

# Objective format for the 400G project

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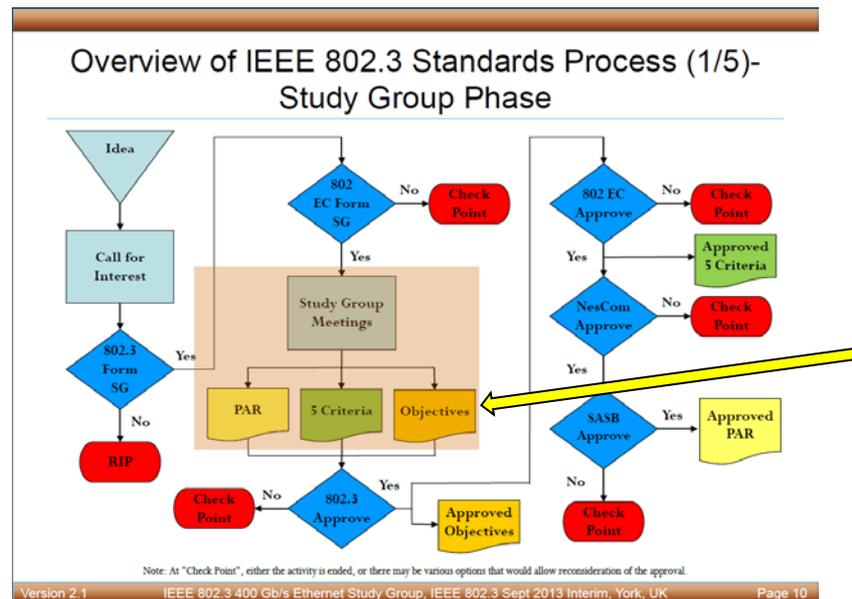
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# Introduction

One of the key outputs of the *400 Gb/s Ethernet* Study Group is the set of objectives.

There has been and will probably continue to be a great deal of discussion on what the BER objective and the reach objectives should be in terms of what the appropriate numbers should be.

This contribution discusses what the **format** of possible objectives should be in order that once a suitable set of numbers is adopted, we don't have further delay in reaching consensus on the exact wording of the objectives.



# Adopted objectives

The following objectives have been adopted by the Study Group:

- Support a MAC data rate of 400 Gb/s
- Support full-duplex operation only
- Preserve the Ethernet frame format utilizing the Ethernet MAC
- Preserve minimum and maximum FrameSize of current Ethernet standard
- Provide appropriate support for OTN
- Specify optional Energy Efficient Ethernet (EEE) capability for 400Gb/s PHYs
- Support optional 400Gb/s Attachment Unit Interfaces for chip-to-chip and chip-to-module applications

# Error performance objective

Previous presentations: [anslow 01 0613 logic](#), [anslow 01 0813 logic](#), [anslow 400 01 0913](#), [anslow 01 1013 logic](#) have discussed not only the value of the BER objective, but also the format it should use.

The most recent of these proposed that the Study Group should adopt a single objective to cover PMDs that use FEC and those that don't. In discussion during and after the Ad Hoc call three variants of the wording have been proposed:

- a) Support a BER of better than or equal to  $10^{-x}$  at the MAC/PLS service interface (or the frame loss ratio equivalent of better than  $6.2 \times 10^{-y}$  for 64-octet frames)
- b) Support a BER of better than or equal to  $10^{-x}$  at the MAC/PLS service interface (or the frame loss ratio equivalent)
- c) Support a BER of better than or equal to  $10^{-x}$  (or equivalent) at the MAC/PLS service interface

While option a) is longer than the objectives adopted so far, it has the merit that it is explicit in defining the FLR objective for FEC enabled PMDs.

Option c) is much shorter, but is open to misinterpretation – strictly the BER and FLR are not equivalent and FLR isn't at the MAC/PLS service interface

Option b) is still fairly short, but leaves the exact FLR value to be debated.

# Previous PMD objectives

P802.3ae (10Gb/s Ethernet) used:

Provide Physical Layer specifications which support link distances of:

- At least X m over MMF
- At least Y km over SMF

P802.3ba (40Gb/s and 100Gb/s Ethernet) used:

Provide Physical Layer specifications which support X Gb/s operation over:

- at least Y km on SMF
- at least Z m on OM3 MMF

P802.3bm had:

Define a 40 Gb/s PHY for operation over at least X km of SMF

Define a 100 Gb/s PHY for operation up to at least Y m of SMF

Define a 100 Gb/s PHY for operation up to at least Z m of MMF

# Discussion of SMF PMD objectives

As the maximum link attenuation is a key parameter in defining SMF PMDs with short reach distances, there has been some debate as to whether the SMF PMD objective(s) adopted by the 400 Gb/s Ethernet Study Group should include the max link attenuation.

Since the attenuation required by users for even very short reach SMF PMDs is about 3.5 dB to 4 dB, it is not very practical to change the objective for these reaches to be attenuation only, as 4 dB would allow a possible SMF reach of up to 14 km. This means that the Study Group has a choice between the traditional reach-only objective format or defining a new format which includes both reach and attenuation.

In the past, the PMD objectives have tended to be the last objectives to be adopted by the various “next rate” study groups and have required a great deal of analysis of possible implementations to be able to reach consensus on what reaches to propose for the various media. Adding a need to define the minimum attenuation that must be accommodated in addition to this seems likely to add to the burden on the Study Group to endlessly discuss possible implementations while not being in a position to make any firm decisions.

# Proposal

For the error performance objective, the Study group should choose between the alternatives of:

- a) Support a BER of better than or equal to  $10^{-x}$  at the MAC/PLS service interface (or the frame loss ratio equivalent of better than  $6.2 \times 10^{-y}$  for 64-octet frames)
- b) Support a BER of better than or equal to  $10^{-x}$  at the MAC/PLS service interface (or the frame loss ratio equivalent)
- c) Support a BER of better than or equal to  $10^{-x}$  (or equivalent) at the MAC/PLS service interface

For the optical PMD objective(s), the Study group should re-use the traditional format of:

Provide Physical Layer specifications which support link distances of:

- At least Y km over SMF
- At least X m over MMF [ Need discussion on whether to specify OMx or not]

Thanks!