SAVE TIME AND ACHIEVE PAYBACK QUICKLY WITH 5th GENERATION INTEL CORE i5 PROCESSORS

Upgrade your laptop–and get the job done in half the time

The Dell Latitude 14 5000 Series (E5450) powered by a 5th generation Intel® Core™ processor enables users to get more done and delivers fast ROI to IT – all in a smaller, sleeker design*

up to **77%** less time moving on to other tasks

up to **43%** less time multitasking

Achieve ROI within **3.7 months**

up to **66%** less time editing files

up to **61%** less time hosting a conference call

Dell Latitude 5000 series

*versus a Dell Latitude 14 E5420 powered by a 2nd generation Intel Core i5 processor
**percentage improvement on the time for all the tasks we tested

Saving time for your users can mean saving money for your business. At Principled Technologies, we created four productivity-based workflows to see how quickly two new Dell Latitude E5450 laptops powered by 5th generation Intel Core i5-5200U processors, one running Windows 7 and the other running Windows 8.1, performed each workflow. We also performed these workflows on a four-year-old laptop powered by an Intel Core i5-2430M processor running Windows 7 and then compared its performance to the new laptops. To see whether Windows 10 changed the performance of the two laptops powered by 5th generation Intel Core i5 processors, we upgraded them and re-ran the workflows. In all three operating system configurations, the new laptops required less than half the time to complete productivity tasks than the four-year-old laptop did.

Faster performance is always a plus, but how quickly would your business' bottom line benefit from upgrading to new laptops powered by 5th generation Intel Core i5-5200U processors? We used the individual time savings to project how long it would take a business to achieve payback for a single 5th generation Intel Core i5 processor-powered laptop.[1] A company that upgraded to the newer laptop running any of the three Windows versions would achieve payback in less than 4 months.[2]

---

[1] The tested configuration of the Intel Core i5-5200U processor-based Dell Latitude E5450 had a list price of $1,370.86 USD.
[2] Based on an average worker completing the tasks in our four scenarios four times a day.

CAN 5th GENERATION INTEL CORE I5 PROCESSORS SPEED THINGS UP ENOUGH TO PAY BACK THEIR COST QUICKLY?

With each laptop refresh, your business faces decisions about whether or not to upgrade. Though upgrading does have an up-front cost, upgraded laptops can help your employees realize important productivity savings, which can then translate to financial savings for your business.

We developed a series of tests that measured application responsiveness and grouped them into the following four scenarios:

- Editing a set of files
- Opening/using several apps at one time
- Closing apps and moving on to other tasks
- Hosting a conference call

These scenarios tested typical tasks in a variety of applications, including common productivity programs such as Microsoft Word and Excel and graphic-intensive applications such as Adobe Photoshop, Adobe Premiere Pro, and other tools in Adobe Creative Cloud 2015. We designed these scenarios to be as consistent as possible on devices that run different versions of Windows.

We then used these scenarios to learn whether upgrading to a 5th gen Intel Core i5 processor-powered laptop could save time for workers. We initially ran the scenarios with three laptops in out-of-the-box configurations:

- A four-year-old Dell Latitude E5420 powered by an Intel Core i5-2430M processor (from the 2nd generation of the Intel Core i5 processor family) running Windows 7
- A Dell Latitude E5450 powered by an Intel Core i5-5200U processor (from the 5th generation of the Intel Core i5 processor family) running Windows 7
- A Dell Latitude E5450 powered by an Intel Core i5-5200U processor (from the 5th generation of the Intel Core i5 processor family) running Windows 8.1

We executed all of the tasks for each scenario three times on each laptop and Windows configuration. We summed the median runs for each task to get the total scenario time. Then, we updated to Windows 10 on both laptops powered by Intel Core i5-5200U processors and repeated the scenarios. Our testing revealed little difference between the two laptops after upgrading to Windows 10.

For more information on the test systems, see Appendix A. For details on our testing, see Appendix B, and for detailed results, see Appendix C.

OUR FINDINGS IN SUMMARY: A RESOUNDING YES

We found that regardless of the version of Windows it ran, the Intel Core i5 processor-powered laptop was faster for all tasks than the four-year-old laptop running Windows 7. Completing all four scenarios took 13 minutes and 25 seconds on the four-year-old laptop whereas it took less than 7 minutes on the new laptop, regardless of operating system (see Figure 1). That's a savings of up to 85.0 percent, which translates to time that employees can gain to work on other things.

A business could expect to see pay back for the $1,370.96 investment in the Intel Core i5-5200U processor-powered Dell Latitude 14 E5450 in 3.8 months with Windows 7 or Windows 10 or 3.8 months with Windows 8.1.
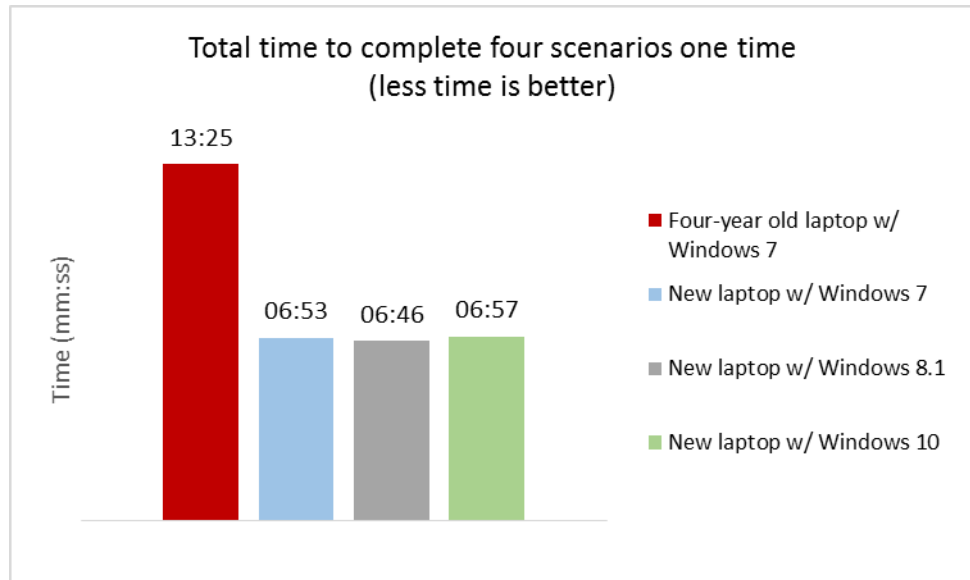

Figure 1: The time in minutes: seconds that each of the laptops needed to complete our four test scenarios.

If an employee performed this set of four scenarios four times daily, the time saved would add up to slightly more than two hours per week. Based on an hourly compensation rate of $38.46 per hour for salary and benefits, we value the time each user gets back at $82.90 to $85.04 depending on the version of Windows. Based on those calculations, a business could expect to see payback for the $1,370.96 investment in the Intel Core i5-5200U processor-powered Dell Latitude 14 E5450 in 3.8 months with Windows 7 or Windows 10 or 3.8 months with Windows 8.1 (see Figure 2).

	Intel Core i5-5200U processor-powered Dell Latitude E5450 + Windows 7	Intel Core i5-5200U processor-powered Dell Latitude E5450 + Windows 8.1	Intel Core i5-5200U processor-powered Dell Latitude E5450 + Windows 10
Hours saved per week when performing our four scenarios four times a day	2.17	2.21	2.16
Value of time saved for user earning $38.46 per hour	$83.55	$85.04	$82.90
Number of months until payback	**3.8**	**3.7**	**3.8**

Figure 2: Months until payback for upgrading our four-year-old laptop to a 5th generation Intel Core i5 processor-powered Dell Latitude E5450 with each of three operating systems we tested.

OUR FINDINGS IN DETAIL: TEST SCENARIOS

Editing a set of files

Lana takes a sip of coffee and launches Microsoft® Outlook® 2013. She has received an email from a client requesting some changes to marketing collateral that she helped produce. She opens the relevant Word files, a PowerPoint® presentation, and an Excel® spreadsheet. After making the changes, she opens Adobe® Photoshop® and edits a batch of photos to correspond to the changes she made on the other files. Finally, she exports the photos as JPGs and created a ZIP archive containing all the edited documents to send back to the client.

As Figure 3 shows, completing this scenario with either the Windows 7 or Windows 8.1 laptop powered by Intel Core i5-5200U processors saved time compared to the four-year-old laptop—66.0 and 65.9 percent respectively.

When we upgraded both laptops powered by 5th generation Intel Core i5 processors to Windows 10, they still saved time compared to the four-year-old laptop—up to 62.5 percent.

Editing a set of files

	1	2 3 4 5	6	7 8		
Intel Core i5-5200U w/ Windows 10					41.6s	
Intel Core i5-5200U w/ Windows 8.1					37.1s	
Intel Core i5-5200U w/ Windows 7					37.7s	
Intel Core i5-2430M w/ Windows 7					111s	

(less time is better)

up to **66**% less time editing files

1 Launch Microsoft Outlook 2013
2 Open Word file
3 Open PowerPoint file
4 Open Excel file
5 Open Adobe Photoshop file
6 Batch edited photos in Photoshop
7 Export a photo as JPG
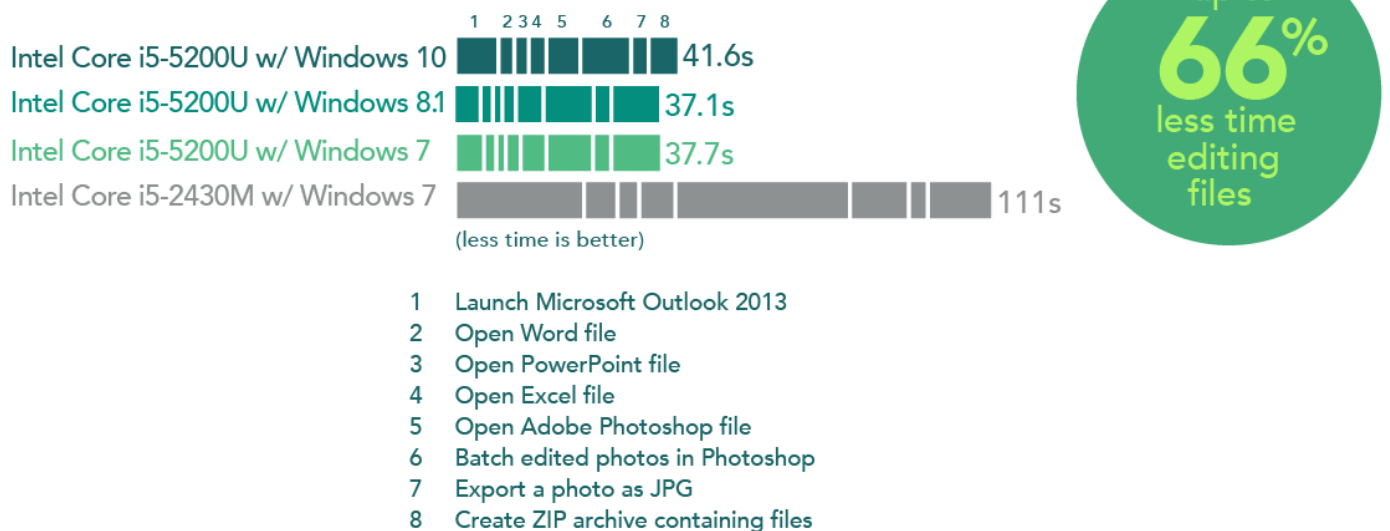8 Create ZIP archive containing files

Figure 3: Completing this scenario with the 5th generation Intel Core i5 processor-powered laptops required up to 66.0 percent less time than doing so using the four-year-old system. Lower numbers are better.

Editing a number of files, including a set of photos, can slow down a system. Lana could save over a minute using any of the 5th gen Intel Core i5 processor-powered laptops. Being able to open applications and edit files more quickly gives Lana more time to devote to other tasks.

Opening/using several apps at one time

As head of marketing for a software development company, Bridget has to make many quick decisions regarding an upcoming campaign. She launches three Adobe CC 2015 products: Lightroom®, Illustrator®, and Premiere Pro. Then she opens a Word file of meeting notes and a PowerPoint of recent social media data for her company. Switching back and forth quickly between apps, she reviews all the necessary documents. Finally, she chooses a video she thinks would work for the campaign and exports it in YouTube quality from Premiere Pro.

As Figure 4 shows, completing this scenario with either the Windows 7 or Windows 8.1 laptop powered by Intel Core i5-5200U processors saved time compared to the four-year-old laptop—43.0 and 41.5 percent respectively.

When we upgraded both laptops powered by 5th generation Intel Core i5 processors to Windows 10, they still saved time compared to the four-year-old laptop—up to 40.6 percent.

Opening/using several apps at one time

Intel Core i5-5200U w/ Windows 10	5m 10.8s
Intel Core i5-5200U w/ Windows 8.1	5m 6.3s
Intel Core i5-5200U w/ Windows 7	4m 58.1s
Intel Core i5-2430M w/ Windows 7	8m 43.2s

(less time is better)

up to **43%** less time opening/using several apps

1 Open Adobe Premiere Pro CC 2015
2 Open Adobe Illustrator CC 2015
3 Open Adobe Lightroom CC 2015
4 Open Word 2013
5 Open PowerPoint 2013
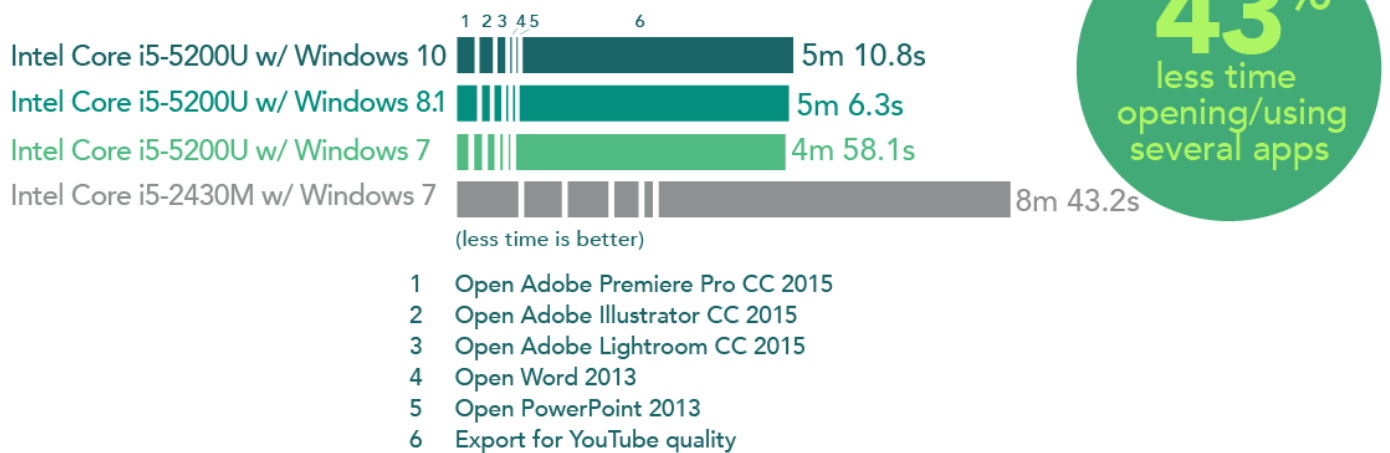6 Export for YouTube quality

Figure 4: Completing this scenario with the 5th generation Intel Core i5 processor-powered laptops required up to 43.0 percent less time than the four-year-old system did. Lower numbers are better.

You might be surprised how speedy a computer can be when it's running only one program. In the real world, though, many users have several programs open at any given point in the workday. It's important that Bridget's laptop can run programs simultaneously, with as little waiting as possible. She could save over 3 minutes using any of the Intel Core i5-5200U processor-powered laptops.

Closing apps and moving on to other tasks

Nick is about to leave the office and work remotely to resolve a user's help desk ticket. Before shutting down his laptop, he opens Control Panel and then Windows Explorer to make sure he has saved some important manuals locally so he can view them later. Then, he closes three Adobe CC 2015 apps—Lightroom, Illustrator, and Premiere Pro—that he has used to review pending internal "how-to" documents regarding IT problems.

As Figure 5 shows, completing this scenario with either the Windows 7 or Windows 8.1 laptop powered by Intel Core i5-5200U processors saved time compared to the four-year-old laptop—77.6 and 75.6 percent respectively.

When we upgraded both laptops powered by 5th generation Intel Core i5 processors to Windows 10, they still saved time compared to the four-year-old laptop—up to 74.9 percent.

Closing apps and moving on to other tasks

Intel Core i5-5200U w/ Windows 10	6.5s
Intel Core i5-5200U w/ Windows 8.1	6.3s
Intel Core i5-5200U w/ Windows 7	5.8s
Intel Core i5-2430M w/ Windows 7	25.9s

(less time is better)

up to **77**% less time closing apps and moving on

1   Open control panel
2   Open Windows Explorer
3   Close Adobe Lightroom CC 2015
4   Close Adobe Illustrator CC 2015
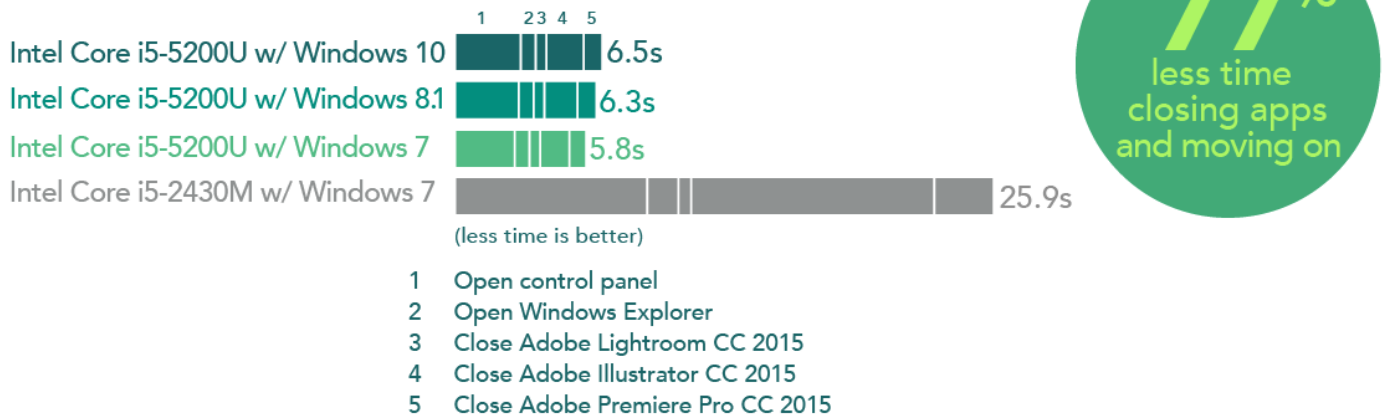5   Close Adobe Premiere Pro CC 2015

Figure 5: Completing this scenario with the 5th generation Intel Core i5 processor-powered laptops required up to 77.6 percent less time than the four-year-old system did. Lower numbers are better.

Every second matters when your workday is ending. Nick would value each of the nearly 20 seconds he could save using any of the laptops powered by Intel Core i5-5200U processors. Closing apps faster puts Nick that much closer to going home for dinner.

Hosting a conference call

Christina schedules a Skype meeting with the Tokyo office of her firm to discuss quarterly expenditures. Before the meeting begins, she powers on her laptop and launches Skype. While sharing a screen with the Tokyo office, she opens a folder and a Word file of relevant data so her colleagues in Tokyo can see it. At the end of the meeting, she sends the file to all the meeting attendees so they can have a copy. Finally, she shuts down her laptop after the meeting adjourns.

As Figure 6 shows, completing this scenario with either the Windows 7 or Windows 8.1 laptop powered by Intel Core i5-5200U processors saved time compared to the four-year-old laptop—50.3 and 61.4 percent respectively.

When we upgraded both laptops powered by 5th generation Intel Core i5 processors to Windows 10, they still saved time compared to the four-year-old laptop—up to 59.8 percent.

Hosting a conference call

Intel Core i5-5200U w/ Windows 10	58.1s
Intel Core i5-5200U w/ Windows 8.1	55.9s
Intel Core i5-5200U w/ Windows 7	71.8s
Intel Core i5-2430M w/ Windows 7	144.6s

(less time is better)

up to **61%** less time hosting a conference call

1 Boot up laptop
2 Open Skype
3 Open folder while screen sharing
4 Open Word file while screen sharing
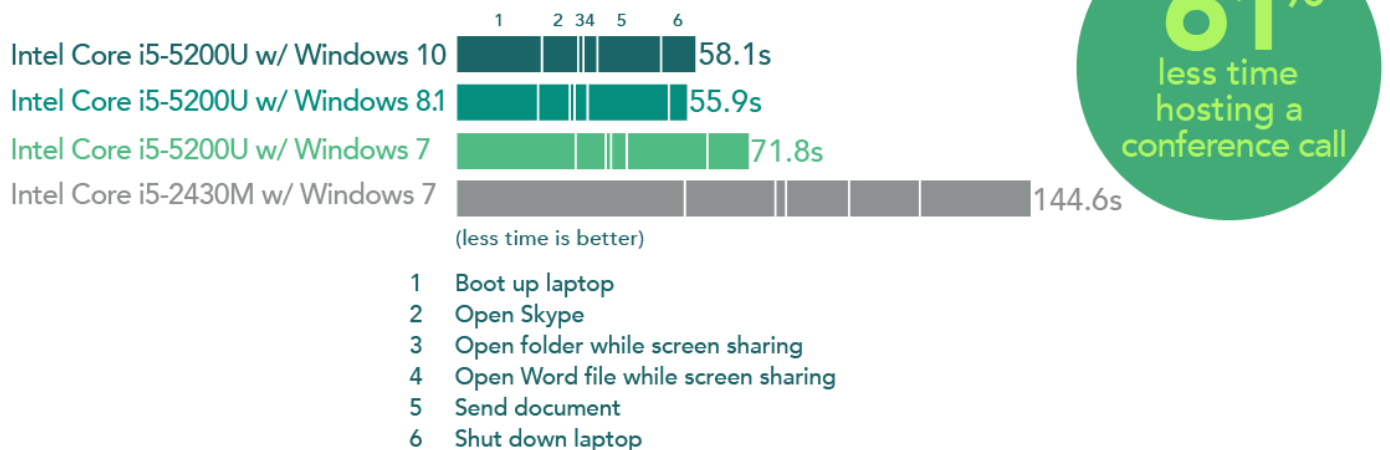5 Send document
6 Shut down laptop

Figure 6: Completing this scenario with the 5th generation Intel Core i5 processor-powered laptops required up to 61.4 percent less time than the four-year-old system did. Lower numbers are better.

For a business with employees all over the world, it's important that Skype meetings run as smoothly as possible. Time spent waiting for your screen to share is time wasted. Christina could save nearly 30 seconds using any of the laptops powered by Intel Core i5-5200U processors. Being able to open docs faster while using a compute-heavy app like Skype means Christina can worry less about awkward downtime during the meeting.

UNDERSTANDING VARIATION

Your employees probably won't execute the identical series of tasks that we tested. However, most workloads do include the types of tasks we tested, including opening and closing various applications, opening and closing files, running simultaneous applications, and booting and shutting down the laptop.

Amount of time spent on tasks

For our scenarios, achieving payback depends on how much time the user spends performing these tasks on the four-year-old laptop. Payback would occur once the savings reached 35.6 hours. We calculate this by dividing the $1,370.96 cost of the 5th generation Intel Core i5 processor-powered Dell Latitude E5450 by the average user's hourly compensation (salary + benefits) of $38.46.

We base our saving in Figure 2 on the assumption that a user is performing this set of tasks four times daily. For users who perform tasks like these more frequently, a company would yield an even faster return on the cost of replacing the four-year-old laptop with the 5th generation Intel Core i5 processor-powered laptop.

Balance of tasks

The balance of tasks that users perform could also affect how quickly your business achieves payback. For example, users who spend more time on the tasks in the "Performing general functions" scenario could see greater performance gains than users who spend more time doing the tasks in the "Multitasking" scenario. If two users both spent one hour performing these types of tasks on the older laptops, but the mix of the tasks differed, the amount of time that upgrading to the 5th generation Intel Core i5 processor-powered Dell Latitude E5450 would save them would also differ. Consequently, the businesses would achieve payback for the new laptops at different rates.

SMALLER AND LIGHTER

In addition to offering considerable performance benefits, the 5th generation Intel Core i5 processor-powered Dell Latitude E5450 has another advantage. Weighing in at only 4.12 pounds, it is 18 percent lighter than the Intel Core i5-2430M processor-powered Dell Latitude E5420. It is also 39 percent smaller—121.4 cubic inches vs. 200.8 cubic inches for the Dell Latitude E5420. Whether your employees are toting their laptops to the coffee shop or just down the hall to a meeting, they will appreciate the convenience that comes with the more streamlined Dell Latitude E5450.

CONCLUSION

Upgrading your employees' laptops to 5th generation Intel Core i5 processor-powered laptops could boost their productivity. We created four business scenarios to compare a four-year-old laptop running Windows 7 to Intel Core i5-5200U processor-powered Dell Latitude E5450 laptops running Windows 7, Windows 8.1, and Windows 10. Regardless of the version of Windows, the 5th generation Intel Core i5 processor-powered laptops completed the group of four tasks in less than half the time.

For a worker who performs these tasks four times daily, these productivity savings could pay back the cost of the newer laptop within 4 months. With these advantages, upgrading to a laptop with a 5th generation Intel Core i5 processor can meet the needs of your employees and your budget.

APPENDIX A – DETAILED SYSTEM INFORMATION

Figure 7 presents detailed information on the systems we tested.

System	Dell Latitude E5420 (Windows 7)	Dell Latitude E5450 (Windows 7 & Windows 10)	Dell Latitude E5450 (Windows 8.1 & Windows 10)
General			
Number of processor packages	1	1	1
Number of cores per processor	2	2	2
Number of hardware threads per core	2	2	2
Total number of processor threads in system	4	4	4
System power management policy	Balanced	Balanced	Balanced
Processor power-saving option	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology	Enhanced Intel SpeedStep Technology
System dimensions (length x width x height) (inches)	13.8 x 9.7 x 1.5	13.2 x 9.2 x 1.0	13.2 x 9.2 x 1.0
System dimensions (cubic inches)	200.79	121.44	121.44
System weight (lbs.)	5.06	4.12	4.12
CPU			
Vendor	Intel	Intel	Intel
Name	Core i5	Core i5	Core i5
Model number	2430M	5200U	5200U
Stepping	D2	E0/F0	E0/F0
Socket type	988B rPGA	1168 BGA	1168 BGA
Core frequency (GHz)	2.4-3(Max Turbo)	2.2-2.7(Max Turbo)	2.2-2.7(Max Turbo)
L1 cache	2 x 32KB + 2 x 32KB	2 x 32KB + 2 x 32KB	2 x 32KB + 2 x 32KB
L2 cache	2 x 256KB	2 x 256KB	2 x 256KB
L3 cache	3MB	3MB	3MB
Platform			
Vendor	Dell	Dell	Dell
Motherboard model number	006X7M-A05	0YDPWM-A00	0YDPWM-A00
Motherboard Chipset	Intel Sandy Bridge	Intel Broadwell-U	Intel Broadwell-U
BIOS settings	Dell A14 (12/26/2013)	Dell A06 (04/10/2015)	Dell A06 (04/10/2015)
Memory module(s)			
Vendor and model number	Samsung® M471B5773DH0-CH9	Hyundai® HMT41GS6BFR8A-PB	Hyundai HMT41GS6BFR8A-PB
Type	PC3-10700	PC3-12800	PC3-12800
Speed (MHz)	1333	1600	1600
Speed running in the system (MHz)	1333	1600	1600
Timing/Latency (tCL-tRCD-tRP-tRASmin)	9-9-9-24	11-11-11-28	11-11-11-28
Size (GB)	2	8	8
Number of RAM module(s)	1	1	1
Total RAM in system	2	8	8
Channel (single/dual)	Single	Single	Single

System	Dell Latitude E5420 (Windows 7)	Dell Latitude E5450 (Windows 7 & Windows 10)	Dell Latitude E5450 (Windows 8.1 & Windows 10)
Operating system 1			
Name	Windows 7 Professional x64	Windows 7 Professional x64	Windows 8.1 Pro x64
Build number	7601	7601	9600
Service Pack	1	1	n/a
File system	NTFS	NTFS	NTFS
Kernel	ACPI x64-based PC	ACPI x64-based PC	ACPI x64-based PC
Language	English	English	English
Microsoft DirectX version	11	11	11
Operating System 2			
Name	n/a	Windows 10 Pro x64	Windows 10 Pro x64
Build number	n/a	10240	10240
Service Pack	n/a	n/a	n/a
File system	n/a	NTFS	NTFS
Kernel	n/a	ACPI x64-based PC	ACPI x64-based PC
Language	n/a	English	English
Microsoft DirectX version	n/a	12	12
Hard disk			
Vendor and model number	Seagate® Momentus® 5400.6	Micron® M510	Micron M510
Number of disks in system	1	1	1
Size (GB)	250	256	256
Buffer size (MB)	8	n/a	n/a
RPM	5400	n/a	n/a
Type	HDD	SSD	SSD
Controller	Intel Mobile Express Chipset SATA AHCI Controller	Intel Mobile Express Chipset SATA RAID	Intel Mobile Express Chipset SATA RAID
Driver	10.1.0.1008 (11/6/2010)	Windows 7 & 10: 13.2.0.1016 (6/20/2014)	Windows 8.1 & 10: 13.2.0.1016 (6/20/2014)
Graphics			
Vendor and model number	Intel HD Graphics 3000	Intel HD Graphics 5500	Intel HD Graphics 5500
Type	Integrated	Integrated	Integrated
Chipset	Intel HD Graphics Family	Intel HD Graphics Family	Intel HD Graphics Family
BIOS version	2089.11	1032.17	1032.17
Total available graphics memory (MB)	787	1696	1696
Dedicated video memory (MB)	64	64	64
System video memory (MB)	0	0	0
Shared system memory (MB)	723	1632	1632
Resolution	1366 x 768	1366 x 768	1366 x 768
Driver	Intel 9.17.10.3040 (2/22/2013)	Windows 7: Intel 10.18.10.3977	Windows 8.1: Intel 10.18.10.3977

System	Dell Latitude E5420 (Windows 7)	Dell Latitude E5450 (Windows 7 & Windows 10)	Dell Latitude E5450 (Windows 8.1 & Windows 10)
		(10/9/2014) Windows 10: Intel 10.18.15.4256 (7/17/2015)	(10/9/2014) Windows 10: Intel 10.18.15.4256 (7/17/2015)
Sound card/subsystem			
Vendor and model number	IDT® High Definition Audio CODEC	Realtek® High Definition Audio	Realtek High Definition Audio
Driver	IDT 6.10.0.6324 (1/25/2011)	Realtek 6.0.1.6060 (12/10/2014)	Realtek 6.0.1.6060 (12/10/2014)
Ethernet			
Vendor and model number	Broadcom® NetXtreme® 57xx	Intel Ethernet Connection I218-LM	Intel Ethernet Connection I218-LM
Driver	Broadcom 14.4.2.4 (2/7/2011)	Intel 12.12.50.7205 (7/31/2014)	Intel 12.12.50.7205 (7/31/2014)
Wireless			
Vendor and model number	Intel Centrino Advanced-N 6250	Intel Dual Band Wireless-AC 7265 802.11AC	Intel Dual Band Wireless-AC 7265 802.11AC
Driver	Intel 15.9.0.5 (6/16/2013)	Windows 7: Intel 17.13.2.2 (11/17/2014) Windows 10: Intel 17.15.0.5 (2/22/2015)	Windows 8.1: Intel 17.13.2.2 (11/17/2014) Windows 10: Intel 17.15.0.5 (2/22/2015)
Optical drive(s)			
Vendor and model number	Integrated	n/a	n/a
Type	DVD±RW	n/a	n/a
USB ports			
Number	4	3	3
Type	USB 2.0	USB 3.0	USB 3.0
Other	SC card, SD card	SD card	SD card
Monitor			
LCD type	Active Matrix® TFT Color LCD	HD Anti-Glare LCD	HD Anti-Glare LCD
Screen size	14in	14in	14in
Refresh rate	60Hz	60Hz	60Hz
Battery			
Type	T54FJ	RYXXH Lithium-ion	RYXXH Lithium-ion
Size (length x width x height)	8 x 1.9 x 0.8[3]	Integrated	Integrated
Rated capacity	60Wh	38Wh	38Wh
Weight (lbs.)	0.7	Integrated	Integrated

Figure 7: System configuration information for the test systems.

APPENDIX B – HOW WE TESTED

Prior to conducting the workflows in the scenarios, we stored all test documents in a folder named Folder_to_zip and copied the folder to each laptop via USB flash dive. We removed the Adobe Premiere Pro video file and the Adobe Illustrator file from the folder and placed them on the desktop.

We repeated each set of timed steps as necessary to acquire three consecutive times that had a variance of 5 percent or less. We recorded the median of these three times.

Setting up the Windows 7 laptops

1. Power on the laptop.
2. Click My language is English.
3. Click Next.
4. When prompted for a user name, type `user`, and click Next.
5. When prompted for a password, click Next.
6. Click Use recommended settings.
7. Select (UTC-05:00) Eastern Time (US & Canada), and click Next.

Setting up the Windows 8.1 laptop

1. Power on the laptop.
2. Select (UTC-05:00) Eastern Time (US & Canada), and click Next.
3. Click I accept.
4. Click Next.
5. When prompted for a computer name, type `pc`, and click Next.
6. Select the appropriate Internet connection, and click Next.
7. Click Use express settings.
8. Click Create a new account.
9. Click Sign in without a Microsoft account.
10. Click Finish.
11. When prompted for a user name, type `user`, and click Finish.
12. After the apps finish installing, click Not right now.

Upgrading the laptops to Windows 10

1. Insert the upgrade media.
2. When prompted to get important updates, click Next.
3. Click Accept.
4. After updates complete, click Install.
5. Click Next.
6. Click Use Express Settings.
7. Click Next.

Preparing the Windows 7 laptops for testing

Updating Windows 7

1. From Windows Search, type `Windows Update`, and press Enter.
2. To install all of the important updates, click Install.
3. After installation is complete, click Restart now.

Turning off Automatic updates

1. From Windows Search, type `Windows Update`, and press Enter.
2. Click Change settings.
3. Select Never check for updates (not recommended).

4. Close the window.

Turning off User Account Control notifications
1. In Windows Search, type `User Account Control.`
2. Select Change User Account Control settings, and press Enter.
3. Move the slider bar to Never notify.
4. Close the window.

Turning off Screen saver
1. In Windows Search, type `Screen saver.`
2. Select Change screen saver, and press Enter.
3. Ensure that the drop down box says None.
4. Close the window.

Setting Turn off the display to Never
1. In Windows Search, type `Power options`, and press Enter.
2. Next to the active power plan, click Change plan settings.
3. Change every setting to Never.
4. Slide both plan brightness sliders completely to the right, and click Save changes.
5. Close the window.

Turning off Action Center alerts
1. In Windows Search, type `Action center`, and press Enter.
2. Click Change Action Center settings.
3. Uncheck every box, and click OK.
4. Close the window.

Capturing a backup image
1. Plug in a Windows PE USB disk, or insert optical media.
2. Plug in a target disk to store the image.
3. Start laptop.
4. Press F12 to enter one-time boot menu.
5. Select the Windows PE media, and press Enter.
6. Identify the system drive (C:\, D:\, etc.).
7. Identify the target drive (D:\, E:\, etc.).
8. In the CMD window, type:
   `dism /capture-image /capturedir:c:\ /imagefile=d:\NAME.wim /name:NAME`
   (`c:\` is the system drive, `d:\` is the target drive, and `NAME` is the name of the file)
9. After the image has been captured, type `exit`, and press Enter.

Installing Microsoft Office 2013 with a Microsoft Office 365™ Online Account
1. Open Internet Explorer.
2. Navigate to login.microsoftonline.com.
3. Enter an email address and password, and click Sign in.
4. Click Install now.
5. Click Run.
6. Click Next.
7. Select No thanks, and click Accept.
8. Click Next.
9. Click Sign in.
10. Enter an email address, and press Enter.
11. Enter a password, and click Sign in.

12. Check to not remember passwords, then click No.
13. If prompted, verify the email address using the code from Microsoft, and click Next.
14. Click Next.
15. Click Next.
16. Click No thanks.
17. Click All done.

Setting up Microsoft Outlook 2013
1. Open Outlook 2013.
2. Click Next.
3. Click Next.
4. Enter name, email address, and password, and click Next.
5. Click Finish.
6. Close Outlook 2013.
7. Open Outlook 2013.
8. Enter email address and password, and check Remember my credentials.
9. Click OK.
10. Close Outlook 2013.

Installing Adobe Creative Cloud® Suite
1. Open Internet Explorer.
2. Navigate to www.adobe.com.
3. Click Learn more about Creative Cloud.
4. Click Free Trial.
5. Click Download trial for Adobe Photoshop CC 2015.
6. For My skill level with Photoshop, select Beginner.
7. For I am a:, select Business Professional.
8. For I am downloading Photoshop for:, select My organization's use – I am not involved in the decision to buy.
9. Click Sign up for an Adobe ID.
10. Enter a first name, last name, email address, and password.
11. Select a date of birth.
12. Click Sign Up.
13. Verify the email address.
14. Return to the Free Trial download page.
15. After Creative Cloud Installer begins to download, click Run.
16. After Creative Cloud installs, enter the Adobe ID email address and password, then click Sign in.
17. Click Continue.
18. Under Find Additional Apps, click Try for Lightroom, Illustrator, and Premiere Pro.
19. Close Internet Explorer.
20. As the programs complete installing, click Start Trial.
21. Close Photoshop.
22. Close Lightroom.
23. Close Illustrator.
24. Close Premiere Pro.
25. Close the Creative Cloud installer.

Installing QuickTime®
1. Open Internet Explorer.
2. Navigate to www.apple.com/quicktime/download/.
3. Uncheck Keep me up to date….

4. Click Download Now.
5. Click Run.
6. Click Next.
7. Click Yes.
8. Click Typical.
9. Click Install.
10. Click Finish.
11. Click No Thanks.
12. Close Internet Explorer.

Installing Skype

1. Open Internet Explorer.
2. Navigate to www.skype.com/en/.
3. Click Download Skype.
4. Click Get Skype for Windows desktop.
5. Click Run.
6. Click I agree – Next.
7. Uncheck Install Skype Click to Call.
8. Uncheck all boxes.
9. Click Create an account.
10. Enter a first name, last name, and email address.
11. Enter a Skype name (or choose the first one generated by Suggestions) and password.
12. Uncheck By email.
13. Complete Captcha challenge.
14. Click I agree – Continue.
15. If prompted, reenter the Skype name and password.
16. Click Continue.
17. Click Continue.
18. Click Add later.
19. Click Start using Skype.
20. Right-click on the Skype icon on the taskbar.
21. Click Quit Skype.
22. Click Quit.
23. Close Internet Explorer.

Completing final preparations for testing

1. From Windows Search, type `System configuration`, and press Enter.
2. Select Startup.
3. Click Disable all.
4. Click Apply.
5. Click OK.

Preparing the Windows 8.1 laptops for testing

Updating Windows 8.1

1. From Windows Search, type `Windows Update`, and click Check for updates.
2. Click Check now.
3. Click View Details.
4. Click Install.
5. After the updates install, restart the laptop.

Turning off Automatic updates

1. From Windows Search, type `Windows Update`, and click Windows Update settings.
2. Click Choose how updates get installed.
3. Select Never check for updates (not recommended).
4. Uncheck all boxes, and click Apply.
5. Close the window.

Turning off User Account Control notifications

1. In Windows Search, type `User Account Control`.
2. Click Change User Account Control settings.
3. Move the slider bar to Never notify, and click OK.
4. Click Yes.

Turning off screen saver

1. In Windows Search, type `Screen saver`.
2. Click Change screen saver.
3. Ensure that the drop down box says None.
4. Close the window.

Setting Turn off the display to Never

1. In Windows Search, type `Power options`, and click Power options.
2. Next to the active power plan, click Change plan settings.
3. Change every setting to Never.
4. Slide both plan brightness sliders completely to the right, and click Save changes.
5. Close the window.

Turning off Action Center alerts

1. In Windows Search, type `Action center`, and click Action Center.
2. Click Change Action Center settings.
3. Uncheck every box, and click OK.
4. Close the window.

Capturing a backup image

1. Plug in an external USB hard drive for the image.
2. Double-click Dell Backup and Recovery.
3. Click Next.
4. Select the external hard drive, and click Continue.
5. Click Yes.
6. Click Agree & Continue.
7. Click Yes.
8. Click OK.
9. Click Next.
10. Click Skip.
11. Click Finish.
12. Close Dell Backup and Recovery.
13. Eject the connected media.
14. Restart the laptop.

Installing Microsoft Office 2013 with a Microsoft Office 365 Online Account

1. Open Internet Explorer.
2. Navigate to login.microsoftonline.com.
3. Enter an email address and password, and click Sign in.

---

4. Click Install now.
5. Click Run.
6. Click Next.
7. Select No thanks, and click Accept.
8. Click Next.
9. Click Sign in.
10. Enter an email address, and press Enter.
11. Enter a password, and click Sign in.
12. Check to not remember passwords, and then click No.
13. If prompted, verify the email address using the code from Microsoft, and click Next.
14. Click Next.
15. Click Next.
16. Click No thanks.
17. Click All done.

Setting Up Microsoft Outlook 2013
1. Open Outlook 2013.
2. Click Next.
3. Click Next.
4. Enter a name, email address, and password, and click Next.
5. Click Finish.
6. Close Outlook.
7. Open Outlook 2013.
8. Enter an email address and password, and check Remember my credentials.
9. Click OK.
10. Close Outlook 2013.

Installing Adobe Creative Cloud Suite
1. Open Internet Explorer.
2. Navigate to www.adobe.com.
3. Click Learn more about Creative Cloud.
4. Click Free Trial.
5. Click Download trial for Adobe Photoshop CC 2015.
6. For My skill level with Photoshop, select Beginner.
7. For I am a:, select Business Professional.
8. For I am downloading Photoshop for:, select My organization's use – I am not involved in the decision to buy.
9. Click Sign up for an Adobe ID.
10. Enter a first name, last name, email address, and password.
11. Select a date of birth.
12. Click Sign Up.
13. Verify the email address.
14. Return to the Free Trial download page.
15. After Creative Cloud Installer begins to download, click Run.
16. After Creative Cloud installs, enter the Adobe ID email address and password, then click Sign in.
17. Click Continue.
18. Under Find Additional Apps, click Try for Lightroom, Illustrator, and Premiere Pro.
19. Close Internet Explorer.
20. As the programs complete installing, click Start Trial.
21. Close Photoshop.

22. Close Lightroom.
23. In Illustrator, press play on the video.
24. Close the video.
25. Close Illustrator.
26. Close Premiere Pro.
27. Close the Creative Cloud installer.

Installing QuickTime
1. Open Internet Explorer.
2. Navigate to https://www.apple.com/quicktime/download/.
3. Uncheck Keep me up to date….
4. Click Download Now.
5. Click Run.
6. Click Next.
7. Click Yes.
8. Click Typical.
9. Click Install.
10. Click Finish.
11. Click No Thanks.
12. Close Internet Explorer.

Installing Skype
1. Open Internet Explorer.
2. Navigate to www.skype.com/en/.
3. Click Download Skype.
4. Click Get Skype for Windows desktop.
5. Click Run.
6. Click I agree – Next.
7. Uncheck Install Skype Click to Call.
8. Uncheck all boxes.
9. Click Create an account.
10. Enter first name, last name, and email address.
11. Enter a Skype name (or choose the first one generated by Suggestions) and password.
12. Uncheck By email.
13. Complete Captcha challenge.
14. Click I agree – Continue.
15. If prompted, reenter the Skype name and password.
16. Click Continue.
17. Click Continue.
18. Click Add later.
19. Click Start using Skype.
20. Right-click on Skype icon on taskbar.
21. Click Quit Skype.
22. Click Quit.
23. Close Internet Explorer.

Completing final preparations for testing
1. From Windows Search, type `Startup`, and click See which processes start up automatically when you start Windows.
2. Select each item, and click Disable.

3. Close the window.

Preparing the Windows 10 laptops for testing

Updating Windows 10
1. From Windows Search, type `Windows Update`, and click Check for updates
2. Click Check for updates.
3. After the updates install, restart the laptop.

Limiting Automatic updates
1. From Windows Search, type `Windows Update`, and click Windows Update settings.
2. Click Advanced options.
3. Select Notify to schedule restart.
4. Check Defer upgrades.
5. Click Choose how updates are delivered.
6. Turn off Updates from more than one place.

Turning off User Account Control notifications
1. In Windows Search, type `User Account Control`.
2. Click Change User Account Control settings.
3. Move the slider bar to Never notify, and click Ok.
4. Click Yes.

Turning off screen saver
1. In Windows Search, type `Screen saver`.
2. Click Change screen saver.
3. Ensure that the drop down box says None.
4. Close the window.

Setting Turn off the display to Never
1. In Windows Search, type `Power options`, and click Power options.
2. Next to the active power plan, click Change plan settings.
3. Change every setting to Never.
4. Slide both plan brightness sliders completely to the right, and click Save changes.
5. Close the window.

Turning off Action Center alerts
1. In Windows Search, type `Notifications & actions`, and click Notifications & actions settings.
2. Turn all notifications off.
3. Close the window.

Capturing a backup image
1. Plug in an external USB hard drive for the image.
2. In Windows Search, type `File History`, and click File History in Control panel.
3. Click System Image Backup.
4. Select the external hard drive, and click Next.
5. Click Start backup.
6. After the backup is complete, close Control panel.

Installing Microsoft Office 2013 with a Microsoft Office 365 Online Account
1. Open Internet Explorer.
2. Navigate to login.microsoftonline.com.
3. Enter email address and password, and click Sign in.
4. Click Install now.
5. Click Run.

6. Click Next.
7. Select No thanks, and click Accept.
8. Click Next.
9. Click Sign in.
10. Enter an email address, and press enter.
11. Enter a password, and click Sign in.
12. If prompted, verify the email address using the code from Microsoft, and click Next.
13. Click Next.
14. Click Next.
15. Click No thanks.
16. Click All done.

Setting Up Microsoft Outlook 2013
1. Open Outlook 2013.
2. Click Next.
3. Click Next.
4. Enter a name, email address, and password, and click Next.
5. Click Finish.
6. Close Outlook.
7. Open Outlook 2013.
8. Enter an email address and password, and check Remember my credentials.
9. Click OK.
10. Close Outlook 2013.

Installing Adobe Creative Cloud Suite
1. Open Internet Explorer.
2. Navigate to www.adobe.com.
3. Click Learn about Creative Cloud.
4. Click Free Trial.
5. Click Download trial for Adobe Photoshop CC 2015.
6. For My skill level with Photoshop, select Beginner.
7. For I am a:, select Business Professional.
8. For I am downloading Photoshop for:, select My organization's use – I am not involved in the decision to buy.
9. Click Sign up for an Adobe ID.
10. Enter a first name, last name, email address, and password.
11. Select a date of birth.
12. Click Sign Up.
13. Verify the email address.
14. Return to the Free Trial download page.
15. After Creative Cloud Installer begins to download, click Run.
16. After Creative Cloud installs, enter the Adobe ID email address and password, and then click Sign in.
17. Click Continue.
18. Under Find Additional Apps, click Try for Lightroom, Illustrator, and Premiere Pro.
19. Close Internet Explorer.
20. As the programs complete installing, click Start Trial.
21. Close Photoshop.
22. Close Lightroom.
23. In Illustrator, press play on the video.
24. Close the video.

25. Close Illustrator.
26. Close Premiere Pro.
27. Close the Creative Cloud installer.

Installing QuickTime
1. Open Internet Explorer.
2. Navigate to www.apple.com/quicktime/download/.
3. Uncheck Keep me up to date….
4. Click Download Now.
5. Click Run.
6. Click Next.
7. Click Yes.
8. Click Typical.
9. Click Install.
10. Click Finish.
11. Click No Thanks.
12. Close Internet Explorer.

Installing Skype
1. Open Internet Explorer.
2. Navigate to www.skype.com/en/.
3. Click Download Skype.
4. Click Get Skype for Windows desktop.
5. Click Run.
6. Click I agree – Next.
7. Uncheck Install Skype Click to Call, and click Continue.
8. Click Create an account.
9. Enter first name, last name, and email address.
10. Enter a Skype name (or choose the first one generated by Suggestions) and password.
11. Uncheck By email.
12. Complete Captcha challenge.
13. Click I agree – Continue.
14. Navigate back to the Skype application, and click Skype Name.
15. Enter the created Skype name and password.
16. Click Continue.
17. Click Continue.
18. Click Add later.
19. Click Start using Skype.
20. Right-click on Skype icon on taskbar.
21. Click Quit Skype.
22. Click Quit.
23. Close Internet Explorer.

Completing final preparations for testing
1. From Windows Search, type `Startup`, and click See which processes start up automatically when you start Windows.
2. Select each item, and click Disable.
3. Close window.

Scenario 1: Editing a set of files

Complete the following steps for the Windows 7, Windows 8.1, and Windows 10 laptops.

Launching Microsoft Outlook 2013

1. Simultaneously click to open Outlook 2013 and start the stopwatch.
2. When the first window appears, stop the stopwatch.
3. Restart the laptop.
4. Repeat steps 1 through 3 as needed.

Opening Microsoft Word 2013

1. Open Folder_to_zip.
2. Double-click Test1.docx and start the stopwatch simultaneously with the second click.
3. When the first window appears, stop the stopwatch.
4. Close Word.
5. Restart the laptop.
6. Repeat steps 1 through 5 as needed.

Opening Microsoft PowerPoint 2013

1. Open Folder_to_zip.
2. Double-click Test1.pptx, and start the stopwatch simultaneously with the second click.
3. When the first window appears, stop the stopwatch.
4. Close Word.
5. Restart laptop.
6. Repeat steps 1 through 5 as needed.

Opening Microsoft Excel 2013

1. Open Folder_to_zip.
2. Double-click Test1.xlsx, and start the stopwatch simultaneously with the second click.
3. When first window appears, stop the stopwatch.
4. Close Word.
5. Restart laptop.
6. Repeat steps 1 through 5 as needed.

Preparing for Adobe Photoshop timing

1. Open Folder_to_zip.
2. Right-click Lighthouse1, and click Copy.
3. Paste 10 copies of Lighthouse1.
4. Create a New Folder.
5. Name the folder `Batch Photos`.
6. Move the 10 copies of Lighthouse1 into the folder Batch Photos.
7. Right-click Lighthouse1.
8. Select Open with.
9. Click Choose default program.
10. Expand Other Programs, and click Adobe Photoshop.
11. Click OK.
12. Close Photoshop.
13. Restart laptop.

Opening Adobe Photoshop CC 2015

1. Open Folder_to_zip.
2. Double-click Lighthouse1, and start the stopwatch simultaneously with the second click.
3. When the photo appears in the Photoshop window, stop the stopwatch.

---

4. Close Photoshop.
5. Restart laptop.
6. Repeat steps 1 through 5 as needed.

Creating a batch action

1. Open Folder_to_zip.
2. Double-click Lighthouse1.
3. Click Window.
4. Click Actions.
5. Click the folder icon to Create new set.
6. Type `Batch Set`.
7. Click the page icon to Create new action.
8. Type `Test`.
9. Click Record.
10. Click File.
11. Click Place Embedded.
12. Click Desktop.
13. Double-click Folder_to_zip.
14. Select lighthouse_logo.
15. Click Place.
16. Move the logo towards the top left corner.
17. Drag the bottom right corner of the logo to approximately double its size.
18. Click the Type tool.
19. Click Place.
20. Change text color to white.
21. Click OK.
22. Change the type size to 36pt.
23. Click on the picture below the logo.
24. Type `Lighthouse Studios`.
25. Click the Move tool.
26. Click the Type tool.
27. Click on the picture below the first section of text.
28. Type `www.website.com`
29. Click the Stop icon to stop recording the actions.

Editing a batch of photos in Adobe Photoshop

1. Open Folder_to_zip.
2. Double-click Lighthouse1.
3. Click File.
4. Select Automate.
5. Click Batch.
6. For Source, choose the folder Batch Photos.
7. Check Suppress File Open Options Dialogs.
8. Check Suppress Color Profile Warnings.
9. For Errors, select Log Errors to File.
10. Click Save As, and enter a name for the file.
11. Click Save.
12. Simultaneously click OK and start the stopwatch.
13. When the final photo has the text and logo, stop the stopwatch.

14. Close Adobe Photoshop.
15. When prompted to save changes, click No for all files.
16. Restart laptop.
17. Repeat steps 1 through 16 as needed.

Exporting photo as JPEG
1. Open Folder_to_zip.
2. Double-click Lighthouse1.
3. Click Window.
4. Click Action.
5. Select Test in the Action list.
6. Press Play.
7. Click File.
8. Select Export.
9. Click Export As.
10. When the photo appears, change the format to JPG.
11. Name the file.
12. Simultaneously click Save and start the stopwatch.
13. When Export window disappears, stop the stopwatch.
14. Close Adobe Photoshop.
15. When prompted to save changes, click Yes.
16. Click Save.
17. Click OK.
18. Restart the laptop.
19. Repeat steps 1 and 2, then 7 through 14, as needed.

Zipping the Folder
1. Right-click Folder_to_zip.
2. Select Send to.
3. Simultaneously click Compressed (zipped) folder and start the stopwatch.
4. When the compressing progress bar disappears, stop the stopwatch.
5. Repeat steps 1 through 4 as needed.

Scenario 2: Opening/using several apps at one time
We performed all actions in this scenario sequentially.

Opening Adobe Premiere Pro CC 2015
1. Simultaneously click to open Adobe Premiere Pro and start stopwatch.
2. When project window appears, stop the stopwatch.
3. Close Adobe Premiere Pro.
4. Restart laptop.
5. Repeat steps 1 through 4 as needed.

Opening Adobe Illustrator CC 2015
1. Open Adobe Premiere Pro, and select the file from Scenario 2.
2. Simultaneously click to open Adobe Illustrator and start the stopwatch.
3. When the Welcome window appears, stop the stopwatch.
4. Close all applications.
5. Restart laptop.
6. Repeat steps 1 through 5 as needed.

Opening Adobe Lightroom CC 2015
1. Open Adobe Premiere Pro, and select the file from Scenario 2.
2. Open Adobe Illustrator.
3. Select Open project.
4. Click Desktop, and select LogoFinalDesign.ai.
5. Simultaneously click to open Adobe Lightroom and start the stopwatch.
6. When the Welcome window appears, stop the stopwatch.
7. Close all applications.
8. Restart laptop.
9. Repeat steps 1 through 8 as needed.

Opening Microsoft Word 2013
1. Open Adobe Premiere Pro, and select the file from Scenario 2.
2. Open Adobe Illustrator.
3. Select Open project.
4. Click Desktop, and select LogoFinalDesign.ai.
5. Open Adobe Lightroom.
6. Simultaneously click to open Word 2013 and start the stopwatch.
7. When the first window appears, stop the stopwatch.
8. Close all applications.
9. Restart laptop.
10. Repeat steps 1 through 9 as needed.

Opening Microsoft PowerPoint 2013
1. Open Adobe Premiere Pro, and select the file from Scenario 2.
2. Open Adobe Illustrator.
3. Select Open project.
4. Click Desktop, and select LogoFinalDesign.ai.
5. Open Adobe Lightroom.
6. Open Microsoft Word 2013.
7. Simultaneously click to open PowerPoint 2013 and start the stopwatch.
8. When the first window appears, stop the stopwatch.
9. Close all applications.
10. Restart the laptop.
11. Repeat steps 1 through 10 as needed.

Exporting video while other programs are open
1. Open Adobe Premiere Pro, and select the file from Scenario 2.
2. Open Adobe Illustrator.
3. Select Open project.
4. Click Desktop, and select LogoFinalDesign.ai.
5. Open Adobe Lightroom.
6. Open Microsoft Word 2013.
7. Open Microsoft PowerPoint 2013.
8. Return to Premiere Pro from the taskbar.
9. Make sure Timeline or video file in the timeline is selected.
10. Click File.
11. Select Export.
12. Click Media.
13. For Format, choose H.264.

14. For Preset, choose YouTube 1080p HD.
15. Simultaneously click Export and start the stopwatch.
16. When the progress bar disappears, stop the stopwatch.
17. Close all applications.

Scenario 3: Closing apps and moving on to other tasks

For consistency, we chose Control Panel for Windows 7, This PC for Windows 8.1, and File Explorer on Windows 10, based on the location of the menu item after clicking the Start button. For both systems, we placed the mouse arrow in the center of the screen, navigated to the Start button, and then navigated to the item of interest.

Opening Control Panel (Windows 7)
1. Boot up the laptop.
2. When the desktop appears, start the stopwatch.
3. Click Start.
4. Click Control Panel.
5. When the Control Panel window appears, stop the stopwatch.
6. Close Control Panel.
7. Restart the laptop.
8. Repeat steps 1 through 7 as needed.

Opening This PC (Windows 8.1)
1. Boot up the laptop.
2. When the desktop appears, start the stopwatch.
3. Click Start.
4. Click This PC.
5. When the This PC window appears, stop the stopwatch.
6. Close This PC.
7. Restart the laptop.
8. Repeat steps 1 through 7 as needed.

Opening File Explorer from the Start menu (Windows 10)
1. Boot up the laptop.
2. When the desktop appears, start the stopwatch.
3. Click Start.
4. Click File Explorer.
5. When the File Explorer window appears, stop the stopwatch.
6. Close File Explorer.
7. Restart the laptop.
8. Repeat steps 1 through 7 as needed.

Opening Windows Explorer (Windows 7 and 8.1)
1. Simultaneously click Windows Explorer icon on taskbar and start the stopwatch.
2. When Explorer window appears, stop the stopwatch.
3. Close Windows Explorer.
4. Repeat steps 1 through 3 as needed.

Opening File Explorer (Windows 10)
1. Simultaneously click File Explorer icon on taskbar and start the stopwatch.
2. When Explorer window appears, stop the stopwatch.
3. Close File Explorer.
4. Repeat steps 1 through 3 as needed.

Closing simultaneously open programs
1. Open Adobe Premiere Pro CC 2015.
2. Open Adobe Illustrator CC 2015.
3. Open Adobe Lightroom CC 2015.
4. If prompted, click Continue Trial.
5. Simultaneously click to close Adobe Lightroom and start the stopwatch.
6. When Adobe Lightroom disappears from taskbar, stop the stopwatch.
7. Simultaneously click to close Adobe Illustrator and start the stopwatch.
8. When Adobe Illustrator disappears from taskbar, stop the stopwatch.
9. Simultaneously click to close Adobe Premiere Pro and start the stopwatch.
10. When Adobe Premier Pro disappears from taskbar, stop the stopwatch.
11. Restart laptop.
12. Repeat steps 1 through 11 as needed.

Scenario 4: Hosting a conference call

We simulated a one-on-one client meeting using a private network and tested each laptop separately. Only the laptop under test and the client laptop used the network during testing. The client laptop was a Latitude E5450 running Windows 8.1. Prior to testing, we installed Skype on the client laptop and created an account utilizing the same steps that we used for the laptops under test.

Booting up laptop
1. Simultaneously press the power button and start the stopwatch.
2. When the desktop background appears, stop the stopwatch.
3. Shut down the laptop.
4. Repeat steps 1 through 3 as needed.

Opening Skype
1. Simultaneously click to open Skype on the laptop under test and start the stopwatch.
2. When the Skype home menu appears, stop the stopwatch.
3. Quit Skype.
4. Restart the laptop under test.
5. Repeat steps 1 through 4 as needed.

Setting up screen sharing
1. Open Skype on both laptops.
2. In Contacts on the laptop under test, select the client laptop account.
3. Click Video Call on the laptop under test.
4. Accept the video call on the client laptop.
5. On the laptop under test, click plus, and click Share screens.
6. Click Start on the laptop under test.

Opening a folder while sharing a screen
1. Set up a Skype call and screen sharing using the instructions in Setting up screen sharing.
2. While sharing a screen, simultaneously double-click to open Folder_to_zip and start the stopwatch on the second click.
3. When the Folder_to_zip window appears, stop the stopwatch.
4. End the call.
5. Quit Skype on the laptop under test.
6. Restart the laptop under test.
7. Repeat steps 1 through 6 as needed.

Opening Word 2013 while sharing a screen

1. Set up a Skype call and screen sharing using the instructions in [Setting up screen sharing](#).
2. While sharing a screen, double-click to open Folder_to_zip.
3. Simultaneously double-click Test1.docx and start the stopwatch on the second click.
4. When the Word window appears, stop the stopwatch.
5. End the call.
6. Quit Skype on the laptop under test.
7. Restart the laptop under test.
8. Repeat steps 1 through 7 as needed.

Sending a file during a Skype call

1. Set up a Skype call and screen sharing using the instructions in [Setting up screen sharing](#).
2. On the laptop under test, click Stop sharing.
3. Click plus, and click Send files.
4. Navigate to Test1.docx, select it, and click Open.
5. On the client laptop, click IM.
6. Click to download Test1.docx.
7. Click Save.
8. Click Yes.
9. Simultaneously click Save and start the stopwatch.
10. When the file is received, stop the stopwatch.
11. End the call.
12. Quit Skype on the laptop under test.
13. Restart the laptop under test.
14. Repeat steps 1 through 13 as needed.

Shutting down the laptops

1. Simultaneously click Shut Down and start the stopwatch.
2. When power button light is off, stop the stopwatch.
3. Boot up laptop.
4. Repeat steps 1 through 3 as needed.

APPENDIX C – DETAILED RESULTS

We used the median time for each task. In addition to the median times for the Windows 10 systems, we averaged those results. Figure 8 shows the detailed results for the Editing a set of files scenario.

Task	Intel Core i5-2430M + Windows 7	Intel Core i5-5200U + Windows 7	Intel Core i5-5200U + Windows 8.1	Intel Core i5-5200U + Windows 10 (from Windows 7)	Intel Core i5-5200U + Windows 10 (from Windows 8.1)	Intel Core i5-5200U + Windows 10 (average)
Launch Microsoft Outlook 2013	00:27.5	00:05.4	00:05.0	00:08.3	00:08.8	00:08.6
Open Word file	00:06.4	00:01.7	00:01.7	00:02.4	00:02.6	00:02.5
Open PowerPoint file	00:03.8	00:01.1	00:01.1	00:02.3	00:02.2	00:02.2
Open Excel file	00:07.0	00:02.3	00:02.0	00:02.9	00:03.0	00:02.9
Open Adobe Photoshop file	00:37.6	00:04.7	00:05.1	00:06.7	00:06.3	00:06.5
Batch Edit photos in Photoshop	00:12.0	00:09.3	00:10.1	00:09.9	00:10.5	00:10.2
Export a photo as JPG	00:03.2	00:03.0	00:02.9	00:03.0	00:02.9	00:02.9
Create ZIP archive containing files	00:13.5	00:10.3	00:10.0	00:05.8	00:05.7	00:05.8
Total	**01:51.0**	**00:37.7**	**00:37.8**	**00:41.3**	**00:42.0**	**00:41.6**

Figure 8: Times in minutes:seconds for each task in this scenario. Lower numbers are better.

Figure 9 shows the detailed results for Doing simultaneous activity scenario.

Task	Intel Core i5-2430M + Windows 7	Intel Core i5-5200U + Windows 7	Intel Core i5-5200U + Windows 8.1	Intel Core i5-5200U + Windows 10 (from Windows 7)	Intel Core i5-5200U + Windows 10 (from Windows 8.1)	Intel Core i5-5200U + Windows 10 (avg)
Open Adobe Premiere Pro CC 2015	01:01.0	00:11.0	00:19.6	00:17.7	00:16.5	00:17.1
Open Adobe Illustrator CC 2015	00:37.5	00:07.5	00:07.5	00:13.2	00:13.1	00:13.1
Open Adobe Lightroom CC 2015	00:40.4	00:06.2	00:06.4	00:07.5	00:07.2	00:07.3
Open Word 2013	00:24.0	00:02.1	00:01.8	00:01.4	00:01.3	00:01.3
Open PowerPoint 2013	00:08.3	00:01.4	00:01.4	00:00.9	00:00.9	00:00.9
Export for YouTube Quality	05:52.0	04:29.8	04:29.6	04:32.9	04:29.2	04:31.0
Total	**08:43.2**	**04:58.1**	**05:06.3**	**05:13.5**	**05:08.1**	**05:10.8**

Figure 9: Times in minutes:seconds for each task in this scenario. Lower numbers are better.

Figure 10 shows the detailed results for the Performing general functions scenario.

Task	Intel Core i5-2430M + Windows 7	Intel Core i5-5200U + Windows 7	Intel Core i5-5200U + Windows 8.1	Intel Core i5-5200U + Windows 10 (from Windows 7)	Intel Core i5-5200U + Windows 10 (from Windows 8.1)	Intel Core i5-5200U + Windows 10 (avg)
Open Control Panel/This PC	00:09.3	00:02.8	00:03.0	00:03.0	00:03.2	00:03.1
Open Windows Explorer	00:01.4	00:00.6	00:00.6	00:00.6	00:00.6	00:00.6
Close Adobe Lightroom CC 2015	00:00.5	00:00.4	00:00.4	00:00.4	00:00.3	00:00.4
Close Adobe Illustrator CC 2015	00:11.8	00:01.3	00:01.5	00:01.7	00:01.7	00:01.7
Close Adobe Premiere Pro CC 2015	00:02.8	00:00.7	00:00.8	00:00.8	00:00.7	00:00.8
Total	**00:25.9**	**00:05.8**	**00:06.3**	**00:06.5**	**00:06.5**	**00:06.5**

Figure 10: Times in minutes:seconds for each task in this scenario. Lower numbers are better.

Figure 11 shows the detailed results for the Hosting a conference call scenario.

Task	Intel Core i5-2430M + Windows 7	Intel Core i5-5200U + Windows 7	Intel Core i5-5200U + Windows 8.1	Intel Core i5-5200U + Windows 10 (from Windows 7)	Intel Core i5-5200U + Windows 10 (from Windows 8.1)	Intel Core i5-5200U + Windows 10 (avg)
Boot up laptop	00:58.4	00:30.2	00:20.5	00:21.0	00:22.1	00:21.5
Open Skype	00:22.7	00:07.1	00:07.5	00:08.4	00:09.0	00:08.7
Open Folder while screen sharing	00:02.1	00:00.7	00:00.6	00:00.7	00:00.6	00:00.7
Open Word file while screen sharing	00:15.6	00:03.4	00:02.7	00:02.8	00:02.9	00:02.9
Send document	00:17.6	00:20.1	00:20.3	00:16.0	00:15.7	00:15.8
Shut down laptop	00:28.2	00:10.3	00:04.3	00:09.6	00:07.4	00:08.5
Total	**02:24.6**	**01:11.8**	**00:55.9**	**00:58.5**	**00:57.7**	**00:58.1**

Figure 11: Times in minutes:seconds for each task in this scenario. Lower numbers are better.

ABOUT PRINCIPLED TECHNOLOGIES

![Principled Technologies logo]

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

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.

When the assessment is complete, we know how to present the results to a broad range of target audiences. We provide our clients with the materials they need, from market-focused data to use in their own collateral to custom sales aids, such as test reports, performance assessments, and white papers. Every document reflects the results of our trusted independent analysis.

We provide customized services that focus on our clients' individual requirements. Whether the technology involves hardware, software, websites, or services, we offer the experience, expertise, and tools to help our clients assess how it will fare against its competition, its performance, its market readiness, and its quality and reliability.

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.