Refined Link Sync Proposal

William Lo September 15, 2025

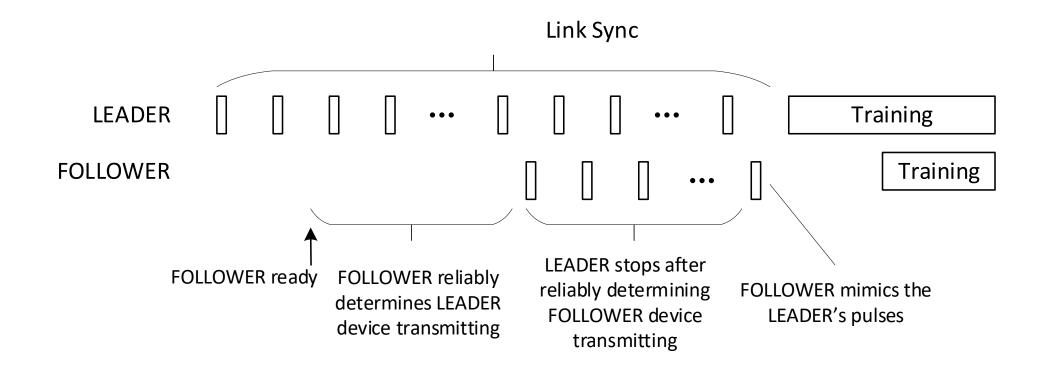


Updates

- Original Intent: Make link sync friendly to crystal-less implementation at the FOLLOWER
 - Don't need precise frequency lock
 - Allow rough estimation of frequency
- Simplify by removing randomization from Lo_3dm_01_050125.pdf
- razavi_01_3dm_01a_July_2025.pdf showed reliability without any randomization
- zherebtcov_Jonsson_3dm_01a_09_04_25.pdf showed DME bursts robust



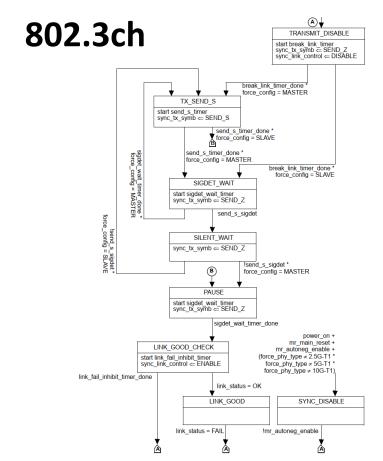
General Process



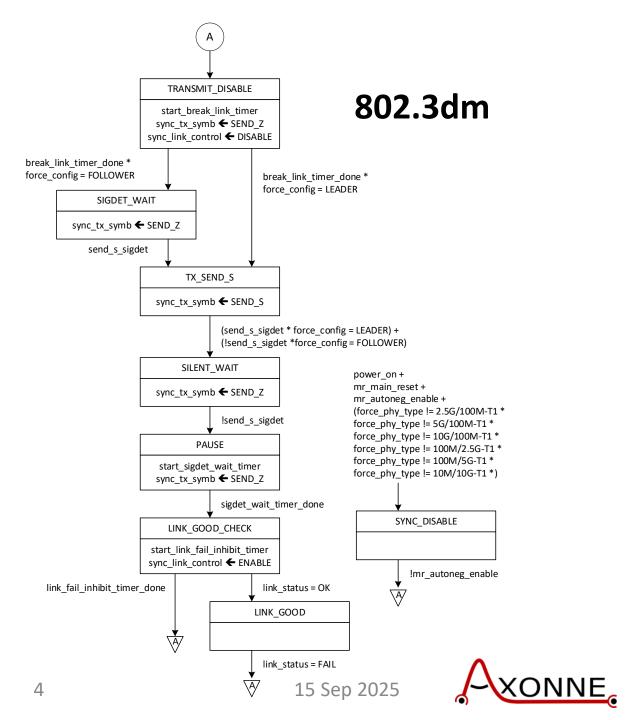


State Diagram

Similar to 802.3ch but simplified



IEEE 802.3dm Asymmetrical Electrical Automotive Fthernet Task Force



Definitions

DME symbol time is nominally 8.533... ns

- SEND_S <u>Pulse</u>
 - Sequence of 4-bit 1001 converted to DME symbols

- SEND_S <u>Signal</u>
 - Some period of quiet followed by SEND_S pulse
 - The quiet period is defined slightly differently for LEADER and FOLLOWER



Variables

- All variables similar to 802.3ch except the following is redefined
- sync_tx_symb SEND_S means:
- At LEADER:
 - Continuous signal of SEND_S pulse followed by 116 DME symbol periods of quiet
- At FOLLOWER:
 - SEND_S pulse sent 435 +/-50ns after detection of LEADER's SEND_S else quiet



What it looks like

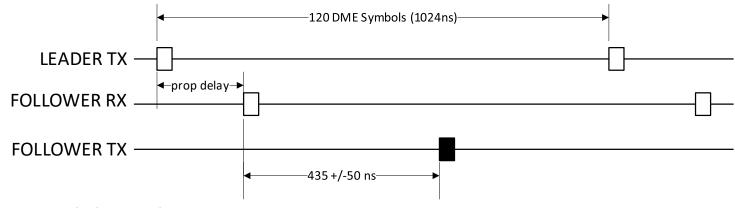
- Prop delay is cable propagation delay
- Open rectangle is LEADER's SEND_S pulse, Filled rectangle is FOLLOWER's SEND_S pulse
- The 435ns is chosen so that
 - @LEADER:

FOLLOWER'S SEND_S pulse at 0m cable always arrives later than LEADER'S SEND_S pulse reflection at 30m cable

@FOLLOWER

FOLLOWER'S SEND_S pulse reflection at 30m cable always arrives earlier than the next LEADER'S SEND_S pulse.

• The +/-50ns allows easy implementation at crystal-less FOLLOWER without an accurate clock





Variables (Continued)

- send_s_sigdet
 - Indicates whether sufficient SEND_S pulses of the SEND_S signal was detected with proper spacing.
 - At least 3 consecutive valid SEND_S pulses shall be detected before setting this variable from FALSE to TRUE.
 - At least 3.1us period with no SEND_S pulses detected shall be detected before setting this variable from TRUE to FALSE.



Variables (Continued)

- Modification of SEND_S and send_s_sigdet definitions
 - Considers not just the SEND_S pulses but the entire SEND_S signal i.e. valid pulses and proper spacing
 - Simplifies the state diagram
 - Eliminates the send_s_timer



State Interaction

- FOLLOWER waits until it see at least 3 valid and properly spaced SEND_S pulses from the LEADER (send s sigdet)
- 2) FOLLOWER transmits SEND_S signal until it sees the LEADER stops sending SEND_S signal for at least 3.1us. (!send s sigdet)
- 3) FOLLOWER exits exchange
- TRANSMIT DISABLE start break link timer sync tx symb ← SEND Z sync_link_control ← DISABLE break link timer done * force config = FOLLOWER break link timer done * force config = LEADER SIGDET WAIT sync_tx_symb ← SEND_Z send_s_sigdet TX SEND S sync tx symb ← SEND S (send s sigdet * force config = LEADER) + (!send s sigdet *force config = FOLLOWER) SILENT_WAIT power on + mr main reset + sync_tx_symb ← SEND_Z mr autoneg enable + (force phy type != 2.5G/100M-T1 * !send s sigdet force phy type != 5G/100M-T1 * PAUSE force phy type != 100M/2.5G-T1 * force_phy_type != 100M/5G-T1 * start sigdet wait timer force_phy_type != 10M/10G-T1 *) sync tx symb ← SEND Z sigdet_wait_timer_done SYNC DISABLE LINK GOOD CHECK start link fail inhibit timer sync link control ← ENABLE !mr_autoneg_enable link fail inhibit timer done link status = OK LINK_GOOD

link status = FAIL

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- 1) LEADER transmits SEND_S signal
- 2) LEADER stops transmitting when it see at least 3 valid and properly spaced SEND_S pulses from the FOLLOWER (send_s_sigdet)
- force_phy_type != 5G/100M-T1*
 force_phy_type != 10G/100M-T1*
 force_phy_type != 100M/2.5G-T1*
 force_phy_type != 100M/5G-T1*
 force_phy_type != 10M/10G-T1*)
 when it sees the FOLLOWER stops
 sending SEND_S signal for at
 least 3.1us. (!send_s_sigdet)



THANK YOU

