Analyze mémoire

Mars 2023

Agenda

- Motivation
- Collecte mémoire (sources et outils)
- Principes d’analyse sous Windows et Linux
- Volatility pour l’analyse d’empreintes windows
  - Processes
  - Noyau
  - Réseau

Agenda

- 9h30 – 11h : cours
- 11h : test Volatility 3
- 13h30 – 15h10 : analyse de dumps
- 15h10 : QCM

Pourquoi?

- Obtenir de l’information sur le système en cours d’exécution, sans passer par l’API système:
  - Processus et fils d’exécution (Thread)
  - Connections réseau en cours
  - Secrets: mot de passe, clés cryptographiques …
  - Fichiers ouverts
  - Registre Windows, journaux systèmes
- Détection des rootkits
  - Pour s’exécuter, un malware doit être présent en mémoire, non protégé par un packer ou de l’offuscation
  - Certains malware ne se trouvent qu’en mémoire

Sources de mémoire volatile

- Mémoire vive
- Fichier d’hibernation (%systemdrive%/hiberfil.sys)
- Fichier de pagination (%systemdrive%/pagefile.sys)
- Crash Dump

- Fichier mémoire des machines virtuelles
  - VMware (.vmem), Hyper-V (.bin), Parallels (.mem), VirtualBox (.sav)

Préserver au mieux l’état du système

Mémoire volatile,
donc à collecter en premier. Garder le câble réseau branché si possible (connections réseau).

Eviter de polluer le système,
donc ne pas installer l’outil de collecte

Ne pas modifier la mémoire persistante,
donc ne pas stocker l’image mémoire sur le disque dur

⇒ Outils à exécuter depuis un périphérique amovible, et
y stocker l’image,
ou transférer l’image par le réseau,
à condition de chiffrer le contenu au vol

Acquisition de la mémoire

Gratuits pour un usage non commercial:

- FTK Imager (AccessData)
- winpmem

Gratuit

- DumpIt (Magnet)

DumpIt (windows)

https://www.magnetforensics.com/resources/magnet-dumpit-for-windows

By Matthieu Suiche

Très simple d'utilisation

- Mettre l'outil sur une clé USB d'une taille > à la taille de la mémoire à collecter
- Exécuter l'outil avec les droits administrateur

```
Pour DumpIt 3: dumpit /T RAW /N /Q
```

FTK Imager

https://www.exterro.com/ftk-imager

Fonctionnalités:

- Interface graphique
- Permet aussi la collecte d'image disque
- Conversion de formats
- « montage » de partition
- Collecte de fichiers protégés (Registre)

Linux

AVML (Microsoft) :

https://github.com/microsoft/avml

Dumpit

https://github.com/MagnetForensics/dumpit-linux

Arsenal Recon Image Mounter

Pour le montage d’image bitlocker

https://arsenalrecon.com/downloads

Find strings in memory

1. Extract strings
   - Strings by sysinternals (ascii and unicode)
   - Strings (GNU binutils)

2. Use grep for keywords

3. BulkExtractor
   https://github.com/simsong/bulk_extractor

Retrouver les objets du système d’exploitation

1. Trouver la structure Kernel Debugger Data Block (KDBG), pointée by Kernel Processor Control Region (KPCR)
2. Trouvez la liste des processus en cours d’execution (EPROCESS)
3. Trouvez les Process Environment Block (PEB) qui décrivent les processus: ligne de commande, régions mémoire, …

The Volatility framework

- Ecrit en Python, open source, portable
- Pour analyser Windows, Linux, Mac OS
- API et système de Plug-ins
  https://github.com/volatilityfoundation/volatility/wiki/Command-Reference
- Historique:
  - Ancêtres: DFRWS 2005, FATKit, Volatools
  - Volatility 1.1.1 (Win XP SP2, 08/2007)
  - Volatility 2.0 (Win7, Win2008, 32bits, 08/2011)
  - Volatility 2.2 (Linux support, 10/2012)
  - Volatility 2.4 (Win8/Win2012/Mavericks Support, 08/2014)
  - Volatility 2.6 (Win10 improvements, Server 2016)
  - Volatility 3.0 (2019)

using Volatility: pslist

```
K:\afti_forensic>volatility-2.4.standalone.exe -f "i:\winxp_sp3\Windows XP Professional-3940642f.vmem"
--profile=WinXPSP3x86 pslist

Volatility Foundation Volatility Framework 2.4
Offset(V)  Name                    PID   PPID   Thds     Hnds   Sess  Wow64 Start                          Exit
---------- -------------------- ------ ------ ------ -------- ------ ------ ------------------------------ ------------------------------
0x823c8830 System                    4      0     46      194 ------      0
0x820679e8 smss.exe                552      4      3       17 ------      0 2014-12-20 20:53:52 UTC+0000
0x81f39930 csrss.exe               616    552      8      232      0      0 2014-12-20 20:53:54 UTC+0000
0x82206020 winlogon.exe            640    552     22      281      0      0 2014-12-20 20:53:54 UTC+0000
0x81f18020 services.exe            684    640     18      246      0      0 2014-12-20 20:53:54 UTC+0000
0x81e4f020 lsass.exe               696    640     22      296      0      0 2014-12-20 20:53:54 UTC+0000
0x82135880 vmacthlp.exe            852    684      2       26      0      0 2014-12-20 20:53:54 UTC+0000
0x821f5da0 svchost.exe             864    684      7      123      0      0 2014-12-20 20:53:54 UTC+0000
0x81f016e8 svchost.exe             936    684     10      185      0      0 2014-12-20 20:53:54 UTC+0000
0x822ca390 svchost.exe            1028    684     29      406      0      0 2014-12-20 20:53:55 UTC+0000
0x81f1a020 svchost.exe            1076    684      4       56      0      0 2014-12-20 20:53:55 UTC+0000
0x81f5b998 svchost.exe            1136    684      3       76      0      0 2014-12-20 20:53:56 UTC+0000
0x8214f020 spoolsv.exe            1468    684      6       51      0      0 2014-12-20 20:53:57 UTC+0000
0x82282020 userinit.exe           1568    640      2       45      0      0 2014-12-20 20:53:57 UTC+0000
0x81f06a80 explorer.exe           1588   1568     19      333      0      0 2014-12-20 20:53:57 UTC+0000
0x82011980 vmtoolsd.exe           1692   1588      1       52      0      0 2014-12-20 20:53:58 UTC+0000
0x82011da0 ctfmon.exe             1716   1588      1       75      0      0 2014-12-20 20:53:58 UTC+0000
```

using Volatility: Linux profiles

Problème:

Il existe des dizaines de versions du kernel Linux
et des centaines de configurations possibles

Comment créer un profil Linux depuis une clé USB:

- Linux memory grabber (Hal Pomeranz)
  https://github.com/halpomeranz/lmg

Bonus, le script *lmg* effectue aussi la capture avec LiME:

- Linux Memory Extractor (Joe Sylve)
  https://github.com/504ensicsLabs/LiME

Mettre System.map et module.dwarf dans une archive .zip (ubuntu-14041.zip) dans volatility/plugins/overlays/linux/

using Volatility: linux_pslist

```
forensics@ubuntu:~/volatility$ python vol.py -f ubuntu-2014-12-21_11.54.35-memory.lime
--profile=Linuxubuntu-14041x64 linux_pslist

Volatility Foundation Volatility Framework 2.4
Offset             Name            Pid   Uid   Gid  DTB              StartTime
0xffff88003dbd0000 init                1 0     0          0x3d2d0000 0
0xffff88003dbd17f0 kthreadd            2 0     0                -0x1 0
0xffff88003dbd2fe0 ksoftirqd/0         3 0     0                -0x1 0
0xffff88003dbd47d0 kworker/0:0         4 0     0                -0x1 0
0xffff88003dbd5fc0 kworker/0:0H        5 0     0                -0x1 0
0xffff88003dbf97f0 rcu_sched           7 0     0                -0x1 0
0xffff88003dbfafe0 rcuos/0             8 0     0                -0x1 0
0xffff88003dbfc7d0 rcuos/1             9 0     0                -0x1 0
0xffff88003dbfdfc0 rcuos/2            10 0     0                -0x1 0
…
0xffff88003669afe0 bash            18388 1000  1000       0x3bee0000 0
0xffff880039a45fc0 gedit           18459 1000  1000        0xad54000 0
0xffff88003668dfc0 kworker/u128:0  18468 0     0                -0x1 0
0xffff88003bed97f0 kworker/u128:2  18584 0     0                -0x1 0
0xffff88003c2397f0 kworker/u128:3  18929 0     0                -0x1 0
0xffff88003b5edfc0 sudo            18968 0     1000       0x3b15d000 0
0xffff88003a290000 lmg             18969 0     0          0x3b6db000 0
0xffff88000010dfc0 insmod          18988 0     0          0x3c3b6000 0
0xffff8800001097f0 systemd-udevd   18989 0     0          0x3c2d3000 0
```

using Volatility: linux_netstat

```
forensics@ubuntu:~/volatility$ python vol.py -f ubuntu-2014-12-21_11.54.35-memory.lime
--profile=Linuxubuntu-14041x64 linux_netstat|grep -i tcp

Volatility Foundation Volatility Framework 2.4
TCP      127.0.1.1       :   53 0.0.0.0         :    0 LISTEN                    dnsmasq/1134
TCP      ::1             :54643 ::1             :    0 CLOSE_WAIT           cups-browsed/1170
TCP      ::1             :54644 ::1             :    0 CLOSE_WAIT        indicator-print/2083
TCP      ::1             :  631 ::              :    0 LISTEN                      cupsd/2365
TCP      127.0.0.1       :  631 0.0.0.0         :32792 LISTEN                      cupsd/2365
TCP      192.168.182.132 :42356 91.189.92.11    :    0 CLOSE_WAIT        unity-scope-hom/3068
TCP      192.168.182.132 :56406 91.189.92.10    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :42219 91.189.92.11    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :56408 91.189.92.10    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :42221 91.189.92.11    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :56410 91.189.92.10    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :42223 91.189.92.11    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :56412 91.189.92.10    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :42645 91.189.92.23    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :42225 91.189.92.11    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :42642 91.189.92.23    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :35596 91.189.92.24    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :35594 91.189.92.24    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :42647 91.189.92.23    :    0 CLOSE_WAIT             gvfsd-http/3146
TCP      192.168.182.132 :42643 91.189.92.23    :    0 CLOSE_WAIT             gvfsd-http/3146
```

Volatility: processes

Pslist: énumère les process « comme Windows ».
Ne trouve pas les process « cachés »

```
Volatility Foundation Volatility Framework 2.4
Offset(V)  Name                    PID   PPID   Thds     Hnds   Sess  Wow64 Start                          Exit
---------- -------------------- ------ ------ ------ -------- ------ ------ ------------------------------ ------------------------------
0x823c8830 System                    4      0     46      194 ------      0
0x820679e8 smss.exe                552      4      3       17 ------      0 2014-12-20 20:53:52 UTC+0000
0x81f39930 csrss.exe               616    552      8      232      0      0 2014-12-20 20:53:54 UTC+0000
0x82206020 winlogon.exe            640    552     22      281      0      0 2014-12-20 20:53:54 UTC+0000
0x81f18020 services.exe            684    640     18      246      0      0 2014-12-20 20:53:54 UTC+0000
0x81e4f020 lsass.exe               696    640     22      296      0      0 2014-12-20 20:53:54 UTC+0000
0x82135880 vmacthlp.exe            852    684      2       26      0      0 2014-12-20 20:53:54 UTC+0000
```

Pstree: hiérarchie des process

```
Name                                                  Pid   PPid   Thds   Hnds Time
-------------------------------------------------- ------ ------ ------ ------ ----
 0x823c8830:System                                      4      0     58    276 1970-01-01 00:00:00 UTC+0000
. 0x820679e8:smss.exe                                 552      4      3     19 2014-12-20 20:53:52 UTC+0000
.. 0x82206020:winlogon.exe                            640    552     18    322 2014-12-20 20:53:54 UTC+0000
... 0x81f08ac8:wpabaln.exe                           1220    640      1     67 2015-01-25 18:35:52 UTC+0000
... 0x81f18020:services.exe                           684    640     17    355 2014-12-20 20:53:54 UTC+0000
.... 0x8227ec38:vmtoolsd.exe                          172    684      8    283 2014-12-20 20:54:14 UTC+0000
.... 0x8223dda0:imapi.exe                            1804    684      5    116 2015-01-24 15:03:21 UTC+0000
.... 0x822ca390:svchost.exe                          1028    684     77   1476 2014-12-20 20:53:55 UTC+0000
..... 0x8228fd30:wuauclt.exe                          836   1028      8    178 2015-01-25 18:35:51 UTC+0000
```

Volatility: processes (2)

Psxview: énumère les process via plusieurs méthodes et compare les résultats
Permet de lister les process « cachés » ou ceux terminés

```
Offset(P)  Name                    PID pslist psscan thrdproc pspcid csrss session deskthrd ExitTime
---------- -------------------- ------ ------ ------ -------- ------ ----- ------- -------- --------
0x02335880 vmacthlp.exe            852 True   True   True     True   True  True    True
0x02211980 vmtoolsd.exe           1692 True   True   True     True   True  True    True
0x0234f020 spoolsv.exe            1468 True   True   True     True   True  True    True
0x024ca390 svchost.exe            1028 True   True   True     True   True  True    True
0x0215b998 svchost.exe            1136 True   True   True     True   True  True    True
0x023c8498 TPAutoConnSvc.e        2000 True   True   True     True   True  True    True
0x02206aa0 wmiprvse.exe           1352 True   True   True     True   True  True    False
0x02406020 winlogon.exe            640 True   True   True     True   True  True    True
0x023c75a8 cmd.exe                 788 True   True   True     True   True  True    True
0x01f8eb18 DumpIt.exe              204 True   True   True     True   True  True    True
0x0248fd30 wuauclt.exe             836 True   True   True     True   True  True    True
0x02211da0 ctfmon.exe             1716 True   True   True     True   True  True    True
0x0247ec38 vmtoolsd.exe            172 True   True   True     True   True  True    True
…
0x023f5da0 svchost.exe             864 True   True   True     True   True  True    True
0x0234d558 alg.exe                1064 True   True   True     True   True  True    True
0x02106a80 explorer.exe           1588 True   True   True     True   True  True    True
0x02360c10 wscntfy.exe            1356 True   True   True     True   True  True    True
0x021016e8 svchost.exe             936 True   True   True     True   True  True    False
0x0243dda0 imapi.exe              1804 True   True   True     True   True  True    True
0x02139930 csrss.exe               616 True   True   True     True   False True    True
0x025c8830 System                    4 True   True   True     True   False False   False
0x022679e8 smss.exe                552 True   True   True     True   False False   False
0x1d726008 x?=?NtFs`q??     32...8 False  False  False    False  False False    True
0x024161d0                        1672 False  True   False    False  False False   False    2015-01-25 18:37:37 UTC+0000
```

Processes, dll

dlllist: énumère les dll (bibliothèques dynamiques) importées
Permet de comprendre les fonctionnalités utilisées par le process

```
************************************************************************
csrss.exe pid:    608
Command line : C:\WINDOWS\system32\csrss.exe ObjectDirectory=\Windows SharedSection=1024,3072,512 Windows=On SubSystemType=Windows
          ServerDll=basesrv,1 ServerDll=winsrv:UserServerDllInitialization,3 ServerDll=winsrv:ConServerDllInitialization,2
          ProfileControl=Off MaxRequestThreads=16
Service Pack 2

Base             Size  LoadCount Path
---------- ---------- ---------- ----
0x4a680000     0x5000     0xffff \??\C:\WINDOWS\system32\csrss.exe
0x7c900000    0xb0000     0xffff C:\WINDOWS\system32\ntdll.dll
0x75b40000     0xb000     0xffff C:\WINDOWS\system32\CSRSRV.dll
0x75b50000    0x10000        0x3 C:\WINDOWS\system32\basesrv.dll
0x75b60000    0x4a000        0x2 C:\WINDOWS\system32\winsrv.dll
0x77d40000    0x90000        0x6 C:\WINDOWS\system32\USER32.dll
0x7c800000    0xf4000        0xe C:\WINDOWS\system32\KERNEL32.dll
0x77f10000    0x46000        0x5 C:\WINDOWS\system32\GDI32.dll
0x75e90000    0xb0000        0x1 C:\WINDOWS\system32\sxs.dll
0x77dd0000    0x9b000        0x3 C:\WINDOWS\system32\ADVAPI32.dll
0x77e70000    0x91000        0x3 C:\WINDOWS\system32\RPCRT4.dll
************************************************************************
```

dlldump: pour extraire les dll sur disque

```
python vol.py -f ~/Desktop/win7_trial_64bit.raw --profile=Win7SP0x64 dlldump –p 1068 -D dlls/
```

Processes, handles

handles: énumère les objets système liés aux process: mutant, file, token, key, process, timer, etc (31 types)

Très utile pour détecter des signes de compromission (IOC), comme les noms des mutants par exemple

```
Offset(V)     Pid     Handle     Access Type                       Details
---------- ------ ---------- ---------- -------------------------- -------
0x810b1660      4        0x4   0x1f0fff Process                    System(4)
0x810b0020      4        0x8        0x0 Thread                     TID 12 PID 4
0xe10192c0      4        0xc    0xf003f Key                        MACHINE\SYSTEM\CONTROLSET001\CONTROL\SESSION MANAGER\MEMORY MANAGEMENT\PREFETCHPARAMETERS
0xe1019880      4       0x10        0x0 Key
0xe13b4578      4       0x14    0x2001f Key                        MACHINE\SYSTEM\SETUP
0xe101d140      4       0x18    0x20019 Key                        MACHINE\HARDWARE\DESCRIPTION\SYSTEM\MULTIFUNCTIONADAPTER
…
0xe13be308      4       0x30    0x20019 Key                        MACHINE\SYSTEM\CONTROLSET001\SERVICES\EVENTLOG
0x810aa3a0      4       0x34   0x1f0003 Event                      TRKWKS_EVENT
0xff255020      4       0x88       0x28 Process                    lsass.exe(688)
0x810d0870      4       0x90   0x1f03ff Thread                     TID 96 PID 4
0xe13c50d0      4       0x94    0x20019 Key                        MACHINE\SYSTEM\CONTROLSET001\SERVICES\ACPI\PARAMETERS
0xe14cbbe0      4       0x9c    0x2001f Key                        MACHINE\HARDWARE\DEVICEMAP\SCSI\SCSI PORT 2\SCSI BUS 0\TARGET ID 0\LOGICAL UNIT ID 0
0x81045960      4       0xa0   0x1f0003 Event                      VxKernel2VoldEvent
…
0xe14c95c0      4       0xb4    0x2001f Key                        MACHINE\HARDWARE\DEVICEMAP\SCSI\SCSI PORT 2
0xe14c9020      4       0xb8    0x2001f Key                        MACHINE\HARDWARE\DEVICEMAP\SCSI
0xe14cbc48      4       0xbc    0x2001f Key                        MACHINE\HARDWARE\DEVICEMAP\SCSI\SCSI PORT 2\SCSI BUS 0\TARGET ID 0
0xe14cc5d0      4       0xc4    0xf000f Directory                  WinDfs
0xe14cb708      4       0xcc    0xf000f Directory                  Harddisk0
0x80f03db0      4      0x1dc        0x3 File                       \Device\Ip
0x80ffae30      4      0x1e0   0x1f01ff File                       \Device\RawIp\47
0x80f65400      4      0x234   0x120089 File                       \Device\Tcp
```

Filtrage par type : -t

```
python vol.py -f ~/Desktop/win7_trial_64bit.raw --profile=Win7SP0x64 handles -p 1068 -t Mutant
```

Processes, getsids

getsids: énumère les privilèges (Security Identifiers) liés aux process
Il faut identifier des processes avec des droits anormalement élevés

```
csrss.exe (608): S-1-5-18 (Local System)
csrss.exe (608): S-1-5-32-544 (Administrators)
csrss.exe (608): S-1-1-0 (Everyone)
csrss.exe (608): S-1-5-11 (Authenticated Users)
winlogon.exe (632): S-1-5-18 (Local System)
winlogon.exe (632): S-1-5-32-544 (Administrators)
winlogon.exe (632): S-1-1-0 (Everyone)
winlogon.exe (632): S-1-5-11 (Authenticated Users)
services.exe (676): S-1-5-18 (Local System)
services.exe (676): S-1-5-32-544 (Administrators)
services.exe (676): S-1-1-0 (Everyone)
services.exe (676): S-1-5-11 (Authenticated Users)
lsass.exe (688): S-1-5-18 (Local System)
lsass.exe (688): S-1-5-32-544 (Administrators)
lsass.exe (688): S-1-1-0 (Everyone)
lsass.exe (688): S-1-5-11 (Authenticated Users)
vmacthlp.exe (844): S-1-5-18 (Local System)
vmacthlp.exe (844): S-1-5-32-544 (Administrators)
vmacthlp.exe (844): S-1-1-0 (Everyone)
vmacthlp.exe (844): S-1-5-11 (Authenticated Users)
svchost.exe (856): S-1-5-18 (Local System)
svchost.exe (856): S-1-5-32-544 (Administrators)
svchost.exe (856): S-1-1-0 (Everyone)
svchost.exe (856): S-1-5-11 (Authenticated Users)
```

Mémoire des process

Memmap: affiche les zones mémoire associées à un process

```
python vol.py -f dump.mem --profile=WinXPSP2x86Memmap –p 1788

VMUpgradeHelper pid:   1788
Virtual    Physical         Size DumpFileOffset  (offset dans le fichier dump)
---------- ---------- ---------- --------------
0x00020000 0x04a58000     0x1000            0x0
0x0012a000 0x07d90000     0x1000         0x1000
0x00150000 0x07c0d000     0x1000         0x2000
0x00151000 0x077ce000     0x1000         0x3000
0x00153000 0x00fa2000     0x1000         0x4000
0x00155000 0x00e82000     0x1000         0x5000
0x0015a000 0x00ea1000     0x1000         0x6000
0x0015b000 0x007e2000     0x1000         0x7000
0x0015c000 0x07d68000     0x1000         0x8000
0x0015d000 0x00e29000     0x1000         0x9000
```

Memdump: pour extraire ces zones

```
python vol.py -f dump.mem --profile=WinXPSP2x86 -p 1788 memdump  -D out
```

Mémoire des process (2)

vaddump: parcours l’arbre de la mémoire allouée dynamiquement avec virtualalloc et sauvegarde chaque section séparemment

```
K:\afti_forensic\volatility-2.4>python vol.py -f dump.vmem --profile=WinXPSP2x86 vaddump -p 216 -D out
Volatility Foundation Volatility Framework 2.4
Pid        Process              Start      End        Result
---------- -------------------- ---------- ---------- ------
       216 alg.exe              0x00190000 0x0019ffff out\alg.exe.5f027e0.0x00190000-0x0019ffff.dmp
       216 alg.exe              0x00020000 0x00020fff out\alg.exe.5f027e0.0x00020000-0x00020fff.dmp
       216 alg.exe              0x00010000 0x00010fff out\alg.exe.5f027e0.0x00010000-0x00010fff.dmp
       216 alg.exe              0x00080000 0x00082fff out\alg.exe.5f027e0.0x00080000-0x00082fff.dmp
```

vadinfo: information détaillée sur ces zones mémoire

```
VAD node @ 0xff134d60 Start 0x00080000 End 0x00082fff Tag Vad
Flags: NoChange: 1, Protection: 1
Protection: PAGE_READONLY
ControlArea @ff245490 Segment e17ab678
NumberOfSectionReferences:          0 NumberOfPfnReferences:          0
NumberOfMappedViews:               13 NumberOfUserReferences:        13
Control Flags: Commit: 1, HadUserReference: 1
First prototype PTE: e17ab6b8 Last contiguous PTE: e17ab6c8
Flags2: Inherit: 1, SecNoChange: 1
```

Journaux système (event logs)

evtlogs: extrait les journaux systèmes. XP and 2003 only

```
python vol.py -f dump\sality.vmem --profile=WinXPSP2x86 evtlogs --save-evt -D out_

Volatility Foundation Volatility Framework 2.4
Saved raw .evt file to secevent.evt
Parsed data sent to secevent.txt
Saved raw .evt file to appevent.evt
Parsed data sent to appevent.txt
Saved raw .evt file to sysevent.evt
Parsed data sent to sysevent.txt
```

Sysevents.txt:

```
2010-06-10 12:01:43 UTC+0000|sysevent.evt|MACHINENAME|N/A|EventLog|6009|Info|5.01.;2600;
      Service Pack 2;Uniprocessor Free
2010-06-10 12:01:43 UTC+0000|sysevent.evt|MACHINENAME|N/A|EventLog|6005|Info|N/A
2010-06-10 12:02:06 UTC+0000|sysevent.evt|MACHINENAME|N/A|Serial|2|Info|\Device\Serial0;
      \Device\Serial0
2010-06-10 12:02:06 UTC+0000|sysevent.evt|MACHINENAME|N/A|Serial|2|Info|\Device\Serial1;
      \Device\Serial1
2010-06-10 16:04:44 UTC+0000|sysevent.evt|BILLY-DB5B96DD3|N/A|EventLog|6011|Info|MACHINENAME;
```

Modules noyau

modules: liste les modules noyau

```
Offset(V)  Name                 Base             Size File
---------- -------------------- ---------- ---------- ----
0x810dbe68 ntoskrnl.exe         0x804d7000   0x1f6280 \WINDOWS\system32\ntkrnlpa.exe
0x810dbe00 hal.dll              0x806ce000    0x20380 \WINDOWS\system32\hal.dll
0x810dbd98 kdcom.dll            0xfc99b000     0x2000 \WINDOWS\system32\KDCOM.DLL
0x810dbd28 BOOTVID.dll          0xfc8ab000     0x3000 \WINDOWS\system32\BOOTVID.dll
0x810dbcc0 ACPI.sys             0xfc36c000    0x2e000 ACPI.sys
0x810d6008 WMILIB.SYS           0xfc99d000     0x2000 \WINDOWS\system32\DRIVERS\WMILIB.SYS
0x810d6fa0 pci.sys              0xfc35b000    0x11000 pci.sys
0x810d6f30 isapnp.sys           0xfc49b000     0x9000 isapnp.sys
```

modscan: scan la mémoire pour trouver des modules (y compris ceux cachés, ou anciens)

```
Offset(P)          Name                 Base             Size File
------------------ -------------------- ---------- ---------- ----
0x0000000001058d80 serenum.sys          0xfc93b000     0x4000 \SystemRoot\system32\DRIVERS\serenum.sys
0x000000000105ad70 vmmemctl.sys         0xfc9f7000     0x2000 \??\C:\Program Files\VMware\VMware Tools\Drivers\memctl\
         vmmemctl.sys
0x000000000105f0c8 dump_vmscsi.sys      0xfbf36000     0x3000 \SystemRoot\System32\Drivers\dump_vmscsi.sys
0x00000000010664a8 srv.sys              0xf355d000    0x53000 \SystemRoot\system32\DRIVERS\srv.sys
0x0000000001067700 mrxdav.sys           0xf35d8000    0x2d000 \SystemRoot\system32\DRIVERS\mrxdav.sys
0x000000000106f050 rasacd.sys           0xfc174000     0x3000 \SystemRoot\system32\DRIVERS\rasacd.sys
0x000000000106f8c8 Msfs.SYS             0xfc7c3000     0x5000 \SystemRoot\System32\Drivers\Msfs.SYS
0x0000000001070e60 i8042prt.sys         0xfc53b000     0xd000 \SystemRoot\system32\DRIVERS\i8042prt.sys
0x000000000108be28 dump_scsiport.sys    0xfbf3a000     0x4000 \SystemRoot\System32\Drivers\dump_diskdump.sys
```

Table des appels système

ssdt: affiche la table des appels systèmes et quel binaire l'implémente

```
[x86] Gathering all referenced SSDTs from KTHREADs...
Finding appropriate address space for tables...
SSDT[0] at 80501030 with 284 entries
  Entry 0x0000: 0x8059849a (NtAcceptConnectPort) owned by ntoskrnl.exe
  Entry 0x0001: 0x805e5666 (NtAccessCheck) owned by ntoskrnl.exe
  Entry 0x0002: 0x805e8ec4 (NtAccessCheckAndAuditAlarm) owned by ntoskrnl.exe
  Entry 0x0003: 0x805e5698 (NtAccessCheckByType) owned by ntoskrnl.exe
  Entry 0x0004: 0x805e8efe (NtAccessCheckByTypeAndAuditAlarm) owned by ntoskrnl.exe
  Entry 0x0005: 0x805e56ce (NtAccessCheckByTypeResultList) owned by ntoskrnl.exe
  Entry 0x0006: 0x805e8f42 (NtAccessCheckByTypeResultListAndAuditAlarm) owned by ntoskrnl.exe
  Entry 0x0007: 0x805e8f86 (NtAccessCheckByTypeResultListAndAuditAlarmByHandle) owned by ntoskrnl.exe
...
SSDT[1] at bf997600 with 667 entries
  Entry 0x1000: 0xbf934ffe (NtGdiAbortDoc) owned by win32k.sys
  Entry 0x1001: 0xbf946a92 (NtGdiAbortPath) owned by win32k.sys
  Entry 0x1002: 0xbf8bf295 (NtGdiAddFontResourceW) owned by win32k.sys
  Entry 0x1003: 0xbf93e718 (NtGdiAddRemoteFontToDC) owned by win32k.sys
  Entry 0x1004: 0xbf9480a9 (NtGdiAddFontMemResourceEx) owned by win32k.sys
...
```

filtrage:

```
$ grep -v win32k.sys ssdt.txt | grep -v ntoskrnl.exe
[x86] Gathering all referenced SSDTs from KTHREADs...
Finding appropriate address space for tables...
SSDT[0] at 80501030 with 284 entries
SSDT[1] at bf997600 with 667 entries
```

Recherche d’objets système en mémoire

driverscan: recherche les structure DRIVER_OBJECT en mémoire

```
Offset(P)              #Ptr     #Hnd Start            Size Service Key          Name         Driver Name
------------------ -------- -------- ---------- ---------- -------------------- ------------ -----------
0x0000000001058388        4        0 0xfc76b000     0x6b00 Fdc                  Fdc          \Driver\Fdc
0x0000000001058e28        4        0 0xfc93b000     0x3c80 serenum              serenum      \Driver\serenum
…
0x00000000010cd5f8        4        0 0xfc211000    0x8c480 Ntfs                 Ntfs         \FileSystem\Ntfs
```

filescan: les fichiers ouverts et le type d’accès

```
Offset(P)            #Ptr   #Hnd Access Name
------------------ ------ ------ ------ ----
0x0000000000096ca0      1      0 R--r-d \Device\HarddiskVolume1\Documents and Settings\Administrator\Start Menu\Programs\
         Windows Media Player.lnk
0x0000000000353ad0      1      0 R--rwd \Device\HarddiskVolume1\WINDOWS\system32\crypt32.dll
0x0000000000353cb8      1      0 R--rwd \Device\HarddiskVolume1\WINDOWS\system32\apphelp.dll
0x00000000003f3f08      1      0 R--r-d \Device\HarddiskVolume1\WINDOWS\system32\ipconf.tsp
0x0000000000471028      4      1 RW---- \Device\HarddiskVolume1\Documents and Settings\Administrator\NTUSER.DAT
```

Et aussi
mutantscan,
symlinkscan,
thrdscan (utilisé par psxview): pour les threads
dumpfiles: trouve des sections mémoires associés à un fichier

Réseau (XP et 2003)

connections: connections TCP actives

```
Offset(V)  Local Address             Remote Address            Pid
---------- ------------------------- ------------------------- ---
0x81e87620 172.16.112.128:1038       41.168.5.140:8080         1484
```

connscan: scanne les connections TCP

```
Offset(P)  Local Address             Remote Address            Pid
---------- ------------------------- ------------------------- ---
0x01eacc00 192.168.16.129:1039       65.55.185.26:443          1068
0x01fd3170 192.168.16.129:1040       207.46.21.58:80           1068
```

sockets: sockets TCP, UDP, RAW

```
Offset(V)       PID   Port  Proto Protocol        Address         Create Time
---------- -------- ------ ------ --------------- --------------- -----------
0x81ddb780      664    500     17 UDP             0.0.0.0         2012-07-22 02:42:53 UTC+0000
0x82240d08     1484   1038      6 TCP             0.0.0.0         2012-07-22 02:44:45 UTC+0000
0x81dd7618     1220   1900     17 UDP             172.16.112.128  2012-07-22 02:43:01 UTC+0000
0x82125610      788   1028      6 TCP             127.0.0.1       2012-07-22 02:43:01 UTC+0000
0x8219cc08        4    445      6 TCP             0.0.0.0         2012-07-22 02:42:31 UTC+0000
0x81ec23b0      908    135      6 TCP             0.0.0.0         2012-07-22 02:42:33 UTC+0000
0x82276878        4    139      6 TCP             172.16.112.128  2012-07-22 02:42:38 UTC+0000
0x82277460        4    137     17 UDP             172.16.112.128  2012-07-22 02:42:38 UTC+0000
0x81e76620     1004    123     17 UDP             127.0.0.1       2012-07-22 02:43:01 UTC+0000
0x82172808      664      0    255 Reserved        0.0.0.0         2012-07-22 02:42:53 UTC+0000
0x81e3f460        4    138     17 UDP             172.16.112.128  2012-07-22 02:42:38 UTC+0000
0x821f0630     1004    123     17 UDP             172.16.112.128  2012-07-22 02:43:01 UTC+0000
```

et aussi **sockscan**

Réseau (Vista et +)

netscan: connections TCP et UDP actives

```
K:\afti_forensic\volatility-2.4>python vol.py -f 20150106-214021.raw --profile=Win7SP1x64 netscan

Offset(V)  Local Address             Remote Address           Pid
Offset(P)          Proto    Local Address                  Foreign Address      State            Pid      Owner          Created
0x4df1a10          UDPv4    0.0.0.0:50505                  *:*                                   2652     svchost.exe    2015-01-06 21:34:26 UTC+0000
0x4df1a10          UDPv6    :::50505                       *:*                                   2652     svchost.exe    2015-01-06 21:34:26 UTC+0000
0x3d646c70         UDPv4    0.0.0.0:5355                   *:*                                   416      svchost.exe    2015-01-06 21:35:16 UTC+0000
0x3d647ec0         UDPv4    127.0.0.1:1900                 *:*                                   2652     svchost.exe    2015-01-06 21:35:13 UTC+0000
0x3d64bc90         UDPv4    0.0.0.0:5355                   *:*                                   416      svchost.exe    2015-01-06 21:35:16 UTC+0000
0x3d64bc90         UDPv6    :::5355                        *:*                                   416      svchost.exe    2015-01-06 21:35:16 UTC+0000
0x3dd22d20         UDPv4    0.0.0.0:3702                   *:*                                   2652     svchost.exe    2015-01-06 21:35:18 UTC+0000
0x3dd22d20         UDPv6    :::3702                        *:*                                   2652     svchost.exe    2015-01-06 21:35:18 UTC+0000
0x3dd23350         UDPv4    0.0.0.0:0                      *:*                                   416      svchost.exe    2015-01-06 21:35:13 UTC+0000
0x3dd23350         UDPv6    :::0                           *:*                                   416      svchost.exe    2015-01-06 21:35:13 UTC+0000
0x3d654cf0         TCPv4    192.168.1.42:139               0.0.0.0:0            LISTENING        4        System
0x3d827480         TCPv4    0.0.0.0:5357                   0.0.0.0:0            LISTENING        4        System
0x3d827480         TCPv6    :::5357                        :::0                 LISTENING        4        System
0x3d8cc010         TCPv4    0.0.0.0:49156                  0.0.0.0:0            LISTENING        536      lsass.exe
0x3d8cc010         TCPv6    :::49156                       :::0                 LISTENING        536      lsass.exe
0x3d8dfd70         TCPv4    0.0.0.0:49156                  0.0.0.0:0            LISTENING        536      lsass.exe
0x3da1c7b0         TCPv4    0.0.0.0:49154                  0.0.0.0:0            LISTENING        888      svchost.exe
0x3dbe6340         TCPv4    0.0.0.0:49155                  0.0.0.0:0            LISTENING        528      services.exe
0x3dbe7af0         TCPv4    0.0.0.0:49155                  0.0.0.0:0            LISTENING        528      services.exe
0x3dbe7af0         TCPv6    :::49155                       :::0                 LISTENING        528      services.exe
0x3dbef1b0         TCPv4    0.0.0.0:445                    0.0.0.0:0            LISTENING        4        System
0x3dbef1b0         TCPv6    :::445                         :::0                 LISTENING        4        System
0x3dc94aa0         TCPv4    0.0.0.0:135                    0.0.0.0:0            LISTENING        712      svchost.exe
0x3dc98820         TCPv4    0.0.0.0:135                    0.0.0.0:0            LISTENING        712      svchost.exe
0x3dc98820         TCPv6    :::135                         :::0                 LISTENING        712      svchost.exe
0x3dc9ec60         TCPv4    0.0.0.0:49152                  0.0.0.0:0            LISTENING        420      wininit.exe
0x3dc9ec60         TCPv6    :::49152                       :::0                 LISTENING        420      wininit.exe
0x3dcb5930         TCPv4    0.0.0.0:49152                  0.0.0.0:0            LISTENING        420      wininit.exe
0x3dcff830         TCPv4    0.0.0.0:49153                  0.0.0.0:0            LISTENING        760      svchost.exe
0x3dcff830         TCPv6    :::49153                       :::0                 LISTENING        760      svchost.exe
0x3dcaecf0         TCPv6    -:0                            e8a9:e702:80fa:ffff:e8a9:e702:80fa:ffff:0 CLOSED           1        ???????
0x3dd55200         TCPv4    -:0                            56.139.242.2:0       CLOSED           1004     svchost.exe
0x3e151650         TCPv4    0.0.0.0:49153                  0.0.0.0:0            LISTENING        760      svchost.exe
0x3e19f010         TCPv4    0.0.0.0:49154                  0.0.0.0:0            LISTENING        888      svchost.exe
0x3e19f010         TCPv6    :::49154                       :::0                 LISTENING        888      svchost.exe
0x3e198500         TCPv4    -:0                            56.139.242.2:0       CLOSED           2
0x3fa5a010         UDPv4    127.0.0.1:50327                *:*                                   2284     iexplore.exe   2015-01-06 21:36:55 UTC+0000
0x3faafae0         UDPv4    127.0.0.1:65250                *:*                                   1396     iexplore.exe   2015-01-06 21:37:00 UTC+0000
0x3fae2670         UDPv4    127.0.0.1:54923                *:*                                   2328     iexplore.exe   2015-01-06 21:36:46 UTC+0000
```

Registre

hivelist: liste les ruches présentes en mémoire et le fichier associé

```
Virtual    Physical   Name
---------- ---------- ----
0xe1c49008 0x036dc008 \Device\HarddiskVolume1\Documents and Settings\LocalService\Local Settings\Application Data\Microsoft\Windows\UsrClass.da
0xe1c41b60 0x04010b60 \Device\HarddiskVolume1\Documents and Settings\LocalService\NTUSER.DAT
0xe1a39638 0x021eb638 \Device\HarddiskVolume1\Documents and Settings\NetworkService\Local Settings\Application Data\Microsoft\Windows\UsrClass
0xe1a33008 0x01f98008 \Device\HarddiskVolume1\Documents and Settings\NetworkService\NTUSER.DAT
0xe153ab60 0x06b7db60 \Device\HarddiskVolume1\WINDOWS\system32\config\software
0xe1542008 0x06c48008 \Device\HarddiskVolume1\WINDOWS\system32\config\default
0xe1537b60 0x06ae4b60 \SystemRoot\System32\Config\SECURITY
0xe1544008 0x06c4b008 \Device\HarddiskVolume1\WINDOWS\system32\config\SAM
0xe13ae580 0x01bbd580 [no name]
0xe101b008 0x01867008 \Device\HarddiskVolume1\WINDOWS\system32\config\system
0xe1008978 0x01824978 [no name]
0xe1e158c0 0x009728c0 \Device\HarddiskVolume1\Documents and Settings\Administrator\Local Settings\Application Data\Microsoft\Windows\UsrClass.
0xe1da4008 0x00f6e008 \Device\HarddiskVolume1\Documents and Settings\Administrator\NTUSER.DAT
```

printkey: permet l’affichage d’une valeur de clé de registre. Ex: printkey -K "Microsoft\Security Center\Svc"

```
Volatility Foundation Volatility Framework 2.4
Legend: (S) = Stable   (V) = Volatile

----------------------------
Registry: \Device\HarddiskVolume1\WINDOWS\system32\config\software
Key name: Svc (S)
Last updated: 2010-08-15 17:43:26 UTC+0000

Subkeys:

Values:
REG_DWORD     AntiVirusOverride : (S) 1
REG_DWORD     AntiVirusDisableNotify : (S) 1
REG_DWORD     FirewallDisableNotify : (S) 1
REG_DWORD     FirewallOverride : (S) 1
REG_DWORD     UpdatesDisableNotify : (S) 1
REG_DWORD     UacDisableNotify : (S) 1
```

Registre, actions utilisateurs

userassist: lancement des applications

```
REG_BINARY    %windir%\system32\cmd.exe :
Count:          2
Focus Count:    3
Time Focused:   0:03:04.659000
Last updated:   2015-01-06 21:35:51 UTC+0000
0x00000000  00 00 00 00 02 00 00 00 03 00 00 00 5f cf 02 00   ............_...
0x00000010  00 00 80 bf 00 00 80 bf 00 00 80 bf 00 00 80 bf   ................
0x00000020  00 00 80 bf 00 00 80 bf 00 00 80 bf 00 00 80 bf   ................
0x00000030  00 00 80 bf 00 00 80 bf ff ff ff ff 60 8a 7b be   ............`.{.
0x00000040  f8 29 d0 01 00 00 00 00                           .)......

REG_BINARY    %windir%\explorer.exe :
Count:          1
Focus Count:    3
Time Focused:   0:00:33.464000
Last updated:   2015-01-06 21:36:08 UTC+0000
0x00000000  00 00 00 00 01 00 00 00 03 00 00 00 c4 80 00 00   ................
0x00000010  00 00 80 bf 00 00 80 bf 00 00 80 bf 00 00 80 bf   ................
0x00000020  00 00 80 bf 00 00 80 bf 00 00 80 bf 00 00 80 bf   ................
0x00000030  00 00 80 bf 00 00 80 bf ff ff ff ff 60 3e 22 c8   ............`>".
0x00000040  f8 29 d0 01 00 00 00 00                           .)......
```

shellbags: parcours de l'arborescence des fichiers avec Windows Explorer (ici `–output=body`)

```
Scanning for registries....
Gathering shellbag items and building path tree...
0|[SHELLBAGS FILE_ENTRY] Name: Users/Attrs: RO, DIR/FullPath: C:\Users/Registry: \??\C:\Users\forensics\AppData\Local\Microsoft\
          Windows\UsrClass.dat /Key: Local Settings\Software\Microsoft\Windows\Shell\BagMRU\1\0/LW: 2015-01-06 21:35:39 UTC+0000|
          0|---------------|0|0|0|1419103052|1419103052|1247541610|1247541610
0|[SHELLBAGS FILE_ENTRY] Name: forensics/Attrs: DIR/FullPath: C:\Users\forensics /Registry: \??\C:\Users\forensics\AppData\Local\Microsoft\
          Windows\UsrClass.dat /Key: Local Settings\Software\Microsoft\Windows\Shell\BagMRU\1\0\0/LW: 2015-01-06 21:35:44 UTC+0000|
          0|---------------|0|0|0|1419103124|1419103124|1419103052|1419103052
```

Système de fichiers, MFT

mftparser: extrait la MFT de la mémoire (ici `–output=body`)

```
python vol.py -f dump.vmem --profile=WinXPSP3x86 mftparser --output=body
> mftparser.txt
```

```
Scanning for MFT entries and building directory, this can take a while
0|[MFT FILE_NAME] SYSTEM~1\_RESTO~1\RP15\snapshot\_R62E7~1 (Offset: 0x1400)|11745|---a-----c-I---|
       0|0|0|1281506955|1281506955|1281506955|1281506955
0|[MFT STD_INFO] SYSTEM~1\_RESTO~1\RP15\snapshot\_R62E7~1 (Offset: 0x1400)|11745|---a-----c-I---|
       0|0|0|1281506955|1281506955|1281506955|1281506955
0|[MFT FILE_NAME] SYSTEM~1\_RESTO~1\RP15\snapshot\_REGISTRY_MACHINE_SYSTEM (Offset: 0x1400)|11745|---a-----c
       0|0|0|1281506955|1281506955|1281506955|1281506955
0|[MFT FILE_NAME] SYSTEM~1\_RESTO~1\RP15\snapshot\_R25B6~1 (Offset: 0x1800)|11746|---a-----c-I---|
       0|0|0|1281506956|1281506956|1281506956|1281506956
0|[MFT STD_INFO] SYSTEM~1\_RESTO~1\RP15\snapshot\_R25B6~1 (Offset: 0x1800)|11746|---a-----c-I---|
       0|0|0|1281506956|1281506956|1281506956|1281506956
```

```
c:\sleuthkit-4.1.2-win32\bin\mactime.pl –b mftparser.txt > mftparser_tl.txt
```

```
Thu Jan 06 2011 15:36:56    70144 ..c. ---a----------- 0        0        55741    [MFT STD_INFO]
Documents and Settings\Administrator\Desktop\A977C3~1.EXE (Offset: 0x1b084400)
Thu Jan 06 2011 15:37:00     7680 .a.. ---a----------- 0        0        2031     [MFT STD_INFO]
WINDOWS\system32\rasadhlp.dll (Offset: 0x2442c00)
Thu Jan 06 2011 15:37:01        0 .a.. ---a----------- 0        0        100969   [MFT STD_INFO]
Documents and Settings\Administrator\Cookies\AD6E43~1.TXT (Offset: 0xed6e400)
```

timeliner

timeliner: clacrée une supertime regroupant des informations de nombreux plugin

```
                                0 m... --------------- 0        0        0        [THREAD] System PID: 4/TID: 12
                                0 .acb --------------- 0        0        0        [THREAD] csrss.exe PID: 608/TID: 616
                                0 .acb --------------- 0        0        0        [THREAD] csrss.exe PID: 608/TID: 620
                                0 .acb --------------- 0        0        0        [THREAD] csrss.exe PID: 608/TID: 624
                                0 .acb --------------- 0        0        0        [THREAD] csrss.exe PID: 608/TID: 628
                                0 .acb --------------- 0        0        0        [THREAD] csrss.exe PID: 608/TID: 640
                                0 .acb --------------- 0        0        0        [THREAD] csrss.exe PID: 608/TID: 644
                                0 .acb --------------- 0        0        0        [THREAD] csrss.exe PID: 608/TID: 648
                                0 .acb --------------- 0        0        0        [THREAD] winlogon.exe PID: 632/TID: 636
Wed Aug 11 2010 08:06:24        0 macb --------------- 0        0        0        [Handle (Key)] MACHINE\SOFTWARE\MICROSOFT\WINDOWS NT\CURRENTVERSION\
           WINLOGON svchost.exe PID: 856/PPID: 676/POffset: 0x0115b8d8
                                0 macb --------------- 0        0        0        [Handle (Key)] MACHINE\SOFTWARE\MICROSOFT\WINDOWS NT\CURRENTVERSION\
           WINLOGON winlogon.exe PID: 632/PPID: 544/POffset: 0x066f0978
                                0 macb --------------- 0        0        0        [Handle (Key)] MACHINE\SOFTWARE\MICROSOFT\WINDOWS NT\CURRENTVERSION\
           WINLOGON\CREDENTIALS winlogon.exe PID: 632/PPID: 544/POffset: 0x066f0978

Wed Aug 11 2010 08:06:35        0 macb --------------- 0        0        0        [Handle (Key)] MACHINE\SYSTEM\CONTROLSET001\SERVICES\LANMANSERVER\
           PARAMETERS svchost.exe PID: 1028/PPID: 676/POffset: 0x01122910
                                0 .acb --------------- 0        0        0        [PROCESS] vmtoolsd.exe PID: 1668/PPID: 676/POffset: 0x069d5b28
                                0 macb --------------- 0        0        0        [SOCKET] LocalIP: 0.0.0.0:0/Protocol: 255(Reserved) PID: 688/
           POffset: 0x0x06237b70
                                0 macb --------------- 0        0        0        [SOCKET] LocalIP: 0.0.0.0:4500/Protocol: 17(UDP) PID: 688/
           POffset: 0x0x069d5250
                                0 macb --------------- 0        0        0        [SOCKET] LocalIP: 0.0.0.0:500/Protocol: 17(UDP) PID: 688/
           POffset: 0x0x05f44008
…
Sun Aug 15 2010 19:38:54        0 macb --------------- 0        0        0        [SOCKET] LocalIP: 0.0.0.0:1048/Protocol: 6(TCP) PID: 1028/POffset: 0x0x04be3c
                                0 macb --------------- 0        0        0        [SOCKET] LocalIP: 127.0.0.1:1047/Protocol: 17(UDP) PID: 1028/POffset: 0x0x061
Sun Aug 15 2010 19:39:06        0 m... --------------- 0        0        0        [THREAD] svchost.exe PID: 1028/TID: 532
Sun Aug 15 2010 19:39:34        0 m... --------------- 0        0        0        [THREAD] svchost.exe PID: 1028/TID: 1692
Sun Aug 15 2010 19:39:40        0 m... --------------- 0        0        0        [THREAD] lsass.exe PID: 688/TID: 740
…
Sun Aug 15 2010 19:43:26        0 macb --------------- 0        0        0        [Handle (Key)] MACHINE\SOFTWARE\MICROSOFT\SECURITY CENTER svchost.exe
           PID: 1028/PPID: 676/POffset: 0x01122910
                                0 macb --------------- 0        0        0        [Handle (Key)] USER\S-1-5-21-1614895754-436374069-839522115-500\
           SOFTWARE\MICROSOFT\WINDOWS\CURRENTVERSION\EXPLORER\USERASSIST\{75048700-EF1F-11D0-9888-006097DEACF9}\COUNT explorer.exe
           PID: 1724/PPID: 1708/POffset: 0x04a065d0
                                0 macb --------------- 0        0        0        [Handle (Key)] USER\S-1-5-21-1614895754-436374069-839522115-500\
           SOFTWARE\MICROSOFT\WINDOWS\CURRENTVERSION\INTERNET SETTINGS VMwareUser.exe PID: 452/PPID: 1724/POffset: 0x04b5a980
```

Résumé

- Examiner en premier les connections réseaux et les adresses IP destination. Quelle est leur réputation ?
- Examiner les processus (pslist, psxview), leur parent, le nombre d’exemplaire d’un processus du même nom (le nom peut etre usurpé). Est-il lancé depuis le bon répertoire ? A-t-il le bon processus père (pstree) ? N’a-t-il pas trop de droits (getssids) pour ce qu’il est censé faire. N’utilise-t-il pas trop de ressources (handles) ? Trop ou trop peu de librairies externes utilisées (dlllist) et des fonctions utilisées surprenantes (aucun lien avec les fonctionnalités « officielles » du processus) ? Quels sont les processus injectés (malfind), les appels systèmes modifiés (ssdt) ?

Résumé (2)

- Quelles sont les sessions en cours (sessions) ? Plug-in Hashdump pour les authentifiants et comptes de domaine stockés en mémoire
- Vérifier les processus lancés au démarrage (autoruns, printkey)
- Quelles sont les dernières applications lancées (userassist), les derniers fichiers créés (mftparser)

Autres plug-ins

- Chrome history, Firefox history, PreFetch, UnInstallInfo (C. David Lassalle, Jr)
  https://github.com/superponible/volatility-plugins

  ```
  $ python vol.py --plugins=volatility-plugins-master -f memdump.mem --
  profile=Win7SP1x64 chromehistory >chromehistory.txt
  ```

- Autoruns (Thomas Chopita)
  https://github.com/tomchop/volatility-autoruns

avec d’autres plug-in:

- https://github.com/volatilityfoundation/community

Volatility 3 (2.4.0, dec 2022)

windows.cmdline.CmdLine
Lists process command line arguments.
windows.dlllist.DllList
Lists the loaded modules in a particular windows memory image.
windows.drivermodule.DriverModule
Determines if any loaded drivers were hidden by a rootkit
windows.driverscan.DriverScan
Scans for drivers present in a particular windows memory image.
windows.dumpfiles.DumpFiles
Dumps cached file contents from Windows memory samples.
windows.envars.Envars
Display process environment variables
windows.filescan.FileScan
Scans for file objects present in a particular windows memory image.
windows.getservicesids.GetServiceSIDs
Lists process token sids.
windows.getsids.GetSIDs
Print the SIDs owning each process
windows.handles.Handles
Lists process open handles.
windows.info.Info Show OS & kernel details of the memory sample being analyzed.

Volatility 3 (2/4)

windows.malfind.Malfind

Lists process memory ranges that potentially contain injected code.

windows.memmap.Memmap

Prints the memory map

windows.mftscan.MFTScan

Scans for MFT FILE objects present in a particular windows memory image.

windows.modscan.ModScan

Scans for modules present in a particular windows memory image.

windows.modules.Modules

Lists the loaded kernel modules.

windows.mutantscan.MutantScan

Scans for mutexes present in a particular windows memory image.

windows.netscan.NetScan

Scans for network objects present in a particular windows memory image.

windows.netstat.NetStat

Traverses network tracking structures present in a particular windows memory image.

windows.privileges.Privs

Lists process token privileges

Volatility 3 (3/4)

windows.pslist.PsList

Lists the processes present in a particular windows memory image.

windows.psscan.PsScan

Scans for processes present in a particular windows memory image.

windows.pstree.PsTree

Plugin for listing processes in a tree based on their parent process ID.

windows.registry.hivelist.HiveList

Lists the registry hives present in a particular memory image.

windows.registry.hivescan.HiveScan

Scans for registry hives present in a particular windows memory image.

windows.registry.printkey.PrintKey

Lists the registry keys under a hive or specific key value.

windows.registry.userassist.UserAssist

Print userassist registry keys and information.

windows.sessions.Sessions

lists Processes with Session information extracted from Environmental Variables

windows.ssdt.SSDT Lists the system call table.

Volatility 3 (4/4)

windows.strings.Strings

Reads output from the strings command and indicates which process(es) each string belongs to.

windows.svcscan.SvcScan

Scans for windows services.

windows.vadinfo.VadInfo

Lists process memory ranges.

windows.vadwalk.VadWalk

Walk the VAD tree.

windows.vadyarascan.VadYaraScan

Scans all the Virtual Address Descriptor memory maps using yara.

yarascan.YaraScan Scans kernel memory using yara rules (string or file).

Tester Volatility 3

- Récupérer le dump compressé et .7z dans Drive_Students_2600\Students_Content_2600\forensic_week
- Installer Volatility 3 (https://github.com/volatilityfoundation/volatility3)
- Tester quelques commandes

```
volatility3-develop>python vol.py -f DESKTOP-USHMJSM-20230315-172341.dmp windows.info > win10_19041\windows_info.txt
```

```
volatility3-develop>python vol.py -f e:\Comae-Toolkit\x64\DESKTOP-USHMJSM-20230315-172341.dmp -r csv windows.pslist > win10_19041\windows_pslist.csv
```

```
volatility3-develop>python vol.py -f d:\2600\DESKTOP-USHMJSM-20230315-172341.dmp -r pretty windows.pslist > win10_19041\windows_pslist.txt
```

Pour aller plus loin

Pour des exemples et plus de détails

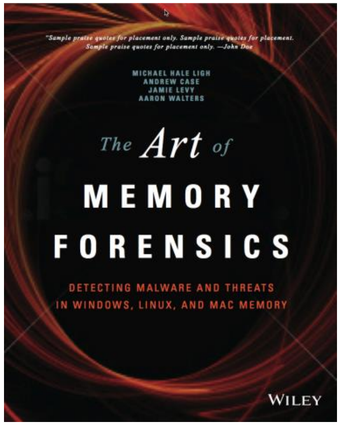
https://github.com/volatilityfoundation/volatility/wiki/Command-Reference

Dump mémoires, pour s'entraîner

https://github.com/volatilityfoundation/volatility/wiki/Memory-Samples

https://code.google.com/p/volatility/wiki/FAQ
#Are_there_any_public_memory_samples_available_that_I_can_use_for

The Art Of Memory Forensics


"Sample praise quotes for placement only. Sample praise quotes for placement. Sample praise quotes for placement only. —John Doe
MICHAEL HALE LIGH
ANDREW CASE
JAMIE LEVY
AARON WALTERS
The Art of
MEMORY
FORENSICS
DETECTING MALWARE AND THREATS
IN WINDOWS, LINUX, AND MAC MEMORY
WILEY