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# Enterprise Data Sheet Technology Vendors

Key Benefits

Ultimate collaborative testing solution that improves team productivity:

- Novice and expert users can leverage the power of Storage Load Testing

- Tests and results can be shared within and across teams with a centralized view

Get the most out of your performance engineering, QA and support teams.

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> *Storage technology vendors can actually test their systems with SLTs that closely model realworld applications and determine the strengths and weaknesses of their networked storage arrays.*
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> **Colin Hutchinson**
> Test Architect
> Oracle

Storage Load Testing

The industry's only collaborativeSLT acquisition, modeling, and performance validation solution for storage technology vendors.
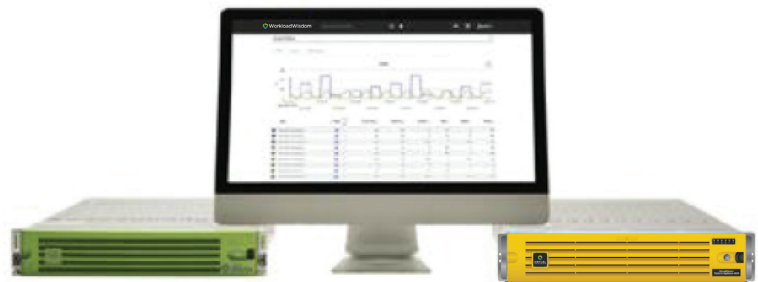
Storage Load Testing is a browser-based software solution that provides advanced SLT profile acquisition, simplified SLT modeling, comprehensive test administration, and a detailed performance reporting framework.

Available as part of an integrated appliance or as a virtual machine, Storage Load Testing offers a shared performance testing and validation platform that can be leveraged by QA, support, field, performance and development engineers.

Storage Load Testing is used to analyze production SLTs, create SLT models, and then administer the generation of highly realistic simulated SLTs against any file, block, or object storage target via Storage Load Testing SLT Generators. Its intuitive, web-based GUI is built for all user levels to provide an advanced networked storage performance validation solution that incorporates a sophisticated SLT modeling methodology.

Storage Load Testing controls multiple load generators that groups of users can utilize on a global or local basis. Intuitive to use, Storage Load Testing comes pre-configured with a test platform, protocol test suites, and test content.

Storage Load Testing offers two primary benefits:

- Deeper understanding of storage system behavior through its highly realistic and granular SLT modeling. This results in finding performance and scalability issues faster and a more comprehensive characterization of storage system performance.

- Superior testing and engineering productivity due to its simple user interface, automated testing, and highly collaborative environment. It dramatically simplifies the manageability of the testing resources and the overall performance testing process.

Storage Load Testing provides:

- A simple interface for acquiring SLT profiles from production systems, and configuring and running complex performance validation scenarios that complements your existing Test Development Environment (TDE) in the lab

- A convenient and effective way to share Storage Load Testing generators, ports, and test content with all results in a centralized repository

- A centralized way to manage and track testing resource usage by individuals and teams

- An easy methodology to characterize production SLTs with high fidelity and analyze test results.
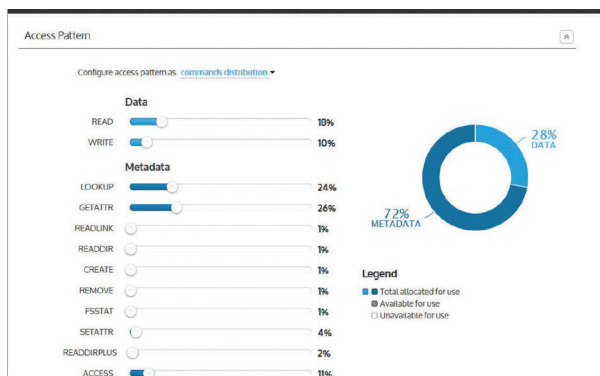

Figure 1: Storage Load Testing SLT modeling web-based GUI to specify access patterns.

Attaining a Deeper Understanding of Storage System Behavior

Storage Load Testing offers a variety of facilities to enable an in-depth understanding of storage system performance behavior and limits that is unparalleled in the industry. In addition to our ability to perform extreme load generation to massive scale, key capabilities include the SLT Iterator, the ability to generate Composite SLTs, support for advanced test beds, the ability to generate compressible and deduplicable data content streams, and support for industry leading SLT profile acquisition and analysis solutions.

The SLT Iterator

The SLT Iterator is a powerful feature of Storage Load Testing that finds breaking points (blind spots) and optimal SLTs (sweet spots) in storage arrays. It is built on top of a sophisticated high-fidelity networked storage SLT model, allowing users to easily automate iterations over hundreds of parameter permutations that define many different characteristics of application and protocol SLTs. These characteristics include block sizes, read vs. write percentages, sequential vs. random percentages, number of files and folders (NAS), LUN hot spots (SAN), load profiles, deduplication and compression ratios, FC queue depth, and more.

Running the SLT Iterator

Once the Iteration suite is defined, the SLT Iterator will automatically execute every permutation, and provide the user with a summarized real-time report. Each permutation runs independently, and the permutations are executed sequentially one by one until all permutations are completed.

During run time, a summary table is presented in real-time allowing the user to monitor the progress and the key performance indicators such as throughput, IOPS and latency for each iteration. In addition, the user has the ability to view a detailed dashboard by clicking on the status of a particular iteration, giving full insight to each permutation.
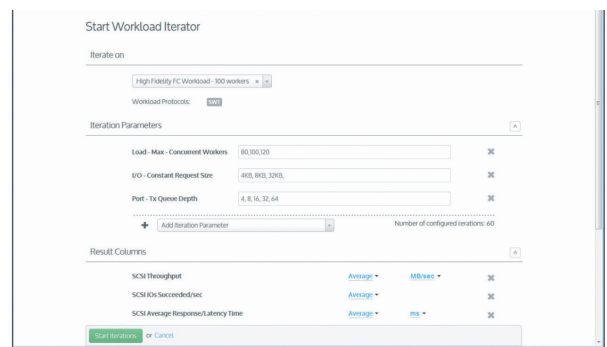

Figure 2: Set-up GUI to configure 60 iterations of varying concurrent workers (sessions), request size, and queue depths

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# ↑	Status	Duration	I/O - Constant Request Size	Access Pattern - Read %	I/O - Pattern - Random %	SCSI Throughput (average)	SCSI IOs Succeeded/sec (average)	SCSI Average Response/Latency Time (average)
1	Finished	01:00	4KB	0	20	315.6 MB/sec	80483.196	1.1 ms
2	Finished	00:59	4KB	0	50	314.7 MB/sec	80250.466	1.2 ms
3	Finished	01:00	4KB	20	20	355.1 MB/sec	90550.401	1.2 ms
4	Finished	01:00	4KB	20	50	355.0 MB/sec	90531.437	1.5 ms
5	Finished	01:00	8KB	0	20	539.4 MB/sec	68913.79	1.2 ms
6	Finished	01:00	8KB	0	50	539.4 MB/sec	68901.995	1.4 ms
7	Finished	00:50	8KB	20	20	610.3 MB/sec	77966.048	1.3 ms
8	Finished	01:00	8KB	20	50	622.1 MB/sec	79471.78	1.7 ms
9	Finished	00:54	16KB	0	20	646.2 MB/sec	41319.51	2.1 ms
10	Finished	00:57	16KB	0	50	645.3 MB/sec	41258.716	2.2 ms

Figure 3: Portion of summary table showing real-time storage testing results including key performance metrics for each SLT iteration.

Composite SLT Editor

Taking a leap from traditional SLT benchmarking methods that are based on freeware tools, where storage protocols are validated one at a time, independently, the Storage Load Testing Composite SLT feature allows the user to create many different SLTs, across different storage protocols, and run them all at the same time against the storage infrastructure. This results in a much more realistic and holistic emulation of production environments, such as commonly found in virtualized infrastructures.
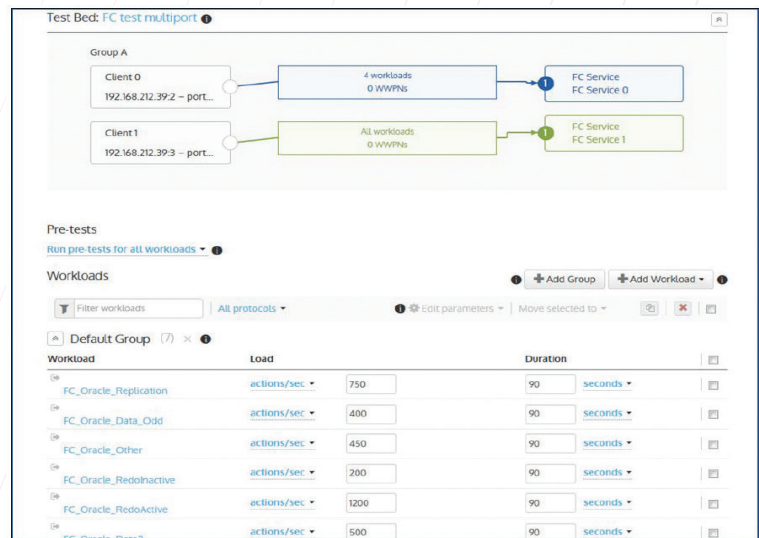

Figure 4: Sample Composite SLT Editor configuration screen, with a multi-LUN Oracle DB key performance metrics for each SLT iteration.

Advanced Test Beds

Storage Load Testing supports an advanced Test Bed facility where one can easily create multi-protocol Test Beds. This also supports the ability to run SLTs across multiple test ports. It also supports the Test Bed Extractor utility, which enables running imported TDE Projects over different Test Beds by automatically extracting information relevant to a Test Bed (e.g. source address(es), destination address(es), Shares, LUNs, etc.) from the imported TDE Project.

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> Using Storage Load Testing has improved our testing coverage, reduced our testing time, and eliminated the need to buy additional servers.
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> **Terry Schwartz**
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> QA Manager
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> F5 Networks

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> Storage Load Testing can simulate the faster and badder client — it's great, like turning on a fire hose.
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> **Colin Hutchison**
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> Test Architect
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> Oracle

Compression and Deduplication

Fiber Channel and iSCSI SLTs support simple testing of data compression and deduplication with three simple parameters: compression percentage, deduplication percentage and the number of unique duplicates. Storage Load Testing calculates the complex data compression percentages and data replication algorithms behind the scenes and generates compressible and deduplicable data content patterns.

SLT Acquisition and Analysis

There are two key modules that help storage professionals understand their current production SLT profiles to better understand performance requirements:

Storage Load Testing SLT Data Importer module

The SLT Data Importer software module of Storage Load Testing imports most production array I/O data exported from storage array tools and other performance monitoring tools for SLT profiling, simplifying the SLT modeling and creation process. Examples of array data that is useful for SLT profiling include: read/write ratios, random/sequential request mix, data/metadata command mix, and IOPS over time. The SLT Data Importer provides out-of-the-box policies for most major storage vendors and allows users to add profiles for new vendors.

SLT Analyzer module

Before now, there was no fast and simple way to analyze and characterize production SLTs and their changing behaviors. The Storage Load Testing SLT Analyzer is a software module of Storage Load Testing that allows storage engineers to analyze temporal SLT behavior via powerful visualization to understand SLT I/O patterns that affect storage performance. The SLT Analyzer processes the data from both the SLT Data Importer and or VirtualWisdom Performance Probes. It creates a detailed SLT profile that can be used
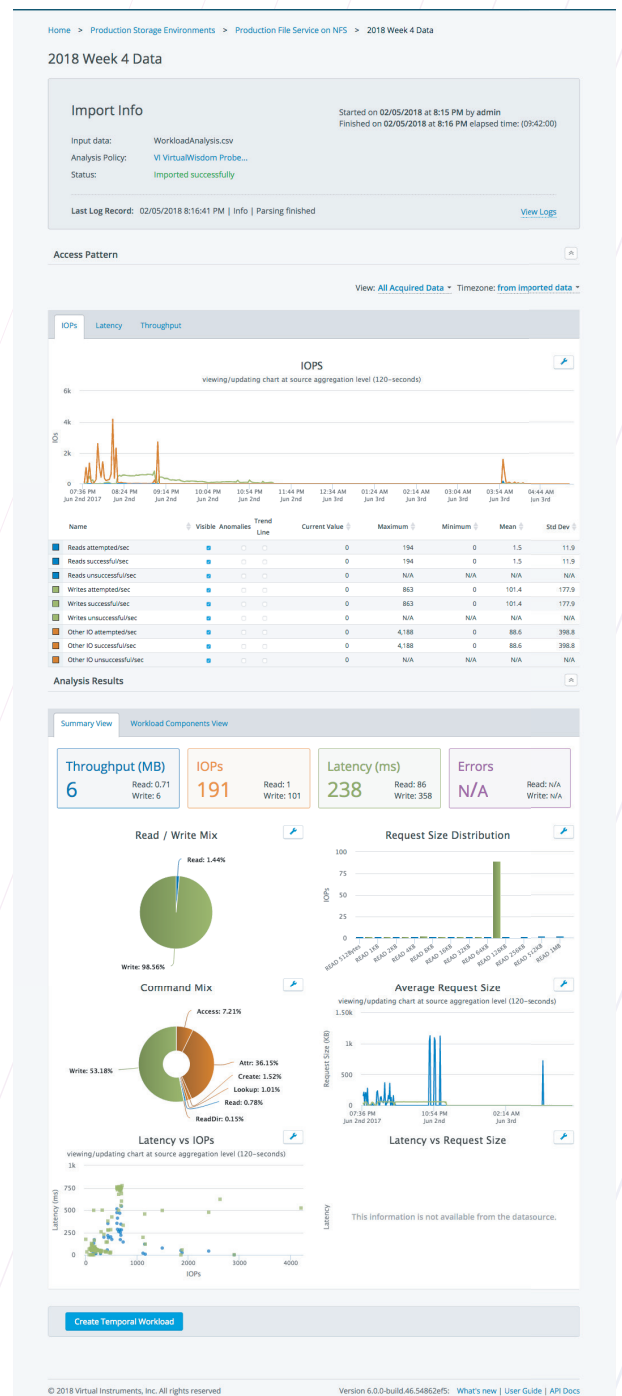

Figure 2: SLT analyzer example; access pattern, IOPS over time.

Superior Testing and Engineering Productivity

Storage Load Testing dramatically increases the testing productivity of QA, performance and development engineers. Customers typically run 10X more tests when using Storage Load Testing as opposed to relying on freeware tools and the stacks of servers that are time-consuming to configure, maintain and analyze. In addition to the productivity-enhancing SLT Iterator described above, Storage Load Testing offers the following features.

Choice of Standard Output Views

You may choose to view reports as a summary table a time-based line graph, or as a histogram.
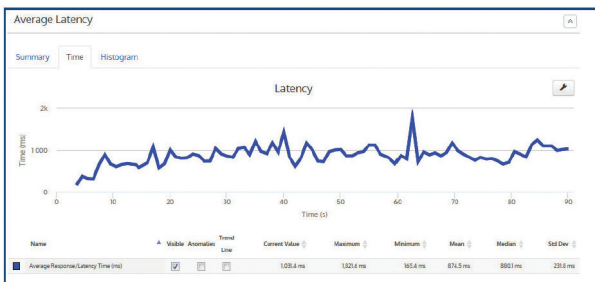

Figure 8: Example above of time-based graph, response time delivered by the storage array / infrastructure to I/O requests
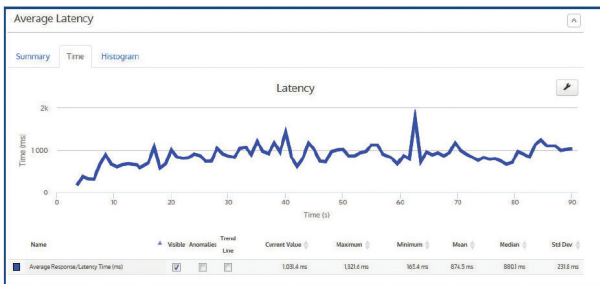

Figure 7: Example above of summary table, response time delivered by the storage array / infrastructure to I/O requests
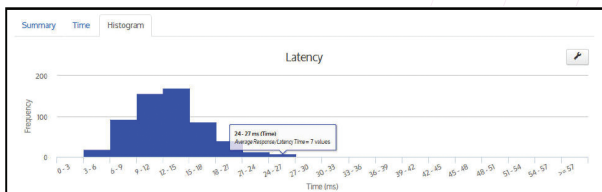

Figure 9: Example of a response time histogram delivered by the storage array / infrastructure to I/O requests

Simple Collaboration

Share Storage Load Testing resources such as SLT generators, ports, tests, and test results with specified groups or individuals based on their role within the organization. Access to specific resources and tests can be dynamically determined to support higher levels of security and efficiency. Such functionality allows team members to work more effectively with each other and increase the ROI in Storage Load Testing SLT Generators.

Sample SLT Models

Pre-configured Protocol SLT Models Library

The following sample SLT models are shipped with Storage Load Testing: iSCSI, FC, NFSv3, NFSv4.1, SMB2.0, and Object storage. These SLT models allow users to define and control key I/O access patterns with a simple web interface, and deploy them to a test bed. All SLT models support the ability to specify I/O characteristics for Read and Write operations independently and select Data Content in the payload.
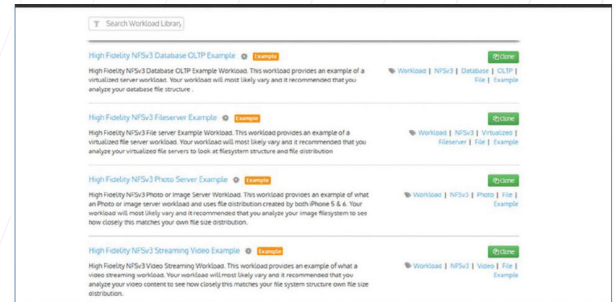
Pre-configured Application SLT Models Library

Storage Load Testing provides a set of customizable SLT models that are characterized and preconfigured for specific applications, such as OLTP, VDI, and various NFS and SMB SLTs including OLTP database, fileserver, photo server, streaming video, Linux server, Windows server, and webserver. Such valuable assets allow users to generate realistic SLTs without the need to do extensive research and manual data collection.

High Fidelity SLT Models

Storage Load Testing supports a granular way to model SLTs. In addition to varying the command mix, the solution also supports the ability to model directory structures, file size distribution, folders, block size distribution (figure 10) and I/O direction.

Simple Test Execution

Load, run and configure tests with a simple "push button" interface. Storage Load Testing allows storage and network administrators to configure and execute tests without requiring protocol expertise or proficiency with the Test Development Environment (TDE).
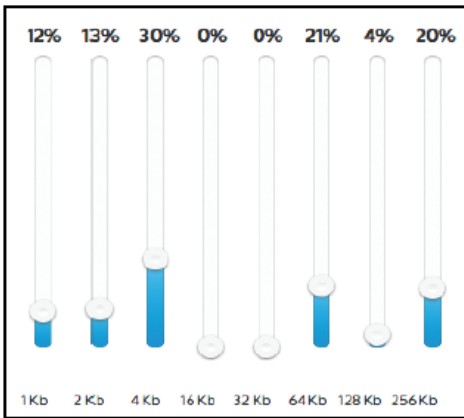

Figure 11: Easily model block size distributions with slider bars

Historical Data Capture and Presentation

Recall any output results and statistics from previous test runs for comparison and analysis.

Preconditioning SLT for Flash

Ensures you are testing a seasoned array and avoids getting artificially fast read results.

Test Lab Administration

Create and save configurations (network profiles) for test beds, devices under test, etc. Simply deploy their tests to pre-configured test beds, and allows network administrators to enforce network constraints, lowering incidences of IP space conflicts, VLA congestion, and other potential conflicts.

Batch Mode with Pass / Fail Conditions

Launch an execution of test series governed by logical conditions. Allows users to efficiently execute batteries of tests, sequentially or in parallel, which is common in regression testing.

Automation

Control all shared resources from a web service API. Allows for easy integration of Storage Load Testing into a test automation harness and also integrates with build servers.

Usage Tracking

Administrators of Storage Load Testing SLT Generators can now see periodic metrics on actual usage of each device or groups of devices such as: port utilization, number of tests actually used, test duration, and total port hours. Ensures generators are being used to their full capacity.
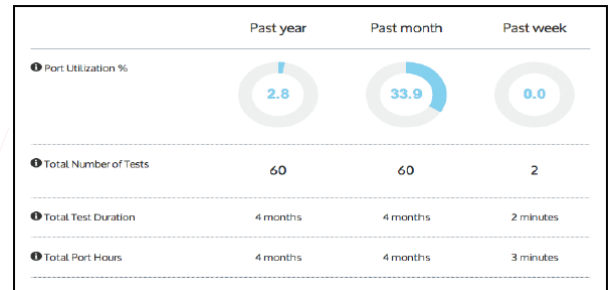

	Past year	Past month	Past week
Port Utilization %	2.8	33.9	0.0
Total Number of Tests	60	60	2
Total Test Duration	4 months	4 months	2 minutes
Total Port Hours	4 months	4 months	3 minutes

Figure 12: Administration screen of appliance usage tracking

Deployment Options

Storage Load Testing is available in two implementations: Pre-configured for superior performance and stability for faster time to value or as a Virtual Machine for flexible deployments.

Licensing and Supportive Platforms

Each Storage Load Testing SLT Generator, whether physical or virtual, requires activation. Every Storage Load Testing SLT Generator that Enterprise manages requires an add-on software license. Storage Load Testing works with all Storage Load Testing SLT Generators, including the Storage Load Testing 1G Series, 10G Series, FC series, Unified Series, Enterprise Series, and Virtual Series. For more information on these products, please refer to the Product datasheet.

Required products

SLT Generators

SLT Generators are used to generate traffic based on SLT models and access patterns that have been configured by Storage Load Testing software. There are both hardware and virtual versions of the appliances. The hardware appliances are purposebuilt 2RU devices with a software and hardware architecture that has been specifically engineered to cost- effectively generate massive traffic loads that can test the performance and scalability limits of any storage subsystem, including the highest-end all flash or hybrid storage systems.

Performance Probes

VirtualWisdom Performance Probes are hardwarebased monitoring devices that enable storage engineers and operations teams to capture network traffic and statistically analyze the SLTs in realtime. Using optical TAPs on 10G Ethernet and 8/16G Fibre Channel, this data can be captured and the SLT Analyzer module of Storage Load Testing to generate a highly accurate SLT for replay in a test lab. This capture/ analyze/ replay capability will dramatically accelerate storage performance problem identification and resolution.

Storage Load Testing Architecture
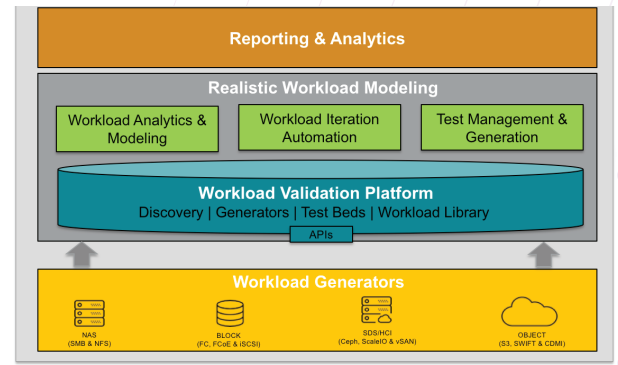
About Storage Load Testing

Storage Load Testing empowers storage and network technology vendors with the insight they need to maximize the performance, scalability and reliability of their products. Storage Load Testing accelerates time to market and helps prove the value of your products to prospective customers. Addressing file, block, and object storage performance validation, Storage Load Testing SLT Generators and software products have the unique ability to stress today's most complex flash and hybrid storage systems to their limits.

Select Storage Load Testing Technology Vendor Customers