Corner Case Discussion IEEE802.3az Figure 40-15b

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Energy Efficient Ethernet

Infineon

Never stop thinking

Supporters

- Chadha, Mandeep (Vitesse)

- Chou, Joseph (Realtek)

- Grimwood, Mike (Broadcom)

- Healey, Adam (LSI)
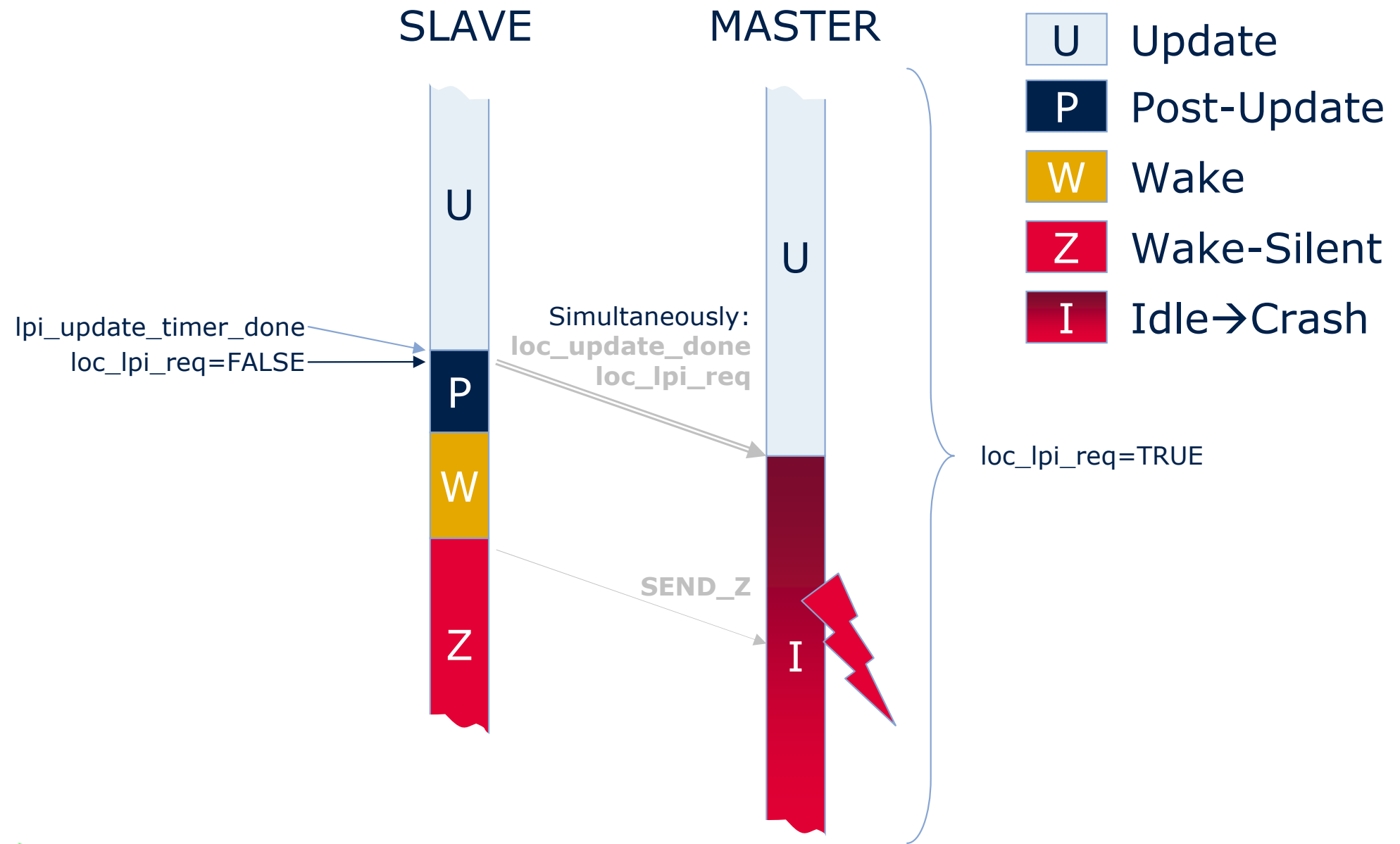
- Parnaby, Gavin (Solarflare)

Description of the Corner Case (1)

- A corner case in the IEEE802.3az-clause40 PHY control state diagram has been identified (see Figure 40-15b)

- Scenario:

  - Master continuously gets loc_lpi_req=true

  - Master and Slave are in UPDATE state

  - Slave gets timed out (lpi_update_timer_done) and transitions into POST_UPDATE. At the same time or shortly after (but within the same symbol period) the slave gets a LPI deassert by loc_lpi_req=false

  - Slave sends both inband status information simultaneously to the Master (since it can only signal with 8ns time-resolution):

    - loc_update_done=true

    - loc_lpi_req=false

- Issue:

  - Master is still in UPDATE and must take immediate transition to IDLE as of Figure 40-15b

  - Slave proceeds with a WAKE and times out into WAKE_SILENT thus ceasing transmission of IDLE symbols which will kill the Master's update of filter coefficients.

Description of the Corner Case (2)

SLAVE   MASTER

U   Update
P   Post-Update
W   Wake
Z   Wake-Silent
I   Idle→Crash

U

lpi_update_timer_done
loc_lpi_req=FALSE

Simultaneously:
loc_update_done
loc_lpi_req

U

P

W

Z

SEND_Z

I

loc_lpi_req=TRUE

The "8ns synchronization effect"

- The state-diagram in Figure 40-15b assumes asynchronous timing.

- However, inband signaling is used to exchange the variables between link-partners. These signals are thus "synchronized" to the symbol period.

- Consequently, the time-resolution for some of the variables is 8ns and not asynchronous.

- This in turn causes the corner case as described before since it generates the possibility that LOC_UPDATE_DONE=TRUE and LOC_LPI_REQ=FALSE are sent simultaneously on the line though being generated in a sequence.

- Since the current implementation of state-transitions in UPDATE does assume both signals not asserted at the same time this corner case is generated.

Counter Measures in the State-Diagram

- **Change:**
  rem_lpi_req in branch condition from UPDATE to POST_UPDATE is changed to qualify the lpi_update_timer expiration only to allow a link-partner to follow into POST_UPDATE for a WAKE

- **Include:**
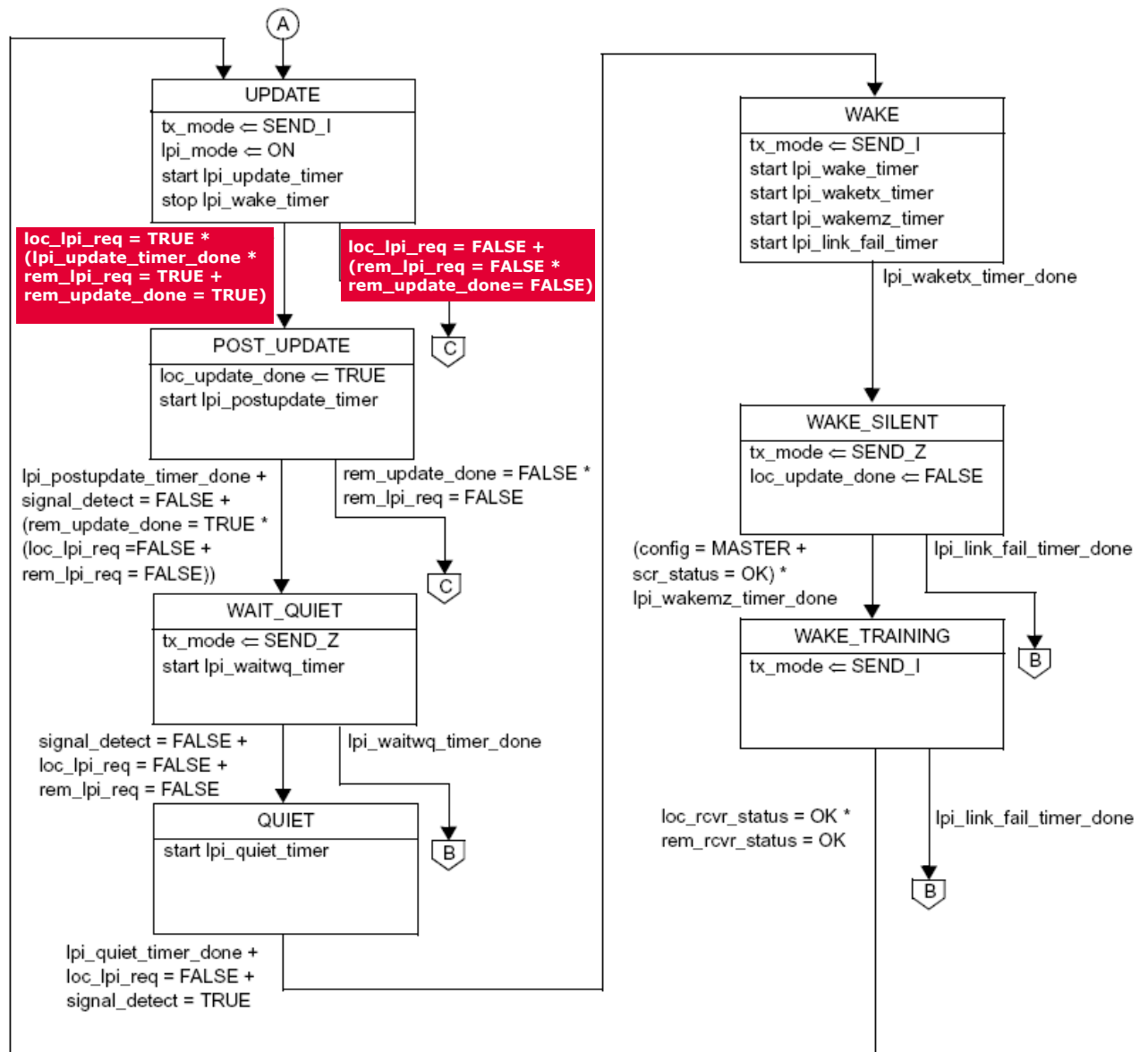 loc_update_done into branch condition from UPDATE to IDLE to judge validity of rem_lpi_req
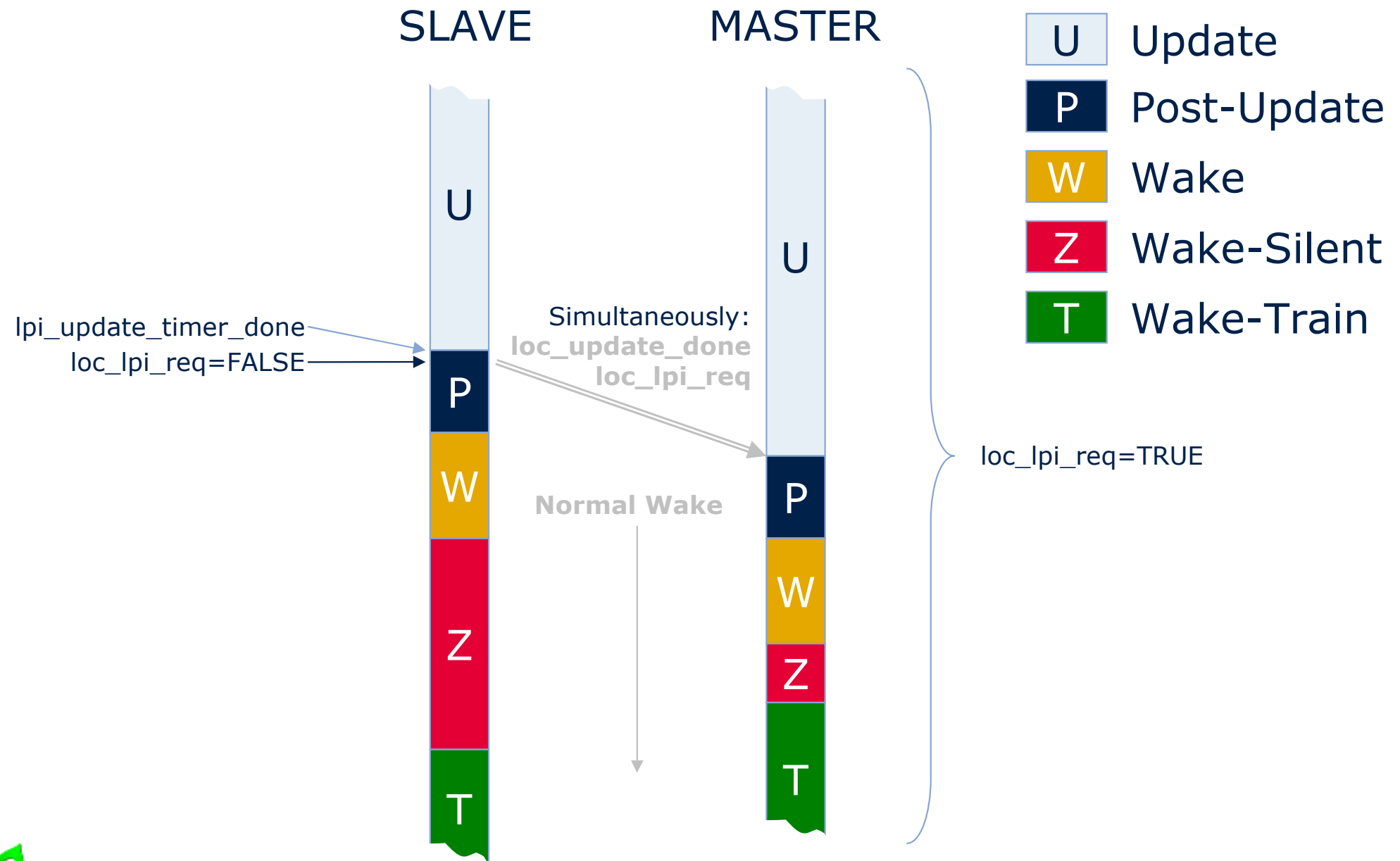

Figure 40–15b—PHY Control state diagram, part b (optional)

Description of the corrected Sequence

SLAVE   MASTER

U

U

lpi_update_timer_done
loc_lpi_req=FALSE

Simultaneously:
**loc_update_done
loc_lpi_req**

P

P

W

loc_lpi_req=TRUE

Normal Wake

W

Z

Z

T

T

U	Update
P	Post-Update
W	Wake
Z	Wake-Silent
T	Wake-Train

Conclusion

- The synchronization effect of the inband singaling to the symbol period generates a corner case in the UPDATE state.

- The corner case can simply be fixed by slight modification of the state transition out of UPDATE.