

Using the D3 library for web-mapping in an SDI environment

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Abstract

We demonstrate the feasibility of using the D3 JavaScript library to produce a National Atlas using SDI web services. We present a state-of-the-art architecture and a proof-of-concept implementation to demonstrate how SDI and mainstream IT can work together.
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1 The context: Atlases and Spatial Data Infrastructures

Atlases present a synthesis of the spatial data and contain collections of complex, high quality maps, created from combinations of geographical datasets. An important aspect of atlases is that a considerable effort has been put into making the information *comparable*: the same level of generalization is applied, data has been collected for similar reference periods, using standard classification methods, class boundaries and legend colours, etcetera. The main point of bringing all the various types of spatial information together in a national atlas is to make sure that this comparison can be fruitful [3].

Nowadays atlases are more and more produced using digital, but still traditional tools: graphic design software and stand-alone visualisation toolkits. And even though these result in products that can be of excellent quality and usability *in themselves*, they are also *on themselves*: They lack the interoperability and connections with the wider digital world outside that we come to expect in this age of Spatial Data Infrastructures (SDIs).

In an SDI such as the Dutch ‘Nationale GeoData Infrastructuur’ (NGDI), many web services come together. This poses challenges if we want to combine depictions of those services in cartographically sound maps. In many existing web mapping set-ups the maps are delivered to the end user as raster images from Web Map Services. Although such map layers can technically be combined in a compound map, the portrayals of the different layers can not be influenced, and therefore can not be optimally used in any web mapping solution.

2 Architecture for atlas mapping in an SDI

To look into solutions to this problem, we developed an architecture for a proof-of-concept prototype, depicted in Figure 1. In our set-up, data is consumed from Web Feature Services (WFS), services that provide vector data instead of the ready-made maps of WMSes. To portray and combine that data we developed a client-side data integration and mapping component (described in more detail in the next section).

The National GeoData Infrastructure layer includes a broad range of possible data services. The two services specifically mentioned in Figure 1 are the ones we use in the prototype at the time of writing. Which services are actually used by the atlas is determined by the settings in the Atlas metadata.

WFS output in most cases is a Geography Markup Language (GML) data stream. Because we can and want to use a very wide range of existing data services, we can expect GML data of different versions and with a large variation in GML application schemata. We decided not to try parsing this client-side, but instead feed the mapping component with GeoJSON data [6]. Although some services in the NGDI do actually supply data in GeoJSON format, most only support GML output. We therefore introduced a conversion component in an intermediate National Atlas services layer, depicted as the GML2GeoJSON proxy in Figure 1.

We foresee the implementation of more National Atlas services, such as a spatial aggregator service, that for example would perform the generalization of socio-economic data at the municipal level into higher level provincial data.

Another component in this National Atlas services layer is the Atlas base map service. This serves data for several map layers that are used repeatedly, such as coastlines and major cities. This enables us to provide a common look and feel to the maps. Note that this is implemented as a standard WFS, and as such is a fully independent stand-alone web service node. It could therefore be considered as part of the NGDI layer just as well.

3 The Atlas Viewer Prototype

To implement the visualization functionality described above, we looked for a solution that would offer flexibility, high-quality graphics as well as standards compliance.

We specifically looked for map viewer components based on HTML5: The modern Open Web Platform, the range of advanced, open Web standards enabling the creation of standards compliant web applications [4]. There are several frameworks that simplify the building of interactive mapping clients using HTML5 in modern browsers, most of these are implemented as

Figure 1: Proposed architecture of combining the SOA-environment of the NGDI with the National Atlas services and the National Atlas map viewer using the D3 library.

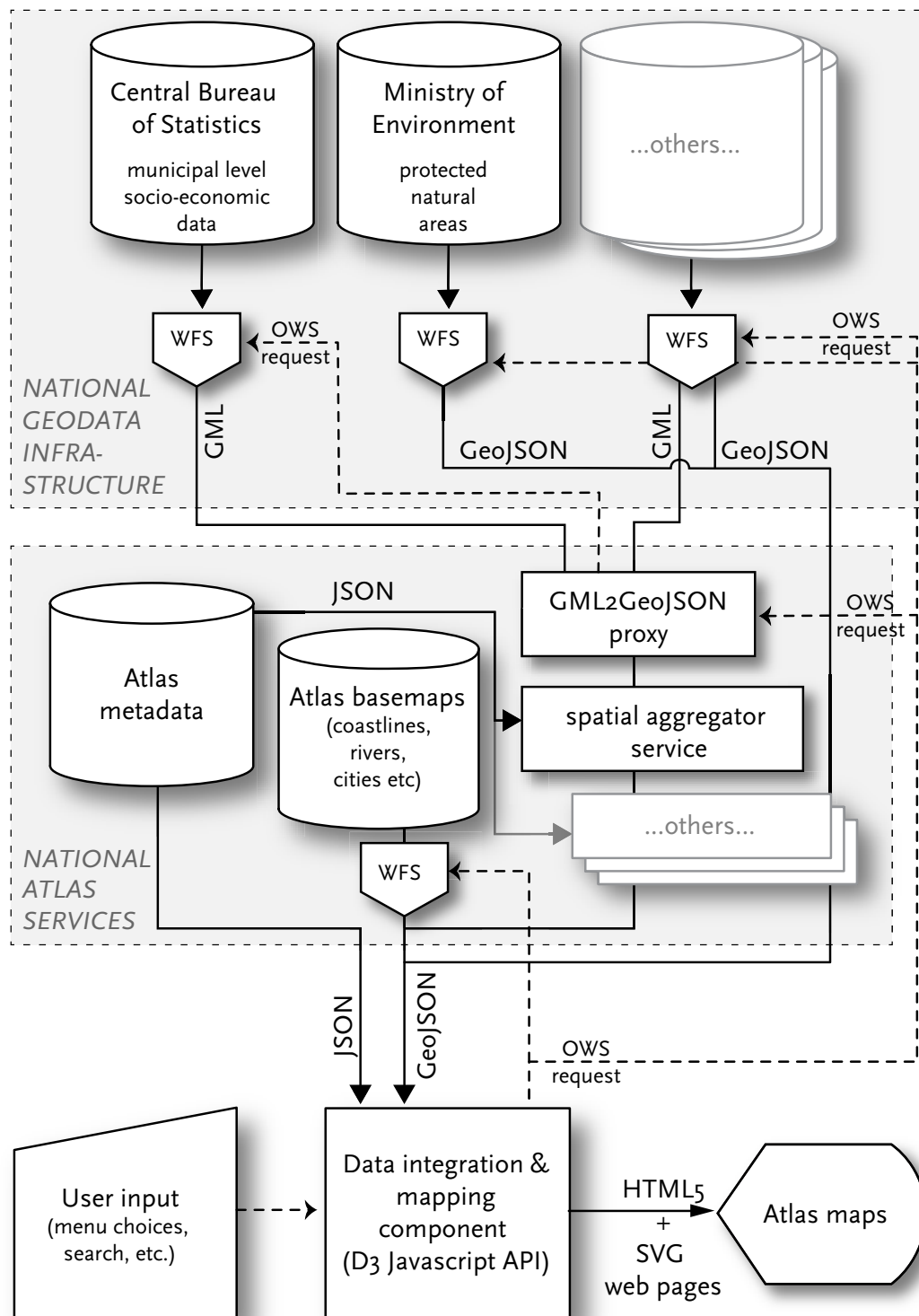
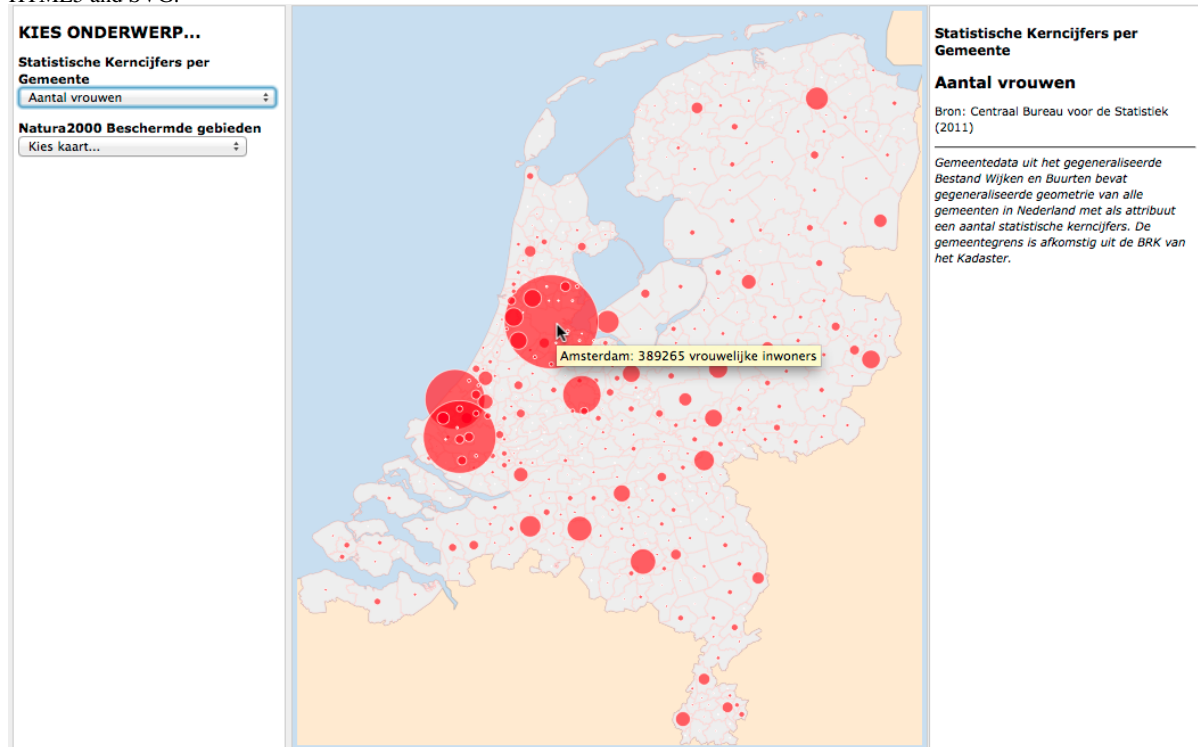


Figure 2: A screendump of the National Atlas viewer prototype. The D3 library was used to interactively map the number of female inhabitants per municipality (from a Central Bureau of Statistics Web Feature Service) as a proportional point symbol map, using HTML5 and SVG.



client-side Javascript libraries. After testing several of these libraries, we opted for the D3 library [1, 2]. D3.js is a JavaScript library for manipulating web pages programmatically, through their Document Object Model (DOM). It allows you to bind arbitrary data to the DOM, and then apply data-driven transformations to it, using the full capabilities of modern web standards such as CSS3, HTML5 and SVG. We found D3 to be fast and efficient, even when using large datasets. Its code structure, based on the popular Javascript framework jQuery, allows for dynamic behaviours of the objects, thus enabling maps with interaction and animation.

The resulting map viewer offers high-quality interactive map views of data from the NGDI. The viewer is still actively being developed. The most recent stable version can be always be tested at the website [5], and a screen dump is provided in Figure 2.

4 Conclusion

The current set-up and proof-of-concept prototype described on this poster and available at the National Atlas website [5], demonstrate that using HTML5 technology, in particular the D3 javascript library, results in high-quality mapping using services from an SDI. We think our set-up provides many advantages in

up-to-dateness, flexibility, extensibility as well as interoperability and adherence to standards. We hope to further enhance the system, and also gradually expand the amount of data mapped.

References

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