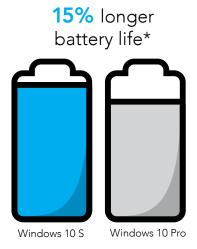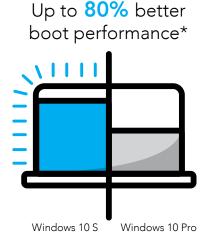# Comparing battery life and boot performance in Microsoft Windows 10 S and Windows 10 Pro

Results from the Microsoft Performance Assessment Toolkit

At Principled Technologies (PT), we compared the battery life and boot performance of two Microsoft® Windows® operating systems: Windows 10 S and Windows 10 Pro. Our test devices consisted of two pairs of identically configured laptops: a pair of Dell™ Latitude™ 3180 laptops, and a pair of HP 15-ay103dx laptops. For specific device configuration information, see Appendix A.

Microsoft commissioned PT to use two tests from the Windows ADK to assess system battery life and boot performance.[1] These tests are part of the Microsoft Performance Assessment Toolkit. We ran the tests via scripts Microsoft supplied to automate the testing process. We used the scripts at three configuration points: at baseline with no applications installed, after installing a set of applications, and after uninstalling those applications. For more details on our testing methodology, see Appendix B.

15% longer
battery life*

Windows 10 S   Windows 10 Pro

Up to **80%** better
boot performance*

Windows 10 S   Windows 10 Pro

*on average, with applications installed

Battery life and boot performance (baseline)

We ran the Fast Startup Boot Time assessment as a measure of boot performance, and the Local Full Screen Video Playback assessment as a measure of battery life.

	HP		Dell	
Assessment results	**Windows 10 S image**	**Windows 10 Pro image**	**Windows 10 S image**	**Windows 10 Pro image**
Boot performance baseline run 1 (sec)	18.0	19.0	22.6	24.9
Boot performance baseline run 2 (sec)	19.0	21.0	22.6	24.6
Boot performance baseline run 3 (sec)	18.3	19.7	23.0	25.5
Boot performance baseline average (sec)	**18.4**	**19.9**	**22.7**	**25.0**
Battery life baseline run 1 (min)	323	324	630	575
Battery life baseline run 2 (min)	315	312	593	567
Battery life baseline run 3 (min)	306	304	560	529
Battery life baseline average (min)	**315**	**313**	**594**	**557**

Battery life and boot performance with applications installed

We installed a set of applications on each device before running this test. For a complete list of the applications we used, see Appendix B. With applications installed, the laptops running Windows 10 S provided 15 percent longer battery life on average compared to the laptops running Windows 10 Pro. The laptops running Windows 10 S had 80 percent better boot performance on average compared to the laptops running Windows 10 Pro.

	HP		Dell	
Assessment results	**Windows 10 S image**	**Windows 10 Pro image**	**Windows 10 S image**	**Windows 10 Pro image**
Boot performance apps installed run 1 (sec)	17.0	145.0	21.8	79.0
Boot performance apps installed run 2 (sec)	16.9	139.0	22.3	80.0
Boot performance apps installed run 3 (sec)	18.0	141.0	22.0	78.6
Boot performance apps installed average (sec)	**17.3**	**141.7**	**22.0**	**79.2**
Battery life apps installed run 1 (min)	262	285	759	520
Battery life apps installed run 2 (min)	323	288	683	554
Battery life apps installed run 3 (min)	302	287	589	524
Battery life apps installed average (min)	**296**	**287**	**677**	**533**

Boot performance and battery life after uninstalling applications

We uninstalled the applications from each laptop and ran both tests again. Boot performance for the laptops running Windows 10 S was similar to the baseline, improving 8.4 percent on average. In addition, battery life for the laptops running Windows 10 S systems was similar after uninstalling applications, improving 1.7 percent on average.

Assessment results	HP		Dell	
	Windows 10 S image	Windows 10 Pro image	Windows 10 S image	Windows 10 Pro image
Boot performance apps uninstalled run 1 (sec)	16.0	20.0	22.0	24.4
Boot performance apps uninstalled run 2 (sec)	16.0	20.0	21.8	24.5
Boot performance apps uninstalled run 3 (sec)	16.2	20.0	21.7	24.4
Boot performance apps uninstalled run average (sec)	**16.1**	**20.0**	**21.8**	**24.4**
Battery life apps uninstalled run 1 (min)	327	301	604	576
Battery life apps uninstalled run 2 (min)	312	317	602	540
Battery life apps uninstalled run 3 (min)	315	304	607	570
Battery life apps uninstalled average (min)	**318**	**307**	**604**	**562**

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1   To access the Windows ADK tests, visit https://developer.microsoft.com/en-us/windows/hardware/windows-assessment-deployment-kit

On April 27, 2017, we finalized the hardware and software configurations we tested. Updates for current and recently released hardware and software appear often, so unavoidably these configurations may not represent the latest versions available when this report appears. For older systems, we chose configurations representative of typical purchases of those systems. We concluded hands-on testing on May 16, 2017.

Appendix A: System configuration information

System	Dell Latitude 3180	HP 15-ay103dx
Processor		
Vendor	Intel	Intel
Name	Pentium®	Core®-i5
Model number	N4200	7200U
Core frequency (GHz)	1.10 – 2.50	2.50 – 3.10
Number of cores	4	2
Cache	2MB L2	3MB SmartCache
Memory		
Amount (GB)	4	8
Type	DDR3L	DDR4
Speed (MHz)	1,600	2,133
Integrated graphics		
Vendor	Intel	Intel
Model number	HD Graphics	HD Graphics 620
Storage		
Amount	64	1 TB
Type	eMMC	SATA
Connectivity/expansion		
Wired internet	N/A	Realtek PCIe FE 10/100
Wireless internet	Intel Dual Band Wireless-AC 7265	Realtek RTL8188EE 802.11 bgn
Bluetooth	4.0	N/A
USB	2 x 3.1	1 x 3.1, 2 x 2.0
Video	1 x HDMI	1 x HDMI
Battery		
Type	Lithium-polymer	Lithium-polymer
Size	Integrated	Integrated
Rated capacity (Wh)	42	31

System	Dell Latitude 3180	HP 15-ay103dx
Display		
Size (in.)	11.6	15.6
Type	LCD HDF	HD SVA WLED-backlit touch screen
Resolution	1,336 x 768	1,366 x 768
Touchscreen	No	Yes
Operating system		
Vendor	Microsoft	Microsoft
Name	Windows 10 S & Pro	Windows 10 S & Pro
Build number or version	15063	15063
BIOS		
BIOS name and version	Dell v1.0.3	Insyde F.24
Dimensions		
Height (in)	0.82	0.95
Width (in)	11.94	15.12
Depth (in)	8.11	10.02
Weight (lbs.)	2.79	4.73

Appendix B: How we tested

Setting up the system

Down-level OS

1. Capture the drivers from the OEM factory image.
   a. Connect an external HDD to the system.
   b. On the external drive create a directory named Drivers.
   c. Hold the "Shift" key and restart the system.
   d. Choose Troubleshoot→Advanced options→Command prompt.
   e. Type `DISM /image:C: /export-driver /destination:D:\drivers` (Note: In this scenario the external drive is labeled D, however, this may be different depending on the configuration of the system.)

Installing Windows 10 S or Windows 10 Pro

1. Disable SecureBoot in the BIOS.
2. Install a clean version of Windows 10 S or Windows 10 Pro onto the test system.
3. Follow the on-screen instructions to complete installation using the default selections when appropriate.
   a. Use the Product Keys provided by Microsoft.
   b. Login to a Microsoft Account (Note: the same account can be used across all systems).
   c. Activate Windows.
4. Open Device Manager and use the OEM factory drivers captured onto the external HDD to install any missing drivers. (Note: Also, be sure to install the video driver.)
5. Run the Windows Update `Windows10.0-KB4016240-x64.exe`, followed by Windows Update and install all updates available.
6. Launch the Windows Store app and install all Store app updates.
7. Verify the date and time is correct and synchronize the system clock with the time server.

Preparing the system for test

1. Copy the OS1tools directory provided by Microsoft to the C drive.
2. Copy the Performance Assessment Toolkit directory (Perf2.0RC1) provided by Microsoft to the C drive.

Additional setup steps for Windows 10 S only

1. Apply the Debug policy provided by Microsoft.
2. Reboot system.

Measuring boot performance

Running the Fast Startup Boot Time assessment

1. Open the OS1tools directory and right-click on the powershell.exe to Run as Administrator.
2. Type the path to the Performance Assessment Toolkit directory, `cd C:\Users\<User name>\Perf2.0RC1`
3. Type `.\performance_assessments.cmd` to launch the script.
4. Type `P` to run the system preparation script. The system will reboot. (Note: This only needs to be done once per day or when a configuration change is made i.e. applications are installed or uninstalled.)
5. After the system has rebooted repeat steps 1-3.
6. Type `2` to execute the Fast Startup assessment.
7. After the Fast Startup assessment has completed type `A` to analyze the performance result and record the result.
8. Repeat two more times.

Measuring battery life

Running the Local Full Screen Video Playback (FSVP) assessment

The Movies & TV app will be used to play media clips locally, so verify that it is the default application to handle MP4 file extensions.

1. Open the OS1tools directory, and right-click on the powershell.exe to Run as Administrator.
2. Type the path to the Performance Assessment Toolkit directory, `cd C:\Users\<User name>\Perf2.0RC1`
3. Type `.\performance_assessments.cmd` to launch the script.
4. Type `P` to run the system preparation script. The system will reboot. (Note: This only needs to be done once per day or when a configuration change is made i.e. applications are installed or uninstalled.)
5. After the system has rebooted repeat steps 1-3.
6. Type `5` to execute the assessment.
7. After the assessment has completed, type `A` to analyze the performance result, and record the result.
8. Repeat two more times.

List of applications we installed/uninstalled

Microsoft provided the list of applications we installed on the systems running Windows 10 Pro. Microsoft selected this set of applications based on popularity and breadth of function. Windows 10 Pro allows users to install desktop applications as well as apps through the Windows store; however, we installed only desktop applications for consistency.

For Windows 10 S, we selected the apps ourselves. We emulated the Microsoft app selection by choosing popular, free apps from the Windows Store. Windows 10 S only permits users to install apps via the Windows Store. Because many of the desktop apps we installed on Windows 10 Pro do not have Windows Store equivalents, we did not precisely match the Windows 10 S selection to the list of Windows 10 Pro applications.

For both systems, we only list the applications we had to install ourselves. For example, Windows 10 S has the Microsoft Edge browser and Windows Defender by default; therefore we do not list those applications here.

During our tests, we ensured that multiple antivirus applications were never running at the same time. For the test configurations with applications installed, we captured boot performance and battery life with only MacAfee LifeSafe enabled. For the test configuration where we installed and then uninstalled applications, we made sure to uninstall the enabled antivirus application before installing a new one.

Windows 10 S applications

- Office 365® Personal (preview)
- Messenger
- Instagram
- Netflix
- Facebook
- Xbox® (beta)
- Kodi
- Movie Maker: Free Video Editor
- Pandora
- Adobe® Photoshop® Express
- VLC Media Player
- Hulu
- Fitbit
- PicsArt – Photo Studio
- Adblock
- Video Editor Master
- Sling TV
- Dropbox
- RAR Opener
- Adblock Plus
- Open PDF+
- Dolby® Access
- Pinterest Save Button
- Docx

- Complete Anatomy
- Speedtest by Ookla
- Xbox Avatars
- Autodesk® SketchBook®
- Phototastic Collage

Windows 10 Pro applications

- 7-Zip
- 360 Total Security
- OpenOffice
- Audacity®
- Avast® Free Antivirus
- CCleaner
- Chrome™ Browser
- Dropbox
- Evernote
- Firefox® Browser
- GIMP
- Google Drive™
- Google Earth™
- iTunes®
- McAfee LiveSafe™
- Notepad++
- Opera Browser
- Paint.net
- Adobe Photoshop
- Adobe Reader® 11
- Adobe Reader DC
- Skype®
- Spotify
- Steam
- VLC Media Player
- WinRAR

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