Cybereason vs. RansomEXX Ransomware

cybereason.com/blog/cybereason-vs.-ransomexx-ransomware

Over the last few months, the Cybereason Nocturnus Team has been tracking the activity around the RansomEXX ransomware. It has been active since 2018, but came to fame in 2020 in attacks on major organizations such as the Texas Department of Transportation. RansomEXX started as a Windows variant, but a Linux variant was discovered earlier this year.

Key Findings

Human-operated targeted attacks: RansomEXX is being used as a part of multi-staged human-operated attacks targeting various government related entities and tech companies. It is being delivered as a secondary payload after initial compromise of the targeted network.

Disables security products: The Windows variant has a functionality that was seen before in other ransomware, disabling various security products for a smooth execution on the infected machine.

Multi-Platform: RansomEXX started solely as a Windows variant, but later a Linux variant was added to the arsenal, sharing similarities with its predecessor.

Fileless ransomware: RansomEXX is usually delivered as a secondary in-memory payload without ever touching the disk, which makes it harder to detect.

Detected and prevented: The Cybereason Defense Platform fully detects and prevents the RansomEXX ransomware.

Background

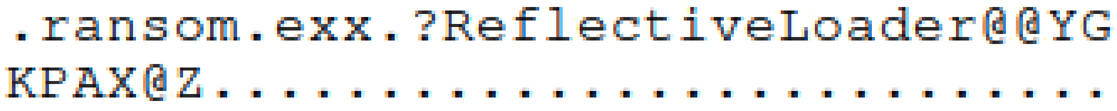
TheRansomEXX family, also known as Defray777 and Ransom X, runs as a solely in-memory payload that is not dropped to disk, making it highly evasive. RansomEXX was involved in three major attacks in 2020 against Texas TxDOT in May of 2020, against Konica Minolta in the end of July, and against Brazil's court system in the beginning of November.

In addition, last December RansomEXX operators published stolen credentials from Embraer, one of the largest aircraft makers in the world, on its own leaks website as part of the ongoing double extortion trend.

In mid 2020, a Linux variant of RansomEXX emerged. This variant, despite sharing similarities with the Windows variant, is simpler than its predecessor and lacks many features such as disabling security software and command and control communication. There are decryptors for both variants, and the threat actors send paying victims a private key to decode their files.

RansomEXX Analysis

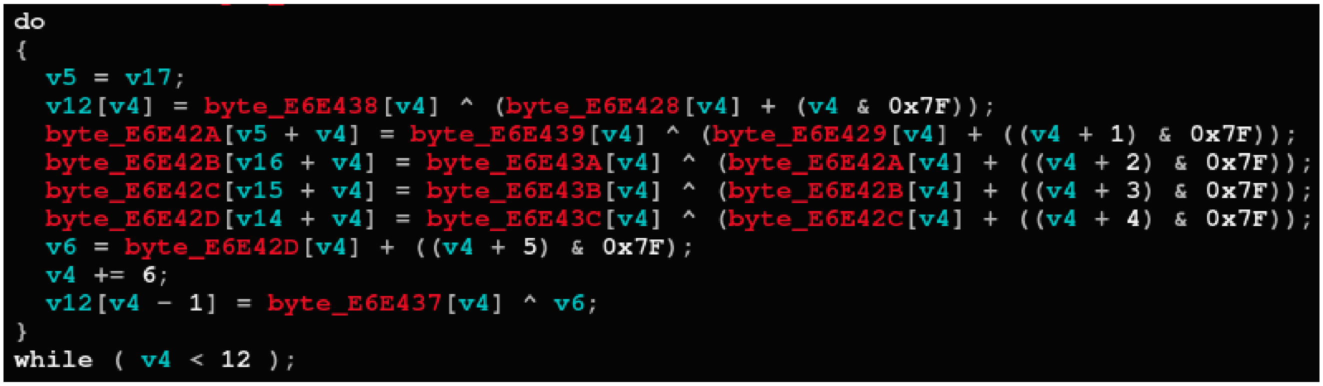
This analysis focuses on the Windows variant of RansomEXX, which can be classified as fileless malware because it is reflectively loaded and executed in memory without touching the disk. Analysis of this sample reveals that it is partially obfuscated but includes indicative information such as the “ransome.exx” string that can be seen hard coded in the binary:



```
.ransom.exx.?ReflectiveLoader@@YG
KPAX@Z...........................
```

ransom.exx string hardcoded in the binary

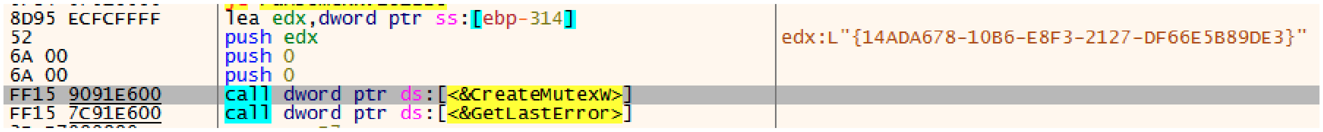
Upon execution, RansomEXX starts decrypting some strings necessary for its operation:



```
do
{
  v5 = v17;
  v12[v4] = byte_E6E438[v4] ^ (byte_E6E428[v4] + (v4 & 0x7F));
  byte_E6E42A[v5 + v4] = byte_E6E439[v4] ^ (byte_E6E429[v4] + ((v4 + 1) & 0x7F));
  byte_E6E42B[v16 + v4] = byte_E6E43A[v4] ^ (byte_E6E42A[v4] + ((v4 + 2) & 0x7F));
  byte_E6E42C[v15 + v4] = byte_E6E43B[v4] ^ (byte_E6E42B[v4] + ((v4 + 3) & 0x7F));
  byte_E6E42D[v14 + v4] = byte_E6E43C[v4] ^ (byte_E6E42C[v4] + ((v4 + 4) & 0x7F));
  v6 = byte_E6E42D[v4] + ((v4 + 5) & 0x7F);
  v4 += 6;
  v12[v4 - 1] = byte_E6E437[v4] ^ v6;
}
while ( v4 < 12 );
```

RansomEXX's strings decryption routine

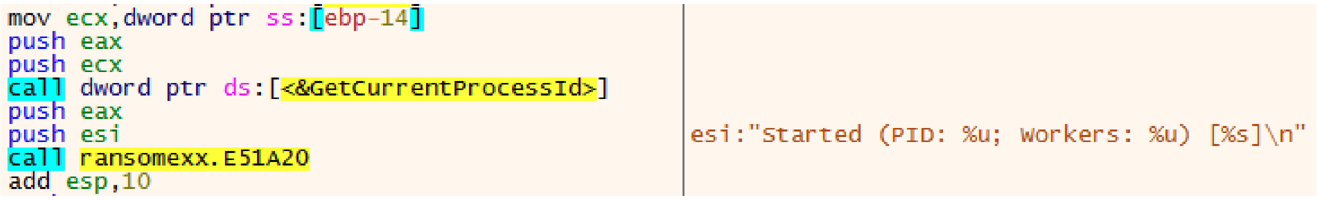
The mutex the malware creates is generated from the GUID of the infected machine:



```
8D95 ECFCFFFF    lea edx,dword ptr ss:[ebp-314]
52               push edx                            edx:L"{14ADA678-10B6-E8F3-2127-DF66E5B89DE3}"
6A 00            push 0
6A 00            push 0
FF15 9091E600    call dword ptr ds:[<&CreateMutexW>]
FF15 7C91E600    call dword ptr ds:[<&GetLastError>]
```

The GUID generated on the infected machine

The decrypted strings at this point include mainly logs:

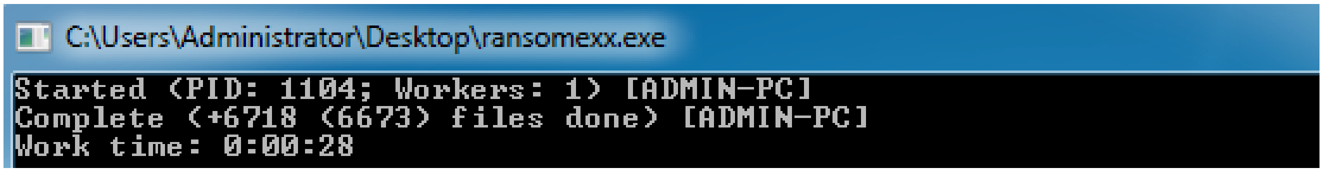


```
mov ecx,dword ptr ss:[ebp-14]
push eax
push ecx
call dword ptr ds:[<&GetCurrentProcessId>]
push eax
push esi                                  esi:"Started (PID: %u; Workers: %u) [%s]\n"
call ransomexx.E51A20
add esp,10
```

Decrypted logging string

RansomEXX spawns a separate thread in the background to handle the logging process.

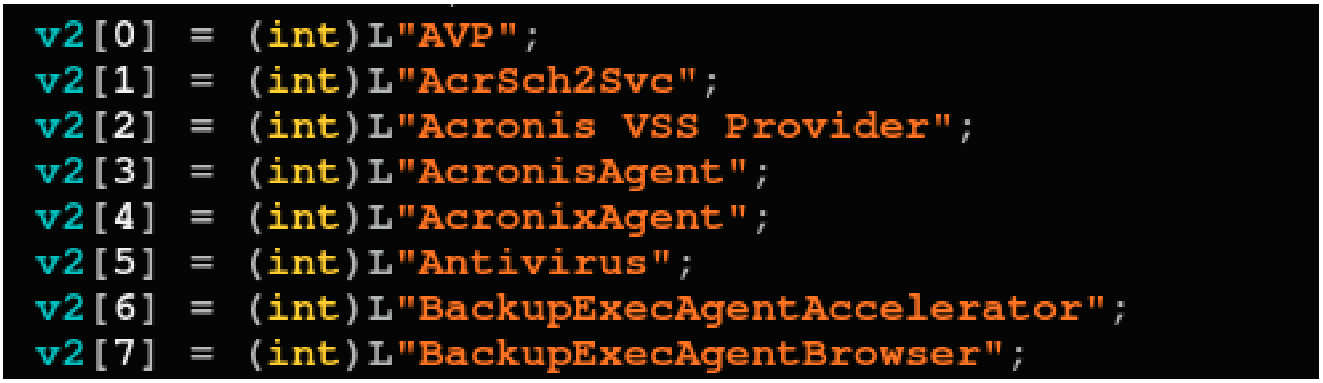
When debugging the sample, the logs themselves can be seen in the console:



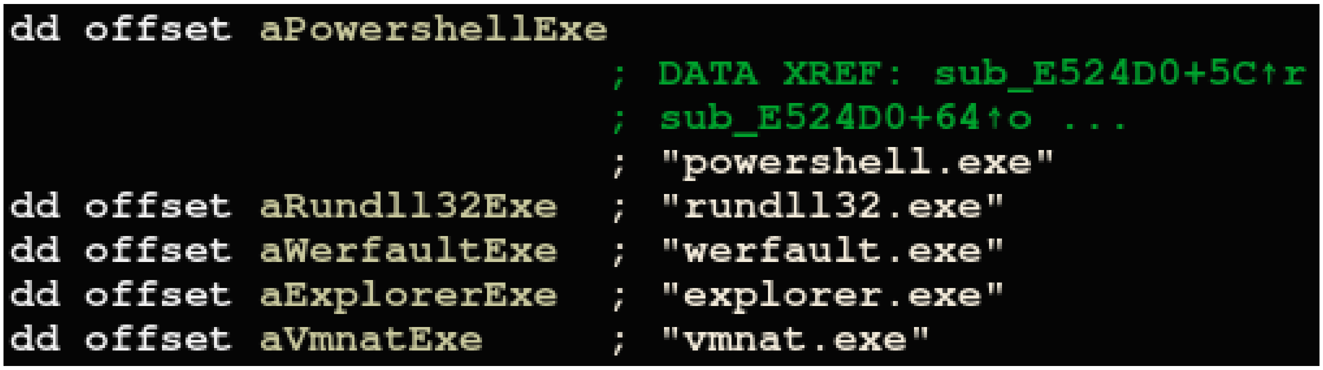
```
Started (PID: 1104; Workers: 1) [ADMIN-PC]
Complete (+6718 (6673) files done) [ADMIN-PC]
Work time: 0:00:28
```

Logging as seen in the command line

The malware then continues with terminating processes and system services that may interfere with the execution, but excludes those that are relevant for its execution:



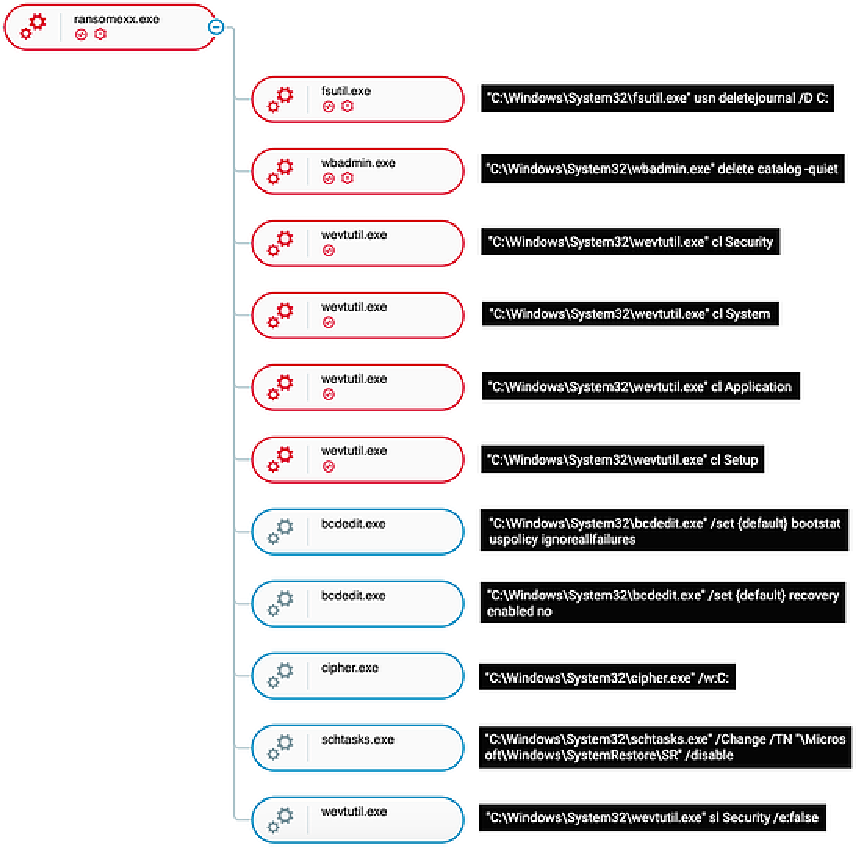
```
v2[0] = (int)L"AVP";
v2[1] = (int)L"AcrSch2Svc";
v2[2] = (int)L"Acronis VSS Provider";
v2[3] = (int)L"AcronisAgent";
v2[4] = (int)L"AcronixAgent";
v2[5] = (int)L"Antivirus";
v2[6] = (int)L"BackupExecAgentAccelerator";
v2[7] = (int)L"BackupExecAgentBrowser";
```



```
dd offset aPowershellExe
                                ; DATA XREF: sub_E524D0+5C↑r
                                ; sub_E524D0+64↑o ...
                                ; "powershell.exe"
dd offset aRundll32Exe          ; "rundll32.exe"
dd offset aWerfaultExe          ; "werfault.exe"
dd offset aExplorerExe          ; "explorer.exe"
dd offset aVmnatExe             ; "vmnat.exe"
```

Some of the terminated services as well as processes excluded from termination

Cybereason detects the execution of RansomEXX together with the below listed commands that are executed post-encryption. These commands' role is to prevent the victim from restoring their system by deleting backups, Windows error recovery etc. Cybereason also detects this malicious usage of Windows utilities:



```
"C:\Windows\System32\fsutil.exe" usn deletejournal /D C:
"C:\Windows\System32\wbadmin.exe" delete catalog -quiet
"C:\Windows\System32\wevtutil.exe" cl Security
"C:\Windows\System32\wevtutil.exe" cl System
"C:\Windows\System32\wevtutil.exe" cl Application
"C:\Windows\System32\wevtutil.exe" cl Setup
"C:\Windows\System32\bcdedit.exe" /set {default} bootstat
uspolicy ignoreallfailures
"C:\Windows\System32\bcdedit.exe" /set {default} recovery
enabled no
"C:\Windows\System32\cipher.exe" /w:C:
"C:\Windows\System32\schtasks.exe" /Change /TN "\Micros
oft\Windows\SystemRestore\SR" /disable
"C:\Windows\System32\wevtutil.exe" sl Security /e:false
```

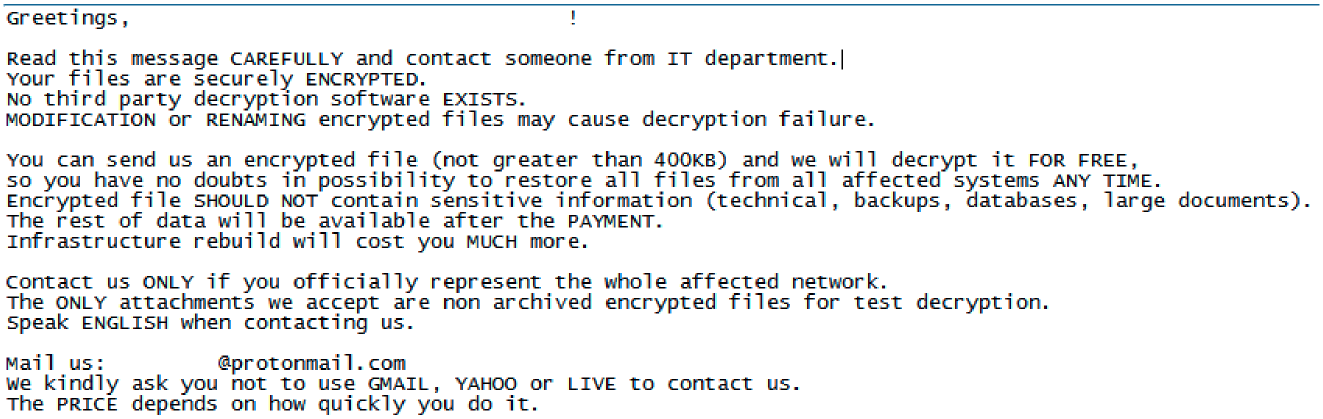
RansomEXX's attack tree as seen in the Cybereason Defense Platform

The depicted above commands are as follows:

Command	Action
"C:\Windows\System32\fsutil.exe" usn deletejournal /D C:	fsutil.exe deletes the Update Sequence Number journal
"C:\Windows\System32\wbadmin.exe" delete catalog -quiet	wbadmin.exe deletes the backup catalog
"C:\Windows\System32\wevtutil.exe" cl Setup "C:\Windows\System32\wevtutil.exe" cl System "C:\Windows\System32\wevtutil.exe" cl Application "C:\Windows\System32\wevtutil.exe" cl Security	wevtutil clears event logs
"C:\Windows\System32\bcdedit.exe" /set {default} bootstatuspolicy ignoreallfailures "C:\Windows\System32\bcdedit.exe" /set {default} recoveryenabled no	bcdedit disable recovery mode

"C:\Windows\System32\cipher.exe" /w:C:	cipher overwrites deleted data in drive C
"C:\Windows\System32\schtasks.exe" /Change /TN "\Microsoft\Windows\SystemRestore\SR" /disable	schtasks disables the system restore scheduled task
"C:\Windows\System32\wevtutil.exe" sl Security /e:false	wevtutil disables the security event logs

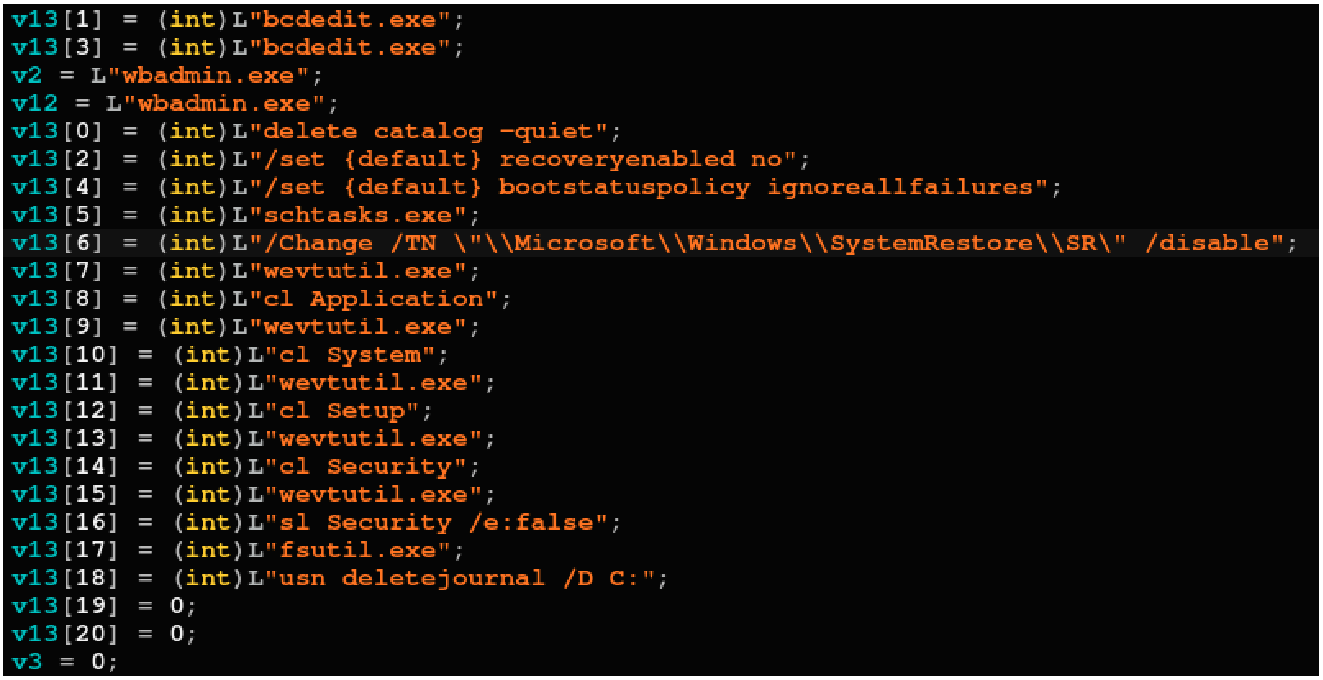
After preparation of the environment RansomEXX encrypted the files on the victim's machine and the following note is left on the machine:



```
Greetings,                                  !

Read this message CAREFULLY and contact someone from IT department.
Your files are securely ENCRYPTED.
No third party decryption software EXISTS.
MODIFICATION or RENAMING encrypted files may cause decryption failure.

You can send us an encrypted file (not greater than 400KB) and we will decrypt it FOR FREE,
so you have no doubts in possibility to restore all files from all affected systems ANY TIME.
Encrypted file SHOULD NOT contain sensitive information (technical, backups, databases, large documents).
The rest of data will be available after the PAYMENT.
Infrastructure rebuild will cost you MUCH more.

Contact us ONLY if you officially represent the whole affected network.
The ONLY attachments we accept are non archived encrypted files for test decryption.
Speak ENGLISH when contacting us.

Mail us:         @protonmail.com
We kindly ask you not to use GMAIL, YAHOO or LIVE to contact us.
The PRICE depends on how quickly you do it.
```

The ransom note left on the victim's machine

The commands that disable file recovery and system restore after successfully encrypting the victim's files, and can also be observed clearly in the sample's code:

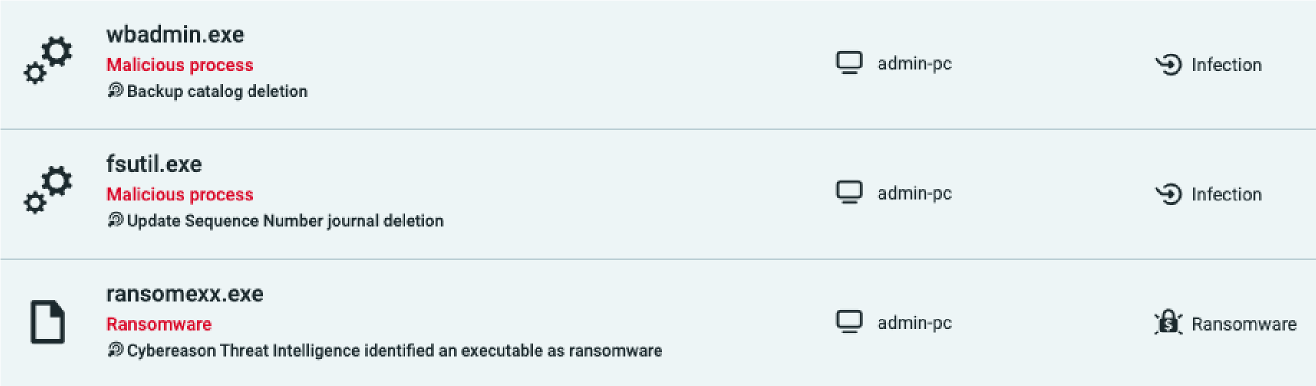


```
v13[1] = (int)L"bcdedit.exe";
v13[3] = (int)L"bcdedit.exe";
v2 = L"wbadmin.exe";
v12 = L"wbadmin.exe";
v13[0] = (int)L"delete catalog -quiet";
v13[2] = (int)L"/set {default} recoveryenabled no";
v13[4] = (int)L"/set {default} bootstatuspolicy ignoreallfailures";
v13[5] = (int)L"schtasks.exe";
v13[6] = (int)L"/Change /TN \"\\Microsoft\\Windows\\SystemRestore\\SR\" /disable";
v13[7] = (int)L"wevtutil.exe";
v13[8] = (int)L"cl Application";
v13[9] = (int)L"wevtutil.exe";
v13[10] = (int)L"cl System";
v13[11] = (int)L"wevtutil.exe";
v13[12] = (int)L"cl Setup";
v13[13] = (int)L"wevtutil.exe";
v13[14] = (int)L"cl Security";
v13[15] = (int)L"wevtutil.exe";
v13[16] = (int)L"sl Security /e:false";
v13[17] = (int)L"fsutil.exe";
v13[18] = (int)L"usn deletejournal /D C:";
v13[19] = 0;
v13[20] = 0;
v3 = 0;
```

Part of the post-encryption commands in RansomEXX’s code

Cybereason Detection and Prevention

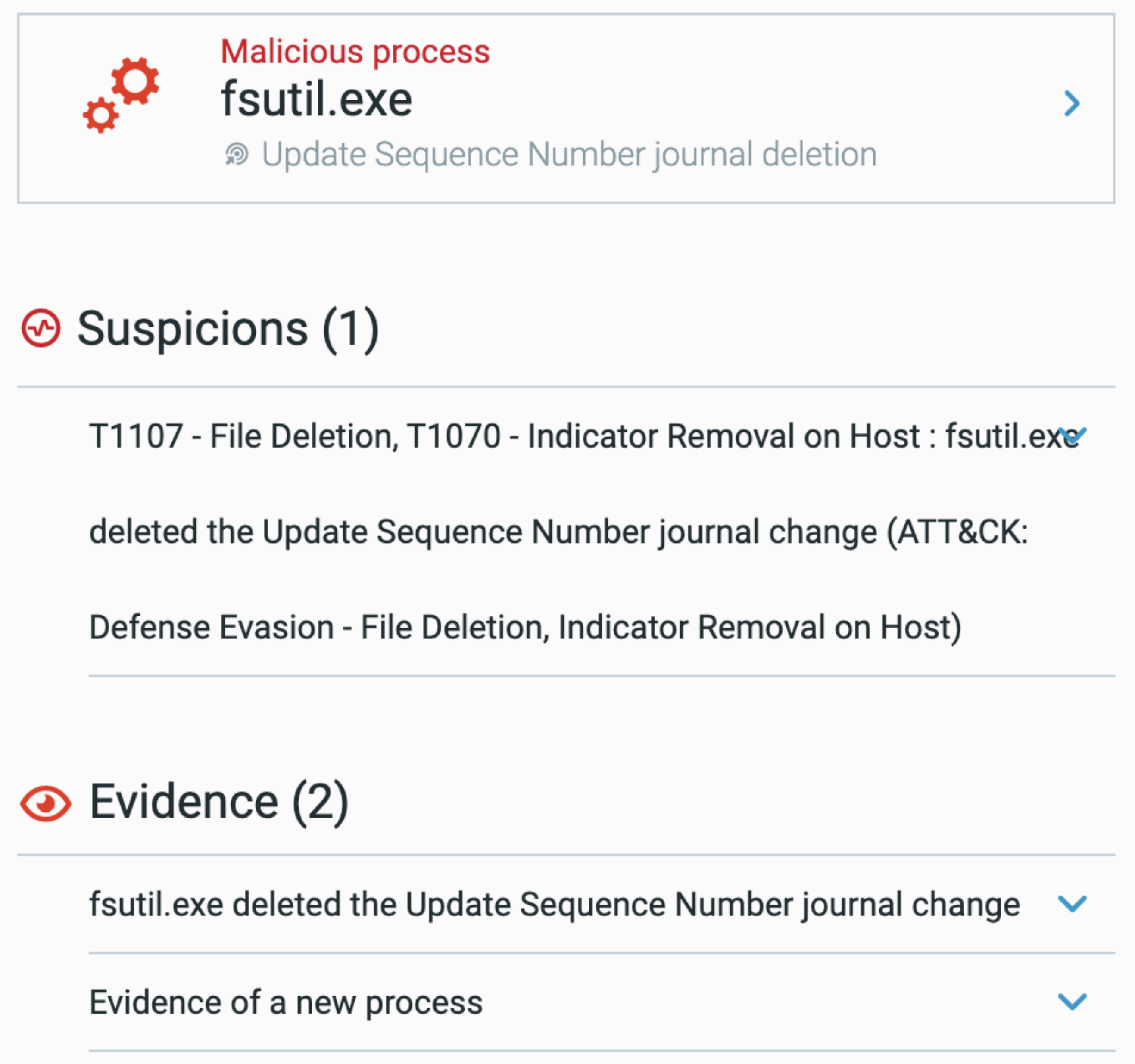
Cybereason detects the Windows utilities that are executed post-encryption as malicious and triggers a Malop(™) for all of them:



wbadmin.exe Malicious process Backup catalog deletion	admin-pc	Infection
fsutil.exe Malicious process Update Sequence Number journal deletion	admin-pc	Infection
ransomexx.exe Ransomware Cybereason Threat Intelligence identified an executable as ransomware	admin-pc	Ransomware

Detection of the ransomware and malicious uses of windows utilities by the Cybereason Defense Platform

Looking at the Malop that was triggered by *fsutil*, the evidence for malicious activity can be seen together with the suspicions mapped to the MITRE ATT&CK matrix:



Malicious process

fsutil.exe

Update Sequence Number journal deletion

Suspicions (1)

T1107 - File Deletion, T1070 - Indicator Removal on Host : fsutil.exe deleted the Update Sequence Number journal change (ATT&CK: Defense Evasion - File Deletion, Indicator Removal on Host)

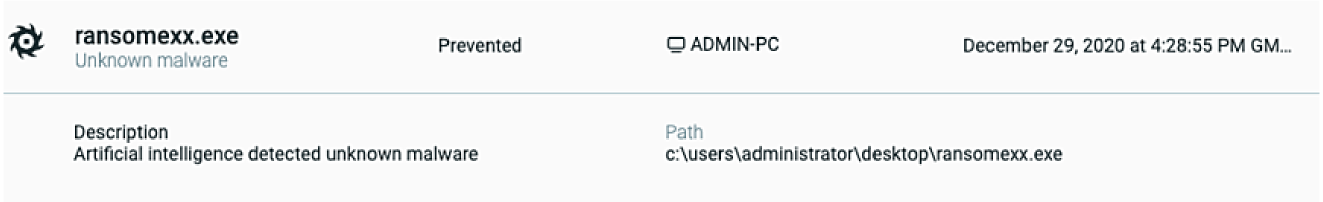
Evidence (2)

fsutil.exe deleted the Update Sequence Number journal change

Evidence of a new process

Suspicions and evidence triggered by fsutil

When Cybereason anti-ransomware prevention is turned on, the execution of the RansomEXX is prevented using the AI module:



ransomexx.exe
Unknown malware

Prevented

ADMIN-PC

December 29, 2020 at 4:28:55 PM GM...

Description
Artificial intelligence detected unknown malware

Path
c:\users\administrator\desktop\ransomexx.exe

Execution prevention of RansomEXX by the Cybereason Defense Platform

Security Recommendations

- **Enable the Anti-Ransomware Feature on Cybereason NGAV:** Set Cybereason Anti-Ransomware protection mode to *Prevent* - more information for customers can be found here

- **Enable Anti-Malware Feature on Cybereason NGAV:** Set Cybereason Anti-Malware mode to *Prevent* and set the detection mode to *Moderate* and above - more information can be found here

- **Keep Systems Fully Patched:** Make sure your systems are patched in order to mitigate vulnerabilities

- **Regularly Backup Files to a Remote Server:** Restoring your files from a backup is the fastest way to regain access to your data

- **Use Security Solutions:** Protect your environment using organizational firewalls, proxies, web filtering, and mail filtering

- **Indicator's of Compromise:** Includes C2 Domains, IP addresses, Docx files SHA-1 hashes, and Msi files. Open the chatbot on the lower right-hand side of this blog to download your copy.

MITRE ATT&CK BREAKDOWN

Defense Evasion	Impact	Execution	Discovery	Privilege Escalation
Impair Defenses: Disable or Modify Tools	**Data Encrypted for Impact**	**Command and Scripting Interpreter: Windows Command Shell**	**Obfuscated Files or Information**	**Process Injection**
Indicator Removal on Host: File Deletion	**Inhibit System Recovery**	**Command and Scripting Interpreter: Unix Shell**	**System Information Discovery**	
		Scheduled Task/Job	**File and Directory Discovery**	
			Software Discovery: Security Software Discovery	

Process Discovery

Daniel Frank

Daniel Frank is a senior Malware Researcher at Cybereason. Prior to Cybereason, Frank was a Malware Researcher in F5 Networks and RSA Security. His core roles as a Malware Researcher include researching emerging threats, reverse-engineering malware and developing security-driven code. Frank has a BSc degree in information systems.

RansomEXX Ransomware | Indicator's of Compromise

IOC	Type	Description

0abaa05da2a05977e0baf68838cff1712f1789e0 6fae9aa52fd89bac83b69c2fbdc65c96e886427f 06606fea0daaa99bd8ebfeb60f19976c20e6bb72 0122efe580848879bb70f40ede63cb2edbfb4163 ccfc9578f721fbad30aa74facf20817abe118bfd 423a2bf7ac322273bdacf638703ea99c44462862 dfc37340f5deaa89681539b0f5c22059aac4c31d 9711cdf002e5b7ecccfa309058d53dde67b029ee 3e6689dc6a8a717b4114a7fe65bba594c597c7b9 18b2704b49828035148aebe9e77b286a30c702b6 e7748b92347f95589fa739cbe5c089046614ce92 427178528152670c68f2f2937f05a5cdfebff1c2 3555aaebe6c113fb8f923a38cb3bd75da6e86277 6185e3514a32d2f3fb9ce292ba514d01584cced8 fc9284b7a140c0d411ebd0eb4752e477d5d213fc 11eec31710902820e79ba1e363d4c1256b75c615 5238ba19bb3c7298ee13fe6eb0cf5f8787c13cd8 24e773aa271fc0636cda6b0966a6034b65cb3052	SHA1	RansomEXX Windows Executable
91ad089f5259845141dfb10145271553aa711a2b 132def0d906a53360bdbdd3da109bfa41bcdbb6c 3bf79cc3ed82edd6bfe1950b7612a20853e28b09 50f191f04aa6cff1d8688a3c5d6cce96739ab6b3	SHA1	RansomEXX Linux Executable

About the Author

Cybereason Nocturnus

The Cybereason Nocturnus Team has brought the world’s brightest minds from the military, government intelligence, and enterprise security to uncover emerging threats across the globe. They specialize in analyzing new attack methodologies, reverse-engineering malware, and exposing unknown system vulnerabilities. The Cybereason Nocturnus Team was the first to release a vaccination for the 2017 NotPetya and Bad Rabbit cyberattacks.

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