ELD-BS: the digital situation dashboard for Baden-Württemberg

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ABSTRACT

This paper presents the *Elektronische Lagedarstellung für den Bevölkerungsschutz* (ELD-BS, engl. *Electronic Situation Dashboard for civil protection*), a software suite for managing crisis relevant information in the German federal state Baden-Württemberg. ELD-BS serves as an easy-to-use and functional tool to support administration work in larger operational situations and in the event of a disaster. The ELD-BS supports communication and data exchange between the authorized access points in the event of an incident, yet it does not replace the formal reporting channels and the communication between the units involved in the operation. ELD-BS is conceptually intended for the overarching use of the administrative levels and particularly allows the exchange of information between the administrative authorities in large-scale operations. The software suite comprises 4 applications, which are accessible from the web and offer different functionalities during crisis response. This paper introduces the individual components and their interaction.

Keywords

Crisis Management Software, Disaster Information Exchange, Information Tools in Emergency Response.

INTRODUCTION

The *Elektronische Lagedarstellung für den Bevölkerungsschutz* (ELD-BS) is a toolbox consisting of several software applications for the management of crisis situations in the German federal state of Baden-Württemberg. It is continuously being developed since 2009 and is operable for the disaster control authorities at all administrative levels since the NATO-summit held in Straßburg, France and Kehl, Germany in 2009 [1]. This paper intends to introduce the ELD-BS to the scientific community, present the tools that it currently hosts and gives a brief overview of the surrounding parameters, as well as the main stakeholders.

ELD-BS TOOLS

The toolbox ELD-BS contains

- the self-titled ELD-BS as the actual situation dashboard,
- a crisis object database (Krisenobjektdatenbank, KODB),
- a document exchange portal for situation reports (Elektronische Lagedarstellung Dokumentenaustauschportal, ELD-DOK) and
- a tool for planning and managing evacuations and accommodations for civil protection (Zentrale Evakuierungs- und Unterbringungsteuerung für den Bevölkerungsschutz, ZEUS-BS).

These tools are presented and discussed briefly in the following.

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USERS

As ELD-BS is intended to give the administrational staff means for communication and information exchange, its user management corresponds to the administrative organization of Baden-Württemberg. Baden-Württemberg is a German state located in the south-west. With 11 million inhabitants and roughly 35.000 km² it is the third largest German state both in size and population. Similar to the other German states, the administrational system of Baden-Württemberg operates in a three-tier system, with the ministry of interior at the top. The second tier is formed by the regional councils Stuttgart, Karlsruhe, Freiburg and Tübingen. Further on, these commissions are broken into the third tier: 35 rural and 9 urban districts, which contain 1101 communes [2]. Though communes form the lowest administrative tier, they also carry responsibility for civil protection. Situations limited to the area of a commune are managed by itself unless transfer of responsibility to a higher-level administration is requested. Rural districts come into play, when a task or situation is too complex or large for single commune to manage. Planning and administration beyond regional boundaries is realized by the administrative regions, which form an intermediate administrative layer between the lower authorities and the Ministry of the interior of Baden-Württemberg.

This composition is reflected by ELD-BS: users can only access contents that are administratively relevant for them. Depending of the application in the ELD-BS tool suite, access rights are defined either by geospatial extent or through a hierarchy. Access rights based on geospatial extend are granted, whenever an information is located in the area of an administrative entity. As an information entry also has a geographical information, it is defined which entities from the tiers contain the location. All entities containing the location have access rights on the corresponding entry. As other option, users of ELD-BS are organized in groups, which are designed according to the tier-system. Through this structure, the ministries have the highest access rights (ergo, they can access all information), whereas communes have the lowest access rights.

ELD-BS

The ELD-BS allows the management of parallel or serial emergency situations for example major damage situations, flood situations, vegetation fires, earthquake and nuclear accidents. Furthermore, unexpected situation types like the the refugee crisis in 2015 or the Covid-19 pandemic starting in 2020 can be addressed as well. It is designed for the usage across different administrative levels, including municipalities, counties and regional boards. Additionally, all ministries of the state of Baden-Württemberg are able to access information. The ELD-BS is a *deployment diary* in which all relevant administrative actors record status information and measures. The information is accessible according to the hierarchy of a user: a member of the ministry is able to see all information, whereas users from regional districts have read access for all entities within their regional boundaries.

This tool offers important functionality to the public crisis management offices: due to transparency and quality assurance, measures during the crisis management must be documented by law. In this deployment diary, the undertaken actions can be persisted, while the flow of information to all responsible entities and superior administrative levels is ensured.

From the abstract point of view, the ELD-BS is a *deployment diary*, but from the detail view it is organized as a hierarchical structure of multiple deployment diaries. There is one diary for each of the administrative units and the reports from those diaries are mirrored into aggregational diaries. This structure reduces the monitoring effort since an administrative unit simply monitors its own diary and the top-level aggregation diary. The access rights for such a diary report are independent of the diary, they are defined for the report itself.

Since confirmability is crucial for such administrative systems, the whole change history is kept for later analysis. In many situations it is also legally required to know exactly who has given certain orders. To support that requirement, the write access to those diaries is not granted directly to persons but to certain roles. The assignment of those roles to a person is also recorded together with the time interval when those assignments were valid. This role-based access management setup also allows for easy deputyship regulations.

As *deployment diary*, ELD-BS is a central tool in the complete tool suite: other applications are able to automatically mirror taken actions into ELD-BS. This yields in a complete summary of all administrative actions from these tools; users can precisely retrace when and which a specific measure has been taken. This offers different perspectives for quality assurance or information for public relations.

The head of the crisis management or the offices involved are able to set the crisis level on the situational dashboard, which shows an aggregated summary of all crisis situations in the state of Baden-Württemberg. An example is given in the picture below, where the rural district *Böblingen* has a thereotical warning level shown in the color yellow. The dashboard shows information in five ascending levels of escalation, as shown in Figure 1.

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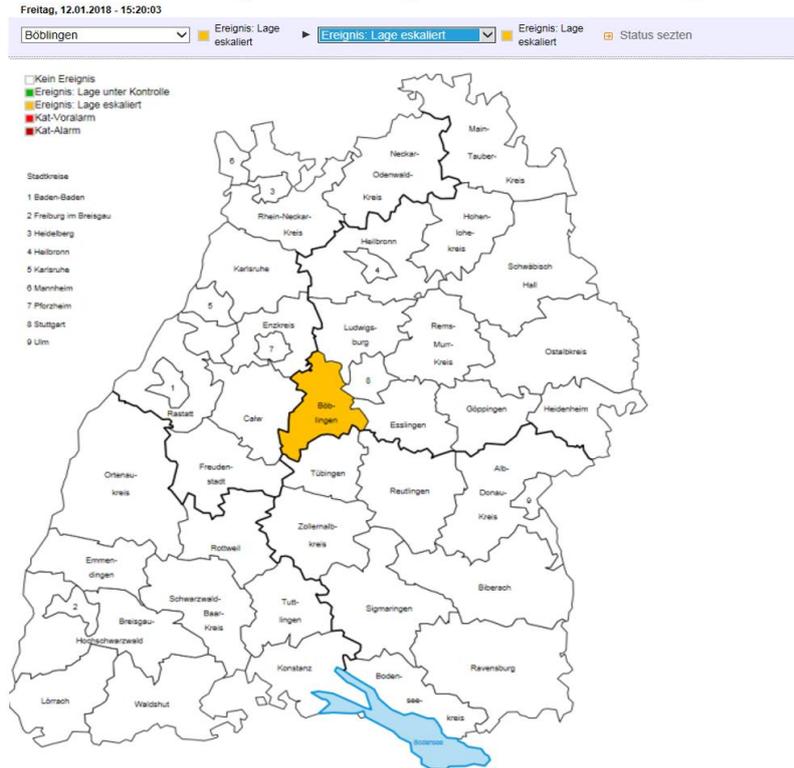
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Figure 1: The dashboard for ELD-BS

Prominent examples of usage are the management of the Covid-19 pandemic starting in 2020 and the refugee crisis in 2015, in which information about the ongoing situations had been exchanged on this platform.

KODB

KODB is a geographical information system, that offers map-based access to data relevant for civil protection. It offers several functionalities.

The first application is the semantic recording of objects relevant in crisis situations. It is used to assess risks in early phases of the crisis management cycle and to support the planning phase and the crisis management teams during ongoing crises. For example, the KODB allows the storage of critical infrastructures for example hospitals, airports or schools. A more complete list can be found in Table 1.

Table 1. Object categories in KODB

Selected categories in KODB	
Educational Establishment	Public Utilities
Daycare	Fuel Stations
Health Care Facilities	Refugee Accommodations
Charity Workshops	Airports
Health Clinics	Correctional Facilities
Iodine Tablet Issuing Offices	Psychiatry
Accommodations	Military
Touristic Places	Large Firms
Venues	Hazardous Facilities
Hospitals	

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The main access mode for the KODB is based on a map. This map shows the area of interest. Object for categories of interest can be added as desired, with a corresponding icon for each category. Figure 2 gives an example of a school on the map. Furthermore, it is possible for the user to enter addresses or names of places as search terms; this takes the user in the map to the operational area.

Figure 2: An object on the map of KODB

Objects in KODB are persisted with further metadata, such as address, contact persons and parking resources. Specialised data for each entity is available as well, such as number of pupils for a school. The application relies on an extensive data model which is based on an ontology; this ontology is subject of disclosure and will not be discussed in this paper. Figure 3 shows the detail page for an element (a primary school) within the KODB: The geographical position and extend is shown on the map. Through different tabs more information can be accessed like the number of pupils and contacts to the staff. The recent view gives information about the object's address. The number of pupils, as well as information about the school administration can be accessed, too.

Figure 3: The detail page of an element in KODB

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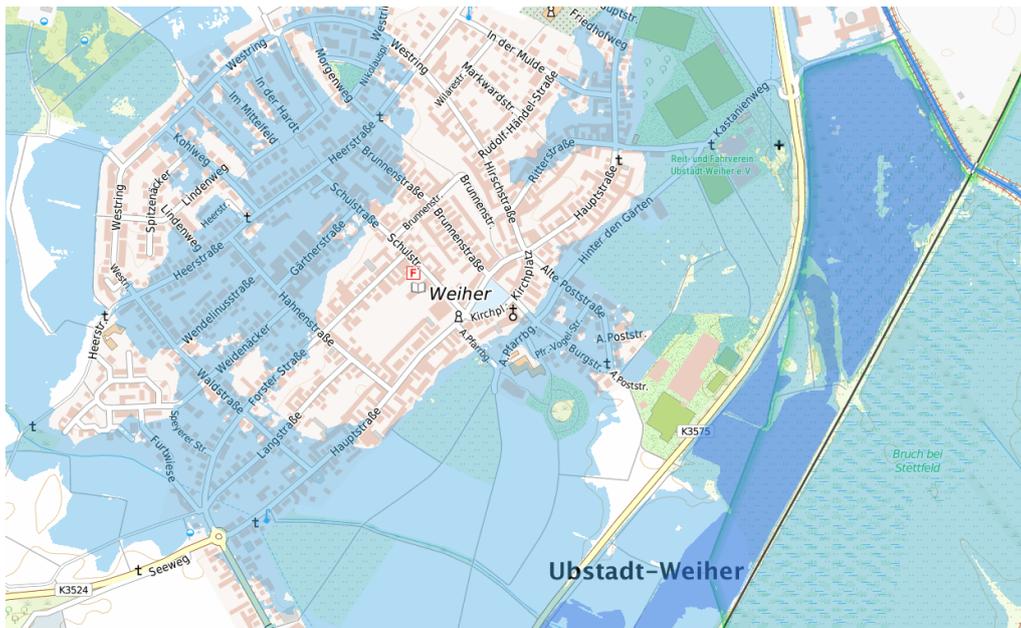*Proceedings of the 19th ISCRAM Conference – Tarbes, France May 2022*

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KODB offers as second functionality information about the inhabitants in the predefined evacuation zones in the perimeter of nuclear facilities. Firstly, all nuclear facilities in the area of responsibility in Germany, France and Switzerland whose operation could affect the population of Baden-Württemberg in the event of a nuclear accident, are mapped within KODB. As the planning framework for the perimeter of nuclear facilities desires the definition of evacuation areas around nuclear facilities [1], KODB implements the intersection of communes and evacuation areas: clicking on one of the sectors prints a list of all communes located in this sector. Figure 4 shows an example, where the red-shaded area is selected on the left. After selecting a zone, KODB offers the calculation of affected communes and an estimation of people living in the area. The calculation is offered based on two calculations. The user can choose between either summing up the number of registered persons in all affected communes or based on a 1 km²-fine population density raster. The resolution of the results varies and one must be aware of the differences in both modes. The following figure does not show the results due to confidentiality reasons.

Figure 4: Geographical areas in the parameters of nuclear facilities

The third component of KODB is a risk map for high tides. It includes layers for flooding, statistically reoccurring every 10, 50, 100 or 1000 years. Figure 5 shows an example for such a map excerpt. The light blue area is the calculated flooding area for a high tide situation reoccurring every 50 years; the dark blue area shows the area that is statistically flooded once in every 10 years.

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Figure 5: Flooding area shown in KODB

All three functionalities, respectively their layers, can be combined in order to gain deeper insights about a recent situation or to take certain circumstances into respect during the planning phase; the combination allows the finding of critical objects during critical risk situations or finding objects at danger during a flooding.
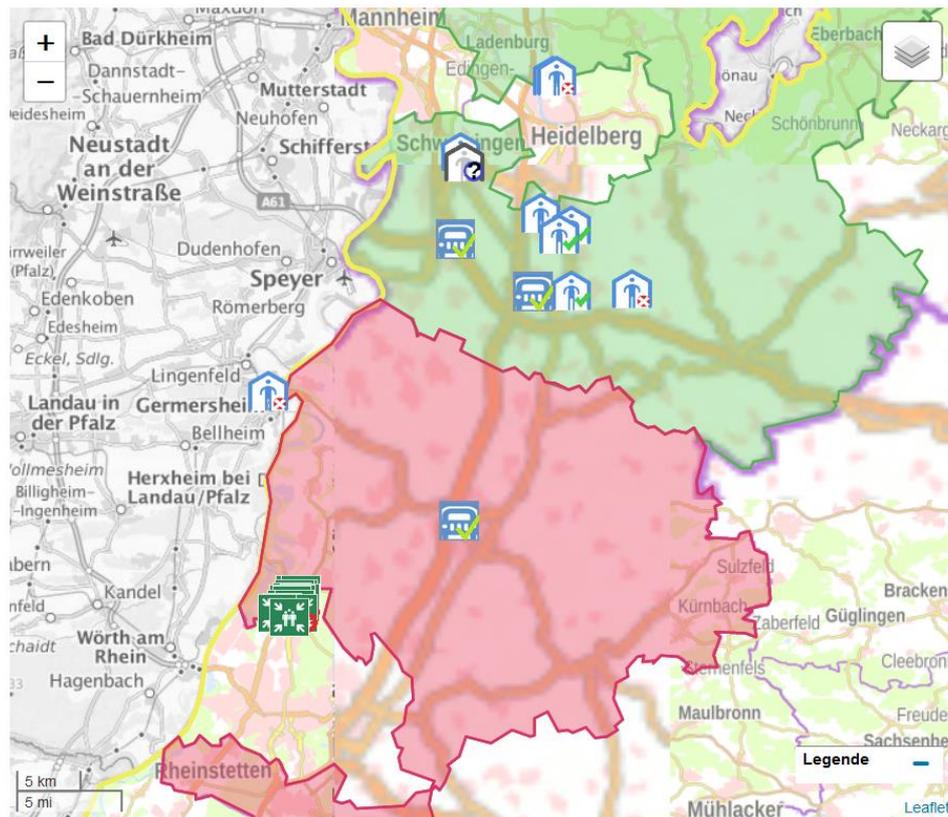
ELD-DOK

ELD-DOK is used among the administrative offices in Baden-Württemberg. It has first been deployed in 2012 and offers secure sharing of planning and informational documents for civil protection. Since 2018 it is part of the ELD-BS tool suite. Municipalities, city and rural districts, the regional councils and the Ministry of the Interior are entitled to access. In this way, disaster response plans can be passed on to users in a target group-oriented manner. Data can be made available in two ways: either as global document accessible for every user with access rights or as secured document or as secured document available for predefined user groups.

User groups are predefined collections of a tuple of a user and a corresponding email address. There, if a document has been updated or made available, the corresponding users can be informed. User management is made available by the underlying software WebGenesis®, which is explained in section WebGenesis®.

ZEUS-BS

ZEUS is a web application offering functionalities for the evacuation of large population groups from hazardous areas to emergency accommodations in a safer area [2], [3]. ZEUS functions are derived from two Standard Operating Procedures (SOPs) for (pre-)planning emergency situations for large scale evacuations and were sharpened during expert panel workshops.

ZEUS functionalities comprise preplanning methods and functions to support authorities during an evacuation situation. This contains the management of collecting points (CPs), civil protection contact points for the allocation of persons to accommodations (CPCPs) and emergency accommodations (EAs). During an evacuation, ZEUS supports staff at CPCPs to find an emergency accommodation with sufficient capacity and, if required, further characteristics appropriate to the needs of the person/group to be assigned. The number of persons accommodated in an EA can be tracked to prevent overloading. ZEUS also offers a set of key performance indicators to reflect the allocation of emergency accommodations during and after the situation, offering the possibility to transparently communicate with the public. Lastly, if desired, ZEUS can mirror all performed actions into an event log in the ELD-BS Dashboard. The developed functionalities provide technical support for disaster management authorities (pre-)planning a large-scale evacuation. Figure 6 shows an excerpt the ZEUS dashboard. Further information are excluded due to security policies.

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Figure 6: The ZEUS dashboard

WEBGENESIS

ELD-BS is developed based upon WebGenesis®, a Content Management System (CMS) developed by Fraunhofer IOSB. It offers the management of communities and knowledge, providing several options for manipulating, requesting, inserting and visualizing data. WebGenesis® separates content and layout, offering standardized templates for information categories and harmonized appearance. It allows the collection, management and visualization of data, as well as expert knowledge.

The backend of WebGenesis® is developed in Java, whereas the frontend relies on the web technologies HTML, CSS and JavaScript.

CONCLUSION

This paper introduced the ELD-BS tool suite, which is a real-world example of software applied in public safety. The software is deployed for the Ministry of the Interior of Baden-Württemberg. It offers different functionality, with the most important tool being the self-title ELD-BS, offering a deployment diary and information exchange tool over all administration levels in Baden-Württemberg.

As ELD-BS has been developed since 2009 it is a tool of maturity. As its usage spread in the different tiers of the administration, it was criticized that dashboards or aggregational overviews are designed for users from a high-level view; the many entities of the lower administration tier cannot access information in a fine granular manner. Furthermore, it has been requested to manage public defense resources within a single tool. Currently, it is being discussed how this can be achieved.

Lastly, user requests are often being implemented: with the latest development ZEUS, the Ministry of Interior directly addressed the planning framework for the evacuation of large areas [6]. Through this request chain, ZEUS implements functionality which are novel to any German federal state. To the best knowledge of the authors its functionalities are not offered by any software in crisis management, yet.

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