



## Attachment B

Definition: Scalable Storage System Acceptance Test

Solicitation Number 6400011050

### 1. SSS Acceptance Test

The SSS Acceptance Test shall comprise multiple components where the overall goal is to ensure that the system as a whole is a high-performance, scalable, resilient and reliable storage system for the OLCF-3 parallel I/O environment. The Acceptance Test shall test the system infrastructure with a combination of benchmarks, forced failures, and stability tests. This section provides an overview of the acceptance test process, where final details shall be negotiated as part of the contract award and prior to delivery of the system.

Any requirement described in the Technical Specification may generate a specific test within the negotiated Acceptance Test procedure. All metrics to be applied to the system acceptance shall be determined during contract award negotiation and prior to delivery.

Upon delivery and installation of the storage system, a series of performance, functionality, and availability tests will be performed on the storage system prior to acceptance of the storage hardware. The acceptance test will consist of the following tests:

#### 1.1. Hardware

The system shall boot and run Offeror diagnostics. All Offeror diagnostics must pass and details of the diagnostic runs shall be delineated to the Company.

#### 1.2. Block level performance

The SSS shall achieve the advertised peak in Technical Specification Section 4.6 performance using the Company provided block and Lustre level performance benchmarks.

#### 1.3. Integrated Lustre solutions

Integrated Lustre solutions shall achieve the advertised of peak in Technical Specification Section 4.6 performance using the Company provided block and Lustre level performance benchmarks.

Integrated Lustre solutions shall be compatible with the Lustre client ecosystem present within the Oak Ridge Leadership Computing Facility.

Integrated Lustre solutions shall complete Company-provided availability, reliability, resiliency, and integrity tests (including failover tests).



#### 1.4. Availability, Reliability, Resiliency, Data Integrity and Stability

##### 1.4.1. Resiliency Testing

Confirm that there are no single points of failure in the SSS. The Table below depicts some of the failure testing and target results that will be conducted. Note that this is not exhaustive and the final resiliency test will be based upon the offer.

Test	Requirement
Controller Power	Controller remains in service via alternate power supply
Tray Power	Tray remains in service via alternate power supply
Controller failure	All storage in the SSU is accessible via the second controller
Disk failure	All data on the tier is available
HCA/SAS failure on host	All storage is accessible via alternate host
HCA/SAS cable failure	All storage is accessible via alternate path (host or controller)
Storage SAS cable failure	All storage is accessible via alternate path
Storage SAS interface failure	All storage is accessible via alternate path

##### 1.4.2. Redundancy Testing

This test is aimed at confirming the redundant capabilities of the functional units of the SSS. Redundancy is expected at the disk level, controller level, internal communication fabric level, external interface level and other auxiliary sub-systems such as cooling and power. The redundancy test shall prove that these physically redundant systems can perform without an interrupt, data loss, or unavailability in case of a naturally occurring (e.g. disk sector failures, temporary or permanent communication link disconnections) or injected faults. Injected faults include but are not limited to “yank test” of disk from a disk set, ungracefully shutting down a controller, killing an internal or external communication link, and disconnecting the power line to a power distribution unit on the storage system. Under such faults the system should continue normal operation or actively and automatically transfer the active and queued tasks to the fail-over unit and be transparent to the upper level file system and the users. The system shall also generate a notification of the failure for the systems administrator(s). Failed components will then be replaced and the SSS shall fail-back to the replaced component and return to normal operating performance.

##### 1.4.3. Reliability Testing

The entire SSS shall be available and stable for a continuous operational up time of at least 21 days. The system should deliver the expected performance described herein without loss of data and/or any down



time. In the event of a hardware failure, degraded mode performance is acceptable, but shall not affect reliability and availability of the system. During this period a continuous series of tests will be performed that confirm performance and the data integrity of the system. The system must transparently detect and correct or detect and report any data inconsistencies.

#### 1.4.4. Data Integrity Testing (Block Storage and Integrated Lustre Solutions)

The following procedure will be used to validate that the SSS will detect and optionally repair silent data corruption on individual disk drives during read operations.

1. Disable background verification to prevent it from discovering any data errors.
2. Build a local file system on an exported LUN.
3. Mount the file system on a host computer.
4. Fill the file system with a known pattern using the Company provided utility.
5. Unmount the file system from the host computer to ensure all writes have been flushed to the SSS.
6. Use a vendor specific method to determine which disk drives correspond to the exported LUN under test.
7. Power down the SSS.
8. Remove one of the disk drives identified in step 6 from the array and insert it into a host computer.
9. Randomly corrupt sectors on the disk drive using the Company provided utility.
10. Re-install the disk drive into the SSS.
11. Power up the SSS.
12. Mount the file system on the host computer.
13. Verify the written pattern is correct. During this test, watch the logs and/or other vendor supplied reporting mechanism for a report of the data integrity error.
14. (Optional) If data integrity errors are automatically repaired, re-perform step 13 and ensure that the errors are not repeated in the reporting mechanism.

#### 1.4.5. Rebuild Performance (Block Storage and Integrated Lustre Solutions)

To minimize the risk of data-loss the time required to recover from a single disk failure must be less than 12 hours with no more than a 70% performance degradation of the RAID set with the failed disk.

### 1.5. Performance Test

The performance capabilities shall be tested for the performance requirements described in the Technical Specification Section 4.6.

The Company will run performance tests to verify that the hardware is performing as expected. A series of tests that measure sequential and random performance will be performed. Furthermore, the performance during rebuild and rebuild times will be measured. All tests will be conducted with the SSS



configuration approved by the Company and will be based on the expected normal operational configuration settings.

#### 1.5.1. SSS Performance

The aggregate bandwidth of the SSS shall be demonstrated utilizing the Company provided I/O benchmark. Both sequential and random read/write bandwidth performance will be demonstrated. Bandwidth will be demonstrated over a range of I/O request sizes. Peak performance will be demonstrated at 1MB request size. Read/IOPs performance will be demonstrated using random 4K read/write requests.

#### 1.5.2. SSU Performance

Demonstrate that all SSUs have the same performance and that performance scales linearly as additional SSUs are added to the SSS up to the peak aggregate SSS performance.

#### 1.5.3. Degraded Mode Performance (Block Storage and Integrated Lustre Solutions)

The performance tests will be repeated while the system is in a degraded mode of operation a number of LUNs degraded (double disk failure + RAID set rebuild process). The system must sustain a performance greater than 70% of the normal (healthy) performance for both individual and aggregate measurements.