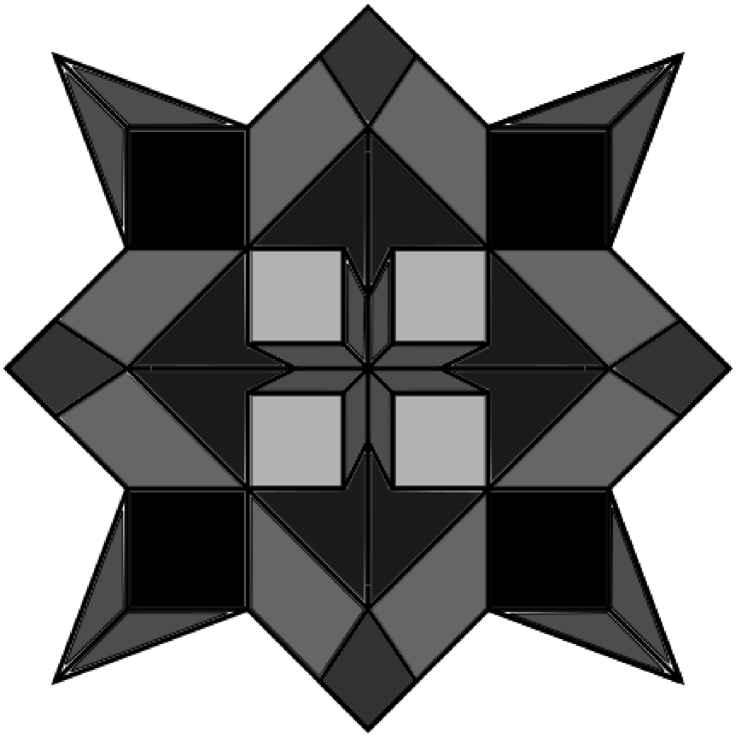


Malware Analysis Report

Remote Access Trojan-Reverse Shell

Aug 2022 | Jan Duinkerken | v1.2

Table of Contents

Executive Summary

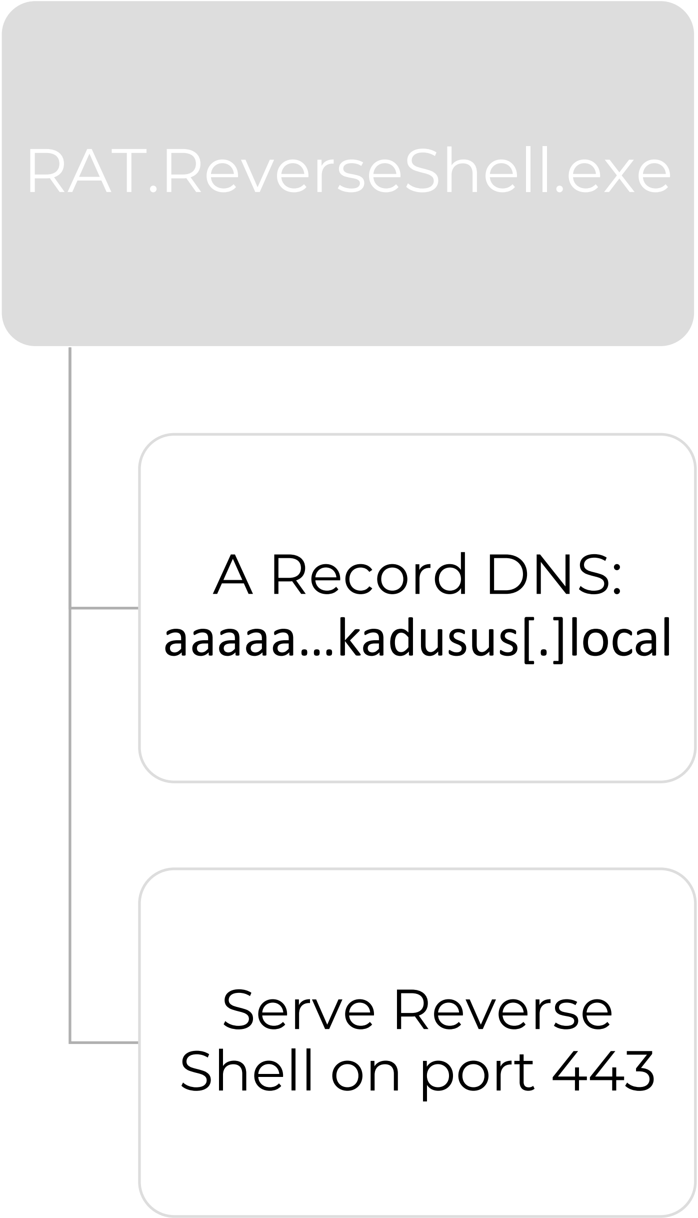
SHA256 hash	481eae82ac4cd1a9cfadc026a628b18d7b4c54f50385d28c505fbcb3e999b8b0

This Trojan’s main functionality is creating a Reverse shell listening on open on port 443 with the purpose of letting the attacker execute code remotely and have complete access to our machines

YARA signature rules are attached in Appendix A. Malware sample and hashes have been submitted to VirusTotal for further examination.

High-Level Technical Summary

This is a really basic trojan; it consists of just one file that launches an A record DNS query to aaaaaaaaaaaaaaaaaaaa[.]kadusus[.]local and if it gets a response it then serves a shell using port 443



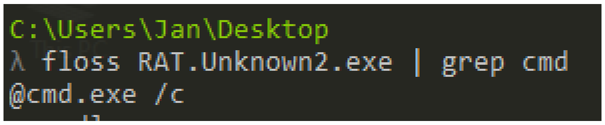
RAT.ReverseShell.exe

A Record DNS: aaaaa…kadusus[.]local

Serve Reverse Shell on port 443

Basic Static Analysis

After running floss against the RAT sample we only got one interesting result:



```
C:\Users\Jan\Desktop
λ floss RAT.Unknown2.exe | grep cmd
@cmd.exe /c
```

Fig 1: FLOSS Command Example Output

This tells us the Trojan is calling the cmd, but we still don’t know what commands it will run or any more concrete information on how it deploys the shell and when it does

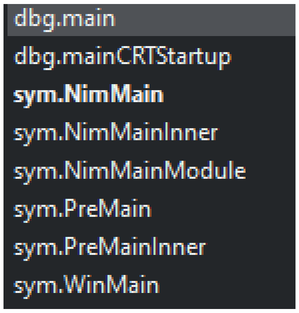
We also analyzed the binary using PEView and PEStudio and didn’t find anything incriminating, but it is interesting that this is a 64 bit executable.

Basic Dynamic Analysis

At first glance the Trojan doesn’t seem to do anything, it doesn’t spawn a shell or create any files. It is only if the domain aaaa…kadusus[.]local is reachable that it opens a TCP connection on port 443 and serves the reverse shell.

Advanced Static Analysis

Running the binary through a decompiler confirms our suspicions that this sample is written in Nim, due to the fact that the main function is divided in 4 stages: main, WinMain, NimMain and NimMainInner.



```
dbg.main
dbg.mainCRTStartup
sym.NimMain
sym.NimMainInner
sym.NimMainModule
sym.PreMain
sym.PreMainInner
sym.WinMain
```

Fig 2: Main Methods as Shown by Cutter

Some interesting parts of the assembly code can be found in Appendix C.

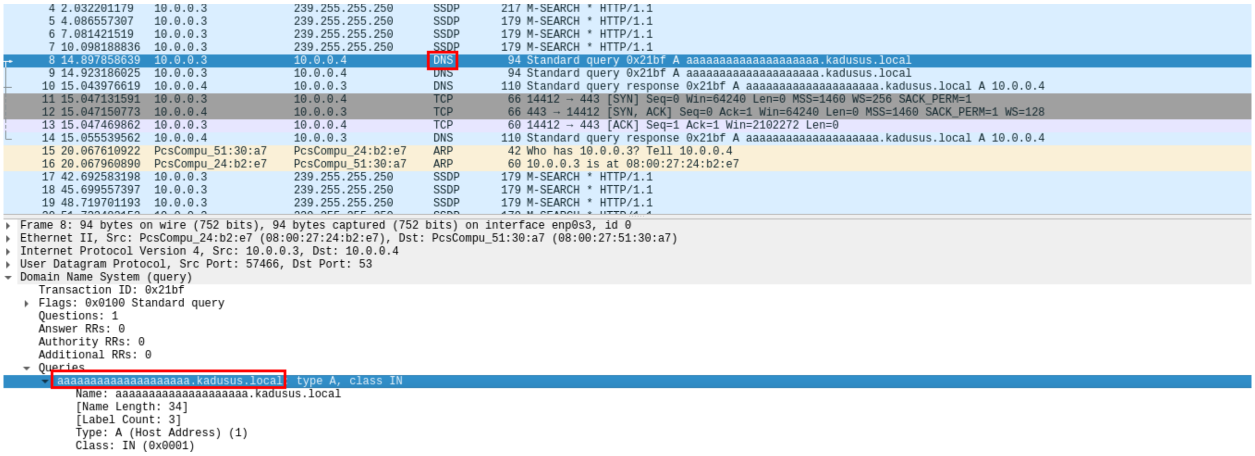
Advanced Dynamic Analysis

By running the executable through a debugger (x64dbg), we were not able to find any more important information. So, we can conclude that the only functionality of this trojan is the one we discovered during the Basic Dynamic Analysis section of this report

Indicators of Compromise

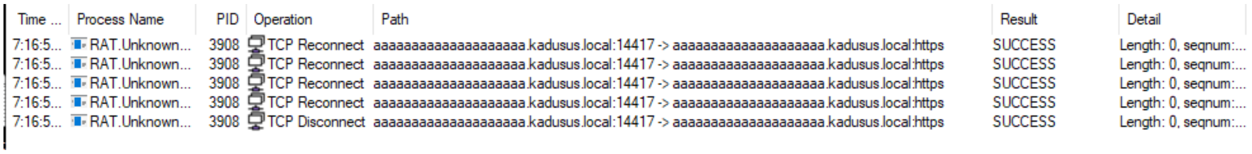
The full list of IOCs can be found in the Appendices.

Network Indicators



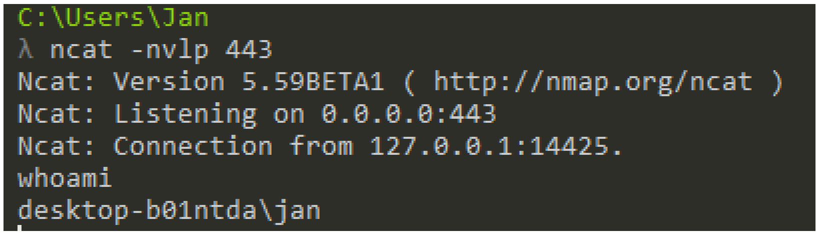
```
 4 2.032201179   10.0.0.3            239.255.255.250     SSDP      217 M-SEARCH * HTTP/1.1
 5 4.086557307   10.0.0.3            239.255.255.250     SSDP      179 M-SEARCH * HTTP/1.1
 6 7.081421519   10.0.0.3            239.255.255.250     SSDP      179 M-SEARCH * HTTP/1.1
 7 10.098188836  10.0.0.3            239.255.255.250     SSDP      179 M-SEARCH * HTTP/1.1
 8 14.897858639  10.0.0.3            10.0.0.4            DNS        94 Standard query 0x21bf A aaaaaaaaaaaaaaaaaaaa.kadusus.local
 9 14.923186025  10.0.0.3            10.0.0.4            DNS        94 Standard query 0x21bf A aaaaaaaaaaaaaaaaaaaa.kadusus.local
10 15.043976619  10.0.0.4            10.0.0.3            DNS       110 Standard query response 0x21bf A aaaaaaaaaaaaaaaaaaaa.kadusus.local A 10.0.0.4
11 15.047131591  10.0.0.3            10.0.0.4            TCP        66 14412 → 443 [SYN] Seq=0 Win=64240 Len=0 MSS=1460 WS=256 SACK_PERM=1
12 15.047150773  10.0.0.4            10.0.0.3            TCP        66 443 → 14412 [SYN, ACK] Seq=0 Ack=1 Win=64240 Len=0 MSS=1460 SACK_PERM=1 WS=128
13 15.047469862  10.0.0.3            10.0.0.4            TCP        60 14412 → 443 [ACK] Seq=1 Ack=1 Win=2102272 Len=0
14 15.055539562  10.0.0.4            10.0.0.3            DNS       110 Standard query response 0x21bf A aaaaaaaaaaaaaaaaaaaa.kadusus.local A 10.0.0.4
15 20.067610922  PcsCompu_51:30:a7   PcsCompu_24:b2:e7   ARP        42 Who has 10.0.0.3? Tell 10.0.0.4
16 20.067960890  PcsCompu_24:b2:e7   PcsCompu_51:30:a7   ARP        60 10.0.0.3 is at 08:00:27:24:b2:e7
17 42.692583198  10.0.0.3            239.255.255.250     SSDP      179 M-SEARCH * HTTP/1.1
18 45.699557397  10.0.0.3            239.255.255.250     SSDP      179 M-SEARCH * HTTP/1.1
19 48.719701193  10.0.0.3            239.255.255.250     SSDP      179 M-SEARCH * HTTP/1.1

Frame 8: 94 bytes on wire (752 bits), 94 bytes captured (752 bits) on interface enp0s3, id 0
Ethernet II, Src: PcsCompu_24:b2:e7 (08:00:27:24:b2:e7), Dst: PcsCompu_51:30:a7 (08:00:27:51:30:a7)
Internet Protocol Version 4, Src: 10.0.0.3, Dst: 10.0.0.4
User Datagram Protocol, Src Port: 57466, Dst Port: 53
Domain Name System (query)
    Transaction ID: 0x21bf
    Flags: 0x0100 Standard query
    Questions: 1
    Answer RRs: 0
    Authority RRs: 0
    Additional RRs: 0
    Queries
        aaaaaaaaaaaaaaaaaaaa.kadusus.local: type A, class IN
            Name: aaaaaaaaaaaaaaaaaaaa.kadusus.local
            [Name Length: 34]
            [Label Count: 3]
            Type: A (Host Address) (1)
            Class: IN (0x0001)
```

Fig 3: WireShark Packet Capture of DNS Query



Time ...	Process Name	PID	Operation	Path	Result	Detail
7:16:5...	RAT.Unknown...	3908	TCP Reconnect	aaaaaaaaaaaaaaaaaaaa.kadusus.local:14417 -> aaaaaaaaaaaaaaaaaaaa.kadusus.local:https	SUCCESS	Length: 0, seqnum:...
7:16:5...	RAT.Unknown...	3908	TCP Reconnect	aaaaaaaaaaaaaaaaaaaa.kadusus.local:14417 -> aaaaaaaaaaaaaaaaaaaa.kadusus.local:https	SUCCESS	Length: 0, seqnum:...
7:16:5...	RAT.Unknown...	3908	TCP Reconnect	aaaaaaaaaaaaaaaaaaaa.kadusus.local:14417 -> aaaaaaaaaaaaaaaaaaaa.kadusus.local:https	SUCCESS	Length: 0, seqnum:...
7:16:5...	RAT.Unknown...	3908	TCP Reconnect	aaaaaaaaaaaaaaaaaaaa.kadusus.local:14417 -> aaaaaaaaaaaaaaaaaaaa.kadusus.local:https	SUCCESS	Length: 0, seqnum:...
7:16:5...	RAT.Unknown...	3908	TCP Disconnect	aaaaaaaaaaaaaaaaaaaa.kadusus.local:14417 -> aaaaaaaaaaaaaaaaaaaa.kadusus.local:https	SUCCESS	Length: 0, seqnum:...

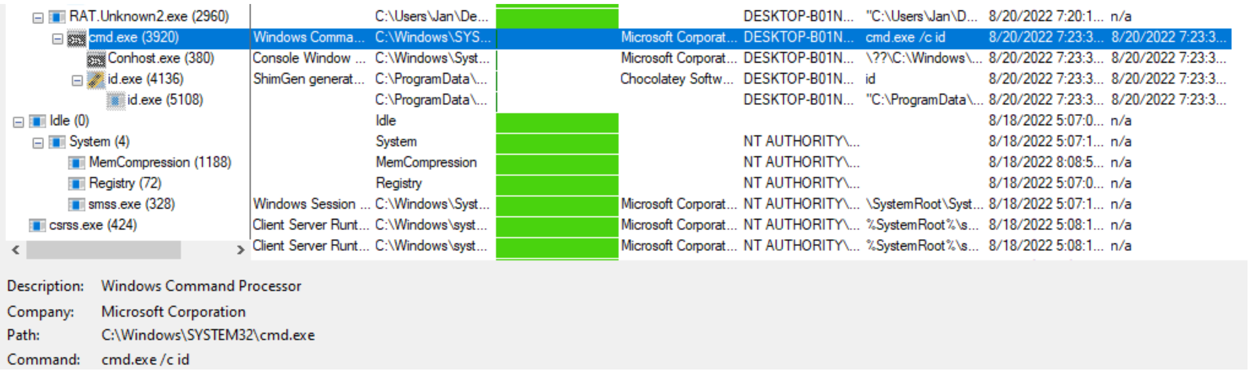
Fig 4: Trojan Serving a Reverse Shell on Port 443.



```
C:\Users\Jan
λ ncat -nvlp 443
Ncat: Version 5.59BETA1 ( http://nmap.org/ncat )
Ncat: Listening on 0.0.0.0:443
Ncat: Connection from 127.0.0.1:14425.
whoami
desktop-b01ntda\jan
```

Fig 5: Reverse Shell

Host-based Indicators



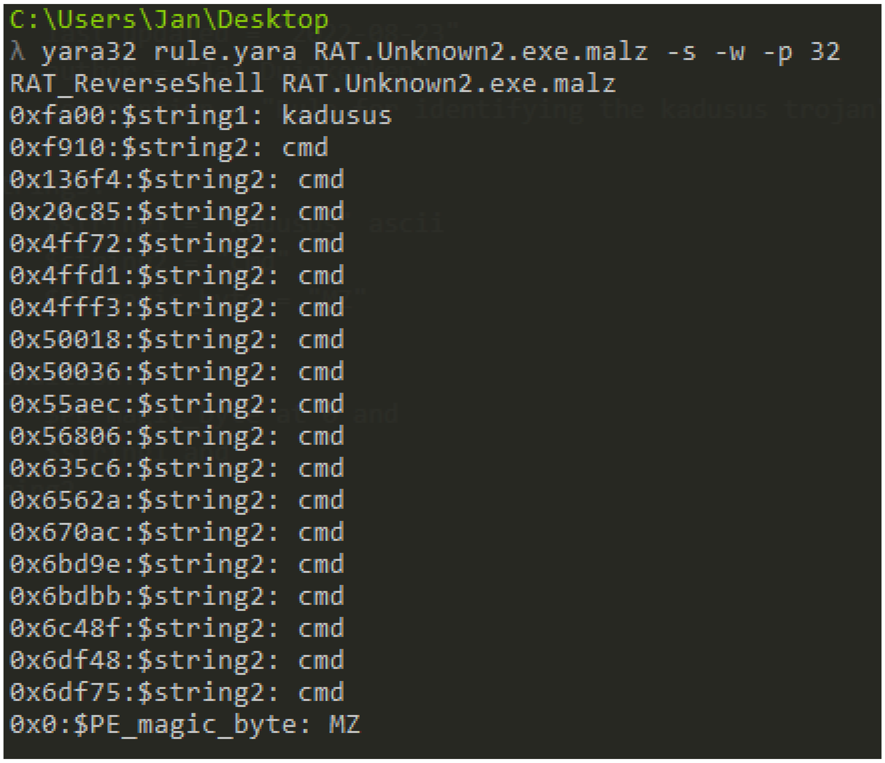
RAT.Unknown2.exe (2960)		C:\Users\Jan\De...	🟩		DESKTOP-B01N...	"C:\Users\Jan\D...	8/20/2022 7:20:1...	n/a
cmd.exe (3920)	Windows Comma...	C:\Windows\SYS...		Microsoft Corporat...	DESKTOP-B01N...	cmd.exe /c id	8/20/2022 7:23:3...	8/20/2022 7:23:3...
Conhost.exe (380)	Console Window ...	C:\Windows\Syst...		Microsoft Corporat...	DESKTOP-B01N...	\??\C:\Windows\...	8/20/2022 7:23:3...	8/20/2022 7:23:3...
id.exe (4136)	ShimGen generat...	C:\ProgramData\...		Chocolatey Softw...	DESKTOP-B01N...	id	8/20/2022 7:23:3...	8/20/2022 7:23:3...
id.exe (5108)		C:\ProgramData\...			DESKTOP-B01N...	"C:\ProgramData\...	8/20/2022 7:23:3...	8/20/2022 7:23:3...
Idle (0)		Idle	🟩				8/18/2022 5:07:0...	n/a
System (4)		System	🟩		NT AUTHORITY\...		8/18/2022 5:07:1...	n/a
MemCompression (1188)		MemCompression	🟩		NT AUTHORITY\...		8/18/2022 8:08:5...	n/a
Registry (72)		Registry	🟩		NT AUTHORITY\...		8/18/2022 5:07:0...	n/a
smss.exe (328)	Windows Session ...	C:\Windows\Syst...	🟩	Microsoft Corporat...	NT AUTHORITY\...	\SystemRoot\Syst...	8/18/2022 5:07:1...	n/a
csrss.exe (424)	Client Server Runt...	C:\Windows\syst...	🟩	Microsoft Corporat...	NT AUTHORITY\...	%SystemRoot%\s...	8/18/2022 5:08:1...	n/a
	Client Server Runt...	C:\Windows\syst...	🟩	Microsoft Corporat...	NT AUTHORITY\...	%SystemRoot%\s...	8/18/2022 5:08:1...	n/a

Description: Windows Command Processor
Company: Microsoft Corporation
Path: C:\Windows\SYSTEM32\cmd.exe
Command: cmd.exe /c id

Fig 6: RAT Process Spawning a Child CMD Process to Run the Remote Commands

Rules & Signatures

A full set of YARA rules is included in Appendix A.



```
C:\Users\Jan\Desktop
λ yara32 rule.yara RAT.Unknown2.exe.malz -s -w -p 32
RAT_ReverseShell RAT.Unknown2.exe.malz
0xfa00:$string1: kadusus
0xf910:$string2: cmd
0x136f4:$string2: cmd
0x20c85:$string2: cmd
0x4ff72:$string2: cmd
0x4ffd1:$string2: cmd
0x4fff3:$string2: cmd
0x50018:$string2: cmd
0x50036:$string2: cmd
0x55aec:$string2: cmd
0x56806:$string2: cmd
0x635c6:$string2: cmd
0x6562a:$string2: cmd
0x670ac:$string2: cmd
0x6bd9e:$string2: cmd
0x6bdbb:$string2: cmd
0x6c48f:$string2: cmd
0x6df48:$string2: cmd
0x6df75:$string2: cmd
0x0:$PE_magic_byte: MZ
```

Fig 7: YARA Rules Firing

Appendices

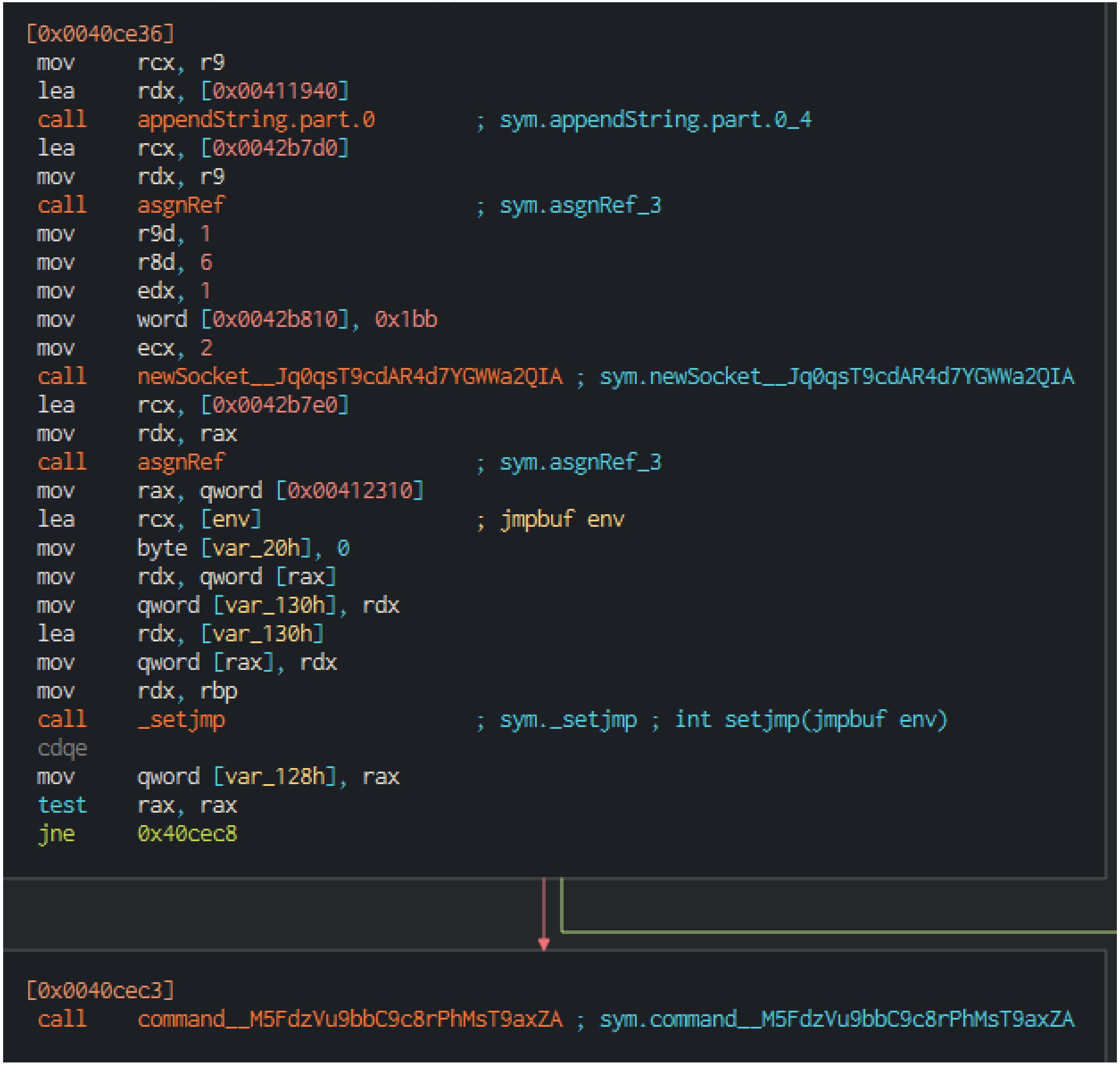
A. Yara Rules

```
rule RAT_ReverseShell {

    meta:
        last_updated = "2022-08-23"
        author = "Jan Duinkerken"
        description = "Rule for identifying the kadusus trojan"

    strings:
        $string1 = "kadusus" ascii
        $string2 = "cmd"
        $PE_magic_byte = "MZ"

    condition:
        $PE_magic_byte at 0 and
        $string1 and
        $string2
}
```

B. DNS Record Queries

Domain
aaaaaaaaaaaaaaaaaaaa[.]kadusus[.]local

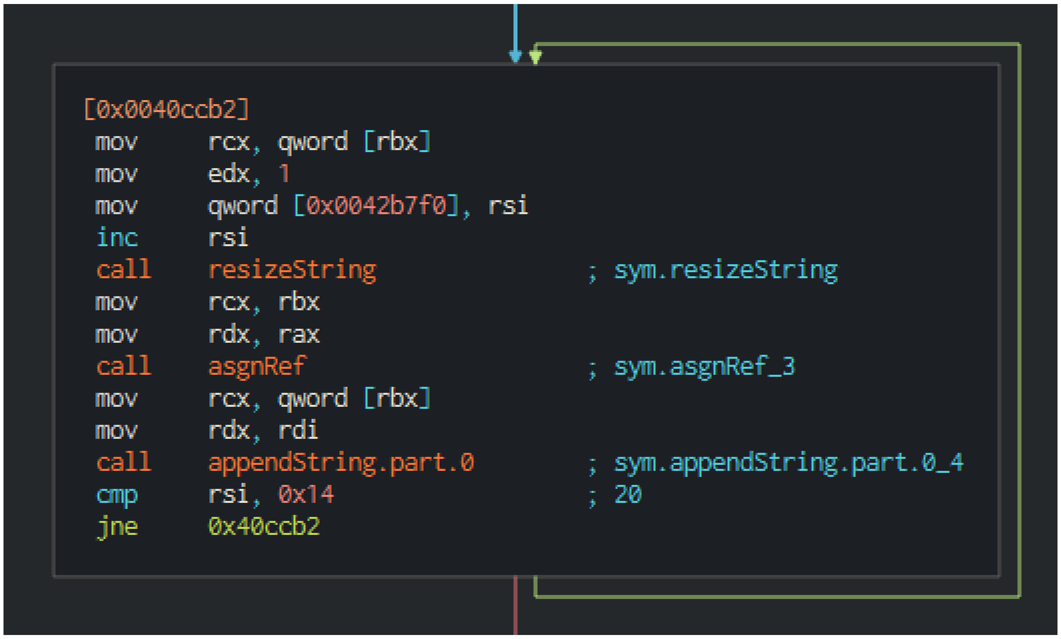
C. Decompiled Code Snippets



```
[0x0040ce36]
 mov     rcx, r9
 lea     rdx, [0x00411940]
 call    appendString.part.0        ; sym.appendString.part.0_4
 lea     rcx, [0x0042b7d0]
 mov     rdx, r9
 call    asgnRef                    ; sym.asgnRef_3
 mov     r9d, 1
 mov     r8d, 6
 mov     edx, 1
 mov     word [0x0042b810], 0x1bb
 mov     ecx, 2
 call    newSocket__Jq0qsT9cdAR4d7YGWWa2QIA ; sym.newSocket__Jq0qsT9cdAR4d7YGWWa2QIA
 lea     rcx, [0x0042b7e0]
 mov     rdx, rax
 call    asgnRef                    ; sym.asgnRef_3
 mov     rax, qword [0x00412310]
 lea     rcx, [env]                 ; jmpbuf env
 mov     byte [var_20h], 0
 mov     rdx, qword [rax]
 mov     qword [var_130h], rdx
 lea     rdx, [var_130h]
 mov     qword [rax], rdx
 mov     rdx, rbp
 call    _setjmp                    ; sym._setjmp ; int setjmp(jmpbuf env)
 cdqe
 mov     qword [var_128h], rax
 test    rax, rax
 jne     0x40cec8
```

```
[0x0040cec3]
 call    command__M5FdzVu9bbC9c8rPhMsT9axZA ; sym.command__M5FdzVu9bbC9c8rPhMsT9axZA
```

Fig 8: Create New Socket and Execute Command



```
[0x0040ccb2]
 mov     rcx, qword [rbx]
 mov     edx, 1
 mov     qword [0x0042b7f0], rsi
 inc     rsi
 call    resizeString                ; sym.resizeString
 mov     rcx, rbx
 mov     rdx, rax
 call    asgnRef                     ; sym.asgnRef_3
 mov     rcx, qword [rbx]
 mov     rdx, rdi
 call    appendString.part.0         ; sym.appendString.part.0_4
 cmp     rsi, 0x14                   ; 20
 jne     0x40ccb2
```

Fig 9: Creating the DNS Record Query Address at Runtime