50 Gb/s Ethernet Over a Single Lane and Next Generation 100 Gb/s & 200 Gb/s Ethernet Study Groups: status and work

Mark Nowell - Cisco

Acting Study Group Chair

Ad hoc meeting 12/2/15

Topics

- CFI recap
- Study Group expectations
  - Study Group work
  - Potential Objectives
  - Potential CSD responses
- Ad hoc work

Consensus Building Presentation

Met Tuesday evening from 7-8pm

- 134 people in the room at time of count

- Presenter and expert panel
  - Mark Nowell – Cisco
  - John D'Ambrosia – Independent
  - Adam Healey – Avago
  - Rob Stone – Broadcom
  - Chris Cole - Finisar

- The presentation discussed the motivation and needs for 50 Gb/s Ethernet Over a Single Lane and Next Generation 100 Gb/s & 200 Gb/s Ethernet for next generation data center applications:
  - http://ieee802.org/3/cfi/1115_1/CFI_01_1115.pdf

Straw Polls & Motions

1. Should a study group be formed for "50 Gigabit/s Ethernet over a single lane"? Y/N/A: 127/0/5 Room count: 134

2. Should a study group be formed for "Next Generation 100 & 200 Gigabit/s Ethernet"? Y/N/A: 124/0/4 Room count: 134

3. Individuals participation: "50 Gb/s": 102 "NG 100 & 200Gb/s": 103

4. Company participation: "50 Gb/s": 66 "NG 100 & 200Gb/s": 66

5. Move that the IEEE 802.3 Working Group request the formation of two Study Groups to develop Project Authorization Requests (PAR) and Criteria for Standards Development (CSD) responses for:

   - **50 Gigabit/s Ethernet over a single lane**
   - **Next Generation 100 Gb/s Ethernet & 200 Gigabit/s Ethernet**
     Y/N/A: 74/0/2

CFI Motion @ Nov Closing Plenary

Move that the IEEE 802.3 Working Group request the formation of two Study Groups to develop Project Authorization Requests (PAR) and Criteria for Standards Development (CSD) responses for:

- **50 Gigabit/s Ethernet over a single lane**
- **Next Generation 100 Gb/s Ethernet & 200 Gigabit/s Ethernet**

M: Mark Nowell

S: John D'Ambrosia

Procedural (>50%)

Y: 74   N: 0   A: 2

OK… now what? 2 Study Groups- how is that going to work?

Plan is to run the efforts jointly as much as possible but maintain procedural separation to facilitate decoupling if it happens.

- For example, this meeting. One ad hoc meeting covering topics for both as well as joint considerations. Minutes, web pages etc will reflect the dual study groups.
- In other words – some extra work for chairs, shouldn't be impactful to the participants
- Goals of study groups remains as usual, develop objectives, PAR and CSDs (x2)

- Goal is to be as clear and transparent as possible on what is happening and if anyone has a question – speak up

The original proposed approach
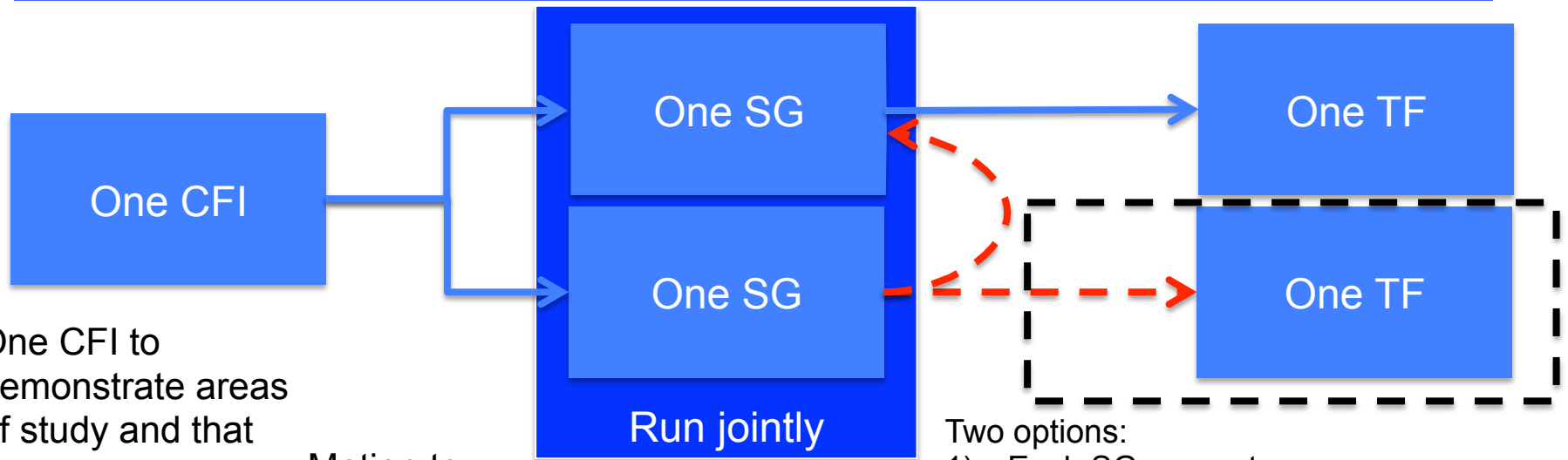
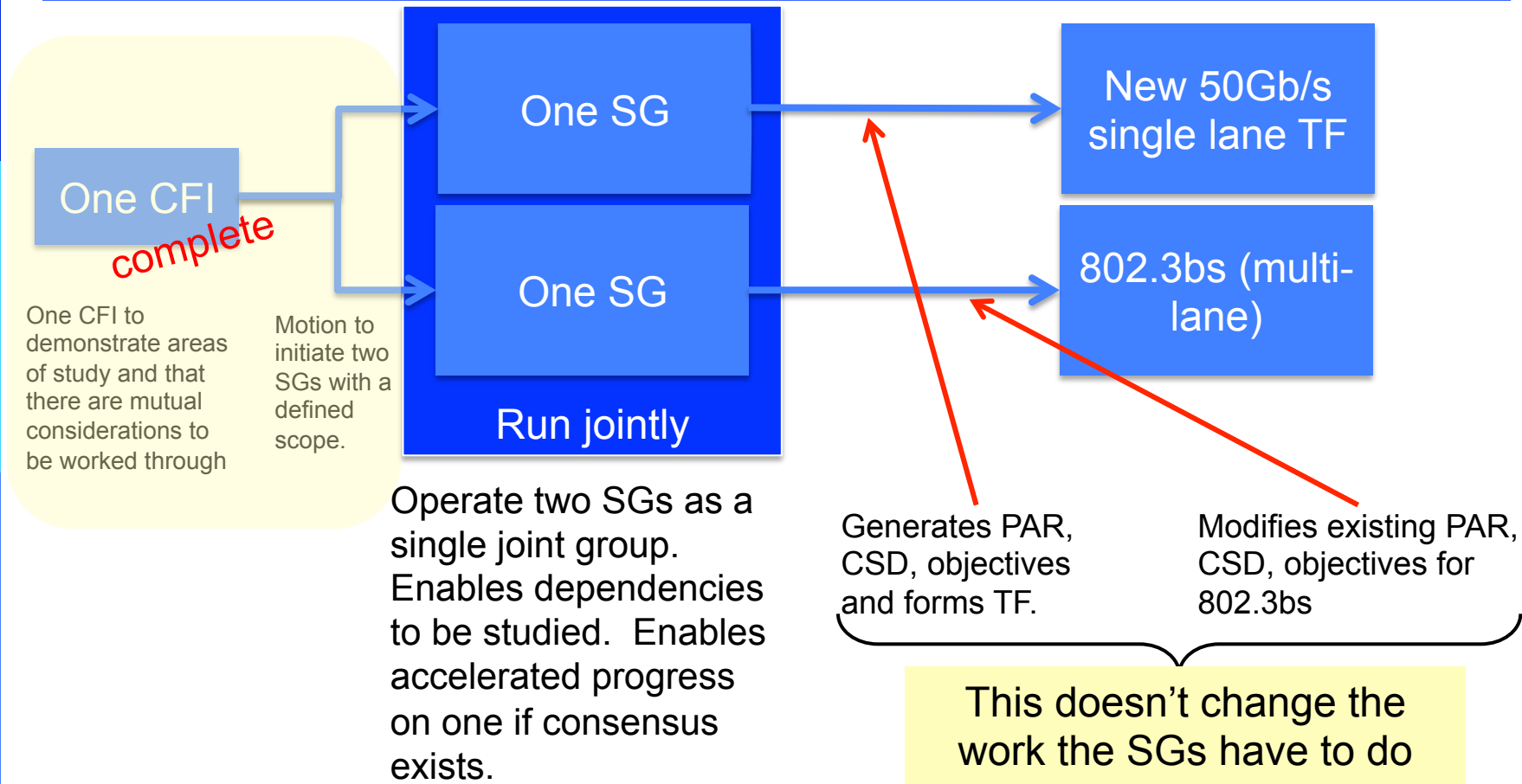One CFI to demonstrate areas of study and that there are mutual considerations to be worked through

Motion to initiate two SGs with a defined scope.

Operate two SGs as a single joint group. Enables dependencies to be studied. Enables accelerated progress on one if consensus exists.

Two options:
1) Each SG generates PAR and forms own TF.
2) Increase scope of one SG to incorporate the other SGs scope and form one TF.

Some current thinking on another scenario…

One CFI

complete

One CFI to demonstrate areas of study and that there are mutual considerations to be worked through

Motion to initiate two SGs with a defined scope.

One SG

One SG

Run jointly

New 50Gb/s single lane TF

802.3bs (multi-lane)

Operate two SGs as a single joint group. Enables dependencies to be studied. Enables accelerated progress on one if consensus exists.

Generates PAR, CSD, objectives and forms TF.

Modifies existing PAR, CSD, objectives for 802.3bs

This doesn't change the work the SGs have to do

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Study Group Work

- Goal of a Study Group is to study the problem and develop the following:
  - Objectives
  - Responses to The Criteria for Standard Development (CSD) – aka 5 Criteria
  - PAR
- Solving the problem, developing solutions, writing specifications are all Task Force activities

Goal of both Study Groups

- Very well supported CFI
- Very strong consensus on need to get things moving
  - Justification was built around maximizing re-use of technology under development
- Opportunity to move fast through Study Group phase
- Two Ad hocs chartered:
  - Study Group ad hoc – Chair: Kent Lusted

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Study Group Ad hocs (same for both SGs)

50 Gb/s Study Group ad hoc charter:

- to discuss the different areas of work that will fall under the work of the study group and to prepare content and contributions towards the study group's goal of developing the required documentation of objectives, PAR and CSD.

Next Generation 100 & 200 Gb/s Study Group ad hoc charter:

- to discuss the different areas of work that will fall under the work of the study group and to prepare content and contributions towards the study group's goal of developing the required documentation of objectives, PAR and CSD.

Some logistics…

Webpages:

50 Gb/s Ethernet Study Group

http://www.ieee802.org/3/50G/index.html

Next generation 100 Gb/s & 200 Gb/s Ethernet Study Group

http://www.ieee802.org/3/NGOATH/index.html

Reflectors:

- We're still waiting for this to be established. Details will be sent out and also posted on the webpages.
- Plan is just to have a common reflector for both Study Groups until a time that it is needed to diverge

50 Gb/s Ethernet Draft Objectives (Foundational)

- Support a MAC data rate of 50 Gb/s
- Support full-duplex operation only
- Preserve the Ethernet frame format utilizing the Ethernet MAC
- Preserve minimum and maximum FrameSize of current IEEE 802.3 standard
- Support a BER of better than or equal to 10^{-12} at the MAC/PLS service interface (or the frame loss ratio equivalent)
- Support optional Energy-Efficient Ethernet operation

50 Gb/s Ethernet Draft Objectives (expected ones)

- Define a single-lane 50 Gb/s PHY for operation over a printed circuit board backplane consistent with channels specified in IEEE Std 802.3bj-2014 Clause 93

- Define a single-lane 50 Gb/s PHY for operation over links consistent with copper twin axial cables, with lengths up to at least 3m

- Define a single-lane 50 Gb/s PHY for operation over MMF with lengths up to at least 100m

- Define a single-lane 50 Gb/s PHY for operation over SMF with lengths up to at least 2km

Other potential 50 Gb/s Ethernet Draft Objectives

- Provide appropriate support for OTN
- Provide appropriate consideration of multi-lane implementations for copper PHYs

100 Gb/s & 200Gb/s Ethernet Draft Objectives
(assuming these are additional to 802.3bs existing)

- Support a MAC data rate of 200 Gb/s
- Provide physical layer specifications which support 200 Gb/s operation link distances of:
  - At least 3m over Twinax Cable
  - At least 100 m over MMF
  - At least 500 m over Parallel SMF
  - At least ? km over duplex SMF
- Provide physical layer specifications which support 100 Gb/s operation link distances of:
  - At least 3m over Twinax Cable
  - At least 2 km over duplex SMF

100 Gb/s & 200Gb/s Ethernet Draft Objectives
(assuming these are additional to 802.3bs existing)

Other objectives to discuss:

- BER objectives for 100 Gb/s (802.3bs vs. 802.3ba?) & 200 Gb/s operation
- Backplane/copper/MMF – how do we handle objectives, analysis and editorial considerations for 100G & 200G if 50G is doing work and considering multi-lane implementations?
- Support optional 100 & 200 Gb/s Attachment Unit Interfaces for chip-to-chip and chip-to-module applications. Define 2-lane objective for 100 Gb/s and 4-lane objective for 200 Gb/s?

50 Gb/s Ethernet Draft CSD responses

Managed Objects

Describe the plan for developing a definition of managed objects. The plan shall specify one of the following:

    a) The definitions will be part of this project.

    b) The definitions will be part of a different project and provide the plan for that project or anticipated future project.

    c) The definitions will not be developed and explain why such definitions are not needed.

- The definition of protocol independent managed objects, to be included in Clause 30 of IEEE Std 802.3, will be part of this project.

- In addition it is expected that the definition of Simple Network Management Protocol (SNMP) managed objects, written using the Structure of Management Information version 2 (SMIv2), and making reference to the protocol independent managed objects provided by this project, will be added in a future amendment to, or revision of, IEEE Std 802.3.1 IEEE Standard for Management Information Base (MIB) Definitions for Ethernet.

No change from 802.3by response

Coexistence

A WG proposing a wireless project shall demonstrate coexistence through the preparation of a Coexistence Assurance (CA) document unless it is not applicable.

    a) **Will the WG create a CA document as part of the WG balloting process as described in Clause 13?**

    b) **If not, explain why the CA document is not applicable**

- A CA document is not applicable because the proposed project is not a wireless project.

No change from 802.3by response

Broad Market Potential

Each proposed IEEE 802 LMSC standard shall have broad market potential. At a minimum, address the following areas:

    a) **Broad sets of applicability.**

    b) **Multiple vendors and numerous users.**

- Ethernet is widely deployed for server to switch applications in data centers. An Ethernet data rate of 50 Gb/s enables a cost effective interconnect solution enabling 50 Gb/s server solutions and intersecting the 200 & 400 Gb/s networking solutions based on 50 Gb/s serial IO technology.

- There will be a significant market potential for 50 Gb/s Ethernet interfaces on servers that optimize the total cost of ownership while meeting the necessary IO bandwidth requirements in data centers.

- 134 participants attended the "50 Gb/s Ethernet over a single lane" Call-For-Interest. 102 individuals representing at least 66 companies indicated that they would support the standardization process. It is anticipated that there will be sufficient participation to effectively complete the standardization process including representatives from end-users, equipment manufacturers and component suppliers.

Compatibility

Each proposed IEEE 802 LMSC standard should be in conformance with IEEE Std 802, IEEE 802.1AC, and IEEE 802.1Q. If any variances in conformance emerge, they shall be thoroughly disclosed and reviewed with IEEE 802.1 WG prior to submitting a PAR to the Sponsor.

    a) **Will the proposed standard comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q?**
    b) **If the answer to a) is "no", supply the response from the IEEE 802.1 WG.**
    c) **Compatibility with IEEE Std 802.3**
    d) **Conformance with the IEEE Std 802.3 MAC**
    e) **Managed object definitions compatible with SNMP**

- As an amendment to IEEE Std 802.3, the proposed project shall comply with IEEE Std 802, IEEE Std 802.1AC and IEEE Std 802.1Q.

- As was the case in previous IEEE Std 802.3 amendments, new physical layers will be defined for 50 Gb/s operation.

- As an amendment to IEEE Std 802.3, the proposed project will conform to the full-duplex operating mode of the IEEE 802.3 MAC.

- By utilizing the existing IEEE Std 802.3 MAC protocol, this proposed amendment will maintain maximum compatibility with the installed base of Ethernet nodes.

- The project will include a protocol independent specification of managed objects with SNMP management capability to be provided in the future by an amendment to or revision of IEEE Std 802.3.1.

Distinct Identity

Each proposed IEEE 802 LMSC standard shall provide evidence of a distinct identity. Identify standards and standards projects with similar scopes and for each one describe why the proposed project is substantially different.

Substantially different from other IEEE 802.3 specifications / solutions.

- The proposed amendment will be the first IEEE 802.3 standard operating at a 50 Gb/s MAC rate.

- There are no existing standards, or projects developing standards, addressing the specification of 50 Gb/s Ethernet.

- The proposed amendment to the existing IEEE 802.3 standard will be formatted as a collection of new clauses, making it easy for the reader to select the relevant specification.

- IEEE Std 802.3 does not define Energy Efficient Ethernet for 50 Gb/s

Technical Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence that the project is technically feasible within the time frame of the project. At a minimum, address the following items to demonstrate technical feasibility:

 a) Demonstrated system feasibility.
 b) Proven similar technology via testing, modeling, simulation, etc.
 c) **Confidence in reliability.**

- The principle of scaling the IEEE 802.3 MAC to higher speeds has been well established by previous work within IEEE.

- The principle of building equipment that supports IEEE 802.3 networks operating at different Ethernet rates has been amply demonstrated by a broad set of product offerings.

- The proposed project will build on the array of Ethernet component and system design experience, and the broad knowledge base of Ethernet network operation.
    - Component vendors have presented data on the feasibility of the necessary components for 50 Gb/s solutions. Proposals, which either leverage existing technologies or employ new technologies, have been provided.
    - Component technology at 50 Gb/s, are already under development for other Ethernet projects (IEEE P802.3bs), and have been demonstrated.

- The reliability of Ethernet components and systems has been established in the target environments with a high degree of confidence.

Economic Feasibility

Each proposed IEEE 802 LMSC standard shall provide evidence of economic feasibility. Demonstrate, as far as can reasonably be estimated, the economic feasibility of the proposed project for its intended applications. Among the areas that may be addressed in the cost for performance analysis are the following:

  a) Balanced costs (infrastructure versus attached stations).
  b) Known cost factors.
  c) Consideration of installation costs.
  d) Consideration of operational costs (e.g., energy consumption).
  e) Other areas, as appropriate.

- The cost factors for Ethernet components and systems are well known.

- Prior experience in the development of 50 Gb/s technology specifications for Ethernet establishes that the new specifications developed by this project will entail a reasonable cost for the resulting performance.

- In consideration of installation costs, the project is expected to use proven and familiar media.

- Network design, installation and maintenance costs are minimized by preserving network architecture, management, and software.

- A 50 Gb/s Ethernet interface will maintain a favorable cost balance for intra-rack and inter-rack server to switch applications.

- Energy Efficient Ethernet will reduce the operational costs and the environmental footprint.

Future 50G/100G/200G Ad hoc work

- Review contributions aimed at locking down objectives
- Prepare content and contributions to substantiate:
  - Technical feasibility
  - Economic Feasibility
  - Broad Market Potential
  - Distinct Identity
  - Compatibility
- Future meetings: 12/9, 12/16, 1/6, 1/13