To Catch an APT: YARA

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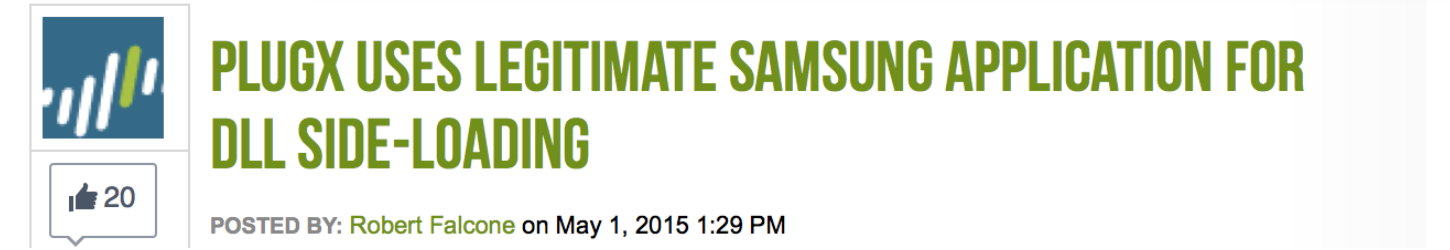
What to expect?

- The Threat Intel Problems
- RE Tools
- About YARA and how to use it
- PlugX Malware
  - String Rules
  - Tuning String Rules
    - Modifiers
    - Conditionals
  - Byte Sequence Rules
    - Quick x86 Primer
    - Build a byte sequence rule
  - Tuning a Byte Sequence Rule
- Results of tracking the PlugX APT tool for almost a year

The Threat Intelligence Problem

The Threat Intelligence Problem



Malicious Code Analysis

Reverse Engineering Tools

Ascii Strings:

0000004D !This program cannot be run in DOS mode.

000001DF `.rdata

00000207 @.data

00000230 .reloc

00000F16 GetProcAddress

00000F28 LoadLibraryA

00000F36 KERNEL32.dll

00000F46 LineTo

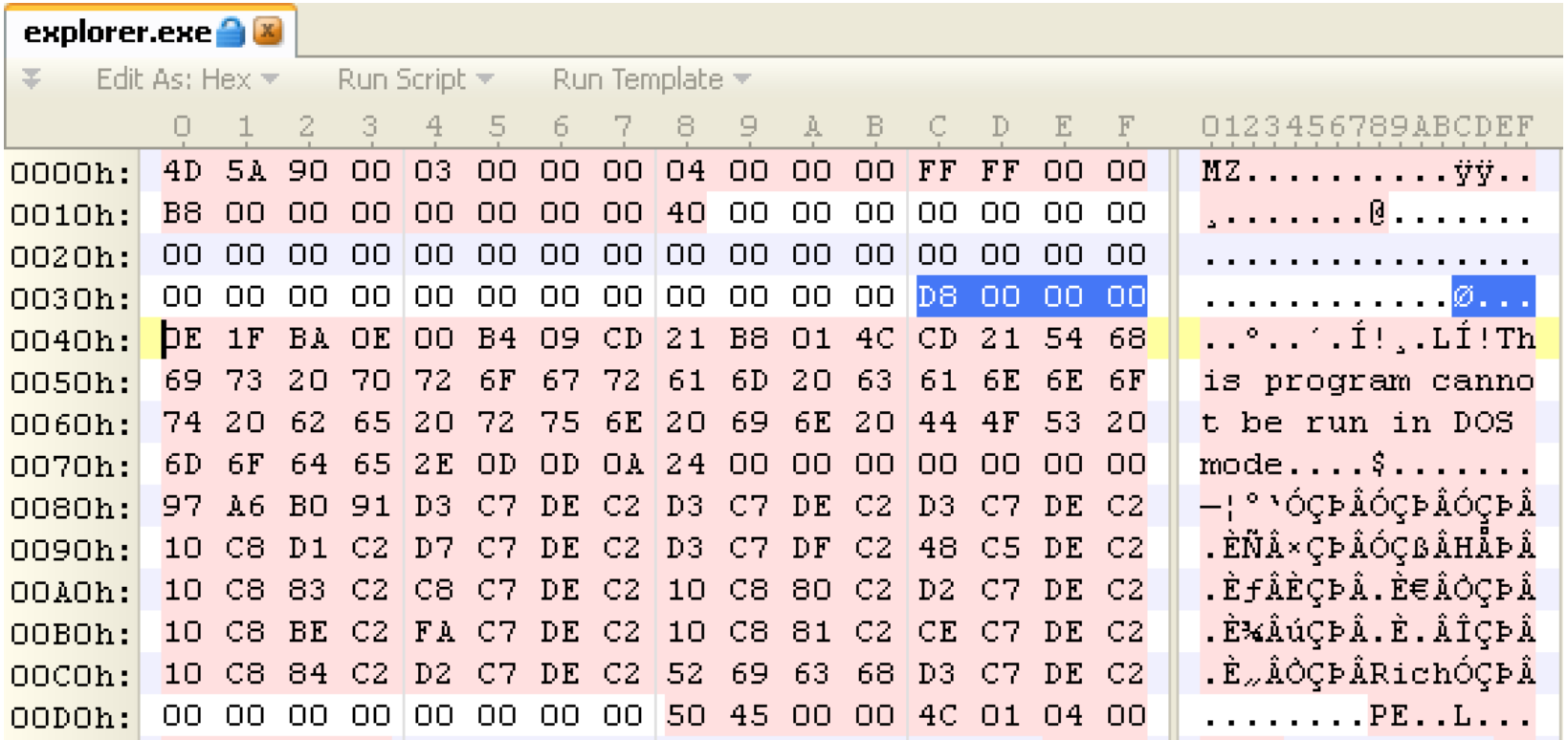
00000F50 MoveToEx

00000F5A GDI32.dll

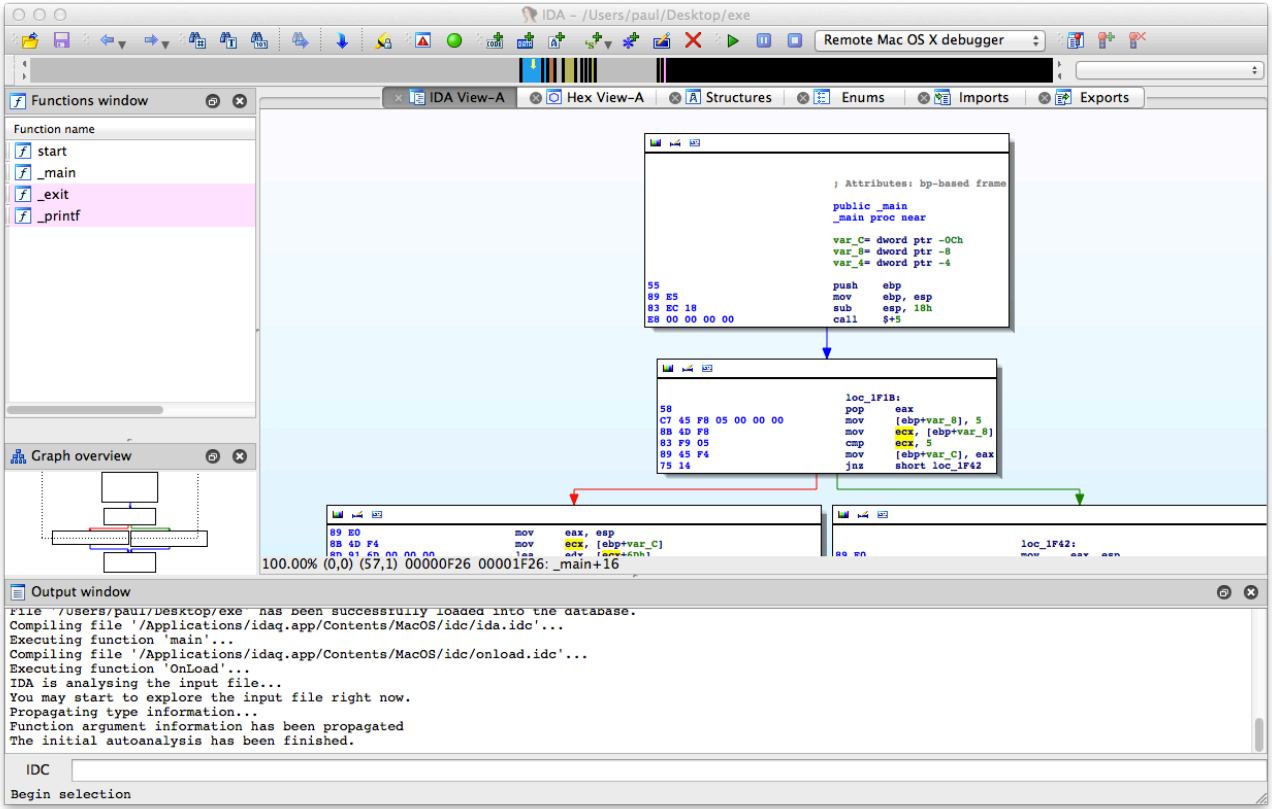
Unicode Strings:

00000E54 msi.dll.eng

Reverse Engineering Tools



Reverse Engineering Tools



The YARA Project (https://github.com/plusvic/yara/releases)

The pattern matching swiss-knife for malware researchers (and everyone else)

Why YARA? Why not IOCs?

- Indicators of Compromise
  - IP Addresses
  - MD5 Hash
  - File Locations & File Names
  - URLs or Domain Names

What does YARA do?

- Scans Data Streams
  - File
  - Network
  - Memory

Tools that incorporate YARA

What does YARA look like?

Usage: yara [OPTION] [RULES_FILE] [SOURCE_FILE | SOURCE_DIR | PID]

Output: [RULE_NAME] [STREAM_LOCATION]

C:_tools\Yara3.3>yara32.exe -r rules.yr C:\malwr\PlugX\24FC5871407F180ECAD9DA6F67DD1878

UNKNOWN_PlugXTrojanLoader_PayloadNames	[SOURCE_DIR]\Extracted\msi.dll
APTGroupX_PlugXTrojanLoader_StringDecode	[SOURCE_DIR]\Extracted\msi.dll
GENERIC_SFXRAR_Installer	[SOURCE_DIR]\x2015.exe

C:_tools\Yara3.3>yara32.exe -r rules.yr C:\malwr\PlugX\D9AB2B14E9B2F1D78C117FDB1BF0601E

UNKNOWN_PlugXPayload_XVHeader	[SOURCE_DIR]\Extracted\FromMem \Region00AB0000-00AD7000.dmp

First YARA Rule

Easy

```
rule ExampleRuleName
{
        meta:
                source = “http://yara.readthedocs.org/en/v3.4.0/writingrules.html”
                description = ”This is a very basic example rule."
        strings:
                $my_text_string = “text here”
                $my_hex_string = { E2 34 A1 C8 23 FB }
                $my_regex = /[0-9a-zA-Z]{32}/
        condition:
                $my_text_string or $my_hex_string or $my_regex
}
```

What can you signature?

TEXT STRINGS

- STRING CONSTANTS
- API Names
- Error messages
- String formatting style
- Grammar mistakes
- C&C commands
- Timestamp formatting
- Unique Sequences
- Regular Expressions

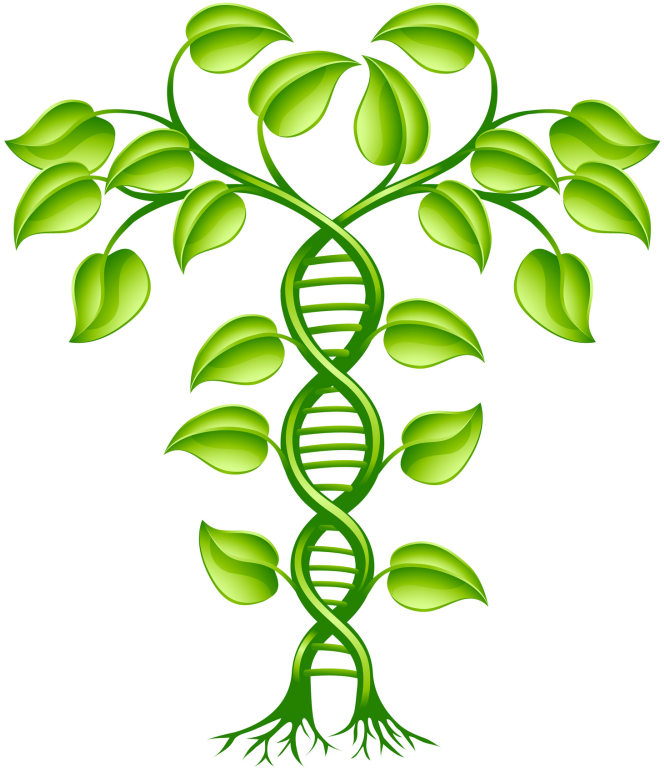
IMPLEMENTATION TRAITS

- Memory allocation habits
- Use of global variables
- Multi-threading model
- Software architecture and design
- Constructor design
- Dynamic API loading technique
- Exception handling
- Usage of public source code
- Programming language and compiler
- Compilation time stamps and time zones

CUSTOM FEATURES

- Obfuscation techniques
- Stealth and evasion techniques
- Encryption and compression algorithms
- Cryptographic Keys & Constants
- Re-used source code
- Malware specific features
- System infiltration
- Propagation mechanisms
- Artifact naming schemes / algorithms
- Data exfiltration techniques
- C&C command parsing implementation

Strings vs. Byte Sequences



Using Yara Effectively

1. **Rules, Rules, Rules**
2. **Descriptive Names**
3. Have at least THREE sources of data
4. Constant enrichment and tuning
5. Share with “meta” (Optional)

PlugX Brief Background

- Remote Access Tool
  - Log Key Strokes, Modify & Copy Files
  - Take Screenshots & Perform Admin Tasks
- 2008
- a.k.a: Korplug, Gulpix, Sogu, TVT, Destory
- Usage has grown
- Five Different Command & Control Network Protocols

Typical PlugX Malware Packaging during Year 2015

Self-Extracting Archive (SFX)

- Digitally Signed EXE
- DLL Loader
- Compressed PlugX Payload

Installer/Dropper

Easy


```
rule GENERIC_SFXRAR_Installer {
        strings:
                $str1 = "RarSFX" ascii wide
                $str2 = "RENAMEDLG" ascii wide
                $str3 = "GETPASSWORD1" ascii wide
                $str4 = "ASKNEXTVOL"ascii wide
                $str5 = "STATIC" ascii wide
                $str6 = "REPLACEFILEDLG" ascii wide
                $str7 = "winrarsfxmappingfile.tmp" ascii wide
        condition:
                (uint16(0) == 0x5A4D) and //Check for MZ magic
                                            header at offset 0
                all of them
}
```

Signature a signed EXE…You're Crazy!!

ASCII/8859-1 Text	
A	0100 0001
S	0101 0011
C	0100 0011
I	0100 1001
I	0100 1001
/	0010 1111
8	0011 1000
8	0011 1000
5	0011 0101
9	0011 1001
-	0010 1101
1	0011 0001
	0010 0000
t	0111 0100
e	0110 0101
x	0111 1000
t	0111 0100

Unicode Text	
A	0000 0000 0100 0001
S	0000 0000 0101 0011
C	0000 0000 0100 0011
I	0000 0000 0100 1001
I	0000 0000 0100 1001
	0000 0000 0010 0000
天	0101 1001 0010 1001
地	0101 0111 0011 0000
	0000 0000 0010 0000
س	0000 0110 0011 0011
ل	0000 0110 0100 0100
ا	0000 0110 0011 0111
م	0000 0110 0100 0101
	0000 0000 0010 0000
α	0000 0011 1011 0001
κ	0010 0010 0111 0000
γ	0000 0011 1011 0011

Tuning String Rules w/Modifiers

wide and fullword

```
$str1 = “setup.msi” wide fullword
```

nocase

```
// will hit on “KeRnEl32.DlL”
$str2 = “kernel32.dll” wide ascii nocase
```

whitespace characters

```
$str4 = “\nuname\n\n” wide ascii
```

Strings Have a Purpose

METASPLOIT_UACBypass_OpenProcessFail

$a1 = "Couldn't open process " wide

$a2 = "ERROR_ACCESS_DENIED\n(We probably tried to inject into an elevated process\nwhich isn't allowed unless we're also elevated.\nPick an unelevated process.)" wide

GENERIC_CMDShell_ComSpecVariable

$shell = "COMSPEC" wide ascii nocase

DarkSeoul_TDrop2_Base64Alphabet

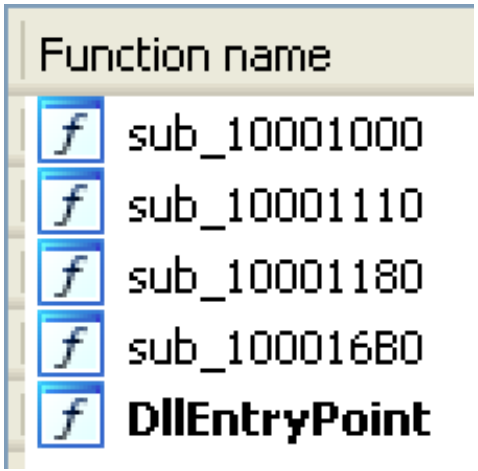
$b64alpha = "3bcd1fghijklmABCDEFGH-J+LMnopq4stuvwxyzNOPQ7STUVWXYZ0e2ar56R89K/" wide ascii

Back to PlugX - DLL Trojan Loader

- Side Loaded (a.k.a Load Order Hijacking)
- Small File Size
- Very Little Executable Code

DLL Trojan Loader (Basic Analysis)

File: msi.dll
Size: 3584
MD5: 9530B64683D7397D081D538C46C4314E
Compiled: Fri, Mar 13 2015, 15:35:47 - 32 Bit DLL



Ascii Strings:
0000004D !This program cannot be run in DOS mode.
000001DF `.rdata
00000207 @.data
00000230 .reloc
00000F16 GetProcAddress
00000F28 LoadLibraryA
00000F36 KERNEL32.dll
00000F46 LineTo
00000F50 MoveToEx
00000F5A GDI32.dll

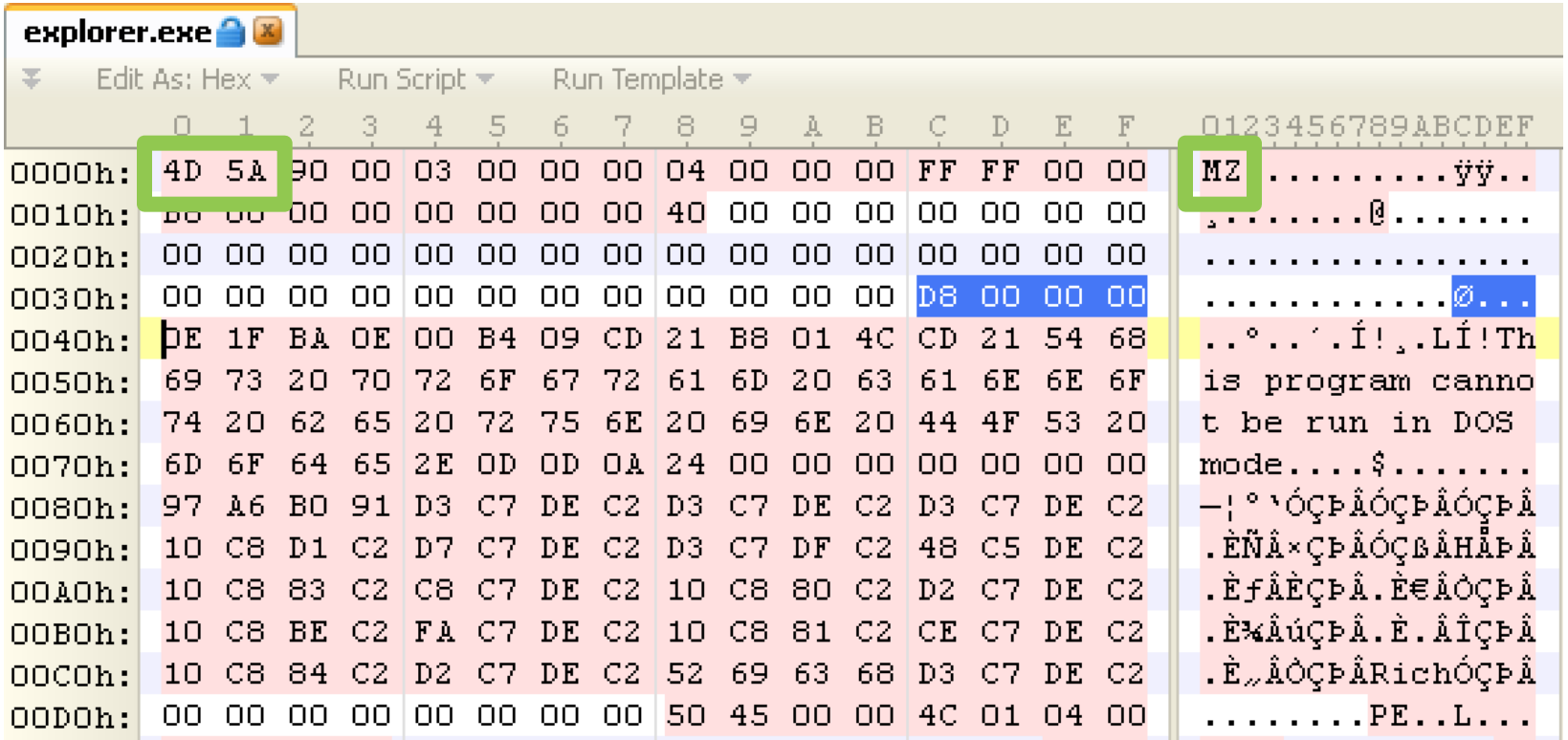
Unicode Strings:
00000E54 msi.dll.eng

PlugX Trojan Loader - Rule 1 (Strings)

Easy

```
rule PlugX_TrojanLoader_PayloadNames
{
        strings:
                $str1 = "msi.dll.eng" wide fullword
        condition:
                any of them
}
```

File Magic Number - Exe Header



Reduce False Positives w/Conditions

Medium

```
rule PlugX_TrojanLoader_PayloadNames
{
        strings:
                $str1 = "msi.dll.eng" wide fullword
        condition:
                (uint16(0) == 0x5A4D) and //Check for MZ magic
                                          header at offset 0
                any of them
}
```

Reduce False Positives w/Conditions

Medium

```
rule PlugX_TrojanLoader_PayloadNames
{
        strings:
                $str1 = "msi.dll.eng" wide fullword
        condition:
                (uint16(0) == 0x5A4D) and //Check for MZ magic
                                          header at offset 0
                (filesize < 11KB) and
                any of them
}
```

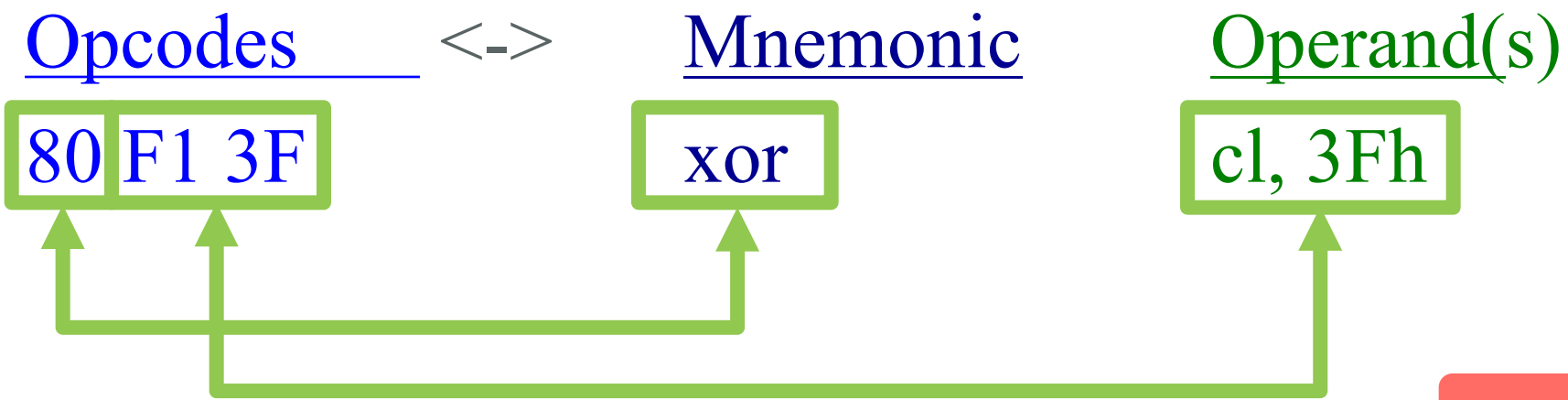
PlugX Trojan Loader - Rule 2 (Byte Sequence)

```
8B 45 F4
8A 0C 38
FF 05 00 30 00 10
2A CB
80 F1 3F
02 CB
6A 00
88 0F
```


```
mov     eax, [ebp+var_C]
mov     cl, [eax+edi]
inc     dword_10003000
sub     cl, bl
xor     cl, 3Fh
add     cl, bl
push    0
mov     [edi], cl
```

Hard

X86 Disassembly (On the Brief)



Hard

http://ref.x86asm.net/coder32.html

```
80 81 82 83 84 85 86 87 88 89 8A 8B 8C 8D 8E 8F 90 91 92 93 94 95 96 97 98 99 9A 9B 9C 9D 9E 9F
A0 A1 A2 A3 A4 A5 A6 A7 A8 A9 AA AB AC AD AE AF B0 B1 B2 B3 B4 B5 B6 B7 B8 B9 BA BB BC BD BE BF
C0 C1 C2 C3 C4 C5 C6 C7 C8 C9 CA CB CC CD CE CF D0 D1 D2 D3 D4 D5 D6 D7 D8 D9 DA DB DC DD DE DF
E0 E1 E2 E3 E4 E5 E6 E7 E8 E9 EA EB EC ED EE EF F0 F1 F2 F3 F4 F5 F6 F7 F8 F9 FA FB FC FD FE FF
```

pf	0F	po	so	o	proc	st	m	rl	x	mnemonic	op1	op2	op3	op4	iext	tested f	mod
		00		r					L	ADD	**r/m8**	r8					o..sza
		01		r					L	ADD	**r/m16/32**	r16/32					o..sza
		02		r						ADD	**r8**	r/m8					o..sza
		03		r						ADD	**r16/32**	r/m16/32					o..sza
		04								ADD	**AL**	imm8					o..sza
		05								ADD	**eAX**	imm16/32					o..sza
		06								PUSH	ES						
		07								POP	**ES**						
		08		r					L	OR	**r/m8**	r8					o..sza
		09		r					L	OR	**r/m16/32**	r16/32					o..sza
		0A		r						OR	**r8**	r/m8					o..sza

Byte Sequence Rule Steps

1. Wildcard Operands
2. Consolidate Wildcards with Jumps
3. Pad Jumps for Larger Constants
4. Hunt Malware Repositories for Other Samples

Wildcard Operands

```
rule APTGroupX_PlugXTrojanLoader_StringDecode
{
        strings:
        $byte = {
                8B 45 F4  //mov     eax, [ebp+var_C]
                8A 0C 38  //mov     cl, [eax+edi]
                FF 05 00 30 00 10 //inc   dword_10003000
                2A CB     //sub     cl, bl
                80 F1 3F  //xor     cl, 3Fh
                02 CB     //add     cl, bl
                6A 00     //push    0
                88 0F     //mov     [edi], cl
        }
        condition:
                any of them
}
```

```
rule APTGroupX_PlugXTrojanLoader_StringDecode
{
        strings:
        $byte = {
                8B ?? ??  //mov     eax, [ebp+var_C]
                8A ?? ??  //mov     cl, [eax+edi]
                FF 05 ?? ?? ?? ?? //inc   dword_10003000
                2A ??     //sub     cl, bl
                80 ?? ??  //xor     cl, 3Fh
                02 ??     //add     cl, bl
                6A ??     //push    0
                88 ??     //mov     [edi], cl
        }
        condition:
                any of them
}
```

Hard

Consolidate Wildcards w/Jumps

```
$byte = {
        8B ?? ??          //mov    eax, [ebp+var_C]
        8A ?? ??          //mov    cl, [eax+edi]
        FF 05 ?? ?? ?? ?? //inc    dword_10003000
        2A ??             //sub    cl, bl
        80 ?? ??          //xor    cl, 3Fh
        02 ??             //add    cl, bl
        6A ??             //push   0
        88 ??             //mov    [edi], cl
}
```

```
$byte = {
        8B [2]            //mov    eax, [ebp+var_C]
        8A [2]            //mov    cl, [eax+edi]
        FF 05 [4]         //inc    dword_10003000
        2A [1]            //sub    cl, bl
        80 [2]            //xor    cl, 3Fh
        02 [1]            //add    cl, bl
        6A ??             //push   0
        88 ??             //mov    [edi], cl
}
```

Hard

Pad Jumps for Larger Constants

```
$byte = {
        8B [2]          //mov     eax, [ebp+var_C]
        8A [2]          //mov     cl, [eax+edi]
        FF 05 [4]       //inc   dword_10003000
        2A [1]          //sub     cl, bl
        80 [2]          //xor     cl, 3Fh
        02 [1]          //add     cl, bl
        6A ??           //push    0
        88 ??           //mov     [edi], cl
}
```

```
$byte = {
        8B [2]          //mov     eax, [ebp+var_C]
        8A [2]          //mov     cl, [eax+edi]
        FF 05 [4]       //inc   dword_10003000
        2A [1]          //sub     cl, bl
        80 [2-5]        //xor     cl, 3Fh
        02 [1]          //add     cl, bl
        6A [1-4]        //push    0
        88 ??           //mov     [edi], cl
}
```

Hard

Look for Alternate Opcodes

Sample #1

8B 45 F4	mov eax, [ebp+var_C]
8A 0C 38	mov cl, [eax+edi]
FF 05 00 30 00 10	inc dword_10003000
2A CB	sub cl, bl
80 F1 3F	xor cl, 3Fh
02 CB	add cl, bl
6A 00	push 0
88 0F	mov [edi], cl

Hard

Sample #2

8A 0C 18	mov cl, [eax+ebx]
8A 45 10	mov al, [ebp+arg_8]
FF 05 00 30 00 10	inc dword_10003000
6A 00	push 0
2A C8	sub cl, al
6A 00	push 0
80 F1 3F	xor cl, 3Fh
6A 00	push 0
02 C8	add cl, al
6A 00	push 0
88 0B	mov [ebx], cl

Consult the Opcode Table

		83		6	03+				L	XOR	**r/m16/32**	imm8
		83		7						CMP	r/m16/32	imm8
		84		r						TEST	r/m8	r8
		85		r						TEST	r/m16/32	r16/32
		86		r					L	XCHG	**r8**	**r/m8**
		87		r					L	XCHG	**r16/32**	**r/m16/32**
		88		r						MOV	**r/m8**	r8
		89		r						MOV	**r/m16/32**	r16/32
		8A		r						MOV	**r8**	r/m8
		8B		r						MOV	**r16/32**	r/m16/32
		8C		r						MOV MOV	**m16** **r16/32**	Sreg Sreg

Adjust for Alternate Opcodes

```
$byte = {
        8B [2]          //mov   eax, [ebp+var_C]
        8A [2]          //mov   cl, [eax+edi]
        FF 05 [4]       //inc   dword_10003000
        2A [1]          //sub   cl, bl
        80 [2-5]        //xor   cl, 3Fh
        02 [1]          //add   cl, bl
        [0-5]           //push  0
        88 ??           //mov   [edi], cl
}
```

```
$byte = {
        (8A|8B) [2]     //mov   eax, [ebp+var_C]
        8A [2]          //mov   cl, [eax+edi]
        FF 05 [4]       //inc   dword_10003000
        2A [1]          //sub   cl, bl
        80 [2-5]        //xor   cl, 3Fh
        02 [1]          //add   cl, bl
        [0-5]           //push  0
        88 ??           //mov   [edi], cl
}
```

Hard

Warning from YARA or VT Hunting

PlugX

Save changes | Enabled | Disabled

$byte1 is slowing down scanning

```
140         any of them
141 }
142 rule TBHK_Campaign_PlugX_Trojan_Loader_08
143 {
144     strings:
145         $byte = {8B 45 F4 [0-2] 8A 0? 38 [0-2] FF 05 00 30 00 10 [0-7] 2A [1-6] 80 [2-7] 02 [1-6] 88}
146     condition:
147         any of them
148 }
149 rule TBHK_Campaign_PlugX_Trojan_Loader_09
150 {
151     strings:
152         $byte1 = { (8B|8A) [2-4] 8A [2-4] FF 05 [4-11] 2A [1-6] 80 [2-7] 02 [1-6] 88 }
153         $byte2 = { (8B|8A) [2-4] 8A [2-4] FF 05 (28|40) 30 00 10 [0-7] 2A [1-6] 80 [2-7] 02 [1-6] 88 }
154     condition:
155         any of them
156 }
```

Look for Similar Address Locations

Sample #1

8B 45 F4	mov eax, [ebp+var_C]
8A 0C 38	mov cl, [eax+edi]
FF 05 00 30 00 10	inc dword_10003000
2A CB	sub cl, bl
80 F1 3F	xor cl, 3Fh
02 CB	add cl, bl
6A 00	push 0
88 0F	mov [edi], cl

Hard

Sample #2

8A 0C 18	mov cl, [eax+ebx]
8A 45 10	mov al, [ebp+arg_8]
FF 05 00 30 00 10	inc dword_10003000
6A 00	push 0
2A C8	sub cl, al
6A 00	push 0
80 F1 3F	xor cl, 3Fh
6A 00	push 0
02 C8	add cl, al
6A 00	push 0
88 0B	mov [ebx], cl

Trojan Loader Rule 2

Hard

```
rule APTGroupX_PlugXTrojanLoader_StringDecode
{
        strings:
        $byte = {
                (8B|8A) [2-4]       // mov    cl, [eax+ebx]
                8A [2-4]            // mov    al, [ebp+arg_8]
                FF 05 00 30 00 10   // inc    dword_10003000
                [0-5]               // <junk_holder>
                2A [1-6]            // sub    cl, al
                80 [2-7]            // xor    cl, 3Fh
                02 [1-6]            // add    cl, al
                88 0?               // mov    [ebx], cl
        }
        condition:
                any of them
}
```

```
FF D7                   call    edi ; LineTo
8B 45 F4                mov     eax, [ebp+var_C]
8A 0C 18                mov     cl, [eax+ebx]
8A 45 10                mov     al, [ebp+arg_8]
FF 05 00 30 00 10       inc     dword_10003000
6A 00                   push    0               ; lppt
2A C8                   sub     cl, al
6A 00                   push    0               ; y
80 F1 3F                xor     cl, 3Fh
6A 00                   push    0               ; x
02 C8                   add     cl, al
6A 00                   push    0               ; hdc
88 0B                   mov     [ebx], cl
FF D6                   call    esi ; MoveToEx
```

Byte Sequence Rule Steps

1. Wildcard Operands
2. Consolidate Wildcards with Jumps
3. Pad Jumps for Larger Constants
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1db2e43952929af6a4374d140c7131b7372d96448175a356dcea8ec29a576f7 c4c189e590053d2cf97569c495c9610 pedll	2016-04-10 21:14:51	PlugX	TBHK_Campaign_PlugX_Trojan_Loader_10
d26e28c81f34d67a82b27140209f9e777739854aa56adf2e6e58eab4a00aa9f cedc2cdf98049785212262cd56915ec 64bits assembly pedll overlay	2016-04-10 21:14:49	9002	UNKNOWN_9002_Strings
1db2e43 pedll			TBHK_Campaign_PlugX_Trojan_Loader_06
1db2e43 pedll	21:14:44		TBHK_Campaign_PlugX_Trojan_Loader_05
1db2e43952929af6a4374d140c7131b7372d96448175a356dcea8ec29a576f7 pedll	2016-04-10 21:14:43	PlugX	TBHK_Campaign_PlugX_Trojan_Loader_04
1db2e43952929af6a4374d140c7131b7372d96448175a356dcea8ec29a576f7 pedll	2016-04-10 21:14:42	PlugX	TBHK_Campaign_PlugX_Trojan_Loader_01
1db2e43952929af6a4374d140c7131b7372d96448175a356dcea8ec29a576f7 pedll	2016-04-10 21:14:41	PlugX	UNKNOWN_PlugX_TLoader_StringDecode

```
7E 4A 8B 45 08 2B C7 89 45 F4 89 4D FC 8D 49 00   ~J.E.+..E..M..I.
6A 03 68 FC 87 00 10 6A 00 6A 00 6A 00 FF D6 8B   j.h....j.j.j....
45 F4 8A 0C 38 FF 05 94 B7 00 10 6A 03 68 FC 87   E...8......j.h..
00 10 2A CB 6A 00 80 F1 3F 6A 00 02 CB 6A 00 88   ..*.j...?j...j..
0F FF D6 47 FF 4D FC 75 C7 8B 7D F8 6A 03 68 FC   ...G.M.u..}.j.h.
```

1db2e43952929af6a4374d140c7131b7372d96448175a356dcea8ec29a576f7 c4c189e590053d2cf97569c495c9610 pedll	2016-04-10 21:14:51	PlugX	TBHK_Campaign_PlugX_Trojan_Loader_10
d26e28c81f34d67a82b27140209f9e777739854aa56adf2e6e58eab4a00aa9f cedc2cdf98049785212262cd56915ec 64bits assembly pedll overlay	2016-04-10 21:14:49	9002	UNKNOWN_9002_Strings
1db2e43 c4c189e5 pedll	21:14:44		TBHK_Campaign_PlugX_Trojan_Loader_06
1db2e43 c4c189e5 pedll	21:14:44		TBHK_Campaign_PlugX_Trojan_Loader_05
1db2e43952929af6a4374d140c7131b7372d96448175a356dcea8ec29a576f7 c4c189e590053d2cf97569c495c9610 pedll	2016-04-10 21:14:43	PlugX	TBHK_Campaign_PlugX_Trojan_Loader_04
1db2e43952929af6a4374d140c7131b7372d96448175a356dcea8ec29a576f7 c4c189e590053d2cf97569c495c9610 pedll	2016-04-10 21:14:42	PlugX	TBHK_Campaign_PlugX_Trojan_Loader_01
1db2e43952929af6a4374d140c7131b7372d96448175a356dcea8ec29a576f7 c4c189e590053d2cf97569c495c9610 pedll	2016-04-10 21:14:41	PlugX	UNKNOWN_PlugX_TLoader_StringDecode

```
7E 4A 8B 45 08 2B C7 89 45 F4 89 4D FC 8D 49 00   ~J.E.+..E..M..I.
6A 03 68 FC 87 00 10 6A 00 6A 00 6A 00 FF D6 8B   j.h....j.j.j....
45 F4 8A 0C 38 FF 05 94 B7 00 10 6A 03 68 FC 87   E...8......j.h..
00 10 2A CB 6A 00 80 F1 3F 6A 00 02 CB 6A 00 88   ..*.j...?j...j..
0F FF D6 47 FF 4D FC 75 C7 8B 7D F8 6A 03 68 FC   ...G.M.u..}.j.h.
```

Hunting Results - More Payload Names

Mc.cp

setup.msi

fslapi.dll.gui

set.conf

McUtil.dll.mc

player.db

msi.dll.eng

MSO.dsm

SXLOC.ZAP

SiteAdv.adv

http.dlp

Pmcutil.dll.bbc

mcf.ep

splash_screen.dll.sky

httpwin.dat

dot1x.1x

msi.dll.kav

FSMA32.dllfox

McUtil.dll.ping

moic.exe.dat

FSPMAPI.dll.fsp

Samsung.hlp

kav.avp

ssMUIDLL.dll.conf

demo.dat

readme.txt

rapi.dll.rap

Hunting Results – Double File Extensions

Mc.cp

setup.msi

fslapi.dll.gui

set.conf

McUtil.dll.mc

player.db

msi.dll.eng

MSO.dsm

SXLOC.ZAP

SiteAdv.adv

http.dlp

Pmcutil.dll.bbc

mcf.ep

splash_screen.dll.sky

httpwin.dat

dot1x.1x

msi.dll.kav

FSMA32.dllfox

McUtil.dll.ping

moic.exe.dat

FSPMAPI.dll.fsp

Samsung.hlp

kav.avp

ssMUIDLL.dll.conf

demo.dat

readme.txt

rapi.dll.rap

Hunting Results – McAfee Theme?

Mc.cp

setup.msi

fslapi.dll.gui

set.conf

McUtil.dll.mc

player.db

msi.dll.eng

MSO.dsm

SXLOC.ZAP

SiteAdv.adv

http.dlp

Pmcutil.dll.bbc

mcf.ep

splash_screen.dll.sky

httpwin.dat

dot1x.1x

msi.dll.kav

FSMA32.dllfox

McUtil.dll.ping

moic.exe.dat

FSPMAPI.dll.fsp

Samsung.hlp

kav.avp

ssMUIDLL.dll.conf

demo.dat

readme.txt

rapi.dll.rap

Hunting Results – Microsoft Installer Theme?

Mc.cp
setup.msi
fslapi.dll.gui
set.conf
McUtil.dll.mc
player.db
msi.dll.eng
MSO.dsm
SXLOC.ZAP
SiteAdv.adv
http.dlp
Pmcutil.dll.bbc
mcf.ep
splash_screen.dll.sky
httpwin.dat
dot1x.1x
msi.dll.kav
FSMA32.dllfox
McUtil.dll.ping
moic.exe.dat
FSPMAPI.dll.fsp
Samsung.hlp
kav.avp
ssMUIDLL.dll.conf
demo.dat
readme.txt
rapi.dll.rap

Hunting Results – News Media Theme?

Mc.cp
setup.msi
fslapi.dll.gui
set.conf
McUtil.dll.mc
player.db
msi.dll.eng
MSO.dsm
SXLOC.ZAP
SiteAdv.adv

http.dlp
Pmcutil.dll.bbc
mcf.ep
splash_screen.dll.sky
httpwin.dat
dot1x.1x
msi.dll.kav
FSMA32.dllfox
McUtil.dll.ping
moic.exe.dat

FSPMAPI.dll.fsp
Samsung.hlp
kav.avp
ssMUIDLL.dll.conf
demo.dat
readme.txt
rapi.dll.rap

YARA House Keeping

- **Rules, Rules, Rules**
- **Naming Scheme**
- Signature All Layers
- Tuning
- Data Sources
  - Known Files
  - Malware
  - New Intelligence
- Use “meta” when Sharing

String Rules

We LOVE Unicode

Reduce FPs for String Rules

- Modifiers
- Whitespace Characters
- File Attributes

Strings Can Be Changed or Obfuscated

Byte Sequence Rules

Find the Broader Campaign

More Opportunities to Signature

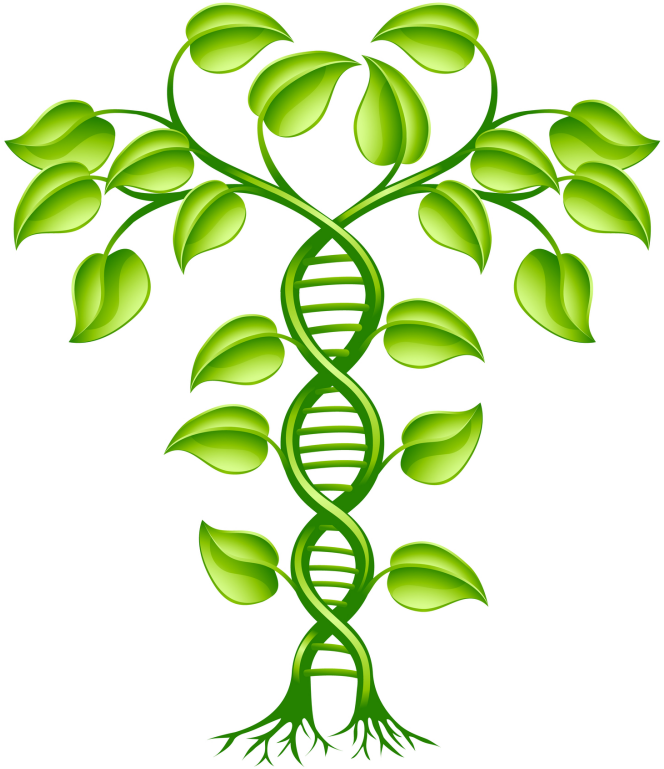
- Implementation Traits
- Custom Features

Consult an Opcode table

Identify Junk Code

Look for opportunities to use

- Alternates - (8A | 8B)
- Lower Nibble Wildcards - 0?
- Make use of Structures
- Check Bit Flags w/Bitwise ’&’ Operator



Resources

GitHub - fideliscyber

Source MD5s:

- 24FC5871407F180ECAD9DA6F67DD1878
- D9AB2B14E9B2F1D78C117FDB1BF0601E

https://yara.readthedocs.org/

http://ref.x86asm.net/coder32.html

http://community.websense.com/blogs/securitylabs/archive/2015/04/24/opportunity-knows-no-boundary-a-case-study-of-acquisition.asp

http://researchcenter.paloaltonetworks.com/2015/05/plugx-uses-legitimate-samsung-application-for-dll-side-loading/

https://www.blackhat.com/docs/webcast/08202015-big-game-hunting.pdf

END

Questions ?

Appendix - A

Byte Sequence Rule Steps

1. Wildcard Operands
2. Consolidate Wildcards with Jumps
3. Pad Jumps for Larger Constants
4. Scan Malware Repository for Other Samples
    1. Adjust for Alternate Opcodes
        - Consult the Opcode table
        - Adjust using Lower Nibble Wildcards or Alternatives
    2. Identify Presence of Junk Code
        - If present, pad jumps for junk code
        - Consolidate Double Jumps
    3. Slightly De-optimize if Needed
        - Re-Insert Higher Nibble Operands for Lower Nibble Wildcards
        - Re-Insert some Operand bytes for Addresses Locations

Junk Code

Sample #1

```
8B 45 F4          mov   eax, [ebp+var_C]
8A 0C 38          mov   cl, [eax+edi]
FF 05 00 30 00 10 inc   dword_10003000
2A CB             sub   cl, bl
80 F1 3F          xor   cl, 3Fh
02 CB             add   cl, bl
6A 00             push  0
88 0F             mov   [edi], cl
```

Sample #2

```
8A 0C 18          mov   cl, [eax+ebx]
8A 45 10          mov   al, [ebp+arg_8]
FF 05 00 30 00 10 inc   dword_10003000
6A 00             push  0
2A C8             sub   cl, al
6A 00             push  0
80 F1 3F          xor   cl, 3Fh
6A 00             push  0
02 C8             add   cl, al
6A 00             push  0
88 0B             mov   [ebx], cl
```

Pad Jumps for Junk Code

```
$byte = {
        (8A|8B) [2]     //mov   eax, [ebp+var_C]
        8A [2]          //mov   cl, [eax+edi]
        FF 05 [4]       //inc   dword_10003000
        6A [1-4]        //push  0
        2A [1]          //sub   cl, bl
        6A [1-4]        //push  0
        80 [2-5]        //xor   cl, 3Fh
        6A [1-4]        //push  0
        02 [1]          //add   cl, bl
        6A [1-4]        //push  0
        88 ??           //mov   [edi], cl
}
```

```
$byte = {
        (8A|8B) [2]     //mov   eax, [ebp+var_C]
        8A [2]          //mov   cl, [eax+edi]
        FF 05 [4]       //inc   dword_10003000
        [0-5]           //push  0
        2A [1]          //sub   cl, bl
        [0-5]           //push  0
        80 [2-5]        //xor   cl, 3Fh
        [0-5]           //push  0
        02 [1]          //add   cl, bl
        [0-5]           //push  0
        88 ??           //mov   [edi], cl
}
```

Consolidate Double Jumps

```
$byte = {
        (8A|8B) [2]     //mov   eax, [ebp+var_C]
        8A [2]          //mov   cl, [eax+edi]
        FF 05 [4]       //inc   dword_10003000
        [0-5]           //push  0
        2A [1]          //sub   cl, bl
        [0-5]           //push  0
        80 [2-5]        //xor   cl, 3Fh
        [0-5]           //push  0
        02 [1]          //add   cl, bl
        [0-5]           //push  0
        88 0?           //mov   [edi], cl
}
```

```
$byte = {
        (8A|8B) [2]     //mov   eax, [ebp+var_C]
        8A [2]          //mov   cl, [eax+edi]
        FF 05 [4-9]     //inc   dword_10003000
        [0-5]           //push  0
        2A [1-6]        //sub   cl, bl
        [0-5]           //push  0
        80 [2-7]        //xor   cl, 3Fh
        [0-5]           //push  0
        02 [1-6]        //add   cl, bl
        [0-5]           //push  0
        88 0?           //mov   [edi], cl
}
```

Look for Equal Higher Nibble Situations

Sample #1

8B 45 F4	mov eax, [ebp+var_C]
8A 0C 38	mov cl, [eax+edi]
FF 05 00 30 00 10	inc dword_10003000
2A CB	sub cl, bl
80 F1 3F	xor cl, 3Fh
02 CB	add cl, bl
6A 00	push 0
88 0F	mov [edi], cl

Sample #2

8A 0C 18	mov cl, [eax+ebx]
8A 45 10	mov al, [ebp+arg_8]
FF 05 00 30 00 10	inc dword_10003000
6A 00	push 0
2A C8	sub cl, al
6A 00	push 0
80 F1 3F	xor cl, 3Fh
6A 00	push 0
02 C8	add cl, al
6A 00	push 0
88 0B	mov [ebx], cl

Lower Order Nibble Wildcards

```
$byte = {
        8B [2]          //mov   eax, [ebp+var_C]
        8A [2]          //mov   cl, [eax+edi]
        FF 05 [4]       //inc   dword_10003000
        [0-5]           //push  0
        2A [1]          //sub   cl, bl
        [0-5]           //push  0
        80 [2-5]        //xor   cl, 3Fh
        [0-5]           //push  0
        02 [1]          //add   cl, bl
        [0-5]           //push  0
        88 ??           //mov   [edi], cl
}
```

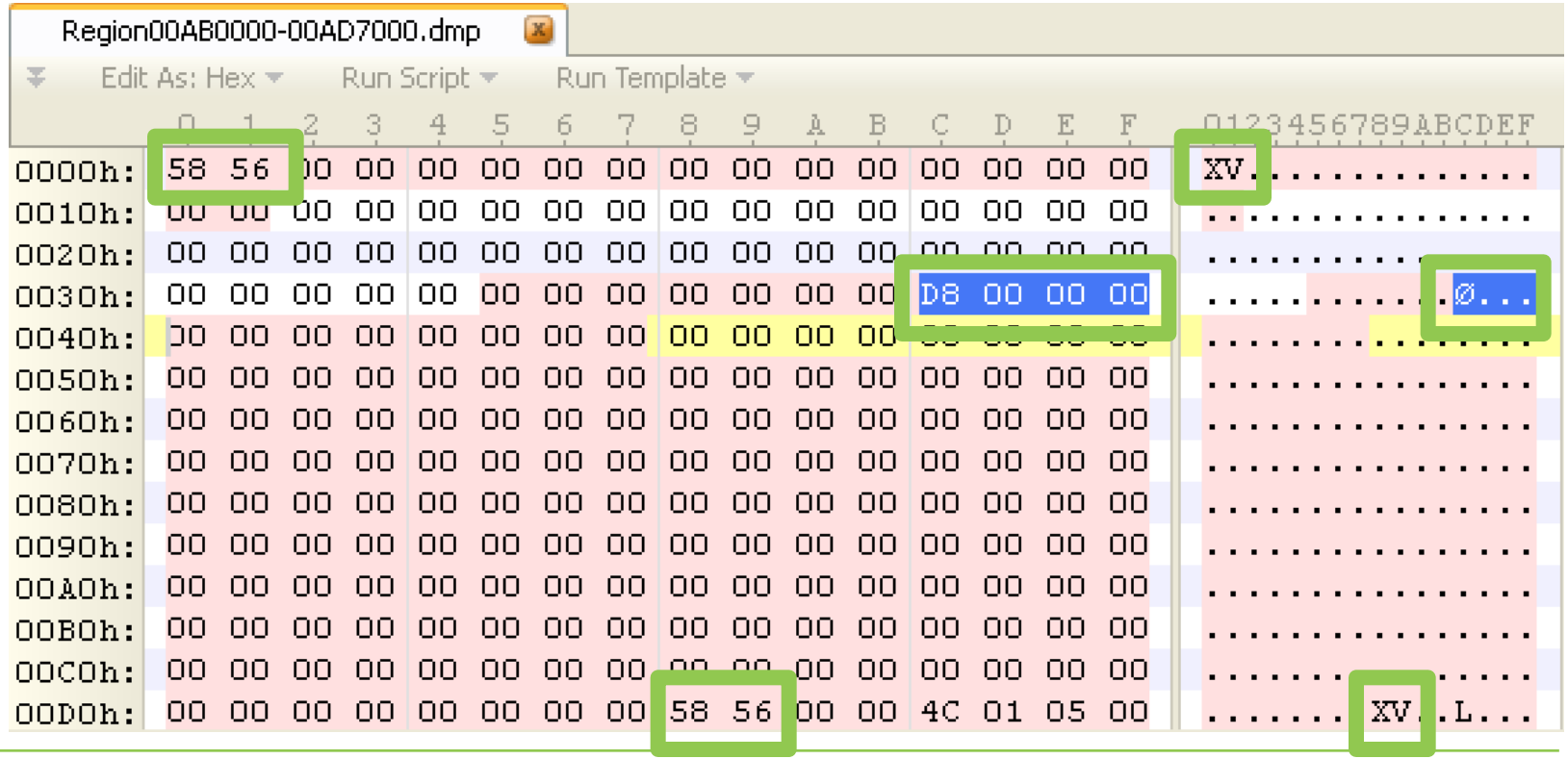
```
$byte = {
        (8A | 8B) [2]   //mov   eax, [ebp+var_C]
        8A [2]          //mov   cl, [eax+edi]
        FF 05 [4]       //inc   dword_10003000
        [0-5]           //push  0
        2A [1]          //sub   cl, bl
        [0-5]           //push  0
        80 [2-5]        //xor   cl, 3Fh
        [0-5]           //push  0
        02 [1]          //add   cl, bl
        [0-5]           //push  0
        88 0?           //mov   [edi], cl
}
```

Appendix - B

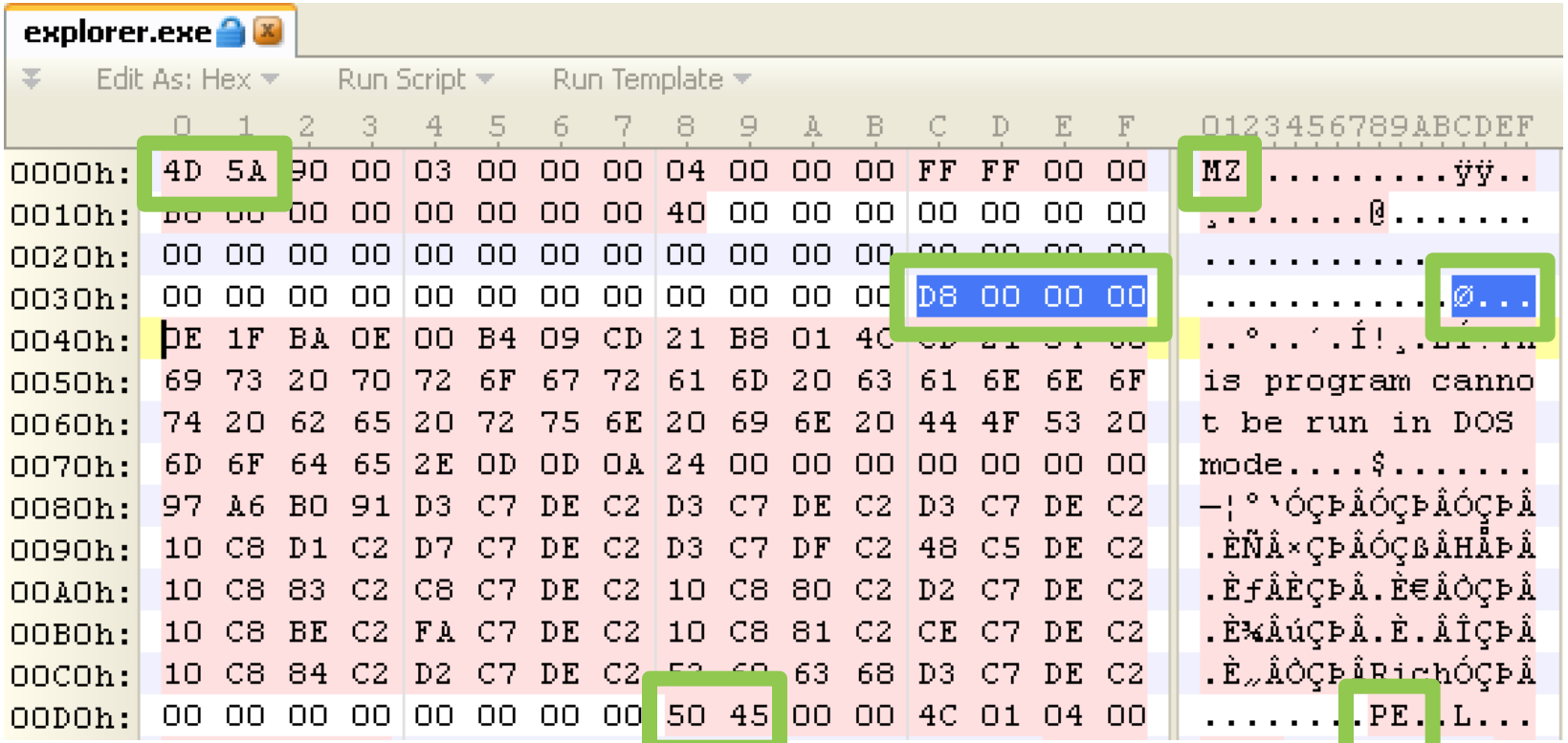
PlugX Payload

```
seg000:00000000                 mov     ebx, 36FBDCB2h
seg000:00000005                 jmp     loc_B
seg000:00000005 ; ---------------------------------------------------------------
seg000:0000000A                 db 0E9h ; T
seg000:0000000B ; ---------------------------------------------------------------
seg000:0000000B
seg000:0000000B loc_B:                  ; CODE XREF:
seg000:00000005j
seg000:0000000B                 add     ecx, 0ED43AD3Fh
seg000:00000011                 inc     ecx
seg000:00000012                 sub     eax, 0A38A7DCCh
seg000:00000017                 xor     eax, 441AC7BAh
seg000:0000001C                 dec     edx
seg000:0000001D                 cmp     eax, 0FA629847h
seg000:00000022                 mov     eax, [esp]
seg000:00000025                 cmp     edx, 0B0A968D3h
seg000:0000002B                 and     edx, 513AB2C1h
```

Inside Memory



To Compare



Walking Structures

Modified MZ & PE Headers

```
rule UNKNOWN_PlugXPayload_XVHeader{
        meta:
                source ="D9AB2B14E9B2F1D78C117FDB1BF0601E”
        condition:
                uint16(0) == 0x5658 and  //Check for XV at offset 0
                uint16(uint32(0x3C)) == 0x5658 //Check for XV at
                                                pointer offset
}
```

Appendix - C

PE Characteristics Bit Flags

```
rule PlugX_TrojanLoader_PayloadNames
{
        strings:
                $str1 = "msi.dll.eng" wide fullword
        condition:
                //Check PE Characteristics Bit Flags
                (((uint16(uint32(0x3C)+0x16))&0x2002) == 0x2002) and
                (filesize < 11KB) and
                any of them
}
```