

SAS-2 Speed Negotiation

Amr Wassal

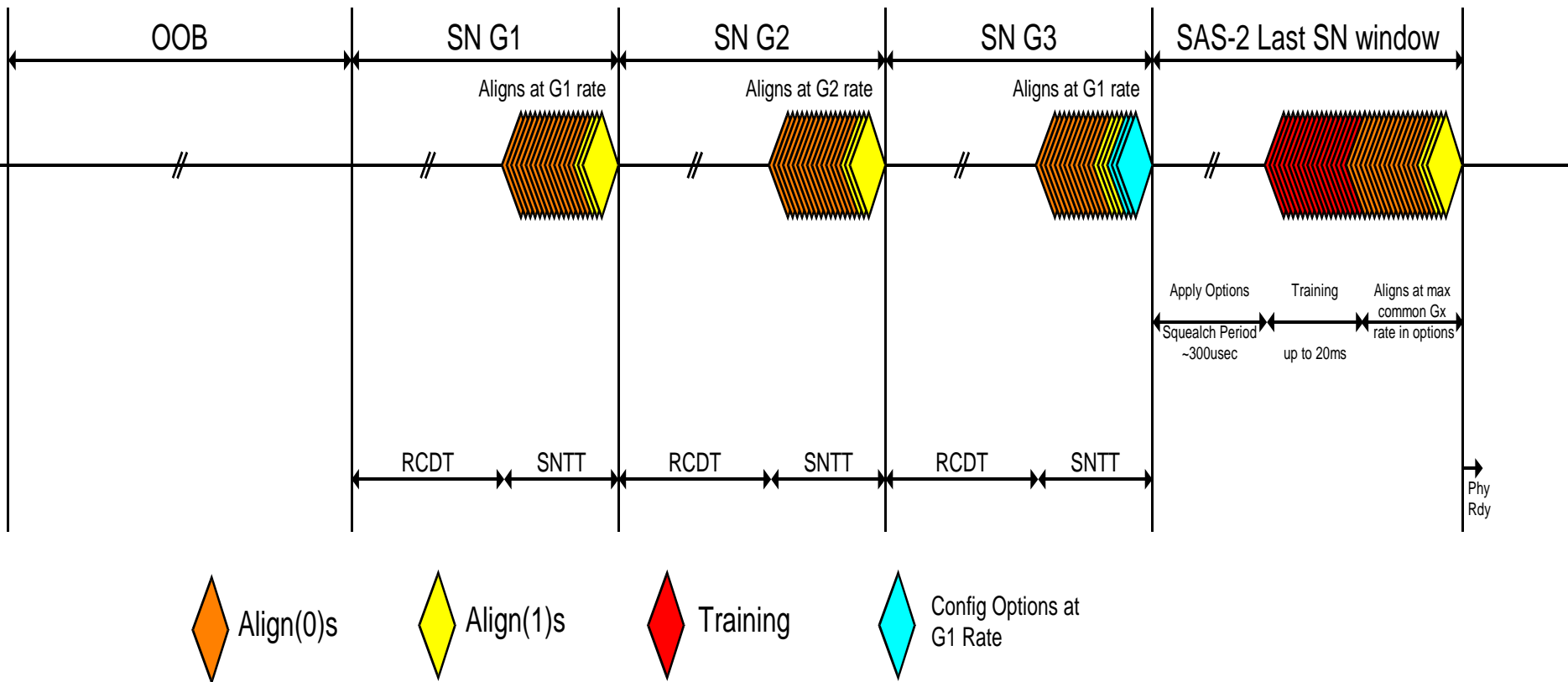
Robert Watson

www.pmc-sierra.com



Changes to Speed Negotiation G3 window (option 1)

- Suggested details proposed to use G1 rate during G3 window.



Phy Rdy

Align(0)s

Align(1)s

Training

Config Options at G1 Rate

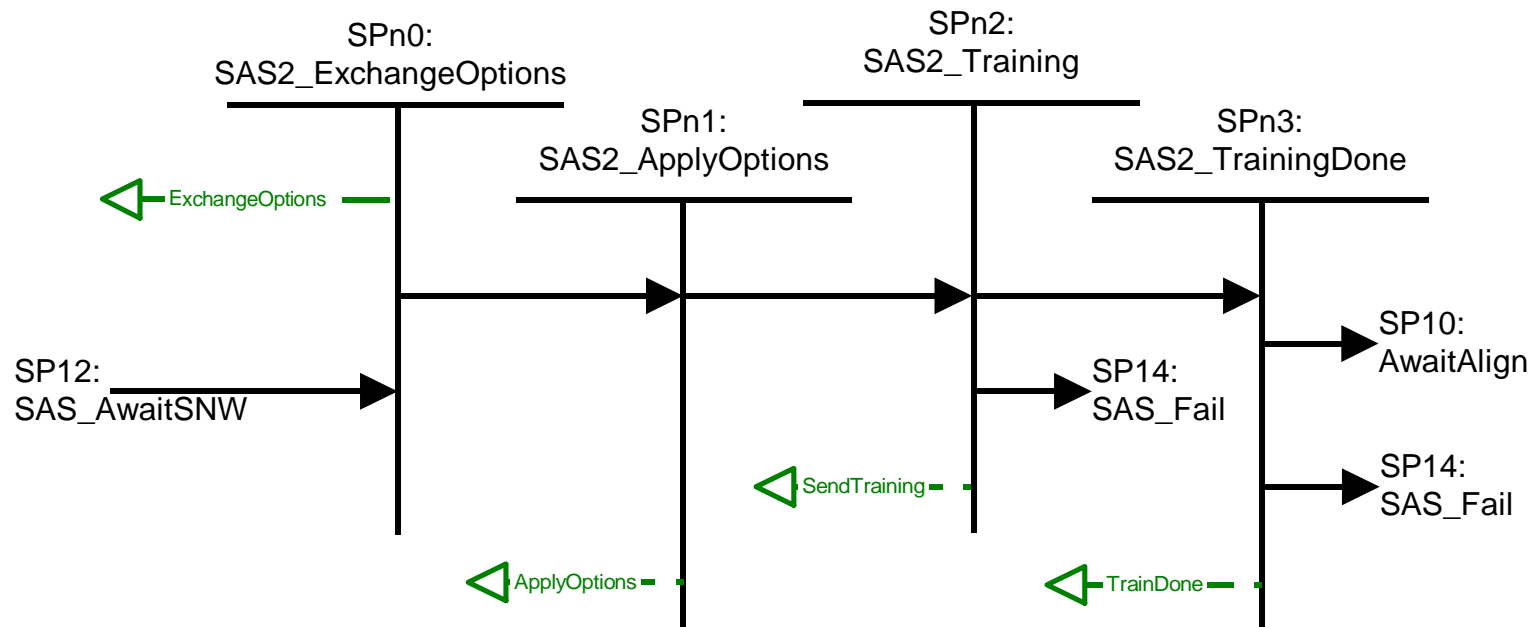
Changes to Speed Negotiation G3 window and the next window

- Sends G1 ALIGNs during G3 window to establish DW sync.
- Send configuration options that include:
 - SSC support: Down, Symmetric, None
 - Physical rates: rates supported
 - Other options can be defined to include discrete ranges for other parameters such as swing and pre-emphasis levels.
- Configuration can be sent in the form of primitives or a short group of DWORDs to set flags in hardware.
- In the window next to G3, a squelch period of ~300usec or more is provided to apply configuration settings.
- Training is done at highest speed negotiated Gx.
- Aligns 0 and 1 are used as usual to acquire DW sync and transition into Phy_rdy. This may not be necessary if the primitives in the training sequence are enough to acquire DW sync.

SAS-2 SP state machine changes

- Changes to existing SP state machine:
 - SP8:SAS_Start must now send a Set Rate message to the transmitter indicating 1.5G when the speed negotiation window is G3.
 - SP12:SAS_AwaitSNW should transition to new states (next slides) if the speed negotiation window is G3, instead of onwards to SP13.
- Note that the global reset transitions have been omitted on following slides and descriptions

SAS-2 SP state machine changes (continued)



SPn0:SAS2_ExchangeOptions

- During this state, the transmitter shall repeatedly send configuration options describing the capabilities of the phy (i.e. rates supported, SSC settings, etc) until the SNTT timer expires.
- The receiver shall monitor the incoming data for such options received from the remote phy.
- Once the SNTT timer has expired, the state machine shall transition to SPn1:SAS2_ApplyOptions
- The ‘final negotiation window’ flag shall be set as well

SPn1:SAS2_ApplyOptions

- The ApplyOptionsT timer shall be started, and the phy shall be configured according to its capabilities and the capabilities of the remote phy.
- Since this configuration will generally affect analog gain settings, timing, clock recovery, etc..., it is not expected that DWS will be maintained and the transmitters should return to DC Idle.
- Once the ApplyOptionsT timer has expired, the devices should transition to SPn2:Training

SPn2:SAS2_Training

- During this state, the transmitter shall send a periodic pattern at the agreed-upon rate, intended to allow analog circuits to train.
- State timer TrainingT shall be started with duration of 20ms.
- Suggest the 05-397r3 proposal pattern of 2 Dwords (80 bits) of a new primitive TRAIN_p (K28.5 D30.3 D30.3 D30.3) followed by 20 Dwords (800 bits) of PRBS data.
- Once the analog circuitry has sufficiently trained, transition to SPn3:SAS2_Training_Done. This is similar to the ALIGN0/ALIGN1 handshaking.
- If the timer expires before training has completed, transition to SP14:SAS_Fail.

SPn3:SAS2_Training_Done

- During this state the transmitter shall send the training pattern, except that TRAIN_P is replaced with TRAIN_DONE_P (K28.5 D30.3 D30.3 D10.2)
- If the state machine both sees and sends TRAIN_DONE_P, transition to SP10:AwaitAlign. Once aligns have been exchanged, SP13:SAS_Pass will transition to SP15:SAS_PHY_Ready, since this has been flagged as the final speed negotiation window.
- If the timer TrainingT expires instead, transition to SP14:SAS_Fail

SAS-2 SP state machine changes (continued)

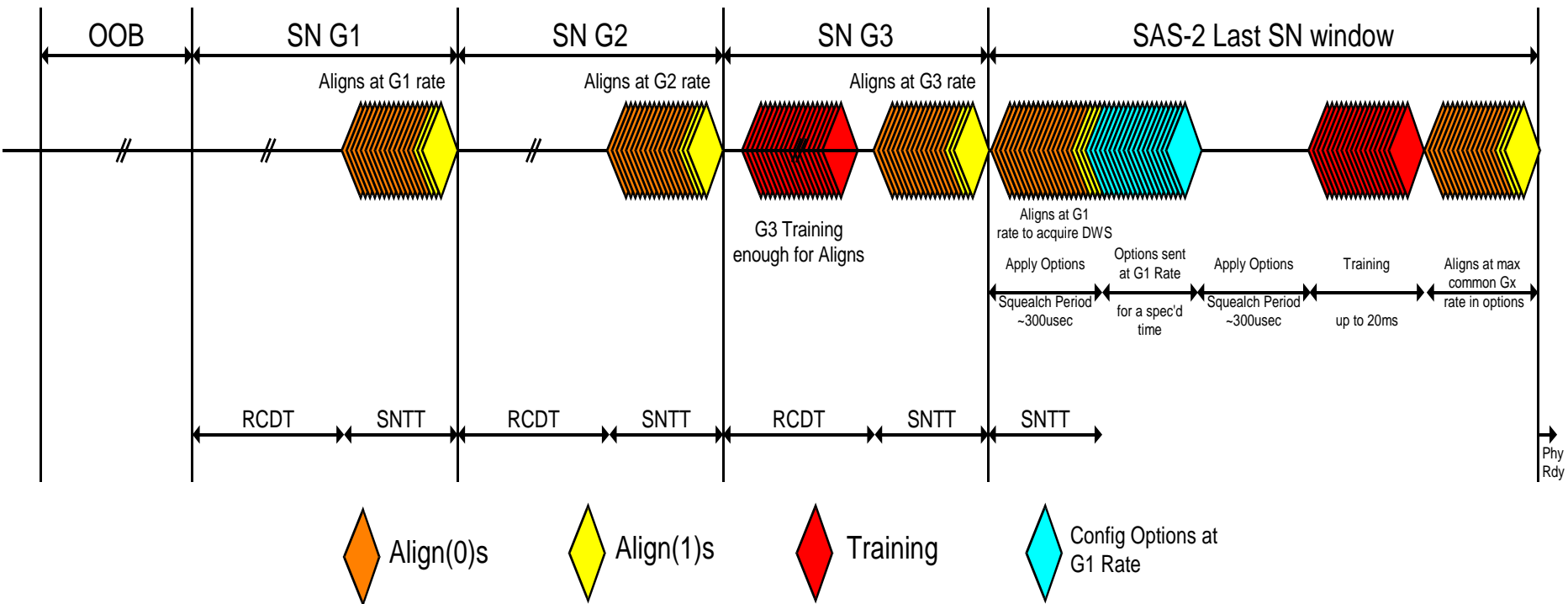
- What happens if we fail?
 - Repeated fails (through SP14:SAS_Fail) should cause the highest available rate to be removed from the 'supported' rates list.
 - Possibly also downgrade other capabilities (SSC, etc) for greater reliability.

Concerns

- Even though the SAS-1.1 spec does not call for any detection in G3 window for those device that do not support it, some legacy devices may behave incorrectly when they see G1 traffic in G3 window.
 - May restart the whole sequence seeing an unexpected rate.
 - May actually lock with align(0) and (1) at G1 rate and confuse the SAS-2 device into moving to the new window.
- To maintain backwards compatibility, configuration options pattern eats of the SNTT interval allotted for Align(0) and (1)s.

Alternate proposal (option 2)

- Continue to use G3 rate in G3 window and move everything else to the next window.



Alternate proposal (continued)

- Most transitions would be identical to Option 1.
- Rate message during SP8:SAS_Start at G3 would remain G3 (not G1). SendTraining message would be sent at this point.
- SP13:SAS_Pass at G3 would send a Set Rate message to G1 and transition to SP10:AwaitAlign. It would also set a flag G3Pass.
- It would transition to SPn0 if the G3Pass flag is set, and the algorithm would continue as in option 1.

Open Questions

- Would legacy devices have an issue with Option 1? (seeing G1 ALIGNs in the G3 window
 - By spec, they should be ignoring the received data during SP9:SAS_RateNotSupported
- Is RCDT (i.e. a DC Idle period) needed before the ALIGN exchange and after training?
- Reasonable values for the new timers
 - May want a microprocessor to control certain aspects of configuration once capability option flags are received
- Format of the configuration options exchange (representation, parameters, variable portions, etc)?



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