



The TRIDEC System-of-Systems; Choreography of large-scale concurrent tasks in Natural Crisis Management

R. Häner and J. Wächter

Helmholtz Centre Potsdam GFZ German Research Centre for Geosciences, CeGIT, Potsdam, Germany
(rainer.haener@gfz-potsdam.de, +49 331 2881703)

The project Collaborative, Complex, and Critical Decision-Support in Evolving Crises (TRIDEC), co-funded by the European Commission in its Seventh Framework Programme aims at establishing a network of dedicated, autonomous legacy systems for large-scale concurrent management of natural crises utilising heterogeneous information resources. TRIDEC's architecture reflects the System-of- Systems (SoS) approach which is based on task-oriented systems, cooperatively interacting as a collective in a common environment. The design of the TRIDEC-SoS follows the principles of service-oriented and event-driven architectures (SOA & EDA) exceedingly focusing on a loose coupling of the systems. The SoS approach in combination with SOA and EDA has the distinction of being able to provide novel and coherent behaviours and features resulting from a process of dynamic self-organisation. Self-organisation is a process without the need for a central or external coordinator controlling it through orchestration. It is the result of enacted concurrent tasks in a collaborative environment of geographically distributed systems. Although the individual systems act completely autonomously, their interactions expose emergent structures of evolving nature. Particularly, the fact is important that SoS are inherently able to evolve on all facets of intelligent information management. This includes adaptive properties, e.g. seamless integration of new resource types or the adoption of new fields in natural crisis management. In the case of TRIDEC with various heterogeneous participants involved, concurrent information processing is of fundamental importance because of the achievable improvements regarding cooperative decision making. Collaboration within TRIDEC will be implemented with choreographies and conversations. Choreographies specify the expected behaviour between two or more participants; conversations describe the message exchange between all participants emphasising their logical relation. The TRIDEC choreography will be based on the definition of Behavioural Interfaces and Service Level Agreements, which describe the interactions of all participants involved in the collaborative process by binding the tasks of dedicated systems to high-level business processes. All methods of a Behavioural Interfaces can be assigned dynamically to the activities of a business process. This allows it to utilise a system during the run-time of a business process and thus, for example enabling task balancing or the delegation of responsibilities. Since the individual parts of a SoS are normally managed independently and operate autonomously because of their geographical distribution it is of vital importance to ensure the reliability (robustness and correctness) of their interactions which will be achieved by applying the Design by Contract (DbC) approach to the TRIDEC architecture. Key challenge for TRIDEC is establishing a reliable adaptive system which exposes an emergent behaviour, for example intelligent monitoring strategies or dynamic system adaptations even in case of partly system failures. It is essential for TRIDEC that for example redundant parts of the system can take over tasks from defect components in a process of re-organising its network.