

## Consumer notebook and desktop systems: Time savings from upgrading to current models

### Executive summary

Intel® Corporation (Intel) commissioned Principled Technologies (PT) to measure and compare three desktop and three notebook computers performing the following custom projects:

- Importing and burning AVCHD video to DVD (Project 1)
- Importing, resizing, and burning photo images to CD (Project 2)
- Copying a DVD to iPod touch (Project 3)
- Watching streaming high-definition video on PC (Project 4)

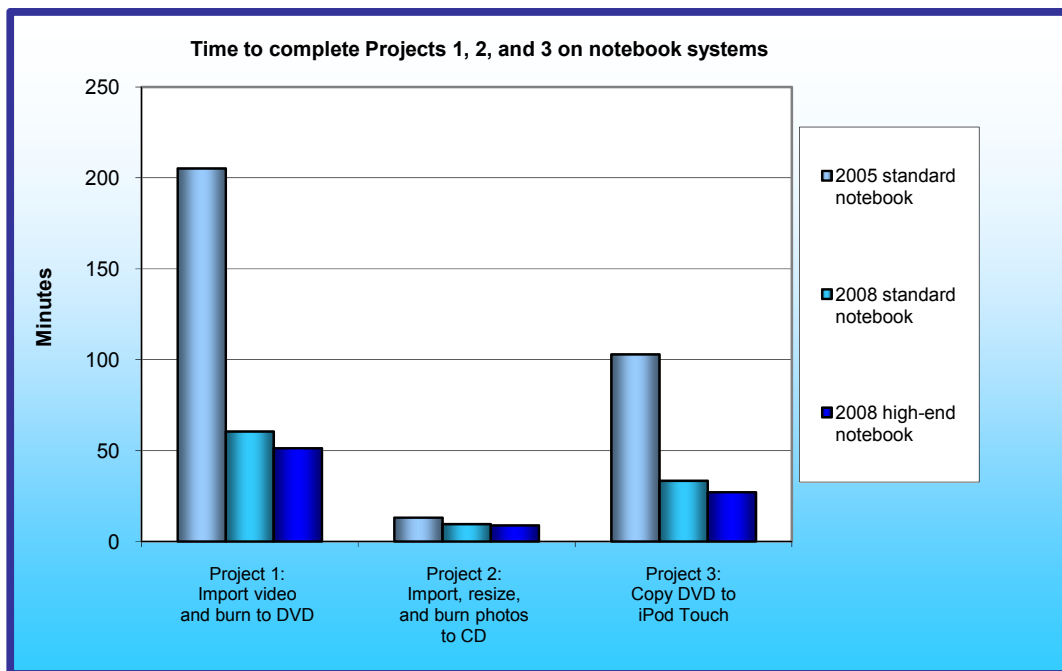
We tested three categories of notebook and desktop computer:

- 2005 standard shipping configuration (2005 standard)
- 2008 standard shipping configuration (2008 standard)
- 2008 maximum shipping configuration—featuring increased processor speed, hard drive size, memory, and video card power (2008 high-end)

Our goal was to measure the increase in speed that the latest generation of processors brought to our custom projects. We chose these projects because they represent

### KEY FINDINGS

- When importing and burning video to DVD, upgrading from the 2005 standard notebook to the 2008 standard notebook saved 2 hours and 25 minutes; upgrading to the 2008 high-end notebook saved 2 hours and 33 minutes. Upgrading from the 2005 standard desktop to the 2008 standard desktop saved 57 minutes; upgrading to the 2008 high-end desktop saved 1 hour and 10 minutes (see Figures 1 through 3).
- When copying a DVD to iPod touch, upgrading from the 2005 standard notebook to the 2008 standard notebook saved 1 hour and 9 minutes; upgrading to the 2008 high-end notebook saved 1 hour and 15 minutes. Upgrading from the 2005 standard desktop to the 2008 standard desktop saved 37 minutes; upgrading to the 2008 high-end desktop saved 43 minutes (see Figures 1 through 3).
- Only the 2008 systems could acceptably play streaming high-definition video (see Figure 4.)



**Figure 1. Median time, in minutes, the three notebook systems we tested took to complete Projects 1, 2, and 3. Lower numbers, indicating shorter times, are better.**

realistic testing scenarios that commonly occur within consumer households. We provide details on the projects in the Project scenarios section. As the Key Findings state and the Test results show in detail, upgrading from the 2005 desktop or notebook system to either of the two 2008 systems yielded considerable time savings in completing the tasks. Upgrading these systems also made it

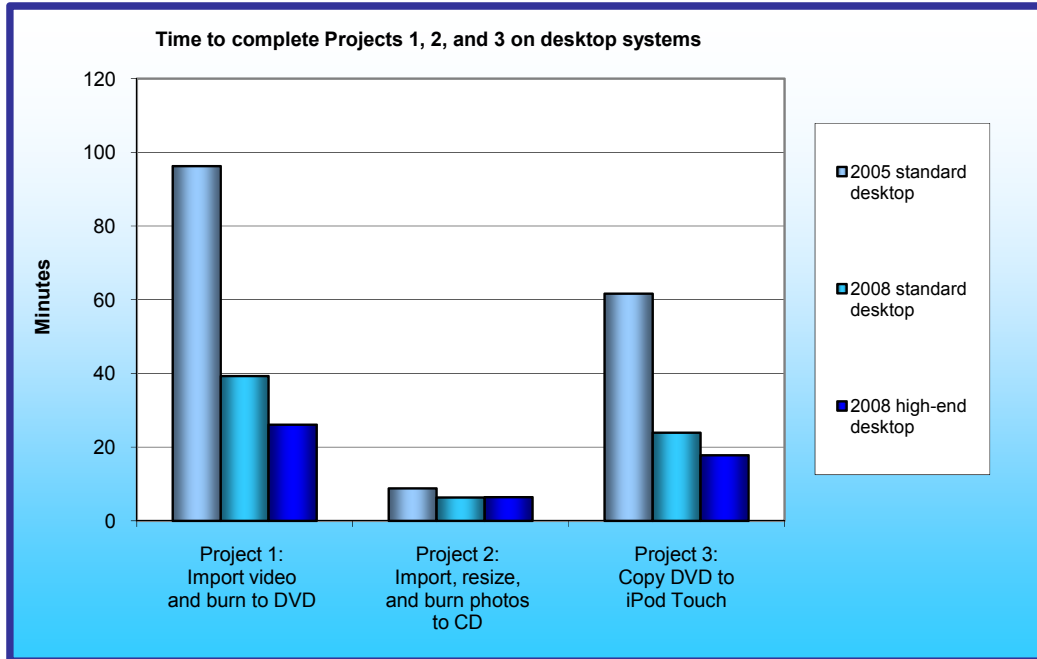


Figure 2. Median time, in minutes, the three desktop systems we tested took to complete Projects 1, 2, and 3. Lower numbers, indicating shorter times, are better.

possible to acceptably view and listen to streaming high-definition video; the four 2008 systems provided very good or perfect video and audio quality while the 2005 notebook provided slideshow-like playback and the 2005 desktop provided very good audio but unwatchable video playback.

The Applications and Methodology sections provide details on our tests and the applications we used. Appendix

A provides system disclosure information.

## Test results

Figure 3 shows the median times the six systems we tested took to complete three scenarios. (We conducted each test three times and report the median time.)

Project	Notebook systems			Desktop systems		
	2005 standard	2008 standard	2008 high-end	2005 standard	2008 standard	2008 high-end
Project 1: Total time to import video from camera and burn to DVD	3 hours 25 minutes	1 hour 0 minutes	51 minutes	1 hour 36 minutes	39 minutes	26 minutes
Project 2: Total time to import photos from camera, fix red eye, resize, and burn to CD	13 minutes	9 minutes	8 minutes	8 minutes	6 minutes	6 minutes
Project 3: Total time to copy DVD to iPod touch	1 hour 42 minutes	33 minutes	27 minutes	1 hour 1 minute	23 minutes	17 minutes

Figure 3: Median times the six systems we tested took to complete three scenarios. Lower numbers, indicating shorter times, are better.

When importing and burning video to DVD (Project 1), upgrading from the 2005 standard notebook to the 2008 standard notebook saved 2 hours and 25 minutes; upgrading to the 2008 high-end 2005 notebook saved 2 hours and 33 minutes. Upgrading from the 2005 standard desktop to the 2008 standard desktop saved 57 minutes; upgrading to the 2008 high-end desktop saved 1 hour and 10 minutes.

When importing photos from camera, fixing red eye, resizing, and burning to CD (Project 2), upgrading from the 2005 standard notebook to the 2008 standard notebook saved 4 minutes; upgrading to the 2008 high-end notebook saved 5 minutes. Upgrading from the 2005 standard desktop to either the 2008 standard desktop or the 2008 high-end desktop saved 2 minutes.

When copying a DVD to iPod touch (Project 3), upgrading from the 2005 standard notebook to the 2008 standard notebook saved 1 hour and 9 minutes; upgrading to the 2008 high-end notebook saved 1 hour and 15 minutes. Upgrading from the 2005 standard desktop to the 2008 standard desktop saved 37 minutes; upgrading to the 2008 high-end desktop saved 43 minutes.

Figure 4 shows the median qualitative ratings for watching streaming video on the six systems we tested, and Figure 5 shows the assessment scales we used. As Figure 4 shows, all of the 2008 systems produced very good or perfect video and audio, while the 2005 standard desktop produced very listenable audio but unwatchable video, and the 2005 standard notebook provided slideshow-like playback.

Watch streaming high-definition Internet video	Notebook systems			Desktop systems		
	2005 standard	2008 standard	2008 high-end	2005 standard	2008 standard	2008 high-end
Video rating	1	4	4	2	5	5
Audio rating	1	5	5	4	5	5

Figure 4: Median qualitative ratings for watching streaming video on the six systems we tested. Higher scores, indicating better quality (see Figure 5), are better.

Video playback assessment scale	Audio playback assessment scale
5 = Perfect picture quality (HD quality)	5 = Perfect sound quality (CD quality)
4 = Occasional jitter but very watchable	4 = Occasional sound oddity (pop, boing, dropout) but very listenable
3 = Noticeable jitter but still watchable	3 = Noticeable sound oddities but still listenable
2 = Bad jitter or unwatchable	2 = Many sound oddities or hard-to-understand speech, unlistenable
1 = Slideshow or no playback	1 = Complete breaks in sound or no sound

Figure 5: Video and audio playback assessment scales.

## Project scenarios

We created a realistic home scenario to illustrate the benefits of an upgraded PC in consumer functions. Our scenario involves four members of the Anderson family. Susan Anderson is a social worker who is training for the Boston Marathon. Her husband, Tom, is a police officer. They have two children, 16-year-old Ashley and 13-year-old Charles, and a pet rabbit. The family shares one computer, which they keep in their living room.

The scenario includes the following projects, each of which involves a different member of the family.

- Project 1: For a school project on animal behavior, Charles uses the family's video camera to record their pet rabbit in its cage; he then saves the video to DVD.
- Project 2: After receiving a digital camera for her birthday, Ashley takes photos at her party and saves them on a CD to share with her friends.
- Project 3: After receiving a DVD of the Boston Marathon as a gift, Susan copies it to her iPod touch so that she can watch it during her daily bus commute.
- Project 4: As he tries to select a movie for the family to see together, Tom goes online to view the trailer.

Each of these projects involves a number of basic operations, such as opening, editing, and closing files. The results of the scenario are the response times for each of these operations. The number of timed operations in each project ranges from one to three and depends on the complexity of the project. We used realistic operations and content for all tests. The Scenario descriptions section provides more details on each project, the files it uses, and the operations we timed.

## Project 1: Importing and burning AVCHD video to DVD

### Story summary

For a school project on animal behavior, Charles uses the family's Sony HDR-SR1 video camera to record their pet rabbit in its cage. Using Adobe Premiere Elements 7, he transfers the video to the computer's hard drive and then burns it to a DVD-R.

### Applications

- Adobe Premiere Elements 7

### Content

- One audio and video compression for high definition (AVCHD) file:
  - File size: 1.72 GB (1,855,684,508 bytes)
  - Length: 20 minutes, 0 seconds

### Timed operations

- Adobe Premiere Elements 7 importing the video from the camera to the hard drive
- Adobe Premiere Elements 7 burning the video to the DVD-R

## Project 2: Importing, resizing, and burning photo images to CD

### Story summary

After receiving a Canon PowerShot SD870 IS digital camera for her birthday, Ashley takes photos at her party and saves them on a CD to share with her friends. Using Adobe Photoshop Elements 7, she transfers the photos to the computer's hard drive; auto fixes redeye, resizes them, and then burns them to a CD-R.

### Applications

- Adobe Photoshop Elements 7

### Content

- 75 10-megapixel JPEG images:
  - File size: 2.10 MB (2,205,129 bytes) to 5.60 MB (5,874,999 bytes)
  - JPEG resolution: 3,648 x 2,736
  - Folder size: 320 MB (336,428,581 bytes)

### Timed operations

- Adobe Photoshop Elements 7 importing the photos from the camera to the hard drive
- Adobe Photoshop Elements 7 resizing the photos
- Adobe Photoshop Elements 7 burning the photos to a CD-R

## Project 3: Copying a DVD to iPod touch

### Story summary

After receiving a DVD of the Boston Marathon as a gift, Susan copies it to her iPod touch so that she can watch it during her daily bus commute. Using CloneDVD Mobile, she copies the video to her hard drive. She then uses iTunes 8 to synchronize the resulting movie output file to her iPod touch.

### Applications

- CloneDVD Mobile
- iTunes 8

### Content

- Boston Marathon Raw Video DVD consisting of 3 chapters:
  - Chapter 1: Raw footage from US Women's Olympic Trials (24:14)
  - Chapter 2: Raw footage from 2008 Boston Marathon (pre-race and first half) (25:20)
  - Chapter 3: Raw footage from 2008 Boston Marathon (second half and finish) (21:01)
- Video\_TS properties:
  - Size: 4.00 GB (4,297,928,704 bytes)

- Contains: 18 files, 0 folders

### Timed operations

- CloneDVD creating the video file from the DVD
- CloneDVD post processing the movie output file
- iTunes 8 syncing the resulting movie output file to iPod touch

## Project 4: Watching streaming high-definition Internet video on PC

### Story summary

As he selects a movie for the family to see together, Tom decides to view the HD version of the trailer for Watchmen, a movie his son recommended. To do so, he goes online via his Linksys WRT600N Dual-Band Wireless-N Gigabit Router with Storage Link. He opens Internet Explorer and visits [www.fancast.com](http://www.fancast.com) to locate the trailer. Once he has done so, he views it using Adobe Flash Player.

### Applications

- Microsoft Internet Explorer
- Adobe Flash Player

### Content

- Watchmen: HD Trailer 1 at [www.fancast.com](http://www.fancast.com)

## Methodology

### Importing and burning AVCHD video to DVD

PT used a Sony HDR-SR1 video camera to create the Audio and Video Compression for High Definition (AVCHD) file. The file has the following key characteristics:

- File size: 1.72 GB (1,855,684,508 bytes)
- Length: 20 minutes, 0 seconds

PT used Adobe Premiere Elements 7 to import and burn the AVCHD video camera footage.

### Setting up the test

1. Reset the system to the base test image.
2. Install Premiere Elements 7:
  - a. Insert the Adobe Premiere Elements 7 DVD.
  - b. Click Run AutoPlay.exe.
  - c. Click Install Adobe Premiere Elements 7.
  - d. Select English, and click OK.
  - e. At the Welcome screen, click Next.
  - f. At the Adobe License Agreement screen, click Accept.
  - g. At the Customer Information screen, enter the serial number and country, and click Next.
  - h. At the Choose your default TV format screen, select NTSC, and click Next.
  - i. At the Setup Type screen, select Complete, and click Next.
  - j. At the Destination Folder screen, leave the default C:\ drive selected, and click Next.
  - k. At the Ready to Install screen, click Install.
  - l. At the Installation Completed screen, click Finish.
3. At the Reboot prompt, reboot the system.

### Running the test

1. After the system reboots, wait 10 minutes.
2. Connect the Sony HDR-SR1 video camera via USB to the system.
3. Close AutoPlay.
4. Launch Premiere Elements 7 by double-clicking the desktop icon.
5. Click New Project.
6. Click Change Settings.
7. Select NTSC→AVCHD→HD 1080i 30, and click OK.

8. Name the project, assign the save directory, and click OK.
9. Click Get Media.
10. Click AVCHD or other hard disk/memory camcorder.
11. From the Get Media drop-down menu, select Camera or Card Reader.
12. From the Rename Files drop-down menu, select Custom Name.
13. Type `Test` in the Enter custom name here dialog box.
14. Simultaneously click Get Media and start the stopwatch.
15. An Importing progress bar appears, followed immediately by an Adding Media progress bar. When the Adding Media progress bar disappears, stop the stopwatch, and record your results.
16. Allow Conforming Test to finish.
17. Click Instant Movie.
18. Drag and drop the AVCHD files to the Sceneline at the bottom of the screen.
19. Insert a blank DVD-R into the system's CD/DVD-RW drive.
20. Close AutoPlay.
21. Click Share.
22. Click Disc.
23. Enter a name for the DVD-R.
24. Simultaneously click Burn and start the stopwatch. A progress bar will appear.
25. When the Burn Completed dialog appears, stop the stopwatch, and record your results.
26. Click Done.
27. Close Premiere. Choose No to save changes.
28. Delete the encoded file from the save directory.
29. Empty the Recycle Bin.
30. Repeat these steps four more times, rebooting between runs.

We report the times, in seconds, that Premiere Elements 7 took to import the AVCHD file from the video camera and burn the file to DVD. Lower times indicate faster performance and are therefore better.

### Importing, resizing, and burning photo images to CD

PT used a Canon PowerShot SD870 IS camera to create the 75 10-megapixel JPEG images. They have the following key characteristics:

- File size: 2.10 MB (2,205,129 bytes) to 5.60 MB (5,874,999 bytes)
- JPEG resolution: 3,648 x 2,736
- Folder size: 320 MB (336,428,581 bytes)

PT used Adobe Photoshop Elements 7 to resize and burn the photos.

### Setting up the test

1. Reset the system to the base test image.
2. Install Photoshop Elements 7:
  - a. Insert the Adobe Photoshop Elements 7 DVD.
  - b. Click Run AutoPlay.exe.
  - c. Click Install Adobe Photoshop Elements 7.
  - d. At the Welcome screen, click Next.
  - e. At the Adobe License Agreement screen, click Accept.
  - f. At the Product Serialization screen, enter the serial number, and click Next.
  - g. At the Destination Folder screen, leave the default C:\ drive selected, and click Next.
  - h. At the Ready to Install screen, click Install.
  - i. At the Installation Completed screen, click Finish.
  - j. Click Yes to restart the system.
4. Launch Photoshop Elements 7 by double-clicking the desktop icon.
5. Click Organize.
6. At the Photoshop Elements Organizer dialog, click No.
7. At the Adobe Updater dialog, click Cancel.
8. Exit Photoshop Elements 7.
9. Reboot the system.

## Running the test

1. After the system reboots, wait 10 minutes.
2. Connect the Canon PowerShot SD870 IS camera via USB to the system.
3. At the AutoPlay prompt, click Organize and Edit using Adobe Photoshop Elements 7.0.
4. Click Advanced.
5. From the Rename Files drop-down menu, select Custom Name.
6. Type `Test` in the Enter custom name here dialog box.
7. Under Advanced Options, check Automatically Fix Red Eyes.
8. Simultaneously click Get Photos and start the stopwatch.
9. A progress bar appears. When the progress bar disappears, stop the stopwatch, and record your results.
10. Photoshop Elements 7 automatically launches.
11. When the Fixing red eye progress bar appears, start the stopwatch.
12. When the Fixing red eye progress bar disappears, stop the stopwatch, and record your results.
13. At the Photoshop Elements dialog, check Don't show me this again, and click OK.
14. Click the first JPEG, and press `Ctrl+A` to select all photos.
15. Allow Generating Thumbnails to finish.
16. Open the Export dialog by pressing `Ctrl+E`.
17. Select JPEG file type.
18. From the Photo Size drop-down menu, select 1,024 x 768.
19. Set the Quality Level to 5.
20. Simultaneously click Export and start the stopwatch. A progress bar will appear.
21. When Photoshop Elements 7 has finished resizing all the photos, it displays a You have successfully exported 75 files dialog. When that happens, stop the stopwatch, and record your results. DO NOT check Don't show again.
22. Click OK.
23. Insert a blank CD-R into the system's CD/DVD-RW drive.
24. Close AutoPlay.
25. In Photoshop Elements 7, click `File→Make a CD/DVD`.
26. Select the Destination CD/DVD-RW drive.
27. Enter a name for the CD-R.
28. Simultaneously click OK and start the stopwatch. A progress bar will appear.
29. When the Verify Disc dialog appears, stop the stopwatch, and record your results.
30. Click Don't Verify.
31. When the Disc one is done prompt appears, click OK.
32. Delete all the edited JPEG images from the Photos workload directory.
33. Empty the Recycle Bin.
34. Repeat these steps four more times, rebooting between runs.

We report the time, in seconds, that Photoshop Elements 7 took to import the files from the camera, automatically fix red eye, resize and export the files, and burn the files to CD. Lower times indicate faster performance and are therefore better.

## Copying a DVD to iPod touch

PT used CloneDVD Mobile to copy and post-process the Intel-provided DVD, and used iTunes 8 to synchronize the resulting movie output file to iPod touch.

## Setting up the test

1. Reset the system to the base test image.
2. Download and install iTunes 8 with the following settings from [www.apple.com/itunes/download/](http://www.apple.com/itunes/download/).
  - a. At the Welcome to the InstallShield Wizard screen, click Next.
  - b. At the License Agreement screen, select I accept the terms in the license agreement, and click Next.
  - c. At the Choose iTunes Installer Options screen, uncheck Automatically update iTunes and other Apple software, and click Install.
  - d. At the Congratulations screen, click Finish.
  - e. At the License Agreement screen, click Agree.
  - f. At the Welcome to iTunes screen, click Next.
  - g. At the Find Music Files screen, uncheck both the Add MP3 and AAC files option and the Add WMA

- files option, and click Next.
  - h. At the Keep iTunes Music Folder Organized screen, select No, I'll change the file and folder names myself, and click Next.
  - i. At the Download Album Artwork screen, click Next.
  - j. At the iTunes Music Store screen, select No, take me to my iTunes Library, and click Finish.
  - k. Connect the iPod touch device.
  - l. Under the Summary tab, check Manually manage music and videos.
  - m. Click Apply.
  - n. With the iPod touch content empty, eject the iPod touch.
  - o. Exit iTunes.
3. Download and install CloneDVD Mobile with the following settings from <http://www.slysoft.com/en/download.html>.
    - a. At the Installation Options screen, click Next.
    - b. At the Installation Directory screen, click Install.
    - c. At the Setup Complete screen, click Close.
  4. Reboot the system.

### Running the test

1. After the system reboots, wait 10 minutes.
2. Insert the DVD into the DVD-ROM.
3. Close AutoPlay.
4. Launch CloneDVD Mobile by double-clicking the desktop icon.
5. At the evaluation dialog, click Continue.
6. At the Where do you want to copy today screen, select Apple iPod touch, and click Next.
7. Click Browse, select the DVD video files, and click OK.
8. Click Next.
9. At the Audio and Subtitle Settings, accept the defaults, and click Next.
10. At the Output Method screen, slide the slider bar to the maximum video quality.
11. Click Go, and name the file.
12. Simultaneously click Save and start the stopwatch.
13. A Progress bar appears. When CloneDVD has created the video file, stop the stopwatch, and record your results.
14. A Post processing output file dialog immediately appears.
15. Start the stopwatch.
16. When the Post processing output file dialog says Creation of media file was successful, stop the stopwatch, and record your results.
17. Click OK.
18. Close CloneDVD Mobile.
19. Connect the iPod touch device. iTunes automatically launches.
20. Select Movie Library, located in the left column.
21. From the upper menu, click File→Add File to Library.
22. Browse to the movie file directory, select it, and click Open.
23. Simultaneously drag the movie file to the iPod touch device and start the stopwatch.
24. A Progress bar appears. When iTunes has synced the movie, stop the stopwatch, and record your results.
25. Delete the movie output file from the iTunes library and from the iPod touch device.
26. Check Do not ask me again, and click Remove.
27. Click Move to Recycle Bin.
28. Empty the Recycle Bin.
29. Repeat these steps four more times, rebooting between runs.

We report the times, in seconds, that CloneDVD took to convert and post process the digital copy to MPEG-4 format, and the time iTunes took to sync the MPEG-4 file to the iPod touch device. Lower times indicate faster performance and are therefore better.



## Watching streaming high-definition Internet video on a PC

PT used Adobe Flash Player to play the streaming high-definition Internet video. PT chose the HD movie trailer. Note that the 2005 standard notebook connected to the Linksys WRT600N Dual-Band Wireless-N Gigabit Router with Storage Link via its 802.11g network adapter and the 2008 systems connected via their 802.11n network adapters. All three desktops connected via their Gigabit Ethernet adapters.

PT used the following assessment scales to assess the subjective user experience:

### Video playback assessment scale

- 5 = Perfect picture quality (HD quality)
- 4 = Occasional jitter but very watchable
- 3 = Noticeable jitter but still watchable
- 2 = Bad jitter or unwatchable
- 1 = Slideshow or no playback

### Audio playback assessment scale

- 5 = Perfect sound quality (CD quality)
- 4 = Occasional sound oddity (pop, boing, dropout) but very listenable
- 3 = Noticeable sound oddities but still listenable
- 2 = Many sound oddities or hard-to-understand speech, unlistenable
- 1 = Complete breaks in sound or no sound

### Setting up the test




1. Reset the system to the base test image.
2. Download and install Adobe Flash Player with the following settings from <http://get.adobe.com/flashplayer/?promoid=DXLUJ>.
  - a. Uncheck Install Free Google Toolbar.
  - b. Click Agree and install now.
  - c. Click Install ActiveX Control.
  - d. Click Install.
3. Go to <http://www.timewarnercable.com/Carolinas/products/speedtest.html>, and note download bandwidth. Verify download bandwidth is 6 Mbs or greater.
4. Reboot the system.

### Running the test

1. After the system reboots, wait 10 minutes.
2. Open a browser window by clicking Start→All Programs→Internet Explorer.
3. In the Address line, type [www.fancast.com](http://www.fancast.com), and press Enter.
4. Type HD in the search bar.
5. Click Watchmen: Watchmen: HD Trailer 1.
6. When the trailer starts playing, click Full screen.
7. Watch the entire video trailer.
8. Note the quality of video according to the Video playback assessment scale and the quality of audio according to the Audio playback assessment scale, and record your rating.
9. Repeat these steps four more times, rebooting between runs.

## Appendix A – Test system information

This appendix provides detailed configuration information about the test systems we used. Figure 6 provides configuration information about the notebook systems, and Figure 7 provides configuration information about the desktop systems.

System	Sony Vaio VGN-FS550 Intel Pentium M 730 1.60 GHz	Sony Vaio NS140E/S Intel Mobile Core 2 Duo T7250 2 GHz	Sony Vaio AW125J/H Intel Mobile Core 2 Duo P8400 2.26 GHz
			
<b>General</b>			
Processor and OS kernel: (physical, core, logical)/(UP, MP)	1P1C1L/UP	1P2C2L/MP	1P2C2L/MP
Number of physical processors	1	1	1
Single/dual core processors	Single	Dual	Dual
System power management policy	VAIO Optimized	VAIO Optimized	VAIO Optimized
Processor power-saving option	EIST	EIST	EIST
System dimensions (length x width x height)	14-1/4" x 10-1/2" x 1-1/2"	14-1/4" x 10-1/2" x 1- 1/2"	17-1/4" x 11-1/2" x 1- 1/4"
System weight	6 lbs. 4 oz.	6 lbs.	7 lbs. 13.5 oz.
<b>CPU</b>			
Vendor	Intel	Intel	Intel
Name	Pentium M	Mobile Core 2 Duo	Mobile Core 2 Duo
Model number	730	T5800	P8400
Stepping	8	D	6
Socket type and number of pins	Socket 479 mPGA	Socket P (478)	Socket P (478)
Core frequency (GHz)	1.60	2.00	2.26
Front-side bus frequency (MHz)	533	800	1,066
L1 cache	32 KB + 32 KB	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache (MB)	2	2	3
<b>Platform</b>			
Vendor	Sony	Sony	Sony
Motherboard model number	VGN-FS550	VGN-NS140E	VGN-AW125J
Motherboard chipset	Intel i915GMS	Intel GM45	Intel PM45
Motherboard revision number	03	07	07
System/motherboard serial number	C20009ZH	C6UDFSCY	C600XH82
BIOS name and version	Phoenix Technologies LTD R0070J0 (12/19/2004)	American Megatrends Inc. R0190Y3 (07/09/2008)	American Megatrends Inc. R0200Y2 (08/12/2008)

<b>System</b>	<b>Sony Vaio VGN-FS550 Intel Pentium M 730 1.60 GHz</b>	<b>Sony Vaio NS140E/S Intel Mobile Core 2 Duo T7250 2 GHz</b>	<b>Sony Vaio AW125J/H Intel Mobile Core 2 Duo P8400 2.26 GHz</b>
BIOS settings	Default	Default	Default
<b>Memory module(s)</b>			
Vendor and model number	Infineon 64D32020GDL6C	Hyundai HYMP125S64CP8-S6 HYMP112S64CP6-S6	Qimonda 64T25602EDL2.5C2
Type	PC-2700	PC2-6400	PC2-6400
Speed (MHz)	333	800	800
Speed running in the system (MHz)	333	800	800
Timing/latency (tCL-tRCD-tRP-tRASmin)	2.5-3-3-7	6-6-6-18	6-6-6-18
Size (MB)	512	3,072	4,096
Number of memory module(s)	2 x 256 MB	1 X 2,048 MB, 1 x 1,024 MB	2 x 2,048 MB
Chip organization	Double-sided	Double-sided	Double-sided
Channel	Dual	Dual	Dual
<b>Hard disk</b>			
Vendor and model number	Hitachi DK23FA-80	Seagate ST9250827AS	Hitachi HTS723232L9SA60
Size (GB)	80	250	320
Buffer size (MB)	8	8	16
RPM	4,200	5,400	7,200
Type	Ultra ATA/66	SATA 3Gb/s	SATA 3Gb/s
Controller	Intel 82801FBM ICH6-M	Intel 82801IM ICH9-M	Intel 82801IM ICH9-M
Driver	Intel 6.1.0.1004 (03/24/2004)	Microsoft 6.0.6001.1800 (06/21/2006)	Microsoft 6.0.6001.18000 (06/21/2006)
<b>Operating system</b>			
Name	Microsoft Windows XP Home Edition	Microsoft Windows Vista Home Premium	Microsoft Windows Vista Home Premium x64
Build number	2600	6001	6001
Service pack	3	1	1
File system	NTFS	NTFS	NTFS
Kernel	ACPI Uniprocessor PC	ACPI x86-based PC	ACPI x64-based PC
Language	English	English	English
Microsoft DirectX version	DirectX 9.0c	DirectX 10	DirectX 10
<b>Graphics</b>			
Vendor and model number	Intel GMA 900	Intel Mobile 4 Series Express Chipset	NVIDIA GeForce 9600M GT
Type	Integrated	Integrated	Discrete
Chipset	Mobile Intel 915GM Express chipset	Intel GMA 4500MHD	NVIDIA 9600M GT
BIOS version	3412	1654	62.94.3c.0.39
Memory size (MB)	128	128	512
Resolution	1,280 x 800	1,280 x 800	1,920 x 1,080
Driver	Intel 6.14.10.3929 (10/8/2004)	Intel 7.15.10.1511 (06/27/2008)	NVIDIA 7.15.11.7622 (7/24/2008)

<b>System</b>	<b>Sony Vaio VGN-FS550 Intel Pentium M 730 1.60 GHz</b>	<b>Sony Vaio NS140E/S Intel Mobile Core 2 Duo T7250 2 GHz</b>	<b>Sony Vaio AW125J/H Intel Mobile Core 2 Duo P8400 2.26 GHz</b>
<b>Sound card/subsystem</b>			
Vendor and model number	Realtek High Definition Audio	Realtek High Definition Audio	Bluetooth Hands-free Audio Realtek High Definition Audio NVIDIA HDMI Audio
Driver	Realtek Semiconductor Corp. 5.10.0.5035 (11/3/2004)	Realtek Semiconductor Corp. 6.0.1.5653 (06/27/2008)	Broadcom Corp. 6.2.0.4400 (7/15/2008) Realtek Semiconductor Corp. 6.0.1.5648 (06/20/2008) NVIDIA 1.0.0.30 (06/25/2008)
<b>Ethernet</b>			
Vendor and model number	Intel PRO/100 VE	Marvell Yukon 88E8055	Marvell Yukon 88E8055
Driver	Intel 8.0.13.0 (08/19/2004)	Marvell 10.57.3.3 (04/04/2008)	Marvell 10.53.2.3 (01/18/2008)
<b>Wireless</b>			
Vendor and model number	Intel PRO/Wireless 2200BG	Intel WiFi Link 5100	Intel WiFi Link 5100
Driver	Intel 9.0.1.9 (10/29/2004)	Intel 12.0.0.73 (04/27/2008)	Intel 12.0.0.73 (04/27/2008)
<b>Modem</b>			
Vendor and model number	HDAUDIO SoftV92 Data Fax Modem	HDAUDIO SoftV92 Data Fax Modem	HDAUDIO SoftV92 Data Fax Modem
Driver	CXT 7.12.12.0 (10/1/2004)	CXT 7.62.0.50 (02/12/2007)	CXT 7.62.0.50 (02/12/2007)
<b>Optical drive(s)</b>			
Vendor and model number	Matshita UJ-831Da	Optiarc AD-7560S	Matshita BD-MLT UJ230AS
Type	24x CD-R Write, 8x DVD-R Write	24x CD-R Write, 8x DVD-R Write	24x CD-R Write, 8x DVD-R Write
<b>USB ports</b>			
Number	3	4	3
Type	2.0	2.0	2.0
Other	Media card reader	Media card reader	Media card reader
<b>IEEE 1394 ports</b>			
Number	1	1 (S400)	1
<b>Monitor</b>			
LCD type	WXGA LCD	WXGA LCD	TFT Active Matrix
Screen size (inches)	15.4	15.4	18.4
Refresh rate (Hz)	60	60	60

<b>System</b>	<b>Sony Vaio VGN-FS550 Intel Pentium M 730 1.60 GHz</b>	<b>Sony Vaio NS140E/S Intel Mobile Core 2 Duo T7250 2 GHz</b>	<b>Sony Vaio AW125J/H Intel Mobile Core 2 Duo P8400 2.26 GHz</b>
<b>Battery</b>			
Type	Sony VGP-BPS2A Lithium Ion	Sony VGP-BPS13/B Lithium Ion	Sony VGP-BPS13/B Lithium Ion
Size (length x width x height)	8" x 2" x 3/4"	8" x 2-1/4" x 3/4"	8" x 2-1/4" x 3/4"
Rated capacity	4400mAh/11.1V (49Wh)	4400mAh/11.1V (49Wh)	4400mAh/11.1V (49Wh)
Weight (oz.)	11	11	11

Figure 6: Notebook test system configurations.

<b>System</b>	<b>HP Compaq dc5100 Intel Pentium 4 640 3.20 GHz</b>	<b>HP Pavilion a6660t Intel Core 2 Duo E7300 2.6 GHz</b>	<b>HP Pavilion Elite d5100t Intel Core 2 Quad Q9300 2.5 GHz</b>
			
<b>General</b>			
Processor and OS kernel: (physical, core, logical)/(UP, MP)	1P1C2L/UP	1P2C2L/MP	1P4C4L/MP
Number of physical processors	1	1	1
Single/dual/quad-core processors	Single	Dual	Quad
System power management policy	Home/office desk	Recommended settings	Recommended settings
<b>CPU</b>			
Vendor	Intel	Intel	Intel
Name	Pentium 4	Core 2 Duo	Core 2 Quad
Model number	640	E7300	Q9300
Stepping	3	6	7
Socket type	Socket LGA775	Socket LGA775	Socket LGA775
Core frequency (GHz)	3.20	2.66	2.50
Front-side bus frequency (MHz)	800	1,066	1,333
L1 cache	16 KB + 12 Kμops	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	2 MB	3 MB	2 x 3 MB
<b>Platform</b>			
Vendor and model number	Hewlett-Packard	Pegatron Corporation	Pegatron Corporation
Motherboard model number	09E0h	Benicia	Burbank
Motherboard chipset	Intel i915P/i915G	Intel P35/G33/G31	Intel P35/G33/G31
Motherboard revision number	B1	A2	A2
Motherboard serial number	2UA5450DVV	MXV90100Z3	MXV90101T8
BIOS name and version	Hewlett-Packard 786C2 v01.08 (04/17/2006)	American Megatrends Inc. 5.35 (12/16/2008)	American Megatrends Inc. 5.20 (10/08/2008)
BIOS settings	Default	Default	Default
<b>Memory module(s)</b>			
Vendor and model number	Micron Technology 4HTF3264Y-53EB2	Hyundai Electronics HYMP112U64CP8-S6	Hyundai Electronics HYMP112U64CP8-S6
Type	PC2-4200	PC2-6400	PC2-6400
Speed (MHz)	533	800	800
Speed running in the system (MHz)	533	800	800
Timing/latency (tCL-tRCD- tRP-tRASmin)	4-4-4-12	6-6-6-18	6-6-6-18

<b>System</b>	<b>HP Compaq dc5100 Intel Pentium 4 640 3.20 GHz</b>	<b>HP Pavilion a6660t Intel Core 2 Duo E7300 2.6 GHz</b>	<b>HP Pavilion Elite d5100t Intel Core 2 Quad Q9300 2.5 GHz</b>
Size (MB)	512	2,048	4,096
Number of memory module(s)	2 x 256 MB	2 x 1,024 MB	4 x 1,024 MB
Chip organization	Single-sided	Single-sided	Single-sided
Channel	Dual	Dual	Dual
<b>Hard disk</b>			
Vendor and model number	Samsung HD080HJ	Western Digital WD3200AAJS	Hitachi HDS721075KLA330
Size (GB)	80	320	750
Buffer size (MB)	8	8	32
RPM	7,200	7,200	7,200
Type	SATA 3Gb/s	SATA 3Gb/s	SATA 3Gb/s
Controller	Intel 82801FB ICH6	Intel 82801IR ICH9R	Intel 82801IR ICH9R
Controller driver	Intel 6.0.0.1011 (02/29/2004)	Intel 8.2.3.1001 (06/11/2008)	Intel 8.2.3.1001 (06/11/2008)
<b>Operating system</b>			
Name	Windows XP Professional	Windows Vista Home Premium	Windows Vista Home Premium
Build number	2600	6001	6001
Service pack	Service Pack 3	Service Pack 1	Service Pack 1
File system	NTFS	NTFS	NTFS
Kernel	ACPI Multiprocessor PC	ACPI x86-based PC	ACPI x64-based PC
Language	English	English	English
Microsoft DirectX version	9.0c	10.0	10.0
<b>Graphics</b>			
Vendor and model number	Intel GMA 900	NVIDIA GeForce 9300GE	NVIDIA GeForce 9500 GS
Type	Integrated	Discrete	Discrete
Chipset	Intel 82915G/GV/910GL Express Chipset	GeForce 9300 GE	GeForce 9500 GS
BIOS version	3329	62.98.29.0.14	62.94.35.0.16
Memory size (MB)	128	128	512
Resolution	1,280 x 1,024	1,280 x 1,024	1,280 x 1,024
Driver	Intel 6.14.10.3924 (09/30/2004)	NVIDIA 7.15.11.7556 (04/17/2008)	NVIDIA 7.15.11.7556 (04/17/2008)
<b>Sound card/subsystem</b>			
Vendor and model number	SoundMAX Integrated Digital Audio	Realtek High Definition Audio	Realtek High Definition Audio
Driver	Analog Devices, Inc. 5.12.1.4070 (04/15/2004)	Realtek Semiconductor Corp. 6.0.1.5657 (07/03/2008)	Realtek Semiconductor Corp. 6.0.1.5657 (07/03/3008)
<b>Ethernet</b>			
Vendor and model number	Broadcom NetXtreme Gigabit	Realtek RTL8168C Family PCI-E Gigabit	Intel 82566DC-2 Gigabit
Driver	Broadcom 7.80.1.0 (11/16/2004)	Realtek 6.2003.214.2008 (02/14/2008)	Intel 9.12.16.0 (01/14/2008)

<b>System</b>	<b>HP Compaq dc5100 Intel Pentium 4 640 3.20 GHz</b>	<b>HP Pavilion a6660t Intel Core 2 Duo E7300 2.6 GHz</b>	<b>HP Pavilion Elite d5100t Intel Core 2 Quad Q9300 2.5 GHz</b>
<b>Optical drive(s)</b>			
Vendor and model number	LITE-ON SOHD-16P9S (The HP system did not come with a DVD burner so we used a SONY DVD RW DRX-820U USB device for the Adobe Photoshop and Elements tests)	PLDS DH16A6L-C	TSSTcorp TS-H653Z
Type	40x CD-R Write, 16x DVD-R Write	40x CD-R Write, 16x DVD-RW Write	40x CD-R Write, 16x DVD-RW Write
Interface	IDE, USB	SATA	SATA
Dual/single layer	Single, dual	Dual	Dual
<b>USB ports</b>			
Number	8	6	6
Type	2.0	2.0	2.0
<b>IEEE 1394</b>			
Number	0	1	2
<b>Monitor</b>			
Type	Samsung SyncMaster997DF	Samsung SyncMaster997DF	Samsung SyncMaster997DF
Screen size (inches)	19	19	19
Refresh rate (Hz)	85	85	85

Figure 7: Desktop test system configurations.



## About Principled Technologies

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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.

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systems. Time savings from upgrading to current models