DELL VS. COMPETITORS: NETBOOK ABRASION AND SOLVENT RESISTANCE

OUR FINDINGS

In today's educational environment, institutions are eager to get the most for their computing dollar, which means buying systems that last. In Principled Technologies' tests in our labs, as the above graphic shows, the Dell Latitude 2110 netbook is more resistant to abrasion and solvents than its closest competitors are. The ability of the Dell Latitude 2110 to withstand abrasion and solvent spills make it an excellent choice for an educational institution, where netbooks need to last.

OUR PROCESS

To gauge the durability of each netbook system, we performed a custom abrasion resistance test, in which we measured the physical damage that resulted when we dragged each netbook across a ceramic tile floor. We also conducted a solvent spill test to determine how well the systems could withstand exposure to various solvents that we spilled on a closed lid.

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A PRINCIPLED TECHNOLOGIES TEST REPORT
Commissioned by Dell Inc.

PROJECT OVERVIEW

We tested the abrasion and solvent resistance of the following 10 netbook systems:

- Acer® Aspire® One 532h
- Apple® iPad™
- ASUS® Eee PC 1001P
- ASUS Eee PC 1201T
- Dell™ Latitude™ 2110
- Equus® NOBi Convertible
- HP Mini 2102
- Lenovo® IdeaPad® S10-3
- Lenovo IdeaPad S10-3t
- Lenovo ThinkPad® X100e

To test the exterior scratch resistance of the netbooks, we dragged each across a commercial-grade ceramic tile floor. We completed three runs, and had a panel of three judges make their assessments after each run. Judges assigned a score of 1 to 5 for least to most scratches, which we then averaged for each test run. Because each netbook sustained increasing damage with each subsequent run, we then had the judges assign an overall ranking at the end of the three test runs for the 10 netbooks, with 1 being the least damaged, and 10 being the most damaged. We then averaged the scores of the three judges to assign an overall average ranking for the netbooks.

To test the solvent resistance of a netbook exterior, we used a dropper to place one drop of each of six solvents (non-acetone nail polish remover, acetone-based nail polish remover, bleach, hydrogen peroxide, isopropyl alcohol, and Oil of Olay® facial wash) on the netbook lids. We completed three test runs for each netbook, leaving the solvents to sit on the lids for 10 seconds for the first run, 60 seconds for the second run, and 5 minutes for the third run, before wiping them away. Three judges assessed the 10 netbooks after each test run, assigning a score from 1 to 5 for least to most discolored or stained, which we then averaged for each test run. Because each netbook sustained increasing damage with each subsequent run, we then had the judges assign an overall ranking at the end of the three test runs for the 10 netbooks, with 1 being the least discolored/stained, and 10 being the most damaged. We then averaged the scores of the three judges to assign an overall average ranking for the netbooks.

WHAT WE FOUND

Abrasion testing

We tested the scratch resistance of the netbooks by dragging the closed netbooks across a commercial-grade ceramic tile floor. The Dell Latitude 2110 performed best during the three abrasion test runs, suffering no discernable damage due to the lid's design. See the How we tested section for the steps we followed for testing.

Figure 1 shows the key to the abrasion test results in Figure 2, which presents detailed results for the three runs of the abrasion test for the netbooks. We present the systems in order of the overall average ranking for the three test runs, with 1 being the most scratch resistant, and 10 being the least scratch resistant, with a description of the damage we recorded for each netbook.

Key to abrasion test results				
				
No damage	**Slight damage**	**Moderate damage**	**Above moderate damage**	**Heavy damage**

Figure 1: Key to abrasion test results.

Overall ranking	Netbook system	Test 1	Test 2	Test 3	Notes
1	**Dell Latitude 2110**				The lid's design allowed only two small strips of surface to touch the ground, leaving no discernable damage.
2	**Lenovo IdeaPad S10-3**				Abrasion damage was minimal to non-existent. By the second and third runs, the system picked up a "dirty" appearance in the textured design rather than a damaged appearance.
3	**Apple iPad**				Testing produced slight scuffs and small scratches around the logo.
4	**ASUS Eee PC 1001P**				System picked up barely visible scuffs.
5	**Equus NOBi Convertible**				The lid's rounded edges allowed only small sections of the lid to touch the ground, though the affected surface was much greater than the Dell Latitude 2110. In later runs, the lid picked up dirt marks as well.
6	**Lenovo ThinkPad X100e**				The first run scuffed the center of the lid. The following runs only produced minimal further scratching.

Overall ranking	Netbook system	Test 1	Test 2	Test 3	Notes
7	HP Mini 2102				For the first run, damage occurred only to the center of the surface of the lid. Each run thereafter only slightly added to the damage.
8	Acer Aspire One 532h				Surface showed deep gouges and scuffs, which got slightly worse with each consecutive run.
9	ASUS Eee PC 1201T				Surface showed very deep gouges after the first run, and a picked up a few more gouges with each run.
10	Lenovo IdeaPad S10-3t				Surface showed several deep gouges after the first run, and picked up more gouges with each subsequent run.

Figure 2: Abrasion test results for the netbook systems.

Solvent resistance testing

We tested the solvent resistance of the netbooks by allowing six different solvents to remain on the closed lids for times ranging from 10 seconds to 5 minutes. The Dell Latitude 2110 performed best during the three solvent resistance test runs, as it suffered only slight discoloration from non-acetone nail polish remover during the third test, when the solvents remained on the lid for 5 minutes. See the How we tested section for the detailed steps we followed for testing.

Figure 3 shows the netbooks, ranked from 1 (least damaged) to 10 (most damaged), with a description of the damage we recorded for each netbook.

Overall ranking	Netbook	Notes
1	Dell Latitude 2110	System only showed signs of discoloration only after the 5-minute test using the non-acetone nail polish remover. The discoloration was only a slightly lighter shade of the system's dark grey color.
2	Equus NOBi Convertible	System was only discolored by the Oil of Olay facial wash, which left a faint oily stain.
3	Lenovo IdeaPad S10-3	System was only affected by Oil of Olay, which left a barely noticeable stain on the textured surface.
4	Apple iPad	The only system affected by bleach. After 5 minutes, the bleach left a faint white stain on the aluminum surface. The Oil of Olay facial wash and acetone-based nail polish remover had a similar effect on the system's aluminum surface.
5	Acer Aspire One 532h	System affected by the non-acetone and acetone-based nail polish remover. After 5 minutes, the non-acetone nail polish remover left a significantly noticeable stain and a sizable smudge on the system's surface. The acetone-based nail polish remover initially left no stains on the lid, but after the 60-second and 5-minute tests, began to cause a ring stain filled in with discoloration.

Overall ranking	Netbook	Notes
6	Lenovo IdeaPad S10-3t	System affected by the non-acetone and acetone-based nail polish removers. Initially, the non-acetone nail polish remover had no effect on the system's surface, but, after the 5-minute test, it left a distinct ring on the surface as well as some discoloration within the ring. The acetone-based nail polish remover produced a stain that was more noticeable with each consecutive test.
7	HP Mini 2102	System affected by the non-acetone and acetone-based nail polish removers. Both left a ring and discoloration, which were more pronounced with each run.
8	ASUS Eee PC 1201T	System affected by the non-acetone and acetone-based nail polish removers. The non-acetone nail polish remover initially had no effect, but, after the 60-second test, a solid discolored circle appeared on the surface and stayed about the same through the 5-minute test. The acetone-based nail polish remover left only slight rings, which were more noticeable after the 5-minute test.
9	ASUS Eee PC 1001P	System experienced immediate discoloration with the non-acetone and acetone-based nail polish removers. After the 5-minute test, the non-acetone nail polish remover left a dark pink stain, noticeable from any angle. The acetone-based nail polish remover initially left a slight ring, but after the5-minute test, it left a solid blue ring on the lid's textured surface.
10	Lenovo ThinkPad X100e	System affected by the non-acetone and acetone-based nail polish removers and Oil of Olay facial wash. The non-acetone immediately left a slight stain after the 10-second test, which became more discolored and noticeable with each consecutive run. The acetone-based nail polish remover left only a light ring, which is only noticeable from certain angles. The Oil of Olay facial wash left a slight oil stain on the lid.

Figure 3: Solvent spill test notes for the 10 netbook systems.

Figure 4 shows the key used for the solvent resistance test results in Figures 5 through 7.

Key to solvent resistance test results				
No damage	Slight damage	Moderate damage	Above moderate damage	Heavy damage

Figure 4: Key to solvent resistance test results.

Figure 5 presents detailed results of the solvent spill test when the solvents remained on the netbook lids for 10 seconds

Overall ranking	Netbook system	Non-acetone nail polish remover	Acetone – based nail polish remover	Bleach	Hydrogen peroxide	Isopropyl alcohol	Oil of Olay facial wash
1	Dell Latitude 2110						
2	Equus NOBi Convertible						
3	Lenovo IdeaPad S10-3						
4	Apple iPad						
5	Acer Aspire One 532h						
6	Lenovo IdeaPad S10-3t						
7	HP Mini 2102						
8	ASUS Eee PC 1201T						
9	ASUS Eee PC 1001P						
10	Lenovo ThinkPad X100e						

Figure 5: Solvent spill results for the 10 netbook systems for a spill lasting 10 seconds.

Figure 6 presents detailed results of the solvent spill test when the solvents remained on the netbook lids for 60 seconds.

Overall ranking	Netbook system	Non-acetone nail polish remover	Acetone – based nail polish remover	Bleach	Hydrogen peroxide	Isopropyl alcohol	Oil of Olay facial wash
1	Dell Latitude 2110						
2	Equus NOBi Convertible						
3	Lenovo IdeaPad S10-3						
4	Apple iPad						
5	Acer Aspire One 532h						
6	Lenovo IdeaPad S10-3t						
7	HP Mini 2102						
8	ASUS Eee PC 1201T						
9	ASUS Eee PC 1001P						
10	Lenovo ThinkPad X100e						

Figure6: Solvent spill results for the ten netbook systems for a spill lasting 60 seconds.

Figure 7 presents detailed results of the solvent spill test when the solvents remained on the netbook lids for 5 minutes.

Overall ranking	Netbook system	Non-acetone nail polish remover	Acetone – based nail polish remover	Bleach	Hydrogen peroxide	Isopropyl alcohol	Oil of Olay facial wash
1	Dell Latitude 2110						
2	Equus NOBi Convertible						
3	Lenovo IdeaPad S10-3						
4	Apple iPad						
5	Acer Aspire One 532h						
6	Lenovo IdeaPad S10-3t						
7	HP Mini 2102						
8	ASUS Eee PC 1201T						
9	ASUS Eee PC 1001P						
10	Lenovo ThinkPad X100e						

Figure 7: Solvent spill results for the 10 netbook systems for a spill lasting 5 minutes.

HOW WE TESTED

Measuring resistance to abrasion

Jane's husband, Jim, is sitting at his table in their ceramic-tiled kitchen. He unplugs his netbook to carry it into the living room, but trips over his cord, sending his netbook flying. The netbook slides on the tile for about 6 feet, scraping the surface of the netbook. What will the damage be to Jim's netbook from such abrasion?

The portability of netbook computers lends itself to mishaps, such as dropping the netbook onto a hard floor. Sliding on such surfaces may cause scratches or abrasions to the exterior of the netbook. Abrasion to a netbook lid may also occur in other day-to-day uses, including simply removing a netbook from its case, or moving it from place to place. Because this is not a drop test, but an abrasion test, we tested these netbook computers' resistance to abrasion by dragging them across a commercial-grade ceramic tile floor to gauge which netbook best withstood exterior abrasion.

To measure the effects of abrasion on the surface of a netbook, we performed the following steps:

1. Insert the card stock device between the display and the keyboard.
2. Place the netbook on the floor, lid side down.
3. Pull the netbook across the floor with a mechanized device at a constant velocity of 3.3 inches per second for 5 feet.
4. Repeat this process with the remaining netbook computers.

5. Evaluate each lid on a scale from 1 to 5, with 1 being equal to lightly scratched and 5 being equal to heavily scratched.
6. Repeat steps 1 through 5 twice more.

Figure 8 shows our method for pulling a netbook across a flat surface for the abrasion test.

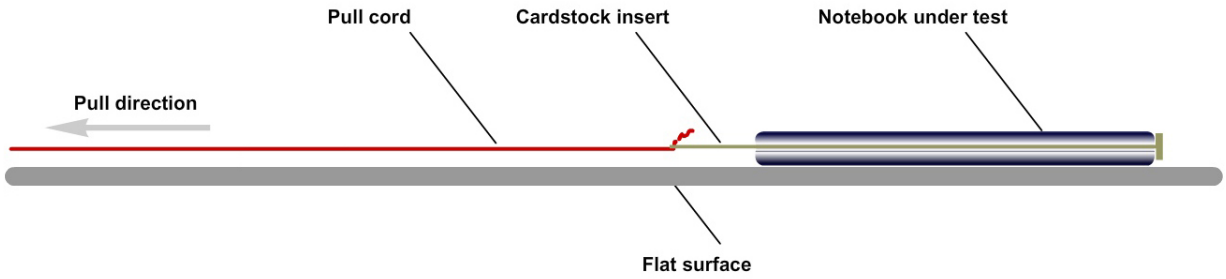

Figure 8: Demonstration of method for pulling a netbook across a flat surface for the abrasion test.

Measuring resistance to solvents

Jane Smith has just placed her netbook computer on an end table in order to remove her nail polish. Jane places the nail polish remover on the end table and reaches for her water, not thinking of the proximity of the nail polish remover to the netbook, and accidentally splashes a drop of the liquid onto the lid of her netbook. It takes Jane several seconds to retrieve a paper towel and remove the nail polish remover. How will Jane's netbook handle the spill of such a solvent?

The size and portability of a netbook computer increases its likelihood of encountering typical household solvents such as nail polish remover, bleach, isopropyl alcohol, hydrogen peroxide, and makeup removing facial wash. We designed this test to measure the effects, both cosmetic and functional, that such solvents have on netbook computers when spilled on the closed lid surface. Because it is unlikely that a spill would be wiped away immediately in an accident, we allowed the solvents to sit on the surface for various periods of time, ranging from 10 seconds to 5 minutes, before cleaning them off.

To measure the effects of solvent spills on the surface of a netbook, we performed the following steps:

1. Place the closed netbook on an absorbent pad on the test bench.
2. Using the location map, below, use a glass dropper to place one drop of non-acetone nail polish remover on the surface of the netbook lid.
3. Wait 10 seconds and wipe with an absorbent paper towel.
4. Mark the area to indicate the solvent type.
5. Repeat steps 2 through 4 with the following solvents, using different areas of the netbook lid:
    a. Acetone-based nail polish remover
    b. Bleach

    c. Hydrogen peroxide
    d. Isopropyl alcohol
    e. Oil of Olay facial wash
6. Evaluate each area for discoloration, bubbling, and corrosion. Evaluate each lid on a scale from 1 to 5, with 1 being equal to lightly damaged and 5 being equal to heavily corroded, bubbled, or discolored.
7. Repeat steps 2 through 6 twice more, substituting the following durations in step 3:
    a. 60 seconds
    b. 5 minutes

Figure 9 shows the placement of solvents on the netbook lid.

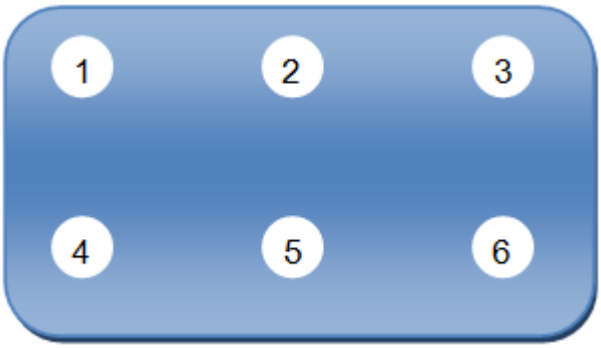

Figure 9: Position diagram for placement of solvents on netbook lid.

APPENDIX A – SYSTEM CONFIGURATION INFORMATION

Figures 10 through 12 provide detailed configuration information about the 10 netbooks we tested.

System	Acer Aspire One 532h	Apple iPad	ASUS Eee PC 1001P	ASUS Eee PC 1201T
				
General				
Number of processor packages	1	N/A	1	1
Number of cores per processor	1	N/A	1	1
Number of hardware threads per core	2	Single core	2	1
System power management policy	Balanced	N/A	Balanced	Balanced
Processor power-saving option	Enhanced Intel Speedstep Technology	N/A	Enhanced Intel SpeedStep Technology	N/A
System dimensions (length x width x height)	10-1/8” x 7-1/4” x 1-1/4”	9-1/2” x 7-1/2” x 1/2”	10-1/4” x 7” x 1-3/8”	11-1/2” x 8-1/4” x 1-1/4”
System weight	2 lbs. 10.5 oz.	1lb. 8.4oz	2 lbs. 14 oz.	3 lbs. 2.5 oz.
CPU				
Vendor	Intel	Apple	Intel	AMD
Name	Atom	Apple A4 custom	Atom	Athlon Neo
Model number	N450	N/A	N450	MV-40
Stepping	A0	N/A	A0	DH-G2
Socket type and number of pins	Micro-FCBGA559	N/A	Micro-FCBGA559	ASB1
Core frequency (GHz)	1.66	N/A	1.66	1.60
Front-side bus frequency	667 MHz	N/A	667 MHz	1,600 MHz
L1 cache	32 KB +24 KB	N/A	32 KB + 24 KB	64 KB +64 KB
L2 cache	512 KB	640 KB	512 KB	512 KB
L3 cache	N/A	N/A	N/A	N/A

System	Acer Aspire One 532h	Apple iPad	ASUS Eee PC 1001P	ASUS Eee PC 1201T
Platform				
Vendor	Acer	N/A	ASUSTek Computer	ASUSTek Computer
Motherboard model number	AO532h	N/A	1005P	1210T
Motherboard chipset	Intel NM10	N/A	Intel NM10	AMD 780G
BIOS name and version	Acer V1.21 (03/17/2010)	N/A	American Megatrends v0706 (01/04/2010)	American Megatrends v0317 (02/02/2010)
Memory module(s)				
Vendor and model number	Kingston ACR128X64D2S800 C6	N/A	ASint Technology B2YJUS73FN1	Transcend Information TS256MSQ64V6U
Type	PC2-6400	N/A	PC2-6400	PC2-5300
Speed (MHz)	800	N/A	800	667
Speed running in the system (MHz)	667	N/A	667	667
Timing/Latency (tCL-tRCD-tRP-tRASmin)	5-5-5-15	N/A	5-5-5-15	5-5-5-15
Size (MB)	1,024	N/A	1,024	2,048
Number of memory module(s)	1	N/A	1	1
Chip organization (Single-sided, Double-sided)	Double-sided	N/A	Double-sided	Double-sided
Channel (Single/Dual)	Single	N/A	Single	Single
Hard disk				
Vendor and model number	Western Digital WD1600BEVT	N/A	Seagate ST9160301AS	Hitachi HTS545025B9A300 ATA Device
Number of disks in system	1	1	1	1
Size (GB)	160	N/A	160	250
Buffer size (MB)	8	N/A	8	8
RPM	5,400	N/A	5,400	5,400
Type	SATA 3.0Gb/s	N/A	SATA 3.0 Gb/s	SATA 3.0 Gb/s
Controller	Intel NM10 Express Chipset	N/A	Intel NM10 Express Chipset	Standard AHCI 1.0 Serial ATA Controller

System	Acer Aspire One 532h	Apple iPad	ASUS Eee PC 1001P	ASUS Eee PC 1201T
Driver	Intel 8.9.0.1023 (06/04/2009)	N/A	Intel 8.9.0.1023 (06/04/2009)	Microsoft 6.1.7600.16385 (06/21/2006)
Operating system				
Name	Windows 7 Starter	OSi 3.2 (modified)	Windows 7 Starter	Windows 7 Starter
Build number	7600	7B367	7600	7600
Service Pack	N/A	N/A	N/A	N/A
File system	NTFS	N/A	NTFS	NTFS
Kernel	ACPI x86-Based PC	N/A	ACPI x86-based PC	ACPI x86-based PC
Language	English	N/A	English	English
Microsoft DirectX version	11	N/A	11	11
Graphics				
Vendor and model number	Intel Graphics Media Accelerator 3150	N/A	Intel Graphics Media Accelerator 3150	ATI Radeon HD 3200 Graphics
Type	Integrated	N/A	Integrated	Integrated
Chipset	Intel Graphics Media Accelerator 3150	N/A	Intel Graphics Media Accelerator 3150	ATI Radeon HD 3200 Graphics
BIOS version	1818.0	N/A	1790.0	010.094.001.038
Total available graphics memory (MB)	250	N/A	251	895
Dedicated video memory (MB)	0	N/A	0	256
System video memory (MB)	64	N/A	64	0
Shared system memory (MB)	186	N/A	187	639
Resolution	1,024 x 600 x 32 bit	N/A	1,024 x 600 x 32 bit	1,366 x 768 x 32 bit
Driver	Intel 8.14.10.1929 (09/23/2009)	N/A	Intel 8.14.10.1929 (09/23/2009)	ATI Technologies 8.56.1.15 (04/24/2009)
Sound card/subsystem				
Vendor and model number	Realtek High Definition Audio	N/A	Realtek High Definition Audio	High Definition Audio Device
Driver	Realtek 6.0.1.5999 (12/09/2009)	N/A	Realtek 6.0.1.1548 (09/29/2009)	Microsoft 6.1.7600.16385 (07/13/2009)

System	Acer Aspire One 532h	Apple iPad	ASUS Eee PC 1001P	ASUS Eee PC 1201T
Ethernet				
Vendor and model number	Atheros AR8132 PCI-E Fast Ethernet Controller (NDIS 6.20)	N/A	Atheros AR8132 PCI-E Fast Ethernet Controller (NDIS 6.20)	Atherose AR8132 PCI-E Fast Ethernet Controller (NIDS 6.20)
Driver	Atheros 1.0.0.14 (09/04/2009)	N/A	Atheros 1.0.0.10 (07/27/2010)	Microsoft 1.0.0.4 (04/01/2009)
Wireless				
Vendor and model number	Atheros AR5B95 Wireless Network Adapter	N/A	Atheros AR2427 Wireless Network Adapter	Realtek RTL8191 Wireless LAN 802 11n PCI-NIC
Driver	Atheros 8.0.0.279 (12/29/2009)	N/A	Atheros 8.0.0.238 (10/05/2009)	Realtek 2015.2.430.2010 (04/30/2010)
USB ports				
Number	3	N/A	3	3
Type	2.0	N/A	2.0	2.0
Other	6-in-1 Media Card Reader	N/A	3-in-1 Media Card Reader	3-in-1 Media Card Reader
IEEE 1394 ports				
Number	0	N/A	0	0
Monitor				
LCD type	CrystalBrite LED-Backlight	LED Backlight	LED-Backlight Display	LED-Backlight Display
Screen size (inches)	10.1	9.7	10.1	12.1
Refresh rate (Hz)	60	N/A	60	60
Battery				
Type	Acer UM09H31 Li-ion	A1315 Li-Ion Polymer	ASUS AL32-1005 Li-ion	ASUS A32-UL20 Li-ion
Size (length x width x height)	8” x 2” x 1-1/4”	N/A	8” x 2” x 1”	8-1/8” x 2” x 1”
Rated capacity	4,400mAh / 10.8V (48Wh)	6,600mAh / 3.75V (24.8Wh)	4,400mAh / 10.8V (48Wh)	4,400mAh / 10.8V (47Wh)
Weight (oz.)	10.5	N/A	11.1	10.9

Figure 10: System configuration information for four of the netbook systems.

System	Dell Latitude 2110	Equus NOBi Convertible	HP Mini 2102	Lenovo IdeaPad S10-3
				
General				
Number of processor packages	1	1	1	1
Number of cores per processor	1	1	1	1
Number of hardware threads per core	2	2	2	2
System power management policy	Dell	Balanced	HP Optimized	Balanced
Processor power-saving option	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology
System dimensions (length x width x height)	10- 3/8” x 7-3/8” x 1-5/8”	10-3/4” x 8-1/2” x 1-3/8”	10-1/2” x 7” x 1-1/8”	10-1/2” x 6-5/8” x1-1/2”
System weight	2 lbs. 14.3 oz.	3 lbs. 1 oz.	2 lbs. 7 oz.	2 lbs. 9 oz.
CPU				
Vendor	Intel	Intel	Intel	Intel
Name	Atom	Atom	Atom	Atom
Model number	N470	N450	N450	N450
Stepping	A0	A0	A0	A0
Socket type and number of pins	Micro-FCBGA559	Micro-FCBGA559	Micro-FCBGA559	Micro-FCBGA559
Core frequency (GHz)	1.83	1.66	1.66	1.66
Front-side bus frequency (MHz)	667	667	667	667
L1 cache	32 KB + 24 KB	32 + 24 KB	32 KB +24 KB	32 KB +24 KB
L2 cache	512 KB	512 KB	512 KB	512 KB
L3 cache	N/A	N/A	N/A	N/A
Platform				
Vendor	Dell	QCI	HP	Lenovo

System	Dell Latitude 2110	Equus NOBi Convertible	HP Mini 2102	Lenovo IdeaPad S10-3
Motherboard model number	0M57NM	Intel powered classmate PC	3660	Mariana3A
Motherboard chipset	Intel NM10	NM10	Intel NM10	NM10
BIOS name and version	Dell Inc. A00 (03/09/2010)	Phoenix SPPNV10A.86A.0026 (03/26/2010)	HP F.12 (04/23/2010)	LENOVO 2ACN21WW (02/03/2010)
Memory module(s)				
Vendor and model number	Hyundai HYMP112S64CP6-S6	Hyundai Electronics HYMP112S64CP6-S6	Hyundai HYMP112S64CP6-S6	Ramaxel Technology RMN1150HC48D7F-667
Type	PC2-6400	PC2-6400	PC2-6400	PC2-5300
Speed (MHz)	800	800	800	667
Speed running in the system (MHz)	667	667	667	667
Timing/Latency (tCL-tRCD-tRP-tRASmin)	5-5-5-15	5-5-5-15	5-5-5-15	5-5-5-15
Size (MB)	1,024	1,024	1,024	1,024
Number of memory module(s)	1	1	1	1
Chip organization (Single-sided, Double-sided)	Double-sided	Double-Sided	Double-sided	Double-sided
Channel (Single/Dual)	Single	Single	Single	Single
Hard disk				
Vendor and model number	Western Digital WD1600BEVT	Seagate ST9160314AS	Toshiba MK1656GSY	Fujitsu MJA2160BH G2
Number of disks in system	1	1	1	1
Size (GB)	160	160	160	160
Buffer size (MB)	8	8	16	8
RPM	5,400	5,400	7,200	5,400
Type	SATA 3.0Gb/s	SATA 3.0 Gb/s	SATA 3.0 Gb/s	SATA 3.0Gb/s
Controller	Standard AHCI 1.0 Serial ATA Controller	Intel ICH7R/DH SATA AHCI Controller	Intel NM10 Express Chipset	Intel NM10 Express Chipset

System	Dell Latitude 2110	Equus NOBi Convertible	HP Mini 2102	Lenovo IdeaPad S10-3
Driver	Microsoft 6.1.7600.20575 (06/21/2006)	Intel 8.9.4.1004 (10/13/2009)	Intel 8.9.0.1023 (06/04/2009)	Microsoft 6.1.7600.16385 (06/21/2006)
Operating system				
Name	Windows 7 Starter	Windows 7 Starter	Window 7 Starter	Window 7 Starter
Build number	7600	7600	7600	7600
Service pack	N/A	N/A	N/A	N/A
File system	NTFS	NTFS	NTFS	NTFS
Kernel	ACPI x86-based PC	ACPI x86-based PC	ACPI x86-Based PC	ACPI x86-based PC
Language	English	English	English	English
Microsoft DirectX version	11	11	11	11
Graphics				
Vendor and model number	Intel Graphics Media Accelerator 3150	Intel Graphics Media Accelerator 3150	Intel Graphics Media Accelerator 3150	Intel Graphics Media Accelerator 3150
Type	Integrated	Integrated	Integrated	Integrated
Chipset	Intel Graphics Media Accelerator 3150	Intel Graphics Media Accelerator 3150	Intel Graphics Media Accelerator 3150	Intel Graphics Media Accelerator 3150
BIOS version	1933.2	1933	1818.0	1851.0
Total available graphics memory (MB)	250	250	250	250
Dedicated video memory (MB)	0	0	0	0
System video memory (MB)	64	64	64	64
Shared system memory (MB)	186	186	186	186
Resolution	1,024 x 600 x 32 bit	1,024 x 600 x 32 bit	1,024 x 600 x 32 bit	1,024 x 600 x 32 bit
Driver	Intel 8.14.10.2023 (12/14/2009)	Intel 8.14.10.2023 (12/14/2009)	Intel 8.14.10.1929 (09/23/2009)	Intel 8.14.10.1929 (09/23/2009)
Sound card/subsystem				
Vendor and model number	Realtek High Definition Audio	Conexant CX20671 Smart Audio HD	IDT High Definition Audio CODEC	Realtek High Definition Audio
Driver	Realtek 6.0.1.6069 (03/17/2010)	Conexant 4.112.0.60 (02/11/2010)	IDT 6.10.6246.0 (10/12/2009)	Realtek 6.0.1.5989 (11/25/2009)

System	Dell Latitude 2110	Equus NOBi Convertible	HP Mini 2102	Lenovo IdeaPad S10-3
Ethernet				
Vendor and model number	Broadcom NetXtreme Gigabit Ethernet	JMicron PCI Express Fast Ethernet Adapter	Realtek PCIe FE Family Controller	Realtek PCIe FE Family Controller
Driver	Broadcom 12.4.1.0 (10/28/2009)	JMicron Technology Corp. 6.0.15.6 (12/30/2009)	Realtek 7.7.1002.2009 (10/02/2009)	Realtek 7.6.820.2009 (08/20/2009)
Wireless				
Vendor and model number	Dell DW1501 Wireless-N WLAN Half-Mini Card	Realtek RTL8191SE Wireless LAN 802.11n PCI-E NIC	Broadcom 802.11b/g WLAN	Atheros AR9285 Wireless Network Adapter
Driver	Broadcom 5.60.48.35 (01/21/2010)	Realtek 2010.0.119.2010 (01/19/2010)	Broadcom 5.60.18.41 (10/23/2009)	Atheros Communications Inc. 8.0.0.279 (01/17/2010)
USB ports				
Number	3	2	3	3
Type	2.0	2.0	2.0	2.0
Other	3-in-1 Media Card Reader	Media Card Reader	5-in-1 Media Card Reader	5-in-1 Memory Card Reader
IEEE 1394 ports				
Number	0	0	0	0
Monitor				
LCD type	LED-Backlight display	Color Touch Screen LCD	WSVGA LED Anti-glare Widescreen Display	LED-Backlit
Screen size (inches)	10.1	10.1	10.1	10.1
Refresh rate (Hz)	60	60	60	60
Battery				
Type	Dell F079N Li-ion Battery	SQU-912 Li-ion	HP AN03 Li-ion	Lenovo L09S6Y14
Size (length x width x height)	8” x 1-1/2” x 7/8”	7-1/2” x 2-1/8” x 3/4”	8” x 1-3/4” x 7/8”	8” x 2-1/8” X 1-1/16”
Rated capacity	2500mAh / 11.1V (28Wh)	4,400mAh / 7.4V (32Wh)	2500mAh / 10.8V (28Wh)	4400mAh / 10.8V (48Wh)
Weight (oz.)	6.7	7.8	5.9	10.5

Figure 11: System configuration information for four of the netbook systems.

System	Lenovo IdeaPad S10-3t	Lenovo ThinkPad X100e
		
General		
Number of processor packages	1	1
Number of cores per processor	1	1
Number of hardware threads per core	2	1
System power management policy	Energy Star	Energy Star
Processor power-saving option	Enhanced Intel SpeedStep Technology	PowerNow!™ Technology
System dimensions (length x width x height)	11” x 6-7/8” x 1-1/8”	11-1/16” x 8-3/8” x 1-1/8”
System weight	2 lbs. 13.5 oz.	3 lbs. 4 oz.
CPU		
Vendor	Intel	AMD
Name	Atom	Athlon Neo
Model number	N450	MV-40
Stepping	A0	DH-G2
Socket type and number of pins	Micro-FCBGA559	ASB1
Core frequency (GHz)	1.66	1.6
Front-side bus frequency	667 MHz	1.6 GT/s
L1 cache	32 KB + 24 KB	64 KB + 64 KB
L2 cache	512 KB	512 KB
L3 cache	N/A	N/A
Platform		
Vendor	Lenovo	Lenovo
Motherboard model number	Caucasus2	3508CTO
Motherboard chipset	Intel NM10	AMD 780G
BIOS name and version	Lenovo v24CN18WW (12/11/2009)	Lenovo 6XET39WW (1.23) 04/30/2010
Memory module(s)		
Vendor and model number	Ramaxel Technology RMN1150HC48D7F-667	Hyundai HYMP112S64CP6-Y5
Type	PC2-5300	PC2-5300
Speed (MHz)	667	667
Speed running in the system (MHz)	667	667
Timing/Latency (tCL-tRCD-tRP-tRASmin)	5-5-5-15	5-5-5-15
Size (MB)	512	1,024

System	Lenovo IdeaPad S10-3t	Lenovo ThinkPad X100e
Number of memory module(s)	1	1
Chip organization (Single-sided, Double-sided)	Double-sided	Double-Sided
Channel (Single/Dual)	Single	Single
Hard disk		
Vendor and model number	Hitachi HTS545016B9A300	Western Digital WD 1600BEVT
Number of disks in system	1	1
Size (GB)	160	160
Buffer size (MB)	8	8
RPM	5,400	5,400
Type	SATA 3.0Gb/s	SATA 3.0 Gb/s
Controller	Intel NM10 Express Chipset	Standard AHCI 1.0 Serial ATA Controller
Driver	Intel 8.9.0.1023 (06/04/2009)	Microsoft 6.1.7600.16385 (06/21/2006)
Operating system		
Name	Windows 7 Starter	Windows 7 Starter
Build number	7600	7600
Service Pack	N/A	N/A
File system	NTFS	NTFS
Kernel	ACPI x86-based PC	ACPI x86-based PC
Language	English	English
Microsoft DirectX version	11	11
Graphics		
Vendor and model number	Intel Graphics Media Accelerator 3150	ATI Radeon HD 3200 Graphics
Type	Integrated	Integrated
Chipset	Intel Graphics Media Accelerator 3150	ATI Radeon HD 3200 Graphics
BIOS version	1933.0	010.094.001.039
Total available graphics memory (MB)	250	511
Dedicated video memory (MB)	0	384
System video memory (MB)	64	0
Shared system memory (MB)	186	127
Resolution	1,024 x 600 x 32 bit	1,366 x 768 x 32 bit
Driver	Intel 8.14.10.1929 (09/23/2009)	ATI 8.663.2.0 (10/19/2009)
Sound card/subsystem		
Vendor and model number	Conexant Pebble High Definition Smart Audio	Conexant 20582 SmartAudio HD

System	Lenovo IdeaPad S10-3t	Lenovo ThinkPad X100e
Driver	Conexant 4.98.13.62 (11/02/2009)	Conexant 4.98.18.62 (12/01/2009)
Ethernet		
Vendor and model number	Broadcom NetLink Gigabit Ethernet	Realtek PCIe GBE Family Controller
Driver	Broadcom 12.4.3 (10/16/2009)	Realtek 7.11.1127.2009 (11/27/2009)
Wireless		
Vendor and model number	Atheros AR9285 Wireless Network Adapter	Realtek 11b/g/n Wireless LAN Mini-PCI Express Adapter II
Driver	Atheros Communications 8.0.0.238 (10/05/2009)	Realtek 2007.2.1103.2009 (11/03/2009)
USB ports		
Number	2	3
Type	2.0	2.0
Other	6-in-1 Media Card Reader	4-in-1 Media Reader
IEEE 1394 ports		
Number	0	0
Monitor		
LCD type	LED Backlight Display	WXGA LED-backlit
Screen size (inches)	10.1	11.6
Refresh rate (Hz)	60	60
Battery		
Type	Lenovo L09S4T09	Lenovo 17+ Li-ion
Size (length x width x height)	9-5/8” x 2” x 5/8”	8-3/8” x 2-1/4” x 1”
Rated capacity	3,740mAh / 7.4V (29Wh)	5,200mAh / 10.8V (57Wh)
Weight (oz.)	6.9	11.8

Figure 12: System configuration information for two of the netbook systems.

APPENDIX B - ABRASION TEST SCORING SHEET

Abrasion Test

System Name:_____ System Inventory ID:_____

Test 1

Judge 1 score: ___

Judge 2 score:___

Judge 3 score:___

Average score:___

Test 2

Judge 1 score: ___

Judge 2 score:___

Judge 3 score:___

Average score:___

Test 3

Judge 1 score: ___

Judge 2 score:___

Judge 3 score:___

Average score:___

APPENDIX C - SOLVENT TEST SCORING SHEET

Solvent test

System Name:_____

Non-acetone nail polish remover

10 second score: ___

60 second score:___

1 minute score:___

Average score:___

Hydrogen peroxide

10 second score: ___

60 second score:___

1 minute score:___

Average score: ___

Acetone-based nail polish remover

10 second score: ___

60 second score:___

1 minute score:___

Average score:___

Isopropyl alcohol

Tester 1 score: ___

Tester 2 score:___

Tester 3 score:___

Average score:___

Bleach

10 second score: ___

60 second score:___

1 minute score:___

Average score:___

Olay Age Defying Cleanser

Tester 1 score: ___

Tester 2 score:___

Tester 3 score:___

Average score:___

ABOUT PRINCIPLED TECHNOLOGIES

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

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