

Auto-Negotiation for PHY AND FEC SELECTION

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Building Consensus Around What is Important

- Many, good points and important issues. From Mike Dudek:
 - Low Latency
 - Low power
 - Allow trade-off between power/latency and Frame Loss ratio (Error rate)
 - Small silicon area
 - Plug and Play (Simple for the customer to use).
 - Have minimal market confusion.
- Many good proposals. From nowell_022515_25GE_adhoc:
 - “We need to pick one”
- If we prioritize, we decide.

Prioritization

- BASED ON UNDERSTANDING OF FEEDBACK:
 1. Maximize Interoperability (Simple for the customer to use).
 1. Have minimal market confusion.
 2. Allow trade-off between power/latency and Frame Loss ratio (Error rate)
 1. Engineered links
 3. Others
 1. Low Latency
 2. Low power
 3. Small silicon area
 4. ...

MAP TO AN ADVERTISEMENTS

APPROACH:

- **PROVIDE THREE PHY TYPES IN BASE PAGE**
 - CR-L (Enables CL108 FEC)
 - CR-S (Enables CL74 BASE R FEC)
 - CR-N (Enables NO FEC)
- **ALLOW PRIORITY TO BE SELETED IN BASE PAGE**
 - HCD_remap
- **RULES AND REQUIREMENTS**
 - CR-S MUST BE IMPLEMENTED IN ALL DEVICES
 - CR-N MUST BE IMPLEMENTED IN ALL DEVICES
 - **To BE IEEE COMPLIANT FOR REACHES DEFINED IN SPEC:**
 - IF CR-L IS ADVERTISED, BOTH CR-S AND CR-N MUST BE ADVERTISED
 - IF CR-S IS ADVERTISED, CR-N MUST BE ADVERTISED

WHY?

- All 3m and below cables will always work
 - If CR-S is advertised, must also advertise CR-N
- All 5m and below cables will always work if RS FEC is provided.
 - If CR-L is advertised, must also advertise CR-S and CR-N
- CR-L and CR-S ports will always be able to interoperate over an appropriate cable
 - A CR-L port must be able to fall back to CR-S

THREE PHY TYPES

- Create three PHY types (CR-L, CR-S and CR-N)
 - CR-L: This PHY type includes CL108 FEC as mandatory to implement and enable
 - CR-S: This PHY type includes Base-R CL74 FEC as mandatory to implement and enable
 - CR-N: This PHY type as no FEC enabled
- Pros:
 - Permits both user and implementer maximum flexibility by selectively advertising
 - CR-N is essentially “free”
 - Plug and Play / Interoperability is clear for end user
- Cons:
 - Three PHY types created in base page (probably fine)

RESOLUTION

- BASE PAGE BITS
 - CR-L, CR-S, CR-N
- PRIORITY
 - CRL, then CR-S, then CR-N
- EQUATIONS for LPA and LPB
 - If (LPA.CR-L & LPB.CR-L)
 - CR-L
 - Else if (LPA.CR-S & LPB.CR-S)
 - CR-S
 - Else if (LPA.CR-N & LPB.CR-N)
 - CR-N
 - Else
 - No link up.

Three PHYs & Channel Support

PHY Type Cable Type	CR-N	CR-S	CR-L
<3m CA-N	Supported	Supported	Supported
3m CA-S	Not Supported	Supported	Supported
5m CA-L	Not Supported	Not Supported	Supported

Supported by all PHYs!

Supports all cable types!

- Can operate in FEC “overkill” mode if necessary over shorter cables to allow maximum interoperability

Link integrity vs latency

- Propose an additional base page bit to control link integrity vs latency prioritization, via HCD re-map
 - HCD_Remap = 0 : HCD CR-L > CR-S > CR-N
 - HCD_Remap = 1 : HCD CR-N > CR-S > CR-L

- *Note: it is assumed that the host will only advertise PHYs consistent with the channel characteristics
e.g., don't advertise CR-N and HCD_Remap =1 on a 5m cable*

RESOLUTION WITH HCD_REMAP

- BASE PAGE BITS
 - CR-L, CR-S, CR-N, HCD_REMAP
- $HCD_REMAP = LPA.HCD_REMAP \& LPB.HCD_REMAP$

- If $!(HCD_REMAP)$
 - If $(LPA.CR-L \& LPB.CR-L)$
 - CR-L
 - Else if $(LPA.CR-S \& LPB.CR-S)$
 - CR-S
 - Else if $(LPA.CR-N \& LPB.CR-N)$
 - CR-N
 - Else
 - No link up.
- If (HCD_REMAP)
 - If $(LPA.CR-N \& LPB.CR-N)$
 - CR-N
 - Else if $(LPA.CR-S \& LPB.CR-S)$
 - CR-S
 - Else if $(LPA.CR-L \& LPB.CR-L)$
 - CR-L
 - Else
 - No link up.

Extending to KR

- **Drop –KR designation, and have PHY types apply equally to –KR and –CR**
- AN between KR and CR is meaningless because they do not share a common MDI
- PHY electrical characteristics are identical
(CR4 is constrained by KR4 per 802.3bj – as outlined in Annex 92A)
- Minimizes addition of base page bits

Summary

- Auto-negotiation using 3 PHY types is proposed to address maximum flexibility and clarity to implementers and end users
- 4 bits total would be added to base page
 - Technology Ability Field (**CR-L, CR-S, CR-N**)
 - Integrity (or Latency) Prioritization bit (**HCD_REMAP**)
- **Link partners blindly advertise PHY types and then select the HCD using a pre-determined priority**
 - **Consistent with past practice**
 - **No need for a priori knowledge of the link partner's abilities**
 - **No need for multiple iterations**
- Above bits apply equally to KR and CR media

Thank you