Hybrid LPI and subset PHY approach

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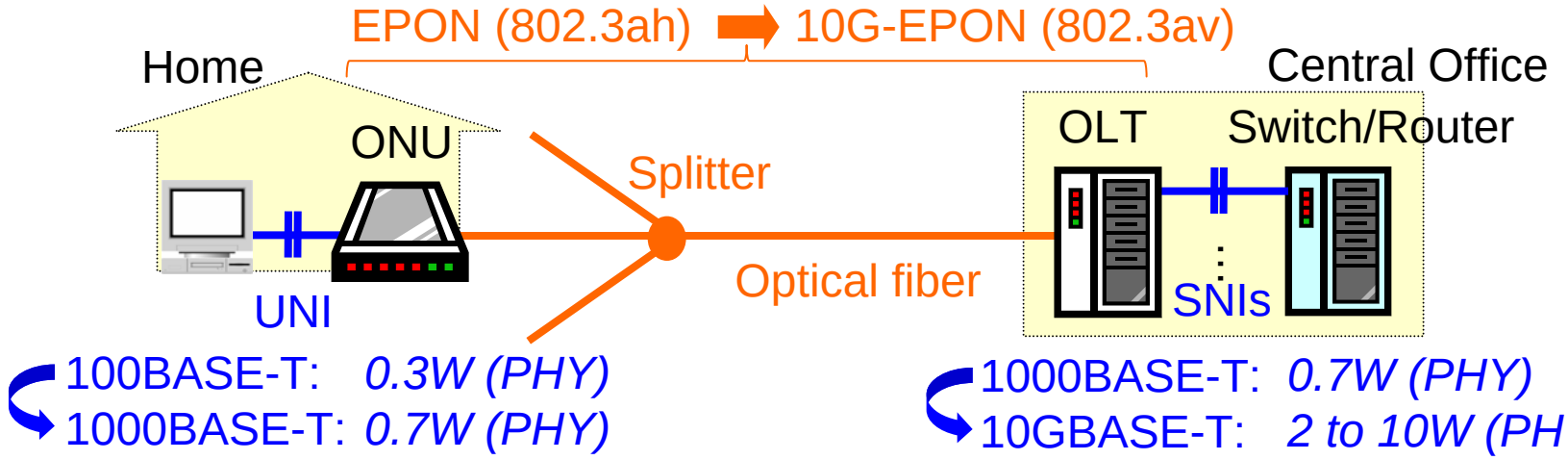
Introduction

- Low Power Idle (LPI) approach has been selected as the baseline for the Energy-Efficient Ethernet specification: it will greatly reduce power consumption when no data frame is transmitted/received in the Ethernet interfaces.
- While LPI is a very effective function, optical access networks need an option that allows a low-speed communication with reduced power.
- To address this, we propose to specify a function to allow the use of subset-PHY option in addition to LPI in 1000BASE-T and 10GBASE-T.

Necessity of EEE in optical access networks

- It is estimated that 60 to 80 percent of power consumption in the future telecommunication network belongs to Optical Access Networks (OANs) because of the high volume.
- In the next generation, PON will evolve from 1G to 10G. Typical User Network Interface (UNI) and Service Node Interface (SNI) will become 1G and 10G, respectively.
- Then, UNI/SNI power saving should be carried out as much as possible.
  - PON power saving is also important but out of scope of this document.

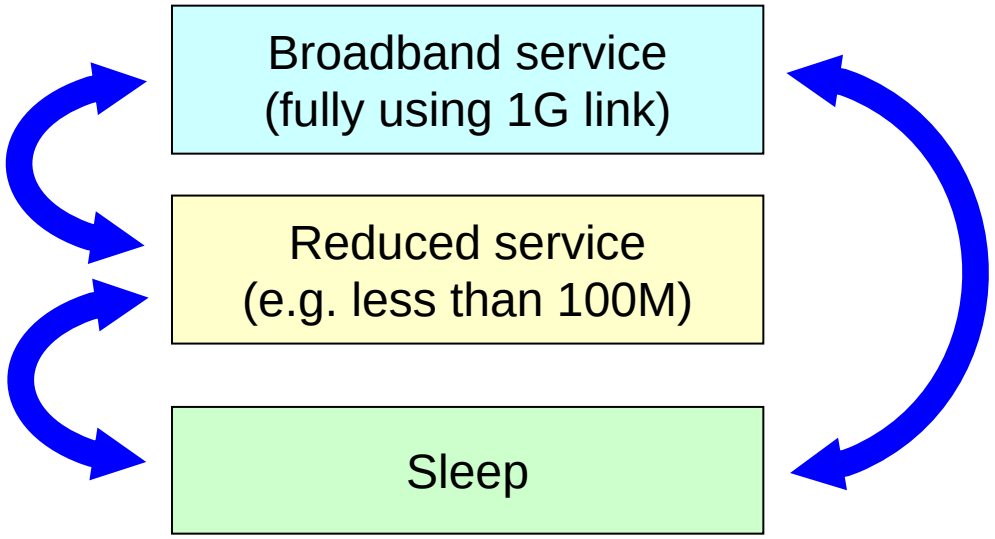
Typical Optical Access Network



Source of PHY-power consumption: http://www.ieee802.org/3/az/public/jan08/dove_01_0108.pdf

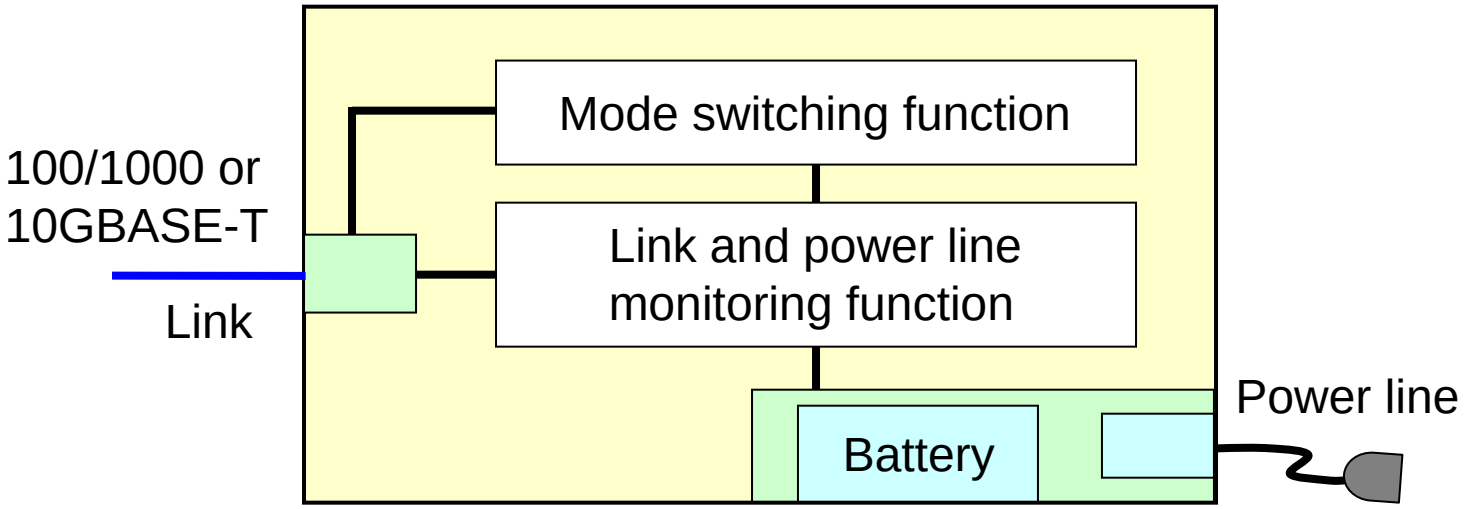
Requirements from access-service viewpoint

- Low Power Idle is a very effective function also in the access network.
- However, one of the important assumptions unique in the access network is to keep “reduced service” mode (e.g. “voice-only” mode) as long as possible, e.g. for the case that electric outage occurs and battery backup becomes effective.



Hybrid LPI and subset PHY approach

- LPI provides two modes: the normal mode and the low-power idle mode.
- We propose to add the third mode: low-speed mode through the subset PHY approach.
- For example, the monitoring function detects data traffic and electric outage, then the mode switching function selects “reduced service” mode or “sleep” mode properly.



Source of subset PHY approach: http://www.ieee802.org/3/az/public/jan08/powell_01_0108.pdf

Auto negotiation

- The Auto-Negotiation function needs to be extended to advertise EEE-capabilities. Unformatted Pages exchanged in the Auto-Negotiation process can be utilized for EEE negotiation.
  - LPI support or not
    - 10GBASE-T LPI support (0 = no, 1 = yes)
    - 1000BASE-T LPI support (0 = no, 1 = yes)
    - etc.
  - Subset-PHY support or not (in addition to LPI support)
    - 10GBASE-T subset-PHY support (0 = no, 1 = yes)
    - 1000BASE-T subset-PHY support (0 = no, 1 = yes)
    - etc.

Source of capabilities negotiation: http://www.ieee802.org/3/az/public/may08/hays_02_0508.pdf

Proposal

- To address the requirement from the access-service viewpoint, we propose to specify a function to allow the use of subset-PHY option in addition to LPI in 1000BASE-T and 10GBASE-T in EEE.

Backup

Another requirement

- When some streams, e.g. multicast video streams, exist in the link over a long time, LPI may not work.
- The long-time streams do not always require high-rate links.
- In this case, the high-rate links between switches (10GBASE-T) should be changed to the low-rate links (1000BASE-T) depending on data rate.