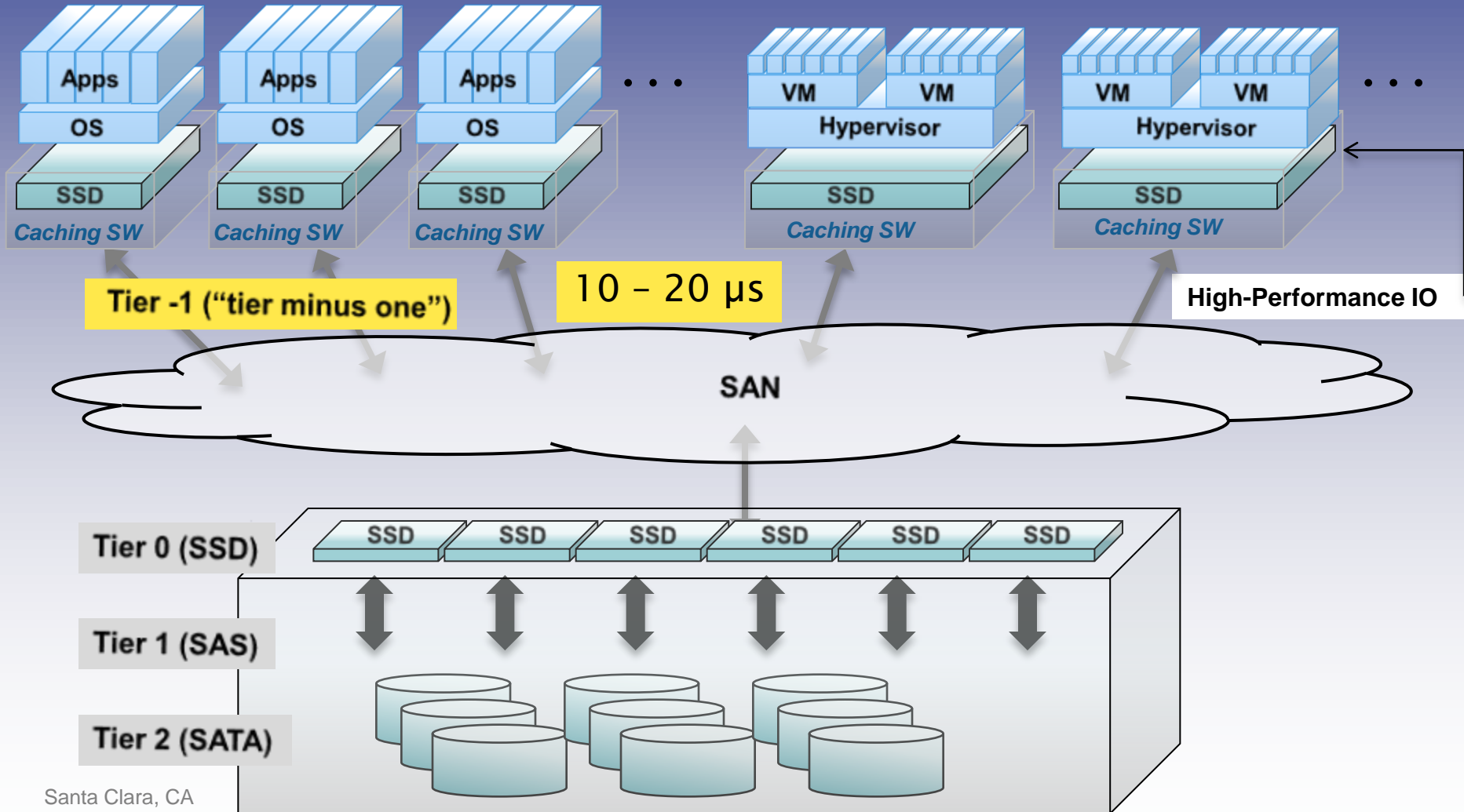# Why Your Next Server Will Have a Solid-State Cache

Ted Sanford

CEO FlashSoft

Why Caching in the Server?

- Performance
  - Active data on flash in the server
  - Near the speed of flash as primary storage
  - 3x to 10x application acceleration
- Economics
  - ROI of caching hot data only – spend far less
  - Server consolidation + storage efficiency
 - Leverage existing storage investments

Flash in the server vs. storage

Apps / OS / SSD — Caching SW (×3)

VM / VM / Hypervisor / SSD — Caching SW (×2)

Tier -1 ("tier minus one")

10 – 20 µs

High-Performance IO

SAN

Tier 0 (SSD) — SSD SSD SSD SSD SSD SSD

Tier 1 (SAS)

Tier 2 (SATA)

Design Goals: Caching for the Server

- Optimized for flash
- Software-only solution
- Any type of SSD: PCIe, SAS, SATA
- Turns SSD into persistent read-write cache
  - Read-only caching also supported
- Transparent to existing SW layers
- Minimal server resource utilization
  - Memory, CPU
- Cross-platform caching engine
  - Windows, Linux, ESX
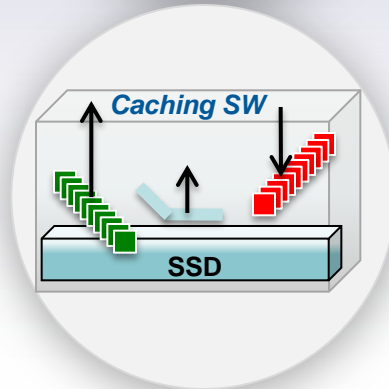
Enabling the SSD Cache
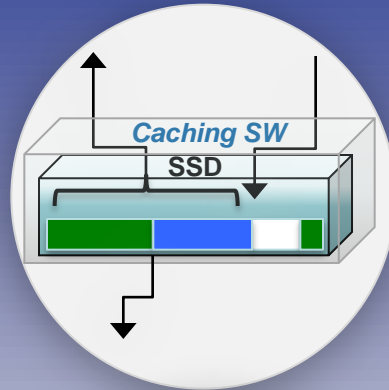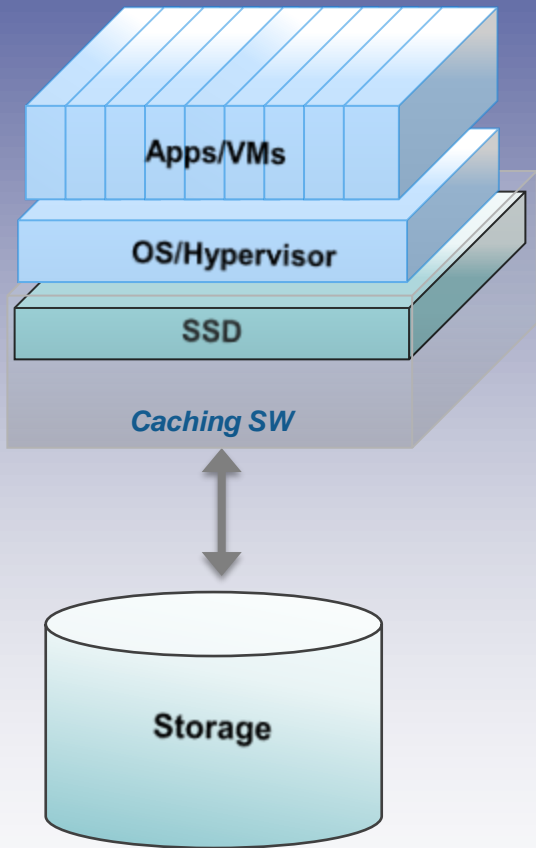
Log Structured Cache
- Circular buffer
- Write variable size blocks
- Minimize amount of metadata
- Reduce data fragmentation
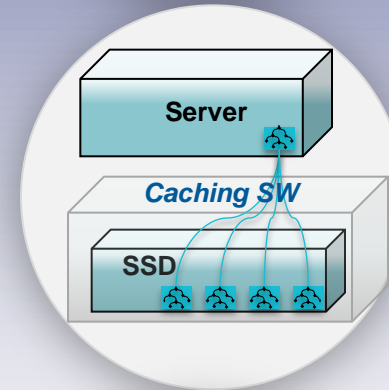
Multi-level Metadata
- Minimal resource utilization
- 150MB memory for 1TB cache
- Low CPU utilization – 3% - 5%
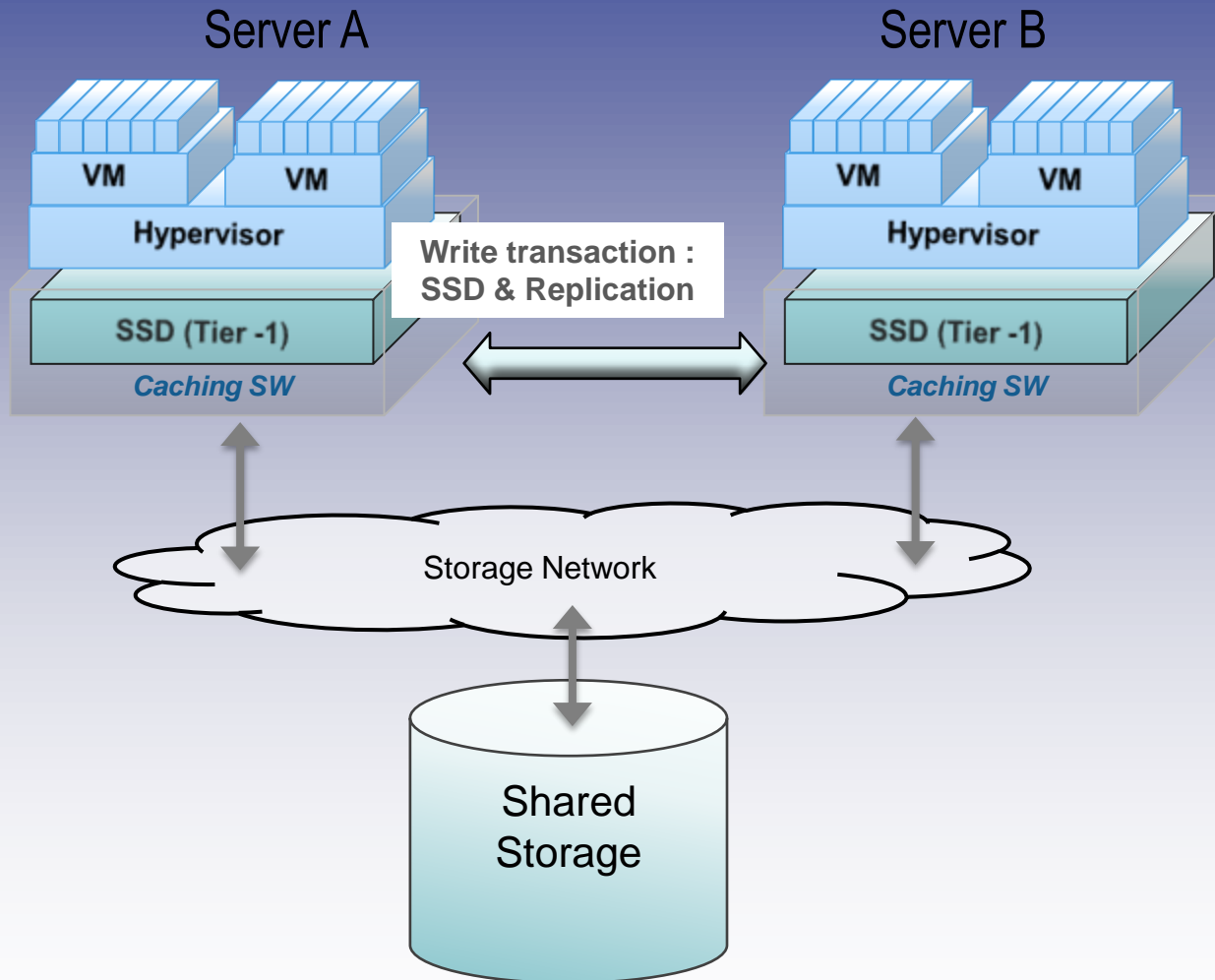- Instant recovery after crash

Software Flexibility
- Tuning for specific SSDs
- Tuning for specific apps
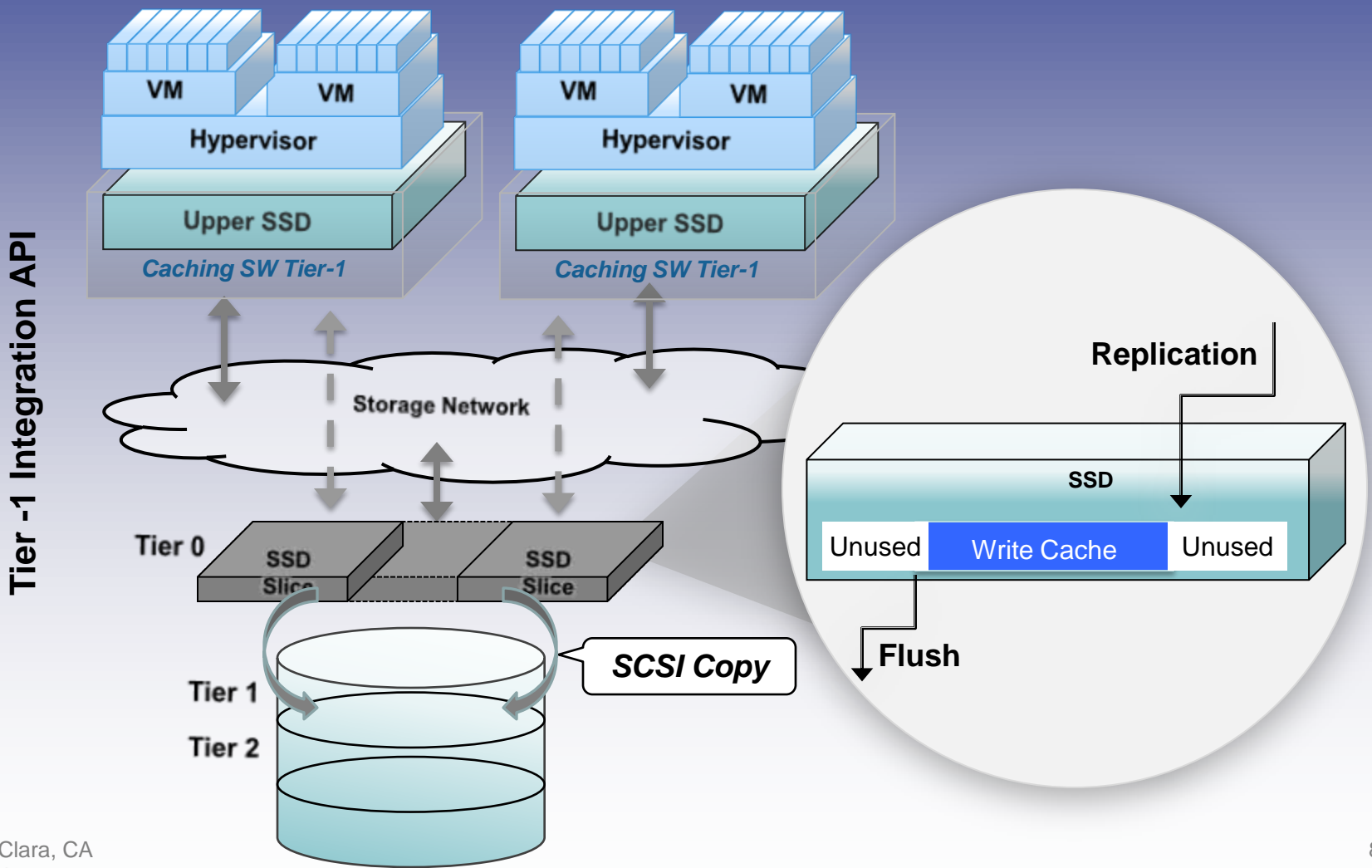- Read-write-flush optimization

- Enable flash to accelerate applications in clusters
  - Read-write and read only cache
- Full High Availability support
  - Server-to-Server Horizontal Replication
    - Leverage existing LAN
  - Server-to-Storage Vertical Replication
    - Integration with underlying storage arrays
    - Tier -1 to Tier 0 API for integration with storage arrays
- Leverage existing cluster services
  - MSCS, VCS

Horizontal Replication

Server A

Server B

VM

VM

Hypervisor

VM

VM

Hypervisor

**Write transaction :
SSD & Replication**

SSD (Tier -1)

Caching SW

SSD (Tier -1)

Caching SW

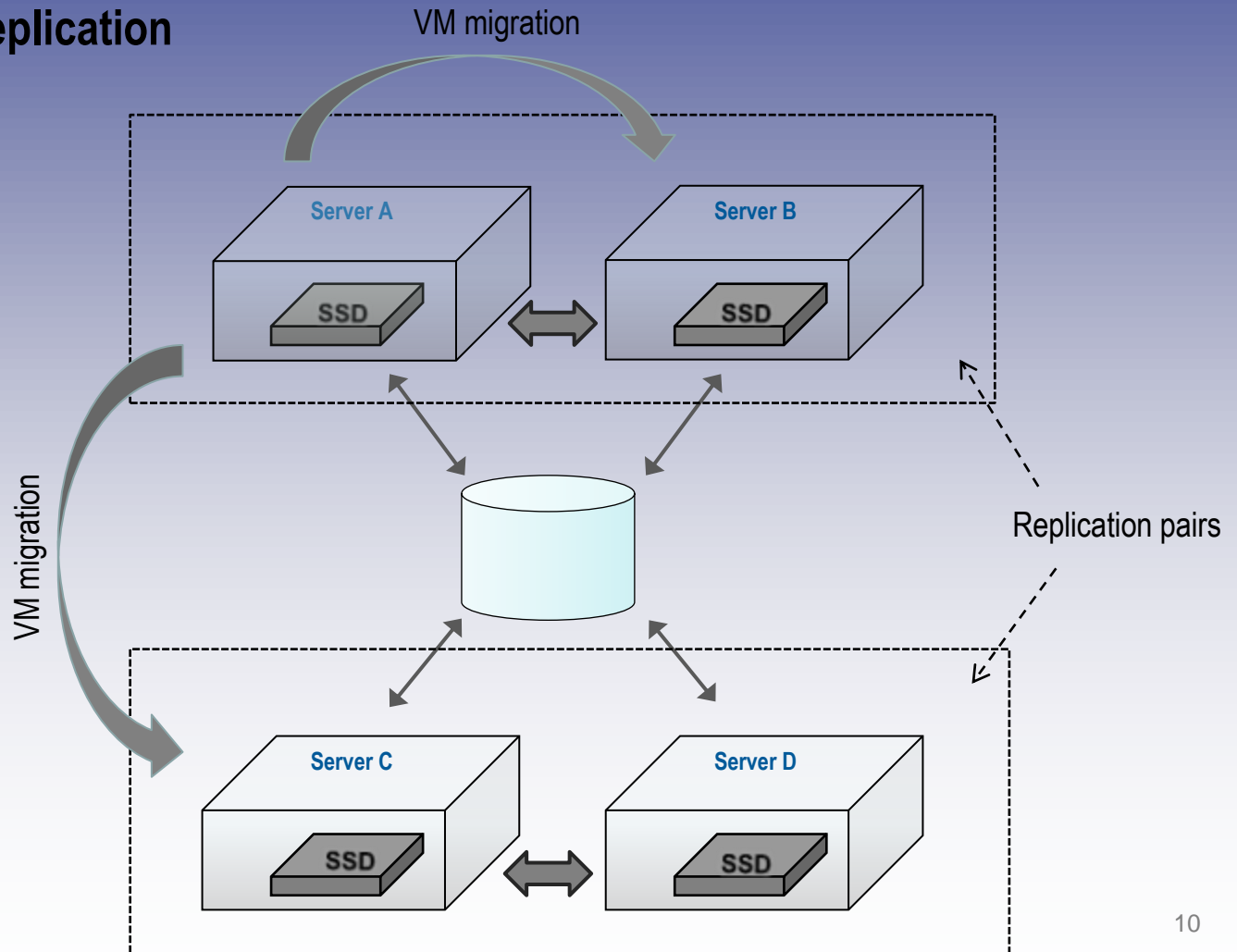Storage Network

Shared
Storage

Vertical Replication

Design Goals: Caching for Virtualization

- Support major virtualization platforms
- Install caching in the host
  - No agent in guest VMs required
  - Guest OS independent
- Low-latency SSD access
- Support all virtualization platform capabilities
  - Write-through caching mode
  - Write-back caching mode

Replication Pairs Architecture
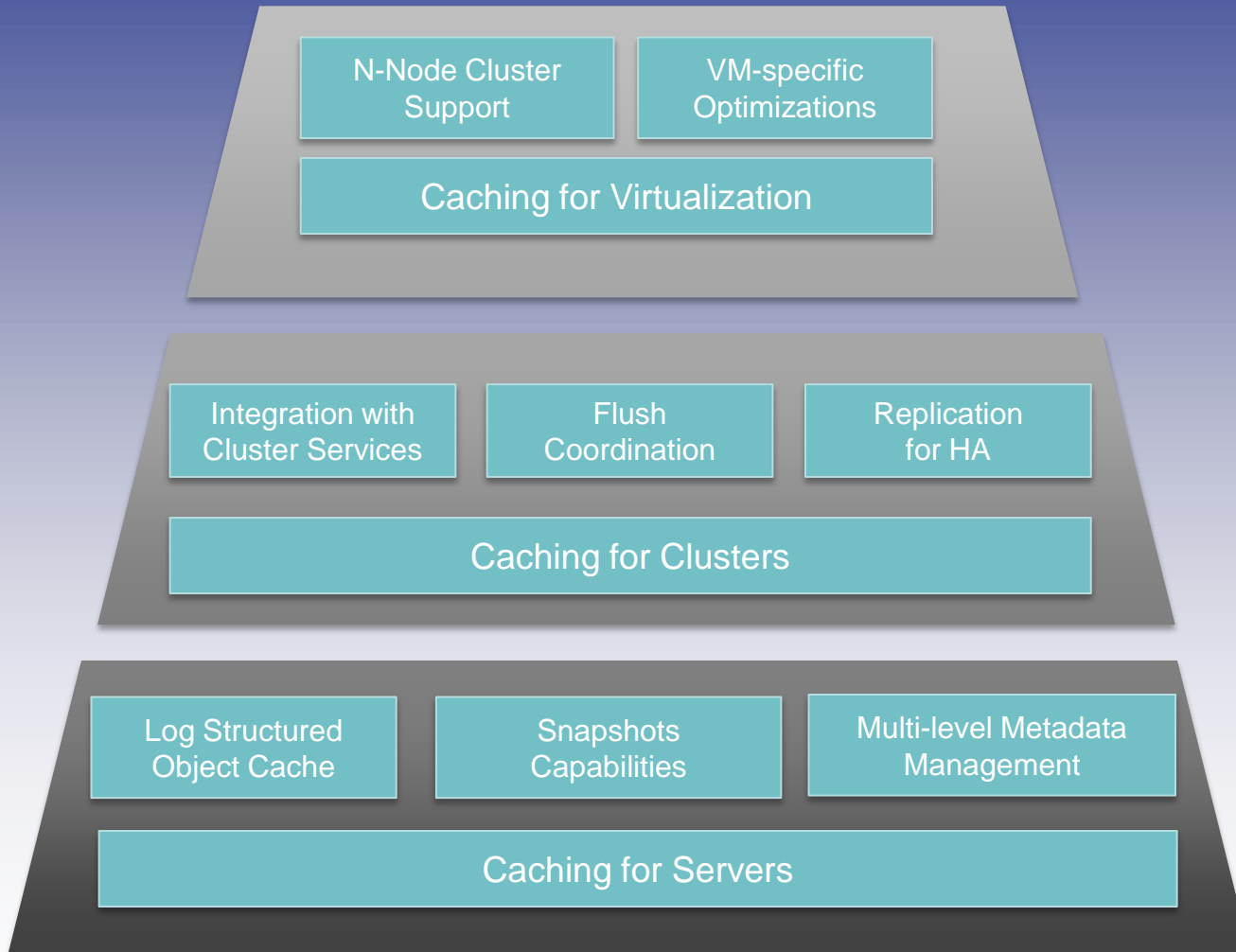
Leverage Horizontal Replication

- **High Availability**
- **Live Migration**
- **Snapshot & Clones**
- **Storage Motion, etc.**

VM migration

Server A

SSD

Server B

SSD

VM migration

Server C

SSD

Server D

SSD

Replication pairs

Technology Pyramid

N-Node Cluster Support

VM-specific Optimizations

Caching for Virtualization

Integration with Cluster Services

Flush Coordination

Replication for HA

Caching for Clusters

Log Structured Object Cache

Snapshots Capabilities

Multi-level Metadata Management

Caching for Servers

Thank You

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