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45drivesxl60

2 x AMD EPYC 7513 32-Core testing with a Dell PowerEdge R7525 [0590KW] (2.6.6 BIOS) and Matrox G200eW3 on Debian GNU/Linux 11 via the Phoronix Test Suite.

Automated Executive Summary

SAMSUNG ZFS MIRROR had the most wins, coming in first place for 50% of the tests.

Based on the geometric mean of all complete results, the fastest (Mirrors) was 24.258x the speed of the slowest (DELL ENT NVME SSD1). SAMSUNG ZFS MIRROR was 0.986x the speed of Mirrors, 5 Per VDEV RaidZ2 was 0.974x the speed of SAMSUNG ZFS MIRROR, 10 Per VDEV RaidZ2 was 0.929x the speed of 5 Per VDEV RaidZ2, DELL ENTERPRISE NVME was 0.183x the speed of 10 Per VDEV RaidZ2, DELL SAMSUNG SSD4 was 0.545x the speed of DELL ENTERPRISE NVME, DELL ENT NVME SSD1 was 0.463x the speed of DELL SAMSUNG SSD4.

Test Systems:

10 Per VDEV RaidZ2

5 Per VDEV RaidZ2

Mirrors

Processor: Intel Xeon Silver 4216 (32 Cores), Motherboard: 45Drives XL60 0123456789, Memory: 256GB, Disk: 742117GB

OS: FreeBSD, Kernel: 12.2-RELEASE-p10 (x86_64), Compiler: Clang 10.0.1, File-System: zfs

DELL ENT NVME SSD1

DELL SAMSUNG SSD4

DELL ENTERPRISE NVME

Processor: 2 x AMD EPYC 7513 32-Core (64 Cores / 128 Threads), Motherboard: Dell PowerEdge R7525 [0590KW] (2.6.6 BIOS), Chipset: AMD Starship/Matisse, Memory: 8 x 64 GB DDR4-3200MT/s 36ASF8G72PZ-3G2B2, Disk: 240GB DELLBOSS VD + 2 x 1920GB Dell Ent NVMe CM + 2 x 3841GB SAMSUNG MZQL23T8, Graphics: Matrox G200eW3, Monitor: DELL E172FP, Network: 4 x Intel X710 for 10GBASE-T + 2 x Broadcom NetXtreme BCM5720 2-port PCIe

OS: Debian GNU/Linux 11, Kernel: 5.15.30-2-pve (x86_64), Vulkan: 1.0.2, Compiler: GCC 10.2.1 20210110, File-System: ext4, Screen Resolution: 1280x1024

Kernel Notes: Transparent Huge Pages: madvise
Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-link-mutex --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-10-Km9U7s/gcc-10-10.2.1/debian/tmp-nvptx/usr,amdgcn-amdhsa=/build/gcc-10-Km9U7s/gcc-10-10.2.1/debian/tmp-gcn/usr, hsa --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-build-config=bootstrap-lto-lean --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib=auto --with-tune=generic --without-cuda-driver -v
Disk Notes: MQ-DEADLINE / errors=remount-ro,relatime,rw / Block Size: 4096
Processor Notes: CPU Microcode: 0xa00115d
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Retpolines IBPB: conditional IBRS_FW STIBP: always-on RSB filling + srbds: Not affected + tsx_async_abort: Not affected

SAMSUNG ZFS MIRROR

Processor: 2 x AMD EPYC 7513 32-Core (64 Cores / 128 Threads), Motherboard: Dell PowerEdge R7525 [0590KW] (2.6.6 BIOS), Chipset: AMD Starship/Matisse, Memory: 8 x 64 GB DDR4-3200MT/s 36ASF8G72PZ-3G2B2, Disk: 240GB DELLBOSS VD + 2 x 1920GB Dell Ent NVMe CM + 2 x 3841GB SAMSUNG MZQL23T8, Graphics: Matrox G200eW3, Monitor: DELL E172FP, Network: 4 x Intel X710 for 10GBASE-T + 2 x Broadcom NetXtreme BCM5720 2-port PCIe

OS: Debian GNU/Linux 11, Kernel: 5.15.30-2-pve (x86_64), Vulkan: 1.0.2, Compiler: GCC 10.2.1 20210110, File-System: zfs, Screen Resolution: 1280x1024

Kernel Notes: Transparent Huge Pages: madvise
Compiler Notes: --build=x86_64-linux-gnu --disable-vtable-verify --disable-werror --enable-bootstrap --enable-checking=release --enable-clocale=gnu --enable-default-pie --enable-gnu-unique-object --enable-languages=c,ada,c++,go,brig,d,fortran,objc,obj-c++,m2 --enable-libphobos-checking=release --enable-libstdcxx-debug --enable-libstdcxx-time=yes --enable-link-mutex --enable-multiarch --enable-multilib --enable-nls --enable-objc-gc=auto --enable-offload-targets=nvptx-none=/build/gcc-10-Km9U7s/gcc-10-10.2.1/debian/tmp-nvptx/usr,amdgcn-amdhsa=/build/gcc-10-Km9U7s/gcc-10-10.2.1/debian/tmp-gcn/usr, hsa --enable-plugin --enable-shared --enable-threads=posix --host=x86_64-linux-gnu --program-prefix=x86_64-linux-gnu- --target=x86_64-linux-gnu --with-abi=m64 --with-arch-32=i686 --with-build-config=bootstrap-lto-lean --with-default-libstdcxx-abi=new --with-gcc-major-version-only --with-multilib-list=m32,m64,mx32 --with-target-system-zlib=auto --with-tune=generic --without-cuda-driver -v
Disk Notes: MQ-DEADLINE / errors=remount-ro,relatime,rw / Block Size: 131072

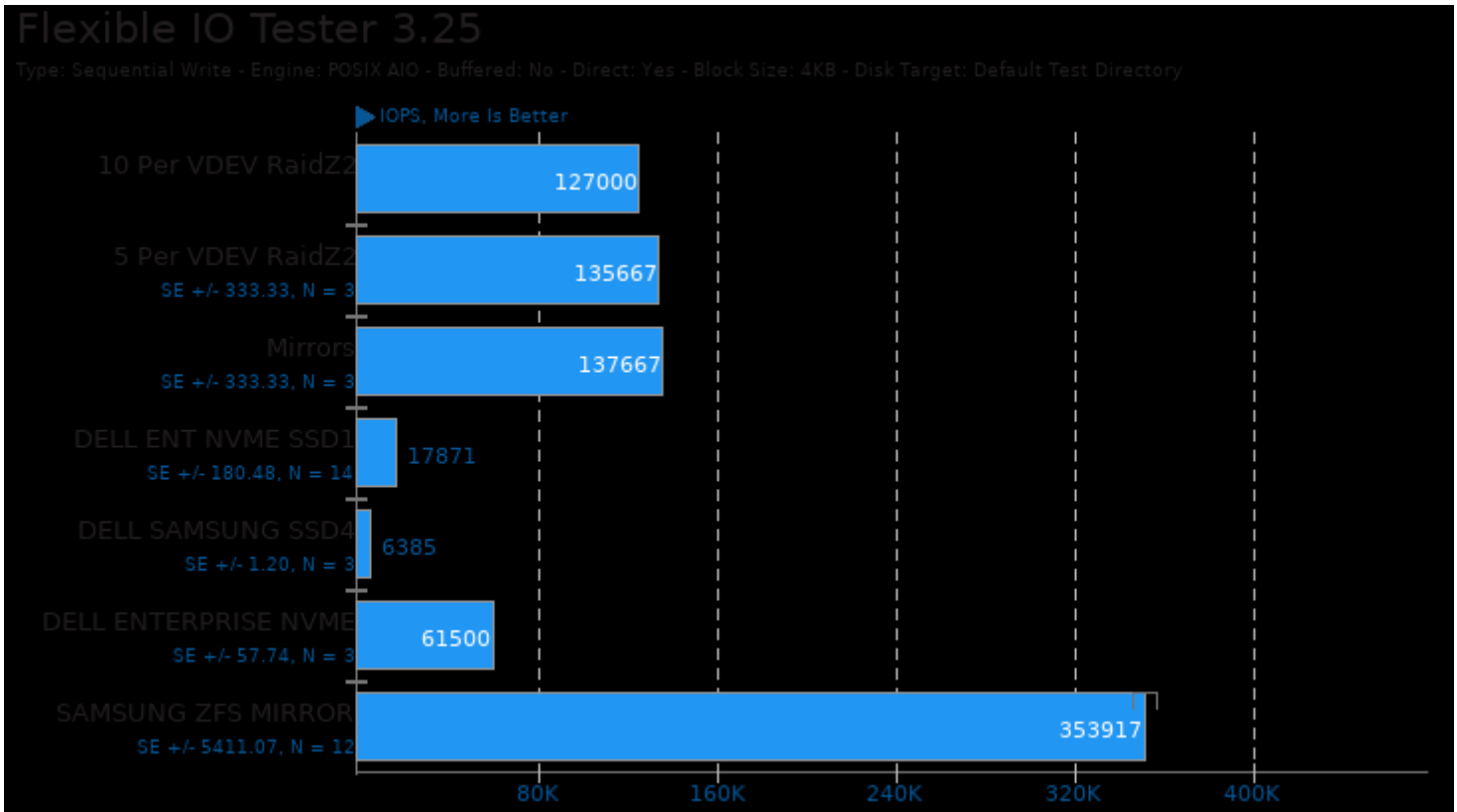
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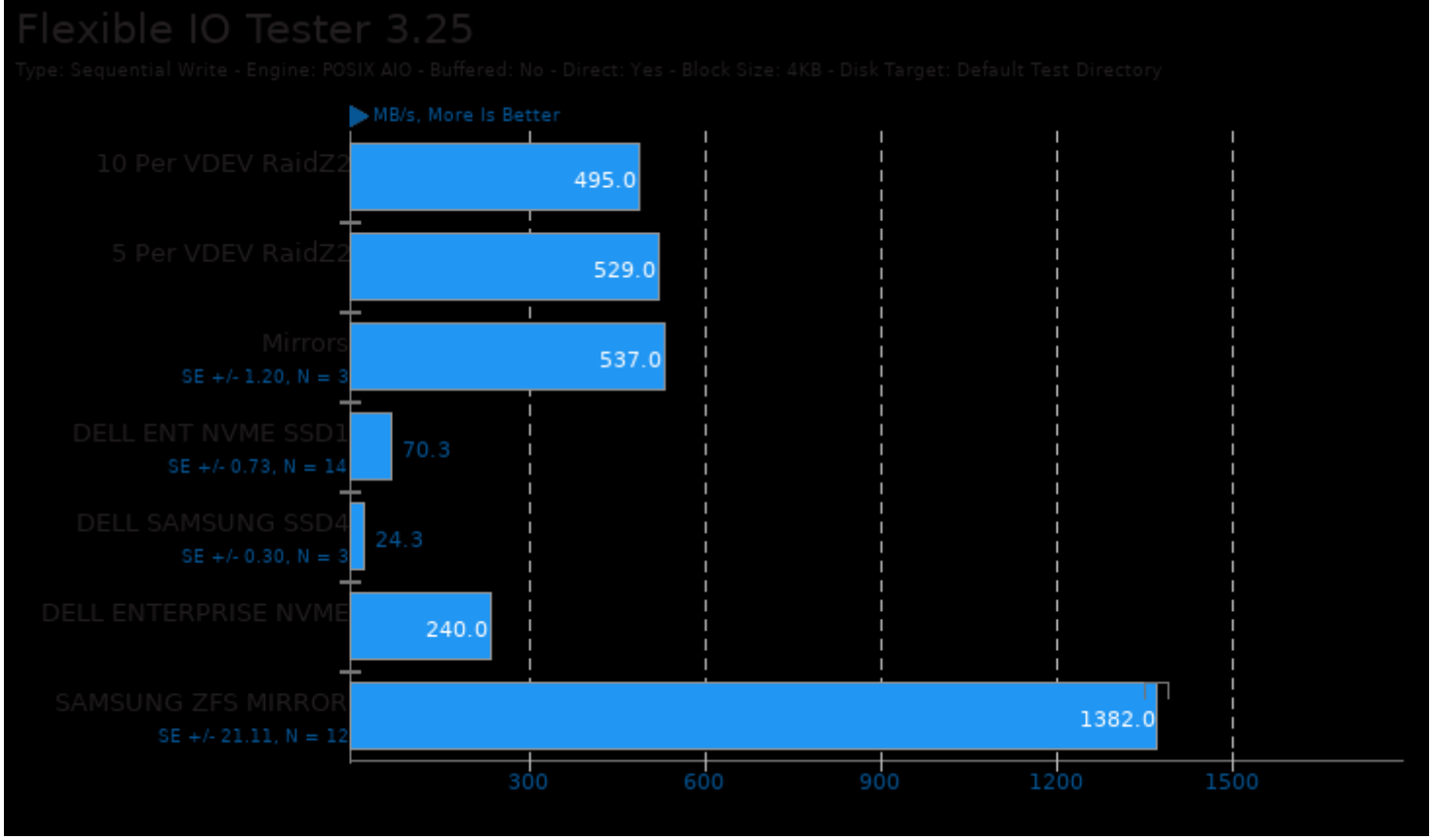
Processor Notes: CPU Microcode: 0xa00115d
Security Notes: itlb_multihit: Not affected + l1tf: Not affected + mds: Not affected + meltdown: Not affected + spec_store_bypass: Mitigation of SSB disabled via prctl and seccomp + spectre_v1: Mitigation of usercopy/swapgs barriers and __user pointer sanitization + spectre_v2: Mitigation of Retpolines IBPB: conditional IBRS_FW STIBP: always-on RSB filling + srbds: Not affected + tsx_async_abort: Not affected

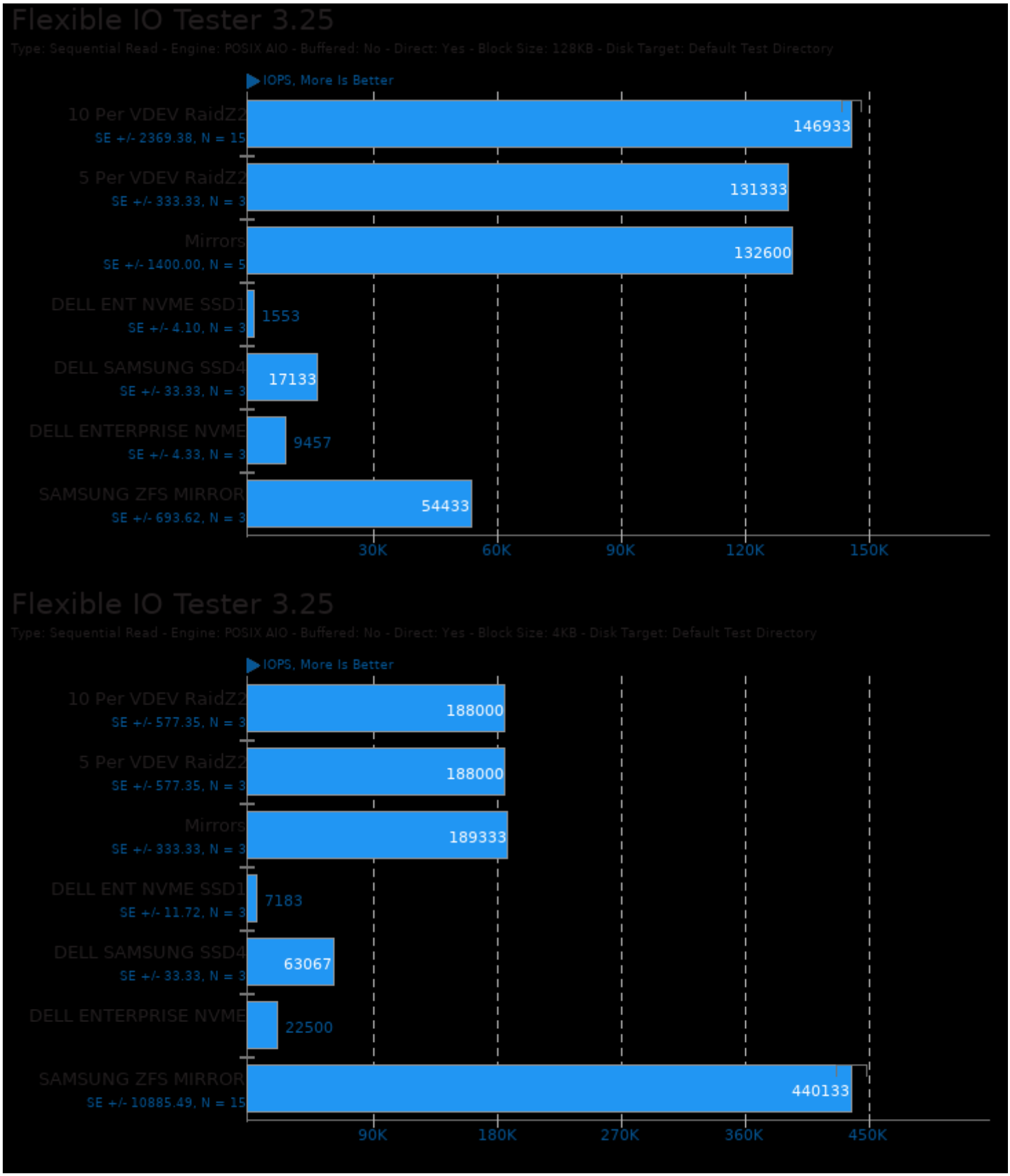
	10 Per VDEV RaidZ2	5 Per VDEV RaidZ2	Mirrors	DELL ENT NVME SSD1	DELL SAMSUNG SSD4	DELL ENTERPRISE NVME	SAMSUNG ZFS MIRROR
Flexible IO Tester - Seq Write - POSIX AIO - No - Yes - 4KB (IOPS)	127000	135667	137667	17871	**6385**	61500	**353917**
Normalized	35.88%	38.33%	38.9%	5.05%	1.8%	17.38%	100%
Standard Deviation		0.4%	0.4%	3.8%	0%	0.2%	5.3%
Flexible IO Tester - Seq Write - POSIX AIO - No - Yes - 4KB (MB/s)	495	529	537	70.3	**24.3**	240	**1382**
Normalized	35.82%	38.28%	38.86%	5.09%	1.76%	17.37%	100%
Standard Deviation			0.4%	3.9%	2.1%		5.3%
Flexible IO Tester - Seq Read - POSIX AIO - No - Yes - 128KB (IOPS)	**146933**	131333	132600	**1553**	17133	9457	54433
Normalized	100%	89.38%	90.25%	1.06%	11.66%	6.44%	37.05%
Standard Deviation	6.2%	0.4%	2.4%	0.5%	0.3%	0.1%	2.2%
Flexible IO Tester - Seq Read - POSIX AIO - No - Yes - 4KB (IOPS)	188000	188000	189333	**7183**	63067	22500	**440133**
Normalized	42.71%	42.71%	43.02%	1.63%	14.33%	5.11%	100%
Standard Deviation	0.5%	0.5%	0.3%	0.3%	0.1%		9.6%
Flexible IO Tester - Seq Read - POSIX AIO - No - Yes - 4KB (MB/s)	735	735	739	**28.1**	246	87.6	**1720**
Normalized	42.73%	42.73%	42.97%	1.63%	14.3%	5.09%	100%
Standard Deviation	0.4%	0.4%	0.4%	0.4%	0.2%	0.6%	9.6%
Flexible IO Tester - Rand Write - POSIX AIO - No - Yes - 4KB (IOPS)	92300	110333	129333	18260	**6242**	61233	**180000**
Normalized	51.28%	61.3%	71.85%	10.14%	3.47%	34.02%	100%
Standard Deviation	0.8%	1.4%	1.9%	4.7%	0.1%	0.2%	
Flexible IO Tester - Rand Write - POSIX AIO - No - Yes - 4KB (MB/s)	360	432	505	71.3	**24.4**	240	**703**
Normalized	51.21%	61.45%	71.83%	10.14%	3.47%	34.14%	100%
Standard Deviation	0.8%	0.9%	1.9%	4.7%	0%	0.2%	0.2%
Flexible IO Tester - Seq Write - POSIX AIO - No - Yes - 128KB (MB/s)	**9131**			**203**	2080	2285	6145
Normalized	100%			2.22%	22.78%	25.02%	67.3%
Standard Deviation	2.2%			0.6%	0.1%	0.1%	2.4%

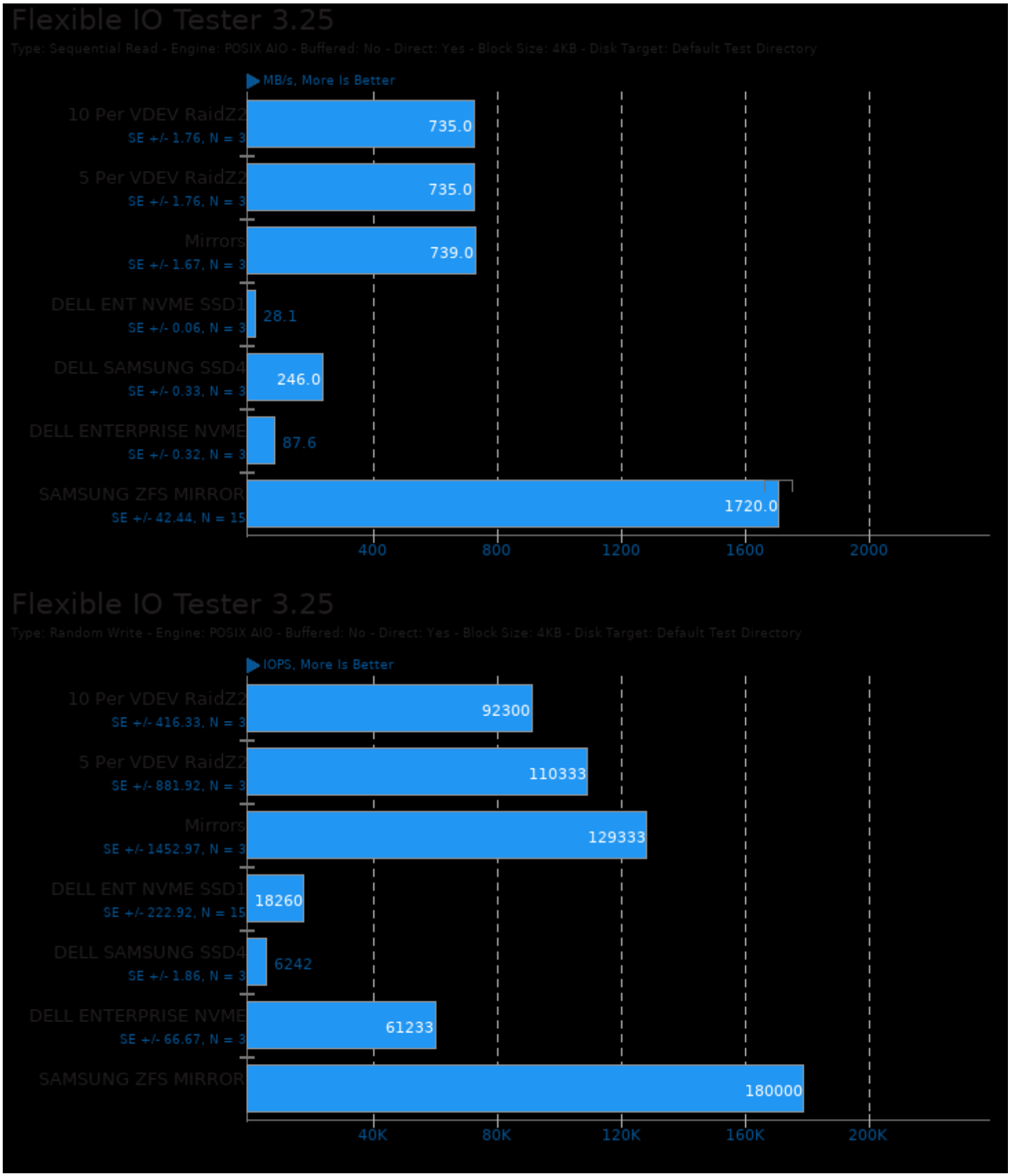
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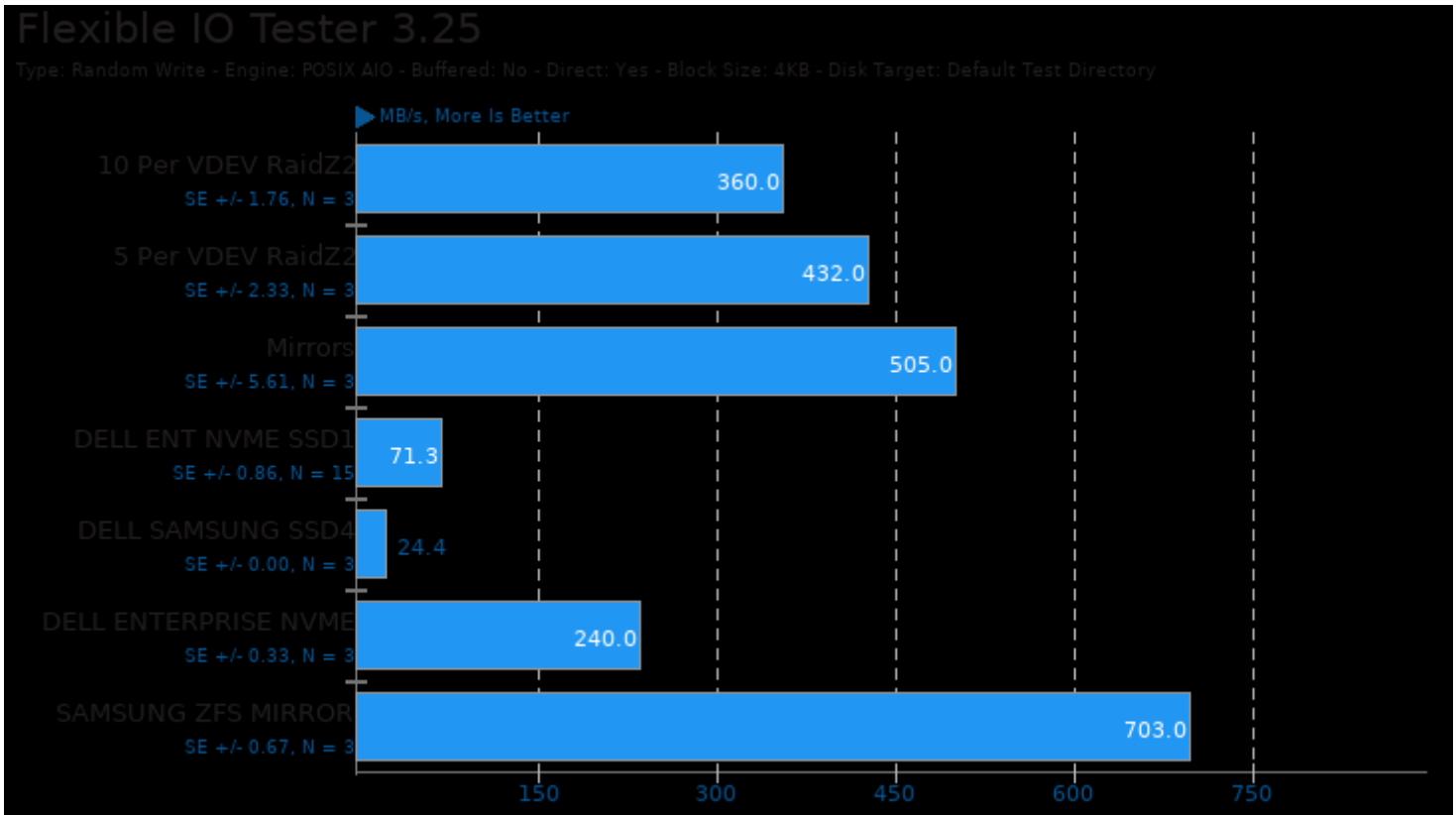
Flexible IO Tester - Seq Write - POSIX AIO - No - Yes - 128KB (IOPS)	73033	91300	**99900**	**1623**	16633	18300	49140
Normalized	73.11%	91.39%	100%	1.62%	16.65%	18.32%	49.19%
Standard Deviation	2.2%	1.3%	1.9%	0.5%	0.3%		2.4%
Flexible IO Tester - Rand Read - POSIX AIO - No - Yes - 4KB (IOPS)	175333	177333	**178333**	**6991**	9825	12100	99133
Normalized	98.13%	99.25%	99.81%	3.91%	5.5%	6.77%	55.48%
Standard Deviation	0.7%	0.7%	0.6%	0.4%	0.1%		0.6%
Flexible IO Tester - Rand Read - POSIX AIO - No - Yes - 4KB (MB/s)	685	692	**697**	**27.3**	38.4	47.2	388
Normalized	98.28%	99.28%	100%	3.92%	5.51%	6.77%	55.67%
Standard Deviation	0.8%	0.7%	0.7%	0.4%	0%	0%	0.6%
Flexible IO Tester - Rand Read - POSIX AIO - No - Yes - 128KB (IOPS)	156667	**157000**	156333	**1561**	6327	7633	58733
Normalized	99.79%	100%	99.58%	0.99%	4.03%	4.86%	37.41%
Standard Deviation	0.4%	0.6%	0.4%	0.3%	1.2%	0.1%	1.8%
Flexible IO Tester - Rand Read - POSIX AIO - No - Yes - 128KB (MB/s)				**196**	791	955	**7340**
Normalized				2.67%	10.78%	13.01%	100%
Standard Deviation				0.3%	1.1%	0.1%	1.8%
Flexible IO Tester - Seq Read - POSIX AIO - No - Yes - 128KB (MB/s)				**195**	2138	1182	**6804**
Normalized				2.87%	31.42%	17.37%	100%
Standard Deviation					0.3%	0.1%	2.3%
Flexible IO Tester - Rand Write - POSIX AIO - No - Yes - 128KB (IOPS)	72700	93500	**95733**	**1617**	16400	18300	49633
Normalized	75.94%	97.67%	100%	1.69%	17.13%	19.12%	51.85%
Standard Deviation	2.1%	1.4%	0.9%	1.1%			0.4%
Flexible IO Tester - Rand Write - POSIX AIO - No - Yes - 128KB (MB/s)	**9083**			**203**	2054	2286	6210
Normalized	100%			2.23%	22.61%	25.17%	68.37%
Standard Deviation	2.1%			1.2%		0.1%	0.4%

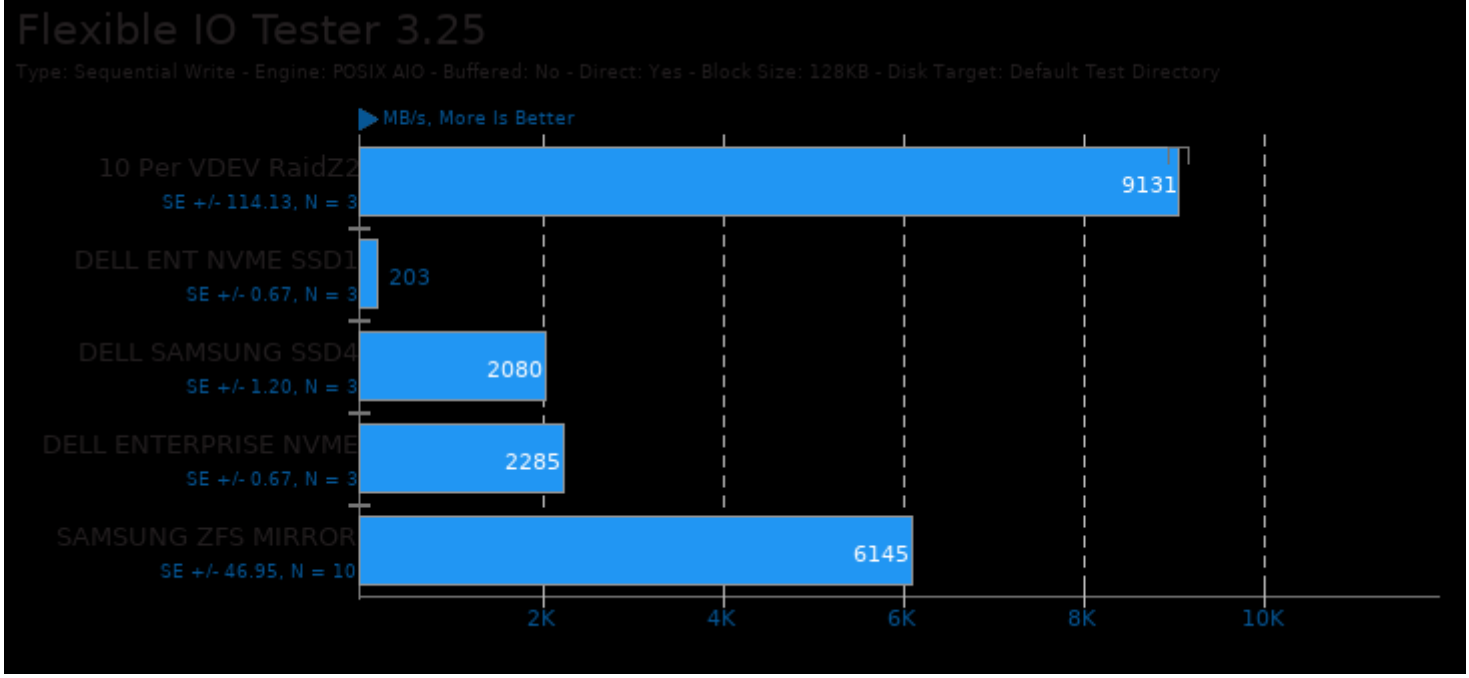

Flexible IO Tester 3.25
Type: Sequential Write - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 4KB - Disk Target: Default Test Directory
IOPS, More Is Better
10 Per VDEV RaidZ2
127000
5 Per VDEV RaidZ2
SE +/- 333.33, N = 3
135667
Mirrors
SE +/- 333.33, N = 3
137667
DELL ENT NVME SSD1
SE +/- 180.48, N = 14
17871
DELL SAMSUNG SSD4
SE +/- 1.20, N = 3
6385
DELL ENTERPRISE NVME
SE +/- 57.74, N = 3
61500
SAMSUNG ZFS MIRROR
SE +/- 5411.07, N = 12
353917
80K
160K
240K
320K
400K

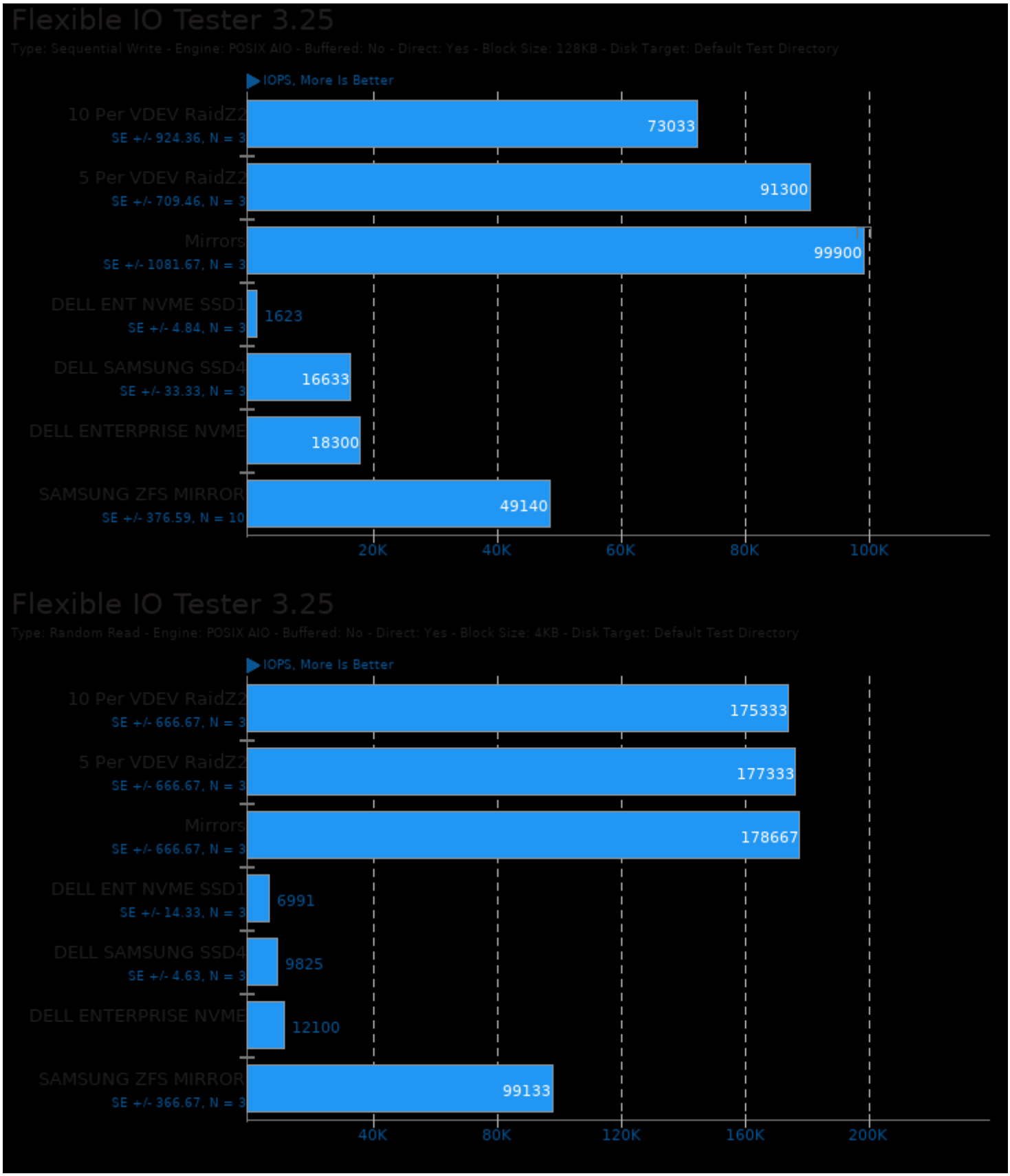

Flexible IO Tester 3.25
Type: Sequential Write - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 4KB - Disk Target: Default Test Directory
MB/s, More Is Better
10 Per VDEV RaidZ2
495.0
5 Per VDEV RaidZ2
529.0
Mirrors
SE +/- 1.20, N = 3
537.0
DELL ENT NVME SSD1
SE +/- 0.73, N = 14
70.3
DELL SAMSUNG SSD4
SE +/- 0.30, N = 3
24.3
DELL ENTERPRISE NVME
240.0
SAMSUNG ZFS MIRROR
SE +/- 21.11, N = 12
1382.0
300
600
900
1200
1500

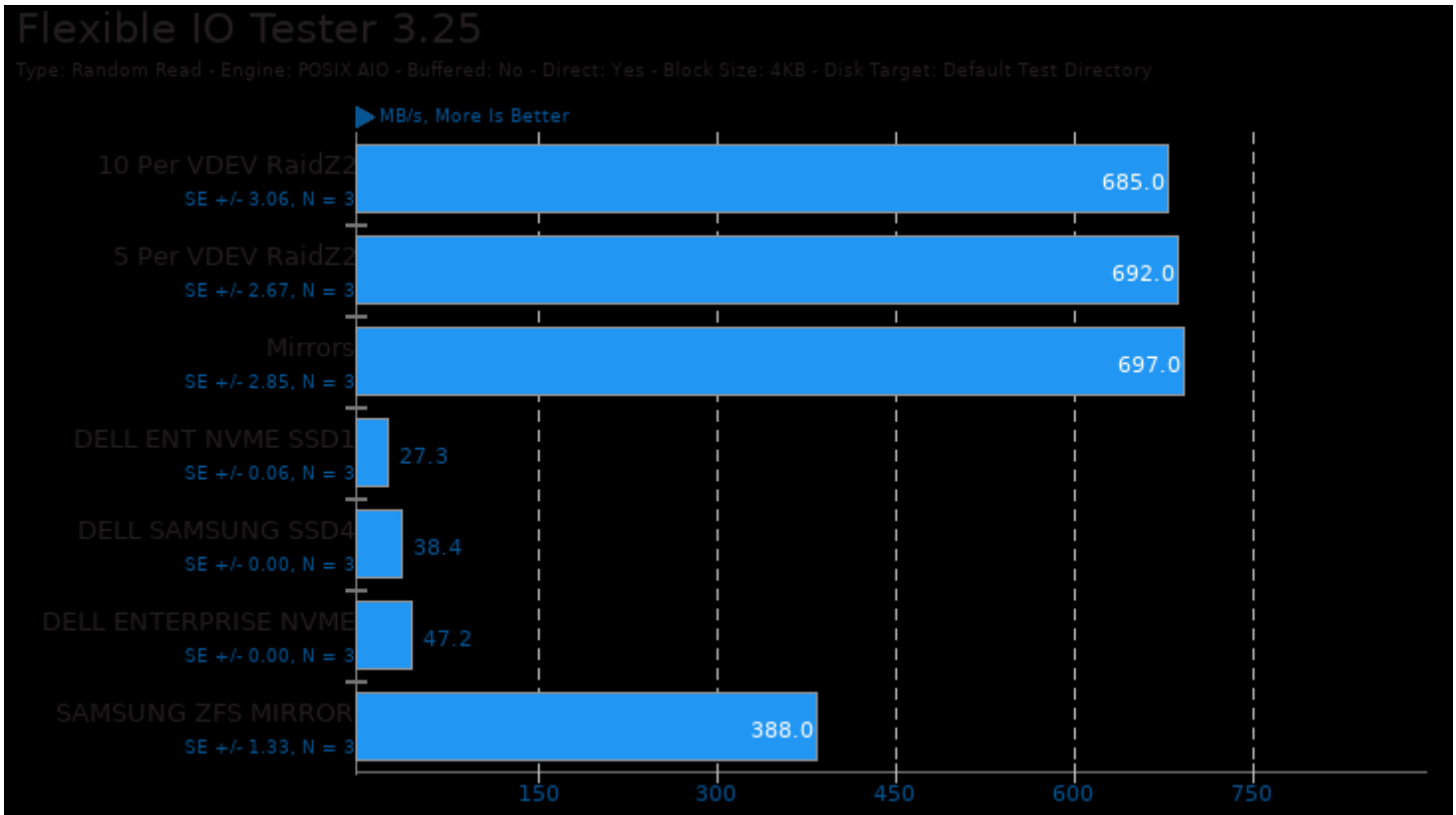

Flexible IO Tester 3.25
Type: Sequential Read - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 128KB - Disk Target: Default Test Directory
IOPS, More Is Better
10 Per VDEV RaidZ2
SE +/- 2369.38, N = 15
146933
5 Per VDEV RaidZ2
SE +/- 333.33, N = 3
131333
Mirrors
SE +/- 1400.00, N = 5
132600
DELL ENT NVME SSD1
SE +/- 4.10, N = 3
1553
DELL SAMSUNG SSD4
SE +/- 33.33, N = 3
17133
DELL ENTERPRISE NVME
SE +/- 4.33, N = 3
9457
SAMSUNG ZFS MIRROR
SE +/- 693.62, N = 3
54433
30K
60K
90K
120K
150K
Flexible IO Tester 3.25
Type: Sequential Read - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 4KB - Disk Target: Default Test Directory
IOPS, More Is Better
10 Per VDEV RaidZ2
SE +/- 577.35, N = 3
188000
5 Per VDEV RaidZ2
SE +/- 577.35, N = 3
188000
Mirrors
SE +/- 333.33, N = 3
189333
DELL ENT NVME SSD1
SE +/- 11.72, N = 3
7183
DELL SAMSUNG SSD4
SE +/- 33.33, N = 3
63067
DELL ENTERPRISE NVME
22500
SAMSUNG ZFS MIRROR
SE +/- 10885.49, N = 15
440133
90K
180K
270K
360K
450K

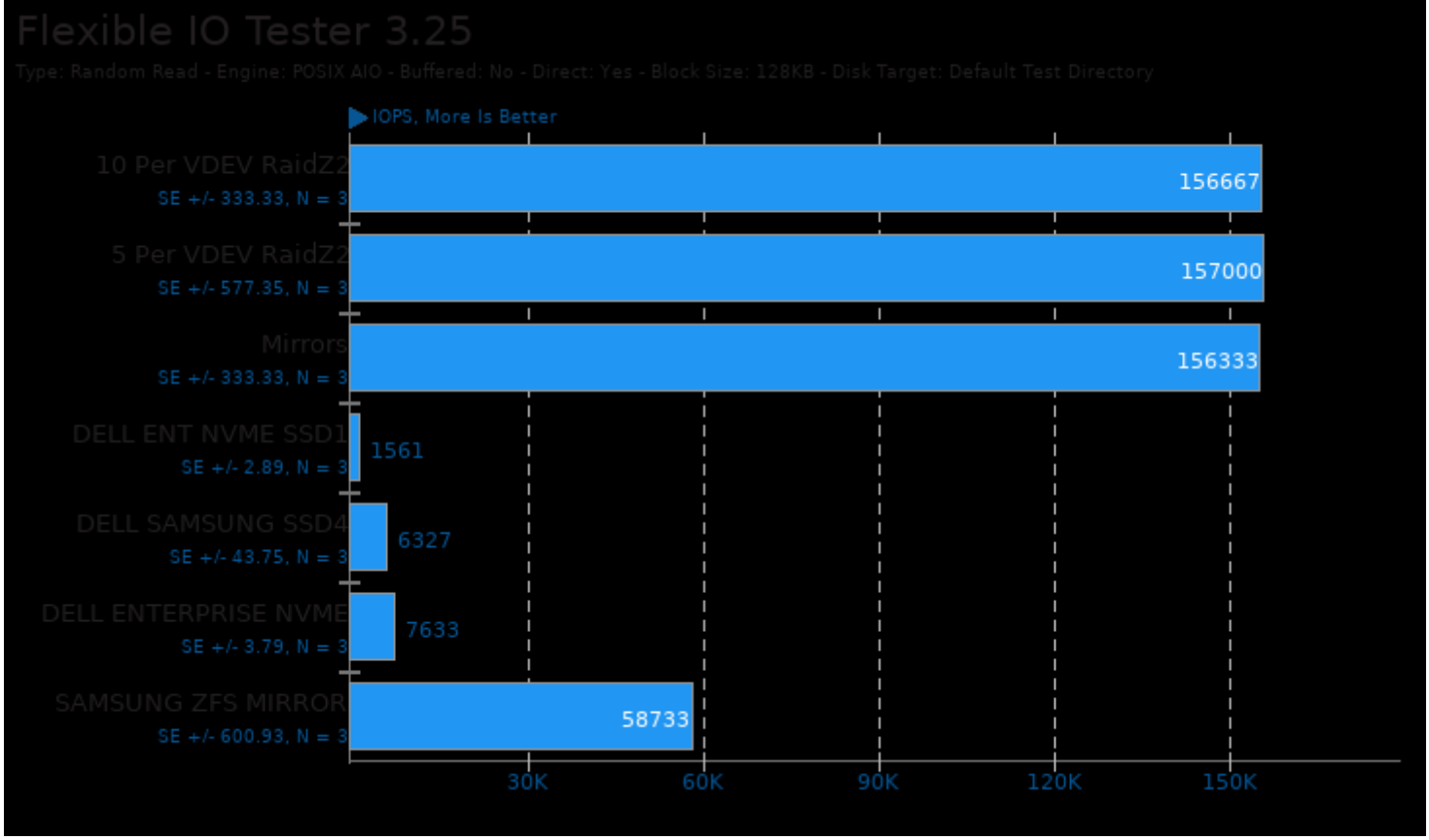

Flexible IO Tester 3.25
Type: Sequential Read - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 4KB - Disk Target: Default Test Directory
MB/s, More Is Better
10 Per VDEV RaidZ2
SE +/- 1.76, N = 3
735.0
5 Per VDEV RaidZ2
SE +/- 1.76, N = 3
735.0
Mirrors
SE +/- 1.67, N = 3
739.0
DELL ENT NVME SSD1
SE +/- 0.06, N = 3
28.1
DELL SAMSUNG SSD4
SE +/- 0.33, N = 3
246.0
DELL ENTERPRISE NVME
SE +/- 0.32, N = 3
87.6
SAMSUNG ZFS MIRROR
SE +/- 42.44, N = 15
1720.0
400
800
1200
1600
2000
Flexible IO Tester 3.25
Type: Random Write - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 4KB - Disk Target: Default Test Directory
IOPS, More Is Better
10 Per VDEV RaidZ2
SE +/- 416.33, N = 3
92300
5 Per VDEV RaidZ2
SE +/- 881.92, N = 3
110333
Mirrors
SE +/- 1452.97, N = 3
129333
DELL ENT NVME SSD1
SE +/- 222.92, N = 15
18260
DELL SAMSUNG SSD4
SE +/- 1.86, N = 3
6242
DELL ENTERPRISE NVME
SE +/- 66.67, N = 3
61233
SAMSUNG ZFS MIRROR
180000
40K
80K
120K
160K
200K

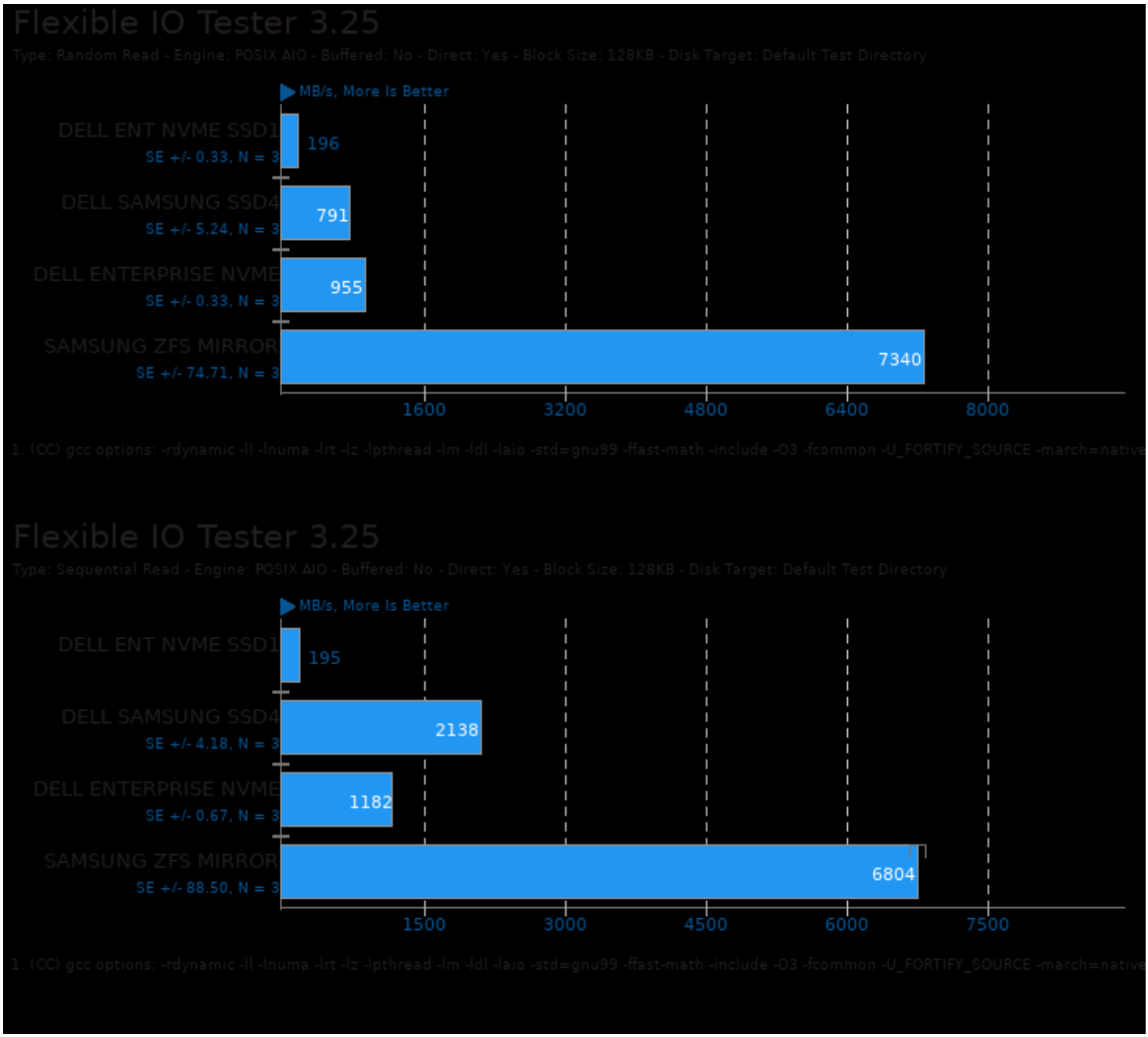

Flexible IO Tester 3.25
Type: Random Write - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 4KB - Disk Target: Default Test Directory
MB/s, More Is Better
10 Per VDEV RaidZ2
SE +/- 1.76, N = 3
360.0
5 Per VDEV RaidZ2
SE +/- 2.33, N = 3
432.0
Mirrors
SE +/- 5.61, N = 3
505.0
DELL ENT NVME SSD1
SE +/- 0.86, N = 15
71.3
DELL SAMSUNG SSD4
SE +/- 0.00, N = 3
24.4
DELL ENTERPRISE NVME
SE +/- 0.33, N = 3
240.0
SAMSUNG ZFS MIRROR
SE +/- 0.67, N = 3
703.0
150
300
450
600
750

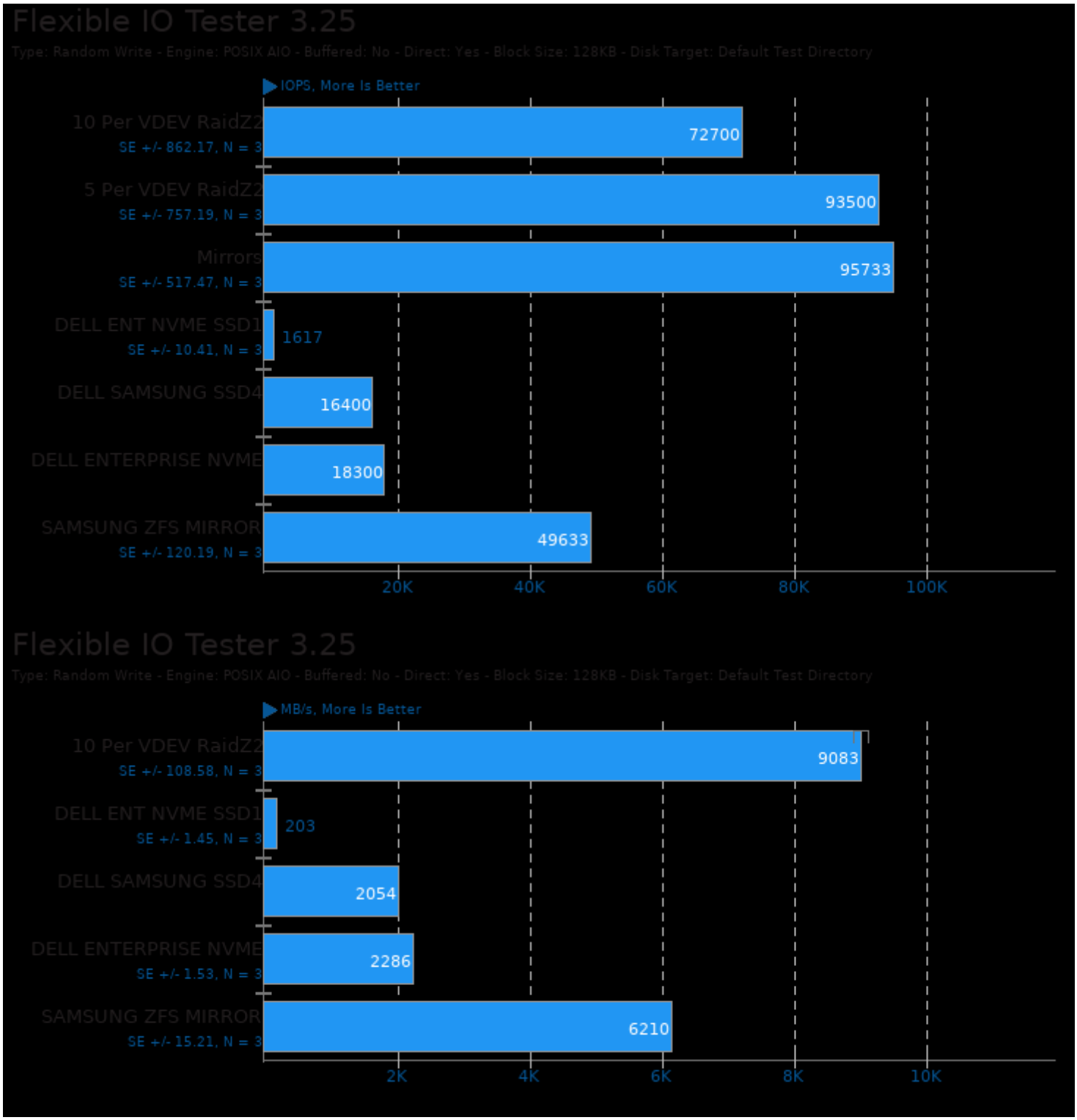

Flexible IO Tester 3.25
Type: Sequential Write - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 128KB - Disk Target: Default Test Directory
MB/s, More Is Better
10 Per VDEV RaidZ2
SE +/- 114.13, N = 3
9131
DELL ENT NVME SSD1
SE +/- 0.67, N = 3
203
DELL SAMSUNG SSD4
SE +/- 1.20, N = 3
2080
DELL ENTERPRISE NVME
SE +/- 0.67, N = 3
2285
SAMSUNG ZFS MIRROR
SE +/- 46.95, N = 10
6145
2K
4K
6K
8K
10K


Flexible IO Tester 3.25
Type: Sequential Write - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 128KB - Disk Target: Default Test Directory
IOPS, More Is Better
10 Per VDEV RaidZ2
SE +/- 924.36, N = 3
73033
5 Per VDEV RaidZ2
SE +/- 709.46, N = 3
91300
Mirrors
SE +/- 1081.67, N = 3
99900
DELL ENT NVME SSD1
SE +/- 4.84, N = 3
1623
DELL SAMSUNG SSD4
SE +/- 33.33, N = 3
16633
DELL ENTERPRISE NVME
18300
SAMSUNG ZFS MIRROR
SE +/- 376.59, N = 10
49140
20K
40K
60K
80K
100K
Flexible IO Tester 3.25
Type: Random Read - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 4KB - Disk Target: Default Test Directory
IOPS, More Is Better
10 Per VDEV RaidZ2
SE +/- 666.67, N = 3
175333
5 Per VDEV RaidZ2
SE +/- 666.67, N = 3
177333
Mirrors
SE +/- 666.67, N = 3
178667
DELL ENT NVME SSD1
SE +/- 14.33, N = 3
6991
DELL SAMSUNG SSD4
SE +/- 4.63, N = 3
9825
DELL ENTERPRISE NVME
12100
SAMSUNG ZFS MIRROR
SE +/- 366.67, N = 3
99133
40K
80K
120K
160K
200K


Flexible IO Tester 3.25
Type: Random Read - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 4KB - Disk Target: Default Test Directory
MB/s, More Is Better
10 Per VDEV RaidZ2
SE +/- 3.06, N = 3
685.0
5 Per VDEV RaidZ2
SE +/- 2.67, N = 3
692.0
Mirrors
SE +/- 2.85, N = 3
697.0
DELL ENT NVME SSD1
SE +/- 0.06, N = 3
27.3
DELL SAMSUNG SSD4
SE +/- 0.00, N = 3
38.4
DELL ENTERPRISE NVME
SE +/- 0.00, N = 3
47.2
SAMSUNG ZFS MIRROR
SE +/- 1.33, N = 3
388.0
150
300
450
600
750


Flexible IO Tester 3.25
Type: Random Read - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 128KB - Disk Target: Default Test Directory
IOPS, More Is Better
10 Per VDEV RaidZ2
SE +/- 333.33, N = 3
156667
5 Per VDEV RaidZ2
SE +/- 577.35, N = 3
157000
Mirrors
SE +/- 333.33, N = 3
156333
DELL ENT NVME SSD1
SE +/- 2.89, N = 3
1561
DELL SAMSUNG SSD4
SE +/- 43.75, N = 3
6327
DELL ENTERPRISE NVME
SE +/- 3.79, N = 3
7633
SAMSUNG ZFS MIRROR
SE +/- 600.93, N = 3
58733
30K
60K
90K
120K
150K


Flexible IO Tester 3.25
Type: Random Read - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 128KB - Disk Target: Default Test Directory
MB/s, More Is Better
DELL ENT NVME SSD1
SE +/- 0.33, N = 3
196
DELL SAMSUNG SSD4
SE +/- 5.24, N = 3
791
DELL ENTERPRISE NVME
SE +/- 0.33, N = 3
955
SAMSUNG ZFS MIRROR
SE +/- 74.71, N = 3
7340
1600
3200
4800
6400
8000
1. (CC) gcc options: -rdynamic -ll -lnuma -lrt -lz -lpthread -lm -ldl -laio -std=gnu99 -ffast-math -include -O3 -fcommon -U_FORTIFY_SOURCE -march=native
Flexible IO Tester 3.25
Type: Sequential Read - Engine: POSIX AIO - Buffered: No - Direct: Yes - Block Size: 128KB - Disk Target: Default Test Directory
MB/s, More Is Better
DELL ENT NVME SSD1
195
DELL SAMSUNG SSD4
SE +/- 4.18, N = 3
2138
DELL ENTERPRISE NVME
SE +/- 0.67, N = 3
1182
SAMSUNG ZFS MIRROR
SE +/- 88.50, N = 3
6804
1500
3000
4500
6000
7500
1. (CC) gcc options: -rdynamic -ll -lnuma -lrt -lz -lpthread -lm -ldl -laio -std=gnu99 -ffast-math -include -O3 -fcommon -U_FORTIFY_SOURCE -march=native



This file was automatically generated via the Phoronix Test Suite benchmarking software on Friday, 29 March 2024 03:25.