ETHDe_FT_So_MI_LB_Test_Result(Sent, REC, CRC, BERR, OO) ETHDe_FT_So_MI_DM_Result(Delay) ETHDe_FT_So_MI_Test_Result(Sent) ETHDe_FT_So_MI_LT_Result(Results)

Processes

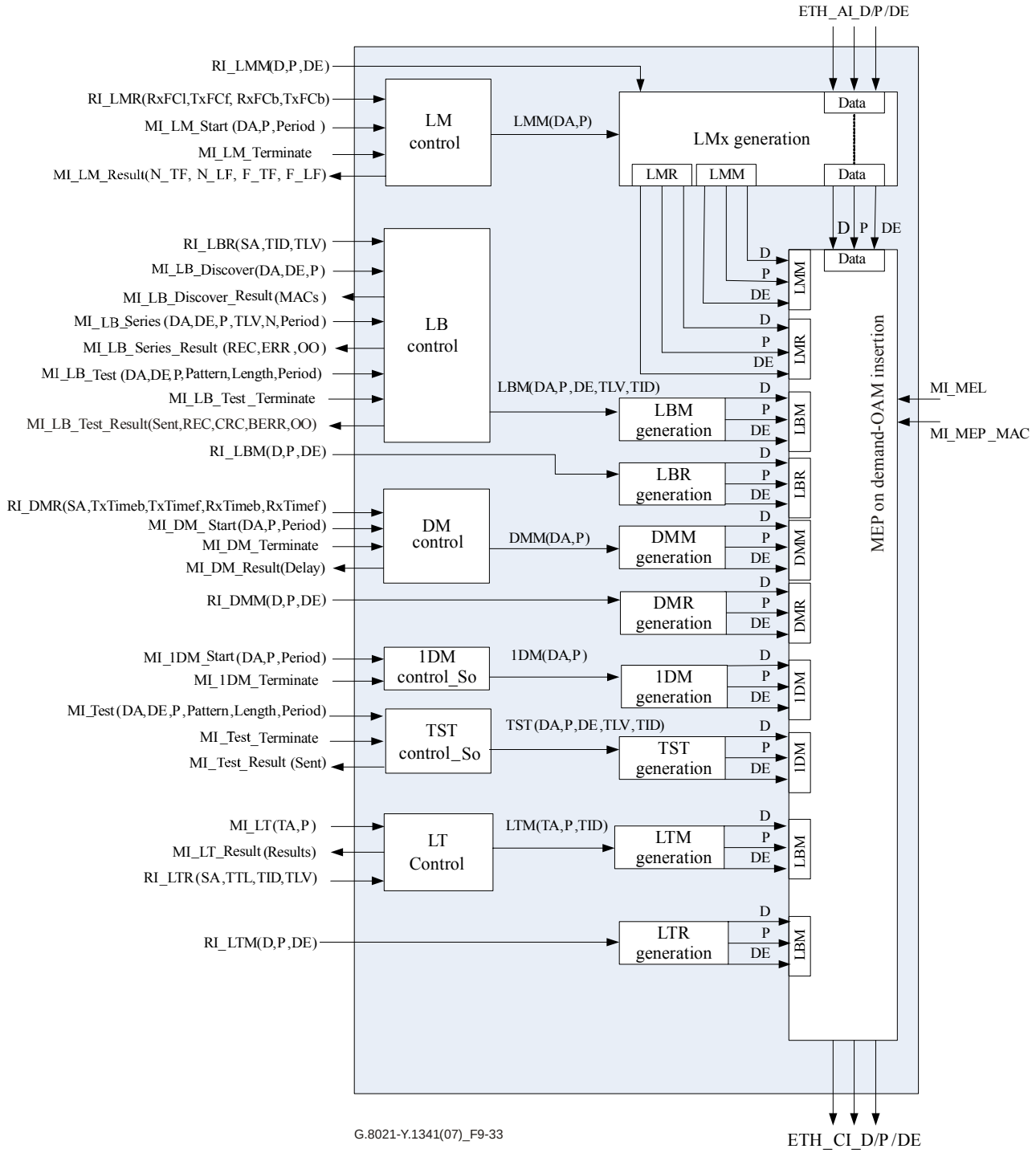

Figure 9-33 – ETHDe_FT_So processes

MEP on demand-OAM insertion process

The MEP ondemand-OAM insertion process inserts OAM traffic units that are generated in the ETHDe_FT_Sk process into the stream of traffic units.

For all ETH_CI_D received on any but the data input port, the SA field is overwritten with the MI_MEP_MAC value. In the M_SDU field, the Ethertype value is overwritten with the OAM Ethertype value (89-02) and the MEL field is overwritten with the MI_MEL value.

If the DA of the OAM traffic unit is a class 1 multicast DA, the OAM insertion process updates the DA to reflect the correct MEL.

This ensures that every generated OAM field has the correct SA, Ethertype and MEL.

LB control process

This process is defined in clause 8.1.8 where the LB protocol is defined. Clause 8.1.8.2 defines the LB control process.

LBM generation process

This process is defined in clause 8.1.8 where the LB protocol is defined. Clause 8.1.8.3 defines the LBM generation process.

LBR generation process

This process is defined in clause 8.1.8 where the LB protocol is defined. Clause 8.1.8.6 defines the LBR generation process.

LM control process

This process is defined in clause 8.1.9 where the LM protocol is defined. Clause 8.1.9.2 defines the LM control process.

LMx generation process

This process is defined in clause 8.1.9 where the LM protocol is defined. Clause 8.1.9.3 defines the LMx generation process.

DM control process

This process is defined in clause 8.1.10 where the DM protocol is defined. Clause 8.1.10.2 defines the DM control process.

DMM generation process

This process is defined in clause 8.1.10 where the DM protocol is defined. Clause 8.1.10.3 defines the DMM generation process.

DMR generation process

This process is defined in clause 8.1.10 where the DM protocol is defined. Clause 8.1.10.5 defines the DMR generation process.

1DM control_So process

This process is defined in clause 8.1.11 where the 1DM protocol is defined. Clause 8.1.11.2 defines the 1DM control_So process.

1DM generation process

This process is defined in clause 8.1.11 where the 1DM protocol is defined. Clause 8.1.11.3 defines the 1DM generation process.

TST control_So process

This process is defined in clause 8.1.12 where the TST protocol is defined. Clause 8.1.12.2 defines the TST control process.

TST generation process

This process is defined in clause 8.1.12 where the TST protocol is defined. Clause 8.1.12.3 defines the TST generation process.

LT control

This process is defined in clause 8.1.13 where the LT protocol is defined. Clause 8.1.13.2 defines the LT control process.

LTM generation

This process is defined in clause 8.1.13 where the LT protocol is defined. Clause 8.1.13.3 defines the LTM generation process.

LTR generation

This process is defined in clause 8.1.13 where the LT protocol is defined. Clause 8.1.13.5 defines the LTR generation process.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.4.1.2 ETH diagnostic flow termination sink function for MEPs (ETHDe_FT_Sk)

The ETHDe_FT_Sk process diagram is shown in Figure 9-34.

Symbol

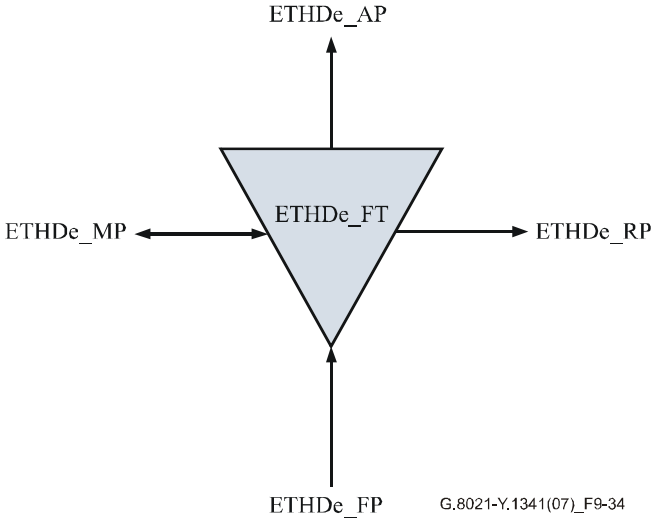

Figure 9-34 – ETHDe_FT_Sk function

Interfaces

Table 9-12 – ETHDe_FT_Sk interfaces

Inputs	Outputs
ETHDe_FP: ETHDe_CI_D ETHDe_CI_P ETHDe_CI_DE ETHDe_MP: ETHDe_MI_LM_Priority ETHDe_MI_MEL ETHDe_MI_MEP_MAC ETHDe_MI_1DM_Start(SA) ETHDe_MI_1DM_Terminate ETHDe_MI_TST_Start(SA,Pattern) ETHDe_MI_TST_Terminate	ETHDe_AP: ETHDe_AI_D ETHDe_AI_P ETHDe_AI_DE ETHDe_RP ETHDe_RI_LMR(RxFCl,TxFCf,RxFCb,TxFCb) ETHDe_RI_LMM(D,P,DE) ETHDe_RI_LBM(D,P,DE) ETHDe_RI_LBR(SA, TID, TLV) ETHDe_RI_DMM(D,P,DE) ETHDe_RI_LTM(D,P,DE) ETHDe_RI_LTR(SA,TTL,TID,TLV) ETHDe_RI_DMR(SA,TxTimeb,TxTimef, RxTimeb,RxTimef) ETHDe_MP: ETHDe_MI_TST_Result(REC,CRC,BER,OO)

Processes

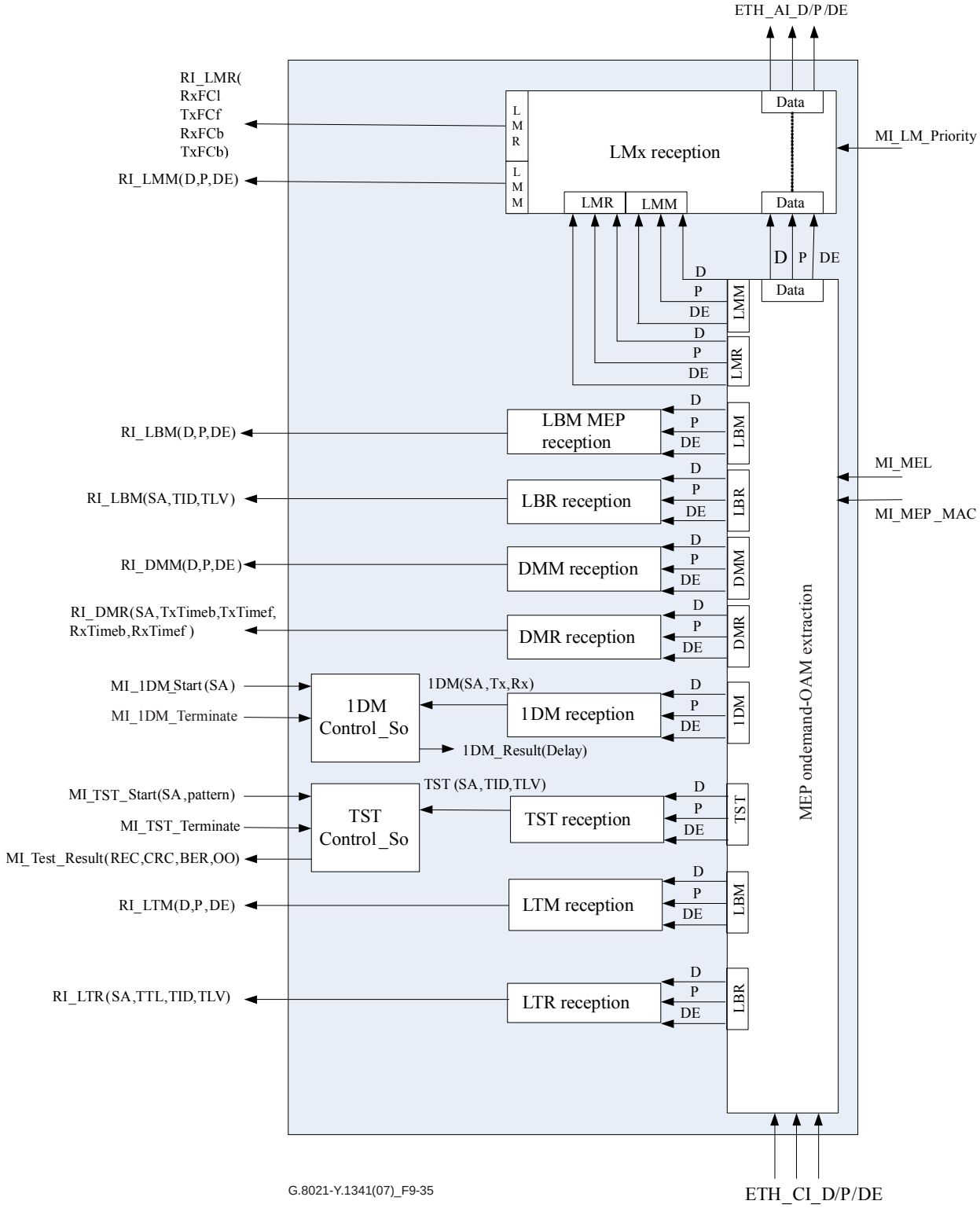

Figure 9-35 – ETHDe_FT_Sk processes

MEP ondemand-OAM extraction process

The MEP ondemand-OAM extraction process extracts OAM traffic units that are processed in the ETHDe_FT_Sk process from the stream of traffic units as defined in the following pseudo code:

```
if (TYPE=<ETHOAM>) and (MEL=MI_MEL) then
  switch(OPC) {
  case <LMM>: extract ETH_CI_D/P/DE signals to LMM port
  case <LMR>: extract ETH_CI_D/P/DE signals to LMR port
  case <DMM>: extract ETH_CI_D/P/DE signals to DMM port
  case <DMR>: extract ETH_CI_D/P/DE signals to DMR port
  case <1DM>: extract ETH_CI_D/P/DE signals to 1DM port
  case <LTM>: extract ETH_CI_D/P/DE signals to LTM port
  case <LTR>: extract ETH_CI_D/P/DE signals to LTR port
  case <LBM>: extract ETH_CI_D/P/DE signals to LBM port
  case <LBR>: extract ETH_CI_D/P/DE signals to LBR port
  case <TST>: extract ETH_CI_D/P/DE signals to TST port
  default: forward ETH_CI Signals to Port  }
else
    forward traffic unit to Data Port
endif
```

LBM MEP reception process

This process is defined in clause 8.1.8 where the LB protocol is defined. Clause 8.1.8.5 defines the LBM MEP reception process.

LBR reception process

This process is defined in clause 8.1.8 where the LB protocol is defined. Clause 8.1.8.7 defines the LBR reception process.

LMx reception process

This process is defined in clause 8.1.9 where the LM protocol is defined. Clause 8.1.9.4 defines the LMx reception process.

DMM reception process

This process is defined in clause 8.1.10 where the DM protocol is defined. Clause 8.1.10.4 defines the DMM reception process.

DMR reception process

This process is defined in clause 8.1.10 where the DM protocol is defined. Clause 8.1.10.6 defines the DMR reception process.

1DM reception process

This process is defined in clause 8.1.11 where the 1DM protocol is defined. Clause 8.1.11.4 defines the 1DM reception process.

1DM control_Sk process

This process is defined in clause 8.1.11 where the 1DM protocol is defined. Clause 8.1.11.5 defines the 1DM control_Sk process.

TST reception process

This process is defined in clause 8.1.12 where the TST protocol is defined. Clause 8.1.12.4 defines the TST reception process.

TST control_Sk process

This process is defined in clause 8.1.12 where the TST protocol is defined. Clause 8.1.12.5 defines the TST control_Sk process.

LTM reception process

This process is defined in clause 8.1.13 where the LT protocol is defined. Clause 8.1.13.4 defines the LTM reception process.

LTR reception process

This process is defined in clause 8.1.13 where the LT protocol is defined. Clause 8.1.13.6 defines the LTR reception process.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.4.2 ETH diagnostic flow termination function for MIPs (ETHDi_FT)

9.4.2.1 ETH diagnostic flow termination source function for MIPs (ETHDi_FT_So)

Symbol

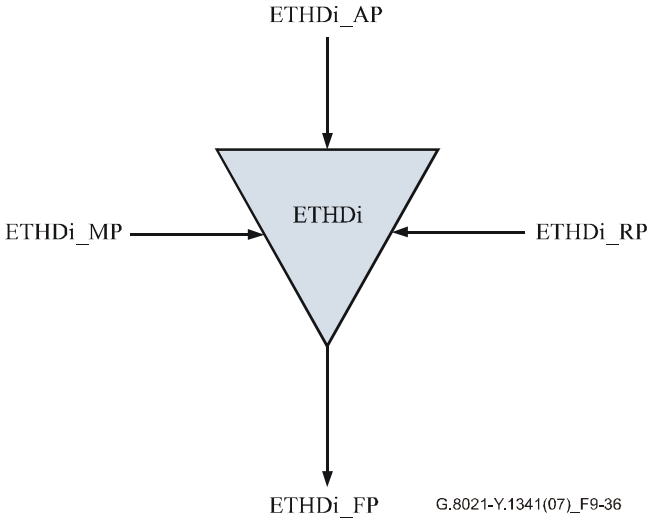

Figure 9-36 – ETHDi_FT_So function

Interfaces

Table 9-13 – ETHDi_FT_So interfaces

Inputs	Outputs
ETHDi_AP: ETHDi_AI_D ETHDi_AI_P ETHDi_AI_DE ETHDi_MP: ETHDi_MI_MEL ETHDi_MI_MIP_MAC ETHDi_RP: ETHDi_RI_LBM(D,P,DE) ETHDi_RI_LTM(D,P,DE)	ETHDi_FP: ETHDi_CI_D ETHDi_CI_P ETHDi_CI_DE

Processes

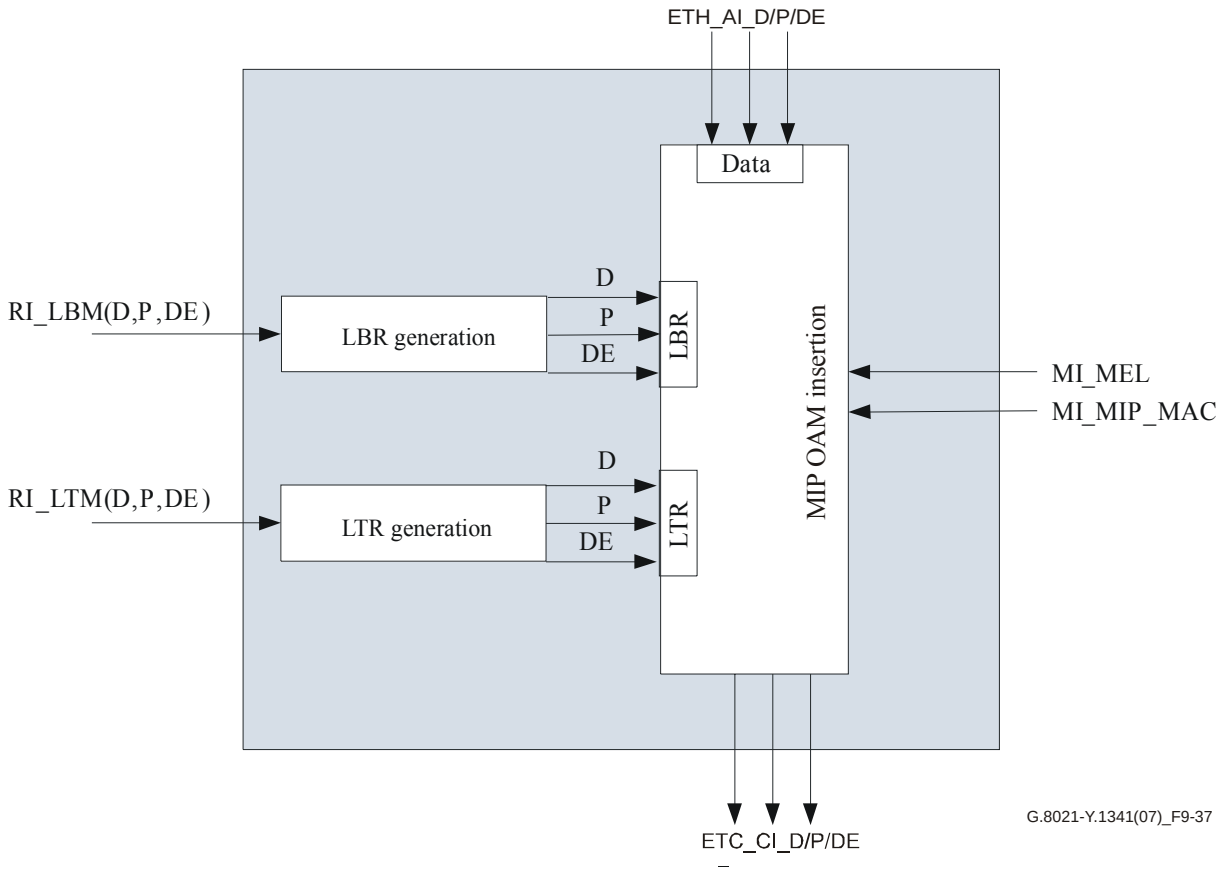

Figure 9-37 – ETHDi_FT_So process diagram

MIP OAM insertion

The MIP OAM insertion process inserts OAM traffic units that are generated in the ETHDi_FT_So process into the stream of traffic units.

For all ETH_CI_D received on any but the data input port, the SA field is overwritten with the MI_MIP_MAC value. In the M_SDU field, the Ethertype value is overwritten with the OAM Ethertype value (89-02) and the MEL field is overwritten with the MI_MEL value.

This ensures that every generated OAM field has the correct SA, Ethertype and MEL.

LBR generation process

This process is defined in clause 8.1.8 where the LB protocol is defined. Clause 8.1.8.6 defines the LBR generation process.

LTR generation process

This process is defined in clause 8.1.13 where the LT protocol is defined. Clause 8.1.13.5 defines the LTR generation process.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.4.2.2 ETH diagnostic flow termination sink function for MIPs (ETHDi/ETH_FT_Sk)

Symbol

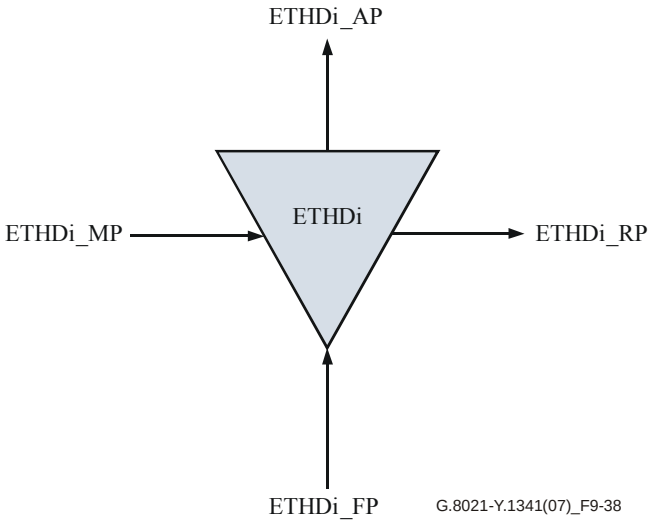

Figure 9-38 – ETHDi_FT_Sk function

Interfaces

Table 9-14 – ETHDi_FT_Sk interfaces

Inputs	Outputs
ETHDi_FP: ETHDi_CI_D ETHDi_CI_P ETHDi_CI_DE ETHDi_MP: ETHDi_MI_MEL ETHDi_MI_MIP_MAC	ETHDi_AP: ETHDi_AI_D ETHDi_AI_P ETHDi_AI_DE ETHDi_RP: ETHDi_RI_LBM(D,P,DE) ETHDi_RI_LTM(D,P,DE)

Processes

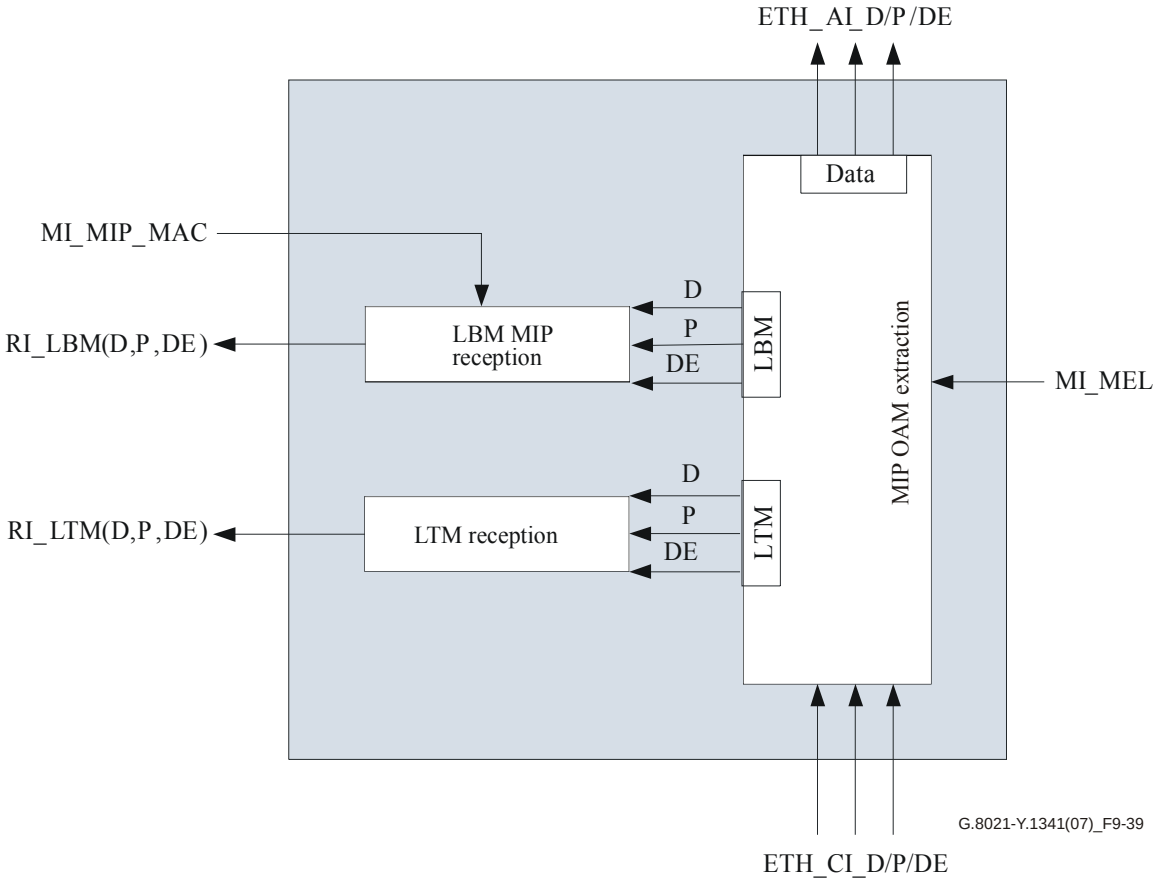

Figure 9-39 – ETHDi_FT_Sk process diagram

MIP OAM extraction process

The MIP OAM extraction process extracts OAM traffic units that are processed in the ETHDi_FT_Sk process from the stream of traffic units as defined in the following pseudo code:

```
if (TYPE=<ETHOAM>) and (MEL=MI_MEL) then
  switch(OPC) {
  case <LBM>: extract ETH-OAM traffic unit and forward to LBM Port
  case <LTM>: extract ETH-OAM traffic unit and forward to LTM Port
  default: forward ETH_CI traffic unit to other output
  }
else
    forward traffic unit to Data Port
endif
```

LBM MIP reception process

This process is defined in clause 8.1.8 where the LB protocol is defined. Clause 8.1.8.4 defines the LBM MIP reception process.

LTM reception process

This process is defined in clause 8.1.13 where the LT protocol is defined. Clause 8.1.13.4 defines the LTM reception process.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.4.3 ETHD/ETH adaptation function (ETHD/ETH_A)

The ETHD/ETH adaptation function is an empty function; it is included to satisfy the modelling rules.

The bidirectional ETHD/ETH adaptation function is performed by a co-located pair of ETHD/ETH adaptation source (ETHD/ETH_A_So) and sink (ETHD/ETH_A_Sk) functions.

9.4.3.1 ETHD/ETH source adaptation function (ETHD/ETH_A_So)

The ETHD/ETH_A_So function symbol is shown in Figure 9-40 and the process in Figure 9-41.

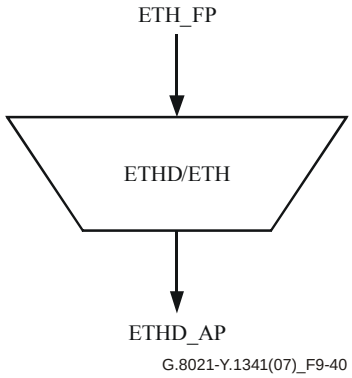

Figure 9-40 – ETHD/ETH_A_So symbol

Interfaces

Table 9-15 – ETHD/ETH_A_So interfaces

Inputs	Outputs
ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE See specific OAM process for additional inputs	ETHD_AP: ETHD_AI_D ETHD_AI_P ETHD_AI_DE See specific OAM process for additional inputs

Processes

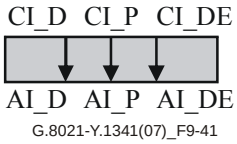

Figure 9-41 – ETHD/ETH_A_So process diagram

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.4.3.2 ETHD/ETH sink adaptation function (ETHD/ETH_A_Sk)

The ETHD/ETH_A_Sk function symbol is shown in Figure 9-42 and the process in Figure 9-43.

Symbol

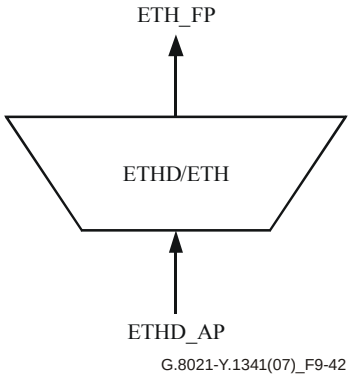

Figure 9-42 – ETHD/ETH_A_Sk symbol

Interfaces

Table 9-16 – ETHD/ETH_A_Sk interfaces

Inputs	Outputs
ETHD_AP: ETHD_AI_D ETHD_AI_P ETHD_AI_DE	ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE

Processes

The ETHD/ETH_A_Sk process diagram is shown in Figure 9-43.

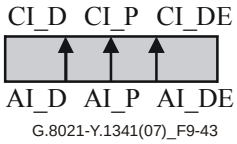

Figure 9-43 – ETHD/ETH_A_Sk process diagram

9.5 Server to ETH adaptation function <server>/ETH_A

Figure 9-44 presents a high level view of the processes that are present in a generic server to ETH adaptation function (<server>/ETH). The information crossing the <server>/ETH termination flow point (ETH_TFP) is referred to as the ETH characteristic information (ETH_CI). The information crossing the server layer access point (<server>_AP) is referred to as the server-specific adapted information (<server>_AI). Note that, for some server signals, not all processes need to be present, as defined in the server-specific adaptation functions.

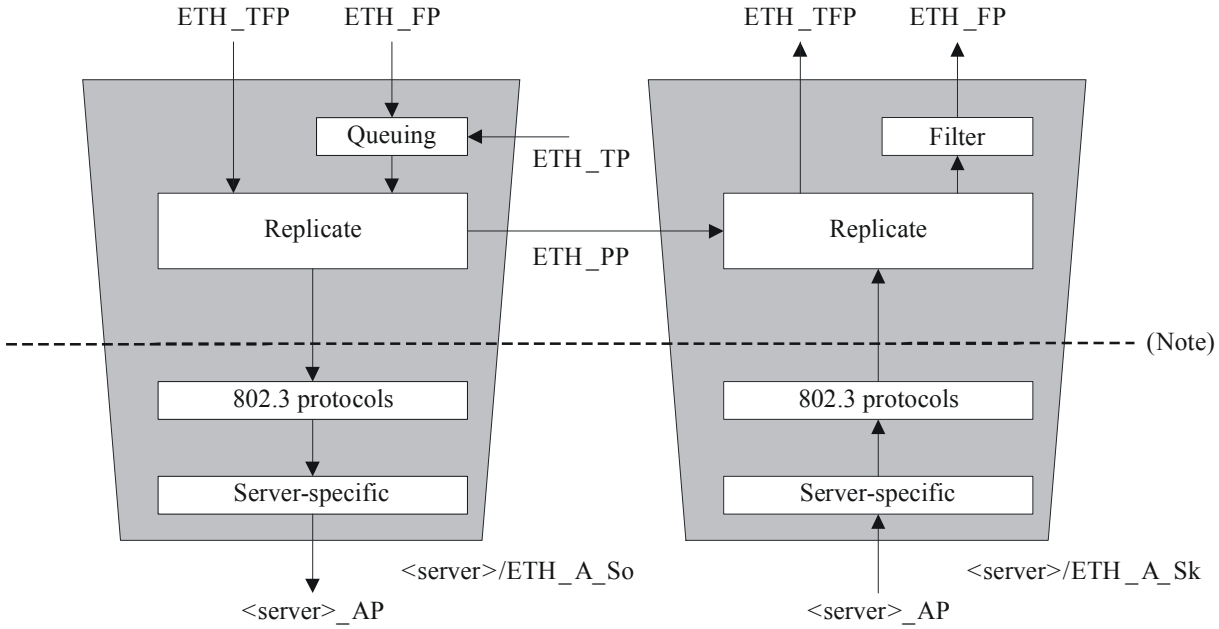

Figure 9-44 – Server to ETH adaptation functions

The following generic processes are specified: "Filter" in clause 8.3, "Queuing" in clause 8.2, "Replicate" in clause 8.4, and "802.3 protocols" in clause 8.5. Server-specific processes are specified in server-specific clauses.

NOTE 1 – Filtering in <server>/ETH_A sink adaptation function is not applied to frames forwarded to the ETH_TFP. The processes connected to this ETH_TFP should filter ETH_CI or process it.

NOTE 2 – Queuing of frames in the source direction is also not applied for frames from the ETH_TFP. If queuing of frames in the sink direction is required when traffic conditioning is applied, this will be included in the traffic conditioning function.

NOTE 3 – For G.8011.1 EPL service, ETH_TFP is unconnected. For services supporting ETH_TFP in the source direction, prioritization of frames received across the ETH_FP and ETH_TFP interfaces will be required. Such prioritization is for further study.

9.6 ETH traffic conditioning and shaping function (ETH_TCS)

9.6.1 ETH shaping function (ETH_TCS_So)

Symbol

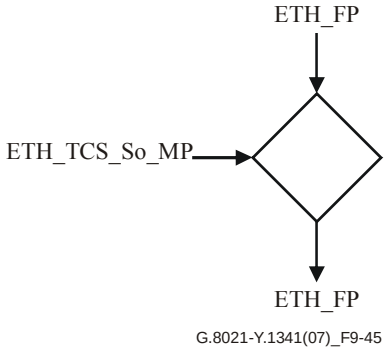

Figure 9-45 – ETH_TCS_So function

Interfaces

Table 9-17 – ETH_TCS_So interfaces

Inputs	Outputs
ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_TCS_So_MP: ETH_TCS_So_MI_Prio_Config ETH_TCS_So_MI_Queue_Config[] ETH_TCS_So_MI_Sched_Config	ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE

Processes

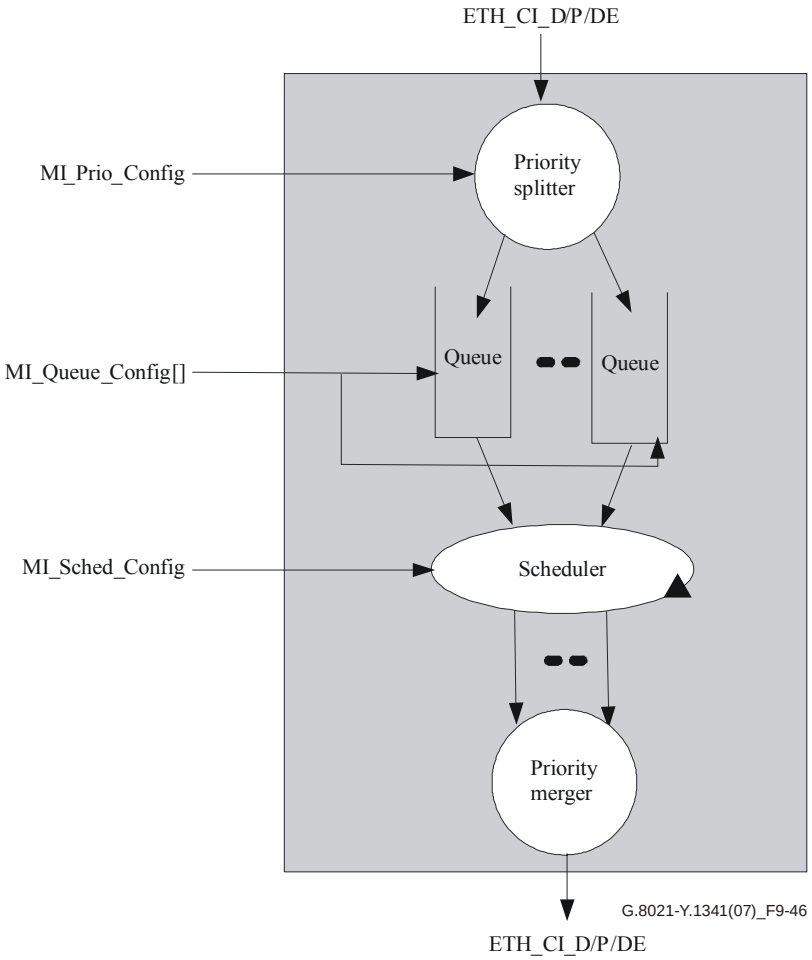

Figure 9-46 – ETH_TCS_So process

Priority splitter process

As defined in clause 8.9.2.

Queue process

As defined in clause 8.9.1.

Scheduler process

As defined in clause 8.9.5.

Priority merger process

As defined in clause 8.9.3.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.6.2 ETH traffic conditioning function (ETH_TCS_Sk)

Symbol

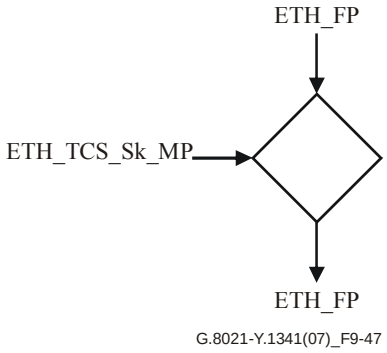

Figure 9-47 – ETH_TCS_Sk function

Interfaces

Table 9-18 – ETH_TCS_Sk interfaces

Inputs	Outputs
ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_TCS_Sk_MP: ETH_TCS_Sk_MI_Prio_Config ETH_TCS_Sk_MI_Cond_Config[]	ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE

Processes

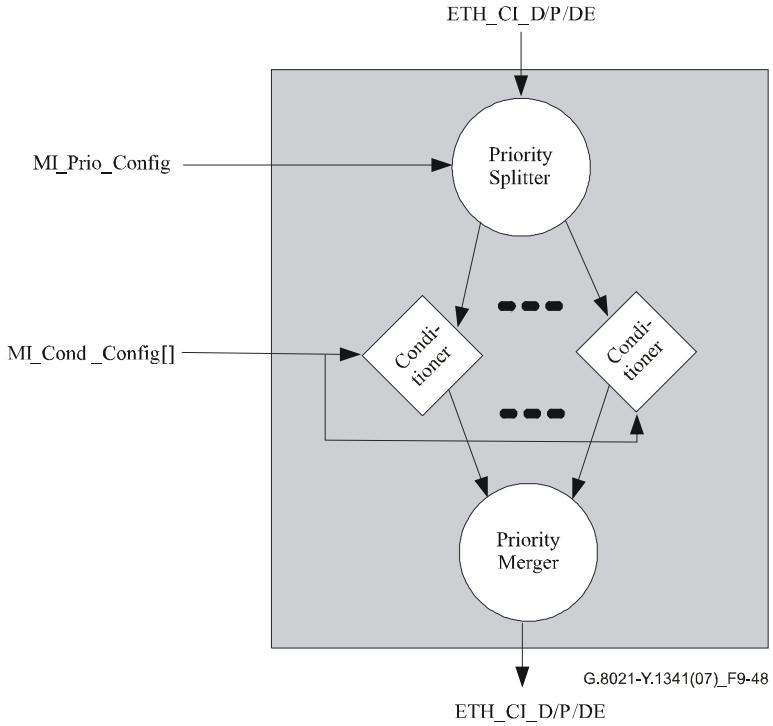

Figure 9-48 – ETH_TCS_Sk process

Priority splitter process

As defined in clause 8.9.2.

Conditioner process

As defined in clause 8.9.4.

Priority merger process

As defined in clause 8.9.3.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.6.3 ETH group traffic conditioning and shaping function (ETH_GTCS)

9.6.3.1 ETH group traffic shaping function (ETH_GTCS_So)

Symbol

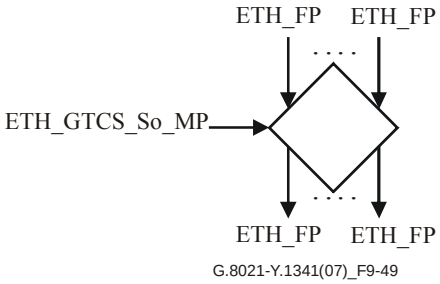

Figure 9-49 – ETH_GTCS_So process

Interfaces

Table 9-19 – ETH_GTCS_So interfaces

Inputs	Outputs
ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_GTCS_So_MP: ETH_GTCS_So_MI_Prio_Config[] ETH_GTCS_So_MI_Queue_Config[][] ETH_GTCS_So_MI_Sched_Config[]	ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE

Processes

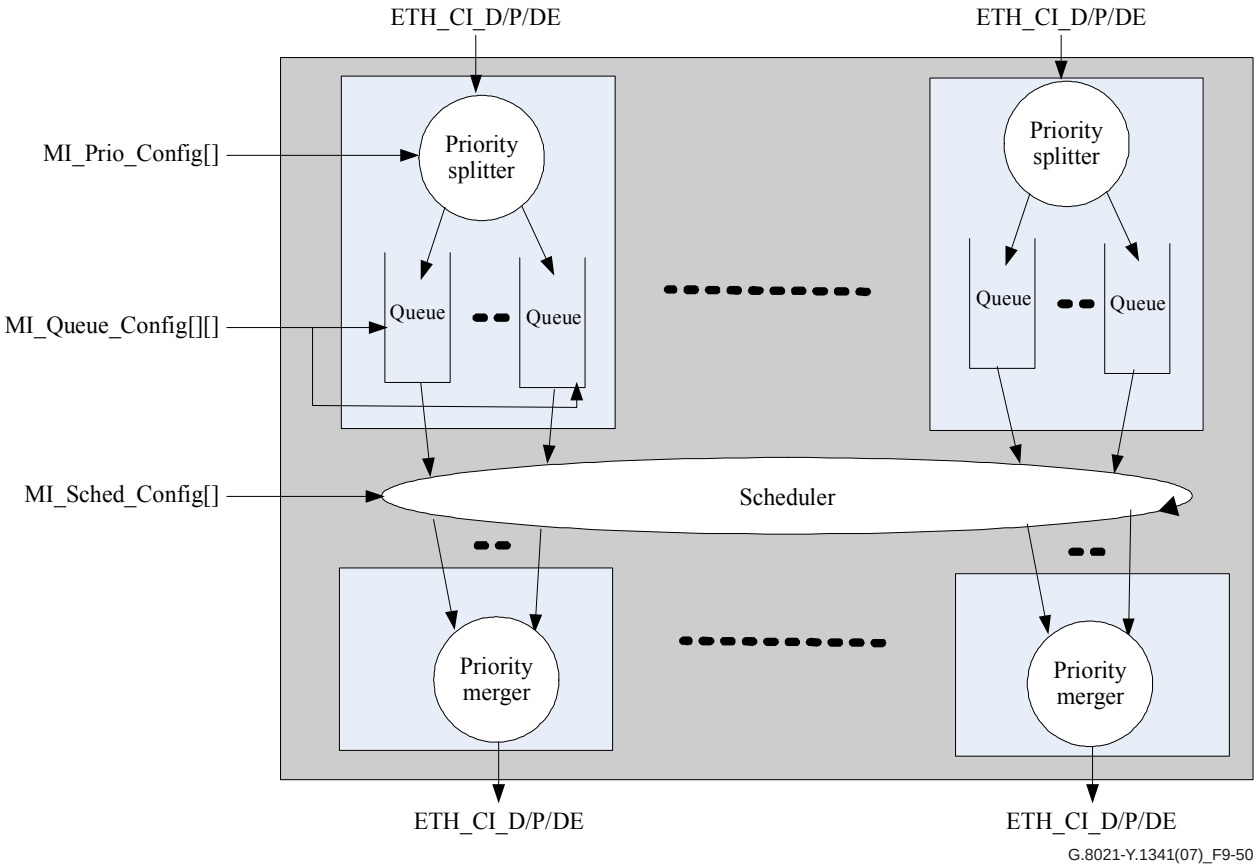

Figure 9-50 – ETH_GTCS_So process

Priority splitter process

As defined in clause 8.9.2.

Queue process

As defined in clause 8.9.1.

Scheduler process

As defined in clause 8.9.5.

Priority merger process

As defined in clause 8.9.3.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.6.3.2 ETH group traffic conditioning function (ETH_GTCS_Sk)

For further study.

9.7 ETH link aggregation functions

The ETH link aggregation functions model the link aggregation functionality as described in clause 43 of [IEEE 802.3 2005]. The definitions in this clause provide references to the appropriate generic process definitions in clause 8 of [ITU-T G.806] where necessary.

The generic model used is shown in Figures 9-51 and 9-52. Figure 9-51 shows the simplified model for the case of a single aggregator, while Figure 9-52 shows the generic model for the case of several aggregators. Np denotes the number of ETYn_AP interfaces (interfaces to the IEEE 802.3 MAC layer), while Na is the number of ETH-LAG_FP interfaces (interfaces to the IEEE 802.3 MAC layer).

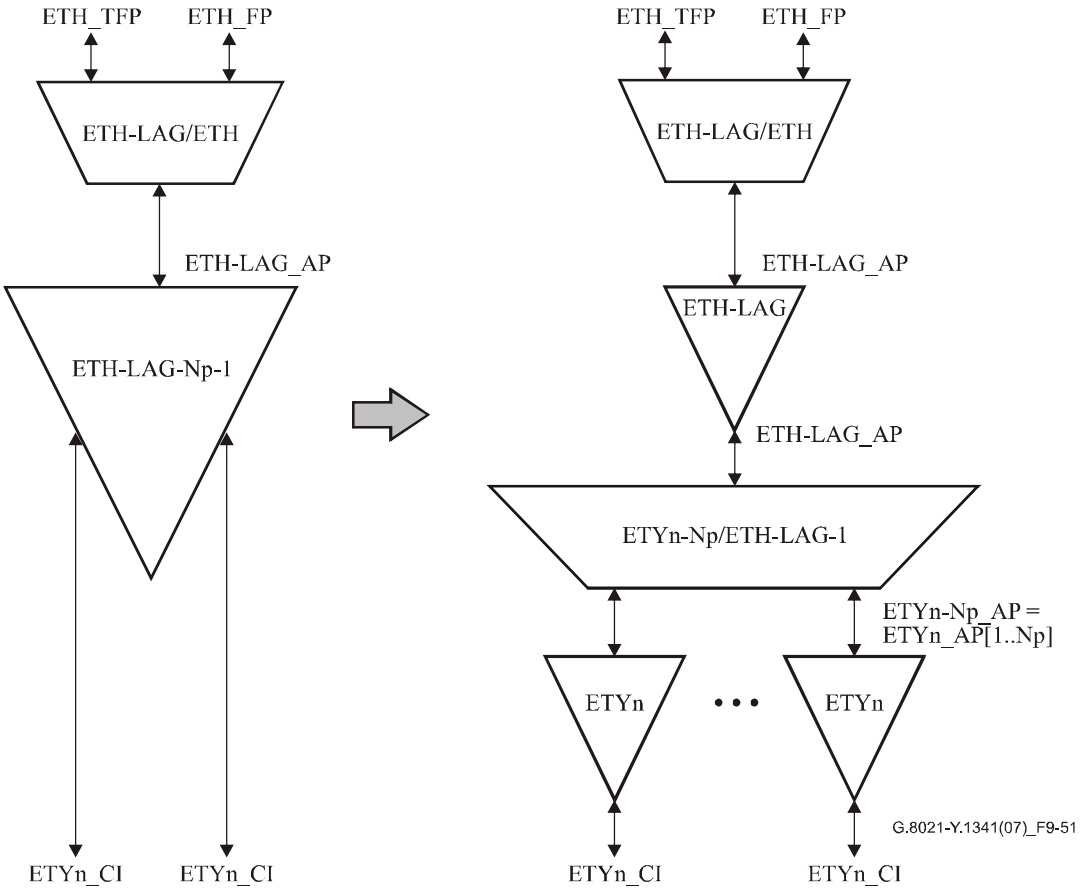

Figure 9-51 – Simplified model of Ethernet link aggregation with decomposition of ETH-LAG-Np-Na_TT function for Na=1

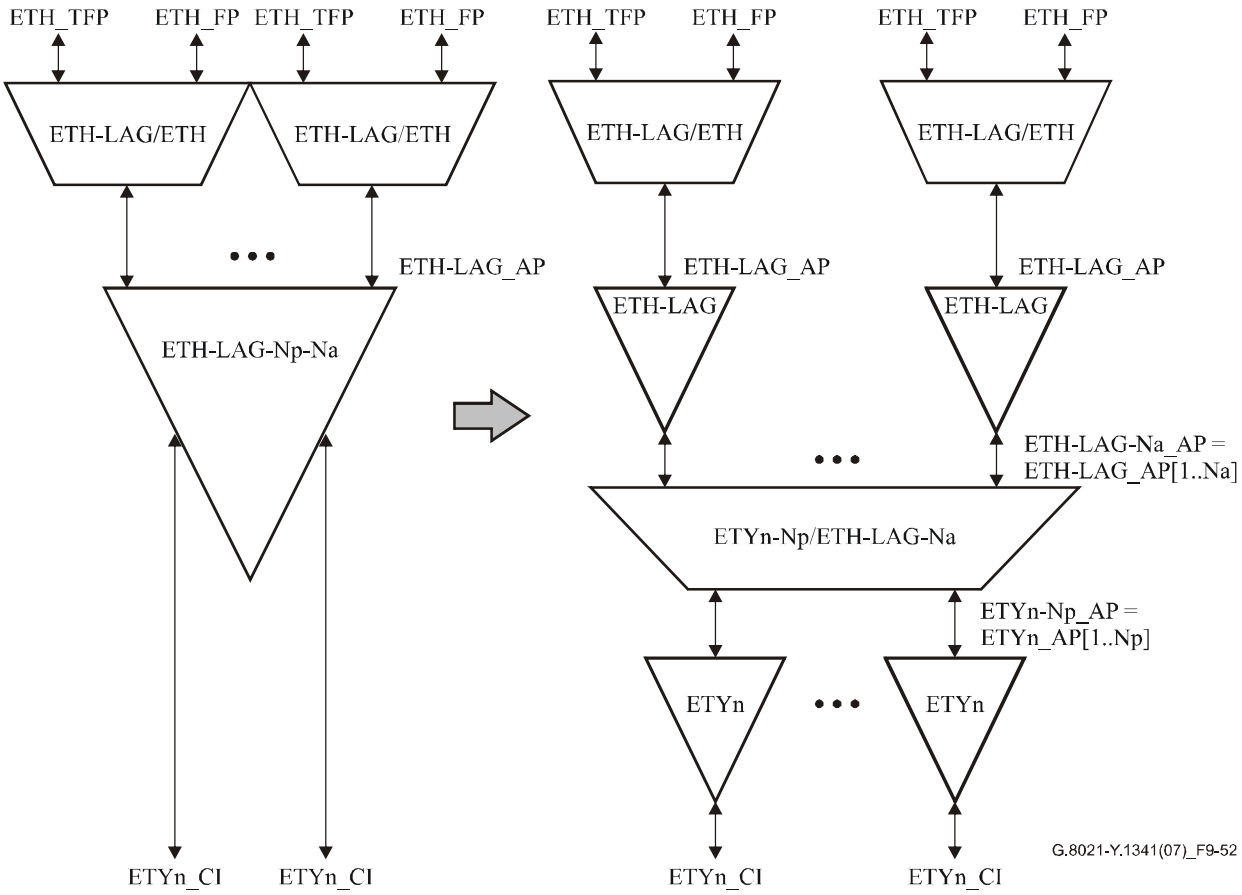

Figure 9-52 – Generic model of Ethernet link aggregation with decomposition of ETH-LAG-Np-Na_TT function

9.7.1 ETH link aggregation layer trail termination function (ETH-LAG-Np-Na_TT)

The ETH-LAG-Np-Na_TT function is decomposed as shown in Figures 9-53 and 9-55.

NOTE – ETH-LAG-Np-Na_TT functions always consist of a pair of identically-sized source and sink functions (i.e., a source function with certain values of Na/Np and a sink function with the same Na/Np values), as per [IEEE 802.3 2005].

9.7.1.1 ETH link aggregation adaptation source function (ETY-Np/ETH-LAG-Na_A_So)

Symbol

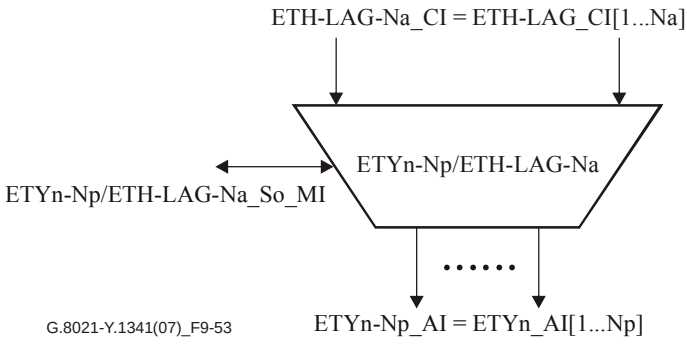

Figure 9-53 – ETY-Np/ETH-LAG-Na_A_So symbol

Interfaces

Table 9-20 – ETY-Np/ETH-LAG-Na_A_So interfaces

Inputs	Outputs
ETH-LAG-Na_FP: ETH-LAG-Na_CI_D = ETH-LAG_CI[1..Na]_D ETH-LAG-Na_CI_P = ETH-LAG_CI[1..Na]_P ETH-LAG-Na_CI_DE = ETH-LAG_CI[1..Na]_DE ETH-LAG-Na_CI_Clock = ETH-LAG_CI[1..Na]_Clock ETYn-Np/ETH-LAG-Na _A_So_MI: ETYn-Np/ETH-LAG-Na_A_So_ MI_TxPauseEnable ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_AP_List ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ ActorAdmin_State	ETYn-Np_AP: ETYn-Np_AI_Data = ETYn_AI[1..Np]_Data ETYn-Np_AI_Clock = ETYn_AI[1..Np]_Clock ETYn-Np/ETH-LAG-Na _A_So_MI: ETYn-Np/ETH-LAG-Na_A_So_ MI_Agg[1..Na]_ ActorSystemID ActorSystemPriority ActorOperKey PartnerSystemID PartnerSystemPriority PartnerOperKey DataRate CollectorMaxDelay ETYn-Np/ETH-LAG-Na_A_So_ MI_AggPort[1..Np]_ ActorOperKey PartnerOperSystemPriority PartnerOperSystemID PartnerOperKey ActorPort ActorPortPriority PartnerOperPort PartnerOperPortPriority ActorOperState PartnerOperState ETYn-Np/ETH-LAG-Na_A_So_ MI_pAggOctetsTxOK[1..Na] ETYn-Np/ETH-LAG-Na_A_So_ MI_pAggFramesTxOK[1..Na] ETYn-Np/ETH-LAG-Na_A_So_ MI_pFramesTransmittedOK[1..Np] ETYn-Np/ETH-LAG-Na_A_So_ MI_pOctetsTransmittedOK[1..Np]
NOTE 1 – The signals MI_Agg[1..Na]_… and MI_AggPort[1..Np]_… represent the attributes of the "Aggregator" and "Aggregator Port" objects of the same name in the model in clause 30.7 of [IEEE 802.3 2005]. As an example, the output MI_Agg[k]_PartnerSystemID corresponds to the IEEE read-only attribute aAggPartnerSystemID for aggregator object #k. NOTE 2 – For the purposes of Ethernet transport equipment, this table contains the minimum set of aggregator and aggregator port inputs and outputs to be supported. This set is a subset of the IEEE 802.3 model, of which some attributes have been omitted because they are specific to the IEEE management philosophy or for simplification in transport equipment. All parameters not explicitly settable per this table take their default values as per clause 43 of [IEEE 802.3 2005]. NOTE 3 – This is the minimum set of common requirements that transport equipment must fulfil.	

Processes

A process diagram of this function is shown in Figure 9-54.

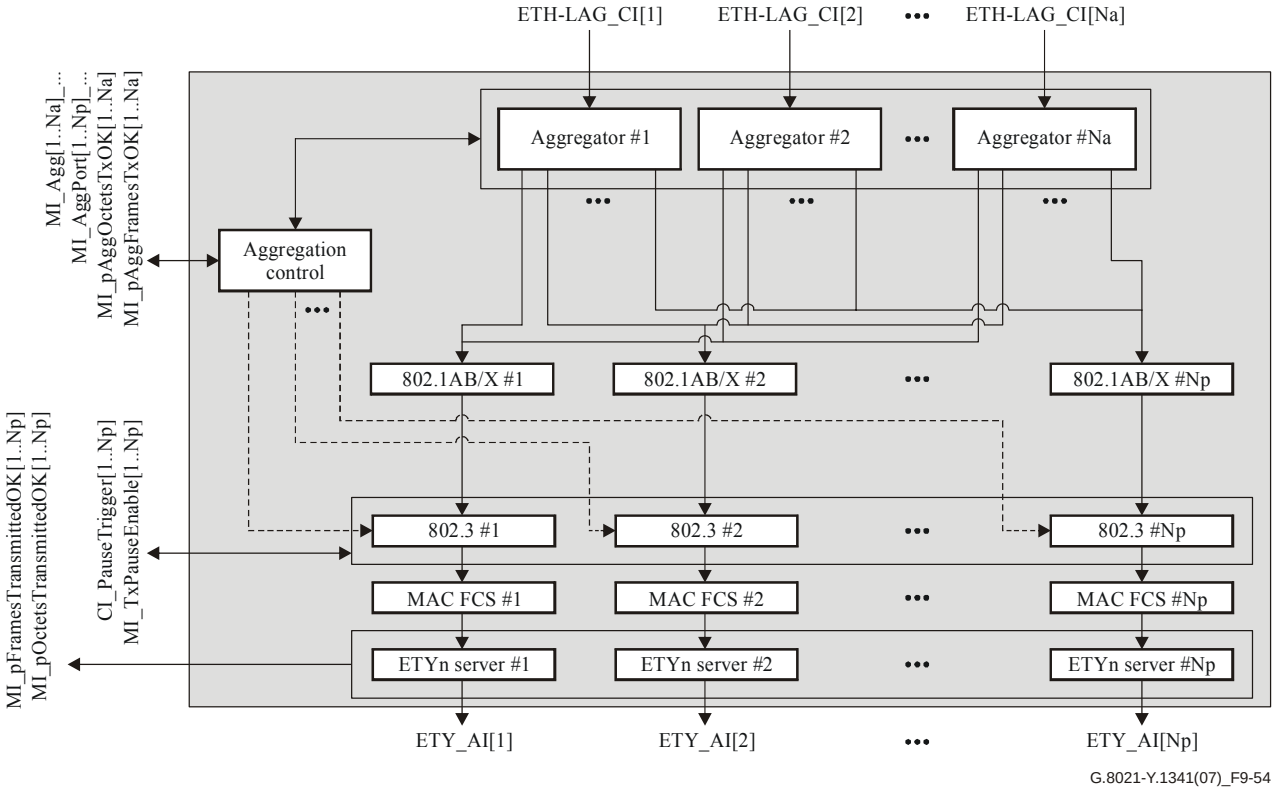

Figure 9-54 – ETY-Np/ETH-LAG-Na_A_So process diagram

The input MI_Agg[1..Na]_AP_List defines, for each aggregator, which ports (access points) are provisioned to be assigned to it. The AP_List attributes for all aggregators are disjunct lists.

The system shall assign a unique value for the parameter aAggActorAdminKey for each aggregator in the system. The system shall also assign the value used for each aggregator to the parameter aAggPortActorAdminKey of all ports in its assigned port list (AP_List).

NOTE 1 – This automated AdminKey assignment is a simplification of the IEEE provisioning model, where the keys are provisioned explicitly for each port and aggregator.

NOTE 2 – Automated assignment of PartnerAdminKey attributes is for further study.

ETYn server process

This process is identical to the "ETYn Server Specific" process defined in clause 8.8.

MAC FCS, 802.1AB/X, 802.3 process

These processes are as per the definitions of the "MAC FCS generation" in clause 8.8.1, "802.1AB/X protocols processes" in clause 8.8.3 and "802.3 protocols" in clause 8.5.

Aggregation control process

This process is the source part of the process of the same name in clause 43 of [IEEE 802.3 2005].

NOTE 3 – The aggregation control process is a single process shared between the source and the sink of a pair of source/sink adaptation functions.

NOTE 4 – As per the IEEE model and given the automated key assignment, only ports from each aggregator's AP_List will be eligible to be selected by that aggregator.

Aggregator process

This process is the source part of the process of the same name in clause 43 of [IEEE 802.3 2005]. A coupled mux state machine model is used.

NOTE 5 – Each "aggregator #k" process is a single process shared between the source and the sink of a pair of source/sink adaptation functions.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring

For each aggregator:

MI_pAggOctetsTxOK[1..Na] per clause 30 of [IEEE 802.3 2005].

MI_pAggFramesTxOK[1..Na] per clause 30 of [IEEE 802.3 2005].

For each access point:

MI_pOctetsTransmittedOK[1..Np] per clause 30 of [IEEE 802.3 2005].

MI_pFramesTransmittedOK[1..Np] per clause 30 of [IEEE 802.3 2005].

9.7.1.2 ETH link aggregation adaptation sink function (ETY-Np/ETH-LAG-Na_A_Sk)

Symbol

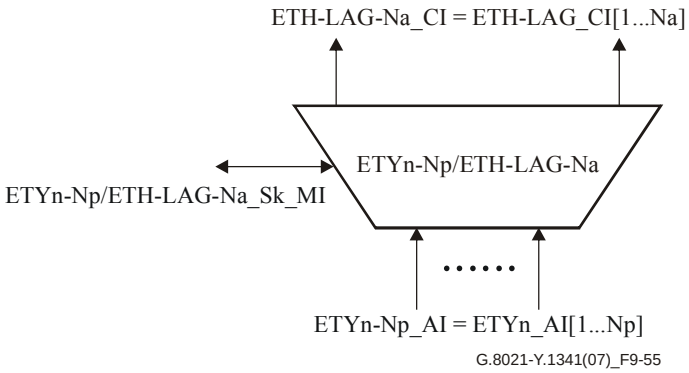

Figure 9-55 – ETY-Np/ETH-LAG-Na_A_Sk symbol

Interfaces

Table 9-21 – ETY-Np/ETH-LAG-Na_A_Sk interfaces

Inputs	Outputs
ETYn-Np_AP: ETYn-Np_AI_D= ETYn_AI[1..Np]_D ETYn-Np_AI_P= ETYn_AI[1..Np]_P ETYn-Np_AI_DE= ETYn_AI[1..Np]_DE ETYn-Np_AI_Clock ETYn_AI[1..Np]_Clock ETYn-Np/ETH-LAG-Na _A_So_MI: ETYn-Np/ETH-LAG-Na_A_Sk_ MI_PLLThr[1..Na]	ETH-LAG-Na_FP: ETH-LAG-Na_CI_D= ETH-LAG_CI[1..Na]_D ETH-LAG-Na_CI_P= ETH-LAG_CI[1..Na]_P ETH-LAG-Na_CI_DE= ETH-LAG_CI[1..Na]_DE ETH-LAG-Na_CI_Clock= ETH-LAG_CI[1..Na]_Clock ETH- LAG-Na_CI_aSSF= ETH-LAG_CI[1..Na]_aSSF ETYn-Np/ETH-LAG-Na _A_So_MI: ETYn-Np/ETH-LAG-Na_A_Sk_ MI_cPLL[1..Na] ETYn-Np/ETH-LAG-Na_A_Sk_ MI_cTLL[1..Na] ETYn-Np/ETH-LAG-Na_A_Sk_ MI_pAggOctetsRxOK[1..Na] ETYn-Np/ETH-LAG-Na_A_Sk_ MI_pAggFramesRxOK[1..Na] ETYn-Np/ETH-LAG-Na_A_Sk_ MI_pFramesReceivedOK[1..Np] ETYn-Np/ETH-LAG-Na_A_Sk_ MI_pOctetsReceivedOK[1..Np] ETYn-Np/ETH-LAG-Na_A_Sk_ MI_pFCSErrors[1..Np]

Processes

A process diagram of this function is shown in Figure 9-56.

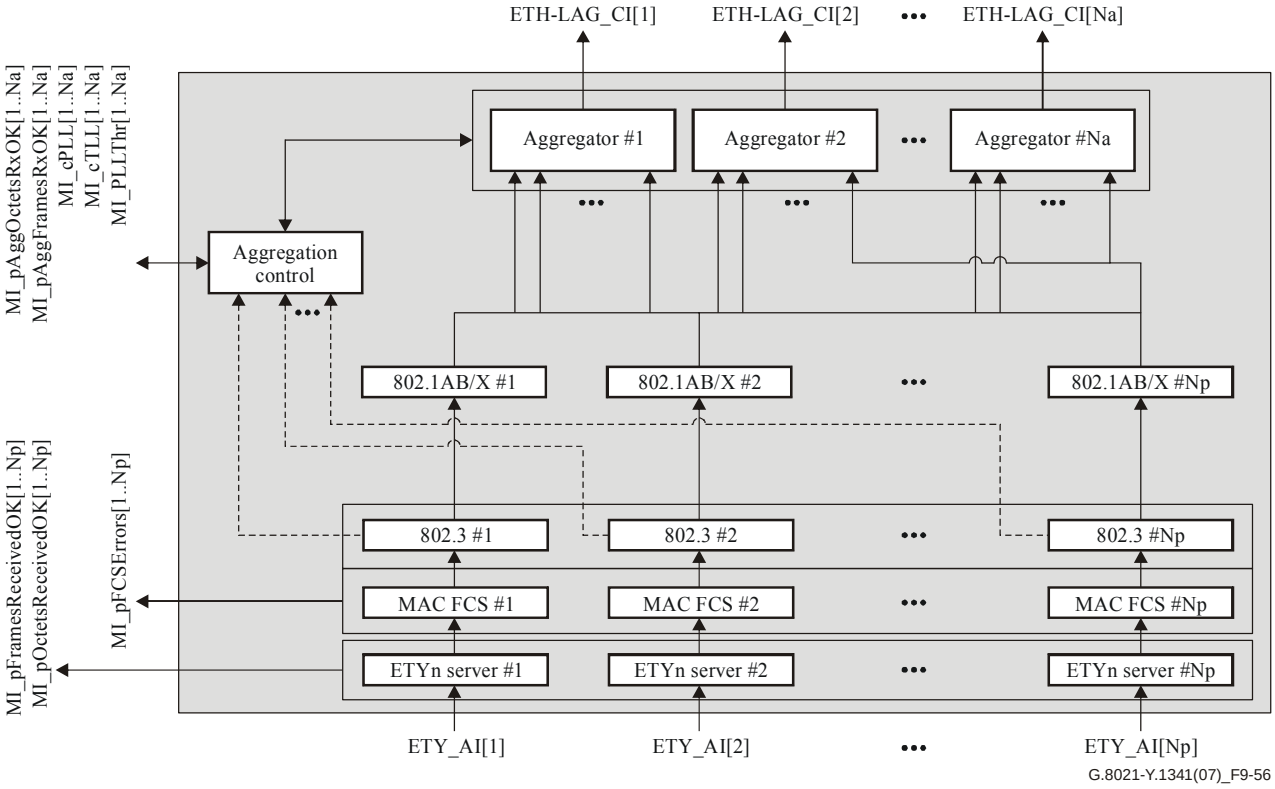

Figure 9-56 – ETY-Np/ETH-LAG-Na_A_Sk process diagram

ETYn server process

This process is identical to the "ETYn Server Specific" process defined in clause 8.8.

MAC FCS, 802.1AB/X, 802.3 process

These processes are as per the definitions of the "MAC FCS check" in clause 8.8.2, "802.1AB/X protocols" in clause 8.8.3 and "802.3 protocols" in clause 8.5.

Aggregation control process

This process is the source part of the process of the same name in clause 43 of [IEEE 802.3 2005].

NOTE 1 – The "aggregation control" process is a single process shared between the source and the sink of a pair of source/sink adaptation functions. The parameters used by this bidirectional process are defined in the interface section of the source adaptation function.

Aggregator process

This process is the source part of the process of the same name in clause 43 of [IEEE 802.3 2005]. A coupled mux state machine model is used.

NOTE 2 – Each "aggregator #k" process is a single process shared between the source and the sink of a pair of source/sink adaptation functions. The parameters used by this bidirectional process are defined in the interface section of the source adaptation function.

Defects

dMNCD[j] (member j not collecting/distributing): The defect shall be raised if an access point (port) in an aggregator's AP_List stays outside of the COLLECTING_DISTRIBUTING state for longer than X_{raise} seconds. The defect shall be cleared if the port enters the COLLECTING_DISTRIBUTING state and stays there for X_{clear} seconds.

$X_{raise} = X_{clear} = 1$ second.

Consequent actions

$$\text{ETH - LAG\_CI[k]\_aSSF} \leftarrow \prod_{j \in \text{MI\_AP\_List[k]}} \text{dMNCD[j]}$$

NOTE 3 – In other words, aSSF will be raised at the output ETH-LAG_CI[k] of an aggregator if all ports in its assigned port list (AP_List[k]) have the dMNCD defect active.

Defect correlations

Defining

$$\text{mAP\_Active[k]} = \sum_{j \in \text{MI\_AP\_List[k]}} (\text{not dMNCD[j]})$$

i.e., the number of active (no-defect) ports among those in an aggregator's AP_List,

then:

$$\text{ETH - LAG\_cTLL[k]} \leftarrow \text{mAP\_Active[k]} = 0$$

$$\text{ETH - LAG\_cPLL[k]} \leftarrow (0 < \text{mAP\_Active[k]}) \text{and} (\text{mAP\_Active[k]} < \text{MI\_PLLThr[k]})$$

NOTE 4 – In other words, a cTLL (total link loss) fault cause will be raised if no ports are active for an aggregator. A cPLL (partial link loss) fault cause shall be raised if the number of active ports is less than the provisioned threshold.

Performance monitoring

For each aggregator:

MI_pAggOctetsRxOK[1..Na] per clause 30 of [IEEE 802.3 2005].

MI_pAggFramesRxOK[1..Na] per clause 30 of [IEEE 802.3 2005].

For each access point:

MI_pFCSErrors[1..Np] per clause 30 of [IEEE 802.3 2005].

MI_pOctetsReceivedOK[1..Np] per clause 30 of [IEEE 802.3 2005].

MI_pFramesReceivedOK[1..Np] per clause 30 of [IEEE 802.3 2005].

9.7.1.3 ETH link aggregation flow termination source function (ETH-LAG_FT_So)

Symbol

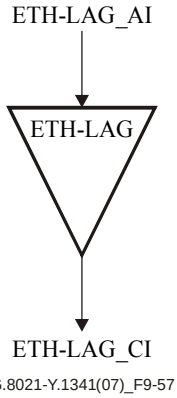

Figure 9-57 – ETH-LAG_FT_So symbol

Interfaces

Table 9-22 – ETH-LAG_FT_So interfaces

Inputs	Outputs
ETH-LAG_AP: ETH-LAG_AI_D ETH-LAG_AI_P ETH-LAG_AI_DE ETH-LAG_AI_Clock	ETH-LAG_FP: ETH-LAG_CI_D ETH-LAG_CI_P ETH-LAG_CI_DE ETH-LAG_CI_Clock

Processes

This function just forwards the ETH-LAG_AP information onto the ETH-LAG_FP without manipulation.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.7.1.4 ETH link aggregation flow termination sink function ETH-LAG_FT_Sk

Symbol

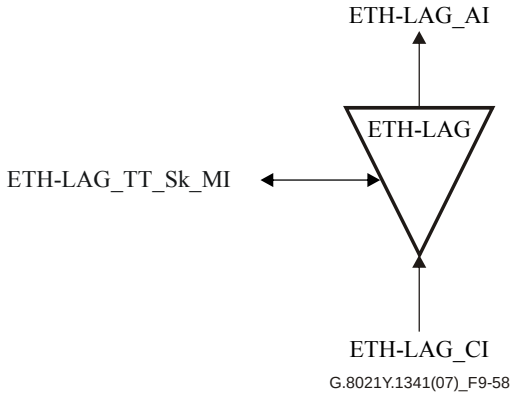

Figure 9-58 – ETH-LAG_FT_Sk symbol

Interfaces

Table 9-23 – ETH-LAG_FT_Sk interfaces

Inputs	Outputs
ETH-LAG_FP: ETH-LAG_CI_D ETH-LAG_CI_P ETH-LAG_CI_DE ETH-LAG_CI_Clock ETH-LAG_CI_SSF ETH-LAG_MP: ETH-LAG_TT_Sk_MI_SSF_Reported	ETH-LAG_AP: ETH-LAG_AI_D ETH-LAG_AI_P ETH-LAG_AI_DE ETH-LAG_AI_Clock ETH-LAG_AI_TSF ETH-LAG_AI_AIS ETH-LAG_MP: ETH-LAG_TT_Sk_MI_cSSF

Processes

This function just forwards the ETH-LAG_FP information onto the ETH-LAG_AP without manipulation.

Defects None.

Consequent actions

aTSF ← CI_SSF

Defect correlations

cSSF ← CI_SSF and SSF_Reported

Performance monitoring None.

9.7.2 ETH-LAG to ETH adaptation function (ETH-LAG/ETH_A)

9.7.2.1 ETH-LAG to ETH link aggregation adaptation source function (ETH-LAG/ETH_A_So)

Symbol

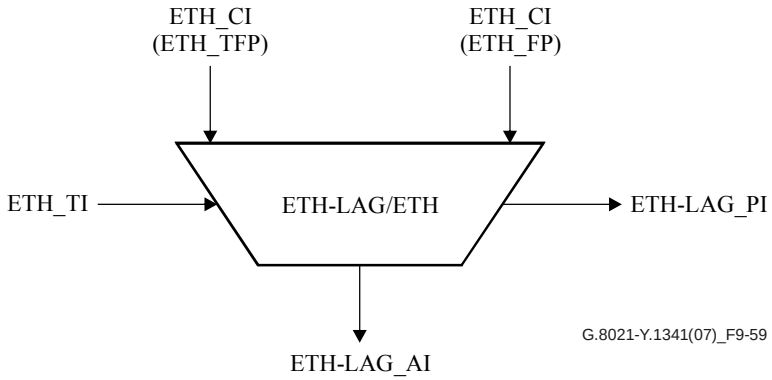

Figure 9-59 – ETH-LAG/ETH_A_So symbol

Interfaces

Table 9-24 – ETH-LAG/ETH_A_So interfaces

Inputs	Outputs
ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_Clock ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_Clock ETH_TP: ETH_TI_Clock	ETH-LAG_AP: ETH-LAG_AI_D ETH-LAG_AI_P ETH-LAG_AI_DE ETH-LAG_AI_Clock ETH-LAG_A_PP: ETH-LAG_A_PI_D (ETHTF_PP) ETH-LAG_A_PI_P (ETHTF_PP) ETH-LAG_A_PI_DE (ETHTF_PP) ETH-LAG_A_PI_D (ETHF_PP) ETH-LAG_A_PI_P (ETHF_PP) ETH-LAG_A_PI_DE (ETHF_PP)

Processes

A process diagram of this function is shown in Figure 9-60.

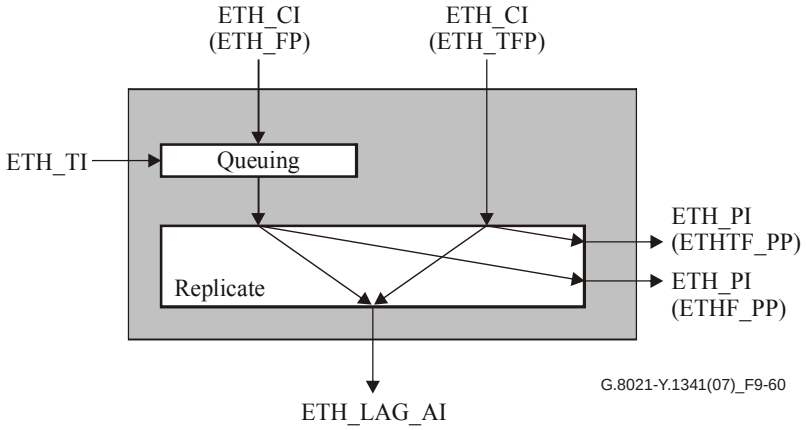

Figure 9-60 – ETH-LAG/ETH_A_So process diagram

See "Queuing" in clause 8.2 and "replicate" in clause 8.4.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

9.7.2.2 ETH-LAG to ETH link aggregation adaptation sink function (ETH-LAG/ETH_A_Sk)

Symbol

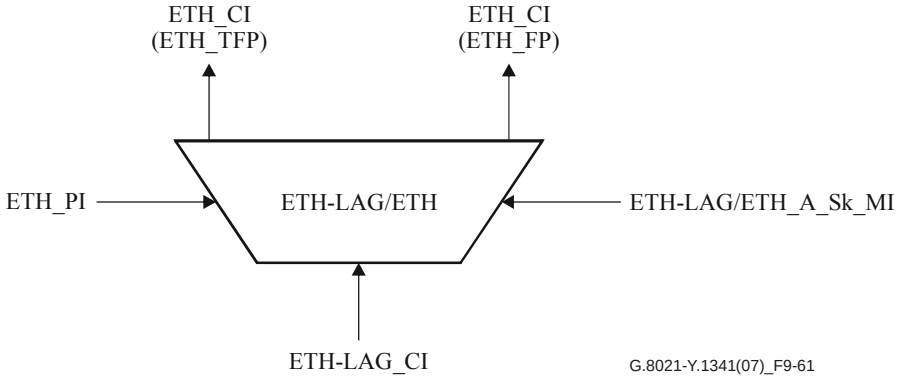

Figure 9-61 – ETH-LAG/ETH_A_Sk symbol

Interfaces

Table 9-25 – ETH-LAG/ETH_A_Sk interfaces

Inputs	Outputs
ETH-LAG_AP: ETH-LAG_AI_D ETH-LAG_AI_P ETH-LAG_AI_DE ETH-LAG_AI_Clock ETH-LAG-AI_TSF ETH-LAG-AI_AIS ETH-LAG/ETH_A_Sk_MI: ETH-LAG/ETH_A_Sk_MI_FilterConfig ETH-LAG_A_PP: ETH-LAG_A_PI_D (ETHTF_PP) ETH-LAG_A_PI_P (ETHTF_PP) ETH-LAG_A_PI_DE (ETHTF_PP) ETH-LAG_A_PI_D (ETHF_PP) ETH-LAG_A_PI_P (ETHF_PP) ETH-LAG_A_PI_DE (ETHF_PP)	ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_Clock ETH_CI_SSF ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_Clock ETH_CI_SSF

Processes

A process diagram of this function is shown in Figure 9-62.

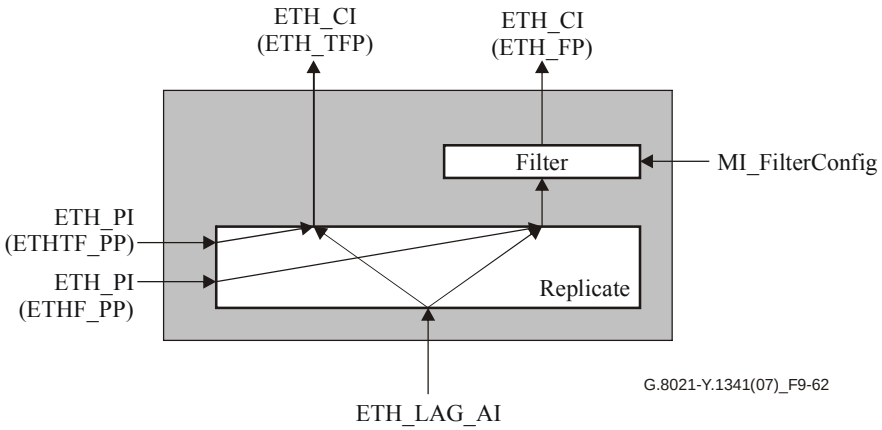

Figure 9-62 – ETH-LAG/ETH_A_Sk process diagram

See "Filter" in clause 8.3 and "replicate" in clause 8.4.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

10 Ethernet PHY layer (ETYn) functions

This Recommendation supports the following full-duplex Ethernet PHYs:

- ETY1: 10BASE-T (twisted pair electrical; full-duplex only).
- ETY2.1: 100BASE-TX (twisted pair electrical; full-duplex only; for further study).
- ETY2.2: 100BASE-FX (optical; full-duplex only; for further study).
- ETY3.1: 1000BASE-T (copper; for further study).
- ETY3.2: 1000BASE-LX/SX (long- and short-haul optical; full duplex only).
- ETY3.3: 1000BASE-CX (short-haul copper; full duplex only; for further study).
- ETY4: 10GBASE-S/L/E (optical; for further study).

10.1 ETYn connection functions

Not applicable; there are no connection functions defined for this layer.

10.2 Ethernet PHY trail termination functions (ETYn_TT)

In the sink direction, Ethernet PHY trail termination functions (ETYn_TT) terminate received optical or electrical Ethernet signals, delivering a conditioned signal to the ETYn/ETH_Sk_A sink adaptation function. In the source direction, ETYn_TT trail termination accepts an electrical signal from the ETYn/ETH_So_A source adaptation function, and outputs an appropriate electrical or optical signal to the Ethernet electrical or optical delivery medium.

NOTE – The ETYn_TT functions are intended to encapsulate the whole functionality of the physical layer in the IEEE 802.3-2002 model. The models in this Recommendation define this functionality just by reference to the IEEE model and intentionally do not provide details on it, as this functionality is well-understood from the IEEE work.

The types of ETYn functions are as defined in Table 10-1:

Table 10-1 – ETYn types

ETYn Type	IEEE 802.3-2002 Interface type
ETY1	10BASE-T
ETY2.1	100BASE-TX
ETY2.2	100BASE-FX
ETY3.1	1000BASE-T
ETY3.2	1000BASE-LX/SX
ETY3.3	1000BASE-CX
ETY4	10GBASE-S/L/E

Note that the 10G WAN PHY is for further study.

10.2.1 ETYn trail termination source function (ETYn_TT_So)

Symbol

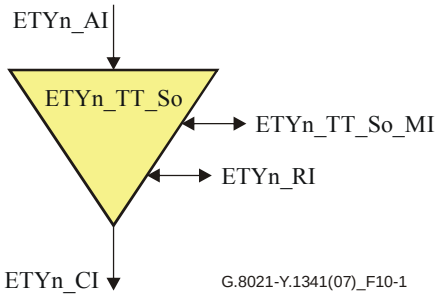

Figure 10-1 – ETYn_TT_So symbol

Interfaces

Table 10-2 – ETYn_TT_So interfaces

Inputs	Outputs
ETYn_AP: ETYn_AI_Data ETYn_AI_Clock ETYn_AI_SSF ETHYn_RP: ETYn_RI_RSF ETYnTT_So_MP: ETYn_TT_So_MI_FTSEnable	ETYn_TFP: ETYn_CI_Data ETYn_CI_Clock ETYn_RP: ETYn_RI_FTS ETYn_TT_So_MP: ETYn_TT_So_MI_PHYType ETYn_TT_So_MI_PHYTypeList

Processes

This source function together with the corresponding sink function implements all processes in the physical layer in the IEEE 802.3-2002 model.

"Fault propagation" process

When the AI_SSF and the FTSEnable (forced transmitter shutdown) are true and RI_RSF (remote signal fail) is false, this process forces the transmitter shutdown by either turning off the output transmitting device or inserting error codes (e.g., /V/, 10B_ERR for 1 GbE).

As soon as the transmitter shutdown is forced, the RI_FTS is asserted. The RI_FTS is reset [for further study] seconds after the forcing of transmitter shutdown is removed.

NOTE – Further detail is intentionally left out of this Recommendation.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring None.

10.2.2 ETYn trail termination sink function (ETYn_TT_Sk)

Symbol

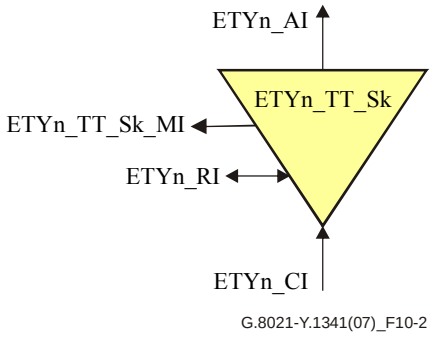

Figure 10-2 – ETYn_TT_Sk symbol

Interfaces

Table 10-3 – ETYn_TT_Sk interfaces

Inputs	Outputs
ETYn_TFP: ETYn_CI_Data ETYn_RP: ETYn_RI_FTS	ETYn_AP: ETYn_AI_Data ETYn_AI_Clock ETYn_AI_TSF ETYn_RP: ETYn_RI_RSF ETYn_TT_Sk_MP: ETYn_TT_Sk_MI_cLOS

Processes

This sink function, together with the corresponding source function, implements all processes in the physical layer in the IEEE 802.3-2002 model.

NOTE 1 – Further detail is intentionally left out of this Recommendation.

Defects

dLOS: The defect is detected as soon as the aMediaAvailable parameter (as defined in [IEEE 802.3 2002]) gets a value different from "available" and the RI_FTS is false. The defect is cleared as soon as the aMediaAvailable parameter becomes "available".

NOTE 2 – aRSF is generated and communicated to the ETY_TT_So (RI_RSF) to prevent a forced transmitter shutdown in case of dLOS. This Recommendation does not specify the remote fault indication signalling.

Consequent actions

aTSF ← dLOS

aRSF ← dLOS

Defect correlations

cLOS ← dLOS

Performance monitoring None.

10.3 ETYn to ETH adaptation functions (ETYn/ETH_A)

Figures 10-3 and 10-4 illustrate the Ethernet trail termination to ETH adaptation function (ETYn/ETH_A and ETYn/ETH-m_A). Information crossing the ETH flow point (ETH_FP) and ETH termination flow point (ETH_TFP) is referred to as ETH characteristic information (ETH_CI). Information crossing the ETYn access point (ETY_AP) is referred to as ETYn adapted information (ETYn_AI).

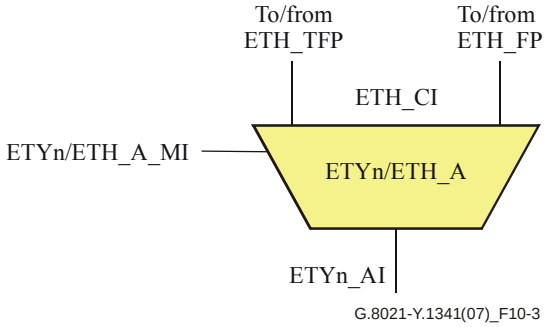

Figure 10-3 – ETYn server to ETH adaptation function

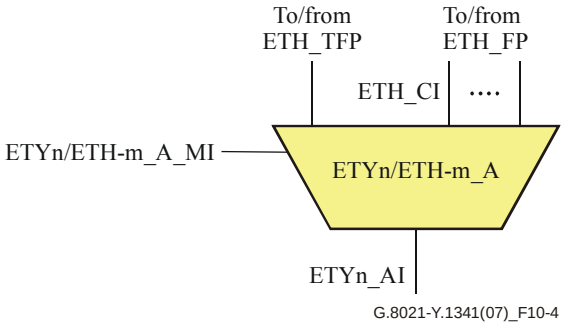

Figure 10-4 – ETYn server to ETH-m adaptation function

The ETYn/ETH_A adaptation function shown in Figure 10-3 can be further decomposed into separate source and sink adaptation functions shown in Figure 10-5:

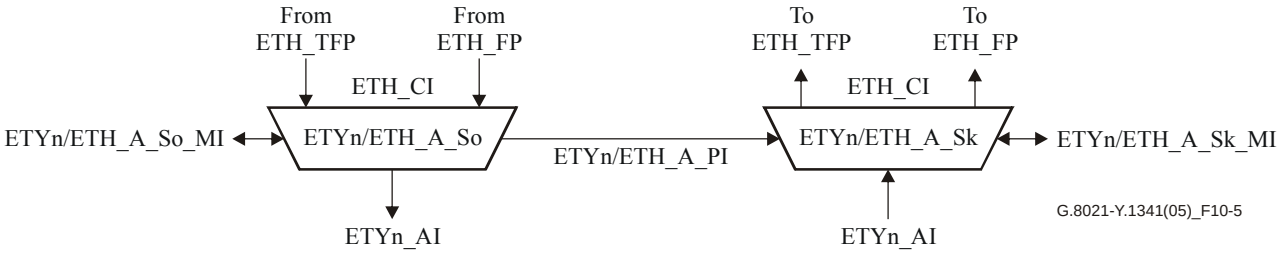

Figure 10-5 – ETYn/ETH_A source and sink adaptation functions

10.3.1 ETYn to ETH adaptation source function (ETYn/ETH_A_So)

Symbol

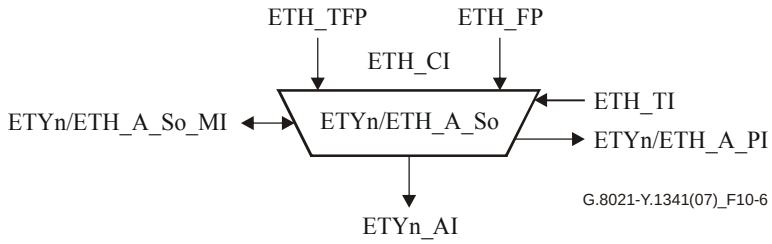

Figure 10-6 – ETYn/ETH_A_So symbol

Interfaces

Table 10-4 – ETYn/ETH_A_So interface

Inputs	Outputs
ETH_FP and ETH_TFP: ETH_CI_Data ETH_CI_Clock ETH_A_CI_PauseTrigger ETH_CI_SSF ETYn/ETH_A_So_MP: ETYn/ETH_A_So_MI_TxPauseEnable ETH_TP: ETH_TI_Clock	ETYn_AP: ETYn_AI_Data ETYn_AI_Clock ETYn_AI_SSF ETH_PP: ETH_PI_Data ETYn/ETH_A_So_MP: ETYn/ETH_A_So_MI_pFramesTransmittedOK ETYn/ETH_A_So_MI_pOctetsTransmittedOK

Processes

A process diagram of this function is shown in Figure 10-7.

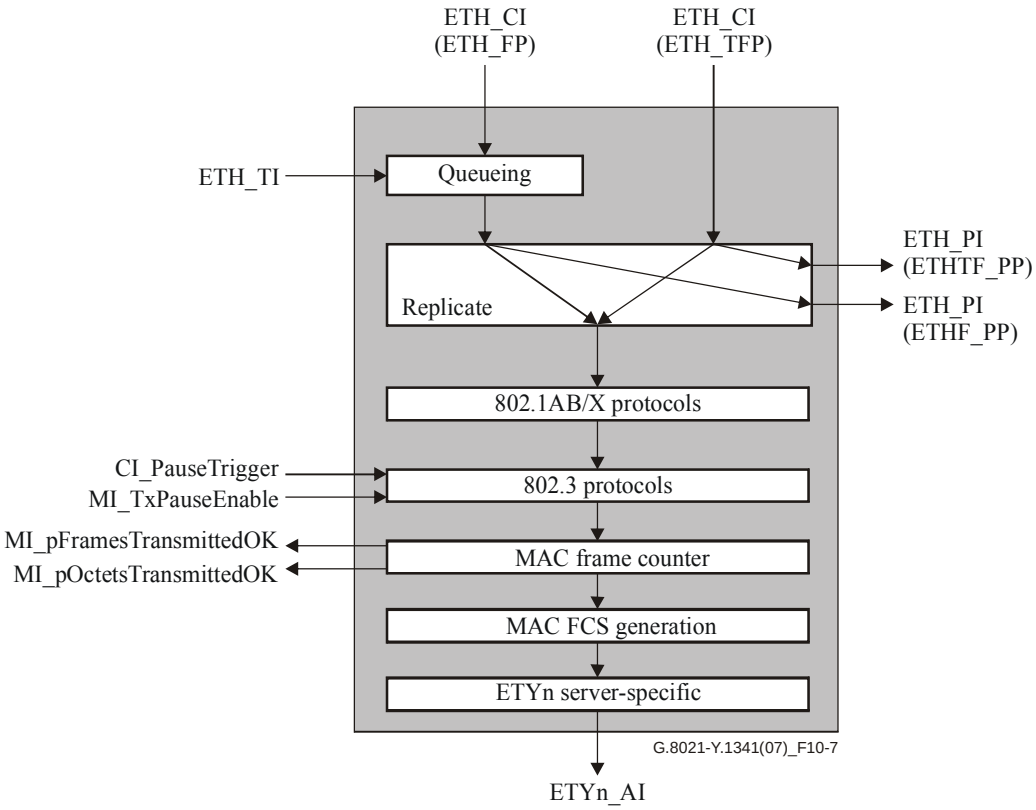

Figure 10-7 – ETYn/ETH_A_So process diagram

Processes

The "queuing", "replicate", "802.3 protocols", "802.1AB/X protocols" and "MAC FCS generate" processes are defined in clause 8 ("generic processes").

The "ETYn Server Specific" source process pads frames shorter than the minimum frame size (of 64 octets) to the minimum frame size according to clause 3.2.7 of [IEEE 802.3 2005].

NOTE – All source processes related to the Ethernet physical layer are encapsulated in this Recommendation by the ETYn_TT_So function.

MAC frame counting process location is for further study.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring For further study.

10.3.2 ETYn to ETH adaptation sink function (ETYn/ETH_A_Sk)

Symbol

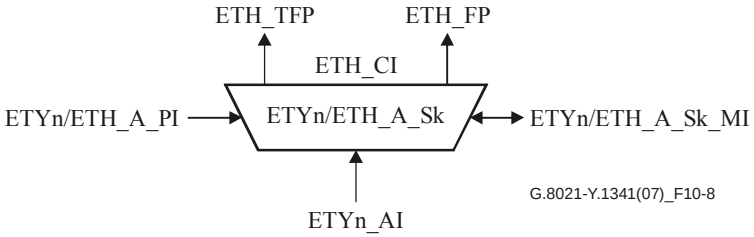

Figure 10-8 – ETYn/ETH_A_Sk symbol

Interfaces

Table 10-5 – ETYn/ETH_A_Sk interfaces

Inputs	Outputs
ETYn_AP: ETYn_AI_Data ETYn_AI_Clock ETH_PP: ETH_PI_Data ETYn/ETH_A_Sk_MP: ETYn/ETH_A_Sk_MI_FilterConfig ETYn/ETH_A_Sk_MI_MAC_Length	ETH_FP and ETH_TFP: ETH_CI_Data ETH_CI_Clock ETH_CI_SSF ETYn/ETH_A_Sk_MP: ETYn/ETH_A_Sk_MI_pErrors ETYn/ETH_A_Sk_MI_pFramesReceivedOK ETYn/ETH_A_Sk_MI_pOctetsReceivedOK

Processes

A process diagram of this function is shown in Figure 10-9.

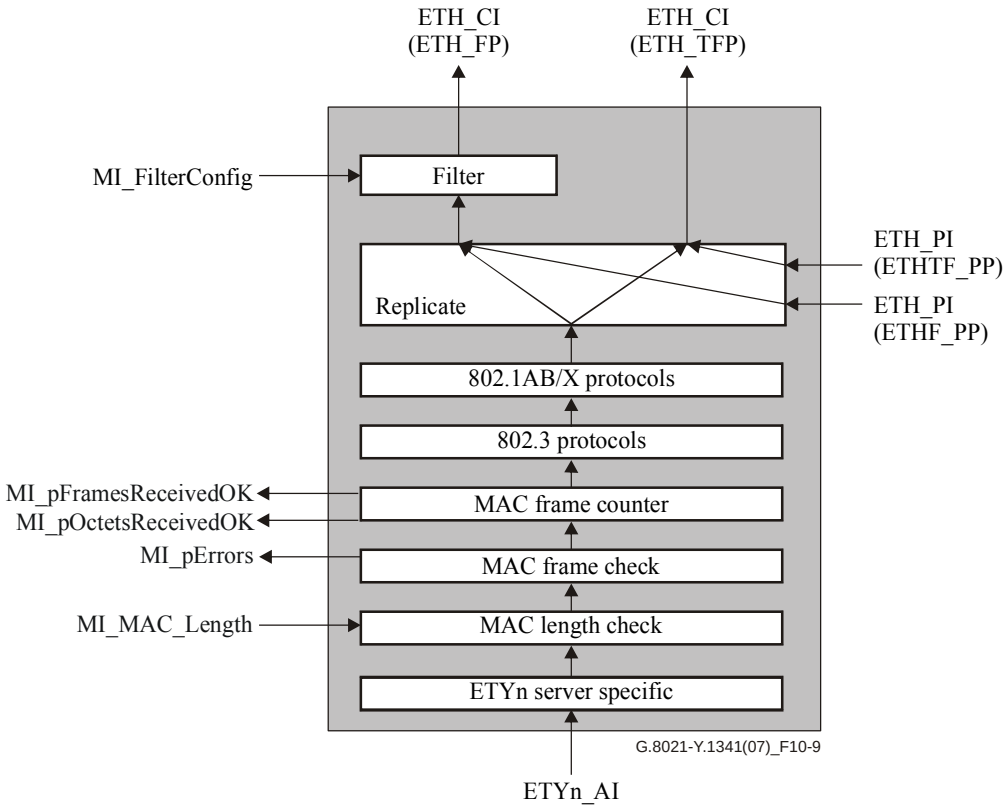

Figure 10-9 – ETYn/ETH_A_Sk process diagram

The "filter", "replicate," "802.3 protocols", "802.1AB/X protocols", MAC frame counting, "MAC FCS check" and "MAC length check" processes are defined in clause 8 ("generic processes").

The "ETYn Server Specific" sink process is a null process.

NOTE – All sink processes related to the Ethernet physical layer are encapsulated in this Recommendation by the ETYn_TT_Sk function.

MAC frame counting: For further study.

Defects None.

Consequent actions

aSSF ← AI_TSF

Defect correlations None.

Performance monitoring For further study.

10.4 1000BASE-(SX/LX/CX) ETY/coding sub-layer adaptation functions (ETY3/ETC3_A)

This adaptation function adapts 1000BASE-SX, -LX or -CX physical layer signals from/to 8B/10B-encoded codewords. Codewords may be extracted from or mapped into GFP-T frames, per clause 11.2, SDH/ETC adaptation functions (S4-X/ETC3_A).

For further study.

11 Non-Ethernet server to ETH adaptation functions

11.1 SDH/ETH adaptation functions (S/ETH_A)

11.1.1 VC-n/ETH adaptation functions (Sn/ETH_A; n = 3, 3-X, 4, 4-X)

This covers non-concatenated, contiguously concatenated, and non-LCAS VCAT. See clause 11.1.2 for LCAS-capable VC-n-Xv/ETH adaptation functions.

11.1.1.1 VC-n/ETH adaptation source function (Sn/ETH_A_So)

This function maps ETH_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 G.707], but with indeterminate POH bytes: J1, B3, G1.

Symbol

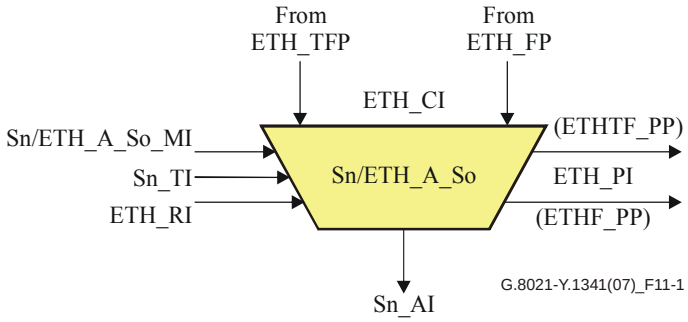

Figure 11-1 – Sn/ETH_A_So symbol

Interfaces

Table 11-1 – Sn/ETH_A_So interfaces

Inputs	Outputs
ETH_TFP: ETH_CI_Data ETH_FP: ETH_CI_Data ETH_CI_SSF ETH_RP: ETH_RI_RSF Sn_TI: Sn_TI_Clock Sn_TI_FrameStart Sn/ETH_A_So_MI: Sn/ETH_A_So_MI_CSFEnable	Sn_AP: Sn_AI_Data Sn_AI_Clock Sn_AI_FrameStart ETHF_PP: ETH_PI_Data ETHTF_PP: ETH_PI_Data

Processes

A process diagram of this function is shown in Figure 11-2.

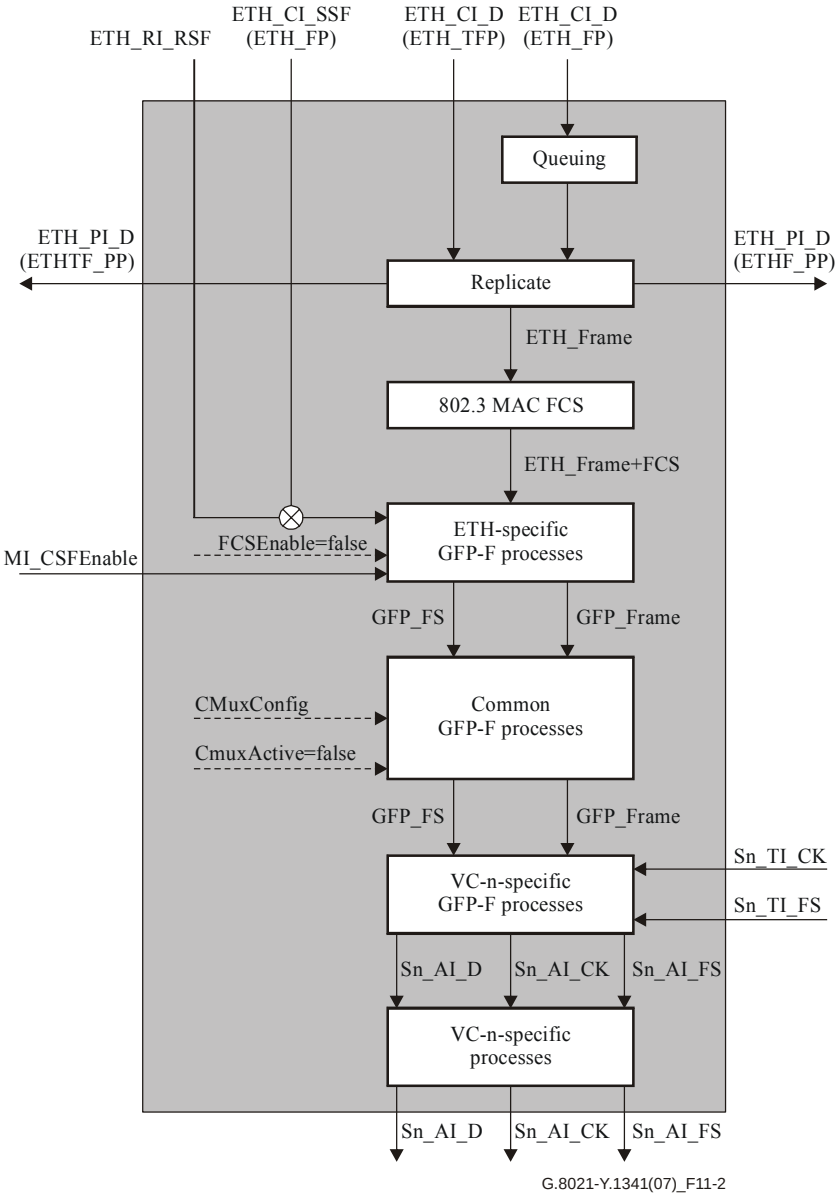

Figure 11-2 – Sn/ETH_A_So process diagram

Queuing process

See clause 8.2.

Replicate process

See clause 8.4.

802.3 MAC FCS generation

See clause 8.8.1.

Ethernet-specific GFP-F source process

See clause 8.5.4.1.1 of [ITU-T G.806]. GFP pFCS generation is disabled (FCSenable=false). The UPI value for frame-mapped Ethernet shall be inserted (Table 6-3 of [ITU-T G.7041]). The Ethernet frames are inserted into the client payload information field of the GFP-F frames according to clause 7.1 of [ITU-T G.7041].

Response to ETH_CI_SSF asserted is for further study.

Common GFP source processes

See clause 8.5.3.1 of [ITU-T G.806]. GFP channel multiplexing is not supported (CMuxActive=false).

VC-n-specific GFP source process

See clause 8.5.2.1 of [ITU-T G.806]. The GFP frames are mapped into the VC-n payload area according to clause 10.6 of [ITU-T G.707].

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 of [ITU-T G.707] is placed in the C2 byte position.

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

NOTE 1 – For Sn/ETH_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 of [ITU-T G.783]).

NOTE 2 – For Sn/ETH_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 of [ITU-T G.783]).

Counter processes

For further study.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring For further study.

11.1.1.2 VC-n/ETH adaptation sink function (Sn/ETH_A_Sk)

This function extracts ETH_CI information from the Sn_AI signal (n = 3, 3-X, 4, 4-X), delivering ETH_CI to ETH_TFP and ETH_FP.

Data at the Sn_AP is as described in [ITU-T G.707].

Symbol

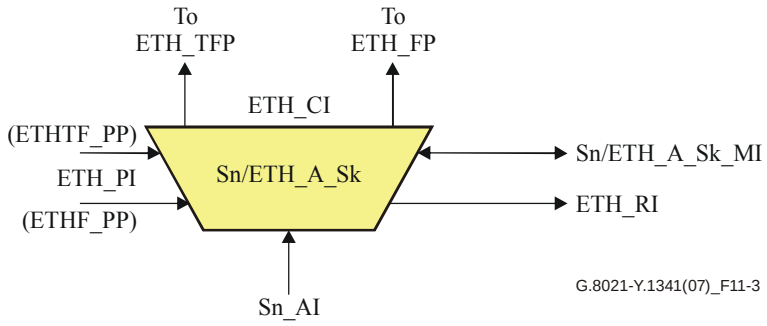

Figure 11-3 – Sn/ETH_A_Sk symbol

Interfaces

Table 11-2 – Sn/ETH_A_Sk interfaces

Inputs	Outputs
Sn_AP: Sn_AI_Data Sn_AI_ClocK Sn_AI_FrameStart Sn_AI_TSF ETHF_PP: ETH_PI_Data ETHTF_PP: ETH_PI_Data Sn/ETH_A_Sk_MI: Sn/ETH_A_Sk_MI_FilterConfig Sn/ETH_A_Sk_MI_CSF_Reported Sn/ETH_A_Sk_MI_MAC_Length	ETH_TFP: ETH_CI_Data ETH_CI_SSF ETH_FP: ETH_CI_Data ETH_CI_SSF ETH_RP: ETH_RI_RSF Sn/ETH_A_Sk_MI: Sn/ETH_A_Sk_MI_AcSL Sn/ETH_A_Sk_MI_AcEXI Sn/ETH_A_Sk_MI_AcUPI Sn/ETH_A_Sk_MI_cPLM Sn/ETH_A_Sk_MI_cLFD Sn/ETH_A_Sk_MI_cUPM Sn/ETH_A_Sk_MI_cEXM Sn/ETH_A_Sk_MI_cCSF Sn/ETH_A_Sk_MI_pFCSErrors

Processes

A process diagram of this function is shown in Figure 11-4.

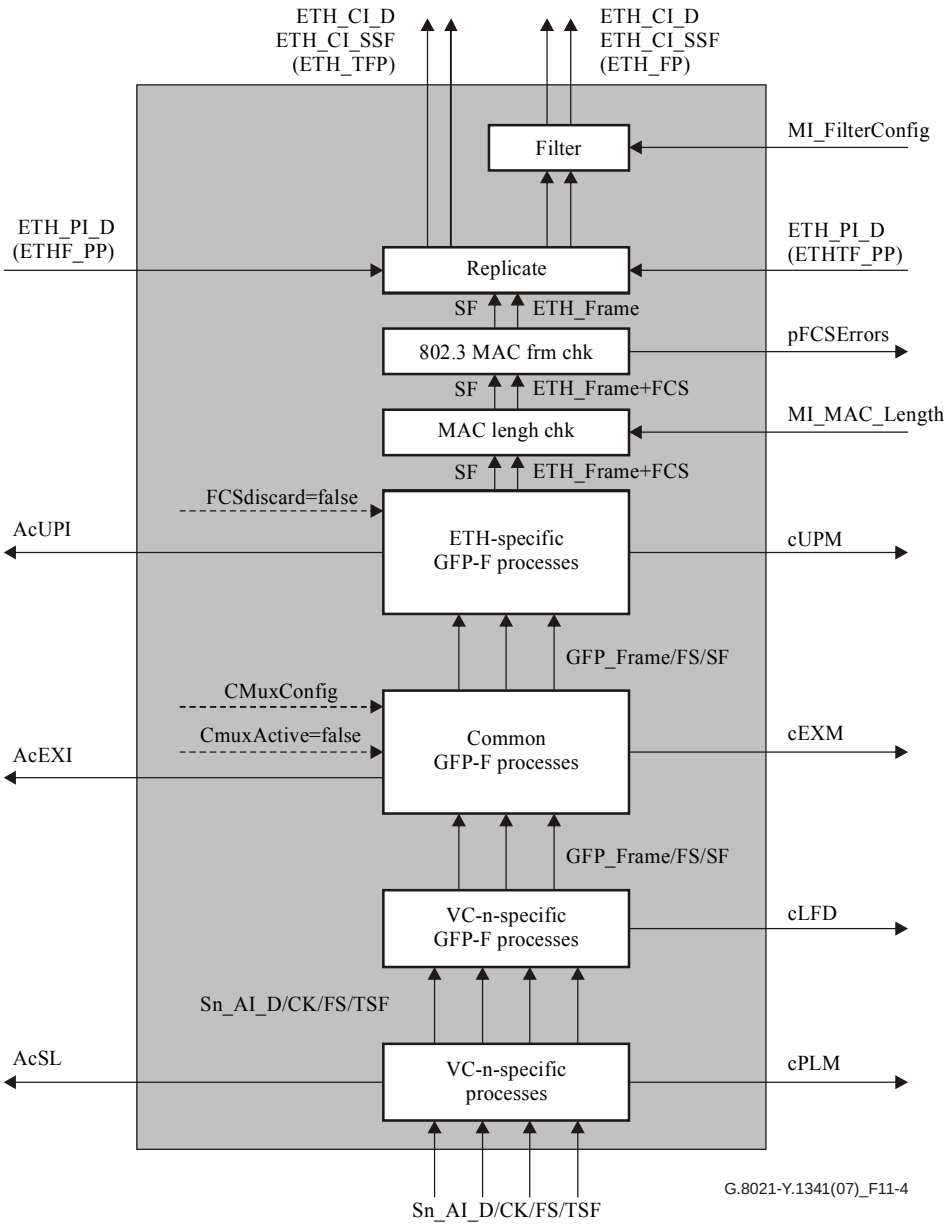

Figure 11-4 – Sn/ETH_A_Sk process diagram

Filter process

See clause 8.3.

Replicate process

See clause 8.4.

802.3 MAC FCS check process

See clause 8.8.2.

Ethernet-specific GFP-F sink process

See clause 8.5.4.1.2 of [ITU-T G.806]. GFP pFCS checking, GFP p_FCSError, p_FDis are not supported (FCSdiscard=false). The UPI value for Frame-Mapped Ethernet shall be expected (Table 6-3 of [ITU-T G.7041]). The Ethernet frames are extracted from the client payload information field of the GFP-F frames according to clause 7.1 of [ITU-T G.7041].

Common GFP sink process

See clause 8.5.3.2 of [ITU-T G.806]. GFP channel multiplexing is not supported (MI_CMuxActive=false).

VC-n-specific GFP sink process

See clause 8.5.2.2 of [ITU-T G.806]. The GFP frames are demapped from the VC-n payload area according to clause 10.6 of [ITU-T G.707].

VC-n-specific sink process

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

Defects

dPLM – See clause 6.2.4.2 of [ITU-T G.806].

dLFD – See clause 6.2.5.2 of [ITU-T G.806].

dUPM – See clause 6.2.4.3 of [ITU-T G.806].

dEXM – See clause 6.2.4.4 of [ITU-T G.806].

Consequent actions

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM or dCSF

Defect correlations

The function shall perform the following defect correlations to determine the most probable fault cause (see clause 6.4 of [ITU-T 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)

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

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

cCSF ← dCFS and (not dEXM) and (not dUPM) and (not dPLM) and (not dLFD) and (not AI_TSF) and CSF_Reported

Performance monitoring

The function shall perform the following performance monitoring primitives processing. The performance monitoring primitives shall be reported to the EMF.

pFCSErrors: Count of FrameCheckSequenceErrors per second.

NOTE – This primitive is calculated by the MAC FCS check process.

11.1.2 LCAS-capable VC-n-Xv/ETH adaptation functions (Sn-X-L/ETH_A; n = 3, 4)

11.1.2.1 LCAS-capable VC-n-Xv/ETH adaptation source function (Sn-X-L/ETH_A_So)

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

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

Symbol

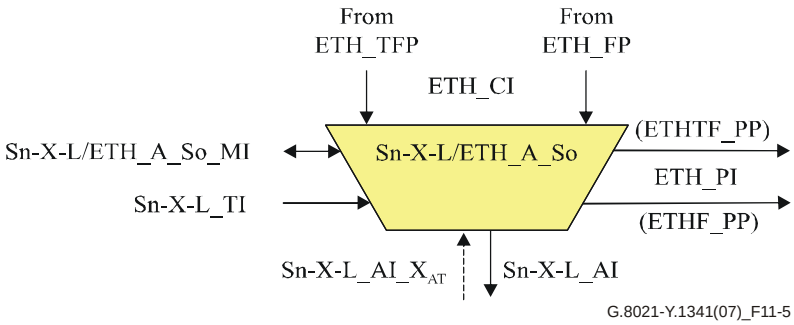

Figure 11-5 – Sn-X-L/ETH_A_So symbol

Interfaces

Table 11-3 – Sn-X-L/ETH_A_So interfaces

Inputs	Outputs
ETH_TFP: ETH_CI_Data ETH_FP: ETH_CI_Data ETH_CI_SSF Sn-X-L_AP: Sn-X-L_AI_X_{AT} Sn-X-L_TI: Sn-X-L_TI_ClocK Sn-X-L_TI_FrameStart Sn-X-L/ETH_A_So_MI: Sn-X-L/ETH_A_So_MI_CSFEnable	Sn-X-L_AP: Sn-X-L_AI_Data Sn-X-L_AI_ClocK Sn-X-L_AI_FrameStart ETHF_PP: ETH_PI_Data ETHTF_PP: ETH_PI_Data

Processes

A process diagram of this function is shown in Figure 11-6.

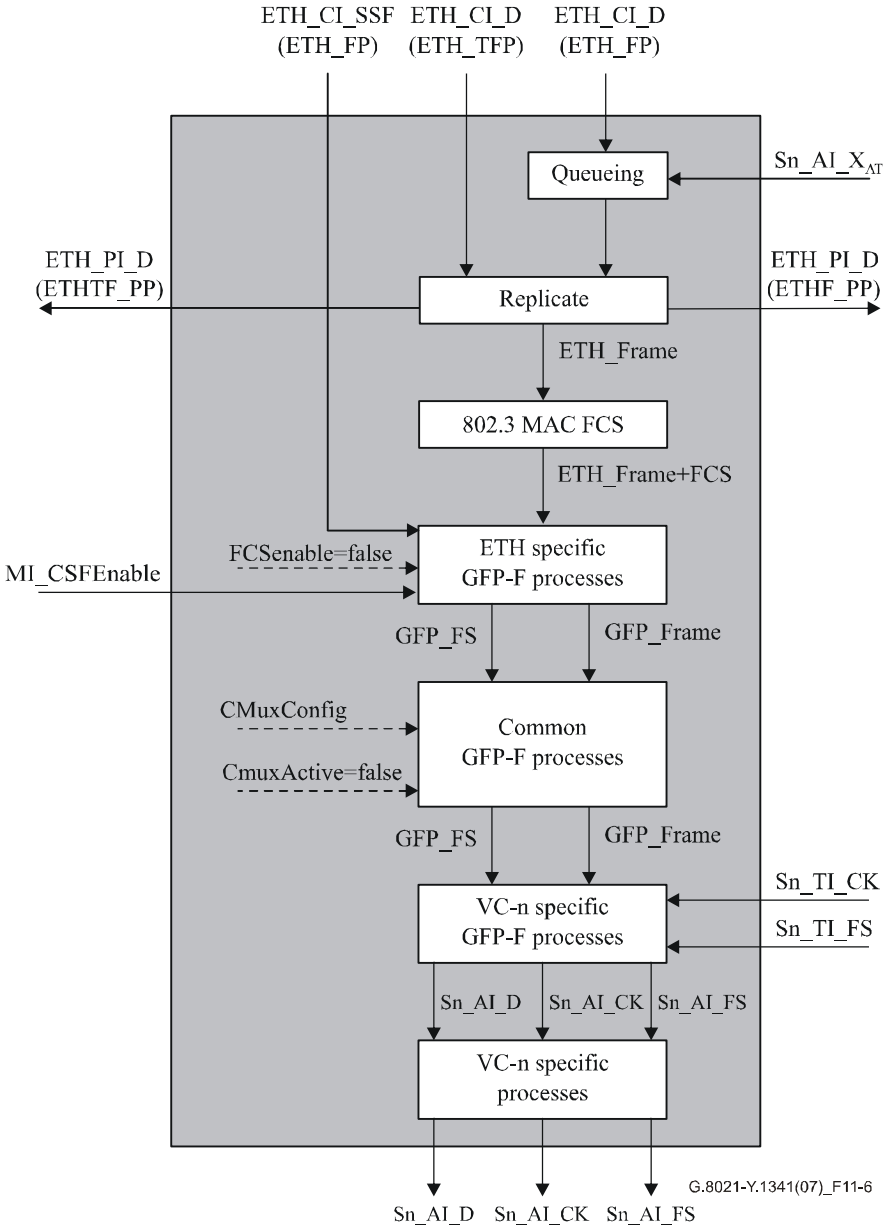

Figure 11-6 – Sn-X-L/ETH_A_So process diagram

See clause 11.1.1.1 for a description of Sn-X-L/ETH_A processes.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring For further study.

11.1.2.2 LCAS-capable VC-n-Xv/ETH adaptation sink function (Sn-X-L/ETH_A_Sk)

This function extracts ETH_CI information from a VC-n-Xv server signal (n = 3 or 4), delivering ETH_CI to ETH_TFP and ETH_FP.

Data at the Sn-X-L_AP is a VC-n-Xv (n = 3 or 4), having a payload as described in [ITU-T G.707].

Symbol

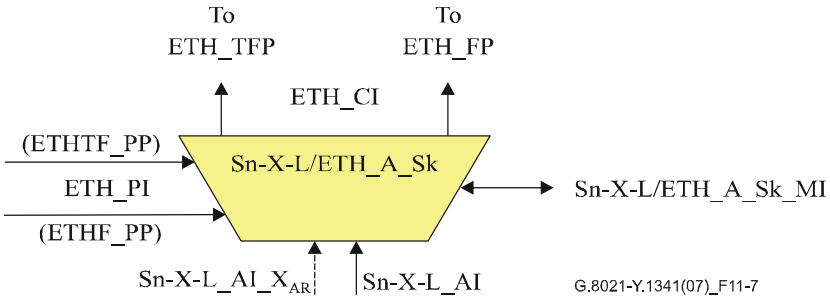

Figure 11-7 – Sn-X-L/ETH_A_Sk symbol

Interfaces

Table 11-4 – Sn-X-L/ETH_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} ETHF_PP: ETH_PI_Data ETHTF_PP: ETH_PI_Data Sn-X-L/ETH_A_Sk_MI: Sn-X-L/ETH_A_Sk_MI_FilterConfig Sn-X-L/ETH_A_Sk_MI_CSF_Reported	ETH_TFP: ETH_CI_Data ETH_CI_SSF ETH_FP: ETH_CI_Data ETH_CI_SSF Sn-X-L/ETH_A_Sk_MI: Sn-X-L/ETH_A_Sk_MI_AcSL Sn-X-L/ETH_A_Sk_MI_AcEXI Sn-X-L/ETH_A_Sk_MI_AcUPI Sn-X-L/ETH_A_Sk_MI_cPLM Sn-X-L/ETH_A_Sk_MI_cLFD Sn-X-L/ETH_A_Sk_MI_cUPM Sn-X-L/ETH_A_Sk_MI_cEXM Sn-X-L/ETH_A_Sk_MI_cCSF Sn-X-L/ETH_A_Sk_MI_pFCSError

Processes

See process diagram and process description in clause 11.1.1.2. The additional Sn-X-L_AI_X_{AR} interface is not connected to any of the internal processes.

Defects

dPLM – See clause 6.2.4.2 of [ITU-T G.806]

dLFD – See clause 6.2.5.2 of [ITU-T G.806]

dUPM – See clause 6.2.4.3 of [ITU-T G.806]

dEXM – See clause 6.2.4.4 of [ITU-T G.806]

Consequent actions

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM or dCSF

NOTE 1 – XAR = 0 results in AI_TSF being asserted, so there is no need to include it as additional contributor to aSSF.

Defect correlations

The function shall perform the following defect correlations to determine the most probable fault cause (see clause 6.4 of [ITU-T 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)

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

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

cCSF per clause 8.5.4.1.2 of [ITU-T G.806].

Performance monitoring

The function shall perform the following performance monitoring primitives processing. The performance monitoring primitives shall be reported to the EMF.

pFCSError: Count of FrameCheckSequenceErrors per second.

NOTE 2 – This primitive is calculated by the MAC FCS check process.

11.1.3 VC-m/ETH adaptation functions (Sm/ETH_A; m = 11, 11-Xv, 12, 12-Xv, 2)

11.1.3.1 VC-m/ETH adaptation source function (Sm/ETH_A_So)

This function maps ETH_CI information onto a VC-m server signal (m = 11, 11-X, 12, 12-X, 2) and sources the Sm_AP signal.

Data at the Sm_AP is a VC-m (m = 11, 11-X, 12, 12-X, 2), having a payload as described in [ITU-T G.707], but with indeterminate POH bytes: J2, V5[1-4], V5[8].

Symbol

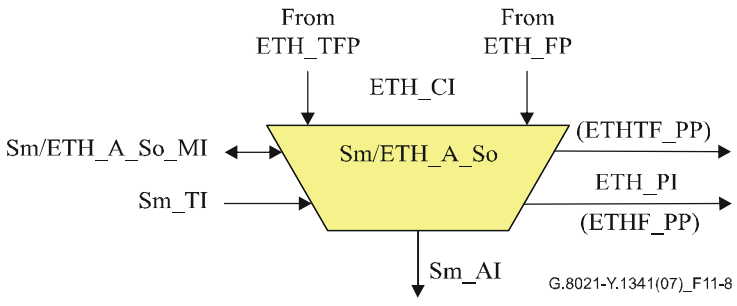

Figure 11-8 – Sm/ETH_A_So symbol

Interfaces

Table 11-5 – Sm/ETH_A_So interfaces

Inputs	Outputs
ETH_TFP: ETH_CI_Data ETH_FP: ETH_CI_Data ETH_CI_SSF Sm_AP: Sm_AI_X_{AT} Sm_TI: Sm_TI_ClocK Sm_TI_FrameStart Sm/ETH_A_So_MI: Sm/ETH_A_So_MI_CSFEnable	Sm_AP: Sm_AI_Data Sm_AI_ClocK Sm_AI_FrameStart ETHF_PP: ETH_PI_Data ETHTF_PP: ETH_PI_Data

Processes

A process diagram of this function is shown in Figure 11-9.

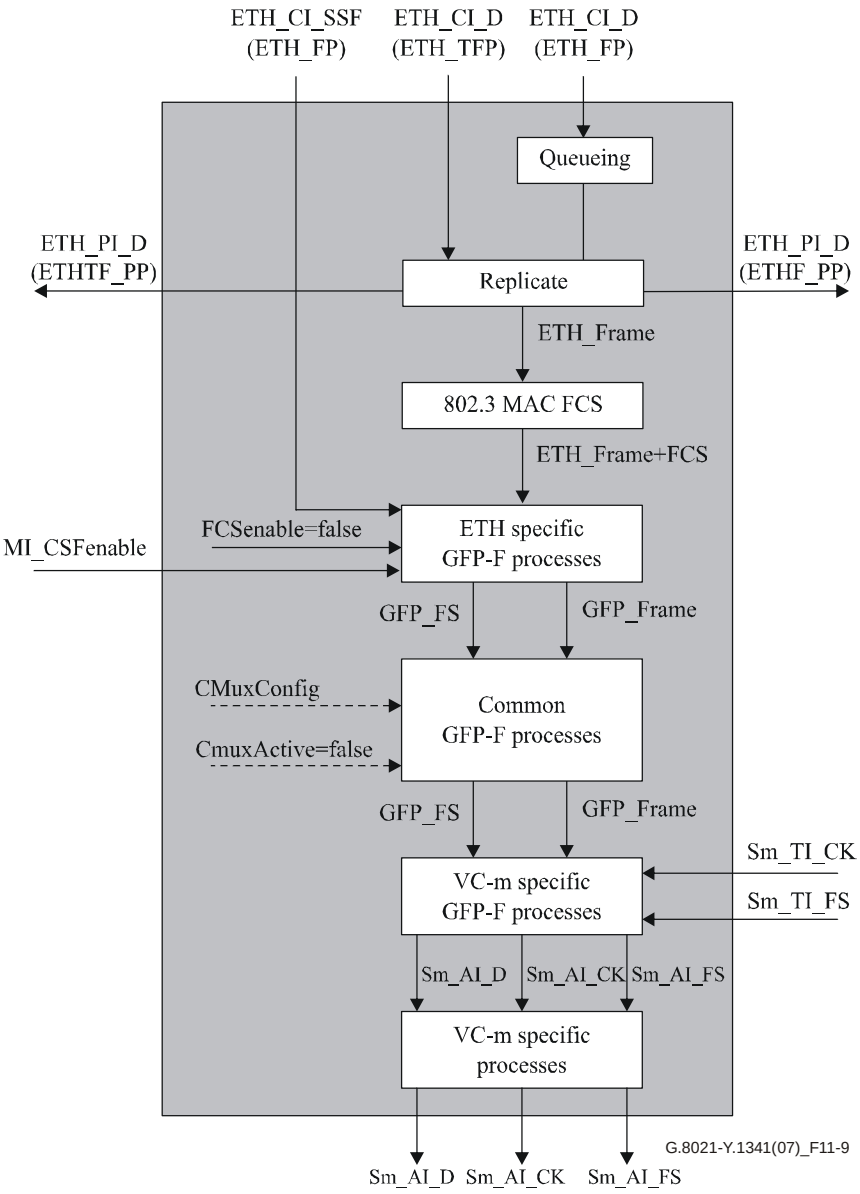

Figure 11-9 – Sm/ETH_A_So process diagram

Queuing process

See clause 8.2.

Replicate process

See clause 8.4.

802.3 MAC FCS generation

See clause 8.8.1.

Ethernet-specific GFP-F source process

See clause 8.5.4.1.1 of [ITU-T G.806]. GFP pFCS generation is disabled (FCSenable=false). The UPI value for Frame-Mapped Ethernet shall be inserted (Table 6-3 of [ITU-T G.7041]). The Ethernet frames are inserted into the client payload information field of the GFP-F frames according to clause 7.1 of [ITU-T G.7041].

Response to ETH_CI_SSF asserted is for further study.

Common GFP source process

See clause 8.5.3.1 of [ITU-T G.806]. GFP channel multiplexing is not supported (CMuxActive=false).

VC-m-specific GFP source process

See clause 8.5.2.1 of [ITU-T G.806]. The GFP frames are mapped into the VC-m payload area according to clause 10.6 of [ITU-T G.707].

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 of [ITU-T G.707] is placed in the K4[1] extended signal label field as described in clause 8.2.3.2 of [ITU-T G.783].

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

NOTE 1 – For Sm/ETH_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 of [ITU-T G.783]).

NOTE 2 – For Sm/ETH_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 of [ITU-T G.783]).

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring For further study.

11.1.3.2 VC-m/ETH adaptation sink function (Sm/ETH_A_Sk)

This function extracts ETH_CI information from the Sm_AI signal (m = 11, 11-X, 12, 12-X, 2), delivering ETH_CI to ETH_TFP and ETH_FP.

Data at the Sm_AP is as described in [ITU-T G.707].

Symbol

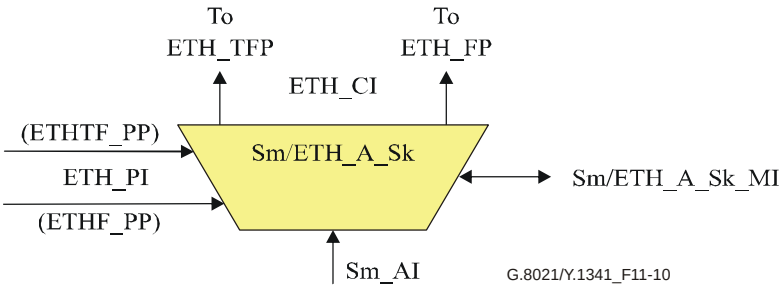

Figure 11-10 – Sm/ETH_A_Sk symbol

Interfaces

Table 11-6 – Sm/ETH_A_Sk interfaces

Inputs	Outputs
Sm_AP: Sm_AI_Data Sm_AI_ClocK Sm_AI_FrameStart Sm_AI_TSF ETHF_PP: ETH_PI_Data ETHTF_PP: ETH_PI_Data Sm/ETH_A_Sk_MI: Sm/ETH_A_Sk_MI_FilterConfig Sm/ETH_A_Sk_MI_CSF_Reported	ETH_TFP: ETH_CI_Data ETH_CI_SSF ETH_FP: ETH_CI_Data ETH_CI_SSF Sm/ETH_A_Sk_MI: Sm/ETH_A_Sk_MI_AcSL Sm/ETH_A_Sk_MI_AcEXI Sm/ETH_A_Sk_MI_AcUPI Sm/ETH_A_Sk_MI_cPLM Sm/ETH_A_Sk_MI_cLFD Sm/ETH_A_Sk_MI_cUPM Sm/ETH_A_Sk_MI_cEXM Sm/ETH_A_Sk_MI_cCSF Sm/ETH_A_Sk_MI_pFCSError

Processes

A process diagram of this function is shown in Figure 11-11.

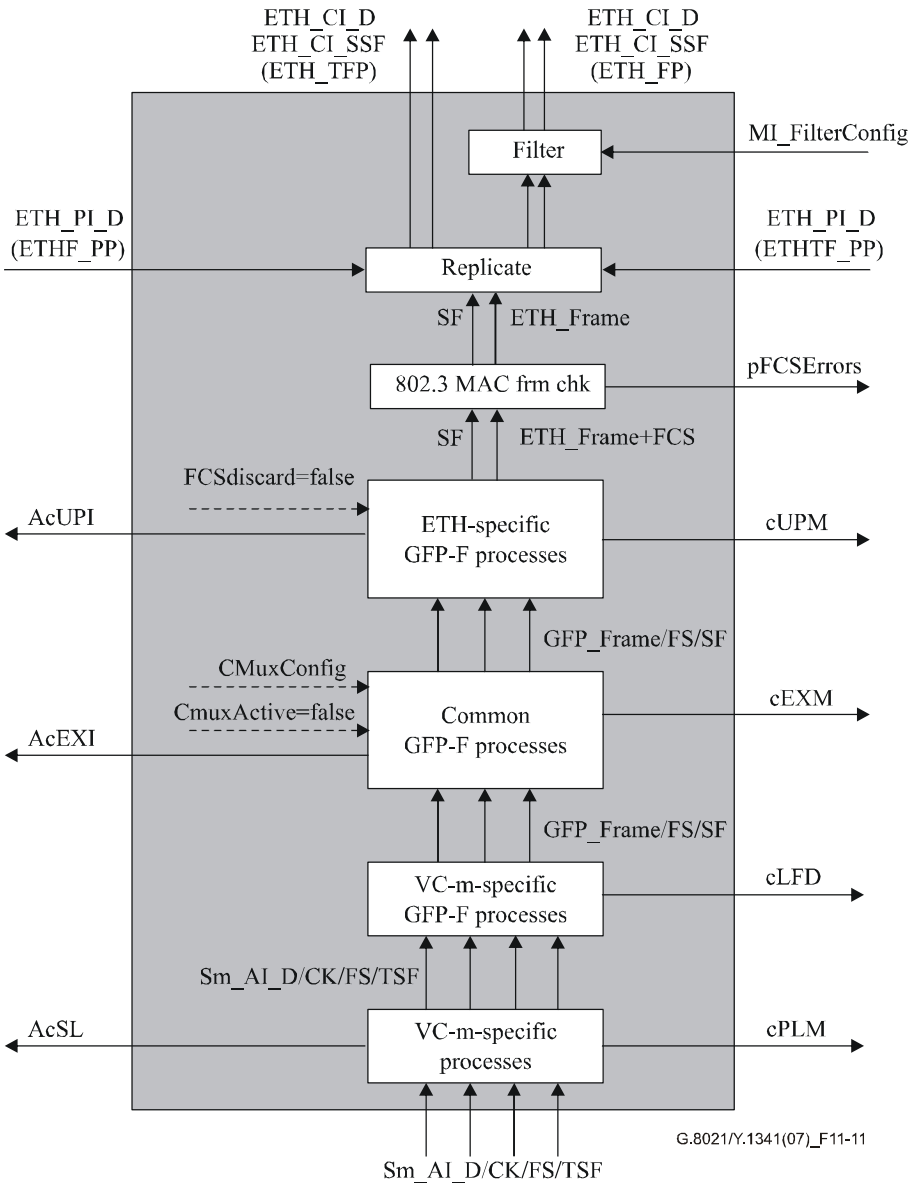

Figure 11-11 – Sm/ETH_A_Sk process diagram

Filter process

See clause 8.3.

Replicate process

See clause 8.4.

802.3 MAC FCS check process

See clause 8.7.

Ethernet-specific GFP-F sink process

See clause 8.5.4.1.2 of [ITU-T G.806]. GFP pFCS checking, GFP p_FCSError, p_FDis are not supported (FCSdiscard=false). The UPI value for frame-mapped Ethernet shall be expected (Table 6-3 of [ITU-T G.7041]). The Ethernet frames are extracted from the client payload information field of the GFP-F frames according to clause 7.1 of [ITU-T G.7041].

Common GFP sink process

See clause 8.5.3.1 of [ITU-T G.806]. GFP channel multiplexing is not supported (CMuxActive=false).

VC-m-specific GFP sink process

See clause 8.5.2.2 of [ITU-T G.806]. The GFP frames are demapped from the VC-m payload area according to clause 10.6 of [ITU-T G.707].

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 clause 8.2.3.2 of [ITU-T G.783] and clause 6.2.4.2 of [ITU-T G.806]. The signal label for "GFP mapping" in Table 9-13 of [ITU-T G.707] shall be expected. The accepted value of the signal label is also available at the Sm/ETH_A_Sk_MP.

Defects

dPLM – See clause 6.2.4.2 of [ITU-T G.806].

dLFD – See clause 6.2.5.2 of [ITU-T G.806].

dUPM – See clause 6.2.4.3 of [ITU-T G.806].

dEXM – See clause 6.2.4.4 of [ITU-T G.806].

Consequent actions

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM or dCSF

Defect correlations

The function shall perform the following defect correlations to determine the most probable fault cause (see clause 6.4 of [ITU-T 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)

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

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

cCSF per clause 8.5.4.1.2 of [ITU-T G.806].

Performance monitoring

The function shall perform the following performance monitoring primitives processing. The performance monitoring primitives shall be reported to the EMF.

pFCSError: Count of FrameCheckSequenceErrors per second.

NOTE – This primitive is calculated by the MAC FCS check process.

11.1.4 LCAS-capable VC-m-Xv/ETH adaptation functions (Sm-X-L/ETH_A; m = 11 or 12)

11.1.4.1 LCAS-capable VC-m-Xv/ETH adaptation source function (Sm-X-L/ETH_A_So)

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

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

Symbol

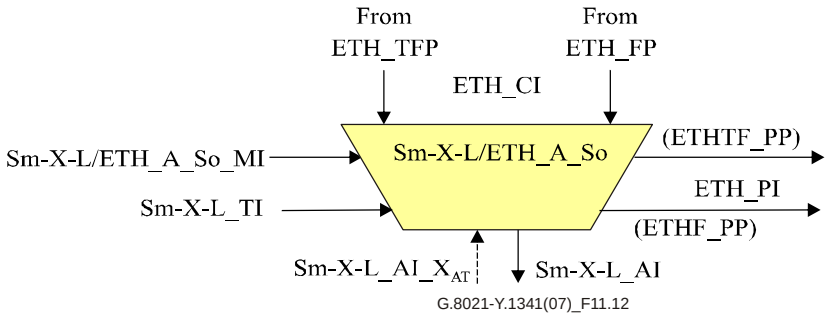

Figure 11-12 – Sm-X-L/ETH_A_So symbol

Interfaces

Table 11-7 – Sm-X-L/ETH_A_So interfaces

Inputs	Outputs
ETH_TFP: ETH_CI_Data ETH_FP: ETH_CI_Data ETH_CI_SSF Sm-X-L_AP: Sm-X-L_AI_X_{AT} Sm _TI: Sm_TI_ClocK Sm_TI_FrameStart Sm-X-L/ETH_A_So_MI: Sm-X-L/ETH_A_So_MI_CSFEnable	Sm-X-L_AP: Sm-X-L_AI_Data Sm-X-L_AI_ClocK Sm-X-L_AI_FrameStart ETHF_PP: ETH_PI_Data ETHTF_PP: ETH_PI_Data

Processes

A process diagram of this function is shown in Figure 11-13.

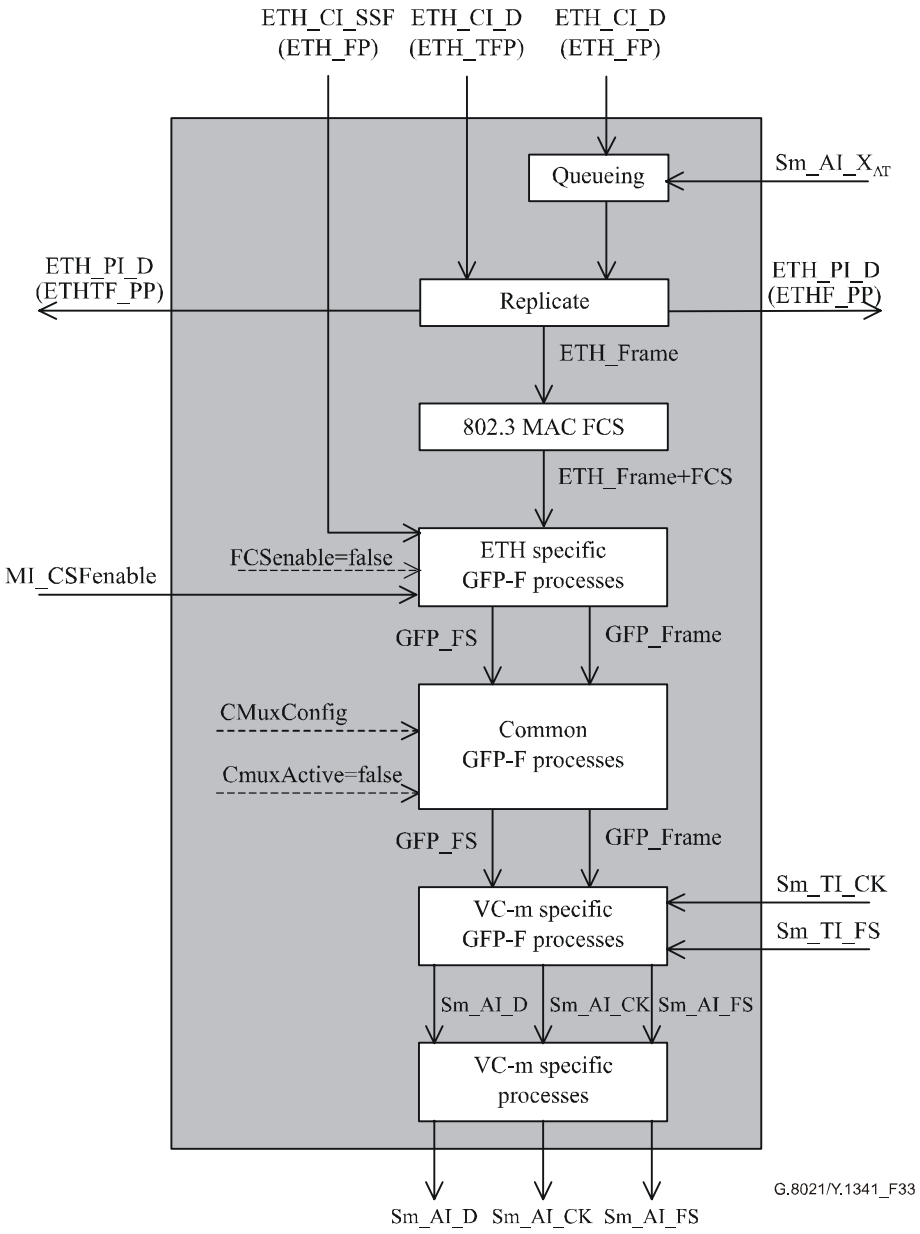

Figure 11-13 – Sm-X-L/ETH_A_So process diagram

See clause 11.1.3.1 for a description of Sm-X-L/ETH_A processes.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring For further study.

11.1.4.2 LCAS-capable VC-m-Xv/ETH adaptation sink function (Sm-X-L/ETH_A_Sk)

This function extracts ETH_CI information from the Sm-X-L_AI signal (m = 11 or 12), delivering ETH_CI to ETH_TFP and ETH_FP.

Data at the Sm_AP is as described in [ITU-T G.707].

Symbol

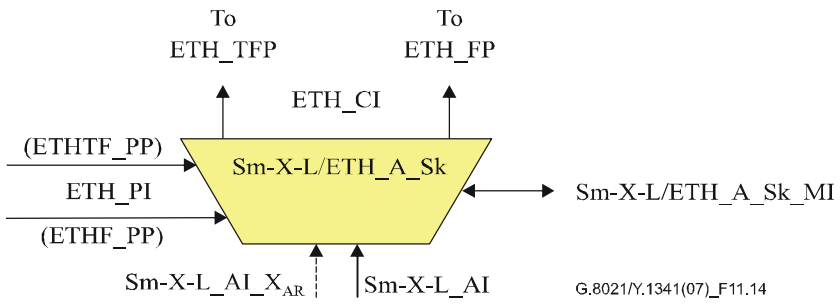

Figure 11-14 – Sm-X-L/ETH_A_Sk symbol

Interfaces

Table 11-8 – Sm-X-L/ETH_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} ETHF_PP: ETH_PI_Data ETHTF_PP: ETH_PI_Data Sm-X-L/ETH_A_Sk_MI: Sm-X-L/ETH_A_Sk_MI_FilterConfig Sm-X-L/ETH_A_Sk_MI_CSF_Reported	ETH_TFP: ETH_CI_Data ETH_CI_SSF ETH_FP: ETH_CI_Data ETH_CI_SSF Sm-X-L/ETH_A_Sk_MI: Sm-X-L/ETH_A_Sk_MI_AcSL Sm-X-L/ETH_A_Sk_MI_AcEXI Sm-X-L/ETH_A_Sk_MI_AcUPI Sm-X-L/ETH_A_Sk_MI_cPLM Sm-X-L/ETH_A_Sk_MI_cLFD Sm-X-L/ETH_A_Sk_MI_cUPM Sm-X-L/ETH_A_Sk_MI_cEXM Sm-X-L/ETH_A_Sk_MI_cCSF Sm-X-L/ETH_A_Sk_MI_pFCSError

Processes

See process diagram and process description in clause 11.1.1.2. The additional Sm-X-L_AI_X_{AR} interface is not connected to any of the internal processes.

Defects

dPLM – See clause 6.2.4.2 of [ITU-T G.806].

dLFD – See clause 6.2.5.2 of [ITU-T G.806].

dUPM – See clause 6.2.4.3 of [ITU-T G.806].

dEXM – See clause 6.2.4.4 of [ITU-T G.806].

Consequent actions

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM or dCSF

NOTE 1 – XAR = 0 results in AI_TSF being asserted, so there is no need to include it as additional contributor to aSSF.

Defect correlations

The function shall perform the following defect correlations to determine the most probable fault cause (see clause 6.4 of [ITU-T 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)

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

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

cCSF per clause 8.5.4.1.2 of [ITU-T G.806].

Performance monitoring

The function shall perform the following performance monitoring primitives processing. The performance monitoring primitives shall be reported to the EMF.

pFCSError: Count of FrameCheckSequenceErrors per second.

NOTE 2 – This primitive is calculated by the MAC FCS process.

11.2 SDH/ETC adaptation functions (S4-X/ETC3_A)

11.2.1 VC-4/ETC3 adaptation source function (S4-X/ETC3_A_So)

This function maps ETC_CI information from an ETC3 onto an S4-X_AI signal. This mapping is currently only defined for X = 7.

Data at the S4-X_AP is a VC-4-Xv, having a payload as described in [ITU-T G.707], but with indeterminate POH bytes: J1, B3, G1.

Symbol

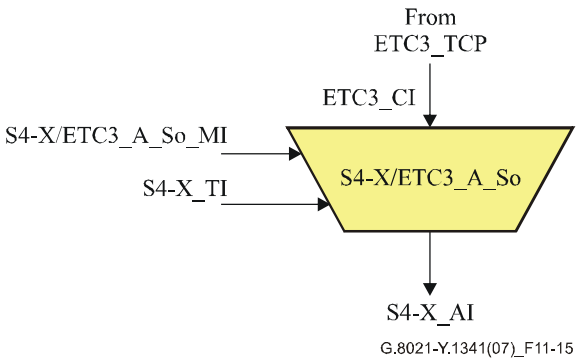

Figure 11-15 – S4-X/ETC3_A_So symbol

Interfaces

Table 11-9 – S4-X/ETC3_A_So interfaces

Inputs	Outputs
ETC3_TCP: ETC3_CI_Data_Control ETC3_CI_Clock ETC3_CI_Control_Ind ETC3_CI_SSF S4-X_TP: S4-X_TI_Clock S4-X_TI_FrameStart S4-X/ETC3_A_So_MP: S4-X/ETC3_A_So_MI_CSFEnable	S4-X_AP: S4-X_AI_Data S4-X_AI_Clock S4-X_AI_FrameStart

Processes

A process diagram of this function is shown in Figure 11-16.

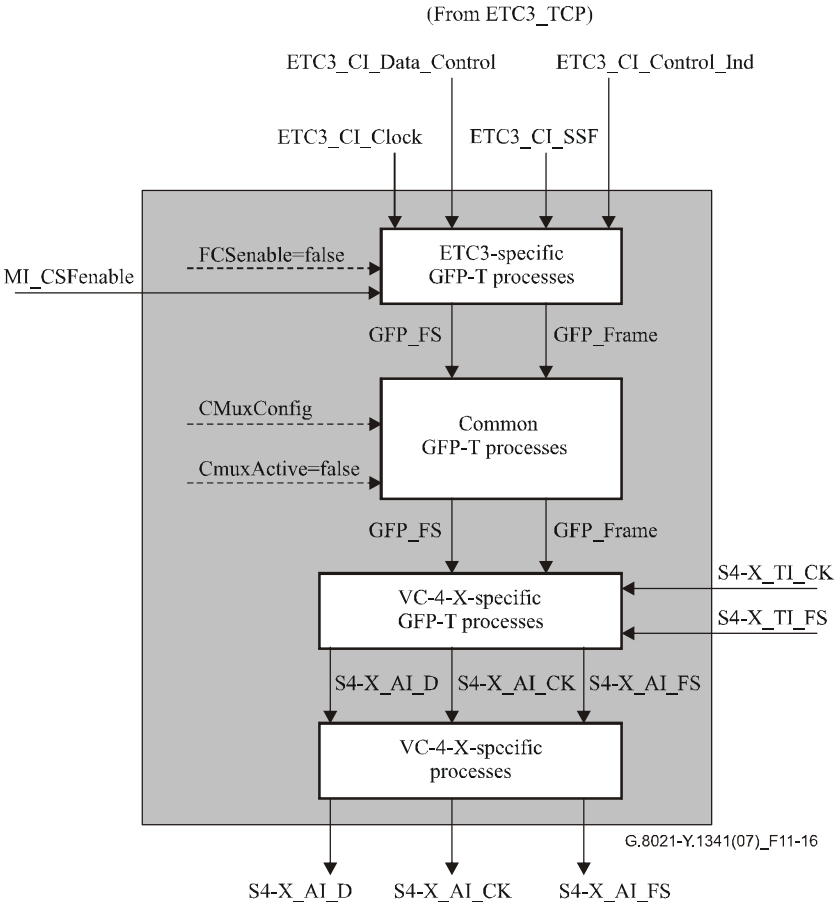

Figure 11-16 – S4-X/ETC3_A_So process diagram

Ethernet specific GFP-T source process

See clause 8.5.4.2.1 of [ITU-T G.806]. GFP pFCS generation is disabled (FCSenable=false). The UPI value for transparent Gb Ethernet shall be inserted (Table 6-3 of [ITU-T G.7041]). The Ethernet codeword information is inserted into the client payload information field of the GFP-T frames according to clause 8 of [ITU-T G.7041].

Response to ETC3_CI_SSF is according to the principles in clauses 8.3 and 8.3.4 of [ITU-T G.7041] and Appendix VIII of [ITU-T G.806]. Details are for further study.

Common GFP source process

See clause 8.5.3.1 of [ITU-T G.806]. GFP channel multiplexing is not supported (CMuxActive=false).

VC-4-X-specific GFP source process

See clause 8.5.2.1 of [ITU-T G.806]. The GFP frames are mapped into the VC-4-X payload area according to clause 10.6 of [ITU-T G.707].

VC-4-X-specific source process

C2: Signal label information is derived directly from the adaptation function type. The value for "GFP mapping" in Table 9-11 of [ITU-T G.707] is placed in the C2 byte position.

NOTE – For S4-X/ETC3_A_So, the H4, K3, F2, and F3 bytes are undefined at the S4-X_AP output of this function (as per clause 12 of [ITU-T G.783]).

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring For further study.

11.2.2 VC-4-X/ETC3 adaptation sink function (S4-X/ETC3_A_Sk)

This function extracts ETC3_CI information from the S4-X_AI signal, delivering ETC3_CI to the ETC3_TCP.

Data at the S4-X_AP is as described in [ITU-T G.707].

Symbol

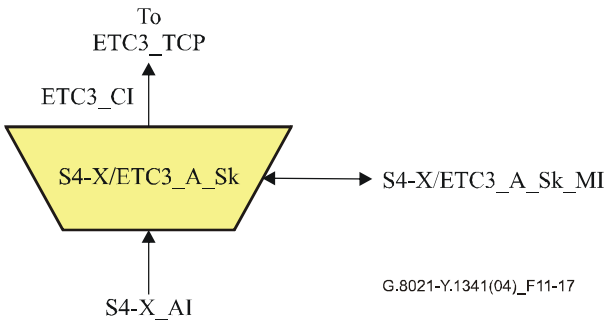

Figure 11-17 – S4-X/ETC3_A_Sk symbol

Interfaces

Table 11-10 – S4-X/ETC3_A_Sk interfaces

Inputs	Outputs
S4-X_AP: S4-X_AI_Data S4-X_AI_ClocK S4-X_AI_FrameStart S4-X_AI_TSF S4-X/ETC3_A_Sk_MI: S4-X/ETC3_A_Sk_MI_CSF_Reported	ETC3_TCP: ETC3_CI_Data_Control ETC3_CI_Clock ETC3_CI_Control_Ind ETC3_CI_SSF S4-X/ETC3_A_Sk_MI: S4-X/ETC3_A_Sk_MI_AcSL S4-X/ETC3_A_Sk_MI_AcEXI S4-X/ETC3_A_Sk_MI_AcPFI S4-X/ETC3_A_Sk_MI_AcUPI S4-X/ETC3_A_Sk_MI_cPLM S4-X/ETC3_A_Sk_MI_cLFD S4-X/ETC3_A_Sk_MI_cUPM S4-X/ETC3_A_Sk_MI_cEXM S4-X/ETC3_A_Sk_MI_cCSF S4-X/ETC3_A_Sk_MI_pCRC16Errors

Processes

A process diagram of this function is shown in Figure 11-18.

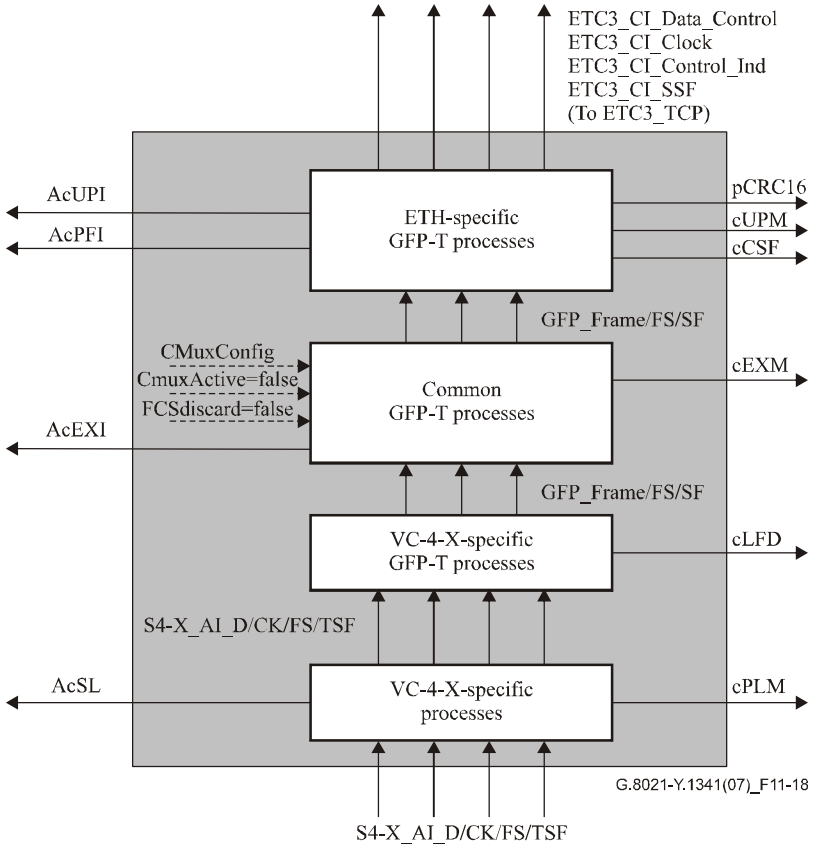

Figure 11-18 – S4-X/ETC3_A_Sk process diagram

Ethernet-specific GFP-T sink process

See clause 8.5.4.2.2 of [ITU-T G.806]. GFP pFCS checking and GFP p_FCSError, are not supported (FCSdiscard=false). The UPI value for Transparent Gb Ethernet shall be expected (Table 6-3 of [ITU-T G.7041]). Frames discarded due to incorrect PFI or UPI values shall be counted in _pFDis. Errors detected in a received superblock are reported as a _pCRC16Error. If ECenable=true, then single transmission channel errors in the superblock shall be corrected using the superblock CRC-16. The Ethernet codeword information is extracted from the client payload information field of the GFP-F frames according to clause 8 of [ITU-T G.7041].

Common GFP sink process

See clause 8.5.3.1 of [ITU-T G.806]. GFP channel multiplexing is not supported (MI_CMuxActive=false). Frames discarded due to EXI mismatch or errors detected by the tHEC shall be counted in _pFDis.

VC-4-X-specific GFP sink process

See clause 8.5.2.2 of [ITU-T G.806]. The GFP frames are demapped from the VC-4-X payload area according to clause 10.6 of [ITU-T G.707].

VC-4-X-specific sink process

C2: The signal label is recovered from the C2 byte as per clause 6.2.4.2 of [ITU-T G.806]. The signal label for "GFP mapping" in Table 9-11 of [ITU-T G.707] shall be expected. The accepted value of the signal label is also available at the S4-X/ETC3_A_Sk_MP.

Defects

dPLM – See clause 6.2.4.2 of [ITU-T G.806].

dLFD – See clause 6.2.5.2 of [ITU-T G.806].

dUPM – See clause 6.2.4.3 of [ITU-T G.806].

dEXM – See clause 6.2.4.4 of [ITU-T G.806].

dCSF – See clause 6.2.6.4 of [ITU-T G.806].

Consequent actions

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM or dCSF

Defect correlations

The function shall perform the following defect correlations to determine the most probable fault cause (see clause 6.4 of [ITU-T 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)

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

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

cCSF per clause 8.5.4.2.2 of [ITU-T G.806].

Performance monitoring

The function shall perform the following performance monitoring primitives processing. The performance monitoring primitives shall be reported to the EMF.

pCRC16Errors: Count of superblock CRC-16 errors per second:

_pFDis = sum (n_FDis_tHEC + n_FDis_eHEC_EXI + n_FDis_PTI_UPI)

11.3 S4-64c/ETH-w adaptation functions

This covers 64B/66B-encoded mapping of Ethernet frames into VC-4-64c.

For further study.

11.4 PDH/ETH adaptation functions (P/ETH_A)

11.4.1 Pq/ETH Adaptation functions (Pq/ETH_A; q = 11s, 12s, 31s, 32e)

11.4.1.1 Pq/ETH Adaptation source function (Pq/ETH_A_So)

This function maps ETH_CI information onto an Pq_AI signal (q = 11s, 12s, 31s, 32e).

Data at the Pq_AP is a Pq (q = 11s, 12s, 31s, 32e), having a payload as described in [ITU-T G.7043] with a value of N = 1. The VLI byte is reserved and not used for payload data.

Symbol

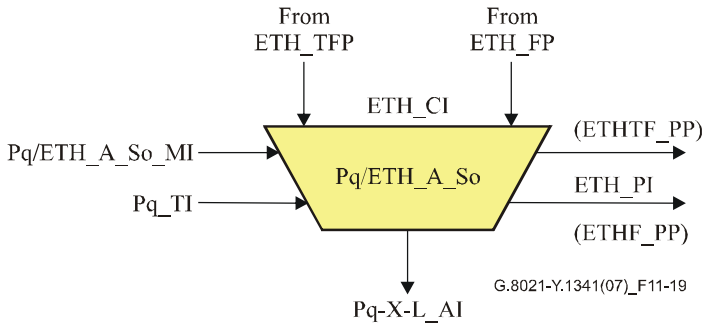

Figure 11-19 – Pq/ETH_A_So symbol

Interfaces

Table 11-11 – Pq/ETH_A_So interfaces

Inputs	Outputs
ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_FP: ETH_CI_Data ETH_CI_SSF Pq_TP: Pq_TI_ClocK Pq_TI_FrameStart Pq/ETH_A_So_MP: Pq/ETH_A_So_MI_CSFEnable	Pq_AP: Pq_AI_Data Pq_AI_ClocK Pq_AI_FrameStart ETHF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE ETHTF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE

Processes

A process diagram of this function is shown in Figure 11-20.

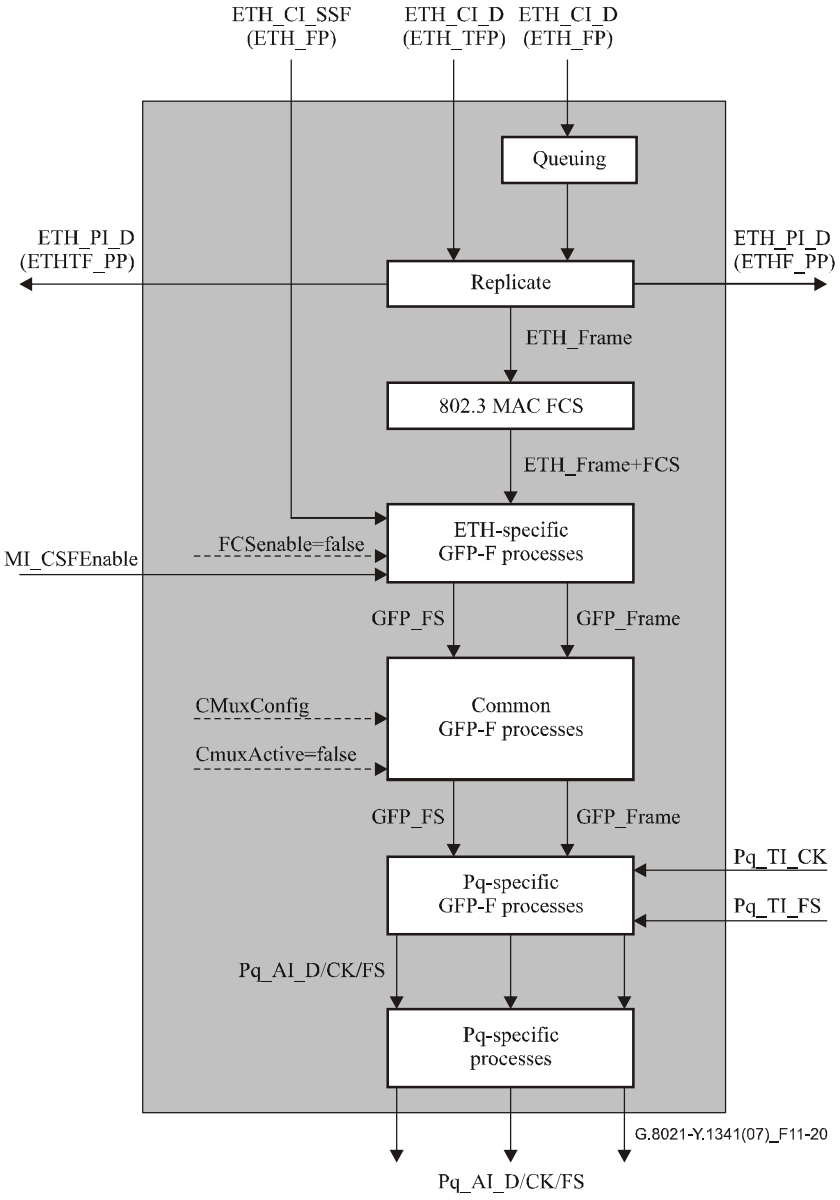

Figure 11-20 – Pq/ETH_A_So process diagram

Queuing process

See clause 8.2.

Replicate process

See clause 8.4.

802.3 MAC FCS generation

See clause 8.8.1.

Ethernet-specific GFP-F source process

See clause 8.5.4.1.1 of [ITU-T G.806]. GFP pFCS generation is disabled (FCSenable=false). The UPI value for frame-mapped Ethernet shall be inserted (Table 6-3 of [ITU-T G.7041]). The Ethernet frames are inserted into the client payload information field of the GFP-F frames according to clause 7.1 of [ITU-T G.7041].

Response to ETH_CI_SSF asserted is for further study.

Common GFP source process

See clause 8.5.3.1 of [ITU-T G.806]. GFP channel multiplexing is not supported (CMuxActive=false).

Pq-specific GFP source process

See clause 8.5.2.1 of [ITU-T G.806]. The GFP frames are mapped into the Pq payload area according to [ITU-T G.8040].

Pq-specific source process

NOTE – The VLI byte is fixed stuff equal to 0x00 at the Pq_AP output of this function.

P31s specific

MA: Signal label information is derived directly from the adaptation function type. The value for "GFP mapping" in clause 2.1 of [ITU-T G.832] is placed in the payload type field of the MA byte.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring For further study.

11.4.1.2 Pq/ETH adaptation sink function (Pq/ETH_A_Sk)

This function extracts ETH_CI information from a Pq_AI signal (q = 11s, 12s, 31s, 32e), delivering ETH_CI to ETH_TFP and ETH_FP.

Data at the Pq_AP is a Pq (q = 11s, 12s, 31s, 32e), having a payload as described in [ITU-T G.7043] with a value of N = 1. The VLI byte is reserved and not used for payload data.

Symbol

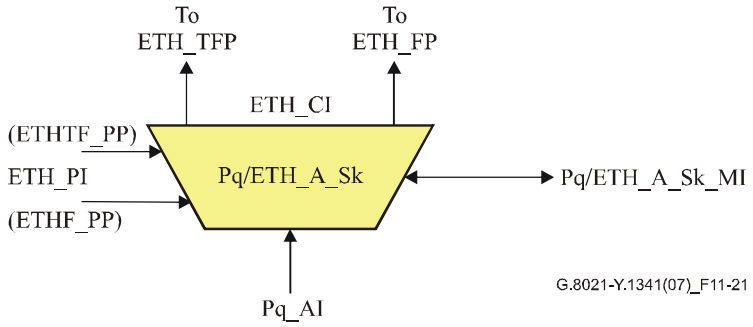

Figure 11-21 – Pq/ETH_A_Sk symbol

Interfaces

Table 11-12 – Pq/ETH_A_Sk interfaces

Inputs	Outputs
Pq_AP: Pq_AI_Data Pq_AI_ClocK Pq_AI_FrameStart Pq_AI_TSF ETHF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE ETHTF_PP: ETH_PI_D ETH_PI_P Pq/ETH_A_Sk_MP: Pq/ETH_A_Sk_MI_FilterConfig Pq/ETH_A_Sk_MI_CSF_Reported	ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_SSF ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_SSF Pq/ETH_A_Sk_MP: Pq/ETH_A_Sk_MI_AcSL Pq/ETH_A_Sk_MI_AcEXI Pq/ETH_A_Sk_MI_AcUPI Pq/ETH_A_Sk_MI_cPLM Pq/ETH_A_Sk_MI_cLFD Pq/ETH_A_Sk_MI_cUPM Pq/ETH_A_Sk_MI_cEXM Pq/ETH_A_Sk_MI_cCSF Pq/ETH_A_Sk_MI_pFCSError

Processes

A process diagram of this function is shown in Figure 11-22.

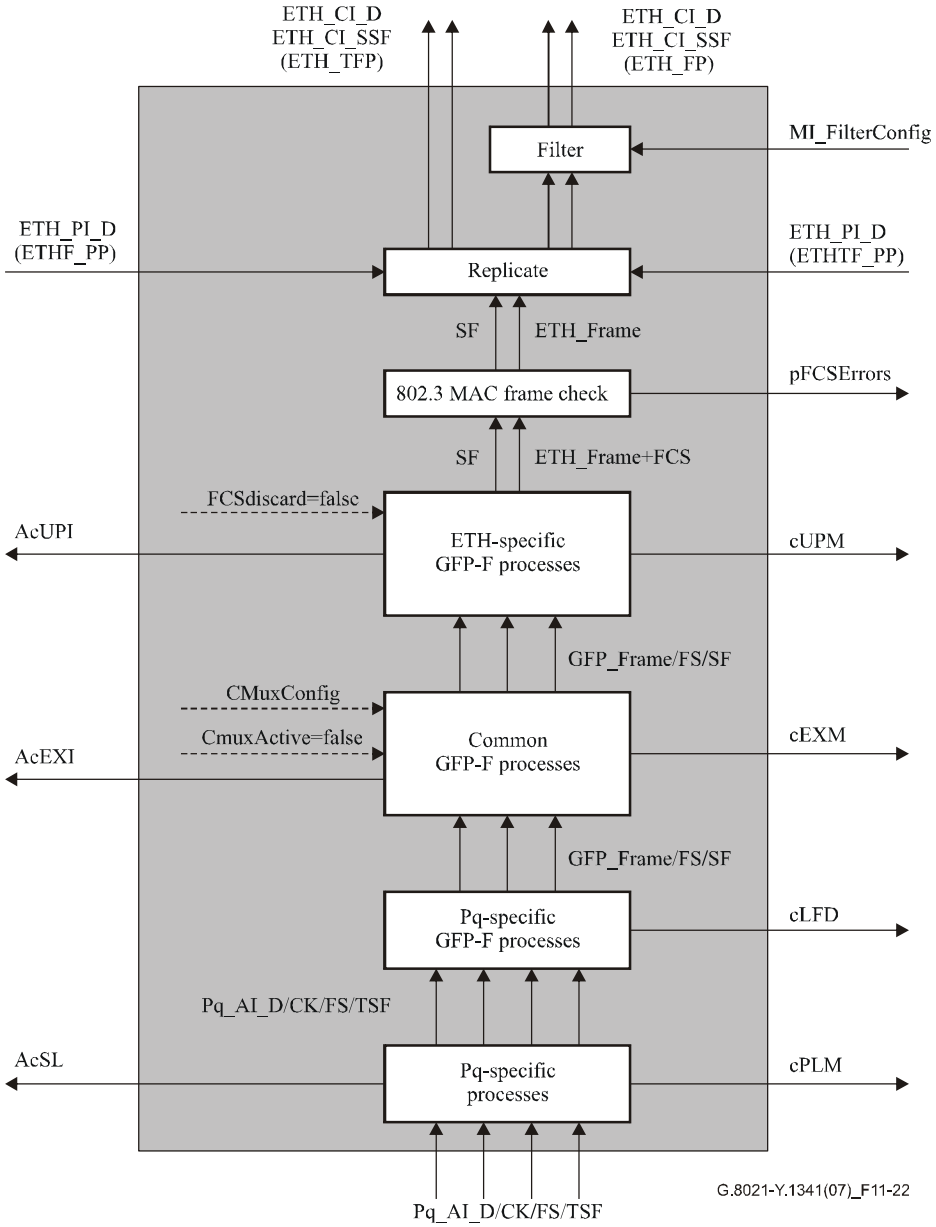

Figure 11-22 – Pq/ETH_A_Sk process diagram

Filter process

See clause 8.3.

Replicate process

See clause 8.4.

802.3 MAC FCS check process

See clause 8.8.2.

Ethernet-specific GFP-F sink process

See clause 8.5.4.2.2 of [ITU-T G.806]. GFP pFCS checking, GFP p_FCSError, p_FDis are not supported (FCSdiscard=false). The UPI value for frame-mapped Ethernet shall be expected (Table 6-3 of [ITU-T G.7041]). The Ethernet frames are extracted from the client payload information field of the GFP-F frames according to clause 7.1 of [ITU-T G.7041].

Common GFP sink process

See clause 8.5.3.2 of [ITU-T G.806]. GFP channel multiplexing is not supported (MI_CMuxActive=false).

Pq-specific GFP sink process

See clause 8.5.2.2 of [ITU-T G.806]. The GFP frames are demapped from the Pq payload area according to [ITU-T G.8040].

Pq-specific sink process

NOTE 1 – The VLI byte at the Pq_AP input of this function is ignored.

P31s-specific

MA: The signal label is recovered from the payload type field in the MA byte as per clause 6.2.4.2 of [ITU-T G.806]. The signal label for "GFP mapping" in clause 2.1 of [ITU-T G.832] shall be expected. The accepted value of the signal label is also available at the P31s/ETH_A_Sk_MP.

Defects

dPLM – See clause 6.2.4.2 of [ITU-T G.806].

dLFD – See clause 6.2.5.2 of [ITU-T G.806].

dUPM – See clause 6.2.4.3 of [ITU-T G.806].

dEXM – See clause 6.2.4.4 of [ITU-T G.806].

NOTE 2 – dPLM is only defined for q = 31s. dPLM is assumed to be false for q = 11s, 12s, 32e.

Consequent actions

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM or dCSF

Defect correlations

The function shall perform the following defect correlations to determine the most probable fault cause (see clause 6.4 of [ITU-T 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)

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

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

cCSF per clause 8.5.4.1.2 of [ITU-T G.806].

Performance monitoring

The function shall perform the following performance monitoring primitives processing. The performance monitoring primitives shall be reported to the EMF.

pFCSError: Count of FrameCheckSequenceErrors per second.

NOTE 3 – This primitive is calculated by the MAC FCS check process.

11.4.2 LCAS-capable Pq-Xv/ETH adaptation functions (Pq-X-L/ETH_A; q = 11s, 12s, 31s, 32e)

11.4.2.1 LCAS-capable Pq-Xv/ETH adaptation source function (Pq-X-L/ETH_A_So)

This function maps ETH_CI information onto an Pq-X-L_AI signal (q = 11s, 12s, 31s, 32e).

Data at the Pq-X-L_AP is a Pq-X-L (q = 11s, 12s, 31s, 32e), having a payload as described in [ITU-T G.7043].

Symbol

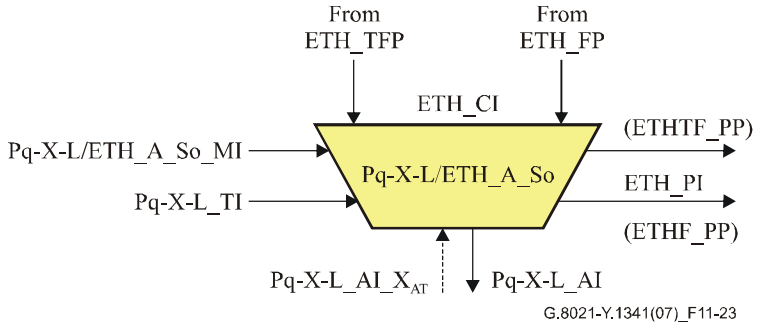

Figure 11-23 – Pq-X-L/ETH_A_So symbol

Interfaces

Table 11-13 – Pq-X-L/ETH_A_So interfaces

Inputs	Outputs
ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_SSF Pq-X-L_AP: Pq-X-L_AI_X_{AT} Pq-X-L_TP: Pq-X-L_TI_ClocK Pq-X-L_TI_FrameStart Pq-X-L/ETH_A_So_MP: Pq-X-L/ETH_A_So_MI_CSFEnable	Pq-X-L_AP: Pq-X-L_AI_Data Pq-X-L_AI_ClocK Pq-X-L_AI_FrameStart ETHF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE ETHTF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE

Processes

A process diagram of this function is shown in Figure 11-24.

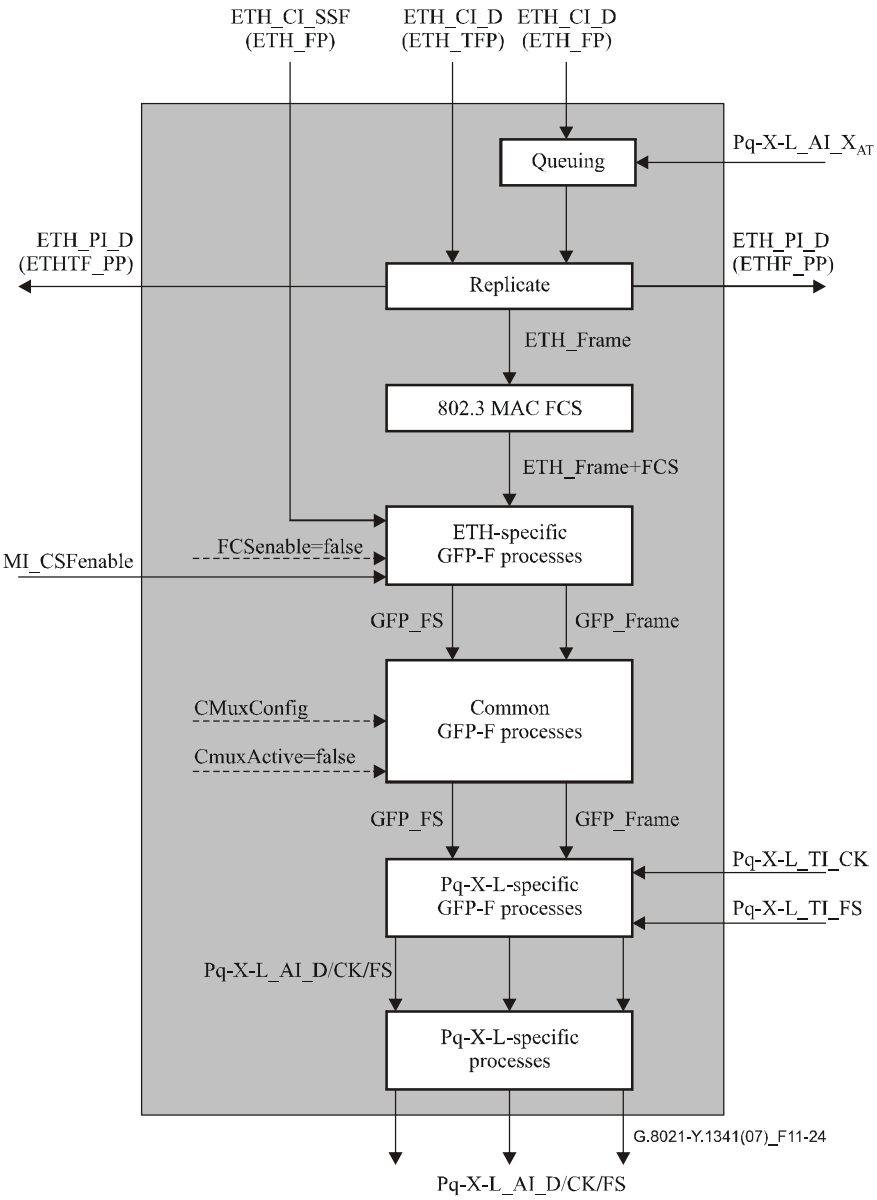

Figure 11-24 – Pq-X-L/ETH_A_So process diagram

Queuing process

See clause 8.2.

Replicate process

See clause 8.4.

802.3 MAC FCS generation

See clause 8.8.1.

Ethernet-specific GFP-F source process

See clause 8.5.4.1.1 of [ITU-T G.806]. GFP pFCS generation is disabled (FCSenable=false). The UPI value for frame-mapped Ethernet shall be inserted (Table 6-3 of [ITU-T G.7041]). The Ethernet frames are inserted into the client payload information field of the GFP-F frames according to clause 7.1 of [ITU-T G.7041].

Response to ETH_CI_SSF asserted is for further study.

Common GFP source process

See clause 8.5.3.1 of [ITU-T G.806]. GFP channel multiplexing is not supported (CMuxActive=false).

Pq-X-L-specific GFP source process

See clause 8.5.2.1 of [ITU-T G.806]. The GFP frames are mapped into the Pq-X-L payload area according to [ITU-T G.8040].

Pq-X-L-specific source process

P31s-X-L-specific

MA: Signal label information is derived directly from the adaptation function type. The value for "GFP mapping" in clause 2.1 of [ITU-T G.832] is placed in the payload type field of the MA byte.

NOTE – The VLI byte is undefined at the Pq-X-L_AP output of this function.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring For further study.

11.4.2.2 LCAS-capable Pq-Xv/ETH adaptation sink function (Pq-X-L/ETH_A_Sk)

This function extracts ETH_CI information from a Pq-X-L_AI signal (q = 11s, 12s, 31s, 32e), delivering ETH_CI to ETH_TFP and ETH_FP.

Data at the Pq-X-L_AP is a Pq-X-L (q = 11s, 12s, 31s, 32e), having a payload as described in [ITU-T G.7043].

Symbol

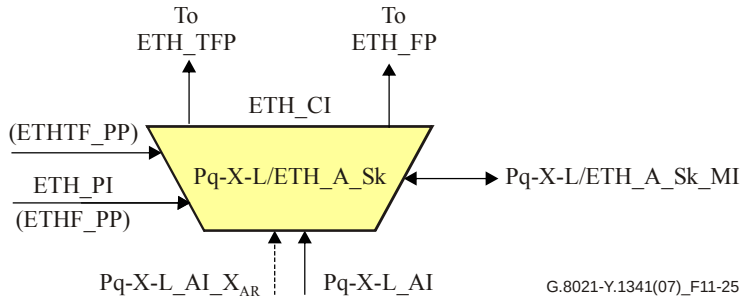

Figure 11-25 – Pq-X-L/ETH_A_Sk symbol

Interfaces

Table 11-14 – Pq-X-L/ETH_A_Sk interfaces

Inputs	Outputs
Pq-X-L_AP: Pq-X-L_AI_Data Pq-X-L_AI_ClocK Pq-X-L_AI_FrameStart Pq-X-L_AI_TSF Pq-X-L_AI_X_{AR} ETHF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE ETHTF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE Pq-X-L/ETH_A_Sk_MP: Pq-X-L/ETH_A_Sk_MI_FilterConfig Pq-X-L/ETH_A_Sk_MI_CSF_Reported	ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_SSF ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_SSF Pq-X-L/ETH_A_Sk_MP: Pq-X-L/ETH_A_Sk_MI_AcSL Pq-X-L/ETH_A_Sk_MI_AcEXI Pq-X-L/ETH_A_Sk_MI_AcUPI Pq-X-L/ETH_A_Sk_MI_cPLM Pq-X-L/ETH_A_Sk_MI_cLFD Pq-X-L/ETH_A_Sk_MI_cUPM Pq-X-L/ETH_A_Sk_MI_cEXM Pq-X-L/ETH_A_Sk_MI_cCSF Pq-X-L/ETH_A_Sk_MI_pFCSError

Processes

A process diagram of this function is shown in Figure 11-26.

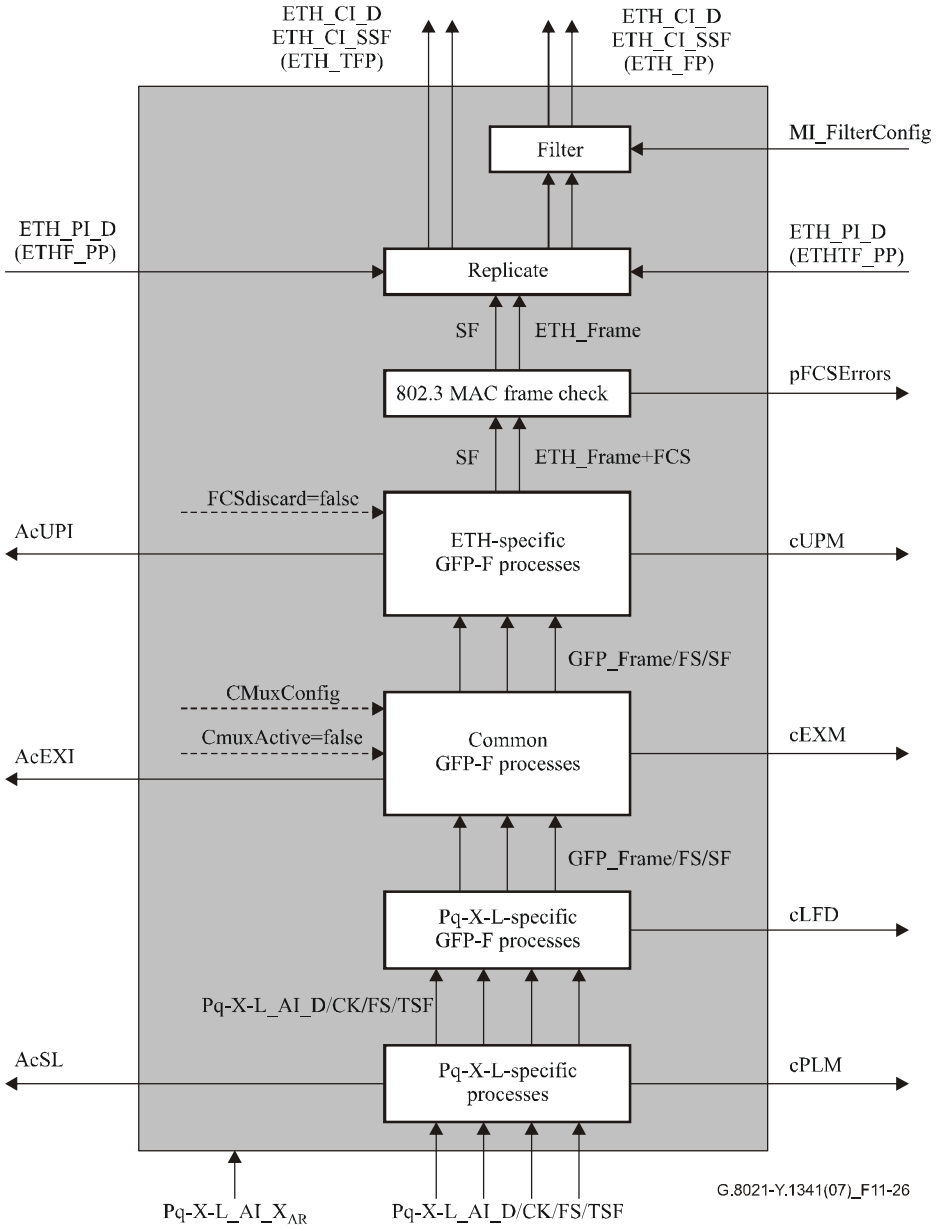

Figure 11-26 – Pq-X-L/ETH_A_Sk process diagram

Filter process

See clause 8.3.

Replicate process

See clause 8.4.

802.3 MAC FCS check process

See clause 8.8.2.

Ethernet-specific GFP-F sink process

See clause 8.5.4.2.2 of [ITU-T G.806]. GFP pFCS checking, GFP p_FCSError, p_FDis are not supported (FCSdiscard=false). The UPI value for frame-mapped Ethernet shall be expected (Table 6-3 of [ITU-T G.7041]). The Ethernet frames are extracted from the client payload information field of the GFP-F frames according to clause 7.1 of [ITU-T G.7041].

Common GFP sink process

See clause 8.5.3.2 of [ITU-T G.806]. GFP channel multiplexing is not supported (MI_CMuxActive=false).

Pq-X-L-specific GFP sink process

See clause 8.5.2.2 of [ITU-T G.806]. The GFP frames are demapped from the Pq-X-L payload area according to [ITU-T G.8040].

Pq-X-L-specific sink process

P31s-X-L-specific

MA: The signal label is recovered from the payload type field in the MA byte as per clause 6.2.4.2 of [ITU-T G.806]. The signal label for "GFP mapping" in clause 2.1 of [ITU-T G.832] shall be expected. The accepted value of the signal label is also available at the P31s-X-L/ETH_A_Sk_MP.

NOTE 1 – The Pq-X-L_AI_X_{AR} interface is not connected to any of the internal processes.

Defects

dPLM – See clause 6.2.4.2 of [ITU-T G.806].

dLFD – See clause 6.2.5.2 of [ITU-T G.806].

dUPM – See clause 6.2.4.3 of [ITU-T G.806].

dEXM – See clause 6.2.4.4 of [ITU-T G.806].

NOTE 2 – dPLM is only defined for q = 31s. dPLM is assumed to be false for q = 11s, 12s, 32e.

Consequent actions

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM or dCSF

NOTE 3 – X_{AR}=0 results in AI_TSF being asserted, so there is no need to include it as additional contributor to aSSF.

Defect correlations

The function shall perform the following defect correlations to determine the most probable fault cause (see clause 6.4 of [ITU-T 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)

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

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

cCSF per clause 8.5.4.1.2 of [ITU-T G.806].

Performance monitoring

The function shall perform the following performance monitoring primitives processing. The performance monitoring primitives shall be reported to the EMF.

pFCSError: Count of FrameCheckSequenceErrors per second.

NOTE 4 – This primitive is calculated by the MAC FCS check process.

11.5 OTH/ETH adaptation functions (O/ETH_A)

11.5.1 ODUk/ETH adaptation functions (ODUkP/ETH_A; k = 1,2,3)

11.5.1.1 ODUk/ETH adaptation source function (ODUkP/ETH_A_So)

The ODUkP/ETH_A_So function creates the ODUk signal from a free-running clock. It maps the ETH_CI information into the payload of the OPUk (k = 1, 2, 3), adds OPUk overhead (RES, PT) and default ODUk overhead.

Symbol

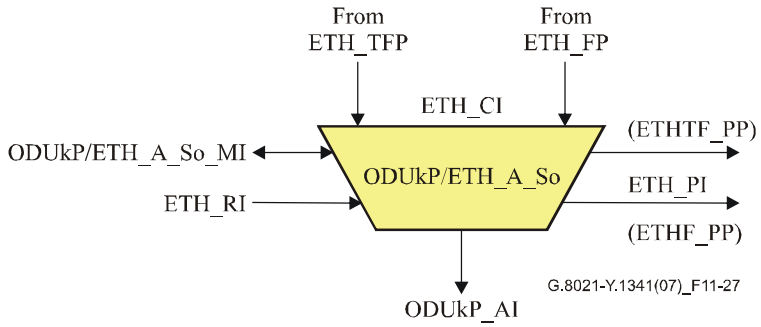

Figure 11-27 – ODUkP/ETH_A_So symbol

Interfaces

Table 11-15 – ODUkP/ETH_A_So interfaces

Inputs	Outputs
ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_SSF ETH_RP: ETH_RI_RSF ODUkP/ETH_A_So_MI: ODUkP/ETH_A_So_MI_Active ODUkP/ETH_A_So_MI_CSFEnable	ODUkP_AP: ODUkP_AI_Data ODUkP_AI_Clock ODUkP_AI_FrameStart ODUkP_AI_MultiframeStart ETHF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE ETHTF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE

Processes

A process diagram of this function is shown in Figure 11-28.

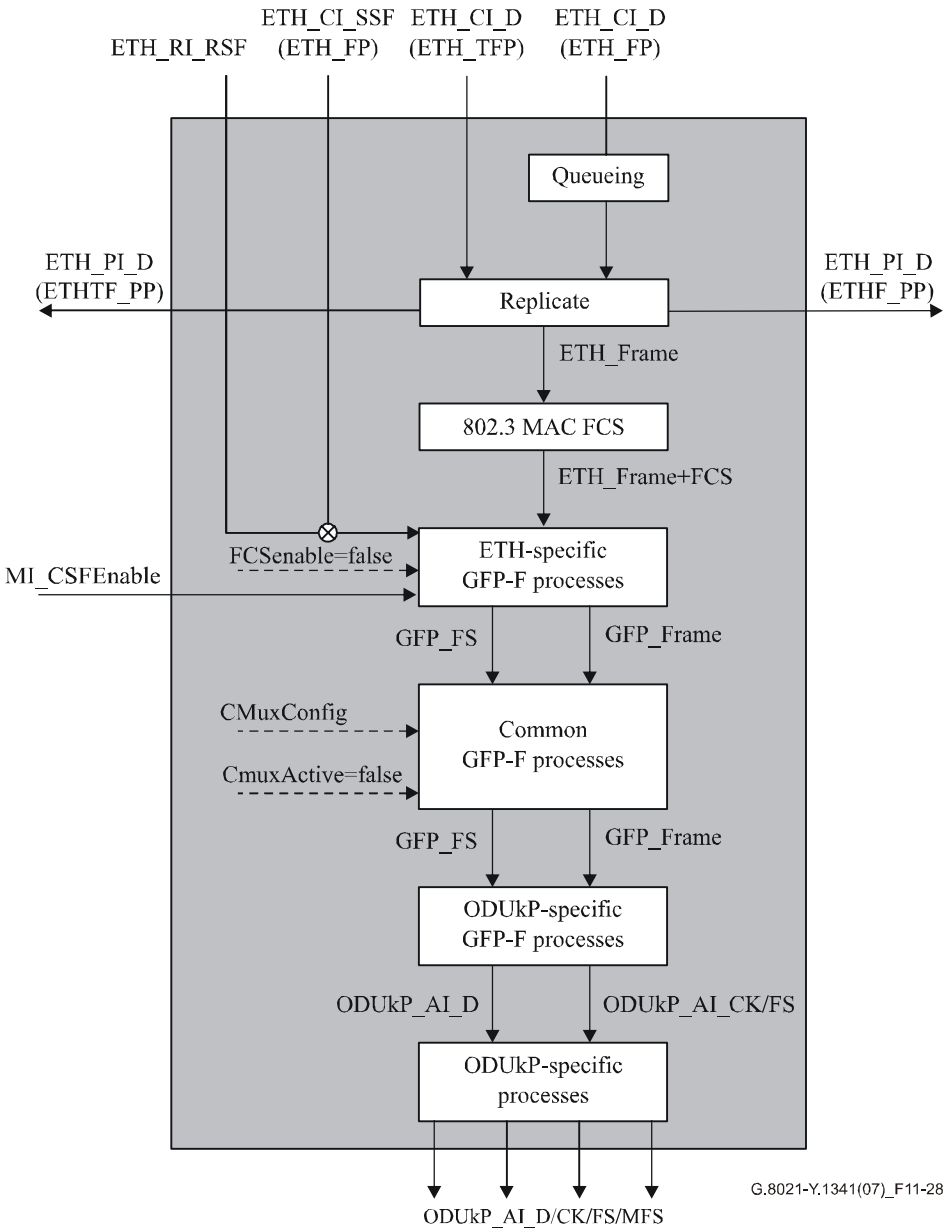

Figure 11-28 – ODUkP/ETH_A_So process diagram

Queuing process

See clause 8.2.

Replicate process

See clause 8.4.

802.3 MAC FCS generation

See clause 8.8.1.

Ethernet-specific GFP-F source process

See clause 8.5.4.1.1 of [ITU-T G.806]. GFP pFCS generation is disabled (FCSenable=false). The UPI value for frame-mapped Ethernet shall be inserted (Table 6-3 of [ITU-T G.7041]). The Ethernet frames are inserted into the client payload information field of the GFP-F frames according to clause 7.1 of [ITU-T G.7041].

Response to ETH_CI_SSF asserted is for further study.

Common GFP source process

See clause 8.5.3.1 of [ITU-T G.806]. GFP channel multiplexing is not supported (CMuxActive=false).

ODUkP-specific GFP source process

See clause 8.5.2.1 of [ITU-T G.806]. The GFP frames are mapped into the ODUk payload area according to clause 17.3 of [ITU-T G.709].

ODUkP-specific source process

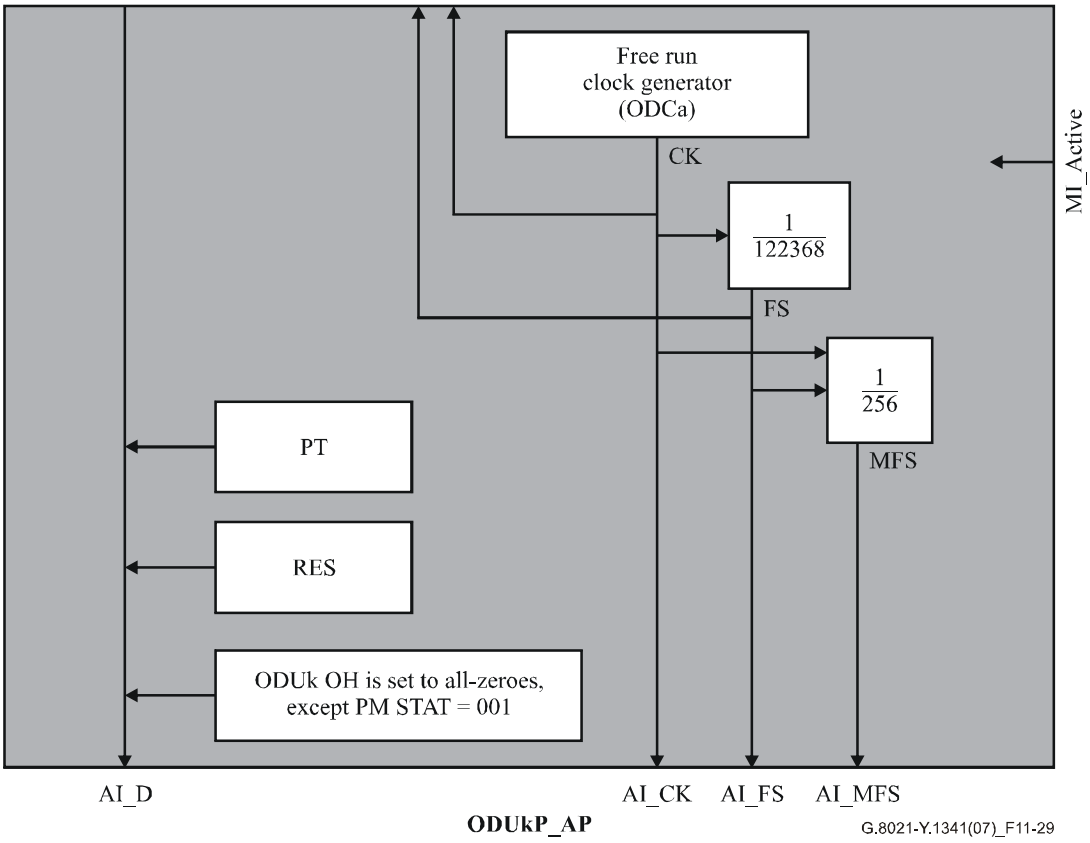

Figure 11-29 – ODUkP-specific source processes

Clock and (multi)frame start signal generation: The function shall generate a local ODUk clock (ODUkP_AI_CK) of "239/(239 – k) * $4^{(k-1)}$ * 2 488 320 kHz ± 20 ppm" from a free-running oscillator. The jitter and wander requirements as defined in Annex A of [ITU-T G.8251] (ODCa clock) apply.

The function shall generate the (multi)frame start reference signals AI_FS and AI_MFS for the ODUk signal. The AI_FS signal shall be active once per 122 368 clock cycles. AI_MFS shall be active once every 256 frames.

PT: The payload type information is derived directly from the adaptation function type. The value for "GFP mapping" shall be inserted into the PT byte position of the PSI overhead as defined in clause 15.9.2.1.1 of [ITU-T G.709].

RES: The function shall insert all-0's into the RES bytes.

All other bits of the ODUk overhead should be sourced as "0"s, except the ODUk-PM STAT field which should be set to the value "normal path signal" (001).

Counter processes

For further study.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring For further study.

11.5.1.2 ODUk/ETH adaptation sink function (ODUkP/ETH_A_Sk)

The ODUkP/ETH_A_Sk extracts ETH_CI information from the ODUkP payload area, delivering ETH_CI to ETH_TFP and ETH_FP. It extracts the OPUk overhead (PT and RES) and monitors the reception of the correct payload type.

Symbol

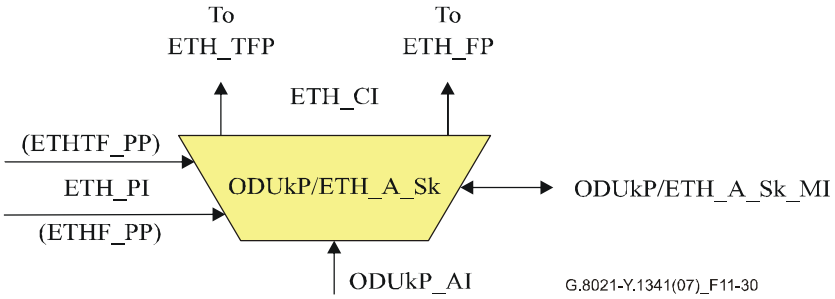

Figure 11-30 – ODUkP/ETH_A_Sk symbol

Interfaces

Table 11-16 – ODUkP/ETH_A_Sk interfaces

Inputs	Outputs
ODUkP_AP: ODUkP_AI_Data ODUkP_AI_ClocK ODUkP_AI_FrameStart ODUkP_AI_MultiframeStart ODUkP_AI_TSF ETHF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE ETHTF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE ODUkP/ETH_A_Sk_MI: ODUkP/ETH_A_Sk_MI_Active ODUkP/ETH_A_Sk_MI_FilterConfig ODUkP/ETH_A_Sk_MI_CSF_Reported ODUkP/ETH_A_Sk_MI_MAC_Length	ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_SSF ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_SSF ETH_RP: ETH_RI_RSF ODUkP/ETH_A_Sk_MI: ODUkP/ETH_A_Sk_MI_AcPT ODUkP/ETH_A_Sk_MI_AcEXI ODUkP/ETH_A_Sk_MI_AcUPI ODUkP/ETH_A_Sk_MI_cPLM ODUkP/ETH_A_Sk_MI_cLFD ODUkP/ETH_A_Sk_MI_cUPM ODUkP/ETH_A_Sk_MI_cEXM ODUkP/ETH_A_Sk_MI_cCSF ODUkP/ETH_A_Sk_MI_pFCSErrors

Processes

A process diagram of this function is shown in Figure 11-31.

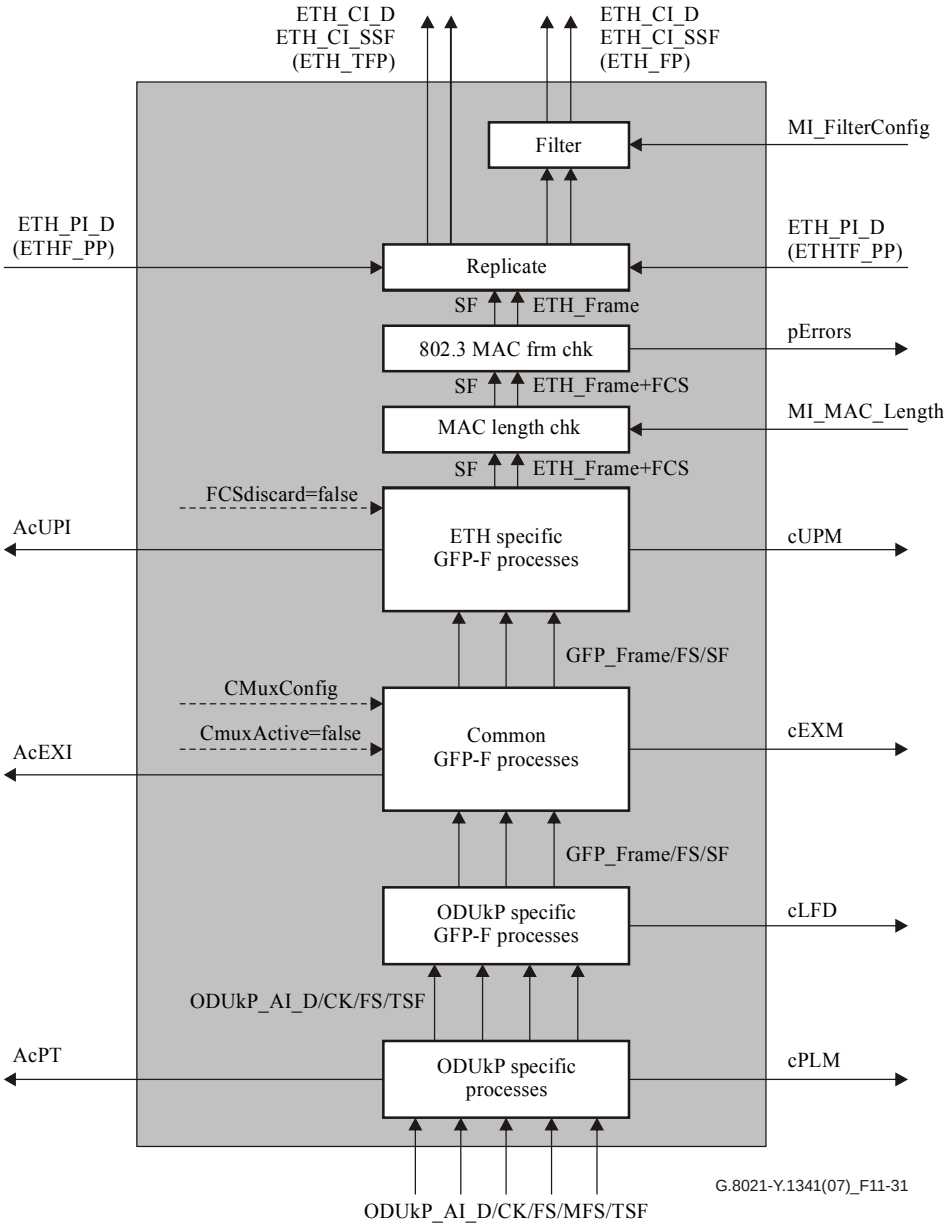

Figure 11-31 – ODUkP/ETH_A_Sk process diagram

Filter process

See clause 8.3.

Replicate process

See clause 8.4.

802.3 MAC FCS check process

See clause 8.8.2.

Ethernet-specific GFP-F sink process:

See clause 8.5.4.2.2 of [ITU-T G.806]. GFP pFCS checking, GFP p_FCSError, p_FDis are not supported (FCSdiscard=false). The UPI value for frame-mapped Ethernet shall be expected (Table 6-3 of [ITU-T G.7041]). The Ethernet frames are extracted from the client payload information field of the GFP-F frames according to clause 7.1 of [ITU-T G.7041].

Common GFP sink process

See clause 8.5.3.2 of [ITU-T G.806]. GFP channel multiplexing is not supported (MI_CMuxActive=false).

ODUkP-specific GFP sink process

See clause 8.5.2.2 of [ITU-T G.806]. The GFP frames are demapped from the ODUk payload area according to clause 17.3 of [ITU-T G.709].

ODUkP-specific sink process

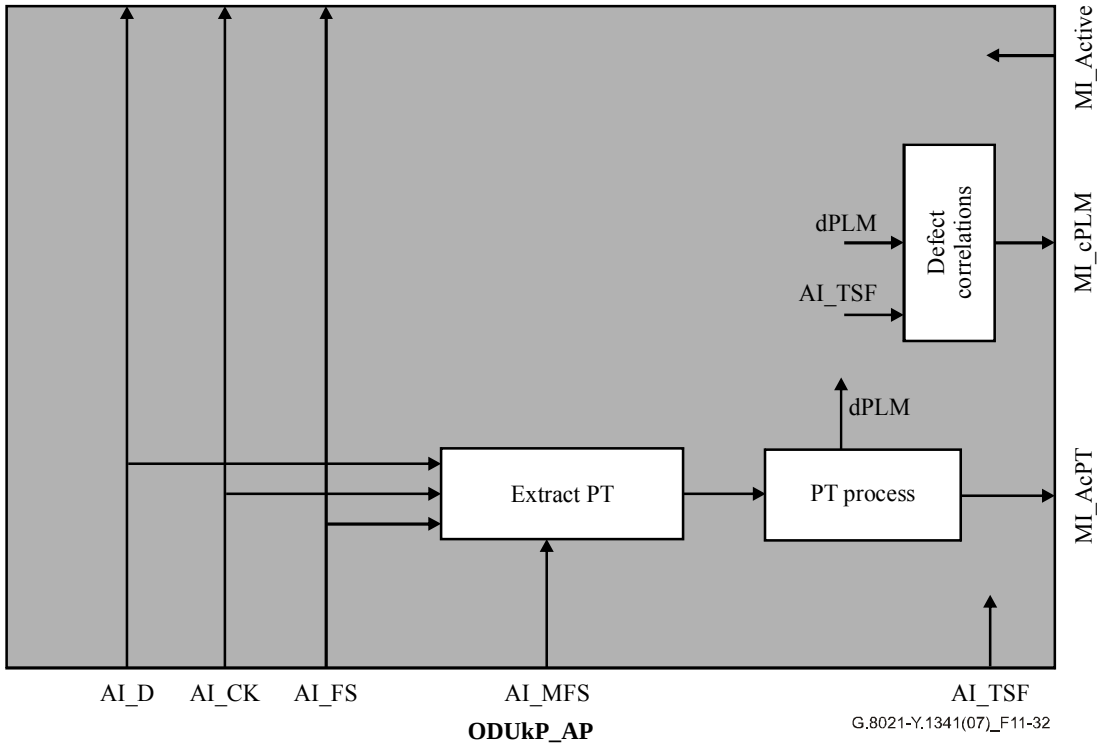

Figure 11-32 – ODUkP specific sink processes

PT: The function shall extract the PT byte from the PSI overhead as defined in clause 8.7.1 of [ITU-T G.798]. The payload type value for "GFP mapping" in clause 15.9.2.1.1 of [ITU-T G.709] shall be expected. The accepted PT value is available at the MP (MI_AcPT) and is used for PLM defect detection.

RES: The value in the RES bytes shall be ignored.

Defects

dPLM – See clause 6.2.4.1 of [ITU-T G.798].

dLFD – See clause 6.2.5.2 of [ITU-T G.806].

dUPM – See clause 6.2.4.3 of [ITU-T G.806].

dEXM – See clause 6.2.4.4 of [ITU-T G.806].

Consequent actions

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dPLM or dLFD or dUPM or dEXM or dCSF

Defect correlations

The function shall perform the following defect correlations to determine the most probable fault cause (see clause 6.4 of [ITU-T 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)

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

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

cCSF ← dCFS and (not dEXM) and (not dUPM) and (not dPLM) and (not dLFD) and (not AI_TSF) and CSF_Reported

Performance monitoring

The function shall perform the following performance monitoring primitives processing. The performance monitoring primitives shall be reported to the EMF.

pFCSErrors: Count of FrameCheckSequenceErrors per second.

NOTE – This primitive is calculated by the MAC FCS check process.

11.5.2 LCAS-capable ODUk-Xv/ETH adaptation functions (ODUkP-X-L/ETH_A; k = 1,2,3)

11.5.2.1 LCAS-capable ODUk-Xv/ETH adaptation source function (ODUkP-X-L/ETH_A_So)

The ODUkP-X-L/ETH_A_So function creates the ODUk-X-L signal from a free-running clock. It maps the ETH_CI information into the payload of the OPUk-Xv (k = 1, 2, 3), adds OPUk-Xv overhead (RES, vcPT).

Symbol

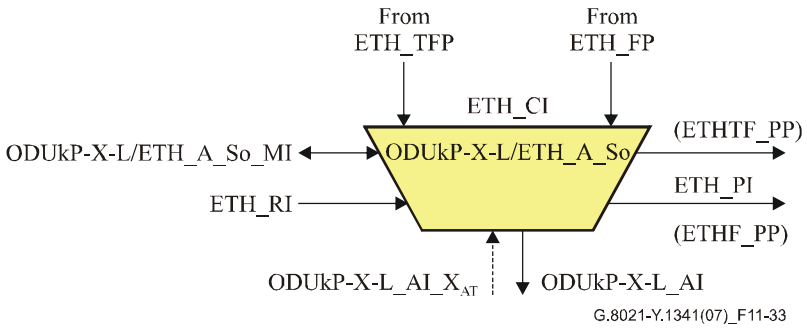

Figure 11-33 – ODUkP-X-L/ETH_A_So symbol

Interfaces

Table 11-17 – ODUkP-X-L/ETH_A_So interfaces

Inputs	Outputs
ETH_TFP: ETH_CI_D ETH_CI_DE ETH_CI_P ETH_FP: ETH_CI_D ETH_CI_DE ETH_CI_P ETH_CI_SSF ODUkP-X-L_AP: ODUkP-X-L_AI_X_{AT} ODUkP-X-L/ETH_A_So_MI: ODUkP-X-L/ETH_A_So_MI_Active ODUkP-X-L/ETH_A_So_MI_CSFEnable	ODUkP-X-L_AP: ODUkP-X-L_AI_Data ODUkP-X-L_AI_ClocK ODUkP-X-L_AI_FrameStart ODUkP-X-L_AI_MultiframeStart ETHF_PP: ETH_PI_D ETH_PI_DE ETH_PI_P ETHTF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE

Processes

A process diagram of this function is shown in Figure 11-34.

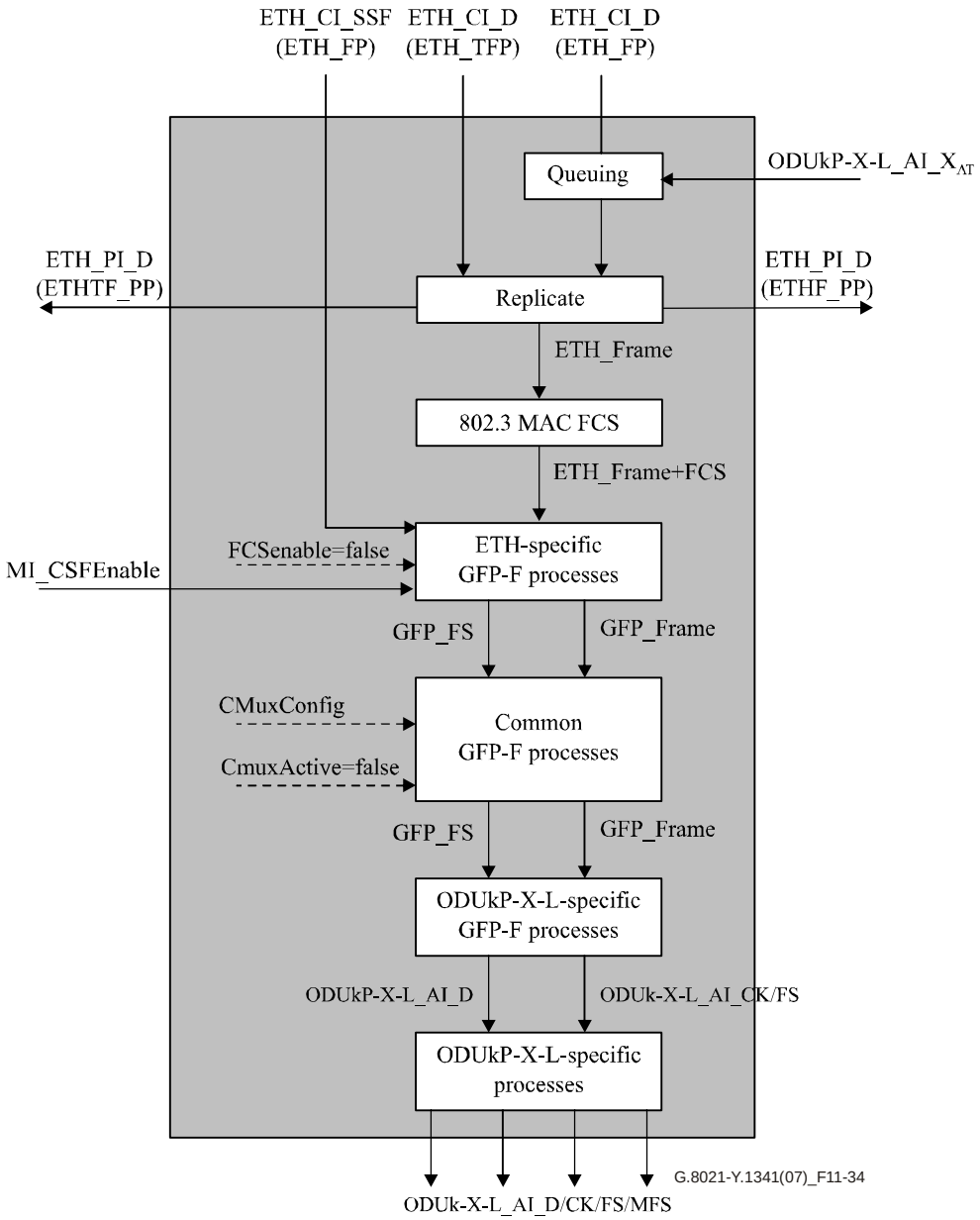

Figure 11-34 – ODUkP-X-L/ETH_A_So process diagram

See clause 11.5.1.1 for a description of ODUkP-X-L/ETH_A processes.

ODUkP-X-L-specific source process

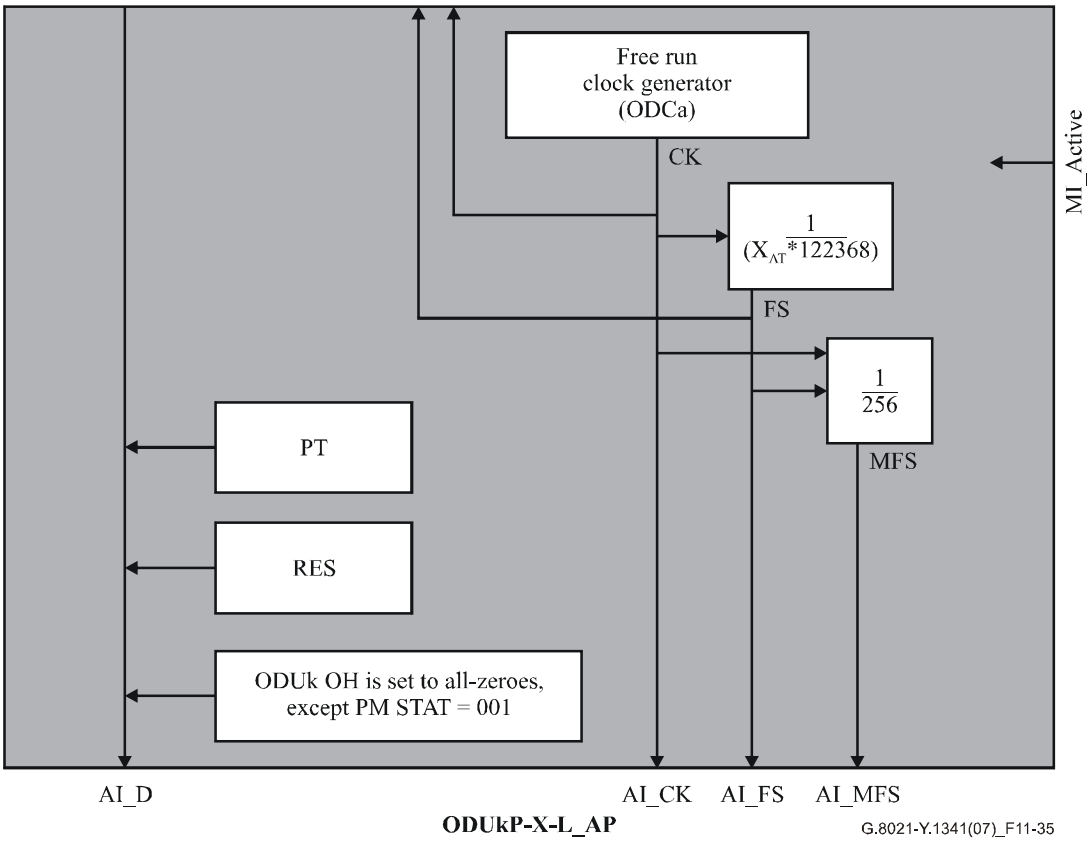

Figure 11-35 – ODUkP-X-L specific source processes

Clock and (multi)frame start signal generation: The function shall generate a local ODUk clock (ODUkP_AI_CK) of " X_{AT} * 239/(239 – k) * $4^{(k-1)}$ * 2 488 320 kHz ± 20 ppm" from a free-running oscillator. The jitter and wander requirements as defined in Annex A of [ITU-T G.8251] (ODCa clock) apply.

The function shall generate the (multi)frame start reference signals AI_FS and AI_MFS for the ODUk signal. The AI_FS signal shall be active once per 122 368 clock cycles. AI_MFS shall be active once every 256 frames.

vcPT: The payload type information is derived directly from the adaptation function type. The value for "GFP mapping" shall be inserted into the vcPT byte position of the PSI overhead as defined in clause 18.1.2.2 of [ITU-T G.709].

RES: The function shall insert all-0's into the RES bytes.

Defects None.

Consequent actions None.

Defect correlations None.

Performance monitoring For further study.

11.5.2.2 LCAS-capable ODUk-Xv/ETH adaptation sink function (ODUkP-X-L/ETH_A_Sk)

The ODUkP-X-L/ETH_A_Sk extracts ETH_CI information from the ODUkP-Xv payload area, delivering ETH_CI to ETH_TFP and ETH_FP. It extracts the OPUk-Xv overhead (vcPT and RES) and monitors the reception of the correct payload type.

Symbol

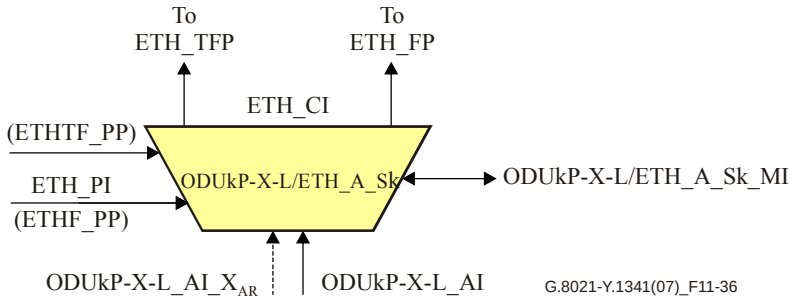

Figure 11-36 – ODUkP-X-L/ETH_A_Sk symbol

Interfaces

Table 11-18 – ODUkP-X-L/ETH_A_Sk interfaces

Inputs	Outputs
ODUkP-X-L_AP: ODUkP-X-L_AI_Data ODUkP-X-L_AI_ClocK ODUkP-X-L_AI_FrameStart ODUkP-X-L_AI_MultiframeStart ODUkP-X-L_AI_TSF ODUkP-X-L_AI_X_{AR} ETHF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE ETHTF_PP: ETH_PI_D ETH_PI_P ETH_PI_DE ODUkP-X-L/ETH_A_Sk_MI: ODUkP-X-L/ETH_A_Sk_MI_Active ODUkP-X-L/ETH_A_Sk_MI_FilterConfig ODUkP-X-L/ETH_A_Sk_MI_CSF_Reported	ETH_TFP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_SSF ETH_FP: ETH_CI_D ETH_CI_P ETH_CI_DE ETH_CI_SSF ODUkP-X-L/ETH_A_Sk_MI: ODUkP-X-L/ETH_A_Sk_MI_AcVcPT ODUkP-X-L/ETH_A_Sk_MI_AcEXI ODUkP-X-L/ETH_A_Sk_MI_AcUPI ODUkP-X-L/ETH_A_Sk_MI_cVcPLM ODUkP-X-L/ETH_A_Sk_MI_cLFD ODUkP-X-L/ETH_A_Sk_MI_cUPM ODUkP-X-L/ETH_A_Sk_MI_cEXM ODUkP-X-L/ETH_A_Sk_MI_cCSF ODUkP-X-L/ETH_A_Sk_MI_pFCSError

Processes

See process diagram and process description in clause 11.5.1.2. The additional ODUkP-X-L_AI_X_{AR} interface is not connected to any of the internal processes.

ODUkP-X-L-specific sink process

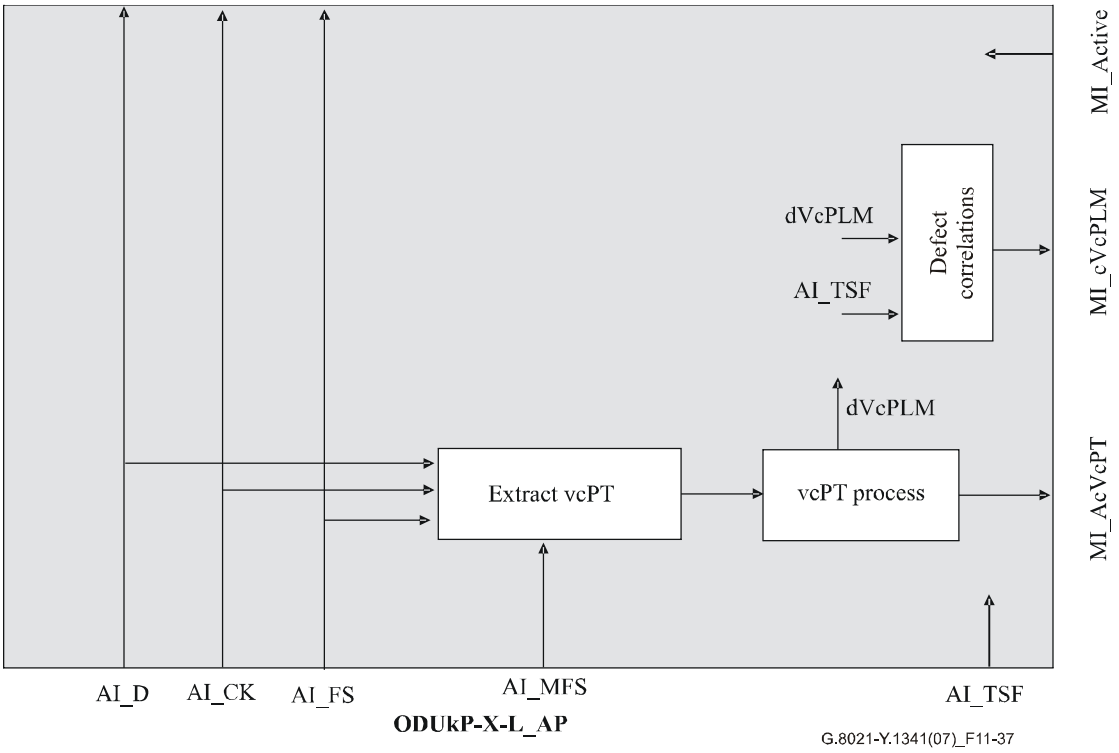

Figure 11-37 – ODUkP-X-L-specific sink processes

PT: The function shall extract the vcPT byte from the PSI overhead as defined in clause 8.7.3 of [ITU-T G.798]. The payload type value for "GFP mapping" in clause 18.1.2.2 of [ITU-T G.709] shall be expected. The accepted PT value is available at the MP (MI_AcPT) and is used for PLM defect detection.

RES: The value in the RES bytes shall be ignored.

Defects

dVcPLM – See clause 6.2.4.2 of [ITU-T G.798].

dLFD – See clause 6.2.5.2 of [ITU-T G.806].

dUPM – See clause 6.2.4.3 of [ITU-T G.806].

dEXM – See clause 6.2.4.4 of [ITU-T G.806].

Consequent actions

The function shall perform the following consequent actions:

aSSF ← AI_TSF or dVcPLM or dLFD or dUPM or dEXM or dCSF

NOTE 1 – X_{AR} = 0 results in AI_TSF being asserted, so there is no need to include it as additional contributor to aSSF.

Defect correlations

The function shall perform the following defect correlations to determine the most probable fault cause (see clause 6.4 of [ITU-T G.806]). This fault cause shall be reported to the EMF.

cVcPLM ← dVcPLM and (not AI_TSF)

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

cUPM ← dUPM and (not dVcPLM) and (not dLFD) and (not AI_TSF)

cEXM ← dEXM and (not dUPM) and (not dVcPLM) and (not dLFD) and (not AI_TSF)

cCSF per clause 8.5.4.1.2 of [ITU-T G.806].

Performance monitoring

The function shall perform the following performance monitoring primitives processing. The performance monitoring primitives shall be reported to the EMF.

pFCSError: Count of FrameCheckSequenceErrors per second.

NOTE 2 – This primitive is calculated by the MAC FCS check process.

11.6 MPLS/ETH adaptation functions (MPLS/ETH_A)

For further study.

11.7 ATM VC/ETH adaptation functions (VC/ETH_A)

For further study.

11.8 RPR/ETH adaptation functions (RPR/ETH_A)

For further study.

Appendix I

Applications and functional diagrams

(This appendix does not form an integral part of this Recommendation)

Figure I.1 presents the set of atomic functions associated with the Ethernet signal transport, shown in several example applications.

- Ethernet UNI/NNI interface port on EoT equipment.
- Ethernet over SDH NNI interface port on EoT equipment.
- Ethernet UNI interface port supporting multiplexed access on EoT equipment.

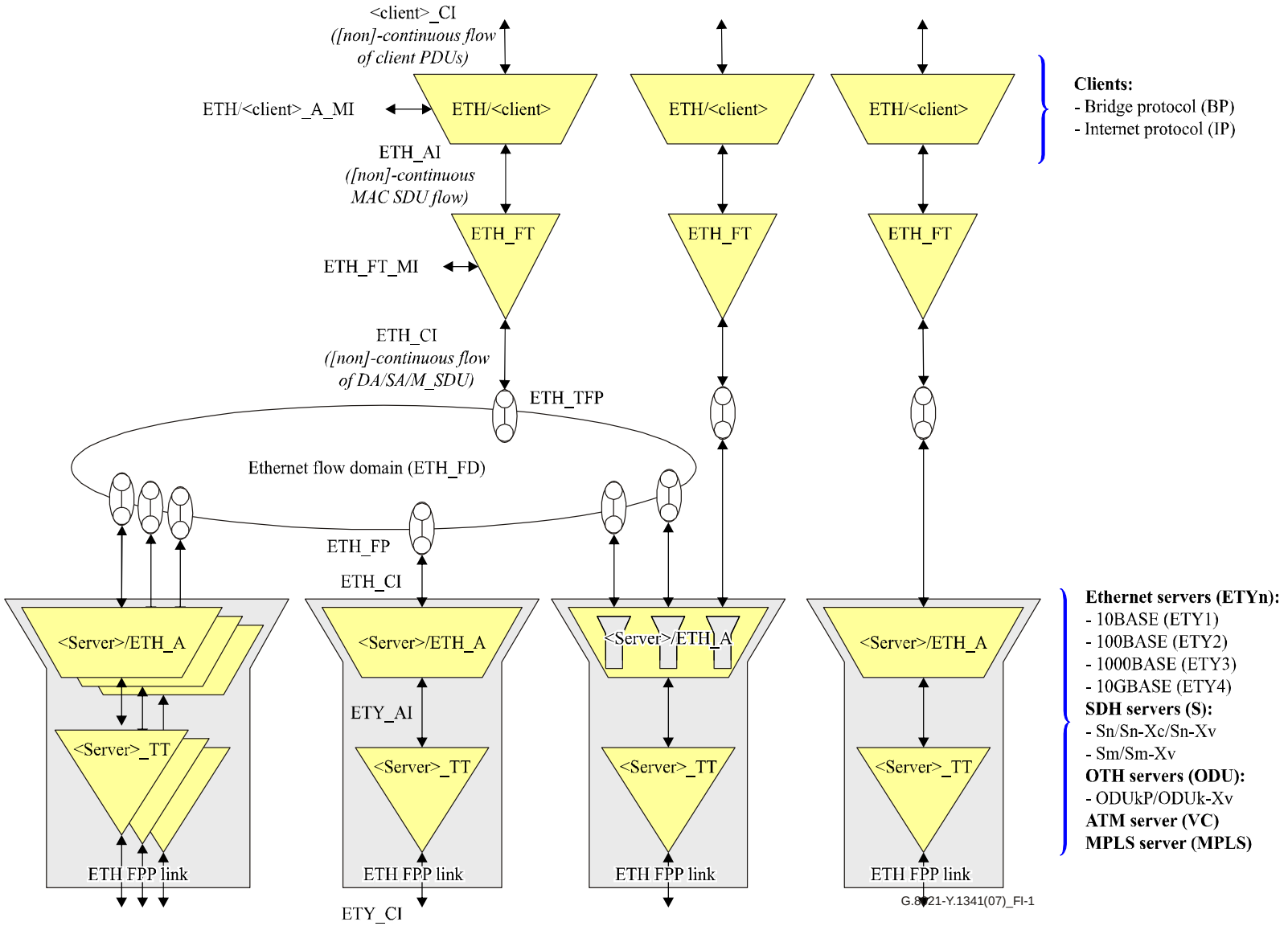

Figure I.1 – Ethernet atomic functions in some possible applications

Appendix II

AIS/RDI mechanism for an Ethernet private line over a single SDH or OTH server layer

(This appendix does not form an integral part of this Recommendation)

In order to address fault notification for failures in either the access links or within the SDH/OTH server layer, the following functionality is required:

a) Convey fault notification for an access link failure from one side of the network to the other.

b) Convey fault notification for an SDH/OTH server layer failure to the access links.

[ITU-T G.7041] defines client management frames (CMFs) for conveying information about the client signal from an ingress edge NE to the egress edge NE. Defined CMF indications are client signal fail (CSF) and remote fail indication (RFI).

[ITU-T G.806] defines the equipment functional details of the CSF and RFI mechanisms.

This Recommendation defines the Ethernet-specific equipment functional details for the CSF and RFI mechanisms.

The combination of the above three Recommendations provides the functionality required by a) and (b).

That basic functionality can be further enhanced by using the clause 57 of [b-IEEE 802.3ah] (EFM OAM) link fault flag in conjunction with the GFP-F CMF CSF and RFI indications, as illustrated below.

A simplifying assumption can be made regarding the conditioning of the Ethernet access links on either side of the SDH/OTH transport network. For an EPL application, the access link is specific to a single service, and since an Ethernet service is bidirectional, a fault in either direction should result in the access link being conditioned as "failed".

The following fault scenarios and accompanying figures illustrate the proposed interworking of the EFM OAM link fault flag with the GFP-F CMF CSF and RFI indications to appropriately condition the Ethernet access links. Only unidirectional faults are considered, the scenarios can be combined per the superposition principle to describe bidirectional faults. Further, only an SDH server layer is shown in the examples. CE = customer edge. PE = provider edge.

Scenario 1

In Figure II.1, a unidirectional fault occurs on the east access link on ingress to the carrier network.

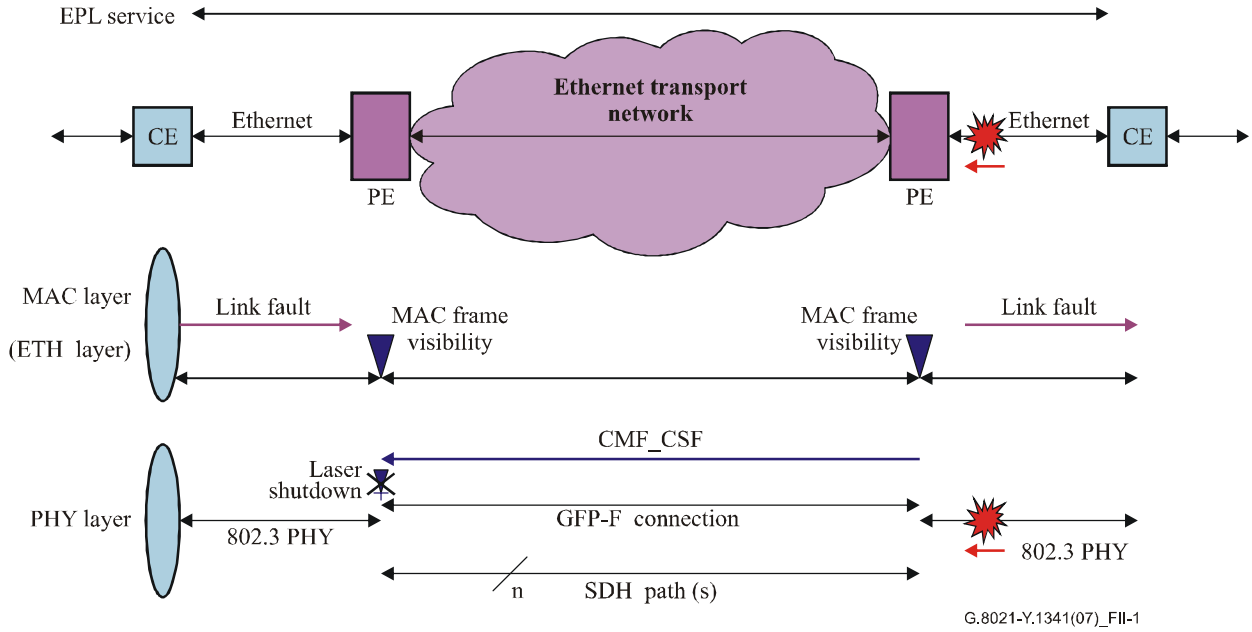

Figure II.1 – Fault on ingress

- The east PE detects loss of signal on the ingress access link:
  - 802.3ah OAM sends link fault upstream, interspersed with idles.
  - GFP-F CMF CSF indication is sent into the network.
- The east CE detects link fault:
  - Idles are sent towards the network and towards the enterprise.
- The west PE detects the GFP-F CMF CSF indication:
  - If there is no network_ETH_AIS indication available, the laser (or electrical driver) is shut down.
- The west CE detects loss of signal:
  - 802.3ah OAM sends link fault upstream, interspersed with idles.
  - Idles are sent towards the enterprise.

Scenario 2

In Figure II.2 a unidirectional fault occurs westbound on the server layer within the carrier network.

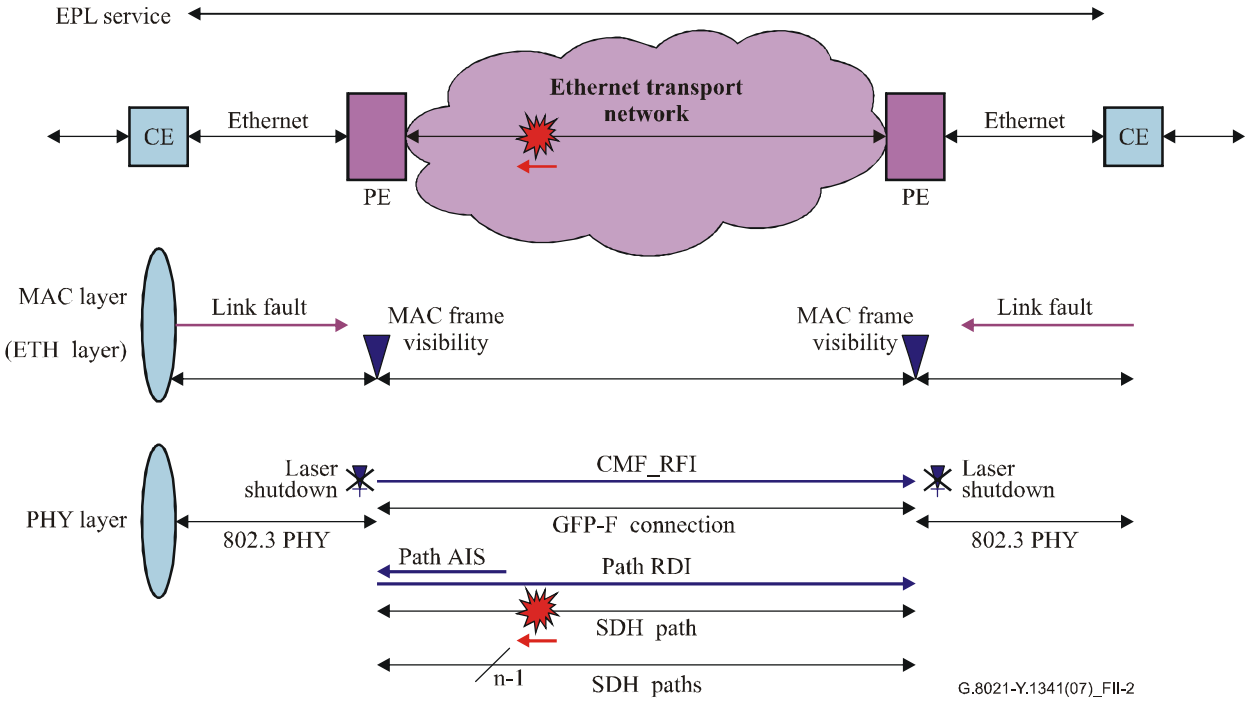

Figure II.2 – Fault within carrier network

- An NE in the carrier network detects the failure of one of the member paths of a VCAT group:
  - SDH path AIS is generated downstream on the affected path.
- The west PE detects SDH Path AIS:
  - SDH path RDI is generated back into the network on the associated path.
  - GFP-F CMF RFI is generated back into the network.
  - If there is no network_ETH_AIS indication available, the laser (or electrical driver) is shut down.
- The west CE detects loss of signal:
  - 802.3ah OAM sends link fault upstream, interspersed with idles.
  - Idles are sent towards the enterprise.
- The east PE detects the GFP-F CMF RFI indication:
  - If there is no network_ETH_RDI indication available, the laser (or electrical driver) is shut down.
- The east CE detects loss of signal:
  - 802.3ah OAM sends link fault upstream, interspersed with idles.
  - Idles are sent towards the enterprise.

Note that for a network failure affecting all member paths of the VCAT group, the same steps above apply with the addition of SDH path AIS and RDI being sent on all the member paths.

Scenario 3

In Figure II.3 a unidirectional fault occurs on the west access link towards the enterprise network.

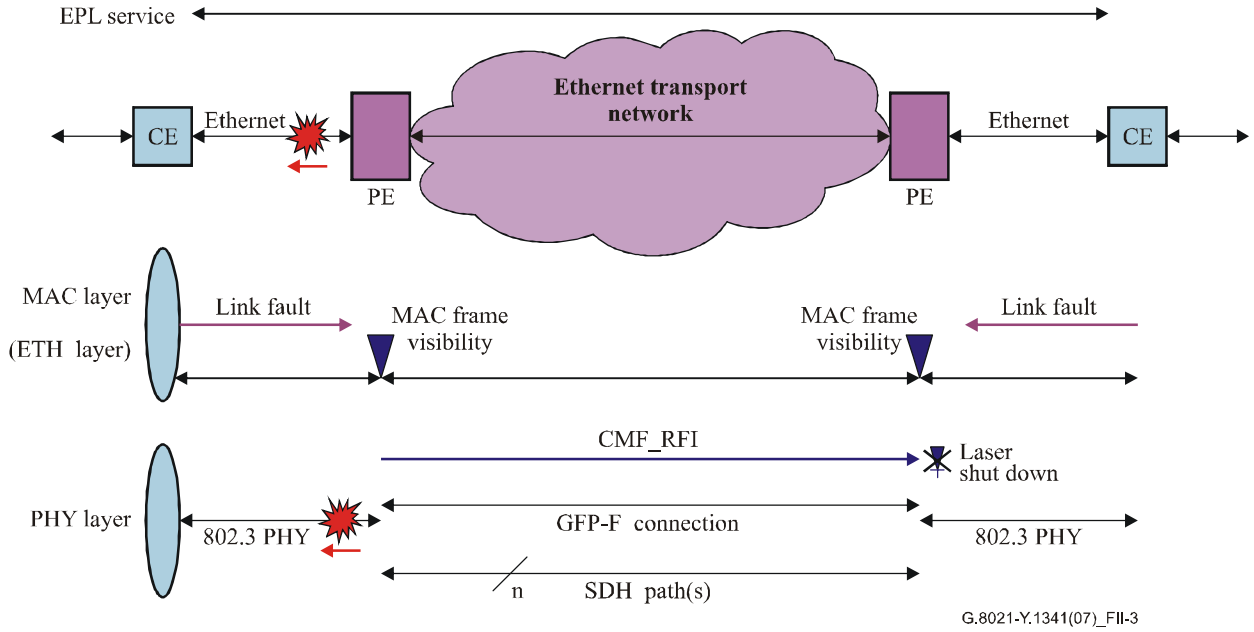

Figure II.3 – Fault on egress

- The west CE detects loss of signal:
  - 802.3ah OAM sends link fault upstream, interspersed with idles.
  - Idles are sent towards the enterprise.
- The west PE detects the link fault indication:
  - GFP-F CMF RFI indication is sent into the network.
  - Idles are sent towards the CE.
- The east PE detects the GFP-F CMF RFI indication:
  - If there is no network_ETH_RDI indication available, the laser (or electrical driver) is shut down.
- The east CE detects loss of signal:
  - 802.3ah OAM sends link fault upstream, interspersed with idles.
  - Idles are sent towards the enterprise.

Note that a PE only reacts to the reception of a link fault indication when there are no other conditioning alarms (i.e., the PE takes no further conditioning action when it receives a link fault indication in response to having shut down its own egress laser).

Appendix III

Compound functions

(This appendix does not form an integral part of this Recommendation)

This appendix contains some useful combinations of atomic functions.

MEP model overview

MEP compound function is indicated by the diagrammatic convention shown in Figure III.1 as defined in [ITU-T G.8010].

Reference

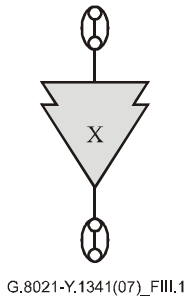

Figure III.1 – MEP compound function

This symbol can be expanded as shown in Figure III.2.

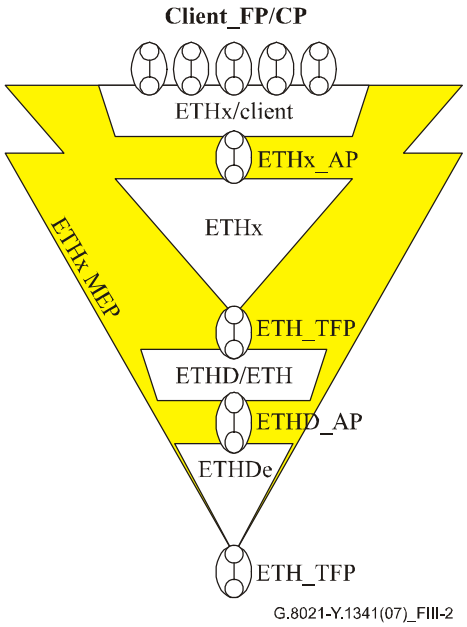

Figure III.2 – Expanded MEP compound function

Then it is divided into two parts: path, tandem connection, section flow termination function and adaptation; and ETH diagnostic adaptation and flow termination function as shown in Figures III.3 and III.4 (using unidirectional representation).

NOTE – Only the case where ETHx/ETH adaptation function is used is indicated here. Other cases should be added as necessary.

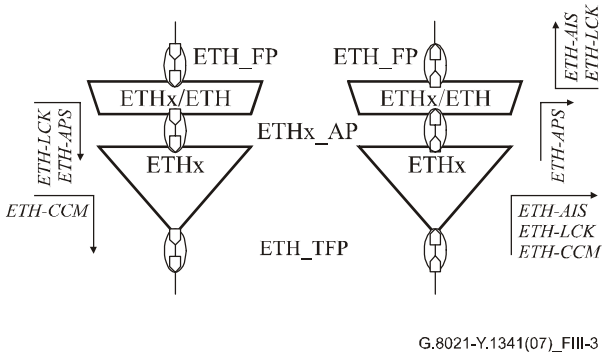

Figure III.3 – ETH path, tandem connection, section flow termination function and adaptation

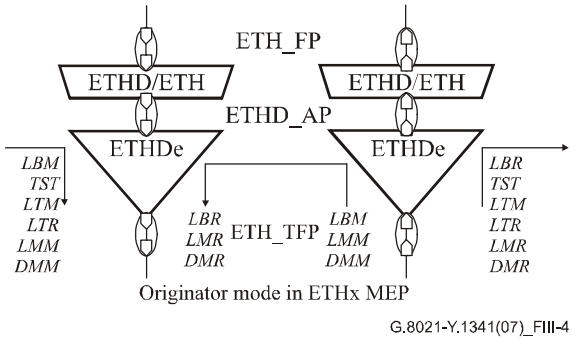

Figure III.4 – ETH diagnostic adaptation and flow termination function for MEPs

MIP model overview

MIP compound function is indicated by the diagrammatic convention shown in Figure III.5 as defined in [ITU-T G.8010].

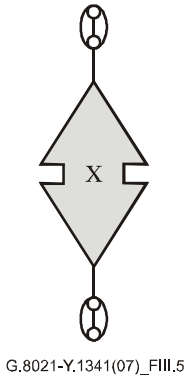

Figure III.5 – MIP compound function

This symbol can be expanded as shown in Figure III.6. It consists of two pairs of the ETH diagnostic adaptation and flow termination functions, each facing in opposite directions. An ETH MIP function is capable to respond to on-demand ETH OAM signals.

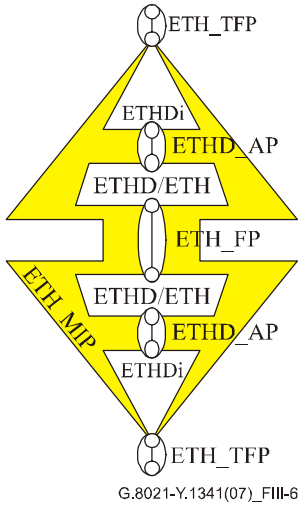

Figure III.6 – Expanded MIP compound function

A variant of this ETH MIP compound function is the half MIP compound function, which consists of a single pair of the ETH diagnostic adaptation and flow termination functions (Figure III.7).

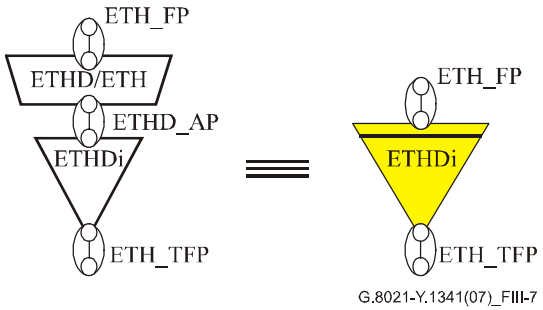

Figure III.7 – ETH half MIP compound function

The ETH diagnostic adaptation and flow termination function is shown in Figure III.8 (using unidirectional representation).

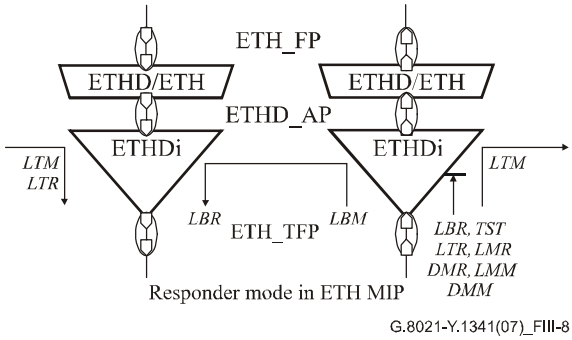

Figure III.8 – ETH diagnostic adaptation and flow termination function for MIPs

Appendix IV

Startup conditions

(This appendix does not form an integral part of this Recommendation)

The set of interconnected ETH_FF functions must be loop-free, since otherwise the integrity of the network may be compromised. This requirement implies that one can only include ports of the ETH_CF in the ETH_FF if it is known that this will not create a loop.

In [IEEE 802.1D] and [IEEE 802.1Q], this is secured by starting in a state without connectivity, except for the exchange of BPDUs. Consequently, the spanning tree protocol extends the connectivity while making sure that this does not create any loops.

This means that the ETH_CF, as defined in this Recommendation, on startup of the equipment may not contain an ETH_FF that includes more than one port of its enclosing ETH_CF function. After startup, ports may be added to ETH_FF functions under control of the spanning tree protocol. Alternatively, this may be done under control of a management system, as long as the management system can guarantee that there are no loops created.

Bibliography

[b-ITU-T I.732] Recommendation ITU-T I.732 (2000), *Functional characteristics of ATM equipment*.

[b-IEEE 802.1ag] IEEE Std. 802.1ag (2007), *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and Metropolitan Area Networks: Virtual Bridged Local Area Networks Amendment 5: Connectivity Fault Management*.
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[b-IEEE 802.3ah] IEEE 802.3ah (2004), *IEEE Standard for Information technology – Telecommunications and information exchange between systems – Local and Metropolitan Area Networks: Specific requirements Part 3: Carrier sense multiple access with collision detection (CSMA/CD) access method and physical layer specifications Amendment: Media Access Control Parameters, Physical Layers, and Management Parameters for Subscriber Access Networks.*
<http://ieeexplore.ieee.org/servlet/opac?punumber=9283>

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