



Ideas to activate optional FEC sublayer/functionality

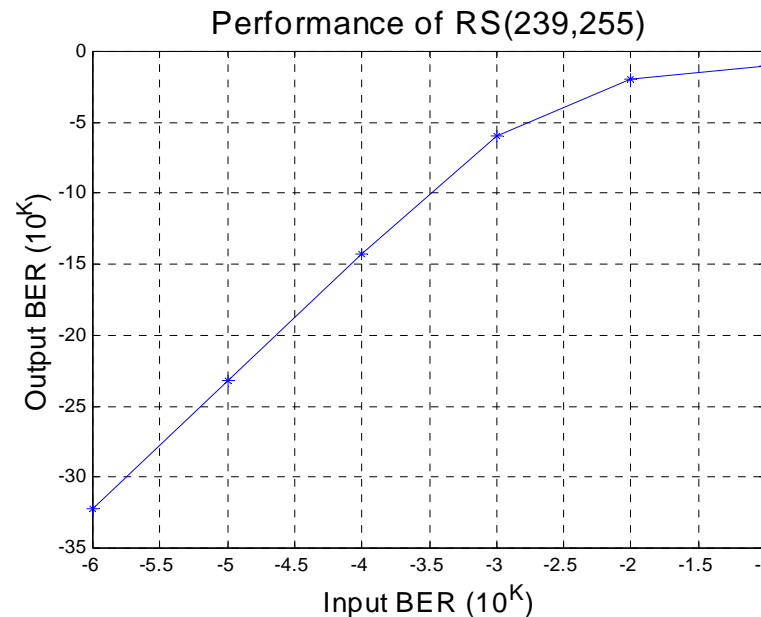
May 13, 2003

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Why FEC?

- Enhance optical fiber reach up to 20Km
- Support 32 or more ONUs per OLT with passive optical splitter
- FEC can reduce BER of 10^{-4} to 10^{-12} or less.



Need of FEC Activation

■ FEC sublayer/functionality is optional

- FEC is option to both the OLT and ONU and it operates only when both OLT and ONU have FEC capability
- But, the OLT/ONU does not know whether the remote system have capability of FEC

■ FEC may be activated only when the link status is bad

- It is because to reduce FEC processing delay & power consumption

■ The OLT should have capability of selectively support FEC encoding and decoding function ONU by ONU.

■ The configuration function described in the D1.414 Clause65 or IEEE802.3 Clause36 is based-on point-to-point operation. So, new and simple auto-negotiation function is needed for FEC

CASE 1 : Manual Activation

■ ONU/OLT knows whether the remote system supports FEC and link status

- If OLT does not support FEC, ONU disables FEC before powered-up manually
- If OLT support FEC, ONU enables FEC while powered-up if possible or needed

■ Procedure

- MPCP/MAC of the OLT stretches IPG time ONU by ONU
- OLT with FEC always transmit data through FEC path
- ONU with FEC always transmit data through FEC path
- ONU without FEC always transmit data through non-FEC path

■ Advantage : Simple. No activation process is needed

■ Disadvantage : Skilled engineer and extra time is needed

CASE 2 : Auto-negotiation #1

- **ONU/OLT does not know whether remote support FEC and link status**
 - OLT with FEC always enables FEC and transmit data through FEC path
 - ONU can activate FEC while powered-up or right after reset

- **Procedure**
 - MPCP/MAC of the OLT stretches IPG time ONU by ONU
 - OLT always transmit data through FEC path
 - ONU with FEC knows whether OLT support FEC right after receiving a discovery gate by searching the FEC header
 - Then, ONU have to decide whether to use FEC or not
 - If ONU decide to use FEC, FEC path is used to both transmit and receive data from now on.
 - Or, non-FEC path is used
 - OLT can require ONU to use FEC by extra channel such as OAM(RFI)
 - If there is need to enable/disable the FEC while operation, ONU may reset whole system or not

CASE 2 : Auto-negotiation #2

■ ONU/OLT does not know whether remote support FEC and link status

- OLT and ONU activates FEC whenever it is needed
- We can use unused 2 bytes of packet preamble to deliver the FEC information such as FEC_capable and FEC_required flag
- Each flag can get one of the values of “0xFF” or “0x00” for noise immunity
- RS sublayer has the responsibility of FEC information flag detection and insertion

■ Procedure

- MPCP of the OLT stretches IPG time ONU by ONU
- OLT and ONU initially does not use FEC but monitors the link status
- OLT and ONU can exchange FEC concerned information each other by preamble
- If there is need to enable/disable the FEC while operation, OLT requires FEC operation to the ONU by setting the packet preamble. At this time, OLT should update its ranging information to the new value to react the FEC processing delay engaged
- If there is need to enable/disable the FEC while operation, ONU may reset whole system or not

Link Status Monitoring

- **To make auto-negotiation possible, link status monitoring function at the OLT is mandatory.**

- **We can use 8B10B decoder of the FEC sublayer**
 - 8B10B decoder counts received code-groups and errored code-groups
 - Received BER can be approximated from the number of received and errored code-groups

- **Link status monitoring for each LLID**
 - It can be done by FEC with additional circuits that searches LLID from packet
 - Or, RS sublayer can do it with help of FEC sublayer
 - Link status monitoring at the RS sublayer is more reasonable rather than FEC sublayer

FEC Information Exchange

■ FEC information exchange is needed to enable auto-negotiation

- We can use packet preamble as described before
- Or, OAM channel(RFI: Remote Failure Indication) can be used
- Or, reserved regions of the MPCP register gate

■ Use of OAM channel

- Simple. But, OAM channel is also option

■ Use of MPCP register gate

- Not simple to operate

■ Use of MAC packet preamble

- It can be done by RS sublayer with information of errored code-group numbers counted from FEC sublayer

Conclusion

■ Auto-negotiation is the last hot issue of the FEC

- Because the configuration function prepared is useless, new simple auto-negotiation function for FEC is needed
- In my opinion, auto-negotiation is more efficient rather than manual activation
- And, it is the right time to start discuss about it.

■ In this proposal, I suggested some kinds of ideas to activate FEC

■ Activation with packet preamble have most flexibility rather than others

- And it can be implemented very simply at the RS sublayer with help of FEC sublayer
- In my opinion, activation with packet preamble would be the right solution