The Mobilitics Inria-CNIL project: privacy and smartphones

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The Mobilitics Inria-CNIL project: privacy and smartphones

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NB: *borrows some results from CNIL (Technical Department / Studies, Innovation and Foresight Department)*

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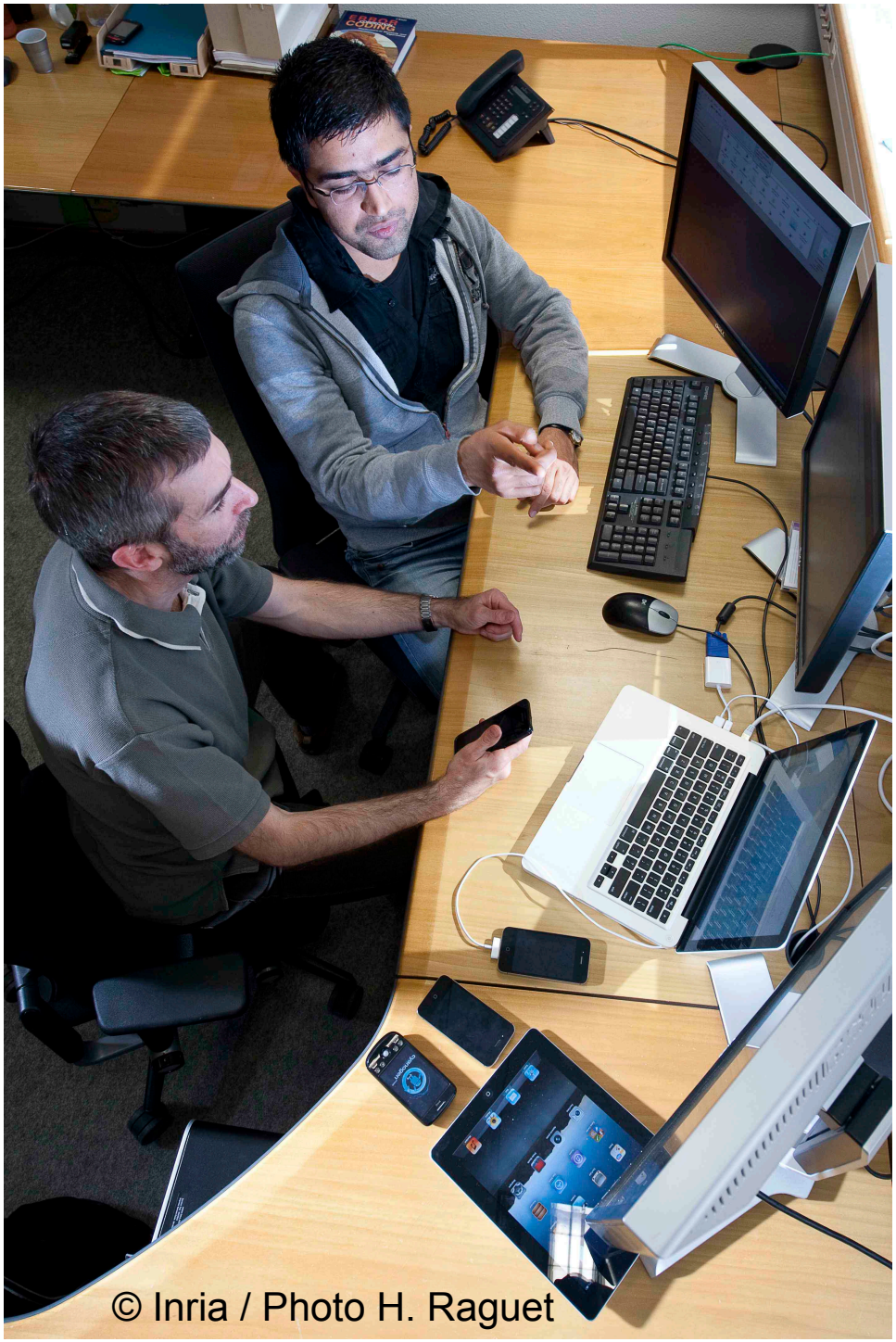
informatiques mathématiques

Outline

- ***motivations***
- about security/privacy on smartphones
- Mobilitics: some results
- conclusions



Our "personal spy assistant"

- smartphones have become our companions
  - useful and user-friendly, always connected
  - easy to customize to match everybody expectations
  - ~20% of mobile phones are smartphones

- but smartphones know a lot of our cyber-activities
  - they **gather** private information
    - **while we're using them**
  - they **generate** private information
    - **GPS, NFC, WiFi, camera**

- and they can potentially send it to remote servers
  - 1st party and 3rd party (more annoying) servers

Privacy leakage example 1

- Spy, spy, spy…

  http://www.stealthgenie.com
  http://global.ikeymonitor.com

stealthGenie

World's Most Powerful Cell Phone Spy Software

- Protect Child
- Monitor Employees
- Geo-Location & Tracking
- Spy on any Phone

What can you do with iKeyMonitor?

For Parents

Read and report SMS and website logs to email box. Figure out the recent situation of children.

For Employers

Watch the key presses and take screen shots. Detect improper behaviors of employees.

For Spouses

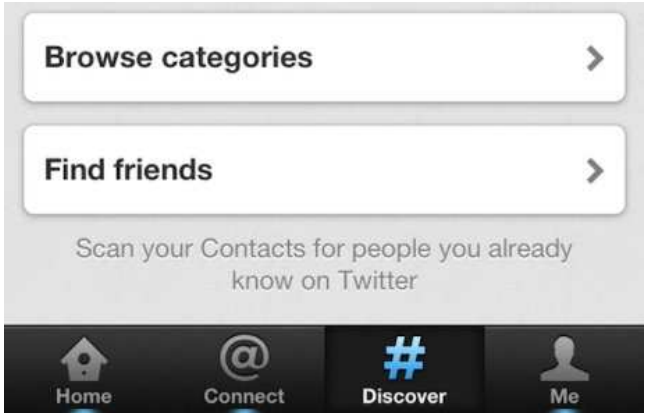
Run in stealth mode and capture everything. Catch cheating spouses or clear suspicions.

For All iOS users

Monitor the activities on the iPhone/iPad you own. Track lost or stolen iPhone and iPad.

Privacy leakage example 2

- Twitter (Feb. 2012):
  - **"La fonctionnalité de recherche d'amis de […] Twitter permet au service en ligne de télécharger sur ses serveurs les carnets d'adresses et la liste de contacts des utilisateurs. Une fois téléchargées sur ses serveurs, ces données sont conservées 18 mois."**



http://www.zdnet.fr/actualites/twitter-copie-et-conserve-18-mois-sans-consentement-les-carnets-d-adresses-des-utilisateurs-39768632.htm

  - **similar scandals with LinkedIn, Path and others in 2012!**

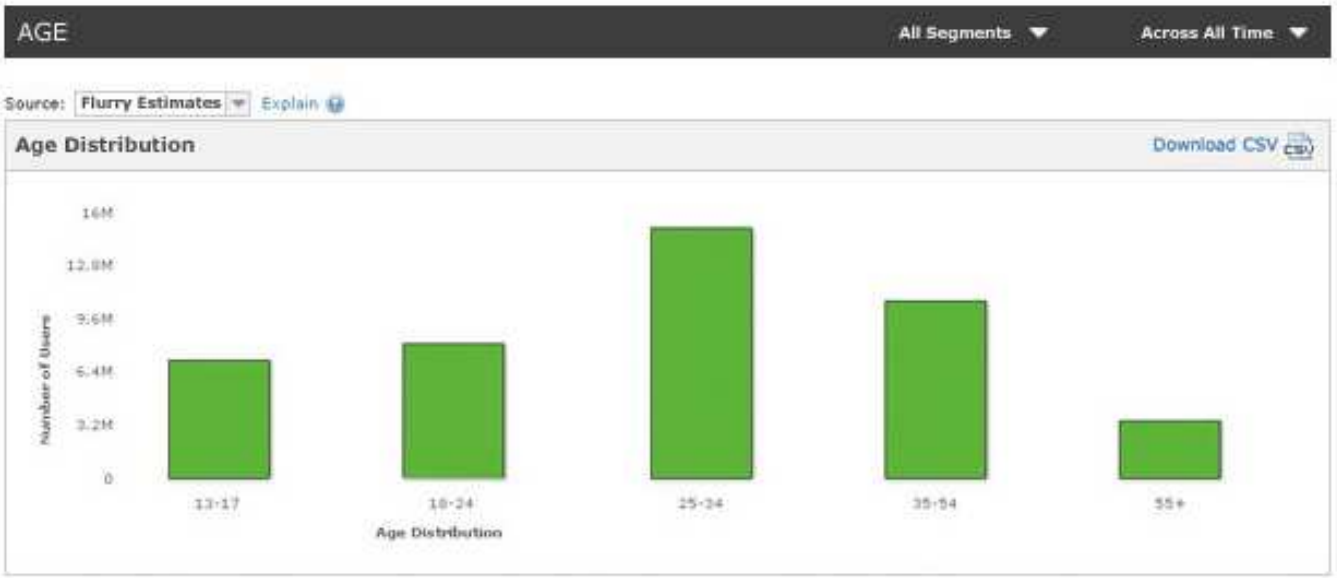
- those are strategic **errors**
  - **big, renown companies have little to gain with such scandals**
  - **corrected promptly in new versions of the app**

Privacy leakage example 3

- data aggregation at Flurry
  - http://www.flurry.com/flurry-analytics.html

The enormous amount of data Flurry handles directly translates into unique, powerful insights for you. The service takes in over 1.4 billion app session reports per day totaling more than 1.5 terabytes, and our storage is in the petabytes. Here are some examples of how we use big data to create advantages for you:

FLURRY ESTIMATES THE AGE, GENDER & INTERESTS OF YOUR APP AUDIENCE



About Mobile Ads

- a way to monetize free (and non-free) Apps
  - makes sense
  - acceptable if done in a ***CNIL-compatible*** way, with informed users

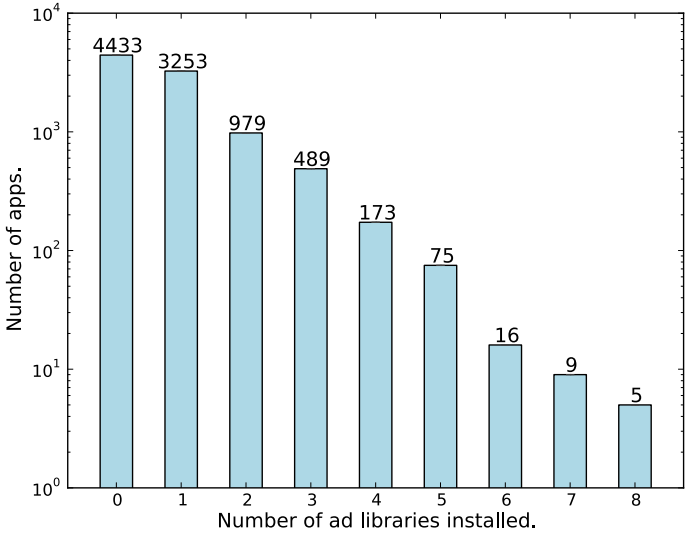
- some facts about mobile world advertising
  - many companies compete, some of them are well-known

admob

  - but many others exist…
    - **ref:** http://en.wikipedia.org/wiki/List_of_mobile_advertising_networks
    - **Adfonic, Enpocket, Greystripe, inMobi, LeadBolt, Millennial Media, MobYD, Trademob, Velti Media, Mojiva, …**

About Mobile Ads…

- some facts
  - **"77% of top 50 Android free Apps were Ad supported"** on July 2011 [1]
  - 35% of Android free Apps that use Ads **use 2 or more Ad libraries** [2]
    - **a way to increase revenues**
    - **a trend is to use "Ad aggregators" who promise to select the Ad lib that maximizes profit**



- ref:
  - **[1] "Don't kill my ads! Balancing Privacy in an Ad-Supported Mobile Application Market", HotMobile 2012.**
  - **[2] "AdSplit: Separating smartphone advertising from applications", Usenix Security 2012.**

About Mobile Ads…

- it does impact the App behavior
  - Ad libs ask for potentially dangerous Android permissions
    - **free Apps usually request 2-3 additional permissions compared to paid Apps of the same category [1]**

Ad Library	Internet	NetworkState	ReadPhoneState	WriteExternalStorage	CoarseLocation	CallPhone
AdMob [22]	✓	✓			○	
Greystripe [25]	✓	✓	✓			
Millennial Media [36]	✓	✓	✓	✓		
InMobi [29]	✓	○			○	○
MobClix [38]	✓	○	✓			
TapJoy [53]	✓	✓	✓	✓		
JumpTap [32]	✓	✓	✓		○	

✓ (required), ○ (optional)

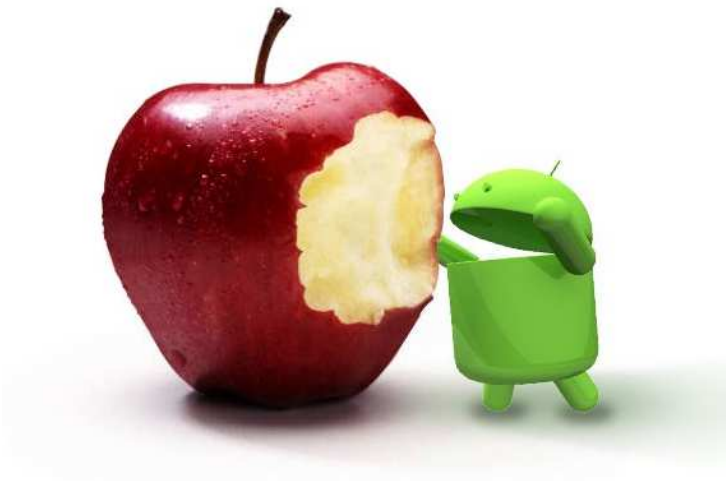
permissions per Ad lib [2]

So…

- **“tracking the trackers”** has become a necessity
  - “teach” companies to behave in a privacy-friendly way
- users must **know** the risks…
  - “teach” the end-user about privacy risks
- users must be able to **control** the risks
  - and give them privacy tools

The Inria-CNIL Mobilitics project

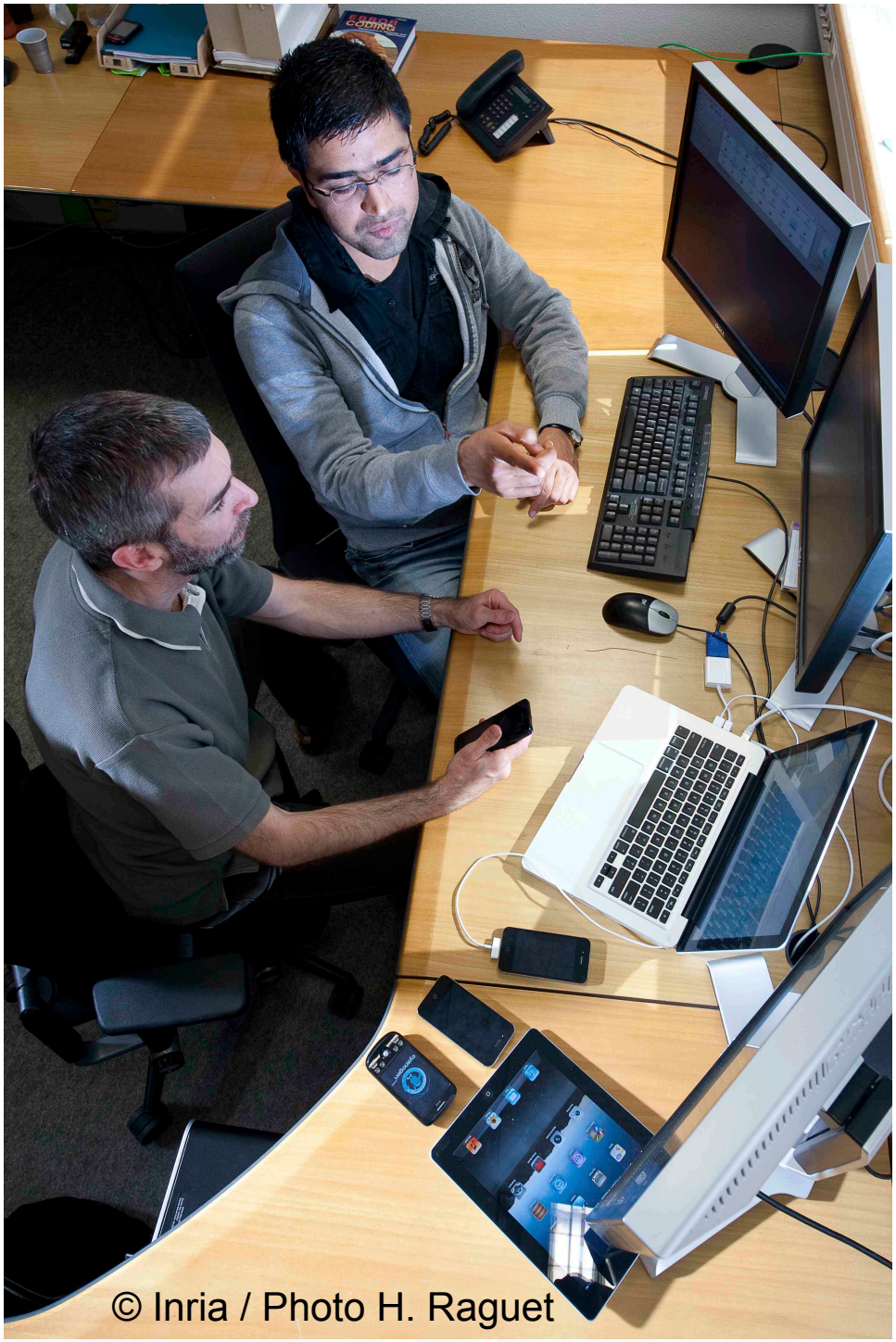
- started in January 2012



- focuses on Android and iOS
  - the leading mobile OS
- analyze privacy leakage by **Apps** and **OS services**
  - compare Android/iOS, identify best practices and trends
  - gather facts that CNIL can use to discuss with companies
- don't be naïve
  - targeted ads can be "the price to pay" for free Apps

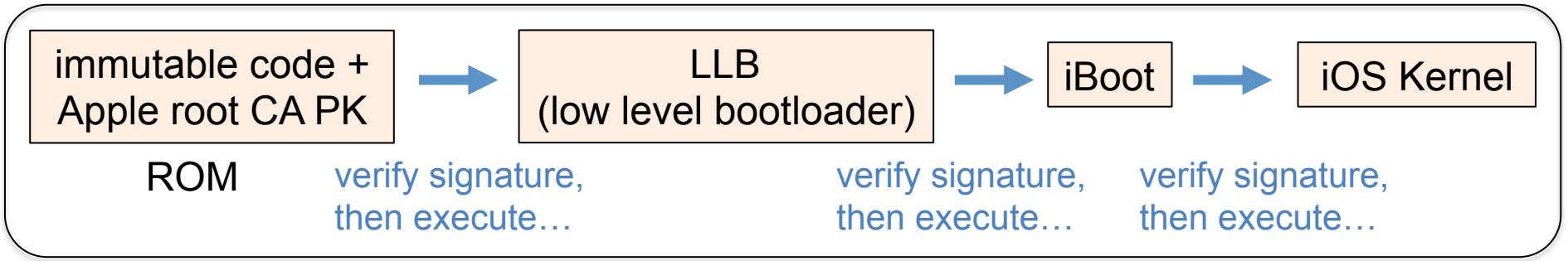
Outline

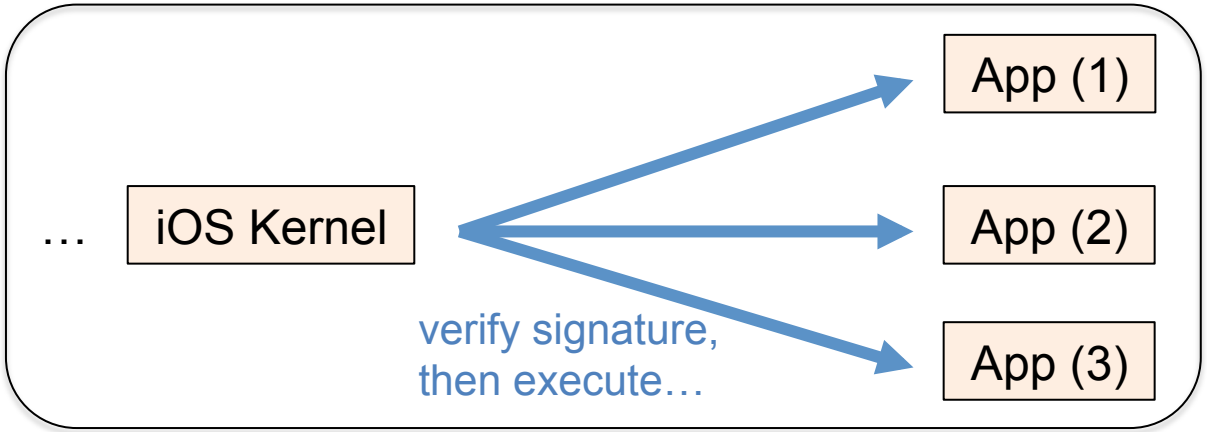
- motivations
- ***about security/privacy on smartphones***
- Mobilitics: some results
- conclusions



About security and privacy

- iOS and Android both feature secure boot
  - integrity verification from the bootloader up to Apps





- it looks fine, but it's not sufficient…
  - **does not prevent any App to misbehave**

Issue 1- Apple or end-user must check well

- two different models for App behavior control W.R.T. privacy
  - **market centric:** check an App prior to accept it on an official market
  - **end-user centric:** ask the user consent when an App wants to perform sensitive operations (at installation time or dynamically)

The market centric approach

- traditionally Apple's approach
  - the only solution in iOS5…
- requires Apple does a good job in **scrutinizing** Apps before accepting them
  - Apple acts as a trusted party
  - many scandals in 2012 and our own discoveries demonstrate it's **not 100% reliable**
    - **problems come from official signed Apps found in the AppStore…**
  - additionally the validation process is totally **obscure** ☹

The end-user centric approach

- give more control to the end-user…
  - …or get rid of your responsibility as a market validator?
    - **two complementary point of views!**
- Android: at installation time

  - an App with “potentially dangerous requirements” needs to ask the user consent first, at installation time
    - **responsibility is transferred to the user**
    - **example AndroidManifest.xml file**

```
<uses-permission android:name="android.permission.CALL_PHONE"/>
<uses-permission android:name="android.permission.GET_TASKS"/>
<uses-permission android:name="android.permission.READ_CONTACTS"/>
<uses-permission android:name="android.permission.SET_WALLPAPER" />
<uses-permission android:name="android.permission.INTERNET" />
```

    - **can we understand all the consequences of each authorization? No!**
    - **can we control the behavior of the App? Not really!**

The end-user centric approach… (cont')

- iOS6: dynamically
  - done through the privacy dashboard

  - but several items are **missing**
    - **Device Name**
    - **UDID (even if banned from new Apps)**
    - **Internet access**
    - **Advertising ID is really hidden elsewhere…**
  - the user cannot control the **behavior** of the App

Issue 2- The consequences of jailbreaking

- why?
  - **"I want to use my device the way I want, rather than what Apple thinks I want…"**

- jailbreaking an iPhone implies
  - **root access through software or hardware exploits**
  - **patching the kernel to get around Apple's code signature verifications and other restrictions recently added**

1. the law does not permit it in all countries…
2. … additionally
   - **the "chain of trust" is broken!**
   - **any App can do whatever it wants**
     - example: keys can easily be compromised, the App acquires a valid entitlement ("keychain-access-groups")

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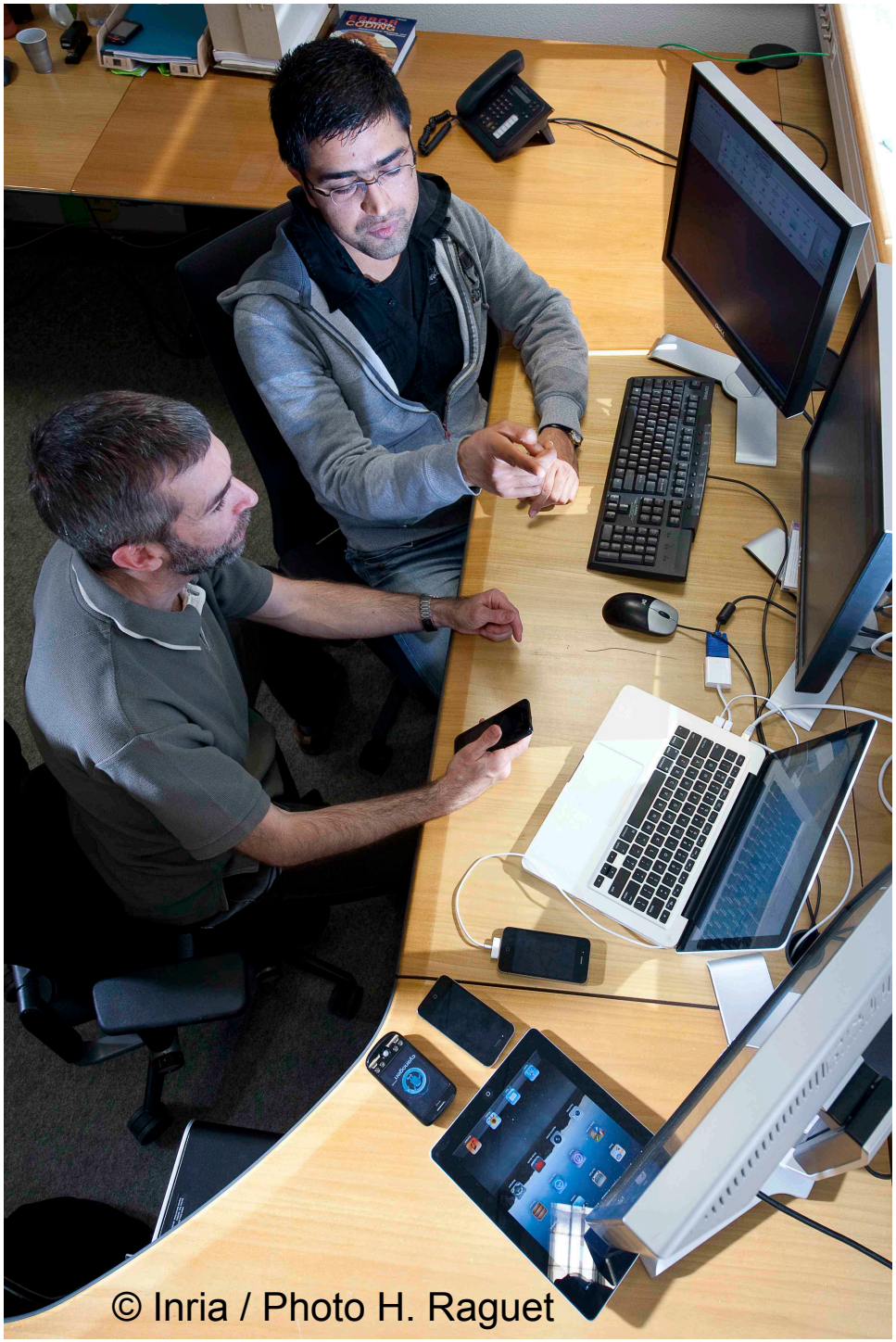


Mobilitics step 1: data collection

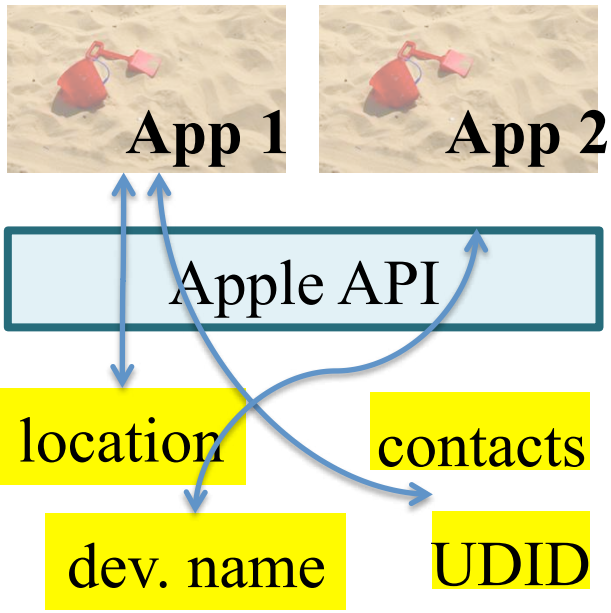
- a two step process…

- step 1: **data collection** on the phone with our Mobilitics App
  - **collect events**
  - **send "sanitized" information to server**
  - **keep most sensitive information locally**

Principles

- each App/service is independent
  - runs in a dedicated “sandbox”
- accessing external information…

  …requires to use the Apple official API



- ⇒ collecting data is done by instrumenting the API
  - the idea is simple, the difficulty is in the details
- it’s a bit different with Android…

Data being collected

- we capture
  - access/manipulation/transmission** of personal data
    - **contacts**
    - **geographic location**
    - **various device and user accounts**
    - **calendar**
    - **photos and videos**
    - **UDID and device name**
    - **voice memos**
    - **etc.**

**only for data sent in cleartext in v1, also with data sent encrypted in v2

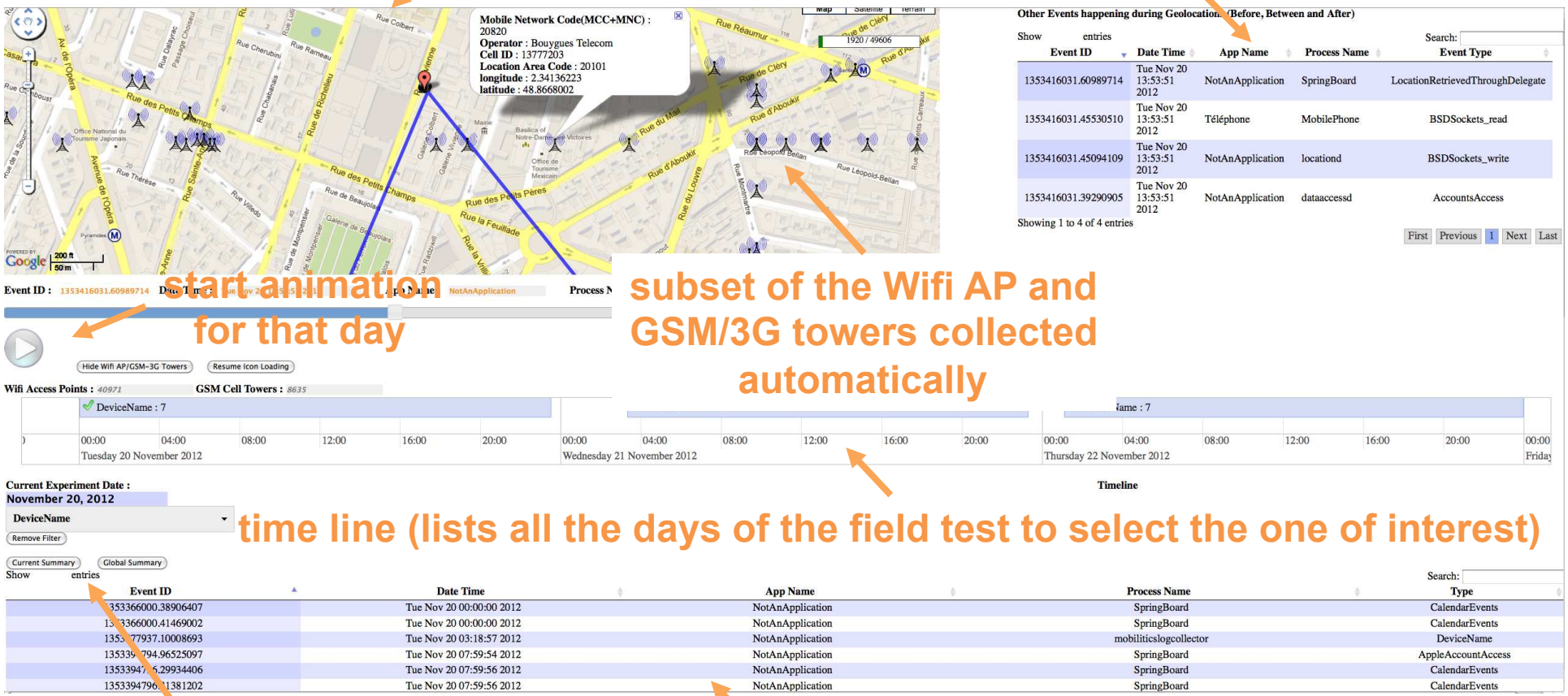
Mobilitics step 2: off line analysis tools

- step 2: **off line analysis tools** for visualization and statistics
  - statistics on the SQL server database
  - visualize the sensitive information kept of the phone
  - visualize the information sent to the server

Sensitive DB visualization tool

map showing phone location and movements for that day

current events



start animation for that day

subset of the Wifi AP and GSM/3G towers collected automatically

time line (lists all the days of the field test to select the one of interest)

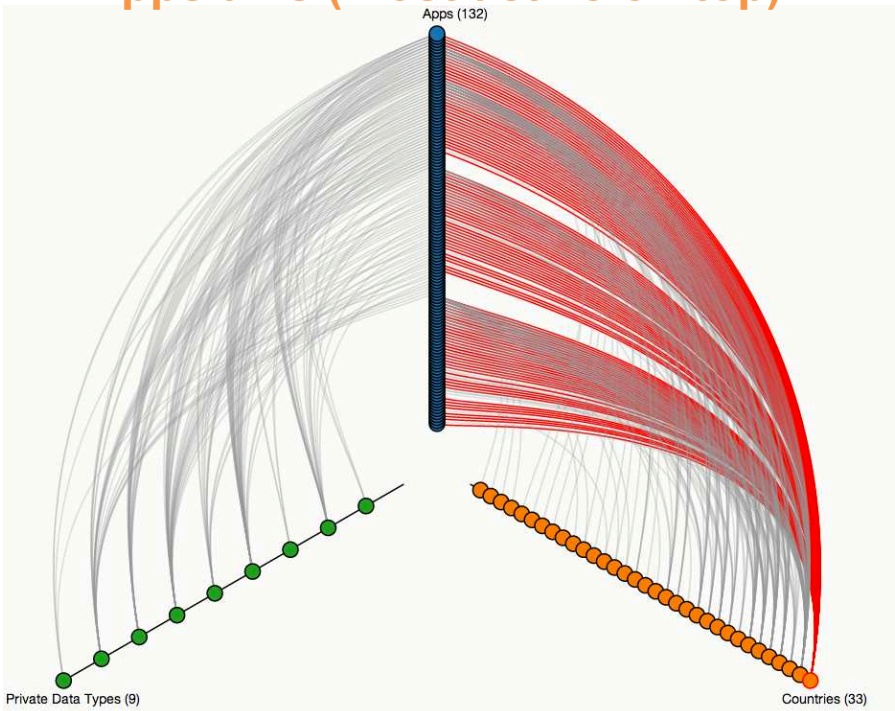
show global stats

DB entries for that day (here sorted by their event time)

Sensitive DB visualization tool…

- per country view

Apps axis (most active on top)



Private data axis

Country axis (most active on the right)

Country:

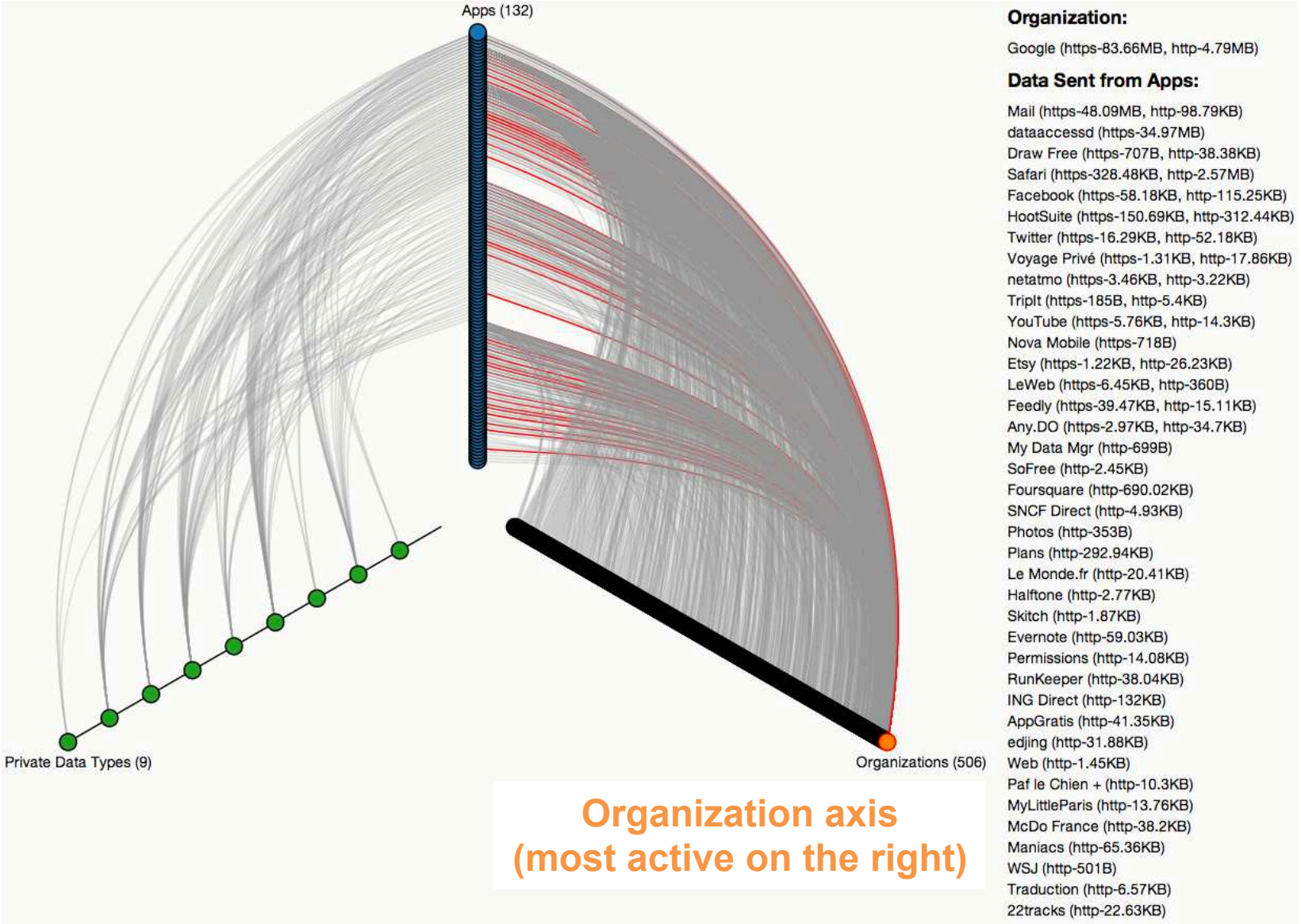
United States (5122-4.27KB, 5223-6.23MB, 13392-3.23KB, 33033-2.42KB, 40002-275B, 40003-165B, 40004-203B, 40005-539B, 40006-73B, 40007-344B, 40010-80B, 40011-363B, 40012-1.29KB, 40013-3.28KB, 40014-176B, 40016-9.99KB, 40017-450B, 40019-233B, 40020-458B, 40021-71B, 40022-290B, 40023-12.42KB, 40024-110B, 40025-145B, 40026-122B, 40027-409B, 40028-4.19KB, 40029-285B, 40030-516B, 40031-1.84KB, 40032-1.94KB, 40033-290B, 40034-10.6KB, 40036-2KB, 40038-1.72KB, 40039-175B, 40040-423B, 40041-129B, 40042-285B, 40043-1.16KB, 40044-1.6KB, 40046-169B, 40047-354B, 52775-205B, https-144.74MB, http-25.05MB, http-alt-593B, jabber-client-182B)

Data Sent from Apps:

Urban Pulse (5122-4.27KB, http-8.97KB)
apsd (5223-6.23MB, https-513.08KB)
Skype (13392-3.23KB, 33033-2.42KB, 40002-275B, 40003-165B, 40004-203B, 40005-539B, 40006-73B, 40007-344B, 40010-80B, 40011-363B, 40012-1.29KB, 40013-3.28KB, 40014-176B, 40016-9.99KB, 40017-450B, 40019-233B, 40020-458B, 40021-71B, 40022-290B, 40023-12.42KB, 40024-110B, 40025-145B, 40026-122B, 40027-409B, 40028-4.19KB, 40029-285B, 40030-516B, 40031-1.84KB, 40032-1.94KB, 40033-290B, 40034-10.6KB, 40036-2KB, 40038-1.72KB, 40039-175B, 40040-423B, 40041-129B, 40042-285B, 40043-1.16KB, 40044-1.6KB, 40046-169B, 40047-354B, 52775-205B, https-186.86KB, http-1.81KB)
ubd (https-355.88KB)
backupd (https-21.54KB)
SpringBoard (https-6.77KB, http-749.92KB)
Mail (https-48.55MB, http-1.08MB)
aosnotifyd (https-368.27KB)
PMP (https-14.48MB)
itunesstored (https-3.28MB, http-419KB)
dataaccessd (https-40.88MB, http-154.08KB)
My Data Mgr (https-5.88KB, http-699B)
12 jours (https-2.17KB)
Météo (https-185B, http-32.03KB)
syncdefaultsd (https-280.33KB)
Draw Free (https-211.83KB, http-1003.84KB)
configd (https-10.97KB, http-4.35KB)
locationd (https-2.51MB)
Shazam (https-17.06KB, http-37.16KB)
Réglages (https-17.69KB)
imagent (https-990.3KB, http-30.3KB)
Safari (https-1.54MB, http-6.7MB)
Facebook (https-9.99MB, http-801.14KB, http-alt-593B)
HootSuite (https-4.75MB, http-3.19MB)
[illegible]ttp-898.57KB)
0.46KB)
92.94KB)
http-17.86KB)
p-241.46KB)
.87KB)
Apple Store (https-13.13KB, http-3.15KB)
RATP (https-9.1KB, http-18.65KB)
Yammer (https-64.11KB)
Evernote (https-5.89MB, http-82.49KB)
Résultats foot (https-750B)
Instagram (https-82.36KB, http-5.08MB)
SoundCloud (https-837.38KB, http-637.85KB)
netatmo (https-3.46KB, http-3.22KB)
RunKeeper (https-444.41KB, http-38.4KB)
iTunes (https-29.85KB, http-7.6KB)
vente-privee (https-71.58KB, http-624B)
Shopwise (https-122.09KB, http-34.35KB)
TripIt (https-30.1KB, http-98.19KB)
L'Œil by LaSer (https-7.13KB, http-308B)

Sensitive DB visualization tool…

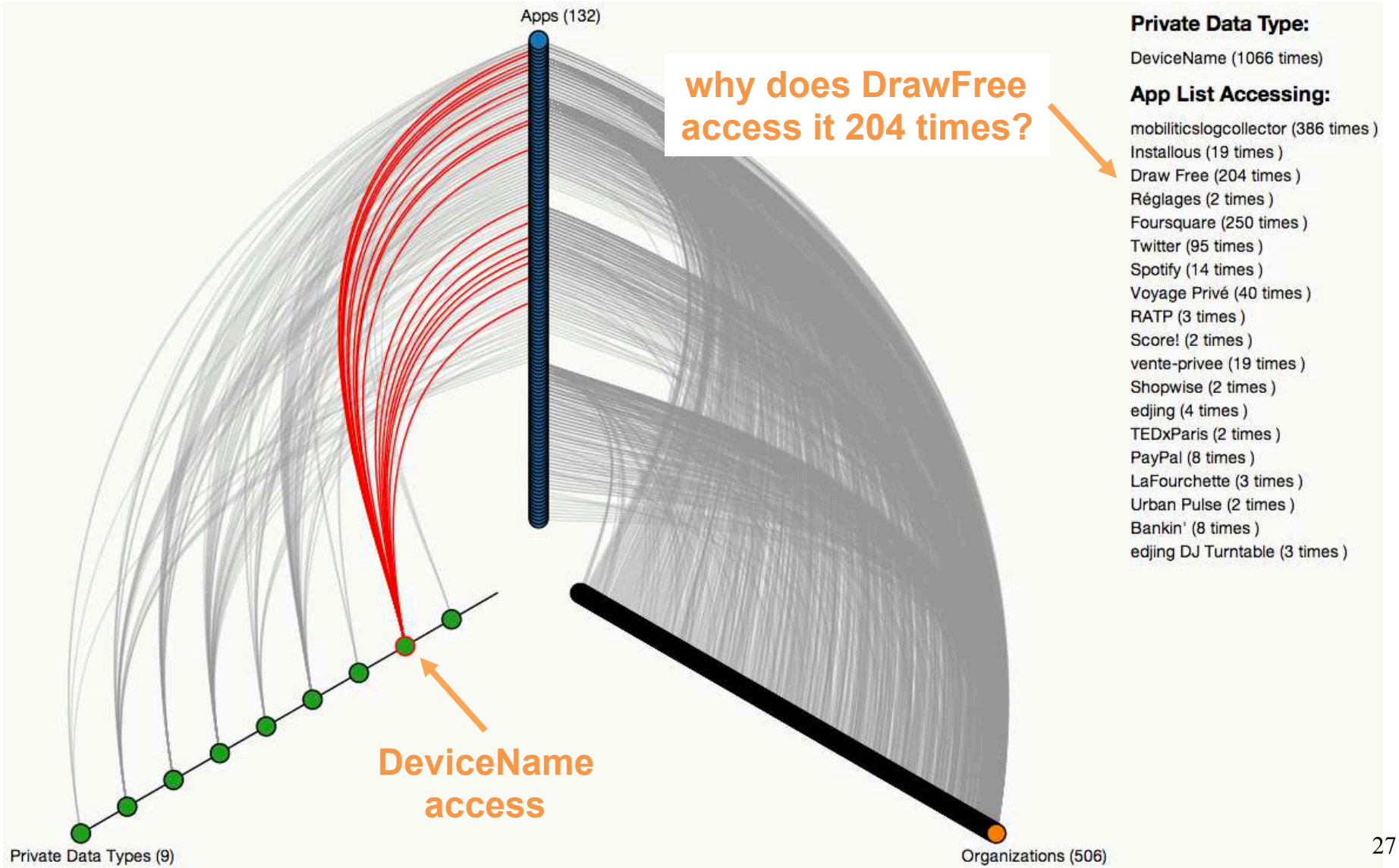
- per organization view



Organization axis (most active on the right)

Sensitive DB visualization tool…

- an example: “DeviceName” access view



Quelques résultats (live test 1)

- 6 volontaires de la CNIL ont utilisé un iPhone “mobilitics” pendant 3 mois
  - novembre 2012 – janvier 2013
- 9 Go de données récoltées
- 7 millions d’événements récoltés
- 189 applications utilisées

Statistiques globales

- résultats

origin: CNIL

Nombre d'applications :	Total : 189	
Qui accèdent au réseau	176	93%
Qui accèdent à l'UDID (identifiant unique Apple)	87	46%
Qui accèdent à la géolocalisation	58	31%
Qui accèdent au nom de l'appareil	30	16%
Qui accèdent à des comptes	19	10%
Qui accèdent au carnet d'adresses	15	8%
Qui accèdent au compte Apple	4	2%
Qui accèdent au calendrier	3	2%

TABLEAU 1 – BILAN STATISTISQUE GLOBAL DE L'EXPERIMENTATION MOBILITICS

La Géolocalisation: La reine des données

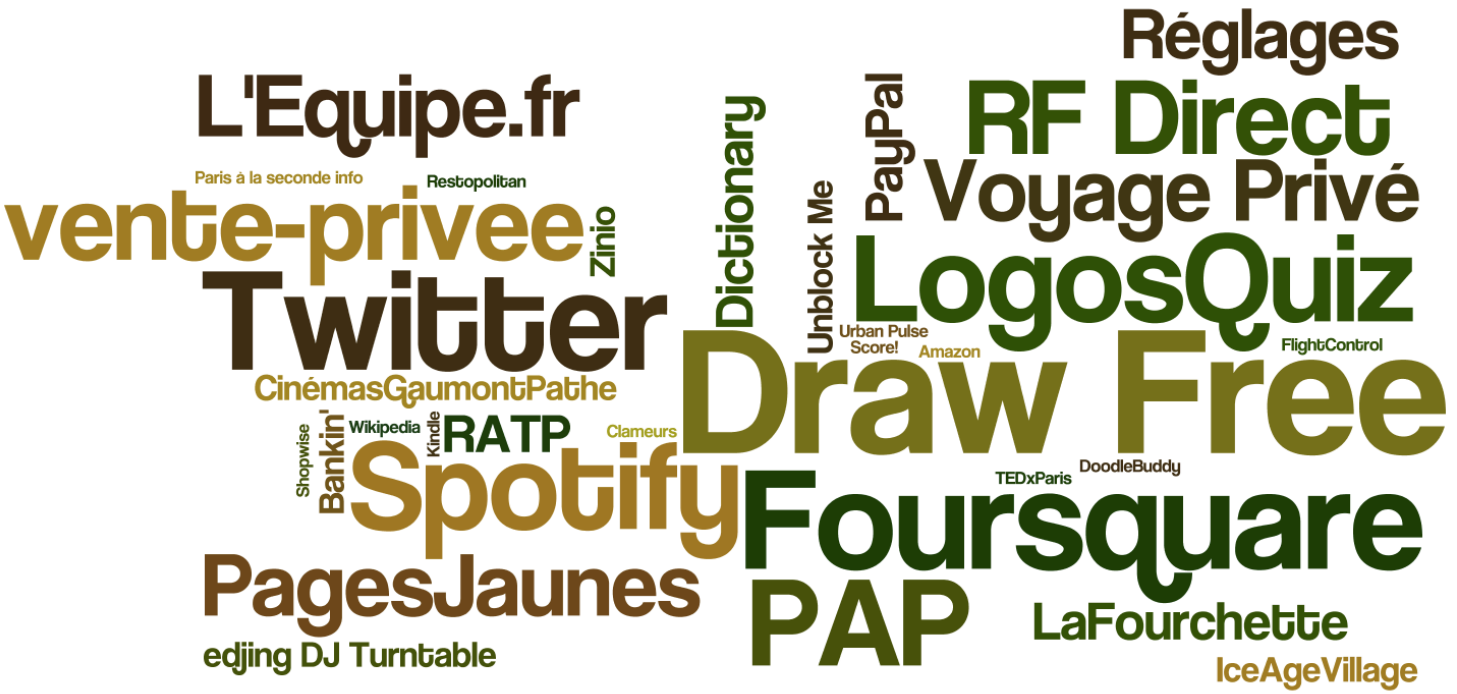
- 31% des applications utilisées ont accédé à la localisation
  - 41 000 « événements » de géolocalisation au total
  - en moyenne 76 événements par jour et par volontaire
  - l'intensité de ces accès surprend

origin: CNIL

Pourquoi accéder au nom de l'appareil?

- 36 applications, soit un peu plus de 15% ont accédé à cette info
  - l'usage fait de cette donnée est peu clair

origin: CNIL



Les identifiants sont très demandés

- l'UDID, un élément clef
  - **idf intégré à l'iPhone qui n'est ni modifiable ni effaçable**
- Cet UDID est très « demandé »
  - **87 applications sur 189 ont accédé à l'UDID (46%)**
- désormais banni, mais d'autres solutions sont là…
  - **ex. OpenUDID, adresse MAC, IMEI, etc.**

origin: CNIL

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CONCLUSIONS

Il y a du travail pour améliorer la situation…

- Apple/Google sont contraints…

  … de proposer des techniques pour redonner du contrôle à l'utilisateur : « privacy dashboard » (iOS), autorisations (Android)

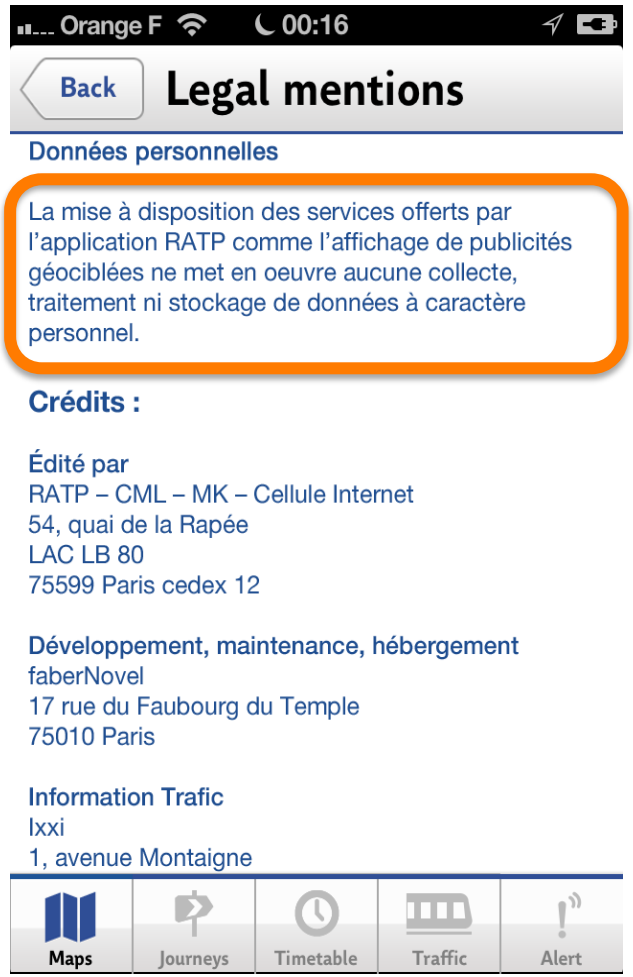
- Mais :
  - elles sont **peu utiles** en l'état
    - **limitées, contrôle à gros grain et conséquences obscures, sans analyse comportementale de l'application**
  - **induisent en erreur** car elles sont contournées
    - **« si c'est techniquement possible, j'ai le droit de le faire »**
  - règne un **flou total**
    - **un développeur qui inclue une bibliothèque publicitaire ne sait rien de son comportement…**

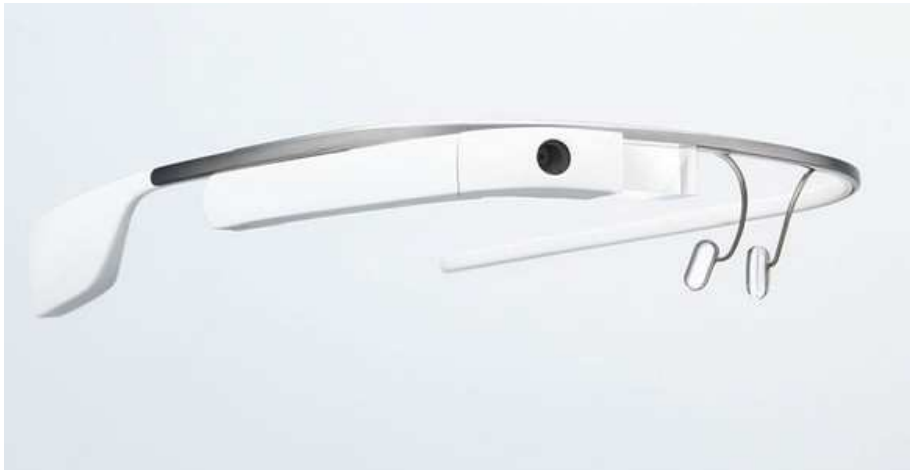
Un cas d'école : l'App RATP version 5.4.1

- « Y'a pas de problèmes » dixit la RATP

- Vraiment ?
  - la liste des Apps actives, mon adresse MAC, le nom de mon téléphone, ma position géographique précise (à 20m près), un identifiant permanent sont envoyés à Adgoji (ssl) et sofialys (en clair !)

- Voir notre blog : part-1 et part-2: https://team.inria.fr/privatics/





Thank you ☺

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