

# Intel® Virtual RAID on CPU (Intel® VROC) Detailed Performance Review Windows Server 2019

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# Notices and Disclaimers

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## Purpose:

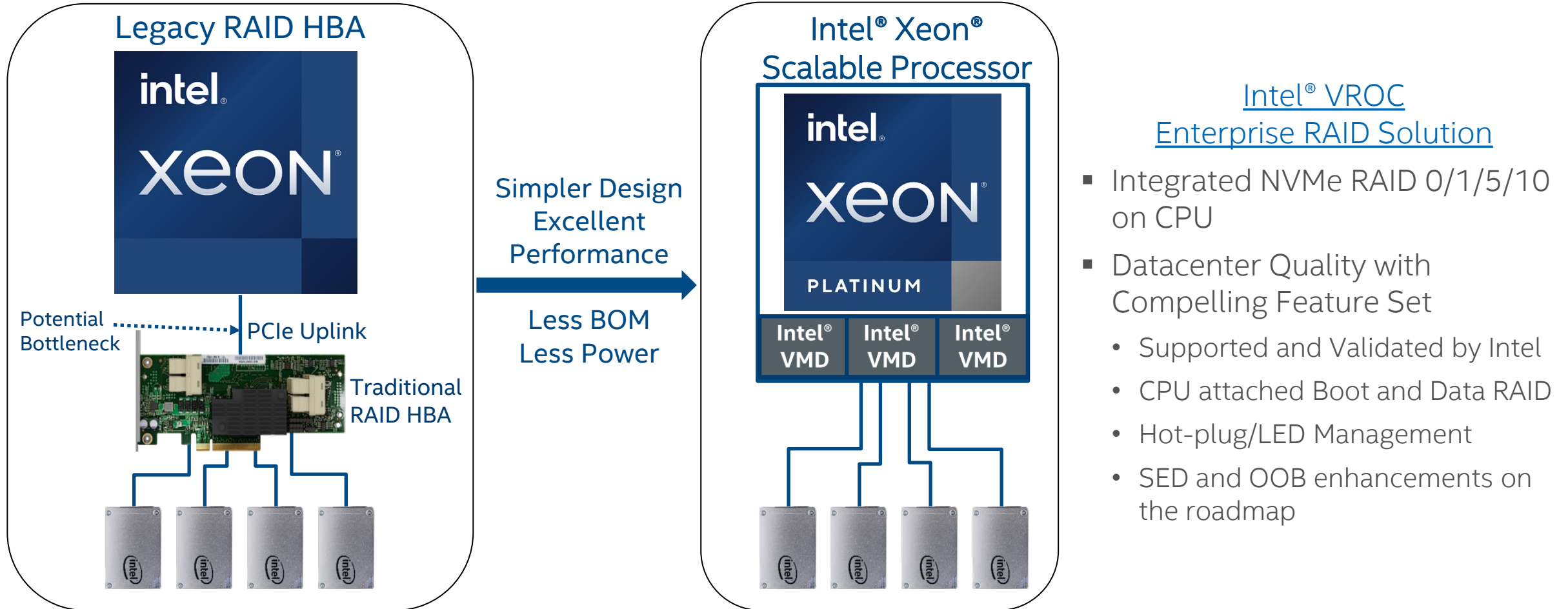
Broad categorical review of Intel VROC (Integrated RAID) on features, performance, latency and CPU% on Windows Server 2019.

## Agenda:

1. Intel VROC Architecture
2. Test Configuration Details
3. RAID0/5/1 Sequential Performance Results
4. RAID0/5/1 Random Performance Review (Latency, CPU%, Bandwidth)

# Intel VROC Architecture

# Intel® VROC is Integrated RAID



## [Intel® VROC Enterprise RAID Solution](#)

- Integrated NVMe RAID 0/1/5/10 on CPU
- Datacenter Quality with Compelling Feature Set
  - Supported and Validated by Intel
  - CPU attached Boot and Data RAID
  - Hot-plug/LED Management
  - SED and OOB enhancements on the roadmap

Intel® VROC onboards RAID HBA functionality onto Intel® Xeon® CPUs<sup>1</sup>

<sup>1</sup>-Intel VROC and Intel VMD are available on all generations (Gen. 1, 2 and 3) and SKUs (Bronze, Silver, Gold, and Platinum) of Intel Xeon Scalable Processor

# Test Configuration Details

# Test Configuration Details

## Tested Configurations:

- Single Drive Performance
- 4x Drive RAID0/10
- 3x Drive RAID5
- 2x Drive RAID1

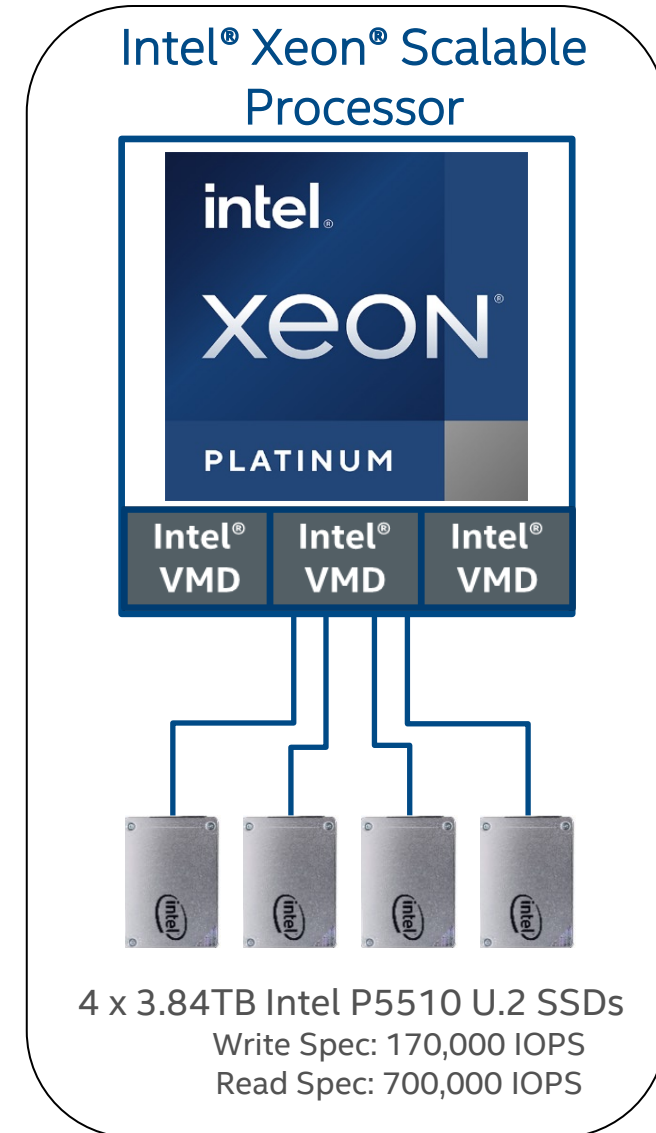
## Workload Details:

- Sequential: 100% Reads, 100% Writes
- 1 Thread, 128 IODepth
- 4k Random: 100% Reads, 100% Writes, 70/30 R/W
- 8 Threads, 16 IODepth
- 8 Threads, 32 IODepth
- 16 Threads, 16 IODepth

## Metrics

- Performance: IOPS
- Bandwidth: MB/sec
- Latency:  $\mu$ sec
- CPU Usage\*: Effective Intel Xeon Cores used

\*CPU Usage measured as total platform CPU % consumption, includes workload generation, storage stack (RAID) usage, and background activity  
Measured as "Cores Used" = CPU% report out \* # cores on system (64 cores)

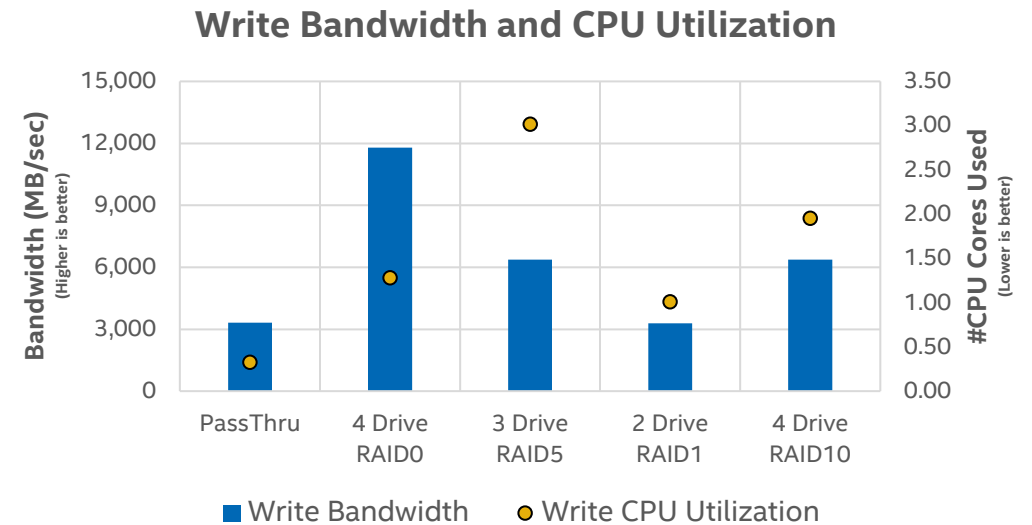
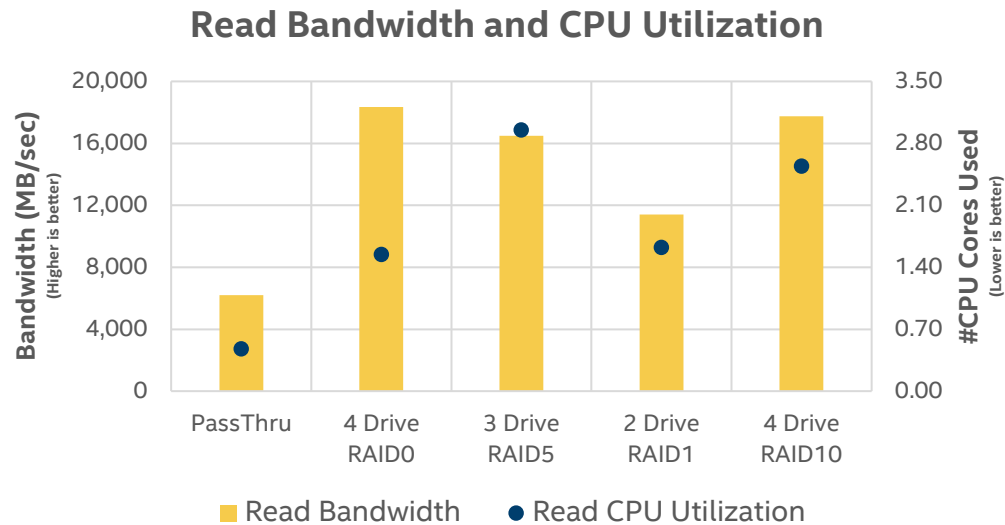


# Sequential Performance



# RAID Levels Performance<sup>1</sup>

Sequential, 1 Thread, 128 IO Depth.



Intel VROC with 4 Drive RAID0 achieves **up to 3x performance** vs passthrough on read sequential workloads and up to 3.5x on write sequential workloads

See backup for configuration details. Results may vary

# Random Performance

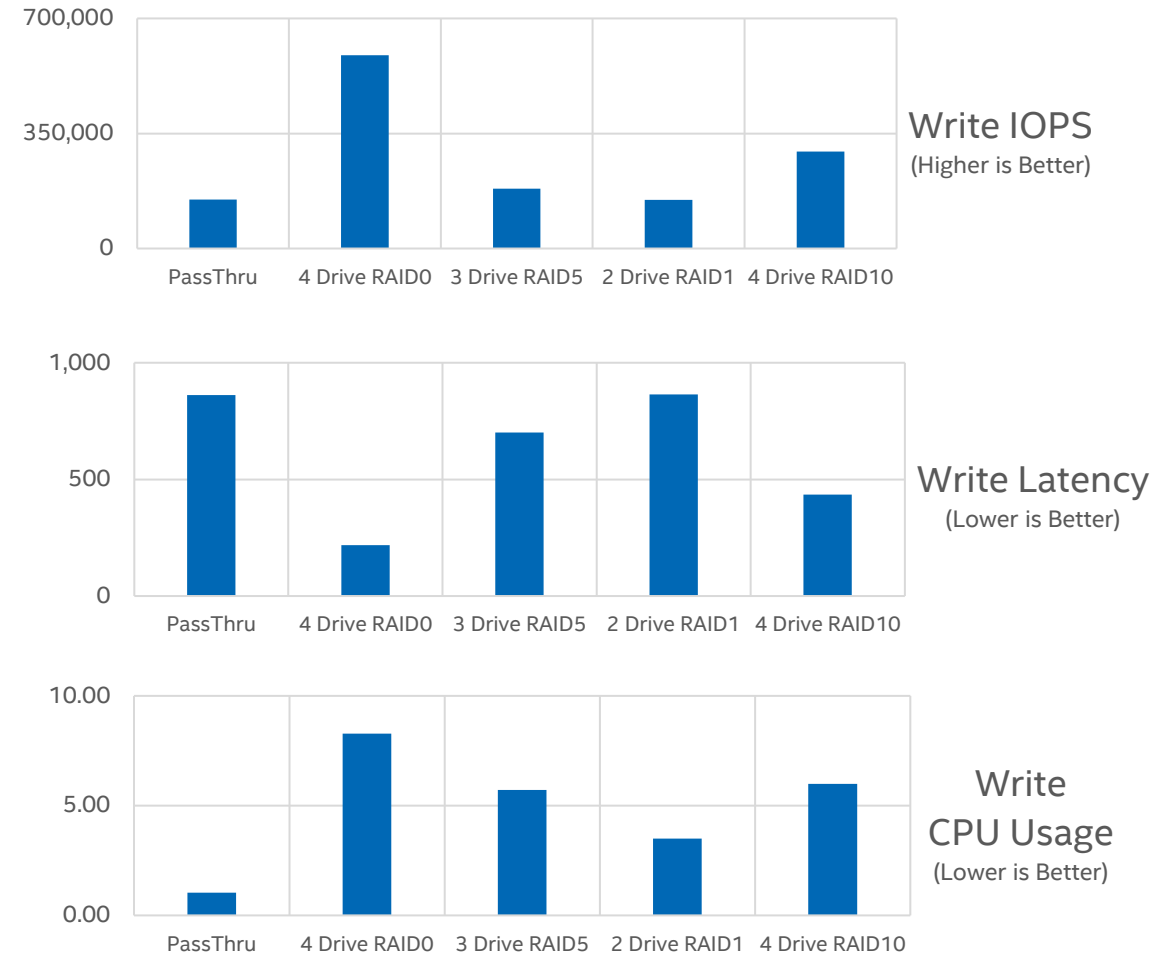
# RAID0/5/1/10 Write Comparison<sup>1</sup>

8 Thread, 16 IODepth

Intel VROC achieves max RAID performance in just 8 Threads and 16 IODepth level

Intel VROC RAID0/5/1/10 writes provides:

- Up to 4x scaling on IOPS when using RAID0 with VROC
- RAID5 IOPS is 1.2x Passthrough, inline with RAID level 5 expectations
- Up to 75% lower latency on RAID0 with much higher performance



See backup for configuration details. Results may vary

# RAID0/5/1/10 Read/Write Comparison<sup>1</sup>

8 Thread, 32 IO Depth

Intel VROC RAID0/5/1 on mixed workloads provides:

- Up to 68% extra IOPS scaling when using RAID5 with VROC
- Up to 3.9x scaling on bandwidth when using RAID0 with VROC
- Up to 75% lower latency when using RAID0 and 40% lower latency when using RAID5 with VROC over Passthrough



See backup for configuration details. Results may vary

# RAID0/5/1/10 Read Comparison<sup>1</sup>

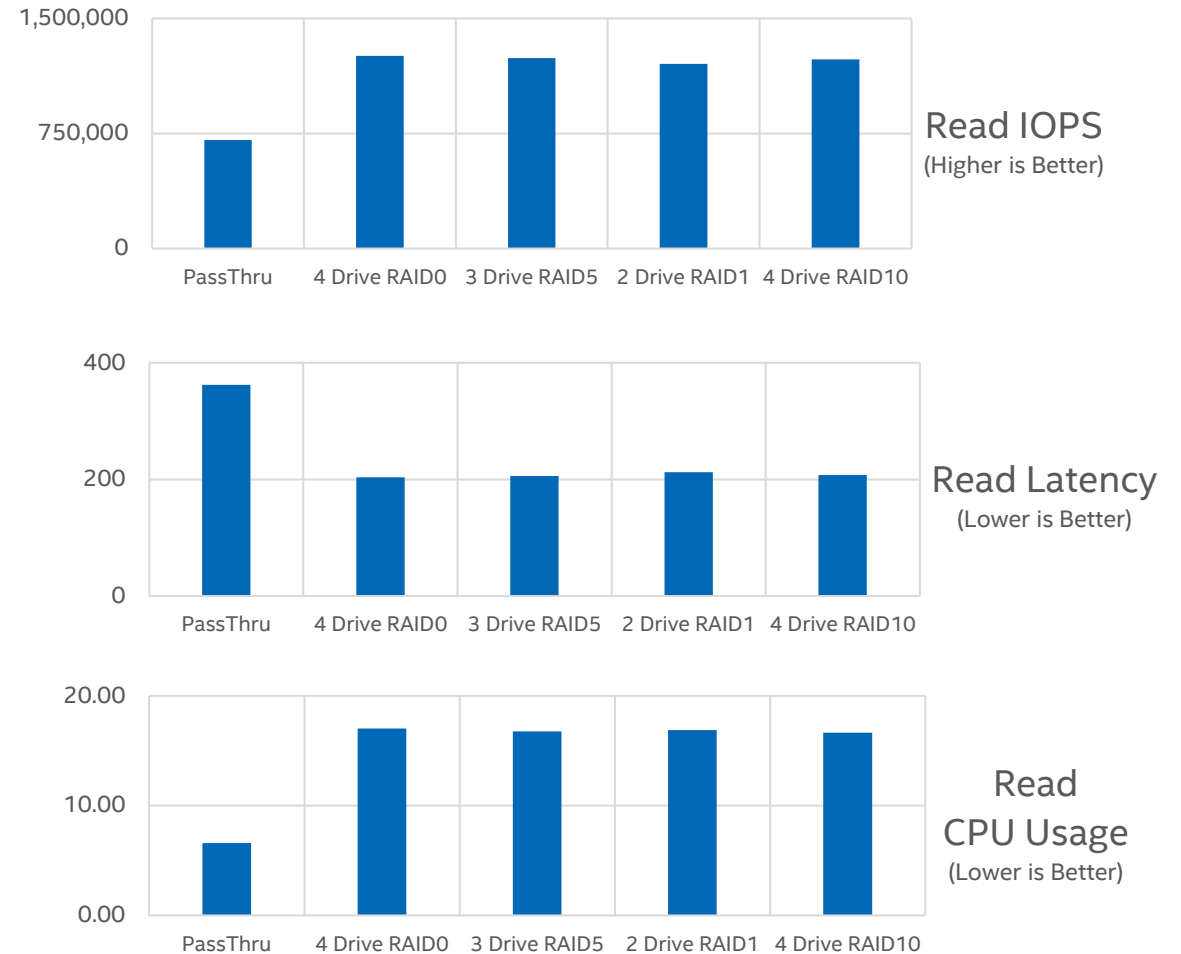
16 Thread, 16 IODepth

Intel VROC RAID0/5/1 reads provides:

- Up to 70% extra bandwidth across all RAID levels with VROC
- Up to 44% lower latency across all RAID levels with VROC

Windows storage stack has ~1.2M IOPS limitation for all storage drivers

Intel VROC Reads approaching max IOPS limit



See backup for configuration details. Results may vary

# Backup

# Configuration Details

## 1. Intel VROC vs RADI HBA Comparison

**System configuration:** Beta Coyote Pass M50CYP2SB2U/M50CYP2SBSTD (chassis M50CYP2UR208BPP), 2 x Intel® Xeon® Platinum 8358 CPU @ 2.60GHz (XCC CPUs) (32 cores each) (Whitley - Icelake), DRAM 128GB, BIOS Release 03/22/2021, BIOS Version: SE5C6200.86B.0022.D08.2103221623 (Contains microcode fix 270)

**OS:** Windows Server 2019 Standard Version 1809 (OS Build 17763.379), Intel(R) VROC PreOS Version: 7.5.6.1010

**Storage:** 4 x 3.84TB Intel P5510 U.2 SSDs (Model: SSDPF2KX038TZ, Firmware: JCV10016) connected to backplane which is connected via SlimSAS cables directly to motherboard on CPU1 (NUMA Node 0).

**BIOS setting:** SpeedStep(Enabled), Turbo(Enabled), ProcessorC6(Enabled), PackageC-State(C0/C1 State), CPU\_PowerAndPerformancePolicy(Performance), HardwareP-States(NativeMode), WorkloadConfiguration(I/O Sensitive)

**RAID Configurations:** Passthrough, 4-Disk RAID0/10, 3-Disk RAID5 and 2-Disk RAID1 with Intel VROC

**Workload Generator:** Iometer 1.1.0 Dyn Buckets 1.2, Seq 1-Thread 128 IODepth, 4K Random 8-thread 16-IODepth, 8-thread 32-IODepth, 16-thread 16-IODepth

Performance results are based on testing as of 5/25/2021 and may not reflect all publicly available updates. See configuration disclosure for details. No product can be absolutely secure.

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