

NumaRAID Technology

Introducing a fundamental change to HPC Storage

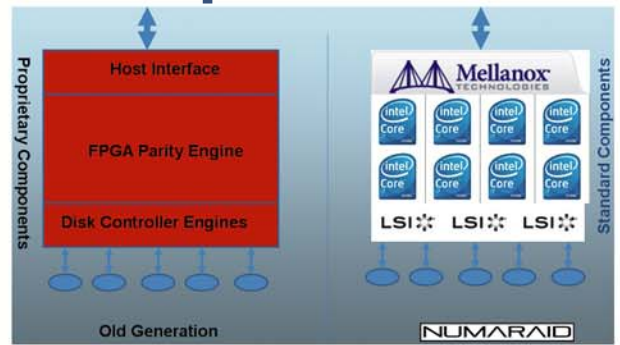
Imagine a High Performance Computing system where:

- * Every disk rotation and every interconnect cycle is used to transfer data to or from an application
- * Every byte of data is validated, and if required, corrected or recreated, just prior to any computation
- * Every CPU cycle and every CPU resource is fully applied to computing a result
- * Every result is stored in a verifiable, redundant fashion

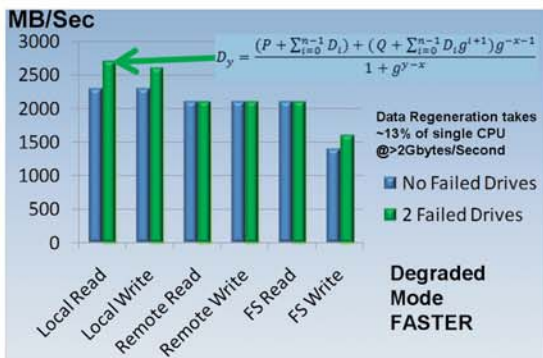
Every **second of time** and every **watt of power** was used effectively.

High Performance RAID Architecture Comparison

- * Software and standard processors replaces high cost proprietary ASICs and FPGAs
- * Leverage economy of scale
- * Lower acquisition and service costs
- * Keep pace with latest technology innovations



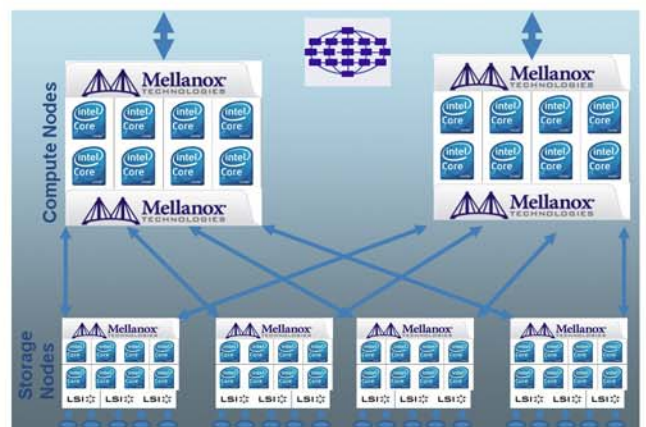
New Levels of Cost and Performance



- * Currently achieves >2Gbytes/second read/write data transfer under extremely heavy load
- * RAID logic requires ~10% of a single CPU
- * ECC solution requires ~13% of a single CPU
- * ECC can be applied to both data reconstruction and Silent Data Corruption detection and correction

A Fundamental Change to HPC Storage

- * Decrease HPC storage hardware costs
- * Increase HPC storage performance
- * Increase HPC network reliability
- * Increase HPC application performance



NumaRAID: An HPC Inspired RAID Stack

- * NumaRAID is a set of Linux kernel modules, command line interfaces and graphical user interfaces
- * NumaRAID is designed to increase the Performance, Reliability, Availability and Serviceability of compute and storage nodes in an HPC cluster
- * By some definitions, NumaRAID transforms an HPC cluster into a SuperComputer
- * NumaRAID is a commercial product, independently certified and deployed worldwide
- * NumaRAID has about 25 man years of investment to date and an active development roadmap

NumaRAID Features and Benefits

| Feature | Competitor D | NumaRAID |
|---|--------------|----------|
| Data rate > 2GBytes/Node | ✓ | ✓ |
| Scalable >250GBytes/Second | ✓ | ✓ |
| Zero degraded mode penalty | ✓ | ✓ |
| Writes as fast as Reads | ✓ | ✓ |
| Partial Reconstruction | ✓ | ✓ |
| WWN Filtering and Masking | ✓ | ✓ |
| Silent Data Corruption protection | ✓ | ✓ |
| Active Storage Application Acceleration | — | ✓ |
| Economy of Scale benefits | — | ✓ |
| Obsolescence protection | — | ✓ |

Certifications



High Performance Storage Solutions Available Now

- * Available on the Mellanox Cluster for remote evaluation
http://www.hpcadvisorycouncil.com/cluster_center_access.php
- * Fully configured, pre-tested hardware available from multiple integrators
- * Site licenses with full source code and documentation/training available from StreamScale

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