Volatility Plugin for Detecting Cobalt Strike Beacon

JPCERT/CC

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Python

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- Email

JPCERT/CC has observed some Japanese organisations being affected by cyber attacks leveraging “Cobalt Strike” since around July 2017. It is a commercial product that simulates targeted attacks [1], often used for incident handling exercises, and likewise it is an easy-to-use tool for attackers. Reports from LAC [2] and FireEye [3] describe details on Cobalt Strike and actors who conduct attacks using this tool.

Cobalt Strike is delivered via a decoy MS Word document embedding a downloader. This will download a payload (Cobalt Strike Beacon), which will be executed within the memory. Since Cobalt Strike Beacon is not saved on the filesystem, whether a device is infected cannot be confirmed just by looking for the file itself. There is a need to look into memory dump or network device logs.

This article is to introduce a tool that we developed to detect Cobalt Strike Beacon from the memory. It is available on GitHub - Feel free to try from the following webpage:

> JPCERTCC/aa-tools · GitHub
>
> https://github.com/JPCERTCC/aa-tools/blob/master/cobaltstrikescan.py

Tool details

This tool works as a *plugin* for The Volatility Framework (hereafter “Volatility”), a memory forensic tool. Here are the functions of cobaltstrikescan.py:

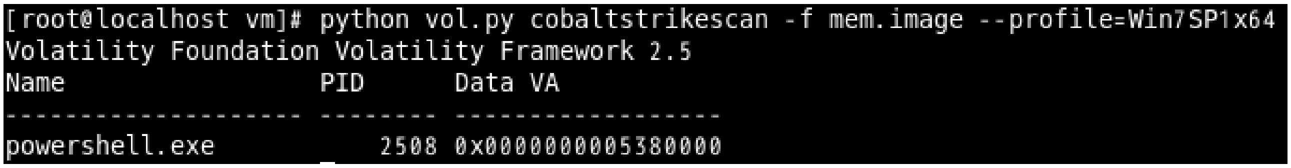
- cobaltstrikescan: Detect Cobalt Strike Beacon from memory image
- cobaltstrikeconfig: Detect Cobalt Strike Beacon from memory image and extract configuration

To run the tool, save cobaltstrikescan.py in ”contrib/plugins/malware” folder in Volatility, and execute the following command:

```
$python vol.py [cobaltstrikescan|cobaltstrikeconfig] –f <memory.image> ––profile=
<profile>
```

Figure 1 shows an example output of cobaltstrikescan. You can see the detected process name (Name) and process ID (PID) indicating where the malware is injected to.

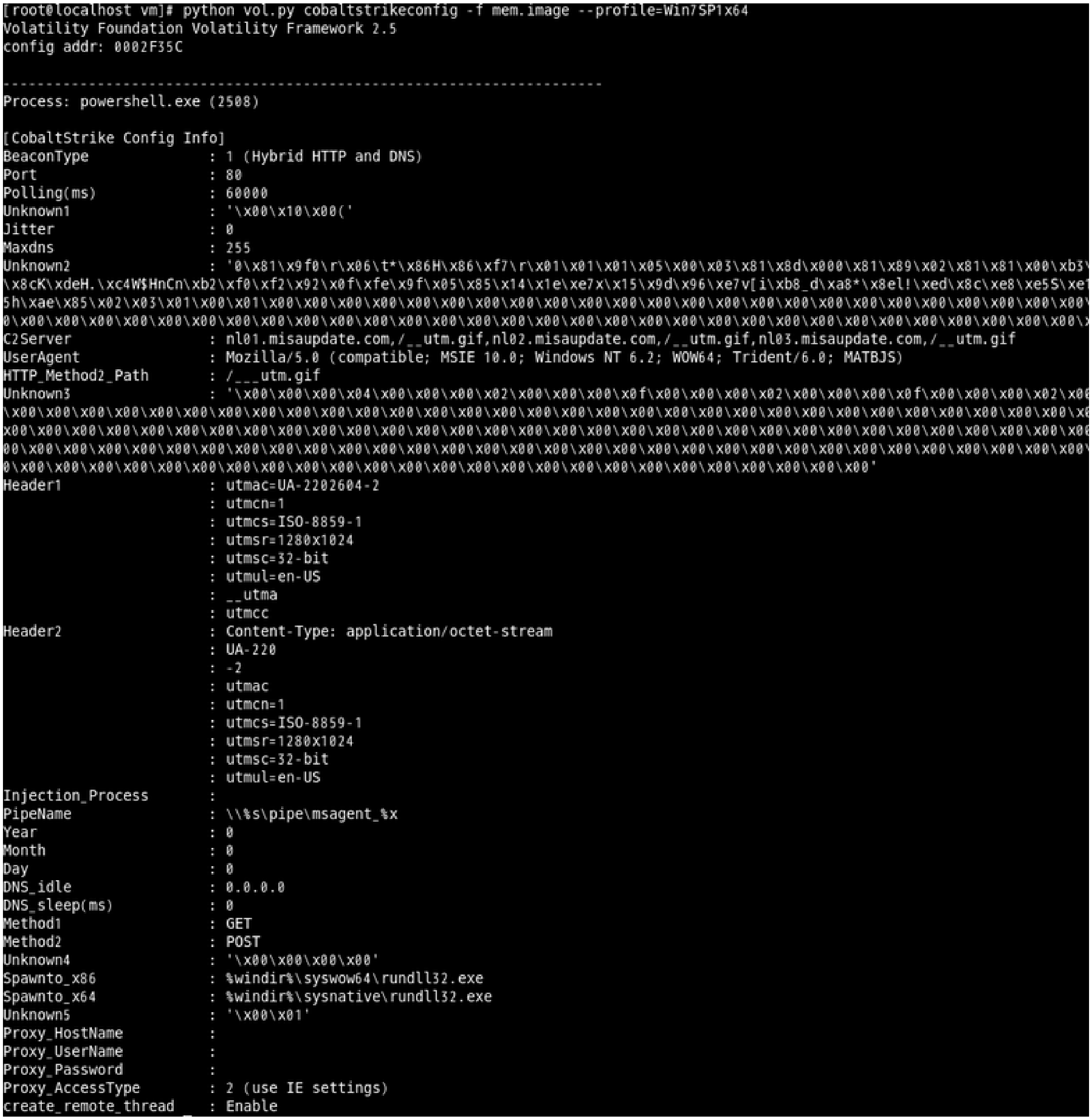
Figure 1: Execution results of cobaltstrikescan



```
[root@localhost vm]# python vol.py cobaltstrikescan -f mem.image --profile=Win7SP1x64
Volatility Foundation Volatility Framework 2.5
Name                 PID      Data VA
-------------------- -------- ------------------
powershell.exe           2508 0x0000000005380000
```

Figure 2 shows an example output of cobalrstrikeconfig. Please refer to Appendix A for configuration details for Cobalt Strike Beacon.

Figure 2: Execution results of cobaltstrikeconfig



```
[root@localhost vm]# python vol.py cobaltstrikeconfig -f mem.image --profile=Win7SP1x64
Volatility Foundation Volatility Framework 2.5
config addr: 0002F35C

--------------------------------------------------------------------
Process: powershell.exe (2508)

[CobaltStrike Config Info]
BeaconType              : 1 (Hybrid HTTP and DNS)
Port                    : 80
Polling(ms)             : 60000
Unknown1                : '\x00\x10\x00('
Jitter                  : 0
Maxdns                  : 255
Unknown2                : '0\x81\x9f0\r\x06\t*\x86H\x86\xf7\r\x01\x01\x01\x05\x00\x03\x81\x8d\x000\x81\x89\x02\x81\x81\x00\xb3\
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C2Server                : nl01.misaupdate.com,/__utm.gif,nl02.misaupdate.com,/__utm.gif,nl03.misaupdate.com,/__utm.gif
UserAgent               : Mozilla/5.0 (compatible; MSIE 10.0; Windows NT 6.2; WOW64; Trident/6.0; MATBJS)
HTTP_Method2_Path       : /___utm.gif
Unknown3                : '\x00\x00\x00\x04\x00\x00\x00\x02\x00\x00\x00\x0f\x00\x00\x00\x02\x00\x00\x00\x0f\x00\x00\x00\x02\x0
\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x00\x0
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Header1                 : utmac=UA-2202604-2
                        : utmcn=1
                        : utmcs=ISO-8859-1
                        : utmsr=1280x1024
                        : utmsc=32-bit
                        : utmul=en-US
                        : __utma
                        : utmcc
Header2                 : Content-Type: application/octet-stream
                        : UA-220
                        : -2
                        : utmac
                        : utmcn=1
                        : utmcs=ISO-8859-1
                        : utmsr=1280x1024
                        : utmsc=32-bit
                        : utmul=en-US
Injection_Process       :
PipeName                : \\%s\pipe\msagent_%x
Year                    : 0
Month                   : 0
Day                     : 0
DNS_idle                : 0.0.0.0
DNS_sleep(ms)           : 0
Method1                 : GET
Method2                 : POST
Unknown4                : '\x00\x00\x00\x00'
Spawnto_x86             : %windir%\syswow64\rundll32.exe
Spawnto_x64             : %windir%\sysnative\rundll32.exe
Unknown5                : '\x00\x01'
Proxy_HostName          :
Proxy_UserName          :
Proxy_Password          :
Proxy_AccessType        : 2 (use IE settings)
create_remote_thread    : Enable
```

In closing

Actors using Cobalt Strike continue attacks against Japanese organisations. We hope this tool helps detecting the attack in an early stage.

- Takuya Endo

(Translated by Yukako Uchida)

Reference

[1] Strategic Cyber LLC:COBALT STRIKE ADVANCED THREAT TACTICS FOR PANETRATION TESTERS

https://www.cobaltstrike.com/

[2] LAC: New attacks by APT actors menuPass (APT10) observed (Japanese)

https://www.lac.co.jp/lacwatch/people/20180521_001638.html

[3] FireEye: Privileges and Credentials: Phished at the Request of Counsel

https://www.fireeye.com/blog/threat-research/2017/06/phished-at-the-request-of-counsel.html

[4] Cybereason: Operation Cobalt Kitty: A large-scale APT in Asia carried out by the OceanLotus Group

https://www.cybereason.com/blog/operation-cobalt-kitty-apt

Appendix A

Table A: Configuration format

Offset	Length	Description
0x00	2	index (Refer to Table B)
0x02	2	Data length 1 = 2 byte, 2 = 4 byte, 3 = as specified in 0x04
0x04	2	Data length
0x06	As specified in 0x04	Data

Table B: Configuration

Offset	Description	Remarks
0x01	BeaconType	0=HTTP, 1=Hybrid HTTP and DNS, 8=HTTPS
0x02	Port number	
0x03	Polling time	
0x04	Unknown	
0x05	Jitter	Ratio of jitter in polling time (0-99%)
0x06	Maxdns	Maximum length of host name when using DNS (0-255)
0x07	Unknown	

Offset	Description	Remarks
0x08	Destination host	
0x09	User agent	
0x0a	Path when communicating HTTP_Header2	
0x0b	Unknown	
0x0c	HTTP_Header1	
0x0d	HTTP_Header2	
0x0e	Injection process	
0x0f	Pipe name	
0x10	Year	Stops operating after the specified date by Year, Month, Day
0x11	Month	
0x12	Day	
0x13	DNS_idle	
0x14	DNS_Sleep	
0x1a	HTTP_Method1	
0x1b	HTTP_Method2	
0x1c	Unknown	
0x1d	Process to inject arbitrary shellcode (32bit)	
0x1e	Process to inject arbitrary shellcode (64bit)	
0x1f	Unknown	
0x20	Proxy server name	
0x21	Proxy user name	
0x22	Proxy password	

Offset	Description	Remarks
0x23	AccessType	1 = Do not use proxy server 2 = Use IE configuration in the registry 4 = Connect via proxy server
0x24	create_remote_thread	Flag whether to allow creating threads in other processes
0x25	Not in use	

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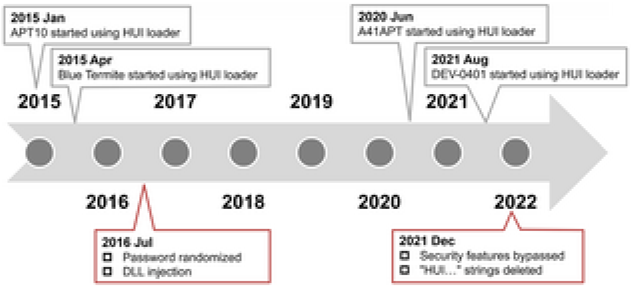
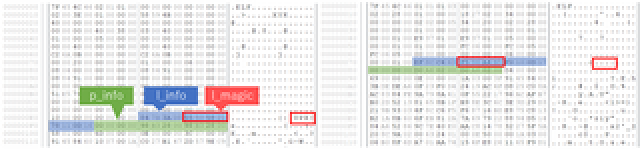
- 
2015 Jan
APT10 started using HUI loader
2015 Apr
Blue Termite started using HUI loader
2020 Jun
A41APT started using HUI loader
2021 Aug
DEV-0401 started using HUI loader
2015
2017
2019
2021
2016
2018
2020
2022
2016 Jul
□ Password randomized
□ DLL injection
2021 Dec
□ Security features bypassed
□ "HUI..." strings deleted
  Analysis of HUI Loader

- 

  [Anti-UPX Unpacking Technique]

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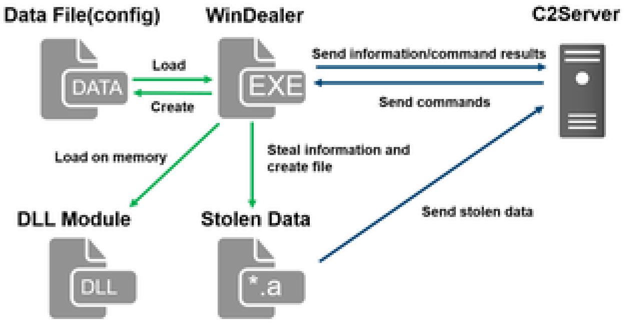
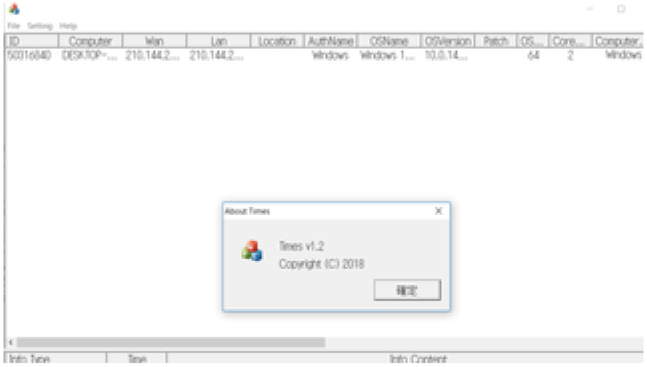
  [FAQ: Malware that Targets Mobile Devices and How to Protect Them]

- 

  [Malware WinDealer used by LuoYu Attack Group]

- 

ID	Computer	Wan	Lan	Location	AuthName	OSName	OSVersion	Patch	OS...	Core...	Computer...
50316840	DESKTOP-...	210.144.2...	210.144.2...		Windows	Windows 1...	10.0.14...		64	2	Windows

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