

Conception for an online-National Atlas of Germany

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1 Introduction

The current version of the National Atlas of Germany exists only as a print- and a CD-version. With the rise of the internet towards a mass medium (1992: 1 million connected computers, 2000: 100 million connected computers) the Institute of Regional Geography, Leipzig started to work on an internet atlas prototype, in close collaboration with the Institute of Cartography at the Dresden University of Technology. The internet atlas should complement the printed and the CD-version. As a result of the collaboration a master thesis was carried out in 2001 which should work on the conception of the content, the layout and the technique for an online-National Atlas of Germany [SCHNABEL, 2002].

2 Internet atlases

To determine the content and the layout of an online-atlas, 12 selected thematic online-atlases were analysed regarding their content, user guidance and user friendliness, layout and interactivity. The 12 selected thematic online-atlases were:

- National Atlas of Canada,
- Atlas de France (National Atlas of France),
- National Atlas of USA,
- National Atlas of Sweden,
- National Atlas of Switzerland (prototype),
- Atlas of Ukraine,
- Western Australian Atlas,
- South Australia Atlas,
- Environmental Atlas Berlin,
- Atlas du Quebec,
- Nationalgeographic Atlas,
- Arctic Environmental Atlas.

The analysis of the above atlases led to the following classification scheme presented in Figure 1. Online-atlases can be divided on the basis of their generation in statically and dynamically generated online-atlases. Static online-atlases are pre-generated once, dynamic online-atlases are generated on demand. A further subclass could be introduced on the basis of the degree of interactivity: view-only and interactive online-atlases [based on KRAAK & BROWN, 2001, p. 3]. In view-only online-atlases the content and the cartographic layout can not be changed. Atlases with the ability to zoom and pan have to be classified in that group because the user can only change the map to a different view. These atlas types often build on scanned raster maps.

In contrary to this group the content of interactive online-atlases can be changed. In dependence of the degree of interaction two interactive atlas types could be derived. The first type limits the interaction of the user to predetermined possibilities which are defaulted by the atlas author. There is also no possibility to change the cartographic layout of the maps. For that type of online-atlases the presentation of maps is important. Reasonable color and theme combinations are used which are predetermined by the atlas author. In the most cases the user can toggle thematic layers and change the map view (zoom, pan). The navigation is easy to use but limited to standard functionality. That's why this atlas type can serve a larger audience.

The second type has a higher degree of freedom. For this class the emphasis is on analysing the map data. That's why this type should be called analytical online-atlas. The user can select and combine layers objects. He can also change the symbology and color-schemes of each map. But the most important aspect is the possibility to do numerical or graphical queries and analysis (e.g. buffering, intersection). The user has also the possibility to embed own scripts and macros just like in a GIS. The possibility to combine different topics and data paired with uncontrolled visualisation parameters can lead to thematically meaningless and cartographic bad visualisations.

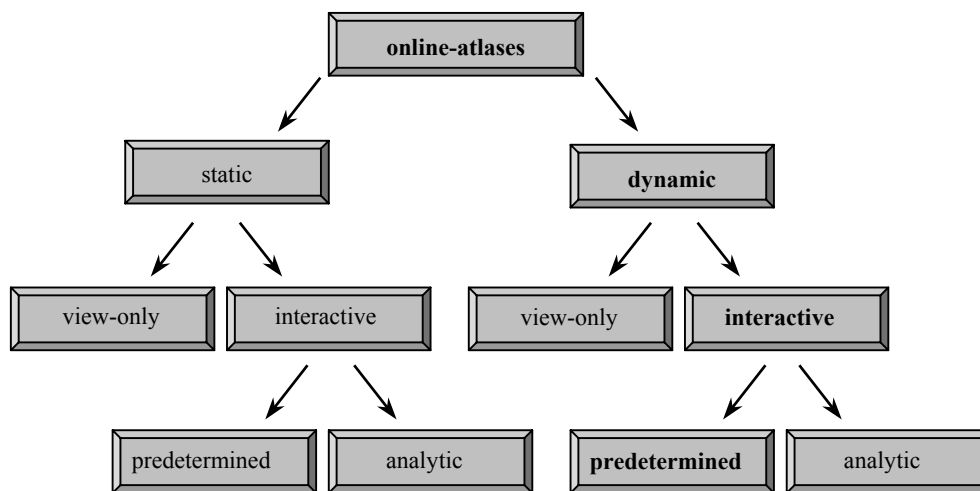


Fig. 1: Classification of online-atlases (depending on the classification of their maps)

If the 12 analysed online-atlases are classified in this scheme the following distribution (illustrated in figure 2) is seen: Most of the analysed thematic online-atlases are predetermined interactive. None of these online-atlases could be classified in the group of the analytic online-atlases [SCHNABEL, 2002].

Online-atlases	Static			Dynamic		
	View-only	Interactive		View-only	Interactive	
		Predet.	Analytic		Predet.	Analytic
NA Canada					X	
NA France	X					
NA USA					X	
NA Sweden		X				
NA Switzerland (prototype)		X				
Atlas Ukraine					X	
W. Australian Atlas					X	
Environmental Atlas Berlin				X		
South Australia Atlas					X	
Atlas Quebec	X					
Nationalgeographic Atlas				X		
Arctic Environmental Atlas					X	

Fig. 2: Classification of the 12 analysed thematic online-atlases

3 Requirements for an online-National Atlas of Germany

3.1 Content

From the analysis of the 12 thematic online-atlases some properties of the content could be derived. The content should be divided into a map-, text-, information- and service part. The map part should contain the maps, the text part the contribution texts and graphics, the information part general information on the atlas (history of the atlas, price list, links to other atlases, staff, ...) and the service part a help, a possibility to contact the atlas authors and a search function. A table of contents, an index and cross-references should facilitate navigation within the atlas and its topics. An important requirement is the bilingualism: the mother tongue German and the world's most accepted internet language English. An important issue is the interactivity which should be controlled and well prepared by the atlas authors. The text and information section should include links that point to additional related information.

In the case of the online-National Atlas of Germany the content is predetermined by the existing two versions (print- and CD-version). Contribution texts, collateral graphics, charts, diagrams, photos and maps already exist, these maps mainly in the Macromedia Freehand graphics format.

To standardise the content of an internet atlas a careful selection of the complementary material is necessary. The selection of the contributions for the internet version depends on the selection of their maps because maps form the main part of the atlas. Only maps with

the scale of 1 : 2.750.000 had been chosen, which allow to see Germany at a glance. Also each contribution should only have one map so that contributions with two or more of such maps should be divided in two or more parts. Contributions without such a map had not been selected for the online-atlas.

Some of the analysed online-atlases have an intro. From the author's point of view an intro is not necessary because the content should be reached as soon as possible.

3.2 Layout

After a careful study of existing online-national atlases an initial layout could be introduced. Figure 3 shows the general structure and design of the atlas pages. Each part can be reached from the start page to already give the user a brief feeling and overview of the content he can expect to explore later on. However, we keep the number of initial links lower in order to avoid confusing first time users. As described in the chapter "Content" a segmentation of the atlas in a map part, a text part, an information part and a service part is necessary. The help function should be opened in a new window to simplify the comparison between the content and the help pages. Amongst other functionality the help system also explains the navigation system of the atlas.

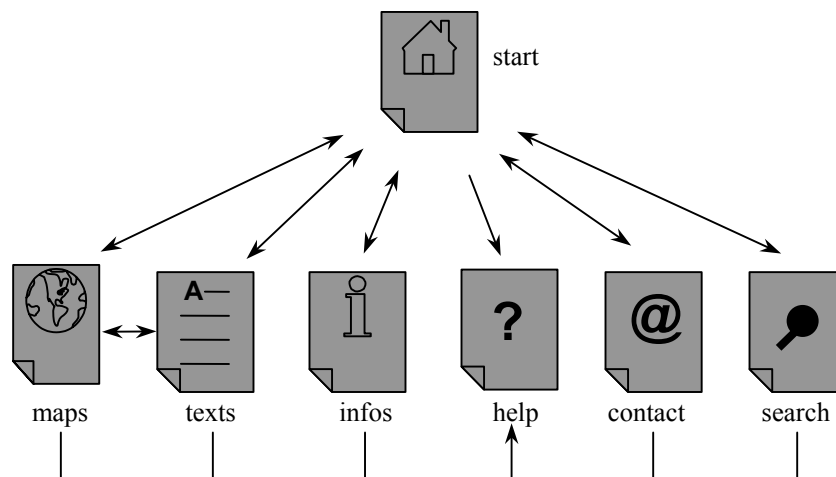


Fig. 3: Structure of the online-National Atlas of Germany

Because of the limited space on the screen it is useful to choose a small frame for navigation in the upper part of the browser window with a logo, buttons and pull-down-menus and a much larger frame in the lower part of the browser-window to display the content. A second navigation frame under the first would be helpful to separate the general navigation elements from the navigation elements for the displayed atlas part. But because of the low space on screens with a resolution of 800 x 600 points it is better not to use this second navigation frame.

The position of the navigation elements should always be the same in every atlas part. It is also useful to choose consistent color schemes (e.g. background color) for all atlas parts. A limitation of grouped menu entries are better than a larger but confusing number of entries.

3.3 Technique

3.3.1 Clientside techniques

After clarification of content and layout issues we want to discuss technical aspects. Generally in the internet the user interacts only through a client software, in most cases the web-browser. The client sends a request to the server and gets a response. While a map-author can't influence the client software a map-user chooses to access web-content, he can decide on serverside issues. This fact means that the map-author should have a good knowledge on up-to-date clientside techniques and specifications for being able to present the online-atlas in an optimal form. The clientside techniques for the internet mainly consists of the output medium "screen" and the browser. A typical screen has a much lower display area, a lower screen resolution (~ 72 dpi) and a lower color accuracy than a printed map. Color accuracy means that one color will be displayed consistently across different output devices. Color profiles help in adapting device specific color spaces to a more general purpose color space that represents the lowest common denominator of all devices. Besides the color representation the screen resolution changes from device to device (figure 4).

screen resolution	distribution
1024 x 768 or more	44 %
800 x 600	50 %
640 x 480	3 %
other	3 %

Fig. 4: Distribution of the screen resolution in July 2002 [source: www.w3schools.com]

The second clientside technique is the browser. The browser is the interface between the user and the internet. In July 2002 the Internet Explorer dominates the market (figure 5).

browser	distribution
Internet Explorer 6.x	39 %
Internet Explorer 5.x	51 %
Internet Explorer 4.x	2 %
Netscape Navigator 4.x	3 %
Netscape Navigator other	1 %
other	4 %

Fig. 5: Distribution of browsers in July 2002 [source: www.w3schools.com]

Because the atlas author has no influence on the clientside techniques he needs browser independence and a screen resolution independence.

3.3.2 Serverside techniques

In contrast to the clientside software the author may choose serverside techniques. The server techniques can be divided into 3 parts: the server software, the server extensions and the server interfaces. As shown in figure 6 the server gets a request from the client. The server interface sends this request to the correct server extension which can answer the question. The server interface translates the answer in pure HTML and sends it back to the client, so that no special plug-ins are necessary.

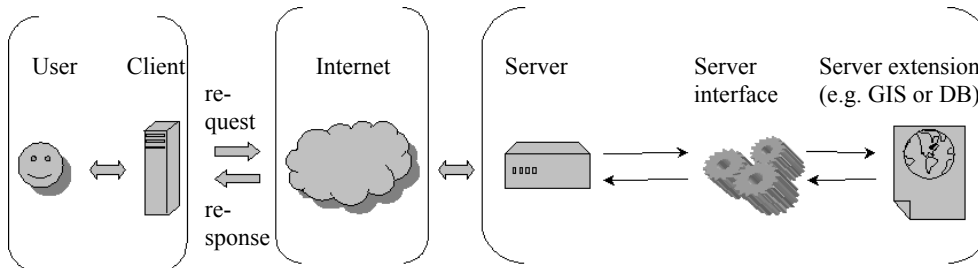


Fig. 6: Internet workflow

As server software the author chose the Apache server. The Apache server is open source and free (in contrast to Microsoft servers like the Internet Information Server or the Personal Web Server which have high license fees). It is intensively used, works very stable and is available for a lot of platforms.

Server extension for GIS and databases are available. The author chose the database MySQL because Geographic Information Systems in most cases are very expensive, depending on companies and involve expensive license fees. The database MySQL is open source and intensively used. It has a high performance and is available for a lot of platforms (in contrast to Microsoft Access which can only be used on Windows systems). And MySQL is free (in contrast to professional databases like Oracle or SQL Server).

As server interfaces a lot of scripting languages are available. The author chose PHP (PHP Hypertext Preprocessor). PHP is an open source scripting language which is very intensively used (in contrast to JSP). It is free, easy to learn, very stable and available for a lot of platforms (in contrast to ASP which only works on Microsoft servers – for other platforms expensive server extensions are available). PHP was especially developed for web servers and allows easy-to-use database requests and file accesses [HESS & KARL, 2001]. The PHP code is embedded in the HTML code of the internet page. If the server gets a request of a client the PHP code will be executed. The result will be transformed into pure HTML and sent back to the client. The advantage is that the user can use his standard browser without installing special plug-ins. Only the server has to interpret the scripting language.

3.3.3 Visualisation techniques

Now we have to select reasonable graphics formats for the internet. For texts XHTML (Extensible Hypertext Markup Language) should be used. HTML is relative inflexible and

loose concerning syntax checks. That's why it is better to use XHTML as its successor. XHTML is based on XML (Extensible Markup Language), has a modular construction and is backwards compatible.

For diagrams and photos raster graphics should be used. It is useful to choose the Graphics Interchange Format (GIF) for simple graphics. It allows a loss-free compression and interlaced or non-interlaced construction. It supports 256 colors and 1 transparent color. For photos the Joint Photographic Expert Group (JPEG) format should be used. It can display over 16,7 million colors and optimises the color palette. The JPEG format has a very strong but lossy compression. The PNG format is a third graphic format which could be used but because of the high distribution of the other two formats it isn't often used. The brand new JPEG 2000 format is not yet distributed but it should be watched for the future. It will allow lossy or loss-free compression (and a approximately 30 percent higher compression than the normal JPEG compression), an incremental progressive decompression, a zooming in regions of interest and it allows to define regions with different qualities [WEINRICH, 2002].

For maps vector graphics are useful because they are resolution independent and have a small file size. There are a lot of vector graphic formats for the internet but in most cases they are developed by only one company and are low distributed. But all of them have a disadvantage: they need a plug-in (installed on the users browser). For maps only two vector formats are reasonable: the Flash and SVG (Scalable Vector Graphics) format.

Flash is a binary coded format with the possibility to zoom and pan, embed movies and sounds and interact and animate objects. But Flash depends on one company (Macromedia). So the specifications of the new versions are not in all cases compatible with the old ones and each version needs a new player. It has an own scripting language ActionScript. But modifications are only possible with the Flash software. Because of the integration of the plug-in in the installer of the Internet Explorer and the Netscape Navigator it is highly distributed.

On the other hand SVG is a text coded format with the possibility to zoom and pan, embed sounds and interact and animate objects. SVG is an official standard (based on XML) and open source. It is clearly structured and can be edited in any text editor. The content and the styling formats can be separated. The plug-in is normal distributed and the number of downloads of the SVG plug-in is increasing [CARTO:NET, 2001].

With the development of a prototype the most reasonable map format is to discover.

4 Prototype

After the specification of the demands on content, layout and technique two prototypes (one for Flash and one for SVG) were created on basis of two selected contributions (National Atlas of Germany – volume “traffic and communication”). At first the maps have to be simplified. Unused and unnecessary layers (e.g. the road borders), text effects (e.g. text masks) and unnecessary vertexes were deleted. A conversion of the color system to rgb and a simplification of the graphic symbols in the map were also necessary. Also each layer in the Freehand file should contain only one style. After the preparation of the maps the Freehand files were converted to the Flash and the SVG format and compressed with the gzip-algorithm. As a next step MySQL-database and PHP files were created (further

information: [SCHNABEL, 2002]). As a result two independent prototypes were created which only differ in their map parts. Now a comparison between these two vector formats was possible (figure 7 and 8). An advanced comparison of the two formats can be found at [HURNI, NEUMANN & WINTER, 2001].

	Flash	SVG
effort for preparation	high (simplification in Freehand)	high (simplification in Freehand)
effort for conversion	low (trouble-free import in Flash)	low (opening in Adobe Illustrator, save as SVG)
effort for postprocessing	high (conversion to film-sequences, scaling)	high (optimisation of the source code by hand)
effort for interactivity	high (creation of buttons, menus, action scripts)	high (creation of groups, IDs, javascripts)

Fig. 7: Comparison between Flash and SVG (effort)

	SWF file (compressed Flash)	SVGZ file (compressed SVG)
contribution 1	140 KByte	87 KByte
contribution 2	201 KByte	170 KByte

Fig. 8: Comparison between Flash and SVG (file size)

In conclusion SVG is more reasonable for internet maps. It is possible to abandon the HTML code and generally display the maps as SVG file. With this format it is also possible to insert title, legend, scale and overview map as nested SVG. So the whole page could be scaled independent of the screen resolution.



Fig. 9: SVG-prototype (start page)

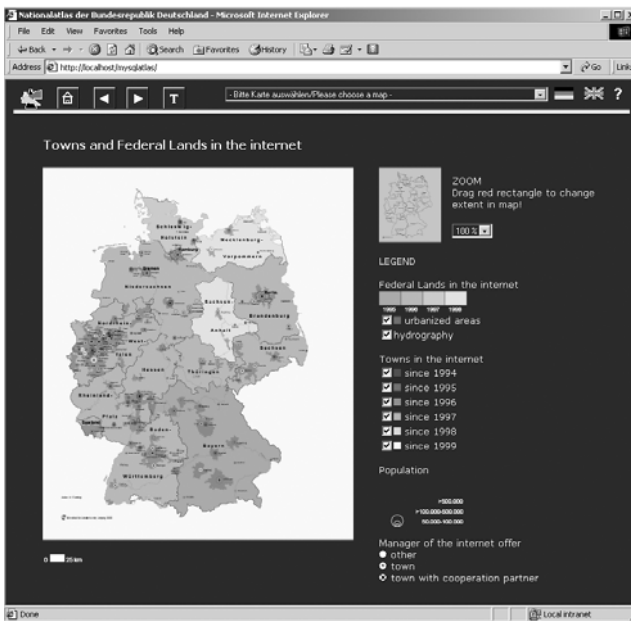


Fig. 10: SVG-prototype (map part)

5 Future

In the future the SVG-prototype should be advanced. There is a need for an automatic conversion of the Freehand files to geographic data which can be stored in the database. This will result in a simpler update. Also a dynamic generation of maps on demand in pure SVG (without HTML) should be considered. Now the prototype is only optimised for the Internet Explorer. In the future a browser independence should be reached. In the medium term the Institute of Regional Geography, Leipzig should reconsider publishing the National Atlas of Germany as stand-alone internet version/application (without print- and CD-version). Then a development of the prototype has to weigh against a pure map-oriented online-GIS. There is also a need for a functionality check of the future open source (!) online-GIS for the usability in the map part – PostGIS, PostGres, GRASS just to name a few.

6 References

- Atlas France (2001): *Atlas de France*. <http://www.mgm.fr/PUB/ATFpre.html>
- Atlas Ukraine (2001): *Digital Atlas of Ukraine*. <http://www.uazone.net/atlas/>
- Atlas Quebec (2001): *Atlas of Quebec*. <http://www.atlasduquebec.qc.ca>
- Carto.net (2001): *Carto.net*. <http://www.carto.net>
- Cartwright, W., M. Peterson & G. Gartner (eds.) (1999): *Multimedia Cartography*. Springer, Berlin, Heidelberg, New York
- Dynamic Webpages (2001): *Dynamic Webpages*. <http://www.dynamic-webpages.de>
- Flash-Hilfe (2001): *Flash-Hilfe*. <http://www.flashhilfe.de>
- Gradias, M. (2001): *Flash 5*. Data Becker GmbH, Düsseldorf
- Hake, G. & D. Grünreich (1994): *Kartographie*. Walter de Gruyter, Berlin, New York
- Herrmann, C. & H. Asche (eds.) (2001): *Web.Mapping 1: Raumbezogene Information und Kommunikation im Internet*. Wichmann, Heidelberg
- Hess, U. & G. Karl (2001): *PHP4*. Moderne Industrie Buch AG & Co. KG, Landsberg
- Hurni, L., A. Neumann & A.M. Winter (2001): *Aktuelle Webtechniken und deren Anwendung in der thematischen Kartographie und der Hochgebirgskartographie*. In: Buzin, R. & T. Wintges (eds.): *Kartographie 2001 – multidisziplinär und multimedial: Beiträge zum 50. Deutschen Kartographentag*. Wichmann, Heidelberg
- Institute of Regional Geography, Leipzig (ed.) (2001): *Nationalatlas Bundesrepublik Deutschland: Verkehr und Kommunikation*. Spektrum Akademischer Verlag, Heidelberg, Berlin
- Kentie, P. (1998): *Web Graphics: Tools und Techniken für die Web-Gestaltung*. Addison-Wesley-Longman, Bonn
- Kraak, M.-J. & A. Brown (eds.) (2001): *Web Cartography: developments and prospects*. Taylor&Francis, London, New York
- Louis, D. & C. Wenz (2001): *Dynamic Web-Publishing*. Markt+Technik, München
- National Atlas Canada (2001): *National Atlas of Canada*. <http://atlas.gc.ca>
- National Atlas Sweden (2001): *National Atlas of Sweden*. <http://www.sna.se>
- National Atlas Switzerland (2001): *A prototype of the National Atlas of Switzerland*. <http://www.karto.ethz.ch/neumann/atlas/>

- National Atlas USA (2001): *National Atlas of USA*. <http://www.nationalatlas.gov>
- Nationalgeographic Atlas (2001): *Nationalgeographic Atlas*.
<http://plasma.nationalgeographic.com/mapmachine/>
- PHP-Center (2001): *PHP-Center*. <http://www.php-center.de>
- PHP-Homepage (2001): *PHP-Homepage*. <http://www.php-homepage.de>
- Schnabel, O. (2002): *Konzeption eines Online-Nationalatlas Bundesrepublik Deutschland*.
Diploma thesis, Dresden University of Technology
- Sieber, R. & H.R. Bär (1996): *Das Projekt "Interaktiver Multimedia Atlas der Schweiz"*.
Kartographie Kongress, Interlaken
- South Australia Atlas (2002): *South Australia Atlas*. <http://www.atlas.sa.gov.au>
- Environmental Atlas Berlin (2002): *Umweltatlas Berlin*.
<http://www.stadtentwicklung.berlin.de/umwelt/umweltatlas/>
- Arctic Environmental Atlas (2002): *Arctic Environmental Atlas*. <http://maps.grida.no/arctic/>
- W3schools (2002): *W3Schools*. http://www.w3schools.com/browsers/browsers_stats.asp
- Weinrich, J. (2002): *JPEG 2000: Ein Shootingstar am Bildformat-Himmel?*. In:
<http://www.x-media.at/heft62001/40.pdf>
- Western Australian Atlas (2002): *Western Australian Atlas* <http://www.atlas.wa.gov.au>
- Winter, A.M. (2000): *Internetkartographie mit SVG – Prototyp für einen thematischen Atlas*. Diploma thesis, University of Vienna