



The First International Symposium  
on Geo-Information for Disaster Management

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## **ORCHESTRA: Developing a Unified Open Architecture for Risk Management Applications**

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# Introduction



# Risks and Disasters

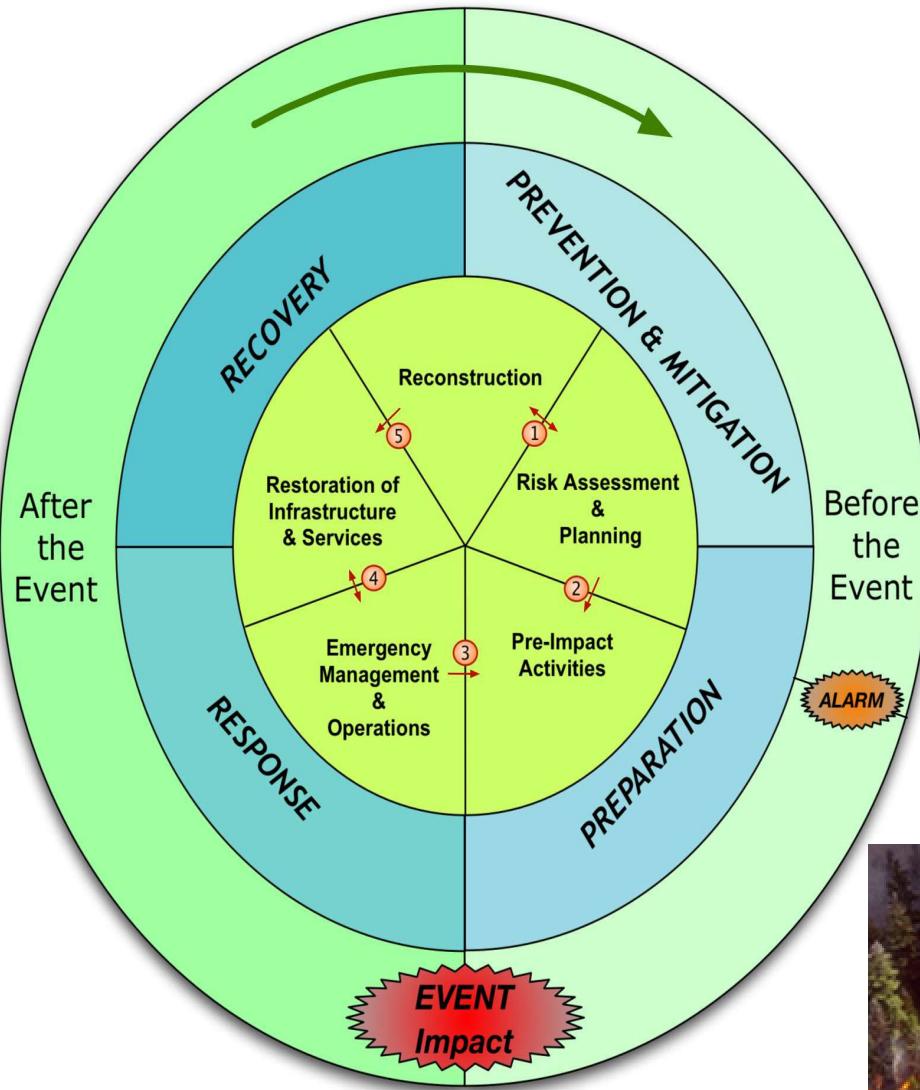
- Public and environment have to face a large series of risks: forest fires, floods, landslides, tornadoes, storms, earthquakes, volcanic eruptions, etc.
- Disasters do not necessarily respect national borders, e.g.
  - 2003 summer forest fires
  - 2002 floods of Central Europe, ...
- The number of natural disasters is increasing
- Number of victims and economic losses of disasters are increasing
- Scientific evidence of extreme climate events, rainfall, drought, ...

# Risk Management Reality

- Governments, civil protection bodies and Emergency services are becoming more dependent on **integrated information systems** to aid different phases of Disaster Risk Management (prevention, preparedness, response, recovery) in complex **trans-boundary, multi-risk scenarios**
- Integration of information systems is difficult due to lack of
  - common terminology,
  - accessibility and availability of data,
  - interoperability (e.g. lack of standards and their use),
  - co-ordination, procedures and business models ...
- A vast number of existing **legacy systems** were not designed to work together



# Risk Management Cycle



Note:

- ① Reconstruction (i.e. Land Use Planning) can be influenced by Risk Assessment & vice versa.
- ② Pre-Impact scenario analysis is often conducted based on previously constructed emergency planning scenarios.
- ③ Lessons Learned from Emergency Experience feeds back into pre-impact planning as well as perhaps exploiting existing communication strategies.
- ④ Emergency Management can prioritize the restoration of services during the response. Service restoration can support the management of the current emergency situation.
- ⑤ After temporary restoration of the most relevant services, reconstruction might be necessary to guarantee a better quality of the service or to recover all non functional services.





# ORCHESTRA project

# The compromise of the European Commission in IST Programme



- European Commission (EC) has highlighted the strategic objective of “Improving Risk Management” within the FP6 of R+TD IST Programme
- Three Integrated Projects (IP) were approved for funding:



- **ORCHESTRA** stands for “Open Architecture and Spatial Data Infrastructure for Risk Management”
  - Started in September 2004, ending in August 2007
  - A consortium of 14 partners in Europe
  - A budget of 13 M€



**OGCE**  
Open Geospatial Consortium (Europe) Limited



**Fraunhofer** Institut  
Informations- und  
Datenverarbeitung

**seibersdorf research**  
Ein Unternehmen der Austrian Research Centers.



Eidgenössische Technische Hochschule Zürich  
Swiss Federal Institute of Technology Zurich



[www.euorchestra.org](http://www.euorchestra.org)



# ORCHESTRA goals



- To design and implement an open **service-oriented architecture** (SOA) for risk management in Europe
- To develop a set of **services** that are useful for various risk management applications
- To validate the ORCHESTRA results (i.e. architecture and services) in **multi-risk scenarios**
- To provide software **standards** for risk management applications, and to provide additional information about these standards in the form of a book (the ORCHESTRA book).
  - In particular, the de-facto standard of OGC and the de-jure standards of ISO and CEN are envisaged to be influenced
  - As input to GMES and INSPIRE

# ORCHESTRA project phases



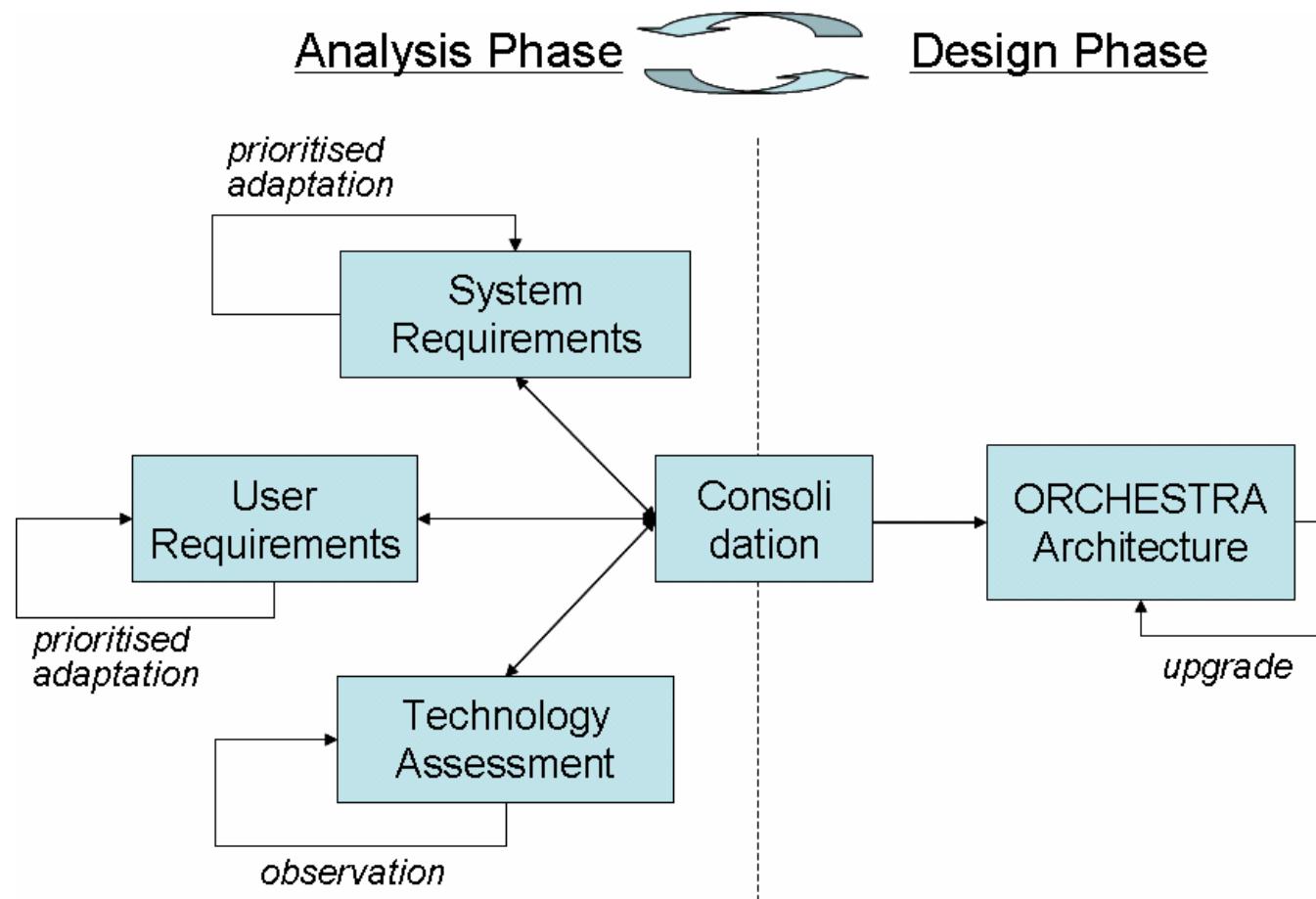
## Analysis phase

- System requirements, analysis of problems in inter-operability, architectural properties for sharing information
- User requirements, end-user services and data, presentation, handling, availability, accuracy, timeliness
- Technology assessment, using the existing solutions for inter-operability (i.e. geographic information systems and ontologies)
- Consolidation process, common understanding of system and user requirements, assessment of current technology

## Design phase

- ORCHESTRA Architecture

# ORCHESTRA project phases





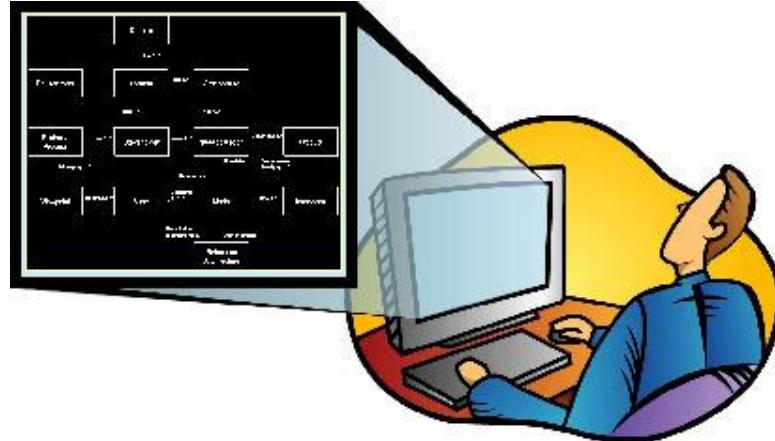
## Towards interoperability

# ORCHESTRA approach to enhance interoperability: use of standards

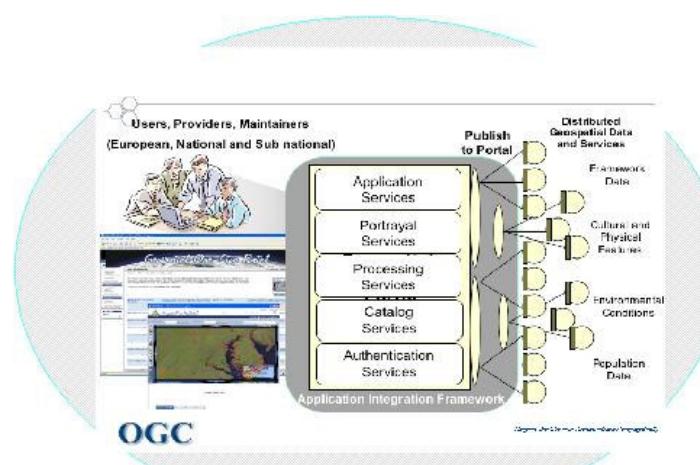


Instead of risk management systems integrated within an organisation...

... systems are networked across and between organisations with interoperable capabilities



Standards-based info structure for risk management



Network platforms, services, components and portals based on standards



## ORCHESTRA approach to enhance interoperability: use of standards

ORCHESTRA architecture design and development will be based on the principles of existing standards:

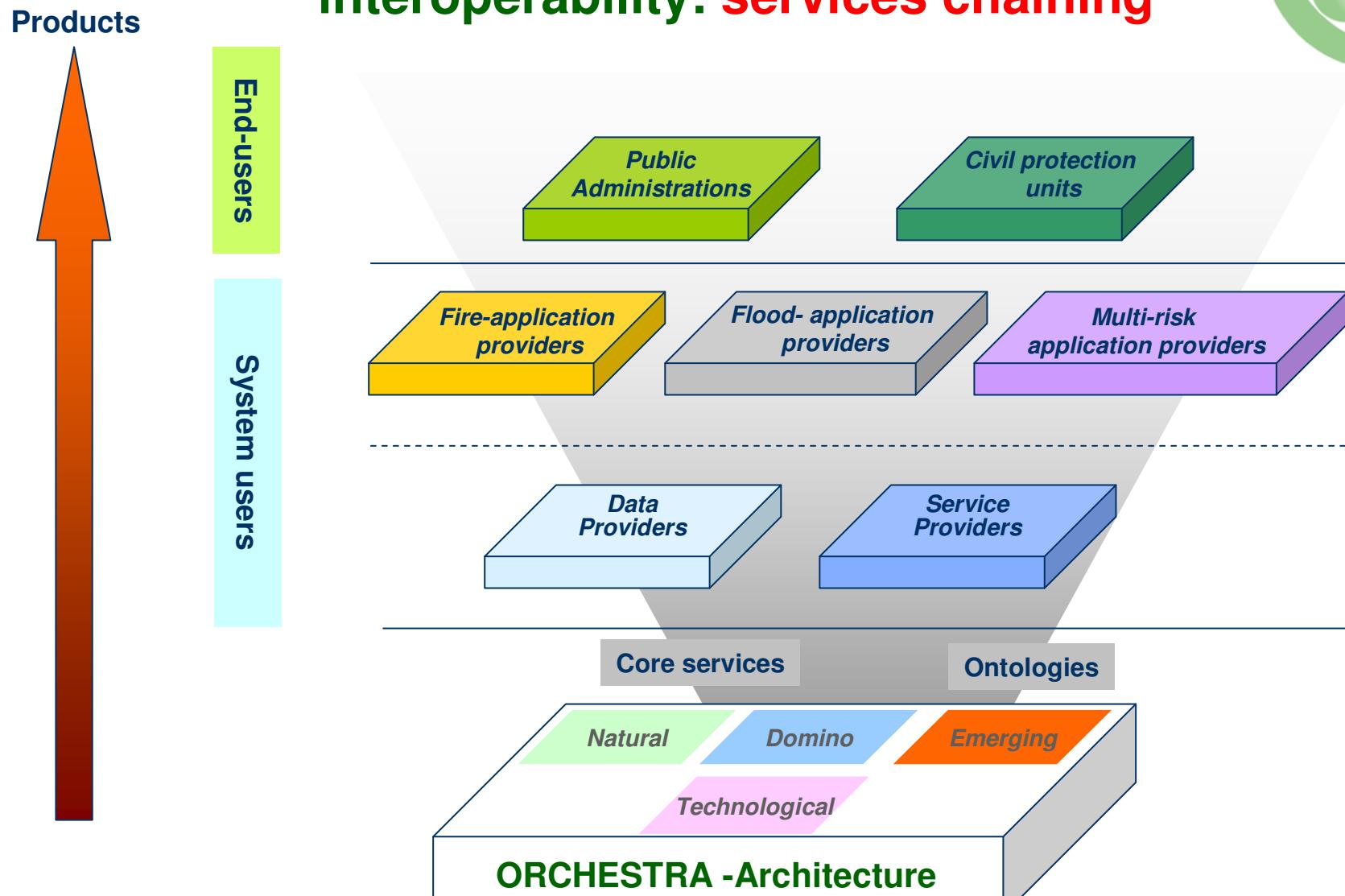
- Reference Model for Open Distributed Processing (ISO/IEC10746), structuring ideas and documentation
- OpenGIS Service Architecture (ISO/DIS 19119), taxonomy of services



## ORCHESTRA approach to enhance interoperability: use of ontologies

- Distributed, heterogeneous sources of information require interoperability
- Focus has been given to syntax and structural level: this allows physical connectivity
- Semantic level should be also addressed: content of the information referring to the same concepts = common semantics
- Ontologies: specification of a conceptualization in a domain of knowledge (i.e. different risk domains). Formal description:
  - Glossary of terms
  - Relationships
- Mapping of ontologies: interoperability between information sources (i.e. multi-risk scenarios)

# ORCHESTRA approach to enhance interoperability: services chaining





## System Users benefits

- Preserve legacy code while adding service interoperability
- Data providers can provide their data for multiple risk situations
- Opens up new business models for service providers
- Be able to discover already existing data and services that can be re-used in other situations
- Develop new value-adding services based on already existing services
- Provide better services to the end users based upon de facto and de jure standards.



## End Users benefits

- Provide flexible service capabilities: Services will be architected to be interoperable and easily integrated in the current technological reality.
- Intelligent Data handling: Coherently handle both spatial and non-spatial data to assure the interchange of information among different actors at different levels from Local to National to Global.
- On-demand access: Be able to inform the citizens about preventing and dealing with risks using different formats and publishing channels.

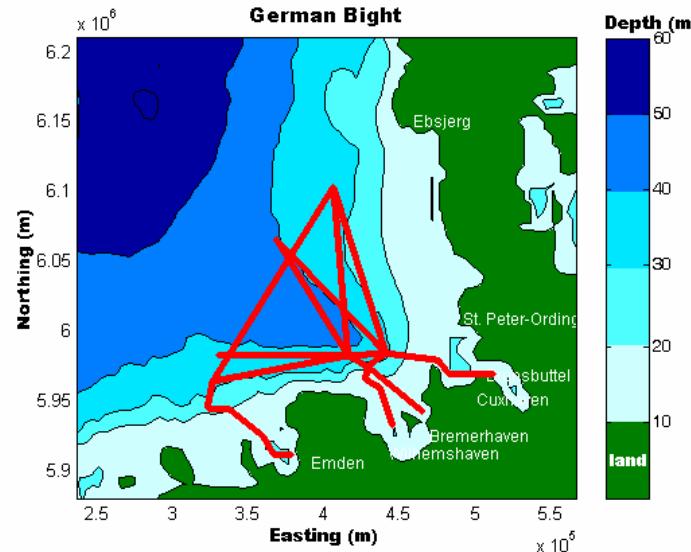


## Example of application: risk management in the coastal zone (CZM)

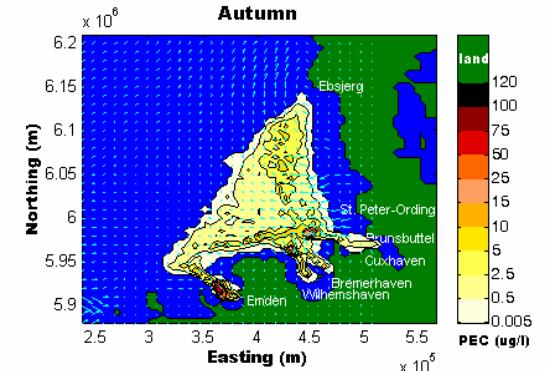
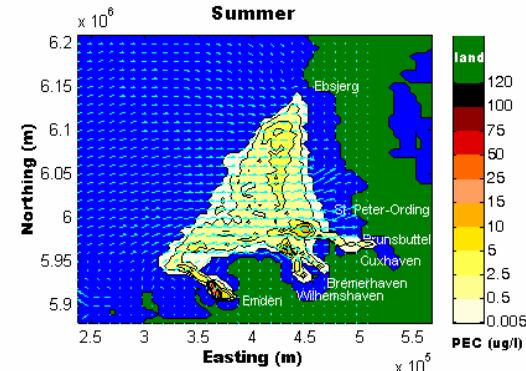
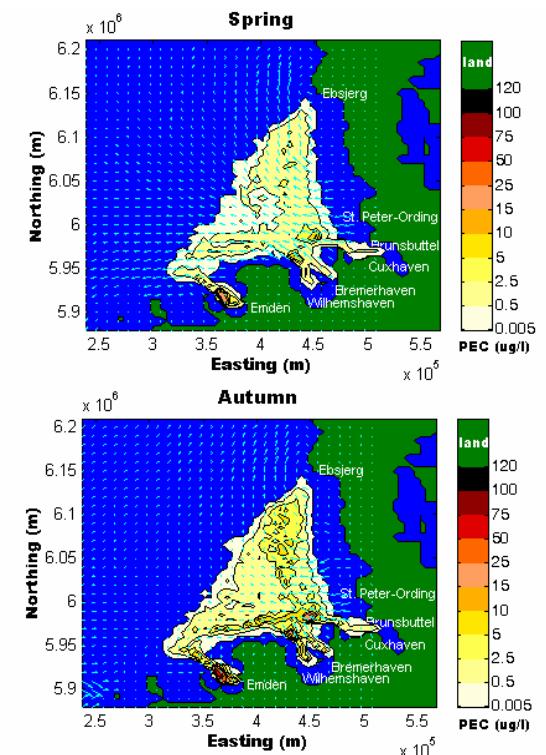
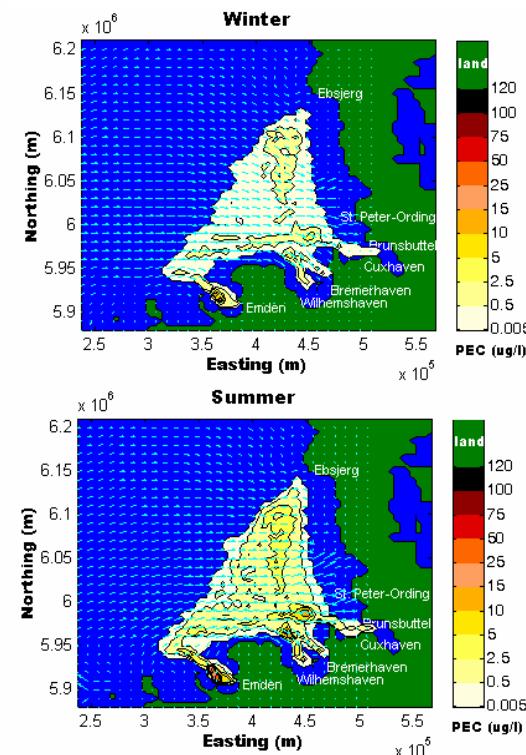
- Environmental risks generated from maritime transport
- Modelling techniques required, evaluation test beds needed
- Information sharing:
  - General toxicity (air, water, ecosystems)
  - Traffic networks
  - Coastal environmental databases
  - Numerical models kernel
- Induction of secondary risks (fishing, leisure, etc.) should be considered
- Mapping of probability of occurrence of all risks -> prediction of hazard maps and dynamic upgrading (according to traffic, conditions etc.)
- Evaluation of multi-risks and their probability of exceedence with respect to statutory criteria



# Example of application: risk management in the coastal zone (CZM)



Illustrative ship traffic network in the German Bight



Illustrative TBT Exposures in the German Bight



## Current activities: User requirements

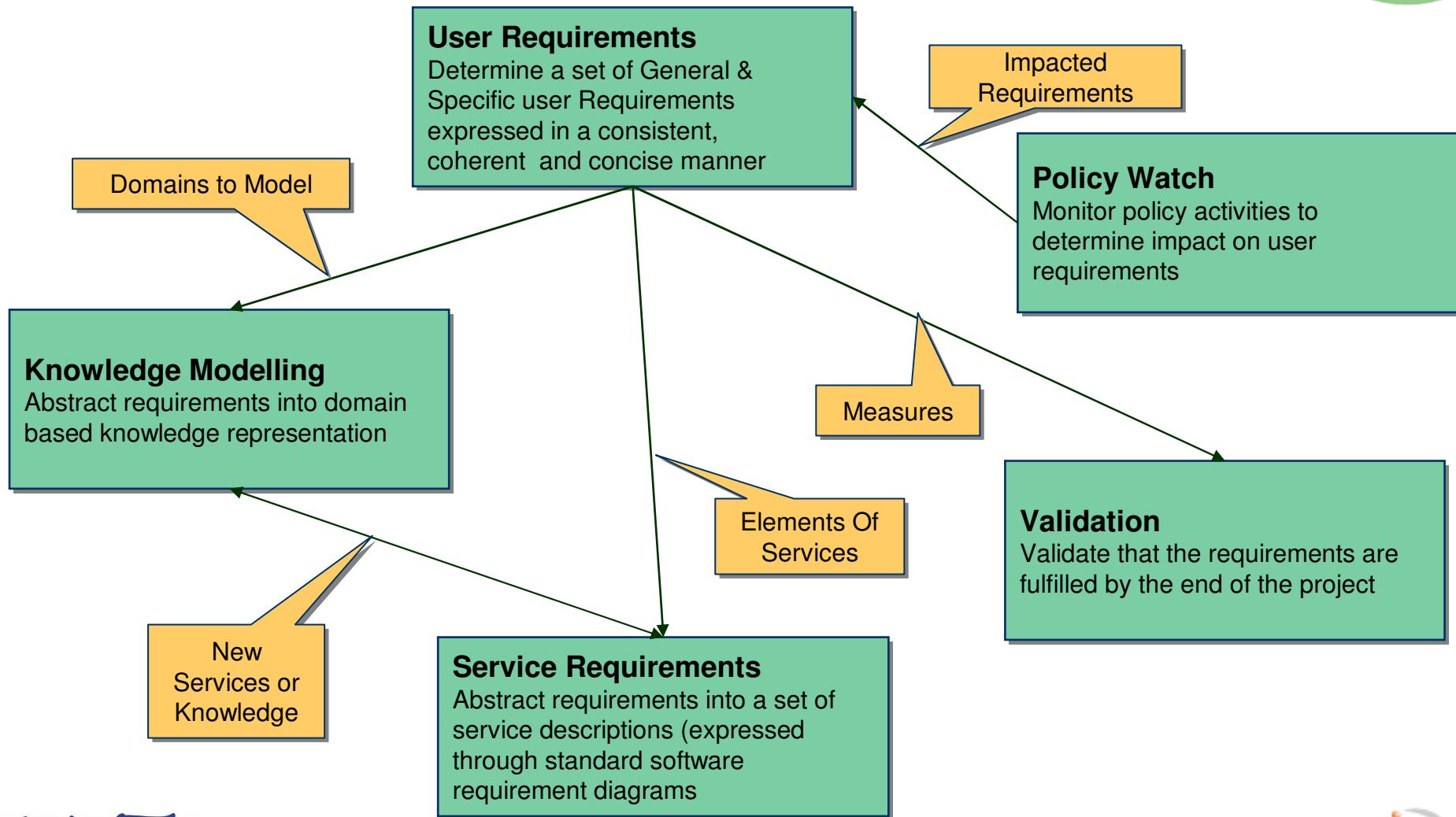
# ORCHESTRA User Requirements: objectives



“Abstract real risk management requirements into a format digestible for ORCHESTRA Architects and Software Scientists”

- Define and maintain the risk management domain dependent requirements for the Orchestra Architecture & Services
- Monitor and possibly contribute to the progress made in the relevant policy -making and in other prescriptive/normative scenes or technical areas that can have an impact on the definition of the ORCHESTRA architecture - especially EU policy
- Ensure that the resulting ORCHESTRA architecture and services embody the identified user requirements

# ORCHESTRA User Requirements: activities





# Conclusions



# Conclusions

- ORCHESTRA aims to deliver an architecture with generic services which are useful in different risk management applications.
- This will make the life easier for risk management application developers, since they can build on these services when developing their own services
- All services developed according to the ORCHESTRA standards will be able to interoperate with each other, making it easier to “develop once, deploy in many different situations”.
- ORCHESTRA will work closely together with INSPIRE and GMES initiatives



# Thanks!

