

The Dell™ Latitude™ 6430u. Powered by Intel.®



Lighter, faster, sleeker, and better for business.

81% faster

to get to work after waking

70% faster

to boot the system

54% faster

to shut down the system

Fully charged

after being in Sleep mode all weekend

84% better

SYSmark 2012 performance

vs. a 4-year-old notebook

Replacing your several-years-old notebook computer with a new Dell Latitude 6430u Ultrabook™ can bring a number of advantages. In addition to extreme portability thanks to its light weight, you can enjoy longer battery life, greater responsiveness, and zippier performance.

The Dell Latitude 6430u also includes two new Intel management features that make it excellent for working on the go. Thanks to Intel Smart Connect Technology (ISCT), your system periodically awakens from the Windows® Sleep state to refresh email, social networking applications, and file-sharing programs such as Dropbox—letting you get down to work quickly. Thanks to Intel Rapid Start Technology™ (IRST), the Dell Latitude 6430u consumes such low levels of power when not in use that it can remain fully charged after a weekend in Sleep mode.

Principled Technologies (PT) tested a Dell Latitude 6430u and an older notebook without these new Intel features. We found that the new Ultrabook improved performance and battery life across the board.



ZIPPY PERFORMANCE + LONG BATTERY LIFE

Not only is the Dell Latitude 6430u Ultrabook lighter, sleeker, and faster than your older notebook, it also uses two Intel technologies to greatly enhance your computing experience:

- **Intel Smart Connect Technology.** ISCT periodically wakes the Latitude from the Windows sleep state to refresh email and other applications. The Dell Latitude 6430u detects the presence of known wireless networks while asleep, waking only when connectivity is available.
- **Intel Rapid Start Technology.** IRST provides power savings similar to the Windows hibernate state, while letting you start back up your Latitude in half the time of hibernation. IRST also reduces power consumption when the notebook isn't in use, which translates to longer battery life.

The Dell Latitude 6430u draws on these two features to help reduce power consumption while still keeping email and other application data current.

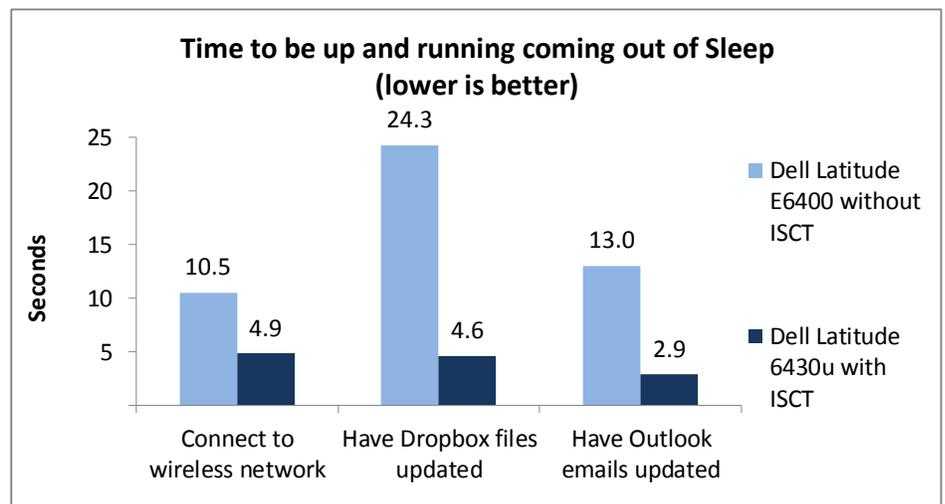
We tested the Dell Latitude 6430u with both these technologies and an older Dell Latitude E6400 notebook system with neither of them on a variety of everyday tasks. (For detailed configuration information on the two systems, see [Appendix A](#). For a detailed description of the tests we conducted, see [Appendix B](#).) We conducted each test three times and report the median run.

WHAT WE FOUND

Intel Smart Connect Technology

ISCT quietly wakes up the Latitude 6430u every so often to check for updates, which means that when you sit down to work, you can open your notebook and jump right in with little to no wait time. Figures 1 and 2 show the results of our testing.

Figure 1: The Dell Latitude 6430u with ISCT performed basic tasks as much as 81.0 percent faster than the older system without ISCT. Lower numbers are better.



While the older notebook system needed 24.3 seconds to have Dropbox files updated, the Dell Latitude 6430u was synchronized and ready to go in less than 5 seconds, a savings of 81.0 percent. Having Outlook emails updated and connecting to the wireless network also took much less time on the Dell Latitude 6430u thanks to ISCT.

Time to come out of Sleep mode and...	Dell Latitude E6400	Dell Latitude 6430u	Percentage time saved with ISCT
Connect to wireless network	10.5	4.9	53.9%
Have Dropbox files updated	24.3	4.6	81.0%
Have Outlook emails updated	13.0	2.9	78.0%

Figure 2: Time, in seconds, the two notebook systems needed to connect and update upon exiting Sleep mode. Smaller numbers, except for percentage time saved, are better.

Battery life

Because battery life is so important to today’s worker, we conducted two tests to compare the Dell Latitude 6430u with the older notebook system. As Figure 3 shows, the Dell Latitude 6430u battery lasted 82.4 percent longer than the battery of the older system. That’s an extra 2 hours and 53 minutes that a user could work.

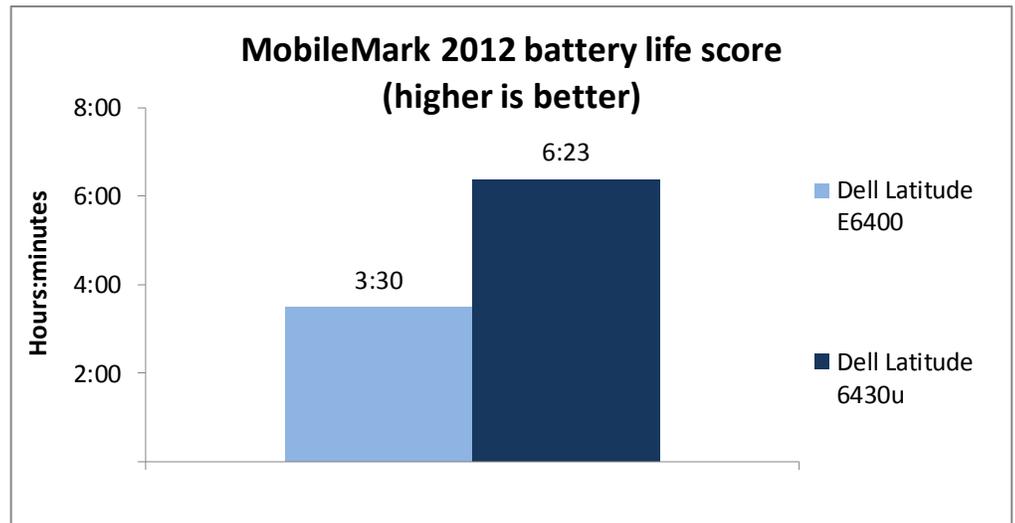


Figure 3: The battery of the Dell Latitude 6430u lasted 82.4 percent longer than that of the older notebook.

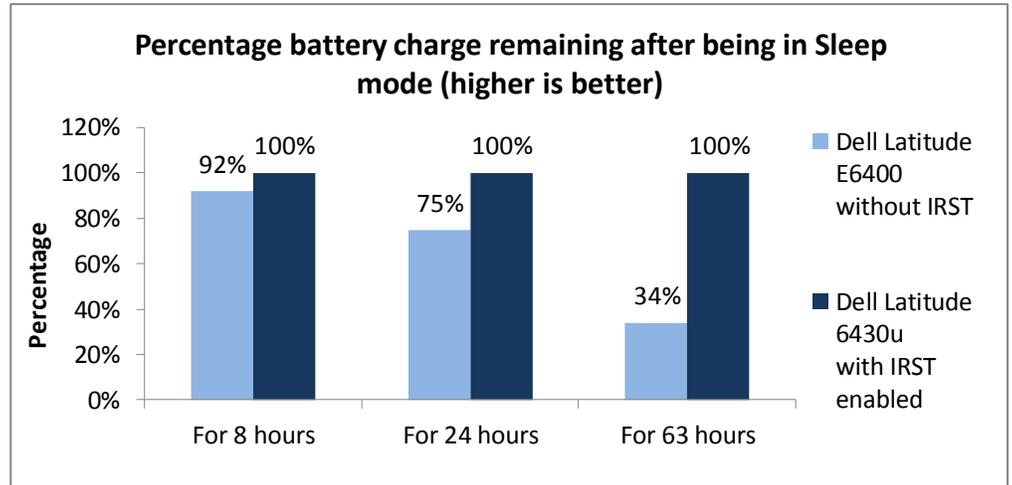
Figure 4 shows the complete results for our battery life testing using the BAPCo® MobileMark® 2012 benchmark.

BAPCo MobileMark 2012	Dell Latitude E6400	Dell Latitude 6430u
Screen brightness (nits)	154	158
Performance Qualification score – median	81	127
MobileMark 2012 - Battery Life score (minutes)	210	383
MobileMark 2012 - Battery Life score (hours: minutes)	3:30	6:23

Figure 4: Median scores for the BAPCo MobileMark 2012 benchmark. Higher numbers are better.

Intel Rapid Start Technology lets you start your system more quickly than resuming from hibernation, and works to keep your battery charged. To measure the effect of IRST on battery life, we tested the Dell Latitude 6430u with this feature enabled and the older system that lacks this feature. As Figures 5 and 6 show, after sleeping for 63 hours (from 5 PM Friday to 8 AM Monday), the battery charge on the older system without IRST dropped to 34 percent, while the battery on the Dell Latitude 6430u with IRST enabled remained fully charged.

Figure 5: The Dell Latitude 6430u with Intel Rapid Start Technology enabled stayed fully charged after a weekend in sleep mode whereas the older system without this feature did not. Higher numbers are better.



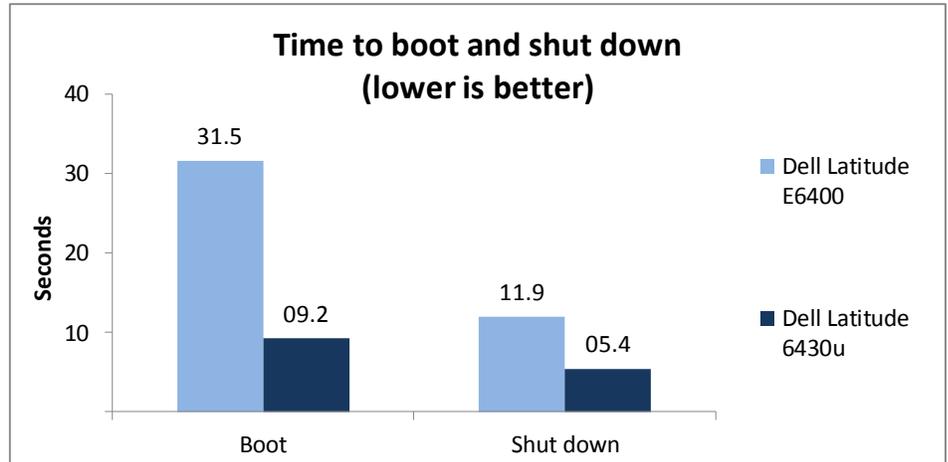
Percentage battery charge remaining after being in Sleep mode for...	Dell Latitude E6400 without IRST	Dell Latitude 6430u with IRST enabled	Percentage improvement with IRST
8 hours	92%	100%	8%
24 hours	75%	100%	25%
63 hours (5 PM Friday to 8 AM Monday)	34%	100%	66%

Figure 6: The battery charge remaining upon exiting Sleep mode. Higher numbers are better.

Boot and shutdown times

The less time users spend waiting for their notebooks to boot up or shut down, the more time they have to be productive. Figures 7 and 8 show the median results for our boot and shutdown tests. The Dell Latitude 6430u needed 70.7 percent less time to boot and 54.9 percent less time to shut down than the older notebook.

Figure 7: The Dell Latitude 6430u took 70.7 percent less time to boot and 54.9 percent less time to shut down than the older notebook.



Boot and shutdown times	Dell Latitude E6400	Dell Latitude 6430u	Percentage win
Boot	31.5	09.2	70.7%
Shutdown	11.9	05.4	54.9%

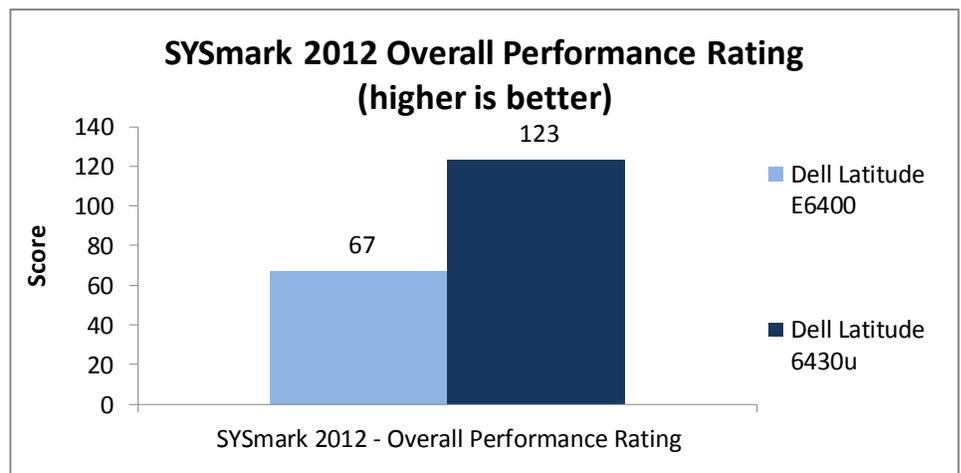
Figure 8: Median boot and shutdown times, in seconds, for the two systems.

General system performance

We used two industry-standard benchmarks to measure the performance of the two systems. These scores indicate that the Dell Latitude 6430u would excel at completing the tasks workers require.

BAPCo SYSmark® 2012 measures system performance for a number of common tasks including office productivity and media creation. Figures 9 and 10 show the median results of our SYSmark 2012 tests. The Dell Latitude 6430u achieved an 84 percent higher SYSmark2012 Overall Performance Rating than the older system.

Figure 9: The overall SYSmark 2012 performance rating of the Dell Latitude 6430u was 84 percent higher than that of the older system.



BAPCo SYSmark 2012	Dell Latitude E6400	Dell Latitude 6430u
SYSmark 2012 Overall Performance Rating	67	123
SYSmark 2012 – Office Productivity	73	123
SYSmark 2012 – Media Creation	65	120
SYSmark 2012 – Web Development	61	109
SYSmark 2012 – Data/Financial Analysis	61	140
SYSmark 2012 – 3D Modeling	63	106
SYSmark 2012 – System Management	82	144

Figure 10: Median scores for the BAPCo SYSmark 2012 benchmark. Higher numbers are better.

Futuremark® PCMark® 7 includes workloads covering storage, computation, image and video manipulation, Web browsing, and gaming. Figures 11 and 12 show the median results of our PCMark tests. The Dell Latitude 6430u achieved a 261 percent higher PCMark score than the older system.

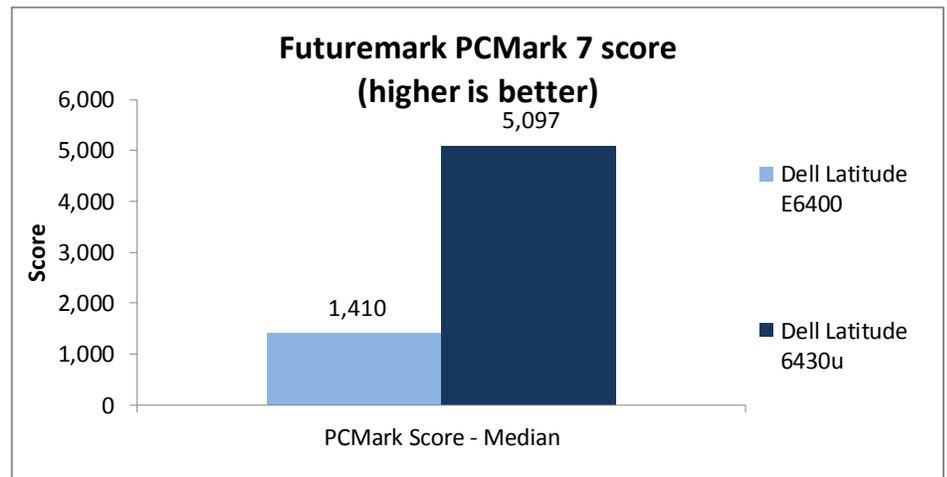


Figure 11: The PCMark score of the Dell Latitude 6430u was 261 percent higher than that of the older system.

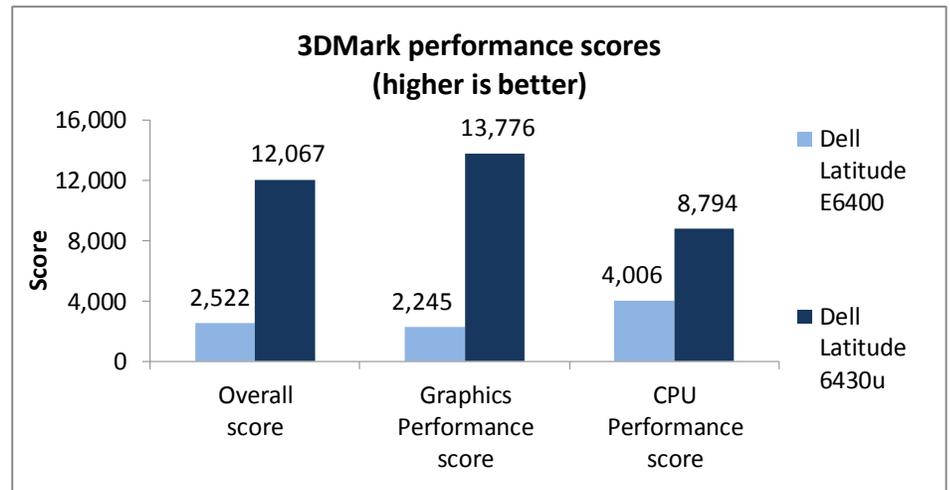
Futuremark PCMark 7 v1.0.4	Dell Latitude E6400	Dell Latitude 6430u
PCMark Score - Median	1,410	5,097
Lightweight Score	1,647	5,213
Productivity Score	1,171	4,098
Creativity Score	1,982	9,842
Entertainment Score	1,039	3,673
Computation Score	1,699	18,698
System Storage Score	1,699	5,326

Figure 12: Median scores for the BAPCo SYSmark 2012 benchmark. Higher numbers are better.

Graphics performance

Graphics performance is an important component of system performance. We tested the graphics performance of the two systems using Futuremark 3DMark® Vantage 1.1.0. As Figures 13 and 14 show, the Dell Latitude 6430u outperformed the older system in all three measures.

Figure 13: The 3DMark Vantage performance scores of the Dell Latitude 6430u were considerably higher than that of the older system.



Futuremark 3DMark Vantage 1.1.0	Dell Latitude E6400	Dell Latitude 6430u
3DMark Entry Score	2,522	12,067
Graphics Entry Score	2,245	13,776
CPU Entry Score	4,006	8,794

Figure 14: Median scores for the Futuremark 3DMark Vantage 1.1.0 benchmark. Higher numbers are better.

WHAT WE TESTED

In this section, we present a brief overview of what we tested. 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>.

BAPCo SYSmark 2012

BAPCo SYSmark 2012 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 2012 records the time the system takes to complete each individual operation in each scenario. For more information on this benchmark, see

<http://www.bapco.com/products/sysmark2012/>.

Futuremark 3DMark Vantage 1.1.0

The Futuremark 3DMark Vantage 1.1.0 benchmark suite tests DirectX®10 performance and measures a system's gaming performance. Tests include HDR rendering, shadow mapping, and pixel shading. For more information on this benchmark, see <http://www.futuremark.com/benchmarks/3dmark-vantage>.

Futuremark PCMark 7 1.0.4

Futuremark's PCMark 7 includes seven PC tests for Windows 7, combining more than 25 individual workloads covering storage, computation, image and video

manipulation, Web browsing, and gaming. Specifically designed to cover the full range of PC hardware from netbooks and tablets to notebooks and desktops, PCMark 7 offers complete PC performance testing for Windows 7 for home and business use. For more information on this benchmark, see <http://www.pcmark.com/benchmarks/pcmark7/>

IN CONCLUSION

No one wants to open their portable system to find a drained battery or to have a long wait while their applications update. The Dell Latitude 6430u Ultrabook uses new technologies from Intel to help you avoid these scenarios.

In our tests, we found that the new Dell Latitude 6430u Ultrabook using Intel Smart Connect Technology came out of Sleep mode and updated Outlook email 78.0 percent faster than an older system without the technology. Intel Rapid Start Technology kept the Dell Latitude 6430u battery fully charged, even after spending a weekend in Sleep mode, while the battery in the older system without IRST drained to 34 percent.

The sleek, lightweight Dell Latitude 6430u also booted and shut down more quickly and delivered much faster performance than the older notebook system we tested. These findings show that the Dell Latitude 6430u Ultrabook can provide your employees with a number of advantages in performance, responsiveness, and user experience compared to an older notebook system.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figure 15 provides detailed configuration information for the test systems.

System	Dell Latitude E6400	Dell Latitude 6430u
General		
Number of processor packages	1	1
Number of cores per processor	2	2
Number of hardware threads per core	1	2
Total number of processor threads in system	2	4
System power management policy	Balanced	Dell
Processor power-saving option	EIST	EIST
System dimensions (length x width x height)	13.25" x 9.6" x 1.25" 33.7 cm x 24.4 cm x 3.2 cm	13.31" x 9.04" x 0.82" 33.8 cm x 22.9 cm x 2.1 cm
System weight	5.2 lbs 2.4 Kg	3.9 lbs. 1.8 Kg
CPU		
Vendor	Intel	Intel
Name	Core™ 2 Duo	Core i5
Model number	P8600	3427U
Stepping	R0	E1
Socket type and number of pins	Socket P (478)	Socket 988B rPGA
Core frequency (GHz)	2.40	1.8 (2.8 GHz Turbo Boost Technology)
Bus frequency	1,066 MHz	DMI 5 GT/s
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	3 MB (shared)	512 KB (256 KB per core)
L3 cache	N/A	3 MB (shared)
Platform		
Vendor	Dell	Dell
Motherboard model number	0U692R	0WTRMG
Motherboard chipset	Intel GM45	Intel QM77
BIOS name and version	Dell A32 (02/09/2012)	Dell A03 (12/03/2012)
Memory module(s)		
Vendor and model number	Hyundai Electronics HMP125S6EFR8C-S6	Hyundai Electronics HMT351S6CFR8C-PB
Type	PC2-6400	PC3-12800
Speed (MHz)	800	1,600
Speed running in the system (MHz)	800	1,600
Timing/Latency (tCL-tRCD-tRP-tRASmin)	6-6-6-18	11-11-11-28
Size (MB)	2,048	4,096
Number of memory module(s)	2	2
Total amount of system RAM (GB)	4	8

System	Dell Latitude E6400	Dell Latitude 6430u
Chip organization (single-sided/double-sided)	Double-sided	Double-sided
Channel (single/dual)	Dual	Dual
Hard disk		
Vendor and model number	Western Digital WD1600BJKT spindle HDD	LITEON LMT-128M3M SSD
Number of disks in system	1	1
Size (GB)	160	128
Buffer size (MB)	16	N/A
RPM	7,200	N/A
Type	SATA 3.0 Gb/s	mSATA SSD
Controller	Intel ICH9M-E/M SATA AHCI Controller	Intel Mobile Express Chipset SATA RAID Controller
Driver	Intel 11.0.0.1032 (11/29/2011)	Intel 11.5.0.1207 (07/09/2012)
Operating system		
Name	Microsoft Windows 7 Professional x64	Microsoft Windows 8 Professional x64
Build number	7601	9200
Service Pack	1	N/A
File system	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC
Language	English	English
Microsoft DirectX version	11	11
Graphics		
Vendor and model number	Mobile Intel GMA 4500MHD	Intel HD Graphics 4000
Type	Integrated	Integrated
Chipset	Mobile Intel 4 Series Express Chipset Family	Intel HD Graphics Family
BIOS version	2107.23	0.3
Total available graphics memory (MB)	1,695	1,664
Dedicated video memory (MB)	64	32
System video memory (MB)	0	0
Shared system memory (MB)	1,631	1,632
Resolution	1,280 x 800	1,366 x 768
Driver	Intel 8.15.10.2869 (10/04/2012)	Intel 9.17.10.2932 (12/12/2012)
Sound card/subsystem		
Vendor and model number	IDT High Definition Audio CODEC	IDT High Definition Audio CODEC
Driver	IDT 6.10.0.6274 (03/09/2010)	IDT 6.10.0.6421 (08/09/2012)
Ethernet		
Vendor and model number	Intel 82567LM Gigabit	Intel 82579LM Gigabit
Driver	Intel 10.0.6.0 (06/12/2009)	Intel 12.2.45.5031 (09/24/2012)
Wireless		
Vendor and model number	Intel WiFi 5100 AGN	Intel Centrino Ultimate-N 6300 AGN
Driver	Intel 14.3.2.1 (01/22/2012)	Intel 15.5.6.48 (10/04/2012)

System	Dell Latitude E6400	Dell Latitude 6430u
Modem		
Vendor and model number	HDA CX11270 Soft Modem	N/A
Driver	Microsoft 7.80.2.52 (11/15/2008)	N/A
Optical drive(s)		
Vendor and model number	TSSTcorp TS-U633A	External models available
Type	DVD-RW	N/A
USB ports		
Number	4	3
Type	3 x USB 3.0, 1 x eSATA/USB 2.0	2 x USB 3.0, 1 x eSATA/USB 3.0
Other	Media card reader, display port	Media card reader, HDMI, VGA
IEEE 1394 ports		
Number	1 (4-pin)	0
Monitor		
LCD type	WXGA	WLED
Screen size	14.1"	14.0"
Refresh rate	60 Hz	60 Hz
Battery		
Type	Dell PT434 lithium-ion	Dell 9KGF8 lithium-ion
Size (length x width x height)	8.25" x 2" x .80" 20.9 cm x 5.1 cm x 2.0 cm	13.19" x 4.38" x 0.5" 33.5 cm x 11.1 cm x 1.3 cm
Rated capacity	5050 mAh / 11.1V (56Wh)	5400 mAh / 11.1V (60Wh)
Weight	11 oz. 0.31 Kg	1 lb. 0.45 Kg

Figure 15: System configuration information for the test systems.

APPENDIX B - HOW WE TESTED

Testing Intel Smart Connect Technology

Intel iSCT – Connecting to a network from sleep

1. Using the Intel Smart Connect Technology Configuration application, set the iSCT feature to update every 5 minutes.
2. Charge the battery to 100%.
3. Boot the system and bring up an administrative command prompt:
For Windows 7:
 - a. Select Windows Start orb.
 - b. Type `cmd` and right-click `cmd.exe`.
 - c. Select Run as administrator.For Windows 8:
 - a. Type `cmd` and right-click Command Prompt.
 - b. Select Run as administrator.
4. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
5. Do not interact with the system until the command completes.
6. After the command completes, wait 5 minutes before running the test.
7. Unplug the system.
8. Put the system into sleep mode (Windows 7: Start→Sleep) (Windows 8: Windows Key + I→Power→Sleep), and allow it to sleep for 30 minutes.
9. At the end of 30 minutes, simultaneously start the timer and press the power button to resume from sleep mode.
10. Stop the timer when the system reconnects to the wireless network, as displayed by the Windows Wireless icon located in the taskbar.
11. Shut down the system, repeat steps 1 through 9 two more times, and report the median of the three runs.

Intel iSCT – Connecting to Microsoft Outlook from sleep

1. Using the Intel Smart Connect Technology Configuration application, set the iSCT feature to update every 5 minutes.
2. Charge the battery to 100%.
3. Boot the system and bring up an administrative command prompt:
For Windows 7:
 - a. Select Windows Start orb.
 - b. Type `cmd` and right-click `cmd.exe`.
 - c. Select Run as administrator.For Windows 8:
 - a. Type `cmd` and right-click Command Prompt.
 - b. Select Run as administrator.
4. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
5. Do not interact with the system until the command completes.
6. After the command completes, wait 5 minutes before running the test.
7. Unplug the system.
8. Open and log into Microsoft Outlook 2010.
9. Leaving the Microsoft Outlook application open, put the system into sleep mode (Windows 7: Start→Sleep) (Windows 8: Windows Key + I→Power→Sleep), and allow it to sleep for 30 minutes. During this time, on a separate system, send emails to the test system at the following intervals: immediately, 5 minutes, 10 minutes, 15 minutes, 20 minutes.

10. At the end of 30 minutes, simultaneously start the timer and press the power button to resume from sleep mode.
11. Stop the timer when the test emails appear. Note if the test system's email has been updated while the system was in sleep mode.
12. Shut down the system, repeat steps 1 through 9 two more times, and report the median of the three runs.

Intel iSCT – Connecting to Dropbox from sleep

1. Using the Intel Smart Connect Technology Configuration application, set the iSCT feature to update every 5 minutes.
2. Charge the battery to 100%.
3. Boot the system and bring up an administrative command prompt:
For Windows 7:
 - d. Select Windows Start orb.
 - e. Type `cmd` and right-click `cmd.exe`.
 - f. Select Run as administrator.For Windows 8:
 - e. Type `cmd` and right-click Command Prompt.
 - f. Select Run as administrator.
4. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
5. Do not interact with the system until the command completes.
6. After the command completes, wait 5 minutes before running the test.
7. Unplug the system.
8. Open Dropbox and sign into the Dropbox account.
9. Leaving the Dropbox application open, put the system into sleep mode (Windows 7: Start→Sleep) (Windows 8: Windows Key + I→Power→Sleep), and allow it to sleep for 30 minutes. During this time, on a separate system, upload 8 files to the Dropbox account: 1 doc, 2 docx, 1 xls, 1 xlsx, 1 ppt, 1 pptx, and 1 pdf.
10. At the end of 30 minutes, simultaneously start the timer and press the power button to resume from sleep mode.
11. Stop the timer when the Dropbox files appear. Note if the test system's Dropbox account has been updated while the system was in sleep mode.
12. Delete the test files from Dropbox and from the hidden `.dropbox.cache` directory.
13. Shut down the system, repeat steps 1 through 9 two more times, and report the median of the three runs.

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, use the notebook's keyboard screen-brightness-adjustment keys to bring the display as close to 150 nits as possible, then retest.
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 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

To obtain the most repeatable results, we chose all options (Required, Recommended, and Optional) 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 life when Intel Rapid Start Technology is enabled

Intel iRST - Idle

1. Using the Intel Rapid Start Technology Manager application, set the iRST timer to 0 minutes.
2. Adjust the screen brightness to 100% while on battery and plugged in.
3. Charge the battery to 100%.
4. Boot the system and bring up an administrative command prompt:
 - a. Select Windows Start orb.
 - b. Type `cmd` and right-click `cmd.exe`.
 - c. Select Run as administrator.
5. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
6. Do not interact with the system until the command completes.
7. After the command completes, wait 5 minutes before running the test.
8. Unplug the system and allow it to sit idle for 1 hour.
9. At the end of 1 hour, record the battery percentage.
10. Shut down the system, repeat steps 1 through 7 two more times, and report the median of the three runs.

Intel iRST Enabled - Sleep

1. Using the Intel Rapid Start Technology Manager application, set the iRST timer to 0 minutes.
2. Charge the battery to 100%.
3. Boot the system and bring up an administrative command prompt:
 - a. Select Windows Start orb.
 - b. Type `cmd` and right-click `cmd.exe`.

- c. Select Run as administrator.
4. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
5. Do not interact with the system until the command completes.
6. After the command completes, wait 5 minutes before running the test.
7. Unplug the system.
8. Simultaneously start the timer and put the system into sleep mode (Windows 7: Start→Sleep) (Windows 8: Windows Key + I→Power→Sleep).
9. Stop the timer when the power LED starts to blink.
10. Record the result as the sleep time.
11. Allow the system to sleep for 1 hour.
12. At the end of 1 hour, simultaneously start the timer and press the power button to resume from sleep mode.
13. Stop the timer when the Windows taskbar appears.
14. Record the result as the resume from sleep time.
15. Record the battery percentage.
16. Shut down the system, repeat steps 1 through 10 two more times, and report the median of the three runs.

Intel iRST Disabled - Sleep

1. Using the Intel Rapid Start Technology Manager application, set iRST to Off.
2. Charge the battery to 100%.
3. Boot the system and bring up an administrative command prompt:
 - a. Select Windows Start orb.
 - b. Type `cmd` and right-click `cmd.exe`.
 - c. Select Run as administrator.
4. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
5. Do not interact with the system until the command completes.
6. After the command completes, wait 5 minutes before running the test.
7. Unplug the system.
8. Simultaneously start the timer and put the system into sleep mode (Windows 7: Start→Sleep) (Windows 8: Windows Key + I→Power→Sleep).
9. Stop the timer when the power LED starts to blink.
10. Record the result as the sleep time.
11. Allow the system to sleep for 1 hour.
12. At the end of 1 hour, simultaneously start the timer and press the power button to resume from sleep mode.
13. Stop the timer when the Windows taskbar appears.
14. Record the result as the resume from sleep time.
15. Record the battery percentage.
16. Shut down the system, repeat steps 1 through 10 two more times, and report the median of the three runs.

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:
 - a. Select Windows Start orb.
 - b. Type `cmd` and right-click `cmd.exe`.
 - c. Select Run as administrator.
5. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
6. Do not interact with the system until the command completes.
7. After the command completes, wait 5 minutes before running the test.

8. Simultaneously start the timer and shut down the system (Start→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 system performance with SYSmark 2012

Avoiding antivirus software conflicts

SYSmark 2012 is not compatible with any virus-scanning software, so we uninstalled any such software that was present on the notebook PCs before we installed the benchmark.

Avoiding pre-installed software conflicts

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

- ABBYY FineReader Pro 10.0
- Adobe Acrobat Pro 9
- Adobe After Effects® CS5
- Adobe Dreamweaver® CS5
- Adobe Photoshop CS5 Extended
- Adobe Premiere Pro CS5
- Adobe Flash Player 10.1
- Autodesk® 3DS Max® 2011
- Autodesk AutoCAD® 2011
- Google SketchUp™ Pro 8
- Microsoft Internet Explorer
- Microsoft Office 2010
- Mozilla Firefox Installer
- Mozilla Firefox 3.6.8
- Winzip Pro 14.5

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 2012 uses.

Setting up the test

Using the SYSmark 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

- Disables Low Battery Actions
- Disables Network Proxies

Level 2 - Recommended

- Creates BAPCo power scheme
- Sets Power Plan Type to High Performance
- 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

Because we are testing how well each system does out of the box, we chose only the Required options in the Configuration tool.

1. Insert the SYSmark 2012 Install DVD into the notebook PC's DVD drive.
2. When the Autoplay menu appears, click Run SYSmark2012_setup.exe.
3. At the Welcome screen, click Next.
4. Enter the serial number, and click Next.
5. Accept the license agreement, and click Next.
6. At the Choose Components screen, select Full, and click Next.
7. At the Choose Install Location screen, accept the default location of C:\Program Files (x86)\BAPCo\SYSmark2012, and click Next.
8. At the Choose Start Menu Folder screen, click Install.
9. Insert Disc 2 when prompted.
10. At the InstallShield Wizard Complete screen, click Finish.
11. Download and install SYSmark 2012 Patch 2 <http://www.bapco.com/support/>.
12. Launch SYSmark 2012.
13. Click Configuration and choose only the Required options.
14. Click Apply, and restart the computer when prompted.

Running the test

1. Launch SYSmark 2012 by double-clicking the desktop icon.
2. Enter a Project name and choose 3 iterations.
3. Click Run Benchmark.

Getting the SYSmark 2012 results

When SYSmark 2012 has completed, the Test Results Viewer appears. 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 performance using Futuremark PCMark 7 1.0.4

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
 - Productivity 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 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. To launch 3DMark Vantage 1.1.0, double-click 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`
3. Do not interact with the system until the command completes.
4. After the command completes, wait 5 minutes before running the test.
5. Double-click the 3DMark Vantage desktop icon to launch the benchmark.
6. In the 3DMark Vantage Main section, click the Preset pull-down menu arrow, and select Entry. (NOTE: Using the default "Performance" Preset on the E6400 system, we received the following message after 3DMark completed "Inaccurate Benchmark Results Detected: 3DMark has detected that the results from this benchmark run do not represent the true performance of the graphics hardware. Please re-run the tests using a lower Preset." The next lowest Preset was Entry, so we ran 3DMark with this preset with no issues reported.)
7. Click the Options tab, click the Graphic Tests tab, and ensure that both tests are selected.
8. Click the CPU Tests tab, and ensure that both tests are selected.
9. Click the Graphic Tests tab, and ensure that both tests are selected.
10. Click the Feature Tests tab, and deselect all six tests by clicking the check mark by each title.
11. Click Run Benchmark.
12. When the benchmark run completes, take a screenshot of the results, and record them as follows:
 - 3DMark Score
 - GPU Score
 - CPU Score
13. Perform steps 1 through 10 two more times, and report the median of the three runs.

ABOUT PRINCIPLED TECHNOLOGIES



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