FFI Forsvarets forskningsinstitutt

Application of Semantic Technologies in Network Based Defence

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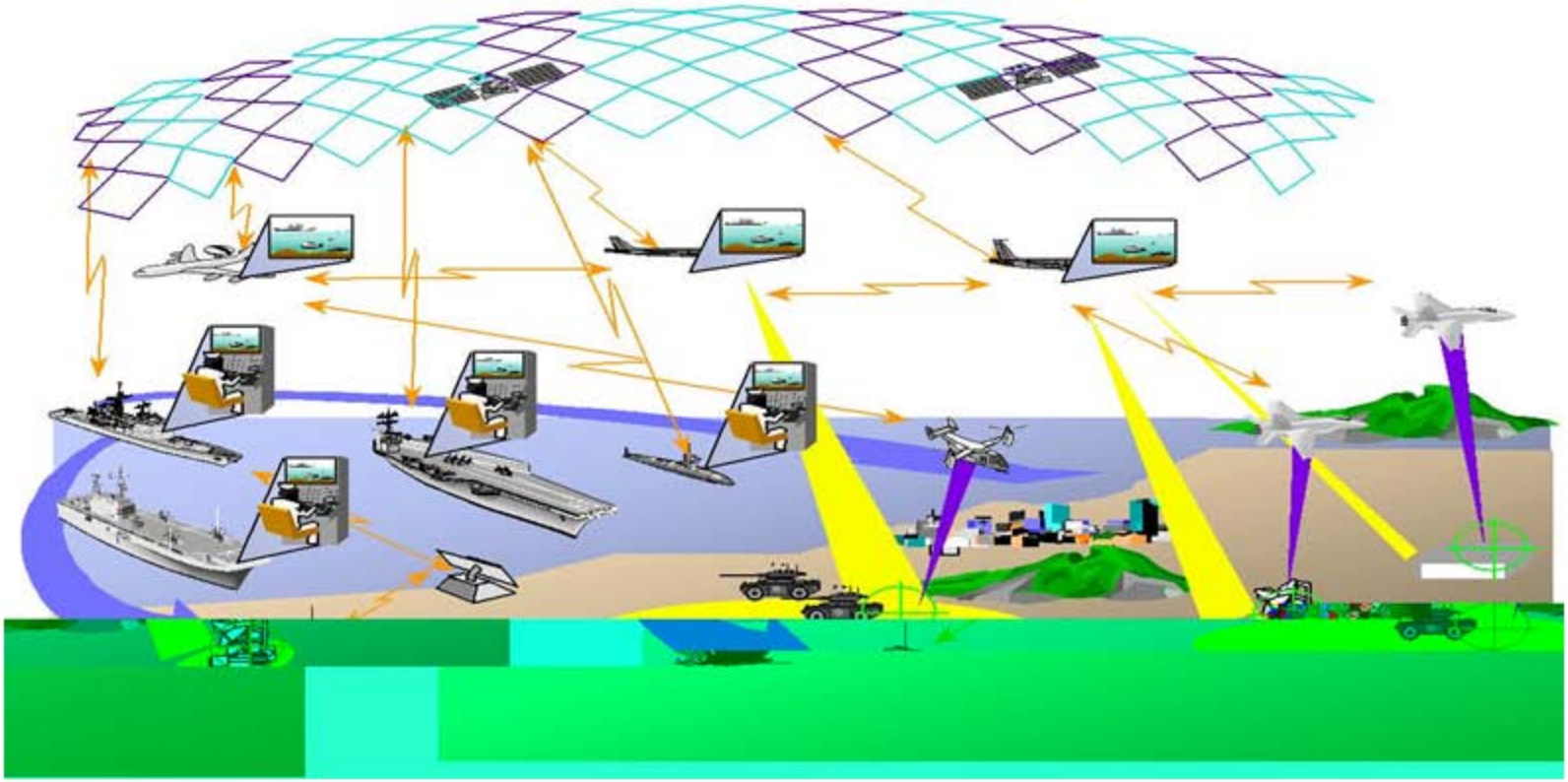
Outline

- Network Based Defence
- Network Based Defence Challenges
- What are Semantic Technologies?
- Core Technologies
- Semantic Technologies Applied to the Challenges
- A Semantic Information Integration Experiment
- Summary

Network Based Defence



- Norwegian adaption of Network Centric Warfare
- Networking of military units in order to improve information sharing
- Information infrastructure essential

Challenges in the Military Domain

- Connecting to information sources in a flexible way
- Information integration
- Information analysis
- Managing information overload

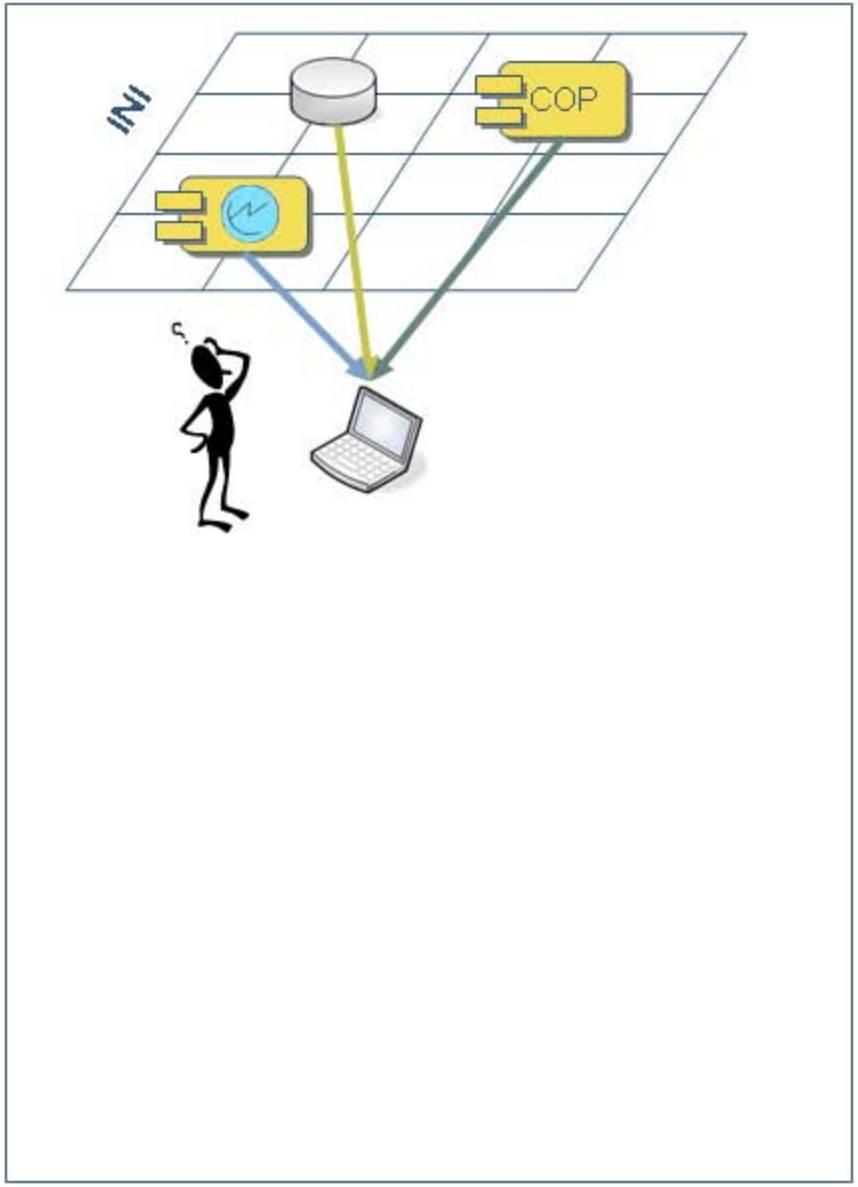
Challenges

Flexible connections

- Unanticipated sources
- Flexibility

Information integration

- Incompatible formats
- Problem amplified by more sources



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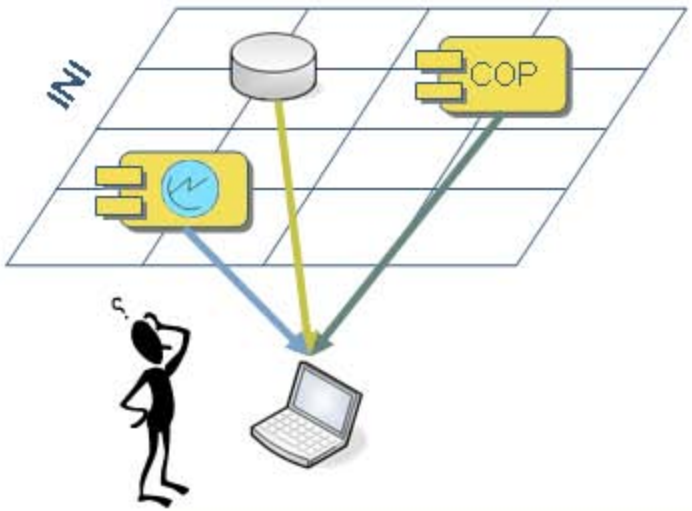

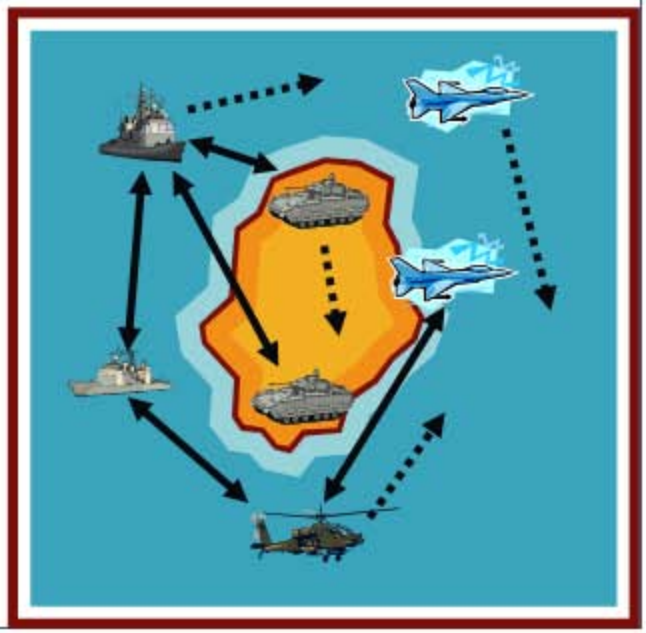

Information analysis

- Labour-intensive process
- Problem amplified by the information volume

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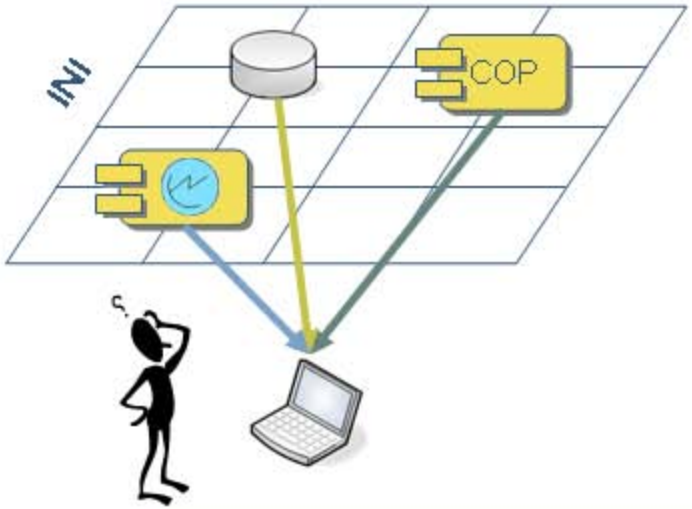


Information analysis

- Labour-intensive process
- Problem amplified by the information volume

Information overload

- Large volumes of information
- Find relevant information

Semantic Technologies

- Software technologies that exploit the meaning (semantics) of the information at hand and involve the use of an explicit knowledge model (Hansen et al. 2007)
- The Semantic Web is an important driver
- Extension of conventional information technologies
- Expected to contribute to adaptive and flexible software
  - The semantics of the information is explicitly represented in semantic models
  - The semantic models are separated from the data and the application code
  - Semantic models can be exchanged in run-time

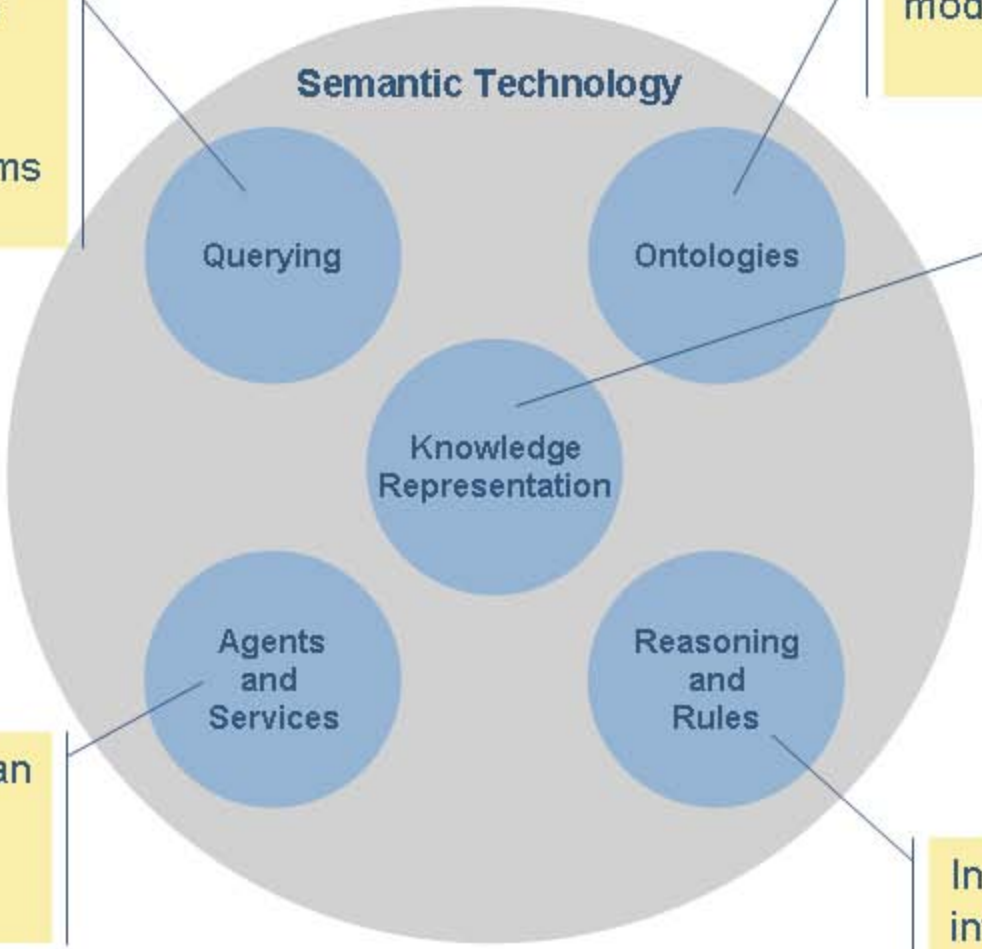
Core Technologies

Fundamental way of collecting information from information systems

SPARQL

A formal, explicit model of a domain

OWL



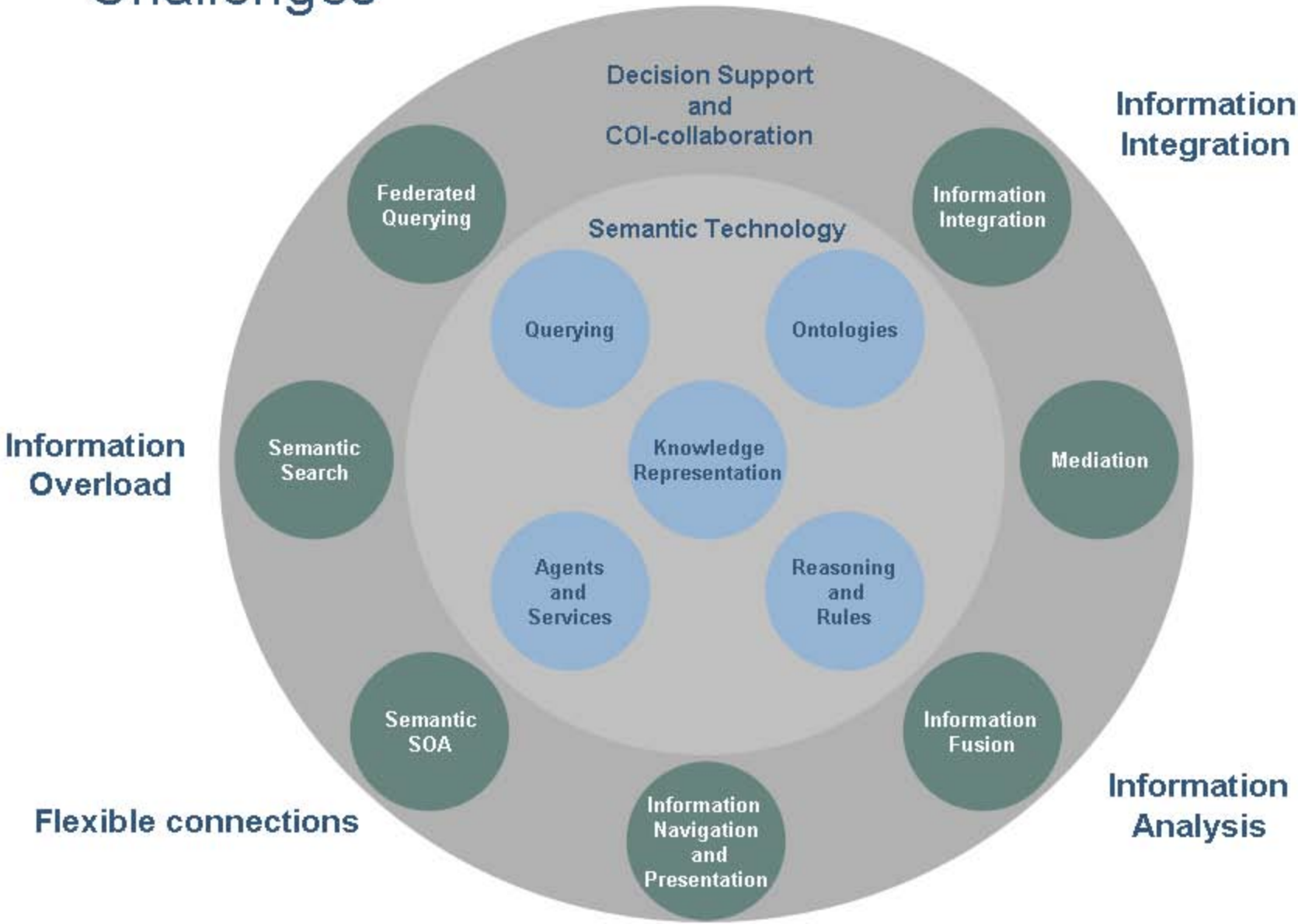
Representing and storing knowledge to make it accessible to computers

RDF

Agents/services can be semantically annotated

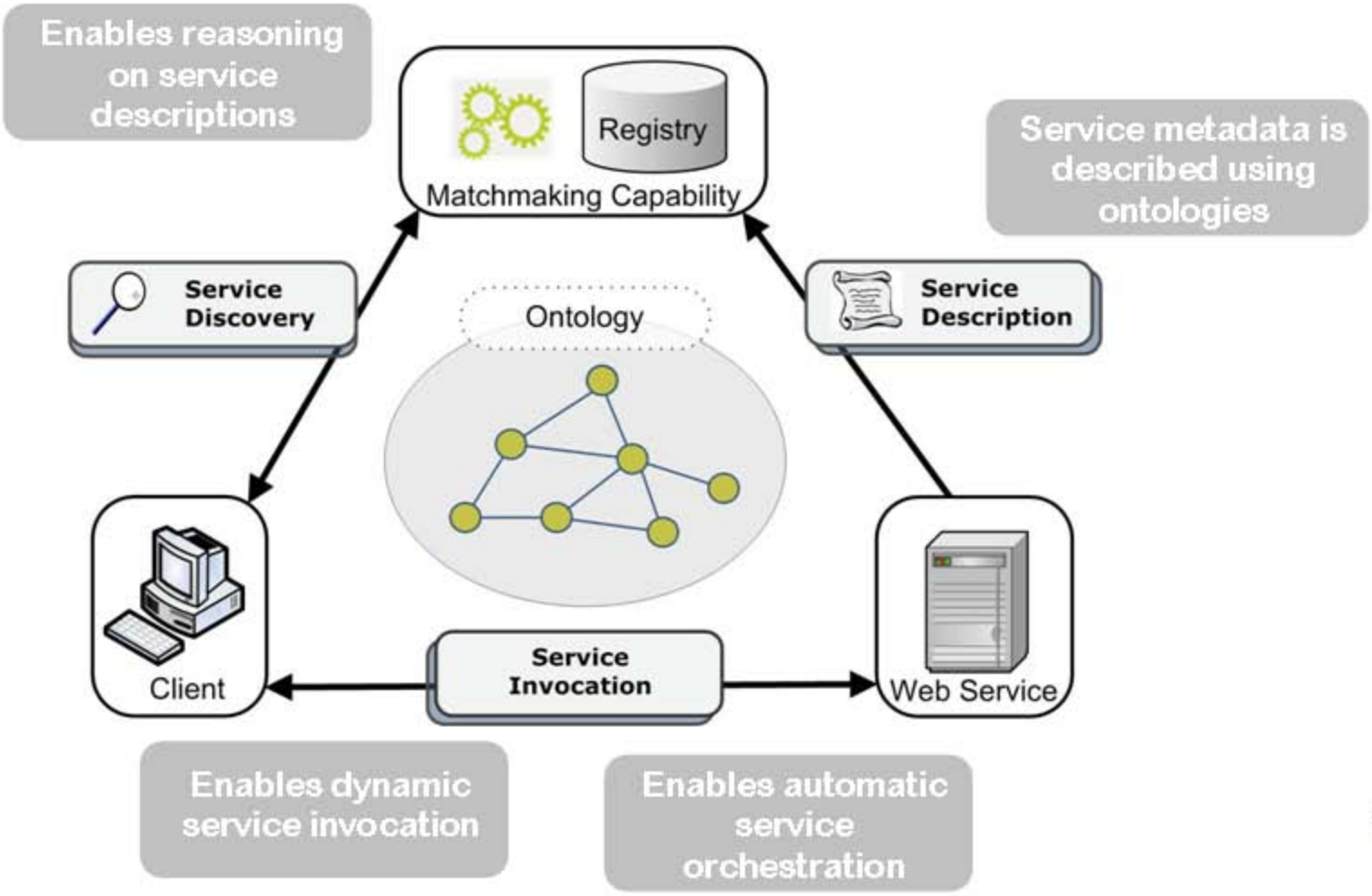
Inferring new information from an information set

Semantic Technologies Applied to the Challenges



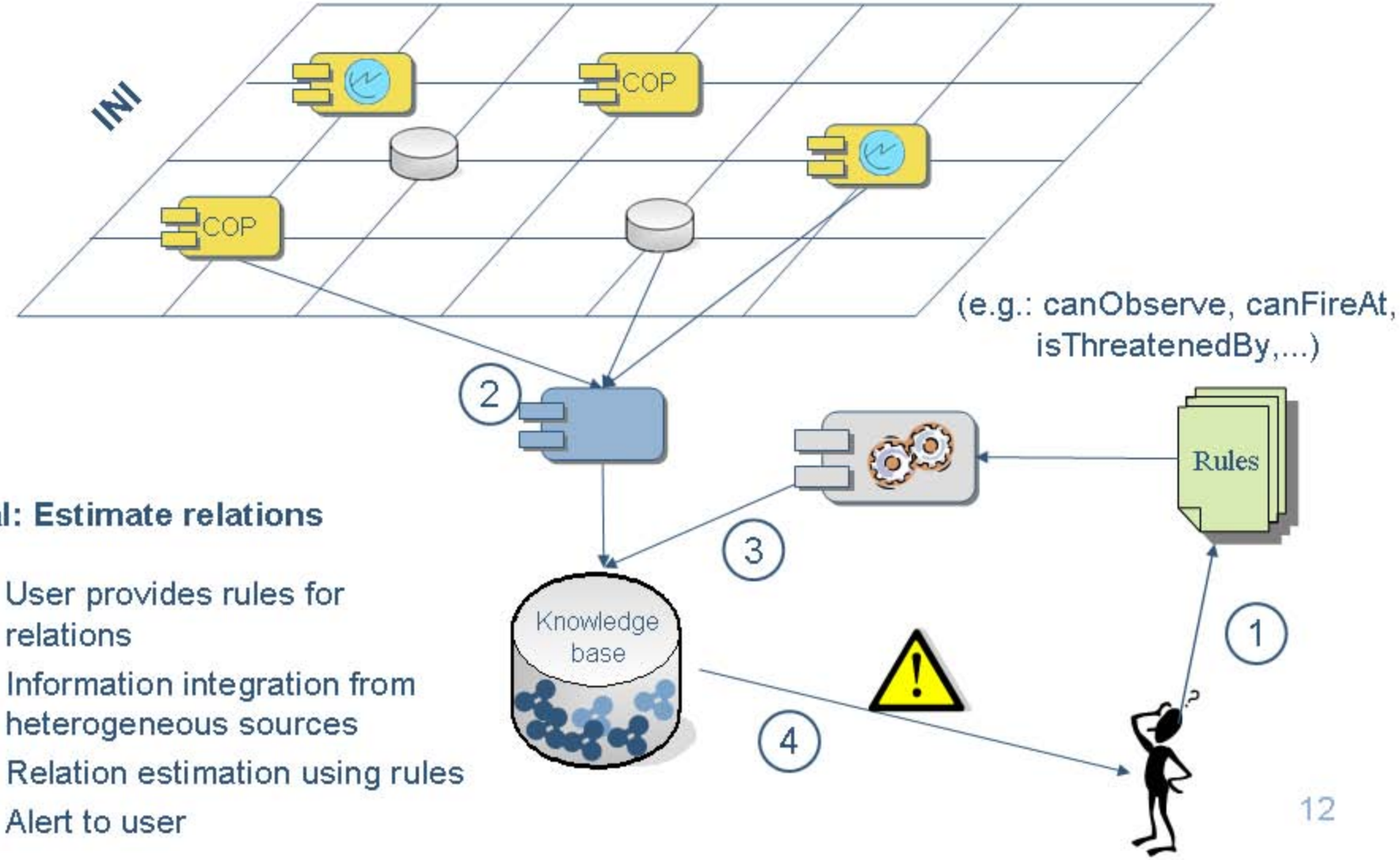
Semantic SOA

- Flexible connections challenge



Information Fusion

- Information analysis challenge
- Information overload challenge

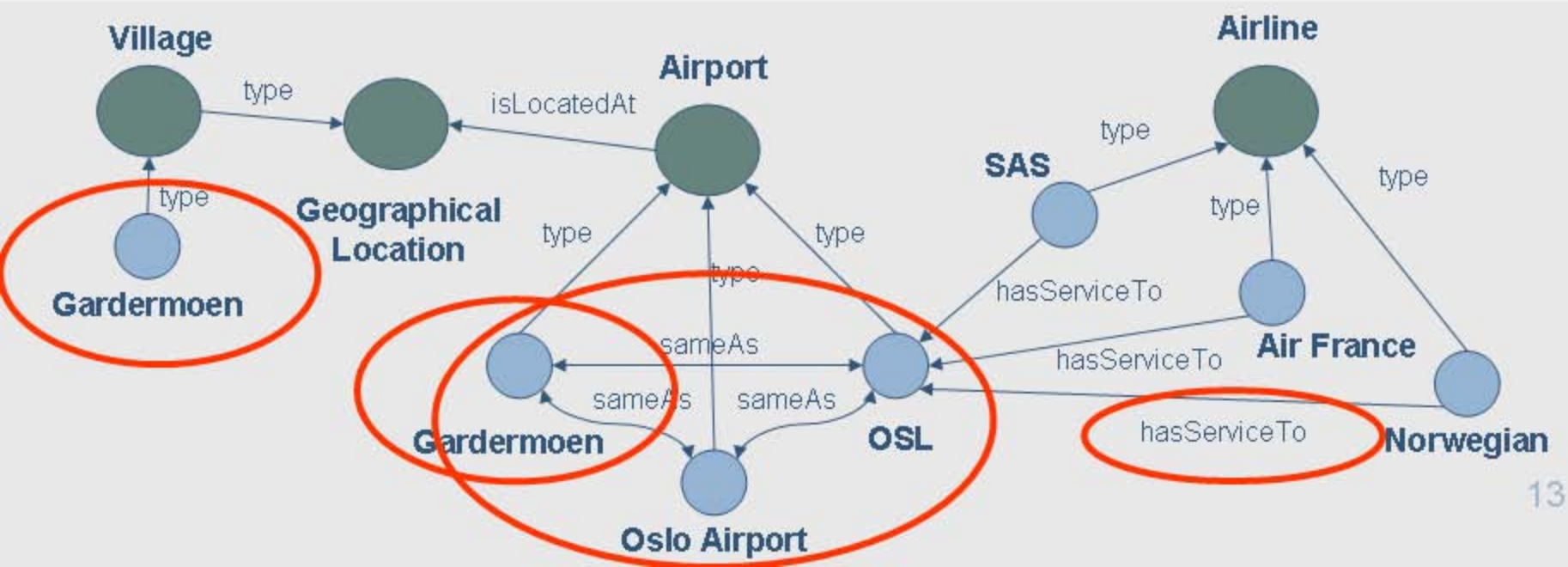


Goal: Estimate relations

1. User provides rules for relations
2. Information integration from heterogeneous sources
3. Relation estimation using rules
4. Alert to user

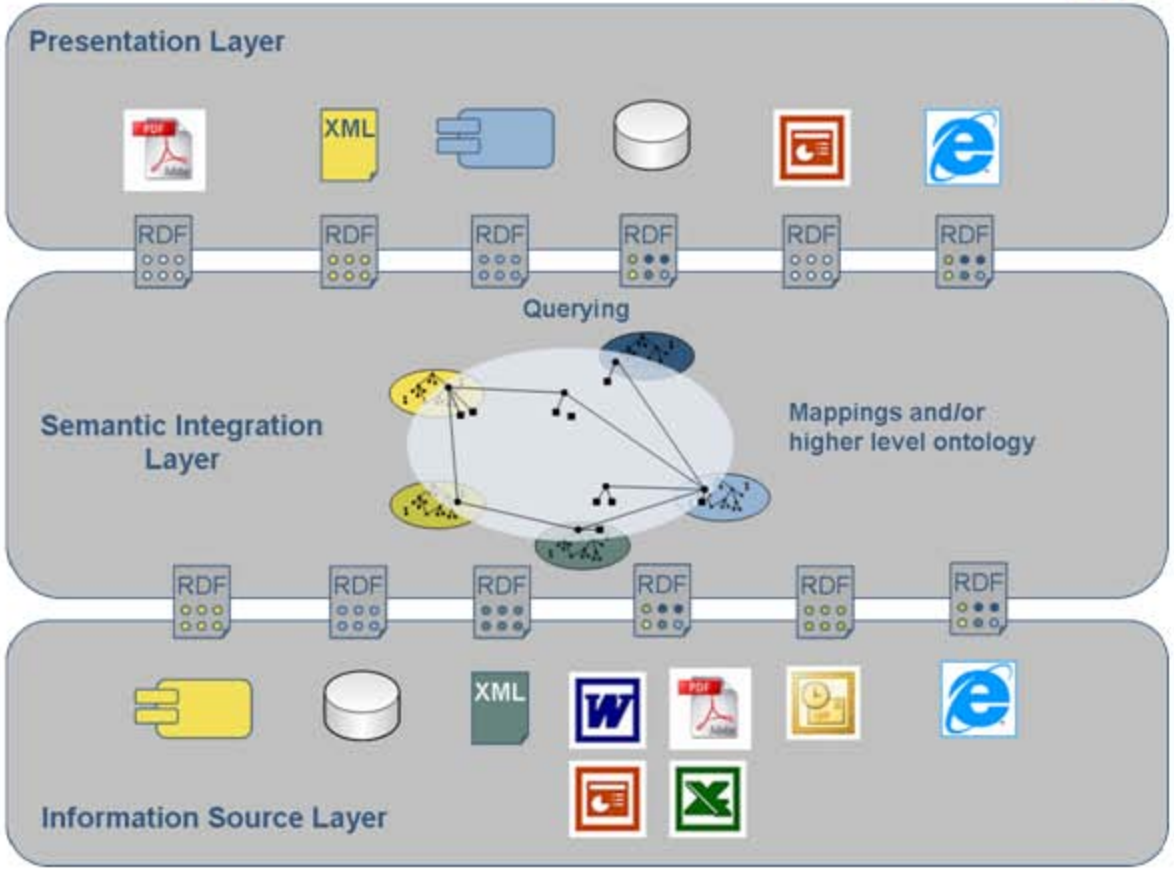
Semantic Search

- Information overload challenge
- Exploiting concepts and relations in order to enhance traditional search
- Added value:
  - Precision
  - Increase interesting hits (synonyms)
  - Avoiding false hits (homonyms etc.)



Semantic Information Integration

- Information integration challenge
- Scalable, manageable and adaptive way to integrate enterprise data
- Bridging ontology to map between source ontologies
  - Solve semantic mismatch at the semantic level
  - Reusable integration statements



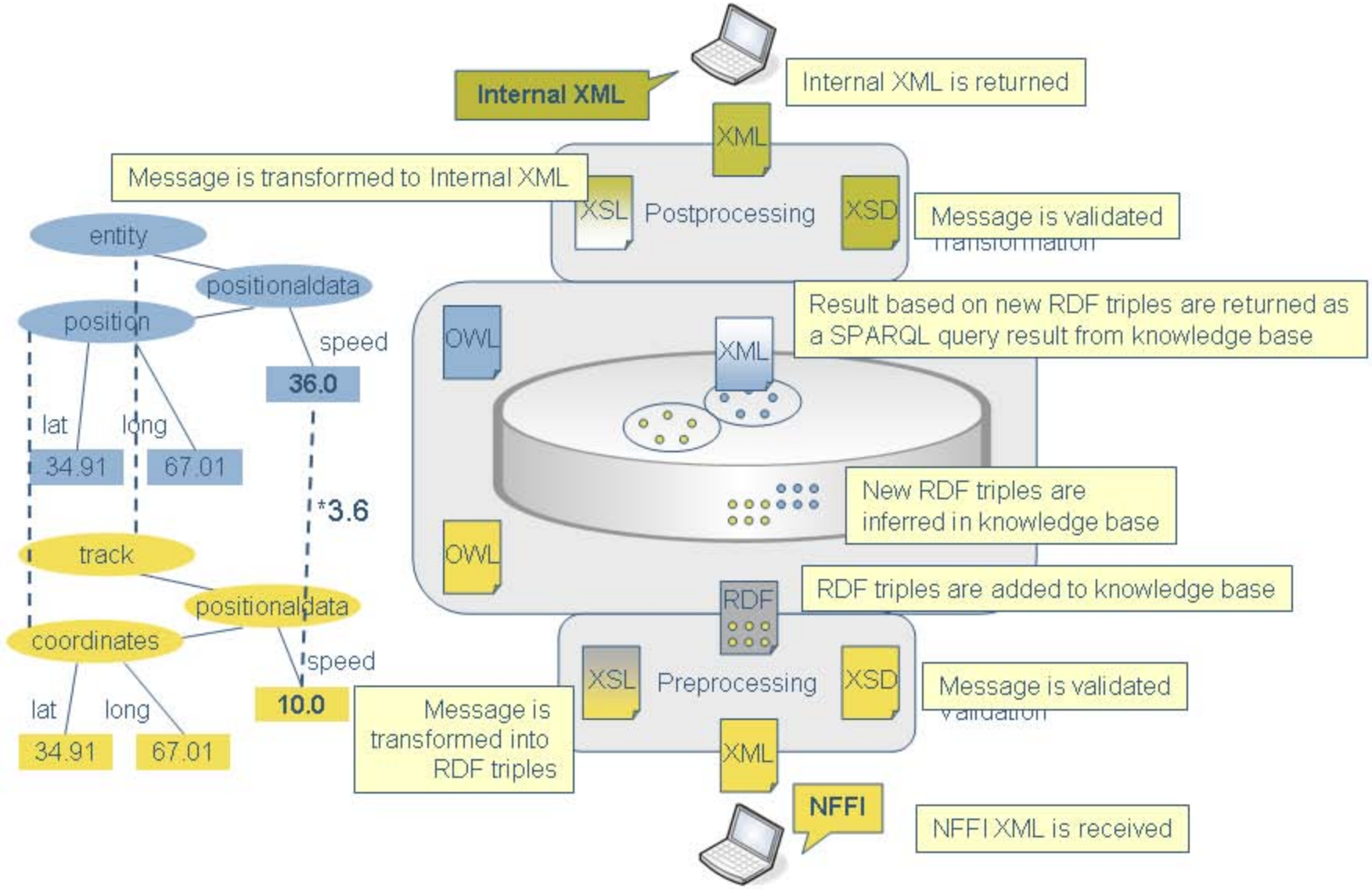
Semantic Information Integration Experiment

- Technological objectives:
  - Overall purpose: Explore semantic technology, methods, and tools
  - Experiment with ontology creation, mapping, and reasoning in the context of semantic information integration
  - Gain experience with semantic information integration and assess the potential benefits of this approach for the Norwegian Defence

- Proof-of-concept demonstrator for semantic data integration and rule execution

- Used to translate between the Nato Friendly Force Information (NFFI) XML format and a proprietary XML format

The SemanticTranslator demonstrator



Summary

- FFI's take on semantic technologies
  - Hansen et al. (2007): Semantic Technologies. FFI-Rapport 2007/02461
  - accessible from http://rapporter.ffi.no/
- Expected to contribute to more adaptive and flexible software
- Can contribute to solve military challenges regarding
  - Connecting to information sources in a flexible way
  - Information integration
  - Information analysis
  - Managing information overload
- Semantic information integration experiment conducted
  - Proof of concept
  - Tools and methods still immature
- **As of 2008: Semantic technologies are experimental, with substantial upside and a promising future**

Questions ?

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