Defeating IsDebuggerPresent()

Notebook:	Reverse Engineering		
Created:	1/09/2020 6:08 PM	**Updated:**	1/09/2020 6:31 PM
Author:	Daniel de Jager		

Defeating IsDebuggerPresent()

A popular anti-forensic technique used by malware authors is to detect whether their applications are being debugged. It is accomplished by using kernelbase.dll (kernel32) function called IsDebuggerPresent() and IsRemoteDebuggerPresent(). This document will focus on defeating IsDebuggerPresent().

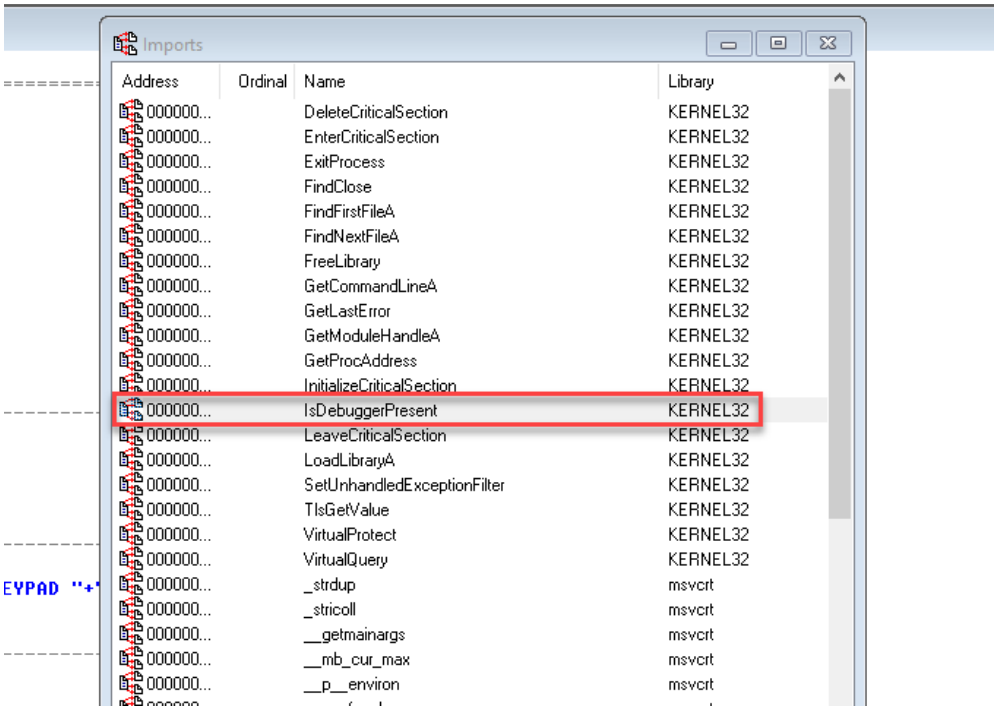
The methodology used is as follows:

- Write a C++ program that checks whether a debugger is present
- Reverse the PE file and change program flow by patching

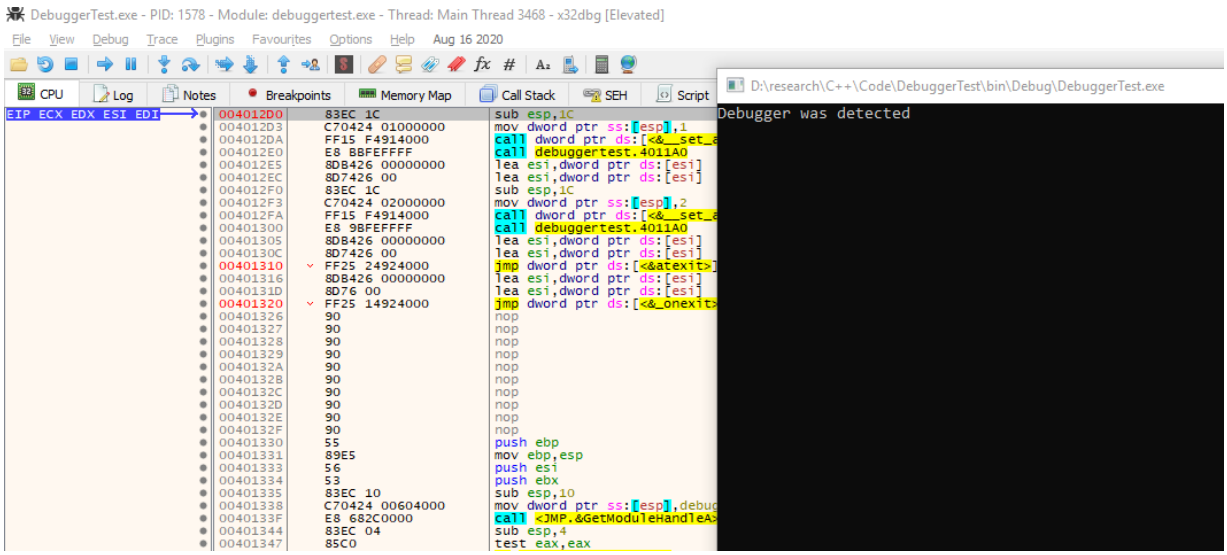
IsDebuggerPresent() Code:

```
#include <iostream>
#include <windows.h>

using namespace std;

int main()
{
   if(IsDebuggerPresent())
   {
      std::cout << "Debugger was detected" << endl;
   }
   else
   {
      std::cout << "Nothing to worry about" << endl;
   }
   std::cin.get();
   return 0;
}
```

- Performing input analysis with IDA shows that the function is imported



- Testing the application in x32DBG shows that the application does indeed detect the debugger



Under the hood of kernelbase.dll

- IsDebuggerPresent() is only three lines of code
- It reads as follows:
    - take the value of the FS register at address 0x30 and store it in EAX
    - take the byte value of eax offset with 2 bytes and replace EAX
    - return

```
.text:1010AAD0
.text:1010AAD0 ; BOOL __stdcall IsDebuggerPresent()
.text:1010AAD0                 public IsDebuggerPresent
.text:1010AAD0 IsDebuggerPresent proc near             ; CODE XREF: sub_101408E5:loc_10140918↓p
.text:1010AAD0                 mov     eax, large fs:30h
.text:1010AAD6                 movzx   eax, byte ptr [eax+2]
.text:1010AADA                 retn
.text:1010AADA IsDebuggerPresent endp
.text:1010AADA
.text:1010AADA ; ---------------------------------------------------------------------------
```

https://en.wikipedia.org/wiki/Win32_Thread_Information_Block#:~:text=In%20computing%2C%20the%20Win32%20Thread,similar%20structure%20in%20OS%2F2.

- FS is a datastructure in Win32 x86 that stores information about the currently running thread - also known as the Thread Environment Block (TEB)
- The TIB can be used get loads of information about the process without calling Win32 API
- TIBx30 points to the process environment block

Bytes/ Type	offset (32-bit, FS)	offset (64-bit, GS)	Windows Versions	Description
pointer	FS:[0x00]	GS:[0x00]	Win9x and NT	Current Structured Exception Handling (SEH) frame Note: the 64-bit version of Windows uses stack unwinding done in kernel mode instead.
pointer	FS:[0x04]	GS:[0x08]	Win9x and NT	Stack Base / Bottom of stack (high address)
pointer	FS:[0x08]	GS:[0x10]	Win9x and NT	Stack Limit / Ceiling of stack (low address)
pointer	FS:[0x0C]	GS:[0x18]	NT	SubSystemTib
pointer	FS:[0x10]	GS:[0x20]	NT	Fiber data
pointer	FS:[0x14]	GS:[0x28]	Win9x and NT	Arbitrary data slot
pointer	FS:[0x18]	GS:[0x30]	Win9x and NT	Linear address of TEB
				End of NT subsystem independent part; below are Win32-dependent
pointer	FS:[0x1C]	GS:[0x38]	NT	Environment Pointer
pointer	FS:[0x20]	GS:[0x40]	NT	Process ID (in some Windows distributions this field is used as 'DebugContext')
4	FS:[0x24]	GS:[0x48]	NT	Current thread ID
4	FS:[0x28]	GS:[0x50]	NT	Active RPC Handle
4	FS:[0x2C]	GS:[0x58]	Win9x and NT	Linear address of the thread-local storage array
4	FS:[0x30]	GS:[0x60]	NT	Linear address of Process Environment Block (PEB)
4	FS:[0x34]	GS:[0x68]	NT	Last error number
4	FS:[0x38]	GS:[0x6C]	NT	Count of owned critical sections
4	FS:[0x3C]	GS:[0x70]	NT	Address of CSR Client Thread
4	FS:[0x40]	GS:[0x78]	NT	Win32 Thread Information
124	FS:[0x44]	GS:[0x80]	NT, Wine	Win32 client information (NT), user32 private data (Wine), 0x60 = LastError (Win95&98), 0x74 = LastError (WinME)
4	FS:[0xC0]	GS:[0x100]	NT	Reserved for Wow64. Contains a pointer to FastSysCall in Wow64.
4	FS:[0xC4]	GS:[0x108]	NT	Current Locale
4	FS:[0xC8]	GS:[0x10C]	NT	FP Software Status Register

https://docs.microsoft.com/en-us/windows/win32/api/winternl/ns-winternl-peb

PEB+2 points to BeingDebugged()

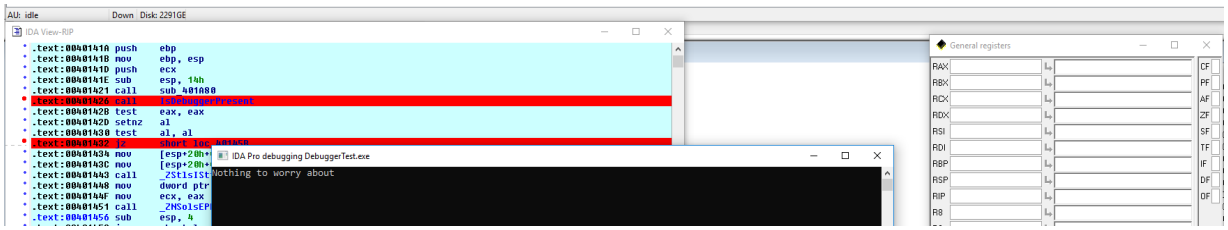
Syntax

C++ Copy

```
typedef struct _PEB {
  BYTE                          Reserved1[2];
  BYTE                          BeingDebugged;
  BYTE                          Reserved2[1];
  PVOID                         Reserved3[2];
  PPEB_LDR_DATA                 Ldr;
  PRTL_USER_PROCESS_PARAMETERS  ProcessParameters;
  PVOID                         Reserved4[3];
  PVOID                         AtlThunkSListPtr;
  PVOID                         Reserved5;
  ULONG                         Reserved6;
  PVOID                         Reserved7;
  ULONG                         Reserved8;
  ULONG                         AtlThunkSListPtr32;
  PVOID                         Reserved9[45];
  BYTE                          Reserved10[96];
  PPS_POST_PROCESS_INIT_ROUTINE PostProcessInitRoutine;
  BYTE                          Reserved11[128];
  PVOID                         Reserved12[1];
  ULONG                         SessionId;
} PEB, *PPEB;
```

Debugging in IDA

- If a change the value of RAX to 0, then I defeat the logic and a debugger is not said not to be present

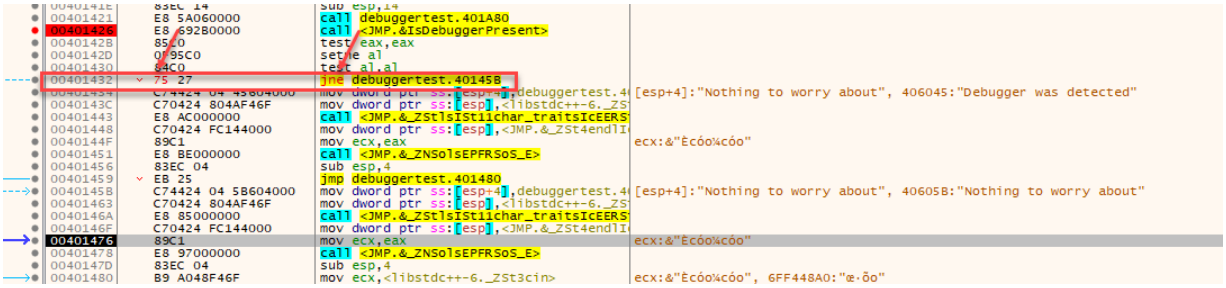


With x32DBG

Here I change the process flow (changed opco JE to JNE) using assembly

Procedure:

- Alt+E
- Click on Application and search for IsDebuggerPresent
- Double Click
- Follow in Assembly
- Press F2 to create a breakpoint
- Execute until the breakpoint is reached then make the changes



Outcome: