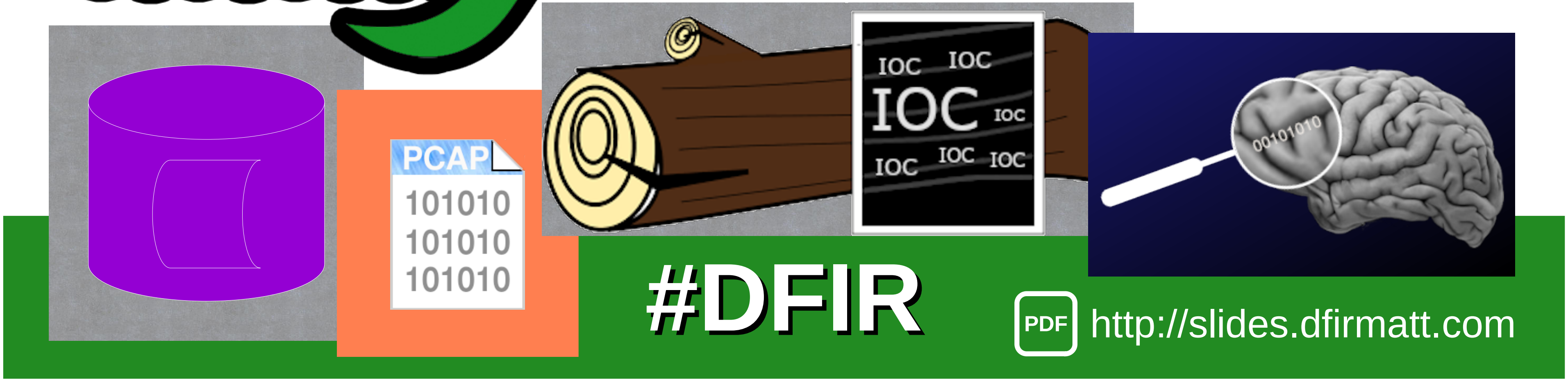
These Artifacts aren’t Fiction

CornCon X

Matt Scheurer

Tuan Phan

October 5, 2024



#DFIR

PDF http://slides.dfirmatt.com

Introducing: Matt Scheurer

I work for a big well-known organization...

As Vice President (VP) of Computer Security and Incident Response (IR). However, I have many years of hands-on technical experience, including Digital Forensics & Incident Response (DFIR).

I am also a Podcast Host for

ThreatReel

https://threatreel.com

Connect / Contact / Follow Matt:

https://www.linkedin.com/in/mattscheurer

https://x.com/c3rkah

Where Matt volunteers...

I am an Official

HACKING
IS NOT A CRIME

Advocate
https://www.hackingisnotacrime.org

WARREN COUNTY
CAREER
CENTER

Advisory Board: Information Technology and Cybersecurity
https://www.mywccc.org/

WOMSA
Empowering Women in Cybersecurity

Women’s Security Alliance (WomSA) Technical Mentor
https://www.womsa.org

Introducing: Tuan Phan

- Independent Info Security Researcher
- Professional Experience
  - eDiscovery, Forensics Investigation, and Insider Threat Strategy

Disclaimer!

Yes, the presenters both have day jobs. However…

Opinions expressed are based solely on their own independent security research and do not express or reflect the views or opinions of their employers.

We are not Lawyers!

This presentation is for educational purposes only! Please consult with qualified legal counsel before using these techniques in an actual investigation.

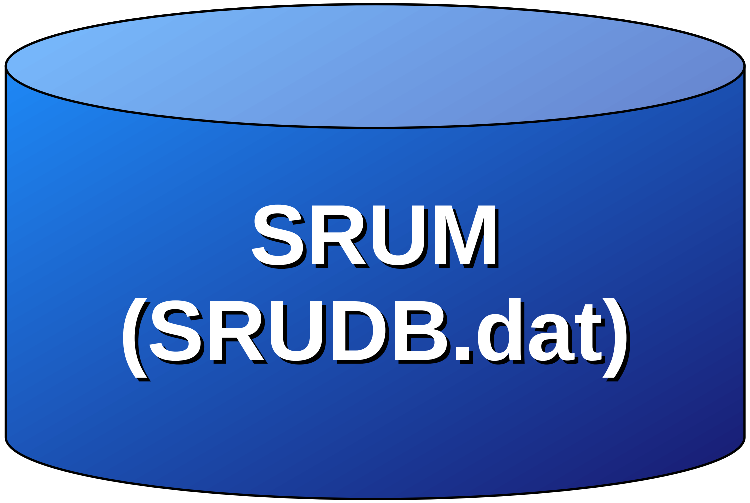
Out-of-Scope Topics

- 3rd party “Forensically Sound” tools for
  - Memory Capture (a.k.a. a “Memory Dumps”)
  - Disk Imaging Tools
- How-To’s
  - Chain of Custody
  - Court Cases and Trials
    - Data handling and acceptable practices
  - Isolation, remote access, and when to disconnect or shutdown
- Data storage, data archival, data write blockers, etc.

Data Preservation Methodology

- Collect a “Forensic Image” first and foremost!
  - Work from a “Forensic Clone”
    - A working copy from your original “Forensic Image”
  - After completing & hashing a “Forensic Image”
    - Creating a “Forensic Clone”, while the “Forensic Image” is copying, provides a good opportunity to conduct live host eDiscovery acquisition
- Minimize activities that could modify system data and access times as much as possible!

The Windows SRUM Database



SRUM
(SRUDB.dat)

The System Resource Utilization Monitor (**SRUM**) is built into Windows 8 and above. System “*App History*” data is recorded and stored in an Extensible Storage Engine (ESE) database named “**SRUDB.dat**”.

The “SRUDB.dat” File

The Windows SRUM database file is located at:

C:\Windows\System32\sru\SRUDB.dat

Think of the SRUM database as holding the same level of details typically found in most commercial Endpoint/Network Detection & Response (**XDR)** solutions, but without any monitoring, alerting, “Detection”, or “Response” capabilities.

Useful SRUM Data

The Windows SRUM was never intended to be used for forensic purposes by Microsoft. Consequently, more details are stored than is typically helpful for our investigations. We’ll focus our efforts on the following:

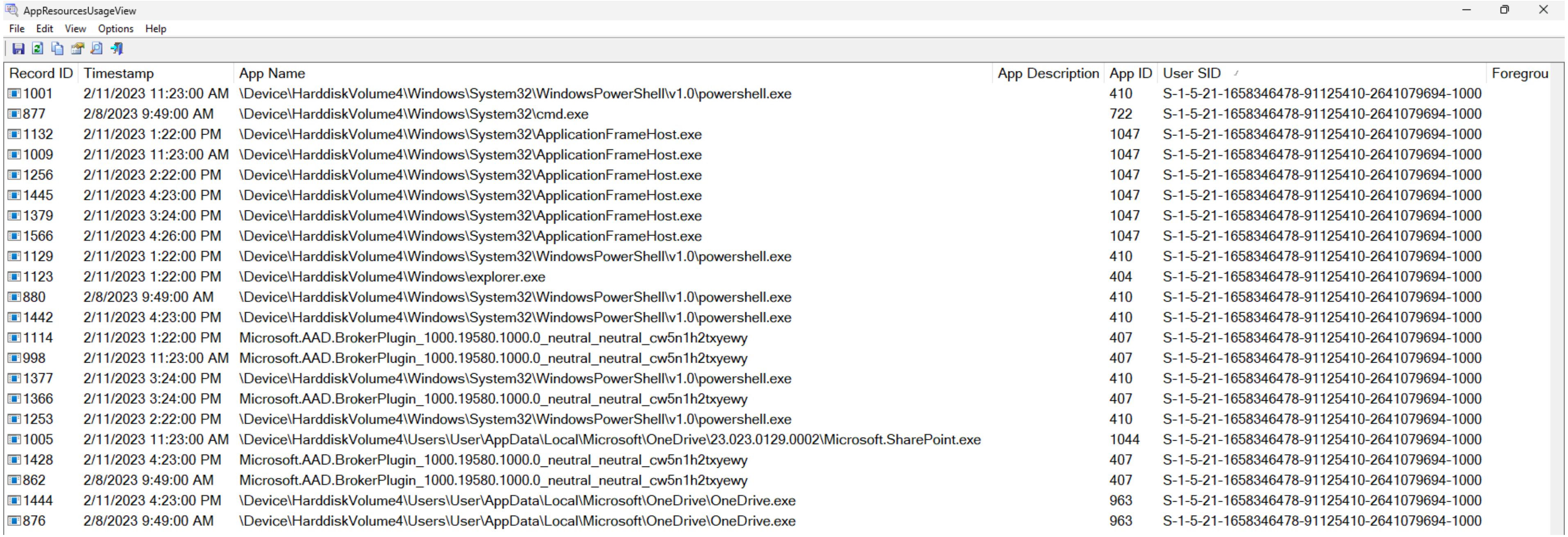
- Application Resources Usage
- Network Usage

“SRUDB.dat” Tools

Here are some Free and Open-Source Software options:

- SRUM Dump 2
  - https://github.com/MarkBaggett/srum-dump
- Velociraptor
  - https://www.rapid7.com/products/velociraptor
- NirSoft (AppResourcesUsageView & NetworkUsageView)
  - https://www.nirsoft.net/utils/app_resources_usage_view.html
  - https://www.nirsoft.net/utils/network_usage_view.html

SRUDB.dat Example Output

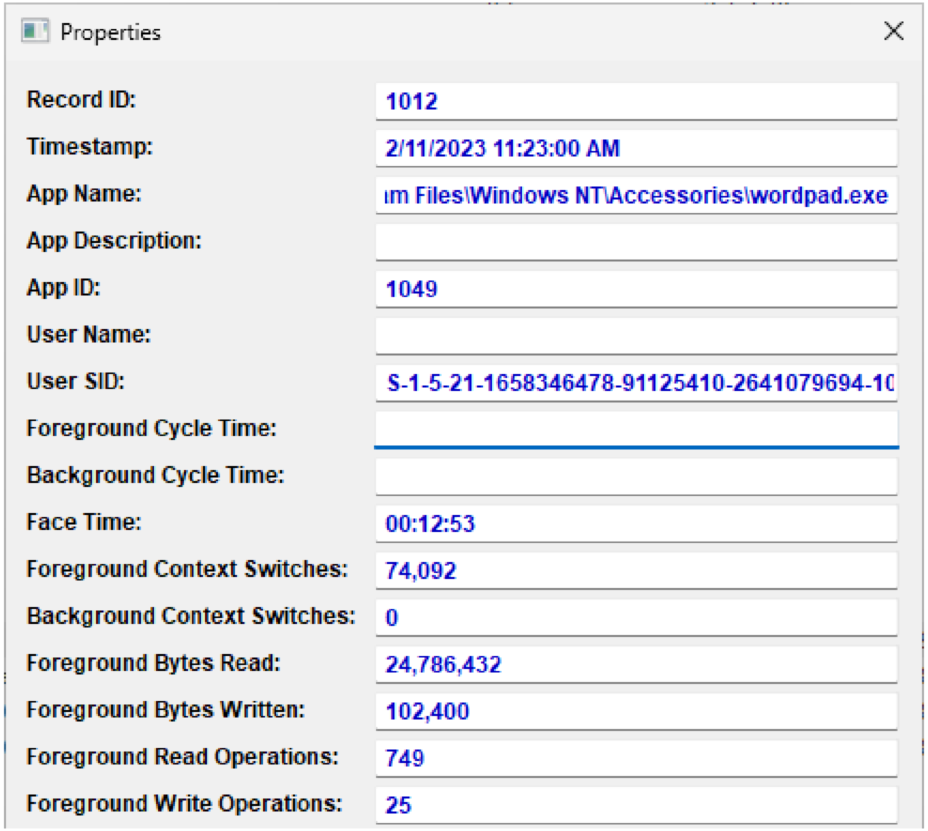


Record ID	Timestamp	App Name	App Description	App ID	User SID	Foregrou
1001	2/11/2023 11:23:00 AM	\Device\HarddiskVolume4\Windows\System32\WindowsPowerShell\v1.0\powershell.exe		410	S-1-5-21-1658346478-91125410-2641079694-1000	
877	2/8/2023 9:49:00 AM	\Device\HarddiskVolume4\Windows\System32\cmd.exe		722	S-1-5-21-1658346478-91125410-2641079694-1000	
1132	2/11/2023 1:22:00 PM	\Device\HarddiskVolume4\Windows\System32\ApplicationFrameHost.exe		1047	S-1-5-21-1658346478-91125410-2641079694-1000	
1009	2/11/2023 11:23:00 AM	\Device\HarddiskVolume4\Windows\System32\ApplicationFrameHost.exe		1047	S-1-5-21-1658346478-91125410-2641079694-1000	
1256	2/11/2023 2:22:00 PM	\Device\HarddiskVolume4\Windows\System32\ApplicationFrameHost.exe		1047	S-1-5-21-1658346478-91125410-2641079694-1000	
1445	2/11/2023 4:23:00 PM	\Device\HarddiskVolume4\Windows\System32\ApplicationFrameHost.exe		1047	S-1-5-21-1658346478-91125410-2641079694-1000	
1379	2/11/2023 3:24:00 PM	\Device\HarddiskVolume4\Windows\System32\ApplicationFrameHost.exe		1047	S-1-5-21-1658346478-91125410-2641079694-1000	
1566	2/11/2023 4:26:00 PM	\Device\HarddiskVolume4\Windows\System32\ApplicationFrameHost.exe		1047	S-1-5-21-1658346478-91125410-2641079694-1000	
1129	2/11/2023 1:22:00 PM	\Device\HarddiskVolume4\Windows\System32\WindowsPowerShell\v1.0\powershell.exe		410	S-1-5-21-1658346478-91125410-2641079694-1000	
1123	2/11/2023 1:22:00 PM	\Device\HarddiskVolume4\Windows\explorer.exe		404	S-1-5-21-1658346478-91125410-2641079694-1000	
880	2/8/2023 9:49:00 AM	\Device\HarddiskVolume4\Windows\System32\WindowsPowerShell\v1.0\powershell.exe		410	S-1-5-21-1658346478-91125410-2641079694-1000	
1442	2/11/2023 4:23:00 PM	\Device\HarddiskVolume4\Windows\System32\WindowsPowerShell\v1.0\powershell.exe		410	S-1-5-21-1658346478-91125410-2641079694-1000	
1114	2/11/2023 1:22:00 PM	Microsoft.AAD.BrokerPlugin_1000.19580.1000.0_neutral_neutral_cw5n1h2txyewy		407	S-1-5-21-1658346478-91125410-2641079694-1000	
998	2/11/2023 11:23:00 AM	Microsoft.AAD.BrokerPlugin_1000.19580.1000.0_neutral_neutral_cw5n1h2txyewy		407	S-1-5-21-1658346478-91125410-2641079694-1000	
1377	2/11/2023 3:24:00 PM	\Device\HarddiskVolume4\Windows\System32\WindowsPowerShell\v1.0\powershell.exe		410	S-1-5-21-1658346478-91125410-2641079694-1000	
1366	2/11/2023 3:24:00 PM	Microsoft.AAD.BrokerPlugin_1000.19580.1000.0_neutral_neutral_cw5n1h2txyewy		407	S-1-5-21-1658346478-91125410-2641079694-1000	
1253	2/11/2023 2:22:00 PM	\Device\HarddiskVolume4\Windows\System32\WindowsPowerShell\v1.0\powershell.exe		410	S-1-5-21-1658346478-91125410-2641079694-1000	
1005	2/11/2023 11:23:00 AM	\Device\HarddiskVolume4\Users\User\AppData\Local\Microsoft\OneDrive\23.023.0129.0002\Microsoft.SharePoint.exe		1044	S-1-5-21-1658346478-91125410-2641079694-1000	
1428	2/11/2023 4:23:00 PM	Microsoft.AAD.BrokerPlugin_1000.19580.1000.0_neutral_neutral_cw5n1h2txyewy		407	S-1-5-21-1658346478-91125410-2641079694-1000	
862	2/8/2023 9:49:00 AM	Microsoft.AAD.BrokerPlugin_1000.19580.1000.0_neutral_neutral_cw5n1h2txyewy		407	S-1-5-21-1658346478-91125410-2641079694-1000	
1444	2/11/2023 4:23:00 PM	\Device\HarddiskVolume4\Users\User\AppData\Local\Microsoft\OneDrive\OneDrive.exe		963	S-1-5-21-1658346478-91125410-2641079694-1000	
876	2/8/2023 9:49:00 AM	\Device\HarddiskVolume4\Users\User\AppData\Local\Microsoft\OneDrive\OneDrive.exe		963	S-1-5-21-1658346478-91125410-2641079694-1000	

Application Resources Usage

May include the following application execution details:

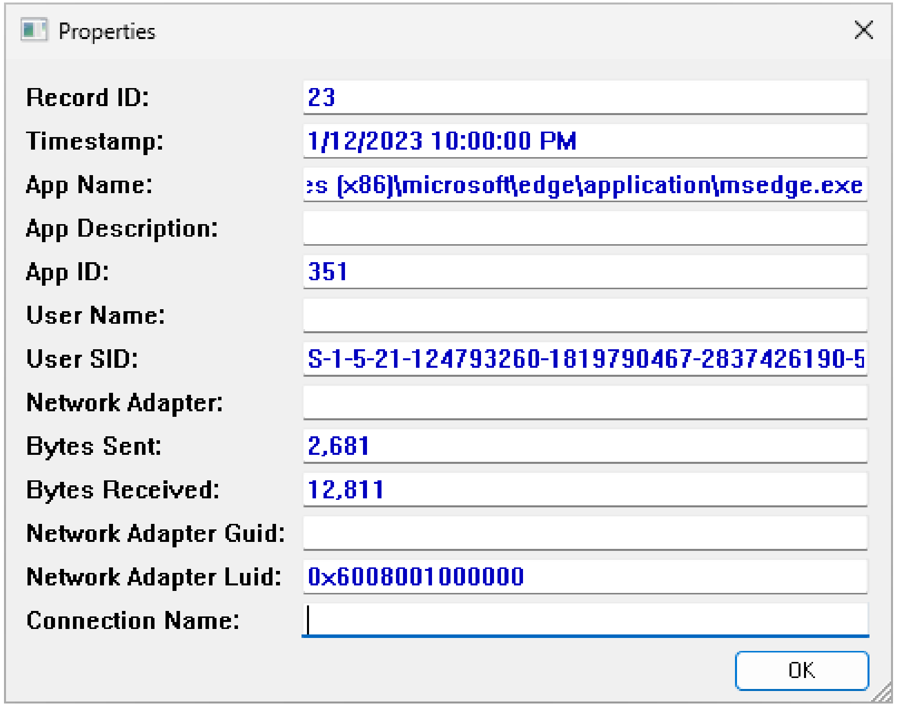
Timestamp, Application Name, User SID, cycle times, bytes read and written, number of read and write operations, and more.



Record ID:	1012
Timestamp:	2/11/2023 11:23:00 AM
App Name:	ım Files\Windows NT\Accessories\wordpad.exe
App Description:	
App ID:	1049
User Name:	
User SID:	S-1-5-21-1658346478-91125410-2641079694-10
Foreground Cycle Time:	
Background Cycle Time:	
Face Time:	00:12:53
Foreground Context Switches:	74,092
Background Context Switches:	0
Foreground Bytes Read:	24,786,432
Foreground Bytes Written:	102,400
Foreground Read Operations:	749
Foreground Write Operations:	25

Network Resource Usage

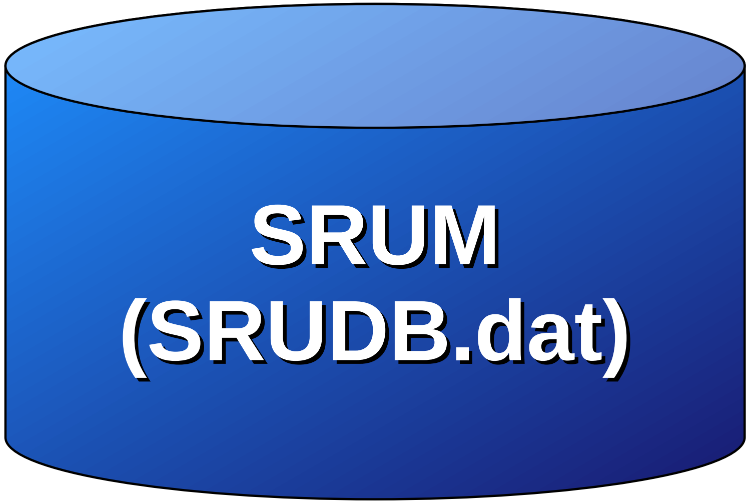
May include: the timestamp, name and description of the service or application, the name and SID of the user, the network adapter, and the total number of bytes sent and received by the specified service or application.



Record ID:	23
Timestamp:	1/12/2023 10:00:00 PM
App Name:	:s (x86)\microsoft\edge\application\msedge.exe
App Description:	
App ID:	351
User Name:	
User SID:	S-1-5-21-124793260-1819790467-2837426190-5
Network Adapter:	
Bytes Sent:	2,681
Bytes Received:	12,811
Network Adapter Guid:	
Network Adapter Luid:	0x6008001000000
Connection Name:	

SRUM Database Conclusions

The Windows SRUM database helps us with identifying file execution, user attribution, activity correlation, and time lining of system events.



SRUM
(SRUDB.dat)

Web Browser Artifacts

- ➔What they are
  - ➔Where they are
    - ➔Why these are important
      - ➔How they are parsed

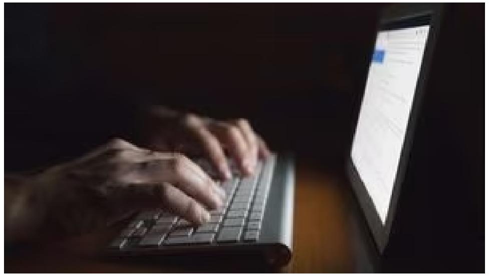
What & Where

- These artifacts are the data left behind by a web browser, when visiting a website
- Computers store a variety of detailed information from visited websites
  - Different browsers store their artifacts/files in different locations

Why these are important

Essential for digital forensic examiners and Incident Response

- These artifacts help to identify
  - The source of malicious attack traffic
  - Proxy policy violation



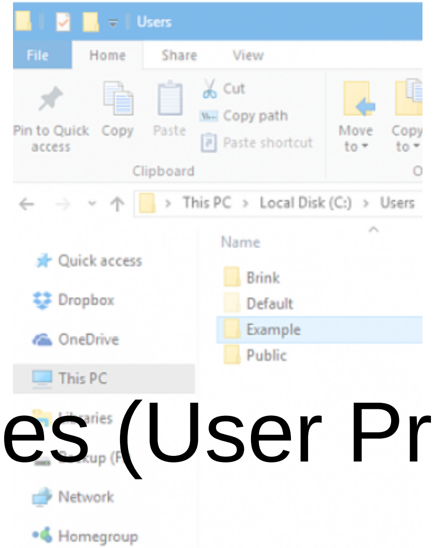
Investigation Tooling

Data Extraction & Analysis Tools

- Free and Open-Source Software
  - Browser History Examiner (BHE) - Foxtron
  - BrowsingHistoryView - Nirsoft
  - BrowserDownloadView- Nirsoft
  - DB Browser for SQLite
  - Hindsight
- Various 3rd party commercial forensic tools

Artifact Sources

- Suspect Hard Drives
- Forensic Clones
  - Hard Drive Images
- Memory Dumps
- Databases and Other Files (User Profile)



High-Value Artifacts

Most Notably...

- History/URLs
  - Typed URLs
  - Searches
- Cache
- Logins
- Cookies

- Form values
  - Auto-fill
- Downloads
- Favorites
  - a.k.a. Bookmarks

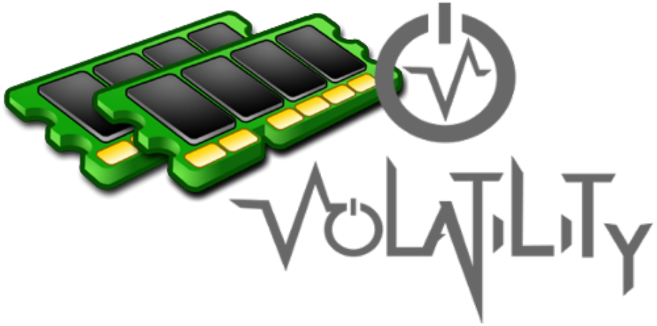
Private Browsing

Private (a.k.a. incognito) browsing modes allow users to surf the web without retaining browser history, cache, cookie files, and more.

Memory Dumps

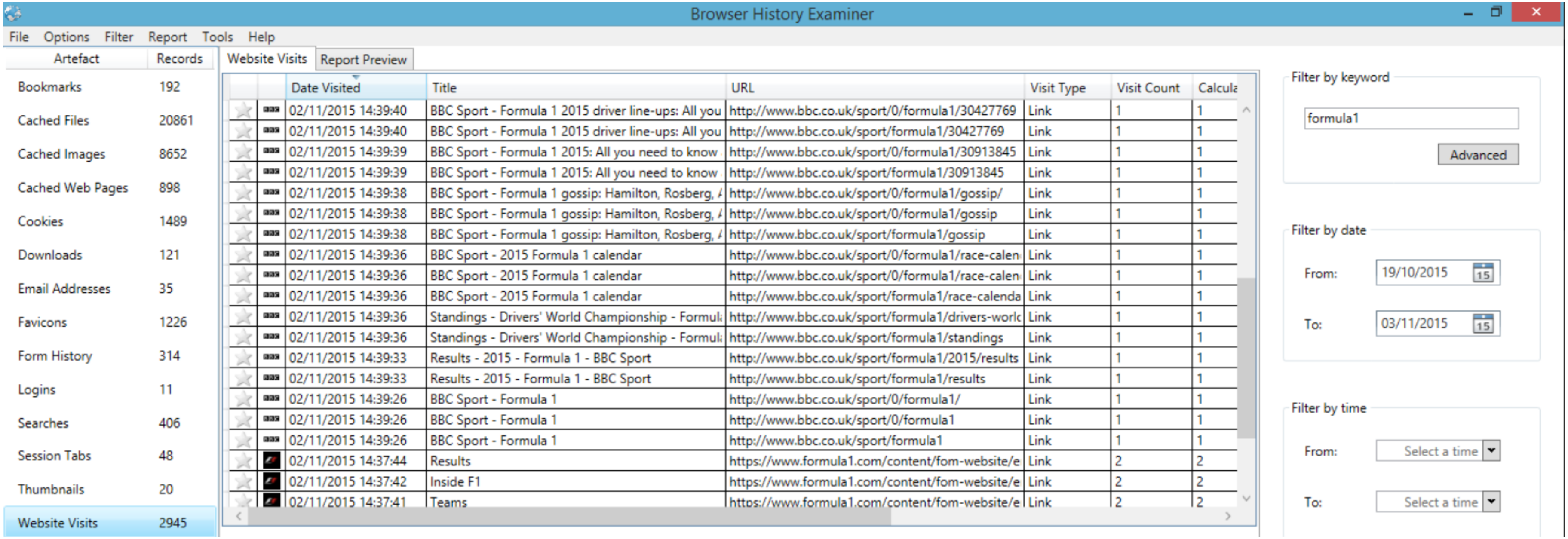
“Memory Dumps” are a snapshot of memory captured for memory analysis

- When a RAM dump is captured, it contains data relating to all running processes and other web browser artifacts at the time of the memory capture



History/URLs

This artifact reveals navigation history of the user, which may be used to identify if a user visited malicious websites.



Browser History Examiner

Artefact	Records
Bookmarks	192
Cached Files	20861
Cached Images	8652
Cached Web Pages	898
Cookies	1489
Downloads	121
Email Addresses	35
Favicons	1226
Form History	314
Logins	11
Searches	406
Session Tabs	48
Thumbnails	20
Website Visits	2945

		Date Visited	Title	URL	Visit Type	Visit Count	Calcula
☆		02/11/2015 14:39:40	BBC Sport - Formula 1 2015 driver line-ups: All you	http://www.bbc.co.uk/sport/0/formula1/30427769	Link	1	1
☆		02/11/2015 14:39:40	BBC Sport - Formula 1 2015 driver line-ups: All you	http://www.bbc.co.uk/sport/formula1/30427769	Link	1	1
☆		02/11/2015 14:39:39	BBC Sport - Formula 1 2015: All you need to know	http://www.bbc.co.uk/sport/0/formula1/30913845	Link	1	1
☆		02/11/2015 14:39:39	BBC Sport - Formula 1 2015: All you need to know	http://www.bbc.co.uk/sport/formula1/30913845	Link	1	1
☆		02/11/2015 14:39:38	BBC Sport - Formula 1 gossip: Hamilton, Rosberg, /	http://www.bbc.co.uk/sport/0/formula1/gossip/	Link	1	1
☆		02/11/2015 14:39:38	BBC Sport - Formula 1 gossip: Hamilton, Rosberg, /	http://www.bbc.co.uk/sport/0/formula1/gossip	Link	1	1
☆		02/11/2015 14:39:38	BBC Sport - Formula 1 gossip: Hamilton, Rosberg, /	http://www.bbc.co.uk/sport/formula1/gossip	Link	1	1
☆		02/11/2015 14:39:36	BBC Sport - 2015 Formula 1 calendar	http://www.bbc.co.uk/sport/0/formula1/race-calen	Link	1	1
☆		02/11/2015 14:39:36	BBC Sport - 2015 Formula 1 calendar	http://www.bbc.co.uk/sport/0/formula1/race-calen	Link	1	1
☆		02/11/2015 14:39:36	BBC Sport - 2015 Formula 1 calendar	http://www.bbc.co.uk/sport/formula1/race-calenda	Link	1	1
☆		02/11/2015 14:39:36	Standings - Drivers' World Championship - Formul	http://www.bbc.co.uk/sport/formula1/drivers-worlc	Link	1	1
☆		02/11/2015 14:39:36	Standings - Drivers' World Championship - Formul	http://www.bbc.co.uk/sport/formula1/standings	Link	1	1
☆		02/11/2015 14:39:33	Results - 2015 - Formula 1 - BBC Sport	http://www.bbc.co.uk/sport/formula1/2015/results	Link	1	1
☆		02/11/2015 14:39:33	Results - 2015 - Formula 1 - BBC Sport	http://www.bbc.co.uk/sport/formula1/results	Link	1	1
☆		02/11/2015 14:39:26	BBC Sport - Formula 1	http://www.bbc.co.uk/sport/0/formula1/	Link	1	1
☆		02/11/2015 14:39:26	BBC Sport - Formula 1	http://www.bbc.co.uk/sport/0/formula1	Link	1	1
☆		02/11/2015 14:39:26	BBC Sport - Formula 1	http://www.bbc.co.uk/sport/formula1	Link	1	1
☆		02/11/2015 14:37:44	Results	https://www.formula1.com/content/fom-website/e	Link	2	2
☆		02/11/2015 14:37:42	Inside F1	https://www.formula1.com/content/fom-website/e	Link	2	2
☆		02/11/2015 14:37:41	Teams	https://www.formula1.com/content/fom-website/e	Link	2	2

Filter by keyword

formula1

Filter by date

From: 19/10/2015

To: 03/11/2015

Filter by time

From: Select a time

To: Select a time

Example History Artifact Paths

Microsoft Edge

- \Users\<username>\AppData\Local\Microsoft\Edge\User Data\Default
- \Users\<username>\AppData\Local\Microsoft\Edge\User Data\Default\Cache

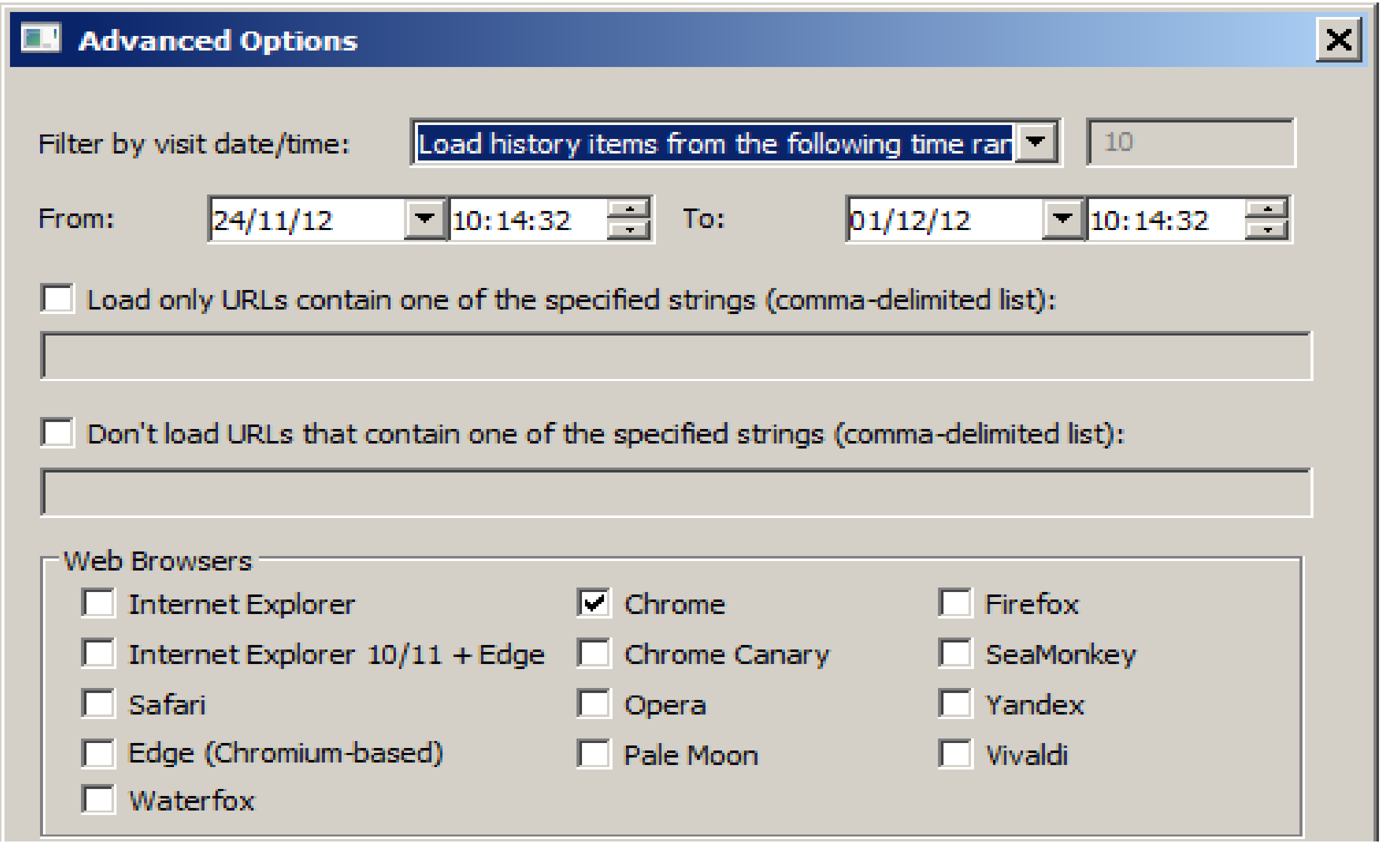
Mozilla Firefox

- \Users\<username>\AppData\Roaming\Mozilla\Firefox\Profiles\<profile folder>
- \Users\<username>\AppData\Local\Mozilla\Firefox\Profiles\<profile folder>\cache2

Google Chrome

- \Users\<username>\AppData\Local\Google\Chrome\User Data\Default
- \Users\<username>\AppData\Local\Google\Chrome\User Data\Default\Cache

History Parsed Example 1/4



Advanced Options

Filter by visit date/time: Load history items from the following time ran 10

From: 24/11/12 10:14:32 To: 01/12/12 10:14:32

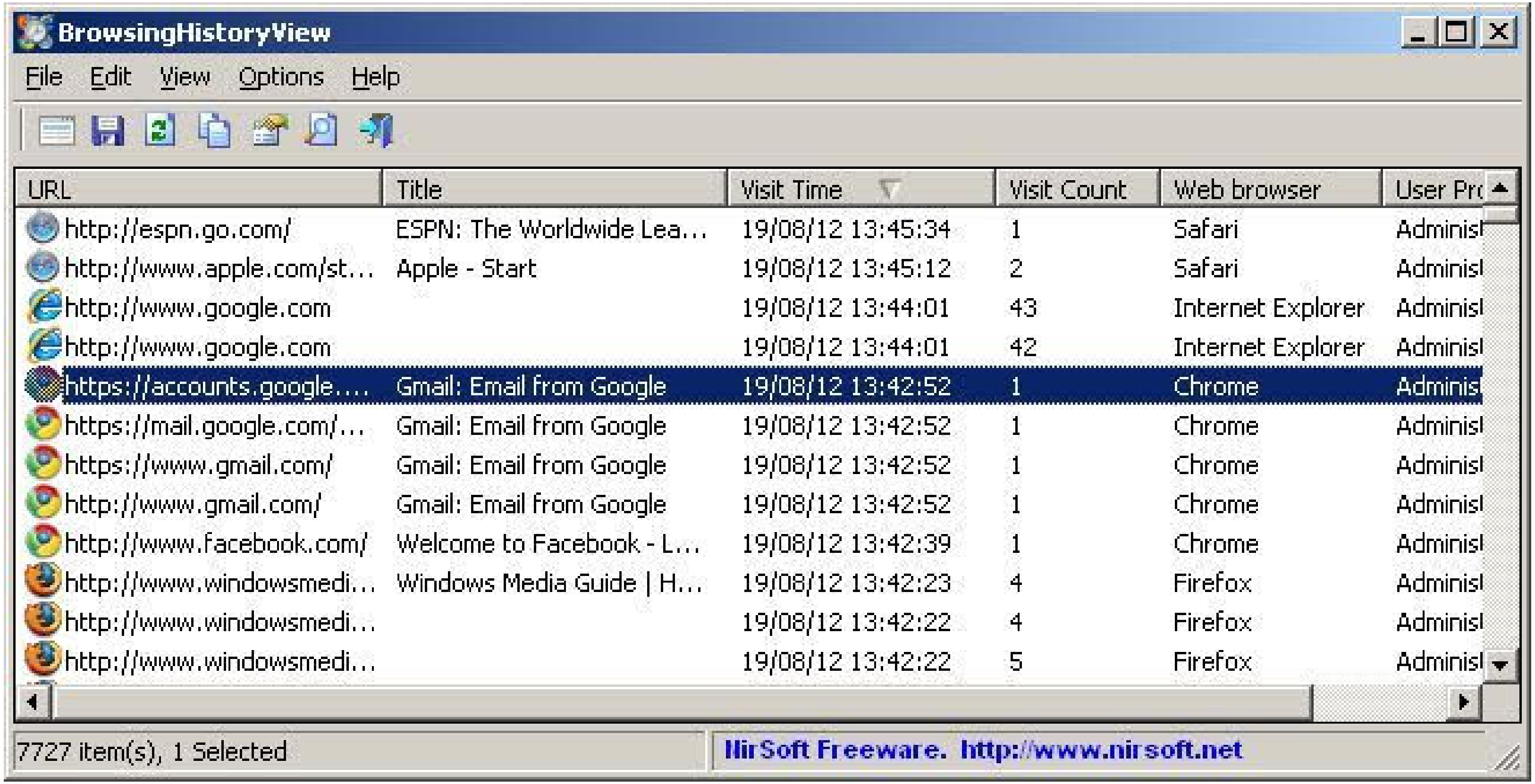
□ Load only URLs contain one of the specified strings (comma-delimited list):

□ Don't load URLs that contain one of the specified strings (comma-delimited list):

Web Browsers

□ Internet Explorer
□ Internet Explorer 10/11 + Edge
□ Safari
□ Edge (Chromium-based)
□ Waterfox
☑ Chrome
□ Chrome Canary
□ Opera
□ Pale Moon
□ Firefox
□ SeaMonkey
□ Yandex
□ Vivaldi

History Parsed Example 2/4

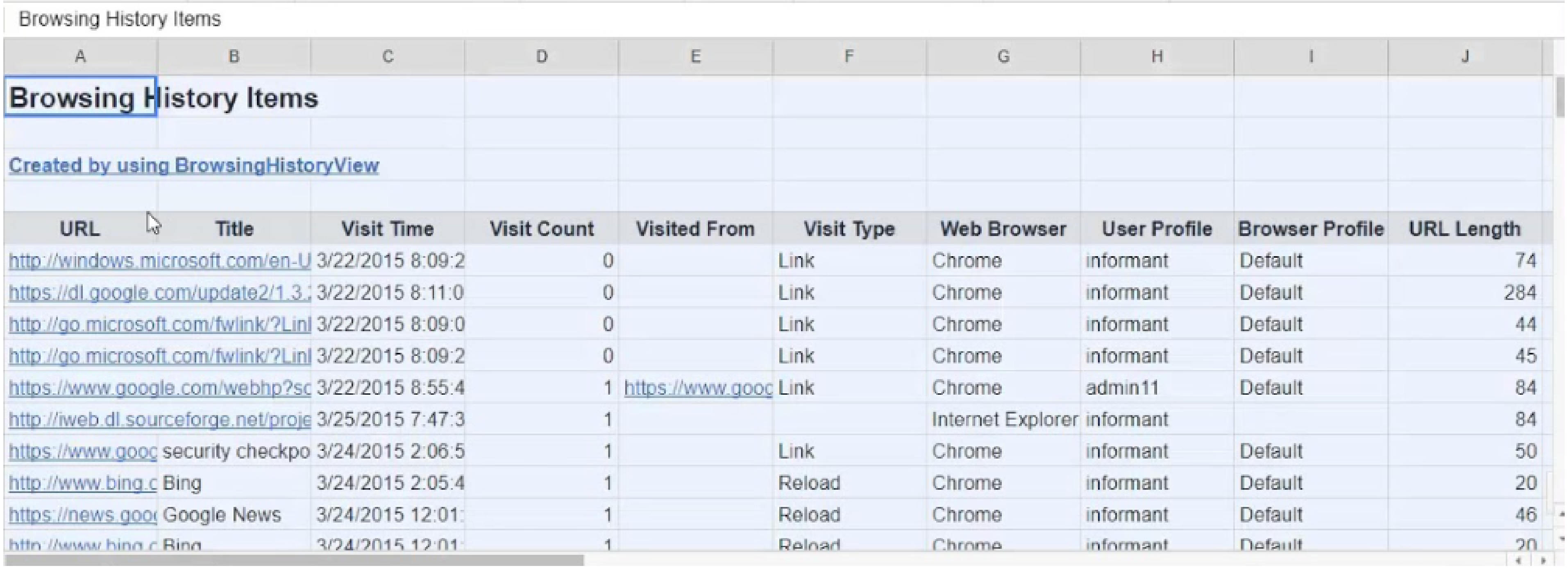


URL	Title	Visit Time	Visit Count	Web browser	User Pro
http://espn.go.com/	ESPN: The Worldwide Lea…	19/08/12 13:45:34	1	Safari	Adminis
http://www.apple.com/st…	Apple - Start	19/08/12 13:45:12	2	Safari	Adminis
http://www.google.com		19/08/12 13:44:01	43	Internet Explorer	Adminis
http://www.google.com		19/08/12 13:44:01	42	Internet Explorer	Adminis
https://accounts.google.…	Gmail: Email from Google	19/08/12 13:42:52	1	Chrome	Adminis
https://mail.google.com/…	Gmail: Email from Google	19/08/12 13:42:52	1	Chrome	Adminis
https://www.gmail.com/	Gmail: Email from Google	19/08/12 13:42:52	1	Chrome	Adminis
http://www.gmail.com/	Gmail: Email from Google	19/08/12 13:42:52	1	Chrome	Adminis
http://www.facebook.com/	Welcome to Facebook - L…	19/08/12 13:42:39	1	Chrome	Adminis
http://www.windowsmedi…	Windows Media Guide | H…	19/08/12 13:42:23	4	Firefox	Adminis
http://www.windowsmedi…		19/08/12 13:42:22	4	Firefox	Adminis
http://www.windowsmedi…		19/08/12 13:42:22	5	Firefox	Adminis

7727 item(s), 1 Selected

NirSoft Freeware. http://www.nirsoft.net

History Parsed Example 3/4



Browsing History Items

Browsing History Items

Created by using BrowsingHistoryView

URL	Title	Visit Time	Visit Count	Visited From	Visit Type	Web Browser	User Profile	Browser Profile	URL Length
http://windows.microsoft.com/en-U		3/22/2015 8:09:2	0		Link	Chrome	informant	Default	74
https://dl.google.com/update2/1.3.:		3/22/2015 8:11:0	0		Link	Chrome	informant	Default	284
http://go.microsoft.com/fwlink/?Linl		3/22/2015 8:09:0	0		Link	Chrome	informant	Default	44
http://go.microsoft.com/fwlink/?Linl		3/22/2015 8:09:2	0		Link	Chrome	informant	Default	45
https://www.google.com/webhp?sc		3/22/2015 8:55:4	1	https://www.gooc	Link	Chrome	admin11	Default	84
http://iweb.dl.sourceforge.net/proje		3/25/2015 7:47:3	1			Internet Explorer	informant		84
https://www.gooc	security checkpo	3/24/2015 2:06:5	1		Link	Chrome	informant	Default	50
http://www.bing.c	Bing	3/24/2015 2:05:4	1		Reload	Chrome	informant	Default	20
https://news.gooc	Google News	3/24/2015 12:01:	1		Reload	Chrome	informant	Default	46
http://www.bing.c	Bing	3/24/2015 12:01:	1		Reload	Chrome	informant	Default	20

Exported to Excel for detailed inspection and analysis.

History Parsed Example 4/4

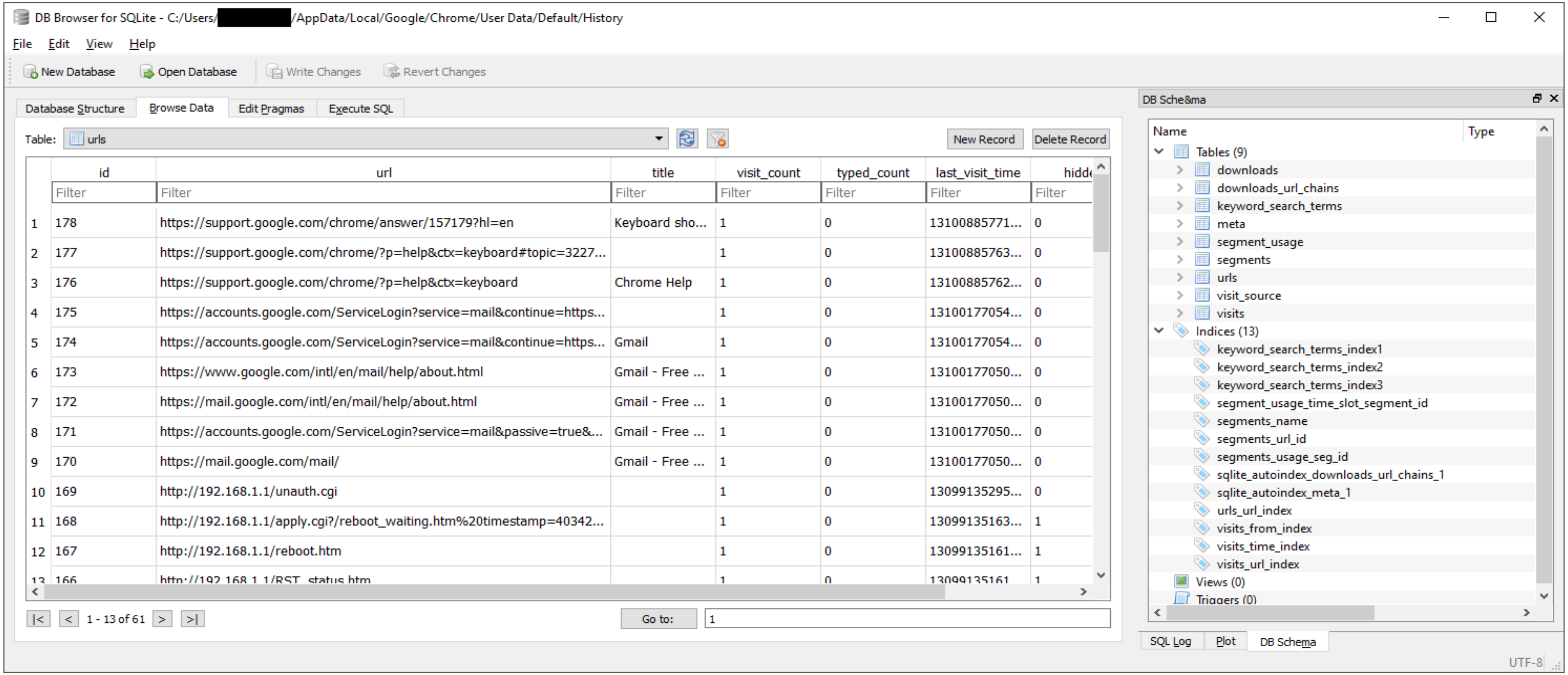


Table: urls

	id	url	title	visit_count	typed_count	last_visit_time	hidde
	Filter	Filter	Filter	Filter	Filter	Filter	Filter
1	178	https://support.google.com/chrome/answer/157179?hl=en	Keyboard sho...	1	0	13100885771...	0
2	177	https://support.google.com/chrome/?p=help&ctx=keyboard#topic=3227...		1	0	13100885763...	0
3	176	https://support.google.com/chrome/?p=help&ctx=keyboard	Chrome Help	1	0	13100885762...	0
4	175	https://accounts.google.com/ServiceLogin?service=mail&continue=https...		1	0	13100177054...	0
5	174	https://accounts.google.com/ServiceLogin?service=mail&continue=https...	Gmail	1	0	13100177054...	0
6	173	https://www.google.com/intl/en/mail/help/about.html	Gmail - Free ...	1	0	13100177050...	0
7	172	https://mail.google.com/intl/en/mail/help/about.html	Gmail - Free ...	1	0	13100177050...	0
8	171	https://accounts.google.com/ServiceLogin?service=mail&passive=true&...	Gmail - Free ...	1	0	13100177050...	0
9	170	https://mail.google.com/mail/	Gmail - Free ...	1	0	13100177050...	0
10	169	http://192.168.1.1/unauth.cgi		1	0	13099135295...	0
11	168	http://192.168.1.1/apply.cgi?/reboot_waiting.htm%20timestamp=40342...		1	0	13099135163...	1
12	167	http://192.168.1.1/reboot.htm		1	0	13099135161...	1
13	166	http://192.168.1.1/RST_status.htm		1	0	13099135161	1

|< < 1 - 13 of 61 > >| Go to: 1

Name	Type
Tables (9)	
downloads	
downloads_url_chains	
keyword_search_terms	
meta	
segment_usage	
segments	
urls	
visit_source	
visits	
Indices (13)	
keyword_search_terms_index1	
keyword_search_terms_index2	
keyword_search_terms_index3	
segment_usage_time_slot_segment_id	
segments_name	
segments_url_id	
segments_usage_seg_id	
sqlite_autoindex_downloads_url_chains_1	
sqlite_autoindex_meta_1	
urls_url_index	
visits_from_index	
visits_time_index	
visits_url_index	
Views (0)	
Triggers (0)	

Parsed with a GUI SQLite database browser

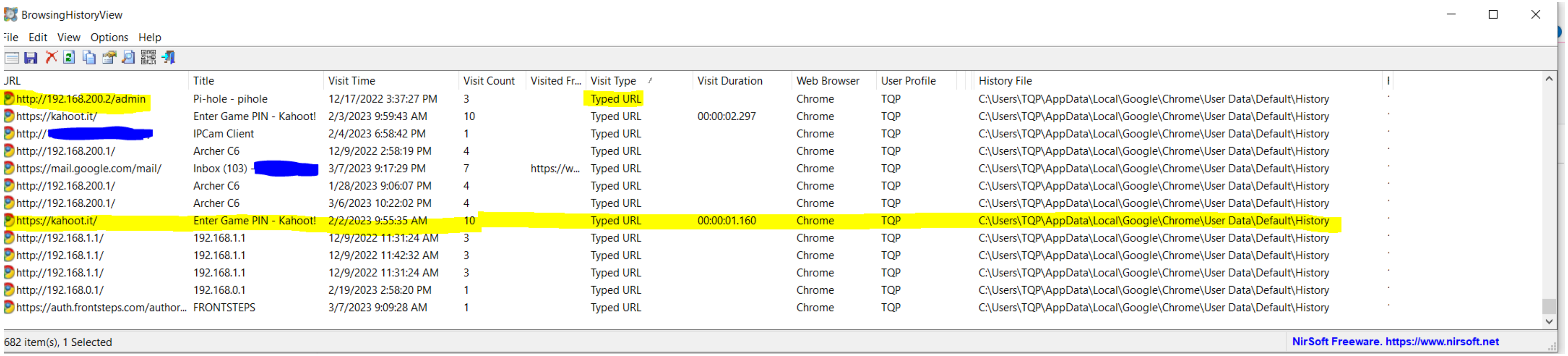
Typed Addresses/URLs

This artifact contains any URL that is typed into the browser address bar.

Also found within the Windows registry (NTUSER.DAT)

- Software\Microsoft\InternetExplorer\TypedURLs

Typed URLs Parsed Example



BrowsingHistoryView

URL	Title	Visit Time	Visit Count	Visited Fr...	Visit Type	Visit Duration	Web Browser	User Profile	History File
http://192.168.200.2/admin	Pi-hole - pihole	12/17/2022 3:37:27 PM	3		Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
https://kahoot.it/	Enter Game PIN - Kahoot!	2/3/2023 9:59:43 AM	10		Typed URL	00:00:02.297	Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
http://[redacted]	IPCam Client	2/4/2023 6:58:42 PM	1		Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
http://192.168.200.1/	Archer C6	12/9/2022 2:58:19 PM	4		Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
https://mail.google.com/mail/	Inbox (103) - [redacted]	3/7/2023 9:17:29 PM	7	https://w...	Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
http://192.168.200.1/	Archer C6	1/28/2023 9:06:07 PM	4		Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
http://192.168.200.1/	Archer C6	3/6/2023 10:22:02 PM	4		Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
https://kahoot.it/	Enter Game PIN - Kahoot!	2/2/2023 9:55:35 AM	10		Typed URL	00:00:01.160	Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
http://192.168.1.1/	192.168.1.1	12/9/2022 11:31:24 AM	3		Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
http://192.168.1.1/	192.168.1.1	12/9/2022 11:42:32 AM	3		Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
http://192.168.1.1/	192.168.1.1	12/9/2022 11:31:24 AM	3		Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
http://192.168.0.1/	192.168.0.1	2/19/2023 2:58:20 PM	1		Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History
https://auth.frontsteps.com/author...	FRONTSTEPS	3/7/2023 9:09:28 AM	1		Typed URL		Chrome	TQP	C:\Users\TQP\AppData\Local\Google\Chrome\User Data\Default\History

682 item(s), 1 Selected

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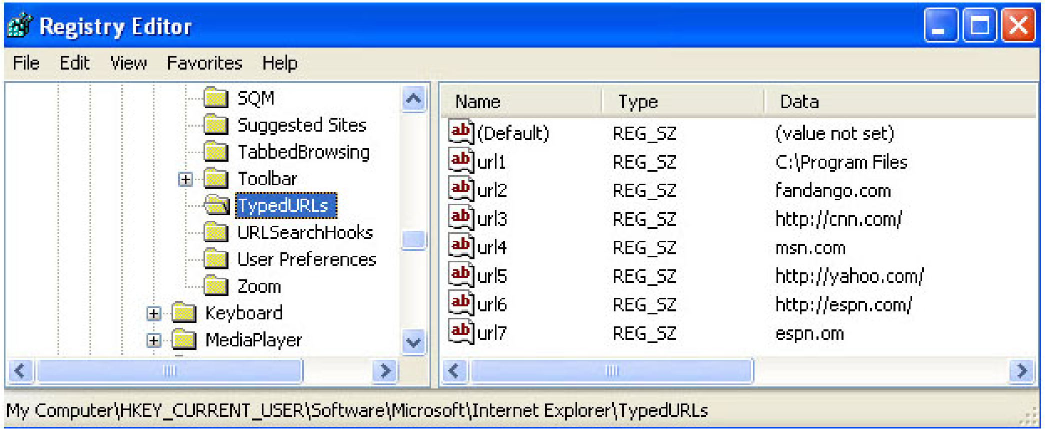
Artifact from Registry:



Registry Editor

Name	Type	Data
(Default)	REG_SZ	(value not set)
url1	REG_SZ	C:\Program Files
url2	REG_SZ	fandango.com
url3	REG_SZ	http://cnn.com/
url4	REG_SZ	msn.com
url5	REG_SZ	http://yahoo.com/
url6	REG_SZ	http://espn.com/
url7	REG_SZ	espn.om

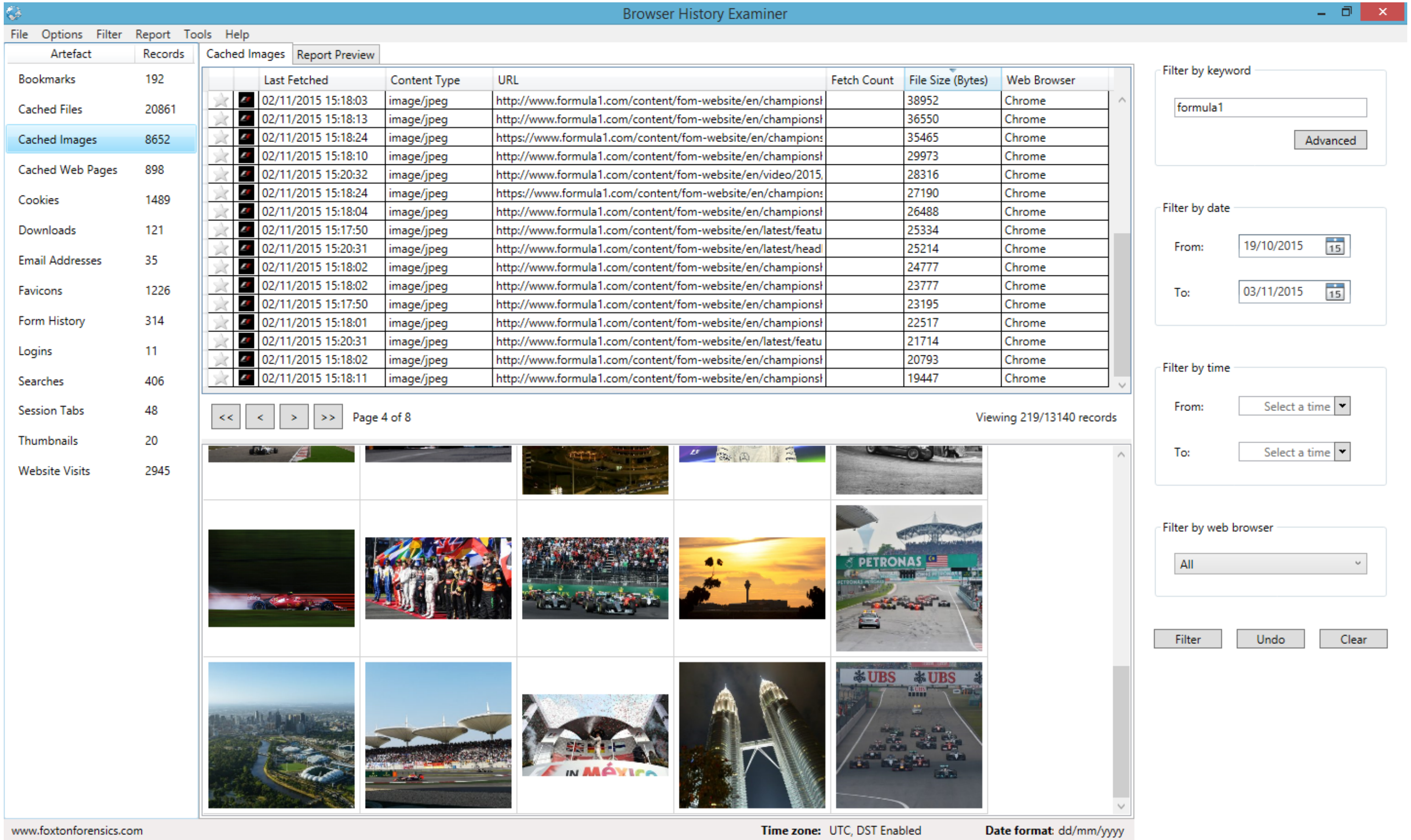
My Computer\HKEY_CURRENT_USER\Software\Microsoft\Internet Explorer\TypedURLs

Browser Cache

Contains cache data from various websites such as: image files, JavaScript files, etc.

- Example artifact paths
  - Chrome & EDGE Cache is stored using an Index file ('index'), a number of Data Block files ('data_#'), and a number of separate data files ('f_######')
  - Firefox Cache is stored using a Cache Map File ('_CACHE_MAP_'), three Cache Block files ('_CACHE_00#_'), and a number of separate data files. The cache structure was changed in Firefox version 32 and named 'Cache v2'

Cache Parsed



Browser History Examiner

File Options Filter Report Tools Help

Artefact	Records
Bookmarks	192
Cached Files	20861
Cached Images	8652
Cached Web Pages	898
Cookies	1489
Downloads	121
Email Addresses	35
Favicons	1226
Form History	314
Logins	11
Searches	406
Session Tabs	48
Thumbnails	20
Website Visits	2945

Cached Images | Report Preview

		Last Fetched	Content Type	URL	Fetch Count	File Size (Bytes)	Web Browser
☆		02/11/2015 15:18:03	image/jpeg	http://www.formula1.com/content/fom-website/en/championsh		38952	Chrome
☆		02/11/2015 15:18:13	image/jpeg	http://www.formula1.com/content/fom-website/en/championsh		36550	Chrome
☆		02/11/2015 15:18:24	image/jpeg	https://www.formula1.com/content/fom-website/en/champions		35465	Chrome
☆		02/11/2015 15:18:10	image/jpeg	http://www.formula1.com/content/fom-website/en/championsh		29973	Chrome
☆		02/11/2015 15:20:32	image/jpeg	http://www.formula1.com/content/fom-website/en/video/2015,		28316	Chrome
☆		02/11/2015 15:18:24	image/jpeg	https://www.formula1.com/content/fom-website/en/champions		27190	Chrome
☆		02/11/2015 15:18:04	image/jpeg	http://www.formula1.com/content/fom-website/en/championsh		26488	Chrome
☆		02/11/2015 15:17:50	image/jpeg	http://www.formula1.com/content/fom-website/en/latest/featu		25334	Chrome
☆		02/11/2015 15:20:31	image/jpeg	http://www.formula1.com/content/fom-website/en/latest/headl		25214	Chrome
☆		02/11/2015 15:18:02	image/jpeg	http://www.formula1.com/content/fom-website/en/championsh		24777	Chrome
☆		02/11/2015 15:18:02	image/jpeg	http://www.formula1.com/content/fom-website/en/championsh		23777	Chrome
☆		02/11/2015 15:17:50	image/jpeg	http://www.formula1.com/content/fom-website/en/championsh		23195	Chrome
☆		02/11/2015 15:18:01	image/jpeg	http://www.formula1.com/content/fom-website/en/championsh		22517	Chrome
☆		02/11/2015 15:20:31	image/jpeg	http://www.formula1.com/content/fom-website/en/latest/featu		21714	Chrome
☆		02/11/2015 15:18:02	image/jpeg	http://www.formula1.com/content/fom-website/en/championsh		20793	Chrome
☆		02/11/2015 15:18:11	image/jpeg	http://www.formula1.com/content/fom-website/en/championsh		19447	Chrome

<< < > >> Page 4 of 8

Viewing 219/13140 records

Filter by keyword: formula1

Advanced

Filter by date

From: 19/10/2015

To: 03/11/2015

Filter by time

From: Select a time

To: Select a time

Filter by web browser: All

Filter Undo Clear

www.foxtonforensics.com

Time zone: UTC, DST Enabled **Date format:** dd/mm/yyyy

Downloads

Provides the file system location where a user’s file downloads were saved

- Example artifact paths
  - Chrome & EDGE Downloads are stored in the 'History' SQLite database, within the 'downloads' and 'downloads_url_chains' tables
  - Firefox Downloads are stored in the 'places.sqlite' database, within the 'moz_annos' table and associated URL information is stored within the 'moz_places' table

Download Parsed Example 1/2

SQLite database browser GUI

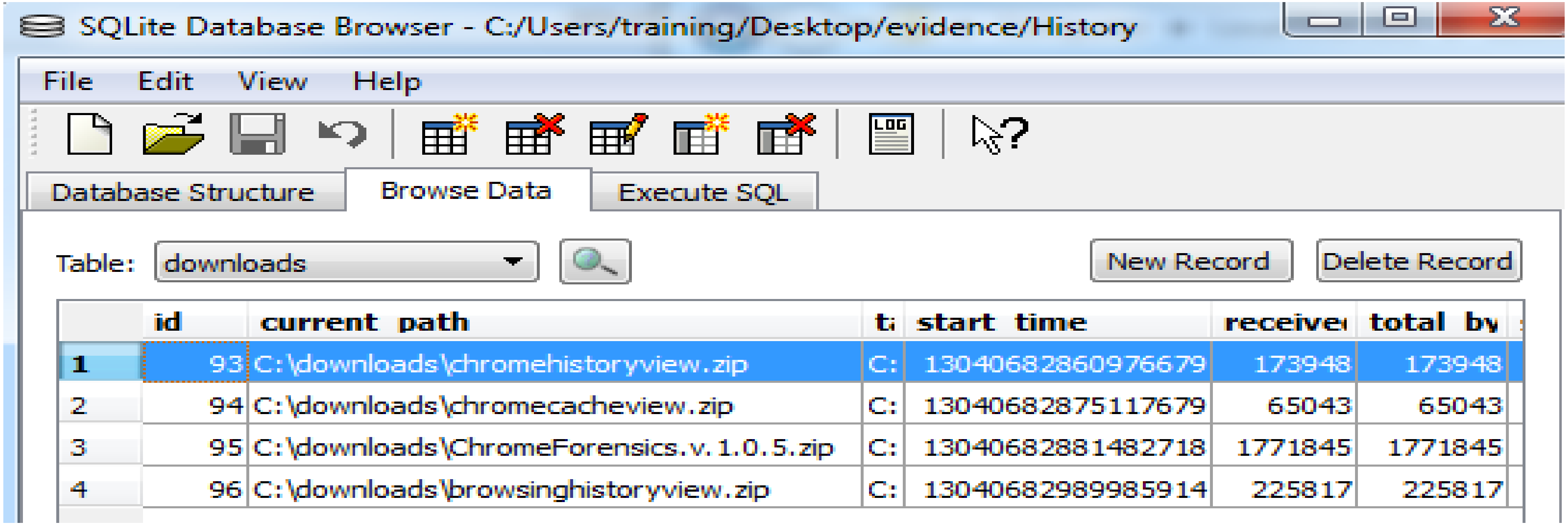
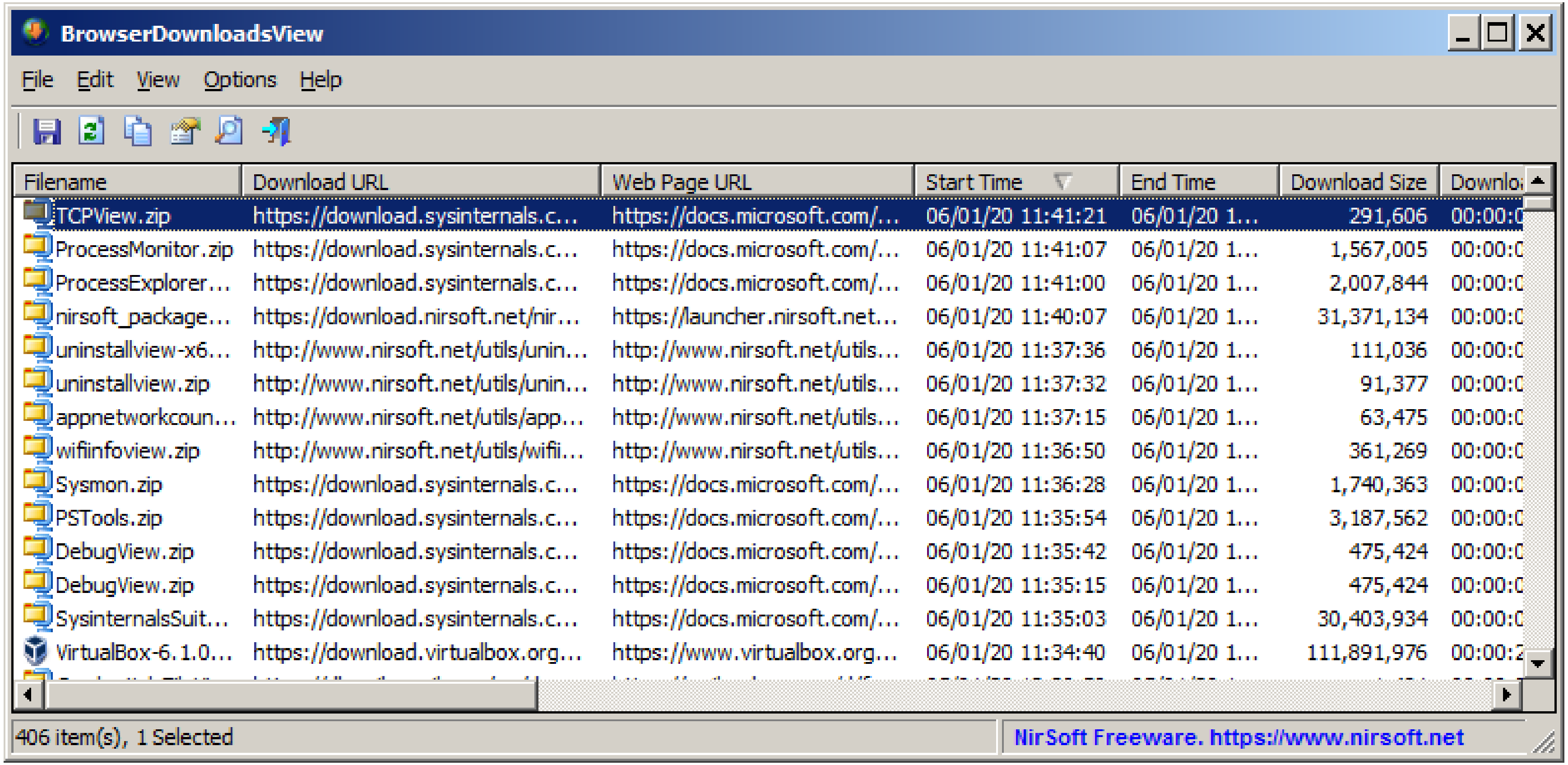


Table: downloads

	id	current_path	t:	start_time	receive	total_by
1	93	C:\downloads\chromehistoryview.zip	C:	13040682860976679	173948	173948
2	94	C:\downloads\chromecacheview.zip	C:	13040682875117679	65043	65043
3	95	C:\downloads\ChromeForensics.v.1.0.5.zip	C:	13040682881482718	1771845	1771845
4	96	C:\downloads\browsinghistoryview.zip	C:	13040682989985914	225817	225817

Download State: The 'value' appears in the 'History' SQLite database → 'downloads' table → 'state' column.

Download Parsed Example 2/2



Filename	Download URL	Web Page URL	Start Time	End Time	Download Size	Downlo:
TCPView.zip	https://download.sysinternals.c...	https://docs.microsoft.com/...	06/01/20 11:41:21	06/01/20 1...	291,606	00:00:0
ProcessMonitor.zip	https://download.sysinternals.c...	https://docs.microsoft.com/...	06/01/20 11:41:07	06/01/20 1...	1,567,005	00:00:0
ProcessExplorer...	https://download.sysinternals.c...	https://docs.microsoft.com/...	06/01/20 11:41:00	06/01/20 1...	2,007,844	00:00:0
nirsoft_package...	https://download.nirsoft.net/nir...	https://launcher.nirsoft.net...	06/01/20 11:40:07	06/01/20 1...	31,371,134	00:00:0
uninstallview-x6...	http://www.nirsoft.net/utils/unin...	http://www.nirsoft.net/utils...	06/01/20 11:37:36	06/01/20 1...	111,036	00:00:0
uninstallview.zip	http://www.nirsoft.net/utils/unin...	http://www.nirsoft.net/utils...	06/01/20 11:37:32	06/01/20 1...	91,377	00:00:0
appnetworkcoun...	http://www.nirsoft.net/utils/app...	http://www.nirsoft.net/utils...	06/01/20 11:37:15	06/01/20 1...	63,475	00:00:0
wifiinfoview.zip	http://www.nirsoft.net/utils/wifii...	http://www.nirsoft.net/utils...	06/01/20 11:36:50	06/01/20 1...	361,269	00:00:0
Sysmon.zip	https://download.sysinternals.c...	https://docs.microsoft.com/...	06/01/20 11:36:28	06/01/20 1...	1,740,363	00:00:0
PSTools.zip	https://download.sysinternals.c...	https://docs.microsoft.com/...	06/01/20 11:35:54	06/01/20 1...	3,187,562	00:00:0
DebugView.zip	https://download.sysinternals.c...	https://docs.microsoft.com/...	06/01/20 11:35:42	06/01/20 1...	475,424	00:00:0
DebugView.zip	https://download.sysinternals.c...	https://docs.microsoft.com/...	06/01/20 11:35:15	06/01/20 1...	475,424	00:00:0
SysinternalsSuit...	https://download.sysinternals.c...	https://docs.microsoft.com/...	06/01/20 11:35:03	06/01/20 1...	30,403,934	00:00:0
VirtualBox-6.1.0...	https://download.virtualbox.org...	https://www.virtualbox.org...	06/01/20 11:34:40	06/01/20 1...	111,891,976	00:00:2

406 item(s), 1 Selected

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Future Trends

- I anticipate a growing need in performing forensic analysis within web browsers on mobile devices and in Cloud environments
- As we look toward the future, two trends are likely to emerge
  - Technology & eBusiness will continue to evolve, with data privacy efforts creating new challenges for investigators
  - Increases in cybercrime creating demand for talented forensic practitioners in this career field

Conclusions

While web browsers play a pivotal role in Internet access, they continue being targeted by threat actors.

Analyzing a web browser’s artifacts help the investigator understand the objective, methods, and criminal activities/insider threats.

Examining a suspect’s system, the web browser’s log details remain a key artifact of most investigations.

PowerShell Artifacts Collection

PowerShell cmdlets and commands useful for digital forensics, artifact collection, and eDiscovery.

The Inspiration

Use of “Living Off The Land Binaries and Scripts” (**LOLBAS**) is a notable trend among Offensive Security practitioners and threat actors alike...

Objectives

- Leverage PowerShell to collect digital forensic artifacts from the endpoint being investigated
- Presentation order based on **RFC 3227**
  - Guidelines for Evidence Collection and Archiving
    - https://www.rfc-editor.org/rfc/rfc3227.html
    - Section: 2.1 Order of Volatility

Reminder: Data Preservation

- Avoid commands that will alter the system, system data, and access times
  - Some Examples (**NOTE:** Not an all-inclusive list)
    - “Clear-”, “Debug-”, “Disable-”, “Enable-”, “Expand-”, “Import”, “Install-”, “New-”, “Register-”, “Remove-”, “Save-”, “Set-”, “Unregister-”, “Update-”, “Write-”, etc.
- Avoid importing or installing external or 3rd party modules

Warning!

PS C:> _

Run as Administrator?

Be prepared to defend running PowerShell as “**Administrator**” if you decide to do so.

- We’ll touch on potentially justifiable use-cases momentarily...

PowerShell Logging

The following syntax timestamps the start and end of our data collection process. All input activity and output results are logged to a file.

```
Start-Transcript -Path "[PATH\FILENAME.EXT]" -NoClobber

Stop-Transcript (NOTE: When the investigation is complete)
```

PowerShell Version

There are a number of automatic variables in PowerShell that store state information. Run the following to display the relevant PowerShell version information:

```
$PSVersionTable

(NOTE: Includes “PSEdition” in PowerShell 5.1 and above)
```

PowerShell Pro Tip!

PowerShell truncates lengthy text output results by default...

Think of these “**Format-List**” variations as verbose output options:

Verbose: `| Format-List`

Very Verbose: `| Format-List *`

Very Very Verbose: `| Format-List -Property *`

System Time

Frequently time-stamping command activity during an investigation before and after each step is recommended. Here are some examples...

```
Get-Date
Get-TimeZone
Get-Uptime -Since (NOTE: Requires PowerShell v6.0+)
Get-ComputerInfo -Property “OsLastBootUpTime”
Get-ComputerInfo -Property “OsUptime”
```

UTC / GMT Time

Investigations are often easier when correlating timestamps using a neutral timezone of reference. The following variable outputs the time in UTC:

```
$Time = Get-Date
$Time.ToUniversalTime()
```

Hashing Files

```
Get-FileHash [FILENAME.EXT] -Algorithm [VALUE]
```

- Value options
  - **SHA1**
  - **SHA256**
  - **SHA384**
  - **SHA512**
  - **MD5**

Volatile Network Artifacts

The following PowerShell cmdlets are useful for collecting the routing table, ARP, network traffic details, and DNS cache respectively:

```
Get-NetRoute
Get-NetNeighbor
Get-NetTCPConnection
Get-NetUDPEndpoint
Get-DnsClientCache
```

Processes and Services

The following cmdlets are useful for obtaining a list of running processes and services on the endpoint being investigated:

```
Get-Process

Get-Service
```

Less Volatile Network Artifacts

The following PowerShell cmdlets are useful for collecting the system network configuration settings and network adapter properties:

```
Get-DnsClient
Get-DnsClientServerAddress
Get-NetIPAddress
Get-NetIPConfiguration
Get-NetAdapter
```

Users and Groups

Unfortunately, PowerShell does **not** offer a “Get-LoggedOnUsers” cmdlet or similar. The following will obtain host user and group details:

```
Get-WmiObject Win32_LoggedOnUser | Select Antecedent -Unique
Query User (NOTE: Not an actual cmdlet, but better!)

Get-LocalGroup | Select *
Get-LocalUser | Select *

Get-ChildItem C:\Users
```

Execution Policy Settings

Use the following commands to obtain the current PowerShell execution policy and the execution policy for each scope in order of precedence:

```
Get-ExecutionPolicy

Get-ExecutionPolicy -List
```

Clipboard, Auto-runs, and Tasks

Use the following commands to retrieve text stored in the Windows clipboard, a list of Windows startup items, and Scheduled Tasks:

```
Get-Clipboard (NOTE: Currently logged in user account)

Get-CimInstance Win32_StartupCommand

Get-ScheduledTask
```

Host Details

Use the following to collect additional details such as installed drivers, programs, hotfixes, disk drives, system details, and other OS information:

```
Get-Windows-Driver -Online -All (NOTE: Requires running as ‘Administrator’)
Get-Package
Get-HotFix
Get-PSDrive
Get-ComputerInfo
```

The Open Files Conundrum

There are significant challenges in obtaining open file details using native PowerShell...

```
Get-SmbOpenFile

NOTES: Requires running as ‘Administrator'. Only works for files
that are remotely accessed

OpenFiles /Query
The system global flag 'maintain objects list' needs to be enabled
to see local opened files.

OpenFiles /Local On (NOTE: Requires running as 'Administrator')
This will take effect after the system is restarted.
```

More PowerShell Tips & Tricks

These commands and cmdlets barely scratch the surface of PowerShell capabilities in alignment with our objectives of collecting and preservation of data with minimal impacts and changes to the host operating system that we are investigating.

Further reading:

https://learn.microsoft.com/en-us/powershell/

https://learn.microsoft.com/en-us/powershell/module/microsoft.powershell.core/

Questions

Who?

What?

When?

Where?

Why?

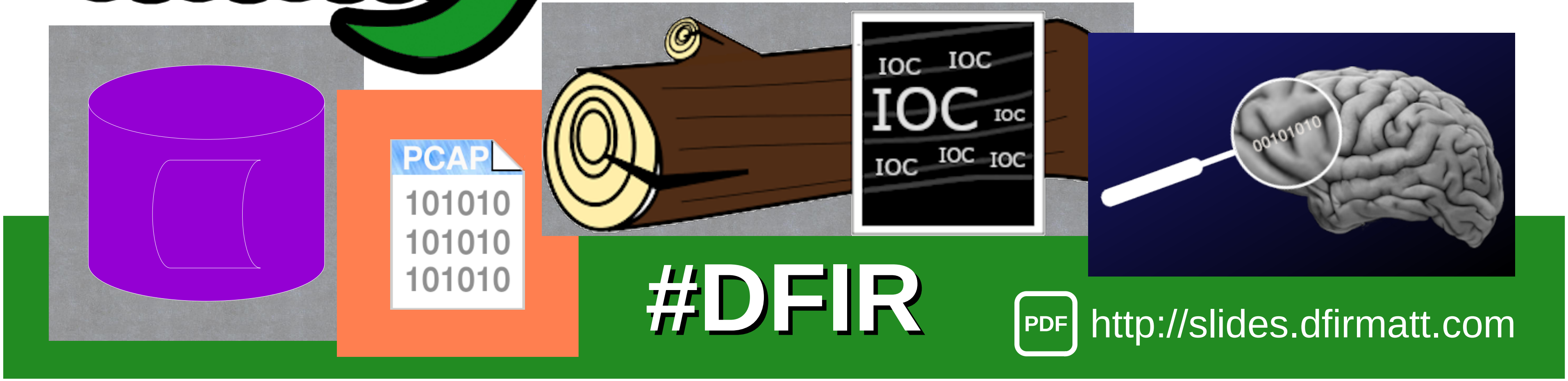
How?

Thank you for attending!

Matt Scheurer

Tuan Phan

October 5, 2024



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