

PRIVACY ISSUES IN GEOSOCIAL NETWORKS



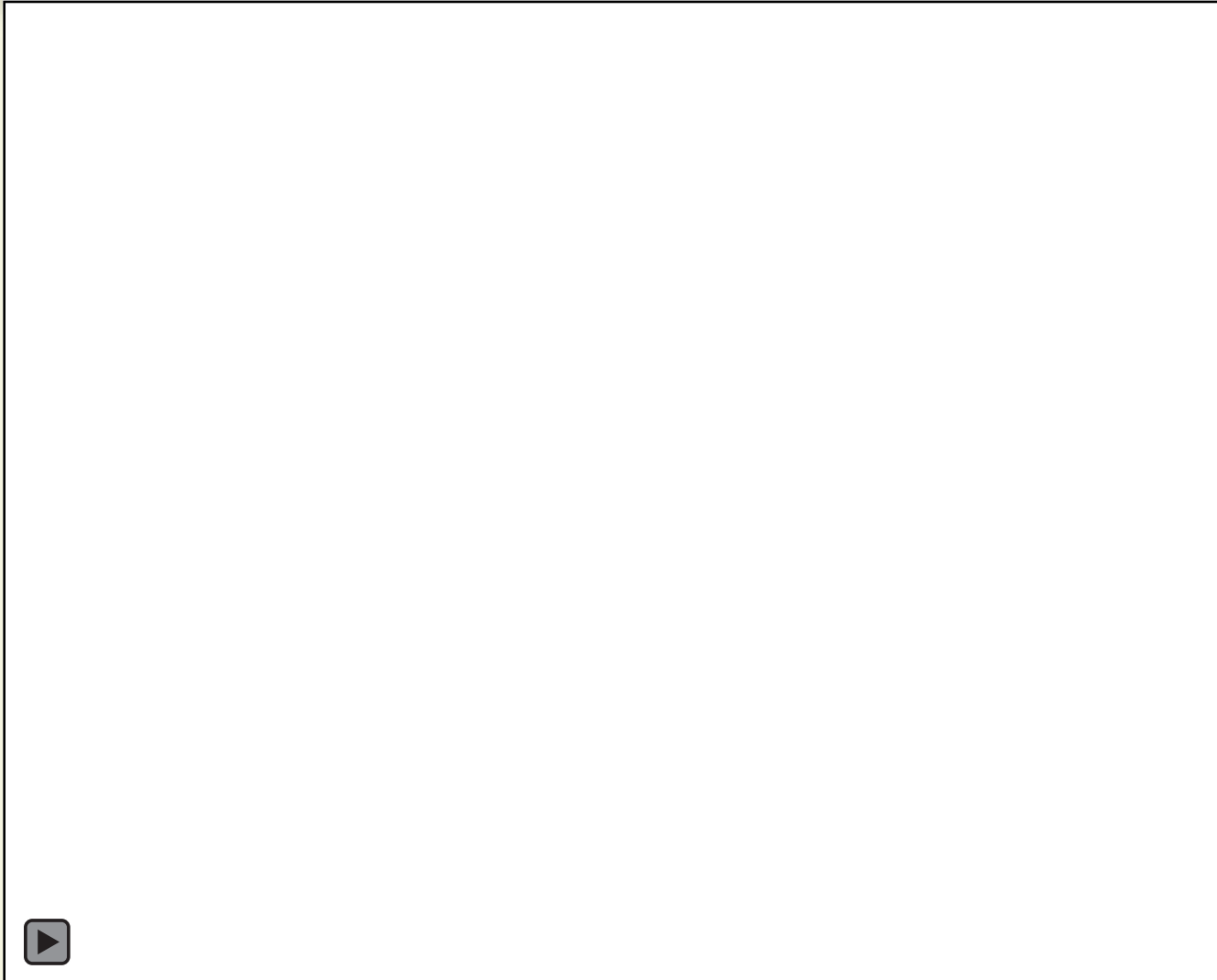
PLAN OF PRESENTATION

- Introduction
- Geosocial networks
- Information Collected
- Privacy Issues and Consequences
- Comparison
- Conclusion

INTRODUCTION



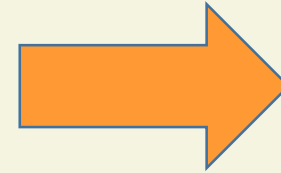
INTRODUCTION



INTRODUCTION



Mobile phones and their applications



The biggest companies may know more about us than we do ourselves.

INTRODUCTION



**Social
Network**



Location



**Locative social media service
Or
Location-based social networking**

INTRODUCTION



Who has access to our information?

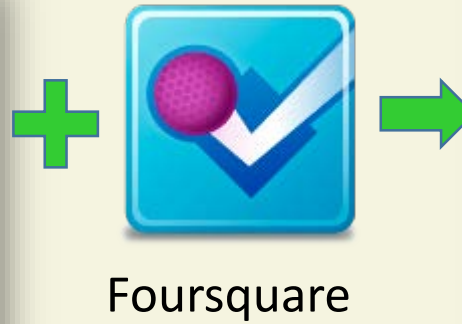
Is it safe to publish it online?



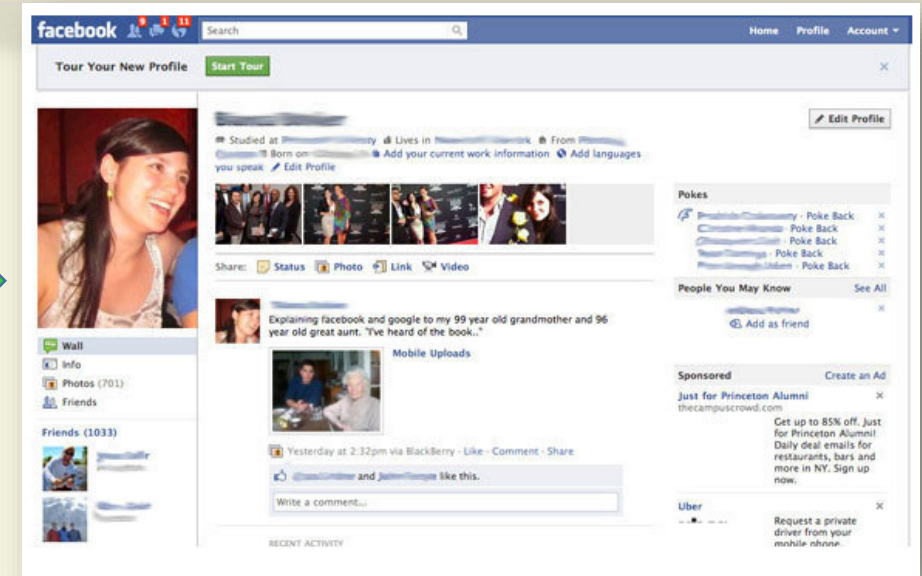
Is our information well protected?



INTRODUCTION



Foursquare



Facebook

Mobile application “*Girls around me*”



Serial killer

INTRODUCTION



2010

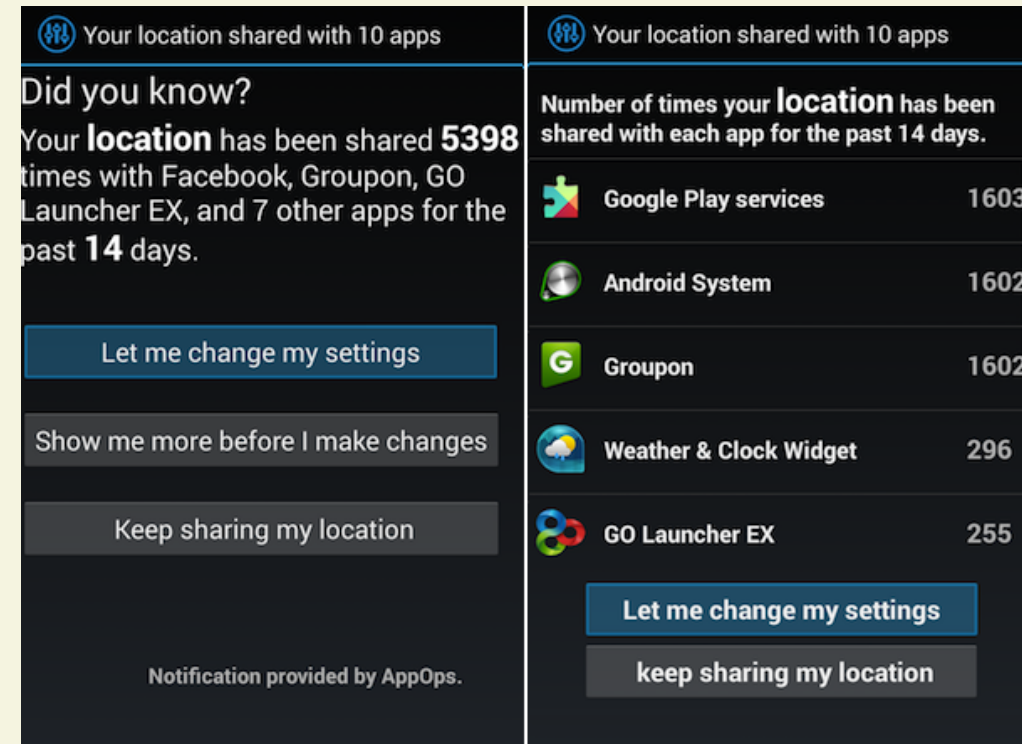


Now

The website “***Please Rob Me***”* can fetch all the **locations** related to a Twitter account, showing the **danger** of publicly **shared location data**

* <http://pleaserobme.com>

One Android user shares his location **5398 times** during **14 days**, with or without his intervention.





GEOSOCIAL NETWORKS



WHAT IS A GEOSOCIAL NETWORK?

*“A web-based or mobile-based service that allows users to **construct a profile containing** some of their **geo-located data** (along with additional information), connect with other users of the system **to share** their geo-located data **and interact** with the content provided by **other users** (for instance by commenting, replying or rating)”*

Gambs, Heen & Potin (2011)

“A comparative privacy analysis of geosocial networks”



WHAT IS A GEOSOCIAL NETWORK?

*“A **Location-Based Social Network** (LBSN) does not only mean adding a location to an existing social network so that people in the social structure can **share location-embedded information**, but also consists of the **new social structure** made up of individuals connected by the **interdependency** derived from their locations in the **physical world** as well as their location-tagged media content, such as photos, video, and texts “*

Yu Zheng (2012)
“Computing With Spatial Trajectories”

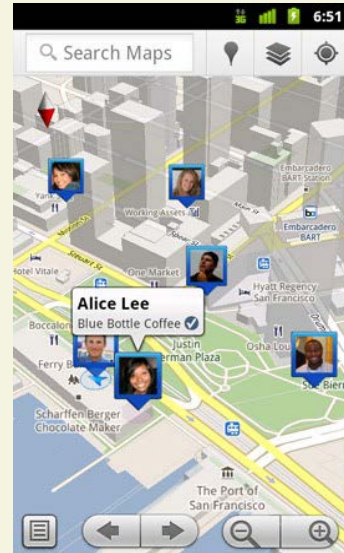


WHAT IS A GEOSOCIAL NETWORK?

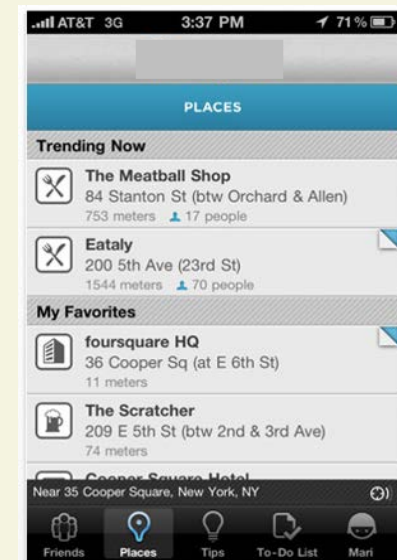


Generating &
Consuming

Interaction



Sharing &
Understanding



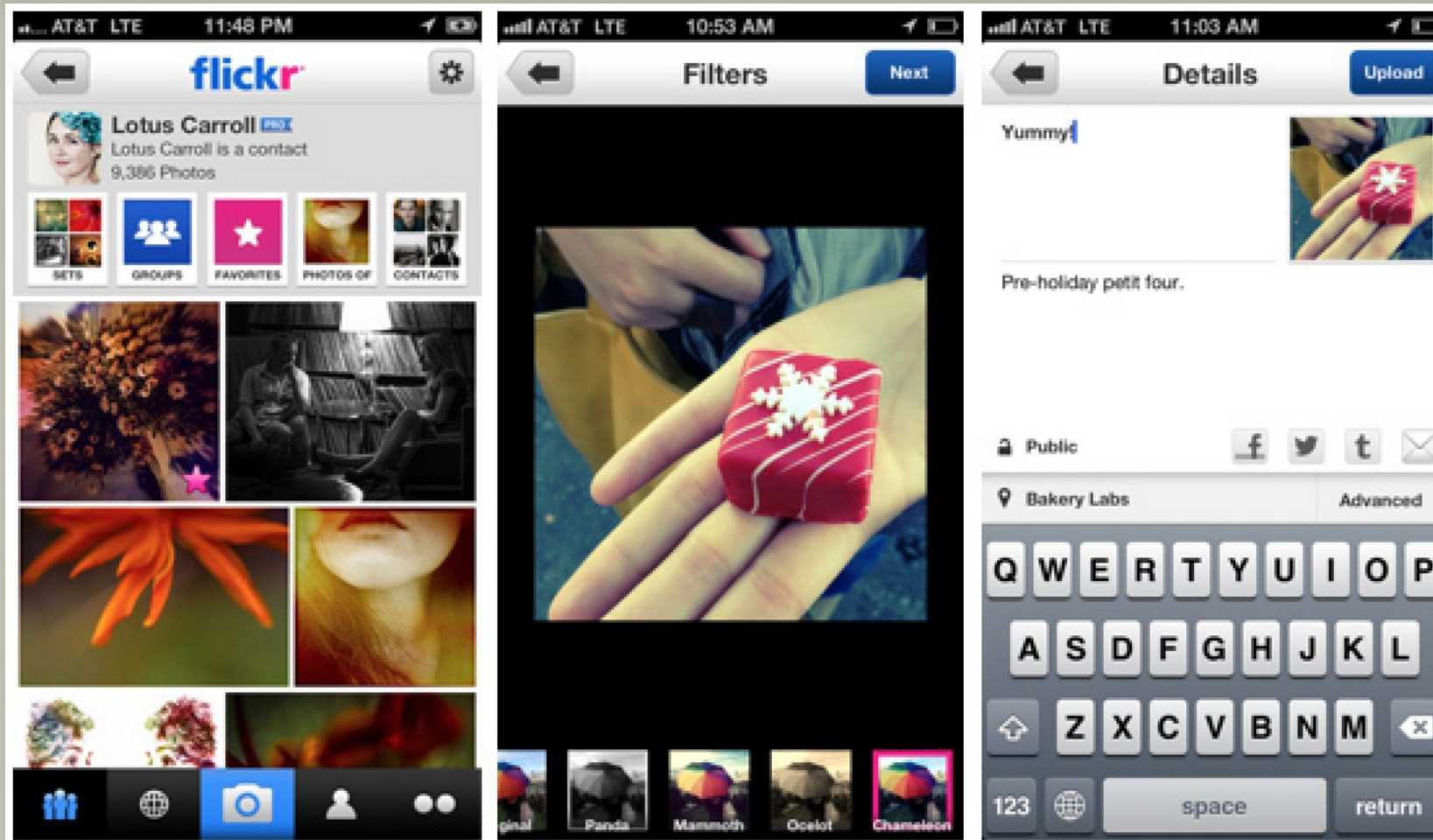
GEOSOCIAL NETWORK - HOW IT WORKS?

Geolocation apps do two things:

1. **Report** your location to other users
2. **Associate** real-world locations (such as restaurants and events) to your location.

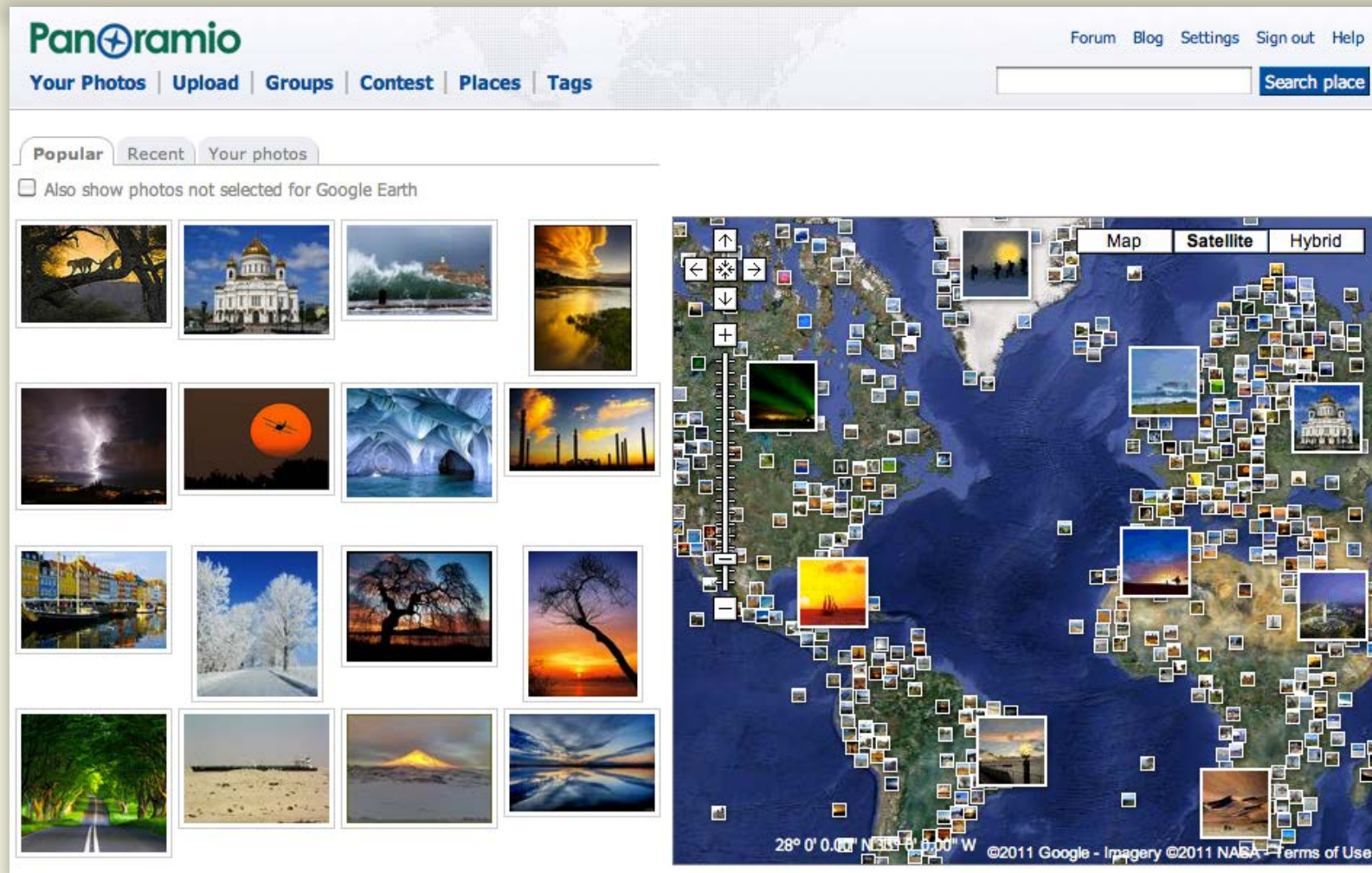


CLASSIFICATION OF GSNs : GEOTAGGED-MEDIA-BASED



<https://www.flickr.com>

CLASSIFICATION OF GSNs : GEOTAGGED-MEDIA-BASED



<https://www.panoramio.com>

CLASSIFICATION (ZHENG 2011)

- **Geotagged-media-based:** enable users to *add location labels* and *comments* on media contents (text, photos, videos or others.)

Examples: Flickr, Panoramio and Geo-twitter



Panoramio



- **Point-location-driven:** share users *current locations* by checking-in into the places they visit and adding “*tips*” to venues.

Examples: Foursquare



CLASSIFICATION OF GSNs : POINT-LOCATION-DRIVEN

The screenshot shows the Foursquare profile of Karen Richards, located in Calgary, Canada. The profile includes a header with the Foursquare logo and navigation links (Me, History, Badges, Stats, Friends). A search bar is present. The main profile section displays a profile picture, name, location, and statistics: 313 Days Out, 836 Check-ins, and 11 Things Done. Below this is a 'Tips' section with a 'To-Do List' and tabs for 'POPULAR' and 'RECENT'. It lists four tips: Cafe Sasta, Mount Royal University, Wyckham House - Students' Association of Mount Royal University, and Wild Rose Brewery. To the right, there are sections for 'Badges (21)' and 'Mayorships (13)', each with a 'See All' link. The badges section shows a grid of 12 icons, and the mayorships section lists four locations: brasserie, Laurier Lounge, Bistro 2210, and Stanley Park.

foursquare Karen in Playa del Carmen | Apps | Help | Settings | Log Out

Me History Badges Stats Friends Search places, people and tips

Karen Richards
Calgary, Canada

DAYS OUT **313** CHECK-INS **836** THINGS DONE **11**

Tips To-Do List POPULAR RECENT

Adding tips is easy. Just [find your favorite spots](#) and get started!

Cafe Sasta
Amazing lattes and a much better place to watch everyone walk down 5th than Starbucks
✓ 1 | May 13, 2010

Mount Royal University
Good Earth is new in Wyckham House and has the best coffee, better than Starbucks.
✓ 4 | November 30, 2009 | Calgary, Canada

Wyckham House - Students' Association of Mount Royal University
Good Earth in Wyckham is best coffee on campus!
✓ 3 | January 4, 2010 | Calgary, Alberta

Wild Rose Brewery

Badges (21) See All
Unlock more badges by following pages!

Mayorships (13) See All

- brasserie
- Laurier Lounge
Calgary, Canada
- Bistro 2210
Calgary, Canada
- Stanley Park

<https://foursquare.com>

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Examples: Flickr, Panoramio and Geo-twitter



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Examples: Foursquare

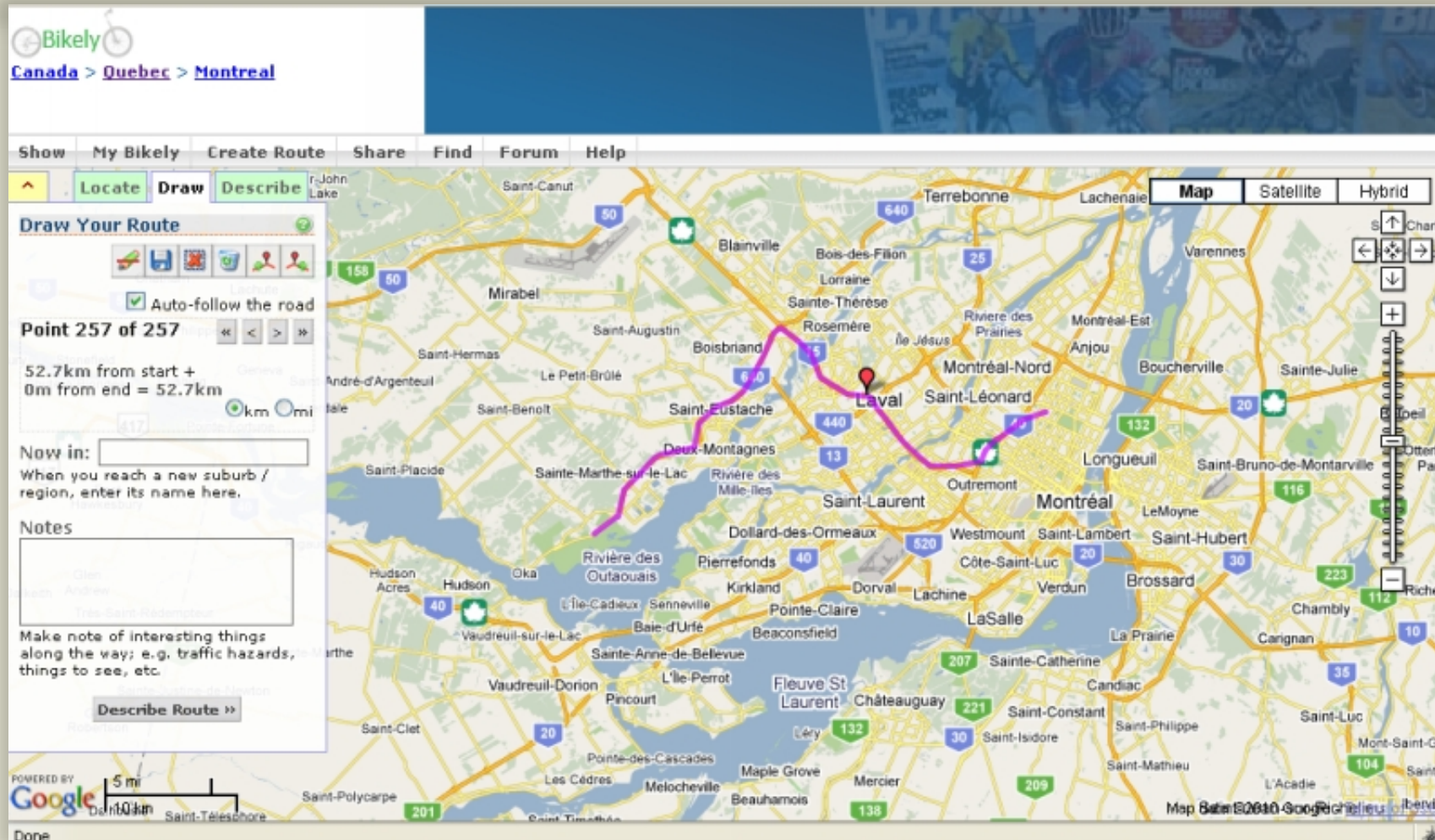


- **Trajectory-centric:** provide *point location* and the *detailed path* by connecting the locations of several points.

Examples : Bikely and SportsDo.



CLASSIFICATION OF GSNs : TRAJECTORY-CENTRIC



<https://www.bikely.com>



INFORMATION COLLECTED



INFORMATION COLLECTED



User **personal** information

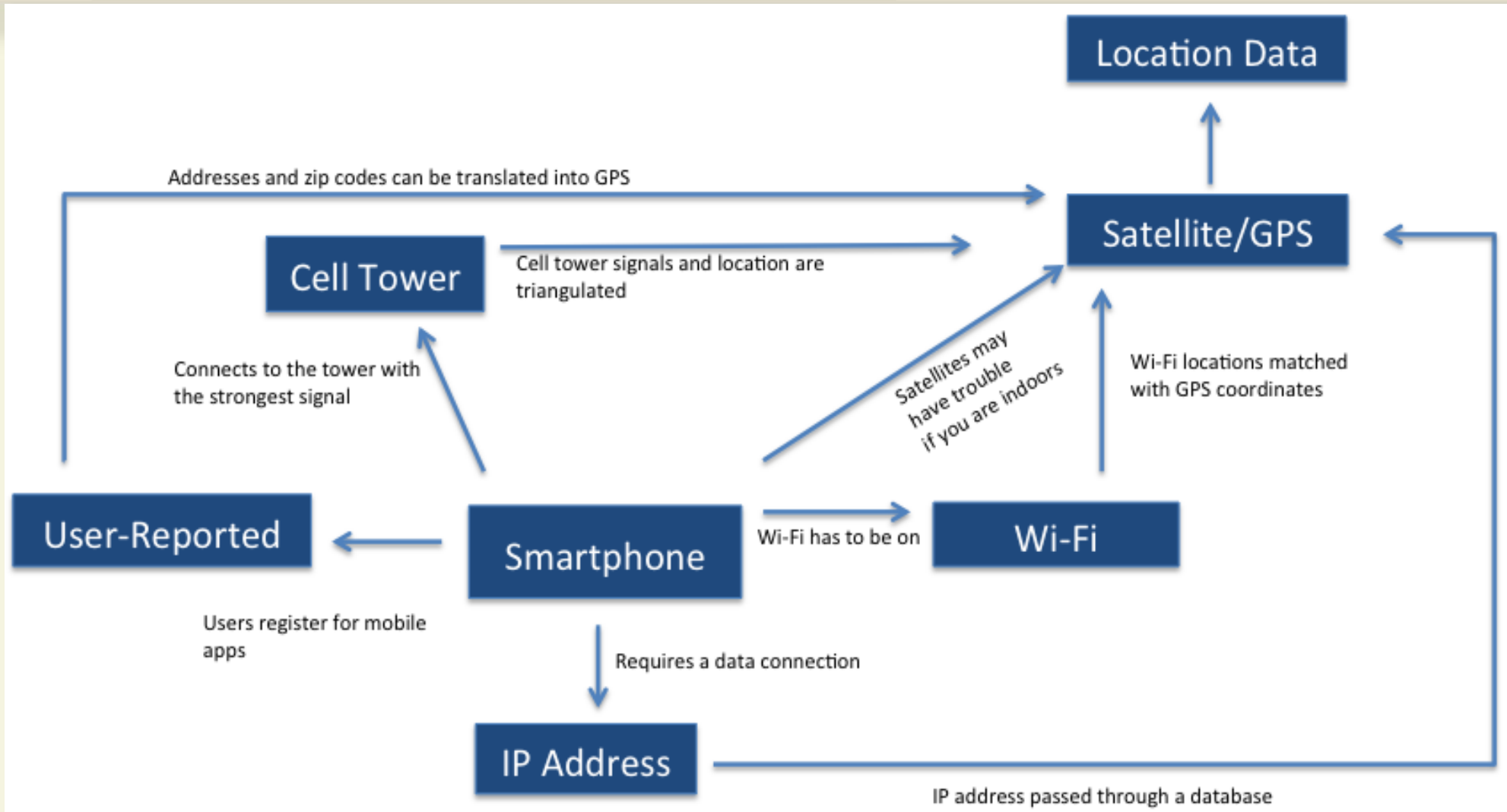


Information
Collected



User **location** information

TECHNIQUES TO GET LOCATION DATA FROM SMARTPHONE



Source: <http://www.businessinsider.com/how-mobile-location-data-is-collected-2013-7>

CATEGORIES

- **System collection:** users' location data are collected and revealed *directly* through a *system interface*.

Example : Facebook and its Graph Search engine

- **Third party application collection:** users' location are collected by a *third party application*. Gathering users' information from different sources to build a *complete profile* including personal content and location data.





PRIVACY ISSUES AND CONSEQUENCES



PRIVACY ISSUES

- “...the decision of sharing something online is *made at the moment*”
(Das and Sahoo 2011)
- “...people's ideas about *privacy are malleable* depending on the context of interaction ”
(Acquisti - TEDGlobal 2013)
- “people are more willing to *divulge* sensitive personal *information* on a social network website than on other sites ” (Acquisti - TEDGlobal 2013)
- “ people disclose information when they see *others do it* ”
(Acquisti - TEDGlobal 2013)
- “...many people are ready to *provide* personal *information online*”
(Gross and Acquisti 2005)



PRIVACY ISSUES: OPINIONS OF PRIVACY FROM COMPANIES

Do you agree or disagree with the following statements? Privacy from Companies and Legality	Agree Percentage
If a website has a privacy policy, that means it will not share my personal information with others. <small>Grade</small>	68%
I like it when companies use the information I post to decide what products to advertise to me. ♂♀	28%
I would like more control over what companies do with the photos and information I post online. <small>Grade</small>	75%
Companies are not interested in what I say and do online. <small>Grade</small>	39%

Young Canadians in a Wired World conducted by MediaSmarts in 2014

PRIVACY ISSUES: PRIVACY POLICY OR TERMS OF USE AGREEMENT

Has someone ever read a privacy policy or online terms of use agreement with you and explained what it means?	Percentage
Yes, my parent(s) or another person in my family ^{Grade}	29%
Yes, a teacher/guidance counsellor	6%
Yes, a librarian	2%
Yes, a coach, instructor, or community leader (for example, Girl Guides, Boy Scouts)	2%
Yes, someone else	6%
No ^{Grade}	65%

Young Canadians in a Wired World conducted by MediaSmarts in 2014

PRIVACY ISSUES : WHO SHOULD BE ALLOWED TO TRACK LOCATION?

Some devices or applications (apps) can track where a person is located (for example, GPS phone, Facebook, Foursquare). Who do you think should be allowed to check and see where YOU are?	Percentage
My friends <small>Grade</small>	39%
My boyfriend/girlfriend (Gr. 7-11 only) <small>Grade</small>	27%
My parent(s) and people in my family ♂♀ <small>Grade</small>	69%
My teacher or principal <small>Grade</small>	8%
Kids my age I have not met before <small>Grade</small>	2%
Adults I have not met before <small>Grade</small>	1%
Anyone who knows me	9%
The company that owns the site or app ♂♀	4%
Marketing companies that want to advertise to me	1%
The police <small>Grade</small>	35%
Other	6%
No one should be allowed to check and see where I am <small>Grade</small>	20%

Young Canadians in a Wired World conducted by MediaSmarts in 2014

LOCATION PRIVACY ISSUES (ALRAYES AND ABDELMOTY -2014)

- **Location Data Collection:** *gathering and storage* of location information and its quality.
- **Location Information Accessibility:** *accessibility and visibility* of information by other users and third parties of the service (*disclosure of the user's data*)
- **Location Data Exploitation:** how the user's location *information* is *used* and for what *purposes*, either by the application itself or any third parties.
- **Location Data Security:** *level of protection* of the user's data against the risk of loss or unauthorized access.

PRIVACY ISSUES

What information is stored?

Where will it be stored?

Could we know who controls the information?

How securely will it be stored?

How it can later be used or disclosed?

How long it will be stored?

EXAMPLES OF CONSEQUENCES

Advantages



Positive Effects



Disadvantages



Negative
Consequences





ADVANTAGES : CASE 1

The screenshot displays the Foursquare interface for Harvard University. At the top, the Foursquare logo is on the left, followed by a search bar containing "I'm looking for..." and a location bar set to "Toronto, ON". To the right are "Log In" and "Sign Up" buttons. Below the header is a large banner image of Harvard University's main building with the text "HARVARD UNIVERSITY" and "Explore Harvard with foursquare". The main content area features the Harvard University crest, the name "Harvard University", and a description: "Harvard University is more than classrooms and buildings. It's an interconnected community of people, ideas, and experiences." Below this is a section titled "Harvard University locations" which includes a map of Cambridge, MA, showing several blue location pins. To the right of the map, it says "Follows (198,596)" and a link "If this page is inappropriate, let us know."

Source: <http://foursquare.com/Harvard>



ADVANTAGES : CASE 2

FOURSQUARE Je recherche... Montréal, QC

Se connecter **S'inscrire**

HISTORY
Super utilisateur Niveau 2

New York, NY
Discover the history hidden in your favorite cities.

1 021 conseils 831 747 abonnés 0 abonnements 6 lieux 9 Listes

★ Expertise

Musées 207 conseils

Points de repère 100 conseils

Stades 92 conseils

1 014 conseils Actifs récemment Populaires

Tous les conseils ★ Musées (207) ★ Monuments/Points d'intérêt (100) ★ Stades (92)

Rejoins plus de 50 millions de personnes qui utilisent Foursquare pour obtenir des conseils adaptés à leurs goûts.

S'inscrire avec Facebook

(Un seul clic, et nous ne publierons jamais rien ni n'ajouterons aucun ami sans ta permission.)
Ou prends l'itinéraire pittoresque : [inscris-toi avec une adresse e-mail](#)

Bentonville Battlefield Août 23, 2013
Site historique • Newton Grove, États-Unis
The Battle of Bentonville, occurring between March 19-21 in 1865, was the largest battle ever fought in North Carolina.
★ Expertise en Monuments/Points d'intérêt

Bushy Run Battlefield Août 21, 2013
Site historique • Jeannette, États-Unis

Source: <https://es.foursquare.com/historychannel>



ADVANTAGES : CASE 3

BBCNewsSportWeatherCapitalFutureShopTVRadioMore...

NEWS TECHNOLOGY

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Cloak 'anti-social' app helps you avoid your friends

19 March 2014 Last updated at 08:21 ET

While most social networks aim to connect people, one new service seeks to join the growing trend of doing the opposite and help you avoid them.

Cloak uses public location data from other social networks, Foursquare and Instagram, to determine the locations of others you know.

Users can choose to receive an alert when certain people are believed to be nearby.

It is the latest in the recent trend of "anti-social", or secretive, apps.

Apps such as Snapchat - which deletes photographs and videos seconds after they have been viewed - and Secret - which broadcasts messages anonymously - are growing in popularity.

Likewise WhatsApp, a private-messaging service recently bought by Facebook for \$19bn (£11.4bn), indicates a shift back to conducting online conversations in private.



The service uses other social networks to determine where friends are

Top stories



Solemn ceremony for MH17 victims

Hamas ties ceasefire to blockade

Arizona execution takes two hours **NEW**

Commonwealth Games begin in Glasgow

Dozens killed in Taiwan plane crash

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Source: <http://www.bbc.com/news/technology-25554192>



ADVANTAGES : CASE 4

The screenshot shows the Coca-Cola Journey website. The header is red with the Coca-Cola logo and navigation links. The main content area features a press release titled "Voters Make Their Voices Heard as Alabama's Pratt Park Captures 'America's Favorite Park' Title" dated August 16, 2012. The title is highlighted with a red box. Below the title is a social media sharing section and a "SUBSCRIBE" button. To the right, there is a "PRESS RELEASES" sidebar with a "Topic" dropdown menu and a list of recent press releases.

Coca-Cola Journey™ Country (Global) Investors | The Coca-Cola Company

FRONT PAGE BRANDS VIDEOS SUSTAINABILITY INNOVATION HISTORY MUSIC UNBOTTLED

Coke Bottle 100 • #cokestyle • Water Replenishment • EKO CENTER • PlantBottle • Food & Recipes • The Happy Adventurer

FRONT PAGE > PRESS CENTER > PRESS RELEASES > VOTERS MAKE THEIR VOICES HEARD AS ALABAMA'S PRATT PARK CAPTURES "AMERICA'S FAVORITE PARK" ...

PRESS CENTER

◀ PRESS RELEASES COMPANY STATEMENTS COMPANY ARTICLES A/V LIBRARY IMAGE LIBRARY PRESS CONTACT ▶

Voters Make Their Voices Heard as Alabama's Pratt Park Captures "America's Favorite Park" Title

Aug 16, 2012

Like Be the first of your friends to like this. SHARE: f 25 t 0 in 0 p 0

Coca-Cola Awards Four Active Communities with \$190,000 in Recreation Grants for Park Improvements

ATLANTA - While Election Day is still months away, people from around the country have already cast a "Yes" vote for parks. After a heated, six-week contest, Pratt Park in Prattville, Ala., was elected "America's Favorite Park," garnering more than 28 million votes. In addition to winning top honors in the 2012 *America Is Your Park* campaign, the Alabama favorite received a \$100,000 recreation grant from the Coca-Cola Live Positively initiative to help enhance its activity areas.

The fierce online campaign included more than 16,000 parks from around the country. The spirited competition among national, state and local parks sparked community support through park events, vote-a-thons and more. Park lovers used

Enter your email, and... > SUBSCRIBE

PRESS RELEASES

Topic

All Topics ▼ >

Added Oct 22, 2015
The Coca-Cola Company to Participate in the Morgan Stanley Global Consumer and Retail Conference

Added Oct 21, 2015
The Coca-Cola Company Announces

<http://www.coca-colacompany.com/press-center/press-releases/voters-...>



DISADVANTAGES

Used by *criminals* to:

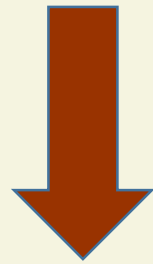
- Identify an individual's present or *predicted future* location
- Cause *harm* others and their property.
- *Burglary* and *theft*
- *Stalking*
- *Kidnapping*
- *Domestic violence*





DISADVANTAGES

The **lack of caution** when posting photos, comments and stories + physical location



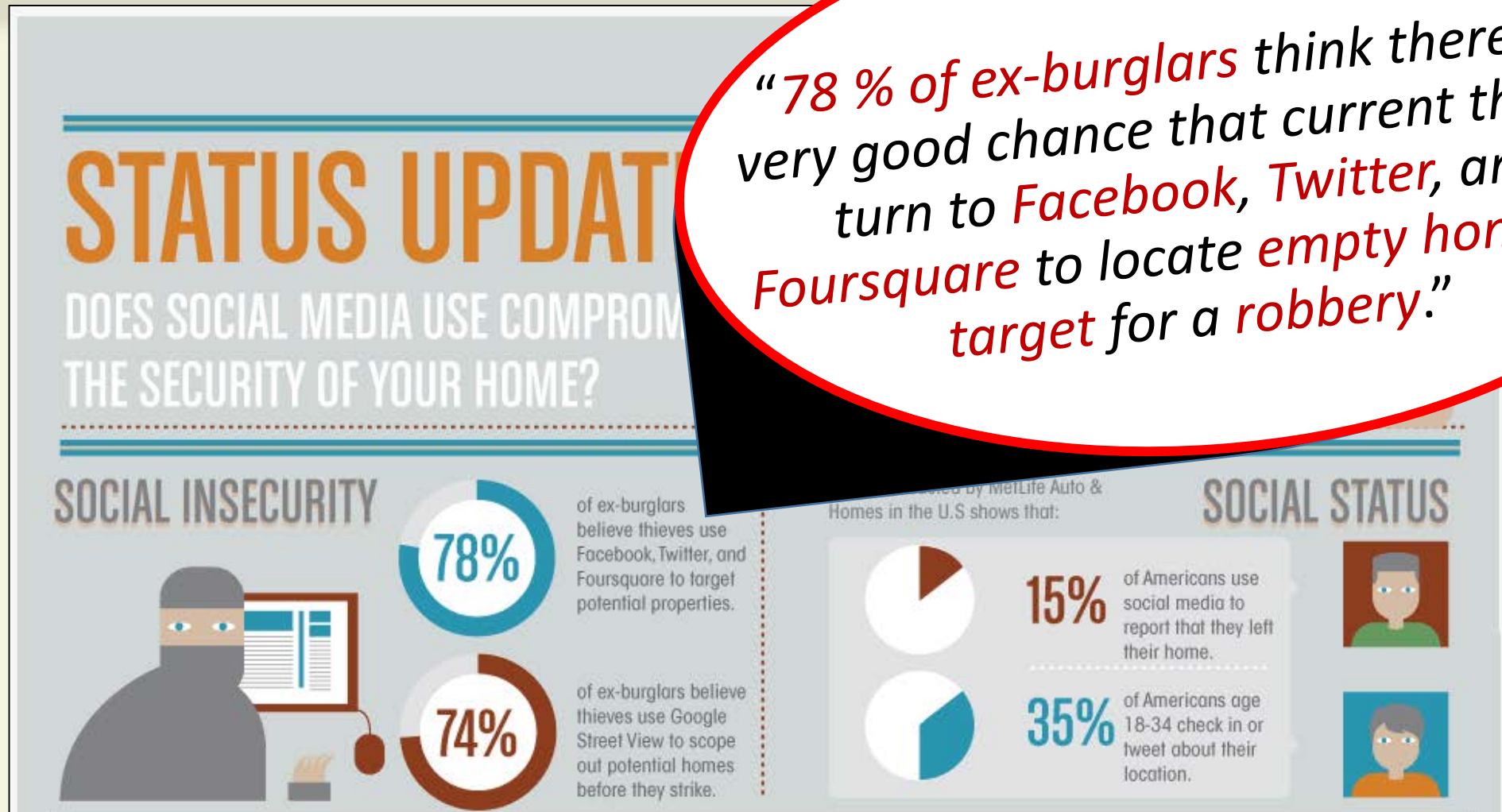
Best tools for

kidnapping, robbery, rape, dismissal from work, divorce or separation of the couple, and so on.





DISADVANTAGES



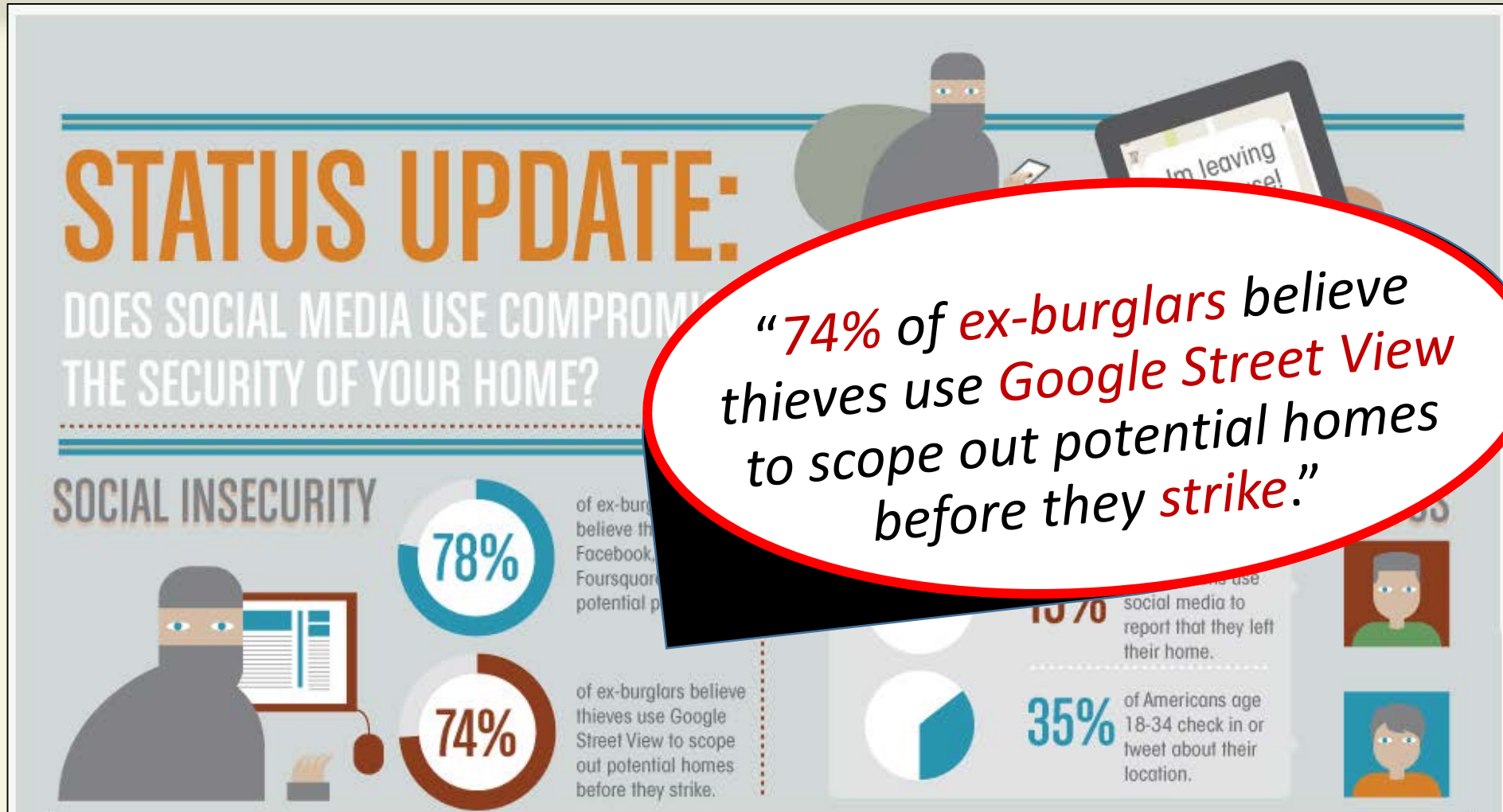
“78 % of ex-burglars think there is a very good chance that current thieves turn to Facebook, Twitter, and Foursquare to locate empty homes to target for a robbery.”

Credit Sesame – 2011

Source: <http://www.creditsesame.com/blog/social-media-safety-dont-make-it-easy-for-burglars/>



DISADVANTAGES



Credit Sesame – 2011

Source: <http://www.creditsesame.com/blog/social-media-safety-dont-make-it-easy-for-burglars/>



DISADVANTAGES

*“It is possible to discover user **Points Of Interests (POIs)** by using **inference attacks** : where someone lives, where he works, places where he practices sports, his usual itineraries, etc.”*

(Gambs et al. 2010)



*“Only **four spatiotemporal points** are enough to uniquely identify **95%** of the individuals”*

(De Montjoye et al. 2013)

COMPARISON



TECHNOLOGY-BASED COMPARISON

Techniques	Spatial and Temporal Cloaking- based	Location Transformation-based
SmokeScreen	■	
Longitude		■
C-Hide&Seek and C-Hide&Hash		■
Mobishare	■	
N-Mobishare	■	
LocX		■

Table 1: Categorization of GSNs privacy-preserving works

KEY PROPERTIES-BASED COMPARISON

Techniques	Centralization	Implementation complexity	Communication cost	Time cost	Hardware cost	User pre-settings
SmokeScreen	Yes	F	F	H	F	Yes
Longitude	Yes	L	F	F	F	Yes
C-Hide&Seek	Yes	F	F	L	F	No
C-Hide&Hash	Yes	F	F	H	F	No
Mobishare	No	H	L	H	H	Yes
N-Mobishare	No	F	L	H	F	Yes
LocX	No	H	L/H	L/H	F	No

Table 2: A comparison between different GSNs privacy-preserving works

ANALYSIS OF TECHNIQUES

- **SmokeScreen**: main disadvantage is the *time cost*. Transforming an opaque identifier to a real identity takes 10 seconds in best cases
- **Longitude**: performs encryptions and computations *faster* than other techniques.
- **C-Hide&Seek and C-Hide&Hash**: C-Hide&Hash provides a *higher level of privacy* than C-Hide&Seek do, but at the cost of *higher communication and computation costs*.



ANALYSIS OF TECHNIQUES

- **Mobishare,**
 - Requires a complex implementation and an additional hardware to adequately perform .
 - Still immature in terms of privacy preserving.
- **LocX:**
 - More complicated to implement than other techniques
 - Is the most efficient one in pointing queries.
 - Main weakness is the nearest-neighbor queries: needs too much time and data to properly perform.



CONCLUSION



CONCLUSION

- **Applications** that are mostly constructed to depend on geo-location services are slowly **invading** and **colonizing** our **daily life**.
- They can have **access** to our **addresses** and locate the residences of our friends, family and acquaintances.
- There's nothing wrong with the use of this type of service as long as the **consumers** are fully conscious and totally **aware** of what is happening with their personal information and **understand** the meaning of **disclosing** location in terms of security.



CONCLUSION

- Many users are **unaware** of the **scope** of **geo-location** technology and this is why they need to be better informed and less complacent.
- Users can be more **circumspect** when it comes to **sharing data** with others.



- All categories of concerned people, policymakers, enterprises and consumers should **work together** to ensure that sensitive personal information is **under control**.

COMMENTS & QUESTIONS?

Thank you

