
Requirements for 10Gb/s EPON

Akihiro OTAKA, NTT
Tsutomu TATSUTA, NTT
Ching-Sheu Wang, Chunghwa Telecom

Outline

This presentation includes 5 requirements for 10Gb/s EPON.

- (1) Bidirectional 10Gb/s
- (2) Compatible fiber plant with 1G EPON
- (3) Migration from 1G EPON
- (4) Cost
- (5) Bandwidth efficiency
- (6) Security

Bidirectional 10 Gb/s

Support of bidirectional 10 Gb/s is necessary.

- 1G upstream / 10G downstream is good for short-term use, such as video distribution, but it is a temporal solution. (1G EPON with RF overlay or multicast transmission may provide video distribution.)
- In the future, new usage will require upstream bandwidth.
 - High Definition TV telephone
 - Large volume of data transfer such as P2P
 - etc.
- 1G Up/10G Down EPON is not suitable for high split ratio use such as 64 split, because the upstream bandwidth decreases from the present 1G EPON with 32 split.
- 10G EPON should be used as 10x point-to-point 1G Media Converter systems for business and MDU market.
- 10G Up/Down EPON is mandatory.
- If 1G Up/10G Down EPON also becomes a target, 1G Up/10G Down EPON must be compatible with 10G Up/Down EPON to avoid frequent upgrade of PON system.

Compatible fiber plant with 1G EPON

Fiber plant which is constructed for 1G EPON, must be used for 10G EPON.

10Gb/s market will increase after deploying large amount of 1G EPON. Therefore, the fiber plant constructed for 1G EPON has to be used for 10G EPON. Reconstructing fiber plant for 10G EPON is unacceptable.

- G.652 SMF
- Class C power budget without FEC (30 dB and penalty < 1 dB, or 29 dB without penalty)
- Support of FEC (FEC activate/deactivate should be selectable.)
- 20km reach
- More than 32 split ratio

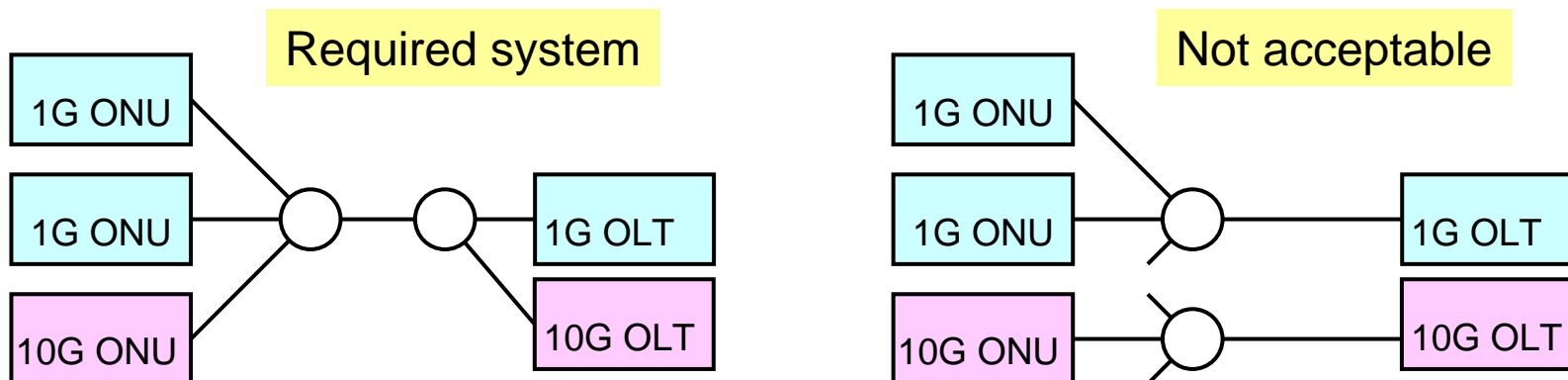
***PX10 and PX20 are insufficient to deploy as the FTTH system.**

Migration from 1G EPON

(1) 10G EPON must avoid to interfere with existing 1G EPON in a same fiber.

(2) Optical overlay of RF video must be also supported.

- 10G market will increase after deploying large amount of 1G EPON.
- Since upgrade of a PON system causes a lot of issues to network operator (compared to that of P2P system), migration mechanism is necessary for wide and easy installation of 10G EPON. **10G EPON and 1G EPON must be able to coexist in a same fiber.**
- If the 10G and 1G EPON can not coexist in a same fiber,
 - A carrier have to install another fiber and splitter for 10G EPON and the advantage of PON is damaged.
 - 10G EPON might be limited to a green field or special users, and its market will become small.



Cost

The cost of the 10G EPON system should be as same as that of 1G EPON system

- Cost means system cost. Not cost per bit rate.
 - In our experience of upgrading ADSL and BPON to 1G EPON, we had deployed the new system with keeping the service price.
 - If the cost of 10G EPON is higher than that of previous system, the service will be limited to heavy users, and major contents providers will keep creating contents for massive 1G users.
- = 10G EPON market will not increase unless the cost of 10G EPON system is as same as that of 1G EPON
- Economic feasibility should be discussed how to realize system cost of 10G EPON equal or less than that of previous installed 1G EPON.

Bandwidth efficiency

Bandwidth efficiency should be at least equal to 1G EPON.

- An objective of bandwidth efficiency is necessary to decide upstream frame structure including timing parameter.
- 1G EPON has already exist, so its bandwidth efficiency must be referred.

Security

IEEE802.1AE/af has responsibility for MAC security in EPON, however IEEE802.1AE/af has the following problems;

- MAC addresses are not encrypted.
 - MAC address of user equipment (i.e. PC) can be snooped.
- Control Message (MPCP) is not encrypted.
 - Bandwidth of the other ONUs can be counted by snooping GATE frames.
- Ethernet frame size becomes bigger.
 - At least 1%-20% of the bandwidth becomes wasted.
- IEEE802.1af has not finished yet.

Should 10G-EPON use IEEE802.1AE/af?

Summary

- The following items must be described in Objectives.

- (1) **Support of bidirectional 10Gb/s**

- Also 1G Up/10G Down EPON and 10G Up/Down EPON must be compatible.

- (2) **Compatible fiber plant with 1G EPON**

- support of SMF, class C without FEC(29 dB without penalty for fiber plant), 20 km reach, more than 32 splitting ratio, and etc.

- (3) **Migration from 1G EPON**

- support of coexistence with existing 1G EPON in a same fiber.

- (4) **Same or better bandwidth efficiency as 1G EPON**

- Technical Feasibility and Economic Feasibility to realize 10G EPON with same cost as 1G EPON must be described in PAR & 5-Criteria.
- Security should be discussed in the study group.