

Potential Applications of Semantic Technologies for Defence



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Outline

- Introduction
- Challenges in the Military Domain
- FFIs view on Semantic Technologies
 - Core Technologies
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FFI



Forsvarets forskningsinstitutt

Norwegian Defence Research
Establishment

- Established 1946
- Major defence R&D organization in Norway
- Approx. 650 employees
- Annual turnover 567 MNoK (2006)

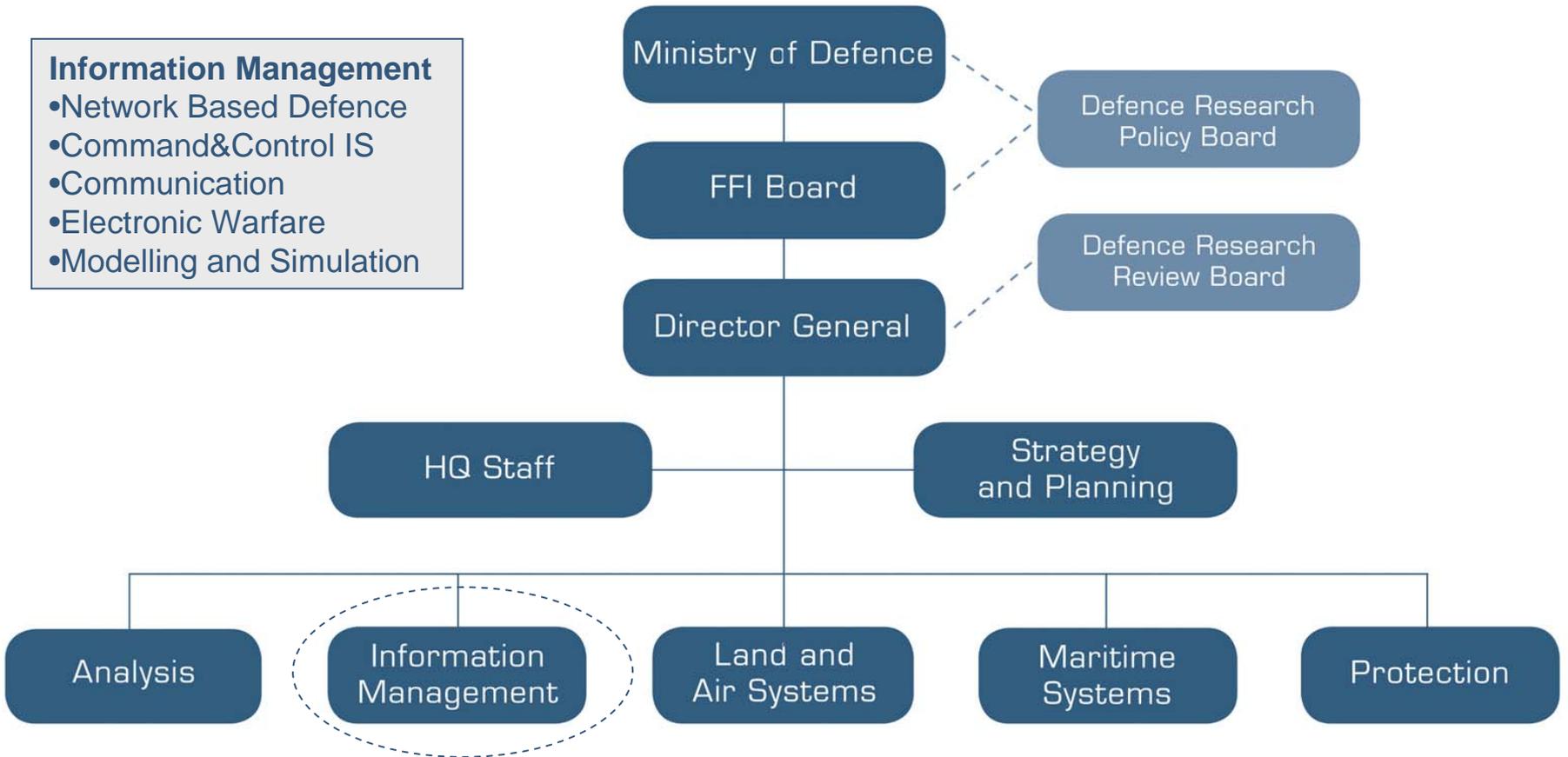


FFI's Charter

- Give advice to the MoD and the Chief of Defence on the potential implications of scientific technical development.
- Advice on the best use of military technology for Norwegian defence purposes.
- Undertake development of weapons and equipment as a basis of competitive national defence industry.
- Investigate geophysical areas of importance to defence.
- Contribute to the national scientific and technical community, and to industrial development.



FFI's organisation





The Semantini project (www.ffi.no)



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Forskning/prosjekter

- Alfabetisk prosjektoversikt
- Temasiden

Hanne Wennemo Aronsen, 2007-03-14

Semantiske tjenester i informasjonsinfrastrukturen (SEMANTINI)

Bakgrunnen for prosjektet er utviklingen i retning av et Nettverksbasert Forsvar (NbF). En viktig forutsetning for et NbF er dynamisk utveksling av informasjon, som igjen forutsetter en velutviklet informasjonsinfrastruktur (INI).

Formålet med prosjektet er å støtte Forsvaret i arbeidet med å utvikle fremtidige tjenester i INI, med hovedfokus på utnyttelse av semantisk teknologi der det er hensiktsmessig. Prosjektet vil evaluere hypotesen om at semantiske løsninger er veien å gå for å muliggjøre interoperabilitet. Med utgangspunkt i visjonen om semantisk interoperabilitet, vil prosjektet arbeide med å konkretisere krav til fremtidige tjenesteområder i INI, så som distribuerte registertjenester, automatisk oversetting, orkestrering av tjenester og bruk av metadata.

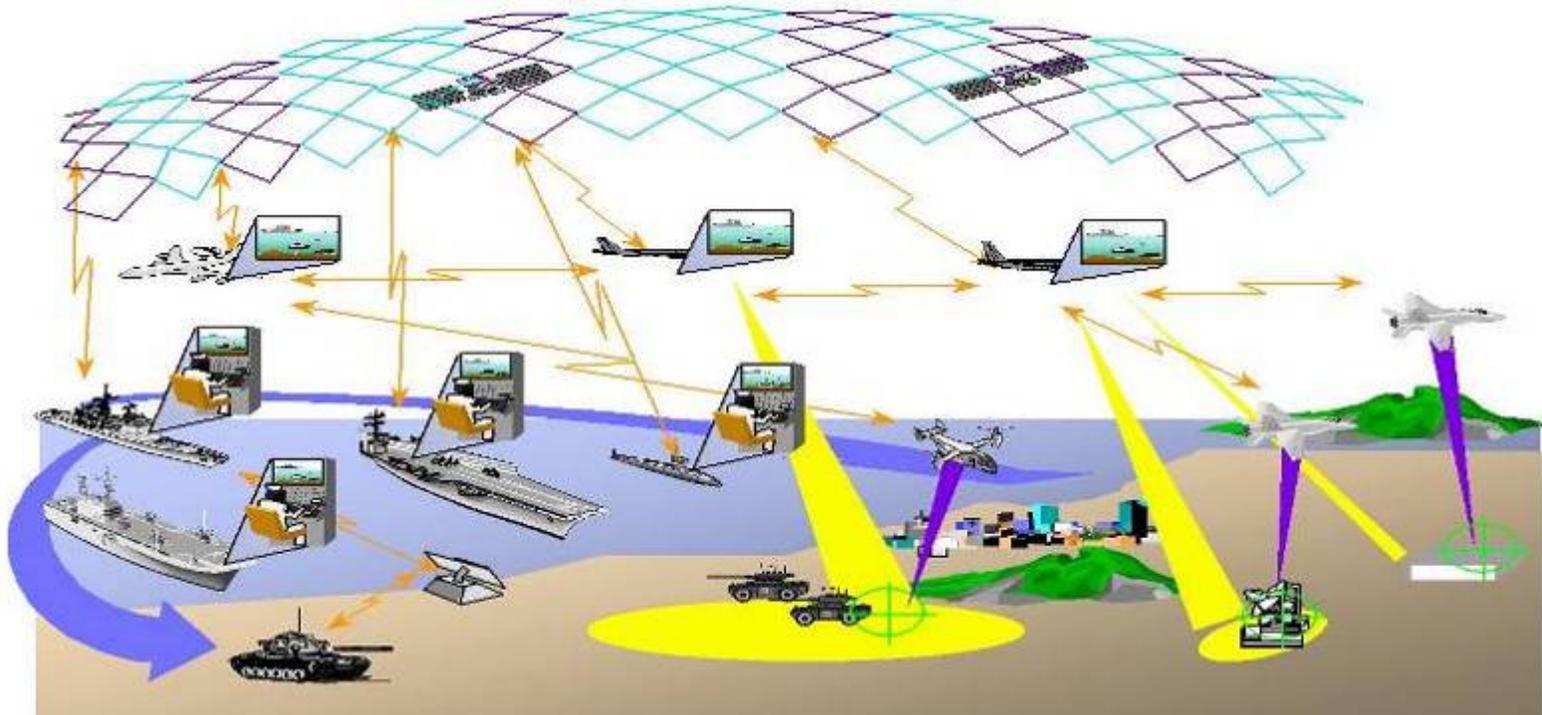
Relaterte artikler

Ingen relaterte artikler.

Postadresse:
Forsvarets
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Postboks 25
2027 Kjeller

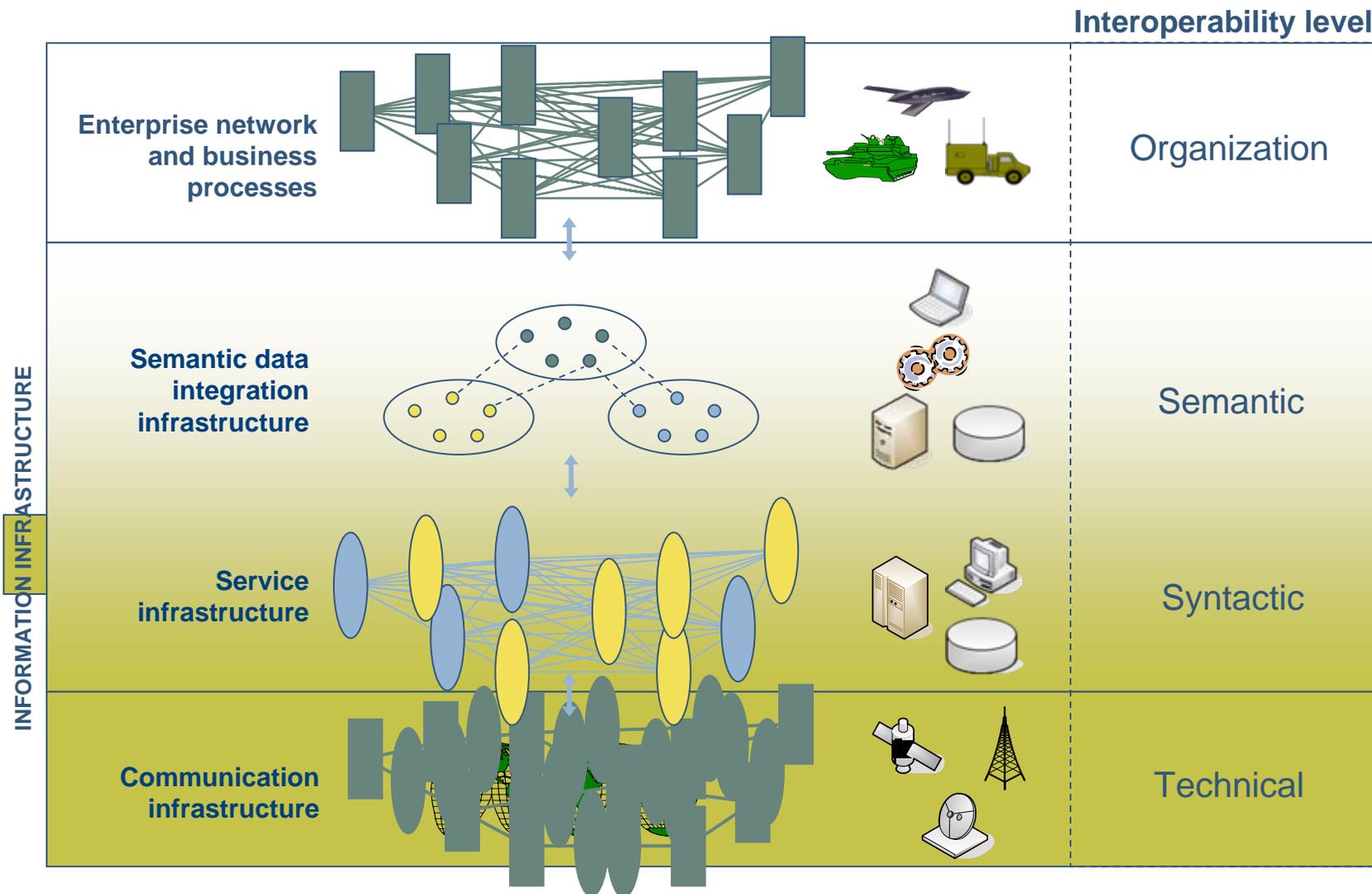
Besøksadresse Kjeller:

Network Based Defence

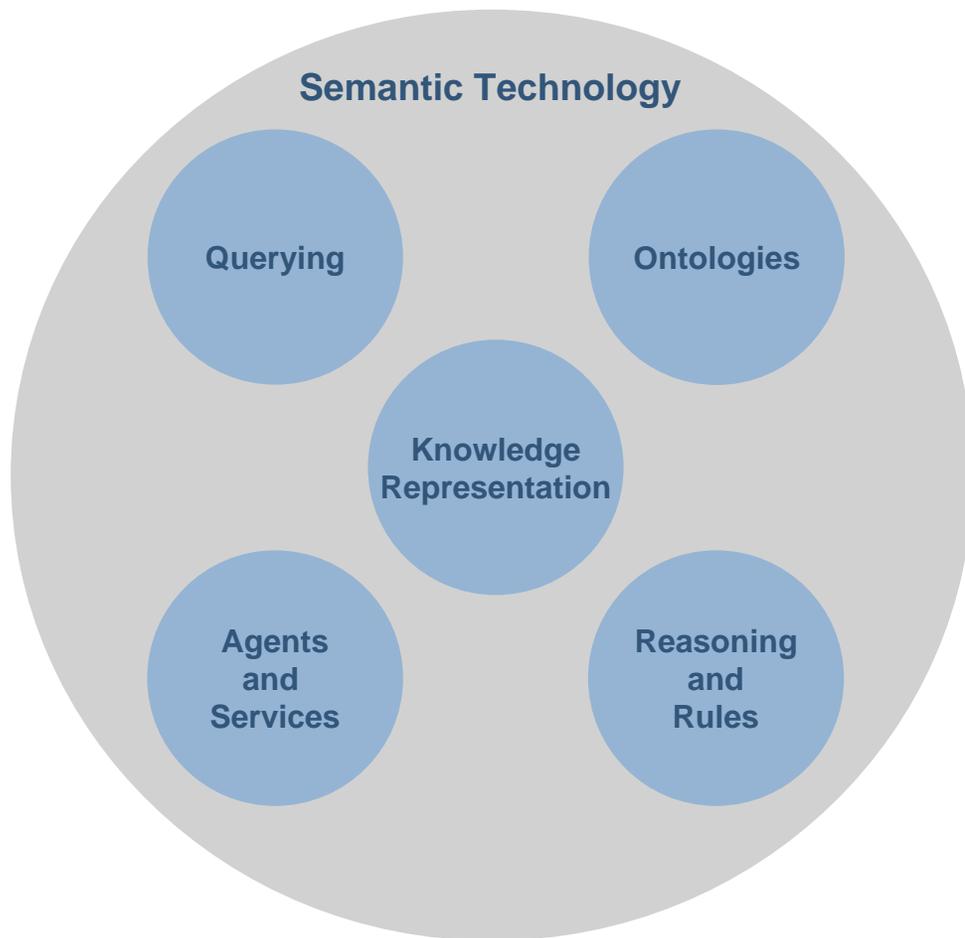


- Alternate terms: Net-Centric Warfare, Network Enabled Capability
- Component types: Sensors, Effectors, Decision Support
- Common Operational Picture, Shared Situation Awareness
- Shorter planning times, coordinated execution

The Information Infrastructure

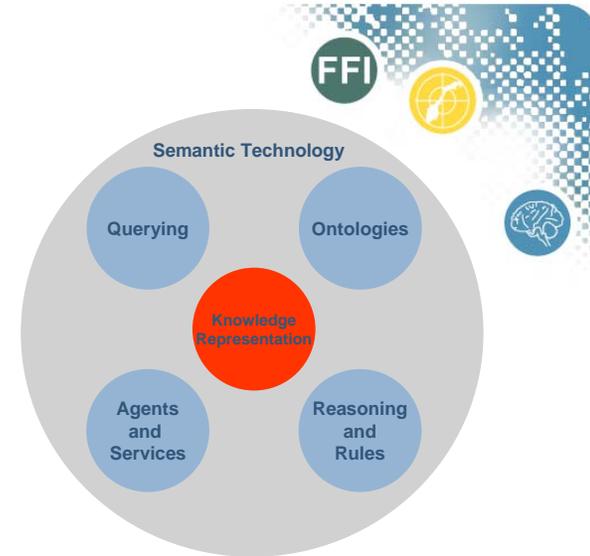


Core Semantic Technologies

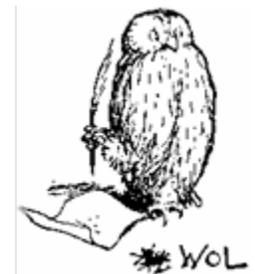


Core Technologies (1)

- Knowledge representation
 - Representing and storing knowledge to make it accessible to computers
 - Based on logic
 - Resource Description Framework (RDF) is a graph-based data model for representing knowledge

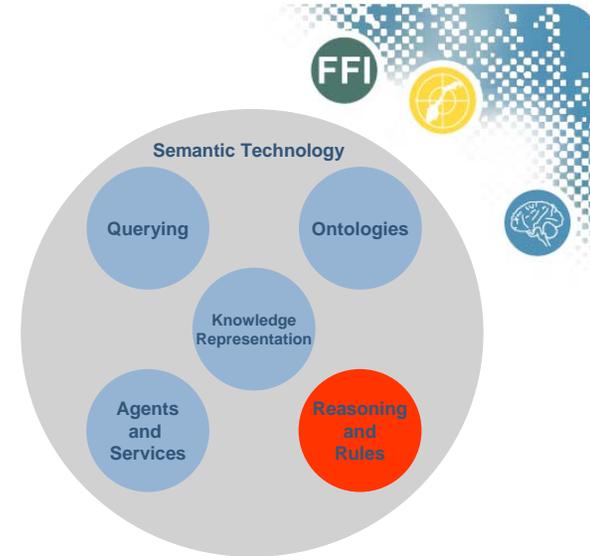


- Ontologies
 - A formal, explicit model of a domain
 - Accessible to computers
 - Linkable
 - Web Ontology Language (OWL) W3C recommended ontology specification language

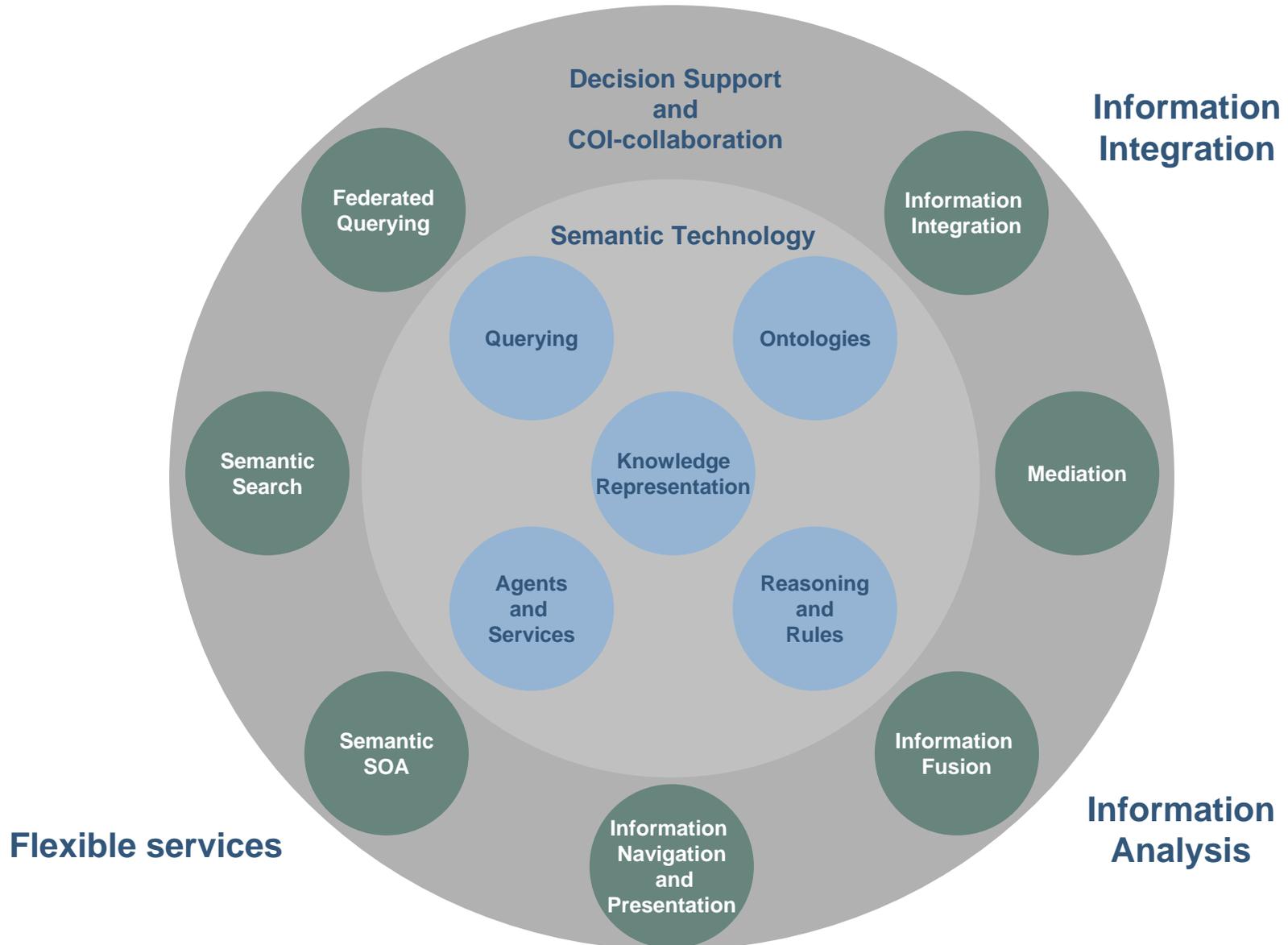


Core Technologies (2)

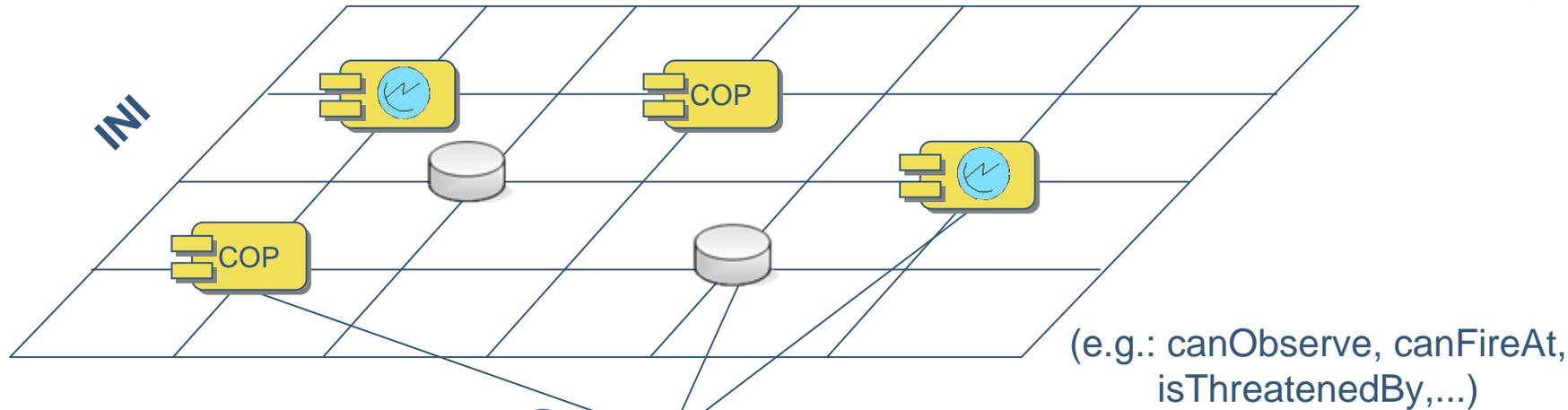
- Reasoning and rules
 - Inferring new information
 - Exploits that the data is modelled with a logic-based data model
 - Initiatives: SWRL, RIF
- Querying
 - SPARQL Protocol and RDF Query Language (SPARQL)
 - Offers a way to query RDF knowledge bases
- Agents and services
 - Services in a Service-Oriented Architecture can be understood as agents
 - Semantic services are services annotated using semantic mark-up
 - Initiatives: OWL-S, WSMO, SAWSDL



Selected Capabilities

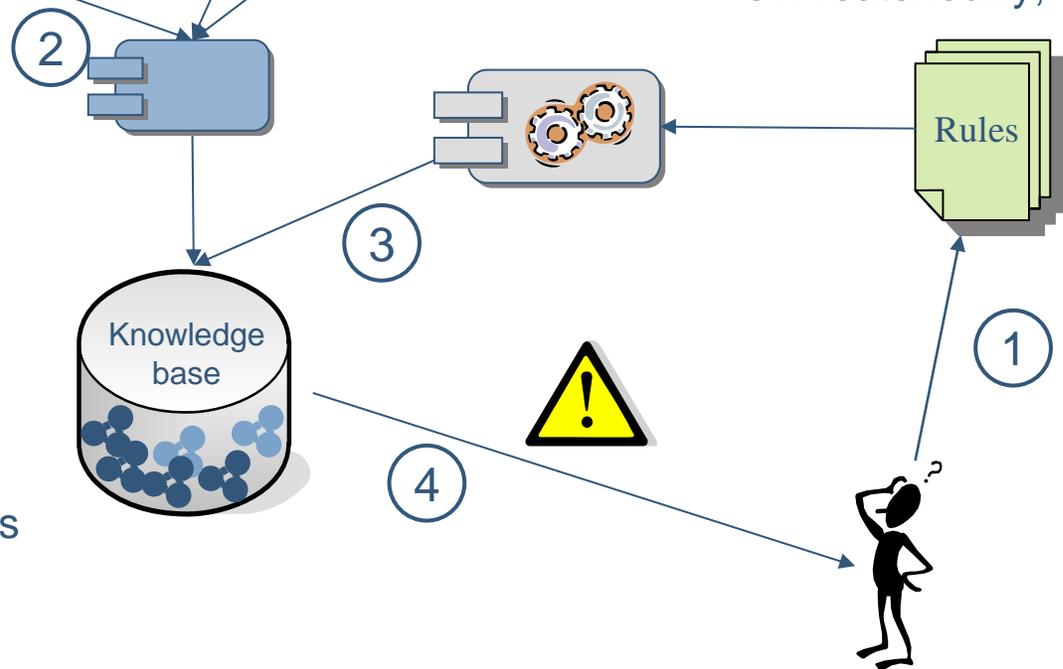


Information Fusion



Situation analysis: Estimate relations

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



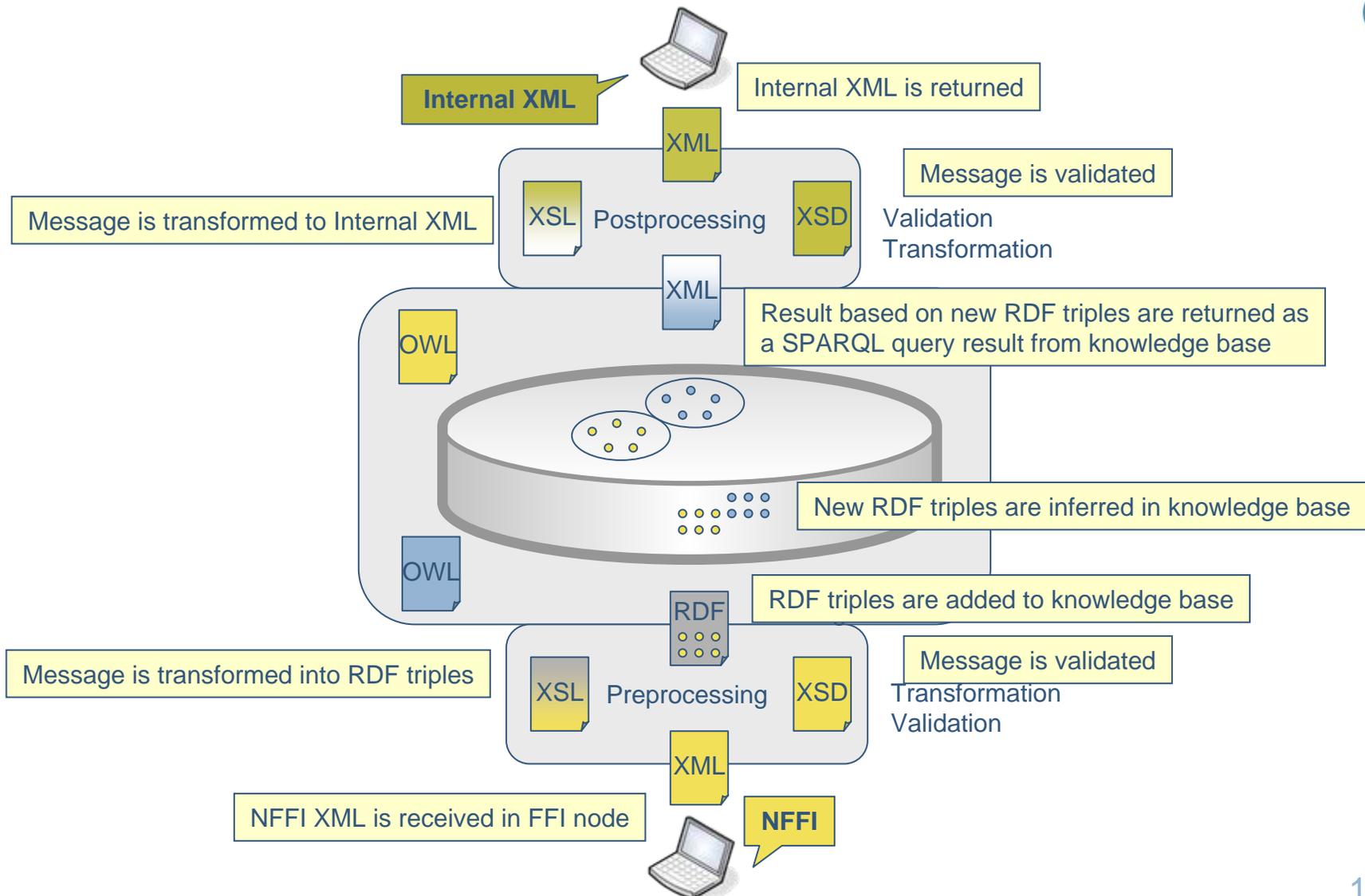
Semantic Information Integration

- Semantic approach to the information integration challenge
 - more scalable, manageable and adaptive way to integrate enterprise data
 - favourable as systems evolve and new models/formats need to be added
- Based on bridging ontology to map between source ontologies
 - Move integration "statements" from individual systems and reuse them in the whole enterprise
 - Can do data integration declaratively (what, not how)
 - Easy to distribute ontologies and mappings (mostly xml files)

Semantic Information Integration Experiment (NATO CWID 2007)

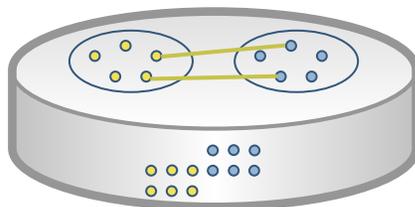
- Technological objectives:
 - Overall purpose: Explore semantic technology, methods, and tools
 - Experiment with ontology creation, mapping, and reasoning in the context of semantic information integration
 - Gain experience with semantic information integration and assess the potential benefits of 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 an internal XML format

The SemanticTranslator demonstrator

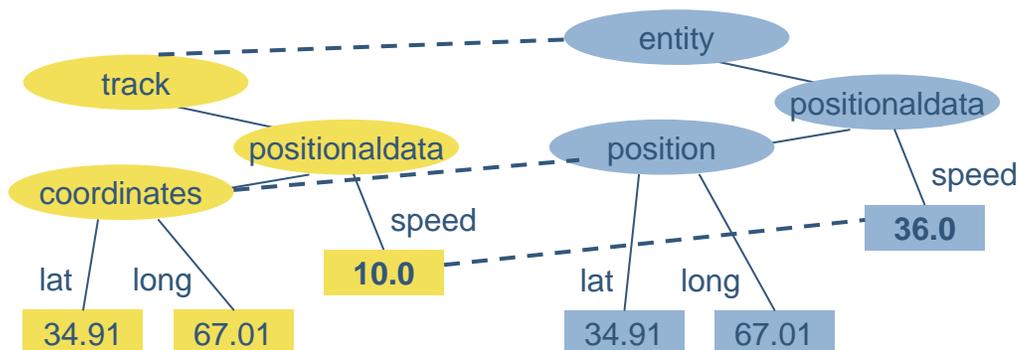


Semantic translation - exemplified

Inference process and rule engine is executed when publishing to knowledge base



Ontology mapping statements:
 "nffi:Track is a gen:Entity"
 "nffi:Coordinate is a gen:position"
 "nffi:speed * 3,6 = gen:speed"



Query: Get all gen:Entities and their associated data

Transformation of XML to RDF

```
<track>
  <positionalData>
    <coordinates>
      <lat>34.91</lat>
      <long>67.01</long>
    </coordinates>
    ...
    <speed>10</speed>
  </positionalData>
</track>
```

NFFI XML

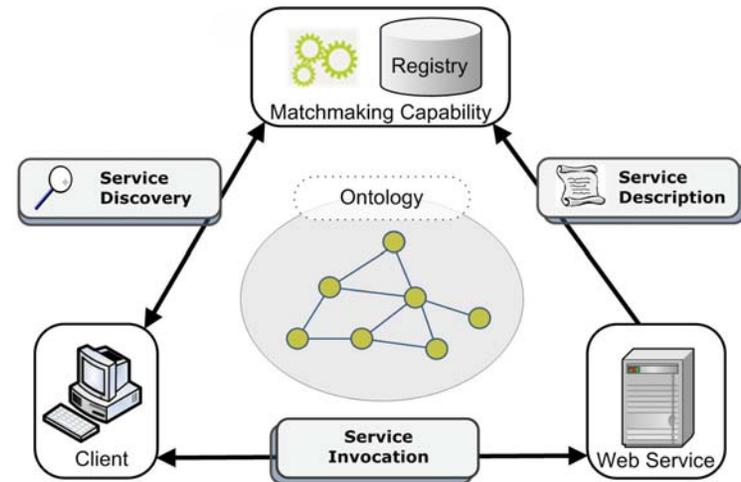
Transformation between XML query result and internal XML

```
<track>
  <position>
    <lat>34.91</lat>
    <long>67.01</long>
  </position>
  ...
  <speed>36</speed>
</track>
```

Internal XML

Semantic Service-Oriented Architecture

- Meeting the challenge of connecting to information sources in a flexible way
- Service metadata described using ontologies
 - What the service does, how it works, and how to access it
- Enables clients (and registries) to reason about a service
- For dynamically:
 - Discovering and selecting services
 - Invoking services (data translation and execution process)
 - Composing new, value-added services from existing services
- Several description initiatives (OWL-S, WSMO, SAWSDL...)



Upcoming SemSOA experiment - goals

- Show that Semantic SOA is technically feasible and that it will add operational value
 - semantic annotation
 - reasoning-based discovery
 - flexible invocation
 - orchestration
- Show benefits from RDF representation
 - information integration
 - information fusion using reasoning
- Gain experience with Semantic SOA
 - draw attention to long-term potential
 - promote semantic technologies in general

Summing up

- FFI's take on semantic technologies is described in FFI-Rapport "Semantic Technologies" by Bjørn Jervell Hansen et al.
 - accessible from <http://rapporter.ffi.no/>
- Adding value to traditional information technology
 - primarily as a contribution to more adaptive and flexible software
- Knowledge representation and Ontologies are core concepts
- Potential contributions to military challenges regarding
 - Flexible and dynamic services
 - Information integration
 - Information analysis
 - Information overload
- Technical experiments to prove concepts and build experience



Thank you for your attention

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