



# WorkloadWisdom Storage Performance Validation: Fundamental to your Change Management Process

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Virtual Instruments offers a comprehensive storage testing and validation solution for SAN, NAS and object storage that is unmatched in the industry. A single 2U appliance can replace racks of servers, hundreds or even thousands of virtual machines (VMs) and loads of customized scripting. With WorkloadWisdom (formerly known as Load DynamiX) storage performance validation appliances, IT operations, storage engineering, performance and QA teams can better understand performance problems and scaling limitations by showing how changes to storage and network product configurations and feature sets impact overall performance. The WorkloadWisdom appliances are easy to deploy, and include pre-built test templates within the user interface that improve testing productivity and efficiency right out-of-the-box.

## WorkloadWisdom Performance Validation

VI has various appliance configurations for Ethernet or Fibre Channel-based storage to help customers answer a few seemingly simple, but in reality, complex questions:

- What storage technology is best for each of our business applications – e.g. Flash, hybrid systems, NFSv4, OpenStack, CEPH?
- Which vendor and/or product is best for each of our workloads?
- Can I benchmark before going live and verify all connections, configurations and ports?
- Will patches, firmware and OS updates degrade performance, cause outages or will they fix issues?

These key questions and more can be answered from testing with the Load DynamiX Enterprise platform.

The WorkloadWisdom platform provides comprehensive storage workload modeling and performance validation, enabling storage architects, IT operations personnel and storage engineers to optimize the performance, availability and cost of the storage infrastructure. The platform supports all file, block and object storage protocols and is comprised of two components: the WorkloadWisdom software and the Performance Validation Appliances for extreme storage load testing.

The WorkloadWisdom application uses a Web-based GUI and is a comprehensive test management platform that includes simplified workload modeling and a rich set of performance analytics. The validation appliances are purpose-built load generators that are capable of executing complex traffic emulation at extreme loads. With WorkloadWisdom's broad protocol coverage, detailed performance emulation of storage protocols provides accurate emulation of workloads across any file, block and object storage system.

## **Change Management and Validation**

One of the best use cases of VirtualWisdoms' capability is in the realm of change management. Every time an application changes, a switch is updated or a storage system is modified, performance can be negatively affected. Nearly every IT operations manager has a nightmare story of when a software update was introduced prematurely into production and negatively affected or brought down a key business application. Being able to automate and validate the effect on latency of application upgrades, changes, and firmware updates on the networked storage infrastructure before putting them into production allows the operations team to mitigate risk, assure consistent performance and save time performing manual tests.

Take for instance, determining the optimal queue depth setting for a Fibre Channel host bus adapter. The size of the queue depth can have a significant impact on IOPs, throughput and latency. The default queue depth for at least one leading HBA vendor changed from 32 to 64 in ESX/ESXi version 5. Do you accept that new value or test for its effect on performance? What if you changed the block request size at the same time? With Load DynamiX, testing such potential changes are fast and simple. An example follows the illustration.

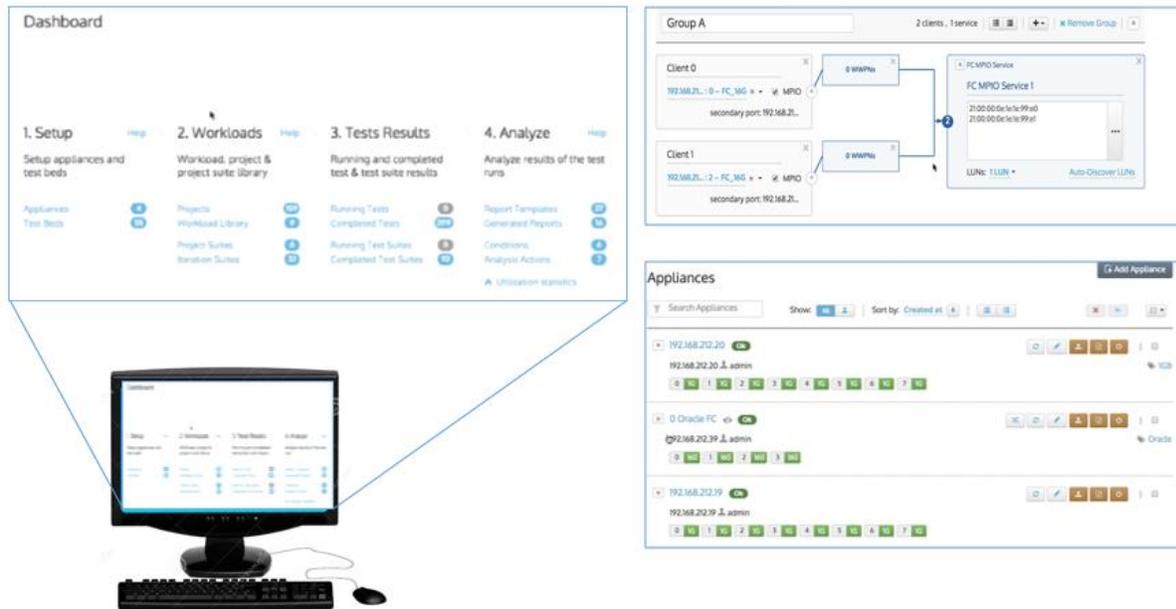


Illustration clockwise from top left:

- The WorkloadWisdom main dashboard, from which all functions are available ... test set up, execution, reporting, analysis, and collaboration. All functionality is available without scripting.
- Test bed setup, graphically showing the relationship between two Load DynamiX appliance ports and the system under test.
- WorkloadWisdom appliance setup, graphically showing the status of each port on the appliance.

From the WorkloadWisdom graphical user interface on the next page, in the Workload Library, the user selects a pre-built Fibre Channel workload and chooses the parameters that match the application(s), such as I/O writes, request size, MPIO type, number of concurrent I/O requests and test duration. This creates an accurate representation of your production application workloads.

✕ Workload ✕ abc ✕ eru

Access Pattern ⌵

CDB Length: (10) ⓘ

Data: Read **92%**  **8%** Write ⓘ

Writes ⌵

Configure Write Pattern as: ⓘ

Random **100%**  **0%** Sequential ⓘ

Sequential I/O Direction: forward ⓘ

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Use bin distribution of request sizes, with custom bins ⓘ

0% 0% **37%** **50%** **13%** 0% 0% 0%

Set slider maximum to: 100% ⌵

■ Allocated: 100%

■ Available for use: 0%

Update Project
Save a copy
or Cancel

A profile that emulates the workload of the application and then iterates the test over various queue depths could be generated. Block sizes were also altered since block size may have an impact on bandwidth and IOPs (variables in the grey columns below).

## VMware Queue Depth Defaults

Finished

Started by admin

34:0000:00

Last Log Record: 2015-02-18 8:35:39 AM | Success | Test Suite finished [Logs](#)

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**Iteration Results** Export to CSV

#	Status	Duration	Port - Tx Queue Depth (FC only)	I/O - Constant Request Size	SCSI Throughput (average)	SCSI I/Os Succeeded/sec (average)	SCSI Average Response/Latency Time (average)	SCSI CDB_WRITE10 - Average Response/Latency Time (average)	SCSI CDB_READ10 - Average Response/Latency Time (average)
1	Finished	02:16	16	4KB	1,634.0 MB/sec	416684.843	0.10 ms	0.1 ms	0.09 ms
2	Finished	02:16	16	8KB	2,875.1 MB/sec	367297.653	0.1 ms	0.1 ms	0.09 ms
3	Finished	02:16	16	16KB	4,317.1 MB/sec	276028.195	0.1 ms	0.2 ms	0.1 ms
4	Finished	02:16	16	32KB	5,203.8 MB/sec	166441.937	0.2 ms	0.3 ms	0.2 ms
5	Finished	02:16	16	64KB	5,636.9 MB/sec	90167.845	0.5 ms	0.5 ms	0.4 ms
6	Finished	02:16	32	4KB	1,718.9 MB/sec	438320.621	0.09 ms	0.10 ms	0.09 ms
7	Finished	02:16	32	8KB	3,002.8 MB/sec	383605.894	0.1 ms	0.1 ms	0.1 ms
8	Finished	02:16	32	16KB	4,474.8 MB/sec	286107.644	0.1 ms	0.2 ms	0.1 ms
9	Finished	02:16	32	32KB	5,221.6 MB/sec	167010.614	0.2 ms	0.3 ms	0.2 ms

In the resulting test table, you can sort by any column heading and you can quickly see what combination of queue depths and block sizes result in the optimal Key Performance Indicators (KPIs), for this application on this array. KPIs are to the right of the grey columns. These results are maintained in the Results Library so future changes can be compared with these new baseline results.

For simple, single tests, results are displayed in real-time via a simple-to-understand and customizable graphical table output. The most useful results typically include the charts on latency, throughput and IOPS that enable visual analysis of different load parameters, access patterns, file structures and configurations.

Performance profile testing like we show above, sometimes called ‘4-corner testing’ or benchmarking, is done in order to fully characterize the behavior of a storage system under a large set of workload conditions. This iterative testing will provide a map of the behavior of the storage system – making it easy to understand the strengths and weaknesses of the array and which workload attributes, and changes, most directly affect performance. From a single command, it’s easy to de-risk changes by simulating workflows, allowing the user to iterate many various workload characterization attributes including I/O load profile, block size, command mix, queue depth settings, etc..

With traditional workload benchmarking methods, workloads and storage protocols are typically validated one at a time, independently, or with a significant amounts of custom built scripting. With Load DynamiX Enterprise, users can create many different workloads, across different storage protocols, and run them all at the same time. Because this legacy method is so time-consuming, it’s not uncommon to just make changes in production and wait to see if the users complain. The WorkloadWisdom approach is simple, accurate and fast, and results in a realistic and holistic emulation of the performance impact of changes to production environments.

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*With WorkloadWisdom, change management – the effect that patches, firmware updates, OS updates, and hardware or configuration changes have on performance -- can be measured and analyzed pre-production. This greatly reduces the risk of problems for the operations teams when making changes and enables periodic regression testing to be done.*

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## Our Take

Virtual Instruments provides a combined software and hardware performance testing and validation solution that includes both pre-defined and customized storage workload modeling and load generation. With the ability to accurately emulate real-world application workload behavior, WorkloadWisdom enables operations personnel, storage engineers and architects to make intelligent deployment decisions regarding networked storage infrastructure. To better meet the needs of IT customers, Virtual Instruments, then called Load DynamiX, developed and released the WorkloadWisdom solution. The primary objective with WorkloadWisdom is to deliver a performance validation toolset for IT organizations that makes it easier to model workloads, create test cases and evaluate results.

Based on experiences gained as the storage performance validation standard for storage vendors, the new WorkloadWisdom solution leverages this easy-to-use software platform with an intuitive Web-based GUI. The Performance Validation Appliance solution is capable of testing the performance of even the largest all flash storage arrays in the industry.

The technology is exceptional, but it is the business benefits that provide the most value to storage planners. The WorkloadWisdom solution lowers storage costs, mitigates business risk and increases storage staff productivity while avoiding incremental lab expenses. These benefits contribute directly to a company's bottom line and justify the investment in the solution. ●

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