Asymmetry in 802.3cy

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Agenda

- Need for asymmetrical mode of operation
- Review of EEE based asymmetry
- Improved asymmetrical mode in 802.3cy

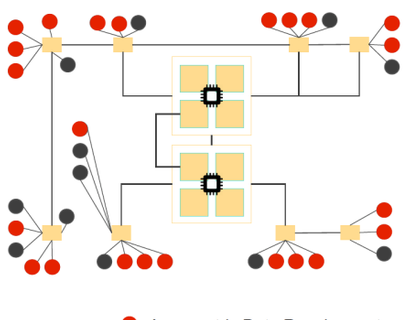
Asymmetrical operation – Clear need in Automotive Applications

Asymmetrical Operation

- Several OEMs and Tier1s have expressed a desire for “asymmetrical” operation of .3ch PHYs and are concerned about not having an explicit objective for this.
- Adopted objectives state the following –
  3. Support full duplex operation only
  7. Support optional Auto-Negotiation
  8. Support optional Energy Efficient Ethernet
- This presentation discusses two methods of combining #3 and #8 to achieve efficient Asymmetrical operation

https://www.ieee802.org/3/ch/public/sep17/dalmia_3ch_01_0917.pdf

Example Network Architecture



https://grouper.ieee.org/groups/802/3/B10GAUTO/public/jul19/mash_B10GAUTO_1_0719.pdf

Motivations and Requirements for Asymmetric Speeds

- Target use cases where one direction transmits high data rate while the other direction is very low data rate.
  - i.e. Cameras, Displays, Sensors
- Asymmetric mode should be power efficient
- Cannot change the Ethernet MAC layer
- Can touch the Reconciliation Sublayer
- Ideally no excess latency when there is traffic to send in the low data rate direction
- Ideally no side band signaling between the Reconciliation Sublayer and the PHY

https://www.ieee802.org/3/ch/public/jan19/Lo_3ch_01_0119.pdf

EEE based Asymmetry

- Proposed back in 2017

https://www.ieee802.org/3/ch/public/sep17/dalmia_3ch_01_0917.pdf

- Presumes echo-cancellation PHYs

- Provides reduction in power relative to normal symmetrical operation but does not reduce complexity of PHY

- Involves latency associated with “wake” time

- **Involves break in PHY transmission yet works with full duplex MACs….**

How does EEE work with “full duplex” MAC?

- EEE works with “full duplex” MAC by stopping the local MAC from temporarily transmitting while the local PHY is in Quiet mode or the remote PHY is in the process of being woken up
- EEE operation relies on LPI client & RS to prevent local MAC from transmitting by asserting CARRIER_STATUS parameter to CARRIER_ON in the PLS_CARRIER.indication primitive of the PLS service interface

  Refer to 78.1.3.1 RS LPI assert function

78.1.1 LPI Signaling

LPI signaling allows the LPI Client to indicate to the PHY, and to the link partner, that a break in the data stream is expected, and the LPI Client can use this information to enter power-saving modes that require additional time to resume normal operation. LPI signaling also informs the LPI Client when the link partner has sent such an indication.

The definition of LPI signaling assumes the use of the MAC defined in Annex 4A for simplified full duplex operation (with carrier sense deferral). This provides full duplex operation but uses the carrier sense signal to defer transmission when the PHY is in the LPI mode.

CARRIER_ON = Local MAC can’t transmit

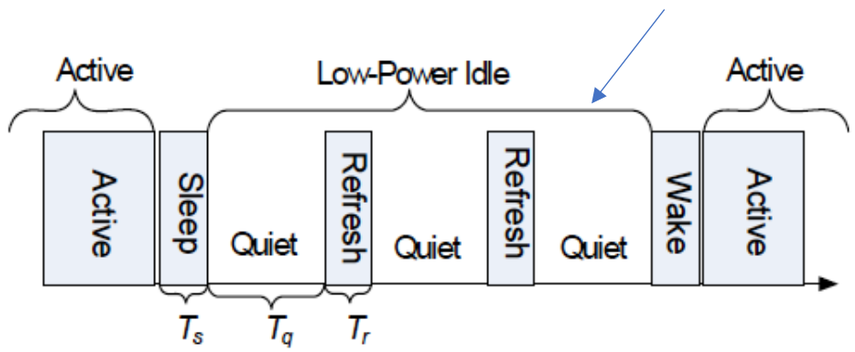
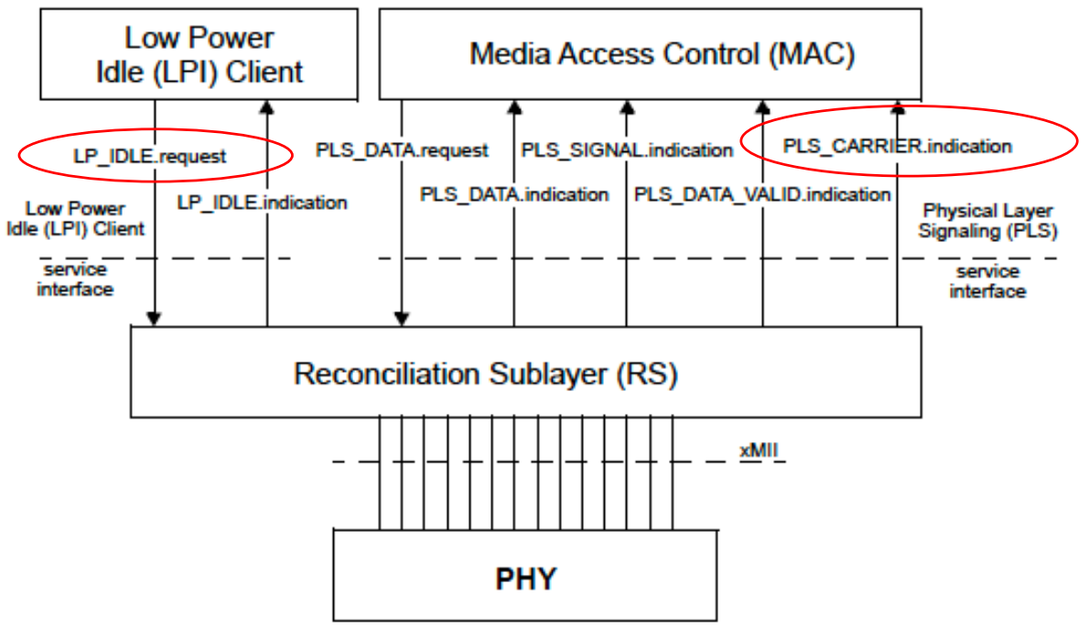


Figure 78–3—Overview of EEE LPI operation

How does EEE work with “full duplex” MAC?



78.1.3.1 RS LPI assert function

In the absence of an LPI request, indicated by the LPI_REQUEST parameter set to DEASSERT in the LP_IDLE.request primitive of the LPI Client interface, the LPI assert function maps the PLS service interface to the transmit xMII signals as under normal conditions.

When an LPI request is asserted, indicated by the LPI_REQUEST parameter set to ASSERT in the LP_IDLE.request primitive of the LPI Client interface, the LPI assert function starts to transmit the “Assert LPI” encoding on the xMII. The LPI assert function also sets the CARRIER_STATUS parameter to CARRIER_ON in the PLS_CARRIER.indication primitive of the PLS service interface. This will prevent the MAC from transmitting.

How do we improve upon EEE based asymmetry?

- Use a mechanism that avoids echo-cancellation!
- Restrict local MAC & PHY from transmitting signals on the line when the far side PHY & MAC are transmitting signals
- Leverage EEE concepts of CARRIER_ON/OFF to work with ‘full duplex’ MAC
- If the two PHYs do not transmit at the same time, the resulting system will have significantly reduced complexity and power consumption

Thank You