Optical auto-negotiation (OAN) background

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Introduction

- There has been a series of contributions proposing methods and reasons to specify optical auto-negotiation for optical PHYs.
- This contribution takes a step back and revisits the reasoning behind defining support for OAN in P802.3dj.
- It also attempts to establish a set of primary goals that we might want to achieve in this project.

Previous presentations on the OAN topic

- 2023 November Plenary Meeting
  - https://www.ieee802.org/3/dj/public/23_1128/brown_3dj_01a_2311.pdf
    Matt Brown, et al
- 2024 January Interim Meeting
  - https://www.ieee802.org/3/dj/public/24_01/brown_3dj_02_2401.pdf
    Matt Brown, et al
  - https://www.ieee802.org/3/dj/public/23_11/parkholm_3dj_02_2311.pdf
    Ulf Parkholm (Ericsson), et al
- 2024 March Plenary Meeting
  - https://www.ieee802.org/3/dj/public/24_03/brown_3dj_03_2403.pdf
    Matt Brown, et al
  - https://www.ieee802.org/3/dj/public/24_03/parkholm_3dj_01_2403.pdf
    Ulf Parkholm (Ericsson), et al

Some history

- Use of Inner FEC along with an associated baseline was adopted in March/May/July 2023 for all 500 m, 2 km, and 10 km PAM4 optical PHY types.
- Ongoing discussion and straw polls indicated a strong desire to support an alternate “mode” without Inner FEC.
- For supporting both Inner FEC modes (“FECi”with Inner FEC and “FECo” without Inner FEC) there were a few considerations:
  - Single PHY type that supports two modes vs two PHY types with each supporting one of the two modes.
  - Automatic coordination between the PHYs at each end to arrive at a common FEC mode.
- With the baselines adopted in November 2023 and January 2024 the two modes were accommodated by separate PMD types:
  - 200GBASE-DR1, 400GBASE-DR2, 800GBASE-DR4/FR4-500, and 1.6TBASE-DR8 are defined without Inner FEC
  - 200GBASE-DR1-2, 400GBASE-DR4-2, 800GBASE-DR4-2/FR4/LR4, and 1.6TBASE-DR8 are defined with Inner FEC
- A means to automatically configure to one or the other Inner FEC mode was not adopted.

Selecting Inner FEC or no Inner FEC

- For 500 m and 2 km optical links, Inner FEC may be selected by configuring for a particular PHY type:
  - For Inner FEC (FECi)…
    - 200GBASE-FR1, 400GBASE-DR2-2, 800GBASE-DR4-2, 1.6TBASE-DR8-2, and 800GBASE-FR4
  - For no Inner FEC (FECo)…
    - 200GBASE-DR1, 400GBASE-DR2, 800GBASE-DR4, 1.6TBASE-DR8, and 800GBASE-FR4-500

Previous selection proposals using Inner FEC

- Early contributions proposed to select FEC mode using the Inner FEC communication channel, but there were issues with this approach.
- For PHY types without inner FEC this would force running at a different (higher) rate and inclusion of sophisticated logic that is otherwise not required
- Use of the Inner FEC, especially at the 213 Gb/s rate would preclude other nice features (for future consideration) that some were asking for, e.g., rate selection (100 Gb/s per lane instead of 200 Gb/s per lane, 400GBASE instead of 800GBASE, etc.)
- Proposals for OLT later excluded this feature with the assumption that an OAN feature would be adopted.

Goals of OAN (primary)

- Reliably select common PHY type (and Inner FEC mode).
  - In particular, for a particular Ethernet rate select between two PHY types, one with Inner FEC (e.g., 400GBASE-FR2) and the other without Inner FEC (e.g., 400GBASE-FR2-2).
  - Determine incompatibility between link partners. For example, two link partners are not configured to support any common PHY type.
- Method and signaling agnostic to the various PHY types that might use OAN.
- Operate reliably without depedence on significant signal processing.
- Ideally, expandable to support forward compatibility.
- Ideally, leverage already defined specifications and methods to achieve this. Don’t reinvent the wheel.

Other potential goals of OAN (future)

- Other ways that OAN might be leveraged for future consideration…
- Fiber connection and link partner discover.
  - For example… in a set of fibers broadcast the AN signal on all transmit fibers and snooping on all receiver fibers could be used to find out what is attached and how (e.g., lane order).
- Select between different Ethernet rates, e.g., select between 200GBASE-DR1 and 400GBASE-DR2
- Selecting configuration of signal processing features, for example convolutional interleaver depth or enable/disable, if needed.
- <u>These however are beyond the scope of the proposed OAN, BUT could be add-ons later.</u>

Summary

- There have been a series of contributions proposing methods and reasons to specify optical auto-negotiation for optical PHYs.
- The primary motivation for OAN now is to provide a mechanism to select FEC mode.
- OAN could be expanded in the future.

Thanks