Towards a baseline Auto-Negotiation proposal
25 Gb/s Ethernet Study Group Architecture Ad Hoc

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What needs to be done

- 802.3-2015 will need to be updated to support 802.3by auto-negotiation

- In many places it is obvious what needs to be done

- The area of difficulty is deciding how to resolve FEC operation

Baseline proposal for AN

- The next few slides indicate the obvious changes that need to be made to 802.3-2015 in the form of a draft baseline proposal

Baseline Proposal for 802.3by Auto-Negotiation - Initial draft

Supporters

Main Message

- 802.3by will take the same approach to Auto-Negotiation as previous backplane and twinax PHYs

- Backplane and twinax PHYs specify the use of Clause 73 for autonegotiation so the same will be done for 802.3by

Assumptions

- 802.3by will be using Clause 73 for Auto-Negotiation
  - ➢ No changes to protocol or management register format
  - ➢ New technology ability bits will be added
- Three new PHY types will be added by 802.3by:
  - ➢ 25GBASE-KR for backplane
  - ➢ 25GBASE-CR for copper twin-axial cable
  - ➢ 25GBASE-SR for MMF (will not use auto-negotiation)
- Implementation of Auto-Negotiation will be mandatory for 25GBASE-KR and 25GBASE-CR
- 802.3by EEE (Energy Efficient Ethernet) will make use of AN next pages just like 802.3az

Changes to 802.3-2015

- The following slides indicate the parts of IEEE 802.3bx that will need to be revised

Change Table 73-4 as follows to add extra technology ability bits:

Table 73–4—Technology Ability Field encoding

Bit	Technology
A0	1000BASE-KX
A1	10GBASE-KX4
A2	10GBASE-KR
A3	40GBASE-KR4
A4	40GBASE-CR4
A5	100GBASE-CR10
A6	100GBASE-KP4
A7	100GBASE-KR4
A8	100GBASE-CR4
A9	25GBASE-KR
A10	25GBASE-CR
~~A9~~A11 through A24	Reserved for future technology

Clause 30 changes

- 30.6.1.1.5 aAutoNegLocalTechnologyAbility
  - insert 25GBASE-KR and 25GBASE-CR after 100GBASE-KP4

Clause 45 changes

- 45.2.7.12 Backplane Ethernet, BASE-R copper status (Register 7.48)
  - ➤ Insert 25GBASE-KR and 25GBASE-CR bits into Table 45–209 and 45.2.7.12.2 Negotiated Port Type
- 45.2.7.13 EEE advertisement (Register 7.60)
  - ➤ Insert 25GBASE-KR and 25GBASE-CR bits into Table 45–210 and Table 45–211. Insert subclauses for the bit definitions as necessary

Clause 73 changes

- Change last sentence in third paragraph of 73.3 to read "Technology-Dependent PHYs include 1000BASE-KX, 10GBASE-KX4, 10GBASE-KR, 25GBASE-KR, 25GBASE-CR, 40GBASE-KR4, 40GBASE-CR4, 100GBASE-CR10, 100GBASE-KR4 and 100GBASE-CR4."

- Change Table 73-4 Technology Ability Field encoding to insert A9 for 25GBASE-KR and A10 for 25GBASE-CR (this is illustrated on slide 9)

More Clause 73 changes

- Change third paragraph in 73.6.4 to include 25GBASE-KR and 25GBASE-CR

- Change last paragraph in 73.6.4 to read "The fields A[24:11] are reserved for future use. Reserved fields shall be sent as zero and ignored on receive."

- If the 100GBASE-KR4 or 100GBASE-CR4 support optional FEC make changes to 73.6.5 if necessary

More Clause 73 changes

- Change last sentence in 73.7 Receive function requirements to read "The receive function incorporates a receive switch to control connection to the 1000BASE-KX, 10GBASE-KX4, 10GBASE-KR, 25GBASE-KR, 25GBASE-CR, 40GBASE-KR4, 40GBASE-CR4, 100GBASE-CR10, 100GBASE-KR4 or 100GBASE-CR4 PHYs."

- Change 73.7.1 DME page reception to read "To be able to detect the DME bits, the receiver should have the capability to receive DME signals sent with the electrical specifications of the PHY (1000BASE-KX, 10GBASE-KX4, 10GBASE-KR, 25GBASE-KR, 25GBASE-CR, 40GBASE-KR4, 40GBASE-CR4, 100GBASE-CR10, 100GBASE-KR4 or 100GBASE-CR4). The DME transmit signal level and receive sensitivity are specified in 73.5.1."

More Clause 73 changes

- Change Table 73–5—Priority Resolution to insert 25GBASE-CR at priority 7 and 25GBASE-KR at priority 8 and move the existing entries in the table down appropriately

- Insert appropriate variables for 25GBASE-KR and 25GBASE-CR into 73.10.1 State diagram variables

- Insert 25GBASE-KR and 25GBASE-CR into the "PD" listing and to "single_link_ready"

Summary

- 802.3by auto-negotiation can use the same methods as 802.3ba and 802.3bj
- This proposal describes the necessary revisions to IEEE 802.3-2015 to specify 802.3by auto-negotiation

What else needs to be done

- The previous slides cover everything that needs to be done besides FEC resolution.

- After offline discussion it is assumed AN needs to complete in single pass.

- This means enough information needs to be exchanged to unambiguously resolve FEC in a single exchange of base pages and next pages.

A next page for FEC

- A next page could be used to advertise FEC ability and host channel characteristics.
- Add new "message code" of decimal 11 for FEC in Annex 73A
- Advertise FEC capability in the "unformatted message code" of the "Message Next Page"
- The "unformatted message code" has 32 bits: U0 to U31
- See next slide for definition of "unformatted message code" for FEC

"unformatted message code" for FEC

- U0 - low host loss
- U1 - medium host loss
- U2 - high host loss
- U3 – 10GBASE-R FEC ability
- U4 – 25GBASE-R FEC ability
  - May be have separate bits for BASE-R and RS FEC
- U5 – 40GBASE-R4 FEC ability
- U6 – 100GBASE-R10 FEC ability
- U7 – 100GBASE-KR4 FEC ability
- U8 – 100GBASE-KP4 FEC ability

Current Clause 73 FEC

- Two existing bits for FEC, one to indicate FEC ability, another to request it.
- FEC is enabled if either side requests it and both are capable of supporting FEC.
- Detailed ability could be advertised using a Next Page.
- Existing FEC request bit can be used to enable FEC.

Things to think about

- Resolution of "No FEC" operation
- Is 802.3by definitely going to be supporting both CL74 and CL91 FEC for 25G?
- Do we want to advertise host channel loss and if we do how will this affect the resolution of FEC?