Computational Storage: Acceleration Through Intelligence & Agility

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What’s the Big Deal?
Sheer volume of data taxing to process

Data Explosion

Can’t store tons of data in the same place
Difficult for different applications to share

Data Islanding

Exorbitant licensing fees
Expensive migrations

High Cost

70% of Alibaba Cloud’s clients encounter:

Sheer volume of data taxing to process
MARKET PROBLEM

High Cost

OPPORTUNITY

Cloud Scale Economics
Unified Storage
Real-time Analytics

SOLUTION

Computational Storage
HTAP: HYBRID Transactional / Analytical Processing
- No lag for analytics
- Low cost, one storage

High Performance & Scalability

High Compatibility

High Reliability & Availability

Hardware Acceleration
Compute at data
Embracing new hardware
Computational Storage Provides the Solution

Real-time analytical processing from transactional data
- Intelligent data management
- Parallelize Compute at Data
- Programmable hardware
By bringing compute to the data, ScaleFlux is transforming the way we are architecting our Flash storage infrastructure.

We’re looking to fully utilize the values of Computational Storage in order to cost-effectively scale real-time analytics across exploding transactional data sets, all the while delivering the most responsive, cloud-native user experience.
How?
Cohesive Application to Storage Acceleration

- Open Channel Flash Management
- Computation Acceleration
- Solution Agility
Open Channel (Host) Flash Management

Data Placement
- ✓ Controllable
- ✓ Application Awareness

Global View
- ✓ Reduce Overprovision
- ✓ Minimize Write Amplification

Multi-Tenant
- ✓ Isolation
- ✓ Consistent
Value Example: KV Store

KV Tailored FTL

Compatible Hardware

Fast Integration
Optimize Application QoS, not just at SSD Level

Aerospike Certification Tool (ACT) v4
300K Transactions per second (100K/s 128KB writes with 200K/s 1536B reads)
Dual Intel 6126 CPU, 256GB DRAM

Vendor A 3.2TB U.2  Vendor B 3.2TB U.2  ScaleFlux CSS 3.2TB U.2

% Read Transactions over 1ms

Lower is Better

Time (Minutes)

Benchmarks Halls
Garbage Collection

3X+ Latency Consistency
Other Open Channel Management Values

Easily Tunable

3D NAND TLC to QLC+

Simple NVM integration

Next: Industry standardization
Cohesive Application to Storage Acceleration

- Open Channel Flash Management
- Computation Acceleration
- Solution Agility
SLOW

Intense Compute
(compression, fuzzy search)

Limited I/O and
Memory Capacity

Computational Storage Subsystem (CSS)

Reduce Data Movement
Accelerate Computation
Parallelize Processing
Tradeoffs and Design Consideration

Compute Functions

- Data intensive, fixed function
- 5-100x speed up vs. CPU
Parallelizing Computational Storage

GZIP Compression
(CPU zlib vs. ScaleFlux css_zlib, corpus.cantebury E5-2667v4)

- 4X
- 13X
- CPU Bound! 482MB/s

Fuzzy Search
(POC Unindexed Text Data, Edit Distance = 8, E5-2637v3)

- 3X
- 100X
- CPU Bound! ~700MB/s
Identify Right Workloads

**INFRASTRUCTURE**

- **STORAGE**
  - Compression (GZIP)
  - Erasure Coding (RS)
  - Security (AES)
  - Authentication (SHA)
  - Error Checking (CRC)

**PLATFORM**

- **DATABASE, ANALYTICS**
  - KV-Store
  - Transactional-Analytical
  - SQL Processing
  - Big Data Analytics

**APPLICATION**

- AI, Genomics, CDN, Search
- Media Scaling & Transcoding
- Neural Networks
- Fuzzy Search
- Filtering, Matching
Cohesive Application to Storage Acceleration

Open Channel Flash Management

Computation Acceleration

Solution Agility
Agility is Important

**ENGAGEMENT**
Demand to POC < 6 months

**FLASH LIFECYCLES**
Reducing to 12 months

**HW AGILITY**
Update after deployment
Solution Agility Across Whole Stack

- **Applications**
  - Database
  - Big Data
  - Content Delivery
  - AI/ML

- **Compute Libraries / APIs**
  - Distributed File Systems (HDFS, Ceph, ...)
  - Virtual File System (VFS)
    - File System (Ext4, XFS, ZFS ...)
  - Open Channel Flash Management
    - Computational Storage Driver

- **Simple Interface**
  - Easy Integration

- **PCIe**

- **AIC or U.2**

- **FPGA**
  - Re-programmable
  - Compute Engines

- **Controllable Data Placement**
- **Performance/QoS (latency)**
- **Programmable HW engines**
Fast TTM for Turnkey Apps

- **270%** Transactions per Second
- **220%** KV-Store Write Throughput
- **260%** Operations per Second
- **170%** Jobs Completed
- **170%** Jobs Completed

Available Through:

- DELL EMC
- Inspur
- Packet

vs. NVMe
Delighted Customers
“…delivering fantastic OPERATIONS PER SECOND for our latest NoSQL database…”

“…INSTANTLY saw how this can help us COST-EFFECTIVELY scale our infrastructure …”

“…accelerating MULTIPLE, BUSINESS-CRITICAL APPLICATIONS for us…”
Ride the Computational Storage Wave!

- Controller/SSD
  - SandForce
  - Fusion I/O
  - anobit
  - Plant

- AFA, HCI
  - XtremIO
  - Nutanix
  - Pure Storage
  - nimble storage
  - simpliVity
  - SOLIDFIRE

- Computational Storage
  - Open Channel FM
  - Compute Acceleration
  - Solution Agility

2006
2011
2018
The pioneer in deploying Computational Storage at scale

- HQ in San Jose, Offices in China
- Shipping Computational Storage worldwide

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