VITESSE

05-427r0 SAS2 Training Sequence

Serial Attached SCSI

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SAS2 PHY Working Group

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YOUR PARTNER FOR SUCCESS

Problem Statement

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- Adaptive equalization is desirable for 6G speeds.
- Adaptive equalization will require a training sequence to optimize the channel.
- Equalizer convergence time is TBD.
  - Dependent on equalizer implementation & channel model
  - May require many milliseconds to adapt to a channel.
- Channel adaptation must occur prior to speed negotiation.
- There is not enough time allotted in the current speed negotiation time for channel adaptation.
- Maintain backward compatibility with SAS1.1 and SATA.

Infineon Proposal

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- Modify speed negotiation phase for 6G only to provide for training sequence
  - Only 250 us is proposed.
  - This time cannot be extended much because it must be contained within the RCDT (Rate Change Delay Time) in order to maintain compatibility with SAS1.1
  - 250 us is probably not enough to adapt to corner case channels.
  - Known training sequence proposed to speed convergence
    - Training sequence based equalizers are more costly than blind equalizers.

Vitesse Proposal

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- Modify OOB sequence to provide for detection of a SAS2 adaptive device.
  - Allows complete freedom to define a new training + speed negotiation sequence that will satisfy the needs for adaptive equalizers.
  - Allows 6G vendors that do not use adaptive equalizers to not carry the extra baggage of training sequences and additional time required to link up.
    - Non adaptive phy's would use current SAS 1.1 speed negotiation sequence.
  - Allows for reasonable training sequence length.
  - Use a PRBS pattern as a training sequence.
  - Maintains backward compatibility with SAS1.1 and SATA.
  - Allows for adaptation at both 1.5G and 3.0G rates. This should allow operation with much longer cable lengths at the lower rates!

Vitesse Proposal Details

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- Define a new OOB symbol COMSAS2. COMSAS2 symbol has 4320 OOBI idle time and 7200 negation time.
- Modify SP state machine to allow sending/detection of COMSAS2 symbol.
  - May cause SAS1.1 PHY's to incorrectly believe a SAS2 adaptive PHY is SATA, Must be handled by SAS2 adaptive PHY by re-issuing COMINIT after receiving COMSAS.
  - Branch SP state machine to new SP states (SPxx) that will handle new SAS2 training and speed negotiation.
  - SATA is handled the same as SAS1.1

Proposed SAS2 OOB Sequence

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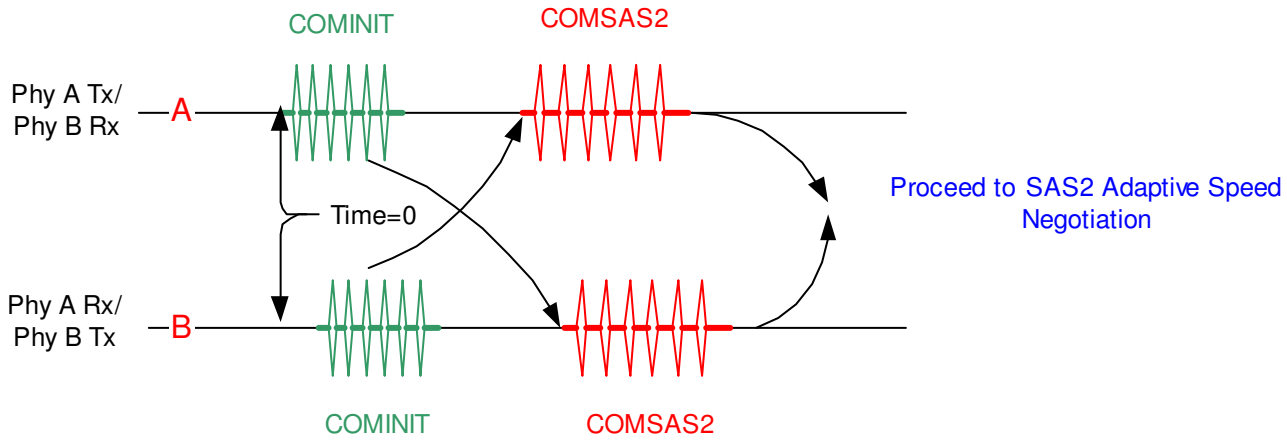
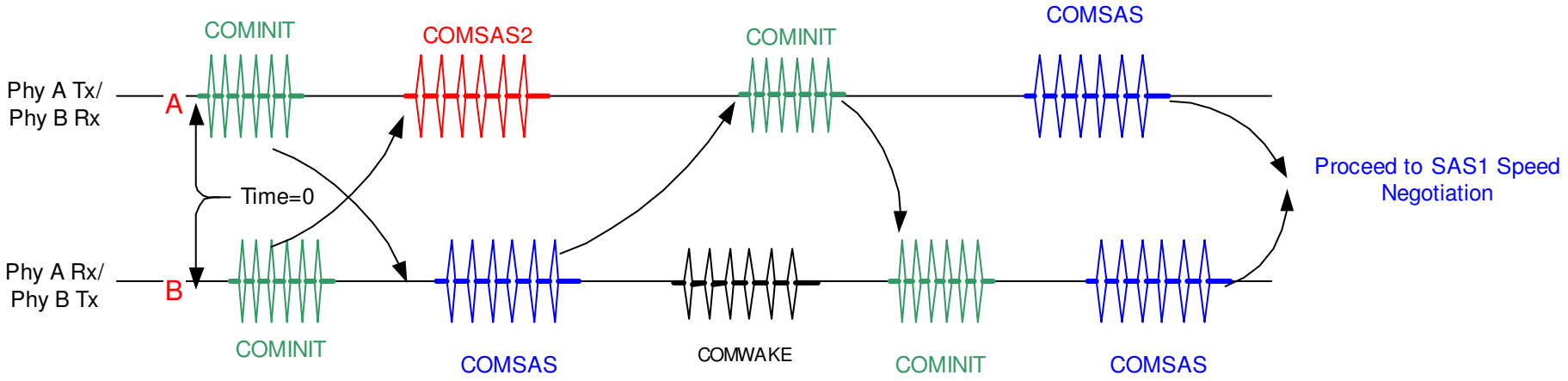
SAS2 to SAS2 OOB sequence

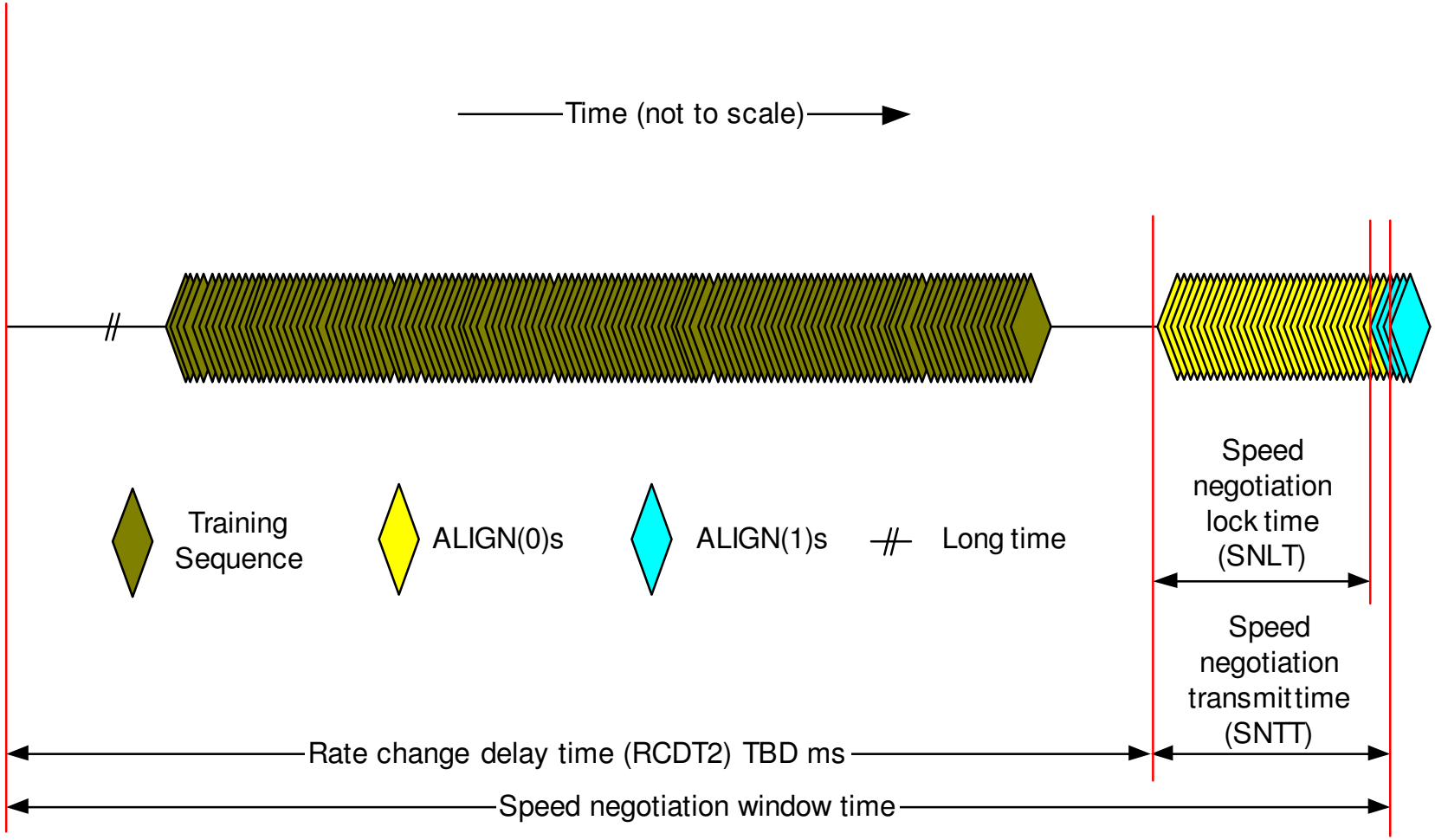


SAS2 to SAS OOB sequence. Comwake may be absent if SAS device implements spinup hold



Proposed SAS2 training + speed negotiation sequence

VITESSE



Summary

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- Adaptive Equalizers may need much longer then 250 us to adapt to some channels.
- The current speed negotiation timing does not allow for enough time to adapt to the channel
- A way to distinguish between SAS1.1 and a new speed negotiation sequence is necessary.
- The proposed method is backwards compatible with SAS1.1 but allows for ultimate flexibility for SAS 2.