# **How Emotet Infects a PC**

In This Document, we are going to discuss **How Emotet Infects** a PC and a detailed analysis of it.

### What is Emotet?

Emotet is a banking malware, I think you have heard this quote before, but from where the "banking" term came?

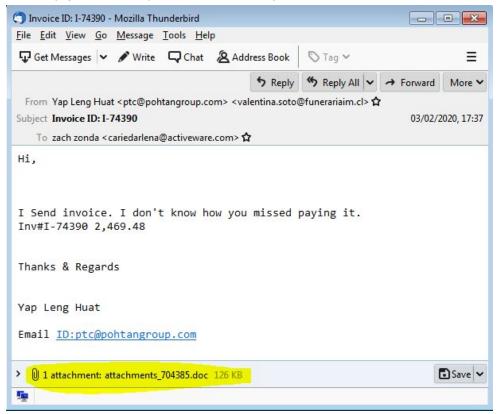
This malware sneaks into your PC and steals your personal information like username, passwords, in the very beginning of its era it is focused on stealing internet banking related information.

Emotet was first encountered in 2014. As it got aged it evolved from just a **banking** trojan to perform many more things.

Now it has the ability to infect the host to send spam email, self upgrading modules, backdoor activity, etc..

#### How does it spread?

It usually got spread by the spam emails, just like in the screenshot below.



Would you open this invoice, if it comes to your inbox? Maybe you don't, but there are still a huge number of people who are not aware of malicious emails and they download the attachment and open it and that's enough to infect your PC.

#### What is in the Attachment?

Attachment is just a doc file. Do you think it can do any harm to your PC? Let's figure out what it can do

> 🗓 1 attachment: attachments\_704385.doc 126 KB

SHA-1 of the doc file: 0dc994ee4c96f4fcd8f8d4a5b3fadba14f15355e

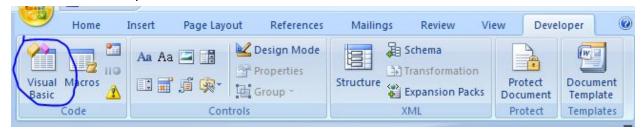


Ah, it is just asking you to enable editing... By enabling the editing you will give it permissions to enable the macros as well.

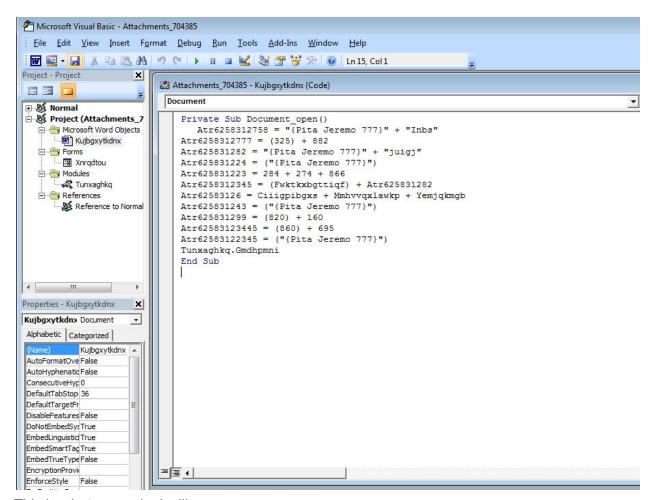
Now, what are macros?: Macros are the piece of program code that enables us to make some daily tasks automate, which can also be used for bad purposes as well... I'll demonstrate it in a minute.;)

#### Let's see what macro looks like.

Just follow the below screenshot to reach macros Click on the Developer Tab > Visual Basic.



After clicking the Visual Basic, You will see a screen like below



This is what macro looks like...

But you must be thinking this looks nothing malicious... What is wrong with this??

Let me run this doc file. And will show you what it does...

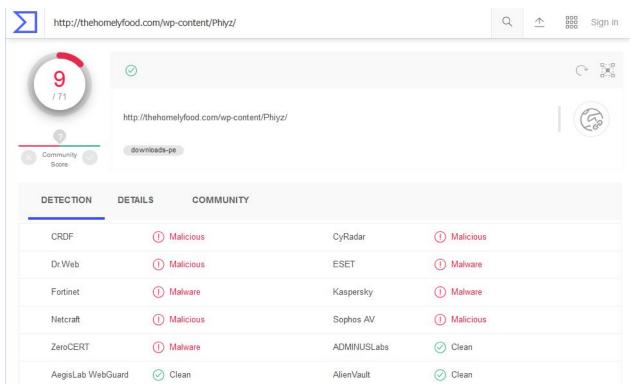
Ah, after executing the document in the safe environment and monitoring its activity, what I saw it is making a connection with 5 URL's

\*\*Note: I just kept my network disabled so nothing malicious can be download\*\*

A 20	502	HTTP	thehomelyfood.com	/wp-content/Phiyz/	
<u>21</u>	502	НТТР	Tunnel to	cfped-duca.com:443	
<u>22</u>	502	HTTP	Tunnel to	bookdigger.azurewebsites	
A 23	502	HTTP	wasap.lse.org.ro	/wp-admin/1Dz89/	8.
A 24	502	HTTP	furiousfox.in	/wp-content/aR/	

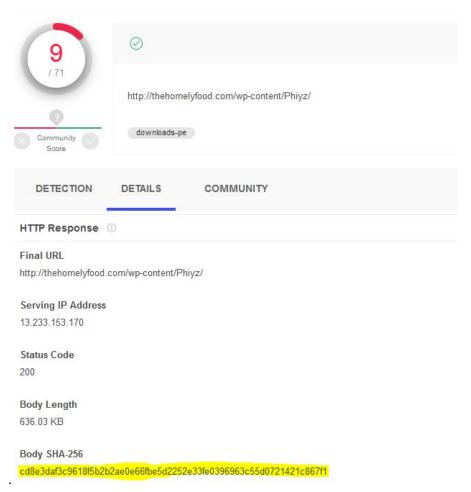
And it is trying to drop its payload in the "c:\user\PCName" folder

But why make connections? Let's check these URLs in the virustotal.com

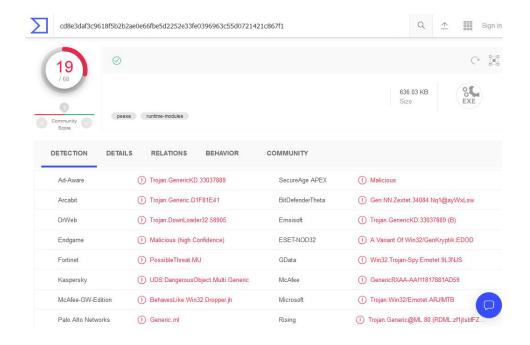


VirusTotal says the URI is malicious, but why? What is it trying to do? Let's check...

<sup>\*\*</sup>Note: Just keep up your network monitoring tool if you are trying with me. (i am using fiddler)\*\*



By going to its details, I got the SHA-256 of the file which this URL is trying to download, Let's click on this SHA and see what it is.



https://www.virustotal.com/gui/file/cd8e3daf3c9618f5b2b2ae0e66fbe5d2252e33fe0396963c55d0721421c867f1/detection

Oh look, It is getting detected by 19 AV vendors.

Now it is confirmed that Email which came to us pretending to be an invoice attached is actually a Malware Spam.

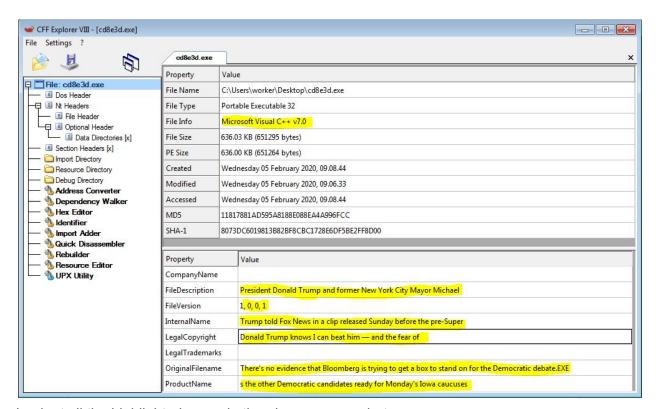
Now let's Dig more deeper into the File Downloaded by the Doc file :

SHA-256: cd8e3daf3c9618f5b2b2ae0e66fbe5d2252e33fe0396963c55d0721421c867f1

#### **Payload Analysis:**

cd8e3daf3c9618f5b2b2ae0e66fbe5d2252e33fe0396963c55d0721421c867f1

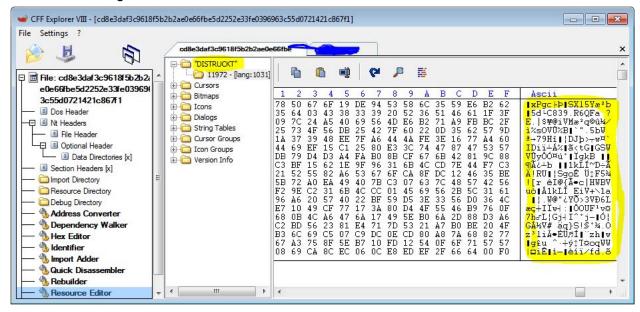
Let's open the file in CFF explorer and see what details we can gather...



Look at all the highlighted areas in the above screen-shot.

- From file info, we can say it's not packed.
- Doesn't even look like legit file description, some bogus values are entered in there related to Trump.. duh...

I found something unusual in the Resource editor as well. Check the Screenshot below.



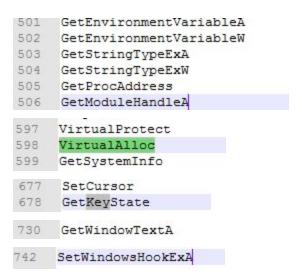
Looking at the highlighted areas, weird "DISTRUKT" Folder in the resource section, and having too much data, the data it looks encrypted as it is so dense.

Maybe this data creates some meaningful stuff after decryption.. Will check this later. (Keep this point in mind)

Let's check strings, why? Because string analysis can tell us a lot about what the program is capable of, and see what I got...:P

```
88 KERNEL32.DLL
89 Fuck Sophos
90 Invalid DateTimeSpan
91 AfxOldWndProc423
```

LOL, it looks like a targeted attack to the SOPHOS, Lets see what else we have...



It does have many more suspicious API calls.

Maybe if you're thinking how to extract strings from this file then follow below process: Download Strings v2.53 from here: https://docs.microsoft.com/en-us/sysinternals/downloads/strings

Use this Command: strings -n 8 YourFileName.exe

#### Let's start debugging in the OLLyDbg

I have loaded the File in OLLyDbg. I am on the Entry point of the file.

```
9941F9F2 $ 6A 69

9941F9F4 68 A8C74690

9941F9F9 E8 D69A0090

9941F9F9 BF 9400000

98C7 FFFFFF
                                                                                                                                                                                                                                                                                                                                         PUSH 60
PUSH cd8e3daf.0046C7A8
CALL cd8e3daf.004204C4
MOU EDI,94
MOU EAX.EDI
CALL cd8e3daf.0041F8C0
MOU DWORD PTR SS:[EBP-18],ESP
MOU DWORD PTR DS:[ESI],EDI
                                                                                                                                . 8BC7
. E8 C6FEFFFF
. 8965 E8
. 8BF4
. 893E
           0041F9F5
0041F9FA
  | MOU ESI,ESP | MOU DWORD PTR DS:[ESI],EDI | MOU EDI,DWORD PTR DS:[ESI],EDI | MOU EDI,DWORD PTR DS:[ESI],EDI | MOU EDI,DWORD PTR DS:[ESI],EDI | MOU DWORD PTR DS:[ESI],EDI | MOU EDI,DWORD PTR DS:[ESI],EDI | MOU DWORD PTR
           0041F9FD
           0041 F9 FF
```

Before stepping over, Let's collaborate what information we have gathered above.

- We found a weird-looking encrypted file in the Resource section "DISTRUKT".
- It is using VirtualAlloc and VirtualProtect.
- Having some spy related modules like SetWindowHook ,GetWindowText, GetKeyState, GetSystemInfo.

let's set some precautionary **breakpoints**. These breakpoints are totally dependent on our above analysis.

#### The BreakPoint on VirtualAlloc:

- VirtualAlloc is helpful because it returns newly created regions in memory in register EAX.
- And I think that our malware is trying to allocate memory regions to encrypted files inside .rsrc "DISTRUKT" and then it will decrypt the file.
- If we use a breakpoint on that, it will stop while allocating the memory and we can further analyze that allocated memory.
  - Note \* VirtualAlloc simply allocates memory not populate it.

# Setting breakpoint on VirtualAlloc:

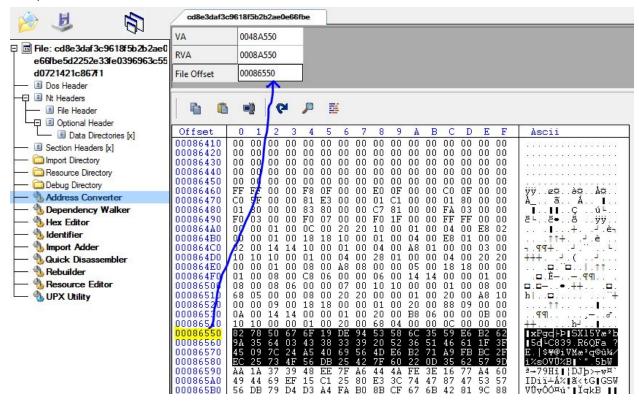
Program entry	noint										
Command : bp VirtualAlloc											
OCATEODO.	00	aa_	no.	OO.	DO	2E	40	aa	12n		
0047E0A8	56	AC	42	00	00	00	00	00	U%B		
0047E0A0											
0047E098									å½B.á?B.		

Press Enter after typing "Bp VirtualAlloc" into the command box.

# The breakpoint on .rsrc memory region:

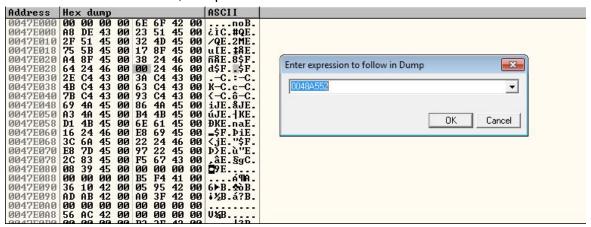
- We are going to set Hardware on access breakpoint on the memory location which I told you to Keep point in mind
- Because if it is going to allocate new memory for data in .rsrc, then it will surely
  access the .rsrc section to copy on the new location, at that point our Hardware
  on Access will give a pause to the program for analysis.

For setting the hardware breakpoint we have to first find the memory location address of .rsrc, Follow the Screenshot for that.

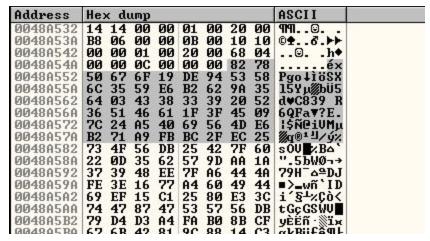


 Just take the offset of the the memory location which we looks like encrypted data in.rsrc and put it into the above converter, it will give us the VA and RVA of the file.

- Now we have VA(virtual address) of the address "0048A550" no. we have to go back to Olly in which our program already loaded.
- Press the shortcut CTRL+G and pop will appear like below, enter the memory location "0048A550" in that, and press OK

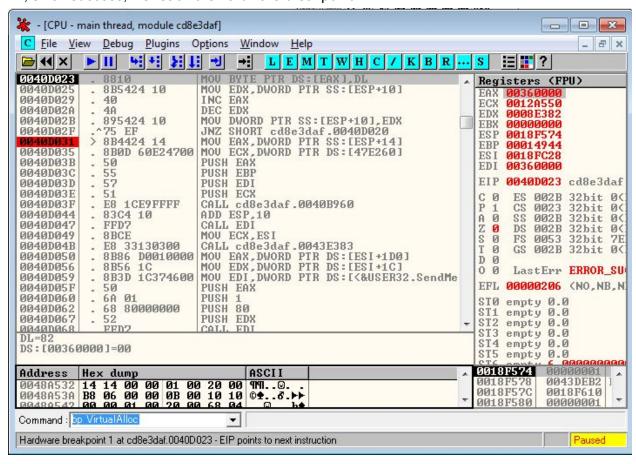


 Now you reached to the memory address "0048A550" and select some area, and now set a Hardware On-access Breakpoint by Right click > Breakpoint > Hardware, On Access > Dword



Now we set the both of the breakpoints, now we will cross our fingers and press F9.

Ah, small success, we reach the hardware breakpoint:

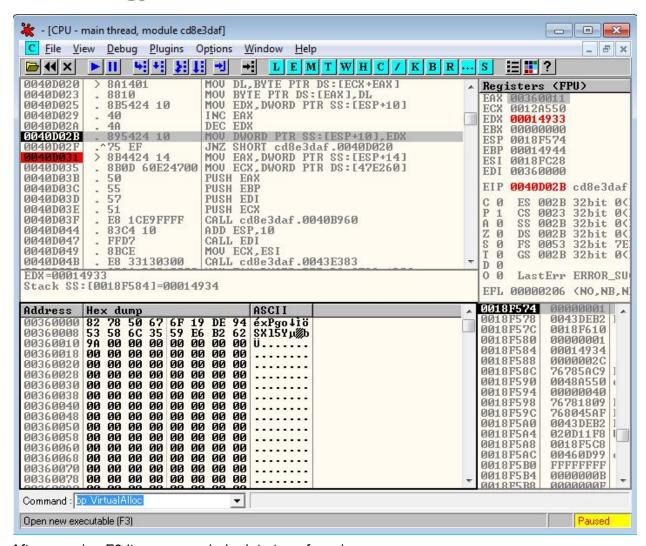


We got the allocated memory location in EAX "00360000", let's follow that location in the dump.

Address	Hex	dump					- 44	ASCII	Α.
00360000	00 0	00	00	00	00	00	00		
00360008	00 0	00	00	00	00	00	00		
00360010	00 0	00 0	00	00	00	00	00		
00360018	00 0	00	00	00	00	00	00		
00360020	00 0	00	00	00	00	00	00		
00360028	00 0	00	00	00	00	00	00		
00360030	00 0	00 0	00	00	00	00	00		
00360038	00 0	00	00	00	00	00	00		
00360040	00 0	00	00	00	00	00	00		
00360048	00 0	00	00	00	00	00	00		
00360050	00 0	00	00	00	00	00	00		
00360058	00 0	00	00	00	00	00	00		
00360060	00 0	00	00	00	00	00	00		
00360068			00	00	00	00	00	22222221	
00360070	00 0	9 99	00	00	00	00	00		
00360078	90 0		ØØ	ØØ	ØØ	ØØ	00	00000000	<u>_</u>
0007,0000	00 0	00	00	00	00	00	00		

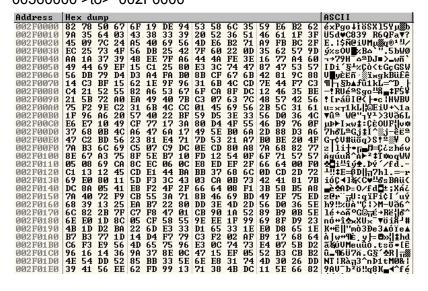
See the allocated memory is empty. Because encrypted data in .rsrc did not start copying yet. Keep Pressing F8 you'll see data getting copied to the allocated memory.

After pressing F8 a couple of times, we see data getting copied, let's set breakpoint outside the loop and press F9 to get the full dump.



After pressing F9 it gave me whole data transferred.

Please mind the Address changes in next screenshot because I have restarted the program: 00360000 >to> 002F0000



### Now Press F8 until you reach the call.

```
ยอสอบอุรหา
                               DEC EDA
              895424 10
                               MOU DWORD PTR SS:[ESP+10],EDX
0040D02B
            . 89542.
0040D02F
                               JNZ SHORT cd8e3daf.0040D020
0040D031
0040D035
            > 8B4424
              8B4424 14 MOU EAX, DWORD PTR SS:[ESP+14]
8B0D 60E24700 MOU ECX, DWORD PTR DS:[47E260]
0040D03B
              50
                               PUSH EAX
0040D03C
            . 55
                               PUSH EBP
                               PUSH ECX
0040D03D
              57
0040D03E
              51
                              CALL cd8e3daf . 0040B960
              E8 1CE9FFFF
0040D03F
              83C4 10
FFD7
                               ADD ESP.10
CALL EDI
0040D044
0040D047
           . 8BCE
0040D049
                               MOU ECX, ESI
           . E8 33130300
                               CALL cd8e3daf.0043E383
0040D04B
           . 8B86 D0010000 MOU EAX, DWORD PTR DS: [ESI+1D0]
0040D050
```

And press F8 on this call too. Just keep eye on HEX dump, to see data getting decrypted.

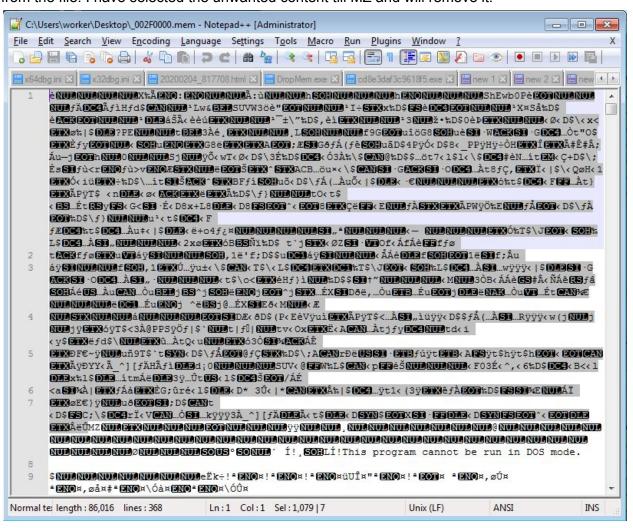
Address	Hex	k dı	ump														ASCII
002F0000	E8	00			00	58	89	C3									ÞXë   ☆: ☆ü   :
002F0010	F9	00	00	68	01	00	00	00	68	05	00		00		68	45	"h⊚h‡ShE
002F0020	77	62	30		E8	04	00	00	00	83	C4	14	C3	83	EC	48	wb@PÞ∳â—¶ âýH
002F0030	83	64		18	00	B9	4C		26	07	53	55			33	F6	âd\$↑.¦Lw&•SUŲW3÷
002F0040	E8	22	04	00	00	B9	49	F7	02	78	89	44	24	1C	E8	14	Þ''♦¦I <b>e</b> xëD\$∟Þ¶
002F0050	04	00	00	B9	58	A4	53	E5	89	44	24	20	E8	06	04	00	♦¦XñSốëD\$ Þ♣♦
002F0060	00	B9	10	E1	8A	C3	8B	E8	E8	FA	03	00	00	B9	AF	B1	.¦⊩βè ⊦ïÞÞ ♥¦»∭
002F0070	5C	94		44	24	2C	E8	EC	03	00	00	B9	33	00	9E	95	\öeD\$, Þý♥¦ 3.×δ
002F0080	89	44	- THE ST.	30	E8	DE	03	00	00	8B	D8	8B	44	24	5C	8B	ëD\$ØÞì♥ïïïD\$\ï
002F0090	78	3C		F8	89	7C	24	10	81	3F	50	45	00	00	74	07	x<♥ºë¦\$⊩ü?PEt•
002F00A0	33	CØ	E9	B8	03	00	00	B8	4C	01	00	00	66	39	47	04	3 400♥@L@f9G◆
002F00B0	75		F6	47	38	01	75	E8	0F	B7	57	06	0F	B7	47	14	u_÷G8@uÞ <b>*</b> ÀW <b>±</b> *ÀG¶
002F00C0	85	D2	74	22	8D	4F	24	03	C8	83	79	04	00	8B	01	75	àÊt"ì0\$♥Ľây♦.ï©u
002F00D0	05	03	47	38	EB	03	03	41	04	3B		0F	47	FØ	83	C1	<b>4</b> ♥G8ù♥♥A♦;ã*G-â <sup>⊥</sup>
002F00E0	28	83	EA	01	75	E3	8D	44	24		50	FF	D3	8B	44	24	(âû@uòìD\$4P EïD\$
002F00F0	38	8B	7.5	50	8D	50	FF	8D	48	FF	F7	D2	48	03	CE	03	8ï_PìP ìH _ÊH♥¦♥
002F0100	C3	23	CA	23	C2	3B	C1	75	97	6A	04	68	00	30	00	00	#"# <sub>T</sub> ; <sup>⊥</sup> սùյ∳հ.0
002F0110	53	6A	00	FF	D5	8B	77		8B		8B		24	5C		C9	Sj. TiwTiTiD\$\36
002F0120	89	44	- T			D3	33	CØ	89			18	40	89	44	24	
002F0130	24	85	F6		37	8B		24					14	23	E8	4E	
002F0140	85	ED	74	19	8B	C7	2B	44	24		3B	C8	73	ØF	83	F9	àÝt↓ïÃ+D\$\;Ľs¢â¨
002F0150	3C	72	05	83	F9	3E	76	05	C6	02	00	EB	04	8A	03	88	<ra><rafa>v fa@. ù fe fe</rafa></ra>
002F0160	02	41	43	42	85	F6	75	D7	8B	5C	24	18	0F	B7	47	06	<b>B</b> ACBà÷uîï\\$↑ <b>x</b> àG <b>•</b>

But this decrypted data still looks of no use. :(

Don't worry, scroll a little down and you'll find a hidden MZ header.

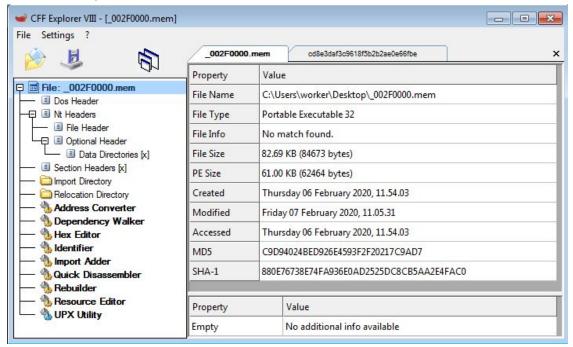
Address	Hex dump															ASCII	
002F04A0	C1	EB	10	33	FF	85	DB	74	1F	8B	6C	24	14	8A	04	2F	<u>-ù</u> ▶3 à t♥ï1\$¶è◆/
002F04B0	C1	C9	ØD	3C	61	0F	BE	CØ	70	03	83	C1	EØ	03	C8	47	Tr. <a*¥ livâ="" td="" tóvlg<=""></a*¥>
002F04C0	3B	FB	72	E9	8B	6C	24	10	8B	44	2A	20	33	DB	8B	70	; rúïl\$⊧ïD* 3∎ï¦
002F04D0	2A	18	03	C2	89	70	24	14	85	FF	74	31	8B	28	33	FF	*f♥⊤ë¦\$¶à t1ï₹3
002F04E0	03	EA	83	CØ	04	89	44	24	1C	0F	BE	45	00	C1	CF	ØD	♥ûâ ┗ĕĎ\$□₩¥E.⊸.
002F04F0	03	F8	45	80	7D	FF	00	75	FØ	8D	04	0F	3B	44	24	18	♥ºEC> .u-ì◆*;D\$↑
002F0500	74	20	8B	44	24	10	43	3B	5C	24	14	72	CF	8B	56	18	t iD\$_C;\\$¶rxiU↑
002F0510	85	D2	0F	85	6B	FF	FF	FF	33	CØ	5F	5E	5D	5B	83	C4	àê#àk 3 L_^][â−
002F0520	10	C3	8B	74	24	10	8B	44	16	24	8D	04	58	ØF	B7	ØC	▶¦ït\$⊳ïD_\$ì•X*à.
002F0530	10	8B	44	16	1C	8D	04	88	8B	04	10	03	C2	EB	DB	4D	▶ïD_∟ì♦êï♦▶♥ŢÙ <b>■</b> M
002F0540	5A	90	00	03	00	00	00	04	00	00	00	FF	FF	00	00	B8	Zé.♥♦©
002F0550	00	00	00	00	00	00	00	40	00	00	00	00	00	00	00	00	
002F0560	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	00	
002F0570	00	00	00	00	00	00	00	00	00	00	00	D8	00	00	00	ØE	ў ў
002F0580	1F	BA	ØE	00	<b>B4</b>	09	CD	21	B8	01	4C	CD	21	54	68	69	▼  ∏ .=!©@L=!Thi
002F0590	73	20	70	72	6F	67	72	61	6D	20	63	61	6E	6E	6F	74	
002F05A0	20	62	65	20	72	75	6E	20	69	6E	20	44	4F	53	20	6D	be run in DOS m
002F05B0	6F	64	65	2E	ØD	ØD	ØA	24	00	00	00	00	00	00	00	65	ode\$e
002F05C0	CB	6B	F7	21	AA	05	A4	21	AA	05	A4	21	AA	05	A4	FC	πk, !¬Φñ!¬Φñ!¬Φñ3
002F05D0	55	CE	A4	22	AA	05	A4	21	AA	04	A4	20	AA	05	A4	2C	
002F05E0	F8	DA	A4	20	AA	05	A4	2C	F8	E5	A4	23	AA	05	A4	5C	° r̃n ¬\$ñ, °õñ#¬\$ñ\
002F05F0	D3	EØ	A4	05	AA	05	A4	5C	D3	DB	A4	20	AA	05	A4	52	EÓÑ <b>⊉¬⊉</b> ñ∖E <b>B</b> ñ ¬ <b>⊉</b> ñR
002F0600	69	63	68	21	AA	05	A4	00	00	00	00	00	00	00	00	00	
002F0610	00	00	00	00	00	00	00	50	45	00	00	4C	01	05	00	18	PEL©♠.→
002F0620	AD	26	5E	00	00	00	00	00	00	00	00	EØ	00	02	01	ØB	
пизги63и	Й1	ИC	ЯΩ	ЯЯ	CE	ЯΩ	ЯΩ	ЯЯ	54	ЯΩ	ЯΩ	ЯΩ	ЯΩ	ЯΩ	ЯΩ	9 D	

Let's save this dump to the disk and open it to Notepad++ and remove the unwanted content from the file. I have selected the unwanted content till MZ and will remove it.



Now save the file after removing it. And load the file inside CFF explorer

# Aha, See we got the perfect PE file;)



SHA - 1: 880E76738E74FA936E0AD2525DC8CB5AA2E4FAC0

### Checking the behavior of an Extracted file.

Now let's dive deep into the extracted PE file..... Will continue in some days.