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A Geo-Distributed System Architecture for Different Domains

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The presentation will describe work on the system-of-systems (SoS) architecture that is being developed in the EU FP7 project TRIDEC on "Collaborative, Complex and Critical Decision-Support in Evolving Crises". In this project we deal with two use-cases: Natural Crisis Management (e.g. Tsunami Early Warning) and Industrial Subsurface Development (e.g. drilling for oil). These use-cases seem to be quite different at first sight but share a lot of similarities, like managing and looking up available sensors, extracting data from them and annotate it semantically, intelligently manage the data (big data problem), run mathematical analysis algorithms on the data and finally provide decision support on this basis.
The main challenge was to create a generic architecture which fits both use-cases. The requirements to the architecture are manifold and the whole spectrum of a modern, geo-distributed and collaborative system comes into play. Obviously, one cannot expect to tackle these challenges adequately with a monolithic system or with a single technology. Therefore, a system architecture providing the blueprints to implement the system-of-systems approach has to combine multiple technologies and architectural styles.
The most important architectural challenges we needed to address are
1. Build a scalable communication layer for a System-of-sytems
2. Build a resilient communication layer for a System-of-sytems
3. Efficiently publish large volumes of semantically rich sensor data
4. Scalable and high performance storage of large distributed datasets
5. Handling federated multi-domain heterogeneous data
6. Discovery of resources in a geo-distributed SoS
7. Coordination of work between geo-distributed systems
The design decisions made for each of them will be presented. These developed concepts are also applicable to the requirements of the Future Internet (FI) and Internet of Things (IoT) which will provide services like smart grids, smart metering, logistics and environmental monitoring.