Applicability of EEE to fiber PHYs

IEEE 802.3 EEE meeting
September 2007
Seoul, Korea

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Background

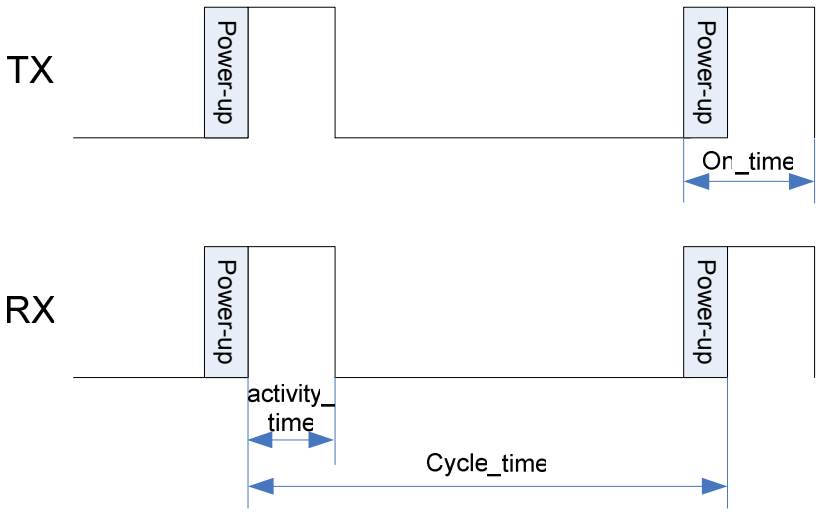
- EEE group focus has been on reducing power consumption of copper PHYs
- Transitioning to lower-speed PHYs is generally not feasible for optical components.
- *However, pausing the traffic (similar to what's been called "0bT") is feasible and desirable for fiber PHYs.*
- We suggest considering power consumption reduction for fiber PHYs:
  - 1000Base-LX
  - 1000Base-SX
  - 1000Base-PX
  - 10GBase-R

Target markets

- Main target market is optical access
  - EPON and P2P, as were defined by 802.3ah, and the potential outcome of 802.3av
  - Strong desire of service providers to decrease power consumption
- Other market can benefit as well
  - “Fiber to surpass copper in the structured cabling systems market by 2008” – FTM Consulting's study

What can be done?

- TX & RX can be turned off
- Power-off function eliminates the power consumption from the optical transceiver, SERDES, and MAC
- The saving is $\frac{on\_time}{cycle\_time}$



No technical feasibility questions

- No need to develop new PHYs
- Just power gate the existing optics and SERDES
  - For example using FET
- We can call this *"zero-base-R"*

Reactivation from low-power mode

- Optics TX & RX should be powered-on sufficient time in advance
  - The sleeping device is responsible to be ready on time

- Preparation period is composed of:
  Optics powering latency + clock recovery + compensating clock drift + symbol lock
  - Optics powering requires ~1mS
  - Max clock drift for 250mS activity cycle is 25uS
  - The values are pre-configured by system manufacture and are unknown to the other end

Transitioning to / from zero-base-R mode

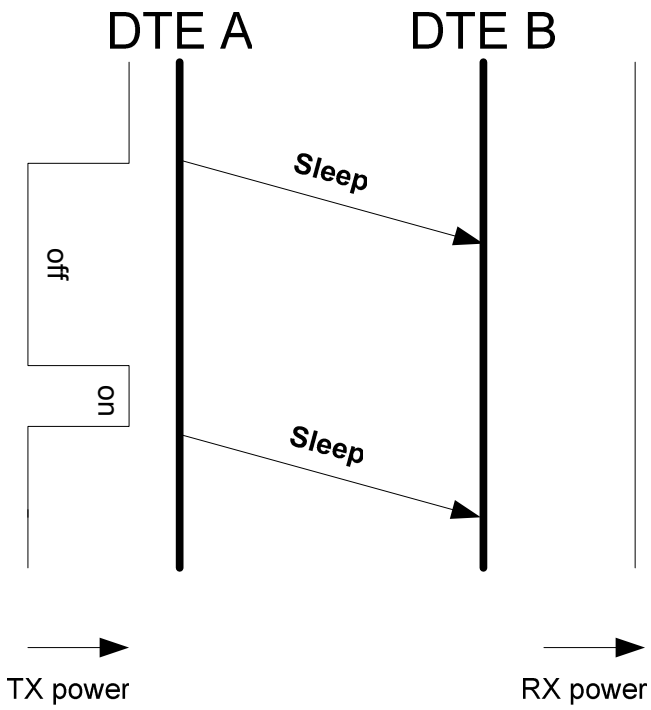
- Mechanism for transitioning a link to *zero-base-R* can fundamentally be the same as for other RPS (cf. http://grouper.ieee.org/groups/802/3/eee_study/public/may07/law_1_0507.pdf)
- However: using data reception for transitioning from *zero-base-R* to normal operation (ie. “wake on lan” or similar) is not desirable as it would it mean that a substantial number of receiver optical components must remain active during sleep.
- Instead: a predetermined sleep period should be specified in the initial transition messaging

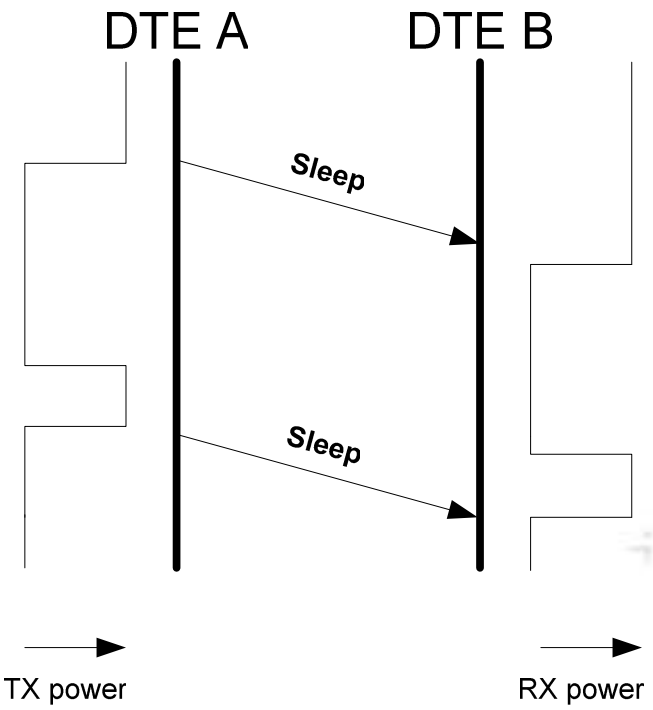
Suggested messaging scheme

- Initial message of the handshake:
  - "I'm going to turn off my transmitter (sleep) for the next N bits"
  - Practically "self pause"
- Receiver can do the following:
  - Turn off the receiver for the specified time
  - Send its own sleep message for an overlapping time
- Receiver must suppress alarms during the sleep time

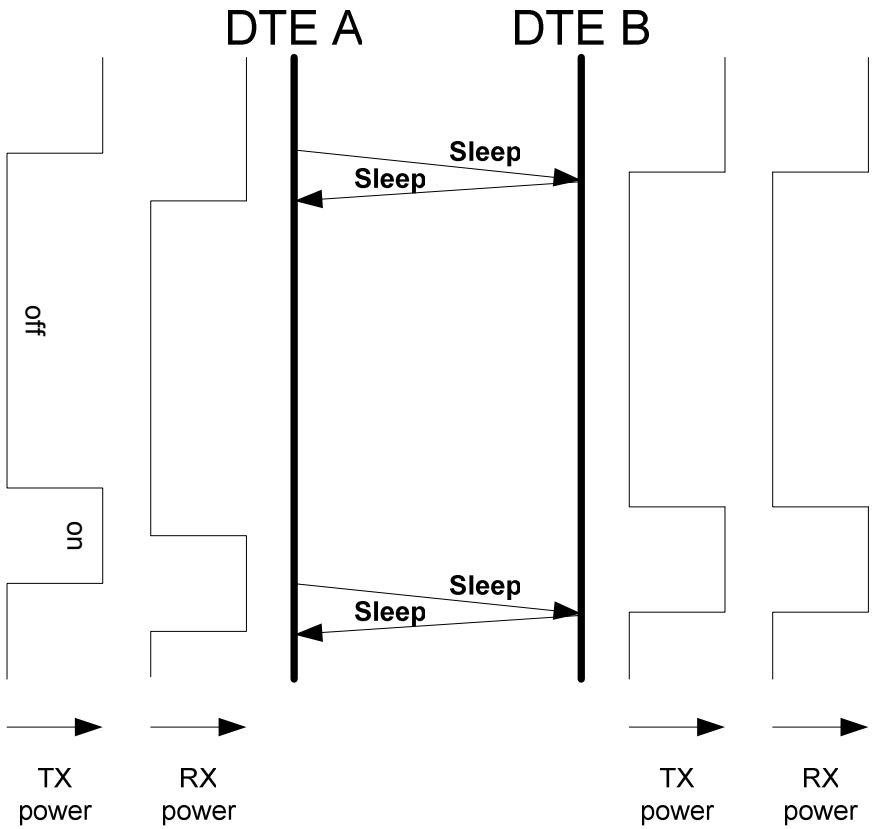
Sample asymmetric sequences

DTE A can turn off transmitter even if DTE B doesn't support gated RX operation





Sample symmetric sequence



Observation about the sleep protocol

- The sleep protocol seems to be capable of supporting Copper PHYs 0-BaseT operation
- It is preferred to use unified protocol for all PHYs

Summary

- We suggest that the TF consider extending the objectives of EEE to include fiber PHYs
  - No other changes needed to objectives
- A time-based activation protocol was presented:
  - Can be utilized also by Copper PHYs
  - Provides synchronized symmetric and asymmetric operation