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# Information Model for Non-hierarchical Information Management

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# Outline

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

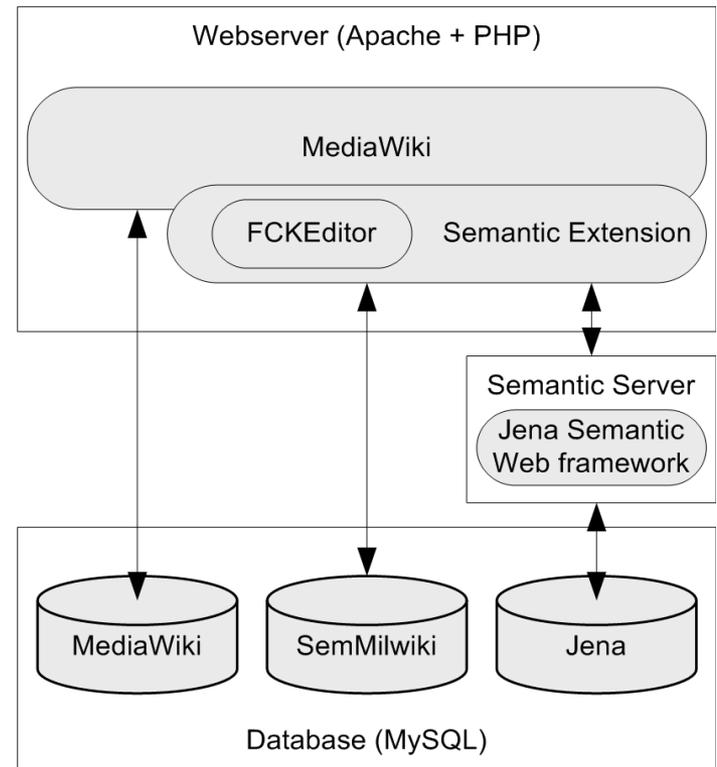
# Semantic technologies for information fusion

- ❖ 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]

# Semantic MiWiki

## FOI plug-in to MediaWiki

- Semantic annotation
- JENA reasoner
- SPARQL-Wizard



# Semantic MiWiki

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

**African Union - Attacks**

Dynamic list of all political persons that have been involved in an event of type Attack and also are supportive of the African Union

Person	Ethnicity
Mamo_Asamoaah	Maninka
Yakar_Dembo	Sosso
Hakeem_Aboubakar	Fula
Abram_Botha	Sosso

**Political persons**

Title:   
Id:   
Title: Political persons  
Description:

**Variables**

Variable	Label	Class/type
A	Person	Person
B	Attack	Attack
C	AU	Select class
D	Ethnicity	Select class

**Relations**

**A: Person**

Add relation

Relation type	Relation to
actor_has_role_in_event	Attack
supports	AU
has_ethnicity	Ethnicity

**B: Attack**

Add relation

Relation type	Relation to
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**Class type**

Click on a namespace in the list below to display the available properties.

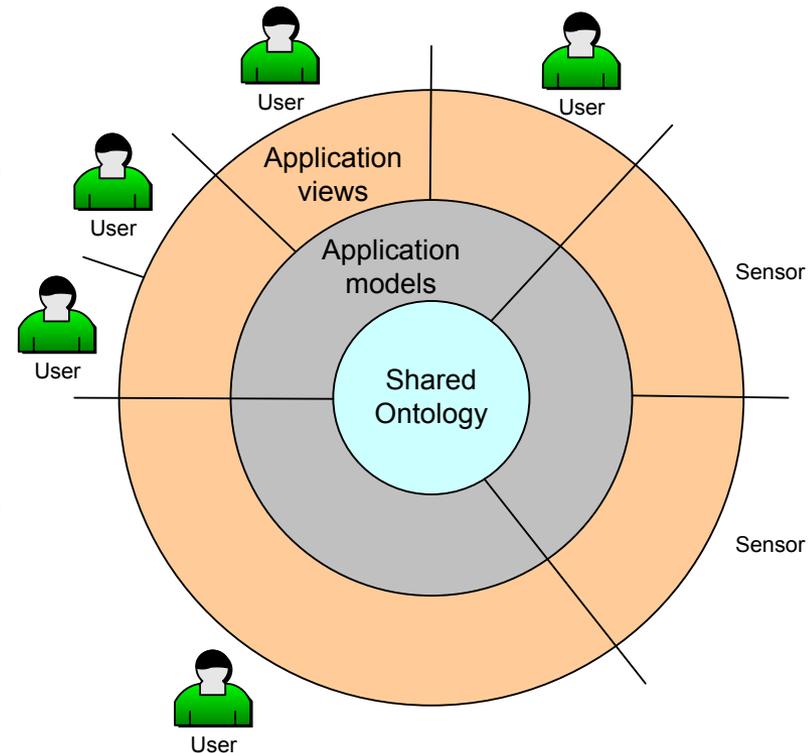
- <http://www.foi.se/2007/ks0ne.ow>
- [Capability \(select\)](#)
- [Event \(select\)](#)
- [Economic\\_event \(select\)](#)
- [Military\\_event \(select\)](#)
- [Attack \(select\)](#)
- [Surrender \(select\)](#)
- [Withdrawal \(select\)](#)
- [Accident \(select\)](#)
- [Natural\\_disaster \(select\)](#)
- [Criminal\\_event \(select\)](#)
- [Social\\_event \(select\)](#)
- [Medical\\_event \(select\)](#)
- [Political\\_event \(select\)](#)
- [Affiliation \(select\)](#)
- [Object \(select\)](#)

# 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.

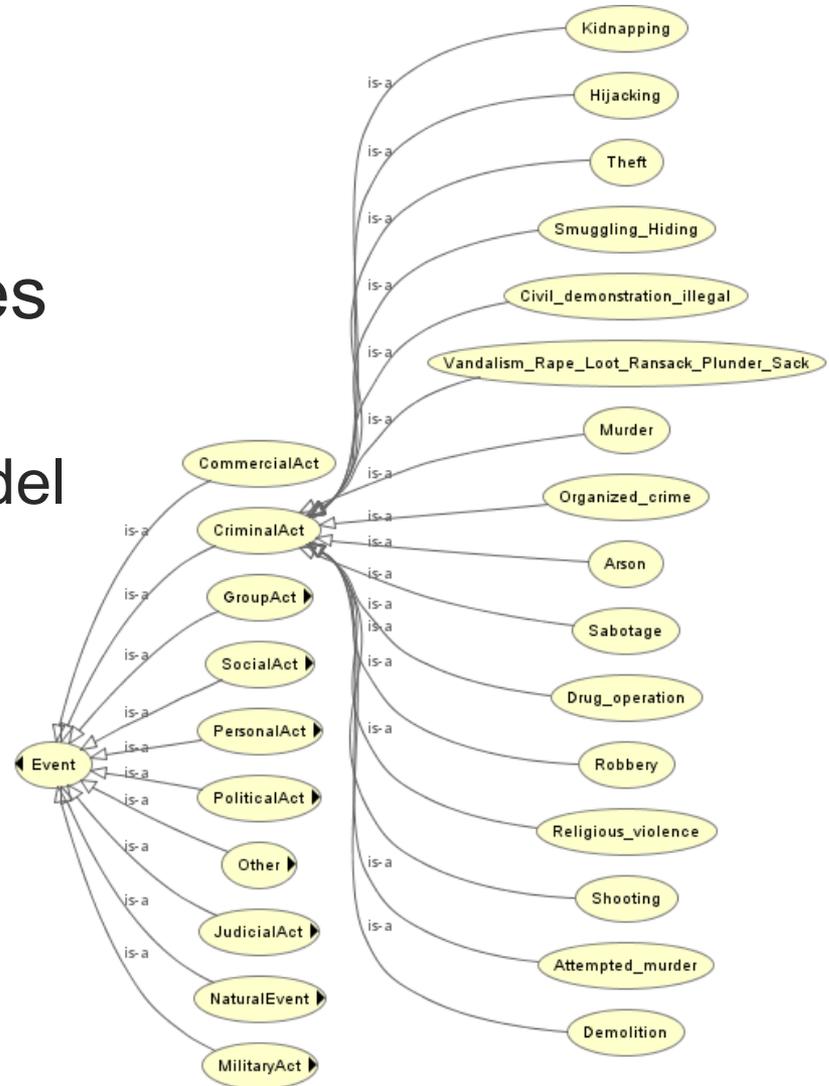
# Transformation distances

- 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



# Ontology

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

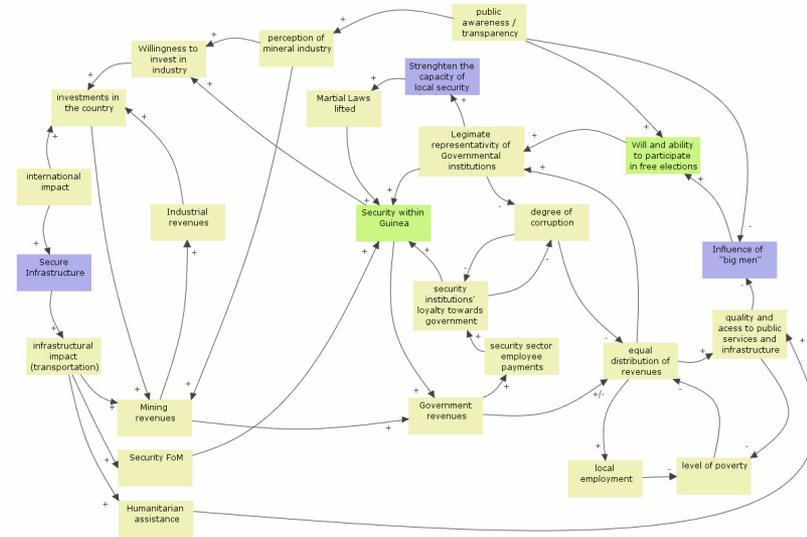


# Experiments

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

# Knowledge Support

- Develops 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

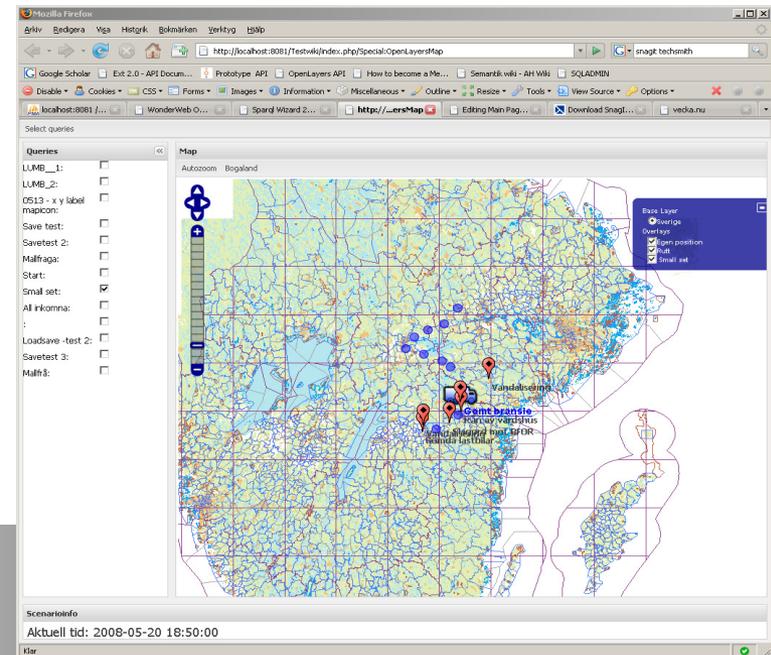
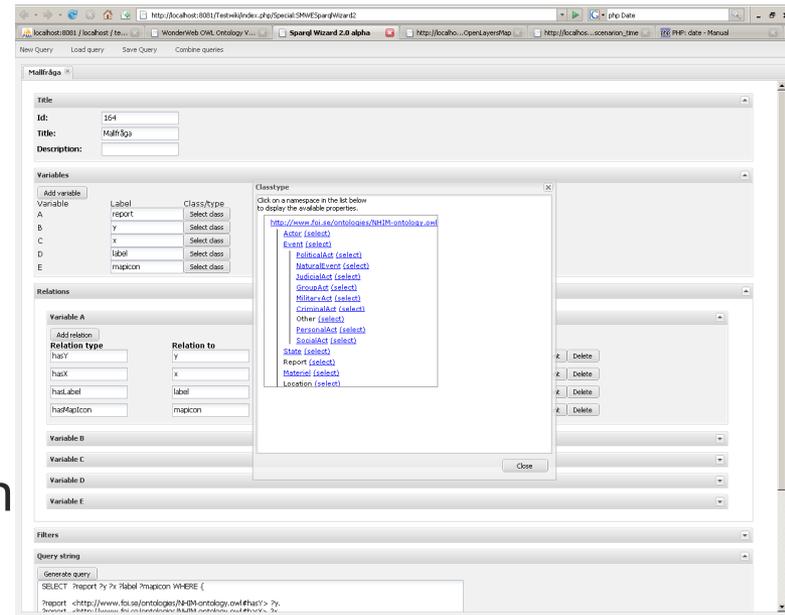


A screenshot of a Mozilla Firefox browser window displaying a page titled "African Union - Attacks". The page content includes a navigation menu, a search box, and a table of political persons. The table lists names and their ethnicities.

Person	Ethnicity
Mamo_Asamoaah	Maninka
Yakar_Dembo	Sosso
Hakeem_Aboubakar	Fula
Abram_Botha	Sosso

# 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
  - ❖ All incoming reports on red activities along the planned route



# Observation 1

- ❖ Different approaches to ontology 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

# 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*)

# 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

# Questions...

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