10 Gigabit Ethernet 9 March, 1999 1pm
Chair: Jonathan Thatcher

This area contains the high-lights of the issues. Following this section are the issues discussed. Please see the web site for the presentation materials.

1. Distance Limitations – what can they be and what should they be. We can leverage off the work in .3z for the link model.
   - The question is what percent of the existing fiber base will support this speed?
   - Should we be using the new advanced MMF specifications?
2. Existing Fiber Base – Should 10gig run on new fiber or existing fiber, too?
3. Market is here – appears to be campus and backbone, ISP, MAN,WAN.
4. Reliability
   - Redundancy - Failure detection is important
   - Cooling vs non-cooling
   - Output power
5. Coding Efficiency – 8B/10B, 16B/18B, scrambled?? What efficiency and what final speed do we need to establish a defined BER at a defined 'actual' data rate? What about Multilevel Analog Signaling?
6. Full Duplex and no CSMA/CD
7. Auto-negotiation
8. How should the speed be set-up? Each has issues. Maybe we should have a few speeds (2.5,10, etc)?
   - 1Gig x 10 – can do today
   - 2.5Gig x 4 – may be most economical
   - 10Gig x 1 – we can do this, but is expensive today
9. Make the MAC so it is speed independent and has no distance constraints. Purge distance and speed from the MAC layer and push it all in the physical level.
10. GaAs or SiGe both have internal cross-talk concerns. External to the chip cross-talk is also an issue. SERDES vs SER & DES as separate chips.
11. Jitter measurement and BER.
    - How do we measure this?
    - Telecom CDR $ vs Datacom CDR $
    - Also, how do we measure this if the parts are integrated because we can no longer see the optic electrical signal before it hits the SERDES? We will have to define the measurement points.
    - Where would the partitioning be? Where is the device split up and what is viable?
    - All elements will have to be considered including the PCB material.
    - Designers will have to learn some high speed design and measurement practices.
12. The jitter budget is going to have to have work.
13. We need to correct the 3 layers of switching that exists today: IP, then ATM, and finally over SONET. This produces lower efficiency, which translates into higher costs for the networks we are building.
14. What about WWDM? Has some good qualities.
15. Will the GMII be scaled to 10Gig? Recommendation for the 'XGI'. No question we will need to define a new interface.
16. We should all be thinking about affordable test equipment for of customers and our own labs. This technology, wither 2.5Gig, 3.125Gig, or 10Gig has a tremendous impact on the cost of test equipment for all of us.
17. Possible OC-192 synergy.
18. Laser Safety limit of WWDM proposal because you have four times the power into the fiber so you have eye safety issues.
19. EMI issues will need to be addressed for both FCC and CISPR covering multiple MACs, etc.

Reviewed rules adopted in the 802.3 plenary.
Sign up sheet question?? Apparently, we don't do this for the pre-study group.

8:30 am wed start time tomorrow

Minutes taken by Joel Goergen

Bruce Tolley – 3COM

-Customer problems: Interest in the customer base for metro area and regional area networking.
-Why start the standard now? Why not wait? This will take a while to get all the work done and integrate Ethernet. We need to start before multiple non-interoperable solutions appear in the market place.
-Switched ports: expectation is gig will reach 30k ports by 2002.

Geoff Thompson asked for clarification on switch ports ? But I missed it.

-Distance assumptions: assume no building will move because of 10Gig. Customers will expect to run 10gig over what they run 1gig over today.
-Criteria for distance: up to technology to decide if distance can be maintained, etc.
-1000baseX: possibility of enhanced parts for 400meters to 500meters. 10Km to 20Km for LX. --- Requirement of 50-70km single mode.
-Emerging applications:
-Starting point for distances: data center 50m, risers 500 meters, campus 2Km to 20Km
-Market for 500meters arising? How big is this market:
-How certain is it that the market will appear – is certain that it will because customers need an aggregation port. Campus LAN will be 30million ports.
-Media to support:
-Shipments and relative costs:
-1000BASE-X shipments:
-Cost Ratios: Switched modular and switch fixed (chassis versus fixed box)

Tom Dineen: Wants to know the viability of the graphs. They would be much more viewable on white. Point taken by Bruce.

What degree do we need to support dark fiber? (I am not sure what this means).

1. Do you have any idea the percentage of fiber that is dispersive and will not support the 10gig? No Chris Diminico: you can look at the documentation of the fiber and determine this.

2. Is there a change in the reliability?
In terms of BER, etc, we have supported that.
Is there a requirement for redundancy?

3. What do you see for these 500meter distances. Survey on line in the archives that Chris presented and a survey that compact presented. Look at the archive for .3z.

4. 50Km was a distance we have to decide if we should support. If there is dark fiber, we don't need to support SONET.

Jonathan: If you have an issue about reliability and availability, it would be worth it to make a brief slide presentation to just get the issue out.

Paul Bottorff / Nortel networks:

-Wide Area Network: Major focus is to expand into other applications in the backbone.
Metropolitan Area Networks where we are running ISP or service to a metro area.
Good match for the wide area back-bone.
-Convergence between the optical networks: One of the problems with gigabit is it does not have capacity to fill wide area backbones.

-What are most people doing: wide area over SONET. Nobody likes it. What you have is 3 layers of switching. IP, ATM and SONET. Producing lower efficiency which translates into higher costs for the networks we are building.
-10Gig Ethernet would be well positioned to form the glue between the IP and the optics.
-Coding Efficiency:
-10Gig Ethernet requires a higher degree of availability: POPs, etc, have users under contract. Boils down to a 50msec recovery time at the lowest levels. Must detect any failure in about 10msec.

Recommendations or Objectives:
1. Think the work will focus in campus – perhaps the most readily available market.
2. Technology should from the start envision new photonics …..???
3. Efficiency of encoding
4. Failure detection is important
5. Full duplex
6. Be better then ATM in terms of code efficiency (and cost).

Steve Haddock / Extreme networks

No handouts
Very Brief

1. MAC layer spec should be full duplex. Let go of CSMA/CD.
2. Make the MAC so it is speed independent and has no distance constraints. Purge distance and speed from the MAC layer and push it all in the physical level.
3. We could do CSMA/CD
4. But should we do CSMA/CD? There is no market demand for shared bandwidth at high speed. No one has undertaken developing an 802.3z repeater. Waste of committee's time to define CSMA/CD.
5. If not CSMA/CD, then is it Ethernet and is it 802.3? Touchy. What makes it Ethernet? We are able to provide a consistent migration without forklift upgrades and retraining employees.
6. What needs to be specified? Not really sure there are speed requirements on the MAC. If we don't want to touch the MAC again after this, we might have to do something around the frame stuff and clauses.
7. End result is to do a speed and distance independent MAC.

Steve asked if anyone thought we needed CSMA/CD – there was no comment so it was taken as a no.

Jonathan: 802.3 rules point out that it is a requirement for an 802.3 standard. David/Geoff: each of these points need to be addressed. If we make exception, we can't gloss over it. We must say why it is un-appropriate to deal with this and then it is brought before 802.3 body for a vote.

Ben Yu / 3COM:

-Hopes to raise questions and issues for 10Gig Ethernet.
-Most of the work is in the physical layer specifications.
-Distance requirements: 50meters, 500meters, 2km, 30km
-Protocol stack: Short wave lasers needed for the 500meter market.
-Media – should work on multi-mode fiber 50un/62.5un and plastic. For server, horizontal riser, and vertical riser.
-Thinks multi-mode solutions will be WDM based.
-Media – should work on single mode fiber: campus, access, and MAN.
-Assumes single mode fiber is standard fiber.
-Media: Copper would be coax, multi-level signal and DSP.
-Lasers: high output power, low voltage and current, narrow spectral width, high linearity, low cost and reliable, stable output power (no rj ???)
-Simplest laser is FP. Thinks distance is less then 2km.
-Distributed feed back lasers, used for single mode fibers. Low current, directly or external modulated.

-Having thermal cooling makes the part more stable. Maybe by trading the distance, you can keep the cost down.
-VCSELs may dominate for 500meter or less applications. Some have shown this up to 1km.
-Modulator: used for extended reach. Is large. Cost is concern.
-Detector:
-PMA: MUX/DEMUX, CDR, byte alignment, PMD, PMA
-PMA process technology:
-PCS sub-layer: encoding and decoding to the MAC. Need for 10gig gmii. Support half duplex? Auto-Negotiation? Thinks it will be attached to 1Gig Ethernet.

-Starting point: Full duplex, 8B/10B encoding, single wavelength 1300nm, and distances up to 30km.

Are there any systems out there now auto-negotiating down from a gig? Don't believe so.

Rich Taborek / Transcendata:

-Multilevel Analog Signaling
-Simple pulse through. 10 GBps/2.5 GHz. New signaling technology applicable to FO. Extends the life of MMF cable.
What is a good distance? As a target we are looking at 1km.
-What is the name of the technology? "TWAVE" is proprietary technology that would be opened up to the IEEE.
-Signal qualities: Synthesized, narrow band f/2 to 1.5f, resistance to dispersion, 4x speeds, usage of 1Gig Ethernet.
-Broad market potential: we have technologies to address the PAR and 5 criteria so we should start this.
-Technical Feasibility: Multiple technologies proposed – really not technically proven for the four technologies so we have some work to do.
What about SNR? Carefully chose values so the receiver receives them perfectly. ???
-Physical Layer Evaluation: max customer investment in the cable plant, longer distance over existing fiber, follow legacy market, this system easily supports 1gig and 10gig given that auto negotiation is done. This layer would support both.
-Multi level analog signaling physical device includes: Frame, PCS, pre 8B/10B, 4level-7level-7level-4level yields 784 codes for 356 data +12 special codes, DC balanced.
1000BASE-X has odd-even character restrictions. This technology, if encoded at the byte level, does not have this restriction.
-PMA layer: 4-7-7-4 code means about 14 levels average optical power. Easy to sync the PLL.

Continuous sinusoid going through the system so you have a zero crossing all the time. Easy to derive receive clock. Any shift in average optical power could be easily filtered out.

Concern about linearity over temp. (and a/d conversion)?? DC balanced for symbol. We do compensation for symbols. But do these parts need to be cooled – no.

DEL-We fully use the power budget for gig Ethernet in a two level system, can we use this in a 14 level system.? What we see with experiments at end of 100km, amplifier can extract the signal with little BER.

Tom Dineen: Wants a process in place to make sure we demonstrate feasibility.

Is this switch friendly in terms of size and modularity? Sees it as a fairly large transceiver on a daughter card. Second generation is a GBIC.

-PMD: similar as 1000BASE-X. Increased distances over 1000BASE-X variants. Not ignoring short wave VCSELs, just more work required. The technology is transparent to whatever media and detectors.

What kind of speeds do cable electronics operate at – close to GHz rate. What is cable TV optical data rates? No answer.

Timeliness of this technology: started at slower speed rates and longer distances. Lab equipment running at OC-12 and preparing for up to 10gig Ethernet.

What do we need to do to this system to meet BER? Trade off the number of levels with the frequency to meet the system BER. 10-12???

General comment that the signal to noise ratio may be a problem. What tricks can you play on the signal to make sure it is received at the end? When you amplify a signal that almost doesn't exist, you amplify the noise. The less frequency content the signal has the easier to amplify that section of the signal.

Rich Dugan / HP:

Silicon Trends kept by Rick Walker: CMOS has negative issues for jitter, but for back-plane technologies may fit. Bipolar had more power then was really necessary. (show a 10Gig SERDES in bipolar).

10 x 1gig link:
4 x 2.5gig link: FR4 can probably be implemented at these rates for connectors and back planes.
1 x 10gig link: Electronics may not be the issue. It may be the cash. Connectors, jitter performance, etc.
2.5gbaud PCB performance: FR4 and Nelco-13

When you say 24inches is it data and non-equalized? YES and YES.

10GBaud PCB performance: Fr4 and Nelco-13 over 4inches. Shows fr-4
Comment on fr-4 and Nelco-13 have the same loss coefficients.
Coding options: 8B/10B requires 25% overhead.
Jitter requirements: All elements will have to be considered including the PCB material. 10Gig Si bipolar serdes will not meet optical link budget restrictions.
Conclusion for silicon is: 10 x 1Gig is quickest, 4x2.5 is reasonable, 1 x 10Gig may have application issues.

Jonathan: Are you saying 10Gig is there but may not work? Rich is saying it is not there unless the jitter budget is set in stone. How do you fit into the Ethernet shoe.

Does this apply only to back planes? If you only had 10Gig for the optical port? 10Gig is suitable if you are willing to spend the money.

Will the GMII be scaled to 10gig? Recommendation for the 'XGI'. No question we will need to define a new interface.

Fred Wennigar / Vitesse

-OC192 devices in production now. Several GaAS programs in development.
-Show clean eye from a multiplexer from pins of chip.
-Goal: make 10gig as affordable as 2.5gig.
-Forward Error Correction: raises serial data rate / improve observed BER.
-Single or Multiple Channel:
-Jitter spec: May need short haul and long haul specs.

Comment on anticipated xtalk at 10Gig? You will have to look at it with both tx and rx in the same package. Consider the notion of keeping them separate unless they can be integrated correctly.

Dan Dove – saw presentation where 10x performance for 10x cost, thought it was objective to have 10x performance for 2x cost? Jonathan: this has not been established as an objective. Group will have to balance this over cost, time, etc. Should not think that there is only one way to approach this.

Geoff mentioned that there could be an early implementation that did not meet the cost goals, but later version would.

Dan Dove – why not offer 2Gig and 10Gig base rates? A multiple speed type thing.

Bill Woodruff / GIGA

-Semiconductor company located in Denmark
-Not experts in optics
-Study Group: Time to start the study group because components are out there shipping devices. Serial technology will drive the lowest possible cost. Clearly OC192 has its own cost models and may not change as quickly. Silicon today has demonstrated OC192 jitter budgets today. So what can the link do and not just the silicon?
-OC192 devices: GaAs devices, have to eliminate SMA connectors, have to let MFG do their thing.
-Current developments: 12.5Gig because of 8B/10B will drive the silicon into SiGe for FEC.
-Other Points: 10Gig should be less then 4x 2.5Gig at similar volumes. Scrambling permits lower device cost.

Think it is misleading. 10Gig volumes will not be at 2.5Gig levels for a while.

Comment on required BER between telecom and datacom? Beyond the scope of this talk. Datacom needs 10x10-12. BER is more a fact of time on the tester.

BER needs to be talked about and defined.

Equalization has been going on for some time and we could do this.

PROOF: silicon MUX, 13.6ps pk-pk jitter. OC192 rates at about 1inch of copper in fr4. 2inches show 2dB loss. Jitter spec for OC192 is .1UI and he is 20% of that.

Del Hanson / HP:

-The GBE fiber optic link model provides a frame work for 10gbe alternatives.
-We can leverage between oc-192 and 10gig Ethernet.
-Objectives: look at both 2.5 and 10Gig links, mm and sm, 850 and 1300nm, etc.
-Alternatives: 10 x 1Gig, 4x 2.5, etc.
-4x2.5Gig: Wide WDM (WWDM), bundle SERDES with transceiver.
Why are the four wave lengths that far apart? To keep low cost, you need to have about four and separate them this far (1280, 1300, 1320, 1340) .

-10Gig serial link issues: can an 8dB optical power budget be achieved. Can we do this? The answer needs to be discussed within the group.
-8B/10B line code: DC balanced, and lots of nice features, but poor overhead.
-SONET: can have 70 ‘0’ or 70 ‘1’ in a row, not dc balanced. But would be nice to use oc-192 because it would be nice to have over-lap.

Point was we should evaluate the price for the overhead vs what we actually get for it.

-Lower over-head block codes: 16B/18B block code (12.5% over-head). Jitter and block codes have to be considered as a set.

-Link Lengths vs line rate:
-Jitter Budgets: Assuming improved fiber and possibly single mode..
Conclusions: 4 x 2.5Gig will be cost effective. Quad SERDES can be developed. Serial 10Gig needs to be developed. The real question is will this technology allow us to move in cost effective over 5Km single mode.

Work is still in progress for distance over what method vs cost for HP efforts. It is all here today if you want to pay the price.

Why will 10gig be more expensive then 4x2.5Gig? Listed these issues on his table. But you need four lasers, how can that cost less? Time, SERDES issues, today, Del thinks 4x2.5 is most cost-effective way to achieve that.

Jonathan: What needs research and time is the understanding of the infrastructure of WDM and the OC base can be used as an informational perspective by someone informative – that is, someone needs to do a tutorial.

How many may not be here on Thursday to vote. Lots.
Will take straw poll at 2pm of everyone in this group on Wednesday as to if we should proceed with a study group.
Back at 8:30am Wednesday

Wednesday, March 10, 1999
8:30am

Rob Hadaway / Nortel
Peter Schvan / Nortel gave the presentation

- 25Ghz technology has been available for years.
- 50ghz and 30ghz SiGe devices are available.

Is there a reason you don't have GaAs listed on the data? I wasn't clear on his answer. Thought he said they felt it was not effective at these speeds for manufacturability.

- What is benefit of SiGe besides speed? BiCMOS compatible, performance advantage over GaAs, on-chip integration, and emerging/existing markets.
- Out standing challenge here is the packaging issues. There is just nothing cost effective.
- How do we solve the xtalk problem?
- Circuits: 5V, .6Watt, 2Volt swing and >15GHz frequency.
- Show BER at 100km span 10E-9. 100ps eye horizontal 500mVpp vertical through an amplifier.
- Burst Mode Optical Receiver:
- Single Chip RX:
- Summary:
    - Bvceo issues
    - Cost
    - Package
    - Understanding the passives such as material, inductors, transmission lines, etc
    - High performance datacam

What is the Ft? More important the Fmax is 100GHz.

Why did you go through all the trouble of the single circuit when you need an external device that could contribute jitter? What is the point of integrating it? Admits there are applications where you would need to integrate external components.

Paper copies to be delivered after lunch.

Ed Cornejo / Lucent

- Serial 10Gigabit approach
    - Vendors moving to SiGe

    - Existing smf can be used
    - Cost effective approach
    - Technology is here today
- Opto-electronics Status
    - EML laser is 80km
    - CW ILM is 600km
    - Un-cooled FP is 1km
    - Un-cooled DFB is 10km
- Integrated Transceiver
    - 12.5Gig
    - mux/demux
- FP 1km maybe 2km
- 10km to 20km

Where do you anticipate the clock and mux/demux functions to exist? Inside the modules.

Why would you integrate? Don't feel customers want to run 10ghz around their boards. People disagree with him.
Do you have publication of the un-cooled FP laser picture? Should be published soon. Feels the FP laser will top out at 2km.

David Dolfi / HP

Wide Wave Division Multiplexing:
- Serial TDM solutions
    - Temperature concerns
    - Tough to support existing fiber infrastructure
    - We can use a cheaper laser for 2.5Gig
    - May not need SiGe if we do lower speeds.
    - Jitter would be tight.
- Parallel Optics
    - Cost issues
- WWDM
    - Longer distances
    - Slower silicon
- SpectraLAN
    - 820,835,850,865 short wave
    - 1280, 1300, 1320, 1340
    - distance to 300m MMF and 10km SMF
- LX parts
    - Un-cooled DFB lasers
    - Low cost approach because the wavelength space is very loose.
    - Mux is 4to1 silica wave guide combiner.
    - Loss is about 6db for the mux per channel.
    - Demux is much lower loss (about 2db)
- DFB Source study
    - Need to examine RIN and BER at high ambient temperature.
    - Small MPN over 6km
- Measurements taken so far
    - All measurements were done at 2.488Gbaud because of equipment limitations.
- Advantages
    - Uses current production technology
    - Packaging and IC are an extension of GBE technology
    - Building data base
- Challenges
    - 4 chip precision die attach is an issue
    - power variation between the channels

- have done all the work at 2.488baud and they will have to evaluate at 3.125baud

WWDM vs TDM. What is the MTBF for using four lasers? No comment yet – not enough data.

4times the cost of GBE LX module.

Shelto VanDoorn / Siemens

- Distances:
  - Short 100m
  - 3km
  - greater then 10km
  - Some customers want to cover 80km or more
- Technology supported
  - 10Gig components are available
  - new ASIC technologies are available
  - new fiber optics
- Parallel optics as a viable option for shorter distances
  - 10 x 1Gig
- Serial Optics as a viable option
  - Where would the partitioning be? Where is the device split up and what is viable?
- WDM Module
- Multi-level encoding
- Coding Schemes:
  - 8B/10B
  - 14B/15B
  - scrambling
  - 16B/18B
  - multi-level
- Distances
  - 12.5Gig/850nm MMF – 25m
  - 12.5Gig/1300nm MMF – 50m
  - 12.5Gig/1300nm SMF – 10km

Siemens proposes we move forward to start the study group.

On the 5un core fiber, do you have expaction as to the distance on 850nm? None yet, more detailed work needs to be done. Fiber is available.

Paul Kolesar – lots of work done at the 9un level.

Jonathan – We should all be thinking about affordable test equipment for of customers and our own labs.

Paul Kolesar / Lucent

Intent is to introduce new technology choice

- Rationale for multiple PMDs
  - Serial 10Gig is a requirement
  - Serial 10Gig 850nm is lowest cost upgrade for building back bones.
- Most manufacturers offering advanced MMF.
  - Experiments show the new MMF fibers can support hundreds of meters.
- Next generation fiber will support all IEEE 802 applications.

How fast can we go on new MMF? Feels we are pushing the limit with MUX/DEMUX on single channel at 10GIg.

Do we believe WDM will work on MMF and give us an extension? Yes.

Serial 10Gig, would we modulate the VCSEL at that speed? Yes

Comment on relative cost between SMF and new MMF. New MMF would be more costly then SMF and MMF is today. Paul used a graph here to explain his position.

Current SONET pricing was (predicting) currently a factor of 10x over existing LX. Prices are based on reapplication of 2.5gbit technology at 10gig. Un-isolated and un-cooled devices.

When will advanced MMF be shipped? Announced and shipping today, he thinks.

Advanced MMF is graded index fiber.

Shows chart of 2200MHZ*KM 50un MMF at 850nm. The distance would require 6dB optical power at 300meters including connectors. Jitter is scaled.

Comment made by HP, Jonathan said it best – Everyone has their own opinion.

Dan Dove / HP has some things to present.

Jonathan
- Thanks to all presenters

Straw poll questions:
1. How many people in this room believe now is the time to start a 10Gigabit study group.
139 yes, 1 no comment

Bob – how many people will be willing to participate in the study group?
People (59+31+ 48 + 2) = 140 in the room
How many companies will be willing to participate in the study group?
David – one time we ask for company votes to report back to that it isn't 140people from one company.
55 companies

Jonathan: How many people in the room support creation of "higher speed study group"? Supports several speeds.
Bob- 100Mbit and Gigabit both started out as this.
X - if this was it, wouldn't have come.
Tom – Thinks this is a good idea.
X – fears things might get to wide and not focused enough to datacom.
Dan Dove – At this stage of the game, we should leave it open. We will have to focus a little for the PAR. We can constrain then.
Bob Grow – first thing is to develop objectives to narrow scope. Don't do this now.
Jonathan – concern for taging group as 10Gig study group is worried that people might not attend if it is deemed as only 10Gig. Up to the study group to pick its own objectives.

Yes - 116
No - 2
Abstain - 16

PicoLite and Cielo may host the interim meeting. 1st week May or 1st week June.

Reflector will be set up after we become a real group.

11am

Dan Dove / HP
Presentation on what he thought was not covered.

- Cost, while not an issue for MAN, will be for WC and servers
- Four MAC channels should be considered with link aggregation
- Speed scalability
  - 10Gig-MII may follow
    - 10Gig serial link
    - 4x2.5Gig WWDM LX
    - 4x2.5Gig WWDM SX
    - 4x2.5Gig Cu link

Shelto – WWDM has eye safety issue because you have four times the power down the fiber.

EMI is going to be a concern.

Distance lengths:
Shelto – Tables need to be up-dated.
Geoff Thompson – We need to look at the tables again. We have some experience in terms of gigabit as to where the sales became difficult in terms of length.
Rich – Data was only for North America and does not cover dark fiber. We need to have more granularity as to where the pain is and how bad it is.
X – room for more definition.

What issues are concerns for us and are we sure we want to do this?
Bob – Technology was picked too early. But secured a significant presence in the market that it couldn't be changed. Example is FDDI choosing 1300nm and then couldn't change it.
Geoff – Why are we doing this and what is the value add we will bring running at this speed? We should look at what we can do value add to compete in the carrier space.
Tom – Quick answer to carrier space is we could succeed if we are cost effective. A major concern to this effort that we apply a process of quality control to prevent the unknown gotcha. As a group we need to come up with a way to determine this early on.
Shelto – Reluctant to go with all kinds of data rates. As chair of T11, they are getting criticism from having to many speed rates.
Joel – Equipment issues, Educating system designers, and EMI.
X – Well aware of plenty of applications where gigabit is not enough. One solution to cover all is probably not going to do it. We should narrow focus.
Dan – Equipment at 10gig is a lot different. Most of us will make sure we have it. Yes, it is not for the squeamish. But 10gig is really great for switching. As a network systems supplier, selling multiple gig switches and they have to aggregate links for bandwidth.
Jonathan – Laser Safety:

1. Class 1 laser safe stuff
   - Require pigtail before you power it on. One potential way to deal with it.
   - Good reason to want to couple more power into the fiber
   - Possible fiber control schemes that will allow us to achieve more power from the multiple wave lengths and still meet safety – such as power one on and then power the other three when the one is linked.

Del – What is likely hood of relaxation at a given wavelength? We need to make life easy for our customers and we should follow class 1 eye safety. As we set budgets, we should look at class 1 eye safety.
Jonathan – can we use a SC hole and get 10gig blockage for EMI. Feels most connectors out there today will not block EMI with 10gig sitting right at the whole.
Paul – What might the penalty be for using open fiber control.
Jonathan – This was in fiber channel and was thrown out. Allows you to put more power into the fiber then safety standards permit. It does this by pulsing down the fiber a max amount of power that can be

averaged over 10seconds. The disadvantage is that it takes 10 seconds to bring up a link. This allows not more then two things in a loop and was not possible to arbitrate loops.
Tom – Could the safety be built into the auto-negotiation state machines?
Jonathan – you could make it any amount of time other then 10sec.
Jonathan – what does next generation GMII look like?

Interim Meeting / Boulder, CO early May or June
OIF is first week in May
4 people could not attend 1st week May
12+15+15=42 can attend
4 people could not attend 1st week June
34+17=51 can attend

TOPIC for next discussion:
1. Eye Safety and how we conform to this. Weather we include it in auto-negotiation or open fiber or whatever.
2. Next Generation GMII.