Questions to be Answered

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Scope and Purpose

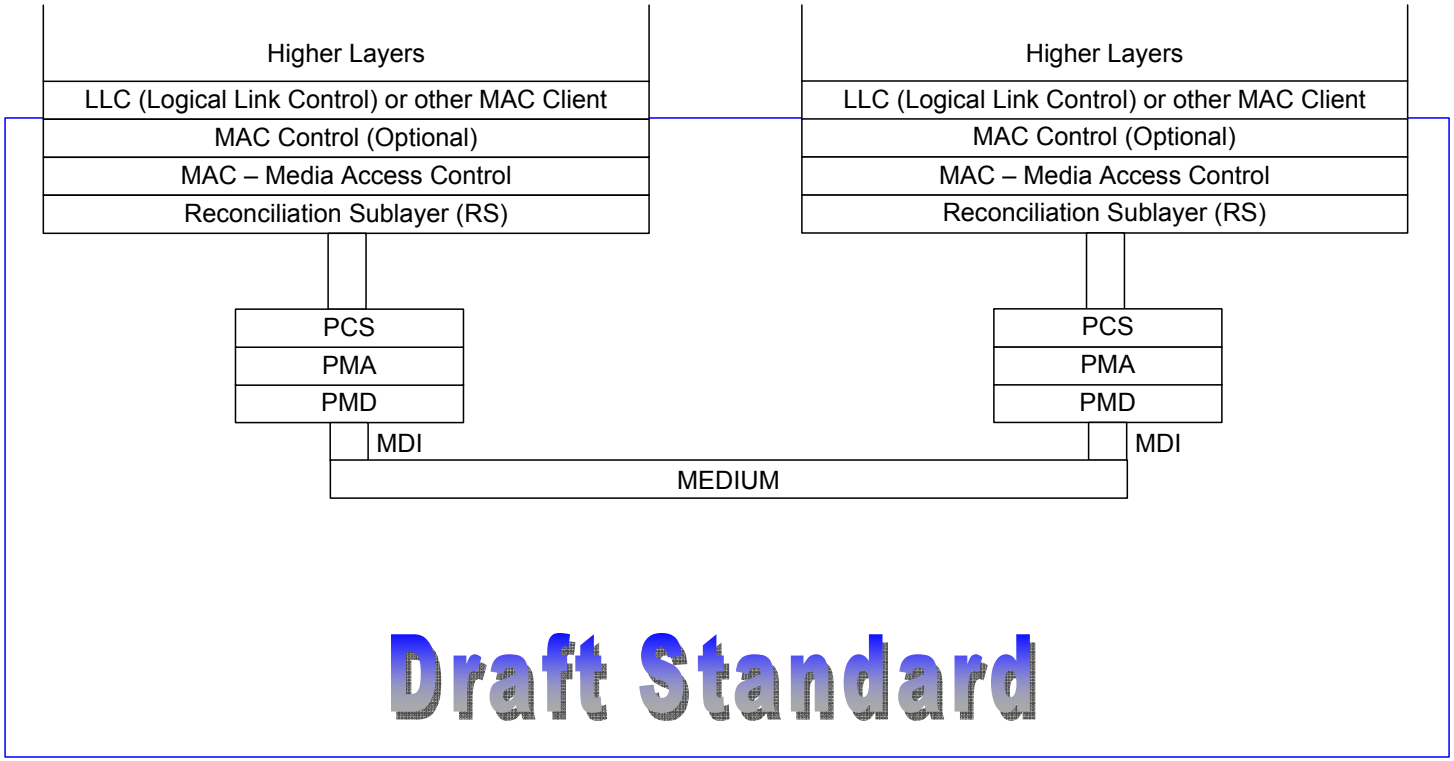
- As a future IEEE P802.3 Task Force, we will be tasked with the development of the draft standard for 40G and 100G Ethernet
- We must create a complete specification
- This presentation only seeks to highlight issues to be addressed
  - First pass pointing to the obvious issues
  - Living list with invite to all to contribute

HSSG Objectives

- Support full-duplex operation only
- Preserve the 802.3 / Ethernet frame format utilizing the 802.3 MAC
- Preserve minimum and maximum FrameSize of current 802.3 standard
- Support a BER better than or equal to 10^{-12} at the MAC/PLS service interface
- Provide appropriate support for OTN
- Support a MAC data rate of 40 Gb/s
- Provide Physical Layer specifications which support 40 Gb/s operation over:
  - at least 100m on OM3 MMF
  - at least 10m over a copper cable assembly
  - at least 1m over a backplane
- Support a MAC data rate of 100 Gb/s
- Provide Physical Layer specifications which support 100 Gb/s operation over:
  - at least 40km on SMF
  - at least 10km on SMF
  - at least 100m on OM3 MMF
  - at least 10m over a copper cable assembly

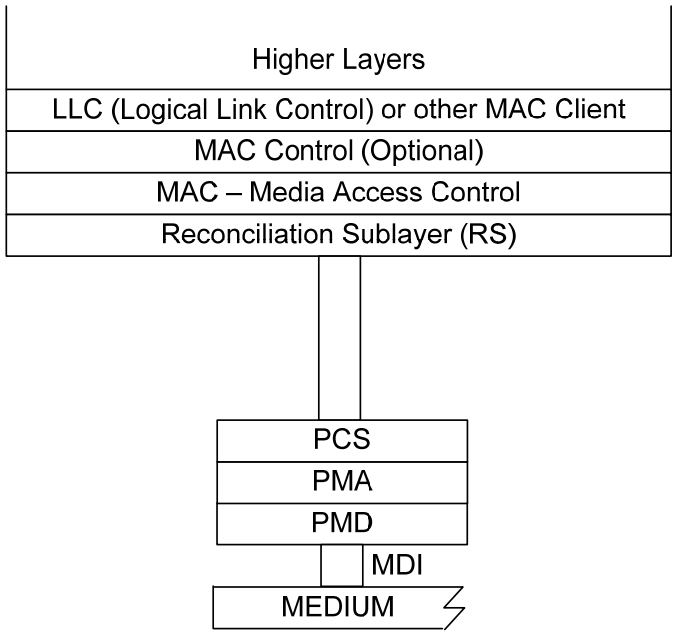
Adopted by HSSG and approved by 802.3 at July 2007 Plenary

The Scope of Our Effort

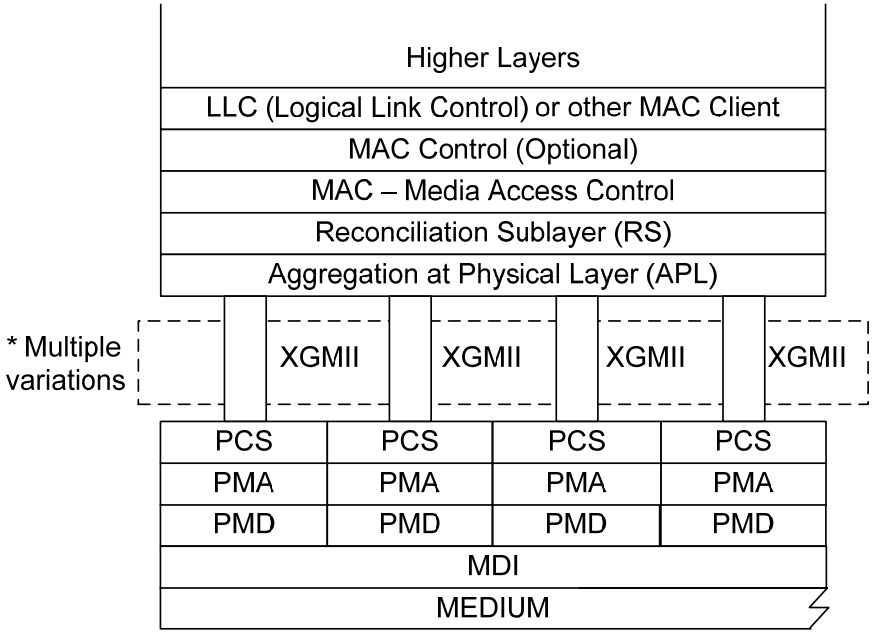


- PCS – Physical Coding Sublayer
- PMA – Physical Medium Attachment
- PMD – Physical Medium Dependent
- MDI – Medium Dependent Interface

Architecture Options Discussion



"Multi-lane PHY"

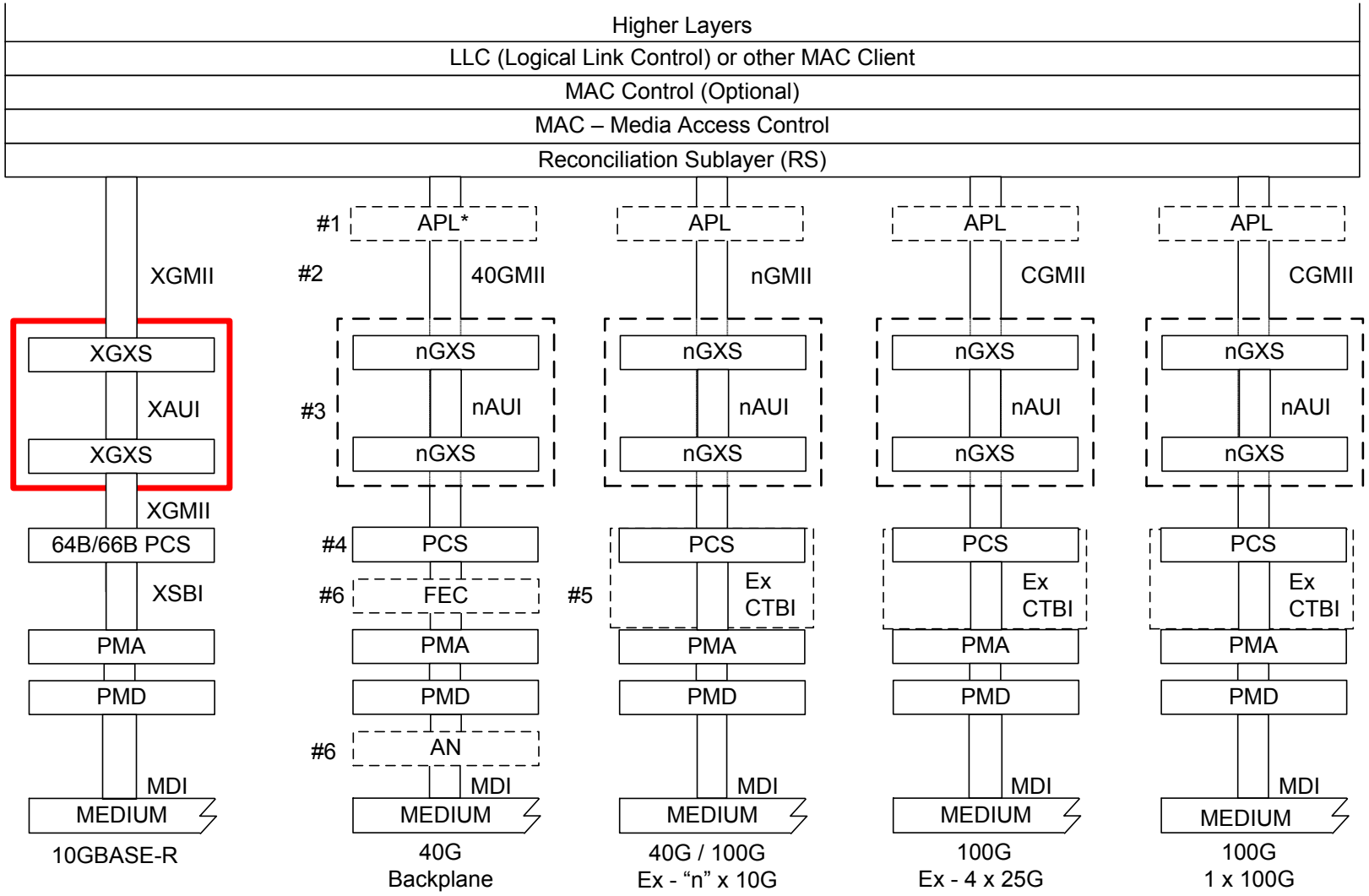


"Aggregation of PHYs"

Refer to Page 7 for comments for Item #1

* see frazier_01_1106 for further details

General Discussion of Possibilities



Refer to Page 7 for comments per Item #

* For complete layer diagram of APL-based architecture see Page 5

Observations from Layer Diagram

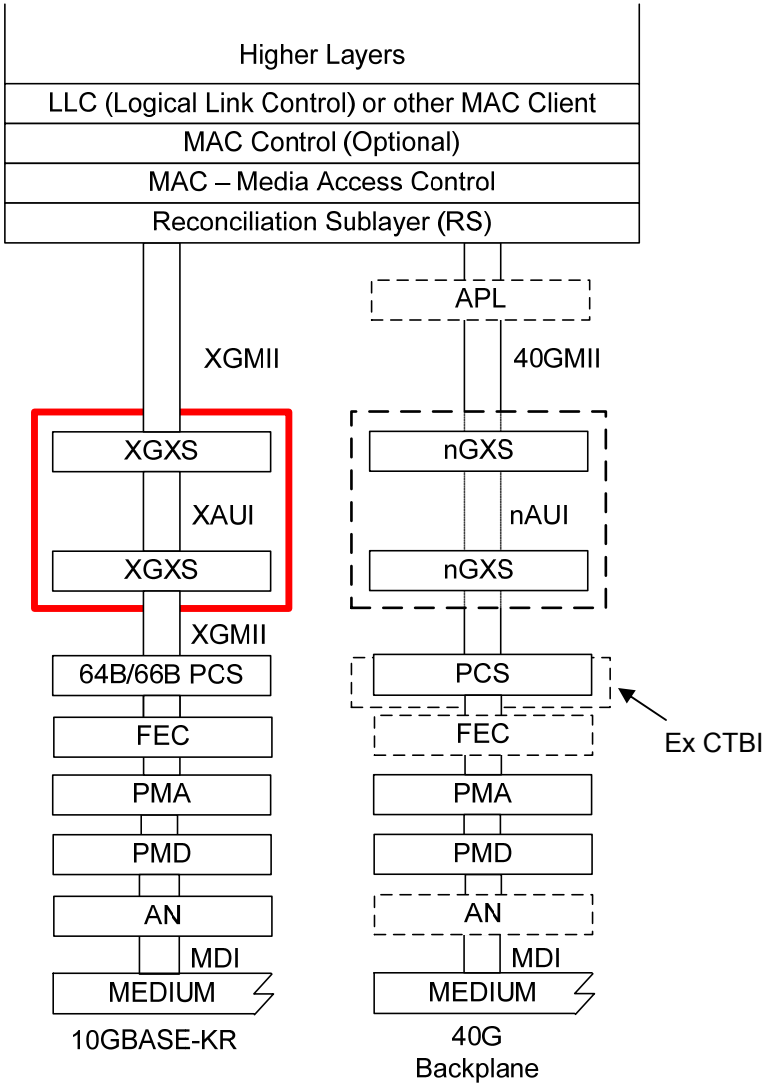
- #1 – Architecture Discussion
  - Multi-lane PHY vs Aggregated PHYs
- #2- Definition of a MII
  - Just logical?
- #3 – Definition of an extender sublayer?
- #4 – PCS [Options Proposed in HSSG]
  - 8B / 10 B
  - 64B / 66B
  - 512B / 513B
- #5 – Define an interface between PCS / PMA?
  - Logical?
  - Compatibility Interface?
- #6 – Re-Use of Existing Backplane Ethernet Layers?
  - FEC - Forward Error Correction (Clause 74)
  - AN - Auto-Negotiation (Clause 73)

Physical Layer Specifications to be Defined

	40G	100G
At least 1m backplane	√	
At least 10m cu cable	√	√
At least 100m OM3 MMF	√	√
At least 10km SMF		√
At least 40km SMF		√

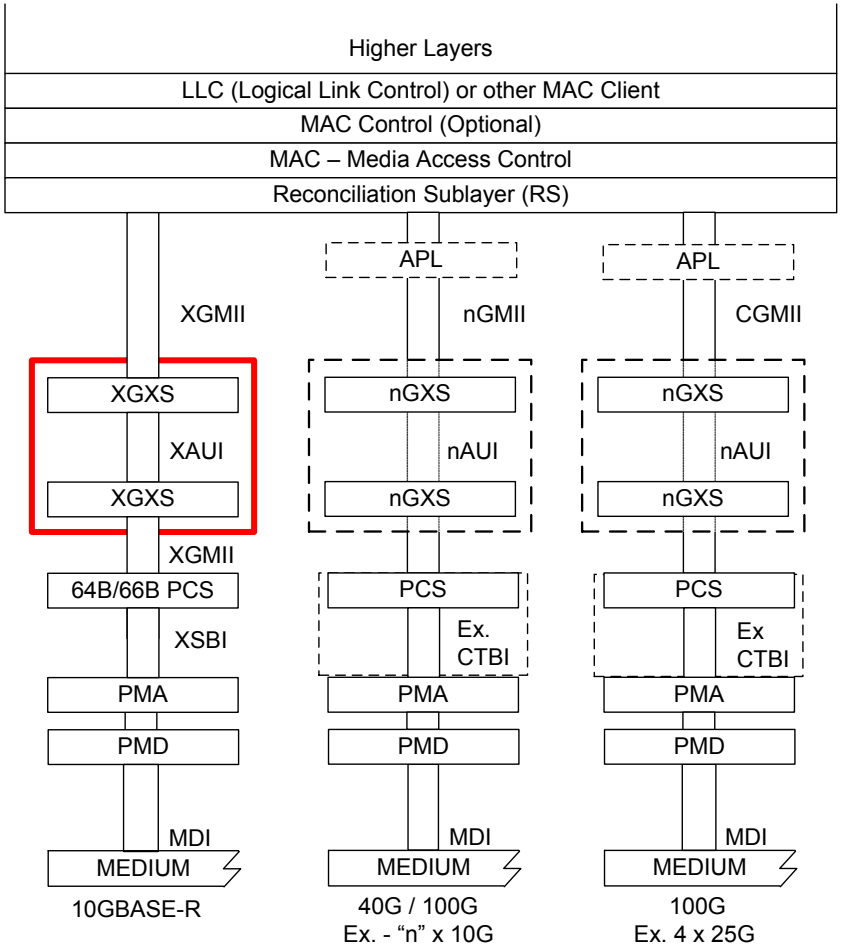
Observations – 40 GbE Backplane

- Leverage off 802.3ap?
- Re-Use of Existing Backplane Ethernet Layers?
  - FEC - Forward Error Correction (Clause 74)
  - AN - Auto-Negotiation (Clause 73)
- EEE has an objective related to 10GBASE-KR. Impact?



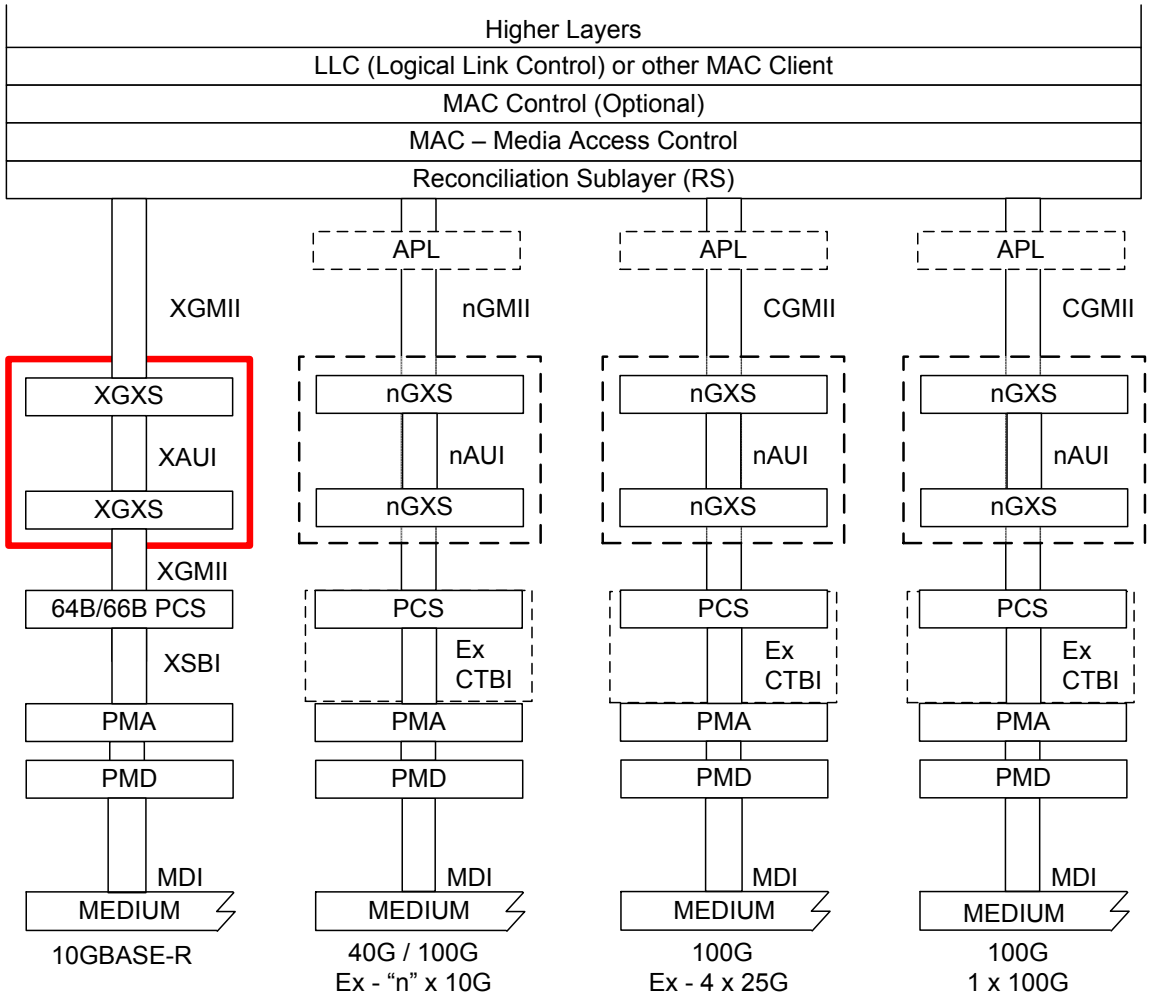
Observations – Cu Cable

- Support 40G / 100Gb Rates
- Type of Cu Cabling?
- Channel Model(s) Development
- 40G
  - “n” lanes by “m” Gb/s
- 100G
  - “x” lanes by “y” Gb/s
- Commonality considerations
  - Same PCS?
  - Same PMA?
  - Does “n” = “x”?
  - Does “m” = “y”?



Observations – MMF / SMF PHYs

- 40G / 100G
- Media - Parallel fiber approach?
- Channel Model(s) Development
- 40G
  - “n” lanes by “m” Gb/s
- 100G
  - “x” lanes by “y” Gb/s
- Commonality considerations
  - Same PCS?
  - Same PMA?
  - Does “n” = “x”?
  - Does “m” = “y”?



100G 10 / 40km SMF PMD Options

SMF	10km 1310nm	40km 1310nm	10km 1550nm	40km 1550nm
10x10G DML	yes + CL	yes + CL + OA	yes	maybe + OA
10x10G ML	yes + CL	yes + CL + OA	yes	yes + OA
5x20G / 4x25G DML	yes	maybe + OA	maybe	maybe + DC
5x20G / 4x25G ML	yes	yes + OA	yes	yes + DC
2x50G DQPSK I/Q ML	yes + CL	yes + CL + OA + DC	yes + CL + DC	yes + CL + OA + DC
1x100G TDM ML	yes + CL + OA	yes + CL + OA + DC	yes + CL + OA + DC	yes + CL + OA + DC

CL = Cooling (or semi-cooling), OA = Optical Amplification, DC = Dispersion Compensation

ML = Modulated Laser, DML = Direct Modulated Laser

Green shading designates alternatives under detailed study by Fiber Optic Ad Hoc contributors

Based on HSSGFO_SMF_alternatives2.pdf, Chris Cole

Objective-
Provide Appropriate Support for OTN

- Rate Independent Objective
  - For 40GE – existing OTN
  - For 100GE – OTN under development in ITU-T

- How do we accomplish?

Management

- Update Clause 30 as required:
  - Objects
  - Attribute
  - Action
  - Notifications
- Update Annex 30A as required
- SNMP MIBs
  - July 2007 HSSG Closing Plenary Report – "Request guidance from 802.3 WG on policy for how task forces address the need for SNMP MIB"

Test Procedures

- Support a BER better than or equal to 10^{-12} at the MAC/PLS service interface
  - Test time with appropriate confidence that actual performance will be better
    - Ex – additional stress in “stressed receiver” test
- Test Patterns
- Testing multi-lane optics at ≈10 Gb/s and higher per lane
- New test procedures take time to develop and validate
  - Start sooner rather than later

Questions (1 of 2)

- Architecture
  - Multi-lane PHY vs Aggregated PHYs
    - Is a solution “n” lanes by “m” Gb/s?
    - Is a solution “n” instances of PHY by “m” Gb/s PHY?
- The Physical Layer Specifications:
  - 40 Gb/s operation over:
    - at least 100m on OM3 MMF
    - at least 10m over a copper cable assembly
    - at least 1m over a backplane
  - 100 Gb/s operation over:
    - at least 40km on SMF
    - at least 10km on SMF
    - at least 100m on OM3 MMF
    - at least 10m over a copper cable assembly

Questions (2 of 2)

- Is a logical instance of nGMII sufficient?
- Define an extender sublayer?
- How should appropriate support for OTN be provided?
- Management
- Test Procedures
- Commonality between 40G and 100G?
- Naming nomenclature

Thank You!