Wibbly wobbly timey wimey stuff

Uso delle timeline nell'analisi forense

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Chi sono

Davide ‘Rebus’ Gabrini

Per chi lavoro non è un mistero.

Oltre a ciò:

- Perito informatico
- Consulente tecnico e Perito forense
- Collaboratore UniPV
- Docente di sicurezza informatica e digital forensics per privati e P.A.
- Certificazioni CIFI, ACE, AME
- Socio IISFA, DEFTA, Tech&Law fellow
- Proud fellow of Italian Hacker Embassy

Come vedete **non** sono qui in divisa.

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Timeline

- Una timeline è una rappresentazione di eventi ordinati cronologicamente
- Gli eventi possono provenire da un'unica fonte o, più sovente, da una pluralità di fonti
- Per le finalità di oggi, ci interessano solo gli eventi di natura digitale, ma un'indagine spesso attinge da fonti molto eterogenee
- Metodo rapido e intuitivo per avere immediata contezza di quanto occorso in un sistema in una determinata finestra temporale

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Timeline

- Utilizzi:
  - Ricostruire le attività di un utente….
  - …o di un intruso.
  - Ricostruire le fasi di un attacco/infezione
  - Individuare il punto di compromissione originale
  - Individuare le cause di un incidente
  - Evidenziare incongruenze che siano sintomo di attività illecite e antiforensics
- Vedere in una rappresentazione lineare la sequenza di creazione di file, chiavi di registro, installazione di servizi ecc. rende comprensibile le modalità di intrusione e permette di individuarne tutti i componenti.

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Da dove arrivano i riferimenti temporali?

- E' importante individuare la fonte dei timestamp: locale (orologio CMOS) o esterna?
- Attendibilità?
- Configurazione Timezone
- Configurazione NTP (server, frequenza di update, ultimo update eseguito ecc.)
- L'applicazione che ha registrato l'evento che tipo di timestamp utilizza?

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Dove sono registrati

- Chi
- Cosa
- Dove
- Come
- Raccolta
- Elaborazione
- Visualizzazione
- Problemi
- Credits

- Il primo posto dove guardare è il filesystem: attributi MAC(B) di ogni file/cartella e altre strutture come p.e. il journal
- Il filesystem non basta: un sistema operativo registra innumerevoli eventi cronologicamente referenziati
- File di log (sistema e applicazioni) e registri degli eventi
- Registro di Windows (contenuto e metadati delle chiavi)
- Feature proprie del sistema operativo (Prefetch, Restore Points, Link, Cestino, thumbs.db, ShellBag, Volume Shadow Copy…)
- Cronologia, Cache e Cookies dei browser
- Cache e database applicativi
- Metadati interni ai documenti (Office, EXIF, pagine HTML…)
- Eventi temporali recuperabili tramite carving da aree deallocate, slack space, memory dump, partizioni di swap, file di ibernazione (record $MFT, chiavi di registro, chat…)

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MAC(B) timestamp

- I timestamp MAC(B) presenti in un filesystem riguardano gli eventi:
  - **M**odified (modifica dei dati)
  - **A**ccessed (lettura dei dati)
  - **C**hanged (modifica dei metadati)
  - **B**irth (creazione del file)
- Non tutti i filesystem registrano le stesse informazioni.
- Non tutti i sistemi operativi sfruttano le possibilità del filesystem.

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MAC(B) Meaning by File System

File System	M	A	C	B
Ext2/3	Modified	Accessed	Changed	N/A
Ext4	Modified	Accessed	Changed	Created
FAT	Written	Accessed	N/A	Created
NTFS	File Modified	Accessed	MFT Modified	Created
UFS	Modified	Accessed	Changed	N/A

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Filesystem e S.O.

- **FAT** registra gli attributi MAC in localtime
- **NTFS** registra 2 serie di attributi MACB in UTC
- Da NT in poi è possibile disabilitare l'aggiornamento dell'attributo Access (per Vista è default)
  - HKLM\SYSTEM\CurrentSet\Control\FileSystem\NtfsDisableLastAccessUpdate
- Linux registra in Unix time (secondi trascorsi dal 1/1/1970 00:00:00 UTC) attributi MAC su **Ext2/3**. Con **Ext4** arriva l'attributo Birth e la granularità al nanosecondo.
  L'aggiornamento degli attributi può essere inibito in fase di mount.
- **HFS+** registra i secondi trascorsi da 1/1/1904 00:00:00 GMT

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NTFS: dove sono i timestamp?

Per ogni file, la Master File Table ($MFT) registra **due** serie di timestamp:

- **$STANDARD_INFO**

Contiene metadati come SID, owner, flags e un set di timestamp MACB. Sono i timestamp che vedete da Esplora Risorse. Modificabile in **user space**.

- **$FILE_NAME**

Contiene il nome file in Unicode e un ulteriore set di timestamp MACB. Modificabile solo in **kernel space**.

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Quando cambiano i timestamp? (NTFS)

$FILE_NAME	Rename	Local Move	Volume Move	Copy	Access	Modify	Create	Delete
Modification		X	X	X			X	X
Accessed			X	X			X	
Change (meta)		X	X	X			X	X
Born			X	X			X	

$STANDARD_INFO	Rename	Local Move	Volume Move	Copy	Access	Modify	Create	Delete
Modification						X	X	
Accessed			X	X	X	X	X	
Change (meta)	X	X	X	X			X	X
Born				X			X	

- Le regole sulla modifica o preservazione dei timestamp nel casi di copia e spostamento di file tra partizioni FAT e NTFS sono riportate alla pagina http://support.microsoft.com/kb/299648/en-us

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Comportamento in Windows 7

Windows 7 File System $STDInfo and $Filename Properties

Timevalue Type	File Rename	Local File Move	Volume File Move	File Copy	File Access	File Modify	File Creation	File Deletion
$STD Info Modification Time						Changed	Changed	
$STD Info Access Time			Changed	Changed	Changed (No Change on VISTA/Win7)	Changed	Changed	
$STD Info Creation Time				Changed			Changed	
$STD Info MFT Entry Modified	Change	Changes	Changed	Changed			Changed	Changed
$Filename Modification Time		Updated to $STDINFO Modification Time		Changed			Changed	Updated to $STDINFO Modification Time
$Filename Access Time			Changed	Changed			Changed	
$Filename Creation Time				Changed			Changed	
$Filename MFT Entry Modified		Updated to $STDINFO Metadata Time		Changed			Changed	Updated to $STDINFO Metadata Time

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Applicazioni

- Singole applicazioni, però, possono adottare timestamp alternativi:
- Nel registro di Windows, i valori FILETIME riportano il numero di intervalli da 100 nanosecondi trascorsi dal 1/1/1601 00:00:00 UTC
- da MacOSX 10 le applicazioni (p.e. Safari) possono usare il Mac Absolute Time, o CFDate: secondi trascorsi dal 1/1/2001 00:00:00 GMT

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Normalizzazione

Quindi è necessario verificare ogni fonte e uniformare tra loro i diversi timestamp

- Conversione fuso orario
- Compensazione eventuali time skew
- Normalizzazione del formato data-ora
- Ricorso a formati standardizzati
  - Body_file

    MD5|name|inode|mode_as_string|UID|GID|size|atime|mtime|ctime|crtime
  - TLN

    Time|Source|Host|User|Description

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Raccolta dati

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Filesystem - fls

Estrazione MAC(B) tramite fls (SleuthKit) da un'immagine forense:

$ fls -f ntfs -o 63 -r -m C: /images/suspect.dd > fs_body_file

- **-f**ilesystem-type
- **-o**ffset
- **-r**ecursive
- **-m**ountpoint

Il body_file è un formato intermedio per le timeline previsto dallo SleuthKit:

MD5|name|inode|mode_as_string|UID|GID|size|atime|mtime|ctime|crtime

I comandi **fls**, **ils** e **mac-robber** generano output in formato body_file; il tool **mactime** legge i body_file e ordina i contenuti in un comodo CSV:

$mactime -d -b fs_body_file >fs_timeline.csv

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body_file

```
0|C:/Bootfont.bin|1862-128-3|r/r--x--x--x|0|0|4952|1276960801|1141300800|1141300800|1141300800
0|C:/$AttrDef|4-128-4|r/rr-xr-xr-x|48|0|2560|1276960582|1276960582|1276960582|1276960582
0|C:/$BadClus|8-128-2|r/rr-xr-xr-x|0|0|0|1276960582|1276960582|1276960582|1276960582
0|C:/$BadClus:$Bad|8-128-1|r/rr-xr-xr-x|0|0|49532633088|1276960582|1276960582|1276960582|1276960582
0|C:/$Bitmap|6-128-1|r/rr-xr-xr-x|0|0|1511616|1276960582|1276960582|1276960582|1276960582
0|C:/$Boot|7-128-1|r/rr-xr-xr-x|48|0|8192|1276960582|1276960582|1276960582|1276960582
0|C:/$Extend|11-144-4|d/dr-xr-xr-x|0|0|344|1276960582|1276960582|1276960582|1276960582
0|C:/$LogFile|2-128-1|r/rr-xr-xr-x|0|0|67108864|1276960582|1276960582|1276960582|1276960582
0|C:/$MFT|0-128-1|r/rr-xr-xr-x|0|0|57950208|1276960582|1276960582|1276960582|1276960582
0|C:/$MFTMirr|1-128-1|r/rr-xr-xr-x|0|0|4096|1276960582|1276960582|1276960582|1276960582
0|C:/$Secure:$SDH|9-144-17|r/rr-xr-xr-x|0|0|56|1276960582|1276960582|1276960582|1276960582
0|C:/$Secure:$SII|9-144-16|r/rr-xr-xr-x|0|0|56|1276960582|1276960582|1276960582|1276960582
0|C:/$Secure:$SDS|9-128-0|r/rr-xr-xr-x|0|0|887276|1276960582|1276960582|1276960582|1276960582
0|C:/$UpCase|10-128-1|r/rr-xr-xr-x|0|0|131072|1276960582|1276960582|1276960582|1276960582
0|C:/$Volume|3-128-3|r/rr-xr-xr-x|48|0|0|1276960582|1276960582|1276960582|1276960582
0|C:/AUTOEXEC.BAT|7420-128-1|r/rrwxrwxrwx|0|0|0|1276955179|1276955179|1276955179|1276955179
0|C:/boot.ini|3528-128-10|r/r--x--x--x|0|0|212|1292187989|1276955625|1276955625|1276960966
0|C:/Config.Msi|29593-144-6|d/dr-xr-xr-x|0|0|48|1292189987|1292183363|1292183363|1292180848
```


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FTK Imager ed Encase

In alternativa a fls, sia FTK Imager che Encase possono esportare CSV contenenti i timestamp di ogni singolo oggetto del filesystem

```
Date,Size,Type,Mode,UID,GID,Meta,File Name
Wed Nov 21 2001 13:13:36,6178,m...,r/rrwxrwxrwx,0,0,51150-128-3,C:/Forensics/Browser/ndphlpr.vxd
Tue Apr 23 2002 20:11:00,261082,m...,r/rrwxrwxrwx,0,0,50090-128-3,C:/IrfanView/Plugins/PopArt.8bf
Thu Oct 17 2002 21:23:14,8200,m..b,r/rrwxrwxrwx,0,0,16305-128-3,C:/Microsoft/OFFICE/DATA/OPA12.BAK
Thu Feb 13 2003 10:43:22,4860,m...,r/rrwxrwxrwx,0,0,50978-128-4,C:/BETA/MFL-FA/RemovableMask.pct
Thu Feb 13 2003 10:44:20,14504,m...,r/rrwxrwxrwx,0,0,50977-128-4,C:/BETA/MFL-FA/RemovableImage.pct
Wed Oct 01 2003 20:40:00,366592,m...,r/rrwxrwxrwx,0,0,51003-128-3,C:/ClamWinPortable/lib/wxc.pyd
Wed Oct 01 2003 20:40:02,35840,m...,r/rrwxrwxrwx,0,0,50988-128-3,C:/ClamWinPortable/lib/htmlc.pyd
Wed Oct 01 2003 20:40:38,71168,m...,r/rrwxrwxrwx,0,0,50987-128-3,C:/ClamWinPortable/lib/gizmosc.pyd
Fri Nov 07 2003 09:42:00,7434,m...,r/rrwxrwxrwx,0,0,44594-128-3,C:/XnView/Masks/PF-Brush.jpg
Fri Nov 07 2003 09:42:00,6445,m...,r/rrwxrwxrwx,0,0,44595-128-4,C:/XnView/Masks/PF-Camera.jpg
Fri Nov 07 2003 09:42:00,11681,m...,r/rrwxrwxrwx,0,0,44596-128-4,C:/XnView/Masks/PF-Diffuse.jpg
Fri Nov 07 2003 09:42:00,5021,m...,r/rrwxrwxrwx,0,0,44597-128-4,C:/XnView/Masks/PF-Ellipse.jpg
Fri Nov 07 2003 09:42:00,5459,m...,r/rrwxrwxrwx,0,0,44598-128-3,C:/XnView/Masks/PF-Fog.jpg
```


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Registro di Windows - regtime

- Ogni chiave di registro ha un attributo temporale LastWrite
- Lo script regtime.pl di Harlan Carvey permette di estrarre i valori LastWrite dai singoli hive:

```
$ regtime.pl –m HKLM-SYSTEM –r /mnt/target/WINDOWS/system32/config/system  > body
$ regtime.pl –m HKLM-SAM –r /mnt/target/WINDOWS/system32/config/SAM >> body
$ regtime.pl –m HKLM-SECURITY–r /mnt/target/WINDOWS/system32/config/SECURITY >> body
$ regtime.pl –m HKLM-SOFTWARE–r /mnt/target/WINDOWS/system32/config/software >> body
$ regtime.pl –m HKCU-USERNAME –r /mnt/target/Users/USERNAME/NTUSER.DAT >> body
```

- Sempre con mactime.pl si può ottenere un più pratico e ordinato CSV.

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log2timeline - Input

Creato da Kristinn Gudjonsson, è il punto di riferimento del settore.

Dispone di numerosissimi moduli ed è in continua espansione:

- Apache2 Access/Error logs
- Google Chrome history
- Encase e FTK Imager dirlisting
- Windows Event Log files (EVT e EVTX)
- EXIF e metadati da vari formati multimediali
- Firefox bookmark e history
- Generic Linux log file
- Internet Explorer history (file index.dat)
- Windows IIS W3C log files
- ISA server text export.
- Mactime e TLN body files
- McAfee AntiVirus Log files
- MS-SQL Error log
- Opera Global and Direct browser history
- OpenXML metadata (metadati dei documenti Office 2007)
- PCAP files

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log2timeline - Input

- PDF metadata
- Windows Prefetch directory
- Windows Recycle Bin (INFO2 or I$)
- Windows Restore Points
- Safari Browser history files
- Skype main.db file
- Windows XP SetupAPI.log file
- Adobe Local Shared Object files (SOL/LSO), aka Flash Cookies
- Squid Access Logs (httpd_emulate off)
- Windows Registry Hives
- UserAssist key of the Windows registry
- Windows Shortcut files (LNK)
- Windows WMIProv log file
- Windows XP Firewall Log files (W3C format)
- Volatility: the output file from the psscan and psscan2 modules

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log2timeline - Output

- BeeDocs (visualization tool per Mac)
- CEF (Common Event Format)
- CFTL (XML per CyberForensics TimeLab)
- CSV e TSV (ideali per fogli di calcolo, database, grep e script)
- Mactime, TLN e TLNX
- SIMILE (XML per SIMILE widget)
- SQLite

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Altri strumenti

- System Combo Timeline
  (analogo a log2timeline, ma con meno feature)
- NFI Aftertime
  (analogo a log2timeline, ma con una strana licenza)
- prefs.pl, evtparse.pl, jobparse.pl, AnalyzeMFT…
  (parser specifici)
- Log Parser di Microsoft consente di eseguire query su log testuali, file XML e CSV, eventi, Registro di sistema, file system e Active Directory. Può produrre output testuali ed essere quindi impegato con gli altri strumenti di analisi.

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Elaborazione

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Elaborazione dati

- Excel e Calc, o eventualmente un DBMS

Date	Size	Type	Meta	File Name
Thu Jan 15 2009 01:10:22	451	.a..	12888-128	C:/Documents and Settings/Donald Blake/Cookies/donald blake@aol[2].txt
Thu Jan 15 2009 10:27:09	0	m...	0	DBlake-NTSUER/Software/Microsoft/Windows/CurrentVersion/Explorer/RunMRU
Thu Jan 15 2009 10:27:09	0	macb	0	[UserAssist] User: Donald Blake - UEME_RUNPATH:C:\WINDOWS\system32\secedit.exe [Count: 1]
Thu Jan 15 2009 10:27:09	11372	macb	7842	[Prefetch] SECEDIT.EXE-160D449D.pf created - run 1 times
Thu Jan 15 2009 10:27:09	11372	macb	7842-128-	C:/WINDOWS/Prefetch/SECEDIT.EXE-160D449D.pf
Thu Jan 15 2009 10:27:10	0	macb	0	[IE History] User connected to URL:Visited: Donald Blake@mk:@MSITStore:C:\WINDOWS\Help\sec
Thu Jan 15 2009 23:59:59	335	m...	7848	[LNK] /mnt/hack/windows_mount/Documents and Settings/Donald Blake/Recent/SECRET.lnk point
Thu Jan 15 2009 23:59:59	376	m...	8180	[LNK] /mnt/hack/windows_mount/Documents and Settings/Donald Blake/Recent/TIVO Research -
Fri Jan 16 2009 18:15:16	163840	.a..	2280-128-	C:/WINDOWS/system32/credui.dll
Fri Jan 16 2009 18:15:16	176	.a..	45-144-6	C:/WINDOWS/inf
Fri Jan 16 2009 18:15:19	56	.a..	31-144-6	C:/WINDOWS/system32/drivers
Fri Jan 16 2009 18:15:20	0	m...	0	SYSTEM/ControlSet001/Enum/USBSTOR/Disk&Ven_M-Sys&Prod_Dell_Memory_Key&Rev_4.50/086
Fri Jan 16 2009 18:15:20	0	m...	0	SYSTEM/ControlSet001/Enum/USBSTOR/Disk&Ven_M-Sys&Prod_Dell_Memory_Key&Rev_4.50/086
Fri Jan 16 2009 18:18:10	449	..cb	8178	[LNK] /mnt/hack/windows_mount/Documents and Settings/Donald Blake/Recent/Blue Harvest Busi
Fri Jan 16 2009 18:18:19	290	.a..	9121	[LNK] /mnt/hack/windows_mount/Documents and Settings/Donald Blake/Recent/DBlake Personal
Fri Jan 16 2009 18:18:25	449	m...	8178	[LNK] /mnt/hack/windows_mount/Documents and Settings/Donald Blake/Recent/Blue Harvest Busi
Fri Jan 16 2009 18:18:26	0	macb	0	[IE History] User connected to URL:Visited: Donald Blake@file:///E:/Blue Harvest Business Plan v1.c
Fri Jan 16 2009 18:18:26	449	m.c.	8178-128-	C:/Documents and Settings/Donald Blake/Recent/Blue Harvest Business Plan v1.lnk
Fri Jan 16 2009 18:25:13	335	..cb	7848	[LNK] /mnt/hack/windows_mount/Documents and Settings/Donald Blake/Recent/SECRET.lnk point
Fri Jan 16 2009 18:25:13	254	.acb	8253	[LNK] /mnt/hack/windows_mount/Documents and Settings/Donald Blake/Recent/SECRET (2).lnk po
Fri Jan 16 2009 18:25:28	0	macb	0	[IE History] User connected to URL:Visited: Donald Blake@file:///C:/Documents and Settings/Donal
Fri Jan 16 2009 18:25:28	0	macb	0	[UserAssist] User: Donald Blake - UEME_RUNPATH:C:\PROGRA~1\WINZIP\winzip32.exe [Count: 5]
Fri Jan 16 2009 18:25:28	56	.a..	3715-144-	C:/Documents and Settings/All Users/Documents

- Excel Template; Pivoting

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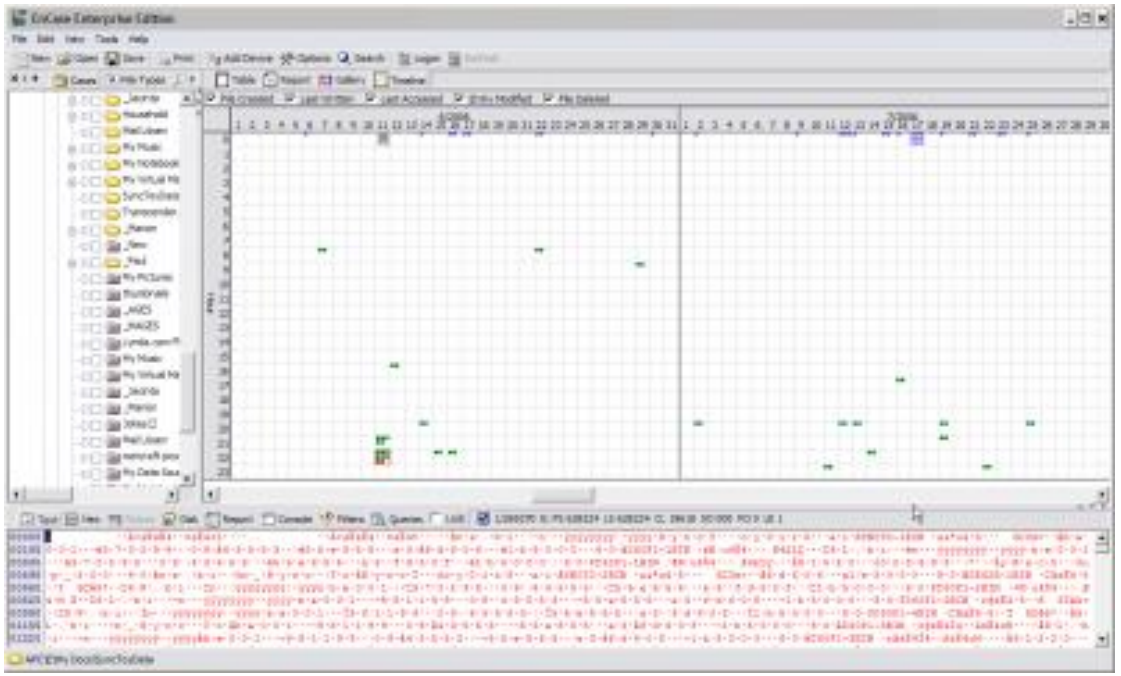
Encase

- Encase permette di muoversi nella timeline molto rapidamente, ma è limitato nell'interfaccia, nella reportistica e soprattutto nella base dati



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NFI Aftertime (per windows e linux)

- Supporta timestamp di diversa provenienza:

E-mail	MBox
Files	MAC-times, Shortcuts
Internet history	Internet Explorer cookies / history
	Safari cookies / history
	Opera cookies
	Mozilla/Firefox cookies / history
Logs	MSN, Zone alarm, Gator
	WTMP
	Console kit
	setupapi.log, WBEM
Multimedia	Exif
Operating System	Windows Event log, Registry, Prefetch, Shadow-files
	Linux / Macintosh logs

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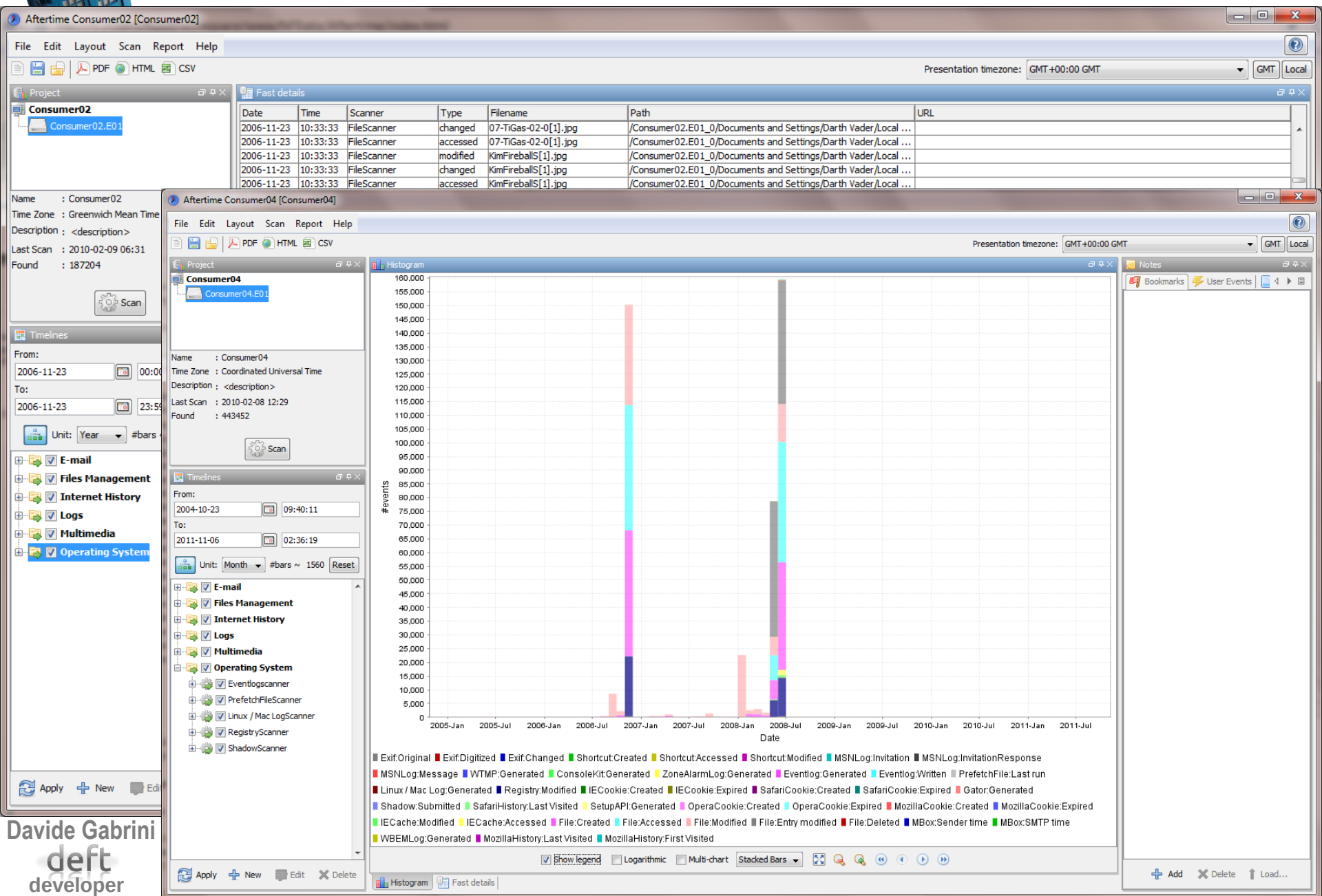

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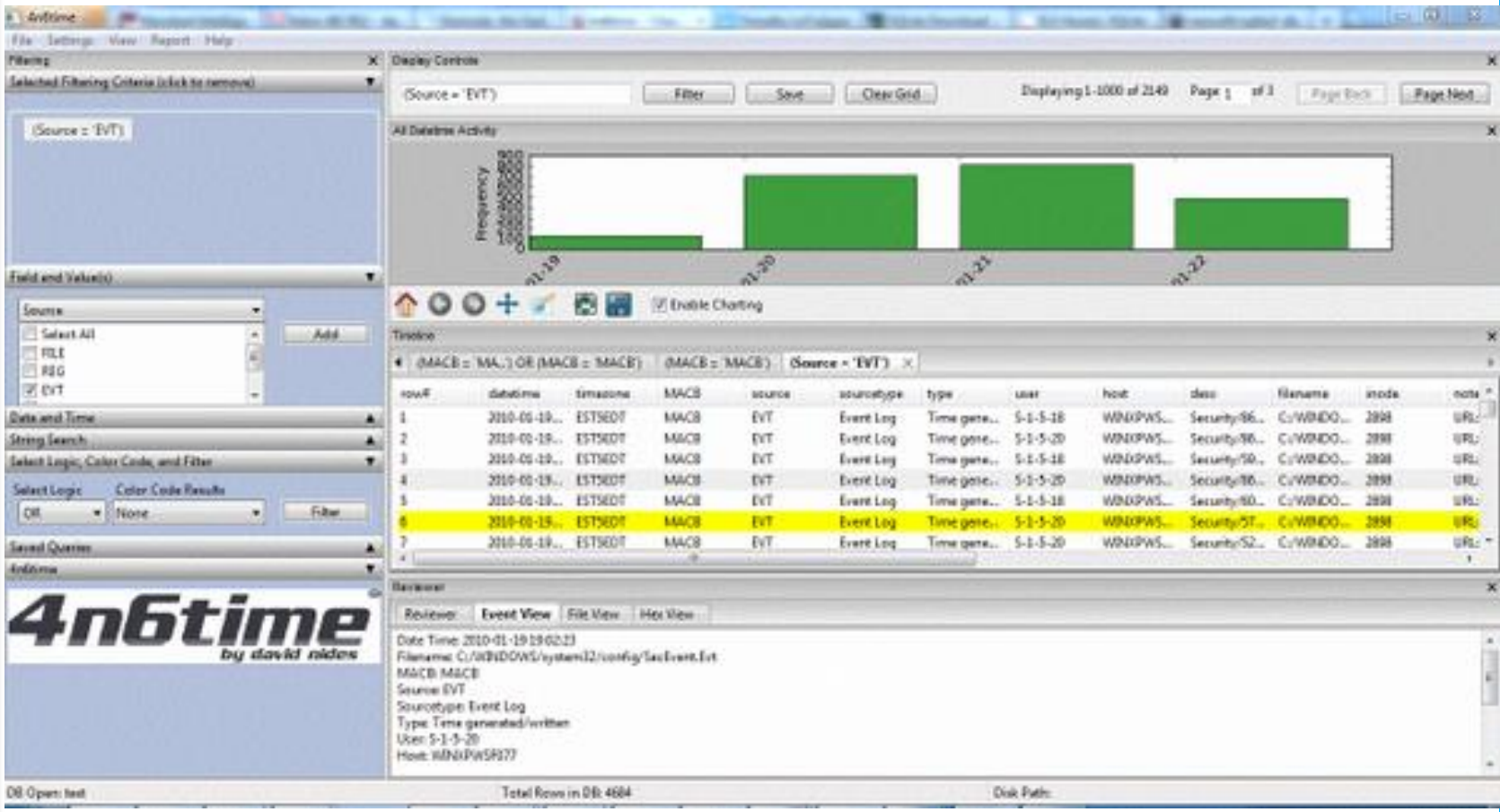
4n6time



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Coming soon: TimeShark

- Progetto italiano di Federico Grattirio per UniPV

Chi

Cosa

Dove

Come

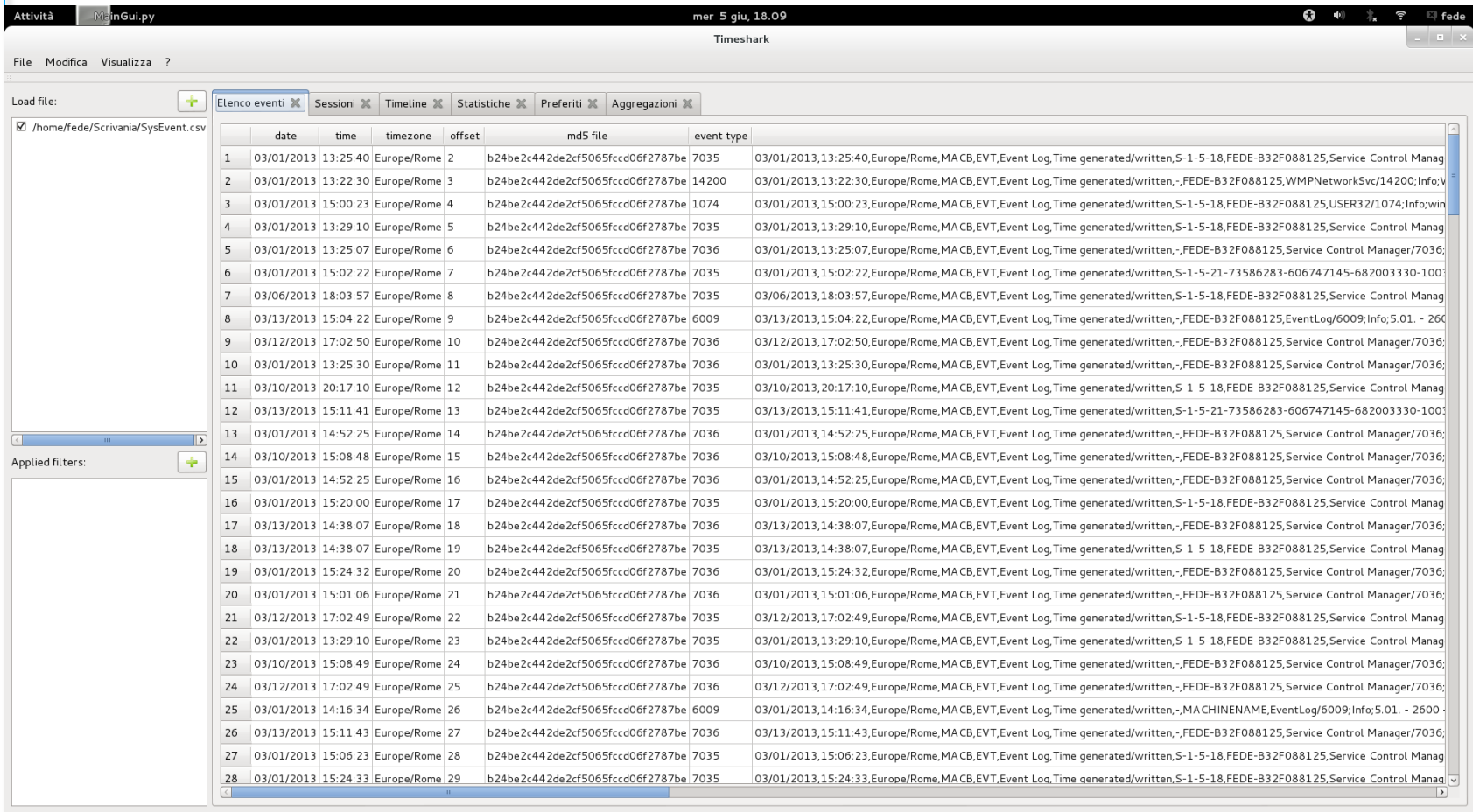
Raccolta

Elaborazione

Visualizzazione

Problemi

Credits



	date	time	timezone	offset	md5 file	event type	
1	03/01/2013	13:25:40	Europe/Rome	2	b24be2c442de2cf5065fccd06f2787be	7035	03/01/2013,13:25:40,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,Service Control Manag
2	03/01/2013	13:22:30	Europe/Rome	3	b24be2c442de2cf5065fccd06f2787be	14200	03/01/2013,13:22:30,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,WMPNetworkSvc/14200;Info;V
3	03/01/2013	15:00:23	Europe/Rome	4	b24be2c442de2cf5065fccd06f2787be	1074	03/01/2013,15:00:23,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,USER32/1074;Info;win
4	03/01/2013	13:29:10	Europe/Rome	5	b24be2c442de2cf5065fccd06f2787be	7035	03/01/2013,13:29:10,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,Service Control Manag
5	03/01/2013	13:25:07	Europe/Rome	6	b24be2c442de2cf5065fccd06f2787be	7036	03/01/2013,13:25:07,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
6	03/01/2013	15:02:22	Europe/Rome	7	b24be2c442de2cf5065fccd06f2787be	7035	03/01/2013,15:02:22,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-21-73586283-606747145-682003330-1003
7	03/06/2013	18:03:57	Europe/Rome	8	b24be2c442de2cf5065fccd06f2787be	7035	03/06/2013,18:03:57,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,Service Control Manag
8	03/13/2013	15:04:22	Europe/Rome	9	b24be2c442de2cf5065fccd06f2787be	6009	03/13/2013,15:04:22,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,EventLog/6009;Info;5.01. - 260
9	03/12/2013	17:02:50	Europe/Rome	10	b24be2c442de2cf5065fccd06f2787be	7036	03/12/2013,17:02:50,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
10	03/01/2013	13:25:30	Europe/Rome	11	b24be2c442de2cf5065fccd06f2787be	7036	03/01/2013,13:25:30,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
11	03/10/2013	20:17:10	Europe/Rome	12	b24be2c442de2cf5065fccd06f2787be	7035	03/10/2013,20:17:10,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,Service Control Manag
12	03/13/2013	15:11:41	Europe/Rome	13	b24be2c442de2cf5065fccd06f2787be	7035	03/13/2013,15:11:41,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-21-73586283-606747145-682003330-1003
13	03/01/2013	14:52:25	Europe/Rome	14	b24be2c442de2cf5065fccd06f2787be	7036	03/01/2013,14:52:25,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
14	03/10/2013	15:08:48	Europe/Rome	15	b24be2c442de2cf5065fccd06f2787be	7036	03/10/2013,15:08:48,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
15	03/01/2013	14:52:25	Europe/Rome	16	b24be2c442de2cf5065fccd06f2787be	7036	03/01/2013,14:52:25,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
16	03/01/2013	15:20:00	Europe/Rome	17	b24be2c442de2cf5065fccd06f2787be	7035	03/01/2013,15:20:00,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,Service Control Manag
17	03/13/2013	14:38:07	Europe/Rome	18	b24be2c442de2cf5065fccd06f2787be	7036	03/13/2013,14:38:07,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
18	03/13/2013	14:38:07	Europe/Rome	19	b24be2c442de2cf5065fccd06f2787be	7035	03/13/2013,14:38:07,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,Service Control Manag
19	03/01/2013	15:24:32	Europe/Rome	20	b24be2c442de2cf5065fccd06f2787be	7036	03/01/2013,15:24:32,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
20	03/01/2013	15:01:06	Europe/Rome	21	b24be2c442de2cf5065fccd06f2787be	7036	03/01/2013,15:01:06,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
21	03/12/2013	17:02:49	Europe/Rome	22	b24be2c442de2cf5065fccd06f2787be	7035	03/12/2013,17:02:49,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,Service Control Manag
22	03/01/2013	13:29:10	Europe/Rome	23	b24be2c442de2cf5065fccd06f2787be	7035	03/01/2013,13:29:10,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,Service Control Manag
23	03/10/2013	15:08:49	Europe/Rome	24	b24be2c442de2cf5065fccd06f2787be	7036	03/10/2013,15:08:49,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
24	03/12/2013	17:02:49	Europe/Rome	25	b24be2c442de2cf5065fccd06f2787be	7036	03/12/2013,17:02:49,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
25	03/01/2013	14:16:34	Europe/Rome	26	b24be2c442de2cf5065fccd06f2787be	6009	03/01/2013,14:16:34,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,MACHINENAME,EventLog/6009;Info;5.01. - 2600
26	03/13/2013	15:11:43	Europe/Rome	27	b24be2c442de2cf5065fccd06f2787be	7036	03/13/2013,15:11:43,Europe/Rome,MACB,EVT,Event Log,Time generated/written,-,FEDE-B32F088125,Service Control Manager/7036;
27	03/01/2013	15:06:23	Europe/Rome	28	b24be2c442de2cf5065fccd06f2787be	7035	03/01/2013,15:06:23,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,Service Control Manag
28	03/01/2013	15:24:33	Europe/Rome	29	b24be2c442de2cf5065fccd06f2787be	7035	03/01/2013,15:24:33,Europe/Rome,MACB,EVT,Event Log,Time generated/written,S-1-5-18,FEDE-B32F088125,Service Control Manag

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Visualizzazione

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Timeline visuali

- Autopsy e l'enscript Timeline Report di Geoff Black generano report HTML
  - Spartani, limitati, ma talvolta pratici

	\change.log.1	Indexed					
45	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380	Folder, Compressed, Not Indexed	16384	12/01/10 08:54:26AM	12/06/10 02:41:23PM	12/02/10 09:23:37AM	12/02/10 09:23:37AM
46	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380\snapshot	Folder, Compressed, Not Indexed	4096	12/01/10 08:54:26AM	12/01/10 08:54:30AM	12/01/10 08:54:29AM	12/01/10 08:54:29AM
47	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_NTUSER_S-1-5-18	File, Archive, Compressed, Not Indexed	270336	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM
48	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_NTUSER_S-1-5-18	File, Archive, Compressed, Not Indexed	270336	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM
49	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_NTUSER_S-1-5-18	File, Archive, Compressed, Not Indexed	270336	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM
50	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_NTUSER_S-1-5-18	File, Archive, Compressed, Not Indexed	270336	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM
51	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_NTUSER_S-1-5-19	File, Archive, Compressed, Not Indexed	241664	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM
52	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_NTUSER_S-1-5-19	File, Archive, Compressed, Not Indexed	241664	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM
53	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_NTUSER_S-1-5-19	File, Archive, Compressed, Not Indexed	241664	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM
54	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_NTUSER_S-1-5-19	File, Archive, Compressed, Not Indexed	241664	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM
55	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_USRCLASS_S-1-5-19	File, Archive, Compressed, Not Indexed	8192	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM
56	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_USRCLASS_S-1-5-19	File, Archive, Compressed, Not Indexed	8192	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM
57	\C\System Volume Information_restore{D2674A2A-0500-4E46-BC0C-00D162391AE9}\RP380 \snapshot_REGISTRY_USER_USRCLASS_S-1-5-19	File, Archive, Compressed, Not Indexed	8192	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM	12/01/10 08:54:26AM

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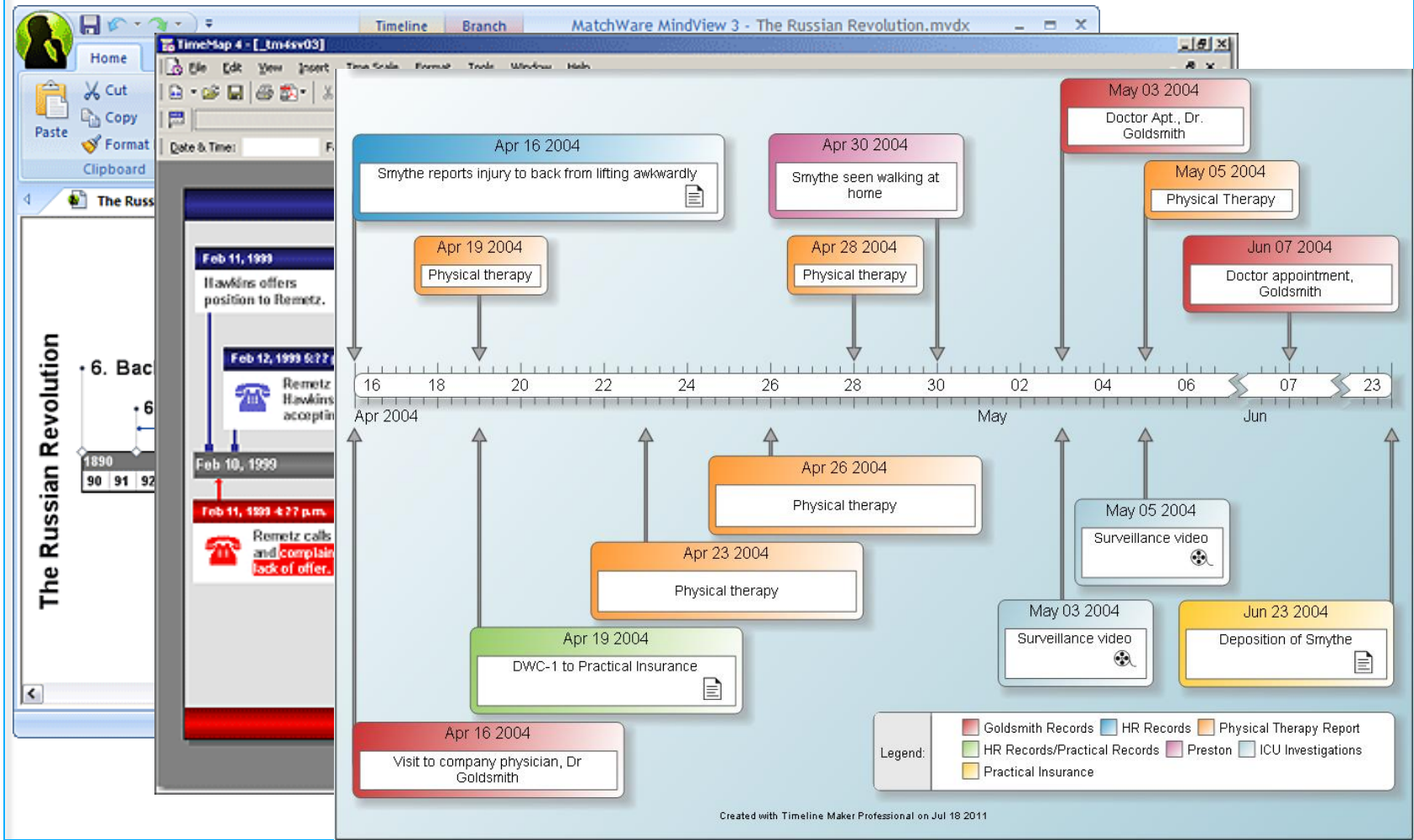
Timeline visuali

- Matchware Timelines, LexisNexis TimeMap, TimelineMaker, SmartDraw, Beedocs…



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Timeline visuali

- Web Scavator, IEF, TimeFlow

Chi

Cosa

Dove

Come

Raccolta

Elaborazione

Visualizzazione

Problemi

Credits

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Problemi, intralci, attacchi

Conoscerli, identificarli e sopravvivere

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Dispersività

- Troppi dati sono difficili da gestire
- Troppo pochi potrebbe non essere abbastanza descrittivi
- …o più facilmente falsati
- Servono scanner automatizzati e strumenti di ricerca e filtering efficienti
- La rappresentazione è spesso problematica

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Intralci

- I programmi che eseguono scansioni massive di file (antivirus, antispyware, indicizzatori ecc.) facilmente ne alterano la data di accesso, rendendo l'informazione poco significativa
- Alcuni antivirus possono essere istruiti a riguardo (p.e. Preserve Filetime in NAV Corporate)

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Intralci intenzionali

- Le manipolazioni possono ovviamente essere intenzionali
- Strategia attuata da taluni malware per confondere le acque e rendere difficoltoso individuare il punto di compromissione e le azioni successive
- Strategia alla portata degli utenti grazie a strumenti come touch, timestomp, SetMACE e tanti altri

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“Ma io cambio l’ora di sistema!”

- Se fatto da Windows Vista o 7, ne troverò traccia nel registro degli eventi (ID 1)
- Con Linux dipende, con Mac OS X non lo so, ma con BSD sì!
- Se fatto da BIOS, ho ancora qualche speranza di accorgermene dalle incongruenze negli artefatti:
  - accessi a file che non avrebbero dovuto esistere
  - uso di applicazioni o servizi non installati
  - File LNK in Windows XP (hanno un contatore!)
  - Restore Point (RP## è incrementale per XP, Vista e 7)
  - Sequenzialità dei log (soprattutto su eventi continui) e delle cache applicative
  - Confronto con dati esterni al sistema
  - Pagine HTML salvare, e-mail ricevute, altri metadati con riferimenti temporali esterni

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CAT Detect

- Progetto interessante, ma fermo dal 2011
- Ricerca incongruenze nella sequenza temporale degli eventi
- Nato per Windows, ma su principi adattabili ad altri O.S.

CAT Detect - Version 1 - Temporal Inconsistency Checking

Enter the query to select a timeline for consistency checking

```
SELECT * FROM (
        (SELECT * FROM RecordedEvents) UNION
        (SELECT * FROM InferredEvents))
        AS AllEvents
        WHERE Time >=
        (SELECT Time FROM RecordedEvents
                WHERE EventID = 180)
        AND Time <=
        ( SELECT Time FROM RecordedEvents
                WHERE EventID = 146)
ORDER BY Time;
```

Launch Query

EventID	Time	Subject	Object	Action	Results
176	2008-10-09T18:47:14	APPLICATION LOCAL SERVICE17605128	SYSTEM	Privilege Use	Success
178	2008-10-09T18:47:14	APPLICATION C:\WINDOWS\explorer.exe18972263	SYSTEM	Detailed Tracking	Success
179	2008-10-09T18:47:14	APPLICATION C:\WINDOWS\system32\winlogon.exe30836417	SYSTEM	Detailed Tracking	Success
180	2008-10-09T18:47:14	APPLICATION C:\WINDOWS\system32\userinit.exe16886931	SYSTEM	Detailed Tracking	Success
181	2008-10-09T18:47:14	USER TARGETBOX$14098944	SYSTEM	Privilege Use	Success
182	2008-10-09T18:47:14	USER TARGETBOX$14098944	SYSTEM	Privilege Use	Success
183	2008-10-09T18:47:14	USER TARGETBOX$14098944	SYSTEM	Privilege Use	Success
184	2008-10-09T18:47:14	USER TARGETBOX$14098944	SYSTEM	Privilege Use	Success
173	2008-10-09T18:47:15	APPLICATION C:\WINDOWS\system32\svchost.exe28732166	SYSTEM	System Event	Success
174	2008-10-09T18:47:15	USER Domain:40717	SYSTEM	Logon/Logoff	Success
175	2008-10-09T18:47:15	APPLICATION C:\WINDOWS\system32\svchost.exe28732166	SYSTEM	System Event	Success
170	2008-10-09T18:47:16	APPLICATION C:\WINDOWS\system32\logonui.exe26903574	SYSTEM	Detailed Tracking	Success
171	2008-10-09T18:47:16	APPLICATION Files\Messenger\msmsgs.exe29616570	SYSTEM	Detailed Tracking	Success
172	2008-10-09T18:47:16	APPLICATION C:\WINDOWS\system32\ctfmon.exe17591548	SYSTEM	Detailed Tracking	Success
169	2008-10-09T18:47:18	USER baddie27660658	SYSTEM	Privilege Use	Success
167	2008-10-09T18:47:22	APPLICATION LOCAL SERVICE17605128	SYSTEM	Privilege Use	Success

Inconsistent Events

Event ID	Rule Broken
940	(tA in T,x in O,SYSTEM, LOGON, Success) happened-before (tB in T,x in O,, CREATED, r in {Success,Failure,unknown}) && preconditional((tA in T,x in O,SYSTEM, LOGON, Success) , (tB in T,x in O,, CRE…
916	(tA in T,x in O,SYSTEM, LOGON, Success) happened-before (tB in T,x in O,, CREATED, r in {Success,Failure,unknown}) && preconditional((tA in T,x in O,SYSTEM, LOGON, Success) , (tB in T,x in O,, CRE…
917	(tA in T,x in O,SYSTEM, LOGON, Success) happened-before (tB in T,x in O,, MODIFIED, r in {Success,Failure,unknown}) && preconditional((tA in T,x in O,SYSTEM, LOGON, Success) , (tB in T,x in O,, MO…
941	(tA in T,x in O,SYSTEM, LOGON, Success) happened-before (tB in T,x in O,, MODIFIED, r in {Success,Failure,unknown}) && preconditional((tA in T,x in O,SYSTEM, LOGON, Success) , (tB in T,x in O,, MO…
918	(tA in T,x in O,SYSTEM, LOGON, Success) happened-before (tB in T,x in O,, OPENED, r in {Success,Failure,unknown}) && preconditional((tA in T,x in O,SYSTEM, LOGON, Success) , (tB in T,x in O,, OPEN…
942	(tA in T,x in O,SYSTEM, LOGON, Success) happened-before (tB in T,x in O,, OPENED, r in {Success,Failure,unknown}) && preconditional((tA in T,x in O,SYSTEM, LOGON, Success) , (tB in T,x in O,, OPEN…

Davide Gabrini

deft

developer

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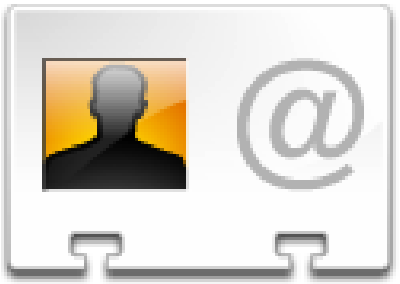
Teniamoci in contatto...

Davide Rebus Gabrini

e-mail: rebus@tipiloschi.net

GPG Public Key: www.tipiloschi.net/rebus.asc
KeyID: 0x176560F7



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