Semantic Web as a Platform for Distributing Cognition

International Semantic Web Doctoral Symposium (ISWDS)

Galway, Ireland, 7th November 2005

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Outline

- Problem statement
- Background: Theory of distributed cognition
- Approach: Distributing Cognition using the Semantic Web
    - internalization and information filtering
- Practical framework: The DYNAMOS project

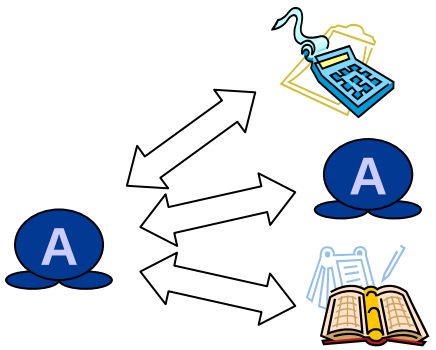
Problem Statement and Proposed Solution

For various reasons, people typically do not access the Web content that would best assist them in performing their current task. (This phenomenon gets amplified in mobile and context-aware scenarios.)

Facilitate the access of material in the Web by allowing people to create and consume a personalized layer of domain- and task-specific information encoded with Semantic Web languages.

Theory of Distributed Cognition

- Cognitive systems consisting (also) of elements which are external to agents
  - artifacts
  - other agents
- Hollan et al. (2000):
  - “Cognitive processes may be distributed across the members of a social group
  - Cognitive processes may involve coordination between internal and external (material or environmental) structure
  - Processes may be distributed through time in such a way that the products of earlier events can transform the nature of later events”
- Application areas: user interface design, ship navigation, airline cockpit control, CSCW, interior design, etc.

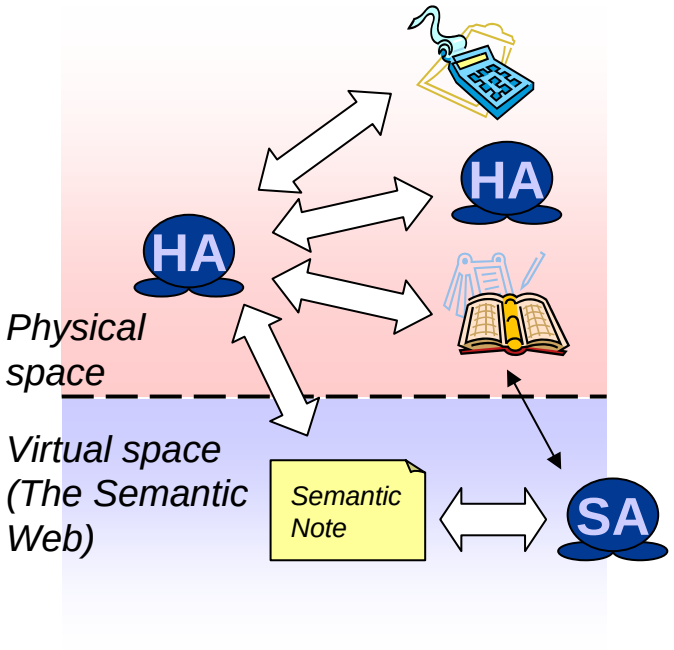


Theory of Distributed Cognition (contd.)

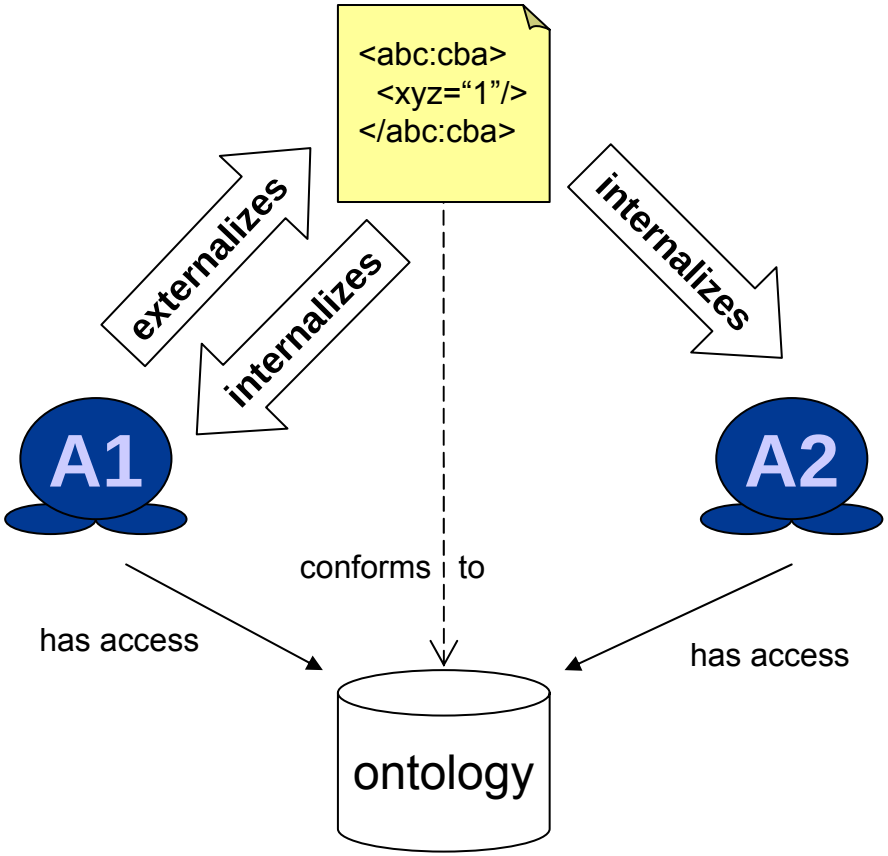
- Distributed Cognition Lab at UCSD: http://hci.ucsd.edu/lab/
  - Ed Hutchins, Jim Hollan, David Kirsh
- Hutchins: *Cognition in the Wild* (1995)
  - US Navy ship navigation
  - relationships between crew and also artifacts
  - expertise
- Activity Theory
  - grounded on dialectic materialism: relationship between a subject and an object is formed via a mediating artifact
  - Vygotsky, L. S. (1978). *Mind in society: the development of higher psychological processes*
  - Leont'ev, A. N. (1978). *Activity, consciousness, and personality*

Distributing Cognition in the Semantic Web

- Semantic Notes as media for distributing cognition
  - Semantic Notes encoded with Semantic Web languages → possibility of including software agents as ”cognition distributors”
- Attaching metadata to Semantic Notes
- Recognizing user contexts
  - activity, location, time, etc.
  - automatically retrieved as well as manually entered
- Matching user contexts with Semantic Notes
  - via user profiles
  - using history data
- Structured and/or unstructured content in the Semantic Notes
  - has impact on the machine-accessibility



Internalization and Externalization Processes

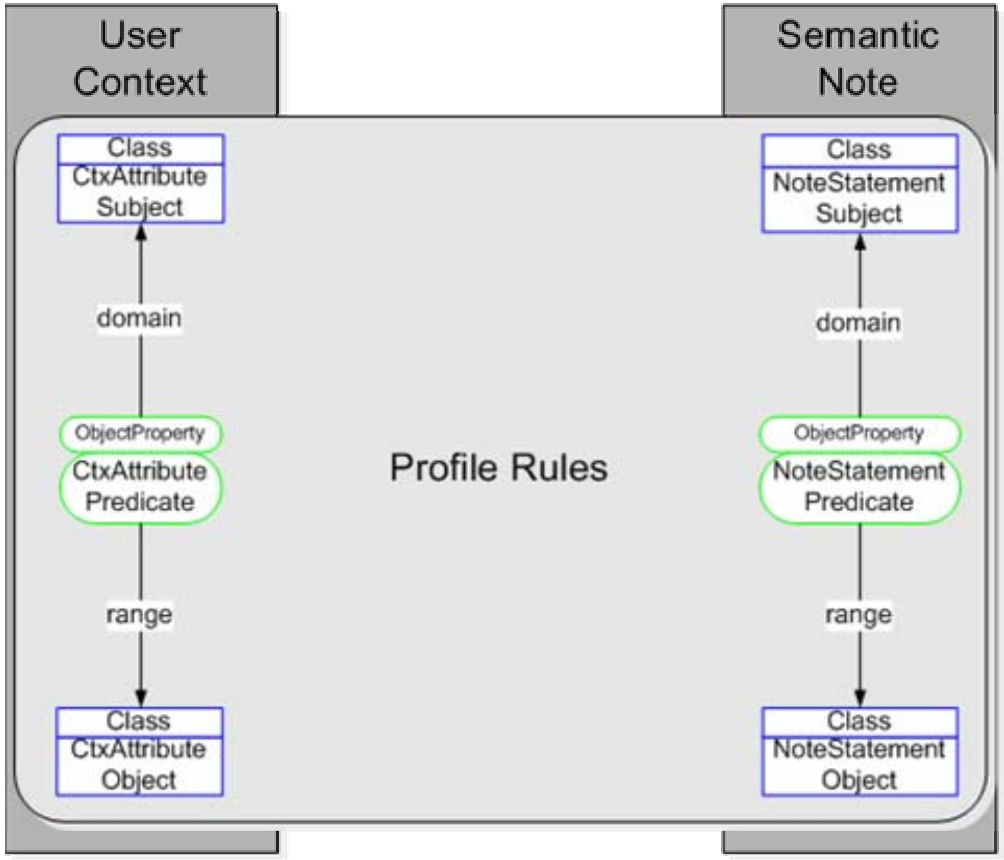


Prerequisite for internalization is that the Semantic Note is understood. Semantic Notes (n) consist of statements (s), which consist of terms (t) corresponding to concepts (φ) found in ontologies (o), which are accessible to the agents (a):

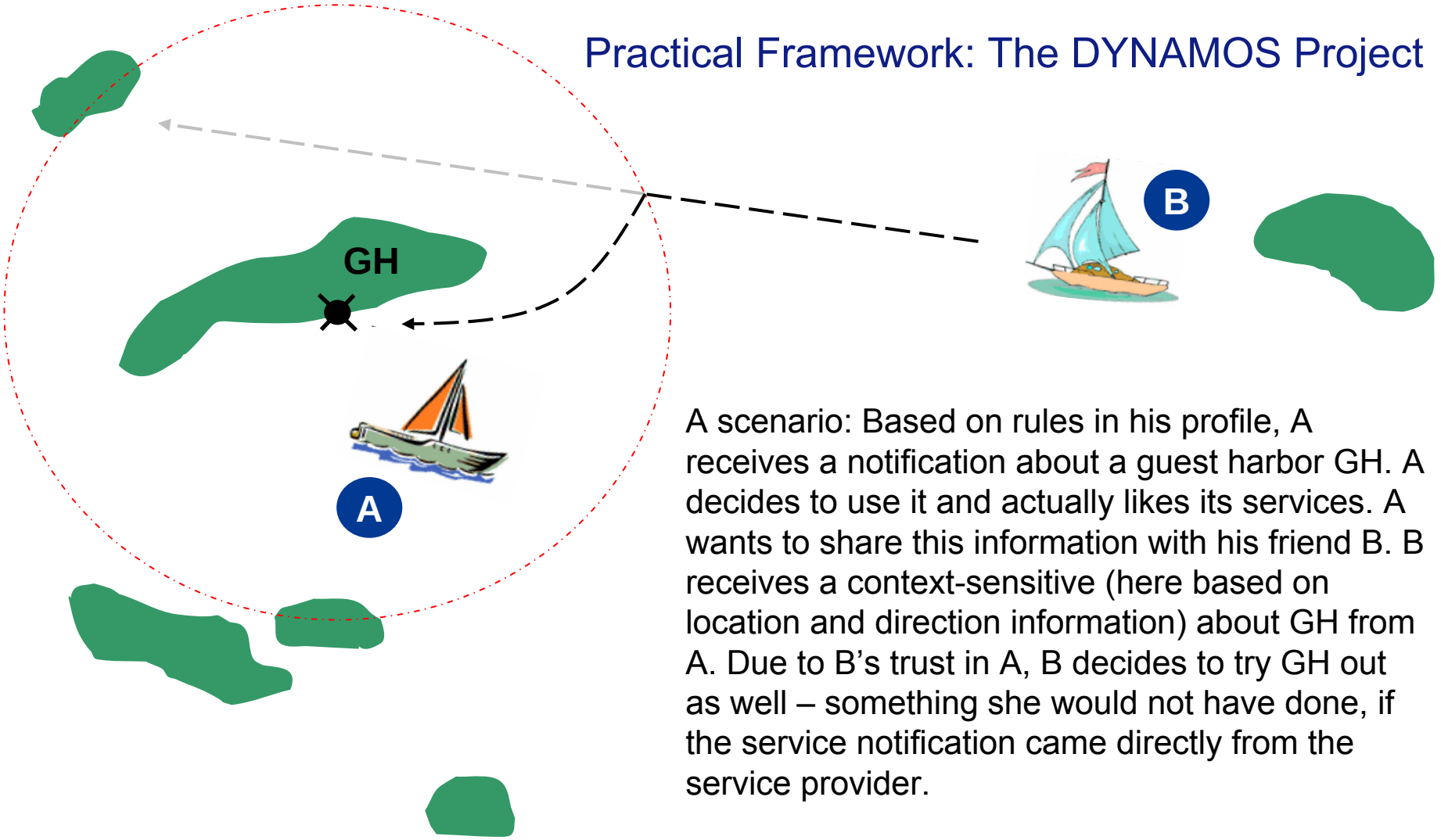
$$understands(a,s) \leftrightarrow \forall t : (t \in s \rightarrow \exists \phi : (conforms(t,\phi) \wedge \phi \in o \wedge access(a,o)))$$

However, also determining the relevance of the Semantic Note is important wrt. internalization

Matching Rules for Information Relevance Determination



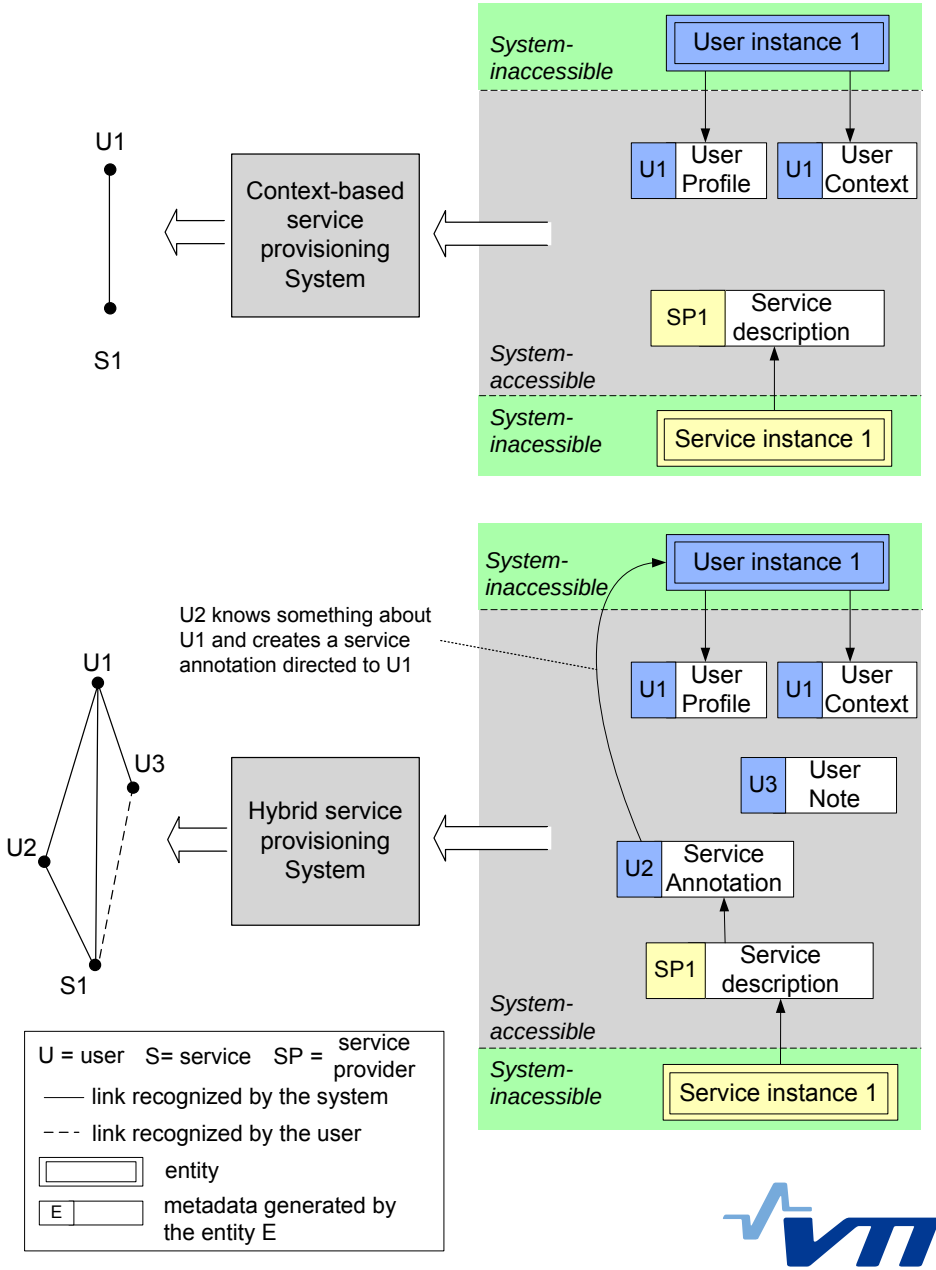
Practical Framework: The DYNAMOS Project



A scenario: Based on rules in his profile, A receives a notification about a guest harbor GH. A decides to use it and actually likes its services. A wants to share this information with his friend B. B receives a context-sensitive (here based on location and direction information) about GH from A. Due to B's trust in A, B decides to try GH out as well – something she would not have done, if the service notification came directly from the service provider.

DYNAMOS Characteristics

- Three kinds of content
  - Service Descriptions (SP)
  - Service Annotations (U)
  - User Notes (U)
- Matching these content based on user contexts and profile rules
- Recognizing the implicit and explicit user interests
- Project participants: VTT, HIIT, TEKES (Fenix), ICT Turku, Suunto, TeliaSonera
- Project website: http://www.vtt.fi/tte/proj/dynamos/



Conclusions and Future Work

- People distribute their cognition all the time
- The Web contains vast amount of information
- Using the Web as a medium for distributing cognition
  - Semantic Web technologies → distributed content is (at least partly) machine-accessible
- Determining information usefulness when internalizing content

- Considering trust strategies wrt. internalization
- Relationship between internalization and externalization
- How could the content distributed in the web stand out and compete with other structures (study affordances etc.)?
- Active vs. passive components for distributing cognition in the Semantic Web
- Assigning weights for the statement kinds (metadata vs. content, etc.)
  - subjective vs. defaults

Thank You!

- Questions?

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