

Covert Malware Launching

Malware Analysis
CSCI 4976 - Fall 2015
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```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     eax, [ebp+var_70]
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F
```

```
loc_313066:                                     ; CODE XREF: sub_312FD8
                                                ; sub_312FD8+55
```

```
push    0Dh
call    sub_31411B
```

```
loc_31306D:                                     ; CODE XREF: sub_312FD8
                                                ; sub_312FD8+49
```

```
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C
```

```
loc_31307D:                                     ; CODE XREF: sub_312FD8
```

```
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
```

```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```

Overview

- IAT Hooking
- Inline Hooking
- DLL Injection
- Direct Injection
- Process Replacement
- Related

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push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
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loc_31307D:                                     ; CODE XREF: sub_312FD8
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call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
```

```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```

IAT Hooking

- **IAT** - Import Address Table
 - Load addresses of DLLs can change
 - Windows loader dynamically resolves addresses of imports
 - Stores these addresses in the **IAT**

```

push     edi
call     sub_314623
test     eax, eax
jz       short loc_31306D
cmp      [ebp+arg_0], ebx
jnz      short loc_313066
mov      eax, [ebp+var_70]
cmp      eax, [ebp+var_84]
jb       short loc_313066
sub      eax, [ebp+var_84]
push     esi

push     esi
push     eax
push     edi
mov      [ebp+arg_0], eax
call     sub_31486A
test     eax, eax
jz       short loc_31306D
push     esi
lea      eax, [ebp+arg_0]
push     esi
mov      esi, 1D0h
push     esi
push     [ebp+arg_4]
push     edi
call     sub_314623
test     eax, eax
jz       short loc_31306D
cmp      [ebp+arg_0], esi
jz       short loc_31308F

loc_313066:                                     ; CODE XREF: sub_312FD8
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push     0Dh
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test     eax, eax
jg       short loc_31307D
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loc_31307D:                                     ; CODE XREF: sub_312FD8
call     sub_3140F3
and      eax, 0FFFFh
or       eax, 80070000h

loc_31308C:                                     ; CODE XREF: sub_312FD8
mov      [ebp+var_4], eax

```

IAT Hooking

- Windows uses two methods...

- Directly call the IAT function pointer

- CALL DWORD PTR DS:[401234]

- call into a jmp table

- CALL 401567

- 401567: JMP DWORD PTR DS:[401234]

```
push edi
call sub_314623
test eax, eax
jz short loc_31306D
cmp [ebp+arg_0], ebx
jnz short loc_313066
mov eax, [ebp+var_70]
cmp eax, [ebp+var_84]
jb short loc_313066
sub eax, [ebp+var_84]
push esi
```

```
push esi
push eax
push edi
mov [ebp+arg_0], eax
call sub_31486A
test eax, eax
jz short loc_31306D
push esi
lea eax, [ebp+arg_0]
push eax
mov esi, 1D0h
push esi
push [ebp+arg_4]
push edi
call sub_314623
test eax, eax
jz short loc_31306D
cmp [ebp+arg_0], esi
jz short loc_31308F
```

```
loc_31306F: ; CODE XREF: sub_312FD8
; sub_312FD8+55
```

```
push 0Dh
call sub_31411B
```

```
loc_31306D: ; CODE XREF: sub_312FD8
; sub_312FD8+49
```

```
call sub_3140F3
test eax, eax
jg short loc_31307D
call sub_3140F3
jmp short loc_31308C
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```
loc_31307D: ; CODE XREF: sub_312FD8
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```
call sub_3140F3
and eax, 0FFFFh
or eax, 80070000h
```

```
loc_31308C: ; CODE XREF: sub_312FD8
```

```
mov [ebp+var_4], eax
```

IAT Hooking

- Code caves!
 - Not every byte is used
 - Steal some for yourself!
 - Shellcode
 - DLL Names
 - WinAPI names
 - ...

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F
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loc_313066:                                     ; CODE XREF: sub_312FD8
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push    0Dh
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loc_31306D:                                     ; CODE XREF: sub_312FD8
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call    sub_3140F3
test    eax, eax
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call    sub_3140F3
and     eax, 0FFFFh
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```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```

IAT Hooking

- Hooking first method
 - Statically: Have to replace all **CALLs** to the **IAT**
 - Dynamically: Replace address in **IAT**
- Hooking second method
 - Only have to replace the entry in the **jmp table!**

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push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
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cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
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push    esi
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push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F

loc_313066:                                     ; CODE XREF: sub_312FD8
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mov     [ebp+var_4], eax
```


IAT Hooking

- Let's give it a shot!

```

push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
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jb      short loc_313066
sub     eax, [ebp+var_84]
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push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
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loc_313066:                                     ; CODE XREF: sub_312FD8
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loc_31306D:                                     ; CODE XREF: sub_312FD8
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call    sub_3140F3
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loc_31308C:                                     ; CODE XREF: sub_312FD8
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```

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- **Inline Hooking**
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test    eax, eax
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cmp     [ebp+arg_0], ebx
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mov     [ebp+arg_0], eax
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test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
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jz      short loc_31306D
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loc_313066:                                     ; CODE XREF: sub_312FD8
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loc_31306D:                                     ; CODE XREF: sub_312FD8
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and     eax, 0FFFFh
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loc_31308C:                                     ; CODE XREF: sub_312FD8
mov     [ebp+var_4], eax
```


Inline Hooking

- Similar idea
- Insert a **JMP** into code
 - Beginning or end of function (or anywhere)
 - Goes to your code
 - log stuff, modify arguments, skip the call, ...

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call    sub_314623
test    eax, eax
jz      short loc_31306D
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jnz     short loc_313066
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cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
mov     esi, 170h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F
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loc_313066:                                     ; CODE XREF: sub_312FD8
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                                              ; sub_312FD8+49
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call    sub_3140F3
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jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C
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loc_31307D:                                     ; CODE XREF: sub_312FD8
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call    sub_3140F3
and     eax, 0FFFFh
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loc_31308C:                                     ; CODE XREF: sub_312FD8
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```
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mov     [ebp+arg_0], eax
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test    eax, eax
jz      short loc_31306D
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lea     eax, [ebp+arg_0]
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mov     esi, 1D0h
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push    [ebp+arg_4]
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jz      short loc_31306D
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loc_31306D:                                     ; CODE XREF: sub_312FD8
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jg      short loc_31307D
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; -----
loc_31307D:                                     ; CODE XREF: sub_312FD8
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h

loc_31308C:                                     ; CODE XREF: sub_312FD8
mov     [ebp+var_4], eax
```

Injection

- That's cool and all, but how do we modify the memory of the other processes?
 - Just ask Windows!
 - `WriteProcessMemory`, `CreateRemoteThread` are key

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call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
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sub     eax, [ebp+var_84]
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push    esi
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push    edi
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test    eax, eax
jz      short loc_31306D
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mov     esi, 1D0h
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cmp     [ebp+arg_0], esi
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loc_313066:                                     ; CODE XREF: sub_312FD8
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call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C

; -----
loc_31307D:                                     ; CODE XREF: sub_312FD8
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h

loc_31308C:                                     ; CODE XREF: sub_312FD8
mov     [ebp+var_4], eax
```

Injection

- Why is it useful for malware?
 - Injected code runs in context of **target process**
 - Helps abuse whitelists
 - Firewall rules
 - IPS
 - Anti-virus

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push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
```

```
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
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loc_313066:                                     ; CODE XREF: sub_312FD8
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loc_31306D:                                     ; CODE XREF: sub_312FD8
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call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
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loc_31307D:                                     ; CODE XREF: sub_312FD8
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call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
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```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```

DLL Injection

- Windows....Load my DLL into this other process for me!
- **LoadLibrary**: Load DLL into my address space and execute DLLMain
- What if we tell another process to call **LoadLibrary**?

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    esi
mov     [ebp+arg_0], eax
call    sub_314623
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
call    [ebp+arg_0], esi
jz      short loc_31308F
```

```
loc_313066:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+55
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```
push    0Dh
call    sub_31411B
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loc_31306D:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+49
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```
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
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jmp     short loc_31308C
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loc_31307D:                                     ; CODE XREF: sub_312FD8
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```
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
```

```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```

DLL Injection

- **CreateRemoteThread(hVictimProcess, ..., LoadLibraryAddress, pDllNameInVictimProcess, ..., ...);**
 - We need some information first
 - Handle to target process
 - Address of **LoadLibrary** IN TARGET PROCESS
 - Address **DLL name/path** IN TARGET PROCESS
 - Luckily what you can't obtain you can stick there yourself
- **DllMain** of loaded DLL is automatically called on load

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
```

```
push    esi
push    eax
push    edi
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
```

```
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31306F
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```
loc_313066:                                     ; CODE XREF: sub_312FD8
push    esi
call    sub_31411B
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loc_31306D:                                     ; CODE XREF: sub_312FD8
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call    sub_3140F3
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loc_31307D:                                     ; CODE XREF: sub_312FD8
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call    sub_3140F3
and     eax, 0FFFFh
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```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```


DLL Injection

- Awesome demo on Spotify

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F
```

```
loc_313066:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+55
```

```
push    0Dh
call    sub_31411B
```

```
loc_31306D:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+49
```

```
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C
```

```
loc_31307D:                                     ; CODE XREF: sub_312FD8
```

```
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
```

```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```

Overview

- IAT Hooking
- Inline Hooking
- DLL Injection
- **Direct Injection**
- Process Replacement
- Related

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F

loc_313066:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+55
push    0Dh
call    sub_31411B

loc_31306D:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+49
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C

; -----
loc_31307D:                                     ; CODE XREF: sub_312FD8
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h

loc_31308C:                                     ; CODE XREF: sub_312FD8
mov     [ebp+var_4], eax
```

Direct Injection

- Windows... Write and execute code in another process for me!
- Similar idea
 - Instead of writing DLL name/path and calling LoadLibrary
 - Write your shellcode and call it directly
- Disadvantages
 - Have to **dynamically resolve** any of your dependencies
 - data, imports, resources

```
push edi
call sub_314623
test eax, eax
jz short loc_31306D
cmp [ebp+arg_0], ebx
jnz short loc_313066
mov eax, [ebp+var_70]
cmp eax, [ebp+var_84]
jb short loc_313066
sub eax, [ebp+var_84]
push esi
```

```
push esi
push eax
push edi
mov [ebp+arg_0], eax
call sub_31466A
test eax, eax
jz short loc_31306D
push esi
lea eax, [ebp+arg_0]
push eax
mov esi, 1D0h
push esi
push [ebp+var_4]
call sub_314623
test eax, eax
jz short loc_31306D
cmp [ebp+arg_0], esi
jz short loc_31308F
```

```
loc_313066: ; CODE XREF: sub_312FD8
; sub_312FD8+55
```

```
push 0Dh
call sub_31411B
```

```
loc_313069: ; CODE XREF: sub_312FD8
; sub_312FD8+49
```

```
call sub_3140F3
test eax, eax
jg short loc_31307D
call sub_3140F3
jmp short loc_31308C
```

```
loc_31307D: ; CODE XREF: sub_312FD8
```

```
call sub_3140F3
and eax, 0FFFFh
or eax, 80070000h
```

```
loc_31308C: ; CODE XREF: sub_312FD8
```

Overview

- IAT Hooking
- Inline Hooking
- DLL Injection
- Direct Injection
- **Process Replacement**
- Related

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi

push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F

loc_313066:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+55
push    0Dh
call    sub_31411B

loc_31306D:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+49
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C

; -----
loc_31307D:                                     ; CODE XREF: sub_312FD8
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h

loc_31308C:                                     ; CODE XREF: sub_312FD8
mov     [ebp+var_4], eax
```

Process Replacement

- In case you're too cool for DLL injection
- **Completely replace** a process' address space
- Similar advantages to **injection**
 - Keeps privileges
 - Whitelist abuse
 - Maintain file path
 - ...

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
```

```
push    esi
push    eax
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F
```

```
loc_313066:                                     ; CODE XREF: sub_312FD8
                                                ; sub_312FD8+55
```

```
push    0Dh
call    sub_31411B
```

```
loc_31306D:                                     ; CODE XREF: sub_312FD8
                                                ; sub_312FD8+49
```

```
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C
```

```
loc_31307D:                                     ; CODE XREF: sub_312FD8
```

```
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
```

```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```

Process Replacement

- Outline

1. **CreateProcess**(..., ..., **CREATE_SUSPENDED**, ..., ...)
2. **Unmap** current sections
3. **Alloc** new sections
4. **Write** new section contents
5. **Set** EIP to entry point
6. **Resume** process

- Look for this API sequence

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F
```

```
loc_313066:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+55
```

```
push    0Dh
call    sub_31411B
```

```
loc_31306D:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+49
```

```
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C
```

```
loc_31307D:                                     ; CODE XREF: sub_312FD8
```

```
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
```

```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```


Process Replacement

- You can also use **Process Explorer!**
 - Properties -> Strings -> (Image vs. Memory)
- The difference is usually **very apparent**

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
```

```
push    esi
push    eax
push    edi
call    [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
push    esi
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F
```

```
loc_313066:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+55
```

```
push    0Dh
call    sub_31411B
```

```
loc_31306D:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+49
```

```
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C
```

```
loc_31307D:                                     ; CODE XREF: sub_312FD8
```

```
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
```

```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

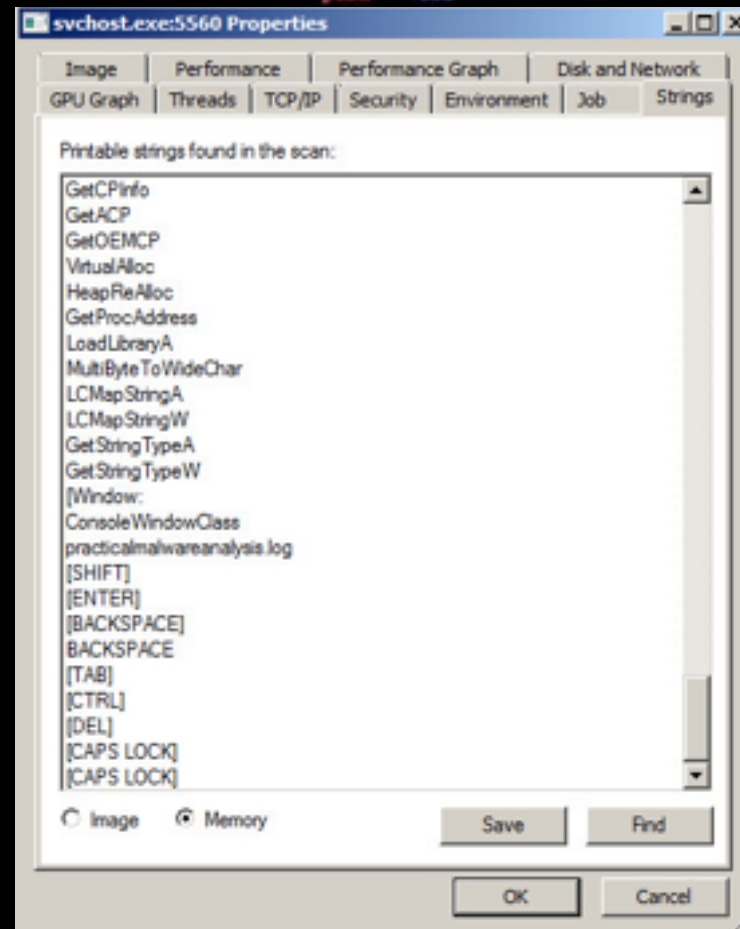
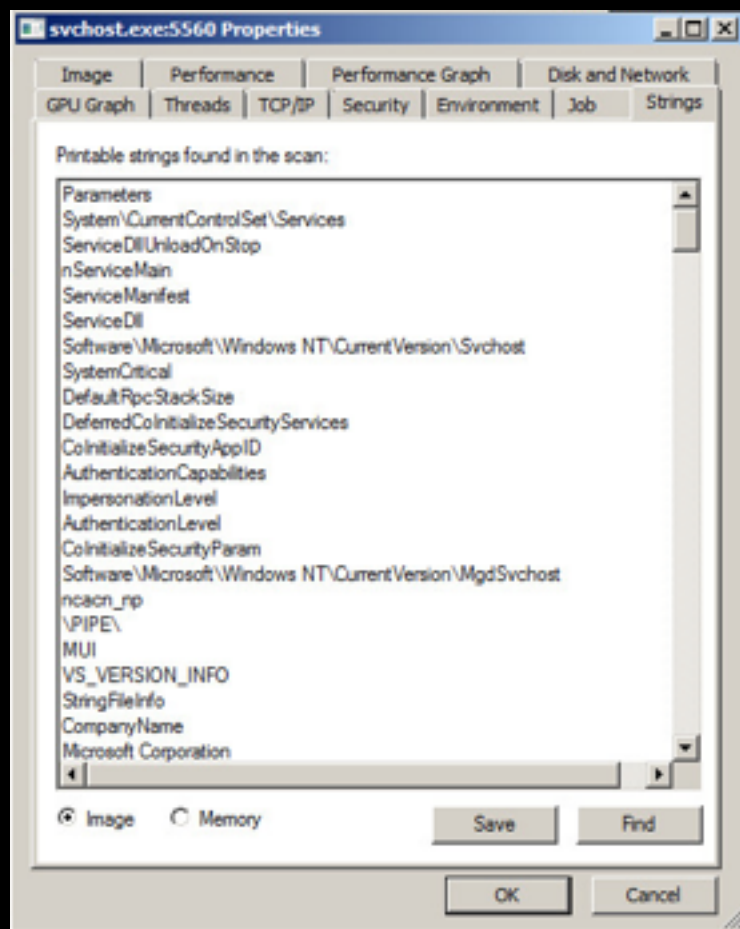
```
mov     [ebp+var_4], eax
```

Process Replacement

```

push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi

```



sub_312FD8
+55

sub_312FD8
+49

sub_312FD8

```

call    sub_3140F3
and     eax, 0FFFFFFFh
or      eax, 80070000h

```

```

loc_31308C:
mov     [ebp+var_4], eax
; CODE XREF: sub_312FD8

```

Overview

- IAT Hooking
- Inline Hooking
- DLL Injection
- Direct Injection
- Process Replacement
- **Related**

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F

loc_313066:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+55
push    0Dh
call    sub_31411B

loc_31306D:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+49
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C

; -----
loc_31307D:                                     ; CODE XREF: sub_312FD8
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h

loc_31308C:                                     ; CODE XREF: sub_312FD8
mov     [ebp+var_4], eax
```

Windows Hooks

- Windows has an event/message system
 - Executes **callbacks** when things occur
 - If you register the handler in your DLL...
 - Then each process is **forced to load your DLL** to run the handler
- **Another way** to get your DLL loaded into other processes
- We did something similar for the keylogger we gave you...

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
push    esi
push    eax
push    edi
mov     [ebp+var_0], eax
call    sub_31466A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+var_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
jnz     short loc_313066
jz      short loc_313066

loc_313066:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+55
push    0Dh
call    sub_314118
loc_31306D:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+49
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C

; -----
loc_31307D:                                     ; CODE XREF: sub_312FD8
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
loc_31308C:                                     ; CODE XREF: sub_312FD8
mov     [ebp+var_4], eax
```

Windows APC

- APC - Asynchronous Procedure Call
 - QueueUserAPC
 - Alternative to CreateRemoteThread
 - Rather than create a new thread for execution
 - Just have an existing thread execute your code when it can
 - When it is waiting (WaitFor..., Sleep, etc)
- Just have it call LoadLibrary or sthg...

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
```

```
push    esi
push    eax
push    edi
mov     [ebp+arg_0], eax
call    sub_31486A
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+var_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F
```

```
loc_31306D:                                     ; CODE XREF: sub_312FD8
                                                ; sub_312FD8+55
```

```
loc_31306D:                                     ; CODE XREF: sub_312FD8
                                                ; sub_312FD8+49
```

```
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C
```

```
loc_31307D:                                     ; CODE XREF: sub_312FD8
```

```
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
```

```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```


References

1. Sikorski, Michael, and Andrew Honig. Practical Malware Analysis the Hands-on Guide to Dissecting Malicious Software. San Francisco: No Starch, 2012. Print.

```
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], ebx
jnz     short loc_313066
mov     eax, [ebp+var_70]
cmp     eax, [ebp+var_84]
jb      short loc_313066
sub     eax, [ebp+var_84]
push    esi
```

```
push    esi
push    eax
push    esi
mov     [ebp+arg_0], eax
call    sub_314623
test    eax, eax
jz      short loc_31306D
push    esi
lea     eax, [ebp+arg_0]
push    eax
mov     esi, 1D0h
push    esi
push    [ebp+arg_4]
push    edi
call    sub_314623
test    eax, eax
jz      short loc_31306D
cmp     [ebp+arg_0], esi
jz      short loc_31308F
```

```
loc_313066:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+55
```

```
push    0Dh
call    sub_31411B
```

```
loc_31306D:                                     ; CODE XREF: sub_312FD8
                                              ; sub_312FD8+49
```

```
call    sub_3140F3
test    eax, eax
jg      short loc_31307D
call    sub_3140F3
jmp     short loc_31308C
```

```
loc_31307D:                                     ; CODE XREF: sub_312FD8
```

```
call    sub_3140F3
and     eax, 0FFFFh
or      eax, 80070000h
```

```
loc_31308C:                                     ; CODE XREF: sub_312FD8
```

```
mov     [ebp+var_4], eax
```