802.3 Working Group

10 Gig Ethernet Call for Interest

Ad Hoc Meeting Summary

March 1999

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Market Requirements

Bruce Tolley, 3COM

- Start now; avoid multiple, competitive, proprietary solutions are established
- Aggregate projected 30M GbE switched ports by 2002
- Distances
  - Support MAN/RAN distances: >50 km
  - Support LAN Distances: 500 m risers; 10 km campus
  - Support server cluster distances <50 m
- Cost goal: 10GbE << 10 x GbE
  - 1000BASE-X launched at 5 to 12 cost of switched 100

10 GbE Scope & Objectives

Paul Bottorff, Nortel Networks

- Phased project
  - First phase for campus backbone networks
  - Later phases for access and metropolitan
- Designed from the start considering wide area
  - Infrastructure is not free
  - Failure detection time around 10 msec
  - Support full-duplex operation only
  - High Encoding Efficiency
    - Better than ATM's "cell tax" and packing overhead

802.3 MAC at 10 Gbps

Steven Haddock,
Extreme Networks

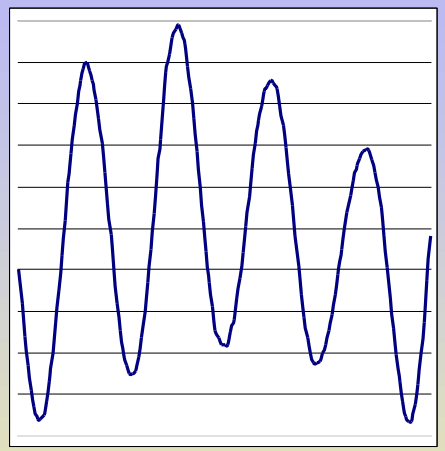
- Make the MAC so it is speed independent and has no distance constraints.
- Purge distance and speed from the MAC layer and push it all in the physical level.

10 GbE Technologies

Ben Yu, 3COM

- Initial market opportunities: campus backbone
  - Standards initially focus on initial markets
- Starting point close to the current GbE standards
  - Full duplex, 8B/10B, 1.3um and SMF
- Identify the interfaces to work on
  - 10 GMII, PMA interface, MDI?
- Define "10 GMII" ASAP to get things started
  - sets the frame work for speed insensitive implementation
  - support for multiple MAC and link aggregation

Multilevel Analog Signaling



Rich Taborek, Transcendata

- New Signaling Technology/PHY for 10 Gbps
  - Narrow band, low dispersion, low EMI
  - AM, 4 bits/baud, 2.5 GHz, 10 Gbps
  - Uses 8B/10B pre-encoded input, preserves 8B/10B qualities
- Compatible with GMII (extensions) & GbE PMD's
- Can utilize existing MMF (&SMF) cable plant
  - >1 km on MMF, >10 km on SMF, can go to 100 km (1550 nm)
- Can utilize 2.4 Gbps optics, may be able to use GbE optics
- Issue: Requires linear lasers & high speed DAC/ADC

High Speed Silicon

Richard Dugan, HP

- Si can support 10 GBd at multiple aggregation rates today.
- Strong industry demand for B/W in many applications
  - Provides economy of scale
- Data rates of ~2.5 GBd can be used over back planes; copper (CX) and optical modules.
- 10 GBd full rate Si available today, but with limited applications.
- Issue: Jitter budget with Si?

10 Gig Serial Technology Map

Fred Wennigar, Vitesse

- Mature GaAs process exists for 10 Gig
- New GaAs process
  - New GaAs process w/Analog Integration and lower power soon
  - ~10 km, 1300 nm, SMF
- All SerDes Building Blocks Exist
- We are agnostic on 10G Vs. 4 x 2.5 Gbps

SiGe BiCMOS Technology

Peter Schvan, Nortel Networks

- SiGe technology demonstrated for 10 Gbps TRX IC's
  - Limiting amp, AGC, CDR, Mux/Demux, VCO, Laser driver
- BiCMOS option allows system-on-chip implementation
  - Integrated 0.25(0.18 soon) logic/memory
  - High cross-talk suppression demonstrated
- Si technology guarantees commodity-like component cost
  - Follows standard cost reduction curve
- Issue: Low-cost packaging solution is needed

10 GbE Device Capabilities

Bill Woodruff, GIGA

- Proponent of Serial
  - Long term, serial solution represents lowest cost
- Jitter primarily a cost issue in optics
  - Electronics can exceed OC-192 at reasonable cost (no premium)
- Don’t forget test technique for jitter.
  - TDM measurements have background jitter ~0.1 ns p-p

10 GbE Optical Links

Del Hanson, HP

- Fiber Optics and SerDes need to be considered together
- Explore synergy with OC-192 (e.g. scrambling)
- Issues:
  - Support for existing and future multimode fiber
  - Worst case jitter budget comparisons at 2.5/10 Gbps (unencoded)
  - Performance vs. cost comparisons in 5-60 km SMF space
  - Is there an advantage to using a lower overhead line code?
    - Is there a jitter penalty?

10 GbE Serial Optical PMD

Ed Cornejo, Lucent

- Single channel solution should inherently cost less than multiple channel solution
  - Low cost optics (uncooled lasers), and electronics (SiGe) are being introduced by multiple suppliers
- Based on the GbE power budget, the following distances are easily achieved using standard SMF.
  - Fabry-Perot 1.3um (1km)
  - DFB 1.3um (20km)
- Because of the higher frequencies associated with 10G, the SerDes should become part of the PMD specifications.

Wide WDM for 10 GbE

Dave Dolfi, H-P

- 4 “color” WDM proposed at 4 x 2.5 Gbps
  - ~300 meters, 1300 nm, 62.5 µm MMF
  - ~10 km, 1300 nm, SMF
- Can utilize low cost DFB lasers
  - Uncooled, unisolated, arbitrary side mode suppression (no spec)
- Can support existing MMF infrastructure
- Demonstrated SX version at 10 Gbps
  - 110 meters, 850 nm, 62.5 µm MMF
- Issue: Packaging challenge

10 Gbps Status and Technology

Schelto van Doorn, Siemens

- The technology is ready, we just need to pick the right one(s)
- The industry wants the speed and needs solutions
- Floated parallel option

Viable PMDs for 10GbE

Paul Kolesar, Lucent

- Good reasons to standardize multiple PMDs
  - Serial SMF addresses long distance
  - Advanced MMF can address in-building LAN with VCSELs
    - Lowest cost migration path
    - Supports 802 applications suite from 10 MBd to 10 GBd

Issues -- What are the Markets

- Campus?
- Backbone?
- ISP?
- MAN?
- WAN?
- Switch Aggregation (up links)?
- etc.

Issues - Distance Requirements

- What can they be; what should they be?
- Should 10 Gig run on new fiber or existing fiber, or both?
- Can we use the .3z link model?
- Are existing cabling standards adequate?
- Request for new fiber survey; new objectives need new view
  - Need information on Dark Fiber
  - Need information on International usage.
  - What % of the existing fiber will support new distances
- Should we use the new advanced MMF specifications?
- Do we want to consider copper (like CX) for short distances?

Implementations / Wavelengths

- How implement?
  - One (or more?) of:
    - 1 Gig x 10
    - 2.5 Gig x 4
    - 10 Gig x 1
  - OC-192 or OC-48 synergy?
- Wavelengths
  - 850nm
  - 1300nm
  - 1550nm

Issues -- What Coding Scheme?

- 8b/10b
- 14b/15b
- 16b/18b
- Scrambled
- Multilevel Analog Signaling

Issues -- "Quality"

- Reliability
  - System reliability
    - Redundancy
    - Failure detection
  - Component reliability
    - Temperature (cooling?)
    - Output power
- Laser Safety
  - OFC?
- BER
- Jitter
  - How measured?
  - Telecom CDR $ Vs Datacom CDR $
- Testing
  - Is equipment available?
- EMI issues

Miscellaneous Issues

- What is ideal physical partitioning?
- What replaces GMII (“XGI”)?
- Require link aggregation for 4 x 2.5 Gig?
- Support more than 1 bit rate (2.5... 10....)?
- New Auto-negotiation features (speed)?

Call for Negative Comments

- Consider limiting scope
  - Increases probability of success
- Penalty for technologies being too early or too late
  - Too early leads to sub optimization
- Information on the carrier space is required
- Quality control needs to be built into process
  - Require feasibility demonstrations
- Concerns about multi-speed Vs 1 speed only
- Expect problems with test & lab equipment; customer use
- Avoid basing standard on unproven technology

Straw Polls

- **How many people will be willing to participate in a "10 Gigabit Ethernet" study group?**
  - Yes - 140
  - No - 0
  - Abstain - 1
- **How many companies will be willing to participate in a 10 Gigabit Ethernet study group?**
  - 55
- **How many people in the room support creation of a "Higher Speed Study Group"?**
  - Yes - 116
  - No - 2
  - Abstain - 16

Motion

In response to the 10 Gigabit Ethernet Call for Interest, that 802.3 approve the creation of a Higher Speed Study Group and authorize an interim meeting.

Moved by: Jonathan Thatcher Second: Peter Wang

Procedural (not technical)

For: 45 Against: 0 Abstain: 3

Note: June 1-3 targeted for interim meeting in Boulder, CO.
Candidate Hosts: Cielo & Picolight

Request

- Will the chair please request two tutorial slots for the next plenary.
  - High Speed Study Group
  - Transcendata Technology Overview