



# High Density SSD Structure with RAID

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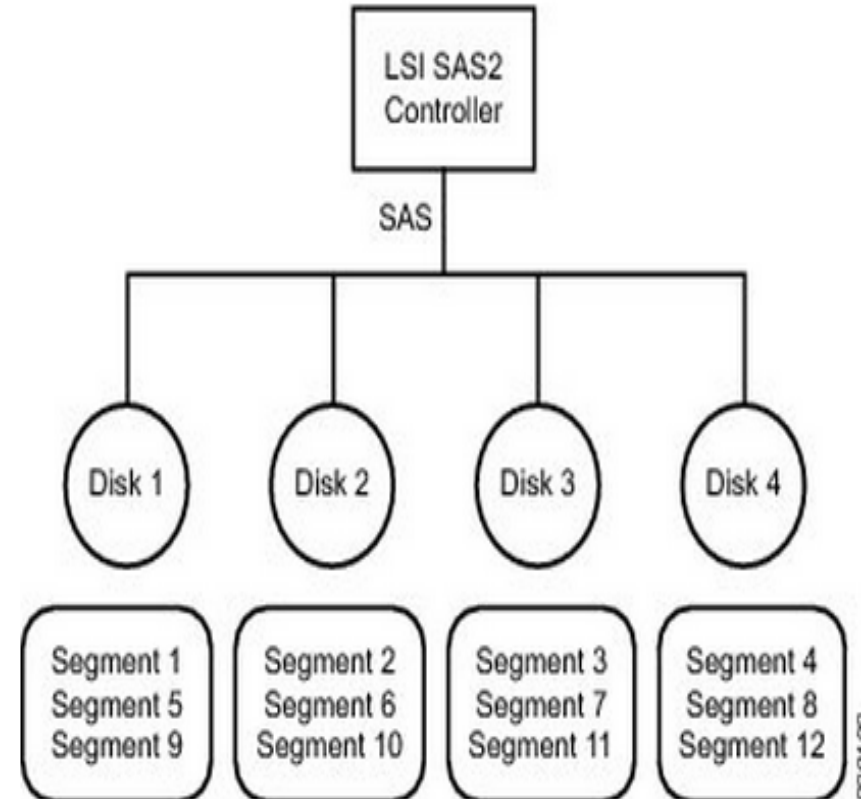
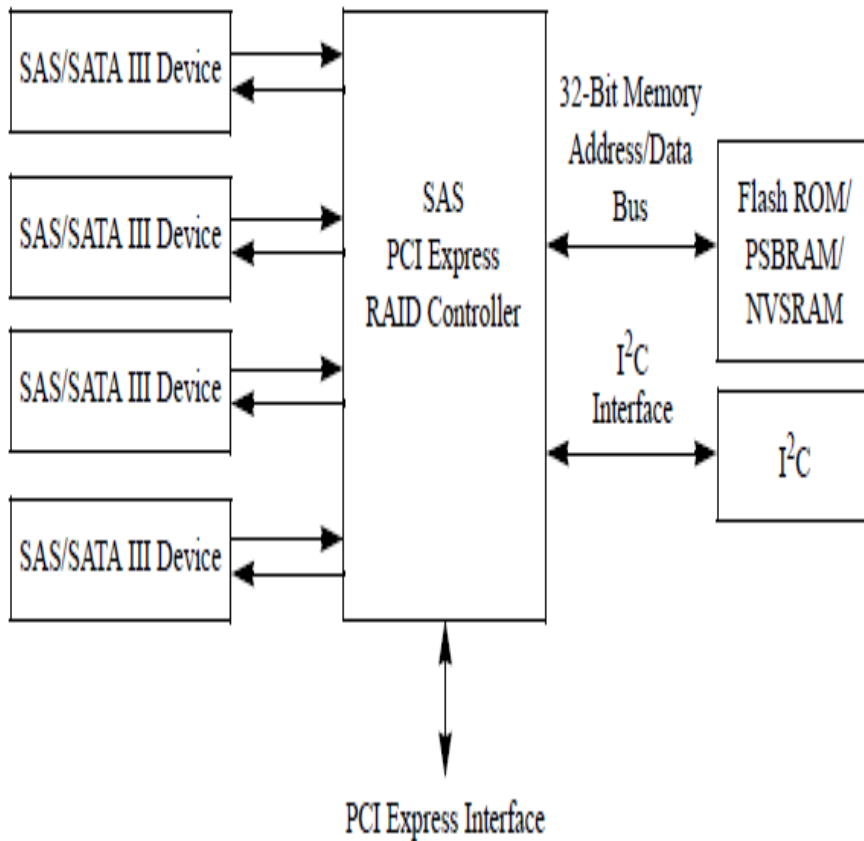
# Concept

- **RAID** is originally **redundant array of inexpensive disks**
- Now commonly **redundant array of independent disks**) is a data [storage virtualization](#) technology that combines multiple [disk drive](#) to a logical unit
- For the purposes of data redundancy or performance improvement

## Benefit

- Emphasis on inexpensive but reliable then disks RAID
  - Back to original concept
- Shield from flash vendor secret backdoor
  - No worry of undocumented scramble techniques
  - Isolate from LDPC/BCH ecc etc
- Time to the market
  - In sync with flash vendor's technologies
  - Ever need early involvement

# HD RAID



# Flash vs HD

Characteristic	15K HDD	NAND Flash	Improvement
Performance	250 IOps	30,000 IOps	86X greater
Latency	10 ms	0.3 ms	30X faster
Reliability (MTBF)	1.2 M Hours	2.0 M Hours	67% greater
RAID Rebuild Times	10-20 Hours	0.3-0.5 Hours	40X faster
Power (Watts per TB)	30	5	83% lower
Efficiency (I/O per watt)	15K HDD	6,500	433X higher

- But Flash need to deal with wearing and ECC, HD does not as eMMC

## eMMC + Striping

- Sandisk eMMC 4.51
  - Interface HS200 ( 200 MB/sec)
  - Sustain read/write (150/45MB/s)
  - 4KB random read/write(4k/800 IOPS)
  
- Samsung Ultra Fast eMMC 5.0
  - Interface HS400 ( 400 MB/sec)
  - Sustain read/write (250/90MB/s)
  - 4KB(?) random read/write(7k/7K IOPS)
  
- Use striping (RAID 0) to boost the performance

# RAS

- Reliability
  - Single device wear leveling is solved by eMMC
  - Global wear leveling is done by cluster ASIC
  - SMART alike will be achieved by vendor command
  - RAID 10, 50, 60 can be easily implement
- Availability
  - eMMC is a JEDEC standard like SDDR
- Serviceability
  - Modula design with current MMC housing

# Challenge

- Electronic challenge
  - Power interrupt reliability
  - No control of Flash type of the shelf
    - Today's eMMC are generally used MLC(3K) ,SLC (100K)or eMLC(30K) are rarely to find
  - SMART like command is not a standard for eMMC
  
- Mechanical challenge
  - Hot wrap mechanism reliability
  - As speed increase, MMC housing is not the best solution, vibration is also an issue



# ASIC Schedule

- SATA version of eMMC bridges are available
- PCIe FPGA Proto type done – As July 1<sup>st</sup>, 2014
- First version ASIC with be single line PCIe 2.0  
RAID 0, 1, 5
- First Silicon – 4Q14