Building a High IOPS Flash Array: A Software-Defined Approach

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Myth 1:
\[ \sum \text{High-IOPS SSDs} = \text{High-IOPS All-Flash Array} \]

Clarification

**SSDs** are not the only hardware component of all-flash array

- **Network adaptors** connect user applications with SSDs
- **Processors** glue SSDs and network adaptors together
Clarification

Off-the-shelf SW/Technology may become the bottleneck

- Data redundancy
- Volume management/snapshot
- HA/scale out
- De-dup/compress
- Random IO cannot be merged into a big chunk
  - cause large overheads
  - impact the HW/SW design
Build a high random IOPS all-flash array

with rich enterprise storage features

on commodity hardware?
Dimensions to Focus

A. Leverage latest generation hardware or hardware-offloading

B. Consume all the hardware resources
   • Considerate configuration
   • Multi-thread programming

C. Minimize overheads on
   • RAID5
   • Snapshot
   • HA/scale out
   • ...

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A. Leverage the Latest Generation of HW or HW-offloading

- NVMe, RDMA
- The performance of commodity hardware is limited.
- Commodity hardware are mainly designed for mainstream market with manufacturing cost consideration.
B. To Consume All The Hardware Resources

Considerately balance SW/HW IRQs on
- HBA
- Network: Ethernet / FC / InfiniBand

![Graph showing IOPS comparison](chart.png)
Multi-thread programming is necessary

**Running under Intel E5-2690 v2**

* The results are bound by the speed of SSDs
C. Minimize Overheads on Data Protection

Overhead: Parity check update

Solution: Write buffer? Low hit ratio for random WRITE

If you want to write $B_2$

$$B_p^{new} = B_2^{old} \oplus B_p^{old} \oplus B_2^{new}$$

$$1W \Rightarrow 2R + 2W$$
FlexiRemap Technology: 1M IOPS with Space-Efficient Data Protection

Compared to conventional RAID configuration:

- More efficient and effective redundancy without performance and lifespan penalty for SSDs
- Automatic workload redirection upon SSD failure

- 20 SSDs (55K IOPS)
- RAID50: 10 SSDs per group
- FlexiRemap: 10 SSDs per group
- accessed range: 80GB
- accessed amount: 40GB
- cache disabled
C. Minimize Overhead on Snapshot

- Overhead: small random WRITE
- Solution: small chunk with low overhead

16MB block size - copy 16MB per 4KB write
4KB block size - the overhead to allocate new block per 4KB write is too large
FlexiRemap Technology:
Small Chunk with Low Overhead

![Graph showing performance improvement before and after snapshot]

Native 4KB-based translation design
NeoSapphire All-Flash Array Series

- High performance with up to 1M IOPS for 4KB random write
- Fault tolerance and automatic data reconstruction upon drive replacement
- Low TCO with excellent performance and energy efficiency
- Web-based graphical management interface for simplified system setup, health monitoring and management
About AccelStor

Building upon its expertise in software and storage technology, AccelStor is devoted to unleashing the true performance of flash-based storage solutions with a software-defined approach. AccelStor has developed an exclusive FlexiRemap software technology that enables its storage arrays to achieve unparalleled scalability, performance, and efficiency in the same grade as such products.

Core Competence

• Innovations beyond Technical Fluency
• Dedication to Success
• Agility

Management team

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