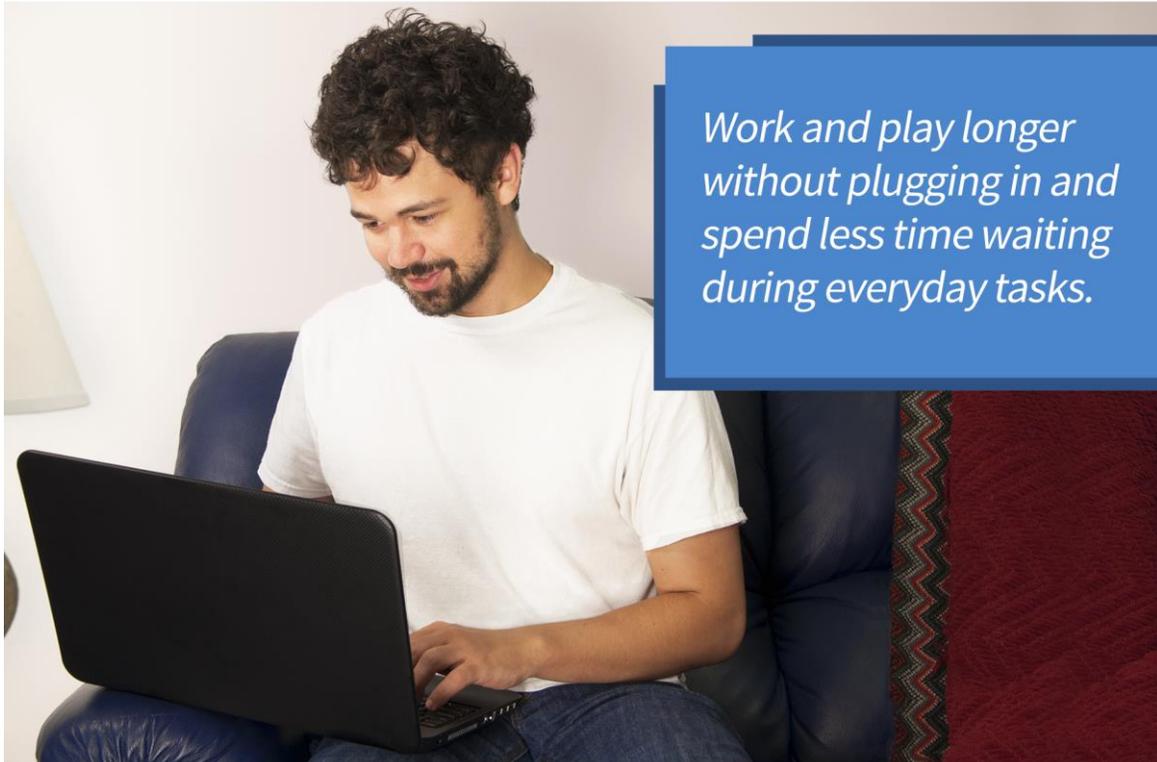


UPGRADING TO A NEW LAPTOP POWERED BY INTEL CORE i5, PENTIUM, OR CELERON PROCESSORS

Do more. Wait less.
On a new laptop powered by Intel® processors



*Work and play longer
without plugging in and
spend less time waiting
during everyday tasks.*

versus a four year old laptop

Every second of your day counts, whether time is ticking away on a project deadline or you're squeezing in some time on the Internet after a hard day. Small delays with your aging laptop can pile up to minutes of wasted time. Watching these seconds slip by is frustrating. You may not have had these problems when your laptop was new—everything you needed could happen quickly. Now, waiting for your laptop to respond and being close to an electrical outlet are just facts of life.

Consider updating your laptop. Laptops today are a lot faster than similar ones from 2010, thanks to much speedier processors. Their batteries also last dramatically longer on just one charge. If you upgrade now, you may find yourself with more time to do the things you need or want with your new noticeably quicker laptop. Plus, you'd be able to use it much longer before the battery conked out.

To measure these improvements, we ran a series of tests in the Principled Technologies labs. We looked at three pairs of laptops, each using a different flavor of Intel® processor—Core™ i5, Pentium®, and Celeron®. For each processor family, we tested an older laptop with a 2010 version of the processor and a newer system powered by a 2014 version.

Across the board, we found that the newer models lasted longer and completed everyday tasks much more quickly—great reasons to ditch the four-year-old laptop and get the benefits of new technology. You can have more time to do the things you need and want to do.



BUYING A NEW LAPTOP—IS IT WORTH IT?

Yes and here's why: The laptop you bought new in 2010 might have seemed fast and long lasting at first, but technology advances quickly and the processors that drive laptops have improved dramatically in recent years. With laptops that use the newest processors, you may be able to spend less time waiting on it and more time actually using it.

We tested three pairs of laptops to see how long they would last on a single charge and how quickly they would start up, copy files, and launch applications. In all cases, the 2014 systems had longer-lasting batteries and performed tasks more quickly than their 2010 counterparts did. Please note that to standardize our results, we gave fresh batteries to the 2010 systems we tested and restored their operating systems to factory condition. If you are still using the original battery with your four-year-old processor, you could see even bigger improvements than we found by updating to a 2014 laptop.

For detailed system configuration, see [Appendix A](#), and for detailed test methodology, see [Appendix B](#).

WHAT WE MEASURED

Battery life—More time for you, less time finding an outlet

One of the most appealing elements of a laptop is mobility; you can take it anywhere without being tethered by a power cord. If your laptop's battery life is short, you might not have this freedom. To learn how the newer Intel processors extended battery life, we tested each of the six systems using a tool called MobileMark that measures battery life. For each of the processor families, upgrading to the system powered by the newer processor would mean you could work and play on your laptop noticeably longer without plugging it in.

Boot time—The quicker the better

If you've had your laptop for a few years, you might be used to long startups or boot times. Wouldn't it be nice to have it up and running without those long seconds of waiting? To learn how the newer Intel processors go from boot to browse faster than the older processors, we hand-timed the startup process. With the newer version of each of the processor families, the wait time is much shorter—less than 20 seconds. That means whether you're opening your laptop for business or leisure, you can get started faster.

Copying files to and from a USB drive—Who wants to wait?

USB drives are convenient for storing files as backups or sharing with others. But that convenience gets overshadowed when the process takes longer than it should – as it can with an older laptop. All of the 2014 laptops we tested were able to copy files *to* a USB drive in less than 19 seconds and *from* a USB drive in less than 16 seconds. That saves valuable time when you need it.

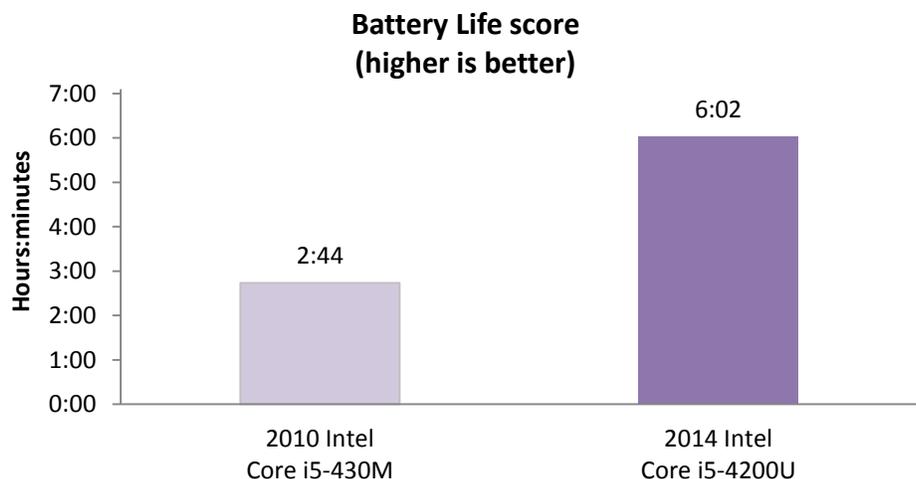
Launching Word and Photoshop—Work can't wait

You know how with older laptops, opening a program can seem like a chore? It shouldn't be like that—waiting for your older system cuts into your precious time for work and play. We timed the process of starting two popular programs, Microsoft® Word and Adobe® Photoshop®, on our six test laptops. As you'll see, for each of the Intel processor families in the newer laptops, the wait time for the program to launch is much shorter, enabling you to start using the program faster.

INTEL CORE I5 PROCESSOR COMPARISON

You can see that based on our MobileMark testing, the laptop with the 2014 Intel Core i5 processor had longer battery life than the laptop with the 2010 model processor (Figure 1). Upgrading to the system powered by the newer processor would mean you could use your laptop dramatically longer without plugging it in. At 6 hours and 2 minutes, the battery in the new laptop lasted over three hours longer than that of the older model—over twice as long—after we replaced the old, worn out battery with a new one.

Figure 1: Upgrading to the laptop powered by the newer Intel processor extended battery life by 3 hours 18 minutes.



We consider everyday tasks to be the things you do to be productive, like use Word or copy a file from your laptop, or even just the little things like starting up your laptop. Looking at the new system versus the old one, you'll see some differences in the time each laptop needed to do these everyday tasks (Figure 2). The 2014 model with the newer processor saved seconds on every task overall.

The 2014 laptop with the Core i5 processor:

- Started up in under 15 seconds, saving over a minute and a half compared to the 2010 laptop
- Copied files both to and from a USB drive in less time than it took the older model to do either of those tasks
- Launched the productivity programs Microsoft Word and Adobe Photoshop CC faster than the older model—less than half the time for Word and almost two seconds faster for Photoshop CC

Performing everyday tasks (lower is better)

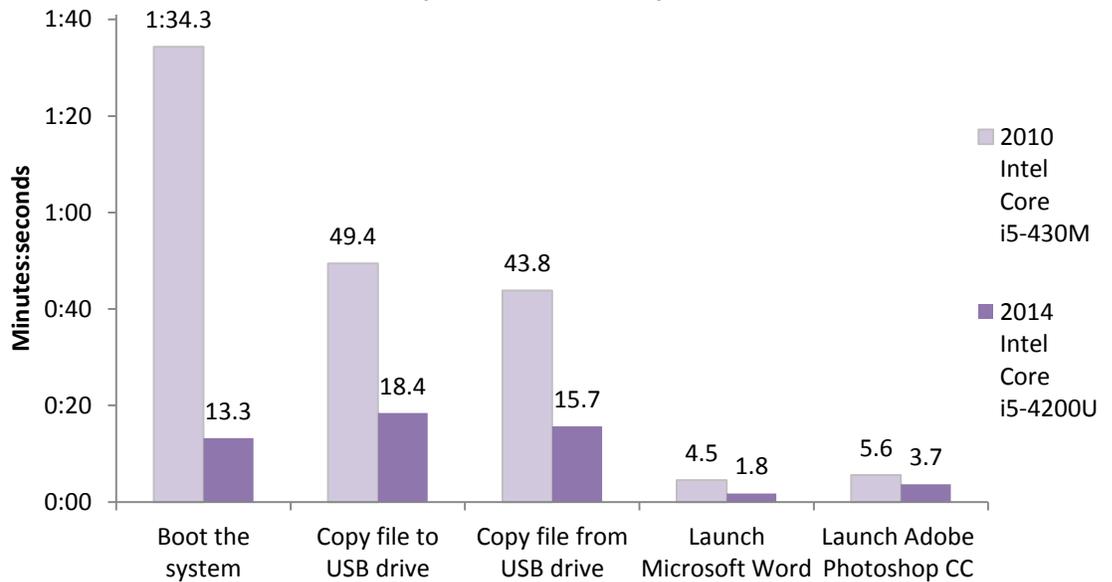


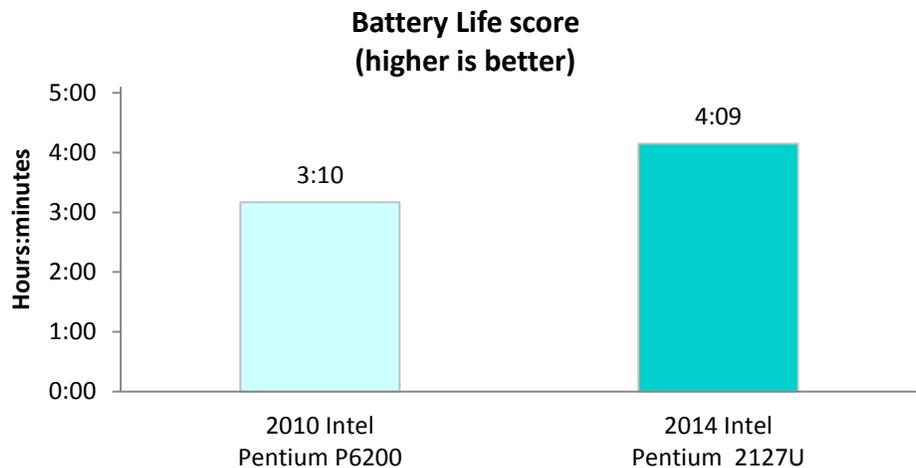
Figure 2: The 2014 Intel Core i5-4200U processor-based laptop was faster across the board than the 2010 Core i5-430M processor-based laptop.

Upgrade to the 2014 Intel Core i5-4200U processor-based laptop and save over a minute when booting the system.

INTEL PENTIUM PROCESSOR COMPARISON

Like the newer Core i5 processor-based system, the laptop with the newer Pentium processor got a better MobileMark score than its four-year-old version (Figure 3). At 4 hours and 9 minutes, the newer laptop's battery lasted about an hour longer than that of the older model, which means more time to work and play without the hassle of finding an outlet.

Figure 3: Upgrading to the laptop powered by the newer Intel processor extended battery life by 59 minutes.



You can see the amount of time the two laptops with Pentium processors needed to perform everyday tasks in Figure 4. Again, upgrading to the newer model can save you valuable time.

The 2014 laptop with the Pentium processor:

- Started up over twice as fast as the older model
- Copied files both to and from a USB drive in less time than the older model took to do either of those tasks
- Launched Word and Photoshop CC faster than the older laptop—over a second faster for Word and three and a half seconds faster for Photoshop CC

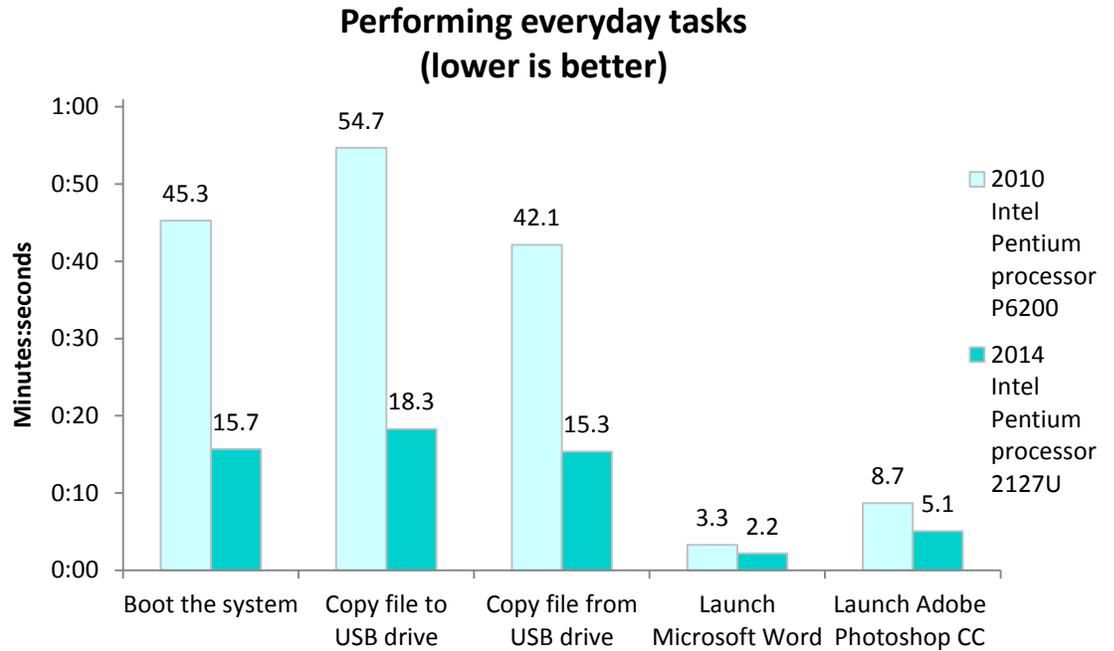


Figure 4: The 2014 Intel Pentium 2127U processor-based laptop was faster across the board than the 2010 Intel Pentium P6200 processor-based laptop.

Upgrade to the 2014 Pentium 2127U processor-based laptop and transfer files to a USB drive in almost a third of the time.

INTEL CELERON PROCESSOR COMPARISON

At 6 hours and 2 minutes, the 2014 laptop with the newer Celeron processor lasted over two hours longer than the older model—even though the older model had a higher-capacity battery (Figure 5).

Figure 5: Upgrading to the laptop powered by the newer Intel processor extended battery life by 2 hours 16 minutes.

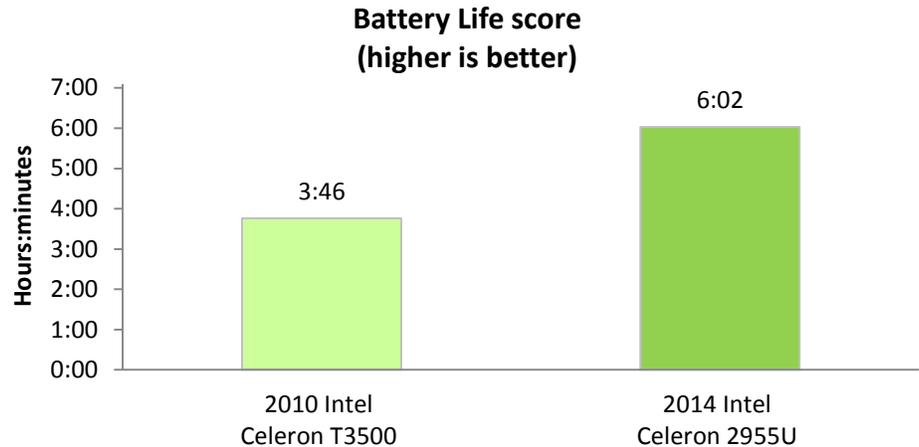


Figure 6 shows the amount of time the two laptops with Celeron processors needed to perform everyday tasks. For each of these, the newer laptop saved precious seconds.

The 2014 laptop with the Celeron processor:

- Started up in less than half the time it took the older model
- Copied files to a USB drive almost four times as fast as the older model.
- Launched productivity programs faster than the older model—more than twice as fast for Word and four seconds faster for Photoshop CC

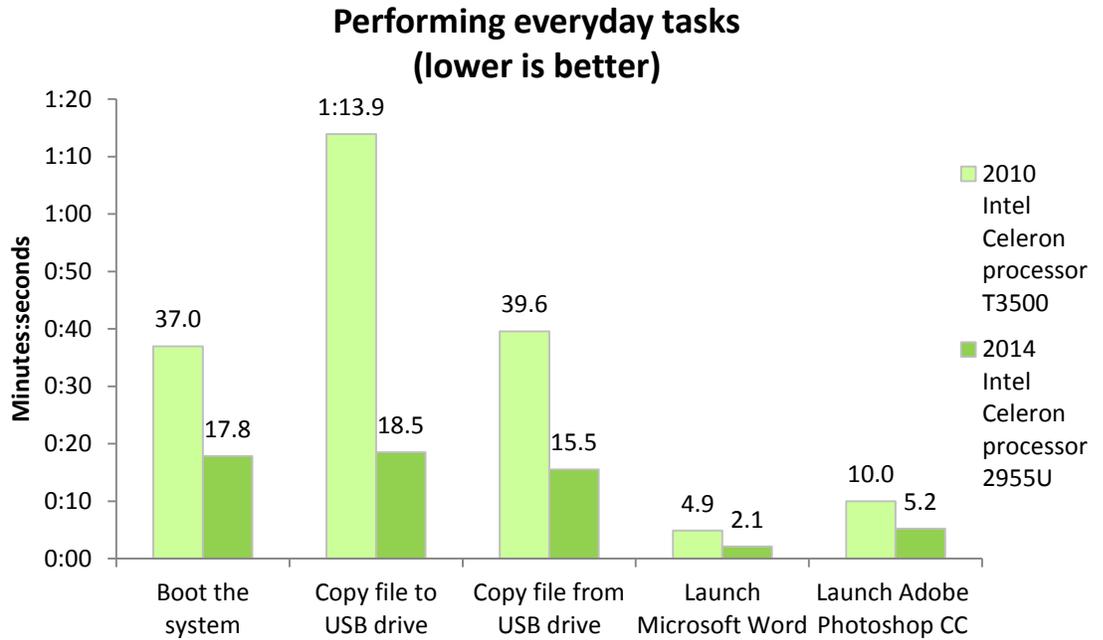


Figure 6: The laptop with the 2014 Intel Celeron 2955U processor was faster across the board than the laptop with the 2010 Intel Celeron T3500 processor.

Upgrade to the 2014 Celeron 2955U processor-based laptop and launch productivity programs faster.

IN CONCLUSION

Whether you notice it or not, little seconds of your day spent waiting on an aging laptop can add up quickly. A few here, a few there—before you know it, you’ve lost valuable time that could have been used elsewhere. Thanks to advances in processor technology, laptops powered by the newer generation of Intel Core i5, Pentium, and Celeron processors are quicker than laptops from 2010, which can translate to better performance and longer battery life. In our testing, we found that with each of these Intel processor families, replacing a four-year-old laptop with a laptop using the newer-generation processor boosted both responsiveness and battery life. Don’t keep waiting—update your laptop to one with a 2014 Intel processor to do more and wait less.

APPENDIX A – DETAILED SYSTEM CONFIGURATION

Figures 7 through 9 show the configuration information for the three sets of laptops we tested.

System	2010 Intel Core i5-430M processor-based system	2014 Intel Core i5-4200U processor-based system
General		
Number of processor packages	1	1
Number of cores per processor	2	2
Number of hardware threads per core	2	2
Total number of processor threads in system	4	4
System power management policy	HP Recommended	HP Recommended
Processor power-saving option	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology
System dimensions (length × width × height)	13 1/4" long × 9" wide × 1 1/4" high	15 1/8" long × 10 1/8" wide × 7/8" high
System weight	4.34 lbs.	5.10 lbs.
CPU		
Vendor	Intel	Intel
Name	Core i5	Core i5
Model number	430M	4200U
Stepping	C2	C0
Socket type and number of pins	Socket 989 rPGA	Socket FCBGA1168
Core frequency (GHz)	2.27	1.60
Bus frequency	Intel DMI 2.5 GT/s	Intel DMI 5 GT/s
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	256 KB (per core)	256 KB (per core)
L3 cache	3 MB	3 MB
Platform		
Vendor	Hewlett-Packard	Hewlett-Packard
Model	Pavilion dm4	Pavilion 15t
Motherboard model number	146A	2163
Motherboard chipset	Intel 5 series chipset	Intel 8 series chipset
BIOS name and version	Hewlett-Packard F.26 (02/14/2011)	Insyde F.42 (12/04/2013)
Memory module(s)		
Vendor and model number	Hyundai HMT125S6TFR8C-H9	Kingston HP16D3LS1KBG/4G
Type	PC3-10700	PC3-12800
Speed (MHz)	1,334	1,600
Speed running in the system (MHz)	1,334	1,600
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-25	11-11-11-28
Size (MB)	2,048	4,096
Number of memory module(s)	2	1
Total amount of system RAM (GB)	4	4

System	2010 Intel Core i5-430M processor-based system	2014 Intel Core i5-4200U processor-based system
Chip organization (single-sided/double-sided)	Double-sided	Double-sided
Channel (single/dual)	Dual	Single
Hard disk		
Vendor and model number	Seagate ST9500420AS	Western Digital WD5000LPVX-60V0TTO
Number of disks in system	1	1
Size (GB)	500	500
Buffer size (MB)	16	8
RPM	7,200	5,400
Type	SATA 3Gb/s	SATA 6Gb/s
Controller	Intel 5 series chipset	Intel 8 series chipset
Driver	Intel 9.5.6.1001 (12/17/2009)	Intel 12.8.1.1000 (08/16/2013)
Operating system		
Name	Windows 7 Home Premium	Windows 8.1
Build number	7601	9600
Service Pack	1	NA
File system	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC
Language	English	English
Microsoft DirectX version	DirectX 11	DirectX 11
Graphics		
Vendor and model number	Intel HD Graphics (Core i5)	Intel HD Graphics 4400
Type	Integrated	Integrated
Chipset	Intel HD Graphics (Core i5)	Intel HD Graphics 4400
BIOS version	2056	5.0.1035
Total available graphics memory (MB)	1,696	1,792
Dedicated video memory (MB)	64	0
System video memory (MB)	0	0
Shared system memory (MB)	1,632	1,792
Resolution	1,366 × 768	1,366 × 768
Driver	Intel 8.15.10.2202 (08/25/2010)	Intel 10.18.10.3325 (10/10/2013)
Sound card/subsystem		
Vendor and model number	IDT High Definition Audio	Realtek High Definition Audio
Driver	IDT 6.10.6269.0 (02/01/2010)	Realtek 6.0.1.7083 (11/05/2013)
Ethernet		
Vendor and model number	N/A	Realtek PCIe FE Family Controller
Driver	N/A	Realtek 8.20.815.2013 (08/15/2013)
Wireless		
Vendor and model number	Broadcom 4313	Ralink RT3290
Driver	Broadcom 5.60.48.35 (01/21/2010)	Ralink 5.0.34.0 (09/24/2013)

System	2010 Intel Core i5-430M processor-based system	2014 Intel Core i5-4200U processor-based system
Optical drive(s)		
Vendor and model number	HP CDDVDW TS-U633F	HP DVDRAM GU90N
Type	CD/DVDW	DVD/CD-ROM
USB ports		
Number	3	3
Type	2 × 2.0, 1 × 2.0/eSATA	1 × USB 2.0, 2 × USB 3.0
Other	SD Media card reader, eSATA, HDMI	SD Media card reader, HDMI
Monitor		
LCD type	LED	LED Backlit
Screen size	14.1"	15.6"
Refresh rate	60	60
Battery		
Type	Lithium-ion	Lithium-ion
Size (length × width × height)	8" long x 2" wide x 3/4" high	10 3/4" long x 1 3/8" wide x 7/8" high
Rated capacity	56 Wh	41.4 Wh
Weight	0.66 lbs.	0.5 lbs.

Figure 7: Configuration details for the 2010 and 2014 Intel Core i5 processor-powered laptop systems.

System	2010 Intel Pentium P6200 processor-based system	2014 Intel Pentium 2127U processor-based system
General		
Number of processor packages	1	1
Number of cores per processor	2	2
Number of hardware threads per core	1	1
Total number of processor threads in system	2	2
System power management policy	Balanced	Dell
Processor power-saving option	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology
System dimensions (length × width × height)	14 3/4" wide × 10 1/4" deep × 1 3/8" high	14 3/4" long × 10 1/4" deep × 1" high
System weight	5.22 lbs.	4.92 lbs.
CPU		
Vendor	Intel	Intel
Name	Pentium	Pentium
Model number	P6200	2127U
Stepping	K0	E1/L1
Socket type and number of pins	Socket 989 rPGA	Socket 988B rPGA
Core frequency (GHz)	2.13	1.90
System Bus	Intel DMI 2.5 GT/s	Intel DMI 5 GT/s
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	256 KB (per core)	256 KB (per core)
L3 cache	3 MB	2 MB
Platform		
Vendor	Dell	Dell
Model	Inspiron N5040	Dell Inspiron 15
Motherboard model number	024DTD	0FXP6Y
Motherboard chipset	Intel 5 series chipset	Intel 7 series chipset
BIOS name and version	Dell A05 (05/30/2012)	Dell A12 (10/25/2013)
Memory module(s)		
Vendor and model number	Nanya Technology, Samsung	Kingston KNWMX1-ETB
Type	PC3-10700	PC3-12800
Speed (MHz)	1,334	1,600
Speed running in the system (MHz)	1,334	1,600
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-25	11-11-11-30
Size (MB)	2,048, 1,024	4,096
Number of memory module(s)	2	1
Total amount of system RAM (GB)	3	4
Chip organization (single-sided/double-sided)	Double-sided	Double-sided
Channel (single/dual)	Dual	Single

System	2010 Intel Pentium P6200 processor-based system	2014 Intel Pentium 2127U processor-based system
Hard disk		
Vendor and model number	Western Digital WD3200BPVT-75JJ5T0	Seagate ST500LT012-1DG14
Number of disks in system	1	1
Size (GB)	320	500
Buffer size (MB)	8	16
RPM	5,400	5,400
Type	SATA 3Gb/s	SATA 3Gb/s
Controller	Intel 5 series chipset	Intel 7 series chipset
Driver	Intel 10.1.2.1004 (01/12/2011)	Intel 11.7.0.1013 (11/19/2012)
Operating system		
Name	Windows® 7 Home Premium	Windows 8.1 Pro
Build number	7601	9600
Service Pack	1	N/A
File system	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC
Language	English	English
Microsoft DirectX version	DirectX 11	DirectX 11
Graphics		
Vendor and model number	Intel HD Graphics (Pentium)	Intel HD Graphics
Type	Integrated	Integrated
Chipset	Intel HD Graphics (Pentium)	Intel HD Graphics
BIOS version	2104.0	2170
Total available graphics memory (MB)	1,275	1,696
Dedicated video memory (MB)	64	64
System video memory (MB)	0	0
Shared system memory (MB)	1,211	1,632
Resolution	1,366 × 768	1,366 × 768
Driver	Intel 8.15.10.2342 (03/25/2011)	Intel 10.18.10.3412 (01/22/2014)
Sound card/subsystem		
Vendor and model number	IDT High Definition Audio	Realtek High Definition Audio
Driver	IDT 6.10.0.6341 (05/27/2011)	Realtek 6.0.1.6959 (07/02/2013)
Ethernet		
Vendor and model number	Realtek PCIe FE Family Controller	Realtek PCIe FE Family Controller
Driver	Realtek 7.45.516.2011 (05/16/2011)	Microsoft 8.1.510.2013 (05/10/2013)
Wireless		
Vendor and model number	Dell Wireless 1502	Dell Wireless 1704
Driver	Atheros 9.2.0.225 (01/24/2011)	Broadcom 6.30.223.99 (05/27/2013)
Optical drive(s)		
Vendor and model number	MATSHITA DVD+-RW UJ8B1	HL-DT-ST GU90N
Type	Microsoft 6.1.7600.16385 (06/21/2006)	DVD+-RW

System	2010 Intel Pentium P6200 processor-based system	2014 Intel Pentium 2127U processor-based system
USB ports		
Number	3	4
Type	2.0	2 × 2.0, 2 × 3.0
Other	SD Media card reader, HDMI, VGA	SD Media card reader, HDMI
Monitor		
LCD type	WLED HD	LED Backlit
Screen size	15.6"	15.6"
Refresh rate	60	60
Battery		
Type	Lithium-ion	Lithium-ion
Size (length x width x height)	8 3/8" long × 2 1/4" wide × 3/4" high	10 3/4" long × 2" wide × 3/4" high
Rated capacity	48 Wh	40 Wh
Weight	0.67 lbs.	0.51 lbs.

Figure 8: Configuration details for the 2010 and 2014 Intel Pentium processor-powered laptop systems.

System	2010 Intel Celeron T3500 processor-based system	2014 Intel Celeron 2955U processor-based system
General		
Number of processor packages	1	1
Number of cores per processor	2	2
Number of hardware threads per core	1	1
Total number of processor threads in system	2	2
System power management policy	Balanced	Dell
Processor power-saving option	N/A	Enhanced Intel SpeedStep® Technology
System dimensions (length × width × height)	14 3/4" long × 9 3/4" deep × 1 3/8" high	14 3/4" long × 10 1/4" deep × 1" high
System weight	5.42 lbs.	4.76 lbs.
CPU		
Vendor	Intel	Intel
Name	Celeron	Celeron
Model number	T3500	2955U
Stepping	R0	C0
Socket type and number of pins	Socket P (478)	Socket 1168 BGA
Core frequency (GHz)	2.10	1.40
Bus frequency (MHz)	800	Intel DMI 5 GT/s
L1 cache	32 KB + 32 KB (per core)	32 KB + 32 KB (per core)
L2 cache	1,024 KB	256 KB (per core)
L3 cache	N/A	2 MB
Platform		
Vendor	HP	Dell
Model	2000	Inspiron 15
Motherboard model number	3676	05VVC5
Motherboard chipset	Intel GM45	Intel 8 series chipset
BIOS name and version	Hewlett-Packard F.24 (09/22/2011)	Dell A07 (11/12/2013)
Memory module(s)		
Vendor and model number	Samsung M471B2873GB0-CH9, A-Data AD7311B0873EV	Kingston KNWMX1-ETB
Type	PC3-10700	PC3-12800
Speed (MHz)	1,334	1,600
Speed running in the system (MHz)	1,334	1,600
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-25	11-11-11-30
Size (MB)	1 × 1,024, 1 × 2,048	4,096
Number of memory module(s)	2	1
Total amount of system RAM (GB)	3	4
Chip organization (single-sided/double-sided)	Double-sided	Double-sided
Channel (single/dual)	Dual	Single

System	2010 Intel Celeron T3500 processor-based system	2014 Intel Celeron 2955U processor-based system
Hard disk		
Vendor and model number	Western Digital WD2500BEVT-60A23T0	Toshiba MQ01ABF032
Number of disks in system	1	1
Size (GB)	250	320
Buffer size (MB)	8	8
RPM	5,400	5,400
Type	SATA 3Gb/s	SATA 3Gb/s
Controller	Intel 2801IM	Intel 8 series chipset
Driver	Microsoft 6.1.7601.175.14 (06/21/2006)	Intel 12.8.0.1016 (08/01/2013)
Operating system		
Name	Windows 7 Ultimate	Windows 8.1
Build number	7601	9600
Service Pack	1	N/A
File system	NTFS	NTFS
Kernel	ACPI x86-based PC	ACPI x64-based PC
Language	English	English
Microsoft DirectX version	DirectX 11	DirectX 11
Graphics		
Vendor and model number	Intel 45 Express Chipset	Intel HD Graphics
Type	Integrated	Integrated
Chipset	Mobile Intel 4 Series Express Chipset Family	Intel HD Graphics
BIOS version	Rev 7	5.0.1035
Total available graphics memory (MB)	1,308	1,792
Dedicated video memory (MB)	64	32
System video memory (MB)	0	0
Shared system memory (MB)	1,244	1,760
Resolution	1,366 × 748	1,366 × 768
Driver	Intel 8.15.10.1749 (05/06/2009)	Intel 10.18.10.3277 (08/19/2013)
Sound card/subsystem		
Vendor and model number	High Definition Audio Device	Realtek High Definition Audio
Driver	Microsoft 6.1.7601.17514 (11/19/2010)	Realtek 6.0.1.7023 (08/21/2013)
Ethernet		
Vendor and model number	Realtek PCIe FE Family Controller	Realtek PCIe FE Family Controller
Driver	Realtek 7.18.322.2010 (03/22/2010)	Realtek 8.18.621.2013 (06/21/2013)
Wireless		
Vendor and model number	Realtek RTL8188CE Wi-Fi Adapter	Dell Wireless 1705
Driver	Realtek 2007.8.201.2013 (02/01/2013)	Dell 10.0.0.263 (08/15/2013)

System	2010 Intel Celeron T3500 processor-based system	2014 Intel Celeron 2955U processor-based system
Optical drive(s)		
Vendor and model number	HP DS8A5LH	N/A
Type	DVD A	N/A
USB ports		
Number	3	4
Type	2.0	2 × 2.0, 2 × 3.0
Other	SD Media card reader, VGA	SD Media card reader, HDMI
Monitor		
LCD type	LED	LED Backlit
Screen size	15.6"	15.6"
Refresh rate	60	60
Battery		
Type	Lithium-ion	Lithium-ion
Size (length × width × height)	8" long × 2 1/8" wide × 3/4" high	10 3/4" long × 2" wide × 3/4" high
Rated capacity	55 Wh	40 Wh
Weight	0.66 lbs.	0.51 lbs.

Figure 9: Configuration details for the 2010 and 2014 Intel Celeron processor-powered laptop systems.

APPENDIX B – DETAILED TEST METHODOLOGY

Measuring battery life with MobileMark 2007 and MobileMark 2012

Installing a compatible version

MobileMark 2012 is incompatible with 32-bit operating systems. We installed MobileMark 2007 on the HP 2000, which has a 32-bit version of Windows 7 Ultimate. We installed MobileMark 2012 on the other five systems.

Avoiding antivirus software conflicts

MobileMark 2007 and 2012 are not compatible with any virus-scanning software, so we uninstalled any such software present on the notebook PCs before we installed the benchmark.

Avoiding pre-installed software conflicts

MobileMark 2007 installs the following applications, which its test scripts employ:

- Adobe Acrobat® Reader 7.0
- Adobe Illustrator® CS2
- Adobe Photoshop CS2
- Apple® QuickTime® 7.1
- Intervideo® WinDVD® 8
- Macromedia® Flash® 8
- Microsoft Office 2003 Pro
- Microsoft Project 2003
- WinZip® 10.0

MobileMark 2012 installs the following applications, which its test scripts employ:

- ABBYY® FineReader Pro 11
- Adobe Acrobat Pro X
- Adobe Flash Player 11
- Adobe Photoshop CS5 Extended 12.04
- Adobe Photoshop Elements 10
- Adobe Premiere® Pro CS 5.5
- CyberLink® PowerDVD® Ultra 11
- Microsoft Excel® 2010 SP1
- Microsoft Internet Explorer®
- Microsoft Outlook® 2010 SP1
- Microsoft PowerPoint® 2010 SP1
- Microsoft Windows Media® Player
- Microsoft Word 2010 SP1
- Mozilla® Firefox® 10.0.2
- WinZip Pro 16

If any of these applications are already on the system under test, they could cause problems with the benchmark due to software conflicts. To avoid any such issues, we uninstalled all conflicting pre-installed software applications before we installed the benchmark, including different versions of any of the programs MobileMark uses.

Adjusting display brightness and power settings

The brightness of a notebook's display affects its battery life. Before you test with MobileMark, BAPCo requires you do the following step: make sure the brightness of the notebook's monitor is greater than or equal to 150 nits on a completely white screen while the notebook is unplugged and running on battery power. The measurement follows the standards from the Video Electronics Standards Association (www.vesa.org).

We complied with this standard for all the tests we ran by setting the notebook PC's brightness as close to 150 nits as we could without going below that brightness level. We used the following procedure before we started each test. Note: This procedure assumes we began with the notebook plugged into the power supply.

1. To create a completely blank, white screen, open Microsoft Paint by clicking Start→All Programs→Accessories→Paint.
2. Press Ctrl+W to open the Resize and Skew dialog.
3. Under Horizontal and Vertical enter 200, and click OK.
4. Click the View tab.
5. Click Full screen to view a white screen.
6. Wait 45 minutes to allow the screen to warm.
7. Unplug the notebook from the power supply, and measure the display's brightness using a luminance meter in the center of the screen. (We used the Gossen Mavolux5032C.)
8. If the reading is below or significantly greater than 150 nits, use the notebook's keyboard screen-brightness-adjustment keys to bring the display as close to 150 nits as possible, then retest.
9. Allow the notebook to run on battery power for 10 minutes, re-measure the display, and adjust the brightness up or down as necessary.
10. Verify that the notebook saved the brightness setting by plugging in the system, unplugging it, and taking another reading.

Note: If the notebook did not save this setting, use its power management application(s) to set the brightness appropriately, and save that setting. If saving the settings is ineffective, use the keyboard brightness setting keys to adjust the screen to bring the display as close to 150 nits as possible. Next, note how many times you pressed the button to achieve the desired brightness. After unplugging the system under test, use the keyboard to set the desired brightness by pressing the brightness button as many times as you previously noted to return the screen to the correct brightness level.

Note: The HP 2000 was unable to reach 150 nits at the highest brightness setting. The highest brightness setting produced 144 nits. We set the HP 2000 to the highest brightness setting and set the newer generation comparison model (Dell Inspiron 15), to a brightness setting that produced 145 nits in order to have comparable testing settings.

Using the MobileMark 2012 built-in Configuration tool

This tool supports three levels of configuration:

1. Only makes changes that are REQUIRED in order for the benchmark to run.
2. Additionally, makes changes that are RECOMMENDED for repeatable results.

3. Additionally, makes OPTIONAL changes that help ensure best results.

The Configuration tool makes the following configuration changes at each of the three levels:

Level 1 - Required

- Disables User Account Control (UAC)
- Disables Windows Update
- Disables System Sleep and Hibernate
- Sets Screen Dimming Timeout (2 minutes)
- Disables Low Battery Actions
- Disables Network Proxies
- Disables Autorun for Optical Drive

Level 2 - Recommended

- Creates BAPCo power scheme
- Sets Power Plan Type to balanced
- Disables Windows Firewall
- Disables Windows Sidebar/Gadgets
- Disables Windows Pop-ups
- Disables Incoming Remote Desktop Connections
- Disables Windows Error Reporting
- Disables Screen Saver and Monitor Timeout
- Sets CPU Adaptive Mode
- Disables Desktop Slideshow
- Disables Disk Defrag

Level 3 - Optional

- Sets Hard Disk Timeout
- Disables Windows Defender
- Disables System Restore
- Ignores Laptop Lid Close
- Sets Maximum Display Brightness
- Disables Adaptive Brightness

We chose the Required, Recommended, and all of the Optional settings except for the Maximum Display Brightness option in the Configuration tool.

Installing MobileMark and configuring the system for testing

1. Verify that the wireless adapter is enabled and connected to a wireless router that is not connected to the Internet.
2. Insert the MobileMark Install DVD into the notebook PC's DVD drive.
3. When the Autoplay menu appears, click Run MobileMark2012_Setup.exe.
4. At the Welcome screen, click Next.
5. Enter the serial number, and click Next.
6. Accept the license agreement, and click Next.
7. At the Choose Components screen, select Full, and click Next.

8. At the Choose Install Location screen, accept the default location of C:\Program Files (x86)\BAPCo\MobileMark, and click Next.
9. At the Choose Start Menu Folder screen, click Install.
10. Insert Disc 2 when prompted.
11. At the InstallShield Wizard Complete screen, click Finish.
12. Launch MobileMark.
13. Click Configuration and choose only the Required options.
14. Click Apply, and restart the computer when prompted.
15. Adjust the screen brightness to no less than 150 nits:
 - a. Click the Windows start button, and type `power options` in the Windows Start Search box.
 - b. Click Change plan settings.
 - c. Click Change advanced power settings.
 - d. Expand the Display option, and change the Display brightness on battery and plugged in to the correct percentage that produces no less than 150 nits.

Note: If you are unable to save these settings, please see the Displaying Brightness section above.

Conditioning the battery

1. Plug the AC power adapter into the notebook PC, and completely charge the battery.
2. Install MobileMark 2012, following the steps we outlined in the Installing MobileMark section earlier in this section.
3. Double-click the MobileMark icon on the desktop.
4. Click the Office Productivity icon.
5. Type `System Conditioning` as the name for this test in the Project Name, check the box next to conditioning, and click Continue.
6. If MobileMark lists no problems or warnings, click Continue. If it does list any problems or warnings, close MobileMark, and correct the problem(s) before proceeding.
7. When prompted, unplug the AC power adapter. The Office Productivity test begins immediately.
8. The test is complete when the notebook PC has fully depleted its battery and is no longer operational when running on battery power.
9. Plug the AC power adapter into the notebook PC, and completely charge the battery.

Measuring battery life with MobileMark

We performed the following steps to run the MobileMark Office Productivity benchmark:

1. Double-click the MobileMark icon on the desktop.
2. Select the Office Productivity test by clicking the Office Productivity icon.
3. Enter a name for this test in the Project Name field, and click Continue.
4. If MobileMark lists no problems or warnings, click Continue. If it does list any problems or warnings, close MobileMark, and correct the problem(s) before proceeding.
5. When prompted, unplug the AC power adapter. The test begins immediately.
6. The Office Productivity test is complete when the notebook PC has fully depleted its battery and is no longer operational when running on battery power.

We executed the MobileMark Office Productivity test three times on the system and took the median battery life run as the representative score for that test.

Getting the MobileMark results

After each MobileMark Productivity test completed, we plugged the AC power adapter into the notebook PC and turned on the system. MobileMark started automatically after the system booted, then analyzed the test scores and opened the Test Results Viewer with the results from the last test.

To submit these results to BAPCo, we saved the test results by performing the following steps:

1. Click Save.
2. Enter a name and select FDR to save the results as an FDR file.
3. Click Save again, and select PDF to save the results as a PDF file.
4. Browse to the Documents directory where the result FDR and PDF files were saved.

Measuring time to boot

1. Simultaneously start the timer and boot the system.
2. Stop the timer when the desktop interface appears.
3. Record the result as the Boot time.
4. Shut the system down.
5. Repeat steps 1 through 4 two more times, and report the median of the three runs.

Measuring file copy times

Setting up the test

1. We used a 1TB Seagate Model SRD00F1 USB 3.0 expansion drive for the USB portion of the file copy testing.
1. Place a 1.15GB zipped archive of small files in the Documents folder.
2. Set up a network share:
 - a. Create a new folder on laptop on the same network as the systems under test.
 - b. Right-click the new folder and select Properties.
 - c. In the sharing tab, click Share.
 - d. Choose Everyone from the drop-down menu, and click Share.

USB file copy

1. Boot the system and open an administrative command prompt:
 - a. In Windows 7, select the Windows Start orb. In Windows 8.1 skip to the next step.
 - b. Type `cmd` and right-click `cmd.exe`.
 - c. Select Run as administrator.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
3. Do not interact with the system until the command completes.
4. After the command completes, wait 5 minutes before running the test.
5. Using a stopwatch to time the process, copy the zip archive folder from the Documents folder to the USB drive.
6. Record the result as the File Copy to USB time.
7. Using the stopwatch to time the process, copy the zip archive folder from the USB drive to the Desktop.
8. Record the result as the File Copy from USB time.
9. Delete the folder from the USB drive and the Desktop.
10. Repeat steps 5 through 9 two more times (making sure the file is named something different each time to avoid caching), and report the median of the three runs.

Measuring application launch time (Microsoft Word and Adobe Photoshop CC)

Setting up the application tests

1. Reset the system with the appropriate test image.
2. Install Microsoft Office 2010 on the legacy systems and Office 2013 on the newer generation laptops.
3. Install Adobe Photoshop CC.
4. Shut down the system.

Time to open a Microsoft Office Word file

Setting up the test

1. Boot the system.
2. Launch Microsoft Word.
3. Verify that Word opens in full screen.
4. Exit Word.
5. Shut down the system.

Running the test

1. Reboot the system and open an administrative command prompt:
 - a. In Windows 7 select the Windows Start orb. In Windows 8.1 skip to the next step.
 - b. Type `cmd` and right-click `cmd.exe`.
 - c. Select Run as administrator.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
3. Do not interact with the system until the command completes.
4. After the command completes, wait 5 minutes before running the test.
5. Simultaneously start the timer and launch Microsoft Word.
6. Stop the timer when Word has loaded.
7. Record the result as the Launch Microsoft Word time.
8. Repeat steps 1 through 7 two more times, and report the median of the three runs.

Time to open an Adobe Photoshop CC file

Setting up the test

1. Boot the system.
2. Launch Adobe Photoshop CC.
3. Verify that Photoshop opens in full screen.
4. Exit Photoshop.
5. Shut down the system.

Running the test

1. Reboot the system and open an administrative command prompt:
 - a. In Windows 7 select the Windows Start orb. In Windows 8.1 skip to the next step.
 - b. Type `cmd` and right-click `cmd.exe`.
 - c. Select run as administrator.
2. Type `Cmd.exe /c start /wait Rundll32.exe advapi32.dll,ProcessIdleTasks`
3. Do not interact with the system until the command completes.
4. After the command completes, wait 5 minutes before running the test.
5. Simultaneously start the timer and double-click the Photoshop test file.
6. Stop the timer when Photoshop has loaded.
7. Record the result as the Launch Photoshop time.
8. Repeat steps 1 through 7 two more times, and report the median of the three runs.

ABOUT PRINCIPLED TECHNOLOGIES



Principled Technologies, Inc.
1007 Slater Road, Suite 300
Durham, NC, 27703
www.principledtechnologies.com

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