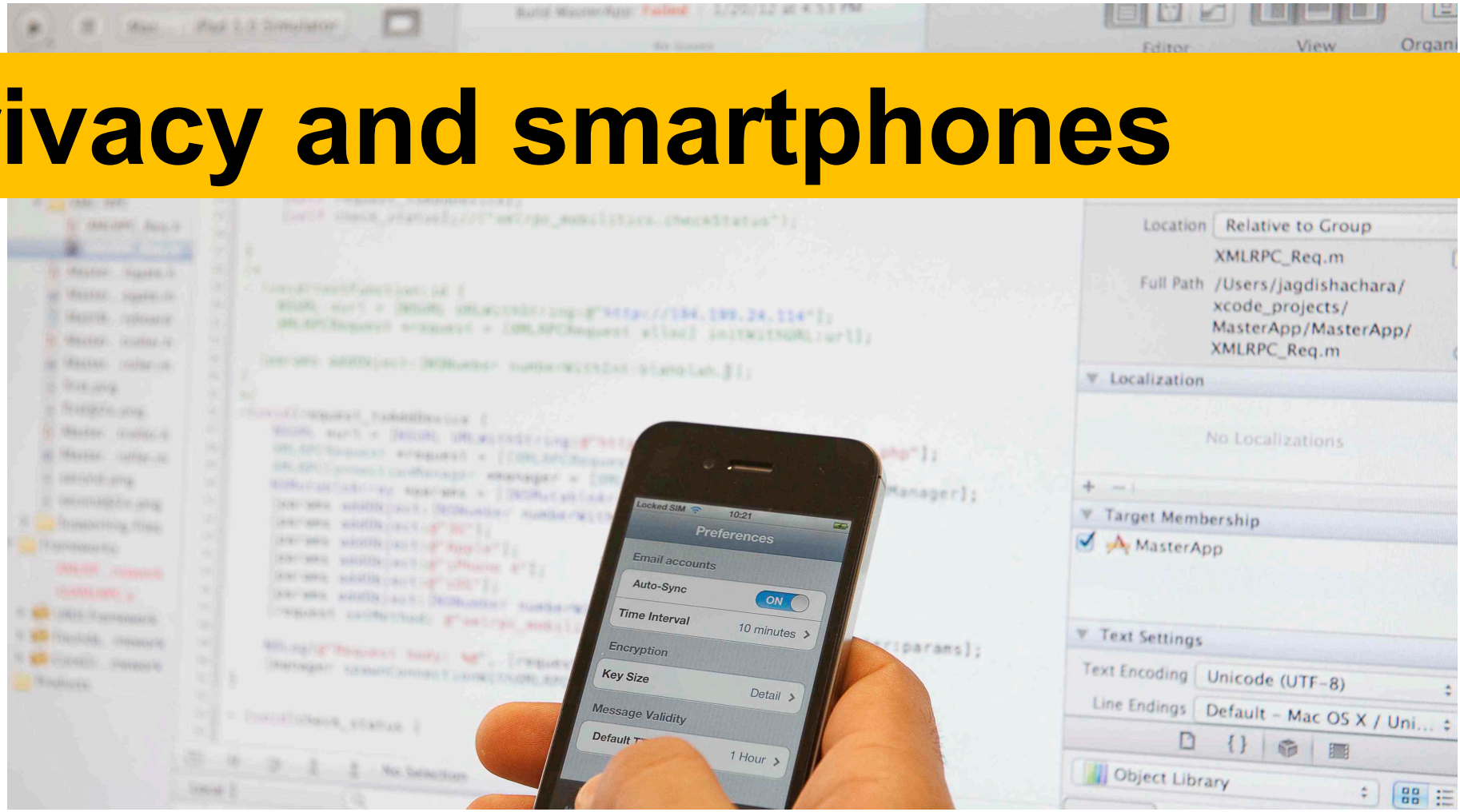
Privacy and smartphones



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February 3rd, 2021

informatiques mathématiques

Inria Grenoble-Lyon-Sophia, PRIVATICS team

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Outline

- Personal data and the French/EU law
- Context: a massive worldwide surveillance
- Why do smartphones interest so many people?
- The ecosystem around applications for smartphones
- Free apps/services in exchange of targeted advertising: where's the problem?
- What is personal in my smartphone: a close-up on technical identifiers
- User control
- Limits of the user control
- Tracking the trackers in practice
- Two further examples: ACCESS_WIFI_STATE and physical world tracking
- Conclusion: towards a virtuous circle

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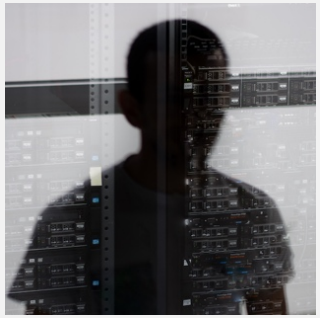
Some vocabulary…

Private company, administration
"data controller"
(responsable de traitements)

has the responsibility of



Data Base containing
"Personal Information"
(données à caractère personnel)

relative to

Physical persons

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"On the Internet, nobody knows you're a dog."

In 1993…
© NewYorker 1993

In 2015…
© NewYorker 2015

"Remember when, on the Internet, nobody knew who you were?"

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What does a smartphone consist in? (1)

- an application processor;
- an operating system (OS) (Android / Google or iOS / Apple)
- applications.

the visible side

- Subject of this lecture

What does a smartphone consist in? (2)

- a full system (processor + OS) for baseband communications
  - ✓ totally hidden to the user;
  - ✓ proprietary technology without any open specifications;
  - ✓ little is known…

the invisible side

- Should we be suspicious?
  - ✓ The community cannot answer given the intrinsic complexity of the required analyses.

http://events.ccc.de/congress/2011/Fahrplan/attachments/2022_11-ccc-qcombbdbg.pdf

At the center of PI collection (1)

- Our everyday “companions”…
  - ✓ useful, always connected, easy to customize

- but they also

concentrate

personal information

when we use them: phone calls, SMS, web, applications, etc.

generate

personal information

GPS, NFC, WiFi, camera, fingerprint sensor, heart rate sensor, etc.

At the center of PI collection (2)

- A smartphone knows a lot on our **cyber-activities on Internet**
  - ✓ Just like a web browser.
- But also in the **physical world**…
  - ✓ And this is new!

- As well as our centers of interest through the list of installed applications
- Many actors are interested by this wealth of PI
  - ✓ Our **“mouchard de poche”?**

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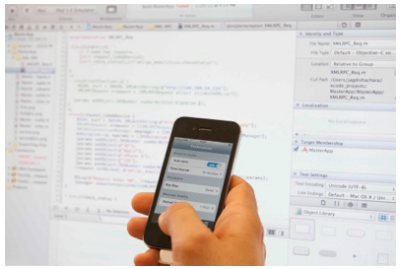
Many actors are involved

App. developer
(or first party)



Advertising and Analytics (A&A)
company (or third party)

Application Store

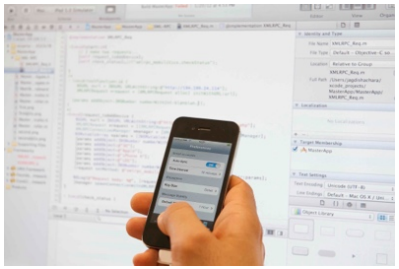
User

Advertiser

An ecosystem centered around the A&A company

- At the interface between developers, users, and advertisers.
- Through the applications, it **collects** users' PI.
  - ✓ *e.g., Applications used, geolocation, and technical identifiers.*
- Creates and progressively improves the accuracy of **user profiles.**
- Launches **Real-Time Bidding** (RTB).
  - ✓ "Who's interested by this user profile?"
- Triggers the display of **targeted advertising** within the application.

App. developer (or first party)



includes a library within the application

€

A&A company (third party)

builds and improves user profiles

develops and manages an application

Application Store

install an app.

User

the app. sends PI

targeted adv.

who's interested by a young and fashion user?

adv. +€€€

Advertiser

A few examples of A&A companies…

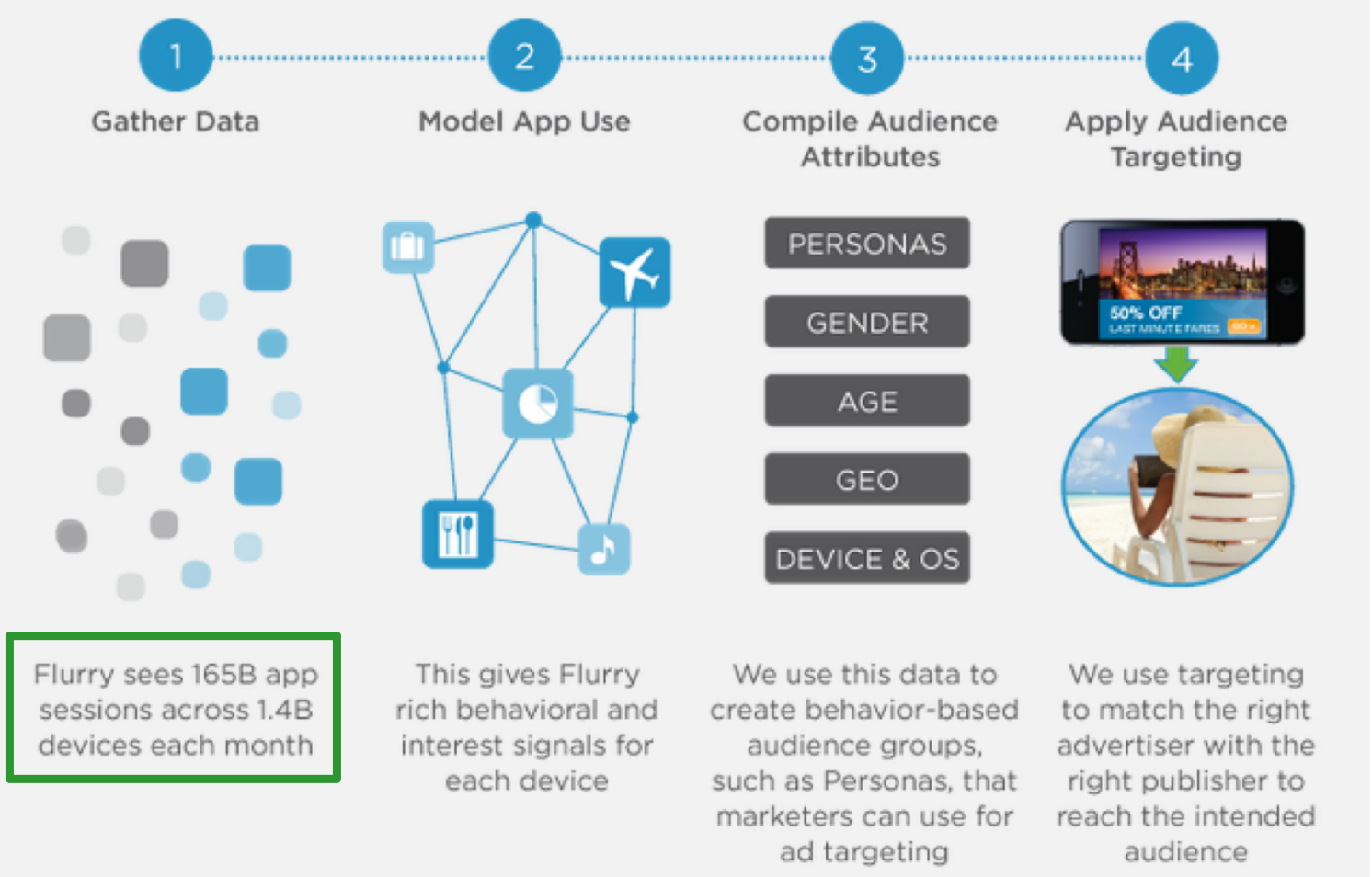
bought by Yahoo! in 2014…

(fined by FTC in 2016…)

bought by AOL in 2015…

More references at:
http://www.mobyaffiliates.com/guides/mobile-advertising-companies/
http://gulyani.com/complete-list-of-mobile-ad-networks-companies/

Very impressive amounts of data transfers!



FLURRY
now
YAHOO! DEVELOPER NETWORK

Data-bases in the order of petabytes (10^{15}).

Source: Flurry web site, February 2016.

… And gross revenues that are impressive too!

- **Alphabet** (owner of Google):
  - 32.6 Billion $ gross revenue for targeted advertising in Oct – Dec 2018 (3 months)
    - ✓ out of a total of 39.1 Billion $ of gross revenue;
    - ✓ advertising represents 116 Billion $ in 2018 out of 136 Billion $ (i.e., 85% of gross revenue)

http://www.zdnet.fr/actualites/trimestriels-le-ca-d-alphabet-en-hausse-de-21-malgre-l-amende-de-l-ue-39855362.htm

https://abc.xyz/investor/news/earnings/2018/Q4_alphabet_earnings/

Ressources

Exemples de régies publicitaires cités dans la séquence :

- https://www.google.com/admob/
- https://developer.yahoo.com
- http://www.millennialmedia.com/
- http://www.onebyaol.com/
- http://www.inmobi.com/

Autres exemples :

- http://www.mobyaffiliates.com/guides/mobile-advertising-companies/
- http://gulyani.com/complete-list-of-mobile-ad-networks-companies/

ZdNet : http://www.zdnet.fr/actualites/trimestriels-le-ca-d-alphabet-en-hausse-de-21-malgre-l-amende-de-l-ue-39855362.htm

Alphabet : https://abc.xyz/investor/news/earnings/2017/Q2_alphabet_earnings/

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Don’t be naive…

- Everyday we use…
  - ✓ high quality, free **services**;
  - ✓ high quality, free **applications**.

- Possible thanks to a business model essentially based on **targeted advertising:**
  - ✓ The advertiser pays for the user.

- This requires a **profiling of users…**
  - ✓ … in order to know their centers of interest.

… But there are limits!

https://www.ftc.gov/news-events/press-releases/2016/06/mobile-advertising-network-inmobi-settles-ftc-charges-it-tracked

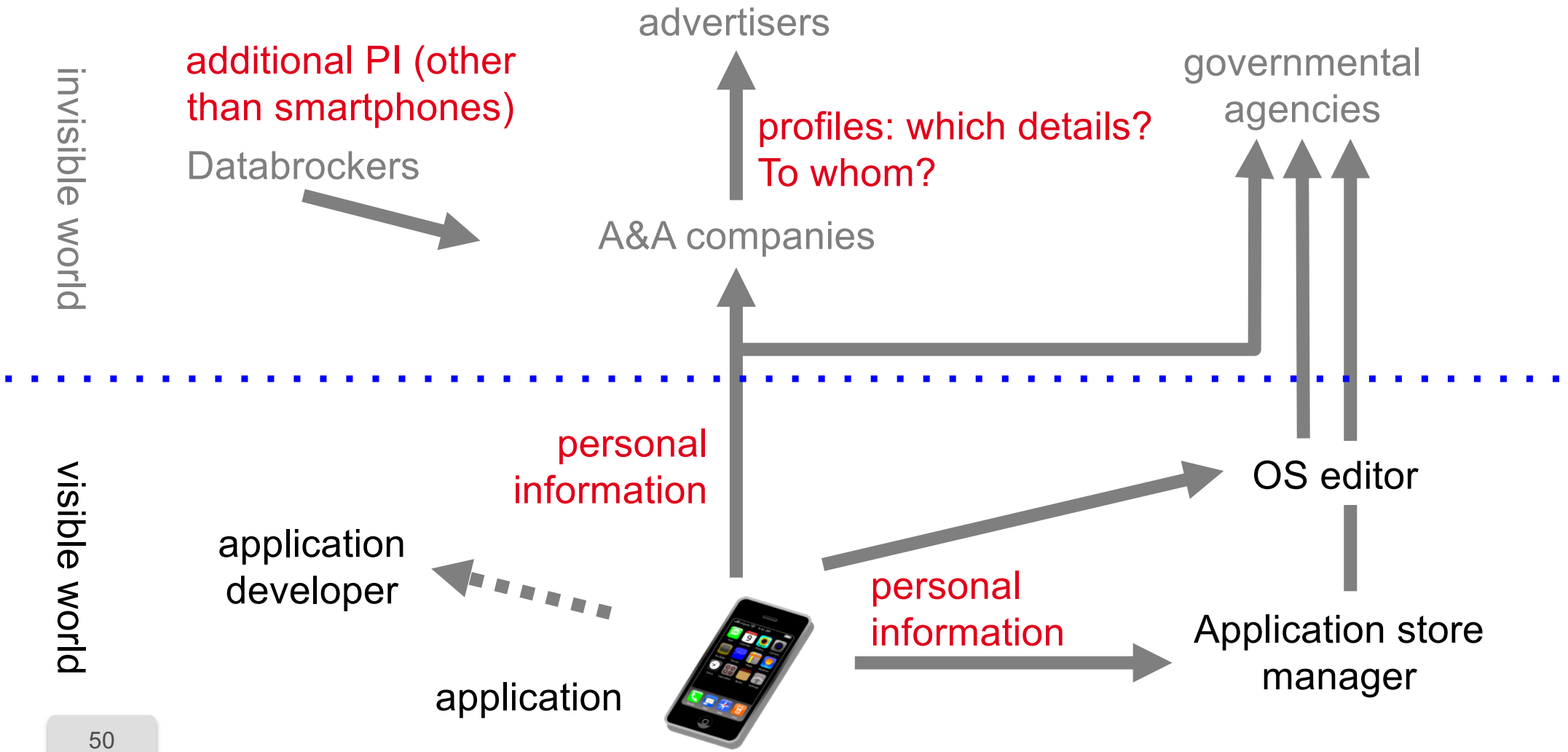
Fair business model or not?

- “Free in exchange for targeted advertising” could be a reasonable business model…

« Les données personnelles sont le nouveau pétrole de l’internet et la nouvelle monnaie du monde numérique. »
M. Kuneva, Commissaire europ. à la consommation, 2009

- … but currently a few fundamental issues remain:
  - ✓ Complexity ;
  - ✓ Disproportion ;
  - ✓ Lack of information ;
  - ✓ Lack of control.

1- The ecosystem is so complex we cannot trust them all



2- A potential disproportion of data collection (1)

- Example: historic of positions recorded by my Android smartphone for Google services.
  - ✓ https://maps.google.com/locationhistory/

2- A potential disproportion of data collection (2)

- Google knows where I work, where I live, what I'm doing during the day, how I move from one place to another, and much more…

2- A potential disproportion of data collection (3)

- All this with an incredible accuracy:
  - ✓ Here is the full list of positions recorded by Google that day.

  - A record **every 5 minutes** during the night…
  - … and **each minute** if I'm moving!

▼ Masquer la date et l'heure

00:00 - 01:00
00:03 00:07 00:12 00:17 00:22 00:26
00:31 00:36 00:41 00:45 00:50 00:55

01:00 - 02:00
01:00 01:04 01:09 01:14 01:19 01:23
01:28 01:33 01:38 01:42 01:47 01:52
01:57

02:00 - 03:00
02:01 02:06 02:11 02:16 02:20 02:25
02:30 02:35 02:39 02:44 02:49 02:54
02:58

03:00 - 04:00
03:03 03:08 03:13 03:17 03:22 03:27
03:32 03:36 03:41 03:46 03:51 03:55

04:00 - 05:00
04:00 04:05 04:10 04:15 04:19 04:24
04:29 04:34 04:38 04:43 04:48 04:53
04:57

05:00 - 06:00
05:02 05:07 05:12 05:16 05:21 05:26
05:31 05:35 05:40 05:45 05:50 05:54
05:59

06:00 - 07:00
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06:32 06:37 06:42 06:47 06:51 06:56

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09:00 - 10:00
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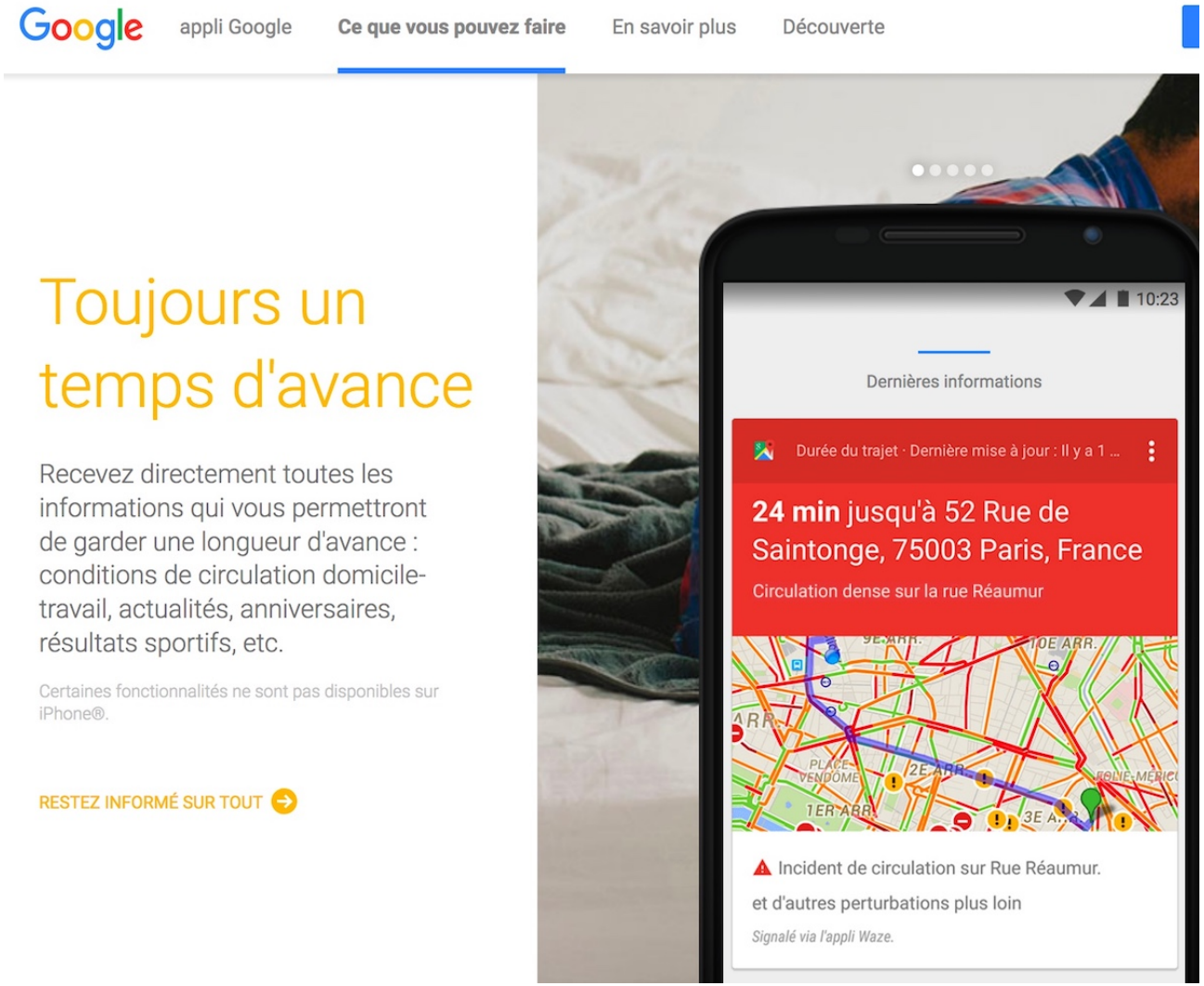
11:00 - 12:00
11:00 11:04 11:09 11:14 11:19 11:23
11:28 11:33 11:38 11:42 11:47 11:52

2- A potential disproportion of data collection (4)



- I have enabled Google Now!
  - ✓ Now called « appli. Google ».

  https://www.google.com/search/about/

- Disproportionate collection of PI with respect to the service provided?
  - ✓ this is my opinion, but you may disagree…

BTW, Google simplified the page design!

Vos trajets AUJOURD'HUI

2014 mai 26

Lundi 26 Mai 2014

4,4 mi
37 min

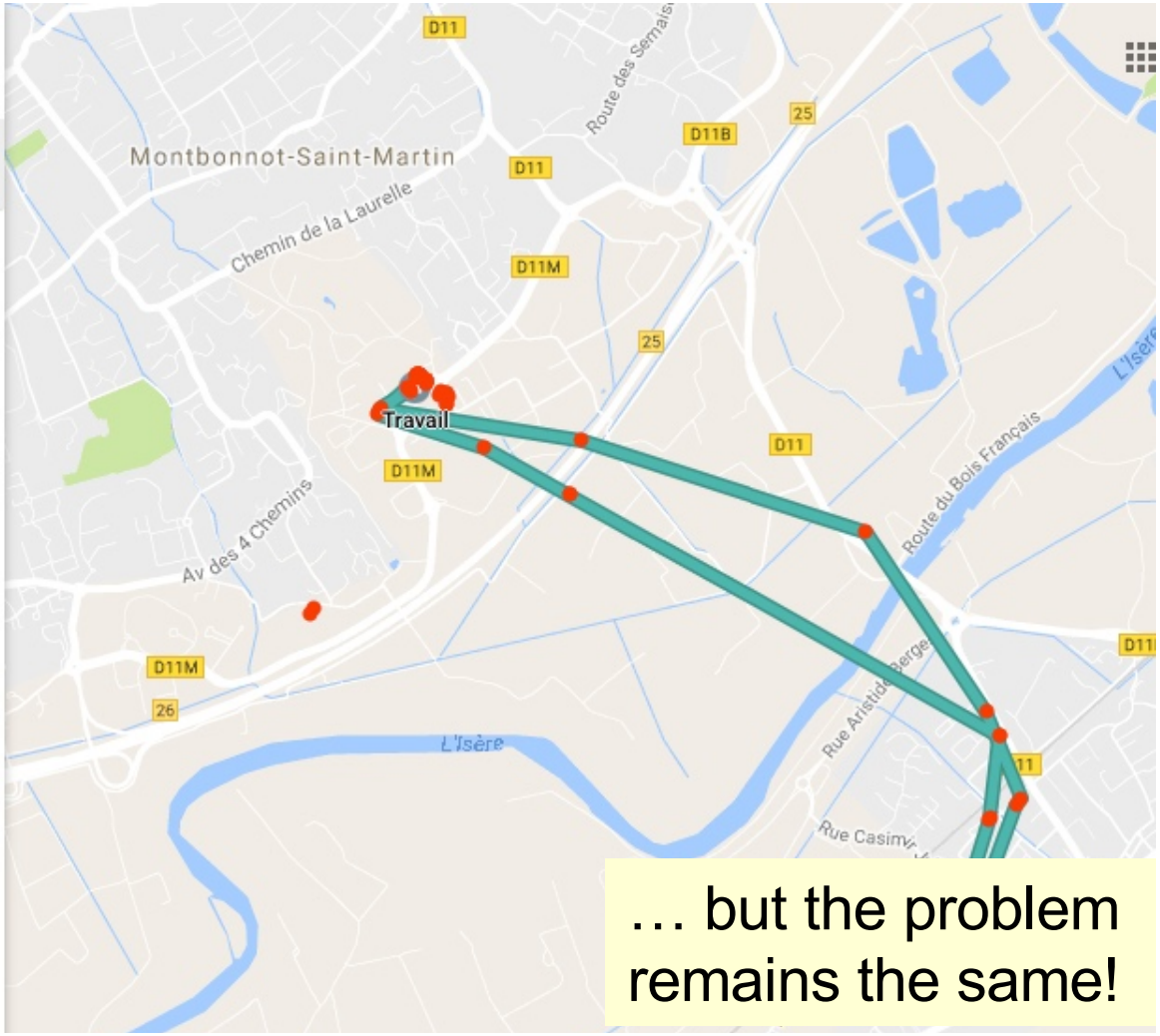
Domicile 07:55

It's less frightening…

26 min

Travail 08:21 – 18:33

655 Avenue de l'Europe, 38330 Montbonnot-Saint-Martin, France



… but the problem remains the same!

2- A potential disproportion of data collection (5)

- Geolocation information is meaningful.
  - ✓ Google knows if I'm going to a place of worship.
  - ✓ Google knows if I'm going to an hospital.

- Those are **sensitive data** according to the "loi Informatique et Liberté".
  - ✓ CANNOT be collected or processed!

3- Lack of information on PI collection

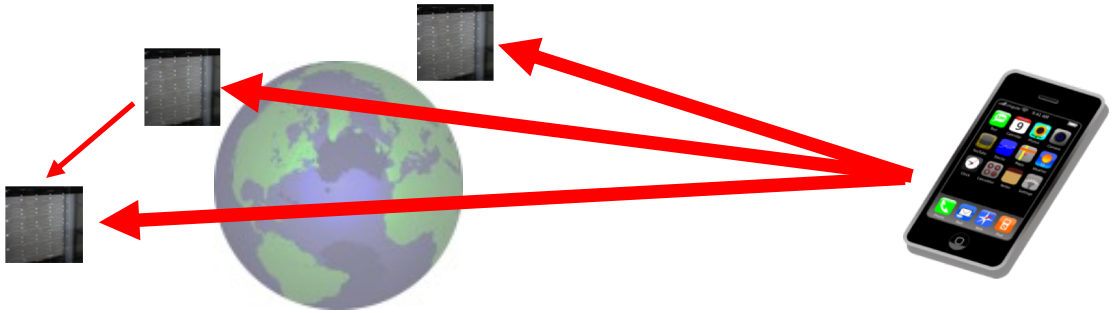
- We don’t know everything…
  - ✓ see the RATP application, 2013 version.
  - ✓ This RATP app. changed a lot since that version, but many others keep on leaking personal information without the user knowing.

- Possible because:
  - ✓ most of the privacy policies (meant to inform the user) are **not written to be understood**;
  - ✓ **lack of transparency** on practices.

Source : https://play.google.com/store/apps/details?id=com.fabernovel.ratp&hl=fr

4- Lack of control on PI collection

- Data is immediately **exfiltrated** beyond EU without any control
  - ✓ the GDPR applies but may be difficult to enforce and checked checked in those countries...



- **No guaranty** regarding the storage, security, usage, exchange of our PI with other actors.

This is just the beginning

- PI collection will become **more and more intrusive** with:
  - ✓ generalization of smartphone payment
  - ✓ wearable connected devices
  - ✓ home connected appliances
  - ✓ e.g., intelligent thermometer
  - ✓ “quantified self” trend
  - ✓ connected cars
  - ✓ IoT

In summary

- “Free in exchange for targeted advertising” could be a reasonable business model…
  - ✓ Remember there’s no free beer!
- … but currently a few fundamental issues remain:
  - ✓ Complexity, disproportion, lack of information, lack of control.
- It’s essential to find solutions.
  - ✓ A increasing number of domains, currently untouched, will be concerned.

Ressources

Federal Trade Commission. *Mobile Advertising Network InMobi Settles FTC Charges It Tracked Hundreds of Millions of Consumers' Locations Without Permission*. June 22, 2016 : https://www.ftc.gov/news-events/press-releases/2016/06/mobile-advertising-network-inmobi-settles-ftc-charges-it-tracked

Appli. Google : https://www.google.com/search/about/

Vos trajets / Appli Google : https://maps.google.com/locationhistory/

Google Play – Application RATP : https://play.google.com/store/apps/details?id=com.fabernovel.ratp&hl=fr

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What is personal on my smartphone?

- Many things…

concentrate

personal information

when we use them: phone calls, SMS, web, applications, etc.

generate

personal information

GPS, NFC, WiFi, camera, fingerprint sensor, heart rate sensor, etc.

- This is the case of **technical identifiers** that focus a lot of interest.
  - They look like random numbers.
  - They look like harmless.

Examples of technical identifiers

- AndroidID
  - ✓ random number that **quasi-uniquely** identifies an Android smartphone
- MAC address of Wi-Fi (or Bluetooth) interface
  - ✓ **uniquely** identifies the network interface (e.g., 68:a8:6d:28:ce:1f)
- IMEI (International Mobile Equipment Identity)
  - ✓ **uniquely** identifies a smartphone (used for instance to block a stolen phone)
- IMSI (International Mobile Subscriber Identity)
  - ✓ **uniquely** identifies a user at his/her cell phone operator

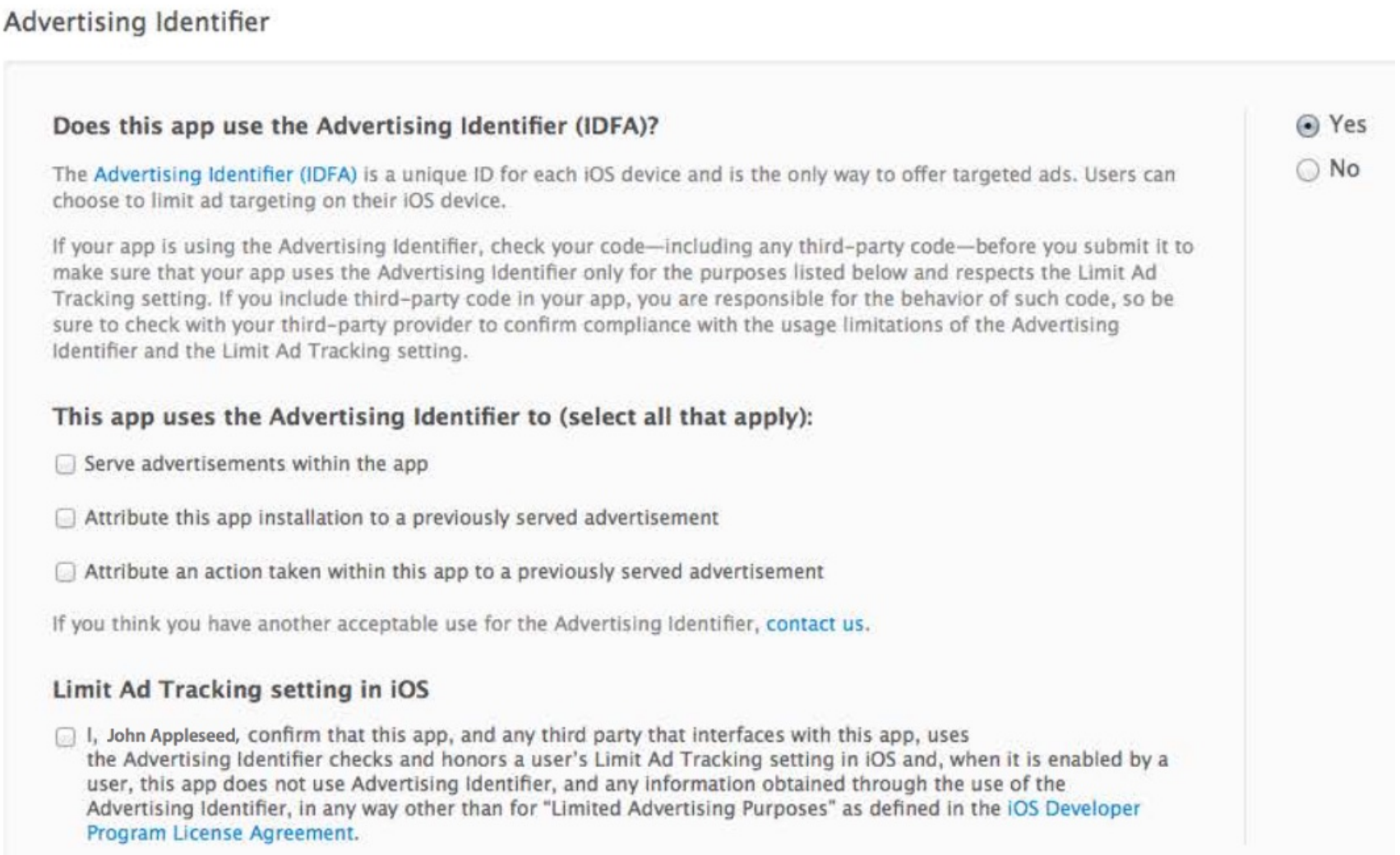
- and the AdID (Advertising Identifier)/IDFA (ID for Advertisers)…

About the Advertising Identifier, or AdID (1)

- Quasi-unique identifier used explicitly for **targeted advertising.**
  - ✓ Historically created by Apple.
  - ✓ Later added by Google.
  - The user can **reinitialize** the AdID at any time ☺.
  - Apple also enables the user to ask not to be tracked.

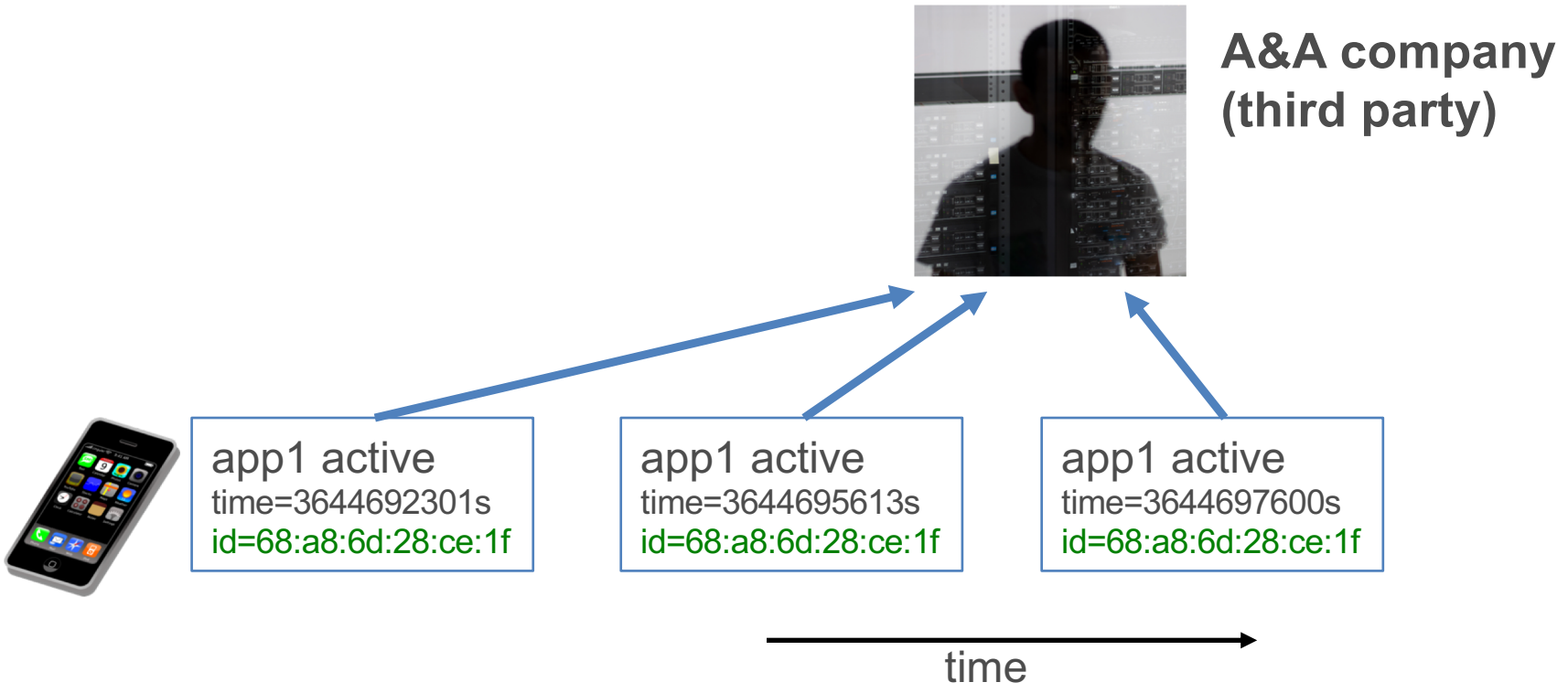
- Two benefits:
  - **Transparency**: it's designed for advertising only.
  - Gives back **control** to the user.

About the Advertising Identifier, or AdID (2)



Technical IDs are very useful for tracking (1)

- Stable IDs are perfect for **tracking users** on the long term.

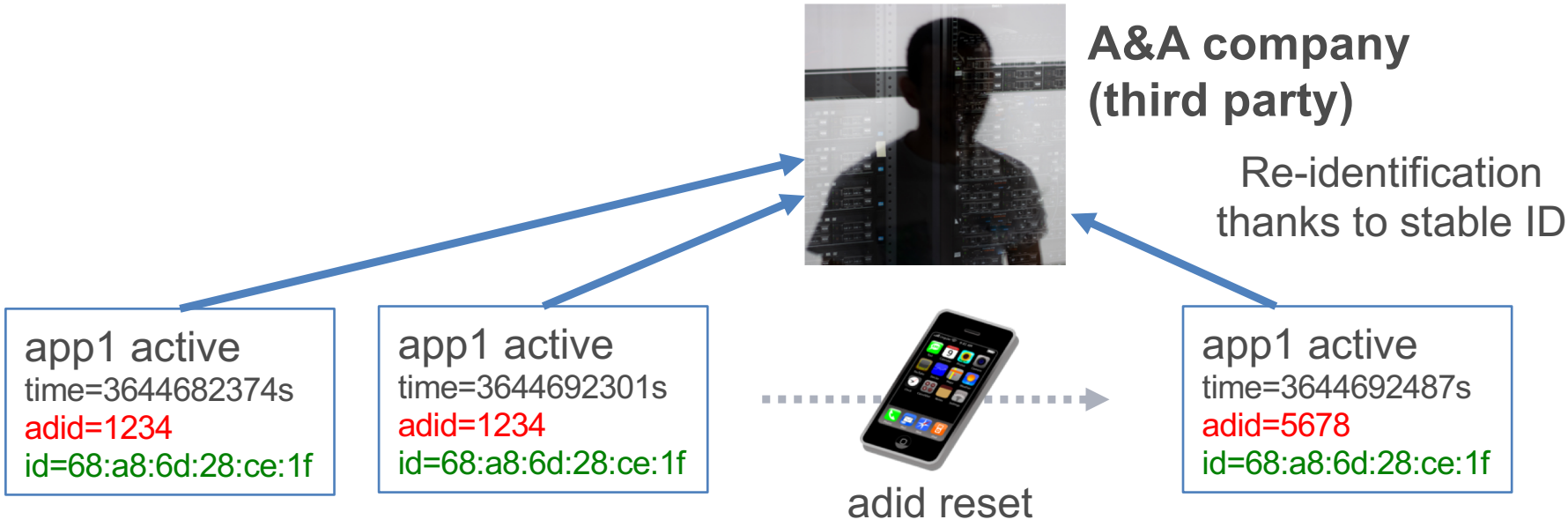


Technical IDs are very useful for tracking (2)

- stable IDs are perfect to **correlate** information collected from several Apps
  - and therefore refine a **user profile**
  - one knows a subset of applications used by this user!

Technical IDs are very useful for tracking (3)

- Stable IDs are perfect to **bypass** any tracking for advertising limitation system.
  - voids the *Advertising Identifier* reset whereas the user thinks the contrary.



Major differences between Google - Apple

- **Google** chose not to fundamentally change the situation ☹
  - ✓ Many technical identifiers remain accessible, sometimes without the user explicit agreement
  - ✓ Google kindly asks A&A companies to use the AdID and not to cheat!
    https://developer.android.com/training/articles/user-data-ids.html

- **Apple** progressively banned access to stable identifiers ☺
  - ✓ The AdID is the only one authorized.
  - ✓ Greatly limits (but does not totally prevent) tracking possibilities.

In summary

- Technical identifiers focus a lot of interest because they are **stable**.
- Used:
  - ✓ to track users;
  - ✓ to correlate information collected separately;
  - ✓ potentially to bypass AdID reset.

- **The Advertising Identifier (AdID)** is a technology that brings transparency and control back to the user.
  - ✓ The user knows its purpose and can reset it at any time/.

- All of this assumes no other stable identifier be collected.
  - ✓ Apple is much more virtuous than Google from this point of view.

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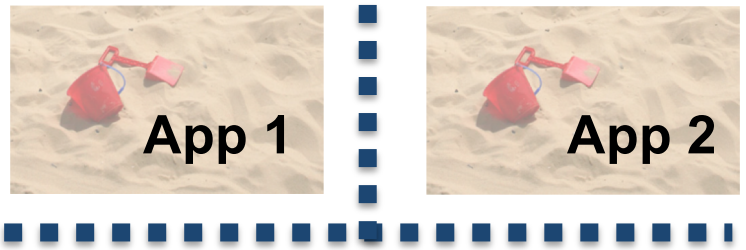
Notion of authorizations (1)

- An application can require authorizations to operate normally.
  - ✓ *Example : Internet access (transmission/reception).*
  - ✓ *Example : Contact access.*

- Goal of authorizations: get the **"free and informed consent"** of the user.
  - ✓ **"Free":** the user can refuse an authorization without consequence.
  - ✓ **"Informed":** the user knows the implications of the authorization.

  - ✓ This is an ideal that should be the goal… but it's not always the case ☹.

Notion of authorizations (2)



- Each application is **isolated**.
  - ✓ Runs in a closed environment (“sandbox”).
  - ✓ By default, an application cannot access remote resources.
  - ✓ Required for security purposes in the smartphone.

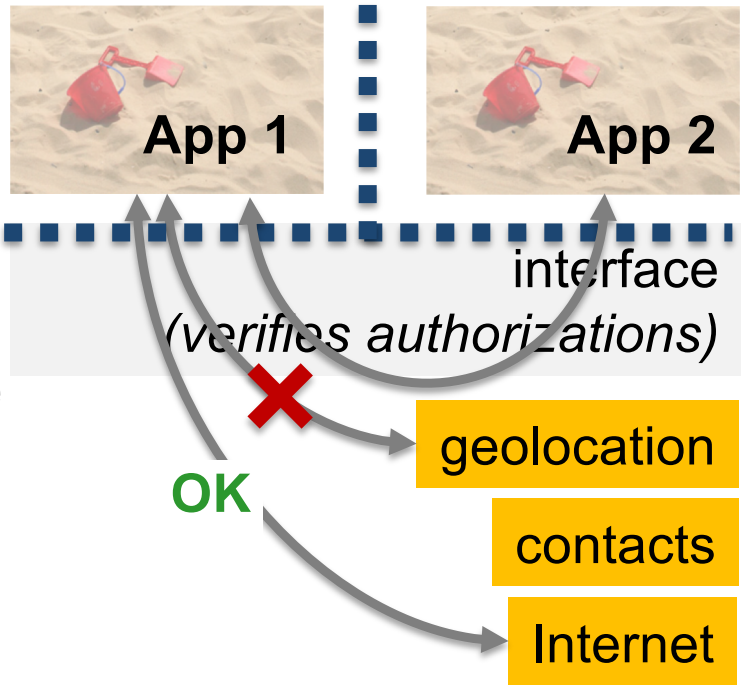
geolocation

contacts

Internet

Notion of authorizations (3)

- Access to external information requires:
  - ✓ having the associated authorization;
  - ✓ using a dedicated interface (API) that will authorize or ban the access.



The user must grant (or refuse) each authorization asked by the application.

A priori or a posteriori authorizations?

- **Store centric:** the store owner checks before accepting an App:
  - ✓ Checks the conformance of an application with Apple/Google's rules.
  - ✓ It's Google (Play Store) et Apple (App Store) responsibilities.

- **User centric:** ask the authorization to the user:
  1. **a priori :** during application **installation**;
  2. **a posteriori : dynamically,** upon application usage.

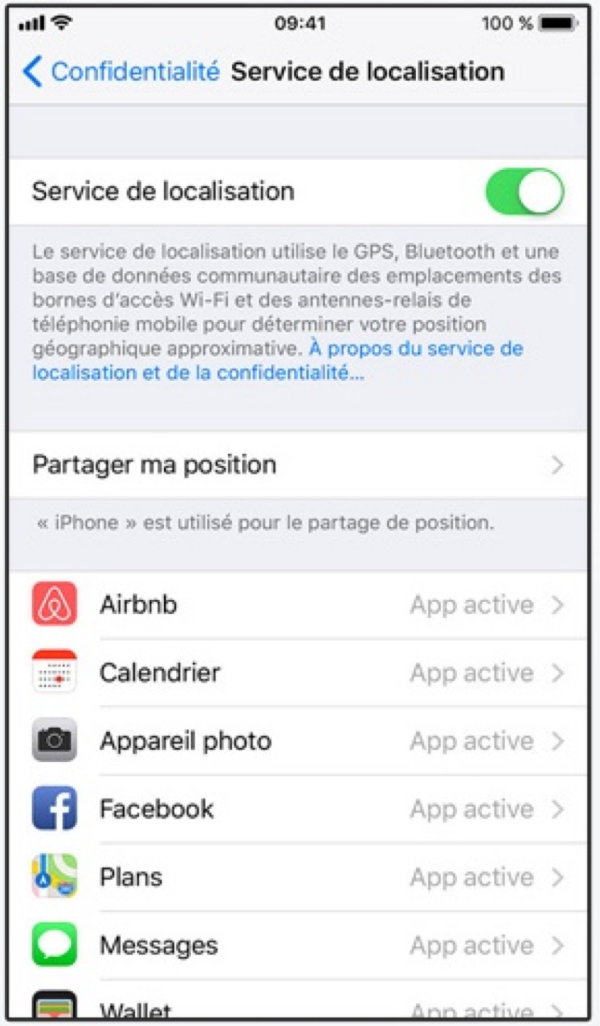
Dynamic Authorizations – iOS (1)

- Ask an explicit and targeted authorization upon **execution**.
  - ✓ Solution chosen by Apple since the beginning.
  - ✓ The user authorizes or refuses individually each authorization ☺.
  - ✓ The user can change his mind at any time ☺.

https://www.apple.com/fr/privacy/manage-your-privacy/

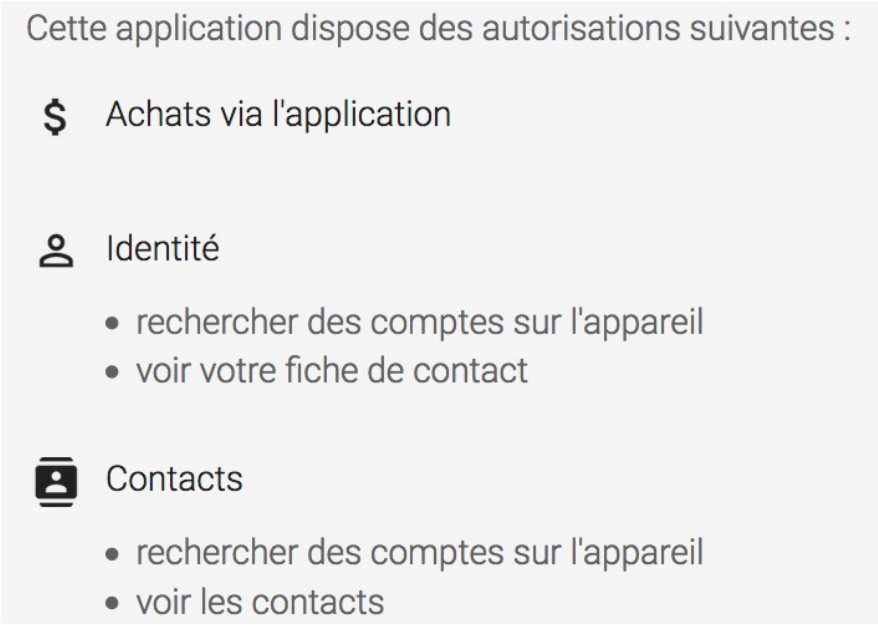
Dynamic Authorizations – iOS (2)

- Several control panels exist in order to:
  - ✓ list all applications asking certain authorizations;
  - ✓ list all authorizations asked by a given application.



At installation time authorizations - Android

- Ask the user to grant authorizations **at installation time**.
  - ✓ The Android **“Permissions”**.
  - ✓ The only approach for Android until **Android 5.1**, and still the rule for many applications.
  - ✓ To accept all, otherwise no installation is possible.

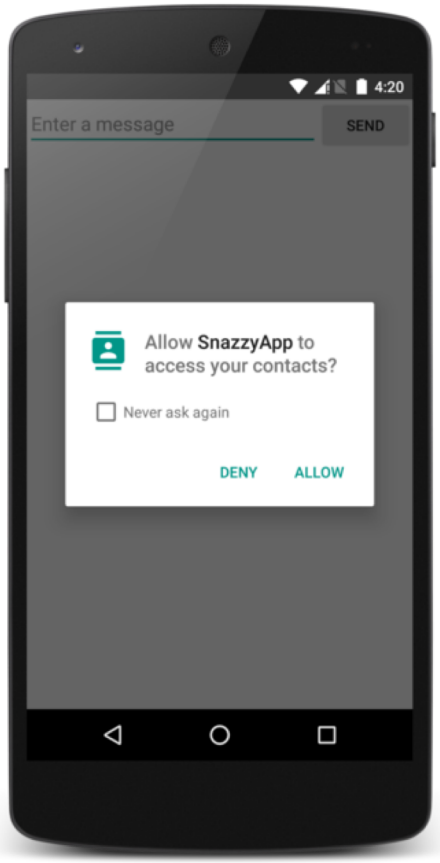


Dynamic Authorizations – Android (1)

- Ask the user to grant explicit authorizations **at execution time**, when/if needed.
  - ✓ Google privileged approach since **Android 6.0 (end of 2015).**

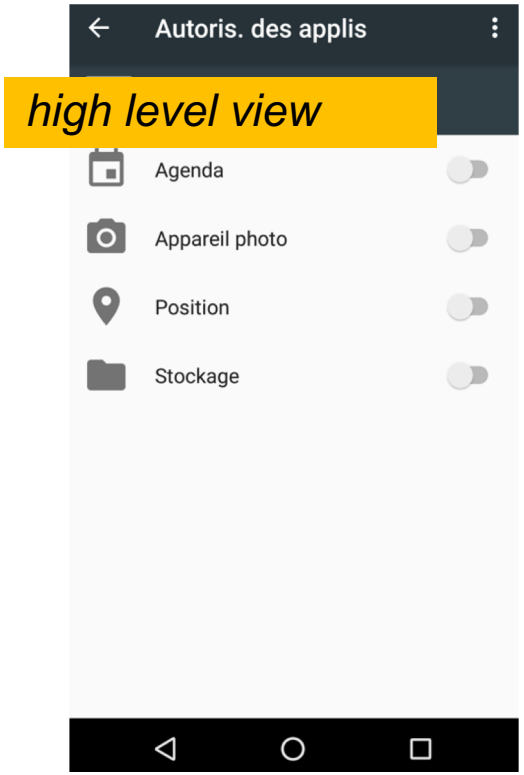
- The user has more control (idem Apple/iOS):
  - ✓ The user authorizes or refuses individually each authorization ☺.
  - ✓ The user can change his mind at any time ☺.

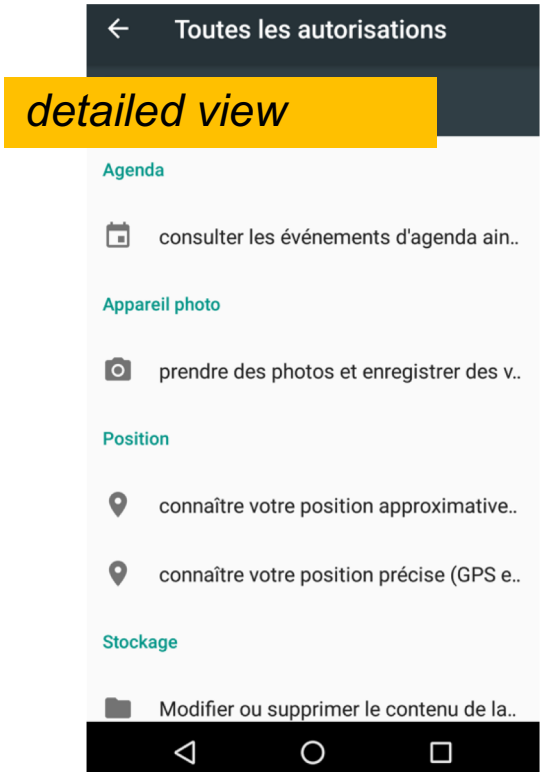
- Google talks about “fluid installation”…
  - ✓ Sure, but authorizations asked by a certain application are no longer displayed. The user needs to search them ☹.



Dynamic Authorizations – Android (2)

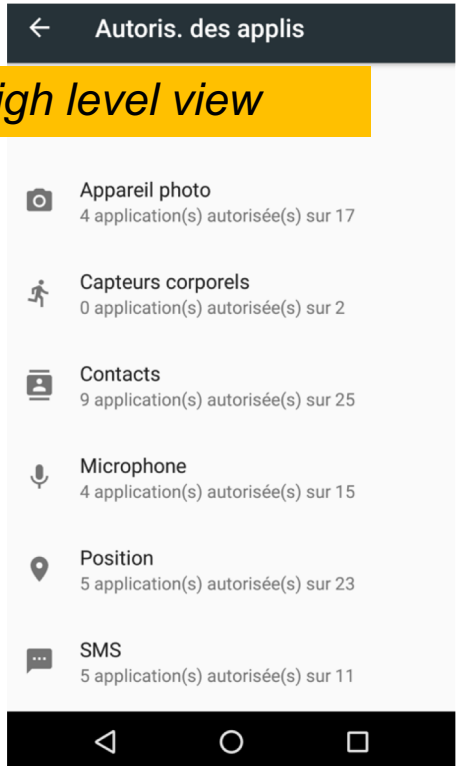
- List all authorizations **for a given application**.
  - ✓ High level view: Parameters > Applications > appli > Authorizations
  - ✓ Detailed view: “All authorizations”

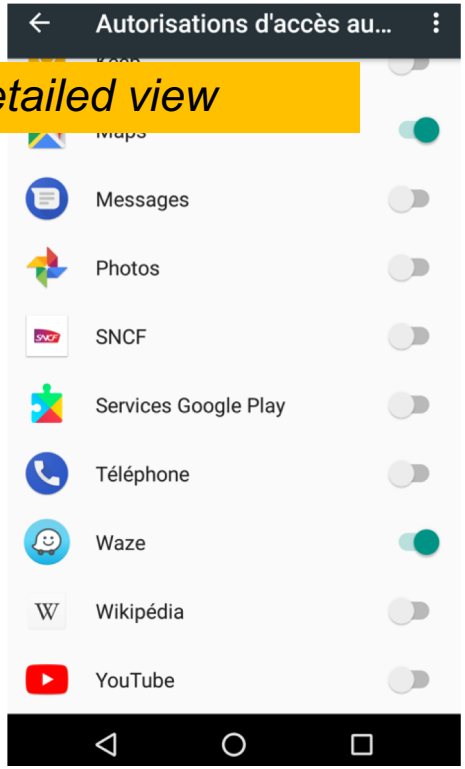




Dynamic Authorizations – Android (3)

- List all applications **for a given authorization**.
  - ✓ Android 6 : Applications > Configure the applis > Autoris. of applis
  - ✓ Android 8 : Apps & notifications > App permissions

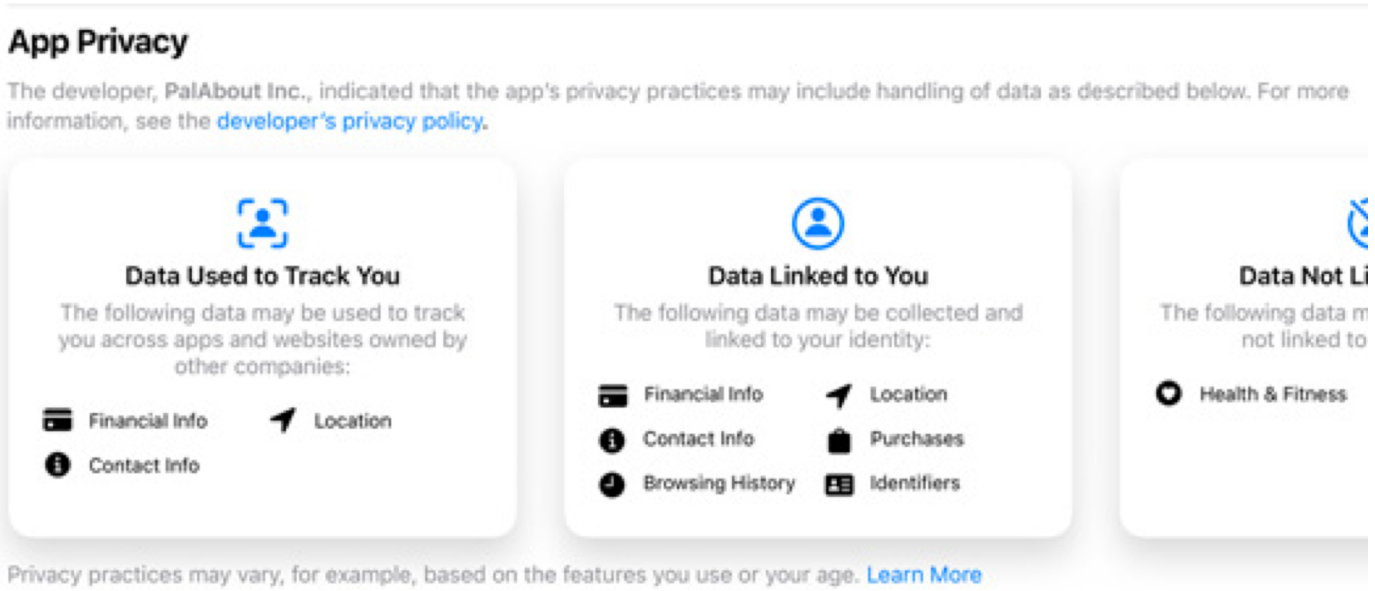




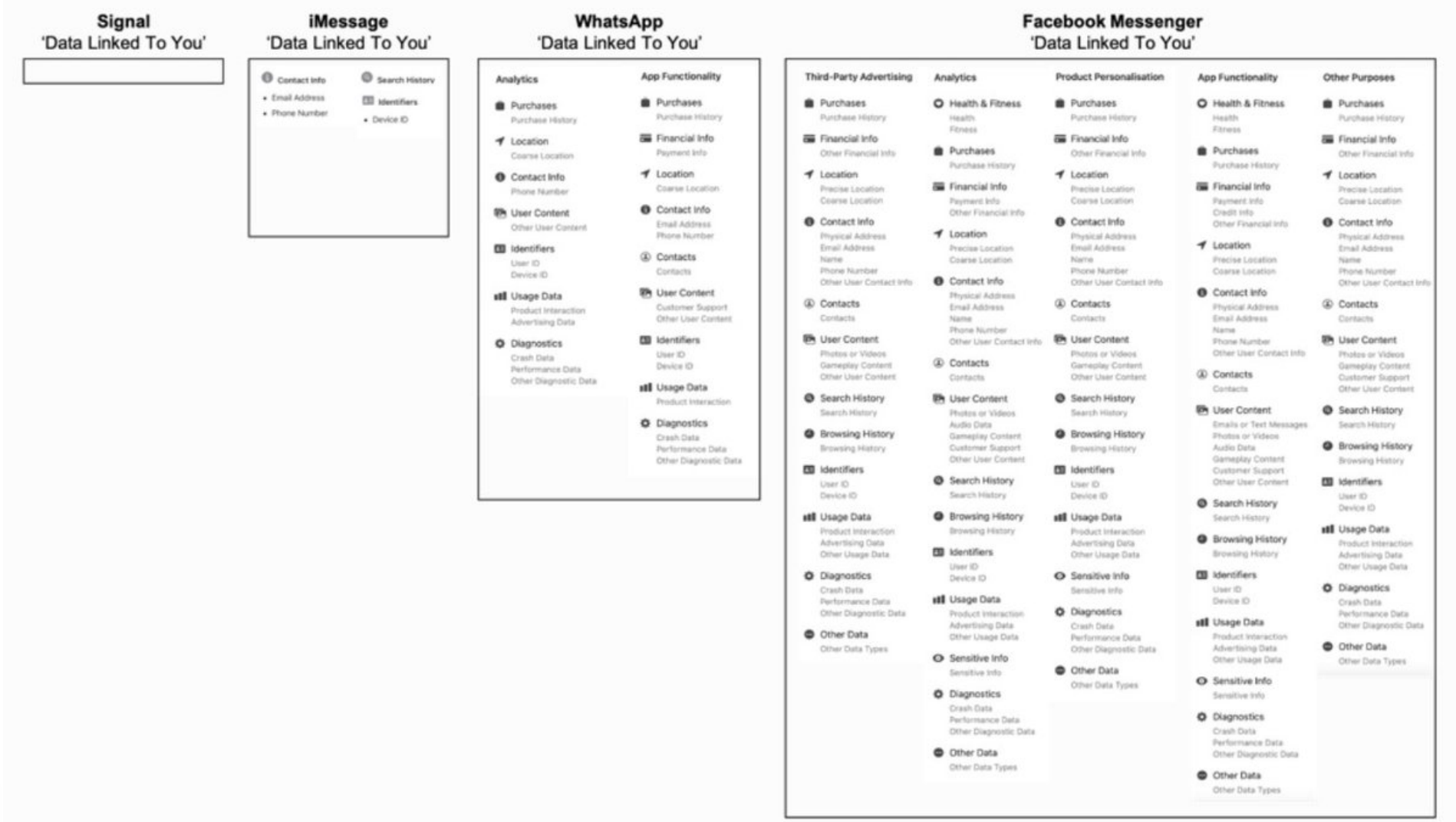
Excellent, Apple requires per–app privacy details

“About privacy information on the App Store and the choices you have to control your data
The App Store now includes detailed privacy information that helps you understand each app's data collection practices.
In June 2020, Apple announced a new privacy information section for product pages on the App Store. This is the beginning of an innovative new program to help customers have more transparency and understanding about what data apps may gather about them."

https://support.apple.com/en-lamr/HT211970



Excellent, Apple requires privacy details (2)



In summary

- Authorizations have two goals:
  - ✓ the user can **determine the privileges** required by each application;
  - ✓ the user can **control** each application.

- Two different approaches:
  - ✓ at **installation time**: very limited, less used;
  - ✓ and/or **dynamically**: much better control.
  - ✓ Fortunately, Android also tends to dynamic authorizations.

- Apple requiring per-app privacy info in the AppStore
  - ✓ excellent initiative for more transparency.

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- **Limits of the user control**
- Tracking the trackers in practice
- Two further examples: ACCESS_WIFI_STATE and physical world tracking
- Conclusion: towards a virtuous circle

Proposed authorizations approaches have limits

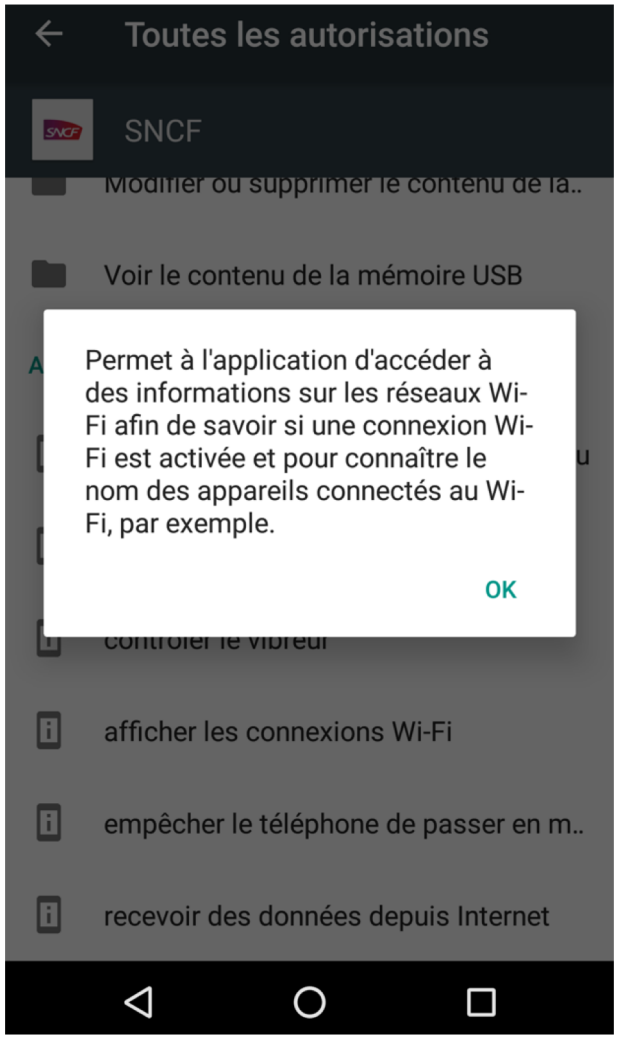
- Limits on the Android side.
- Limits on the iOS side.
- Limits common to Android and iOS :
  - ✓ lack of **behavioral** control of the application;
  - ✓ lack of control on the **composition** of authorizations.

Limits of Android authorization system (1)

- The installation based authorization system is **too basic** ☹
  - ✓ User needs to accept **all** authorizations.
  - ✓ If the user changes his mind, he has no other choice than uninstalling the application.
  - ✓ **The world is not binary, it's more complex.**
  - ✓ This approach is progressively abandoned, and users can change their mind later one with Android >= 6.

Limits of Android authorization system (2)

- The authorization system is **too complex** ☹
  - A total of **147 authorizations** (Oct. 2017).
  - The users **can not always appreciate all the implications of authorizations**…
    - ✓ … and sometimes specialists can't either!
  - Example : *« afficher les connections Wi-Fi »*
    - ✓ ambiguous ("Name of connected devices"? All of them?)
    - ✓ non exhaustive list provided
    - ✓ also grants access to the Wi-Fi MAC address…
      Useful to track me but it's never said.



Limits of Android authorization system (3)

- The authorization system makes questionable assumptions.
  - ✓ Distinguishes “normal” and “dangerous” authorizations.
  - ✓ **No explicit information nor user solicitation is needed for “normal” authorizations!**
  - ✓ … it’s up to the user to go and look at all authorizations in the Play Store or in the smartphone’s Parameters.

Limits of Android authorization system (4)

https://developer.android.com/guide/topics/permissions/normal-permissions.html

Normal Permissions

"Many permissions are designated as PROTECTION_NORMAL, which indicates that there's no great risk to the user's privacy or security in letting apps have those permissions. […]

If an app declares in its manifest that it needs a normal permission, the system automatically grants the app that permission at install time. The system does not prompt the user to grant normal permissions, and users cannot revoke these permissions."

- Do you really think there's no risk for the user privacy?
- These authorizations enable, for instance to:
  - ✓ access stable identifiers to track the user;
  - ✓ know the list of Wi-Fi networks used in the past;
  - ✓ access Internet (e.g. to send personal information to remote servers);
  - ✓ activate Wi-Fi ;
  - ✓ etc.

Limits of Android authorization system (5)

- A simple yet strong message towards A&A companies:
  - ✓ « […] utiliser l'identifiant publicitaire […] au lieu de tout autre identifiant d'appareil pour l'ensemble des aspects publicitaires. »
- But:
  - ✓ this relies on the good will of A&A companies (access to other stable identifiers is trivial and does not necessarily require to ask the user);
  - ✓ **only concerns** targeted advertising. Are you concerned if you want to track somebody for another purpose?

https://support.google.com/googleplay/android-developer/answer/6048248?hl=fr
https://developer.android.com/training/articles/user-data-ids.html

What about iOS?

- The **advertising identifier** is the only one that can be collected…
  - ✓ … and only by applications that display targeted advertising.
  - ✓ Any other usage is strictly forbidden.

- Stable identifiers have been soon **banned**.
  - ✓ UDID : May 2013.
  - ✓ Wi-Fi MAC address: iOS7, September 2013.

Using Identifiers in Your Apps

March 21, 2013

Starting May 1, the App Store will no longer accept new apps or app updates that access UDIDs. Please update your apps and servers to associate users with the Vendor or Advertising identifiers introduced in iOS 6. You can find more details in the UIDevice Class Reference.

Limits common to Android and iOS (1)

- No **behavioral control** of the application ☹

  - ✓ Example: authorizing an application to access my geolocation and Internet for a punctual need does not mean I authorize this application to send my geolocation every minute to remote servers (*a fortiori* in non-EU countries)!

Limits common to Android and iOS (2)

- No control on the **composition of authorizations** ☹

  - ✓ Example: authorizing an application to access my geolocation and Internet does not mean I authorize this application to send my geolocation to remote servers (*a fortiori* in non-EU countries)!

A common drift

- It’s not because it’s technically feasible that:
  - ✓ (1) it’s legal;
  - ✓ (2) the user gave his/her consent.

- The InMobi A&A company has been condemned because of their bad practices
  - see ACCESS_WIFI_STATE later…
    - ✓ https://www.ftc.gov/news-events/press-releases/2016/06/mobile-advertising-network-inmobi-settles-ftc-charges-it-tracked

In summary

- The Android approach is **far from satisfying** IMHO.
  - ✓ The trend to dynamic authorizations is a real plus.
  - ✓ However Android permissions remain questionable.

- The iOS approach is **more virtuous**.
  - ✓ A deliberate choice of Apple to favor privacy in his commercial offer.
  - ✓ Visible in iOS for long.

- Improvements remain possible in both environments.
  - ✓ Offering more control and information to the user while keeping a simple and attractive GUI remains a challenge.

Further references

- CNIL – Inria, « Mobilitics, saison 2 : nouvelle plongée dans l'univers des smartphones et de leurs applications », décembre 2014. https://www.cnil.fr/fr/mobilitics-saison-2-nouvelle-plongee-dans-lunivers-des-smartphones-et-de-leurs-applications

- J. Achara, M. Cunche, V. Roca, A. Francillon, **« Short Paper: WifiLeaks: Underestimated Privacy Implications of the ACCESS_WIFI_STATE Android Permission »,** 7th ACM Conference on Security and Privacy in Wireless and Mobile Networks (WiSec)), July 2014. http://hal.inria.fr/hal-00997716/en/
  - ✓ Traite des dérives permises par la permission ACCESS_WIFI_STATE telle que définie avant Android 6.0.

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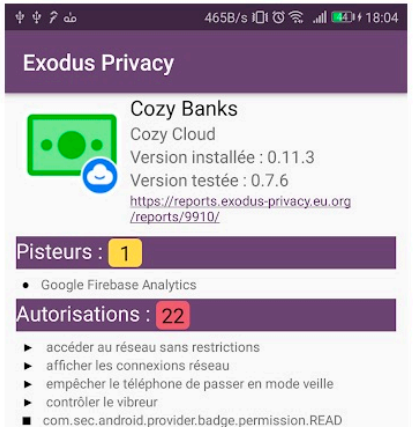
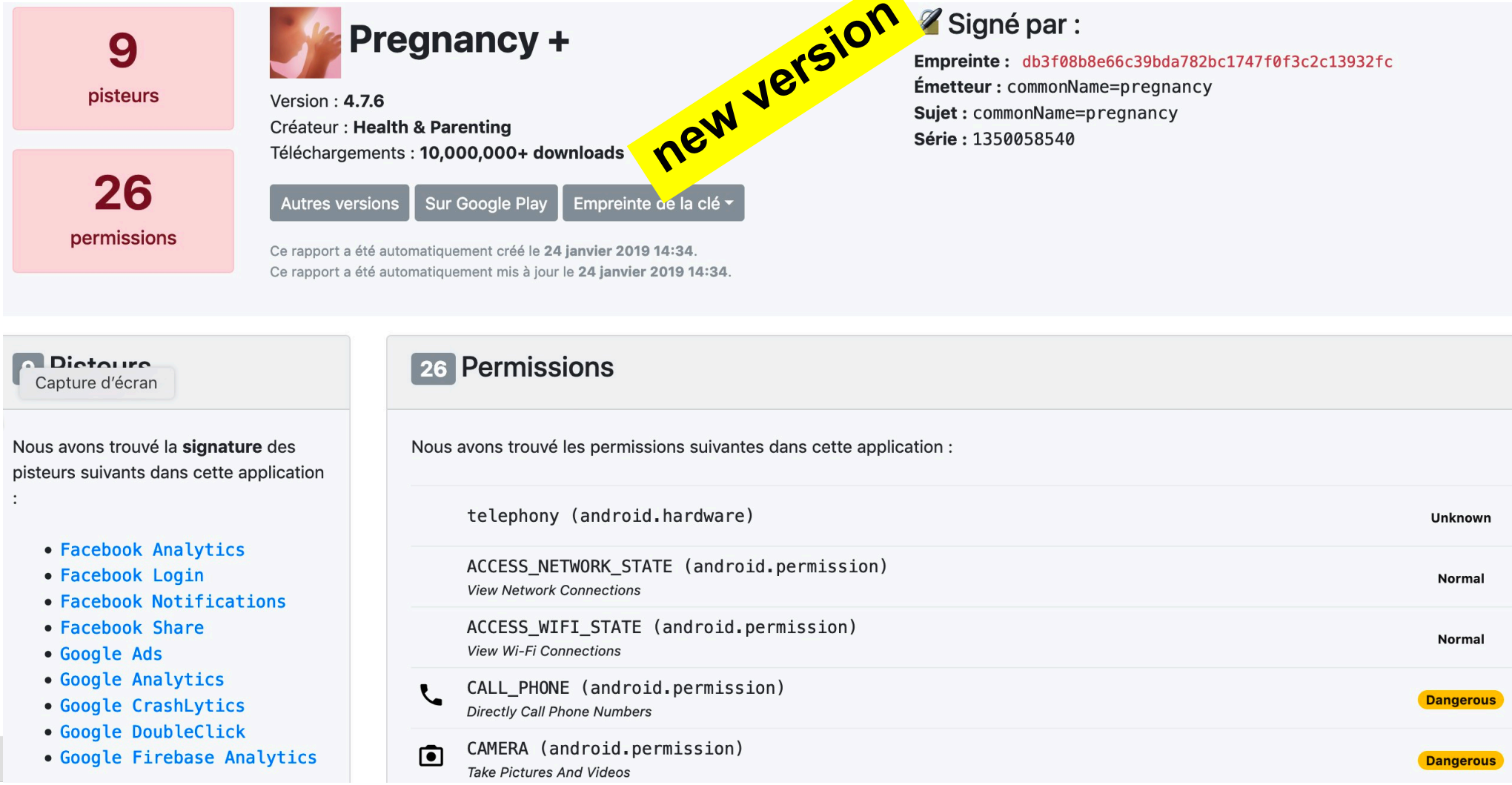
Tracking the trackers with Exodus-Privacy

- An impressive analysis service to track trackers in Android apps!
  - ✓ a French 1901 law non-profit organization
- a web site with app and tracker analyses
  - ✓ https://reports.exodus-privacy.eu.org/fr/search/
  - ✓ similar in spirit to what exists for web sites
- an Android app to install on your smartphone
  - ✓ https://play.google.com/store/apps/details?id=org.eu.exodus_privacy.exodusprivacy



In practice: Pregnancy+ analysis



In practice: Pregnancy+ analysis (2)

11
pisteurs

23
permissions

Pregnancy +

Version : **4.6.1.1**
Créateur : **Health & Parenting**
Téléchargements : **5,000,000+ downloads**

old version

Autres versions | Sur Google Play | Empreinte de la clé

Ce rapport a été automatiquement créé le **3 avril 2018 03:53**.
Ce rapport a été automatiquement mis à jour le **16 août 2018 16:22**.

Signé par :

Empreinte : db3f08b8e66c39bda782bc1747f0f3c2c13932fc
Émetteur : commonName=pregnancy
Sujet : commonName=pregnancy
Série : 1350058540

11 Pisteurs

Capture d'écran

Nous avons trouvé la **signature** des pisteurs suivants dans cette application :

- Facebook Analytics
- Facebook Login
- Facebook Notifications
- Facebook Places
- Facebook Share
- Flurry
- Google Ads
- Google Analytics
- Google CrashLytics

23 Permissions

Nous avons trouvé les permissions suivantes dans cette application :

	telephony (android.hardware)	Unknown
	ACCESS_NETWORK_STATE (android.permission) *View Network Connections*	Normal
	ACCESS_WIFI_STATE (android.permission) *View Wi-Fi Connections*	Normal
	CALL_PHONE (android.permission) *Directly Call Phone Numbers*	Dangerous
	CAMERA (android.permission) *Take Pictures And Videos*	Dangerous

In practice: Pregnancy+ analysis (3)

- Looking at **Privacy Policy** https://www.philips.co.uk/c-w/privacy/pregnancy-and-baby.html

contradiction
+
very intrusive approach, with sensitive data collection

Sensitive Personal Data
We ask that you not send us and you not disclose any sensitive personal data (e.g., social security numbers, information related to racial or ethnic origin, political opinions, religion or other beliefs, health, biometrics or genetic characteristics, criminal background or trade union membership) on or through the App or otherwise to us.

Account Data
We collect your personal data when you create an account. You may log in to the App using your account or using your social media profile. The personal data we collect may include your username, profile photo, name, email address, gender, country, language, due date, social media profile, location and password.

- The personal data collected is used to create and manage your account. You can use your account to securely log in to the app. If you create an account to log in to the app, we will send you a welcoming email, communicate with you in response to your enquiries, and send you strictly service-related announcements or direct marketing communication if you have opted in. You may also use your account to participate in a promotion or game, participate in a social media activity related to a promotion (for example clicking "like" or "share") and participate in product testing or surveys.

Other Provided Data
This data includes:

Baby+ and Pregnancy+
Baby's due date
Baby's gender
Capture d'écran
Your gender
Your photo
Your location
Your email address
Your relationship to baby
Date baby is born
Your uploaded pictures
Your weekly notes
Your diary entries and memories
Your doctor's visits (personal notes that you may wish to record, such as: pregnancy weight, blood pressure, foetal heart rate, time and date of appointment, name and profession of health care provider)
mother's weight

In practice: tracker statistics (Flurry close-up)

Flurry

Page web du pisteur

Règles de détection

- Règle de détection (code) : `com.flurry.`
- Règle de détection (réseau) : `flurry\.com`

Primary Location

United States

Website

Capture d'écran

oo.com

About

Flurry is part of the Yahoo Developer network suite. Flurry's product, Flurry Analytics, offers mobile analytics, monetization, and advertising services Yahoo, 01; Yahoo, 14; Wikipedia, 01).

Ownership

Oath Inc. (subsidiary of Verizon Communications; Oath includes Yahoo and AOL) Wikipedia, 01; Ars Technica, 01

Products and Services

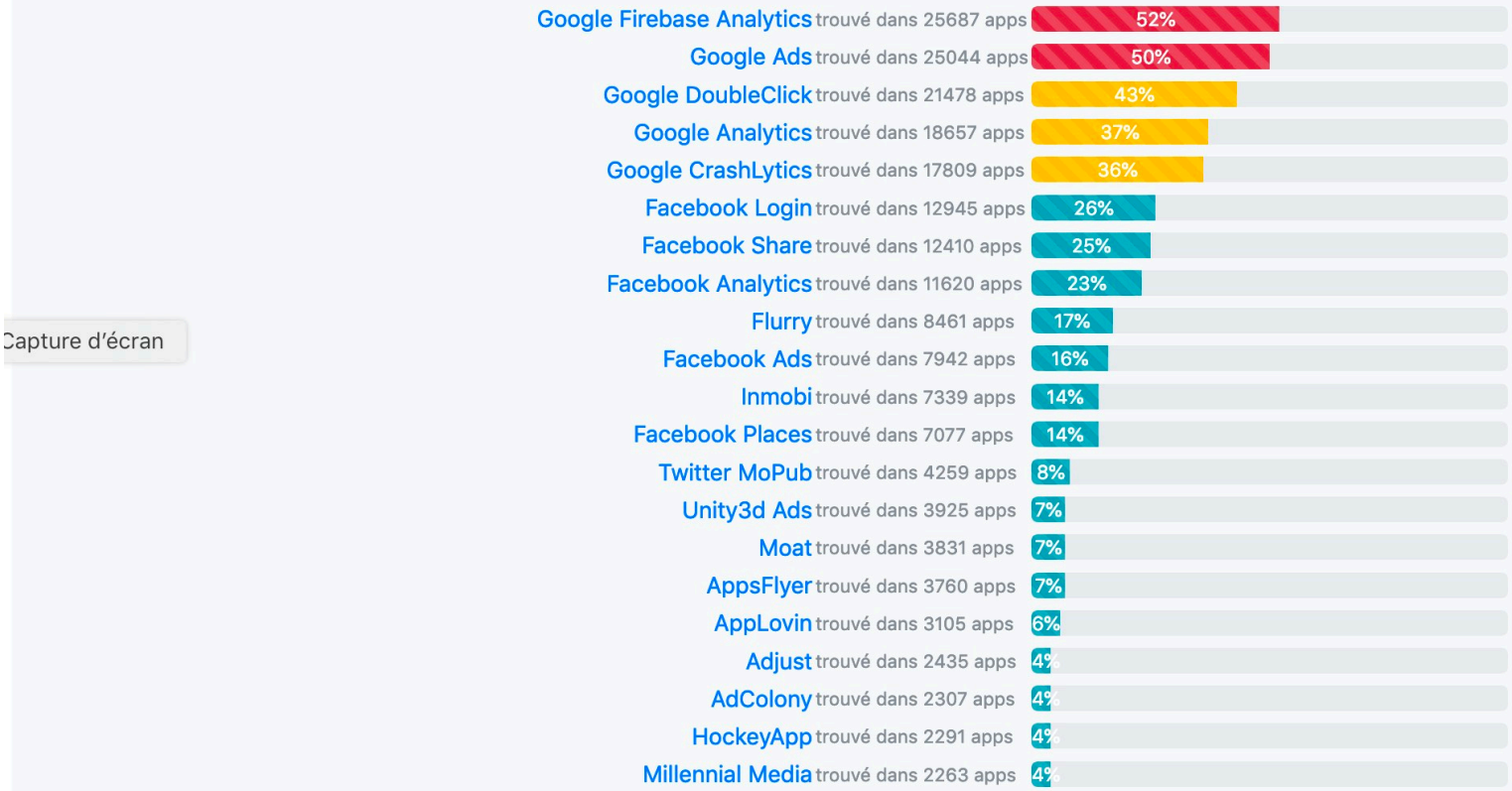
8461 Rapports disponibles pour ce pisteur

Notes with Caller ID	1.0.333	13 février 2019 07:12
TV Time - #1 Show Tracker	7.4.3-19020608	13 février 2019 07:08
IPTV Extreme	89.0	13 février 2019 01:09
Video Popup Player :Multiple Video Popups	1.17	13 février 2019 01:09
TV Guide+ Germany EPG	1.10.26d	13 février 2019 01:08
TV Guide UK EPG free	1.10.26d	13 février 2019 01:08
HÖRZU TV Programm als TV-App	1.0.25	13 février 2019 01:08
Guida programmi TV Plus Gratis	1.10.26d	13 février 2019 01:08
Pandora	1902.1	13 février 2019 01:07

In practice: tracker statistics (global view) (2)

Statistiques

Pisteurs les plus fréquents



Capture d'écran

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ACCESS_WIFI_STATE: an Android authorization with unexpected implications (1)

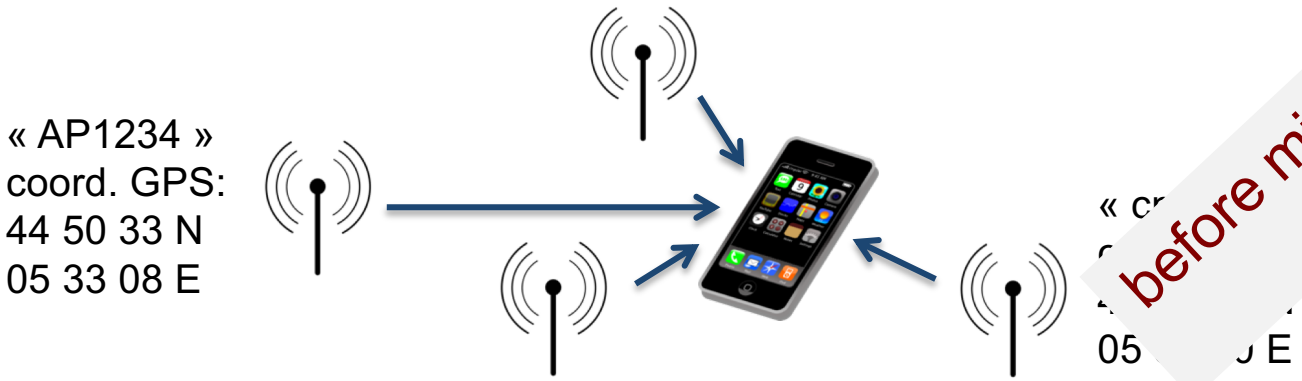
- Imagine an App, that without asking the user explicit authorization

- … can **track** the user thanks to a stable identifier.
  - ✓ it's the Wifi MAC address
  - ✓ e.g., 68:a8:6d:28:ce:1f
  - ✓ guaranteed to be unique in the world
  - ✓ impossible to re-initialize

ACCESS_WIFI_STATE: an Android authorization with unexpected implications (2)

- Imagine an App, that without asking the user explicit authorization…

- … knows your **location**.
  - ✓ Listen to Wi-Fi networks in range, then thanks to a broad database giving the geolocation of all AP can locate the smartphone by triangulation
  - ✓ in urban environments, can be very accurate



before mid-2016 (things have changed since)

ACCESS_WIFI_STATE: an Android authorization with unexpected implications (3)

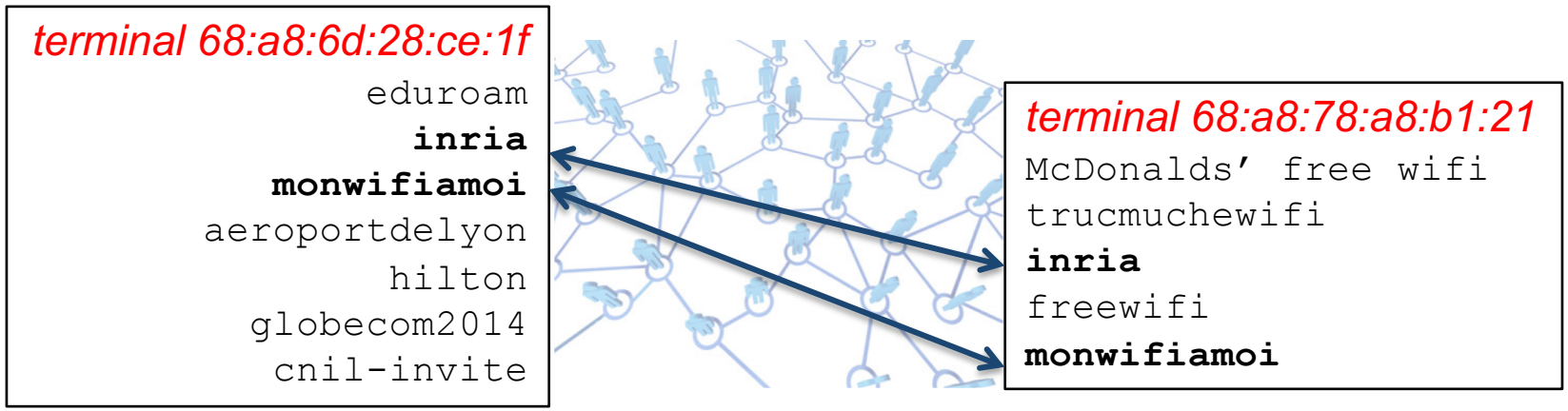
- Imagine an App, that without asking the user explicit authorization…
- … knows a part of your **travels history** and your **profile**.
  - ✓ via the list of Wifi AP to which you connected, which is automatically registered in your smartphone

terminal 68:a8:6d:28:ce:1f

```
eduroam
Inria
monwifiamoi
aeroportdelyon
hilton
globecom2014
cnil-invite
```

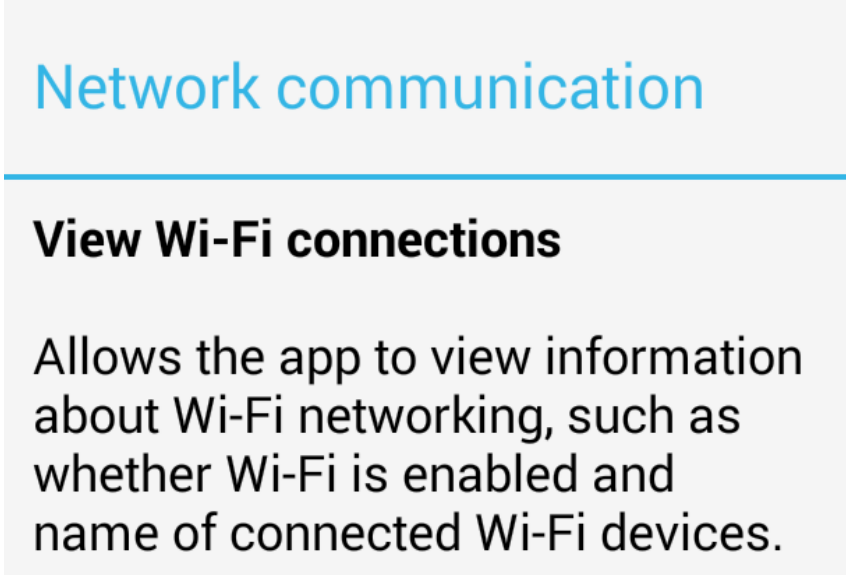
ACCESS_WIFI_STATE: an Android authorization with unexpected implications (4)

- Imagine an App, that without asking the user explicit authorization…
- … can infer **social links** between users.
  - ✓ by calculating the distance between their Wi-Fi connection list, after creating a large dedicated database



ACCESS_WIFI_STATE: an Android authorization with unexpected implications (5)

- **Till 2016**, it was sufficient to request the **ACCESS_WIFI_STATE** and **INTERNET** authorizations…
  - ✓ No user could imagine this is possible.
  - ✓ And the authorization descriptions gives no clue…



ACCESS_WIFI_STATE: is it in use?

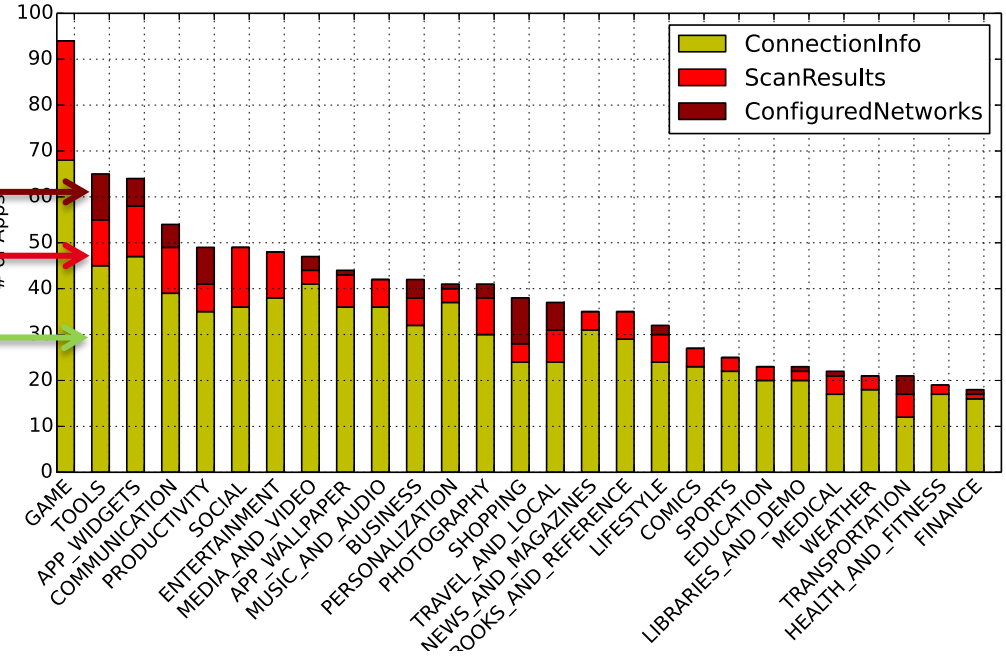
- Yes… In 2014, out of the 2700 most popular Apps, 41% ask both permissions and many of them use them.

number of applications concerned

wifi connection list

in rage Wifi AP list

Wifi address + other info



Application types in Play Store

J. Achara, M. Cunche, V. Roca, A. Francillon, **"Short paper: WifiLeaks: Underestimated Privacy Implications of the ACCESS WIFI STATE Android Permission"**, IEEE WiSec'14, juillet 2014. http://hal.inria.fr/hal-00997716/en/

ACCESS_WIFI_STATE: two outcomes (1)

News & Events » Press Releases » Mobile Advertising Network InMobi Settles FTC Charges It Tracked Hundreds of Millions c

Mobile Advertising Network InMobi Settles FTC Charges It Tracked Hundreds of Millions of Consumers' Locations Without Permission

Company Will Pay $950,000 For Tracking Children Without Parental Consent

FOR RELEASE

June 22, 2016

our work triggered this enquiry ☺

ACCESS_WIFI_STATE: two outcomes (2)

- mid-2016 Google changed the ACCESS_WIFI_STATE authorization
  - ✓ listening to Wi-Fi network is now protected by the "geolocation" permission

Did our work triggered this enquiry? No confirmation.

Tracking users in physical world thanks to their smartphone Wi-Fi interface (1)

- Wi-Fi tracking system[11]
  - Set of sensors collect Wi-Fi signal
  - Detect and track Wi-Fi devices and their owners
  - MAC address used as identifier

M. Cunche slide (Inria, Privatics)

[11] A. B. M. Musa and Jakob Eriksson. "Tracking unmodified smartphones using Wi-Fi monitors". In: *Proceedings of the 10th ACM Conference on Embedded Network Sensor Systems*. 2012.

Tracking users in physical world thanks to their smartphone Wi-Fi interface (2)

- Physical analytics
  - Similar to Web Analytics
  - Frequency and length of visit, number of visitor, peak hour ....
- Trajectory reconstruction
  - Signal received by several sensors
  - Triangulation based on signal strength

M. Cunche slide (Inria, Privatics)

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A shared responsibility

- **The user** has a key role but also a **limited power**.
  - ✓ Common sense rules can reduce the risks…
  - ✓ … but there are limits (especially with Android).
- **The Operating System editor** has a **key role**.
  - ✓ He defines the **rules!**
  - ✓ Major differences between Google and Apple. Is it surprising given their business model?
- **The regulator** has a **key role**.
  - ✓ FR and EU laws are very protective.
  - ✓ New EU regulation (GDPR) further reinforces the power of EU with respect to foreign companies.

Virtuous Circle: the free model

Application developer

money

free services and Apps

Advertiser

money

targeted advertising

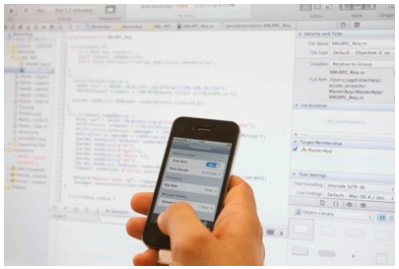
Users

anonymized user profile

A&A company

PI provided by the user freely, knowingly and in a controlled way

Virtuous Circle: the paying model



Application developer

money

low cost services and applications

Utilisateurs

There are several conditions

- The **users**:
  - ✓ are “responsible”: someone must **financially support** the work of developers;
  - ✓ have **control** on the provided information.

- Each **actor**:
  - ✓ is **transparent** with respect to his practices;
  - ✓ can **prove** his practices, also known as **accountability**.

- **Trusted third parties** are needed:
  - ✓ in order to **check** practices.

An utopia?

- Of course, we all know the “**privacy paradox**”
  - ✓ Users say they worry about privacy but at the same time they act in the opposite way.
  - ✓ Isn’t it the result of the recognition they have lost control?

- In economy, **markets with a strong information asymmetry are known to be fragile**
  - ✓ they are not sustainable during long periods
  - ✓ Users do not trust them;
  - ✓ Alternative solutions appear.

- … it's everybody's interest at **mid/long term.**

- The Exodus Privacy service (and app) to identify trackers in Android apps
  - ✓ https://exodus-privacy.eu.org

Accueil • Tous les cours • Protection de la vie privée dans le monde numérique

Protection de la vie privée dans le monde numérique

Les thématiques Droit et juridique | Informatique | Enjeux de société | Numérique, technologie

Ce cours archivé reste ouvert aux inscriptions bien qu'il ne fasse pas l'objet d'une animation par l'équipe pédagogique : ses contenus ne sont plus mis à jour et risquent de ne plus être d'actualité.
Si vous vous inscrivez, vous pouvez consulter librement les ressources en lecture seule mais

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Inscription

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Début du Cours
01 jan 2020

Fin du cours
05 jan 2020

Effort estimé
03:00 h/semaine

Langue
Français

https://www.fun-mooc.fr/courses/course-v1:inria+41015+archiveouvert/about

Thank you… ☺

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