

# Towards a Reference Model for Social User Profiles Concept & Implementation

neturalcommunication

Digital Media in Excellence.

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- Motivation
- Approach
- Packages & Classes
- Implementation
- Evaluation
- Ongoing and Future Work
- Discussion
- References



Reference Model for Social User Profiles **Motivation** 

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# Current situation

#### Many social networks (SN)

- Facebook, LinkedIn, XING, Twitter, MySpace, Google+, ...
- → different purposes & communities
- → scattered user profiles

#### Various user models (UM)

- FOAF, SIOC, OpenSocial, Relationship Ontology, GUMO, URM, UUCM, GRAPPLE, ...
- different coverage & granularity
- → little focus on social aspects

→ Common basis ? ←

# Goal

- Design of a reference model for social user profiles
- Basis for evaluation of SNs & UMs and for implementation
- Capability to represent quantitative and qualitative user preferences at different granularities



Reference Model for Social User Profiles Approach

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# Rationale behind

- Reuse
  - Bottom-up: from existing SNs and UMs
  - Top-down: surveys on user modeling

(e.g., Carmagnola et al., [4], Stefanidis et al., [8], Torre et al., [9])

- Focus on meta information
  - **Privacy:** access control and anonymity (e.g., Wang and Kobsa, [10])
  - Provenance: generation and usage of resources (e.g., Moreau et al., [7])
  - Context: environment of a resource (e.g., Tanca et al., [3])
  - Quality: consistency, accuracy, reliability, etc. (e.g., Batini et al., [2])
- Expressivity
  - include concrete concepts from existing SNs & UMs
     → for simplification of queries and inference
- Extensibility
  - include further SNs & UMs
    - $\rightarrow$  generic components to express arbitrary facts



## Reference Model for Social User Profiles Packages & Classes (1)

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# Reference Model for Social User Profiles Packages & Classes (2)





- First prototypical implementation in OWL 2
  - Generic class Resource and domain specific extensions



- Relation is modeled explicitly as resource
  - to have a URI
  - <owl:inverseOf> and property chains to infer direct
    relations between resources





## Reference Model for Social User Profiles Implementation (2): Prototype in OWL2

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 Default RDF style: triples with subject, predicate, object





# Reference Model for Social User Profiles Implementation (3): Prototype in OWL2

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# Reification of datatype properties

(to attach meta information)





# Reification of object properties

(to attach meta information arbitrarily)





hasTarget

setOn



hasSource

user35accessName

publicAccess

"2010-10-20"



## Reference Model for Social User Profiles Implementation (6): Benefits

- Benefits
  - Mappings of arbitrary SNs and UMs
  - Extensions to the model if required
  - Reasoning on generic or specific level
  - Integration with external knowledge bases
  - Export of integrated profiles according to the Linked Data Initiative



Motivation ■ Approach ■ Packages & Classes ■ Implementation ■ Evaluation ■ Future Work ■ Discussion ■ References

- Purpose of reference models: aid development of specialized models, supporting specific requirements and scenarios
- Assessing coverage and overlap of
  - available data from SNs
    - Facebook

[http://www.facebook.com/]

- LinkedIn
   [http://www.linkedin.com/]
- Twitter

[http://twitter.com/]

MySpace

[http://www.myspace.com/]

concepts from existing UMs

- FOAF: Friend of a Friend [http:// xmlns.com/foaf/spec/]
- SIOC: Semantically-Interlinked Online Communities [http://rdfs.org/ sioc/spec/]
- OpenSocial [http:// www.opensocial.org/]
- GUMO: General User Model Ontology (cf. Heckmann et al., [5])
- URM: User Role Model (cf. Zhang et al., [11])
- UUCM: Unified User Context Model (cf. Mehta et al., [6])



## Reference Model for Social User Profiles Evaluation (2)





Reference Model for Social User Profiles Evaluation (3)





Reference Model for Social User Profiles **Evaluation (4)** 

Motivation ■ Approach ■ Packages & Classes ■ Implementation ■ Evaluation ■ Future Work ■ Discussion ■ References

# **Lessons learned**

- (1) **Integration** of multiple SNs increases **coverage** of user profiles
- (2) Social **cognition** is **hardly provided** by SN, especially desires and **preferences** are not provided explicitly
- (3) UMs are **diverse** and often **focused**
- (4) **OpenSocial** fits most evaluated SNs, **specialized models** for particular focus
- (5) MetaInfo is rarely incorporated by SN and UM



## Reference Model for Social User Profiles Ongoing and Future Work (1)

Motivation ■ Approach ■ Packages & Classes ■ Implementation ■ Evaluation ■ Future Work ■ Discussion ■ References

# Language to define resources and relations

- OWL generator based on Xtext
- Editor in Eclipse
- Simple syntax with classes and properties
- Automatic reification of properties
- Generation of property chains for direct relationships





## Reference Model for Social User Profiles Ongoing and Future Work (2)

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# **OWL generator**

#### Input:

- input code
- abstract language specification



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#### Output: ontology in OWL





## Reference Model for Social User Profiles Ongoing and Future Work (3)

- Build adaptors to extract instance data from SN and external knowledge bases
- Integrate data and build social user profiles
  - Definition of **mappings** for individual concepts
- Semantic-based social profiling
  - **Performance** evaluation (reasoning)
  - Brokerage (bringing together social networkers and service providers)
- Track provenance
  - e.g., using OPM (Open Provenance Model) (cf. Moreau et al., [7])
- Implementation of privacy
  - e.g., using AC4RDF (Access Control For RDF) (cf. Abel et al., [1])



# Reference Model for Social User Profiles **Discussion: Open Issues**

Motivation ■ Approach ■ Packages & Classes ■ Implementation ■ Evaluation ■ Future Work ■ Discussion ■ References

- Generality vs. expressiveness
  - Right level of detail for domain specific extensions?
    - Complexity of the model/ontology

# Reuse of existing concepts

- Which social networks and user models should be included?
  - Employ it as taxonomy
- Degree of formalization
  - How detailed should the model specify semantics?
    - Comments vs. formalized rules (exchangeable)
    - Automated reasoning



# Reference Model for Social User Profiles **References**

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# Thank you!



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## **Evaluation**

#### **Packages and comprised concepts**

MetaInfo	<ul> <li>Access control, policy, permission, preference, integrity, anonymity</li> </ul>
	<ul> <li>Artifact, process, agent, usage, generation, control, trigger, derivation, role, originator, submitter,</li> </ul>
	<ul> <li>Completeness, conciseness, consistency, accuracy, timeliness, relevancy, reliability, believability,</li> </ul>
	<ul> <li>Location, time, date, duration, software, hardware</li> </ul>
Relation	<ul> <li>Identification, demographics, ownership</li> </ul>
	<ul> <li>Participation, production, usage, action</li> </ul>
	Communication
	<ul> <li>Friendship (user to user), membership (group)</li> </ul>
	<ul> <li>Personality, desires, preferences, beliefs, feelings, interests, competence, taste</li> </ul>
	•Studies, work
	<ul> <li>Blog (user to group), chat (addressed)</li> </ul>



#### **Evaluation** Social networks / User models & APIs

#### **Social networks**

- **Facebook** (Graph API)
- LinkedIn
- MySpace
- Twitter
- XING

#### Details and references:

http://social-nexus.net/

#### **User models & APIs**

- BIO (Biographical Information)
- Competence Ontology
- DCMES (Dublin Core Meta)
- **FOAF** (Friend of a Friend)
- GRAPPLE (Generic Responsive Adaptive Personalized Learning Environment User Modeling Ontology)
- **GUMO** (General User Model Ontology)
- HR-XML (Human Resources)
- OpenSocial
- OPMV (Open Provenance Model)
- PIMO (Personal Information Model)
- Relationship Ontology
- **SIOC** (Semantically interlinked online communities)
- URM (User Role Model)
- **UUCM** (Unified User Context Model)



#### Evaluation Social network selection

#### Social networks

- Facebook (Graph API)
- LinkedIn
- MySpace
- Twitter
- XING

#### **Top sites worldwide (selection)**

(<u>http://www.alexa.com/topsites/global</u>, 28.2.2011)

- 2. Facebook
- 3. YouTube
- 6. blogger.com
- 9. Twitter
- 10. QQ.com
- 17. LinkedIn
- 33. Flickr
- 40. V Kontakte
- 68. MySpace
- 81. Orkut
- 185. Skype
- 233. icio.us
- 244. XING
- 255. Hi5

Details and references:

http://social-nexus.net/



#### **Utilization of reference models**\*

- Framework for the identification, development, and coordination of related standards
- Development of more specialized models to support specific requirements and scenarios
- ... may be mapped onto a collection of software components and data flows between those components, to obtain a so-called reference architecture (refinement & implementation → system architecture)
- ... enables the use of an architecture-based development process (characterized by composing or assembling separately developed components into a functional entity, while respecting the constraints and organizational structure imposed by the system architecture)

\*: Mišić, Zhao, Evaluating the Quality of Reference Models, ER2000 Conf., LNCS 1920, 2000, Springer



#### Reference model Concepts

#### **Important concepts for reference models**\*

- Abstract
- Entities and relationships
- Clarification within an environment or problem space (do not describe "all things")
- Technology agnostic

   (no assumptions about technology or platforms)
- \*: http://en.wikipedia.org/wiki/Reference\_model (28.5.2011)



#### **TheHiddenU** System Architecture





#### Problems

#### Scattered Social Content

- in many diverse social networks
- potential heterogeneities, redundancies, and even contradictions

#### Reluctant to Share

content with service providers
 as long as it is obscure and beyond their control

#### Untargeted Service Provision

- though personalized services would be demanded

#### Goals

- Semantic-based mechanisms to leverage techniques for integrating, profiling and privatizing social content
- Bring together social networkers & service providers through brokerage



TheHiddenU Challenges & Components

## Challenges

#### Semantic-based Profiling

- Profiler composition language for service providers
- Extensible library of **reusable profiler** (input, reasoning, provisioning)

#### Semantic-based Brokerage

- Flexible **registering** of services
- Comfortable discovering & subscribing to services
- **Provisioning** of services (API and protocols)

#### Components

- Service Provider Directory
  - to make providers' services available to social networkers
  - to filter according to profile information, friends, and interests

#### Service Bazaar

- to discover and subscribe to services
- to match between info demand of services and privacy demands of social networkers