9 Service availability

9.1 Device and transceiver status monitoring and diagnostic functions

9.2 Definitions of events

9.2.1 Introduction

This subclause specifies events generated in EPON by ONU and OLT devices.

Sub-clause 9.2.2. lists all the critical link events derived from IEEE Std 802.3, 57.2.10.1, and supported in SIEPON.4. Critical link events are carried within the *Flags* field of each OAMPDU. Refer to IEEE Std 802.3, 57.4.2.1 for the definition and encoding of the *Flags* field.

Sub-clause 9.2.3 defines SIEPON.4-specific events that are reported using *Event Notification* OAMPDU (see IEEE Std 802.3, 57.4.3.2) containing one or more *Extended Event* TLVs (see 13.4.4.2).

~~In the case of the ONU generated events, the associated information is delivered to the OLT using the event notification mechanism specified in 13.4.4.~~

~~**Editoral note (to be removed prior to publication): align with DPoE OAM spec, table 13**~~

9.2.2 Critical link e~~E~~vents defined in IEEE Std 802.3, Clause 57

~~This standard lists all the critical link events derived from IEEE Std 802.3, 57.2.10.1, and supported in EPON. Other events derived from IEEE Std 802.3 are described in 9.1.2. For more details, see IEEE Std 802.3, 57.2.10.1.~~

9.2.2.1 Downstream link fault

9.2.2.2 Upstream link fault

9.2.2.3 Dying Gasp

9.2.2.4 ONU critical event

9.2.2.5 OLT critical event

9.2.3 Extended events

9.2.3.1 LoS

For the PON port, a loss of signal (LoS) condition is detected by lack of incoming optical power or loss of clock and data recovery lock to the downstream bit clock. The transceiver status monitoring for the ONU and the OLT is as specified in 9.1.3. On any of the UNI ports, the LoS condition corresponds to the Link Down condition detected by the UNI port PHY.

9.2.3.2 Key Exchange Failure

The Key Exchange Failure alarm indicates that a scheduled key exchange has failed. Encryption continues with the previous key for another key exchange interval. Another key exchange is attempted at the next key exchange time.

9.2.3.3 Port Disabled

The Port Disabled event indicates that one of the ONU ports has been disabled by management action. If the PON port is disabled, then this event notification is not transmitted, and this alarm is visible only locally on the ONU.

9.2.3.4 Power Failure

A Power Failure alarm indicates that the ONU lost power and is imminently going to be removed from the EPON. An ONU makes every attempt to send this *Extended Event* TLV when it detects loss of power. An ONU may not be able to actually send this *Extended Event* TLV if the required transmission grants are not allocated by the OLT before the ONU runs out of power.

9.2.3.5 Statistics Alarm

The Statistics Alarm indicates a crossing of predefined thresholds on a specific statistical attribute (counter). The extended attribute *aAlarmPortStatThr* (see 14.4.4.1) is used to provision statistical alarms associated with PON ports or service ports, and a simular attribute *aAlarmLlidStatThr* (see 14.4.4.2) is used to provision statistical alarms associated with LLIDs, including the multicast LLIDs.

9.2.3.6 ONU Busy

The ONU Busy alarm may be raised by an ONU to inform the OLT that it has been busy for an extended period and may have problems responding to any further OAM requests in the usual timely fashion.

9.2.3.7 MAC Table Overflow

The MAC Table Overflow alarm is raised by an ONU to inform the OLT that an ingress MAC address has not been learned because the total number of MAC addresses has been exceeded. For example, if the ONU was provisioned to allow four MAC addresses on a particular UNI port, then the first four addresses seen would be learned; the fifth address would cause this alarm to be raised.

9.2.3.8 PON_IF_Switch

The PON_IF_Switch alarm is raised by the ONU to inform the OLT that the PON interface on the ONU was switched from the active interface to backup interface, according to the tree protection mechanism defined in 9.3.4.

13 Extended OAM for Nx25G-EPON

13.1 Introduction

13.2 Requirements

13.3 Device discovery and capability discovery

13.4 eOAMPDU structure

13.4.1 Extended OAM organizationally-unique identifier (OUI)

13.4.2 eOAMPDU frame format

13.4.3 TLV-oriented structure

13.4.4 TLVs for 802.3 OAMPDUs

13.4.4.1 *Extended Information* TLV

13.4.4.2 *Extended Event ~~Notification~~* TLV

The basic structure of the *Organization Specific Event* TLV shall be as specified in IEEE Std 802.3, 57.5.3.5.

The SIEPON.4-specific extension of the *Organization Specific Event* TLV is further defined in this standard under the OUI `OUI_1904_4` (see Table 13-1). This TLV is refered to as the *Extended Event* TLV. Specific fields in the *~~Organization Specific~~Extended Event* TLV shall be as shown in Figure 13-6 and specified below~~:~~:

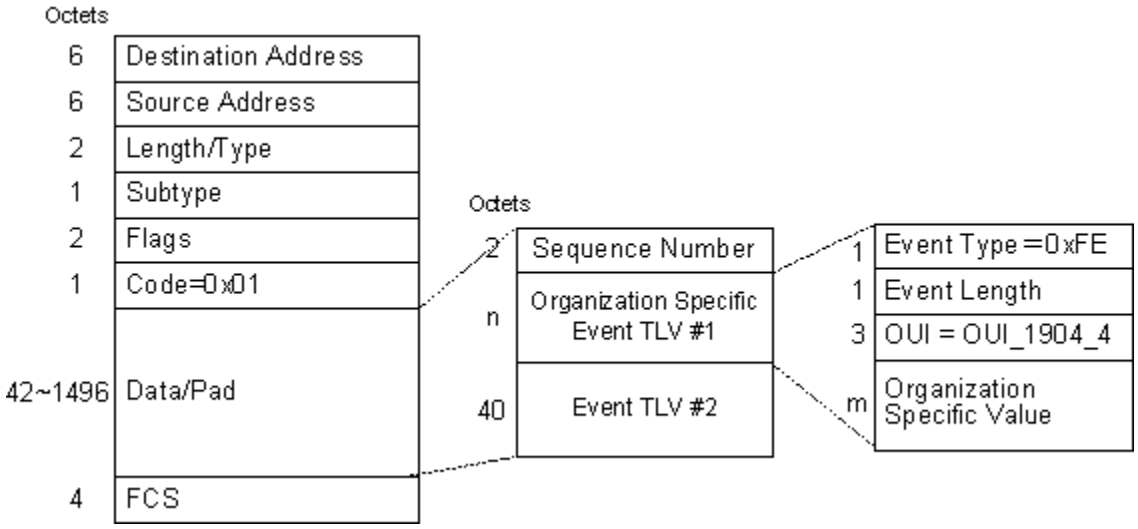

Figure 13-6—Relationship between *~~Organization Specific~~Extended Event* TLV and the *Event Notification* OAMPDU

a) `Event Type` = 0xFE, according to the encoding of this field as defined in IEEE Std 802.3, Table 57–12.

b) `Event Length`. This one-octet field indicates the length (in octets) of this TLV-tuple.

c) `OUI` value, equal to OUI_1904_4.

d) `Organization Specific Value` carries the specific set of event-associated information. Further, the structure of the `Organization Specific Value` shall be as specified in Table 13-7 and described below.

Table 13-7—Internal structure of the `Organization Specific Value` field

Octet(s)	Field	Notes
1	EventCode	This field identifies the type of alarm that was identified by the source OAM client. See Table 13-8 for definition of individual values for the `EventCode` field. These alarm codes are grouped into link faults, critical events, and Dying Gasp alarm types, with code values numbered accordingly. Only the values listed in the table are supported. Other values are reserved and ignored on reception.
1	EventRaised	This field indicates whether the given event was raised. The following values are supported: 0x00: The given event was cleared. 0x01: The given event was raised. Other values are reserved and ignored on reception.
2	ObjectType	This field identifies the object element that generated the given event, as defined in 14.2.1.1. Other values of the `ObjectType` are reserved and ignored on reception.~~generating the alarm in question.~~
2 or 4	ObjectInstance	This field identifies the ~~object element instance generating the alarm in question.~~ specific instance of the object that generated the given event, as defined in 14.2.1.2.
2	EventTimeStamp	This field identifies the time at which the given event occurred. This field shall be filled in by the ONU at the time the given event notification OAMPDU is created, using the same clock as the basic OAM Link Event TLVs (see IEEE Std 802.3, 57.5.3).~~Identifies the time at which the given event occurred.~~
0, 3, or 4	EventInfo	This field is optional. It ~~Provides~~ provides additional information related to the given alarm or warning event~~.~~: — For the *Statistics Alarm* (`EventCode` = 0x81), this field contains a variable descriptor TLV (see 13.4.3.1) that identifies a specific statistical attribute whose value has crossed a predefined threshold. — For the *PON_IF_Switch Alarm* (`EventCode` = 0x84), this field contains a specific failure code that caused the PON interface switch event at the ONU (refer to the definitions of `backupPortStatus` and `primaryPortStatus` in 9.3.4.5.2 and `eOAMR_Switch_Event` in 9.3.4.5.4).

~~— `ObjectType` field identifies the object that generated the given event, as defined in 14.2.1.1. Other values of the `ObjectType` are reserved and ignored on reception.~~

— `ObjectInstance` field identifies the specific instance of the object that generated the given event, as defined in 14.2.1.2.

— `EventTimeStamp` field identifies the time at which the given event occurred. This field shall be filled in by the ONU at the time the given event notification OAMPDU is created, using the same clock as the basic OAM Link Event TLVs (see IEEE Std 802.3, 57.5.3).

— `EventInfo` optional field provides additional information related to the given alarm/warning event. The content of this field depends on the definition of the given alarm/warning as specified in TBD.

Table 13-8—Code points for the `EventCode` field

Event Group	Event Name	Code	Defined in
Link Fault Alarms	LoS	0x11	13.4.4.2.19.2.3.1
	Key Exchange Failure	0x12	13.4.4.2.29.2.3.2
Critical Event Alarms	Port Disabled	0x21	13.4.4.2.39.2.3.3
Dying Gasp Alarms	Power Failure	0x41	13.4.4.2.49.2.3.4
Other Alarms	Statistics Alarm	0x81	13.4.4.2.59.2.3.5
	ONU Busy	0x82	13.4.4.2.69.2.3.6
	MAC Table Overflow	0x83	13.4.4.2.79.2.3.7
	PON_IF_Switch	0x84	13.4.4.2.89.2.3.8

An ONU may transmit any alarm via any L-ONU, i.e., on any bi-directional LLID registered at that ONU.

13.4.4.2.1 LoS (0x11)

For the PON port, a loss of signal (LoS) condition is detected by lack of incoming optical power or loss of clock and data recovery lock to the downstream bit clock. The transceiver status monitoring for the ONU and the OLT is as specified in 9.1.3. On any of the UNI ports, the LoS condition corresponds to the Link Down condition detected by the UNI port PHY.

13.4.4.2.2 Key Exchange Failure (0x12)

The Key Exchange Failure alarm indicates that a scheduled key exchange has failed. Encryption continues with the previous key for another key exchange interval. Another key exchange is attempted at the next key exchange time.

13.4.4.2.3 Port Disabled (0x21)

The Port Disabled event indicates that one of the ONU ports has been disabled by management action. If the PON port is disabled, then this event notification is not transmitted, and this alarm is visible only locally on the ONU.

13.4.4.2.4 Power Failure (0x41)

A Power Failure alarm indicates that the ONU lost power and is imminently going to be removed from the EPON. An ONU makes every attempt to send this *Event Notification* TLV when it detects loss of power. An ONU may not be able to actually send this *Event Notification* TLV if the required transmission grants are not allocated by the OLT before the ONU runs out of power.

13.4.4.2.5 Statistics Alarm (0x81)

The Statistics Alarm indicates a crossing of predefined thresholds on a specific statistic, as indicated by the *Alarm* TLV, as defined in Table 13-9. Typically, these thresholds would be set for counters for error conditions such as CRC errors.

Table 13-9—*Alarm* TLV structure

Size (octets)	Field (name)	Value
1	Branch	Branch of statistic that crossed threshold
2	Leaf	Leaf of statistic that crossed threshold

13.4.4.2.6 ONU Busy (0x82)

The ONU Busy alarm may be raised by an ONU to inform the OLT that it has been busy for an extended period and may have problems responding to any further OAM requests in the usual timely fashion.

13.4.4.2.7 MAC Table Overflow (0x83)

The MAC Table Overflow alarm is raised by an ONU to inform the OLT that an ingress MAC address has not been learned because the total number of MAC addresses has been exceeded. For example, if the ONU was provisioned to allow four MAC addresses on a particular UNI port, then the first four addresses seen would be learned; the fifth address would cause this alarm to be raised.

13.4.4.2.8 PON_IF_Switch (0x84)

The PON_IF_Switch alarm is raised by the ONU to inform the OLT that the PON interface on the ONU was switched from the active interface to backup interface, according to the tree protection mechanism defined in 9.3.4.