

StorPool Performance Test: 12 SSDs = 468,000 IOPS

A small stand-alone storage system with just 12x Intel S3510 SATA SSDs, worth \$35k over 3 years. Only \$0.07/IOPS

This is a performance test of a small stand-alone, all-flash storage system, which we delivered early 2017 for a customer. It is quite impressive, both in terms of overall performance metrics (IOPS, MB/s, latency) and also in terms of capital efficiency – \$/IOPS, \$/GB for such a system.

System under test:

3 storage nodes, each with:

- Dell R330 server
- CPU: Intel Xeon E3-1230v5
- RAM: 2x 16 GB DDR4 UDIMM @2133 MT/s
- NIC: 2-port Intel X710 10GbE NICs
- HBA: Dell PERC H730 adapter in JBOD mode (Avago 3108 w/ OEM firmware)
- 4x Intel S3510 1.6 TB
- Linux kernel version: 3.10.0-514.2.2.el7.x86_64

Total storage system resources:

- 3 storage nodes
- 6x 10GE ports
- 12x S3510 1.6 TB SSDs. 19.2 TB total raw space

Network:

- 2x IBM/Blade Networks G8124 – 24-port 10GbE switch
- Direct-attach SFP+ cables

5 initiators (hypervisors), each with:

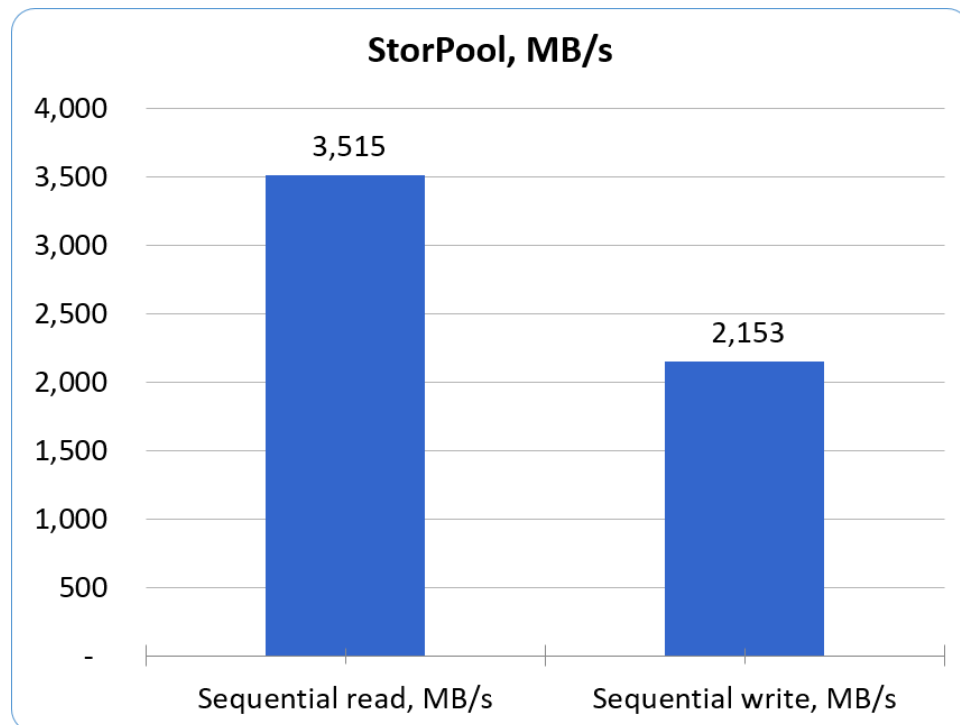
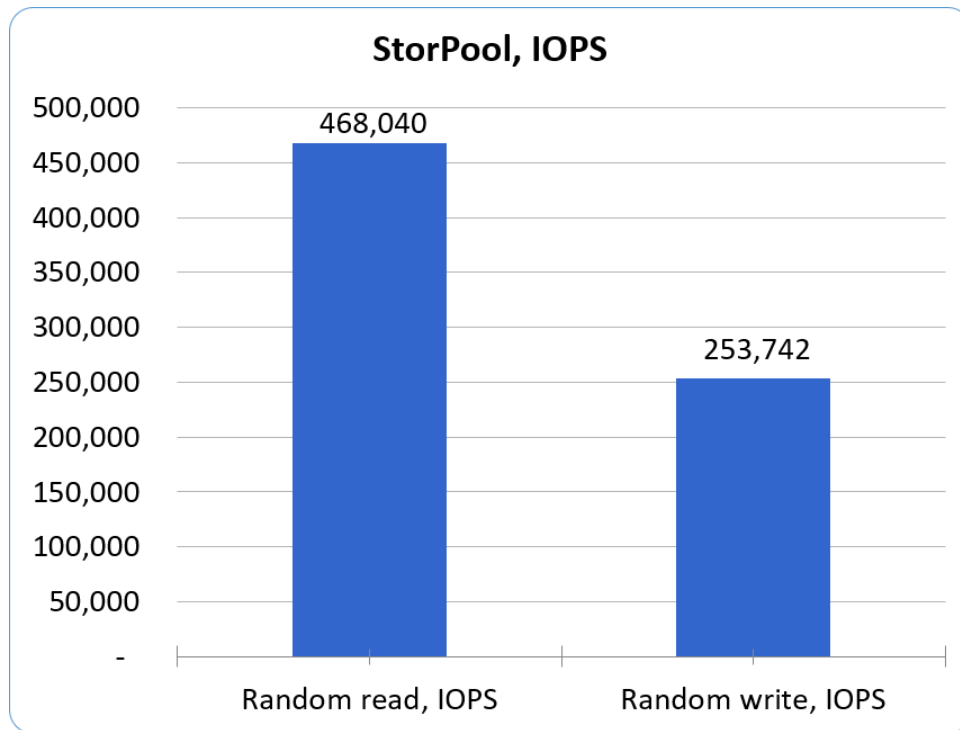
- Dell R630 server
- CPU: 2x Intel Xeon E5-2620v4
- RAM: 16x 16GB DDR4 RDIMM @2133 MT/s
- 4-port Intel X710 10GbE NICs, 2 ports used for storage
- Linux kernel version: 2.6.32-642.11.1.el6.x86_64
- StorPool software version: 16.01.248.9d12c0a

Test system and parameters:

- Test was performed from all 5 client hosts in parallel to show total system throughput
- Test performed on All-SSD storage pool with 2 copies and usable capacity 8,128 GiB
- Test performed on 5x 100 GiB volumes
- Volumes were configured to store 2 copies on SSDs, taking total approx 1,100 GiB raw space (including copies and protection)
 - this allocation policy provides maximum 8,128 GiB usable space from the available SSDs
- Test performed from 5 initiators in parallel to show total system throughput
- Performance testing tool: FIO, version 2.0.13, AIO, Direct

Test results:

Test	Result	Test parameters		
		block size	queue depth	
			per client host	total
Random read, IOPS	468,040	4k	64	320
Random write, IOPS	253,742	4k	64	320
Sequential read, MB/s	3,515	1M	64	320
Sequential write, MB/s	2,153	1M	64	320

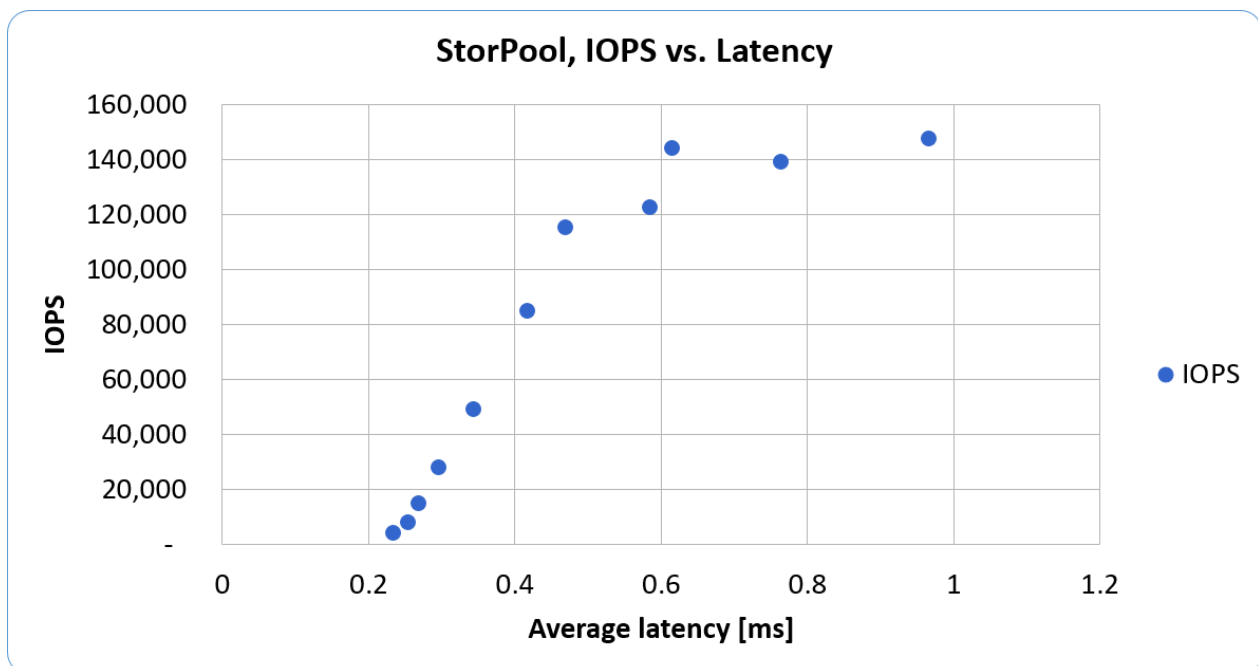


Measured storage latency under different load levels:

- Test was performed from one initiator with different load levels, to show latency under load
- At the high end of the queue depth scale, this test is limited by capability of the initiator, not by the whole storage system

Test	Result		Test parameters	
	Average latency [ms]	IOPS	Block size	queue depth
Random read+write 50/50	0.234	4,245	4k	1
Random read+write 50/50	0.253	8,040	4k	2
Random read+write 50/50	0.268	15,168	4k	4
Random read+write 50/50	0.295	27,952	4k	8
Random read+write 50/50	0.343	49,358	4k	16
Random read+write 50/50	0.417	85,246	4k	32
Random read+write 50/50	0.469	115,386	4k	48
Random read+write 50/50	0.584	122,906	4k	64
Random read+write 50/50	0.615	144,454	4k	80
Random read+write 50/50	0.764	139,412	4k	96
Random read+write 50/50	0.966	147,788	4k	128

Note: When used from multiple initiators, this storage system can deliver at least 200,000 IOPS random read+write 4k at sub-1 ms latency.



Financials:

The cost of this system as tested was just \$35,000 over 36 months (as on Jan 2017). This makes \$4/GB usable and \$0.07/IOPS. The system scales seamlessly and online with small steps.

First upgrade is filling the empty bays of the servers, which doubles capacity and reduces price to \$3.6/GB.

Summary

This is just one particular configuration, which we delivered to a customer. The StorPool software itself is flexible and can be used to deliver different kinds of systems. Here are a couple of examples of other StorPool powered systems:

- StorPool “SSD-Hybrid” and all-SSD systems:
<https://storpool.com/blog/performance-test-storpool-ssd-hybrid-shared-storage-system-20x-ssds-40x-hdds>
- Nearly 1mln IOPS for \$61,000: <https://storpool.com/wp-content/uploads/2017/03/Vesper-Technologies-and-StorPool-solution-brief.pdf>

For any questions – please contact us at the contacts below:

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