



PANASAS[®] ACTIVESCALE[®] OPERATING ENVIRONMENT

The Storage Software Platform that Enables Unrivalled Performance, Scalability and Manageability

The foundation of Panasas ActiveStor parallel storage solutions is the Panasas ActiveScale operating environment which includes the PanFS[™] parallel file system, and the DirectFLOW[®] Protocol. The ActiveScale operating environment delivers orders of magnitude performance improvements over traditional file storage architectures and dramatically lowers the cost of managing data storage by supporting Terabytes (TBs) to Petabytes (PBs) of data capacity growth all within a single, easily managed namespace.



An Object-Based Architecture Delivers Intelligent Parallel Storage

The core principle of the ActiveScale object-based architecture is distributing block management to the storage device in contrast to traditional storage systems that manage blocks on the file server and create a storage bottleneck. Data objects are written to smart object storage devices on a massively parallel scale to remove the performance bottlenecks of traditional designs. Also, data objects can be resized without limitation and independently from other storage system activity, allowing the management of all data within a single seamless namespace and providing independent and parallel growth properties.

PanFS[™] Parallel File System: The Heart of the ActiveScale OS

Designed from the ground up for efficient partitioning of workload and minimal interdependence between clustered elements, the Panasas PanFS parallel file system turns files into smart data objects and then dynamically distributes data transfer operations across the StorageBlade[®] modules. Panasas DirectorBlade[®] modules provide metadata services and are clustered together to create a highly scalable, fault-tolerant storage architecture enhanced with fine-grained, dynamic load balancing. The DirectorBlade modules coordinate access to the StorageBlade modules while maintaining cache coherency among the clients. To remove potential I/O bottlenecks, active "hot spots" are identified quickly and object migration routines are invoked to move existing data objects to less utilized StorageBlade modules.

DirectFLOW[®] Protocol Enables Direct Communication Between Clients and Storage

The performance advantage of Panasas storage is attributed to the out-of-band DirectFLOW protocol that is the foundation of the pNFS standard. It enables direct communication between clients and StorageBlade modules.

FEATURES AND BENEFITS

DirectFLOW[®] Protocol:

- **Maximizes Performance**
Provides faster time-to-results due to faster application runtime
- **Increases Productivity**
Ensures maximum cluster utilization as jobs run in parallel, therefore more jobs are completed in less time

Single Global Namespace:

- **Reduces IT Support**
Simplifies storage management and provides seamless scalability as the size and number of jobs to be processed increases

NFS and CIFS Support:

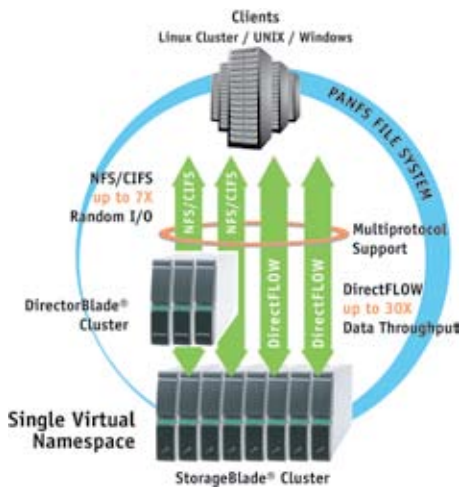
- **Easy to Integrate**
Supports existing Unix and Windows environments
- **Easy to Manage**
NFS and CIFS management integrated into PanActive Manager for seamless manageability

ActiveScale Failover HA Software:

- **Maximizes Availability**
Ensures constant data access

ActiveImage Snapshots:

- **Maximizes Manageability**
Easy, instant backup and restore



The DirectFLOW® protocol moves the metadata manager out of the data transfer path enabling multiple parallel I/O paths to be created between the storage cluster and client nodes. DirectorBlade modules provide simultaneous metadata services for DirectFLOW clients and support clustered NFS and CIFS access to the storage cluster.

The DirectFLOW protocol enables direct communication between clients and storage.

This concurrency eliminates the bottleneck of traditional, monolithic storage systems and delivers massive throughput performance improvement. ActiveStor storage clusters also support NFS and CIFS protocols enabling UNIX® and Windows® applications to take full advantage of the storage cluster with no client agent required.

Predictive Self-Management Technologies Ensure Maximum Performance and Continuous Access to Data

Panasas Predictive Self-Management technologies work together to deliver health-monitoring and self-healing capabilities, ensuring the ActiveStor storage cluster always delivers maximum performance and continuous access to data.

ActiveScan Monitoring ensures continuous performance and data availability by monitoring data objects, parity, disk media and individual disk drive attributes. If a potential problem is detected, the data objects or the parity can be moved to empty space on the disk or to other StorageBlade modules, eliminating reconstruction. If a reconstruction is required, all DirectorBlade modules cooperate in parallel to speed reconstruction up to 10x the rate of conventional RAID controllers, completing rebuild of an 800 GB Blade in approximately 30 minutes. Real time monitoring of client load generation automatically identifies user performance bottlenecks and notifies administrators.

Tiered Parity Data Protection is a comprehensive architecture that executes appropriate families of error detection and correction codes. Three tiers of protection are independent, yet complementary to each other, and collectively provide the most comprehensive and scalable reliability architecture available today for high

performance storage. Vertical Parity isolates and repairs media errors at the disk sector level. Horizontal Parity enables faster and more efficient RAID reconstructions. Network Parity identifies silent data corruption.

ActiveScale Failover provides protection from network and metadata service failures. In the event that a DirectorBlade module encounters a problem, the metadata services it is running are automatically transferred to another DirectorBlade module within the storage cluster. Storage clusters may be configured with redundant network switches allowing ActiveScale Failover failover to the spare switch in the event of network failure in the data path of the primary switch.

ActiveImage Snapshots creates and recovers snapshots in seconds. Panasas ActiveImage snapshots provide enterprise class data protection through point-in-time copies that can be easily retrieved at any time by a user or system administrator. Using intelligent copy-on-write technology, only the changes made to data are recorded limiting the overhead required and enabling maximum flexibility in snapshot scheduling and administration.

NDMP Backup and Restore Software provides standards-compliant NDMP instruction set communication interface between the PanFS parallel file system and third-party backup and recovery management applications. The NDMP software provides integration with ActiveImage snapshots, resulting in a granular, flexible and reliable backup and restore capability. Combining industry-leading backup and recovery applications from vendors such as Symantec, Veritas and EMC Legato with the Panasas NDMP functionality provides a cost effective and reliable solution for backup and recovery that greatly enhances data protection.

The Panasas Promise: Accelerate Time to Results and Maximize ROI

Panasas offers comprehensive storage solutions that deliver the highest bandwidth and I/O performance; scalable performance and capacity; and simple unified management. Panasas integrated hardware and software solutions have been deployed in hundreds of installations around the globe, helping organizations accelerate time to results and maximizing ROI from data intensive and high performance computing environments.

For more information, contact us today at www.panasas.com or 1-888-PANASAS.



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