Malware Analysis Workshop

Cyber Security Seminar & Workshop

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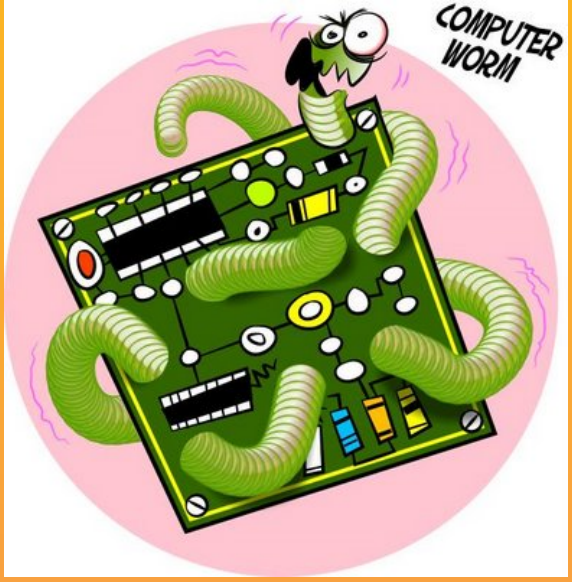
Indonesia Honeynet Project

CBN

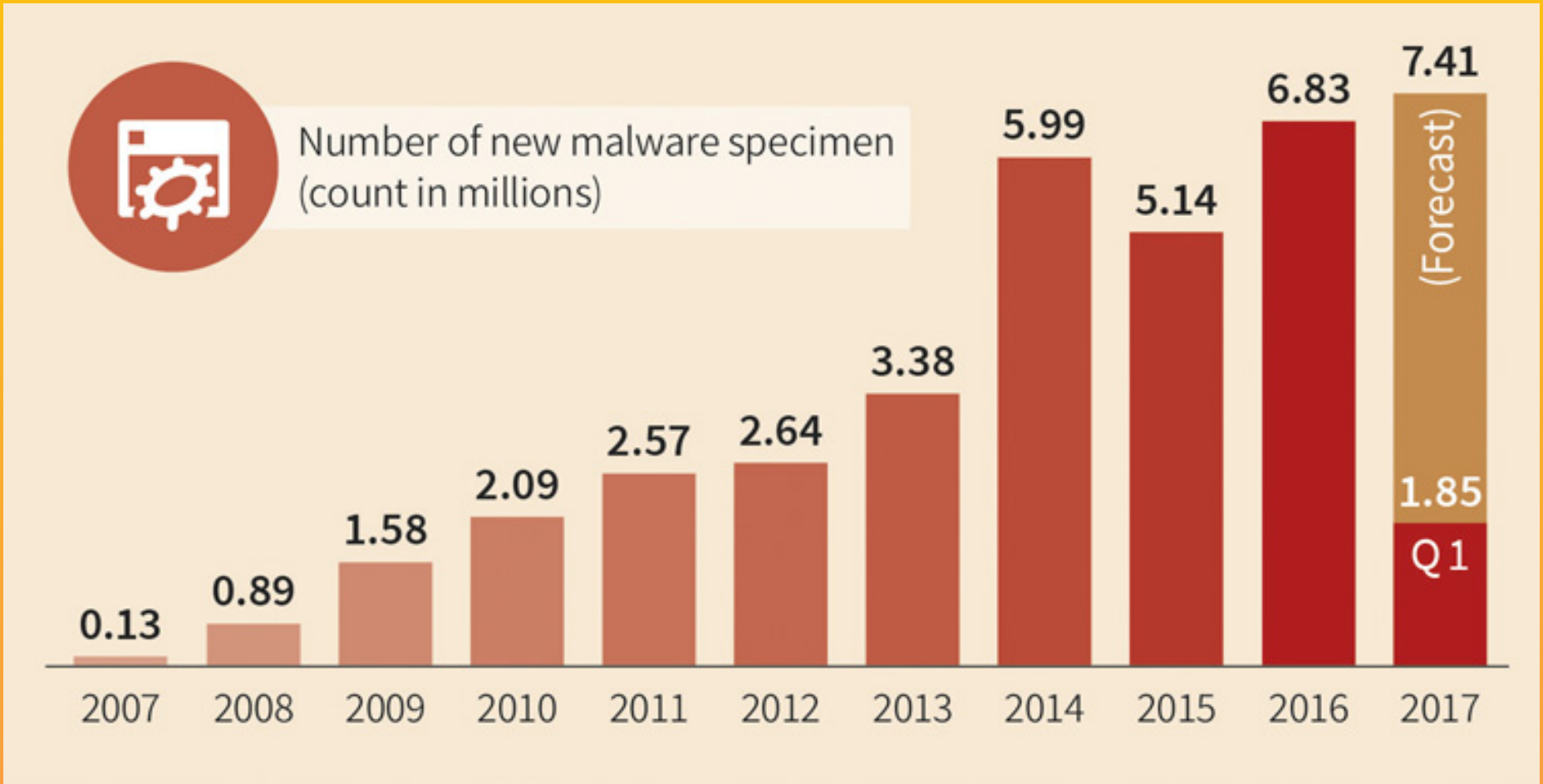
SGU SWISS GERMAN UNIVERSITY

What is Malware

- Malware (Malicious Software)
  - All kind of software that disrupt computer operations, gather sensitive information or gain access to private computer systems

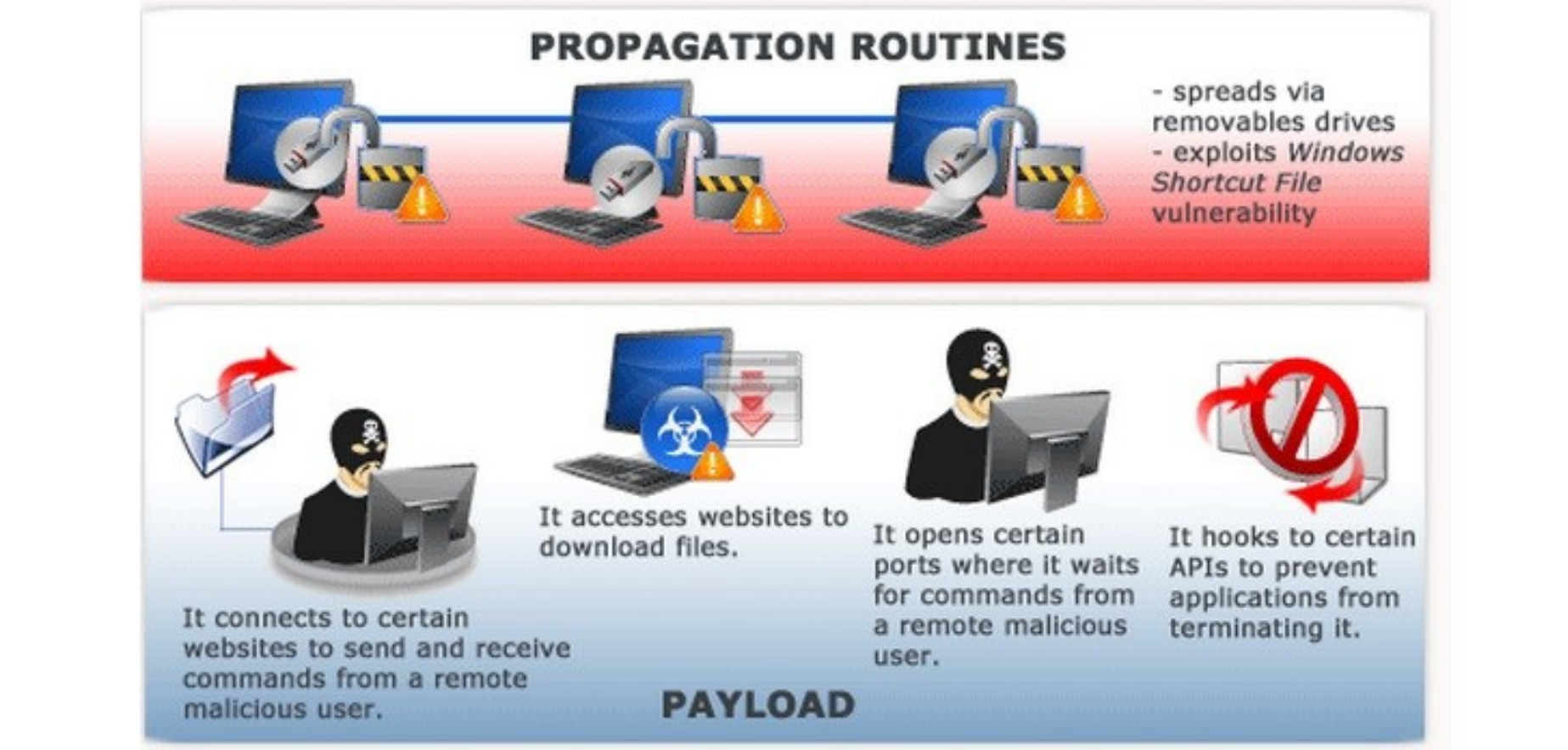


Statistics say it all

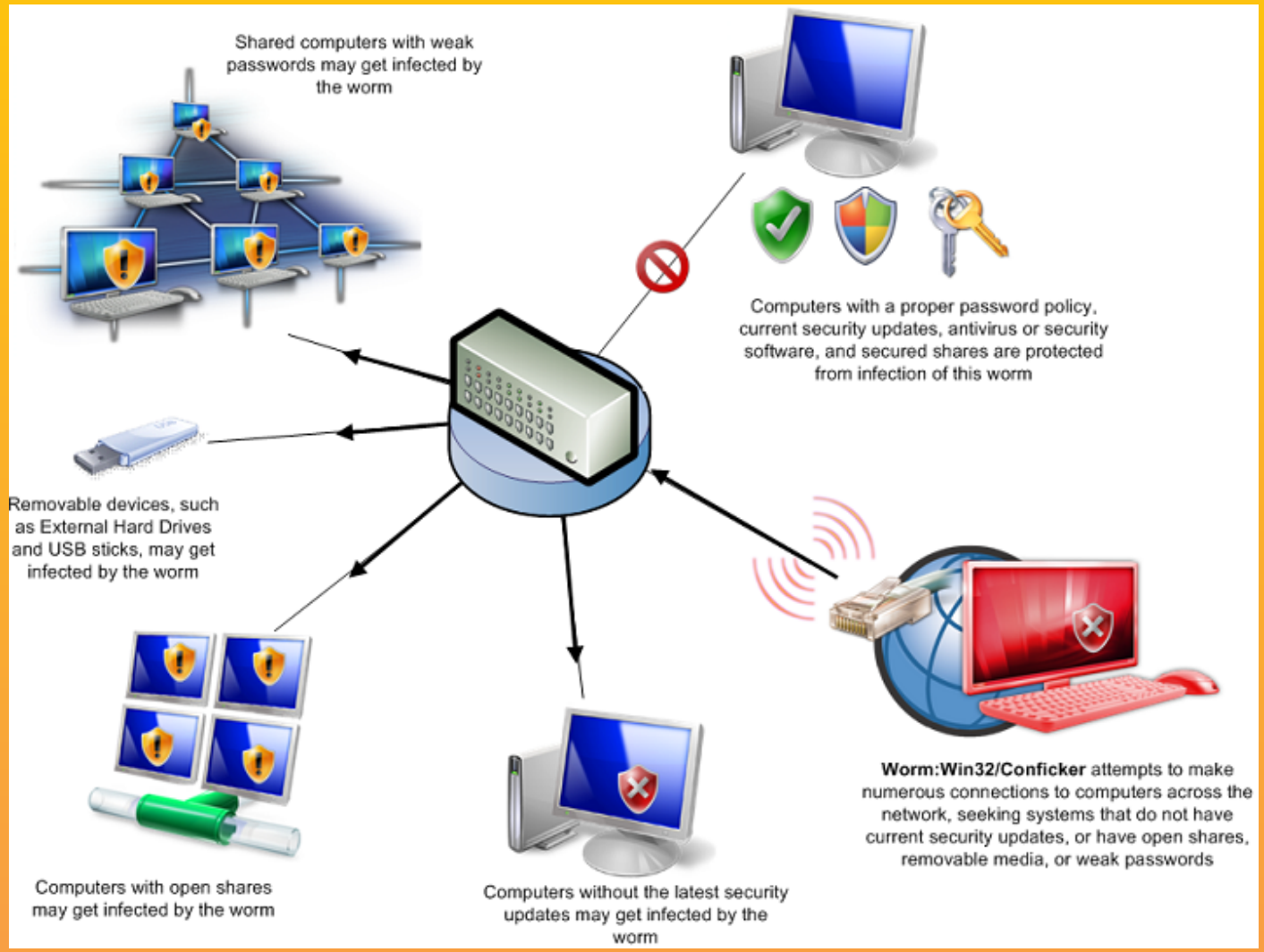


5 Stages Malware attack

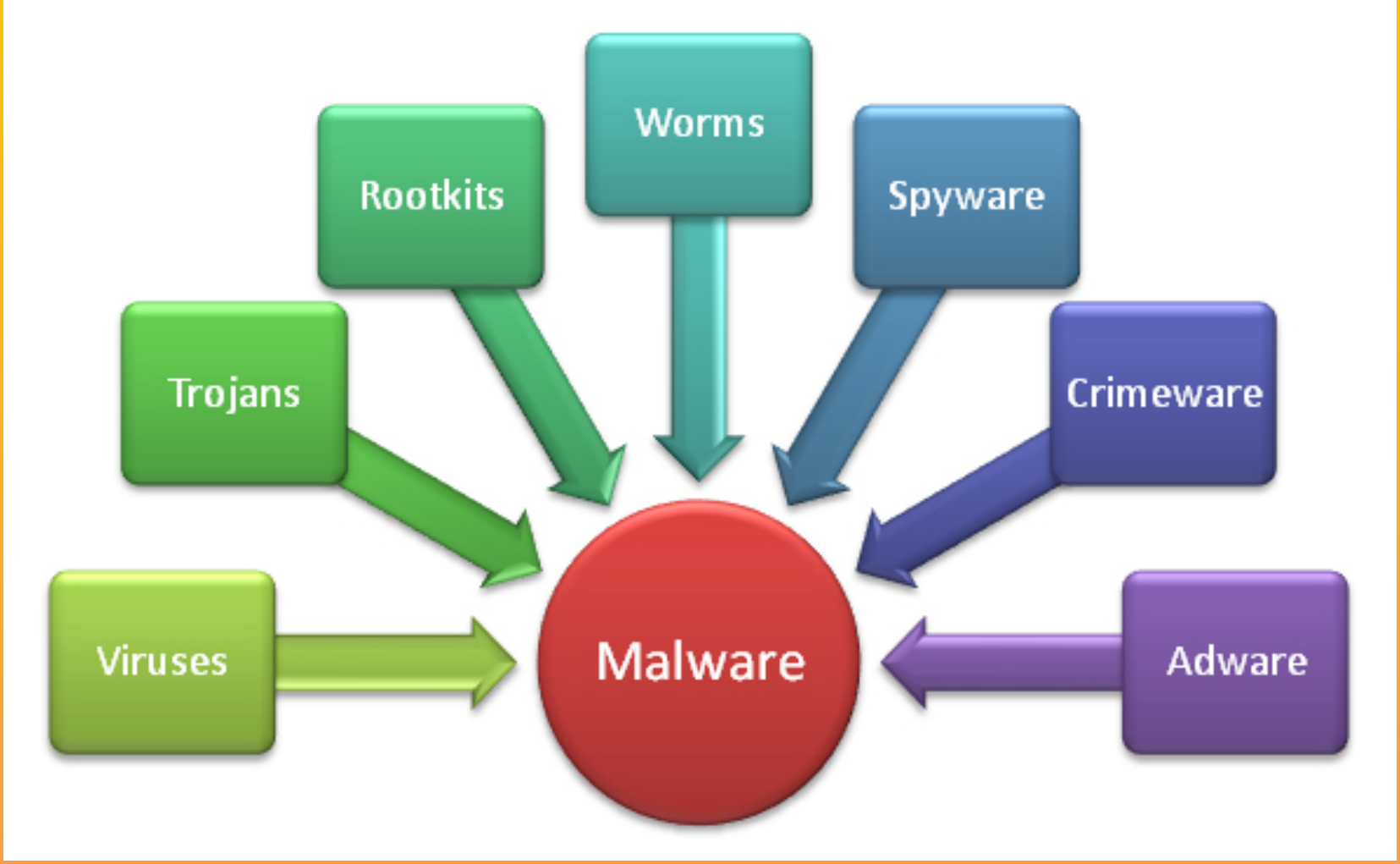
Malware Propagation



Malware Propagation



Malware Types



Malware Defense Mechanism

- Anti Detection
  - Polymorphism
  - Metamorphism
  - Hide inside kernel or other process
  - "Kill Switch"
    - Detect internet access
    - Time based malware
    - Detect Environment

Malware Defense Mechanism

- Anti Analysis
  - Encryption
  - Anti-Debugging
  - Anti-VM

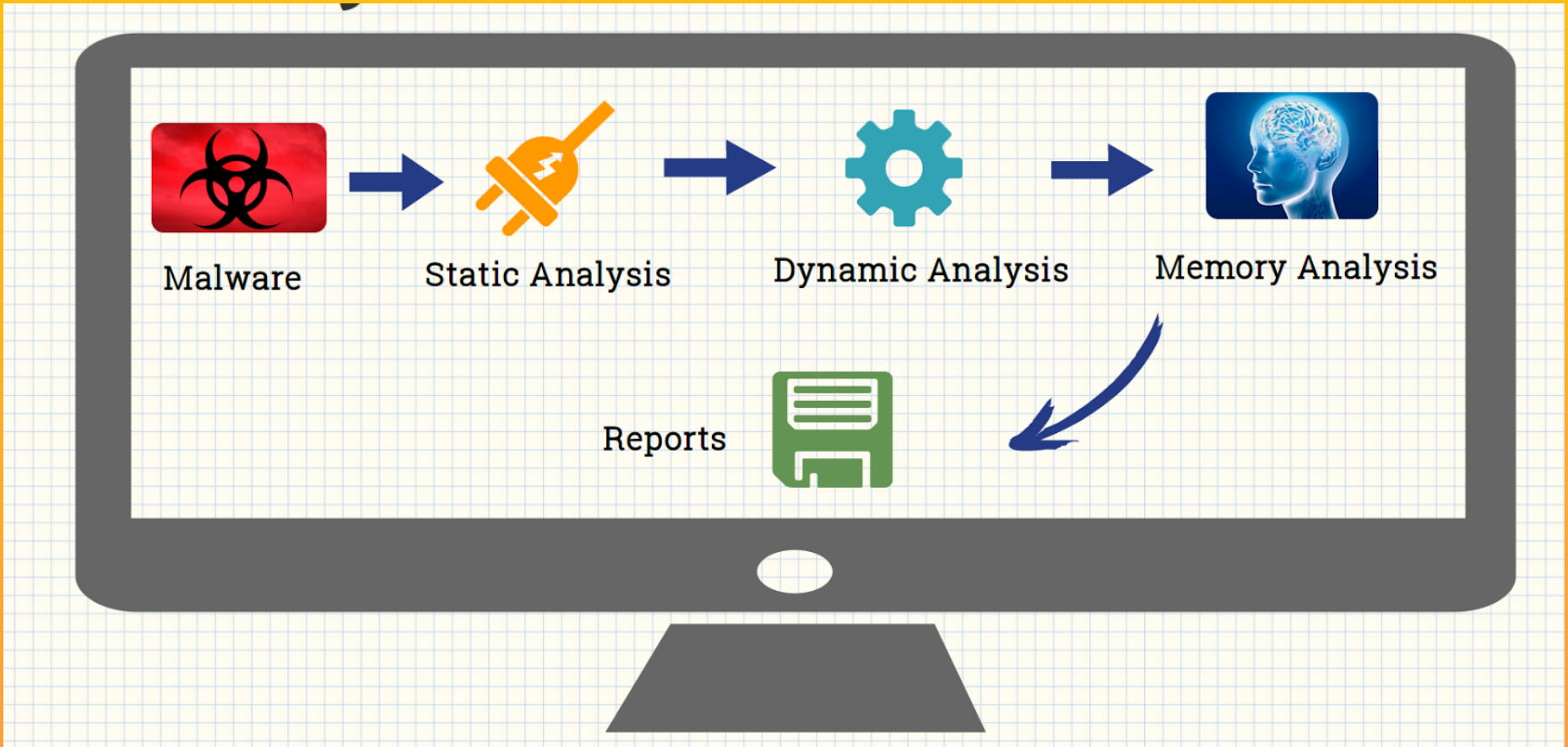
Purpose of Malware Analysis

- Identify a Malware
- Malware Capabilities / Behavior
- Malware Propagation Technique
- Malware Signatures / How to Detect
- How to Resolve from Infection

Type Malware Analysis

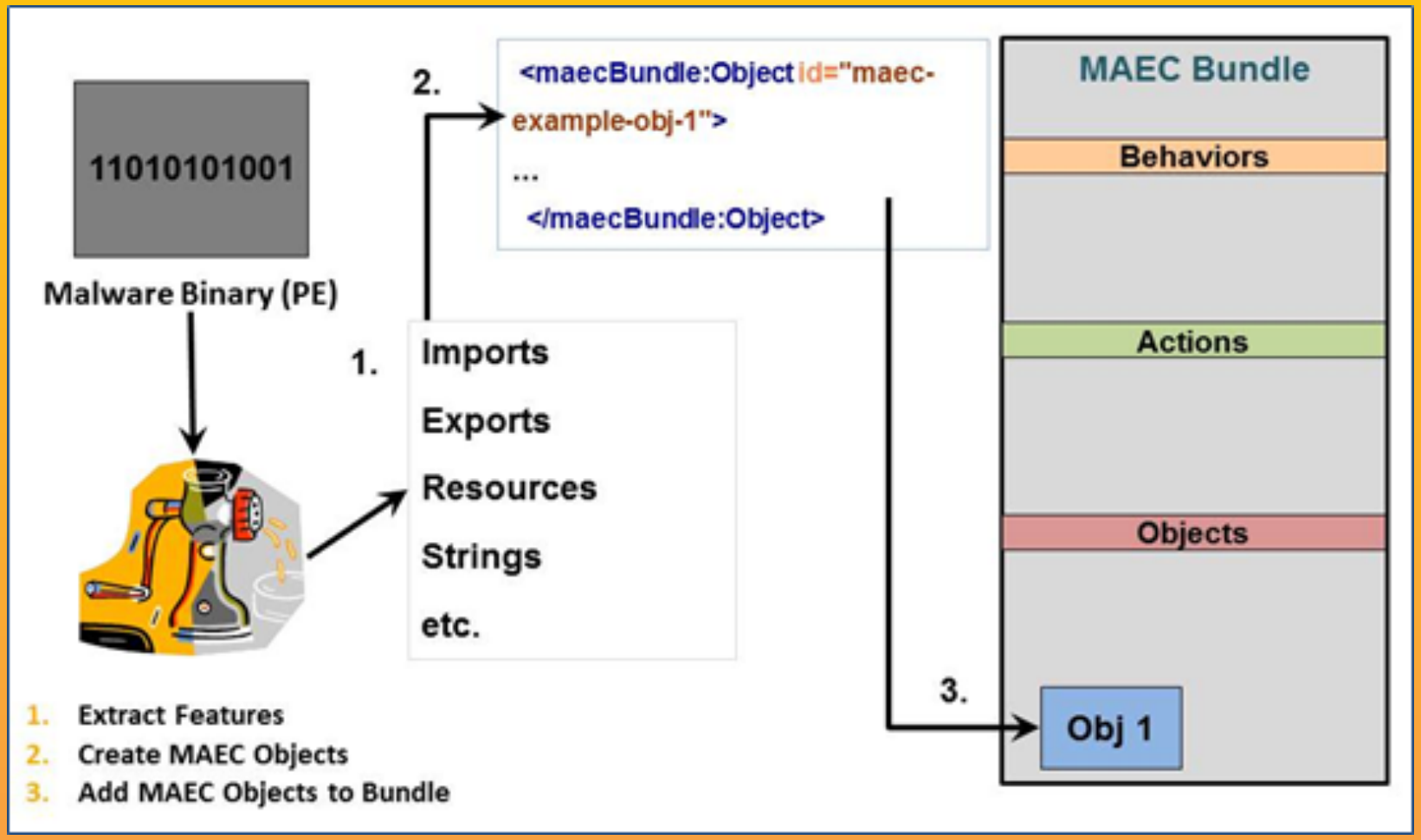
Static Analysis	A method of examining computer program/code **without executing** the program
Dynamic Analysis	A method of examining computer program/code **while executing** the program in a real or virtual processor
Memory Analysis	A method of examining computer program/code **after executing** the program in a real or virtual processor

Malware Analysis Process

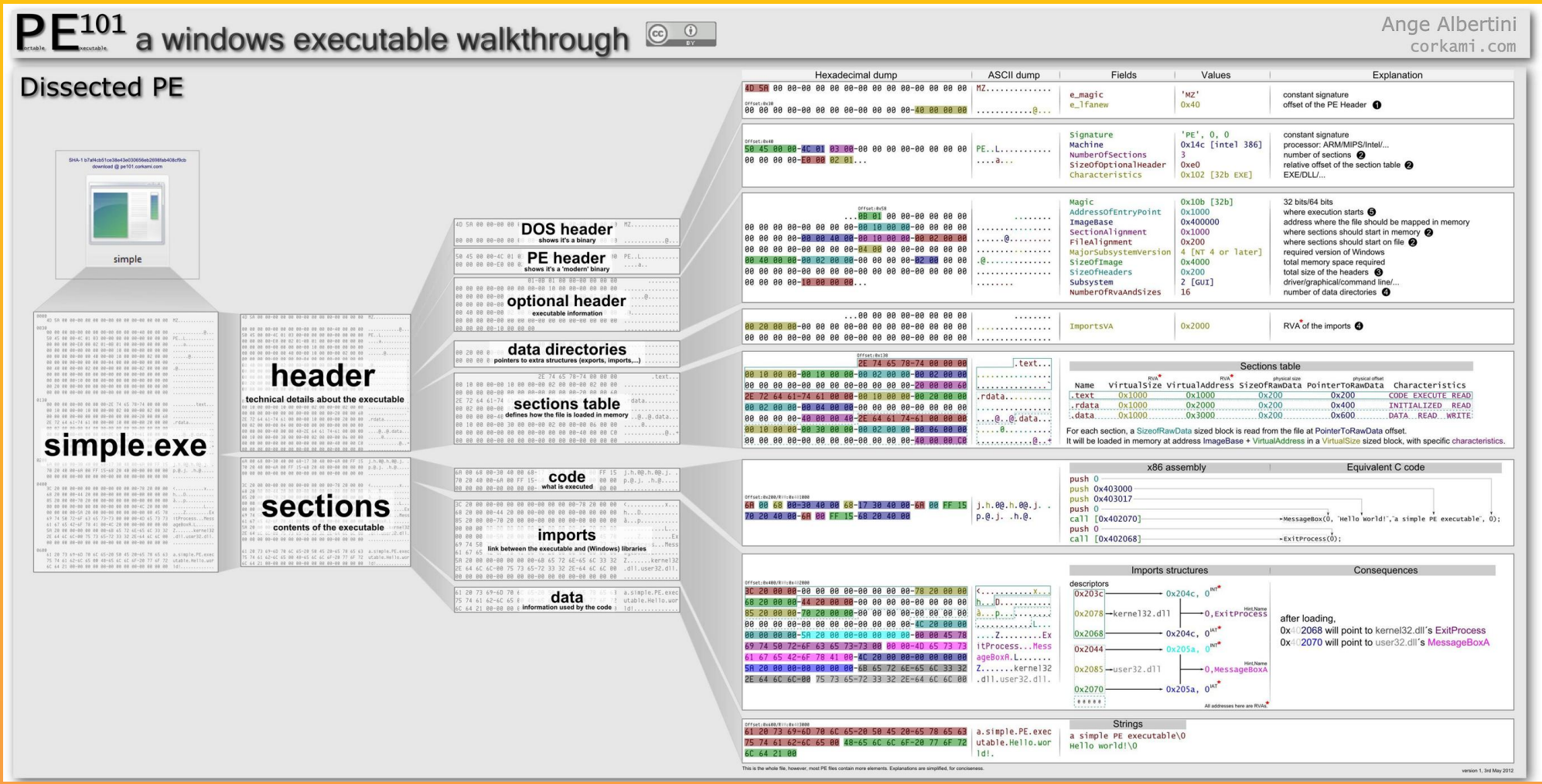


Static Analysis

Malware Static Analysis



Inside of a File



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Inside of a File – Hex Version

```
          0  1  2  3  4  5  6  7  8  9  a  b  c  d  e  f
00000000h: 4D 5A 50 00 02 00 00 00 04 00 0F 00 FF FF 00 00 ; MZP.........ÿÿ..
00000010h: B8 00 00 00 00 00 00 00 40 00 1A 00 00 00 00 00 ; ¸.......@.......
00000020h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
00000030h: 00 00 00 00 00 00 00 00 00 00 00 00 00 01 00 00 ; ................
00000040h: BA 10 00 0E 1F B4 09 CD 21 B8 01 4C CD 21 90 90 ; º....´.Í!¸.LÍ!□□
00000050h: 54 68 69 73 20 70 72 6F 67 72 61 6D 20 6D 75 73 ; This program mus
00000060h: 74 20 62 65 20 72 75 6E 20 75 6E 64 65 72 20 57 ; t be run under W
00000070h: 69 6E 33 32 0D 0A 24 37 00 00 00 00 00 00 00 00 ; in32..$7........
00000080h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
00000090h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
000000a0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
000000b0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
000000c0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
000000d0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
000000e0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
000000f0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
00000100h: 50 45 00 00 4C 01 08 00 19 5E 42 2A 00 00 00 00 ; PE..L....^B*....
00000110h: 00 00 00 00 E0 00 8E 81 0B 01 02 19 00 A0 02 00 ; ....à.Ž□..... ..
00000120h: 00 DE 00 00 00 00 00 00 B4 AD 02 00 00 10 00 00 ; .Þ......´-......
00000130h: 00 B0 02 00 00 00 40 00 00 10 00 00 00 02 00 00 ; .°....@.........
00000140h: 01 00 00 00 00 00 00 00 04 00 00 00 00 00 00 00 ; ................
00000150h: 00 D0 03 00 00 04 00 00 00 00 00 00 02 00 00 00 ; .Ð...............
00000160h: 00 00 10 00 00 40 00 00 00 00 10 00 00 10 00 00 ; .....@..........
00000170h: 00 00 00 00 10 00 00 00 00 00 00 00 00 00 00 00 ; ................
00000180h: 00 D0 02 00 1E 18 00 00 00 40 03 00 00 8E 00 00 ; .Ð.......@...Ž..
00000190h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
000001a0h: 00 10 03 00 04 2B 00 00 00 00 00 00 00 00 00 00 ; .....+..........
000001b0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
000001c0h: 00 00 03 00 18 00 00 00 00 00 00 00 00 00 00 00 ; ................
000001d0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
000001e0h: 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 ; ................
000001f0h: 00 00 00 00 00 00 00 00 43 4F 44 45 00 00 00 00 ; ........CODE....
00000200h: 88 9E 02 00 00 10 00 00 00 A0 02 00 00 04 00 00 ; ^ž....... ......
00000210h: 00 00 00 00 00 00 00 00 00 00 00 00 20 00 00 60 ; ............ ..`
00000220h: 44 41 54 41 00 00 00 00 D4 06 00 00 00 B0 02 00 ; DATA....Ô....°..
```

DOS HEADER

DOS STUB

PE HEADER

Signature

FileHeader

OptionalHeader

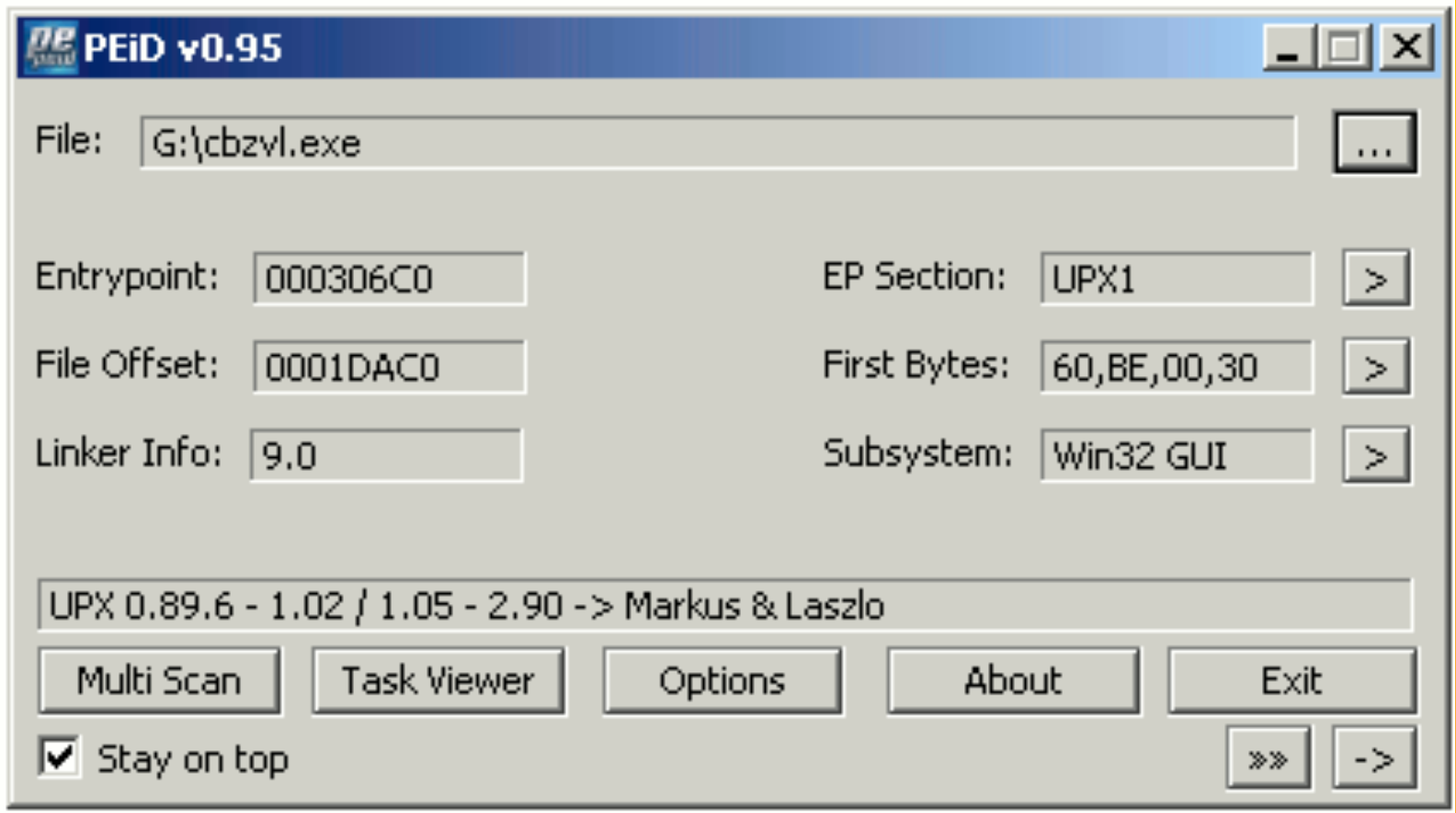
DATA DIRECTORY

SECTION TABLE

Check file type

- Open File with Hexa Editor
- Search 2 first character with the website
  - http://garykessler.net/library/file_sigs.html
- File [filename] ➔ Check for file type
- Cek Bunch of Files below :
  - http://45.126.133.156/yohanes/files/tebak1
  - http://45.126.133.156/yohanes/files/tebak2
  - http://45.126.133.156/yohanes/files/tebak3
  - http://45.126.133.156/yohanes/files/tebak4

PEID



PEID Used to check initial information of a file

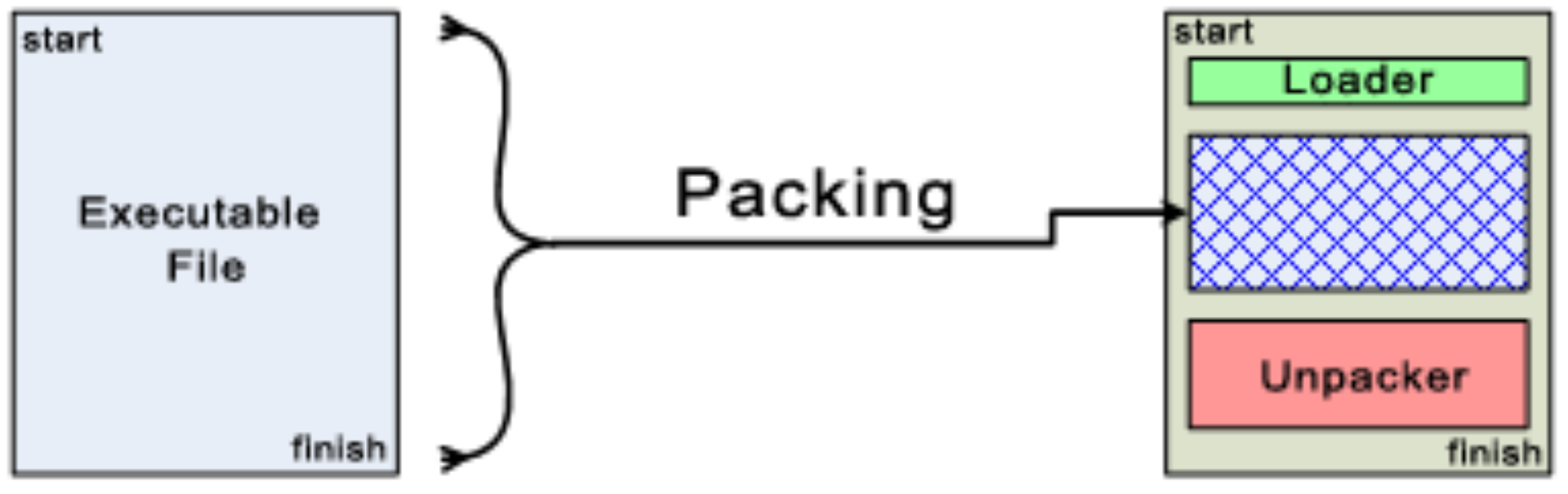
PESCANNER

```
remnux@remnux: ~/analysis
File  Edit  Tabs  Help

Sections
==========================================================================================
Name        VirtAddr      VirtSize      RawSize     MD5                                Entropy
------------------------------------------------------------------------------------------
.text       0x1000        0x16414       0x17000     2a7865468f9de73a531f0ce00750ed17 5.427415
.rdata      0x18000       0x945         0x1000      c663fda3d7b936dfc47c996cdb0fbe57 3.023484
.data       0x19000       0xc92         0x1000      5bd6727d52ce29a93bdec4b619bc282c 4.931830
.rsrc       0x1a000       0x375a0       0x38000     746376cceec9bf357c62cea98995c126 7.983700    [SUSPICIOUS]

Resource entries
==========================================================================================
Resource type       Total
-------------------------
RT_FONT             : 2

Imports
==========================================================================================
[1] kernel32.dll
[2] ctl3d32.dll
[3] crypt32.dll
[4] user32.dll
[5] dbnmpntw.dll

Suspicious IAT alerts
==========================================================================================
[1] CopyFileA
[2] CreateDirectoryW
[3] FindNextFileW
[4] GetDriveTypeW
[5] GetProcAddress
[6] GetStartupInfoA
[7] GetTickCount
[8] LoadLibraryA

remnux@remnux:~/analysis$
```

Check Static Features

- Check Strings inside a file :
- Strings [filename]
- Pescanner [filename]
  - http://45.126.133.156/yohanes/files/file1.exe
  - http://45.126.133.156/yohanes/files/file2.exe
  - http://45.126.133.156/yohanes/files/file3.exe
  - http://45.126.133.156/yohanes/files/file4.exe
  - http://45.126.133.156/yohanes/files/file5.exe
  - http://45.126.133.156/yohanes/files/file6.exe

Packed Executables



Static Analysis of malware

- Hexdump malware
- Pescanner [malware]
- Strings [malware]
- Clamscan [malware]
- Analyze this 2 malwares:
  - http://45.126.133.156/yohanes/files/malware1.bin
  - http://45.126.133.156/yohanes/files/malware2.bin

Find the Flags (CTF)

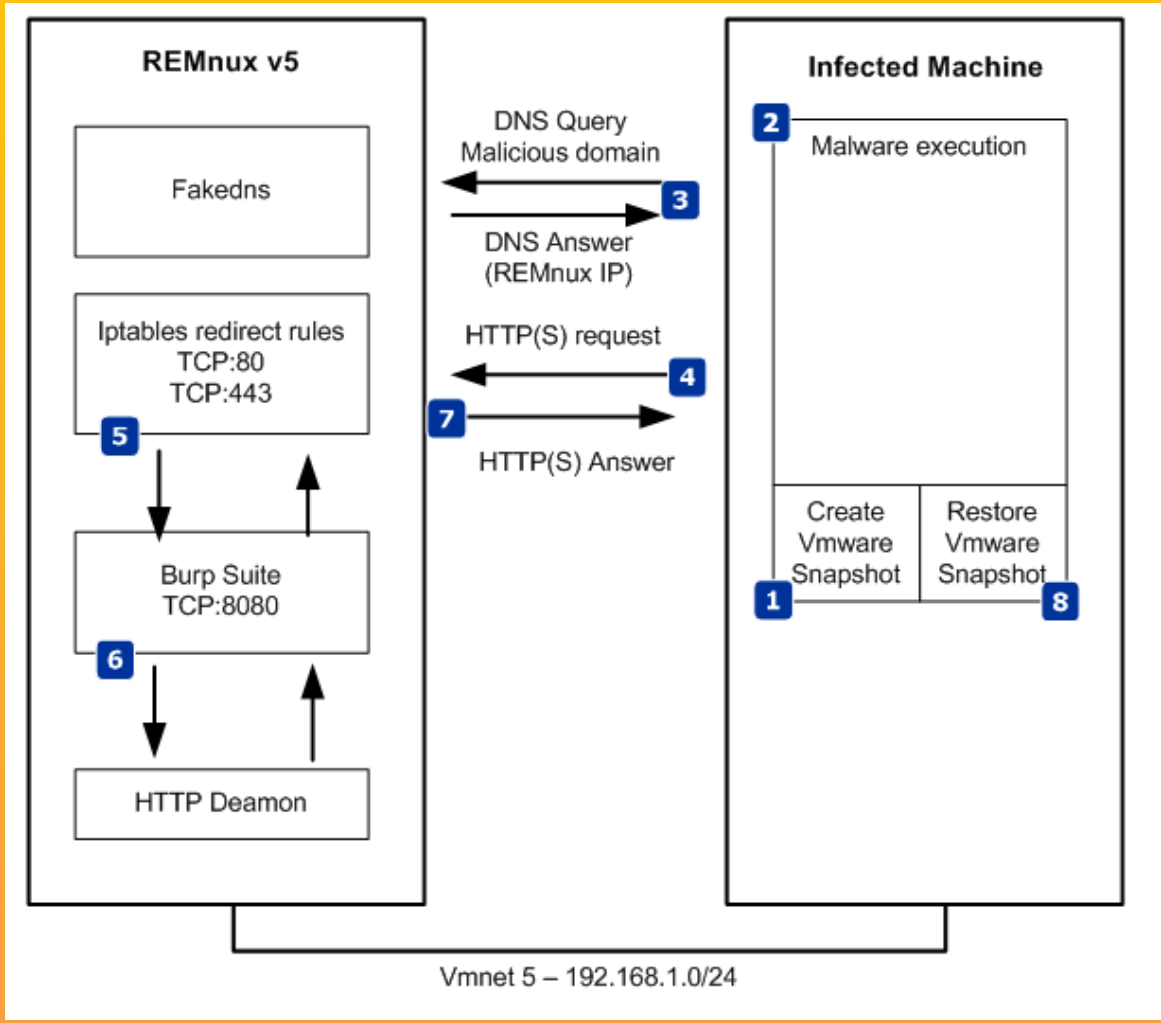
- http://45.126.133.156/yohanes/files/1
- http://45.126.133.156/yohanes/files/2
- http://45.126.133.156/yohanes/files/5
- http://45.126.133.156/yohanes/files/6

Dynamic Analysis

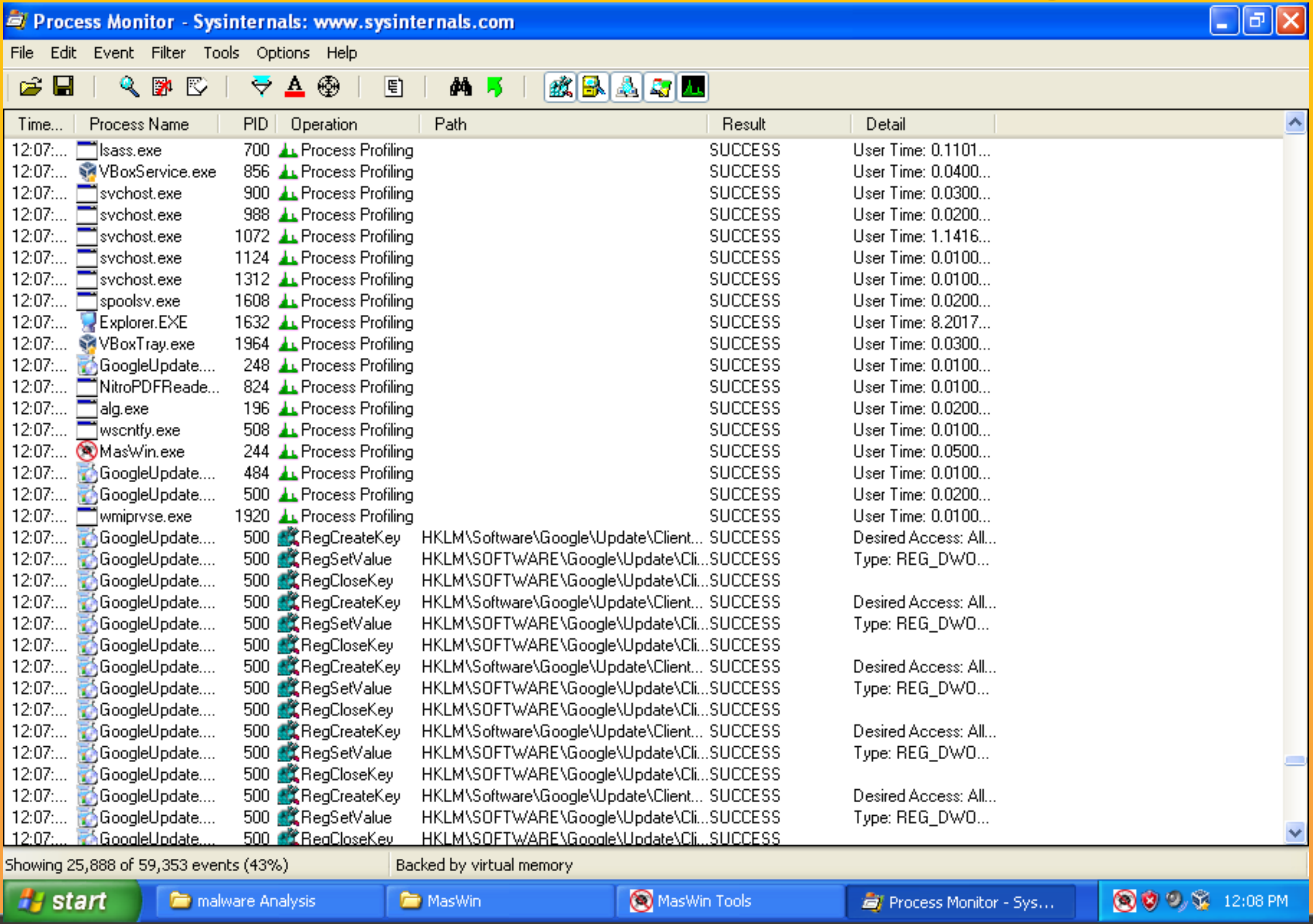
Malware Dynamic Analysis

- Running Malware deliberately, while monitoring the results
- Requires a safe environments
- Must prevent malware from spreading to production machines
- Real machines can be airgapped – no network connection to the internet or to other machine

Topology Dynamic Analysis



Process Monitoring

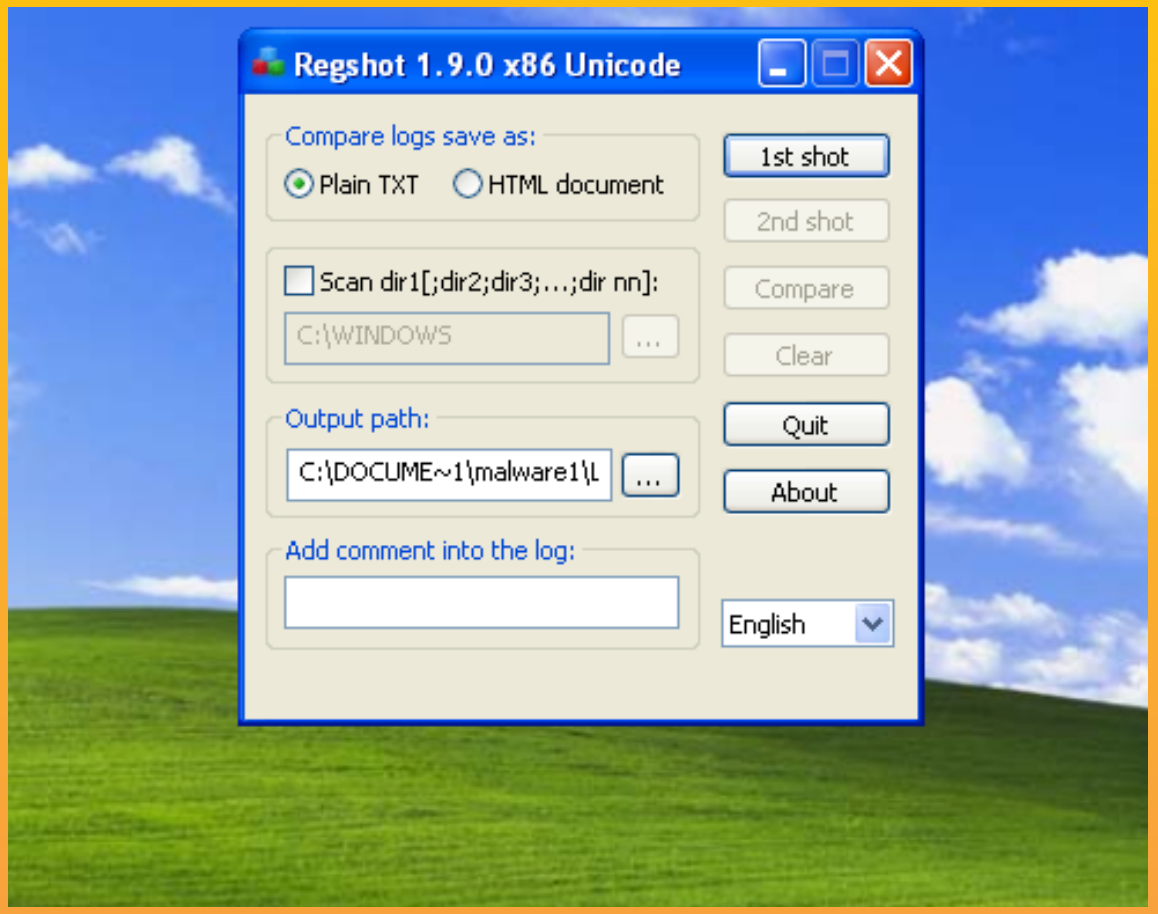


Time...	Process Name	PID	Operation	Path	Result	Detail
12:07:...	lsass.exe	700	Process Profiling		SUCCESS	User Time: 0.1101...
12:07:...	VBoxService.exe	856	Process Profiling		SUCCESS	User Time: 0.0400...
12:07:...	svchost.exe	900	Process Profiling		SUCCESS	User Time: 0.0300...
12:07:...	svchost.exe	988	Process Profiling		SUCCESS	User Time: 0.0200...
12:07:...	svchost.exe	1072	Process Profiling		SUCCESS	User Time: 1.1416...
12:07:...	svchost.exe	1124	Process Profiling		SUCCESS	User Time: 0.0100...
12:07:...	svchost.exe	1312	Process Profiling		SUCCESS	User Time: 0.0100...
12:07:...	spoolsv.exe	1608	Process Profiling		SUCCESS	User Time: 0.0200...
12:07:...	Explorer.EXE	1632	Process Profiling		SUCCESS	User Time: 8.2017...
12:07:...	VBoxTray.exe	1964	Process Profiling		SUCCESS	User Time: 0.0300...
12:07:...	GoogleUpdate....	248	Process Profiling		SUCCESS	User Time: 0.0100...
12:07:...	NitroPDFReade...	824	Process Profiling		SUCCESS	User Time: 0.0100...
12:07:...	alg.exe	196	Process Profiling		SUCCESS	User Time: 0.0200...
12:07:...	wscntfy.exe	508	Process Profiling		SUCCESS	User Time: 0.0100...
12:07:...	MasWin.exe	244	Process Profiling		SUCCESS	User Time: 0.0500...
12:07:...	GoogleUpdate....	484	Process Profiling		SUCCESS	User Time: 0.0100...
12:07:...	GoogleUpdate....	500	Process Profiling		SUCCESS	User Time: 0.0200...
12:07:...	wmiprvse.exe	1920	Process Profiling		SUCCESS	User Time: 0.0100...
12:07:...	GoogleUpdate....	500	RegCreateKey	HKLM\Software\Google\Update\Client...	SUCCESS	Desired Access: All...
12:07:...	GoogleUpdate....	500	RegSetValue	HKLM\SOFTWARE\Google\Update\Cli...	SUCCESS	Type: REG_DWO...
12:07:...	GoogleUpdate....	500	RegCloseKey	HKLM\SOFTWARE\Google\Update\Cli...	SUCCESS	
12:07:...	GoogleUpdate....	500	RegCreateKey	HKLM\Software\Google\Update\Client...	SUCCESS	Desired Access: All...
12:07:...	GoogleUpdate....	500	RegSetValue	HKLM\SOFTWARE\Google\Update\Cli...	SUCCESS	Type: REG_DWO...
12:07:...	GoogleUpdate....	500	RegCloseKey	HKLM\SOFTWARE\Google\Update\Cli...	SUCCESS	
12:07:...	GoogleUpdate....	500	RegCreateKey	HKLM\Software\Google\Update\Client...	SUCCESS	Desired Access: All...
12:07:...	GoogleUpdate....	500	RegSetValue	HKLM\SOFTWARE\Google\Update\Cli...	SUCCESS	Type: REG_DWO...
12:07:...	GoogleUpdate....	500	RegCloseKey	HKLM\SOFTWARE\Google\Update\Cli...	SUCCESS	
12:07:...	GoogleUpdate....	500	RegCreateKey	HKLM\Software\Google\Update\Client...	SUCCESS	Desired Access: All...
12:07:...	GoogleUpdate....	500	RegSetValue	HKLM\SOFTWARE\Google\Update\Cli...	SUCCESS	Type: REG_DWO...
12:07:...	GoogleUpdate....	500	RegCloseKey	HKLM\SOFTWARE\Google\Update\Cli...	SUCCESS	
12:07:...	GoogleUpdate....	500	RegCreateKey	HKLM\Software\Google\Update\Client...	SUCCESS	Desired Access: All...
12:07:...	GoogleUpdate....	500	RegSetValue	HKLM\SOFTWARE\Google\Update\Cli...	SUCCESS	Type: REG_DWO...
12:07:...	GoogleUpdate....	500	RegCloseKey	HKLM\SOFTWARE\Google\Update\Cli...	SUCCESS	

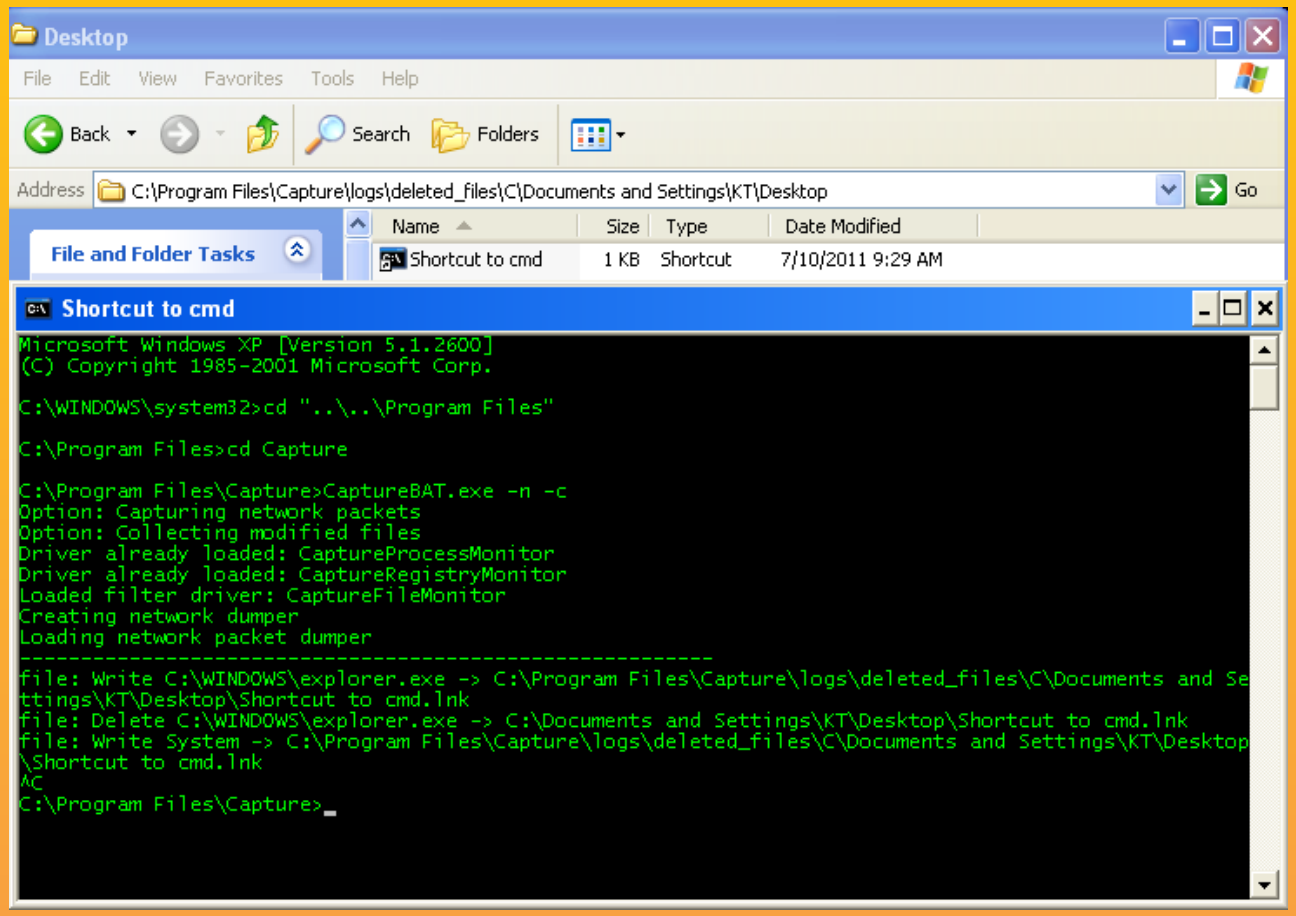
Showing 25,888 of 59,353 events (43%)

Backed by virtual memory

Registry Monitoring (Regshot)



CaptureBAT



- CaptureBAT.exe –c –n –l test.exe
- Open With Wireshark

Folderchangeview

FolderChangesView - C:\

File Edit View Options Help

Filename	Modified Count	Created Count	Deleted Count	Renamed Count	Full Path	Extension	File Owner
NTUSER.DAT.LOG	24	0	0	0	C:\Documents and Settings\malware1\NTUSER...	LOG	MALWARE-01\ma
software.LOG	12	0	0	0	C:\WINDOWS\system32\config\software.LOG	LOG	BUILTIN\Administ
VERCLSID.EXE-3667BD...	2	0	0	0	C:\WINDOWS\Prefetch\VERCLSID.EXE-3667B...	pf	BUILTIN\Administ
FOLDERCHANGESVIEW...	2	0	0	0	C:\WINDOWS\Prefetch\FOLDERCHANGESVIE...	pf	BUILTIN\Administ
wow.txt.lnk	1	1	1	0	C:\Documents and Settings\malware1\Recent\...	lnk	
Recent	4	0	0	0	C:\Documents and Settings\malware1\Recent		MALWARE-01\ma
change.log	2	0	0	0	C:\System Volume Information_restore{FABF...	log	BUILTIN\Administ
test.lnk	1	1	1	0	C:\Documents and Settings\malware1\Recent\...	lnk	
wow.txt.txt	2	0	0	0	C:\Source\malware analysis tools\test\wow.txt...	txt	MALWARE-01\ma
NOTEPAD.EXE-336351...	2	0	0	0	C:\WINDOWS\Prefetch\NOTEPAD.EXE-336351...	pf	BUILTIN\Administ

Cuckoo Sandbox

file:///home/jnieto/cuckoo/cuckoo-master/storage/analyses/37/reports/report.html

cuckoo

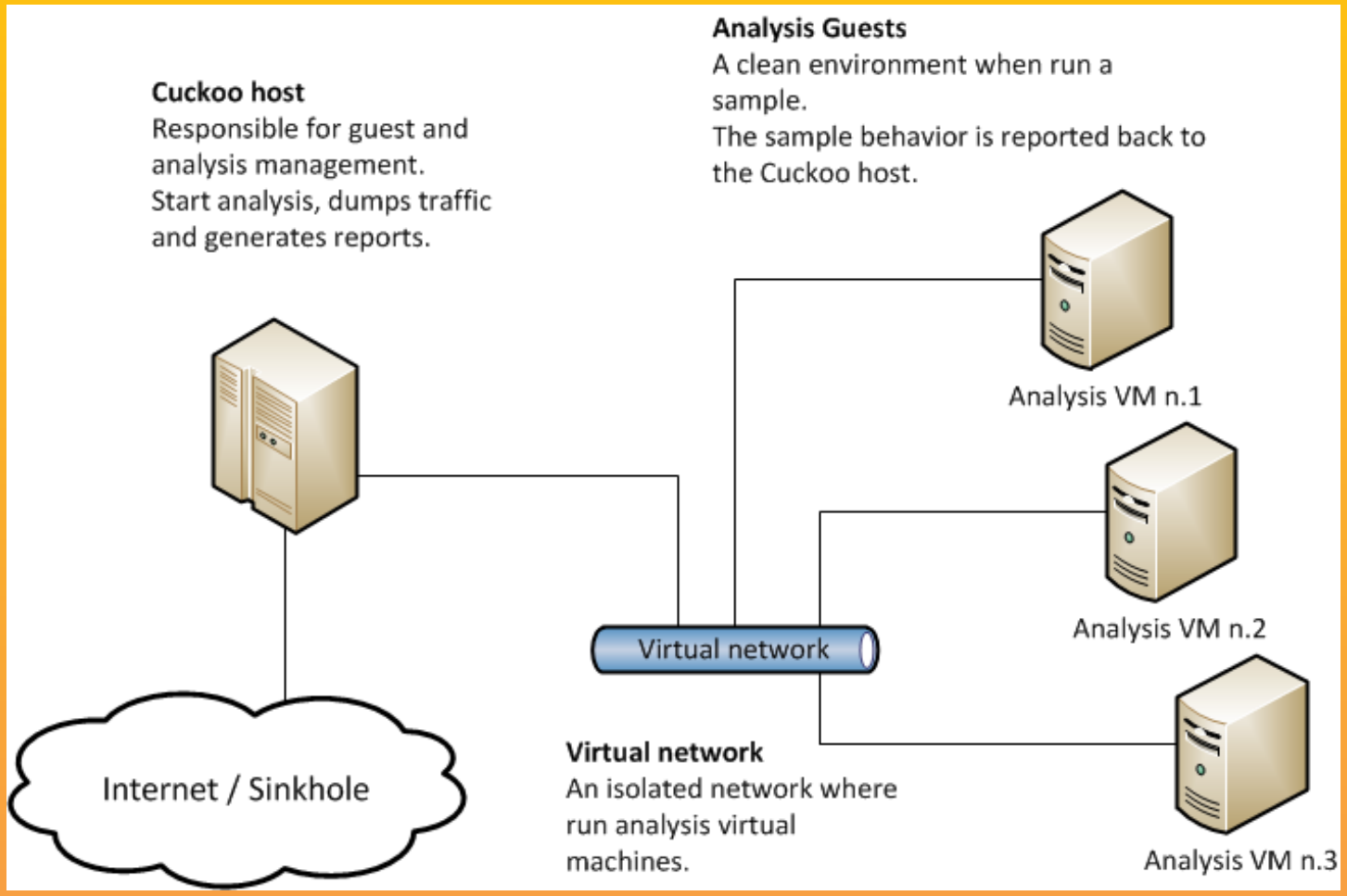
Info | File | Signatures | Screenshots | Static | Dropped | Network | Behavior

Category	Started On	Completed On	Duration	Cuckoo Version
FILE	2013-07-20 19:57:37	2013-07-20 20:00:02	145 seconds	0.6

File Details

File name	iwmsax.exe
File size	473558 bytes
File type	PE32 executable for MS Windows (GUI) Intel 80386 32-bit
CRC32	C5CF164C
MD5	ccdabe0075b01bde734c61eece0d1e46
SHA1	3051356e74ed3c84194513f2d93111c41ad13871
SHA256	baf6d9cdac23c577146801a53324332455c5bbbe8dbc5d726bef2b394a43c726
SHA512	a40b0b1bd8afa6020a3d12976bad21c54051bdda3fd676f20151a8877211e4e3b502869c4d549c12ae3116c21b52dd423b1537626391e4a93af24eca09bd6480
Ssdeep	None
PEiD	None matched
Yara	None matched

Cuckoo Sandbox



Analysis test

- http://45.126.133.156/yohanes/files/malware1.bin
- http://45.126.133.156/yohanes/files/malware2.bin

Simple Reverse Engineering

Radare2

```
remnux@remnux: ~
File  Edit  Tabs  Help
16c46
|           0x00400553    488910        mov [rax], rdx
|           0x00400556    48b96c61682.  mov rcx, 0x33743453206
8616c
|           0x00400560    48894808      mov [rax+0x8], rcx
|           0x00400564    48be6b346d6.  mov rsi, 0x676e69626d3
46b
|           0x0040056e    48897010      mov [rax+0x10], rsi
|           0x00400572    bf24064000    mov edi, str.12
|           0x00400577    e884feffff    call sym.imp.puts
|              sym.imp.puts(unk)
|           0x0040057c    8b45fc        mov eax, [rbp-0x4]
|           0x0040057f    89c6         mov esi, eax
|           0x00400581    bf29064000    mov edi, str.d
|           0x00400586    b800000000    mov eax, 0x0
|           0x0040058b    e880feffff    call sym.imp.printf
|              sym.imp.printf()
|           0x00400590    b800000000    mov eax, 0x0
|           0x00400595    c9           leave
\           0x00400596    c3           ret
[0x00400440]>
remnux@remnu...   *(Untitled)   16:36
```

Install GCC

- Test apakah ada GCC untuk kompilasi C
  - $#locate glibc =>
  - harusnya muncul :"/usr/share/man/man7/glibc.7.gz”
  - $#gcc ➔ harusnya muncul :
    - "gcc: fatal error: no input files" => Berarti sudah terinstalll
  - kalo ga ada : install GCC :
    - $#apt-get install gcc

Create Hello file.c

```
#include <stdio.h>int main()
{
    printf("Haloo");
    return 0;
    }
```

Open at edb kali linux

- Search for Helloo string and replace with another string
- Edit the string to another

Search for the Flag

- R2 [filename]
- Type 'aa' ➔ to start analyze all
- Type 'pdf@main' ➔ to find the int main function
- Find the flag:
  - http://45.126.133.156/yohanes/files/wow
  - http://45.126.133.156/yohanes/files/wow1

Memory Analysis

Volatility

```
jnieto@behindthefirewalls:/home/volatility-2.1$ python vol.py -f zeus.vmem pstree
Volatile Systems Volatility Framework 2.1
Name                                                  Pid   PPid   Thds   Hnds Time
-------------------------------------------------- ------ ------ ------ ------ --------------------
 0x810b1660:System                                      4      0     58    379 1970-01-01 00:00:00
. 0xff2ab020:smss.exe                                 544      4      3     21 2010-08-11 06:06:21
.. 0xff1ec978:winlogon.exe                            632    544     24    536 2010-08-11 06:06:23
... 0xff255020:lsass.exe                              688    632     21    405 2010-08-11 06:06:24
... 0xff247020:services.exe                           676    632     16    288 2010-08-11 06:06:24
.... 0xff1b8b28:vmtoolsd.exe                         1668    676      5    225 2010-08-11 06:06:35
..... 0xff224020:cmd.exe                              124   1668      0 ------ 2010-08-15 19:17:55
.... 0x80ff88d8:svchost.exe                           856    676     29    336 2010-08-11 06:06:24
.... 0xff1d7da0:spoolsv.exe                          1432    676     14    145 2010-08-11 06:06:26
.... 0x80fbf910:svchost.exe                          1028    676     88   1424 2010-08-11 06:06:24
..... 0x80f60da0:wuauclt.exe                         1732   1028      7    189 2010-08-11 06:07:44
..... 0x80f94588:wuauclt.exe                          468   1028      4    142 2010-08-11 06:09:37
..... 0xff364310:wscntfy.exe                          888   1028      1     40 2010-08-11 06:06:49
.... 0xff217560:svchost.exe                           936    676     11    288 2010-08-11 06:06:24
.... 0xff143b28:TPAutoConnSvc.e                      1968    676      5    106 2010-08-11 06:06:39
..... 0xff38b5f8:TPAutoConnect.e                     1084   1968      1     68 2010-08-11 06:06:52
.... 0xff22d558:svchost.exe                          1088    676      7     93 2010-08-11 06:06:25
.... 0xff218230:vmacthlp.exe                          844    676      1     37 2010-08-11 06:06:24
.... 0xff25a7e0:alg.exe                               216    676      8    120 2010-08-11 06:06:39
.... 0xff203b80:svchost.exe                          1148    676     15    217 2010-08-11 06:06:26
.... 0xff1fdc88:VMUpgradeHelper                      1788    676      5    112 2010-08-11 06:06:38
.. 0xff1ecda0:csrss.exe                               608    544     10    410 2010-08-11 06:06:23
 0xff3865d0:explorer.exe                             1724   1708     13    326 2010-08-11 06:09:29
. 0xff374980:VMwareUser.exe                           452   1724      8    207 2010-08-11 06:09:32
. 0xff3667e8:VMwareTray.exe                           432   1724      1     60 2010-08-11 06:09:31
```

Download the images

- http://45.126.133.156/yohanes/files/cridex.zip
- http://45.126.133.156/yohanes/files/zaptftis.rar

Volatility

- ./vol.py imageino –f <Destination of the memory Dump>
- ./vol.py –profile=WinXPSP2x86 pslist –f <Destination of the memory Dump> ➔ show all running process
- ./vol.py –profile=WinXPSP2x86 kdbgscan –f <Destination of the memory Dump> ➔ show kernel debugger block (show hidden process)

Volatility

- ./vol.py –profile=WinXPSP2x86 kpcrscan –f <Destination of the memory Dump> ➔ show processor specific data
- ./vol.py –profile=WinXPSP2x86 dlllist–f <Destination of the memory Dump> ➔ show all running dll
- ./vol.py –profile=WinXPSP2x86 dlldump -D <Destination Directory> -f <memory image location> ➔ Dump all DLL into folder

Volatility

- ./vol.py –profile=WinXPSP2x86 psscan-D <Destination Directory> -f <memory image location> ➔ scan all process
- ./vol.py –profile=WinXPSP2x86 -f <memory image location> ➔ Show all process in a tree
- ./vol.py –profile=WinXPSP2x86 connection -f <memory image location> ➔Show all running connection

Volatility

- ./vol.py –profile=WinXPSP2x86 sockets -f <memory image location> ➔ show all open sockets (ports)
- ./vol.py –profile=WinXPSP2x86 hivescan -f <memory image location> ➔ search for any injected process
- ./vol.py –profile=WinXPSP2x86 hivelist -f <memory image location> ➔ search for any injected process on virtual memory

Volatility

- ./vol.py –profile=WinXPSP2x86 svcscan -f <memory image location> ➔ show all services on memory


Backspace
Screen
Home
Page Up
Thank You
Page Down
Insert
Shift