SEVENTH FRAMEWORK PROGRAMME (FP7)
SPECIFIC PROGRAMME 'COOPERATION' - ICT
THEME: INTELLIGENT INFORMATION MANAGEMENT (ICT-2009.4.3)
GRANT AGREEMENT NO: 258723

TRIDEC

COLLABORATIVE, COMPLEX AND CRITICAL DECISION-SUPPORT IN EVOLVING CRISES

Annual Public Report 2011

TRIDEC is developing new approaches and technologies for intelligent information management in collaborative, complex and critical decision processes in earth management. The key target is the design and implementation of a collaboration infrastructure of interoperable services efficiently supporting the intelligent management of both dynamically increasing volumes and dimensionality of relevant information. This will enable multiple decision makers to respond quickly via a collaborative decision-support environment.

TRIDEC integrates software services development, and computational methods with collaborative technologies. TRIDEC will establish rapid, on-demand interoperability of inherited legacy applications and tools. Collaborative computing is used to make them work together to establish the decision-support enterprise system of services. This will allow to deliver timely critical information to decision makers during evolving crisis situation in natural crises or subsurface development.

The TRIDEC consortium consists of ten partners from the drilling industry, information technology and research, developing pilot applications for two core domains of earth management, namely natural crisis management and drilling exploration. The project will be concluded in August, 2013.

1 Summary of Activities

In the first project year, the TRIDEC consortium has essentially concentrated its efforts on the following major topics:

1. Starting the elicitation and compilation of user and system requirements. Requirements provide the essential input for the design of the system and the development of the first application prototype scheduled for August 2011. Two project meetings dedicated to these topics have already been organised.
2. Maintaining and extending the structures and procedures needed for project management and project execution including consortium meetings, regular conference calls to coordinate independent software development activities distributed among the individual work packages..
3. Strengthening collaboration and communication within the project by updating and extending the information exchange facilities such as the TRIDEC Project Portal. The portal has become a central information hub for both public information and project information management for the consortium and the Technical and Scientific Advisory Board.
4. Compilation of user and system requirements for the design of the system and the first application prototype.
5. Development of the first demonstrator, a light-weight system consisting of the core common components integrated with an initial decision support system assisted by a knowledge base with basic data fusion and data mining strategies. This release focuses on supporting a simple version of an event driven service bus, and a resource, component and service repository. The first demonstrator was released in September 2011

The achievements constitute the solid ground for the further elaboration of requirements thus providing the profound basis for a solid design and effective development of the next generation of more complex TRIDEC demonstrators scheduled for 2012 ad 2013.

2 Progress in Important Working Areas

TRIDEC puts the focus on the core working areas requirements engineering, design, and system architecture as well as, the development of a service platform and two application demonstrators in earth management, i.e. in Natural Crisis Management and Industrial Subsurface Exploration.

The main objectives of TRIDEC are included in the core work areas:

- Construction of a robust, scalable service infrastructure supporting the integration and utilisation of existing resources including distributed sensor systems, monitoring facilities, and geo-information repositories as well as simulation, processing, and data fusion systems
- Development of services for the flexible management and configuration of system resources especially sensor systems including the configuration of discrete sensor networks and tasking of sensors in order to realise intelligent observation and monitoring strategies
- Design and implementation of a knowledge base for intelligent information management providing essential context information for the aggregation, storage and retrieval of large volumes of information e.g. about system components, prognostic models, rules, data and information models, ontologies, as well as past crisis events and simulated data for system tests
- Construction of tools for the design and execution of complex information logistic processes and workflows steering ingest and fusion of data as well as rules for the selection of context information delivered by the TRIDEC knowledge-base.
- Design and implementation of an adaptable framework for collaboration and decision-support environments supporting complex business processes including both the intelligent management of crisis situations and the systematic testing of system features and training of decision makers.

TRIDEC focuses on two application fields namely environmental crisis (Tsunami use case) and subsurface development (Drilling Operations use case). Both fields have a very high social and economical relevance and represent only two examples of the broad applicability of the innovative TRIDEC concept. Detailed progress reports are given for them below.

2.1 Service Platform Development

The development of the TRIDEC system follows a spiral approach and includes three system life-cycles. In the reporting period the 1st cycle of the TRIDEC development processes has been executed. One of the initial key activities of TRIDEC addressed the elicitation of end-user requirements. This process started with the definition of a common set of terms supporting the understanding and the communication between representatives from the application fields and system architects. Scenarios, stories and use cases helped to capture specific user requirements in terms of interactions between the user and the system.

The complex scientific and organisational context of tsunami warning systems made it necessary to compile an overview about the state-of-the-art of tsunami warning systems in the North East Atlantic and the Mediterranean region. Complementary to the user requirements elicitation process the respective standards and technologies relevant for intelligent information management have been investigated including an overview about standardization bodies and relevant standards. The functional and non-functional system requirements for both application fields, Natural Crisis Management (NCM) and Industrial Subsurface Development (ISD) have been summarised in a specific system requirements document.

The design and development process of the TRIDEC event driven service platform includes three activity fields including architecture and core components, knowledge base as well as services orchestration and decision support workflows organised by the respective TRIDEC work packages.

The architecture specification started with a review of relevant technologies and the analysis of thematic and system requirements. In the technology review relevant projects have been analysed and grouped accordingly. Based on this the architectural design started including the modelling of resilience, performance and scalability. Special attention was put on the fact that the architecture has to be applied to completely different scenarios (Natural Crisis Management and Industrial Subsurface Development). For this purpose the adaption of Message Oriented Middleware (MOM) and appropriate solutions were outlined. A first version of the TRIDEC middleware has been implemented.

The knowledge based service framework provides TRIDEC with an intelligent processing capability that will add value to multiple distributed information feeds in an efficient, scalable and robust way. Activities focused on the establishment of the knowledge base service requirements including the architectural and knowledge base design taking into account the decision support requirements analysis and specification of thematic models and services for decision support workflows. Additionally, a strategic list of fusion and mining algorithms have been explored for handling large volumes of data and extracting knowledge intelligently and critically in time.

Flexible service orchestration and easy adoptable decision support workflows are very important to address the complexity and diversity of crisis management scenarios and contingency plans. In most cases during the crisis itself, urgent need arises for ad-hoc modification of models and/or workflows. Based on comprising literature studies and the existing architecture specifications selected tools for decision support and workflow management have been adopted and generic decision support services have been implemented in their first iterative version. The implemented components were made available to other TRIDEC partners together with software installation and configuration documentation for system integration. On-going work is concerned with design and implementation of the decision support ontologies and of the semantic registry together with the context management services.

2.2 Application Development

The development of **pilot applications** for the demonstration of the TRIDEC system in both application fields Natural Crisis Management (Tsunami use case) and Industrial Subsurface Exploration (Drilling use case) have been promoted and fostered by the responsible work packages very consequently.

For Natural Crisis Management, a light weight demonstrator of a tsunami warning system supporting earthquake and sea level monitoring, the prediction of tsunami hazards for coastal areas and the dissemination of simple warning messages has been implemented. The human-computer interaction component, namely the Command and Control User Interface (CCUI), has been adapted and enhanced which provides the respective perspectives to support Officers on Duty (OOD) in keeping under surveillance the entire process of crisis management from sensor monitoring through crisis assessment up to tailoring and disseminating warnings (Figure 1).

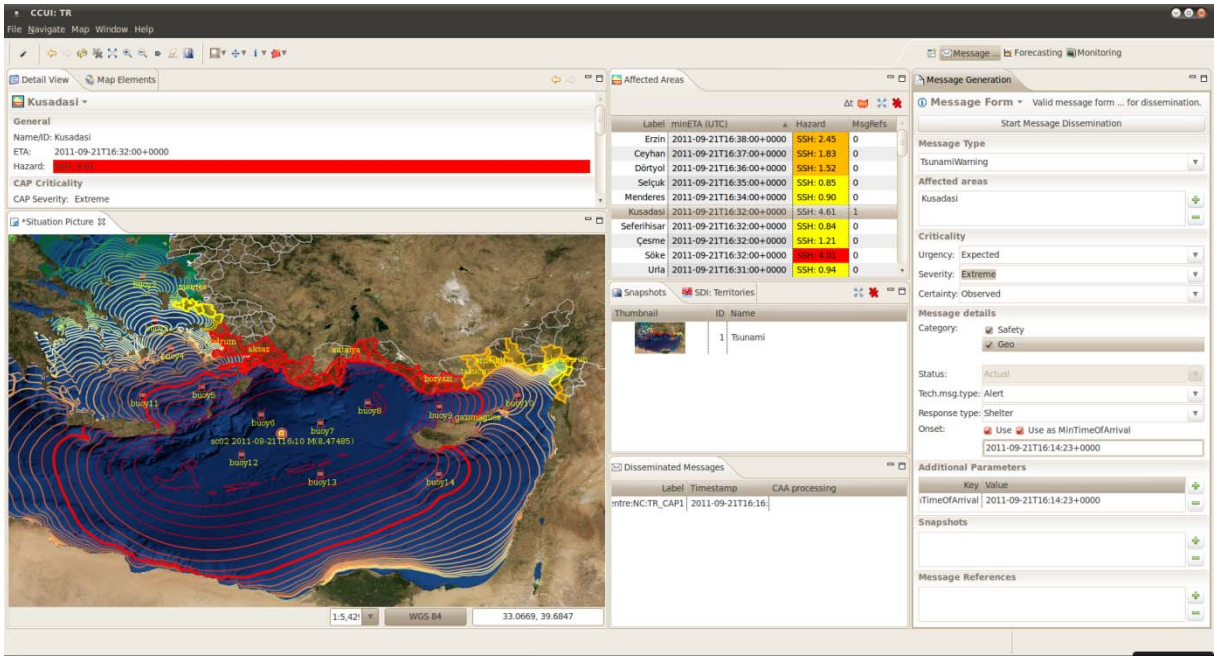

Figure 1: *Screen caption of the message composition perspective of the TRIDEC Command and Control User Interface (CCUI) for tsunami early warning. The temporal spreading pattern (right) of a confirmed tsunami is used to customize warning message content for dissemination to coastal communities under risk by an Officer on Duty (OOD) in a Tsunami Early Warning Centre.*

A specific environment for demonstration and testing has been prepared. For this purpose a special tool developed by the German Indonesian Tsunami Warning System (GITEWS) for simulating tsunami wave propagation has been adapted to TRIDEC requirements. In order to demonstrate the system under realistic conditions a database for pre-calculated sensors data (Virtual Scenario Database, VSDB) has been prepared (Figure 2). For tsunami assessment and verification a central database (Matching Scenario Database, MSDB) has been filled with a large number of pre-computed set of simulations of tsunami propagation.

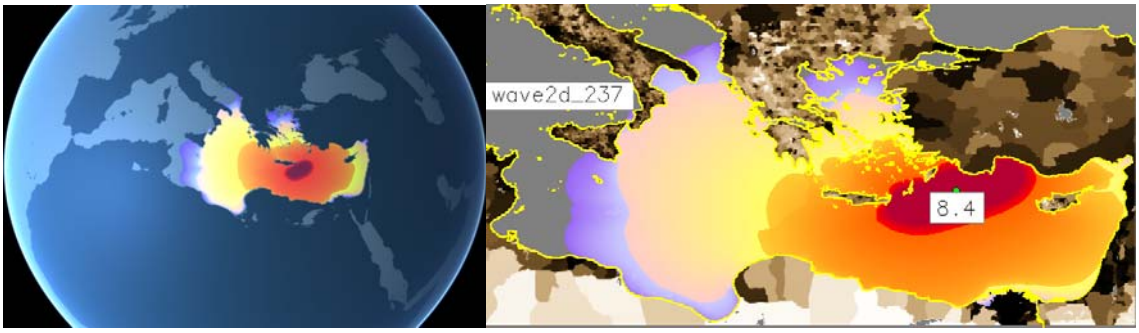

Figure 2: *Examples of Tsunami wave propagation simulations for the eastern Mediterranean (right: East Crete scenario #229, Magnitude: Mw 8.6). Tsunami simulation includes both estimated wave heights over time (left example) and the estimated time of arrival (right example).*

For subsurface development, i.e. the Drilling use case, the development of the first demonstrator of the TRIDEC Drilling Support system (TDS-light) has been realised supporting drilling at a single rig. The main goal is to build a drilling operation alarm system to provide the drilling crew on the rig or the monitoring crew in the data centre with the necessary information to guarantee by informing the crew of potential upcoming critical situations and by providing information of how this situation can be avoided.

Live data from sensors extended by generated features are used as input for online data processing algorithms. Both input data and outcome of the algorithms are visualized in a user interface to support drilling employees at the rig. From a technical point of view the construction of a framework has been fostered integration of TRIDEC components from several work-packages put together and integrated.

Figure 3: *The Innova Rig, an innovative drill rig for science and exploration serves as a test bed for the TRIDEC Drilling use case.*

Currently, the testbed uses historical data to demonstrate the TRIDEC Drilling Support system by using a simulator for data streams. Data stream are the input for a feature generator developed in TRIDEC which extends the data processing algorithms' potential for better recognition performance. First versions of online algorithms were integrated. As the basic demonstrator framework is now available, algorithms can now be improved, new ones developed and consequently tested within an integrated system.

3 User Involvement, Promotion and Awareness

User involvement is important for the design, development, and validation of the TRIDEC system. The consortium fosters the growth of a network of authorities and industry partners as well as research institutions.

Figure 4: *Panel Discussion including TRIDEC experts at the European Geosciences Union General Assembly 2011 in Vienna.*

To communicate the projects achievements, the TRIDEC project website is continuously updated to inform the general public about the achieved results while the online project portal is used as a central point of information for consortium members and the TRIDEC Technical and Scientific Advisory Board (TAB).

Project results and work in progress have been disseminated by printed information such as the project fact sheet and dissemination materials (project presentation, image brochure and TRIDEC leaflet). Results and on-going activities of the TRIDEC project were announced within the respective scientific communities via active participation in congresses, conferences and other scientific or technical meetings.

Key events successfully targeted within the first project year:

- ICT2010 Conference: “Web of Events” Session (Brussels, Belgium, 27-29 September 2010).
- Earthquake and Tsunami Early Warning Application Workshop at the Bogaziçi University Kandilli Observatory and Earthquake Research Institute (Istanbul, Turkey, October 5th 2010).
- OGC Technical Committee/Planning Committee Meeting (Bonn, Germany, February 28 – March 4th 2011). European Geosciences Union General Assembly 2011, (Vienna, Austria, April 3 -8 2011).
- The 8th International Conference on Information Systems for Crisis Response and Management – ISCRAM 2011 – (Lisbon, Portugal, May 8-11, 2011).
- The International Emergency Management Society **(**TIEMS) Annual Conference (Bucharest, Romania June 7-10 2011**)**

- ISESS Conference (Brno, Czech Republic, June 27 -29 2011)
- AGIT Conference (Salzburg, Austria, 6th-8th July).
- IOC/NEAMTWS: Tsunami and Civil Protection Workshop: Tsunami hazard in the NEAM region – A challenge for Science and Civil Protection. (Ispra, Italy June 15-16, 2011)
- The First ICSU World Data System Conference: Global Data for Global Science (Kyoto, Japan: September 3-6 2011)

4 Future Work

In TRIDEC's second project year, the developed versions for the NCM and ISE demonstrators will be extended with matured infrastructure components including advanced components for data fusion, data mining and decision support integrated in a robust event driven service architecture. Thus prescribed work flows for more extensive thematic services will be supported and design changes necessitated by the performance, resilience and scalability modelling will be included.

The pilot application for natural crisis management will be extended in year two. This includes the porting of proven concepts for centre to centre (C2C) communication, based on existing emergency-management standards for crisis communication. Also, the spatial focus for Tsunami monitoring will be extended from the Mediterranean Sea to also include the north-eastern Atlantic.

For the TRIDEC Drilling Support system, a test phase is planned during year two, where live data from a rig will be observed by the TRIDEC system.

5 Further Information

Further information and up to date status reports can be obtained from the TRIDEC website at http://www.tridec-online.eu or via mail (tridec-contact@gfz-potsdam.de).

5.1 Consortium

The TRIDEC Consortium includes following ten partners:

Helmholtz Centre Potsdam, GFZ German Research Centre for Geosciences, CeGIT Centre for GeoInformation Technology (Germany) http://www.gfz-potsdam.de/

University of Southampton, IT Innovation Centre (United Kingdom) http://www.it-innovation.soton.ac.uk/

Queen Mary and Westfield College, University of London - Department of Electronic Engineering (United Kingdom) http://www.elec.qmul.ac.uk/

Joanneum Research Forschungsgesellschaft GmbH – Institute of Information Systems & Information Management (Austria) http://www.joanneum.at/en/digital.html

Fraunhofer - IOSB - Fraunhofer-Institute of Optronics, System Technologies and Image Exploitation (Germany) http://www.iosb.fraunhofer.de/servlet/is/6974/

TDE Thonhauser Data Engineering GmbH (Austria) http://www.tde.at/

Q-Sphere Limited (United Kingdom) http://www.q-sphere.com/

Instituto de Meteorologia, I.P. - Departamento de Sismologia e Geofísica (Portugal) http://www.meteo.pt

Alma Mater Studiorum - Universita di Bologna – Department of Physics (Italy) http://www.df.unibo.it/

Bogazici Universitesi - Kandilli Observatory and Earthquake Research Institute (Turkey) http://www.koeri.boun.edu.tr/eng/topeng.htm

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