Kaminario Scale-out Performance Storage Architecture

Kaminario K2 and Dell
Kaminario and Dell have partnered to deliver a unique solution to eliminate storage I/O bottlenecks, reduce latency and increase throughput. The Kaminario Scale-out Performance Storage Architecture™ (SPEAR) is a fundamentally new and better way to store and retrieve performance sensitive data. Kaminario SPEAR combines off-the-shelf Dell blade servers, solid-state drive (SSD) media (DRAM and/or Flash) and the revolutionary SPEAR Storage Operating System to create a blazingly fast, highly available, and easy to deploy distributed storage grid appliance. SPEAR also features Kaminario's unique DataProtect™ storage services, enabling the K2 to provide end-to-end high availability and fast, high volume data protection to SSD storage while delivering extreme performance.

System Hardware
Kaminario K2 all solid-state SAN storage hardware is based on reliable, energy-efficient and scalable Dell PowerEdge blade servers. Kaminario K2 does not contain any specially designed hardware. It uses commodity enterprise-grade Dell components that ensure the K2 is well tested and easy to maintain. It also allows the quick adoption of new stable technology when it is available. Due to the SPEAR design, the appliance is transparent to applications and databases, enabling fast deployment (typically less than one day).

The Kaminario K2 consists of the following hardware components:

- **Rack** — Standard 42” casings to house the K2 components
- **Enclosures** — Holds blade servers, along with switches
- **Blade servers** — The Dell blade servers (blades) are the “smart” components; they manage the data and hold DRAM and/or Flash (MLC) SSDs for primary storage and HDDs or Flash SSDs for data backup and redundancy
- **Switches** — There are 3 types of switches used in a Kaminario K2:
  - Fibre Channel (FC) — Exposes the Kaminario K2 FC ports to multiple external hosts
  - 10 GbE — Interconnects all blades for the purpose of sending host data between the blades
  - 1 GbE — Interconnects all blades for the purpose of supporting management communications between the blades.
- **Uninterrupted Power Supplies (UPS)** — Two UPSs for continuous power

The Kaminario SPEAR is an N+1 redundant architecture. In case of a failure of any hardware component, there is (at least) an additional component that can compensate for the loss of the failed piece.

SPEAR Capabilities
**Fast**
- High performance all solid-state SAN storage (DRAM and/or Flash)
- Millions of IOPS, with ultra-low latency and high throughput
- Dramatic application performance improvement
- Consistent performance for any workload over time

**Safe**
- DataProtect™ for self-healing high availability and fast data protection
- Fast, automated failover
- Hot-swappable components
- Non-disruptive operations
- Fast mirroring and striping
- Fast, high volume snapshots
- Fast asynchronous replication

**Easy**
- Open, blade-based, high-end industry standard components
- Modular, scale-out architecture
- No change to operating systems, applications, databases, or data
- Fast deployment — typically one day
- No need for performance tuning
- Supports virtualization and cloud environments

Dell PowerEdge Blade Server Summary
Dell PowerEdge blade servers are reliable, energy efficient and scalable. They are specialized for performance-intensive applications, databases, compute intensive applications and virtualization.
SPEAR Storage Operating System (OS)

The SPEAR OS exposes industry standard SSD-based (DRAM and/or Flash) block level storage to applications as logical shares. It manages the following SPEAR components:

- **ioDirectors** — Present the K2 data to host servers as standard block devices and load balances the data to optimize K2 system resources utilization and scalability.

- **DataNodes** — The storage layer of the K2 and responsible for storing data in Flash or DRAM SSD and mirroring data for redundancy and data protection.

The SPEAR Storage OS is composed of three fundamental patent-pending software capabilities:

1. **Automated Data Distribution™** — Automatically senses the capacity available in both the I/O and storage tiers of the distributed storage grid. SPEAR optimizes data distribution by automatically and randomly allocating data over that capacity. The result is an ultra-efficient use of the available resources that speeds processing and eliminates hot spots. Data distribution is continually balanced for consistently high performance and ultra-low latency.

2. **Intelligent Parallel I/O Processing™** — I/O requests are distributed across the K2 storage grid, smartly parallelizing all READS and WRITES. Parallelizing the I/O service over multiple nodes shortens the average response time of I/O requests (both READ and WRITE).

3. **DataProtect™** — DataProtect assures self-healing high availability and fast data protection for backup and disaster recovery while delivering extreme storage performance to mission critical applications. It supports the following capabilities:

   - **Self-healing High Availability**
     - N+1 hardware redundancy
     - Fast automatic failover
     - Hot-swap components
     - Non-disruptive operation

   - **Fast Data Protection**
     - Fast mirroring and striping RAID 10HD (Hybrid Distributed)
     - Fast high volume snapshots: 8,000 SNAPs, capable of SNAPs in < 1 second
     - Fast asynchronous replication: < 15 second RPO

K2 System Management and GUI

The Kaminario K2 System Management Software and GUI simplifies storage installation, configuration and performance monitoring.

All SPEAR software components also support redundancy for high availability.

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