imProved Accessibility: Reliability and security of Alpine transport infrastructure related to mountainous hazards in a changing climate

PARAmount

Decision Support System

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1 Introduction

Within the project DIS-ALP Portal (Alpine Space Programme) a portal for events of natural hazards was developed for the whole alpine space. In the course of the projects PARAmount and Monitor II (South East Europe Programme) several concepts (e.g. scenario model) and technical components (e.g. CSA – Continuous Situation Awareness) have been developed. Merging the results of these three projects generates synergies and results in added values for the respective results. Combining the components and data elements brings following benefits

- Combination of event data and detailed scenario based information in one system as an essential component of a decision support system
- Utilization of new technologies used in the technical component CSA of Monitor II in order to update the DIS-ALP portal to state of the art technology

Natural hazard events are usually complex and need to be described in complex scenarios. Much information describing these scenarios mostly is present in isolated and distributed systems. One major goal is to make this information accessible and to promote the interaction of the different systems. Thereby it should be possible to combine and show the hazard scenarios with the real events of natural hazards.

Natural hazards are not static events and can sometimes evolve very rapidly. In order to improve decision processes an optional dynamic component shall be integrated.

2 Decision support system

2.1 Integrated user interface and use case

The user interface contains the well known components of DIS-ALP but basically is based on the concepts of CSA of Monitor II. These concepts allow upgrading of the system with new components. The UI concept consists of a central map and map interaction component. The general maptools like zooming, panning, searching and the well known layer structure are the basis of the map window.

The user is allowed to import natural hazard data. These data can be filtered by time, thematically (e.g. phenomenon rockfall) and by geographical areas. Additionally it is possible to define scenarios of natural hazard events, which form the basis for decision processes of the involved stakeholders.

Figure 1 shows an example of the user interface. Display of rockfalls hazard is shown with detailed information as a basis for the decision process.

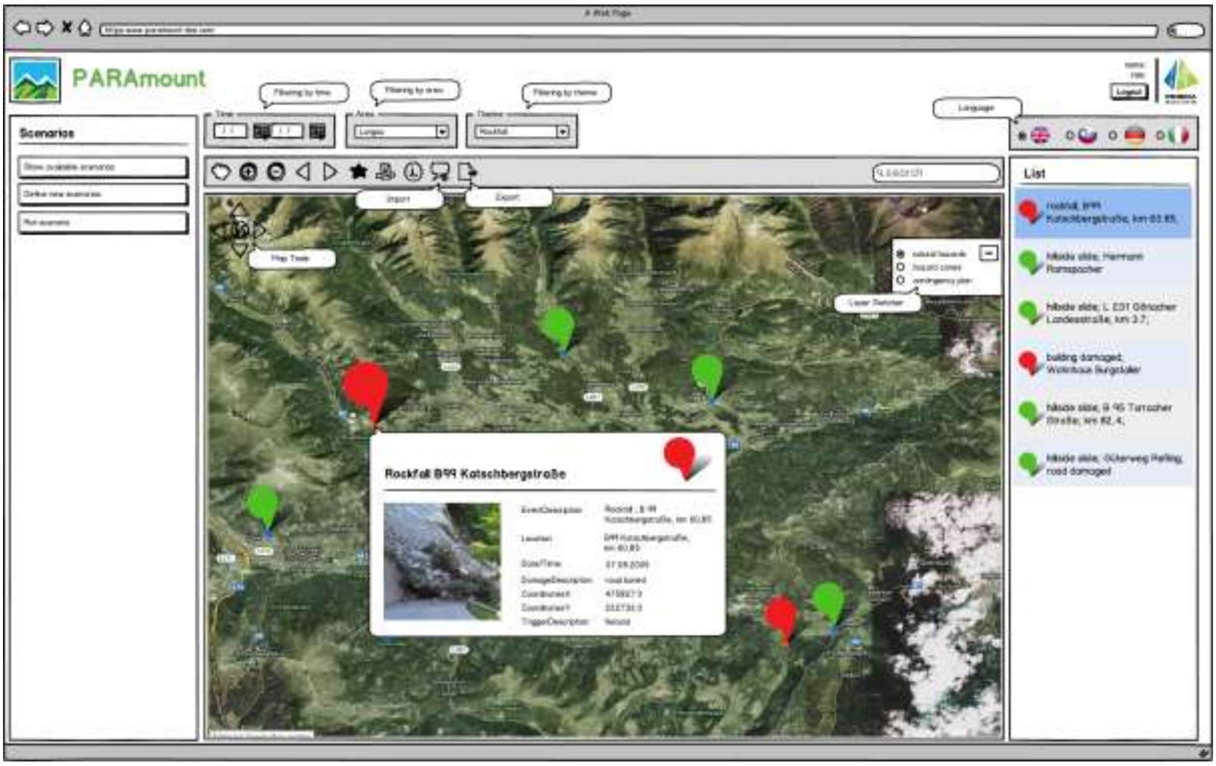

Figure 1: User interface: Example of display of rockfalls (including description of GUI-elements)

2.2 System architecture

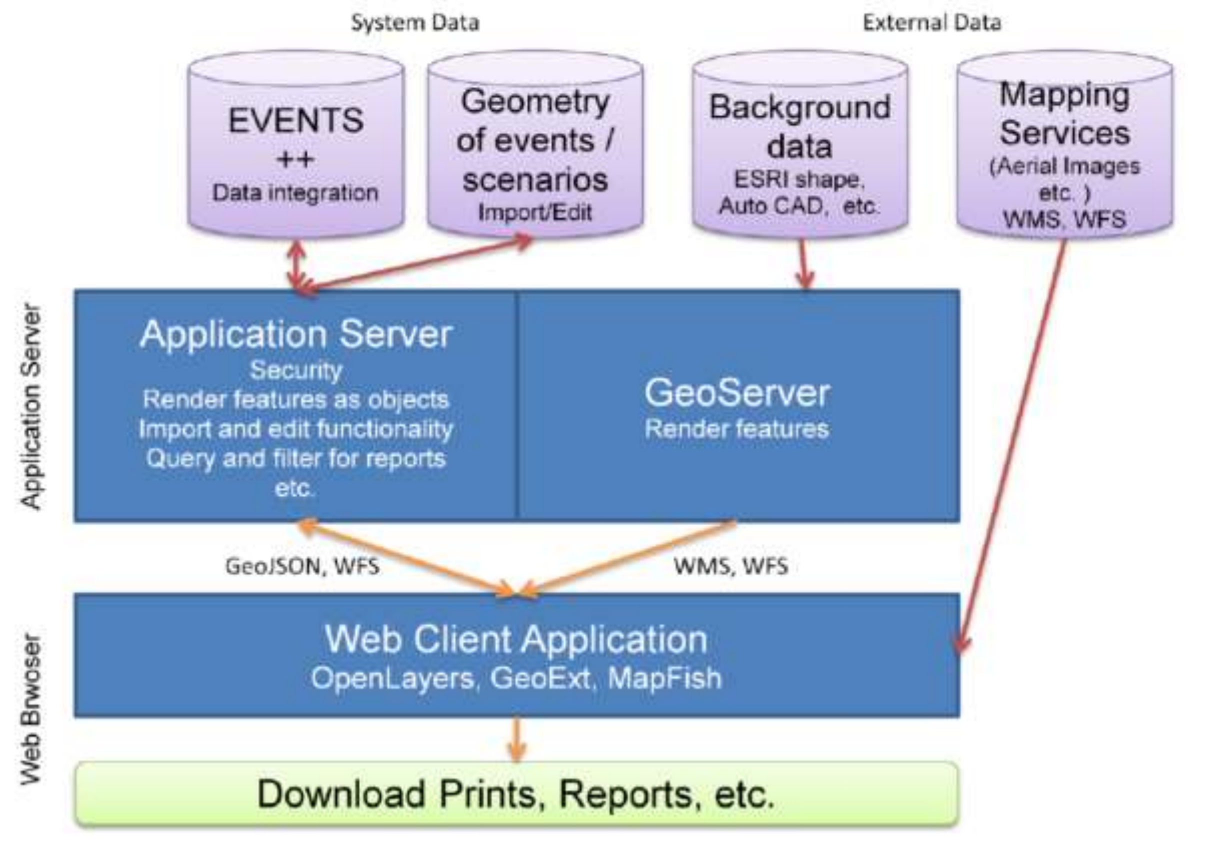

Figure 2: Overview of the system architecture

Figure 2 shows the main functional components of the system. Data sources (internal and external) as input for the decision support system. The server layer with the geoserver component for rendering the data and the application server based on JBoss .The web based client component for displaying data and export functionalities.

The chosen architecture allows extensions of the system without changing the system architecture. New data sources can be integrated seamlessly via standardised OGC-interfaces. Additionally new displaying options can be provided if needed.

Well established OpenSource components (Figure 3) have been chosen for the system. These components are developed by a very broad developer community and are constantly updated. The components can be described as very stable and are widely used by many applications. Therefore the chosen system architecture is based on a technological and widespread stable basis. This easily allows future enhancements and extensions.

Component	Description
JBoss	Java based high end application server.
Hibernate	Object-relational mapping and persistence application for database independent application development.
Hibernate spatial	Spatial extension for Hibernate, providing persistence also for data with spatial geometries.
JTS Topology Suite	High quality geometry management and geometrical functions (e.g. overlay, intersection etc.)
Geoserver	Standards based and highly interoperable server application for integrating, visualising and editing spatial data.
OpenLayers	Java script library for visualising map data in web browsers.
GeoExt	Java Script Toolkit for rich web mapping applications.

Figure 3: **Components for system development**

2.3 Data model

In order to deal with constantly new requirements a generic and extensible data model is used for the system, the PEvent-model. PEvent describes any possible objects, e.g. events, measures, observations, et cetera.

The base attributes are stored in the table PEvent. All additional attributes are stored in a table PEventTag.

The **benefits** using this data model can be describes as follows:

- it is possible to store any possible data
- it is possible to store all geometry types
- typing via programme code is possible hierarchically

The **access** can be done

- via views on specific codes (measures, events, …)
- via materialized views respectively indexed views for ESRI ArcSDE technology

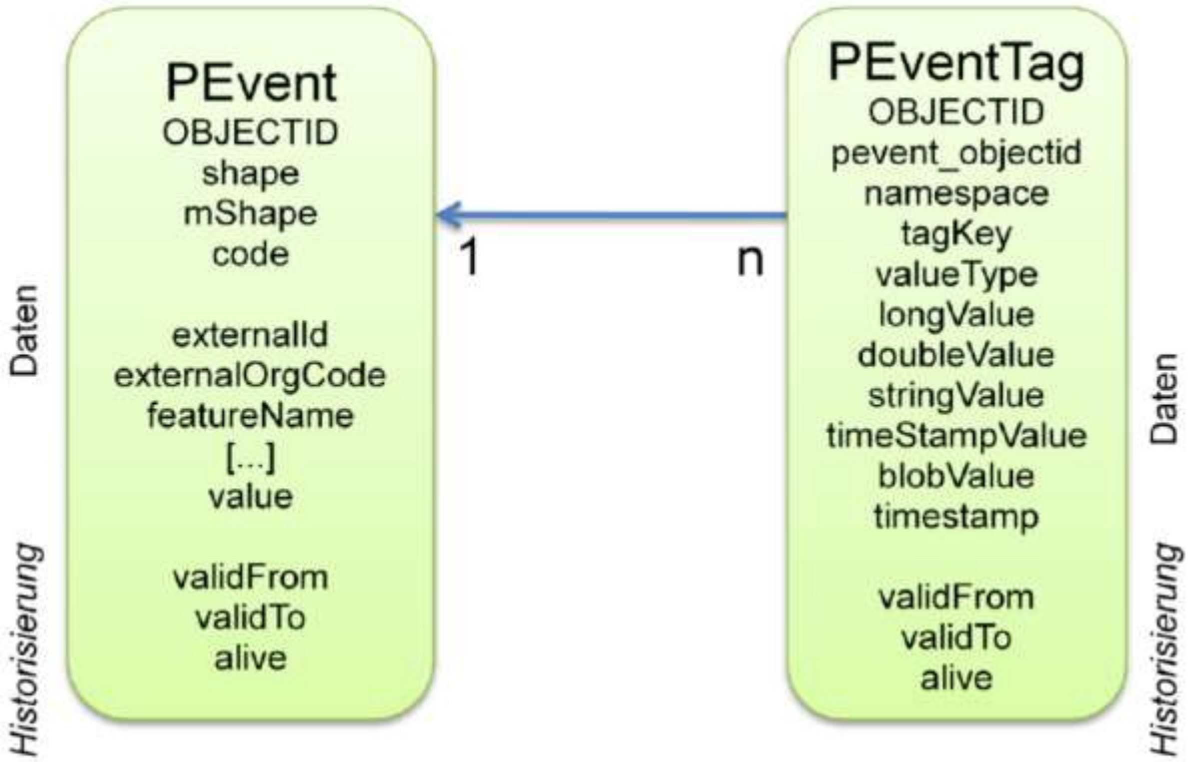

Figure 4: Simplified representation of the PEvent model

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