

Store
Process
Analyze
Collaborate
Archive
Cloud

Burst Buffers

#BurstForward

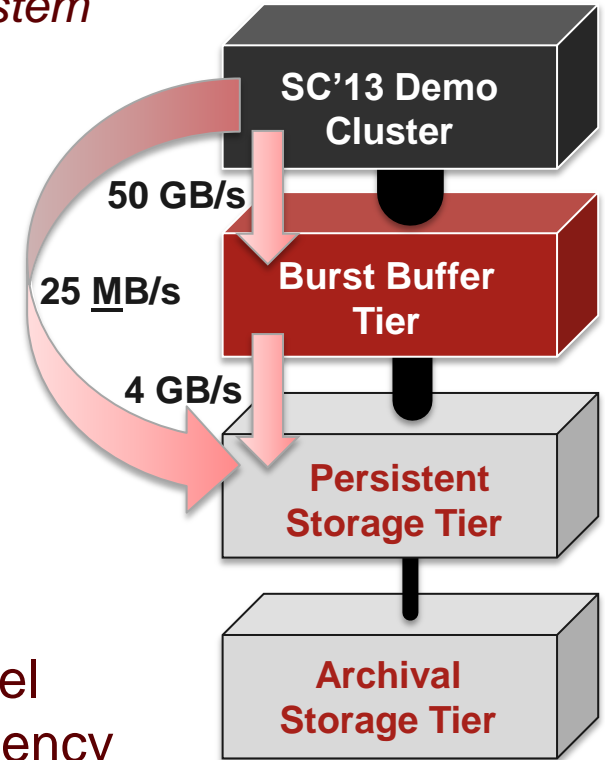
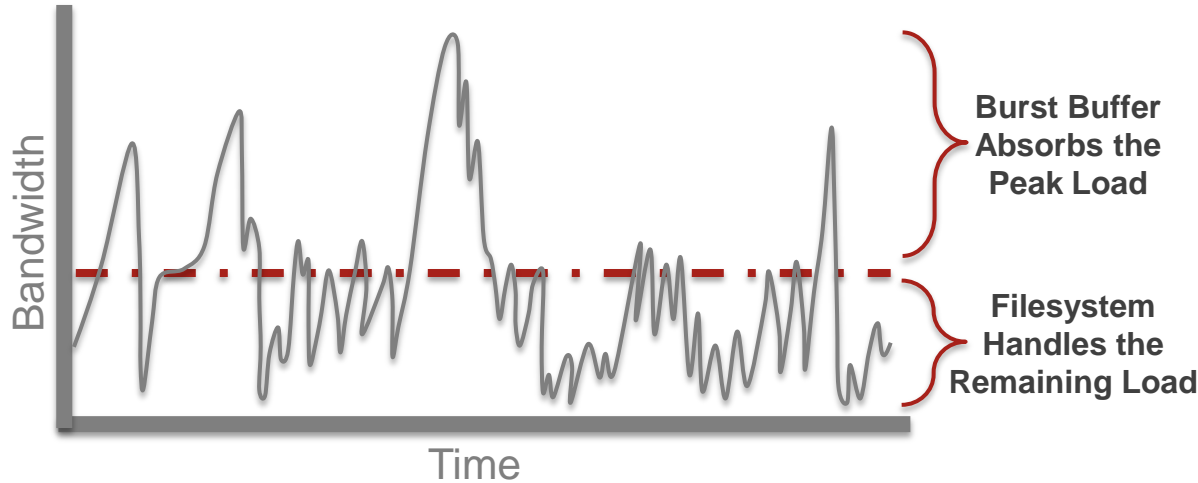
Invent
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Mike Vildibill
VP, Product Management, and
Emerging Technologies Development

Use Case: HPC Burst Buffer

Analysis: Argonne's LCF production storage system

- 99% of the time, storage BW utilization < 33% of max
- 70% of the time, storage BW utilization < 5% of max



Burst Buffers demand smaller, highly robust parallel file systems that sustain very high bandwidth efficiency

Many Potential IME Use Cases

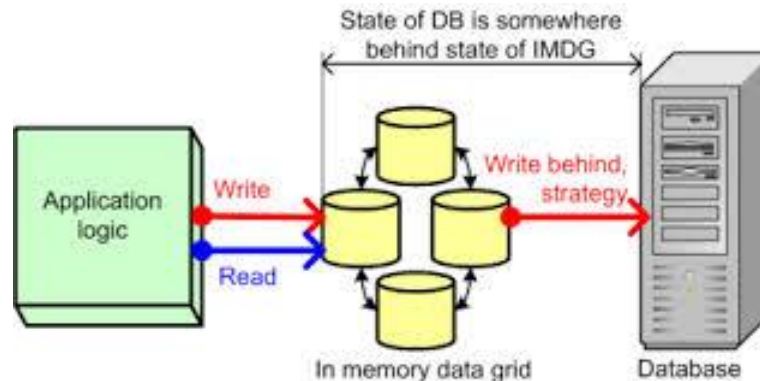
Burst Buffers is Just One of Many Use Cases

HPC Requirements

- ▶ **Burst Buffer I/O Acceleration**
 - Checkpoint-Restart
 - Write-back and Write-through Cache for File Alignment (direct effect) and Block Alignment (indirect effect)
 - Stage-in, Stage-out, Demand Loading
 - Isolation of ill-behaving applications
- ▶ **Out-of-Core I/O**
- ▶ **Data Analysis Support**
 - Post-processing
 - Visualization
- ▶ **Temporary Data Storage**
 - Sequential-job Data Sharing (many-task computing)
 - Concurrent-job Data Sharing (application-coordinated sharing of data)
 - Intermediate Results

Exploring Other Use Cases

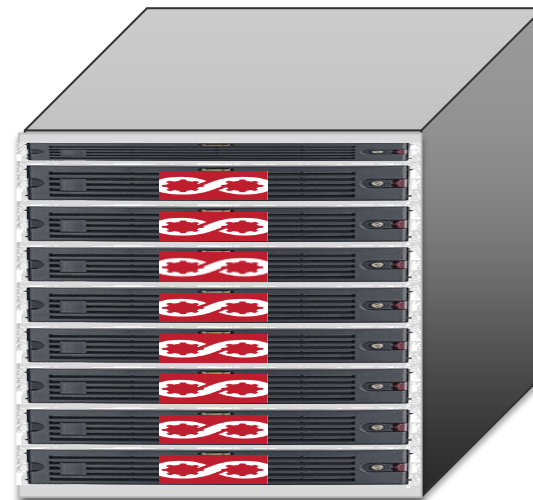
- ▶ **NAS Acceleration**
- ▶ **Key-Value + NoSQL Databases**
- ▶ **Emerging In Memory Data Grid Models**



IME Customer Testbeds

Platforms for Collaboration, Experimentation and Development

- ▶ **Example: 17U IME Scalable Unit:**
 - 8 IME Servers using a 36-port IB FDR switch
 - 2x IB to each IME Server (16 total)
 - 16 IB to Compute Cluster
 - 4 IB to PFS
 - Performance and Capacity:
 - 192 SSDs; Raw Capacity 37 to 150 TB
 - Internal SSD bandwidth:
 - ~100 GB/s (Read)
 - 68 to 100 GB/s (Write)
- ▶ Bandwidth to compute cluster: 80 GB/s
- ▶ Bandwidth to PFS: 16 GB/s
- ▶ I/O Transactions Rate: 20 Million IOPs (4K)



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