CYSIV
A FORESCOUT COMPANY

Threat Report: StrongPity Spyware

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Table of Contents

Table of Figures

1 EXECUTIVE SUMMARY

Promethium is an Advanced Persistence Threat (APT) that has been active since 2012. However, technical reports about their operations were not published until 2016. Since then, many cyber campaigns related to espionage have been attributed to the group due to the tools and techniques being used.

Promethium's main weapon is StrongPity spyware, which is usually used in targeted attacks. StrongPitty is distributed through spear phishing and watering hole attacks. However, the latter technique is the main attack vector. StrongPity can easily gain administrator privileges because the victim will give full permission to run the (trojanized) installer. This is a huge advantage of this type of attack, since the malware will not have to perform privilege escalation.

By analyzing different campaigns of Promethium APT, the Cysiv threat research team has identified three main techniques used to distribute StrongPity spyware:

1. Malicious Internet Service Provider (ISP)
2. Domain typosquating
3. Software downloading websites

StrongPity was used to target individuals in Turkey, Italy, Belgium, Western Europe, and was then expanded to other countries including France, Canada, Colombia, Russia, India, and Vietnam. In order to target a wider variety of victims, Promethium APT has trojanized many different software installers with StrongPity. The targeted software can be divided into three main categories:

1. Data compression, encryption and archiving tools
2. Internet tools
3. Windows utilities

Some trojanized installers with StrongPity will check for common anti-virus software before dropping the malicious modules. If an anti-virus process is detected, it will not drop any malicious files. The installers can also execute a Powershell command to add the directories used by StrongPity (including %TEMP%, %Windir%/System32, and %Windir%/SysWOW64) to the Windows Defender exclusions list and prevent sample submission.

Despite using different files names for different modules of StrongPity spyware in different campaigns, the Cysiv threat research team has been able to summarize the main modules of the spyware, which includes a service installer module, a data exfiltration module and a data packing module.

The StrongPity samples analyzed by the Cysiv threat research team connect to more than 50 domains. These domains are registered and used at different times. However, the pattern of domain names the group like to use is apparent.

Protection Provided by Cysiv:

Cysiv SOC-as-a-Service provides protection from a broad range of threats, including StrongPity spyware:

- 24x7 monitoring provides organizations with real time alerts and quick isolation and remediation to contain a threat during the early stages of an attack to prevent a compromise, data loss or breach.
- Threat hunting helps to identify suspicious activity and digital footprints that are indicative of an intrusion.
- Anti-malware that may already be deployed (or can be deployed by Cysiv) on endpoints, for users, and that can be monitored as part of the Cysiv service, will constantly monitor for abnormal activities and block any connection to suspicious URLs, IPs and domains.
- Anti-malware that may already be deployed (or can be deployed by Cysiv) on servers and workloads, and that can be monitored as part of the Cysiv service, uses a variety of threat detection capabilities, notably behavioral analysis that protects against malicious scripts, injection, ransomware, memory and browser attacks related to fileless malware. Additionally, it will monitor events and quickly examines what processes or events are triggering malicious activity.
- Network security appliances that may already be deployed (or can be deployed by Cysiv) and that can be monitored as part of the Cysiv service will detect malicious attachments and URLs, and are able to identify suspicious communication over any port, and over 100 protocols. These appliances can also detect remote scripts even if they're not being downloaded in the physical endpoint.

2 ANALYSIS

2.1 Overview

Promethium is an Advanced Persistence Threat (APT) that has been active since 2012. However, technical reports about their operations were not published until 2016. Since then, many cyber campaigns related to espionage have been attributed to the group because of the tools and techniques being used.

Promethium's main weapon is StrongPity spyware, which is bundled into legitimate software installers. Over time, the group has added many different software and countries into their target list. However, the main modules of StrongPity spyware remain almost unchanged. This proves that StrongPity's simple design is still working effectively despite the deployment of basic security controls and practices.

2.2 Attack Vectors

StrongPity spyware is usually used in targeted attacks and is distributed through spear phishing and watering hole attacks. However, the latter technique is the main attack vector. StrongPity can easily gain administrator privileges because the victim will give full permission to run the (trojanized) installer. This is a huge advantage of this type of attack, since the malware will not have to perform privilege escalation.

StrongPity has been used to target individuals in Turkey, Italy, Belgian, Western Europe, and has since been expanded to other countries such as France, Canada, Colombia, Russia, India, and Vietnam. In order to target a wider group of victims, Promethium APT has trojanized many different software installers with StrongPity (See section 2.3.1).

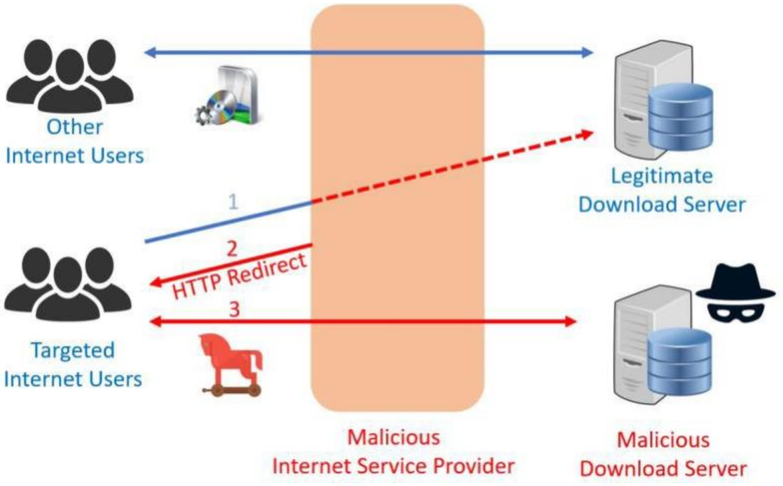
By analyzing different campaigns of Promethium APT, the Cysiv threat research team has identified three main techniques used to distribute StrongPity spyware:

1. Malicious Internet Service Provider (ISP)
2. Domain typosquating
3. Software downloading websites

2.2.1 MALICIOUS INTERNET SERVICE PROVIDERS

Deploying a watering hole attack at an Internet Service Provider (ISP) level is one of the most stealthy way to target Internet users. In this case, the targeted individuals will be unknowingly redirected to a malicious download server by the malicious ISP when they try to download certain software (See Figure 1).

Figure 1 – Malicious ISP Watering Hole Attack



At the ISP level, any unencrypted traffic can be tampered. Therefore, redirection is possible when the website uses a non-HTTPS connection for downloads or supports HTTPS but does not restrict to HTTPS only.

2.2.2 DOMAIN TYPOSQUATING

Domain typosquatting has also been used to distribute StrongPity spyware. The attacker(s) simply register for a domain that looks similar to the legitimate the domain, which tricks the user into accessing the malicious domain instead of the benign one.

As an example, Promethium APT set up a domain name to target WinRAR users. More specifically, it registered the domain name **ralrab[.]com** to mimic the legitimate WinRAR distribution site **rarlab[.]com**.

2.2.3 SOFTWARE DOWNLOADING WEBSITES

Software aggregation and sharing sites are also a great target for watering hole attacks. In 2016, the group targeted the TrueCrypt application on the downloading website tamin-dir[.]com to redirect users to their malicious downloading website:

- hxxp://www.true-crypt[.]com/download/TrueCrypt-Setup-7.1a.exe
- hxxp://true-crypt[.]com/files/TrueCrypt-7.2.exe

This technique still works since many Internet users do not follow security practices when downloading the installing software.

2.3 Trojanized Installers

Most of the trojanized installers with StrongPity spyware have unusually high entropy and are signed with invalid digital certificates. When executed, the installers will start the installation of the benign software, but then will drop StrongPity's three main components and steal data in the background. This section identifies the common characteristics of the trojanized installers.

2.3.1 TARGETED SOFTWARE

As mentioned, Promethium APT has trojanized many different software installers with StrongPity to expand its victims over time. Figure 2 is a non-exhaustive list of the software that has been targeted by Promethium APT.

Figure 2 – Targeted Software

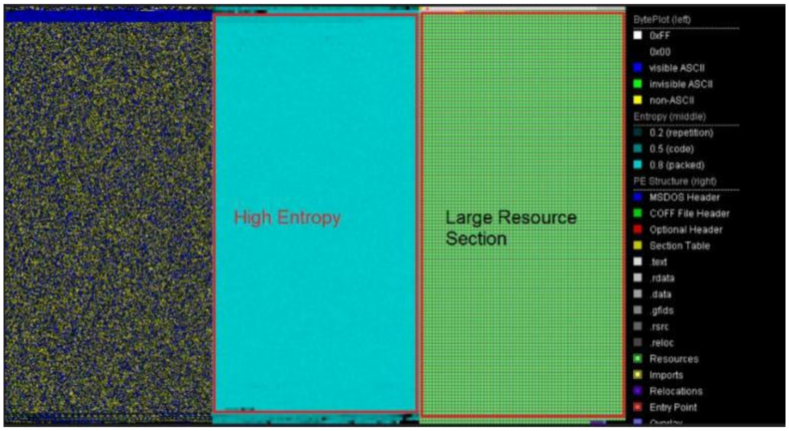
Data Compression, Encryption and Archiving Tools	Internet Tools	Windows Utilities
TrueCrypt WinRAR 7z VPNpro	Internet Donwload Manager Opera Browser Firefox Browser Skype	CCleaner Driver Booster The VLC Media Player Disk Drill DriverPack 5kPlayer Winbox SanDisk WinUtils

2.3.2 COMMON CHARACTERISTICS

All of the trojanized installers (and StrongPity modules) observed match the signature of a Microsoft Linker (14.0, Visual Studio 2015 14.0). This common characteristic among all modules over a couple of few years suggests that either only Promethium APT has access to the source code of StrongPity spyware or the group has developed a StrongPity builder for different targeted software.

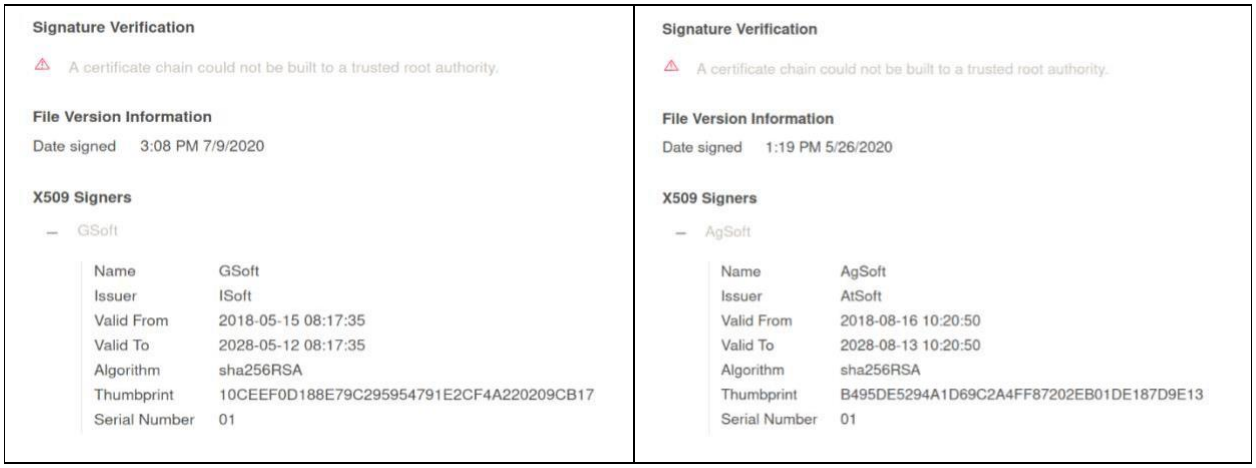
Another common characteristic among all the trojanized installers is their unusually large and high entropy .rsrc section (See Figure 3). All the StrongPity's modules are encrypted and stored in this section.

Figure 3 – Unusually High Entropy PE Section



Finally, the trojanized installers are usually signed with invalid code signing certificates (Figure 4).

Figure 4 – Examples of StrongPity Invalid Code Certificates



Signature Verification

⚠ A certificate chain could not be built to a trusted root authority.

File Version Information

Date signed 3:08 PM 7/9/2020

X509 Signers

– GSoft

Name	GSoft
Issuer	ISoft
Valid From	2018-05-15 08:17:35
Valid To	2028-05-12 08:17:35
Algorithm	sha256RSA
Thumbprint	10CEEF0D188E79C295954791E2CF4A220209CB17
Serial Number	01

Signature Verification

⚠ A certificate chain could not be built to a trusted root authority.

File Version Information

Date signed 1:19 PM 5/26/2020

X509 Signers

– AgSoft

Name	AgSoft
Issuer	AtSoft
Valid From	2018-08-16 10:20:50
Valid To	2028-08-13 10:20:50
Algorithm	sha256RSA
Thumbprint	B495DE5294A1D69C2A4FF87202EB01DE187D9E13
Serial Number	01

Invalid certificates have been observed being reused for different trojanized installers that are built at almost the same time. The certificates are usually signed with the name of software companies but cannot be verified.

2.3.3 ANTI-VIRUS EVATION TECHNIQUES

Some StrongPity trojanized installers will check for common anti-virus software before dropping the malicious modules. If the anti-virus process is detected, it will not drop any malicious files. The installers can also execute a Powershell command to add the directories used by StrongPity (including %TEMP%, %Windir%/System32, and %Windir%/SysWOW64) to the Windows Defender exclusions list and prevent sample submission:

```
powershell.exe Set-MpPreference -ExclusionPath ‘C:\Windows\System32’, ‘C:\Windows\SysWOW64’,
‘C:\Users\admin\AppData\Local\Temp’ -MAPSReporting 0 -DisableBehaviorMonitoring 1 -
SubmitSamplesConsent 2
```

2.4 StrongPity Modules

2.4.1 LIST OF MAIN MODULES

Despite different files names being used for different modules of StrongPity spyware in different campaigns, Cysiv Threat Research team is able to summary three main modules of the spyware, which includes a service installer module, a data exfiltration module and a data packing module. The list of modules is shown in Figure 5.

Figure 5 – StrongPity’s Main Modules

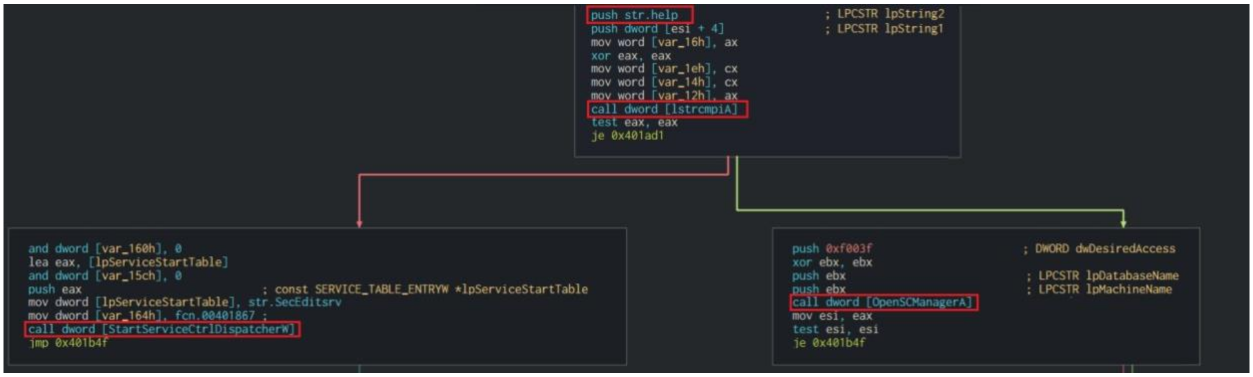
Module	Observed Names
Service Installer Module	nvvscv.exe, netplviz.exe, services.exe, dusntask.exe, wvsvcs32.exe, rmaserv.exe, seceditr.exe.
Data Exfiltration Module	dcomx32.exe, IpOve32.exe, printoi32.exe, ngentask.exe, spoolcl.exe, printque.exe, winprint32.exe, sivsnui.exe, winslui32.exe.
Data Packing Module	evntwn32.xml, wiminit.xml, mssqldbserv.xml, sqlhostserv.xml, wintcsr.exe, spoolsrv32.exe, spools32.exe, winsys.exe, srvolpsm.exe.

The three modules will be dropped (in %TEMP%, %Windir%/System32, and %Windir%/SysWOW64) at the same time as dropping the benign installer, and only the service installer module will be started after the benign installer has started. The service installer will register to run as a service and start the data exfiltration module. The data exfiltration module will then start the data packing module and exfiltrate the packed data to its command and control server.

2.4.2 SERVICE INSTALLER MODULE

When executed with the option ‘help’, the service installer module will register itself to run as a service. The command line option comparison is shown in Figure 6.

Figure 6 – Service Installer Options



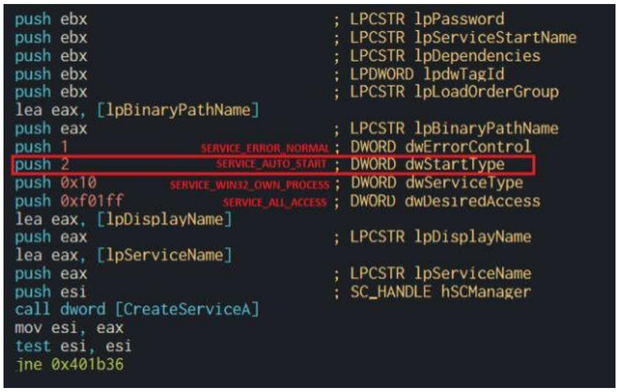
```
push str.help                        ; LPCSTR lpString2
push dword [esi + 4]                 ; LPCSTR lpString1
mov word [var_16h], ax
xor eax, eax
mov word [var_1eh], cx
mov word [var_14h], cx
mov word [var_12h], ax
call dword [lstrcmpiA]
test eax, eax
je 0x401ad1
```

```
and dword [var_160h], 0
lea eax, [lpServiceStartTable]
and dword [var_15ch], 0
push eax                         ; const SERVICE_TABLE_ENTRYW *lpServiceStartTable
mov dword [lpServiceStartTable], str.SecEditsrv
mov dword [var_164h], fcn.00401867 ;
call dword [StartServiceCtrlDispatcherW]
jmp 0x401b4f
```

```
push 0xf003f                     ; DWORD dwDesiredAccess
xor ebx, ebx
push ebx                         ; LPCSTR lpDatabaseName
push ebx                         ; LPCSTR lpMachineName
call dword [OpenSCManagerA]
mov esi, eax
test esi, esi
je 0x401b4f
```

As shown in Figure 7, the service will be registered to run in an independent process, with all access, and be started automatically by the service control manager during system start-up. This will ensure the module has all the access it needs to achieve its malicious goals.

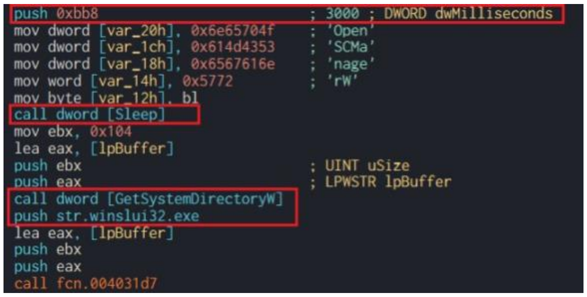
Figure 7 – Service Registration



```
push ebx                                       ; LPCSTR lpPassword
push ebx                                       ; LPCSTR lpServiceStartName
push ebx                                       ; LPCSTR lpDependencies
push ebx                                       ; LPDWORD lpdwTagId
push ebx                                       ; LPCSTR lpLoadOrderGroup
lea eax, [lpBinaryPathName]
push eax                                       ; LPCSTR lpBinaryPathName
push 1                   SERVICE_ERROR_NORMAL  ; DWORD dwErrorControl
push 2                     SERVICE_AUTO_START  ; DWORD dwStartType
push 0x10          SERVICE_WIN32_OWN_PROCESS   ; DWORD dwServiceType
push 0xf01ff                SERVICE_ALL_ACCESS ; DWORD dwDesiredAccess
lea eax, [lpDisplayName]
push eax                                       ; LPCSTR lpDisplayName
lea eax, [lpServiceName]
push eax                                       ; LPCSTR lpServiceName
push esi                                       ; SC_HANDLE hSCManager
call dword [CreateServiceA]
mov esi, eax
test esi, esi
jne 0x401b36
```

When executed as a service, the module will start the data exfiltration module as shown in Figure 8 (i.e. C:\Windows\system32\winslui32.exe in this case). A small delay is also added before starting the new process to reduce the possibility of being noticed.

Figure 8 – Executing Data Exfiltration Module

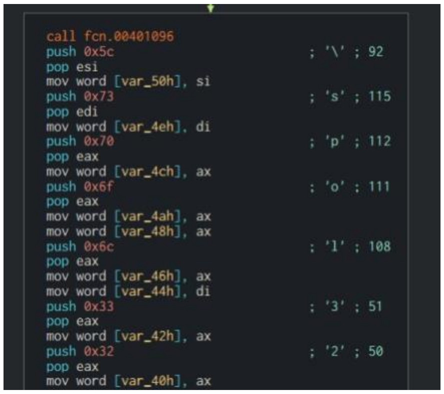


```
push 0xbb8                              ; 3000 ; DWORD dwMilliseconds
mov dword [var_20h], 0x6e65704f         ; 'Open'
mov dword [var_1ch], 0x614d4353         ; 'SCMa'
mov dword [var_18h], 0x6567616e         ; 'nage'
mov word [var_14h], 0x5772              ; 'rW'
mov byte [var_12h], bl
call dword [Sleep]
mov ebx, 0x104
lea eax, [lpBuffer]
push ebx                                ; UINT uSize
push eax                                ; LPWSTR lpBuffer
call dword [GetSystemDirectoryW]
push str.winslui32.exe
lea eax, [lpBuffer]
push ebx
push eax
call fcn.004031d7
```

2.4.3 DATA EXFILTRATION MODULE

As noted earlier, the data exfiltration module will start the data packing module to collect data on the victim's machine. The path to the data packing module is built at run time on the stack as shown in Figure 9. In this case, the path is %Temp%\ACB-D11C-335AAF\spools32.exe.

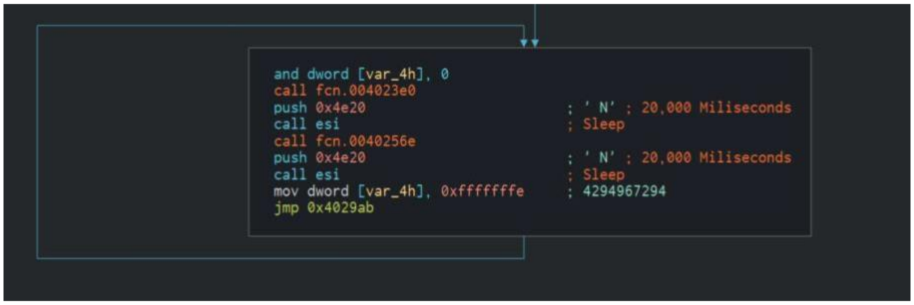
Figure 9 – Data Stealer Module's Name in Stack String



```
call fcn.00401096
push 0x5c                               ; '\' ; 92
pop esi
mov word [var_50h], si
push 0x73                               ; 's' ; 115
pop edi
mov word [var_4eh], di
push 0x70                               ; 'p' ; 112
pop eax
mov word [var_4ch], ax
push 0x6f                               ; 'o' ; 111
pop eax
mov word [var_4ah], ax
mov word [var_48h], ax
push 0x6c                               ; 'l' ; 108
pop eax
mov word [var_46h], ax
mov word [var_44h], di
push 0x33                               ; '3' ; 51
pop eax
mov word [var_42h], ax
push 0x32                               ; '2' ; 50
pop eax
mov word [var_40h], ax
```

After the preparation steps, it will enter an infinite loop to find the packed data (prepared by the data packing module), and transfer them to the C2 server (Figure 10). A long sleep of 20 seconds is also added between the exfiltration steps to avoid consuming unusually high Internet bandwidth.

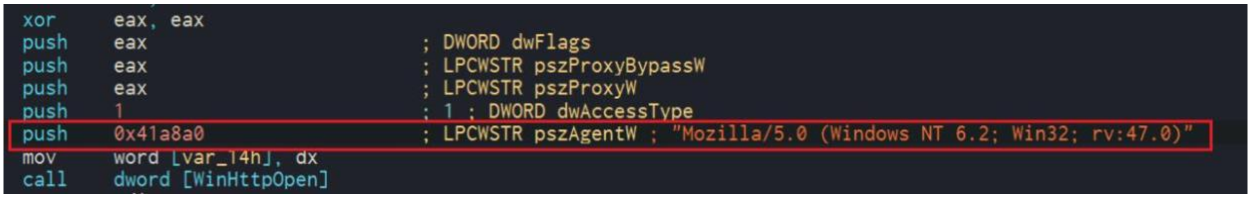
Figure 10 – C2 Exfiltration Infinite Loop



```
and dword [var_4h], 0
call fcn.004023e0
push 0x4e20                       ; ' N' : 20,000 Miliseconds
call esi                          ; Sleep
call fcn.0040256e
push 0x4e20                       ; ' N' : 20,000 Miliseconds
call esi                          ; Sleep
mov dword [var_4h], 0xfffffffe    ; 4294967294
jmp 0x4029ab
```

Inside the infinite loop, the module will build an HTTP header to communicate with the server. It starts by creating a WinHTTP-session with a hardcoded user-agent string as shown in Figure 11.

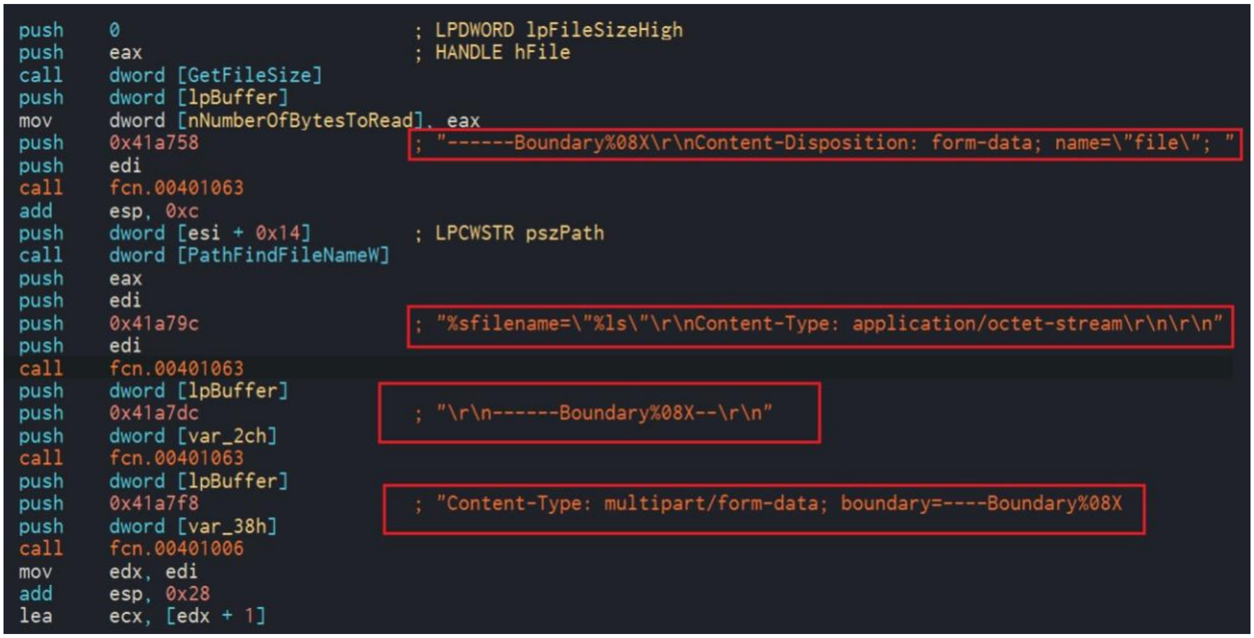
Figure 11 – Hardcoded User-agent String



```
xor     eax, eax
push    eax                         ; DWORD dwFlags
push    eax                         ; LPCWSTR pszProxyBypassW
push    eax                         ; LPCWSTR pszProxyW
push    1                           ; 1 ; DWORD dwAccessType
push    0x41a8a0                    ; LPCWSTR pszAgentW ; "Mozilla/5.0 (Windows NT 6.2; Win32; rv:47.0)"
mov     word [var_14h], dx
call    dword [WinHttpOpen]
```

The rest of the HTTP request is built as shown in Figure 12, which include the file name in the Content-Disposition header.

Figure 12 – HTTP Request for Data Exfiltration



```
push    0                          ; LPDWORD lpFileSizeHigh
push    eax                        ; HANDLE hFile
call    dword [GetFileSize]
push    dword [lpBuffer]
mov     dword [nNumberOfBytesToRead], eax
push    0x41a758                   ; "------Boundary%08X\r\nContent-Disposition: form-data; name=\"file\"; "
push    edi
call    fcn.00401063
add     esp, 0xc
push    dword [esi + 0x14]         ; LPCWSTR pszPath
call    dword [PathFindFileNameW]
push    eax
push    edi
push    0x41a79c                   ; "%sfilename=\"%ls\"\r\nContent-Type: application/octet-stream\r\n\r\n"
push    edi
call    fcn.00401063
push    dword [lpBuffer]
push    0x41a7dc                   ; "\r\n------Boundary%08X--\r\n"
push    dword [var_2ch]
call    fcn.00401063
push    dword [lpBuffer]
push    0x41a7f8                   ; "Content-Type: multipart/form-data; boundary=----Boundary%08X
push    dword [var_38h]
call    fcn.00401006
mov     edx, edi
add     esp, 0x28
lea     ecx, [edx + 1]
```

The data will be transferred to the C2 server in the form of an HTTP POST request's payload.

2.4.4 DATA PACKING MODULE

The data packing module is straight forward. It will search for files with the targeted extensions (such as .ppt, .pptx, .xls, .xlsx, .txt, .doc, .docx, .pdf, and .rtf). It will then compress the files into a temporary ZIP file and create .sft files for exfiltration. Note that this module is only started by the exfiltration module.

2.5 C2 Infrastructure

Promethium APT uses different domains for different campaigns for timespan. This can be a way to isolate different group of victim's data or to avoid detection (Old domains being backlisted).

The StrongPity samples analyzed by Cysiv Threat Research team connects to more than 50 domains as shown in Figure 13. These domains are registered and used at different time. However, we can see the pattern of domain names that the group like to use.

Figure 13 – Command and Control Domains

StrongPity’s Command and Control Domains
apn-state-upd2.com
app-mx3-delivery.com
app-system2-update.com
apt5-secure3-state.com
awe232-service-app.com
cdn2-state-upd.com
cdn2-svr-state.com
cdn2-system3-secrv.com
dangerposedbyhaving.com
dwn-balance.net
file3-netwk-system.com
fileservingpro.com
forwardyournetwork.com
hostoperationsystems.com
hybirdcloudreportingsoftware.com
inhousesoftwaredevelopment.com
mailtransfersagents.com
mentiononecommon.com
ms21-app3-upload.com
ms2-cdn4-east-upd.com
ms6-upload-serv3.com
ms-sys-security.com
mx1-upd-systm.com
mx3-rewc-state.com
network-msx-system33.com
oem-sec4-mx32.com
safecopydisk.com
secretinformations.com
secure-upd21-app2.com
selectednewfile.com
service-net2-file.com
srv5-upd51-mx3-sec22.com
srv6-service-cdmcom
srv-cdn3-system.com
state-awe3-apt.com
svr-sec2-system.com
sys4-upload2-srv.com
syse-update-app4.com
system2-access-sec43.com
system2-cdn5-mx8.com
system6-mxe-ups3.com
system-upload-srv.com
upd2-app-state.com
upd32-secure-serv4.com
upd3-srv-system-app.com
upd56-state3-cdn7-mx8.com
upd8-sys2-apt.com
update5-sec3-system.com
upd-cdn6-state.com
upd-ms3-app-state.com
upd-ncx4-server.com
upd-network-ms2.com
upd-secure-srv1.com
updt-servc-app2.com

When communicating with their server, different StrongPity spyware variants will contact hardcoded URL paths. Therefore, there are not many URL paths used on the server side. The list of common command and control URL path of StrongPity spyware is shown in Figure 14. Note that this list is not exhaustive.

Figure 14 – Common Command and Control URL Path

StrongPity’s Common Command and Control URL Path
/parse_ini_file.php
/ini.php
/phpinfo.php
/s3s3sxhxTuDSrkBQb88wE99Q.php
/kU2QLsNB6TzexJv5vGdunVXT.php
/p55C3xhxTuD5rkBQbB8wE99Q.php
/p5Pss34GvX21pxO0bz25vLqU.php
/p5pss34gvx21pxo0bz25vlqu.php
/goN9Z2In7mYQmN92dzX11CQL.php

3 REFERENCES

Note: A comma-separated values (.csv) file of more IOCs is available separately.

```
02d68d2a9b62d1fd79c80e7c01182d18966a8fccc07d997b0f4c3ef71e87910f
05be705bfc38c5daff3e1050d3b1424127f3eb555e185cf0bc93cc4a36fe306f
0713eb6b1f49b3dab0f6000a005f9376bf5b91480d2fe69f77df97fe66c89c7d
0db11972e8b3be2a954bb017a4a9d01758167badce14f5b919db8d2eed16b5eb
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13ace63b9e6524cdc0932767bde4a296d83f05d2e5679876dffb75a1a0ffc00b
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1af0958f8590b626bedfcd1972cd3ea49d9576db86f1e768e5520f9615d01a19
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