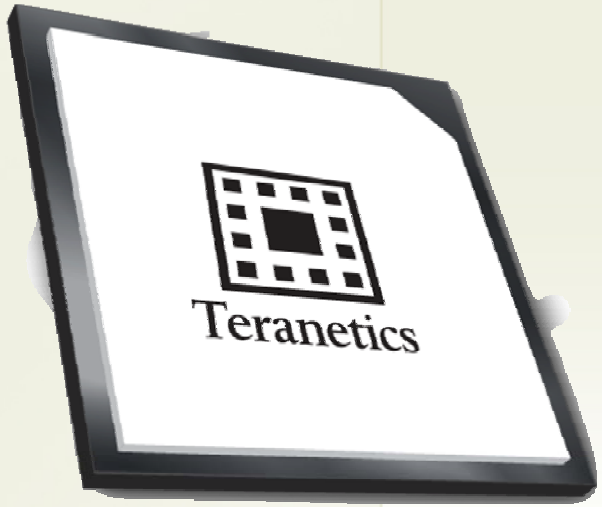

Alert signal proposal for 10GBASE-T EEE

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Sept 13, 2008

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Supporters

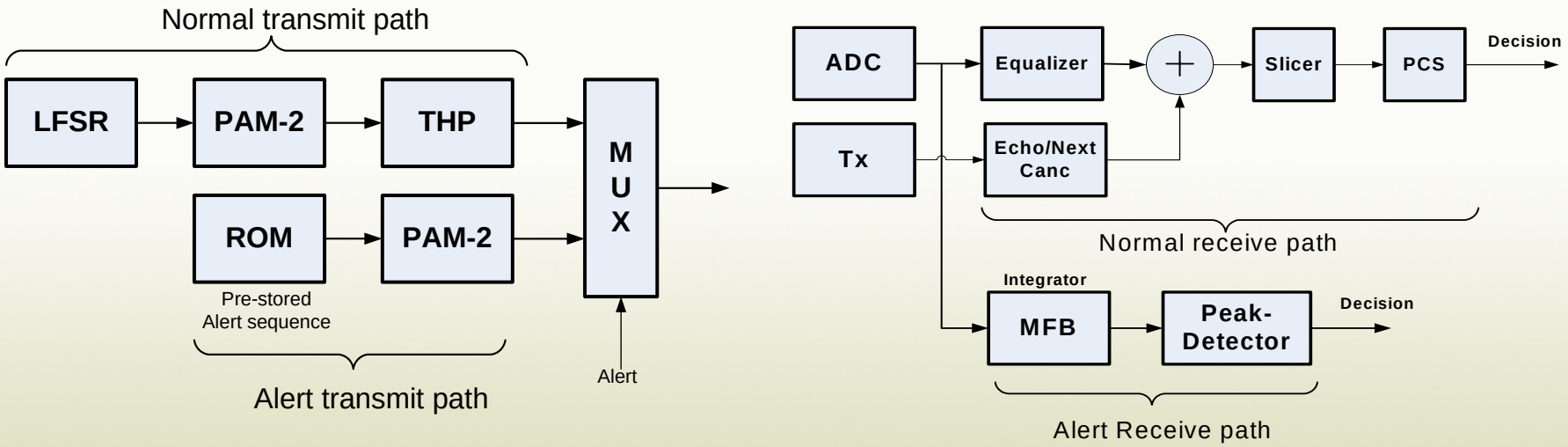
- George Zimmerman, Solarflare
- Brett McClellan, Solarflare

Alert – Definition and Discussion

- Definition: Signal transmitted to inform the link partner that the local transmitter is returning to the active state
- Requirements:
  - Needs to be easily detectable signal with low miss-detection probability
  - Short enough to ensure fast recovery time
  - Listening mechanism will be active all the time – hence should be implemented with as low power consumption as possible
- Low-latency detection is big plus

Advantages of using Pre-defined pseudo random sequence as alert signal

- Very low power transmit and receive path implementation is possible
- Provides significant SNR margin comparing to randomly-scrambled bits equalization and detection – proportional to difference between Matched filter bound vs equalized (Saltz) SNR
- Allows simple peak-detection implementation in the receiver with Very low latency detection (less then 1 LDPC frame)
- No Transmit/Receive Equalization required



Alert Structure

- PBO identical to normal mode, PAM-2 constellation
- LFSR and THP are bypassed
- Different PR patterns for Master and Slave with low cross-correlation peak value
  - To prevent false-alarm when both link partners transmit Alert simultaneously
- 128-bits PR sequence with Good Auto-correlation features
  - Allows simple peak detection
  - Low latency detection possible (in the order of 128 symbols, ~160nsec)
  - Seamless fit into 256 symbols LDPC frame boundaries
- $T_A = 4xT_F$
  - Receiver can combine multiple 128 sequences for additional processing gain

Alert structure - Con't

- **xPR_Master =**
- 1 1 -1 -1 -1 -1 -1 -1 1 1 -1 -1 1 1 1 1
- 1 1 1 1 -1 -1 1 1 1 1 -1 -1 1 1 -1 -1
- -1 -1 -1 -1 -1 -1 1 1 -1 -1 -1 -1 -1 -1 1 1
- -1 -1 -1 -1 -1 -1 -1 -1 1 1 -1 -1 1 1 -1 -1
- -1 -1 1 1 1 1 1 1 1 1 1 1 -1 -1 -1 -1
- 1 1 -1 -1 -1 -1 1 1 1 1 -1 -1 1 1 -1 -1
- -1 -1 -1 -1 -1 -1 -1 -1 1 1 1 1 -1 -1 1 1
- 1 1 -1 -1 1 1 -1 -1 1 1 1 1 -1 -1 -1 -1

- **xPR_Slave is time reversed of Master**

- **Example of Matlab code for Alert pattern generation:**
  - N=128
  - randn('state',105)
  - xhalf = sign(randn(1, N/2));
  - x = kron(xhalf,[1 1]);

Alert incorporation into Refresh/Quiet staggering scheme

- Alert is always transmitted on the same lane. Master transmits on lane A, Slave transmits on lane C
  - Simplifies transceiver's operation during quite stage
- Alert is allowed at any stage – Quiet or Refresh
- Switching between Normal and Alert path is only allowed on the LDPC frame boundary
  - No synchronization issue
- See sedarat_02_0908.pdf proposal on Refresh/Quiet cycle for more details on Staggering scheme

Summary

- Simple alert scheme has been presented
  - Very low power transmit and receive path implementation
  - Well-known low-risk technique - pseudo-random pattern transmission with following matched filter bound detection
  - low-latency (~160nsec) detections allows additional time for receiver's circuits activation; multiple sequences detection can be applied in parallel to reduce false-alarm probability
- MFB detections provides additional SNR margin comparing to the Equalization technique
- Proposed algorithm integrates well into staggering Quiet/Refresh scheme
  - Alert can be transmitted any time
  - No synchronization issue