Towards a certification process for Tsunami Early Warning Systems

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TRIDEC — Collaborative, Complex and Critical Decision-Support in Evolving Crises

Challenges in Tsunami Early Warning

The natural disaster of the Boxing Day Tsunami of 2004 was followed by an information catastrophe. Crucial early warning information could not be delivered to the communities under imminent threat, resulting in over 240,000 casualties in 14 countries. This tragedy sparked the development of a new generation of integrated modular Tsunami Early Warning Systems (TEWS). While significant advances were accomplished in the past years, recent events, like the Tohoku 2011 tsunami demonstrate that the key technical challenge for Tsunami Early Warning research on the supranational scale still lies in the timely issuing of status information and reliable early warning messages.

A second challenge stems from the main objective of the UNESCO Intergovernmental Oceanographic Commission (IOC) Tsunami Programme, the integration of national TEWS towards ocean-wide networks: Each of the increasing number of integrated Tsunami Early Warning Centres has to cope with the continuing evolution of sensors, hardware and software while having to maintain reliable inter-center information exchange services. To avoid future information catastrophes, the performance of all components involved in the TEWS process, ranging from individual sensors, to Warning Centers within their particular end-to-end Warning System Environments, and up to federated Systems of Tsunami Warning Systems has to be regularly validated against defined criteria.

The TRIDEC Project

The TRIDEC project (Collaborative, Complex, and Critical Decision Processes in Evolving Crises) focuses on the handling of real-time intelligent information in Earth management and its long-term application. 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 enables multiple decision makers to respond quickly via a collaborative decision-support environment.

The technical development is based on mature system architecture models and industry standards. The use of standards already applies to the operation of individual TRIDEC reference installations and their interlinking into an integrated service infrastructure for supranational warning services. This is a first step towards best practices and service lifecycles for Early Warning Centre IT service management, including Service Level Agreements (SLA) and Service Certification.

TRIDEC integrates software services development, and computational methods with collaborative technologies. Collaborative computing is used to make them work together to establish a decision support enterprise system of services. This will allow to deliver critical information timely to decision makers during evolving crisis situations in natural crises or subsurface development.

The Role of the German Research Centre for GeoSciences GFZ

Since 2004, GFZ German Research Centre for Geosciences (GFZ) has built up expertise in the field of TEWS. Within GFZ, the Centre for GeoInformation Technology (CEGIT) has focused its work on the geoinformatics aspects of TEWS in two projects already: The German Indonesian Tsunami Early Warning System (GITEWS) funded by the German Federal Ministry of Education and Research (BMBF) and the Distant Early Warning System (DEWS), a European project funded under the sixth Framework Programme (FP6). This activity is continued in the TRIDEC project (Collaborative, Complex, and Critical Decision Processes in Evolving Crises) funded under the European Union's seventh Framework Programme (FP7).

The Significance of the IT Infrastructure Library (ITIL) for Tsunami Early Warning

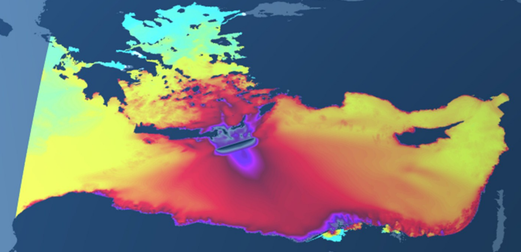
The emerging Tsunami Early Warning Infrastructure in the Mediterranean Sea consists of multiple sensor networks, connecting National and Regional Tsunami Early Warning Centres, which operate differing software systems to provide warning services. The provision of warning services in such a complex and evolving IT environment requires a reliable and standard-based approach: Therefore, TRIDEC is based on mature system architecture models and industry standards. This applies also to individual TRIDEC reference installations and their interlinking into an integrated service infrastructure for supranational warning services: A set of best practices for IT service management is being prepared to align the TEWS software services with the requirements by the Early Warning Centre management: The concept of service lifecycles is adapted for the TEWS domain, as defined by the IT Infrastructure Library (ITIL). ITIL consists of proven concepts and best practices, enabling a process-oriented high level view of the design, operation and transition of software services under a common strategy, accompanied by continual service improvement actions.

ITIL will be adopted for TRIDEC to define, establish and maintain Standard Operation Procedures (SOP) and Service Level Agreements (SLA) for individual warning centres. The cyclic procedures, tasks and checklists laid out by ITIL will be used to establish a baseline to plan, implement, and maintain TEWS service components. This allows to ensure compliance with given international TEWS standards and to measure improvement of the provided services.

Towards a reference cerification procedure

While on a global scale the integration of TEWS progresses towards Systems of Systems (SoS), there is still an absence of accredited and reliable certifications for national TEWS or regional Tsunami Early Warning Systems of Systems (TEWSoS). Concepts for TEWS operations have already been published under the guidance of the IOC, and can now be complemented by the recent research advances concerning SoS architecture. Combined with feedback from the real world, such as the NEAMwave 2012 Tsunami exercise in the Mediterranean, this serves as a starting point to formulate initial requirements for TEWS and TEWSoS certification:

Certification activities will cover the establishment of new TEWS and TEWSoS, and also both maintenance and enhancement of existing TEWS/TEWSoS. While the IOC is expected to take a central role in the development of the certification strategy, it remains to be defined which bodies will actually conduct the certification process. Certification requirements and results are likely to become a valuable information source for various target groups, ranging from national policy decision makers, government agency planners, national and local government preparedness officials, TWC staff members, Disaster Responders, the media and the insurance industry.



Background: Visualisation of a simulated Tsunami event in the Mediterranean Sea with an epicentre SE of Crete. The false color globe map depicts the wave height totals for the simulation area.

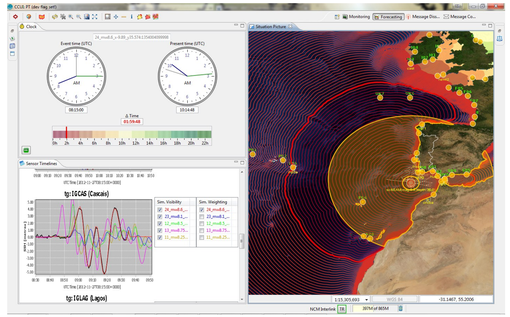


Figure: The Command and Control User Interface (CCUI), a human-computer interaction component for Natural Crises Management supports Officers on Duty (OOD) in monitoring the entire process of crisis management from sensor monitoring through crisis assessment up to tailoring and disseminating warnings. The TRIDEC CCUI was successfully field-tested during the NEAMWave 2012 tsunami drill in the Mediterranean Sea in November 2012.

Collaborative, Complex and Critical Decision Support in Evolving Crises

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