IntelliFlash™

Operating Environment

Modern data centers need to maximize the value of their storage investment by putting their data to work. The IntelliFlash Operating Environment (OE) is built to do just that – easy, efficient, and intelligent infrastructure enabling businesses to achieve:

INTELLIGENCE that automates storage media and maximizes the uptime and efficiency of all your IntelliFlash storage systems with intelligent analytics, PERFORMANCE that delivers fast storage performance, across all workloads and capacity achieving higher efficiencies at low costs, and AGILITY that enables developers and data scientists to innovate faster and seamlessly across private and public cloud infrastructures.

Whether you're looking to accelerate databases, virtualized servers and desktops, or the foundation of a flash multi-cloud environment, the IntelliFlash OE can enable you to turbo-charge your business success through a simple, intelligent infrastructure.

FLASH OPTIMIZED UNIFIED STORAGE

The IntelliFlash OE provides all the storage services – block, file or virtual machine to consolidate all applications, such as high-performance databases, critical business applications, fast-edge analytics, large-scale virtualized servers, databases, file services, and web-scale applications.

IntelliFlash OE delivers enterprise-class data services for all workloads, increasing productivity with real-time data reduction, proven 99.999% availability, non-disruptive upgrades, built-in data protection, multi-media flash management, and intelligent analytics.

The IntelliFlash OE is flash-optimized and seamlessly integrates multiple classes of storage media to deliver optimal performance (high performance at low latency) and the best economics for a wide range of enterprise applications.

With the IntelliFlash OE you'll experience a unified storage platform with a choice of media including NVMe™ flash, performance flash, dense flash, hard disk drives, or a mixture thereof. You can select the optimal combination of flash and hybrid storage to meet the specific performance and economic needs of your business applications - using a single system.

INTELLIGENT METADATA ACCELERATION

The IntelliFlash metadata aggregation and placement technology is a patented, core innovation and the key to delivering advanced data services at the I/O speed and scale flash offers. IntelliFlash OE automatically separates metadata from application data and then organizes, aggregates, and places metadata on low-latency performance layer accelerating data services such as deduplication, compression, snapshots, clones, and thin provisioning.

IntelliFlash OE organizes metadata into flexible, multi-layered data structures and distributes them across multiple flash media types for full data integrity and protection. To deliver consistent I/O, data services, and performance at scale, IntelliFlash OE employs a Caching and Scaling engine.

This engine caches the most frequently-accessed metadata and application data in high performance storage layers (DRAM, persistent memory, and flash) enabling predictable low latency for data reads and writes. The caching algorithms are adaptive and optimized for various I/O patterns to ensure high cache hit rates. As data and consequently metadata grow over time, the IntelliFlash OE enables automated expansion of metadata storage space. This in turn ensures dynamic scaling of metadata management and advanced data services to handle massive data sets.
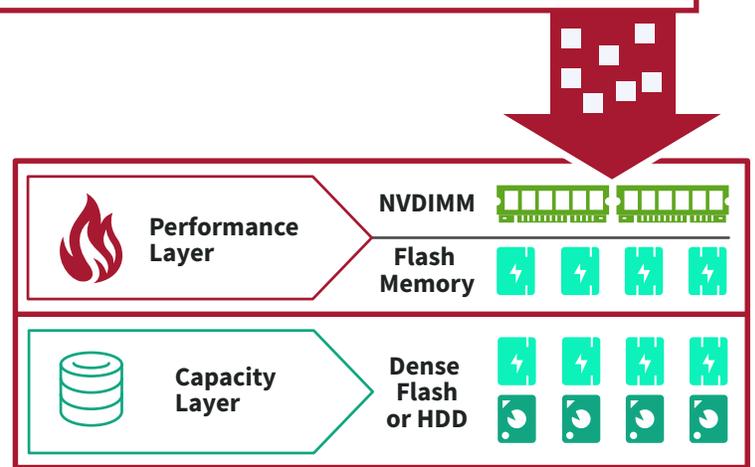

Figure 1. IntelliFlash metadata acceleration and caching architecture

INTELLIGENT MEDIA OPTIMIZATION

IntelliFlash Media Optimization provides the foundation for intelligently and reliably storing data on different types of storage media and optimizing media use within the system. IntelliFlash OE is optimized for the underlying geometry of the medium (NVMe flash, performance flash, dense flash, or hard disk) to ensure long life even under high I/O workloads. Data writes are aligned to sector boundaries for disks and to the native page sizes of flash to avoid fragmented I/O and eliminate unnecessary writes.

KEY OPTIMIZATIONS INCLUDE:

- Tracking flash media wear leveling and moving data around to help ensure uniform wear across flash memory pages.

- Continuously monitor, compact and free up blocks to minimize write amplification and avoid degrading performance.

- Automatically deduplicate and compress data before committing to media thus minimizing write cycles and extending the life of the storage media.

- Dynamic stripe widths to eliminate performance overhead and media wear.

- Pipelined I/O scheduling and coalescing of write operations to ensure performance and optimal writes to media.

▶ **FLASH OPTIMIZED UNIFIED STORAGE**

IntelliFlash intelligent data services enable continuous data availability, data protection, and data recovery features reducing the effective cost of owning and operating storage.

THESE SERVICES INCLUDE:

- Real-time compression algorithms that can be turned on or off at the storage pool, LUN or share level to reduce the overall storage consumption and minimize media wear enabling more data to be served out of persistent, high performance, storage media thus accelerating performance.

- Thin provisioning optimizes capacity utilization through just-in-time consumption of actual storage.

- Intelligently storing data and data checksums for every data block written to the array in separate data structures to ensure data integrity.

- 256-bit AES encryption of data at rest protecting against theft or loss of a drive during maintenance or transit.

- Real-time encryption of data on SAS flash and hard disk without loss of performance.

- Point-in-time VM-consistent and application-consistent snapshots enabling seamless application data recovery.

- Asynchronous snapshot-based replication of data volumes performed across pools and across storage systems.

- Intelligent data reconstruction capabilities ensure quick recovery and minimize exposure to device failures.

- Secure multitenant application architecture enables storage provisioning for containerized microservices with CSI drivers for NFS, SMB & iSCSI protocols

- Network Attached Storage (NAS) capability provides file storage and sharing services for virtualized and non-virtualized environments. Enables a large capacity, multi-protocol access, high-performance, enterprise grade file server.

▶ **AGILE STORAGE SYSTEM FOR HYBRID CLOUD ENVIRONMENTS**

All media in IntelliFlash systems are dual ported and accessible through a pair of highly available, redundant controllers.

The controllers are configured as active/active and can be used simultaneously for data access.

In the event of a controller failure, IntelliFlash OE seamlessly and non-disruptively fails over I/O from one controller to the other.

 Regardless of the protocol, IntelliFlash OE enables redundant media fabrics by aggregating I/O ports within and across the two controllers, for high data availability.
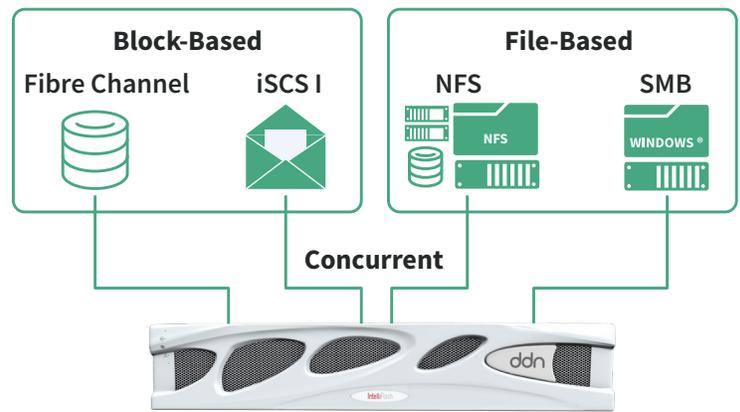

Figure 2. IntelliFlash concurrent multi-protocol access

The IntelliFlash OE natively supports block and file access. Supported block protocols include iSCSI and Fibre Channel; file protocols include NFS 3.x/4.x and SMB 1/2/3. All protocols can be used simultaneously over a variety of storage ports.

THE INTELLIFLASH OE PROVIDES FLEXIBILITY THROUGH MULTIPLE MANAGEMENT OPTIONS:

- IntelliFlash CSI interface for Kubernetes (K8s) Container Orchestration to manage persistent storage volume lifecycles for file and block protocols.

- Microsoft® Hyper-V virtual machines can be easily managed through Microsoft Systems Center Virtual Machine Manager (SCVMM).

- Storage management and data protection tasks can be scripted and automated through a programmable, task-oriented REST API.

- The IntelliFlash call-home capabilities provide various alerts that are sent to administrators and Customer Support to ensure proactive and timely intervention.

With the broader adoption of hybrid clouds, enterprises need data mobility between different storage tiers and more importantly, the ability to leverage public cloud elasticity.

IntelliFlash S3 Cloud Connector enables taking snapshots and backing them up to the cloud or quickly migrating volumes for bring-up on the cloud, seamlessly extending private cloud data services and resources to the public cloud, or any S3-compliant object storage system increasing modern data center storage economics.

The IntelliFlash Live Dataset Migration feature enables seamless adoption of newer IntelliFlash storage systems through live migration of iSCSI/FC LUNs from one IntelliFlash system to another, including application migration without any reconfigurations.

IntelliFlash storage systems deliver incredibly high performance while maximizing efficiency not only for IT, but for your business, by keeping your storage costs in check and making your data come alive.

ABOUT DDN

DataDirect Networks (DDN) is the world's leading big data storage supplier to data-intensive, global organizations. DDN has designed, developed, deployed, and optimized systems, software, and solutions that enable enterprises, service providers, research facilities, and government agencies to generate more value and to accelerate time to insight from their data and information, on premise and in the cloud.