10GBASE-KR PCS

Andre Szczepanek

Texas Instruments a-szczepanek@ti.com

Supporters

- Ilango Ganga, Intel
- tbd

Agenda

- Re-cap of DFE Error Propagation issue
- CRC8 Solution
- How to add CRC8 into the PCS
- Document changes to create 10GBASE-KR

DFE Error Propagation & MTTFPA

- 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
- We need to improve our error detection performance if we use DFEs

CRC8 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 * 2⁴⁰
 - Data_rate/BER * 2⁴⁰
 - 3.5 Million years for 1e⁻¹² BER at 10Gbps

page 5

How to add CRC8 into the PCS

Add CRC8 insert & remove processes

- Allows the CRC8 layer to depend on the R PCS to detect or correct invalid character sequences
 - Keeps the SMs simple
- Allows the CRC8 layer to access the R error counters
 - No new error counters

CRC8 processes operate on XGMII words

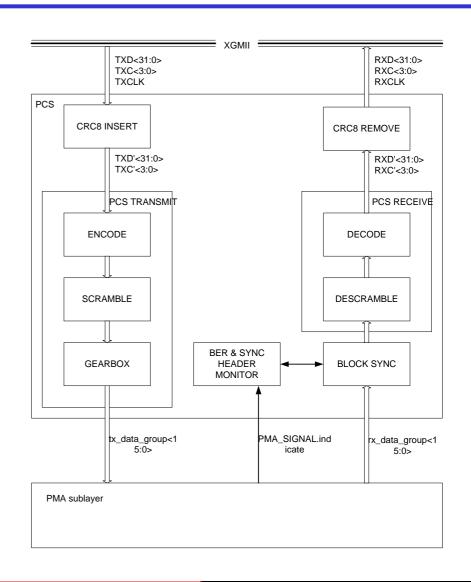
- Not double words like rest of PCS.
 - keeps the SMs simple

Insert Process (Tx)

 Overwrites EOP & 1st IPG character with CRC8::EOP

Remove Process (Rx)

- Checks CRC8
- Overwrites CRC8::EOP with EOP::IDLE



Overview of PCS changes

(See associated word document szczepanek_02_0705)

- Remove all WIS references
- Update diagrams
- Add 2 new processes CRC8 Insert, and remove
 - Above existing Rx & Tx processes
 - Alter text in Rx & Tx processes to indicate communication with remove/insert rather than the XGMII
- Add SMs and variables, timers.. for the processes
 - CRC8 SMs updated to remove conflicting nomenclature
- Increment errored_block_count on CRC8 errors

Conclusion

- The effects of DFE Error Propagation on MTTFPA can be addressed by the addition of CRC8 to the PCS
- A 10GBASE-KR specific PCS clause should be created to do this
- The changes to clause 49 are straightforward
 - szczepanek_02_0705
- szczepanek_02_0705 should be adopted as the baseline text for a 10GBASE-KR PCS clause

Motion

- Adopt the changes in szczepanek_02_0705 as the basis for the creation of a 10GBASE-KR PCS. Direct the editor to create a 10GBASE-KR PCS based on this document and clause 49.
 - Made :
 - Second: