

Generating the draft

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Introduction

- Primary task is to get consensus to generate a draft D1.0 coming out of the July 802 Plenary meeting...
- Have consensus on the following items
 - Channel models: form the basis of link segment
 - For PAM modulation, 8 or higher PAM
 - Transmit return loss specification
 - Define a power backoff scheme
- How far can we get with this?
- What do we need and in what priority order?

Framework

- Introduction
 - Overview, Objectives, Operation,
 - Functional blocks, Interfaces, Modes
- Interfaces and Service Primitives
- Physical Coding Sublayer
- Physical Medium Attachment Sublayer
- PMA Electrical Specifications
- MDI Interface Specifications
- Link segment characteristics
- Management Interface
 - Autonegotiations (AN), Power backoff (PB)
- Other: Environmental, etc.
- Protocol implementation conformance statements

Clause 55 Introduction

■ Clause 55.1: Overview

■ 55.1.1: Objectives

■ 55.1.2: Relationship of 10GBASE-T to other standards

■ 55.1.3: Operation of 10GBASE-T is where we get stuck... [..\IEEE\802.3an\gige_pdf\802.3-2002.pdf](#)

The 10GBASE-T PHY employs full duplex baseband transmission over four pair cabling specified in [link segment spec]. The aggregate data rate of 10 Gb/s is achieved by transmission at a data rate of 2.5 Gb/s over each wire pair, as shown in Figure []. The use of hybrids and cancellers enables full duplex transmission by allowing symbols to be transmitted and received on the same wire pairs at the same time. Baseband [or other] signaling with a modulation rate of ??MHz is used on each of the wire pairs. The transmitted symbols are selected from a four-dimensional ?-level symbol constellation. Each four-dimensional symbol can be viewed as a 4-tuple (An, Bn, Cn, Dn) of one-dimensional symbols taken from the range {12 to -12} or ???.

10GBASE-T uses a continuous signaling system; in the absence of data, Idle symbols are transmitted. Idle mode is a subset of code-groups in that each symbol is restricted to the set {2, 0, -2} to improve synchronization. >8-level Pulse Amplitude Modulation or other modulation is employed for transmission over each wire pair. The modulation rate of ??? MBaud results in a symbol period of ?? ns.

A 10GBASE-T PHY can be configured either as a MASTER PHY or as a SLAVE PHY. The MASTER- SLAVE relationship between two stations sharing a link segment is established during Auto- Negotiation (see Clause 28, 55.?, and Annex 28C). The MASTER PHY uses a local clock to determine the timing of transmitter operations. The SLAVE PHY recovers the clock from the received signal and uses it to determine the timing of transmitter operations, i.e., it performs loop timing, as illustrated in Figure []. In a multiport to single-port connection, the multiport device is typically set to be MASTER and the single-port device is set to be SLAVE. The PCS and PMA subclauses of this document are summarized in 55.1.3.1 and 55.1.3.2. Figure [] shows the functional block diagram.

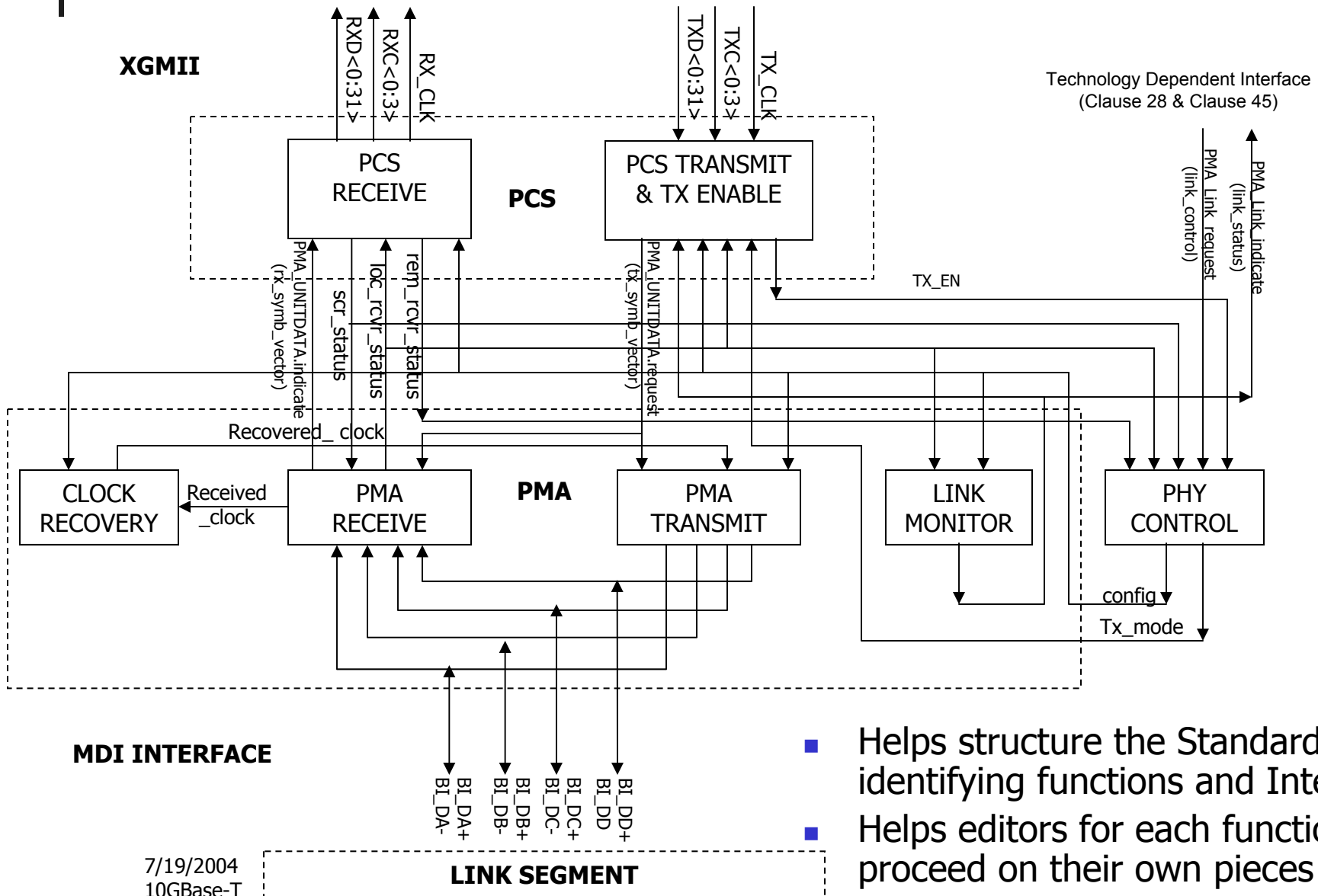
■ 55.1.4 Signaling (for training and normal modes)

■ 55.1.5 Inter-sublayer interfaces

■ The functional block diagram and agreement on material already being debated will let us generate a reasonably complete 55.1. Decisions on the following will make it more complete:

- OFDM or PAM? Specific levels?
- THP or no THP for PAM

Functional Block diagram



- Helps structure the Standard by identifying functions and Interfaces
- Helps editors for each function to proceed on their own pieces

Physical Coding Sublayer (PCS)

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 - Modulation:
 - Transmit processing:
 - Scrambling:
 - Framing:
 - FEC:
 - Precoding?
 - TX shaping?
 - Receiver operation
 - Startup:
 - Volunteers: Jose Tellado
- Decisions need to be made on material under discussion
- Startup will need serious scrutiny by the task force

Physical Medium Attachment

- PMA functions
 - MDI
 - Automatic MDI/MDI-X configuration
 - State variable and diagrams
 - Volunteers: ??
- PMA electrical specifications
 - PMA to MDI Interface tests
 - Electrical specifications
 - Volunteer: Sandeep Gupta

Other

- Management Interface and Auto-negotiation (AN)
 - Base page and next page exchange
 - Management registers
 - Power backoff
 - Volunteer: Eric Lynskey
- Link segment
 - Characteristics – Chris DiMinico
- MDI specification – Terry Cobb
- Other
 - Environmental specifications
 - Misc.
- Protocol Implementation conformance statements

Choices

- Six proposals on the table - varying degrees of completeness
 - OFDM/LDPC higuichi_1_0504
 - THP/LDPC/12PAM seki_1_0504
 - THP/LDPC/8PAM rao_1_0504
 - DFE/TCM/10PAM mcclellan_1_0504, jones_1_0504
 - THP/LDPC/12PAM tellado_1_0504
 - THP/LDPC/8PAM takatori_1_0504
- Equalization debate
- Transmit voltage
- Power backoff
- Baud rate range
 - Impacts link segment specification
- Need to adopt a baseline proposal to meet schedule
 - Few proposals better for Task Force and Editors

Goals for this Meeting

- Adopt at least one proposal to support the Framework
 - PCS
 - PMA
 - PMA Electrical specifications
 - MDI Interface specifications
 - Management Interface & Auto Negotiation
- Link segment is done
 - Update as per feedback from ISO/IEC and TIA
 - Provide further guidance to ISO/IEC and TIA
- Subsequent meetings
 - Decisions on operation in all modes covering state diagrams
 - Detailed definition of management

Summary I

- Liason reports
 - TIA TR-42 – Val Rybinski
 - ISO/IEC – Alan Flatman
 - EMC work
 - Ed2.1 for Class E and F
 - Do we change NEXT/Return loss in our link specification?
- NEXT can be mitigated – Wayne Larson
- Baseline text for 55.X MDI & environmental specifications – Terry Cobb
 - Can we get agreement and a motion to accept this as the basis for Draft 1.0?
- TSB 155 Draft 1.0 – Chris DiMinico
 - Relax NEXT/PSNEXT, improve return loss for existing CAT6
- 10GBASE-T Cabling recommendation – Alan Flatman
 - Penetration of enhance Class E will take time
 - Relax NEXT/PSNEXT for existing E at $f > 330\text{MHz}$
 - Reduce link specifications to 500MHz
 - The task force seems ready to relax specs beyond 500Mhz
- PHY based cable diagnostics definition – Hugh Barrass
 - Hugh to work with interested PHY vendors to develop further
 - Can we capture some level of agreement?

Summary II

- Auto-negotiation for 10GBASE-T- Eric Lynskey
 - Can we accept his proposal to form the baseline for Draft 1.0?
 - Go with extended base-pages and later fold back into the 1000BASE-T pages if possible?
 - Features in clause 45, 22 or both
 - Tighten link test pulse template for 10GBASE-T?
 - Power backoff should be part of auto-negotiation or Startup?
- PHY PMA electrical specs – Sandeep Gupta
 - Can we close on the max transmit voltage?
 - For backoff, can we settle on number of levels and min?
 - Can we agree on the level-accuracy proposal?
 - What else can we agree on?
 - Time-line and steps to closing on remaining items
- ANEXT reduction by correlative coding for 10GBASE-T – Masahiro Murakawa/Shinji Nishimura

Summary III

- Structured Low-Density Parity-Check Codes – Prof Shu Lin
 - All codes presented so far have been based on RS code
- Performance eval. of low latency LDPC code – K. Seki/T. Higuchi
 - The task force must lock down agreement on LDPC
 - Time-line, criteria and steps to selection of final choice?
- Can all candidate codes be put on the table ASAP?
 - Subjecting choice to early collective scrutiny could save us a lot of compute time

Table 1 LDPC codes of length 1024 constructed based on the (32,31) extended RS code

Codes	Rates	γ	Minimum Distance
(1024,845)	0.8252	8	≥ 10
(1024,833)	0.8134	10	≥ 12
(1024,821)	0.8017	12	≥ 14
(1024,809)	0.7900	14	≥ 16
(1024,797)	0.7783	16	≥ 18
(1024,793)	0.7744	20	≥ 22
(1024,783)	0.7646	30	≥ 32
(1024,781)	0.7626	32	34

Summary IV

- THP as a companion to LDPC – Amir Mezer
 - Comparison of THP + LDPC vs. alternatives
 - The task force must lock down agreement on THP
- 10GBASE-T PAM scheme: Fixed THP precoder for all cable types and lengths – Gottfried Ungerboeck
 - Multiple presentations over a few meetings
 - Is the Task force ready to decide?

Summary V – proposals

- 10GBASE-PAM scheme: Proposed Overall Architecture
- LDPC 4D-PAM8 proposal for 10GBASE-T – Sailesh Rao
- LDPC-PAM12 PHY proposal for 10GBASE-T – Seki/Tellado
- Task for must lock down agreement on PAM, THP, LDPC
- Differences
 - PAM levels: 8 or 12?
 - LDPC code block size
 - Specific LDPC code
 - Framing
 - Cancellation required?
 - Transmit filtering
- Discussion items
 - SNR margin under various conditions
 - Noise margin
 - Other tradeoffs: clock rate, framing
 - Transmit filtering – can we agree on a transmit PSD mask?

Work ahead

- Work plan to pick specific LDPC code
 - Criteria
 - Latency, Coding gain, Rate, Complexity
 - Expectations on simulation results
 - 10^{-12} or 10^{-13} ?
 - Confidence level
- Cable diagnostics details
 - Hugh Barrass to develop further
- Power backoff
 - Hiroshi and Sailesh to come back with a proposal
- Transmit PSD
 - One proposal is to use a digital filter: $0.75 + 0.25D$
 - Albert Vareljian to suggest analog filter
 - Alternative proposals?
- More detailed analysis on power consumption has been requested
- PMA electricals – more decisions to be made
- Startup – requires more scrutiny from the Task Force