



**TESTING SERVICES FOR MISSION CRITICAL
PRODUCTS & SOLUTIONS**



CONTACT INFORMATION

600 Center Ridge Dr. Suite 600
Austin, Texas 78753
512.670.7300 voice
512.670.5078 fax
info@medusalabs.com
www.medusalabs.com

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Medusa Labs Overview

Medusa Labs is a world-class provider of testing services for Server, Storage and Networking interfaces and protocols. We particularly focus on Enterprise Systems and Storage Area Networking, and are experts in SCSI, RAID, Fibre Channel and InfiniBand.

Medusa tests customer's products quickly and thoroughly in an enterprise environment to ensure that the products will survive the rigorous demands of mission-critical applications. Whereas other testing services loosely mimic the user's actual environment and therefore offer incomplete results, Medusa Labs has the equipment, tools, and knowledge to provide highly accurate test assessments. Our testing services allow our customers to deliver performance, reliability, and robustness with properly configured and integrated systems in a mission-critical enterprise environment.

Medusa Labs conducts testing in a 16,000 square foot state of the art facility in Austin, Texas. Our closed-door lab is secure with badge access, no windows and security video cameras. The lab is designed for highly accelerated testing, interoperability, and performance verification of enterprise products and solutions. We have the ability to perform everything from product functional testing to full enterprise verification in highly stressed client/server environments. Our focus is on high-end, high-performance components and system configurations. We also provide additional supporting services to our clients, including specific customer and OEM configuration validation.

Customers come to us for our fast turnaround, superior analysis, excellent results, competitive prices, and, of course, 100% confidentiality. We work hand-in-hand with our customers' engineers to provide solutions, not just information. We provide not only the results of our tests, but the debug, analysis, and regression that is needed to ensure that the products we test perform as expected—not by our customers, but by their customers.

Medusa Labs understands that all too often a product will function in a controlled client/server test scenario only to fail in an environment far and above that for which it has been tested. Gone are the days of testing a product with a server, a few clients, and some storage devices. Mission-critical products must be able to survive in an enterprise of multiple servers, hundreds of clients, and complex storage applications. Verifying that a product can perform in this type of environment is where Medusa Labs excels.

Medusa's engineers bring decades of experience into the testing arena. We have created, and continue to enhance, all of our own, proprietary software test tools. We believe these tools are the best in the industry. We helped develop some of the industry's key technologies --such as the Fibre Channel specification -- and continue to have a vigorous passion for improving products and sharing our knowledge. Our experience and enthusiasm translate into higher quality testing services and more meaningful results.

Testing Services Overview

Initial Evaluation Testing Services

Medusa Labs provides initial evaluation services for products to establish a baseline of the product's functionality, data integrity/load testing, usability, interoperability, and performance. We use this information to determine how the product stacks up against competitive products and to determine the scope of any further testing required. Upon completion of the initial evaluation, Medusa Labs will recommend whether the product needs further testing in the functional, product, or enterprise levels and will describe and categorize the issues discovered in the evaluation.

Functional Testing Services

Functional testing evaluates the core of the product through intensive, device-specific tests designed and engineered by Medusa Labs. Functional testing focuses on the device itself and the device's interactions with industry-standard environments. This phase of testing verifies robustness in the engineering design and includes low-level testing of all key features and attributes. Our engineers execute a matrix of tests designed to uncover potential problems with the specific bus interface (e.g., lockups, hangs, incompatibilities, data corruption) and provide analysis of low-level performance and bandwidth characteristics of the device. Basic compatibility and interoperability are verified through the use of industry-standard devices, platforms, and architectures with the most rigorous test tools and techniques available in the industry.

Product Testing Services

Product testing tests the product's feature sets, abilities, usability, user interface, and overall robustness. Our focus is on the product's ability to perform every function and feature for which it was designed. Using Medusa Labs' internally developed test tools and techniques, as well as industry-standard tools, we will take the product to its limits. Error situations are induced and monitored using analyzers. Applications are fully evaluated for usability and ease of use—all the way down to the documentation. The product is evaluated for its adherence to applicable protocols and standards. Using highly accelerated test methodologies and tools, we find in minutes or hours what other tests and tools cannot find even after weeks of effort. Our engineers work directly with your engineers to provide debugging, analysis, resolution, and regression of all issues. Medusa Labs helps you reduce your product's time to market, give your customers the quality product they deserve, and avoid high maintenance and support costs that erode profits.

Enterprise and Configuration Testing Services

Enterprise-level testing is designed to elevate a stable product into a world-class product. Medusa Labs helps you make your product a mission-critical component that can be relied upon under any circumstances. This testing verifies the product's ability to interoperate and perform in a strenuous server environment. As many as 80 test clients are attached via 100-Mbit Ethernet or via Fibre Channel, each simulating ten to fifty real-world clients in the average enterprise network environment. Data warehouse, multi-user, multi-platform, and clustering style environments are rigorously tested to ascertain compatibility and functionality within the enterprise environment. Due to the highly specific nature of the configurations involved in the enterprise environment, we determine specific configurations on a per customer basis.

Performance and Benchmarking Services

Performance and benchmarking services are handled at two levels. During functional, product, and enterprise testing, configurations are regularly checked for acceptable or better levels of performance with benchmarks developed by Medusa Labs and with industry-standard benchmarks. Beyond this level, Medusa Labs offers thorough benchmarking services that are designed to pinpoint every bottleneck the product will encounter and provide the analysis and debugging necessary to tune the product to new peaks of performance. This service can be applied from the lowest product level to high-end customer configurations and applications. Scalability, response times, latency times, bus utilization, and saturation are but a few of the areas targeted in full-scale performance and benchmarking services.

Initial Evaluation Test Services

Functionality Evaluation

- Ability of the product to perform as designed.
- Basic adherence to the protocols, specifications, environments, and standards for which it was designed.
- Feature set implementation and usability.

Data Integrity/Load Evaluation

- Ability to handle high throughput environments.
- Ability to transfer data quickly and accurately.
- Avoidance of unwanted bottlenecks.

Usability Evaluation

- Documentation usability, usefulness, and accuracy.
- Software interface user-friendliness and usefulness.
- Usability under all supported environments.

Interoperability Evaluation

- Interoperability with other industry-standard devices.
- Interoperability with like devices.

Performance Evaluation

- Basic evaluation of maximum and minimum performance with sequential/random reads and writes

Functional Test Services

Chipset Interaction and Basic Performance

- Test the full bandwidth of a device's capabilities for read and write transfers using utilities that bypass operating system overhead and issue I/Os directly to the device driver level.
- Report I/O response time, I/Os per second, MB/sec, processor utilization, and other characteristics.
- Sample device reads and writes of varying size (2 KB – 512 KB).
- Test each available slot to ensure signal integrity and bus compliance with devices such as peer buses and PCI bridges.
- Perform all measurements across a set of industry-standard chipsets/machines, including single, dual, quad and eight-way Intel® Pentium based servers.

PCI Device / Bus Master Interaction

- Test the device under several different, full bus PCI loads using industry-standard PCI master devices.
- Combine different network, SCSI, RAID, and video cards with the device, and test at varying I/O loads from nominal to full bandwidth.
- Test multiple instances of the device (up to the vendor's maximum specification) under full bus loads in several different configurations, including split peer and bridge buses, to evaluate the device's performance scaling and functionality.

Low-Level Functional Tests

- Evaluate the product's compliance to the PCI 2.1 register specification including Advanced Power Management ports, Subsystem Vendor ID, PCI Parity, etc.
- Test devices for interrupt sharing and resource usage.
- Verify that utilities, diagnostics, and flash features work in all slots and interfaces.

Product Test Services

RAID and SCSI Test Services: Adapters, Controllers, Drives and Enclosures

RAID- and SCSI-Specific Testing

RAID devices, adapters, and disk enclosures are tested in a variety of high-stress environments. Data, from bytes to terabytes, are moved at the highest possible rates to and from the RAID device using utilities written to target and simulate high-usage environments. The tests simulate an environment with thousands of users to push the device to its theoretical limits. Tests are performed against all available RAID levels of operation, cache policies, and stripe sizes, etc. Full performance and benchmark suites are performed and comparisons made with other industry-standard RAID components. RAID and SCSI operations are verified using analyzers and injectors. SCSI-specific tests are completed from the hard drive to magneto-optical levels verifying compatible operation, good interoperability, and acceptable data transfer rates.

RAID Testing Emphasis

- Optimal and degraded arrays for data striping and integrity per the RAB (RAID Advisory Board) specification.
- “Hot swap” drive testing for Case 3 and 4 drives for compliance with the drive vendor’s limited warranties.
- Hot spare operations and functionality including customer interfacing, order of preference for rebuilds, etc.
- Cold spare operations.
- Data regeneration and RAID consistency checks for proper XOR operation and data availability per the RAB specification.
- Data availability and consistency during degraded (non-optimal) operations.
- The device’s error-logging capabilities for customer and technical support use. Includes the manageability of the device over the life of the product and the ability to troubleshoot and debug problems when they occur.
- Critical operation handling and recovery (gross SCSI bus errors, ill-behaving SCSI devices, catastrophic failures, etc.)
- Cache coherency testing for battery-backed devices (where applicable) to the documented limits of the device. This testing allows further testing of a variety of industry-standard memory modules and components.
- Battery backup testing, verification of error handling, customer messaging, etc.

- RAID manageability through the device's utilities and industry-standard server management utilities (HP OpenView, Intel LanDesk Manager, etc.)
- Enclosure management (SAF-TE, SES, AEMI, etc.)
- Factory configuration and support (if requested by the customer).
- RAID enclosures for compatibility with different industry-standard SCSI host bus adapters.

RAID-Specific Bandwidth and Performance Testing

- Benchmarking and comparing all supported RAID levels in both optimal and degraded modes (where applicable) with other devices.
- Comparisons of RAID initialization and rebuild times across industry-standard controllers.

SCSI Testing Emphasis (where applicable)

- BIOS compatibility with other devices (via INT 13h, INT 40h, etc.) and ability to interact with other SCSI controllers.
- Handling of faulty devices using known faulty and troublesome components and by using SCSI injectors.
- Signal integrity and device timings.
- BIOS geometry-handling and compatibility.
- Peripheral device compatibility and functionality with non-disk type devices (CD-ROM, tape backup, MO drives, WORM drives, etc.)
- Bootable CD-ROM support for Floppy Emulation Mode and No Floppy Emulation mode to verify compliance with the El Torito specification.
- SCSI compatibility with a wide range of industry-standard hard drives (Seagate, Quantum, Western Digital, etc.).
- The complete suite of SCSI protocol and operational behaviors: queue tag depths, synchronous offsets, clock rates, spin-up timings, power-on self-test (POST) sequences, command completion times, average latency, etc.
- Stress-testing of SCSI buses will be thoroughly from minimum to maximum queue tags to 100% data bus saturation across the maximum number of spindles supported by the device.

Industry-Standard Comparisons and Overall Evaluation (*Included as part of any Product Test Service*)

- Evaluate ease of use and "look and feel" consistency of user applications and tools across operating systems, server management tools, etc.
- Verify documentation accuracy and usability and installation procedures along with the ability to cleanly remove added drivers and software.
- Test and verify all software functions and features for functionality, usability, and compliance within their respective operating systems.
- Evaluate each device for its ability to be easily integrated into the customer's existing environments.

Network Test Services: Adapters, Hubs, Switches, Bridges and Routers

Mixed Environment Tests

- Use combinations of multiple client and server networking operating systems to generate high traffic patterns and data rates using multiple protocols (TCP/IP, IPX/SPX, and NetBEUI) simulating industry client/server and workgroup environments.
- Verify connectivity will be verified with a wide range of industry-standard networking components.

Router, Bridge, and Gateway Tests

- Ensure the product's is able to perform in multi-protocol router and gateway environments.
- Test dynamic and static routes for uptime and monitored for consistent throughput and cost metrics.
- Run tests will be run on all routable protocols.

Packet and Protocol Tests

- Test product's ability to handle multiple packet sizes efficiently and quickly.
- Inject faulty and troublesome devices into the test to induce errors such as runt packets, CRC errors, etc.
- Perform TCP sliding-window and delayed-acknowledge tests.
- Verify throughput and accuracy for both connectionless and connection-oriented protocols via TCP, IP, UDP, ICMP, IPX, SPX, NetBEUI, and NETBIOS layers.

Threading and Saturation Tests

- Test the product as both a server product and a client product with a range of connections from the maximum to the minimum. These tests determine the product's ability to maintain high connection rates and continuous throughput without consuming large amounts of bandwidth or processing time.
- The product can be evaluated against like and competitive technologies to ensure that it meets or exceeds specifications.

Fibre Channel Test Services

Loop Connectivity

- Verify loop initialization procedures as master and non-master. Verify previously hard- and soft-assigned addressing and ALPA generation via LISM, LIFA, LIPA, LIHA, LISA, LIRP, and LILP.
- Inject and analyze loop initialization sequences with and without loop activity.
- Verify ability to perform link recovery.
- Verify login capabilities are handled in loop topologies.
- Verify ability to perform the arbitration process including idles, ARB, primitives, and arbitration fairness.
- Verify correct generation and reception of frame header fields, including frame control bits, sequence count values, and assignment of sequence identifiers.
- Verify link control frames and basic link service commands.

Fabric Connectivity

- Verify ability to perform primitive sequences and process-ordered sets.
- Verify N-Port and F-Port connectivity.
- Verify F-LOGI and P-LOGI sequences.
- Verify correct generation and reception of frame header fields, including frame control bits, sequence count values, and assignment of sequence identifiers.
- Verify link control frames and basic link services commands..
- Verify that device-discovery sequences used will consistently locate attached devices.
- Verify ability to recover from link errors, N-Port errors, device errors, etc.
- Check fabric address assignment.

Compatibility

- Test ability to handle variable payload sizes and credits.
- Verify interoperability and connectivity with multiple devices on the loop using like and unlike device types.
- Verify that data transfer rates reach the maximum specified for the device.
- Stress all internal and external data paths.
- Verify the ability to handle faulty/misbehaving devices.
- Test and monitor interactions of multiple Fibre Channel protocols (e.g., IP and SCSI).
- Verify and analyze the complete suite of SCSI and IP protocol implementations (where applicable).
- Test SCSI error recovery and handling in diverse situations.

Performance and Benchmarking Services

Fibre Channel, RAID, SCSI, and Networking

Medusa Labs Benchmark Services

- Evaluate single-threaded and multithreaded performance using unbuffered, direct I/O.
 - Measured using Synchronous, Asynchronous and Multi-Threaded I/O
 - 1-KB to 512-KB I/O sizes measured for:
 - Random reads
 - Sequential reads
 - Random writes
 - Sequential writes
 - 75% random reads
 - 50% random reads
 - 25% random reads
- Provide data to help point out strong and weak spots in drivers, firmware, and/or hardware implementation.
- Thoroughly evaluate the devices' ability to scale under loads.
- Demonstrate product's ability to scale as more devices are connected or multiples of the product are used.
- Delivers pertinent data needed for analysis of true performance that is not bound by operating system limitations.
- Provides information on:
 - Processor utilization
 - Threading capability
 - I/O and MB/sec throughput for each combination of I/O size and I/O type
 - Saturation limits

Industry-Standard Benchmarks

- Ziff-Davis benchmarks (ServerBench, NetBench, WinBench 32, and WinStone)
- Symbios NTIOGEN and UNIXIO Suites
- Intel IOMeter Benchmarks
- Industry-standard applications (MS-SQL, Lotus Notes, etc.) in customer-specified configurations to assess acceptable or higher levels of performance and response time