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FROM CLASSIC ATLAS DESIGN TO COLLABORATIVE PLATFORMS: THE SWISSATLASPLATFORM PROJECT

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INTRODUCTION

Geodata and its visualization are increasingly relevant in everyday life. The information retrieval by means of route planners, navigation systems, GPS data, digital map systems, and geoportals is rapidly growing and influences many of our decisions. Although such applications cannot be defined as atlas systems in a strict sense, atlases have to compete with these geoinformation providers.

This public awareness of geovisualization is a great opportunity for products like digital atlases. People may not only take notice of this category of geoinformation systems, but may even begin to regard the use of atlases as (daily) routine. Nevertheless, some challenges are arising: what is the future benefit of atlases, which features could make them a really unique information source for users? Atlases should not be a mere collection of geoinformation but rather a distinctive compilation of cartographically well designed maps emphasizing the characteristics of the thematic information depicted, and ready to be explored by tailored atlas tools.

To strive for competitive atlases, a new philosophy has to be introduced, combining current geovisualization techniques with collaborative aspects in an open atlas platform system.

CLASSIC DIGITAL ATLAS DESIGN

Nowadays, digital national and regional atlases have expert competences in easy-to-use functionality, interactivity, and high-level visualization techniques. Geodata and statistical data can be manipulated in multiple ways, and on-hand navigation in space and time, as well as various views of thematic maps in 2d and 3d, are realized.

There are various examples of such mature atlas systems. Among these the *Atlas of Canada* can be mentioned. The Atlas of Canada was the first web-based atlas worldwide. Additionally to maps, the atlas has an integrated Data & Services section, which offers a Web Map Service (WMS) and data (both free of charge and for sale). The Atlas of Canada is available in English and French.

Another example of an atlas system is the web-based *ÖROK Atlas of Austria*. The cartographical character of the atlas functionality makes it different from a typical GIS visualization. This becomes clear through the fact that there is not a collection of GIS-based tools, but an online system which structures and organizes all functions (ÖROK 2011). The web-based ÖROK Atlas of Austria is based entirely on Open Source products, which enables the compatibility with all current systems and data formats. The atlas contains a national section, as well as a Europe section.

The *Tirol Atlas* is another example of a web-based atlas. It achieves map visualizations of high quality by using Scalable Vector Graphics (SVG) and uses free databases like PostgreSQL/PostGIS, which are a contribution to the Open Source System (Förster 2003). The atlas also contains different sections developed for different user groups, among these, e.g. an atlas for kids and a Tirol Atlas lexicon. The atlas and its different sections are available in three languages (English, German, and Italian).

All of these atlases have different expert competences, however, none of them includes 3d-visualization.

The new *Swiss World Atlas interactive* was published along with the printed version in late 2010. This interactive atlas offers visualizations in 3d in terms of a virtual globe and block diagrams, as well as map views in 2d. The atlas also contains a section with visualizations of the Earth in the solar system and visualizations of the Moon. The Swiss World Atlas interactive is available in German, French, Italian and English.

The interactive *ATLAS OF SWITZERLAND 3*, published in 2010 on DVD is a good example of a mature atlas system, which contains various options for 3d data visualization as well as 2d visualization (fig. 1). The Atlas of Switzerland's 3d mode offers map visualizations in panoramas, block diagrams and prism maps, while the 2d mode consists of a national section and a Europe section. Both the 3d mode and the 2d mode contain a multitude of tools and map functions. The *sky tool*, which offers the possibility to display clouds, the night sky, stars, planets, or even constellations and galaxies is one of these unique tools. Further, the *terrain tool* with various terrain analysis options, among these, e.g. visibility, distance, lighting, silhouette, and fog visualization can be mentioned. In addition to these, the atlas offers the *index tool*, the *split screen tool*, and the *map legend tool* with color analyzer and symbol scaling. THE ATLAS OF SWITZERLAND 3 is available in four languages (German, French, Italian and English).

Closed atlas systems like the ATLAS OF SWITZERLAND 3 have the advantage that the functions and tools are tailored, based on the data at hand and for the user community. This means that there are no dispensable functions or tools in the system and the maps and symbolization can be cartographically tailored to match the data. The high amount of available functions might, however, be overwhelming for the user. Further, the fact that these atlases are closed systems and their structure is more or less fix, makes changing features or adding data very complex. When it comes to web-based systems, apart from the expert competences of the different web-based atlases mentioned above, one of the biggest advantages is the easy access for the user. However, the development of such a web-based atlas is very time-consuming and complex, and the lack of synergy between the different atlas systems entails to encapsulate them.

The big challenge and an aim for the future is to combine all of the advantages of the above mentioned web-based and rich systems into one web atlas platform.

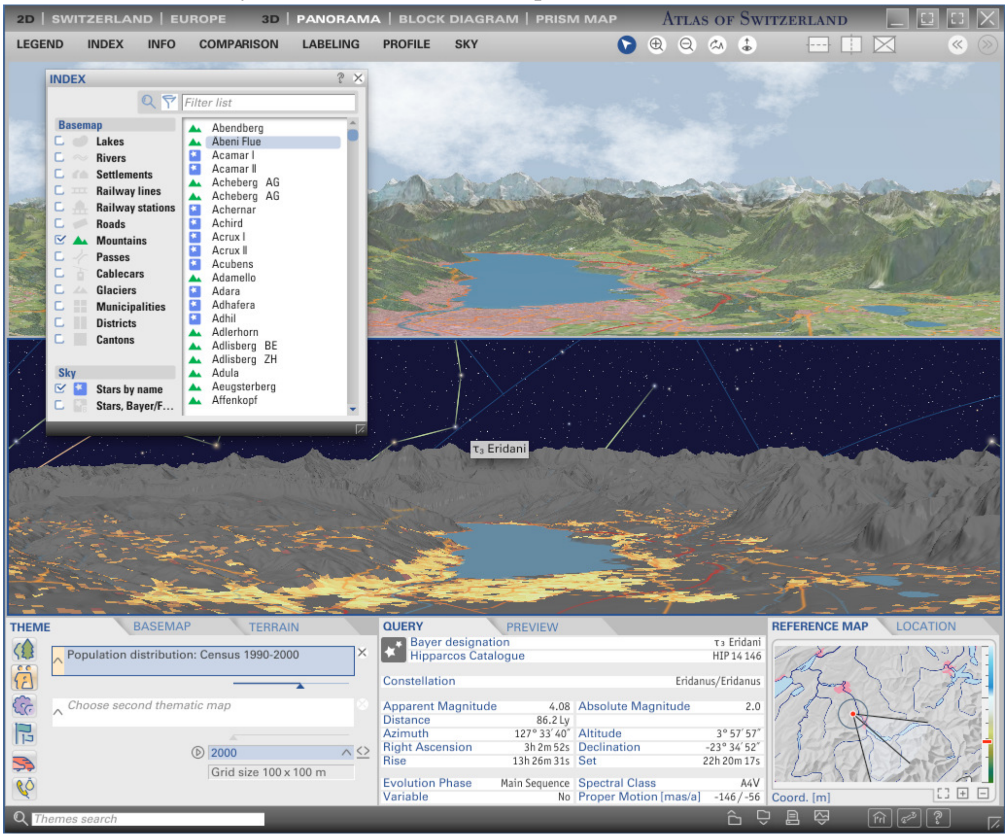

Fig. 1: GUI with a multitude of options; ATLAS OF SWITZERLAND 3.

THE ATLAS PLATFORM IDEA

To meet the current challenges and developments in the field of geovisualization, new ideas are required for the concept of next generation atlases. On the one hand, conceptual ideas of GIS, game and 3d technology, geodata viewers and geoportals, navigation systems, and the Web 2.0 have to be considered. On the other hand, an assessment of user needs and requirements with respect to a new atlas generation is necessary. Concerning the future of the ATLAS OF SWITZERLAND, user-centered studies evaluating the usefulness and usability of existing atlas tools, functionality, and data content are in progress.

At this point in time, it is already becoming clear that an open atlas system allowing multiple use and collaboration is desirable. A main criterion of such a system will be the expandability for both functionality and data.

Functional extensibility will be based on an atlas toolbox consisting of a core with basic functionality and of modular extensions for advanced functions and tools. The collaborative architecture of the system will rely on standardized interfaces and will be open for third party extensions. Such a modular and open framework allows atlas authors to compile new instances of the atlas according to their needs and preferences. Ideally, an *atlas generator* would assist atlas authors without programming skills in creating a custom application by connecting the core and modules through piping technique in a graphical interface. The multi-use atlas platform could function like a chassis does in the car industry, where different car bodies are built on top of the same chassis thus resulting in various models, even from different brands. In the same way, instances of the atlas could be reused for different purposes on the commune, county, or country level, for entire globes, or to visualize the night sky.

In view of the fact that nowadays, the map users has become the map creator as well (Taylor 2007) and to take advantage of synergy effects, a future atlas system should support collaboration not only on the functional level but also on the data level. Both atlas authors as well as public and private data owners should be able to contribute statistical and graphical geodata, either in the form of attributes, geometry or ready-made maps. The framework which integrates user-generated content must be able to handle data from diverse sources in a straightforward manner and therefore rely on open interfaces and international standards. Further, some form of cartographic and data quality control will be necessary in order to ensure the high quality standards nowadays maintained by regional and national atlases.

Such an extensible and collaborative platform fulfills the requirements of an atlas toolbox as defined by Asche (2007), stating that approved content or additional functionality should be exchangeable between different instances of the platform in a bidirectional way. It is a actual value-added chain by allocating resources and taking advantage of synergy effects: a community of atlas authors which contribute specific atlas tools to the platform and a community of (non-) professional map authors contributing geodata and maps to the atlas products.

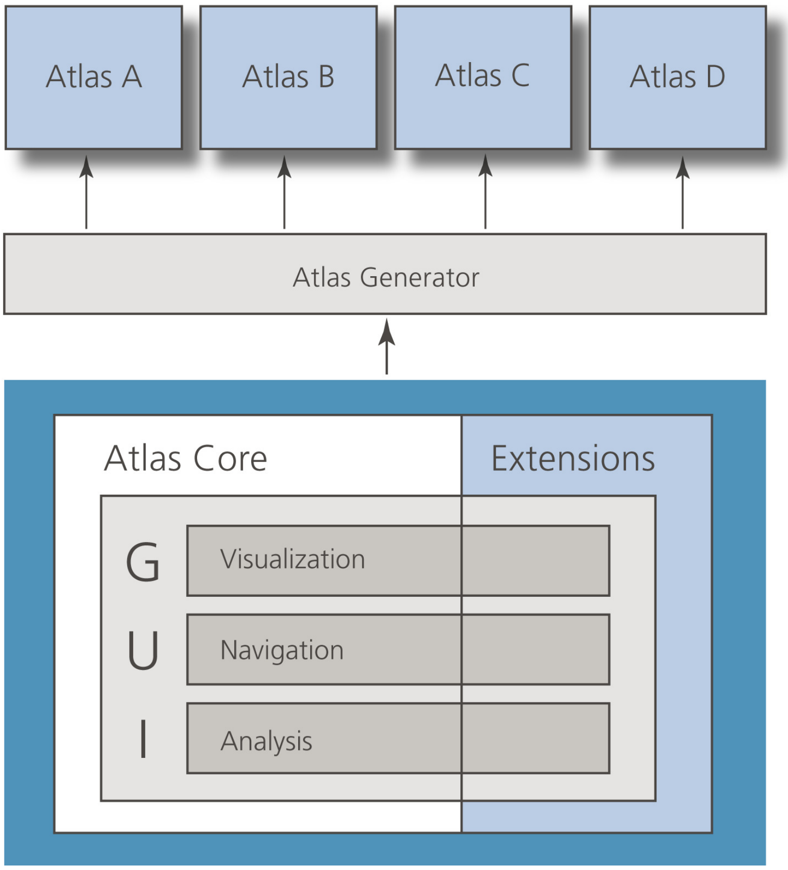

Fig. 2: Atlas platform concept.

THE SWISS ATLAS PLATFORM PROJECT

Upon release of the third version of the ATLAS OF SWITZERLAND in December 2010, plans for the future development of atlases were already taking shape. The follow-up project will again be conceived as a long-term program, running at least for four years.

As the planned system should meet the needs of both developer and user, the concept of a web-based, open atlas platform – the *SwissAtlasPlatform (APS)* – is in elaboration. The project is based on three main pillars that are closely connected: Research, development, and – as a synthesis – the compilation of web-based atlases for public use.

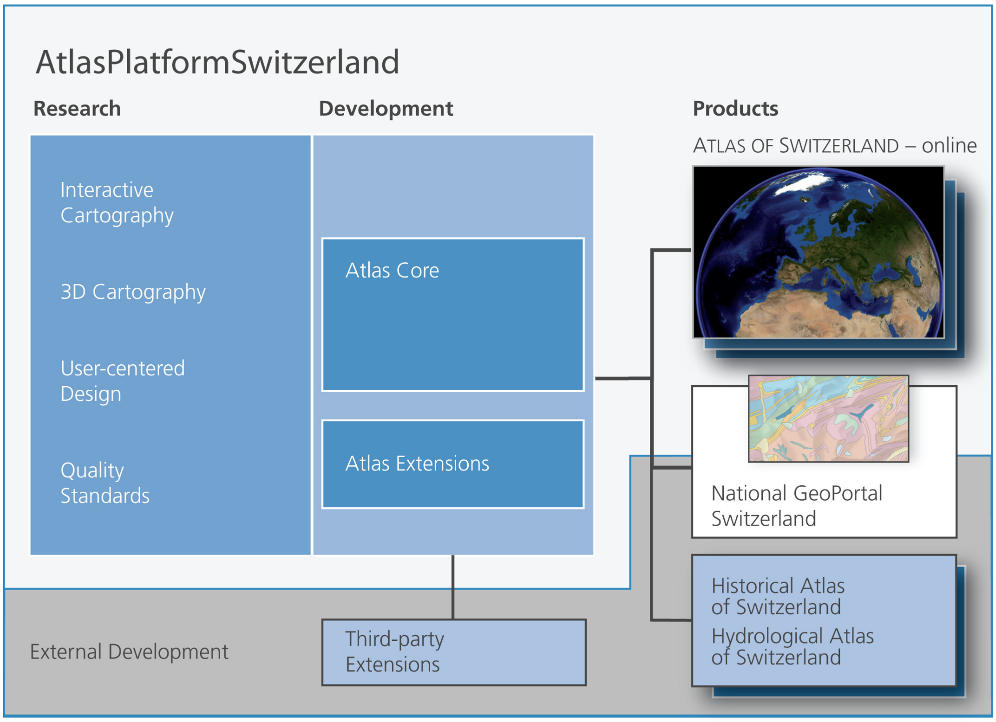

Fig. 3: The SwissAtlasPlatform (APS) concept.

Research

Research activities within this conceptual frame will concentrate on methods and techniques in the four fields of interactivity, 3d cartography, user-centered design, and on quality aspects. General focus of the elaborated methods is laid on the suitability in a 3d web environment.

a) Interactive tools

Tools for navigation should lead to an intuitive map access; investigations in novel combined tools (e.g. a space-time tool) using graphical means seem to be promising. From the field of computer games, some ideas for spatial navigation, as the choice of a „means of transportation" such as aircraft, train, car, or foot could be tested and adopted. Better orientation, searching, and localization tools for tracking and tracing purposes are also needed.

Tools and techniques for visualization could incorporate floating sub- and supra-terrain layers, billboard concepts for point symbols and charts, symbol representation at different scales or distances with one master geometry (fig. 4; Asche 2009), and four seasons views akin to nature, to mention just a few.

Tools for data analysis are most relevant for high-level atlases. Research in this field should concentrate on graphical data brushing and selection possibilities (Andrienko 2009) as well as easy-to-use data and map comparison.

Fig. 4: Conceptual idea of a single master geometry for all representations (Asche 2009).

b) 3d cartography

The concept of 3d cartography, where a 2d map situation is treated as a special case of 3d will be pursued. Most of the data and geometry should be used in both "worlds". Research has to be done whether we could omit the „world" of 2d maps and eventually find 3d-based visualizations that can supersede pure 2d maps (by means of on-the-fly or preprocessed terrain generalization); by synchronized substitution of map symbolization, scalable geometry etc.). The concepts of granularity and levels of detail (LOD) will play an important role.

c) User-centered design

Atlases are often designed for a wide public and should therefore instantly offer and display the relevant information to the user in an easy-to-use way. The aim is to reach an appropriate technical and graphical „thin“ GUI configuration with just the „right“ tools at hand, e.g., the one’s that are most often used. Research in user-centered design supports the underlaying decision making process and will result in a more flexible, dynamic GUI with inter-coordinated and complementary tools.

d) Quality standards and controlling

Research in data quality has to consider data accuracy, data completeness, sources, metadata information, etc. Minimal standards for static and dynamic maps in a 3d atlas environment have to be accessed and defined. In case of contribution by external partners or private persons, control mechanisms for acceptation of a theme, a map geometry and/or data have to be defined. Concerning data quality standards, these thematic contributions could be judged by an expert team to be accepted on one of the three graded levels: a) private use, b) public candidate, or c) finally become an integral atlas component.

Development

As depicted in the development line of figure 3, the APS system will consist of three main parts: an APS core with a 3d virtual globe and some basic tools for navigation, visualization, and query, as well as *internal and external APS extensions*, integrated into a flexible *atlas GUI*.

a) APS core elements

3d virtual globe technology with full navigation and raster/vector overlay capabilities will be used as viewer application (Nebiker et al. 2010). There are already some qualified products that could be integrated in an APS core. Usually, the geographic extent of the application is not restricted but can be defined according atlas author’s needs (e.g. rectangular or island shape). The specification includes the integration of web services, and optional real-time visualizations as well as different perspective views. In addition, the number of elements that can be handled by a virtual globe should be nearly infinite and „real“ 3d objects should be allowed. The globe technology therefore has to be capable of handling and visualizing a huge amount of dynamically streamable content – tiled raster/vector data on multiple zoom level – with high performance (fig. 5).

Basic atlas tools are designated as an integral part of the APS core. Layer management tools and spatial navigation tools including moving around, zooming, panning, as well as a reference map will be ready for use. Panels with geographical and thematic indices, legend, and standard query functions are further examples of an operating APS core.

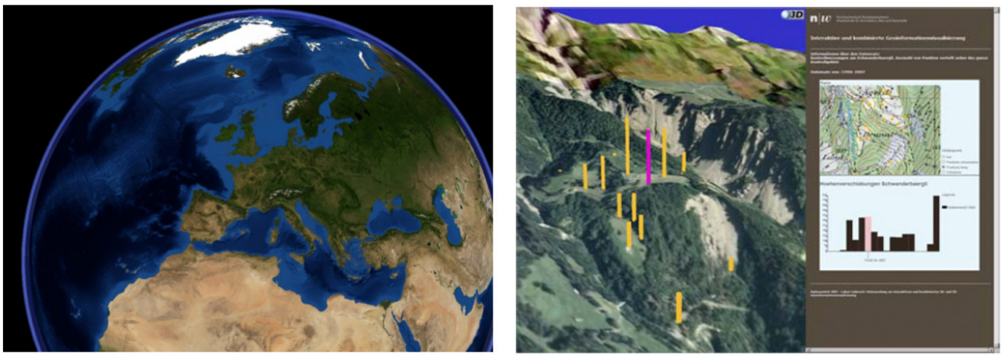

Fig. 5: Virtual globe as 3d viewer application; example taken from i3d open globe project (Bleisch & Nebiker 2008).

b) APS extensions

Internal extensions may contain more sophisticated navigation tools, e.g. backtracking, or a localizer tool. Smart visualization tools may offer a *myMap function* for coloring or a *sky tool* for different sky views and atmospheric effects. Analysis tools will be offered for map comparison and data brushing. Access to geographic databases and web services like WMS, WTS, WFS, or OSM will be supported following the OpenLayers strategy.

External extensions: Atlas authors may use the APS and augment it with additional functionality by means of a software development kit (SDK). A hydrological atlas may implement real-time tools for monitoring purposes (Lienert & Sieber 2010), a historical atlas might need some extended spatio-temporal functionality.

c) Atlas GUI

As mentioned above, the *atlas GUI* concept will allow for a flexible and modular selection and composition of the GUI elements. According to the functionality defined for a specific atlas, authors can choose or create a GUI design dedicated for a unique overall „look and feel". Within this overall design, the authors will be able to modify the segmentation of the GUI, the arrangement and flexibility of elements (fixed, dockable, moveable) and optionally even the design of the GUI elements. As a basic specification for national and regional atlases, multilingualism will be supported.

In-house APS development will mainly focus on basic atlas tools, modular internal APS extensions, the GUI, and on connecting techniques for atlas components. From a technical point of view, this could be realized by means of an open architecture SDK with a set of given functions and an extension mechanism to add new functionality.

Synthesis and Applications

Basically, the APS will be conceived for genuine online atlases. The APS concept allows for different scenarios of client-server relationship that could be realized (fig. 6). The spectrum is ranging from a „pure" web application (e.g. an atlas application on mobile devices) to a thin or thick client web solution (scenario 1-3). The decision to choose a specific scenario is mainly dependent on the kind of data and the atlas business model. Scenario 4 refers to a classic desktop application and is therefore not considered as a current focus.

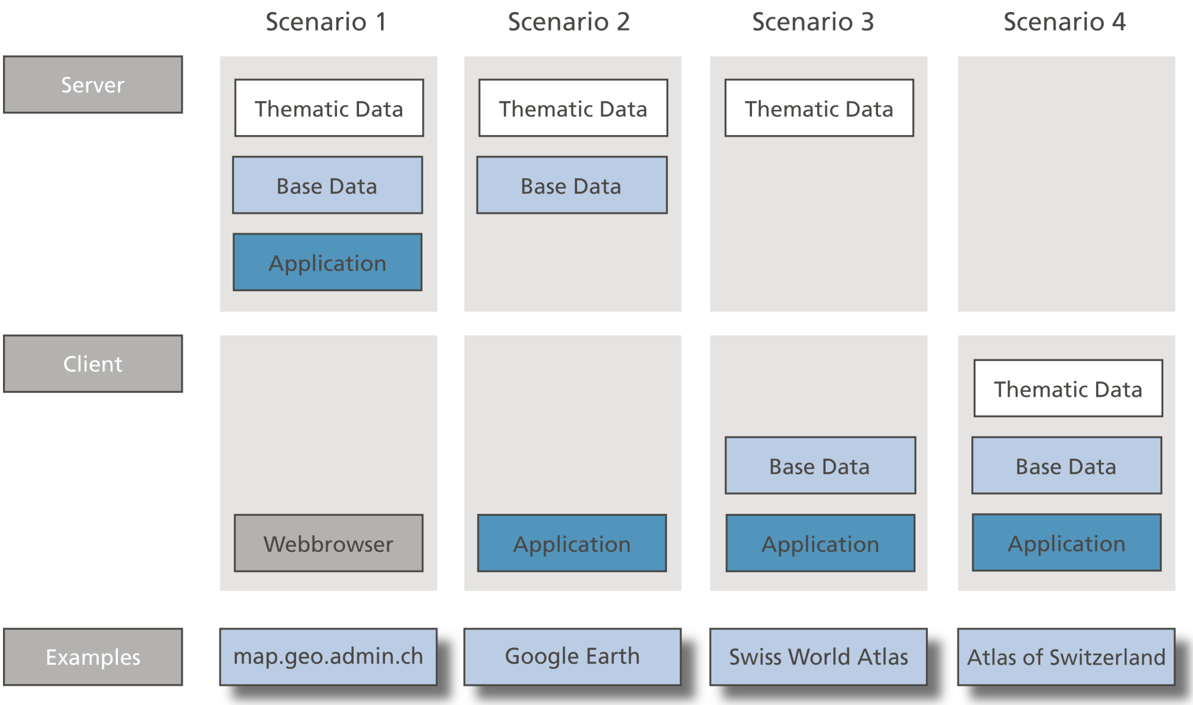

Fig. 6: Client-server scenarios for APS-based atlas applications.

As a synthesis of the research and development process, future atlas products like the *ATLAS OF SWITZERLAND – ONLINE*, specific thematic atlases with statistical, historical, or hydrological topics, or visualization components of geoportals can be realized. There is already a strong interest in collaboration from various national and international atlas authors.

a) ATLAS OF SWITZERLAND – ONLINE

The new generation of the national ATLAS OF SWITZERLAND will be designed as web-based application, following scenario 1 to 3 as possible solutions. It will incorporate the APS core and internal extensions, and can be augmented with third-party components relevant to the project. Based essentially on 3d visualization techniques, the atlas will present elaborate cartographic representations, tailor-made analytic tools, and a user-friendly GUI. This first version of the ATLAS OF SWITZERLAND – ONLINE will be iteratively developed during the next few years.

According to the collaborative idea, data owners from the Swiss administration and even private persons can contribute with their particular data and map graphics. A quality control mechanism will be installed to guarantee high quality maps and easy-to-use functionality (usability).

b) Thematic and topographic atlases

Atlas systems with a more specialized scope are free to use parts of the APS functionality only. Currently, atlas authors from related projects are planning to apply the APS to their own web atlas project. The scenario type and the dimensionality (2d or 3d) appropriate to their projects are currently in discussion. The Historical Lexicon of Switzerland HLS is planning a new Swiss Historical Atlas based on the APS technology. The editorial team of the Hydrological Atlas of Switzerland HADES will use the APS as a base atlas system and develop specific expert functionality (external hydrology plug-ins) on their own. Thus, every authoring team can focus on its needs and – at the same time – contribute to a comprehensive atlas toolbox.

c) Geoportal module

Following a new and promising trend in atlas cartography, the Atlas of the Nederlands will be running as „front-end“ of the Dutch National Geoportal (Aditya 2007). In a similar way, the APS could be used as 3d or 2d visualization module for Geoportals on the web. These so-called Geoviewers will probably follow scenario 1 or 2, and mainly use core functionality of the APS.

OUTLOOK

The open atlas platform concept – and especially the APS architecture – seems to be very powerful and promising for future cartographic applications. Collaboration on a technical as well as on an authoring level leads to a consistent, modular, and growing APS. To realize their own tailor-made atlas projects, atlas authors will just have to select, combine and connect functions and GUI elements from the APS toolbox in a kind of an assembly line. Atlas users can profit from next generation atlas technology on the web in many ways: with easy-to-use navigation, tailored visualization and analysis tools, and open access to data integration.

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