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Report on Dissemination Activities

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and

Consortium members

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Executive Summary

This document reports on the dissemination activities that have been done for the project TELEIOS in the first 12 months of execution.

The dissemination channels considered include scientific publications, demos, workshops, post-graduate courses and theses, the production of promotional material such as flyers and posters, the establishment of close links with other FP7 projects, as well as interaction with standard bodies and the wider public.

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1. Introduction

This document reports on the dissemination activities for the project TELEIOS in the first 12 months of execution. The document reports on all activities that have been performed in order to let the outside world know about the existence and results of the TELEIOS project.

The research and development work performed in TELEIOS is motivated by the fact that the availability of Earth Observation (EO) data now outstrips the availability of human intelligence to exploit it. As TELEIOS is targeted explicitly to EO scientists in terms of functionality, the TELEIOS architecture is based on the requirements solicited from a large community of EO scientists and two representative use cases. The TELEIOS infrastructure enables better leveraging of the skills of EO scientists, improved quality and quantity of output, and reduced time and cost for their research. It goes beyond existing software (KIM/KEO/KAOS) developed by partners that many EO scientists in Europe are already familiar with. In addition, it improves significantly existing EO data management tools by making them more functional and more scalable.

TELEIOS will demonstrate this technological infrastructure by adopting a use case-guided development and evaluation strategy based on the two use cases of the project.

As described in deliverable D10.1, the dissemination channels considered include scientific publications, demos, workshops, post-graduate courses and theses, the production of promotional material such as flyers and posters, the establishment of close links with other FP7 projects, as well as interaction with standard bodies and the wider public.

In Section 2 we review the overall dissemination plan as it was described in deliverable D10.1. In Section 3 we give a detailed presentation of the individual dissemination activities that have been performed in the first 12 months of the TELEIOS project by each member of the consortium. Finally, in Section 4 we summarize our dissemination effort in a table that lists the dissemination activities in chronological order, and in Section 5 we present snapshots of selected dissemination material.

2. Overall dissemination plan

The general objectives of the dissemination activities for the whole consortium are:

- To ensure maximum awareness and visibility of the achievements and results of the project by presenting the project results in as many public events as possible, aiming to reach a wide audience.
- To promote the use of new technologies developed and tested in the project, to companies and institutions that already have an interest in Earth Observation but are still discouraged by the current methods and tools.
- To contact potential users of our systems, not yet aware of the EO potential, demonstrating the advantages of the TELEIOS approach, thus facilitating the enlargement of the user community.

2.1. *Main research results to be disseminated*

In this section we present the main results to be disseminated organized by work packages.

- **WP1:** The TELEIOS infrastructure
 - The TELEIOS architecture.
 - The implemented TELEIOS infrastructure in its three versions.
- **WP2:** Data models and query languages
 - The extensions of the Semantic Web technologies RDF and SPARQL so that they account for time and space.
 - The new array data models and query languages for EO image data.
 - The new data models and query languages for continuous/stream queries over EO image databases.
- **WP3:** Knowledge discovery from EO images
 - Knowledge discovery techniques for EO images and related GIS data.
 - Semi-supervised learning methods for spatio-temporal and contextual pattern discovery.
 - Human machine interaction (HMI) techniques for image information mining.
- **WP4:** Scalable storage and query processing for EO image metadata
 - Query processing and optimization techniques for a temporal and spatial extension of RDF and SPARQL on top of MonetDB: definite geospatial information.

- Query processing and optimization techniques for a temporal and spatial extension of RDF and SPARQL on top of MonetDB: indefinite geospatial information.
- Benchmarking and evaluation techniques.
- **WP5:** Ad-hoc and continuous/stream queries for EO images
 - Query processing and optimization for ad-hoc array queries on top of MonetDB.
 - Query processing and optimization for continuous/stream queries on top of MonetDB.
 - Benchmarking and evaluation techniques.
- **WP6:** A Virtual Observatory for TerraSAR-X data
 - Development of ontologies for the VO for TerraSAR-X data.
 - A new generation of EO portals that go beyond EOWEB.
 - Rapid mapping applications.
- **WP7:** Real-time fire monitoring based on continuous acquisitions of EO images and geospatial data
 - The real-time fire monitoring and burned area mapping application.
 - Evaluation of the real-time fire monitoring application and the TELEIOS infrastructure.

2.2. *Dissemination channels*

The work programme of TELEIOS contains a specific work package, i.e., WP8, which is aimed at involving the general EO community in the activities of TELEIOS by capturing the requirements of EO scientists, letting them experiment with TELEIOS technologies, and taking their feedback into account. The workshops of WP8 are the main dissemination channel of TELEIOS research to ESA (since they take place at ESRIN under the auspices of ESA) and the EO community in general.

In addition to dissemination carried out in the workshops of WP8, several other forms of dissemination will be undertaken:

- **Scientific publications.** The forums where research results appear (scientific journals, conferences and specialized workshops) are the ultimate measure of the output of any research activity. Therefore, one of the goals will be to present the results of the research within the project in top rated scientific workshops, conferences, and journals.
- **Demos.** Demos of individual components and the TELEIOS infrastructure will be presented in related conferences, workshops and other events in order to reach a wider audience and improve the involvement of different application communities.

- **Workshops.** We plan to organize workshops in currently popular research areas related to the project (Geospatial Semantic Web, Linked Geospatial Data, Scientific Databases, Knowledge discovery from EO images) etc.
- **Post-graduate courses and theses.** Whenever TELEIOS results are related to post-graduate courses taught by academic partners, we will include the results in the course material to enable students become familiar with state of the art European research. Similarly, TELEIOS related topics will be given as diploma, M.Sc., and Ph.D. theses.
- **Project website.** The project website has been active since the beginning of the project at <http://www.earthobservatory.eu/>. The detailed design of the website is described in Deliverable D10.2, thus we do not give any other details here.
- **Production of promotional material such as flyers and posters.** This will serve as a marketing opportunity of TELEIOS to the relevant research, industrial, governmental, and user communities. The material will be prepared by NKUA and distributed by the project partners when they attend various related events. As part of this activity the TELEIOS Brief Project Fact Sheet has been prepared (Deliverable 10.1) and is available on the website of the project.
- **Establishment of close links with other FP7 projects.** In case that TELEIOS partners participate in relevant projects (e.g., SemsorGrid4Env, LOD2, SAFER) the links will be through the relevant partners as explained in the dissemination plan of each individual partner. Otherwise, this will be sought mainly through the participation of the consortium partners in relevant activities of the FP7 framework.
- **Interaction with standard bodies.** We intend to interact with standard bodies such as the W3C and OGC to disseminate the results of TELEIOS and push for initiation/continuation of work in relevant areas. This will be done through the relevant partners as described in the dissemination plan of each individual partner.
- **Targeting end users.** Partners will disseminate the results of TELEIOS to relevant end users of their individual countries (e.g., space agencies, environment protection agencies, civil protection authorities etc.) as explained in the dissemination plan of each individual partner.
- **Targeting the wider public.** All partners will take advantage of local media to announce the initiation of TELEIOS, and its results as the project goes on. A press release has been prepared in English by NKUA at the beginning of the project and has been distributed to all partners so that they can modify it as they see fit and use it for press releases in their national press.

3. TELEIOS 1st User Community Workshop

The first important dissemination event of TELEIOS in Year 1 was the 1st User Community Workshop that took place at the premises of ESA in Frascati on the 13th of October, 2010 (M2). The workshop was organized under the lead of Fraunhofer (WP8 leader) and NKUA (coordinating node) with the support of all partners.

The purpose of the workshop was twofold: first, to capture an initial set of high-level requirements from relevant stakeholders and potential users of the TELEIOS system and infrastructure, and second, to present and discuss with the participants the TELEIOS ideas as described in the technical annex.

In advance of the workshop and the kick-off meeting of the project, the TELEIOS consortium members had proposed a set of potential workshop participants (people and institutions). In particular, NOA contacted stakeholders that are related to the NOA use case, e.g., the General Secretariat for Civil Protection of Greece, the Ministry of Environment of Greece, and the partners of the European project SAFER in the field of fire monitoring at a European level. Similarly, DLR contacted stakeholders that are related to the DLR use case. At the end of July 2010, an invitation letter was sent out by Fraunhofer and for those who replied, a workshop website was set up for further information and registration.

The workshop was very successful attracting 30 participants covering the roles of users of EO technologies, data providers, EO scientist, and technology providers. Details of the user requirements capture activities that were one during the workshop are reported in Deliverable D8.1 “Requirements specification of the TELEIOS user community” that was delivered on M3.

4. Individual dissemination activities in Year 1

4.1. NKUA

NKUA participates in TELEIOS as a research institution and is also the coordinating node. NKUA leads the part of WP2 that works towards the extension of the data model RDF and the query language SPARQL. The new extension will account for representing and querying temporal and geospatial image metadata, but also image content specified by spatial constraints. NKUA also leads WP4 that works towards query processing and optimization algorithms for the temporal/spatial extension of RDF and SPARQL proposed in WP2, and the implementation of these algorithms on top of MonetDB.

The main objectives of the dissemination activities of NKUA are the following:

- To ensure maximum awareness and visibility of the achievements and results of the TELEIOS project as a whole as the coordinating partner.
- To ensure maximum awareness of their research results on geospatial and temporal extensions of RDF and SPARQL.

NKUA has performed the following activities in order to disseminate the project results.

4.1.1. Scientific publications

- **Paper at BASR workshop 2011**

The NKUA team members Manolis Koubarakis, Kostis Kyzirakos, Manos Karpathiotakis, Charalampos Nikolaou, Michael Sioutis, and Stavros Vassos are included as authors of the paper “Challenges for Qualitative Spatial Reasoning in Linked Geospatial Data” [1].

The paper was presented by at the “Benchmarks and Applications of Spatial Reasoning 2011 (BASR)” workshop¹ that took place in conjunction with the “Twenty-second International Joint Conference on Artificial Intelligence (IJCAI)” conference² at Barcelona, Spain, on July 18, 2011.

The paper can be found in the website of TELEIOS in the publications section,³ and the reference information about this paper is also available in CiteULike,⁴ a popular website that organizes academic publications.

The abstract of the paper follows.

“Linked geospatial data has recently received attention, as researchers and practitioners have started tapping the wealth of geospatial information available on the Web. We discuss some core research problems that arise when querying linked geospatial data, and explain why these are relevant for the qualitative

¹ <http://qsr.informatik.uni-freiburg.de/ijcai11-bench/>

² <http://ijcai-11.i3ia.csic.es/>

³ <http://www.earthobservatory.eu/Publications>

⁴ <http://www.citeulike.org/user/stavros/article/9473900>

spatial reasoning community. The problems are presented in the context of our recent work on the models stRDF and stSPARQL and their extensions with indefinite geospatial information.”

4.1.2. Workshops

- **Organization of Terra Cognita 2011**

The NKUA team member Manolis Koubarakis is co-organizing the “Terra Cognita 2011” workshop⁵ that will take place in conjunction with the 10th International Semantic Web Conference (ISWC 2011)⁶, at Bonn, Germany on October 2011.

The workshop aims to bring together Semantic Web and geospatial researchers in order to encourage the use of semantics in geospatial applications and the use of spatial elements in semantic research and applications thereby advancing the Geospatial Web. The goal of the workshop is to bring together researchers and practitioners from various disciplines, as well as interested parties from industry and government, to advance the frontiers of this research area.

4.1.3. Post-graduate courses and theses

- **Course on Knowledge Technologies**

Manolis Koubarakis taught the post-graduate course “Knowledge Technologies”⁷ in the 2010-2011 fall semester at the Department of Informatics and Telecommunications of NKUA. The course is essentially an introduction to the Semantic Web so concepts and techniques related to WP2 and WP4 were covered.

In addition 1 diploma thesis, 2 M.Sc. theses and 2 PhD theses are currently going on at NKUA on topics related to WP2 and WP4 under the supervision of Manolis Koubarakis.

4.1.4. Establishment of close links with other projects (national, European, international)

- **FP7 project SemsorGrid4Env**

NKUA participates in the FP7 projects SemsorGrid4Env: “Semantic Sensor Grids for Rapid Application Development for Environmental Management”.⁸ SemsorGrid4Env finishes in September 2011. The work of NKUA in SemsorGrid4Env forms the basis of the NKUA work in WP2 and WP4, so the collaboration with this project is well established.

⁵ <http://asio.bbn.com/terracognita2011/>

⁶ <http://iswc2011.semanticweb.org/>

⁷ <http://cgi.di.uoa.gr/~pms509/>

⁸ <http://www.semsorgrid4env.eu/>

NKUA has already disseminated to SemsorGrid4Env partners the extension of SensorGrid4Env technologies that are relevant (new version of stSPARQL, extensions of stSPARQL with indefinite information, new implementation on MonetDB).

Among other things, Kostis Kyzirakos participated in the tutorial "Building Semantic Sensor Webs and Applications"⁹ that took place at the 8th European Semantic Web Conference (ESWC 2011)¹⁰ where he presented stSPARQL and its implementation Strabon.

4.1.5. Interaction with standard bodies

- **Open Geospatial Consortium (OGC)**

NKUA disseminated their work on geospatial extensions of RDF and SPARQL to OGC. To do this NKUA became a member of OGC on January 27, 2011 and participated in parts of the activity of the relevant OGC Standard Working Group for GeoSPARQL. Currently, GeoSPARQL is a candidate standard [16] and recently OGC released a public request for comments for GeoSPARQL.¹¹ NKUA participated in the OGC meeting in Bonn on March 3, 2011, and various teleconferences regarding GeoSPARQL, to disseminate our geospatial extensions of RDF and SPARQL.

By following closely the work of the GeoSPARQL working group and keeping in mind that the version of stSPARQL implemented in the system Strabon is very close syntactically and semantically to GeoSPARQL, Strabon can easily offer a GeoSPARQL implementation to facilitate its adoption by the communities of Geospatial Semantic Web and Linked Geospatial Data.

No interaction with the W3C is currently foreseen since there are no known W3C plans for working on geospatial extensions of RDF and SPARQL. An interesting idea would be to use the GeoSPARQL standard as input to W3C work once the OGC standard work has been completed.

4.1.6. Targeting the wider public

- **TELEIOS website**

The project website has been active since the beginning of the project at <http://www.earthobservatory.eu/>. The detailed design of the website is described in Deliverable D10.2, thus we do not give any other details here. The material that is presented in the website has been constantly updated by NKUA in order to report on the activities of the consortium and reflect the current status of the

⁹ <http://semsorgrid4env.eu/index.php/events-meetings/49-building-semantic-sensor-webs-and-applications-eswc-2011>

¹⁰ <http://www.eswc2011.org/>

¹¹ <http://www.opengeospatial.org/standards/requests/80>

project. A recent snapshot of the home page of TELEIOS can be found in Section 5.

- **TELEIOS flyer**

The TELEIOS Brief Project Fact Sheet has been prepared (Deliverable 10.1) and is available in the website of TELEIOS in the Deliverables section¹². This was the basis for producing a promotional flyer that is intended to be distributed by the project partners when they attend various events. The TELEIOS flyer can be found in the Resources section of the TELEIOS website¹³. A snapshot of the flyer can also be found in Section 5.

- **Poster at ESA-JRC-EUSC 2011**

NKUA prepared a poster that illustrates the goals and challenges of TELEIOS for the “Seventh Conference on Image Information Mining: Geospatial Intelligence from Earth Observation (ESA-JRC-EUSC)” conference¹⁴ that took place at Ispra-Varese, Italy. The poster was presented by Manolis Koubarakis on the 30th of March, 2011, in the “Poster and demonstration” session.

The poster can be found in the website of TELEIOS in the News section¹⁵. A low resolution image snapshot of the poster can also be found in Section 5.

- **Press release**

NKUA has advertised TELEIOS in the local press in Greece by conducting a press release and contacting all the major Greek newspapers. As a result a number of articles have appeared in the local media:

- The article “TELEIOS: Research project for the prevention of natural disasters” was published on May 9, 2011 in the Greek newspaper “Imerisia”. The article can be found in the online version of the newspaper¹⁶ as well as in the website of TELEIOS in the News section.¹⁷
- The article “TELEIOS observatory for forests, disasters” was published on May 14, 2011 in the Greek newspaper “Eleytherotypia”. The article can be found in the online version of the newspaper¹⁸ as well as in the website of TELEIOS in the News section.¹⁹
- The article “TELEIOS: A perfect virtual observatory” was published on May 23, 2011 in the Greek newspaper “Academic Voice”. The article

¹² <http://www.earthobservatory.eu/Deliverables>

¹³ <http://www.earthobservatory.eu/Resources>

¹⁴ http://rssportal.esa.int/tiki-index.php?page=2011_ESA-EUSC-JRC

¹⁵ http://www.earthobservatory.eu/ESA_JRC_EUSC_2011_Poster

¹⁶ <http://www.imerisia.gr/article.asp?catid=12304&subid=2&pubid=111131357>

¹⁷ http://www.earthobservatory.eu/TELEIOS_research_project_for_the_prevention_of_natural_disasters

¹⁸ <http://www.enet.gr/?i=issue.el.home&date=14%2F05%2F2011&id=275291>

¹⁹ http://www.earthobservatory.eu/TELEIOS_observatory_for_forests_disasters

can be found in the online version of the newspaper²⁰ as well as in the website of TELEIOS in the News section.²¹

- Jointly with NOA: The article “TELEIOS: Perfect fire control through remote sensing” was published on June 28, 2011 in the Greek newspaper “Vima”. The article can be found in the online version of the newspaper²² as well as in the website of TELEIOS in the News section.²³
- The article “Perfect (TELEIOS) fire control through remote sensing in the University of Athens” was published on June 28, 2011 in the Greek news portal “Cosmo.gr”. The article can be found in the website of the portal²⁴ as well as in the website of TELEIOS in the News section.²⁵

- **Short video showcasing TELEIOS-related material**

As part of the dissemination plan of the SemsorGrid4Env project, a professional short video has been produced showcasing to the public at large the activities performed in the frame of this grant agreement. The TELEIOS NKUA and NOA teams appear in the video, illustrating the connection of the two projects, and discussing some of the highlights of the TELEIOS project and the connection to SemsorGrid4Env. The video will be available at the SemsorGrid4Env project web site²⁶ and disseminated accordingly by the SemsorGrid4Env partners.

4.2. Fraunhofer

Fraunhofer participates in TELEIOS as a research institution. Fraunhofer leads WP8 that facilitates the involvement of the wider international community of EO scientists in TELEIOS. This is done by involving EO scientists from Month 1 of the project and for the whole project duration. Fraunhofer also contributes in the work on knowledge discovery from images and GIS data (jointly with DLR in WP3), and in the development of ontologies for EO data (jointly with DLR in WP6).

The main objectives of the dissemination activities of Fraunhofer are the following:

- Disseminate the project results to relevant standardisation bodies such as the OGC.

²⁰ <http://www.alogos.gr/articles/1208-TELEIOS-To-téleio-idea-to-paratirhthrio.html>

²¹ http://www.earthobservatory.eu/TELEIOS_the_perfect_earth_observatory

²² <http://www.tovima.gr/society/article/?aid=408490>

²³ http://www.earthobservatory.eu/TELEIOS_fire_control_through_remote_sensing

²⁴ <http://www.cosmo.gr/Environment/Hellas/330793.html>

²⁵ http://www.earthobservatory.eu/TELEIOS_the_perfect_fire_control_management

²⁶ <http://www.sensorsgrid4env.eu/>

- Reuse the methodologies for requirements gathering developed for TELEIOS in other projects.

Fraunhofer has performed the following activities in order to disseminate the project results:

4.2.1. Post-graduate courses and theses

- **Course on Geoinformation Systems**

The graduate course on “Geoinformation Systems” taught every winter semester at TU Darmstadt, especially the semantic web part, was influenced by the ideas pursued in the TELEIOS project.

4.2.2. Establishment of close links with other project (national, European, international)

- **FP6 project HUMBOLDT**

The TELEIOS requirements gathering methodology of WP8 was influenced by Fraunhofer's work in the HUMBOLDT²⁷ project.

- **FP7 project GeoViqua**

Within the recently started FP7 project GeoViqua²⁸ the methodology of gathering requirements of WP8 of the TELEIOS project is being reused.

4.2.3. Interaction with standard bodies

- **Open Geospatial Consortium (OGC)**

Due to Fraunhofer's strong connection to the Open Geospatial Consortium, they have supported NKUA in the process of influencing the OGC work on spatial and temporal extensions of RDF, especially in the scope of the OGC Standard Working Group for GeoSPARQL.

4.3. DLR

DLR participates in TELEIOS as a research institution (Remote Sensing Technology Institute - DLR/IMF), data provider (by providing us with access to TerraSAR-X data) and user partner who will implement the use case of WP6. The objective of WP6 is to build a VO for TerraSAR-X data and demonstrate its functionality by developing selected rapid mapping applications.

The main objectives of the dissemination activities of DLR are the following:

²⁷ <http://www.esdi-humboldt.eu/home.html>

²⁸ <http://www.geoviqua.org/>

- To ensure awareness of the major space agencies and international space organizations that satellite image data can be classified and retrieved by content. This capability is a strategic key technology for future ground segments and image archives.
- To acquaint remote sensing experts with the actual capabilities of content-based queries when applied to high resolution remote sensing image data. The capabilities have to be understood by the users with respect to instrument constraints and firmly established performance criteria.

Within the reporting period, DLR has performed the following activities in order to disseminate the project results:

4.3.1. Scientific publications

DLR has conducted, submitted, and presented the following publications that are not funded by TELEIOS but are related to the project:

- **IEEE Transactions on Geoscience and Remote Sensing Journal**
 - “Evaluation of Bayesian despeckling and texture extraction methods based on Gauss Markov and Auto-binomial Gibbs random fields: Application to TerraSAR-X data” [2].

The paper has been submitted, reviewed, and accepted for publication. The final text of this publication will be published by IEEE and made available on IEEE Xplore Digital Library.²⁹

This paper compares and evaluates despeckling and texture extraction methods to be applied to TerraSAR-X data. These methods become important when it comes to automated texture extraction in the framework of the envisaged Virtual Observatory for TerraSAR-X data.

- **ESA JRC EUSC 2011**
 - “Information Similarity Measures for Change Detection: Estimation and Evaluation” [3],
 - “Indexation of large Satellite Image Repositories Using Small Training Sets” [4],
 - “A Novel Data Compression Technique for Remote Sensing Data Mining” [5],
 - “Data Cleaning: Approaches for Earth Observation Image Information Mining” [6].

The papers were presented in the “ESA JRC EUSC 2011 - Image Information Mining: Geospatial Intelligence from Earth Observation” conference³⁰ that took place at Ispra, Italy, on March 30-April 1, 2011.

²⁹ <http://ieeexplore.ieee.org/Xplore/>

³⁰ http://rssportal.esa.int/tiki-index.php?page=2011_ESA-EUSC-JRC

The papers refer to change detection, image indexing, as well as data and information mining, i.e., typical topics of the Virtual Observatory for TerraSAR-X data.

- **JURSE 2011**

- “Information theoretical similarity measure for change detection” [7].

The paper was presented in the “Joint Urban Remote Sensing Event”³¹ that took place at Munich, Germany, on April 11-13, 2011.

The paper refers to change detection that is a topic closely related to the handling of Virtual Observatory for TerraSAR-X data.

- **MultiTemp 2011**

- “Status and the Challenges of Multitemporal EO Data Analysis: the Potential of Information Mining” [8],
- “Coarse to Fine Patches-Based Multitemporal Analysis of Very High Resolution Satellite Images” [9].

The papers were presented in the “6th International Workshop on the Analysis of Multi-Temporal Remote Sensing Images” workshop³² that took place at Trento, Italy, on July 12-14, 2011.

- **IGARSS 2011**

- “Mining large satellite image repositories using semi-supervised methods” [10],
- “Satellite Image Artifacts Detection Based on Complexity Distortion Theory” [11],
- “From Shannon Communication Theory to Semantic Coding: Concepts for Image Information Mining” [12],
- “Knowledge Based Image Information Functions for the TerraSAR-X / TanDEM-X Payload Ground Segment: Validation Results” [13],
- “Multi-Viewing for Improved High Resolution SAR Image Interpretation” [15].

The papers were presented in the “2011 IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2011)”³³ that took place at Vancouver, Canada, on July 25-29, 2011.

The papers refer to Image Information Mining and Interpretation that is a topic closely related to the handling of Virtual Observatory for TerraSAR-X data.

³¹ <http://www.pf.bv.tum.de/jurse2011/>

³² <http://www.multitemp2011.org>

³³ <http://www.igarss11.org/>

4.3.2. Post-graduate courses and theses

- **Ph.D. theses**

During the reporting period, one Ph.D. dissertation supervised by the DLR team member M. Datcu has been completed: D. Espinoza-Molina, “*Image Information Mining Validation Scenarios Using TerraSAR-X Images*”.

This thesis analyses the information extraction capability of selected algorithms. The results of these comparisons open the way towards an efficient Virtual Observatory for TerraSAR-X images as promised for TELEIOS.

In addition, four other theses being supervised by M. Datcu are still ongoing. We expect them to be finished during the TELEIOS funding period.

4.3.3. Establishment of close links with other projects (national, European, international)

- **GMES related projects**

We have an intensive in-house collaboration with colleagues who are involved in SAFER³⁴, where our aim is to provide satellite image interpretation tools for rapid mapping in the case of major disasters.

- **FP7 project OBSERVE**

We are participating in the EU FP7 project OBSERVE³⁵ that concentrates on capacity building for the Balkan countries. Here, again, the development of automated image interpretation tools is considered. Interaction with standard bodies.

- **Image Information Mining group**

DLR is a member of the international Image Information Mining group. Many of the activities of DLR in the group are related to TELEIOS as the Virtual Observatory relies on retrieving images from existing archives.

4.3.4. Targeting end users

- **EOWEB**

DLR can address end users via its web-based data distribution interface, EOWEB³⁶. Details of this interface have been described in deliverable D6.1 “Requirements specification for the VO for TerraSAR-X data and applications”.

³⁴ <http://www.emergencyresponse.eu/gmes/en/ref/home.html>

³⁵ <http://observe-fp7.eu>

³⁶ <http://eoweb.dlr.de:8080/servlets/template/welcome/entryPage.vm>

4.4. CWI

CWI participates in TELEIOS as a research institution through its database research group. CWI leads the part of WP2 that works towards array data models and query languages for EO image data, and data models and query languages for continuous/stream queries over EO image databases. CWI also leads WP5 that works towards the development of query processing and optimization techniques for queries over EO image data that is implemented as arrays on MonetDB, and the development of a functional/performance benchmark for evaluation.

The main objectives of the dissemination activities of CWI are the following:

- To ensure maximum awareness of their research results on exploiting and extending database technology to provide efficient and scalable data management solutions for science in general and EO in particular.
- To make their aforementioned research results available in open source as part of or extensions of the MonetDB systems.

CWI has performed the following activities in order to disseminate the project results:

4.4.1. Scientific publications

- **Paper at Workshop on Array Databases 2011**

The CWI team members Martin Kersten, Ying Zhang, Milena Ivanova, and Niels Nes are authors of the paper “SciQL, A Query Language for Science Applications” [2].

The paper was presented at the “Workshop on Array Databases 2011”³⁷ that took place in conjunction with the EDBT/ICDT 2011 Joint Conference³⁸ (“14th International Conference on Extending Database Technology” and “14th International Conference on Database Theory”) in Uppsala, Sweden. The paper was presented on the 25th of March, 2011 in the morning session.

The paper can be found on the website of TELEIOS in the publications section,³⁹ and the reference information about this paper is also available in CiteULike,⁴⁰ a popular website that organizes academic publications.

The abstract of the paper follows.

“Scientific applications are still poorly served by contemporary relational database systems. At best, the system provides a bridge towards an external library using user-defined functions, explicit import/export facilities or linked-in Java/C# interpreters. Time has come to rectify this with SciQL, a SQL query language for scientific applications with arrays as first class citizens. It provides a seamless symbiosis of array-, set-, and sequence- interpretation using a clear

³⁷ <http://www.rasdaman.com/ArrayDatabases-Workshop/>

³⁸ <http://edbticdt2011.it.uu.se/>

³⁹ <http://www.earthobservatory.eu/Publications>

⁴⁰ <http://www.citeulike.org/user/teleios/article/9244465>

separation of the mathematical object from its underlying implementation. A key innovation is to extend value based grouping in SQL:2003 with structural grouping, i.e., fixed sized and unbounded groups based on explicit relationships between their dimension attributes. It leads to a generalization of window-based query processing with wide applicability in science domains. This paper is focused on the language features, extensively illustrated with examples of its intended use.”

4.4.2. Demos

- **Data-Intensive-Research (DIR) workshops**

Martin Kersten gave presentations about SciQL in the “Data-Intensive-Research (DIR) workshops series”⁴¹ on 4th November 2010, 24th November 2010, 17th March 2011, with a great take up from the potential users reaching out towards different disciplines.

4.4.3. Workshops

- **First MonetDB hands-on workshop**

A first MonetDB hands-on workshop for TELEIOS members⁴² was organized by the CWI Database Architectures group at CWI in March 2011 (Monday March 7 – Friday March 11).

The workshop program for the first 2.5 days involved a mixture of presentations by the MonetDB team and hands-on exercises of the participant. After a general introduction to MonetDB, its intension, design and architecture, the participants got started by downloading and installing MonetDB – both using pre-built binary packages and compiling the whole system from source code – learned how to configure and start the server connect the client and run their first “hello world” example in SQL. The morning session of second day was devoted to a detailed introduction to and exercises with the MonetDB SQL functionality. The afternoon session of the second day taught how to connect standard tools and applications to the MonetDB SQL server using standard interfaces like JDBC and ODBC, and ended with an exercise to implement mini database applications in Java, C, and Python. During the morning session of the third day, we demonstrated how to extend MonetDB by adding new modules implemented in MAL and C.

The remaining 2 days focused on TELEIOS uses cases and work packages. In various break-out groups, we designed and partly implemented first prototypical examples for both use cases (DLR & NOA), sketched the design of an RDF/SPARQL front-end for MonetDB and discussed the steps to be taken to replace PostgreSQL with MonetDB as database back-end for NKUA’s Strabon system.

Given sufficient capacities, next to 10 members of TELEIOS also 3 members of EMILI were invited and joined the workshop. 9 members of the CWI database

⁴¹ http://wiki.esi.ac.uk/Data-Intensive-Research_Theme

⁴² <http://www.cwi.nl/events/monetdb-hands-workshop>

architectures group were actively involved in preparing and running (different parts of) the workshop (3 working on TELEIOS, 1 on EMILI, and 2 on LOD2).

4.4.4. Post-graduate courses and theses

- **Course on Advanced Database Technology**

TELEIOS members Martin Kersten and Stefan Manegold taught the M.Sc. course “Advanced Database Technology” in the 2010-2011 fall semester at the University of Amsterdam. The course included scientific database topics, focusing in particular on EO and TELEIOS related material from WP2 and WP4.

- **M.Sc. and Ph.D. theses**

- Under the supervision of Milena Ivanova and Martin Kersten, João Nuno Arajújo Sa (Master student at University of Amsterdam and Universidade do Minho, Portugal) prepared his Master’s thesis on “Science Data Vaults in MonetDB: A Case Study” (January – August 2011).
- Under the supervision of Stefan Manegold and Martin Kersten, Holger Pirk started his PhD within the TELEIOS project (WP5).

4.4.5. Establishment of close links with other projects (national, European, international)

- **FP7 projects LOD2, EMILI, PlanetData**

“LOD2: Creating Knowledge out of Interlinked Data”, “EMILI: Emergency Management in Large Infrastructures“, and “PlanetData: A European Network of Excellence on Large-Scale Data Management“. Like TELEIOS, all these projects deal with large-scale data management in various flavors and application scenarios, and MonetDB forms the database back-bone of all these projects. A particular link exists between LOD2, PlanetData and TELEIOS, as MonetDB will provide the scalable database support for RDF and SPARQL as required by all three projects. A similar link exists between EMILI and TELEIOS regarding database-supported evaluation of continuous queries over data streams.

- **Dutch project COMMIT**

In particular with respect to database support for spatiotemporal data, there is also a close link with the Dutch “COMMIT” program that will start in summer 2011. Martin Kersten leads the project on “Spatiotemporal data-warehouses for travelers”.

- **NL/EU project LOFAR and NSF project LSST**

In the area of scientific databases, the Database Architectures group of CWI is involved in the LOFAR project (LOW Frequency ARray; astronomy; NL/EU) and maintains close links with the LSST project (Large Synoptic Survey Telescope; astronomy; USA) as well as Data Intensive Research initiative of the

UK e-Science programme. Further co-operations with seismologists and biologists are being established.

4.4.6. Targeting the wider public

- **Press releases and interviews**

CWI has advertised TELEIOS in the Dutch media via news reports⁴³ and a radio interview with Martin Kersten. The interview was broadcast live on Dutch national radio on 28th August 2010 and is available online via the radio's web site⁴⁴. The news report, entitled “*Virtual observatory helps to fight forest fires*” in English (“*Virtueel observatorium helpt bosbranden te bestrijden*” in Dutch), has been published by numerous Dutch newspapers, magazines and news web sites.⁴⁵

- **SciLens website**

Information about scientific database extensions of MonetDB related to TELEIOS have been made publicly accessible via the SciLens website⁴⁶. Besides introducing and discussing the specifics of large-scale data-management for earth observation, the web site advertises [SciQL](#), the SQL-query language for science applications with arrays as first class citizens, as it is designed and implemented in TELEIOS.

- **MonetDB distribution channel**

MonetDB extensions as results of WP2 and WP5, possibly also WP4, have been made publicly available in open source. Implementation of both the array query language SciQL and the stream processing support in MonetDB takes place directly on the public MonetDB source code repository, making each check-in of new and modified code publicly available immediately. Likewise, bug-fixes and extensions in particular of MonetDB's geometry module, as required by WP4, are publicly available from the MonetDB source code repository as well as via the Apr2011-SP2 and Aug2011 releases of MonetDB.

4.5. NOA

NOA participates in TELEIOS as a research institution through their Institute for Space Applications and Remote Sensing (ISARS/NOA). NOA leads WP7 that works towards the design, implementation, and validation of a fully automatic fire monitoring

⁴³ http://www.cwi.nl/2010/1088/Virtual_observatory_helps_to_fight_forest_fires

⁴⁴ http://radio.tros.nl/?page=detail&p=42641&type=broadcast_detail&col=left&userPage=38

⁴⁵ http://www.google.com/search?q=Virtueel+observatorium+helpt+bosbranden+te+bestrijden&ie=utf-8&oe=utf-8&aq=t&rls=org.mozilla:en-US:unofficial&client=firefox-a#q=Virtueel+observatorium+helpt+bosbranden+te+bestrijden&hl=en&client=firefox-a&hs=or&rls=org.mozilla:en-US:unofficial&prmd=ivns&ei=LyYjTtbEK9GeOqStpPEO&start=10&sa=N&bav=on.2,or_r_gc.r_pw.&fp=86582d5fedad0c80&biw=1575&bih=740

⁴⁶ <http://www.scilens.org/>

processing chain, that combines in real-time, EO image acquisitions, and/or volumes of GMES fire monitoring products (FMM-1, and FMM-2), with auxiliary geo-information (e.g. land use/land cover, administrative data, etc) and human-like reasoning in order to draw reliable decisions and generate highly accurate fire products.

The main objectives of the dissemination activities of NOA are the following:

- To foster and promote to the Greek and European end user communities the enhanced through TELEIOS NOA's capabilities of delivering state-of-the-art, reliable and real-time services related to Emergency Response for fire crisis management.
- To involve research groups and institutes in the ongoing scientific refinement of Emergency Response products for fire monitoring, and lay the foundations for facilitating research collaborations.

NOA has performed the following activities in order to disseminate the project results:

4.5.1. Scientific publications

- **Paper at BASR workshop 2011**

The NOA team members of TELEIOS Dimitrios Michail, Themistoklis Herekakis, Charalampos Kontoes, and Ioannis Papoutsis are included as authors of the paper "Challenges for Qualitative Spatial Reasoning in Linked Geospatial Data" [1].

The paper was presented at the "Benchmarks and Applications of Spatial Reasoning 2011 (BASR)" workshop⁴⁷ that took place in conjunction with the "Twenty-second International Joint Conference on Artificial Intelligence (IJCAI)" conference⁴⁸ at Barcelona, Spain. The paper was presented on the 18th of July, 2011 in the morning session.

The paper can be found on the website of TELEIOS in the publications section,⁴⁹ and the reference information about this paper is also available in CiteULike,⁵⁰ a popular website that organizes academic publications.

The abstract of the paper follows.

"Linked geospatial data has recently received attention, as researchers and practitioners have started tapping the wealth of geospatial information available on the Web. We discuss some core research problems that arise when querying linked geospatial data, and explain why these are relevant for the qualitative spatial reasoning community. The problems are presented in the context of our recent work on the models stRDF and stSPARQL and their extensions with indefinite geospatial information.

⁴⁷ <http://qsr.informatik.uni-freiburg.de/ijcai11-bench/>

⁴⁸ <http://ijcai-11.iia.csic.es/>

⁴⁹ <http://www.earthobservatory.eu/Publications>

⁵⁰ <http://www.citeulike.org/user/stavros/article/9473900>

4.5.2. Establishment of close links with other projects (national, European, international)

- **FP7 projects SAFER and linkER (EC/GMES)**

NOA has explicitly referred to TELEIOS within SAFER, an EC funded project that offers space based services to support crisis management. NOA's participation in SAFER is focused on delivering services with respect to wildfires. To this respect, in D30140-3 (dealing with the fire thematic services and their validation report) it is stated that the future evolution of the services offered by NOA will benefit from TELEIOS as follows (copied from the respective section):

“An additional improvement of the service will be introduced by increasing the reliability of the product itself. This enhancement is expected to come from TELEIOS (T0 on September 2010), a European Commission funded project that aims at designing and implementing a Virtual Observatory infrastructure for EO data. The Virtual Observatory will use state-of-the art scalable DBMS technology to store and query raw image data, image metadata and symbolic representations of images capturing their content and its semantics. Whilst NOA cannot guarantee the level of maturity of the TELEIOS technologies within the lifetime of SAFER, it is expected that TELEIOS will offer the potential to improve the SAFER BSM service, by applying queries that implement human logic rules (e.g. an exclusively urban area cannot be burnt, small part of the polygon lies into the sea, exclude agricultural areas, etc.).”

4.5.3. Interaction with end users

- **Government bodies in Greece**

NOA has disseminated the project preliminary results to actors within Greece with a mandate a) to act in fire emergencies (General Secretariat for Civil Protection, Fire-brigade), b) to take political decisions related to forest management (Ministry of Environment, Energy & Climate Change), and c) to conduct environmental research (Forest Research Institute, Hellenic Biotope/Wetland Centre).

4.5.4. Targeting the wider public

- **Press release**

- Jointly with NKUA: The article “TELEIOS: Perfect fire control through remote sensing” was published on June 28, 2011 in the Greek newspaper “Vima”. The article can be found in the online version of the newspaper⁵¹ as well as in the website of TELEIOS in the News section.⁵²

- **Interviews**

⁵¹ <http://www.tovima.gr/society/article/?aid=408490>

⁵² http://www.earthobservatory.eu/TELEIOS_fire_control_through_remote_sensing

- Phone interview for the radio show “Reservoir” at “Deftero Porgramma” 103.7 FM, with the radio producers Yiannis Daras and Yiorgos Loverdos, where the NOA team member Charalabos Kontoes referred to how TELEIOS can serve SAFER.
- Phone interview on 06/08/2011 for the radio show “Morning News” at Skai 100.3 FM, with the radio producer Yiorgos Psaltis, where the NOA team member Charalabos Kontoes referred to the benefits expected by TELEIOS in wildfire monitoring.
- TV interview on 09/08/2011 for the morning news show “Skai Now”, to Yiorgos Psaltis, where the NOA team member Charalabos Kontoes revisited the subject of the TELEIOS technologies for wildfire monitoring.

4.6. ACS

ACS is working since early 1980’s in the development of EO archives and catalogues. ACS has fundamentally contributed to the development of the last generation of knowledge-based image information mining tools (KIM, KEO, KES), wisely conceived by ESA for its growing and highly valuable digital images asset. ACS leads WP1 that aims at the design and development of the TELEIOS infrastructure on which all newer and more effective methods for EO data management foreseen by TELEIOS will be implemented and experimented with.

ACS participates to TELEIOS as an industrial partner, aiming at the improvement of its technological solutions through the collaboration with research institutions and keeping in tight contact with the user community of EO data. ACS perspective is thus twofold:

- To reinforce its position at the leading edge of image information mining technology, spreading the knowledge on new methods and tools.
- To pave the way for future commercial exploitation of the concepts developed in the research activities.

ACS has performed the following activities in order to disseminate the project results:

4.6.1. Establishment of close links with other projects (national, European, international)

- **FP7 project SciDIP-ES**

ACS has participated to the proposal preparation of the FP7 Project SciDIP-ES, which is coordinated by ESA and technically supervised by STFC (UK). SciDIP-ES focuses on tools and infrastructures for long term preservation of scientific data (particularly Earth Observation data). In this project, which has been approved for funding and starts officially on September 2011, several concepts developed in TELEIOS have been introduced: semantic annotation and

querying for EO data, Knowledge Discovery, aggregation of heterogeneous data and context analysis.

ACS takes care of the scientific and technological communication between the two projects and will constantly aim at their cross-fertilization.

4.6.2. Targeting end users

- **EO users**

ACS participated to the “Seventh Conference on Image Information Mining: Geospatial Intelligence from Earth Observation (ESA-JRC-EUSC)”, held at Ispra-Varese, Italy. ACS supported the presentation of the poster prepared by NKUA for that event.

ACS is proposing some technological concepts developed in TELEIOS (Knowledge Discovery, advanced query mechanisms for EO archives) to selected EO users. We refer in particular to:

- the systems for sea monitoring developed for EMSA (European Maritime Safety Agency), where innovative search engines for EO data are being developed
- the Ground Segments for the new generation of ESA EO satellites (Sentinel 1, Sentinel 2 and Sentinel 3), where new search paradigm are proposed.

- **Bio-medical users**

Some technical concepts derived from TELEIOS activities are being experimented on biomedical images, in particular in histopathology. Innovative search tools incorporating these concepts have been proposed to primary manufacturers of acquisition equipments.

5. Summary

In this document we presented the dissemination activities for the project TELEIOS in the first 12 months of execution. The dissemination channels considered include scientific publications, demos, workshops, post-graduate courses and theses, the production of promotional material such as flyers and posters, the establishment of close links with other FP7 projects, as well as interaction with standard bodies and the wider public.

6. References

- [1] M. Koubarakis, K. Kyzirakos, M. Karpathiotakis, C. Nikolaou, M. Sioutis, S. Vassos, D. Michail, D. Herekakis, C. Kontoes, I. Papoutsis, “Challenges for Qualitative Spatial Reasoning in Linked Geospatial Data”, In *Proceedings of the IJCAI 2011 Workshop on Benchmarks and Applications of Spatial Reasoning (BASR-11)*, 2011.
- [2] D. Espinoza-Molina, D. Gleich and M. Datcu, "Evaluation of Bayesian despeckling and texture extraction methods based on Gauss Markov and Auto-binomial Gibbs random fields: Application to TerraSAR-X data", *IEEE Transactions on Geoscience and Remote Sensing*.
- [3] S. Cui, L. Gueguen, M. Datcu, “Information Similarity Measures for Change Detection: Estimation and Evaluation”, In *Proceedings of ESA JRC EUSC 2011 Image Information Mining Conference*, Ispra, Italy, 2011.
- [4] P. Blanchart, M. Ferecatu, M. Datcu, “Indexation of large Satellite Image Repositories Using Small Training Sets”, In *Proceedings of ESA JRC EUSC 2011 Image Information Mining Conference*, Ispra, Italy, 2011.
- [5] A. Roman-Gonzalez, M. Veganzones, M. Grana, M. Datcu, “A Novel Data Compression Technique for Remote Sensing Data Mining”, In *Proceedings of ESA JRC EUSC 2011 Image Information Mining Conference*, Ispra, Italy, 2011.
- [6] A. Roman-Gonzalez, M. Datcu, “Data Cleaning: Approaches for Earth Observation Image Information Mining”, In *Proceedings of ESA JRC EUSC 2011 Image Information Mining Conference*, Ispra, Italy, 2011.
- [7] S. Cui, M. Datcu, L. Gueguen, “Information theoretical similarity measure for change detection”, In *Proceedings of Joint Urban Remote Sensing Event (JURSE 2011)*, Munich, Germany, 2011.
- [8] M. Datcu, “Status and the Challenges of Multitemporal EO Data Analysis: the Potential of Information Mining”, In *Proceedings of the 6th International Workshop on the Analysis of Multi-Temporal Remote Sensing Images (MultiTemp 2011)*, Trento, Italy, 2011.

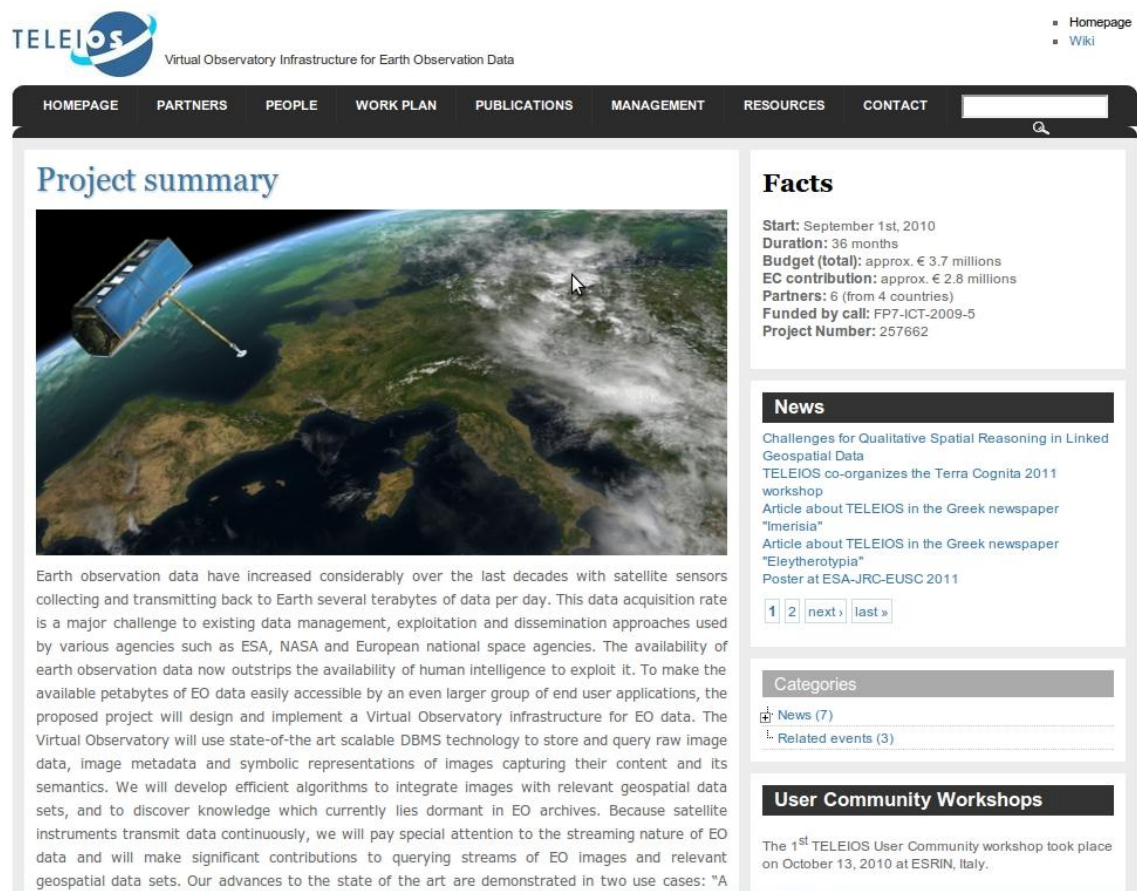
- [9] S. Cui and M. Datcu, "Coarse to Fine Patches-Based Multitemporal Analysis of Very High Resolution Satellite Images", In *Proceedings of the 6th International Workshop on the Analysis of Multi-Temporal Remote Sensing Images (MultiTemp 2011)*, Trento, Italy, 2011.
- [10] P. Blanchart, M. Ferecatu, M. Datcu, "Mining large satellite image repositories using semi-supervised methods", In *Proceedings of the 2011 IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2011)*, Vancouver, Canada, 2011.
- [11] A. Roman-Gonzalez, M. Datcu, "Satellite Image Artifacts Detection Based on Complexity Distortion Theory" , In *Proceedings of the 2011 IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2011)*, Vancouver, Canada, 2011.
- [12] M. Datcu, G. Schwarz, "From Shannon Communication Theory to Semantic Coding: Concepts for Image Information Mining" , In *Proceedings of the 2011 IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2011)*, Vancouver, Canada, 2011.
- [13] D. Espinoza-Molina, G. Schwarz, M. Datcu, "Knowledge Based Image Information Functions for the TerraSAR-X / TanDEM-X Payload Ground Segment: Validation Results" , In *Proceedings of the 2011 IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2011)*, Vancouver, Canada, 2011.
- [14] K. Molch, G. Schwarz, M. Datcu, "Multi-Viewing for Improved High Resolution SAR Image Interpretation", In *Proceedings of the 2011 IEEE International Geoscience and Remote Sensing Symposium (IGARSS 2011)*, Vancouver, Canada, 2011.
- [15] M. Kersten, Y. Zhang, M. Ivanova, and N. Nes, "SciQL, "A Query Language for Science Applications", In *Proceedings of the EDBT/ICDT 2011 Workshop on Array Databases*, Uppsala, Sweden, 2011.
- [16] Open Geospatial Consortium Inc OGC. GeoSPARQL - A geographic query language for RDF data. OGC Candidate Standard (11-052r3), 07, 2011.

7. Appendix

7.1. Project logo



7.2. Project website



TELEIOS Virtual Observatory Infrastructure for Earth Observation Data

- Homepage
- Wiki

HOMEPAGE PARTNERS PEOPLE WORK PLAN PUBLICATIONS MANAGEMENT RESOURCES CONTACT

Project summary



Earth observation data have increased considerably over the last decades with satellite sensors collecting and transmitting back to Earth several terabytes of data per day. This data acquisition rate is a major challenge to existing data management, exploitation and dissemination approaches used by various agencies such as ESA, NASA and European national space agencies. The availability of earth observation data now outstrips the availability of human intelligence to exploit it. To make the available petabytes of EO data easily accessible by an even larger group of end user applications, the proposed project will design and implement a Virtual Observatory infrastructure for EO data. The Virtual Observatory will use state-of-the art scalable DBMS technology to store and query raw image data, image metadata and symbolic representations of images capturing their content and its semantics. We will develop efficient algorithms to integrate images with relevant geospatial data sets, and to discover knowledge which currently lies dormant in EO archives. Because satellite instruments transmit data continuously, we will pay special attention to the streaming nature of EO data and will make significant contributions to querying streams of EO images and relevant geospatial data sets. Our advances to the state of the art are demonstrated in two use cases: "A

Facts

Start: September 1st, 2010
Duration: 36 months
Budget (total): approx. € 3.7 millions
EC contribution: approx. € 2.8 millions
Partners: 6 (from 4 countries)
Funded by call: FP7-ICT-2009-5
Project Number: 257662

News

Challenges for Qualitative Spatial Reasoning in Linked Geospatial Data
 TELEIOS co-organizes the Terra Cognita 2011 workshop
 Article about TELEIOS in the Greek newspaper "Imerisia"
 Article about TELEIOS in the Greek newspaper "Eleytherotyphia"
 Poster at ESA-JRC-EUSC 2011

1 2 next » last »

Categories

News (7)
 Related events (3)

User Community Workshops

The 1st TELEIOS User Community workshop took place on October 13, 2010 at ESRIN, Italy.

7.3. Project flyer (A4 size)



<http://www.earthobservatory.eu>




TELEIOS in a Nutshell

Earth observation (EO) data has increased considerably over the last decades as satellite sensors collect and transmit back to Earth many gigabytes of data per day. The aim of project TELEIOS is to increase the usability of the terabytes of satellite images lying dormant in archives by automating the relevant data management, integration and knowledge discovery tasks.



Main Innovation

The main innovation of project TELEIOS is the development of a Virtual Observatory infrastructure that goes beyond the current state of the art in Earth Observation portals and Image Information Mining systems. This will be achieved by combining advanced image mining, database, geospatial and semantic web technologies, and pursuing the following technical innovations:

- **An extension of SQL with multidimensional arrays** for querying scientific databases, and especially satellite image databases.
- **Knowledge discovery techniques for satellite images** and other relevant data sets, especially geospatial ones.
- **Geospatial extensions to RDF and SPARQL** for specifying and querying satellite image annotations capturing image metadata and knowledge discovered from the images, and being linked to relevant data sources available on the web as linked data.
- **Query processing and optimization techniques** for SQL extensions with multi-dimensional arrays and geospatial extensions of SPARQL.
- **Scalable implementations of the techniques developed in TELEIOS on top of MonetDB**, an open-source DBMS for high-performance applications. Scalability will be shown using very large data sets, e.g., terabytes of image data, billions of triples of image annotations.

Use Cases

TerraSAR-X Virtual Observatory
We will demonstrate the advantages of TELEIOS technologies building a Virtual Observatory for TerraSAR-X satellite data provided by our partner DLR, and demonstrating its functionality in the development of rapid mapping applications.

Real-time Fire Monitoring
The goal of this use case is to increase the precision of techniques currently in use by our partner NOAA in two important problems of fire monitoring and management: real-time hot spot and active front detection, and burnt area assessment.

Involving the Earth Observation User Community

To facilitate the involvement of the wider international community of EO scientists in TELEIOS, we will organize 3 User Community workshops with the support of the European Space Agency. The purpose of the workshops is to capture the requirements of EO scientists with respect to the kinds of software and applications targeted by TELEIOS, involve them in the use and evaluation of the Virtual Observatory infrastructure, and solicit their feedback regarding our advances to the state of the art.

Project Information

Title
Virtual Observatory Infrastructure for Earth Observation Data

Start date
September 1st, 2010

Duration
36 months

Partners

National and Kapodistrian University of Athens, Greece (Coordinator)

Fraunhofer IGD, Germany

German Aerospace Center

Centrum Wiskunde & Informatica, Netherlands

National Observatory of Athens, Greece

Advanced Computer Systems, Italy

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7.4. Poster at ESA-JRC-EUSC 2011 (A0 size)

Project Information
 Title: Virtual Observatory Infrastructure for Earth Observation Data
 Start date: September 1st 2009
 Duration: 36 months

Coinfunder:
 National and Kapodistrian University of Athens, Greece

TELEIOS: Virtual Observatory Infrastructure for Earth Observation Data

Goals and Challenges

Context and Objectives

Earth observation (EO) data has increased considerably over the last decades as satellite sensors collect and transmit back to Earth many gigabytes of data per day. The aim of project TELEIOS is to increase the usability of the terabytes of satellite images lying dormant in archives by automating the relevant data management, integration and knowledge discovery tasks.

The main innovation of project TELEIOS is the development of a Virtual Observatory infrastructure that goes beyond the current state of the art in Earth Observation portals and Image Information Mining systems. This will be achieved by combining advanced image mining, database, geospatial and semantic web technologies, and pursuing the following technical innovations:

- **Extensions of SQL based on the concept of a multidimensional array.** These extensions are appropriate for querying scientific databases in general and satellite image databases in particular.
- **Knowledge discovery techniques for satellite images** and other relevant data sets, especially geospatial ones.
- **Geospatial extensions to RDF and SPARQL** for specifying and querying satellite image annotations capturing image metadata and knowledge discovered from the images, and being linked to relevant data sources available on the web as linked data.
- **Query processing and optimization techniques** for multi-dimensional array queries, and the geospatial extensions of SPARQL.
- **Scalable implementations of the techniques developed in TELEIOS on top of MonetDB**, an open-source database system for high-performance applications. Scalability will be shown using very large data sets, e.g., terabytes of image data, billions of triples of image annotations.

Use Cases

TerraSAR-X Virtual Observatory
 We will demonstrate the advantages of TELEIOS technologies building a Virtual Observatory for TerraSAR-X satellite data provided by our partner DLR, and demonstrating its functionality in the development of rapid mapping applications.

Real-time Fire Monitoring
 The problem of fire monitoring and management in Europe is very important and is being addressed by large scale initiatives such as the GMES SAFIR project. In TELEIOS we will concentrate on the development of solutions for two relevant problems: (i) real time hotspot and active front detection, and (ii) burnt area assessments. The goal here is to increase the precision of techniques currently in use by our partner NOAA.

Expected Final Results

- ✓ **Geospatial Extensions of RDF and SPARQL** appropriate for specifying and querying satellite image annotations.
- ✓ **Query processing and optimization techniques** for the geospatial extensions of SPARQL, and efficient implementation on top of MonetDB.
- ✓ **The query language SciQL**, an extension of SQL with the concept of a multidimensional array.
- ✓ **Query processing and optimization techniques** for SciQL, and efficient implementation on top of MonetDB.
- ✓ **Knowledge discovery techniques** for satellite images and relevant geospatial data sets.
- ✓ **The TELEIOS infrastructure** for deployment of applications.

Project Summary

The availability of Earth Observation (EO) data today outstrips the availability of human intelligence to exploit it. As satellite sensors collect and transmit back to earth several gigabytes of data per day a major challenge is faced by existing data management, exploitation and dissemination approaches used by various agencies such as ESA, NASA and European national space agencies.

To make the available petabytes of EO data easily accessible by an even larger group of end-user applications, the proposed project will design and implement a Virtual Observatory infrastructure for EO data.

The Virtual Observatory will use state-of-the-art scalable OWL2 technology to store and query raw image data, image metadata and symbolic representations of images capturing their content and its semantics.

We will develop efficient algorithms to integrate images with relevant geospatial data sets, and to discover knowledge which currently lies dormant in EO archives.

Our advances to the state of the art are demonstrated in two use cases: "A Virtual Observatory for TerraSAR-X data" and "Real-time fire monitoring based on continuous acquisitions of satellite images in combination with land cover data".

With the support of the European Space Agency, EO scientists will be involved in our project throughout its entire life-time, from requirements definition, through development to testing and validation. We are confident that our results have a leading impact in the EO community.

Partners

National and Kapodistrian University of Athens, Greece
 Fraunhofer IGD, Germany
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 Centrum Wiskunde & Informatica, Netherlands
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 Advanced Computer Systems, Italy

Project Website and Info

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