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Intel® Optane™ SSD 800P Powers Most Responsive Desktop Platform

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Storage Performance Hinges on Responsiveness

There are many ways to measure the performance of a PC and many ways to measure the performance of any single sub-system of that computer. Storage performance is no different, and with the movement towards evaluating the performance of computing hardware based on end-user experiences, the expectations of how storage should behave has evolved. As processor performance, graphics capability, and workloads evolve for the consumer, the demand for higher performing storage solutions has increased.

Throughput is still a valuable metric for storage performance in some select instances including large file copies and transfers. But in recent years the impact of latency on individual IO requests has quickly become the dominant gauge of user-experience based storage performance. Consumer workloads and even the majority of enthusiast and workstation environments operate at low queue depths for the vast majority of IO requests. As a result, the ability to service those requests quickly (the measurement of average latency) is crucial to showing value to the user.

Application testing and benchmarks that put an emphasis on responsiveness and storage latency are most capable of measuring the impact of new storage options on desktop users. Intel® Optane™ technology represents Intel's answer to the request for faster storage in both mobile, desktop, workstation, and enterprise markets.

Intel® Optane™ SSD 800P Brings Peak Performance

Based on the same 3D XPoint technology that powers the workstation-class 900P as well as the system accelerating Optane™ Memory, the new Intel® Optane™ SSD 800P offers best-in-class performance that provides the world's most responsive storage solution for desktop PCs. The responsiveness of a drive is measured with latency and tells us how quickly the drive responds to user and operating system requests and directly correlates to the user experience of everyday tasks like application loads, game launches, and more.

By combining the performance of 3D XPoint™ technology with higher capacities than were available with Optane™ Memory, Intel® Optane™ SSD 800P provides desktop users and enthusiasts the best combination of features and capability. (You can find more details on the implications and technology of 3D XPoint™ [by reading our white paper here.](#))



Testing Configuration

Intel® Optane™ SSD 800P performance was evaluated across multiple test system configurations.

- Configuration 1
 - ASUS STRIX Z370-E Gaming (C-states disabled)
 - Intel® Core™ i7-8700K
 - 16GB DDR4-2400
 - NVIDIA GeForce GTX 1080
 - Windows 10 Pro 64-bit 10.0.16299 (High Performance power plan)
- Configuration 2
 - ASUS Prime B250-PLUS (C-states disabled)
 - Intel® Core™ i5-7500
 - 8GB DDR4-2400
 - NVIDIA GeForce GTX 1080
 - Windows 10 Pro 64-bit 10.0.16299 (High Performance power plan)
- Configuration 3 (for RAID testing)
 - ASUS Prime Z270-A (C-states disabled)
 - Intel® Core™ i7-7700K
 - 16GB DDR4-2400
 - Intel® HD Graphics 630
 - Windows 10 Pro 64-bit 10.0.16299 (High Performance power plan)

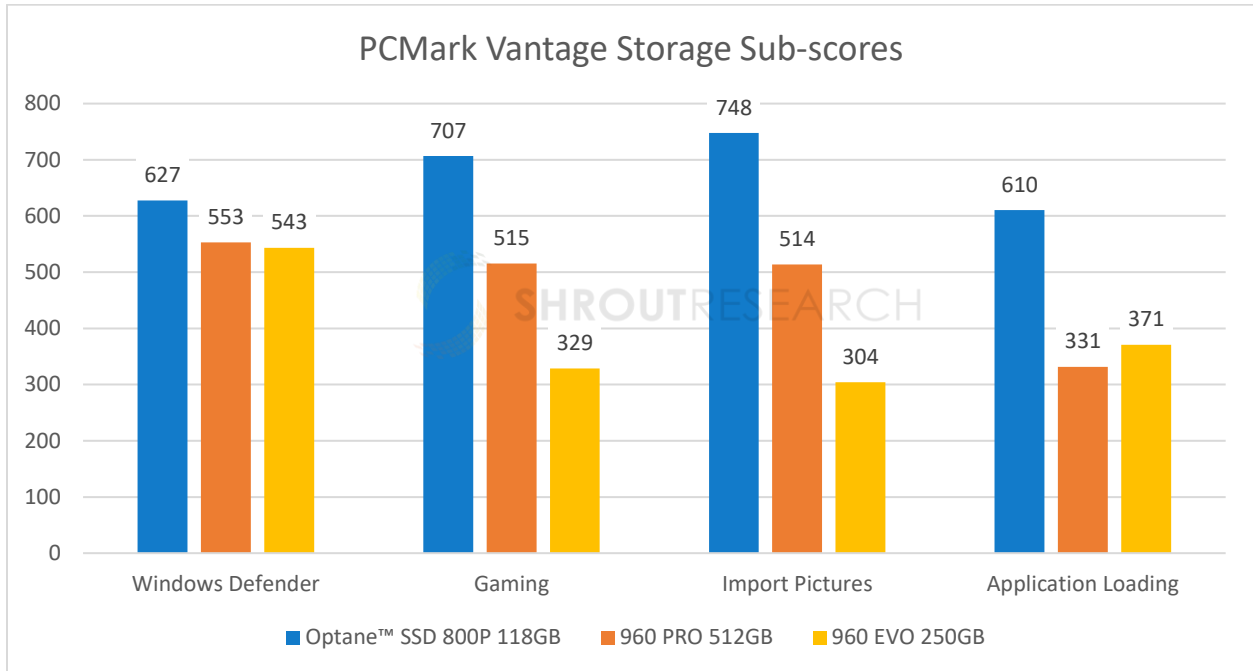
Storage Options Tested:

- Intel® Optane™ SSD 800P 118GB
- Samsung 960 PRO 512GB
- Samsung 960 EVO 250GB



PCMark Vantage

PCMark Vantage is a slightly older benchmark suite from Futuremark that attempts to measure storage performance with similar consumer-based workloads. The HDD Suite focuses on tasks like virus scanning, game data streaming, photo importing, video time shifting, and more.



See Appendix A

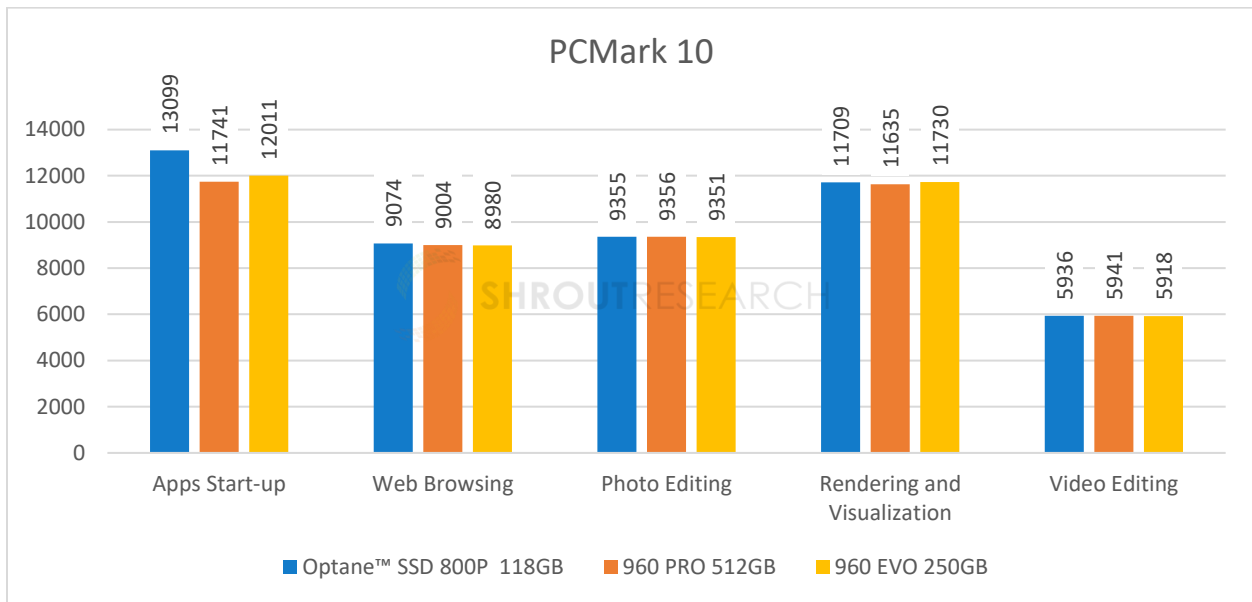
Intel® Optane™ SSD 800P ranges from 15% faster in Windows Defender to earning a 2.46x advantage in the Import Pictures operation. Strong gains are also seen in Application Loading and Gaming-related storage activity.



PCMark 10

PCMark 10 is the latest industry standard benchmark from Futuremark that features a wide variety of tests that cover the modern workplace. This includes:

- Video conferencing
- App load times
- Office applications
- Photo/video editing
- Rendering
- Basic gaming



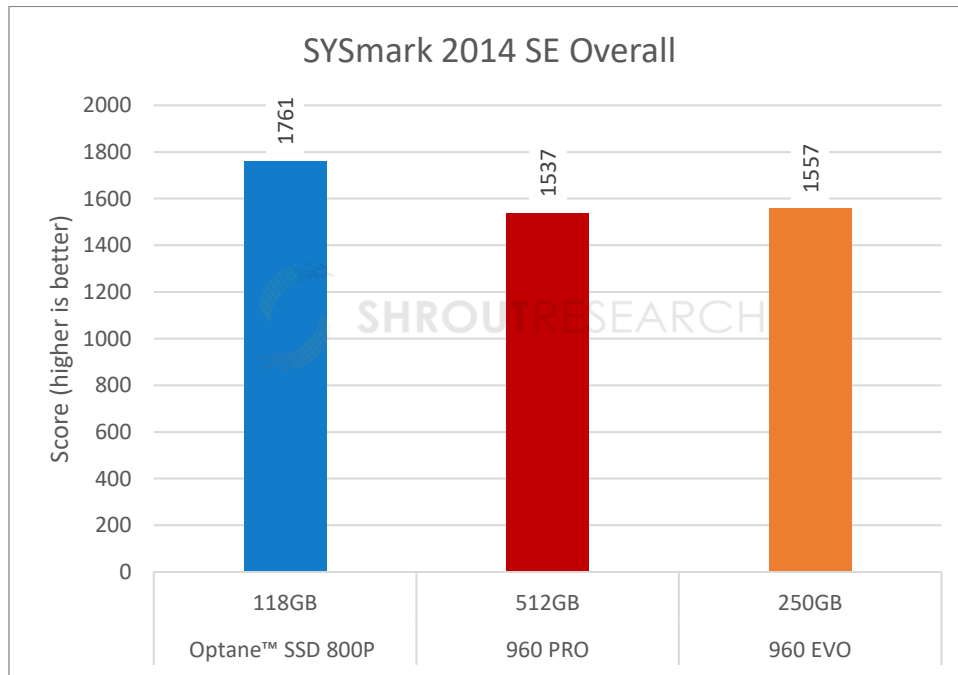
See Appendix A

In PCMark 10, Intel® Optane™ SSD 800P shows its strongest gains of nearly 12% in Application Start-up, while remaining competitive in other areas.



SYSmark 2014 SE

SYSmark 2014 SE is an application-based benchmark reflecting usage patterns of business consumers.



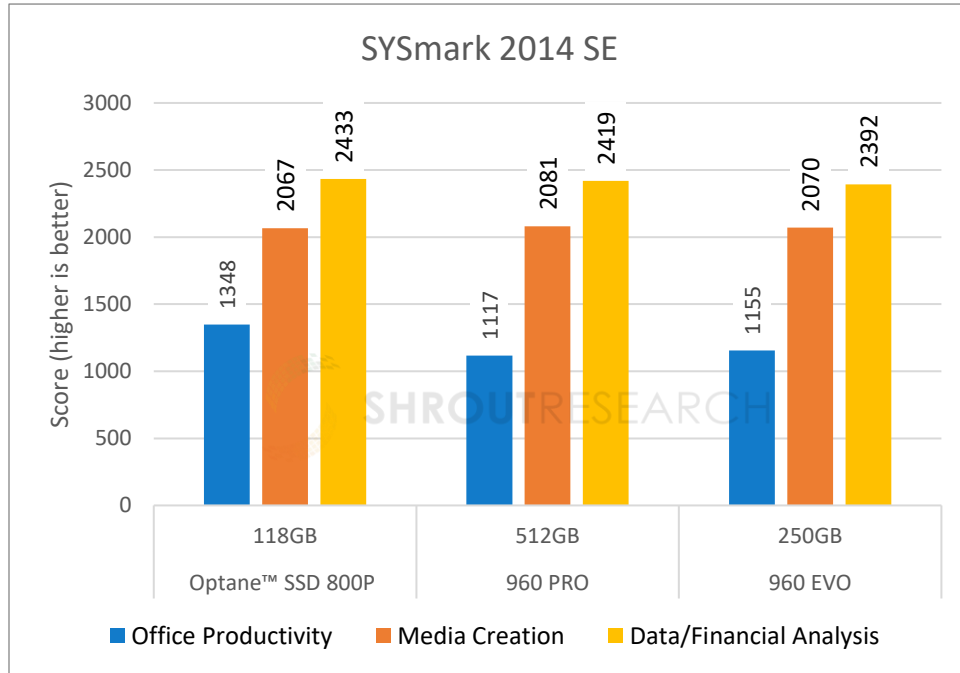
See Appendix A

Intel® Optane™ SSD 800P showed an overall advantage of nearly 15%, indicating a general system improvement across a mix of workloads.



SYSmark 2014 SE Sub-tests

These tests focus on individual categories of performance including productivity, media creation, and data analysis.



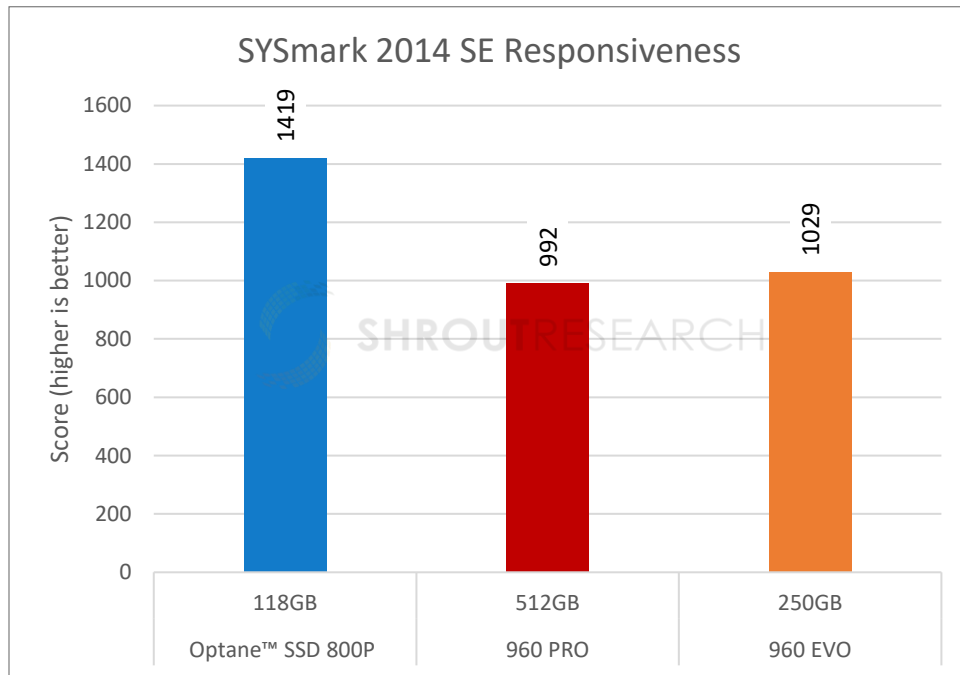
See Appendix A

In the SYSmark 2014 SE Sub-tests, Intel® Optane™ SSD 800P matches the leading competitive NVMe products in Media Creation and Data/Financial Analysis, but shows a solid 20% improvement in Office Productivity.



SYSmark 2014 SE Responsiveness

SYSmark 2014 SE is an application-based benchmark reflecting usage patterns of business consumers. The Responsiveness test addresses specific “pain points” for these users including application launch times, multi-tab browsing, file copying and encryption, application installs, and more.



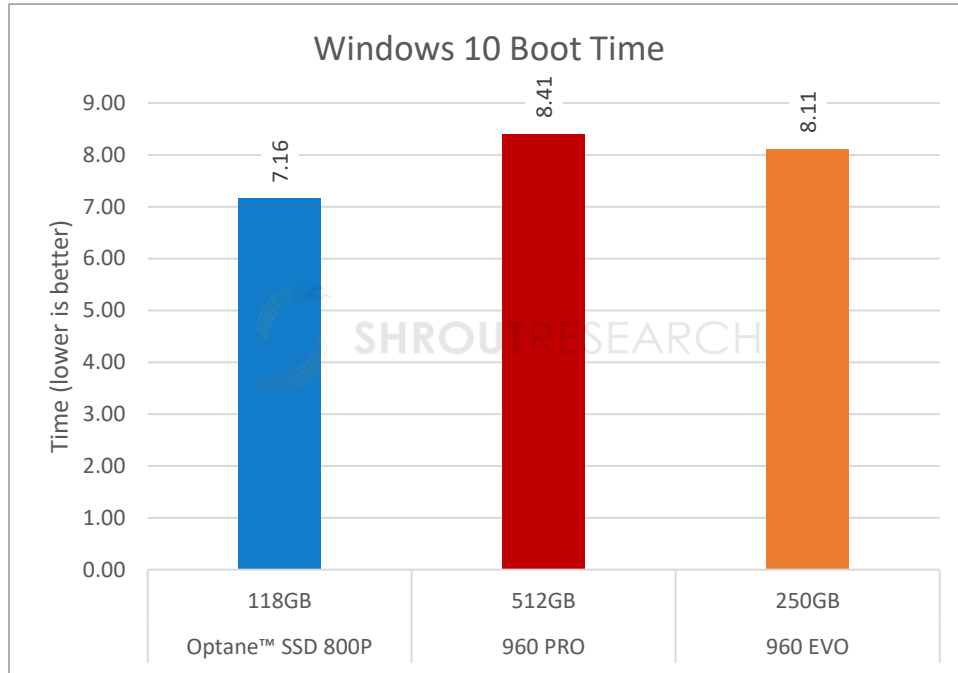
See Appendix A

The SYSmark 2014 SE Responsiveness test shows us the performance capability and promise of the underlying 3D XPoint™ technology, demonstrating a 38% gain in responsiveness over the 960 EVO and an impressive 43% improvement over the 960 PRO.



Windows 10 Boot Times

Using our stopwatch, we measure the boot times from power on until the Windows 10 desktop is first displayed.



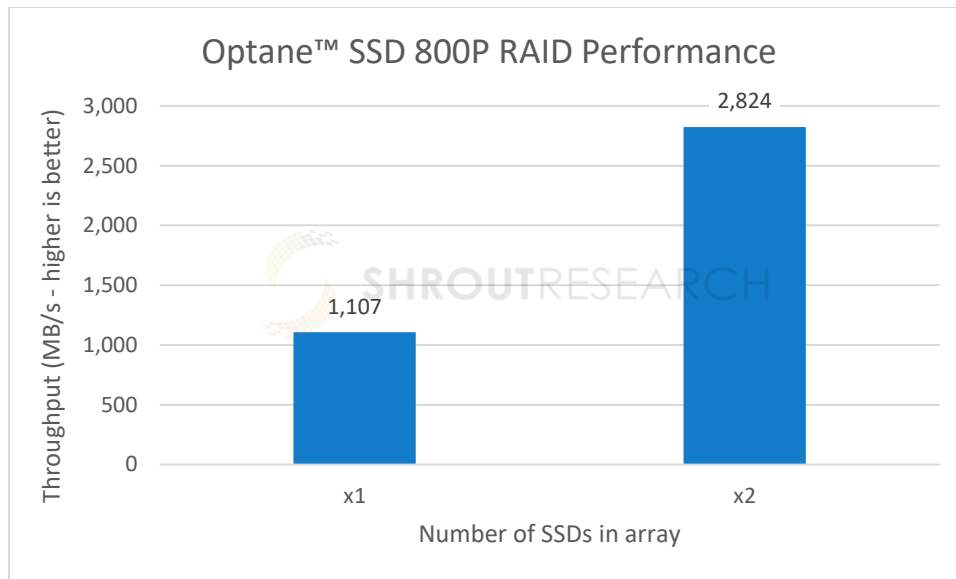
See Appendix B

Intel® Optane™ SSD 800P booted between 10-15% faster than competing NVMe SSDs. This result was obtained with an i5-7500 system. Other desktop systems offered similar results.



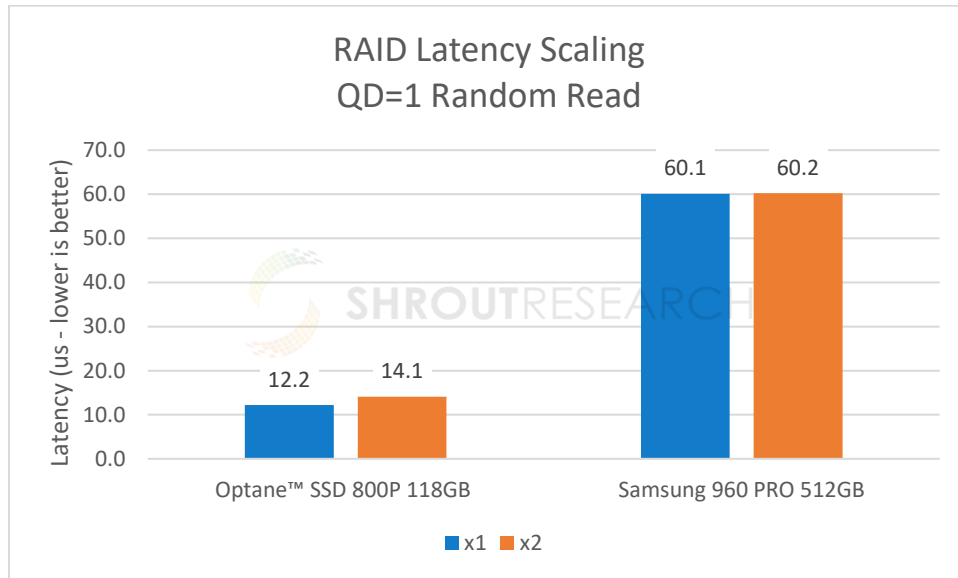
RAID Testing

Users preferring a larger boot partition or enhanced throughput performance over a single SSD solution may choose to place two Intel® Optane™ SSD 800P units in a RAID configuration. This is easily accomplished on modern Z170, Z270, and Z370 platforms with the built-in Intel® Rapid Storage Technology (RST) feature. The smaller M.2 form factor also enables easier installation without taking the PCIe slot real estate required by the physically larger 900P.



See Appendix C

Two Intel® Optane™ SSD 800P operating in tandem, combined with the RAID stripe interleave effectively increasing the Queue Depth of 128KB transfers, we see a 2.55x improvement in throughput – 55% higher than the typical 100% scaling assumed for such a configuration.



See Appendix C

The tested Z270 platform minimizes the latency penalty typical to a RAID configuration, enabling the 800P to maintain its latency and responsiveness advantage over competing NAND-based SSDs.

Intel® Optane™ SSD 800P Offers Excellent Desktop Performance and Responsiveness

Testing clearly indicates that Intel® Optane™ SSD 800P leads in performance, especially in environments surrounding responsiveness and random access workloads. PCMark Vantage sub-tests result in a score as much as 2.46x faster than the leading NVMe SSD solutions from Samsung, and the SYSmark 2014 SE Responsiveness Test that addresses key user pain points gives the SSD 800P a 38-43% advantage over the competing NAND-based solutions.

For users that require more capacity but don't want to sacrifice the performance advantages that Intel® Optane™ SSD 800P provides, a multi-drive array can be utilized to combine two drives. This more than doubles the peak throughput while maintaining the IO latency benefit that keeps the system responsive.

Our testing of Intel® Optane™ SSD 800P shows the value of 3D XPoint™ technology for low latency storage performance. Desktop systems and enthusiasts that want to use the most responsive storage option for their boot drive will find Intel® Optane™ SSD 800P to be the best solution on the market. The ability to load applications faster, start games quicker, and access files immediately has a dramatic impact on the overall computing experience, and the technology that Intel® has built is unmatched.



Author: Allyn Malventano, Technology Analyst at [Shrout Research](#)

Editor: Ryan Shrout, President and Analyst at [Shrout Research](#)

Please direct questions about this paper to ryan@shroutresearch.com.

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Disclosure: This paper was commissioned by Intel. All testing, evaluation, and analysis was performed in-house by Shrout Research and its contractors. Shrout Research provides consulting and research services for many companies in the technology field, other of which are mentioned in this work.

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Appendix

The following test system configurations were used in the preparation of this paper:

<i>Appendix A</i>	Product / Version
Motherboard	ASUS STRIX Z370-E Gaming
CPU	Intel® Core™ i7-8700K
RAM	16GB DDR4-2400
GPU	NVIDIA GeForce GTX 1080
OS	Windows 10 Pro RS3

<i>Appendix B</i>	Product / Version
Motherboard	ASUS Prime B250-Plus
CPU	Intel® Core™ i5-7500
RAM	8GB DDR4-2400
GPU	NVIDIA GeForce GTX 1080
OS	Windows 10 Pro RS3

<i>Appendix C</i>	Product / Version
Motherboard	ASUS Prime Z270-A
CPU	Intel® Core™ i7-7700K
RAM	16GB DDR4-2400
GPU	Intel® HD Graphics 630
OS	Windows 10 Pro RS3
Test Configuration	Sequential: QD=1, 128KB Sequential Read Random: QD=1, 4KB Random Read