

# Synergy of social networks defeats online privacy

Eleonora Petridou  
Marek Kuczyński

System And Network Engineering  
University of Amsterdam

February 2, 2011

## Research question

*“What are the privacy risks associated with social network user profiling?”*

## Sub questions

- 1 What is online privacy?
- 2 Current exposure and privacy policies
- 3 Business models and the future
- 4 Attack vectors and combining acquired information
- 5 Countermeasures

# Overview

## Concent discussed during this presentation

- Evolution Of Social Networks
- Characteristics Of Social Networks
- Business Models
- Proof Of Concept
- Risk Scenarios
- Countermeasures
- Conclusion

Please ask your questions at the end of the presentation!

# Evolution Of Social Networks

Based on Web 2.0, founded between 2003 - 2008

## Incentives to use

- Communication with friends all over the world
- Quick and indirect overview of other people's lives
- Social pressure

# Monetizing Online Social Networks

## Interested parties

- Third-parties
- Individual users
- Social networks themselves

facebook

## Social Contact Oriented



WWW.WHITEHOUSE.GOV

[Become a Supporter](#)

[Add to my Page's Favorites](#)

[View Updates](#)

President Barack Obama is the 44th President of the United States of America.

### Information

**Current Office**

Barack Obama [Become a Supporter](#)

Wall

Info

Boxes

Events

Barack Obama

Just Fans



Barack Obama



**Organizing for America | Tell Congress to Support President Obama's Budget**

Source: [my.barackobama.com](http://my.barackobama.com)

Call your elected representatives and tell them to support President Obama's budget. It's a bold plan that confronts the long-term threats to our prosperity and builds a new foundation for economic growth by investing in energy, health care, and education.

March 26 at 1:25pm · [Show Feedback \(34,171\)](#) · [Share](#)



**Barack Obama** The White House is inviting you to post your questions on the economy and vote on submissions from others. The President will answer some of the most popular in an online town hall on Thursday. Submit your questions at <http://www.whitehouse.gov/OpenForQuestions/>



**Open for Questions: President Obama Answers Your Questions**

Length: 1:27

March 24 at 7:18pm · [Show Feedback \(45,540\)](#) · [Share](#)


**facebook**

## Social Contact Oriented

### Features

- 500+ million users
- Revenue \$800 million (2010)

### Privacy observations

- Personalised advertising - cookies
- Instant personalisation of other websites -  Like
- Anonymizing the data → Unknown algorithm  
→ Who receives the data?

**facebook**

## Social Contact Oriented

### Business model

- Facebook Pages
  - Users connect with a brand or name
  - Shop online
- Social Ads
  - Targeted advertising
  - Attribute filtering
  - “Like” by friends
- Facebook credits and credit cards



# LinkedIn

## Business Oriented



Account Type: Basic

▼ Marek Kuczynski

[Add Connections](#)
[Home](#) [Profile](#) [Contacts](#) [Groups](#) [Jobs](#) [Inbox](#) [Companies](#) [More](#)

Jobs ▼



Advanced

**Jobs Home**[Saved Jobs](#)[Saved Searches](#)[Advanced Search](#)[Zero in on \\$100k+ jobs with detailed salary information >>](#)

### Search for Jobs

Job Title, Keywords, or Company Name

Search

[Advanced](#)**Employers:**[Post a Job](#)[Manage Jobs](#)

#### Job Seeker Toolkit

80%

**Your profile is 80% complete.** Make a strong first impression with an up-to-date profile.[Update profile >](#)

116

**You have 116 connections.** Build your network to be referred for job opportunities.[Add connections >](#)

0

**You are following 0 companies.** Stay up-to-date on companies that interest you.[Follow companies >](#)

### Jobs you may be interested in <sup>Beta</sup>

[Email Alerts](#) | [See More >](#)**System Administrator Apeldoorn**

Neomax - Apeldoorn Area, Netherlands

x

**Infrastructure Engineer - Solution Architect**

Nuon - Schiphol-Rijk

x

**Infrastructure Manager**

Canon Europe Ltd. - Amstelveen (near Amsterdam)

x

**IT Administrator**

Kars &amp; Co. B.V. - Nijmegen Area, Netherlands

x

**Principal Technical Architect**

Canon Europe Ltd. - Amstelveen

x



# LinkedIn

## Business Oriented

### Features

- 90 million users
- Profit \$10.1 million in Q1 2010

### Privacy observations

- Not selling personally identifiable information to third parties  
→ How is data anonymized?
- Job history cannot be private

# LinkedIn

Business Oriented

## Business model

- Direct Ads
  - Specific audience
  - Search based on job, education, location etc.
- Premium accounts
  - For job seekers
  - For recruiters



## Communication Oriented



The best way to discover what's new in your world.

Art Project Chicago Public Schools ATD-HE Secret Diary Lines Sainz TRENDING TOPICS Langston Hughes Apple

### See who's here



Friends and industry peers you know. Celebrities you watch. Businesses you frequent. Find them all on Twitter.

### Top Tweets [View all >](#)



**ImBruceBruce** S.T.E.A.L. Strategically Transfer Equipment to Another Location #ThingsBrokePeopleDo

35 minutes ago ·



**rustyroockets** I am hosting Saturday Night Live, Feb 12th. If you have any sketches/jokes please send. Remember, I will ONLY play drug addicts.

30 minutes ago ·



**ajcookofficial** Heading back to Criminal Minds for @pagetpaget final episode. @GUBLERNATION is directing. It's going to be GOOD/WEIRD/SAU!!!

4 hours ago ·

### New to Twitter?

Easy, free, and instant updates. Get access to the information that interests you most.

[Sign Up >](#)

### A #NewTwitter

Catch a glimpse of the new Twitter.com.





## Communication Oriented

### Features

- 175 million users
- Applications extending Twitter's functionality  
→ Twitpic

### Privacy observations

- Everything is public by default
- No disclosure to third parties  
→ Exception only the legal cases



## Communication Oriented

### Business model

- Promoted Tweets  
→ Top of results



# Sports Oriented

FREE YOUR ENDORPHINS

Michael Butler Settings Logout

endomondo

HOME FRIENDS & TEAMS CHALLENGES **WORKOUTS** ROUTES LIVE MAP

Search

MAP enter place to find Map Satellite Hybrid

**WORKOUTS**

Share New Import Export Delete

**DETAILS**

Name:	
Sport:	Walking
Start Time:	Jun 18, 2010 10:59 AM
Distance:	0.32 mi
Duration:	3m:56s
Avg Speed:	4.9 mph
Max Speed:	31.6 mph
Calories:	
Altitude:	328 ft / 869 ft
Heart Rate:	- / -

**NOTES**

**SPEED/ALTITUDE**

mph	ft
6.8	869
5.4	734

**ROUTES**



## Sports Oriented

### Features

- Software package Endotracker
- Personal profile
  - Statistics
  - Image of the route in Google Maps

### Privacy observations

- Public profile by default
- Data exposed at user's own risk
- Data anonymization → Distribution





## Sports Oriented

### Business model

- Online shop with training equipment
- Premium accounts for businesses
- Pro version



# Location Oriented



Marek in Diemen, Noord-Holland | [Apps](#) | [Help](#) | [Settings](#) | [Log Out](#)

[Me](#) | [History](#) | [Badges](#) | [Stats](#) | [Friends](#)

Search places, people and tips



## Metrostation Ganzenhoef

+ ADD TO MY TO-DO LIST

Ganzenhoefpad  
Diemen, Noord-Holland 1103



[Like](#)



Categories: Subway

Tags: *untagged*

edit

Do you manage this venue? [Claim here](#)

YOUR CHECK-INS	TOTAL PEOPLE	TOTAL CHECK-INS
1	42	98

### Mayor

Last 60 Days



**Marleen**  
27 checkins



### Photos

No photos here yet!



Have you been here? Leave a tip to let other people know what's good.

### Tips

[POPULAR](#) [RECENT](#)





## Location Oriented

### Features

- GPS enabled devices required
- Checkins at locations
- Discounts
- Tips and suggestions

### Privacy observations

- Personalised advertisements and emails
- Data not sold to third parties



## Location Oriented

### Business model

- Still in the process
- Some of the venues are already paying

# Privacy Incidents And Enumeration Strategies

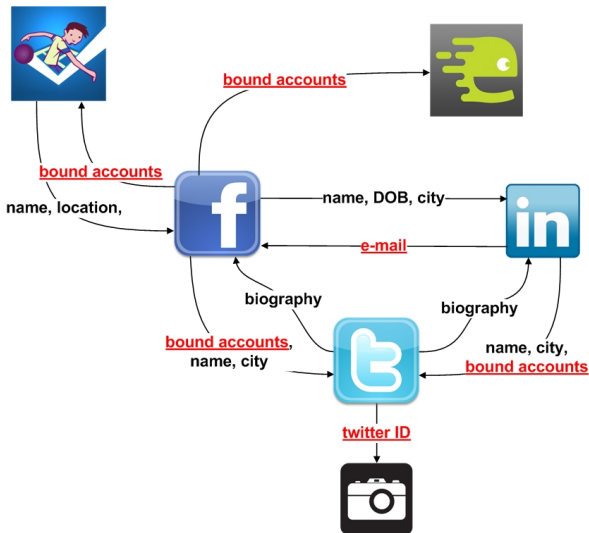
## Recent privacy related incidents

- Lawsuits over Facebook/Myspace messages
- Middle-East countries blocking Facebook
- Subpoenas for Twitter information

## Enumerate information based on...

- ... one individual → e.g. Job interviews, credit check?
- ... an interest → e.g. Soda producer, political parties?
- ... everything, see what comes out → e.g. Google, FBI?

# Connecting The Dots...



## Created Data Sources

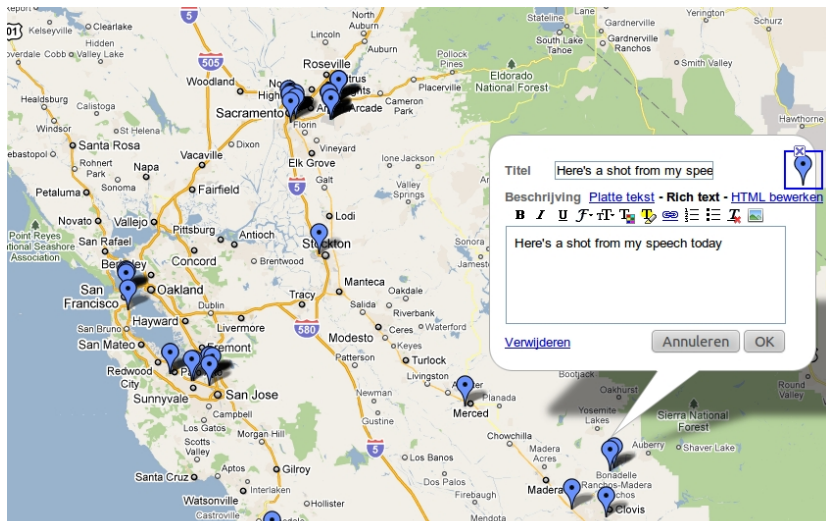
### Data gathered in POC

- Facebook → Tree of targetted user
- LinkedIn → Tree of targetted connection
- Twitter/Twitpic → Celebrity Twitpic GPS coordinates
- Foursquare → Who was at a venue at certain time?
- Visualizing it all

### Easy accessible sources

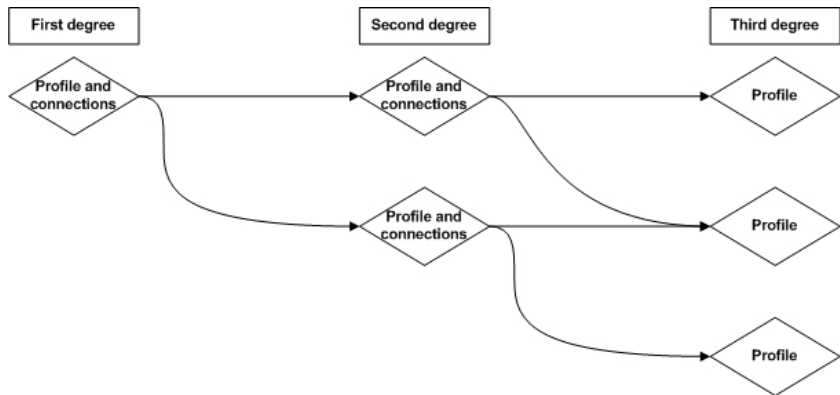
- Twitter → Marketing relevant data
- Endomondo → Plot of user workouts

# Plotting Twitpic EXIF Data



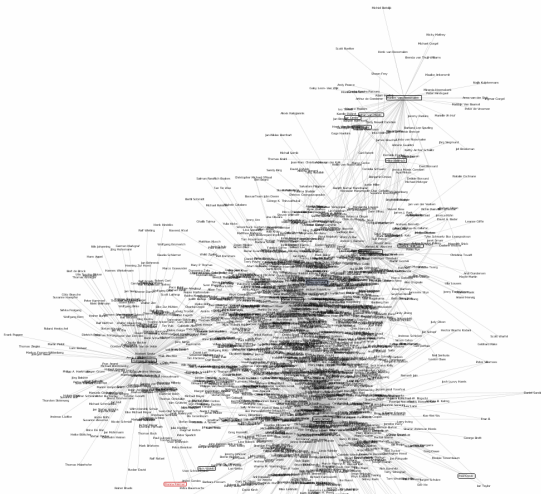


# Crawling Facebook, LinkedIn



# Visualizing Data With Vizster - Overview

vizster



# Visualizing Data With Vizster - Properties

## ff4d655b6f36a0658da2410dc6b90558

Last Name	
User ID	
Nickname	
Email	e8dc0f229455b01cea4aaef3b49e0a0e
Profile Pic	
Mobile phone	
Address	
Location	95a46ba40e643b4f636efb992ce9c6ae
Workplace	
Groups	
Last tweet	c3656271b6328fb26d9b10dbb894857f
GPS last tweetpic	
Timestamp last tweetpic	
Date of last tweetpic	
GPS last Foursquare checkin	
Timestamp last Foursquare checkin	
Date of birth	83589779bbfe9fd85a5835b586e8c10b
Age	fe9d26c3e620eeb69bd166c8be89fb8f
Sport	
Height	
Gender	<input type="checkbox"/>
Status	<input type="checkbox"/>

# Answering The Research Question

## Research question

*“What are the privacy risks associated with social network user profiling?”*

## Risks of social profiling

- Theft, stalking (*i.e. Twitpic + Endomondo*)
- Identity theft (*i.e. LinkedIn + Facebook*)
- Insurance issues (*i.e. Foursquare + Facebook*)
- Police, corrupt governments (*i.e. Facebook + Twitpic*)
- Corporate spying, headhunters (*i.e. Facebook + LinkedIn*)

## Countermeasures

### Make the users aware...

- ... of what options are enabled by default
- ... who is interested in their data and why
- ... of data retention on social networks
- ... of GPS logging in (mobile) photo cameras

### Restricting Access To Data

- Limit the exposure relations and bound accounts
- Make privacy settings part of the sign-up (opt-in!)
- Block accounts with excessive data volumes

# Conclusion

## What's next?

- Maturity and exposure of social networks is growing
- No real leads on data selling, but advertising business is huge
- Risks are increasing as features and dependance on social networks grows
- Legislation will not save or protect the user, this issue is global
- User awareness seems to be the only viable option

## How will we help?

- Newbie guide to "secure" social networking → <http://www.socialsynergy.nl>

Thanks for your attention

**Questions?**

`http://www.socialsynergy.nl`

`eleonora.petridou@os3.nl&marek.kuczynski@os3.nl`

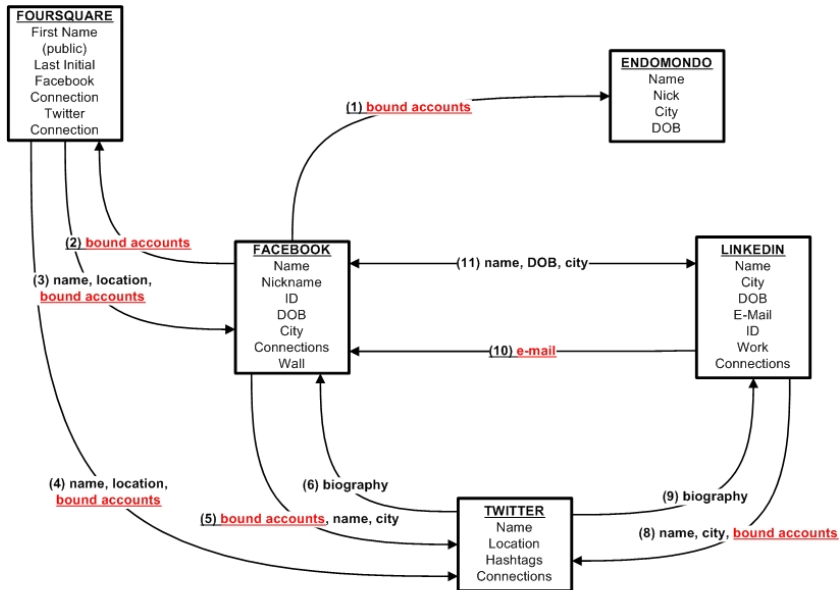
# EXTRA SLIDES

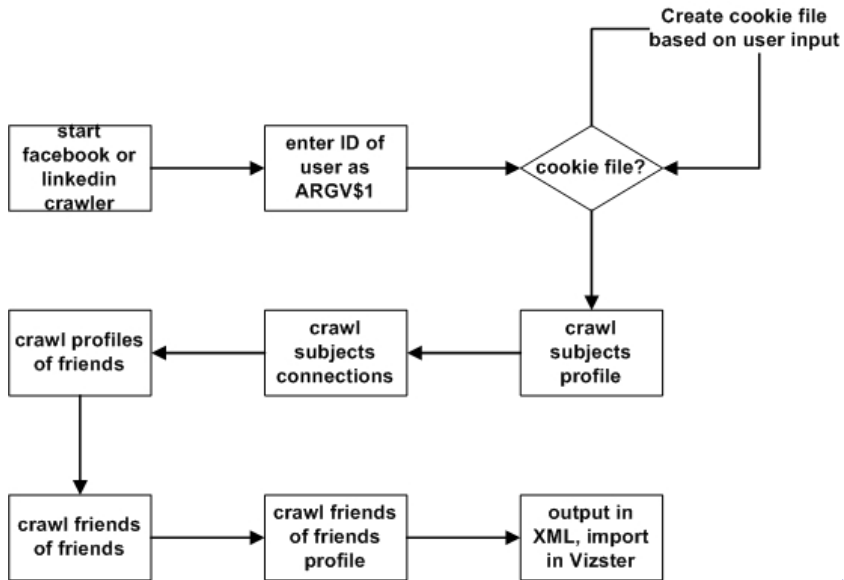
## APPENDIX

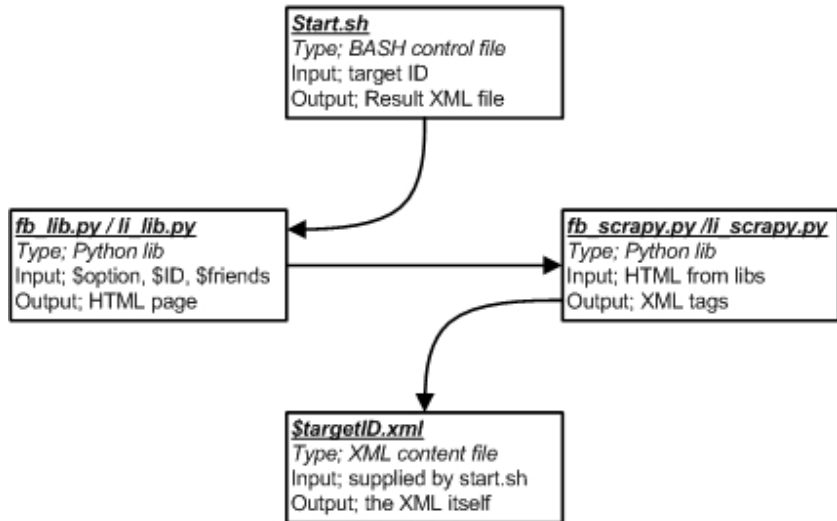


#	How to match the data items?
1	The Facebook "Wall" may contain an application that links directly to someone's Endomondo profile.
2	The Facebook "Wall" may contain an application that links directly to someone's Foursquare profile.
3	The name, nickname and location retrieved from Foursquare may lead to a positive match with Facebook. The account linking option of Foursquare offers a direct link to someone's Facebook account.
4	The name, nickname and location retrieved from Foursquare may lead to a positive match with Twitter. The account linking option of Foursquare offers a direct link to someone's Twitter account.
5	Postings on the "wall" of someone may be put there through Twitter. In this case, the Twitter account name of someone can be retrieved. Additionally, a match can be made based on full name and city.
6	A match between Twitter and Facebook can be made if the biography and name of a Twitter user match to an individual on Facebook.
7	The Twitpic ID of someone is identical to that of Twitter, so this option can always be checked reliably.
8	LinkedIn provides the name and geographical area of a person by default, but a Twitter account can be bound to someone's LinkedIn profile as well.
9	A match between Twitter and LinkedIn can be made if the biography and name of a Twitter user match to an individual on LinkedIn.
10	The e-mail of a user is exposed by default on LinkedIn, it can be used on Facebook to retrieve a profile if it was registered with the same e-mail address.
11	The bi-directional connection between Facebook and LinkedIn can be created if the full name, date of birth and/or city match.

	Facebook	Endomondo	Twitter	LinkedIn	Foursquare
First name	Yes*	Yes*	Yes*	Yes*	Yes
Last name	Yes*	Yes*	Yes*	Yes*	Yes
Nick name	Yes(URL)	No	Yes*	No	No
Profile pic	Yes	Yes	Yes	Yes	Yes
E-Mail	No*	No*	No*	Yes*	No
Age	No	Yes	No	Yes	No
Date of birth	No*	Yes	No	Yes	No
Height	No	Yes	No	No	No
Gender	Yes*	Yes	No	No	No
Relationship status	Yes	No	No	Yes	No
City	Yes	Yes	Yes	Yes	Yes
Country	Yes	Yes	Yes	Yes*	Yes
Address	No	No	No	No	No
Mobile Phone	No	No	No	Yes	No
Workplace	Yes	No	No	Yes*	No
Groups	Yes	No	No	Yes	No
Connections	All	Yes	Yes	Yes	Yes
Family Relations	Yes	Yes	Yes	Yes	Yes
Tweets	No	No	Yes	No	No
GPS locations	No	Yes	Yes(Twitpic)	No	Yes
Height	No	Yes	No	No	No
Sport	No	Yes	No	No	No
User content	Yes (wall)	Yes	Yes	Yes	Yes
Apps bound to other social networks	No	Yes	Yes	No	Yes
Search engine	Yes	Yes	Yes	Yes	Yes





**START****END**