PrimoCache

The Acceleration Experience of the Cooperation with Intel Optane Memory and PrimoCache

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OVERVIEW

Intel Optane Memory is a desktop system acceleration solution for the new 7th Gen core processor-based platforms based on 3D XPoint technology. It accelerates large-capacity slow hard drives to solve the insufficiency of traditional hard drive performance, allowing the system to access frequently used information or data faster, thereby improving the overall system responsiveness.

However, Optane Memory requires specific motherboard support, the installation and configuration is complicated and cumbersome, and the operating system is limited to Windows 10 or above. While adopting PrimoCache software cache solution can completely overcome above limits, turning Optane Memory into a cache for any other hard drives, allowing you to enjoy the acceleration effect of high-performance Optane Memory on various motherboard-based computers. The solution is simple and flexible, without the need to configure the BIOS, which also applies to operating systems prior to Windows 10.

In this article, Optane Memory and PrimoCache software were installed on two computers using 6th Gen CPUs and motherboards, and the application experience was measured before and after the use of the cache. The article will list the results of tests and compare them. The two computers used in the tests were a HP OMEN notebook with a mechanical hard disk and an Intel NUC with a SATA SSD. Optane Memory is available in 16GB, 32GB and 64GB capacities, and the tests used the 16GB module.

This article does not show you how to use the PrimoCache software or how to configure the Optane Memory as a cache. For detailed instructions on these, please read the PrimoCache help documentation or Quick Start Guide. The PrimoCache software can be downloaded from the official website.

HP OMEN NOTEBOOK – ACCELERATING MECHANICAL DRIVE

The hardware configuration and the operating system information of the HP OMEN notebook are shown in the following table.

Model	HP OMEN II Notebook
Baseboard	Intel HM170 (Skylake PCH-H)
CPU	Intel Core i5-6300HQ CPU @ 2.30GHz
RAM	Kingston DDR4-2133 16GB x2 (32GB)
Drive	HGST HTS721010A9E630 (1TB, 7200RPM, SATA3, 32MB)
Video Adapter	NVIDIA GeForce GTX 960M (GM107M) 2GB
OS	Windows 10 Professional x64 Build 16299.125

WINDOWS BOOT TIME

Test Tool: BootRacer.

Test Item: The time from BIOS startup to Windows desktop ready.

Test Conditions: To avoid other tasks affecting test results, turn off the network, SuperFetch service, Fast Startup and Windows update, and set up automatic Windows login.

FRESHLY-INSTALLED WINDOWS 10

Freshly installed Windows 10 system with latest patches and drivers

(unit: second)	No Cache	Optane + PrimoCache	Compare
Boot Time	**102.41**	**25.79**	↑ **3.97 times**

REGULAR WINDOWS 10

Applications and games are installed on the freshly installed Windows 10: Microsoft Office 2016, Adobe Photoshop CC 2018, Autodesk AutoCAD 2018, Visual Studio Community 2017 and game Forza Motorsport 6: Apex.

(unit: second)	No Cache	Optane + PrimoCache	Compare
Boot Time	**161.38**	**37.85**	↑ **4.26 times**

FILE COPY

Test Tool: Windows built-in Robocopy program.

Test Target: File read speed.

Test Conditions: To accurately reflect the read speed and minimize the impact of write speed, all files are copied from the tested hard drive to a ram-disk which is a virtual disk consisting of RAM.

The file sets for the test are shown in the table below.

	File Size	File Count	Total Size
Small File Set	0 - 25KB	10000	12.38MB
Big File Set	600MB - 1.5GB	6	4.33GB
Regular File Set	0 - 8MB	1000	115.22 MB

SINGLE-THREADED COPY SPEED (ROBOCOPY WITHOUT /MT)

(unit: MB/s)	No Cache	Optane + PrimoCache	Compare
Small File Set	**0.256**	**0.567**	↑ **2.21 times**
Big File Set	**129.239**	**731.021**	↑ **5.66 times**
Regular File Set	**7.278**	**21.562**	↑ **2.96 times**

8-THREADED COPY SPEED (ROBOCOPY WITH /MT)

(unit: MB/s)	No Cache	Optane + PrimoCache	Compare
Small File Set	**0.528**	**1.744**	**↑ 3.30 times**
Big File Set	**103.440**	**993.583**	**↑ 9.61 times**
Regular File Set	**14.334**	**89.716**	**↑ 6.26 times**

EXCEL FILES OPENING TIME

Test Scheme: Open 10 Excel files at the same time and test the ready time. File size of each file ranges from 600KB to 6.5MB and total file size is 18.9MB.

(unit: second)	No Cache	Optane + PrimoCache	Compare
Ready Time	**22.12**	**11.40**	**↑ 1.94 times**

AUTOCAD 2018 STARTUP TIME

Test Scheme: Start the AutoCAD 2018 application and test the ready time.

(unit: second)	No Cache	Optane + PrimoCache	Compare
Ready Time	**64.30**	**15.25**	**↑ 4.22 times**

PHOTOSHOP CC 2018 STARTUP TIME

Test Scheme: Open a 158MB PSD file and test the ready time.

(unit: second)	No Cache	Optane + PrimoCache	Compare
Ready Time	**62.20**	**11.81**	**↑ 5.27 times**

VISUAL STUDIO COMMUNITY 2017 STARTUP TIME

Test Scheme: Open a VS project and test the ready time. The VS project used in the test comes from the Github/OpenCV project.

(unit: second)	No Cache	Optane + PrimoCache	Compare
Ready Time	**55.68**	**10.90**	**↑ 5.11 times**

FORZA MOTORSPORT 6 STARTUP TIME

Test Scheme: Test the time from game startup to ready of the operating main menu, including the opening animation.

(unit: second)	No Cache	Optane + PrimoCache	Compare
Ready Time	**54.20**	**47.25**	**↑ 1.15 times**

INTEL NUC – ACCELERATING SATA SSD

Model	Intel NUC6i7KYK
Baseboard	Intel HM170 (Skylake PCH-H)
CPU	Intel Core i7-6770HQ CPU @ 2.60GHz
RAM	Samsung DDR4-2133 8GB x1
Drive	LITEON IT L8T-256L9G SSD
Video Adapter	Intel Iris Pro Graphics 580 (Built-in)
OS	Windows 10 Professional x64 Build 16299.251

WINDOWS BOOT TIME

FRESHLY-INSTALLED WINDOWS 10

(unit: second)	No Cache	Optane + PrimoCache	Compare
Boot Time	**19.63**	**17.27**	**↑ 12.0%**

REGULAR WINDOWS 10

(unit: second)	No Cache	Optane + PrimoCache	Compare
Boot Time	**30.54**	**26.44**	**↑ 13.4%**

FILE COPY

SINGLE-THREADED COPY SPEED (ROBOCOPY WITHOUT /MT)

(unit: MB/s)	No Cache	Optane + PrimoCache	Compare
Small File Set	**0.516**	**0.625**	**↑ 21.0%**
Big File Set	**437.193**	**698.494**	**↑ 59.8%**
Regular File Set	**23.139**	**23.736**	**↑ 2.6%**

8-Threaded Copy Speed (Robocopy with /MT)

(unit: MB/s)	No Cache	Optane + PrimoCache	Compare
Small File Set	**2.588**	**2.590**	**↑ 0.1%**
Big File Set	**561.480**	**998.526**	**↑ 77.8%**
Regular File Set	**130.849**	**137.383**	**↑ 5.0%**

Excel Files Opening Time

(unit: second)	No Cache	Optane + PrimoCache	Compare
Ready Time	**15.53**	**13.77**	**↑ 11.4%**

AutoCAD 2018 Startup Time

(unit: second)	No Cache	Optane + PrimoCache	Compare
Ready Time	**15.66**	**14.47**	**↑ 7.6%**

Photoshop CC 2018 Startup Time

(unit: second)	No Cache	Optane + PrimoCache	Compare
Ready Time	**15.86**	**14.32**	**↑ 9.7%**

Visual Studio Community 2017 Startup Time

(unit: second)	No Cache	Optane + PrimoCache	Compare
Ready Time	**14.10**	**12.07**	**↑ 14.4%**

FORZA MOTORSPORT 6 STARTUP TIME

(unit: second)	No Cache	Optane + PrimoCache	Compare
Ready Time	**77.34**	**76.41**	↑ **1.2%**

CONCLUSIONS

Combined with the above test results, it can be seen that due to the ultra-high read performance of Intel Optane Memory, after adopting the cache solution of Optane Memory and PrimoCache, the performance on systems using mechanical hard drives is significantly improved, and there is also a certain amount of performance improvement on systems using SATA SSDs.

The following is a simple list of possible usage scenarios of the Optane Memory with PrimoCache, but not limited to these scenarios.

- Choose a motherboard that supports PCIe x2 M.2 interface, equipped with a traditional SATA mechanical hard drive and a 16GB Optane Memory module. Install the Windows operating system, applications and data on the mechanical hard drive, and then use the PrimoCache software to activate the Optane Memory to accelerate the mechanical drive.

- Choose a motherboard that supports PCIe x2 M.2 interface, equipped with a traditional SATA mechanical hard drive and a 32GB Optane Memory module. Divide the Optane Memory into two partitions (for example, 24GB and 8GB), and then install the operating system on the 24GB partition, and place applications and data on the mechanical hard drive. Use the PrimoCache software to activate the Optane Memory 8GB partition to accelerate the mechanical drive.

In addition, PrimoCache supports Windows XP and all subsequent Windows desktop operating systems, including Windows 7, 8 and 10 operating systems. Optane Memory can also be simply considered as a low-capacity high-speed SSD, so as long as there is a corresponding driver, Optane Memory can work under Windows 7, 8 and 10, cooperating with PrimoCache and providing cache acceleration solution for any other hard drives. If the motherboard does not have the M.2 interface, a M.2 to PCIe adapter card will allow Optane Memory to be installed on any computers that support PCIe.