Smart Mapping - the New VectorTiles Map of Germany

Markus SEIFERT

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SUMMARY

The project Smart Mapping tries to answer the ongoing question on how the official topographical map of the future will look like. Worldwide, the trend is emerging that the focus of official cartography will lie in the flexible and mobile Web presentation of spatial data and not necessarily in the production of printed maps. Considering the diminishing human resources, official surveying relies increasingly on the use of modern technologies and centralized processes for the development and provision of quality-tested standard products of the German authoritative surveying (AdV). The AdV plenary has set up a working group on "Smart Mapping", in which the federal (Länder) and state governments are jointly developing a procedure, which will allow automated production of various cartographic products (without interaction) on the basis of official geospatial reference data. In doing so, multiple requirements must be taken into account, such as actuality, nation-wide uniformity and flexible extensibility. Based on the concepts developed last year, the working group "Smart Mapping" has recently set up a beta version of a web-based vector map (based on VectorTiles), which is described in this paper.

The DVW working group "Geoinformation" works closely with the FIG Commission 3 and 7 in order to discuss new approaches in information technology and land management.

[1] German Association of Surveying (DVW), www.dvw.de

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1. INTRODUCTION

At the beginning of 2018, the Official German Surveying (AdV) launched a joint project between the federal and state governments to make official cartography fit for the future and to develop innovative products. The innovation of the new project "Smart Mapping" lies in the redesign of a **modular development platform** for fast, agile and economical generation of cartographic products of the German surveying administrations. The aim of this platform is to gradually address the central development of the well-known AdV Standard Products and to test and deploy new or further developed cartographic products.

The characteristic of common AdV products from "Smart Mapping" is a uniform appearance, uniform conditions of use, full coverage of the Federal Republic and – apart from the initial data – a high up-to-date (currently up to 2 weeks) for the web presentation. Thanks to its modular design, the process can flexibly add new data sources and new tools.

This publication introduces the first results of the Smart Mapping project for an official topographic map of the future. On the basis of the central development platform, a prototype for a (mobile) vector map with 3D buildings and contour lines is presented (German product name: basiskarte.de). With this presentation, the technical and organizational framework conditions, the technology used (Vector Tiles) as well as other innovation potentials of Smart Mapping will be presented.

An important aspect is the improvement of the usability of official data in order to combine it with data of other users and to develop any application with little effort and technical expertise. Numerous examples of

2. OBJECTIVES

The functionality of the new process as well as the development platform will first be tested as part of a proof of concept before new or further developed AdV cartographic products are developed in the following development steps. In the first implementation step, therefore, the production of a new **vector-based web map** was implemented prototypically (see Fig. 1). The proposed working title for this new AdV product is basiskarte.de. Hereby, the AdV follows the principle "mobile first". The implementation can be used on mobile devices as well as on desktop computers.

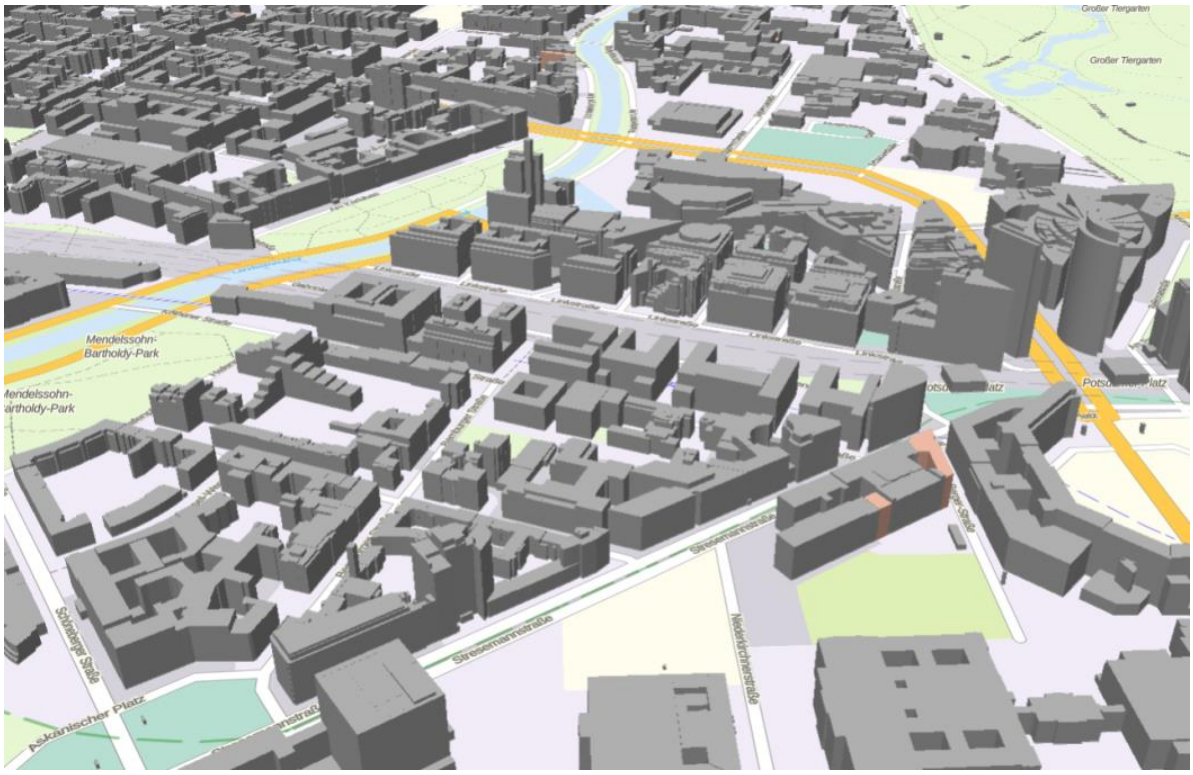

Fig. 1: Prototype vector map in oblique view (in Berlin).

Smart mapping is therefore not just another new AdV product, but a common procedure of the federal and state governments, which is functionally supervised by a development community supported by the federal government and the Länder and is continuously updated. The technical realization and the provision are coordinated centrally at one point for economic reasons.

The characteristic of standardized AdV products resulting from smart mapping is a uniform picture, uniform conditions of use, full coverage of the Federal Republic and a high level of actuality. Thanks to its modular design, the process can flexibly integrate new data sources and new tools and thus develop agilely. The derivation of a configurable print output, which could possibly replace the digital topographic maps (DTK) in the medium term, is also currently being examined in the smart mapping process.

3. INTRODUCTION OF AGILE DEVELOPMENTS METHODS

The creation of the concepts developed in 2018 has shown that the implementation of such a complex smart mapping platform requires new ways that have been unconventional for the German mapping agencies so far. Due to the high technical complexity and the impact of the possible measures, which is therefore difficult to assess, **agile development** was introduced. The goal of agile development is to make the implementation process more flexible, faster and

leaner than the classic approach models. The decision-making paths are short and the work packages to be implemented step-by-step are manageable.

The implementation is carried out by the new working group on Smart Mapping with active participants from all surveying administrations of the Länder, the Federal Office for Cartography and Geodesy (BKG) as well as the Centre for Geoinformation of the German Army (ZGeoBw) and in the future also other experts from Science and research. The working group currently consists of more than 20 agile geodata experts who have been exempted for development work by their sending authorities (or at least for part of their working time) to work together on the new smart mapping technologies. The experts come mainly from the fields of surveying, software development, cartography and data management. A nationwide collaboration with such a high number of developers is quite challenging, but by using modern communication tools and collaborative development software it is possible to work effectively with separated people.

4. THE BETA VERSION OF THE NEW OFFICIAL VECTOR MAP

Compared to the previous raster web maps of the AdV (e.g. WebAtlasDE), the new vector tiles map contains also LoD1 buildings, contour lines and hillshade representation, each of course covers the entire national territory. A self-developed application (Map Editor) also provides different representations (styles) (see Fig. 2). With an editing function, any elements can be selected and highlighted, as well as any cutouts can be integrated into your own web applications as an IFrame.

Fig. 2: Different standard styles of the web map (from left to right): relief, standard, night design, aerial photo, infrared

A vector map offers a number of advantages over the traditional raster map. The most important of these are listed as follows:

- Vector tiles require less data than raster data, which allows fast data transfer especially for mobile applications (online and offline)
- The object-oriented information in the data can be analyzed, selected and displayed as desired
- Always vector-sharp display, regardless of screen resolution and zoom level. This makes it also suitable for 4K screens and high-resolution smartphones
- Card rotation and tilt with appropriate adjustment of the textural labeling
- 3D display, especially for terrain and buildings (the unique data sets of the mapping agencies are particularly prominent).
- Users can request additional information about selected map objects (interactivity; is usually used for points of interest)
- A variety of map styles can be offered because computational rendering is reduced in advance, and tiling is required only once per update
- Individualization of the map layout by customers is possible
- Freely scalable map applications, no fixed zoom levels
- Creation of a raster service (WMS, WMTS) from the vector data also possible
- Combination with any other content possible.

For web applications, the new vector-based web map therefore offers significant advantages, so AdV has decided to further develop the product into a standard AdV product and thus to replace the raster-based WebAtlasDE in the medium term.

5. THE SOFTWARE - OPEN SOURCE FIRST

The increasing performance of clients and faster internet allow the use of new web technologies, including geospatial data and map applications. Maps are increasingly no longer displayed as pre-rendered raster images on the web, but are delivered as vector data to the client, who then displays them themselves (renders). This technology, which is still quite new for official surveying, is based on so-called **VectorTiles**, which are currently available in various formats, since a final standard has not yet established. As a result, there is still plenty of room for development on both the server side and the client side when developing applications. Smart Mapping aims to make these modern technologies usable with official data sources.

The prototype of the web map uses both proven and new software and technologies. Here is an overview:

- Linux Server: Linux operating system for the development platform
- GDAL/OGR: a free program library for the transformation of spatial raster data
- Postgresql / PostGIS: GIS database
- T-Rex: to create VectorTiles in the database

- Apache HTTP Server: Platform web server
- MapServer: Providing geospatial services
- GeoServer: Web server that allows maps and data of various formats to provide standard applications such as web browsers and desktop GIS
- Map Editor based on Mapbox GL: Web application for displaying the web map.

The working group decides by itself which tools are used. Previously, only open source products were used.

6. NEXT STEPS

The selected data topics must still be completed and made available nationwide. The AdV wants to enter into an early dialogue with web developers and users and has planned a timely release as an open "beta version" on 1.3.2020.

The beta version is available in www.adv-smart.de and contains the following components which can be used for testing purposes (see License Terms):

- Smart Mapping homepage
- Smart mapping map application (Map Editor)
- Smart Mapping VectorTile service
- Smart Mapping hillshading service.

Corresponding documentation is also included. The further development to the adV standard product is planned until the end of 2020. Then the WebAtlasDE is to be replaced by the new web map. At the same time, a high-resolution printing functionality is to be realized. An evaluation is then carried out as to whether such a print edition is a possible successor to the DTKs or whether the existing procedures must continue to exist.

CONTACT

Dr. Markus Seifert
Project Leader of Smart Mapping
Agency for Digitisation, High Speed Internet and Surveying
Alexandrastr. 4, 80538 Munich
Germany
Telefone: +49 89 2129 1002
Mobile: +49 173 8633042
E-Mail: Markus.Seifert@ldbv.bayern.de
Internet: http://www.gdi.bayern.de