



Flash vs. Disk Storage: Testing Workloads is Key

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SwiftTest



SwiftTest Overview



- The leader in Storage Performance Validation.
- Our Mission: *To provide storage experts with critical insight to cost-effectively develop and deliver high performance, high availability storage infrastructure.*

➤ Founded in 2008; venture-backed



➤ Headquarters in Santa Clara, CA

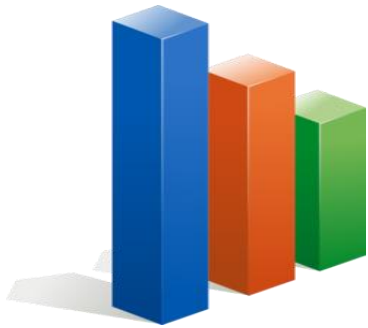


Key Customer Questions when Considering SSDs vs. HDDs

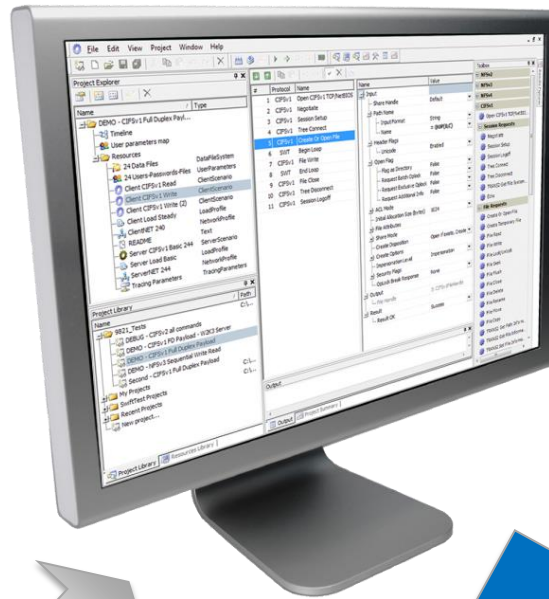
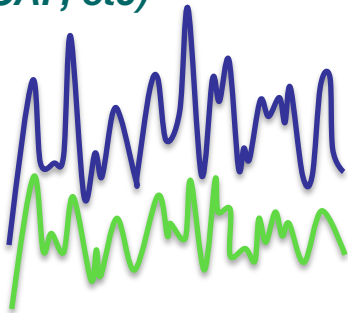
- Which applications will benefit from flash?
- How much faster would flash be over my current HDD storage arrays?
- How much head room do I have with a specific flash configuration?
- How much flash does my app really need?
- Hybrid or all-flash?
- Which vendor offers the best value to support my workload demands and budget constraints?
- How can I evaluate flash without impacting my production storage?
- How do I validate the performance impact of caching, compression, dedupe & tiering?

Simulating a Production Workload

PRODUCTION STATS
(Workload Analyzers, Netstat, NFSstat, etc)



PACKET CAPTURES
(PCAP, etc)




PRE-BUILT TEST SUITES



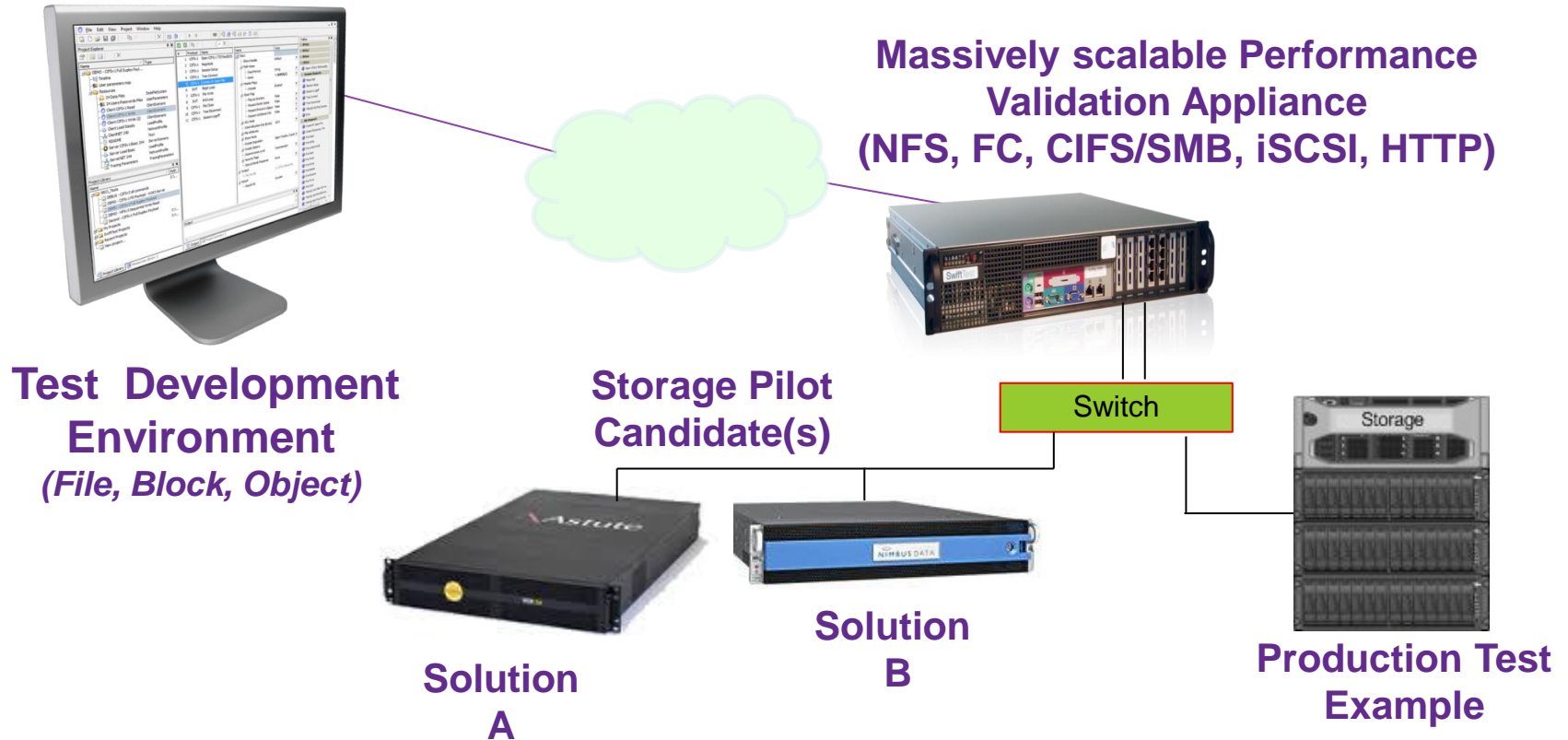
**ACCURATE, REALISTIC
WORKLOAD MODEL**

Realistic Workload Simulations that Don't Require Banks of Servers/VMs to Drive Are Key

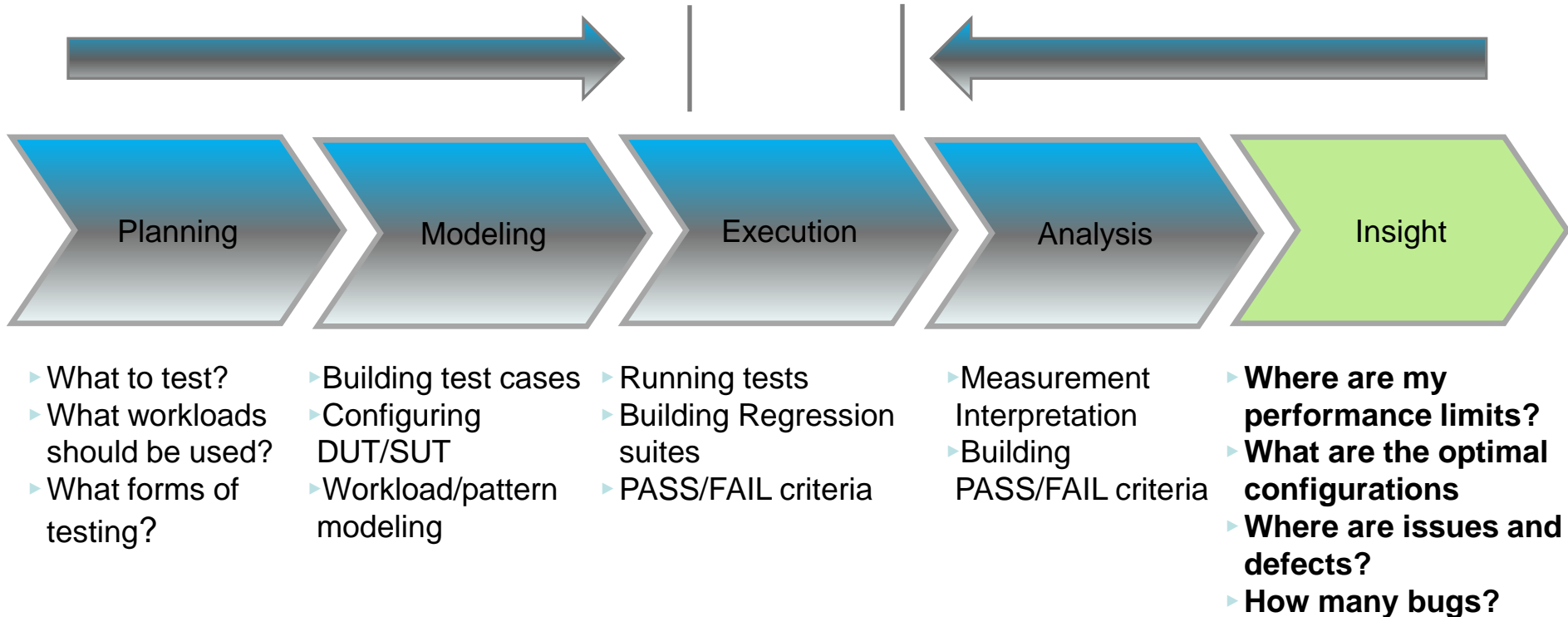
	 In Production	SwiftTest Simulation
Total NFS ops	~65K	~66K
Avg. Latency <ul style="list-style-type: none"> • Read • Write • Metadata Ops 	1.5 ms 10 ms 0.5 ms 0.5 ms	1.4 ms 11.5 ms 0.6 ms 0.4 ms
Op-Mix <ul style="list-style-type: none"> • Reads • Writes • Metadata Ops <ul style="list-style-type: none"> • Getattr • Lookup • Access 	5% 1% 94% 62% 11% 17%	5% 1% 94% 63% 13% 14%
Avg. CPU Utilization	81%	80%
Max. Disk Utilization	55%	54%

Workload models proved that a Hybrid SSD/HDD approach based on an open server platform would support workloads at less than 50% of the cost

Workload Models help Evaluate New Flash Storage Products without impacting Production Storage Systems



How Can You Dramatically Compress Time to Insight



Dramatically compress time to insight by introducing:

- 1. Modeling tools – statistical workload models**
- 2. Simulation/Automation tools – ability to automate test workflow and run large numbers of test simulations**
- 3. Analytics tools – ability to generate results against specific methodology objectives – not merely report metrics**

Flash Storage Validation Functions

Content Generation

- Data File System
- Sequential, Random, Seeded Random
- Block/Chunk Size
- File Size Distribution

I/O Access Patterns

- Automatic offsets to simplify config for long writes/reads
- Forward/Backward/Random
- Looping / Functions
- User Parameters
- Model Read, Write separately

Advanced Storage Testing Functions

Caching/Compression
Tiering
Deduplication
Data Integrity

Advanced Measurements

- Data Verification/Integrity
- Per Command Metrics
 - Response time
 - Counters
- TCP/Protocol Throughput
- Network Statistics

Metadata

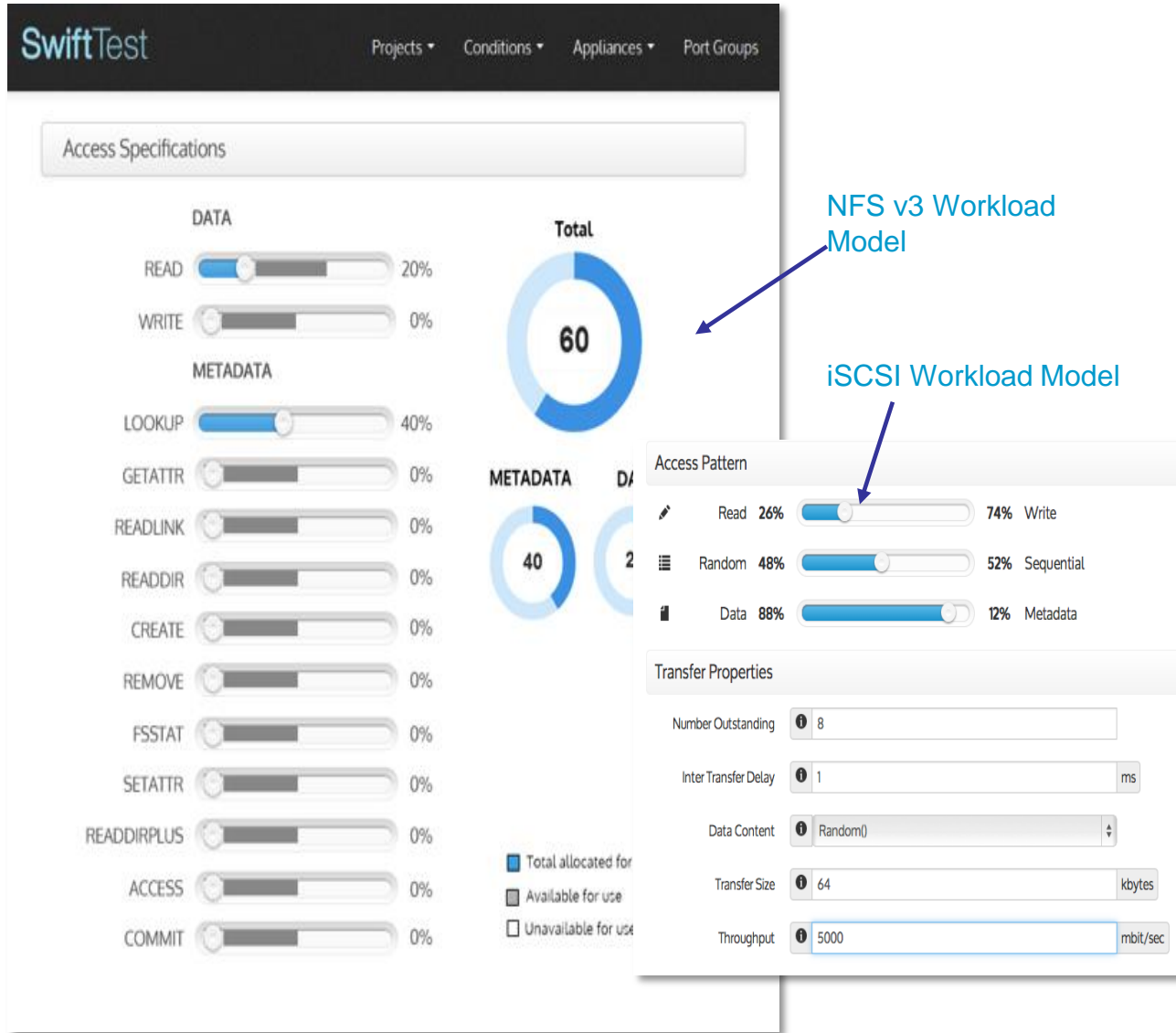
- Rich attributes
- Flexible Metadata/data mixtures/patterns
- Increasing command set

Data Center Realism

- Parallel Scenarios
- Asynchronous Behavior
- Advanced Load Profile
- Client Contention (Raise/Wait Events)
- Client Leasing
- Mixed NAS & SAN traffic
- Network: IPv4/IPv6, VLAN, MAC control

Simplifying & Automating the Workload Modeling Process

Workload Model



The screenshot displays the SwiftTest interface for configuring workload models. The main panel shows 'Access Specifications' with sliders for DATA (READ: 20%, WRITE: 0%) and METADATA (LOOKUP: 40%, GETATTR: 0%, READLINK: 0%, REaddir: 0%, CREATE: 0%, REMOVE: 0%, FSSTAT: 0%, SETATTR: 0%, REaddirPLUS: 0%, ACCESS: 0%, COMMIT: 0%). A central donut chart shows a 'Total' of 60. A legend indicates: Total allocated for (blue), Available for use (grey), and Unavailable for use (white).

A popup window titled 'Access Pattern' is open, showing detailed settings:

- Access Pattern:**
 - Read: 26% (slider at 74%)
 - Write: 74%
 - Random: 48% (slider at 52%)
 - Sequential: 52%
 - Data: 88% (slider at 12%)
 - Metadata: 12%
- Transfer Properties:**
 - Number Outstanding: 8
 - Inter Transfer Delay: 1 ms
 - Data Content: Random()
 - Transfer Size: 64 kbytes
 - Throughput: 5000 mbit/sec

Annotations with blue arrows point to the 'Total' donut chart (labeled 'NFS v3 Workload Model') and the 'Access Pattern' popup (labeled 'iSCSI Workload Model').

NFS v3 Workload Model

iSCSI Workload Model

Access Pattern

Read 26% 74% Write
Random 48% 52% Sequential
Data 88% 12% Metadata

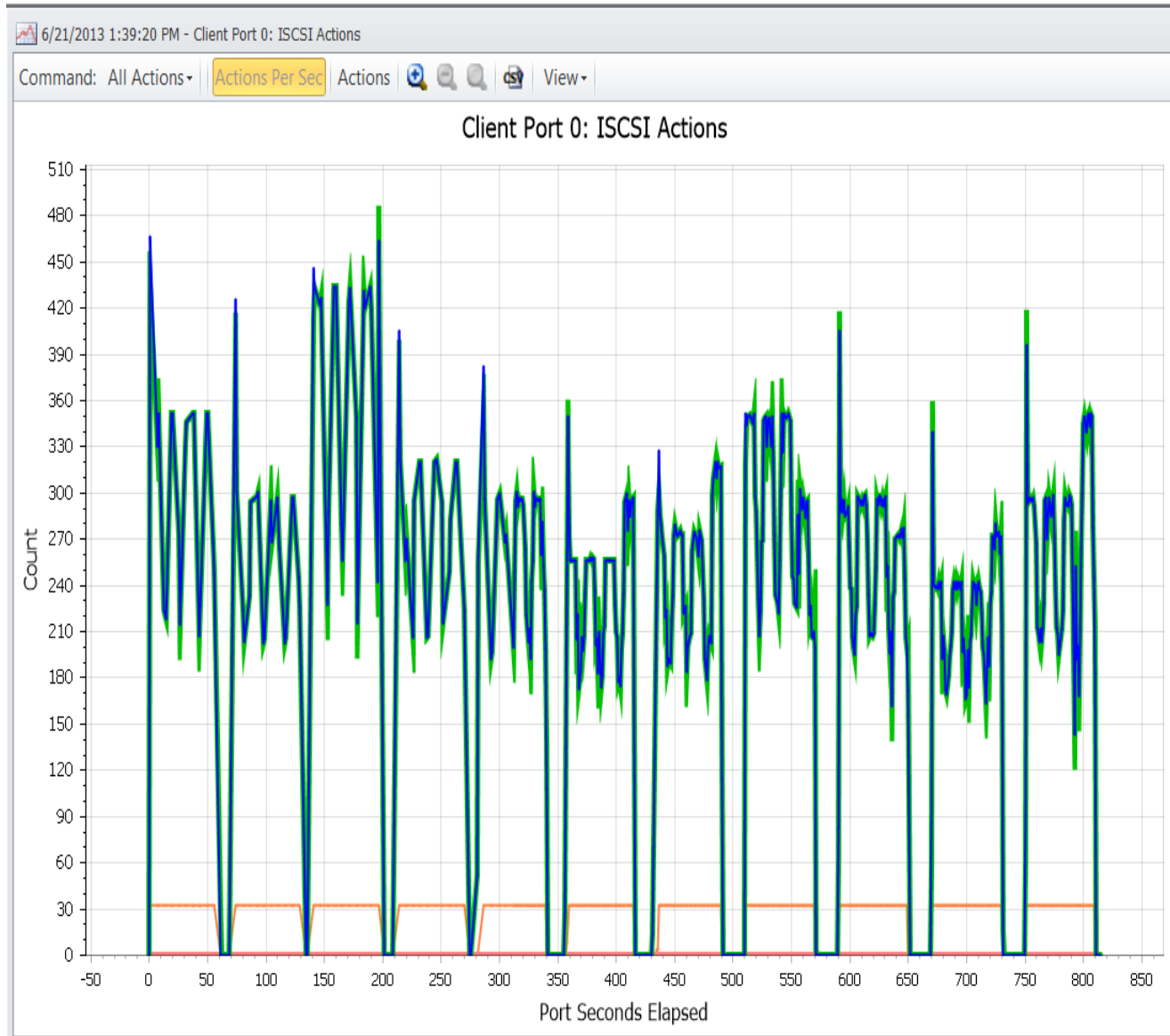
Transfer Properties

Number Outstanding 8
Inter Transfer Delay 1 ms
Data Content Random()
Transfer Size 64 kbytes
Throughput 5000 mbit/sec



Measuring iSCSI IOPS by block size

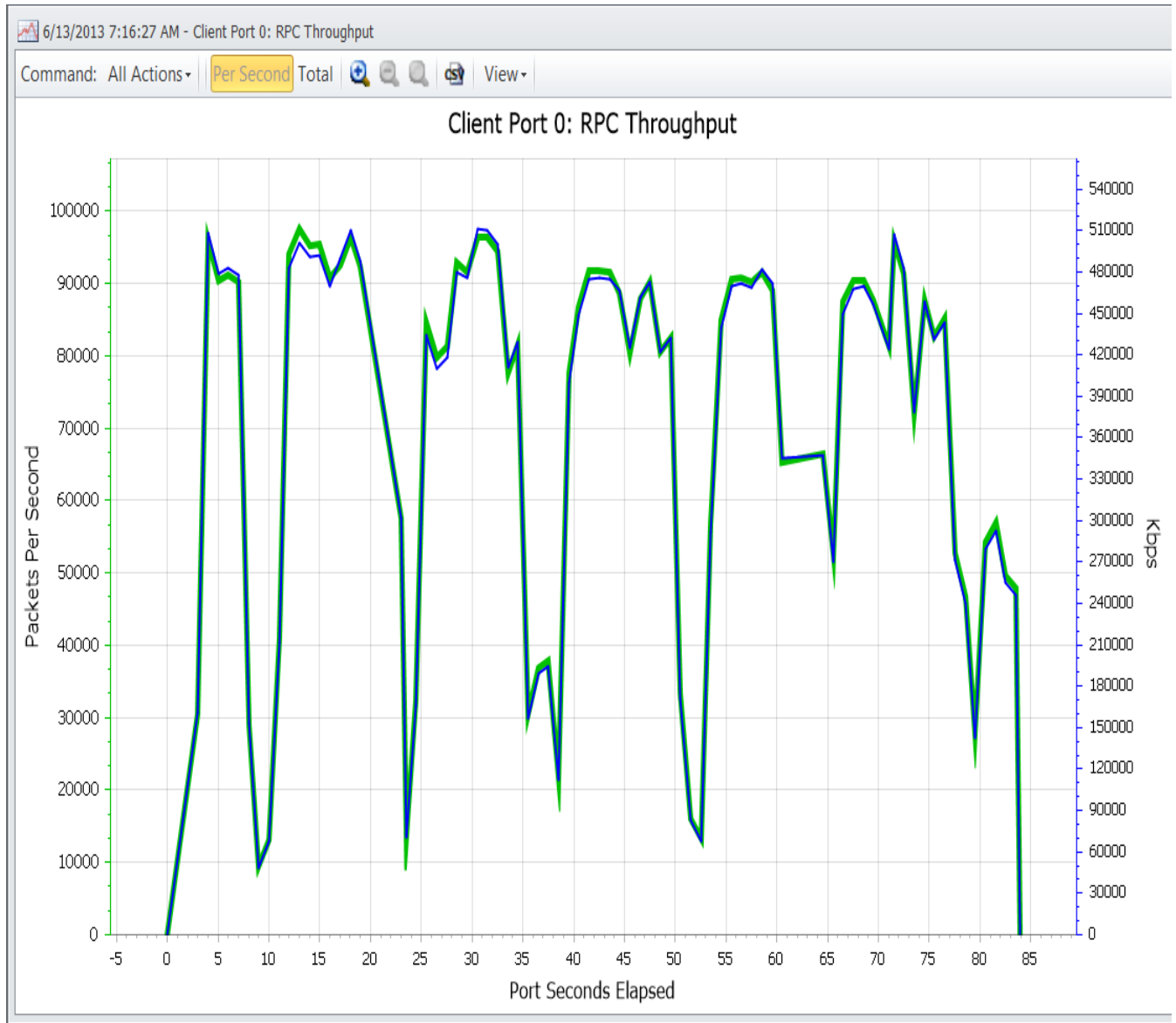
iSCSI IOPS





Measuring NFS Throughput

NFSv3 Throughput



Benefits of Storage Performance Validation

Cost Optimization

Select most cost effective solution for your workload

Increased Reliability

Ensure uptime under load

Performance Assurance

Confidence in the scalability of new products

Engineering Productivity

More insight, less resources devoted to testing



SwiftTest

Thank you!

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