Error Handling for 100BASE-T1L

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Introduction

- ► At the July meeting the 802.3dg group approved a motion to adopt a constant latency MII to 8N/8N+1 encoding/decoding for 100BASE-T1L
    - See Lo_3dg_01a_0724

- ► At the September meeting a PCS for 100BASE-T1L was presented that included a simpler scheme for the constant latency MII to 8N/8N+1 encoding
    - See Riesco_3dg_01a_09172024

- ► With both of these proposals there is a limitation with respect to error handling compared to previous PHY technologies for speeds ≤ 1 Gbit/s and compared to multi-G PHY technologies

Error Handling in Other PHY Technologies

► Previous PHY technologies for speeds ≤ 1 Gbit/s that do not use 8N/(8N+1) encoding use packet delimiters

- Delimiters are added/removed by the PHY PCS so that
  - Errors anywhere within a packet are decoded as MII/GMII data reception with errors (RX_DV = 1, RX_ER = 1)
  - Errors during IPGs are decoded as MII/GMII false carrier indications (RX_DV = 0, RX_ER =1, RXD = 0xE)

► Multi-G PHY technologies also use packet delimiters

- Packet delimiters are defined in the permissible TX/RX encodings of the corresponding Media Independent Interfaces (and mapped in the PCS encoder/decoder)
  - Data valid status is generated at the Multi-G Reconciliation Sublayer (RS DATA_VALID_STATUS) based on those delimiters (see for example 46.1.7.5 for XGMII)
  - Enables the Multi-G Reconciliation Sublayers (RS) to differentiate if errors were received within a packet or not

Receiver Errors Handling

► The 8N/(8N+1) encoding/decoding adopted proposal does not use explicit start or end packet delimiters

► At the transmitter side, a packet may contain 8N/(8N+1) encoded data and error control octets

- Normal data transmission (TX_EN = 1, TX_ER = 0) is encoded as data
- Transmit error propagation (TX_EN = 1, TX_ER = 1) is encoded as error control

► At the receiver, any errors will be decoded as error control octets

- Since there are no packet delimiters, and a packet may start with an error, it is not possible in general to differentiate if errors occurred within a packet or not
  - RX_ER and RX_DV must both be asserted when an error is decoded within a packet
  - But if the error occurred during the IPG, that may result in a received packet with errors
    - The MAC frameCheckError/alignmentError counters will be incremented incorrectly

Proposed Error Handling in 100BASE-T1L

▶ It is desirable to differentiate if errors occurred within a packet or not

- Prevents data reception with error being signalled on the MII for errors received outside a packet
    - The consequences might be minor for fully standard compliant MACs, but could cause unforeseen problems with existing MAC devices, referred to as MACs from now on
    - Most MACs supporting Clause 22 RS and MII are proven for older technologies like 100BASE-TX
        - 100BASE-T1L will have to interoperate with those MACs

▶ It is proposed to add start and end packet delimiter control codes to the 8N/(8N+1) encoding

- Note that existing Cs/CD control codes already act as packet delimiters when a packet starts/ends on odd encoder cycles

▶ This is consistent with the use of start and end packet delimiters in almost all previous technologies; 100BASE-X, 1000BASE-X, 1000BASE-T, 100BASE-T1, 10BASE-T1L, 10BASE-T1S and all the Multi-G technologies

- **This is necessary to work robustly with the huge range of MACs in the field**

Questions ?