R4ndom's Tutorial #12: A Tougher NOOBy Example

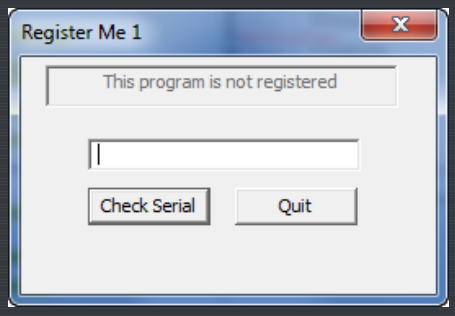
by R4ndom on Jul.09, 2012, under Beginner, Reverse Engineering, Tutorials

Introduction

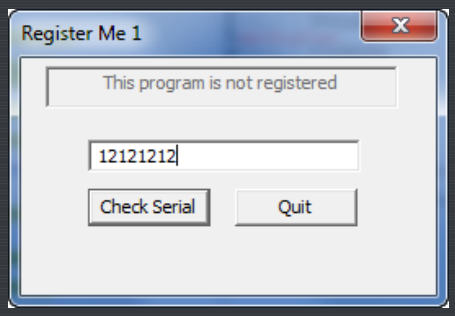
In this tutorial we will be going over a program that's a little more challenging. It is called ReverseM1, written by R4ndom. I will also be discussing the plugin "Ascii Table" for Olly. It is downloadable on the tools page. This ReverseMe is a perfect example of why the LAME way of patching is often just that- lame.

Getting Started

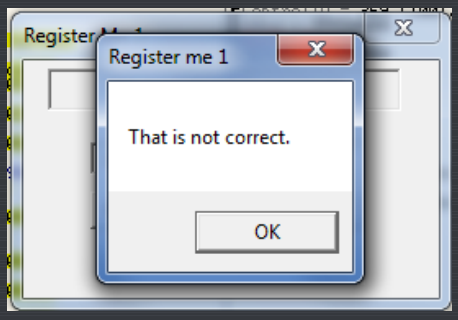
Go ahead and run the program:



We can see that it says it is not registered and is asking for a serial number. Let's give it one:

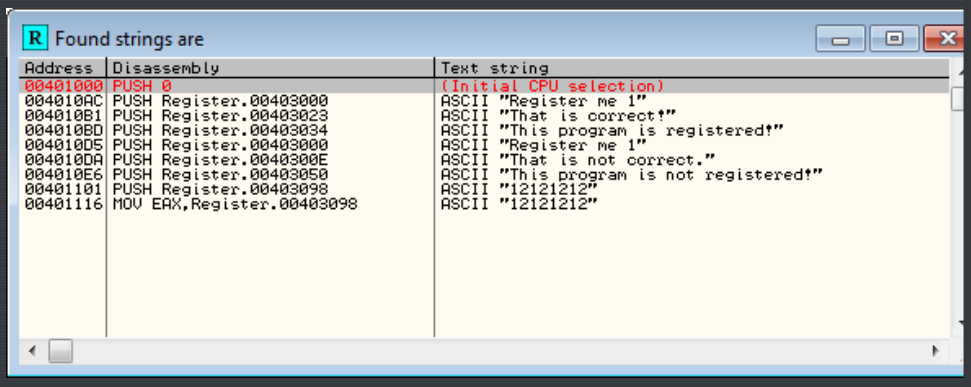


and click "Check Serial":

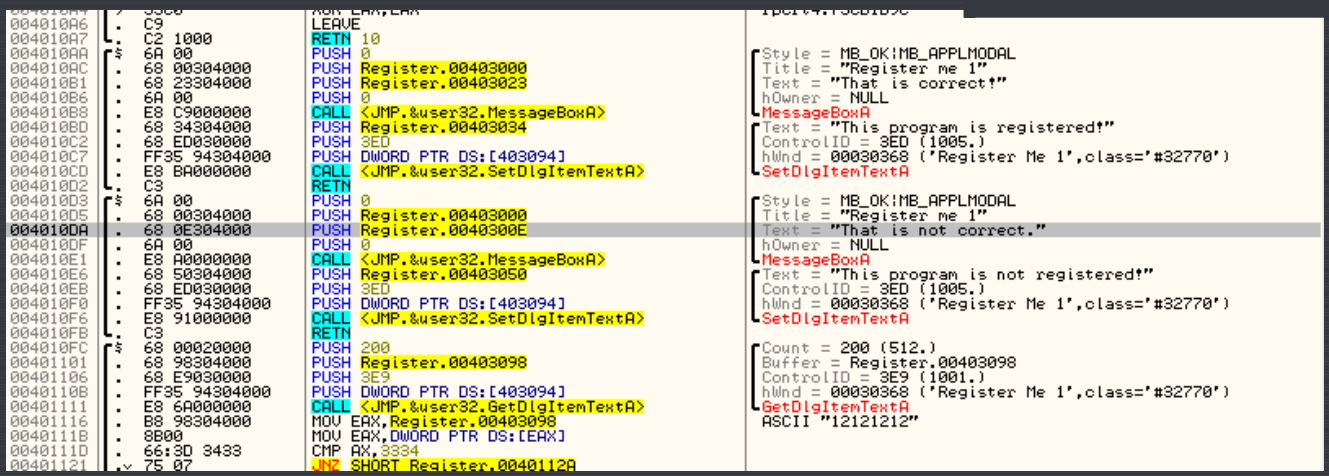


and we can see we are not correct (again!). Let's open the app in Olly and do our trusty "search for

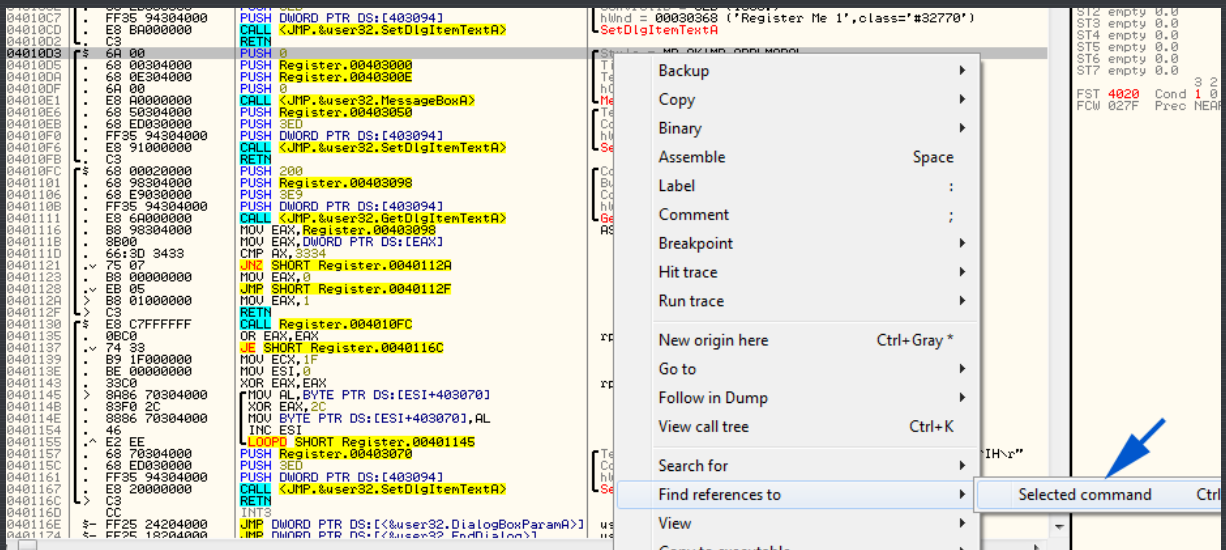
strings":



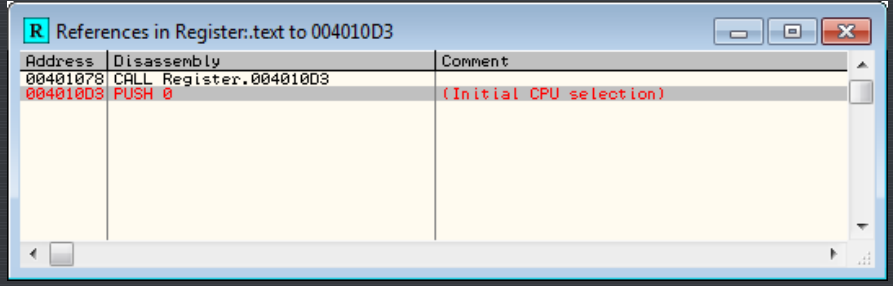
Well, that looks promising. Let's check out the "That is not correct" string:



and we come to the heart of the matter. Because each of these are separate methods, we will need to see where they are called from, so let's do that:



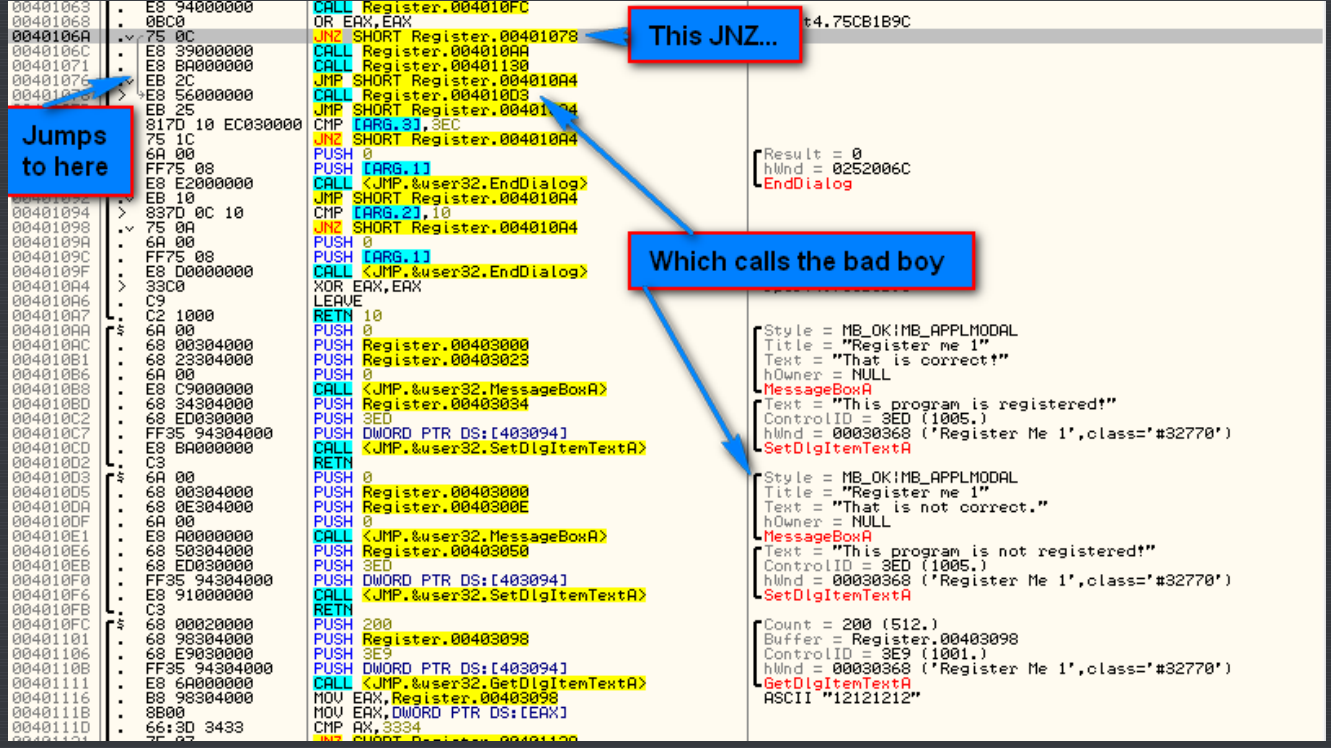
and Olly opens the References window:



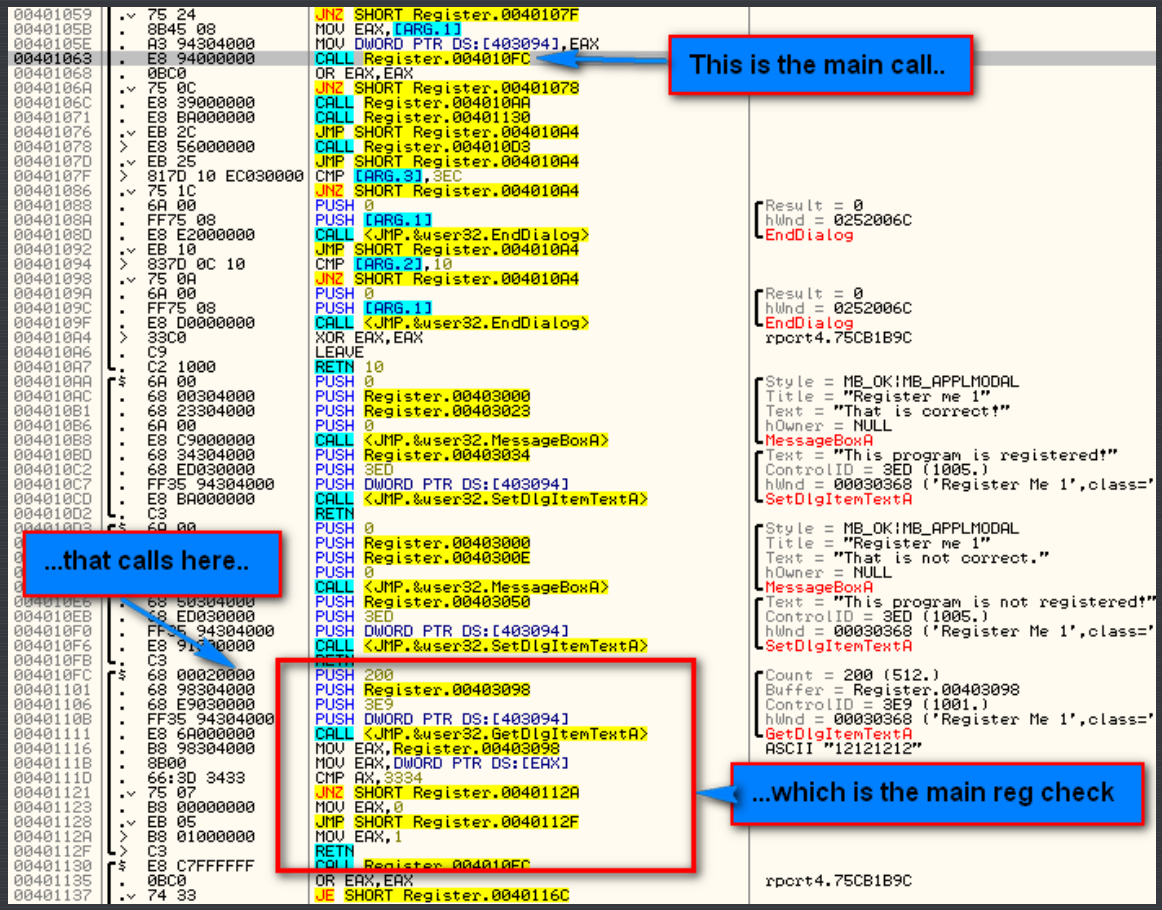
and we see that there is one call to this function. Let's double-click that and see what it looks like:

```
00401063  .   E8 94000000      CALL Register.004010FC
00401068  .   0BC0             OR EAX,EAX                              rpcrt4.75CB1B9C
0040106A  .v  75 0C            JNZ SHORT Register.00401078
0040106C  .   E8 39000000      CALL Register.004010AA
00401071  .   E8 BA000000      CALL Register.00401130
00401076  .v  EB 2C            JMP SHORT Register.004010A4
00401078  >   E8 56000000      CALL Register.004010D3
0040107D  .v  EB 25            JMP SHORT Register.004010A4
0040107F  >   817D 10 EC030000 CMP [ARG.3],3EC
00401086  .v  75 1C            JNZ SHORT Register.004010A4
00401088  .   6A 00            PUSH 0                                  Result = 0
0040108A  .   FF75 08          PUSH [ARG.1]                            hWnd = 0252006C
0040108D  .   E8 E2000000      CALL <JMP.&user32.EndDialog>            EndDialog
00401092  .v  EB 10            JMP SHORT Register.004010A4
00401094  >   837D 0C 10       CMP [ARG.2],10
00401098  .v  75 0A            JNZ SHORT Register.004010A4
0040109A  .   6A 00            PUSH 0                                  Result = 0
0040109C  .   FF75 08          PUSH [ARG.1]                            hWnd = 0252006C
0040109F  .   E8 D0000000      CALL <JMP.&user32.EndDialog>            EndDialog
004010A4  >   33C0             XOR EAX,EAX                             rpcrt4.75CB1B9C
004010A6  .   C9               LEAVE
004010A7  L.  C2 1000          RETN 10
004010AA  r$  6A 00            PUSH 0                                  Style = MB_OK!MB_APPLMODAL
004010AC  .   68 00304000      PUSH Register.00403000                  Title = "Register me 1"
004010B1  .   68 23304000      PUSH Register.00403023                  Text = "That is correct!"
004010B6  .   6A 00            PUSH 0                                  hOwner = NULL
004010B8  .   E8 C9000000      CALL <JMP.&user32.MessageBoxA>          MessageBoxA
004010BD  .   68 34304000      PUSH Register.00403034                  Text = "This program is registered!"
004010C2  .   68 ED030000      PUSH 3ED                                ControlID = 3ED (1005.)
004010C7  .   FF35 94304000    PUSH DWORD PTR DS:[403094]              hWnd = 00030368 ('Register Me 1',class='#32770')
004010CD  .   E8 BA000000      CALL <JMP.&user32.SetDlgItemTextA>      SetDlgItemTextA
004010D2  L.  C3               RETN
004010D3  r$  6A 00            PUSH 0                                  Style = MB_OK!MB_APPLMODAL
004010D5  .   68 00304000      PUSH Register.00403000                  Title = "Register me 1"
004010DA  .   68 0E304000      PUSH Register.0040300E                  Text = "That is not correct."
004010DF  .   6A 00            PUSH 0                                  hOwner = NULL
004010E1  .   E8 A0000000      CALL <JMP.&user32.MessageBoxA>          MessageBoxA
004010E6  .   68 50304000      PUSH Register.00403050                  Text = "This program is not registered!"
004010EB  .   68 ED030000      PUSH 3ED                                ControlID = 3ED (1005.)
004010F0  .   FF35 94304000    PUSH DWORD PTR DS:[403094]              hWnd = 00030368 ('Register Me 1',class='#32770')
004010F6  .   E8 91000000      CALL <JMP.&user32.SetDlgItemTextA>      SetDlgItemTextA
004010FB  L.  C3               RETN
004010FC  r$  68 00020000      PUSH 200                                Count = 200 (512.)
00401101  .   68 98304000      PUSH Register.00403098                  Buffer = Register.00403098
00401106  .   68 E9030000      PUSH 3E9                                ControlID = 3E9 (1001.)
0040110B  .   FF35 94304000    PUSH DWORD PTR DS:[403094]              hWnd = 00030368 ('Register Me 1',class='#32770')
00401111  .   E8 6A000000      CALL <JMP.&user32.GetDlgItemTextA>      GetDlgItemTextA
00401116  .   B8 98304000      MOV EAX,Register.00403098               ASCII "12121212"
0040111B  .   8B00             MOV EAX,DWORD PTR DS:[EAX]
0040111D  .   66:3D 3433       CMP AX,3334
00401121  .v  75 07            JNZ SHORT Register.0040112A
00401123  .   B8 00000000      MOV EAX,0
```

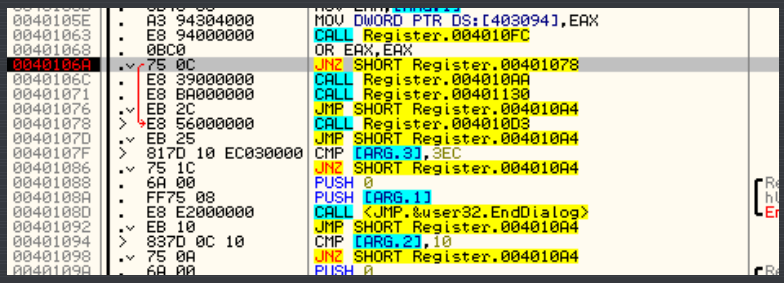
Here, we can see that the bad boy is called from address 401078, and we can also immediately see that there is a jump instruction that jumps to this call at address 40106A:



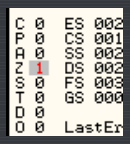
Scrolling up a couple lines we can see the proverbial call to check routine/compare/jump that we've seen before. From this we can guess that the main checking routine is at 4010FC, called from address 401063. After returning, the EAX register is checked if it contains zero or not, and if it doesn't, we jump to the bad boy.



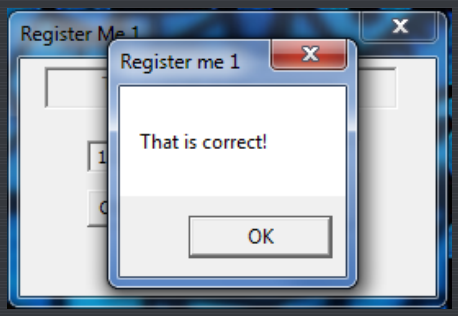
Let's test out our hypothesis and set a breakpoint at address 40106A and re-start the app. After entering a serial number (I entered the same '12121212') we break at the jump after the call to the serial check:



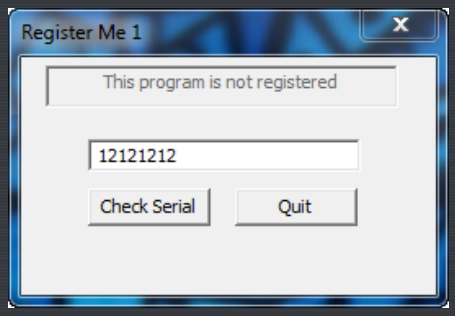
Now let's help Olly in the right direction so he won't take the jump (and fall through to the call to the good boy):



and hit run:



Yeah, that was easy!! Click OK and:



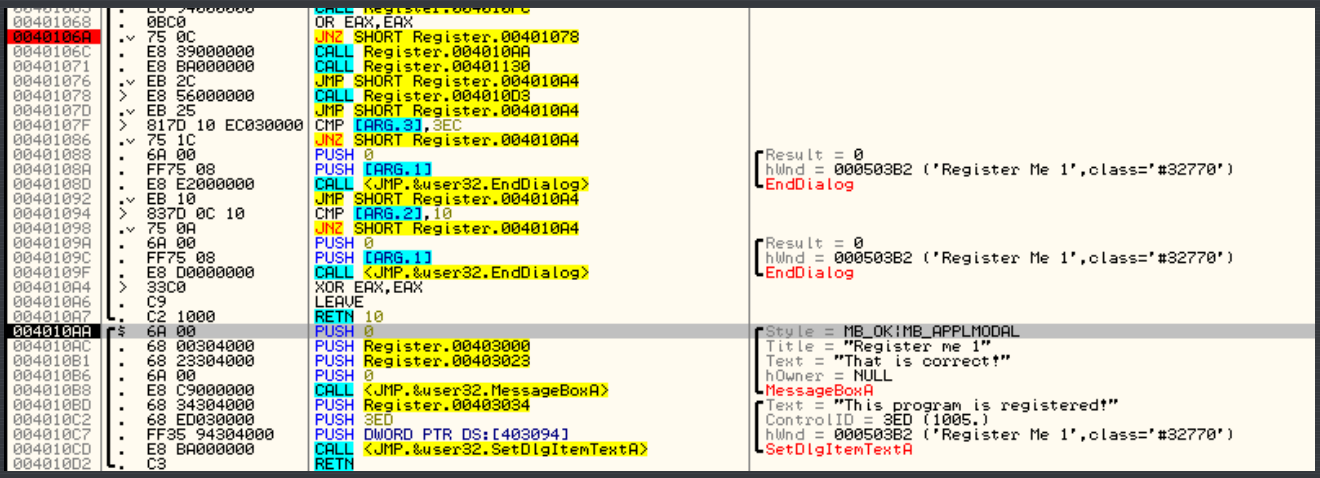
Oh F%$@ that S&*@, what the F$^& is going on here, you A$$$%^#!!!!! Obviously it didn't register our program. This means that there must be something we missed.

Looking a Little Closer

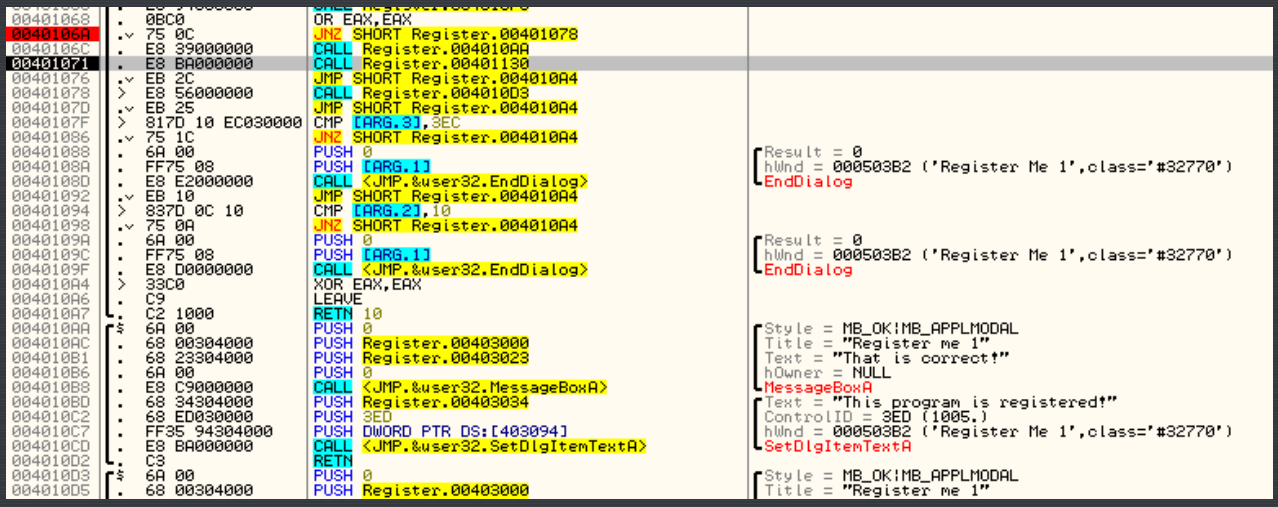
Let's re-start the app, enter a serial and let Olly break again at 40106A:

We see that if we keep Olly from making the jump to the bad boy, execution falls through to the call at line 40106C, which will call address 4010AA. Looking down at that routine, we can see that it is pretty standard; it opens a message box with "That is correct" and then changes the label on the main screen to

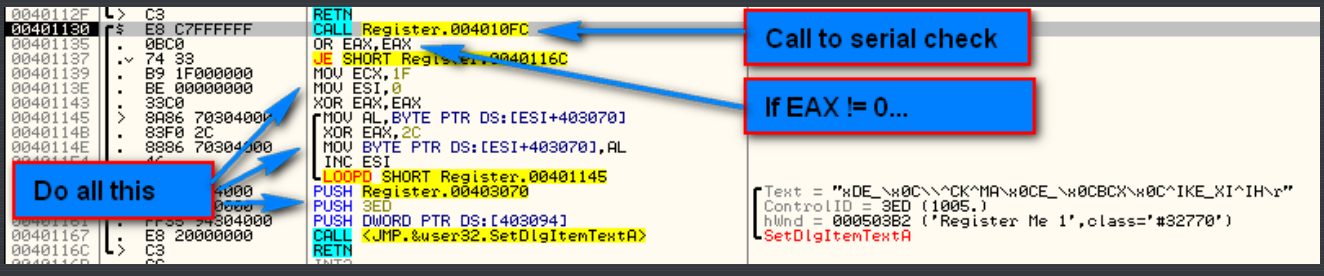
"This program is registered!".



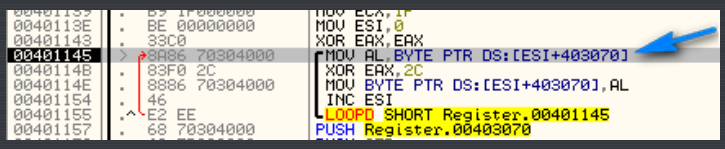
But wait! Once we return from that call, there is another call at 401071:



That call calls 401130, so let's have a look-see at that routine. First of all, we notice that it calls SetDlgItemTextA, but with a strange looking string. Let's step through this line by line. At 401130 a call is made to address 4010FC. Looking above at this we can see that this is the serial check routine. It then OR's EAX with itself to see if it's zero, and if it is not, it performs a lot of weird looking stuff:

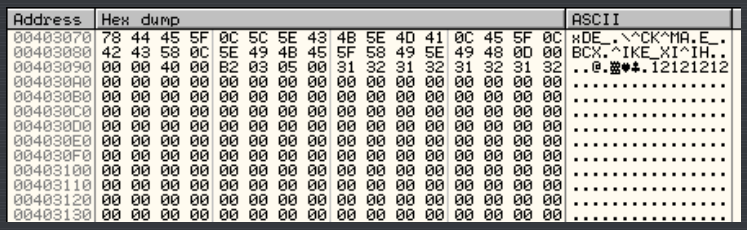


So what we can gather from this so far is that, after we patch the app to display the good boy message, another call is made, and within this call, a call is made to the check serial routine again, performing the same analysis on the results. This is a backup check! Now let's see what happens if we fail this second backup check (which we will since we only patched the jump):



First, ECX is loaded with 1F (31 decimal) ** Sorry, it's a little cut off**. ESI is then loaded with zero and EAX is zeroed out. We then enter a loop. We'll go through the loop step-by-step. The first line moves a byte from an address, ESI + 403070, and since we know ESI equals zero, the address is actually just

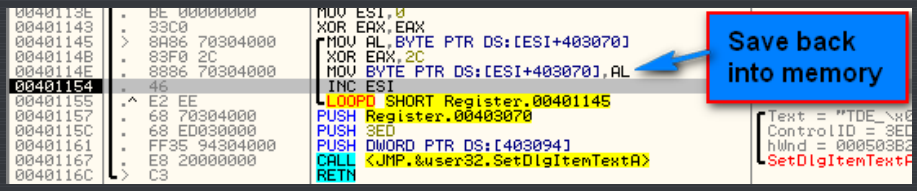
403070, into the AL register. Let's see what's at this address in the dump. Either right click and select Follow in dump -> constant or just click in the dump window and select goto and type in the address 403070:



If we look carefully, we can see that this is the string that appeared above in the argument to SetDlgTextItemA. So it is loading the first character of this weird looking string into AL.

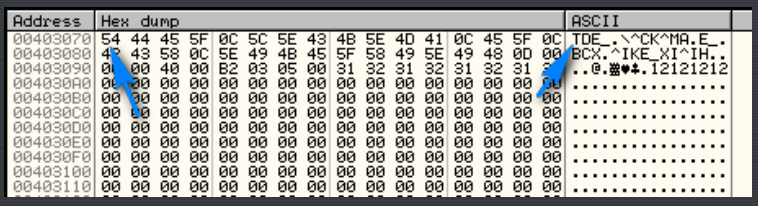
**** One thing you should know is that in a lot of assembly language instructions, certain registers are used in default ways, for example ECX is used as a counter, ESI is used as a source address, and EDI is used as a destination. This is the case in this example.****

Next, we XOR this character with 2C, then save it back into the same memory address:

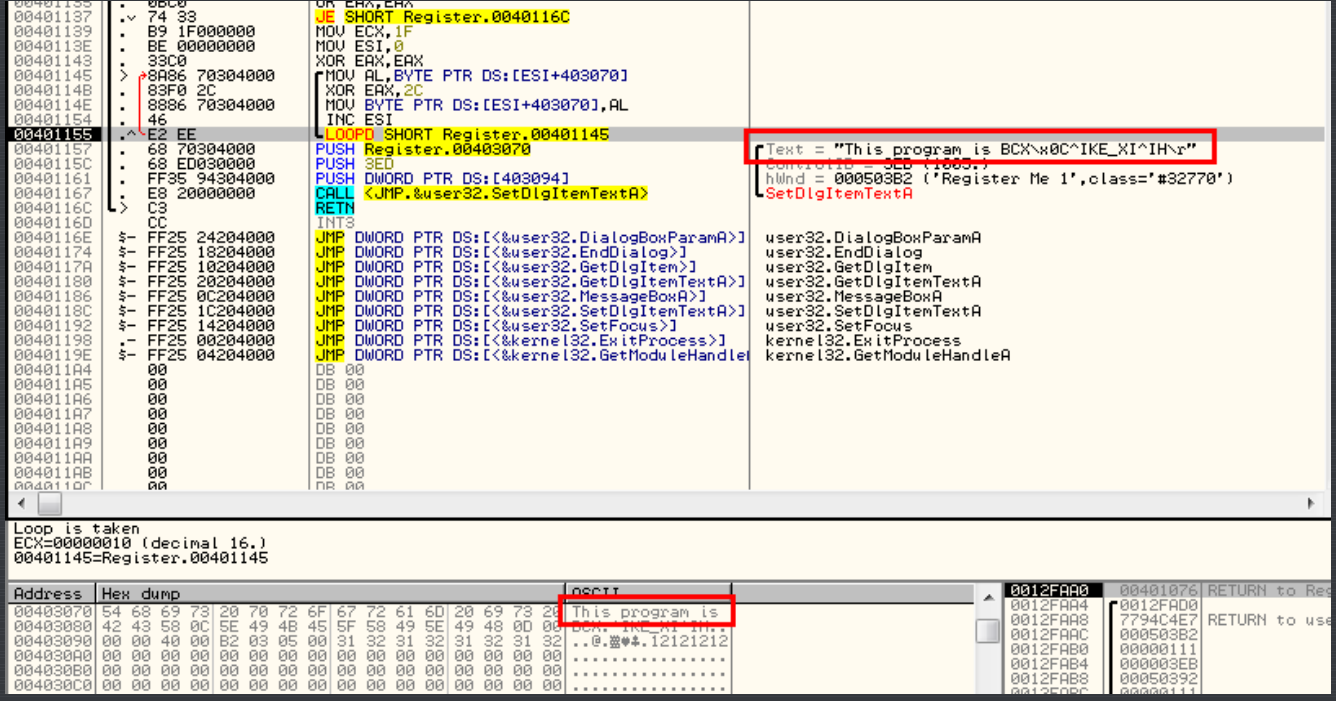


Lastly, we increment ESI (the source register) and do a LOOPD. LOOPD means lower the ECX register by one and loop until ECX equals zero. This tells us that the value that was loaded into ECX originally, 31 decimal, is the length of this loop.

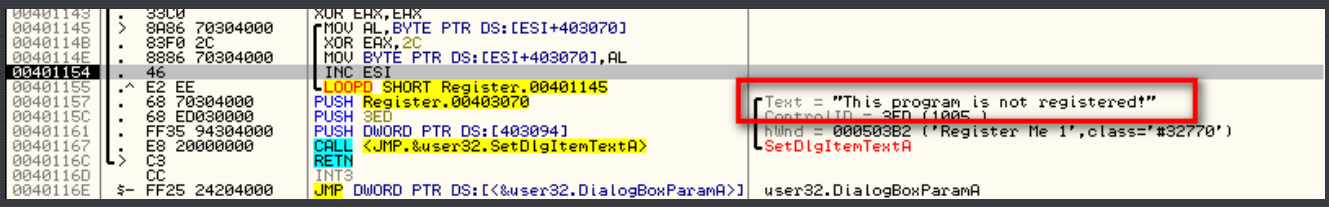
From a big picture, this loop is basically cycling through each character of this weird string, XOR-ing it with 2C, and saving it back into memory. This will go on until ECX equals zero, or 31 times. Single step once past the LOOPD instruction to go back up to the top and look in the dump window:



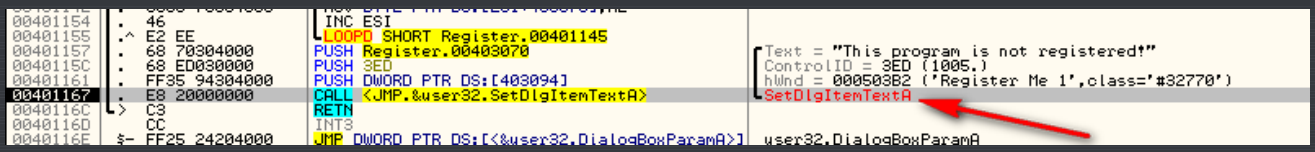
You will notice that the first digit of this string has been replaced. The original character was XOR'ed and now it is a "T". If you step through this loop several times, you will see the dump window's string change. You will also see the argument for the SetDlgItemTextA change as well:



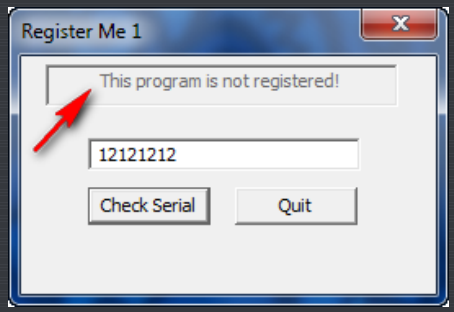
Stepping completely through the loop, we can see the final message, which looks surprisingly familiar; "This program is not registered!". This is the same message displayed on the main screen showing that the app is in fact not registered yet:



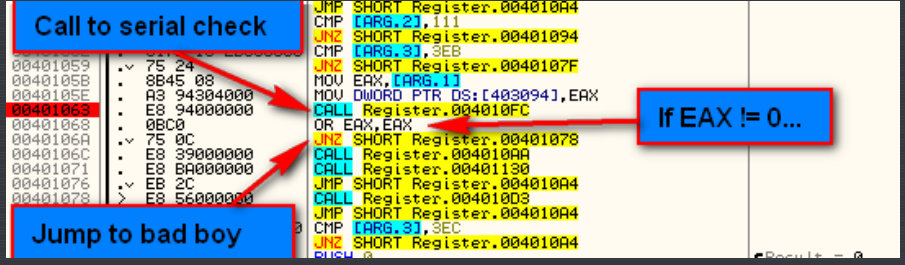
You can see that this string then becomes a value passed to the SetDlgItemTextA routine, in effect replacing the registered message that was put up at the end of the good boy with a copy of the unregistered message that was there before:



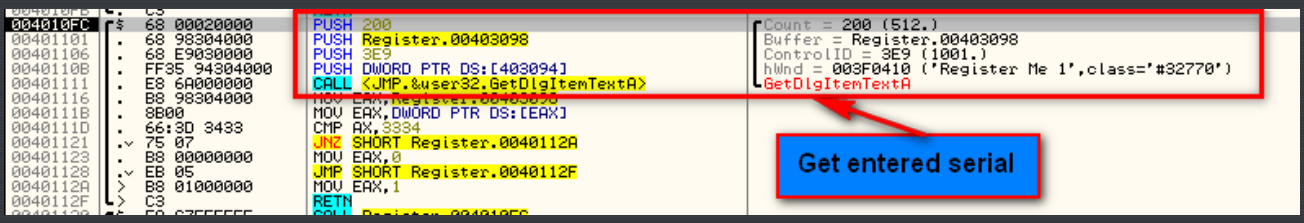
And here we see it in the main app:



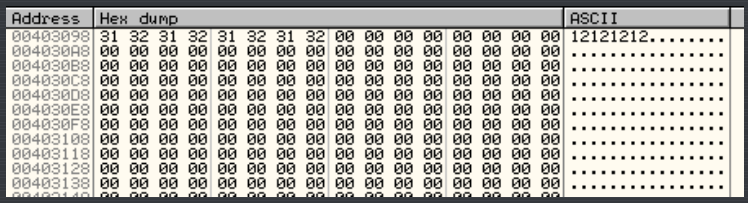
So now we know that the smarter way to patch this app is to go into the serial check and make sure it always returns the right value, as it's called not only as the first check, but also after the success screen is displayed. Just to remind you, the call to the serial check is called, then eax is tested for zero. If it's not a zero, we jump to the bad boy- so we want that routine to return a zero! Then, the second time the serial check routine is called, it will return a zero again, and our second check will be passed:



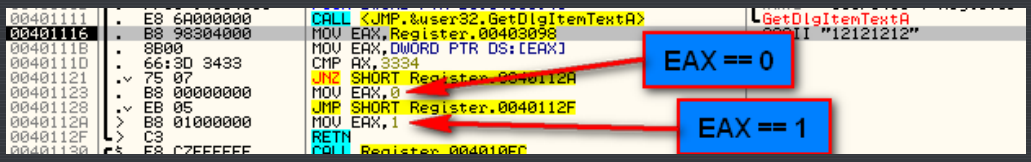
So let's go to the serial checking routine and see what we can do about it. At the beginning of the routine is a call to GetDlgItemTextA, as we could guess just get's our entered serial. You can see this by right clikcing on the argument at address 401101 (that points to the buffer that the text will be placed in) and following it in the dump:



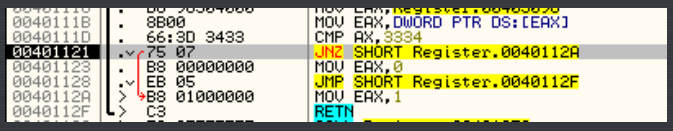
After we step over the GetDlgItemTextA instruction, we can see our serial in the buffer:



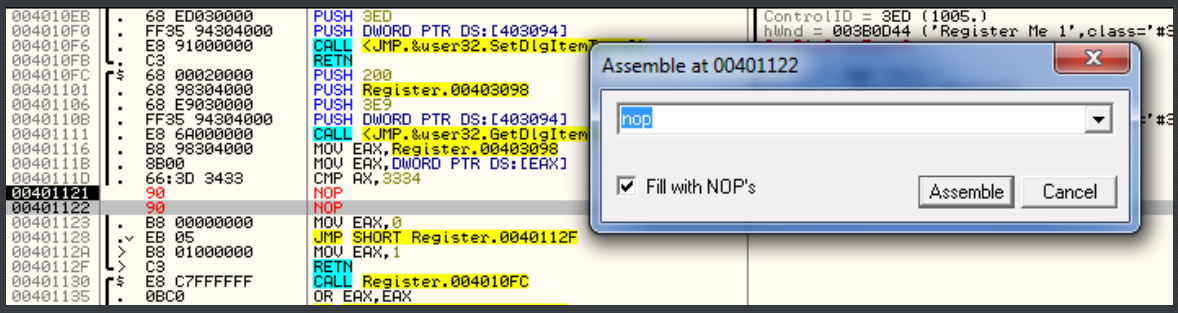
After it is stored in the buffer, the address of the beginning of the buffer is moved into EAX, and then the contents of this address are moved into EAX. This basically moves the first four bytes of our password into EAX. These bytes are then compared with 3334, and if they don't match, EAX is filled with a 1 (bad), otherwise, if they do match, EAX is stored with a zero (good):



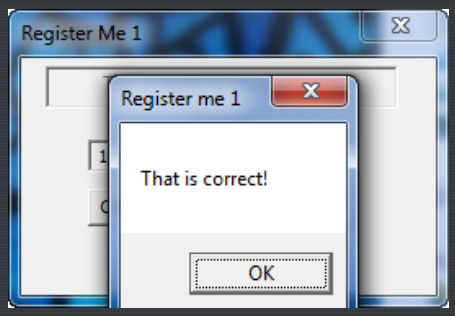
We can see that the main decission maker is the JNZ instruction at address 401121:



This line determines whether EAX will equal zero or 1 right before the return. So what we want to do is guarantee that EAX will always equal zero:

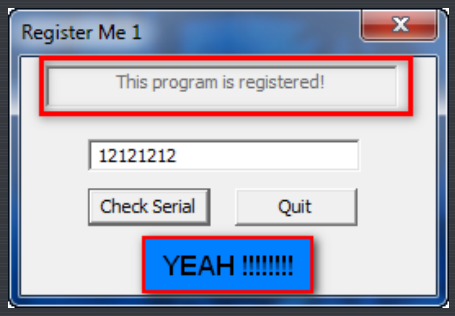


So now, the code will always fall through to moving zero into EAX and then jumping directly to the return. Now running the app:



and noticing that after the call to the serial check, we naturally jump to the goodboy:

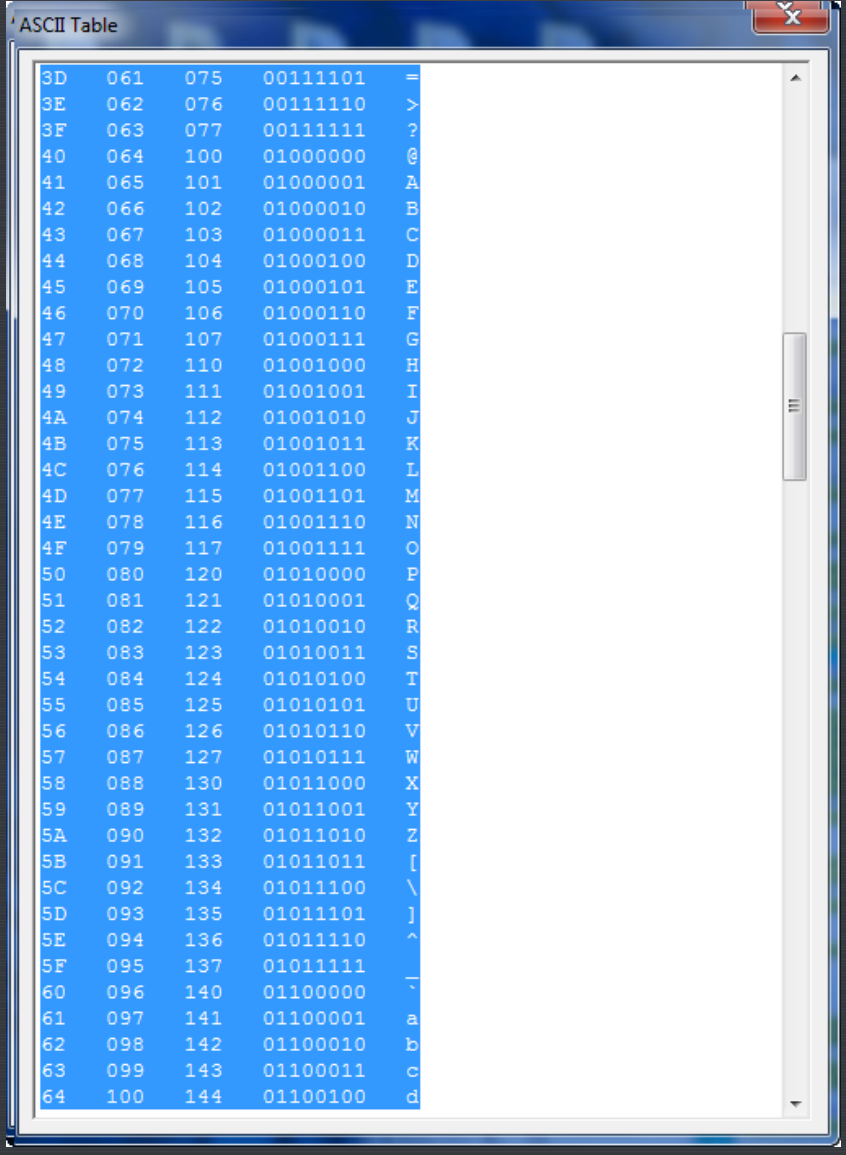
and on the second check we will jump to the good boy as well:



So we have now found one patch that will register this program, no matter what the serial entered is. . Congratulations.

ASCII Table Plugin

One thing you should do is try to find out what the password is (or what the requirements are for it). To help you, download and install the “Ascii Table” plugin and copy it into your plugin directory. After restarting, choose “Plugins” -> “Ascii table” and show the table. Even though it leaves a lot to be desired, it does give you a quick table of all ASCII values:



****If anyone would like to take it upon themselves to update or re-do this plugin, I would be eternally grateful. For one, the text should not be highlighted nor editable (why would I want to edit the ASCII chart?). Secondly, making the window sizable would be really great. If anyone does it, please tell me and I will forever be in your debt ****

-Till next time

R4ndom