CIRCL - Digital Forensics 1.0.3

Introduction: Windows-, Memory- and File Forensics

CIRCL *TLP:CLEAR*

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Overview

1. Windows Registry
2. Event Logs
3. Other Sources of Information
4. Malware Analysis
5. Analysing files
6. Live Response
7. Memory Forensics
8. Bibliography and Outlook

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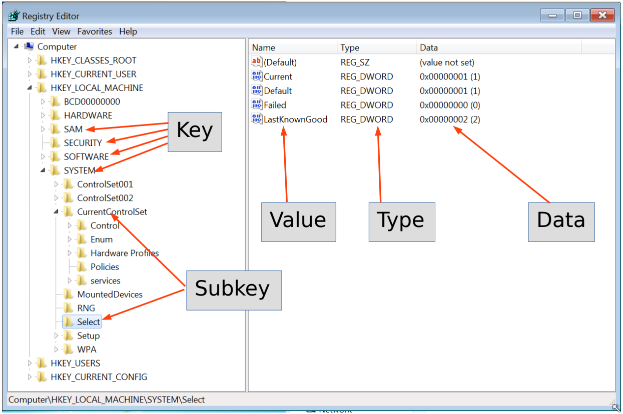
1. Windows Registry

1.1 About: Windows Registry

- MS DOS and old Windows
  - On system boot: What programs to load
  - How the system interact with the user
    - → `autoexec.bat`
    - → `config.sys`
    - → `system.ini`
    - → `win.ini`
- `https://support.microsoft.com/en-us/help/256986/`
  - A central hierarchical database
  - Replace text based config files
  - Contains information for operating
    - Hardware system wide
    - OS all aspects
    - Applications installed
    - User preferences / behavior

→ A gold mine for forensics

1.1 About: Windows Registry



```
Computer
  HKEY_CLASSES_ROOT
  HKEY_CURRENT_USER
  HKEY_LOCAL_MACHINE
    BCD00000000
    HARDWARE
    SAM
    SECURITY
    SOFTWARE
    SYSTEM
      ControlSet001
      ControlSet002
      CurrentControlSet
        Control
        Enum
        Hardware Profiles
        Policies
        services
      MountedDevices
      RNG
      Select
      Setup
      WPA
  HKEY_USERS
  HKEY_CURRENT_CONFIG
```

Name	Type	Data
(Default)	REG_SZ	(value not set)
Current	REG_DWORD	0x00000001 (1)
Default	REG_DWORD	0x00000001 (1)
Failed	REG_DWORD	0x00000000 (0)
LastKnownGood	REG_DWORD	0x00000002 (2)

Computer\HKEY_LOCAL_MACHINE\SYSTEM\Select

Key data structures contains a last write time stamp

1.1 About: Windows Registry

- Hive files: Location

  `%SystemRoot%\system32\config`
  → `SAM, SECURITY, SYSTEM, SOFTWARE`
  `%UserProfile%\NTUSER.DAT`
  `%UserProfile%\AppData\Local\Microsoft\Windows\UsrClass.dat`

  → Created during system boot

- How often do you manually edit the Registry?
  - `regedit.exe`
  - Black Magic for many admins
    → Every user interacts with the Registry

- Timestamps → Timeline

1.2 Under the hood: Key Cell

```
0000:  a0ff ffff  6e6b 2000  6f0f 0e3b b78d d101   ....nk .o..;....
0010:  0200 0000 085e 0500  0000 0000 0000 0000   .....^..........
0020:  ffff ffff ffff ffff  0200 0000 0021 0500   .............!..
0030:  102e 0000 ffff ffff  0000 0000 0000 0000   ................
0040:  1400 0000 1000 0000  0000 0000 0a00 0000   ................
0050:  496e 7465 7266 6163  6573 0080 0200 0000   Interfaces......
```

```
Offsets:    0x00       0       4         Size
            0x04       4       2         Node ID
            0x06       6       2         Node type
            0x08       8       8         Last write time
                  ...     ...
            0x4c      76       2         Lenght of key name
            0x50      80     <76>        key name + padding
```

- Exercise: Calculate the size of the key cell

  `a0 ff ff ff`

- Exercise: Calculate the size of the key name

  `0a 00`

1.2 Under the hood: Value Cell

```
0000:                                d8ff ffff  766b 0d00          ....vk..
0010:  0400  0080  0200  0000   0400  0000  0100  0000   .................
0020:  4c61  7374  4b6e  6f77   6e47  6f6f  6400  0000   LastKnownGood...
```

```
Offset:    0×00       0        4        Size
           0×04       4        2        Node ID
           0×06       6        2        Value name length
           0×08       8        4        Data lenght
           0×0c      12        4        Data offset
           0×10      16        4        value typw
```

- Exercise: Calculate the size of the value cell

  `d8 ff ff ff`

- Exercise: Calculate the size of the value name length

  `0d 00`

1.3 Hive files

- SAM
  - Security Accounts Manager: Local users
- Security
  - Audit settings
  - Machine, domain SID
- System
  - Hardware configuration
  - System configuration
- Software
  - Windows settings
  - Application information
- NTUser.dat
  - User behavior and settings
- UsrClass.dat
  - Graphical User Interface information

1.3 Hive files

- Windows XP:

  C:\Documents and Settings\<username>\NTUSER.DAT

  C:\Documents and Settings\<username>\Local Settings\
  Application Data\Microsoft\Windows\UsrClass.dat

- Windows Vista and above:

  C:\Users\<user>\NTUSER.DAT

  C:\Users\<user>\AppData\Local\Microsoft\Windows\
  UsrClass.dat

- C:\Windows\inf\setupapi.log
  (Plug and Play Log)

1.3 Hive files - Exercise: Get hive files

```
Extract registry hive files from forensic image
===============================================
```

```
-
      mkdir registry/out
```

1.3 Hive files - Exercise: Get hive files

```
Extract registry hive files from forensic image
===============================================

   1. Investigate Meta-Information
   -------------------------------
      ewfinfo image.E01
      ewfexport image.E01
```

```
-
      mkdir registry/out
```

1.3 Hive files - Exercise: Get hive files

```
Extract registry hive files from forensic image
===============================================

  1. Investigate Meta-Information
  -------------------------------

    ewfinfo image.E01
    ewfexport image.E01


  2. Mount evidences
  ------------------

    sudo mkdir /media/case1
    mmls image.raw
    sudo mount -o ro,offset=$((512*63)) image.raw /media/case1/
```

-

1.3 Hive files - Exercise: Get hive files

```
Extract registry hive files from forensic image
===============================================

   1. Investigate Meta-Information
   -------------------------------

      ewfinfo image.E01
      ewfexport image.E01


   2. Mount evidences
   ------------------

      sudo mkdir /media/case1
      mmls image.raw
      sudo mount -o ro,offset=$((512*63)) image.raw /media/case1/


   3. Copy files
   -------------

      mkdir registry
      cp /media/case1/WINDOWS/system32/config/SAM registry
      cp /media/case1/WINDOWS/system32/config/software registry
      cp /media/case1/WINDOWS/system32/config/system registry
      cp /media/case1/WINDOWS/system32/config/SECURITY registry
      cp /media/case1/Documents\ and\ Settings/Jean/NTUSER.DAT registry
      cp /media/case1//Documents\ and\ Settings/Jean/Local\ Settings/
         Application\ Data/Microsoft/Windows/UsrClass.dat registry/
      ls registry/
      mkdir registry/out
```

1.4 RegRipper

- https://github.com/keydet89/RegRipper4.0
- Plugins: 385

```
regripper —h
        Rip v.3.0 — CLI RegRipper tool
        Rip [—r Reg hive file] [—f profile] [—p plugin] [options]
        Parse Windows Registry files, using either a single module, or a profile.


ls /usr/lib/regripper/plugins | grep pl$ | wc —l
        249


ls /usr/lib/regripper/plugins | grep —v pl$
        all
        amcache
        ntuser
        sam
        security
        software
        syscache
        system
        usrclass
```

1.4 RegRipper - Examples

```
regripper -p compname -r software
   Select not found.


regripper -p compname -r system
   ComputerName     = JEAN-13FBF038A3
   TCP/IP Hostname = jean-13fbf038a3


regripper -p run -r NTUSER.DAT

   Software\Microsoft\Windows\CurrentVersion\Run
   LastWrite Time 2008-07-18 04:36:52Z
     MSMSGS - "C:\Program Files\Messenger\msmsgs.exe" /background
     Aim6 - "C:\Program Files\AIM6\aim6.exe" /d locale=en-US ee://aol/imApp


regripper -p run -r software

   Microsoft\Windows\CurrentVersion\Run
   LastWrite Time 2008-07-06 07:21:46Z
     VMware User Process - C:\Program Files\VMware\VMware Tools\VMwareUser.exe
     VMware Tools - C:\Program Files\VMware\VMware Tools\VMwareTray.exe

   Microsoft\Windows\CurrentVersion\Run\OptionalComponents
   LastWrite Time 2008-07-06 07:21:46Z
```

1.4 RegRipper - Examples

```
mkdir registry/out

regripper -f sam -r SAM > out/sam.txt
regripper -a     -r SAM > out/sam2.txt
less registry/out/sam.txt

     User Information
    -------------------------
     Username        : Administrator [500]
     Full Name       :
     User Comment    : Built-in account for administering the computer/domain
     Account Type    : Default Admin User
     Account Created : 2008-05-13 22:20:14Z
     Name            :
     Last Login Date : 2008-07-21 01:22:18Z
     Pwd Reset Date  : 2008-05-13 22:23:39Z
     Pwd Fail Date   : Never
     Login Count     : 24
     Embedded RID    : 500
       --> Password does not expire
       --> Normal user account

     Username        : Guest [501]
     Full Name       :
     User Comment    : Built-in account for guest access to the computer/domain
     Account Type    : Default Guest Acct
     Account Created : 2008-05-13 22:20:14Z
```

1.5 RegRipper: Exercise

1. Extract Hive files from invected PC
2. Rip them with RegRipper profiles
3. Collect important general information
4. Try to find incident related artefacts
5. Add the information to report

1.5 RegRipper: Exercise

1. Extract Hive files from invected PC
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4. Try to find incident related artefacts
5. Add the information to report

```
mkdir registry/out

     regripper -a -r SAM           > out/sam.txt
     regripper -a -r SECURITY      > out/security.txt
     regripper -a -r software      > out/software.txt
     regripper -a -r system        > out/system.txt
     regripper -a -r NTUSER.DAT    > out/NTUser.txt
     regripper -a -r UsrClass.dat > out/UsrClass.txt

     ls -lh out/
          24K Nov 11 07:46 NTUser.txt
         7.1K Nov 11 07:47 sam.txt
          603 Nov 11 07:46 security.txt
         658K Nov 11 07:46 software.txt
         157K Nov 11 07:46 system.txt
         1.5K Nov 11 07:47 UsrClass.txt
```

1.6 General information: sam, security

```
less out/SAM.txt

    Username          : Administrator [500]
            Last Login Date : 2008—07—21 01:22:18Z
            Pwd Fail Date   : Never
            Login Count     : 24

    Username          : Jean [1004]
            Last Login Date : 2008—07—20 00:00:41Z
            Pwd Fail Date   : Never
            Login Count     : 80

    Group Name      : Administrators [7]
    LastWrite       : 2008—05—14 05:35:35Z
      S—1—5—21—484763869—796845957—839522115—1006
      S—1—5—21—484763869—796845957—839522115—1008
      S—1—5—21—484763869—796845957—839522115—1007
      S—1—5—21—484763869—796845957—839522115—1005
      S—1—5—21—484763869—796845957—839522115—1003
      S—1—5—21—484763869—796845957—839522115—500
      S—1—5—21—484763869—796845957—839522115—1004


less out/security.txt
```

1.6 General information: system, software

```
regripper -p winver -r software

    ProductName                  Microsoft Windows XP
    CSDVersion                   Service Pack 3
    BuildLab                     2600.xpsp.080413-2111
    RegisteredOrganization
    RegisteredOwner              Jean User
    InstallDate                  2008-05-13 21:29:32Z


regripper -p networkcards -r software

    Description                                     Key LastWrite time
    VMware Accelerated AMD PCNet Adapter            2008-05-14 05:31:26Z


regripper -p uninstall -r software

    2008-07-19 23:32:23Z
      VMware Tools v.3.2.0.1288
    .....


regripper -p ips -r system

    IPAddress             Domain
    192.168.117.129       localdomain
```

1.6 General information: system, software

```
regripper -p profilelist -r software

    Path      : %SystemDrive%\Documents and Settings\Jean
    SID       : S-1-5-21-484763869-796845957-839522115-1004
    LastWrite : 2008-07-21 01:18:00Z

    Path      : %SystemDrive%\Documents and Settings\Devon
    SID       : S-1-5-21-484763869-796845957-839522115-1007
    LastWrite : 2008-07-12 06:04:40Z

    Path      : %SystemDrive%\Documents and Settings\Administrator
    SID       : S-1-5-21-484763869-796845957-839522115-500
    LastWrite : 2008-07-21 01:31:01Z


regripper -p shutdown -r system

    ControlSet001\Control\Windows key, ShutdownTime value
    LastWrite time: 2008-07-21 01:31:32Z
    ShutdownTime  : 2008-07-21 01:31:32Z


regripper -p timezone -r system

    ControlSet001\Control\TimeZoneInformation
    LastWrite Time 2008-05-14 06:55:57Z
      DaylightName   -> GMT Daylight Time
```

1.7 Tracing user activity

- MRU - Most Recently Used
  - Open/Save As dialog box

```
regripper -p comdlg32 -r NTUSER.DAT
```

  - Recent Docs opened via Win. Explorer

```
regripper -p recentdocs -r NTUSER.DAT
```

- ShellBags (Win7+)
  - Properties of folders

```
regripper -p shellbags -r UsrClass.dat
```

- Program execution
  - UserAssist: GUI based launched

```
regripper -p userassist -r NTUSER.DAT
```

  - ShimCache: Track compatibility issues

```
regripper -p shimcache -r system
```

1.7 Tracing user activity

USB attached devices

USBStor: Attached devices

```
less /media/case1/WINDOWS/setupapi.log
regripper -p usbstor -r system
```

USBStor: Vendor & Product ID

```
regripper -p usb -r system
```

MountedDevices

```
regripper -p mountdev -r system
```

MountPoints

```
regripper -p mp2 -r NTUSER.DAT
```

SANS Posters:

https://www.sans.org/posters/windows-forensic-analysis/
https://www.sans.org/posters/hunt-evil/

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2. Windows Event Logs

2.1 Inroduction

- Up to Windows XP
  - Mainly 3 `.evt` files:

    Security: `secevent.evt`
    System: `sysevent.evt`
    Application: `appevent.evt`
    ... maybe some server service specific
  - Location: `/Windows/System32/config/`
  - Binary Event Log file format

- Beginning with Vista
  - Many `.evtx` files:

    `Security.evtx`
    `System.evtx`
    `Application.evtx`
    → 120 files ++
  - Location: `/Windows/System32/winevt/Logs/`
  - New binary XML format

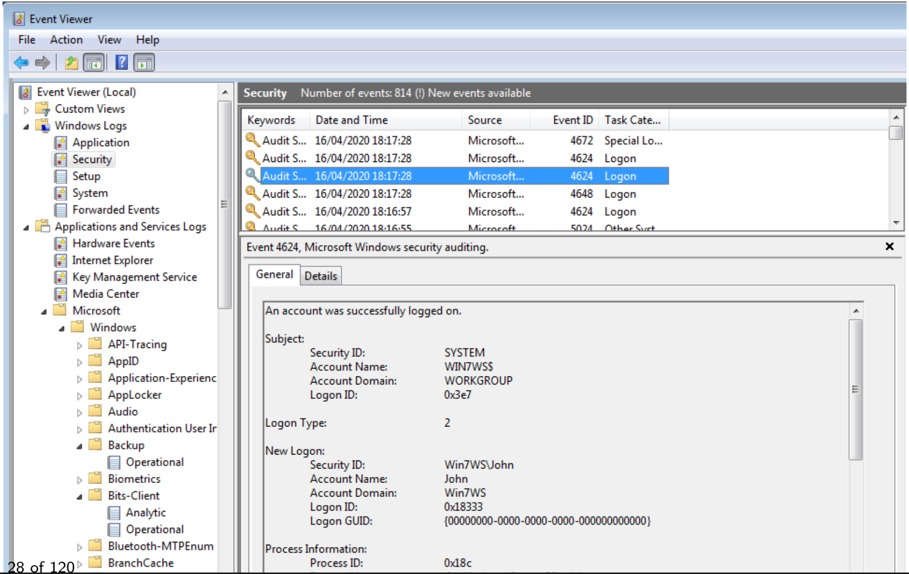
2.1 Inroduction

- Advantage
  - Full fledged logging
  - Logging important events: E.g. Logon Success, ...
  - Detailed information

- Disadvantage
  - Limited period of time
  - Importand events not logged by default: E.g. Logon Fail
  - Manny events, hard to find related information

- Always interesting
  - Logon / Logoff
  - System boot
  - Services started
  - Hardware (dis)connected

2.2 Example: Event Viewer



Security Number of events: 814 (!) New events available

Keywords	Date and Time	Source	Event ID	Task Cate...
Audit S...	16/04/2020 18:17:28	Microsoft...	4672	Special Lo...
Audit S...	16/04/2020 18:17:28	Microsoft...	4624	Logon
Audit S...	16/04/2020 18:17:28	Microsoft...	4624	Logon
Audit S...	16/04/2020 18:17:28	Microsoft...	4648	Logon
Audit S...	16/04/2020 18:16:57	Microsoft...	4624	Logon
Audit S...	16/04/2020 18:16:55	Microsoft...	5024	Other Syst...

Event 4624, Microsoft Windows security auditing.

```
An account was successfully logged on.

Subject:
        Security ID:            SYSTEM
        Account Name:           WIN7WS$
        Account Domain:         WORKGROUP
        Logon ID:               0x3e7

Logon Type:                     2

New Logon:
        Security ID:            Win7WS\John
        Account Name:           John
        Account Domain:         Win7WS
        Logon ID:               0x18333
        Logon GUID:             {00000000-0000-0000-0000-000000000000}

Process Information:
        Process ID:             0x18c
```

2.3 Get support

- Review logging policies

```
$ rip.pl -r SECURITY -p auditpol
.....
ystem:Other System Events                         S/F
Logon/Logoff:Logon                                 S
Logon/Logoff:Logoff                                S
Logon/Logoff:Account Lockout                       S
Logon/Logoff:IPsec Main Mode                       N
Logon/Logoff:IPsec Quick Mode                      S
Logon/Logoff:IPsec Extended Mode                   N
Logon/Logoff:Special Logon                         N
Logon/Logoff:Other Logon/Logoff Events             N
Logon/Logoff:Network Policy Server                 S/F
Object Access:File System                          N
.....
```

- Online:
  - Microsoft TechNet
  - https://www.ultimatewindowssecurity.com/securitylog/encyclopedia/
  - http://eventid.net/

2.4 Extracting and exploring event logs: Exercise

Extracting event logs

-

2.4 Extracting and exploring event logs: Exercise

Extracting event logs

```
mkdir evtx
mkdir evtx/out

mmls nps-2008-jean.raw
sudo mount -o ro,offset=$((512*63)) nps-2008-jean.raw /media/sansforensics/casenps/

cp /media/sansforensics/casenps/WINDOWS/system32/config/AppEvent.Evt evtx/
cp /media/sansforensics/casenps/WINDOWS/system32/config/SecEvent.Evt evtx/
cp /media/sansforensics/casenps/WINDOWS/system32/config/SysEvent.Evt evtx/
ls -lh evtx/
```

Exploring event logs

2.4 Extracting and exploring event logs: Exercise

Extracting event logs

```
mkdir evtx
mkdir evtx/out

mmls image.raw
sudo mount=o ro,offset=$((512*63)) image.raw/media/case1/

cp /media/case1/WINDOWS/system32/config/AppEvent.Evt evtx/
cp /media/case1/WINDOWS/system32/config/SecEvent.Evt evtx/
cp /media/case1/WINDOWS/system32/config/SysEvent.Evt evtx/
ls -lh evtx/
```

Exploring event logs

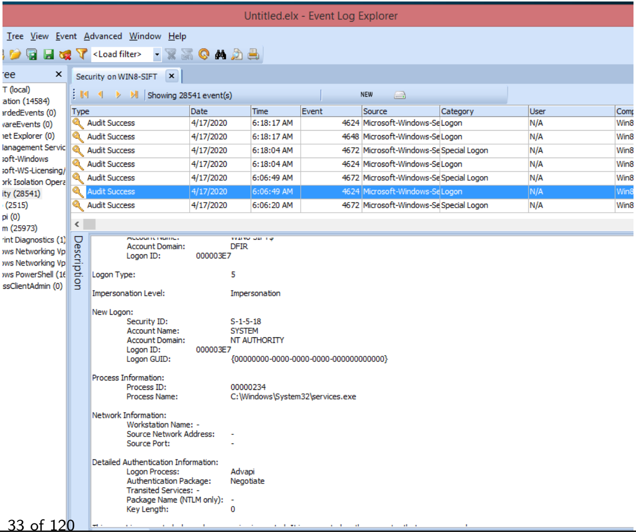
```
sudo apt install libevt-utils

evtinfo evtx/AppEvent.Evt
evtinfo evtx/SecEvent.Evt
evtinfo evtx/SysEvent.Evt

evtexport AppEvent.Evt | less
evtexport SysEvent.Evt | less
```

2.4 Extracting and exploring event logs

https://eventlogxp.com/



Type	Date	Time	Event	Source	Category	User	Comp
Audit Success	4/17/2020	6:18:17 AM	4624	Microsoft-Windows-Se	Logon	N/A	Win8
Audit Success	4/17/2020	6:18:17 AM	4648	Microsoft-Windows-Se	Logon	N/A	Win8
Audit Success	4/17/2020	6:18:04 AM	4672	Microsoft-Windows-Se	Special Logon	N/A	Win8
Audit Success	4/17/2020	6:18:04 AM	4624	Microsoft-Windows-Se	Logon	N/A	Win8
Audit Success	4/17/2020	6:06:49 AM	4672	Microsoft-Windows-Se	Special Logon	N/A	Win8
Audit Success	4/17/2020	6:06:49 AM	4624	Microsoft-Windows-Se	Logon	N/A	Win8
Audit Success	4/17/2020	6:06:20 AM	4672	Microsoft-Windows-Se	Special Logon	N/A	Win8

```
          Account Name:             WIN8-SIFT$
          Account Domain:           DFIR
          Logon ID:           000003E7

Logon Type:                         5

Impersonation Level:                Impersonation

New Logon:
          Security ID:              S-1-5-18
          Account Name:             SYSTEM
          Account Domain:           NT AUTHORITY
          Logon ID:           000003E7
          Logon GUID:               {00000000-0000-0000-0000-000000000000}

Process Information:
          Process ID:               00000234
          Process Name:             C:\Windows\System32\services.exe

Network Information:
          Workstation Name: -
          Source Network Address:   -
          Source Port:              -

Detailed Authentication Information:
          Logon Process:            Advapi
          Authentication Package:   Negotiate
          Transited Services: -
          Package Name (NTLM only): -
          Key Length:               0
```

2.5 Example .evtx

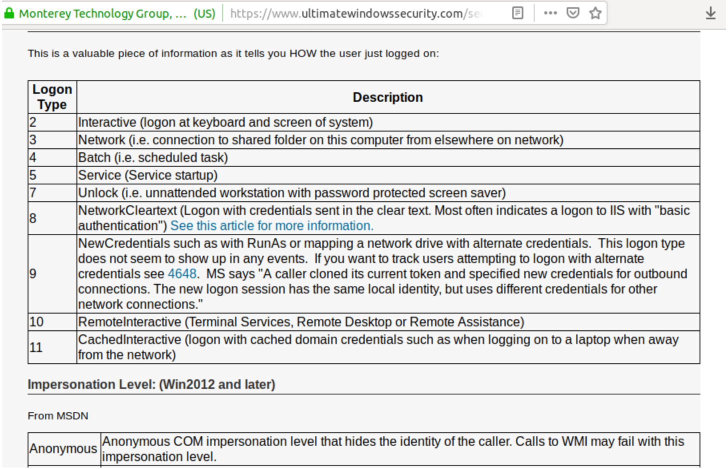
- Logon Success

```
$ evtxexport Security.evtx | less
.....
Event number            : 668
Written time            : Apr 15, 2019 12:58:33.650031000 UTC
Event level             : Information (0)
Computer name           : Win7WS
Source name             : Microsoft-Windows-Security-Auditing
Event identifier        : 0x00001210 (4624)
Number of strings       : 20
String: 1               : S-1-5-18
String: 2               : WIN7WS$
String: 3               : WORKGROUP
String: 4               : 0x00000000000003e7
String: 5               : S-1-5-21-3408732720-2018246097-660081352-1000
String: 6               : John
String: 7               : Win7WS
String: 9               : 2
.....
String: 17              : 0x0000018c
String: 18              : C:\Windows\System32\winlogon.exe
String: 19              : 127.0.0.1
```

- Logon Fail

```
$ evtxexport Security.evtx | grep 4625
```

2.5 Example .evtx



Monterey Technology Group, ... (US) https://www.ultimatewindowssecurity.com/se

This is a valuable piece of information as it tells you HOW the user just logged on:

Logon Type	Description
2	Interactive (logon at keyboard and screen of system)
3	Network (i.e. connection to shared folder on this computer from elsewhere on network)
4	Batch (i.e. scheduled task)
5	Service (Service startup)
7	Unlock (i.e. unnattended workstation with password protected screen saver)
8	NetworkCleartext (Logon with credentials sent in the clear text. Most often indicates a logon to IIS with "basic authentication") See this article for more information.
9	NewCredentials such as with RunAs or mapping a network drive with alternate credentials. This logon type does not seem to show up in any events. If you want to track users attempting to logon with alternate credentials see 4648. MS says "A caller cloned its current token and specified new credentials for outbound connections. The new logon session has the same local identity, but uses different credentials for other network connections."
10	RemoteInteractive (Terminal Services, Remote Desktop or Remote Assistance)
11	CachedInteractive (logon with cached domain credentials such as when logging on to a laptop when away from the network)

Impersonation Level: (Win2012 and later)

From MSDN

Anonymous	Anonymous COM impersonation level that hides the identity of the caller. Calls to WMI may fail with this impersonation level.

2.6 Other log files

- `/Windows/setuplog.txt`
  - ○ Untill WinXP, when Windows is installed
- `/Windows//Debug/netsetup.log`
  - ○ Untill WinXP, when Windows is installed
- `/Windows/setupact.log`
  - ○ Graphical part of setup process

```
2019—04—05 11:39:56, Info  CBS Starting the TrustedInstaller main loop.
2019—04—05 11:39:56, Info  CBS TrustedInstaller service starts successfully.
2019—04—05 11:39:56, Info  CBS Setup in progress, aborting startup processing check
2019—04—05 11:39:56, Info  CBS Startup processing thread terminated normally
```

- `/Windows/setupapi.log`

```
/Windows/inf/setupapi.dev.log
/Windows/inf/setupapi.app.log
/Windows/inf/setupapi.offline.log
```

- `/Windows/Tasks/SCHEDLGU.TXT`
  - ○ Task Scheduler Log

2.7 Exercise: Automated tools

```
Example: Chainsaw
=================

wget https://github.com/WithSecureLabs/chainsaw/releases/
           download/v2.10.1/chainsaw_all_platforms+rules.zip

7z x chainsaw_all_platforms+rules.zip
cd chainsaw
chmod +x ./chainsaw_x86_64-unknown-linux-gnu
git clone https://github.com/sbousseaden/EVTX-ATTACK-SAMPLES.git

./chainsaw_x86_64-unknown-linux-gnu hunt EVTX-ATTACK-SAMPLES/ -s sigma/
    --mapping mappings/sigma-event-logs-all.yml | less


[+] Loading detection rules from: sigma/
[!] Loaded 3336 detection rules (490 not loaded)
[+] Loading forensic artefacts from: EVTX-ATTACK-SAMPLES/Command
    and Control, 2 (extensions: .evt, .evtx)



Challenge: Hayabusa
===================

https://github.com/Yamato-Security/hayabusa
```

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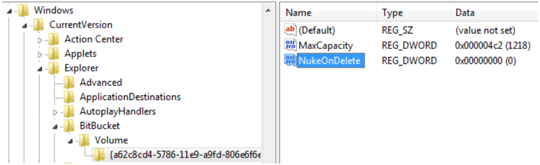
3. Other Windows Artifacts

3.1 Recycle Bin - User support to undelete

- Files move to Recycle Bin:
  - Moved by mouse
  - Right click: `Delete`
- Not move to Recycle Bin:
  - Right click: `Delete + SHIFT`
  - Command line: `del`
  - Files on network shares
- NukeOnDelete
  - `HKEY_USERS/_UUID_/Software/Microsoft/Windows/CurrentVersion/Explorer/BitBucket/Volume/{_Volume ID_}/NukeOnDelete`



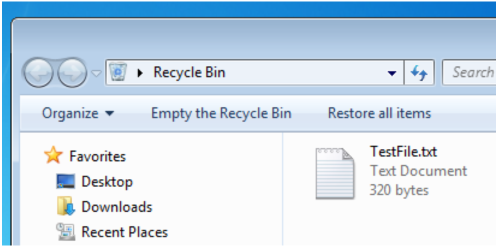
```
Windows
  CurrentVersion
    Action Center
    Applets
    Explorer
      Advanced
      ApplicationDestinations
      AutoplayHandlers
      BitBucket
        Volume
          {a62c8cd4-5786-11e9-a9fd-806e6f6e
```

Name	Type	Data
(Default)	REG_SZ	(value not set)
MaxCapacity	REG_DWORD	0x000004c2 (1218)
NukeOnDelete	REG_DWORD	0x00000000 (0)

3.1 Recycle Bin - Life-Investigate

- Play script: `TextFile.txt`
  - 2019-04-30 17:31:57 UTC+2: Born
  - 2019-04-30 17:34:44 UTC+2: Content Modified
  - 2019-04-30 17:35:32 UTC+2: Deleted

- Analyze Recycle.Bin:



TestFile.txt
Text Document
320 bytes

3.1 Recycle Bin - Forensics

- Play script: `TextFile.txt`
  - 2019-04-30 17:31:57 UTC+2: Born
  - 2019-04-30 17:34:44 UTC+2: Content Modified
  - 2019-04-30 17:35:32 UTC+2: Deleted

- Analyze `Recycle.Bin` directory:

```
/$Recycle.Bin/S-1-5-21-3408732720-2018246097-660081352-1000/
        129 Apr  5 11:46  desktop.ini
        544 Apr 30 17:35 '$IOMHI9A.txt'
        320 Apr 30 17:34 '$ROMHI9A.txt'


strings -el \$IOMHI9A.txt
        C:\Users\John\Documents\recycleTest\TestFile.txt


strings \$ROMHI9A.txt
                Test File
                =========
        This is a test file. It is just created to test Forensic
        Artifacts for the 'Recycle Bin'.
        .....
```

3.1 Recycle Bin - Forensics

- Play script: `TextFile.txt`
  - 2019-04-30 17:31:57 UTC+2: Born
  - 2019-04-30 17:34:44 UTC+2: Content Modified
  - 2019-04-30 17:35:32 UTC+2: Deleted

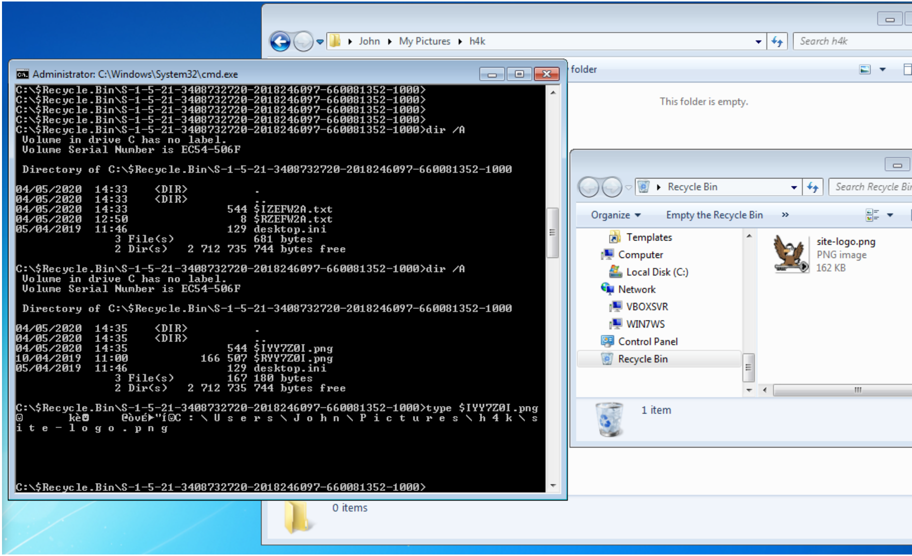
- File system timeline `Recycle.Bin` directory:

```
Tue Apr 30 2019 17:31:57
     320 ...b   47164—128—1 /$Recycle.Bin/S—1—5—21— ..... —1000/$ROMHI9A.txt


Tue Apr 30 2019 17:34:44
     320 ma..   47164—128—1 /$Recycle.Bin/S—1—5—21— ..... —1000/$ROMHI9A.txt


Tue Apr 30 2019 17:35:32
     544 macb   44155—128—1 /$Recycle.Bin/S—1—5—21— ..... —1000/$IOMHI9A.txt
      48 mac.   47022—144—1 /Users/John/Documents/recycleTest
     320 ..c.   47164—128—1 /$Recycle.Bin/S—1—5—21— ..... —1000/$ROMHI9A.txt
     376 mac.    9632—144—1 /$Recycle.Bin/S—1—5—21— ..... —1000
```

3.1 Recycle Bin - Filename & Extension



```
C:\$Recycle.Bin\S-1-5-21-3408732720-2018246097-660081352-1000>
C:\$Recycle.Bin\S-1-5-21-3408732720-2018246097-660081352-1000>
C:\$Recycle.Bin\S-1-5-21-3408732720-2018246097-660081352-1000>
C:\$Recycle.Bin\S-1-5-21-3408732720-2018246097-660081352-1000>
C:\$Recycle.Bin\S-1-5-21-3408732720-2018246097-660081352-1000>dir /A
 Volume in drive C has no label.
 Volume Serial Number is EC54-506F

 Directory of C:\$Recycle.Bin\S-1-5-21-3408732720-2018246097-660081352-1000

04/05/2020  14:33    <DIR>          .
04/05/2020  14:33    <DIR>          ..
04/05/2020  14:33               544 $IZEFW2A.txt
04/05/2020  12:50                 8 $RZEFW2A.txt
05/04/2019  11:46               129 desktop.ini
               3 File(s)            681 bytes
               2 Dir(s)   2 712 735 744 bytes free

C:\$Recycle.Bin\S-1-5-21-3408732720-2018246097-660081352-1000>dir /A
 Volume in drive C has no label.
 Volume Serial Number is EC54-506F

 Directory of C:\$Recycle.Bin\S-1-5-21-3408732720-2018246097-660081352-1000

04/05/2020  14:35    <DIR>          .
04/05/2020  14:35    <DIR>          ..
04/05/2020  14:35               544 $IYY7Z0I.png
10/04/2019  11:00           166 507 $RYY7Z0I.png
05/04/2019  11:46               129 desktop.ini
               3 File(s)        167 180 bytes
               2 Dir(s)   2 712 735 744 bytes free

C:\$Recycle.Bin\S-1-5-21-3408732720-2018246097-660081352-1000>type $IYY7Z0I.png
☺       kè☻     @òvÉ►"í☺C : \ U s e r s \ J o h n \ P i c t u r e s \ h 4 k \ s
i t e - l o g o . p n g



C:\$Recycle.Bin\S-1-5-21-3408732720-2018246097-660081352-1000>
```

3.2 LNK Files

- Link or shortcut to files, applications, resources
- User activity: Files access
  - Local
  - Network shares
  - Appached devices
- LNK file remain after target file is deleted

```
Thu May 02 2019 14:54:02
     280  ...b        43701-144-1  /Users/John/Documents/LNK


Thu May 02 2019 14:54:28
      66  macb        43702-128-1  /Users/John/Documents/LNK/Test.txt


    1573  macb        43922-128-4  /Users/John/AppData/Roaming/Microsoft/
                                       Windows/Recent/LNK.lnk


    2779  macb        43716-128-4  /Users/John/AppData/Roaming/Microsoft/
                                       Windows/Recent/Test.txt.lnk
```

3.2 LNK Files

- Information inside LNK files
  - Target file MAC times
  - Target file size
  - Target file path
  - Volume information

```
exiftool Test.txt.lnk
        ...
        Create Date          : 2019:05:02 14:54:28+02:00
        Access Date          : 2019:05:02 14:54:28+02:00
        Modify Date          : 2019:05:02 14:54:28+02:00
        Target File Size     : 66
        Icon Index           : (none)
        Run Window           : Normal
        Hot Key              : (none)
        Drive Type           : Fixed Disk
        Volume Label         :
        Local Base Path      : C:\Users\
        Net Name             : 8
        Net Provider Type    : Unknown (0x20000)
        Relative Path        : ..\..\..\..\..\Documents\Test\Test.txt
        Working Directory    : C:\Users\John\Documents\Test
        Machine ID           : john-pc
```

3.2 LNK Files: Exercise

Extract and investigate LNK file for document: 'm57biz.xls'

Prepration work:

3.2 LNK Files: Exercise

Extract and investigate LNK file for document: 'm57biz.xls'

Prepration work:

```
sudo mount -o ro,offset=$((512*63)) image.raw /media/case1
mkdir lnk
```

Copy LNK file:

-

3.2 LNK Files: Exercise

Extract and investigate LNK file for document: 'm57biz.xls'

Prepration work:

```
sudo mount -o ro,offset=$((512*63)) image.raw /media/case1
mkdir lnk
```

Copy LNK file:

```
cp /media/case1/Documents\ and\ Settings/Jean/Recent/m57biz.lnk lnk/
```

Investigate with exiftool:

3.2 LNK Files: Exercise

Extract and investigate LNK file for document: 'm57biz.xls'

```
Prepration work:
```

```
sudo mount -o ro,offset=$((512*63)) image.raw /media/case1
mkdir lnk
```

```
Copy LNK file:
```

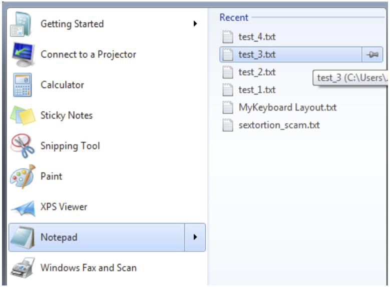
```
cp /media/case1/Documents\ and\ Settings/Jean/Recent/m57biz.lnk lnk/
```

```
Investigate with exiftool:
```

```
exiftool lnk/m57biz.lnk
   .....
   File Attributes                  : Archive
   Create Date                      : 2008:07:20 01:28:03+00:00
   Access Date                      : 2008:07:20 01:28:03+00:00
   Modify Date                      : 2008:07:20 01:28:03+00:00
   Target File Size                 : 291840
   Drive Type                       : Fixed Disk
   Local Base Path                  : C:\Documents and Settings\Jean\Desktop\m57biz.xls
   Machine ID                       : jean-13fbf038a3
```

3.3 Jump Lists

- Introduced with Windows 7
- Similar `Recent` folder
- Recently opened documents / application
- Makes them accessible at Windows main menu



```
AppData/Roaming/Microsoft/Windows/Recent/AutomaticDestinations
AppData/Roaming/Microsoft/Windows/Recent/CustomDestinations
```

3.3 Jump Lists

- File names start with 16 hex characters → JumpList ID
- File names end with `.xxxDestinations-ms`

```
C:> dir \Users\John\AppData\Roaming\Microsoft\Windows\Recent\AutomaticDestinations

04/05/2020  12:50              33 792 1b4dd67f29cb1962.automaticDestinations—ms
14/06/2019  16:43               4 608 28c8b86deab549a1.automaticDestinations—ms
10/04/2019  14:32              29 696 6824f4a902c78fbd.automaticDestinations—ms
10/04/2020  14:12               9 216 7e4dca80246863e3.automaticDestinations—ms
04/05/2020  12:50               8 704 918e0ecb43d17e23.automaticDestinations—ms
10/04/2019  14:30               3 072 b74736c2bd8cc8a5.automaticDestinations—ms
09/04/2019  14:43               6 144 de48a32edcbe79e4.automaticDestinations—ms
```

- Each Hex value correspond to an fixed application
- `918e0ecb43d17e23 = Notepad.exe`

→ `https://github.com/EricZimmerman/JumpList/blob/master/JumpList/Resources/AppIDs.txt`

3.3 Jump Lists

- Exercise: Identify applications

```
cd JumpLists/AutomaticDestinations/
ls -l

    1b4dd67f29cb1962.automaticDestinations-ms -->
    28c8b86deab549a1.automaticDestinations-ms -->
    6824f4a902c78fbd.automaticDestinations-ms -->
    7e4dca80246863e3.automaticDestinations-ms -->
    918e0ecb43d17e23.automaticDestinations-ms -->
    b74736c2bd8cc8a5.automaticDestinations-ms -->
    de48a32edcbe79e4.automaticDestinations-ms -->
```

- Exercise: Analyze the Notepad Jump List file

3.3 Jump Lists

- Exercise: Identify applications

```
cd JumpLists/AutomaticDestinations/
ll

    1b4dd67f29cb1962.automaticDestinations-ms --> Windows Explorer
    28c8b86deab549a1.automaticDestinations-ms --> Internet Explorer 8
    6824f4a902c78fbd.automaticDestinations-ms --> Firefox 64.x
    7e4dca80246863e3.automaticDestinations-ms --> Control Panel
    918e0ecb43d17e23.automaticDestinations-ms --> Notepad (32-bit)
    b74736c2bd8cc8a5.automaticDestinations-ms --> WinZip
    de48a32edcbe79e4.automaticDestinations-ms --> Acrobat Reader 15.x
```

- Exercise: Analyze the Notepad Jump List file

3.3 Jump Lists

- Exercise: Identify applications

```
cd JumpLists/AutomaticDestinations/
ll

    1b4dd67f29cb1962.automaticDestinations-ms --> Windows Explorer
    28c8b86deab549a1.automaticDestinations-ms --> Internet Explorer 8
    6824f4a902c78fbd.automaticDestinations-ms --> Firefox 64.x
    7e4dca80246863e3.automaticDestinations-ms --> Control Panel
    918e0ecb43d17e23.automaticDestinations-ms --> Notepad (32-bit)
    b74736c2bd8cc8a5.automaticDestinations-ms --> WinZip
    de48a32edcbe79e4.automaticDestinations-ms --> Acrobat Reader 15.x
```

- Exercise: Analyze the Notepad Jump List file

```
7z l 918e0ecb43d17e23.automaticDestinations-ms
        Date        Time     Attr          Size   Compressed  Name
    ------------------- ----- ------------ ------------  --------
                             .....         1398         1408  2
                             .....         1368         1408  1
                             .....          436          448  4
                             .....          392          448  3

--> file
--> exiftool
--> strings
7z x 918e0ecb43d17e23.automaticDestinations-ms
strings -el DestList
```

3.4 Prefetch Files

- Application prefetching since XP
  - Monitor an application when it starts
  - Collect information about resources needed
  - Wait 10sec after application started
    → Know where to find the resources
    → Better performance: App launch faster
    → Better user experience

- Forensics value:
  - Proof an application was started
    - Secondary artifact
    - Created by the OS
    - Not deleted by the attacker
  - Even if the application don't exists anymore
  - And more .....

3.4 Prefetch Files

- Example: From file system time line

```
Thu May 02 2019 14:52:40
    179712 .a..      10940-128-3 /Windows/notepad.exe

Thu May 02 2019 14:52:50
        56 mac.      42729-144-6 /Windows/Prefetch
     16280 macb      43700-128-4 /Windows/Prefetch/NOTEPAD.EXE-D8414F97.pf
```

- Elements of the file name at `/Windows/Prefetch`
  - Application name
  - One way hash of path to the application
  - File extension: `.pf`
- Information found inside a Prefetch file:
  - Run count: How often application run
  - Last time executed
  - Application name incl. parameter
  - Path to application and resources

3.4 Prefetch Files

- Parsing a Prefetch file

```
prefetch.py -f NOTEPAD.EXE-D8414F97.pf

        Executable Name: NOTEPAD.EXE
        Run count: 1
        Last Executed: 2019-05-02 12:52:40.339584

        Resources loaded:
        1:      \DEVICE\HARDDISKVOLUME2\WINDOWS\SYSTEM32\NTDLL.DLL
        2:      \DEVICE\HARDDISKVOLUME2\WINDOWS\SYSTEM32\KERNEL32.DLL
        3:      \DEVICE\HARDDISKVOLUME2\WINDOWS\SYSTEM32\APISETSCHEMA.DLL
        4:      \DEVICE\HARDDISKVOLUME2\WINDOWS\SYSTEM32\KERNELBASE.DLL
        .....
        .....
```

- Additional benefits like:
  - User folder where the malware got executed
  - Compare Run count of different VSS could
    → Behavior of user

3.4 Prefetch Files: Exercise

Extract and investigate the Excel prefetch file

Copy prefetch file:

```
mkdir prefetch
cp /media/sansforensics/casenps/WINDOWS/Prefetch/EXCEL.EXE-1C75F8D6.pf prefetch/
```

Investigate LNK file:

```
strings -el prefetch/EXCEL.EXE-1C75F8D6.pf | less

pref.pl -f prefetch/EXCEL.EXE-1C75F8D6.pf

    File      : prefetch/EXCEL.EXE-1C75F8D6.pf
    Exe Path  : \DEVICE\HARDDISKVOLUME1\PROGRAM FILES\MICROSOFT OFFICE\OFFICE\EXCEL.EXE
    Last Run  : Sun Jul 20 01:27:40 2008
    Run Count: 2
```

3.5 XP Restore Points

- Backup of:
  - Critical system files
  - Registry partially
  - Local user profiles
  - But NO user data!
- Created automatically:
  - Every 24 hours
  - Windows Update
  - Installation of applications incl. driver
  - Manually
- For user: Useful to recover a broken system
- For analyst:
  - `rp.log`
  - Description of the cause
  - Time stamp
  - State of the system at different times

3.6 VSS - Volume Shadow Copy Service

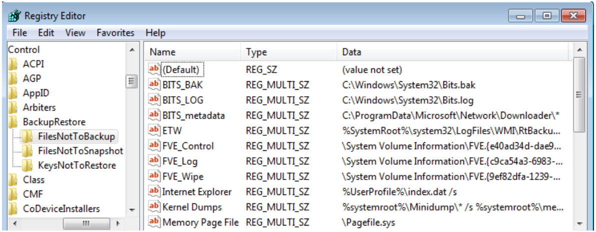
- Backup Service
  - System files
  - User data files
  - Operates on block level
- On live system
  - Run CMD as administrator

```
>vssadmin list shadows /for=c:/
vssadmin 1.1 - Volume Shadow Copy Service administrative command-line tool
(C) Copyright 2001-2005 Microsoft Corp.

Contents of shadow copy set ID: {33eb3a7b-6d03-4045-aa70-37b714d49c72}
   Contained 1 shadow copies at creation time: 10/04/2019 16:06:30
      Shadow Copy ID: {34d9910b-ac1d-4b10-b282-89dde217d0fb}
         Original Volume: (C:)\\?\Volume{a62c8cd4-5786-11e9-a9fd-806e6f6e6963}\
         Shadow Copy Volume: \\?\GLOBALROOT\Device\HarddiskVolumeShadowCopy1
         Originating Machine: Win7WS
         Service Machine: Win7WS
         Provider: 'Microsoft Software Shadow Copy provider 1.0'
         Type: ClientAccessibleWriters
         Attributes: Persistent, Client-accessible, No auto release, Differential,
         Auto recovered
```

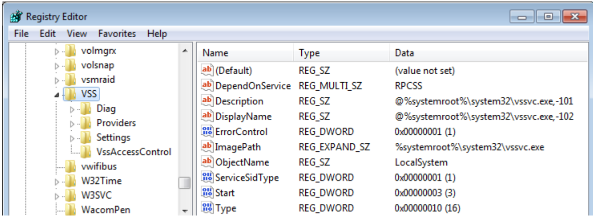
3.6 VSS - Configuration

`HKEY_LOCAL_MACHINE/SYSTEM/CurrentControlSet/services/VSS`



Name	Type	Data
(Default)	REG_SZ	(value not set)
BITS_BAK	REG_MULTI_SZ	C:\Windows\System32\Bits.bak
BITS_LOG	REG_MULTI_SZ	C:\Windows\System32\Bits.log
BITS_metadata	REG_MULTI_SZ	C:\ProgramData\Microsoft\Network\Downloader\*
ETW	REG_MULTI_SZ	%SystemRoot%\system32\LogFiles\WMI\RtBacku...
FVE_Control	REG_MULTI_SZ	\System Volume Information\FVE.{e40ad34d-dae9...
FVE_Log	REG_MULTI_SZ	\System Volume Information\FVE.{c9ca54a3-6983-...
FVE_Wipe	REG_MULTI_SZ	\System Volume Information\FVE.{9ef82dfa-1239-...
Internet Explorer	REG_MULTI_SZ	%UserProfile%\index.dat /s
Kernel Dumps	REG_MULTI_SZ	%systemroot%\Minidump\* /s %systemroot%\me...
Memory Page File	REG_MULTI_SZ	\Pagefile.sys

`HKEY_LOCAL_MACHINE/SYSTEM/CurrentControlSet/Control/BackupRestore`



Name	Type	Data
(Default)	REG_SZ	(value not set)
DependOnService	REG_MULTI_SZ	RPCSS
Description	REG_SZ	@%systemroot%\system32\vssvc.exe,-101
DisplayName	REG_SZ	@%systemroot%\system32\vssvc.exe,-102
ErrorControl	REG_DWORD	0x00000001 (1)
ImagePath	REG_EXPAND_SZ	%systemroot%\system32\vssvc.exe
ObjectName	REG_SZ	LocalSystem
ServiceSidType	REG_DWORD	0x00000001 (1)
Start	REG_DWORD	0x00000003 (3)
Type	REG_DWORD	0x00000010 (16)

3.5 VSS - Analysis

Analyze disk image

```
vshadowinfo -o $((512*206848)) 8d34ce.raw

    Volume Shadow Snapshot information:
        Number of stores:       1

    Store: 1
        Identifier              : 237c8de3-5b99-11e9-9925-080027062798
        Shadow copy set ID      : 33eb3a7b-6d03-4045-aa70-37b714d49c72
        Creation time           : Apr 10, 2019 14:06:30.365699200 UTC
        Shadow copy ID          : 34d9910b-ac1d-4b10-b282-89dde217d0fb
        Volume size             : 11 GiB (12777947136 bytes)
        Attribute flags         : 0x0042000d
```

Mounting VSC: A 2 step approach

```
sudo vshadowmount -o $((512*206848)) 8d34ce.raw /mount/vss/

sudo ls -l /mount/vss/
        -r--r--r-- 1 root root 12777947136 Jan  1  1970 vss1

sudo file /mount/vss/vss1
        /mount/vss/vss1: DOS/MBR boot sector, code offset 0x52+2, OEM-ID "NTFS

sudo mount -o ro /mount/vss/vss1 /mnt/
```

CIRCL FORENSICS Training

4. Basic Malware Analysis

4.1 Introduction

Take care: Self-Infection:

- Keep away from production
- Isolated machines (VMs)
- Network considerations

Exchange of malware via email:

- Password protected archive
- Password: `infected`

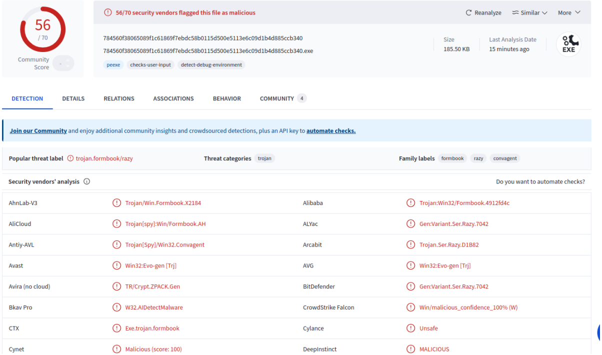
5 Phases of analysis

1. OSINT - Open Source Intelligence
2. Automatic Analysis (Sandbox)
3. Static Analysis
4. Dynamic Analysis (Behavioral Analysis)
5. Reverse Engineering

4.2 OSINT - IoCs

- Is the file `Form.exe` malicious?
- What it is doing?

```
    ls —l  Form.exe                                                  189952  Form.exe
   md5sum  Form.exe                               a8371cb187d99711691ccbecf8f35657
  sha1sum  Form.exe                       8dec32121d2f9f876c2b157451968796608d3dd5
sha256sum  Form.exe  784560f38065089f1c61869f7ebdc58b0115d500e5113e6c09d1b4d885ccb340
```



56 / 70 Community Score

ⓘ 56/70 security vendors flagged this file as malicious

Reanalyze · Similar · More

784560f38065089f1c61869f7ebdc58b0115d500e5113e6c09d1b4d885ccb340
784560f38065089f1c61869f7ebdc58b0115d500e5113e6c09d1b4d885ccb340.exe

peexe · checks-user-input · detect-debug-environment

Size: 185.50 KB

Last Analysis Date: 15 minutes ago

EXE

DETECTION · DETAILS · RELATIONS · ASSOCIATIONS · BEHAVIOR · COMMUNITY 4

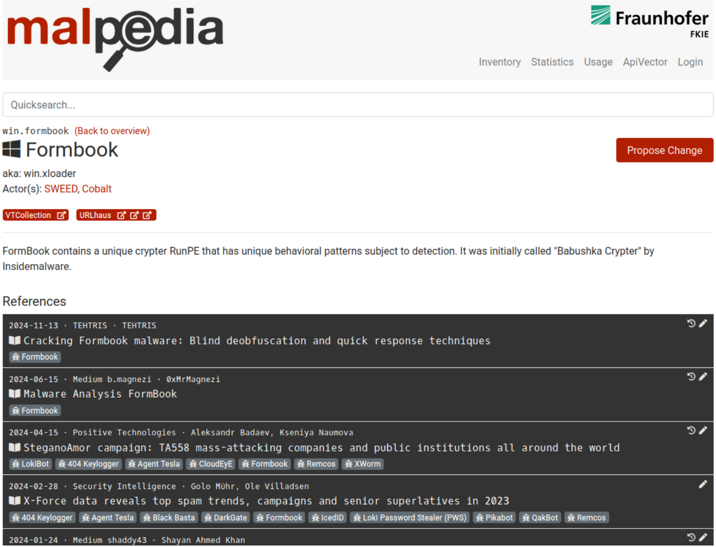
Join our Community and enjoy additional community insights and crowdsourced detections, plus an API key to **automate checks.**

Popular threat label ⓘ trojan.formbook/razy **Threat categories** trojan **Family labels** formbook razy convagent

Security vendors' analysis ⓘ Do you want to automate checks?

AhnLab-V3	ⓘ Trojan/Win.Formbook.X2184	Alibaba	ⓘ Trojan:Win32/Formbook.4912fd4c
AliCloud	ⓘ Trojan[spy]:Win/Formbook.AH	ALYac	ⓘ Gen:Variant.Ser.Razy.7042
Antiy-AVL	ⓘ Trojan[Spy]/Win32.Convagent	Arcabit	ⓘ Trojan.Ser.Razy.D1B82
Avast	ⓘ Win32:Evo-gen [Trj]	AVG	ⓘ Win32:Evo-gen [Trj]
Avira (no cloud)	ⓘ TR/Crypt.ZPACK.Gen	BitDefender	ⓘ Gen:Variant.Ser.Razy.7042
Bkav Pro	ⓘ W32.AIDetectMalware	CrowdStrike Falcon	ⓘ Win/malicious_confidence_100% (W)
CTX	ⓘ Exe.trojan.formbook	Cylance	ⓘ Unsafe
Cynet	ⓘ Malicious (score: 100)	DeepInstinct	ⓘ MALICIOUS

4.2 OSINT - Malpedia



win.formbook (Back to overview)

Formbook

aka: win.xloader

Actor(s): SWEED, Cobalt

FormBook contains a unique crypter RunPE that has unique behavioral patterns subject to detection. It was initially called "Babushka Crypter" by Insidemalware.

References

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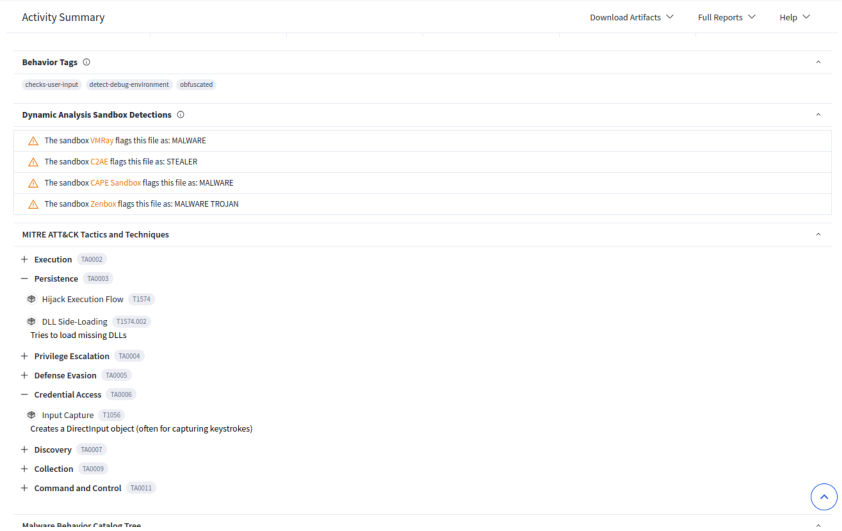
2024-01-24 · Medium shaddy43 · Shayan Ahmed Khan

4.2 OSINT - VirusTotal Details



Activity Summary

Behavior Tags

checks-user-input · detect-debug-environment · obfuscated

Dynamic Analysis Sandbox Detections

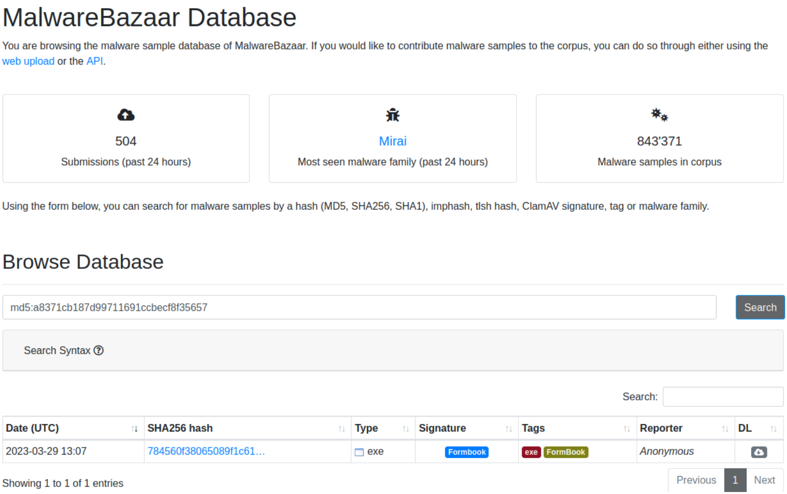
- ⚠ The sandbox VMRay flags this file as: MALWARE
- ⚠ The sandbox C2AE flags this file as: STEALER
- ⚠ The sandbox CAPE Sandbox flags this file as: MALWARE
- ⚠ The sandbox Zenbox flags this file as: MALWARE TROJAN

MITRE ATT&CK Tactics and Techniques

- + Execution TA0002
- − Persistence TA0003
  - Hijack Execution Flow T1574
  - DLL Side-Loading T1574.002
    Tries to load missing DLLs
- + Privilege Escalation TA0004
- + Defense Evasion TA0005
- − Credential Access TA0006
  - Input Capture T1056
    Creates a DirectInput object (often for capturing keystrokes)
- + Discovery TA0007
- + Collection TA0009
- + Command and Control TA0011

Malware Behavior Catalog Tree

4.2 OSINT - abuse.ch - MalwareBazaar



MalwareBazaar Database

You are browsing the malware sample database of MalwareBazaar. If you would like to contribute malware samples to the corpus, you can do so through either using the web upload or the API.

504
Submissions (past 24 hours)

Mirai
Most seen malware family (past 24 hours)

843'371
Malware samples in corpus

Using the form below, you can search for malware samples by a hash (MD5, SHA256, SHA1), imphash, tlsh hash, ClamAV signature, tag or malware family.

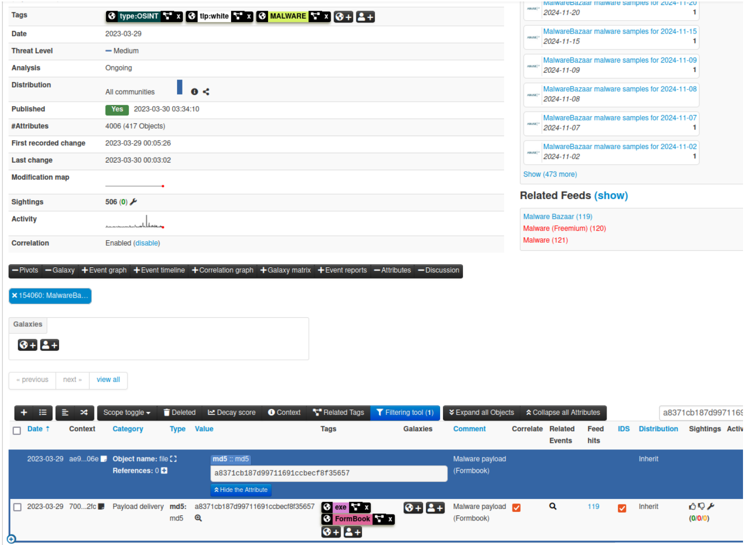
Browse Database

md5:a8371cb187d99711691ccbecf8f35657

Date (UTC)	SHA256 hash	Type	Signature	Tags	Reporter	DL
2023-03-29 13:07	784560f38065089f1c61…	exe	Formbook	exe FormBook	*Anonymous*	☁

Showing 1 to 1 of 1 entries

4.2 OSINT - MISPPriv



Tags	type:OSINT x tlp:white x MALWARE x
Date	2023-03-29
Threat Level	Medium
Analysis	Ongoing
Distribution	All communities
Published	Yes 2023-03-30 03:34:10
#Attributes	4006 (417 Objects)
First recorded change	2023-03-29 00:05:26
Last change	2023-03-30 00:03:02
Modification map	
Sightings	506 (0)
Activity	
Correlation	Enabled (disable)

MalwareBazaar malware samples for 2024-11-20 2024-11-20	1
MalwareBazaar malware samples for 2024-11-15 2024-11-15	1
MalwareBazaar malware samples for 2024-11-09 2024-11-09	1
MalwareBazaar malware samples for 2024-11-08 2024-11-08	1
MalwareBazaar malware samples for 2024-11-07 2024-11-07	1
MalwareBazaar malware samples for 2024-11-02 2024-11-02	1

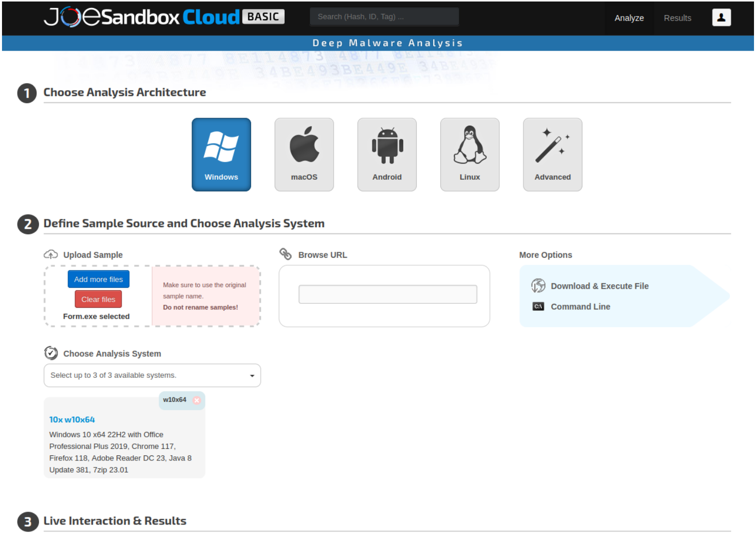
Show (473 more)

Related Feeds (show)

Malware Bazaar (119)
Malware (Freemium) (120)
Malware (121)

□	Date ↑	Context	Category	Type	Value	Tags	Galaxies	Comment	Correlate	Related Events	Feed hits	IDS	Distribution	Sightings	Activ
	2023-03-29	ae9...06e	Object name: file References: 0		md5 :: md5 a8371cb187d99711691ccbecf8f35657 Hide the Attribute			Malware payload (Formbook)					Inherit		
□	2023-03-29	700...2fc	Payload delivery	md5: md5	a8371cb187d99711691ccbecf8f35657	exe x FormBook x		Malware payload (Formbook)	☑		119	☑	Inherit	(0/0/0)	

4.3 Sandbox - Joe



JOESandbox Cloud BASIC

Search (Hash, ID, Tag) ...

Analyze Results

Deep Malware Analysis

1 Choose Analysis Architecture

2 Define Sample Source and Choose Analysis System

Upload Sample

Form.exe selected

Make sure to use the original sample name.
Do not rename samples!

Browse URL

More Options

Choose Analysis System

Select up to 3 of 3 available systems.

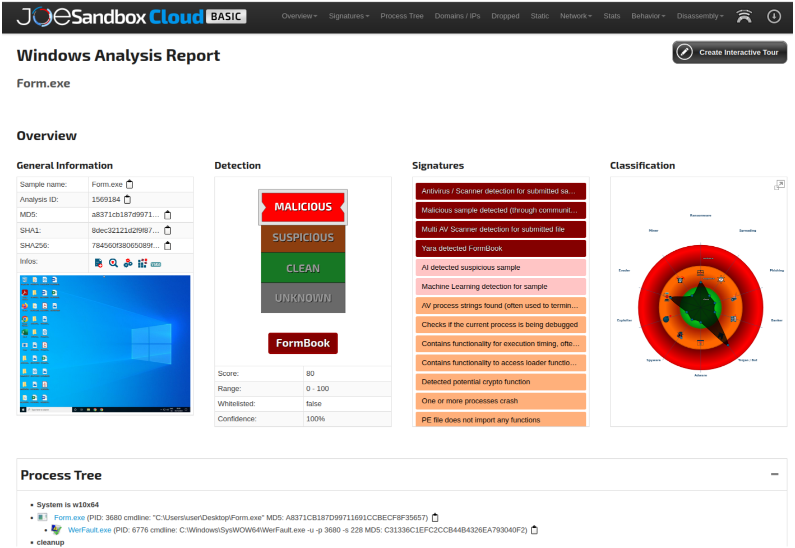
w10x64

10x w10x64

Windows 10 x64 22H2 with Office Professional Plus 2019, Chrome 117, Firefox 118, Adobe Reader DC 23, Java 8 Update 381, 7zip 23.01

3 Live Interaction & Results

4.3 Sandbox - Joe



Windows Analysis Report

Form.exe

Overview

General Information

Sample name:	Form.exe
Analysis ID:	1569184
MD5:	a8371cb187d9971…
SHA1:	8dec32121d2f9f87…
SHA256:	784560f38065089f…
Infos:	

Detection

Score:	80
Range:	0 - 100
Whitelisted:	false
Confidence:	100%

Signatures

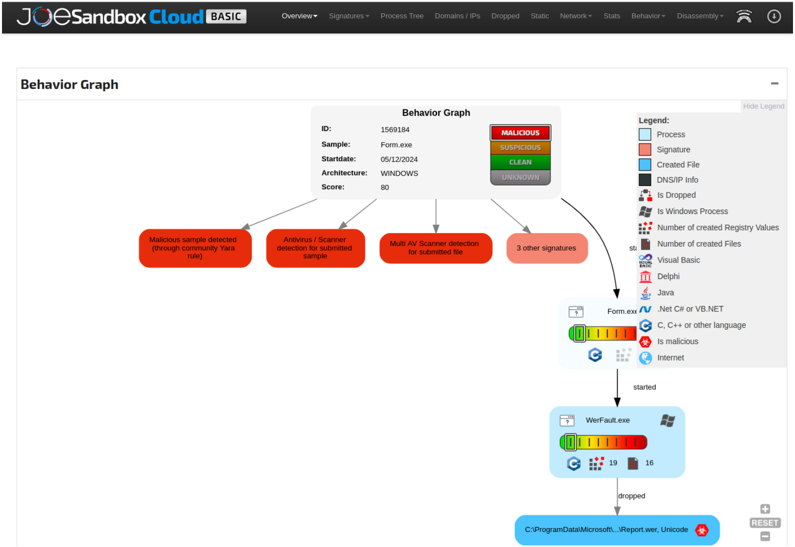
- Antivirus / Scanner detection for submitted sa…
- Malicious sample detected (through communit…
- Multi AV Scanner detection for submitted file
- Yara detected FormBook
- AI detected suspicious sample
- Machine Learning detection for sample
- AV process strings found (often used to termin…
- Checks if the current process is being debugged
- Contains functionality for execution timing, ofte…
- Contains functionality to access loader functio…
- Detected potential crypto function
- One or more processes crash
- PE file does not import any functions

Classification

Process Tree

- System is w10x64
- Form.exe (PID: 3680 cmdline: "C:\Users\user\Desktop\Form.exe" MD5: A8371CB187D99711691CCBECF8F35657)
  - WerFault.exe (PID: 6776 cmdline: C:\Windows\SysWOW64\WerFault.exe -u -p 3680 -s 228 MD5: C31336C1EFC2CCB44B4326EA793040F2)
- cleanup

4.3 Sandbox - Joe

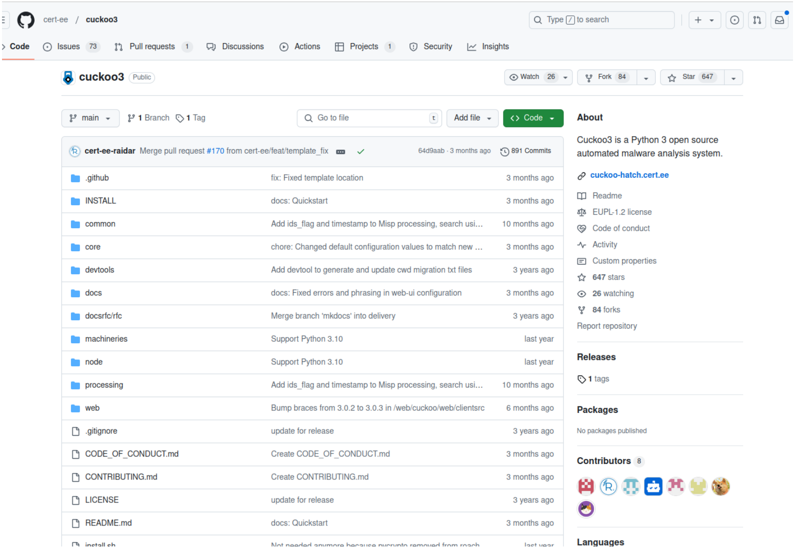


Behavior Graph

Behavior Graph

ID:	1569184
Sample:	Form.exe
Startdate:	05/12/2024
Architecture:	WINDOWS
Score:	80

4.3 Sandbox - Cuckoo3



cert-ee-raidar Merge pull request #170 from cert-ee/feat/template_fix ✓ 64d9aab · 3 months ago 891 Commits

.github	fix: Fixed template location	3 months ago
INSTALL	docs: Quickstart	3 months ago
common	Add ids_flag and timestamp to Misp processing, search usi...	10 months ago
core	chore: Changed default configuration values to match new ...	3 months ago
devtools	Add devtool to generate and update cwd migration txt files	3 years ago
docs	docs: Fixed errors and phrasing in web-ui configuration	3 months ago
docsrfc/rfc	Merge branch 'mkdocs' into delivery	3 years ago
machineries	Support Python 3.10	last year
node	Support Python 3.10	last year
processing	Add ids_flag and timestamp to Misp processing, search usi...	10 months ago
web	Bump braces from 3.0.2 to 3.0.3 in /web/cuckoo/web/clientsrc	6 months ago
.gitignore	update for release	3 years ago
CODE_OF_CONDUCT.md	Create CODE_OF_CONDUCT.md	3 months ago
CONTRIBUTING.md	Create CONTRIBUTING.md	3 months ago
LICENSE	update for release	3 years ago
README.md	docs: Quickstart	3 months ago
install.sh	Not needed anymore because pycrypto removed from roach	last year

About

Cuckoo3 is a Python 3 open source automated malware analysis system.

cuckoo-hatch.cert.ee

- Readme
- EUPL-1.2 license
- Code of conduct
- Activity
- Custom properties
- 647 stars
- 26 watching
- 84 forks

Report repository

Releases

1 tags

Packages

No packages published

Contributors 8

Languages

4.4 Static Analysis

- Malware delivery: Email
  - Office documents
  - PDF
  - .EXE
- Analyze:
  - Hash values
  - Strings
  - Resources
  - Imported functions
  - Exported functions
  - Certificate
  - .....

  → Capabilities of the malware

4.4 Static Analysis - Strings

```
pestr -n 7 Form.exe | less
```

```
!This program cannot be run in DOS mode.
<Ar5<zw1<Zv
EThis program cannot be run in DOS mode.
:Yf/yZjP
[)sk/Jo
X|e^BZ8
Rh%';,V
```

```
pescan Form.exe
```

```
file entropy:                     7.322160 (probably packed)
fpu anti-disassembly:             no
imagebase:                        normal
entrypoint:                       normal
DOS stub:                         normal
TLS directory:                    not found
timestamp:                        normal
section count:                    1 (low)
```

```
pesec Form.exe
```

```
ASLR:                             yes
DEP/NX:                           yes
SEH:                              yes
Stack cookies (EXPERIMENTAL):     yes
```

4.4 Static Analysis - PE - Portable Execution format

- Describe program files
- Contain:
  - Meta data
  - Instructions
  - Text data
  - Resources: Pictures and alike
- Tell Windows how to load a program
- Provide resources to running program
- Provide resources like code signature

```
|  1. DOS Header                               |
|  2. PE Header                                |
|  3. OPtional Header                          |
|  4. Section Headers                          |
|  5. .text Section (Program Code)             |
|  6. .idata Section (Importd Libs)            |
|  7. .rsrc Section (Strings, Images, ...)     |
|  8. .reloc Section (Memory Translation)      |
```

4.4 Static Analysis - PE - Basic Analysis

```
file Form.exe
```

```
    Form.exe: PE32 executable (GUI) Intel 80386, for MS Windows
```

```
exiftool Form.exe
```

```
    File Name                      : Form.exe
    File Size                      : 186 KiB
    .....
    File Type                      : Win32 EXE
    File Type Extension            : exe
    MIME Type                      : application/octet-stream
    Machine Type                   : Intel 386 or later, and compatibles
    Time Stamp                     : 2000:07:31 02:00:25+02:00
    Image File Characteristics     : Executable, 32-bit
    PE Type                        : PE32
    Linker Version                 : 11.0
    Code Size                      : 185856
    Initialized Data Size          : 0
    Uninitialized Data Size        : 0
    Entry Point                    : 0x12e0
    OS Version                     : 6.0
    Image Version                  : 0.0
    Subsystem Version              : 6.0
    Subsystem                      : Windows GUI
    Warning                        : Error processing PE data dictionary
```

4.4 Static Analysis - PE - Basic Analysis

```
file Quotation.exe
```

```
    Quotation.exe: PE32 executable (GUI) Intel 80386, for MS Windows
```

```
exiftool Quotation.exe
```

```
    ...
    Machine Type                    : Intel 386 or later, and compatibles
    Time Stamp                      : 2005:08:14 14:47:46+02:00
    PE Type                         : PE32
    Linker Version                  : 6.0
    Code Size                       : 647168
    Initialized Data Size           : 32768
    Uninitialized Data Size         : 0
    Entry Point                     : 0x15f4
    OS Version                      : 4.0
    Character Set                   : Unicode
    Comments                        : Natcher
    Company Name                    : Glucosazone
    Legal Copyright                 : CRUSTER3
    Legal Trademarks                : Forearming
    Product Name                    : UNKLE
    File Version                    : 1.02.0009
    Product Version                 : 1.02.0009
    Internal Name                   : Aurous
    Original File Name              : Aurous.exe
```

4.4 Static Analysis - PE - Header

```
readpe —H Form.exe
```

```
    DOS Header
        Magic number:                       0x5a4d (MZ)
        Bytes in last page:                 144
        Pages in file:                      3
        .....

    Optional/Image header
        Magic number:                       0x10b (PE32)
        Linker major version:               11
        Linker minor version:               0
        Size of .text section:              0x2d600
        Size of .data section:              0
        Size of .bss section:               0
        Entrypoint:                         0x12e0
        Address of .text section:           0x1000
        Address of .data section:           0x2f000
        ImageBase:                          0x400000
        Alignment of sections:              0x1000
        Alignment factor:                   0x200
        .....
        Size of image:                      0x2f000
        Size of headers:                    0x200
        Checksum:                           0
        Subsystem required:                 0x2 (IMAGE_SUBSYSTEM_WINDOWS_GUI)
        DLL characteristics:                0x8140
        .....
```

4.4 Static Analysis - PE - Imported Functions

```
readpe -i ../1.exe
```

```
    Library
        Name:                               COMCTL32.dll
        Functions
                Name:                               ImageList_GetDragImage
                Name:                               ImageList_Merge
                Name:                               ImageList_SetOverlayImage
                Name:                               UninitializeFlatSB
                Name:                               ImageList_DragEnter
    Library
        Name:                               OLEAUT32.dll
        Functions
            Function
                Ordinal:                            294
    Library
        Name:                               ADVAPI32.dll
        Functions
                Name:                               RegOpenKeyExA
                Name:                               MapGenericMask
                Name:                               AdjustTokenGroups
                Name:                               SetSecurityDescriptorDacl
                Name:                               GetSecurityDescriptorLength
                Name:                               StartServiceA
                Name:                               OpenServiceA
    Library
        Name:                               MSVCRT.dll
        Functions
                Name:                               _mbsspnp
```

4.4 Static Analysis - PE - Resources

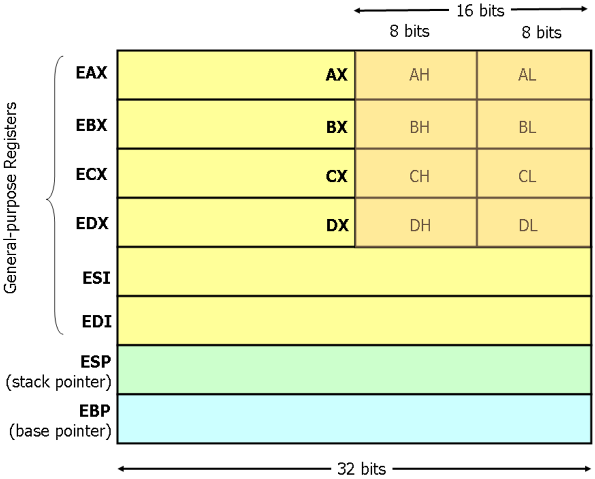
```
wrestool -l ../1.exe
```

```
--type=3 --name=23166 --language=2064 [type=icon offset=0x398cd8 size=455]
--type=3 --name=23167 --language=2064 [type=icon offset=0x398e78 size=648]
--type=3 --name=23168 --language=2064 [type=icon offset=0x398f78 size=642]
--type=3 --name=23169 --language=2064 [type=icon offset=0x399118 size=671]
--type=3 --name=23170 --language=2064 [type=icon offset=0x399358 size=1152]
--type=3 --name=23171 --language=2064 [type=icon offset=0x3995d8 size=1401]
--type=3 --name=23172 --language=2064 [type=icon offset=0x399a18 size=739]
--type=5 --name=34145 --language=2064 [type=dialog offset=0x398740 size=426]
--type=5 --name=34146 --language=2064 [type=dialog offset=0x3988f0 size=382]
--type=5 --name=34147 --language=2064 [type=dialog offset=0x398a70 size=562]
--type=9 --name=44061 --language=2064 [type=accelerator offset=0x3986e8 size=88]
--type=0 --name=5676 --language=2064 [offset=0x398ca8 size=11]
--type=0 --name=5677 --language=2064 [offset=0x398cb8 size=30]
--type=0 --name=5678 --language=2064 [offset=0x399c58 size=219344]
--type=0 --name=5679 --language=2064 [offset=0x3cf528 size=3852]
--type=14 --name=63607 --language=2064 [type=group_icon offset=0x398e60 size=20]
--type=14 --name=63608 --language=2064 [type=group_icon offset=0x398f60 size=20]
--type=14 --name=63609 --language=2064 [type=group_icon offset=0x399100 size=20]
--type=14 --name=63610 --language=2064 [type=group_icon offset=0x399340 size=20]
--type=14 --name=63611 --language=2064 [type=group_icon offset=0x3995c0 size=20]
--type=14 --name=63612 --language=2064 [type=group_icon offset=0x399a00 size=20]
--type=14 --name=63613 --language=2064 [type=group_icon offset=0x399c40 size=20]
```

4.4 Static Analysis - Considerations

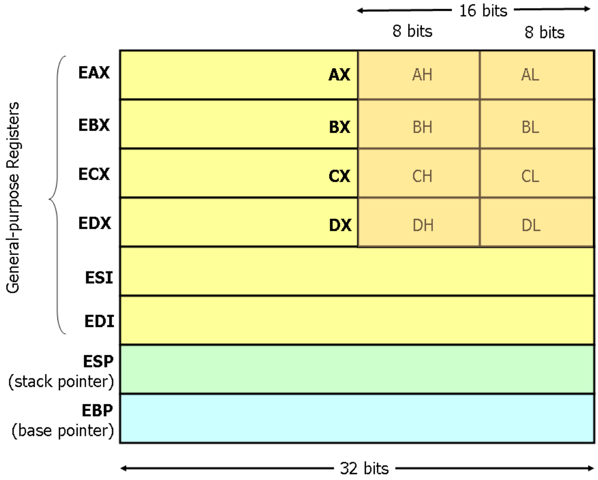
- Perfect disassembly → Unsolved problem
- Linear disassembly
  - Identify the program code
  - Decode the bytes
- Linear disassembly limitations
  - Don't know how instructions get decoded by CPU
  - Could not counter fight obfuscation
- Obfuscation techniques
  - Packing
  - Resource Obfuscation
  - Anti-Disassembly
  - Dynamic Data Download
- Counter fight obfuscation
  - Dynamic Analysis
  - Run malware in isolated environment

4.5 x86 Assembly: General-Purpose Registers



https://www.cs.virginia.edu/ evans/cs216/guides/x86.html

4.5 x86 Assembly: Stack and Control Flow Registers



https://www.cs.virginia.edu/ evans/cs216/guides/x86.html

4.5 x86 Assembly: Instructions

```
Arithmetic:      add ebx, 100        Adds 100 to the value in EBX
                 sub ecx, 123        Substract 123 from the value in ECX
                 inc ah              Increments value in AH by 1
                 dec al              Decrements value in AL by 1

Data Movement:   mov eax, ebx        Move value in EBX into register EAX
                 mov eax, [0x4711]   Move value at memory 0x4711 intp EAX
                 mov eax, 1          Move the value 1 into register EAX
                 mov [0x4711], eax   Move value of EAX into memory 0x4711

Stack:           push 1              Increment ESP; Store 1 on top of stack
                 pop eax             Store highest value in EAX; Decrement ESP

Control Flow:    call [address]      1. Put EIP on top of the stack
                                     2. Put [address] into EIP
                 ret                 1. Popped top of teh stack into EIP
                                     2. Resume execution
                 jmp 0x1234          Start executing progamm code at 0x1234
                 cmp eax, 100        1. Compares value in EAX with 100
                                     2. Based on result set EFLAGS register
                 jge 0x1234          1. Interpret EFLAGS register
                                     2. If 'greater' or 'equal' flag then jump
```

4.5 x86 Assembly: Control Flow Graphs

```
start:              Symbol for address of next instruction
mov eax, 3          Initialize a counter of 3 into EAX

loop:               Symbol for address of next instruction
sub eax, 1          Substract 1 from value in EAX
cmp 0, eax          Compare value in EAX with 0; Set EFLAGS
jne $loop           IF EFLAGS 'not equal' jump to 'loop'

end:                Symbol for address of next instruction
mov eax, 12
```

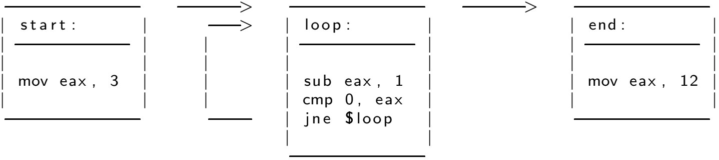
.

4.5 x86 Assembly: Control Flow Graphs

```
start:              Symbol for address of next instruction
mov eax, 3          Initialize a counter of 3 into EAX

loop:               Symbol for address of next instruction
sub eax, 1          Substract 1 from value in EAX
cmp 0, eax          Compare value in EAX with 0; Set EFLAGS
jne $loop           IF EFLAGS 'not equal' jump to 'loop'

end:                Symbol for address of next instruction
mov eax, 12
```



```
start:
mov eax, 3
```

```
loop:
sub eax, 1
cmp 0, eax
jne $loop
```

```
end:
mov eax, 12
```

.

CIRCL FORENSICS Training

5. Analysing files

5.1 Analysing files

- Standard Linux commands

  ```
  file
  strings
  exiftool
  md5sum, sha1sum
  7z
  ```

  .....

- Dedicated tools

  ```
  oledump.py
  pdfid.py, pdf-parser.py
  VirusTotal tools
  ```

  .....

- Exercise: Run `exiftool` on carving recovered documents

5.2 Analysing files

- Online resources

  NSRL - National Software Reference Library
  VirusTotal
  CIRCL: DMA
  CIRCL: MISP Threat Sharing Platform

- Demo: Search MD5

  ```
  A479C4E7ED87AEDAFAD7D9936DC80115
  81e9036aed5502446654c8e5a1770935
  ```

- Analysing files could become a training on it's own

5.2 Analysing files: Outlook PST

1. Preparation:

```
sudo mount -o ro,offset=$((512*63)) nps-2008-jean.raw /media/sansforensics/casenps/
mkdir outlook
mkdir outlook/out
```

2. Copy .pst file

```
cp /media/sansforensics/casenps/Documents\ and\ Settings/Jean/Local\ Settings/
        Application\ Data/Microsoft/Outlook/outlook.pst outlook/.
```

3. Extract Emails

```
file outlook/outlook.pst
    outlook/outlook.pst: Microsoft Outlook email folder (<=2002)


readpst outlook/outlook.pst -o outlook/out/


cd outlook/out/
ls
    Inbox.mbox   Outbox.mbox   'Sent Items.mbox'
```

5.2 Analysing files: Outlook PST

```
4. Analyze Emails

less Sent\ Items.mbox

    I've attached the information that you have requested to this email message.
    .....
    .....
   -----Original Message-----
    From: alison@m57.biz [mailto:tuckgorge@gmail.com]
    Sent: Sunday, July 20, 2008 2:23 AM
    To: jean@m57.biz
    Subject: Please send me the information now
    .....
    Hi, Jean.
    I'm sorry to bother you, but I really need that information now --
    .....
   ----boundary-LibPST-iamunique-1836211713_-_-
        filename="m57biz.xls"


less Inbox.mbox

    From "tuckgorge@gmail.com" Sun Jul 20 01:22:45 2008
    X-Original-To: jean@m57.biz
    To: jean@m57.biz
    From: tuckgorge@gmail.com (alison@m57.biz)
```

CIRCL FORENSICS Training

6. Live Response

6.1 Volatile Data

- Memory dump
- Live analysis:
  - → System time
  - → Logged-on users
  - → Open files
  - → Network -connections -status
  - → Process information -memory
  - → Process / port mapping
  - → Clipboard content
  - → Services
  - → Command history
  - → Mapped drives / shares
  - → !!! Do not store information on the subject system !!!
- Image of live system (Possible issues)
- Shutdown and image if possible

6.1 Collecting Volatile Data

```
https://docs.microsoft.com/en-us/sysinternals/
```

- System Time

```
> date /t & time /t        # Don't foget to note wall-clock-time
    Tue 03/26/2019           # Note timezone of PC
    01:31 PM
```

- Loggedon Users

```
> net session

> .\PsLoggedon.exe
    Users logged on locally:
        3/26/2019 1:30:23 PM      John-PC\John
    No one is logged on via resource shares.

> .\logonsessions.exe
    [5] Logon session 00000000:0001ad9d:
        User name:    John-PC\John
        Auth package: NTLM
        Logon type:   Interactive
        Session:      1
        Sid:          S-1-5-21-3031575581-801213887-4188682232-1001
        Logon time:   3/26/2019 1:30:23 PM
        Logon server: JOHN-PC
```

6.1 Collecting Volatile Data

- Open Files

```
> net file
```

```
> .\psfile.exe
```

- Network Connections and Status

```
> netstat -anob
    Proto  Local Address        Foreign Address       State          PID     RpcSs
    TCP    0.0.0.0:135          0.0.0.0:0             LISTENING      696     [svchost.exe]
    TCP    0.0.0.0:445          0.0.0.0:0             LISTENING      4
    TCP    0.0.0.0:554          0.0.0.0:0             LISTENING      2504    [wmpnetwk.exe]
    TCP    0.0.0.0:10243        0.0.0.0:0             LISTENING      4
    TCP    0.0.0.0:49152        0.0.0.0:0             LISTENING      364     [wininit.exe]

> netstat -rn
    Network Destination          Netmask            Gateway          Interface   Metric
              0.0.0.0            0.0.0.0           10.0.2.2          10.0.2.15       10
             10.0.2.0      255.255.255.0          On-link            10.0.2.15      266
            10.0.2.15    255.255.255.255          On-link            10.0.2.15      266

> ipconfig /all
```

6.1 Collecting Volatile Data

- Running Processes

```
> tasklist
   Image Name                    PID Session Name        Session#    Mem Usage
   ========================= ======== ================ =========== ============
   System                          4 Services                   0        600 K
   smss.exe                      252 Services                   0        792 K
   csrss.exe                     328 Services                   0      3,224 K
   wininit.exe                   364 Services                   0      3,316 K
   csrss.exe                     372 Console                    1      4,196 K
   winlogon.exe                  400 Console                    1      6,272 K
   services.exe                  460 Services                   0      6,628 K
   lsass.exe                     468 Services                   0      8,428 K
   lsm.exe                       476 Services                   0      3,040 K
   svchost.exe                   584 Services                   0      6,596 K
   cmd.exe                      3100 Console                    1      2,480 K

> tasklist /svc
   Image Name                    PID Services
   ========================= ======== ============================================
   svchost.exe                   584 DcomLaunch, PlugPlay, Power
   svchost.exe                   696 RpcEptMapper, RpcSs
   svchost.exe                   792 Audiosrv, Dhcp, eventlog,
                                     HomeGroupProvider, lmhosts, wscsvc
   svchost.exe                   844 AudioEndpointBuilder, CscService,
                                     HomeGroupListener, Netman, TrkWks, UxSms,
   svchost.exe                   876 EventSystem, fdPHost, FontCache, netprofm,
                                     nsi, WdiServiceHost
```

6.1 Collecting Volatile Data

- Running Processes

```
> .\pslist.exe −x

> .\pslist.exe −t
    Name                                    Pid Pri Thd  Hnd      VM      WS    Priv
    explorer                               1252   8  26  912  212044   47672   36304
      VBoxTray                              360   8  12  153   61384    5624    1476
      cmd                                   548   8   1   24   29256    2564    2628
        pslist                             3452  13   1  123   45908    3640    1652
      WzPreloader                          1244   8   6  119  109748    9064   11224
      cmd                                  3100   8   1   20   27464    2480    1804

> .\Listdlls.exe

> .\handle.exe
```

- Processes/Port Mapping

```
> .\tcpvcon −n −c −a
    TCP,svchost.exe,692,LISTENING,0.0.0.0,0.0.0.0
    TCP,System,4,LISTENING,10.0.2.15,0.0.0.0
    TCP,wmpnetwk.exe,2428,LISTENING,0.0.0.0,0.0.0.0
    TCP,wininit.exe,364,LISTENING,0.0.0.0,0.0.0.0
    TCP,svchost.exe,776,LISTENING,0.0.0.0,0.0.0.0
    TCP,svchost.exe,896,LISTENING,0.0.0.0,0.0.0.0
    TCP,services.exe,460,LISTENING,0.0.0.0,0.0.0.0
```

6.1 Collecting Volatile Data

- Command History

```
> doskey /history
    netstat -anob
    .\Listdlls.exe
    .\handle.exe
    .\tcpvcon -n -c -a
    cls
    doskey /history
```

- Processes/Port Mapping

6.2 Non Volatile Data

- Clear Pagefile at shutdown

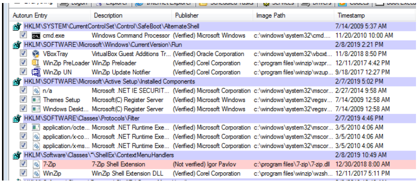
```
> reg QUERY "HKLM\SYSTEM\CurrentControlSet\Control\Session Manager\Memory Management"
    .....
    ClearPageFileAtShutdown     REG_DWORD     0x0
    .....
```

- Update Last Access disabled

```
> reg QUERY "HKLM\SYSTEM\CurrentControlSet\Control\FileSystem"
    .....
    NtfsDisableLastAccessUpdate     REG_DWORD     0x0
    .....
```

- Autostart locations

```
> .\Autoruns.exe
```



Autorun Entry	Description	Publisher	Image Path	Timestamp
HKLM\SYSTEM\CurrentControlSet\Control\SafeBoot\AlternateShell				7/14/2009 5:37 AM
☑ cmd.exe	Windows Command Processor	(Verified) Microsoft Windows	c:\windows\system32\cmd....	11/20/2010 10:00 AM
HKLM\SOFTWARE\Microsoft\Windows\CurrentVersion\Run				2/8/2019 2:21 PM
☑ VBoxTray	VirtualBox Guest Additions Tr...	(Verified) Oracle Corporation	c:\windows\system32\vboxt...	11/8/2018 8:50 PM
☑ WinZip PreLoader	WinZip Preloader	(Verified) Corel Corporation	c:\program files\winzip\wzpr...	12/11/2017 4:42 PM
☑ WinZip UN	WinZip Update Notifier	(Verified) Corel Corporation	c:\program files\winzip\wzup...	9/18/2017 12:27 PM
HKLM\SOFTWARE\Microsoft\Active Setup\Installed Components				2/7/2019 5:02 PM
☑ n/a	Microsoft .NET IE SECURIT...	(Verified) Microsoft Corporation	c:\windows\system32\mscor...	2/27/2014 9:58 AM
☑ Themes Setup	Microsoft(C) Register Server	(Verified) Microsoft Windows	c:\windows\system32\regsv...	7/14/2009 12:58 AM
☑ Windows Deskt...	Microsoft(C) Register Server	(Verified) Microsoft Windows	c:\windows\system32\regsv...	7/14/2009 12:58 AM
HKLM\SOFTWARE\Classes\Protocols\Filter				2/7/2019 4:46 PM
☑ application/octe...	Microsoft .NET Runtime Exe...	(Verified) Microsoft Corporation	c:\windows\system32\mscor...	3/5/2010 4:06 AM
☑ application/x-co...	Microsoft .NET Runtime Exe...	(Verified) Microsoft Corporation	c:\windows\system32\mscor...	3/5/2010 4:06 AM
☑ application/x-ms...	Microsoft .NET Runtime Exe...	(Verified) Microsoft Corporation	c:\windows\system32\mscor...	3/5/2010 4:06 AM
HKLM\Software\Classes\*\ShellEx\ContextMenuHandlers				2/8/2019 10:49 AM
☑ 7-Zip	7-Zip Shell Extension	(Not verified) Igor Pavlov	c:\program files\7-zip\7-zip.dll	12/30/2018 8:00 AM
☑ WinZip	WinZip Shell Extension DLL	(Verified) Corel Corporation	c:\program files\winzip\wzsh...	12/11/2017 5:11 PM

6.3 Across the network

- Get Nmap command-line zipfile

  `https://nmap.org/download.html`

- On Linux set up a netcat listener

```
nc -k -l 9999 >> logfile.txt
```

- Sending from subject system

```
ncat aaa.bbb.ccc.ddd 9999

echo "Date and Time" | ncat.exe aaa.bbb.ccc.ddd 9999
date /t | ncat.exe aaa.bbb.ccc.ddd 9999
time /t | ncat.exe aaa.bbb.ccc.ddd 9999
echo "————————————" | ncat.exe aaa.bbb.ccc.ddd 9999
```

CIRCL FORENSICS Training

7. Memory Forensics

7.1 About Memory Forensics

- History
  - 2005: String search
  - → EProcess structures
- Finding EProcess structures
  - Find the doubly linked list (ntoskrnl.exe)
  - Brute Force searching
- Information expected
  - Processes (hidden)
  - Services (listening)
  - Malware
  - Network connections
  - Registry content
  - Passwords
  - Cleartext data

7.2 Capturing memory

- Prepare USB device

  File system: ExFAT; NTFS

  Executable capturing tool

  No installation - Little impact as possible

  Write capture on device

  Administrator privileges required

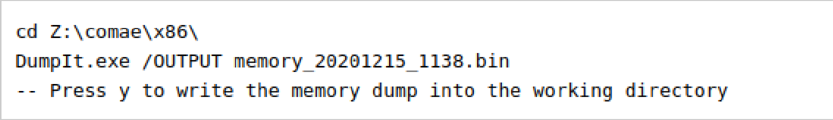
- Capture memory from running system

  DumpIt.exe

  `DumpIt.exe` part of Comae-Toolkit

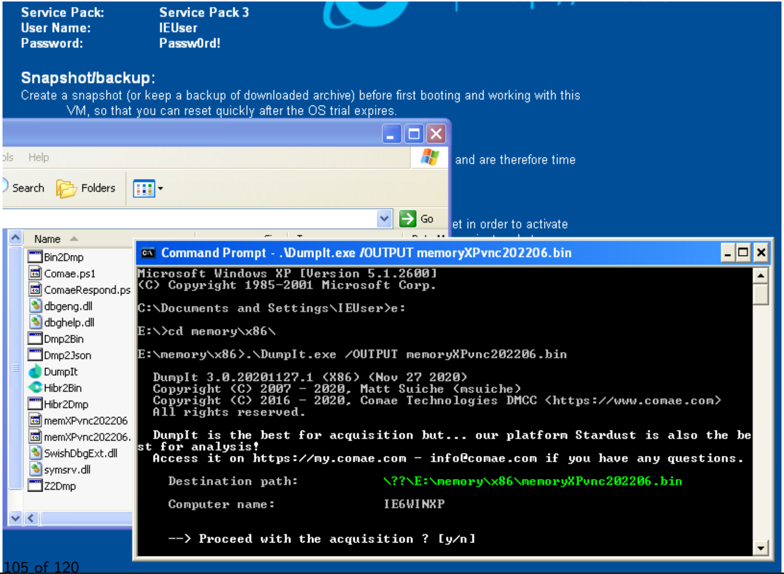
  `https://www.comae.com/`

  `https://github.com/Crypt2Shell/Comae-Toolkit/`



```
cd Z:\comae\x86\
DumpIt.exe /OUTPUT memory_20201215_1138.bin
-- Press y to write the memory dump into the working directory
```

7.2 Capturing memory



Service Pack: Service Pack 3
User Name: IEUser
Password: Passw0rd!

Snapshot/backup:
Create a snapshot (or keep a backup of downloaded archive) before first booting and working with this VM, so that you can reset quickly after the OS trial expires.

and are therefore time

et in order to activate

```
Microsoft Windows XP [Version 5.1.2600]
(C) Copyright 1985-2001 Microsoft Corp.

C:\Documents and Settings\IEUser>e:

E:\>cd memory\x86\

E:\memory\x86>.\DumpIt.exe /OUTPUT memoryXPvnc202206.bin

  DumpIt 3.0.20201127.1 (X86) (Nov 27 2020)
  Copyright (C) 2007 - 2020, Matt Suiche (msuiche)
  Copyright (C) 2016 - 2020, Comae Technologies DMCC <https://www.comae.com>
  All rights reserved.

  DumpIt is the best for acquisition but... our platform Stardust is also the be
st for analysis!
  Access it on https://my.comae.com - info@comae.com if you have any questions.

    Destination path:           \??\E:\memory\x86\memoryXPvnc202206.bin

    Computer name:              IE6WINXP


    --> Proceed with the acquisition ? [y/n]
```

7.2 Capturing memory

- Hibernation file: `hiberfil.sys`

  Created when going into hibernation mode

  Fully fleded memory content

  Compressed and slightly modified

  Can be converted into raw memory dump

  Force hibernation:

  ```
  powercfg /h[ibernate] [on|off]
  psshutdown -h
  ```

- Pagefile: `pagefile.sys`

- Swapfile: `swapfile.sys` (Windows 8)

- Crash dump: `memory.dmp` (Blue Screen)

7.3 BulkExtractor Exercise

1. Preparation

```
sudo mount -o ro,offset=$((512*2048)) circl-dfir.dd /media/case1

mkdir memory
mkdir memory/out

cp /media/case1/memory/* memory
cd memory
```

2. BulkExtractor

```
bulk_extractor -o out/ DEMO-PC-20180315-160249.raw
```

3. Investigate results

```
ls -lh out/

less out/url_histogram.txt
less out/email_histogram.txt
less out/aes_keys.txt
```

7.4 Volatility Overview

Volatility 2 or Volatility 3

```
python vol.py -h | less
python vol.py -info | less

     ...
     imagecopy          Copies a physical address space out as a raw DD image
     imageinfo          Identify information for the image
     ...
     pslist             Print all running processes by following the EPROCESS lists
     psscan             Scan Physical memory for _EPROCESS pool allocations
     pstree             Print process list as a tree
     psxview            Find hidden processes with various process listings
     ...
     sockets            Print list of open sockets
     sockscan           Scan Physical memory for _ADDRESS_OBJECT objects (tcp sockets)
     ...
```

```
vol.py -f <filename> <plugin [options]> --profile=<profile>
vol.py -f memdump.raw imageinfo
```

```
sudo apt install python3-pefile
git clone https://github.com/volatilityfoundation/volatility3.git
```

7.4 Volatility Overview: Exercise

Identify profile:

```
vol.py −f DEMO−PC−20180315−160249.raw imageinfo

      Suggested Profile(s) : Win7SP1x86_23418, Win7SP0x86, Win7SP1x86_24000, Win7SP1x86
                 AS Layer1 : IA32PagedMemory (Kernel AS)
                 AS Layer2 : FileAddressSpace (memory/DEMO−PC−20180315−160249.raw)
                  PAE type : No PAE
                       DTB : 0x185000L
                      KDBG : 0x82954c70L
      Number of Processors : 1
  Image Type (Service Pack) : 1
            KPCR for CPU 0 : 0x82955d00L
         KUSER_SHARED_DATA : 0xffdf0000L
       Image date and time : 2018−03−15 16:02:54 UTC+0000
  Image local date and time : 2018−03−15 17:02:54 +0100


   —> vol.py −f <filename> <plugin [options]> —profile=Win7SP1x86_23418


export VOLATILITY_PROFILE=Win7SP1x86_23418

   —> vol.py −f <filename> <plugin [options]>
```

7.5 Volatility: Process Analysis

`pslist`

- Running processes
- Process IP - PID
- Parent PIP - PPID
- Start time

`pstree`

- Like `pslist`
- Visual child-parent relation

`psscan`

- Brute Force
- Find inactive and/or hidden processes

`psxview`

- Run and compare some tests
- Correlate `psscan` and `pslist`

7.5 Volatility: Process Analysis

```
volatility --profile=Win7SP1x86 -f Win-Enc-20190415.raw pslist > pslist.txt
```

```
 Offset(V)  Name                    PID   PPID  Thds     Hnds   Ses  Wow64 Start
 ---------- -------------------- ------ ------ ------ -------- ------ ------ ------------------------------
0x84233af0 System                    4      0     70      505 ------      0 2019-04-15 15:02:52 UTC+0000
0x848d8288 smss.exe                248      4      2       29 ------      0 2019-04-15 15:02:52 UTC+0000
0x8487a700 csrss.exe               324    308      9      384      0      0 2019-04-15 15:02:54 UTC+0000
0x84fbb530 csrss.exe               360    352      7      274      1      0 2019-04-15 15:02:54 UTC+0000
0x84fc3530 wininit.exe             368    308      3       77      0      0 2019-04-15 15:02:54 UTC+0000
0x84fd0530 winlogon.exe            396    352      4      112      1      0 2019-04-15 15:02:54 UTC+0000
0x85048a18 services.exe            456    368      8      203      0      0 2019-04-15 15:02:55 UTC+0000
0x8505ac00 lsass.exe               464    368      7      580      0      0 2019-04-15 15:02:55 UTC+0000
0x8505caa0 lsm.exe                 472    368     10      145      0      0 2019-04-15 15:02:55 UTC+0000
...
...
...
0x85050b60 WmiPrvSE.exe           3268    564      9      175      0      0 2019-04-15 15:06:52 UTC+0000
0x8438bd40 owxxb-a.exe            3432   3368     15      471      1      0 2019-04-15 15:07:13 UTC+0000
0x84394030 VSSVC.exe              3676    456      6      123      0      0 2019-04-15 15:07:22 UTC+0000
0x84394488 svchost.exe            3728    456      6       70      0      0 2019-04-15 15:07:23 UTC+0000
0x84a243c8 notepad.exe            3820   3432      1       64      1      0 2019-04-15 15:08:05 UTC+0000
0x846d8030 iexplore.exe           3832   3432     19      427      1      0 2019-04-15 15:08:06 UTC+0000
0x846d2d40 iexplore.exe           3908   3832     11      293      1      0 2019-04-15 15:08:07 UTC+0000
0x846e5a58 dllhost.exe            3928    564      6       94      1      0 2019-04-15 15:08:07 UTC+0000
0x84684d40 dllhost.exe            4012    564     10      212      1      0 2019-04-15 15:08:08 UTC+0000
```

7.5 Volatility: Process Analysis

```
volatility —profile=Win7SP1x86 –f Win–Enc–20190415.raw psxview > psxview
```

```
 Offset(P)  Name              PID pslist psscan thrdproc pspcid csrss session deskthrd
---------- ---------------- ------ ------ ------ -------- ------ ----- ------- --------
.....
.....
0x3f60f030 taskhost.exe      352 True   True   True     True   True  True    True
0x3fa84d40 dllhost.exe      4012 True   True   True     True   True  True    True
0x3ec23148 spoolsv.exe      1296 True   True   True     True   True  True    True
0x3f63f470 explorer.exe      920 True   True   True     True   True  True    True
0x3ff0bd40 owxxb–a.exe      3432 True   True   True     True   True  True    True
0x3f3d0530 winlogon.exe      396 True   True   True     True   True  True    True
0x3f3c3530 wininit.exe       368 True   True   True     True   True  True    True
0x3ec9f030 svchost.exe       688 True   True   True     True   True  True    True
0x3ef3d758 VBoxTray.exe     1832 True   True   True     True   True  True    True
0x3fae5a58 dllhost.exe      3928 True   True   True     True   True  True    True
0x3ec50b60 WmiPrvSE.exe     3268 True   True   True     True   True  True    True
0x3ec88b90 svchost.exe       564 True   True   True     True   True  True    True
0x3ecd3768 svchost.exe       820 True   True   True     True   True  True    True
0x3ef4f030 SearchIndexer.   2008 True   True   True     True   True  True    True
0x3ec08d40 svchost.exe      1444 True   True   True     True   True  True    True
0x3ed10d40 svchost.exe      1008 True   True   True     True   True  True    True
0x3f6243c8 notepad.exe      3820 True   True   True     True   True  True    True
0x3ecd95f8 svchost.exe       852 True   True   True     True   True  True    True
0x3fad2d40 iexplore.exe     3908 True   True   True     True   True  True    True
.....
.....
```

7.6 Volatility: Network Analysis

- Windows XP and 2003 Server
  - `connections`
  - `connscan`
  - `sockets`
- Windwos 7
  - `netscan`

```
volatility --profile=Win7SP1x86 -f Win-Enc-20190415.raw netscan > netscan.txt
```

```
Proto    Local Address          Foreign Address       State            Pid     Owner
.....
UDPv4    0.0.0.0:0              *:*                                    2748    powershell.exe
UDPv6    :::0                   *:*                                    2748    powershell.exe
TCPv4    0.0.0.0:49155          0.0.0.0:0             LISTENING         456    services.exe
TCPv4    0.0.0.0:49156          0.0.0.0:0             LISTENING         464    lsass.exe
TCPv6    :::49156               :::0                  LISTENING         464    lsass.exe
TCPv4    10.0.2.15:49167        2.17.201.11:80        ESTABLISHED      1128    svchost.exe
TCPv4    10.0.2.15:49166        93.184.220.29:80      ESTABLISHED      1128    svchost.exe
TCPv4    10.0.2.15:49165        50.62.124.1:80        ESTABLISHED      3432    owxxb-a.exe
TCPv4    10.0.2.15:49160        216.239.32.21:80      ESTABLISHED      3432    owxxb-a.exe
TCPv4    10.0.2.15:49162        2.17.201.8:80         ESTABLISHED      3432    owxxb-a.exe
TCPv4    10.0.2.15:49168        13.107.21.200:80      ESTABLISHED      3832    iexplore.exe
TCPv4    10.0.2.15:49159        94.23.7.52:80         CLOSE_WAIT       2748    powershell.exe
.....
```

7.7 Volatility: Other plugins

- Other useful plugins

```
volatility -f memdump.raw sessions
volatility -f memdump.raw privs
volatility -f memdump.raw hivelist
volatility -f memdump.raw filescan
volatility -f memdump.raw timeline
volatility -f memdump.raw hashdump
```

- Get SIDs

```
volatility --profile=Win7SP1x86 -f Win-Enc-20190415.raw getsids

  powershell.exe (2748): S-1-5-21-3408732720-2018246097-660081352-1000 (John)
  owxxb-a.exe (3432): S-1-5-21-3408732720-2018246097-660081352-1000 (John)
  notepad.exe (3820): S-1-5-21-3408732720-2018246097-660081352-1000 (John)
  iexplore.exe (3832): S-1-5-21-3408732720-2018246097-660081352-1000 (John)
  iexplore.exe (3908): S-1-5-21-3408732720-2018246097-660081352-1000 (John)
  dllhost.exe (3928): S-1-5-21-3408732720-2018246097-660081352-1000 (John)
```

7.7 Volatility: Other plugins

- Command line history

```
vol.py ——profile=Win7SP1x86 −f memdump.raw cmdline
vol.py ——profile=Win7SP1x86 −f memdump.raw cmdscan
vol.py ——profile=Win7SP1x86 −f memdump.raw consoles
```

- Find suspicious processes

```
volatility ——profile=Win7SP1x86 −f Win—Enc−20190415.raw malfind

 Process: owxxb—a.exe Pid: 3432 Address: 0×400000
 Vad Tag: VadS Protection: PAGE_EXECUTE_READWRITE
 Flags: CommitCharge: 134, MemCommit: 1, PrivateMemory: 1, Protection: 6

 0×00400000  4d 5a 90 00 03 00 00 00 04 00 00 00 ff ff 00 00   MZ..............
 0×00400010  b8 00 00 00 00 00 00 00 40 00 00 00 00 00 00 00   ........@.......
 0×00400020  00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00   ................
 0×00400030  00 00 00 00 00 00 00 00 00 00 00 00 08 01 00 00   ................

 0×00400000 4d              DEC EBP
 0×00400001 5a              POP EDX
 0×00400002 90              NOP
```

7.8 Volatility Exercise

```
python volatility3/vol.py -q --help | less
mkdir out2


python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.pslist >out2/pslist
python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.pstree >out2/pstree
python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.psscan >out2/psscan
python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.psxview >out2/psxvie


python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.netscan.NetScan >out


python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.dumpfiles.DumpFiles
python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.filescan.FileScan >


python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw timeliner > out2/timeliner


python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.registry.hivelist.H


python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.consoles.Consoles >
python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.cmdline.CmdLine > ou
python volatility3/vol.py -q -f ./DEMO-PC-20180315-160249.raw windows.cmdline.CmdScan > ou
```

CIRCL FORENSICS Training

8. Bibliography and Outlook

8.1 Bibliography

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  Harlan Carvey
  Syngress 2nd edition
  ISBN-13: 978-1-59-749422-9

- Windows Forensics

  Dr. Philip Polstra
  CreateSpace Independent Publishing
  ASIN: B01K3RPWIY

- Windows Forensic Analysis for Windows 7 3E

  Harlan Carvey
  Syngress
  ISBN-13: 978-1-59-749727-5

8.2 Outlook

- Scheduled Tasks
- Windows 8 analyzis
- Windows 10 analyzis
- Internet artifacts
- Mobile Forensics

Overview

1. Windows Registry
2. Event Logs
3. Other Sources of Information
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5. Analysing files
6. Live Response
7. Memory Forensics
8. Bibliography and Outlook