THE DFIR REPORT

Real Intrusions by Real Attackers, The Truth Behind the Intrusion

REPORTS .

ANALYSTS

SERVICES ~

Thursday, October 31, 2024

ACCESS DFIR LABS

MERCHANDISE

SUBSCRIBE

CONTACT US

THREAT INTELLIGENCE

DETECTION RULES

DFIR LABS

MENTORING & COACHING PROGRAM

CASE ARTIFACTS

adfind

bazar

cobaltstrike

ransomware

rdp

ryuk

yara

Ryuk in 5 Hours

October 18, 2020

Intro

The Ryuk threat actors went from a phishing email to domain wide ransomware in 5 hours. They escalated privileges using Zerologon (CVE-2020-1472), less than 2 hours after the initial phish. They used tools such as Cobalt Strike, AdFind, WMI, and PowerShell to accomplish their objective.

Ryuk has been one of the most proficient ransomware gangs in the past few years, with the FBI claiming \$61 million USD having been paid to the group as of February 2020. Earlier in the year, the group grew a little quiet, but that seems to have changed in the past few weeks, with incidents like what occurred at UHS hospitals.

Case Summary

In our previous <u>Ryuk case</u>, we saw the threat actors leverage access to an environment via the Bazar Loader malware. This time around, we saw them accomplish their objective faster, but the

general tactics and techniques stayed similar between incidents.

Bazar was introduced to the environment again with the delivery via phishing emails. For an in depth breakdown on this loader, see <u>this analysis</u> by Roman Marshanski & <u>Vitali Kremez</u>. Bazar, once running, was seen again injecting into explorer.exe, svchost.exe, and spawning command shell processes.

From this loader we saw initial mapping of the domain, using built-in windows utilities such as NItest. However, unlike the last case, the threat actors started at a lower privileged user and rather than proceed slowly or cautiously, they exploited the recently disclosed Zerologon vulnerability (CVE-2020-1472) to reset the machine password of the primary domain controller.

Lateral movement was initiated via SMB file transfers and WMI executions of Cobalt Strike Beacons. The network indicators align similarly to the prior campaign and were noted by Kyle Ehmke in response to our last post pivoting off the prior report's intel. From memory analysis, we were also able to conclude the actors were using a trial version of Cobalt Strike with the EICAR string present in the network configuration for the beacon. Both portable executable and DLL beacons were used.

After moving laterally to the secondary domain controller, the threat actor started on more domain discovery via Net and the PowerShell Active Directory module. From there, the threat actors appeared to use the default named pipe privilege escalation module on the server. At this point, the threat actors used RDP to connect from the secondary domain controller, to the first domain controller, using the built in Administrator account.

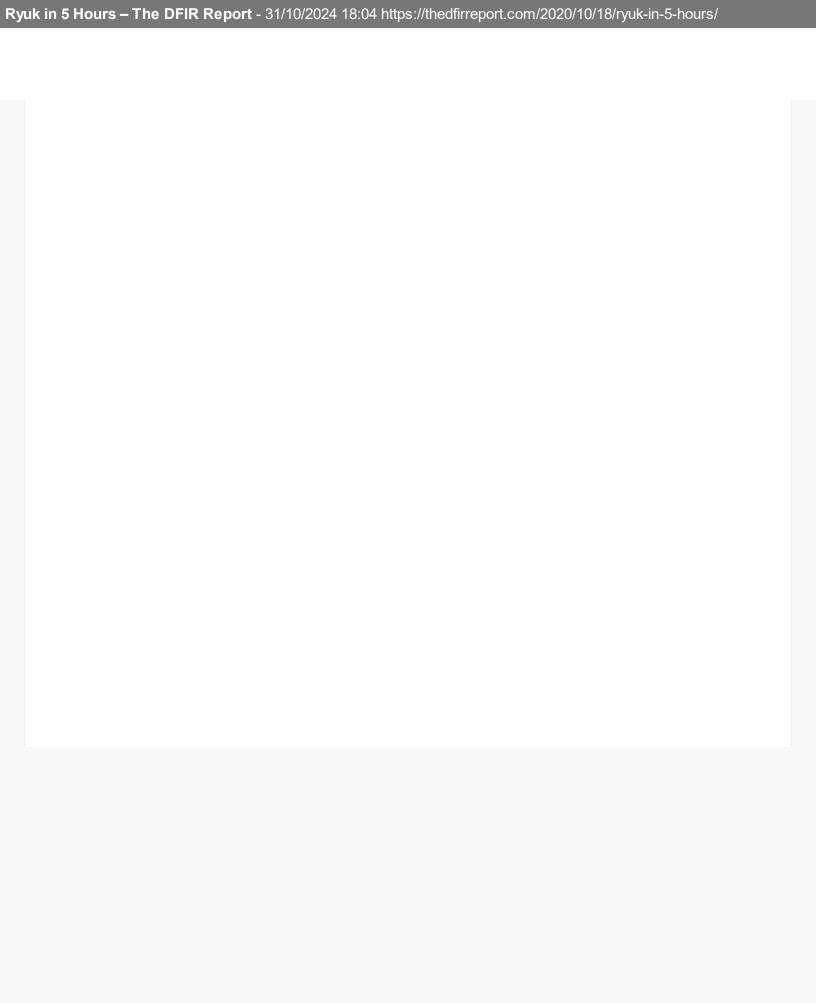
Once on the main domain controller, another Cobalt Strike beacon was dropped and executed. Then more domain reconnaissance was performed using <u>AdFind</u>. Once this completed, at the four hour mark, the threat actors were ready for their final objective.

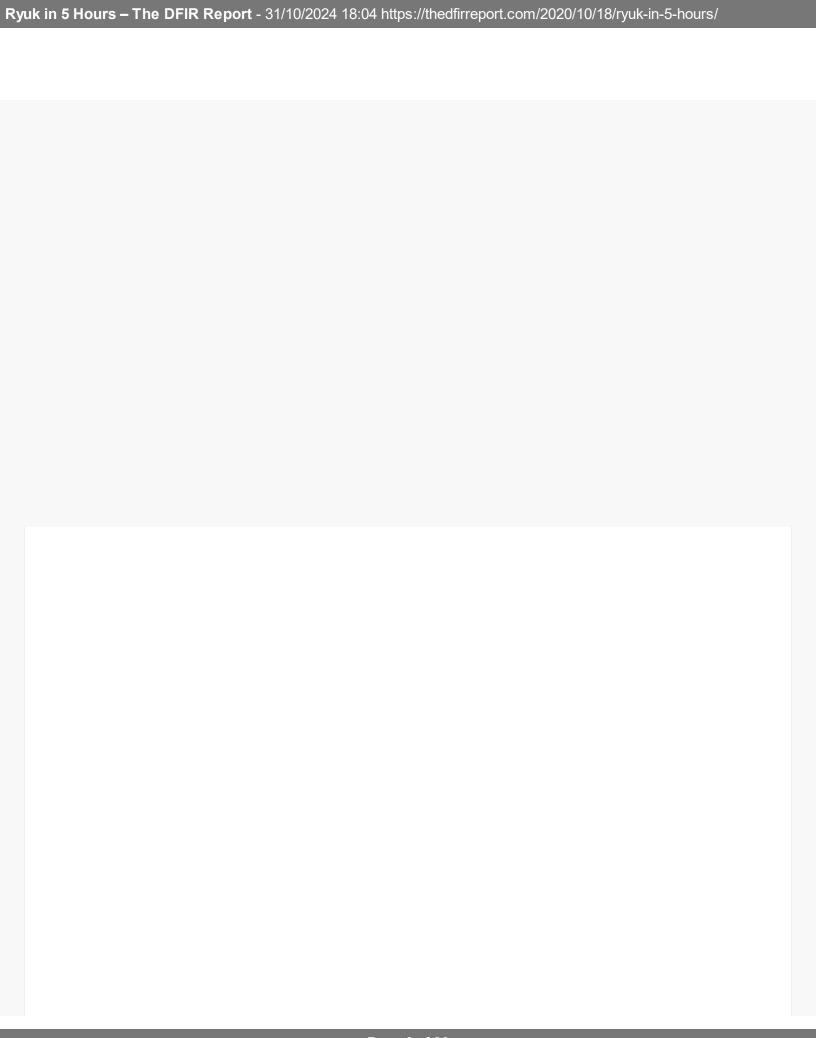
Four hours and 10 minutes in, the threat actors used the pivot from the primary domain controller to RDP into the Backup server. Backup servers were again targeted first for deployment of the ransomware executable, followed by servers and then workstations. The threat actors finished their objective by executing the ransomware on the primary domain controller, and at the 5 hour mark, the attack completed.

While last time we commented on the lead time between the first and second day to aid detection and response activity, this case goes to show that you can't count on that kind of timescale. You need to be ready to act in less than an hour, to make sure you can effectively disrupt the threat actor.

Timeline

Ryuk in 5 Hours – The DFIR Report -	· 31/10/2024 18:04 https://thedfirreport.com/2020/10/18/ryuk-in-5-hours/





MITRE ATT&CK

Initial Access

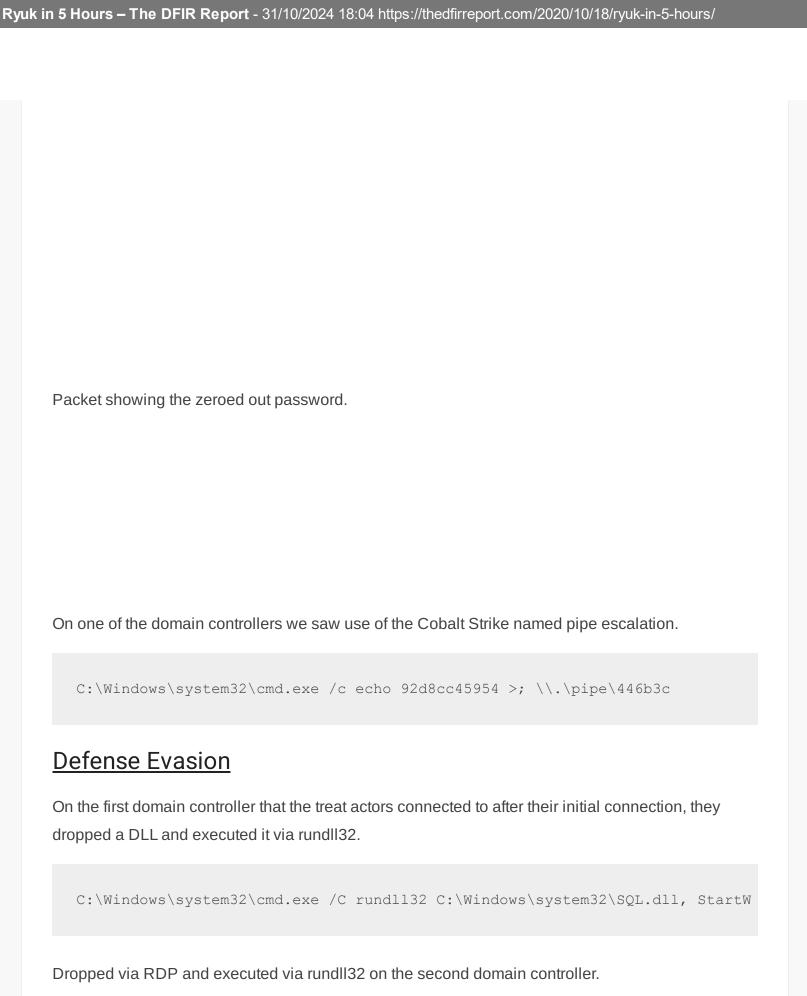
Access was initiated by a phishing email leading to the Bazar Loader malware executable.

Execution

Bazar relies on user execution of an executable to run. This user was a Domain User and did not have any other permissions.

Privilege Escalation

CVE-2020-1472 was used to reset the credentials on one of the domain controllers in the environment. After resetting the password, the threat actors then targeted a different domain controller, potentially due to breaking services by use of their exploit.



```
rundl132 C:\PerfLogs\arti64.dll, rundll
```

Shortly after, the DLL was called again via regsrv32.

```
regsvr32 C:\PerfLogs\arti64.dll
```

Then a 2nd DLL was dropped and executed in a similar manner on the 2nd DC.

```
rundll32 C:\\PerfLogs\\socks64.dll, rundll
```

Discovery

Ran on the beachhead.

```
nltest /domain_trusts /all_trusts
nltest /dclist:DOMAIN
net group "Domain admins" /DOMAIN
```

Ran on a domain controller.

```
net group "enterprise admins" /domain
nltest /domain_trusts /all_trusts
nltest /dclist:"DOMAIN"
ping DOMAINCONTROLLER
cmd.exe /C time
net user administrator /domain
```

Then they imported the PowerShell Active Directory module.

They then ran the following looking for host names, operating systems and last logon dates of all AD systems.

```
C:\Windows\system32\cmd.exe /C Get-ADComputer -Filter {enabled -eq $true} -p
```

After already completing the above discovery work and having already pivoted to their 2nd domain controller, the threat actors moved on to AdFind for further domain reconnaissance.

```
C:\Windows\Temp\adf\AdFind.exe
C:\Windows\Temp\adf\adf.bat
```

Contents of the script ran the following with AdFind.

```
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
```

The threat actor then ran this command a few times.

```
nltest /domain_trusts /all_trusts
```



The first lateral movement occurred to the domain controller not affected by the use of CVE-2020-1472. An executable was transferred to it via SMB using a domain administrator account.

After transferring the exe, the threat actors utilized WMI from the beachhead host to execute the file.

C:\Windows\system32\cmd.exe /C WMIC/node:"DC.DOMAIN.local" process call crea

The presence of the EICAR strings point to the Cobalt Strike software being used as a trial version.

They accessed the GPO's for the domain but none were modified or added.

mmc.exe" "C:\Windows\System32\gpedit.msc"

Shortly there after we saw a Cobalt Strike DLL transferred via the RDP connection.

RDP was used to pivot from the main domain controller and distribute the final ransomware payload enterprise wide.

Command and Control

After our previous report, <u>@kyleehmke</u> pivoted off of our prior Ryuk report and used the network data to link several of these <u>domains</u> which we saw in this case.

Bazar:

Report_Print.exe

3.137.182.114:443

cstr3.com

Cobalt Strike:

servisses.exe

88.119.171.94:443

Certificate [86:77:d8:5e:51:69:ac:e2:08:07:2e:b0:dc:6c:10:9e:25:80:70:a6]

Not Before 2020/10/06 13:33:55 UTC

Not After 2021/10/06 13:33:55 UTC

Issuer Org <u>lol</u>

Subject Common <u>havemosts.com</u>

Subject Org lol

Public Algorithm rsaEncryption

JA3: 57f3642b4e37e28f5cbe3020c9331b4c

JA3s: e35df3e00ca4ef31d42b34bebaa2f86e

SQL.dll

5.2.64.174:443

Certificate [36:d5:68:f9:be:2a:34:e1:76:3d:89:78:e5:62:4d:fc:ae:02:97:ad]

Not Before <u>2020/10/02 16:45:57 UTC</u>

Not After <u>2021/10/02 16:45:57 UTC</u>

Issuer Org <u>lol</u>

Subject Common <u>quwasd.com</u>

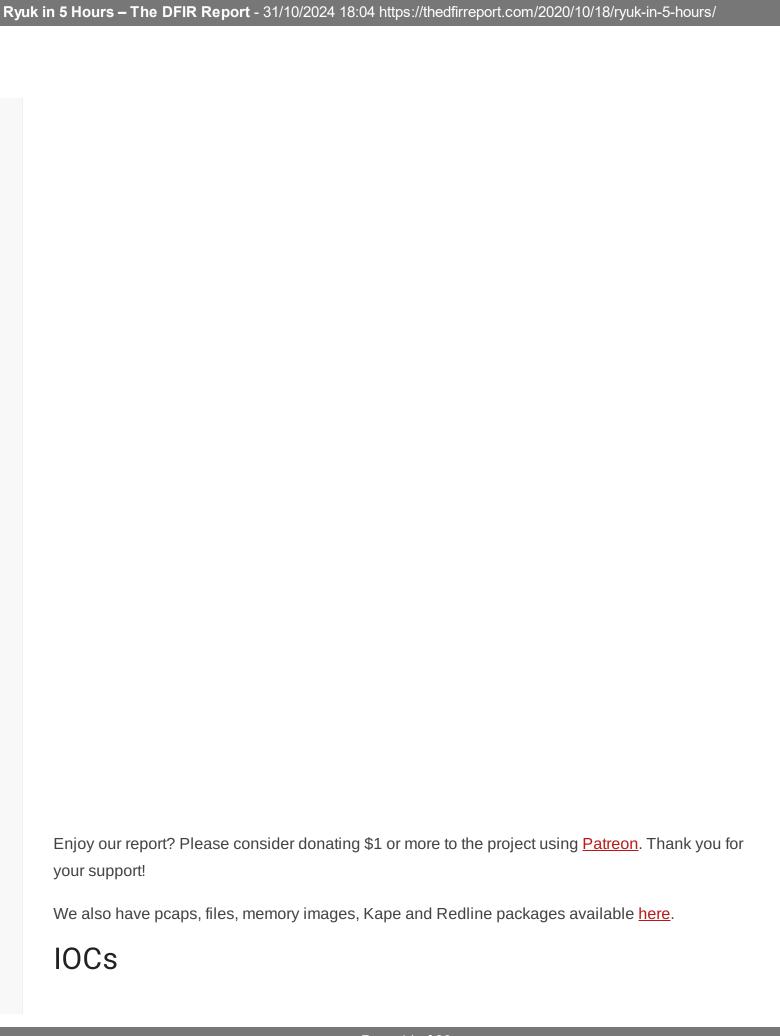
Subject Org lol

JA3: a0e9f5d64349fb13191bc781f81f42e1

JA3s: ae4edc6faf64d08308082ad26be60767

<u>Impact</u>

Starting around 4.5 hours after the initial Bazar malware was executed, the Ryuk threat actors acted on their final objectives and initiated RDP connections from the domain controller previously exploited, to the rest of the environment. This time they initiated the ransomware first on the secondary domain controller (their 1st pivot) and transferred the Ryuk executable over the RDP connection.



https://misppriv.circl.lu/events/view/80223 & https://otx.alienvault.com/pulse/5f8cce76f5614d9b220181b6

Network

```
3.137.182.114:443
cstr3.com
88.119.171.94:443
havemosts.com
5.2.64.174:443
quwasd.com
```

File

```
servisses.exe
d971827d974effedaeaf7d62b619b1dd
c3a846eb04e2fe765e56fa15a0d5c1eb650ccba3
1d8b7faf5f290465cc742e07abca78fac419135b191071cc77912263cd1dde1d
socks64.dll
890206f0c506366d480e02fc9fed988a
ba1542d9b55fff21bda9495ed884404b0436cff2
feb8c2bcb71da02dbbeecb999869e053cf96af8cce6f9705cadca4338133d3b5
SQL.dll
3785d87f6995b4b95d9b55f8d2556237
9b44a8f0bb2d65fb19e7ca7bbd85b36c176f3d60
d67461ba45a4edf3b2a69b3e64303fda8130bd1fc7a1173f35c1fe67b40c9639
arti64.dll
3785d87f6995b4b95d9b55f8d2556237
9b44a8f0bb2d65fb19e7ca7bbd85b36c176f3d60
d67461ba45a4edf3b2a69b3e64303fda8130bd1fc7a1173f35c1fe67b40c9639
xxx.exe
5b8b66ddbbf1fd67211e9a4bf78c1700
```

cdb042dd8e9dc17f677c991b386f4cd242f2628d ccde47a0d315dcd4740fccfe8e8110fbb1fd85bb305734fec409f52051790c98

Detections

Network

```
GPL NETBIOS SMB-DS IPC$ share access
ET POLICY SMB2 NT Create AndX Request For a DLL File - Possible Lateral Move
ET POLICY SMB2 NT Create AndX Request For an Executable File
```

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_susp_wmi_execution.yml

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

https://github.com/Neo23x0/sigma/blob/master/rules/windows/process_creation/win_susp_net_exec_ution.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-domina
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

```
rule ryuk 1006 servisses procdump {
meta:
description = "files - file servisses-procdump.exe"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
date = "2020-10-13"
hash1 = "387894a0b404c67e722799308b12ff2be31d2e8ce798aa53d971f0c13805d54d"
strings:
$s1 = "c:/crossdev/src/winpthreads-svn6233/src/mutex.c" fullword ascii
$s2 = "mutex global shmem" fullword ascii
$s3 = "mutex global static shmem" fullword ascii
$s4 = " pthread key dest shmem" fullword ascii
$s5 = " pthread key sch shmem" fullword ascii
$s6 = " pthread key max shmem" fullword ascii
$s7 = " pthread key lock shmem" fullword ascii
$s8 = "cannot find name of executable" fullword ascii
$s9 = "tiles32.png" fullword ascii
$s10 = "GetModuleFileName: %s" fullword ascii
$s11 = "IP DEST HOST UNREACHABLE (11003)" fullword ascii
$s12 = "This program requires Windows NT!" fullword ascii
$s13 = "SNMP INVALID SESSION" fullword ascii
$s14 = "SNMP TRAP ERRORS" fullword ascii
$s15 = "SNMP SELECT FDERRORS" fullword ascii
$s16 = "Some different radices: %d %x %o %#x %#o " fullword ascii
$s17 = "c:/crossdev/src/winpthreads-svn6233/src/rwlock.c" fullword ascii
$s18 = " pthread tls shmem" fullword ascii
$s19 = "IP DEST PORT UNREACHABLE (11005)" fullword ascii
$s20 = "pthr root shmem" fullword ascii
condition:
uint16(0) == 0x5a4d and filesize < 2000KB and
(pe.imphash() == "a90d500745a1ce2417c01fecefbc2851" or 8 of them)
rule ryuk 1006 files socks64 {
meta:
description = "files - file socks64.dll"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
```

```
date = "2020-10-13"
hash1 = "feb8c2bcb71da02dbbeecb999869e053cf96af8cce6f9705cadca4338133d3b5"
strings:
$x1 = "C:\\Users\\Izidu\\Desktop\\2019\\WindowsSDK7-Samples-master\\WindowsS
$s2 = "C:\\Users\\Izidu\\Desktop\\2019\\WindowsSDK7-Samples-master\\WindowsS
$s3 = "PluginSample.dll" fullword ascii
$s4 = "AppPolicyGetProcessTerminationMethod" fullword ascii
$s5 = "luginSample.pdb" fullword ascii
$s6 = "rundll" fullword ascii
$s7 = "AcquireSamplePlugin::DisplayConfigureDialog" fullword wide
$s8 = "AppPolicyGetThreadInitializationType" fullword ascii
$s9 = "`template-parameter-" fullword ascii
$s10 = "operator<=>" fullword ascii
$s11 = "operator co await" fullword ascii
$s12 = "AppPolicyGetWindowingModel" fullword ascii
$s13 = "Transfer Completed Successfully!" fullword wide
$s14 = "AppPolicyGetShowDeveloperDiagnostic" fullword ascii
$s15 = "noexcept" fullword ascii
$s16 = "Read-Only Photo Acquire Plugin" fullword wide
$s17 = "api-ms-win-appmodel-runtime-l1-1-2" fullword wide
$s18 = "Software\\Microsoft\\Windows\\CurrentVersion\\Photo Acquisition\\Plu
$s19 = ".?AUIUserInputString@@" fullword ascii
$s20 = "g0DVNrB\"Rtf#" fullword ascii
condition:
uint16(0) == 0x5a4d and filesize < 2000KB and
( pe.imphash() == "Ofd22f187f22ab4ec2eb55f91ccefa7a" and ( pe.exports("SGeru
}
rule ryuk 1006 Report Print {
meta:
description = "files - file Report Print.exe"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
date = "2020-10-13"
hash1 = "23ac461f9b5128841cafabb4282432252ea7b57874595cf6fe8457fc1ac65007"
strings:
```

```
$s1 = "kErNel32.Dll" fullword wide
$s2 = "DOOKOL.exe" fullword ascii
$s3 = "c:/crossdev/src/winpthreads-svn6233/src/mutex.c" fullword ascii
$s4 = "hmutex" fullword ascii
$s5 = ". FindPESectionExec" fullword ascii
$s6 = "mutex global shmem" fullword ascii
$s7 = "processthreadsapi.h" fullword ascii
$s8 = "mutex global static shmem" fullword ascii
$s9 = "TargetIp" fullword ascii
$s10 = "c:\\crossdev\\gccmaster\\build-tdm64\\gcc\\x86 64-w64-mingw32\\libgc
$s11 = "h:\\crossdev\\gccmaster\\build-tdm64\\runtime\\mingw-w64-crt" fullwc
$s12 = "J mingw winmain lpCmdLine" fullword ascii
$s13 = "GNU C 4.8.1 - mtune = generic - march = x86 - 64 - g - 02 - 02 - 02 - fbuilding - 1
$s14 = "GNU C 4.8.1 - mtune = generic - march = x86 - 64 - g - 02 - 02 - 02 - fbuilding - 1
$s15 = "GNU C 4.8.1 - m64 - mtune = generic - march = x86 - 64 - g - 02 - std = gnu99" ful
$s16 = "GNU C 4.8.1 -mtune=generic -march=x86-64 -q -02 -02 -02 -fbuilding-l
$s17 = "9lpszCommandLine" fullword ascii
$s18 = "= mingw GetSectionForAddress" fullword ascii
$s19 = " mingw winmain lpCmdLine" fullword ascii
$s20 = "%Target" fullword ascii
condition:
uint16(0) == 0x5a4d and filesize < 3000KB and
(pe.imphash() == "8f0088451a1156246379abc67514cacf" and pe.exports("CSBhvSW
rule ryuk 1006 files xxx {
meta:
description = "files - file xxx.exe"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
date = "2020-10-13"
hash1 = "ccde47a0d315dcd4740fccfe8e8110fbb1fd85bb305734fec409f52051790c98"
strings:
$s1 = "DOOKOL.exe" fullword ascii
$s2 = "c:/crossdev/src/winpthreads-svn6233/src/mutex.c" fullword ascii
$s3 = "hmutex" fullword ascii
$s4 = "mutex global shmem" fullword ascii
$s5 = "processthreadsapi.h" fullword ascii
```

```
$s6 = "mutex global static shmem" fullword ascii
$s7 = "fake get output format" fullword ascii
$s8 = "&rvaTarget" fullword ascii
$s9 = "h:\\crossdev\\gccmaster\\build-tdm64\\runtime\\mingw-w64-crt" fullwor
s=0 = "c:\\crossdev\\gccmaster\\build-tdm64\\gcc\\x86 64-w64-mingw32\\32\\1
$s11 = "E mingw winmain lpCmdLine" fullword ascii
$s12 = "GNU C 4.8.1 -m32 -mtune=generic -march=x86-64 -g -O2 -O2 -fbuild
$s13 = "GNU C 4.8.1 - m32 - mtune = generic - march = x86 - 64 - g - 02 - 02 - 02 - fbuild
$s14 = "GNU C 4.8.1 - m32 - mtune = generic - march = x86 - 64 - g - 02 - 02 - 02 - fbuild
$s15 = "GNU C 4.8.1 - m32 - mtune = generic - march = x86 - 64 - g - 02 - std = gnu99" ful
$s16 = " mingw winmain lpCmdLine" fullword ascii
$s17 = "Npthread getspecific" fullword ascii
$s18 = " gthread getspecific" fullword ascii
$s19 = "= mingw GetSectionForAddress" fullword ascii
$s20 = "4lpszCommandLine" fullword ascii
condition:
uint16(0) == 0x5a4d and filesize < 2000KB and
(pe.imphash() == "00f3261b5b33a9b1e8b6003f4056a885" and pe.exports("CSBhvSW
rule ryuk 1006 servisses {
meta:
description = "files - file servisses.exe"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
date = "2020-10-13"
hash1 = "1d8b7faf5f290465cc742e07abca78fac419135b191071cc77912263cd1dde1d"
strings:
$s1 = "DOOKOL.exe" fullword ascii
$s2 = "c:/crossdev/src/winpthreads-svn6233/src/mutex.c" fullword ascii
$s3 = "mutex global shmem" fullword ascii
$s4 = "mutex global static shmem" fullword ascii
$s5 = " pthread key dest shmem" fullword ascii
$s6 = " pthread key max shmem" fullword ascii
$s7 = " pthread key sch shmem" fullword ascii
$s8 = " pthread key lock shmem" fullword ascii
```

```
$s9 = "cannot find name of executable" fullword ascii
$s10 = "tiles32.png" fullword ascii
$s11 = "GetModuleFileName: %s" fullword ascii
$s12 = "IP DEST HOST UNREACHABLE (11003)" fullword ascii
$s13 = "This program requires Windows NT!" fullword ascii
$s14 = "SNMP INVALID SESSION" fullword ascii
$s15 = "SNMP TRAP ERRORS" fullword ascii
$s16 = "SNMP SELECT FDERRORS" fullword ascii
$s17 = "Some different radices: %d %x %o %#x %#o " fullword ascii
$s18 = "c:/crossdev/src/winpthreads-svn6233/src/rwlock.c" fullword ascii
$s19 = " pthread tls shmem" fullword ascii
$s20 = "IP DEST PORT UNREACHABLE (11005)" fullword ascii
condition:
uint16(0) == 0x5a4d and filesize < 2000KB and
(pe.imphash() == "a90d500745a1ce2417c01fecefbc2851" and pe.exports("KADWEGA
rule ryuk 1006 files SQL {
meta:
description = "files - file SQL.dll"
author = "The DFIR Report"
reference = "https://thedfirreport.com"
date = "2020-10-13"
hash1 = "d67461ba45a4edf3b2a69b3e64303fda8130bd1fc7a1173f35c1fe67b40c9639"
strings:
$s1 = ".data$ ZN12 GLOBAL N 110fake mutexE" fullword ascii
$s2 = ".data$ ZZN12 GLOBAL N 116get static mutexEvE4once" fullword ascii
$s3 = "DOOKOL.dll" fullword ascii
$s4 = " ZN12 GLOBAL N 110fake mutexE" fullword ascii
$s5 = " ZZN12 GLOBAL N 116qet static mutexEvE4once" fullword ascii
$s6 = ".data$ ZN12 GLOBAL N 115emergency mutexE" fullword ascii
$s7 = ".data$ ZN12 GLOBAL N 1L12static mutexE" fullword ascii
$s8 = " shmem winpthreads grabber mutex global shmem" fullword ascii
$s9 = " shmem winpthreads init mutex global shmem" fullword ascii
$s10 = " shmem winpthreads ptr mutex global shmem" fullword ascii
$s11 = "c:/crossdev/src/winpthreads-svn6233/src/mutex.c" fullword ascii
$s12 = "pthread mutex lock intern" fullword ascii
$s13 = " shmem winpthreads init mutex global static shmem" fullword ascii
```

```
$s14 = "__shmem_winpthreads_grabber_mutex_global_static_shmem" fullword asci
$s15 = "__shmem_winpthreads_ptr_mutex_global_static_shmem" fullword ascii
$s16 = "_Z7ExecutePv" fullword ascii
$s17 = "hmutex" fullword ascii
$s18 = "._FindPESectionExec" fullword ascii
$s19 = "_ZN9__gnu_cxx17__recursive_mutex6unlockEv" fullword ascii
$s20 = ".text$_ZN9__gnu_cxx17__recursive_mutex6unlockEv" fullword ascii
condition:
uint16(0) == 0x5a4d and filesize < 2000KB and
( pe.imphash() == "d16819dafefb97404d0d0e42adb82e5c" and ( pe.exports("CSBhv))</pre>
```

If you have detections you would like to add to this section, please contact us and we will credit you.

MITRE

Spearphishing Link – T1192

- Remote Desktop Protocol T1076
- Remote File Copy T1105
- ♦ Windows Management Instrumentation T1047
- Command-Line Interface T1059
- Omain Trust Discovery T1482
- Remote System Discovery T1018
- System Time Discovery T1124
- ♦ Data Encrypted for Impact T1486
- ♦ Commonly Used Port T1043

Standard Application Layer Protocol − T1071		
Standard Cryptographic Protocol – T1032		
♦ User Execution – T1204		
♦ Valid Accounts – T1078		
Sexploitation for Privilege Escalation – T1068		
Signed Binary Proxy Execution – T1218		
(internal case 1006)		
Share this: Twitter LinkedIn Reddit Facebook WhatsApp adfind _ bazar _ cobalt strike _ kegtap _ malspam _ ryuk		
≪ RYUK'S RETURN RYUK SPEED RUN, 2 HOURS TO RANSOM >>		
Coord		
Search Search		

Type your email...

Subscribe



Register For Our Next CTF



Reports



Threat Intelligence



Detection Rules



DFIR Labs



Mentoring and Coaching

Proudly powered by WordPress | Copyright 2023 | The DFIR Report | All Rights Reserved