**MASS Storage Requirements**

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| **Category** | **Minimum Requirements** |
| Storage type | Solution shall provide both block and file capability within the same unified storage system.  |
|  | All storage systems shall operate under a single unified management. |
|  | Solution shall provide that Storage systems proposed will use a 64bit Operating system |
|  | All storage systems (extra small, small, medium, large) shall be a part of the same product family and same Operating System. |
| Minimum IO/sec | The solution shall provide required PLUS 20% input/output (I/O) operations per seconds (IOPS) per controller head pair with no performance degradation on failover, sustaining a minimum 60/40 read-write ratio, using Redundant Array of Independent Disk (RAID) 6 (equivalent RAID type may be considered) during all system functions including maximum snapshot operations, maximum clone operations, data deduplication, thin provisioning, tiering, and cluster fail over.  |
|  | Shall provide utilization of appropriate disk type, spindle count, cache, and raid type to meet I/O requirements on all volumes created on the storage system. |
|  | Shall provide a minimum of up to a 100% increase in (IOPs) I/Os per second within the same storage system model without having to replace the system with a different model. |
|  | The proposed solution shall not exceed a maximum of 10ms total latency of the backend disk sub system on all supported protocols |
| Workload | Solution shall support server virtualization and proposed application workloads.  |
| System Cache | Storage system shall provide automatic monitoring and optimize the use of system cache to improve system performance |
| Minimum Throughput | Solution shall support server virtualization and proposed application throughputs.  |
| Cluster type | All systems included as part of the solution shall be installed with the latest general availability software and hardware applicable to that vendor’s storage array. |
|  | Shall provide storage system with the latest General Availability Operating System code at first site delivery. All following sites will receive the same base code version (or VA specified code version) including, but not be limited to storage components firmware, shelf firmware, and disk firmware applicable to the proposed storage system and the VA.  |
|  | Shall provide a minimum of N+1 controllers allowing redundancy. The system will be able to meet all workload requirements with a single controller failure. |
|  | Shall provide storage controller heads capable of both manual and automated failover to a peer controller within a maximum of 30 seconds. |
|  | All storage drives and shelves shall have access to both controller heads. |
|  | During a failover all mount points for Network File System (NFS), Common Internet File System (CIFS), Internet Small Computer System Interface (iSCSI), and Fibre Channel (FC) Logical Unit Numbers (LUNs) shall be presented by the new controlling cluster head without remapping. |
| Storage Capacity | All usable capacity shall be configured using RAID 6 (equivalent RAID type may be considered) in usable native disk capacity without disk compression or deduplication within the same storage system model without having to replace the system with a different model. |
|  | The solution shall provide site size required usable storage capacity for server virtualization, plus an estimated 20% usable overhead for growth AND estimated requirement to retain 30 deduplicated snapshots of used data. |
|  | Shall provide Storage system with global hot spares. |
|  | The number of hot spares shall meet the vendors documented best practices based on drive types, storage capacity and required IOP’s listed above. |
| Supported Disk type | Shall provide that the storage system drive types be Serial Attached SCSI (SAS and not NL-SAS) and/or Solid State drives for server virtualization including database workload and the solution shall meets the IOPS and all other performance requirements set forth herein |
|  | Shall provide minimum of 10K RPM for all virtualization workload spinning disks. |
|  | Solution shall provide both SSD and SAS for physical usable data storage that meet the storage capacity and required IOP’s listed above. |
|  | System shall support expansion of SAS or SATA drives dedicated for data archiving or local backups at a later date. These storage system drive types be Serial-ATA (SATA) or equivalent for data backup and restore workload and the solution shall meets the IOPS and all other performance requirements set forth herein |
|  | Solution shall not include Fiber Channel (FC) disk drives. |
| Redundant Array of Independent Disk (RAID) levels | The storage system shall use RAID 6 or equivalent and must perform at the IOPs required per site and these specifications. |
| Volume sizing | Shall provide storage system that expand and reduce volume size by both Graphical User Interface (GUI) and Command Line Interface (CLI) interface.  |
|  | Shall provide storage system that perform immediate volume resize (after change commit, apply, and GUI refresh) without any data migration and downtime.  |
|  | The storage system shall be able to expand and reduce all logical volumes on all supported protocols. |
| Return disk option | Non-return disk option is required for all storage systems. |
| Storage unit uptime | All storage systems shall support a minimum of five nines storage system uptime (99.999%, equals 5.3 minutes availability during a rolling 12 month period), excluding planned downtime. |
| Upgrades / Expansions | Shall provide that the storage system when adding, upgrading and replacing storage subsystem components shall meet the required storage subsystem uptime requirement. |
|  | Shall provide that the storage system when adding, upgrading and replacing storage subsystem components require no data migration. |
|  | Shall provide that the storage system when adding, upgrading and replacing storage subsystem components require no reconfiguration of existing data and network connectivity including no LUN remapping to any connecting Hosts.  |
|  | Shall provide storage system with a minimum ONE empty expansion slots per storage controller head. |
| Support of External Components/Appliances | Any storage system proposed requiring external components/appliances shall include necessary components (ex. Host Bus Adaptors (HBAs), NICs or other adapters) needed to support proposed storage solution. |
| Redundancy | Shall provide redundancy in all storage system components with no single point of failure, no degradation, and non-disruptive to operations for all system component replacements, repairs, and upgrades. System shall maintain all required performance for IOPS and throughput during a controller head failover. |
|  | Shall provide redundancy in all storage system components with no single point of failure, fully functional and non-disruptive to operations for all firmware and microcode upgrades and updates. System shall maintain all required performance for IOPS and throughput during a controller head failover. |
| Connectivity | Shall provide the storage system with the required protocols of the overall proposed solution. The protocol must be of a VMware supported implementation and design. |
|  | All Storage system Protocols shall be able to use all of the storage system capacity.  |
|  | Solution shall provide and include software licenses for required/proposed protocol |
| Fiber Channel - Hosts to Storage Connectivity | Storage system shall provide 8-Gbit/s Fibre Channel port speed to meet storage and application performance requirements in the same system.  |
|  | Storage system shall provide a minimum of two (2) Fibre Channel (FC) ports on each storage controller head to support block storage protocols for front end hosts |
|  | Shall provide that storage system for all fiber Channel ports can autosense (ability to automatically change throughput speed (port) to match connecting Host and switch port speeds) speed of 2, 4, 8. |
|  | Shall provide system with a minimum of two redundant multi-path connections from Host to Storage system. |
|  | Shall provide that System shall support Asymmetric Logical Unit Access (ALUA) for all Fibre Channel LUNs. |
|  | System shall provide the ability to expand Fibre Channel ports non-disruptively, when adding additional ports per controller head and still maintain storage performance requirements in the same system. |
| IP - Hosts to Storage Connectivity | If Gbe required, the storage subsystems shall provide a minimum of four (4) useable (for production data) one (1) Gb Ethernet ports per storage controller head for both file and block protocols. |
|  | Shall provide that these interfaces (Ethernet) shall be redundant on each individual controller head. |
|  | Storage subsystems shall provide port expansion to meet storage and application performance requirements in the same unit(s). |
|  | All Ethernet components shall support Jumbo frame and Link Aggregation Control Protocol (LACP). |
|  | System shall provide native 10Gb for both file and block |
|  | System shall provide ability to expand Ethernet ports non-disruptively, when adding additional ports per controller head and still maintain storage performance requirements in that same system. |
| 10Gbe and FCoE connectivity | If 10GbE required, storage system shall provide a minimum of two(2) 10 GbE ports for all block and file protocols that also support 10GbE Fibre Channel over Ethernet (FCoE) host connectivity per controller head. |
| SCSI Initiator (Host Connections) | System shall provide a minimum of 256 simultaneous active iSCSI initiators/clients. |
| Multipath I/O software | Solution shall provide load balancing, multi path failover software as needed by vendors proposed solution. |
| Replication | Storage system shall provide asynchronous block and file replication with all models of this storage family (Extra small, small/medium/large system). |
|  | Solution shall provide both File and Block data replication licenses. |
|  | Solution shall provide replication function with compression. |
|  | Solution shall provide replication with efficient block level transfer for all supported protocols. |
|  | Solution shall provide change-block tracking for replication. |
| LUN and Volume creation | Storage system shall provide ability to create LUN and Volumes across all spindles. |
|  | Storage system shall provide the ability to create a LUN with all available storage to any connecting hosts for all protocols. |
| LUN and Volume Expansion | Shall provide Dynamic LUN and Volume expansion. |
|  | System shall provide storage capacity expansion with no LUN remapping of the storage system. |
|  | Shall provide that any storage system expansion will maintain the same redundancy, performance and efficiency of the system as the initial delivered system exhibits on all supported protocols |
| Thin provisioning | Storage system shall provide over-provisioning and over-allocation of storage capacity (all file and block protocols) that allows hosts to view more storage capacity than has been physically reserved on the storage system array itself. |
| Primary storage deduplication | Shall provide deduplication for all supported SAN and NAS protocols and file systems. |
|  | Shall provide Native storage based data deduplication method that will not degrade overall application performance and storage performance (IOPs and throughputs). |
| Snapshots | System shall provide capability of creating a minimum of 90 space efficient pointer based, point in time copies per volume without degrading performance below IOPS requirements specified in the above Requirements. |
|  | Snapshots shall not degrade performance below IOPS requirements specified in the above Requirements. |
|  | Shall provide storage system with space efficient snapshots without dedicated snapshot space reservation. |
|  | Shall provide storage system snapshot creation on storage volumes using any and all of the supported storage protocols. |
|  | File level restores from snapshots shall be restorable from storage Command Line Interface. |
|  | Shall provide direct internal storage File level restores from snapshots with a minimum throughput of 5 GB per minute. |
|  | Shall provide readable and writeable system snapshots. |
|  | Shall provide solution that allows users to restore their own files from snapshots. |
|  | Shall provide snapshots that are accessible to Windows hosts via Volume Snapshot Service (VSS). |
| Snapshots Clones | Storage system shall provide the capability of creating point-in-time delta clone (Delta clone is a copy based on pointers to the original data, which is updated when changes occur to the original data). |
|  | Shall provide space efficient system Clones without dedicated space reservation. |
|  | Shall provide readable and writeable snapshot clones. |
| Tiering | Shall provide automated and continuous Data Tiering without the need for manual configuration.  |
|  | Shall provide initial storage system configuration that never tier server virtualization workload data to a drive operating below 10k RPM. |
|  | Shall provide that data tiering shall support all file and block system protocols. |
| Storage device scale up capability | Storage system controllers/controller head modules shall be upgradeable in the same storage system product family without forklift upgrade. Adding or upgrading storage subsystem components adhering to storage device uptime requirements and no data migration is required. Shall not be disruptive to normal operations. |
| Footprint | Solution shall be collocated within RU requirements for site, or collocated in solution provided rack of 42U. |
| Firmware and microcode upgrade or updates | Completely non-disruptive to operations firmware and microcode upgrade or updates for all components with zero downtime. |
| Boot from SAN | Storage subsystem shall support host boot from SAN. Storage system must support Windows, and Linux operating systems and the VMware vSphere 5.1 and above hypervisor version. |
| Power switches | Power Switches shall be protected from inadvertent action. |
| Standardized layouts | Components must be mounted in standardized configurations for all VA installations. |
| Role-based access | Solution must include security configurations that support role-based access required to limit functions and audit trail logging for access to storage. |
|  | Shall provide a single sign-on integrated with Microsoft Active Directory (AD) to manage storage system(s) in a data center implementation from a single master management console. AD integration will include support for smartcard/two-factor authentication. |
| Product availability | The proposed solution shall not provide storage systems that are within two (2) years of its end of sale date from the time of award. |
|  | The proposed solution shall not provide storage systems that are within five (5) years from its end-of support date from the time of award. |
|  | Storage system shall be compatible with Enterprise backup solutions current in use by the VA including major versions: CommVault Simpana |
| Backup | Solution shall include all software licenses - All readable and writable Snapshots (file and block), All Replication (file and block), All Deduplication (file and block), All Clone (file and block) |
| Licenses | Shall provide support for all VMware vStorage APIs for Array Integration (VAAI), vStorage APIs for Data Protection (VADP), and vSphere API for Storage Awareness (VASA) primitives. |
| Support VMware Virtualization Environment | Solution shall provide a "single pane of glass" (GUI and/or CLI) in which a single application permits management of all major operations. |
| Storage Management Software | Storage Management software shall include creation of aggregates, volumes, and LUNs, and creation of initiator groups and file system exports |
|  | Storage Management software shall have regular updates for the life of the product. |
|  | Shall provide single Storage Management software to manage all extra small/small/medium/large storage systems (file and block). |
|  | Storage solution shall provide advanced software and all needed licenses for in depth performance monitoring, environmental monitoring, management, configuration, and trending of all storage systems.  |
|  | Contract shall have a vendor TAM (Technical Account Manager) assign, vendor PM works with VA PM during the system implementation. |
| Miscellaneous Requirements in PWS | Contract shall have a vendor TAM assigned throughout the life of the maintenance and service contract. |
|  | Proposal shall provide environmental specification in technical proposal |
|  | Solution shall include all appropriate connection adapters. |
|  | Solution shall include all appropriate cables and length. |