Co0L BSidesSP 2015

Ricardo Amaral a.k.a L0gan

$Whoami

Ricardo L0gan

Security Specialist with over 15 years of experience, enthusiastic in malware research, pen-test and reverse engineering. I've a solid knowledge on topics like network security, hardening and tuning across multiple platforms such as Windows, Linux, OS X and Cisco. Beginner in programming languages as Python, C and Assembly.

In Brazil I contribute to the Slackware community (Slackshow and Slackzine) and I'm member of the Staff of some events: H2HC, SlackShow and Bsides SP.

Long live Open Source - Use Linux (Slackware)

Agenda

0x00 Motivation of Research
0x01 OS X, The New Target
0x02 The Mach-O Format
0x03 Tools For Analysis (Static / Dynamic)
0x04 Current Threats
0x05 Conclusions

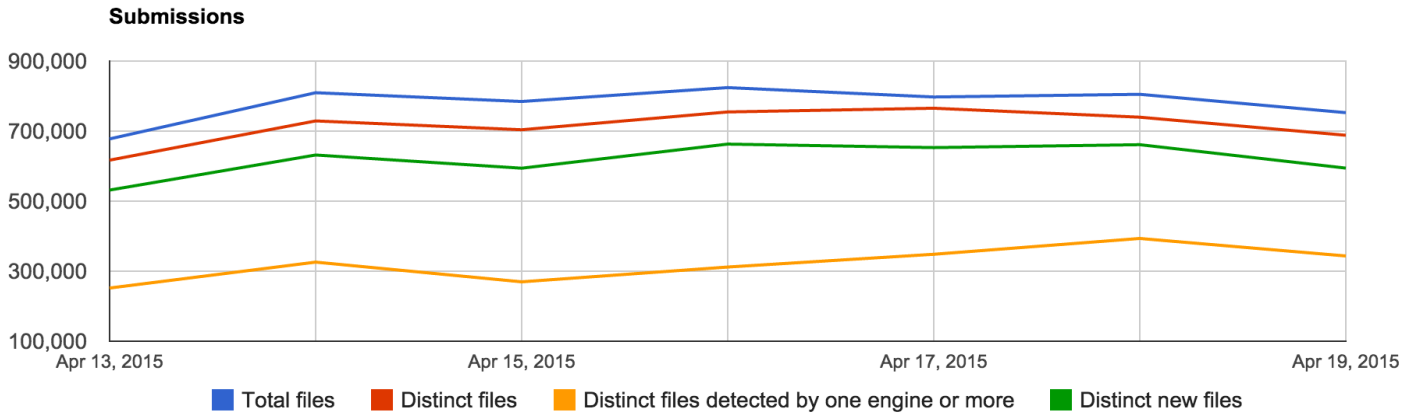
0x00 - Motivation of Research

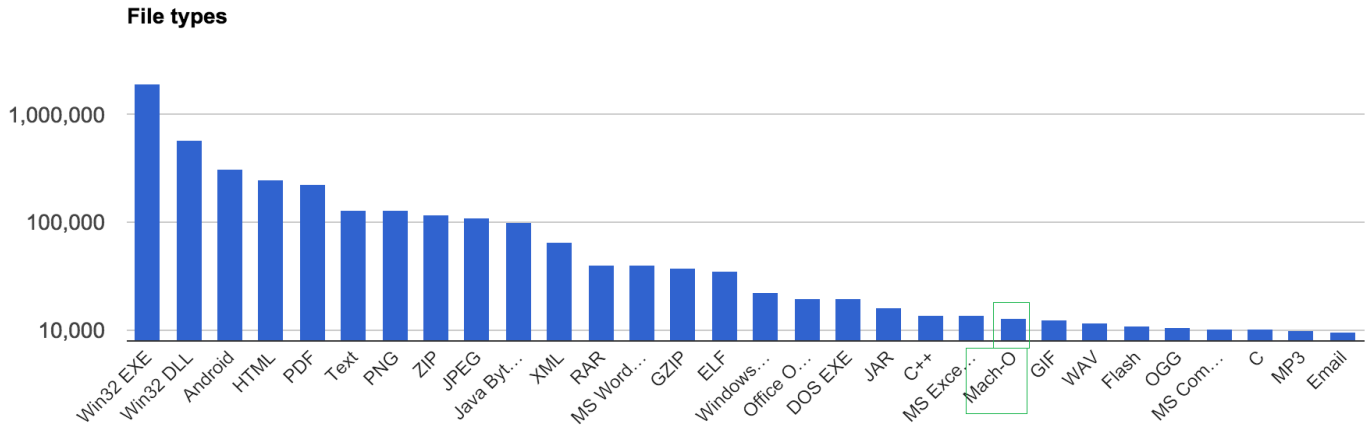
Windows always gets infected!!!

Does Linux ever gets infected??

“Mac OS ever gets infected...”

0x01 – OS X, The New Target





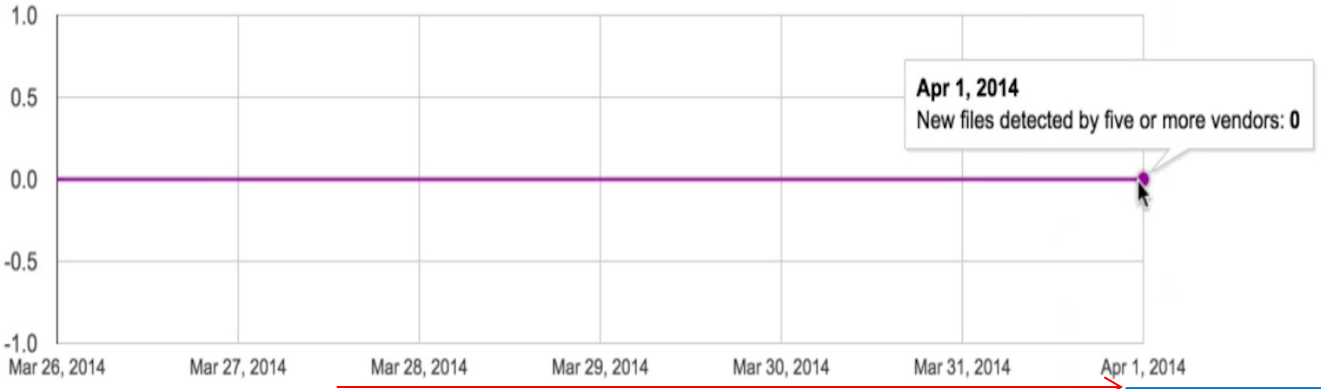
Source: www.virustotal.com

0x01 – OS X, The New Target

Processed files

The following graph displays some global trends regarding the total number of files processed by virustotal. You may focus on particular file types.

Ending on	File type
2014-04-01	Mach-O Executable



7-day period in April 2014

Source: www.virustotal.com

0x01 – OS X, The New Target

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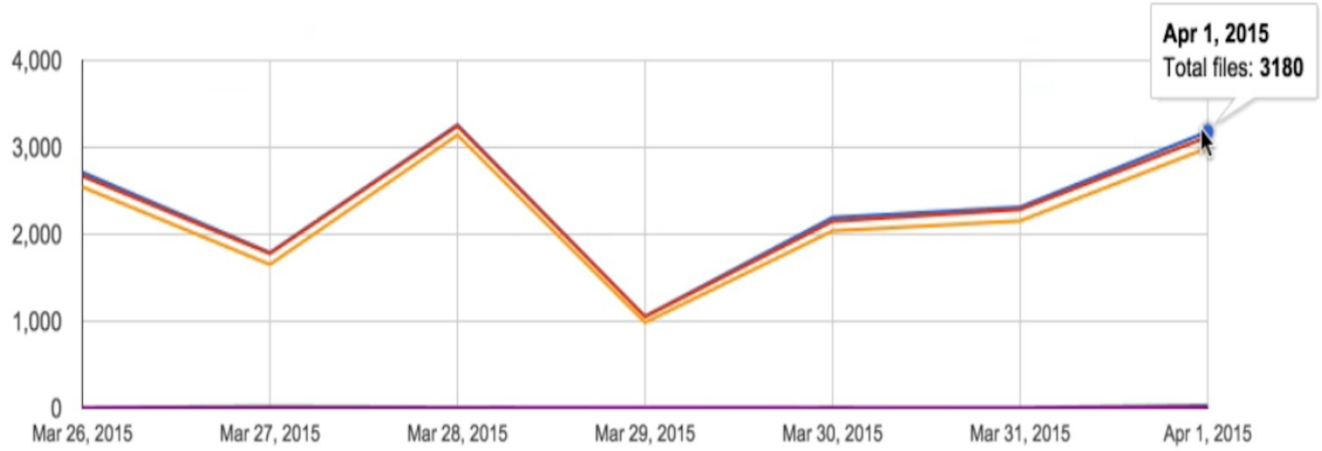
2015-04-01	Mach-O Executable



7-day period in April 2015

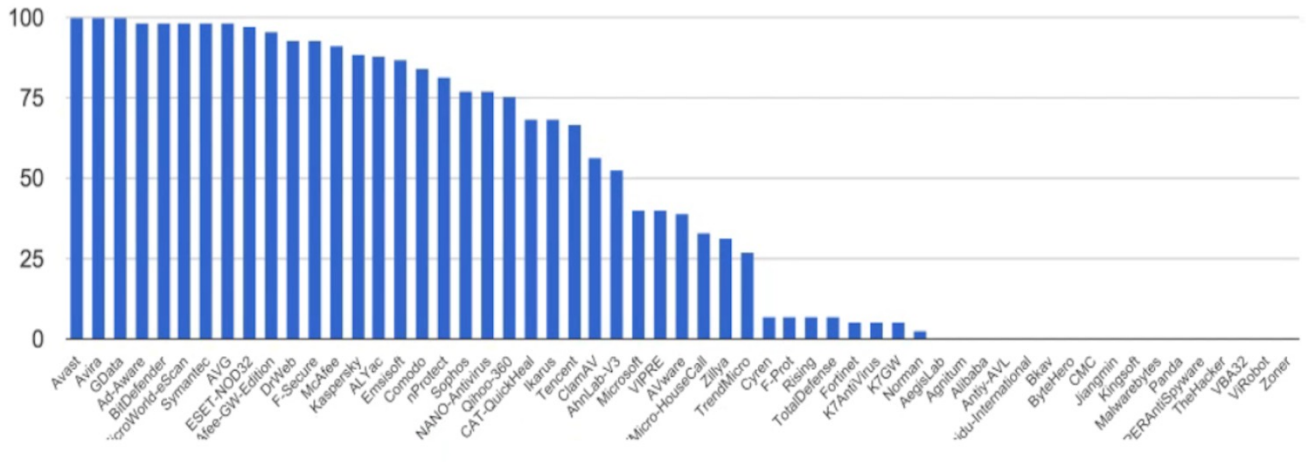
Source: www.virustotal.com

0x01 – OS X, The New Target

Detection ratios by vendor

The following chart displays the detection performance by vendor regarding files matching a given age, file type and total detection count criteria. In other words, of all files matching the given criteria that have been processed by the given engine, what percentage of them were detected by the engine under consideration?

Submitted on	Age	Positives	Type
2015-05-04	Any	5+	Mach-O Executable

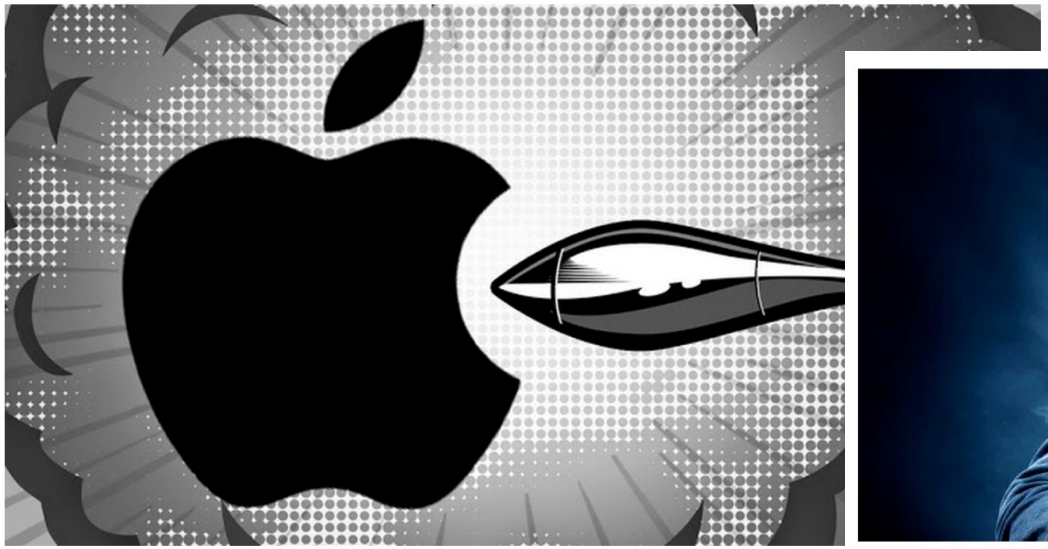


Source: www.virustotal.com

0x01 – OS X, The New Target

Windows? NO, Linux and Mac OS X Most Vulnerable Operating System In 2014

Tuesday, February 24, 2015 Swati Khandelwal



Source: http://thehackernews.com/2015/02/vulnerable-operating-system.html

Revoltado com a Apple, hacker do mundo jailbreak publica detalhes de uma falha de segurança do OS X

Rafael Fischmann 23/07/2015 às 09:31

0x01 – OS X, The New Target

Operating system	# of vulnerabilities	# of HIGH vulnerabilities	# of MEDIUM vulnerabilities	# of LOW vulnerabilities
Apple Mac OS X	147	64	67	16
Apple iOS	127	32	72	23
Linux Kernel	119	24	74	21
Microsoft Windows Server 2008	38	26	12	0
Microsoft Windows 7	36	25	11	0
Microsoft Windows Server 2012	38	24	14	0
Microsoft Windows 8	36	24	12	0
Microsoft Windows 8.1	36	24	12	0
Microsoft Windows Vista	34	23	11	0
Microsoft Windows RT	30	22	8	0

Source: http://thehackernews.com/2015/02/vulnerable-operating-system.html

0x02 - The Mach-O Format

Binary (Linux)

```
logan@SLack-Hack-14 ~ $
logan@SLack-Hack-14 ~ $ file /usr/bin/cal
/usr/bin/cal: ELF 32-bit LSB  executable, Intel 80386, version 1 (SYSV), dynamically linked (uses shared libs), stripped
logan@SLack-Hack-14 ~ $
```

Binary (Windows)

```
loganbr ~/Downloads $
loganbr ~/Downloads $ file calc.exe
calc.exe: PE32+ executable for MS Windows (GUI) Mono/.Net assembly
loganbr ~/Downloads $
```

Binary (OS X)

```
loganbr ~/Downloads $ file /usr/bin/cal
/usr/bin/cal: Mach-O 64-bit executable x86_64
loganbr ~/Downloads $
```

0x02 - The Mach-O Format

The mach-o format was adopted as the standard in OS X from version 10.6 on

We are currently in version 10.11 (~~Yosemite~~ El Capitan).

0x02 - The Mach-O Format

CA FE BA BE - Mach-O Fat Binary
FE ED FA CE - Mach-O binary (32-bit)
FE ED FA CF - Mach-O binary (64-bit)
CE FA ED FE - Mach-O binary (reverse byte 32-bit)
CF FA ED FE - Mach-O binary (reverse byte 64-bit)

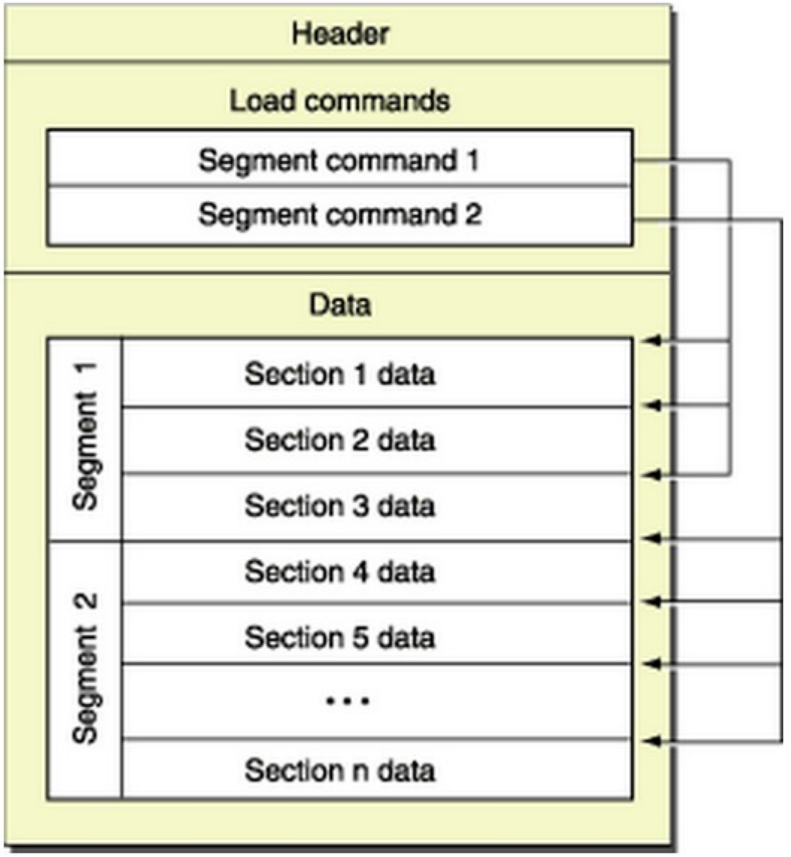
0x02 - The Mach-O Format

Mach-O (Mach Object)

HEADER
LOAD COMMANDS
SECTIONS

Architecture of object code

ppc ppc64 i386 x86_64 armv6
armv7 armv7s arm64



0x02 - The Mach-O Format

HEADER

```
loganbr ~ $ vim /usr/include/mach-o/loader.h
```

```
/*
 * The 64-bit mach header appears at the very beginning of object files for
 * 64-bit architectures.
 */
struct mach_header_64 {
    uint32_t    magic;      /* mach magic number identifier */
    cpu_type_t  cputype;    /* cpu specifier */
    cpu_subtype_t   cpusubtype; /* machine specifier */
    uint32_t    filetype;   /* type of file */
    uint32_t    ncmds;      /* number of load commands */
    uint32_t    sizeofcmds; /* the size of all the load commands */
    uint32_t    flags;      /* flags */
    uint32_t    reserved;   /* reserved */
};
```

0x02 - The Mach-O Format

LOAD COMMANDS

```
loganbr ~ $ vim /usr/include/mach-o/loader.h
```

```
struct load_command {
    uint32_t cmd;       /* type of load command */
    uint32_t cmdsize;   /* total size of command in bytes */
};
```

0x02 - The Mach-O Format

SECTIONS

```
loganbr ~ $ vim /usr/include/mach-o/loader.h
```

```
struct section_64 { /* for 64-bit architectures */
    char        sectname[16];   /* name of this section */
    char        segname[16];    /* segment this section goes in */
    uint64_t    addr;       /* memory address of this section */
    uint64_t    size;       /* size in bytes of this section */
    uint32_t    offset;     /* file offset of this section */
    uint32_t    align;      /* section alignment (power of 2) */
    uint32_t    reloff;     /* file offset of relocation entries */
    uint32_t    nreloc;     /* number of relocation entries */
    uint32_t    flags;      /* flags (section type and attributes)*/
    uint32_t    reserved1;  /* reserved (for offset or index) */
    uint32_t    reserved2;  /* reserved (for count or sizeof) */
    uint32_t    reserved3;  /* reserved */
};
```

0x03 – Tools For Analysis (Static / Dynamic)

Static Analysis

- file
- strings
- hex editor (graphical)
- lipo
- otool
- nm
- codesign
- machOView (graphical)
- hopper (graphical)
- class-dump

Dynamic Analysis

- xcode (graphical)
- IDA Pro (graphical)
- lldb
- fseventer
- open snoop
- activity Monitor (graphical)
- procoxp
- tcpdump
- cocoaPacketAnalyzer (graphical)
- wireshark (graphical)
- lsock
- little Snitch

0x03 – Tools For Analysis (Static)

FILE

```
logan /opt/malware/mach-o $ file *
malware:      directory
malware.zip: Zip archive data, at least v1.0 to extract
old:          directory
sample_01:    Mach-O universal binary with 3 architectures
sample_01 (for architecture x86_64):    Mach-O 64-bit executable x86_64
sample_01 (for architecture i386):      Mach-O executable i386
sample_01 (for architecture ppc7400):   Mach-O executable ppc
sample_02:    Mach-O executable i386
sample_03:    Mach-O executable i386
sample_04:    Mach-O executable i386
sample_05:    Mach-O universal binary with 2 architectures
sample_05 (for architecture armv7):     Mach-O executable arm
sample_05 (for architecture armv7s):    Mach-O executable arm
sample_06:    Mach-O 64-bit executable x86_64
sample_07:    Mach-O universal binary with 2 architectures
sample_07 (for architecture armv7):     Mach-O executable arm
sample_07 (for architecture armv7s):    Mach-O executable arm
sample_08:    Mach-O executable i386
sample_09:    Mach-O executable ppc
sample_10:    Mach-O universal binary with 2 architectures
sample_10 (for architecture i386):      Mach-O executable i386
sample_10 (for architecture ppc7400):   Mach-O executable ppc
logan /opt/malware/mach-o $
```

mach-o

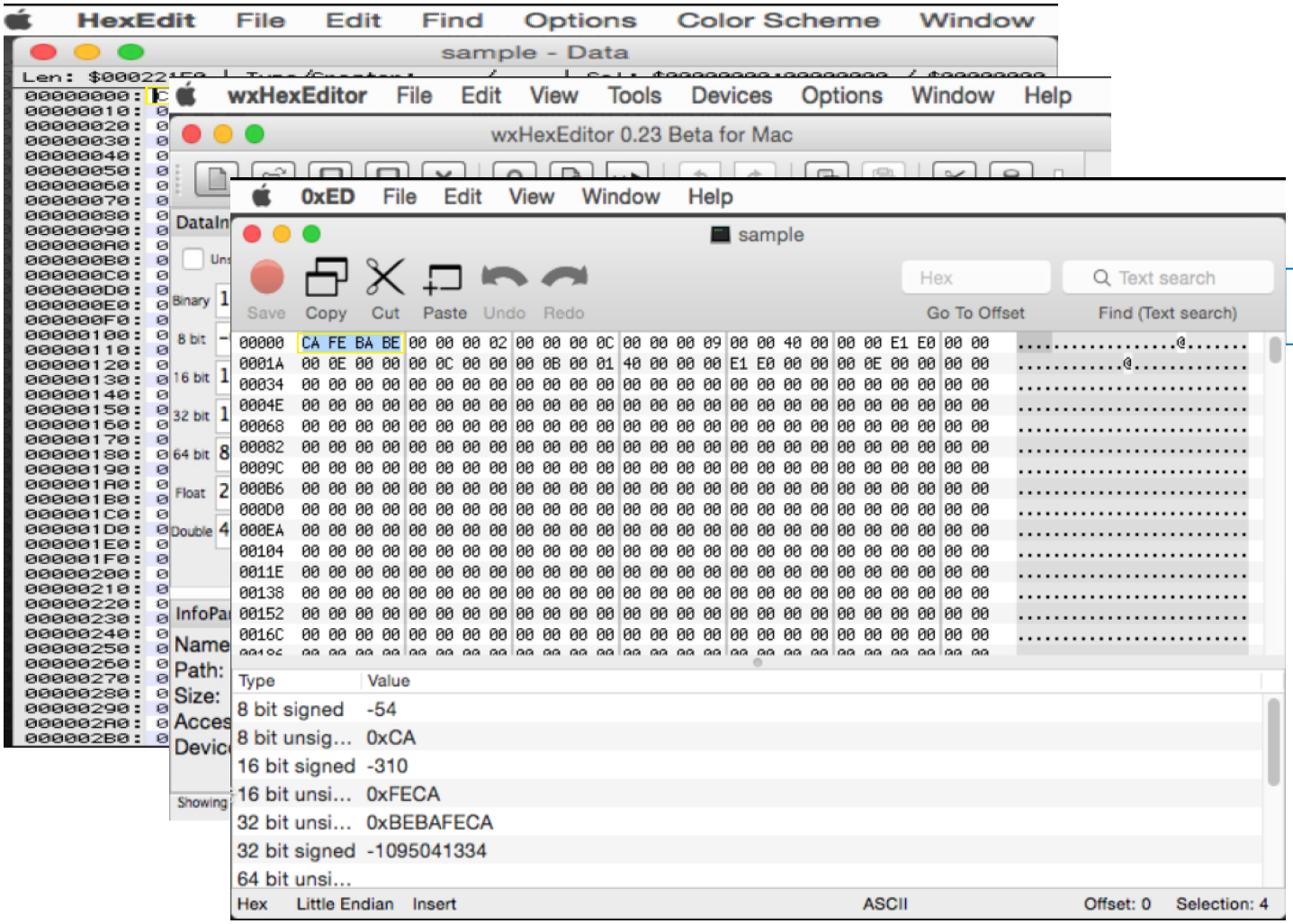
0x03 – Tools For Analysis (Static)

STRINGS

```
logan /opt/malware/mach-o $ strings sample
IODeviceTree
text/html; charset=utf-8
;/?:@&=+$
%@=%@&
POST
application/x-www-form-urlencoded; charset=utf-8
Content-Type
text/html
Accept
no-cache
Cache-Control
Pragma
close
Connection
something is wrong: %@
CFBundleExecutable
http://www.comeinbaby.com/start_log/?app=%@&sn=%@
serial-number
kill -HUP SpringBoard
mv "%@" "%@"
_objc_autoreleasePoolPush
_objc_autoreleasePoolPop
__TEXT
__LINKEDIT
_object_setInstanceVariable
_object_setIvar
_object_copy
_objc_retain
_objc_retainBlock
_objc_release
```

0x03 – Tools For Analysis (Static)

HEX EDITOR



HexEdit

wxHexEditor

0xED

0x03 – Tools For Analysis (Static)

```
logan /opt/malware/mach-o $ lipo -detailed_info sample
Fat header in: sample
fat_magic 0xcafebabe
nfat_arch 2
architecture armv7
    cputype CPU_TYPE_ARM
    cpusubtype CPU_SUBTYPE_ARM_V7
    offset 16384
    size 57824
    align 2^14 (16384)
architecture armv7s
    cputype CPU_TYPE_ARM
    cpusubtype CPU_SUBTYPE_ARM_V7S
    offset 81920
    size 57824
    align 2^14 (16384)
logan /opt/malware/mach-o $ lipo -detailed_info sample_10
Fat header in: sample_10
fat_magic 0xcafebabe
nfat_arch 2
architecture i386
    cputype CPU_TYPE_I386
    cpusubtype CPU_SUBTYPE_I386_ALL
    offset 4096
    size 17652
    align 2^12 (4096)
architecture ppc7400
    cputype CPU_TYPE_POWERPC
    cpusubtype CPU_SUBTYPE_POWERPC_7400
    offset 24576
    size 13636
    align 2^12 (4096)
logan /opt/malware/mach-o $
```

LIPO

0xcafebabe

0x03 – Tools For Analysis (Static)

LIPO

```
logan /opt/malware/mach-o $ lipo -info sample
Architectures in the fat file: sample are: armv7 armv7s
logan /opt/malware/mach-o $
logan /opt/malware/mach-o $
logan /opt/malware/mach-o $ lipo -info sample_10
Architectures in the fat file: sample_10 are: i386 ppc7400
logan /opt/malware/mach-o $
```

```
logan /opt/malware/mach-o $
logan /opt/malware/mach-o $ lipo -extract i386 -output sample10_i386 sample_10
logan /opt/malware/mach-o $
logan /opt/malware/mach-o $ file sample10_i386
sample10_i386: Mach-O universal binary with 1 architecture
sample10_i386 (for architecture i386):  Mach-O executable i386
logan /opt/malware/mach-o $
```

0x03 – Tools For Analysis (Static)

OTOOL

```
logan /opt/malware/mach-o $ otool -f sample
Fat headers
fat_magic 0xcafebabe
nfat_arch 2
architecture 0
    cputype 12
    cpusubtype 9
    capabilities 0x0
    offset 16384
    size 57824
    align 2^14 (16384)
architecture 1
    cputype 12
    cpusubtype 11
    capabilities 0x0
    offset 81920
    size 57824
    align 2^14 (16384)
logan /opt/malware/mach-o $ otool -f sample10_i386
Fat headers
fat_magic 0xcafebabe
nfat_arch 1
architecture 0
    cputype 7
    cpusubtype 3
    capabilities 0x0
    offset 4096
    size 17652
    align 2^12 (4096)
```

0x03 – Tools For Analysis (Static)

NM

```
logan /opt/malware/mach-o $ nm sample

sample (for architecture armv7):
0000b744 s  stub helpers
0000bef0 s _.str3
         U _CFDataGetBytePtr
         U _CFDataGetLength
         U _CFDataGetTypeID
         U _CFGetTypeID
         U _CFURLCreateStringByAddingPercentEscapes
         U _IOMasterPort
         U _IORegistryEntrySearchCFProperty
         U _IORegistryGetRootEntry
         U _NSLog
0000c4d0 S _NXArgc
0000c4d4 S _NXArgv
0000c120 s _OBJC_$_CLASS_METHODS___ARCLite__
         U _OBJC_CLASS_$_NSArray
         U _OBJC_CLASS_$_NSAutoreleasePool
         U _OBJC_CLASS_$_NSBundle
         U _OBJC_CLASS_$_NSDictionary
         U _OBJC_CLASS_$_NSMutableArray
         U _OBJC_CLASS_$_NSMutableDictionary
         U _OBJC_CLASS_$_NSMutableOrderedSet
         U _OBJC_CLASS_$_NSMutableString
         U _OBJC_CLASS_$_NSMutableURLRequest
         U _OBJC_CLASS_$_NSOrderedSet
         U _OBJC_CLASS_$_NSString
         U _OBJC_CLASS_$_NSURL
         U _OBJC_CLASS_$_NSURLConnection
0000c274 s _OBJC_CLASS_$___ARCLite__
0000c0d0 s _OBJC_CLASS_RO_$___ARCLite__
0000c288 s _OBJC_METACLASS_$___ARCLite__
0000c0f8 s _OBJC_METACLASS_RO_$___ARCLite__
         U __Block_copy
```

0x03 – Tools For Analysis (Static)

CODESIGN

```
1. Infected (bash)
logan /opt/malware/mach-o $ codesign -dvvv sample_07
Executable=/opt/malware/mach-o/sample_07
Identifier=com.maiyadi.start
Format=Mach-O universal (armv7 armv7s)
CodeDirectory v=20100 size=466 flags=0x0(none) hashes=15+5 location=embedded
Hash type=sha1 size=20
CDHash=11e74087e067823ed346173aa4a6f96152bf0abc
Signature size=4319
Authority=iPhone Developer: li tjcy (967X86AAT5)
Authority=Apple Worldwide Developer Relations Certification Authority
Authority=Apple Root CA
Signed Time=May 6, 2014, 12:06:50 AM
Info.plist=not bound
TeamIdentifier=not set
Sealed Resources=none
Internal requirements count=1 size=176
logan /opt/malware/mach-o $
```

0x03 – Tools For Analysis (Static)

MachOView

MachOView File Edit Format View Window Help

sample_01

RAW RVA Search

- Fat Binary
  - Fat Header
  - Executable (X86_64) [SDK10.6]
    - Mach64 Header
    - Load Commands
    - Section64 (__TEXT,__text)
    - Section64 (__TEXT,__symb...
    - Section64 (__TEXT,__cstring)
    - Section64 (__TEXT,__const)
    - Section64 (__TEXT,__stub_...
    - Section64 (__TEXT,__unwin...
    - Section64 (__TEXT,__eh_frame)
    - Section64 (__DATA,__progr...
    - Section64 (__DATA,__mod_i...
    - Section64 (__DATA,__nl_sy...
    - Section64 (__DATA,__la_sy...
    - Section64 (__DATA,__data)
    - Dynamic Loader Info
    - Symbol Table
    - Dynamic Symbol Table
    - String Table
  - Executable (X86) [SDK10.6 Ta...
  - Executable (PPC)

Offset	Data	Description	Value
00000000	BEBAFECA	Magic Number	FAT_CIGAM
00000004	03000000	Number of Architecture	3
00000008	07000001	CPU Type	CPU_TYPE_X86_64
0000000C	03000080	CPU SubType	CPU_SUBTYPE_X86_64_ALL
00000010	00100000	Offset	4096
00000014	F0420000	Size	17136
00000018	0C000000	Align	4096
0000001C	07000000	CPU Type	CPU_TYPE_I386
00000020	03000000	CPU SubType	CPU_SUBTYPE_I386_ALL
00000024	00600000	Offset	24576
00000028	88410000	Size	16776
0000002C	0C000000	Align	4096
00000030	12000000	CPU Type	CPU_TYPE_POWERPC
00000034	0A000000	CPU SubType	CPU_SUBTYPE_POWERPC_7400
00000038	00B00000	Offset	45056
0000003C	AC500000	Size	20652
00000040	0C000000	Align	4096

0x03 – Tools For Analysis (Static)

HOPPER

Hopper Disassembler v3 File Edit Find Modify Navigate Debug Scripts Window Help

sample10_i386.hop

D A C P U

Labels Strings

Search

Tag Scope

start
dyld_stub_binding_helper
__dyld_func_lookup
_init_daemon
_encryptFile
_copyfile
_main
___progname
_environ
_NXArgv
_NXArgc
RC4
RC4_set_key
access
chdir
chmod$UNIX2003
close$UNIX2003
exit
fclose
fopen
fork
fread
free
fwrite$UNIX2003
malloc
memset

```
0000174b          hlt
                dyld_stub_binding_helper:
0000174c          call        0x1751
00001751          pop         eax
00001752          push        dword [ds:eax+0x8bf]
00001758          mov         eax, dword [ds:eax+0x8c3]
0000175e          jmp         eax
                __dyld_func_lookup:
00001760          call        0x1765
00001765          pop         eax
00001766          mov         eax, dword [ds:eax+0x8b3]
0000176c          jmp         eax

================ B E G I N N I N G   O F   P R O C E D U R E

                _init_daemon:
0000176e          push        ebp
0000176f          mov         ebp, esp
00001771          push        ebx
00001772          sub         esp, 0x14
00001775          call        imp___jump_table__fork
0000177a          test        eax, eax
0000177c          jne         0x178e

0000177e          call        imp___jump_table__setsid
00001783          xor         ebx, ebx
00001785          call        imp___jump_table__fork
0000178a          test        eax, eax
0000178c          je          0x179a
```

> analysis section __dyld
Analysis segment __OBJC
> analysis section __image_info
Analysis segment __IMPORT
> analysis section __jump_table
Analysis segment __LINKEDIT
Analysis segment External Symbols
Background analysis ended

Address 0x176e, Segment __TEXT, _init_daemon + 0, Section __text, file offset 0x76e

0x03 – Tools For Analysis (Static)

CLASS-DUMP

1. Infected (bash)

```
logan /opt/malware/mach-o $ class-dump sample
//
//     Generated by class-dump 3.5 (64 bit).
//
//     class-dump is Copyright (C) 1997-1998, 2000-2001, 2004-2013 by Steve Nygard.
//

#pragma mark -

//
// File: sample
// UUID: 4D44DD86-BAF1-30F6-983E-9E11EA45F07D
//
//                            Arch: armv7
//              Minimum iOS version: 4.3.0
//                     SDK version: 7.1.0
//
// Objective-C Garbage Collection: Unsupported
//

@protocol __ARCLiteIndexedSubscripting__
- (void)setObject:(id)arg1 atIndexedSubscript:(unsigned int)arg2;
- (id)objectAtIndexedSubscript:(unsigned int)arg1;
@end

@protocol __ARCLiteKeyedSubscripting__
- (void)setObject:(id)arg1 forKeyedSubscript:(id)arg2;
- (id)objectForKeyedSubscript:(id)arg1;
@end

logan /opt/malware/mach-o $
```

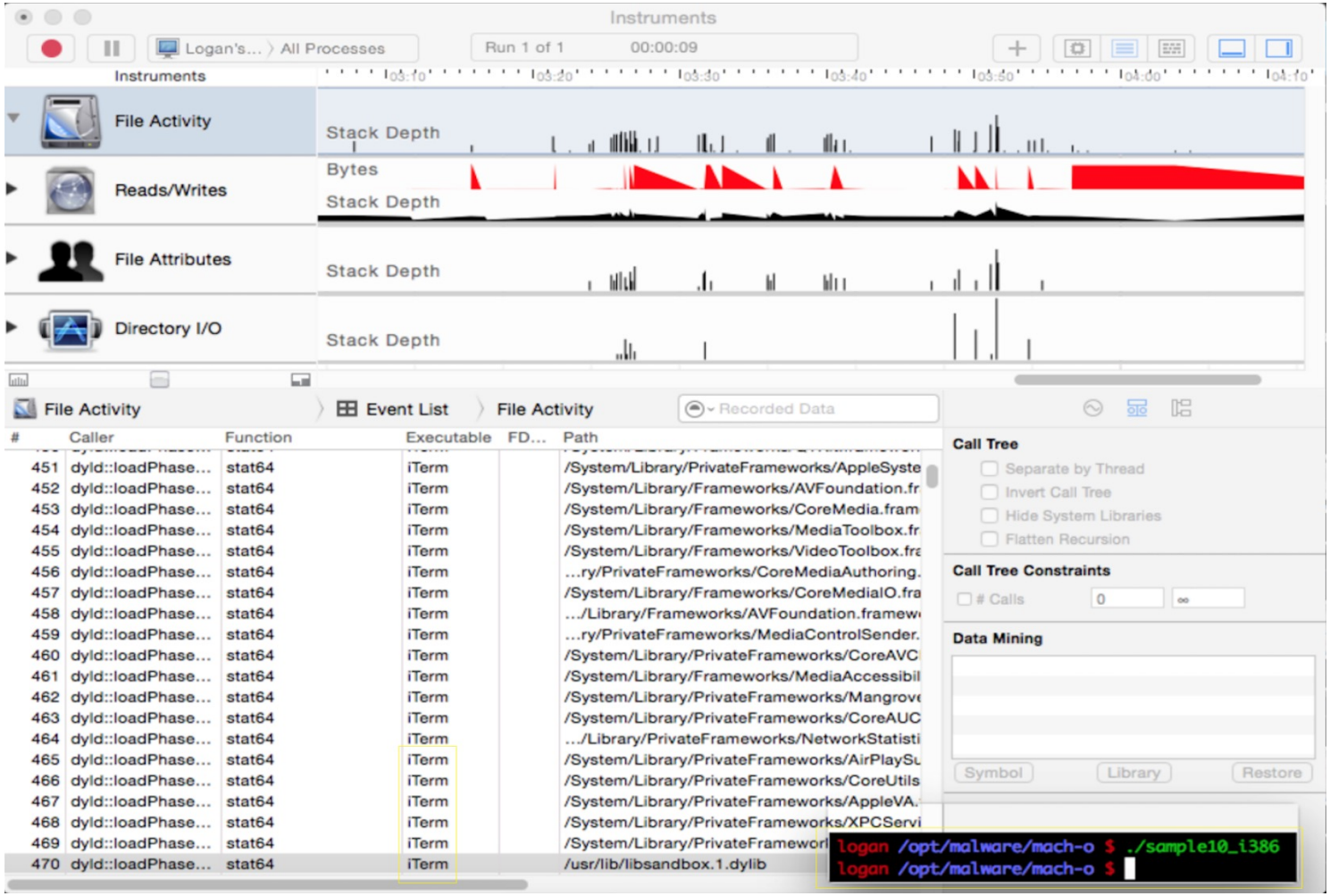
0x03 – Tools For Analysis (Dynamic)

VMWARE FUSION / PARALLELS / VIRTUALBOX

- Keep Virtualization Software Updated
- Use System Tools Installed in VM
- Network Host-Only mode
- If you use Shared Folder(Host) leave it as “read-only”
- Disable Gatekeeper (Allow apps downloaded from: **Anywhere**)

0x03 – Tools For Analysis (Dynamic)

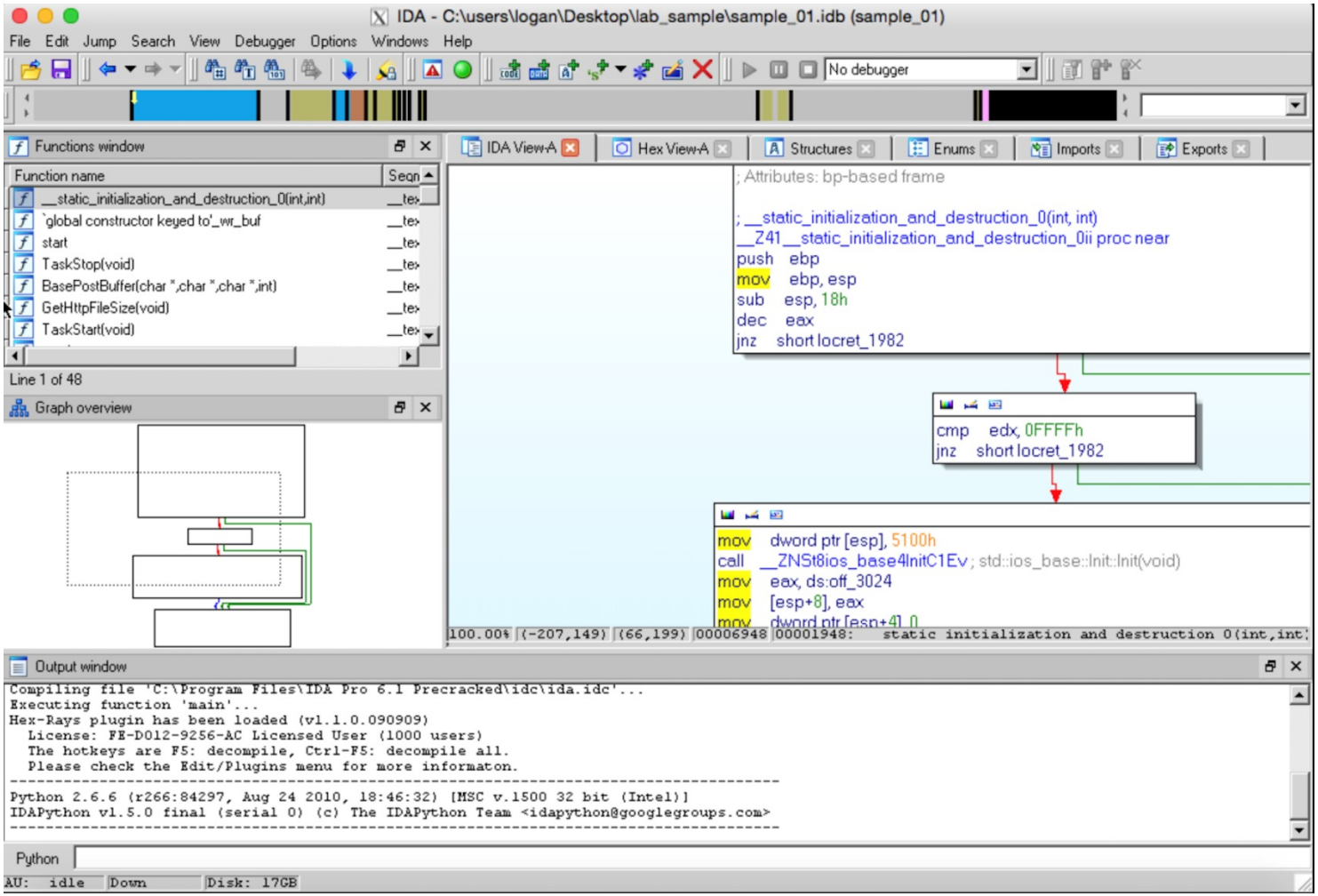
XCODE



0x03 – Tools For Analysis (Dynamic)

IDA PRO

also is a static tool



0x03 – Tools For Analysis (Dynamic)

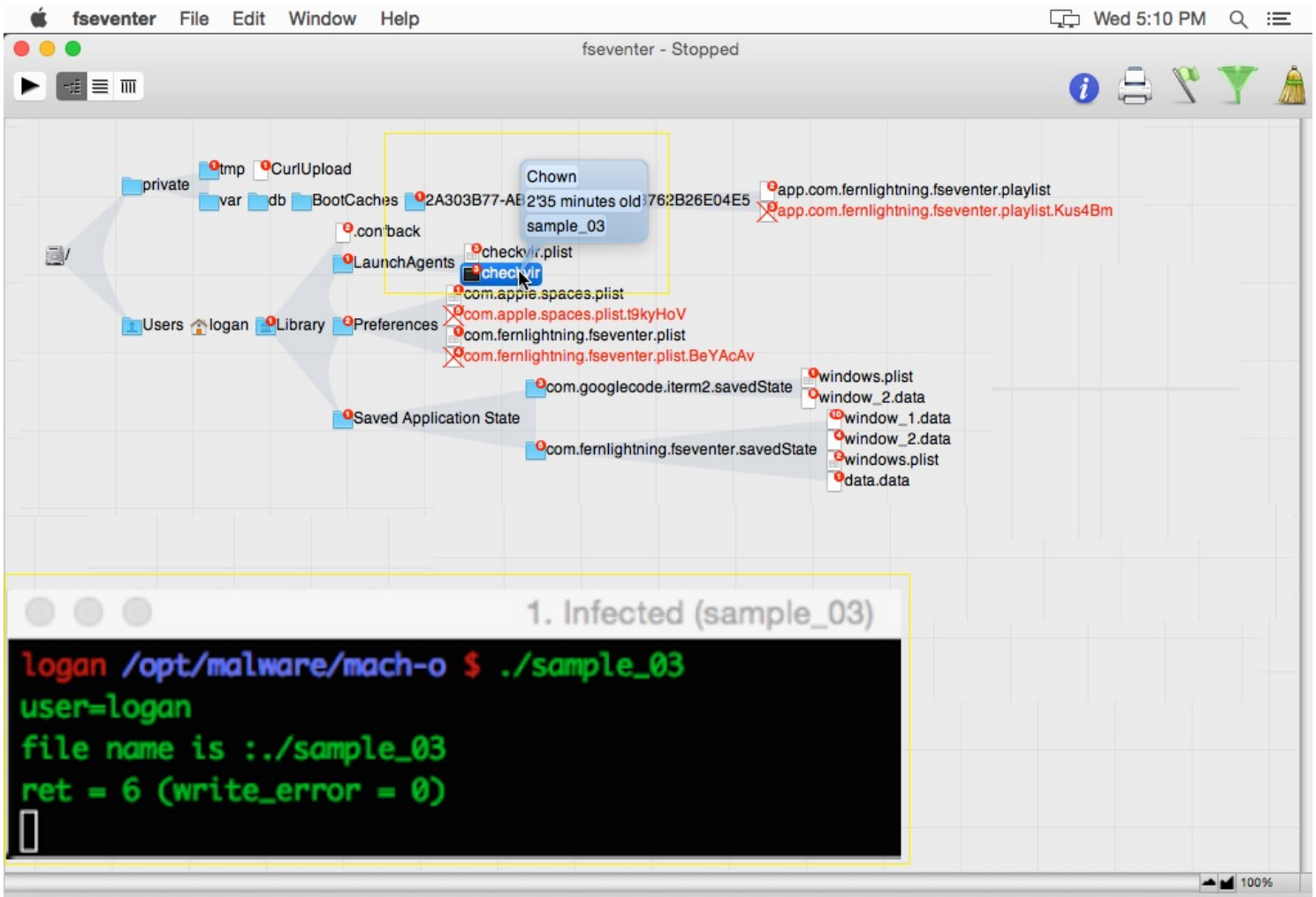
LLDB

1. Infected (lldb)

```
logan ~/Desktop/lab_sample $
logan ~/Desktop/lab_sample $ lldb sample
(lldb) target create "sample"
Current executable set to 'sample' (armv7).
(lldb) disassemble --name main
sample`main:
sample[0xacac] <+0>:   push   {r4, r5, r6, r7, lr}
sample[0xacae] <+2>:   add    r7, sp, #0xc
sample[0xacb0] <+4>:   push.w {r8, r10, r11}
sample[0xacb4] <+8>:   sub    sp, #0x20
sample[0xacb6] <+10>:  movw   r0, #0x14be
sample[0xacba] <+14>:  movt   r0, #0x0
sample[0xacbe] <+18>:  movw   r2, #0x158c
sample[0xacc2] <+22>:  movt   r2, #0x0
sample[0xacc6] <+26>:  add    r0, pc
sample[0xacc8] <+28>:  add    r2, pc
sample[0xacca] <+30>:  ldr    r1, [r0]
sample[0xaccc] <+32>:  ldr    r0, [r2]
sample[0xacce] <+34>:  blx    0xbfa8                    ; symbol stub for: objc_msgSend
sample[0xacd2] <+38>:  movw   r1, #0x14b6
sample[0xacd6] <+42>:  movt   r1, #0x0
sample[0xacda] <+46>:  add    r1, pc
sample[0xacdc] <+48>:  ldr    r1, [r1]
sample[0xacde] <+50>:  blx    0xbfa8                    ; symbol stub for: objc_msgSend
sample[0xace2] <+54>:  str    r0, [sp, #0x1c]
sample[0xace4] <+56>:  movw   r0, #0x14ec
sample[0xace8] <+60>:  movt   r0, #0x0
sample[0xacec] <+64>:  movw   r2, #0x1562
sample[0xacf0] <+68>:  movt   r2, #0x0
sample[0xacf4] <+72>:  add    r0, pc
sample[0xacf6] <+74>:  add    r2, pc
sample[0xacf8] <+76>:  ldr    r1, [r0]
sample[0xacfa] <+78>:  ldr    r0, [r2]
sample[0xacfc] <+80>:  mov    r5, r2
sample[0xacfe] <+82>:  str    r1, [sp, #0x8]
sample[0xad00] <+84>:  mov    r8, r1
sample[0xad02] <+86>:  blx    0xbfa8                    ; symbol stub for: objc_msgSend
sample[0xad06] <+90>:  mov    r7, r7
```

0x03 – Tools For Analysis (Dynamic)

FSEVENTER



0x03 – Tools For Analysis (Dynamic)

OPEN SNOOP

```
logan ~ $ sudo opensnoop -a
TIME          STRTIME                  UID    PID  FD ERR PATH                 ARGS
1684253508    2015 Apr 22 04:23:11   501    196  35   0 /Applications/0xED.app Dock\0
1684253612    2015 Apr 22 04:23:11   501    196  35   0 /Applications/0xED.app/Contents Dock\0
1684253685    2015 Apr 22 04:23:11   501    196  35   0 /Applications/0xED.app/Contents/Info.plist Dock\0
1684253881    2015 Apr 22 04:23:11   501    196  35   0 /Applications/0xED.app Dock\0
1684253941    2015 Apr 22 04:23:11   501    196  35   0 /Applications/0xED.app/Contents Dock\0
1684253992    2015 Apr 22 04:23:11   501    196  35   0 /Applications/0xED.app/Contents/Info.plist Dock\0
1684255714    2015 Apr 22 04:23:11   501    196  35   0 /Applications/0xED.app/Contents/PkgInfo Dock\0
1684256230    2015 Apr 22 04:23:11   501    196  35   0 /Library/Caches/com.apple.iconservices.store/69650B76-3F59-9236-5
5DF-98891864DFB3.isdata Dock\0
1684619763    2015 Apr 22 04:23:12   501   2507   3   0 /dev/dtracehelper    sh\0
1684621266    2015 Apr 22 04:23:12   501   2507  -1   6 /dev/tty             sh\0
1684625346    2015 Apr 22 04:23:12   501   2509   3   0 /dev/dtracehelper    grep\0
1684625619    2015 Apr 22 04:23:12   501    190   4   0 /Users/logan/Library/Preferences/com.apple.spaces.plist.MPIBvC1 c
fprefsd\0
1684624901    2015 Apr 22 04:23:12   501    190   4   0 /Users/logan/Library/Preferences/ByHost/com.apple.loginwindow.564
D4EC2-D722-B7E0-9098-4A8FA55B4CBE.plist.FFaj8zs cfprefsd\0
1684624821    2015 Apr 22 04:23:12   501   2508   3   0 /dev/dtracehelper    ps\0
1684656366    2015 Apr 22 04:23:12   501   2510   3   0 /dev/dtracehelper    sh\0
1684674588    2015 Apr 22 04:23:12   501   2512   3   0 /dev/dtracehelper    grep\0
1684672404    2015 Apr 22 04:23:12   501   2510  -1   6 /dev/tty             sh\0
1684674195    2015 Apr 22 04:23:12   501   2511   3   0 /dev/dtracehelper    ps\0
1685058001    2015 Apr 22 04:23:12     0     30   5   0 /var/db/BootCaches/2A303B77-AB26-435A-BBDA-3762B26E04E5/app.com.s
uavetech.0xED.playlist.2IzoWq warmd\0
1685428714    2015 Apr 22 04:23:13   501   2513   3   0 /dev/dtracehelper    lssave\0
1685439436    2015 Apr 22 04:23:13   501   2513   4   0 /var/folders/58/r3pxxb4s1nnfyt6xjb4vh4wm0000gn/0//com.apple.Launc
hServices-103501.csstore~ lssave\0
1685435681    2015 Apr 22 04:23:13   501   2513   3   0 /dev/autofs_nowait   lssave\0
1685435708    2015 Apr 22 04:23:13   501   2513   4   0 /Users/logan/.CFUserTextEncoding lssave\0
1685436099    2015 Apr 22 04:23:13   501   2513   3   0 /dev/autofs_nowait   lssave\0
1685436110    2015 Apr 22 04:23:13   501   2513   4   0 /Users/logan/.CFUserTextEncoding lssave\0
1685434581    2015 Apr 22 04:23:13   501   2513  -1   2 /etc/.mdns_debug     lssave\0
```

0x03 – Tools For Analysis (Dynamic)

ACTIVITY MONITOR

Activity Monitor File Edit View Window Help

Activity Monitor (My Processes)

CPU Memory Energy Disk Network

Process Name	% CPU	CPU Time	Threads	Idle Wake Ups	PID	User
Activity Monitor	2.7	1.46	6	3	16352	logan
iTerm	1.4	1.14	8	3	16354	logan
Dock	0.1	7.38	5	0	196	logan
Spotlight	0.1	4.10	6	0	206	logan
diagnostics_agent	0.1	0.48	4	0	267	logan
loginwindow	0.1	5.75	4	0	65	logan
distnoted	0.1	2.93	8	0	188	logan
sample_03	0.0	0.04	2	2	16318	logan
pkd	0.0	0.40	4	0	220	logan
nsurlstoraged	0.0	0.87	4	0	237	logan
sample_03	0.0	0.01	2	1	16369	logan
cfprefsd	0.0	4.11	4	0	190	logan
fontd	0.0	2.63	3	0	209	logan
bird	0.0	0.21	4	0	217	logan
com.apple.CoreSimulator.C...	0.0	0.13	5	0	16179	logan
iconservicesagent	0.0	0.30	4	0	229	logan
LaterAgent	0.0	0.60	3	0	288	logan
CalNCService	0.0	0.30	2	0	239	logan
imagent	0.0	0.27	2	0	242	logan
CallHistorySyncHelper	0.0	0.25	2	0	245	logan
Finder	0.0	47.51	3	0	199	logan
cloudd	0.0	1.95	2	0	248	logan
pbs	0.0	0.22	2	0	251	logan

System: 1.74%
User: 3.01%
Idle: 95.25%

CPU LOAD

Threads: 642
Processes: 169

0x03 – Tools For Analysis (Dynamic)

PROCXP

1. Infected (procexp.universa)

```
04:59:35  Up 06:03:40 Load Average:  1.19 1.03 0.83
CPU:   3/3 active <Unable to get processor information>
RAM:  1699M Free + 1370M Used (Active:  764M + Inactive:  166M + Wired:  439M Comp:    0M)   36M purgeable
           Memstatus: 85 Comp:    0M + Decomp:    0M  File: 1585M  Anon:  596M Throttled:    0M
Pkts:  TX: 13513/1M (0 bytes/sec)  RX: 10785/838K (0 bytes/sec)
Unable to get Power Source information
```

PID	PPID	UID	TTY	COMMAND	PRI	#TH	VSS	RSS	S	STIME	TIME	CPU	FDs	Net RX	Net TX
731	1	501	none	QuickLookSatell	4	2	2425M	7672K	S	04:59:23	00.16	0	4	----	----
730	1	501	none	quicklookd	4	7	2929M	10M	S	04:59:23	00.20	0	21	----	----
729	1	501	none	mdworker	4	3	2430M	7832K	S	04:59:21	00.04	0	5	----	----
726	1	501	none	syncdefaultsd	31	2	2422M	13M	S	04:59:08	00.12	0	4	----	----
725	296	501	268435	procexp.univers	31	4/1	2443M	45M	R	04:59:06	00.84	48	5	0B	0B
578	1	501	none	helpd	4	2	2422M	5416K	S	03:18:58	00.03	0	4	----	----
456	1	501	none	USBAgent	31	2	2400M	5276K	S	02:27:12	00.03	0	4	----	----
417	1	501	none	nbagent											
365	1	501	none	mdflagwriter											
345	1	501	none	EscrowSecurity											
313	1	501	none	storedownloadd											
312	1	501	none	LaterAgent											
311	1	501	none	storeassetd											
310	1	501	none	storelegacy											
296	295	501	268435	bash											
292	1	501	none	CoreServicesUI											
285	1	501	none	com.apple.Inpu											
283	1	501	none	iTerm											
281	1	501	none	AppleSpell											
280	1	501	none	pbs											
275	1	501	none	com.apple.noti											
273	1	501	none	com.apple.meta											
272	1	501	none	CalNCService											

1. Infected (procexp.universa)

```
Process: 723    Name: syncdefaultsd     Parent:     1   Status: runnable
Flags:   64-bit,called exec,Adaptive,Important,Donor
UID:      501   RUID:   501     SVUID:   501
GID:       20   RGID:    20     SVGID:    20

Virtual size:          2422M (2540539904)      Resident size:         13M (14589952)
Time:     00.11   =   00.09 (User)    +    00.02 (System)
Syscalls:        3427   Mach Traps:    1571
Disk I/O: Read      0K  Written:        60K
No Network I/O detected for this process

#Threads:   2     (Process has no workqueues)
(press T to display Thread Information)

Process Hierarchy:
 723   syncdefaultsd  has no children

4 File descriptors: 3 files (press F for detailed information)
```

0x03 – Tools For Analysis (Dynamic)

TCPDUMP

```
loganbr ~ $ tcpdump -i en0 -w lab_infected.pcap
tcpdump: listening on en0, link-type EN10MB (Ethernet), capture size 65535 bytes
^C101 packets captured
102 packets received by filter
0 packets dropped by kernel
loganbr ~ $
loganbr::Zion-Logan-2::                0:bash*
```

0x03 – Tools For Analysis (Dynamic)

COCOA

lab_infected.pcap

Open Capture Jump Find Print — Select a filter predicate — Filter

Id	Source	Destination	Captured Length	Packet Length	Protocol	Date Received	Time Delta	Information
32	172.16.1.243	146.255.36.1	66	66	TCP	2015-05-03 16:20:26.131	4.607989	56980 -> HTTP ([ACK, FIN], Seq=2041904939, Ack=86042694…
33	172.16.1.243	8.8.8.8	77	77	UDP	2015-05-03 16:20:26.298	4.775345	49245 > DOMAIN
34	146.255.36.1	172.16.1.243	66	66	TCP	2015-05-03 16:20:26.349	4.826088	HTTP -> 56980 ([ACK, FIN], Seq=860426947, Ack=204190494…
35	172.16.1.243	146.255.36.1	66	66	TCP	2015-05-03 16:20:26.349	4.826150	56980 -> HTTP ([ACK], Seq=2041904940, Ack=860426948, Wi…
36	8.8.8.8	172.16.1.243	179	179	UDP	2015-05-03 16:20:26.459	4.935370	DOMAIN > 49245
37	172.16.1.243	146.255.36.1	78	78	TCP	2015-05-03 16:20:29.484	7.960776	56981 -> HTTP ([SYN], Seq=1784175861, Ack=0, Win=65535)
38	172.16.1.243	255.255.255.255	167	167	UDP	2015-05-03 16:20:29.714	8.190599	17500 > 17500
39	172.16.1.243	172.16.1.255	167	167	UDP	2015-05-03 16:20:29.714	8.190769	17500 > 17500
40	146.255.36.1	172.16.1.243	74	74	TCP	2015-05-03 16:20:29.715	8.192112	HTTP -> 56981 ([ACK, SYN], Seq=3313510592, Ack=1784175…
41	172.16.1.243	146.255.36.1	66	66	TCP	2015-05-03 16:20:29.715	8.192154	56981 -> HTTP ([ACK], Seq=1784175862, Ack=3313510593,…
42	172.16.1.243	146.255.36.1	145	145	TCP	2015-05-03 16:20:29.715	8.192326	56981 -> HTTP ([ACK, PUSH], Seq=1784175862, Ack=331351…
43	172.16.1.243	213.199.179.168	77	77	UDP	2015-05-03 16:20:30.121	8.598231	57757 > 40008

Details	Values
▼ Packet	
ID	42
Date received	2015-05-03 16:20:29.715 (-0300)
Time since first p…	8.192326 seconds
Packet length	145 bytes
Captured length	145 bytes
▼ Ethernet-Header	
Source	60:03:08:9f:01:38
Destination	b8:c7:5d:cd:ed:d6
Type	IP (0x0800)
▼ IP-Header	
Length	20 bytes
Version	4
▶ Differentiated Se…	0x00
Total length	131 bytes
Identification	0xd711 (55057)

```
000:  B8 C7 5D CD ED D6 60 03 08 9F 01 38 08 00 45 00 00 83 D7 11 40 00 40 06 FE 5F AC 10 01 F3 92 FF 24 01 DE 95 00   ..]...`....8..E.....@.@.._.....$....
037:  50 6A 58 5C F6 C5 80 28 C1 80 18 10 08 6B 5E 00 00 01 01 08 0A 36 2C E5 AC C5 AB 1F DC 47 45 54 20 2F 70 6C 61   PjX\...(.....k^.....6,......GET /pla
074:  69 6E 20 48 54 54 50 2F 31 2E 31 0D 0A 55 73 65 72 2D 41 67 65 6E 74 3A 20 63 75 72 6C 2F 37 2E 33 38 2E 30 0D   in HTTP/1.1..User-Agent: curl/7.38.0.
111:  0A 48 6F 73 74 3A 20 69 70 65 63 68 6F 2E 6E 65 74 0D 0A 41 63 63 65 70 74 3A 20 2A 2F 2A 0D 0A 0D 0A         .Host: ipecho.net..Accept: */*....
```

Fileformat: 2.4 Snaplength: 65535 bytes Linktype: ETHERNET (DLT_EN10MB) Filesize: 15033 bytes Packets: 101 of 101 (1 selected)

0x03 – Tools For Analysis (Dynamic)

WIRESHARK

File Edit View Go Capture Analyze Statistics Telephony Tools Internals Help

Filter: Expression... Clear Apply Save

No.	Time	Source	Destination	Protocol	Length	Info
29	4.607613	146.255.36.1	172.16.1.243	TCP	66	[TCP Dup ACK 28#1] 80→56980 [ACK] Seq=1 Ack=80 Win=14848 Len=0 TSval=3316322701 TSecr=908908157
30	4.607614	146.255.36.1	172.16.1.243	HTTP	321	HTTP/1.1 200 OK (text/html)
31	4.607664	172.16.1.243	146.255.36.1	TCP	66	56980→80 [ACK] Seq=80 Ack=256 Win=131072 Len=0 TSval=908908464 TSecr=3316322706
32	4.607989	172.16.1.243	146.255.36.1	TCP	66	56980→80 [FIN, ACK] Seq=80 Ack=256 Win=131072 Len=0 TSval=908908464 TSecr=3316322706
33	4.775345	172.16.1.243	8.8.8.8	DNS	77	Standard query 0xb16c A images.shazam.com
34	4.826088	146.255.36.1	172.16.1.243	TCP	66	80→56980 [FIN, ACK] Seq=256 Ack=81 Win=14848 Len=0 TSval=3316323012 TSecr=908908464
35	4.826150	172.16.1.243	146.255.36.1	TCP	66	56980→80 [ACK] Seq=81 Ack=257 Win=131072 Len=0 TSval=908908682 TSecr=3316323012
36	4.935370	8.8.8.8	172.16.1.243	DNS	179	Standard query response 0xb16c CNAME images-fastly.shazam.com.a.prod.fastly.net CNAME prod.fastly.net A 23.
37	7.960776	172.16.1.243	146.255.36.1	TCP	78	56981→80 [SYN] Seq=0 Win=65535 Len=0 MSS=1460 WS=32 TSval=908911814 TSecr=0 SACK_PERM=1
38	8.190599	172.16.1.243	255.255.255.255	DB-LSP-	167	Dropbox LAN sync Discovery Protocol
39	8.190769	172.16.1.243	172.16.1.255	DB-LSP-	167	Dropbox LAN sync Discovery Protocol
40	8.192112	146.255.36.1	172.16.1.243	TCP	74	80→56981 [SYN, ACK] Seq=0 Ack=1 Win=14480 Len=0 MSS=1380 SACK_PERM=1 TSval=3316326364 TSecr=908911814 WS=512
41	8.192154	172.16.1.243	146.255.36.1	TCP	66	56981→80 [ACK] Seq=1 Ack=1 Win=131328 Len=0 TSval=908912044 TSecr=3316326364
42	8.192326	172.16.1.243	146.255.36.1	HTTP	145	GET /plain HTTP/1.1
43	8.598231	172.16.1.243	213.199.179.168	UDP	77	Source port: 57757 Destination port: 40008
44	8.598336	172.16.1.243	64.4.23.166	UDP	78	Source port: 57757 Destination port: 40029
45	8.598336	172.16.1.243	111.221.77.153	UDP	77	Source port: 57757 Destination port: 40024
46	8.598336	172.16.1.243	111.221.77.154	UDP	84	Source port: 57757 Destination port: 40024
47	8.598337	172.16.1.243	111.221.77.168	UDP	73	Source port: 57757 Destination port: 40021
48	8.598941	146.255.36.1	172.16.1.243	TCP	66	80→56981 [ACK] Seq=1 Ack=80 Win=14848 Len=0 TSval=3316326598 TSecr=908912044
49	8.599482	146.255.36.1	172.16.1.243	TCP	66	[TCP Dup ACK 48#1] 80→56981 [ACK] Seq=1 Ack=80 Win=14848 Len=0 TSval=3316326598 TSecr=908912044

```
    [Coloring Rule Name: HTTP]
    [Coloring Rule String: http || tcp.port == 80 || http2]
⊟ Ethernet II, Src: Apple_9f:01:38 (60:03:08:9f:01:38), Dst: Apple_cd:ed:d6 (b8:c7:5d:cd:ed:d6)
  ⊞ Destination: Apple_cd:ed:d6 (b8:c7:5d:cd:ed:d6)
  ⊞ Source: Apple_9f:01:38 (60:03:08:9f:01:38)
    Type: IP (0x0800)
⊞ Internet Protocol Version 4, Src: 172.16.1.243 (172.16.1.243), Dst: 146.255.36.1 (146.255.36.1)
⊞ Transmission Control Protocol, Src Port: 56981 (56981), Dst Port: 80 (80), Seq: 1, Ack: 1, Len: 79
⊟ Hypertext Transfer Protocol
  ⊞ GET /plain HTTP/1.1\r\n
    User-Agent: curl/7.38.0\r\n
    Host: ipecho.net\r\n
    Accept: */*\r\n
    \r\n
    [Full request URI: http://ipecho.net/plain]
    [HTTP request 1/1]
    [Response in frame: 50]
```

```
0000  b8 c7 5d cd ed d6 60 03  08 9f 01 38 08 00 45 00   ..]...`. ...8..E.
0010  00 83 d7 11 40 00 40 06  fe 5f ac 10 01 f3 92 ff   ....@.@. ._......
0020  24 01 de 95 00 50 6a 58  5c f6 c5 80 28 c1 80 18   $....PjX \...(...
0030  10 08 6b 5e 00 00 01 01  08 0a 36 2c e5 ac c5 ab   ..k^.... ..6,....
0040  1f dc 47 45 54 20 2f 70  6c 61 69 6e 20 48 54 54   ..GET /p lain HTT
0050  50 2f 31 2e 31 0d 0a 55  73 65 72 2d 41 67 65 6e   P/1.1..U ser-Agen
```

Frame (frame), 145 bytes | Packets: 101 · Displayed: 101 (100,0%) · Load time: 0:00.000 | Profile: Default

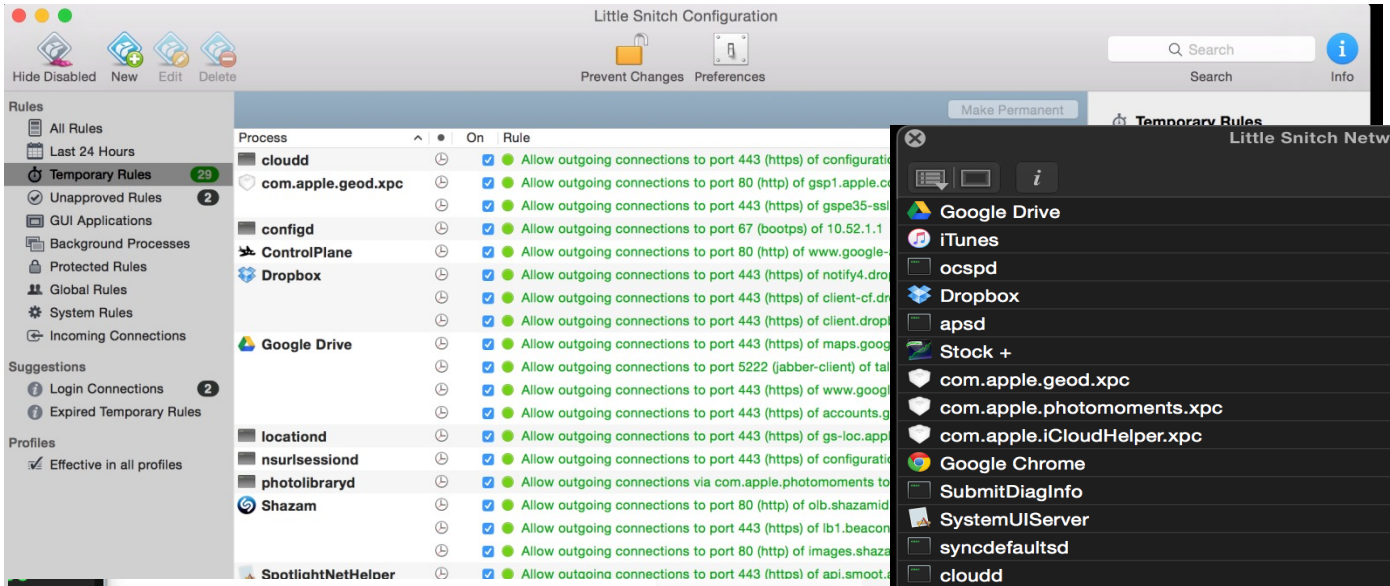
0x03 – Tools For Analysis (Dynamic)

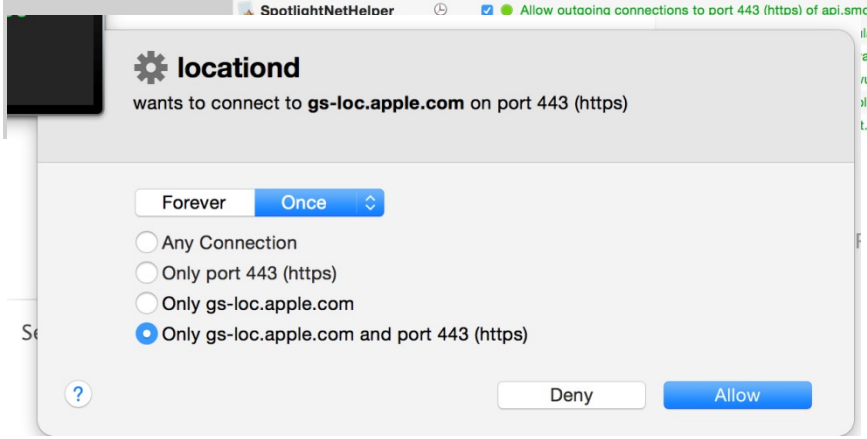
LSOCK

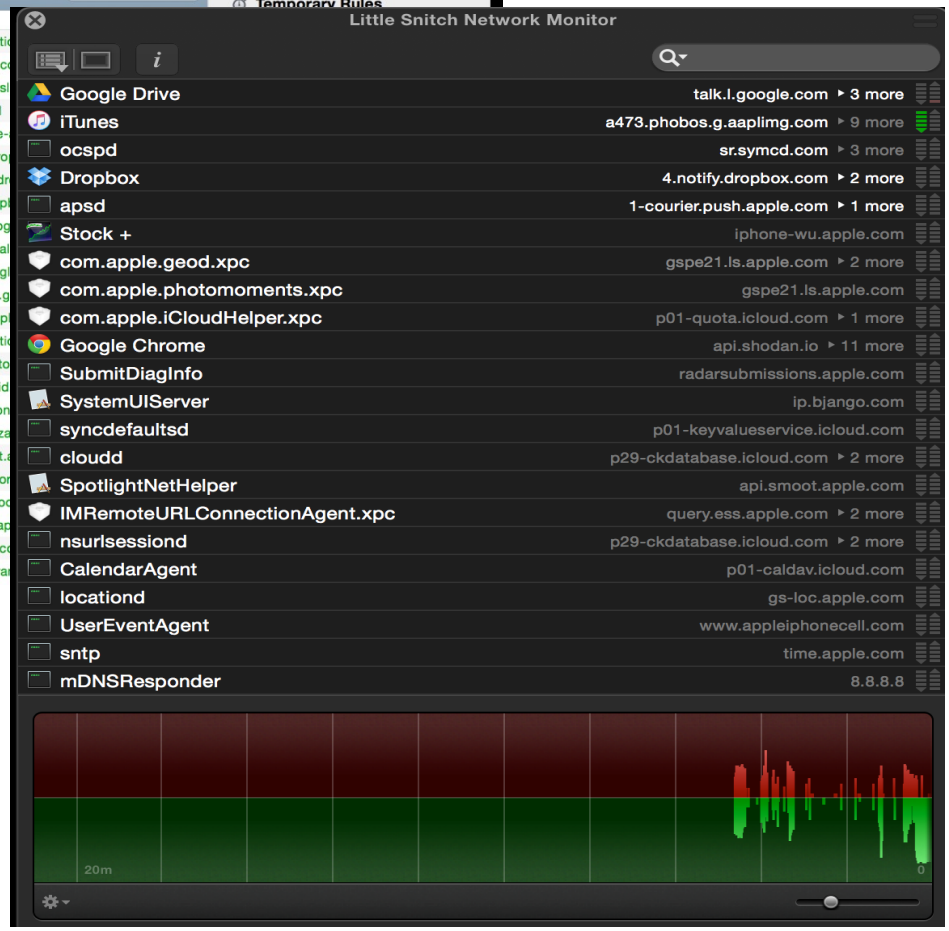
Time	Local Addr	Remote Addr	If	State	P
11:18:52	0.0.0.0:23945	*.*	0	N/A	1
11:18:52	fe80::20c:29ff:fe5b:4cbe:123	*.*	4	N/A	
11:18:52	fe80::1:123	*.*	1	N/A	7
11:18:52	127.0.0.1:123	*.*	1	N/A	7
11:18:52	::1:123	*.*	1	N/A	7
11:18:52	:::123	*.*	0	N/A	7
11:18:52	0.0.0.0:123	*.*	0	N/A	7
11:18:52	0.0.0.0:0	*.*	0	N/A	5
11:18:52	0.0.0.0:0	*.*	0	N/A	1
11:18:52	:::5353	*.*	1	N/A	4
11:18:52	0.0.0.0:5353	*.*	1	N/A	4
11:18:52	:::0	*.*	0	N/A	4
11:18:52	0.0.0.0:0	*.*	0	N/A	4
11:18:52	:::0	*.*	0	N/A	2
11:18:52	0.0.0.0:137	*.*	0	N/A	1
11:18:52	0.0.0.0:138	*.*	0	N/A	1
11:18:52	::1:7026	::1:49328	1	ESTABLISHED	9
11:18:52	::1:49328	::1:7026	1	ESTABLISHED	9
11:18:52	::1:7026	::1:49327	1	ESTABLISHED	9
11:18:52	::1:49327	::1:7026	1	ESTABLISHED	9
11:20:15	0.0.0.0:0	*.*	0	N/A	4
11:20:15	:::5353	*.*	0	N/A	4
11:20:16	172.16.249.144:49330	201.6.16.157:443	4	SYN_SENT	9
11:20:16	0.0.0.0:0	*.*	0	CLOSED	9
11:20:16	0.0.0.0:0	*.*	0	CLOSED	9
11:20:16	172.16.249.144:49333	201.6.16.177:80	4	CLOSED	9
11:20:16	0.0.0.0:49334	*.*	0	CLOSED	9
11:20:16	0.0.0.0:49335	*.*	0	CLOSED	9
11:20:17	172.16.249.144:123	*.*	4	N/A	7
11:20:20	172.16.249.144:49337	64.233.186.95:443	4	CLOSED	9
11:20:20	0.0.0.0:0	*.*	0	CLOSED	9
11:20:20	0.0.0.0:0	*.*	0	CLOSED	9
11:20:21	172.16.249.144:49340	173.194.118.62:443	4	SYN_SENT	9

0x03 – Tools For Analysis (Dynamic)

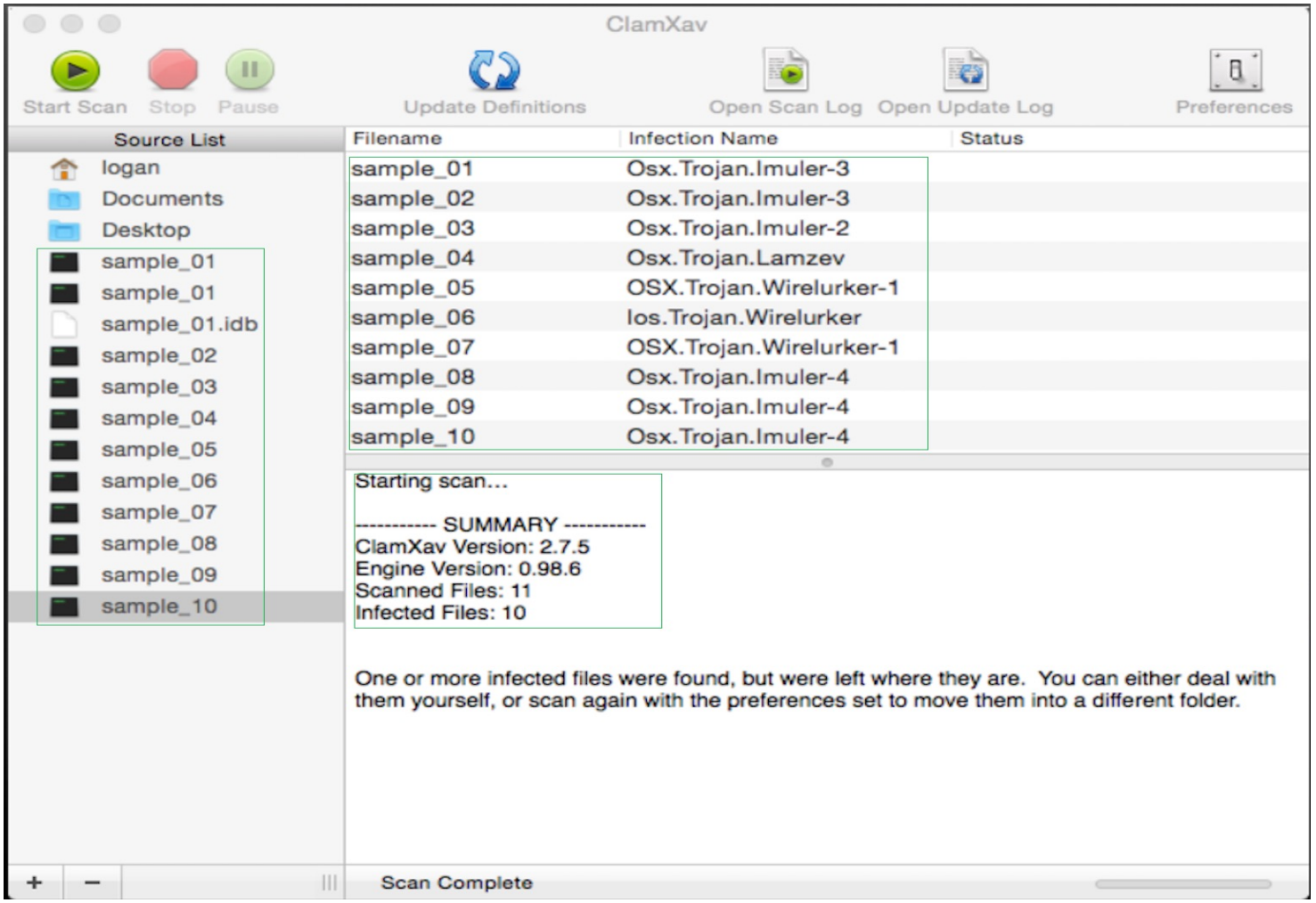
Little Snitch







0x04 – Current Threats



0x04 – Current Threats

virustotal

SHA256: 27989189a16e2eeca12588c78df8932d5e22416d9b0acb89b58e5ab070c30ffc

Nome do arquivo: 95268cc9dff1812c27f80f7b044a08695c976cb3_uploadermodule

Taxa de detecção: 32 / 56

Data da análise: 2015-04-20 02:54:09 UTC (1 dia, 11 horas atrás)

Antivírus	Resultado	Atualização
AVG	BackDoor.Generic_c.FCZ	20150420
Ad-Aware	MAC.OSX.Backdoor.Imuler.B	20150420
AhnLab-V3	OSX64-Trojan/Imuleruploader	20150419
Avast	MacOS:Imuler-J [Trj]	20150419
Avira	MACOS/Imuler.A	20150419
BitDefender	MAC.OSX.Backdoor.Imuler.B	20150420
CAT-QuickHeal	Backdoor.MacOSX.Imuler.B	20150418
ClamAV	Osx.Trojan.Imuler-3	20150420
Comodo	UnclassifiedMalware	20150419
DrWeb	Trojan.Muxler.2	20150420

Source: www.virustotal.com

0x04 – Current Threats

Mac.BackDoor.OpinionSpy.3

Names:
MacOS_X/OpinionSpy.A (Microsoft),
Mac.BackDoor.OpinionSpy.3 (F-Secure),
Mac.BackDoor.OpinionSpy.3 (Trend)

.OSA --> ZIP:

- PremierOpinion
- upgrade.xml

Source:
http://vms.drweb.com/virus/?i=4354056&lng=en
http://news.drweb.com/show/?i=9309&lng=en&c=5

0x04 – Current Threats

OSX_KAITEN.A

Names:
MacOS_X/Tsunami.A (Microsoft),
OSX/Tsunami (McAfee),
OSX/Tsunami-Gen (Sophos),
OSX/Tsunami.A (F-Secure),
OSX/Tsunami.A (ESET)

Binary:
/tmp/.z

Source:
http://www.trendmicro.com/vinfo/us/threat-encyclopedia/malware/osx_kaiten.a

0x04 – Current Threats

OSX_CARETO.A

Names:
MacOS:Appetite-A [Trj] (Avast)
OSX/BackDoor.A (AVG)
MAC.OSX.Backdoor.Careto.A (Bitdefender)
OSX/Appetite.A (Eset)
MAC.OSX.Backdoor.Careto.A (FSecure)
Trojan.OSX.Melgato.a (Kaspersky)
OSX/Backdoor-BRE (McAfee)
Backdoor:MacOS_X/Appetite.A (Microsoft)
OSX/Appetite-A (Sophos)

Source:
http://www.trendmicro.com/vinfo/us/threat-encyclopedia/malware/osx_careto.a

0x05 – Conclusions

Hacking is a way of life

Bonus Track: https://github.com/trendmicro/Aleph

Reference:

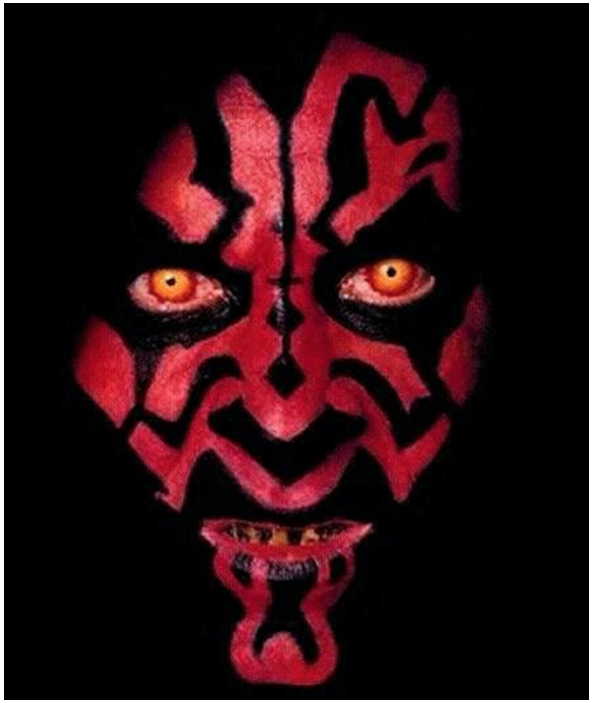
Sarah Edwards
REVERSE Engineering Mac Malware - Defcon 22
https://www.defcon.org/images/defcon-22/dc-22-presentations/Edwards/DEFCON-22-Sarah-Edwards-Reverse-Engineering-Mac-Malware.pdf

https://developer.apple.com/library/mac/documentation/DeveloperTools/Conceptual/MachORuntime/index.html

http://www.agner.org/optimize/calling_conventions.pdf

Thanks a Lot

Any Questions ?



http://www.slideshare.net/l0ganbr

Contact

ricardologanbr@gmail.com

@l0ganbr