COMPARING DESKTOP DRIVE PERFORMANCE: SEAGATE SOLID STATE HYBRID DRIVE VS. HARD DISK DRIVES AND SEAGATE CLIENT SOLID STATE DRIVE

Seagate® solid state hybrid drives:
High performance *and* high capacity

Faster system boot time
Reduced cold boot times by as much as 23.1%

Faster application launch
Decreased application launch time by up to 23.7%

Greater disk performance
As much as 387.3% higher HDD score on Futuremark® PCMark® Vantage v1.2.0

versus traditional hard drives

When selecting a desktop computer, you generally have a choice of storage options. Upgrading from a traditional spindle hard disk drive (HDD) to a Seagate Solid State Hybrid Drive (SSHD) can boost performance dramatically, speeding up everyday activities such as booting and launching applications. SSHDs approach the performance of client-class solid-state drives (SSDs) while maintaining the high capacity of HDDs.

To learn about the effects of the Seagate SSHD on performance, we tested a Lenovo® H520 desktop in the Principled Technologies labs with five drive configurations. We tested a Seagate SSHD and compared it against three Western Digital HDDs—two different 7,200 RPM HDDs and a 10,000 RPM HDD—and a Seagate Client SSD. We measured boot time and application launch time and ran an industry-standard benchmark test to quantify disk performance.

In our tests, the Seagate SSHD configuration outperformed the hard drive configurations considerably, by up to 387.3 percent. Even better, the Seagate SSHD also performed comparably to the Seagate Client SSD in some tests, while maintaining the larger storage capacity of a traditional hard drive. This performance level and capacity potential show that selecting the Seagate Solid State Hybrid Drive for your next desktop computer can be a very wise move.

THE SPEED OF AN SSD WITH THE CAPACITY OF AN HDD

No one likes to wait around while his or her computer boots, opens applications, or performs other everyday tasks. While the solid-state drives that have emerged over the past few years speed up these activities considerably, they tend to hold much less data than traditional hard drives. Seagate has designed their Solid State Hybrid Drive to deliver the performance of a client-class SSD with the capacity of an HDD.

To compare the performance of the Seagate SSHD with that of three Western Digital HDDs and a Seagate Client SSD, we ran each configuration on the same Lenovo H520 desktop. The drives we tested were:

- 1TB Seagate Desktop SSHD ST1000DX001 (Seagate SSHD)
- 240GB Seagate 600 SSD ST240HM000(Seagate Client SSD)
- 1TB Western Digital WD Blue WD10EZEX, 7,200 RPM (WD Blue HDD 7.2k)
- 1TB Western Digital WD Black WD1002FAEX, 7,2000 RPM(WD Black HDD 7.2k)
- 1TB Western Digital WD VelociRaptor WD1000DHTZ, 10,000 RPM (WD HDD 10k)

We installed Microsoft® Windows® 8.1 Professional x64 on each of the primary storage devices. We conducted every test five times to account for the potential learning achieved over time and report the results from the fifth and final run. Across the tests we conducted, the Seagate SSHD configuration delivered better performance than the HDDs and comparable or better performance than the Seagate Client SSD. Appendix A provides detailed system configuration information. Appendix B provides the specifics of our testing.

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BOOT TIME

The less time users spend waiting for their desktops to boot, the more time they have to be productive. Figures 1 and 2 show the median results for our boot tests. Though the Seagate Client SSD took the least time to boot, the Seagate Solid State Hybrid Drive was just over a second slower. The Seagate SSHD configuration made boot times much quicker than the Western Digital HDD configurations, speeding up boot times by as much as 23.1 percent.

Figure 1: The desktop with the Seagate SSHD booted more quickly than with HDDs and comparably to the Seagate Client SSD configuration. Smaller numbers are better.
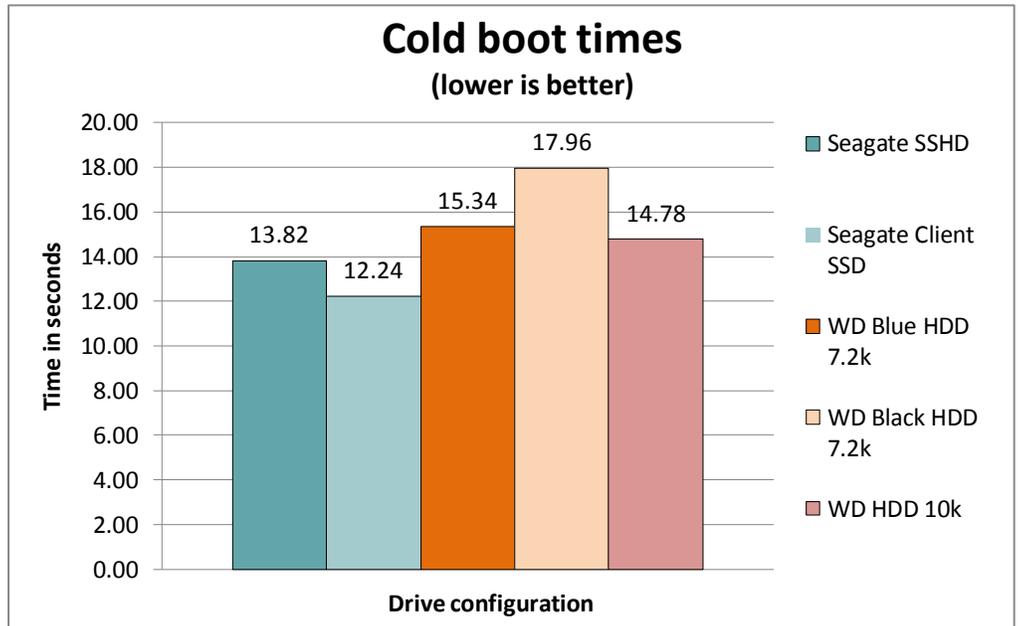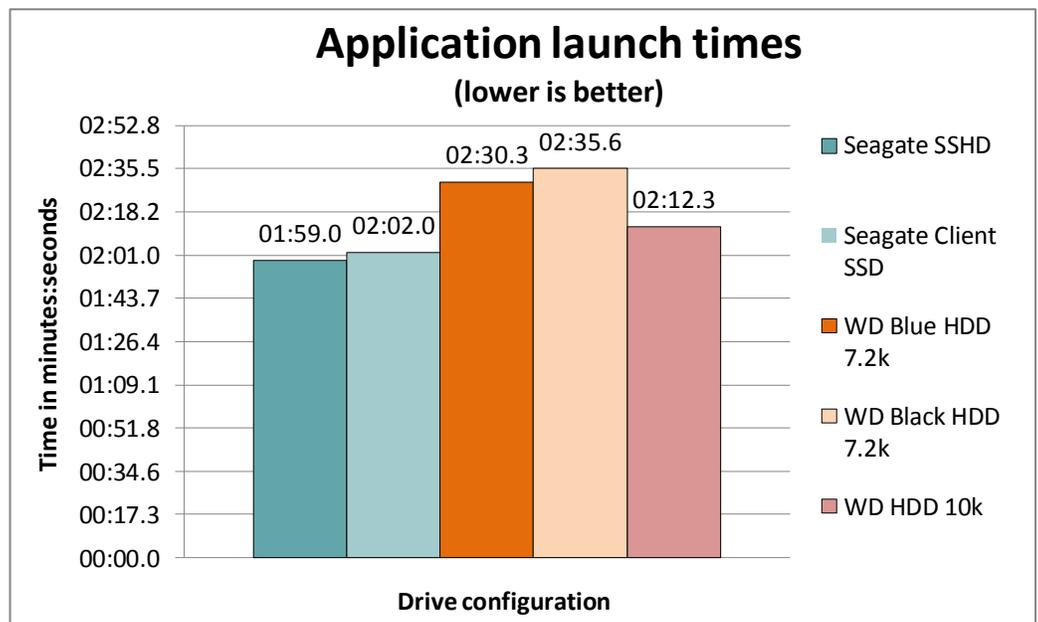

Boot times	Seagate SSHD	Seagate Client SSD	WD Blue HDD 7.2k	WD Black HDD 7.2k	WD HDD 10k
Boot time, in seconds	13.82	12.24	15.34	17.96	14.78
Percent SSHD improvement		-12.9%	9.9%	23.1%	6.5%

Figure 2: Fifth run boot times, in seconds, for the five drive configurations.

APPLICATION LAUNCH TIME

The less time users spend waiting for their applications to launch, the more quickly they can get down to work. We used a Seagate-created script called Seagate App Launch to launch seven popular applications and record how long each drive configuration took to complete the task. Figures 3 and 4 show the fifth run result for the application launch tests. The Seagate Solid State Hybrid Drive took the shortest amount of time. The greatest improvement was over the Western Digital 7,200 Black HDD, where the SSHD decreased launch time by 23.7 percent. The Seagate SSHD configuration also launched applications 2.5 percent more quickly than the Seagate Client SSD.

Figure 3: The desktop with the Seagate SSHD launched applications more quickly than with HDDs and the Seagate Client SSD. Smaller numbers are better.

Application launch times	Seagate SSHD	Seagate Client SSD	WD Blue HDD 7.2k	WD Black HDD 7.2k	WD HDD 10k
Overall time	01:58.63	02:02.02	02:30.27	02:35.57	02:12.29
Percent SSHD improvement		2.5%	20.7%	23.7%	9.8%

Figure 4: Fifth run application launch times, in minutes:seconds, for the system with all five storage options.

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DISK PERFORMANCE

We used an industry-standard benchmark to measure the disk performance of the drive configurations. These scores indicate that the Seagate Solid State Hybrid Drive would excel at completing the tasks workers require.

Futuremark PCMark Vantage v1.2.0 is a PC benchmark. Figure 5 shows the results for the PCMark Vantage HDD test, which quantifies disk performance. As it shows, the Seagate SSHD delivered overwhelmingly superior performance to the Western Digital HDDs—achieving scores as much as 387.3 percent higher.

Figure 5: The PCMark Vantage HDD score of the desktop with the Seagate SSHD was as much as 387.3 percent higher than with the spindle HDD drives.
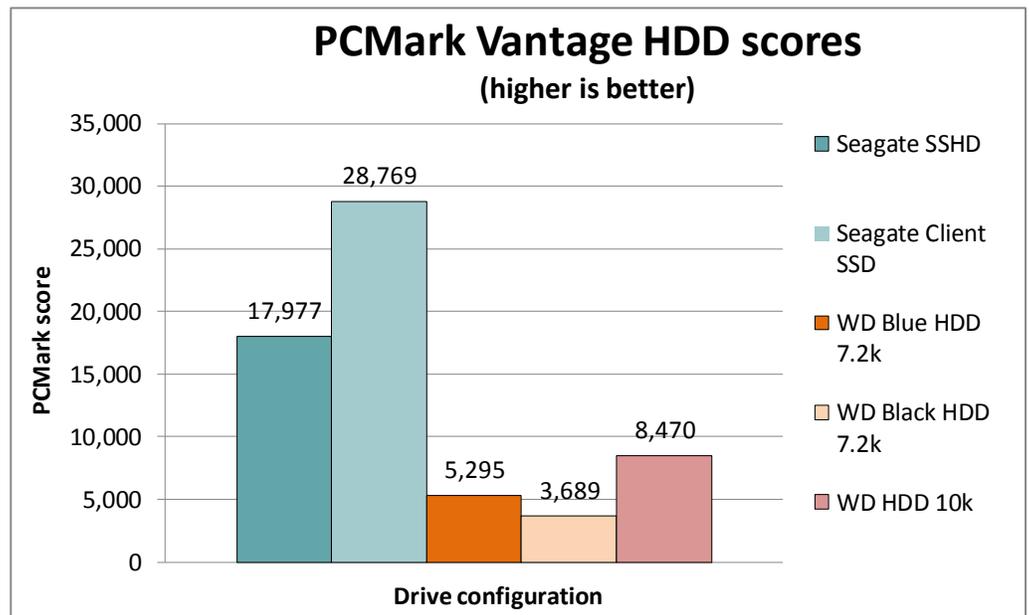

Figure 6 shows the result from our fifth run of the HDD test in the PCMark Vantage suite. The Seagate Solid State Hybrid Drive dramatically outperformed the three HDD configurations.

Futuremark PCMark Vantage	Seagate SSHD	Seagate Client SSD	WD Blue HDD 7.2k	WD Black HDD 7.2k	WD HDD 10k
HDD Score	17,977	28,769	5,295	3,689	8,470
Percent SSHD improvement		-37.5%	239.5%	387.3%	112.2%

Figure 6: Fifth run score for the Futuremark PCMark Vantage HDD test. Higher numbers are better.

WHAT WE TESTED

Seagate App Launch

Seagate App Launch is the script we used to test application launch times. This script opened the following popular applications and recorded the time when all were complete:

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- Microsoft Office PowerPoint®
- Apple® iTunes®
- Microsoft Internet Explorer®
- Adobe® Premiere Elements®
- Microsoft Office Excel®
- Adobe Photoshop®
- Apple QuickTime®

Futuremark PCMark Vantage v1.2.0

Futuremark PCMark Vantage v1.2.0 is a PC benchmark offering one-click complete performance testing. It includes eight PC tests covering photos, video, gaming, music, communication, and productivity. You can complete system testing or test at the component level with a range of CPU and HDD tests.

For more information on this benchmark, see www.futuremark.com/benchmarks/pcmark-vantage/.

IN CONCLUSION

In our tests, the Seagate SSHD configuration outperformed all three hard drive configurations and delivered results comparable to a Seagate Client SSD configuration. It launched applications as much as 23.7 percent more quickly and delivered disk performance increases of up to 387.3 percent over the HDDs we tested.

By speeding up the tasks that users perform day in and day out, the Seagate Solid State Hybrid Drive can boost productivity and let you spend more of your day working and less of it waiting—without forcing you to choose between speed and storage capacity.

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APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 7 provides detailed configuration information about the system and drive configurations we used for testing.

System	Lenovo H520
General	
Number of processor packages	1
Number of cores per processor	4
Number of hardware threads per core	1
Total number of processor threads in system	4
System power management policy	Balanced
Processor power-saving option	EIST
CPU	
Vendor	Intel®
Name	Core™ i5
Model number	3330
Stepping	E1
Socket type	Socket 1155 LGA
Core frequency (GHz)	3.00 GHz (Turbo Boost 3.2 GHz)
Bus frequency	5 GT/s
L1 cache	32 KB + 32 KB per core
L2 cache	256 KB per core
L3 cache	6 MB shared
Platform	
Vendor	Lenovo
Motherboard model number	MAHOBAY
Motherboard chipset	Intel H61
BIOS name and version	Lenovo ESKT23A (02/18/2013)
Memory module(s)	
Vendor and model number	Ramaxel Technology RMR5030EB68F9W1600
Type	PC3-12800
Speed (MHz)	1,600
Speed running in the system (MHz)	1,600
Timing/Latency (tCL-tRCD-tRP-tRASmin)	11-11-11-28
Size (MB)	4,096
Number of memory module(s)	2
Total amount of system RAM (GB)	8
Chip organization (single-sided/double-sided)	Double-sided
Channel (single/dual)	Dual
Hard disk	
First storage drive	
Vendor and model number	Seagate ST1000DX001 SSHD
Size	1 TB
Buffer size (MB)	64

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System	Lenovo H520
RPM	7,200
Type	SATA 6.0Gb/s
Controller	Intel Express Chipset SATA AHCI Controller
Driver	Intel 12.8.0.1016 (08/01/2013)
Second storage drive	
Vendor and model number	Seagate ST240HM000 MLC 600 SSD
Size	240 GB
Buffer size (MB)	N/A
RPM	N/A
Type	SATA 6.0Gb/s
Controller	Intel Express Chipset SATA AHCI Controller
Driver	Intel 12.8.0.1016 (08/01/2013)
Third storage drive	
Vendor and model number	Western Digital WD10EZEX spindle HDD
Size	1 TB
Buffer size (MB)	64
RPM	7,200
Type	SATA 6.0Gb/s
Controller	Intel Express Chipset SATA AHCI Controller
Driver	Intel 12.8.0.1016 (08/01/2013)
Fourth storage drive	
Vendor and model number	Western Digital WD1002FAEX
Size	1 TB
Buffer size (MB)	64
RPM	7,200
Type	SATA 6.0Gb/s
Controller	Intel Express Chipset SATA AHCI Controller
Driver	Intel 12.8.0.1016 (08/01/2013)
Fifth storage drive	
Vendor and model number	Western Digital WD1000HTZ
Size	1 TB
Buffer size (MB)	64
RPM	10,000
Type	SATA 6.0Gb/s
Controller	Intel Express Chipset SATA AHCI Controller
Driver	Intel 12.8.0.1016 (08/01/2013)
Operating system	
Name	Windows 8.1 Professional x64
Build number	9600
Service Pack	N/A
File system	NTFS
Kernel	x64-based PC
Language	English

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System	Lenovo H520
Microsoft DirectX version	11
Graphics	
Vendor and model number	Intel HD Graphics 2500
Type	Integrated
Chipset	Intel HD Graphics 2500
BIOS version	0.0
Total available graphics memory (MB)	1,792
Dedicated video memory (MB)	32
System video memory (MB)	0
Shared system memory (MB)	1,760
Resolution	1,280 x 1,024
Driver	Intel 10.18.10.3316 (10/01/2013)
Sound card/subsystem	
Vendor and model number	Realtek® High Definition Audio
Driver	Realtek 6.0.1.7030 (08/30/2013)
Ethernet	
Vendor and model number	Realtek PCIe GBE Family Controller
Driver	Realtek 8.18.621.2013 (06/21/2013)
Optical drive(s)	
Vendor and model number	PLDS DH16ACSH
Type	DVD-RW
USB ports	
Number	8
Type	2x USB 3.0, 6x USB 2.0
Other	7-in-1 card reader
Monitor	
Type	ViewSonic® VG730m
Screen size	17"
Refresh rate	60 Hz

Figure 7: Configuration information for the test system.

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APPENDIX B – HOW WE TESTED

Measuring time to boot

1. Simultaneously start the timer and boot the system.
2. When the word Start appears in the Windows Modern UI, stop the timer.
3. Record the result as the Boot time.
4. Shut down the system.
5. Repeat steps 1 through 4 four more times, and report the fifth run.

Measuring system performance with Seagate App Launch

1. Reboot the system.
2. Do not interact with the system until the spinning circle disappears and then wait 10 seconds.
3. Double-click the App Launch Icon.
4. When the test completes, take a screenshot of the results and record the time as App Launch Score.
5. Repeat steps 1 through 4 four more times, and report the fifth run.

Measuring system performance using Futuremark PCMark Vantage v1.2.0

Setting up the test

1. Reset the system with the appropriate test image.
2. Download the PCMark_Vantage_v120_installer.exe Windows package from www.futuremark.com/support/downloads.
3. Double-click the PCMark_Vantage_v120_installer.exe file to install PCMark Vantage with the default options.
4. Download Futuremark_SystemInfo_v419_installer.msi from www.futuremark.com/support/downloads.
5. Double-click the Futuremark_SystemInfo_v419_installer.msi file to install Futuremark System Info with default options.
6. Click the PCMark Vantage desktop icon to launch PCMark Vantage. Enter the registration code, click Register, and click OK.
7. Exit PCMark Vantage.

Running the test

1. Reboot the system.
2. Double-click the PCMark Vantage x64 desktop icon to launch the benchmark.
3. Select all test suites.
4. Click Run Benchmark.
5. When the benchmark run completes, take a screenshot of the results, and record them as follows:
   - PCMark Score
   - Memories Score
   - TV and Movies Score
   - Gaming Score
   - Music Score
   - Communications Score
   - Productivity Score
   - HDD Score
6. Repeat steps 1 through 5 four more times, and report the fifth run.

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ABOUT PRINCIPLED TECHNOLOGIES

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We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.