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Application of SOA (Service Oriented Architecture) in Early Warning Systems for Tsunamis and other Natural Hazards

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The DEWS (Distant Early Warning System) [1] project, funded under the 6th Framework Programme of the European Union, has the target to create a new generation of interoperable early warning systems. Two major objectives have steered the development process: usage of free and open source software (FOSS) and compliance to the principles of a Service Oriented Architecture (SOA). The second objective was mainly driven by the superior ambition of the development of a generic early warning framework not only for tsunamis but also for other natural hazards. The development of a reference architecture enforced the clear separation between hazard-specific and generic functionality. Integration of sensor networks was realized with Open Geospatial Consortium (OGC) [2] Sensor Web Enablement (SWE) [3] services. Sensor types are relatively specific for different hazard types: while inundation sensors can be used both for tsunami and floodwater hazards, contamination meters requires a complete different semantic integration into the client application. Based on sensor measurements a simulation system supports the operator with forecasts to enable the dissemination of precise warning messages. The simulation integration was realized with the Web Processing Service (WPS) [4] but here again semantic integration is simulation specific and has to be realized inside the client application. In contrast the integration of Spatial Data Infrastructure (SDI) via Web Mapping Service (WMS) [5] and Web Feature Service (WFS) [6] to complete the situation report is independent from any hazard type and depends on the data availability and requirements of each warning centre. The downstream component - the message dissemination from the operator via information logistics to the dissemination channel endpoints - has been realized independently from any specific hazard type. Using the Common Alerting Protocol (CAP) [7] and Emergency Data Exchange Language (EDXL) [8] enables the re-usage for all kind of emergency messages. Hazard-specific message types and their key-value-pairs like maximum inundation height for tsunamis have to be specified in a database that can be easily maintained via a graphical user interface. The used strategies are leveraged by the SOA principles and not only allow the (re-)usage of single system components – it also enables the replacement of components without modifications of others.

[1] DEWS, www.dews-online.org
[2] OGC, www.opengeospatial.org
[3] SWE, www.opengeospatial.org/projects/groups/sensorweb
[4] WPS, www.opengeospatial.org/standards/wps
[5] WMS, www.opengeospatial.org/standards/wms
[6] WFS, www.opengeospatial.org/standards/wfs
[7] CAP, http://www.oasis-emergency.org/cap
[8] EDXL, http://docs.oasis-open.org/emergency/edxl-de/v1.0/EDXL-DE_Spec_v1.0.pdf