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Windows Fall Creator

Pick Up Where I Left Off

Disclaimer:

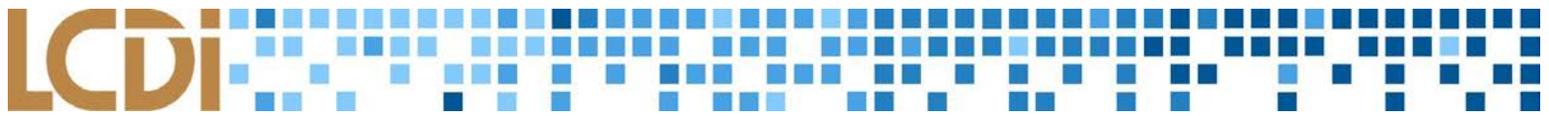
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Introduction

The Windows Fall Creator update to Windows 10 was released to the general public in the Fall of 2017, and included a vast number of new features. One of these features was coined “Pick Up Where I Left Off”, or PWILO. This feature is designed to create a smooth transition between devices and power states for the everyday Windows user. It does this by restoring closed apps and web pages at the convenience of the user. Windows put off releasing this feature with the Fall Creator Update, and delayed it until the Redstone 4 Update that was scheduled for release in Spring of 2018. As a result of this feature’s purpose and the delay in release, the security, storage, and collection of data involved with PWILO is questioned. The Windows Fall Creator Team is investigating these aspects of this feature. The goal of this project is to be able to definitively state the security implications that PWILO includes, as well as the impact it has on system performance.

Background

In 2017, Microsoft announced that it would be releasing Windows 10 updates twice a year around the months of March and September (Warren, 2017). This announcement is part of making Windows a service, not a static operating system. The newest updates, dubbed the Windows Fall Creator Update and Redstone 4, were released to mainstream users in the Fall of 2017 and the Spring of 2018. The majority of the project took place in the time between the two updates, and most of the research is from that time period. With that being said, the research that the group was doing on PWILO was predominantly first of its kind, and there were very few resources available to assist us. During this time, the feature was also in preliminary states, which meant that most of the research and sources were not definitive and peer reviewed. The team was sailing into uncharted waters, and exploring something that not many others had done yet.

Purpose and Scope

Through this report, various aspects of PWILO will be discussed, including but not limited to: The security implications, where data pertaining to it is stored, how it is affected by multiple users, how it works with other devices, how it collects data, its *reliability*, and the impacts it has on computer resources and hardware. These findings will be fairly entry level in scope, as this is a new feature that is still in its developmental stages.

There is not much existing research on the topic, and its functionality is still limited, so the research that could



actually be conducted was limited. The most complex that the methods will get is examining memory RAM dumps to see what kind of PWILO data is included in them, and the most basic procedures will involve visual and user experience observations. The majority of this report will reside somewhere in between that data floor and ceiling.

Research Questions

1. How *reliable* is Pick Up Where I Left Off?
2. Where is the data from Pick Up Where I Left Off stored?
3. Are there any security risks involved with Pick Up Where I Left Off?
4. Are there any hardware/resource usage implications involved with Pick Up Where I Left Off?
5. What devices does Pick Up Where I Left Off work with, and how does it interact with different devices?

Terminology

Build - A version or update of a software or operating system.

Cortana - The virtual voice assistant included in Microsoft Windows 10. She is integrated with the Pick Up Where I Left Off Feature, and can be used to control it, as well as many other tasks and services.

Memory Forensics - The process of analyzing the temporary volatile data stored in a computer's RAM.

Operating System - A collection of software and programs that are run on a computer.

Power State - Referring to the current state of a computer. These can include being shut completely off, in hibernation, sleeping, logged off, etc.

Reliable - For the purposes of this report, this refers to the dependability, stability, level of accuracy, and timely manner that PWILO functions in. In this report, if something is qualified as *reliable*, it defined as above.

PWILO (Pick Up Where I Left Off) - The feature of Windows being researched.

RAM - A physical hardware device in a computer that stores temporary data that disappears when the computer is not powered on.



RAM Dump - The process of extracting data stored in a computer's RAM, and saving it in a state that can be analyzed and maintained.

Redstone 4 - The newest update released for Windows by Microsoft as of the Spring of 2018.

Timeline - A visual display of what a user was doing previously, allowing users to easily re-open files, apps, and websites that they were previously working on.

Virtual Machine (VM) - An operating system running inside another operating system. In other words, a VM is like having a computer inside another computer.

Volatile Memory - Data stored in a computer that is not saved when the power is shut off. This data is typically stored in RAM.

Windows Insider Program - An initiative started by Microsoft for developers to help develop new Windows updates. It allows users to access new versions of Windows before the general public, and also before they are perfected.

Methodology and Methods

Equipment Used

There was a small selection of equipment used for this project. The main piece of equipment that was used for nearly every aspect of the project was the four Virtual Machines that were configured to run the latest update of the Windows 10 Insider Preview Build. Depending on the date, these VMs ran many different version of the insider preview, and were updated about once a week. These had 32 bit operating systems, 2 virtual CPUs, 4096 MB of RAM, and about 100 GB of storage each. The second piece of technology that was used for this project was a Toshiba Laptop. This laptop ran Windows 10 Insider Preview 17123.1 only, as it was used for testing at the end of the project. This laptop had a 64 bit operating system, an Intel(R) N3530 @ 2.16 GHz processor, 4GB of RAM, and a 750 GB hard disk drive. The initial scope of the project included the use of a Windows Phone and a Microsoft Surface Pro, but due to time limitations and the functionality of the Pick Up Where I Left Off Feature, these were not used.



Table 1: Device List

Device	OS Version	Comments
VMs (4)	Windows 10 Insider Preview Build	Versions of OS varied weekly
Toshiba Laptop	Windows 10 Insider Preview Build	Used for verification of VM data

Data Collection

The PWILO team decided on a specific procedure to dictate how data was collected for this project. Initially, before experimental data was collected, the group researched and documented notes on various aspects of the feature to learn more about what type of data could realistically be generated from the virtual machines. A summary of these notes can be found in the [Appendix](#) Section of this report under “[Initial Research Notes](#)”. After this, the team decided that the four VMs would be used for data collection of distinct and different scenarios. These scenarios consisted of one user on one computer, two users on one computer, and one user moving between two devices. Each of these devices got a Microsoft Account that was associated with a user. These accounts can be seen in the “[Accounts](#)” table in the [Appendix](#) Section of this report. For example, the two VMs that had one user sharing two computers both got the same Microsoft account that was associated with that particular user. After this, each VM was enrolled in the Windows Insider Program, so that they could test the PWILO feature. The plan was to collect data for each research question the same way on each VM to see how it was affected by different users and devices. The data for this project will be stored in the “[Different Power States Data Collection](#)” table located in the [Appendix](#) Section of this report.

Normal, everyday user activities will be conducted on each VM in combination with different power states to gauge how PWILO works and how *reliable* it is. The success rates of how often PWILO restores tasks that were previously open will be recorded. This will provide an estimate of how often the feature actually works. Data collection for where PWILO stores data will be conducted by analyzing network packets to determine if the location is online, and sifting through the local hard drive to see if it is stored locally. The security risks will be assessed by examining the stored files for PWILO and their encryption, if they have any. This will be used to determine how easily a third party could access PWILO features. Data for hardware and resource implications will be collected by starting and stopping the PWILO feature while monitoring and recording the CPU, RAM,



and Disk usage. The devices that PWILO works with will be tested with simulated everyday activities, and the results will be recorded in a table to gauge how well, or if at all, PWILO works with them.

Analysis

In order to test the *reliability* of PWILO, the team will perform many everyday tasks in a VM. Changing the power state of the machine at various times with various applications open can be used to see what applications will be restored with PWILO. Tasks like this will be performed and recorded. Events can later be examined to determine how often PWILO functions as intended, and how *reliable* it is. For example, if PWILO constantly opens the same applications that were open before a restart, it is fairly *reliable*. Conversely, if PWILO functions sporadically or inconsistently with which applications it opens after a change in power state, then it is not *reliable*.

In order to verify where PWILO data is stored, the team will be using a combination of Wireshark and searching through the OS hard drive. PWILO will be used normally and Wireshark will monitor the packets being sent and received from the machine. Then, the team will also comb through the hard drive and attempt to find files related to PWILO. If the team finds no files on the hard drive related to PWILO and finds many packets being sent and received from a Microsoft site regarding PWILO, then it can be concluded that most data for PWILO is stored online. Conversely, if no packets for PWILO are found in Wireshark and lots of data files related to it are found on the hard drive, then it can be concluded that the feature stores data locally.

The team will address the security risks of PWILO by analyzing the findings from where the data is stored. If the data is stored online, then the team will focus on the encryption of the data being sent as well as where it is being stored online. If the data is stored locally, the team will focus on the protection and encryption of the files, and additionally what data can be extracted from the data files stored on the hard drive. This aspect of the project is largely dependant on finding out where the data is stored.

The hardware and resource use implications of PWILO will be addressed by the team as well. The team will monitor the Windows Resource Monitor, specifically the RAM, CPU, Disk, and Network usage statistics, and log these statistics over time. They will get a baseline without PWILO running, and then they will repeat the collection of data with PWILO enabled and running. The resource data can then be compared to see what type of effect PWILO has on each section of computer hardware. A big difference between the baseline and trial will



indicate that PWILO requires a lot of resources to operate, and conversely a small difference will indicate that it does not require many resources to function.

The team will investigate the devices that PWILO works with, as well as how it interacts with different devices with different OSs as well. With Cortana/PWILO active on another device, the team will log off or shutdown a computer and start using a different device using the same Microsoft user account to see if the information and activity will be transferred over. Multiple trials of these types of activities will be run on different devices in different scenarios, and they will be recorded. Based on what Microsoft has published about the feature, this should be a seamless transition between devices and it is expected that the data will be stored in the cloud in order to retrieve it on another device. The data will be examined for different devices, and if this seamless transition occurs, then it will be concluded that PWILO works with that specific type of device. A failure of data transition will indicate that PWILO does not function with a specific type of device.

Results

While the Windows Fall Creator team was not able to achieve many definitive conclusions regarding the research questions specifically, they were able to arrive at a few different verdicts regarding Pick Up Where I Left Off. For the team's purposes, they were unsuccessful at getting PWILO to function as intended by Microsoft. There were points in the project where, in different situations and with different versions of the Insider Build, glimpses of the feature shined through but did not last. These glimpses were seen in the timeline, as well as in the notification center and with Cortana asking the user if they wanted to PWILO. At times, after reboots and randomly, the timeline would include all previous apps and programs as it should, but moments later it would be lacking most or all of them. Occasionally, after sign-ins and restarts, Cortana or the notification center would ask if the user wanted to restore previous tasks and PWILO as it should, but at most times this feature was nowhere to be found. Even when it did function normally, some apps that were open wouldn't be restored, and others that were not open would be. There was no noticeable pattern with these fluctuations, and the team was not able to achieve any predictable results. Some of these results can be seen in the teams data generation, located in [Table 2](#) in the [Appendix](#).

Conclusion

Only one research question can be answered with some degree of certainty at this point in time. Number 1, or, "How *reliable* is Pick Up Where I Left Off?", is the only question that the team had a chance to tackle in the



allotted time, and therefore the only question that a conclusion will be given to in order to avoid conjecture. It is clear that with Windows 10 Insider Preview 17128.1, Windows Pick Up Where I Left Off is not *reliable* enough to be used in everyday activities with an expectation of consistency. As for the other research questions, the team can only speculate, but it appears as though PWILO is detrimental to system speed and performance when running, at least in this developmental stage. It was impossible to obtain solid conclusions pertaining to the other questions given the lack of functionality seen in the PWILO feature at this point. There is a possibility that these inconclusive results could be traced back to the VMs that were used in collecting data, or the fact that the operating systems on the VMs were 32 bit and not 64 bit. These are both aspects of the research that should theoretically make no difference for the PWILO feature, but in reality they may have affected the data.

Further Work

This project will require further work due to the incomplete nature of the feature. What will most likely need to be done is to have a team assigned to this project either during Fall Semester 2018, or Spring Semester 2019 to continue exploring the Pick Up Where I Left Off feature. By this point, the feature should be fully released, bug tested, and functioning, and the team will be able to conduct more meaningful research and data generation on the topics could not be during this project. These areas could include, but are not limited to, security issues, hardware/performance implications, multi-device support, and forensics implications. Another aspect of the project that should be examined is the performance of the feature on both VMs and physical machines, as well as 32 and 64 bit operating systems. The further work that will need to be conducted on this project is largely fluid, and will be based on the decisions made by the team and supervisors at the time it is being re-examined. This is resulting from the fact that it is not certain where Windows will choose to go with Pick Up Where I Left Off, and what changes will be made to it between now and then.

Appendix

Table 2: Different Power States Data Collection

Time	User Action	Machine Action	Comments
Thursday, March 22, 2018			
8:57	Power on Virtual Machine	Power on	

8:58	Enter Password	Log in to windows	
9:00	Click-on Microsoft Solitaire Collection	Open App	Took a long time to load
9:02		Internet Connection Problem	
9:05	Tried to go to the website the error message gave and look up the error code however it did not list the error code that was seen.	Went to Microsoft Edge website	
9:12	Clicked on Paint 3D app	opened paint 3d	
9:13	Started Paint 3D Project	followed mouse operations	
9:19	Saved Paint 3D Project	Saved as 3D paint project	saved as "SummerDay"
9:19	Closed Paint 3D app	closed app	
9:20	Shut Down VM	shut down windows	
9:28	Powered on VM	powered on	
9:28	Entered Password	Logged in windows	
9:29	Looked for anything that resembled PWILO features (opened Cortana,	followed mouse operations,	when in task view there is a note saying: "Use your PC more to see your

	opened notebook, opened task view)	opened Cortana, notebook, and task view	activities here.” 
9:37	Opened Paint 3D app	opened app	
9:38	Paint 3D Project		
9:52	Saved Paint 3D Project	saved as 3D paint project	Saved as “Fishies”
9:52	Shut down VM	shut down windows	Kept app open this time
9:54	Powered on VM	powered on	
9:55	Entered password	logged in windows	
9:57	Opened task view	followed mouse operations, open task view	while the previous session still did not show, it now showed activity from March 1st 
9:59	Opened Cortana and notebook searching for anything that resembled PWILO from the last session	followed mouse operations, opened Cortana and notebook	found nothing
10:03	Opened Microsoft Mahjong	opened app	

10:04	Started new puzzle	started puzzle and followed mouse operations	played puzzle called “Crosshair”
10:08	Closed app	closed app	
10:09	Shut down VM	shut down windows	
10:10	powered on VM	powered on	
10:11	entered password	logged into windows	
10:12	Opened task view	followed mouse operations, open task view	while the previous session still again did not show it did still show activity from March 1st 
10:13	Opened Cortana and notebook looking for anything resembling PWILO from the last session	followed mouse operations, opened Cortana and notebook	found nothing
10:14	Opened Microsoft Mahjong	opened app	
10:17	Started new puzzle	followed mouse operations	played puzzle called “Nautilus”
10:21	powered off VM	shut down windows	with app still open

10:24	power on VM	powered on	
10:25	entered password	logged on	
10:25	opened task view	followed mouse operations, opened task view	while the previous session still again did not show it did still show activity from March 1st 
10:27	Opened Cortana and notebook looking for anything resembling PWILO from the last session	followed mouse operations, opened Cortana and notebook	found nothing
10:52	Opened News app	open app	
10:53	Clicked on article	opened full article	“Rescue dog detects cancer on owner’s nose, saves her life.” (Inside edition 3/22/18)
10:55	Closed News App	closed app	left article open in news app and just closed app from the article
10:55	Shut down VM	shut down windows	
10:56	Powered on VM	powered on	
10:57	Entered password	logged on	
10:57	Opened Task View	followed mouse operations,	while the previous session still again did not show it did still show activity

		opened task view	from March 1st
			
10:59	Opened Cortana and notebook looking for anything resembling PWILO from the last session	followed mouse operations, opened Cortana and Notebook	found nothing
11:00	Opened News app	open app	
11:00	Clicked on article	opened full article	“Austin bomber: ‘Challenged young man’ or ‘terrorist’?” (Washington Post, 3/22/18)
11:02	Shut down VM	shut down windows	news app still open with article open when shut down
11:03	Powered on VM	powered on	
11:04	entered password	logged in	
11:05	opened task view	followed mouse operations, opened task view	while the previous session still again did not show it did still show activity from March 1st
			

11:06	Opened Cortana and notebook looking for anything resembling PWILO from the last session	followed mouse operations, opened Cortana and Notebook	found nothing again
11:06	Shutdown VM	shutdown windows	
Friday, March 23, 2018			
10:42	Powered on VM	powered on	
10:43	entered password	logged in	
10:46	Opened Paint 3D		
10:47	Started a new project		
11:00	Saved project		Saved as "Red Blob"
11:02	Closed Paint 3D		
11:10	Opened Microsoft Edge		
11:12	Browsed to different web pages		They only showed up in the timeline once they were closed
11:20	Shutdown VM	shutdown windows	
11:22	Powered on VM		PWILO did not show up and the apps that showed previously in the timeline disappeared
11:29	Opened News app		For some reason, the stuff from March 1 disappeared

			
11:30	Scrolled through random news stories		The articles that were opened showed up in the timeline as well as the stuff from March 1st, but not the stuff from earlier in the day
11:39	closed news app		
11:40	Shutdown VM		
12:11	Powered on VM		
12:11	Logged into VM		No PWILO and no timeline, but March 1
12:15	Opened up edge		
12:16	Browsed to different pages		
12:17	Opened Solitaire		Same internet connection problem
12:19	Started a Klondike Game		
12:34	Closed Solitaire		
12:35	Opened News		
12:36	Scrolled through articles		
12:39	Closed news		This is what the timeline looked like before it was shut down

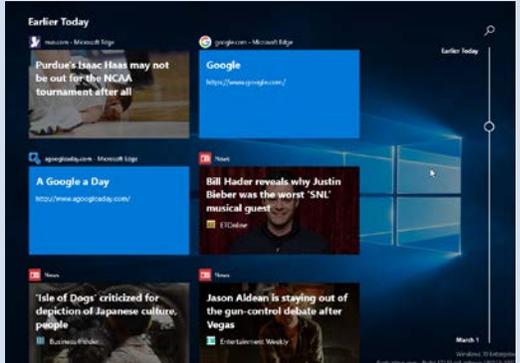
			
12:40	Shutdown VM		
12:42	Powered on VM		
12:43	Logged into VM		<p>This is what it looked like when I powered back on</p> 
12:45	Opened edge and started exploring		
12:50	closed edge		<p>Before final shutdown</p> 
12:51	Shutdown VM		
Concludes Data Generation			

Table 3: Initial Research Notes

Topic	Notes	Source
One User, Multiple Devices	<ul style="list-style-type: none"> ● Microsoft account needed ● Works with IOS and Android ● Works with applications, websites, and files ● Available to general public after Redstone 4 Update ● Works if idle time is less than 30 minutes ● Will work in the action center or the timeline feature ● Supported by Cortana ● Can be tested with a Windows Insider Build ● Can be accessed with windows + tab key or task view button 	<u>Dua, Kunal</u>
General PWILO	<ul style="list-style-type: none"> ● Stop on one device and pick back up on another ● Cortona should handle the instal of the feature 	<u>Bright, Peter</u> <u>Bowden, Zac</u> <u>Martin, Jim</u> <u>TinsleyNET Admin</u>

	<p>for you</p> <ul style="list-style-type: none"> • Powered by Microsoft Graph • Need a microsoft or 365 account to work • Similar to Apple's Handoff feature • Make phone calls through PC • Release date with Redstone 4 • use Microsoft Cloud • Timeline will be the new task view utility • One drive is supported 	<u>Brink, Shawn</u>
Enable/Disable PWILO	<ul style="list-style-type: none"> • Simple as flipping a switch, or have Cortana do it for the user • A restart is required 	<u>Wahab, Fatima</u> <u>Tkachenko, Sergey</u>
Changing Power States	<ul style="list-style-type: none"> • PWILO works with restarts and reboots • Does not work when you shut down 	<u>Wahab, Fatima</u>

Table 4: Accounts

Account	Name of User	Username/email	Location	VM Used On	Type
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Platform					
Google	Mickey Mouse	20MickeyMouse18@gmail.com	US	1	one user one computer
Microsoft	Mickey Mouse	20MickeyMouse18@gmail.com	Vermont, US	1	one user one computer
Google	Minnie Mouse	20MinnieMouse18@gmail.com	US	2	two users one computer
Microsoft	Minnie Mouse	20MinnieMouse18@gmail.com	Vermont, US	2	two users one computer
Google	Donald Duck	20DonaldDuck18@gmail.com	US	2	two users one computer
Microsoft	Donald Duck	20DonaldDuck18@gmail.com	Vermont, US	2	two users one computer
Google	Daisy Duck	20DaisyDuck18@gmail.com	US	3, 3b	one user two computers
Microsoft	Daisy Duck	20DaisyDuck18@gmail.com	Vermont, US	3, 3b	one user two computers
Google	Pluto Disney	20PlutoDisney18@gmail.com	US	Dell Windows Phone	Misc.
Microsoft	Pluto Disney	20PlutoDisney18@gmail.com	Vermont, US	Dell Windows Phone	Misc.
Google	Goofy Disney	20GoofyDisney18@gmail.com	US	Nokia Windows Phone	Misc.
Microsoft	Goofy Disney	20GoofyDisney18@gmail.com	Vermont, US	Nokia Windows Phone	Misc.
Google	Snow White	20SnowWhite18@gmail.com	US	Surface Pro	Misc.
Microsoft	Snow White	20SnowWhite18@gmail.com	Vermont, US	Surface Pro	Misc.

		mail.com			
Google	Chip Dale	20ChipDale18@gmail.com	US	Laptop	Laptop
Microsoft	Chip 'n' Dale	20ChipDale18@gmail.com	Vermont, US	Laptop	Laptop

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