*GBASE-T Auto-Negotiation Proposal

2.5/5GBASE-T Ad Hoc - April 2015

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Objectives

- Propose an Auto-Negotiation scheme to unify 2.5/5/25/40GBASE-T
IEEE Current Status

- Message page 9 used for 10GBASE-T and will be extended for 40GBASE-T
  - Yellow – can be shared for 2.5 / 5 / 10 / 25 / 40GBASE-T
  - Blue – Need 3 bits per speed (Need 12 new bits)
  - Tan – Only 8 bits left

<table>
<thead>
<tr>
<th></th>
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<tr>
<td>D0-10</td>
<td>M0-10</td>
<td>Message Code = 9</td>
<td>D34</td>
<td>U18</td>
<td>PHY Short Reach</td>
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<tr>
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<td>Toggle</td>
<td>D35</td>
<td>U19</td>
<td>Fast Retrain</td>
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<td>D12</td>
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<td>Acknowledge 2</td>
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<td>PMA Training Request</td>
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<tr>
<td>D13</td>
<td>MP</td>
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<td>U21</td>
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<td>D38</td>
<td>U22</td>
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<td>D15</td>
<td>NP</td>
<td>Next Page</td>
<td>D39</td>
<td>U23</td>
<td>1000BASE-T EEE</td>
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<tr>
<td>D16-26</td>
<td>U0-U10</td>
<td>Master/Slave Seeds</td>
<td>D40</td>
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<td>Port Type</td>
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<td>U16</td>
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<td>D46</td>
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<tr>
<td>D33</td>
<td>U17</td>
<td>LD Loop Timing</td>
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Options for IEEE Specification

- **Option 1: Add new message page**
  - Allocates more bits
  - Longer Auto-Negotiation time

- **Option 2: One bit advertised capabilities for all speeds**
  - i.e. if EEE advertised, then all advertised speeds must be capable of EEE
  - i.e. Same for fast retrain

- **Option 3: Make optional capabilities mandatory for given speed**
  - i.e. EEE is mandatory, fast retrain is mandatory

- **Option 4: Make use of extra bits already available somewhere else**
  - 1000BASE-T1 (802.3bp) does this
  - See next page
Option 4: Don’t Pollute Auto-Negotiation Space

- Use Auto-Negotiation to advertise only speed
  - 2500BASE-T, 5000BASE-T, 25GBASE-T, 40GBASE-T
  - EEE, fast retrain capabilities not exchanged during Auto-Negotiation

- Exchange optional capabilities during training InfoField exchange
  - Octet 12 used to exchange EEE, fast retrain capabilities
  - Octet 12 valid only during PMA_PBO_Exch state when Message<7:6> = 01
General Flow

- First step - determine speed
- Second step – determine other capabilities
- Keep 10GBASE-T unchanged

Auto-Negotiate to determine speed

- 2500/5000/25G/40GBASE-T
- 10GBASE-T

2500/5000/25G/40GBASE-T
- Link Training
- Use info field to determine other capabilities

10GBASE-T
- Link Training
- All capabilities already determined via AN

Link to negotiated speed

Link Down
Octet 12 Format

- Octet 12 valid when Message<7:6> = 01. Otherwise reserved
  - Octet 12 must hold consistent value during exchange else behavior undefined

- Oct12<4:0> = Reserved

- Oct12<5> = Fast Retrain
  - 0 = Fast Retrain not supported
  - 1 = Fast Retrain supported

- Oct12<6> = THP Bypass Request in PMA_Coeff_Exch state
  - 0 = Local device requests link partner not to bypass THP during fast retrain
  - 1 = Local device requests link partner to bypass THP during fast retrain

- Oct12<7> = EEE Ability
  - 0 = EEE not supported
  - 1 = EEE supported

- EEE ability is enabled if both PHYs advertise EEE Ability
Fast Retrain Options

- Device requests link partner’s transmitter to behave a certain way during retraining.

- **THP bypass request = 0**
  - link partner THP not bypassed in the PMA_Ceoff_Exch state during fast retrain
  - Current IEEE specified method for 10GBASE-T

- **THP bypass request = 1**
  - link partner THP bypassed in the PMA_Ceoff_Exch state during fast retrain
  - Allows for better/faster retraining in some implementations

- Possible for one PHY to request one method and the other PHY to request other method
IEEE Message 9 proposed mapping

- Only use 4 out of 8 reserved bits (yellow)
- Only 10GBASE-T has EEE and Fast Retrain bits
- Loop Timing, no short reach assumed for 2.5, 5, 25, and 40G

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Summary

- Scheme allows 2.5 / 5 / 10 / 25 / 40GBASE-T to remain on Page 9
  - No new page needed
  - Retains per speed flexibility on optional capabilities
  - Decouples optional capabilities from Auto-Negotiation
  - Keeps spare bits available for future BASE-T speeds

- Info Field allows future expansion of optional capabilities independent of Auto-Negotiation
THANK YOU