



Thinner. Lighter. Newer. And...



2 times faster

at launching popular Microsoft® Office applications



52 percent longer

battery life



2.5 times faster

secure hard drive encryption



33 percent smoother

3D gaming performance for Diablo® III

Ultrabook™ prototype vs. a previous-generation laptop

When you first purchased your laptop, it responded quickly, easily ran the latest games, and had a long battery life. Now, a few years later, it's time to replace that laptop with one that can handle your current demands. With so many options on the market, how do you choose?

New Ultrabooks inspired by Intel® fit deliver excellent performance and new Intel technologies in a smaller package so that you can complete all your tasks in a lighter, more comfortably portable system.

In the Principled Technologies labs, we compared the performance of a pre-production, 3rd generation Intel Core™ Ultrabook prototype to a 2010 laptop system in a number of areas, including system responsiveness, battery life, encryption time, and graphics and gaming performance.

The Ultrabook prototype provided a better experience than the 2010 laptop in every area: it opened common applications up to twice as quickly, improved battery life by 52.6 percent, sped up hard drive encryption by 60.2 percent, and improved graphics performance by up to 174.0 percent.



GET MORE OUT OF LESS

The prototype we tested, like all Ultrabooks, is designed for maximum portability with a sleek design—it's less than an inch thick and weighs just over 3 pounds. Using a thinner Intel Core processor with Intel Turbo Boost Technology 2.0 and solid-state storage, the Ultrabook has the power to handle your everyday tasks, from Web browsing to media creation and manipulation to gaming. Some Ultrabooks also have touch-screen technology to further enhance the user experience.

We tested an Ultrabook prototype in a variety of test areas: system performance, system responsiveness, graphics and gaming performance, general benchmark performance, battery life, Web browsing performance, and encryption performance.

If your laptop is more than a couple of years old, updating your system will give you a significantly better experience today. We compared the performance of an Ultrabook prototype with an Intel Core i7-3667U processor and Intel HD Graphics 4000 running Microsoft Windows® 8, to that of a commercially available 2010 laptop with an Intel Core i7-620M processor, NVIDIA® NVS 3100 graphics, 4 GB of memory, and a 7,200-RPM SATA hard drive running Windows 7. For detailed system configuration information, see [Appendix A](#). For detailed steps on how we tested, see [Appendix B](#).

In every test, the Ultrabook prototype outperformed the 2010 laptop system. Figure 1 summarizes the most dramatic performance increases the Ultrabook achieved. Continue reading for an in-depth look at our complete set of test results.

	Ultrabook prototype	2010 laptop	Percentage difference
Boot time (secs)	11.90	47.09	74.7%
Hibernate time (sec)	3.60	18.05	80.1%
Launching Microsoft PowerPoint® (secs)	1.28	3.02	57.6%
Graphics - 3DMark® Score	3,280	1,197	174.0%
Performance – PCMark® Score	4,295	1,994	115.4%
Battery Life score (hh:mm)	4:50	3:10	52.6%
Dromaeo JavaScript (runs/sec)	485.13	292.16	66.0%
Time to encrypt the HDD (mm:ss)	20:18	51:03	60.2%

Figure 1: Selected test results for the Ultrabook prototype and 2010 laptop.

SYSTEM PERFORMANCE

No one likes waiting for a laptop to boot, resume from sleep, or shut down. Older systems use older technologies, and may not provide the system performance that a new laptop can provide.

We hand-timed both the Ultrabook prototype and the 2010 laptop booting, shutting down, sleeping, hibernating, and resuming from hibernate or sleep. In every instance, the Ultrabook prototype was dramatically faster. It took only 11.9 seconds to boot while the older laptop took 47 seconds. Figure 2 compares the times, in seconds, the systems needed to complete these basic, everyday tasks.

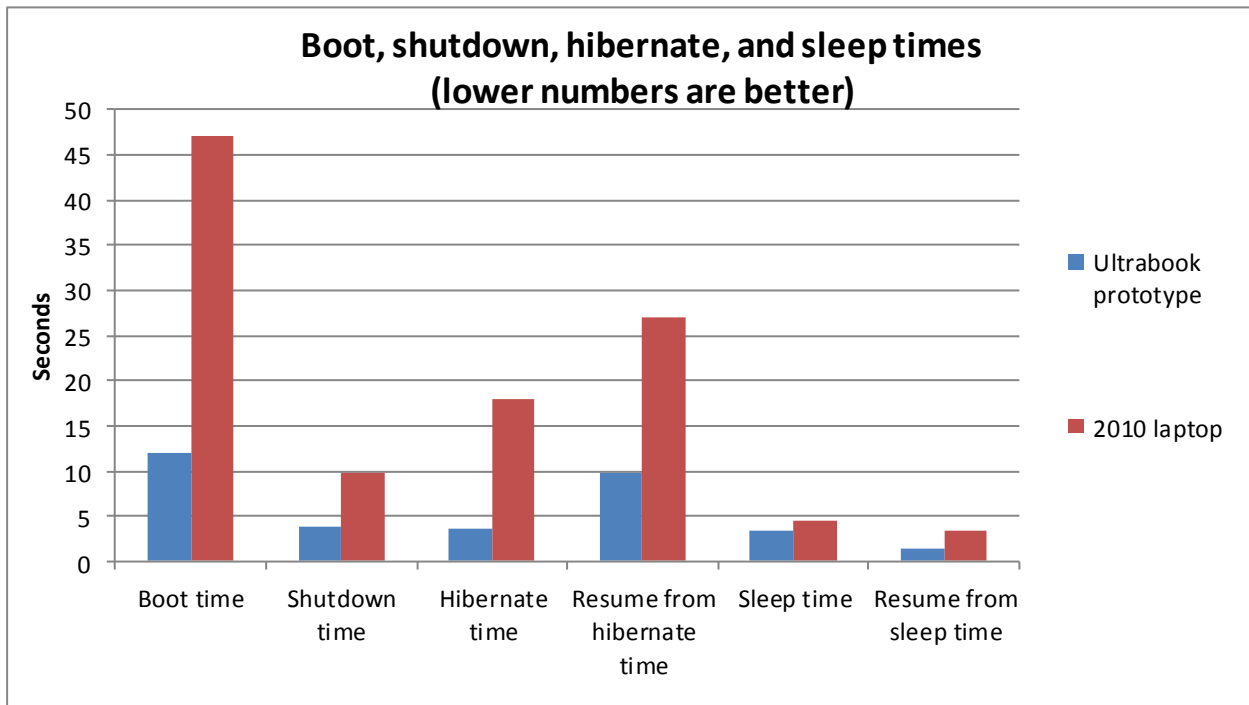


Figure 2: System performance time comparison for the Ultrabook prototype and the 2010 laptop we tested.

Figure 3 details the median results of our system performance tests. The Ultrabook prototype was quicker than the 2010 laptop in every area we tested, including hibernating 80.1 percent faster.

	Ultrabook prototype (seconds)	2010 laptop (seconds)	Percentage difference
Boot time	11.90	47.09	74.7%
Shutdown time	3.92	9.89	60.4%
Hibernate time	3.60	18.05	80.1%
Resume from hibernate time	9.82	26.98	63.6%
Sleep time	3.34	4.47	25.3%
Resume from sleep time	1.46	3.32	56.0%

Figure 3: Median times, in seconds, for the system performance tests. Lower times are better.

SYSTEM RESPONSIVENESS

It isn't only booting and shutting down your laptop that can keep you waiting. When you open applications multiple times a day, lagging performance can leave you frustrated.

We tested the responsiveness of both systems launching common applications including Microsoft Office applications (Word®, Excel®, and PowerPoint®). As in our system performance tests, the Ultrabook prototype left the 2010 laptop in the dust, reducing the time to launch applications by as much as 57.6 percent. Figure 4 compares the application launch times for the two systems.

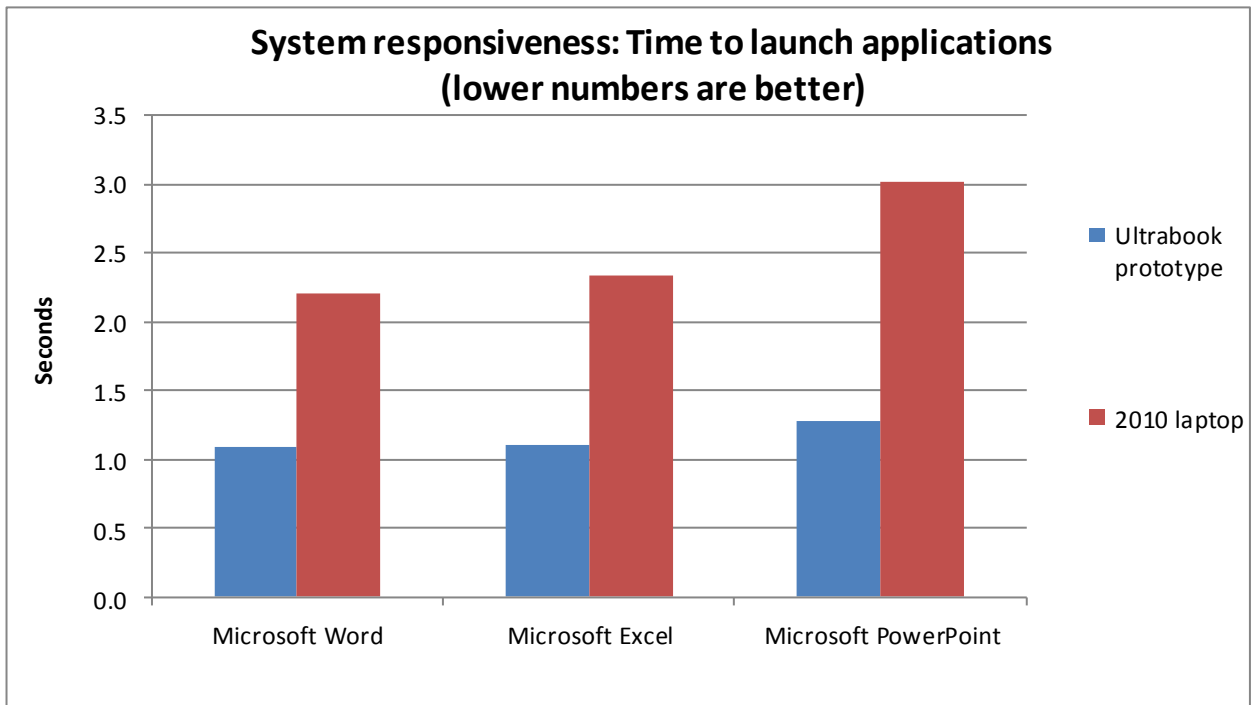


Figure 4: Application launch times for the Ultrabook prototype and the 2010 laptop we tested.

As our tests show, moving from your older laptop to a new Ultrabook can also speed up even more specialized tasks such as photo and video editing. We tested the responsiveness of the systems when launching photo and video projects and converting those projects to a different file type in Adobe® Photoshop® Elements and Adobe Premiere® Elements, and found that the Ultrabook prototype outperformed the 2010 laptop, reducing the time for common tasks by as much as 55.5 percent. Figure 5 compares the time it took the systems to complete common photo and video editing tasks.

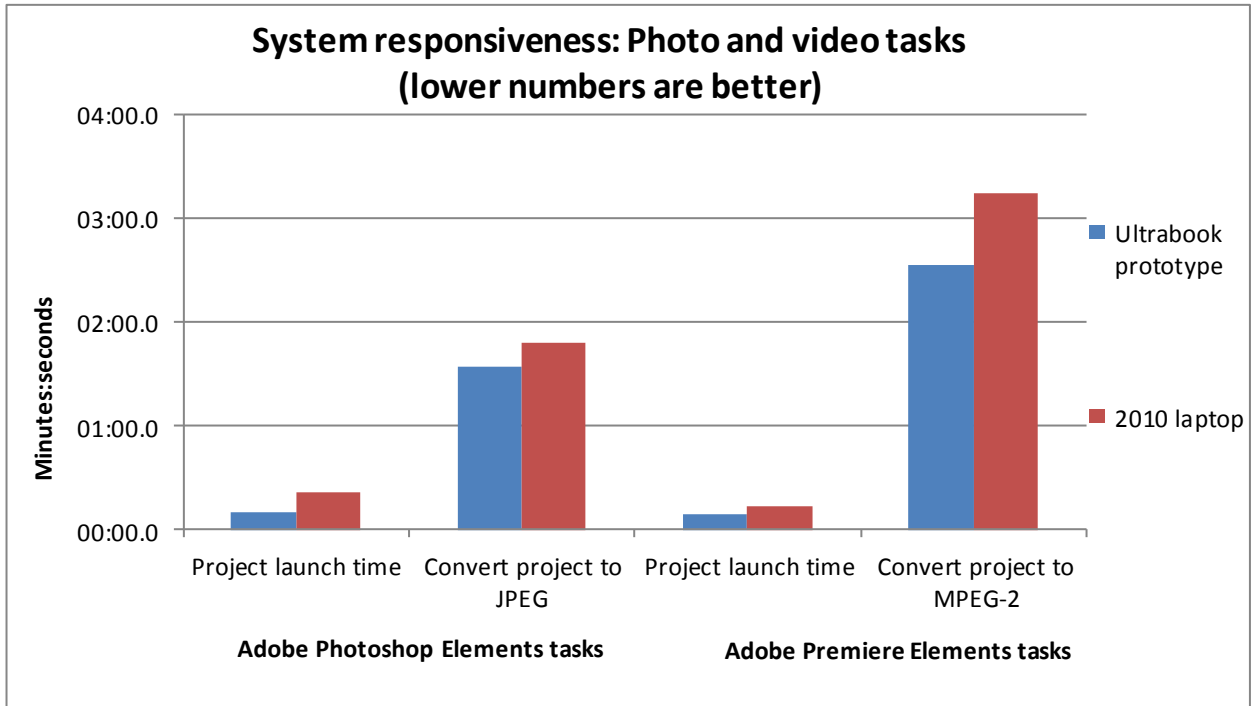


Figure 5: Photo and video editing application task times for the Ultrabook prototype and the 2010 laptop we tested.

Figure 6 details the median results of our system responsiveness tests. The Ultrabook prototype was quicker than the 2010 laptop in every area we tested, including being up to 57.6 percent faster when launching Microsoft PowerPoint.

	Ultrabook prototype (mm:ss)	2010 laptop (mm:ss)	Percentage difference
Application launch times			
Microsoft Word	00:01.09	00:02.21	50.7%
Microsoft Excel	00:01.10	00:02.34	53.0%
Microsoft PowerPoint	00:01.28	00:03.02	57.6%
Adobe Photoshop Elements tasks			
Project launch time	00:09.65	00:21.68	55.5%
Convert project to JPEG	01:34.42	01:48.51	13.0%
Adobe Premiere Elements tasks			
Project launch time	00:09.20	00:13.03	29.4%
Convert project to MPEG-2	02:33.62	03:15.40	21.4%

Figure 6: Median times, in minutes:seconds, for the system responsiveness tests. Lower times are better.

GRAPHICS PERFORMANCE

You might not play games with complex graphics yourself, but knowing that a system can handle the most demanding graphics with ease lets you know it will likely meet your overall performance needs as well. Despite its sleek profile, the new Ultrabook with its integrated graphics card can deliver outstanding graphics and gaming experiences. In our tests, it outperformed the 2010 system, which contained an NVIDIA NVS 3100 discrete graphics card solution.

First, we examined the graphics performance of the two systems using two benchmarks, UNIGINE Heaven DX 11 and the industry-standard 3DMark Vantage 1.1.0. On these benchmarks, the Ultrabook prototype outperformed the 2010 laptop by up to 174.0 percent, delivering 2.75 times the graphics performance. Figures 7 through 9 present the graphics performance scores that the systems achieved on the two benchmarks.

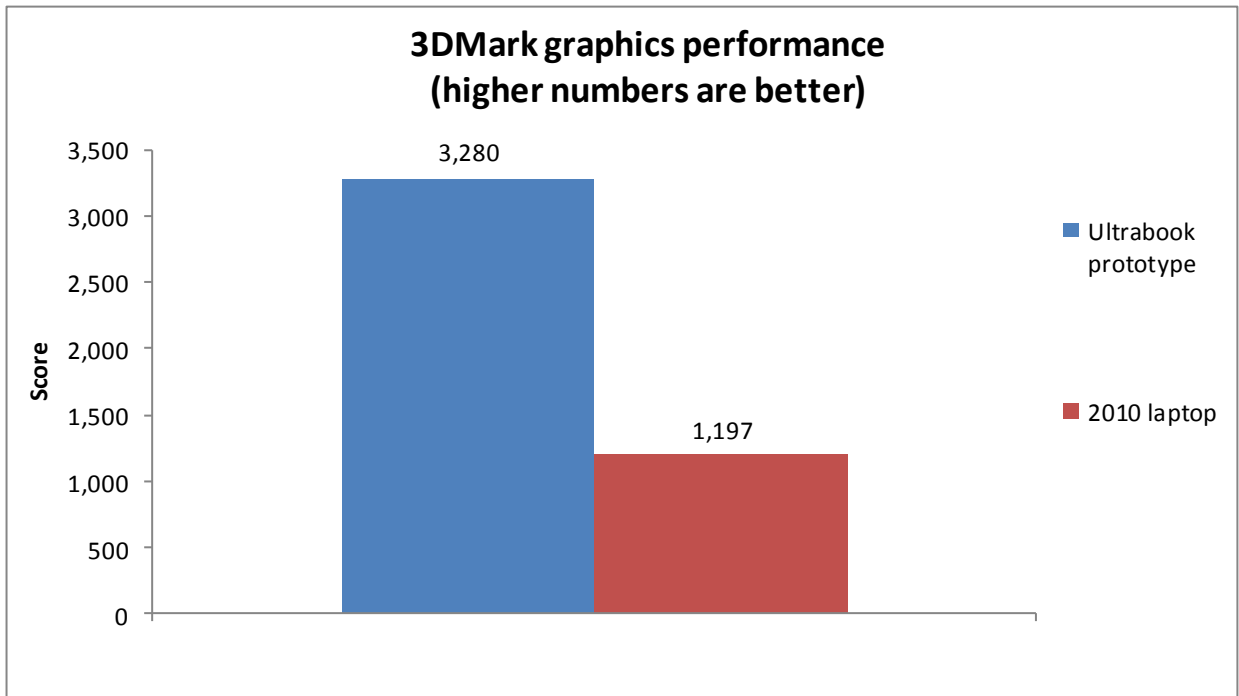


Figure 7: 3DMark graphics performance benchmark results for the Ultrabook prototype and the 2010 laptop we tested.

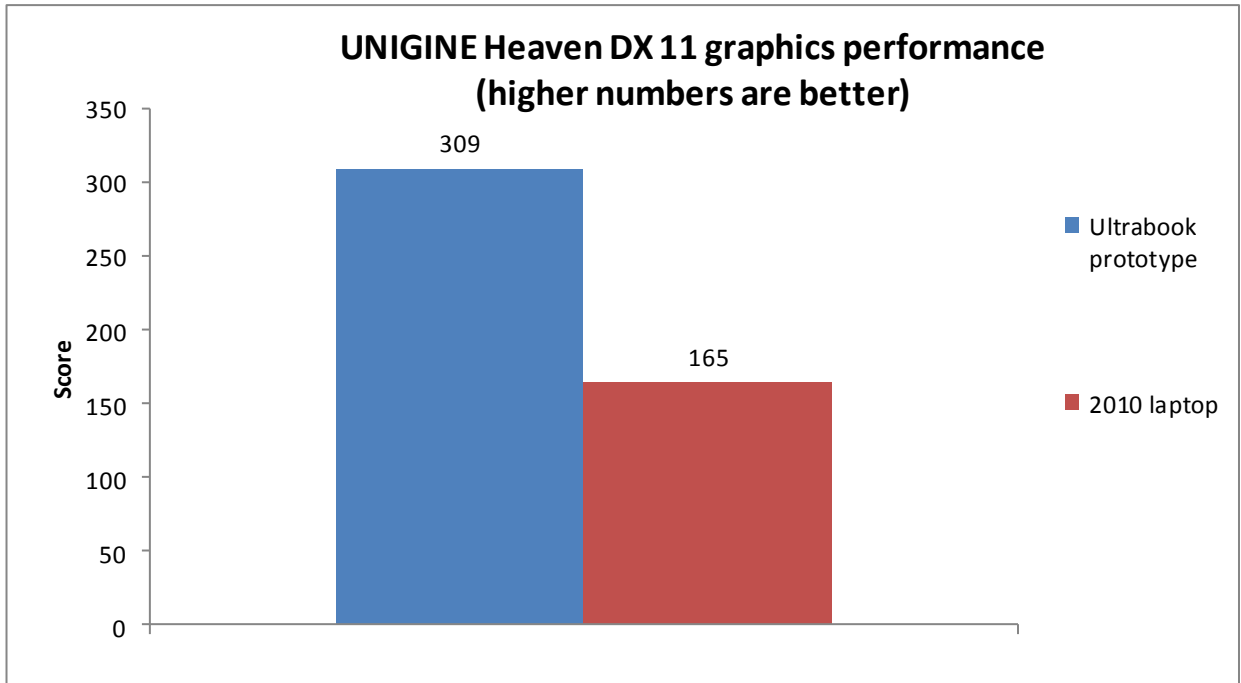


Figure 8: UNIGINE Heaven DX 11 graphics performance benchmark results for the Ultrabook prototype and the 2010 laptop we tested.

Graphics performance benchmarks			
	Ultrabook prototype	2010 laptop	Percentage difference
3DMark Vantage 1.1.0			
3DMark Score	3,280	1,197	174.0%
Graphics Score	2,681	933	187.4%
CPU Score	9,933	7,951	24.9%
UNIGINE Heaven DX 11			
Score	309	165	87.3%
Average FPS	12.3	6.6	86.4%
Min FPS	8.2	3.9	110.3%
Max FPS	23.4	12.5	87.2%

Figure 9: Median graphics performance benchmark results for the two systems. Higher numbers are better.

To better compare the graphical experience the systems provided, we then ran a number of common games on the system and used counters (either internal to the game or external) to determine the average frames per second (FPS) the systems delivered during gameplay. The more frames per second that a system processes, the smoother the gaming experience. The Ultrabook improved average FPS over the 2010 laptop on all the games we tested - ranging from 33.0 percent improvement on Diablo III performance to a whopping 71.1 percent improvement on Total War Shogun 2. Figure 10 compares the average FPS for common video games on the two systems.

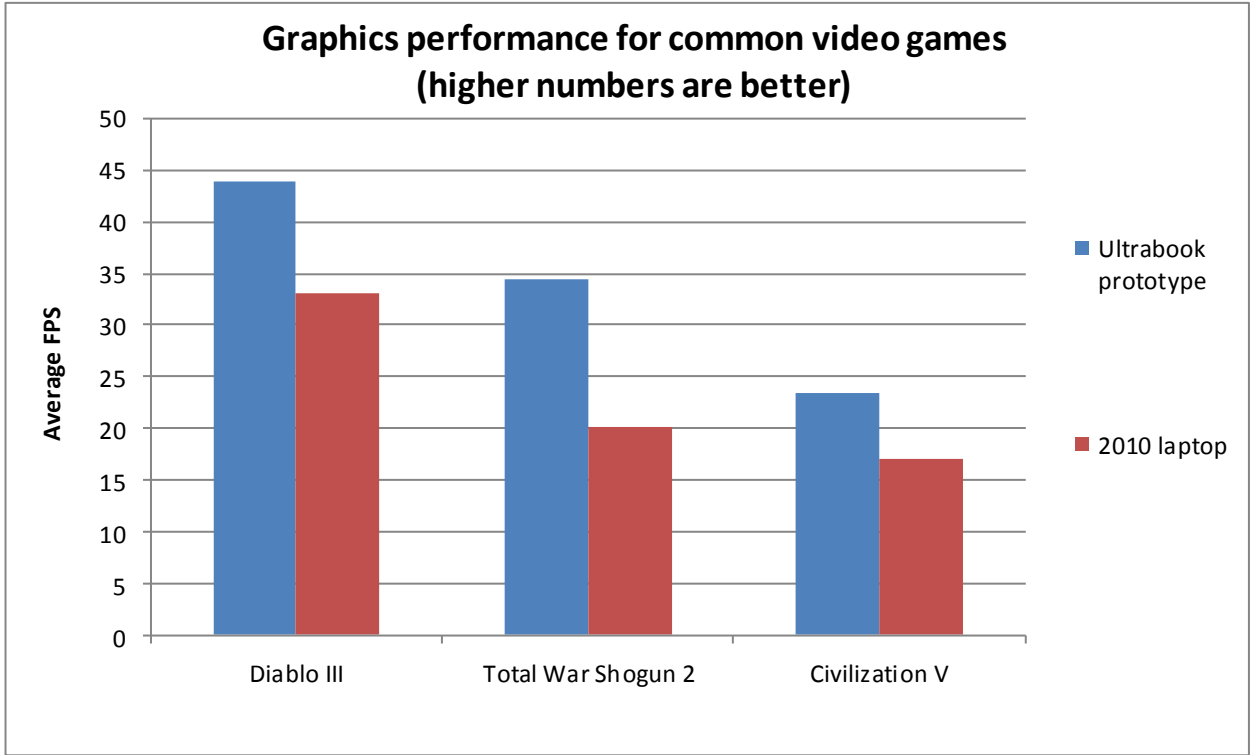


Figure 10: Graphics performance for common games, in average FPS, for the Ultrabook prototype and the 2010 laptop we tested.

Figure 11 details the average FPS results of the systems running the games we tested.

Graphics performance – Average FPS of common video games			
	Ultrabook prototype	2010 laptop	Percentage difference
Diablo III (Diablo III Old Tristram using FRAPS - 60 seconds)	43.9	33.0	33.0%
Total War Shogun 2 (Games Settings benchmark)	34.4	20.1	71.1%
Civilization V (Leader Benchmark)	23.35	17.09	36.6%

Figure 11: Average frames per second (FPS) while running each game. Higher numbers are better.

BENCHMARK PERFORMANCE

It's important that your laptop be up to the task of handling today's media, so that you can organize your music, produce videos, and create photos. To see how the Ultrabook fared against the 2010 laptop in general performance including media creation, we ran two industry-standard benchmarks: HDXPRT 2012, which evaluates the capabilities of PCs in common consumer digital media uses, and PCMark 7, which evaluates the full range of system performance.

Figure 12 compares the overall HDXPRT Create HD Score for the two systems. The Ultrabook prototype achieved a 92.6 percent higher score than the 2010 laptop, indicating it was better able to meet a number of media creation and manipulation demands.

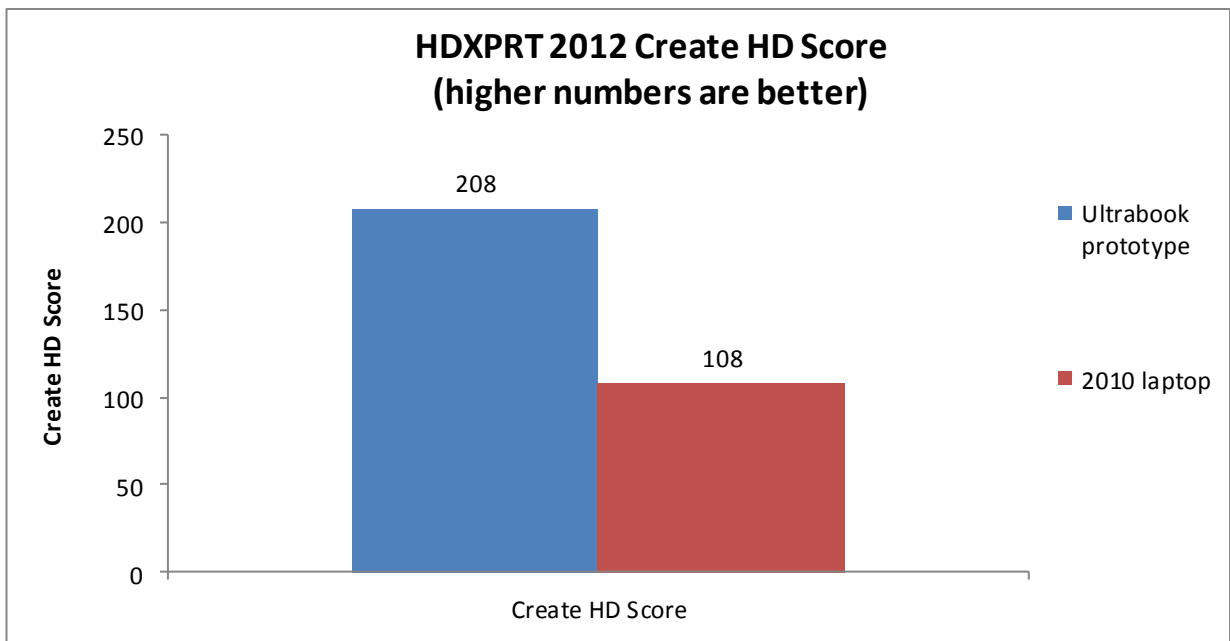


Figure 12: HDXPRT 2012 Create HD Scores for the Ultrabook prototype and the 2010 laptop we tested.

Figure 13 details the performance results for the two systems on the HDXPRT 2012 benchmark.

HDXPRT 2012 performance			
	Ultrabook prototype	2010 laptop	Percentage difference
Create HD Score (higher is better)	208	108	92.6%
Media Organizer - minutes (lower is better)	4.19	6.73	37.7%
Media Creator - minutes (lower is better)	11.60	17.76	34.7%
Photo Blogger - minutes (lower is better)	7.17	10.15	29.4%
Video Producer – minutes (lower is better)	2.10	12.58	83.3%
Music Maker - minutes (lower is better)	2.58	3.24	20.4%

Figure 13: HDXPRT 2012 performance scores for the two systems. A higher overall Create HD Score is better, but lower category scores are better.

Figure 14 compares the PCMark 7 performance scores of the two systems. The Ultrabook prototype achieved higher PCMark7 scores than the 2010 laptop in every category, for a combined 115.4 percent PCMark 7 score improvement - over twice the performance.

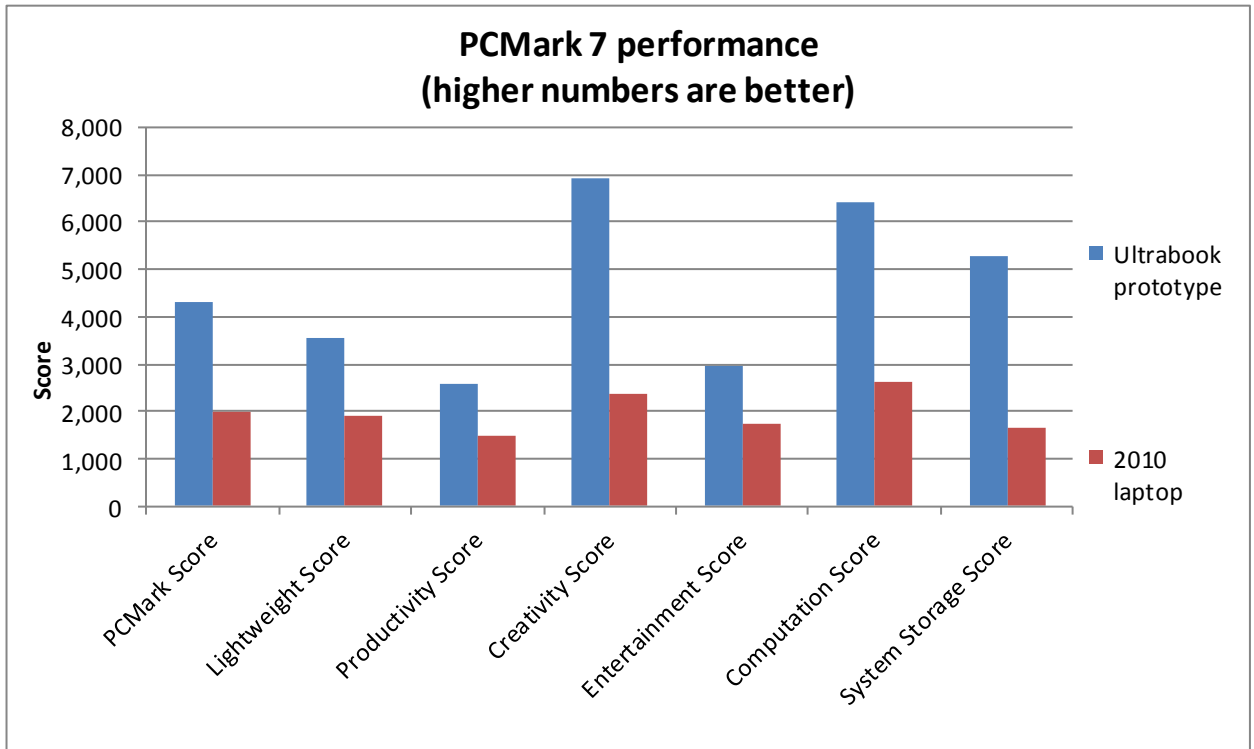


Figure 14: PCMark 7 scores for the Ultrabook prototype and the 2010 laptop we tested.

Figure 15 details the performance results for the two systems on the PCMark 7 benchmark.

PCMark 7 performance			
	Ultrabook prototype	2010 laptop	Percentage difference
PCMark Score	4,295	1,994	115.4%
Lightweight Score	3,548	1,911	85.7%
Productivity Score	2,589	1,504	72.1%
Creativity Score	6,935	2,381	191.3%
Entertainment Score	2,951	1,722	71.4%
Computation Score	6,415	2,618	145.0%
System Storage Score	5,294	1,640	222.8%

Figure 15: PCMark 7 benchmark scores for the two systems. Higher numbers are better.

BATTERY LIFE

Two of the major attractions of a laptop are maximum portability and flexibility, so why hold on to a system that tethers you to an electrical outlet? The Ultrabook can provide long battery life to keep you moving while handling your demanding workloads.

We used the BAPCo® MobileMark® 2012 benchmark to evaluate battery life during normal use and a 1080p custom video playback test, where the systems ran a video on loop until the battery expired, to test battery life when watching HD movies. Figure 16 compares the battery life scores of the systems. The Ultrabook prototype lasted up to 1 hour 40 minutes longer than the 2010 laptop during the MobileMark 2012 test.

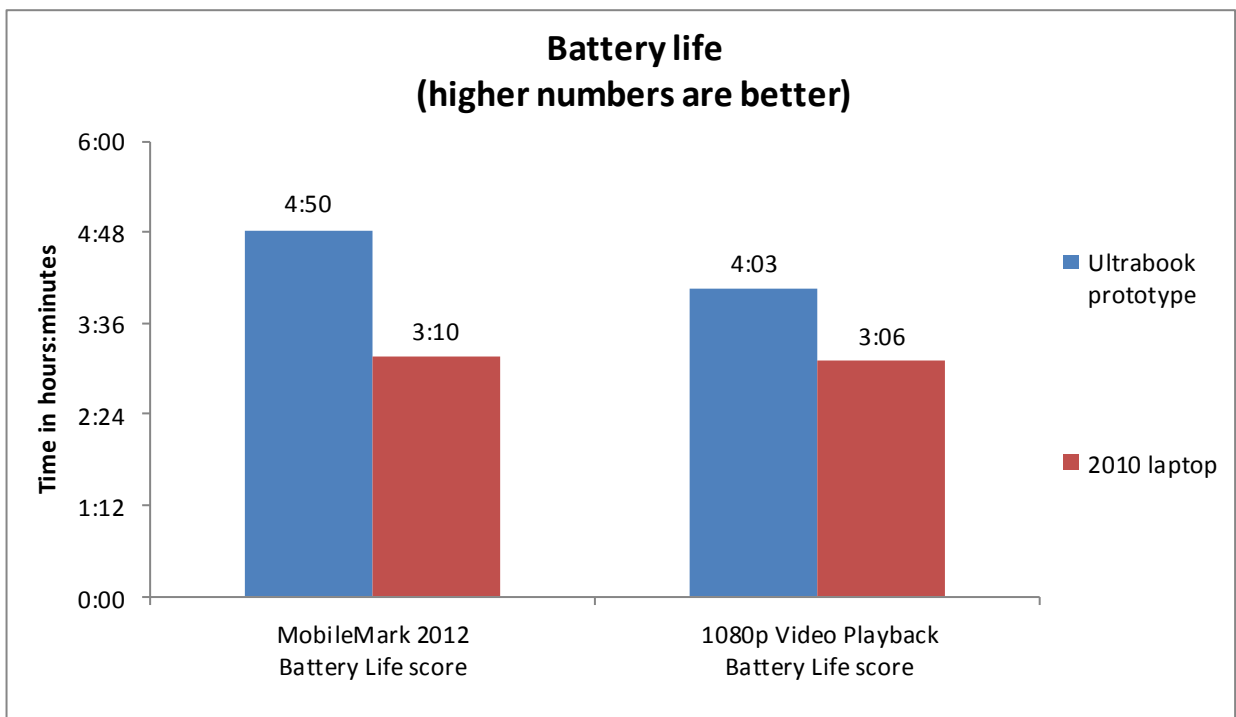


Figure 16: Battery life times for the Ultrabook prototype and the 2010 laptop we tested.

Figure 17 presents the battery life performance results for the systems in detail.

Battery life performance			
	Ultrabook prototype	2010 laptop	Percentage difference
MobileMark 2012			
Performance Qualification score	136	118	15.3%
Battery Life score (mm)	290	190	52.6%
Battery Life score (hh:mm)	4:50	3:10	52.6%
1080p Video Playback test			
Battery Life score (mm)	243	186	30.6%
Battery Life score (hh:mm)	4:03	3:06	30.6%
Screen brightness (nits)	156	152	NA

Figure 17: Detailed battery life results for the two systems.

WEB BROWSING PERFORMANCE

Today's Web is an astoundingly interactive environment. Thus, systems with more power to handle JavaScript and HTML5 make for a better Web browsing experience.

Figure 18 details the Web browsing performance results for the two systems. The Ultrabook prototype delivered 66.0 percent more runs per second than the 2010 laptop on the Dromaeo JavaScript benchmark and reduced latency by up to 45.4 percent on SunSpider JavaScript tests.

Web browsing performance			
	Ultrabook prototype	2010 laptop	Percentage difference
Dromaeo JavaScript (higher is better)	485.13 runs/s	292.16 runs/s	66.0%
SunSpider JavaScript (lower is better)	111.0 ms	203.4 ms	45.4%
GUIMark 2 HTML5 (higher is better)			
Vector Charting Test - FPS	26	21	23.8%
Bitmap Gaming Test - FPS	60	59	1.7%

Figure 18: Web browsing performance results for the two systems.

ENCRYPTION TIME

While the portability of laptops is an enormous plus, it also opens up the possibility of loss or theft. Encrypting your hard drive is an effective way to keep your personal data safe. New technologies have made encryption on the Ultrabook faster than ever.

We encrypted the hard drives of both systems using BitLocker®, and found that encrypting the disk on the Ultrabook prototype was 2.5 times faster, or took 60.2 percent less time than encrypting the 2010 laptop. Figure 19 compares the full disk

encryption times on the systems. Note: For this test, we resized the 2010 laptop's hard drive to 180GB in order to match the Ultrabook prototype's 180GB HDD size.

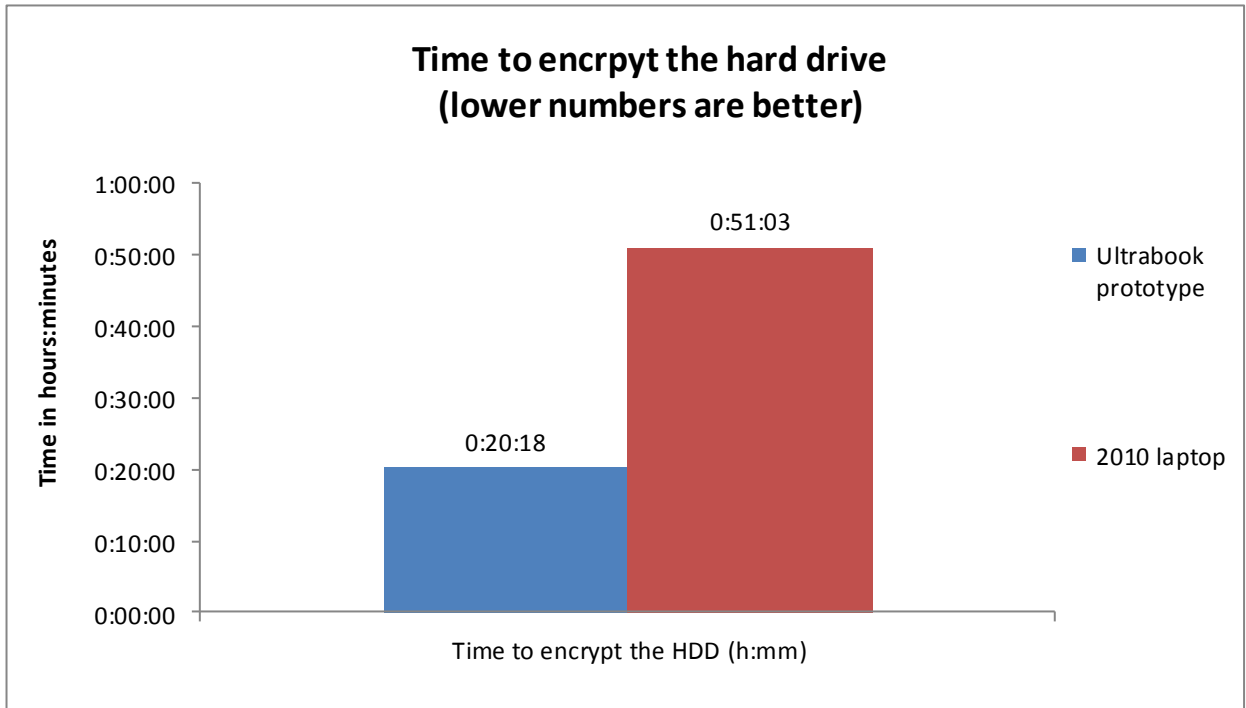


Figure 19: Full disk encryption times for the Ultrabook prototype and the 2010 laptop we tested.

Once a hard disk is encrypted, new files that are stored on the hard drive must also be encrypted to continue protecting all data. We ran another set of responsiveness tests, this time with encrypted disks, to compare the encryption performance of the systems as the user experiences it day to day. Again, the Ultrabook prototype outperformed the 2010 laptop, this time by 54.1 percent when launching a project in Adobe Photoshop Elements with an encrypted disk. Figure 20 compares the times it took the systems to complete system responsiveness tasks with encrypted disks.

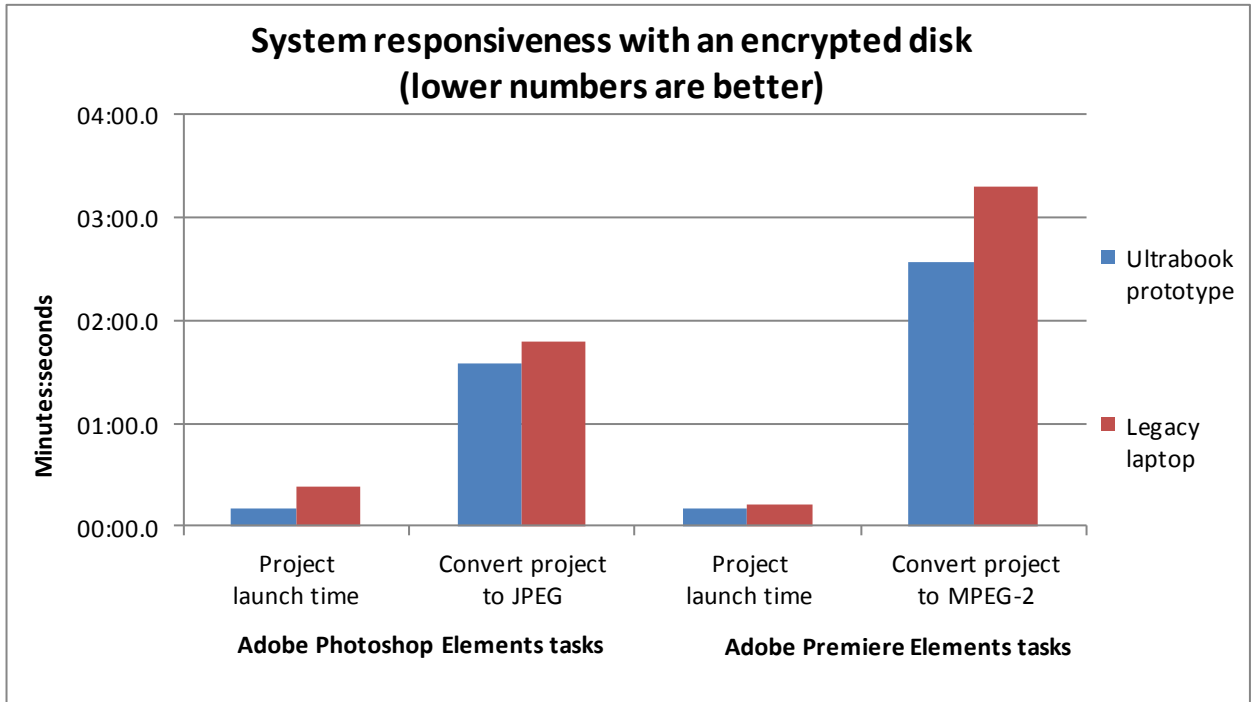


Figure 20: System responsiveness times for tasks with an encrypted disk for the Ultrabook prototype and the 2010 laptop we tested.

Figure 21 presents the results of our full disk encryption and system responsiveness with encrypted disks tests.

Encryption times			
	Ultrabook prototype	2010 laptop	Percentage difference
Time to encrypt the HDD (mm:ss)	20:18.00	51:03.00	60.2%
Adobe Photoshop Elements tasks			
Project launch time (mm:ss)	00:10.60	00:23.09	54.1%
Convert project to JPEG (mm:ss)	01:34.65	01:47.30	11.8%
Adobe Premiere Elements tasks			
Project launch time (mm:ss)	00:10.09	00:12.67	20.4%
Convert project to MPEG-2 (mm:ss)	02:33.77	03:18.03	22.4%

Figure 21: Detailed encryption test results for the two systems.

THE BENCHMARKS WE USED

In this section, we present a brief overview of the benchmarks we used in our testing. For detailed system configuration information, see [Appendix A](#). For step-by-step details on how we tested, see [Appendix B](#).

BAPCo MobileMark 2012

MobileMark 2012 is an industry-standard benchmark that provides a battery life rating and a performance rating based on common office scenarios. In our tests, we focus solely on the battery life rating. MobileMark 2012 uses applications and workloads specific to mobile systems. These include office activities like file and document management, data processing, and rich content creation. This module provides a score for battery life of the tested applications.

MobileMark 2012 includes the following applications with their corresponding tasks:

- ABBYY® FineReader Pro 11
- Adobe Acrobat® Pro X
- Adobe Flash® Player 11
- Adobe Photoshop CS5 Extended 12.04
- Adobe Photoshop Elements 10
- Adobe Premiere Pro CS 5.5
- CyberLink PowerDVD Ultra 11
- Microsoft Excel 2010 SP1
- Microsoft Internet Explorer® 9
- Microsoft Outlook® 2010 SP1
- Microsoft PowerPoint 2010 SP1
- Microsoft Windows Media Player
- Microsoft Word 2010 SP1
- Mozilla® Firefox® 10.0.2
- WinZip® Pro 16

MobileMark 2012 measures system battery life in minutes. It records system battery life at the start of the benchmark and repeats the workload until the system battery life is depleted, or until the system powers down due to low battery life.

MobileMark 2012 records a timestamp once per minute. At the end of the benchmark, it compares the beginning timestamp to the final (last recorded) timestamp. MobileMark 2012 derives its system battery life rating as the number of minutes between the start and end timestamps.

For more information on this benchmark, see

<http://www.bapco.com/products/mobilemark2012/index.php>.

Futuremark® 3DMark Vantage

Futuremark 3DMark Vantage is a benchmark designed to rate the performance of DirectX® 10 gaming PCs. It includes two graphics tests, two CPU tests, and six feature tests. The benchmark reports both graphics and CPU scores, as well as an overall 3DMark score to rate overall gaming performance.

For more information on 3DMark Vantage, see

<http://www.3dmark.com/3dmarkvantage/>.

Futuremark PCMark 7

Futuremark PCMark 7 is an industry-standard benchmark designed to test the performance of Windows 7 PCs. It uses over 25 workloads to test storage, computation, image and video manipulation, Web browsing, and gaming. PCMark 7 reports the following scores: Lightweight, Productivity, Creativity, Entertainment, Computation, and System Storage, and uses these scores to create an overall PCMark Score.

For more information on PCMark 7, see

<http://www.pcmark.com/benchmarks/index.html>.

HDXPRT 2012

The High Definition eXperience & Performance Ratings Test (HDXPRT) 2012, is a benchmark that evaluates the capabilities of PCs in consumer digital media uses, including

- Media Organizer
- Media Creator
- Photo Blogger
- Video Producer
- Music Maker

For more information on HDXPRT 2012, see www.hdxprt.com.

UNIGINE Heaven DX 11

Heaven Benchmark is a DirectX 11 GPU benchmark based on advanced UNIGINE™ engine. According to the UNIGINE Web site, it “reveals the enchanting magic of floating islands with a tiny village hidden in the cloudy skies. Interactive mode provides emerging experience of exploring the intricate world of steampunk.”

For more information on UNIGINE Heaven DX 11, see

<http://unigine.com/products/heaven/>.

IN CONCLUSION

In our tests, an Ultrabook prototype improved performance dramatically over a 2010 laptop system in every area we tested. The Ultrabook prototype reduced boot time by 74.7 percent, launched common applications up to 57.6 percent faster, provided up to 2.75 times the graphics performance, increased battery life by up to 52.6 percent, and encrypted a hard disk 2.5 times faster than the 2010 laptop we tested. It also provided a responsive touch-screen interface.

The benefits of replacing your older laptop with a new Ultrabook are clear: you can get more performance and a better experience out of a sleeker, more easily portable Ultrabook system.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 22 provides detailed configuration information for the test systems.

System	Ultrabook prototype	2010 laptop system
General		
Number of processor packages	1	1
Number of cores per processor	2	2
Number of threads	4	4
System power management policy	Balanced	Balanced
Processor power-saving option	Enhanced Intel SpeedStep® Technology	Enhanced Intel SpeedStep Technology
System dimensions (length x width x height)	13" x 8-7/8" x 5/8"	13-1/16" x 9-5/8" x 1-1/4"
System weight	3 lbs. 2.0 oz.	5 lbs. 2.5 oz.
CPU		
Vendor	Intel	Intel
Name	Core™ i7	Core i7
Model number	3667U	620M
Stepping	E1	C2
Socket type and number of pins	Socket 988B rPGA	Socket 989 rPGA
Core frequency (GHz)	2.00	2.66
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	512 KB (256 KB per core)	512 KB (256 KB per core)
L3 cache	4 MB	4 MB
Platform		
Vendor	Intel	Dell
Motherboard model number	Latexo FFRD	0K42JR
Motherboard chipset	Intel UM77	Intel QM57
BIOS name and version	American Megatrends ACRVMBY 1.86C.0091.P03.1206261010 (06/26/2012)	Dell A12 (05/09/2012)
Memory module(s)		
Vendor and model number	Micron 4KTF25665HZ-1G4D1	Samsung M471B5673FH0-CF8
Type	PC3-10700	PC3-8500
Speed (MHz)	1,333	1,066
Speed running in the system (MHz)	1,333	1,066
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-24	7-7-7-20
Amount of System RAM (GB)	4	4
RAM stick size (MB)	2,048	2,048
Number of memory module(s)	2	2
Channel (single/dual)	Dual	Dual

System	Ultrabook prototype	2010 laptop system
Hard disk		
Vendor and model number	Intel SSDSC2BW180A3H	Seagate ST9500420AS
Number of disks in system	1	1
Size (GB)	180	500
Buffer size (MB)	N/A	16
RPM	N/A	7,200
Type	SATA 6.0 Gb/s	SATA 3.0 Gb/s
Controller	Intel 7 Series/C216 Chipset Family SATA AHCI Controller	Intel 5 Series 6 Port SATA AHCI Controller
Driver	Intel 9.3.0.1011 (08/26/2011)	Intel 9.6.0.1014 (03/03/2010)
Operating system		
Name	Microsoft Windows 8 Professional RTM	Microsoft Windows 7 Ultimate
Build number	9200	7601
Service Pack	N/A	1
File system	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC
Language	English	English
Microsoft DirectX version	DirectX 11	DirectX 11
Graphics		
Vendor and model number	Intel HD Graphics 4000	NVIDIA® NVS 3100
Type	Integrated	Discrete
Chipset	Intel HD Graphics 4000	NVS 3100
BIOS version	2137.0	70.18.53.0.4
Total available graphics memory (MB)	1,696	2,266
Dedicated video memory (MB)	64	512
System video memory (MB)	0	0
Shared system memory (MB)	1,632	1,754
Resolution	1,600 x 900 x 32-bit	1,440 x 900 x 32-bit
Driver	Intel 9.17.10.2753 (05/14/2012)	NVIDIA 8.17.12.9679 (05/10/2012)
Sound card/subsystem		
Vendor and model number	Realtek® High Definition Audio	IDT High Definition Audio
Driver	Realtek Semiconductor Corp 6.0.1.6612 (04/10/2012)	IDT 6.10.0.6292 (07/22/2010)
Ethernet		
Vendor and model number	N/A	Intel 82557LM Gigabit
Driver	N/A	Intel 11.6.92.0 (12/03/2010)
Wireless		
Vendor and model number	Intel Centrino® Advanced-N 6235	Intel Centrino Ultimate-N 6300
Driver	Intel 15.5.0.30 (03/28/2012)	Intel 13.3.0.24 (07/14/2010)
Optical drive(s)		
Vendor and model number	N/A	TSSTcorp TS-U633F
Type	N/A	DVD-RW

System	Ultrabook prototype	2010 laptop system
USB ports		
Number	2	4
Type	USB 3.0	USB 2.0
Other	Media card reader, HDMI	Media card reader, eSATA
IEEE 1394 ports		
Number	0	1 – 4 pin
Monitor		
LCD type	LCD eDP with Cando+Atmel touchscreen	WXGA+ Anti-Glare LED Display
Screen size	13.3"	14.1"
Refresh rate	60 Hz	60 Hz
Battery		
Type	ATL 594793 Lithium-ion	W1193 Lithium-ion
Size (length x width x height)	N/A - integrated	8-1/4" x 1-7/8" x 13/16"
Rated capacity	47Wh	60Wh
Weight	N/A - integrated	11.3 oz.

Figure 22: System configuration information for the test systems.

APPENDIX B - HOW WE TESTED

MEASURING TIME TO BOOT, HIBERNATE, SLEEP, AND SHUT DOWN

Measuring time to boot and shut down

1. Simultaneously start the timer and boot the system.
2. Stop the timer when the word Start appears.
3. Record the result as the Boot time.
4. Bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
5. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
6. After the command completes, wait 5 minutes before running the test.
7. Open the Charm bar, and click Settings→Power.
8. Simultaneously start the timer and click Shut down.
9. Stop the timer when the power LED turns off.
10. Record the result as the shutdown time.
11. Repeat steps 1 through 10 two more times, and report the median of the three runs.

Measuring time to hibernate/resume from hibernation

1. Boot the system and open an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Open the Charm bar, and click Settings→Power.
5. Simultaneously start the timer and click Hibernation.
6. Stop the timer when the power LED turns off.
7. Record the result as the hibernation time.
8. Simultaneously start the timer and press the power button to resume from hibernation mode.
9. Stop the timer when the Windows taskbar appears.
10. Record the result as the resume from hibernation time.
11. Shut down the system.
12. Repeat steps 1 through 11 two more times, and report the median of the three runs.

Measuring time to sleep/resume from sleep

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Open the Charm bar, and click Settings→Power.
5. Simultaneously start the timer and click Sleep.

6. Stop the timer when the power LED starts to blink.
7. Record the result as the sleep time.
8. Simultaneously start the timer and press the power button to resume from sleep mode.
9. Stop the timer when the Windows taskbar appears.
10. Record the result as the Resume from sleep time.
11. Shut down the system.
12. Repeat steps 1 through 11 two more times, and report the median of the three runs.

MEASURING TIME TO OPEN APPLICATIONS

Setting up the Microsoft Office tests

1. Install Microsoft Office 2010 with default options.
2. Install Office 2010 Service Pack 1.

Measuring time to open Microsoft Word

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Open the Charm bar, and click Search.
5. Type `Word`
6. Simultaneously start the timer and click the Microsoft Word button.
7. Stop the timer when Microsoft Word is fully displayed.
8. Close Microsoft Word.
9. Shut down the system.
10. Repeat steps 1 through 9 two more times, and report the median of the three runs.

Measuring the time to open Microsoft Excel

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Open the Charm bar, and click Search.
5. Type `Excel`
6. Simultaneously start the timer and click the Microsoft Excel button.
7. Stop the timer when Microsoft Excel is fully displayed.
8. Close Microsoft Excel.
9. Shut down the system.
10. Repeat steps 1 through 9 two more times, and report the median of the three runs.

Measuring the time to open Microsoft PowerPoint

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.

- c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Open the Charm bar, and click Search.
5. Type Power Point
6. Simultaneously start the timer and click the Microsoft PowerPoint button.
7. Stop the timer when Microsoft PowerPoint is fully displayed.
8. Close Microsoft PowerPoint.
9. Shut down the system.
10. Repeat steps 1 through 9 two more times, and report the median of the three runs.

Measuring the time to open Apple iTunes

Setting up the test

1. Download and install iTunes 10.6.3 with the default options from <http://www.apple.com/itunes/download>.

Running the test

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Open the Charm bar, and click Search.
5. Type `iTunes`
6. Simultaneously start the timer and click the Apple iTunes button.
7. Stop the timer when Apple iTunes is fully displayed.
8. Close Apple iTunes.
9. Shut down the system.
10. Repeat steps 1 through 9 two more times, and report the median of the three runs.

Measuring the time to open Adobe Photoshop Elements 10

Setting up the test

1. Download and install Photoshop Elements with default options from http://www.adobe.com/cfusion/tdrc/index.cfm?product=photoshop_elements&loc=en_us.
2. Copy the test Photoshop Elements test file to the desktop.

Running the test

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Simultaneously double-click the Adobe Photoshop Elements test file, and start the stopwatch.
5. Stop the stopwatch when the file is loaded into Photoshop Elements.
6. Click `File→Save As`
7. Select JPEG from the drop down format menu and enter a file name.

8. Click Save.
9. In JPEG Options, slide the file size bar all the way to the right for the largest file (12).
10. Simultaneously click OK, and start the stopwatch.
11. Stop the stopwatch when the progress bar disappears and the cursor stops spinning.
12. Shut down the system.
13. Repeat steps 1 through 12 two more times, and report the median of three runs.

Measuring the time to open Adobe Premiere Elements 10 and encode a file to MPEG

Setting up the test

1. Download and install Premiere Elements with default options from http://www.adobe.com/cfusion/tdrc/index.cfm?product=premiere_elements&loc=en_us
2. Copy the Adobe Premiere Elements test file to the desktop.

Running the test

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
2. After the command completes, wait 5 minutes before running the test.
3. Simultaneously double-click the Adobe Premiere Elements test file, and start the stopwatch.
4. Stop the stopwatch when the project is loaded into Adobe Premiere Elements.
5. Click the Share tab and select Computer.
6. Select MPEG, enter a file name, and simultaneously click Save, and start the stopwatch.
7. Stop the stopwatch when the progress bar disappears and the Done button appears.
8. Shut down the system.
9. Repeat steps 1 through 9 two more times, and report the median of three runs.

MEASURING GRAPHICS PERFORMANCE

Measuring graphics performance with 3DMark Vantage 1.1.0

Installing and patching 3DMark Vantage

1. Download the 3DMark_Vantage_v110_installer.exe Windows package from <http://www.futuremark.com/benchmarks/3dmarkvantage/download/>
2. Install 3DMark Vantage 1.1.0 with the default options by double-clicking the 3DMark_Vantage_v110_installer.exe file.
3. At the Welcome screen, click Next.
4. At the License Agreement screen, click I accept the terms of the license agreement, and click Next.
5. At the Setup Type screen, click Express, and click Next.
6. At the Ready to Install the Program screen, click Install.
7. When the 3DMark Vantage Read Me page appears in your Web browser, review the document, and click Close when you are finished.
8. At the Setup Complete screen, click Finish.
9. Launch 3DMark Vantage 1.1.0 by double-clicking on the 3DMark Vantage desktop icon. Enter the registration code, and click Register.
10. Exit 3DMark Vantage 1.1.0.

Running 3DMark Vantage 1.1.0

1. Boot the system and bring up a command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Double-click the 3DMark Vantage desktop icon to launch the benchmark.
5. In the 3DMark Vantage Main section, click the Preset pull-down menu arrow, and select Performance.
6. Click the Options tab, then click the Graphic Tests tab, and ensure that both tests are selected.
7. Click the CPU Tests tab, and ensure that both tests are selected.
8. Click the Graphic Tests tab, and ensure that both tests are selected.
9. Click the Feature Tests tab, and deselect all six tests by clicking the check mark by each title.
10. Click Run Benchmark.
11. When the benchmark run completes, take a screenshot of the results, and record them as follows:
 - a. 3DMark Score
 - b. GPU Score
 - c. CPU Score
12. Perform steps 1 through 10 two more times, and report the median of the three runs.

Measuring graphics performance with UNIGINE Heaven DX 11

Installing and patching 3DMark Vantage

1. Download Heaven DX11 from <http://unigine.com/products/heaven/>.
2. Install Heaven DX11 with the default options by double-clicking the Unigine_Heaven-3.0.exe file.
3. At the Welcome screen, click Next.
4. At the License Agreement screen, click I accept the license agreement, and click Next.
5. At the User Information screen, click Next.
6. At the Select Destination Location screen, click Next.
7. At the Select Components screen, click Next.
8. At the Ready to Install screen, click Install.
9. Click Finish.

Running UNIGINE Heaven DX 11

1. Boot the system and bring up a command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Double-click the Heaven DX11 Benchmark 3.0 desktop icon to launch the benchmark.
5. Select the following options:
 - a. API: DirectX 11
 - b. Tessellation: Disabled
 - c. Shaders: High
 - d. Anisotropy: 4x
 - e. Stereo 3D: Disabled
 - f. Multi monitor: Unchecked

- g. Anti-aliasing: Off
 - h. Full screen: Checked
 - i. Resolution: 1440x900
6. Click Run.
7. Click Benchmark.
8. When the benchmark run completes, save the results, and record them.
9. Perform steps 1 through 9 two more times, and report the median of the three runs.

Measuring graphics performance with Diablo III

Setting up the test

1. Download the Diablo-III-SetUp-enUS.exe game client from <http://us.battle.net/d3/en/purchase>
 - a. Double-click the Diablo-III-SetUp-enUS.exe file.
 - b. Click Install.
 - c. After the game has been installed, click Play.
 - d. Click Options.
 - e. Set the video options to:
 - i. Full screen
 - ii. 1280x720p 16:9 widescreen
 - iii. Max Foreground FPS 150
 - iv. Max Background FPS 8
 - v. Texture Quality: High
 - vi. Shadow Quality: Medium
 - vii. Physics: High
 - viii. Clutter Density: Medium
 - f. Enter account name and password.
 - g. Play the enough of the game to get to the "Old Tristram" level, and exit the game.
2. Download FRAPSsetup.exe from <http://www.fraps.com/download.php>
 - a. Double-click the FRAPSsetup.exe file.
 - b. At the license agreement, click I agree.
 - c. At the Destination Folder screen, accept the defaults, and click Next.
 - d. Click Install.
 - e. Click Finish.
 - f. Launch FRAPS by clicking the desktop icon.
 - g. Under the General tab, check the boxes next to:
 - i. Start Fraps minimized
 - ii. Fraps window always on top
 - iii. Run Fraps when Windows starts
 - h. Under the FPS tab, check the boxes next to:
 - i. FPS
 - ii. Frametimes
 - iii. MinMaxAvg
 - iv. Stop benchmark after 60 seconds
 - i. Exit FRAPS.

Running the test

1. Boot the system and open an administrative command prompt:
 - a. Type CMD
 - b. Right-click the Command Prompt app to open App options.
 - c. Click Run as administrator button.

2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Launch Diablo III by clicking on the desktop icon.
5. Click Play.
6. Enter the account name and password.
7. Click Resume game.
8. Press F11 to start FRAPS and play 1 minute of the game level.
9. When 1 minute has passed exit the game.
10. View the FRAPS files saved in `C:\Program Files\FRAPS\Benchmarks` and record the results.
11. Shut down the system.
12. Repeat steps 1 through 11 two more times, and report the median of the three runs.

Measuring graphics performance with Civilization V

Setting up the test

1. Insert the Civilization V DVD.
2. Click Install Sid Meier's Civilization V.
3. Accept the license agreement, and click Install.
4. Accept the Steam license agreement, and click Next.
5. Click Install.
6. Enter Log In information, and click Next.
7. Enter the product code, and click Next.
8. Click Next.
9. Click Next.
10. Click I Agree.
11. Deselect Create start menu shortcut, and click Next.
12. Click Finish.
13. Create the benchmark shortcuts:
 - a. Navigate to the Civilization V launch executable: `C:\Program Files (x86)\Steam\steamapps\common\Sid Meier's Civilization V`
 - b. Right-click `CivilizationV.exe`, and choose Send to → Desktop (create shortcut)
 - c. On the Desktop, right-click the newly created shortcut, and select Properties.
 - d. In the Target field add the following: `-LeaderBenchmark`
 - e. Click Apply.
14. Navigate to the Civilization V config file: `C:\Program Files (x86)\Steam\steamapps\common\Sid Meier's Civilization V`
15. Right-click `Config.ini`, and select Edit.
16. Set `LoggingEnabled` to 1.
17. Click Save.
18. Close `Config.ini`.

Running the test

1. Boot the system and open an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Double-click the Civilization V benchmark desktop shortcut to launch the benchmark.

5. Select Sid Meier's Civilization V DirectX 10 & 11 (Recommended).
6. When the test completes, record the score, and shut down the system.
7. Repeat steps 1 through 7 two more times, and report the median of the three runs.
8. Shut down the system.
1. Repeat steps 1 through 7 two more times, and report the median of the three runs.

Measuring graphics performance with Total War Shogun 2

Setting up the test

1. Insert the Total War Shogun DVD into the disk drive.
2. Click Run SETUP.EXE
3. Click OK.
4. Click Install Total War: SHOGUN 2.
5. Accept the terms of the license agreement, and click Install.
6. Accept the terms of the Steam license agreement, and click Next.
7. Click Install.
8. Enter Log In information, and click Next.
9. Enter the product key, and click Next.
10. Click Next.
11. Click Next.
12. Insert Disk 2, and click OK.
13. Click Finish.
14. Allow Total War: Shogun 2 time to finish autodownloading and patching.
15. Select Total War: Shogun 2, and click Play.
16. Select Options.
17. Set the following graphic options:
 - a. Particle Effects: Low
 - b. Anti-Aliasing: None
 - c. Texture Filtering: Trilinear
 - d. Depth of Field: Off
 - e. Shader Model: Shader Model 3 (Low)
 - f. DirectX Mode: DirectX 9
 - g. Unit Detail: Low
 - h. Building Detail: Medium
 - i. Shadows: Low
 - j. Unit Size Large
 - k. Maximum Fleet Size: Large
 - l. Trees: Medium
 - m. Grass: Medium
 - n. Water: Medium
 - o. Sky: Low
 - p. Terrain Quality: Low
 - q. Check Distortion Effects (heat haze)
18. Click Apply now.

Running the test

1. Boot the system and open an administrative command prompt:
 - a. Type CMD
 - b. Right-click the Command Prompt app to open App options.
 - c. Click Run as administrator button.

2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Double-click the Steam desktop icon to launch Steam.
5. Select the Library Tab.
6. Select Total War: Shogun 2, and click Play.
7. Select Benchmark Game Settings, and click Play.
8. Record the results.
9. Select Total War: Shogun 2, and click Play.
10. Select Benchmark DX9 CPU, and click Play.
11. Record the results, and click Ok.
12. Shut down the system.
13. Repeat steps 1 through 12 two more times, and report the median of the three runs.

MEASURING SYSTEM PERFORMANCE

Measuring system performance with HDXPRT 2012

Setting up the test

1. Insert the HDXPRT DVD-ROM into your DVD drive.
2. At the HDXPRT Install screen, click Install HDXPRT.
3. Accept the HDXPRT end user license agreement.
4. After the setup is complete, select Yes, I want to restart my computer now, and click Finish.

Running the test

1. Click the HDXPRT 2012 shortcut on the desktop.
2. Click Run HDXPRT.
3. Enter a test name, choose 3 iterations, and click Run.
4. The Results Screen automatically appears at the end of a successful run. The test results files are found in the `C:\ProgramFiles\HDXPRT\Reports\<TestName>` directory.

Measuring system performance with Futuremark PCMark 7

Setting up the test

1. Reset the system with the appropriate test image.
2. Download the PCMark_7_v104_installer.exe Windows package from www.futuremark.com/benchmarks/pcmarkvantage/download/.
3. Install PCMark 7 1.0.4 with the default options by double-clicking the PCMark_7_v104_installer.exe file.
4. Launch PCMark 7 1.0.4 by clicking on the PCMark 7 desktop icon. Enter the registration code, click Register, and click OK.
5. Exit PCMark 7 1.0.4.

Running the test

1. Reboot the system.
2. Double-click the PCMark 7 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
 - Lightweight Score
 - Creativity Score
 - Entertainment Score

- Computation Score
 - System Storage Score
6. Repeat steps 1 through 5 two more times, and report the median of the three runs.

MEASURING BATTERY LIFE

Measuring battery life with MobileMark 2012

Avoiding antivirus software conflicts

MobileMark 2012 is not compatible with any virus-scanning software, so we uninstalled any such software present on the laptop PCs before we installed the benchmark.

Avoiding pre-installed software conflicts

MobileMark 2012 installs the following applications, which its test scripts employ:

- ABBYY FineReader Pro 11
- Adobe Acrobat Pro X
- Adobe Flash Player 11
- Adobe Photoshop CS5 Extended 12.04
- Adobe Photoshop Elements 10
- Adobe Premiere Pro CS 5.5
- CyberLink PowerDVD Ultra 11
- Microsoft Excel 2010 SP1
- Microsoft Internet Explorer
- Microsoft Outlook 2010 SP1
- Microsoft PowerPoint 2010 SP1
- Microsoft Windows Media Player
- Microsoft Word 2010 SP1
- Mozilla Firefox 10.0.2
- WinZip Pro 16

If any of these applications are already on the system under test, they could cause problems with the benchmark due to software conflicts. To avoid any such issues, before we installed the benchmark, we uninstalled all conflicting pre-installed software applications, including different versions of any of the programs MobileMark 2012 uses.

Adjusting display brightness and power settings

The brightness of a laptop's display affects its battery life. Therefore, BAPCo requires that, before you test with MobileMark 2012, you do the following step: make sure the brightness of the laptop's monitor is greater than or equal to 150 nits on a completely white screen while the laptop is unplugged and running on battery power. The measurement follows the standards from the Video Electronics Standards Association (www.vesa.org).

We complied with this standard for all the tests we ran by setting the laptop PC's brightness as close to 150 nits as we could without going below that brightness level. We used the following procedure before we started each test.

Note: This procedure assumes we began with the laptop plugged into the power supply.

1. To create a completely blank, white screen, open Microsoft Paint by typing `Paint`.
2. Press `Ctrl+W` to open the Resize and Skew dialog.
3. Under Horizontal and Vertical enter 200, and click OK.

4. Click the View tab.
5. Click Full screen to view a white screen.
6. Wait 45 minutes to allow the screen to warm.
7. Unplug the laptop from the power supply, and measure the display's brightness using a luminance meter in the center of the screen. (We used the Gossen Mavolux5032C.)
8. If the reading is below or significantly greater than 150 nits, adjust the screen brightness to as close to 150 nits, without going under, as possible. Then retest:
 - a. Type `Power Options`, and click Settings to filter the results. Click Power Options.
 - b. Click Change plan settings.
 - c. Click Change advanced power settings.
 - d. Expand the Display option, and change the Display brightness on battery and plugged in to the correct percentage that produces no less than 150 nits.
9. Allow the laptop to run on battery power for 10 minutes, re-measure the display, and adjust the brightness up or down as necessary.
10. Verify that the laptop saved the brightness setting by plugging in the system, unplugging it, and taking another reading.

Using the MobileMark built-in Configuration Tool

This tool supports three levels of configuration:

1. Only makes changes that are REQUIRED in order for the benchmark to run.
2. Additionally, makes changes that are RECOMMENDED for repeatable results.
3. Additionally, makes OPTIONAL changes that help ensure best results.

The Configuration tool makes the following configuration changes at each of the three levels:

Level 1 - Required

- Disables User Account Control (UAC)
- Disables Windows Update
- Disables System Sleep and Hibernate
- Sets Screen Dimming Timeout (2 minutes)
- Disables Low Battery Actions
- Disables Network Proxies
- Disables Autorun for Optical Drive

Level 2 - Recommended

- Create BAPCo power scheme
- Set Power Plan Type to balanced
- Disables Windows Firewall
- Disables Windows Sidebar/Gadgets
- Disables Windows Pop-ups
- Disables Incoming Remote Desktop Connections
- Disables Windows Error Reporting
- Disables Screen Saver and Monitor Timeout
- Sets CPU Adaptive Mode
- Disables Desktop Slideshow
- Disables Disk Defrag

Level 3 - Optional

- Sets Hard Disk Timeout
- Disables Windows Defender
- Disables System Restore

- Ignores Laptop Lid Close
- Sets Maximum Display Brightness
- Disables Adaptive Brightness

We chose all options listed - Level 3- in the Configuration tool.

Installing MobileMark 2012 and configuring the system for testing

1. Verify that the wireless adapter is enabled and connected to a wireless router that is not connected to the Internet.
2. Insert the MobileMark 2012 Install DVD into the laptop PC's DVD drive.
3. When the Autoplay menu appears, click Run MobileMark2012_Setup.exe.
4. At the Welcome screen, click Next.
5. Enter the serial number, and click Next.
6. Accept the license agreement, and click Next.
7. At the Choose Components screen, select Full, and click Next.
8. At the Choose Install Location screen, accept the default location of C:\Program Files (x86)\BAPCo\MobileMark2012, and click Next.
9. At the Choose Start Menu Folder screen, click Install.
10. Insert Disc 2 when prompted.
11. At the InstallShield Wizard Complete screen, click Finish.
12. Launch MobileMark 2012.
13. Click Configuration and choose only the Required options.
14. Click Apply, and restart the computer when prompted.
15. Adjust the screen brightness to no less than 150 nits:
 - a. Type `power options`, then click Settings to filter the results, and click on Power Options.
 - b. Click Change plan settings.
 - c. Click Change advanced power settings.
 - d. Expand the Display option, and change the Display brightness on battery and plugged in to the correct percentage that produces no less than 150 nits.

Conditioning the battery

1. Plug the AC power adapter into the laptop PC, and completely charge the battery.
2. Install MobileMark 2012, following the steps we outlined in the Installing MobileMark 2012 section earlier in this section.
3. Double-click the MobileMark 2012 icon on the desktop.
4. Click the Office Productivity icon.
5. Type `System Conditioning` as the name for this test in the Project Name, check the box next to conditioning, and click Continue.
6. If MobileMark 2012 lists no problems or warnings, click Continue. If it does list any problems or warnings, close MobileMark 2012, and correct the problem(s) before proceeding.
7. When prompted, unplug the AC power adapter. The Office Productivity test begins immediately.
8. The test is complete when the laptop PC has fully depleted its battery and is no longer operational when running on battery power.
9. Plug the AC power adapter into the laptop PC, and completely charge the battery.

Measuring battery life with MobileMark 2012

We performed the following steps to run the MobileMark 2012 Office Productivity benchmark:

1. Double-click the MobileMark 2012 icon on the desktop.
2. Select the Office Productivity test by clicking the Office Productivity icon.
3. Enter a name for this test in the Project Name field, and click Continue.

4. If MobileMark 2012 lists no problems or warnings, click Continue. If it does list any problems or warnings, close MobileMark 2012, and correct the problem(s) before proceeding.
5. When prompted, unplug the AC power adapter. The test begins immediately.
6. The Office Productivity test is complete when the laptop PC has fully depleted its battery and is no longer operational when running on battery power.

We executed the MobileMark 2012 Office Productivity test three times on the system and took the median battery life run as the representative score for that test.

Getting the MobileMark 2012 results

After each MobileMark Productivity 2012 test completed, we plugged the AC power adapter into the laptop PC and turned on the system. MobileMark 2012 started automatically after the system booted, then analyzed the test scores and opened the Test Results Viewer with the results from the last test.

To submit these results to BAPCo, we saved the test results by performing the following steps:

1. Click Save.
2. Enter a name and select FDR to save the results as an FDR file.
3. Click Save again, and select PDF to save the results as a PDF file.
4. Browse to the Documents directory where the result FDR and PDF files were saved.

Measuring battery life with 1080p video playback from file on hard disk

Setting up the test

1. Copy the Elephant's Dream 1080p test file to the Videos folder.
2. Set power options:
 - a. Open the Charm bar, and click Settings.
 - b. Click Control Panel.
 - c. Click Power Options.
 - d. Under the Balanced option, click Change plan settings.
 - e. Choose Never from the drop down menus for Dim the display, Turn off the display, and Put the computer to sleep.
3. Adjust the screen brightness to no less than 150 nits:
 - a. Type `Power Options`, click Settings to filter the results, and click Power Options.
 - b. Click Change plan settings.
 - c. Click Change advanced power settings.
 - d. Expand the Display option, and change the Display brightness on battery and plugged in to the correct percentage that produces no less than 150 nits.

Running the test

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Open the Charm bar, and click Search.
5. Type Windows Media Player.
6. Click on the Windows Media Player button.
7. Click on Videos, and select the Elephant's Dream 1080p test file.
8. Click Play and simultaneously unplug the system, and start the stopwatch.

9. Click the automatic repeat button and expand Windows Media Player to full-screen.
10. Stop the stopwatch when the computer shuts down, and record the time.
11. Fully recharge the battery to 100%.
12. Repeat steps 1 through 11 two more times, and report the median of the three runs.

BROWSING WEB SITES

Dromaeo (JavaScript)

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Click on the Internet Explorer button.
5. In the address bar, type `http://dromaeo.com` and press Enter.
6. Click Run Recommended Tests.
7. Click Run to start the tests.
8. After the test finishes, record the results that appear.
9. Turn off the System.
10. Repeat steps 1 to 9 two more times, and report the median of the three runs.

Sunspider (JavaScript)

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Click on the Internet Explorer button.
5. In the address bar, type <http://www.webkit.org/perf/sunspider/sunspider.html> and press Enter.
6. Click the Start SunSpider 0.9.1 now! link to start the test.
7. After the test finishes, record the total result that appears.
8. Turn off the System.
9. Repeat steps 1 to 8 two more times, and report the median of the three runs.

GUIMark 2 (HTML5)

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Click on the Internet Explorer button.
5. In the address bar, type <http://www.craftymind.com/guimark2/> and press Enter.
6. Scroll down to find the Vector Charting Test, and click the HTML5 link.

7. Click Start Test.
8. After the test finishes, record the result that appears.
9. Restart the system.
10. Bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
11. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
12. Do not interact with the system until the command completes.
13. After the command completes, wait 5 minutes before running the test.
14. Click the Internet Explorer button.
15. In the address type <http://www.craftymind.com/guimark2/> and press Enter.
16. Scroll down to find the Bitmap Gaming Test, and click the HTML5 link.
17. Click Start Test.
18. After the test finishes, record the result that appears
19. Shut down the system.
20. Repeat steps 1 through 19 two more times, and report the median of the three runs.

ENCRYPTING DATA WITH BITLOCKER

BitLocker Drive Encryption

Setting up the test

1. Verify that TPM is enabled and activated in the BIOS.

Running the test

1. Go to the Control Panel and click BitLocker Drive Encryption.
2. Verify that the C: drive is selected and click Turn On BitLocker.
3. At the BitLocker Drive Encryption checklist setup screen, click Next.
4. At the preparing your drive for BitLocker screen, click Next. When the drive has been prepared a green checkmark will appear next to Prepare your drive for BitLocker.
5. Click Next.
6. At the How do you want to store your recovery key screen, select Save the recovery key to a USB flash drive, and click Save.
7. Click Next.
8. Simultaneously start the timer and click Start Encrypting.
9. Stop the timer when the encrypting progress bar has disappeared and the drive is encrypted.
10. Decrypt the drive and perform steps 1 through 9 two more times, and report the median of the three runs.

BitLocker Photoshop Elements

Setting up the test

1. Verify that TPM is enabled and activated in the BIOS and that the drive has been encrypted by the previous test.
2. Download and install Photoshop Elements with default options from http://www.adobe.com/cfusion/tdrc/index.cfm?product=photoshop_elements&loc=en_us.
3. Copy the test Photoshop Elements test file to the desktop.

Running the test

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.

2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Simultaneously double-click the Adobe Photoshop Elements test file, and start the stopwatch.
5. Stop the stopwatch when the file is loaded into Photoshop Elements.
6. Click File→Save As
7. Select JPEG from the drop down format menu and enter a file name.
8. Click Save.
9. In JPEG Options, slide the file size bar all the way to the right for the largest file.
10. Simultaneously click OK, and start the stopwatch.
11. Stop the stopwatch when the progress bar disappears and the cursor stops spinning.
12. Shut down the system.
13. Repeat steps 1 through 12 two more times, and report the median of three runs.

BitLocker Premiere Elements

Setting up the test

1. Verify that TPM is enabled and activated in the BIOS and that the drive has been encrypted by the previous test.
2. Download and install Premiere Elements with default options from http://www.adobe.com/cfusion/tdrc/index.cfm?product=premiere_elements&loc=en_us
3. Copy the Adobe Premiere Elements test file to the desktop.

Running the test

1. Boot the system and bring up an administrative command prompt:
 - a. Type `CMD`
 - b. Right-click the Command Prompt app to open App options.
 - c. Click the Run as administrator button.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
Do not interact with the system until the command completes.
3. After the command completes, wait 5 minutes before running the test.
4. Simultaneously double-click the Adobe Premiere Elements test file, and start the stopwatch.
5. Stop the stopwatch when the project is loaded into Adobe Premiere Elements.
6. Click the Share tab and select Computer.
7. Select MPEG, enter a file name, and simultaneously click Save, and start the stopwatch.
8. Stop the stopwatch when the progress bar disappears and the Done button appears.
9. Shut down the system.
10. Repeat steps 1 through 9 two more times, and report the median of three runs.

ABOUT PRINCIPLED TECHNOLOGIES



Principled Technologies, Inc.
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