8802-3/802.3 REVISION REQUEST 1255

DATE: 5th Feb, 2014
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REQUESTED REVISION:
STANDARD: 802.3-2012
CLAUSE NUMBER: 67
CLAUSE TITLE: System considerations for Ethernet subscriber access networks

PROPOSED REVISION TEXT:
Changes are needed in Table 67-1: add references to PX30, PX40, as well as all PRX and PR PHYs added under 802.3av and 802.3bk projects; and in subclause 67.6.1, discussing unidirectional operation, which seems to be specified right now for 1G-EPON only. See "Clause 67 updates.FM" for detailed changes.

RATIONALE FOR REVISION: Clause 67 has not been really updated after the end of 802.3av and 802.3bk projects. It contains information on 802.3ah EPON (PX10, PX20) but does not mention any higher speed systems.

IMPACT ON EXISTING NETWORKS: None, Clause 67 is just an overview of EFM systems.

Please attach supporting material, if any
Submit to:- David Law, Chair IEEE 802.3
and copy:- Adam Healey, Vice-Chair IEEE 802.3

At:- E-Mail: stds-802-3-maint-req@ieee.org

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For information about this Revision Request see -
http://www.ieee802.org/3/maint/requests/revision_history.html#REQ1255

67. System considerations for Ethernet subscriber access networks

67.1 Overview

This clause provides information on building Ethernet subscriber access networks, also referred to as "Ethernet in the First Mile" or EFM networks.

EFM encompasses a family of technologies that vary in media type and signaling speed. EFM is designed to be deployed in networks of one or multiple EFM media type(s) as well as interact with mixed 10/100/1000/10000 Mb/s Ethernet networks. Any network topology defined in IEEE Std 802.3 can be used within the subscriber premises and then connected to an Ethernet subscriber access network via an IEEE Std 802.1D compliant bridge, or a router.

Further, within a given EFM domain, the specific EFM technologies allow for a variety of topologies affording the subscriber access network maximum flexibility. For example, a 1000BASE-PX10 P2MP system with 16 ONUs can be built with a 1:16 splitter or as a tree-and-branch network utilizing more than one splitter.

The design of multiple-domain networks is governed by the rules defining each of the transmission systems incorporated into the design. The physical size of a network is limited by the characteristics of individual network components. These characteristics include the media lengths and type.

Table 67–1 summarizes the various EFM media characteristics.

67.2 Discussion and examples of EFM P2MP topologies

This subclause discusses EFM P2MP topologies. It details flexibility of trading off split ratio for link span. This subclause also shows some examples of different P2MP topologies.

67.2.1 Trade off between link span and split ratio

While the P2MP PMDs are nominally described in terms of a link span of either 10 km or 20 km with a 1:16 split ratio, other link spans and split ratios can be implemented provided that the requirements of Table 60–1 are met.

Table 67–1—Characteristics of the various EFM network media segments

Media type	Rate (Mb/s)	Number of PHYs per segment	Nominal reach (km)
Optical 100 Mb/s fiber segment (100BASE-LX10, 100BASE-BX10)	100	2	10
Optical 1000 Mb/s fiber segment (1000BASE-LX10, 1000BASE-BX10)	1000	2	10
Optical 1000 Mb/s P2MP segment (1000BASE-PX10)	1000[a]	17[b,c]	10
Optical 1000 Mb/s P2MP segment (1000BASE-PX20)		17[b,c]	20
Optical 1000 Mb/s P2MP segment (1000BASE-PX30)		33[b,c]	20
Optical 1000 Mb/s P2MP segment (1000BASE-PX40)		65[b,c]	20
Optical 10/1 Gb/s P2MP segment (10/1GBASE-PRX10)	10000 / 1000[d]	17[b,c]	10
Optical 10/1 Gb/s P2MP segment (10/1GBASE-PRX20)		17[b,c]	20
Optical 10/1 Gb/s P2MP segment (10/1GBASE-PRX30)		33[b,c]	20
Optical 10/1 Gb/s P2MP segment (10/1GBASE-PRX40)		65[b,c]	20
Optical 10 Gb/s P2MP segment (10GBASE-PR10)	10000[e]	17[b,c]	10
Optical 10 Gb/s P2MP segment (10GBASE-PR20)		17[b,c]	20
Optical 10 Gb/s P2MP segment (10/1GBASE-PR30)		33[b,c]	20
Optical 10 Gb/s P2MP segment (10GBASE-PR40)		65[b,c]	20
Copper high-speed segment (10PASS-TS)	10[f]	2	0.75
Copper long reach segment (2BASE-TL)	2[c]	2	2.7

[a]1000 Mb/s in downstream direction, 1000 Mb/s in upstream direction.

[b]P2MP segments may be implemented with a trade off between link span and split ratio listed. Refer to 67.2.1.

[c]The number of PHYs in the P2MP segment includes the OLT PHY.

[d]10000 Mb/s in downstream direction, 1000 Mb/s in upstream direction (asymmetric data rate in 10/1G-EPON).

[e]10000 Mb/s in downstream direction, 10000 Mb/s in upstream direction (symmetric data rate in 10/10G-EPON).

[f]Nominal rate stated at the nominal reach in this table. Rate and reach can vary depending on the plant. For 2BASE-TL please refer to Annex 63B for more information. For 10PASS-TS, please refer to Annex 62A for more information.

67.2.2 Single splitter topology

A P2MP topology implemented with a single optical splitter is shown in Figure 67–1.

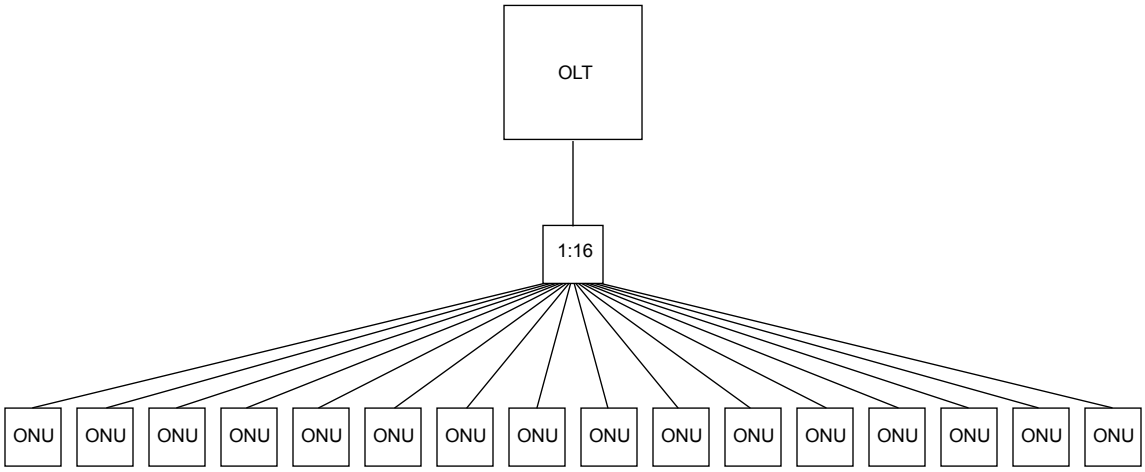


Figure 67–1—Single splitter topology

67.2.3 Tree-and-branch topology

A P2MP topology implemented with a tree-and-branches of optical splitters is shown in Figure 67–2.

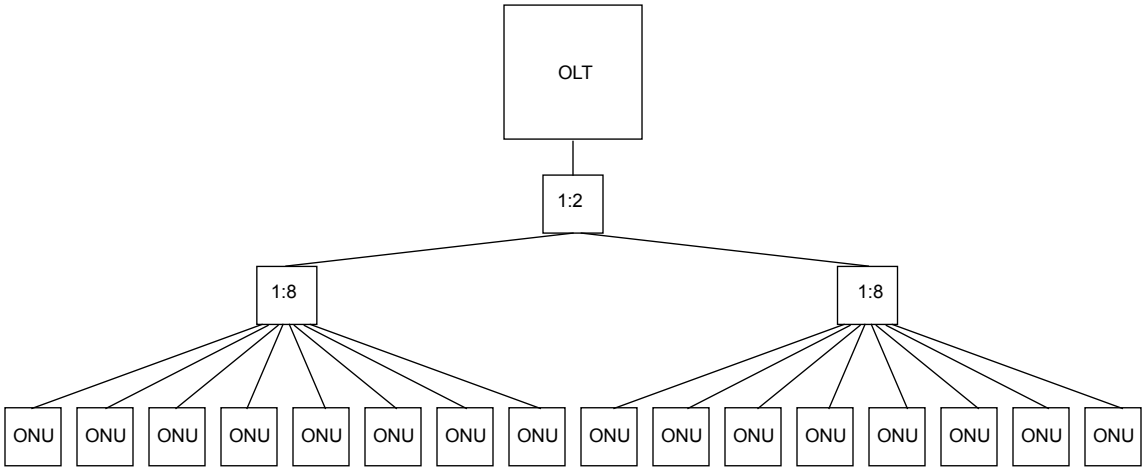


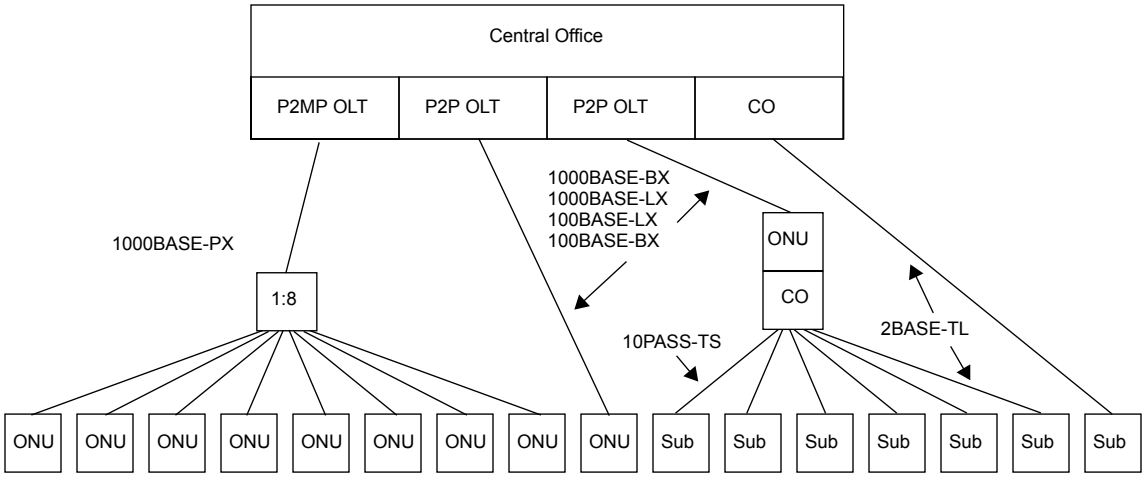
Figure 67–2—Tree-and-branch topology

67.2.4 Interoperability between certain 1000BASE-PX10 and 1000BASE-PX20

1000BASE-PX20-D PMD is interoperable with a 1000BASE-PX10-U PMD, this allows certain upgrade possibilities from 10 km to 20 km P2MP networks.

67.3 Hybrid media topologies

Hybrid media topologies, such as those shown in Figure 67–3, can be implemented using a combination of P2P or P2MP optical links and copper links.



CO = central office
ONU = optical network unit
Sub = subscriber premise equipment
OLT = optical line terminal

Figure 67–3—Hybrid media topologies

67.4 Topology limitations

The physical size of EFM networks is not limited by the round-trip collision propagation delay. Instead, the maximum link length between DTEs is limited by the signal transmission characteristics of the specific link.

67.5 Deployment restrictions for subscriber access copper

10PASS-TS and 2BASE-TL PHYs have been specified to allow deployment on public access networks. Non-loaded cable is a requirement of the signaling methods employed. The 10PASS-TS do not preclude coexistence with POTS. However, it is important that systems are designed and configured to comply with all appropriate regulatory, governmental and regional requirements. Refer to Annex 62A (10PASS-TS) and Annex 63A (2PASS-TL) for further information regarding configuration profiles.

67.6 Operations, Administration, and Maintenance

All P2P and emulated P2P links, including all of the EFM network media segments, support the optional OAM sublayer as defined in Clause 57. 2BASE-TL and 10PASS-TS PHYs do not support unidirectional links as defined in 57.2.6 (see 61.1).

67.6.1 Unidirectional links

Some Physical Layer devices have the optional ability to encode and transmit data while one direction of the link is non-operational.

This ability should be used only when the OAM sublayer is present and enabled or for a 1000BASE-PX-D, 10/1GBASE-PRX, or 10GBASE-PR PHY. Otherwise, MAC Client frames will be sent across a unidirectional link potentially causing havoc with bridge and other higher layer protocols. The feature should not be enabled for 1000BASE-PX-U, 10/1GBASE-PRX-U, or 10GBASE-PR-U PHYs in service, to avoid simultaneous transmission by more than one ONU.

67.6.2 Active and Passive modes

A device may be configured to be in either Active or Passive OAM mode. At least one end of a given link is required to be in Active mode.

In an access network, customer premises devices will commonly be configured as Passive devices. All other devices in an access network will commonly be configured as Active devices. For a detailed description of Active and Passive mode, refer to 57.2.6.

67.6.3 Link status signaling in P2MP networks

In P2MP networks the local_link_status parameter should reflect the status of a logical link associated with the underlying instance of Multipoint MAC Control. This is achieved by mapping the local_link_status parameter to variable 'registered' defined in 64.3.3.2 for 1 Gb/s P2MP links and in 77.3.3.2 for 10 Gb/s links as follows:

local_link_status = OK if registered = true

local_link_status = FAIL if registered = false