International Telecommunication Union

ITU-T G.8013/Y.1731

TELECOMMUNICATION
STANDARDIZATION SECTOR
OF ITU

Amendment 1

(05/2012)

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

Packet over Transport aspects – Ethernet over Transport aspects

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

Internet protocol aspects – Operation, administration and maintenance

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OAM functions and mechanisms for Ethernet based networks

Amendment 1

Recommendation ITU-T G.8013/Y.1731 (2011) – Amendment 1

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Recommendation ITU-T G.8013/Y.1731

OAM functions and mechanisms for Ethernet based networks

Amendment 1

Summary

Amendment 1 to Recommendation ITU-T G.8013/Y.1731 (2011) provides the following modifications:

– The proactive loss measurement messages/loss measurement reply (LMM/LMR).
– Updates on performance monitoring (PM) and client signal fail (CSF) related description.
– Update of references and abbreviations.
– New clause 8.4.2 on dual-ended ETH-SLM.
– New clause 9.24 on 1SL PDU.
– New clause 10.24 on 1SL (One-way synthetic loss measurement).

History

Edition	Recommendation	Approval	Study Group
1.0	ITU-T Y.1731	2006-05-22	13
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2.1	ITU-T Y.1731 (2008) Amd. 1	2010-07-29	15
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3.1	ITU-T G.8013/Y.1731 (2011) Cor. 1	2011-10-29	15
3.2	ITU-T G.8013/Y.1731 (2011) Amd. 1	2012-05-07	15

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OAM functions and mechanisms for Ethernet based networks

Amendment 1

1) Clause 2, References

Delete the following references:

[IEEE 802.1ag] IEEE 802.1ag-2007, *IEEE Standard for Local and Metropolitan area Networks: Virtual Bridged Local Area Networks Amendment 5: Connectivity Fault Management.*

[IEEE 802.1Q] IEEE 802.1Q-2005, *IEEE Standard for Local and Metropolitan area Networks: Virtual Bridged Local Area Networks.*

Replace above references by:

[IEEE 802.1Q] IEEE 802.1Q-2011, *IEEE Standard for Local and Metropolitan area Networks: Virtual Bridged Local Area Networks.*

Consequently, references within the text to [IEEE 802.1ag] will be changed to [IEEE802.1Q].

2) Clause 4, Abbreviations

Add the following abbreviation:

1SL One-way Synthetic Loss measurement

3) Clause 7.12, Ethernet client signal fail (ETH-CSF)

3.1) 7.12 Ethernet Client Signal Fail (ETH-CSF)

Update the first paragraph of clause 7.12 as below:

The Ethernet Client Signal Fail function (ETH-CSF) is used by a MEP to propagate to a peer MEP the detection of a failure or defect event in an Ethernet client signal when the client itself does not support appropriate fault or defect detection or propagation mechanisms, such as ETH-CC or ETH-AIS. The ETH-CSF messages propagate in the direction from the Ethernet MEP, associated with the ingress client port~~Ethernet source adaptation function~~ detecting the failure or defect event, to the ~~Ethernet sink adaptation function associated with the~~ Ethernet peer MEP.

3.2) 7.12.1 CSF transmission

Update clause 7.12.1 as below:

Frames with ETH-CSF information can be issued by a MEP, upon notification of an Ethernet CSF event from the corresponding ingress client port~~its associated Ethernet client source adaptation function~~.

Transmission of packets with CSF information can be enabled or disabled on a MEP.

Upon receiving an Ethernet CSF notification from the ingress client portits Ethernet client-specific source adaptation function the associated MEP can immediately start periodic transmission of frames with ETH-CSF information. A MEP continues periodic transmission of frames with ETH-CSF information until the Ethernet CSF indication is removed by the source adaptation function.

Clearing an Ethernet CSF condition by the Ethernet client-specific source adaptation function is Ethernet client and application specific. The clearance of the Ethernet CSF condition by the source adaptation function is communicated to the sink adaptation function associated with the peer MEP via:

– the non-sending ETH-CSF or

– the forwarding of a ETH-CSF PDU with Client Defect Clear Indication (C-DCI) information.

3.3) 7.12.2 CSF reception

Update the first two paragraphs of clause 7.12.2 as below:

An Ethernet MEP detects an Ethernet remote CSF condition when an ETH-CSF PDU with no C-DCI information is received.

The clearance of the Ethernet remote CSF condition by the Ethernet client is detectedClearing an Ethernet CSF condition by the Ethernet client-specific sink adaptation function is Ethernet client and application specific. The clearance of the Ethernet CSF condition by the sink adaptation function is communicated to the source adaptation function associated with the peer MEP when:

<…>

4) Clause 8.1, Frame loss measurement (ETH-LM)

4.1) 8.1 Frame loss measurement (ETH-LM)

Update clause 8.1 as below:

Delete Note 1 and replace it by the following:

NOTE 1 – Both proactive and on-demand ETH-LM count OAM frames as follows:

- For single-ended ETH-LM, OAM frames that are only used for proactive functions used by termination functions (e.g., those for ETH-CC) are counted.
- For dual-ended ETH-LM, OAM frames for proactive functions used by termination functions are NOT counted.
- In both cases:
  - Proactive OAM frames used by adaptation functions (e.g., those for ETH-APS and ETH-CSF) are counted.
  - OAM frames that can be used for on-demand functions (e.g., those for ETH-LB, ETH-LT and on-demand ETH-LM, ETH-DM and ETH-SLM) are NOT counted.

Update the paragraph after Note 5 as below:

Specific configuration information required by a MEP to support ETH-LM is the following:

- MEG Level – MEG Level at which the MEP exists
- Unicast MAC address of remote MEP to which ETH-LM is intended. Multicast Class 1 MAC address is also allowed

- ETH-LM transmission period – default transmission period is 100ms (i.e., a transmission rate of 10 frames/second). The ETH-LM transmission period should be such that the frame and/or octet counters whose values are carried in ETH-LM information should not wrap around to the same value even if one or more ETH-LM frames are lost. This is primarily a concern for frame loss measurements at lower priority levels. Refer to Appendix III.2 for examples of frame counter wrapping periods.
- Priority –identifies the priority of the frames with ETH-LM information. This information is configurable per operation.
- Drop Eligibility – Frames with ETH-LM information are always marked as drop ineligible. This information is not necessarily configured.

4.2) 8.1.1.2, CCM with dual-ended ETH-LM frame reception

Update the last paragraph in clause 8.1.1.2 as below:

If the Period field value in the received CCM frame is different than the MEP's own configured CCM transmission period, the MEP detects an unexpected Period defect condition~~, in which case the frame loss measurements are not carried out~~.

4.3) 8.1.2 Single-ended ETH-LM

Update clauses 8.1.2 and 8.1.2.1 as below:

8.1.2 Single-ended ETH-LM

Single-ended ETH-LM is used for on-demand and proactive OAM. In this case, a MEP sends frames with ETH-LM request information to its peer MEP and receives frames with ETH-LM reply information from its peer MEP to carry out loss measurements.

The PDU used for single-ended ETH-LM request is LMM, as described in clause 9.12. The PDU used for single-ended ETH-LM reply is LMR, as described in clause 9.13. Frames which carry the LMM PDU are called LMM frames. Frames which carry the LMR PDU are called LMR frames. The same LMM and LMR frame formats can be used for proactive and on-demand single-ended ETH-LM. The distinction of proactive LMM/LMR frames from on-demand LMM/LMR frames is by the value of a flag field in the LMM/LMR frames.

8.1.2.1 LMM transmission

~~For an on-demand loss measurement,~~ When configured for Single-ended loss measurement, a MEP periodically transmits LMM frames with the following information element:

- **TxFCf**: Value of the local counter TxFCl at the time of LMM frame transmission,

5) Clause 8.2, Frame delay measurement (ETH-DM)

5.1) 8.2.1.2 1DM reception

Update the first paragraph in clause 8.2.1.2 as follows:

When configured for one-way delay measurements, a MEP, upon receiving a valid 1DM frame, uses the following values to make one-way frame delay measurement. A 1DM frame with a valid MEG Level and a destination MAC address equal to the receiving MEP's MAC address or Multicast Class 1 MAC Address is considered to be a valid 1DM frame. These values serve as input to the one-way frame delay variation measurement:

5.2) 8.2.2.2 DMM reception and DMR transmission

Update the first paragraph in clause 8.2.2.2 as follows:

Whenever a valid DMM frame is received by a MEP, a DMR frame is generated and transmitted to the requesting MEP. A DMM frame with a valid MEG Level and a destination MAC address equal to the receiving MEP's MAC address or Multicast Class 1 MAC Address is considered to be a valid DMM frame. Every field in the DMM frame is copied to the DMR frame with the following exceptions:

6) Clause 8.4, Synthetic loss measurement (ETH-SLM)

6.1) 8.4.1.2 SLM reception and SLR transmission

Update the first paragraph in clause 8.4.1.2 as follows:

Whenever a valid SLM frame is received by a MEP, an SLR frame is generated and transmitted to the requesting MEP. An SLM frame with a valid MEG Level and a destination MAC address equal to the receiving MEP's MAC address or Multicast Class 1 MAC Address is considered to be a valid SLM frame. Every field in the SLM frame is copied to the SLR frame with the following exceptions:

6.2) 8.4.1.3 SLR reception

Revise the first paragraph in clause 8.4.1.3 as follows:

After transmission of a SLM frame (with a given TxFCf value), a MEP will expect to receive a corresponding SLR frame (carrying same TxTCf value) ~~within the timeout value~~ from its peer MEP(s). In on-demand mode, SLR frames received more than 5s after the command that terminates SL measurement must be discarded, as specified in [ITU-T G.8021]~~after the timeout value (5 seconds) must be ignored~~.

6.3) 8.4.2 Dual-ended ETH-SLM

Add new clause 8.4.2 as below:

8.4.2 Dual-ended ETH-SLM

Dual-ended ETH-SLM can be used for on-demand and proactive OAM. It carries out loss measurements applicable to both point-to-point ETH connection or multipoint ETH connectivity. It allows a MEP in a MEG to send periodic dual-ended frames with ETH-SLM information to its peer MEP(s) to facilitate frame loss measurement at the peer MEP. The receiving MEP terminates the dual-ended frames and makes the near-end loss measurements.

The selection of on-demand or proactive is performed by the management function that initiates the test; however this is local information and does not need to be conveyed in the PDU.

Dual-ended ETH-SLM is suitable where it is required and practical to measure unidirectional FLR from every MEP to all its peer MEPs (e.g., any-to-any measurements)

The PDU used for dual-ended ETH-SLM information is 1SL, as described in clause 9.24. Frames which carry the 1SL PDU are called 1SL frames.

8.4.2.1 1SL transmission

When configured for dual-ended operation, a MEP periodically transmits 1SL frames with the following information elements:

- Test ID: Value containing a number configured by the MEP and then used to run multiple tests simultaneously.
- Source MEP ID: MEP's own identity in the MEG
- TxFCf: Value of the local counter TxFCl at the time of 1SL frame transmission.

The 1SL PDU is transmitted with a period value equal to the 1SL transmission period configured for performance monitoring application at the transmitting MEP.

8.4.2.2 1SL reception

When configured for one-way synthetic loss measurements, a MEP, upon receiving a valid 1SL frame, uses the following values to make one-way frame delay measurement. A 1SL frame with a valid MEG Level and a destination MAC address equal to the receiving MEP's MAC address or Multicast Class 1 MAC Address is considered to be a valid 1SL frame.

Whenever a valid 1SL frame is received by a MEP with a given TxFCf value, the MEP will expect to receive a subsequent 1SL frame (TxFCf value incremented by one).

For a given measurement period, a MEP uses the following values to determine near-end frame loss in the period:

- Last received 1SL frame's TxFCf value and local counter RxFCl at the end of the measurement period. These values are represented as $TxFCf[t_c]$ and $RxFCl[t_c]$, where t_c is the end time of the measurement period
- 1SL frame's TxFCf value of the first received 1SL after the test starts and local counter RxFCl at the beginning of the measurement period. These values are represented as $TxFCf[t_p]$ and $RxFCl[t_p]$, where t_p is the start time of the measurement period

  $\text{Frame loss}_{\text{near-end}} = | TxFCf[t_c] - TxFCf[t_p] | – | RxFCl[t_c] – RxFCl[t_p] |$

7) Clause 9, OAM PDU types

7.1) 9.1 Common OAM information elements

Add the following information to Table 9-1 in numerical order:

OpCode Value	OAM PDU Type	OpCode Relevance for MEPs/MIPs
53	1SL	MEPs
32, 34, 36, 38, 44, ~~53,~~ 56-63	Reserved (Note 2)	

7.2) 9.12 LMM PDU

Update clauses 9.12 and 9.12.2 as below:

9.12 LMM PDU

LMM is used to support single-ended proactive and on-demand ETH-LM request, as described in clause 8.1.2.

9.12.2 LMM PDU format

LMM PDU format used by a MEP to transmit LMM information is shown in Figure 9.12-1.

	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	MEL			Version (1~~0~~)					OpCode (LMM=43)								Flags ~~(0)~~								TLV Offset (12)							
5	TxFCf																															
9	Reserved for RxFCf in LMR																															
13	Reserved for TxFCb in LMR																															
17	End TLV (0)																															

Figure 9.12-1 – LMM PDU format

The fields of the LMM PDU format are as follows:

– MEG Level: refer to clause 9.1

– Version: refer to clause 9.1, value for the LMM PDU on this version is set to 1~~always 0~~

– OpCode: Value for this PDU type is LMM (43).

– Flags: One information elements in the Flags field, the LSB bit (Type), is used to indicate the type of the LMM operation as follows:~~Set to all-ZEROes.~~

MSB							LSB
8	7	6	5	4	3	2	1
Reserved (0)							Type
~~Reserved (0)~~							

Figure 9.12-2 – Flags format in LMM PDU

Type: Bit 1 is set to 1 if it is the proactive operation, or set to 0 if it is the on-demand operation.

– TLV offset: Set to 12

– TxFCf: 4-octet integer values with samples of the frame counters, as specified in clause 9.12.1.

– Reserved: Reserved fields are set to all ZEROes

– End TLV: An all-ZEROes octet value.

7.3) 9.13 LMR PDU

Update clause 9.13 as below:

9.13 LMR PDU

LMR PDU is used to support single-ended proactive and on-demand ETH-LM reply, as described in clause 8.1.2.

7.4) 9.24, 1SL PDU

Add new clause 9.24 as below:

9.24 1SL PDU

1SL is used to support dual-ended proactive and on-demand ETH-SLM, as described in clause 8.4.2

9.24.1 1SL information elements

Information elements carried in 1SL include:

- Source MEP ID: Source MEP ID is a 2-octet field where the last 13 least significant bits are used to identify the MEP transmitting the 1SL frame. MEP ID is unique within the MEG
- Test ID: Test ID is a 4-octet field set by the transmitting MEP and used to identify when multiple tests run simultaneously towards different MEPs including concurrent on-demand and proactive tests
- TxTCf: TxTCf is a 4-octet field which carries the number of 1SL frame transmitted by the MEP towards its peer MEPs

9.24.2 1SL PDU format

1SL PDU format used by a MEP to transmit 1SL information is shown in Figure 9.24-1.

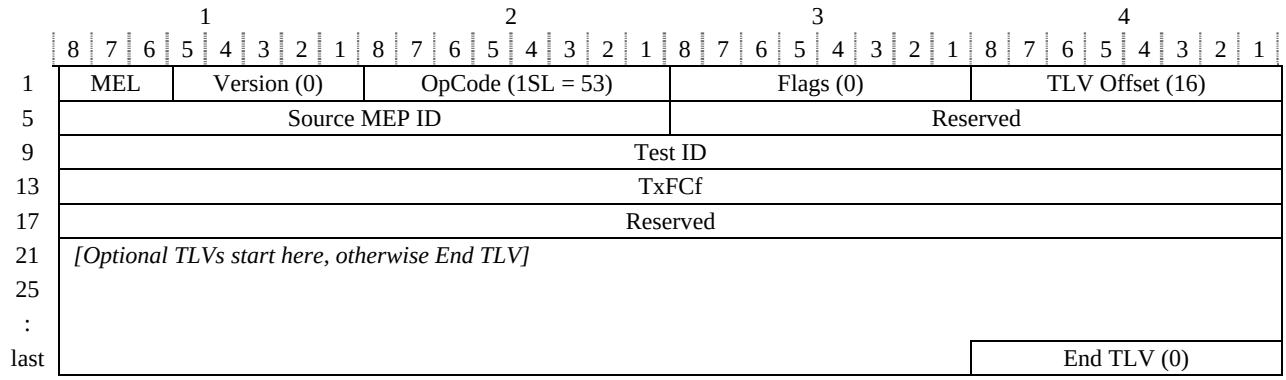

Figure 9.24-1 – 1SL PDU format

The fields of the 1SL PDU format are as follows:

- MEG Level: refer to clause 9.1
- Version: refer to clause 9.1, value is always 0
- OpCode: Value for this PDU type is 1SL (53)
- Flags: Set to all-ZEROes
- TLV Offset: Set to 16
- Reserved: Reserved fields are set to all ZEROes
- Source MEP ID: A 2-octet field used to identify the MEP transmitting the 1SL frame, as specified in clause 9.24.1
- Test ID: A 4-octet field used to identify an unique test among MEPs, as specified in clause 9.24.1
- TxFCf: A 4-octet integer value representing the number of 1SL frames transmitted., as specified in clause 9.24.1
- Optional TLV: A Data TLV (Figure 9.3-3) may be included in any 1SL transmitted. For the purpose of ETH-SLM, the value part of Data TLV is unspecified

- End TLV: An all-ZEROes octet value

8) Clause 10, OAM frame addresses

8.1) 10.23 SLR

Add following information to Table 10-1 in clause 10.23:

OAM Type	DAs for frames with OAM PDU
1SL	Unicast DA or Multicast class 1 DA

8.2) New clause 10.24, 1SL

Add new clause 10.24 as follows:

10.24 1SL

1SL frames are generated with unicast DAs. 1SL frames may be generated with Multicast class 1 DA if multipoint measurements are desired.

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