101.2 Reconciliation Sublayer (RS) for EPoC

This subclause is modelled after 76.2 for 10G-EPON, removing multi-rate MII interface definitions.

101.2.1 Overview of EPoC RS operation

This subclause extends {Clause 46} to enable multiple MAC instances to interface with a single Physical Layer, and to enable data links with asymmetric data rates, i.e., with the downstream data rate different than the upstream data rate.

The number of supported MAC instances is limited only by the implementation. It is acceptable for only one MAC instance to be connected to the EPoC Reconciliation Sublayer.

{Figure 101–1} shows the relationship between the EPoC RS and the ISO/IEC OSI reference model. The mapping of XGMII signals to PLS service primitives is described in {46.1.7} for XGMII with exceptions noted herein.

101.2.2 Summary of major concepts

A successful registration process, described in {102.3.3}, results in the assignment of values to the MODE and LLID variables associated with the given MAC instance. This may be one of many MAC instances in a CLT or a single MAC instance in a CNU. The MODE and LLID variables are used to identify a packet transmitted from that MAC instance and how received packets are directed to that MAC instance. The RS in the OLT shall operate in unidirectional mode as defined in {66.4}.

As described in {102.1.2}, multiple MAC instances within a CLT are bound to the single XGMII instance. Only one PLS_DATA.request primitive is active at any time. At the CNU, the only MAC instance is bound to the XGMII.

In the transmit direction, the RS maps the active PLS_DATA.request to the XGMII signals (TXD<31:0>, TXC<3:0>, and TX_CLK) according to the MAC instance generating the request. The RS replaces octets of preamble with the values of MODE and LLID variables of the transmitting MAC.

In the receive direction, the MODE and LLID values embedded within the preamble identify the MAC instance to which this packet should be directed. The RS establishes a temporal mapping of the XGMII signals (RXD<31:0>, RXC<3:0> and RX_CLK) to the correct PLS_DATA.indication and PLS_DATA_VALID.indication primitives.

101.2.3 10 Gigabit Media Independent Interface (XGMII)

This subclause describes the interface between the MAC and PHY in a CLT or a CNU. The physical implementation of the interface is primarily intended to be chip-to-chip, but may also be used as a logical interface between ASIC logic modules within an integrated circuit. These interfaces are used to provide media independence, so that an identical media access controller may be used with all {EPOC_PMD_NAME} PHY types.

101.2.3.1 XGMII structure

The XGMII structure is discussed in {46.1.6}, and {Figure 46–2} depicts a schematic view of the RS inputs and outputs.

101.2.3.2 XGMII operation

The XGMII operation is discussed in {Clause 46}.

101.2.3.3 Mapping of XGMII signals to PLS service primitives

Except as noted in Table 101–1 and Table 101–2, the mapping of the signals provided at the XGMII to the PLS service primitives is defined in {46.1.7}.

Table 101–1—Mapping of PLS_DATA.request primitive

MAC location	Signals
CLT	TXD<31:0>, TXC<3:0>, TX_CLK
CNU	TXD<31:0>, TXC<3:0>, TX_CLK

Table 101–2—Mapping of PLS_DATA.indication primitive

MAC location	Signals
CLT	RXD<31:0>, RXC<3:0>, RX_CLK
CNU	RXD<31:0>, RXC<3:0>, RX_CLK

101.2.4 Functional specifications for multiple MAC instances

This subclause describes the functional specifications for the support of multiple MAC instances connected to a single RS sublayer with EPoC-specific extensions.

101.2.4.1 Variables

The variables of {65.1.3.1} are inherited except as shown below.

logical_link_id
        Value: 15 bits
        This variable shall be set to the broadcast value of 0x7F-FE for the unregistered CNU MAC. Enabled CLT MACs may use any value for this variable. If the optional multicast LLID feature is supported, the CLT may use a multicast_link_id along with the mode bit set to 0. Registered CNU MACs may use any value other than the reserved values listed in {Table 101–4} or a multicast_link_id for this variable.

101.2.4.2 EPoC RS Transmit function

The transmit function of the extended EPoC RS replaces some of the octets of the preamble as transmitted by the MAC with several fields: SLD (start of LLID delimiter), LLID (Logical Link Identifier), and CRC8:

— the SLD field identifies the location of the LLID and CRC8 fields; and

— the LLID field identifies the source or destination MAC instance; and

— the CRC8 field provides verification of the integrity on the LLID field.

Table 101–3 shows the replacement mapping between preamble/SFD received from a MAC instance and the modified preamble/SFD transmitted towards the XGMII.

The XGMII transmit function is described in {46.3.1}.

Table 101–3—Preamble/SFD replacement mapping

Column	Lane	Field	Preamble/SFD	Modified preamble/SFD
0	0	—	0x55	0x55
	1	—	0x55	0x55
	2	SLD	0x55	0xD5
	3	—	0x55	0x55
1	0	—	0x55	0x55
	1	LLID[15:8]	0x55	<logical_link_mode, logical_link_id[14:8]>[a]
	2	LLID[7:0]	0x55	<logical_link_id[7:0]>[b]
	3	CRC8	0xD5	CRC8 calculated over column 0, lane 2 through column 1 lane 2

[a]logical_link_mode maps to TXD[15], logical_link_id[14] maps to TXD[14], and logical_link_id[8] maps to TXD[8].
[b]logical_link_id[7] maps to TXD[23] and logical_link_id[0] maps to TXD[16].

101.2.4.2.1 SLD

The SLD is one octet long, it has the value of 0xD5 (see Table 101–3), and it is transmitted as the third octet in the column on the XGMII. The SLD field identifies the location of the LLID and CRC8 fields in the modified preamble, relative to the beginning of the preamble and the start of the frame.

The 10 Gb/s RS transmit function maintains an alignment for the start control character to lane 0 in the column on the XGMII. This means that the SLD is aligned to lane 2 in the column on the XGMII containing the start control character.

101.2.4.2.2 LLID

The LLID field is two octets in length and it replaces the last two octets of preamble (see Table 101–3), transmitted on lanes 1 and 2 in the column on XGMII following the column containing the start control character. The LLID field is a concatenation of two separate fields, i.e., logical_link_mode and logical_link_id, representing values of the respective variables for the associated MAC instance.

101.2.4.2.3 CRC8

The CRC8 field is one octet long, it contains an 8-bit cyclic redundancy check value, and it is transmitted on lane 3 in the column on XGMII following the column containing the start control character. The CRC8 value is computed as a function of the contents of the modified preamble beginning with the SLD field (offset 3) through the LLID field (offset 7). The encoding is defined by the generating polynomial shown in {Equation (65-1)}.

{Figure 65–2} represents an example of a serial implementation of the CRC8 calculation. The CRC8 calculation process shall produce the same result as the example implementation show in {Figure 65–2}.

Before the process of CRC8 calculation begins, the shift register shall be initialized to the value 0x00. The content of the shift register is transmitted without inversion.

101.2.4.3 EPoC RS Receive function

The receive function of the extended EPoC RS is responsible for:

a) Locating the SLD field; and

b) Using the location of the SLD field to locate the CRC8 field and verifying that the received CRC8 value matches the CRC8 calculated over the received preamble (see 101.2.4.2.3); and

c) Using the location of the SLD field to locate the LLID field and parsing the LLID field to determine the destination MAC instance; and

d) If the frame is not discarded due to incorrect CRC8 or unknown LLID value, then replacing the SLD and LLID fields with normal preamble pattern and the CRC8 field with the SFD and transferring the resulting frame to the appropriate MAC instance; and

e) Otherwise, discarding the entire frame, replacing it with normal inter-frame pattern.

The XGMII receive function is described in {46.3.2}.

101.2.4.3.1 SLD

The SLD is transmitted as the third octet following the start control character (see Table 101–3) and therefore it is aligned to lane 2 in the same column containing the start control character. This is the only possibility considered when parsing the incoming octet stream for the SLD.

If the SLD field is not found at the expected position, the extended EPoC RS shall discard the entire received frame.

If the received frame is transferred to the associated MAC instance, the extended EPoC RS shall perform the following operations:

a) replace the SLD with a normal preamble octet (0x55); and

b) pass through without any modification two octets preceding the SLD and one octet following the SLD, as shown in Table 101–3.

101.2.4.3.2 LLID

The third and fourth octets following the SLD (see Table 101–3) contain the logical_link_mode and logical_link_id values. CLTs and CNUs act upon these values in a different manner.

If the device is a CLT, then the following comparison is made:

a) The received logical_link_mode is ignored.

b) If the received logical_link_id has a value of 0x7F-FE and an enabled MAC exists with an associated logical_link_id with the same value, then the comparison is considered a match to that MAC instance.

c) If the received logical_link_id has a value other than 0x7F-FE and an enabled MAC exists with an associated logical_link_mode with a value of 0 and an associated logical_link_id matching the received logical_link_id, then the comparison is considered a match to that MAC instance.

If the device is a CNU, then the following comparison is made:

a) If the received logical_link_mode has a value of 0 and the received logical_link_id value matches the associated logical_link_id variable, then the comparison is considered a match.

b) If the received logical_link_mode has a value of 1 and the received logical_link_id value does not match the associated logical_link_id variable, or the received logical_link_id has a value of 0x7F-FE, then the comparison is considered a match.

c) If the CNU supports the multicast LLID feature, the received logical_link_mode has a value of 0 and the received logical_link_id value matches an assigned multicast_link_id, then the comparison is considered a match.

If no match is found, then the extended EPoC RS shall discard the packet.

If a match is found, then the frame is intended to be transferred to the associated MAC instance.

If the frame is transferred to the associated MAC instance, the extended EPoC RS shall perform the following operations:

a) replace both octets of the LLID field with normal preamble octets (0x55); and

b) pass through without any modification one octet preceding the LLID, as shown in Table 101–3

A number of LLIDs have been reserved (see Table 101–4) for various purposes, including downstream broadcast, discovery messages, and upstream registration request messages. An additional block of LLIDs has been set aside for future use and definition. A registered CNU shall not transmit frames with one of the reserved LLIDs, as defined in Table 101–4.

Table 101–4—Reserved LLID values

LLID	Used in	Purpose
0x7F-FF	1000BASE-PX RS	Downstream: 1 Gb/s SCB Upstream: ONU registration at 1 Gb/s
0x7F-FE	10/1GBASE-PRX	Downstream: 10 Gb/s SCB Upstream: ONU registration at 1 Gb/s
	10/10GBASE-PR	Downstream: 10 Gb/s SCB Upstream: ONU registration at 10 Gb/s
0x7F-FD to 0x7F-00	N/A	Reserved for future use

The CLT shall use the broadcast LLID of 0x7F-FE when transmitting on a downstream SCB channel or when performing the MPCP registration of a newly discovered CNU. The CNU shall use the broadcast LLID of 0x7F-FE when performing the MPCP registration.

101.2.4.3.3 CRC8

The octet following the LLID field contains CRC8 (see Table 101–3). The value carried in the CRC8 field is compared against the value of CRC8 calculated over the received octets, beginning with the SLD field and ending with the last octet of the LLID field in the received frame.

If the received and calculated CRC8 values do not match, then the extended EPoC RS shall discard the entire received frame.

If the received and calculated CRC8 values match, then the extended EPoC RS transfers the received frame to the associated MAC instance.

If the receive frame is transferred to the associated MAC instance, then the extended EPoC RS shall replace the CRC8 field with the SFD.