



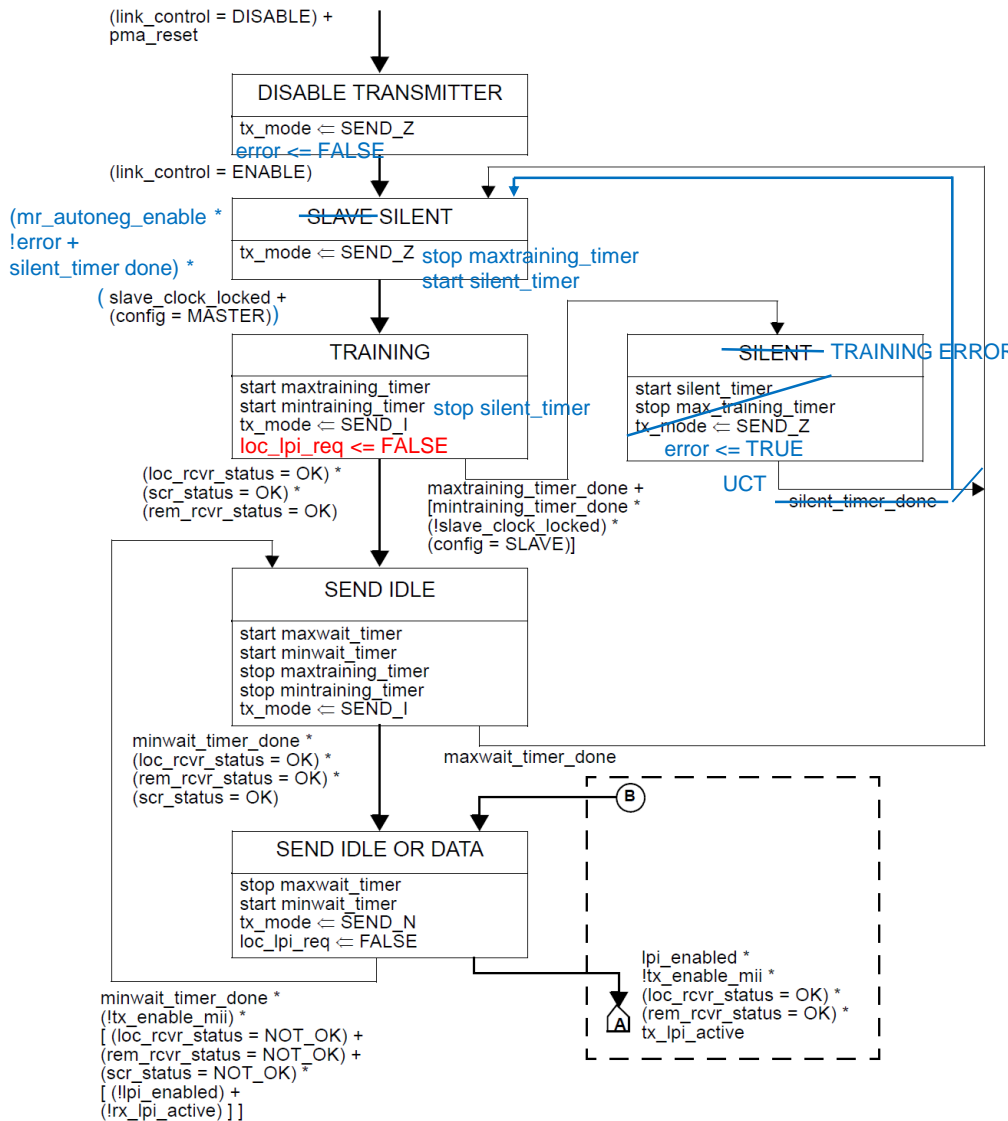
10 Mb/s Single Twisted Pair Ethernet 10BASE-T1L PHY Training Synchronization

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PHY Control State Diagram Changes

- Some time ago, the SILENT state was introduced in the PHY control state diagram.
- The need for this SILENT state was to provide a 100 ms pause, so that the master PHY can detect, if the slave PHY restarts the training.
- Nevertheless there are specific situations, where this synchronization does not work as intended.
- Each 10BASE-T1L PHY tries to recover the link, if anything goes wrong for a typical time of 200 ms.
- During this time, the PHY control state diagram goes from SEND IDLE OR DATA state to SEND ILDE state, and only, if the problem occurs for longer than 200 ms, then the PHY goes back to training state.
- If now a short reset of the master or the slave PHY occurs, this PHY will go back to training, but the other PHY still stays in SEND IDLE state, continuing to transmit idle symbols.
- If the local PHY comes up again within less than 200 ms, then the remote PHY likely will do nothing.
- If the training of the local PHY takes longer, the remote PHY will restart training and thus be able to disturb the training of the local PHY, which is expecting the remote PHY to continuously transmit
- To mitigate these undefined conditions, a simple way is to extend the SLAVE SILENT state for a minimum time for both the master and the slave PHY (and then name it just “SILENT”).
- This time needs to be longer than the 200 ms maxwait_timer period (e.g. 245 ms +/- 5 ms).
- If this is the case, then both PHYs will reliably break the link and start the training from the beginning.
- If Auto-Negotiation is enabled, then Auto-Negotiation will synchronize the training start, so that the silent time is not needed for the first training attempt; it is only needed if an error during training occurs.

PHY Control State Diagram Changes



- The blue marked changes are necessary to mitigate the problem of synchronizing both PHYs during training, as described on the previous page (depending on if AN is enabled or not).
- Change the timer interval for the silent_timer from 100 ms ± 1 ms to 245 ms ± 5 ms to safely break the link.
- Add a new variable definition: `error`: This variable indicates, if an error during the link training occurred. Values: TRUE or FALSE
- Alternatively, Auto-Negotiation could be required as mandatory, but this would then be significantly different to other SPE PHYs, which are supporting force mode with optional Auto-Negotiation (so it may be preferable to keep it).

Thank You