Modeling Social Networking Privacy

Carolina Dania

IMDEA Software Institute - Spain
Universidad Complutense de Madrid

(Partially funded by NeSSOS)

Supervisors

Manuel Clavel

IMDEA Software Institute
Universidad Complutense de Madrid

Marina Egea

Atos Research & Innovation Dept.

Outline

- Social Networks
  - Facebook
  - Privacy
  - Example
- Research project
  - Goals
  - Requirements
- Preliminary results
- Research plan

Outline

- Social Networks
  - Facebook
  - Privacy
  - Example
- Research project
  - Goals
  - Requirements
- Preliminary results
- Research plan

Social Networks

Social Networks

- online services that reflect social relations among people. E.g. shared interests and/or activities

Social Networks

- online services that reflect social relations among people. E.g. shared interests and/or activities

- Many people act as “Internet natives”

Social Networks

- online services that reflect social relations among people. E.g. shared interests and/or activities

- Many people act as “Internet natives”

- when they need information, they open a browser and search for it

Social Networks

- online services that reflect social relations among people. E.g. shared interests and/or activities

- Many people act as “Internet natives”

- when they need information, they open a browser and search for it
- when they want to share information, they post it on a social network

Facebook

Facebook

- is the leader among social networking sites

Facebook

- is the leader among social networking sites
- created by Mark Zuckerberg in 2004

Facebook

- is the leader among social networking sites
- created by Mark Zuckerberg in 2004
- some figures:
  - has more than 800 million users,
  - the users upload, on average, 250 million photos per day

Everybody knows Facebook

Everybody knows
Facebook

You are in Facebook!

Muro
Información
Fotos
Amigos

Amigos (74)

Moritz Hammer

Marco Brambilla
Politecnico di Mil...

Alejandro Nicol...

Nathalie Moreno

Susy Sienra

Sebas PF

Anton Fasching

Guille de Leona...

Nora Parcus

+1 Agregar a mis amigos | Mensaje | ⚙

Trabajó en Universidad de Múnich · Estudió en Universidad de Buenos Aires, Argentina · Vive en Múnich · De Buenos Aires · Nació el 2 de octubre de 1951

Formación y empleo

Empresas

Universidad de Múnich
- NESSOS, ASCENS

Universidad

Universidad de Buenos Aires, Argentina

Escuela secundaria

Escuela Commercial de San Isidro, Buenos Aires, Argentina
Promoción del 1969

Actividades e intereses

Otros Ascens, Latino Sur

Información básica

Sexo Mujer

Nora y tú

Amigos en común: Marianne Busch.

Descubre juegos nuevos

Tarot Gratis
Juliana Iosa y 4 amigos más juegan Tarot Gratis.
Jugar ahora

Páginas recomendadas

Ver todas

Camila
A Belu Marguati le gusta esta página.
Me gusta

"Ricardo Arjona"
A Belu Marguati y 12 amigos más les gusta esto.
Me gusta

Starbucks
A Teresa Trigo y 11 amigos más les gusta esto.
Me gusta

CSI: NY
A Belu Marguati le gusta esta página.
Me gusta

National Geographic
A Eleonora Sacco y 6 amigos más les gusta esto.
Me gusta

Dr. House
A Flor Dania y 29 amigos más les gusta esto.
Me gusta

facebook

Buscar

Buscar amigos | Inicio

Anton Philippov

+1 Agregar a mis amigos

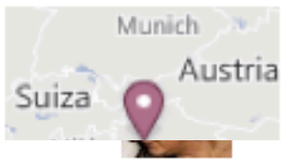
Vive en Trento

De Petropavlovsk, Soltüstik Qazaqstan, Kazakhstan

Información | Fotos | Mapa | Me gusta

Anton y tú no son amigos(as). Si conoces a Anton, envíale una solicitud de amistad o envíale un mensaje.

Acerca de Anton



Sebas PF

Anton Fasching

Guille de Leona...

común: Marianne Busch.

gos nuevos

ot Gratis
ana losa y 4 amigos más
gan Tarot Gratis.
Jugar ahora

nendadas Ver todas

nila
elu Marguati le gusta esta
ina.
Me gusta

cardo Arjona"
elu Marguati y 12 amigos
s les gusta esto.
Me gusta

rbucks
eresa Trigo y 11 amigos más
gusta esto.
Me gusta

: NY
elu Marguati le gusta esta
ina.
Me gusta

National Geographic
A Eleonora Sacco y 6 amigos más les gusta esto.
Me gusta

Dr. House
A Flor Dania y 29 amigos más les gusta esto.
Me gusta

facebook Buscar

Buscar amigos | Inicio

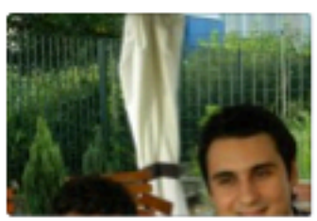
facebook Search

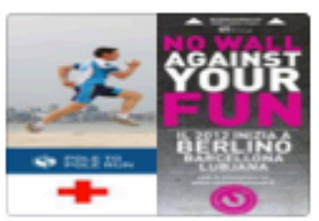
Carolina Inés Dani

Luca Allodi

+1 Add Friend | Message | ás

PhD student at University of Trento
Studied Sicurezza Informatica at University of Milan





Photos | Map | Likes 176

las

About

Anton Fasching

Guille de Leona...

NATIONAL GEOGRAPHIC

más les gusta esto.

Me gusta

Dr. House

A Flor Dania y 29 amigos más les gusta esto.

Me gusta

facebook

Buscar

Buscar amigos | Inicio

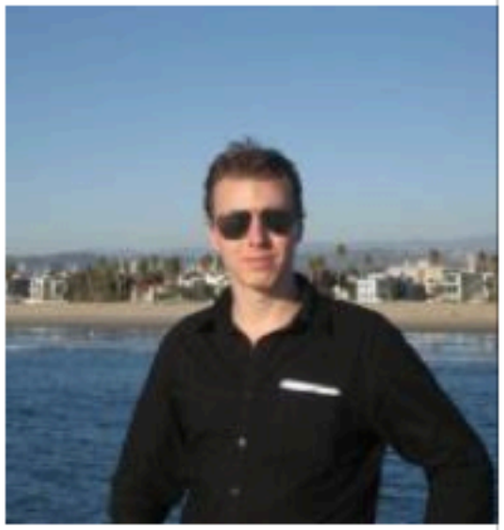
facebook

Search

Carolina Inés Dani

facebook

Search



Wall

Info

Photos

Friends

Subscribers (2)

Friends (326)

Dimitri Van Lan...

Cedric Blommaert

Guille de Leona...

Bert Lagaisse

+1 Add

Lives in Leuven, Belgium From Oostrozebeke, Belgium

Wall

RECENT ACTIVITY

Bert likes Wordfeud. · Like This Page

RECENT ACTIVITY

Bert likes Flanders DC. · Like This Page

Bert likes Starbucks and 2 other pages.

Bert Lagaisse likes a link.

Google, I See What You Did There...

Funny Pictures brought to you by LolSnaps. Constant updates of the best funny pictures on the web.

Share · January 28 at 9:04pm ·

2 people like this.

RECENT ACTIVITY

Bert likes Battle of Talents and Welke muppet ben jij?

sage

A Flor Dania y 29 amigos más les gusta esto.

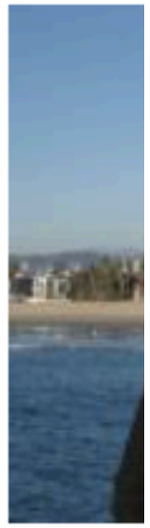
Me gusta

Tuesday, February 21, 12

facebook facebook facebook

Search

Buscar amigos | Inicio



PicBadges.com

Wall
Info
Photos
Friends

Maarten De Cat

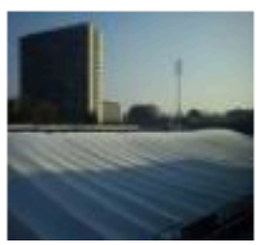
harde werker at colruyt · Went to Miniemeninstituut · Lives in Leuven, Belgium
Knows Nederlands taal, Français, English · From Leuven, Belgium

Wall

Maarten De Cat
Just een goei fritteke gegeten van bij @ frituur sportcentrum.
See Translation
Share · 16 hours ago near Heverlee, Brabant ·
Annelies Vansantvoet likes this.

Maarten De Cat
Freezing to work!!!
Share · February 8 at 6:31am near Heverlee, Brabant ·
Decremer Johan likes this.

Maarten De Cat likes a link.



Kom NU naar Den Dreef en voorkom een forfait-nederlaag!
Zonet kregen wij telefoon van de veiligheidsverantwoordelijke van OHL met een rampzalige boodschap: Onder de ballon van de veldverwarming is condens ontstaan dat beginnen

Friends (199)

Maxime Annys

Els Cammaerts

Carlos Charre

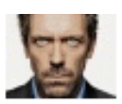
Friends

Cedric Blommaert

Guille de Leona...

RECENT ACTIVITY

Bert likes Battle of Talents and Welke muppet ben jij?



A Flor Dania y 29 amigos más les gusta esto.
Me gusta

facebook facebook facebook facebook

Search

Buscar

Carolina Inés D

Muro

Información

Fotos

Amigos

Amigos (118)

José Antonio M...
Universidad de ...

Daniel Mérida B...
Universidad de ...

Teresa Ruiz

Javier Cubo

Guille de Leona...

Francisco Moyano Lara

+1 Agregar a m

Estudió en Universidad de Málaga

Formación y empleo

Empresas

Universidad de Málaga

Universidad

Universidad de Málaga
Promoción del 2009

Escuela secundaria

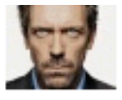
N-5 Miguel Romero Esteo

Información básica

Sexo Hombre

Información de contacto

Bert likes Battle of Talents and Welke muppet ben jij?



A Flor Dania y 29 amigos más les gusta esto.

Me gusta

facebook facebook facebook facebook facebook

Search Buscar Buscar

Buscar amigos Inicio Carolina Inés D

Muro
Información
Fotos
Amigos

Carmen Fernandez-Gago

Formación y empleo

Empresas Universidad de Málaga

Actividades e intereses

Otros Feria de Málaga, Campero malagueño, Pampling

Amigos (95)

Cristina Mate

Ana Nieto Jimé...

 Elena Pozo Ruz

Celia Casado Ca...

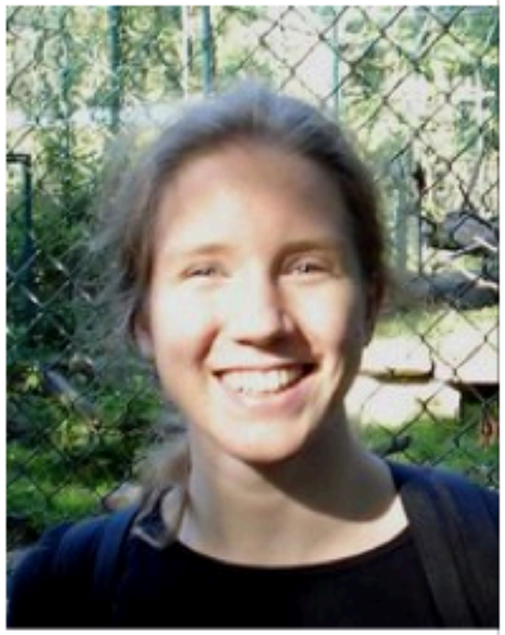
les gusta esto.
Me gusta

facebook facebook facebook facebook facebook

Search Buscar Buscar busch

Buscar amigos | Inicio

Carolina Inés D



Marianne Busch

✔ Frie

Doktorand at Ludwig Maximilian University of Munich · Studied Informatik at Ludwig Maximilian University of Munich · In a relationship · Born on November 26

Wall

RECENT ACTIVITY

Marianne likes Ascens and LMU Alumni Informatik e.V.

There are no more posts to show.

- Wall
- Info
- Photos (1)
- Friends

Friends (152)

Dhana Sauernh...
Ludwig Maximili...

Annabelle Klarl
Ludwig Maximili

Me gusta

facebook
Search
Buscar
Carolina Inés D
Buscar
busch
Carolina Inés Dania
Carolina Inés Dania
Update Info
Activity Log 1
PhD student at Imdea Software
Studied at Universidad Nacional de Córdoba, Arg...
Lives in Madrid, Spain
Knows Spanish, English
Buchardo, Cordoba...
4
About
Friends 274
Photos 433
Map 217
Likes 41

Privacy on social networks

Privacy on social networks

- is a growing concern among the users of social networking sites, and their developers

Privacy on social networks

- is a growing concern among the users of social networking sites, and their developers

"I also understand that many people are just naturally skeptical of what it means for hundreds of millions of people to share so much personal information online, especially using any one service..." M. Zuckerberg. Nov 2011

Privacy on social networks

- is a growing concern among the users of social networking sites, and their developers

"I also understand that many people are just naturally skeptical of what it means for hundreds of millions of people to share so much personal information online, especially using any one service..." M. Zuckerberg. Nov 2011

"Many policies and procedures that are in operation are not formally documented. This should be remedy." Irish Data Protection Commissioner. Dec 2011

Privacy
on Facebook

Privacy on Facebook

- is difficult to understand

  e.g. when tagging policies and privacy settings conflict each other

Privacy on Facebook

- is difficult to understand

  e.g. when tagging policies and privacy settings conflict each other

- has been in a constant state of flux and is prompted to change again soon

Privacy on Facebook

- is difficult to understand

  e.g. when tagging policies and privacy settings conflict each other

- has been in a constant state of flux and is prompted to change again soon

- is only informally and partially described

Outline

- Social Networks
  - Facebook
  - Privacy
  - Example
- Research project
  - Goals
  - Requirements
- Preliminary results
- Research plan

Posting and Tagging
(from Facebook Help Center)

Posting and Tagging
(from Facebook Help Center)

- What is tagging and how does it work? A tag links a person (...) to something that you post.

Posting and Tagging
(from Facebook Help Center)

- What is tagging and how does it work? A tag links a person (...) to something that you post.

- When I tag someone in a photo or post, who can see it?

Posting and Tagging
(from Facebook Help Center)

- What is tagging and how does it work? A tag links a person (...) to something that you post.

- When I tag someone in a photo or post, who can see it?

1. The audience you selected for your post
2. Friends of the person you tagged (if the audience is set to ‘Friends’ or more)

Example (friendship)

Example (friendship)

Alice

Example (friendship)

Alice

Bob

Example (friendship)

Alice

Bob

Ted

Example (friendship)

Alice

Bob

Peter

Ted

Example (friendship)

Alice

Bob

Peter

Ted

Example (friendship)

Bob is friend of
Alice and Ted

Alice ⟷ Bob

Peter

Ted

Example (friendship)

Bob is friend of
Alice and Ted

Alice ⟷ Bob

Peter ⟷ Ted

Ted is friend
of Peter

Example (friendship)

Bob is friend of
Alice and Ted

Alice ⟷ Bob

Peter ⟷ Ted

Ted is friend
of Peter

- Peter is not friend of Alice and Bob

Example (friendship)

Bob is friend of
Alice and Ted

Alice ⟷ Bob

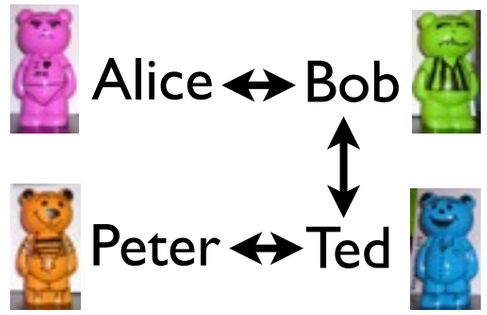
Peter ⟷ Ted

Ted is friend
of Peter

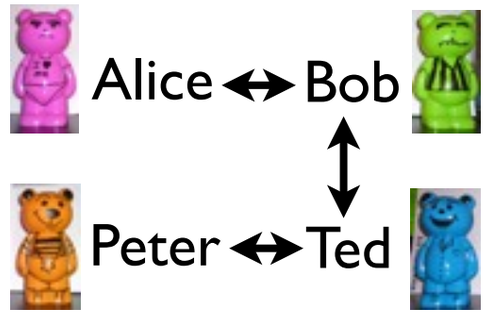
- Peter is not friend of Alice and Bob
- Ted is not friend of Alice

Example

Example

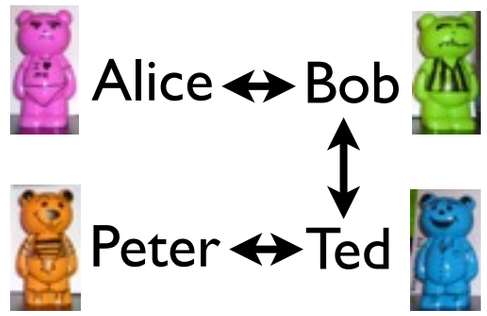


Example



Scenario 1: Alice posts a photo in her wall and set its audience to "Friends"

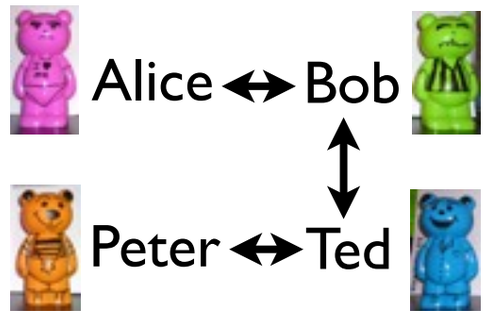
Example



Scenario 1: Alice posts a photo in her wall and set its audience to "Friends"

Bob tags Ted in this photo

Example

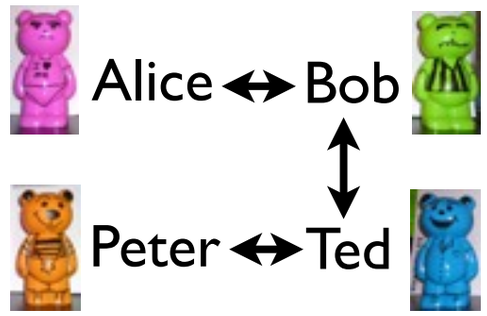


Scenario 1: Alice posts a photo in her wall and set its audience to "Friends"

Bob tags Ted in this photo

Can Peter see this photo in Alice's wall?

Example

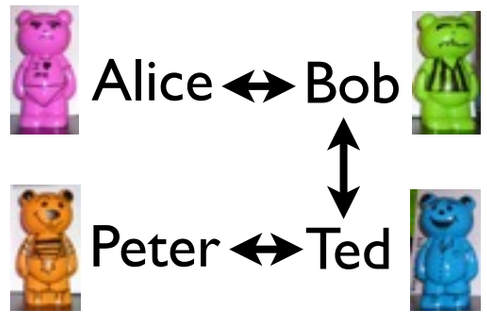


Scenario 1: Alice posts a photo in her wall and set its audience to "Friends"

Bob tags Ted in this photo

Can Peter see this photo in Alice's wall? Yes

Example



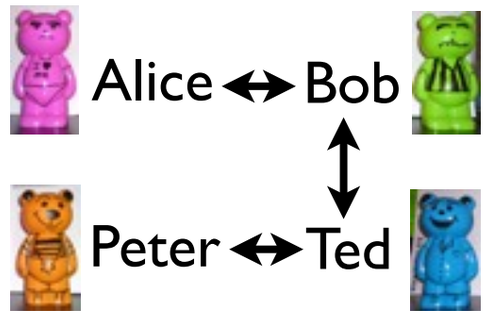
Scenario 1: Alice posts a photo in her wall and set its audience to "Friends"

Bob tags Ted in this photo

Can Peter see this photo in Alice's wall? Yes

Scenario 2: Bob posts a photo in Alice's wall where the default audience is set to 'Friends'

Example



Scenario 1: Alice posts a photo in her wall and set its audience to "Friends"

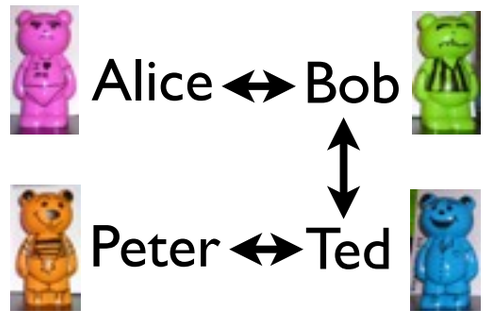
Bob tags Ted in this photo

Can Peter see this photo in Alice's wall? Yes

Scenario 2: Bob posts a photo in Alice's wall where the default audience is set to 'Friends'

Bob tags Ted in this photo

Example



Scenario 1: Alice posts a photo in her wall and set its audience to "Friends"

Bob tags Ted in this photo

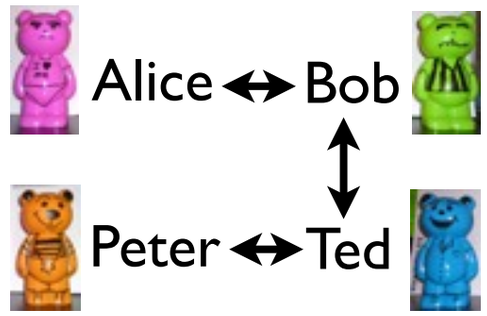
Can Peter see this photo in Alice's wall? Yes

Scenario 2: Bob posts a photo in Alice's wall where the default audience is set to 'Friends'

Bob tags Ted in this photo

Can Peter see this photo in Alice's wall?

Example



Scenario 1: Alice posts a photo in her wall and set its audience to "Friends"

Bob tags Ted in this photo

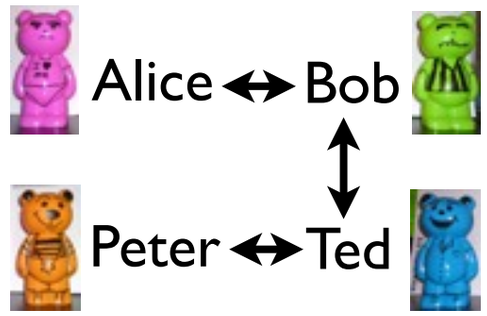
Can Peter see this photo in Alice's wall? Yes

Scenario 2: Bob posts a photo in Alice's wall where the default audience is set to 'Friends'

Bob tags Ted in this photo

Can Peter see this photo in Alice's wall? No.

Example



Scenario 1: Alice posts a photo in her wall and set its audience to "Friends"

Bob tags Ted in this photo

Can Peter see this photo in Alice's wall? Yes

Scenario 2: Bob posts a photo in Alice's wall where the default audience is set to 'Friends'

Bob tags Ted in this photo

Can Peter see this photo in Alice's wall? No. Why?

Outline

- Social Networks
  - Facebook
  - Privacy
  - Example
- Research project
  - Goals
  - Requirements
- Preliminary results
- Research plan

Goals

Goals

- develop a methodology for modeling and analyzing social networking privacy policies

Goals

- develop a methodology for modeling and analyzing social networking privacy policies
  - modeling means for us to use formal model with rigorous semantics

Goals

- develop a methodology for modeling and analyzing social networking privacy policies
  - modeling means for us to use formal model with rigorous semantics
  - analyzing means for us to use formal methods (as automated as possible)

Goals

- develop a methodology for modeling and analyzing social networking privacy policies
  - modeling means for us to use formal model with rigorous semantics
  - analyzing means for us to use formal methods (as automated as possible)
- validate this methodology with a case study: modeling and analyzing Facebook's privacy policy

Requirements

Requirements

- [modeling] it is crucial to use a language able to formalize fine-grained access control policies (dynamic access control)

Requirements

- [modeling] it is crucial to use a language able to formalize fine-grained access control policies (dynamic access control)

  E.g. Can Peter see a photo in Alice's wall if Peter is a friend of Alice?

Requirements

- [modeling] it is crucial to use a language able to formalize fine-grained access control policies (dynamic access control)

  E.g. Can Peter see a photo in Alice's wall if Peter is a friend of Alice?

  simple RBAC is not sufficient

Requirements

- [modeling] it is crucial to use a language able to formalize fine-grained access control policies (dynamic access control)

  E.g. Can Peter see a photo in Alice's wall if Peter is a friend of Alice?

  simple RBAC is not sufficient

- [analyzing] it is crucial to use a language with a formal semantics

Requirements

- [modeling] it is crucial to use a language able to formalize fine-grained access control policies (dynamic access control)

  E.g. Can Peter see a photo in Alice's wall if Peter is a friend of Alice?

  simple RBAC is not sufficient

- [analyzing] it is crucial to use a language with a formal semantics

  E.g. XACML currently lacks of a formal semantics

SecureUML

SecureUML

- formal language for modeling fine-grained access control policies, both static and dynamic

SecureUML

- formal language for modeling fine-grained access control policies, both static and dynamic
  - dynamic access control policies depend on the run-time satisfaction of authorization constraints

OCL

OCL

- a strongly typed declarative language

OCL

- a strongly typed declarative language
- using OCL you can:

OCL

- a strongly typed declarative language
- using OCL you can:
  - refer to any, some, or all the elements in a scenario

OCL

- a strongly typed declarative language
- using OCL you can:
  - refer to any, some, or all the elements in a scenario
  - refer to the value of any properties of any element in a scenario

OCL

- a strongly typed declarative language
- using OCL you can:
  - refer to any, some, or all the elements in a scenario
  - refer to the value of any properties of any element in a scenario
  - perform standard operations on primitive types, or collections of elements in a scenario

Outline

- Social Networks
  - Facebook
  - Privacy
  - Example
- Research project
  - Goals
  - Requirements
- Preliminary results
- Research plan

Modeling Facebook
(posting and tagging)

Modeling Facebook
(posting and tagging)

- Facebook's profile, walls, posts, photos, tags, etc, can be modeled as entities, and privacy settings can be modeled as attributes

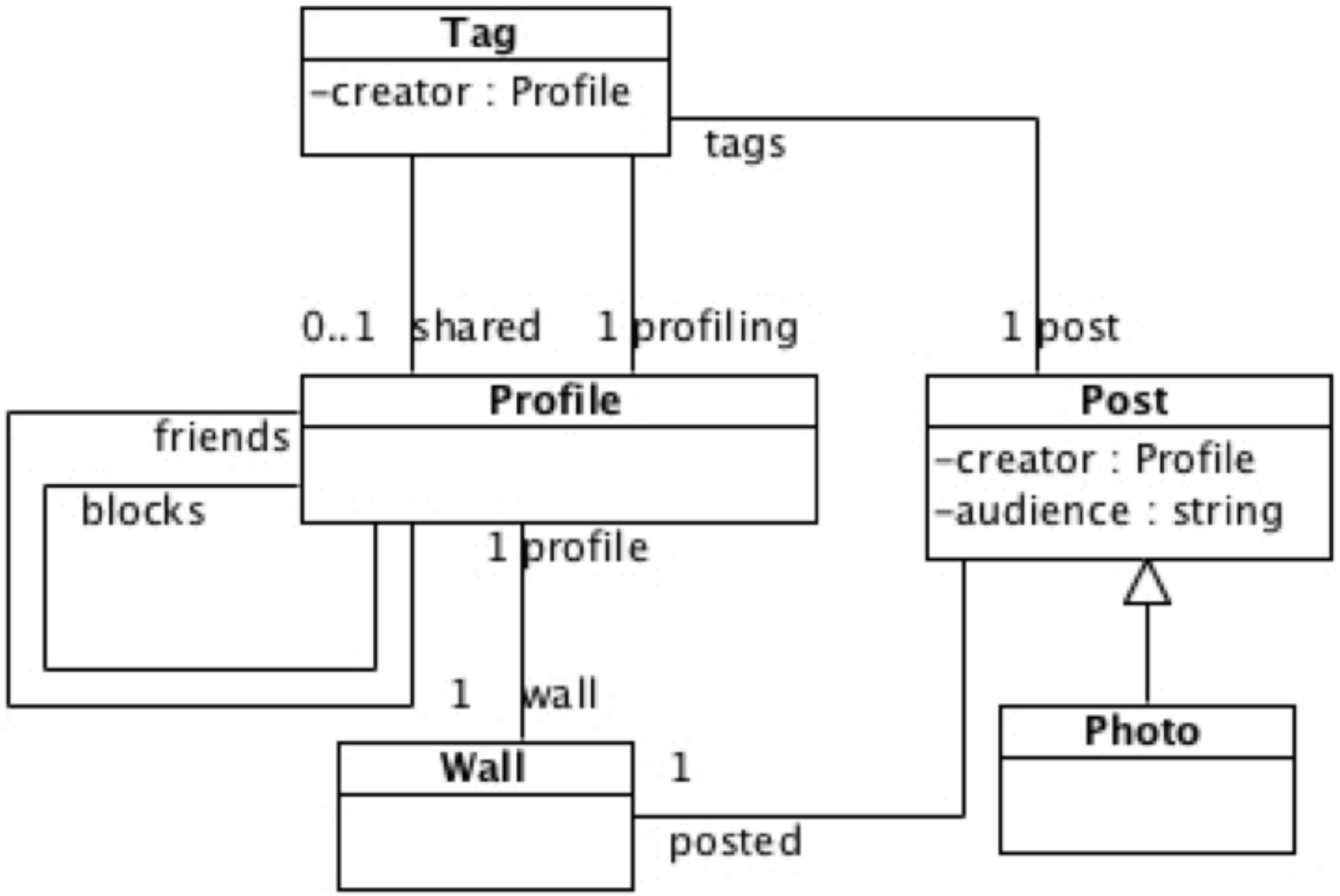
Modeling Facebook
(posting and tagging)

- Facebook's profile, walls, posts, photos, tags, etc, can be modeled as entities, and privacy settings can be modeled as attributes

- Facebook's privacy clauses are modeled using OCL

Facebook data model

Facebook data model

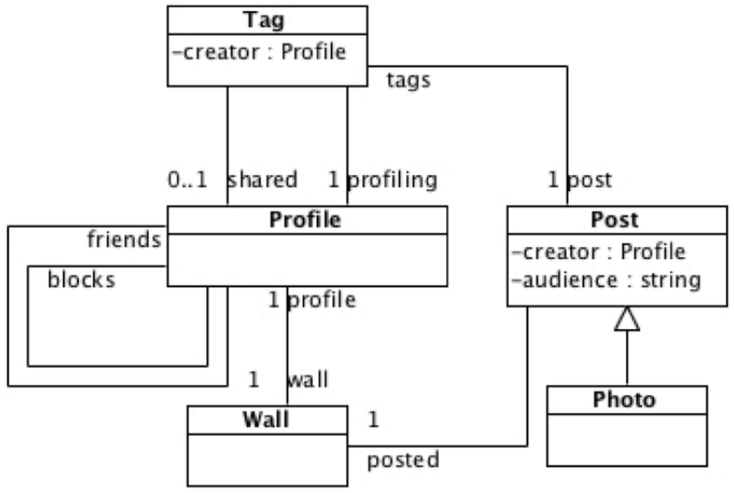


Facebook

(authorization constraints)

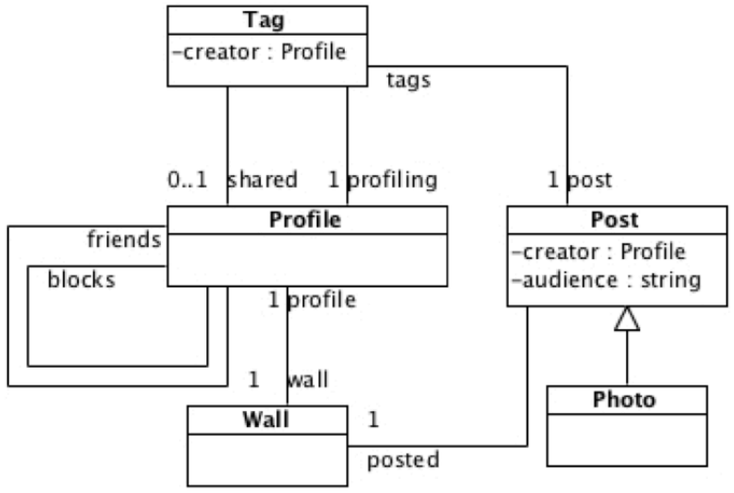
Facebook

(authorization constraints)



Facebook

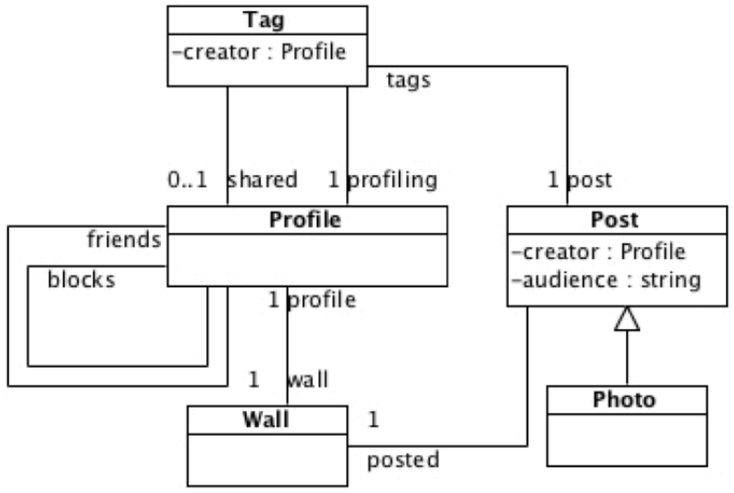
(authorization constraints)



- anybody (@caller) can read any post (@post) that is posted in his/her wall, independently of the creator of the post

Facebook

(authorization constraints)

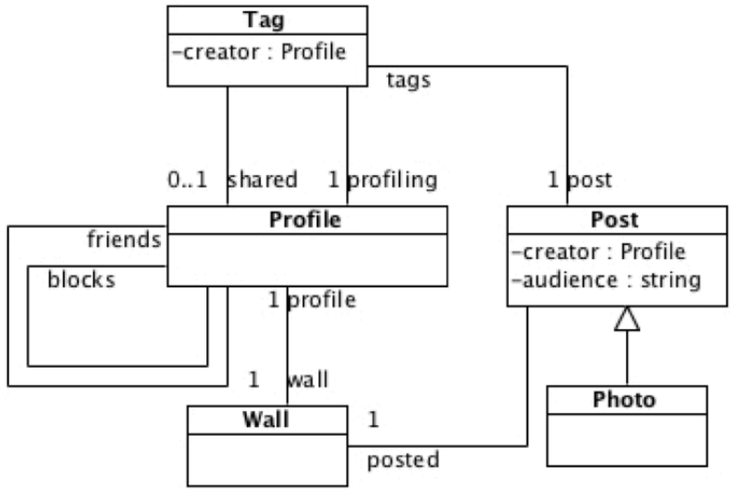


- anybody (@caller) can read any post (@post) that is posted in his/her wall, independently of the creator of the post

```
@caller=@post.posted.profile
```

Facebook

(authorization constraints)



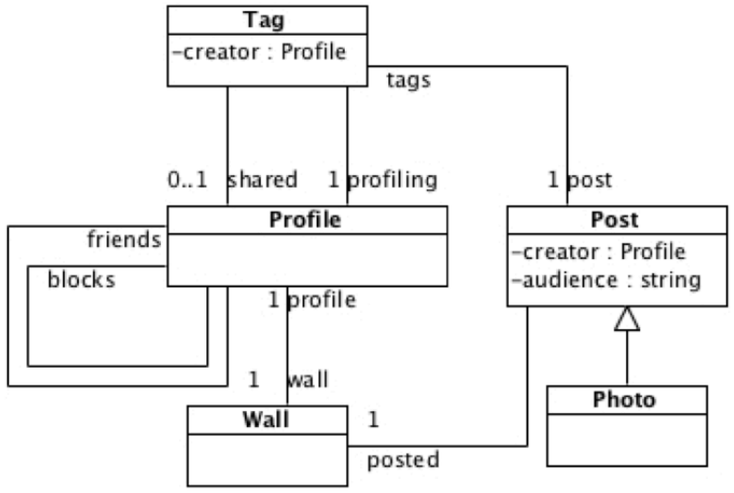
- anybody (@caller) can read any post (@post) that is posted in his/her wall, independently of the creator of the post

```
@caller=@post.posted.profile
```

- anybody (@caller) can read any post (@post) that is posted in a wall when he/she is a friend of the owner of the wall and the audience selected is “Friends”

Facebook

(authorization constraints)



- anybody (@caller) can read any post (@post) that is posted in his/her wall, independently of the creator of the post

```
@caller=@post.posted.profile
```

- anybody (@caller) can read any post (@post) that is posted in a wall when he/she is a friend of the owner of the wall and the audience selected is “Friends”

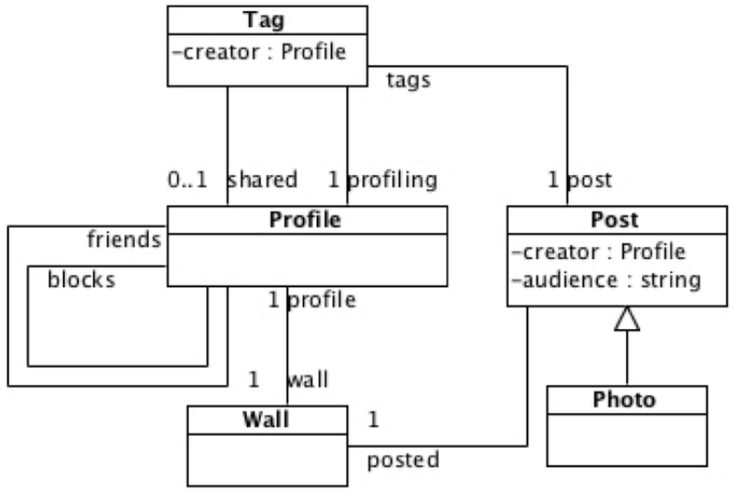
```
@post.posted.profile.friends->includes(@caller)
and @post.audience='Friends'
```

Facebook

(authorization constraints)

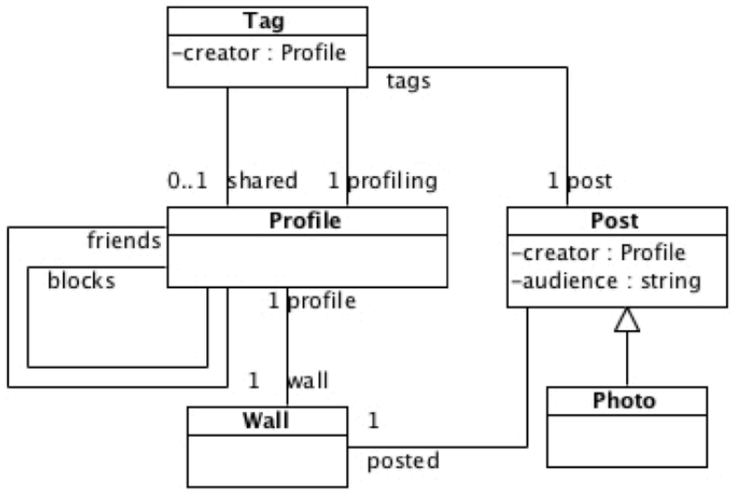
Facebook

(authorization constraints)



Facebook

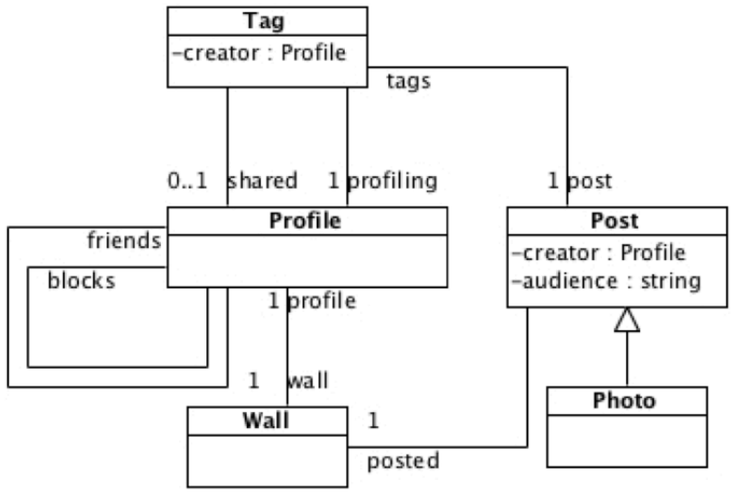
(authorization constraints)



- anybody (@caller) can read any post (@post) that is posted in a wall,
  - when the audience selected is “Friends”,
  - he/she is a friend of somebody tagged on the post,
  - he/she is not blocked by the owner of the wall, and
  - the owner of the post happens to be the creator of the post

Facebook

(authorization constraints)



- anybody (@caller) can read any post (@post) that is posted in a wall,
  - when the audience selected is “Friends”,
  - he/she is a friend of somebody tagged on the post,
  - he/she is not blocked by the owner of the wall, and
  - the owner of the post happens to be the creator of the post

```
@post.audience='Friends' and
@post.tags.profiling.friends->includes(@caller)
and
@post.posted.profile.blocks->excludes(@caller)
and @post.posted.profile=@post.creator
```

Outline

- Social Networks
  - Facebook
  - Privacy
- Research project
  - Goals
  - Requirements
- Preliminary results
- Research plan

Research plan

Research plan

- we have formalized, using SecureUML +OCL, the Facebook's privacy policy for tagging and posting

Research plan

- we have formalized, using SecureUML +OCL, the Facebook's privacy policy for tagging and posting
  - our understanding of this policy is based on the available information and our "experiments".

Research plan (cont.)

Research plan (cont.)

- we plan to formalize the whole Facebook's privacy policy (including for advertisements, applications, and so on).

Research plan (cont.)

- we plan to formalize the whole Facebook's privacy policy (including for advertisements, applications, and so on).
  - we are trying to contact Facebook: no success yet :-) !!!

Research plan (cont.)

- we plan to formalize the whole Facebook's privacy policy (including for advertisements, applications, and so on).
  - we are trying to contact Facebook: no success yet :-) !!!
- we plan to use existing mappings from OCL to first order logic to apply theorem proving tools to analyze the Facebook's privacy policy.

Potential impact

Potential impact

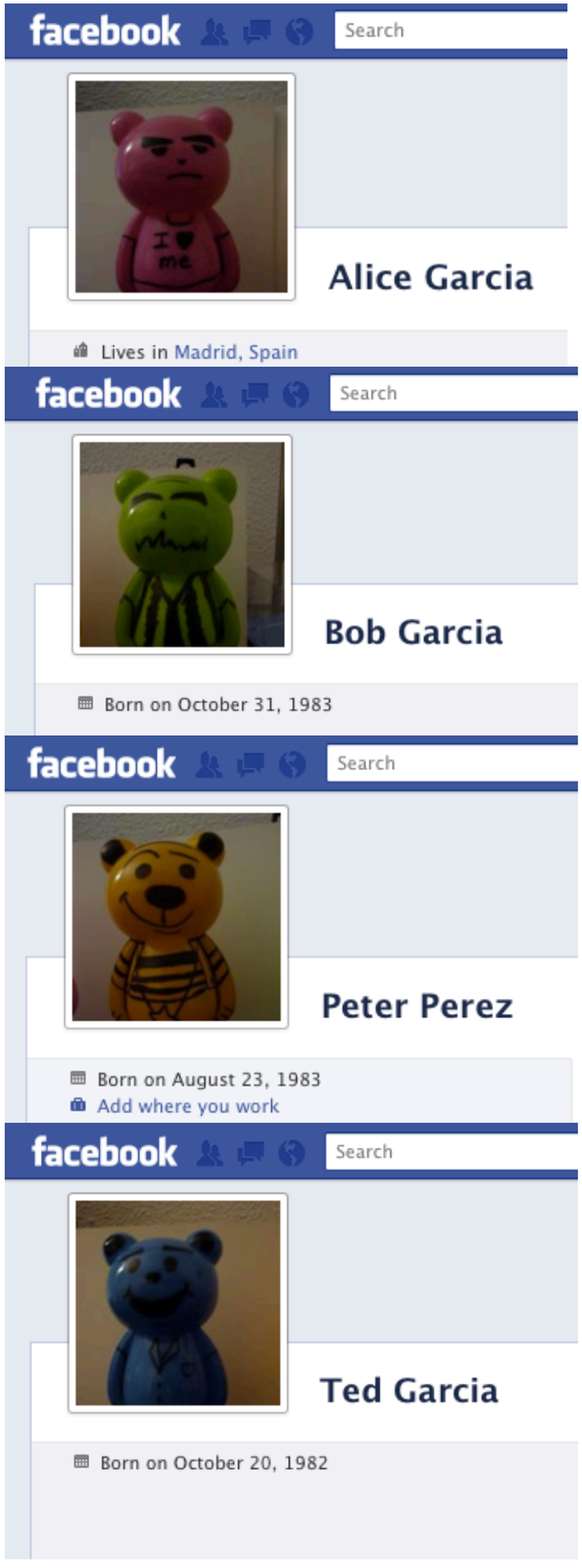
- a tool for checking whether a person can see a post.

Potential impact

- a tool for checking whether a person can see a post.
- a tool for assessing the risk/posibility of a post becoming visible for a person

Potential impact

- a tool for checking whether a person can see a post.
- a tool for assessing the risk/posibility of a post becoming visible for a person
- a tool for assessing the impact, on the visibility of a post, of a default privacy policy



Thanks!!

Questions?