

# A COMPARISON OF PERFORMANCE AND BATTERY LIFE ON DELL LATITUDE AND HP PAVILION NOTEBOOK SYSTEMS

**Dell™ Latitude™ notebooks powered by the  
2nd generation Intel® Core™ processor family:**



**Better performance  
and longer battery  
life improves the  
user experience**

versus comparable HP notebooks with AMD mobile processors



Workers can be only as productive as their tools allow them to be. On a sluggish system, the most basic office tasks can become exercises in frustration, lowering user productivity and morale. On a notebook system, battery life also factors into the user experience; simply put, longer is better.

Principled Technologies ran a set of industry-standard benchmarks to measure system performance and battery life. We tested two Dell notebook systems powered by 2<sup>nd</sup> generation Intel Core processors, a mid-range Dell Latitude E6420 notebook and a high-end Dell Latitude E6520, and two HP notebooks powered by AMD processors, a mid-range HP Pavilion dm1z and a high-end HP Pavilion dv6z Select Edition.

The Intel Core processor-based Dell Latitude systems delivered longer battery life—as much as 62 minutes longer—and higher benchmark scores—as much as 384.5 percent higher—than the corresponding HP Pavilion systems, making Dell a great choice for productivity and user satisfaction in the workplace.



A PRINCIPLED TECHNOLOGIES TEST REPORT

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## DELL AND INTEL DELIVER PERFORMANCE AND BATTERY LIFE

Responsive performance enhances worker productivity. That’s why, when choosing notebook systems for the workplace, it makes sense to purchase systems powerful enough to execute tasks quickly and efficiently. It also makes sense to purchase notebooks that can run for a long time on a single battery charge.

We used MobileMark 2007 v1.06 Productivity 2007 to test battery life and SYSmark 2007 Preview v1.06 and MAXON CINEBENCH R10 to test overall system performance. In our tests, the Intel Core processor-based Dell Latitude E6420 notebook and Dell Latitude E6520 delivered considerably better battery life and performance. (Learn more about the systems we tested in [Appendix A](#) and more about the testing we conducted in [Appendix B](#).)

Figure 1 shows the BAPCo MobileMark 2007 battery life testing results. The Dell Latitude E6420 notebook, with a score of 428 minutes, outperformed the HP Pavilion dm1z notebook’s score of 366 by 16.9 percent, or 62 minutes. The Dell Latitude E6520’s score of 293 minutes was 15.4 percent higher—providing an

extra 39 minutes of life—than the HP Pavilion dv6z Select Edition’s 254-minute score.

SYSmark 2007 Preview v1.06 measures system performance in four workload scenarios: e-learning, office productivity, video creation, and 3D modeling.

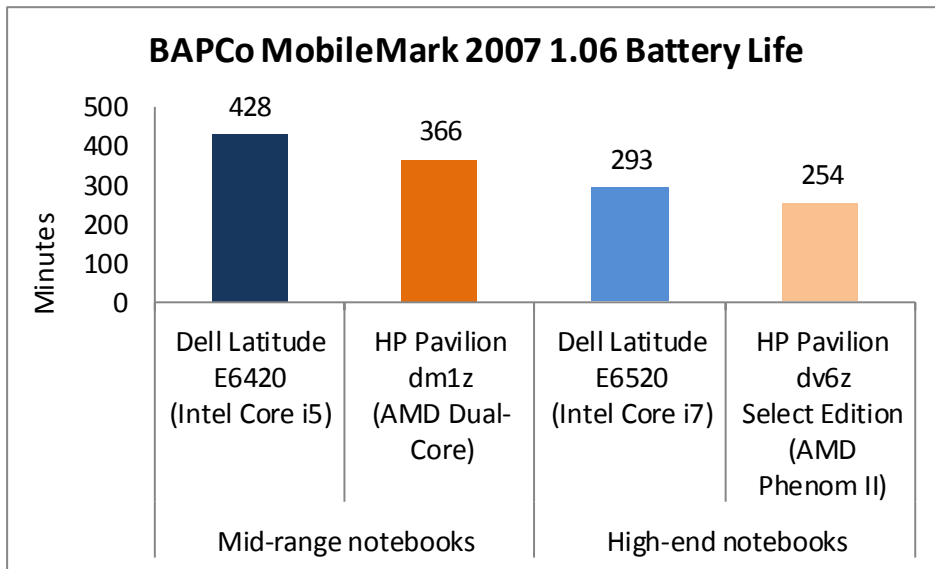


Figure 1: MobileMark 2007 Preview battery life results for our test systems. Higher numbers are better.

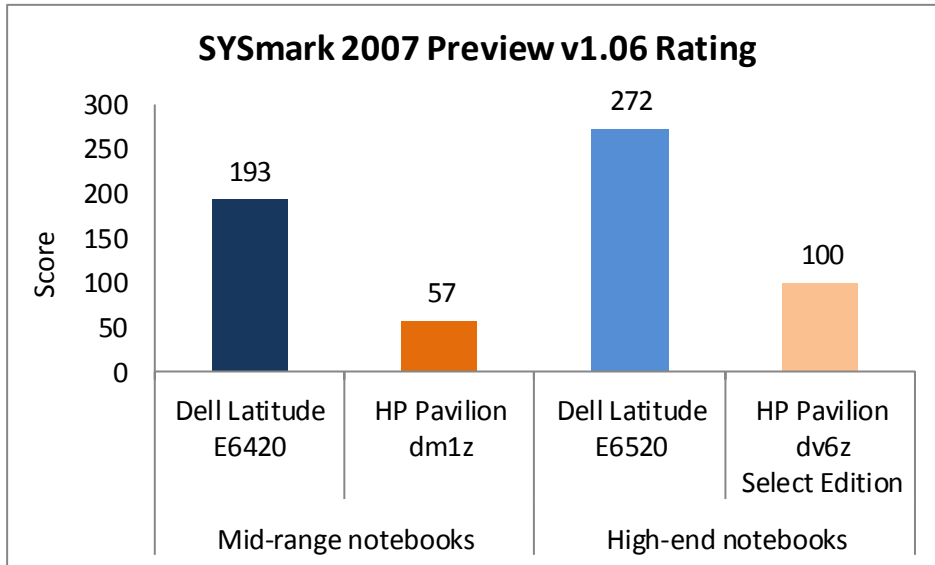


Figure 2: SYSmark 2007 Preview productivity results for our test systems. Higher numbers are better.

Figure 2 shows the SYSmark 2007 Preview performance results for the four notebook systems. The Dell Latitude E6420 notebook, with a score of 193, outperformed the HP Pavilion dm1z notebook by 238.6 percent. The Dell Latitude E6520's score of 272 was 172.0 percent higher than the HP Pavilion dv6z Select Edition's score of 100.

MAXON CINEBENCH consists of two main components. The first test sequence targets the computer's main processor. CINEBENCH plays a scene that makes use of various CPU-intensive features. During the first run, the benchmark uses only one CPU or CPU core to determine a reference value. On computers with multiple CPUs or cores, CINEBENCH runs a second test using all available CPU power. The benchmark produces a single-CPU score for all computers, and a multiple-CPU score for those computers with multiple cores.

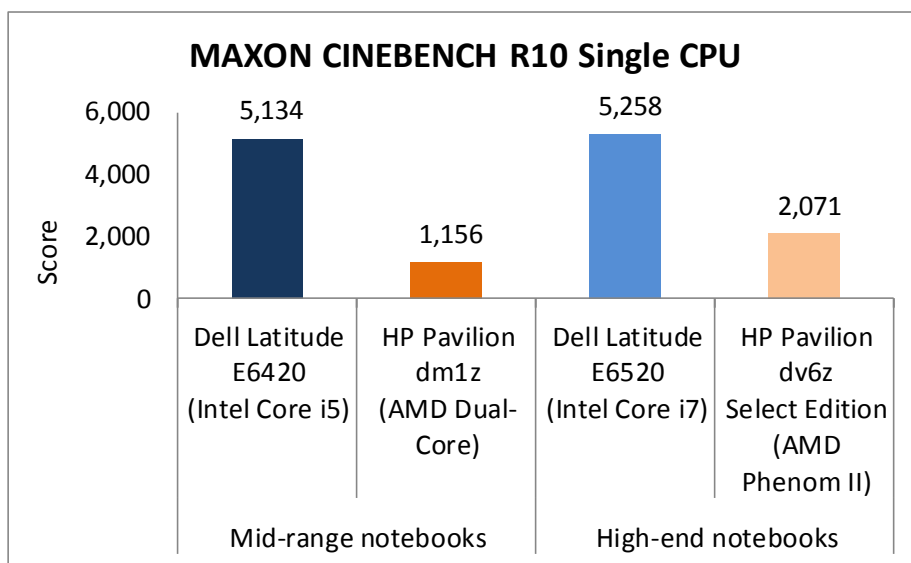
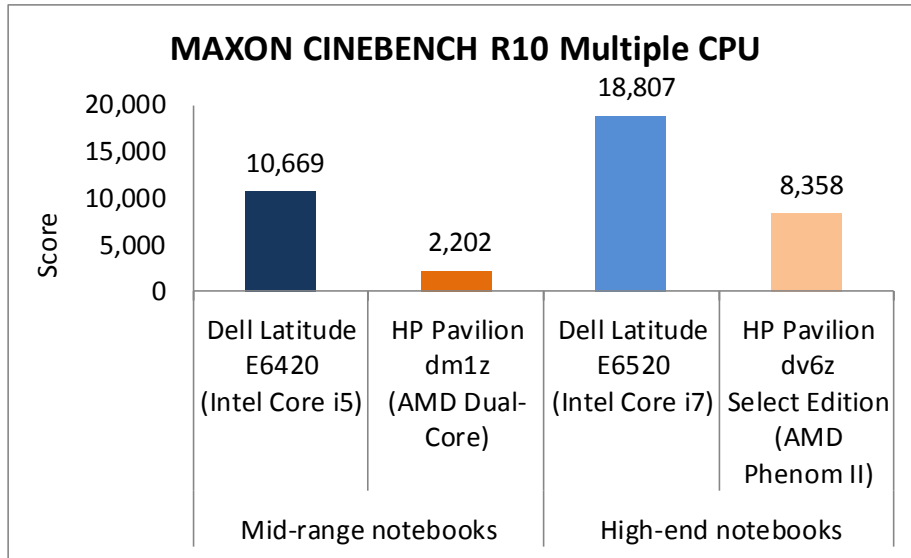


Figure 3: CINEBENCH R10 Single CPU test results for our test systems. Higher numbers are better.

As Figure 3 shows, the Dell Latitude E6420 notebook, with a single-CPU score of 5,134, outperformed the HP Pavilion dm1z notebook by 344.1 percent. The Dell Latitude E6520's single-CPU score of 5,258 was 153.9 percent higher than the HP Pavilion dv6z Select Edition's score of 2,071.



As Figure 4 shows, the Dell Latitude E6420 notebook, with a multiple-CPU score of 10,669, outperformed the HP Pavilion dm1z notebook by 384.5 percent. The Dell Latitude E6520's multiple-CPU score of 18,807 was 125.0 percent higher than the HP Pavilion dv6z Select Edition's score of 8,358.

Figure 4: CINEBENCH R10 multiple-CPU test results for our test systems. Higher numbers are better.

## TEST RESULTS

Figures 5 and 6 show a detailed breakdown of benchmark results for the four test systems. These results represent the median of three test runs. [Appendix C](#) presents the results from all three runs.

Mid-range systems	Dell Latitude E6420 (Intel Core i5)	HP Pavilion dm1z (AMD Dual-Core)	Percentage improvement with Dell Latitude E6420 (Intel Core i5)
BAPCo MobileMark 2007 1.06 Battery Life (minutes)	428	366	62 (16.9%)
BAPCo SYSmark 2007 Preview v1.06	193	57	136 (238.6%)
MAXON CINEBENCH R10 Single CPU	5,134	1,156	3,978 (344.1%)
MAXON CINEBENCH R10 Multiple CPU	10,669	2,202	8,467 (384.5%)

Figure 5: Benchmark score for the mid-range systems. Higher numbers are better.

High-end systems	Dell Latitude E6520 (Intel Core i7)	HP Pavilion dv6Z Select Edition (AMD Phenom II)	Percentage improvement with Dell Latitude E6520 (Intel Core i7)
BAPCo MobileMark 2007 1.06 Battery Life (minutes)	293	254	39 (15.4%)
BAPCo SYSmark 2007 Preview v1.06	272	100	172 (172.0%)
MAXON CINEBENCH R10 Single CPU	5,258	2,071	3,187 (153.9%)
MAXON CINEBENCH R10 Multiple CPU	18,807	8,358	10,449 (125.0%)

Figure 6: Benchmark score for the high-end systems. Higher numbers are better.

## SUMMARY

Workers need notebook systems that allow them to do their jobs, in a timely manner and without the frustration and delays that underperforming systems cause. In our tests, we found that Dell Latitude notebooks powered by the Intel Core processor family outperformed comparable HP Pavilion notebooks, while providing longer battery life. With up to 384.5 percent increased performance and up to 16.9 percent longer battery life over HP systems, Dell Latitude notebooks are an excellent choice to meet workers' performance and productivity needs.

## APPENDIX A – DETAILED SYSTEM CONFIGURATION INFORMATION

Figure 7 presents each test system and the details of its configuration.

System	Dell Latitude E6420 (Intel Core i5)	Dell Latitude E6520 (Intel Core i7)	HP Pavilion dm1z (AMD Dual-Core)	HP Pavilion dv6z Select Edition (AMD Phenom II)
<b>General</b>				
Number of processor packages	1	1	1	1
Number of cores per processor	2	4	2	4
Number of hardware threads per core	4	8	1	4
System power management policy	Dell	Dell	HP Recommended	HP Recommended
Processor power-saving option	Enhanced Intel SpeedStep® Technology	Enhanced Intel SpeedStep Technology	AMD PowerNow!™ Technology (Cool'n'Quiet™ Technology)	AMD PowerNow! Technology (Cool'n'Quiet Technology)
System dimensions (length x width x height)	13-7/8" x 9-4/8" x 1-3/8"	15-1/8" x 10-1/4" x 1-3/8"	11-4/8" x 8-3/8" x 1-1/8"	15" x 9-7/8" x 1-3/8"
System weight	5 lbs. 5 oz.	6 lbs. 5 oz.	3 lbs. 6 oz.	5 lbs. 8 oz.
<b>CPU</b>				
Vendor	Intel	Intel	AMD	AMD
Name	Core i5	Core i7	Dual-Core Processor	Phenom II
Model number	2520M	2720QM	E-350	N970
Stepping	D2	D2	B0	BL-C3
Socket type and number of pins	Socket 988B rPGA	Socket 988B rPGA	Socket FT1 BGA	Socket S1 (638)
Core frequency (GHz)	2.50	2.20	1.60	2.20
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)	64 KB + 64 KB (per core)
L2 cache	512 KB (256 KB per core)	1 MB (256 KB per core)	1 MB (512 KB per core)	2 MB (512 KB per core)
L3 cache	3 MB	6 MB	N/A	N/A
<b>Platform</b>				
Vendor	Dell	Dell	HP	HP
Motherboard model number	0K0DNP	OJ4TFW	1611	1640
Motherboard chipset	Intel QM67	Intel QM67	AMD A40/A50 Series FCH	AMD 785GX
BIOS name and version	Dell A01 (03/02/2011)	Dell A01 (03/02/2011)	HP F.05 (03/04/2011)	HP F.25 (02/15/2011)

System	Dell Latitude E6420 (Intel Core i5)	Dell Latitude E6520 (Intel Core i7)	HP Pavilion dm1z (AMD Dual-Core)	HP Pavilion dv6z Select Edition (AMD Phenom II)
<b>Memory module(s)</b>				
Vendor and model number	Micron® 8JSF25664HZ-1G4D1	Samsung M471B5273DHO-CH9	Hyundai HMT325S6BFR8C-H9	Micron 16JSF51264HZ-1G4D1
Type	PC3-10600S	PC3-10600S	PC3-10600	PC3-10600S
Speed (MHz)	1,333	1,333	1,333	1,333
Speed running in the system (MHz)	1,333	1,333	1,066	1,333
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-24	9-9-9-24	7-7-7-20	9-9-9-24
Size (MB)	4,096	8,192	4,096	8,192
Number of memory module(s)	2 x 2,048 MB	2 x 4,096 MB	2 x 2,048 MB	2 x 4,096 MB
Chip organization (single-sided/double-sided)	Double-sided	Double-sided	Double-sided	Double-sided
Channel (single/dual)	Dual	Dual	Dual	Dual
<b>Hard disk</b>				
Vendor and model number	Western Digital WD2500BEKT-75PVMTO	Samsung SSD PM810	Seagate ST9250410AS	Samsung HM640JJ
Number of disks in system	1	1	1	1
Size (GB)	250	128	250	640
Buffer size (MB)	16	128	16	16
RPM	7,200	N/A	7,200	7,200
Type	SATA 3.0 Gb/s	SATA II 3.0 Gb/s	SATA 3.0 Gb/s	SATA 3.0 Gb/s
Controller	Intel QM67	Intel QM67	AMD A40/A50 Series FCH	AMD SB800
Driver	Intel 10.1.0.1008 (11/06/2010)	Intel 10.1.0.1008 (11/06/2010)	Microsoft 6.1.7600.20713 (06/21/2006)	Microsoft 6.1.7600.20713 (06/21/2006)
<b>Operating system</b>				
Name	Windows 7 Ultimate	Windows 7 Professional	Windows 7 Professional	Windows 7 Professional
Build number	7600	7600	7600	7600
Service Pack	N/A	N/A	N/A	N/A
File system	NTFS	NTFS	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC	ACPI x64-based PC	ACPI x64-based PC
Language	English	English	English	English
Microsoft DirectX® version	DirectX 11	DirectX 11	DirectX 11	DirectX 11

System	Dell Latitude E6420 (Intel Core i5)	Dell Latitude E6520 (Intel Core i7)	HP Pavilion dm1z (AMD Dual-Core)	HP Pavilion dv6z Select Edition (AMD Phenom II)
<b>Graphics 1</b>				
Vendor and model number	Intel HD Graphics 3000	NVIDIA® NVS 4200M	AMD Radeon™ HD 6310M	ATI Mobility Radeon HD 6550
Type	Integrated	Discrete	Integrated	Discrete
Chipset	Intel HD Graphics Family	NVS 4200M	ATI Radeon HD 6310M	ATI Mobility Radeon HD 6550
BIOS version	2089.11	75.19.17.1.2	BR39197.bin	BR38060.010
Total available graphics memory (MB)	1,696	4,095	1,972	4,083
Dedicated video memory (MB)	64	512	384	1,024
System video memory (MB)	0	0	0	0
Shared system memory (MB)	1,632	3,583	1,588	3,059
Resolution	1,366 x 768 x 32-bit	1,920 x 1,080 x 32-bit	1,366 x 768 x 32-bit	1,366 x 768 x 32-bit
Driver	Intel 8.15.10.2266 (12/16/2010)	NVIDIA 8.17.12.6696 (02/02/2011)	ATI Technologies Inc. 8.792.0.0 (11/09/2010)	ATI Technologies Inc. 8.770.2.2000 (09/29/2010)
<b>Graphics 2</b>				
Vendor and model number	N/A	N/A	N/A	AMD M880G with ATI Mobility Radeon HD 4250
Type	N/A	N/A	N/A	Integrated
Chipset	N/A	N/A	N/A	ATI Mobility Radeon HD 4250
BIOS version	N/A	N/A	N/A	VER010.094.001.045. 035812
Total available graphics memory (MB)	N/A	N/A	N/A	3,131
Dedicated video memory (MB)	N/A	N/A	N/A	320
System video memory (MB)	N/A	N/A	N/A	0
Shared system memory (MB)	N/A	N/A	N/A	2,811
Resolution	N/A	N/A	N/A	1,366 x 768 x 32-bit
Driver	N/A	N/A	N/A	ATI Technologies Inc. 8.770.2.2000 (09/29/2010)



System	Dell Latitude E6420 (Intel Core i5)	Dell Latitude E6520 (Intel Core i7)	HP Pavilion dm1z (AMD Dual-Core)	HP Pavilion dv6z Select Edition (AMD Phenom II)
<b>Sound card/subsystem</b>				
Vendor and model number	Intel Display Audio	NVIDA High Definition Audio	ATI High Definition Audio Device	ATI High Definition Audio Device
Driver	Intel 6.14.0.3074 (10/15/2010)	NVIDIA 1.2.14.0 (12/13/2010)	ATI Technologies Inc. 7.11.0.7710 (08/30/2010)	ATI Technologies Inc. 7.11.0.7706 (05/06/2010)
<b>Ethernet</b>				
Vendor and model number	Intel 82579LM Gigabit	Intel 82579LM Gigabit	Realtek PCIe GBE Family	Realtek PCIe GBE Family
Driver	Intel 11.8.81.0 (10/28/2010)	Intel 11.8.81.0 (10/28/2010)	Realtek 7.27.920.2010 (09/20/2010)	Realtek 7.23.623.2010 (06/23/2010)
<b>Wireless</b>				
Vendor and model number	Intel Centrino™ Ultimate-N 6300 AGN	Intel Centrino Ultimate-N 6300 AGN	Ralink RT5390	Broadcom® 43224AG
Driver	Intel 14.0.1.2 (12/21/2010)	Intel 14.0.1.2 (12/21/2010)	Ralink Technology Corp. 3.1.13.0 (11/04/2010)	Broadcom 5.60.350.11 (05/07/2010)
<b>Optical drive(s)</b>				
Vendor and model number	TSSTcorp TS-U333B	TSSTcorp TS-U633J	HP HSTNN-ID06	HP TS-L633R
Type	DVD ROM	DVD+/-RW	BD-ROM	CD/DVD-RW
<b>USB ports</b>				
Number	3	3	3	3
Type	2.0	2.0	2.0	2.0
Other	eSATA, Media Card Reader	eSATA, HDMI, Media Card Reader	HDMI, Media Card Reader	eSATA, HDMI, Media Card Reader
<b>Monitor</b>				
LCD type	HD LED WXGA	HD LED WXGA	HD LED WXGA	HD LED WXGA
Screen size	14"	15.6"	11.6"	15.6"
Refresh rate(Hz)	60	60	60	60
<b>Battery</b>				
Type	T54FJ Lithium-ion	T54FJ Lithium-ion	HSTNN-OB2D Lithium-ion	HSTNN-DBOX Lithium-ion
Size (length x width x height)	8-1/8" x 2" x 3/4"	8-1/8" x 2" x 3/4"	8" x 2-3/8" x 1"	8" x 2" x 7/8"
Rated capacity	5400mAh/ 11.1V (60Wh)	5400mAh/ 11.1V (60Wh)	5100 mAh / 10.8V (55Wh)	5100 mAh / 10.8V (55Wh)
Weight	11 oz.	11 oz.	11 oz.	11 oz.

Figure 7: Configuration information for the four test systems.

## APPENDIX B – ABOUT OUR TESTING

### The benchmark tests we conducted

#### MobileMark 2007 v1.06

MobileMark 2007 is an industry-standard benchmark BAPCo created to measure system battery life and performance. MobileMark 2007 measures system battery life in minutes. MobileMark 2007 records system battery life at the start of the Productivity 2007 benchmark, and repeats the benchmark workload until the system battery life is depleted, or until the notebook system powers down due to low battery life. At the 7 percent battery life setting, MobileMark 2007 records a timestamp once per minute. At the end of the benchmark, it compares the beginning timestamp to the final (last recorded) timestamp. MobileMark 2007 derives its system battery life rating as the number of minutes between the start and end timestamps.

MobileMark 2007 Productivity 2007 consists of the following applications and corresponding tasks: Microsoft Project 2003 (project management), Microsoft Excel 2003 (calculation sheets), Microsoft Outlook 2003 (emails, calendars, scheduler), Microsoft PowerPoint 2003 (slide presentations), Microsoft Word 2003 (formatted text documents), WinZip Computing and WinZip Pro 10.0 (compressed archives), Adobe Photoshop CS2 (manipulated and compressed images), Adobe Illustrator CS2 (manipulated images), and Adobe Flash 8 (vector graphics, animation).

We followed the run rules that MobileMark 2007 specifies here:

<http://www.bapco.com/support/mobilemark2007/Manual/rules.html>.

#### SYSmark 2007 Preview v1.06

SYSmark 2007 Preview is a performance metric BAPCo created to measure system performance. SYSmark 2007 Preview determines its overall rating from the mean result from four workload scenarios: e-learning, office productivity, video creation, and 3D modeling. SYSmark 2007 Preview records the time the system takes to complete each individual operation in each scenario.

SYSmark 2007 Preview consists of the following applications and corresponding tasks: Adobe® After Effects® 7 (e-learning), Adobe Illustrator® CS2 (video creation), Adobe Photoshop® CS2 (video creation), Autodesk® 3ds Max® 8 (3D modeling), Macromedia® Flash 8 (e-learning), Microsoft® Excel® 2003 (office productivity), Microsoft Outlook® 2003 (office productivity), Microsoft PowerPoint® 2003 (office productivity), Microsoft Word 2003 (office productivity), Microsoft Project 2003 (office productivity), Microsoft Windows

Media™ Encoder 9 series (video creation), Sony® Vegas 7 (video creation), SketchUp 5 (3D modeling), and WinZip® 10.0 (office productivity).

To learn more, visit <http://www.bapco.com/support/sysmark2007preview/Help/Help.html>.

## MAXON CINEBENCH R10

CINEBENCH is a free, real-world cross platform test suite designed to evaluate and compare the CPU and graphics performance across various systems and platforms. Based on MAXON CINEMA 4D software, which creates 3D content, the benchmark consists of two main components: the graphics-card performance test, and the CPU performance test.

CINEBENCH uses the processing power of a system to render 3D scenes that stress all available processor cores, and reports performance in points (pts). Higher scores are better, as they indicate a faster processor.

To learn more, visit <http://www.maxon.net>.

## Detailed test methodology

### Measuring performance with BAPCo SYSmark 2007 Preview v1.06

#### *Setting up the test*

1. Reset the system to the base test image.
2. 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.
3. Purchase and install SYSmark 2007 Preview v1.05 from <https://www.bapcostore.com/store/product.php?productid=16165&cat=251&page=1>.
4. At the Welcome to InstallShield Wizard screen, click Next.
5. At the License Agreement screen, select I accept the terms in the License Agreement, and click Next.
6. At the Choose Destination Location screen, click Next.
7. At the Ready to Install the Program screen, click Install.
8. When the installation is complete, click Finish.

#### *Running the test*

1. Launch SYSmark 2007 Preview by double-clicking the desktop icon.
2. Click Run.
3. Select Official Run, choose 3 Iterations, check the box beside run conditioning run, and enter a name for that run.

4. When the benchmark completes and the main SYSmark 2007 Preview menu appears, click Save FDR to create a report.

Record the results for each iteration.

### **Measuring battery life with BAPCo MobileMark 2007 v.1.06**

#### *Preparing to measure battery life with MobileMark 2007 v.1.06*

We conditioned the battery prior to testing. To do so, we performed two complete drains of the battery, starting from a battery at 100 percent charge. To expedite the draining process, we ran the MobileMark 2007 Productivity 2007 test until the battery completely discharged. We recorded the room temperature at the beginning of each official run.

#### *Antivirus software conflicts*

MobileMark 2007 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.

#### *Pre-installed software conflicts*

MobileMark 2007 installs the following applications, which its test scripts employ:

- Adobe Photoshop 6.0.1
- InterVideo WinDVD 6.0
- Macromedia Flash 5.0
- Microsoft Excel 2002
- Microsoft Outlook 2002
- Microsoft PowerPoint 2002
- Microsoft Word 2002
- Netscape Communicator 6.01
- Network Associates McAfee VirusScan 5.13
- WinZip Computing WinZip 8.0

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 MobileMark 2007 uses.

#### *Installing MobileMark 2007 v.1.06*

1. Reset the notebook to the base image using Symantec's Ghost product.
2. Turn off the wireless network adapter by using the external toggle switch.
3. Insert the MobileMark 2007 Install DVD in the notebook PC's DVD drive.
4. At the Welcome screen, click Next.
5. Accept the license agreement, and click Next.
6. At the Ready to Install the Program screen, click Install.
7. Run the BAPCo Auto-configuration tool, v.1.3.2, to set the power options.

- a. Insert the Auto-configuration tool in the notebook PC's DVD drive.
- b. Double-click BAPCo\_AutoConfig.exe.
- c. Type **M** to choose MobileMark 2007.
- d. Type **3** to choose the changes that produce the best possible scores, as follows:
  - i. Set Critical battery alarm to 0%.
  - ii. Set Low battery alarm to 0%.
  - iii. Disable screen saver.
  - iv. Stop and disable Windows Update.
  - v. Disable desktop cleanup wizard.
  - vi. Disable Windows Security Center warnings.
  - vii. Disable Windows Firewall.
  - viii. Disable incoming Remote Desktop connections.
  - ix. Disable Windows Error Reporting to Microsoft.
  - x. Disable Windows Defender.

#### *Displaying brightness and power settings*

Because the brightness of a notebook's display affects its battery life, BAPCo required that, before we tested with MobileMark 2007, we made sure the brightness of the notebook's monitor was greater than or equal to 60 nits on a completely white screen while the notebook was unplugged and running on battery power. The measurement follows the standards from the Video Electronics Standards Association ([www.vesa.org/Standards/summary/2001\\_6a.htm](http://www.vesa.org/Standards/summary/2001_6a.htm)).

We complied with this standard for all the tests we ran by setting each notebook PC's brightness as close to 60 nits as we could without going below that brightness level. We used the following procedure, which assumes we began with the notebook plugged into the power supply, to meet this requirement before we started each test:

1. To create a completely blank white screen, open Microsoft Paint by clicking Start→All Programs→Accessories→Paint.
2. Open the Attributes by pressing Ctrl+E.
3. Enter dimensions that are larger than the current screen resolution. For example, if the screen resolution is 1,280 x 800, enter 1,600 for Width and 1,200 for Height.
4. Click OK.
5. Press Ctrl+F to view the bitmap image and render the screen completely white.
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 use the Gossen Mavolux5032C.)
8. If the reading is below or significantly greater than 60 nits, use the notebook's keyboard screen-brightness-adjustment keys to bring the display as close to 60 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. If the notebook did not save this setting, use its power-management application(s) to set the brightness appropriately, and save that setting.

#### *Conditioning the battery*

1. Plug the AC power adapter into the notebook PC, and completely charge the battery.
2. Install MobileMark 2007 v1.05, following the steps we outlined in the Installing MobileMark 2007 section.
3. Double-click the MobileMark 2007 icon on the desktop.
4. Highlight the Productivity 2007 item in the left panel.
5. Enter a name for this test in the Project Name field at the top-right panel, and click Next Step.
6. If MobileMark lists no problems or warnings, click Next Step. If it does list any problems or warnings, close MobileMark 2007, and correct the problem(s) before proceeding.
7. Unplug the AC power adapter. The Productivity 2007 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. Repeat steps 3 through 8 for the second conditioning run and for all official runs.
10. Plug the AC power adapter into the notebook PC, and completely charge the battery.

#### *Measuring battery life with MobileMark 2007 v.1.06*

We performed the following steps to run the MobileMark Productivity 2007 benchmark:

1. Double-click the MobileMark 2007 icon on the desktop.
2. Select the Productivity 2007 test by highlighting it in the left panel.
3. Enter a name for this test in the Project Name field in the top right panel, and click Next Step.
4. If MobileMark lists no problems or warnings, click Next. If it does list any problems or warnings, close MobileMark 2007, and correct the problem(s) before proceeding.
5. Unplug the AC power adapter. The test begins immediately.
6. The Productivity 2007 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 Productivity 2007 test three times on each system configuration and used the average result of each set of three as the representative score for that test.

5. Configure the notebook with the standard battery and the BAPCo recommendations for running MobileMark 2007.
6. Execute the Productivity 2007 test three times in this configuration.
7. Configure the notebook with the maximum-sized battery available at the time of purchase and the BAPCo recommendations for running MobileMark 2007.
8. Execute the Productivity 2007 test three times in this configuration.

#### *Getting the MobileMark 2007 results*

After each MobileMark test completed, we plugged the AC power adapter into the notebook PC and turned on the system. MobileMark 2007 started automatically after the system booted, 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 directory. To do so, we performed the following steps:

1. Browse to the C:\ Program Files\BAPCo\MobileMark 2007\results directory.
  - a. Select My Computer.
  - b. Select Local Disk (C:).
  - c. Select the Program Files directory.
  - d. Select the BAPCo directory.
  - e. Select the MobileMark2007 directory.
  - f. Select the results directory. (Note: The name of the directory for the Productivity 2007 results is the name you gave the test in Step 6 of the MobileMark Productivity 2007 process.)

### **Measuring performance with MAXON CINEBENCH R10**

#### *Setting up the test*

1. Reset the system to the base test image.
2. Download CINEBENCH R10.zip from <http://www.maxon.net/en/downloads/downloads/cinebench.html>.
3. Right-click the CINEBENCH ZIP file, and choose Extract All.
4. Click Extract.

#### *Running the test*

1. Launch CINEBENCH R10 by double-clicking the CINEBENCH R10.exe file in the CINEBENCH R10 folder.
2. Enter the MHz frequency of the processor in the MHz (real freq.) field.
3. Enter a name in the Tester field.
4. Click the Start all tests button.
5. When the picture finishes rendering in multi-processor mode, save the results.
  - a. Click the To Clipboard button.
  - b. Launch notepad and paste the results into an empty notepad document.
  - c. Save the results in the format system\_run\_N.txt.
6. Close CINEBENCH R10.
7. Reboot the system.
8. Repeat steps 1 through 7 two times, and report the median.

## APPENDIX C – DETAILED RESULTS

Figures 8 and 9 present the detailed test results for the systems.

Mid-range systems	Dell Latitude E6420 (Intel Core i5)			HP Pavilion dm1z (AMD Dual-Core)		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
<b>BAPCo MobileMark 2007 1.06 Battery Life Rating (higher is better)</b>						
MobileMark 2007 - Productivity - Battery Life score (minutes)	427	428	428	365	369	366
MobileMark 2007 - Productivity - Performance Qualification score	301	295	295	83	83	83
<b>BAPCo SYSmark 2007 Preview v1.06</b>						
SYSmark 2007 Preview v1.06 - E-Learning	168	169	170	52	52	52
SYSmark 2007 Preview v1.06 - VideoCreation	202	202	204	73	74	74
SYSmark 2007 Preview v1.06 - Productivity	180	182	179	50	51	50
SYSmark 2007 Preview v1.06 - 3D	227	223	227	56	56	56
<b>MAXON CINEBENCH R10</b>						
CB Single - Median	5,074	5,134	5,143	1,158	1,156	1,148
CB Dual - Median	10,619	10,686	10,669	2,202	2,209	2,180
Open GL - Median	5,858	5,842	5,852	1,951	1,942	1,927
Multiprocessor Speedup - Median	2.09	2.08	2.07	1.9	1.91	1.9

Figure 8: Benchmark results for the two mid-range notebook systems. Higher numbers are better.

High-end systems	Dell Latitude E6520 (Intel Core i7)			HP Pavilion dv6z Select Edition (AMD Phenom II)		
	Run 1	Run 2	Run 3	Run 1	Run 2	Run 3
<b>BAPCo MobileMark 2007 1.06 Battery Life Rating (higher is better)</b>						
MobileMark 2007 - Productivity - Battery Life score (minutes)	296	293	293	244	254	255
MobileMark 2007 - Productivity - Performance Qualification score -	358	361	366	133	96	124
<b>BAPCo SYSmark 2007 Preview v1.06</b>						
SYSmark 2007 Preview v1.06 - E-Learning	219	218	219	70	70	70
SYSmark 2007 Preview v1.06 - VideoCreation	375	373	373	174	168	171
SYSmark 2007 Preview v1.06 - Productivity	237	238	238	77	78	77
SYSmark 2007 Preview v1.06 - 3D	283	283	283	107	110	112
<b>MAXON CINEBENCH R10</b>						
CB Single	5,253	5,258	5,281	2,027	2,152	2,071
CB Dual	18,671	18,904	18,807	8,444	8,358	8,009
Open GL	5,342	5,367	5,407	3,866	3,853	3,723
Multiprocessor Speedup	3.55	3.60	3.56	4.16	3.88	3.87
tcvis-01	1.87	1.88	1.83	7.85	8.31	8.37

Figure 9: Benchmark results for the two high-end notebook systems. Higher numbers are better.



# ABOUT PRINCIPLED TECHNOLOGIES



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