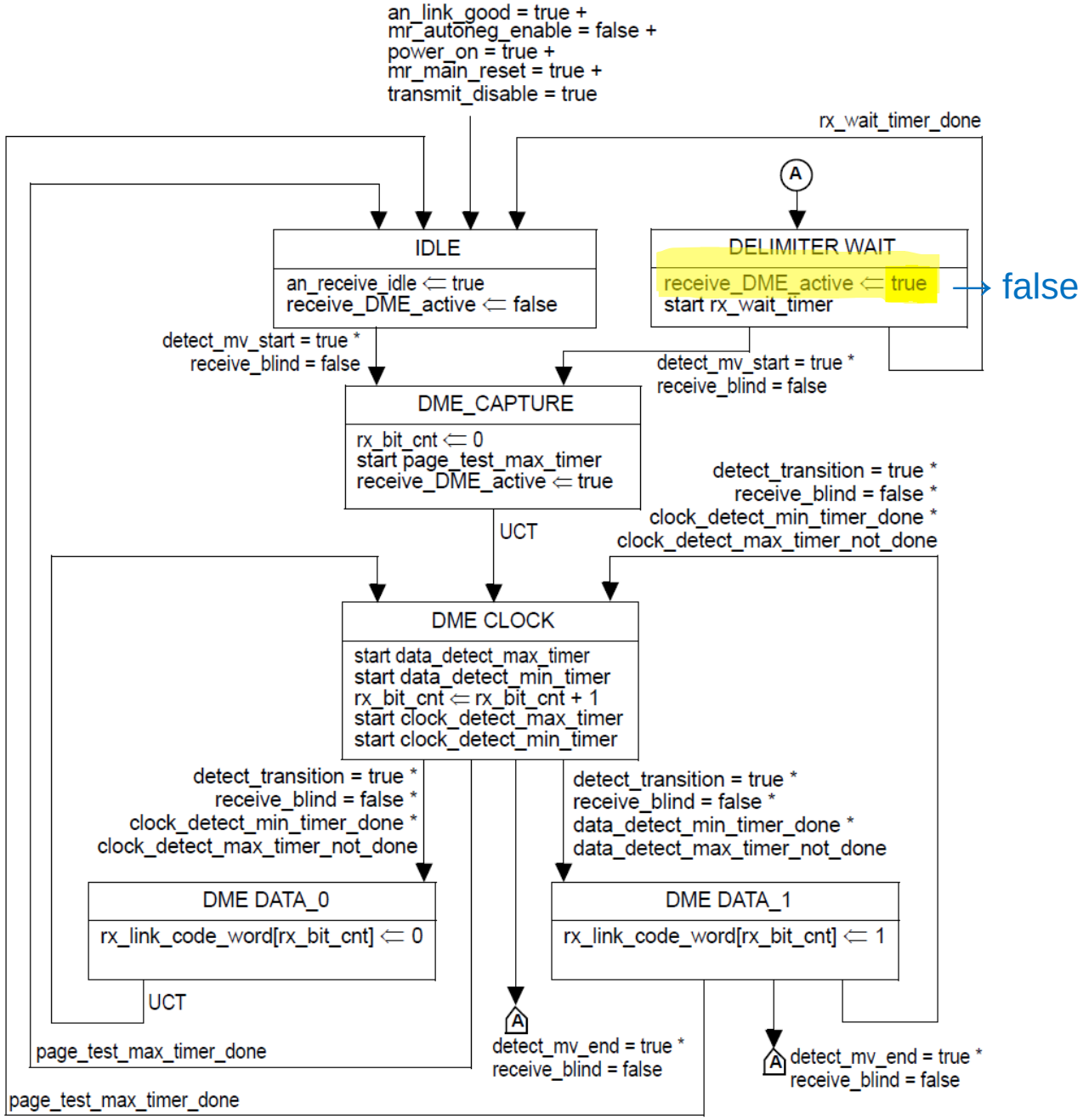
receive_DME_active in DELIMITER WAIT state of Figure 98-9 Receive state diagram

Niall Fitzgerald

ANALOG DEVICES

AHEAD OF WHAT'S POSSIBLE™



Overview

- DELIMITER WAIT state is entered after successful completion of reception of DME page from the link partner (condition detect_mv_end = true).
- No DME page reception is ongoing in DELIMITER WAIT
  - receive_DME_active should be assigned to false
  - But Figure 98-9 currently shows it as assigned to true
- Description of variable from subclause 98.5.1:

receive_DME_active

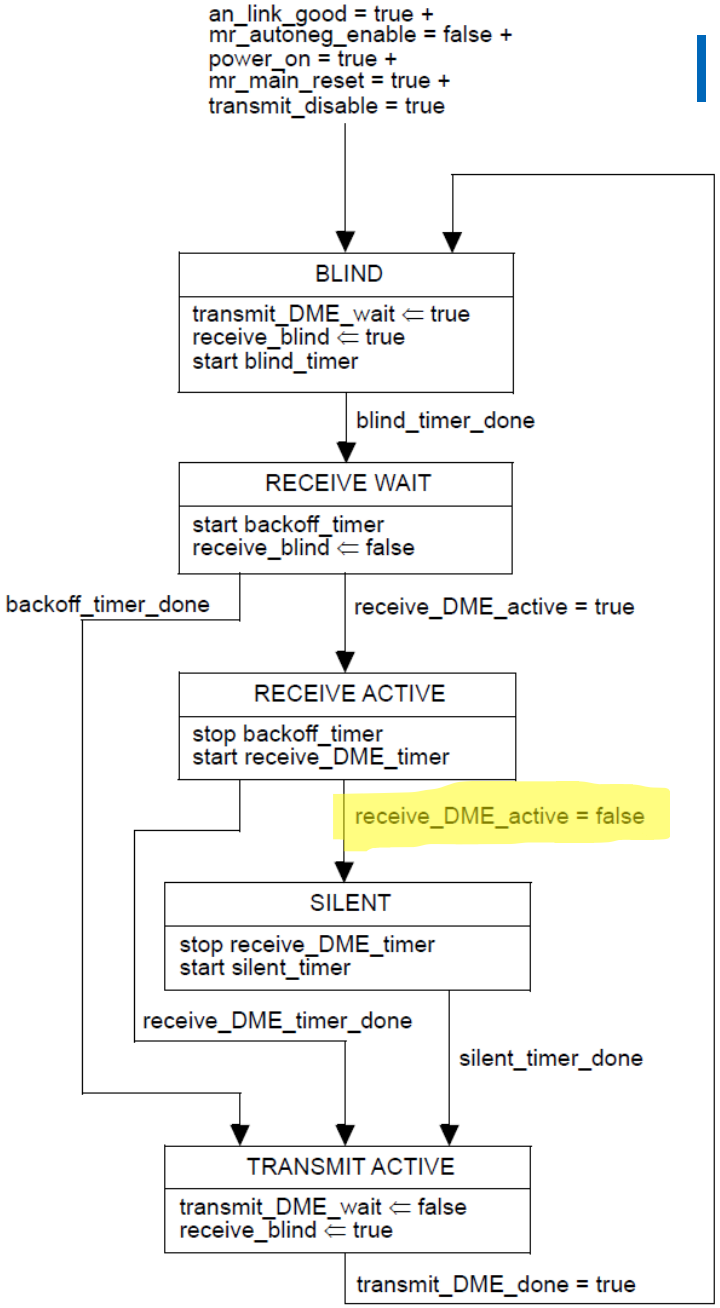
Status indicating whether or not a DME page reception is in progress.

Values:

true: DME page reception in progress

false: DME page reception completed

Impact on Half-duplex operation (1)



- Figure 98-10 Half-duplex state diagram
- The intended flow here is straightforward, i.e. to transition through each state in turn, and repeat.
- Purpose of receive_DME_active is to keep Half-duplex state diagram synchronized with receive activity.
- When DME page reception is ongoing, this state machine will be in the RECEIVE ACTIVE state
  - Waiting for completion of DME page reception, i.e. the condition receive_DME_active = false.
- Once the DME page reception has completed, the Receive state machine will enter DELIMITER WAIT, but currently it does not assert receive_DME_active = false there.
- Exit from RECEIVE ACTIVE then relies on receive_DME_timer_done, and the transition skips SILENT
  - This timer is defined in subclause 98.5.2
  - Timer for the maximum amount of time to receive a complete page before timeout.

Impact on Half-duplex operation (2)

- Half-duplex state diagram intended to operate as follows:
  - Once either PHY successfully receives a DME page, then both PHYs will fall into a pattern of alternating DME page transmission and reception. One PHY will transmit and the other PHY receives, and then the other PHY transmits and the one PHY receives.
  - Auto-Negotiation (i.e. Arbitration state diagram) will then proceed to completion quickly.
- Issue with receive_DME_active in DELIMITER WAIT means that Half-duplex state diagram and Receive state diagram do not remain in sync.
  - Transition from RECEIVE WAIT to RECEIVE ACTIVE state occurs on receive_DME_active = true, but the Receive state diagram is holding this at true, so this transition does not occur with start of DME page reception (detect_mv_start in Receive state diagram).
- Lack of synchronization can give rise to DME page collision:
  - A PHY might commence DME page transmission before ongoing reception of a DME page from the link partner has completed.
  - The link partner might commence DME page transmission before ongoing local DME page transmission has completed.
- DME page collision will likely provoke rx_wait_timer_done (in Receive state diagram):
  - Causes transition back to IDLE, assertion of an_receive_idle = true, and Arbitration transition back to TRANSMIT DISABLE (restart of Auto-Negotiation).

Origin of problem

- Problem appears to have been introduced in IEEE 802.3bp standardization (1000BASE-T1 and Auto-Negotiation) when diagrams were redrafted for IEEE P802.3bp/D2.1.
- Some presentations give some insight into original intent and evolution of Clause 98 Auto-Negotiation, and all include versions of the Receive state diagram, and all show receive_DME_active = false in DELIMITER WAIT:
  - http://www.ieee802.org/3/bp/public/mar14/Lo_3bp_04_0314.pdf; see slide 11.
  - http://www.ieee802.org/3/bp/public/jul14/Lo_3bp_02a_0714.pdf; see slide 10.
  - http://www.ieee802.org/3/bp/public/jan15/McClellan_3bp_05_0115.pdf; see slide 2.
- Also baseline text for Clause 98 Auto-Negotiation:
  - http://www.ieee802.org/3/bp/public/nov14/mcclellan_3bp_03_1114_%20Autoneg_baseline_text_proposal_v0p4.pdf; see page 26.
- Comments received against D2.0 here: http://www.ieee802.org/3/bp/comments/8023bp_D20_approved.pdf
  - See comments #6, #7, #8, #121. #316, #29 concerning diagram clarity and legibility.
  - Problem appears to have been introduced inadvertently, when the diagrams were redrafted to address these comments.