It’s Not Safe To Pay SafePa | Huntress

Archived: 2026-04-05 18:13:35 UTC

Background

During October 2024, Huntress analysts observed two incidents involving the deployment of SafePay ransomware across disparate customer infrastructures separated by business vertical and geography. In both incidents, the encrypted file extension was **.safepay**, and the name of the ransom note was **readme_safepay.txt**, something that Huntress analysts had not previously observed. Further, following the first incident, analysts were unable to locate any open reporting on this particular ransomware variant.

Dark Web Presence

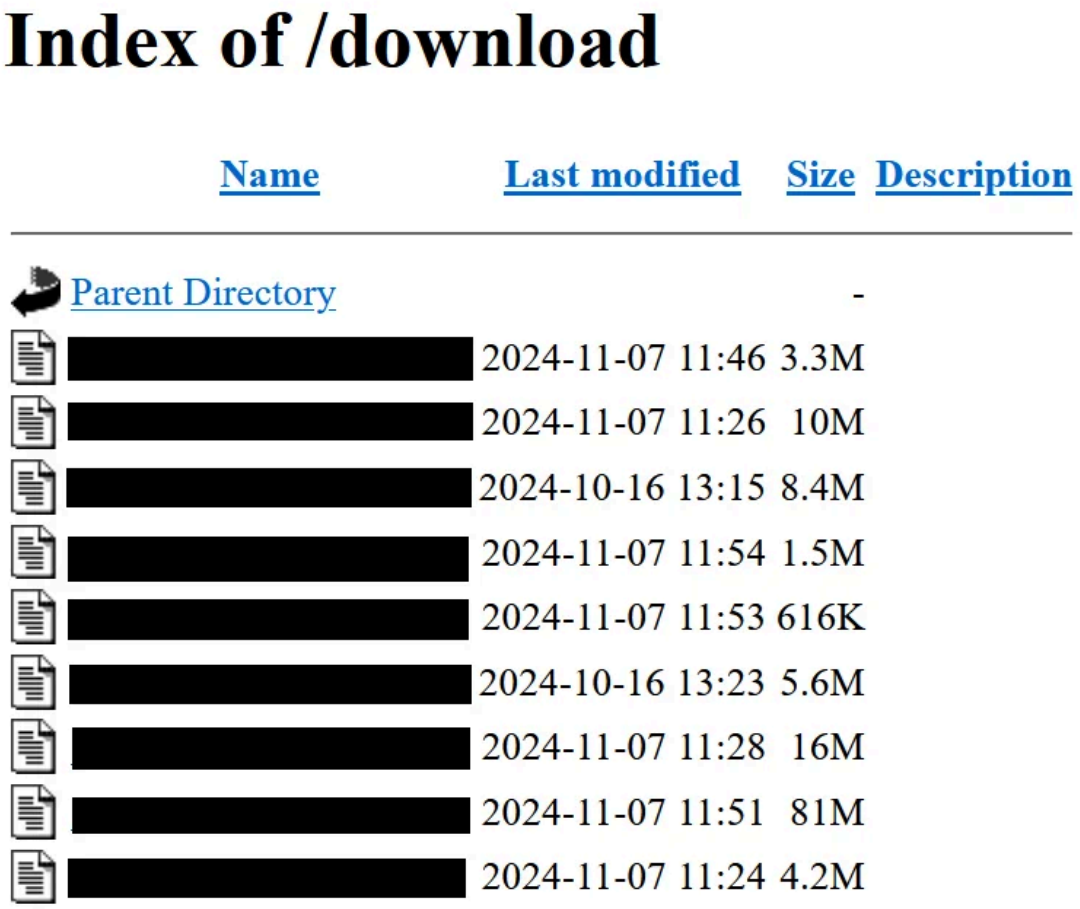
The SafePay ransomware group is a more obscure cybercrime gang than others, and for that reason, there is not much discussion surrounding SafePay on illicit forums or chat rooms.

They do include a V3 onion link to their leak site in their ransom note, however, as well as a less common link to a “TON” site—apparently, “The Open Network” which claims to be a "decentralized and open internet, created by the community using a technology designed by Telegram."

Their Tor leak site simply lists past victims to be clicked on and expanded for more details.

Figure 1: The SafePay ransomware leak site

At the time of writing, there are 22 victims listed. Clicking on their name opens a modal to either download a text file that lists the filenames and folder structure for the stolen data, or the data itself if it is available. Their download folder is susceptible to directory indexing:

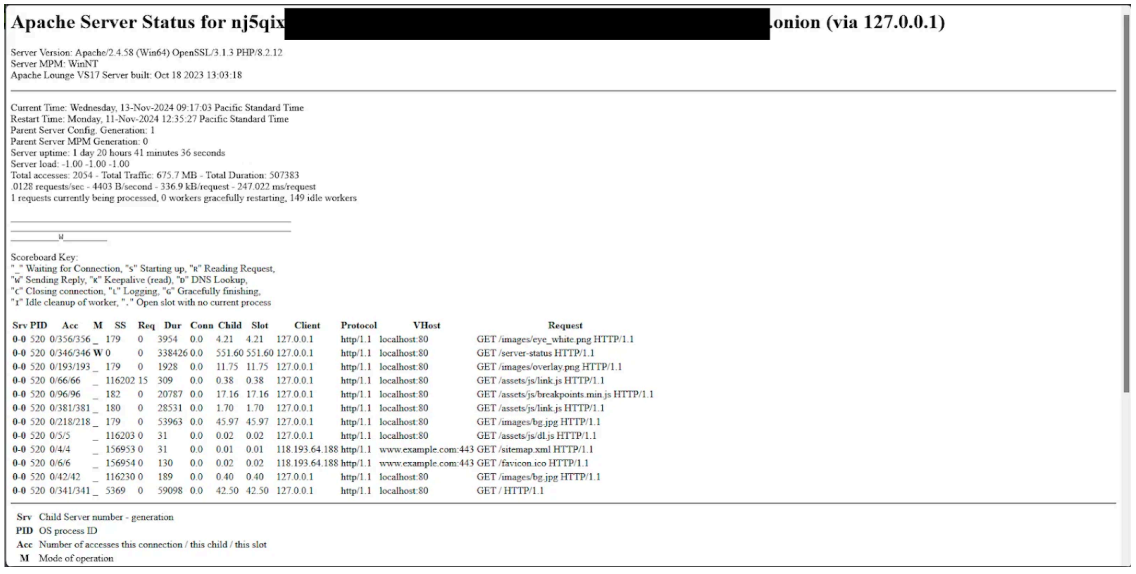


Index of /download

Name	Last modified	Size	Description
Parent Directory		-	
[redacted]	2024-11-07 11:46	3.3M	
[redacted]	2024-11-07 11:26	10M	
[redacted]	2024-10-16 13:15	8.4M	
[redacted]	2024-11-07 11:54	1.5M	
[redacted]	2024-11-07 11:53	616K	
[redacted]	2024-10-16 13:23	5.6M	
[redacted]	2024-11-07 11:28	16M	
[redacted]	2024-11-07 11:51	81M	
[redacted]	2024-11-07 11:24	4.2M	

Figure 2: Directory listing of the leak site's download folder

Additionally, the Apache server status endpoint is still accessible and exposes some further details about the backend server.



Apache Server Status for nj5qix[redacted]onion (via 127.0.0.1)

Server Version: Apache/2.4.58 (Win64) OpenSSL/3.1.3 PHP/8.2.12
Server MPM: WinNT
Apache Lounge VS17 Server built: Oct 18 2023 13:03:18

Current Time: Wednesday, 13-Nov-2024 09:17:03 Pacific Standard Time
Restart Time: Monday, 11-Nov-2024 12:35:27 Pacific Standard Time
Parent Server Config. Generation: 1
Parent Server MPM Generation: 0
Server uptime: 1 day 20 hours 41 minutes 36 seconds
Server load: 1.00 1.00 1.00
Total accesses: 2054 - Total Traffic: 675.7 MB - Total Duration: 507383
.0128 requests/sec - 4403 B/second - 336.9 kB/request - 247.022 ms/request
1 requests currently being processed, 0 workers gracefully restarting, 149 idle workers

Scoreboard Key:
"_" Waiting for Connection, "s" Starting up, "R" Reading Request,
"W" Sending Reply, "K" Keepalive (read), "D" DNS Lookup,
"C" Closing connection, "L" Logging, "G" Gracefully finishing,
"I" Idle cleanup of worker, "." Open slot with no current process

Srv	PID	Acc	M	SS	Req	Dur	Conn	Child	Slot	Client	Protocol	VHost	Request
0-0	520	0/356/356	_	179	0	3954	0.0	4.21	4.21	127.0.0.1	http/1.1	localhost:80	GET /images/eye_white.png HTTP/1.1
0-0	520	0/346/346	W	0	0	338426	0.0	551.60	551.60	127.0.0.1	http/1.1	localhost:80	GET /server-status HTTP/1.1
0-0	520	0/193/193	_	179	0	1928	0.0	11.75	11.75	127.0.0.1	http/1.1	localhost:80	GET /images/overlay.png HTTP/1.1
0-0	520	0/66/66	_	116202	15	309	0.0	0.38	0.38	127.0.0.1	http/1.1	localhost:80	GET /assets/js/link.js HTTP/1.1
0-0	520	0/96/96	_	182	0	20787	0.0	17.16	17.16	127.0.0.1	http/1.1	localhost:80	GET /assets/js/breakpoints.min.js HTTP/1.1
0-0	520	0/381/381	_	180	0	28531	0.0	1.70	1.70	127.0.0.1	http/1.1	localhost:80	GET /assets/js/link.js HTTP/1.1
0-0	520	0/218/218	_	179	0	53963	0.0	45.97	45.97	127.0.0.1	http/1.1	localhost:80	GET /images/bg.jpg HTTP/1.1
0-0	520	0/5/5	_	116203	0	31	0.0	0.02	0.02	127.0.0.1	http/1.1	localhost:80	GET /assets/js/dl.js HTTP/1.1
0-0	520	0/4/4	_	156953	0	31	0.0	0.01	0.01	118.193.64.188	http/1.1	www.example.com:443	GET /sitemap.xml HTTP/1.1
0-0	520	0/6/6	_	156954	0	130	0.0	0.02	0.02	118.193.64.188	http/1.1	www.example.com:443	GET /favicon.ico HTTP/1.1
0-0	520	0/42/42	_	116230	0	189	0.0	0.40	0.40	127.0.0.1	http/1.1	localhost:80	GET /images/bg.jpg HTTP/1.1
0-0	520	0/341/341	_	5369	0	59098	0.0	42.50	42.50	127.0.0.1	http/1.1	localhost:80	GET / HTTP/1.1

Srv Child Server number - generation
PID OS process ID
Acc Number of accesses this connection / this child / this slot
M Mode of operation

Figure 3: Apache server status

Incident 1

During incident 1, the first observed indication of the threat actor's activity was an attempt to run **ShareFinder.ps1**, which was detected and blocked by Windows Defender. The threat actor had accessed the endpoint via the Remote Desktop Protocol (RDP), and as such, disabled Windows Defender using the same sequence of LOLBin commands observed during an INC ransomware deployment incident earlier this year and was then able to run the **ShareFinder.ps1** PowerShell script.

About 40 minutes later, the same user archived files from the host with **WinRAR.exe**. An example command line of the attacker archiving files can be seen as follows:

WinRAR.exe a -v5g -ed -r -tn1000d -m0 -mt5 -x*.rar -x*.JPEG -x*.RAW
-x*.PSD -x*.TIFF -x*.BMP -x*.GIF -x*.JPG -x*.MOV -x*.pst -x*.FIT
-x*.FIL -x*.mp4 -x*.avi -x*.mov -x*.mdb -x*.iso -x*.exe -x*.dll
-x*.bak -x*.msg -x*.png -x*.zip -x*.ai -x*.7z -x*.DPM -x*.log -x*.dxf
-x*.insp -x*.upd -x*.db -x*.dwg -x*.nc1 -x*.metadata -x*.dg -x*.inp
-x*.dat -x*.TIFF -x*.tiger -x*.pcp -x*.rvt -x*.rws -x*.nwc -x*.tif
-x*.frx -x*.dyf -x*.rcs -x*.diff C:\[redacted].rar
\\[redacted]\C$\Users

This was observed across three different hosts (remotely archiving files from user directories on other hosts).

A short time after that, FileZilla was installed using **FileZilla_3.67.1_win64_sponsored-setup.exe,** and **filezilla.exe** and **fzsftp.exe** both executed after that. They were quickly uninstalled as well.

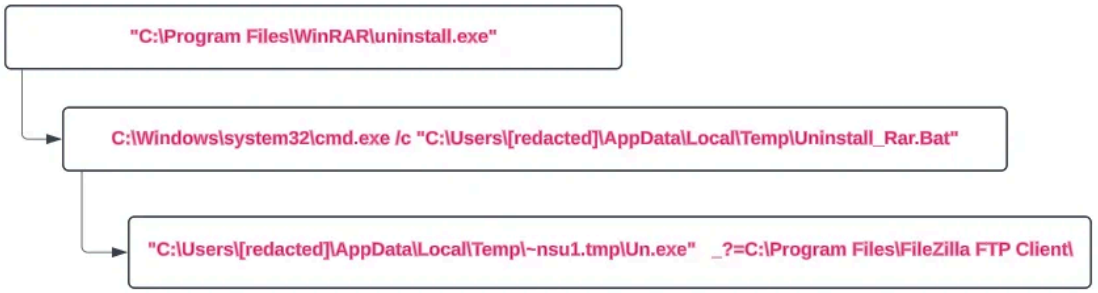


Figure 4: Process tree of uninstalling WinRAR

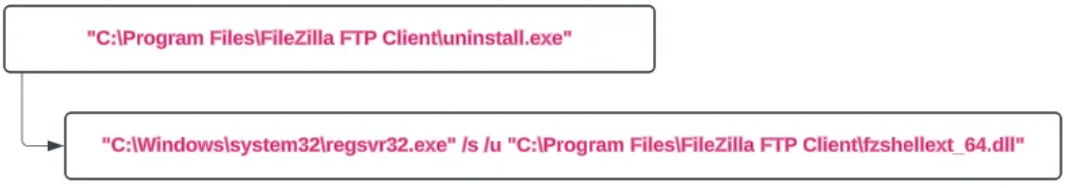


Figure 5: Process tree of uninstalling FileZilla

The following day, this process repeated (WinRAR and FileZilla installed, executed, and uninstalled).

This activity looks like potential Data Exfiltration from the network—collected and archived with WinRAR and then possibly exfiltrated out using FTP (no network evidence of this activity was collected).

Finally, on the second day following the use of the PowerShell script, the threat actor returned, logging in via RDP, and within approximately 15 minutes, began executing several commands that deployed file encryption via previously identified network shares. An example of one of those commands appeared as follows:

"C:\Windows\SysWOW64\regsvr32.exe" /n "/i:-pass=[REDACTED] -enc=3 -uac -path=\\[REDACTED]\ [SHARE]\ -uac=[REDACTED]" C:\locker.dll

The Huntress platform generated alerts for this activity, as illustrated in Figure 6.

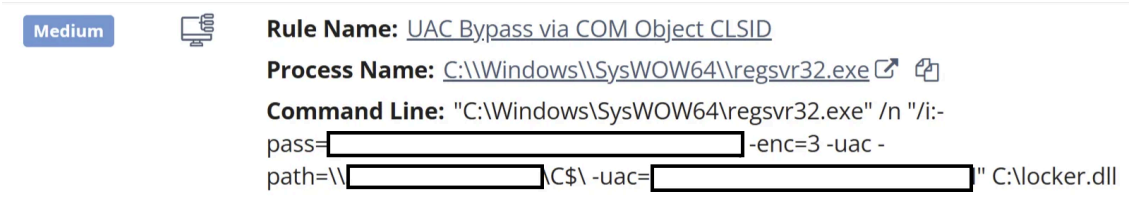


Figure 6: Ransomware Deployment Alerts

Following these alerts, the following commands were observed as part of the ransomware execution:

bcdedit / set{default} recoveryenabled no

wmic shadowcopy delete

Both of these commands were detected and alerted via the Huntress platform, but by that point, the file encryption process was already underway.

Incident 2

While investigating incident 2, analysts determined that the Huntress agent deployment was extremely limited, inhibiting visibility, detection, and response.

Huntress analysts did note that there was an initial successful network login to the **Administrator** account, originating from the threat actor workstation **WIN-3IUUOFVTQAR**, which was then followed by multiple failed login attempts to the non-existent **Work** user account, from the same workstation. Following this activity, the Administrator account was used to successfully log in via the Remote Desktop Protocol (RDP).

Huntress analysts were not able to recover a copy of the ransomware executable during this incident due to the fact that the file encryption deployment likely occurred from another endpoint that did not have an agent installed. This is supported by the fact that during incident 1, the ransomware was deployed via UNC paths.

Also during this incident, there was no indication that the threat actor attempted to disable Windows Defender. Rather, in this instance, Windows Defender did detect the ransomware process, but recorded a **Microsoft-Windows-Windows Defender/1119** failure event, as illustrated in Figure 7.

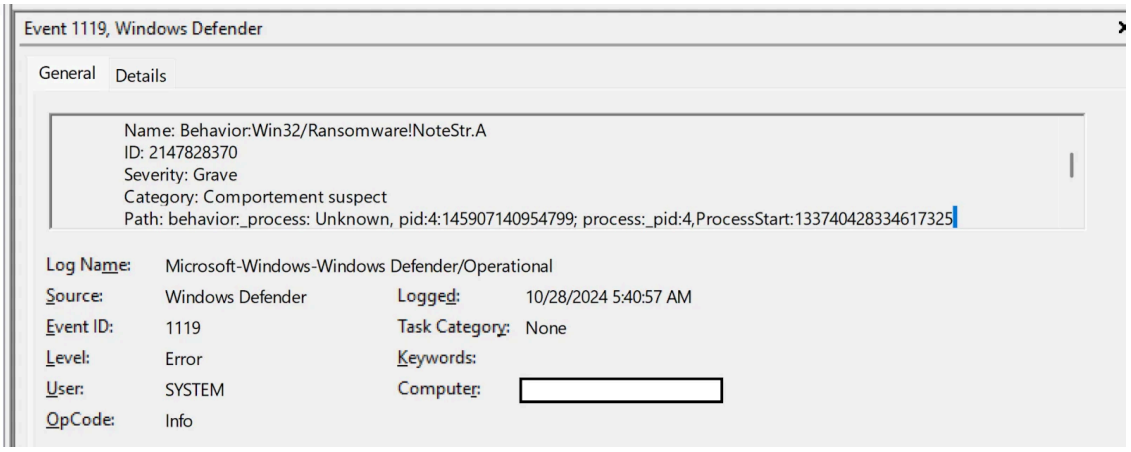


Figure 7: Windows Defender Error Message

Unfortunately, the ransomware execution was not prevented, and as with the first incident, ransomware canary files were modified, prompting additional reporting from the Huntress SOC.

Reverse Engineering

During our analysis of the ransomware binary, we began to notice a large number of similarities to the extensively analyzed Lockbit samples from the end of 2022. This isn't particularly surprising given that the source for Lockbit has been leaked several times.

Usage

The ransomware is run via **regsrv32.exe** and accepts the following flags:

Flag	Usage
-uac	UAC bypass flag
-selfdelete	Enable self-delete flag
-network	Network propogation
-logging	Enable logging
-pass	Password

-netdrive	Network drive flag
-path	Path for files to encrypt
-enc	Encryption level

Cyrillic Language Killswitch

As is relatively common for ransomware, before executing encryption on a host, the malware attempts to verify that it isn't running in any Eastern European countries. It does this by calling **GetSystemDefaultUILanguage** and checking that the resulting language ID is greater than the Cyrillic language IDs, as seen in Figure 8.

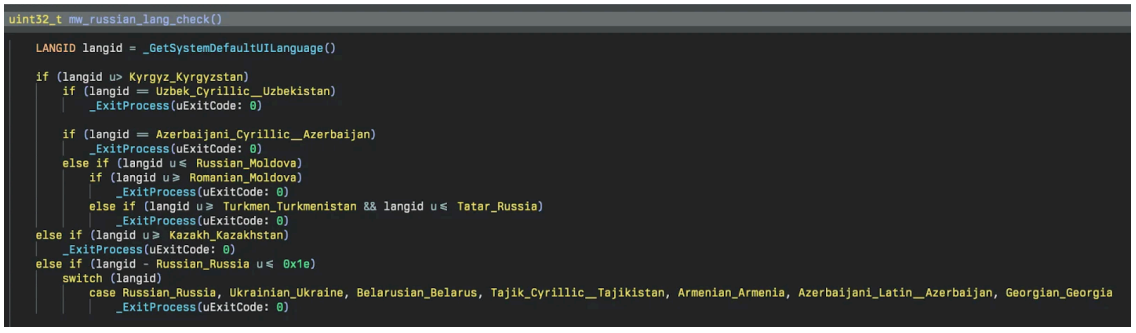


Figure 8: Code showing a Russian language check

String Encryption

Most of the strings throughout the binary are obfuscated with a simple three-step XOR loop consisting of a random single-byte key, the index of the character, and the first byte of **kernel32.dll** ('M').

```
def xor_decrypt(enc: str, key: int) -> str:
    enc_bytes = bytes.fromhex(enc)
    decrypted = []
    for idx, val in enumerate(enc_bytes):
        val ^= idx
        val ^= ord("M")
        val ^= key
        decrypted.append(val)
```

	return "".join([chr(i) for i in decrypted if i != 0])

Process Termination

Malware attempts to stop certain processes that are running via **ZwTerminateaProcess**. Below is the list of processes that are attempted to stop:

- sql
- oracle
- ocssd
- dbsnmp
- synctime
- agntsvc
- isqlplussvc
- xfssvccon
- mydesktopservice
- ocautoupds
- encsvc
- firefox
- tbirdconfig
- mydesktopqos
- ocomm
- dbeng50
- sqbcoreservice
- excel
- infopath
- msaccess
- mspub
- far
- onenote
- outlook
- powerpnt
- steam
- thebat
- thunderbird
- visio
- winword
- wordpad
- notepad
- wuauclt
- onedrive
- sqlmangr

Service Termination

Ransomware attempts to stop services that are running via **ControlService**. Below are services it attempts to stop:

- vss
- sqlsvc
- memtas
- mepocs
- msexchange
- Sophos
- Veeam
- backup
- GxVss
- GxBlr
- GxFWD
- GxCVD
- GxCIMgr

Privilege Adjusting

This malware goes through the appropriate steps to enable SeDebugPrivilege for their current running token. This is done by the following APIs: ZwOpenProcessToken, LookupPrivilegeValueA, PrivilegeCheck, and AdjustTokenPrivileges. This is very common within malware, as setting **SeDebugPrivilege** circumvents certain access checks to Windows objects. If you are curious about this, you can read more about this here.

Token Impersonation

One of the ways that this malware likes to privilege escalate is through token impersonation. The way they are implementing this is by calling **DuplicateToken** to obtain an impersonation (thread) token from a primary (process) token. We can see this in the code snippet below:

```
BOOL result = DuplicateToken(ExistingTokenHandle: hProcessToken, ImpersonationLevel: SecurityImpersonation, DuplicateTokenHandle: &g_duplicate_token_handle)

HANDLE duplicate_token_handle = g_duplicate_token_handle
```

After this token handle is set to a global variable, it is then used in another function that calls **ZwSetThreadInformation**. Let's take a look at how this is called:

```
hThread = CreateThread(lpThreadAttributes: nullptr, dwStackSize: 0, lpStartAddress: network_drive_parser, lpParameter: nullptr, dwCreationFlags: 4, lpThreadId: nullptr)
```

	if (hThread != 0)
	ZwSetInformationThread(ThreadHandle: hThread, ThreadInformationClass: ThreadHideFromDebugger, ThreadInformation: nullptr, ThreadInformationLength: 0)
	if (g_duplicate_token_handle != 0)
	ZwSetInformationThread(ThreadHandle: hThread, ThreadInformationClass: ThreadImpersonationToken, ThreadInformation: &g_duplicate_token_handle, ThreadInformationLength: 4)
	NtResumeThread(ThreadHandle: hThread, SuspendCount: nullptr)

What we can see above is that a thread is created in a suspended state via **CreateThread**, passing in **CREATE_SUSPENDED** in **dwCreationFlags**. The purpose of this thread is to enumerate and parse network drives. If the thread is created successfully then the **ThreadHideFromDebugger** flag is set on the thread, which allows the thread to run without a debugger being able to trace the execution. Next, the duplicated token is set to the thread via **ZwSetInformationThread**. Lastly, the thread is able to execute via **NtResumeThread**.

Thread Creation & Management

In order to increase the performance of the ransomware, SafePay (or Lockbit really) create a number of worker threads for both encryption and network enumeration. The way they do this is interesting because in lieu of just a standard CreateThread, they use a custom implementation that provides better anti-analysis capabilities.

```
int32_t mw_create_encryption_worker_threads()

    if (_CryptAcquireContextW(phProv: &crypto_provider, szContainer: nullptr, szProvider: nullptr, dwProvType: PROV_RSA_AES, dwFlags: 0xf0000000) != 0)
        TEB* fsbase
        HANDLE eax_2 = _CreateIoCompletionPort(FileHandle: -1, ExistingCompletionPort: nullptr, CompletionKey: 0, NumberOfConcurrentThreads: fsbase->ProcessEnvironmentBlock->NumberOfProcessors)
        _completionPort = eax_2

        if (eax_2 != 0)  // eax_6 will be the number of processors * 2
            PVOID eax_6 = try_alloc_or_sleep(size: fsbase->ProcessEnvironmentBlock->NumberOfProcessors << 2)
            thread_pool = eax_6

            if (eax_6 != 0)
                struct _PEB* ProcessEnvironmentBlock = fsbase->ProcessEnvironmentBlock
                DWORD dwFlags = 0
                int32_t ThreadInformation = 1
                int32_t i = 0

                if (ProcessEnvironmentBlock->NumberOfProcessors u> 0)
                    do
                        thread_pool[i] = _CreateThread(lpThreadAttributes: nullptr, dwStackSize: 0, lpStartAddress: mw_encryption_worker_thread, lpParameter: nullptr, dwCreationFlags: 4, lpThreadId: nullptr)
                        HANDLE ThreadHandle = thread_pool[i]

                        if (ThreadHandle != 0)
                            dwFlags += 1
                            _ZwSetInformationThread(ThreadHandle, ThreadInformationClass: ThreadHideFromDebugger, ThreadInformation: nullptr, ThreadInformationLength: 0)
                            _ZwSetInformationThread(ThreadHandle: thread_pool[i], ThreadInformationClass: ThreadAffinityMask, &ThreadInformation, ThreadInformationLength: 4)
                            _NtResumeThread(ThreadHandle: thread_pool[i], SuspendCount: nullptr)
                            int32_t ThreadInformation_1 = ThreadInformation
                            int32_t ThreadInformation_2 = ThreadInformation_1 * 2

                            if (ThreadInformation_1 == neg.d(ThreadInformation_1))
                                ThreadInformation_2 = 1

                            ThreadInformation = ThreadInformation_2

                        i += 1
                    while (i u< fsbase->ProcessEnvironmentBlock->NumberOfProcessors)
```

Figure 9: Decompilation of function that creates worker encryption threads

If logging is enabled it will return how many threads were created to the logfile. Finally, they clean up by freeing the memory allocated for the thread pool, close the completion port, and release the crypto context. The cleanup code can be seen in Figure 10.

```
1000702b                if (logging_enabled != 0)
10007034                    char* k32_M_1 = k32_M
1000703a                    int32_t i_1 = 0
10007040                    // Decrypts to: 'Created [%d] threads for
10007042                    // encryption'
10007042                    int32_t created_n_threads_for_encryption
10007042                    __builtin_memcpy(dest: &created_n_threads_for_encryption, src: "\xc3\x81\xf0\x83\xe1\x85\xe7\x87\xfc\x89\xef\x8b\xe8\x8d\x
10007042
100070d2                    do
100070c0                        ProcessEnvironmentBlock.b = *(&created_n_threads_for_encryption + i_1)
100070c4                        ProcessEnvironmentBlock.b ^= i_1.b
100070c6                        ProcessEnvironmentBlock.b ^= *k32_M_1
100070c8                        ProcessEnvironmentBlock.b ^= 0xcd
100070ca                        *(&created_n_threads_for_encryption + i_1) = ProcessEnvironmentBlock.b
100070ce                        i_1 += 1
100070d2                    while (i_1 u< 0x48)
100070d2
100070d7                    DWORD dwFlags_1 = dwFlags
100070d9                    mw_write_to_log_file(&created_n_threads_for_encryption)
100070d9
100070e3                if (dwFlags != 0)
1000711d                    return 1
1000711d
100070eb                _NtClose(Handle: _completionPort)
100070f7                mw_free_memory(lpMem: thread_pool)
10007106                _CryptReleaseContext(hProv: crypto_provider, dwFlags)
10007114                return 0
10007114
10006f82            _NtClose(Handle: _completionPort)
10006f90            _CryptReleaseContext(hProv: crypto_provider, dwFlags: 0)
10006f90
```

Figure 10: Cleanup code

Detection Opportunities

Defense Evasion

We observed the threat actor disabling some Windows Defender settings using the **systemsettingsadminflows.exe** binary. In this case, the parent process of **SystemSettings.exe** shows that the changes were made using the Windows Settings GUI, typically accessed through the Menu. This indicates the threat actor was moving around on the desktop interactively. While a user may do this occasionally as well, it is unlikely that most users would change Windows Defender Virus & Threat Protection settings very often. These are settings such as Automatic File Submission and Real-Time Threat Protection.

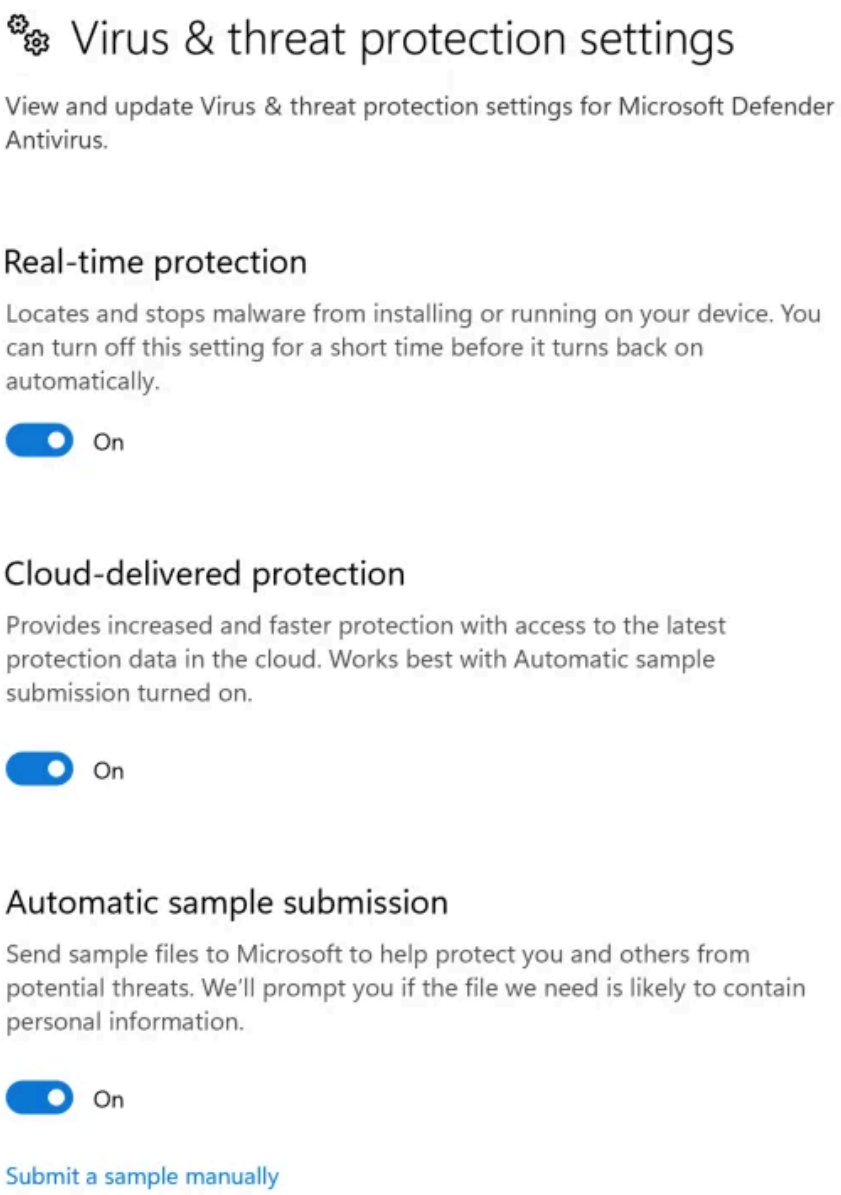


Figure 11: Screenshot of Windows Defender settings

Normally, these settings are set by Group Policy, Local Security Policies, or by custom configurations during initial setup of the system. Changes made by Administrators will typically be made through PowerShell, direct registry changes, or updates to Security Policies (not by clicking on toggle switches in the GUI). For many environments, this may be unusual enough to alert on every time it happens. We have provided the following Sigma rules to detect this behavior:

- **Windows Defender Threat Protection Settings Disabled via GUI**
- **Windows Defender Threat Protection Settings Disabled**

Many changes to Defender can be detected with Windows Event logs as well, with events like **Microsoft-Windows-Windows Defender/5001** (Defender RTP Disabled) and **Microsoft-Windows-Windows Defender/5007** (Defender Malware Protection Configuration Change). The following are Sigma detectors that are available from the SigmaHQ repository that detect these changes:

- **SigmaHQ rule for Disabling RTP**
- **SigmaHQ Windows Event Log rule for Malware Protection Configuration Change**
- **SigmaHQ Windows Event rule for Defender Configuration Change - Sample Submission**

Privilege Escalation

The adversary likely used a well-known UAC Bypass Privilege Escalation technique, often utilized by several other ransomware groups such as Lockbit and BlackCat/ALPHV. This technique results in an elevated process created by a specified COM Object that can be used to execute malicious commands or binaries. When this technique is used, the parent process is **DllHost.exe** with the CLSID of the COM Object that is used (CMSTPLUA in this case) present in the command line. While this may happen legitimately at times, it should generally not happen often, especially with unsigned binaries, system binaries that can be used for proxy execution, or scripting interpreters as the child process executed.

Elastic has a good example rule for the general activity—UAC Bypass via ICMLuaUtil Elevated COM Interface, and a Sigma version can be found here. To look even more specifically, you can detect using the same logic, but looking only for child processes that:

1. Have invalid signatures (malicious binaries)

2. Are scripting interpreters (CMD, PowerShell, etc).

3. Can be used for System Binary Proxy Execution

These methods can be used to find signs of potential privilege escalation using this COM Object UAC Bypass method.

We created a couple of new Sigma rules to detect some of these more interesting behaviors:

- **System Binary Proxy Execution Using CMSTPLUA COM Interface**
- **Scripting Interpreter Execution Using CMSTPLUA COM Interface**

Data Collection

The adversary used WinRAR to archive data before exfiltration. This is a common and well-known tool used for this purpose. There were a number of interesting things happening in the commands used. Here are a couple of Sigma rules we created to detect some of this behavior that is often used maliciously and is less common during typical WinRAR use in many environments.

- **Create WinRAR Archive - Recurse Subfolders**
- **Create WinRAR Archive - Specify Volume Size**

Conclusion

In both incidents, the threat actor’s activity was found to originate from a VPN gateway or portal, as all observed IP addresses assigned to threat actor workstations were within the internal range. The threat actor was able to use

valid credentials to access customer endpoints, and was not observed enabling RDP, nor creating new user accounts, nor creating any other persistence. During incident 1, the threat actor was observed using a freely available PowerShell script to map accessible shares, which were then fed to the file encryption process. Across both incidents, the ransom note left as a result of the file encryption process starts with the words, "**Greetings! Your corporate network was attacked by SafePay team,**" and goes on to state that "important" data was stolen, as well as providing contact instructions.

IOCs

In addition to the use of known credentials and access via RDP, the following IOCs were observed:

MITRE ATT&CK Mapping

Tactic	Technique ID	Technique Name	Description
Execution	T1059	Command and Scripting Interpreter	Powershell used to download and execute payload, collect and archive files, and exfiltrate data
	T1059.001	Powershell	Executed sharefinder.ps1
	T1059.003	Windows Command Shell	Launched malicious dll
Privilege Escalation	T1548.002	Abuse Elevation Control Mechanism: Bypass User Account Control	UAC Bypass Using Elevated COM Interface to execute malicious dll
Defense Evasion	T1202	System Binary Proxy Execution	Used regsvr32.exe to execute malicious dll
	T1070.004	File Removal	Removed zip file that was downloaded with powershell Removed files after archiving them using 7zip
	T1562.001	Impair Defenses: Disable or Modify Tools	Disabled Windows Defender Settings
Discovery	T1135	Network Share Discovery	Used ShareFinder.ps1 script
Collection	T1560.001	Archive Collected Data: Archive via Utility	Used WinRAR to archive files

Exfiltration	T1048	Exfiltration Over Alternative Protocol	Exfiltration using FTP
Impact	T1486	Data Encrypted for Impact	File encryption
	T1490	Inhibit System Recovery	Deleted Volume Shadow Copies, Disabled Windows Recovery in Boot Configuration

Special thanks to Alden Schmidt, Jonathan Johnson, Matt Anderson, Jamie Levy, John Hammond, and others for their tireless efforts and contributions to this investigation and write-up.

Source: https://www.huntress.com/blog/its-not-safe-to-pay-safepay