13 Extended OAM for EPON

13.1 Profile-independent eOAM management

13.2 Non-SNMP-optimized eOAM management

13.3 SNMP-optimized eOAM management

13.4 DPoE eOAM management

13.4.1 eOAMPDU structure

13.4.1.1 eOAMPDU frame format

13.4.1.2 TLV-oriented structure

13.4.1.3 TLVs for 802.3 OAMPDUs

13.4.1.3.1 *Extended Information* TLV

The *Information* OAMPDU defined in IEEE Std 802.3, Clause 57, can contain the Organization Specific Information as *Information* TLV (IEEE Std 802.3, 57.5.2.3). Presence of this *Extended Information* TLV in the *Information* OAMPDU during the OAM discovery process indicates that the OLT or the ONU supports the extended OAM.

The format of the *Extended Information* TLV shall be as specified in Table 13-83 and described in the following text.

Table 13-1—Structure of the *Extended Information* TLV

Size (octets)	Field (name)	Value
1	Type	0xFE (*Organization Specific Information* TLV)
1	Length	0x05
3	OUI	OUI_A
1	InfoType	0x00

Size (octets)	Field (name)	Value
1	Version	This field identifies the version of the eOAM used by this profile. Bits [7:4] represent the major version number Bits [3:0] represent the minor version number The following values are defined: 0x01: reserved for backward compatibility, same as 0x10 0x02: pre-DPoE OAM, without Certificate Authority support 0x03: pre-DPoE OAM, with Certificate Authority support 0x10: OAM compliant with DPoE-SP-OAMv1.0-I04 and previous versions 0x11: OAM compliant with DPoE-SP-OAMv1.0-I05 and subsequent versions of DPoE-SP-OAMv1.0 0x20: OAM compliant with IEEE Std 1904.1-2013 Package A and DPoE-SP-OAMv2.0-I01 and through DPoE-SP-OAMv2.0-I05 0x21: OAM compliant with DPoE-SP-OAMv2.0-I06 and DPoE-SP-OAMv2.0-I07 0x22: OAM compliant with IEEE Std 1904.1-2015~~6~~, Package A and DPoE-SP-OAMv2.0-~~I06~~ I08 and subsequent versions Other values are reserved and ignored on reception.

The following fields comprise the *Extended Information* TLV:

a) `Type`: this field is used to indicate the data type held in the given TLV. In the case of the *Extended Information* TLV, this field carries the value of 0xFE, according to IEEE Std 802.3, Table 57–6, indicating the *Organization Specific Information* TLV.

b) `Length`: this field is used to indicate the length of the TLV, expressed in units of octets.

c) `OUI`: this field is used to identify the organization to which the given *Information* TLV belongs. At least one of the *Organization Specific Information* TLVs exchanged between the ONU and the OLT during the eOAM discovery process shall be of *Extended Information* TLV type, containing the OUI_A.

d) `InfoType`: this field is used to identify the subtype of the *Extended Information* TLV.

e) `Version`: this field is used to indicate the version of the eOAM supported by the given device. The internal format of this field is as follows: aaaa.bbbb (4 bits followed by 4 bits), where “aaaa” represents the major version number, and “bbbb” represents the minor version number. For example, a `Version` field carrying the value of 0b0010.0000 represents a major version 2, and a minor version 0.

13.4.2 eOAMPDU

Most management functions required for the proper operation of EPON are carried out through the process of reading and writing individual attributes of the managed objects hosted in the ONU. As an example, setting the operating speed for an UNI port requires writing an appropriate value into the speed attribute of the proper port object. Likewise, information can be read from the respective managed objects hosted on the ONU using dedicated eOAMPDUs.

It is also possible to cause the ONU to perform certain actions, e.g., disable specific UNI ports, reset counters, by setting appropriate values in the stored managed objects.

13.4.2.1 eOAMPDU codes

eOAMPDUs specified for this profile shall be as defined in Table 13-87. These eOAMPDUs use the Organization Specific Extension mechanisms defined in IEEE Std 802.3, Clause 57. Other values are reserved and ignored on reception.

Table 13-87—eOAMPDUs and assignment of Opcode values

Opcode	eOAMPDUs	Defined in
0x00	Reserved, ignored on reception	
0x01	*eOAM_Get_Request*	13.4.2.2
0x02	*eOAM_Get_Response*	13.2.3.3
0x03	*eOAM_Set_Request*	13.4.2.4
0x04	*eOAM_Set_Response*	13.4.2.5
0x05	Reserved, ignored on reception ~~*eOAM_MC_Control*~~	~~13.4.2.6~~
0x06	Reserved, ignored on reception ~~*eOAM_MC_Register*~~	~~13.4.2.7~~
0x07	Reserved, ignored on reception ~~*eOAM_MC_Response*~~	~~13.4.2.8~~
0x08	*eOAM_KeyExchange*	13.4.2.11
0x09	*eOAM_Software*	13.4.2.10
0x0A	Reserved, ignored on reception ~~*eOAM_MC_ControlResponse*~~	~~13.4.2.9~~
0x0B	Reserved, ignored on reception	
0x0C	Reserved, ignored on reception	
0xFC	*eOAM_Early_WakeUpOLT*	13.4.2.12
0xFD	*eOAM_Early_WakeUpONU*	13.4.2.13
0xFE	*eOAM_Sleep_Allowed*	13.4.2.14

13.4.2.2 *eOAM_Get_Request* eOAMPDU

13.4.2.3 *eOAM_Get_Response* eOAMPDU

13.4.2.4 *eOAM_Set_Request* eOAMPDU

13.4.2.5 *eOAM_Set_Response* eOAMPDU

~~13.4.2.6 *eOAM_MC_Control* eOAMPDU~~

~~The *eOAM_MC_Control* eOAMPDU is used by the OLT to configure the ONU with all information necessary to forward data from the specific multicast group into associated UNI ports.~~

~~The structure of the *eOAM_MC_Control* eOAMPDU shall be as specified in Table 13-92 and as described in more detail below.~~

Table 13-92—Structure of the *eOAM_MC_Control* eOAMPDU

Size (octets)	Field (name)	Value + notes
21	eOAMPDU header	Varies
1	Opcode	0x05
1	Action	This field defines the action to be executed on the ONU in relation with the multicast forwarding rules. The following values are supported: 0x00: Add UNI port(s) to the group forwarding list. 0x01: Remove UNI port(s) from the group forwarding list. 0x02: Remove all ports and deregister the mLLID. Other values are reserved and ignored on reception.
2	LLID	This field identifies the value of the multicast LLID used to transfer data for the given multicast group. The following values are supported: 0x00 00 to 0x7F FF. Other values are reserved and ignored on reception.
16	IpSa	This field identifies the IP source address for the given multicast group. IPv4 addresses are aligned in the four least significant octets, and the 12 most significant octets are set to 0x00.
16	IpDa	This field identifies the IP destination address for the given multicast group. IPv4 addresses are aligned in the four least significant octets, and the 12 most significant octets are set to 0x00.
1	PortCount	This field identifies the number (N) of UNI ports that are associated with the given multicast group. Identification of individual UNI ports follows.
1	Port 1	This field is used to list all UNI port instances to be added or removed from the given multicast.
…	…	
1	Port N	
Varies	Pad (optional)	0x00 … 00
4	FCS	Varies

a) eOAMPDU header, `Opcode`, `Pad`, and `FCS` fields are defined in 13.4.1.1.

b) `Action` identifies the target action for the given multicast group, i.e., whether the definition of this group is modified, added, or removed.

c) `LLID` identifies the multicast LLID that carries the content for the given multicast group.

d) `IpSa/IpDa` identify the source and destination addresses for the given multicast group.

e) `PortCount` identifies the number of UNI ports associated with the given multicast group, followed by their listing in the form of a set of `Port N` fields.

13.4.2.7 *eOAM_MC_Register* eOAMPDU

The *eOAM_MC_Register* eOAMPDU is used by the OLT to associate a multicast LLID with a unicast LLID assigned by the MPCP discovery and registration process. The default multicast LLID for a unicast link is 0x7F FF (1G-EPON) or 0x7F FE (10G-EPON).

The structure of the *eOAM_MC_Register* eOAMPDU shall be as specified in Table 13-93 and as described in more detail below.

Table 13-93—Structure of the *eOAM_MC_Register* eOAMPDU

Size (octets)	Field (name)	Value + notes
21	eOAMPDU header	Varies
1	Opcode	0x06
1	Flags	This field defines the action related to the registration of the multicast LLID (either target action or the status of the previous action). The following values are supported: 0x01: (Re)Register 0x02: Deallocate 0x03: Success 0x04: Nack Other values are reserved and ignored on reception.
2	multiLLID	This field identifies the value of the multicast LLID used to transfer data for the given multicast group. The following values are supported: 0x00-00 to 0x7E-FF. Other values are reserved and ignored on reception.
2	uniLLID	This field identifies the value of the unicast LLID previously assigned to the given ONU. The following values are supported: 0x00-00 to 0x7E-FF. Other values are reserved and ignored on reception
Varies	Pad (optional)	0x00 … 00
4	FCS	Varies

a) eOAMPDU header, `Opcode`, `Pad`, and `FCS` fields are defined in 13.4.1.1.

b) `Flags` identifies target action or the status of the previous action associated with the registration of the multicast LLID on the given ONU.

c) `multiLLID` identifies the multicast LLID that carries the content for the given multicast group.

d) `uniLLID` identifies the unicast LLID previously assigned to the given ONU.

13.4.2.8 *eOAM_MC_Response* eOAMPDU

The *eOAM_MC_Response* eOAMPDU is used by the ONU to acknowledge the request from the OLT to associate a multicast LLID with a unicast LLID assigned by the MPCP discovery and registration process. The default multicast LLID for a unicast link is 0x7F-FF (1G-EPON) or 0x7F-FE (10G-EPON).

The structure of the *eOAM_MC_Response* eOAMPDU shall be as specified in Table 13-94 and as described in more detail below.

Table 13-94—Structure of the *eOAM_MC_Response* eOAMPDU

Size (octets)	Field (name)	Value + notes
21	eOAMPDU header	Varies
1	Opcode	0x07

Size (octets)	Field (name)	Value + notes
1	Flags	This field defines the action related to the registration of the multicast LLID (either target action or the status of the previous action). The following values are supported: 0x01: (Re)Register 0x02: Deallocate 0x03: Success 0x04: Nack Other values are reserved and ignored on reception.
2	multiLLID	This field identifies the value of the multicast LLID used to transfer data for the given multicast group. The following values are supported: 0x00-00 to 0x7E-FF. Other values are reserved and ignored on reception.
2	uniLLID	This field identifies the value of the unicast LLID previously assigned to the given ONU. The following values are supported: 0x00-00 to 0x7E-FF. Other values are reserved and ignored on reception.
Varies	Pad (optional)	0x00 … 00
4	FCS	Varies

a) eOAMPDU header, `Opcode`, `Pad`, and `FCS` fields are defined in 13.4.1.1.

b) `Flags` identifies target action or the status of the previous action, associated with the registration of the multicast LLID on the given ONU.

c) `multiLLID` identifies the multicast LLID that carries the content for the given multicast group.

d) `uniLLID` identifies the unicast LLID previously assigned to the given ONU.

13.4.2.9 *eOAM_MC_ControlResponse* eOAMPDU

The *eOAM_MC_ControlResponse* eOAMPDU is used by the ONU to confirm the reception of the *eOAM_MC_Control* eOAMPDU, carrying all information necessary to forward data from the specific multicast group into associated UNI ports.

The structure of the *eOAM_MC_ControlResponse* eOAMPDU shall be as specified in Table 13-95 and as described in more detail below.

Table 13-95—Structure of the *eOAM_MC_ControlResponse* eOAMPDU

Size (octets)	Field (name)	Value + notes
21	eOAMPDU header	Varies
1	Opcode	0x0A
1	ResultCode	This field defines the result of the multicast configuration operation using the *eOAM_MC_Control* eOAMPDU. The following values are supported: 0x00: Operation was successful; no errors. 0x01: Operation failed; no changes were made to configuration. Other values are reserved and ignored on reception.
Varies	Pad (optional)	0x00 … 00
4	FCS	Varies

a) eOAMPDU header, Opcode, Pad, and FCS fields are defined in 13.4.1.1.

b) ResultCode identifies the return code of the configuration operation requested by the *eOAM_MC_Control* eOAMPDU.

14 Management entities

14.1 Introduction

14.2 Management entities for non-SNMP-optimized eOAM profile

14.3 Management entities for SNMP-optimized eOAM profile

14.4 Management entities for DPoE eOAM profile

14.4.1 Branch 0xD6 “identification”

14.4.2 Branch 0x07 “basic attributes”

14.4.3 Branch 0xD7 “extended attributes”

This subclause lists extended management attributes, which are not part of the definitions in IEEE Std 802.3, Clause 30. The extended attributes shown in Table 14-132 shall be supported.

The extended attributes can be part of *eOAM_Get_Request*, *eOAM_Get_Response*, *eOAM_Set_Request*, and *eOAM_Set_Response* eOAMPDUs.

Table 14-133—Extended attributes defined in branch 0xD7

Leaf	Attribute	Defined in
Object group: ONU management		
0x00-02	aOnuId	14.4.3.1.2
0x00-03	aOnuFwVersion	14.4.3.1.3
0x00-04	aOnuInfoChipset	14.4.3.1.4
0x00-05	aOnuInfoDateManufacture	14.4.3.1.5
0x00-06	aOnuInfoManufacturer	14.4.3.1.6
0x00-07	aOnuLlidCount	14.4.3.1.7
0x00-08	aOnuPonPortCount	14.4.3.1.8
0x00-09	aOnuUniPortCount	14.4.3.1.9
0x00-0A	aOnuInfoPacketBuffer	14.4.3.1.10
0x00-0B	aLlidReportThresholds	14.4.3.1.11
0x00-0C	aLlidForwardState	14.4.3.1.12
0x00-0D	aLlidOamFrameRate	14.4.3.1.13
0x00-0E	aOnuManOrgName	14.4.3.1.14
0x00-0F	aOnuCvcCvsValidity	14.4.3.1.15
0x00-10	aOnuUniPortType	14.4.3.1.16
0x00-11	aVendorName	14.4.3.1.17
0x00-12	aModelNumber	14.4.3.1.18
0x00-13	aHardwareVersion	14.4.3.1.19
0x00-14	aLineRateMode	14.4.3.1.20
0x01-0E	aOnuFwFileName	14.4.3.1.21
Object group: Bridging		
0x01-01	aOnuDynMacTableSize	14.4.3.2.1
0x01-02	aOnuDynMacAgeLimit	14.4.3.2.2
0x01-03	aUniDynMacTable	14.4.3.2.3
0x01-04	aUniStatMacTable	14.4.3.2.4
0x01-05	aUniPortAutoNeg	14.4.3.2.5
0x01-06	aUniAdmissionControl	14.4.3.2.6

Leaf	Attribute	Defined in
0x01-07	aUniMinLearnMacCount	14.4.3.2.7
0x01-08	aUniMaxLearnMacCount	14.4.3.2.8
0x01-09	aOnuMaxLearnMacCount	14.4.3.2.9
0x01-0A	aUniLengthDiscard	14.4.3.2.10
0x01-0B	aUniFloodUnknown	14.4.3.2.11
0x01-0C	aUniLocalSwitching	14.4.3.2.12
0x01-0D	aOnuLlidQueueConfig	14.4.3.2.13
0x01-0F	aUniMacTableFull	~~14.4.3.2.15~~ 14.4.3.2.14
0x01-10	aOnuMulticastLlid	14.4.3.2.15
0x01-11	aUniMacLearned	14.4.3.2.16
Object group: Statistics and counters		
0x02-01	aCountRxFramesGreen	14.4.3.3.1
0x02-02	aCountTxFramesGreen	14.4.3.3.2
0x02-03	aCountRxFrames2Short	14.4.3.3.3
0x02-04	aCountRxFrames64	14.4.3.3.4
0x02-05	aCountRxFrames65to127	14.4.3.3.5
0x02-06	aCountRxFrames128to255	14.4.3.3.6
0x02-07	aCountRxFrames256to511	14.4.3.3.7
0x02-08	aCountRxFrames512to1023	14.4.3.3.8
0x02-09	aCountRxFrames1024to1518	14.4.3.3.9
0x02-0A	aCountRxFrames1519	14.4.3.3.10
0x02-0B	aCountTxFrames64	14.4.3.3.11
0x02-0C	aCountTxFrames65to127	14.4.3.3.12
0x02-0D	aCountTxFrames128to255	14.4.3.3.13
0x02-0E	aCountTxFrames256to511	14.4.3.3.14
0x02-0F	aCountTxFrames512to1023	14.4.3.3.15
0x02-10	aCountTxFrames1024to1518	14.4.3.3.16
0x02-11	aCountTxFrames1519	14.4.3.3.17
0x02-12	aQueueDelayThr	14.4.3.3.18
0x02-13	aQueueDelayValue	14.4.3.3.19
0x02-14	aCountFramesDropped	14.4.3.3.20
0x02-15	aCountOctetsDropped	14.4.3.3.21
0x02-16	aCountOctetsDelayed	14.4.3.3.22
0x02-17	aCountUsOctetsUnused	14.4.3.3.23
0x02-1D	aPonOptMonitTemp	14.4.3.3.24
0x02-1E	aPonOptMonitVcc	14.4.3.3.25
0x02-1F	aPonOptMonitBias	14.4.3.3.26
0x02-20	aPonOptMonitTxPower	14.4.3.3.27
0x02-21	aPonOptMonitRxPower	14.4.3.3.28
0x02-22	aCounterRxFramesY	14.4.3.3.29
0x02-23	aCounterTxFramesY	14.4.3.3.30
0x02-24	aCounterTxOctetsG	14.4.3.3.31
0x02-25	aCounterRxOctetsY	14.4.3.3.32
0x02-26	aCounterRxOctetsG	14.4.3.3.33
0x02-27	aCounterTxOctetsY	14.4.3.3.34
0x02-28	aCounterTxFramesL2Unicast	14.4.3.3.35
0x02-29	aCounterTxFramesL2Multicast	14.4.3.3.36
0x02-2A	aCounterTxFramesL2Broadcast	14.4.3.3.37
0x02-2B	aCounterRxFramesL2Unicast	14.4.3.3.38
0x02-2C	aCounterRxFramesL2Multicast	14.4.3.3.39
0x02-2D	aCounterRxFramesL2Broadcast	14.4.3.3.40

Leaf	Attribute	Defined in
0x02-2E	aOnuCounterNumber	14.4.3.3.41
0x02-2F	aCounterRxFramesL2CP	14.4.3.3.42
0x02-30	aCounterRxOctetsL2CP	14.4.3.3.43
0x02-31	aCounterTxFramesL2CP	14.4.3.3.44
0x02-32	aCounterTxOctetsL2CP	14.4.3.3.45
0x02-33	aCounterDiscardFramesL2CP	14.4.3.3.46
0x02-34	aCounterDiscardOctetsL2CP	14.4.3.3.47
0x02-35	aCounterL2TxErrors	14.4.3.3.48
0x02-36	aCounterL2RxErrors	14.4.3.3.49
Object group: Alarms		
0x03-01	aAlarmPortStatThr	14.4.3.4.1
0x03-02	aAlarmLlidStatThr	14.4.3.4.2
0x03-03	aAlarmStatusControl	14.4.3.4.3
Object group: Encryption		
0x04-01	aEncryptionKeyExpiration	14.4.3.5.1
0x04-02	aEncryptionMode	14.4.3.5.2
Object group: Frame processing		
0x05-01	aRuleSetConfig	14.4.3.6.1
0x05-02	aRuleCustomField	14.4.3.6.2
0x05-03	aRuleTpidCAlter	14.4.3.6.3
0x05-04	aRuleTpidSAlter	14.4.3.6.4
~~0x05-05~~	~~aRuleIpmcFwrConfig~~	~~14.4.3.6.5~~
0x05-06	aRuleTpidIAlter	14.4.3.6.6
0x05-07	aRuleTpidBAlter	14.4.3.6.7
Object group: Service-level agreements		
0x06-01	aRateLimitBroadcast	14.4.3.7.1
0x06-04	aQueueCIR	14.4.3.7.2
0x06-05	aFecMode	14.4.3.7.3
0x06-06	aQueueEIR	14.4.3.7.4
0x06-07	aQueueColorMarking	14.4.3.7.5
0x06-08	aQueueRateLimiterCap	14.4.3.7.6
0x06-09	aCouplingFlag	14.4.3.7.7
Object group: Clock transport		
0x07-01	aClockTranspCapab	14.4.3.9.1
0x07-02	aClockTranspStatus	14.4.3.9.2
0x07-03	aClockTranspTransfer	14.4.3.9.3
0x07-04	aClockTranspPropagParam	14.4.3.9.4
0x07-05	aClockTranspRtt	14.4.3.9.5
Object group: Demarc auto-configuration		
0x08-00	aDacConfig	14.4.3.10.1
0x08-01	aDacConfigFlags	14.4.3.10.2
0x08-02	aDacPassChallenge	14.4.3.10.3
0x08-03	aDacStatus	14.4.3.10.4
Object group: UNI management		
0x08-20	aEeeStatus	14.4.3.11.1
0x08-21	aPoeStatus	14.4.3.11.2
0x08-22	aMediaType	14.4.3.11.3
Object group: Optical Line Protection		
0x09-00	aOnuProtectionCapability	14.4.1.9.1
0x09-01	aOnuConfigProtection	14.4.1.9.2
0x09-02	aOnuConfigPonActive	14.4.1.9.3
0x09-03	aONUConfigHoldoverPeriod	14.4.1.9.4

Leaf	Attribute	Defined in
Object group: Power saving		
0xFF-FF	aOnuPwrSavingCap	14.4.3.8.1

All other `Leaf` values are reserved and ignored on reception.

14.4.3.1 ONU management

14.4.3.2 Bridging

14.4.3.2.1 Attribute *aOnuDynMacTableSize* (0xD7/0x01-01)

14.4.3.2.2 Attribute *aOnuDynMacAgeLimit* (0xD7/0x01-02)

14.4.3.2.3 Attribute *aUniDynMacTable* (0xD7/0x01-03)

14.4.3.2.4 Attribute *aUniStatMacTable* (0xD7/0x01-04)

14.4.3.2.5 Attribute *aUniPortAutoNeg* (0xD7/0x01-05)

14.4.3.2.6 Attribute *aUniAdmissionControl* (0xD7/0x01-06)

14.4.3.2.7 Attribute *aUniMinLearnMacCount* (0xD7/0x01-07)

14.4.3.2.8 Attribute *aUniMaxLearnMacCount* (0xD7/0x01-08)

14.4.3.2.9 Attribute *aOnuMaxLearnMacCount* (0xD7/0x01-09)

14.4.3.2.10 Attribute *aUniLengthDiscard* (0xD7/0x01-0A)

14.4.3.2.11 Attribute *aUniFloodUnknown* (0xD7/0x01-0B)

14.4.3.2.12 Attribute *aUniLocalSwitching* (0xD7/0x01-0C)

14.4.3.2.13 Attribute *aOnuLlidQueueConfig* (0xD7/0x01-0D)

14.4.3.2.14 Attribute *aUniMacTableFull* (0xD7/0x01-0F)

14.4.3.2.15 Attribute *aOnuMulticastLlid* (0xD7/0x01-10)

This attribute represents the array of multicast LLID values currently configured in the given ONU. This attribute consists of the following sub-attributes: *sLlidCount* and *sLlidValue[sLlidCount]*.

Sub-attribute *aOnuMulticastLlid.sLlidCount*:
Syntax: Unsigned integer
Remote access: Read-Only
Description: This sub-attribute represents the number of multicast LLIDs provisioned in the ONU.

Sub-attribute *aOnuMulticastLlid.sLlidValue[sLlidCount]*:
Syntax: LLID value
Remote access: Read-Only
Description: This sub-attribute represents the multicast LLID values provisioned in the ONU.

A single *ONU Multicast LLIDs* TLV (0xD7/0x01-10) may carry up to 64 instances of the sub-attribute *sLlidValue [sLlidCount]*. If necessary, more than one *ONU Multicast LLIDs* TLV (0xD7/0x01-10) can be used within the same eOAMPDU to deliver the list of provisioned multicast LLID values. In this case, the subsequent instance of the *ONU Multicast LLIDs* TLV (0xD7/0x01-10) continues reporting *sLlidValue [sLlidCount]* sub-attributes from the position following the last sub-attribute reported in the previous instance of the *ONU Multicast LLIDs* TLV (0xD7/0x01-10).

The *aOnuMulticastLlid* attribute may also require more than one eOAMPDU to deliver all the *sLlidValue [sLlidCount]* sub-attributes to the OLT. In such a case, each eOAMPDU carries the *Sequence* TLV (0xD7/0x00-01) to indicate that the ONU response spans multiple eOAMPDUs.

The *aOnuMulticastLlid* attribute is associated with the ONU object (see 14.4.1.1). The Variable Container TLV for the *aOnuMulticastLlid* attribute shall be as specified in Table 14-170.

Table 14-170— *ONU Multicast LLIDs* TLV (0xD7/0x01-10)

Size (octets)	Field (name)	Value	Notes
1	Branch	0xD7	Branch identifier
2	Leaf	0x01-10	Leaf identifier
1	Length	$2 \times M$	The size of TLV fields following the `Length` field, where M is the number of multicast LLID values present in this TLV ($M \leq 64$)
2	LlidValue[0]	Varies	Value of *sLlidValue[0]* sub-attribute
…	…	…	…
2	LlidValue [M]	Varies	Value of *sLlidValue[M]* sub-attribute

14.4.3.2.16 Attribute *aUniMacLearned* (0xD7/0x01-11)

This attribute represents the UNI port on which the given MAC address was learned. ~~The ONU holds an instance of this attribute for each MAC address learned on UNI port(s).~~ This attribute consists of the following sub-attributes: *sMacAddress* and *sUniPort*.

Attribute *aUniMacLearned.sMacAddress*:

Syntax: MAC address
Remote access: Read/Write
Description: This sub-attribute indicates the MAC address queried by the OLT. The value of *sUniPort* sub-attribute is automatically updated upon writing a new value of *sMacAddress* sub-attribute.

Attribute *aUniMacLearned.sUniPort*:

Syntax: UNI port
Remote access: Read-Only
Description: This sub-attribute represents the instance of UNI port on which the MAC address value *sMacAddress* has been learned or configured via management. The following values are defined:

`0x00-0xFE`: Instance of UNI port.
`0xFF`: MAC address sMacAddress has not been learned on any UNI port.

The *aUniMacLearned* attribute is associated with the ONU object (see 14.4.1.1). The Variable Container TLV for the *aUniMacLearned* attribute shall be as specified in Table 14-171.

Table 14-171—*UNI MAC Learned* TLV (0xD7/0x01-11)

Size (octets)	Field (name)	Value	Notes
1	Branch	0xD7	Branch identifier
2	Leaf	0x01-11	Leaf identifier
1	Length	Varies	The size of TLV fields following the `Length` field. This field takes the following values: In *GetRequest* eOAMPDU: `0x06` In *GetResponse* eOAMPDU: `0x07`
6	MacAddress	Varies	Value of *sMacAddress* sub-attribute
1	UniPort	Varies	Value of *sUniPort* sub-attribute. This field is only present in *GetResponse* eOAMPDU.

14.4.4 Branch 0x09 “basic actions”

14.4.5 Branch 0xD9 “extended actions”

This subclause specifies a set of extended management actions used by the OLT to enforce a specific behavior in the ONU. The extended management actions shown in Table 14-262 shall be supported by this profile.

Table 14-270—Extended actions defined in branch 0xD9

Leaf	Attribute	Defined in
Object group: ONU management		
0x00-01	acOnuReboot	14.4.5.1.1
Object group: Bridging		
0x01-01	acMacClearDynamicTable	14.4.5.2.1
0x01-02	acMacAddDynamicAddress	14.4.5.2.2
0x01-03	acMacDeleteDynamicAddress	14.4.5.2.3
0x01-04	acMacClearStaticTable	14.4.5.2.4
0x01-05	acMacAddStaticAddress	14.4.5.2.5
0x01-06	acMacDeleteStaticAddress	14.4.5.2.6
0x01-07	acConfigMulticastLlid	14.4.5.2.7
Object group: Statistics and counters		
0x02-01	acCountersClear	14.4.5.3.1
Object group: Alarms		
0x03-01	acAlarmGetCurrentSummary	14.4.5.4.1
Object group: Frame processing		
0x05-01	acRulesClearAll	14.4.5.5.1
0x05-02	acRulesAddOne	14.4.5.5.2
0x05-03	acRulesDeleteOne	14.4.5.5.3
Object group: Transmission control		
0x06-01	acEnableUserTraffic	14.4.5.6.1
0x06-02	acDisableUserTraffic	14.4.5.6.2
0x06-03	acLoopbackEnable	14.4.5.6.3
0x06-04	acLoopbackDisable	14.4.5.6.4
0x06-05	acLaserTxPowerOff	14.4.5.6.5

All other `Leaf` values are reserved and ignored on reception.

14.4.5.1 ONU management

14.4.5.2 Bridging

14.4.5.2.1 Action *acMacClearDynamicTable* (0xD9/0x01-01)

14.4.5.2.2 Action *acMacAddDynamicAddress* (0xD9/0x01-02)

14.4.5.2.3 Action *acMacDeleteDynamicAddress* (0xD9/0x01-03)

14.4.5.2.4 Action *acMacClearStaticTable* (0xD9/0x01-04)

14.4.5.2.5 Action *acMacAddStaticAddress* (0xD9/0x01-05)

14.4.5.2.6 Action *acMacDeleteStaticAddress* (0xD9/0x01-06)

14.4.5.2.7 Action *acConfigMulticastLlid* (0xD9/0x01-07)

This action is used by the OLT to (a) add one multicast LLID in the given ONU or (b) delete one or all multicast LLID values already configured in the given ONU. Multiple multicast LLIDs ~~values~~ may be provisioned ~~into~~in the ONU. This action consists of the following sub-attributes: *sLlidValue* and *sLlidAction*.

Sub-attribute *acConfigMulticastLlid.sLlidValue*:
Syntax: LLID value
Remote access: Write-Only
Description: This sub-attribute indicates the value of the LLID that is to be added or deleted by this action. Valid LLID values are defined in 802.3, clause 76.2.6.1.3.2.

Sub-attributen *acConfigMulticastLlid.sLlidAction*:
Syntax: Enumeration
Remote access: Write-Only
Description: This sub-atribute dteremines the action, as follows:

- `add_llid`: a single LLID value indicated by the *sLlidValue* sub-attribute is added.
- `del_llid`: a single LLID value indicated by the *sLlidValue* sub-attribute is deleted.
- `del_all`: all provisioned multicast LLID values are cleared. The value of *sLlidValue* sub-attribute is ignored when this action is selected.

The *acConfigMulticastLlid* action is associated with the ONU object (see 14.4.1.1). The Variable Container TLV for the *acConfigMulticastLlid* action shall be as specified in Table 14-160.

Table 14-166—*Config Multicast LLID* TLV (0xD9/0x01-07)

Size (octets)	Field (name)	Value	Notes
1	Branch	0xD9	Branch identifier
2	Leaf	0x01-07	Leaf identifier

Size (octets)	Field (name)	Value	Notes
1	Length	Varies	The size of TLV fields following the `Length` field. This field takes the following values: ~~When *LlidAction* = `add_llid`: 0x03~~ ~~When *LlidAction* = `del_llid`: 0x03~~ When *LlidAction* = `add_all`: 0x01; - otherwise: 0x03.
1	LlidAction	Varies	Value of *sLlidAction* sub-attribute, defined as follows: `add_llid`: 0x00 `del_llid`: 0x01 `del_all`: 0x02
2	LlidValue	Varies	Value of *sLlidValue* sub-attribute. This field is only present when the *LlidAction* field is equal to `add_llid` or `del_llid`.