IEEE P802.3ae – 10 Gigabit Ethernet Minutes
Task Force Plenary Meeting
September 12 - 14, 2000
New Orleans, LA.

Prepared by: Jeff Warren

Administrative

The meeting convened at 8:37am, September 12th, 2000. Jonathan Thatcher, the 10 GE Task Force chairman, opened the meeting with a presentation of the agenda. Jonathan then appointed Jeff Warren as the permanent recording secretary for the P802.3ae Task Force, this was approved by acclimation. The agenda was reviewed. A motion to approve the agenda was made by Steve Haddock and seconded by Bob Grow, this passed by acclamation. Jonathan then reviewed all the administrative items such as reflector and web locations, membership, voting and sign-in rules.

This three day meeting was organized as a joint meeting during the first day and a half then the group split into two parts with 50% of the participants working in the "Logic Track" and 50 % of the participants working in the "PMD Track".

Some important links:
- ❑ Agenda = http://grouper.ieee.org/groups/802/3/ae/public/sep00/index.html
- ❑ E-mail Reflector = http://grouper.ieee.org/groups/802/3/10G_study/email/thrd1.html
- ❑ Reflector Instructions = http://grouper.ieee.org/groups/802/3/ae/reflector.html
- ❑ Voting Rules = http://grouper.ieee.org/groups/802/3/rules/member.html
- ❑ Patent Policy = http://grouper.ieee.org/groups/802/3/patent.html

The next IEEE meeting will be held in Tampa, FL. from November 6th – 10th. Prior to this meeting the 10GEA has offered to host a two-day meeting. Bob Grow, the 10GEA technical leader extended an open invitation to any IEEE member who is actively involved with the drafting and editing of this 1st draft 10 GE standard to participate. This meeting shall be held in Austin, Texas October 24th and 25th, 2000.

Raddisson Hotel	Two Day Agenda
111 Cesar Chavez	10/24 – Jitter Issues
Austin TX. 78771	10/25 – Editorial Tasks
(512) 478-9611	
(800) 333-3333 reservations.	

The P802.3ae 10 Gigabit Ethernet Task Group meeting was adjourned at 5:05pm on September 14, 2000.

Goals for this Meeting

This meeting was dedicated primarily to closing PMD issues, including MMF objective modifications and reviewing draft 1.0. This marked the beginning of the ***"Task Force Draft Review & Editing Phase".*** The on-line comment database was not used during this meeting, it is targeted to go on-line for the next IEEE meeting this coming November. The specific objectives for the week include resolution of the MMF PMDs, identification, solution and/or plan for a solution to key issues with the 1st draft 10 GbE standard. Key issues are defined as issues that impact multiple clauses or will require a significant on going effort to resolve them. Additionally Jonathan wants to organize problem resolution "Swat Teams", develop a plan for the MDI connector selection, deal with break link, remote fault and OAM&P functions.

Meeting Accomplishments

General Discussion (moderated by Jonathan Thatcher): The distance objectives for multi-mode fiber PMDs was resolved by a vote of 76 to 8 (90 % approval) also two MMF PMDs were adopted by a vote of 71 to 15 (83 % approval). The group felt that these two PMDs provide the best solution for campus and lowest cost long-term tera POP and equipment room interconnects. These PMDs also satisfy the new MMF objectives. There are now four distinct PMDs voted into the standard, they are 1550nm Serial, 1310nm Serial, 1310nm WDM and 850nm Serial. The new MMF objectives now specify ***"At least 300 meters over installed MMF"*** and ***"At least 65 meters over MMF".*** Installed in this case means all MMF specified in the 802.3z standard (62.5 micron 160/500 MHz*km FDDI-grade is the worst case). There was an attempt to add a 5th PMD "850nm CWDM", this failed to reach the 75% approval required by a vote of 29 to 35 (45 % approval). There are several sub-groups forming to tackle key issues, for example the "Jitter Group", these new groups will have their own reflectors set up for discussions. The old reflectors, i.e. cabling, copper, PAM, distance and 64/66 reflectors will be shut down to new e-mails, they will go into archive mode. The committee discussed and approved three interim meetings for 2001, please reference the Future meetings schedule below for details. The previously authorized 11/5/00 interim meeting is not necessary. There was an extended discussion of MDI connectors, previously the chairman of P802.3ae and 802.3 recommended the SC Duplex connector shall be used for this particular project. This SC Duplex could be replaced or additional connectors could be added. Some participants felt the connector does not need to be specified for the TP2 patch cord conformance point. Most felt the important point is to specify connector performance, e.g. losses across a connector and connector polarity was a concern.

Logic Track Summary (moderated by Ben Brown): This group completed a review of clauses 1, 2, 3, 4, 6, 22, 30, 31, 35, 46, 47, 48, 49 and 50. Ben suggested smaller more narrowly focused groups will be required in the future, e.g. XGMII sub-group. There is strong support for HSTL2 on the XGMII, however there's a lot of work to be accomplished in the next few months. The logic group is leaning towards the Shimon/Frazier "Remote Fault and Break Link" proposal as opposed to the LSS proposal. Signal Detect was discussed but more work is required. There will be

references to the T1.416 ANSI standard for the 10 GE WAN PHY. New WAN world issues are emerging that traditional Ethernet did not have to contend with in the past such as testing links prior to data transmission and how to deal with the various bit error counters. A logic track motion which changed the XGMII electrical to HSTL (1.8v) and timing to be source-simultaneous in both TX & RX directions passed by an 802.3 vote of 26 to 1 with 21 individuals abstaining. All attendees voted 60 to 4 with 48 abstaining.

PDM Track Summary (moderated by Walt Thirion): A total of 11 presentations were given during this track, the group reviewed clauses 51, 52 and 54. The group is comfortable with the 1310nm WWDM, 1310nm Serial and 850nm Serial PMDs. However the 1550nm Serial PMD which was previously thought to be solid is now the PMD that needs more work in the area of distances to be supported. The Piers Dawe spreadsheet used for modeling optical links, version 2.3.4 was adopted by a vote of 75 to 1 (99 % approval). This spreadsheet does not cover transmitter chirp very well.

Outline for these Minutes

Future IEEE Meetings

Month	Days	Year	Meeting Type	City	State/Country
November	6th – 10th	2000	Plenary	Tampa	Florida
January	16th – 18th	2001	Interim	Irvine	California
March	12th – 16th	2001	Plenary	Hilton Head	South Carolina
May	21st – 23rd	2001	Interim	*Open*	*Open*
July	9th – 13th	2001	Plenary	Portland	Oregon
September	1st half	2001	Interim	Copenhagen	Denmark

Link to the next meeting location: http://grouper.ieee.org/groups/802/meeting/index.html

➢ Preserve the 802.3/Ethernet frame format at the MAC Client service interface.
➢ Meet 802 Functional Requirements, with the possible exception of Hamming Distance.
➢ Preserve minimum and maximum FrameSize of current 802.3 Std.
➢ Support full-duplex operation only.
➢ Support star-wired local area networks using point-to-point links and structured cabling topologies.
➢ Specify an optional Media Independent Interface (MII).
➢ Support proposed standard P802.3ad (Link Aggregation)
➢ Support a speed of 10.000 Gb/s at the MAC/PLS service interface
➢ Define two families of PHYs
  ➢ A LAN PHY, operating at a data rate of 10.000 Gb/s
  ➢ A WAN PHY, operating at a data rate compatible with the payload rate of OC-192c/SDH VC-4-64c
➢ Define a mechanism to adapt the MAC/PLS data rate to the data rate of the WAN PHY
➢ Provide Physical Layer specifications which support link distances of:
  ➢ **At least 65 meters over MMF****
  ➢ **At least 300 meters over installed MMF***
  ➢ At least 2 km over SMF
  ➢ At least 10 km over SMF
  ➢ At least 40 km over SMF

> *********** **NEW** ***********
> *********** **MODIFIED OBJECTIVES** ***********
> * Installed = all MMF specified in 802.3z (62.5 micron 160/500 MHz*km FDDI-grade is the worst case).
> ** Implies that the solution is cost optimized for this distance.

➢ Support fiber media selected from the second edition of ISO/IEC 11801 (802.3 to work with SC25/WG3 to develop appropriate specifications for any new fiber media).

P802.3ae Contacts

➤ For the latest list of key P802.3ae contacts please reference the IEEE P802.3ae 10Gb/s Ethernet Task Force Chairs and Editors web page located at http://grouper.ieee.org/groups/802/3/contacts.html this web page is maintained by David Law.

Name	P802.3ae Standards Title	e-mail
Jonathan Thatcher	P802.3ae Task Force Chair Clause 52 (Serial PMDs) Editor (acting)	jonathan@worldwidepackets.com
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Brad Booth	Task Force Chief Editor Clause 45 (intro) Editor	bradley.booth@intel.com
Walt Thirion	PMD Track Chair	wthirion@jatotech.com
Ben Brown	Logic Track Chair	bbrown@amcc.com
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Ed Turner	Clause 33 (MDC/MDIO) Editor	Edward_Turner@3Com.com
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Bill Lane	Technical Writer	bill_lane@ieee.org

802.3ae Agenda

Speaker	T	Topic	Time Req	Time Allc	Start Time
Tue, 12 Sept 2000		**Call to Order**			**8:30 AM**
Jonathan Thatcher	Z	Opening Business	0:25	0:25	8:30 AM
Chris Diminico		TIA liaison report	0:15	0:15	8:55 AM
Rich Taborek		10G Fibre Channel liaison report	0:15	0:15	9:10 AM
Chris Simoneaux	L	XGP Overview and Status Report	0:25	0:25	9:25 AM
Schelto van Doorn	L	Multi Source Agreement for 10Gig Transponder	0:10	0:10	9:50 AM
		Break	**0:20**	**0:20**	**10:00 AM**
Jonathan Thatcher	L	MMF PMD Objectives -- Are they right?	0:10	0:10	10:20 AM
		Discussion -- Objective Motion?	0:20	0:20	10:30 AM
Tom Palkert	T	4 Fiber Very Short Reach 10GBE		0:10	10:50 AM
Sam Kim	U	4 Channel Very Short Reach 10 GBE Optical XCVR		0:15	11:00 AM
Pat Gilliland	T	10Gb/s Four Fiber Parallel Transmission Solutions	0:25	0:25	11:15 AM
Phil Schofield	T	Structured Cabling for Parallel PMDs		0:20	11:40 AM
		Lunch	**1:20**	**1:00**	**12:00 PM**
Ali Ghiasi	T	User Perspective on 850 nm Variants	0:20	0:20	1:00 PM
Doug Collins	L	Evaluating short wavelength VCSELs	0:20	0:20	1:20 PM
Jared Stack	L	Modal beam conditioning for enhanced MMF B/W	0:20	0:20	1:40 PM
Jack Jewell	U	850 nm Serial PMD Specifications	0:10	0:10	2:00 PM
Jack Jewell		?	0:10	0:10	2:10 PM
Paul Bottorff	T	Multimode PMD Proposal and Supporting Rationale	0:20	0:20	2:20 PM
Bill Wiedemann	L	CWDM 10GBASE-SX Proposal	0:30	0:30	2:40 PM
		Discussion -- PMD Motions?		1:00	3:10 PM
Jim Tavacoli	L	Challenges in Designing 10 GB/S Backplanes	0:20	0:20	4:10 PM
		Break	**0:20**	**0:20**	**4:30 PM**
Shimon Muller	L	Remote Fault & Break Link Proposal for 10GbE	0:30	0:30	4:50 PM
Kevin Daines	L	BL & RF Revisited	0:15	0:15	5:20 PM
Osamu Ishida	T	Link Signaling Sublayer (LSS) Proposal	0:20	0:20	5:35 PM
Rich Taborek	T	10GE Proposal: LSS for Remote Fault & Break Link	0:15	0:15	5:55 PM
		Break	**0:20**	**0:30**	**6:10 PM**
Vipul Bhatt	T	Equalization - Overview and Potential	0:10	0:10	6:40 PM
Abhijit Phanse	T	Fiber Equalization - A Review of Technologies	0:10	0:10	6:50 PM
Henning Buelow	U	SiGe IC Solutin for 10G Equalization of PMD	0:20	0:20	7:00 PM
Fow-Sen Choa	T	Adaptive Equalization Techniques for MMF Transmissions	0:10	0:10	7:20 PM
Moe Win	T	Similarities of PMD and DMD for 10Gbps Equalization	0:20	0:20	7:30 PM
Oscar Agazzi	T	Feasibility of DSP-Based Equalization for Optical Channels -	0:20	0:20	7:50 PM
Wed, 13 Sept 2000		**Call to Order**			**8:00 AM**
Shimon Muller	L	Changes to Existing Clauses - Status Update		0:10	8:00 AM
David Law	T	Clause 30 update - 10Gb/s MIB		0:10	8:10 AM
Edward Turner	T	Clause 33 update - MDIO/MDC management interface	0:10	0:10	8:20 AM
Brad Booth	T	Editor and Clause 45 Update		0:15	8:30 AM
Bob Grow	L	Clause 46 update		0:05	8:45 AM

Dawson Kesling	T Clause 47 Update - XAUI		0:10	8:50 AM
Rich Taborek	Clause 48 Update -		0:10	9:00 AM
Pat Thaler	L Clause 49 10GBASE-R PCS		0:10	9:10 AM
Tom Alexander	L Clause 50 (WIS) Status	0:15	0:15	9:20 AM
Justin Chang	T Clause 51 Update – Serial PMA	0:10	0:10	9:35 AM
Jonathan Thatcher	L Clause 52 Update – Serial PMD		0:10	9:45 AM
David Cunningham	Clause 54 Update – WDM		0:10	9:55 AM
	Break -- Change Room --	0:20	0:30	**9:55 AM**
	PMD/PMA Track			**10:25 AM**
Peter Ohlen	T Dispersion penalty for single-mode serial PMDs		0:15	10:25 AM
Peter Ohlen	U OMA for single-mode serial PMDs		0:15	10:40 AM
Piers Dawe	L 1310 nm serial eye mask and jitter		0:15	10:55 AM
Piers Dawe	L Recap: Enhanced Link Budget Spreadsheet		0:15	11:10 AM
David Law	Z Tutorial on MIB / MDIO		0:20	11:25 AM
Walt Thirion	Review PMA and PMD Clauses			11:45 AM
	LOGIC Track			**10:25 AM**
David Martin	T WIS Fault Isolation		0:20	10:25 AM
Joel Dedrick	L XGMII Timing	0:20	0:20	10:45 AM
Norival Figueira	T WIS MIB	0:30	0:30	11:05 AM
Ben Brown	Review Logic Clauses			11:35 AM
Wed, 14 July 2000	**Recombine Tracks**			**3:00 PM**
	Track Reports		0:30	3:00 PM
	Motion Madness		1:00	3:30 PM
	Closing		0:30	4:30 PM
	Adjourn			**5:00 PM**

Closing Discussions

➢ David Law reminded the group that if they have presentations on the web that they need to update them if they are out of date.

➢ The jitter group that is forming as well as others will have a unique reflector set up for discussion. The cabling, copper, PAM, distance and 64/66 reflectors will be shut down to new e-mails, they will go into archive mode.

➢ May 21, 22, 23 2001 York Meeting. After the meeting David Law determined that this meeting location is not possible due to limited hotel room availability.

➢ Previous Ottawa minutes have been approved.

➢ Minutes will come out in two pieces – 1st motions and important notifications then everything else.

➢ The previously authorized 11/5/00 interim meeting is not necessary.

➢ Connector Discussion:
  ❑ The chairman of 802.3ae and 802.3 has recommended the SC Duplex connector shall be used for this particular project.
  ❑ This SC Duplex could be replaced or additional connectors could be added.
  ❑ Is the intent to put in a connector and require it be used? We should do something that is conformance testable.
  ❑ The conformance point is TP2 (a patch cord) there is no reason to specify a particular connector since any connector would work.
  ❑ We should not specify a connector, the only place where we need a connector specified is at the end of the patch cord, and perhaps this could be an SC, however the MDI does not necessarily need to have connector specified.
  ❑ It would be a good idea to include connector performance, e.g. losses across a connector.
  ❑ SC25 suggested that if a standards group did not pick a connector by 2/01 that they would pick it for them.
  ❑ There is one aspect of the SC Duplex connector that has to be fixed, that being which side is Tx and which side is Rx.
  ❑ The vast majority of the test equipment in this world does not have SC Duplex; the ST and simplex SC are more popular.
  ❑ There was a motion to "not specify any connector at all, just worry about getting polarity correct", this motion was tabled. Reference general motion #5.
  ❑ At this time the group decided not to make a decision about any connectors, therefore the SC Duplex connector referenced in the current draft standard remains as is.

Motions

- **Motion # 1   General Motion**
  Description: Modify the distance objectives for MMF PMDs to:

  At least 300 meters over installed MMF*
  At least 65 meters over MMF**

  * Installed = all MMF specified in 802.3z (62.5 micron 160/500 MHz*km FDDI-grade is the worst case).
  ** Implies that the solution is cost optimized for this distance.
  - ▪
- Motion Type: Technical > 75% required
- Moved By: Tom Dineen
- Seconded By: Mack McCarron
- Results: 802.3 Voters   Y: 76   N: 8   A: 7
               Attendees   Y: 147 N: 23   A: 31
               Time: 4:12pm
               P/F: **Passed**
- **Discussion:** The distance could be as little as 50 meters for the bulk of the shorter distances. The 11801 cabling standard says equipment room cords are limited to 30 meters, considering this standard and round trips we would need a 60 meter length. Howard thought this motion should not have occurred at this time of the meeting. The 300 meters is critical for the campus environment. The 100 meters should be reduced to TIA room jumper lengths and is the largest immediate market for 10 GbE. A new length of 50 – 80 meters would be better. Customers continue to support the 300 meters over installed MMF for in building campus BB links. The FDDI-grade standard is a 15 year old spec, at some point it is appropriate to nudge the market and improve the standards we reference. Limiting the installed cable plant to 62.5 is short sighted because 50 micron has been installed over the years. The reason why 62.5 is referenced is because this is the worst case fiber so other cable types, including 50 micron is satisfied. 10 GbE will be bi-modal, very short and very long, lets go with MMF very short and SMF very long. We need to make progress on PMDs today – so the threat to stall it should not be allowed. The short computer room markets is the predominant WAN and MAN application and 65 meters works just fine. There is a concern that 65 meters will support many of the computer room applications but not all and that 100 meters is a better solution. The distance should not be adapted to what a particular current PMD proposal can met, rather the distance should be set at what the actual market requirement is. Another person spoke in favor of delaying the motion until additional presentations were given. Carrier customers say CO also needs 300 meters but in all those applications new fiber will be installed. A cost effective equipment room solution is required. If a cost effective solution were available at 100 meters then this would be better than a cost effective solution at 65 meters. Objection - there was a comment that we should consider PMDs based on existing objectives. Favor – the objects have changed,

lets get them reworded and corrected based on our customers real requirements. Favor – satisfies equipment room wiring. Favor – but remove the words installed. Favor – amending the 300 meter objective is a good thing and changes the way we look at the PMDs on the table. Favor – 65 meters is the bottom line of what we want to support, the high water point is undefined. Favor – the motion is appropriate and should be passed. Favor – the 65 meters works well for ISO 11801 distances specified for computer rooms. Objection – the 65 meter number does appear that it is matching the current technology capabilities. Favor – over the past year there has been an application space study done which supports the 65 meter distance.

> **Shimon / Howard moved to table the motion until a later point in time during this meeting. Passed.**

➢ Pat Thaler and Paul Bortoff moved to remove this motion from the table, this <u>procedural motion</u> passed by acclimation.

> Roy Bynum's Motion to Amend failed by lack of second.

- ▪ **Motion # 2**   **General Motion**
  Description: Move that, to complete the objectives, the P802.3ae Task Force adopt the set of MMF PMDs comprised of :
  - ❖ 1310 nm WWDM as presented in hanson_1_0500, and
  - ❖ 850 nm serial PMD as jewell_1_0900 as the basis for two of the PMDs in draft D1.1.

  - ▪ Motion Type: Technical > 75% required
  - ▪ Moved By: Paul Bottorff
  - ▪ Seconded By: Joel Goergen
  - ▪ Results: 802.3 Voters   Y: 71   N: 15   A: 7
                 Attendees   Y: 136 N: 31 A: 38
                 Time: 4:43pm
                 P/F: **Passed**

  Discussion: These two PMDs give us the best solution for campus and lowest cost long term tera POP interconnects and equipment rooms. The mover felt that the motion to divide would be considered unfriendly. There was a request to know how the mover and seconder voted on the same vote at the last meeting. Answer the same motion was not made and it is irrelevant. These two PMDs and the previous two PMDs are an excellent set and its time to move forward with them.

> An unfriendly motion to Amend by Bill Wiedemann and seconded by Howard.

  Description: Move that the P802.3ae Task Force adopt the following PMD:
  - ❖ 1310 nm WWDM as presented in hanson_1_0500
  As the basis for a PMD in draft D1.1.

  - ▪ Motion Type: Technical > 75% required
  - ▪ Moved By: Bill Wiedemann

- Seconded By: Howard Frazier
- Results: 802.3 Voters   Y: 22   N: 60   A: 10
                 All voters   Y: 57   N: 104 A: 43
                 Time: 4:37
                 P/F: **Fails**
- Discussion: This PMD seems to be supported by everyone so lets get it into the standard. Getting each PMD voted in individual is the best way to gauge a PMDs individual technical merits. This PMD fulfills the building backbone and campus building to building links. There were 2 people that think the passing of this motion will satisfy the newly passed MMF PMD objectives. There were a number of individuals that objected to splitting this motion into two pieces. In favor of each PMD standing on it's own. The deadlock situation we have is appropriately broken by a coalition. Opposed for same reasons previously articulated. Against because the new objectives are satisfied by the two PMDs initially proposed. Coalitions and block voting is OK. It makes sense to vote on PMDs as a set, called the question.

- **Motion # 3   General Motion**
Description: Move that the P802.3ae Task Force adopt the 850nm CWDM PMD as presented in wiedemann_1_0700 as the basis for a PMD in draft D1.1.

  - Motion Type: Technical > 75% required
  - Moved By: Bill Wiedemann
  - Seconded By: Stefan Wurster
  - Results: 802.3 Voters   Y: 29   N: 35   A: 27
                    Attendees   Y: 70   N: 64   A: 68
                    Time: 4:56pm
                    P/F: **Failed**
Discussion: The solution is more optimized that the previous 850 nm solution, it has multiple suppliers and customers, it will be in the market place so lets get it into the standard. Strong support for the motion primarily due to lowest cost. Opposed due to significant overlap with other PMD options. Favor – because it should hit the market earlier. Opposed – the 300 meter objective over installed fiber will probably never be achieved. True but this is not claimed by wiedemann_1_0700. Opposed, presentations are all marketing not technical in nature. This should go into the next revision of Ethernet. No objections to calling the question.

- **Motion # 4   PMD Track Motion**
Description: Move that the P802.3ae PMD Sub Task Force adopt and recommend that P802.3ae adopt the model structure and equations version 2.3.4 as found in the spreadsheet.   http://www.ieee802.org/3/10G_study/public/email_attach/3pmd046.xls but note that the MPN calculation is believed to be pessimistic and is under active review, and that the effect of transmitter chirp is not well covered.

  - Motion Type: Technical > 75% required

- Moved By: Piers Dawe
- Seconded By: Peter Pepeljugoski
- Results: Attendees   Y: 75   N: 1   A: 10
                Time: 12:13pm
                P/F: **Passed**

Discussion: Reference minutes from PMA / PMD Track recorded by Jack Jewell.

During the 802.3ae wrap-up meeting this motion passed by affirmation

- **Motion # 5   General Motion**
Description: Move that the IEEE P802.3ae task force does not define any specific MDI connector style. The task force shall define the MDI connection orientation.

- Motion Type: Technical > 75% required
- Moved By: Tad Szostak
- Seconded By: Schelto VanDoorn
- Results: 802.3 Voters   Y: N: A:
                Attendees   Y: N: A:
                Time:
                P/F: **Tabled This Motion**

Discussion: Favor – need to be open to a varity of connectors that will evolve with the fiber plants. The motion as stated would lead others to think we will never use a connector. The orientation (polarity) in the motion is with reference to the equipment.

Motion to Table by Walt Thirion & Roy Brynum – Yes = 30 No = 8 Abstain = 1

- **Motion # 6   Logic Track Motion**
Description: Move that the P802.3ae task force agree to the following changes to Draft D1.0 :
- ❖ Change XGMII electrical to HSTL (1.8v) with the class to be determined in November
- ❖ Change XGMII timing to be source-simultaneous in both TX & RX directions

- Motion Type: Technical > 75% required
- Moved By: Bob Grow
- Seconded By: Ben Brown
- Results: 802.3 Voters   Y: 26   N: 1   A: 21
                Attendees   Y: 60   N: 4   A: 48
                Time: 3:38pm
                P/F: **Passed**

General Presentations

1. **Opening Business (Jonathan Thatcher)**
   http://grouper.ieee.org/groups/802/3/ae/public/sep00/intro_0900.pdf

   Mr. Thatcher defined the objectives for the week, which include resolution of the MMF PMD's, identification and solution or plan for a solution to the key issues with the 1st draft 10 GbE standard. These key issues impact multiple clauses or will require a significant on going effort to resolve them. Additionally Jonathan wants to organize problem resolution "Swat Teams", develop a plan for the connector selection, deal with break link, remote fault and OAM&P functions. The first draft standard is available to IEEE802.3ae active participants. The draft is located at URL http://www.ieee802.org/3/ae/private/index.html the username is 802.3ae and the password is ***_*****.

   The Big Ticket Items defined at the start of this meeting were:
   - **MAC** - IPG Rules
   - **XGMII** - SSTL v. e.g., HSTL, Single-ended v. Differential clock
   - **XAUI** - Initialization protocol (ties to RF & BL), Remote Fault & Break Link transport, Signal Detect transport (medium to PCS)
   - **WIS** - Clocking and Errors, Undefined Overhead Bytes
   - **PMA** - Clock Utilization
   - **PMD** - Signal Detect, Jitter Methodology, Test Patterns, Connector
   - **MDC/MDIO** - Optionality
   - **10GBASE-R PCS** - State Machine Refinement

2. **TIA-TR42 Liaison Report (Chris Diminico)**
   http://grouper.ieee.org/groups/802/3/ae/public/sep00/diminico_1_0900.pdf

   Mr. Diminico discussed the new specifications for MMF used by this group, how TIA activities are important to this group. The new MMF specification is running in lock step with our standards timeline. The 10G MMF ballot is targeted for November of this year. Final closure is targeted for early next year. The status of this specification was communicated with the 802.3ae and 802.3 chairs. The topology, media and distances for Internet data centers and central offices are under study at TIA.

3. **10G Fibre Channel Liaison Report (Taborek)**
   http://grouper.ieee.org/groups/802/3/ae/public/sep00/taborek_2_0900.pdf

   Mr. Taborek stated that this liaison is important to the IEEE802.3ae task force because the FC group is very interested in picking up work done here in IEEE. There is an initial 10GFC proposal for extending (alternative) 4X & 8X FC. Baseline proposals have been selected and the document is underway, this currently includes 4 optical and 1 copper PMD, too many according to Rich. The objectives are not targeting specific distances. Small form factor transceivers are required. Rich is the editor of the standard and conducts bi-monthly meetings. The web site for this group

is, www.t11.org The logic proposals are mostly identical to GbE logic proposals, with the addition of LSS. The line rate is 2% faster than 10GbE (12.75 Gbps) to get an integer multiple of FC 1X rate, this equates to 12x FC's 1.0625 Gbps previous baud rate. SFF for 850nm parallel optics and copper is expected. There is a concern that 10GFC is too radical a change for disk drive technology, there are people that only want 4X speeds to the disk drives. Does the FC world use repeater and re-timer as we do in IEEE, answer these are new terms to FC and will take on the same meaning as defined here in IEEE802.3ae.

10GFC Implementation Example
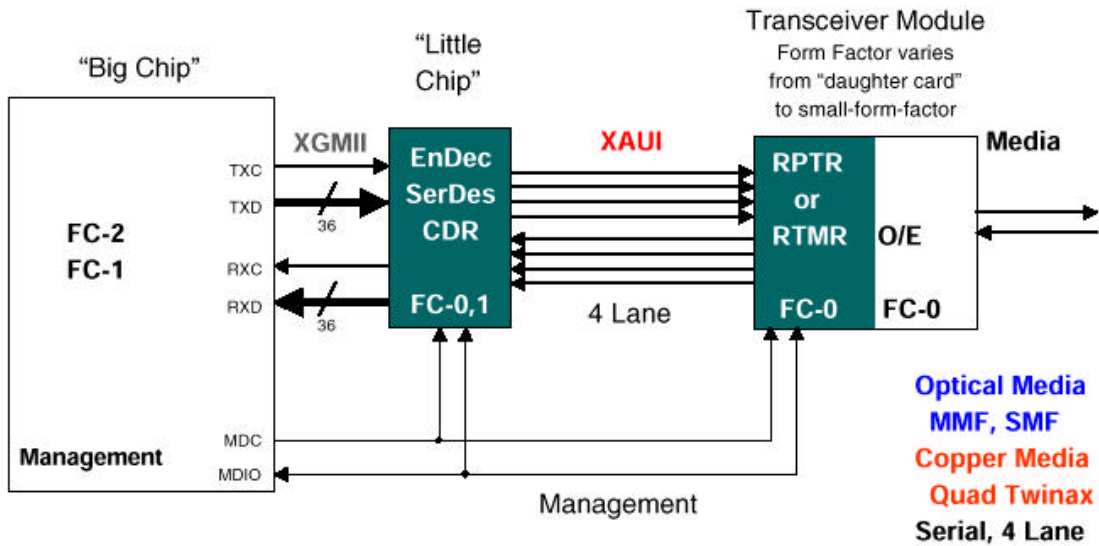
4. XGP Overview and Status Report (Chris Simoneaux)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/simoneaux_1_0900.pdf

Mr. Simoneaux discussed a new group that has been formed. This is a group of 14 companies that are defining 10Gbps optical transceivers, the same group of people that developed a SFF pluggable in the past. This will include a common foot print and functional specifications, will be hot pluggable. Will support multiple fiber and electrical interfaces. The electrical interface includes support for 4 lanes from upper layer IC's. The electrical attachment, connector receptacle, cage assembly, bezel, and plug concepts were shown. The group is working through the operation procedures for the future meetings and attempting to resolve intellectual property issues. An SFP style 50 pin Z-axis package is planned. The group will have face-to-face meetings every two months and conduct bi-weekly conference calls, contact csimoneaux@picolight.com for details. The list of 14 companies has not been disclosed yet. None of the definitions are cast in concrete yet. The integrated mux and

demux is needed for some PMDs, not all. The connector pin-out and control lines are pinned down. The EMI issues are of great concern to this group.


XGP Attachment Approach
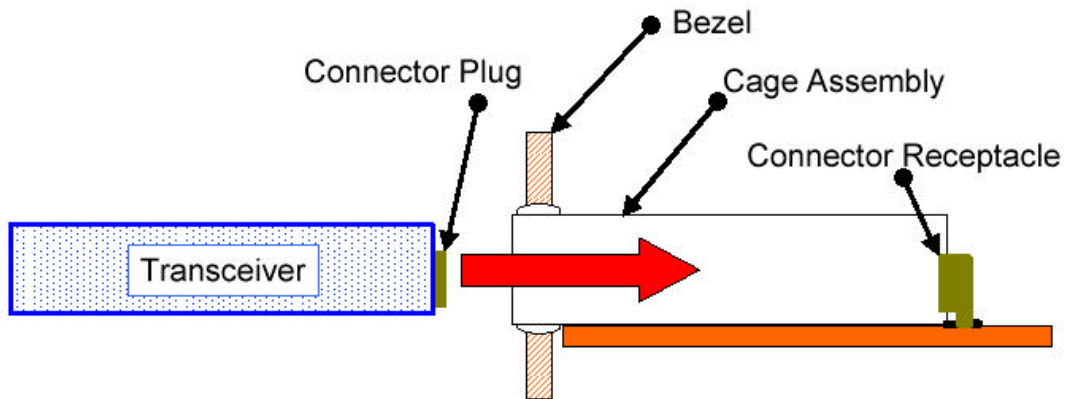
5. **Multi Source Agreement for 10Gig Transponder (Schelto van Doorn)**
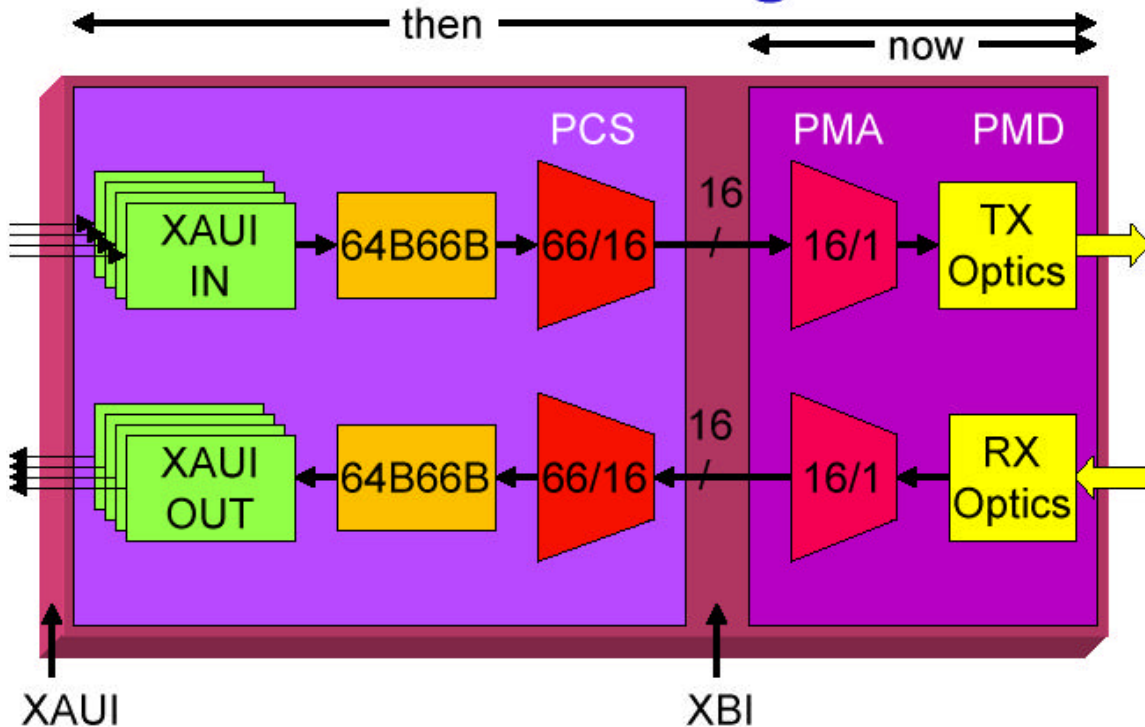   http://grouper.ieee.org/groups/802/3/ae/public/sep00/doorn_1_0900.pdf

Mr. Van Doorn described an transceiver package supported by four companies, Infineon Technologies, JDS Uniphase Corporation, Lightlogic Inc. and Nortel Networks Limited that includes XAUI, 64/66 PCS, PMA and PMD with pigtails because they are very concerned with EMI issues. MSA is open to all companies, 10GbE single and multi mode devices are available NOW. This includes Y-Axis insertion so you could place this anywhere on the PCB, is not hot pluggable. The size of this device is significantly smaller than previous efforts in other committees.
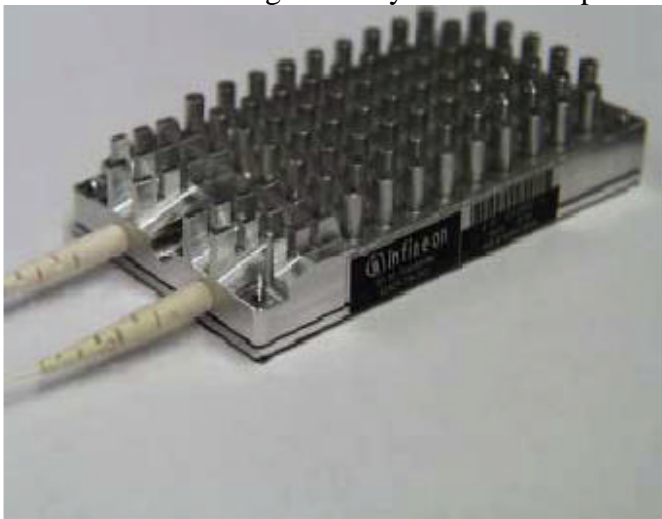
Dimension: 75mm x 42mm x 16mm
3˝ x 1.6˝ x 0.6˝
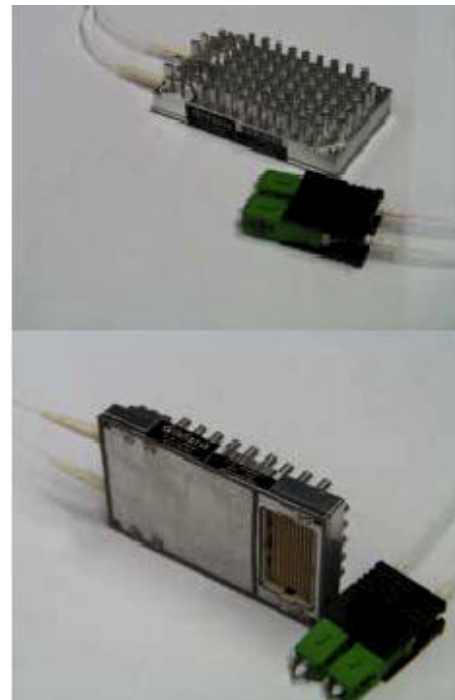
MSA Block Diagram

6. MMF PMD Objectives – Are they right? (Jonathan Thatcher)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/thatcher_1_0900.pdf

Mr. Thatcher started with the two objectives that do not have corresponding PMD options in draft 1. These MMF objectives are holding the committee back and it seems to be that there is a general feeling that 300meters is desired for installed MMF and a short distance, low cost, jumper that supports under 100 meters is desired. This yields four application spaces, WAN / MAN, Campus, Premise Wiring and Equipment to Equipment E2E. Changing the objectives now makes sense because we understand more about our market place today. An overwhelming majority modified the MMF objectives; i.e. 90 % of the 802.3 voters were in favor of the MMF text below.

<div align="center">

300 meters over installed MMF*
65 meters over MMF**

</div>

   * Installed = 62.5 micron 160/500 MHz*km (FDDI-grade) multi-mode fiber
      ** Implies that the solution is cost optimized for this distance.

Discussion: The distance could be as little as 50 meters for the bulk of the shorter distances. The 11801 cabling standard says equipment room cords are limited to 30 meters, considering this standard and round trips we would need a 60 meter length. Howard thought this motion should not have occurred at this time of the meeting. The

300 meters is critical for the campus environment. The 100 meters should be reduced to TIA room jumper lengths and is the largest immediate market for 10 GbE. A new length of 50 – 80 meters would be better. Customers continue to support the 300 meters over installed MMF for in building campus BB links. The FDDI-grade standard is a 15 year old spec, at some point it is appropriate to nudge the market and improve the standards we reference. Limiting the installed cable plant to 62.5 is short sighted because 50 micron has been installed over the years. The reason why 62.5 is referenced is because this is the worst case fiber so other cable types, including 50 micron is satisfied. 10 GbE will be bi-modal, very short and very long, lets go with MMF very short and SMF very long. We need to make progress on PMDs today – so the threat to stall it should not be allowed. The short computer room markets is the predominant WAN and MAN application and 65 meters works just fine. There is a concern that 65 meters will support many of the computer room applications but not all and that 100 meters is a better solution. The distance should not be adapted to what a particular current PMD proposal can met, rather the distance should be set at what the actual market requirement is. Another person spoke in favor of delaying the motion until additional presentations were given. Carrier customers say CO also needs 300 meters but in all those applications new fiber will be installed. A cost effective equipment room solution is required. If a cost effective solution were available at 100 meters then this would be better than a cost effective solution at 65 meters. Objection - there was a comment that we should consider PMDs based on existing objectives. Favor – the objects have changed, lets get them reworded and corrected based on our customers real requirements. Favor – satisfies equipment room wiring. Favor – but remove the words installed. Favor – amending the 300 meter objective is a good thing and changes the way we look at the PMDs on the table. Favor – 65 meters is the bottom line of what we want to support, the high water point is undefined. Favor – the motion is appropriate and should be passed. Favor – the 65 meters works well for ISO 11801 distances specified for computer rooms. Objection – the 65 meter number does appear that it is matching the current technology capabilities. Favor – over the past year there has been an application space study done which supports the 65 meter distance.

7. **Distance Objectives (Bill Wiedemann)**
   http://grouper.ieee.org/groups/802/3/ae/public/sep00/wiedemann_1_0900.pdf

   Mr. Wiedemann spoke in favor of NOT changing the current objectives. These changes could delay the standards efforts. Bill claimed that several PMD companies that are supporting 1310 nm WWDM and 850 nm Serial have got together to define markets that satisfy their solutions. Bill suggested that individuals vote often and vote no for sub-optimal solutions. Bill pointed out that an abstain or non-vote will endorses three Yes votes. Mr. Thompson has problems with the factual errors of this presentation that "the objects have to go up to IEEE" and the assertion that "you must vote" and a third assertion about companies having prearranged votes established. Bob Grow also objected to the statement about "abstaining" as an invalid vote, this should be allowed because people that abstain sometimes do so because they don't want to take a position in front of various component suppliers.

8. 4 Channel Very Short Reach 10GBE Optical XCVR (Sam Kim)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/kim_1_0900.pdf

Mr. Kim felt that a PMD for short distance interconnect is required and stated several companies support this presentation. They are sampling prototypes in Q300 and plan for a 1Q01 multi-vendor milestone. Four VCSEL array solution supporting 2.5 or 3.125 Gb/s across each channel. Most of the work done on this effort has been for OIF office interconnect at 2.5Gbps. A w/c eye at 300 meters shows usable operation at both temp ranges. Have demonstrated the solution with a quad SERDES at 4x2.5Gbps and expect similar performance with 4x3.125 Gbps SERDES. The tricky part of developing these types of transceivers is the "Cross Talk", with both transmit and receive turned on the cross talk is within acceptable limits. This solution has broad market potential, multiple suppliers early next year, will have excellent EMI profiles and is expected to have the lowest cost due to 1.5W power consumption (less SERDES) plus it is ½ the size of a small form factor LC. If SERDES consumes 1.5W this is a total of 3W for the overall solution. The 12 ribbon 50 micron 500MHz fiber was used in the testing. Field termination was questioned, there's a presentation coming up that will address this later this afternoon, however this solution is expected to be a jumper so it could be manufactured off-site.
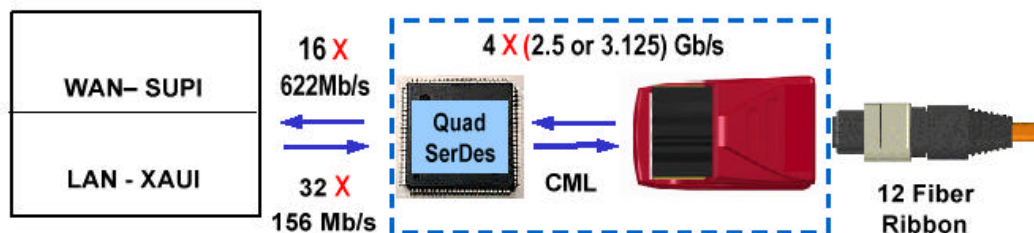
9. 10 Gb/s Four Fiber Parallel Transmission Solutions (Pat Gilliand)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/gilliland_1_0900.pdf

Mr. Gilliand addressed both the 100 and 300 meter space and described the applications for both. The solution would include support for the optional XAUI interface. The solution is also connector independent supporting both ferrule array and ribbon fiber connectors. The distances over various fiber types (MMF & SMF) were specified in the pitch. All the typical transmitter and receiver characteristics were shown. The new information was how the 3.125 mm pitch allows for non OFC applications. New connectors with 3mm pitch means it will be significantly larger than other products, yes 2 – 2.5 times wider. The 300 meter length is based on 1310 nm and 62.5 micron fiber. This solution would apply to more than IEEE standards,

Pat also suggested this work applies to Fiber Channel 10G, ATM (OC-48)x4 cross connect and Infiniband.

10. Structure Cabling for Parallel PMDs (Phil Schofield)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/schofield_1_0900.pdf

Mr. Schofield started by describing the enterprise premise MMF installed base. Fiber construction parameters such as fiber counts, types, TIA/EIA 598 color coding, construction, plus flammability ratings, etc were discussed. Typical trunk cable was shown, including the universal color-coding scheme. Fiber splicing of existing cabling plants is typically used to adapt trunk cables to wiring cabinets, a variety of the cabinetry was shown. Mechanical connections are also used for both ribbon and simplex cabling. The actual cable preparation step performed prior to splicing was outlined. Phil concluded by restating the field termination of either ribbon or simplex cabling is common practice, this is not an obstacle to moving forward.
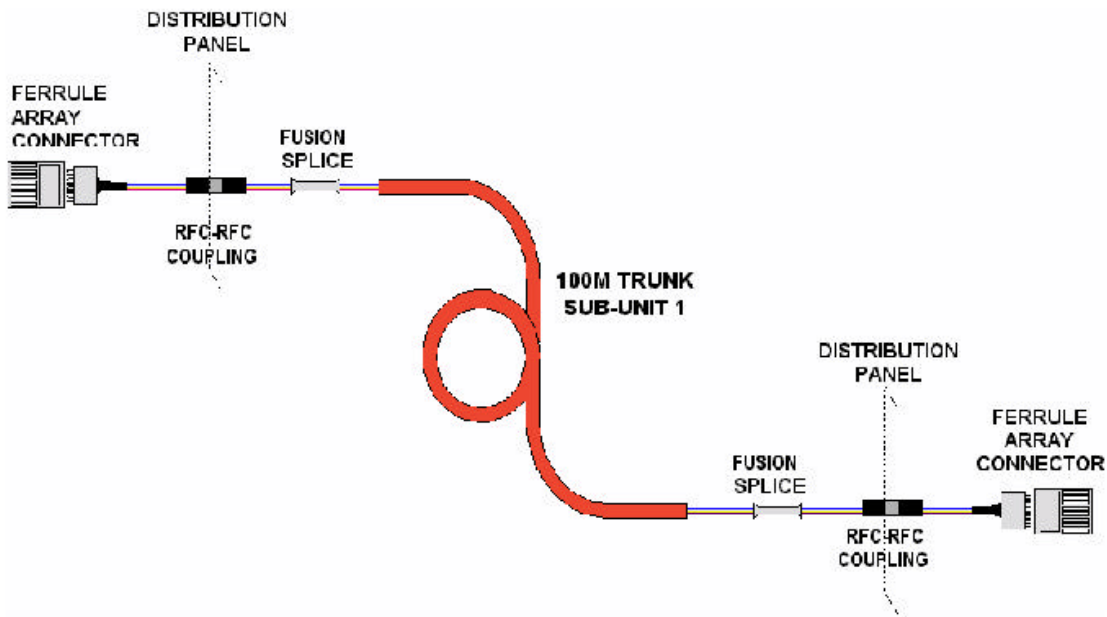
11. 4 Fiber Very Short Reach 10GBE (Tom Palkert)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/palkert_1_0900.pdf

Mr. Palkert's pitch is supported by 8 companies. Leverage the costs of back planes, move some costs to line cards. Majority of applications are 2 –20 meters, e.g. 50% of GE connections are less than 25 meters. These short distances are cost sensitive. The FC, Infiniband and OIF have all concluded that this 8 fiber parallel solution has strong merit. There was a dispute that in the very near future the lowest laser cost was the 850 nm Serial, not the parallel fiber solution. CWDM does not need controlled

launch. The 1310 nm WWDM missing data was offered, e.g. suppliers are committed to sampling parts now. The parallel fiber solution does not require any filters and no wavelength controls.

## Short Reach PMD Comparison
(Assuming Deployment in Q1 2001)

	Parallel Fiber	CWDM	WWDM	850mm Serial
SERDES - required	None	None	None	Yes
Filters (WDM)	None	Yes	Yes	None
Controlled Launch	None	Yes	Yes	Yes
Other Standards	FC, Infiniband, OIF	OIF, FC		OIF
Laser Costs	Lowest	Lower	Highest	Medium
Time to Market	Now	January	?	January
# of Fibers	8	2	2	2

12. User Perspective on 850nm Variants (Ali Ghiasi)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/ghiasi_1_0900.pdf

Mr. Palkert pitched for Ali. Described the pros and cons of 850 nm variants. Parallel optics is the lowest cost at less than 25 meters and impractical for greater than 100 meters due to cable cost. There were a lot of clarification questions relative to the cost chart. This parallel "jumper cable" option for the data center should require less power than its competitive serial solution.

Optical Technology Relative Cost

Relative Cost of 10 Gig Optical Transciver

Relative Cost to 2.5 Gig SW included two xcvr plus the cable
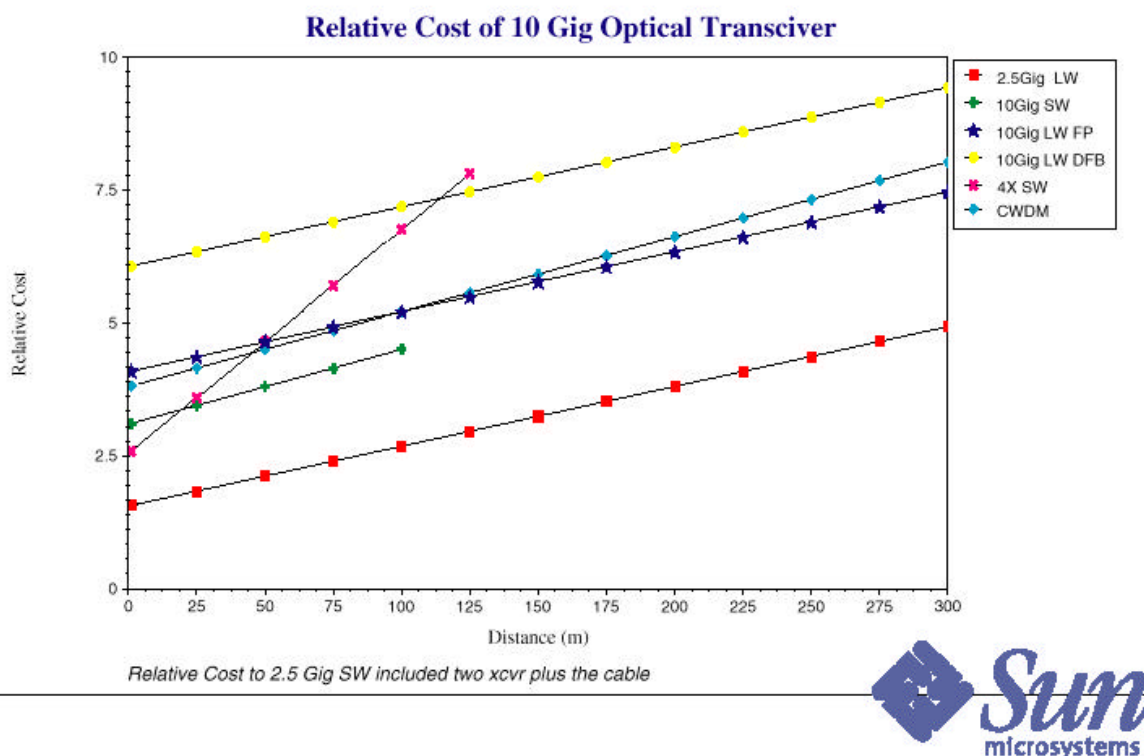
13. Modal beam conditioning for enhanced MMF B/W (Jared Stack)

Mr. Stack discussed the how fiber defects, which exist in the installed base of fiber, cause problems, e.g. differential modal delay. The vortex lens could be used for either 1310 or 850 nm applications to keep light away from the center of the fiber. This pitch seems to indicate that the current offset launch is flawed, Mr. Cunningham said this is not the case. The wrong modes were offset, when the correct modes are offset the results of the video shown would be very different. Having any axial launch is what Jared wanted to avoid, he felt this was achieved. The fibers used for the video were 2 – 5 meters. How would fiber cleaning impact this technique, getting the light to project across a larger area would help the situation. Jared (Digital Optics) presented a novel launch scheme for coupling light into the skew rays of a graded index fiber. This was accomplished by a beam shaping deffractive optical element to create a launch condition, which excited a specific fiber eigenmode. This eigenmode was chosen in order to avoid the regions in the multi-mode fiber which could contribute to differential modal delay (DMD). A video was shown of the coupled beam profile, which propagated in a manner that avoided these regions, even when the fiber was perturbed. Experimental results were presented to confirm that the element does improve the bandwidth of DMD challenged fiber. This approach offered an on-axis alternative to existing methods for the conditioned launch problem.

14. 850 nm Serial PMD Specifications (Jack Jewell)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/jewell_1_0900.pdf

Mr. Jewell's presentation is a series of 850nm Serial PMD specifications targeted for clause 53. Jack cleared up some confusion, stated that the mode conditioning patch cord does not apply. Operating ranges for all fiber types has been calculated and detailed in table 38-2. The transmit characteristics are based on detailed test measurements. Average launch power will be less than class 1 laser safety limits. The receiver characteristics were developed to be compatible with higher receive powers. There is close to 1 dB of margin left over. The jitter budget is very straightforward. Piers Dawe's link model was used. They continue to refine target specifications. A single transceiver can be used for both the new fiber and legacy fiber types. This transceiver will do one launch. There is ample experimental work that shows a single transceiver can be used for both fiber types. There is a different distance (270m 'vs' 300m) specified in the OIF standard. The reason is that the OIF number 270m relied on less data and is a more relaxed/conservative number.
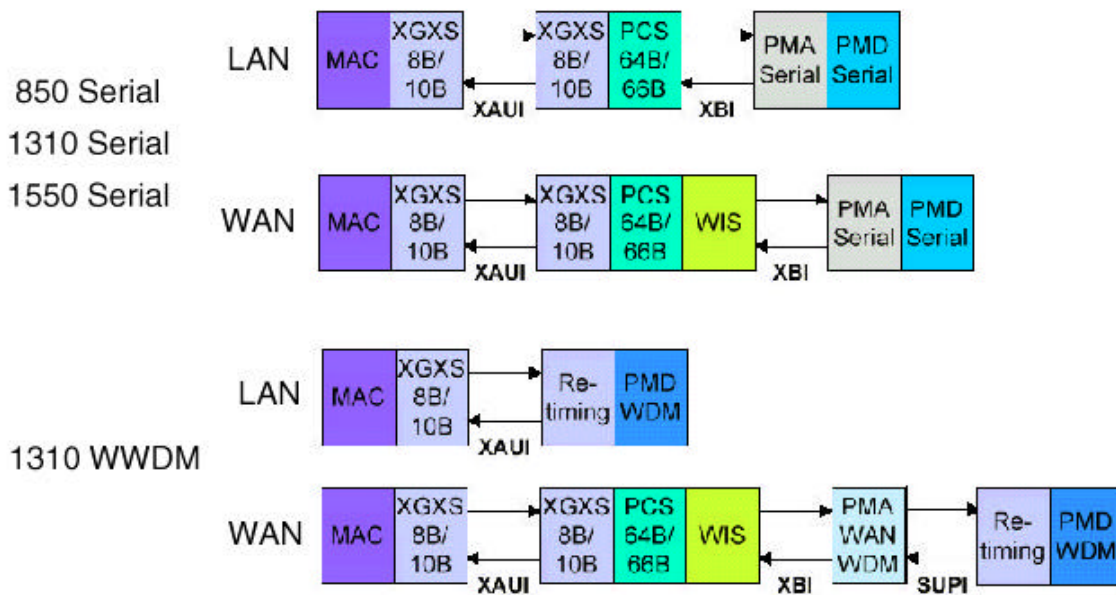
15. Multimode PMD Proposal and Supporting Rationale (Paul Bottorff)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/bottorff_1_0900.pdf

Mr. Bottorff endorses the change in MMF objectives. A total of 57 individuals from 25 companies have looked at this presentation. The PMD's for MMF are 850 nm Serial (low cost equipment interconnects) proposed in jewell_1_099 and 1310 nm WWDM (campus & building) proposed in hanson_1_0500. After 300 meters you'll use SMF. Fewer PMDs is better. The short reach market is approximately 80 % of the 10 GbE market. There have been demos of both 1310 WWDM & 850 Serial nm technologies. The campus customers would like to purchase in confidence knowing that their 10 GbE campus ports will operate over both SMF and MMF.

An attempted **STRAWPOLE** – To complete the objectives, the P802.3ae Task Force adopt the set of MMF PMDs comprised of 1310 nm WDM PMD as presented in hanson_1_0500 and 850 nm serial PMD as presented in jewell_1_0900 as the basis for two of the PMDs in draft D1.1. This straw pole was presented but not voted upon.

Implementation Examples

850 Serial
1310 Serial
1550 Serial

LAN | MAC | XGXS 8B/10B | XGXS 8B/10B | PCS 64B/66B | PMA Serial | PMD Serial
XAUI | XBI

WAN | MAC | XGXS 8B/10B | XGXS 8B/10B | PCS 64B/66B | WIS | PMA Serial | PMD Serial
XAUI | XBI

1310 WWDM

LAN | MAC | XGXS 8B/10B | Re-timing | PMD WDM
XAUI

WAN | MAC | XGXS 8B/10B | XGXS 8B/10B | PCS 64B/66B | WIS | PMA WAN WDM | Re-timing | PMD WDM
XAUI | XBI | SUPI

16. CWDM 10GBASE-SX4 Proposal (Bill Wiedemann)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/wiedemann_2_0900.pdf

Mr. Wiedemann stated that 71 individuals representing 38 companies support this proposal. The existing MMF objectives are all exceeded and the IEEE schedule can be met. All five criteria can be achieved too, see Bill's charts for details on 5 criteria or past minutes for this proposal. A new quote from a top system vendor said regardless of the PMD voting in this meeting they will use 850 nm CWDM. This will capture more market space than the 850 nm Serial solution. There are three functional blocks to the solution, a XAUI re-timer, Four SW VCSELs and Quad PIN. The solution has been demonstrated. The size is equal to the size of a GBIC. The technology used for this solution is identical as used for parallel fiber solutions. Over 23 Laser Drivers, TIAs, Lasers and Detectors are available today for use in this solution. CWDM optics are modulation rate independent. The solution will help future Ethernet efforts at either 40 or 100 Gbps using the same package, this will enable tera bit solutions. All parts are available from multiple suppliers, GA of the solution by 4/01. Bill ran through the standards tables, they are identical to tables he has presented in the past two meetings. Bill feels that the sentiment is for a four PMD solution, not a 5 PMD solution. Fully automated solutions will drive these 850 nm CWDM cost extremely low, down to 1.3x the cost of 1 GE today, this is very compelling. The center wavelengths have changed, this is because the solution can be sold into other markets. Who are the four companies that have strong interest to be suppliers of 10Gbase-SX4 850CWDM.

Functional Blocks
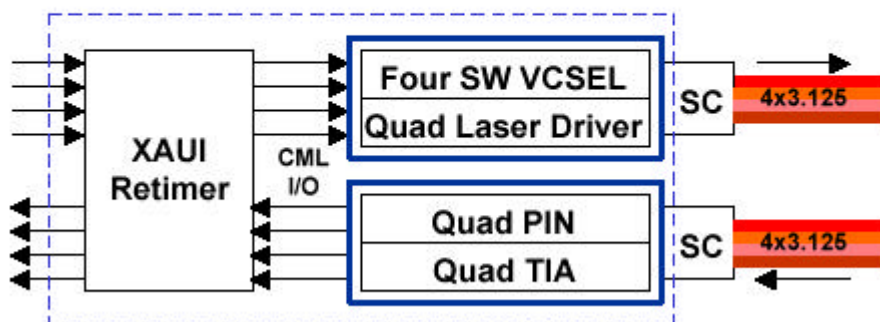
17. Challenges in Designing 10 GB/S Backplanes (Jim Tavacoli)
http://www.ieee802.org/3/ae/public/sep00/tavacoli_1_0900.pdf

Mr. Tavacoli's pitch focuses on the physical layer devices used to make back plane interconnections. Jim classifies these back plane interconnections as a full communications system. The parameters we worry about are cross talk (use adaptive transmit levels), EMI (scrambler), density (higher bit rate per symbol), high frequency losses (use lower line frequencies), reflections (use adaptive equalization) at vias, connectors and terminations. Optical back planes are a good solution but expensive. Another solution is PAM for multiple symbol possibilities per pulse.

18. Remote Fault & Break Link Proposal for 10-Gigabit Ethernet (Shimon Muller)
http://www.ieee802.org/3/ae/public/sep00/muller_1_0900.pdf

Mr. Muller described how people were telling him that they were uncomfortable with LSS but are very concerned that remote fault and break link be supported with some other mechanism that is robust and simple. Simon worked with Howard Frazier on this proposal. This solution ONLY supports BL & RF. BL would use continuos K28.7 signaling across all lanes for XAUI and a reserved0 64b/66b control frame. RF uses K28.1 and a reserved1 64b/66b control frame. Shimon reviewed the details of the transmit synchronization state machine which shows that if both ends of the link achieve synchronization we'll transition to the IN_SYNC_2 state. This is a seven state SM but actual implementations do not need to be seven states. The details of the receiver detection state machines were also reviewed. Here there is some hysteresis used to prevent "sync, not in sync" oscillations due to bit errors. The potential solutions under consideration for OAM&P are frame based such as SNMP or a new MAC frame. The MAC frame option is nice because it scales up (to 100 Gbps Ethernet) and down (to 1 GE). Shimon suggest this proposal be considered as the basis for future work in this area and that OAM&P is an unrelated item to BL & RF. WAN PHY performance monitoring turns out to be a very valuable capability for OAM&P.

19. BL & RF Revisited (Kevin Daines)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/daines_1_0900.pdf

Mr. Daines talked about the three reasons why LSS failed at the previous meeting, they were lack of scalability, robustness and some thought we don't even need or want this functionality. Kevin is proposing the MAC control frame method that could be standardized with a new opcode in annex 31A and a new annex 31C with BL & RF bit definitions. The overhead required for one minimum frame 64 bytes every 125 microseconds equates to 0.05376 %. The is a scalable solution to both 1 GE and future Ethernet speeds. It is LAN/WAN PHY independent too, can be optional and simple to standardize. Kevin felt these BL & RF functions should be an objective so that future presentations are not out of order. Shimon did not feel we need an objective to standardize on RF & BL. Between Shimon's pitch and Kevin's pitch the two can be combined to establish a combined solution. Kevin feels an objective is best but if not an objective then he wants a formal motion to kick off this activity. Howard felt a Physical layer solution is better because we don't need a MAC. Bob Grow felt that this proposal as pitch is a concept only at this time and lacks details like state machines. Pat Thaler felt a set of RF & BL goals was appropriate.

20. Link Signaling Sublayer (LSS) Proposal (Osamu Ishida)
http://www.ieee802.org/3/ae/public/sep00/ishida_1_0900.pdf

Mr. Ishida gave another review of the LSS proposal. Please reference the past 4 meeting minutes for details on LSS. A single bit error can cause a RF_detect. A hamming distance of 4 is not strong enough according to Pat because this will cause a change in the status of the link. A noise hit will cause this link to break.

21. 10GE Proposal: LSS for Remote Fault & Break Link (Rich Taborek)
http://www.ieee802.org/3/ae/public/sep00/taborek_1_0900.pdf

Mr. Taborek evaluated the Muller and Ishida proposals. Rich added Offline to Shimon's proposal. These BL & RF functions seem to be a defacto requirement. The LSS has a heartbeat, you know the link is working, according to Rich this is a very key feature. The extensible LSS protocol is good because it could be used for Signal Detect. Rich doesn't feel the MAC frame based method can work and it is not extensible. Rich proposed we go back to the Link Pulses, but no handshakes and no negotiations. It is critical to support OAM&P for these long 40+ km links. The web pitch needs to be updated It is misleading to say there are no counters and timers in the LSS proposal. The presence of idle is a defacto heartbeat. Rich is pro LSS on this issue of break link and remote fault.

22. Equalization Overview and Potential (Vipul Bhatt)
http://www.ieee802.org/3/ae/public/sep00/bhatt_1_0900.pdf

Mr. Bhatt points out that 10 GbE is expected to have a very long life. A future standard on equalized 10 GbE can not impact the current 10 GbE standards time line,

use an ad-hoc committee. Vipul's plans to produce a white paper by the 802.3ae WG ballot time frame. This can extend the distance of 1310 & 1550 nm links, eliminate offset jumpers required by 1310 nm WWDM links. Only the receiver amplifier will get added functionality. This is a single chip SiGe and/or CMOS solution. This should overcome the effects of DMD on multi-mode fiber. Single mode links will also benefit from this effort. Early estimates weigh in at 1.5W, 200k gates in 0.25 micron technology. At this point Vipul requested the chairman to authorize an ad-hoc group to study this area. Both MMF and equalization "experts" must be part of this ad-hoc. Multi-mode and single-mode links will benefit from equalization.

23. Fiber Equalization – A Review of Technologies (Abhijit Phanse)
http://www.ieee802.org/3/ae/public/sep00/phanse_1_0900.pdf

Mr. Phanse gave a broad overview of what equalization is, described its complexity too. The proposed 10G fiber equalization was compared with 1000Base-T and multi-level fiber equalization techniques.

	ON-OFF Fiber Equalization	1000 Base-T	Multi-level Fiber Equalization
Coding	ON-OFF NRZI • 2 levels	PAM5 with PR shaping and Trellis coding • 17 levels	PAM5 with Tomlinson-Harishima precoding with Trellis • Multi-level linear analog
Clock	10GHz	125MHz	5GHz
Echo Canceller	Simplex • No echo canceller required	Full Duplex • Requires complex echo cancellation	Simplex • No echo canceller required
Equalization	Adaptive receiver equalization	Adaptive receiver equalization	Adaptive (transmitter) Tomlinson-Harishima pre-emphasis

Reference the pitch for additional comparisons, such as Next Cancellers, StartUp, Auto-negotiation, Link Linearity Requirements and Standards Process.

24. Changes to Existing Clauses – Status Update (Shimon Muller)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/muller_2_0900.pdf

Mr. Muller reported that this clause is approximately 75% edited. The next time around this clause will use that same format style as the past, i.e. strike outs, underlines for new text, etc. The Rate Control needs more work since it is not obvious

by just reading the Pascal code. The interactions between Rate Control and XGMII will need to be cleared up with a description of the sliding window in the reconciliation sub-layer. Shimon pointed out a few minor changes to the Rate Control diagram

25. Clause 30 update – 10Gb/s MIB (David Law)
http://www.ieee802.org/3/ae/public/sep00/law_1_0900.pdf

Mr. Law reported that the 10Gb/s MIB in the draft is based on the MIB Blue Book contribution. Annex 30A & 30B are on hold until the IEEE publishers are finished with an update to these annexes. The WIS proposal needs to be accepted this week to move forward with WIS MIB developments.

26. Clause 33 update – MDIO/MDC management interface (Edward Turner)
http://www.ieee802.org/3/ae/public/sep00/turner_1_0900.pdf

Mr. Turner gave a brief overview of the major issues. This first draft is based on the Blue Book contributions. The device types were finalized and the access types were enhanced. The PMA was combined with PMD since these will always be managed together, likewise for a few other object pairs. Need to nail down when interfaces are actually optional and when required and must determine the electrical interface spec. Issue in the areas of WIS error monitoring, Link OK, … also exist. The clause is ready for Task Force review.

27. Editor and Clause 45 Update (Brad Booth)
http://www.ieee802.org/3/ae/public/sep00/booth_1_0900.pdf

Mr. Grow reported for Brad. Brad is also awaiting the 2000 edition from IEEE editors. There were minor tweaks to the nomenclature identified during an editors draft meeting. The D1.0 spec is ONLY available to IEEE participants and future password distribution will NOT occur via e-mail. Do not distribute the password to individuals outside your company. The WAN WWDM PMA is not in the draft yet because it was not part of the core proposals. The new nomenclature is as follows:
➢ 3 Different PCS's are defined:
  – X   applies to 8b/10b PCS
  – R   applies to 64b/66b PCS
  – W   applies to 64b/66b + WIS PCS
➢ Current port types, prior to addition of 850nm Serial and 1310nm WDM:
  – LR   1310nm Serial
  – LW   1310nm Serial WAN
  – ER   1550nm Serial LAN
  – EW   1550nm Serial WAN

A new clause that describes the XAUI has been added and this caused some renumbering of other clauses. Brad is looking for feedback on draft content. The new clause number is as follows:

- ➢ Clause 33 - MDIO/MDC for 10G
- ➢ Clause 45 - Introduction
- ➢ Clause 46 - XGMII
- ➢ Clause 47 - XAUI
- ➢ Clause 48 - 8b/10b PCS + PMA
- ➢ Clause 49 - 64b/66b PCS
- ➢ Clause 50 - WIS
- ➢ Clause 51 - Serial PMA
- ➢ Clause 52 - Serial PMDs

28. Clause 46 Update (Bob Grow)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/grow_1_0900.pdf

Mr. Grow discussed the big clause 46 issue which is what type of electrical interface shall we use, e.g. HSTL or SSTL. Clocking is also going to take some time to resolve, there has been a lot of reflector discussion here – should this be single, dual or differential. The last issue to be resolved is where the IPG shrinkage gets described.

29. Clause 47 Update XAUI (Dawson Kesling)
http://www.ieee802.org/3/ae/public/sep00/kesling_1_0900.pdf

Mr. Kesling outline a number of driver and receiver characteristics to be resolved for the clause he is editing, they are:

- ➢ Driver characteristics
    - – Far- end template details
    - – Link model definition
    - – Pre- emphasis standardization
    - – Ringing limits
    - – Driver load definition
    - – Output impedance definition
- ➢ • Receiver characteristics
    - – AC coupling location
    - – Input impedance

30. Clause 48 Update (Rich Taborek)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/taborek_3_0900.pdf

Mr. Taborek's clause supports definitions of components for the four lane 8B/10B PCS and PMA. The sub-clauses for Rich's clause were detailed along with their current progress which ranged from 10% complete for the PICS Proforma to 100 % complete for the Compatibility Considerations and Environmental Specifications sub-clauses. Auto-Negotiation is not supported. The packet sequence checking has been moved into the Reconciliation Sub-Layer. The major issues are initialization protocol, Remote Fault (RF) & Break Link (BL) plus Signal Detect (SD) transport. For SD will need to determine how to convey SD from the media to the PCS layer, Rich is leaning

towards LSS for this. Some minor issue are skip insertion rules, re-timers for long re-timer links, XGMII error character handling and skew budget.

31. Clause 49 10GBASE-R PCS (Pat Thaler)
http://www.ieee802.org/3/ae/public/sep00/thaler_1_0900.pdf

Ms. Thaler stated that all of Rick Walker's prior work on the 66/64 code has been captured in this clause she is editing and that all the figures should be accurate and some additional refinement will be needed for the state machines. The major and minor issues were briefly discussed, for example one of the major issues is when IDLEs can be deleted and what the minimum IDLE size should be. An example of a minor issue is the naming convention used below the PCS layer, this is somewhat confused by the fact that the PCS layer can be on top of either the WIS layer or the PMA layer. Pat also talked about her assumption that rate adaptation for the WIS shall occur in the 10GBASE-R PCS because the WAN interface sub-layer works on a scrambled data stream.

32. Clause 50 (WIS) Status (Tom Alexander)
http://www.ieee802.org/3/ae/public/sep00/alexander_1_0900.pdf

The clause 50 structure is in place now. The issues are overhead bytes, need definition on error propagation, internationalization of WIS, pointer interpretation. Need to determine where to define layer management registers. Another ANSI standard was referenced, ANSI T1.105-1995.

33. Clause 51 Update – Serial PMA (Justin Chang)
http://www.ieee802.org/3/ae/public/sep00/chang_1_0900.pdf

Mr. Chang discussed the clause status and issues. Much of this was leveraged by the OIF and the key figures, diagrams and tables were incorporated into the draft. Both 6xx and 3xx MHz transmit clock operational modes are supported. This is 90 % completed. The "On the Wire Order" of data is currently different MSB 'vs' LSB for the LAN 'vs' WAN implementations, this is a major issue. The transmit clock(s) specification(s) variation in delay and jitter between clocks needs further work and is dependent on PMA design. Our spec could specify numbers for these delay and jitter parameters or just add a warning note, to be determined later. The loop back and test functions are blank now and need to be filled in. Need to determine the impact of the multi-source optical transceiver announcement on the XSBI, will specs be made public and when. IEEE will not spec pin-outs. The LVDS spec is using work derived from the IEEE 1596.3 work. The ppm on clocks has not been resolved.

34. Clause 52 Report (Jonathan Thatcher)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/thatcher_2_0900.pdf

Mr. Thatcher reported that the major changes are completed less the 850 nm relevant sections because that technology was not voted in during the last meeting. The major issues list totals 9 items, e.g. MDI connector, signal detect, etc…. The SC connector

was added to our specification as a place holder until the connector issues are resolved.

35. WDM Clause 54 (David Cunningham)

Mr. Cunningham reported this newly defined clause is underway. The presentation was not uploaded to the web, but will be after this meeting.

PMD / PMA Track Presentations

➢ Walt Thirion provided the following "Logic Track" breakout meeting highlights. A total of 11 presentations were given, the group reviewed clauses 51, 52 and 54. The group is comfortable with the 1310nm WWDM, 1310nm Serial and 850nm Serial PMDs. However the 1550nm Serial PMD which was previously thought to be solid is now the PMD that needs more work in the area of distances to be supported.

➢ Jack Jewell, Chris Simoneaux and Dan Raush took turns recording the minutes for the PMD / PMA track meeting. That session began at 10:30am September 13th, 2000 and ended 3:00pm September 14th, 2000.

➢ Motions made in the track will be reconfirmed at the Task Force level during each meeting.

➢ The comments database tool will be used to track the formal progress of resolving the drafting issues.

➢ During this Track meeting a total of six presentations were delivered:

36. Review PMA and PMD Clauses (Walt Thirion)

➢ **The following minutes were provided by Jack Jewell from Picolight**. Jack was the 1st person taking notes during the PMD / PMA Track meeting.

37. Dispersion penalty for single-mode serial PMDs (Peter Ohlen)
http://www.ieee802.org/3/ae/public/sep00/ohlen_2_0900.pdf

Spectral Width is not sufficient information. Different forms of chirp have different effects on propagation. Some negative chirp actually compensates for the dispersion via propagation. Recommends Dispersion Penalty measurement via comparing receive sensitivity with & without a fiber with dispersion. Recommends introducing a dispersion penalty in the current draft, with 2-3dB being estimated as a "reasonable figure." Discussion followed. David Dolfi indicated that the spreadsheet could be modified to account for positive and negative chirp – also cautioned about fiber variance making standardized measurements difficult. Question as to whether or not referencing the SONET chirp specification (EIA/TIA 526-10) would be sufficient. Insufficient knowledge of the SONET spec in the audience to address this. ----- Piers Dawe volunteered to give 5-minute tutorial. EIA/TIA 526-10 can be obtained via the Web for about $30. Procedure uses short length of dispersion-shifted fiber in order to avoid low signal-to-noise issues in the receiver. The problem is that at 1550nm the dispersion is already large and the zero-dispersion point can't be shifted significantly shorter. Walt finally cut off discussion since it went way over time, but the issue is important and needs to be handled by the group of people involved.

38. Optical Modulation Amplitude for single-mode serial PMDs (Peter Ohlen)
http://www.ieee802.org/3/ae/public/sep00/ohlen_1_0900.pdf

OMA = P1-P2
Pave = (P1+P2)/2

ER = P1/P2

Use of OMA allows wider range of input parameters, so long as eye safety is not violated and the receiver is not overloaded. External modulators get more symmetric eye more easily at low ER. Directly-modulated lasers are faster at lower ER. Lower dispersion penalty at lower ER for 1550nm lasers. Bottom line: use of OMA makes transmitter design easier. ER spec would need to be replaced by Max and Min OMA specs. Discussion: Mike Dudek spoke strongly in favor and volunteered to work on it since he mostly wrote the OMA spec for FC. Petar Pepeljugoski also spoke in favor, but cautioned that the DCD_DJ parameter would need to be suitably modified. Group voted that this activity is important and should be handled by a group to present recommendations at the next meeting. Mike Dudek was volunteered to lead that group and he accepted.

39. 1310 nm Serial Eye Mask and Jitter (Piers Dawe)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/dawe_2_0900.pdf

What to use? **Scaled GigE mask?** But lasers don't follow Moore's law. 10Gig serial transmitter is relatively slower – currently 0.4UI vs 0.325UI for GigE. Actual lasers from four vendors fail the mask, but make low BER links. Summary: No, too harsh. **OC-192 mask?** Smaller in both time and intensity than Ethernet. Summary: not ideal. [Both Ethernet and SONET always measured through standard fR=0.75 Bessel-Thompson filter.] **Or something else?** Likes hex shape, fixed central position. Different PMDs may need different masks. 2nd part of talk dealt with jitter specs. Pointed out that silicon is moving faster than laser progress, (so DJ/RJ balance maybe should be modified?). New jitter budget options were presented. Discussion: Several points that the SONET mask should be good enough. No one had a clear idea as to why the eye mask has overshoot and undershoot barriers.

40. Recap: Enhanced Link Budget Spreadsheet (Piers Dawe)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/dawe_1_0900.pdf

Advantages and disadvantages of the spreadsheet were presented. Would like to do better in scrambled line codes, interactions between impairments, chirp, laser MPN, polarization mode dispersion, and jitter. Two recent updates improve scrambled line codes, addresses some interactions between impairments, uses more self-consistent internal equations (preparation for revised MPN formula), and has presentational improvements. This is the "046" version that has been on the web for a few months. Piers will update it to include the 850 serial PMD per yesterday's adoption of that PMD. Motion made to adopt this spreadsheet as recorded below.

Motion
Move that the P802.3ae Sub Task Force adopt and recommend that P802.3ae adopt the model structure and equations version 2.3.4 as found in the spreadsheet [website for the 046 version] but note that the MPN calculation is believed to be pessimistic and is under active review, and that the effect of transmitter chirp is not well covered.
Proposed: Piers Dawe   Seconded: Petar Pepeljugoski   Technical: >75%

Vote: Y: 75   N: 1   A: 10   PASSES

41. Tutorial on MIB / MDIO (David Law)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/law_2_0900.pdf

General tutorial on the mechanics of writing the spec.
MIB definition –
Register definition –
Function – how it works
Link Status
Auto-Negotiation – deals with situations when the expected information is not present or inappropriate
Test Mode -

42. Comments on Serial PMD Optical Specs (Marc Verdiell)
paper copies handed out

Comments regarding costs of components, which translate back to specs/objectives.
10km spec eliminates Fabry-Perot solution (2km spec would allow)
12dB return loss requires isolation at transmitter (20dB would allow UN-isolated transmitter; 14dB for FP)
-20dBm requires APD (-18dBm would allow PIN)
Eye mask too stringent
Rise times too stringent
Spectral quality not well specified
-140dB/Hz RIN too stringent
Experimental data shows DFB working OK until return loss exceeds –20dB. A Fabry-Perot laser is still OK at –14dB return loss. A 10GbE mask is proposed which adds side corners to the SONET rectangular mask and also adds over- and under-shoot limits that are relaxed compared to Ethernet. Shows data, which shows $<10^{-12}$ BER for case, which fails Ethernet mask but just passes newly proposed mask. Recommends replacing rise/fall spec with the eye mask. Discussion: Mixed reactions to various aspects. Question as to whether the reflection (return loss) should apply to the front end (close to the laser) or from the detector end. If it relates to the detector end, then clearly the approach is to make the receivers have sufficiently low return to the fiber. Marc thought that a 2km-optimized PMD, i.e. Fabry-Perot without isolation, would be lower-enough cost compared to the 10km solution to warrant reconsideration. Much resistance from Ethernet veterans.

43. OMA and Extinction Ratio for Serial PMDs (Marc Verdiell)
paper copies handed out

Basically echoes the earlier OMA presentation, which favors OMA spec over ER. One concern is that a low ER could cause problems in amplified links, but they are not the subject of 10GbE. Others commented that people want really 60-80km for the 1550nm spec. Much discussion on this point. Rob Marsland commented that RIN

could suffer. Mike Dudek clarified, pointing out that the noise should be ratio'ed to the OMA rather than the average power. There was also more discussion on the 10km vs 2km link issue (from previous talk). Discussion appeared to end with less feeling of solidity in the 40km and 10km Objectives. The 40km spec in particular appeared to cause considerable discomfort. Walt indicated that some 1550 vendors had presentations showing 60km possibility? Perhaps high ER should be kept in the 1550nm spec.

44. Implementation of SiGe IC Solution for 10G Equalization of PMD (Henning Bulow) (Polarization Mode Dispersion)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/buelow_1_0900.pdf

PMD is similar in some ways to differential modal dispersion in MMF, but there are only 2 polarization modes. Showed effective eye-opening in correcting 70ps of PMD. Correction greatly decreases the PMD-related receive sensitivity penalty, which otherwise rises exponentially. "Attractive concept also for DMD mitigation."

45. Similarities of PMD and DMD for 10Gbps Equalization (Moe Win)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/win_1_0900.pdf

Implemented Nonlinear Canceler (NLC) using 10Gig GaAs IC fabricated by Rockwell. 2-and 3-bit cancellation. The 1dB penalty point is pushed from DGD of 50ps to 65 and 70ps.

Another general discussion followed in which the situation of PMD sounded painfully similar to DMD discussions of a couple years ago. Important topics included what percentage of "installed" SMF had this issue. Rob Marsland reported that (Lucent??) had said that fiber manufactured between 1984 and 1992 had a lot of bad fiber. The lengths at which PMD is important are quit long, on the order of 100km at 10Gb/s for serious effects in roughly 20% of some grades of fiber. The equalization group planning to meet at 5pm volunteered to compile some information. Information will be collected as much as possible and compiled at 10am Thursday. Mike Hackert said there were plenty of people at Corning who could shed much light on the subject, but who would have left work by now.

46. 10Gb/s Multimode Fiber Transmissions Over any (Loss-Limited) Distances Using Adaptive Equalization Techniques – Fow-Sen Choa (Vipul Bhatt presenting)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/choa_1_0900.pdf

Fow-Sen did experiments with MMF in which large ISI penalties from DMD were corrected.

47. DSP-Based Equalization for Optical Channels (Oscar Agazzi)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/agazzi_1_0900.pdf

Decision-Feedback Equalization (DFE) and its implementation using DSP techniques. Detailed technical explanation. Can correct as long as the distortions don't change any faster than about 1µs. Example used for 1310nm light over 320m of MMF.

<p style="text-align:center">*********** **END OF Jack Jewell Minutes** ************</p>

➢ **The following minutes were provided by Chris Simoneaux from Picolight.** Chris was the 2nd person taking notes during the PMD / PMA Track meeting. Chris's note taking was limited to the PMD for Serial PHYs (Changes to Clause 38, Draft 5.0) discussions.

- Changed max receive power for 1550nm to +1 dBm
- 1550nm spec needs work. Needs work on link model spread sheet.
- Working Group was formed to develop both link power budget and link model spread sheet
- Jonathan used the wrong Hanson presentation when putting together the document for 1550. There may be several inaccurate specs on this one.
- An effort to remove isolators from the 1550 link failed. The argument for removing the isolators seems to be that optical isolators are expensive and that angled connectors would act as isolators. The rest of the group does not believe that optical isolators are expensive. Also, you can't guarantee that angle connectors will be present.
- A motion to include a max cutoff frequency of 15 GHz in Table 52-9, failed.
- What is the real distance we want to support @ 1550nm? This question needs answering.
- Jitter specs and methodology questions: (need resolution)
- Can we measure DJ w/ scrambled code?
- Tx eye mask?
- Will the jitter budget be different for the different PMDs?
- Management register usage?

<p style="text-align:center">*********** **END OF Chris Simoneaux Minutes** ************</p>

➢ **The following minutes were provided by Dan Raush from Agilent**. Dan was the 3rd person taking notes during the PMD / PMA Track meeting.

- **Discussion**

   Thirion, Thatcher and Cunningham all agree that the draft editing and change process requires formal proposals with data and analysis to support them and that votes will be required to make the changes.

   We only have 3 meetings between now and January 2001 target date for Working Group Ballot. Are we committed to get the work done.

The Serial 1550 specification in Clause 52 needs work and Krister Fröjdh has offered to lead this activity starting with the Austin 10/24-25 10GEA hosted meeting.

Vipul Bhatt will chair an Equalization Ad Hoc group of about 25 interested people including Optics and DSP experts. This group will consider PMD and DMD issues, solutions at 850, 1310 and 1550nm, and MMF/SMF cases. They will attempt to report on their work prior to the IEEE 802.3ae Working Group Ballot. Hackert will provide liaison to the TIA for this effort.

48. Clause 51 PMA Report (Justin Chang)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/chang_1_0900.pdf

Clause Status

1. All elements transferred in from earlier presentations.
2. Modes supported include both 6xxMHz and 3xxMHz mode transmit clock operations.
3. Key figures, diagrams and tables are incorporated.
4. 90% complete … see major and minor sections for work outstanding

Major Items

1. Transmit clocks specifications:
   PMA_TXSRC_CLK & PMA_TX_CLK relationship…
   - table entry for delay and jitter but need to discussed
   - OIF, Barcelona agreed to put in "Warning clause"

Parameter	Description	Condition	Value
TD	Variation in delay	Frequency < 1kHz	30ns (p-p)
CJ	Jitter between clks	Frequency > 1kHz	175ps(p-p)

2. Included sections 51.7 and 51.8 – Loopback and Test functions. Historical from 802.3z. Working group yet to agree on inclusion and content. Possible ties to MDIO?
3. Multi-Source-Agreement? (MSA) announcement:
   - Infineon Technologies, JDS Uniphase, Nortel Networks and LightLogic, Inc. Announce Small Footprint OC-192 Multi-Source Agreement for Optical Transponder
   - How does this impacts work to date on XSBI? Will specs be made public and when. Does IEEE802.3ae need to spec pin-out, footprint?

Minor Issues

1. Nomenclature cleanup:
   - Data-group(15:0) – need/how to spec differential signals for a bus
2. Specifications for "rising and falling" edges

3. "Required mode" – use Option A and B instead?
4. LVDS values – Leveraged from IEEE1596.3

Assumptions

REFCLK tolerance:
- using: 6xx MHz +/- 100ppm
- possibilities: 3xx MHz, +/-20ppm

Inclusion of sections 51.7 and 51.8
- Loopback and Test functions

Discussion

LSBF/MSBF treatment is a major issue that is not dealt with in the source document robinson_1_0500. WAN compatible with OIF while the LAN is using the inverse.

Figure 51-1 2 signals were removed, how will ref clk be treated?

PMA_TX_Clk and PMA_TXCLK_SBC in Table 51-6 TX Clock Specs - Editors Note: Placeholder
FIFO Depth Specification addition?

Loopback has new information beyond Blue Book source
Thirion agrees to leave it in. Will add items to Big Ticket List
- Both directions defined
- Timing on Clock
- Connect to systems people

Test Functions – none listed yet

Source Clock Table 51-1 is now listed as +/- 100ppm at 6xx MHz
Clause 51.5.2.2 states 311 MHz TS Clk / TS Clk Source
Robinson suggests deleting this
Bhatt agrees suggests 6xx MHz only is his choice

49. Clause 52 Serial PMD Report (Jonathan Thatcher)
http://grouper.ieee.org/groups/802/3/ae/public/sep00/thatcher_2_0900.pdf

Status

Major changes complete for optical aspects supporting 1000BASE-LR/ER/LW/EW

Time to integrate the 850 nm should be short (started, not complete).

Clause carefully color-coded to indicate changes from clause 38 (need to determine if this should be reset for draft 1.1)

Major Issues (see clause)

1. Jitter specifications and methodology
2. Test patterns
3. Signal Detect
4. MDI (connector)
5. Measurement methods and specifications
6. Support of both speeds
7. Use of management registers / additional features/functions
8. OAM specifications and impact
9. 40 km or further?

Discussion

1. MDIO vs Discrete Pin for Signal Detect

➤ Dudek suggested a separate pin be used rather than MDIO.

➤ Thatcher suggested that Signal Detect is needed at higher levels and felt a separate pin was the way to go.

➤ Bhatt suggested having both an MDIO register and separate pin for Signal Detect status

➤ Thatcher admits use of editorial discretion. He has put Signal Detect into the draft per previous standards and suggests that a 75% vote would be required to change this technical item in the draft.

➤ Thatcher states only items required for interoperation will go into the final draft. He points out that MDI is the only interface accessible for interoperation testing.

➤ Dawe states that test points 1 and 2 from 1GbE are not present in Serial 10GbE as the PMA and PMD are assumed to be merged. Therefore suggests that PMA may be the location for SD to originate from.

➤ Thatcher says that the PMD is the location that SD is generated.

➤ Bhatt says that debug should occur at lowest level

➤ Mayer agrees that SD should be reported both as a register in MDIO and as a separate pin.

➤ ??? says a common solution should be found for both the Serial and WWDM PMDs.

➤ Thatcher suggests that WWDM PMD should be the lead for SD definition and that Serial PMD would be a degenerate case.

➤ Thatcher describes the "Agreement of the Group" to be that SD should be reported on a separate pin and that the MDIO register implementation will be optional.

❖ Bhatt raises two points,

❖ Is AC or DC signal used at optical input?

❖ What should TX do relative to SD status?

❖ van Doorn states that upper layers detect trouble with optical signal input earlier than PMD triggers SD status change

❖ Cunningham states that SD should be defined to be an indicator of whether light is there, not whether it is modulated or not. Does not believe TX Disable is required for the PMD definition. Reminds the group that 802.3z required

SD and that 802.3ae is likely to require at least what was decided in 802.3z as a requirement on SD.

❖ Thatcher says state machines in PCS require SD.
❖ van Doorn would like to see more rigorous definition of SD assert/deassert timing.

➢ Thatcher states the SD will be placed on the PMD action list and asks van Doorn to take the lead to make proposals

❖ Thirion reminds the group that all comments on the D1.0 contents should be accompanied with proposed solutions.
❖ Dudek states SD is required
❖ Cunningham reminds group of 802.3z history on why SD timing was not included in specification and suggests the group not go there…
❖ Coenen requests that the compliant….statement in Table 52-2 be deleted
❖ Dallesasse agrees with Cunningham statement on SD timing specifications
❖ van Doorn reports that the Logic Track group has been discussing SD and that this group thinks that the RX electrical outputs will be squelched if SD is deasserted.

2. MDIO vs Discrete Pin for Tx Disable

➢ van Doorn suggests that TX Disable should be provided on a separate pin
➢ Dudek suggests that this is a higher level function
➢ Thirion asks that question "what is meant by compliant in Table 52.2"?
➢ Thatcher says to put TX Dis on the PMD action list
➢ Dawe suggests that TX cross-talk is real issue and asks why we are standardizing TX Dis

3. 850 Serial PMD Specifications 52.3

➢ Marsland suggests that the 850 material in D1.0 needs to be undeleted.
➢ Thatcher agrees to for D1.1, will include the jewel_1_0700 material in D1.1. based on votes this week.

4. Transmitter and Receiver Optical Characteristics Tables 52-8 and 52-9

➢ Mayer suggests deleting TX Type row.
➢ <u>Thatcher takes **group vote** and decision to delete TX Type row is made by **acclimation.**</u>
➢ Dolfi suggests that the Average Receive Power Max row be incremented to +1 dB for the 1310 nm column.
➢ Bhatt suggests the same should be done for both 1310 and 1550 columns
➢ Thatcher reminds that TX optical power range and RX Sensitivity and Overload are normally linked.
➢ Verdiell suggests that the TX max output and RX overload for 1550nm should both be changed to –1dB.

- ➢ Thatcher suggests that the group need to decide if it is writing a specification for the End Customer to engineer his link from at installation or to provide a fixed power budget. Requests proposals for the next meeting.
- ➢ Bradshaw agrees to organize a proposal on TX and RX optical specs for the next meeting based on eye safety limits for the TX? Or wrt attenuator?.
- ➢ Marsland points out typo in Table 52-9 vs hanson_1_0500 text, i.e., the RX overload specification for 1310 should be +1 dB not –1dB.
- ➢ Dawe points out typo in Table 52-8 vs hanson_1_0500 text, i.e., 1550nm TX tr/f should be 33ps not 30ps.
- ➢ Verdiell suggests that TX optical tr/f be deleted and replaced by an eye mask specification.
- ➢ Dudek reminds group that TX optical tr/f is required as a parameter in the current link model.
- ➢ Verdiell proposes to change TX optical tr/f from 30ps to 36ps for 1550nm.
- ➢ Cunningham, Bhatt, Dudek, Pepeljugoski state that this change can only be made if the link model supports it.
- ➢ Verdiell states that current links operate today to 40km with a 36ps specification.
- ➢ Cunningham states that it is ok to modify the link model if proof can be established for the changes. The fundamental use of the link model is to establish interoperation.
- ➢ Marsland states that the link model is broken for 1550nm as chirp is not included.
- ➢ Thatcher states that he has become a convert to the link model as it enables a process to reach closure on specifications. The link model represents "worst case" scenario not reality or typical scenarios, i.e., it has guard bands built in.
- ➢ Verdiell states that the link model for 1550 is too conservative vs the ITU model.
- ➢ Dawe agrees to work with Verdiell on updating the link model for the 1550 optical power budget.
- ➢ Bradshaw suggests that the 1550 TX wavelength range lower limit be changed from 1530nm to 1528nm to be in agreement with the ITU C Band DWDM specifications.
- ➢ Discussion ensued on what the impact of low cost EDFAs will be on these links.
- ➢ Pepeljugoski states that a Side Mode Suppression Ratio specification from hanson_1_0500 text needs to be added to Table 52-8 for both wavelength PMDs.
- ➢ Verdiell suggests that SMSR could be deleted and replaced by a dispersion penalty specification.
- ➢ Thatcher states that the 1550 proposal is broken.
- ➢ Coenen suggests that it is just cracked.
- ➢ Thatcher states that the 1310 specification is not broken and that any changes to the D1.0 will need to be voted in.
- ➢ Cunningham suggests that the 1550 specification be moved to a separate subsection.
- ➢ Fröjdh suggests that 1550 rms spectral width vs chirp should be specified and that the RX sensitivity specification is too demanding.
- ➢ Verdiell proposes a change for Return Loss from 12 to 20 dB for the 1550 case.
- ➢ Pepeljugoski agrees saying he had proposed this before.
- ➢ Thatcher states that a proposal is needed to do this.

- Dudek and Cunningham agree to look at connector return loss. Possible change from −26 dB to −35 dB.
- ???? comments that there is no RX electrical upper cut-off frequency maximum specification at this time, unlike the 802.3z specification.
- Pepeljugoski suggests that it is not required.
- Thatcher states that it is required for VCSEL based solutions.
- A **motion** is made to put 15GHz into the draft as the RX electrical upper cut-off frequency maximum specification by Dudek and seconded by Dawe.
- Cunningham supports this. ??did he?
- Frojdh suggests a no vote for 1550nm
- Dawe feels 15GHz is reasonable.
- Cunningham suggests that our change process requires a delay in voting on this motion.
- A **motion to postpone** consideration of this motion until our November meeting is made and **passed by acclamation**.

5. 52.10 Fiber optic cabling model

- Tszostak suggests that unallocated link margin be moved into the link power budget like 802.3z to be consistent with how cable plants are specified in practice.
- Cunningham reminds the group that unallocated margin can only be used for overcoming passive losses such as connectors, not for distance extension, per the link model.
- Thatcher requests a proposal to initiate this change. Tszostak, Frazier??, Thatcher, Cunningham, Dawe agree to take this on and will include the use of attenuators for link engineering.

6. Table 52–10—Worst case link power budget and penalties

- Dawe suggests changing the reference to 1270nm in the notes to 1290nm as an editorial change.
- Thatcher requests a link model acceptance test for this change and Dawe/Dudek agree to run the model.

7. Jitter

- ???? said 802.3z methods to no show the way. Test points 1 and 4 are not accessible therefore the jitter contribution is hard to assess.
- Dudek reminds us of Fibre Channel Jitter Group and the bathtub curve methods. Comments on RX jitter tolerance being specified under test patterns with 3 forms of jitter; Deterministic, Random and Sinusoidal.
- Thatcher asks for presentations and suggests that 10Gbps Ethernet Alliance may be able to help the overall IEEE 802.3ae PMA/PMD Sub Task Force with a one day "open" meeting on jitter (on 10/24) at their October meeting (10/25). Suggests that sources of inspiration might be SONET/SDH specifications and the Fibre Channel Jitter Study Groups document. Raises the question about what

happens in the non-8B/10B scrambled environments of the Serial LAN PMD and the WAN PMDs.

➢ Thatcher requests that van Doorn post a link to the Fibre Channel Jitter documents to the reflector. Also invite Dennis Petrich CTO of WaveCrest to the meeting as well as other test equipment vendors with jitter measurement equipment for possible demonstrations at the 10GEA open meeting 10/24.

8. Misc. Issues with 52

➢ Annex A may have to be brought back form 802.3z work.

50. Clause 54 WWDM PMD Report (David Cunningham)

Status Report on Major Issues

1. Retimer will be in the PMD – basically we are working to XAUI, but not a defined electrical interface, it is an abstract interface definition. A new diagram needs to be created to illustrate this concept.
2. MDIO registers etc., for WWDM.
3. SIGNAL_DETECT parameters and function for LX4 and LW4. – Simmons has the lead
4. Specifications for LW4 WAN: - These will be lumped together with discussion of similar issues in the Serial PMD group.
   transmit,
   receive,
   worst case power budget,
   jitter, methodology and test methods.
5. Eye masks for LX4 and LW4. – Dawe has the lead
6. Measurement and test procedures for LX4 and LW4. – Dolfi has the lead
7. MDI. - Likely to be Duplex SC as a carry over from 802.3z

Discussion

➢ Dolfi typo in 54.1.1.1.2 the value should be 3.125 GBaud not 3.25 GBaud.
➢ Thatcher 54.1.1.1.1 add PMD_UNITDATA.request (rx_bit [0:3]) to this paragraph
➢ Van Doorn retimers should be in PMA
➢ Draper SUPI is needed for the WAN
➢ Cunningham to resolve XAUI/SUPI and Retimer Location issues with those editors and create an new figure 54-1.
➢ ????proposes to add Off-set Launch Patch Cord note
➢ ????SD proposals needed
➢ Dudek RX cross-talk specification missing
➢ Lemoff this is covered in the RX test conditions
➢ Dudek the test conditions need to account for worst case laser center wavelengths
➢ Pepeljugoski the RX optical filter specifications should be added to Table 54-6

- ➢ Lemoff suggests the Off-set Launch Patch Cord effect needs to be clarified in Table 54-6.
- ➢ Cunningham raises the issue of where the retimer is relative to Table 54-7.
- ➢ ????Test methods and availability of test equipment should be on the Issues list for WWDM.
- ➢ Thatcher suggests that the test conditions need to specify the state of all channels in addition to the Channel Under Test. Conditions such as filter parameters, TX channel center wavelengths need to be statistically analyzed.
- ➢ Dudek suggests that skew is missing from the TX and RX specifications.
- ➢ ?????suggests that the eye safety limits per the US FDA CDRH may be worse case in the US versus the IEC specifications.
- ➢ ???? points out that the MDI optical connector needs to be specified.

*********** END OF Dan Raush Minutes ************

Logic Track Presentations & Minutes

➢ Ben Brown provided the following "Logic Track" breakout meeting highlights.

The logic track group used a mixture of line-by-line and big issue methods to review the clauses. Ben stated that both methods took a long time and that in the future, the logic track will need to narrow the scope of work to smaller more focused break out groups, for example MAC, 64b/66b, XGMII, WIS, XAUI / Electrical, PMA, etc. Ben than reported the logic track progress by clause, Ben's summary slides have been reproduced here.

Clauses 1,2,3,4,6,22,31,35 & Annex 31B:
- ❑ Line-by-line review
- ❑ No major issues

Clause 30: Management
- ❑ Presentation from Norival Figueira on WIS MIB
- ❑ Need to resolve more of the WIS features before we come back to the WIS MIB

Clause 46: XGMII
- ❑ Strong support for moving to HSTL2
- ❑ Need more direction regarding which class
- ❑ Timing straw poll:
  - Source-Simultaneous in both directions: 43
  - Source-Centered in both directions: 7
  - Asymmetric (TX=SS, RX-SC): 10
- ❑ Clocking straw poll:
  - Single ended (same driver as data): 41
  - Differential: 4
  - Complementary (same driver as data but uses 2): 5
- ❑ Strong support for allowing the receive RS to perform error checking, e.g. /S/ in lane 0, SFD 7 bytes later in lane 3. Potential presentation in November

Clause 47: XAUI
- ❑ Much discussion on the electricals
- ❑ Small group of interested parties moved to a breakout earlier today to take this off line
  - 15 people
  - TX Specs, RX Eye, Channel Link Model
  - Will continue in Austin then Tampa

Clause 48: 10GBASE-X
- ❑ Some good ideas were presented regarding how to transport Signal Detect across a XAUI when the transceiver is merely a retimer - expect a presentation in November for a way to do this
- ❑ Strong support for RF&BL in the LAN. Need to keep EMI low, little interest in continued "heartbeat" beyond the existing IDLE stream when outside of RF&BL. Straw poll on transport:
  - 13 voted for the LSS proposal

28 voted for the Shimon / Howard proposal
40 Abstain
- ❏ I've challenged the 2 teams to take this direction and bring a combined proposal to Tampa

Clause 49: 10GBASE-R
- ❏ No major issues

Clause 50: 10GBASE-W
- ❏ Need to add logic to signal detect up to PCS when SONET framing isn't valid
- ❏ Pull definitions out of T1.416 for clause 1 but still reference their source

Other Logic Track Issues
- ❏ We need a larger discussion on WAN PHY and how it will fit into the Ethernet world...
- ❏ In WIS MIB, the threshold for Severely Errored Seconds has a limitation such that BER lower than 10^{-10} is not detectable
- ❏ How useful are bit error counters? When the error has occurred, we throw the packet away
- ❏ In regards to the section trace octet: We need to wrestle with the notion of testing links prior to "turning them up". The telecom world can test links prior to putting any data on the link. We need to decide how to test and bring-up. The link is either up or down – Ethernet tradition

> **Kevin Daines recorded the minutes for the Logic Track meeting.** That session began at 10:30am September 13th, 2000 and ended 2:50pm September 14th, 2000.

- • Ben Brown (Logic Track Chair) opened track session
- • Thanks to Brad Booth and team of editors for putting together Draft 1.0.
- • PMA/PMD Track notified Logic Track that they intend to gather a group of issues impacting the Logic clauses and present later, tomorrow probably.
- • Decision to review draft, clause by clause, and hear relevant presentations (4 total) as they are appropriate.

> **Clause 30 – (David Law)**

Only review needed is to hear the Norival Figueira's WIS MIB presentation

[figueira_1_0900.pdf]
- - Review of overhead bytes requiring mgmt
- - oWIS object class

Geoff Thompson raised issue about oWIS managed object class, asking if we're SONET or Ethernet. The managed objects are something other than physical link based (i.e. path, section, etc).

David Law clarified that some of these error counters are not visible to the PCS, and hence may provide more information about the link.

GT – asked if the SONET counters have been compared against existing Ethernet counters

NF – No

Roy Bynum – Supports using these additional counters since we're going beyond the LAN (extended LAN)

NF – Believes capturing errors at Section, Path and Far End Path are critical and can't be collapsed into Ethernet counters.

GT- Ethernet has no concept of Section/Path/etc. I don't believe we've ever talked about our philosophy going forward. How many new attributes/counters to we need? This is a major decision point.

Jim Hesson – Let's focus on the major issues. Specifically jitter.

DL – Perhaps we should examine the MIB in the context of Clause 50 (WIS)?

Tom Dineen – Supports the existence of the WIS MIB. We need to be able to detect problems at any point, section, path, etc.

RB – We have been talking about this for a year. They have to do with cable plant mgmt. This WIS MIB is just an extension to the thinking we've always had.

BB – Let's move this discussion to Clause 50.

DL – Maybe we should work on the functions first, and then work on the mgmt clause.

BB – I have always thought that mgmt took a backseat to the rest of the work. Maybe we should bring it forward.

GT – I disagree with David here. Let's work on the mgmt and the functions in parallel. Let's limit the discussion to issue definition only, not try to solve issues being worked on in two tracks.

BB – Summarized discussion of last 15 min.

NF – I am surprised that since we voted in the presentation that was in the blue book, we have this controversy now.

BB – Well, that is exactly what is going to happen. We have voted in presentations and now are reviewing in detail the presentations/implementation in draft 1.0.

<figueira_1_0900.pdf, Page 9>

Stephen Haddock – Suggest that uncommon acronyms be spelled out. (i.e. SES)

SH – [Draft 1.0 Editorial comment – Clause 30] – acronyms should be spelled out in the behavior section. Acronyms are okay in the attribute name.

Example:
 aSectionSESthreshold
ATTRIBUTE
APPROPRIATE SYNTAX
    -    INTEGER
BEHAVIOR DEFINED AS
A GET operation returns the value for x for "Section Errored Seconds" definition…….

RB – Taking Geoff's stance now, since this is Ethernet we may want to reference Ethernet BER instead of SONET.

GT – Let's use international references instead of ANSI when possible.

<figueira_1_0900.pdf, Page 10>

NF – Limitation on x is that if threshold is set to 1 then BER lower than 10^{-10} is not detectable.

GT – We may want PMA/PMD track to be aware of this limitation.

DL – We may want to put an annex in the standard with the calculations about this attribute.

NF – The referenced standard has this explanation.

<figueira_1_0900.pdf, Page 9>

? – Is this a rate of errors, errors in a given period? What is the sample period?

NF – 1 second.

GT – So this counter needs to be read every second?

RB – This counter is an error trigger. It is a threshold only.

<figueira_1_0900.pdf, Page 11>

GT – I understand what this now does, but we need to make sure it is clearly defined.

Bob Grow – As an example, what is a second? Is it 1 sec? Is it 1.0000 second?

DL – The mgmt clause should tell you what you need to do in hardware. The annex MIB tells you what the sw has to do.

BG – Should we define it here, or is it defined in ITU?

GT – We need to define it here.

DL – Increment rates, as described in the APPROPRIATE SYNTAX, give guidance as to whether or not it is implementable in sw.

GT – Is this a sticky counter. Will it roll over or not?

<figueira_1_0900.pdf, Page 12>

? – In hw you have an 8-bit counter, and sw checks it every second.

GT – The issue is taking a rate across a moving one second window.

<figueira_1_0900.pdf, Page 14>

GT – How useful are bit error counters? When the error has occurred, we throw the packet away. Let's throw this over the wall.

<figueira_1_0900.pdf, Page 15>

GT – This entire structure was built before WDM. Should this be based on lambda or fiber?

RB – The aJ0ValueTX is meant to insure that links are built/repaired correctly.

GT – We need to wrestle with the notion of testing links prior to "turning them up". The telecom world can test links prior to putting any data on the link. We need to decide how to test and bring-up. The link is either up or down – Ethernet tradition.

TD – Since we voted to do both LAN and WAN PHYs, we need to speak both languages, (analogy of deciding to be bilingual: we need to speak both English and French).

NF – Concluded by summarizing that this presentation was based on proposal voted into Draft 1.0.

> **[PMA/PMD Clause 50 Issues]**

\<figueira_1_0900.pdf, Page 6\>
DL – Perhaps we should examine the MIB in the context of Clause 50 (WIS)?

\<figueira_1_0900.pdf, Page 10\>
NF – Limitation on x is that if threshold is set to 1 then BER lower than 10^{-10} is not detectable.
GT – We may want PMA/PMD track to be aware of this limitation.

\<figueira_1_0900.pdf, Page 14\>
GT – How useful are bit error counters? When the error has occurred, we throw the packet away. Let's throw this over the wall.

\<figueira_1_0900.pdf, Page 15\>
GT – We need to wrestle with the notion of testing links prior to "turning them up". The telecom world can test links prior to putting any data on the link. We need to decide how to test and bring-up. The link is either up or down – Ethernet tradition.

➢ **Clause 1 – (Shimon Muller)**

Detailed review of draft.

Howard Frazier – When we change a paragraph, it would good to include the paragraph in the draft for review.

Rich Seifert – Are we going to go through all of the other sections where speed is concerned?

HF – Don't really like the change from LAN to network. Maybe we just say once, that LAN means LAN and beyond (MAN/WAN), and leave the rest of the instance alone.

TD – concurs with HF

Pat Thaler – This change was talked about in a presentation. Also, LAN still appears in several places, including Figure 1-1.

GT – Like Howard's direction on this, let's perhaps mention this once, in Clause 1.

[Draft 1.0 Editorial comment] In Clause 1, mention 'LAN and beyond' whenever LAN is stated in text.

SM – The editors talked about future additions to Figure 1-1. We can't keep adding vertical layer stacks for new speeds, we'll run out of room.

HF – Let's combine 100 Mb/s, 1 Gb/s & 10 Gb/s into one vertical. MII becomes the common denominator. Let's make it simpler.

Several echoed HF's comment.

[Draft 1.0 Editorial comment] Figure 1-1 changes, remove 'blob' indicating connector on the MII. Combine 100/1 Gb/10 Gb. Revise comment about GMII/XGMII.

[Draft 1.0 Editorial comment] 1.1.2.2, "The following " instead of Five/Eight etc.

GT – Comment about 1.1.4: needs to be rewritten.

[Draft 1.0 Editorial comment] 1.1.4 Please rewrite

➢ **Clause 2 – (Shimon Muller)**

Detailed review of draft.

Adding fcs as a parameter to MA_DATA.request to MA_DATA.indication service primitives are a 'service to humanity'.

PT – We didn't fix the fcs during .x, but Shimon has talked us into it. Let's fix it correctly.

SM – Please send me text to put in. Let's not wordsmith here.

[Draft 1.0 Editorial comment] Clause 2 – This text should imply that passing the fcs parameter is optional. Pat Thaler doesn't think it does. She'll advise a rewording of the text.

➢ **Clause 3 – (Shimon Muller)**

Detailed review of draft.

[Draft 1.0 Editorial comment] Clause 3 – These typos should be forwarded to David Law who is running the Maintenance project.

<<< Lunch 12:40pm-2pm >>>

➢ **Clause 4 – (Shimon Muller)**

Detailed review of draft.

SH – What is the conformance test for MACs that implement the fcs option (including fcs in passing frames – tx and rx)? Might need something in the PICS.

[Draft 1.0 Editorial comment] 4.2.3.2.2 – delete 'For example'

HF – Raised concern about renumbering all figures, cited case of other documents outside IEEE, which may reference internal figure.

SM – We have over a year to work this out.

4.2.7.1

HF – Suggest splitting fcsParamSize should be broken up. Let's not concatenate the fcs and the fcs flag.

[Draft 1.0 Editorial comment] 4.2.7.2 – Change "In bits" to "In bit times" (i.e. slotTime, interFrameSpacing, etc)

PT – Raised issue about order of bits of the fcs parameter in the service interface. It is clearly defined on the wire, but not in the service interface.

SM – The service interface only has fields and the MAC clause describes how to send fields (i.e. serialize the bits on the wire).

[Draft 1.0 Editorial comment] Clause 2 – May want to address the order of the bits of the fcs parameter since it is the odd one.

HF – Raised concern about the terminology of 'extension' and 'paceMode'. Let's use a different word.

SM – Open to suggestions. Please advise.

[Draft 1.0 Editorial comment] – 4.2.7.2 – Change 'ifsExtensionCount' et al using a different word for 'extension'.
Augment?, expand?, stretch?

[Draft 1.0 Editorial comment] – 4.2.7.3 – passReceiveFcsMode may need attribute in mgmt Clause 30

PT – Adding an optional bit in mgmt may be awkward since this impacts < 10 Gb/s speeds as well. We may not want to bit in mgmt Clause 30. Pat/David discuss?

[Draft 1.0 - 4.2.8, line 44]
HF – Why does "if fcsParam[1] then" test the lowest bit? Is that the MSB or LSB? If we define a separate bit then we'll be able to just simply assign the fcs parameter to the fcsField of the frame (i.e. like destinationField, sourceField, etc)

KD – Suggested naming the single bit indicating presence of fcs carefully, so as not to connote validity implicitly.

[Draft 1.0 Editorial comment] 4.2.7.1, 4.2.8 – Split fcsParam into two, fcsParam and fcsParamPresent for instance. Then TransmitDataEncap procedure doesn't need the while … do loop assigning bits one at a time.

HF – VLAN tag is missing from 4.2.8 line 52
else fcsField := CRC32(destinationField, sourceField, lengthOrTypeField, dataField*);*

SM – Might also be missing from 4.2.10, crc function definition

4.2.8 – function TransmitLinkMgmt, line 29
HF – Question about line that states frameWaiting := true. The suggested change removes the check for halfDuplex.

SH – Raised question about interFrameSpacingPart1 timing. It looks weird, but it may be the same.

JH – Why don't we change the Pascal code to Verilog?

PT – We can't change the basis for lots of implementations.

Tom Alexander – We may have inadvertently changed the interFrameSpacingPart1 since the original code used the function StartRealTimeDelay which immediately returned, and then the next line; see below:

While carrierSense do StartRealTimeDelay
Until not RealTimeDelay(interFrameSpacingPart1)

HF – Assignment to function is not allowed. Should use procedure. See next comment.

[Draft 1.0 Editorial comment] 4.2.8 – The following line needs to be fixed:
while RealTimeDelay(interFrameSpacing) do nothing;

HF - Raised issue about paceMode

[Draft 1.0 Editorial comment] – Suggest we want to make sure paceMode only comes into play at 10 Gb/s?

[Draft 1.0 Editorial comment] – Change fcsParam assignment on receive to look like transmit.

HF – Does it make sense to assign fcsParam[1] (or its replacement) with the value of the variable passReceiveFcsMode? Is this redundant perhaps.

SM – No, the setter of the variable may not be the same as the receiver of the frames.

KD – 112 should be changed to 104

[Draft 1.0 Editorial comment] 4.4.2.1 – change ifsExtensionRatio to 104

SM – Disagree. Let's resolve off-line.

➢ **Clause 6 – (Shimon Muller)**

Detailed review of draft.

No comments

➢ **Clause 22 – (Shimon Muller)**

Detailed review of draft.

HF – Figure 22-1 has been altered such that the 1 Gb/s vertical has been removed. Since 1 Gb/s uses Clause 22, shouldn't this still exist here.

[Draft 1.0 Editorial comment] Fix Figure 22-1 by:
1) adding the 1 Gb/s vertical back in.
2) Removing the 'blobs' connoting connectors from the 100 Mb/s MII

➢ **Annex 31 – (Shimon Muller)**

Detailed review of draft.

SM – Typos found in 31B.3.1. Rich Seifert, please look at this section.

➢ **Clause 35 – (Shimon Muller)**

Detailed review of draft.

[Draft 1.0 Editorial comment] Fix Figure 35-1 by removing 'blob' connoting connectors, from the GMII

<< break at 3:20pm >>

Ben Brown – Since going line by line took such a long time, let's instead focus the balance of the time on big issues. Individuals wishing to comment on items not talked about in the Logic Track should send e-mails directly to clause editors.

➢ **Clause 46 – (Bob Grow)**

BG – Gave high-level overview of RS and XGMII. Pointed out Figure 46-7, and asked for careful review.

JH – HSTL 1.8V
3 others echoed JH, by advocating HSTL 1.8V
? – HSTL is 1.5V

JH – There is an extension which covers 1.8V.

Straw Poll
By large majority (> 90%), HSTL 1.8V won over SSTL 2.5V. << No count of hands was taken. >>

BG – What is my editorial task relating to the electrical specification. Should I just reference the EIA spec?

HF – I don't see a problem with doing this. Referencing an international standard is better, but EIA is good.

? - The HSTL standard is EIA/JESD8-6 Class 1.

HF – Advise everyone to go look at EIA/JESD8-6 (from eia.org). Recommend just referencing spec.

Presentation from Joel Dedrick, "XGMII Timing" (dedrick_1_0900.pdf)

JD - Noted that uploaded presentation prior to meeting has error on page 4. Will upload fixed presentation soon.

JD – Has issue with delay requirements on transmit clock in that centering the clock via CMOS delay elements vary from min to max more than the window itself.

JD – Suggest that TX_CLK is just output as a data bit (clocked out) and move the sampling problem to the XGXS.

BG – Not all implementations will have an XGXS.

JD – Rather than solving all cases (like XGMII to XGMII) let's solve the frequent, most used case (XGMII-XGXS).

BG – Asymmetry (Tx/Rx) bothers me. I am concerned about the migration of two chips into one chip. What happens when my MAC XGMII needs to change.

JD – When the MAC and XGXS become one chip, this problem goes away.

RB – Raised question about width of valid window (pg. 6 of the presentation).

JD – Window size isn't important at this time, rather the architecture/concept shift.

? – Suggest source-simultaneous for both directions. Since ASICs have longer delays on clocks, so the delay on a clock would then 'center' it in the valid window.

HF – Disagree with the intent of the proposal. What about FPGA implementations? I would want a symmetric Tx/Rx interface.

JD – I don't assume existence of PLLs in ASIC to make the Rx side work.

JH – Why not spec both ways?

JD – Might have EMI problems (having both clocks).

BB – PCB traces, from practice, are good at simulating delay traces. Support source-simultaneous.

SH – Source simultaneous would work using PCB traces.

? – Source simultaneous for both Tx/Rx.

JD – Summarizing last couple of minutes: what some in the group are suggesting is to just meander the clock trace along side the data lines to implement the delay.

? – 1" PCB = 180ps.

? – Since the distance of the XGMII is only about 4", you don't have a lot of room to work with.

? – We need synchronized solution.

Straw Poll

Source-simultaneous: Tx & Rx = 43
Source-centered: Tx & Rx = 7
Source simultaneous Tx, source-centered Rx = 10

BG – In the future, when individuals want to introduce changes, a presentation is fine but exact changes to the draft standard in the form of figures and text should be submitted to support the schedule.

BG – In talking with Ben Brown, we feel we can make changes via motions in the tracks and then report to the entire Task Force on the last day of the meeting.

PT – Should we talk about the error checking issue?

BG – Propose we make an assumption about the alignment of the preamble and SFD.

HF – With embedded delimiters (i.e. delimiters encoded in the txd<7:0> lines) should we put in checking logic?

PT – We have never had hamming distance in the MII or GMII or any chip to chip interface historically. Now at 156 MHz/10 Gb/s do we need to have checking/hamming distance on the XGMII?

BG – On the receive side, the decoder is going to detect some start character. It will then be required to align this start indication along with the balance of the preamble and SFD. Should the RS then check all 8 bytes for qualifying the start of packet on receive.

Straw Poll
Add checking logic per Bob Grow's comment above: (< 90%)
Leave it out. (> 10%)

PT – It would be nice if MACs didn't have to have the barrel shifter to allow starts on any alignment.

HF – We might want to see a presentation on the topic. I will kick off the discussion on the reflector which could lead to a presentation at the Nov meeting. HOWARD ACTION ITEM.

? – Comment about RXC encoding in Table 46-4 (which shows RXC<3:0> and has hex values) not matching Table 46-3 which shows lane encodings (or just a single RXC bit).

[Draft 1.0 Editorial comment] Table 46-4 should be renamed as a Figure (i.e Figure 46-5)

[Draft 1.0 Editorial comment] 46.2.4.6 – The second byte should be RXD<15:8> rather than RXD<15:7>

[Draft 1.0 Editorial comment] line immediately before 46.2.4.5, references TX_ER which we no longer have.

[Draft 1.0 Editorial comment] Table 46-3 implies that Start is permissible on any lane when clearly this not the case. Suggest a footnote be added to clarify.

HF – Did we talk about clocks? Single-ended? Differential? Can we hear from a differential clock advocate?

JD – We might be talking instead about a complementary clock rather than a differential clock.

? – With DDR memories, clock going to DDR is complementary, data clock coming back is single-ended.

TD – Advocate differential because that has better matching rise/fall times.

JD – Advocate complementary. Since we moved to HSTL, and moved to simultaneous-clocking we want clocks to look like data and ideally use the same drivers.

JH + 3 others – advocate single-ended

HF – making a clock differential shouldn't help EMI since the interface has 32 other signals toggling at the same frequency.

Straw poll (based on assumption of HSTL moving forward)
Single-ended clocks: 41
Differential: 4
Complementary: 5

Zvi Regev gave a brief impromptu presentation about LVDS via an overhead.

JH – The current AC/DC could be considerably higher with this approach.

Questions about performance of individual bits.

Presenter proposes that we investigate this.

JH – presumes drain output

Jim Tavacoli – Isn't this is the same as the 16-bit OIF interface? Shouldn't we just use the LVDS 16-bit OIF interface here with the XGMII.

BG – But then we've doubled the number of pins.

➢ **Clause 47 – (Dawson Kesling)**

DK - Figure 47-2 is already out of sync.

[Draft 1.0 Editorial comment] Figure 47-2 : Propose we remove it and just reference from another clause.

HF – When did we decide to do pre-emphasis?

DK – Pre-emphasis was always perceived to be permitted.

Definition of "peak amplitude" sought:

Is it instantaneous absolute difference in voltage between differential pairs at a given point in time

OR

Is it maximum difference in voltage any two points in time.

JD – Feels that the peak amplitude is half what it should be.

DK – 100 ohm differential resistance load is assumed. Has anyone assumed anything else?

TD – Regarding Table 47-1, in GbE, the receiver was defined and the transmitter just had to make it work.

JH – Recommend eye mask be defined for both transmitter and receiver template.

DK – Propose pulling the transition time out of Table 47-1

[Draft 1.0 Editorial comment] Table 47-1 pull out 'Transition times' line from table and change to 160ps.

Rich Taborek – Should we change pre-emphasis to pre-distortion?

[Draft 1.0 Editorial comment] Change pre-emphasis to pre-distortion.

RT – Should we specify transmitter jitter? As it exists in Table 47-1.

JD – 14 x RMS random jitter plus deterministic.

DK – Let's specify jitter like in GbE. Table 38-10

DK – Output impedence, we have 100 ohms, but I don't think it's appropriate.

RD – We need both a DC spec and a return spec.

DK – Let's take this offline.

DK – We need some channel model or golden PCB for reference.

DK – It looks like we're heading toward a transmit template.

RT – The diamond in the eye should probably change to either a square or a hexagon.

RD – Figure 47-4 The receive eye should represent 0-20".

JD – Jitter without frequency is meaningless.

DK – Table 47-3 is mostly empty, shouldn't we fill it? Or just represent it textually.

HF, others – We may want to discuss AC coupling in this group. Unsure of assumptions coming in to this meeting.

DL – Thinks the channel spec should be in an annex.

DK – We need to have consensus about what the channel is, whether we specify it or not.

RT – Do we really want to require AC coupling. Shouldn't DC coupling work? Somewhat restrictive if a cap is required.

JD – Disagree with notion that AC coupling is not required. AC coupling should be required.

DL – If an implementation is built without AC coupling but is made to work, then it would be deemed non-conformant without AC coupling.

RD – The HARI (now XAUI) group couldn't come up with anything else, so we recommended AC coupling.

? – Clause 39 might be a good reference point to start from with regard to coupling.

TD – Clause 39 (1000BASE-CX) dealt with copper links between equipment which had to deal with grounding.

DK – Hot insert topic taken offline.

<<6:30pm - Adjourned for the day>>

9/14/00 8:20am – Reconvened

➢ **Clause 48 – (Rich Taborek)**

Detailed review of draft.

Rich Taborek – Walked through Figures 48-1, 48-2.

RB – Raised issue with Mgmt block within Figure 48-2. Since there is no voted in proposal regarding mgmt, why is it there?

RT – Mgmt is a placeholder block. The assumption is mgmt will be added in the future to the draft standard.

? – Doesn't feel the tx_code_group<39:0> and rx_code_group<39:0> should appear in Figure 48-2.

RT – They appear because they are part of a service interface.

RT – Walked through Tables 48-1, 48-2.

RT – Walked through Figure 48-3.

[Draft 1.0 Editorial comment] Figure 48-3 – Change 2nd column of idles to an R column.

RT – Walked through Figure 48-3.

? – Can you describe function of the comma?

RT – The comma functionality is just referenced from Clause 36. Please refer to that text.

RT – Walked through Table 48-3.

RT – Walked through Figure 48-5.

RT – Question to group: Should we specify a polynomial for the random number generator.

PT – We may want to specify a polynomial or at least a spectral mask.

Rich Seifert – $x^7 + x^6 + 1$ is commonly used.

SH – Doesn't feel we need to specify a polynomial. This won't affect interoperability. It only affects EMI.

TD – We should specify a polynomial.

SM – We should not specify a polynomial. Systems quite often have random number generators; it should be sufficient to describe the behavior or characteristics or the random number.

Jim Hesson – Support no polynomial.

PT – We should specify a polynomial.

TD – We should specify a polynomial.

BB – How do we do PICS testing to a polynomial.

SH – Not opposed to having a polynomial.

? – Components I procure should work and meet specifications, EMI etc.

SM – Perhaps we should go with an Informative Annex with the polynomial.

[Draft 1.0 Editorial comment] 48.2.4.3 Add text regarding randomized /I/ which references a polynomial as a suggested implementation.

[Draft 1.0 Editorial comment] Figure 48-5 Fix typo: 0 <= /K/

[Draft 1.0 Editorial comment] Table 48-4 Change 'Medium' to < 18 from < 16

[Draft 1.0 Editorial comment] Table 48-4 Change 'PCB/Total' to 2 UI

SH – Does Figure 48-8 really add anything?

PT – The transmit state diagram doesn't handle error conditions e.g. what happens when no T is sent across the XGMII.

RT – The PCS doesn't currently do any checking; this is a major issue for review. Does the RS do the checking or the PCS?

Several chimed in about the delay constraints in Table 48-5. Should they be in terms of pause quanta or bit times.

[Draft 1.0 Editorial comment] 48.5.1 text refers to Table 48-5b should be Table 48-5

RT – In Clause 36 we've had prescient functions to do error checking (i.e. check_end).

BB – In 64b66b, if the 66-bit word following a T is not correct, then the T is errored out.

Several commenters agree that the PCS needs to do end delimiter checking similar to GbE. A sublayer needs to perform checking peculiar to its coding.

[Draft 1.0 Editorial comment] Look at checking/state machines to figure out how to work in the look ahead checking. Ideally the packet should be invalidated with an E within the envelope of the frame.

It is recognized that a partial column and the first full column need to be well-formed idles, else you can't trust the end delimiter.

RS will do SFD alignment checking. RS will also do the minimum required to cause a MAC to drop a bad frame without any look ahead logic.

RT – Showed a slide from his presentation at the May meeting titled "Implementation Example". Slide showed, from left to right,

MAC, RS, XGXS, XAUI, XGXS, PCS, PMA, PMD

DL – Where is "Link OK" in this diagram?

SH – The problem arises when the XGXS/PCS pair really gets reduced to a retimer. Where is Link OK in that case.

RT – Showed a slide from his presentation at the September meeting entitled "10GFC Implementation Example". Slide showed, from left to right,
MAC, RS, EnDec/SerDes/CDR, XAUI, RPTR/RTMR, O/E

DL – Wonders where we define the bit to be with respect to the MIB and mgmt clauses.

HF – You have a signal detect function which outputs a signal detect line. It is common for xcvr makers, in the absence of light, not only output false on signal detect, but also squelch the rx outputs. With the outputs squelched, downstream sublayers can determine link status.

RT – Is not familiar with this practice.

DL – Is concerned that having just one Link Status might mask an internal XAUI problem.

? – Suggestion made to send idles without A's might indicate signal detect=false.

RT – Suggests that this issue is integrally tied to BL/RF/LSS. We may want to pass more information across the XAUI via ordered sets.

BB – Let's cut off this discussion and move on. Let's have a discussion/presentation in November.

DL – If anyone presents, please consider where link ok comes from with respect to the mgmt clause.

RT – reviewed minor issues
Skip insertion
Wording about retimers
XGMII character passing
Skew budget numbers

RT – Not allowing a skip column immediately after a packet would allow for proper error checking. Rich to work on this issue.

[Draft 1.0 Editorial comment] Skip insertion rules to be reviewed by Rich.

DK – Is there a maximum delay constraint for the electrical interface for XAUI. 20" is talked about but should we talk about a maximum delay number?

RT – Let's talk about that during the electrical discussion (possible breakout).

XAUI electrical breakout in Buena Vista, possibly after lunch

Break at 10am-10:20am

BB – Remote Fault and Break Link discussion

Straw Poll
Break Link and Remote Fault should be included: > 80% of voters

RB – The WAN PHY already has the functionality of RF and BL. The LAN PHY has first level support personnel which can address broken links. The WAN topology does not.

SM – Do we need RF/BL in the LAN? We should probably address these separately. Then if both are widely supported then maybe they can be combined.

BB – Again stressed the need to limit the topic to BL/RF and not include OAM&P.

SM – Feels that most people want RF. Feels only some want OAM&P.

PT – LANs don't always have support people in smaller organizations. Also, Ethernet is going beyond 10km now, so we need RF. Some systems even provide modem support for remote diagnostics. RF is a critical feature for reducing repair time.

RB – Takes exception to the notion that you can talk about RF/BL without talking about OAM&P.

HF – Feels RF/BL is essential. From 100 Mb/s days we've put in RF/BL. And it worked. In 1 Gb/s we didn't do as well a job in specifying it and it is not commonly used. Feels we should put it in 10 Gb/s and make it robust.

Bill Quackenbush – Let's not cripple 40 km LAN links by not including RF/BL functionality. Let's put it in.

BG – Let's redo the straw poll.

RB – When we turn our products over to the sales team, we will inadvertently confuse the marketplace. Which PHY will they need to

Keith Anderson – I was chair of 10BASE-F and we've always had diagnostic signaling. Don't know why we wouldn't put it here.

Geoff Thompson – 10BASE-FB had remote fault. But it was designed to be backward compatible to FOIRL and was meant to connect repeaters. With the advent of switches, the need for repeaters decreased. 10BASE-FL had proprietary remote fault and sold very well, since the market wanted RF capability. We need to put it in.

Straw Poll
Do you want to have RF in the LAN?
Yes: 78
No: 1

BB – Let's limit the discussion about the specific proposals regarding transporting RF/BL to 30 minutes.

RT – Can we generalize the requirements of the transport, without dealing with specific requirements?

? – I think the fundamental difference between the two proposals LSS (Ishida) and RF/BL (Muller) is the actual code being sent.

BB – A more fundamental difference is LSS's continuous signaling vs. RF/BL's signal when condition arises.

RT – The actual codes being sent can be worked out no matter which proposal is chosen.

SM – Why are we trying to go through all the trouble of putting this information in between packets when there is a fundamental problem with the receive side or we're about to reset the link entirely. We need to decide periodic signaling (LSS) vs. "send no more frames, signal problem" (BL/RF).

BB – Let's remove EMI from the list of concerns. Shimon's can be fixed to intersperse idles for instance. Let's instead look at fundamental issues. Do we want a heartbeat or do we want to cease packets.

? – Support for Shimon's expressed.

GT – Simplex Ethernet is not one of our goals. We don't intend to maintain packets on one part of the link.

PT – Don't feel that sending different codes on different lines is "simple". We just need to look at periodicity for EMI reasons.

? – Thinks it's early to limit the transport to just RF/BL.

Osamu Ishida – Wanted to clarify that LSS does not send packets or frames. It sends idles which have special meaning.

JH – Support Muller's transport works fine.

RT – We need to be careful to consider proposals and how they affect the WIS etc.

KD – Let's focus on the transport requirements, before getting to deep on specific proposals.

? – Feels Shimon's is the most robust.

? – If we used the same SSD then we could encode information, 1-bit per idle code, and communicate information over the idle stream.

BB – Thinks last 30 min was constructive.

Straw Poll
Should we be able to send packets while sending RF/BL?
Yes: 1
No: most of the people in the room

Straw Poll
Do we need a heartbeat in addition to idle?
Yes: 5
No: 49

RT – I fear that without lane alignment and de-skewing, we won't be synced with the RF/BL proposal.

SM – Doesn't care about the loss of packets.

Straw Poll
Which proposal do you support:
LSS (Ishida): 13
RF/BL (Muller): 28
Abstain: 40

BB – Recommendation is that Osamu Ishida, Rich Taborek and Shimon get together and try to come up with unified proposal for November.

Jonathan Thatcher – Spent 30min talking about signal detect in PMA/PMD track. That track presumes that signal detect is a requirement, much like Clause 38, although only 50% of the room support it. Since MDIO/MDC is optional, this may

need to be a pin on the transceiver. One assumption is: pass a signal to the PMA for further qualification; the PMA then passes a qualified signal detect on to the PCS.

➢ **Clause 49 – (Pat Thaler)**

Detailed review of draft.

PT – Clause 49 is the 64b66b

[Draft 1.0 Editorial comment] Change Figure 49-1 to remove 'blobs' on the xMII which connote connectors.

DL – I don't see signal detect in Figure 49-2.

PT – We didn't have signal detect in the baseline proposal, so I didn't put it in.

PT – As far as terminology goes, each 66b block encodes eight characters.

? – Figure 49-3 shows the gearbox before the WIS block. I thought in presentations previously, that the gearbox was shown after the WIS.

PT – It makes more architectural sense here.

Raj – Figure 49-4 looks wrong, there is a bit order problem.

[Draft 1.0 Editorial comment] Figure 49-4 : Fix arrows in picture relative to bit ordering problem.

Straw Poll
Should we follow Howard's maxim which is Transmit a set value and ignore on receive.
Yes: 11
No: 0

TD – We may want to leave the possibility of using these few unused bits (referring to Figure 49-5) in the future.

PT – Since they're infrequent, this is probably useless.

[Draft 1.0 Editorial comment] Figure 49-6 needs to be fixed with respect to the equation. Due to convention we may need to change the bit order of the equation/scrambler picture.

[Draft 1.0 Editorial comment] Figure 49-10: We probably don't want to just send E whenever we're not locked. This will have EMI issues.

BB – Figure 49-9 maybe we should only count BER when we're locked.

[Draft 1.0 Editorial comment] Figure 49-9 Fix state machine such that errors are not counted when not locked.

PT – Solicit help for state machine work from group.

Break for lunch 12:00. Reconvene at 1:15pm.

➢ **Clause 50 – WIS - (Tom Alexander)**

Overview of issues

TA – Talked about Figures 50-1, 50-2

- **Major issues:**
    1. PCS must interpret all-zeroes as WIS receive failure
    2. Bounds on error propagation delay to PCS
    3. Internationalization of WIS spec (ITU?)
    4. Pointer interpreter state machine not defined
        a. Reference G.783
    5. Additional O/H Bytes – B2/M0/M1 support? J1 trace?
    6. PICS must be filled in
        a. Reference ATMF Test SWG (Document is rather sparse though)

- Major Issues #1,2
    ❑ BB – The PCS requires a signal detect w/ or w/o a WIS. We need to indicate presence or absence of light. We also need a signal which communicates inability of to acquire lock.
    ❑ ? – Why not just send the 'AIS all-ones pattern' back to the PCS?
    ❑ PT – All-ones sent to the 64b66b would tell it loss of framing/lock.
    ❑ TD – The WIS should detect errors and within a few clocks drop signal detect. That's why, CRC errors don't pile up at the MAC.
- Major Issue #3
    ❑ ? – Is the intention to reference two standards or just one.
    ❑ RB – We want to reference just one, but the ITU version isn't quite done yet.
    ❑ [Draft 1.0 Editorial comment] Put in editor's note regarding the future availability and reference-ability of the ITU spec.
- Major Issue #4
    ❑ NF – Prefers we should just reference via a paragraph of text the state machine diagram in the T1.105.
- Major Issue #6
    ❑ TA – There is a compliance statement within the ATM Forum which talks about conformance for SONET. Do we want to reference it?
    ❑ DL – The PICS form at the end of the clause, follows paragraph by paragraph, the text of the clause. You can't just point to some other document.

- **Minor Issues**
    1. Where should layer mgmt register definition details go? Clause 33 or 50?
    2. Should definitions and abbreviations in T1.416 be copied into WIS clause. Chief editor wants some.
    3. SUPI is not shown in WIS layer diagram.
    4. State diagram syntax is a bit untidy.
    5. WIS and PMA service interface must be reconciled.
        a. Can do this with PMA editor
        b. PCS bit re-labeling stuff should be validated.
    6. Should H1/H2 concatenation indication be checked?
        a. Also, should its coding be made consistent with ITU specs?

- Minor Issue #1
    - ❑ DL – Prefers register definitions go in Clause 50.
- Minor Issue #2
    - ❑ DL - What about conflicts with other parts of the base standard? Such as segment?
    - ❑ BB – T1.416 can still be referenced but a minimum level of detail is needed in Clause 50.
    - ❑ NF – In no case should a definition included in .3 regarding WIS supercede a definition in T1.416.
- Minor Issue #3
    - ❑ [Draft 1.0 Editorial comment] Change Figure 50-1 to show two stacks with two PMAs
- Minor Issue #4
    - ❑ DL – State machine conventions are found throughout .3, suggest Clause 36.
    - ❑ Clarification on signal detect – signal will be taken from the PMA and passed through to the PCS.
- Minor Issue #5
    - ❑ Discussion about bit ordering ensued.
    - ❑ BB – Let's get a small team together to recommend something going forward. Suggest Tom Alexander and Norival Figueira propose something in November.
- Minor Issue #6
    - ❑ TA – I recommend we don't check H1/H2.
    - ❑ TD – We may want to check H1/H2 in case that gear is confused. Could be useful in debug.