

Dell™ Latitude™ E5400 notebook competitive analysis

Executive summary

Dell Inc. (Dell) commissioned Principled Technologies (PT) to test the performance and battery life of four notebook systems, which we list in alphabetical order:

- Acer® TravelMate® 4730
- Dell Latitude E5400
- HP® Compaq® 6530b
- Lenovo® ThinkPad® R400

We performed tests to determine which of the four systems

- had the longest-lasting battery
- achieved the best performance
- arrived most quickly after ordering
- best protected data during a 29-inch drop

For the battery life testing, we compared the four systems in both

standard and extended single battery configurations. (Note: The HP was not available with an extended single battery configuration.)

KEY FINDINGS

- With the standard single battery configuration, the Dell Latitude E5400 lasted 5.9 percent longer than the HP Compaq 6530b, and 2.2 percent longer than the Lenovo ThinkPad R400. (See Figure 1.)
- With the extended single battery configuration, the Dell Latitude E5400 lasted 57.7 percent longer than the Acer TravelMate 4730 and 2.9 percent longer than the Lenovo ThinkPad R400. (See Figure 2.)
- The Dell Latitude E5400 achieved the highest SYSmark performance score: 16.8 percent better than the Acer TravelMate 4730, 6.6 percent better than the HP Compaq 6530b, and 0.7 percent better than the Lenovo ThinkPad R400. (See Figure 3.)
- After three drops from a height of 29 inches, both the Dell Latitude E5400 and the HP Compaq 6530b showed zero data defects. The Lenovo ThinkPad R400 had 29.4 percent data corruption and the Acer TravelMate 4730 had 0.6 percent data corruption.
- Once we placed the order for the Dell Latitude E5400, 11 days elapsed until we received it. The Lenovo ThinkPad R400 took 34 days (309 percent longer). The Acer TravelMate 4730 took 14 days (127 percent longer). The HP Compaq 6530b also took 11 days to arrive. (See Figure 4.)

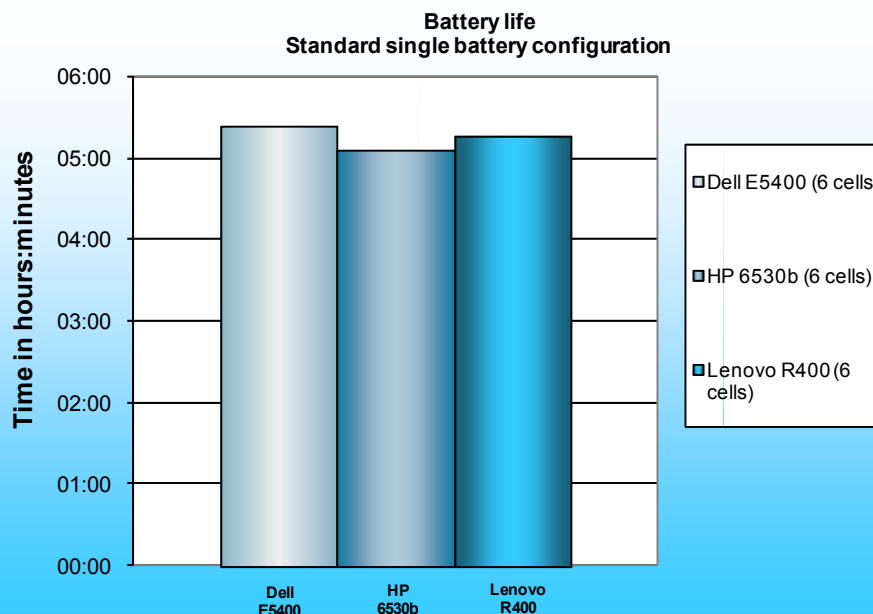


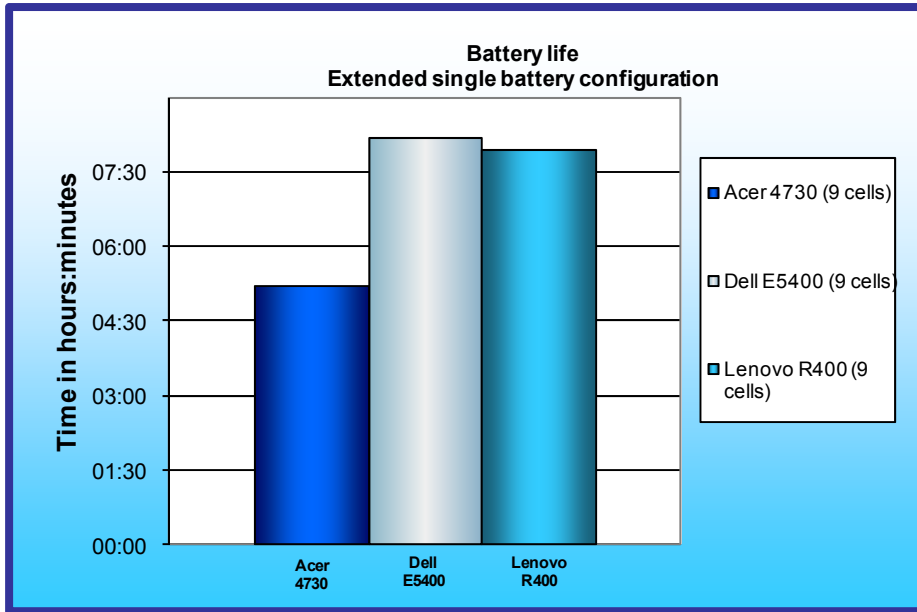
Figure 1: Battery life, in hours:minutes, for the standard single battery configuration. Note: The Acer TravelMate 4730 offers no 6-cell battery. Higher numbers, indicating longer battery life, are better.

available with an extended single battery option, so we include it only in the standard single battery configuration comparison. The Acer TravelMate 4730 was available with only a 9-cell battery, so we include it only in the extended single battery configuration comparison. The Acer also has a slower processor than the other three systems; this was the fastest processor available at the time of purchase. See Appendix A for detailed system configurations.)

Battery life: standard single battery

Figure 1 shows the battery life of the three systems with the standard single battery configuration. (At the time of testing, only Dell, HP, and Lenovo offered a 6-cell

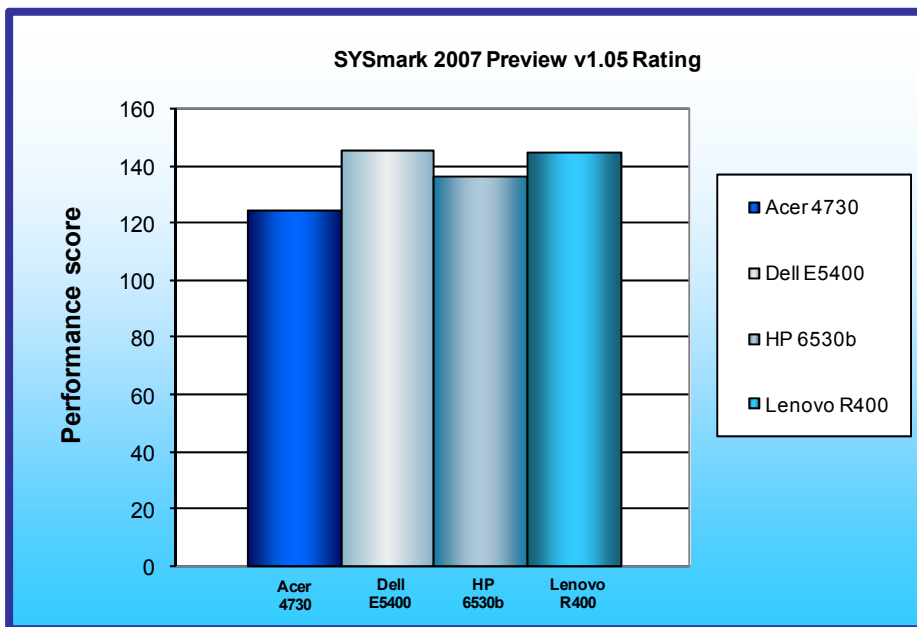
battery on their systems.) The Dell Latitude E5400 achieved the longest battery life: 5.9 percent longer than the HP Compaq 6530b and 2.2 percent longer than the Lenovo ThinkPad R400.



Battery life: extended single battery

Figure 2 shows the battery life of the three systems with the extended single battery configuration. (At the time of testing, only Acer, Dell, and Lenovo offered a 9-cell battery on their systems. The HP Compaq 6530b offered only multiple-battery options in the form of 8-cell and 12-cell slices). The Dell Latitude E5400 achieved the longest battery life: 2.9 percent longer than the Lenovo ThinkPad R400 and 57.7 percent longer than the Acer TravelMate 4730.

Figure 2: Battery life, in hours:minutes, for the extended single battery configuration. Note: The HP Compaq 6530b offers no 9-cell battery. Higher numbers, indicating longer battery life, are better.



System performance

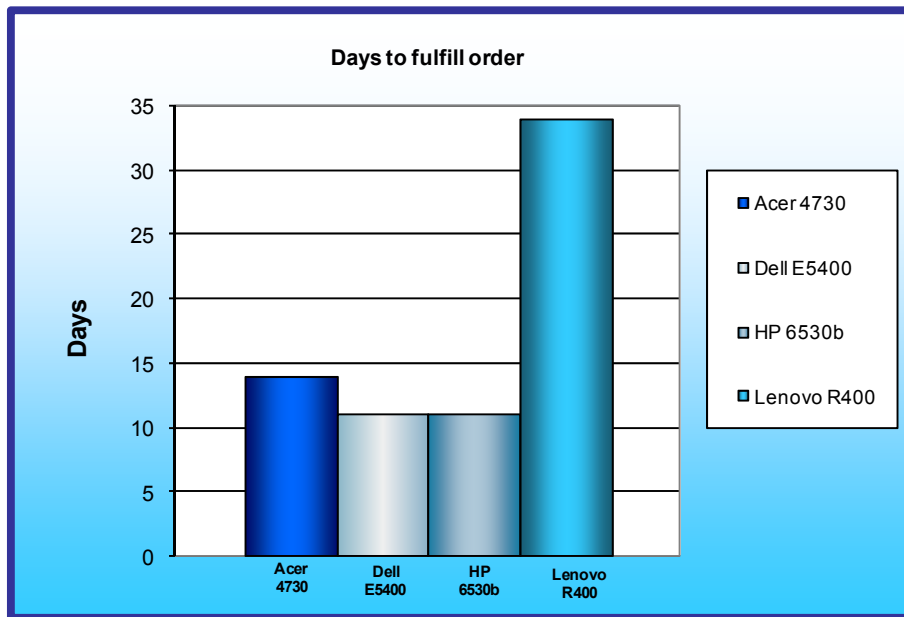
We measured performance of the four systems using SYSmark 2007 Preview v1.05. As Figure 3 shows, the Dell Latitude E5400 achieved the highest performance, 0.7 percent better than the Lenovo ThinkPad R400, 6.6 percent better than the HP Compaq 6530b, and 16.8 percent better than the Acer TravelMate 4730.

Figure 3: SYSmark 2007 Preview v1.05 Rating score for the four test systems. Higher numbers are better.

Physical data protection

We measured how well each system protected its data after sustaining a 29-inch flat drop onto commercial-grade carpet when open and while running Mobile Mark 2007. The Dell Latitude E5400 and the HP Compaq 6530b both

had zero data defects after three separate drops from this height. The Acer TravelMate 4730 had 0.6 percent data corruption after three drops, and the Lenovo ThinkPad R400 had 29.4 percent data corruption and failed to boot after the second drop.



Time for the system to arrive after we ordered it

As Figure 4 shows, once we placed the order for the Dell Latitude E5400, 11 days elapsed until we received it. The HP Compaq 6530b also took 11 days to arrive. The Acer TravelMate 4730 took 14 days (127 percent longer) to arrive and the Lenovo ThinkPad R400 took 34 days (309 percent longer).

Figure 4: Number of days that elapsed from the time we ordered the test system to the time it arrived. Lower numbers are better.

Results summary

Figure 5 presents our results and comparative ratings for the four notebook systems.

Test	Raw results				Comparative ratings			
	Acer TravelMate 4730	Dell Latitude E5400	HP Compaq 6530b	Lenovo ThinkPad R400	Acer TravelMate 4730	Dell Latitude E5400	HP Compaq 6530b	Lenovo ThinkPad R400
Days elapsed between our ordering and receiving the system (lower is better)	14	11	11	34	1.273	1.000	1.000	3.091
SYSmark 2007 Preview v1.05 Rating (higher is better)	125	146	137	145	0.856	1.000	0.938	0.993
Standard single battery configuration								
Number of cells in battery	NA	6	6	6	NA	6	6	6
MobileMark 2007 v1.05 Battery Life Rating (higher is better)	NA	5 hrs 24 mins	5 hrs 6 mins	5 hrs 17 mins	NA	1.000	0.944	0.978
MobileMark 2007 v1.05 Performance Rating (higher is better)	NA	267	248	252	NA	1.000	0.929	0.944
Extended single battery configuration								
Number of cells in battery	9	9	NA	9	9	9	NA	9
MobileMark 2007 v1.05 Battery Life Rating (higher is better)	5 hrs 12 mins	8 hrs 12 mins	NA	7 hrs 58 mins	0.634	1.000	NA	0.972
MobileMark 2007 v1.05 Performance Rating (higher is better)	211	266	NA	254	0.793	1.000	NA	0.951

Figure 5: Results and comparative ratings for the four test systems.

Test	Drop test results			
	Acer TravelMate 4730	Dell Latitude E5400	HP Compaq 6530b	Lenovo ThinkPad R400
Number of bad blocks before first drop (lower is better)	0	0	0	0
Number of bad blocks after one drop (lower is better)	14	0	0	604
Number of bad blocks after two drops (lower is better)	14	0	0	736
Number of bad blocks after three drops (lower is better)	14	0	0	NA
Result	Fail	Pass	Pass	Fail

Figure 6: Drop test results for the four test systems.

Test methodology

PT proposed and ordered the four test systems.

We tested the battery life of each system under the same conditions:

- Using MobileMark 2007 Productivity test, the current industry-standard productivity battery life benchmark
- With the battery settings that MobileMark 2007 requires
- In adherence with BAPCo testing rules

Creating the base test image

With the exception of MobileMark 2007, which required us to remove conflicting applications, PT conducted all testing on the original factory image.

We powered on each notebook, and if a notebook vendor required us to respond to specific system preparation steps, we did so until the Windows desktop appeared. Once each installation was complete, PT ran Windows Update and installed all updates available as of 9/18/2008, including Service Pack 3 for Windows XP if that update was not already on the system. At that point, PT used Symantec's Ghost product to create an image of the disk with that out-of-box software setup. Those images facilitated repeatable testing and experimenting. We made them by following this process:

1. Insert a bootable Ghost CD.
2. Power down the computer.
3. Attach an external USB hard disk.
4. Power on the computer.
5. At the Symantec Ghost screen, click OK.
6. Select Local→Disk→To Image.
7. Click OK.
8. Select the Primary disk, and click OK.
9. Select the external hard disk in the copy image to drop-down box, name the file `BASE`, and click Save.
10. At the Compress Image dialog, select Fast.
11. At the Proceed dialog, select Yes.
12. When the ghost image is complete, click OK, and exit Ghost.
13. Power down the computer.
14. Disconnect the USB hard disk.
15. Reboot the computer.

Preparing to measure battery life with MobileMark 2007 v.1.05

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.1.05

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:
 1. Set Critical battery alarm to 0%.
 2. Set Low battery alarm to 0%.
 3. Disable screen saver.
 4. Stop and disable Windows Update.
 5. Disable desktop cleanup wizard.
 6. Disable Windows Security Center warnings.
 7. Disable Windows Firewall.
 8. Disable incoming Remote Desktop connections.
 9. Disable Windows Error Reporting to Microsoft.
 10. 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).

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 1280 x 800, enter 1600 for Width and 1200 for Height.
4. Click OK.
5. Press Ctrl+F to view the bitmap image and render the screen totally 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 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 earlier in this 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.1.05

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.

1. Configure the notebook with the standard battery and the BAPCo recommendations for running MobileMark 2007.
2. Execute the Productivity 2007 test three times in this configuration.
3. Configure the notebook with the maximum-sized battery available at the time of purchase and the BAPCo recommendations for running MobileMark 2007.
4. 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 5 of the MobileMark Productivity 2007 process.)

Measuring performance with BAPCo SYSmark 2007 Preview v1.05

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 system arrival time

This test counts the number of elapsed days from our ordering a specific computer configuration to the time it arrives. We followed these steps for all four systems:

1. Open a browser, go to the notebook vendor's Web site, and navigate to the Small & Medium Business section.
2. Move through the online ordering process, and place the order for the notebook system.
3. Note the date you placed the order.
4. Note the date the system arrived.
5. Count the total number of days between steps 3 and 4.

Measuring physical data protection

This test measures the damage that the impact from a drop of 29 inches inflicted upon an open notebook running MobileMark 2007. We used a Lansmont PDT56ED Precision Drop Tester and dropped each notebook onto commercial carpet. We opened the notebook so that the screen and keyboard formed a 120-degree angle. We then placed the notebook flat on the platen. Orienting the notebook in this way resulted in a flat drop. (Figure 7 shows our test setup.)

We scanned the hard disk with PC-Doctor Service Center 6 and HD Tune Pro 3.00 and recorded the number of bad sectors and blocks before and after the drop test. We also recorded any other physical defects, such as cracks or breaks in the display, as well as hinges or displaced screws, which the impact of the drop caused. Refer to Appendix C for the drop test checklist. We videotaped the test and took still photographs of the notebooks at the conclusion of the test.

For obvious reasons, we conducted this test only after we completed all other testing. We dropped each notebook three times, if possible, using this process:

1. Reset the notebook to the base image using Symantec's Ghost product.
2. Install BAPCo's MobileMark 2007 v1.05 onto the test notebook as we described above.
3. Run PC-Doctor's Fixed Disk Tests to get baseline data on the state of the hard disk:
 - a. Insert the PC-Doctor Service Center 6 CD into the optical drive and the Multipurpose USB Device into a USB port, and reboot the notebook.
 - b. Choose C: as the log drive.
 - c. Type `R` to select PC-Doctor Standalone from the list of available tools.
 - d. Use the arrow keys to highlight Utility in the PC-Doctor menu, and press Enter.
 - e. Use the arrow keys to highlight Surface Scan Hard Disk in the Utility menu, and press Enter.
 - f. Use the arrow keys to highlight the Read Test, and press Enter.
 - g. Select Disk 1, and press Enter.
 - h. Press F3 to save the log to a file.
 - i. Enter a file name, and press Enter.
 - j. Press Esc until you see the main menu, then select Quit to reboot.
4. Save the PC-Doctor results as pre-test disk status.
5. Install EFD Software's HD Tune Pro 3.00 onto the test notebook.
6. Run HD Tune Pro's Error Scan Test to get baseline data on the state of the hard disk.
7. Save the results as pre-test disk status.
8. Set the height of the platen on the Lansmont Precision Drop Tester to 29 inches above the surface of the 28 oz. commercial carpeting.
9. Start recording with the digital video camera.
10. Place the fully charged notebook on the platen of the drop tester, with the notebook's base flat on the platen and the screen facing forward, open at a 120-degree angle.
11. Launch MobileMark 2007's Productivity 2007 test.
12. Unplug the notebook, and drop the notebook onto the commercial carpeting.
13. Wait until the notebook is completely still.





14. If the battery or any other components come off the system, inspect them for damage, and reinstall them if possible.
15. Complete the checklist in Appendix C, including the latest version available of Dell Diagnostics, if applicable.
16. Take digital pictures of the notebook from all angles after completing the checklist.
17. Stop MobileMark 2007's Productivity 2007 test.
18. Reconnect the notebook's AC Adapter.
19. Run PC-Doctor's Fixed Disk Tests using the above process, and record the results as the notebook's post-test disk status.
20. Repeat steps 7 through 18, for a total of three drop tests, if the notebook is able to run MobileMark.



Figure 7: Our physical data protection test setup.

Appendix A—Test system configuration information

As per Dell's request, PT purchased the notebook systems for this test. Figure 8 presents detailed configuration information for the systems.

System	Acer TravelMate 4730	Dell Latitude E5400	HP Compaq 6530b	Lenovo ThinkPad R400
				
General				
Processor and OS kernel: (physical, core, logical)/(UP, MP)	1P2C2L/MP	1P2C2L/MP	1P2C2L/MP	1P2C2L/MP
Number of physical processors	1	1	1	1
Single/Dual-core processors	Dual	Dual	Dual	Dual
System power management policy	MobileMark 2007	MobileMark 2007	MobileMark 2007	MobileMark 2007
Processor power-saving option	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology
System dimensions (length x width x height)	13-1/4" x 10-1/2" x 1-3/4"	9-1/2" x 13-1/4" x 1-1/2"	9" x 13" x 1-1/2"	9-1/2" x 13" x 1-1/2"
Weight of system with 6-cell battery	NA	5 lbs. 10 oz.	5 lbs. 5 oz.	5 lbs. 8.5 oz.
Weight of system with 9-cell battery	5 lbs. 9.5 oz.	5 lbs. 15.5 oz.	NA	5 lbs. 15 oz.
CPU				
Vendor	Intel	Intel	Intel	Intel
Name	Core 2 Duo mobile	Core 2 Duo mobile	Core 2 Duo mobile	Core 2 Duo mobile
Model number	P8400	T9400	T9400	T9400
Stepping	M0	C0	E0	C0
Socket type and number of pins	Socket P (478)	Socket P (478)	Socket P (478)	Socket P (478)
Core frequency (GHz)	2.26	2.53	2.53	2.53
Front-side bus frequency (MHz)	1,066	1,066	1,066	1,066
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	3 MB (shared)	6 MB (shared)	6 MB (shared)	6 MB (shared)
Platform				
Vendor	Acer	Dell Inc.	Hewlett-Packard	Lenovo
Motherboard model number	TravelMate 4730	0D693C	30DD	7443CTO
Motherboard chipset	Intel GM45/GM47	Intel GL40/GM45/GS45/PM45	Intel GL40/GM45/GS45/PM45	Intel GM45/GM47

System	Acer TravelMate 4730	Dell Latitude E5400	HP Compaq 6530b	Lenovo ThinkPad R400
Motherboard revision number	07	07	07	07
System/motherboard serial number	LXTQ60Z1029091 F2751601	864JXG1	CNU90953CX	L3-A3789
BIOS name and version	Acer v1.18 (12/24/2008)	Dell Inc. A09 (02/25/2009)	Hewlett-Packard 68PDD Ver F.0A (12/15/2008)	Lenovo 7UET61WW 2.07 (02/13/2009)
BIOS settings	Default	Default	Default	Default
Memory module(s)				
Vendor and model number	Samsung M4 70T2864QZ3-CE6	Samsung M4 70T2864EH3-CF7	Samsung M470T5663QZ3- CF7	Elpida EBJ11UE6BASA- AE-E
Type	PC2-5300	PC2-6400	PC2-6400	PC3-8500
Speed (MHz)	677	800	800	1,066
Speed running in the system (MHz)	667	800	800	1,066
Timing/Latency (tCL-tRCD-tRP-tRASmin)	5-5-5-15	6-6-6-18	6-6-6-18	7-7-7-20
Size (MB)	2,048	2,048	2,048	2,048
Number of memory module(s)	2 x 1,024	2 x 1,024	1 x 2,048	2 x 1,024
Chip organization (single-sided, double-sided)	Double-sided	Double-sided	Double-sided	Double-sided
Channel (single/dual)	Dual	Dual	Single	Dual
Hard disk				
Vendor and model number	Western Digital WD1600BEVT	Hitachi HTS723216L9A36 2	Seagate ST9160411AS	Hitachi HTS 722016K9SA00
Size (GB)	160	160	160	160
Buffer size (MB)	8	16	16	16
RPM	5,400	7,200	7,200	7,200
Type	SATA	SATA	SATA	SATA
Controller	Intel ICH9M-E/M	Intel ICH9M-E/M	Intel ICH9M-E/M	Intel ICH9M-E/M
Driver	Intel 8.0.0.1039 (4/15/2008)	Intel 8.2.2.1001 (6/15/2008)	Intel 8.0.0.1039 (6/11/2008)	Intel 8.6.3.1004 (11/03/2008)
Operating system				
Name	Windows XP Professional	Windows XP Professional	Windows XP Professional	Windows XP Professional
Build number	2600	2600	2600	2600
Service pack	Service Pack 3	Service Pack 3	Service Pack 3	Service Pack 3
File system	NTFS	NTFS	NTFS	NTFS
Kernel	ACPI Multiprocessor PC	ACPI Multiprocessor PC	ACPI Multiprocessor PC	ACPI Multiprocessor PC
Language	English	English	English	English
Microsoft DirectX version	DirectX 9.0c	DirectX 9.0c	DirectX 9.0c	DirectX 9.0c
Graphics				
Vendor and model number	Mobile Intel GMA 4500MHD	Mobile Intel GMA X4500HD	Mobile Intel GMA X4500HD	Mobile Intel GMA 4500MHD

System	Acer TravelMate 4730	Dell Latitude E5400	HP Compaq 6530b	Lenovo ThinkPad R400
Type	Integrated	Integrated	Integrated	Integrated
Chipset	Mobile Intel 4 Series Express Chipset	Mobile Intel 4 Series Express Chipset	Mobile Intel 4 Series Express Chipset	Mobile Intel 4 Series Express Chipset
BIOS version	1659.0	1659.0	1625.0	1654.1
Total available graphics memory (MB)	256	1,024	1,024	1,024
Resolution	1,280 x 800 x 32 bit	1,440 x 900 x 32 bit	1,440 x 900 x 32 bit	1,440 x 900 x 16 bit
Driver	Intel 6.14.10.4957 (6/11/2008)	Intel 6.14.10.4980 (8/25/2008)	Intel 6.14.10.4953 (5/21/2008)	Intel 6.14.10.5002 (10/21/2008)
Sound card/ subsystem				
Vendor and model number	Realtek High Definition	IDT High Definition Audio, Intel High Definition Audio HDMI	SoundMAX Integrated Digital HD Audio	Conexant High Definition SmartAudio 221
Driver	5.10.0.5631 (5/26/2008)	IDT 5.10.0.6124 (11/13/2008), Intel 5.10.0.1046 (7/30/2008)	AnalogDevices 5.10.1.5820 (4/11/2008)	Conexant 3.53.0.0 (5/28/2008)
Ethernet				
Vendor and model number	Broadcom NetXtreme Gigabit	Broadcom NetXtreme 57xx Gigabit	Broadcom Netlink Gigabit	Intel 82567LM Gigabit
Driver	Broadcom 10.78.0.0 (3/19/2008)	Broadcom 10.85.0.0 (6/19/2008)	Broadcom 10.62.1.2 (11/30/2007)	Intel 9.52.10.1003 (9/19/2008)
Wireless				
Vendor and model number	Intel Wireless WiFi Link 5100	Intel Wireless WiFi Link 5300	Intel Wireless WiFi Link 5100	Intel Wireless WiFi Link 5300
Driver	Intel 12.2.0.11 (11/17/2008)	Intel 12.0.0.82 (7/8/2008)	Intel 12.2.0.11 (11/17/2008)	Intel 12.1.0.14 (8/28/2008)
Modem 1				
Vendor and model number	HDAUDIO Soft Data Fax Modem with SmartCP	NA	Agere Systems HDA Modem	ThinkPad Modem Adapter
Driver	CXT 7.73.0.0 (4/14/2008)	NA	Agere 2.1.92.0 (11/21/2008)	Conexant 7.73.0.0 (3/28/2008)
Optical drive(s)				
Vendor and model number	Slimtype DS8A2S	HL-DT-ST DVD+-RW GT10N	TSSTcorp TS-L633M	Matshita UJ870A
Type	DVD RW	DVD/CD RW	DVD/CD RW	DVD RW
Interface	SATA	SATA	SATA	SATA
Dual/Single layer	Dual	Dual	Dual	Dual
USB ports				
Number	3	4	4	3
Type	2.0	2.0	2.0	2.0
Other	NA	NA	NA	NA
IEEE 1394 ports				

System	Acer TravelMate 4730	Dell Latitude E5400	HP Compaq 6530b	Lenovo ThinkPad R400
Number (4-pin)	0	1	1	1
Monitor				
LCD type	WXGA	WXGA	WXGA	WXGA
Screen size (inches)	14.1	14.1	14.1	14.1
Refresh rate (Hz)	60	60	60	60
Battery 1				
Type	Acer TM07B41	Dell KM742	HP HSTNN-UB69	Lenovo 42T4678
Size (length x width x height)	8" x 2-3/4" x 1"	8" x 2" x 3/4"	8" x 2" x 3/4"	8-3/4" x 2-1/2" x 3/4"
Rated capacity	7,200 mAh x 11.1V = 80 Wh	4,840 mAh x 11.1V = 56 Wh	4910 mAh x 10.8 V = 55 Wh	5200 mAh x 10.8V = 57 Wh
Cell count	9	6	6	6
Weight	1 lb.	11.4 oz.	10.8 oz.	11.3 oz.
Battery 2				
Type	NA	Dell WU841	NA	Lenovo 42T4644
Size (length x width x height)	NA	8-3/4" x 2-3/4" x 3/4"	NA	8-3/4" x 3-1/4" x 1"
Rated capacity	NA	7660 mAh x 11.1V = 85Wh	NA	7800 mAh x 10.8V = 84Wh
Cell count	NA	9	NA	9
Weight	NA	1 lb. 1 oz.	NA	1 lb. 2 oz.
AC adapter				
Vendor	Lite-On	Dell	HP	Lenovo
Make/model	PA-1650-02	HA90PE1-00	PPP014L-SA	92P1156
Watts (W)	65	90	90	65

Figure 8: Detailed system configuration information for the test systems.

Appendix B—Notebook drop test checklist

Figure 9 presents the checklist we used as we evaluated the notebook systems' condition after the drop test.

<p>TEST: _____ UNIT S/N: _____</p> <p>DELL Diagnostics revision number: _____</p> <p>Pre-drop disk scan results: _____</p> <p>Post-drop disk scan results: _____</p> <p>HDD</p> <ul style="list-style-type: none">• Verify that HDD is functional <p>RMS devices</p> <ul style="list-style-type: none">• Verify that all internal removable media storage (RMS) devices (FDD, CD-ROM, etc.) are functional <p>LCD</p> <ul style="list-style-type: none">• Abrasion or buffing on the LCD from the keyboard• Loss of pixels at any color layer• Appearance of lines, bars, brightness change, etc.,• Broken or deformed parts.• Loose or partially unseated connectors. <p>Keyboard</p> <ul style="list-style-type: none">• Broken or deformed or unseated keys• Loss of functionality of any key, Touch Pad, TouchPad buttons, PointStick, PointStick buttons <p>External connectors</p> <ul style="list-style-type: none">• Broken, deformed, or unseated connectors• Loss of functionality of any connector <p>Latch</p> <ul style="list-style-type: none">• Verify that all latches (display, battery, memory door, etc.) are fully functional <p>Battery</p> <ul style="list-style-type: none">• Verify that the battery is fully functional. <p>Cracks or breakage</p> <ul style="list-style-type: none">• Cracks, breakage, deformation, or separation at any point on the display assembly and the base assembly. <p>Paint degradation</p> <ul style="list-style-type: none">• Scratching, chipping on painted parts <p>Floatlines/seams</p> <ul style="list-style-type: none">• Separation between LCD back and bezel at any point around display, and between palmrest and base <p>Hinge caps</p> <ul style="list-style-type: none">• Separation, misfit of hinge cap <p>Doors</p> <ul style="list-style-type: none">• Verify that all doors (HDD door, memory door, FDD door, etc.) are fully functional. <p>Screws</p> <ul style="list-style-type: none">• Verify that screws are set at their original screw setting. <p>Rubber feet</p> <p>Movement or dislodging of any rubber (stationary) foot on notebook</p>
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Figure 9: Notebook drop test checklist.

About Principled Technologies

We provide industry-leading technology assessment and fact-based marketing services. We bring to every assignment extensive experience with and expertise in all aspects of technology testing and analysis, from researching new technologies, to developing new methodologies, to testing with existing and new tools.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, Web sites, or services, we offer the experience, expertise, and tools to help you assess how it will fare against its competition, its performance, whether it's ready to go to market, and its quality and reliability.

Our founders, Mark L. Van Name and Bill Catchings, have worked together in technology assessment for over 20 years. As journalists, they published over a thousand articles on a wide array of technology subjects. They created and led the Ziff-Davis Benchmark Operation, which developed such industry-standard benchmarks as Ziff Davis Media's Winstone and WebBench. They founded and led eTesting Labs, and after the acquisition of that company by Lionbridge Technologies were the head and CTO of VeriTest.



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