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| INTERNATIONAL TELECOMMUNICATION UNION | | **STUDY GROUP 15** |
| **TELECOMMUNICATION STANDARDIZATION SECTOR**  STUDY PERIOD 2013-2016 | | TD 121 (PLEN/15) |
| **English only**  **Original: English** |
| **Question(s):** | 10/15 | 1-12 July 2013 |
| **TD** | | |
| **Source:** | Editor G.8021/Y.1341 | |
| **Title:** | Draft Amendment 2 to Recommendation ITU-T G.8021/Y.1341 (2012) (for Consent, July 2013) | |

Draft Amendment 2 to Recommendation ITU-T G.8021/Y.1341 (2012)

Characteristics of Ethernet transport network equipment functional blocks:  
Amendment 2

**Summary**

Amendment 2 to Recommendation ITU-T G.8021/Y.1341 (2012) updates the description concerning performance measurement functions. It also covers the update of ETH sublayering model, and MIP OAM extraction process.

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| History   |  |  |  |  |  | | --- | --- | --- | --- | --- | | Edition | Recommendation | Approval | Study Group |  | | 1.0 | ITU-T G.8021/Y.1341 | 2004-08-22 | 15 |  | | 1.1 | ITU-T G.8021/Y.1341 (2004) Amd. 1 | 2006-06-06 | 15 |  | | 2.0 | ITU-T G.8021/Y.1341 | 2007-12-22 | 15 |  | | 2.1 | ITU-T G.8021/Y.1341 (2007) Amd. 1 | 2009-01-13 | 15 |  | | 2.2 | ITU-T G.8021/Y.1341 (2007) Amd. 2 | 2010-02-22 | 15 |  | | 3.0 | ITU-T G.8021/Y.1341 | 2010-10-22 | 15 |  | | 3.1 | ITU-T G.8021/Y.1341 (2010) Amd .1 | 2011-07-22 | 15 |  | | 4.0 | ITU-T G.8021/Y.1341 | 2012-05-07 | 15 |  | | 4.1 | ITU-T G.8021/Y.1341 (2012) Amd .1 | 2012-10-29 | 15 |  | | 4.2 | ITU-T G.8021/Y.1341 (2012) Amd .2 | 2013-xx-yy | 15 |  | |

Draft Amendment 2 to Recommendation ITU-T G.8021/Y.1341 (2012)

Characteristics of Ethernet transport network equipment functional blocks:  
Amendment 2

1. **Update clause 3**

# 3 Definitions

This Recommendation uses the following terms defined elsewhere:

**<…>**

**3.1.79 one-way**: [ITU-T G.8001]

**3.1.80 two-way**: [ITU-T G.8001]

**3.1.81 single-ended**: [ITU-T G.8001]

**3.1.82 dual-ended**: [ITU-T G.8001]

1. **Update clause 5**

# 5. Methodology and conventions

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].

All process descriptions in clauses 6, 8 and 9 use the SDL methodology defined in [ITU-T Z.100].

Pseudocode in this recommendation uses “switch” statements where each “case” statement is exclusive (i.e. “case” statements do not fall through to each other).

1. **Update clauses 8.1.10 and 8.1.10.1**

**8.1.10 Single-ended delay measurement (DM) processes**

**8.1.10.1 Overview**

Figure 8-47 shows the different processes inside MEPs and MIPs that are involved in the on-demand single-ended delay measurement protocol.

NOTE - In previous versions of this recommendation, single-ended delay measurement is known as two-way delay measurement. In regard to those definitions, refer to Recommendation ITU-T G.8001.

The MEP on-demand OAM source insertion process is defined in clause 9.4.1.1, the MEP on-demand OAM sink extraction process in clause 9.4.1.2, the MIP on-demand OAM sink extraction process in clause 9.4.2.2, and the MIP on-demand 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.



**Figure 8-47 – Overview of processes involved with on-demand single-ended delay measurement**

The on-demand DM control process controls the on-demand DM protocol. The protocol is activated upon receipt of the MI\_DM\_Start(DA,P,Test ID,Length,Period) signal and remains activated until the MI\_DM\_Terminate signal is received. The result is communicated via the MI\_DM\_Result(count, B\_FD[], F\_FD[] ,N\_FD[]) signal when the process is terminated by the MI\_DM\_Terminate signal or when an intermediate result is requested via the MI\_DM\_Intermediate\_Request signal. If the on-demand DM control process activates the multiple monitoring on different CoS levels simultaneously, each result is independently managed per CoS level. Optional test ID TLVs can be utilized to distinguish each measurement if multiple measurements are simultaneously activated in an ME. If the protocol is used in multipoint-to-multipoint environments, the multicast class 1 address can be used for a DA and the test result is independently managed per peer node.

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.

At the source MEP side, the DMM generation process stamps the value of the local time to the TxTimeStampf field in the DMM message when the first bit of the frame is transmitted. Note well that at the sink MEP side, the DMM reception process stamps the value of the local time to the RxTimeStampf field in the DMM message when the last bit of the frame is received.

The DMR generation and reception process stamps with the same way as the DMM generation and reception process.

Figure 8-48 shows the different processes inside MEPs and MIPs that are involved in the proactive single-ended delay measurement protocol.

The MEP proactive OAM insertion process is defined in clause 9.2.1.1, the MEP OAM proactive extraction process in clause 9.2.1.2, the MIP OAM extraction process in clause 9.4.2.1, and the MIP OAM insertion process in clause 9.4.2.2. 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.



**Figure 8-48 – Overview of processes involved with proactive single-ended delay measurement**

The proactive DM control process controls the proactive DM protocol. If MI\_DM\_Enable is set the DMM frames are sent periodically. The DMM frames are generated with a periodicity determined by MI\_DM\_Period and with a priority determined by MI\_DM\_Pri. The result (B\_FD, F\_FD, N\_FD) is reported via a DMR reception. If the proactive DM control process activates the multiple monitoring on different CoS levels simultaneously, each result is independently managed per CoS level. Optional test ID TLVs can be utilized to distinguish each measurement if multiple measurements are simultaneously activated in an ME. If the protocol is used in multipoint-to-multipoint environments, the multicast class 1 address can be used for a DA and the test result is independently managed per peer node.

1. **Update clauses 8.1.11 and 8.1.11.1**

**8.1.11 Dual-ended delay measurement (1DM) processes**

**8.1.11.1 Overview**

Figure 8-57 shows the different processes inside MEPs and MIPs that are involved in the on-demand dual-ended delay measurement protocol.

NOTE - In previous versions of this recommendation, dual-ended delay measurement is known as one-way delay measurement. In regard to those definitions, refer to Recommendation ITU-T G.8001.

The MEP on-demand OAM source insertion process is defined in clause 9.4.1.1, the MEP on-demand OAM sink extraction process in clause 9.4.1.2, and the MIP on-demand OAM sink extraction process in clause 9.4.2.2. 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 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.



**Figure 8-57 – Overview of processes involved with on-  
demand dual-ended delay measurement**

The on-demand 1DM protocol is controlled by the on-demand 1DM Control\_So and 1DM Control\_Sk processes. The on-demand 1DM Control\_So process triggers the generation of 1DM traffic units upon receipt of an MI\_1DM\_Start(DA,P,Test ID,Length,Period) signal. The on-demand 1DM Control\_Sk process processes the information from received 1DM traffic units after receiving the MI\_1DM\_Start(SA,Test ID) signal. The result is communicated by the sink MEP when the on-demand 1DM Control\_Sk process is terminated by the MI\_1DM\_Terminate signal or when an intermediate result is requested via the MI\_1DM\_Intermediate\_Request 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.

At the source MEP side, the 1DM generation process stamps the value of the local time to the TxTimeStampf field in the 1DM message when the first bit of the frame is transmitted. Note well that at the sink MEP side, the 1DM reception process records the value of the local time when the last bit of the frame is received.

Figure 8-58 shows the different processes inside MEPs and MIPs that are involved in the proactive dual-ended delay measurement protocol.



**Figure 8-58 – Overview of processes involved with   
proactive dual-ended delay measurement**

The MEP proactive-OAM source insertion process is defined in clause 9.2.1.1, the MEP proactive OAM sink extraction process in clause 9.2.1.2, and the MIP on-demand OAM sink extraction process in clause 9.4.2.2.

The proactive 1DM Control\_So process triggers the generation of 1DM traffic units if MI\_1DM\_Enable signal is set. The 1DM frames are generated with a periodicity determined by MI\_1DM\_Period and with a priority determined by MI\_1DM\_Pri. The result (N\_FD) is reported via a 1DM reception by the 1DM Control\_Sk process.

1. **Update figure 8-66**



Figure 8-66 – Overview of processes involved with the test protocol

1. **Update clause 8.1.12.2**

#### 8.1.12.2 TST Control\_So process

Figure 8-67 defines the behaviour of the TST Control\_So process. This process starts the transmission of TST traffic units after receiving the MI\_Test(DA,DE,P,Pattern,Length,Period) signal. Each 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:

1. **Update clauses 8.1.14 and 8.1.14.1**

**8.1.14 Single-ended synthetic loss measurement (SL) processes**

**8.1.14.1 Overview**

Figure 8-81 shows the different processes inside MEPs and MIPs that are involved in the on-demand single-ended synthetic loss measurement protocol.

NOTE - In previous versions of this recommendation, single-ended synthetic loss measurement is known as two-way synthetic loss measurement. In regard to those definitions, refer to Recommendation ITU-T G.8001.

The MEP on-demand OAM insertion process is defined in clause 9.4.1.1, the MEP OAM on‑demand extraction process in clause 9.4.1.2, the MIP OAM extraction process in clause 9.4.2.1, and the MIP OAM insertion process in clause 9.4.2.2. 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.



**Figure 8-81 – Overview of processes involved with an on-demand single-ended synthetic loss measurement protocol**

The SL protocol is controlled by the on-demand SL control process.

The on-demand SL control process is activated upon receipt of the MI\_SL\_Start(DA,P,Test\_ID,Length,Period) signal and remains activated until the MI\_SL\_Terminate signal is received. The measured synthetic loss values are output via the MI\_SL\_Result(N\_TF,N\_LF,F\_TF,F\_LF) signal when the process is terminated by the MI\_SL\_Terminate signal or when an intermediate result is requested via the MI\_SL\_Intermediate\_Request signal.

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

Figure 8-82 shows the different processes inside MEPs and MIPs that are involved in the proactive single-ended synthetic loss measurement protocol.

The MEP proactive OAM insertion process is defined in clause 9.2.1.1, the MEP OAM proactive extraction process in clause 9.2.1.2, the MIP OAM extraction process in clause 9.4.2.1, and the MIP OAM insertion process in clause 9.4.2.2. 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.



**Figure 8-82 – Overview of processes involved with a proactive   
single-ended synthetic loss measurement protocol**

The SL protocol is controlled by the proactive SL control processes.

The proactive SL control process is activated upon receipt of the MI\_SL\_Enable signal and remains activated until the signal is deactivated. The measured results are output every 1s using the RI\_SL\_Result (N\_TF, N\_LF, F\_TF, F\_LF) signal.

1. **Update clauses 8.1.15 and 8.1.15.1**

**8.1.15 Dual-ended synthetic loss measurement (1SL) processes**

**8.1.15.1 Overview**

Figure 8-91 shows the different processes inside MEPs and MIPs that are involved in the on-demand dual-ended synthetic loss measurement protocol.

NOTE - In previous versions of this recommendation, dual-ended synthetic loss measurement is known as one-way synthetic loss measurement. In regard to those definitions, refer to Recommendation ITU-T G.8001.

The MEP on-demand OAM source insertion process is defined in clause 9.4.1.1, the MEP on-demand OAM sink extraction process in clause 9.4.1.2, the MIP on-demand OAM sink extraction process in clause 9.4.2.2. 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 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.



**Figure 8-91 – Overview of processes involved with on-demand   
dual-ended synthetic loss measurement**

The on-demand 1SL protocol is controlled by the on-demand 1SL Control\_So and 1SL Control\_Sk processes. The on-demand 1SL Control\_So process triggers the generation of 1SL traffic units upon receipt of an MI\_1SL\_Start(DA,P, Test\_ID,Length,Period) signal. The on-demand 1SL Control\_Sk process processes the information from received 1SL traffic units after receiving the MI\_1SL\_Start(SA,Test\_ID) signal. The result is communicated by the sink MEP when the process is terminated by the MI\_1SL\_Terminate signal or when an intermediate result is requested via the MI\_1SL\_Intermediate\_Request signal.

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

Figure 8-92 shows the different processes inside MEPs and MIPs that are involved in the proactive dual-ended synthetic loss measurement protocol.



**Figure 8-92 – Overview of processes involved with proactive   
dual-ended synthetic loss measurement**

The MEP proactive-OAM source insertion process is defined in clause 9.2.1.1, the MEP proactive OAM sink extraction process in clause 9.2.1.2, and the MIP on-demand OAM sink extraction process in clause 9.2.2.2.

The proactive 1SL protocol is controlled by the proactive 1SL Control\_So and 1SL Control\_Sk processes. The proactive 1SL Control\_So process triggers the generation of 1SL traffic units if MI\_1SL\_Enable signal is set. The 1SL frames are generated with a periodicity determined by MI\_1SL\_Period and with a priority determined by MI\_1SL\_Pri. The result is reported every one second by the 1SL Control\_Sk process.

1. **Update clause 9**

# 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 proactive ITU-T G.8013/Y.1731 OAM information (e.g., CCM). The ETHDy flow termination functions insert and extract the on-demand ITU-T G.8013/Y.1731 OAM information (e.g., LBM, LTM). The ETHx/ETH and ETHG/ETH adaptation functions insert and extract the administrative and control ITU-T G.8013/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].

NOTE - ETHx/ETHG adaptation function is not included in Figure 9-1 because this atomic function is not used in ETH MEP and MIP functions described in clause 9.8.

1. **Update clause 9.1.2**

### 9.1.2 Subnetwork connection protection process

SNC protection with sublayer monitoring based on TCM is supported.

Figure 9-9 shows the involved atomic functions in SNC/S. The ETHx\_FT\_Sk provides the TSF/TSD protection switching criterion via the ETHx/ETH\_A\_Sk function (SSF/SSD) to the ETH\_C function.



Figure 9-9 – SNC/S atomic functions

NOTE - Since SNC/S is ETH subnetwork protection with sublayer monitoring, ETHx flow termination and ETHx/ETH adaptation functions in Figure 9-9 correspond to ETHT (tandem connection) sublayer where this abbreviation is described in Amendment 1 to [ITU-T G.8010].

1. **Update clause 9.1.3**

### 9.1.3 Ring protection control process

Ring protection with inherent, sub-layer, or test trail monitoring is supported.

Figure 9-11 shows a subset of the atomic functions involved, and the signal flows associated with the ring protection control process. This is only an overview of the Ethernet ring protection control process as specified in [ITU-T G.8032]. The ETH\_FT\_Sk provides the TSF protection switching criterion via the ETHDi/ETH\_A\_Sk function (SSF). [ITU-T G.8032] specifies the requirements, options and the ring protection protocol supported by the ring protection control process.



Figure 9-11 – Ring protection atomic functions and control process

1. **Update figures 9-21, 9-23, 9-25, 9-27 and 9-29**



Figure 9-21 – ETHx/ETH\_A\_So symbol



Figure 9-23 – ETHx/ETH\_A\_Sk symbol



Figure 9-25 – ETHx/ETH-m\_A symbol



Figure 9-27 – ETHx/ETH-m\_A\_So symbol



Figure 9-29 – ETHx/ETH-m\_A\_Sk symbol

1. **Update clause 9.4.2.2**

#### 9.4.2.2 ETH diagnostic flow termination sink function for MIPs (ETHDi\_FT\_Sk)

<…>

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-LBM OAM traffic unit   
 forward one copy of ETH-LBM OAM traffic unit to LBM Port  
 forward one copy of ETH-LBM OAM traffic unit to Data Port

case <LTM>: extract ETH-LTM OAM traffic unit and forward to LTM Port  
 default: forward ETH\_CI traffic unit to Data port

}  
else

forward ETH CI traffic unit to Data Port

endif

NOTE – Further filtering of OAM traffic units is performed by the OAM MEL filter process which forms part of the ETH adaptation functions specified in clause 9.3.

MIP OAM insertion process

The MIP OAM insertion process inserts OAM traffic units that are generated in the ETHDi\_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\_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.

<...>

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