Ontologies and Ontology Extension for Marine Environmental Information Systems

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Outline

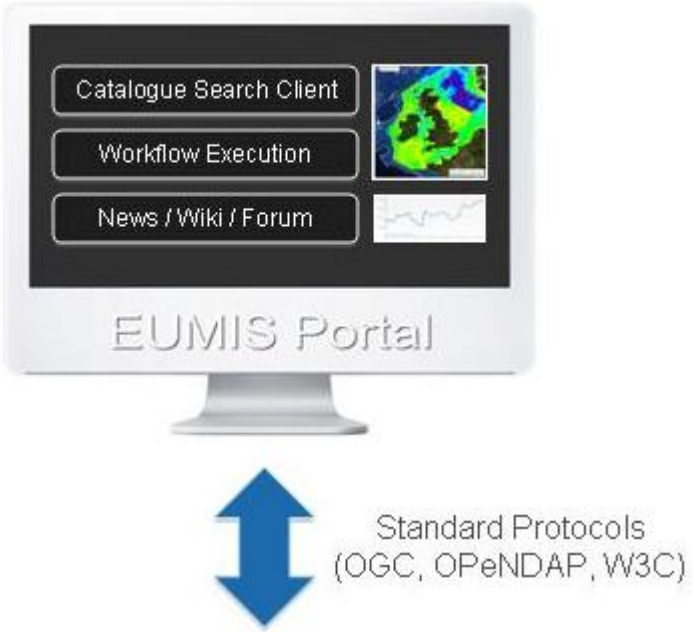
- NETMAR overview
- Initial investigation
- Ontology extension process
- NETMAR semantic framework
- Future work
- Conclusions

NETMAR overview

- *NETMAR aims to develop a pilot European Marine Information System (EUMIS) for searching, downloading and integrating satellite, in situ and model data from ocean and coastal areas. It will be a user-configurable system offering flexible service discovery, access and chaining facilities using OGC, OPeNDAP and W3C standards. It will use a semantic framework coupled with ontologies for identifying and accessing distributed data, such as near-real time, forecast and historical data. EUMIS will also enable further processing of such data to generate composite products and statistics suitable for decision-making in diverse marine application domains.*

NETMAR overview

- *System concept*
  - *Portal w/access to*
    - *All data & services*
    - *Service chains*
    - *Web-GIS*
    - *Support functions*
  - *Network of services*
    - *Semantic discovery*
    - *Data Delivery*
    - *Data Processing*



NETMAR overview

- *Use cases (pilots):*
  - *UC-1: Arctic Sea Ice and Metocean Observing System*
  - *UC-2: Oil spill drift forecast and Shoreline Cleanup assessment services in France*
  - *UC-3: Relationships between physical and biological variables*
  - *UC-4: Ecosystem model validation*
  - *UC-5: International Coastal Atlas Network (ICAN) for coastal zone management*
  - *UC-6: Phytoplankton blooms in Gulf of Biscay and English Channel*

Initial investigation

- Identifying and analysing user requirements for the defined use cases
  - Diverse data
  - Different terminology used
  - Semantic requirements
    - Semantics-based *data and service discovery*
    - Semantic *interoperability* of data, services and metadata
    - Semantics-based *service chaining*
    - *Multi-domain* vocabularies (ontologies)
    - *Multilingual* vocabularies (ontologies)
    - Vocabulary *browsing*

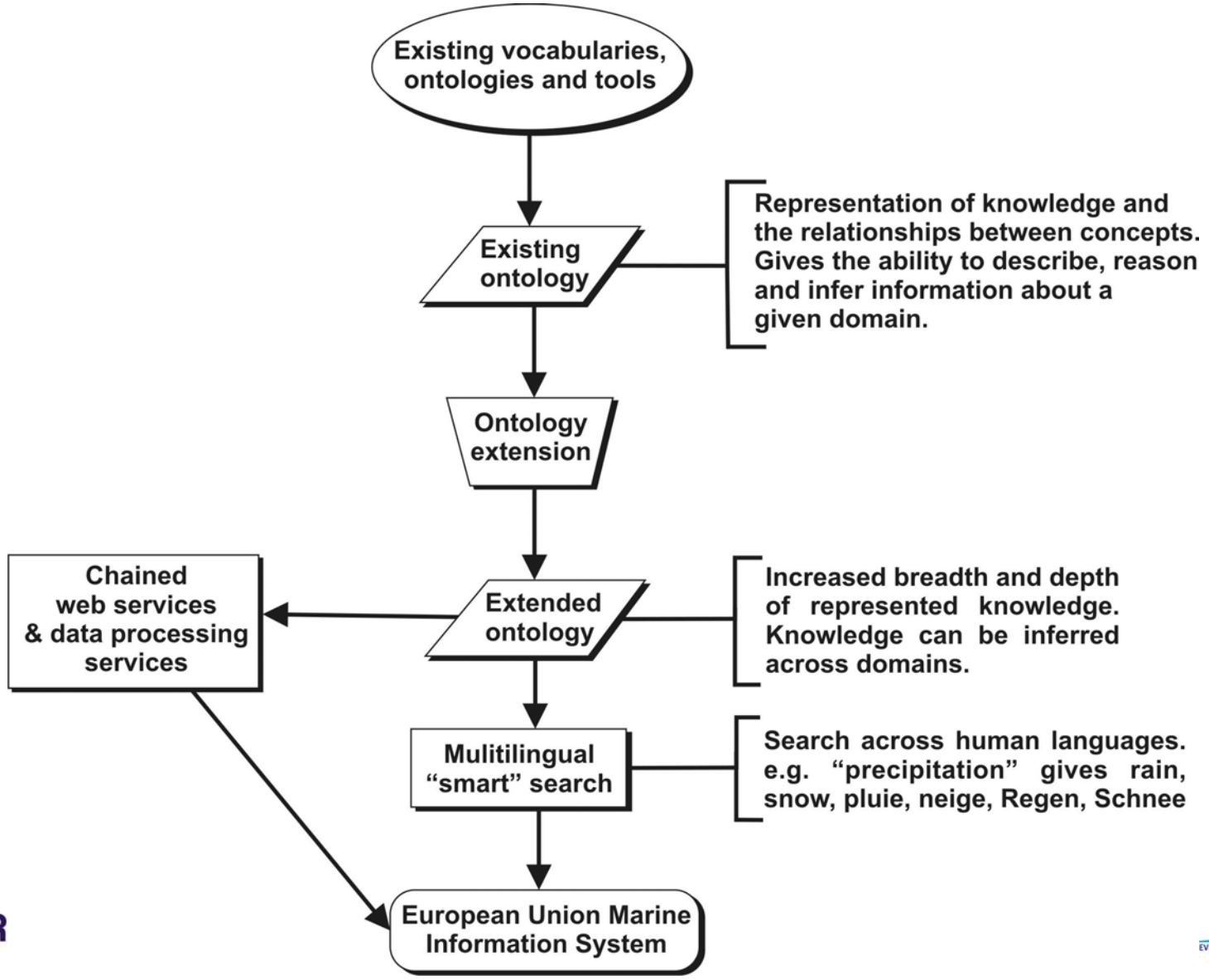
Initial investigation

- Review of ontologies and semantic frameworks
  - Key semantic resources identified
    - GEMET, INSPIRE themes, NERC Vocabulary Server, NASA SWEET, MMI ontologies, etc.
  - Standard technologies and tools
    - RDF, OWL, SKOS, SPARQL, etc.
    - Jena, Sesame, Mulgara, etc.
    - CMAPTools Ontology Editor, Protégé, SWOOP, etc.
  - EIS semantic frameworks
    - ICAN, NERC VS, GEMET, InterRisk, ORCHESTRA, MMI and OOI semantic frameworks, OOSTethys, etc.

Initial investigation

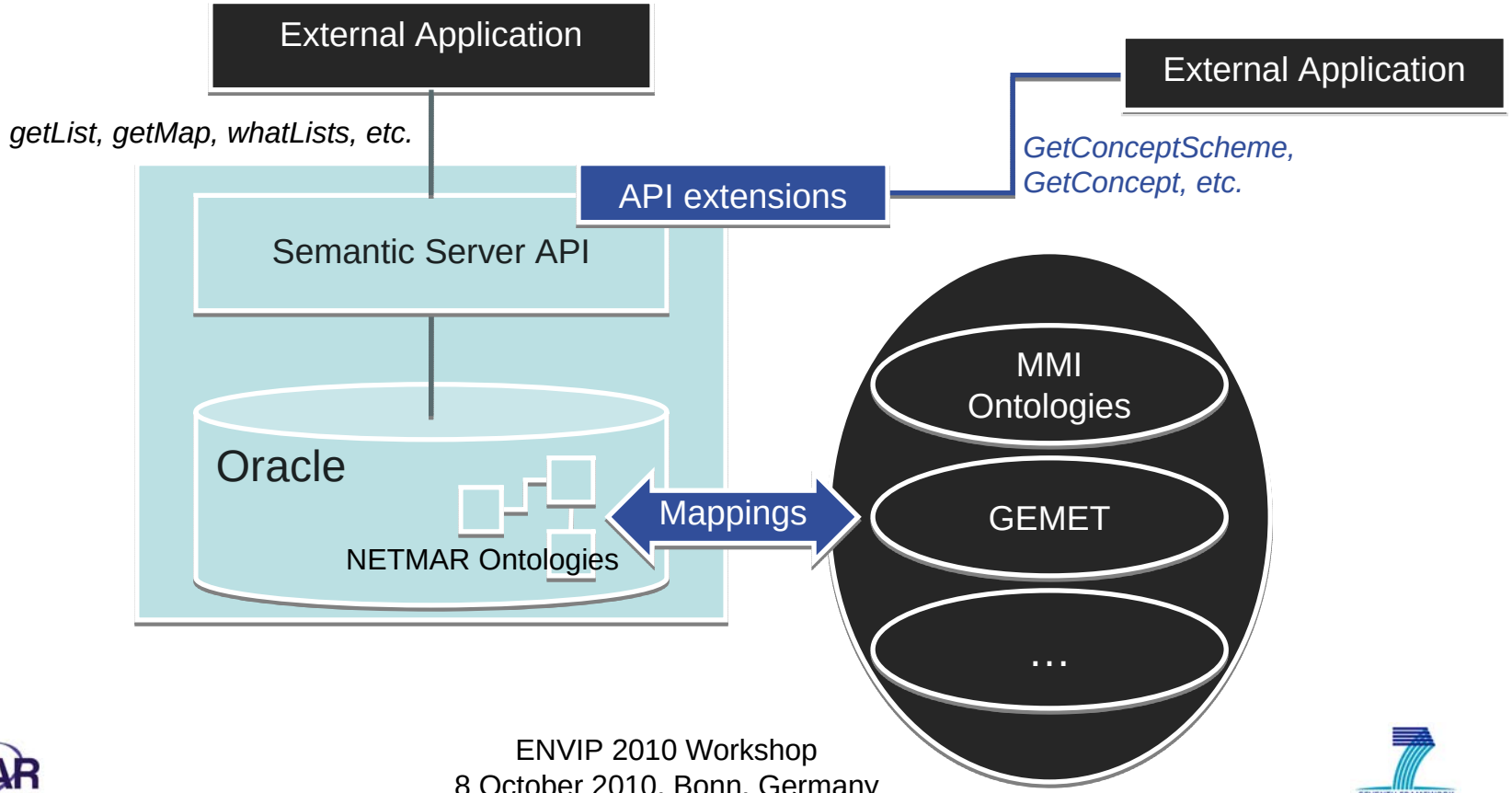
- Methodologies for ontology extension (”bridging”)
  - Many algorithms presented in literature
  - Recognised that re-use of algorithms for another domain is difficult
  - Even with automatic algorithms there is still a need for human validation
  - Our approach is based on manual mapping by domain experts, validated by a governance body
    - Large number of mappings in place already
    - Need to “bridge” to other existing ontologies

Ontology extension process



Ontology extension process

- NETMAR will build on the NERC Vocabulary Server and extends its ontologies and API



Ontology extension process

- The work on ontology extension has recently started in NETMAR. Semantic resources have been identified and work in ongoing to identify mappings between them to satisfy requirements of the use cases.
- Once developed, the extended ontology will be integrated with a semantic framework to support ”smart search” and processing services that use semantics to select proper input data for services.
- The aim is to demonstrate proof-of-concept for multi-lingual and multidomain searches and data processing, focusing on the selected case studies.

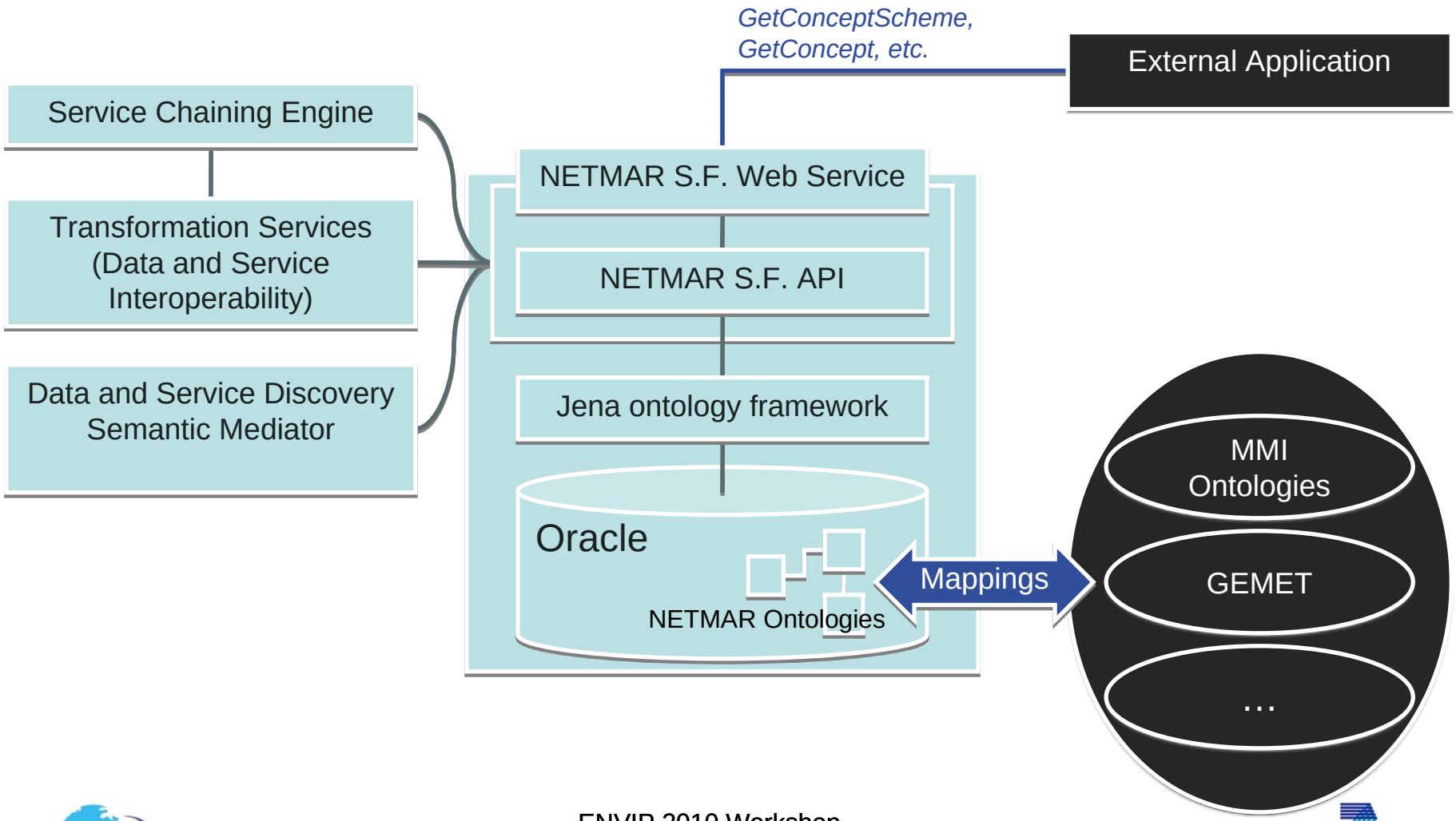
NETMAR semantic framework

- Objective
  - support semantic operations required by the NETMAR EUMIS components
    - Data discovery, interoperability, service chain editor, etc.
- Approach
  - Build on existing approaches
    - NERC VS, ORCHESTRA, ICAN, etc.
  - Submit SF specification to a standardisation body

    → Standardise SF method names

    GetCapabilities, GetConceptScheme, GetConcept, GetConceptHierarchy, GetRelatedConcepts, etc.

NETMAR semantic framework



Future work

- Develop ontology extensions
  - Build on the identified semantic resources and tools
  - Capitalize on expertise in NETMAR and its user communities
- Design semantic framework
  - Build on best practices and experiences from other projects (ORCHESTRA, SANY, etc.)
  - Aim for standardisation of SF method names
- Integrate the ontology extension and the SF
  - Use only standard and open technologies and tools

Conclusions

- NETMAR will develop a pilot European Marine Information System (EUMIS) integrating semantic data/service discovery, ontology extensions and semantic frameworks, data delivery and data processing services, and service composition w/handling of uncertainty.
- To facilitate ”smart” discovery, ontology extensions between selected semantic resources will be developed.
- An expert-based mapping methodology have been chosen.
  - Aim to demonstrate proof-of-concept for multi-lingual and multidomain searches and data processing, with focus on the identifies case studies.
- Results will be integrated in the EUMIS pilot.

Thank you!

NETMAR web site:
http://netmar.nersc.no/

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Consortium

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