OIC 2008

Information Model for Non-hierarchical Information Management

Christian Mårtenson & Pontus Svenson

Swedish Defence Research Agency (FOI)

FOI

Outline

- Semantic technologies for information fusion
- The Semantic MilWiki
- Transformation distances
- Knowledge Support
- Non-hierarchical information management
- Observations

FOI

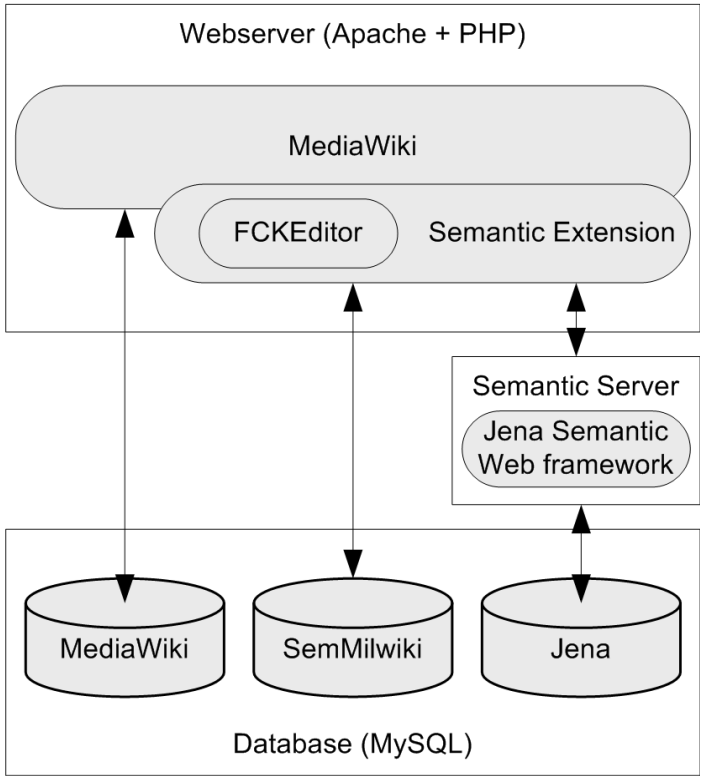
Semantic technologies for information fusion

- Information fusion deals with the combination and integration of data from different sources (sensors, human observers, databases, simulation) in order to help users achieve situation awareness.
- User involvement is a vital part of fusion
- Semantic techniques could be used to determine what information should be sent to which fusion algorithms [SPIE-paper, to appear]

FOI

Semantic MilWiki

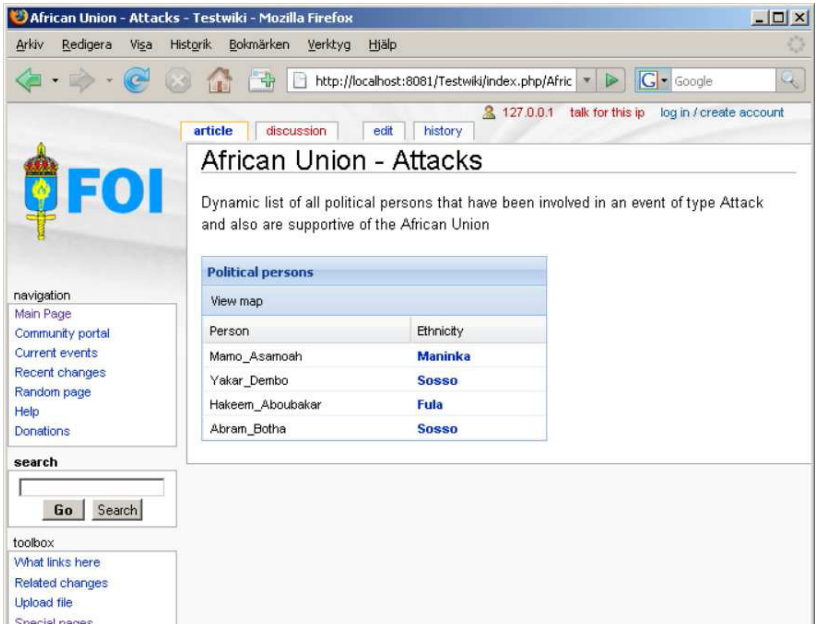
- FOI plug-in to MediaWiki
  - Semantic annotation
  - JENA reasoner
  - SPARQL-Wizard

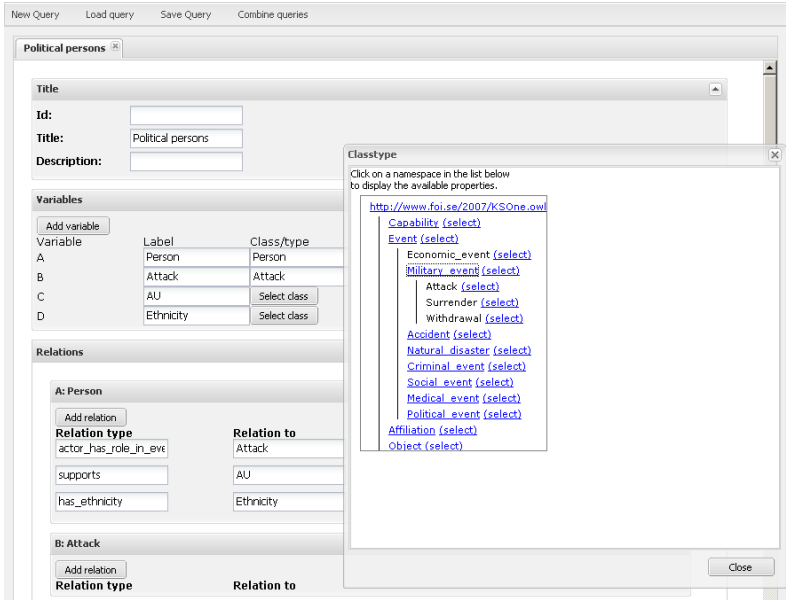


FOI

Semantic MilWiki

- Combining structured and unstructured information
- Dynamic content
- Collaborative (semantic) editing





FOI

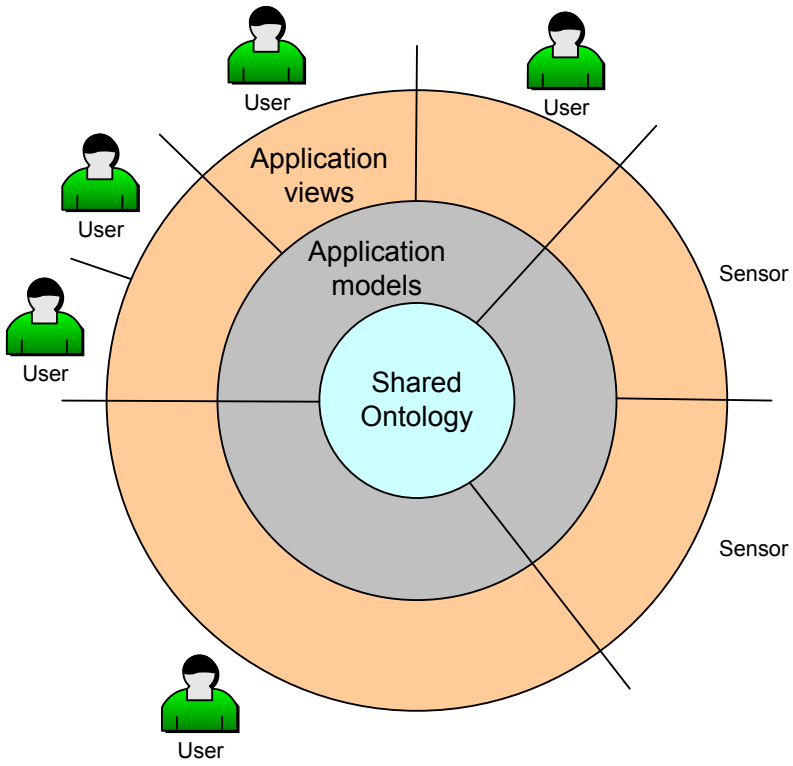
Layers of ontologies

- *Shared ontology*. In order to build systems of systems, a shared ontology can be applied to enable interoperability (JC3IEDM for C2-domain)
- *Application model*. Each application has a dedicated information model for optimal manipulation and storage of its data
- *Application view model*. The application interfaces are designed to serve user needs in an intuitive way. The representation of information in the interface defines an implicit ontology.
- *User model*. Each user of the system has its own mental model of the world and the system, depending on things like current task, role and cultural background.

FOI

Transformation distances

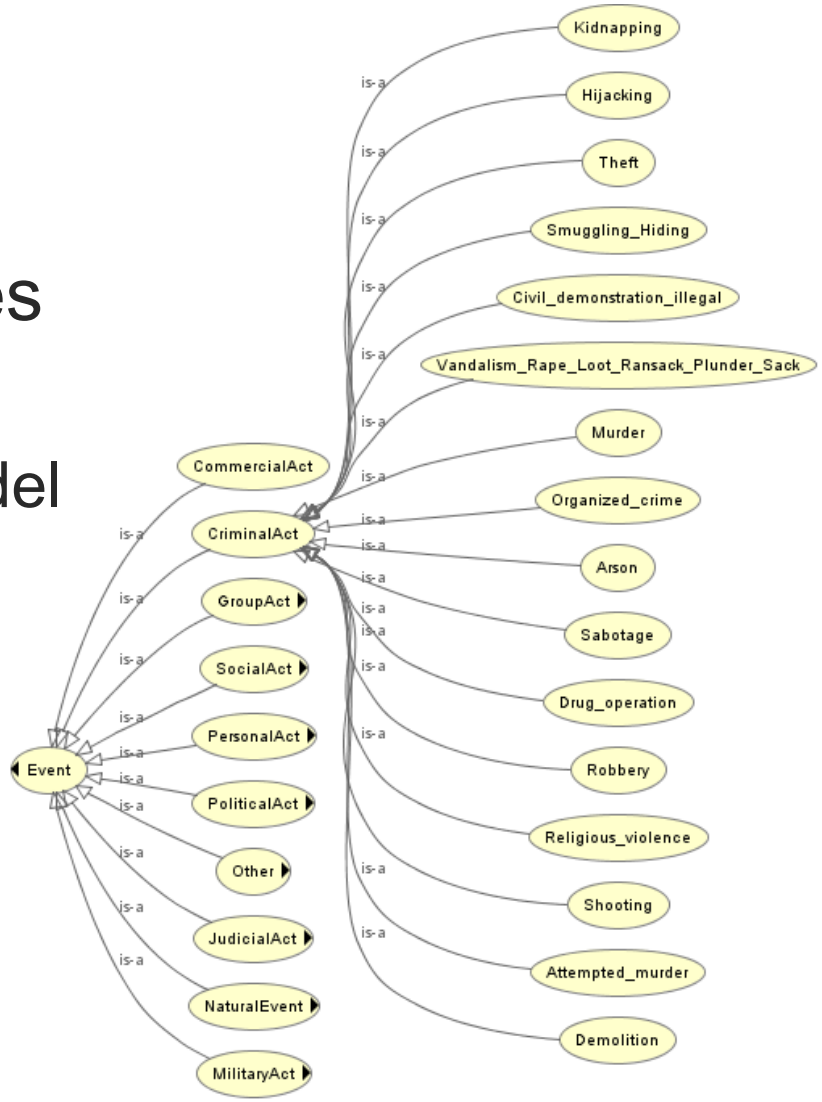
- Information between different ontology layers has to be transformed
- By *transformation distance* we mean the degree of heterogeneity of two ontologies
- Long transformation distances increase risk for incompatibilities



FOI

Ontology

- Designed for minimal transformation distances
  - Close to both shared ontology and user model
- Based on JC3IEDM
  - Added deeper hierachies for classes and relations
  - Added inverses, transitivity, symmetry



FOI

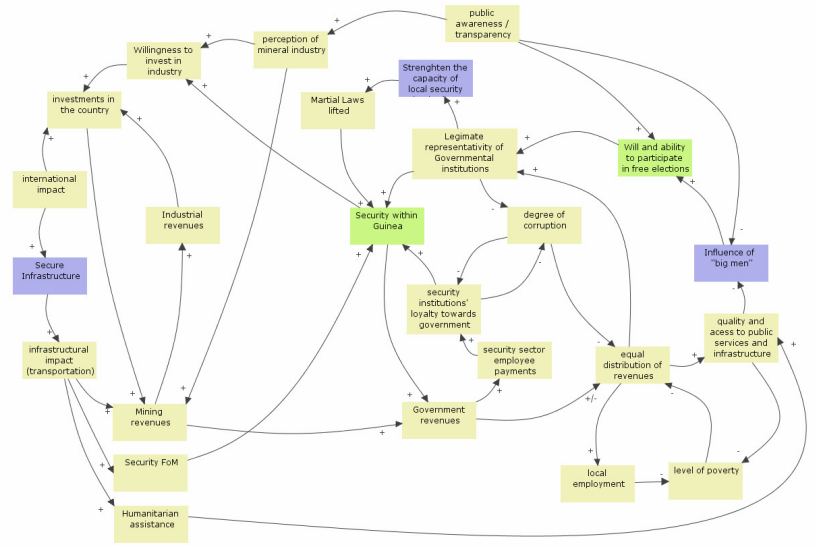
Experiments

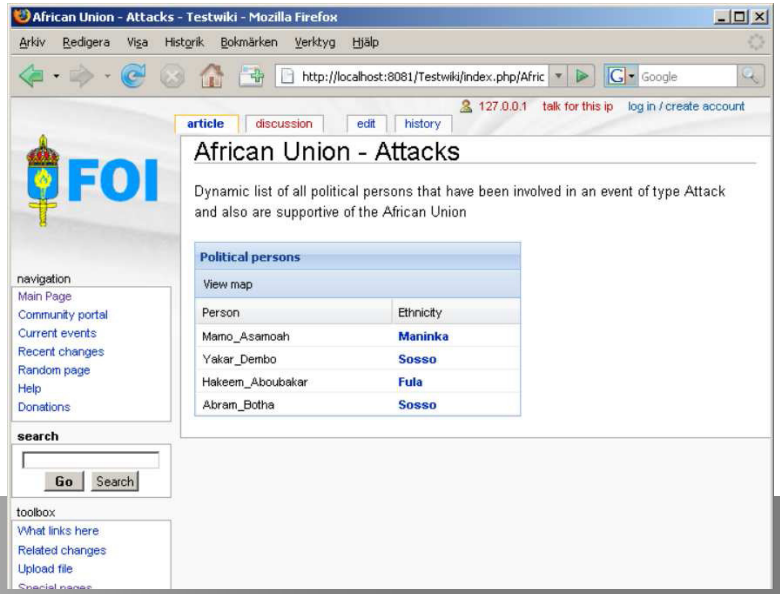
- Two ”explorative” workshops at the Joint C,D & E Centre (Swedish Armed Forces)
  - Knowledge Support (KS)
  - Non-hierarchical Information Management (NHIM)

FOI

Knowledge Support

- Developes new intelligence doctrine at operational level
- Uses systems analysis to produce knowledge
  - Semantic MilWiki could feed the model with facts
  - Dynamic queries catches new information and suggests model updates
- Example
  - List all political persons that have been involved in an attack AND support the African Union

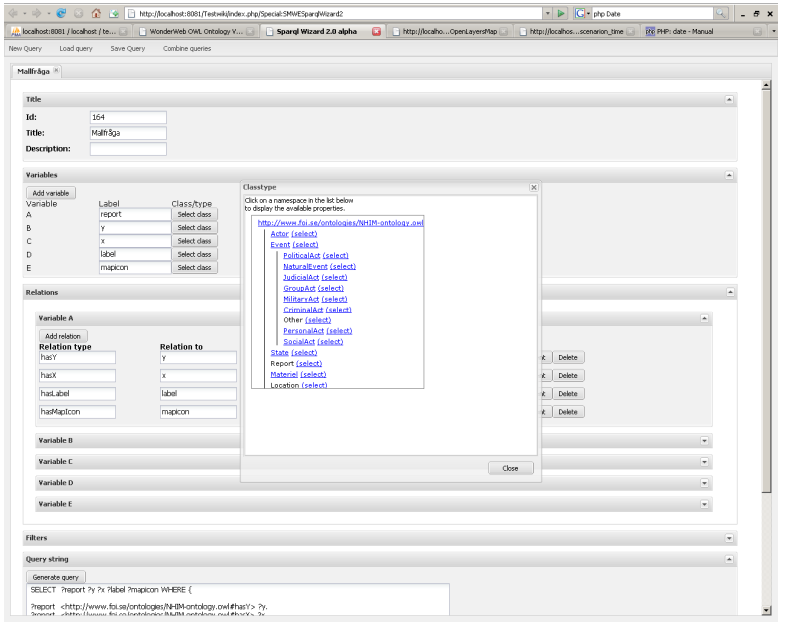


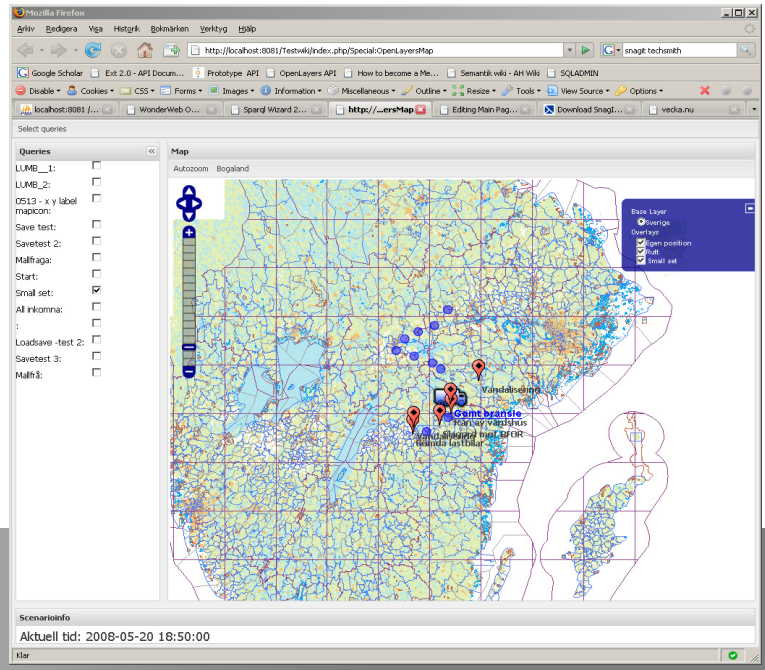


FOI

NHIM

- Improve decision-making using non-hierarchical information paths
  - Faster but also *more* information
- Semantic queries used to select information to show to platoon commanders on an escort mission
- Example subscription
  - All incoming reports on red activities along the planned route





FOI

Observation 1

- Different approaches to ontolology construction
  - In KS the analysts presumed knowledge needs were used as basis (top down, user-driven)
  - In NHIM the intelligence reports formed the starting point (bottom up, data-driven)
- The approaches can (should) be used in combination

FOI

Observation 2

- Conceptual mismatch between producers and consumers in NHIM (a transformational distance on user model level)
  - Producers: Tagging of intelligence reports fairly straight-forward using *objective* tags (involved actors, type of event, location)
  - Consumers: Formulating subscription queries fairly straight-forward using *subjective* tags (affects *Attitude_to_blue_forces*, *Road_conditions* or *Fuel_availability)*

FOI

Future work

- Investigate if context models (task, role, situation) can be used to translate subjective statements to objective
- Explore how the minimal transformation distance approach will hold when introducing fusion of uncertain statements
- Implement an information supply mechanism for information fusion systems based on semantic techniques
- Study how good relational extraction has to perform in order to be of value to an intelligence analyst

FOI

Questions…

cmart@foi.se

FOI