DanaBot | ThreatLabz

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Key Points

- DanaBot is a malware-as-a-service platform discovered in 2018 that is designed to steal sensitive information that may be used for wire fraud, conduct cryptocurrency theft, or perform espionage related activities
- The malware is heavily obfuscated which makes it very difficult and time consuming to reverse engineer and analyze
- Zscaler ThreatLabz has reverse engineered the various obfuscation techniques used by DanaBot and developed a set of tools using IDA Python scripts to assist with binary analysis

DanaBot, first discovered in 2018, is a malware-as-a-service platform that threat actors use to steal usernames, passwords, session cookies, account numbers, and other personally identifiable information (PII). The threat actors may use this stolen information to commit banking fraud, steal cryptocurrency, or sell access to other threat actors.

While DanaBot isn't as prominent as it once was, the malware is still a formidable and active threat. Recently, version 2646 of the malware was spotted in the wild and also a researcher tweeted screenshots of Danabot's advertisement website shown in Figure 1.

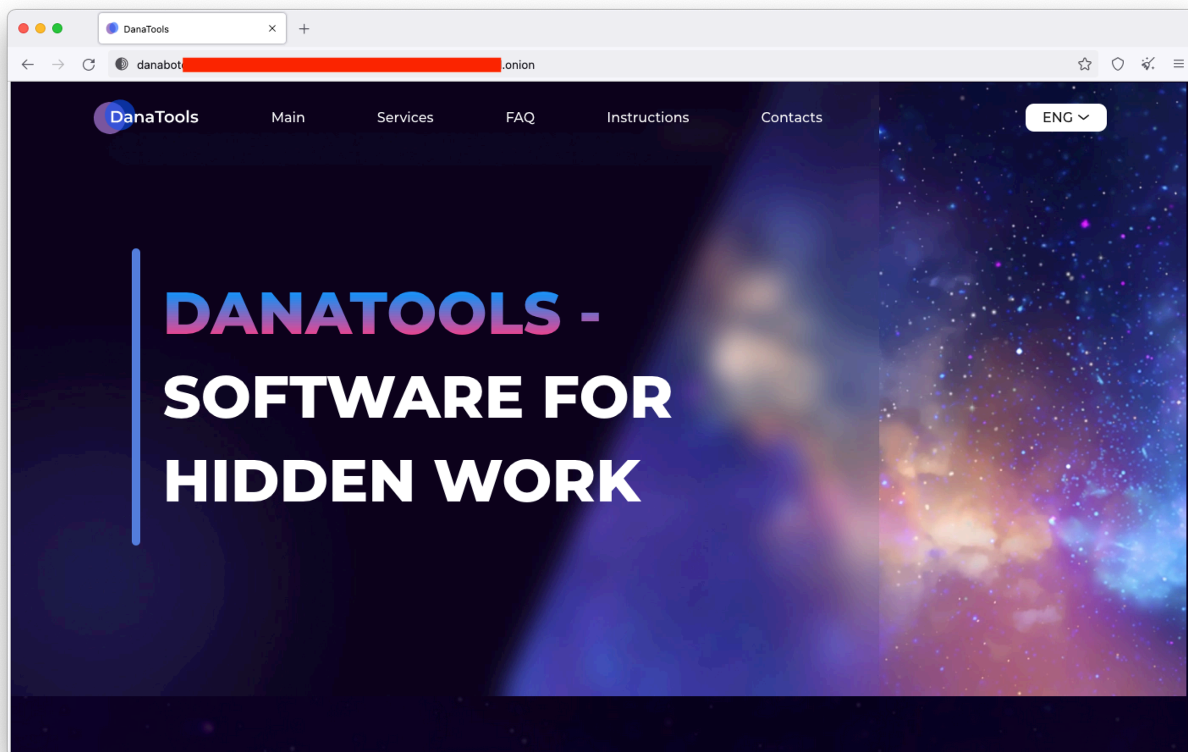


Figure 1: DanaBot’s advertisement website

Unfortunately, the DanBot developers have done a very good job of obfuscating the malware code. Therefore, it is very difficult and time consuming process to to reverse engineer and analyze. This is a companion blog post to a set of IDA Python scripts that Zscaler ThreatLabz is releasing on our Github page. The goal of the scripts is to help peel away some of the layers of DanaBot’s obfuscations and inspire additional research into not only the obfuscation techniques, but the malware itself.

Technical Analysis

The following sections summarize the numerous techniques that the DanaBot developers have implemented to obfuscate the malware binary code.

Junk Byte Jumps

One of the first anti-analysis techniques that DanaBot employs is a “junk byte jump” instruction. This is an anti-disassembly technique where a jump instruction will always jump over a junk byte. The junk byte is skipped during normal program execution, but causes IDA Pro to display an incorrect disassembly. An example of this technique is shown in Figure 2:

```
.text:00C73EA4 B8 00 00 00 00        mov     eax, 0          ; jumptable 00C73E5D case 0
.text:00C73EA9 83 F8 01              cmp     eax, 1
.text:00C73EAC 72 01                 jb      short near ptr loc_C73EAE+1
.text:00C73EAE
.text:00C73EAE             loc_C73EAE:                       ; CODE XREF: sub_C6A01C+9E90↑j
.text:00C73EAE 0D 8B 45 E0 8B        or      eax, 8BE0458Bh
.text:00C73EB3 10 FF                 adc     bh, bh
.text:00C73EB5 52                    push    edx
.text:00C73EB6 14 85                 adc     al, 85h
.text:00C73EB8 C0 0F 8E              ror     byte ptr [edi], 8Eh
.text:00C73EBB DF 19                 fistp   word ptr [ecx]
```

Figure 2: An example of a junk byte jump

The *[01_junk_byte_jump.py]* IDA Python script searches for junk byte jump patterns and patches them with NOP instructions. This operation fixes IDA Pro's disassembly as shown in Figure 3.

```
.text:00C73EA4 90                    nop                     ; jumptable 00C73E5D case 0
.text:00C73EA5 90                    nop
.text:00C73EA6 90                    nop
.text:00C73EA7 90                    nop
.text:00C73EA8 90                    nop
.text:00C73EA9 90                    nop
.text:00C73EAA 90                    nop
.text:00C73EAB 90                    nop
.text:00C73EAC 90                    nop
.text:00C73EAD 90                    nop
.text:00C73EAE 90                    nop
.text:00C73EAF 8B 45 E0              mov     eax, [ebp+var_20]
.text:00C73EB2 8B 10                 mov     edx, [eax]
.text:00C73EB4 FF 52 14              call    dword ptr [edx+14h]
.text:00C73EB7 85 C0                 test    eax, eax
.text:00C73EB9 0F 8E DF 19 00 00     jle     def_C73E5D      ; jumptable 00C73E5D default case
```

Figure 3: An example of a patched junk byte jump

Dynamic Returns

The next anti-analysis technique is a "dynamic return" operation. This technique calculates a new return address at the end of a function, causing a change in the program's control flow. In DanaBot's implementation, they are used to "extend" a function–exposing additional hidden code. An example of a dynamic return is shown in Figure 4.

```
.text:00D14456 E8 00 00 00 00     call    $+5        ; push next address (0x00D1445B) onto the stack
.text:00D1445B 58                 pop     eax        ; pop that pushed address (0x00D1445B) into eax
.text:00D1445C 83 C0 09           add     eax, 9     ; add 9 to the address: 0x00D1445B + 9 = 0x00D14464
.text:00D1445F 50                 push    eax        ; push this calculated address (0x00D14464) onto the stack as the new return address
.text:00D14460 C2 00 00           retn    0          ; return to the calculated address (0x00D14464)
.text:00D14460               ; ---------------------------------------------------------------------------
.text:00D14463 E6                 db 0E6h            ; junk byte
.text:00D14464 8D                 db  8Dh            ; calculated address
.text:00D14464                                       ;
.text:00D14464                                       ; this data will be converted into code and extend the original function
.text:00D14465 45                 db  45h ; E
.text:00D14466 DC                 db 0DCh
.text:00D14467 8B                 db  8Bh
.text:00D14468 15                 db  15h
.text:00D14469 2C                 db  2Ch ; , OFF32 SEGDEF [_data,DB8E2C]
.text:00D1446A 8E                 db  8Eh
.text:00D1446B DB                 db 0DBh
.text:00D1446C 00                 db    0
.text:00D1446D 8A                 db  8Ah
.text:00D1446E 12                 db  12h
.text:00D1446F 88                 db  88h
.text:00D14470 50                 db  50h ; P
.text:00D14471 01                 db    1
.text:00D14472 C6                 db 0C6h
.text:00D14473 00                 db    0
.text:00D14474 01                 db    1
.text:00D14475 8D                 db  8Dh
```

Figure 4: An example of a dynamic return

Using the *[02_dynamic_return.py]* IDA Python script, these dynamic returns can be patched, the functions extended, and the hidden code exposed. An example of this is shown in Figure 5.

```
.text:00D14456 90                nop                     ; call    $+5
.text:00D14457 90                nop
.text:00D14458 90                nop
.text:00D14459 90                nop
.text:00D1445A 90                nop
.text:00D1445B 90                nop                     ; pop     eax
.text:00D1445C 90                nop                     ; add     eax, 9
.text:00D1445D 90                nop
.text:00D1445E 90                nop
.text:00D1445F 90                nop                     ; push    eax
.text:00D14460 90                nop                     ; retn    0
.text:00D14461 90                nop
.text:00D14462 90                nop
.text:00D14463 90                nop                     ; junk byte
.text:00D14464 8D 45 DC          lea     eax, [ebp-24h]  ; calculated address
.text:00D14464                                           ;
.text:00D14464                                           ; this data will be converted into code and extend the original function
.text:00D14467 8B 15 2C 8E DB 00 mov     edx, off_DB8E2C
.text:00D1446D 8A 12             mov     dl, [edx]
.text:00D1446F 88 50 01          mov     [eax+1], dl
.text:00D14472 C6 00 01          mov     byte ptr [eax], 1
.text:00D14475 8D 55 DC          lea     edx, [ebp-24h]
.text:00D14478 8D 45 D8          lea     eax, [ebp-28h]
.text:00D1447B E8 94 61 6F FF    call    sub_40A614
.text:00D14480 8D 45 D4          lea     eax, [ebp-2Ch]
.text:00D14483 8B 15 98 8C DB 00 mov     edx, off_DB8C98
.text:00D14489 8A 12             mov     dl, [edx]
.text:00D1448B 88 50 01          mov     [eax+1], dl
.text:00D1448E C6 00 01          mov     byte ptr [eax], 1
.text:00D14491 8D 55 D4          lea     edx, [ebp-2Ch]
.text:00D14494 8D 45 D8          lea     eax, [ebp-28h]
```

Figure 5: An example of a patched dynamic return

Stack String Deobfuscation Preparation and Code Re-analysis

Before moving on to additional DanaBot anti-analysis techniques, we've included three IDA Python scripts:

- *03_uppercase_jumps.py*
- *04_letter_mapping.py*
- *05_reset_code.py*

The first two scripts are preparation steps to help with stack string deobfuscation described in a later section. The first script patches out a code pattern that is used to uppercase letters (this removes a small function basic block that interferes with stack string reconstruction) and the second script renames variables that store the letters used in stack strings.

Before running the third script, check that IDA Pro's "Options->Compiler…" is set to "Delphi" (see Figure 6.)

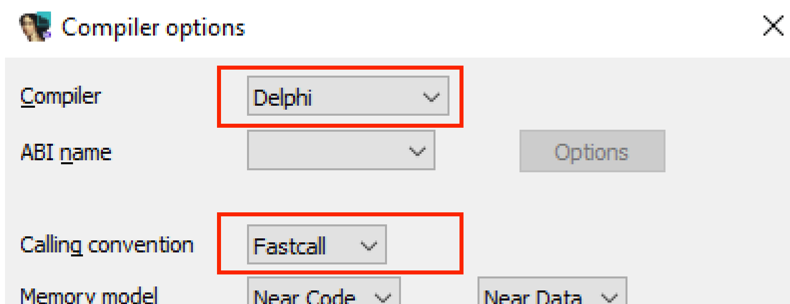


Figure 6: IDA Pro's Compiler options

Since the previous scripts patched a lot of existing code and exposed a bunch of new code, the *05_reset_code.py* script helps reset and re-analyze the modified code in IDA Pro to get a cleaner IDB database. Once the script and analysis completes, some manual clean up may be required. Our general method is:

- Search → Sequence of bytes…
- Search for the standard function prolog: 55 8B EC

- Sort by Function
- For each result without a defined function:
    - Right click → Create function…
    - Look for any addresses that are causing issues in the Output window
    - Right click → Undefine
    - Right click → Code

Junk StrAsg and StrCopy Function Calls

DanaBot adds a lot of junk code to slow down and complicate reverse engineering. One of the junk code patterns is adding extraneous *StrAsg* and *StrCopy* function calls. These functions are part of the standard Delphi library and are used to assign or copy data between variables. Figure 7 shows an example snippet of code with a number of these calls. If we trace the variable arguments we can see that they are usually assigned to themselves or a small set of other variables that aren't used in actual malware code.

```
char sub_4DAA24()
{
  // [COLLAPSED LOCAL DECLARATIONS. PRESS KEYPAD CTRL-"+" TO EXPAND]

  v124 = &savedregs;
  v123[1] = &unk_4DC551;
  v123[0] = NtCurrentTeb()->NtTib.ExceptionList;
  __writefsdword(0, v123);
  v231 = 0;
  v122[2] = &savedregs;
  v122[1] = &unk_4DC4B9;
  v122[0] = NtCurrentTeb()->NtTib.ExceptionList;
  __writefsdword(0, v122);
  System::__linkproc__ UStrCopy(junk1, 1, 1, &junk2);
  v221 = 158 - v222;
  v219 = 0;
  do
  {
    ++v219;
    System::__linkproc__ UStrCopy(junk2, 1, 0, &junk2);
  }
  while ( v219 < 1 );
  System::__linkproc__ UStrLAsg(&junk1, junk1);
  System::__linkproc__ UStrLAsg(&junk1, junk1);
  System::__linkproc__ UStrLAsg(&junk2, junk1);
  if ( v220 > i )
  {
    for ( i = 0; i != 11; ++i )
    {
      v217 = sub_407818(v226);
      v227 = 181 * v222;
      v225 = v223 + 141;
      System::__linkproc__ UStrCopy(junk2, 1, 0, &junk2);
      System::__linkproc__ UStrCopy(junk2, 1, 0, &junk1);
      System::__linkproc__ UStrCopy(junk1, 1, 1, &junk1);
```

Figure 7: Example of junk StrAsg and StrCopy function calls

The IDA Python script [*06_fake_UStrLAsg_and_UStrCopy.py*] tries to find and patch these junk calls. Figure 8 shows the result in the example from Figure 7.

```
char sub_4DAA24()
{
  // [COLLA                                  SS KEYPAD CTRL-"+" TO EXPAND]
            RET 0001 al          char;
  v127 = &s TOTAL STKARGS SIZE: 0
  v126 = &unk_4DC551;
  ExceptionList = NtCurrentTeb()->NtTib.ExceptionList;
  __writefsdword(0, &ExceptionList);
  v234 = 0;
  v124 = &savedregs;
  v123 = &unk_4DC4B9;
  v122 = NtCurrentTeb()->NtTib.ExceptionList;
  __writefsdword(0, &v122);
  v224 = 158 - v225;
  for ( i = 0; i < 1; ++i )
    ;
  if ( v223 > j )
  {
    for ( j = 0; j != 11; ++j )
    {
      v220 = sub_407818(v229);
      v230 = 181 * v225;
      v228 = v226 + 141;
    }
  }
```

Figure 8: Example of patched junk StrAsg and StrCopy function calls

Stack Strings

The next obfuscation method is DanaBot's version of creating "stack strings". The malware assigns letters of the alphabet to individual variables and then uses those variables, pointers to those variables, and various Delphi character/string handling functions to construct strings one character at a time. Figure 9 is an example construction of the string "wow64.dll".

```
BYTE5(v27) = *gp_w[0];                          // w
BYTE4(v27) = 1;
w_System::Move(&v27, (&v27 + 4));
v26 = *gp_o;                                    // o
v25 = 1;
LOBYTE(v3) = 2;
System::__linkproc__ PStrNCat(v3, &v25, ExceptionList);
w_System::Move(v24, &v27);
v26 = *gp_w[0];                                 // w
v25 = 1;
LOBYTE(v4) = 3;
System::__linkproc__ PStrNCat(v4, &v25, ExceptionList);
w_LStrFromPCharLen_0(v24, ExceptionList, v17);
ExceptionList = v28;
w_IntToStr(6, &v23);                            // 6
v15 = v23;
w_IntToStr(4, &v22);                            // 4
v14 = v22;
HIBYTE(v5) = BYTE1(gp_d);                       // d
LOBYTE(v5) = *gp_d;
w_LStrFromPCharLen(0, v5);
v13 = v21;
HIBYTE(v6) = BYTE1(gp_l);                       // l
LOBYTE(v6) = *gp_l;
w_LStrFromPCharLen(0, v6);
v12 = v20;
HIBYTE(v7) = BYTE1(gp_l);                       // l
LOBYTE(v7) = *gp_l;
w_LStrFromPCharLen(0, v7);
System::__linkproc__ LStrCatN(v19, v12, v13, &g_dot, v14, v15, ExceptionList);
```

Figure 9: Example stack string of “wow64.dll”

These stack strings litter most of the malicious functions in DanaBot and very easily lead to reverse engineering fatigue. On top of that, while some of the constructed strings are used for malware purposes, most of them turn out to be junk strings. Figure 10 is a snippet of output from a script that will be introduced below. As can be seen in the figure, most of the strings are random DLL, executable, and Windows API names.

```
setting comment zqoskwuerypenubeys at 0xce37f4
setting comment swmystemebobiledll at 0xce3ac9
setting comment wmidll at 0xce3d5b
setting comment sppcomapidll at 0xce3f06
setting comment mpcisbdaonstdll at 0xce4220
setting comment aaclientdll at 0xce45ba
setting comment abtrokerexe at 0xce486b
setting comment gpapidll at 0xce4aa7
setting comment kbdltdll at 0xce4cd9
setting comment unimdmatdll at 0xce4f38
setting comment cnbdll at 0xce528e
setting comment cnbpdll at 0xce556e
setting comment netutilsdll at 0xce59f8
setting comment mwsmmicrosoftananagementresourcesdll at 0xce77a2
setting comment sbsmscordbidll at 0xce817c
setting comment appidpolicyconverterexe at 0xce8877
setting comment mfpsdll at 0xce907b
setting comment apimswincorestringldll at 0xce921f
setting comment eehixtensdll at 0xce9a34
setting comment epnreabdll at 0xcea1a5
setting comment piulcverfncrementongounteralue at 0xcead16
setting comment imjppdmgexe at 0xceb414
setting comment cmscigdll at 0xceb696
setting comment adsmsextdll at 0xceb94c
setting comment mvstoccicrosoftisualtudiooolsfficeontainerontrolnidll at 0xcebc20
setting comment tvdiatadll at 0xcec529
```

Figure 10: Example script output showing junk strings

The best way to extract these stack strings is by emulating the construction code, but due to the following reasons we experimented with another deobfuscation technique:

- There are thousands of these strings
- There are not clear start/end patterns to automatically extract the construction code
- They rely on standard Delphi functions which aren't particularly easy to emulate
- Most of them are junk strings
- The sheer amount of construction code hinders malware analysis the most

The goal of the IDA Python scripts *07_stack_string_letters_to_last_StrCatN_call.py* and *08_set_stack_string_letters_comments.py* is not to extract a wholly accurate stack string, but enough of the string to determine whether the string is junk or not. After some trial and error experimentation, the scripts also try their best to remove the stack string construction code to allow for much easier analysis. If the string turns out to be legitimate, the original construction code is saved as comments so a proper extraction of the string can be done if/when needed.

Empty Loops and Junk Math Loops

After removing the junk *StrAsg* and *StrCopy* function calls and the stack strings, there will be a bunch of empty loops. The IDA Python script *09_empty_loops.py* can be used to remove these loops. There will also be loops left that just contain junk math code (see Figure 11.) The IDA Python script *10_math_loops.py* will remove these junk code math loops.

```
2108            do
2109            {
2110              ++j;
2111              m = 7 * i;
2112            }
2113            while ( j < 14 );
```

Figure 11: Example junk math loops

Junk Strings and Junk Global Variables

As we saw in the stack strings section above, there were a lot of DLL, executable, and Windows API name based junk strings. These junk strings exist as normal strings as well, see Figure 12 as an example.

Strings

Address	Length	Type	String
.text:00CC9...	0000000E	C (1...	ec.dll
.text:00CC9...	00000018	C (1...	IMJPAPI.DLL
.text:00CC9...	0000000C	C (1...	R.DLL
.text:00CC9...	00000070	C (1...	osoft.VisualStudio.Tools.Applications.Contract.v9.0.dll
.text:00CC9...	00000042	C (1...	stem.ServiceModel.WasHosting.dll
.text:00CC9...	00000016	C (1...	acerpt.exe
.text:00CC9...	00000018	C (1...	oledb32.dll
.text:00CC9...	00000014	C (1...	srwmi.dll
.text:00CC9...	00000012	C (1...	OKSE.dll
.text:00CCA...	00000020	C (1...	exicons0009.dll
.text:00CCA...	0000001C	C (1...	msidcrl30.dll
.text:00CCA...	00000010	C (1...	r20.dll
.text:00CCA...	00000010	C (1...	Cui.exe
.text:00CCA...	00000040	C (1...	i-ms-win-core-handle-l1-1-0.dll
.text:00CCA...	00000018	C (1...	pidgenx.dll
.text:00CCA...	00000018	C (1...	mshwgst.dll
.text:00CCA...	00000016	C (1...	InkDiv.dll
.text:00CCA...	00000014	C (1...	krskf.dll
.text:00CCA...	00000016	C (1...	dmintf.dll
.text:00CCA...	00000040	C (1...	stem.Diagnostics.StackTrace.dll
.text:00CCA...	00000016	C (1...	PMONTR.DLL
.text:00CCA...	00000030	C (1...	cationNotifications.exe
.text:00CCA...	00000014	C (1...	c100u.dll
.text:00CCA...	0000003E	C (1...	i-ms-win-core-synch-l1-1-0.dll
.text:00CCA...	00000014	C (1...	csnap.dll
.text:00CCA...	00000024	C (1...	ostNavigators.dll
.text:00CCA...	00000016	C (1...	msv1_0.dll
.text:00CCA...	0000002A	C (1...	msvcr110_clr0400.dll
.text:00CCA...	0000000E	C (1...	ex.dll

Line 5379 of 5913

Figure 12: Example junk strings

While we haven’t found good patterns to automatically remove references to these junk strings, the IDA Python script [11_rename_junk_variables.py] renames them as “junk” to ease manual analysis.

DanaBot also adds a lot of junk code involving global variables and various math operations, see Figure 13 for an example.

```
if ( g_junk1 > g_junk2 )
{
  k = i * n;
  g_junk1 = g_junk3 + 1;
  g_junk2 = 246 * (g_junk3 + 1);
  g_junk2 += 142;
  g_junk3 -= 141;
}
g_junk1 = g_junk3;
g_junk2 *= g_junk3;
g_junk3 = g_junk1;
v584 = g_junk2 + 4;
```

Figure 13: Example junk global variable math

The IDA Python script *12_rename_junk_random_variables.py* attempts to locate and rename these variables as "junk" to help with analysis.

Miscellaneous Tips and Tricks

Based on our experience reverse engineering DanaBot over the years, we have found the following miscellaneous tricks and tips to be helpful. The first is using the Interactive Delphi Reconstructor (IDR) program to export standard Delphi library function and variable names. We use Tools → MAP Generator and Tools → IDC Generator to export MAP and IDC files. While IDR creates an IDA IDC script, we don't use it directly as it degrades the quality of the IDA Pro disassembly/decompilation. Instead, we use the scripts *idr_idc_to_idapy.py* and *idr_map_to_idapy.py* to extract the information from the generated IDC and MAP files and use the output scripts to import the naming information.

DanaBot resolves some of its Windows API functions by hash, so we use OALabs' HashDB IDA Plugin (which recently added support for DanaBot's hashing algorithm) to resolve the names by hash.

Finally, we make liberal use of IDA Pro's right click → Collapse item feature to hide the remaining junk code, especially the renamed junk strings and global variables.

Before and After Example

As an overall example, Figure 14 is a screenshot for a section of DanaBot code before the deobfuscation scripts have been applied. The details of the code don't particularly matter for this discussion, but the snippet shows DanaBot's initialization of its 455-byte binary structure used in its initial "system information" command and control beacon.

```
1591      dword_DB8AC0 *= 197;
1592      dword_DB8AC4 = sub_407360(v696, v728, v775, v783, v790, v796, v802, v809, v
1593      dword_DB8AC0 = dword_DB8ABC;
1594      if ( 2 * dword_DB8ABC > dword_DB8ABC )
1595      {
1596        v1016 = dword_DB8AC0 + 4;
1597        dword_DB8AC4 = System::__linkproc__ TRUNC((dword_DB8AC0 + 4));
1598        dword_DB8ABC = 252 - dword_DB8AC4;
1599        dword_DB8AC0 = dword_DB8AC4 - 249;
1600        dword_DB8AC4 = sub_407818(dword_DB8AC4);
1601      }
1602      sub_407918(&s455, 455, 0);
1603      for ( k = 0; k != 8; ++k )
1604      {
1605        System::__linkproc__ UStrLAsg();
1606        for ( m = 0; m != 6; ++m )
1607        {
1608          dword_DB8ABC -= 69;
1609          dword_DB8ABC -= dword_DB8AC0;
1610          v1016 = dword_DB8ABC + 14;
1611          sub_407818((dword_DB8ABC + 14));
1612          dword_DB8AC0 = dword_DB8ABC * dword_DB8ABC;
1613          dword_DB8AC4 = dword_DB8ABC * dword_DB8ABC + 111;
1614        }
1615        dword_DB8AC0 = dword_DB8AC4 + dword_DB8ABC;
1616        dword_DB8ABC += dword_DB8AC4;
1617        if ( dword_DB8ABC > dword_DB8AC4 )
1618        {
1619          dword_DB8ABC -= 149;
1620          dword_DB8AC0 = 147 * dword_DB8ABC;
1621          dword_DB8AC0 = System::__linkproc__ TRUNC(dword_DB8ABC);
1622          dword_DB8AC4 = dword_DB8AC0;
1623          v1016 = dword_DB8AC0 + 4;
1624          dword_DB8ABC = System::__linkproc__ TRUNC((dword_DB8AC0 + 4));
```

Figure 14: Example of code before deobfuscations

Figure 15 is an example of the same code snippet after applying the deobfuscation scripts.

```
311     junk_random_3 *= 197;
312     junk_random_4 = idr609611_Random(v34, v35, v36);
313     junk_random_3 = junk_random_5;
314     if...
315     idr609737__FillChar(&s455, 455, 0);
316     for...
317     junk_random_3 = 0;
318     junk_random_5 = 0;
319     junk_random_3 = idr609696__ROUND(0);
320     *&s455.command = 1024;
321     idr610929__PStrNCpy(&s455.arg, &gp_s744->botid, 32u);
322     j = m + k;
323     idr611389__UStrEqual(L"msobjs.dll", junk_string_259);
324     if...
325     idr611330__UStrFromString(v34, v35, v36); // sqloledbdll
326     idr611318__UStrToString(255, *gp_build_hash, v55);
327     idr610929__PStrNCpy(&s455.arg2, v55, 0x20u);
328     v58 = k + 134;
329     j = idr609696__ROUND((k + 134));
330     junk_random_4 = junk_random_3;
331     if...
332     junk_random_5 += 108;
333     junk_random_3 = 0;
334     v67 = junk_string_257;
335     if...
336     if...
337     generate_random_data(v53);
338     idr610998__LStrFromWStr(v34);
339     get_md5_hex_digest(v53[1], &v54);
340     encode_len_crc32_data(v54, &s455.rand2, 0x108);
341     i = 230 - j;
342     k = 0;
343     do...
344     v58 = junk_random_5 + 4;
345     junk_random_4 = idr609701__TRUNC((junk_random_5 + 4));
```

Figure 15: Example of code after deobfuscations

Conclusion

While there is still room for improvement, the DanaBot malware code is much easier to analyze and reason about. Expanding the scope to the entire binary, the deobfuscation techniques significantly reduce the complexity and time spent while reverse engineering the malware. We look forward to making further improvements/additions and welcome other researchers' contributions to the existing scripts to peel away more layers of DanaBot's obfuscation.

Zscaler Detection Status

- W32/Danabot

Cloud Sandbox Detection

zscaler Cloud Sandbox

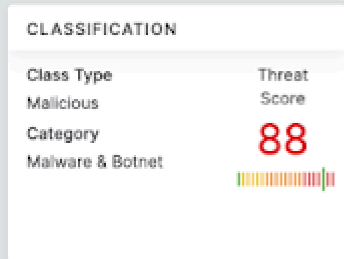
SANDBOX DETAIL REPORT

• High Risk • Moderate Risk • Low Risk

Report ID (MD5): 014751C83DB75E84BFF37F67036...

Analysis Performed: 11/17/2022 9:07:47 AM

File Type: dll



MITRE ATT&CK

This report contains 10 ATT&CK techniques mapped to 6 tactics

VIRUS AND MALWARE

No known Malware found

SECURITY BYPASS

- AV Process Strings Found
- May Try To Detect The Virtual Machine To Hinder Analysis

NETWORKING

- May Use The Tor Software To Hide Its Network Traffic
- URLs Found In Memory Or Binary Data

STEALTH

- Tries To Detect Virtualization Through RDTSC Time Measurements
- Disables Application Error Messages

SPREADING

No suspicious activity detected

INFORMATION LEAKAGE

- Enumerates The File System

EXPLOITING

- Known MD5
- May Try To Detect The Windows Explorer Process

PERSISTENCE

- Creates Temporary Files
- May Use Bcdedit To Modify The Windows Boot Settings
- PE File Contains Sections With Non-Standard Names

SYSTEM SUMMARY

- Dynamic Yara Hits
- One Or More Processes Crash
- Queries Information About The Installed CPU
- Binary Contains Paths To Debug Symbols
- Classification Label

DOWNLOAD SUMMARY

Original file	10 MB
Dropped files	2 MB
Packet capture	No network traffic

ORIGIN

Origin information not identified

FILE PROPERTIES

File Type dll

Digital Certificate Vendor File is not digitally signed

File Size 10,740,736 bytes

MD5 014751c83db75e84bff37f67036822e7

SHA1 868a60a08d6e3b94ff4b3fe3696b5d5f-f2733e12

SSDEEP 196608:lMnUzPCDNtqRHWJhmhf/alqJ81Lq-YVhqXg8UlNc94ArNGmT/qZA:lMniCDNtq1a8g5Lqfg8UeUmDk

DROPPED FILES

- 7718_014751c83db75e84bff37f67036822e7-Dynamic_yara_data.Zip
- C:\ProgramData\Microsoft\Windows\WER\Temp\WER1453.Tmp.Dmp
- C:\ProgramData\Microsoft\Windows\WER\ReportQueue\AppCrash_loaddll32.Exe_e125fe1a6ce-fe5b6a4a2528781ba6c3f59779d6_addb03b0_fc59a4aa-4324-4d18-A034-5d604aeb6660\Report.Wer
- C:\ProgramData\Microsoft\Windows\WER\Temp\WER183C.Tmp.WERInternalMetadata.Xml
- C:\ProgramData\Microsoft\Windows\WER\Temp\WER19D3.Tmp.Xml
- ZsApiList.Txt

SCREENSHOTS

NETWORK PACKETS

ALL 24 | SMTP 0 | ICMP 0 | HTTP 0 | UDP 24 | TCP 0 | IRC 0 | FTP 0 | DNS 0 | HTTPS 0

TIME	SOURCE	DESTINATION	PROTOCOL
09:08:51 GMT-0500 (Eastern	192.168.1.17	8.8.8.8	UDP
09:08:51 GMT-0500 (Eastern	8.8.8.8	192.168.1.17	UDP
09:08:52 GMT-0500 (Eastern	192.168.1.17	8.8.8.8	UDP
09:08:52 GMT-0500 (Eastern	8.8.8.8	192.168.1.17	UDP
09:08:55 GMT-0500 (Eastern	192.168.1.17	8.8.8.8	UDP
09:08:55 GMT-0500 (Eastern	8.8.8.8	192.168.1.17	UDP
09:08:56 GMT-0500 (Eastern	192.168.1.17	8.8.8.8	UDP
09:08:56 GMT-0500 (Eastern	8.8.8.8	192.168.1.17	UDP
09:09:01 GMT-0500 (Eastern	192.168.1.17	8.8.8.8	UDP
09:09:02 GMT-0500 (Eastern	8.8.8.8	192.168.1.17	UDP
09:09:34 GMT-0500 (Eastern	192.168.1.17	8.8.8.8	UDP
09:09:34 GMT-0500 (Eastern	8.8.8.8	192.168.1.17	UDP
09:09:36 GMT-0500 (Eastern	192.168.1.17	8.8.8.8	UDP

General — Timestamp: 09:08:51 GMT-0500 (Eastern Standard Time)
Internet Protocol — Source Address - Destination Address: 192.168.1.17 - 8.8.8.8
Transport Protocol — Source Port - Destination Port: 51029 - 53

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Indicators of Compromise

IOC	Notes
8c6224d9622b929e992500cb0a75025332c9cf901b3a25f48de6c87ad7b67114	SHA256 hash of DanaBot version 2646 main component