

An examination of Win10 (version 1803) ActivitiesCache.db database

Windows Timeline, is a new feature of Windows 10 introduced with version 1803.
It is part of the Connected Devices Platform

- The [Connected Devices Platform Service](#), is a Windows service that provides a way for devices such as PC's and smartphones to discover and send messages between each other.
- [Connected Devices Platform Service \(CDPSvc\) Defaults](#) in Windows 10.

and the Microsoft Graph's Cross-device experience ([Project Rome](#)) .

The CDP settings for the Current User are stored in the registry at:
NTUSER.DAT -> 'Software\Microsoft\Windows\CurrentVersion\CDP'

Name	Type	Data
ab(Default)	REG_SZ	(value not set)
0110CdpSessionUserAuthzPolicy	REG_DWORD	0x00000001 (1)
abCdpUserSettingsVersion	REG_SZ	RS4
0110EnableRemoteLaunchToast	REG_DWORD	0x00000001 (1)
0110NearShareChannelUserAuthzPolicy	REG_DWORD	0x00000000 (0)
0110RomeSdkChannelUserAuthzPolicy	REG_DWORD	0x00000001 (1)

and

CapabilityAccessManager	Name	Type	Data
CDP	ab(Default)	REG_SZ	(value not set)
SettingsPage	0110BluetoothLastDisabledNearShare	REG_DWORD	0x00000000 (0)
ClickNote	0110NearShareChannelUserAuthzPolicy	REG_DWORD	0x00000001 (1)
Clip			

Before Windows 10 version 1803

The service and the 'ActivitiesCache.db' database existed before the 1803 upgrade (May 2018), but with limited functionality. Another possibly related* activity store location is at:
'Software\Microsoft\Windows\CurrentVersion\CloudStore\Store\Cache\DefaultAccount\\$\$windows.data.taskflow.shellactivities\Current'

*(considering that the current ActivitiesCache.db uses taskflow to retrieve device information as seen further down)

Cache	0	1	2018-05-10 13:57:42
DefaultAccount	0	91	2018-05-17 20:24:23
\$windows.data.bluelightreduction.bluelightreductionstate	0	1	2018-05-10 13:57:42
\$windows.data.bluelightreduction.settings	0	1	2018-05-10 13:57:42
\$windows.data.calling.callfavorites	0	1	2018-05-10 14:03:05
\$windows.data.calling.callhistory	0	1	2018-05-10 14:03:05
\$windows.data.curatedtilecollection.rootcollection	0	1	2018-05-10 13:57:42
\$windows.data.messaging.settings	0	1	2018-05-10 14:03:05
\$windows.data.notifications.quiethourssettings	0	1	2018-05-10 13:57:48
\$windows.data.placeholdertilecollection	0	1	2018-05-10 13:57:42
\$windows.data.placeholdertilecollectionlocal	0	1	2018-05-10 13:57:42
\$windows.data.platform.partitioning.activepartitions	0	1	2018-05-10 13:58:00
\$windows.data.platform.partitioning.systempartitionindex	0	1	2018-05-10 13:58:00
\$windows.data.signals.registrations	0	1	2018-05-10 13:58:16
\$windows.data.taskflow.shellactivities	0	1	2018-05-10 13:57:42
Current	1	0	2018-05-10 13:57:42
\$windows.data.unifiedtile.localstartglobalproperties	0	1	2018-05-10 13:57:42

where there is a value named 'Data':

Value...	Value...	Data	Value Slack
0x0	0x0	0x0	0x0
Data	Reg...	02-00-00-00-D0-ED-CA-EB-63-E8-D3-01-00-00-00-43-42-01-00-CB-0...	00-00
Type viewer	Slack viewer		
00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F 10			
00000000 02 00 00 00 D0 ED CA EB 63 E8 D3 01 00 00 00 43		... Ðí ÈécéÓ.... C	
00000011 42 01 00 CB 0A 0A B5 03 D2 0A 30 4D 00 69 00 63 00		B.. È.. µ. Ó. 0M i. c.	
00000022 72 00 6F 00 73 00 6F 00 66 00 74 00 2E 00 4D 00 69		r. o. s. o. f. t... Mi	
00000033 00 63 00 72 00 6F 00 73 00 6F 00 66 00 74 00 53 00		. c. r. o. s. o. f. t. S.	
00000044 74 00 69 00 63 00 6B 00 79 00 4E 00 6F 00 74 00 65		t. i. c. k. y. N. o. t. e	
00000055 00 73 00 5F 00 38 00 77 00 65 00 6B 00 79 00 62 00		, s. _ , 8. w. e. k. y. b.	

Its value is in hex and it seems to hold interesting information, including the Filetime of last update (which corresponds to the Last Write Timestamp of the registry key).

If Windows is updated to version 1803, this 'log' stops being updated. This can be checked by looking in the SYSTEM hive at the Setup key like:

Source OS (Updated on 3/25/2018 01:40:42)
Source OS (Updated on 5/10/2018 14:50:04)

In that case, interestingly,

Offset	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	ANSI ASCII
00000000	02	00	00	00	D0	ED	CA	EB	63	E8	D3	01	00	00	00	00	Ðí ÈécéÓ
00000016	43	42	01	00	CB	0A	0A	B5	03	FILETIME: 10-05-18 16:36:37 +300	CB	È	µ	Ó	0M i		
00000032	63	00	72	00	6F	00	73	00	6F	00	66	00	74	00	2E	00	c r o s o f t .
00000048	4D	00	69	00	63	00	72	00	6F	00	73	00	6F	00	66	00	M i c r o s o f t
00000064	74	00	53	00	74	00	69	00	63	00	6B	00	79	00	4E	00	t s t i c k y N
00000080	6F	00	74	00	65	00	73	00	5F	00	38	00	77	00	65	00	o t e s _ 8 w e

this Filetime is very close to the date of the ntuser.dat.LOG files (*which coincides with the date the 1803 update occurred*), and that can also be seen from the last entry above:

NTUSER.DAT	12 Jun 18 1:06 pm
ntuser.dat.LOG1	10 May 18 4:50 pm
ntuser.dat.LOG2	10 May 18 4:50 pm

Further [examination](#) shows a consistent pattern:

- 0xD2 14 = Start of Entry
- Next byte = length of block (x2)
- Start of path & executable
- 0xC6 1F = End of block
- Next 4 bytes = unknown
- 0xD2 23 = Executable Block
- Next byte = length of block (x2)
- Executable
- 0xD2 28 = Payload block
- Next byte = length of block (x2)
- Payload (eg email, URL etc.)
- 0xC6 32 = end of block
- Next 9 bytes = (A) is the same as (B) of the next entry (upwards)
- 0xC6 3C = Pointer to next entry
- Next 9 bytes = (B) is the same as (A) of the next entry (upwards) *
- 0x CA500000 = End of Entry

*Top most entry is the newest one, so for the last entry these 9 bytes are all 0xFF

Offset	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
000000000	02	00	00	00	69	BC	79	90	8F	E9	D3	01	00	00	00	00
000000016	43	42	01	00	CB	0A	0A	91	03	D2	14	25	FILETIME: 12-05-18			
000000032	5C	00	24	00	57	00	49	00	4E	00	44	00	4F	00	57	00
000000048	53	00	2E	00	7E	00	42	00	54	00	5C	00	53	00	6F	00
000000064	75	00	72	00	63	00	65	00	73	00	5C	00	53	00	65	00
000000080	74	00	75	00	70	00	48	00	6F	00	73	00	74	00	2E	00
000000096	65	00	78	00	65	00	C6	1F	80	8D	DC	01	D2	23	0D	53
000000112	00	65	00	74	00	75	00	70	00	48	00	6F	00	73	00	74
000000128	00	2E	00	65	00	78	00	65	00	D2	28	10	57	00	69	00
000000144	6E	00	64	00	6F	00	77	00	73	00	20	00	31	00	30	00
000000160	20	00	53	00	65	00	74	00	75	00	70	00	C6	32	80	9E
000000176	9D	A9	F3	B1	FA	E9	01	C6	3C	FF	FF	FF	FF	FF	FF	FF
000000192	FF	FF	01	CA	50	00	00	D2	14	39	46	00	3A	00	5C	00
000000208	5F	00	46	00	6F	00	72	00	65	00	6E	00	73	00	69	00
000000224	63	00	20	00	54	00	6F	00	6F	00	6C	00	73	00	5C	00
000000240	64	00	6D	00	64	00	65	00	2D	00	70	00	72	00	6F	00
000000256	66	00	2D	00	32	00	21	00	34	00	2E	00	36	00	2E	00
000000272	34	00	34	00	38	00	2D	00	77	00	69	00	6E	00	36	00
000000288	34	00	2D	00	67	00	75	00	69	00	5C	00	64	00	6D	00
000000304	64	00	65	00	2E	00	65	00	78	00	65	00	C6	1F	8E	9D
000000320	9C	01	D2	23	08	64	00	6D	00	64	00	65	00	2E	00	65
000000336	00	78	00	65	00	D2	28	17	49	00	4D	00	44	00	45	00
000000352	20	00	33	00	2E	00	34	00	2E	00	32	00	20	00	46	00
000000368	72	00	65	00	65	00	20	00	45	00	64	00	69	00	74	00
000000384	69	00	6F	00	6E	00	C6	32	E7	81	B1	91	F3	B1	FA	E9
000000400	01	C6	3C	80	9E	9D	A9	F3	B1	FA	E9	01	CA	50	00	00
000000416	D2	14	2C	43	00	3A	00	5C	00	50	00	72	00	6F	00	67
000000432	00	72	00	61	00	6D	00	20	00	46	00	69	00	6C	00	65

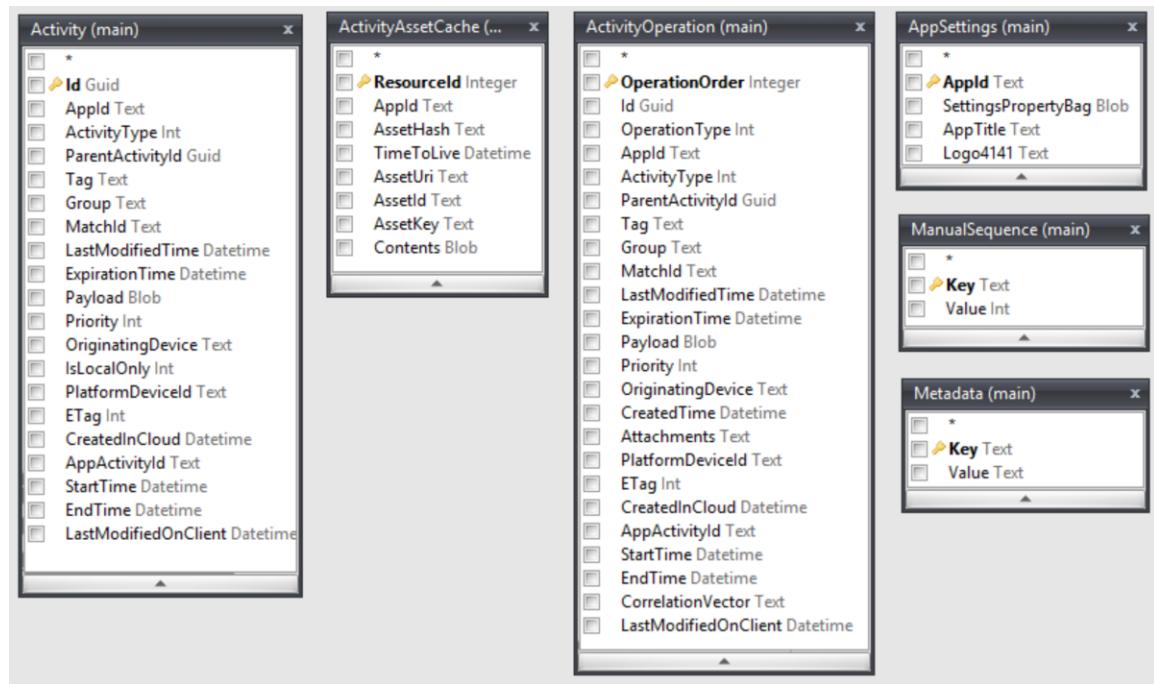
With a bit of tweaking in Notepad++, it shows web page titles, email (used in accounts of Outlook), File Explorer paths followed and name of the remote devices accessed with Teamviewer among other.

```
508 C:\Program Files (x86)\TeamViewer\TeamViewer.exe[08:500]#$TeamViewer.exe[(
509 TeamViewerZ2Y`-t:$0H<qX'-t:$0HPC0X0)
510
511 C:\Program Files (x86)\TeamViewer\TeamViewer.exe[08:500]#$TeamViewer.exe[($Wait for partnerZ2Ap-Y:$0Z<Y'-t:$0HPC0X0)
512
513 C:\Program Files (x86)\TeamViewer\TeamViewer.exe[08:500]#$TeamViewer.exe[(
514 TeamViewerZ2B&Bf-Y:$0Z<Ap-t:$0HPC0X0)
515
516 C:\Program Files (x86)\TeamViewer\TeamViewer.exe[08:500]#$TeamViewer.exe[($Sponsored sessionZ2o"Y6@t:$0Z<B&Bf-Y:$0HPC0X0)
517
518 C:\Program Files (x86)\TeamViewer\TeamViewer.exe[08:500]#$TeamViewer.exe[(
519 TeamViewerZ2QY00@t:$0Z<d"Y@t:$0HPC0X0)
520
521 C:\Program Files (x86)\TeamViewer\TeamViewer.exe[08:500]#$TeamViewer.exe[($Wait for partnerZ2o$E0@t:$0Z<QY00@t:$0HPC0X0)
522
523 C:\Program Files (x86)\TeamViewer\TeamViewer.exe[08:500]#$TeamViewer.exe[(-ZEUS_X6 - TeamViewer - Free license (non-commercial use
524 only)Z2(Z`@t:$0Z<CE0@t:$0HPC0X0)
525
```

Back to the 'ActivitiesCache.db' database.

The location of both old and new dBs is at the
"%userprofile%\appdata\local\ConnectedDevicesPlatform" folder.

The old dB table structure was similar to the new dB, but it included 6 tables + the master table, with different fields:



The information held was also different:

E.g. the ‘AppSettings’ table in the old DB looked like this:

AppId	SettingsPropertyBag	AppTitle	Logo4141
1 windows.immersivecontrolpanel_cv5n1h2txyewy!microsoft.windows.immersivecontrolpanel	BLOB	NULL	NULL
2 Microsoft.SkypeApp_kzf8qxf38zg5c!ppleae38af2e007f4358a809ac99a64a67c1	BLOB	NULL	NULL
3 Microsoft.SkypeApp_kzf8qxf38zg5c!App	BLOB	NULL	NULL
4 Microsoft.MicrosoftEdge_8wekyb3d8bbwe!MicrosoftEdge	BLOB	NULL	NULL
5 AD2F1837.HPPrinterControl_v10z8vjag6ke6!AD2F1837.HPPrinterControl	BLOB	NULL	NULL
6 Microsoft.BingNews_8wekyb3d8bbwe!AppexNews	BLOB	NULL	NULL
7 Microsoft.WindowsCamera_8wekyb3d8bbwe!App	BLOB	NULL	NULL
8 Microsoft.Windows.Photos_8wekyb3d8bbwe!App	BLOB	NULL	NULL
9 VirtualPulse.PlayerforMedia_nh7p8cqfc4t04!App	BLOB	NULL	NULL

And included UWP ([Universal Windows Platform](#)) Apps only.

The new dB does not have any entries in this table.

The ‘Metadata’ table was also different:

Key	Value
1 CurrentEtag	5b15de40-92c2-11e7-9117-01020305070d
2 CurrentSettings	{"ActivityTypes": [4,3,2,1,0], "Environment": "prod"}
3 PendingStrongAuth	{"pendingStrongAuth": true}

The new dB has different fields:

Key	Value
1 CurrentSettings	{"ActivityTypes": [4,3,2,1,0,5,13,6], "Environment": "prod"}
2 DatabaseInstanceId	38608
3 DatabaseInstanceIdUpdateTime	2018-05-10T14:00:55.845Z

After examination of various new ‘ActivitiesCache.db’ files, any entries seen in the new database have an ‘ActivityType’ (*seen above*) of 5 or 6, which appear to represent ‘Open App/File/Url’ and ‘App In Focus’ respectively – type 13 was not observed in any dB yet.

The ‘DatabaseInstanceIdUpdateTime’ date seen above, is the date & time (in UTC) that the current dB file was created.

A Microsoft Account related DB includes one more field, the ‘CurrentEtag’ but instead of using an ETAG in the form found elsewhere in the dB, it lists it in the form of a GUID – that is the Cloud ETAG:

Key	Value
1 CurrentSettings	{"ActivityTypes": [4,3,2,1,0,5,13,6], "Environment": "prod"}
2 DatabaseInstanceId	23919
3 DatabaseInstanceIdUpdateTime	2018-05-10T13:58:59.758Z
4 CurrentEtag	8df03b30-642c-11e8-9117-01020305070d

The ‘SmartLookUp’ view in the old DB was also different:

```
1 select      [O].[Id],  
2       [O].[AppId],  
3       [O].[AppActivityId],  
4       [O].[ActivityType],  
5       [O].[ParentActivityId],  
6       [O].[Tag],  
7       [O].[Group],  
8       [O].[MatchId],  
9       [O].[LastModifiedTime],  
10      [O].[ExpirationTime],  
11      [O].[Payload],  
12      [O].[Priority],  
13      [O].[OriginatingDevice],  
14      [A].[IsLocalOnly],  
15      [A].[PlatformDeviceId],  
16      [A].[CreatedInCloud],  
17      [O].[StartTime],  
18      [O].[EndTime],  
19      [O].[LastModifiedOnClient],  
20      [O].[ETag]  
21 from [ActivityOperation] as [O]  
22 left outer join [Activity] as [A] on [O].[Id] = [A].[Id]  
23 where [O].[OperationType] <> 3  
24 union  
25 select      [Id],  
26       [AppId],  
27       [AppActivityId],  
28       [ActivityType],  
29       [ParentActivityId],  
30       [Tag],  
31       [Group],  
32       [MatchId],  
33       [LastModifiedTime],  
34       [ExpirationTime],  
35       [Payload],  
36       [Priority],  
37       [OriginatingDevice],  
38       [IsLocalOnly],  
39       [PlatformDeviceId],  
40       [CreatedInCloud],  
41       [StartTime],  
42       [EndTime],  
43       [LastModifiedOnClient],  
44       [ETag]  
45 from [Activity]  
46 where [Id] not in (select [Id]  
47   from [ActivityOperation])
```

The new Timeline & ActivitiesCache.db

The **NEW** (updated) database stores information for each user in the %LOCALAPPDATA% \ConnectedDevicesPlatform folder or more commonly familiar as: C:\users\username\appdata\local\ConnectedDevicesPlatform

This folder has a file named '**CDPGlobalSettings.cdp**' which is essentially a .json file

CDPGlobalSettings	
Tag	Value
<object>	
AFSEnvironment	0
AFSUrl	https://activity.windows.com
ActivityStoreInfo	
AfcDefaultUser	undefined
AfcPrivacySettings	
ActivityFeed	0
CloudSync	0
PublishUserActivity	0
UploadUserActivity	1
AfsPostInitializeSyncWaitMs	10000
AfsSyncFrequencyMs	3600000
Authentication.Environment	0
BluetoothTransportEnabled	true
CcsApiVersion	/api/v1
CcsDefaultServerName	romeccs.microsoft.com
CcsPollingEnabled	false
CcsPollingInterval	0
CcsSeenRequestIds	
CcsSeenRequestIdsLastUpdate...	0000-00-00T00:00:00.000
Cloud.SessionIdleTimeoutInter...	3600
CloudTransportEnabled	true
CustomAuthCsid	

and includes information for the service including the store location for the database that holds the windows timeline entries for the current user.

Tag	Value
<object>	
AFSEnvironment	0
AFSUrl	https://activity.windows.com
ActivityStoreInfo	
<element #0>	
active	true
activityStoreId	288AC2E2-C67D-6FAB-153F-7AE...
stableUserId	4a7cc0f3b728d240

The folder name may include one or more of:

- A Local account starting with an L.UserName, and/or
- folder(s) which appear to be name with random numbers but are the cid's of Microsoft accounts (e.g. Outlook.com, Live.com, Hotmail.com or MSN.com domains).

Name	Date modified
ActivitiesCache.db	24-May-18 10:55
ActivitiesCache.db-shm	24-May-18 10:54
ActivitiesCache.db-wal	24-May-18 11:00

If a user logs in to Windows with a MS account, then the respective dB is populated.

Information as to which online account has this specific ID can be found at:

NTUSER.DAT -> '[Software\Microsoft\IdentityCRL\UserExtendedProperties](#)'

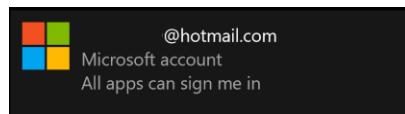
Under each online account (email) the 'cid' Value contains the respective value for each Microsoft Account & folder.

If a user logs in with a local account, then the L.UserName database is populated.

A Microsoft Exchange (Office365 etc) account starts with 'AAD' and is in the form of AAD.[sid]. AAD denotes a business account (*as in Azure Active Directory*) and information associated with this account 's [sid] can be found in NTUSER.dat at ->
'[Software\Microsoft\MSOIdentityCRL\UserExtendedProperties](#)' and/or
'[Software\Microsoft\OneDrive\Accounts\Business1](#)'

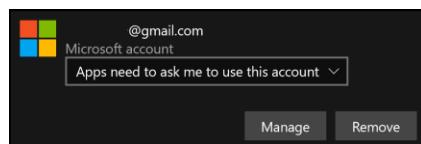
However, there are two cases when, even if a user continues to use a local account to sign in Windows 10 , the activities can still be synchronized across devices:

1. The User has set up a Microsoft Account at "Settings-> Accounts->Email&app accounts" and set it up so that all apps can sign in with this account:



In this case the L.UserName folder is removed, and the active folder is the folder that corresponds to this account. All activities are synched across devices.

2. The User has set up a Microsoft Account at "Settings-> Accounts->Email&app accounts" and set it up so that Apps need permission to use this account:



In this case, the local activities are stored in the L.Username folder, but any activity on other devices is stored in the respective folder that corresponds to this MS account.

The timeline settings ('Settings → Privacy → Activity History') enable or not activity to be tracked in the '[ActivitiesCache.db](#)'. In order for the activity to be shared across devices (*via the cloud*) you need to login with a Microsoft account, enable Windows Hello (i.e. create pin and or biometric/photo login).

<https://support.microsoft.com/en-us/help/4026102/windows-10-about-sync-settings>

To enable cross-device experiences, your app users must login with either a [Microsoft Account](#) or an [Azure Active Directory](#) account.

https://github.com/Microsoft/project-rome/blob/master/cross-device_app_configuration.md



https://github.com/microsoftgraph/microsoft-graph-docs/blob/master/api-reference/beta/resources/intune_deviceconfig_windows10generalconfiguration.md

A list of settings that can be roamed or backed up (synced) across devices can be found here:
<https://docs.microsoft.com/en-us/azure/active-directory/active-directory-windows-enterprise-state-roaming-windows-settings-reference>

The 'AfcPrivacySettings' in 'CDPGlobalSettings.cdp' depicts the relative settings in Windows 10 'Settings → Privacy- >Activity History', for example:

All settings ON:



CDPGlobalSettings	
Tag	Value
> ActivityStoreInfo	
└ AfcDefaultUser	undefined
└ AfcPrivacySettings	
└ ActivityFeed	0
└ CloudSync	0
└ PublishUserActivity	0
└ UploadUserActivity	0

Upload to cloud off



AfcDefaultUser	undefined
AfcPrivacySettings	
ActivityFeed	0
CloudSync	0
PublishUserActivity	0
UploadUserActivity	1

Publish off, cloud off

Activity history

Jump back into what you were doing with apps, docs, or other activities, either on your PC or your phone.

Let Windows collect my activities from this PC

Let Windows sync my activities from this PC to the cloud

AfcPrivacySettings	
ActivityFeed	0
CloudSync	0
PublishUserActivity	1
UploadUserActivity	1

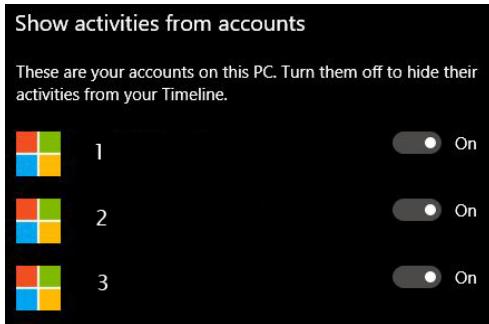
The same settings can also be configured through Group Policy at ‘Computer Configuration -> Administrative Templates -> System ->OS Policies’

Setting

- Enables Activity Feed
- Allow publishing of User Activities
- Allow upload of User Activities

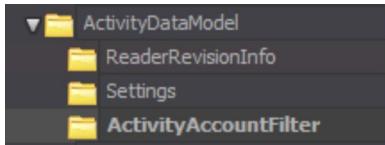
Opening the respective folder we can see the ‘ActivitiesCache.db’ (*and possibly also the ActivitiesCache.wal and ActivitiesCache.db-sdb files*) which is the storage of all timeline activity for the current user. When a user switches from a Local to a MS account, the ‘L.UserName’ is deleted and a new one is created (if it didn’t exist before) under the respective MS account folder. Any previous entries in the ‘L.UserName’’s ‘ActivitiesCache.db’ now appear in the new ‘ActivitiesCache.db’ linked to the MS account, and sync to the cloud. Switching from a MS to a local account, the MS account related db is still available and holds timeline data.

When a user logs in Windows with a MS account, and the relevant check boxes in ‘Settings -> Privacy- >Activity History’ are set to On,



any activity created with his other MS account(s), is updated in the '[ActivitiesCache.db](#)' in the respective '%LOCALAPPDATA% \ConnectedDevicesPlatform\ SubFolder, and can be seen in his timeline view .

Any -excluded from sync- accounts (*above setting set to off*) can be seen at the registry at:
NTUSER.dat
[Software\Microsoft\Windows\CurrentVersion\ActivityDataModel\ActivityAccountFilter](#)



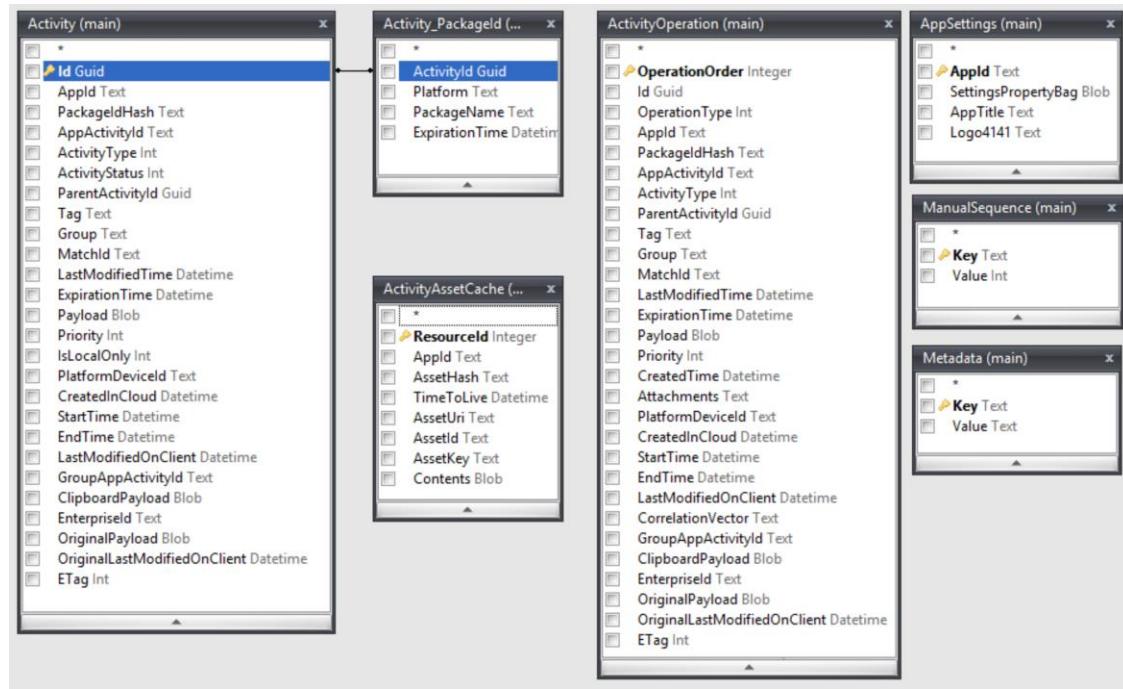
The synchronized entries in a MS account related dB will show the 'Device ID' of the machine the entry originated from. The Device Name and Model of the originating machine can be seen in the NTUSER.dat's '[Software\Microsoft\Windows\CurrentVersion\TaskFlow\DeviceCache](#)':

Device ID
qcz3R4I70roQ43jHkxaTglaAC2eQunmzl6lKwNi+KOc=
qcz3R4I70roQ43jHkxaTglaAC2eQunmzl6lKwNi+KOc=
qcz3R4I70roQ43jHkxaTglaAC2eQunmzl6lKwNi+KOc=

Even if a user logs in with a local account, when a MS Account was previously used for login, the entries of '[ActivitiesCache.db](#)' of that account will also appear in the user's timeline (for the previous 7 days). So it may be prudent to examine all '[ActivitiesCache.db](#)' databases in a system.

Following is the analysis of the new 'ActivitiesCache.db' file, using [DB Browser for SQLite](#), [SQLite Expert Professional](#), [Notepad++](#) and [JSON Viewer](#).

The database has the following structure (7 tables + the master table):



The 'Metadata' table includes the date/time the database was created by the system:

The screenshot shows the 'Metadata (main)' table with the following data:

	Key	Value
1	CurrentSettings	{"ActivityTypes": [4,3,2,1,0,5,13,6], "Environment": "prod"}
2	DatabaseInstanceId	3428
3	DatabaseInstanceIdUpdateTime	2018-05-24T08:16:50.365Z

Note: see page 2 above for the differences with the old database

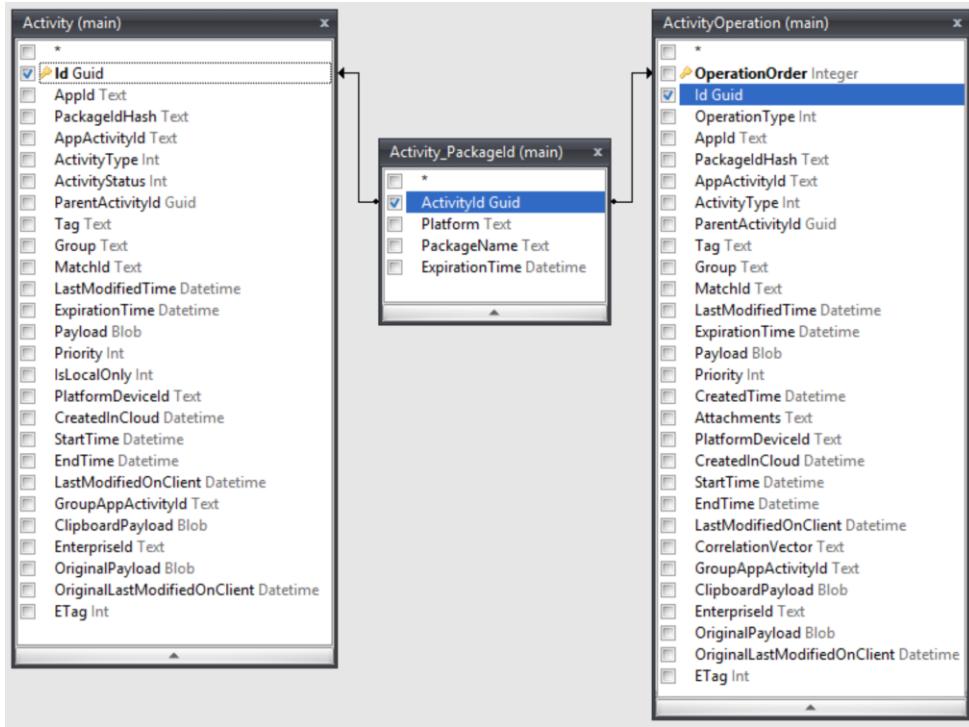
The 'ManualSequence' table shows the last Activity (ETAG) recorded in the database:

The screenshot shows the 'ManualSequence (main)' table with the following data:

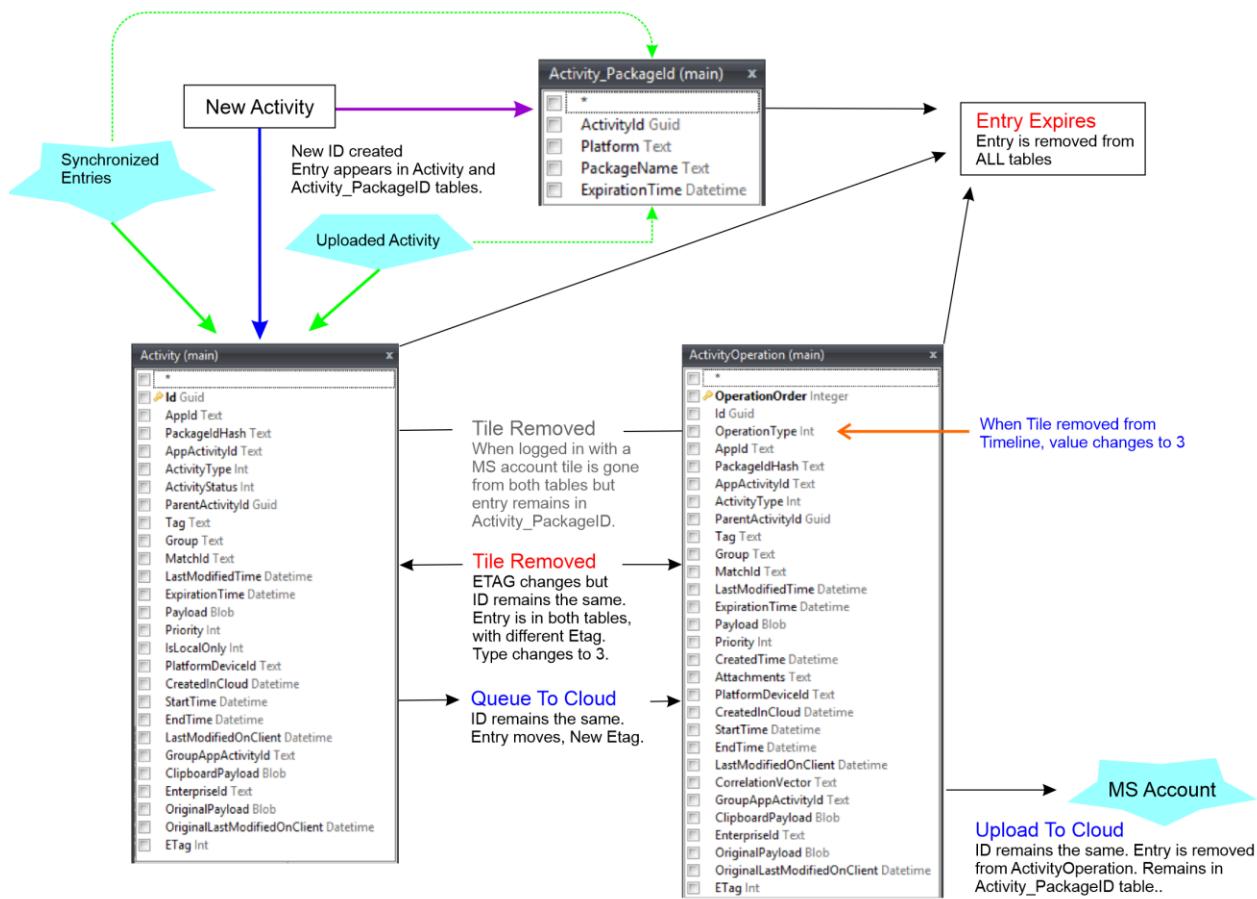
	Key	Value
1	Activity	839

From the 7 tables above, only three hold information of user activities:

'Activity', 'ActivityOperation' and 'Activity_PackageID'



The Windows Timeline process looks like this:



Any new application execution or focus change, triggers an entry to the '[Activity](#)' table, and relevant entries in the '[Activity_PackageID](#)' table.

Note: *It should be noted that any new entries/transactions are written first to the write ahead log ('ActivitiesCache.wal')*

Name	Date modified	Type	Size
ActivitiesCache.db	27-May-18 5:20 pm	DB File	4.196 KB
ActivitiesCache.db-shm	27-May-18 4:07 pm	DB-SHM File	32 KB
ActivitiesCache.db-wal	27-May-18 5:22 pm	DB-WAL File	528 KB

and the database is updated when the wal file reaches 1000 pages and commits the transactions. The default settings of the database show that each page is 4096 bytes long:

Auto Vacuum	None
Automatic Index	<input checked="" type="checkbox"/>
Checkpoint Full FSYNC	<input type="checkbox"/>
Foreign Keys	<input checked="" type="checkbox"/>
Full FSYNC	<input type="checkbox"/>
Ignore Check Constraints	<input type="checkbox"/>
Journal Mode	WAL
Journal Size Limit	-1
Locking Mode	Normal
Max Page Count	1073741823
Page Size	4096
Recursive Triggers	<input type="checkbox"/>
Secure Delete	<input type="checkbox"/>
Synchronous	Full
Temp Store	Default
User Version	18
WAL Auto Checkpoint	1000

The query below (which is in essence two united queries) extracts all possible useful information from this database in a readable form. This query will not work properly in any SQLite browser that does not include support for the [json1 extension](#).

```

1  SELECT -- This is the ActivityOperation Table Query
2    ActivityOperation.ETag as 'Etag',
3    json_extract(ActivityOperation.Payload, '$.appDisplayName') as 'Program Name',
4    case
5      when json_extract(ActivityOperation.AppId, '$[0].application') = '308046B0AF4A39CB'
6        then 'Firefox-308046B0AF4A39CB'
7      when json_extract(ActivityOperation.AppId, '$[1].application') = '308046B0AF4A39CB'
8        then 'Firefox-308046B0AF4A39CB'
9      when length (json_extract(ActivityOperation.AppId, '$[1].application')) > 17
10        and length (json_extract(ActivityOperation.AppId, '$[1].application')) < 22
11        then
12          replace(replace(replace(replace(
13            json_extract(ActivityOperation.AppId, '$[0].application'),
14            '([' || '6D8809377-6AF0-444B-8957-A3773F02200E' || ')', '*ProgramFiles (x64)'),
15            '([' || '7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E' || ')', '*ProgramFiles (x32)'),
16            '([' || '1AC14E77-02E7-4E5D-B744-2EB1AE5198B7' || ')', '*System'),
17            '([' || 'F38BF404-1043-42F2-9305-67DE0B28FC23' || ')', '*Windows'),
18            '([' || 'D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27' || ')', '*System32')
19        else replace(replace(replace(replace(json_extract(ActivityOperation.AppId,
20          '$[1].application'),
21            '([' || '6D8809377-6AF0-444B-8957-A3773F02200E' || ')', '*ProgramFiles (x64)'),
22            '([' || '7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E' || ')', '*ProgramFiles (x32)'),
23            '([' || '1AC14E77-02E7-4E5D-B744-2EB1AE5198B7' || ')', '*System'),
24            '([' || 'F38BF404-1043-42F2-9305-67DE0B28FC23' || ')', '*Windows'),
25            '([' || 'D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27' || ')', '*System32')
26      end as 'Application',
27      json_extract(ActivityOperation.Payload, '$.displayText')|| ' (' ||json_extract(ActivityOperation.Payload, '$.description')|| ')' as 'File/title/path
28      opened',
29      case when json_extract(ActivityOperation.Payload, '$.shellContentDescription') like '%FileShellLink%'
30        then json_extract(ActivityOperation.Payload, '$.shellContentDescription.FileShellLink')
31      else json_extract(ActivityOperation.Payload, '$.type')|| '-' ||json_extract(ActivityOperation.Payload,'$.userTimezone')
32      end as 'Payload/Timezone',
33      case ActivityOperation.ActivityType
34        when 5 then 'Open App/File/Page' when 6 then 'App In Use/Focus'
35        else 'Unknown yet'
36      end as 'Activity_type',
37      case json_extract(ActivityOperation.AppId, '$[0].platform')
38        when 'afs_crossplatform' then 'Yes'
39        when 'host' then
40          (case json_extract(ActivityOperation.AppId, '$[1].platform')
41            when 'afs_crossplatform' then 'Yes' else null end)
42        else null
43      end as 'Synced',
44      case
45        when json_extract(ActivityOperation.AppId, '$[0].platform') = 'afs_crossplatform'
46          then json_extract(ActivityOperation.AppId, '$[1].platform')
47        else json_extract(ActivityOperation.AppId, '$[0].platform')
48      end as 'Platform',
49      case ActivityOperation.OperationType
50        when 1 then 'Active' when 2 then 'Updated' when 3 then 'Deleted' when 4 then 'Ignored'
      end as 'TileStatus',

```

```

51    case
52        when ActivityOperation.Id in
53            (select Activity.Id from Activity where Activity.Id = ActivityOperation.Id)
54            then 'Removed'
55        end as 'WasRemoved',
56    case
57        when ActivityOperation.Id
58            in(select Activity.Id from Activity where Activity.Id = ActivityOperation.Id)
59            then null else 'In Queue'
60        end as 'UploadQueue',
61        coalesce(json_extract(ActivityOperation.Payload, '$.activationUri'),json_extract(ActivityOperation.Payload, '$.reportingApp')) as 'App/Uri',
62        ActivityOperation.Priority as 'Priority',
63        time(json_extract(ActivityOperation.Payload, '$.activeDurationSeconds'),'unixepoch') as 'Active Duration',
64    case
65        when cast((ActivityOperation.EndTime - ActivityOperation.StartTime) as integer) < 0 then '-'
66        else time(cast((ActivityOperation.EndTime - ActivityOperation.StartTime) as integer),'unixepoch')
67    end as 'Calculated Duration',
68    datetime(ActivityOperation.StartTime, 'unixepoch', 'localtime') as 'StartTime',
69    datetime(ActivityOperation.LastModifiedTime, 'unixepoch', 'localtime') as 'LastModified',
70    case
71        when ActivityOperation.OriginalLastModifiedOnClient > 0
72            then datetime(ActivityOperation.OriginalLastModifiedOnClient, 'unixepoch', 'localtime')
73            else ' '
74        end as 'LastModifiedOnClient',
75    case
76        when ActivityOperation.EndTime > 0
77            then datetime(ActivityOperation.EndTime, 'unixepoch', 'localtime')
78            else null
79        end as 'EndTime',
80    case
81        when ActivityOperation.CreatedInCloud > 0
82            then datetime(ActivityOperation.CreatedInCloud, 'unixepoch', 'localtime')
83            else null
84        end as 'CreatedInCloud',
85        cast((ActivityOperation.ExpirationTime - ActivityOperation.LastModifiedTime)
86            as integer) / '86400' as 'Expires In days',
87        datetime(Activity.PackageId.ExpirationTime, 'unixepoch', 'localtime') as 'Expiration on PackageID',
88        datetime(ActivityOperation.ExpirationTime, 'unixepoch', 'localtime') as 'Expiration',
89        ActivityOperation.PlatformDeviceId as 'Device ID',
90        ActivityOperation.PackageIdHash as 'Application Hash',
91        '{' || substr(hex(Activity_PackageId.ActivityId), 1, 8) || '-' ||
92            substr(hex(Activity_PackageId.ActivityId), 9, 4) || '-' ||
93            substr(hex(Activity_PackageId.ActivityId), 13, 4) || '-' ||
94            substr(hex(Activity_PackageId.ActivityId), 17, 4) || '-' ||
95            substr(hex(Activity_PackageId.ActivityId), 21, 12) || '}' as 'ID',
96        json_extract(ActivityOperation.OriginalPayload, '$.appDisplayName') as 'Original Displayed Name',
97        json_extract(ActivityOperation.OriginalPayload, '$.displayText') as 'Original File/title opened',
98        json_extract(ActivityOperation.OriginalPayload, '$.description') as 'Original Full Path /Url',
99        coalesce(json_extract(ActivityOperation.OriginalPayload, '$.activationUri'),json_extract(ActivityOperation.OriginalPayload, '$.reportingApp')) as
100        'Original_App/Uri',
101        time(json_extract(ActivityOperation.OriginalPayload, '$.activeDurationSeconds'),'unixepoch') as 'Orig.Duration'

```

```

101
102    from Activity_PackageId
103    join ActivityOperation on Activity_PackageId.ActivityId = ActivityOperation.Id
104    where Activity_PackageId.Platform = json_extract(ActivityOperation.AppId, '$[0].platform')
105        and Activity_PackageId.ActivityId = ActivityOperation.Id
106
107 union -- Join Activity & ActivityOperation Queries to get results from both Tables
108
109 select -- This the Activity Table Query
110     Activity.ETag as 'Etag',
111     json_extract(Activity.Payload, '$.appDisplayName') AS 'Program Name',
112     case
113         when json_extract(Activity.AppId, '$[0].application') = '308046B0AF4A39CB'
114             then 'Firefox-308046B0AF4A39CB'
115         when json_extract(Activity.AppId, '$[1].application') = '308046B0AF4A39CB'
116             then 'Firefox-308046B0AF4A39CB'
117         when length (json_extract(Activity.AppId, '$[0].application')) > 17 and
118             length(json_extract(Activity.AppId, '$[0].application')) < 22
119             then replace(replace(replace(json_extract(Activity.AppId, '$[1].application'),
120                 '|||'6D809377-6AF0-444B-8957-A3773F02200E'|||'), '*ProgramFiles (x64)'),
121                 '|||'7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'|||'), '*ProgramFiles (x32)'),
122                 '|||'1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'|||'), '*System'),
123                 '|||'F38BF404-1D43-42F2-9305-67DE0B28FC23'|||'), 'Windows'),
124                 '|||'D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'|||'), 'System32')
125         when json_extract(Activity.AppId, '$[0].application') = '308046B0AF4A39CB'
126             then 'Firefox-308046B0AF4A39CB'
127         else replace(replace(replace(replace(
128             (json_extract(Activity.AppId, '$[0].application),
129                 '|||'6D809377-6AF0-444B-8957-A3773F02200E'|||'), '*ProgramFiles (x64)'),
130                 '|||'7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'|||'), '*ProgramFiles (x32)'),
131                 '|||'1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'|||'), '*System'),
132                 '|||'F38BF404-1D43-42F2-9305-67DE0B28FC23'|||'), 'Windows'),
133                 '|||'D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'|||'), 'System32')
134     end as 'Application',
135     json_extract(Activity.Payload, '$.displayText')|| ' (' ||json_extract(Activity.Payload, '$.description')||')' as 'File/title/path opened',
136     case when json_extract(Activity.Payload, '$.shellContentDescription') like '%FileShellLink%'
137         then json_extract(Activity.Payload, '$.shellContentDescription.FileShellLink')
138         else json_extract(Activity.Payload, '$.type')||' - ' ||json_extract(Activity.Payload,'$.userTimezone')
139     end as 'Payload/Timezone',
140     case Activity.ActivityType
141         when 5 then 'Open App/File/Page' when 6 then 'App In Use/Focus'
142         else 'Unknown yet'
143     end as 'Activity_type',
144     case json_extract(Activity.AppId, '$[0].platform')
145         when 'afs_crossplatform' then 'Yes'
146         when 'host' then (case json_extract(Activity.AppId, '$[1].platform')
147             when 'afs_crossplatform' then 'Yes' else null end) else null
148     end as 'Synced',
149     case
150         when json_extract(Activity.AppId, '$[0].platform') = 'afs_crossplatform'

```

```

151     then json_extract(Activity.AppId, '$[1].platform')
152     else json_extract(Activity.AppId, '$[0].platform')
153   end as 'Platform',
154   case Activity.ActivityStatus
155     when 1 then 'Active' when 2 then 'Updated' when 3 then 'Deleted' when 4 then 'Ignored'
156     end as 'TitleStatus',
157     null as 'WasRemoved',
158     'No' as 'UploadQueue',
159     coalesce(json_extract(Activity.Payload, '$.activationUri'),json_extract(Activity.Payload, '$.reportingApp')) as 'App/Uri',
160     Activity.Priority as 'Priority',
161     time(json_extract(Activity.Payload, '$.activeDurationSeconds'),'unixepoch') as 'Active Duration',
162   case
163     when cast ((Activity.EndTime - Activity.StartTime) as integer) < 0 then '-'
164     else time(cast((Activity.EndTime - Activity.StartTime) as integer),'unixepoch')
165   end as 'Calculated Duration',
166   datetime(Activity.StartTime, 'unixepoch', 'localtime') as 'StartTime',
167   datetime(Activity.LastModifiedTime, 'unixepoch', 'localtime') as 'LastModified',
168   case
169     when Activity.OriginalLastModifiedOnClient > 0
170       THEN datetime(Activity.OriginalLastModifiedOnClient, 'unixepoch', 'localtime')
171       ELSE '-'
172   end as 'LastModifiedOnClient',
173   case
174     when Activity.EndTime > 0
175       then datetime(Activity.EndTime, 'unixepoch', 'localtime')
176     else "-"
177   end as 'EndTime',
178   case
179     when Activity.CreatedInCloud > 0
180       then datetime(Activity.CreatedInCloud, 'unixepoch', 'localtime')
181     else "-"
182   end as 'CreatedInCloud',
183   cast((Activity.ExpirationTime - Activity.LastModifiedTime) as integer) / '86400' as 'Expires In days',
184   datetime(Activity.PackageId.ExpirationTime, 'unixepoch', 'localtime') as 'Expiration on PackageID',
185   datetime(Activity.ExpirationTime, 'unixepoch', 'localtime') as 'Expiration',
186   Activity.PlatformDeviceId as 'Device ID',
187   Activity.PackageIdHash as 'Application_Hash',
188   '{' || substr(hex(Activity.PackageId.ActivityId), 1, 8) || '-' ||
189   substr(hex(Activity.PackageId.ActivityId), 9, 4) || '-' ||
190   substr(hex(Activity.PackageId.ActivityId), 13, 4) || '-' ||
191   substr(hex(Activity.PackageId.ActivityId), 17, 4) || '-' ||
192   substr(hex(Activity.PackageId.ActivityId), 21, 12) || '}' as 'ID',
193   json_extract(Activity.OriginalPayload, '$.appDisplayName') as 'Original Program Name',
194   json_extract(Activity.OriginalPayload, '$.displayText') as 'Original File/title opened',
195   json_extract(Activity.OriginalPayload, '$.description') as 'Original Full Path /Url',
196   coalesce(json_extract(Activity.OriginalPayload, '$.activationUri'),json_extract(Activity.OriginalPayload, '$.reportingApp')) as 'Original_App/Uri',
197   time(json_extract(Activity.OriginalPayload, '$.activeDurationSeconds'),'unixepoch') as 'Orig.Duration'
198
199 from Activity_PackageId
200 join Activity on Activity_PackageId.ActivityId = Activity.Id
201 where Activity_PackageId.Platform = json_extract(Activity.AppId, '$[0].platform')
202   and Activity_PackageId.ActivityId = Activity.Id
203
204 order by Etag desc; -- Edit this Line to change the sorting

```

This query can also be found online at:

<https://kacos2000.github.io/WindowsTimeline/>

The above query pulls information from the ‘Activity’, ‘ActivityOperation’ and ‘Activity_PackageId’ tables. The ‘Activity_PackageId’ table is more or less a ‘cache’ of the unique IDs of each application execution and its expiration time.

Some field explanations provided by [Microsoft](#):

Name	Type	Description
status	EnumType	Set by the server. A status code used to identify valid objects. Values: active, updated, deleted, ignored.
userTimezone	String	Optional. The timezone in which the user's device used to generate the activity was located at activity creation time. Values supplied as Olson IDs in order to support cross-platform representation.
createdDateTime	DateTimeOffset	Set by the server. DateTime in UTC when the object was created on the server.
lastModifiedDateTime	DateTimeOffset	Set by the server. DateTime in UTC when the object was modified on the server.
id	String	Required. Client-set GUID for the historyItem object.
startedDateTime	DateTimeOffset	Required. UTC DateTime when the historyItem (activity session) was started. Required for timeline history.
lastActiveDateTime	DateTimeOffset	Optional. UTC DateTime when the historyItem (activity session) was last understood as active or finished - if null, historyItem status should be Ongoing.
expirationDateTime	DateTimeOffset	Optional. UTC DateTime when the historyItem will undergo hard-delete. Can be set by the client.
activeDurationSeconds	int	Optional. The duration of active user engagement. If not supplied, this is calculated from the startedDateTime and lastActiveDateTime.

The [Activity](#)' table's '**ID**' (Primary key) field is a unique value:

[Activity]([Id] GUID PRIMARY KEY NOT NULL)

It is the unique ID of each entry/user activity. The same ID can be seen more than 2 times in the [Activity_PackageID](#) table depending on the '[Platform](#)' field which has the following possible values (*Note: most of project Rome is still undocumented, so not all entries can be defined*):

- “[Host](#)” (is listed as many times as the number of entries in the Activity table),
- “[packageid](#)”**, (is listed as many times as the number of entries and includes the executable and its path for all [x_exe](#) & [windows_win32](#) apps, as seen in the [Activity_PackageID](#)’s [PackageName](#) field)
- “[x_exe_path](#)” for Programs called from a specific path (e.g. Standalone executables)

** as seen below:

ETag	ID	Activity_PackageId.PackageName	Activity_json_Packageid
41723	3254D1271207F6C50CED...	*System\cmd.exe	*System\cmd.exe
41722	2FB37475807AA6C1D3C9...	*System\snippingtool.exe	*System\SnippingTool.exe
41721	3A99ABF8D3BA3ABE6B31...	microsoft.office.desktop_8wekyb3d8bbw!powerpoint	NULL
41720	935EB39CF7CE0C170659...	*ProgramFiles (x64)\lsoft technologies\active@ disk editor...	*ProgramFiles (x64)\LSoft Technologies\Active@ Disk Edi...
41719	2922B987D85B0B6FA4ED...	*ProgramFiles (x64)\tracker software\pdf viewer\pdfxcview...	*ProgramFiles (x64)\Tracker Software\PDF Viewer\PDFXC...
41718	F13910B8FE851B13E14D...	microsoft.windowscalculator_8wekyb3d8bbw!app	Microsoft.WindowsCalculator_8wekyb3d8bbw!App
41717	FF1241976D7A557AEA1E...	microsoft.windowscalculator_8wekyb3d8bbw!app	Microsoft.WindowsCalculator_8wekyb3d8bbw!App
41715	D222BC19A52035C3398E...	*System\snippingtool.exe	*System\SnippingTool.exe
41713	5A61C68F4DE1C99F14A4...	*System\snippingtool.exe	*System\SnippingTool.exe
41707	587C1298F7A2D926DBD...	microsoft.windows.explorer	Microsoft.Windows.Explorer
41706	68547C5BDBFD068D2F3F...	microsoft.windows.explorer	Microsoft.Windows.Explorer
41704	A7B05CED895ABC4DCCF...	*System\notepad.exe	*System\notepad.exe

By running the following query:

```

select
Activity.ETag,
hex(Activity_PackageId.ActivityId) as 'ID',
replace(replace(replace(replace(replace(
Activity_PackageId.PackageName,
lower('308046B0AF4A39CB'), 'Mozilla Firefox'),
'{|||lower('6D809377-6AF0-444B-8957-A3773F02200E'||'|', '*ProgramFiles (x64)'), 
'{|||lower('7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'||'|', '*ProgramFiles (x32)'), 
'{|||lower('1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'||'|', '*System'), 
'{|||lower('F38BF404-1D43-42F2-9305-67DE0B28FC23'||'|', '*Windows'), 
'{|||lower('D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'||'|', '*System32') as
'Activity_PackageId.PackageName',
case
when json_extract(Activity.AppId, '$[0].platform') like '%packageid%' then
replace(replace(replace(replace(
(json_extract(Activity.AppId, '$[0].application'),
'308046B0AF4A39CB'), 'Mozilla Firefox'),
'{|||6D809377-6AF0-444B-8957-A3773F02200E'||'|', '*ProgramFiles (x64)'), 
'{|||7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'||'|', '*ProgramFiles (x32)'), 
'{|||1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'||'|', '*System'), 
'{|||F38BF404-1D43-42F2-9305-67DE0B28FC23'||'|', '*Windows'), 
'{|||D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'||'|', '*System32')
when json_extract(Activity.AppId, '$[1].platform') like '%packageid%' then
replace(replace(replace(replace(
(json_extract(Activity.AppId, '$[1].application'),
'308046B0AF4A39CB'), 'Mozilla Firefox'),
'{|||6D809377-6AF0-444B-8957-A3773F02200E'||'|', '*ProgramFiles (x64)'), 
'{|||7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'||'|', '*ProgramFiles (x32)'), 
'{|||1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'||'|', '*System'), 
'{|||F38BF404-1D43-42F2-9305-67DE0B28FC23'||'|', '*Windows'), 
'{|||D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'||'|', '*System32')
when json_extract(Activity.AppId, '$[2].platform') like '%packageid%' then
replace(replace(replace(replace(
(json_extract(Activity.AppId, '$[2].application'),
'308046B0AF4A39CB'), 'Mozilla Firefox'),
'{|||6D809377-6AF0-444B-8957-A3773F02200E'||'|', '*ProgramFiles (x64)'), 
'{|||7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'||'|', '*ProgramFiles (x32)'), 
'{|||1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'||'|', '*System'), 
'{|||F38BF404-1D43-42F2-9305-67DE0B28FC23'||'|', '*Windows'), 
'{|||D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'||'|', '*System32')
when json_extract(Activity.AppId, '$[3].platform') like '%packageid%' then
replace(replace(replace(replace(
(json_extract(Activity.AppId, '$[3].application'),
'308046B0AF4A39CB'), 'Mozilla Firefox'),
'{|||6D809377-6AF0-444B-8957-A3773F02200E'||'|', '*ProgramFiles (x64)'), 
'{|||7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'||'|', '*ProgramFiles (x32)'), 
'{|||1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'||'|', '*System'), 
'{|||F38BF404-1D43-42F2-9305-67DE0B28FC23'||'|', '*Windows'), 
'{|||D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'||'|', '*System32')
when json_extract(Activity.AppId, '$[4].platform') like '%packageid%' then
replace(replace(replace(replace(
(json_extract(Activity.AppId, '$[4].application'),
'308046B0AF4A39CB'), 'Mozilla Firefox'),
'{|||6D809377-6AF0-444B-8957-A3773F02200E'||'|', '*ProgramFiles (x64)'), 
'{|||7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'||'|', '*ProgramFiles (x32)'), 
'{|||1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'||'|', '*System'), 
'{|||F38BF404-1D43-42F2-9305-67DE0B28FC23'||'|', '*Windows'), 
'{|||D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'||'|', '*System32')
when json_extract(Activity.AppId, '$[5].platform') like '%packageid%' then
replace(replace(replace(replace(
(json_extract(Activity.AppId, '$[5].application'),
'308046B0AF4A39CB'), 'Mozilla Firefox'),
'{|||6D809377-6AF0-444B-8957-A3773F02200E'||'|', '*ProgramFiles (x64)'), 
'{|||7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'||'|', '*ProgramFiles (x32)'), 
'{|||1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'||'|', '*System'), 
'{|||F38BF404-1D43-42F2-9305-67DE0B28FC23'||'|', '*Windows'), 
'{|||D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'||'|', '*System32')
when json_extract(Activity.AppId, '$[6].platform') like '%packageid%' then
replace(replace(replace(replace(
(json_extract(Activity.AppId, '$[6].application'),
'308046B0AF4A39CB'), 'Mozilla Firefox'),
'{|||6D809377-6AF0-444B-8957-A3773F02200E'||'|', '*ProgramFiles (x64)'), 
'{|||7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'||'|', '*ProgramFiles (x32)'), 
'{|||1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'||'|', '*System'), 
'{|||F38BF404-1D43-42F2-9305-67DE0B28FC23'||'|', '*Windows'), 
'{|||D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'||'|', '*System32')
when json_extract(Activity.AppId, '$[7].platform') like '%packageid%' then
replace(replace(replace(replace(
(json_extract(Activity.AppId, '$[7].application'),
'308046B0AF4A39CB'), 'Mozilla Firefox'),
'{|||6D809377-6AF0-444B-8957-A3773F02200E'||'|', '*ProgramFiles (x64)'), 
'{|||7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E'||'|', '*ProgramFiles (x32)'), 
'{|||1AC14E77-02E7-4E5D-B744-2EB1AE5198B7'||'|', '*System'), 
'{|||F38BF404-1D43-42F2-9305-67DE0B28FC23'||'|', '*Windows'), 
'{|||D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'||'|', '*System32')
when json_extract(Activity.AppId, '$[8].platform') like '%packageid%' then
replace(replace(replace(replace(

```

```

(json_extract(Activity.AppId, '$[8].application'),
'308046B0AF4A39CB', 'Mozilla Firefox'),
'{|||'6D809377-6AF0-444B-8957-A3773F02200E'|||}', '**ProgramFiles (x64)'),
'{|||'7CSA40EF-A0FB-4BFC-874A-C0F2e0b9fa8e'|||}', '**ProgramFiles (x32)'),
'{|||'1AC14E77-02E7-4E5D-B744-2EB1AE519887'|||}', '**System'),
'{|||'F38BF404-1D43-42F2-9305-67DE0B28FC23'|||}', '**Windows'),
'{|||'D65231B0-B2F1-4857-A4CE-A8E7C6EA7D27'|||}', '**System32') end as 'Activity_json_Packageid'

from Activity_PackageId
join Activity on Activity.Id = Activity_PackageId.ActivityId
where Activity_PackageId.ActivityId = Activity.Id and Activity_PackageId.Platform = 'packageid'
Order by etag desc

```

plus one or more of the following ([platform-specific application IDs](#)):

- “**windows_win32**” for Installed Software (non UWP) Applications
- “**windows_universal**” for Windows [UWP](#) Apps
- “**msa**”,
- “**ios**”,
- “**android**”, and
- “**web**”

As seen by this [MS example](#):

Example:

```
{"platform": "windows_universal", "application": "Microsoft.Contoso_8wekyb3d8bbwe"},  
{"platform": "windows_win32", "application": "DefaultBrowser_NOPUBLISHERRID!Microsoft.Contoso.Default"},  
{"platform": "android", "application": "com.example.myapp"},  
{"platform": "ios", "application": "com.example.myapp"},  
{"platform": "web", "application": "https://contoso.com"},  
{"platform": "web", "application": "https://chat.contoso.com"},  
{"platform": "msa", "application": "00000000603E0BE"},  
{"platform": "msa", "application": "48932b46-98b1-4020-9be4-cc7a65643c9e"},  
]
```

If the Sync activity is enabled (user logs in with a MS Account) then another entry may also be seen: “**afs_crossplatform**” which shows a [cloud sync](#) enabled activity, and is an additional entry to the same ones seen when using a local account.

When using a MS account:

5251	afs_crossplatform	6082723978844556501	1529741627
5252	windows_win32	{7c5a40ef-a0fb-4bfc-874a-c0f2e0b9fa8e}\foobar2000\f...	1529741627
5253	packageid	{7c5a40ef-a0fb-4bfc-874a-c0f2e0b9fa8e}\foobar2000\f...	1529741627
5254	host		1529741627

When using a Local account there is NO ‘**afs_crossplatform**’ entry:

79	e% @#I#... windows_win32	microsoft.window...	1529742843
80	e% @#I#... packageid	microsoft.window...	1529742843
81	e% @#I#... host		1529742843

As can also be seen below (*these are for a single ID of a Microsoft Word entry*):

ActivityId	Platform	PackageName	ExpirationTime
CA06838559F87AE076659BF18C593CF9	host	word.activity.windows.com	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	afs_crossplatform	16883319693718197224	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	windows_universal	microsoft.office.word_8wekyb3d8bbwe	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	windows_universal	microsoft.office.desktop_8wekyb3d8bbwe	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	android	com.microsoft.office.word	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	ios	com.microsoft.office.word	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	windows_win32	microsoft.office.winword.exe.15	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	windows_win32	{7c5a40ef-a0fb-4bfc-874a-c0f2e0b9fa8e}\microsoft office\office15\winword.exe	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	windows_win32	{6d809377-6af0-444b-8957-a3773f02200e}\microsoft office\office15\winword.exe	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	windows_win32	{7c5a40ef-a0fb-4bfc-874a-c0f2e0b9fa8e}\microsoft office\office14\winword.exe	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	windows_win32	{6d809377-6af0-444b-8957-a3773f02200e}\microsoft office\office14\winword.exe	2018-06-29 16:39:49
CA06838559F87AE076659BF18C593CF9	msa	0000000000003edf6	2018-06-29 16:39:49

The above can be seen by using this query:

```
Select
hex(Activity_PackageId.ActivityId) as 'ActivityId',
    Activity_PackageId.Platform ,
    Activity_PackageId.PackageName ,
    datetime (Activity_PackageId.ExpirationTime , 'unixepoch') as 'ExpirationTime'
FROM Activity_PackageId
join Activity on Activity_PackageId.ActivityId = Activity.Id
order by Activity.ActivityId
```

The 'Activity_PackageId' table seemingly has more information than the 'Activity' table. That is not exactly true though, as the 'Activity' table's 'AppID' field holds this information and a lot more. The 'Activity' and 'ActivityOperation' table 'AppID' fields are in fact Binary Large Objects (BLOB) in 'json array' format e.g.:

'AppID' entry for an Installed Application in Windows:

Element #0	application	platform
<element #0>	{7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E}\TeamViewer\TeamViewer.exe	windows_win32
<element #1>	{7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E}\TeamViewer\TeamViewer.exe	packageId
<element #2>	alternateId	
<element #3>		windows_universal

Note: Notice that the path shown above is in the form of a GUID. It is a KNOWNFOLDERID used by windows for standard known folders like 'program files'. In the json file above, this is the GUID for ProgramFilesX86 (C:\Program Files (x86)\) folder. There are various lists of CLSIDs in the internet like [https://msdn.microsoft.com/en-us/library/windows/desktop/dd378457\(v=vs.85\).aspx](https://msdn.microsoft.com/en-us/library/windows/desktop/dd378457(v=vs.85).aspx)

'AppID' entry for a standalone executable:

Tag	Value
<array>	
<element #0>	
application	D:_Forensic Tools\XMLView\xmlview.exe
platform	x_exe_path
<element #1>	
application	D:_Forensic Tools\XMLView\xmlview.exe
platform	packageId
<element #2>	
application	
platform	alternateId
<element #3>	
application	
platform	windows_universal

and 'AppID' entry for a Windows UWP app

Tag	Value
<array>	
<element #0>	
application	Microsoft.MicrosoftStickyNotes_8wekyb3d8bbwe!App
platform	windows_universal
<element #1>	
application	Microsoft.MicrosoftStickyNotes_8wekyb3d8bbwe!App
platform	packageId
<element #2>	
application	
platform	alternateId

Since this is a json array, we can do a query to see what values it holds in the 'application' and 'platform' fields. The `$[x].` depicts the number of the element in the array, and 'platform' or 'application' the respective field name:

```
-- List all entries in the AppID json array

select
hex(Activity.ID) as 'ID',
json_extract(Activity.AppId, '$[0].platform') as 'p0' ,
json_extract(Activity.AppId, '$[0].application') as '0' ,
json_extract(Activity.AppId, '$[1].platform') as 'p1' ,
json_extract(Activity.AppId, '$[1].application') as '1' ,
json_extract(Activity.AppId, '$[2].platform') as 'p2' ,
json_extract(Activity.AppId, '$[2].application') as '2' ,
json_extract(Activity.AppId, '$[3].platform') as 'p3' ,
json_extract(Activity.AppId, '$[3].application') as '3' ,
json_extract(Activity.AppId, '$[4].platform') as 'p4' ,
json_extract(Activity.AppId, '$[4].application') as '4' ,
json_extract(Activity.AppId, '$[5].platform') as 'p5' ,
json_extract(Activity.AppId, '$[5].application') as '5' ,
json_extract(Activity.AppId, '$[6].platform') as 'p6' ,
json_extract(Activity.AppId, '$[6].application') as '6' ,
json_extract(Activity.AppId, '$[7].platform') as 'p7' ,
json_extract(Activity.AppId, '$[7].application') as '7' ,
json_extract(Activity.AppId, '$[8].platform') as 'p8' ,
json_extract(Activity.AppId, '$[8].application') as '8'

from Activity
order by ID asc
```

	A0	P0	A1	P1	A2	P2	A3	P3
19	{7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E}\Acronis\TrueImageHome\TrueImage.exe	x_exe_path	{7C5A40EF-A0FB-4BFC-874A-C0F2... packageId		alternateld		windows_universal	
20	Microsoft.Office.OUTLOOK.EXE.15	windows_win32	Microsoft.Office.OUTLOOK.EXE.15	packageId	alternateld		windows_universal	
21	{6D809377-6AF0-444B-8957-A3773F02200E}\VOW Software\plist Editor Pro\plistEditor.exe	windows_win32	{6D809377-6AF0-444B-8957-A377... packageId		alternateld		windows_universal	
22	{7C5A40EF-A0FB-4BFC-874A-C0F2E0B9FA8E}\Acronis\TrueImageHome\TrueImage.exe	x_exe_path	{7C5A40EF-A0FB-4BFC-874A-C0F2... packageId		alternateld		windows_universal	
23	{6D809377-6AF0-444B-8957-A3773F02200E}\SQLite Expert\Professional 5\SQLiteExpertP...	windows_win32	{6D809377-6AF0-444B-8957-A377... packageId		alternateld		windows_universal	
24	Microsoft.Office.OUTLOOK.EXE.15	windows_win32	Microsoft.Office.OUTLOOK.EXE.15	packageId	alternateld		windows_universal	

Or

2	p3	3	p4	4	p5	5	p6	6	p7	7	p8	8
1	ossoftEdge_Bwekeyb3d8bbwelMicrosoftEdge	msa	f44b1140-bc5e-48c6-8dc0-5cf5a53c0e34	msa	000000004C1BC462	android com.microsoft.emmx.daily	android com.microsoft.emmx.selfhost	android com.microsoft.emmx	ios	com.microsoft.emmx.daily-df		
2	ossoftEdge_Bwekeyb3d8bbwelMicrosoftEdge	msa	f44b1140-bc5e-48c6-8dc0-5cf5a53c0e34	msa	000000004C1BC462	android com.microsoft.emmx.daily	android com.microsoft.emmx.selfhost	android com.microsoft.emmx	ios	com.microsoft.emmx.daily-df		
3	ossoftEdge_Bwekeyb3d8bbwelMicrosoftEdge	msa	f44b1140-bc5e-48c6-8dc0-5cf5a53c0e34	msa	000000004C1BC462	android com.microsoft.emmx.daily	android com.microsoft.emmx.selfhost	android com.microsoft.emmx	ios	com.microsoft.emmx.daily-df		
4	ossoftEdge_Bwekeyb3d8bbwelMicrosoftEdge	msa	f44b1140-bc5e-48c6-8dc0-5cf5a53c0e34	msa	000000004C1BC462	android com.microsoft.emmx.daily	android com.microsoft.emmx.selfhost	android com.microsoft.emmx	ios	com.microsoft.emmx.daily-df		
5	ossoftEdge_Bwekeyb3d8bbwelMicrosoftEdge	msa	f44b1140-bc5e-48c6-8dc0-5cf5a53c0e34	msa	000000004C1BC462	android com.microsoft.emmx.daily	android com.microsoft.emmx.selfhost	android com.microsoft.emmx	ios	com.microsoft.emmx.daily-df		

Similarly, the '**Activity**' and the '**ActivityOperation**' table 'payload' fields (blob) are also in json format with different entries related to the different platform type as follows:

For "**x_exe_path**" , "**windows_win32**" and "**windows_universal**" it doesn't include duration when an app is first executed:

Tag	Value
<object>	
displayText	JSONView.exe
activationUri	ms-shellactivity:
appDisplayName	JSONView.exe
backgroundColor	black

but includes it in subsequent entries:

Tag	Value
<object>	
type	UserEngaged
reportingApp	ShellActivityMonitor
activeDurationSeconds	16
shellContentDescription	
MergedGap	600
userTimezone	Europe/Bucharest

Having included my own duration calculation (calculated by subtracting the '**StartTime**' from the '**EndTime**'), the duration is sometimes different than the one included in the json blob. A longer calculated duration could indicate that the app is in focus but idle i.e. the user does not interact with it.

When "windows_universal" or "windows_win32" applications open a file, the 'payload' field includes quite a bit of information.

"windows_universal" (In this case MS Edge - which uses the [Adaptive Card framework](#) - bing search for CDPTraces.log) can be seen below:

Tag	Value
<object>	
displayText	CDPTraces.log - Bing
activationUri	microsoft-edge:https://www.bing.com/search?q=CDPTraces.log&form=...
appDisplayName	Microsoft Edge
description	https://www.bing.com/search?q=CDPTraces.log&form=WNSGPH&qs=S...
backgroundColor	#FF0078D7
adaptiveContent	
\$schema	http://adaptivecards.io/schemas/adaptive-card.json
type	AdaptiveCard
body	
<element #0>	Container
type	TextBlock
text	CDPTraces.log - Bing
weight	bolder
size	large
wrap	true
maxLines	3
<element #1>	TextBlock
type	https://www.bing.com/search?q=CDPTraces.log&form=WNSGPH&qs=S...
text	normal
size	true
wrap	3
maxLines	https://www.bing.com/search?q=CDPTraces.log&form=WNSGPH&qs=S...
contentUri	
attribution	
iconUri	https://www.bing.com/sa/simg/bing_p_rr_teal_min.ico
alternateText	bing.com
attributionDisplayText	bing.com

And 'windows_win32' here:

Tag	Value
<object>	
displayText	Photos.sqlite_embedded_table-ZGENERICALBUM_rowid-42_column-ZCLC
activationUri	ms-shellactivity:
appDisplayName	plist Editor Pro
description	D:\Costas\Desktop\temp\iOS 11iPhone Image\Photos.sqlite_embedded_
backgroundColor	black
contentUri	file:%7BB4BFCC3A-DB2C-424C-B029-7FE99A87C641%7D/.temp/iOS%2
shellContentDescription	MBAAAEFCAAAAAAADAAAAAAAY0gAAAAgAAAAAsAnjYCVpPdALw5Im
FileShellLink	

The 'ExpirationTime' fields in both [Activity](#) and [Activity_PackageId](#) tables are the same for each 'ID' and 'ActivityId' respectively (Unique field entry GUID).

All Dates/Times are stored by the database in UTC. To get the local times, we can adjust the query by using, 'localtime' e.g. :

```
datetime(Activity.StartTime , 'unixepoch', 'localtime'),
```

The 'ExpirationTime' is exactly 2592000 seconds or 30 Days from the relevant entry's 'LastModified' time, and is easily seen by using the following:

```
Select  
(Activity.ExpirationTime - Activity.LastModifiedTime) as 'Expires in'  
From Activity
```

Sorting the query by the 'ETAG' field gives a historical list (sort of a timeline) according to the Events recorded in the db, but is not the same as if sorted by Start, End or Expiry datetimes. The ETAG can change for a particular entry's GUID depending on the current action the database has recorded for that ID (e.g. user removed Tile from timeline).

An example that an ID can have multiple ETAGs associated with it, is shown below:

	ID	Program Name	Nr_of_ETAGs_per_ID
1	14A18F08264CCBEEE1F87294159CC174	Microsoft.MicrosoftEdge_8wekyb3d8bbwe!MicrosoftEdge	12
2	E410C45C9351D584F5FF8771FB79EBE0	Microsoft.MicrosoftEdge_8wekyb3d8bbwe!MicrosoftEdge	12
3	3850384E31582BB4D7444A87238EBE71	Microsoft.MicrosoftEdge_8wekyb3d8bbwe!MicrosoftEdge	11
4	7FBBCA86B1284531AB13714378DE462BF	Microsoft.MicrosoftEdge_8wekyb3d8bbwe!MicrosoftEdge	11
5	AF83A1D79E8018D88E34C6DA0367D8D2	Microsoft.MicrosoftEdge_8wekyb3d8bbwe!MicrosoftEdge	11
6	005A5B3C02AF18D3D743923C12A6A1A4	{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\SnippingTool.exe	4
7	00AEED61A3676A61C4683F4ADF956DC	{6D809377-6AF0-444B-8957-A3773F02200E}\Windows NT\Accessories\wordpad...	4
8	0197B6BDC361072CAE085484AF9E9D13	{6D809377-6AF0-444B-8957-A3773F02200E}\Windows NT\Accessories\wordpad...	4
9	019F2517AFD0B40206B668B4B979C5F3	Chrome	4
10	026D393D2A3C851046DD8296FFFFA0C1	Chrome	4

by running this query against a MS account's 'ActivitiesCache.db':

```
1 select  
2 hex(Activity.id) as 'ID',  
3 json_extract(Activity.AppId, '$[2].application') as 'Program Name',  
4 count(activity.etag) as 'Nr_of_ETAGs_per_ID'  
5 from Activity  
6 join Activity_PackageId on activity.id = Activity_PackageId.ActivityId  
7 group by ID  
8 order by Nr_of_ETAGs_per_ID desc
```

The 'PlatformDeviceID' seen in the 'Activity' & 'ActivityOperations' tables:

can be found in the user's NTUSER.dat at

“Software\Microsoft\Windows\CurrentVersion\TaskFlow\DeviceCache\”.

As seen below:

Key name	# values	Drag a column header here to group by that column
7it7kvkbMz9R20MhUL/UCKdTVs4450r...	1	
7Ba1plaSCvXW10umf0Q2LPoqGRdvznK4e...	1	
en8WEeuzdXY4kusjOThs+6fAUSeU5xorU6c...	1	
10k6hyGOHLcJluwoRZmpcjqja7+5dYJ80np5...	1	
S+3dLRYe2vDz10adn54ou0R.OxKWRpztByf...	1	
Yd98tlyKjWtQSSjTPj+weOyQ/ceopRR.yL6aX...	1	
YHgsOGnQyfV1sCENXZFVgAshHBF3bKutop4...	1	

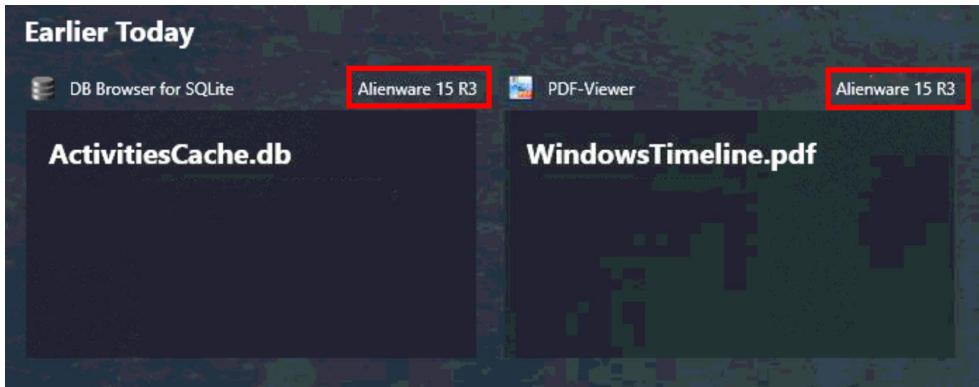
But it is not fixed - it looks encoded with the [QuickXorHash](#) Algorithm, similar to the 'FileShellLink' in the 'Payload' field blob - and it changes occasionally,

	Device ID
190	TDdtGmqdscQk7BxppyGhb2yzThGYW8Ldm8tsq+GJ9n4=
191	TDdtGmqdscQk7BxppyGhb2yzThGYW8Ldm8tsq+GJ9n4=
192	TDdtGmqdscQk7BxppyGhb2yzThGYW8Ldm8tsq+GJ9n4=
193	TDdtGmqdscQk7BxppyGhb2yzThGYW8Ldm8tsq+GJ9n4=
194	Yd9BtyKlyWtQS5jTPjr+weOyQ/ceqpRRyL6aX0XAiro=
195	Yd9BtyKlyWtQS5jTPjr+weOyQ/ceqpRRyL6aX0XAiro=
196	Yd9BtyKlyWtQS5jTPjr+weOyQ/ceqpRRyL6aX0XAiro=

still depicting the same Machine (*as seen at the relevant registry entries*). I have not yet found the pattern as to why or when it changes when a user logs in with a local account.

It is used to show the Device* origin of a Tile in the Timeline view, such as:





**(if no device name is seen in one or more tiles in the user's Timeline view, then the activity is local)*

The device name seen above is derived from the “DeviceModel” entry in the registry for the specific DeviceID. That information originates from the OEM information value in ‘SystemProductName’ at “HKLM\SYSTEM\ControlSet001\Control\SystemInformation” which is usually filled by the device manufacturer, or is blank when the computer is user assembled.

The ‘AppActivityId’ field has 3 possible observed values:

- ECB32AF3-1440-4086-94E3-5311F97F89C4 which looks like a GUID but having checked 4 different computers of different users except my own ones, this GUID remains the same in all of them .
- An alphanumeric identifier (Hash?) following the above GUID, which is specific to a file opened, or
- A URL opened by MS Edge (on MS Account related ‘ActivitiesCache.db’ databases).

This can be seen by running the following:

```
select
case when Activity.AppActivityId not like '%-%-%-%\%' then Activity.AppActivityId
when Activity.AppActivityId not like '%.%-%-%-' then Activity.AppActivityId
else substr(Activity.AppActivityId , 38)
end as 'DeviceID',
datetime(Activity.StartTime, 'unixepoch', 'localtime') AS 'StartTime',
json_extract(Activity.Payload, '$.displayText') as 'File_Name'
from Activity
join Activity_PackageId on activity.id = Activity_PackageId.ActivityId
group by File_Name
order by StartTime asc
```

	DeviceID	StartTime	File_Name
13	ECB32AF3-1440-4086-94E3-5311F97F89C4	2018-05-01 07:20:10	7-Zip File Manager
14	ECB32AF3-1440-4086-94E3-5311F97F89C4	2018-05-01 07:24:15	SystemPropertiesAdvanced.exe
15	ECB32AF3-1440-4086-94E3-5311F97F89C4	2018-05-01 07:28:48	Opera Browser
16	ECB32AF3-1440-4086-94E3-5311F97F89C4	2018-05-01 07:35:45	ESEDatabaseView.exe
17	ECB32AF3-1440-4086-94E3-5311F97F89C4	2018-05-01 07:45:59	jre-8u171-windows-x64.exe
18	4cc59f0fe7ab8e7280b2c4228bcd76193b3e5f3f	2018-05-01 07:58:11	backup.tar
19	fc1379ad2d57897a2013f92a6e5d53e0dbd1e0f8	2018-05-01 08:01:38	tealium.db
20	b6e7e75f16f5d0fdd4260be2a2e1058bcfb619a	2018-05-01 08:05:13	flixster_dc2.db

The ‘[PackageIDHash](#)’ field is a unique value related to each application. It appears to be the ‘[QuickXorHash](#)’ of the executable – with this query:

```
select
    Activity.PackageIdHash as 'Hash',
    Activity_PackageId.PackageName as 'Name',
    datetime(Activity.StartTime, 'unixepoch', 'localtime') AS 'StartTime'
    from Activity
    join Activity_PackageId on activity.id = Activity_PackageId.ActivityId
group by Hash
order by StartTime desc
```

we can see that different versions of the same application have a different Hash value:

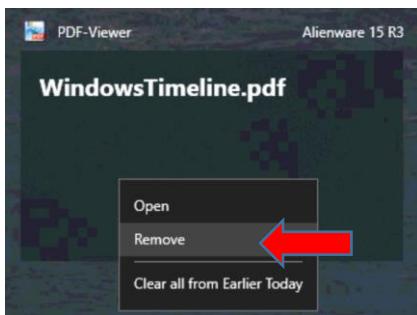
	Hash	Name	StartTime
1	LpMbiNsalvhwz9KScqy+21v9qKArm8vsmGRxfqVh8k=	d:\forensic tools\dmde-3.2.0.692-win32-gui\dmde.exe	2018-05-28 19:44:18
2	83TnIWHEKlgYDl4QLfHkrWYjNrlRwf7OP4R6Djg6TXI=	d:\forensic tools\dmde-3.0.6.648-win32-gui\dmde.exe	2018-05-28 19:44:00

The ‘[Activity](#)’ table’s ‘[ActivityStatus](#)’ and ‘[ActivityOperation](#)’ tables’s ‘[OperationType](#)’ have 3 observed values ranging from 1 to 3 and depict the related Tile Status as:

- 1 -> Active (means it is still an open application)
- 2-> Updated (means the entry is an update for a previously Active entry)
- 3-> Deleted (means the Tile is removed from the Timeline)

And there [could be a 4th entry](#) with a value of 4, meaning that the entry is ‘Ignored’.

When a Tile is removed from the Timeline by the user,



the associated ID(s) to this Tile remain the same, but the entries are copied from the ‘[Activity](#)’ to the ‘[ActivityOperation](#)’ table with a NEW ‘[Etag](#)’ and new type/status value:

```

1 select
2 activity.etag as 'Activity Etag',
3 hex(activity.id) as 'Activity ID',
4 Activity.ActivityStatus as 'Type',
5 ActivityOperation.ETag as 'ActivityOperation Etag',
6 hex(ActivityOperation.Id) as 'ActivityOperation ID',
7 ActivityOperation.OperationType as 'Type'
8 from Activity
9 join ActivityOperation on Activity.Id = ActivityOperation.Id

```

	Activity Etag	Activity ID	Type	ActivityOperation Etag	ActivityOperation ID	Type
1	19255	942964941C4A1FC75A837A1CFC8CFF92	1	20098	942964941C4A1FC75A837A1CFC8CFF92	3
2	19264	0DE4C1CFA7AD59E7B9F9A3A0509D21CA	1	20099	0DE4C1CFA7AD59E7B9F9A3A0509D21CA	3
3	19267	4B8DDEC337073252145BE8B622D2A619	1	20100	4B8DDEC337073252145BE8B622D2A619	3
4	19270	3704910DA81C809DB04126F03E300092	1	20101	3704910DA81C809DB04126F03E300092	3
5	19410	289D11B903A8BC64FE6305B96BC46750	1	20102	289D11B903A8BC64FE6305B96BC46750	3

When the user logs in with a local account, and a tile is removed from the Timeline, the associated entries for that are copied from the '['Activity'](#)' to the '['ActivityOperation'](#)' table with a different '['ETAG'](#)' value, and stay there until expiration time.

An easy way to figure out which entries are User Removed can be derived from viewing the '['SmartLookup'](#)' view (*automatically created query included in the database*) which, in essence, is the source of the actual timeline a user observes:

```

1  select
2      [O].[Id],
3      [O].[AppId],
4      [O].[PackageIdHash],
5      [O].[AppActivityId],
6      [O].[ActivityType],
7      [O].[OperationType] AS [ActivityStatus],
8      [O].[ParentActivityId],
9      [O].[Tag],
10     [O].[Group],
11     [O].[MatchId],
12     [O].[LastModifiedTime],
13     [O].[ExpirationTime],
14     [O].[Payload],
15     [O].[Priority],
16     [A].[IsLocalOnly],
17     [O].[PlatformDeviceId],
18     [A].[CreatedInCloud],
19     [O].[StartTime],
20     [O].[EndTime],
21     [O].[LastModifiedOnClient],
22     1 AS [IsInUploadQueue],
23     [O].[GroupAppActivityId],
24     [O].[ClipboardPayload],
25     [O].[EnterpriseId],
26     [O].[OriginalPayload],
27     [O].[OriginalLastModifiedOnClient],
28     [O].[ETag]
29  from  [ActivityOperation] as [O]
30  left outer join [Activity] as [A] on [O].[Id] = [A].[Id]
31 union
32 select
33     [Id],
34     [AppId],
35     [PackageIdHash],
36     [AppActivityId],
37     [ActivityType],
38     [ActivityStatus],
39     [ParentActivityId],
40     [Tag],
41     [Group],
42     [MatchId],
43     [LastModifiedTime],
44     [ExpirationTime],
45     [Payload],
46     [Priority],
47     [IsLocalOnly],
48     [PlatformDeviceId],
49     [CreatedInCloud],
50     [StartTime],
51     [EndTime],
52     [LastModifiedOnClient],
53     0 AS [IsInUploadQueue],
54     [GroupAppActivityId],
55     [ClipboardPayload],
56     [EnterpriseId],
57     [OriginalPayload],
58     [OriginalLastModifiedOnClient],
59     [ETag]
60  from  [Activity]
61  where [Id] not in (select [Id]
62      from  [ActivityOperation])

```



The key here is the line: `FROM [Activity] WHERE [Id] NOT IN (SELECT [Id] FROM [ActivityOperation])`

If we check the ‘SmartLookup’ query data view, it lists all ‘Activity’ table entries plus all ‘ActivityOperation’ table entries minus the ‘Activity’ table entries that appear in both tables with the same ID. Why? Because when the `ActivityOperation.Id` is also found in the `Activity.Id` then the entry has been (user) removed from the timeline.

What this query also does, is to mark (and list) all entries in the ‘Activity’ table with a value of 0 in the field [IsInUploadQueue], and all entries in the ‘ActivityOperations’ with a value of 1 in the [IsInUploadQueue]. What this means, is that the entries in the ‘ActivityOperations’ table are in the ‘Upload to Cloud Queue’ unless they also appear in the ‘Activity’ table.

However, when a user is logged in with a MS Account, and the user removes a tile from the Timeline, the respective entries are copied to the ‘ActivityOperation’ table with a new ‘Etag’ value and a new type/status of 3 (*Deleted*) momentarily until they are synced, and then they are

moved to the ‘Activity’ table until they expire. The type/status value 3 tells the other synchronized devices not to display this tile in their Timeline. This may be confusing when examining an offline system:

Table: ActivityOperation

	OperationOrder	Id	OperationType	AppId
1	1	◆d◆ J ◆Z...	3	[{"application":...
2	2	◆◆3◆Y◆◆...	3	[{"application":...
3	3	K◆◆◆7 2R ...	3	[{"application":...
4	4	BLOB	3	[{"application":...
5	5	(◆ ◆ ◆d...	3	[{"application":...

The following query checks every ID on ‘Activity_PackageID’ against both ‘Activity’ and ‘ActivityOperation’ tables and provides the relevant results:

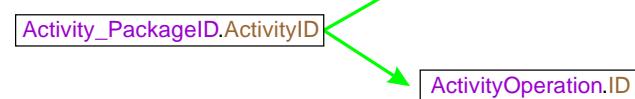
Archived:

ID not in either table.



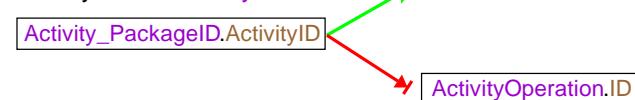
Tile Removed:

ID in both tables.



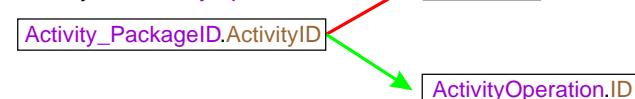
New Activity:

ID only in the ‘Activity’ table.



In Upload Queue:

ID only in ‘ActivityOperation’ table.



```

select
case
when
    Activity_PackageId.ActivityId in (select Activity.Id from activity) and
    Activity_PackageId.ActivityId in (select ActivityOperation.Id
                                    from ActivityOperation)
then 'Tile Removed - '|hex(Activity_PackageId.ActivityId)
else
    case
    when     Activity_PackageId.ActivityId not in
                (select Activity.Id from activity) and
                Activity_PackageId.ActivityId not in
                (select ActivityOperation.Id from ActivityOperation)
            then 'Is Archived - '|hex(Activity_PackageId.ActivityId)
    else
  
```

```

        case
        when Activity_PackageId.ActivityId in
        (select Activity.Id from activity) and
        Activity_PackageId.ActivityId not in
        (select ActivityOperation.Id from ActivityOperation)
            then 'New Activity - '||hex(Activity_PackageId.ActivityId)
        else
        case
            when Activity_PackageId.ActivityId
            not in (select Activity.Id from Activity)
            and Activity_PackageId.ActivityId
            in (select ActivityOperation.Id from ActivityOperation)
            then '
        In Upload Queue - '||hex(Activity_PackageId.ActivityId)
        end
        end
    end
end as 'Status_ID', -- This field includes both the Status and the unique ID of the associated activity
Activity_PackageId.PackageName as 'PackageName', -- The program/ associated with the above ID
datetime(Activity_PackageId.ExpirationTime, 'unixepoch', 'localtime') as 'ExpirationTime',
Activity_PackageId.Platform

from Activity_PackageId
where Activity_PackageId.Platform in ('windows_win32', 'windows_universal', 'x_exe_path')
group by Status_ID
order by ExpirationTime asc

```

We can see which ID's entry is a:

- 'New activity'
- 'Had the associated timeline tile removed'
- 'In the Upload Queue'
- Archived' (*until expiration time*)

	Status_ID	PackageName	ExpirationTime	Platform
2464	New Activity - FAC3BF8F86CC8D737E2912333C1B480B	microsoft.office.outlook.exe.15	2018-08-21 18:29:32	windows_win32
2465	New Activity - A082487B90E1920C1E794CCE485D46D6	microsoft.office.outlook.exe.15	2018-08-21 18:29:54	windows_win32
2466	Is Archived - AA02BBBF0A259DEAE764099B3E5BCB8B	(6d809377-6af0-444b-8957-a3773f02200e)\db browser for sqlite\db browser for sqlite.exe	2018-08-24 10:30:25	windows_win32
2467	Is Archived - 5D82FFF1A179FFEAC9A59CE52FC48ACA	windows.immersivecontrolpanel_cw5n1h2txyewy	2018-08-24 10:30:44	windows_universal
2468	New Activity - E4D4D3EE8FF161D4D330C2C5FAAEECF2	(6d809377-6af0-444b-8957-a3773f02200e)\db browser for sqlite\db browser for sqlite.exe	2018-08-24 10:30:44	windows_win32
2469	Is Archived - F48D10A0C52199D9D35BDB1EE68CBC4E	windows.immersivecontrolpanel_cw5n1h2txyewy	2018-09-25 23:06:50	windows_universal
2470	Is Archived - 65D2974DC6A859499B8B20FA926146BE	microsoft.office.outlook.exe.15	2018-11-21 17:29:58	windows_win32
2471	Is Archived - 732C5C66B18DBB39B19AAE2D48AA8C65	windows.immersivecontrolpanel_cw5n1h2txyewy	2018-11-21 17:29:59	windows_universal

Another view of the timeline and the items discussed above can be seen with this query:

<https://github.com/kacos2000/WindowsTimeline/blob/master/WindowsTimeline2.sql>

As a final note, and not yet sure if this is related, there appears to be a new Jumplist in windows 1803, located at NTUSER.dat

["Software\Microsoft\Windows\CurrentVersion\Search\JumplistData"](#):

▼ Search	16	5	2018-06-12 07:47:54
► Flighting	3	2	2018-06-12 09:29:44
► InkReminder	0	1	2018-05-10 13:58:25
► JumplistData	43	0	2018-06-12 09:29:04
► Microsoft.Windows.Cortana_...	0	2	2018-05-10 14:01:18
► RecentApps	0	0	2018-05-11 16:20:19

Which in the value field has a list of applications each

Value Name	Value Type	Data
E7CF176E110C211B	RegQword	131732693443306503
{6D809377-6AF0-444B-8957-A3773F02200E}\Emsisoft Anti-Malware\a2start.exe	RegQword	131732664857040045
windows.immersivecontrolpanel_cw5n1h2bxewy!microsoft.windows.immersivecontrolpanel	RegQword	131732661999990249
OperaSoftware.OperaWebBrowser.1482616678	RegQword	131732632253640937
{6D809377-6AF0-444B-8957-A3773F02200E}\DB Browser for SQLite\DB Browser for SQLite.exe	RegQword	131732229857044091
{6D809377-6AF0-444B-8957-A3773F02200E}\Windows NT\Accessories\wordpad.exe	RegQword	131732218473490864
D:\Forensic Tools\RegistryExplorer_RECcmd\RegistryExplorer.exe	RegQword	131732192428203938
Microsoft.Office.EXCEL.EXE.15	RegQword	131732189855753289
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\WindowsPowerShell\v1.0\powershell.exe	RegQword	131732037370491875
Microsoft.AutoGenerated.{4386C36E-24C8-1079-C3DA-17FF7E718F1E}	RegQword	131731995196161952
{6D809377-6AF0-444B-8957-A3773F02200E}\Tracker Software\PDF Viewer\PDFXCVIEW.exe	RegQword	131731867951745237
Corel.DrawHome.20	RegQword	131731845581242218
Microsoft.Office.WINWORD.EXE.15	RegQword	131731121065717654
D:\Costas\Downloads\XWFIM\XWFIM.exe	RegQword	131731056023994705
{1AC14E77-02E7-4E5D-B744-2EB1AE5198B7}\notepad.exe	RegQword	131731055155095654
{6D809377-6AF0-444B-8957-A3773F02200E}\WinRAR\WinRAR.exe	RegQword	131731054662301052
D:\Costas\Dropbox\JACIS_QA\JSONView\JSONView.exe	RegQword	131731044186574237
Microsoft.Windows.RemoteDesktop	RegQword	131730894892470341

with a Data value (in Windows FileTime) which appears to be the date/time an application was launched through the search (Cortana box), or the taskbar, but certain apps only appear if you open a file (e.g. MS Word opens a .doc file for editing or viewing).

Source date/times	Original	date	format
131732693443306503	131732693443306503	12 Jun 18 9:29:04 am	FileTime

What's interesting with this JumpList is that while some of these entries do not appear (*in my testing*) in the normal Custom or Automatic jumplists, they appear with the same dates in **ActivitiesCache.db**. Further testing of this is needed though.

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