Update on CRC8

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Supporters

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The Problem

- A long Mean Time To False Packet Acceptance (MTTFPA) is a basic requirement of the Ethernet standard

- The Ethernet CRC32 has considerable error detection capability
  - In addition to a hamming distance of 4, it can also detect any 32bit burst or any two 8-bit bursts in a packet.
  - This provides an MTTFPA in the billions of years

- The self-synchronous Scrambler in the 10GbaseR PCS has error propagation properties that compromise the burst error detection capabilities of the Ethernet CRC32
  - On its own this still yields an acceptable MTTPFA because it is primarily a function of hamming distance for a non-bursty channel (walker_1_0300.pdf)

- However if a particular channel/DFE based receiver combination causes error bursts we have a problem
  - DFE Error bursts cascaded with 64b66b scrambling yield unacceptable MTTFPAs

Proposed Solution

- **Add an additional CRC8**
  - Use the same CRC8 polynomial as 10Gbase-T
    - $1 + X^5 + X^6 + x^8$ (see clause 55.3.7)
    - 10GbaseT added CRC8 to address their MTTFPA problem

- **MTTFPA results with CRC8**
  - The probability of a packet being falsely accepted as good is no worse than the probability that a bad packet has a good CRC32 & a good CRC8
    - 1 in 2^{40}
  - So the MTTPFA is at least the rate of bad packets * 2^{40}
    - Data_rate/BER * 2^{40}
    - 3.5 Million years for $1e^{-12}$ BER at 10Gbps

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Where/how to add CRC8

- Create a KR PCS based on the R PCS with the addition of a CRC8 top-layer
  - Allows the CRC8 layer to depend on the R PCS to detect/correct invalid character sequeces
    - Keeps CRC8 State Machines simple
  - Allows the CRC8 layer to access the R error counters
    - Don't need to create new error counters
- CRC8 layer only needs to work on XGMII words
  - Not double words like the R-PCS.
  - Makes the SMs simpler

- For outbound packets (Tx)
  - overwrites EOP & 1st IPG character with CRC8::EOP
- For inbound packets (Rx)
  - Checks CRC8, overwrites CRC8::EOP with EOP::IDLE

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Work So far

- See associated word/visio document

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Moving Forward

- **Please review the associated word document and provide feedback**
  - All help gratefully accepted !

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