



Windows Forensics

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The **Windows Registry** is like the brain of a Windows system. It is a collection of databases that store all the important configuration details for the system. These details include information about the computer's hardware, installed software, user settings, and even recently used files or devices. From a **forensics perspective**, the registry is valuable because it provides critical insights into a computer's activity, such as which programs were run, what devices were connected, and much more.

You can view and edit the registry using a built-in tool called **regedit.exe**. This tool allows users to explore and modify the data in the registry.

Key Components of the Windows Registry:

1. Keys and Values:

- **Registry Keys:** These are like folders in a file system. When you open the registry in regedit.exe, the "folders" you see are the keys.
- **Registry Values:** These are the actual data stored inside the keys. Think of them as files stored inside folders.
- **Registry Hive:** A collection of keys, subkeys, and values grouped together in one file.

Structure of the Registry:

The registry is organized into **five root keys**, each serving a specific purpose:

1. HKEY_CURRENT_USER (HKCU):

- Stores settings and configurations for the currently logged-in user.
- Examples: Desktop background, Control Panel settings, screen colors, etc.
- This key reflects the user's profile and is specific to them.

2. HKEY_USERS (HKU):

- Contains data for all user profiles on the system.
- The **HKEY_CURRENT_USER** is a subkey of this root key.
- Think of it as a master key containing settings for every user account.

3. HKEY_LOCAL_MACHINE (HKLM):

- Stores system-wide settings for the computer, regardless of which user is logged in.
- Examples: Hardware configuration, software installed for all users, etc.
- It is vital for system stability and contains information that applies to every user.

4. HKEY_CLASSES_ROOT (HKCR):

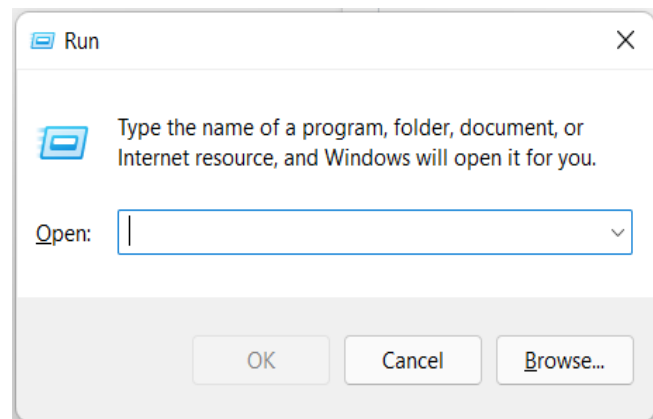
- Contains settings that determine how files and programs interact.
- Example: When you double-click a `.txt` file, this key ensures it opens with Notepad (or another default program).
- **Details on its behavior:**
 - It is a merged view of two keys:
 - **HKEY_LOCAL_MACHINE\Software\Classes:** Default settings for all users.
 - **HKEY_CURRENT_USER\Software\Classes:** Overrides default settings for the current user.
 - If you change something in HKCR:
 - If a corresponding key exists in **HKEY_CURRENT_USER\Software\Classes**, the change is saved there.
 - Otherwise, the change is saved in **HKEY_LOCAL_MACHINE\Software\Classes**.

5. HKEY_CURRENT_CONFIG (HKCC):

- Contains information about the computer's **hardware configuration** during startup.
- Example: Details about the current hardware profile being used (like which monitor or printer is connected).

Accessing the Registry:

1. Press the **Windows Key + R** to open the Run prompt.
2. Type `regedit.exe` and hit **Enter**.
3. This will open the **Registry Editor** window.



Exploring the Registry:

- On the left side, you'll see a **tree view** with the root keys (like HKCU, HKLM, etc.).
- When you click on a key, its **values** (data) will appear on the right pane.
- You can view or edit these values by right-clicking on them and selecting **Properties**.



Why is the Registry Important?

- **System Configuration:** Stores critical information that makes your system run smoothly.
- **Forensics Use:** Helps investigators trace user activity, identify recently connected devices, or check recently used programs.
- **Customizations:** Advanced users can modify the registry to tweak system behavior.

Summary of Root Keys:

Root Key	Purpose
HKEY_CURRENT_USER	Current user's settings (desktop, Control Panel, etc.).
HKEY_USER	Settings for all user profile on the system
HEKEY_LOCAL_MACHINE	System-wide settings (hardware, software, etc)
HKEY_CLASSES_ROOT	Determines which program opens fuels and how programs interact with files.
HKEY_CURRENT_CONFIG	Current hardware profile used during system startup.

Accessing the Registry on a Live System

When working on a **live Windows system**, you can access the registry using the built-in tool called **regedit.exe**. This tool allows you to view all the standard **root keys** (like HKEY_LOCAL_MACHINE, HKEY_CURRENT_USER, etc.) that were explained earlier.

Accessing the Registry on a Disk Image

If you're analyzing a **disk image** (instead of a live system), you cannot use regedit.exe directly. Instead, you need to know where the **registry hives** (the actual registry files) are located on the disk. These hives are stored in specific locations, typically in the directory:

`C:\Windows\System32\Config`

The key hives in this directory are:

1. **DEFAULT**
 - This hive is mounted under: `HKEY_USERS\DEFAULT`
2. **SAM**
 - This hive is mounted under: `HKEY_LOCAL_MACHINE\SAM`
3. **SECURITY**
 - This hive is mounted under: `HKEY_LOCAL_MACHINE\SECURITY`
4. **SOFTWARE**
 - This hive is mounted under: `HKEY_LOCAL_MACHINE\SOFTWARE`
5. **SYSTEM**
 - This hive is mounted under: `HKEY_LOCAL_MACHINE\SYSTEM`

These hives contain vital information about the system, including software configurations, security settings, user accounts, and more.

Hives Containing User Information

























There are additional **hives** that contain user-specific information. These hives are located in the user's profile directory. For **Windows 7 and later versions**, a user's profile directory is typically:

`C:\Users\<username>\`
























The two user-specific hives are:

1. NTUSER.DAT

- Location: `C:\Users\<username>\`
- Mounted on: `HKEY_CURRENT_USER` when the user logs in.
- This hive contains personal settings, configurations, and information specific to that user.

 .dotnet	10/15/2021 11:20 PM	File folder	
 .ipython	9/6/2021 8:55 AM	File folder	
 .ssh	8/11/2021 2:01 PM	File folder	
 .templateengine	10/15/2021 11:23 PM	File folder	
 .vscode	8/7/2021 6:55 PM	File folder	
 3D Objects	8/7/2021 5:46 PM	File folder	
 ansel	8/7/2021 6:30 PM	File folder	
 AppData	10/16/2021 11:36 AM	File folder	
 Contacts	10/16/2021 11:38 AM	File folder	
 Desktop	12/21/2021 7:32 PM	File folder	
 Documents	12/21/2021 7:33 PM	File folder	
 Downloads	12/22/2021 3:14 PM	File folder	
 Favorites	10/16/2021 11:38 AM	File folder	
 Links	10/16/2021 11:38 AM	File folder	
 Music	10/16/2021 11:38 AM	File folder	
 OneDrive	10/16/2021 11:40 AM	File folder	
 Pictures	10/16/2021 11:38 AM	File folder	
 PycharmProjects	11/24/2021 2:01 PM	File folder	
 Saved Games	10/16/2021 11:38 AM	File folder	
 Searches	10/16/2021 11:38 AM	File folder	
 source	10/15/2021 11:17 PM	File folder	
 Videos	10/23/2021 9:44 AM	File folder	
 .pagerc	8/23/2021 11:09 AM	PAGERC File	4 KB
 NTUSER.DAT	12/26/2021 2:47 AM	DAT File	2,560 KB

2. USRCLASS.DAT

	0	10/16/2021 11:38 AM	File folder	
	1024	10/21/2021 10:56 AM	File folder	
	1033	10/16/2021 11:38 AM	File folder	
	ActionCenterCache	12/26/2021 2:47 AM	File folder	
	Application Shortcuts	10/16/2021 11:38 AM	File folder	
	Burn	10/16/2021 11:39 AM	File folder	
	Caches	12/26/2021 11:40 AM	File folder	
	CloudStore	6/5/2021 8:10 AM	File folder	
	Explorer	10/23/2021 11:45 AM	File folder	
	Fonts	9/3/2021 9:32 PM	File folder	
	GameExplorer	6/5/2021 8:10 AM	File folder	
	History	10/16/2021 11:36 AM	File folder	
	Notifications	8/7/2021 5:46 PM	File folder	
	PowerShell	10/21/2021 10:51 AM	File folder	
	PPBCompatCache	10/16/2021 11:55 AM	File folder	
	PPBCompatUaCache	10/16/2021 11:55 AM	File folder	
	Ringtones	10/16/2021 11:38 AM	File folder	
	RoamingTiles	8/7/2021 5:46 PM	File folder	
	Safety	10/24/2021 10:12 PM	File folder	
	Shell	9/13/2021 11:40 AM	File folder	
	Themes	8/8/2021 7:36 PM	File folder	
	WinX	12/7/2019 4:14 AM	File folder	
	usrClass.dat	12/26/2021 2:47 AM	DAT File	5,120 KB

- Location: `C:\Users\<username>\AppData\Local\Microsoft\Windows`
- Mounted on: `HKEY_CURRENT_USER\Software\CLASSES`.
- This hive stores additional user-specific settings related to software.

Both **NTUSER.DAT** and **USRCLASS.DAT** are **hidden files**, so you may need to enable the option to view hidden files in Windows to see them.

The AmCache Hive

Another important hive is the **AmCache hive**, which is located at:

`C:\Windows\AppCompat\Programs\Amcache.hve`

The **AmCache hive** is crucial because it contains information about **programs recently run** on the system. This is highly useful for forensic investigations to determine which programs were executed and when.

Transaction Logs and Backups

1. Transaction Logs

- These are **log files** that act as a **journal** for changes made to registry hives.
- When changes are made to a registry hive, they are first written to these **transaction logs** before being applied to the hive itself. This means that the transaction logs might contain the **most recent changes** that haven't yet been applied to the registry hive.
- The transaction logs for each hive are stored in the same directory as the hive and have the same name but with a **.LOG** extension.

For example:

- The transaction log for the SAM hive is located at:
`C:\Windows\System32\Config\SAM.LOG`
- If there are multiple logs, they will be named as `SAM.LOG1`, `SAM.LOG2`, etc.

Why Are Transaction Logs Important?

Transaction logs are valuable in forensic investigations as they may contain critical information about recent changes that are not visible in the main registry hives.

2. Registry Backups

- Windows automatically creates **backups of registry hives** every ten days.
- These backups are stored in:
`C:\Windows\System32\Config\RegBack`
- If registry keys have been **deleted** or **modified**, you can check these backups to see the earlier state of the registry.

Why Are Backups Useful?

Backups allow investigators to compare the current state of the registry with the past state to detect modifications or deletions.

Summary of Key Locations

Hive/File	Location	Mounted Under
DEFAULT	<code>C:\Windows\System32\Config</code>	<code>HKEY_USERS\DEFAULT</code>
SAM	<code>C:\Windows\System32\Config</code>	<code>HKEY_LOCAL_MACHINE\SAM</code>
SECURITY	<code>C:\Windows\System32\Config</code>	<code>HKEY_LOCAL_MACHINE\SECURITY</code>
SOFTWARE	<code>C:\Windows\System32\Config</code>	<code>HKEY_LOCAL_MACHINE\SOFTWARE</code>
SYSTEM	<code>C:\Windows\System32\Config</code>	<code>HKEY_LOCAL_MACHINE\SYSTEM</code>
NTUSER.DAT	<code>C:\Users\<username>\</code>	<code>HKEY_CURRENT_USER</code>
USRCLASS.DAT	<code>C:\Users\<username>\AppData\Local\Microsoft\Windows</code>	<code>HKEY_CURRENT_USER\Software\CLASSES</code>

AmCache.hve	C:\Windows\AppCompat\Programs\Amcache.hve	Not directly mounted; useful for recent program info
Transaction Logs	Same directory as registry hives, with .LOG	Stores recent changes
Registry Backups	C:\Windows\System32\Config\RegBack	Contains backups of registry hives

Final Notes

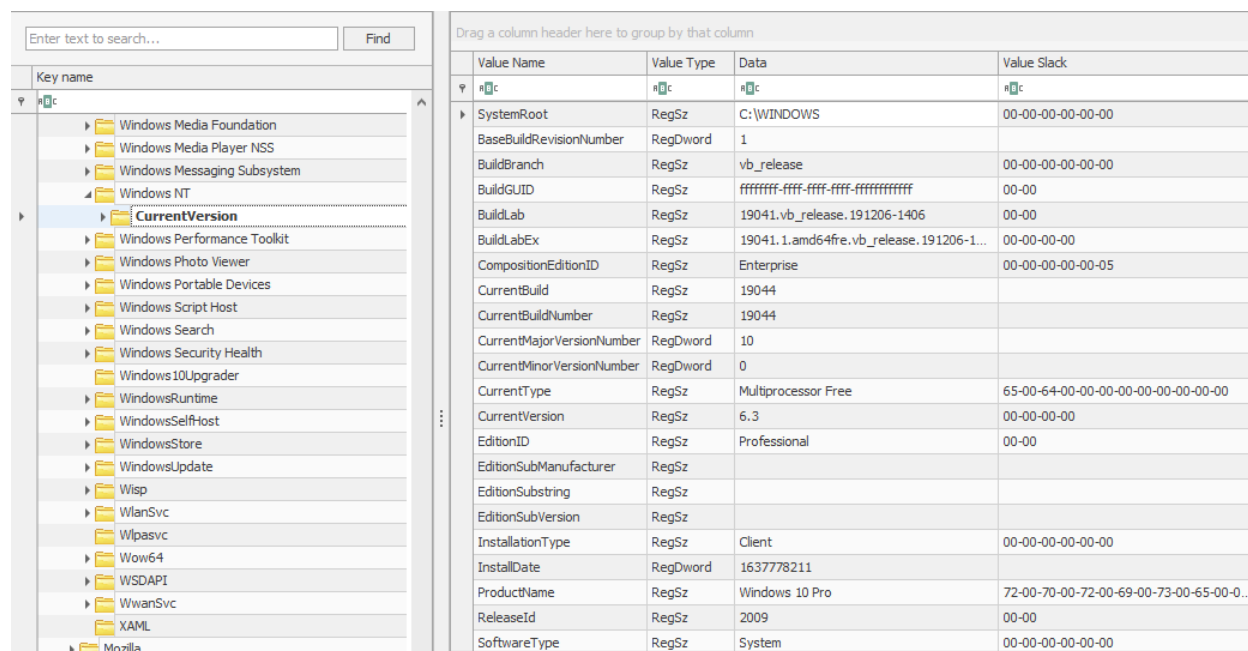
- **Live system:** Use regedit.exe to explore registry keys.
- **Disk image:** Look for hives in the specified directories.
- **Hidden files:** NTUSER.DAT and USRCLASS.DAT require enabling hidden file visibility.
- **AmCache hive:** Critical for identifying recently run programs.
- **Transaction logs and backups:** Essential for forensic investigations to track changes and restore deleted/modified registry data.

Simplified Explanation for Forensic Analysis Using the Windows Registry

When investigating a Windows system for forensic purposes, we can use the **Windows Registry** to gather important information about the system. Below are the key steps and what each part of the registry tells us:

1. Finding the OS Version

- To determine the **Operating System version** (e.g., Windows 10, Windows 11), we check the registry key:
SOFTWARE\Microsoft\Windows NT\CurrentVersion
- This key tells us the OS version from which the forensic data was collected.



Key name	Value Name	Value Type	Data	Value Slack
SOFTWARE\Microsoft\Windows NT\CurrentVersion	SystemRoot	RegSz	C:\WINDOWS	00-00-00-00-00-00
	BaseBuildRevisionNumber	RegDword	1	
	BuildBranch	RegSz	vb_release	00-00-00-00-00-00
	BuildGUID	RegSz	ffffffff-ffff-ffff-ffffffff	00-00
	BuildLab	RegSz	19041.vb_release.191206-1406	00-00
	BuildLabEx	RegSz	19041.1.amd64fre.vb_release.191206-1...	00-00-00-00
	CompositionEditionID	RegSz	Enterprise	00-00-00-00-00-05
	CurrentBuild	RegSz	19044	
	CurrentBuildNumber	RegSz	19044	
	CurrentMajorVersionNumber	RegDword	10	
	CurrentMinorVersionNumber	RegDword	0	
	CurrentType	RegSz	Multiprocessor Free	65-00-64-00-00-00-00-00-00-00-00-00
	CurrentVersion	RegSz	6.3	00-00-00-00
	EditionID	RegSz	Professional	00-00
	EditionSubManufacturer	RegSz		
	EditionSubstring	RegSz		
	EditionSubVersion	RegSz		
	InstallationType	RegSz	Client	00-00-00-00-00-00
	InstallDate	RegDword	1637778211	
	ProductName	RegSz	Windows 10 Pro	72-00-70-00-72-00-69-00-73-00-65-00-0...
	ReleaseId	RegSz	2009	00-00
	SoftwareType	RegSz	System	00-00-00-00-00-00

2. Finding the Current Control Set

- Control Sets** store the system's configuration for startup. Commonly, there are two:
 - ControlSet001**: Represents the current configuration used during startup.
 - ControlSet002**: Stores the last known good configuration.
- To find the **CurrentControlSet** (the active one), look at: **SYSTEM\Select\Current**

- The **last known good configuration** is located at:
SYSTEM\Select\LastKnownGood

Enter text to search...	Find
Key name	
<ul style="list-style-type: none"> <ul style="list-style-type: none"> Select Setup Software State WaaS WPA Unassociated deleted values 	
C:\Users\THM-4n6\Desktop\UsrClass.dat clean	

Value Name	Value Type	Data	Value
Current	RegDword	1	
Default	RegDword	1	
Failed	RegDword	0	
LastKnownGood	RegDword	1	

3. Finding the Computer Name

- The **computer's name** helps confirm that we're investigating the right machine.
- The registry key to find the computer name is:
SYSTEM\CurrentControlSet\Control\ComputerName\ComputerName

Enter text to search...	Find
Key name	
<ul style="list-style-type: none"> ComputerName ComputerName Control 	

Value Name	Value Type	Data	Value Slack
(default)	RegSz	mnmsvc	02-00-B0-00
ComputerName	RegSz	THM-4N6	00-00-00-00

4. Finding Time Zone Information

- Knowing the **time zone** helps us interpret timestamps (some are in UTC, others in local time).
- Time zone information is found at:
SYSTEM\CurrentControlSet\Control\TimeZoneInformation

Enter text to search...	Find
Key name	
<ul style="list-style-type: none"> Terminal Server TimeZoneInformation Ubpm UnitedVideo USB usbflags usbstor VAN Version Video 	

Value Name	Value Data	Value Data Raw
Bias	-300	4294966996
DaylightBias	-60	4294967236
DaylightName	@tzres.dll,-871	@tzres.dll,-871
DaylightStart	Month 0, week of month 0, day of week 0, Hours:Minutes:Seconds:Milliseconds 0:0:0:0	00-00-00-00-00-00-00-00-00-00-00-00-00
StandardBias	0	0
StandardName	@tzres.dll,-872	@tzres.dll,-872
StandardStart	Month 0, week of month 0, day of week 0, Hours:Minutes:Seconds:Milliseconds 0:0:0:0	00-00-00-00-00-00-00-00-00-00-00-00-00
TimeZoneKeyName	Pakistan Standard Time	Pakistan Standard Time
ActiveTimeBias	-300	4294966996

5. Finding Network Interfaces

- To see the **network interfaces** (like Wi-Fi or Ethernet adapters) on the machine, look at:
SYSTEM\CurrentControlSet\Services\Tcpip\Parameters\Interfaces
- Each interface has a unique ID (GUID) with details like:
 - IP addresses
 - Subnet Mask
 - DNS Servers
 - DHCP details

Key name	Value Name	Value Type	Data	Value Slack	Is Deleted	Data Record Reallocated
Enter text to search... Find						
Key name						
▼						
DNSRegisteredAdapters						
Interfaces						
{0de746f8-3a1b-4f74-bb71-a9c9615dd273}						
{44d5640f-2572-49d5-a87f-51d5055b82e6}						
{49cc068d-4d9d-11ec-a780-806e6f6e6963}						
{61988577-c1a8-41f1-a283-21cc83b7435a}						
{7b1e8ddb-fc33-43b1-8cd5-7f0e3afa9ecb}	EnableDHCP	RegDword	1			
NsiObjectSecurity	Domain	RegSz				
PersistentRoutes	NameServer	RegSz				
Winsock	DhcpIPAddress	RegSz	192.168.100.58	BA-00-B8-16-0A-00		
Performance	DhcpSubnetMask	RegSz	255.255.255.0			
Security	DhcpServer	RegSz	192.168.100.1	35-00-00-00-65-00-7...		
ServiceProvider	Lease	RegDword	86400			
Tcpip6	LeaseObtainedTime	RegDword	1637778828			
TCPIPSTUNNEL	T1	RegDword	1637822028			
tcpipreg	T2	RegDword	1637854428			
TCPIPTUNNEL	LeaseTerminatesTime	RegDword	1637865228			
tdx	AddressType	RegDword	0			
Telemetry	IsServerNapAware	RegDword	0			
terminpt	DhcpConnForceBroadcastFlag	RegDword	0			
TermService	DhcpNameServer	RegSz	192.168.100.1			
Themes	DhcpDefaultGateway	RegMultiSz	192.168.100.1	00-00-00-00-00-00		
	DhcpSubnetMaskOpt	RegMultiSz	255.255.255.0	00-00-00-00-00-00		
	DhcpInterfaceOptions	RegBinary	FC-00-00-00-00-00-0...	00-00-00-00		
	DhcpGatewayHardware	RegBinary	C0-A8-64-01-06-00-...	2E-00-30-00-00-00		
	DhcpGatewayHardwareCount	RegDword	1			

6. Finding Past Networks

- To find **networks the machine was connected to previously**, use:
 - Unmanaged Networks:**
SOFTWARE\Microsoft\Windows NT\CurrentVersion\NetworkList\Signatures\Unmanaged
 - Managed Networks:**
SOFTWARE\Microsoft\Windows NT\CurrentVersion\NetworkList\Signatures\Managed
- The **last write time** shows when the machine last connected to these networks.

Key name	Value Name	Value Type	Data	Value Slack	Is Deleted	Data Record Reallocated
Enter text to search... Find						
Key name						
▼						
Managed						
Unmanaged						
010103000F0000F008000000F0000F04	ProfileGuid	RegSz	{A3D7C922-7D34-4688...}	CA-63-7F-00-CA-99		
010103000F0000F008000000F0000F05D0C	Description	RegSz	Network 2			
010103000F0000F008000000F0000F07444CC	Source	RegDword	8			
010103000F0000F008000000F0000F07BDEDE	DnsSuffix	RegSz	eu-west-1.compute.int...	F5-48-B1-00-F5-57		
NoTimeModeTimes	FirstNetwork	RegSz	Network 2			
	DefaultGatewayMac	RegBinary	02-D4-DB-FF-33-74	87-01-C0-51-87-01		

7. Finding Programs that Start Automatically (Autoruns)

- Programs or commands that run automatically during login can be found at:
 - NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Run**
 - SOFTWARE\Microsoft\Windows\CurrentVersion\Run**
 - SOFTWARE\Microsoft\Windows\CurrentVersion\RunOnce**
- To check for **services that start at boot**, look at:
 - SYSTEM\CurrentControlSet\Services**
 - If the **Start key** is set to **0x02**, it means the service starts at boot.

Enter text to search... Find	Drag a column header here to group by that column					
Key name	Value Name	Value Type	Data	Value Slack	Is Deleted	Data Record Reallocated
<ul style="list-style-type: none"> <ul style="list-style-type: none"> RetailDemo Run RunOnce Command... 	*c:	*c:	*c:	*c:	<input type="checkbox"/>	<input type="checkbox"/>
	SecurityHealth	RegExpandSz	%windir%\system32\Secu...	00-00-00-00	<input type="checkbox"/>	<input type="checkbox"/>
	VMware User Process	RegSz	"C:\Program Files\VMware...	00-00	<input type="checkbox"/>	<input type="checkbox"/>
	VMware VM3DSERVICE Process	RegSz	"C:\WINDOWS\system32\...	47-00	<input type="checkbox"/>	<input type="checkbox"/>

8. Finding User Information (SAM Hive)

- The **SAM hive** (Security Accounts Manager) contains user account details such as:
 - Username and IDs (RIDs)**
 - Number of logins
 - Last login and failed login times
 - Password policy (e.g., expiry, hints, etc.)
 - Groups the user belongs to
- This information is located at:
 - SAM\Domains\Account\Users**

Enter text to search... Find	Drag a column header here to group by that column														
Key name	User Id	Invalid ...	Total L...	Create...	Last Lo...	Last Pa...	Last In...	Expires...	User N...	Full Na...	Passwo...	Groups	Comment	User C...	Home ...
<ul style="list-style-type: none"> Account Aliases Groups Users Builtin LastSkuUpgrade RXACT C:\Users\THM-4n6\Desktop ROOT Console Control Panel Environment EUDC Keyboard Layout Printers Software Amazon Classes Microsoft 	501	0	0	2021-1...					Guest			Guests	Built-in account for guest access to the computer/domain		
	503	0	0	2021-1...					DefaultA count			System Managed Accounts Group	A user account managed by the system.		
	504	0	0	2021-1...		2021-1...			WDAGUti lityAccou nt				A user account managed and used by the system for Windows Defender Application Guard scenarios		
	1001	0	19	2021-1...	2021-1...	2021-1...	2021-1...		THM-4n6	count	Administr...				

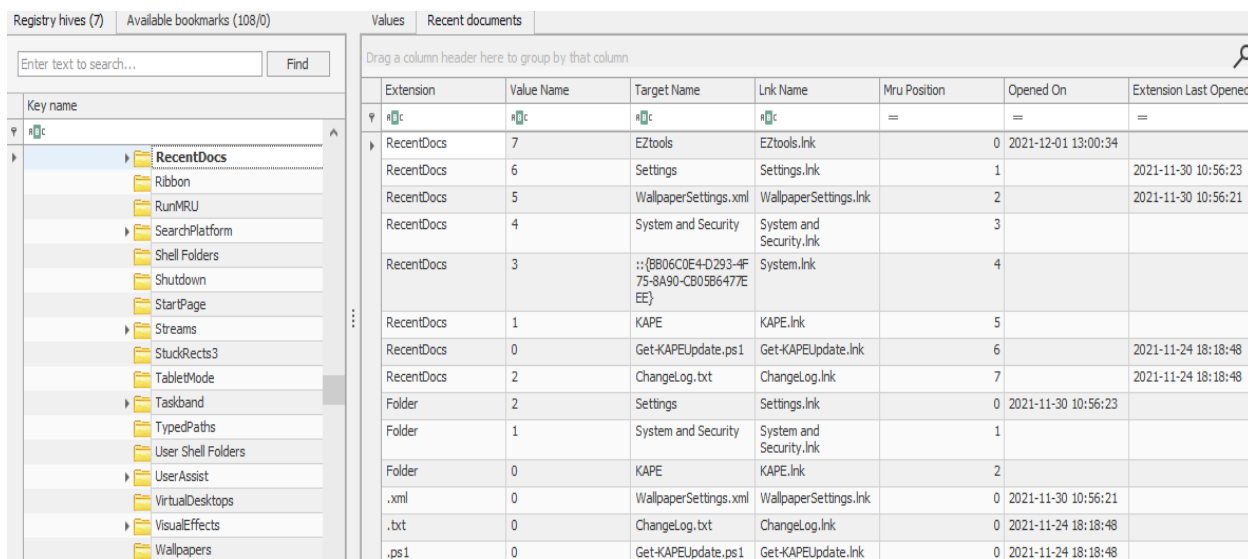
Why Is This Information Important?

- **OS Version:** Helps identify the type of system you're analyzing.
- **Control Sets:** Determines system configurations during startup.
- **Computer Name:** Confirms the machine's identity.
- **Time Zone:** Helps create a timeline of events.
- **Network Interfaces and Past Networks:** Tracks network connections and IP addresses.
- **Autoruns:** Finds programs/services that run on startup (potentially malicious ones).
- **SAM Hive:** Provides detailed user account and login activity information.

This data is critical for piecing together evidence during a forensic investigation

Recent Files

- **What is it?**
Windows keeps a record of files that a user recently opened. This is visible in "Recent Files" in Windows Explorer.
- **Where is it stored?**
This information is stored in the **NTUSER.DAT** file under the registry path:
NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Explorer\RecentDocs



Extension	Value Name	Target Name	Link Name	Mru Position	Opened On	Extension Last Opened
RecentDocs	7	EZtools	EZtools.lnk	0	2021-12-01 13:00:34	
RecentDocs	6	Settings	Settings.lnk	1		2021-11-30 10:56:23
RecentDocs	5	WallpaperSettings.xml	WallpaperSettings.lnk	2		2021-11-30 10:56:21
RecentDocs	4	System and Security	System and Security.lnk	3		
RecentDocs	3	::{B06C0E4D-2934-F75-8A90-CB05B6477EE}	System.lnk	4		
RecentDocs	1	KAPE	KAPE.lnk	5		
RecentDocs	0	Get-KAPEUpdate.ps1	Get-KAPEUpdate.lnk	6		2021-11-24 18:18:48
RecentDocs	2	Changelog.txt	Changelog.lnk	7		2021-11-24 18:18:48
Folder	2	Settings	Settings.lnk	0	2021-11-30 10:56:23	
Folder	1	System and Security	System and Security.lnk	1		
Folder	0	KAPE	KAPE.lnk	2		
.xml	0	WallpaperSettings.xml	WallpaperSettings.lnk	0	2021-11-30 10:56:21	
.txt	0	Changelog.txt	Changelog.lnk	0	2021-11-24 18:18:48	
.ps1	0	Get-KAPEUpdate.ps1	Get-KAPEUpdate.lnk	0	2021-11-24 18:18:48	

- **How does it work?**
Registry Explorer organizes these files, showing the **Most Recently Used (MRU)** file at the top. You can also check specific file types, such as PDFs or Word documents.

For example:

`NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Explorer\RecentDocs\ .pdf`

This shows a list of recently opened PDF files.

- **What else can we find?**

It even includes the **last opened time** for each file.

Office Recent Files

- **What is it?**

Microsoft Office also keeps a list of recently opened files (like Word documents, Excel sheets, etc.).

- **Where is it stored?**

This information is stored in the **NTUSER.DAT** file under paths like:

`NTUSER.DAT\Software\Microsoft\Office\VERSION`

Here, "VERSION" depends on the Office version. For example:

- Office 2013 = `15.0`
- Office 2016 = `16.0`
- Office 365 uses the user's **Live ID** for storing recent files.

- **What does it include?**

The registry stores the **complete path** of recently opened files.

ShellBags

- **What is it?**

Windows remembers the layout and view settings (e.g., list, details, icons) for folders that users open.

- **Why is it important?**

This data can show **folders recently accessed** by a user, which is useful in forensic analysis.

- **Where is it stored?**

The information is in the following registry keys:

1. `USRCLASS.DAT\Local Settings\Software\Microsoft\Windows\Shell\Bags`
2. `USRCLASS.DAT\Local Settings\Software\Microsoft\Windows\Shell\BagMRU`
3. `NTUSER.DAT\Software\Microsoft\Windows\Shell\BagMRU`
4. `NTUSER.DAT\Software\Microsoft\Windows\Shell\Bags`

- **How do we analyze it?**

Tools like **ShellBag Explorer** (by Eric Zimmerman) make it easy to interpret this data.

Value	Icon	Shell Type	MRU Positi...	Created On	Modified On	Accessed On	First Interacted	Last Interacted	Has Explored	Miscellaneous
My Computer	No im...	Root folder: GUID	=	=	=	=	=	=	<input checked="" type="checkbox"/>	
KAPE		Directory	1	2021-11-25 03:34:14	2021-11-25 03:34:14	2021-11-25 03:34:14		2021-12-01 13:06:47	<input checked="" type="checkbox"/>	NTFS file system
Home Folder		Root folder: GUID	2				2021-11-24 18:20:02		<input checked="" type="checkbox"/>	
Search Folder		Users property view	3				2021-11-30 11:08:01		<input type="checkbox"/>	
Search Folder		Users property view	4				2021-11-30 11:08:52		<input checked="" type="checkbox"/>	
Control Panel		Root folder: GUID	5						<input type="checkbox"/>	
E:\		Users property view: Drive letter	6				2021-11-24 18:20:02		<input checked="" type="checkbox"/>	

Open/Save and LastVisited Dialog MRUs

- **What is it?**

When you open or save a file in Windows, a dialog box appears. Windows **remembers the last location** where you opened/saved files.

- **Where is it stored?**

This data is saved in the following registry keys:

1. `NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Explorer\ComDlg32\OpenSavePIDMRU`
2. `NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Explorer\ComDlg32\LastVisitedPidlMRU`

Value Name	MRU Position	Executable	Absolute Path	Opened On
0		notepad.exe	My Computer\C:\Program Files\Amazon\Ec2ConfigService\Settings	2021-11-30 10:56:19

- **Why is it important?**

It helps forensic analysts find **recently opened/saved files** and their locations.

Windows Explorer Address/Search Bars

- **What is it?**

Windows Explorer keeps a record of:

1. Paths typed in the address bar (e.g., "C:\Users\Documents").
2. Searches made in the search bar.

- **Where is it stored?**

1. Address bar paths:

NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Explorer\TypedPaths

2. Search bar queries:

NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Explorer\WordWheelQuery

- **Why is it useful?**

This data provides insights into user activity, such as **locations accessed** and **queries searched**.

Enter text to search... Find	Drag a column header here to group by that column					
Key name	Value Name	Value Type	Data	Value Slack	Is Deleted	Data Record Reallocated
TypedPaths	url1	RegSz	C:\	72-00-5F-00-67-00-72-00-61-...	<input type="checkbox"/>	<input type="checkbox"/>
User Shell Folders	url2	RegSz	C:\Program Files	33-00-32-00-00-00-00-00-00-00	<input type="checkbox"/>	<input type="checkbox"/>
User Assist	url3	RegSz	C:\Windows\System32	60-53-09-00	<input type="checkbox"/>	<input type="checkbox"/>

Key Takeaways

1. **Recent Files:** Tracks files opened recently by type and time.
2. **Office Recent Files:** Tracks recent Microsoft Office documents.
3. **ShellBags:** Records folder layouts and access history.
4. **Open/Save Dialogs:** Shows recently accessed file locations.
5. **Explorer Activity:** Tracks typed paths and search queries.

Each of these can provide critical information about a user's activities on a system during forensic analysis.

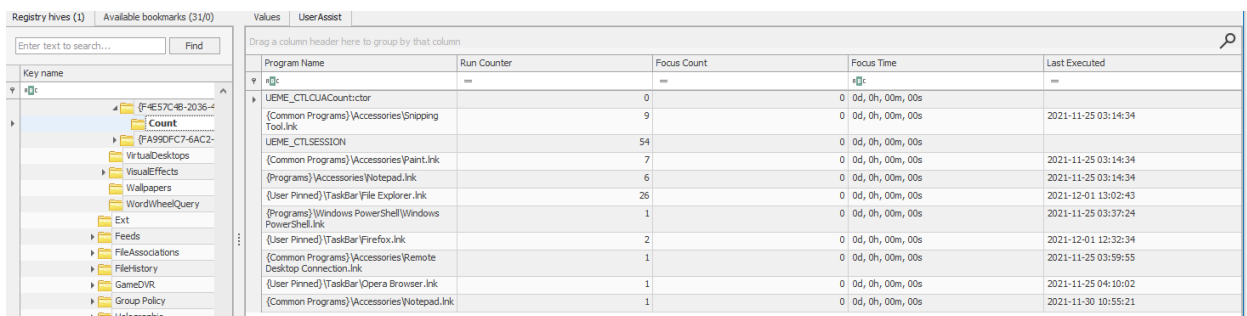
Here's a simplified explanation of these Windows artifacts and their purposes, written in easy-to-understand language:

1. UserAssist

- **What it is:** Windows keeps track of programs you open using Windows Explorer. This is saved in the **UserAssist** registry key for each user. It helps Windows know which programs you use most often.

Location in Registry:

NTUSER.DAT\Software\Microsoft\Windows\CurrentVersion\Explorer\UserAssist\{GUID}\Count



Program Name	Run Counter	Focus Count	Focus Time	Last Executed
UIEME_CTLCLUACountictor	0	0	0d, 0h, 00m, 00s	
(Common Programs)\Accessories\Snipping Tool.lnk	9	0	0d, 0h, 00m, 00s	2021-11-25 03:14:34
UIEME_CTLSESSION	54	0	0d, 0h, 00m, 00s	
(Common Programs)\Accessories\Paint.lnk	7	0	0d, 0h, 00m, 00s	2021-11-25 03:14:34
(Programs)\Accessories\Notepad.lnk	6	0	0d, 0h, 00m, 00s	2021-11-25 03:14:34
{User Pinned}\TaskBar\File Explorer.lnk	25	0	0d, 0h, 00m, 00s	2021-12-01 13:02:43
(Programs)\Windows PowerShell\Windows PowerShell.lnk	1	0	0d, 0h, 00m, 00s	2021-11-25 03:37:24
{User Pinned}\TaskBar\Firefox.lnk	2	0	0d, 0h, 00m, 00s	2021-12-01 12:32:34
(Common Programs)\Accessories\Remote Desktop Connection.lnk	1	0	0d, 0h, 00m, 00s	2021-11-25 03:59:55
{User Pinned}\TaskBar\Opera Browser.lnk	1	0	0d, 0h, 00m, 00s	2021-11-25 04:10:02
(Common Programs)\Accessories\Notepad.lnk	1	0	0d, 0h, 00m, 00s	2021-11-30 10:55:21

- **What it stores:**
 - The name of the program.
 - The number of times the program was opened.
 - The last time the program was launched.
- **Limitations:** Programs launched from the command line are **not** recorded here.
- **Tools to View:** Use **Registry Explorer** to view this data.

2. ShimCache (Application Compatibility Cache)

- **What it is:** ShimCache tracks all programs launched on your system. It was designed to help old programs work with newer versions of Windows (backward compatibility).

Location in Registry:

SYSTEM\CurrentControlSet\Control\Session Manager\AppCompatCache

- **What it stores:**
 - File names of the programs.
 - File size.
 - Last modified time (not the execution time).

- **How to Read:** ShimCache data is not easy to read directly in Registry Explorer. Instead, use the **AppCompatCache Parser** tool. It can convert the data into a CSV (spreadsheet) file that shows the information clearly.

ControlSet	CacheEntry Path	LastModifiedTimeUTC	Executed	Duplicate	SourceFile
1	0 C:\Users\THM-4n6\Desktop\Kape\kape.exe	6/24/2021 6:23	NA	FALSE	C:\Users\THM-4n6\Desktop\SYSTEM_clean
1	1 C:\Users\THM-4n6\Desktop\Kape\kape.exe	6/24/2021 6:23	NA	FALSE	C:\Users\THM-4n6\Desktop\SYSTEM_clean
1	2 C:\Program Files\Common Files\microsoft shared\ink\TabTip.exe	10/6/2021 13:52	NA	FALSE	C:\Users\THM-4n6\Desktop\SYSTEM_clean
1	3 C:\Windows\System32\rdpinput.EXE	12/7/2019 9:09	NA	FALSE	C:\Users\THM-4n6\Desktop\SYSTEM_clean
1	4 C:\Windows\Microsoft.NET\Framework\v4.0.30319\mscorsvw.exe	10/6/2021 13:45	NA	FALSE	C:\Users\THM-4n6\Desktop\SYSTEM_clean

Command to Use Parser:

AppCompatCacheParser.exe --csv <output file path> -f <SYSTEM hive file path> -c <control set>

3. AmCache

- **What it is:** AmCache is similar to ShimCache but provides more detailed information about programs that were run on the system.

Location in File System:

C:\Windows\appcompat\Programs\Amcache.hve

-
- **What it stores:**
 - Execution path (where the program was launched from).
 - Installation, execution, and deletion times of the program.
 - The SHA-1 hash of the program (used for security checks).

Registry Key for Last Run Programs:

Amcache.hve\Root\File\{Volume GUID}\

- **Tools to Use:** Use **Registry Explorer** to view AmCache data.

Timestamp	Path	Name	Product Name	Publisher	Version	SHA1
2021-12-01 12:45:37	c:\program files\windowsapps\microsoft\microsoft3dviewer_7.2107.7012.0_x64__8wekyb3d8bbwe\3dviewer.exe	3DViewer.exe	view 3d	microsoft corporation	7.2107.7012.0	8c3846b00a123040b4e6c2796773e9039996048
2021-12-01 12:55:19	c:\program files\7-zip\7z.exe	7z.exe	7-zip	igor pavlov	19.00	6c7ea8bb435363ae3945c0ef30e5b872e4591
2021-12-01 12:55:19	c:\program files\7-zip\7zfm.exe	7zFM.exe	7-zip	igor pavlov	19.00	e45e198607d3d739874ebaa71780e3e7a2f6d62a
2021-12-01 12:55:19	c:\program files\7-zip\7zG.exe	7zG.exe	7-zip	igor pavlov	19.00	ef22612543e9404e515448bdad49034968250de
2021-12-01 13:00:29	c:\program files\{98951643-944f-46c7-8d46-60f211a6a966}\google\update\download\{8a63d3d5-d564-463c-af11-9a9a9e530960}\96.0.4664.45\96.0.4664.45_chrome_installer.exe	96.0.4664.45_chrome_installer.exe		google llc	96.0.4664.45	c28b26e577152fab11f1461e192194ca05166e0f
2021-12-01 12:55:49	c:\program files\amazon\son\amazon-son-agent.exe	amazon-son-agent.exe				e57361919370937385b8c7023835f45707e30809
2021-12-01 12:57:38	c:\programdata\package cache\{71aad347-faef-4dc7-8d46-60f211a6a966}\amazon\amazon-sm-agent-setup.exe	AmazonSMAgentSetup.exe	amazon son agent	amazon web services	3.1.338.0	91949548f15643875e0393844da70ea59682836a
2021-12-01 13:00:20	c:\users\thm-4n6\desktop\amcacheparser.exe	Amcacheparser.exe	amcacheparser	eric ammenman	1.4.0.0	13ab202121d4ff43326e426fa224e5405d0b3c27

4. BAM/DAM

- **What it is:**
 - **BAM (Background Activity Monitor):** Keeps track of programs running in the background.
 - **DAM (Desktop Activity Moderator):** Manages power consumption by controlling app activities.

Location in Registry:

sql

Copy code

`SYSTEM\CurrentControlSet\Services\bam\UserSettings\{SID}`

`SYSTEM\CurrentControlSet\Services\dam\UserSettings\{SID}`

- Here, **SID** refers to the unique user ID on the computer.
- **What it stores:**
 - Program names and their full paths.
 - The last time the program was executed.
- **Tools to Use:** Use **Registry Explorer** to view this data.

Program	Execution Time
Microsoft.Windows.ShellExperienceHost_cw5n1h2bxyewy	2021-11-24 18:02:15
Microsoft.Windows.Cortana_cw5n1h2bxyewy	2021-11-24 18:02:15
Device\HarddiskVolume2\Windows\explorer.exe	2021-11-24 18:02:15
Device\HarddiskVolume2\Windows\System32\ApplicationFrameHost.exe	2021-11-24 18:02:15
windows.immersivecontrolpanel_cw5n1h2bxyewy	2021-11-24 15:40:31
Device\HarddiskVolume2\Program Files\VMware\VMware Tools\vmtoolsd.exe	2021-11-24 18:02:14
Device\HarddiskVolume2\Windows\System32\cmd.exe	2021-11-25 03:23:14
Device\HarddiskVolume2\Program Files (x86)\Mozilla Firefox\firefox.exe	2021-11-25 03:46:20
Device\HarddiskVolume2\Program Files (x86)\Google\Update\GoogleUpdate.exe	2021-11-25 03:43:40
Device\HarddiskVolume2\Windows\System32\WindowsPowerShell\v1.0\powershell.exe	2021-11-24 17:56:18
Device\HarddiskVolume2\Windows\System32\notepad.exe	2021-11-25 03:42:53
Device\HarddiskVolume2\Users\THM-4n6\AppData\Local\Programs\Opera\opera.exe	2021-11-25 04:12:35
Device\HarddiskVolume2\Program Files\Google\Chrome\Application\chrome.exe	2021-11-25 03:43:50
Device\HarddiskVolume2\Windows\System32\mscsc.exe	2021-11-25 04:00:04
Device\HarddiskVolume2\Windows\System32\SystemSettingsAdminFlows.exe	2021-11-25 04:00:54
Device\HarddiskVolume2\Windows\System32\SystemPropertiesComputerName.exe	2021-11-25 04:01:35
Device\HarddiskVolume2\Windows\System32\rundll32.exe	2021-11-24 17:38:19
Device\HarddiskVolume2\Program Files (x86)\Windows\InstallationAssistant\Windows10UpgraderApp.exe	2021-11-24 18:01:52
Device\HarddiskVolume2\Program Files (x86)\Microsoft\EdgeUpdate\MicrosoftEdgeUpdate.exe	2021-11-24 15:21:35
Device\HarddiskVolume2\Program Files (x86)\Microsoft\Edge\Application\msedge.exe	2021-11-24 15:23:43

Summary:

- **UserAssist:** Tracks programs opened using Windows Explorer.
- **ShimCache:** Tracks all launched programs for compatibility purposes.
- **AmCache:** Stores more detailed data about executed programs, including their installation times and security hashes.
- **BAM/DAM:** Monitors background apps and optimizes power usage.

1. Device Identification

- **Purpose:** Tracks USB devices connected to the system, including their **Vendor ID**, **Product ID**, and **Version**.

Registry Keys:

SYSTEM\CurrentControlSet\Enum\USBSTOR

SYSTEM\CurrentControlSet\Enum\USB

Timestamp	Manufacturer	Title	Version	Disk Id	Serial Number	Device Name	Installed	First Installed	Last Connected	Last Removed
2021-11-24 18:25...	Ven_Kingston	Prod_DataTraveler...2.0	Rev_PMAP	{e251921f-4da2-11ec-a783-001a7dda7110}	1C6F654E59A380C1790366AE80	Kingston DataTraveler 2.0 USB Device		2021-11-24 18:25...	2021-11-24 18:25...	2021-11-24 18:40...
2021-11-24 18:27...	Ven_USB3.0	Prod_External_Device	Rev_SOM1	{f529a9d6-4d9e-11ec-a782-001a7dda7110}	0123456789ABCDEF80	USB3.0 External Device USB Device		2021-11-24 18:27...	2021-11-24 18:27...	2021-11-24 18:27...

- **What it shows:**
 - Unique device details (e.g., vendor, product).
 - Connection timestamps.
- **Tool:** Use **Registry Explorer** to view this information in a readable format.

2. First/Last Connection and Removal Times

- **Purpose:** Tracks the first connection, last connection, and last removal times of USB devices.

Registry Key:

SYSTEM\CurrentControlSet\Enum\USBSTOR\Ven_Prod_Version\USBSerial#\Properties\{83da6326-97a6-4088-9453-a19231573b29}\####

- Replace #### with:
 - **0064** → First connection time.
 - **0066** → Last connection time.
 - **0067** → Last removal time.
- **Tool:** **Registry Explorer** automatically shows this data under the **USBSTOR** key.

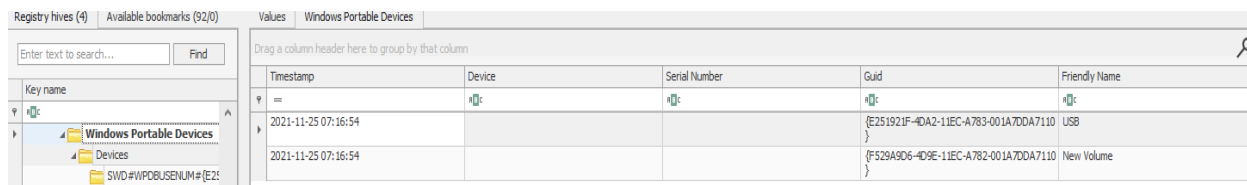
3. USB Device Volume Name

- **Purpose:** Identifies the **volume name** of the connected USB device.

Registry Key:

SOFTWARE\Microsoft\Windows Portable Devices\Devices

- **What to do:** Match the **GUID** here with the **Disk ID** from the **USBSTOR** key to link the volume name with the specific USB device.



Timestamp	Device	Serial Number	Guid	Friendly Name
2021-11-25 07:16:54			{E251921F-4DA2-11EC-A783-001A7DDA7110}	USB
2021-11-25 07:16:54			{F529A9D6-4D9E-11EC-A782-001A7DDA7110}	New Volume