

Datasheet

IT Organizations

STORAGE PERFORMANCE VALIDATION SOLUTIONS FOR IT ORGANIZATIONS

Comprehensive workload modeling and load generation to optimize storage performance and cost

As the Gold Product of the Year, Load DynamiX is used by Global 2000 IT organizations for its unique ability to generate massive, realistic application workloads that stress networked storage infrastructure to its limits.

Load DynamiX combines an intuitive storage workload modeling application with a purpose-built load generation appliance that helps storage architects and engineers fully characterize performance and determine storage system limits before purchase decisions are made and new technology is deployed.

Why Use Load DynamiX?

Load DynamiX customers deploy our solutions in their preproduction environments to:

- Evaluate the best shared storage technology for your business,
- Determine the best storage vendor / product for each of your workloads,
- **Optimize your storage configurations** and eliminate over and under provisioning,
- Benchmark performance and validate connectivity before going live, and
- Validate that infrastructure updates won't impact performance and availability.



Use the Gold Standard

Load DynamiX won the **"Product of the Year"** Gold award in the storage management category by Storage Magazine in 2014





Load DynamiX Product Benefits

Customers who adopt Load DynamiX as the foundation of their storage performance and change validation process enjoy important benefits:

- Performance assurance: Assure chosen storage solutions will meet performance SLAs under their specific workloads.
- Storage cost optimization: Reduce over-provisioning and choose the lowest cost storage system for each workload; quantify the benefit and effects of flash/SSDs, deduplication, compression, and tiering.
- Risk mitigation: Identify problems in the dev lab prior to production deployment; validate all infrastructure changes against workload requirements and troubleshoot more effectively by recreating failureinducing workload conditions.
- **Faster application roll-outs:** Validate new applications to make deployment decisions faster and more confidently.

Performance Validation Solution Overview

How does Load DynamiX work?

With Load DynamiX, storage engineers, architects and managers can confidently answer this simple question before live deployment: How will my storage perform in production? This is accomplished via 2 testing methodologies.

Performance Profiling

Using configurable workloads for any file or block protocol, fully characterize the behavior of a storage system under a wide variety of loading conditions. Identify the strengths and weaknesses of each array and quantify the headroom for each configuration.

Workload Modeling

Guided by what you learned from the performance profiling, create accurate emulations of storage workloads by gathering storage traffic data and analyzing storage statistics from your production arrays. Or use Load DynamiX sample workloads.

Evaluating and assessing storage infrastructure needs to be an ongoing process. The ideal solution is a workload modeling and simulation product that is purpose built for the task, such as Load DynamiX."

> George Crump President Storage Switzerland





Figure 1. The solution includes Load DynamiX Enterprise workload modeling software combined with a 2U load generation appliance.



Load DynamiX Test Methodologies

Two test methodologies for storage infrastructure

Methodology 1: Performance Profiling

The objective of intelligent performance profiling is to fully characterize the behavior of a storage system under a large set of workload conditions. This method is sometimes referred to as "four corners testing" or "sweet spot / blind spot analysis" or "multi-dimensional benchmarking". Doing so provides the storage engineer with 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 most directly affect performance. Engineers can then use this information to optimally match their workloads to storage systems.

Fibre channel performance		rivacy Filvace
440 tests		
× fc) [× demo]		
Iterate on		
Test High Fidelity FC Workload	~ *	
Test High Fidelity FC Workload Project Protocols: FC SCSI		
Project Protocols: FC SCSI		۲
Test High Fidelity FC Workload Project Protocols: FC SCSI Iteration Parameters Access Pattern - Read %	0, 20, 40, 60, 80, 100	×
Test High Fidelity FC Workload Project Protocols: FC SCSI Iteration Parameters Access Pattern - Read % I/O - Constant Request Size	0, 20, 40, 60, 80, 100 4KB, 8KB, 16KB, 32KB, 64KB	×
Test High Fidelity FC Workload Project Protocols: FC SCSI Iteration Parameters Access Pattern - Read % I/O - Constant Request Size Port - Tx Queue Depth (FC only)	0, 20, 40, 60, 80, 100 4KB, 8KB, 16KB, 32KB, 64KB 1, 2, 4, 8, 16, 32, 64, 128	× × ×
Test High Fidelity FC Workload Project Protocols: Iteration Parameters Access Pattern - Read % I/O - Constant Request Size Port - Tx Queue Depth (FC only) Load - Throughput Value	0, 20, 40, 60, 80, 100 4KB, 8KB, 16KB, 32KB, 64KB 1, 2, 4, 8, 16, 32, 64, 128 1MB, 5MB, 10MB	× × × ×

Figure 2. Input screen of Load DynamiX Enterprise Workload Iterator; testing for the effect of various parameters on performance.

In the Load DynamiX Enterprise interface, this methodology is enabled by an iteration workflow (input screen in figure 2) that allows the user to iterate on any of the many workload characterization attributes exposed by Load DynamiX workload models (examples include: load profile, block size, command mix, queue depth settings, etc). The workflow can result in a suite of tests that stress the storage system under hundreds or even thousands of workload configurations, with automated test execution, aggregation of data and presentation of results (see figure 3).



-	Fibre channel performance Fir							nished		
1 L	:00:05:19 .ast Log Re	cord: 2015-0	01-26 11:38:3	5 AM Suc	cess Tes	t Suite finished	i			00:00 Logs
ltera	tion Resu Status	lts 🛃 Expo	Access Pattern	I/O - Constant	Port - Tx Queue Depth	Load - Throughput	Data Reduction - Uncompressed	SCSI Throughput	SCSI IOs Succeeded/sec	SCSI Average Response/Latency
			- Read	Size	(FC only)	Value	ratio	(average)	<u>(average)</u> ↓	Time (average)
48	Finished	01:01	0	4KB	128	10MB	1.5	8.3 MB/sec	2115.387	2.6 ms
47	Finished	01:00	0	4KB	128	10MB	2	8.0 MB/sec	2044.602	2.7 ms
42	Finished	01:00	0	4KB	64	10MB	1.5	7.5 MB/sec	1921.051	3.5 ms
41	Finished	01:00	0	4KB	64	10MB	2	7.2 MB/sec	1837.487	3.9 ms
36	Finished	01:00	0	4KB	32	10MB	1.5	6.5 MB/sec	1663.073	4.3 ms
288	Finished	01:00	20	4KB	128	10MB	1.5	6.5 MB/sec	1657.239	6.5 ms
35	Finished	01:00	0	4KB	32	10MB	2	6.3 MB/sec	1612.252	4.5 ms
282	Finished	01:00	20	4KB	64	10MB	1.5	6.2 MB/sec	1586.806	6.8 ms
281	Finished	01:00	20	4KB	64	10MB	2	6.1 MB/sec	1554.01	7.1 ms
287	Finished	01:01	20	4KB	128	10MB	2	6.1 MB/sec	1545.593	6.7 ms

Figure 3. Extract of output report of Iterator function, showing effect of access pattern, block size, queue depth, load throughput, and data reduction ratio on key performance metrics

Methodology 2: Workload Modeling

When creating a workload model, users can characterize their existing or planned application workloads. For situations where an existing production environment can serve as reference, a precise workload model can be derived directly from production storage systems. There are two approaches available. One can extract statistical data about your I/O profile using vendor-provided (.nar, .bpt, perfstats, etc) or open source tools such as NetStat and NFSstat. These tools provide statistics on command mix (read/write, data/metadata, sequential/random) and file/block size distributions that can be used to create a highly accurate workload model. An alternative approach is to capture and process actual production traffic using tools such as Wireshark, an open-source packet analysis tool that generates PCAPs (packet captures) in real-time. To understand storage infrastructure performance in new "greenfield" situations where production statistics don't exist, Load DynamiX offers a growing library of preconfigured workload models.





Figure 4. Configuring an access pattern using the Load DynamiX Enterprise storage workload modeling solution.

Once a workload model is created via statistics collected from production storage systems or via PCAPs, users can customize those models and vary workloads under a variety of conditions. Workload models allow for easy, yet powerful configuration of I/O access patterns, including control of command mix distributions, directory structures, file sizes and block/chunk size distributions. Precise distribution of metadata commands, unique to Load DynamiX, is key to accurately reflecting real-world, file-based workloads. Load DynamiX also generates reducible data content patterns that can test vendors' compression and de-dupe implementations, which is critical to evaluating flash storage. Workload modeling is accomplished with simple to use slider bars that enable quick 'what-if' scenarios of 'apples to apples' comparisons of different products, technologies or configurations.

Running Tests

With the Load DynamiX Enterprise performance profile or workload model in place and test scenarios defined, the tests can then be executed with one of the Load DynamiX load generating appliances (see figure 1). The appliances are purpose-built devices with a high-performance real-time software and hardware architecture that has been specifically engineered to cost-effectively generate massive traffic loads that can characterize the performance and determine the scalability limits of any storage subsystem over Ethernet or Fiber Channel storage networks.



The Ethernet based appliances come in a variety of configurations that currently support up to eight 1Gb Ethernet ports (1G Series) or up to eight 10Gb Ethernet ports (10G Series). Each appliance can be used to generate traffic for NFS, CIFS/SMB, iSCSI, HTTP/S, CDMI, S3, or OpenStack Swift workloads. The Fibre Channel based appliance, the FC Series, currently supports up to eight 16/8/4Gb Fibre Channel ports. The Unified Series appliance supports a combination of 10G and FC ports. All appliances include Load DynamiX Enterprise.

Analyzing Results

Once the tests have been run, you can visualize the results in real-time or at a later period via a simple to understand graphical output. Load DynamiX Enterprise collects thousands of metrics every second and has extensive reporting capabilities. The most useful results typically include the charts on latency, throughput and IOPS that enable the visual analysis of different load parameters, access patterns, file structures and configurations. As the screen shots below illustrate, making comparisons of the results is very easy. Leveraging performance data to make product and configuration deployment decisions is the key to maximizing storage system ROI.



Figure 5. Load DynamiX Enterprise showing a latency comparison report.

Load DynamiX puts us in the driver's seat when it comes to our storage roadmap and cost structure."

Justin Richardson Senior Storage Engineer Go Daddy





IT Solution Bundles

The table below lists the Load DynamiX product bundles available for IT organizations.

IT Solution Bundles (based on a 2U Chassis)	Protocols Included	Performance Data
 1G Series 8 ports of 1GbE 	NFSv3, SMB2.0, iSCSI	Single Port: 1.9 Gbps 8-Port: 14 Gbps
 10G Series Base Solution 2 to 8 ports of 10GbE 10G BASE-T or SFP+ 10G Series Advanced Solution 	NFSv3, SMB2.0, iSCSI	2-Port: 35 Gbps
 2 to 8 ports of 10GbE 10GBASE-T or SFP+ 	NFS v3/v4, SMB2.0/3.0, iSCSI, HTTP, HTTPS, CDMI, OpenStack Swift and Cinder, Amazon S3	8-Port: 140 Gbps
 FC Series Solution 2 to 8 ports of 16/8/4 Gb FC 2 ports of 10GbE FCoE 	FC, FCoE (direct access, tapes / VTL)	2-Port FC: 46 Gbps 4-Port FC: 92 Gbps 8-Port FC: 180 Gbps
 Unified Solution 2-4 ports of 10Gb Ethernet and 2-4 ports of 16/8/4Gb FC 2 ports FC + 2 ports FCoE 	NFSv3, SMB2.0, iSCSI, FC, SCSI, VTL, NPIV, FCoE	4-Port 10 GbE: 70 Gbps 4-Port FC: 92 Gbps



Load DynamiX Appliance Features and Specifications

Superior Realism		 Extremely flexible I/O access patterns Richest metadata emulation to evaluate real-world performance Parallel scenarios and asynchronous constructs to model hypervisor, application and OS behavior using multiple protocols Canned and user-defined content generation options to validate caching, tiering and deduplication functions 					
Storage Protocols	File	 Client: SMB, SMB 2.x, SMB 3.0 dialect, MS-RPC, NFSv2, NFSv3, NFSv4, NFSv4.1 Server: CIFS/SMB, SMB 2.x, NFSv3 					
	Block	 Initiator: iSCSI, Fibre Channel, FCoE, OpenStack Cinder Target: iSCSI 					
	Object	 Client: HTTP, HTTPS, OpenStack Swift, SNIA CDMI, Amazon S3 Server: HTTP, HTTPS 					
Network		 MAC, VLAN, DCB, IPv4, IPv6, TCP, S3 FC, NPIV 					
Load Profiles		 Specify the number of concurrent users, new users per second, actions per second, network bandwidth or TCP throughput Timeline load parameterization to simulate network I/O patterns Run multiple realistic user workloads simultaneously 					
Measurements and Reporting		 Data verification to validate data integrity with error logs Detail statistics including per-command response time and errors CSV result export PCAP capture Built-in Reporting Tool 					
Authentication		 NTLM, Kerberos, CHAP, Openstack Keystone 					
Hardware Appliances		 2 RU enclosure (17.25" X 3.47" X 28.5") 1280W redundant power supply AC Input: 100-240V, 9-3.5A, 50-60 Hz Operating temperature range: 50 – 95°F / 10-35°C Operating humidity range: 8-90% (non-condensing) Weight: 85lbs / 38.6kg 					



Load DynamiX Case Studies

Solving real customer storage challenges



Go Daddy — Leading Cloud Service Provider

<u>Go Daddy was growing fast ...too fast</u>. They needed to control storage costs while ensuring their applications would always work. Load DynamiX enabled them to significantly reduce their storage expenditures, transition to a new storage architecture, and avoid costly failures, even while adding petabytes of storage every month.

ADP

This payroll processing company <u>chose to deploy Load DynamiX</u> to help them analyze which storage systems performed best in each of their critical environments. Based on detailed emulations of their actual application I/O profiles, they determined which vendor offered the best NFS, SMB and Fibre Channel storage systems for each of their data centers. They were very surprised by the results. Relying on Load DynamiX ensured ADP minimized user response times, optimized cost and avoided making painful mistakes that could have had a major impact on their customers.





General Electric (GE)

The <u>Corporate Infrastructure Services team at GE</u> spent months and millions of dollars on a key big data business intelligence application. Under production load, the application failed to meet user performance requirements. Using Load DynamiX, the customer was able to troubleshoot the storage infrastructure, identify and address I/O bottlenecks, and dramatically improve performance. They then used Load DynamiX to choose new vendors for their next generation storage architecture for their business-critical applications.

Global 50 Financial Corporation

This financial institution runs on a sophisticated, multi-vendor infrastructure and must sustain maximum performance with extreme availability. Milliseconds of delay can mean millions in the banking industry, so there's no room to second-guess storage or network capabilities, or the impact of changing conditions. The customer uses Load DynamiX to help predict storage and network infrastructure behavior and prevent unwanted latency. Load DynamiX eliminates business risk!





Leading SaaS Provider to Financial Services Industry

A SaaS provider to the mortgage industry was planning to migrate to a private cloud. The CTO needed assurance that no outages or performance slowdowns would occur during or after the deployment. Using Load DynamiX technology, the customer was able to determine real-world behavior and configure the infrastructure for optimal performance, maximum uptime, and lowest cost.



About Load DynamiX

Load DynamiX solutions are used to test networked storage performance. The company empowers IT organizations with critical insight to maximize storage system performance by validating real-world application workloads before production deployment. Organizations reduce storage performance risk and optimize storage investments when using Load DynamiX.

Headquarters

2331 Zanker Road San Jose, CA 95131

Year Founded

2009

Products

An integrated test management platform comprising Load DynamiX Enterprise software combined and extreme load generation appliances

Investors

- Azure Capital Partners
- Benhamou Global Venture
- HighBar Partners
- Kinetic Ventures

Award Winning Technology



I can't say enough good things about Load DynamiX. Their solution helped us choose the right storage technologies for both optimal performance and price."

Brian Walker

Principal Architect, Cloud Solutions

GE

