

Testing “Out Of The Box” PC Performance On Retail And Built-To-Order Systems

For Intel Corporation

Executive summary

Intel Corporation (Intel) commissioned Principled Technologies (PT) to run a set of benchmarks and performance tests on six retail PCs and two built-to-order PCs as the systems came out of the box. The goal of the testing was to gauge the performance, using some common industry benchmarks and some other performance tests, that PC buyers would experience on systems they purchased from such common retail stores as Best Buy or ordered online from such well-known sites as www.hpshopping.com. Intel identified the test systems, tests, test procedures, and test settings. PT purchased and set up the eight systems, and PT executed all tests. We ran the following benchmarks and performance tests:

- SYSmark 2004 with Patch2 – Overall score
- PCMark04 1.20 – Overall score
- PCMark04 – CPU score
- Quake III Arena V.1.32 Demo Four (demo four.dm_68)
- Halo Timedemo
- Magix MP3 2005 Diamond performance test
- Windows Movie Maker 2.1 performance test
- Windows Media Encoder 9.0 performance test
- XMPEG 5.03 with DivX 5.2.1

Appendix A provides the cost for all the systems. Appendix B provides details of their configurations.

Whenever possible, we tested the systems as they came out of the box. Some tests had specific requirements and/or issues that led us to make system changes so we could run the test. We note all such changes in the notes below the test results. Figure 1 presents the results of the tests, along with basic processor information for each system. Many of the tests and results contain footnotes that refer to the Notes following the figure.

System	HP Pavilion a720n	Gateway 420GR	HP Pavilion a706n	Insignia / VPR Matrix D400	Compaq Presario SR1214NX	eMachines T2984	HP Pavilion a750e	HP Pavilion a750y
Processor	Athlon XP 3200+	Pentium 4 515	Athlon XP 3000+	Pentium 4	Athlon XP 2900+	Pentium Celeron D 340	Athlon 64 3200+	Pentium 4 520
Processor frequency (GHz)	2.20	2.93	2.10	2.80	2.00	2.93	2.20	2.80
Benchmark or test								
SYSmark 2004 ^(1,2) - Overall score (higher is better)	115 _(3,4)	152 ⁽³⁾	112 ^(3,5)	125 ^(3,4)	111 ⁽³⁾	126 ⁽³⁾	135 ⁽⁴⁾	149 ⁽⁴⁾
PCMark04 1.20 ^(6,7) - Overall score (higher is better)	2446	3364	2377	2740	2312	2959	3067	3655
PCMark04 1.20 ^(6,7) - CPU score (higher is better)	3391	3885	3250	3578	3120	3763	3908	4210
Quake III Arena V.1.32 - Demo Four ^(6,8) (frames per second; higher is better)	61.9	109.9	63.4	112.4	61.0	107.5	66.2	116.1
Halo Timedemo ⁽⁹⁾ (frames per second; higher is better)	8.1 ⁽¹⁰⁾	21.0	8.3 ⁽¹⁰⁾	20.7	N/A ⁽¹¹⁾	21.8 ⁽¹²⁾	N/A ⁽¹³⁾	20.9
Magix MP3 2005 Diamond ^(6,14,15) (seconds; lower is better)	160	126	175	150	182	170	133	102
Windows Movie Maker 2.1 performance test ⁽⁶⁾ (seconds; lower is better)	248	146	256	194	264	171	163	130
Windows Media Encoder 9.0 performance test ⁽⁶⁾ (seconds; lower is better)	249	215	256	246	266	238	198	188
XMPEG 5.03 with DivX 5.2.1 ⁽⁶⁾ (seconds; lower is better)	139	79	142	95	148	86	102	91

Figure 1: Results of all nine tests on all eight test systems.

Notes:

⁽¹⁾ We updated SYSmark 2004 to have Patch 2, the latest patch available from BAPCo at the time of the test. All these Overall scores (with the exceptions in subsequent footnotes below) are what SYSmark computed as the result of three official runs.

⁽²⁾ Before running SYSmark 2004 on each PC we made the system changes BAPCo recommends: doubling the Virtual Memory settings to twice the amount of physical memory, uninstalling Microsoft Office and Adobe Acrobat Reader, uninstalling any printers or faxes, and turning off System Restore.

⁽³⁾ Even after we made the changes BAPCo recommends, SYSmark 2004 consistently failed with a printer timeout error on these systems. We were able to get the benchmark to complete successfully and produce Full Disclosure Reports (FDRs) by uninstalling Norton Antivirus if it was present and by turning off Windows Update.

⁽⁴⁾ During our testing, which initially involved a trial run and three results-producing runs, SYSMark produced an official score but we did not end up with the benchmark's Full Disclosure Reports (FDRs). To comply with BAPCo results publication guidelines, we had to do subsequent runs to obtain official FDRs. Due to the difficulties we experienced in trying to get SYSmark to generate an FDR with three runs on the systems with this footnote, we opted for one-run tests--a legitimate SYSmark option--to generate their FDRs.

- ⁽⁵⁾ The SYSmark test was able to complete on this system, but it would not produce an FDR. In the spirit of providing full results, we show this result here, though we were unable to file an FDR for it with BAPCo.
- ⁽⁶⁾ The score for this test is the median of three test runs.
- ⁽⁷⁾ PCMark04 requires Windows Media Encoder 9, so we had to install that software on each PC for this test.
- ⁽⁸⁾ We ran this Quake III Arena test, which was the file "demo four.dm_68", at a resolution of 640 x 480 with 16-bit color.
- ⁽⁹⁾ We ran this Halo Timedemo test at a resolution of 640 x 480 with 16-bit color.
- ⁽¹⁰⁾ During this test, Halo was clearly unplayable on systems with this footnote, with huge black and white polygons on the screen. We tried updating the systems' video drivers, but that did not solve the problem. We were able to get timedemo scores, but we do not feel these scores are valid because it was impossible to identify anything on screen during the demo run.
- ⁽¹¹⁾ The Compaq SR1214NX was unable to run this test. Each time we started the game, a Halo fatal error concerning Direct3D appeared.
- ⁽¹²⁾ When we tried to run this test on this system, a message appeared warning that the system did not meet the game's minimum requirements. To make the test run, we had to accept different default settings for this one system than for the others. Specifically, on this system specular, shadows, and decals were gray and read "no"; the particles setting was low; and texture quality was medium. On the other systems, specular, shadows, and decals were "yes", and particles and texture quality were both high.
- ⁽¹³⁾ This system was unable to complete this test without crashing. We tried updating the video drivers and forcing the system to use 1.1 pixel shaders by using a command switch, but it still would not run this test.
- ⁽¹⁴⁾ Per the directions that Intel provided, we did the following before we ran this test: turned off Visual Effects, disabled System Restore, disabled Windows Update, turned off Screen saver, disabled hibernation, and selected Never to all power options. These system changes all help make system behavior more consistent throughout the execution time of a test, so that no test is interrupted by an event, such as a screen saver appearing or a Windows update occurring, that would affect the test's results.
- ⁽¹⁵⁾ This test yielded more variability in results than other tests. We determined that the cause of this variability was Norton Antivirus. Because the test would run with Norton Antivirus and the goal of the test was to gauge the out-of-box performance of the systems, the results we show here are with Norton Antivirus present.

The following section details the methodologies we followed to run each of the benchmarks and tests.

Test methodology

We unpacked and set up each system. We did not purchase monitors with the systems, so we used monitors from our test stock. (The system configuration information in Appendix B provides the standard graphics adapter settings we used.) We then went through the following process with each PC the first time we booted it:

1. Pressed Next to set up Windows XP.
2. Answered "yes" to do you hear music playing out of the speakers?
3. Selected United States, English and U.S. keyboard.
4. Selected Pacific Time.
5. Selected "yes" to both the manufacturer (if present) and Microsoft End User License Agreements.
6. Selected "yes" to automatic updates, because we feel that is what a typical end user would do.
7. We named each computer after its maker and speed (e.g., emachine293).
8. We left each machine description blank.
9. Selected "skip" during the How will this computer connect to the internet?
10. Selected "no" to registering with Microsoft.
11. Selected "finish".

We then used Symantec's Ghost product to capture an image of the system's disk over our local network to a server. (To avoid perturbing any system's disk, we did not make a local Ghost image.) We then burned each Ghost image to a DVD.

Standard process before starting each benchmark or test

Each time we were to run a new benchmark or test, we used the Ghost image DVD to return the machine to the original, just-set-up image. We then installed the software necessary to run the benchmark or test, made any system changes necessary to let the benchmark or test run, and then rebooted.

After we completed each run of a benchmark or test, we would reboot before running the next iteration of that benchmark or test.

The following subsections summarize the steps we followed to run each of the five benchmarks/tests in this report. These steps are the ones we followed to get successful runs of each benchmark/test. (In some cases we had to experiment to find workarounds for issues with the test; the sections below include the results of those experiments.)

SYSmark 2004

We performed the following steps on each PC to make it ready to run this benchmark:

1. Right click My Computer and choose Properties->Advanced tab. Choose the Settings button under the Performance heading. Choose the Advanced tab. Click the Change button under the Virtual memory heading. Select the Custom size radio button. Set the Windows XP Virtual memory size to twice the physical memory size (e.g., with 512MB of physical RAM set the Virtual memory to 1024MB) by entering that figure for both the Initial size and Maximum size fields. Click OK and close all My Computer windows.
2. Via the Printers and faxes option on the Control panel, uninstall any printers or faxes currently on the system by right clicking each installed printer and fax and selecting Delete. The benchmark requires this step.
3. Via the Control panel, uninstall Microsoft Office if it is present on the machine. The benchmark requires this step.
4. Via the Control panel, uninstall Adobe Acrobat Reader if it is present on the machine. The benchmark requires this step.
5. Via the Control panel, uninstall Norton Antivirus if it is present on the machine. The benchmark requires this step.
6. Right click My Computer and choose Properties->System Restore tab. Select Turn off System Restore on all drives to turn off System Restore. The benchmark requires this step.
7. Right click My Computer and choose Properties->Automatic Updates tab. Select Turn off Automatic Updates to disable Windows Update.
8. Reboot the system.
9. Install SYSmark 2004 with its Default options.
10. During its installation, SYSmark 2004 detects which programs autostart when the machine boots and recommends that you allow SYSmark 2004 to move these programs to an alternate key named OriginalRun. SYSmark 2004 will undo this change when you uninstall it. Click "yes" to allow this.
11. Install SYSMark 2004 patch 2.

We rebooted before the first SYSmark 2004 run (it reboots itself during the three real runs) and then followed this process to run the benchmark:

1. Go to Start-> Programs->SYSmark 2004 to run SYSmark 2004.
2. Click "Run".
3. Select "Trial Run".
4. Click "Run".
5. Select "Official Run" and choose 3 iterations. SYSmark 2004 will automatically reboot the system.

6. When the benchmark has completed the three official runs, the main SYSmark 2004 menu will appear. Select the "Reports" button and then "Official Report scores" to view SYSmark 2004's test scores.

The benchmark produces, among other results, an overall score; higher scores are better.

PCMark04 1.2.0

We performed the following steps on each PC to make it ready to run this benchmark:

1. Install Windows Media Encoder 9. The benchmark requires this software.
2. Install PCMark04 version 1.2.0 Business Edition with set-up defaults.

We rebooted before each run and then followed this process to run the benchmark:

1. Start PCMark04.
2. Under "Tests" select "System Test Suite", "CPU Test Suite", "Memory Test Suite", "Graphics Test Suite", and "HDD Test Suite".
3. Select Run PCMark.

PCMark04 displays its results when its test completes. It produces, among other results, an overall score and a CPU score; higher scores are better for both.

Quake III Arena V.1.32 - Demo Four

We performed the following steps on each PC to make it ready to run this test:

1. Install Quake III Arena with installation defaults.
2. Start game.
3. The first time the game starts, a Windows XP SP2 security alert will appear. Select Unblock.
4. Click on "Setup".
5. Select "System".
6. Under Graphics Option Set, make the following settings:
 - GL Driver=Default
 - GL Extensions=On
 - Video Mode=640x480
 - Color Depth=16 bit
 - Fullscreen=On
 - Lighting=Lightmap
 - Geometric Detail=High
 - Texture Detail=Default bar slide setting
 - Texture Quality=Default
 - Texture Filter=Bilinear
7. Click "Accept".
8. Leave Defaults settings for display, sound, and network.
9. Exit the game.

We rebooted before each run and then followed this process to run the test:

1. Start the game.
2. Press the "~" key to open the command console.
3. Type timedemo 1 and press "Enter".
4. Press the "~" key to exit the command console.
5. Select Demos.
6. Select demo "FOUR.DM_68" and click on "play".

7. After the demo has finished, press the “~” key and record the Frames Per Second (fps) the game produces.

A higher number of frames per second is better.

Halo Timedemo

We performed the following steps on each PC to make it ready to run this test:

1. Install Halo with all set-up defaults.
2. At the main menu screen, choose Settings. The program requires a test name. We used “Test”.
3. Choose Video setup and select the following setting options:
 - 640x480
 - 75Hz
 - No vsync
 - specular=yes
 - shadows=yes
 - Decals=No (We chose this setting because some of the test systems did not support Decals.)
 - particles=high
 - texture quality=high
 - For the gamma setting, leave the default.
4. Click ok and exit the game.

We rebooted before each run and then followed this process to run the test:

1. Open the Windows command prompt.
2. Change to the c: directory and then to the installation location of the game (in our case, C:\program files\Microsoft Games\halo).
3. Type “halo.exe –timedemo –vidmode 640,480,75” and press enter to run the test.
4. The game will produce a file, timedemo.txt, in its main directory. This file contains the results of the timedemo test.

The results are in frames per second. A higher number of frames per second is better.

Magix MP3 2005 Diamond performance test

We performed the following steps on each PC to make it ready to run this test:

1. Turn off Windows XP Visual Effects by right clicking on “My Computer”->Advanced tab->Settings button, and then in the performance section->Visual Effects tab->Choose custom and uncheck all boxes.
2. Right click My Computer and choose Properties->System Restore tab. Select Turn off System Restore on all drives to turn off System Restore.
3. Right click My Computer and choose Properties->Automatic Updates tab. Select Turn off Automatic Updates to disable Windows Update.
4. Choose the Display option on the Control Panel, and then select the Screen Saver tab. Under Screen saver choose (None) to turn off screen saver.
5. Click the Power button on that same page. Choose Never for System hibernates and set all power options to Never.
6. Copy the “65min.wav” content file from the content CD that Intel supplied to the directory C:\.
7. Install Magix MP3Maker Deluxe 2005 with all defaults.

We rebooted before each run and then followed this process to run the test:

1. Start Magix MP3Maker Deluxe 2005.

2. In the Explorer tab page up until you've selected the root C:\ and the 65min.wav file appears (this takes about three tabs up).
3. Check the 65min.wav and click the Selection button under the "Add to playlist" heading in the middle of the screen.
4. Highlight the 65min.wav file in the playlist and click the "Convert playlist" icon on the top toolbar.
5. Take the default settings, which should be MP3 High Quality at 128kbps, and select start.
6. The encoding begins. Watch the "used encode time" and record the time it presents before the progress box disappears.
7. Convert the time to seconds.
8. After recording the time, delete the 65min.wav file from the playlist and from the "My Music" folder in Albums.

A lower number of seconds to perform the conversion is better.

Windows Movie Maker 2.1 performance test

Windows XP service pack 2 contains Windows Movie Maker version 2.1, so we did not have to install this program. We performed the following steps on each PC to make the system ready to run this test:

1. Turn off Windows XP Visual Effects by right clicking on "My Computer"->Advanced tab->Settings button, and then in the performance section->Visual Effects tab->Choose custom and uncheck all boxes.
2. Right click My Computer and choose Properties->System Restore tab. Select Turn off System Restore on all drives to turn off System Restore. The performance test requires this step.
3. Right click My Computer and choose Properties->Automatic Updates tab. Select Turn off Automatic Updates to disable Windows Update.
4. Choose the Display option on the Control Panel, and then select the Screen Saver tab. Under Screen saver choose (None) to turn off screen saver.
5. Click the Power button on that same page. Choose Never for System hibernates and set all power options to Never.
6. Copy the "Kitesurfing.avi" content file from the content CD that Intel supplied to the desktop.

We rebooted before each run and then followed this process to run the test:

1. Launch Movie Maker.
2. Click on "File" and select "Import into Collections".
3. Browse to the file "Kitesurfing.avi" and click "Import".
4. Drag each of the file's five video scenes to the video timeline in the bottom of the Movie Maker window.
5. Click "File" and select "Save Movie File".
6. In the Save Movie Wizard dialog, select "My computer" and click "Next".
7. In the Saved Movie File dialog, click "Next".
8. In the Movie Setting dialog, select "Next". Movie Maker will then start encoding the video.
9. When Movie Maker finishes the encoding, locate the file Movie.wmv in the "My videos" folder.
10. To calculate how long the encoding took, right click on the "Movie.wmv" icon, select "Properties", and subtract the "Created" time from the "modified" time, then convert to seconds.
11. Delete the file before rebooting and running the test again.

A lower number of seconds to complete the encoding is better.

Windows Media Encoder 9.0 performance test

We performed the following steps on each PC to make it ready to run this test:

1. Turn off Windows XP Visual Effects by right clicking on "My Computer"->Advanced tab->Settings button, and then in the performance section->Visual Effects tab->Choose custom and uncheck all boxes.
2. Right click My Computer and choose Properties->System Restore tab. Select Turn off System Restore on all drives to turn off System Restore. The performance test requires this step.
3. Right click My Computer and choose Properties->Automatic Updates tab. Select Turn off Automatic Updates to disable Windows Update.
4. Choose the Display option on the Control Panel, and then select the Screen Saver tab. Under Screen saver choose (None) to turn off screen saver.
5. Click the Power button on that same page. Choose Never for System hibernates and set all power options to Never.
6. Copy the "Kitesurfing.avi" content file from the content CD that Intel supplied to the desktop.
7. Install Windows Media Encoder 9.0.

We rebooted before each run and then followed this process to run the test:

1. Launch Windows Media Encoder.
2. Select "Convert a file" from the New Session Wizard dialog, and click "OK".
3. In the "Source file" field, browse to the location of the "kitesurfing.avi" file on the desktop, and click "Next".
4. Select "Windows Media Server (streaming)" in the Content Distribution dialog, and click "Next".
5. Click "Finish" in the Encoding Options dialog. Windows Media Encoder will then start encoding the video.
6. When Windows Media Encoder finishes the encoding, record the "Session duration" and convert the time to seconds.
7. Delete the file before rebooting and running the test again.

A lower number of seconds to complete the encoding is better.

XMPEG 5.03 with DivX 5.2.1 performance test

We performed the following steps on each PC to make it ready to run this test:

1. Turn off Windows XP Visual Effects by right clicking on "My Computer"->Advanced tab->Settings button, and then in the performance section->Visual Effects tab->Choose custom and uncheck all boxes.
2. Right click My Computer and choose Properties->System Restore tab. Select Turn off System Restore on all drives to turn off System Restore. The benchmark requires this step.
3. Right click My Computer and choose Properties->Automatic Updates tab. Select Turn off Automatic Updates to disable Windows Update.
4. Choose the Display option on the Control Panel, and then select the Screen Saver tab. Under Screen saver choose (None) to turn off screen saver.
5. Click the Power button on that same page. Choose Never for System hibernates and set all power options to Never.
6. Copy the "NewMpeg2.mpg" file to the desktop.
7. Install DivX 5.2.1 with default settings.
8. Reboot system.
9. Install XMPEG 5.0.3 with default settings.
10. Reboot system.
11. Start XMPEG by clicking on the desktop icon.
12. Click OK to legal information.
13. Click on the flashing red "warning: 20 iDCT tests not performed. Click here to proceed" message to run a diagnostic test that optimizes the software for the system.
14. After optimization completes, a "video conversion wizard" dialog box appears. Uncheck "Show this wizard at startup again" and choose "cancel".
15. Right click on the XMPEG 5.0 window and select "open".

16. Select the "NewMpeg2.mpg" that is located on the desktop and click "open".
17. Right click on the XMPEG 5.0 window again and select "Options".
18. Uncheck the boxes for auto under "format" and "fps" sections.
19. Make sure the "YV12" format is selected and click "OK".
20. Right click on XMPEG 5.0 window again and select "Set Plug-In options".
21. Highlight the "DivX 5.2.1 Codec" and click on "Configure 1st pass" and then click on "OK" in the DivX codec properties dialog box.
22. Click on the audio tab and select "No compression" and click "OK".

We rebooted before each run and then followed this process to run the test:

1. Start XMPEG by clicking on the desktop icon.
2. Right click on the XMPEG 5.0 window and select "Start Conversion".
3. When the encoding progress bar reaches 100% the encode is done.
4. The program puts its output file, Output Video file.avi, in the C:\ directory. To calculate how long the conversion took, right click on the "Output video file.avi" icon, select "Properties", and subtract the "Created" time from the "modified" time, then convert to seconds.

A lower number of seconds to complete the conversion is better.

Appendix A: Test system price and purchase information

We purchased the six retail systems on November 9, 2004 at the following store:

Best Buy #299
Pleasant Valley Promenade
6254 Glenwood Avenue
Raleigh, NC 27612

We purchased the two built-to-order systems on October 15, 2004 via www.hpshopping.com.

Figure 2 presents the purchase source, SKU, and price information for all the systems.

System	HP Pavilion a720n	Gateway 420GR	HP Pavilion a706n	Insignia / VPR Matrix D400	Compaq Presario SR1214NX	eMachines T2984	HP Pavilion a750e	HP Pavilion a750y
Processor	Athlon XP 3200+	Pentium 4 515	Athlon XP 3000+	Pentium 4	Athlon XP 2900+	Pentium Celeron D 340	Athlon 64 3200+	Pentium 4 520
Processor frequency (GHz)	2.20	2.93	2.10	2.8	2.00	2.93	2.20	2.80
Purchase source (BB = Best Buy; HP = www.hpshopping.com)	BB	BB	BB	BB	BB	BB	HP	HP
SKU or part number ⁽²⁾	6839898	6830815	6840207	671772	6842893	6830931	PJ620AV #ABA	PJ621AV# ABA
Unit price (\$)	729.99	699.99	609.99	559.99	549.99	549.99	949.99	1,019.99
Tax (\$) ⁽¹⁾	51.10	49.00	42.70	39.20	38.50	38.50	N/A	N/A
Shipping (\$) ⁽³⁾	N/A	N/A	N/A	N/A	N/A	N/A	33.33	33.33
Total we paid (\$)	781.09	748.99	652.69	599.19	588.49	588.49	983.32	1,053.32
Rebate or discount offer(s) (\$) ⁽⁴⁾	50.00	N/A	50.00	50.00	50.00	50.00	50.00	50.00
Effective price after rebate or discount (\$)	731.09	748.99	602.69	549.19	538.49	538.49	933.32	1,003.32

Figure 2: Price and purchase information for eight all test systems.

Notes:

⁽¹⁾ Tax reflects the North Carolina tax rate of 7.0% for the systems we purchased at Best Buy.

www.hpshopping.com did not charge tax.

⁽²⁾ Best Buy identifies systems by SKU. www.hpshopping.com identifies systems by HP part number.

⁽³⁾ We picked up the systems we purchased locally at Best Buy, so there were no shipping charges on those systems. The \$33.33 shipping charge for each system we ordered from www.hpshopping.com is a pro-rated share of the total shipping charge for all the systems we ordered at that time.

⁽⁴⁾ Best Buy offers rebates on many system models. At the time of our purchase from www.hpshopping.com, the site was offering a discount on the entire order we made that amounted to \$50.00 per system.

Appendix B: Test system configuration information

This appendix provides detailed configuration information about each of the eight test systems.

System	HP Pavilion a720n	Gateway 420GR	HP Pavilion a706n	Insignia / VPR Matrix D400	Compaq Presario SR1214N X	eMachines T2984	HP Pavilion a750e	HP Pavilion a750y
System configuration information								
General								
Processor and OS kernel: (physical, core, logical) / (UP, MP)	1P1C1L / UP	1P1C1L / MP ⁽¹⁾	1P1C1L / UP	1P1C1L / MP ⁽¹⁾	1P1C1L / UP	1P1C1L / UP	1P1C1L / UP	1P1C2L / MP
Number of physical processors	1	1	1	1	1	1	1	1
Single/Dual Core processors	Single core	Single core	Single core	Single core	Single core	Single core	Single core	Single core
Processor HT Status	N/A	N/A ⁽²⁾	N/A	N/A ⁽²⁾	N/A	N/A	N/A	HT ON
System Power Management Policy (AC / AlwaysOn, AC/Adaptive, DC/AlwaysOn, DC/Adaptive, Other)	AC / AlwaysOn	AC / AlwaysOn	AC / AlwaysOn	AC / AlwaysOn	AC / AlwaysOn	AC / AlwaysOn	AC / AlwaysOn	AC / AlwaysOn
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
CPU								
Segment (S=Server, D=Desktop, M=Mobile)	D	D	D	D	D	D	D	D
Vendor	AMD	Intel	AMD	Intel	AMD	Intel	AMD	Intel
Name	Athlon XP	Pentium 4E	Athlon XP	Pentium 4	Athlon XP	Celeron D	Athlon 64	Pentium 4E
Code name	Barton	Prescott	Barton	Northwood	Barton	Prescott	Claw-Hammer	Prescott
Model number	Athlon XP 3200+	Pentium 4 515	Athlon XP 3000+	Pentium 4	Athlon XP 2900+	Pentium Celeron D 340	AMD Athlon 64 3200+	Pentium 4 520
Stepping	N/A	4	N/A	9	N/A	4	N/A	N/A
Socket type and number of pins	Slot A / Socket A	Socket T / LGA775	Socket A / PGA462	Socket X1 / PGA478	Socket A / PGA462	Socket J2E1 / PGA478	Socket 754	Socket T / LGA775
Core frequency	2200	2933	2100	2800	2000	2930	2200	2800
Front-side bus frequency	400	533	400	400	400	533	1600	800
L1 Cache	64KB	16KB + 12KB	64KB	8KB + 12KB	64KB	16KB + 12KB	64KB + 64KB	16KB + 12KB
L2 Cache	512KB	1MB	512KB	512KB	512KB	256KB	512KB	1MB
L3 Cache	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Serial number	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Platform								

Vendor and model number	ASUS	Intel D915GAG	ASUS	Intel D845GVSR	ASUS	Intel D845GVSR	Asus K8S	Asus PTGD1
Motherboard model number	Kelut 2.02	Intel 915G	Kelut 2.02	Intel 845G	Kelut 2.02	Intel 845G	SiS 760	Intel 915G
Motherboard chipset	VIA KM400	Intel 915G Express	VIA KM400	Intel 845G Express	VIA KM400	Intel 845G Express	SiS 760	Intel 915G Express
Motherboard chipset codename	N/A	Grantsdale	N/A	Brookdale	N/A	Brookdale	Tecate	Grantsdale
Motherboard revision number	N/A	B1	N/A	A1	N/A	B1	LA	LA
System/motherboard serial number	MB-01234567890	BQAG43700644	MB-1234567890	BQSR44051821	MB-1234567890	TGSR43107156	MXP44300PM/MB-1234567890	MXP44300PG/X312345678
Bios name and version	Phoenix Technologies 3.10	American Megatrends EV91510A.15A.0067.2004.0722.1717	Phoenix Technologies 3.11	American Megatrends VA84510A.86A.0037.P12.0404132146	Phoenix Technologies 3.10	American Megatrends 63-0100-000001-00101111-081804-iBRKDL	Phoenix Technologies 3.02	American Megatrends 3.06
BIOS settings	Setup Default	Setup Default	Setup Default	Setup Default	Setup Default	Setup Default	Setup Default	Setup Default
BIOS additional settings	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Chipset INF driver ⁽³⁾	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Memory module(s)								
Vendor and model number	Siemens 64D64320GU6C04107A13	Samsung M368L3223FTN-CCC	Samsung M368L6423FTN-CCC	Samsung M368L6423FTN-CB3	Siemens 64D64320GU6C04126924	Samsung M368L6423FTN-CCC	Infineon HYS64D64320GU-5-C	Hynix HYMD232646B8J-D43AA
Type	PC2700 DDR-SDRAM	PC3200 DDR-SDRAM	PC3200 DDR-SDRAM	PC2700 DDR-SDRAM	PC2700 DDR-SDRAM	PC3200 DDR-SDRAM	PC3200 DDR400	PC3200 DDR400
Speed (MHz)	333	400	400	333	333	400	400	400
Speed in the system currently running @ (MHz)	333	400	400	333	333	400	400	400
Timing/Latency (tCL-tRCD-tRP-tRASmin)	2.5-3-3-7	3-3-3-8	3-3-3-8	2.5-3-3-7	3-3-3-8	2.5-3-3-7	3-3-3-8	3-3-3-8
Size	512MB	512MB	512MB	512MB	512MB	512MB	512MB	512MB
Number of sticks	1 x 512MB	2 x 256MB	1 x 512MB	1 x 512MB	1 x 512MB	1 x 512MB	1 x 512MB	2 x 256MB
Chip organization (Single-sided, Double-sided)	Single-sided	Single-sided	Single-sided	Single-sided	Single-sided	Single-sided	Double-sided	Single-sided

Channel (Single/Dual)	Dual	Dual	Dual	Dual	Dual	Dual	Single	Dual
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Hard disk								
Vendor and model number	Western Digital WDC WD2000 BB-00GUA0	Western Digital WDC WD160 0JD-22HBB0	Western Digital WDC WD1600 BB-22GUA0	Western Digital WDC WD120 0BB-00GUA0	Samsung SP0802N	Western Digital WDC WD800 BB-22FJA0	Western Digital WD800J D-22JNA0	Sam-sung SP0812 C
Hard Disk - Size	200GB	160GB	160GB	120GB	80GB	74.5GB	80GB	80GB
Hard Disk - Buffer Size	8MB	8MB	8MB	8MB	8MB	8MB	8MB	8MB
Hard Disk - RPM	7200	7200	7200	7200	7200	7200	7200	7200
Hard Disk - Type	Serial ATA 1.0	Serial ATA 1.0	Serial ATA 1.0	Serial ATA 1.0	Serial ATA 1.0	Serial ATA 1.0	Serial ATA 1.0	Serial ATA 1.0
Hard Disk - Controller	VIA Bus Master IDE	Intel 82801F B/FBM Ultra ATA Storage	VIA Bus Master IDE	Intel 82801D B/DBL (ICH4/I CH4-L)	VIA Bus Master IDE	Intel 82801D B Ultra ATA Storage -24CB	Inte-grated SiS 964 SATA	Inte-grated Intel ICH6 SATA
Hard Disk - Driver	WinXP driver: Microsoft hard disk 5.1.2600.2180	WinXP driver: Micro-soft hard disk 5.1.253 5.0	WinXP driver: Microsoft hard disk 5.1.2600.2180	WinXP driver: Micro-soft hard disk 5.1.253 5.0	WinXP driver: Microsoft hard disk 5.1.2535.0	Intel Corp. 4.0.100 1.0	WinXP driver: Micro-soft: hard disk 5.1.253 5.0	WinXP driver: Micro-soft: hard disk 5.1.253 5.0
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Operating system								
Name	Windows XP Home	Windows XP Home	Windows XP Home	Windows XP Home	Windows XP Home	Windows XP Home	Windows XP Home	Windows XP Home
Build number	Build 2600	Build 2600	Build 2600	Build 2600	Build 2600	Build 2600	Build 2600	Build 2600
Service pack	SP2	SP2	SP2	SP2 ⁽⁴⁾	SP2	SP2 ⁽⁴⁾	SP2	SP2
File system	NTFS	NTFS	NTFS	NTFS	NTFS	NTFS	NTFS	NTFS
Kernel	ACPI Uni-processor PC	ACPI Multi-processor PC ⁽¹⁾	ACPI Uni-processor PC	ACPI Multi-processor PC ⁽¹⁾	ACPI Uni-processor PC	ACPI Uni-processor PC	ACPI Uni-processor PC	ACPI Multi-processor PC
Language	English	English	English	English	English	English	English	English
Microsoft DirectX version	9.0c	9.0c	9.0c	9.0c	9.0c	9.0c	9.0c	9.0c
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Graphics								
Vendor and model number	VIA/S3G Uni-Chrome IGP	Intel 82915G/ GV/910 GL	VIA/S3G Uni-Chrome IGP	Intel 82845G/ GL/GE/ PE/GV	VIA Technol-ogies KM400	Intel 82845G/ GL/GE/ PE/GV	SiS 760	Intel 915G Express
Chipset	VIA/S3G Uni-Chrome IGP	Intel 82915G/ GV/910G L Express	VIA/S3G Uni-Chrome IGP	Intel Graphics Chipset (KCH)	VIA Technol-ogies - KM400	Inte-grated 845G Express	SiS 760	Intel Graphics Media Acceler-ator (GMA) 900

Chipset codename	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
BIOS version	98.D2.00.19	Intel Graphics Platform (SoftBIOS)	98.D2.00.19	Intel Graphics Platform (SoftBIOS)	VEN_1043, DEV_8118	Intel Video BIOS	0.99.00	Intel Video Bios 0.0
Type (P=PCI Express, A=AGP 8X, I=Integrated)								
Memory size	64MB shared	64MB shared	64MB shared	64MB shared	64MB shared	64MB shared	128MB shared	128MB shared
Resolution	1024 x 768 x 32-bit color ⁽⁵⁾	1024 x 768 x 32-bit color	1024 x 768 x 32-bit color ⁽⁵⁾	1024 x 768 x 32-bit color	1024 x 768 x 32-bit color ⁽⁵⁾	1024 x 768 x 32-bit color	1024 x 768 x 32-bit color	1024 x 768 x 32-bit color
Driver	VIA/S3G 6.14.10.132	WinXP driver: Microsoft 6.14.10.3924	VIA/S3G 6.14.10.132	WinXP driver: Microsoft 6.14.10.3732	VIA/S3 6.14.10.110	Intel Corp. 6.14.10.3722	WinXP driver: SiS 6.14.10.3594	WinXP driver: Intel 6.14.10.3882
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Sound card/subsystem								
Vendor and model number	Realtek AC97 Audio	Realtek High Definition Audio	Realtek AC97 Audio	Realtek AC'97 Audio	Realtek AC97 Audio	Sound-MAX Digital Audio	Realtek AC'97 Audio	Intel High Definition Audio w/ 7.1 channel Realtek ALC880 codec
Type (P=PCI, I=Integrated)								
Driver	Realtek 5.10.0.5600	Realtek 5.10.00.5027	Realtek 5.10.0.5600	Realtek 5.10.0.5580	Realtek 5.10.0.5570	Analog Devices 5.12.1.3571	WinXP driver: 5.10.0.5600	WinXP driver: 5.10.00.5027
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Network card/subsystem								
Vendor and model number	VIA Rhine II Fast Ethernet Adapter	Intel PRO/100 VE Network Connection	VIA Rhine II Fast Ethernet Adapter	Intel PRO/100 VE Network Connection	VIA Rhine II Fast Ethernet Adapter	Intel PRO/100 VE Network Connection	SiS 900-Based 10/100	Realtek RTL8139 /810x
Type (P=PCI, I=Integrated)								
Driver	VIA 3.27.0.412	Intel Corp. 7.1.12.0	VIA 3.27.0.412	Intel Corp. 6.4.14.0	VIA 3.27.0.412	Intel Corp. 6.4.14.0	WinXP driver: 1.16.0.8	WinXP driver: 5.505.1004.2002
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Wireless network card/subsystem								
Vendor and model number	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Type (PCI, Integrated)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Driver	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Optical drive(s)								
Vendor and model number	LITE-ON SOHW-822S (CD 40X Rd, 40X Wr) (DVD 5x Rd)	NEC ND-2510A (CD 40X Rd, 32X Wr) (DVD 5X Rd, 4X Wr)	HL-DT-ST RW/DVD GCC-4481B (CD 48X Rd, 48X Wr) (DVD 6X Rd)	Sony DDU161 3 (CD 40X Rd) (DVD 5X Rd)	Samsung SD-616E (CD 40X Rd) (DVD 5X Rd)	Sam-sung SD-616E (CD 48X Rd) (DVD 6X Rd)	Philips CDD725 2/44 IDE (48X Rd, 48X Wr)	Philips CDD725 2/44 IDE (48X Rd, 48X Wr)
Type (CDROM, CDRW, DVD-ROM, DVD-W)	DVD-RW	DVD-RW	CD-RW/DVD-ROM	DVD-ROM	DVD-ROM	DVD-ROM	CD-R/RW	CD-R/RW
Interface (I=Internal, E=External)	I	I	I	I	I	I	I	I
Other information	Samsung CD-ROM SC-148A (CD 48X Rd)	Samsung CD-ROM SC-148A (CD 48X Rd)	N/A	Sony CD-RW CRX230 ED (CD 244X Rd, 52X Wr)	ASUS CRW-4832AS (CD 52X Rd, 48X Wr)	Samsung CD-R/RW SW-252S (CD 48X Rd, 48X Wr)	N/A	N/A
USB ports								
USB - # of USB Ports	5	5	4	4	4	5	6	6
USB - Type of USB ports (USB1.1, USB2)	2.00	1.10	2.00	2.00	1.10	1.10	4 - 1.1; 2 - 2.0	2.00
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Monitor								
CRT/LCD type (P=Plug & Play, T=TFT, R=Reflective)	P	P	P	P	P	P	P	P
CRT/LCD refresh rate	75 Hz	75 Hz	75 Hz	75 Hz	75 Hz.	75 Hz	75 Hz	75 Hz
Mobile LCD screen brightness (nits)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Mobile LCD screen size	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Other information	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A

Figure 3: System configuration information for all test systems.

Notes:

(1) This is what the Windows Device Manager showed under "My Computer". The BIOS did not offer an option for enabling HT Technology.

(2) The BIOS did not offer an option for enabling HT.

(3) No .INF file data was available because the drivers were installed by the manufacturers.

(4) The Insignia and eMachines systems came with Windows XP Service Pack 1 installed, but with downloading of automatic updates enabled. We felt this would mean that real users would almost immediately end up with Service Pack 2 (SP2). For that reason, and because all the other systems came with SP2, we used a Microsoft SP2 CD to upgrade these two systems to SP2 before we tested them. (We captured Ghost images of these systems both as they came out of the box with SP1 and after the upgrade to SP2. We ran all tests starting with the SP2 images.)

(5) We had to set the resolution and refresh rate of these systems to 1024 x 768 with 32-bit color and 75 Hz refresh, because we connected them to MAG 771FS-s monitors and they defaulted to 800 x 600 x 32-bit and

60Hz refresh. We connected the other systems to Dell E772p monitors and so they booted with 1024 x 768 x 32-bit color and 75Hz refresh.



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