13　Extended OAM for Nx25G-EPON

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13.4.6.1　eOAMPDU codes

eOAMPDUs shall be as defined in Table 13-1. 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 13-1—eOAMPDUs and assignment of Opcode values

Opcode	eOAMPDUs	Defined in
0x01	*eOAM_Get_Request*	13.4.6.2
0x02	*eOAM_Get_Response*	13.4.6.3
0x03	*eOAM_Set_Request*	13.4.6.4
0x04	*eOAM_Set_Response*	13.4.6.5
0x09	*eOAM_Software*	13.4.6.6
0x0A	*eOAM_Certificate_Request*	13.4.6.7
0x0B	*eOAM_Certificate_Response*	13.4.6.8

13.4.6.2　*eOAM_Get_Request* eOAMPDU

13.4.6.3　*eOAM_Get_Response* eOAMPDU

13.4.6.4　*eOAM_Set_Request* eOAMPDU

13.4.6.5　*eOAM_Set_Response* eOAMPDU

13.4.6.6 *eOAM_Software* eOAMPDU

13.4.6.7 *eOAM_Certificate_Request* and *eOAM_Certificate_Response* eOAMPDUs

The *eOAM_Certificate_Request* and *eOAM_Certificate_Response* eOAMPDUs are specific types of the generic eOAMPDU, as defined in Table 13-2. These eOAMPDUs allow the NMS to perform remote management of certificates installed in ONUs.

The *eOAM_Certificate_Request* eOAMPDUs are issued by the OLT to request an ONU to perform a certificate-related management action. The OLT shall not generate any *eOAM_Certificate_Response* eOAMPDUs.

The *eOAM_Certificate_Response* eOAMPDUs are issued by the ONU to report the result of the taken action. The ONUs shall not generate *eOAM_Certificate_Request* eOAMPDUs.

A specific certificate-related management action requested by the *eOAM_Certificate_Request* eOAMPDU is identified by the ActionCode field that follows the Opcode field. The *eOAM_Certificate_Response* eOAMPDU shall carry the same value of ActionCode field as was received in the corresponding *eOAM_Certificate_Request* eOAMPDU. Table 13-x1 illustrates the available actions and identifies the related *eOAM_Certificate_Request* and *eOAM_Certificate_Response* eOAMPDU sub-types.

Table 13-x1—Certificate management actions and related eOAM message sub-types

Action	ActionCode value	Requests (Opcode = 0x0A)	Responses (Opcode = 0x0B)
Install NAC	0x00	*eOAM_Install_NAC_Request* (see 13.4.6.7.1)	*eOAM_Install_NAC_Response* (see 13.4.6.7.2)
Retrieve DAC	0x01	*eOAM_Retrieve_DAC_Request* (see 13.4.6.7.3)	*eOAM_Retrieve_DAC_Response* (see 13.4.6.7.4)
Retrieve NAC	0x02	*eOAM_Retrieve_NAC_Request* (see 13.4.6.7.3)	*eOAM_Retrieve_NAC_Response* (see 13.4.6.7.4)

13.4.6.7.1 *eOAM_Install_NAC_Request* eOAMPDU

The *eOAM_Certificate_Request* eOAMPDU with the ActionCode field value of 0x00 (Install NAC) is referred to as *eOAM_Install_NAC_Request* eOAMPDU. The *eOAM_Install_NAC_Request* eOAMPDU is used by the NMS to remotely install a NAC certificate into an ONU (see 11.3.3).

The structure of the *eOAM_Install_NAC_Request* eOAMPDU shall be as presented in Table 13-x1.

Table 13-x2 —Structure of the *eOAM_Install_NAC_Request* eOAMPDU

Size (octets)	Field name	Value and notes
21	eOAMPDU header	See Table 13-2
1	Opcode	0x0A (see Table 13-10)
1	ActionCode	0x00 (see Table 13-x1)

Size (octets)	Field name	Value and notes
2	CertificateLength	The length of the Certificate field. The value of 0x00 indicates that this is a request to remove the existing NAC certificate
< 1489	CertificateData	NAC certificate data (records) as defined in 11.3.3. This field is not present if the CertificateLength is 0x00.
< 35	Pad	This field is optional; it is included only when needed to satisfy the minimum OAMPDU size requirements. When included, the Pad value is 0x00-…-00.
4	FCS	See 13.4.2

If the ONU that received the *eOAM_Install_NAC_Request* eOAMPDU already has a NAC installed, the existing NAC shall be replaced (overwritten) with the new NAC.

The action of overwriting of the existing NAC certificate takes place even in the situation when no new NAC certificate is supplied by the *eOAM_Install_NAC_Request* eOAMPDU (i.e., when the value of the CertificateLength field is set to 0x00). Essentially, such zero-length *eOAM_Install_NAC_Request* eOAMPDU serves as a request to remove the existing NAC certificate.

13.4.6.7.2 *eOAM_Install_NAC_Response* eOAMPDU

The *eOAM_Certificate_Response* eOAMPDU with the ActionCode field value of 0x00 (Install NAC) is referred to as *eOAM_Install_NAC_Response* eOAMPDU. The *eOAM_Install_NAC_Response* eOAMPDU is issued by an ONU to convey the results of NAC installation or NAC removal actions.

The structure of the *eOAM_Install_NAC_Response* eOAMPDU shall be as presented in Table 13-x3.

Table 13-x3—Structure of the *eOAM_Certificate_Response* eOAMPDU

Size (octets)	Field name	Value and notes
21	eOAMPDU header	See Table 13-2
1	Opcode	0x0B (see Table 13-10)
1	ActionCode	0x00 (see Table 13-x1)
1	ActionStatus	Value encoding the status of a taken/attempted action, as defined in Table 13-x4
1	CertificateStatus	Value encoding the status of the installed certificate, as defined in Table 13-x5
35	Pad	0x00-…-00
4	FCS	See 13.4.2

The ActionStatus field carries the response code, as defined in Table 13-x4. Only the values specified in Table 13-x4 are allowed. Other values are reserved and cause the *eOAM_Install_NAC_Response* eOAMPDU to be ignored by the OLT/NMS.

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Table 13-x4—Values carried in `ActionStatus` field

Code	Name	Description
0x00	Install - success	The received certificate was successfully stored in ONU's non-volatile storage.
0x01	Replace - success	The existing certificate stored in ONU's non-volatile repository was successfully replaced by a new certificate.
0x02	Remove - success	The existing certificate was successfully removed, i.e., it was overwritten by an empty (zero-length) certificate.
0x03	Remove - no action	A request to remove certificate is received, however no certificate is stored in ONU's secure non-volatile storage.
0x04	Incompatible format	Unable to parse the message and extract certificate. An existing certificate, if any, remains in place.
0x05	Insufficient storage	Storage is insufficient to hold the new certificate. An existing certificate, if any, remains in place.
0x06	Operation timeout	Cannot perform requested action due to other activity. An existing certificate, if any, remains in place.
0x07	Illegal operation	ONU cannot recognize the request. No action is taken.
0x08	Undefined	Unknown error or one not covered above.

The `CertificateStatus` field conveys the status of the installed certificate after performing the requested action (i.e., after installing a new certificate or after removing an existing certificate). Only the values specified in Table 13-x5 are allowed. Other values are reserved and cause the *eOAM_Install_NAC_Response* eOAMPDU to be ignored by the OLT/NMS.

Table 13-x5—Values carried in `CertificateStatus` field

Code	Name	Description
0x00	No certificate	No certificate is present in ONU's secure non-volatile storage.
0x01	Valid certificate	A valid Network Authentication Credential (NAC) certificate is present in ONU's secure non-volatile storage.
0x02	Expired certificate	An expired Network Authentication Credential (NAC) certificate is present in ONU's secure non-volatile storage.
0x03	Invalid format	A certificate is present in ONU's secure non-volatile storage, but its format does not comply with requirements in 11.3.3
0x04	Corrupted data	Data stored in ONU's secure non-volatile storage is corrupted.

13.4.6.7.3 *eOAM_Retrieve_DAC_Request* and *eOAM_Retrieve_NAC_Request* eOAMPDUs

The *eOAM_Certificate_Request* eOAMPDU with the `ActionCode` field value of 0x01 (Retrieve DAC) is referred to as *eOAM_Retrieve_DAC_Request* eOAMPDU. The *eOAM_Retrieve_DAC_Request* eOAMPDU is used to retrieve the DAC certificate from an ONU (see 11.3.2).

The *eOAM_Certificate_Request* eOAMPDU with the `ActionCode` field value of 0x02 (Retrieve NAC) is referred to as *eOAM_Retrieve_NAC_Request* eOAMPDU. The *eOAM_Retrieve_NAC_Request* eOAMPDU retrieves a previously-installed NAC certificate from the ONU (see 11.3.3).

The structure of the *eOAM_Retrieve_DAC_Request* and *eOAM_Retrieve_NAC_Request* eOAMPDUs shall be as presented in Table 13-x6.

Table 13-x6— Structure of *eOAM_Retrieve_DAC_Request* and
***eOAM_Retrieve_NAC_Request* eOAMPDUs**

Size (octets)	Field name	Value and notes
21	eOAMPDU header	See Table 13-2
1	Opcode	0x0A (see Table 13-10)
1	ActionCode	Identifies the message type as follows: `0x01`: a request to retrieve the DAC `0x02`: a request to retrieve the NAC..
37	Pad	0x00-…-00
4	FCS	See 13.4.2

13.4.6.7.4 *eOAM_Retrieve_DAC_Response* and *eOAM_Retrieve_NAC_Response* eOAMPDUs

The *eOAM_Certificate_Response* eOAMPDU with the `ActionCode` field value of 0x01 (Retrieve DAC) is referred to as *eOAM_Retrieve_DAC_Response* eOAMPDU. The *eOAM_Retrieve_DAC_Response* eOAMPDU is used by the ONU to convey the contents of the DAC certificate to the OLT/NMS (see 11.3.2).

The *eOAM_Certificate_Response* eOAMPDU with the `ActionCode` field value of 0x02 (Retrieve NAC) is referred to as *eOAM_Retrieve_NAC_Response* eOAMPDU. The *eOAM_Retrieve_NAC_Response* eOAMPDU is used by the ONU to convey the contents of the NAC certificate, if one is present (see 11.3.3).

The structure of the *eOAM_Retrieve_DAC_Response* and *eOAM_Retrieve_NAC_Response* eOAMPDUs shall be as presented in Table 13-x7.

Table 13-x7 — Structure of *eOAM_Retrieve_DAC_Response* and
***eOAM_Retrieve_DAC_Response* eOAMPDUs**

Size (octets)	Field name	Value and notes
21	eOAMPDU header	See Table 13-2
1	Opcode	0x0B (see Table 13-10)
1	ActionCode	Identifies the message type as follows: `0x01`: a response carrying the DAC certificate data `0x02`: a response carrying the NAC certificate data
2	CertificateLength	The length of the Certificate field. The value of 0x00 indicates that the requested certificate (NAC or DAC) is not present or cannot be retrieved.

Size (octets)	Field name	Value and notes
< 1489	CertificateData	DAC or NAC certificate data (records) as defined in 11.3.2 or 11.3.3 respectively. This field is not present if the `CertificateLength` is 0x00.
< 35	Pad	This field is optional; it is included only when needed to satisfy the minimum OAMPDU size requirement. When included, the `Pad` value is 0x00-…-00.
4	FCS	See 13.4.2