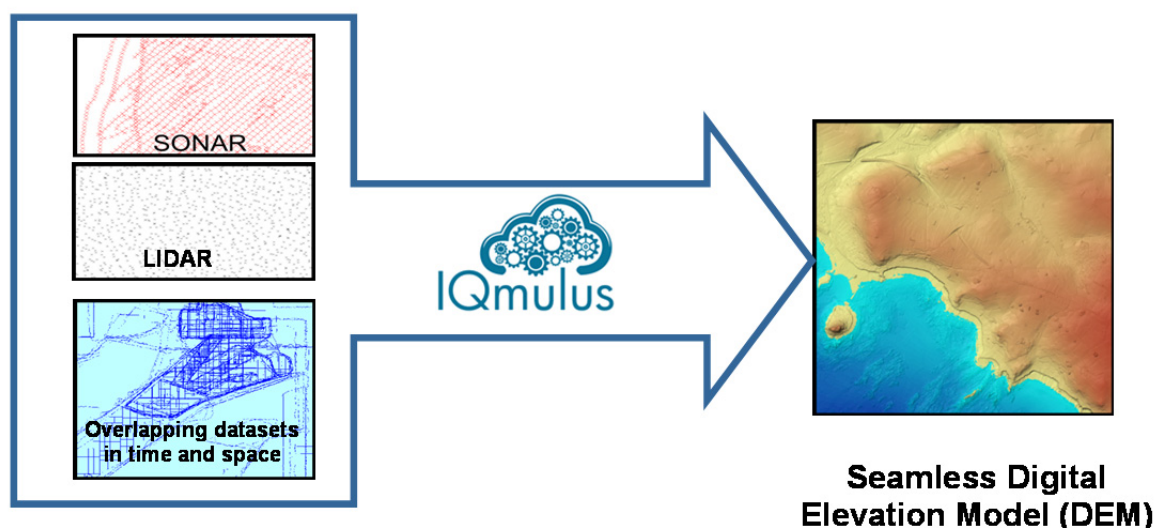## 2   PUBLISHABLE SUMMARY

http://www.IQmulus.eu

A High-volume Fusion and Analysis Platform for Geospatial Point Clouds,
Coverages and Volumetric Data Sets

The IQmulus Mission

IQmulus will leverage the information hidden in large heterogeneous
geospatial data sets and make them a practical choice to support reliable decision making

IQmulus (November 2012 – October 2016) is a four-year *Large-scale Integrating Project* funded by the EU Seventh Framework Programme under *Grant Agreement FP7-ICT-2011-318787* in the area of *Intelligent Information Management* within *ICT 2011.4.4 Challenge 4: Technologies for Digital Content and Languages.*

Contact for project information

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THE IQMULUS CONCEPT

Valuable information exists in huge geospatial datasets but is hidden and not integrated in the decision process

Multidimensional spatial data acquired by Airborne LIDAR surveys, SAR satellites, stereophotogrammetry and mobile mapping systems are increasingly used as the basis for digital reconstruction. All these systems provide point clouds, often enriched with other sensor data, yielding extremely high volumes of raw data.

Often, available information is only accessed for damage assessment in a "what went wrong?" analysis

Recent emergencies, such as the toxic industrial mud spill in Ajka, Hungary, in October 2010, and the flooding rain in Genova, Italy, in November 2011, have highlighted the fact that crucial information is embedded in existing large geospatial datasets but not available to the decision makers when needed. Most often this knowledge is first extracted and accessed in hindsight for damage assessment and belated "what went wrong" analysis.

IQmulus will make information from large geospatial datasets available on time, with interactive visual decision support, and at the relevant level of decision making

Efficient use of geospatial datasets for decision support depends on the users being able to specify desired workflows on a high level, workflows that screen the user of from unnecessary technical jargon and implementation details. The users in IQmulus have been active from the start through the initial requirement specification phase, and will have an essential role in the testing of components and the two testing and evaluation cycles of the project.

IQmulus will be validated in two test cases of economic and social importance to Europe

The two test scenarios Maritime Spatial Planning and Land Applications for Rapid Response and Territorial Management address expert users both from within and from outside the project consortium, e.g., engineers investigating suitable locations for a wind park, and decision makers that address emergency cases requiring quick responses.

IQMULUS GOALS

Develop methods for knowledge-driven processing of topographic data

High-quality coregistration from multiple heterogeneous data sets;

- Efficient **feature extraction and classification** for detecting keypoints and correlations between different geodatasets (e.g., coverages and point clouds);
- Efficient and effective **surface generation, using multi-resolution** and level-of-detail techniques;
- **High-quality change detection methods** to characterize dynamic events;
- **Descriptive information** associated to a dataset (**metadata**) explaining the process or workflow that produced it, leading to provision of processing and capturing semantics.

Develop methods for the visual analysis and inspection of huge spatial datasets

- Visualization and exploration of **large heterogeneous** n-dimensional geodatasets, based on **leading-edge GPU technology**, with corresponding data pre-processing services;
- **Web-based visualization** for non-expert decision makers, realized via **client-side** or **server-side rendering**, with corresponding pre-processing services.

Integration of the services into a platform able to sustain data-intensive processing

- **Domain-specific languages** with which users will be able to specify workflows for processing data sets, independently of underlying execution architectures;
- **Spatial data-processing middleware** that abstracts the different parallel and distributed processing infrastructures, e.g., GPGPUs, Map/Reduce and Cloud environments, with the choice of optimal processing settings for a given algorithm and dataset description.

Main IQmulus Activities in Project Year 1

November 1, 2012 – October 31, 2013

- A careful and detailed elaboration of *User Requirements* by organizing 14 user workshops in 4 countries, gathering 125 users of different levels of expertise from 24 organizations. This led to the formulation of 115 user stories, which were then condensed to *3 show cases* (1 marine, 2 land) to be treated by the first functional prototype due after year 2 of the project.
- The design of the first version of the *system architecture* and the development of a *first "technical but not functional" prototype* to lay the foundation for the creation of the first "functional" prototype in year 2.
- A *common basis for the processing services* to be deployed by establishing development guidelines for data integration and processing, and producing first versions of two processing toolkits for *Spatio-temporal Data Fusion* and *Feature Extraction and Classification*.
- Transformation of the users' visualization needs into technical specifications for guiding the development of the visualization technology and prototypical integration and testing of the *expected visualization workflows.*
- Some dissemination highlights:
  - A press conference in Genova, Italy, on the project and its goals on January 15, 2014, presenting IQmulus to ca. 20 journalists.
  - The presentation "Frankenstein's Data" at the European Data Forum 2013 in Dublin, Ireland, in April 2013, the annual meeting-point for data practitioners from industry, research, the public-sector and the European Commission to discuss the opportunities and challenges of the emerging Big Data Economy in Europe.
  - The first IQmulus Processing Contest was devised, preparing a call for participation and running the contest. A presentation of the contest results was organized for the ISPRS Workshop Laser Scanning 2013 in Antalya, Turkey, in November 2013.

Project partners

- SINTEF ICT, Department of Applied Mathematics (coordinating), Oslo, Norway
- Fraunhofer Institute for Computer Graphics Research (Fraunhofer), Competence centers for Spatial Information Management, Visual Computing System & Interactive Engineering Technologies, Darmstadt, Germany
- Institute for Applied Mathematics and Information Technologies of the National Research Council (CNR-IMATI), Genova, Italy
- M.O.S.S. Computer Grafik Systeme GmbH (MOSS), Munich, Germany
- HR Wallingford Ltd (HRW), Wallingford, UK
- Hungarian National Mapping and Cadastral Agency (FOMI), Institute of Geodesy, Cartography and Remote Sensing, Budapest, Hungary
- University College London (UCL), Research centre for Photogrammetry, 3D Imaging and Metrology, London, UK
- Delft University of Technology (TUDelft), Department of Geoscience & Remote Sensing,& Man-Machine Interaction Group, Delft, The Netherlands
- Institut National de l'Information Géographique et Forestière (IGN), Paris, France
- Université de Bretagne Occidentale (UBO), European Institute for Marine Studies, Brest, France
- L'Institut Francais de Recherche pour l´Exploitation de la Mer (Ifremer), Brest, France
- Regione Liguria, Genova, Italy