
IEEE 802.3ap Signaling Ad Hoc

**IEEE 802.3ap Task Force
22 Oct'04**

Agenda

- **Signaling ad hoc & progress to date**
- **Remaining work items**
 1. **Signaling Quality Metrics**
 2. **Definition of aggressors**
 3. **Define link elements**
- **Outcomes for Today 😊**
 - **Establish baseline signaling quality metrics**
 - **Establish baseline for treatment of aggressors**

Signaling ad hoc - Progress to date

- **Initial ad hoc work item list:**
 - http://www.ieee802.org/3/ap/public/signal_adhoc/workplan_01_0804.pdf
- **Ad hoc to Define:**
 - **Methodology**
 - Non simulator-dependent
 - **Define simulation elements from component edge to component edge**
 - **Define signaling solution comparison metrics**
- **Purpose is:**
 - **To create a traceable decision making path through the standards development**
- **Progress to date:**
 - **Discussed simulation engine options**
 - Hspice and StatEye methodologies
 - NEXT/FEXT treatment and equalizer treatment
 - **Created initial list of 17 channels for simulation purposes**
 - List not completely agreed upon

Signaling ad hoc

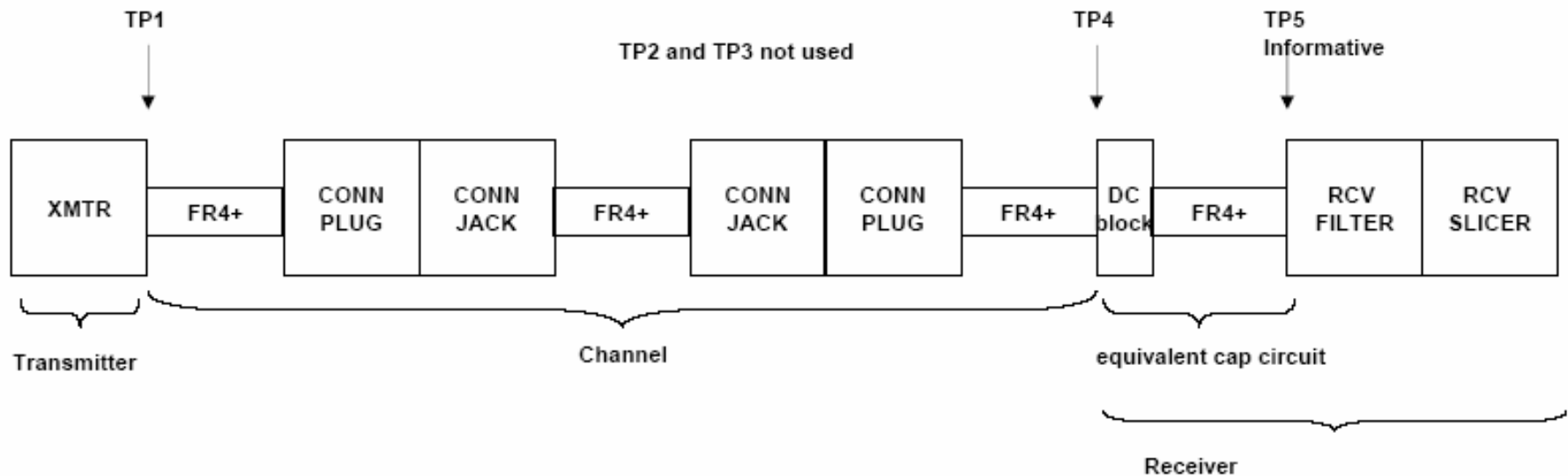
- **What can we make progress on?**

22 Oct Conference Call Work Items

- **Open work items**
 1. **Signaling Quality Metrics**
 - BER
 - Voltage/timing margin
 - Power, complexity
 2. **Definition of aggressors**
 - NEXT / FEXT
 - Background (system) noise
 - Random noise
 3. **Define remaining link elements**
 - Channel selection for simulation
 - Elements beyond the channel model
 - Package
 - AC Coupling cap and TP5 trace
- **Outcomes Today ☺**
 - **Finalize signaling quality metrics**
 - **Finalize the treatment of aggressors**

Channel Simulation Model

- Current model with TPs from the channel ad hoc

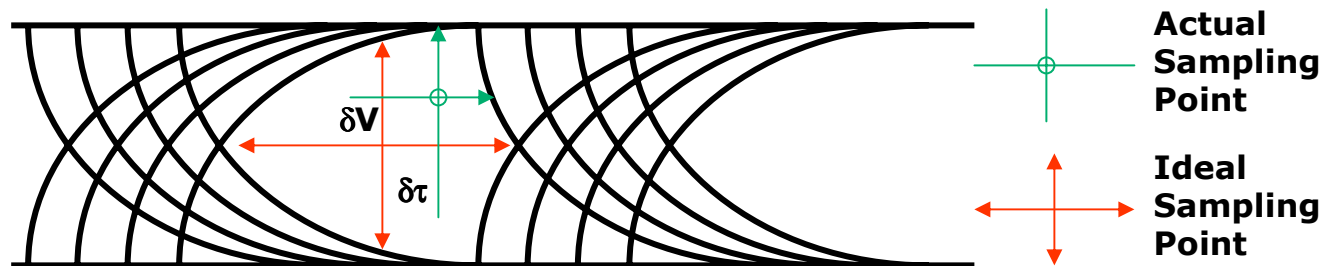


Signaling Quality Metrics

1. Voltage & Timing Margin

▪ Proposal:

- Establish an equivalent equalized sampler eye
 - Sweep sampling instant across eye to establish amplitude vs. sampling τ
 - Need an adaption assumption for this
 - Suggest we use a quasi-static assumption - freeze equalizer adaption during eye margining
- Establish the eye width and height – center ideal sampling point



- Establish a list of input referred de-ratings:
 - Input voltage offset (δV)
 - Timing recovery offset ($\delta \tau$)
- Remainder is voltage (V_M) & timing margin (τ_M)

Signaling Quality Metrics

2. BER

- **Systems vendors want low BER as key performance metric**

http://www.ieee802.org/3/ap/public/jul04/mandich_01_0704.pdf

http://www.ieee802.org/3/ap/public/may04/kundu_01_0504.pdf

- **Proposal:**

- **Minimum BER of 10^{-15}**
- **Typical BER of $<10^{-18}$**

- **How should we calculate BER?**

- **Signal amplitude**
 - **Minimum equalized Eye amplitude at the sampling instant (i.e. the inside edge of the eye)**
- **Noise**
 - **2D-CDFs of jitter (horizontal) and noise (vertical)**
- **Simplify the equalization model**
 - **Affected by Equalization and TR adaption**
 - **Consider Quasi-static vs. dynamic equalization and timing recovery**

Signaling Quality Metrics

3. Power & Complexity

- Power is a key performance target for system vendors
- Previous presentation has discussed this need:
http://www.ieee802.org/3/ap/public/jul04/altmann_01_0704.pdf
- Presentation and discussion indicated need for a power/complexity reporting matrix

Signaling Quality Metrics straw polls

- **Voltage/Timing margin**
 - Should we include the following as quality metrics for signaling proposals (single votes each):
 - Voltage & timing margin – Yes/No
 - BER – Yes/No
 - Power & Complexity – Yes/No
 - Should we establish baseline voltage and timing margin as proposed here?
 - Yes
 - No
- **BER**
 - Should we establish a minimum BER target of 10^{-15}
 - Yes
 - No
 - Should we establish a typical BER target of 10^{-18}
 - Yes
 - No
- **Power/Complexity**
 - Should we establish a power & complexity reporting matrix such as described in [altmann_01_0704.pdf](#) ?
 - Yes
 - No

Treatment of Aggressors

- **Aggressors we could consider**
 - **NEXT, FEXT**
 - **Environmental noise**
 - **Thermal and electronic noise**
 - **Others?**
- **Aggressor properties for simulation**
 - **Random**
 - **Normal distribution – Characterized by σ & PSD**
 - **PSD limited by NBW of Rx input**
 - **Multiple aggressors power-sum**
 - **Contribute to noise level**
 - **Deterministic**
 - **Characterized by max deviation**
 - **Multiple aggressors can power-sum or peak-sum**
 - **Subtract from Eye amplitude**

Treatment of Aggressors - Proposal

Aggressor	Property	Treatment	Proposed value
NEXT	Random	o and PSD from from NEXT & FEXT Mask	-
FEXT			
NEXT	Det.	Subtract from Eye	-
FEXT			
Thermal Noise	Random	Flat PSD at Rx input	1) 1.4nV/ $\sqrt{\text{Hz}}$ (100 Ω) 2) Flat SNR (-45dB) per http://www.ieee802.org/3/ap/public/sep04/lu_01_0904.pdf
Environmental Noise	Det.	Subtract from Eye	-
Others			

N.B. Mutually Exclusive
(select one or other)

Aggressor Treatment straw polls

- **NEXT/FEXT treatment**
 - Random and contributes to noise?
 - Deterministic and reduces equalized amplitude?
- **Should we use the NEXT/FEXT mask to determine total NEXT/FEXT power?**
 - Yes
 - No
- **Should we limit NEXT/FEXT Bandwidth by Noise BW of Rx Input?**
 - Yes
 - No
- **Should the NBW be coding-selective or fixed?**
 - Coding specific
 - Fixed
- **Should we use a flat PSD for thermal noise distribution?**
 - Yes
 - No
- **What value should we use a for thermal noise?**
 - 100W equivalent (1.4nV/√Hz)
 - -45dB relative to Rx signal amplitude (per http://www.ieee802.org/3/ap/public/sep04/liu_01_0904.pdf)
- **Should we have a background noise contribution?**
 - Yes
 - No
- **What magnitude for fixed background should we use? – Chicago rules, set bin values**

Proposals Needed

- **This process is contribution-driven.**
 - **Without contributions, there is not much to discuss**
- **Need to make progress on the remaining open work items**
- **We need specific proposals for simulate-able models for other elements in the link. Specifically:**
 - 1. Transmitter output BW and Impedance model**
 - 2. AC Coupling cap and TP5 link**
 - 3. Receiver input BW and Impedance model**

Meeting Schedule

- **Friday, October 22 (10:00AM PDT)**
 - Signaling quality metrics
 - Treatment of aggressors
- **Friday, Nov 6 (10:00AM PDT)**
 - Finalize channel link elements
- **Do we need another interim mtg? Opportunity to have a call on Friday, Oct 29 (10:00AM PDT)**