Value PC Performance: Built-To-Order Systems

For Intel Corporation

Executive summary

Intel Corporation (Intel) commissioned Principled Technologies (PT) to run a set of performance tests on two built-to-order Hewlett Packard (HP) Desktop Home PCs:

- HP Pavilion a1100e (with an AMD Sempron 3200+ processor)
- HP Pavilion a1100y (with an Intel Celeron D 346 processor)

The goal of the testing was to gauge the performance that PC buyers would experience on systems they purchased online from such well-known sites as www.hpshopping.com, using some common industry benchmarks and some additional performance tests. Intel identified the test systems, tests, test procedures, and test settings. PT purchased and set up the two PCs, and PT executed all tests. We ran the following custom tests and industry-standard benchmarks:

Key findings

- ❖ The Intel Celeron D 346 processor-based system turned in higher scores than the AMD Sempron 3200+ processor-based system on a majority of the industry-standard benchmarks.
- ❖ The Intel Celeron D 346 processor-based system turned in faster results than the AMD Sempron 3200+ processor-based system on a majority of the custom tests.
- ❖ The Intel Celeron D 346 processor-based system supports 7.1 surround sound, while the AMD Sempron 3200+ processor-based system supports only 5.1 surround sound.

Industry-standard benchmarks
- BAPCo SYSmark 2004 SE
- BAPCo WebMark 2004 + Patch 1
- Futuremark PCMark05

Custom tests
- iTunes 6.0
- Lame 3.97a + MP3 Gain
- Windows Media Encoder 9 with Advanced Profile
- XMPEG 5.03 with DivX Pro codec 6.1

We also analyzed the audio capabilities of each system.

Appendix A provides the purchase price of both systems, and Appendix B details their configurations. Whenever possible, we tested each system as it came out of the box. One change was necessary. The AMD-based HP a1100e booted with a display resolution of 800x600x16-bit color depth, which SYSmark 2004 SE does not support. We changed that system's resolution to 1024x768x32-bit color depth, the out-of-box resolution of the Intel-based HP a1100y and one that SYSmark 2004 SE supports.

Table 1 summarizes the test results, each of which is the median result of three runs on each system. For the industry-standard benchmarks, higher scores are better. For all other performance tests, lower scores are better because they represent the time the system required to complete each workload. In the rightmost column, we compare the median results of the systems. We calculate this comparison by dividing the Intel-based system's score by the AMD-based system's score for tests in which a higher score is better, and by dividing the AMD-based system's score by the Intel-based system's score for tests in which a lower score is better. Consequently, comparative results above 1.00 indicate tests the Intel-based system won, and those below 1.0 indicate tests the AMD-based system won.

Tests	HP Pavilion a1100e (AMD Sempron 3200+)	HP Pavilion a1100y (Intel Celeron D 346)	Comparative Result
Industry-standard benchmarks (higher is better)			
BAPCo SYSmark 2004 SE – Overall score	131	130	0.99
BAPCo WebMark 2004 + Patch 1 – Overall score	96	98	1.02
Futuremark PCMark05 Business Edition – Overall score	2034	2168	1.07
Custom tests (Lower is better)			
iTunes 6.0	233	235	0.99
Lame 3.97a + MP3 Gain	424	400	1.06
Windows Media Encoder 9 with Advanced Profile	197	193	1.02
XMPEG 5.03 with DivX Pro codec 6.1	93	77	1.21

Table 1: Results of performance tests on the AMD-based HP a1100e and the Intel-based HP a1100y.

Differences in audio capabilities

The systems provided somewhat different audio capabilities. Figure 1 shows the front audio interface that both systems provide. The blue and pink connections are for line-in and microphone input. The green connection is for headphones.

Figure 1: The front analog audio interfaces for both systems.

A key audio difference between the systems is the number of speakers their surround-sound capabilities support. The Intel-based system can drive up to eight speakers (7.1 surround sound), while the AMD-based system supports up to six (5.1 surround sound). The additional two speakers the Intel-based system can support are side surround units, which would sit between the front and rear speakers on the right and left sides.

This difference is visible in the digital and analog connections on the systems. Figure 2 below shows the audio interfaces on the Intel-based HP a1100y system. It provides one digital audio in, one digital audio out and six mini-plug-interface analog connections. The blue and pink connections are for line-in and microphone input. The green connection doubles as a basic two-speaker interface and, in a 7.1 configuration, as a front right/left interface. The black connection handles the rear right/left speakers, the gray connection handles the side right/left speakers, and the orange handles the center speaker and subwoofer.
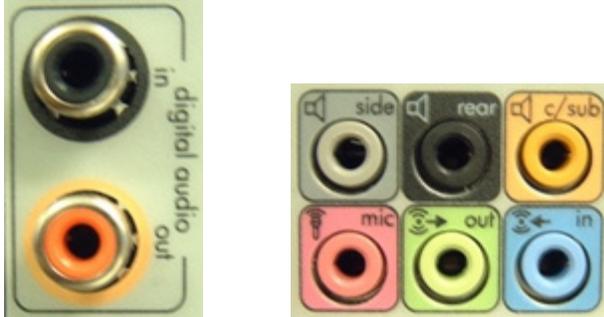
Figure 2: The rear digital and analog audio interfaces for the Intel-based HP a1100y.

Figure 3 below shows the audio interfaces on the AMD-based HP a1100e system. It has one digital audio out and three mini-plug-interface analog connections. As on the Intel-based counterpart, the green doubles as a basic two-speaker interface and, in a 5.1 configuration, as a front right/left interface. The blue connection doubles as a line-in input and rear right/left speakers, while the pink connection doubles as a microphone input and the center speaker and subwoofer connections. This means that if the AMD-based system is in an analog 5.1 configuration, line-in would be available only via the front line-in connection, while the Intel-based system would have both the rear and front line-in connections available. Both systems came from HP with a software application pre-installed that configures these audio connections between uses.

Figure 3: The rear digital and analog audio interfaces for the AMD-based HP a1100e.

Both systems provide a digital PCM (Pulse Code Modulation) coaxial connection that lets you connect to any receiver with a coaxial audio input. The PCM signal identifies the type of audio signal the PC is sending to the receiver—such as Dolby Digital 2.0 or 5.1, DTS, or Pro Logic surround. The Intel-based system came with both input and output PCM connections, while the AMD-based system came only with an output PCM connection.

We tested the surround sound capabilities of both systems in a variety of ways, each of which used a different audio format:

> Game:
> - Doom 3
>
> Downloadable 5.1 audio clip:
> - Experience Windows Media Player 10 1080p downloaded from http://www.microsoft.com/windows/windowsmedia/content_provider/film/ContentShowcase.aspx
>
> DVD movies:
> - *The Fifth Element*, Superbit Version (Audio format: Dolby Digital 5.1, DTS 5.1)
> - *The Lord of the Rings: The Fellowship of the Ring*, Special Extended Version (Audio format: Dolby Digital 5.1 EX, DTS ES 6.1)
>
> DVD audio:
> - Queen, *A Night at the Opera* (Audio format: DTS 5.1, 96 kHz, 24-bit sampling, Dolby Digital 2.0)

We used a Sony STR-DE598 home theater receiver to accept either the analog or digital PCM connection from the systems. Because the systems did not come configured with DVD-ROMs, we attached an external DVD player for the audio tests. On the Intel-based system we were able to hook an external Samsung DVD-HD841 DVD player to the digital coaxial input and the Sony receiver to the digital coaxial output. Using the

digital pass-through feature in the software, we were able to successfully play the DVD movies and audio. We were unable to do this on the AMD-based system because it did not provide a digital coaxial input; it offers only digital coaxial outputs. So, to verify that the digital PCM connections worked properly when playing DVDs on the AMD-based system, we had to temporarily install a LITE-ON model SHOW-1673S DVD-RW drive, which we pulled from our test stock.

Both systems played the game, the audio clip, and the movies without any problems. When we played the DTS 96 kHz/24-bit DVD-Audio disc, however, the AMD-based system had a difficult time communicating with the receiver. Normally, during playback the computer notifies the receiver, through the PCM connection, of the type of decoding format to use. The receiver then displays that format once in its front panel. When we played the DTS 96 kHz/24-bit audio track with the AMD-based system, the receiver flashed DTS 96/24 on the front panel several times during playback. The interruption lasted less than a second, but it occurred approximately every 5 to 15 seconds. After a couple of minutes, we found that it was difficult to enjoy the music and stopped playback.

Test methodology

This section details the methodology we followed in testing the systems.

Configuration differences

When we configured the systems on www.hpshopping.com, we made them as identical as possible. We could not avoid the following differences:

- The motherboard for the AMD-based a1100e supports only DDR RAM, with the fastest RAM available on www.hpshopping.com being DDR400 (PC3200) dual channel SDRAM. The motherboard for the Intel-based a1100y, by contrast, supports DDR2-533MHz SDRAM, which was the only option available for our purchase.
- The hard drive controllers in the systems also differ. Though both are Serial ATA devices, the AMD-based a1100e uses the ATI SB400 controller, while the Intel-based a1100y uses the Intel 82801FB (ICH6) controller.
- The Intel-based a1100y system came with the integrated Intel GMA 900 video adapter with 128 MB of video RAM, while the AMD-based a1100e came with the integrated ATI Radeon Xpress 200 video adapters with 256 MB of video RAM.
- The Intel-based a1100y system came with the integrated Realtek High Definition audio adapter, while the AMD-based a1100e came with the integrated Realtek AC'97 audio adapters. The Realtek High Definition audio adapter enables the a1100y to support up to 7.1 surround sound, while the Realtek AC'97 support only up to 5.1 surround sound.
- The prices differ, with the AMD-based a1100e costing $499.00 and the Intel-based a1100y costing $509.00.

Appendix A provides complete cost information for both systems, and Appendix B details their configurations.

Initial setup

When the systems arrived, we unpacked and set up each one. They came with identical keyboards and mice. We did not purchase monitors with the systems, so we used identical MAG Innovision 786N monitors from our test stock. We went through the following process with each PC the first time we booted it:

1. Pressed Next to set up Windows XP.
2. Selected Yes! I hear music through the computer speakers. Pressed Next.
3. Selected United States, English and U.S. keyboard.
4. Selected Eastern Time.
5. Selected Yes, I accept to both the manufacturer and Microsoft End User License Agreements.
6. Selected Not right now to automatic updates, because our goal was to test each PC as it came out of the box.
7. We named each computer with its model and processor vendor (a1100e_AMD or a1100y_INTEL).

8. We left each computer description blank.
9. Pressed Next.
10. Selected Skip during the How will this computer connect to the Internet? part of the setup process.
11. Selected No, not at this time to registering with Microsoft. Press Next.
12. Selected Finish.
13. Selected Exit at the Easy Internet Sign-up screen.
14. Selected the radio button that said, No, do not send any data to HP, and checked the box that said, Don't show me this message again.
15. Clicked Continue.
16. Selected Start at HP Easy Setup screen.
17. Selected Do not activate this service now at the Updates from HP, and clicked Next, because our goal was to test each PC as it came out of the box.
18. Accepted the defaults, and clicked Next at the HP Organize screen.
19. Accepted the defaults, and clicked Next at the Support Tools screen.
20. Accepted the defaults, and clicked Next at the HP Extended Services Plans screen.
21. Accepted the defaults, and clicked Next at the Register with HP screen.
22. Accepted the defaults, and clicked Next at the Protect your PC screen.
23. Selected Finish at the Setup Complete screen.
24. Clicked Next at the Norton Internet Security 2005 screen.
25. Selected I accept the License Agreement, and clicked Next.
26. Clicked Register Later.
27. Clicked Next at the Subscription screen.
28. Accepted the defaults, and clicked Finish at the Next Steps screen.
29. Clicked Next at the LiveUpdate screen.
30. Ignored the message that said, LiveUpdate could not retrieve the update list, and clicked Finish, because our goal was to test each PC as it came out of the box.
31. Clicked the AntiVirus button on the HP Organize toolbar.
32. Selected I accept the License Agreement at the Norton Security Center screen, and clicked OK.
33. Clicked the drop down box beside Virus Protection, and checked the Do not alert me about virus protection status.
34. Clicked the drop down box beside Firewall Protection, and checked the Do not alert me about firewall status.
35. Clicked the drop down box beside Windows Automatic Updates, and checked the Do not alert me about Windows Automatic Updates status.
36. Rebooted the system.
37. Click No at the HP Organize Demonstration video dialog box.
38. If a Norton AntiVirus Definition Alert dialog appears select Notify me again in 14 day(s) and uncheck Enable automatic LiveUpdate and click OK.

We used Symantec's Ghost product to capture an exact image of the hard disk directly to the internal CD-RW drive. Each time we ran a new benchmark or test on a machine, we used the Ghost image CDs to return that machine to the above out-of-box configuration. After re-imaging, we installed the software necessary to run the benchmark or test, standardized the test system to 1024x768x32-bit resolution, and rebooted.

We rebooted before running each benchmark or test.

The following subsections summarize the steps we followed to obtain each of the benchmark or test results in this report.

Industry standard benchmarks
BAPCo SYSmark 2004 SE

SYSmark 2004 SE would not run successfully on either system as it booted out-of-the-box. When we attempted to run the benchmark in the out-of-the-box configuration, SYSmark 2004 SE presented the following errors:

Figure 4: Error message when attempting to install BAPCo SYSmark 2004 SE.

Figure 5: Error message when attempting to run BAPCo SYSmark 2004 SE at 800 x 600 resolution.

Figure 6: Norton AntiSpam message that appears during the BAPCo SYSmark 2004 SE benchmark run.

So we could install SYSmark, we removed the preinstalled version of Microsoft Office Standard Edition 2003. Then, so the benchmark would run, we changed the screen resolution to 1024 x 768 x 32-bit color depth on the AMD-based HP a1100e. The Intel-based HP a1100y booted to this resolution out of the box. We ran all tests at this resolution. To prevent Norton AntiSpam from interfering during the benchmark, we opened the Microsoft Outlook application that SYSmark 2004 SE installed and selected No to the Norton AntiSpam Email Client Integration question.

SYSmark 2004 SE comes on a DVD. Each of the test systems came with a CD-RW drive but no DVD drive. To work around this limitation, we installed SYSmark 2004 SE over our local area network by creating a shared directory named SYSmark2004SE and copying the entire contents of the SYSmark 2004 SE benchmark DVD into it.

We performed the following steps to run this benchmark:

Setup
1. Reset the system to the base test image.
2. Uninstall Microsoft Office Standard Edition 2003.
   a. Start→Control Panel→Add or Remove Programs→Microsoft Office Standard Edition 2003→Click on Remove.
   b. Click Yes at the Are you sure you want to uninstall this product screen.
3. Reboot the system.
4. Using Windows Explorer, browse to the SYSmark2004SE directory on the network.

5. Click setup.exe.
6. Install SYSmark 2004 SE with default settings.
   a. Click Next at the Welcome to the InstallShield Wizard for SYSmark 2004 SE screen.
   b. Select I accept, and click Next at the License Agreement screen.
   c. Enter User Name, Company Name, and Serial Number at the Customer Information screen, and click Next.
   d. Click Next at the Destination Directory screen.
   e. Click Next at the Select Program Folder screen.
   f. Select Yes at the Do you want to move the programs to the alternate key screen.
   g. Select Yes at the Do you want to move these programs to the alternate folder now screen.
   h. Select Yes, I want to restart my computer now, and click Finish.
7. Disconnect the system from the network.
8. To prevent Norton AntiSpam from interfering during the benchmark, open Microsoft Outlook.
9. Select No to the Norton AntiSpam Email Client Integration question that appears, and exit Outlook.
10. Reboot the system.

Running the test
1. Reboot the system.
2. Launch SYSmark 2004 SE.
3. Click Run on the left-side menu.
4. Select Official Run, choose 3 Iterations, and enter a name for that run.
5. When the benchmark completes, the main SYSmark 2004 SE menu appears. Select the Report button, then Official Report, which produces the SYSmark 2004 SE test scores.
6. At the top, click Disclosure, enter all required information (which the benchmark designates with an asterisk), and click OK. When the report appears, click File→Export, and designate a location for the benchmark's Full Disclosure Report.

We report the benchmark's Overall score.

BAPCo WebMark 2004 + Patch 1 (Offline)

WebMark 2004 + Patch 1 would not run successfully on the test systems as they booted out-of-the-box. When we attempted to run the benchmark in the out-of-the-box configuration, WebMark 2004 + Patch 1 presented with the following errors:

Figure 7: Error message concerning the Flash Player version when running BAPCo WebMark 2004 + Patch 1.
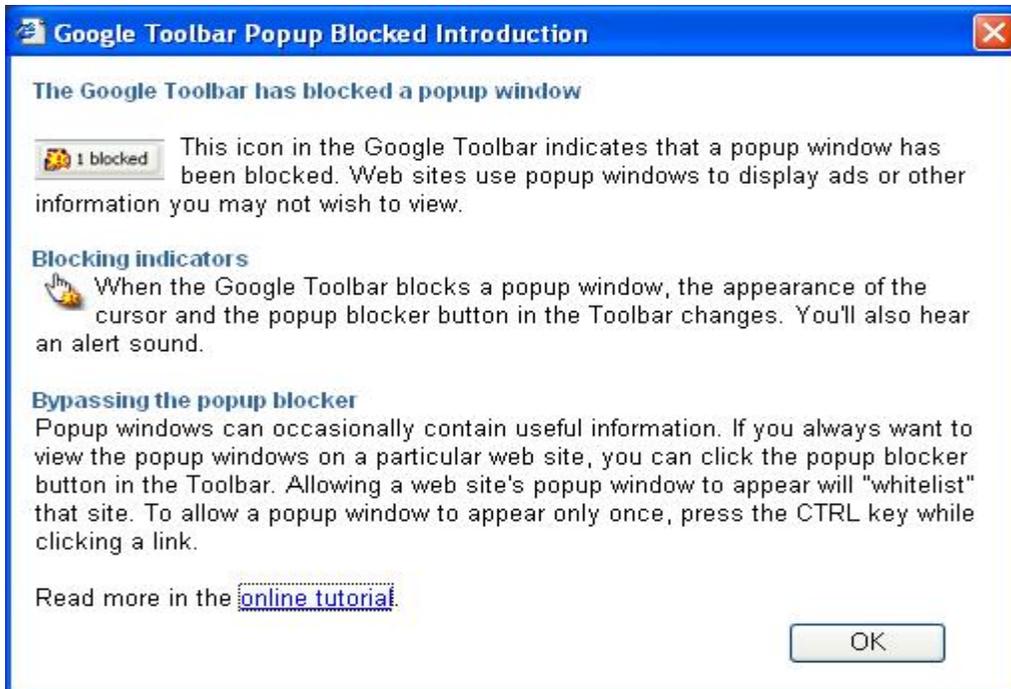
Figure 8: Google Toolbar Popup Blocker message when running BAPCo WebMark 2004 + Patch 1.
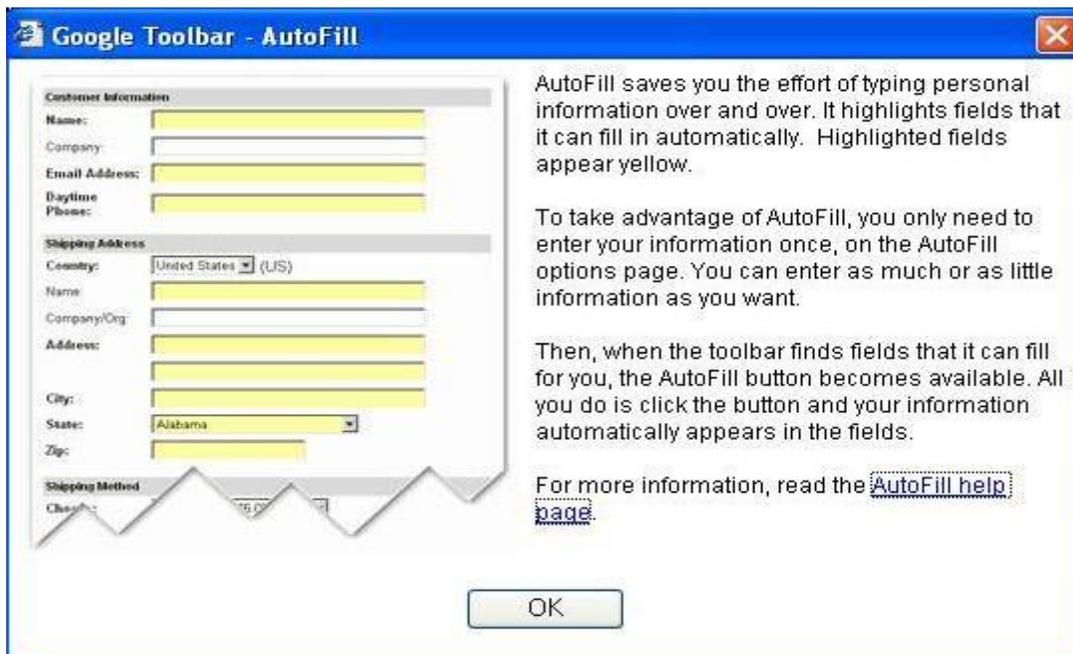

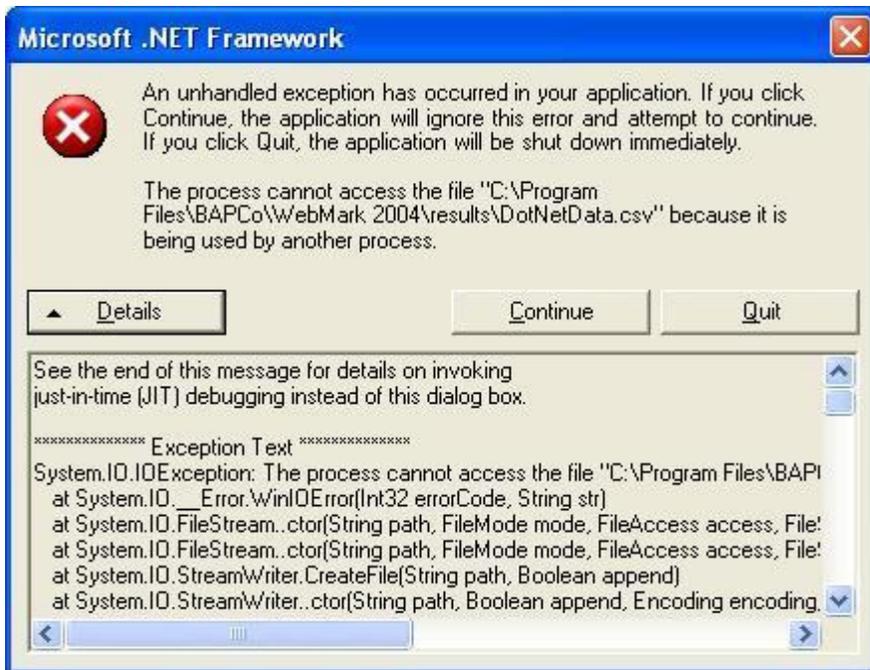**Figure 9: Google Toolbar AutoFill message when running BAPCo WebMark 2004 + Patch 1.**

Figure 10: Error message concerning Microsoft .NET Framework when running BAPCo WebMark 2004 + Patch 1.

To get around these issues, we uninstalled Flash Player 7 and Microsoft .NET, and we disabled the Google Popup Blocker and AutoFill feature prior to installing WebMark 2004 + Patch 1. We performed the following steps to run this benchmark:

Setup
1. Reset the system to the base test image.
2. Uninstall Flash Player.
   a. Download the Macromedia Flash Player Uninstaller from: http://www.macromedia.com/shockwave/download/alternates/.
   b. Click Uninstall at the Macromedia Flash Player Uninstaller screen.
   c. Click OK at the Macromedia Flash Player has been uninstalled successfully screen.
3. Uninstall Microsoft .NET Framework 1.1.
   a. Start→Control Panel→Add or Remove Programs→Microsoft .NET Framework 1.1→Click on Change/Remove.
   b. Click Yes at the Are you sure you want to uninstall this product screen.
4. Disable the Google Toolbar Popup Blocker and AutoFill setting.
   a. Right click Internet Explorer.
   b. Select Properties.
   c. Click the Connections tab.
   d. Click the Setup… button.
   e. Click Next at the Welcome to the New Connection Wizard screen.
   f. Select Connect to the Internet, and click Next.
   g. Select Set up my connection manually, and click Next.
   h. Select Connect using a broadband connection that is always on, and click Next.
   i. Click Finish.
   j. Double-click the Internet Explorer icon.
   k. On the Google Toolbar select Options.
   l. Under Accessories Uncheck the boxes beside Popup Blocker and AutoFill button.
   m. Click OK, and close Internet Explorer.
5. Reboot the system.
6. Install WebMark 2004 Client with setup defaults.

> a. Click Next at the WebMark 2004 Setup screen.
> b. Select Install WebMark 2004 Client.
> c. Click Yes at the Question dialog that appears.
> d. Click Yes at the License Agreement screen.
> e. Enter the fields for User Name, Company Name, and Serial Number.
> f. Click Next.
> g. Click Next at the Destination Directory screen.
> h. Click Finish.

7. Reboot the system.
8. Install the WebMark Patch 1 Client with default settings.
> a. Click Next at the WebMark 2004 Patch 1 Installation screen.
> b. Select Install WebMark 2004 Patch 1 Client.
> c. Click Yes at the Question dialog that appears.
> d. Select Yes, I want to restart my computer now, and click Finish.
9. Reboot the system.

Running the test
1. Reboot the system.
2. Launch WebMark 2004.
3. In the Web-based interface, click Run Benchmark.
4. Under Project name, enter the name of the system (e.g., a1100y).
5. Select Offline mode.
6. Select Official Run.
7. Click Run Project, and the benchmark will begin.
8. Once it completes, the WebMark 2004 Web interface reappears with the results.
9. Click Generate FDR, and fill in the necessary information.
10. Click Save FDR, and close the FDR page.
11. Click the Export Results button, and save the .xml file.
12. Repeat two times.

We report the benchmark's Overall score.

Futuremark PCMark05 Business Edition

PCMark05 Business Edition produced the following error when we installed it on the systems as they came out of the box:

Figure 11: Windows Media Encoder 9 requirement message that appears during Futuremark PCMark 05 installation.

To meet this requirement, we installed Windows Media Encoder 9 prior to installing PCMark05. We performed the following steps to run this benchmark:

Setup
1. Reset the system to the base test image.
2. Download and install Windows Media Encoder 9 with default settings from: http://www.microsoft.com/windows/windowsmedia/9series/encoder/default.aspx.
   a. Click Next at the Welcome to the Microsoft Windows Media Encoder 9 Series Setup Wizard.
   b. Select I accept the terms in the License Agreement, and click Next.
   c. Click Next at the Installation Folder screen.
   d. Click Install at the Ready to Install screen.
   e. Click Finish at the Completing the Windows Media Encoder 9 Series Setup Wizard.
3. Reboot the system.
4. Purchase and install PCMark05 Advanced v1.1.0 with setup defaults.
   a. Click Next at the Welcome to the InstallShield Wizard for PCMark05 (version 1.1.0) screen.
   b. Select I accept the terms of the license agreement, and click Next.
   c. Click Next at the Choose Destination Location screen.
   d. Click Install at the Ready to Install the Program screen.
   e. Click Yes at the Question dialog that appears asking to install portions of DirectX 9.0c.
   f. Select I accept the agreement, and click Next.
   g. Click Next at the DirectX 9.0 Runtime Install screen.
   h. Click Finish at the Installation Complete screen.
   i. Enter the registration code, and click Next.
   j. Click OK at the Congratulations dialog that appears.
   k. Uncheck View the Readme, and click Finish at the InstallShield Wizard Complete screen.
5. Reboot the system.

Running the test
1. Reboot the system.
2. Launch PCMark05.
3. Under Tests, click Select.
4. Click Select All to check all tests available.
5. Click OK.
6. Click the Run PCMark button to run the tests.
7. Record the results.
8. Repeat two times.

We report the benchmark's Overall score.

Custom tests
iTunes 6.0

We used this application to test the time each system takes to convert a .wav file to an .mp3 file.

The methodology for this test required a large .wav file. We used the Magix MP3 Maker Deluxe 2005 and Super Sound Joiner applications to create a single .wav file from all the songs on disc one of Pearl Jam greatest hits compilation, *Rearviewmirror*. The file has the following key characteristics:

- Length (hh:mm:ss): 1:07:13
- Size: 678 MB (711,491,806 bytes)

We followed these steps to create the .wav file:

Creating the mixTest.wav
1. Purchase and install Magix MP3 Maker Deluxe 2005.
   a. Click INSTALL at the main setup screen.
   b. Click Next at the Welcome screen.
   c. Click Next at the Choose Destination Location screen.

      d.   Click Next at the Create link screen.
      e.   Uncheck the box next Registering online, and click Next.
      f.   Click Next at the License agreement screen.
      g.   Click Next at the Start Installation screen.
      h.   Click Next at the Link file types screen.
      i.   Click Finish.
      j.   Click No at the question about watching the tutorial-video.
      k.   Close the application.

2. Purchase and install Super Sound Joiner from: http://www.009soft.com/products/super-sound-joiner.htm.
      a.   Click Next at the Welcome to the Super Sound Joiner Setup Wizard screen.
      b.   Select I accept the agreement at the License Agreement screen, and click Next.
      c.   Click Next at the Select Destination Location screen.
      d.   Click Next at the Select Start Menu Folder screen.
      e.   Click Install at the Ready to Install screen.
      f.   Uncheck the View Readme.txt box, and click Finish.
      g.   Enter User Name and Registration Code, and click Register.
      h.   Click OK at the Registration has succeeded screen.
      i.   Exit the application.
3. Insert CD 1 of PearlJam *Rearviewmirror* into the CD-ROM drive.
4. Launch Magix MP3 Maker Deluxe 2005.
5. In the Explorer Tab, browse to the music CD-ROM.
6. Highlight all the songs listed, and click the selection button under Add to Playlist.
7. Highlight all the songs now listed in the playlist.
8. From the top menu bar select Convert, and then Convert playlist.
9. In the Format field under the encoder section select Wavefile (*.WAV).
10. Click Start.
11. After Magix MP3 Maker has encoded the songs, close the application.
12. Launch Super Sound Joiner.
13. Click Options and name the file. We named the file mixTest.wav.
14. Click Add, then browse to where you saved the .wav files (default is the My Music directory).
15. Select all the songs, and then click Open.
16. From the top menu, click Join.
17. When the process completes, browse to where the joined .wav files are (default is the C:\ directory).
18. Close the application.

We performed the following steps to run this test:

Setup
1. Reset the system to the base test image.
2. Uninstall any previous versions of iTunes that HP pre-installed on the system.
3. Reboot the system.
4. Download iTunes 6.0 from http://www.apple.com/itunes/download/.
5. Launch the iTunes installer with setup defaults.
      a.   Choose Setup Language, and click OK.
      b.   Click Next at the Welcome to iTunes 6 Installer screen.
      c.   Select I accept the terms of the license agreement, and click Next.
      d.   Click Next at the About iTunes screen.
      e.   Accept the defaults, and click Next at the Setup Type screen.
      f.   Click Next at the Choose Destination Location screen.
      g.   Click Next at the Born to be together screen.
      h.   Click Finish at the Installation Successful screen.
6. Copy the mixTest.wav file to My Music.
7. Launch iTunes via its desktop icon.
8. Click Agree at the License Agreement.

9. Choose Always allow connections to this program on all ports from the Norton Internet Security Alert dialog that appears.
10. Use the default choices for iTunes Setup Assistant.
    a. Click Next at the Welcome to iTunes screen.
    b. Accept the defaults, and click Next at the Find Music Files screen.
    c. Accept the default, and click Next at the Keep iTunes Music Folder Organized screen.
    d. Accept the default, and click Finish at the iTunes Music Store screen.
    e. Click OK at the iTunes could not connect to the Music Store error that appears.
11. Under the Edit menu, select Preferences.
12. Click the Advanced tab.
13. Click the Importing tab.
14. From the drop-down menu next to Import Using, choose MP3 Encoder.
15. Uncheck Play songs while importing.
16. Uncheck Create filenames with track number.
17. Click OK.
18. Right click the mixTest file in the iTunes Library, and select Clear.
19. Check Do not ask me again, and click Remove.
20. Reboot system.

Running the test
1. Reboot the system.
2. Launch iTunes via its desktop icon.
3. From the file menu, select Add File to Library.
4. Browse to the My Music directory, and choose the test file (mixTest.wav) to add to the library.
5. Click Open after you select the file.
6. iTunes will now show this file in its song-list pane.
7. Right-click the file, and select the option Convert Selection to MP3.
8. During the encoding process, iTunes shows a new mixTest file being created with an Incomplete in the Time column beside it.
9. When the converting progress bar disappears, iTunes has finished the encoding.
10. Use Windows Explorer to locate the output mixTest.mp3 file in the iTunes directory within the My Music folder.
11. Right-click the file, and choose Properties.
12. Calculate the difference between the file Created and Modified times. This time is how long iTunes took to encode the file to .mp3 format.
13. Delete the .mp3 file, and clear any items in the iTunes Library.
14. Repeat two times.

We report the time, in seconds, that iTunes took to convert the file. The time we report is the difference of the file creation and modification times.

Lame 3.97a + MP3Gain

We used these applications to test the time each system takes to convert two .wav files into .mp3 files, while normalizing the sound of two additional .mp3 files at the same time.

Intel provided the four files this test uses. The files have the following key characteristics:

1. mixSK1a.wav
   - Length (mm:ss): 35:00
   - Size: 353 MB (370,527,962 bytes)
2. mixSK1b.wav
   - Length (mm:ss): 34:29
   - Size: 348 MB (365,025,044 bytes)
3. MixTestGain1.mp3
   - Length (hh:mm:ss): 1:09:29

- Size: 79.5 MB (83,400,107 bytes)
4. MixTestGain2.mp3
   - Length (hh:mm:ss): 1:09:29
   - Size: 79.5 MB (83,402,752 bytes)

This step requires two stopwatches.

We performed the following steps to run this test:

Setup
1. Reset the system to the base test image.
2. Create a folder in the C:\ directory named Lame.
3. Download the Lame binary to the C:\Lame directory from:
   http://softlab.technion.ac.il/project/LAME/html/lame.html.
4. Copy the following four files into the C:\Lame directory: mixSK1a.wav, mixSK1b.wav,
   MixTestGain1.mp3, and MixTestGain2.mp3.
5. Download and install with setup defaults mp3gain-win-full-1_2_5.exe from:
   http://mp3gain.sourceforge.net/download.php
   a. Click Next at the Welcome to the MP3Gain Setup Wizard screen.
   b. Click Next at the Choose Components screen.
   c. Click Install at the Installation Directory screen.
   d. Uncheck Run MP3Gain, and click Finish.
6. Reboot the system.

Running the test
1. Reboot the system, and reset the stopwatches.
2. Open a command prompt by clicking Start→Run→type cmd.
3. Go to the Lame directory by typing 'cd C:\Lame'.
4. Repeat steps 1 and 2 so you have two command prompts open.
5. Launch two instances of MP3Gain by clicking Start→All Programs→MP3Gain→MP3Gain twice.
6. Type lame.3.97a.icl-mt.exe –-nores –-mt mixSK1a.wav into one of the command prompts.
7. Type lame.3.97a.icl-mt.exe –-nores –-mt mixSK1b.wav into the other command prompt.
8. Click Add File(s) in one of the two MP3Gain windows.
9. Browse to the C:\Lame directory, and select MixTestGain1.mp3.
10. Click Add File(s) in the other MP3Gain window.
11. Browse to the C:\Lame directory, and select MixTestGain2.mp3.
12. Position the two command prompts in the lower left and lower right areas of the display.
13. Position the two MP3Gain windows in the upper left and upper right areas of the display.
14. Start Lame 3.97a by pressing the Enter key in each command prompt.
15. Click the Track Gain button in one of the MP3Gain windows, and start stopwatch #1.
16. Click the Track Gain button in the other MP3Gain window, and start stopwatch #2.
17. All four tasks should be running simultaneously.
18. Stop each stopwatch when its corresponding MP3Gain window has finished normalization.
19. Record how long each MP3Gain task took to complete.
20. Record the REAL time in each of the command prompts for the Lame tasks, and convert that time to
    seconds.
21. Sum the four task times, and divide by four to produce an average.
22. Delete the Lame mixSK1a.wav.mp3 and mixSK1b.wav.mp3 files output files and the MP3Gain
    mixTestGain1.mp3 and mixTestGain2.mp3 input files.
23. After deleting the mixTestGain1.mp3 and mixTestGain2.mp3 files, copy the originals back into the
    C:\Lame directory for the next run.
24. Repeat two times.

We report the times, in seconds, for all four tasks to complete. The times we report for the MP3Gain tasks
are stopwatch times, while for the Lame tasks we report the REAL time the Lame program lists for the
conversions.

Windows Media Encoder 9.0 with Advanced Profile

We used this application to test the time each system takes to encode an .avi file to a .wmv file.

Intel provided the file, kitesurfing.avi, this test uses. The file has the following key characteristics:

- Length (mm:ss): 2:01
- Size: 416 MB (436,644,352 bytes)
- Video resolution: 720 x 480

We performed the following steps to run this test:

Setup
1. Reset the system to the base test image.
2. Download and install Microsoft Media Player 10 with default settings from:
   http://www.microsoft.com/windows/windowsmedia/mp10/default.aspx.
   a. Click I Accept at the License Agreement screen.
   b. Click I Accept at the Confirm software download license agreement screen.
   c. Click Next at the Welcome screen.
   d. Click Next at the Select Your Privacy Options.
   e. Click Finish.
   f. Click No at the Do you want to search your computer for files that have not been added to the library yet screen.
   g. Close Windows Media Player 10.
3. Download and install Windows Media Encoder 9 with default settings from:
   http://www.microsoft.com/windows/windowsmedia/9series/encoder/default.aspx.
   a. Click Next at the Welcome screen.
   b. Select Accept at the License Agreement, and click Next.
   c. Click Next at the Installation Folder screen.
   d. Click Install to begin the installation process.
   e. Click Finish.
4. Copy the kitesurfing.avi to the My Videos directory.
5. Reboot the system.

Running the test
1. Reboot the system.
2. Launch Windows Media Encoder 9 by clicking Start→Programs→Windows Media→Windows Media Encoder.
3. Highlight Custom Session, and click OK.
4. Under the Sources tab, click the File radio button from the choices for Source from.
5. Click the Browse button, and navigate to the kitesurfing.avi file in the My Videos directory.
6. Click Open.
7. Click the Output tab.
8. Uncheck Pull from encoder in the center of the screen.
9. Check Encode to file towards the bottom of the screen.
10. Type Output in the File name box.
11. Click the Compression tab.
12. Click the Edit… button.
13. In the Media Types section, select Windows Media Video 9 Advanced Profile next to Video.
14. Click OK.
15. Click Apply. A dialog will appear stating that the output file has been renamed with a new extension.
16. Click OK.
17. Click the small green Start Encoding button at the top of the screen. The green progress bar at the bottom right of the screen will show the status of the encoding process.
18. When the encoding process completes, an Encoding Results window will appear.

19. Record the Session Duration.
20. Click Close.
21. Close Windows Media Encoder. A window will appear asking to save the session.
22. Click No.
23. Using Windows Explorer, find and delete the output.wmv file.
24. Repeat two times.

We report the time, in seconds, that Windows Media Encoder 9 took to encode the file. The time we report is the Session Duration time Windows Media Encoder 9 displays.

XMPEG 5.03 with DivX Pro codec 6.1

We used this application to test the time each system takes to encode an .mpg file to an .avi file.

Intel provided the hdwatermellon.mpg file this test uses. This file has the following key characteristics:

- Length (mm:ss): 00:24
- Size: 51.8 MB (54,349,828 bytes)
- Video resolution: 1920 x 1088

We performed the following steps to run this test:

Setup
1. Reset the system to the base test image.
2. Copy the hdwatermellon.mpg file to the My Documents directory.
3. Download DivX 6 Create Bundle with DivX Pro codec 6.1 from http://www.divx.com/divx/create/download/.
4. Install DivX 6 Create Bundle with default settings.
    a. Select language, and click OK.
    b. Click Next at the Welcome screen.
    c. Check the I accept the terms in the License Agreement, and click Next.
    d. Click Next at the Choose Components screen.
    e. Click Next at the Choose Install Location for DivX software screen.
    f. Click Next at the Free! Google Desktop screen.
    g. Click Close at the Installation Complete screen.
5. Reboot the system.
6. Download and install XMPEG 5.03 with default settings from http://www.free-codecs.com/XMPEG_download.htm.
    a. Select language, and click OK.
    b. Click Next at the Welcome to the XMPEG Setup Wizard screen.
    c. Click I Agree at the License Agreement screen.
    d. Click Next at the Choose Components screen.
    e. Click Next at the Choose Install Location screen.
    f. Click Install at the Choose Start Menu Folder screen.
    g. Click Next at the Installation Complete screen.
    h. Click Finish.
7. Close the readme file.
8. Click OK to the legal information.
9. Click the flashing red Warning: 20 iDCT tests not performed. Click here to proceed to a message to run a diagnostic test that optimizes the software for the system.
10. After optimization completes, a video conversion wizard dialog box appears. Uncheck Show this wizard at startup again, and choose Cancel.
11. Right click the XMPEG 5.0 window, and select Open….
12. Select the hdwatermellon.mpg is located in the My Documents directory, and click Open.
13. Right click the XMPEG 5.0 window again, and select Options.
14. Uncheck the boxes for auto under the Format and FPS sections.

15. Make sure the YV12 format is selected, and click OK.
16. Right click the XMPEG 5.0 window again, and select Set Plug-In options….
17. Highlight the DivX 6.1 Codec (1 Logical CPU).
18. Click Configure 1st pass.
19. Set the Certification Profile to Unconstrained.
20. Select Bitrate Based, and set to 1-pass at 8000 kbit/s.
21. Click the Codec tab, and select Insane Quality as the Encoding mode.
22. Click OK.
23. If a popup concerning purchasing DivX Pro appears, check Do not show this window again until the end of my trial, and click Close.
24. Click the Audio tab, and select No Compression.
25. Click OK.
26. Exit XMPEG.
27. Reboot the system.

Running the test
1. Reboot the system.
2. Launch XMPEG.
3. Right click the XMPEG 5.0 window, and select Open.
4. Select the hdwatermellon.mpg in the My Documents directory, and click Open.
5. Right click the XMPEG 5.0 window, and select Start Conversion….
6. When the encoding progress bar reaches 100%, the encoding is finished.
7. Exit XMPEG.
8. The program puts its output file, Output Video file.avi, in the C:\ directory. To calculate how long the conversion took, right click the Output video file.avi, select Properties, and subtract the Created time from the Modified time.
9. Repeat two times.

We report the time, in seconds, that XMPEG took to encode the file. The time we report is the difference of the file creation and modification times.

Appendix A: Test system price and purchase information

We purchased the two HP built-to-order systems on December 1, 2005 via www.hpshopping.com.

Figure 12 below presents the SKU and price information for the PCs.

System	HP Pavilion a1100e	HP Pavilion a1100y
Processor	AMD Sempron 3200+	Intel Celeron D 346
Processor frequency (GHz)	1.8	3.06
Part number	EG097AV#ABA	PY194AV#ABA
Unit price ($)	499.00	509.00
HP PC Instant Rebate ($)	100.00	100.00
Tax ($) [1]	0.00	0.00
Shipping ($) [2]	120.00	120.00
Total we paid ($)	519.00	529.00
HP PC Mail-In Rebate ($)	50.00	50.00
Effective price after rebate ($)	469.00	479.00

Figure 12: Purchase information for the two HP PCs.

Notes:
[1] www.hpshopping.com did not add any tax.
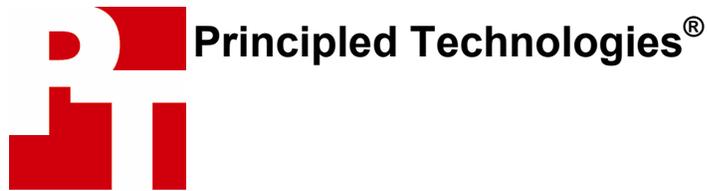[2] Expedited shipping for the complete order cost $120.00 per system.

Appendix B: Test system configuration information

This appendix provides detailed configuration information about the two test systems.

System	HP Pavilion a1100e	HP Pavilion a1100y
General		
Processor and OS kernel: (physical, core, logical) / (UP, MP)	1P1C1L / UP	1P1C1L / UP
Number of physical processors	1	1
Single/Dual Core processors	Single core	Single core
Processor HT Status	No	No
System Power Management Policy (AC/AlwaysOn, AC/Adaptive, DC/AlwaysOn, DC/Adaptive, Other)	AC / AlwaysOn	AC / AlwaysOn
CPU		
Segment (S=Server, D=Desktop, M=Mobile)	D	D
Vendor	AMD	Intel
Name	Sempron	Celeron D
Model number	Sempron 3200+	Celeron D 346
Stepping	E6	E0
Socket type and number of pins	Socket 939	LGA775
Core frequency (GHz)	1.8	3.06
Front-side bus frequency	HyperTransport 1600 MHz	533 MHz
L1 Cache	64 KB + 64 KB	16KB + 12 KB
L2 Cache	256 KB	256 KB
Platform		
Vendor	ASUSTek	ASUSTek
Motherboard model number	A8AE-LE (Amberine)	PTGV-LA (Grafito)
Motherboard chipset	ATI RS482	Intel i915GV
Motherboard revision number	0n31211CT101AMBEM00	0n31211CT101GRAFI00
System/motherboard serial number	MXG5480G5G	MXG5480JQY
Bios name and version	Phoenix Tech. V3.13	American Megatrends V3.04
BIOS settings	Setup default	Setup default
Memory module(s)		
Vendor and model number	Samsung M3 68L3223FUN-CCC	Hyundai Electronics HYMP532U64P6-E3
Type	PC3200	PC2-3200
Speed (MHz)	400	400
Speed running in the system (MHz)	400	400
Timing/Latency (tCL-tRCD-tRP-tRASmin)	3-3-3-8	3-3-3-8
Size	512 MB	512 MB
Number of sticks	2 x 256 MB	2 x 256 MB
Chip organization (Single-sided, Double-sided)	Single-sided	Single-sided
Channel (Single/Dual)	Dual	Dual
Hard disk		
Vendor and model number	Seagate ST380013AS	Seagate ST380013AS
Size	80 GB	80 GB
Buffer Size	8 MB	8 MB
RPM	7,200	7,200
Type	Serial ATA 1.5Gb/s	Serial ATA 1.5Gb/s
Controller	ATI SB400	Intel 82801FB (ICH6)

Driver	Microsoft version 5.1.2535.0	Microsoft version 5.1.2535.0
Operating system		
Name	Windows XP Home	Windows XP Home
Build number	2600	2600
Service pack	SP2	SP2
File system	NTFS	NTFS
Kernel	ACPI Uniprocessor PC	ACPI Uniprocessor PC
Language	English	English
Microsoft DirectX version	DirectX 9.0c	DirectX 9.0c
Graphics		
Vendor and model number	ATI Radeon Xpress 200	Intel 82915G/GV/910GL Graphics
Chipset	ATI Radeon Xpress 200 Chipset	Intel GMA 900
BIOS version	BK-ATI VER008.043I.008.000	Intel Video BIOS 3402
Type (P=PCI Express, A=AGP 8X, I=Integrated)	I	I
Memory size	256 MB	128 MB
Resolution	1024 x 768 x 32-bit color	1024 x 768 x 32-bit color
Driver	ATI 6.14.10.6553	Intel 6.14.10.4332
Sound card/subsystem		
Vendor and model number	Realtek AC97 Audio	Realtek High Definition Audio
Type (P=PCI, I=Integrated)	I	I
Driver	Realtek version 5.10.0.5840	Realtek version 5.10.0.5128
Network card/subsystem		
Vendor and model number	Realtek RTL8139/810x	Intel Pro/100VE
Type (P=PCI, I=Integrated)	I	I
Driver	Realtek version 5.621.304.2005	Intel version 8.0.15.0
Optical drive(s)		
Vendor and model number	TSSTcorp TS-H292C	TSSTcorp TS-H292C
Type (CD-ROM, CD-RW, DVD-ROM, DVD-W)	CD-RW (48x32x48)	CD-RW (48x32x48)
Interface (I=Internal, E=External)	I	I
USB ports		
Number	6 (2 front, 4 back)	6 (2 front, 4 back)
Type	2.0	2.0
Monitor		
CRT/LCD type (P=Plug & Play, T=TFT, R=Reflective)	CRT / P	CRT/ P
CRT/LCD refresh rate	60 Hz	60 Hz
Other information	MAG Innovision Model 786N	MAG Innovision Model 786N

Figure 13: System configuration information for both test systems.

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