

PERFORMANCE COMPARISON: SAMSUNG SOLID-STATE DRIVE VS. HARD DISK DRIVE IN A DELL LATITUDE 14 7000 SERIES LAPTOP

GET A BETTER USER EXPERIENCE ON A DELL™ LATITUDE™ 14 7000 SERIES LAPTOP WITH A SAMSUNG SSD

versus the same E7440 model equipped with an HDD



- ▶ 4.6X the disk performance
- ▶ 47% faster to power on and shut down
- ▶ up to 42% faster to launch common applications and open files
- ▶ 30% more battery life after spending the weekend in sleep mode

When it comes to your employees' laptops, every second counts. A zippy system can boost productivity and make the workday go more smoothly. Choosing or upgrading to a Samsung solid-state drive (SSD) can take a laptop from fast to super-fast. This means your employees will enjoy not only improved overall performance, but also reduced time to perform everyday tasks such as booting up, shutting down, and launching applications.

In our labs, Principled Technologies tested two nearly identical Dell Latitude 14 7000 Series (Model E7440) laptops running Microsoft® Windows® 7 Professional—one with a 512GB Samsung PM851 SSD and the other with a hard drive (HDD). We found that the Dell Latitude E7440 with a Samsung SSD outperformed the same system with an HDD in both performance and battery life. This means that upgrading your Dell Latitude 14 7000 Series laptop with a Samsung SSD can boost employee productivity versus using a traditional HDD.



THE NEED FOR SPEED

Today's workers do not like to wait. A laptop that performs everyday tasks briskly can make an employee's work life much more pleasant and allow them to work more efficiently. Because laptop performance is so important to today's worker, we took a Dell Latitude 14 7000 Series laptop running Windows 7 and conducted a range of tests to examine the effects of replacing the traditional HDD with a Samsung SSD. Across the board, the 512GB Samsung SSD-based system outperformed the HDD-based system.

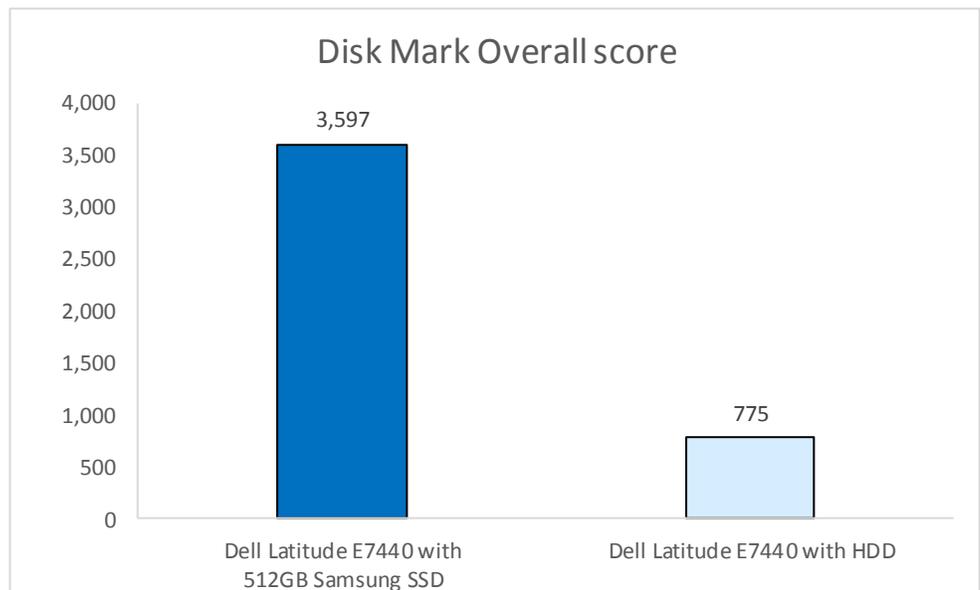
We conducted every test three times and present the results for the median run of each test. We provide complete system configuration information in Appendix A and the details of our testing in Appendix B.

SYSTEM PERFORMANCE

Because performance is so important to today's worker, we used two industry-standard benchmarks to rate the performance of the two systems.

The Disk Mark component of the PassMark® PerformanceTest™ measures read and write speed to one or more disks. As Figure 1 shows, the 512GB Samsung SSD-based Dell Latitude E7440 scored 364.1 percent higher overall on the PassMark Disk Mark test than the HDD-based system. It also scored 404.4 percent higher on the PassMark Sequential Read test, 228.7 percent higher on the PassMark Sequential Write test, and 2,309.1 percent higher on the PassMark Random Seek + RW score (see Figure 2).

Figure 1: PassMark Disk Mark scores for the two systems. Higher scores are better.



	Dell Latitude E7440 with 512GB Samsung SSD	Same system with HDD	Percentage improvement with 512GB Samsung SSD
Disk Mark Overall score	3,597.00	775.00	364.1%
Sequential Read - MB/sec	503.90	99.90	404.4%
Sequential Write - MB/sec	358.30	109.00	228.7%
Random Seek + RW - MB/sec	132.50	5.50	2,309.1%

Figure 2: Median scores for PassMark 8.0 Disk Mark. Higher numbers are better.

BAPCo® SYSmark® 2014 measures system performance for a number of common tasks including office productivity and media creation. As Figure 3 shows, the 512GB Samsung SSD-based laptop achieved a 9.4 percent higher SYSmark2014 Overall Performance Rating than the system with the HDD.

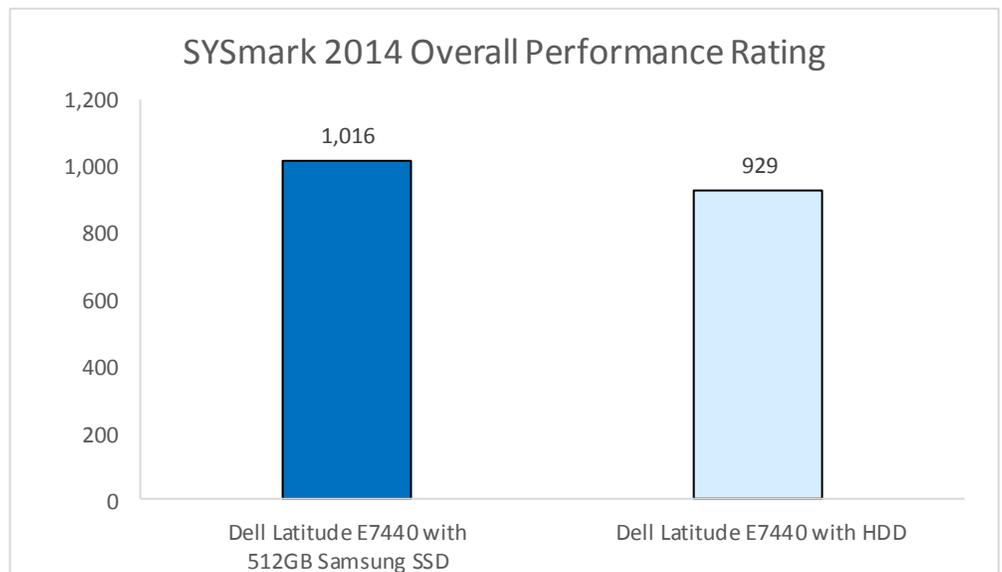


Figure 3: SYSmark Overall Performance Rating scores for the two systems. Higher scores are better.

The 512GB Samsung SSD-based Dell Latitude E7440 outperformed the HDD-based system in all subtests as well (see Figure 4).

BAPCo SYSmark 2014	Dell Latitude E7440 with 512GB Samsung SSD	Same system with HDD	Percentage improvement with Samsung 512GB SSD
Overall Performance Rating	1,016	929	9.4%
SYSmark 2014 – Office Productivity	970	861	12.7%
SYSmark 2014 – Media Creation	931	856	8.8%
SYSmark 2014 – Data/Financial Analysis	1162	1089	6.7%

Figure 4: Median scores for the BAPCo SYSmark 2014 benchmark. Higher numbers are better.

SYSTEM AND APPLICATION RESPONSIVENESS

The less time users spend waiting for their laptops to boot up, the more time they have to be productive. At the same time, no one wants to wait for a system to shut down when they're done for the day. We looked at the impact of replacing a traditional HDD with a 512GB Samsung SSD for these tasks. Figure 5 shows the median results: the 512GB Samsung SSD-based Dell Latitude E7440 reduced the time needed for these tasks by as much as 48.0 percent compared to the same system equipped with an HDD.

Task	Dell Latitude E7440 with 512GB Samsung SSD	Same system with HDD	Percentage improvement with 512GB Samsung SSD
Boot	18.06	33.93	46.8%
Shut down	6.36	12.24	48.0%

Figure 5: Median times, in seconds, for the two systems. Except for percentage improvement, smaller numbers are better.

Users have better things to do than spend time waiting for their laptops to launch applications. Figure 6 shows the median results for our application-launching tests, in which we launched two popular applications from Adobe®. As with our system responsiveness tests, the 512GB Samsung SSD-based laptop reduced the time needed for these tasks by as much as 41.7 percent compared to the HDD-based system.

Launching applications	Dell Latitude E7440 with 512GB Samsung SSD	Same system with HDD	Percentage improvement with 512GB Samsung SSD
Adobe Photoshop® Elements 13	4.70	5.57	15.6%
Adobe Premiere® Elements 13	8.53	14.63	41.7%

Figure 6: Median times, in seconds, for the two systems. Except for percentage improvement, smaller numbers are better.

Waiting for large files to open and save to disk can be very tedious. Figures 7 and 8 show the median results for performing these tasks. The 512GB Samsung SSD-based Dell Latitude E7440 reduced the time needed to open large files by as much as 42.9 percent compared to the HDD-based notebook and did a quicker job of saving and encoding them.

Opening large files	Dell Latitude E7440 with 512GB Samsung SSD	Same system with HDD	Percentage improvement with 512GB Samsung SSD
Adobe Photoshop Elements – Opening a project	9.78	17.12	42.9%
Adobe Premiere Elements – Opening a project	11.77	16.37	28.1%

Figure 7: Median times, in seconds, the two systems needed to open large files. Except for percentage improvement, smaller numbers are better.

Saving and encoding tasks	Dell Latitude E7440 with 512GB Samsung SSD	Same system with HDD	Percentage improvement with 512GB Samsung SSD
Adobe Photoshop Elements – Saving a file as a JPEG	48.34	60.39	20.0%
Adobe Premiere Elements – Encoding a file to MPEG	154.61	155.91	0.80%

Figure 8: Median times, in seconds, the two systems needed to save and encode large files. Except for percentage improvement, smaller numbers are better.

BATTERY LIFE

Laptops with long battery life are ideal for today’s worker, who is often mobile. If a laptop runs longer without charge, employees aren’t faced with the hassles of plugging in on the go.

We compared the battery life of the two laptops and found that the 512GB Samsung SSD-based Dell Latitude lasted 21 minutes longer on a single charge than the HDD-based system did (see Figure 9).

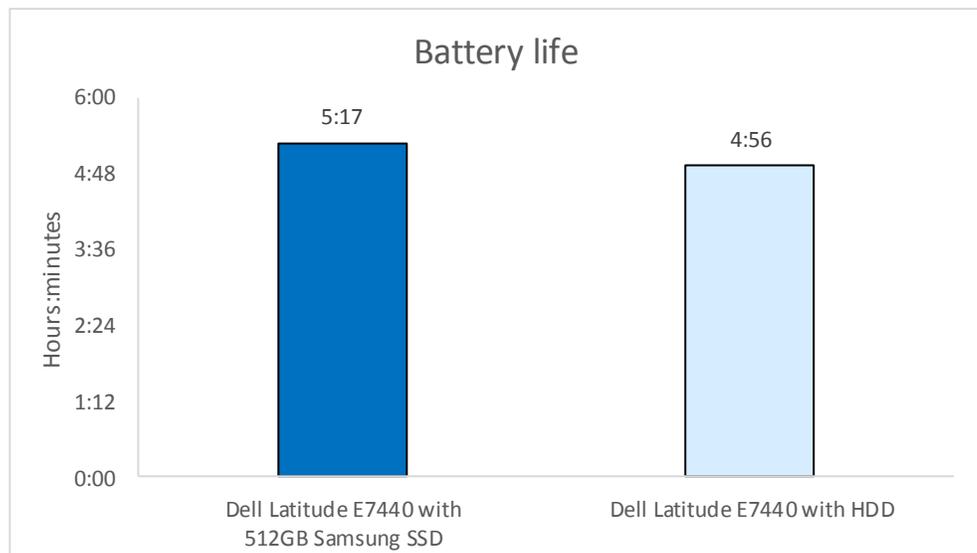


Figure 9: MobileMark 2012 Battery Life scores the two test laptops achieved. Higher scores are better.

Battery charge after sleep

SSDs allow you to take advantage of certain technologies, such as Intel® Rapid Start Technology™ (IRST), which dramatically reduces the amount of power a system consumes when it is not in use. IRST can let you start your system more quickly than resuming from hibernation, and works to keep your battery charged.

As Figure 10 shows, after sleeping for 63 hours (from 5 PM Friday to 8 AM Monday), the battery charge on the HDD-based system dropped to 70 percent, while

the battery on the 512GB Samsung SSD-based Dell Latitude E7440 remained fully charged.

Percentage battery charge remaining after being in Sleep mode for...	Dell Latitude E7440 with 512GB Samsung SSD	Same system with HDD	Percentage improvement with 512GB Samsung SSD
63 hours (5 PM Friday to 8 AM Monday)	100%	70%	30%

Figure 10: The percentage battery charge remaining upon exiting Sleep mode. Higher numbers are better.

THE BENCHMARK TESTS WE USED

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

PassMark Performance Test

The Disk Mark component of PassMark Performance Test measures data transfer speed when reading or writing data both sequentially and randomly to one or more disks. Many factors affect this speed, and the Advanced Disk Drive Test allows the user to vary most of these factors and compare the results. For more information on this benchmark, see www.passmark.com/products/pt.htm.

BAPCo SYSmark 2014

BAPCo SYSmark 2014 is an application-based benchmark that tests performance in the following office workload scenarios: office productivity, media creation, Web development, data/financial analysis, 3D modeling, and system management. SYSmark 2014 records the time the system takes to complete each individual operation in each scenario. For more information on this benchmark, see www.bapco.com/products/sysmark-2014.

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 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>.

IN CONCLUSION

A zippy Samsung SSD-based laptop can speed up your employees' experience at work. Saving a few seconds here and there over the course of the day might sound inconsequential, but those seconds can add up. We found that the Dell Latitude E7440 with a 512GB Samsung PM851 SSD outperformed the same system with an HDD in both performance and battery life. Investing in Samsung SSDs for your Dell Latitude 14 7000 Series laptops can boost both employee productivity and morale. As SSDs continue to evolve, employees will likely be able to benefit from the performance advantages of SSDs without sacrificing storage space.

For more info on the Dell Latitude 14 7000 Series laptop, visit

www.dell.com/us/business/p/latitude-e7440-ultrabook/fs?pf=v. To learn about the SSD options that Dell offers, visit www.dell.com/business/ssd.

For more info on Samsung SSD technology, visit

www.samsung.com/global/business/semiconductor/product/flash-ssd/overview.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 11 provides detailed configuration information for the test systems. The systems were identically configured outside of the hard disk.

System	Dell Latitude E7440 with 512GB Samsung SSD	Dell Latitude E7440 with HDD
Hard disk		
Vendor and model number	Samsung PM851	Seagate ST500LT012
Number of disks in system	1	1
Size (GB)	512	500
Buffer size (MB)	NA	16
RPM	NA	5,400
Type	SATA 6.0 Gb/s	SATA 3.0 Gb/s
Controller	Intel 8 Series Chipset Family SATA AHCI Controller	Intel 8 Series Chipset Family SATA AHCI Controller
Driver	Intel 13.1.0.1058 (05/02/2014)	Intel 13.1.0.1058 (05/02/2014)
General		
Number of processor packages	1	1
Number of cores per processor	2	2
Number of hardware threads per core	4	4
Total number of processor threads in system	8	8
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)	13.2" x 9.1" x 0.8"	13.2" x 9.1" x 0.8"
System weight	3.96 lbs.	3.96 lbs.
CPU		
Vendor	Intel	Intel
Name	Core™ i5	Core i5
Model number	4300U	4300U
Stepping	C0	C0
Socket type and number of pins	Socket 1168 BGA	Socket 1168 BGA
Core frequency (GHz)	1.90	1.90
L1 cache	2 x 32 KB + 2 x 32 KB	2 x 32 KB + 2 x 32 KB
L2 cache	2 x 256 KB	2 x 256 KB
L3 cache	3 MB	3 MB
Platform		
Vendor	Dell	Dell
Motherboard model number	0PC4X0	0PC4X0
Motherboard chipset	Haswell-ULT	Haswell-ULT
BIOS name and version	Dell A05 (09/23/2013)	Dell A05 (09/23/2013)

System	Dell Latitude E7440 with 512GB Samsung SSD	Dell Latitude E7440 with HDD
Memory module(s)		
Vendor and model number	Micron 8KTF51264HZ-1G6E	Micron 8KTF51264HZ-1G6E
Type	PC3-12800	PC3-12800
Speed (MHz)	1,600	1,600
Speed running in the system (MHz)	1,600	1,600
Timing/Latency (tCL-tRCD-tRP-tRASmin)	11-11-11-28	11-11-11-28
Size (MB)	4,096	4,096
Number of memory module(s)	1	1
Total amount of system RAM (GB)	4	4
Channel (single/dual)	Single	Single
Operating system		
Name	Windows 7	Windows 7
Build number	7601	7601
Service Pack	1	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 4400	Intel HD Graphics 4400
Type	Integrated	Integrated
Chipset	Intel HD Graphics Family	Intel HD Graphics Family
BIOS version	2177.14	2177.14
Total available graphics memory (MB)	1,792	1,792
Dedicated video memory (MB)	0	0
System video memory (MB)	0	0
Shared system memory (MB)	1,792	1,792
Resolution	1920 x 1080	1920 x 1080
Driver	Intel 10.18.10.3574 (04/24/2014)	Intel 10.18.10.3574 (04/24/2014)
Sound card/subsystem		
Vendor and model number	Realtek High Definition Audio	Realtek High Definition Audio
Driver	Realtek 6.0.1.6053 (10/16/2014)	Realtek 6.0.1.6053 (10/16/2014)
Ethernet		
Vendor and model number	Intel Ethernet I218-LM	Intel Ethernet I218-LM
Driver	Intel 12.12.50.4 (06/12/2014)	Intel 12.12.50.4 (06/12/2014)
Wireless		
Vendor and model number	Intel Dual Band Wireless-AC 7260	Intel Dual Band Wireless-AC 7260
Driver	Intel 17.0.5.8 (06/18/2014)	Intel 17.0.5.8 (06/18/2014)

System	Dell Latitude E7440 with 512GB Samsung SSD	Dell Latitude E7440 with HDD
USB ports		
Number	3	3
Type	USB 3.0	USB 3.0
Other	Media Card Reader, HDMI port, Display port	Media Card Reader, HDMI port, Display port
Monitor		
LCD type	HD WLED-backlit	HD WLED-backlit
Screen size	14"	14"
Refresh rate (Hz)	60	60
Battery		
Type	4-cell Lithium Ion	4-cell Lithium Ion
Size (length x width x height)	12 1/8" x 2 15/16" x 1/4"	12 1/8" x 2 15/16" x 1/4"
Rated capacity	47 Wh	47 Wh
Weight	0.63 lbs.	0.63 lbs.

Figure 11: Configuration information for the test systems.

APPENDIX B - HOW WE TESTED

MEASURING SYSTEM PERFORMANCE

Measuring disk performance with PassMark PerformanceTest 8

Setting up the test

1. Download PassMark PerformanceTest Professional 8.0 from <http://www.passmark.com/products/pt.htm>.
2. Double-click petst.exe to run setup.
3. At the Welcome screen, click Next.
4. Accept the license agreement, and click Next.
5. At the Choose Install Location screen, accept the default location of C:\Program Files\PerformanceTest, and click Next.
6. At the Select Start Menu Folder screen, click Next.
7. At the Ready to Install screen, click Install.
8. At the Completing the PerformanceTest Setup Wizard screen, deselect View Readme.txt, and click Finish to launch PerformanceTest.
9. At the Purchasing information screen, copy and paste the Username and key, and click Continue.
10. At the Key accepted screen, click OK.

Running the test

1. Boot the system and double-click the desktop icon to launch PassMark PerformanceTest.
2. Bring up an elevated command prompt:
 - a. Select Windows Start orb.
 - b. Type `cmd` and press Control-Shift-Enter.
3. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
4. Do not interact with the system until the command completes.
5. After the command completes, wait five minutes before running the test.
6. From the top menu, click Tests→Disk→All.
7. After the run has finished, record the PassMark Disk Mark results containing Sequential Read, Sequential Write, and Random Seek results.
8. Power the system off.
9. Repeat the steps 1 through 8 two more times.

BAPCo SYSmark 2014 v1.0.1.21

Antivirus software conflicts

SYSmark 2014 is not compatible with any virus-scanning software, so we uninstalled any such software that was present on the notebooks before we installed the benchmark.

Pre-installed software conflicts

SYSmark 2014 installs the following applications, which its test scripts employ:

- Adobe Acrobat XI Pro
- Adobe Photoshop CS6 Extended
- Adobe Premiere Pro CS6
- Google Chrome™
- Microsoft Excel 2013
- Microsoft OneNote® 2013

- Microsoft Outlook 2013
- Microsoft PowerPoint 2013
- Microsoft Word 2013
- Trimble® SketchUp® Pro 2013
- WinZip Pro 17.5

If any of these applications are already on the system under test, they will 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 SYSmark 2014 uses.

Setting up the test

1. Disable the User Account Control.
 - a. Click Start→Control Panel.
 - b. At the User Accounts and Family Safety settings screen, click Add or remove user account.
 - c. At the User Account Control screen, click Continue.
 - d. Click Go to the main User Accounts page.
 - e. At the Make changes to your user account screen, click Turn User Account Control on or off.
 - f. At the User Account Control screen, click Continue.
 - g. Uncheck Use User Account Control to help protect your computer, and click OK.
 - h. At the You must restart your computer to apply these changes screen, click Restart Now.
2. Purchase and install SYSmark 2014 v1.0.1.21 with default settings from www.bapco.com/products/sysmark-2014.
3. To launch SYSmark 2014, double-click the desktop icon, and select Configuration.
4. Select All Options, and click Save.

Running the test

1. Double-click the SYSmark 2014 desktop icon.
2. Make sure Office Productivity, Media Creation, and Data/Financial Analysis are selected.
3. Enter a Project name.
4. Select 3 Iterations, check the box beside Conditioning Run and beside Process Idle Tasks, and click Run Benchmark.
5. When the benchmark completes and the main SYSmark 2014 menu appears, click Save FDR to create a report.

MEASURING SYSTEM AND APPLICATION RESPONSIVENESS

Measuring time to boot and shut down

1. Simultaneously start the timer and boot the system.
2. Stop the timer when the Windows taskbar appears.
3. Record the result as the Boot time.
4. Bring up an administrative command prompt:
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. Press the Windows key, and highlight Power→Shut down.
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 the time to open Adobe Photoshop Elements 13 and encoding a file to JPEG

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.
3. Setup Adobe Photoshop Elements for testing:
 - a. Open Photoshop Elements.
 - b. Click the Option button.
 - c. Select Photo Editor from the drop-down menu, and click Done.
 - d. Click the Photo Editor button.
 - e. When Photoshop opens, click the Quick tab.
 - f. Close Adobe Photoshop Elements.

Measuring the time to open Adobe Photoshop Elements

1. Boot the system and bring up an administrative command prompt.
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 five minutes before running the test.
4. Simultaneously start the timer and click the Adobe Photoshop Elements button.
5. Stop the timer when Adobe Photoshop Elements is fully displayed.
6. Close Adobe Photoshop.
7. Shut down the system.
8. Repeat steps 1 through 7 two more times, and report the median of the three runs.

Running the test

1. Boot the system and bring up an administrative command prompt.
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 five 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 13 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.
3. Set up Adobe Premiere Elements for testing:
 - a. Open Premiere Elements.
 - b. Click the Option button.

- c. Select Video Editor from the drop-down menu, and click Done.
- d. Click the Video Editor button.
- e. Select New Project.
- f. When Premiere opens, click the Quick tab.
- g. Close Adobe Premiere Elements.

Measuring the time to open Adobe Premiere Elements

1. Boot the system and bring up an administrative command prompt.
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 five minutes before running the test.
4. Simultaneously start the timer and click the Adobe Premiere Elements button.
5. Stop the timer when Adobe Premiere Elements is fully displayed.
6. Close Adobe Premiere.
7. Shut down the system.
8. Repeat steps 1 through 7 two more times, and report the median of the three runs.

Running the test

1. Boot the system and bring up an administrative command prompt.
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 five 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 Publish + 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.

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 notebook 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 notebook'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 notebook's monitor is greater than or equal to 150 nits on a completely white screen while the notebook 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 notebook 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 notebook plugged into the power supply.

1. To create a completely blank, white screen, open Microsoft Paint by clicking Start→All Programs→Accessories→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 notebook 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. Click the Windows start button, and type `power options` in the Windows Start Search box.
 - 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 notebook 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 notebook saved the brightness setting by plugging in the system, unplugging it, and taking another reading.

Note: If the notebook did not save this setting, use its power management application(s) to set the brightness appropriately, and save that setting. If saving the settings is ineffective, use the keyboard brightness setting keys to adjust the screen to bring the display as close to 150 nits as possible. Next, note how many times you pressed the button to achieve the desired brightness. After unplugging the system under test, use the keyboard to set the desired

brightness by pressing the brightness button as many times as you previously noted to return the screen to the correct brightness level.

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 notebook 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. Click the Windows start button, and type `power options` in the Windows Start Search box.
 - 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.

Note: If you are unable to save these settings, please see the Displaying Brightness section above.

Conditioning the battery

1. Plug the AC power adapter into the notebook 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 notebook PC has fully depleted its battery and is no longer operational when running on battery power.
9. Plug the AC power adapter into the notebook 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 notebook 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 notebook 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 charge after sleep

Setting up the test

1. Using the Intel Rapid Start Technology Manager application, set the iRST timer to 0 minutes.
2. Charge the battery to 100%.
3. Disable Intel Smart Connect Technology:
 - a. Right-click the Intel Smart Connect icon in the taskbar, and select Open Configuration Utility.
 - b. Drag the On/Off button to Off.
 - c. Close Intel Smart Connect.

Running the test

1. Boot the system and bring up an administrative command prompt.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
3. Do not interact with the system until the command completes.
4. After the command completes, wait 5 minutes before running the test.
5. Unplug the system.
6. Simultaneously start the timer and put the system into sleep mode (Start→Sleep).
7. Allow the system to sleep for 63 hours.
8. At the end of the test period, press the power button to resume from sleep mode.
9. Record the battery percentage.

ABOUT PRINCIPLED TECHNOLOGIES



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