# SAS-2.1 and SAS-3
Features for consideration

March 2008

SAS-2.1 and SAS-3

- SAS-2.1 delivers only protocol enhancements, no phy layer changes
  - 2009 completion.
  - Protocol enhancements
  - Bug fixes

- SAS-3 delivers 1200MBytes/s, and supporting protocol enhancements
  - Phy working group should start before SAS-2.1 completion
  - 2011 completion
  - 12Gbits/s line speed
  - Backwards compatible with previous generation physical rates
  - SAS-3 phys should function on SAS-2 interconnect

Wide port target support
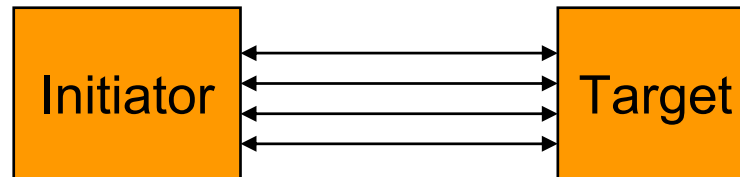
- SAS-2 assumes targets are single port devices
- Where targets supports wide port operation then connection bandwidth should be aggregated for greater performance.
- Requires additional sequencing definitions
- Sequencing related exception and error cases

Power Management

- Power modes are not empirically defined for SCSI with the result that they are rarely used.
- Create power saving modes that will allow disk drives to park heads, idle and stop motor.
  - Target to save 2-10W per disk in slumber
  - Defined response time

Power Save mode	Response time	Est. Power Saved
SATA Partial Slumber	10uS	Phy shutdown ~100mW
SATA Slumber	10mS	Phy shutdown ~100mW
Park Heads	300mS *	1-2W
Slow spin	1S *	4-8W
Stop	3S *	4-12W

* These numbers are arbitary and need to be refined

- Enable initiators to re-schedule open requests.
  - REJECT_RETRY (Slumber)

Active Cables

- Copper and optical active cables
- Define powered connectors for active cable support
- Active cables should be considered "end point" for signal integrity
- Active cables should support all SAS Phy features (e.g. SSC)
- Active cable characteristics
    - Tolerance of active cable delays may require reporting of characteristics.
    - Potential for extreme use cases
        - Active cable will impact SATA HOLD/HOLDA delay
        - Active cables connected to long traces
        - Cascaded active cables
    - Reporting should allow system to adapt/respond

- Define parameters for compliance of active cable

SAS-3

- Double bandwidth to 1200MBytes/s per link

- 12Gb/s line rate
  - Maintain 8b/10b encoding
  - Retains current primitives
  - Simplifies backwards compatibility
  - Adaptive transmitter to allow operability on SAS-2 infrastructure
  - **Recommended**

- Alternative : 9.90 Gb/s uses 64b/66b encoding
  - Primitives all change
  - Speed negotiation will require link layer primitive translation
  - Complex backward compatibility support
  - **Not recommended**

- Consider Native 12GHz Optical interface
  - Eliminate OOB for optical

Thank You

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