Idle Request During LPI Using OAM

IEEE 802.3bp - Interim Meeting - January 2015

William Lo, Marvell

Ability to Retrain

- **Fast Retrain not defined in 1000BASE-T1**
  - Not compatible with 1G MAC – No definition of Link Interruption over GMII
  - LPI is asymmetric in 1000BASE-T1 – no way to indicate Link Interruption to MAC via GMII while traffic is being received on GMII
  - Don't really need fast retrain anyway, signal should be robust – fast retrain only done in 10GBASE-T
- **However during low power idle (LPI) it may be beneficial to request the link partner to stop sending quiet/refresh and send normal idles if the local receiver is having difficulty**
  - Quiet/Refresh – Link partner sends signal 1.67% of the time
  - DSP most vulnerable to drift during LPI
  - A request for normal idles gives unhealthy DSP a chance to relock instead of dropping link
  - Request should be make before situation becomes critical

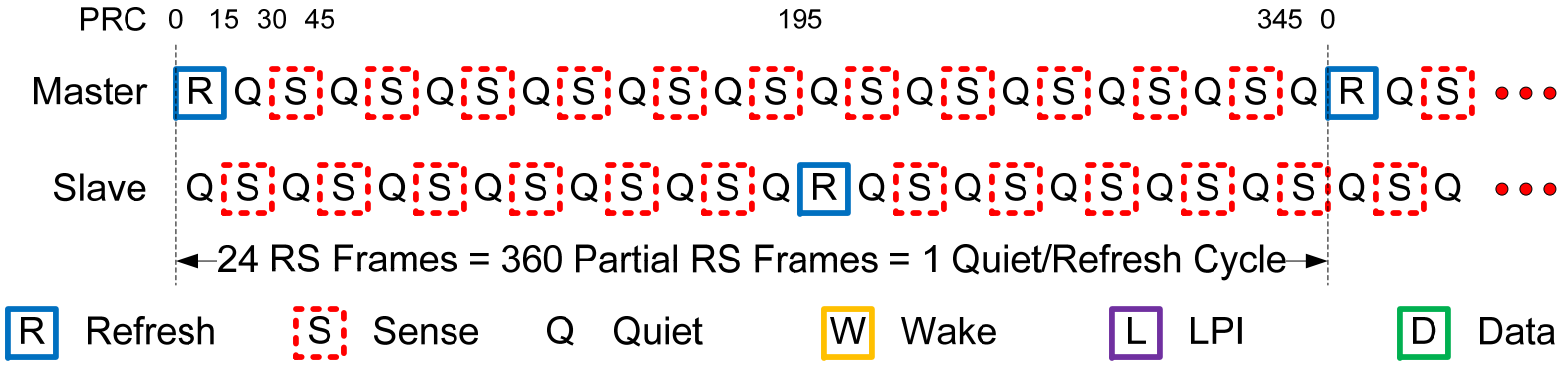
Use OAM Channel to Request Normal Idles

- OAM Frames are passed even during LPI
  - 1036.8 us per OAM frame (Lo_3bp_02_0115.pdf)
- PHY B transmit path in LPI, PHY A receive path in LPI
- PHY A uses its transmit OAM channel Health (SNR) bit to 01
  - 11 - SNR OK
  - 10 - SNR Marginal
  - 01 - Request link partner to exit LPI
  - 00 - Link is dying and will drop and re-link within 2 to 4ms
- PHY B sees PHY A SNR = 01 and its transmit path must exit LPI ASAP
- PHY B transmit path cannot enter LPI as long as it is receiving SNR = 01 from PHY A
- PHY B can re-enter LPI at its leisure once PHY A's SNR ≠ 01

MAC B	PHY A's SNR	PHY B's Transmit Path
Normal	Don't Care	Normal Traffic
LPI	Not 01	LPI / Quiet-Refresh
LPI	01	Normal Idles

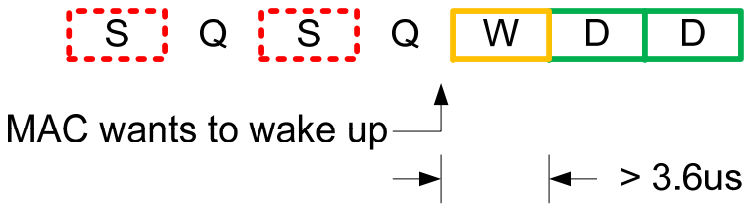
Review – LPI quiet, refresh, wake

- **Exit LPI must be under 16.5us**
  - **Lo_3bp_03_0714.pdf page 16 (note we need to baseline a number)**
  - **Can only start exit process during a sense window (Lo_3bp_02a_1114.pdf)**
  - **Link partner can send wake only during PHY's sense window**
  - **Only one RS frame of idles needed for wake**
  - **Each square below is 3.6us and aligns exactly to Reed Solomon frame boundary**
  - **Analysis in following slides does not include implementation delay**

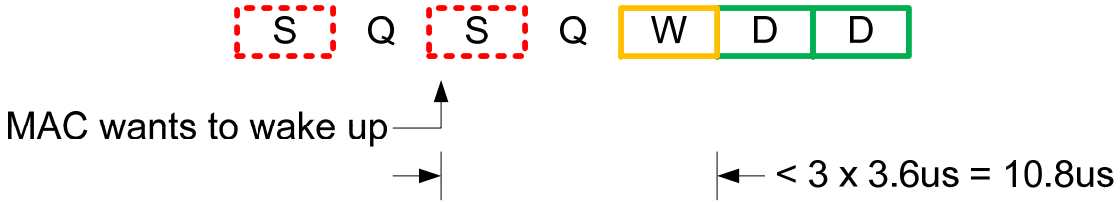


Background – Normal Wake Up Time

- **Best case – MAC wants to wake up just before sense window**

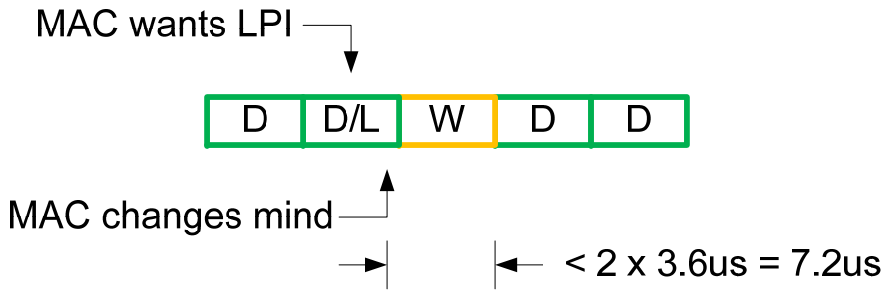


- **Worst case – MAC just misses sense window**

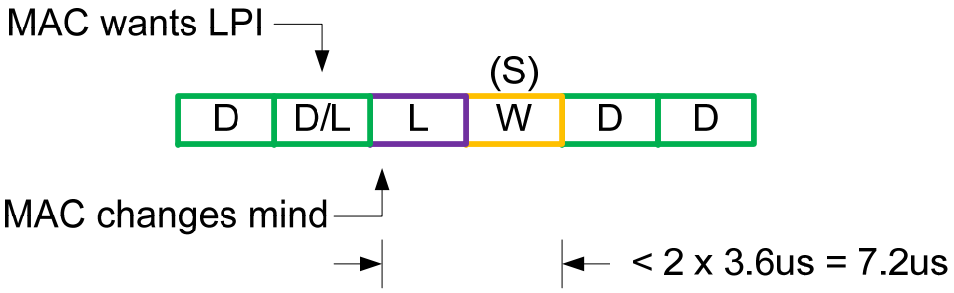


Background – Normal MAC Changes Mind Wake Up Time

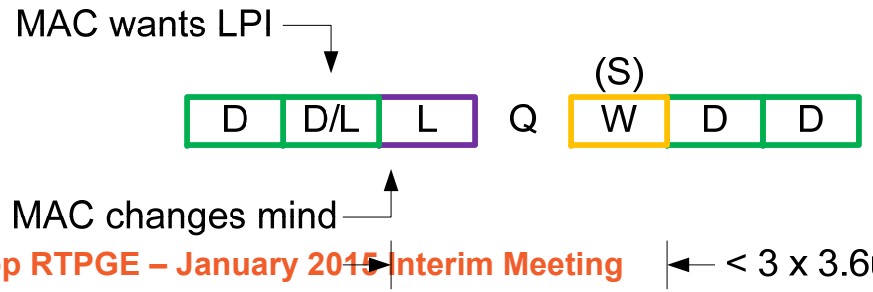
- **MAC changes mind before full frame of RS LPI sent**



- **Best case – MAC changes mind after full frame RS LPI sent**

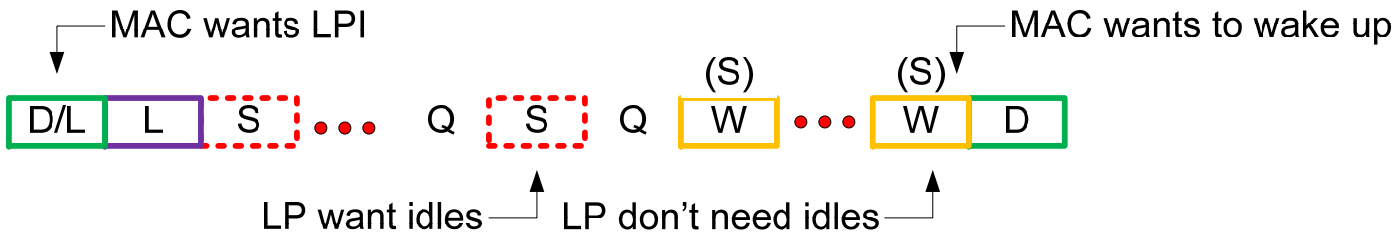


- **Worst case – MAC changes mind after full frame RS LPI sent**

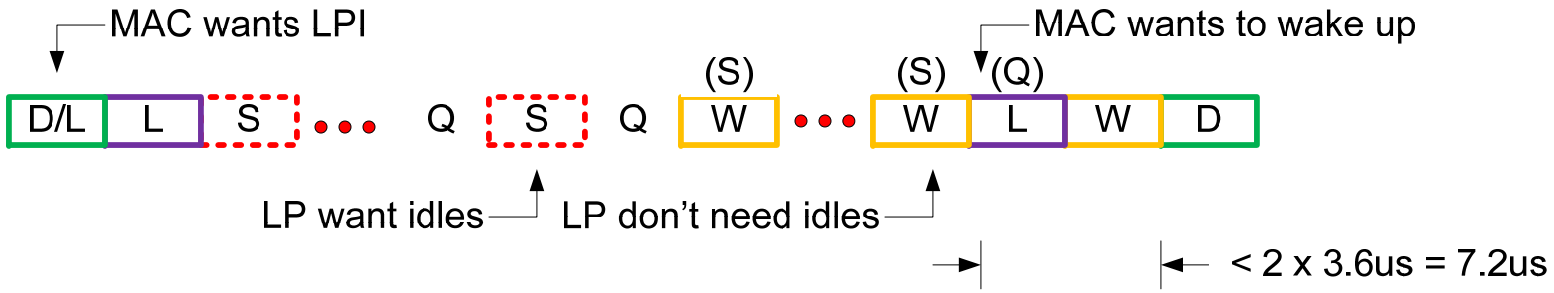


OAM – re-entering LPI followed by MAC exiting

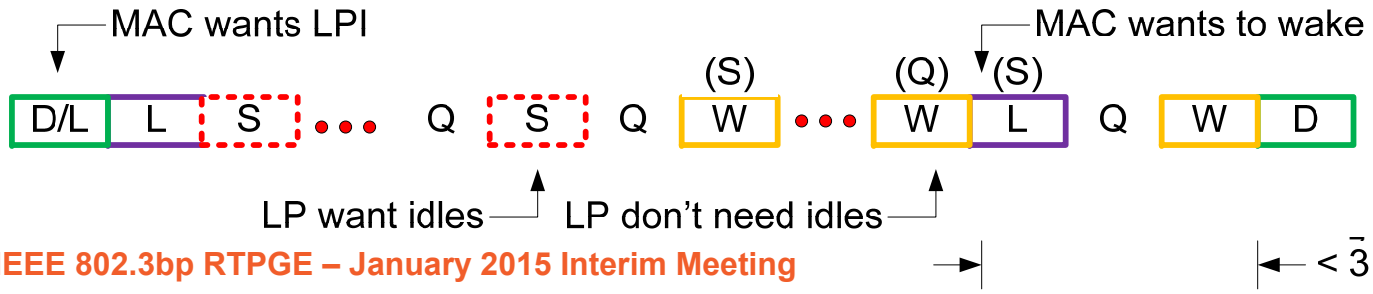
- **Exit time is no worse than MAC changing mind case**
  - **MAC exits LPI while link partner requests idles – No delay**



  - **Best case – MAC exits LPI while link partner release PHY from idles via OAM**



  - **Worst case – MAC exits LPI while link partner release PHY from idles via OAM**



Motions

- Use OAM to indicate to link partner to send idles instead of quiet/refresh as described in page 3 of Lo_3bp_03_0115.pdf
- Exchange of 1000BASE-T1 OAM frames is mandatory if 1000BASE-T1 EEE is supported.
  - The support for the OAM message portion is optional.

THANK YOU