66. Extensions of the 10Gb/s Reconciliation Sublayer (RS), 100BASE-X PHY, and 1000BASE-X Physical Coding Sublayer (PCS) for ~~Operations, Administration, and Management (OAM)~~unidirectional transport

This clause describes additions and modifications to ~~various legacy Ethernet clauses for the purpose of supporting subscriber access networks. Two additional embodiments of the 100BASE-X PHY family are added for subscriber access networks: 100BASE-LX10 and 100BASE-BX10, see Clause 58. These both require the 100BASE-X PCS and PMA as specified in 66.1. Four additional embodiments of the 1000BASE-X PHY family are added for subscriber access networks: 1000BASE-LX10 and 1000BASE-BX10, see Clause 59, and 1000BASE-PX10 and 1000BASE-PX20, see Clause 60. These both require the 1000BASE-X PCS and PMA as specified in 66.2 and modified by Clause 65.~~

Comment: 100BASE-LX10 and 1000BASE-LX10 are intended for IT, industrial and general (campus) use as well as for access networks. Per clauses 56 and 67, unidirectional is not REQUIRED for OAM, nor is OAM required for EFM, nor is unidirectional required for most PMD types. It turns out that listing the PMD types again here adds nothing to the story. I thought that it was too much to list the other PMDs (1000BASE-SX, 100BASE-FX, 1000BASE-LX, 10G, any more?) for which unidirectional capability would also become an option per this clause. But a simple list or table would be OK.

~~Specifically, one change is common to~~ the 100BASE-X, 1000BASE-X and 10GBASE physical layers, making them capable of unidirectional operation which is required to initialize a 1000BASE-PX network, and allows the transmission of~~in order to support~~ Operations, Administration and Management (OAM) frames in spite of a defective or absent signal received at the transmitting DTE~~or, solely for 1000BASE-X, Point to Multi Point (P2MP) for a subscriber access network~~. This modified physical layer capability is optional except for 1000BASE-PX-D.

However, unidirectional operation should only be enabled under very limited circumstances. Before enabling this mode, the MAC should be operating in full-duplex mode, ~~or in the case of P2MP the MAC should be operating in half-duplex mode,~~ and Auto-Negotiation, if applicable, should be disabled. In addition, the OAM sublayer above the MAC (see Clause 57) must be enabled on both ends of the link or ~~this~~ (for 1000BASE-X). the PCS must be part of a 1000BASE-PX-D PHY~~reside within an Optical Line Terminal (OLT) in a 1000BASE-PX network~~ (see Clauses 60 and 64). Unidirectional operation should not be invoked for 1000BASE-PX-U (except for out-of-service test purposes or where the PON contains just one ONU). Failure to follow these restrictions results in an incompatibility with the assumptions of the bridge protocol, a PON that cannot initialize, or collisions which are unacceptable in the P2MP protocol.

66.1 Modifications to the physical coding sublayer (PCS) and physical medium attachment (PMA) sublayer, type 100BASE-X

66.1.1 Overview

This subclause specifies optional changes to the 100BASE-X PCS and PMA for unidirectional transport~~support of subscriber access net-works~~. These are changes to the ~~existing~~ 100BASE-X PCS and PMA ~~for legacy ethernet as~~ described in Clause 24.

Comment: IMHO, unidirectional is of very minor use even for OAM. It doesn't "support subscriber access networks", they'll work without it. And if transport of OAM frames from non-receiving DTEs were useful for managing obscure failure conditions remotely, then it would be useful in campus networks too for the same purpose.

We should not talk about "the existing": when this text is ratified, clauses 24 and 66 will both be "existing" on an equal footing.

In a world of pluggable optics and commodity silicon, a new (66.1) or old (24) PCS may be connected to a new (e.g. 100BASE-LX10) or old (e.g. 100BASE-FX) PMD. It's not necessary or desirable to categorize these options as "legacy" or "for access networks".

66.1.2 Functional specifications

If unidirectional capable, t~~T~~he 100BASE-X PCS and PMA ~~for subscriber access networks~~ shall conform to the requirements of the 100BASE-X PCS specified in 24.2 and the 100BASE-X PMA specified in 24.3 with the following exception: Thi~~s~~e alternative 100BASE-X PCS ~~for subscriber access networks~~ has the ability to transmit data from the MII regardless of the value of link_status. The following are the detailed changes to Clause 24 in order to support this additional ability.

See D2.1 comment 483: is the phrase "value of link_status" correct?

66.1.2.1 Variables

Insert a new variable among those already described in 24.2.3.2:

mr_unidirectional_enable

> A control variable that enables the unidirectional mode of operation. This variable~~s~~ is provided by a management interface that may be mapped to the Clause 22 Control register Unidirectional enable bit (0.1).
>
> Values: FALSE; Unidirectional capability is not enabled
>
> TRUE; Unidirectional capability is enabled

66.1.2.2 Transmit state diagram

The description of the transmit state diagram is changed to include the contribution of the new mr_unidirectional_enable variable. The second paragraph of 24.2.4.2 is changed to read (~~strikethroughs~~ show deleted text and underscores show inserted text):

Collision detection is implemented by noting the occurrence of carrier receptions during transmis-sions, following the model of 10BASE-T. The indication of link_status ≠ OK by the ~~PMA at any time~~ PMA, when mr_unidirectional_enable = FALSE, causes an immediate transition to the IDLE state and supersedes any other Transmit process operations. When mr_unidirectional_enable = TRUE and faulting = FALSE, the Transmit process ignores the value of link_status. This enables the ability to transmit data from the MII when link_status ≠ OK. The indication of faulting = TRUE also causes a transition to the IDLE state. This is because it is misleading to transmit to a station which is known not to be receiving.

Additionally, the functionality of figure 24-8 shall be changed as represented by Figure 66–1.

Figure 66–1—Transmit state diagram

66.1.2.3 Far-end fault generate

The description of the far-end fault generate state diagram is also changed to include the contribution of the new mr_unidirectional_enable variable. The first paragraph of 24.3.4.5 is changed to read (strikethroughs show deleted text and underscores show inserted text):

> Far-End Fault Generate simply passes tx_code-bits to the TX process when signal_status=ON or when mr_unidirectional_enable=TRUE. When signal_status=OFF and mr_unidirectional_enable=FALSE, it repetitively generates each cycle of the Far-End Fault Indication until signal_status is reasserted or mr_unidirectional_enable is set to TRUE.

Additionally, the functionality of figure 24-16 shall be changed as represented by Figure 66–2.

Comment: According to figure 66-2, unidirectional disables far end fault generation. I can see that a change would be necessary to allow unidirectional operation. However, would it not be preferable to allow transmission of OAM frames embedded in far end fault indications (like the 10G proposal for OAM frames embedded in RF)? Far end fault looks like a fast-acting way of informing the transmitting station of a new fault and may be useful in protection switching.

Figure 66–2—Far-End Fault Generate state diagram

66.2 Modifications to the physical coding sublayer (PCS), type 1000BASE-X

66.2.1 Overview

This subclause specifies changes to the 1000BASE-X PCS for unidirectional transport~~support of subscriber access networks~~. These are changes to the ~~existing~~ 1000BASE-X PCS ~~for legacy ethernet as~~ described in Clause 36. They are optional for P2P 1000BASE-X PHYs, mandatory for 1000BASE-PX-D and optional but to be used with caution for 1000BASE-PX-U.

66.2.2 Functional specifications

If unidirectional capable, t~~T~~he 1000BASE-X PCS ~~for subscriber access networks~~ shall conform to the requirements of the 1000BASE-X PCS specified in 36.2 with the following exception: The~~is~~ alternative 1000BASE-X PCS ~~for subscriber access net works~~ has the ability to transmit data from the GMII regardless of whether the PHY has determined that a valid link has been established~~the value of link_status~~. The following are the detailed changes to Clause 36 in order to support this additional ability.

Per D2.1 comment 483 about "value of link_status".

66.2.2.1 Variables

As D3.0

66.2.2.2 Transmit

As D3.0

66.2.2.3 Transmit state diagram

~~The~~ A unidirectional capable 1000BASE-X PCS ~~for subscriber access networks~~ shall implement the transmit process as depicted in Figure 36-5 and Figure 36-5, including compliance with the associated state variables as specified in 36.2.5.1 and as modified in 66.2.2.1.

66.3 Modifications to the reconciliation sublayer (RS) for 10 Gb/s operation

It's surprising that 10G is being altered; it isn't obviously part of "Ethernet for subscriber access". If we can't get a consensus on precisely what if any changes to make for 10G, we should abandon 66.3 altogether: there are no registers and no state diagrams lost by deleting 66.3.

66.3.1 Overview

This subclause specifies changes to the 10 Gb/s RS for unidirectional transport~~support of subscriber access networks~~. These are changes to the ~~existing~~ 10 Gb/s RS ~~for legacy ethernet as~~ described in Clause 46.

66.3.2 Functional specifications

If unidirectional capable, t~~T~~he 10 Gb/s RS ~~for subscriber access networks~~ shall conform to the requirements of the 10 Gb/s RS specified in Clause 46 with the following exception: The 10Gb/s RS for subscriber access networks has the ability to transmit data from the XGMII in spite of a defective or absent received signal~~regardless of the value of link_status~~. The following are the detailed changes to Clause 46 in order to support this additional ability.

66.3.2.1 Link fault signaling

The description of the link fault signaling functional specification is changed to include the contribution of the new mr_unidirectional_enable variable. The second paragraph of 46.3.4 is changed to read (~~strikethroughs~~ show deleted text and underscores show inserted text):

Sublayers within the PHY are capable of detecting faults that render a link unreliable for communication. Upon recognition of a fault condition a PHY sublayer indicates Local Fault status on the data path. When this Local Fault status reaches an RS, the RS tests the unidirectional_enable variable. If this variable is FALSE, the RS stops sending MAC data, and continuously generates a Remote Fault status on the transmit data path (possibly truncating a MAC frame being transmitted). If this variable is TRUE, the RS continues to allow the transmission of MAC data but replaces IPG with a Remote Fault status. When Remote Fault status is received by an RS, the RS ~~tests the unidirectional_enable variable. If this variable is FALSE, the RS~~ stops sending MAC data, and continuously generates Idle control characters. ~~If this variable is TRUE, the RS continues to allow the transmission of MAC data.~~ When the RS no longer receives fault status messages, it returns to normal operation, sending MAC data.

I can see the very small benefit of a station transmitting frames when it isn't receiving. But when the far station is telling it, loud and clear, that it can't hear it, there's no point and the near station should stop kidding itself. Such a thing was forbidden in 2003 and I haven't heard a reason why it should be desirable in 2004.

66.3.2.2 Variables

As D3.0

66.3.2.3 State Diagram

The description of what the RS outputs onto TXC<3:0>and TXD<31:0> is changed to include the contribution of the new mr_unidirectional_enable variable. The lettered list of 46.3.4.3 is changed to read (~~strikethroughs~~ show deleted text and underscores show inserted text):

a) link_fault = OK

The RS shall send MAC frames as requested through the PLS service interface. In the absence of MAC frames, the RS shall generate Idle control characters.

b) link_fault = Local Fault

If unidirectional_enable=FALSE, t~~T~~he RS shall continuously generate Remote Fault Sequence ordered_sets.

If unidirectional_enable=TRUE, the RS shall send MAC frames as requested through the PLS service interface. After a MAC frame and before transition to generation of Remote Fault Sequence the RS shall ensure a column of idles has been sent. In the absence of MAC frames, the RS shall generate Remote Fault Sequence ordered_sets.

c) link_fault = Remote Fault

If unidirectional_enable=FALSE, t~~T~~he RS shall continuously generate Idle control characters.

~~If unidirectional_enable=TRUE, the RS shall send MAC frames as requested through the PLS service interface. In the absence of MAC frames, the RS shall generate Idle control characters.~~

66.4 Protocol Implementation Conformance Statement (PICS) proforma for Clause 66, Extensions of the 10 Gb/s Reconciliation Sublayer (RS), 100BASE-X PHY, and 1000BASE-X Physical Coding Sublayer (PCS) for Operations, Administration, and Management (OAM)

66.4.1 Introduction

As D3.0

66.4.2 Identification

66.4.2.1 Implementation identification

As D3.0

66.4.2.2 Protocol summary

Identification of protocol standard ***Font size to right ->***	IEEE Std 802.3ah-200x, Extensions of the 10 Gb/s Reconciliation Sublayer (RS), 100BASE-X PHY, and 1000BASE-X Physical Coding Sublayer (PCS) for Operations, Administration, and Management (OAM)

66.4.3 Major capabilities/options

Item	Feature	Subclause	Value/Comment	Status	Support
*OLT	1000BASE-PX-D	66.2.1	PCS is part of a 1000BASE-PX-D s	O	Yes [ ] No [ ]
*HUN	100BASE-X unidirectional fFunctionality	66.1	100BASE-X PHY ~~Device support~~has additional functionality ~~required for 100BASE-X PHY for subscriber access networks~~	O	Yes [ ] No [ ]
*GIG	1000BASE-X unidirectional fFunctionality	66.2	1000BASE-X PCS ~~Device support~~has additional functionality ~~required for 1000BASE-X PCS for subscriber access net-works~~	O OLT:M	Yes [ ] No [ ] N/A [ ]
*XG	10Gb/s unidirectional fFunctionality	66.3	10Gb/s RS ~~Device support~~has additional functionality ~~required for 10Gb/s RS for subscriber access networks~~	O	Yes [ ] No [ ]

66.4.4 PICS proforma tables for Extensions of the 10Gb/s Reconciliation Sublayer (RS), 100BASE-X PHY, and 1000BASE-X Physical Coding Sublayer (PCS) for Operations, Admin-istration, and Management (OAM)

66.4.4.1 Extensions of the 100BASE-X PHY

As D3.0

66.4.4.2 Extensions of the 1000BASE-X PCS

As D3.0

66.4.4.3 Extensions of the 10 Gb/s RS

Item	Feature	Subclause	Value/Comment	Status	Support
LF1	Integrates 10 Gb/s RS	66.3.2	See Clause 46	XG:M	Yes [ ]
LF2	link_fault = OK and MAC frames	66.3.2.3	RS services MAC frame transmission requests	XG:M	Yes [ ] No [ ]
LF3	link_fault = OK and no MAC frames	66.3.2.3	In absence of MAC frames, RS transmits Idle control characters	XG:M	Yes [ ] No [ ]
LF4	link_fault = Local Fault and unidirectional_enable = FALSE	66.3.2.3	RS transmits continuous Remote Fault Sequence ordered_sets	XG:M	Yes [ ] No[ ]

LF5	link_fault = Local Fault and unidirectional_enable = TRUE and MAC frames	66.3.2.3	RS services MAC frame trans-mission requests	XG:M	Yes [ ] No[ ]
LF6	link_fault = Local Fault and unidirectional_enable = TRUE and MAC frame ends	66.3.2.3	RS transmits one full column of IDLE after frame	XG:M	Yes [ ] No[ ]
LF7	link_fault = Local Fault and unidirectional_enable = TRUE and no MAC frames	66.3.2.3	RS transmits continuous Remote Fault Sequence ordered_sets	XG:M	Yes [ ] No[ ]
LF8	link_fault = Remote Fault ~~and unidirectional_enable = FALSE~~	66.3.2.3	RS transmits continuous Idle control characters	XG:M	Yes [ ] No [ ]
~~LF9~~	~~link_fault = Remote Fault and unidirectional_enable = TRUE and MAC frames~~	~~66.3.2.3~~	~~RS services MAC frame trans-mission requests~~	~~XG:M~~	~~Yes [ ]~~ ~~No [ ]~~
~~LF10~~	~~link_fault = Remote Fault and unidirectional_enable = TRUE and no MAC frames~~	~~66.3.2.3~~	~~RS transmits continuous Idle control characters~~	~~XG:M~~	~~Yes [ ]~~ ~~No[ ]~~