

Transceiver friendly auto-negotiation signaling for 802.3ap

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Problem Statement

Auto-negotiation with SSP bursts requires additional capabilities in the transceiver, e.g.

- Transmitter must be turned on and off relatively quickly (to produce 100 ns bursts)
- Receiver must have envelope detector to detect bursts

If auto-negotiation is used to pass information during training, SSP bursts don't provide continuous signal

- PLL will have to acquire lock and receiver will have to adapt at start of each training sequence

Ideally, auto-negotiation signaling should require little or no additional transceiver capability and should provide continuous signal



Objectives for auto-negotiation signaling

- Provide continuous clock information during training
- DC balanced
- Low enough in frequency to operate on untrained link
- High enough in frequency to require minimal additional passband
- Simple encoder/decoder independent of PCS encoding
- Minimal additional requirements on transceivers
- Minimize adaptation of Clause 28 state machines
- Different from expected training signals



Overview

Signal with Differential Manchester

- Coding rule is the same as Clause 28 with signal transitions replacing pulses.

312.5 MBaud during auto-negotiation

- One symbol at this rate is
 - 33 symbols of 10.3125 GBaud (10 Gig 64B/66B)
 - 10 symbols of 3.125 GBaud (XAUI 8B/10B)
 - 4 symbols of 1.25 GBaud (1 Gig 8B/10B)
- Maximum distance between transitions: 6.4 ns

1/4 operational Baud rate during training



Signal characteristics

Auto-negotiation -

Transmit with the signal characteristics of the slowest supported speed.

Receiver should tolerate the signal characteristics of any supported speed.

Training

Signal characteristics of the selected speed apply to both transmit and receive.



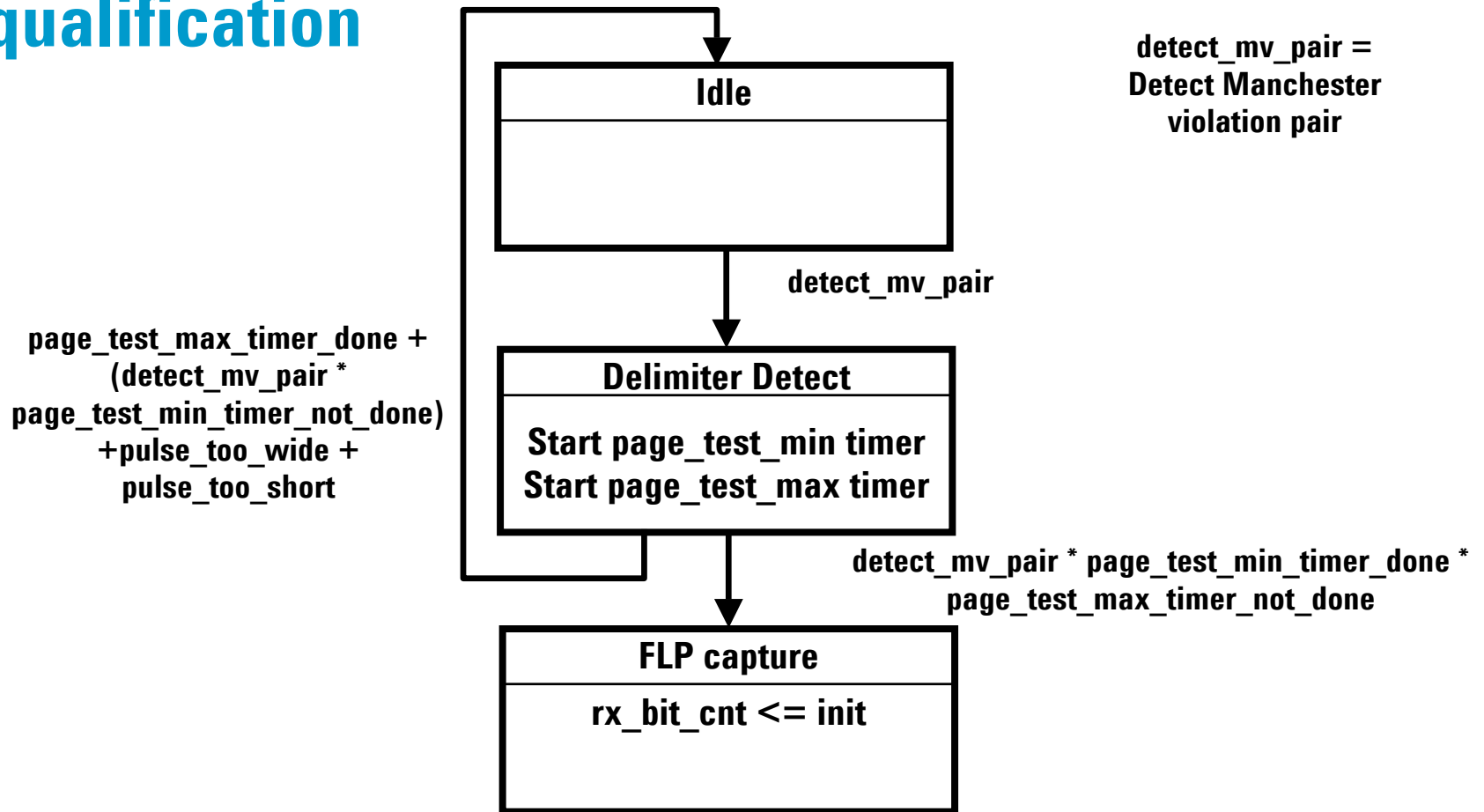
Delimiter selection

Manchester violations

Selected for compatibility with Brink training proposal.

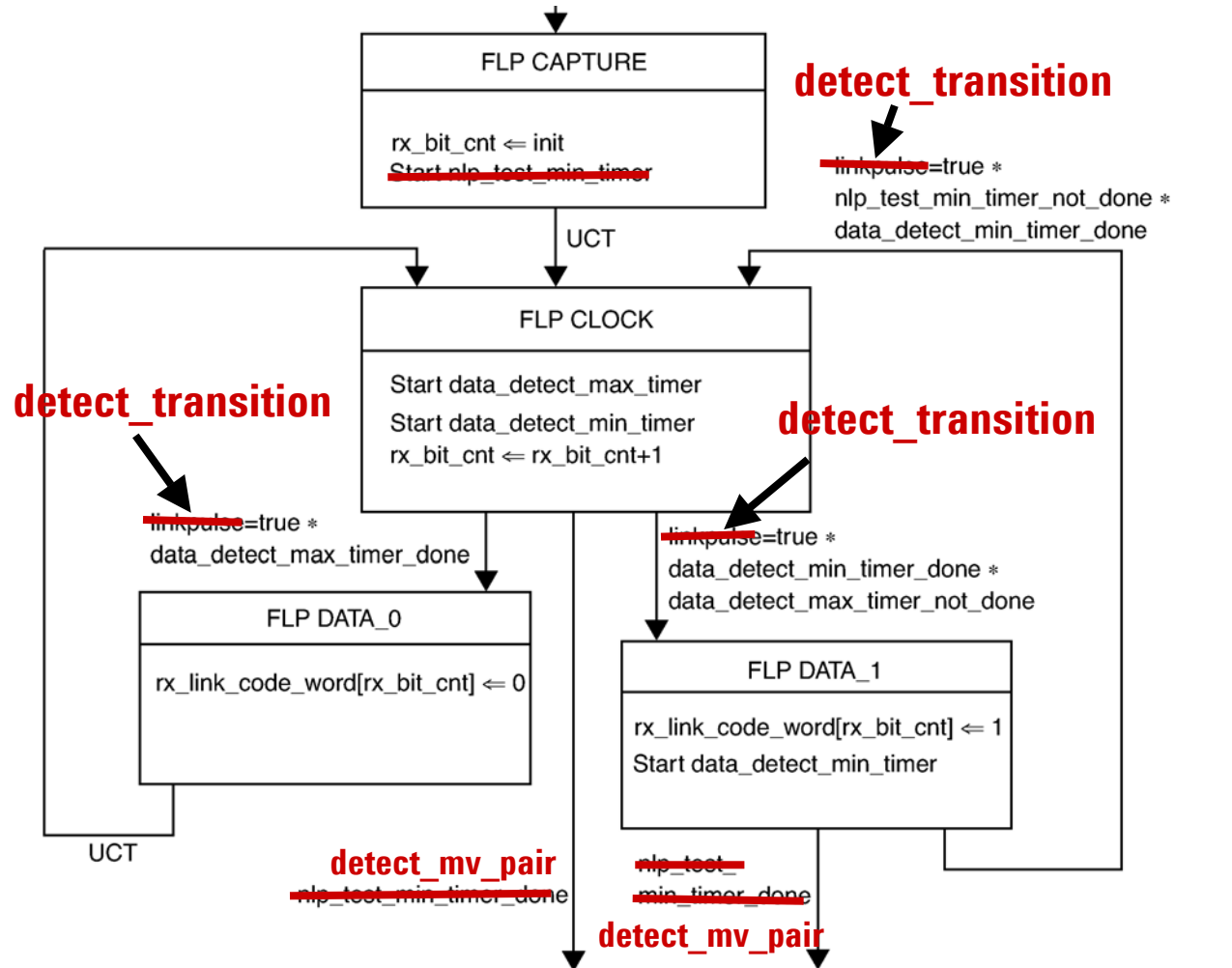


Receive state machine auto-negotiation qualification



Modifying receive state machine for differential Manchester

replace linkpulse variable with detect_transition variable - value is true when a transition in the level of the received signal is detected

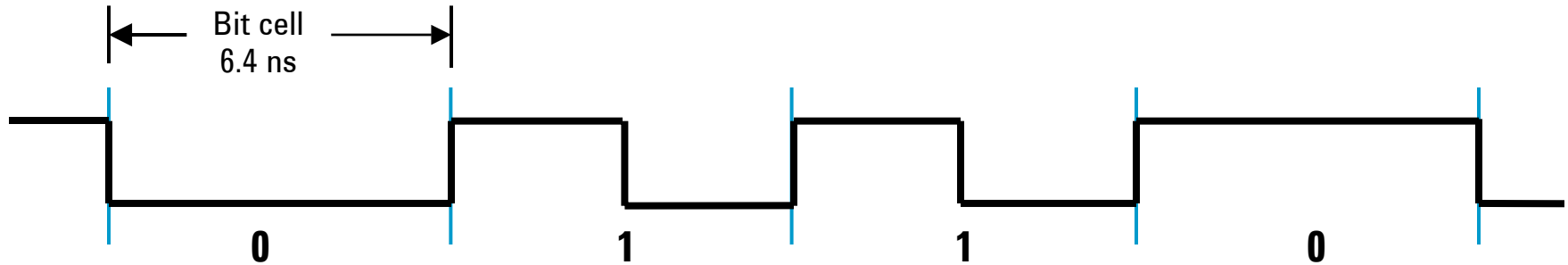


Background

slides from thaler_1_1104



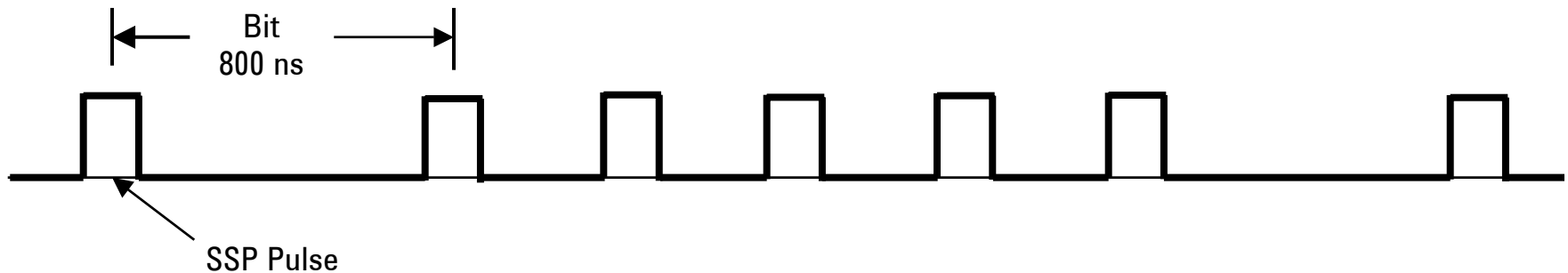
Differential Manchester



Encoding rules

- Bit cell edge always has a transition
- Bit cell center has transition for 1, no transition for 0

Equivalent SSP signal

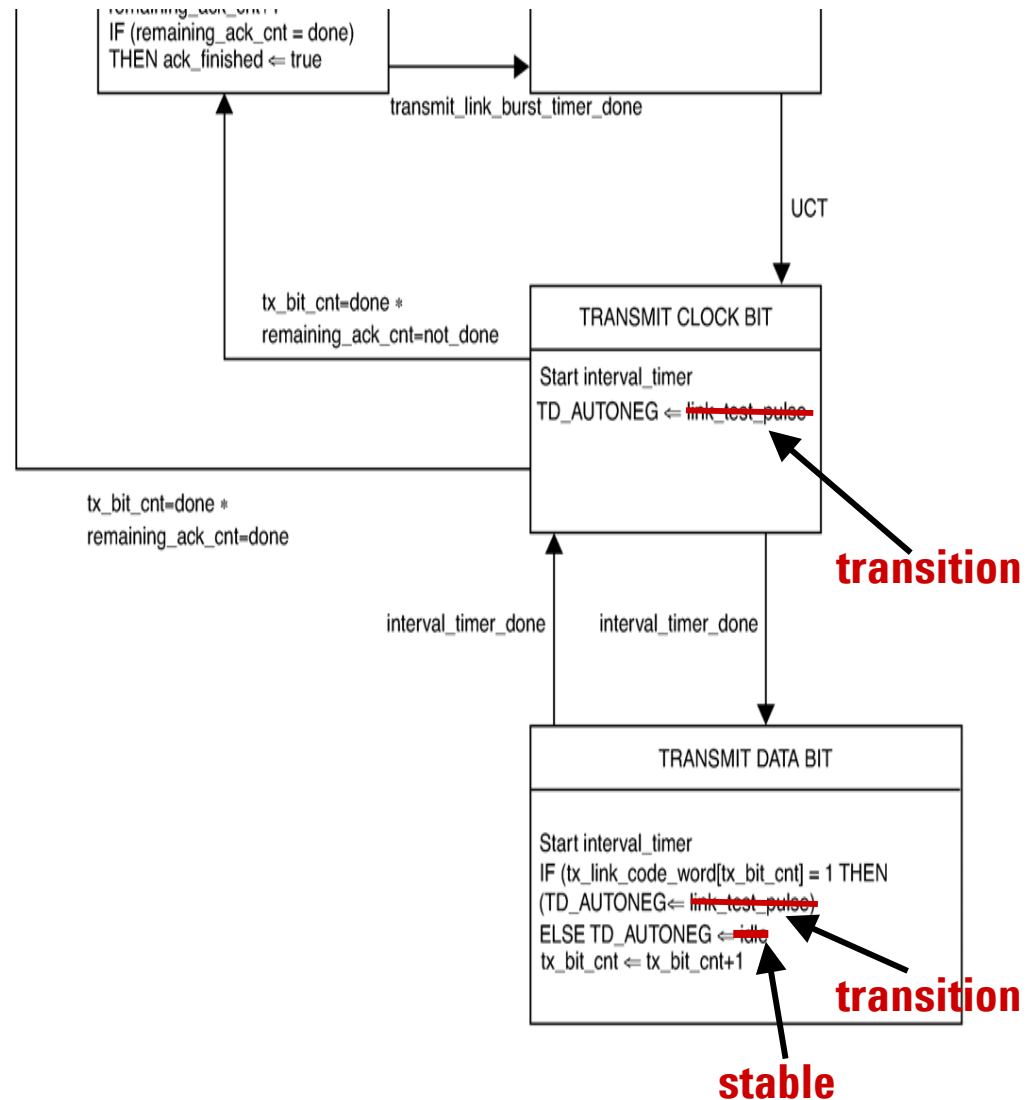


Modifying transmit state machine for differential Manchester

Change TD_AUTONEG values to:

transition - change signal level from 1 to 0 or 0 to 1

stable - maintain current signal level



Delimiting pages

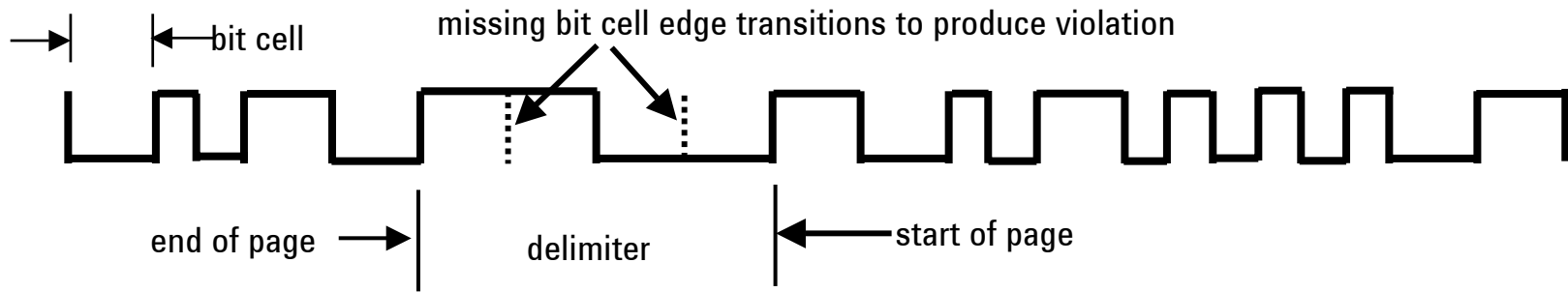
Two alternatives are proposed:

- **Manchester violation** - Between pages transmit current signal level for 2 bit cells followed by alternate signal level for 2 bit cells. Thus two bit cell edge transitions are omitted - a Manchester violation that is detected as the start delimiter.
- **Run of zeros delimiter** - Delimiter is n zeros followed by a one where n is greater than the page length. Detection is done by maintaining a count of contiguous zeros received. When a 1 is received and the count is greater than page length, a page will start on the next bit cell.

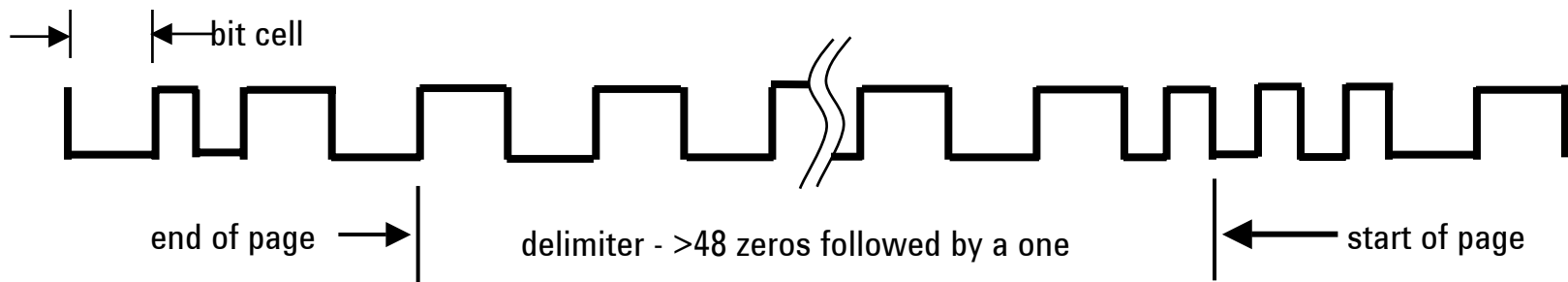


Delimiter examples

Manchester violation delimiter



Run of zeros delimiter



Delimiter Comparison

Manchester violation

- + faster**
- +? easier to detect**
- introduces lower frequency content**

Run of zeros

- + same frequency content as pages**
- slower**

