IEEE P802.3az/D1.0
Clause 40 lpi_mode Encoding

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Overview

- The presentation, chou_01_1108.pdf, proposes two changes to the state diagram:
  - "CASE A": Enforcement of WAKE_SILENT during the Wake-up process.
  - "CASE B": Use of *rem_lpi_mode* and associated state transitions to avoid sending zeros to an active link parter.

- This presentation proposes a mechanism for encoding *loc_lpi_mode* (related to CASE B).

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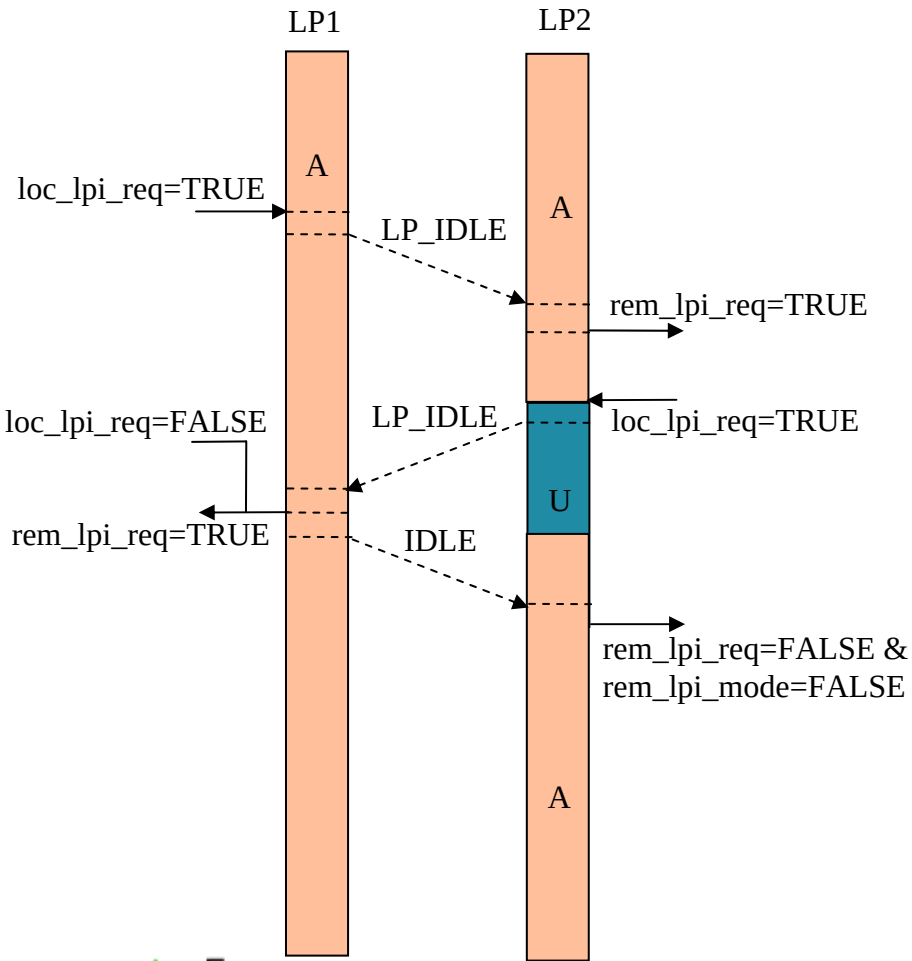
Exception Case Requiring Special Handling – lpi_mode Encoding



- Enforcement of WAKE_SILENT results in a corner case in which zeros may be sent to an active link partner.
- To avoid this case, if rem_lpi_mode = FALSE and rem_lpi_mode = FALSE, then a transition is made from Update directly to Active.
- Requires a mechanism for encoding rem_lpi_mode.

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Summary of Proposed PCS Encoding

Pairs ($Sd_n[k]$)	802.3-2005 Encoding	802.3az D1.0 Encoding	Proposed EEE Encoding
A & B ($Sd_n[0]$ and $Sd_n[1]$)	$cext_n$, $cext\_err_n$	$cext_n$, $cext\_err_n$	$cext_n$, $cext\_err_n$, *loc_lpi_req*
C ($Sd_n[2]$)	*loc_rcvr_status*	*loc_rcvr_status*	*loc_rcvr_status*
D ($Sd_n[3]$)	----	*loc_lpi_req*	*lpi_mode*

MAC-based control

PHY-based control

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802.3-2005 PCS Encoding of $cext_n$ and $cext\_err_n$ into $Sd_n[1]$ and $Sd_n[0]$

$$cext_n = \begin{cases} tx\_error_n & if\ ((tx\_enable_n = 0)\ and\ ((TXD_n[7:0] = 0x0F)) \\ 0 & else \end{cases}$$

$$cext\_err_n = \begin{cases} tx\_error_n & if\ ((tx\_enable_n = 0)\ and\ ((TXD_n[7:0] \neq 0x0F)) \\ 0 & else \end{cases}$$

$$Sd_n[1] = \begin{cases} Sc_n[1] \wedge TXD_n[1] & if\ (tx\_enable_{n-2} = 1) \\ Sc_n[1] \wedge cext\_err_n & else \end{cases}$$

$$Sd_n[0] = \begin{cases} Sc_n[0] \wedge TXD_n[0] & if\ (tx\_enable_{n-2} = 1) \\ Sc_n[0] \wedge cext_n & else \end{cases}$$

	$cext_n$	$cext\_err_n$
tx_enable_n=0 * tx_error_n=1 * TXD_n[7:0]=0x0F	1	0
tx_enable_n=0 * tx_error_n=1 * TXD_n[7:0]≠0x0F	0	1
tx_enable_n=1 + (tx_enable_n=0 * tx_error_n=0 * TXD_n[7:0]=0x00~0xFF)	0	0

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Proposed PCS Encoding of $cext_n$, $cext\_err_n$, and loc_lpi_req using $Sd_n[1]$ and $Sd_n[0]$

$$cext_n = \begin{cases} tx\_error_n & if\ (((tx\_enable_n = 0)\ and\ ((TXD_n[7:0] = 0x0F)\ or\ ((TXD_n[7:0] = 0x01)\ and\ (tx\_mode \neq SEND\_Z))) \\ 0 & else \end{cases}$$

$$cext\_err_n = \begin{cases} tx\_error_n & if\ (((tx\_enable_n = 0)\ and\ (((TXD_n[7:0] \neq 0x0F)\ and\ (TXD_n[7:0] \neq 0x01))\ or\ ((TXD_n[7:0] = 0x01)\ and\ (tx\_mode \neq SEND\_Z))) \\ 0 & else \end{cases}$$

$$Sd_n[1] = \begin{cases} Sc_n[1] \wedge TXD_n[1] & if\ (tx\_enable_{n-2} = 1) \\ Sc_n[1] \wedge cext\_err_n & else \end{cases}$$

$$Sd_n[0] = \begin{cases} Sc_n[0] \wedge TXD_n[0] & if\ (tx\_enable_{n-2} = 1) \\ Sc_n[0] \wedge cext_n & else \end{cases}$$

	$cext_n$	$cext\_err_n$
tx_enable_n=0 * tx_error_n=1 * TXD_n[7:0]=0x0F	1	0
tx_enable_n=0 * tx_error_n=1 * TXD_n[7:0]≠0x0F * TXD_n[7:0] ≠0x01	0	1
tx_enable_n=0 * tx_error_n=1 * TXD_n[7:0]=0x01 * tx_mode ≠SEND_Z	1	1
tx_enable_n=1 + (tx_enable_n=0 * tx_error_n=0 * TXD_n[7:0]=0x00~0xFF)	0	0

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Proposed Encoding of *loc_lpi_mode* using $Sd_n[3]$

$$Sd_n[3] = \begin{cases} Sc_n[3] \wedge TXD_n[3] & if\ (tx\_enable_{n-2} = 1) \\ Sc_n[3] \wedge 1 & elseif\ (loc\_lpi\_mode = ON) \\ Sc_n[3] & else \end{cases}$$

- *loc_lpi_mode* is a PHY-generated control signal, similar to *loc_rcvr_status* (which uses $Sd_n[2]$)

Summary

- Enforcing WAKE_SILENT during the wake process improves robustness and interoperability.
- A consequence of this enforcement is that a corner case is introduced in which one link partner may send zeros (WAKE_SILENT) to an active link partner.
- By encoding *loc_lpi_mode,* this consequential corner case is avoided.
- This presentation proposes a mechanism for encoding *loc_lpi_mode*.
  - This mechanism involves first encoding *loc_lpi_req* with $cext_n$ and $cext\_err_n$ on Pairs A and B.
  - This frees up Pair D for encoding *loc_lpi_mode*.
- Pair C continues to be used for encoding *loc_rcvr_status*.

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Thank you

Back-up

GMII Permissible Encodings
(IEEE *Draft* P802.3az/D1.0, Table 35-1)

TX_EN	TX_ER	TXD<7:0>	Description	PLS_DATA.Request Parameter
0	0	00 through FF	Normal inter-frame	TRANSMIT_COMPLETE
0	1	00	Reserved	___
0	1	01	Assert low power idle	___
0	1	02 through 0E	Reserved	___
0	1	0F	Carrier Extend	EXTEND (eight bits)
0	1	10 through 1E	Reserved	___
0	1	1F	Carrier Extend Error	EXTEND_ERROR (eight bits)
0	1	20 through FF	Reserved	___
1	0	00 through FF	Normal data transmission	ZERO, ONE (eight bits)
1	1	00 through FF	Transmit error propagation	No applicable parameter
NOTE—Values in TXD<7:0> column are hexadecimal.				

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