STUDY AND ANALYSIS OF ORWEB (AND ORFOX) ANONYMIZER(S) ON ANDROID DEVICES

CLAUDIA MEDA & MATTIA EPIFANI

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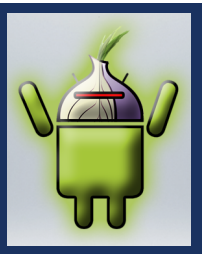
LAUSANNE, 31 MARCH 2016

ORBOT
HTTPS://GUARDIANPROJECT.INFO/APPS/ORBOT/



What is Orbot?

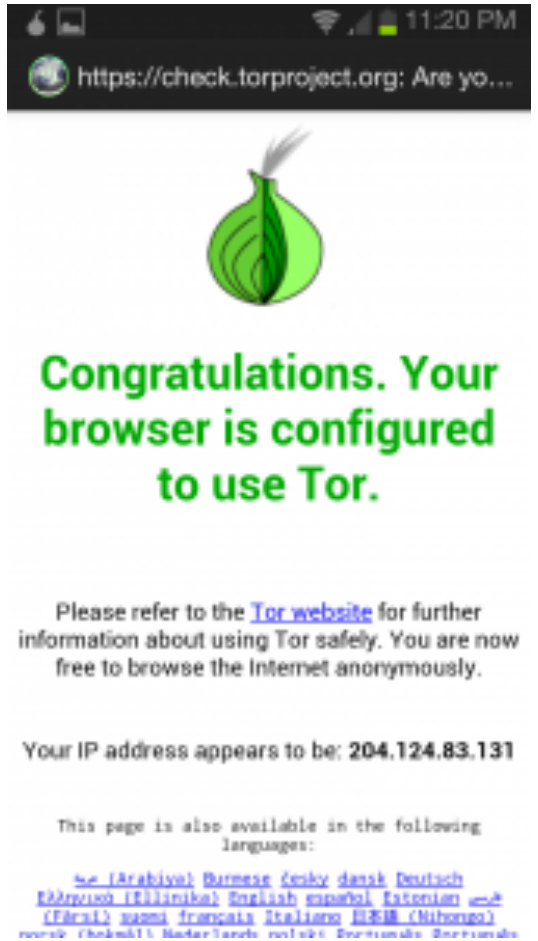
- Open source software for Internet traffic encryption through computers around the world
- Configured to transparently proxy all of Internet traffic through **Tor** (The Onion Router)
- Choice which specific apps can be use through Tor
- Private internet connection
- Private web surfing
- Private chat messaging
- Privacy on Twitter

ORWEB
HTTPS://GUARDIANPROJECT.INFO/APPS/ORWEB/

What is Orweb?

- Current default browser for Orbot on Android → evades tracking and censorship by bouncing encrypted traffic several times through computers around the world.
- Based on Orbot

Orfox
Summer/Autumn 2015



"When a communication arrives from Tor, you can never know where or whom it's from"

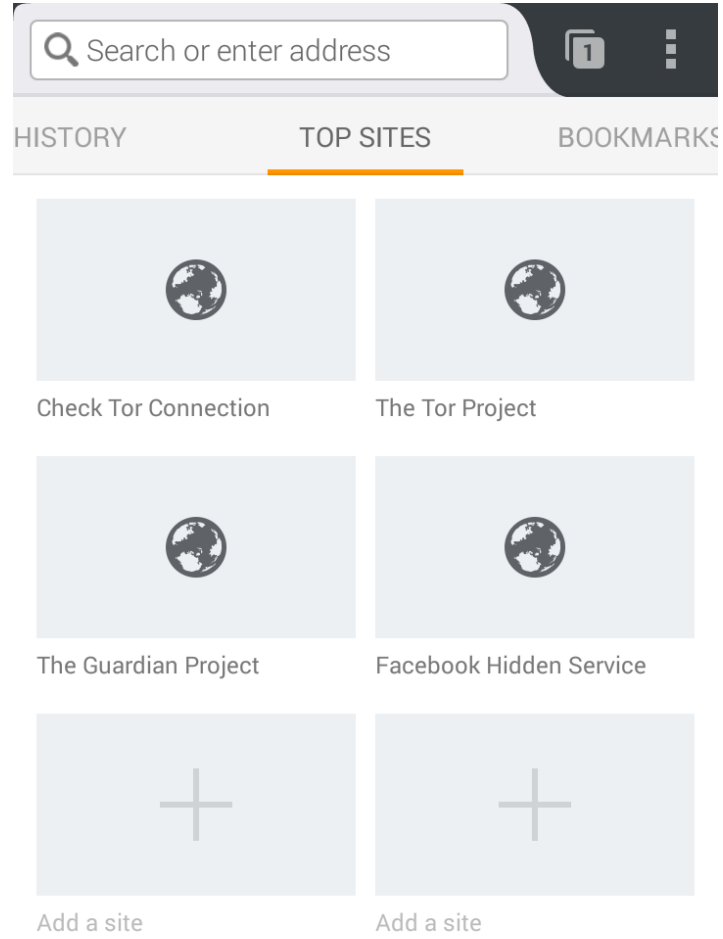
New York Times

ORFOX

HTTPS://GUARDIANPROJECT.INFO/2015/06/30/ORFOX-ASPIRING-TO-BRING-TOR-BROWSER-TO-ANDROID/

What is Orfox?

- New browser for Android → BETA release available on Google Play for public testing only
- Built from the same source code as Tor Browser (which is built upon Firefox)
- Required Orbot app to connect to the Tor network
- It allows users to bookmark sites



ANALYSIS METHODOLOGY – PART I

1 ENVIRONMENT
Samsung Galaxy S5 with Android 5.0
Rooting with KingoRoot

2 INSTALLATION
Orbot download, install and execution
Orweb download, install and execution
Orfox download, install and execution

3 DEVICE PHYSICAL ACQUISITION

SYSTEM FOLDER
PACKAGES.LIST
INSTALLED APPS INFORMATION (PACKAGE NAME, UID, APP PATH)

- Package name **org.torproject.android**
  UserID **10076**
  App path **/data/data/org.torproject.android**

ORBOT

- Package name **info.guardianproject.browser**
  UserID **10077**
  App path **/data/data/info.guardianproject.browser**

ORWEB

- Package name **info.guardianproject.orfox**
  UserID **10078**
  App path **/data/data/info.guardianproject.orfox**

ORFOX

SYSTEM FOLDER
PACKAGES.XML
LIST OF PERMISSIONS AND PACKAGES/APPLICATIONS

<package name="**org.torproject.android**" userId="**10076**" version="**15012310**" ut="151b5c6d5a5" it="151b5c6d5a5" ft="151b5c6cf20" flags="540228" dt="151b5c6db57" dm="2" nativeLibraryRootRequiresIsa="true" nativeLibraryDir="/data/app/org.torproject.android-1/lib/arm" nativeLibraryRootDir="/data/app/org.torproject.android-1/lib" nativeLibraryPath="/data/app/org.torproject.android-1/lib" codePath="/data/app/org.torproject.android-1" primaryCpuAbi="armeabi-v7a" installer="com.android.vending">
<perms>
<item name="**android.permission.RECEIVE_BOOT_COMPLETED**"/>
<item name="**org.torproject.android.MANAGE_TOR**"/>

Attribute	Description	Timestamp
UT	Timestamp in hex format of last update	Fri, 18 Dec 2015 – 15:48:05
IT	Timestamp in hex format of fist time installation	Fri, 18 Dec 2015 – 15:48:05

</package>

SYSTEM FOLDER
PACKAGE-USAGE.LIST
APP LAST EXECUTION TIME (EPOCH)

Application	Timestamp
org.torproject.android	1451345825.267
info.guardianproject.browser	1450459648.348
info.guardianproject.orfox	1452006535.657

SYSTEM FOLDER

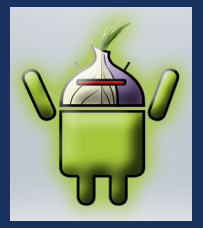
POWERMANAGER

POWER (AND APPS) USAGE STATISTICS

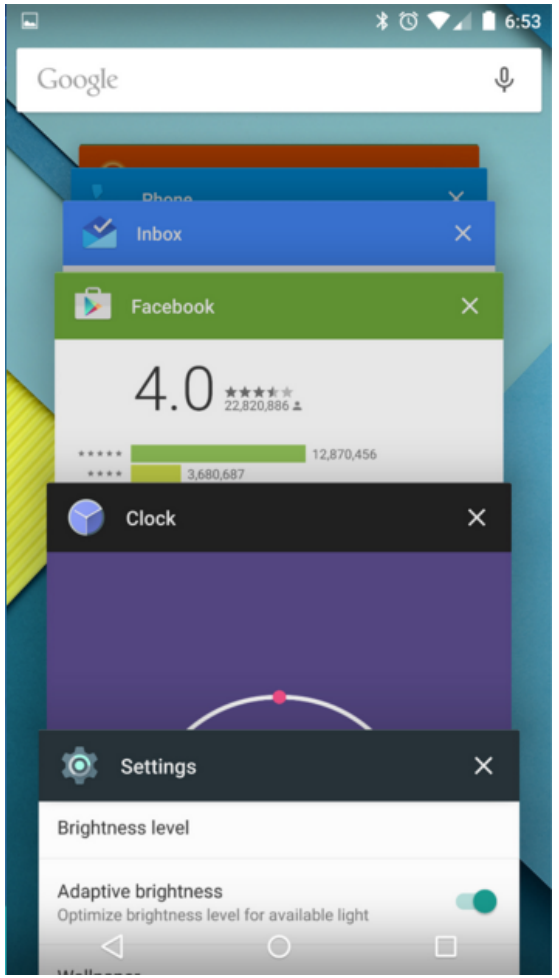
info.guardianproject.browser

time	power	totalpower	usage_time
Filter	Filter	Filter	Filter
1450455938456	0.0	0.0	0
1450457755107	0.0	0.0	0
1450460984733	0.0	0.0	0
1451385746078	0.653686011023...	0.653686011023...	10710

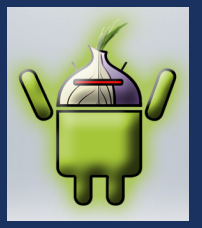
SYSTEM FOLDER
\RECENT_TASKS
RECENT ACTIVITIES LOGS (XML FORMAT)




```
<?xml version='1.0' encoding='utf-8' standalone='yes' ?>
<task task_id="13" real_activity="info.guardianproject.browser/.Browser"
affinity="info.guardianproject.browser" root_has_reset="true"
auto_remove_recents="false" asked_compat_mode="false" user_id="0"
effective_uid="10077" task_type="0" first_active_time="1451385683082"
last_active_time="1451385798766" last_time_moved="1451385798756"
never_relinquish_identity="true" task_description_color="ff212121"
task_affiliation_color="-14606047" task_affiliation="13" prev_affiliation="-1"
next_affiliation="-1" calling_uid="10077"
calling_package="info.guardianproject.browser" multiwindow_style="0"
is_private_mode="false">
<intent action="android.intent.action.MAIN"
component="info.guardianproject.browser/.Browser" flags="10200000">
<categories category="android.intent.category.LAUNCHER" />
</intent>
</task>
```

SYSTEM FOLDER
\USAGESTATS\WEEKLY - \USAGESTATS\MONTHLY - \USAGESTATS\YEARLY
USAGE STATISTICS



```
<?xml version='1.0' encoding='utf-8' standalone='yes' ?>
<usagestats version="1" endTime="2381450658">
…
<packages>
<package lastTimeActive="1454766326" package="org.torproject.android"
timeActive="193858" lastEvent="2" />
<package lastTimeActive="1456652361" package="info.guardianproject.browser"
timeActive="3519627" lastEvent="2" />
…
</packages>
</usagestats>
```

DATA FOLDER
\COM.ANDROID.VENDING\DATABASES\LOCALAPPSTATE.DB
APPLICATION INFORMATION AND UPDATES

- Package Name
- Delivery Data Timestamp
- First Download Timestamp

package_name	delivery_data_timestamp_ms	first_download_ms
tv.peel.smartremote	1451338441276	1451338442217
stericson.busybox	1450446629183	1450446629822
org.torproject.android	1450453680050	1450453680778
info.guardianproject.browser	1450454309701	1450454310364

- Account
- Title
- Last Notified Version
- Last Update Timestamp

account	title	last_notified...	last_update_timestamp_...
orbotforensics@gmail.com	Peel Smart Remote	86120	1451338461971
mattia.epifani@realitynet.it	BusyBox	186	0
orbotforensics@gmail.com	Orbot: Proxy with Tor	15012310	0
orbotforensics@gmail.com	Naviga in Privato	7010	0

DATA FOLDER
\COM.SEC.ANDROID.APP.LAUNCHER\DATABASES\LAUNCHER.DB
APPLICATION DESKTOP SHORTCUTS (POSITION, ICON, INTENT, ETC.)



- Screen position
- Intent

cellX	cellY	spanX	spanY	title	intent
1	3	1	1	Orweb	#Intent;action=android.intent.action.MAIN;category=android.intent.category.LAUNCHER;launchFlags=0x10000000;package=info.guardianproject.browser;component=info.guardianproject.browser/.Browser;end
3	2	1	1	Orbot	#Intent;action=android.intent.action.MAIN;category=android.intent.category.LAUNCHER;launchFlags=0x10000000;package=org.torproject.android;component=org.torproject.android/.OrbotMainActivity;end

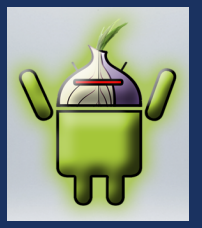
- Icon Package
- Icon Resource
- Icon

iconPackage	iconResource	icon
info.guardianproject.browser	info.guardianproject.browser:drawable/ic_launcher	
org.torproject.android	org.torproject.android:drawable/ic_launcher	

DATA FOLDER

\COM.SAMSUNG.ANDROID.SM\DATABASES\LOWPOWERCONTEXT-SYSTEM-DB

SAMSUNG SMART MANAGER



Package name

Start Time

End Time

id	package_name	start_time	start_time_string	end_time	end_time_string	uploaded	created_at	modified_at
74	org.torproject.android	1450454093829	2015/12/18 16:54:53	1450454157367	2015/12/18 16:55:57	<null>	1450459124000	1450459124000
76	info.guardianproject.browser	1450454335077	2015/12/18 16:58:55	1450454758257	2015/12/18 17:05:58	<null>	1450459124000	1450459124000
78	info.guardianproject.browser	1450454812155	2015/12/18 17:06:52	1450454910645	2015/12/18 17:08:30	<null>	1450459124000	1450459124000
87	info.guardianproject.browser	1450457718584	2015/12/18 17:55:18	1450458131244	2015/12/18 18:02:11	<null>	1450459124000	1450459124000
88	info.guardianproject.browser	1450458133410	2015/12/18 18:02:13	1450458134810	2015/12/18 18:02:14	<null>	1450459124000	1450459124000
89	info.guardianproject.browser	1450458136523	2015/12/18 18:02:16	1450458137820	2015/12/18 18:02:17	<null>	1450459124000	1450459124000
90	info.guardianproject.browser	1450458143235	2015/12/18 18:02:23	1450458146889	2015/12/18 18:02:26	<null>	1450459124000	1450459124000
91	info.guardianproject.browser	1450458397807	2015/12/18 18:06:37	1450459089757	2015/12/18 18:18:09	<null>	1450459124000	1450459124000
92	info.guardianproject.browser	1450459100118	2015/12/18 18:18:20	1450459101350	2015/12/18 18:18:21	<null>	1450459124000	1450459124000
93	info.guardianproject.browser	1450459102819	2015/12/18 18:18:22	1450459104457	2015/12/18 18:18:24	<null>	1450459124000	1450459124000
94	info.guardianproject.browser	1450459106692	2015/12/18 18:18:26	1450459107923	2015/12/18 18:18:27	<null>	1450459124000	1450459124000
96	org.torproject.android	1450459466971	2015/12/18 18:24:26	1450459483405	2015/12/18 18:24:43	<null>	1450461534000	1450461534000
97	org.torproject.android	1450459535906	2015/12/18 18:25:35	1450459649363	2015/12/18 18:27:29	<null>	1450461534000	1450461534000

SYSTEM AND DATA FOLDER
OTHER FILES

- \system\batterystats-checkin.bin
- \system\AppOps.XML
- \system\procstats\state-YYYY-MM-DD-HH-MM-SS.bin
- \data\com.android.vending\databases\library.db
- \data\com.android.vending\databases\package_verification.db
- \data\com.google.android.partnersetup\shared_prefs\ApplicationHidingPreferences.xml
- \data\com.samsung.android.sm\databases\sm.db
- \data\com.google.android.googlequicksearchbox\databases\icingcorpora.db

ANALYSIS METHODOLOGY – PART 2

1

BROWSING WITH ORWEB

Visited sites
genoacfc.it
thehiddenwiki.org
rso4hutlefirefqp.onion
torlinkbgs6aabns.onion
xfnwyig7olypdq5r.onion
dfrws.org
luccacomicsandgames.com
starwars.com

2

DEVICE PHYSICAL ACQUISITION

ORWEB APPLICATION FOLDER
\DATA\INFO.GUARDIANPROJECT.BROWSER\APP_WEBVIEW\COOKIES
COOKIES DATABASE

host_key
rso4hutlefirefqp.onion
xfnwyig7olypdq5r.onion
.flickr.com
.flickr.com
adv.luccacomicsandgames.com
adv.luccacomicsandgames.com
adv.luccacomicsandgames.com
adv.luccacomicsandgames.com
adv.luccacomicsandgames.com

SQLite DB
Temporarily store website Cookies

Information not immediately deleted

Information about previously visited sites

Unallocated space inside DB file and Cookies-journal

ORWEB APPLICATION FOLDER
\DATA\INFO.GUARDIANPROJECT.BROWSER\CACHE\ORG.CHROMIUM.ANDROID_WEBVIEW CACHE FOLDER

Specific structure of cache element

Header
30 5C 72 A7 1B 6D FB FC 05 00 00 00

URL

Encoded content (i.e. JPG file)

HTTP response with DATE and TIME

```
Offset(h)  00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
00000000   30 5C 72 A7 1B 6D FB FC 05 00 00 00 4A 00 00 00  0\r§.mûü....J...
00000010   E7 8F E1 36 00 00 00 00 68 74 74 70 3A 2F 2F 67  ç.á6....http://g
00000020                                      70 2D 63 6F  enoacfc.it/wp-co
00000030                                      79 2F 6C 75  ntent/gallery/lu
00000040                                      6E 6F 50 72  glio-2015/TanoPr
00000050                                      31 38 2E 6A  ess_Srl_140618.j
00000060                                      00 01 01 01  pgÿØÿà..JFIF....
00000070                                      45 41 54 4F  .`.`..ÿþ.;CREATO
00000080                                      31 2E 30 20  R: gd-jpeg v1.0
00000090                                      50 45 47 20  (using IJG JPEG
000000A0                                      79 20 3D 20  v62), quality =
000000B0                                      02 02 03 03  90.ÿÛ.C.........
```


```
00007960                                      20 32 30 30  ×...HTTP/1.1 200
00007970                                      4C 65 6E 67   OK.Content-Leng
00007980   74 68 3A 20 33 30 39 32 36 00 45 54 61 67 3A 20  th: 30926.ETag:
00007990   22 37 38 63 65 2D 35 32 33 63 64 61 33 35 34 62  "78ce-523cda354b
000079A0   38 62 38 22 00 44 61 74 65 3A 20 46 72 69 2C 20  8b8".Date: Fri,
000079B0   31 38 20 44 65 63 20 32 30 31 35 20 31 36 3A 30  18 Dec 2015 16:0
000079C0   38 3A 32 39 20 47 4D 54 00 4C 61 73 74 2D 4D 6F  8:29 GMT.Last-Mo
000079D0   64 69 66 69 65 64 3A 20 54 68 75 2C 20 30 35 20  dified: Thu, 05
000079E0   4E 6F 76 20 32 30 31 35 20 31 36 3A 32 39 3A 35  Nov 2015 16:29:5
000079F0   39 20 47 4D 54 00 53 65 72 76 65 72 3A 20 41 70  9 GMT.Server: Ap
00007A00   61 63 68 65 2F 32 2E 34 2E 31 30 00 41 63 63 65  ache/2.4.10.Acce
00007A10   70 74 2D 52 61 6E 67 65 73 3A 20 62 79 74 65 73  pt-Ranges: bytes
00007A20   00 43 6F 6E 74 65 6E 74 2D 54 79 70 65 3A 20 69  .Content-Type: i
00007A30   6D 61 67 65 2F 6A 70 65 67 00 00 00 09 00 00 00  mage/jpeg.......
00007A40   31 32 37 2E 30 2E 30 2E 31 00 00 00 B6 1F 00 00  127.0.0.1...¶...
```

ANALYSIS METHODOLOGY – PART 3

1

BROWSING WITH ORFOX

Visited sites
thehiddenwiki.org
3g2upl4pq6kufc4m.onion
wikitjerrta4qgz4.onion
easycoinsayj7p5l.onion
torbox3uiot6wchz.onion
bodybuilding.com
genoacfc.it
volleyball.org
atpworldtour.com

2

ADDED GENOACFC.IT TO BOOKMARKS

3

DEVICE PHYSICAL ACQUISITION

ORFOX APPLICATION FOLDER
\DATA\INFO.GUARDIANPROJECT.ORFOX\FILE\MOZILLA\<ID>.DEFAULT

STORE TEMPORARY FILE DURING BROWSER ACTIVITY

- Browser.db-wal
- Tabs.db
- Tabs.db-wal

Tabs.db:
- current Tabbed sites

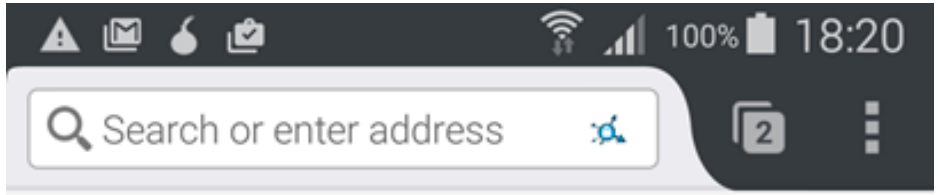
Tabs.db-wal:
- previously Tabbed sites

```
root@klte:/data/data/info.guardianproject.orfox/files/mozilla/9wks9tiv.default # ls -la
-rw------- u0_a78    u0_a78           0 2016-01-15 17:10 .parentlock
drwx------ u0_a78    u0_a78             2016-01-05 16:00 HTTPSEverywhereUserRules
-rw------- u0_a78    u0_a78         208 2016-01-15 17:37 SiteSecurityServiceState.txt
-rw------- u0_a78    u0_a78      154384 2016-01-15 17:11 blocklist.xml
-rw-rw---- u0_a78    u0_a78        4096 2016-01-05 16:00 browser.db
-rw------- u0_a78    u0_a78       32768 2016-01-15 17:37 browser.db-shm
-rw------- u0_a78    u0_a78     2315472 2016-01-15 17:37 browser.db-wal
-rw------- u0_a78    u0_a78         218 2016-01-15 17:10 compatibility.ini
-rw------- u0_a78    u0_a78      131072 2016-01-05 16:00 cookies.sqlite
-rw------- u0_a78    u0_a78       32768 2016-01-15 17:10 cookies.sqlite-shm
-rw------- u0_a78    u0_a78           0 2016-01-15 17:10 cookies.sqlite-wal
drwx------ u0_a78    u0_a78             2016-01-15 17:10 extensions
-rw------- u0_a78    u0_a78         193 2016-01-15 17:10 extensions.ini
-rw------- u0_a78    u0_a78        3687 2016-01-15 17:10 extensions.json
-rw------- u0_a78    u0_a78           0 2016-01-05 16:00 extensions.sqlite
-rw------- u0_a78    u0_a78      196608 2016-01-05 16:00 formhistory.sqlite
drwx------ u0_a78    u0_a78             2016-01-05 16:01 gmp
drwx------ u0_a78    u0_a78             2016-01-05 16:01 gmp-gmpopenh264
-rw-rw---- u0_a78    u0_a78       73728 2016-01-15 17:37 health.db
-rw------- u0_a78    u0_a78       41552 2016-01-15 17:37 health.db-journal
lrwxrwxrwx u0_a78    u0_a78             2016-01-15 17:10 lock -> 127.0.0.1:+15172
                                      37 2016-01-15 17:11 prefs.js
                                      30 2016-01-15 17:09 profile_info_cache.json
                                         2016-01-15 17:32 readercache
                                      06 2016-01-15 17:10 revocations.txt
                                         2016-01-05 16:01 safebrowsing
                                      07 2016-01-05 16:00 search.json
                                      41 2016-01-15 17:07 sessionstore.bak
                                      41 2016-01-15 17:37 sessionstore.js
                                       2 2016-01-15 17:09 snippets.json
                                         2016-01-15 17:13 startupCache
                                      42 2016-01-05 16:00 suggestedsites.json
-rw-rw---- u0_a78    u0_a78       40960 2016-01-15 17:36 tabs.db
-rw------- u0_a78    u0_a78       32768 2016-01-15 17:37 tabs.db-shm
-rw------- u0_a78    u0_a78      420272 2016-01-15 17:37 tabs.db-wal
-rw------- u0_a78    u0_a78          27 2016-01-05 16:00 times.json
-rw------- u0_a78    u0_a78       98304 2016-01-05 16:02 webappsstore.sqlite
-rw------- u0_a78    u0_a78       32768 2016-01-15 17:10 webappsstore.sqlite-shm
-rw------- u0_a78    u0_a78           0 2016-01-15 17:10 webappsstore.sqlite-wal
```

ORFOX APPLICATION FOLDER
\DATA\INFO.GUARDIANPROJECT.ORFOX\FILE\MOZILLA\<ID>.DEFAULT

BROWSER.DB-WAL

- Bookmarks
- Reading List
- Top Sites (only if added by user)
- Visited websites URLs




```
Cyber Certifications | Researchhttps://www.sans.org/€
 encyclopediahttps://en.m.wikipedia.org/wiki/Genoa€
ehttp://genoacfc.it/€          R W M RF „ Y_zrmCHvT69md
e ý R N!, R N!,cGduvBu09b7k\    3M          % Firefox Marl

                        7        % SANS Information Security Training |
  RF%·ý RF%·ö8A_ecdfx198u|    ]W          % Genoa - Wikipedia, the free
 RF!FL RF!FIAuvNDEwNYVzKa    I3          % Genoa Cfc â€" Official Websit
-c          % Firefox: Supporthttps://support.mozilla.org/products/mobil
etplacehttps://marketplace.firefox.com/ þ R N!, R N!,YfTwi-1dqoLxj    KS
```

ANALYSIS METHODOLOGY – PART 4

1

UNINSTALL

- Orbot uninstall
- Orweb uninstall
- Orfox uninstall

2

DEVICE PHYSICAL ACQUISITION

RESIDUAL TRACES AFTER UNINSTALL

- \system\powerManager
- \system\usagestats\monthly - \usagestats\weekly - \usagestats\yearly
- \data\com.android.vending\databases\localappstate.db
- \data\com.android.vending\databases\library.db
- \data\com.android.vending\databases\package_verification.db
- \data\com.google.android.googlequicksearchbox\databases\icingcorpora.db
- \data\com.google.android.partnersetup\shared_prefs\ApplicationHidingPreferences.xml
- \data\com.samsung.android.sm\databases\lowpowercontext-system-db
- \data\com.samsung.android.sm\databases\sm.db

PROPOSED INVESTIGATION METHODOLOGY

\SYSTEM

- PACKAGES.LIST
- PACKAGE-USAGE.LIST
- POWERMANAGER
- RECENT_TASKS
- USAGESTATS

\DATA

- LOCALAPPSTATE.DB
- LAUNCHER.DB
- LOWPOWERCONTEXT-SYSTEM-DB

\INFO.GUARDIANPPROJECT.BROWSER

- \COOKIES
- \CACHE
  - STRING HEADER SEARCH
    [30 5C 72 A7 1B 6D FB FC 05 00 00 00]

\INFO.GUARDIANPROJECT.ORFOX

- BROWSER.DB-WAL
- TABS.DB
- TABS.DB-WAL

Q&A?

Claudia Meda

- PhD student in Science and Technology for Electronic and Telecommunications Engineering
  University of Genoa, Italy

claudia22.meda@gmail.com

@KlodiaMaida

https://it.linkedin.com/in/claudia-meda-3142046b

Mattia Epifani

- Digital Forensics Analyst
- CEO @ REALITY NET – System Solutions – Genoa, Italy
- GCFA, GMOB, GNFA, GREM
- CEH, CHFI, CCE, CIFI, ECCE, AME, ACE, MPSC

mattia.epifani@realitynet.it

@mattiaep

http://www.linkedin.com/in/mattiaepifani

http://www.realitynet.it

http://blog.digital-forensics.it