ThreatMon

UNDERSTANDING THE 'KAPEKA' BACKDOOR: **DETAILED ANALYSIS BY APT44**

TABLE OF CONTENTS

Introduction 4

What is Kapeka Backdoor? 5

Countries Targeted by APT44 (Sandworm) 6

Infection Chain 7

Technical Analysis 8

- Backdoor Dropper Analysis 8
- Backdoor Analysis 12

Mitre Attack 17

IOCs 18

Detection 19

- Dropper Yara Rule 19
- Backdoor Yara Rule 20

Mitigation 21

Uncover the Advantages of the ThreatMon's Module Offerings 22

Introduction

This report focuses on a technical analysis of the origins, propagation methods, and activities of the recently discovered Kapeka Backdoor. In particular, a detailed examination and evaluation of the Kapeka Backdoor attributed to the Russian Sandworm Group was conducted. The analysis revealed that this malware has been actively used by the Russian APT44 group since 2022.

Kapeka Backdoor is a sophisticated malware that prepares a platform for malware execution by communicating with infected devices. Through command-and-control (C2) communication, attackers can send commands and take control of target systems. This backdoor is similar to another backdoor known as QUEUESEED, which has the same hash and characteristics. Both malware have been attributed to the Russian APT group Sandworm.

This report aims to highlight the importance of this threat by discussing the technical details and attack vectors of the Kapeka Backdoor in detail. It also aims to help organizations be better prepared for such attacks by providing information on attack detection and defense strategies.

Kapeka Backdoor and What You Need to Know

What is Kapeka Backdoor?

Kapeka is a sophisticated backdoor designed for initial discovery and persistent infiltration of targeted systems. It is developed in C++ and disguises itself as a Microsoft Word Add-in (.wll). The installer silently installs, runs the backdoor, and removes itself from the environment. It continues to initiate data collection and external data transfer to threat actors, providing persistence through scheduled task creation or autorun registry entries, depending on system privileges.

Using multi-threading, Kapeka efficiently processes incoming directives and communicates with the Command and Control (C2) server via the WinHttp 5.1 COM interface. Its capabilities include file manipulation, execution of uploaded code, execution of shell commands, and even self-updating and uninstallation, giving attackers extensive control over compromised systems.

Initially dropped as a hidden file inside a folder named 'Microsoft' in paths such as 'C:\ProgramData' or 'C:\Users<username>\AppData\Local', Kapeka proceeds via a scheduled task or autorun registry entry, depending on the privileges of the process.

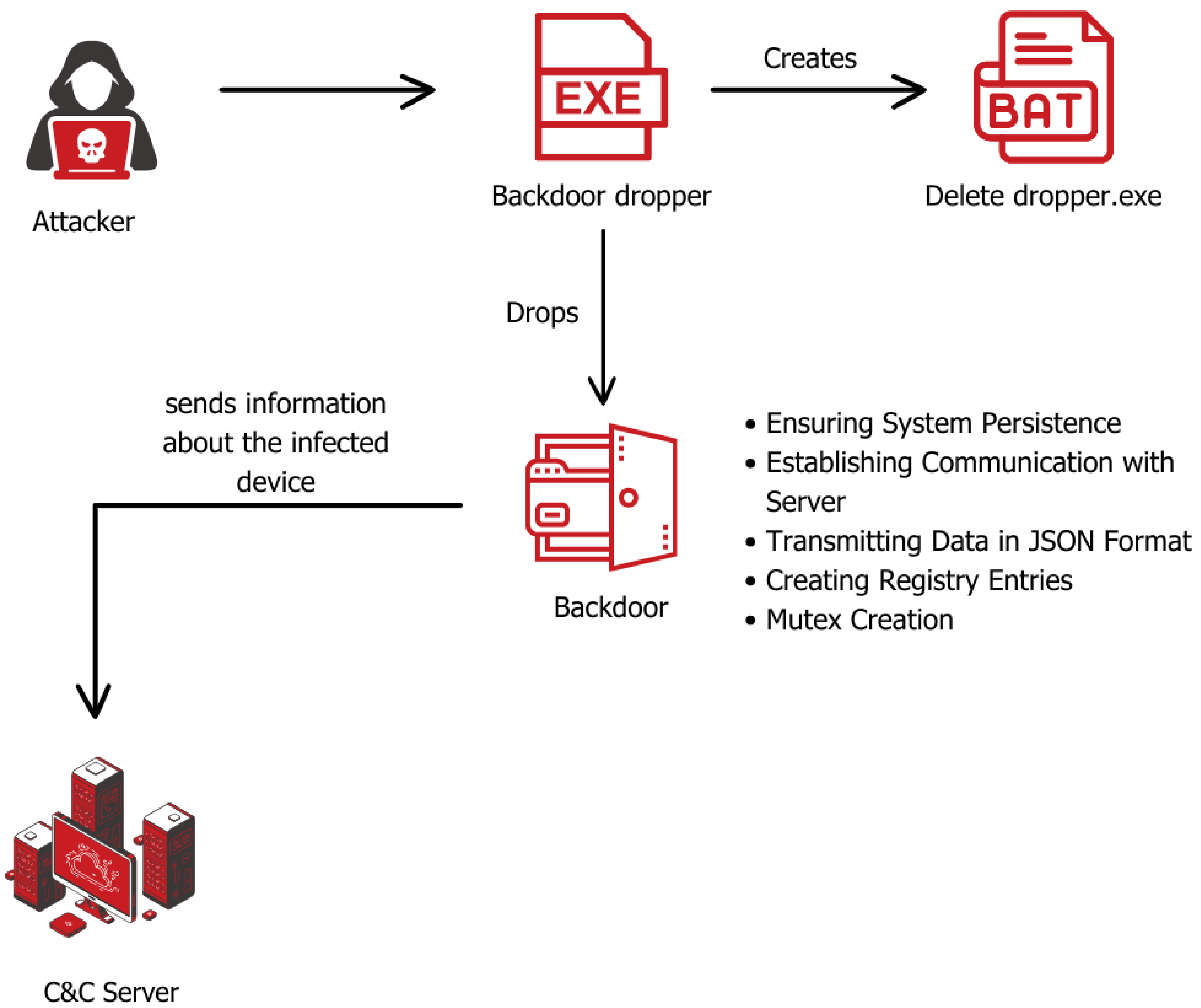
The backdoor operates with four main threads: the first thread manages the initialization, C2 communication, and exit routines; the second thread monitors Windows logout events and signals the primary thread to execute the exit routine during logout; the third thread monitors incoming tasks and starts subsequent threads to execute each task received from C2; and the last thread monitors task completion and sends the processed results back to C2.

In addition, the backdoor communicates with the C2 server to receive tasks and send back fingerprint information and task results. It has a reconfigurable feature and allows updates during runtime by fetching a new version from the C2 server. The latest iteration of the backdoor includes a special algorithm that applies CRC32 and PRNG operations to both GUID and hard-coded values within the binary file. Furthermore, the embedded and persistent configurations of the backdoor are encoded in JSON format.

Countries Targeted by APT44 (Sandworm)

APT44 is a threat actor operating in a wide geographical area and targeting organizations in various sectors. It operates in countries such as Azerbaijan, Belarus, Georgia, Iran, Israel, Kazakhstan, Kyrgyzstan, Lithuania, Poland, and Russia, with a particular focus on Ukraine. In addition to targeting organizations related to energy, industrial control systems, SCADA, and national defense, this group targets organizations in various sectors such as governments, transportation, energy, media, and social organizations. APT44's activities pose a significant risk, especially in regions that intersect with the interests of the Russian state, which is why it also targets organizations in North America, Europe, the Middle East, Central Asia, and Latin America.

INFECTION CHAIN



TECHNICAL ANALYSIS

Backdoor Dropper Analysis

File Name	dropper.exe
MD5	50b5582904fe34451f5cb2362e11cb24
SHA256	bd07fb1e9b4768e7202de6cc454c78c6891270af0208 5c51fce5539db1386c3f

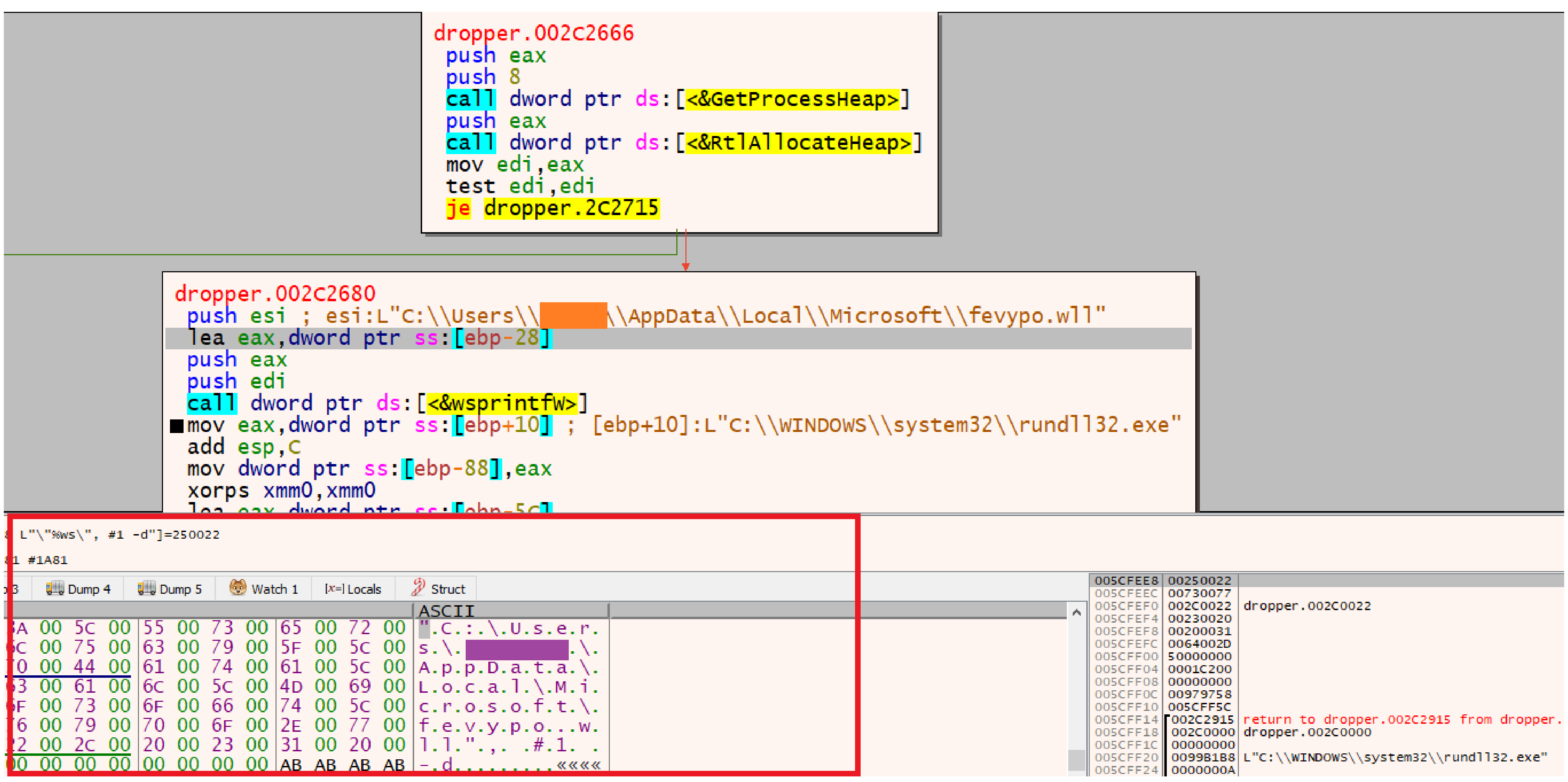


Figure 1 - Dropped dll

The DLL has been loaded to be executed by rundll32.exe from the location **C:\Users\admin\AppData\Local\Microsoft\fevypo.wll.**

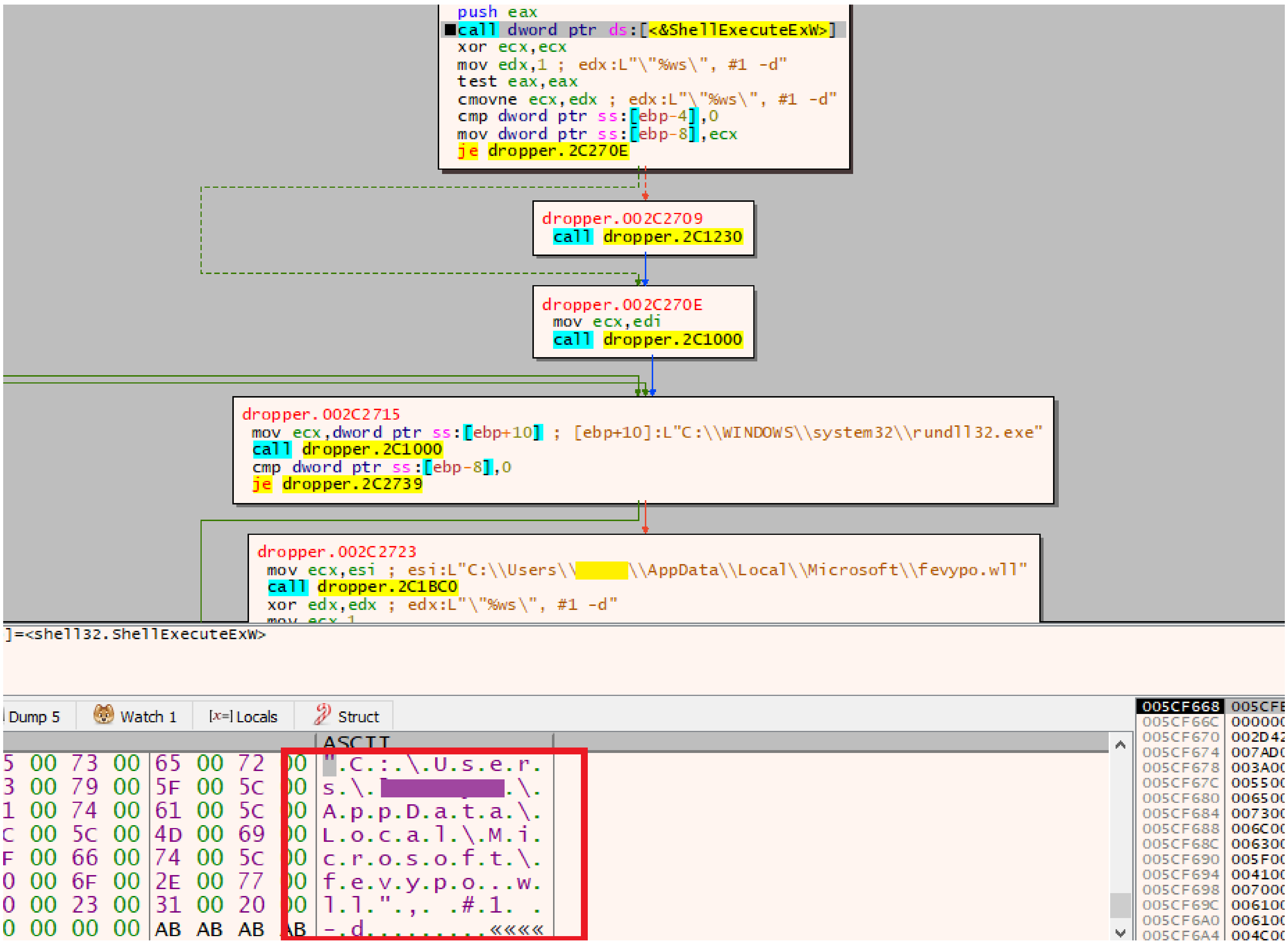


Figure 2 - Execute dll

The provided command utilizes the ShellExecute API to invoke the rundll32.exe utility with specific parameters. It directs the system to execute the function designated by ordinal number 1 within the vozet.wll DLL file located at "**C:\Users\admin\AppData\Local\Microsoft"** directory. The addition of the "-d" flag instructs the DLL to run in debug mode. This command facilitates executing a particular function within the DLL through rundll32.exe, providing a pathway for potential debugging and analyzing the DLL's behavior.

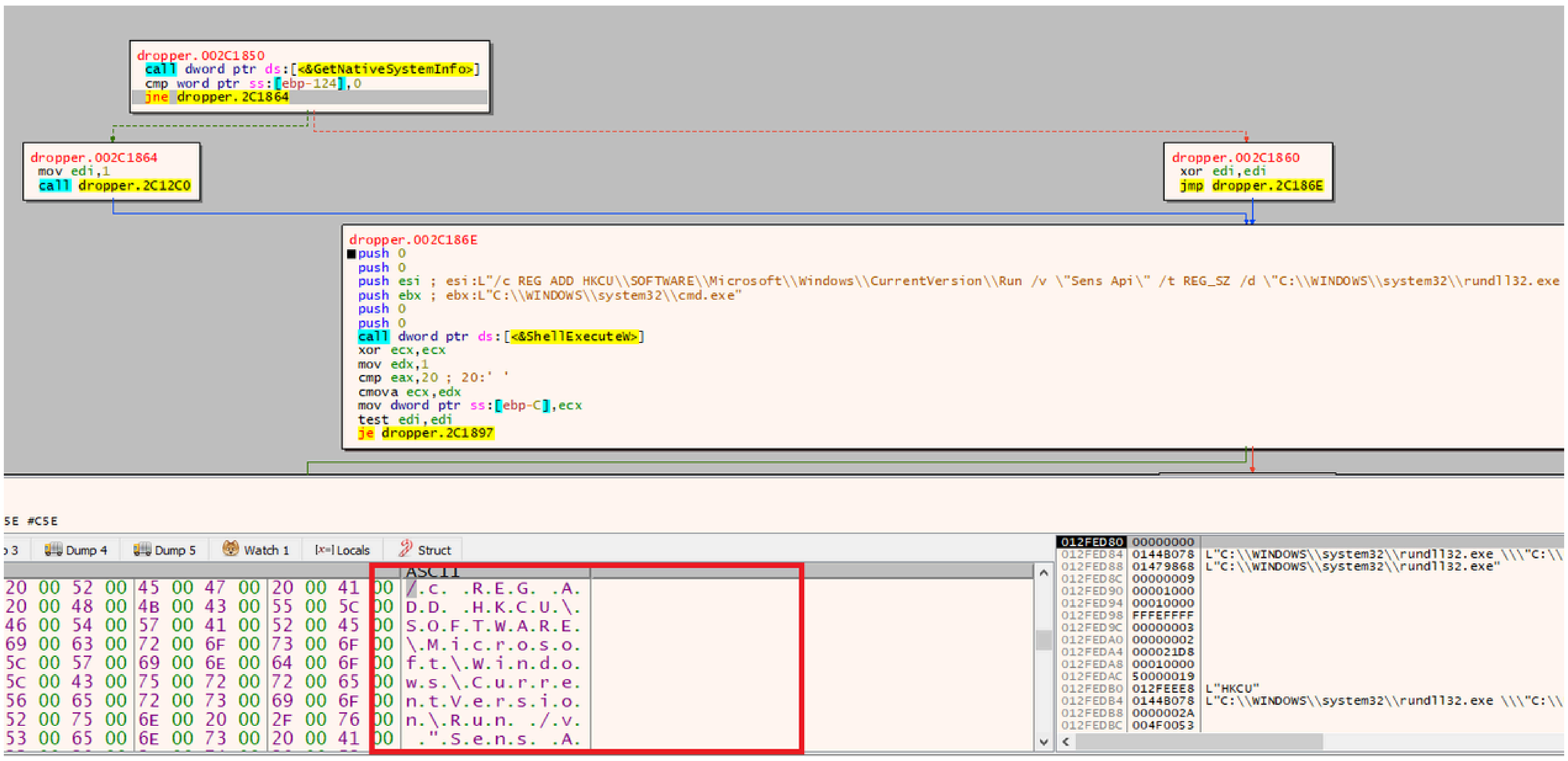


Figure 3 - Registry entry

The provided command utilizes the "reg add" command to create a new registry entry under **"HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Run"**. This entry, named "Sens Api", is of type REG_SZ (String) and contains the path to rundll32.exe and the necessary parameters to execute a specific function within the fevypo.wll DLL file. Upon system startup, this registry entry triggers the execution of the specified function.

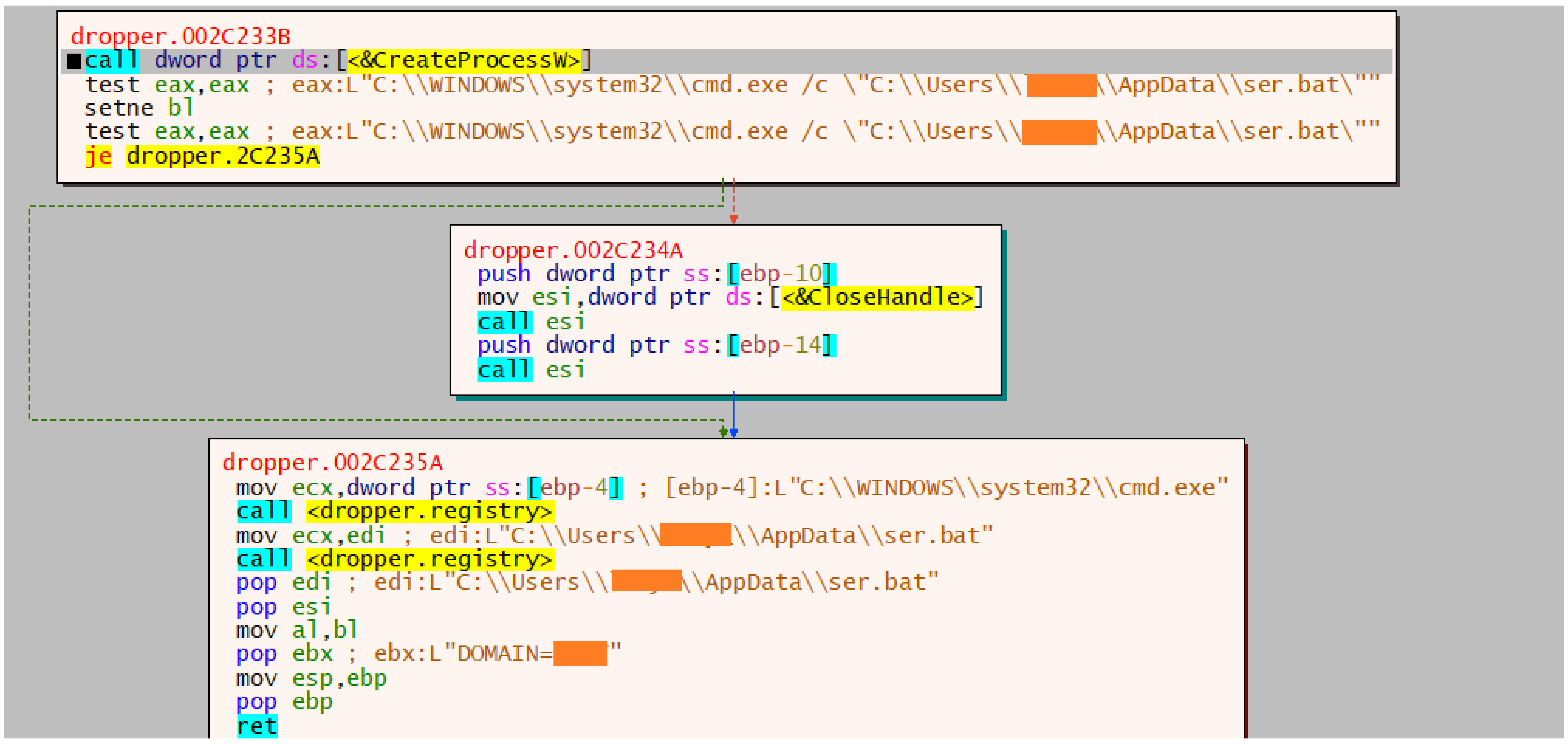


Figure 4- Execute .bat file

A batch file is created under the directory **"C:\Users\admin\AppData"**. This batch file is designed to facilitate the removal of the malicious backdoor dropper from the system after the backdoor has been installed.

*ser.bat - Notepad

File Edit Format View Help

```
@echo off
:label
del /q /f "C:\Users\admin\Desktop\dropper.exe"
if exist "C:\Users\admin\Desktop\dropper.exe" goto label
```

Figure 5- .bat file detail

After the installer completes the installation of the backdoor, it creates a batch file that checks for its presence and deletes it if it exists. This batch file is executed using a command prompt (cmd.exe) on the system. The installer thus permanently removes itself from the system.

Backdoor Analysis

File Name	kapeka.dll
MD5	5294aaf2ff80547172ebb9e0bcb52e0f
SHA256	f30b9f6e913798ca52154c88725ee262a7bf92fe7caac1ae2e5147e457b9b08a

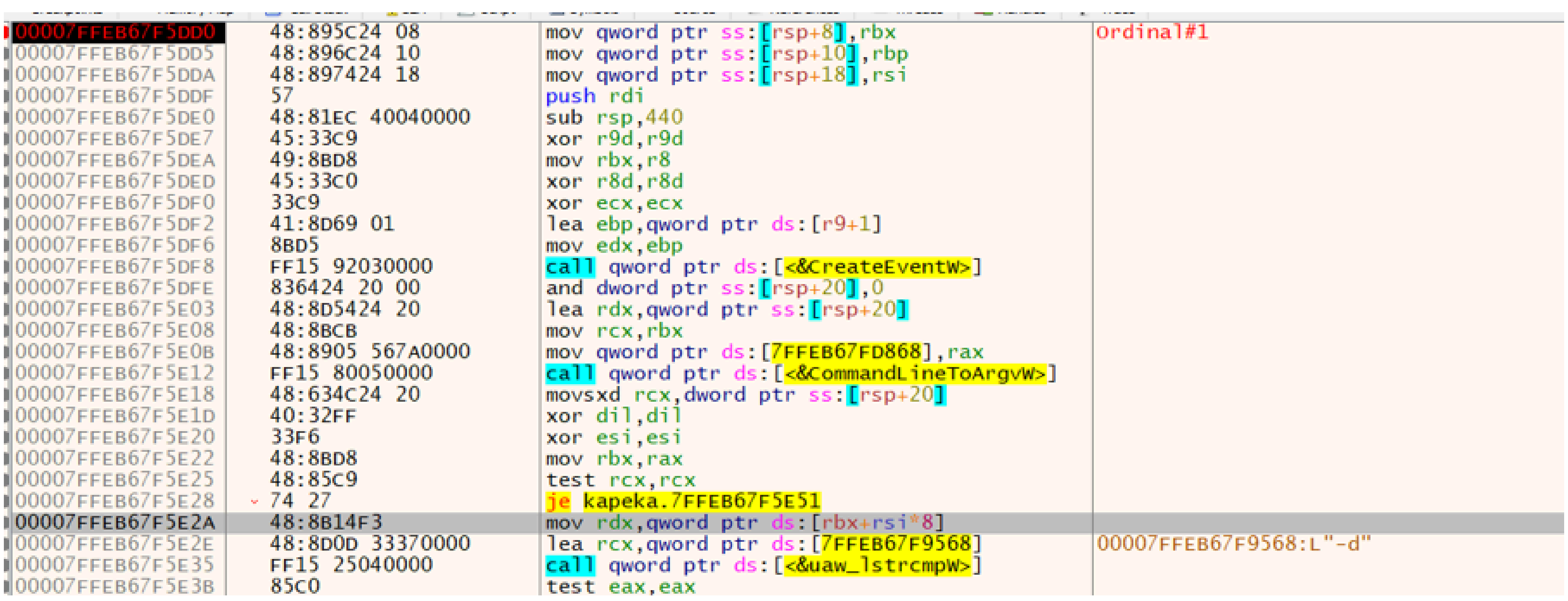


Figure 6- The -d parameter is used to check whether it is running or not

The backdoor also reads the current configuration held in the registry during the initialization phase. Depending on whether the backdoor is initialized with the '-d' argument and the current configuration in the registry, the backdoor chooses which configuration to use. If the **'-d'** argument (specifying the first run) is provided, the backdoor prefers its embedded configuration, otherwise it reads the current configuration from the registry, reverting to the embedded configuration if it is not available.

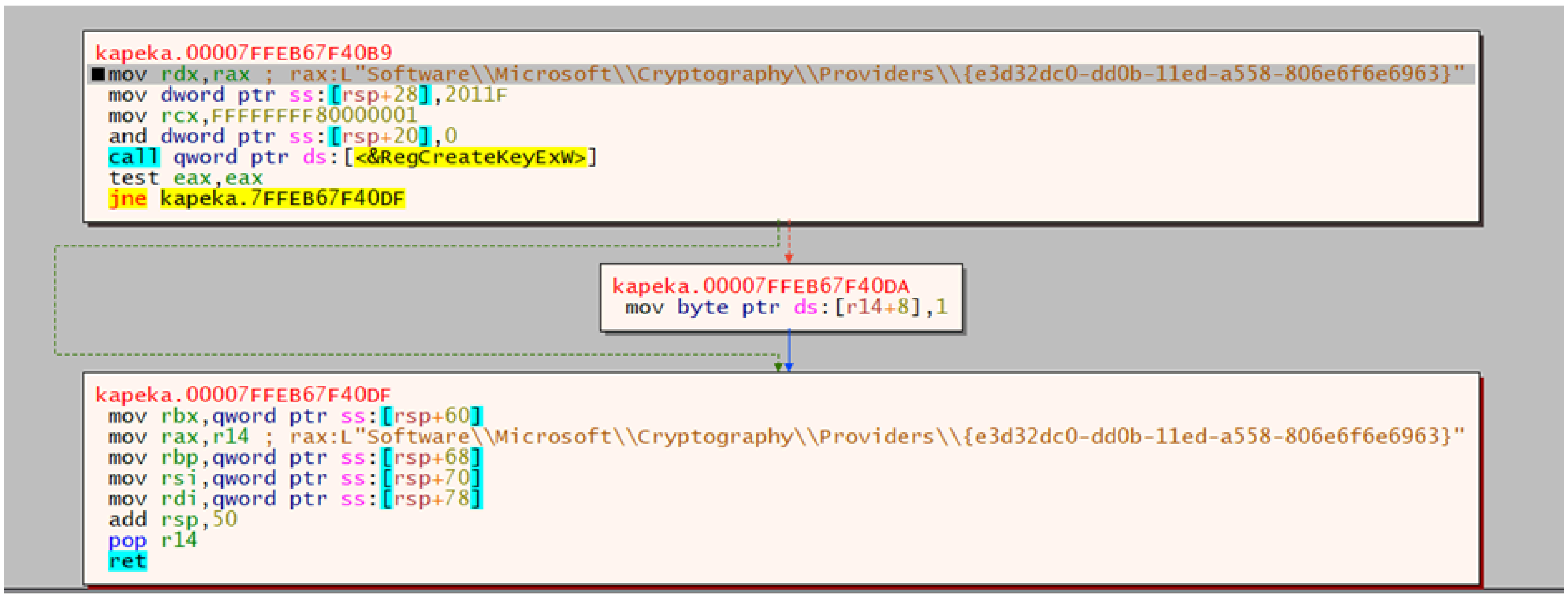


Figure 7- Create a registry key

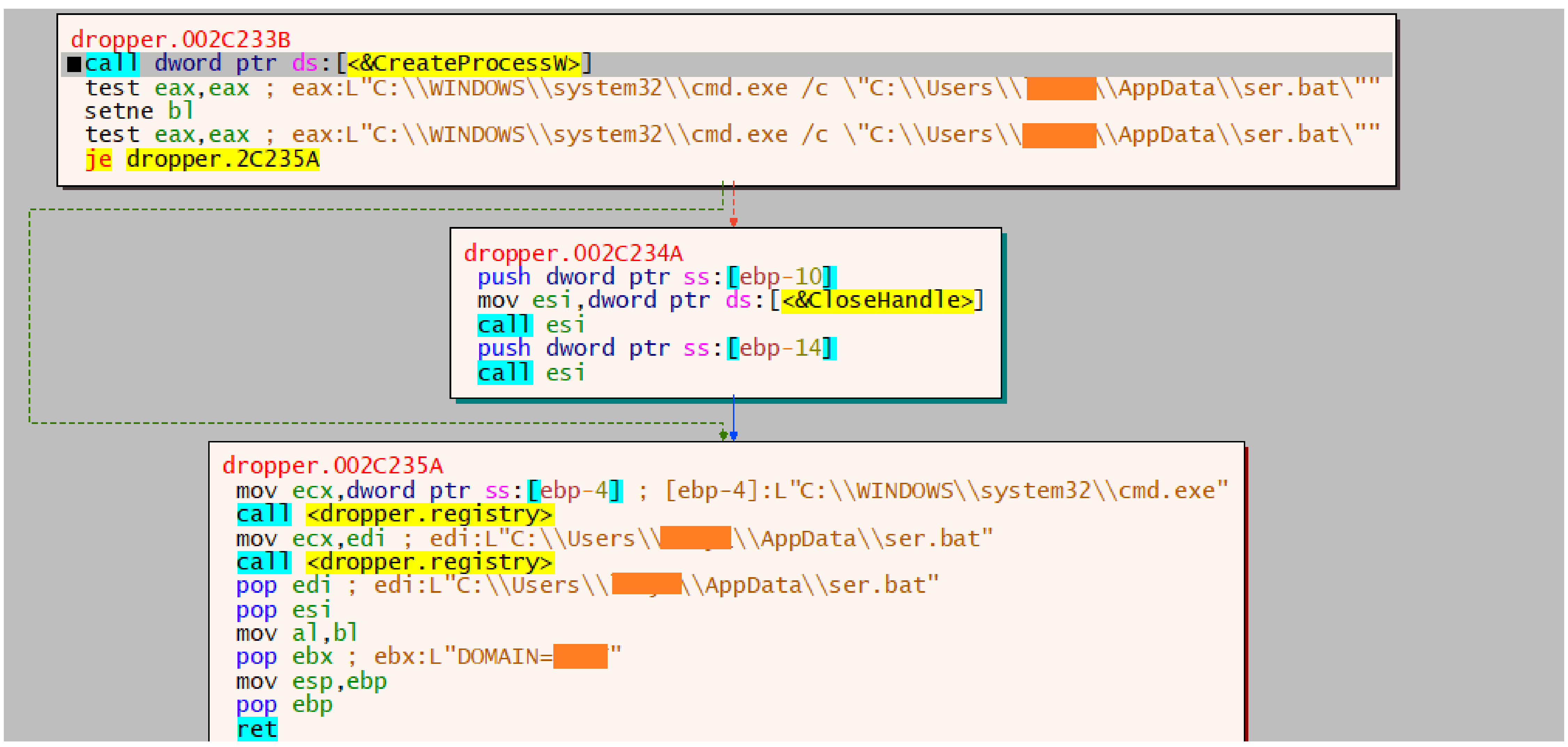


Figure 8- Create mutex

The backdoor protects its settings by storing them in a registry value named "Seed" in the path "**HKU<SID>\Software\Microsoft\Cryptography\Providers<GUID>**". Initially, it gets a GUID value by using GetCurrentHwProfileW() and obtaining the szHwProfileGuid field. If GetCurrentHwProfileW() fails, the backdoor defaults to a hard-coded GUID value. Also, the backdoor generates the mutex using an algorithm similar to "**Global\BFE_Notify_Event_{{{e3d32dc0-dd0b-11ed-a558-806e6f6e6963}}**".

```
 aPhsy0j:                                ; DATA XREF: sub_7FFEB67F3544+1E3↑o
                                         ; sub_7FFEB67F3544+201↑o
+text "UTF-16LE", 'pHsy0J',0
 align 8
 aOzyekp:                                ; DATA XREF: sub_7FFEB67F3544+243↑o
                                         ; sub_7FFEB67F3544+261↑o
+text "UTF-16LE", 'ozYekP',0
 align 8
 a8orgrb:                                ; DATA XREF: sub_7FFEB67F3544+28F↑o
                                         ; sub_7FFEB67F3544+2AD↑o
+text "UTF-16LE", '8ORGRb',0
 align 8
 aB0hqgu:                                ; DATA XREF: sub_7FFEB67F3544+2DB↑o
                                         ; sub_7FFEB67F3544+2F9↑o
+text "UTF-16LE", 'b0HqGu',0
 align 8
 aXsrmvc:                                ; DATA XREF: sub_7FFEB67F3544+33E↑o
                                         ; sub_7FFEB67F3544+35C↑o
+text "UTF-16LE", 'xsRMVc',0
 align 8
 aQ200c6:                                ; DATA XREF: sub_7FFEB67F3544+38A↑o
                                         ; sub_7FFEB67F3544+3A8↑o
+text "UTF-16LE", 'q200c6',0
 align 8
 aRaj5mj:                                ; DATA XREF: sub_7FFEB67F3544+3ED↑o
                                         ; sub_7FFEB67F3544+40B↑o
+text "UTF-16LE", 'RAJ5MJ',0
 align 8
 a7n4qjp:                                ; DATA XREF: sub_7FFEB67F3544+450↑o
                                         ; sub_7FFEB67F3544+46E↑o
```

Figure 9- Json keys

Additionally, the backdoor employs JSON formatting for both internal data exchange and communication with the command and control server. In total, there are **36 distinct JSON keys** utilized, each concealed and comprised of 6 characters. To ensure security, the backdoor employs three distinct encryption and encoding methods: **AES-256 in CBC mode, XOR, and RSA-2048**.

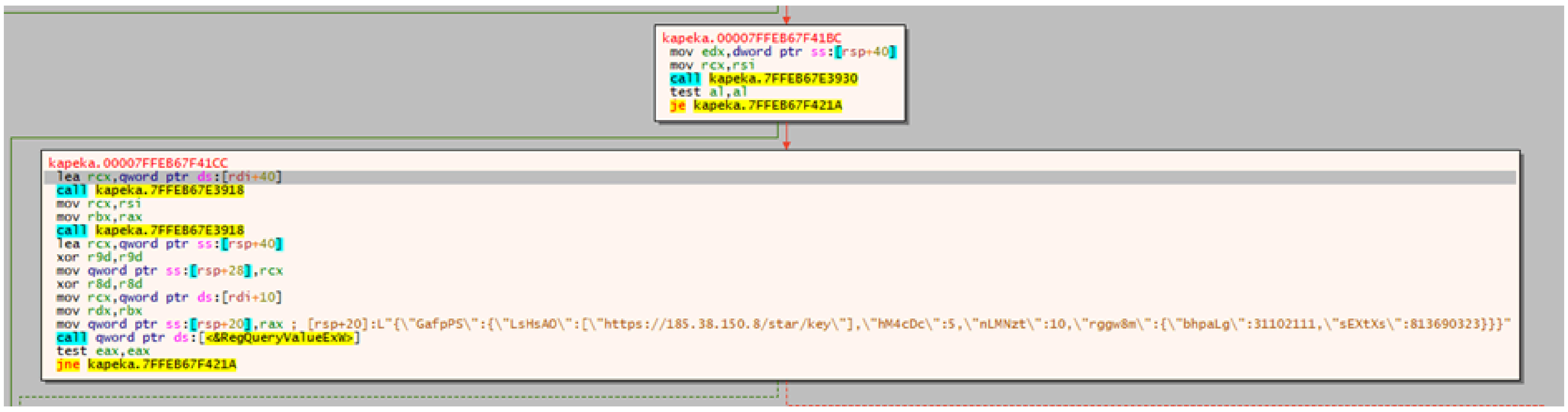


Figure 10- Communication information


```json
{
  "GafpPS": {
    "LsHsAO": [
      "https://185.38.150.8/star/key"
    ],
    "hM4cDc": 5,
    "nLMNzt": 10,
    "rggw8m": {
      "bhpaLg": 31102111,
      "sEXtXs": 813690323
    }
  }
}
```


Figure 11- C2 configuration

JSON data is the configuration of the Kapeka backdoor. It contains keys and values used to control the functionality and behavior of the backdoor. This structure includes settings such as the URL for connecting to a specific command and control server, connection frequency, update time and other properties. It covers both embedded (hard-coded) and persistent configuration information, indicating that it contains configuration settings stored on the device. This structure covers the key features that are crucial for determining the backdoor's control mechanisms and communication behaviors.

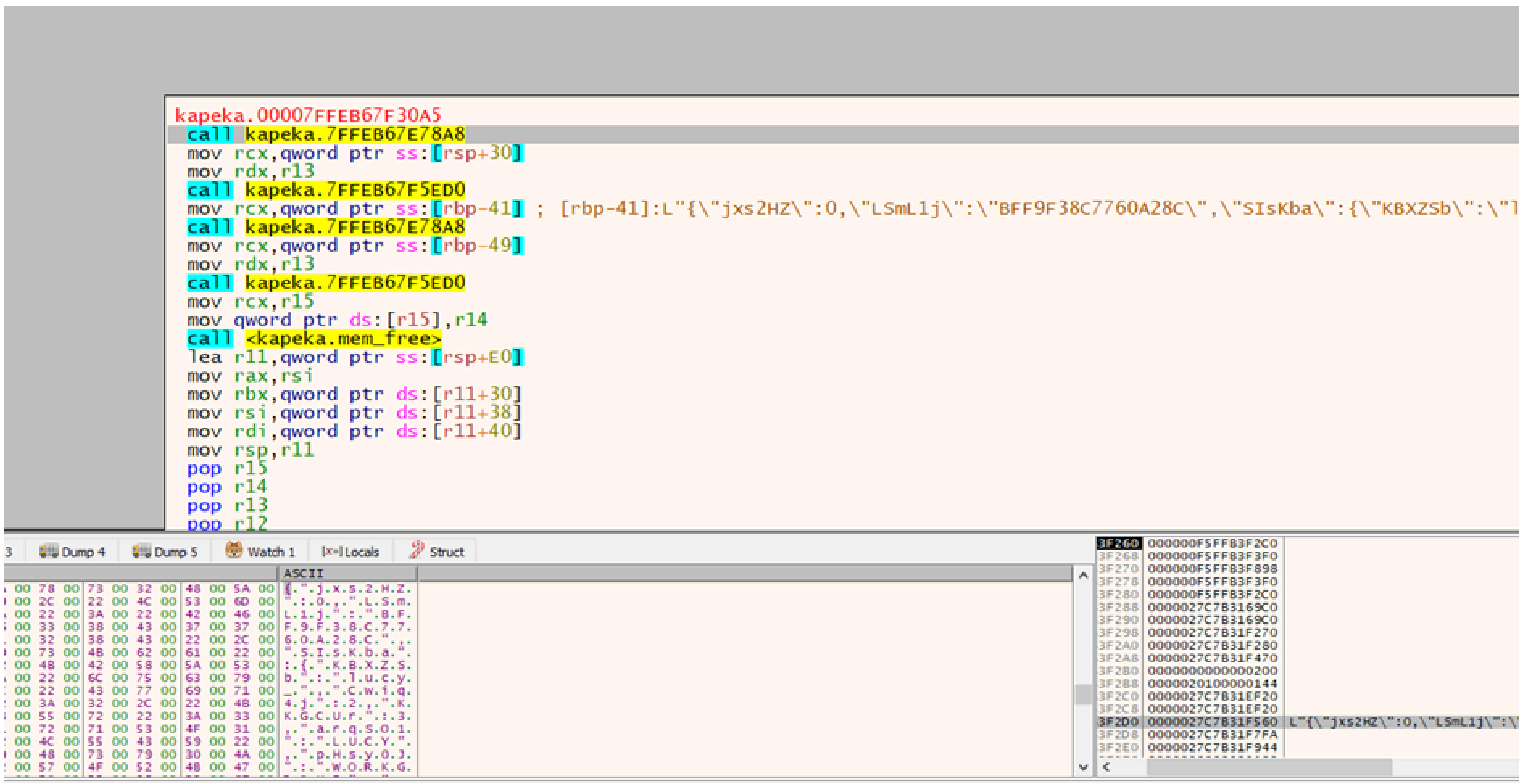


Figure 12- Sends information about the user profile in JSON format

During the initialization phase, the backdoor obtains information about the infected system and its user through a series of Windows APIs and registry queries. This information is organized internally in a predefined structure and then converted into JSON format. During its initial and subsequent interactions with the command and control server, the backdoor transmits this JSON data to the server


```json
{
  "jxs2HZ": 0,
  "LSmL1j": "BFF9F38C7760A28C",
  "SIsKba": {
    "KBXZSb": "username",
    "Cwiq4j": 2,
    "KKGCUr": 3,
    "arqSO1": "Hostname",
    "pHsy0J": "WORKGROUP",
    "ozYekP": 10,
    "8ORGRb": 0,
    "b0HqGu": "Windows 10 Pro",
    "xsRMVc": 64,
    "q200c6": "",
    "RAJ5MJ": "product key",
    "7N4QJp": "mail",
    "tczMsk": "",
    "GQKkuo": 1,
    "Wqk8xK": 0,
    "eEM2N9": "en",
    "NPvllV": "US"
  }
}
```


Figure 13- Details of the information sent in JSON

After acquiring device-specific information, the Kapeka backdoor completes its access to the compromised device.

Leveraging the generated autorun key, the backdoor ensures that it is automatically reactivated on every system boot and seamlessly re-establishes communication with the designated server.

In this way, it ensures long-term persistence inside the victim's system in a continuous and covert manner.

Mitre Attack

Execution	T1059.003	Command and Scripting Interpreter: Windows Command Shell
Persistence	T1547.001	Boot or Logon Autostart Execution: Registry Run Keys / Startup Folder
Discovery	T1082	System Information Discovery
Defense Evasion	T1112	Modify Registry
Defense Evasion	T1218.011	System Binary Proxy Execution: Rundll32
Defense Evasion	T1036	Masquerading
Command and Control	T1071.001	Application Layer Protocol: Web Protocols

IOC’s

IP	185[.]38[.]150[.]8
IP	196[.]245[.]156[.]154
IP	193[.]189[.]100[.]203
IP	5[.]45[.]75[.]45
URL	hxxps://185[.]38[.]150[.]8:443/star/key
URL	hxxps://194[.]61[.]121[.]211/application
Dropper Hash	bd07fb1e9b4768e7202de6cc454c78c6891270af02085c51fce5539db1386c3f
Dropper Hash	80fb042b4a563efe058a71a647ea949148a56c7c
Backdoor Hash	272cfaebf22e0f6a34c0a93b7c9c5b67c725947ba0f17e60ed67dbf6e1602043
Backdoor Hash	6c3441b5a4d3d39e9695d176b0e83a2c55fe5b4e
Backdoor Hash	5294aaf2ff80547172ebb9e0bcb52e0f

DETECTION

Dropper Yara Rule

```
import "hash"
rule Kapeka_Backdoor{

   meta:
   author = "Kerime Gencay"
   source = "ThreatMon"
   description = "Kapeka_Backdoor Rule"
   file_name = "dropper.exe"
   hash = "50b5582904fe34451f5cb2362e11cb24"

strings:
   $opc1 = {8B 55 C8 8D 45 F8 8B 4D FC 50 C7 45 F8 00 00 00 00 E8 AB EB FF FF 84 C0 74 1A 8D 45 F4}
   $opc2 = {FF 15 9C D0 40 00 50 FF 15 A0 D0 40 00 8B F0 85 F6 74 19 53 8D 45 DC 50 56 FF 15 9C D1 40 00 8B 45 FC}
   $opc3 = {FF 15 80 D1 40 00 33 C9 BA 01 00 00 00 85 C0 0F 45 CA 83 7D FC 00 89 4D F8 74 05}

condition:
   uint16(0) == 0x5A4D and (any of ($opc*))
}
```

Backdoor Yara Rule

```
import "hash"
rule Kapeka_Backdoor{

   meta:
   author = "Kerime Gencay"
   source = "ThreatMon"
   description = "Kapeka_Backdoor Rule"
   file_name = "kapeka.dll"
   hash = "5294aaf2ff80547172ebb9e0bcb52e0f"
strings:
   $str1 = "jxs2HZ"
   $str2 = "BFF9F38C7760A28C"
   $str3 = "LsHsAO"
   $str4 = "jRcZrx"
   $str5 = "SIsKba"
   $str6 = "KKGCUr"
   $str7 = "GafpPS"
   $str8 = "LsHsAO"

   $opc1 = {E8 E4 AE FF FF 4C 8B C0 33 D2 33 C9 FF 15 37 D7 00 00 48 85 C0 48 89 87
08 04 00 00}
    $opc2 = {48 8D 0D 54 63 00 00 E8 43 10 FF FF 41 8D 54 24 05 48 8B D8 48 8D 4C
24 20}
    $opc3 = {FF 15 22 F4 00 00 48 8D 0D 83 1A 01 00 48 89 47 10 FF 15 F1 F5 00 00 48
8D 0D 92 1A 01 00 48 89 47 60 FF 15 E0 F5 00 00}

condition:
   uint16(0) == 0x5A4D and (any of ($str*,$opc*))
}
```

MITIGATION

- Implement application whitelisting to allow only trusted and authorized programs to run on the system.
- Restrict user and application access to the Windows Registry and regularly monitor and audit registry changes.
- Limit unnecessary information exposure and regularly review and restrict access to sensitive data.
- Use advanced threat detection tools that can identify Obfuscated or encrypted files and code.
- Implement strong authentication and access controls and educate users about social engineering tactics.
- Regularly monitor and restrict the use of archive and compression tools.
- Use secure. encrypted connections (HTTPS), and implement multi-factor authentication to protect session cookies.
- Implement proper password policies and practices, and regularly audit and secure credentials.

Uncover the Advantages of the ThreatMon's Module Offerings

ThreatMon Advanced Threat Intelligence Platform combines Threat Intelligence, External Attack Surface Management, and Digital Risk Protection. ThreatMon identifies the distinctive nature of each business and provides bespoke solutions that cater to its specific needs.

Uncover the Advantages of the ThreatMon's Module Offerings

Extensive Integrations
Leverage extensive integrations that align seamlessly with all your security programs, third-party security tools, and external repositories.

Advanced Intelligence Platform
Empower your organization with ThreatMon's broad intelligence platform, enabling in-depth analysis of intelligence data and accurate prediction of threats for more effective security measures.

All-in-One Platform
View and manage security threats on your assets or in the outside world that could affect your company in one place.

Real-time Dashboard
View all threats that may directly or indirectly affect your organization and new emerging threats in real time with their analysis.

AI-ML based Intelligence
Inform your organization about future threats in advance with threat detection methods trained with Artificial Intelligence and Machine Learning models.

%100 Cloud
Get higher availability and flexibility by eliminating the dependency on physical servers.

Custom API Integration
Provide high-level security by easily integrating with other security products with an API personalised to your needs.

Advance Automation
Get instant notifications with Advanced Automation capabilities to effectively detect security threats and issues with minimal false/positives.

Features at a Glance

ATTACK SURFACE MANAGEMENT

- Digital Asset Detection & Continuous Monitoring
- Vulnerable Asset Intelligence
- Real-time Dashboards
- ThreatMon Asset Risk Scoring
- Mobile Application Security Intelligence
- DDoS Intelligence
- SSL Security Monitoring
- Passive Vulnerability Scan
- Continuous Pentest
- Customized Alarm & Notification

THREAT INTELLIGENCE

- AI/ML-based Threat Intelligence
- Threat Hunting
- Threat Activity Alerts
- Customer API Integration
- Vulnerability Intelligence
- Darkweb Intelligence
- Security News
- Threat Reports
- APT MITRE ATT&CK, and Graph Threat Feeds
- Threat Feed/IOCs Integration

DIGITAL RISK PROTECTION

- VIP Protection
- Social Media Monitoring
- Security Posture Card
- Phishing/Impersonating Domain Monitoring
- Integrated Takedown
- Critical Data Breach Monitoring
- Reputation Tracking
- Deep/Darkweb Asset Monitoring
- Github/Gitlab Intelligence
- Social Media Intelligence