MacroSAN MS9000G3
Storage System Datasheet

MacroSAN Technologies Co.,Ltd.

I. Product overview

MacroSAN MS9000G3 series storage is a new generation of tightly coupled four-control high-end hybrid flash memory storage. Combined with the high-end storage architecture technology of MacroSAN Technologies Co., Ltd. and the third-generation V4 engine technology, it provides higher reliability than traditional dual-controller storage. When any three controllers fail at the same time, data is not lost and services are not interrupted, ensuring that critical services remain online for 7×24 hours, and providing a safe, reliable, intelligent and efficient storage platform for core applications in data centers.

MS9000G3 Equipment Front View

II. Product characteristics

Extremely reliable

High-reliability tightly coupled four-control architecture: MS9000G3 adopts the third generation V4 engine technology of Macrosan, integrating four controllers in one controller enclosure, and implementing four-control Active-Active tight coupling based on 100GE RDMA high-speed interconnection. In terms of cache data access, quadruple cache mirroring technology is adopted to realize real-time synchronization of cache data in four controllers, and to ensure that cache data is not lost when any three controllers fail at any time. In terms of hard disk access, the innovative hard disk network switching matrix architecture is adopted, and each controller and all disk cabinets are interconnected through SAS channel /RDMA, so that

when any three controllers fail at the same time, all hard disk access is not affected. Provides the ultimate reliability support for users' critical services.

Fully Redundant Architecture: The MS9000G3 adopts a modular, fully redundant architectural design, which enables rapid fault isolation and online replacement of components in the event of any component failure to ensure business continuity.

Cache power-down protection: Cache landing technology is adopted, when the storage is accidentally powered down, the cached data will be swiped down to the built-in SSD for permanent preservation through the battery that comes with the storage, ensuring that the data in the cache will not be lost.

CRAID technology: the unique IDDC + CRAID technology, can realize the hard disk partially damaged minute-level rapid reconfiguration, single RAID group tolerate any three hard disk whole disk failure, data is not lost, based on the global load technology, the IO is distributed to all the hard disk, greatly improving the IO concurrency ability to achieve rapid reconfiguration, 1 TB of data can be shortened to 20 minutes within the reconfiguration time, and allows Multiple disks in a RAID group to experience media failure at the same time without data loss. At the same time, combined with the storage system hard disk slow power-up technology, to avoid a large number of hard disk power-up at the same time, caused by current overload, bringing tripping and other risks, to further protect the system high reliability.

Controller self-healing technology: When the controller of the storage engine at the same time abnormal (crash or hardware and software failures, etc.), the system can quickly and automatically repair and restore normal operation, and to ensure that the cache data is not lost, the business interruption time is greatly reduced.

Cache Freeze Technology: When the data disk is unable to write data due to flash-off or failure, the data in the cache can be frozen, and the frozen cache data will be brushed to the data disk after the failure of the data disk is repaired to ensure that the data will not be lost.

Data consistency protection: Supports data consistency protection based on T10 PI, which ensures the data integrity of the entire path from the host port to the hard disk during data reading and writing, prevents silent data errors, and safeguards user data security.

MacroPath Multipath Software: When the server accesses LUNs through multiple paths, MacroPath can recognize the paths and manage them in an integrated way, detect the operation status of the paths in real time, and warn you when the paths fail and switch to the normal paths in a timely manner, so as to ensure the high efficiency and reliability of the business.

Complete Data Protection

The MS9000G3 provides rich data protection features, including data snapshots, data replication, clone, symmetric dual-activity storage, and other features. With these features, it realizes data management and protection from online to nearline, and from local to remote, providing users with multi-level and cross-region storage solutions easily.

Data Snapshot: MacroSAN's continuous data snapshot function can create up to 2048 incremental history-based point-in-time copies of a single data volume to provide continuous data protection. When data "soft" failure occurs, such as data corruption caused by software programs, virus damage, accidental deletion, etc., the data can be quickly recovered by "rolling back" to the appropriate point-in-time mark. Supports cascading snapshots to further protect the security of snapshot data.Snapshot support for ROW and COW.

Encryption: Supports hardware-level encryption for data at rest via Self-Encrypting Drives (SED), and complies with GM/T 0002-2012 SM4, the cryptographic industry standard of the People's Republic of China, to meet the security requirements of government and enterprise customers.Snapshot support for ROW and COW.

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Data replication: It supports both synchronous and asynchronous replication, which can be converted online according to business needs, taking into account business performance and data protection. It supports local replication within the device and remote replication across devices, and the replication link supports 10/25/100GE Ethernet and 16/32G FC, providing users with flexible configuration options. Asynchronous replication supports customized data transmission intervals, and can provide hopping, one-to-many, and many-to-one configurations, which can quickly restore services based on the data copy in the event of an unexpected disaster, and ensure the continuity of the user's business. Synchronous replication is based on IO-level synchronization, saving a fully synchronized real-time mirror for the main LUN data, so that when the main LUN data fails, the storage service can be provided by the mirrored data, RPO=0.

Clone: Clone function can be online to provide a moment with the production volume is completely consistent with the high availability, high flexibility of the data copy, create a clone can be immediately after the cloning of the clone volume to the front-end business use, without waiting for the completion of the data synchronization, suitable for frequent data analysis of the data generated by the data analysis or testing of the application scenarios. It also supports forward synchronization and reverse synchronization, so that the system can quickly synchronize the data according to the differences without the need to re-clone the full amount of data, so as to realize the continuous protection and flexible use of data.

Symmetric Dual-Activity Storage: Without introducing any third-party hardware and software, the storage symmetric dual-activity is realized directly through two MS9000G3 storage devices, which are redundant with each other. When one of the storage fails, the other storage can take over the business in real time, realizing zero RPO and RTO. The double-activation link between two MS9000G3 storage devices supports 10/25/100GE Ethernet and 16/32G FC. the double-activation function can be combined with the replication function to realize a multi-site, cross-region ring 3DC disaster recovery solution, providing solution-level high-reliability guarantee.

Superior Performance

High-performance hardware platform:MS9000G3 adopts disk control separation architecture design, the storage controller is based on the 5th Gen Intel Xeon Processors, built-in hardware acceleration, the internal communication of the engine uses high-speed 100GE RDMA channel, providing excellent IO processing capability; Support NVMe over Fabrics, front-end support high-speed 16/32Gb NVMe over FC, 25/100Gb NVMe over RoCE protocol, back-end support through 25/100GE RMDA interface expansion NVMe SSD, Build a high-performance end-to-end NVMe architecture to break through performance bottlenecks and provide extreme IOPS and ultra-low latency.

Efficient Horizontal Expansion: MS9000G3 adopts MacroSAN CloudSAN horizontal SAN expansion architecture, which supports online horizontal expansion via 10/25/100GE Ethernet, 16/32G FC network protocols, and can be expanded up to 48 storage controllers, 192TB of Tier-1 cache(DDR5), 1,152 host interfaces,with a maximum capacity of 38,400 disks, to build a large-scale parallel storage system to meet the growing data processing needs.

Intelligent Cache Scheduling: MS9000G3 adopts asymmetric cache scheduling technology in cache policy, dynamically adjusting the size of read and write caches according to the actual situation, in order to meet the real-time changes in the performance requirements of LUNs.

Dynamic Load Balancing: The MS9000G3 supports dynamic load balancing between controllers, adjusting workloads between controllers without interruption, eliminating performance bottlenecks, and achieving strict service level objectives.

Quality of Service Control QoS: With the increasing performance and scalability of storage, more and more business systems are accommodated in a single set of storage, and users need to specify different service priorities for different types of services. the QoS function provided by the MS9000G3 integrates and pools storage resources such as CPU, memory, ports, etc., to ensure that higher-priority service requests can obtain higher IOPS/bandwidth, and lower response latency.

Intelligent Storage Platform for Flash

The high performance of flash hard drives has been unanimously recognized by the industry. With the ODSP storage operating system, MS Series storage integrates this leading hard drive technology into its high-performance architecture to provide the ultimate flash convergence solution.

Intelligent media identification for ultimate performance: ODSP storage operating system can intelligently identify the back-end storage media, and for flash hard disk, it automatically executes flash optimization algorithms, reduces the frequency of hard disk operation, shortens the IO path, and provides the ultimate performance.

Global Wear Balance Enhances Flash Memory Lifespan: Based on CRAID3.0, CRAID3.0 flash memory optimization technology is formed by integrating flash memory characteristics, which is able to slice each flash hard disk into several small pieces to form a global resource pool, and then intelligently distribute IO to all the small pieces evenly through discrete algorithms, thus achieving global wear balance and significantly enhancing the lifespan of flash memory.

Intelligent Data Management

The MS9000G3 takes the resource space and virtualizes it to form a Cell resource pool. Based on the dynamic allocation and free flow of Cell, MacroSAN has constructed a set of intelligent management method, i.e. ICMT (Intelligent Cell Management Technology).

Auto-tiering/HotCache: With ICMT technology, there is no binding between LUNs and RAID, hard disks. Through Cell-based data copying and migration, it can realize the free flow of data on different hard disk media according to the access frequency of data, thus realizing automatic tiering and HotCache Level 2 hotspot caching.

Automatic Thin Provisioning: Based on ICMT's automatic thin provisioning technology, the system automatically recognizes front-end service IOs and coordinates the dynamic allocation of storage resources, which can significantly reduce the difficulty of capacity planning for system administrators.

Adaptive Deduplication: Based on the ODSP storage software platform, it realizes global data block-level, online and post-line adaptive non-destructive deduplication, reduces the data volume and improves the utilization rate of storage space. The system automatically switches between online and

postline deduplication modes according to the business load, reducing the impact of deduplication processing on business performance. Secondary comparison is performed before deleting duplicate data to avoid data loss. Supports flexible online enabling and disabling of the deletion function in terms of data volume, and supports simultaneous enabling of the online compression function to improve the data reduction ratio.

Online compression: Through the built-in data compression function module of the storage system, the data is compressed online at the first time when the data is written. Lossless data compression is adopted to avoid data loss caused by data compression. At the same time, through powerful hardware resources and optimized compression algorithms, the impact of data compression on the front-end business system is reduced to a minimum to ensure maximum smooth access to the business. Supports the configuration of hardware acceleration card to improve the compression ratio and reduce the occupation of storage controller resources. Supports flexible online on and off compression function by data volume unit, and supports simultaneous enabling with adaptive deletion function to improve data reduction ratio.

Efficient Operational Deployment

SAN/NAS Integration: In the same set of hardware equipment, simultaneously provide SAN, NAS two kinds of data storage services, no need to configure additional NAS gateway equipment, reduce equipment investment, shorten the data access path, and effectively reduce the complexity of the deployment and operation and maintenance.NAS support file system snapshot, replication, dual-living and other functions, you can build the SAN/NAS integration of the dual-activation of the high-reliability program.

Support for Cloud and Container Loads: The MS9000G3 provides the ability to interface with the OpenStack cloud platform and K8S container orchestration platform, providing high-performance and high-reliability storage resources for cloud and container environments, simplifying management, and improving business deployment efficiency.

Cloud Disk: for enterprise-level users to quickly complete the deployment and construction of private cloud/private network disk/online document management system. The maximum number of users that can

be supported by MacroSAN Cloud Disk is 10,000+, and at the same time, it can support the online preview of documents in 100+ formats such as ai, psd, eps, CAD, 3D, pictures, audio, video, multimedia, etc. It can help enterprises to realize the centralized storage and management, convenient sharing, mobile office, collaborative office, group rights management and other needs of the documents, and provide the team with a highly transparent and secure collaborative environment.

Open Platform, Interconnection

Heterogeneous virtualization: Built-in virtualized data management engine can integrate storage array devices of different brands and architectures, such as IP SAN and FC SAN, into the unified storage resource pool of MacroSAN for unified management, which effectively reduces the management difficulty and maintenance cost, and improves the utilization rate of resources. In addition, the heterogeneous virtualization function can be paired with replication, snapshot, dual-living and other software to achieve local or cross-site data protection, supporting virtualization of mainstream storage vendors' storage products and effectively protecting users' existing investments.

Non-disruptive Data Migration (NDM): MacroSAN's NDM technology can realize online data migration within a single device and across devices, with no front-end perception and no business disruption during the migration process. All series of hybrid and all-flash arrays support NDM technology. Hybrid arrays can realize non-disruptive data migration between hybrid arrays and all-flash arrays through NDM technology. In addition, for third-party storage arrays, MacroSAN can also realize data migration to third-party storage arrays through NDM technology and heterogeneous virtualization function to achieve resource integration.

Comprehensive support for IPv6: Supports IPv4 and IPv6 dual protocol stacks, IP SAN storage network can be constructed between hosts and storage via IPv4/v6 protocols, out-of-band management network can be constructed between management terminals and storage via IPv4/v6 protocols, and data replication network can be constructed between storage and storage via IPv4/v6 protocols, in order to satisfy IPv4 and IPv6 requirements for different application scenarios. deployment, application and management needs in different application scenarios.

Full-series interconnection: Based on ODSP unified software platform, MS9000G3 can be compatible with the full series of MS products without third-party hardware and software, and can realize unified management, simplify operation and maintenance, and realize flexible data migration and protection solutions through MacroSAN UBSM unified block storage management platform.

III. Product specifications

Product Model	MS9040G3
Maximum controllers	48
CPU/SP	2* 5th Gen Intel Xeon Processors
Cache/SP	256GB-1TB DDR5
PCIe Channel	PCIe Gen4
Maximum front-End host port	1,152
Front-end channel port types	16/32Gb/s FC、10/25/40/100Gb/s iSCSI、16/32Gb NVMe over FC、25/100Gb NVMe over RoCE
Expanded Hard Disk Enclosure Types	2U DSU: 25 disk slot, support 2.5" NVMe SSD 4U DSU: 24 disk slot, support 2.5"/3.5" disk 2U DSU: 25 disk slot, support 2.5" disk
Drive types	NVMe SSD、SAS SSD、HDD、SED(Self-Encrypting Drive)、 etc. （Support mixed insertion of different types of hard disks）
Maximum drives	38,400
Maximum LUNs	65536
Disk detection and diagnosis	Support periodic disk detection Support intelligent dynamic adjustment of disk detection speed
RAID level Supported and hot standby types	RAID/CRAID（CRAID3.0）0、1、3、4、5、6、10、50、60、X0 etc. Support dedicated hot standby, global hot standby, and idle hard disk hot standby
CRAID characteristics	The CRAID group allows multiple hard disks to have media errors, tolerates physical failures of any three disks, and supports normal reconstruction, local reconstruction, and fast reconstruction
Operating system supported	AIX, HP-UX, Solaris, Windows, Linux, etc
Virtualization system supported	VMware、Citrix、Hyper-V、OpenStack、KVM、XEN etc.
Multipath supported	Multi-path software that supports the configuration of ALUA/SLUA features can realize dynamic load balancing and link failover

Basic management software	ODSP management suite including basic storage management, CRAID, system monitoring, log and alarm etc.
Management model	Support graphical,CLI, WebService access interface, SMI-S and Cinder management interface
Value-added features	Thin provisioning, Intelligent tiering, Non-disruptive data migration(NDM), Performance monitoring, Snapshot, Replication, Cloning,Symmetric dual-active, Heterogeneous virtualization, QoS, Multi-tenants, Deduplication, CompressionEncryption(SM4),etc.
Protocols Support	Support FC, iSCSI, NVMe over FC, NVMe over RoCE, CIFS, NFS, HTTP, FTP, S3, etc.
Power input	100V ~ 127V AC/200V ~ 240V AC； 60Hz/50Hz 240V HVDC
Temperature	Working temperature:5℃ to 35℃ Storage temperature: without battery: -20℃~+60℃; with battery: -15℃~+40℃
Humidity	Working humidity: 10%~90% R.H. (non-condensing) Storage humidity: 10%~90% R.H. (non-condensing)