### Lab 09 – All analysis

### 1120162015 李博

### Lab 9-1

### 1. How can you get this malware to install itself?

通过对程序的静态分析,我发现在 mian 函数中有两个分支可以进入 copyfile 函数所在的子函数,如下图。

```
.text:00402B63 ; 54:
                           else if ( argc == 3 )◀
                                          [ebp+argc], 3
.text:00402B63
                                  cmp
.text:00402B67
                                  jnz
                                          short loc_402B9A
  .text:00402B69 ; 56:
                              if ( sub_4025B0(&ServiceName) )
                                                                         // Lab09-01
                                          400h
 .text:00402B69
                                  push
 .text:00402B6E
                                  lea
                                          ecx, [ebp+ServiceName]
                                                           ; char *
  .text:00402B74
                                  push
                                          ecx
                                          sub_4025B0
 .text:00402B75
                                  call
 .text:00402B7A
                                          esp, 8
  .text:00402B7D
                                  test
                                          eax, eax
  .text:00402B7F
                                  jz
                                          short loc_402B89
                                          eax, 0FFFFFFFh
  .text:00402B81
                                  or
  .text:00402B84
                                          loc_402D78
                                  imp
  .text:00402B89
                              try_copy(&ServiceName);
  .text:00402B89 ; 58:
  .text:00402B89
  .text:00402B89 loc_402B89:
                                          edx, [ebp+ServiceName]
 .text:00402B89
                                  lea
  .text:00402B8F
                                  push
                                                           ; lpServiceName
  .text:00402B90
                                  call
                                          try copy
 .text:00402B95
                                  add
                                          esp, 4
.text:00402B98
                                          short loc_402BC2
                                  jmp
  .text:00402B9A
  .text:00402B9A
                              if (argc != 4) 🐗
  .text:00402B9A
  .text:00402B9A loc_402B9A:
                                                           ; CODE XREF: _main+77↑j
  .text:00402B9A
                                          [ebp+argc], 4
.text:00402B9E
                                          short loc 402BBD
                                  inz
  .text:00402BA0 ; 64:
                              <mark>try_copy</mark>(argv[2]);
                                          eax, [ebp+argv]
  .text:00402BA0
                                  mov
.text:00402BA3
                                          ecx, [eax+8]
                                  mov
  .text:00402BA6
                                          [ebp+lpServiceName], ecx
  .text:00402BAC
                                          edx, [ebp+lpServiceName]
                                  mov
                                                           ; lpServiceName
  .text:00402BB2
                                  push
                                          edx
 .text:00402BB3
                                  call
                                          try_copy
  .text:00402BB8
                                  add
                                          esp, 4
.text:00402BBB
                                          short loc 402BC2
```

第一个分支进入条件为

argc==3 并且 argv[argc-1]==" abcd", argv[1]==" -in"。 该分支的作用即**安装自身**至 C:\Windows\System32。 通过 ollydbg 中调试->参数来输入程序的参数



如下图,为ollydbg 动态调试跟进至复制文件函数的代码处。



## 2. What are the command-line options for this program? What is the pass-word requirement?

该程序的命令行参数有四种,分别为-in(安装),-re(移除),-c 和-cc。

需要的 password 为"abcd",需输入在命令行的最后一个参数即 argv[argc-1]=="abcd"。

# 3. How can you use OllyDbg to permanently patch this malware, so that it doesn't require the special command-line password?

首先在 IDA 里定位至相应代码段,关键在 **call Delitself**,位于 0x 00402B3A。

```
.text:00402B2A ; 19:
                         if (!check_abcd((int)v10))
.text:00402B2A
                                        eax, [ebp+var_4]
.text:00402B2D
.text:00402B2E
                                call
                                        check_abcd
.text:00402B33
                                add
                                        esp, 4
.text:00402B36
                                test
                                        eax, eax
.text:00402B38
                                        short loc_402B3F
                                jnz
.text:00402B3A ; 20:
                           DelItself()
                               call
.text:00402B3A
                                        DelItself
.text:00402B3F
.text:00402B3F ; 21:
                         if ( _mbscmp((const unsigned __int8 *)argv[1], &in) )
```

由于该程序没有地址随机化,故在 Ollydbg 中可以直接定位至地址 0x0402B3A,如下图,用 nop (0x90)填充 0x0402B3A-0x0402B3E 之间的数据即可。

00402B36	85C0	test eax,eax
00402B38	, 75 <b>0</b> 5	jnz short Lab09-01.00402B3F
00402B3A	9.0	nop
00402B3B	90	nop
00402B3C	90	nop
00402B3D	90	nop
00402B3E	90	nop
00402B3F	8B4D 0C	mov ecx,dword ptr ss:[ebp+0xC]
00402B42	8B51 04	mov edx,dword ptr ds:[ecx+0x4]

#### 4. What are the host-based indicators of this malware?

### a. 该字符串用于定位至系统盘

```
.data:0040C134 aSystemrootSyst db '%SYSTEMROOT%\system32\',0
.data:0040C134 ; DATA XREF: try_copy:loc_402632↑o
.data:0040C134 ; sub_402900:loc_4029E1↑o
.data:0040C14B align 4
```

### b. 该字符串用于调用命令行

### c. 创建注册表项

```
; 19:
        if ( RegCreateKeyExA(HKEY_LOCAL_MACHINE, SubKey, 0, 0, 0, 0xF003Fu, 0, &phkResult, 0) )
push
                        ; lpdwDisposition
        ecx, [ebp+phkResult]
lea
push
                        ; phkResult
                          lpSecurityAttributes
push
        0F003Fh
                        ; samDesired
push
        0
                         ; dwOptions
push
        0
push
                          1pClass
push
                          Reserved
        offset SubKey
                           "SOFTWARE\\Microsoft \\XPS"
push
        80000002h
push
                         ; hKey
call
        ds:RegCreateKeyExA
test
        eax, eax
        short loc 4011B9
jz
```

### 5. What are the different actions this malware can be instructed to take via the network?

#### a. 休眠

```
.text:004020BA ; 23:
                          Sleep(1000 * v3);
.text:004020BA
                                         ecx, [ebp+var_404]
                                mov
.text:004020C0
                                imul
                                         ecx, 3E8h
.text:004020C6
                                                          ; dwMilliseconds
                                push
                                         ecx
                                call
.text:004020C7
                                         ds:Sleep
                                         loc_402356
.text:004020CD
                                jmp
```

#### b. 接收文件

```
.text:00401A53 loc 401A53:
                                                         ; CODE XREF: sub 4019E0+5B1j
.text:00401A53
                                                          ; sub_4019E0+D2↓j
.text:00401A53
                                         0
                                                           flags
                                push
.text:00401A55
                                         200h
                                                          ; len
                                push
.text:00401A5A
                                lea
                                         edx, [ebp+buf]
.text:00401A60
                                push
                                         edx
                                                          ; buf
.text:00401A61
                                mov
                                         eax, [ebp+s]
.text:00401A64
                                push
                                         eax
                                         ds:recv
text:00401A65
                                call
.text:00401A6B
                                         [ebp+nNumberOfBytesToWrite], eax
                                mov
                                                         ; lpOverlapped
.text:00401A6E
                                push
.text:00401A70
                                push
                                                          ; lpNumberOfBytesWritten
                                         ecx, [ebp+nNumberOfBytesToWrite]
.text:00401A72
                                mov
.text:00401A75
                                                          ; nNumberOfBytesToWrite
                                push
                                         ecx
                                         edx, [ebp+buf]
.text:00401A76
                                lea
                                                          ; lpBuffer
.text:00401A7C
                                push
                                         edx
.text:00401A7D
                                mov
                                         eax, [ebp+hFile]
.text:00401A83
                                push
                                                          ; hFile
                                         eax
.text:00401A84
                                         ds:WriteFile
                                call.
.text:00401A8A
                                test
                                         eax, eax
                                         short loc_401AAE
.text:00401A8C
                                inz
.text:00401A8E
                                lea
                                         ecx, [ebp+s]
.text:00401A91
                                push
                                         ecx
                                         sub_401740
.text:00401A92
                                call
.text:00401A97
                                add
                                         esp, 4
.text:00401A9A
                                         edx, [ebp+hFile]
                                mov
.text:00401AA0
                                push
                                                         ; hObject
.text:00401AA1
                                call
                                         ds:CloseHandle
.text:00401AA7
                                mov
                                         eax, 1
.text:00401AAC
                                jmp
                                         short loc_401AE6
.text:00401AAE ;
```

### c. 上传文件

```
ds:ReadFile
 .text:00401906
                                 call
.text:0040190C
                                 test
                                         eax, eax
 .text:0040190E
                                 jnz
                                         short loc_401945
 .text:00401910
                                         ds:GetLastError
                                 call
 .text:00401916
                                         eax, 26h
                                 cmp
.text:00401919
                                 jz
                                         short loc_40193E
.text:0040191B
                                 lea
                                         edx, [ebp+s]
 .text:0040191E
                                 push
                                         edx
                                         sub_401740
 .text:0040191F
                                 call
 .text:00401924
                                 add
                                         esp, 4
 .text:00401927
                                         eax, [ebp+hFile]
                                 mov
                                                          ; hObject
.text:0040192D
                                 push
                                         eax
                                         ds:CloseHandle
 .text:0040192E
                                 call
 .text:00401934
                                 mov
                                         eax, 1
 .text:00401939
                                 jmp
                                         loc_4019D8
 .text:0040193E
.text:0040193E
                                                          ; CODE XREF: sub_401870+A91j
 .text:0040193E loc_40193E:
                                         [ebp+NumberOfBytesRead], 0
.text:0040193E
                                 mov
 .text:00401945
                                                          ; CODE XREF: sub_401870+9E↑j
.text:00401945 loc_401945:
                                                          ; sub_401870+136√j
.text:00401945
.text:00401945
                                 push
                                                           ; flags
.text:00401947
                                         ecx, [ebp+NumberOfBytesRead]
                                 mov
 .text:0040194A
                                 push
                                                            len
                                         edx, [ebp+Buffer]
.text:0040194B
                                 lea
                                                          ; buf
.text:00401951
                                 push
                                         edx
.text:00401952
                                 mov
                                         eax, [ebp+s]
.text:00401955
                                 push
                                         eax
 .text:00401956
                                 call
                                         ds:send
                                         [ebp+var_214], eax
.text:0040195C
                                 mov
.text:00401962
                                         [ebp+var_214], 0FFFFFFFh
                                 cmp
.text:00401969
                                         short loc_40198B
                                 jnz
```

#### d. 执行 shell

```
.text:004022A6
                                mov
                                         dword ptr [ebp+hostshort], eax
.text:004022AC ; 48:
                          v11 = strtok(0, asc_40C0A4);
                                         offset asc_40C0A4 ; "`"
.text:004022AC
                                push
                                                          ; char *
.text:004022B1
                                push
.text:004022B3
                                call
                                         _strtok
.text:004022B8
                                add
                                         esp, 8
.text:004022BB
                                mov
                                         [ebp+var_41C], eax
.text:004022C1 ; 49:
                          v13 =
                                _popen(v11, aRb);
.text:004022C1
                                         offset aRb
                                push
.text:004022C6
                                         edx, [ebp+var_4147]
                                mov
.text:004022CC
                                                          ; char *
                                         edx
                                push
text:004022CD
                                call
                                         __poper
text:004022D2
                                add
                                         esp, 8
text:004022D5
                                         [ebp+var 420], eax
                                mov
.text:004022DB ; 50:
                          if (!v13)
.text:004022DB
                                cmp
                                         [ebp+var_420], 0
.text:004022E2
                                jnz
                                         short loc_4022EB
.text:004022E4
                                mov
                                         eax, 1
.text:004022E9
                                         short loc_402358
                                jmp
 +0v+.004022ED
```

### e. 无操作

```
strncmp(&v14, aNothing, strlen(aNothing));
.text:00402330 ; 61:
.text:00402330
.text:00402330 loc_402330
                                                       ; CODE XREF: sub_402020+242↑j
                                      edi, offset aNothing ; "NOTHING"
.text:00402330
                              mov
.text:00402335
                                      ecx, 0FFFFFFFh
                              or
.text:00402338
                              xor
                                      eax, eax
.text:0040233A
                              repne scasb
.text:0040233C
                              not
                                      ecx
.text:0040233E
                              add
                                      ecx, 0FFFFFFFh
.text:00402341
                              push
                                      ecx ; size_t
                                      offset aNothing; "NOTHING"
.text:00402342/
                              push
.text:00402347
                                      edx, [ebp+var_400]
                              lea
.text:0040234D
                                      edx
                                                     ; char *
                              push
                                      _strncmp
.text:0040234E
                              call
.text:00402353
                                      esp, 0Ch
                              add
```

### 6. Are there any useful network-based signatures for this malware?

#### a. 通信的目标网址

```
.data:0040C0E8 aHttpWwwPractic db 'http://www.practicalmalwareanalysis.com',0
.data:0040C0E8 ; DATA XREF: try_copy+2D6^to
.data:0040C110 a80 db '80',0 ; DATA XREF: try_copy+2D1^to
```

### b. 通信方式

```
.data:0040C068 ; char asc_40C068[]
data:0040C068 asc 40C068
                                db 0Dh,0Ah
                                                      ; DATA XREF: sub 401AF0+1A41o
 .data:0040C068
                                db 0Dh,0Ah,0
 .data:0040C06D
                               align 10h
                               db ' HTTP/1.0',0Dh,0Ah ; DATA XREF: sub_401AF0+9F1o
 .data:0040C070 aHttp10
 .data:0040C070
                               db 0Dh,0Ah,0
.data:0040C07E
                               align 10h
 .data:0040C080 aGet
                               db 'GET ',0
                                                      ; DATA XREF: sub_401AF0:loc_401B35↑o
 .data:0040C085
                               align 4
```

C.

```
      .rdata:0040B170 ; char aCommandCom[]

      .rdata:0040B170 aCommandCom
      db 'command.com',0
      ; DATA XREF: __popen+217^0

      .rdata:0040B17C aC
      db '/c',0
      ; DATA XREF: __popen+1E8^0

      .rdata:0040B17C
      ; __popen+228^0

      .rdata:0040B17F
      align 10h
```

### Lab 9-2

### 1. What strings do you see statically in the binary?

a. 在IDA中的变量上Y一下,可改变变量类型,如下图

```
37
    v13 = 49;
38
    v14 = 113;
    v15 = 97;
    v16 = 122;
40
41
    v17 = 50;
42
    v18 = 119;
43
    v19 = 115;
44
    v20 = 120;
45
   v21 = 51;
46
   v22 = 101;
47
    v23 = 100;
48
    v24 = 99;
49
    v25 = 0;
50
    v26 = 111;
51
    v27 = 99;
                               15
52
    v28 = 108;
                              16
                                    WSAData[0] = (char *)'zaq1';
53
    v29 = 46;
                                    WSAData[1] = (char *)'xsw2';
                              17
54
    v30 = 101;
                              18
                                    WSAData[2] = (char *)'cde3';
55
    v31 = 120;
                              19
                                    LOBYTE(WSAData[3]) = 0;
56
    v32 = 101;
                              20
                                    WSAData[4] = (char *)'.lco';
57
    v33 = 0;
                              21
                                    WSAData[5] = (char *)'exe';
```

b.

```
; DATA XREF: _main+A3↑o
.data:00405034 unk_405034
.data:00405035
                                             db 46h ; F
                                             db
                                                 6
16h
54h ; T
 .data:00405036
.data:00405037
                                            db db db db db db db db db db
 .data:00405038
.data:00405039
                                                  42h ; B
 data:0040503A
                                                  12h
 .data:0040503B
                                                  1Bh
 data:0040503C
 .data:0040503D
                                                  0Ch
7
 data:0040503E
 .data:0040503F
.data:00405040
                                                  5Dh ; ]
1Ch
0
 .data:00405041
.data:00405042
                                                  16h
45h ; E
 .data:00405043
 .data:00405045
.data:00405046
                                            db
db
db
db
db
db
                                                  16h
                                                  1Dh
52h ; R
 data:00405047
 .data:00405048
 data:00405049
 .data:0040504A
 .data:0040504B
                                            db
db
                                                  48h ; H
2
 .data:00405040
 .data:0040504D
 .data:0040504E
.data:0040504F
                                            db
db
 .data:00405050
.data:00405051
                                            db
db
                                                 1Ch
                                                  14h
 data:00405052
.data:00405053
```

### 2. What happens when you run this binary?

什么也没发生。

### 3. How can you get this sample to run its malicious payload?

通过 IDA 静态分析可以发现,在 main 函数中,进行了文件名校验的过程,如下。

```
.text:0040122B ; 26: if ( strcmp((const char *)&WSAData[4], v15) )
.text:0040122B
                                                                   cmp - ocl.exe
                                     eax, [ebp+var_4];
                             mov
                                                    ; char *
.text:0040122E
                             push
                                     eax
                                     ecx, [ebp+WSAData.szDescription+0Ch]
.text:0040122F
                             lea
                                                     ; char *
.text:00401235
                             push
                                     ecx
.text:00401236
                                     _strcmp
                             call
.text:0040123B
                             add
                                     esp, 8
.text:0040123E
                             test
                                     eax, eax
                                     short loc_40124C
.text:00401240
                             jz
.text:00401242 ; 27: return 1;
.text:00401242
                                  eax, 1
                             mov
.text:00401247
                             jmp loc 4013D6
```

故将文件名改为 ocl.exe 即可。

### 4. What is happening at 0x00401133?

将一个字符串赋值至栈。

### 5. What arguments are being passed to subroutine 0x00401089?

参数一为在 0x401133 处放到栈上的字符串 1qaz2wsx3edc

```
.data:00405034 unk_405034
                              db 46h; F
.data:00405035
                              db
                                  6
.data:00405036
                              db
                                  16h
                              db 54h; T
.data:00405037
.data:00405038
                              db
                                 42h ; B
                              db
.data:00405039
                                  5
                              db 12h
.data:0040503A
                               db 1Bh
.data:0040503B
.data:0040503C
                              db 47h; G
                               db 0Ch
.data:0040503D
.data:0040503E
                              db
.data:0040503F
                              db
                                    2
.data:00405040
                              db 5Dh; ]
.data:00405041
                              db 1Ch
.data:00405042
                              db
.data:00405043
                              db 16h
                              db 45h; E
.data:00405044
.data:00405045
                              db
                                  16h
                               db
.data:00405046
                                    1
                              db 1Dh
.data:00405047
.data:00405048
                              db 52h; R
.data:00405049
                              db
                                  0Bh
.data:0040504A
                              db
                                    5
.data:0040504B
                              db 0Fh
.data:0040504C
                              db
                                  48h ; H
.data:0040504D
                              db
                                    2
                              db
                                    8
.data:0040504E
                                    9
.data:0040504F
                              db
.data:00405050
                              db 1Ch
.data:00405051
                               db 14h
```

梦蚁—刀

#### 6. What domain name does this malware use?

通过 Ollydbg 动态调试,直接在解密函数之后查看寄存器 eax 值如下。



7. What encoding routine is being used to obfuscate the domain name?

异或加密

```
.text:004010D4 loc_4010D4:
                                                    ; CODE XREF: sub_401089+92↓j
.text:004010D4
                                    ecx, [ebp+var_108] ; i ++
                            mov
.text:004010DA
                            add
                                     ecx, 1
.text:004010DD
                                     [ebp+var_108], ecx
                             mov
.text:004010E3
.text:004010E3 loc_4010E3:
                                                    ; CODE XREF: sub_401089+491j
.text:004010E3
                                     [ebp+var_108], 20h; 比较i的上限0x20
                             cmp
.text:004010EA
                                     short loc_40111D
                             jge
|.text:004010EC; 15: *(&v5 + i) = a1[i % v4] ^ *(_BYTE *)(i + a2);
.text:004010EC
                           mov
                                     edx, [ebp+arg_4]
.text:004010EF
                             add
                                     edx, [ebp+var_108]
.text:004010F5
                             movsx
                                    ecx, byte ptr [edx]
.text:004010F8
                                     eax, [ebp+var_108]
                             mov
.text:004010FE
                             cdq
.text:004010FF
                             idiv
                                     [ebp+var_104]
.text:00401105
                                     eax, [ebp+arg_0]
                            mov
.text:00401108
                           movsx
                                     edx, byte ptr [eax+edx]
                            xor
                                                   ; 异或
.text:0040110C
                                     ecx, edx
.text:0040110E
                            mov
                                     eax, [ebp+var_108]
                            mov [ebp+eax+var_100], cl
.text:00401114
.text:0040111B
                             jmp short loc_4010D4
```

### 8. What is the significance of the CreateProcessAcall at 0x0040106E?

创建线程来启动命令行,并且通过设置 showWindow 标志位为 0 来 隐藏 shell。

### Lab 9-3

1. What DLLs are imported by Lab09-03.exe?

```
| Text |
```

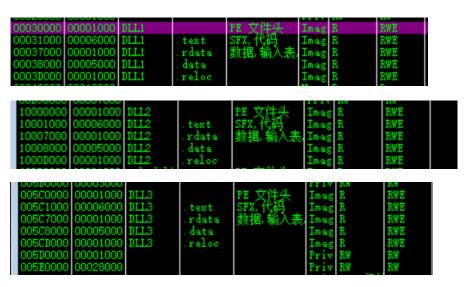
2. What is the base address requested by DLL1.dll, DLL2.dll, and DLL3.dll?

基地址为 0x10000000

3. When you use OllyDbg to debug Lab09-03.exe, what is the assigned based address for: DLL1.dll, DLL2.dll, and DLL3.dll?

当程序运行至下图代码段时, DLL3 被加载。

在 Ollydbg 中查看内存



4. When Lab09-03.exe calls an import function from DLL1.dll, what does this import function do?

输出字符串 "DLL 1 mystery data %d\n" 和一个变量。

5. When Lab09-03.exe calls WriteFile, what is the filename it writes to?

文件名为 temp.txt

```
db 'temp.txt',0
.data:10008030 FileName
                                              ; DATA XREF: DllMain(x,x,x)+15↑o
.data:10008039
                          align 4
赋值过程如下
                          , uwpcair cuncceaa
         4000000011
         offset FileName ; "temp.txt"◀
 push
 call
         ds:CreateFileA
         dword 1000B078, eax
mov
; Exported entry 2. DLL2ReturnJ
 ; Attributes: bp-based frame
public DLL2ReturnJ
DLL2ReturnJ proc near
         ebp
push
mov
         ebp, esp
mov
         eax, dword 1000B078
         ebp
pop
retn
DLL2ReturnJ endp
```

6. When Lab09-03.exe creates a job using NetScheduleJobAdd, where does it get the data for the second parameter?

来自栈上的局部变量

```
.text:00401078
                               add
                                       esp, 4
.text:0040107B
                               lea
                                       eax, [ebp+JobId]
                                                         JobId
.text:0040107E
                               push
                                       eax
.text:0040107F
                                       ecx, [ebp+Buffer]
                               mov
                                       ecx
                                                       ; Buffer
.text:00401082
                               push
                                       0
.text:00401083
                               push
                                                        Servername
.text:00401085
                               call
-ARABARATC
                          dd?
-0000001C Buffer
                          dd?
-00000018 hFile
                          dd?
-00000014 hModule
                          dd?
-00000010 var_10
-0000000C NumberOfBytesWritten dd ?
-000000008 var 8
                          dd?
-000000004 JobId
                          dd?
+00000000 S
                          db 4 dup(?)
+00000004 r
                          db 4 dup(?)
                          dd ?
+000000008 argc
                          dd ?
+0000000C argv
+00000010 envp
                          dd?
```

- 7. While running or debugging the program, you will see that it prints out three pieces of mystery data. What are the following:DLL 1 mystery data 1, DLL 2 mystery data 2, and DLL 3 mystery data 3?
- a. DLL 1 mystery data 1 是 GetCurrentProcessId 的返回值,即进程标识符

```
result = GetCurrentProcessId();
dword 10008030 = result;
```

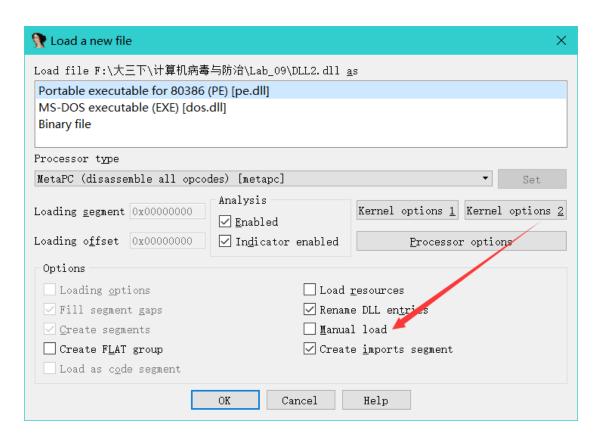
b. DLL 2 mystery data 2 是 CreateFileA 的返回值,即文件的句柄

c. DLL 3 mystery data 3 是字符串

'ping <u>www.malwareanalysisbook.com</u>'的首地址

## 8. How can you load DLL2.dll into IDA Pro so that it matches the load address used by OllyDbg?

在加载 dll 时. 选择 manual load



接着将 olldbg 中的 dll2 的地址 0x30000 输入即可。

♠ Please enter an address			
Please specify the new image base			
Input 0:30000	~		
O <u>K</u> Cancel			

### 结果

