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GITTA: OPEN CONTENT MATERIAL FOR GIS EDUCATION

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Abstract: The GIS e-learning project GITTA (Geographic Information Technology Training Alliance) was developed between 2001 and 2004 by ten institutes from seven Swiss universities. Altogether about forty tutors developed nearly fifty lessons and ten case studies in three languages (German, French and English) and integrated these into their curriculum. Towards the end of the project the consortium decided to make the content freely accessible (released under the Creative Commons license), to let academic institutions from all over the world benefit from the GIS e-learning lessons by integrating selected lessons into their own curriculum. On the technical side GITTA uses a free XML framework called eLML (eLesson Markup Language) that was released as an open source project by the University of Zurich. The paper documents the increasing interest in GITTA material since the opening of the project. It also explains the problems and risks of an open project compared to a closed project accessible only to students enrolled at project partner universities.

Key words: GIS, e-learning, Web, Open Content, Creative Commons, SCORM, IMS, XML

1   Introduction

The Swiss parliament decided 1999 to foster the creation of e-learning projects in Swiss higher education institutions. For this purpose a Federal Program called "Swiss Virtual Campus" (SVC, 2001) was founded with the purpose of funding and promoting innovative Information and Communication Technology (ICT) based e-learning projects at Swiss universities. The Geographic Information Technology Training Alliance GITTA (Fisler, 2004) was one of the fifty projects funded by the SVC during their three-year "Impulse Program". Between 2001 and 2004 a consortium of 10 interdisciplinary Geographic Information Science and Technology (GIST) teaching institutions from Swiss universities, Federal Institutes of Technology (ETH) and universities of applied sciences – together covering around 80% of the Swiss GIST offerings in higher education – built up a modular online course suite in GIST. The main motivation was to exploit synergies, increase the teaching capacity and improve the quality of GIST courses within each partners institute. For this purpose nearly 40 contributors created a pool of 50 basic and intermediate e-learning lessons for GIST teaching. Additionally case studies, in which students had to solve complex problems using GIS technology, were created. Originally the course was strictly for internal use by the partners only and not accessible without authentication. More information about the pedagogical concept behind the case studies can be found in Niederhuber et al. (2005).

When the GITTA project officially ended in 2004 the consortium decided to apply for further minor funding by the SVC's Consolidation Program that lasts until the end of 2006. During this "Maintenance Phase" the GITTA project had to find sustainable ways of surviving without financial support by the SVC and had to ensure that the course would not become deserted due to technical reasons or a lack of up-to-date content. After evaluating different options such as restricting access to partner institutes or financing by offering access via paid subscriptions, the consortium agreed on a radical "open access" strategy and thus opening the content and also the technical framework under an open content respectively open source license. By creating an open "GITTA community" that uses and maintains the GITTA course, the long-term survival of this project is hoped to be guaranteed even if one or more original partners of the project decided to leave the GITTA consortium.

2   About the GITTA e-learning project

Even before being able to apply for SVC funding, the GITTA consortium had to agree on the course content and the depth that the course should cover. Furthermore the consortium wanted to base the course on didactical guidelines and had to agree on a pedagogical model. Finally a sustainable technical implementation had to be found to realize the GITTA course.

2.1   Content overview

The GITTA course originally consisted of 50 lessons at two difficulty levels – basic and intermediate – covering 6 topics. Eventually 43 lessons where developed: 29 basic lessons and 14 intermediate lessons. Out of the 21 intermediate lessons originally planned, 7 had to be dropped due to either lack of resources or lack of interest in using the particular lesson. The lessons were grouped into organizational units called modules covering the following 6 topics:

1. *GI-Systems:* The module offers a basic introduction to Geographic Information Systems Technology (GIST), and provides information about existing commercial products and their areas of application. The module presents the most commonly used Geographic Information Systems (GIS) software products and is only available on basic level.
2. *Data Capture:* The Data Capture module introduces students to sources of geographic data and to the broad process of digital capture and data pre-processing. It focuses on selected capture procedures in order to detail strategies and methodologies for the production of relevant geographic information and is structured into the following content: Overview of sources, primary sources, derived sources, and metadata quality. Each lesson contains exercises and a self-test.
3. *Database Systems:* The Database System module incorporates the concepts and architectures associated with databases. Specific terms are discussed and the characteristic of a database approach in GIST is compared to other systems. The fundamentals of database architecture are followed by an explanation of data models and the Structured Query Language (SQL) introduction.
4. *Spatial Modeling:* This module presents the main concepts – projections, location, and topology – that drive the modeling of the Geographic Space (GS). It gives an overview of GS modeling processes, using regularly and irregularly distributed observation units (raster and object models). Furthermore the properties of spatial information are analyzed from the point of view of its measurement scale and origin (measured, derived, or interpreted). Finally, the process of digitization is presented.
5. *Spatial Analysis:* The main goal of the module is to provide the technical knowledge required for the development of analytical GIS applications. Lessons include fundamentals and techniques for dealing with continuous and discrete spatial variables, spatial queries, terrain analysis, suitability analysis, accessibility analysis, and uncertainty handling. These topics are dealt with on the basic level and later refined at an intermediate level. A close relationship exists with the Spatial Modeling module.
6. *Data Presentation:* The basic Data Presentation module describes the history and use of maps, while introducing the different map types available. Its emphasis is on topographical cartography and the components required for map development, including graphical design and readability rules. A further focus is set on cartographic generalization concepts, procedures, and methods. In the intermediate lessons, thematic map design as well as mapping with a GIS and cartographic software is discussed.

Besides the modules, ten case studies, in which students are confronted with realistic and practice-relevant GIST cases were created. In each case study original data material is provided and a tutor is helping the student to find solutions for solving the case using GIS tools. It usually takes the student around thirty hours to solve such a case study. Due to the copyright restrictions of the data sets used not all case studies could be published as open content.

2.2 Pedagogical aspects

The didactical foundation of the GITTA course is a pedagogical model called ECLASS (Gerson, 2000). ECLASS is an abbreviation for the following elements:

- *E*ntry: Stands for the introduction into the lesson or a unit (the sub-category of a lesson)
- *C*larify: A clarify element is used to explain some theory, models, principles or facts
- *L*ook: Examples that help the student to understand the theory
- *A*ct: Animate the student to become active, try out a model or discuss issues
- *S*elf-Assessment: Check if the learning objectives of the lesson or unit were fulfilled
- *S*ummary: Provides a brief summary of either the whole lesson or an individual unit

The original ECLASS model was slightly modified and additional elements such as glossary, bibliography and metadata were added to be able to create a self-contained e-learning course. Furthermore the three elements clarify, look and act together form a so-called "learning object" and can be used in any order or even multiple times within a learning object. This allows the author to start with an example (look), followed by the theory related to the example (clarify) or the other way round. Also the uncommon but sometimes successful approach is possible in which the student starts with a short exercise (act) and only after having tried out some solutions reads the theoretical background (clarify) and sees some real world examples (look). The ECLASS model is on one hand flexible enough to represent different learning scenarios (as e.g. described in Horton, 2000) and to meet the requirements of the creators of the e-learning lessons but ensures on the other hand that the content complies with the defined didactical guidelines.

These didactical guidelines where then mapped into an XML structure (Fisler and Bleisch, 2006) that allowed a strict checking if the author has correctly used the pedagogical model or not. The details are explained in the next chapter.

2.3 Technical aspects

Compared to other SVC projects, the GITTA consortium carried out an extensive evaluation of possible solutions for the technical realization of the e-learning lessons. In the end some important requirements such as sustainability, platform-independence etc. were defined and only XML fulfilled all these criteria. XML is an open source standard defined by the World Wide Web Consortium (W3C, 1996) and allows a strict separation between content and layout. XML allows via the definition of an XML schema the validation of XML documents according to a set of rules – e.g. pedagogical guidelines – defined by the creator of the schema file. Therefore the consortium agreed on choosing the XML technology for realizing GITTA.

Using XML meant that a suitable XML schema for creating the GITTA content had to be found. Back in 2001 none of the available schemata fitted the projects needs and therefore a new schema, based on the ECLASS model described above, was developed. Together with a set of transformation files, the resulting XML framework was named «eLesson Markup Language» or «eLML» and was released – after three years of implementing and testing – under an open source license in 2004. In 2005 eLML has become the strategic platform for creating e-learning content at the University of Zurich and is used today at different universities in Switzerland and Germany. In 2006 version 3 has been released offering lots of new features like full CSS support, easy configuration, SCORM (2001) and IMS Content Package (2000) export for easy import into a learning management system (LMS) – tested with both WebCT and OLAT (1999), an open source LMS used at the University of Zurich –, XHTML and PDF generator etc. Furthermore the University of Zurich is developing a web-frontend for an easy "WYSIWYG"-like workflow for content production with eLML. The release is planned for autumn 2006.

The details behind eLML, the implementation of the XML framework, the detailed possibilities and features etc. are not part of this publication. More information about eLML can be found on the website www.elml.ch or in the WEBIST conference publication of Fisler & Bleisch (2006).

3   The step towards open content

The e-learning strategy at the University of Zurich (2003) states that (translated from German):
«The access to e-learning material via Internet is generally open, …»

The detailed explanation by the University of Zurich's legal counselling department Unitectra (Henggeler, 2003) recommended that e-learning content – if no copyright protected material or sensitive data is used – should be published under the open content license Creative Commons. The reasons for using Creative Commons rather than an open source license are explained in the following chapter.

In early 2004 the GITTA consortium agreed on adopting this strategy and releasing GITTA under the Creative Commons license in late 2005. The Swiss Virtual Campus (SVC) agreed on funding a two year Maintenance Phase (from mid 2004 to mid 2006) to realize the step towards open content, to release the XML structure as an open source project (eLML – see chapter 2.3) and to create a sustainable coordination structure for assuring a long life of the GITTA project. The first lessons released as "open content" where finally published on the GITTA website in February 2006.

3.1   Why use the Creative Commons (CC) license?

The term "open content" is ambiguous and without an exact definition. When talking about any kind of "open" license, the common points are that the user is usually free to use, copy, distribute and display a certain software or work but that the copyright always remains with the author. Unfortunately the term "open content" itself does not include anything about the exact terms of use. The term "open source", on the other hand, is a license type exactly defined by the Open Source Initiative (OSI, 1998) and is often confused with open content. To understand the differences (see table 1) and the reasons for choosing the Creative Commons license (CC, 2001), a closer look at some main differences of "open" licenses is needed. When distributing a work under an "open" license, the following points are mainly of interest to the author:
1. Attribution: Must the name of the work's author be clearly stated and visible?
2. Commercial use: Is commercial use of the work allowed or prohibited?
3. Derivates: Does the author allow the creation of derivates of his or her work?
4. Share Alike: If derivates are allowed, under which license will they have to be released?

Any OSI approved open source license must comply with the ten criteria that are part of the open source definition (OSI, 1998). These criteria state that there must be no discrimination against persons or fields of endeavor (like commercial/non-commercial), that the source code must always be distributed freely and derivates of the code are allowed etc. In other words, the open source definition has hardly any restrictions. This definition may be suitable for software but when it comes to content or works like books, photos, movies or music, the author of the work might want to restrict the use of his or her work. Some examples where open source might be inappropriate should clarify this dilemma:
- The painter of a picture might not like to see derivates of his work, as from his point of view the picture is complete.
- The composer of a song might allow the creation of derivates (usually called "samples" or "remixes") but she might want to restrict that derivates must be published under the same license again (share alike). If the original song was released for non-commercial use only, the DJ creating a remix will not be allowed to commercially use the remix.
- If e-learning content is published by a university, the university might have no interest that an individual or company is using and selling this material and therefore might want to allow non-commercial use only. Whether derivates of the e-learning course shall be allowed or not, remains to be discussed.

These examples show that when it comes to releasing any kind of content under an "open" license, there should be a way of restricting the use of it. Since this is against the open source definition, a new license type had to be found. Today the Creative Commons license is the most well known of these "open content" licenses specializing in the release of any kind of content. On the Creative Commons website (2001) it is possible to define via a web-form the criteria under which a work can be used. The author then receives a computer readable (using RDF tags), a human readable summary, and the full legal code of the license chosen.

Table 1: Comparison between open source and open content (e.g. Creative Commons) licenses

	Open Source (e.g. GNU GPL) Usually used for software	**Open Content (e.g. Creative Commons)** For content (pictures, movies, text etc.)
1. Attribution:	Not necessary (but usually done)	Naming the author is mandatory
2. Commercial use:	No restrictions	Can be prohibited
3. Derivates:	No restrictions	Can be prohibited
4. Share Alike:	No restrictions	Can be required

3.2 Releasing the content under the CC license

As described in the last chapter, usually some types of restrictions must be made when releasing e-learning material as open content. In the case of GITTA, the use of copyright-protected material such as geodata or illustrations from books etc. within the lessons made it necessary to release the GITTA course for non-commercial use only. Agencies such as Swisstopo (responsible for Swiss geodata) did not permit the use of their material in one of our lessons for commercial purposes since they are interested in selling their data themselves. The GITTA consortium agreed in using the so called "by-nc-sa" Creative Commons license that states that you are free to copy, distribute, display, and use the lessons under the following conditions:

1. Attribution (by): It must be apparent that the lessons used are part of the GITTA project
2. Non-Commercial (nc): Only non-commercial use of the GITTA lessons is allowed
3. Derivates: It is allowed to create derivates of the GITTA lessons (see next chapter)
4. Share Alike (sa): The created derivates (e.g updated lessons, new lessons etc.) must also be published under the same Creative Commons license ("by-nc-sa")

The first condition (Attribution) is pretty obvious: since the GITTA partner institutions spent a lot of time and money to create the GITTA lessons, they also want to earn the credits for it. The second condition (Non-Commercial) was not defined by the GITTA consortium but is – as already described – a restriction by most copyright-holders of material used within GITTA lessons. The idea behind allowing the creation of derivates (third point) is described in detail in the following chapter. The fourth restriction (Share Alike) should prevent that someone creating derivates of GITTA lessons publishes these derivates under a new license. The "Share Alike" condition assures that these new lessons are also accessible as open content (otherwise the GITTA community would no longer have access to altered versions of their lessons).

The transition from a closed internal project to an "open content" e-learning project required many changes and some of them were very labor intensive. Within a university it is perfectly legal to use and even alter copyright protected material as long as the source is mentioned, and the course material is used internally and accessible to students only. But when the access is opened, the copyright holders of material used within the course (e.g. data, illustrations, photos, animations, citations etc.) must grant permission to publish their work as open content. Getting these publication authorizations or replacing material where the request was declined was the most time-consuming task of the transition. Time was also needed to redesign the website, include the new copyright information on every lesson page, clear legal issues etc.

3.3   Creating a GITTA community

The idea behind allowing the creation of derivates of GITTA lessons was to create a "GITTA community" that will use and maintain the released GITTA lessons. As known from other community projects such as Wikipedia or the Apache Foundation, the creation of an "open" community can be very successful and authors tend to participate actively with no financial reward for their work. It is possible that other universities or institutions start using GITTA lessons and find a lesson promising but maybe not complete or not up-to-date. If they decide to participate in the GITTA project and want to join the community, such authors must submit a short application with their professional background, GIS knowledge and motivation for participating before getting full access to the GITTA repository server. On the technical side, the Concurrent Versions Systems (CVS) ensures that:

- all changes of a lesson are logged;
- it is possible to revert to a prior state of the lesson (e.g. before an error was introduced); and
- the GITTA staff can track changes made by an author.

Even with the technical possibilities to correct errors introduced by mistake or maliciously, the amount of work to control all changes is still very high. Five months after the release of the first GITTA lessons under the Creative Commons license, it is too early to quantify the amount of time and work needed for these controls.

4   Results and discussion

Since the release of the first lessons as "open content" was only accomplished in February 2006, there has been little time to evaluate the results of GITTA's "opening strategy". The results presented here are based on the four-month period after the opening compared to the months before the opening. From a quantitative point of view the opening strategy seems to be very successful. Both the amount of page views (including the GITTA website and all public accessible GITTA lessons) and the number of new GITTA newsletter subscribers has dramatically risen since the opening of the first GITTA lessons in February 2006 (see figure 1).
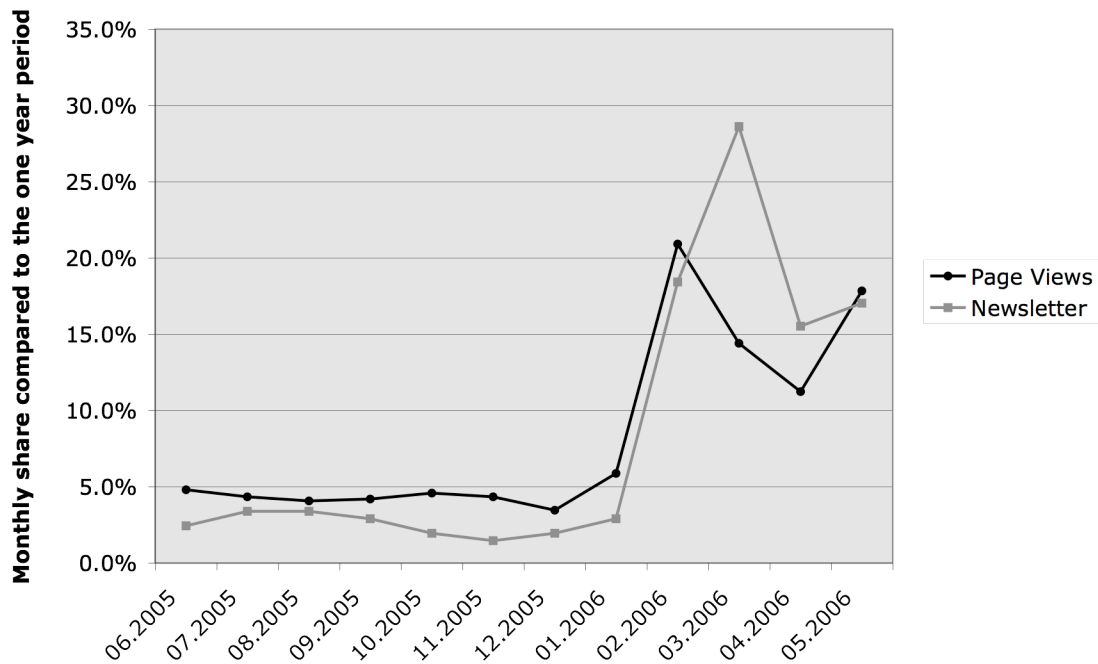

Figure 1: Distribution of the page views and number of new subscribers to the GITTA newsletter compared from June 2005 to May 2006.

If the four months before and after the opening of the GITTA course are compared, more than 90% of the total newsletter subscribers and nearly 80% of all page views were measured after the opening (see figure 2). These numbers might seem impressive but they should be interpreted with care since it is not clear if this sudden rise in interest was only due to the announcement of the GITTA open content release. The high numbers of page views does not necessarily implicate that the people accessing GITTA are actually using the material. Furthermore for getting the full access link one must subscribe to the GITTA newsletter, otherwise it is not possible to access the lessons. This is one possible explanation for the dramatic rise of newsletter subscribers. It remains to be seen if the interest in GITTA lessons will stay at a high level or drop again to the lower values of the time before the opening.
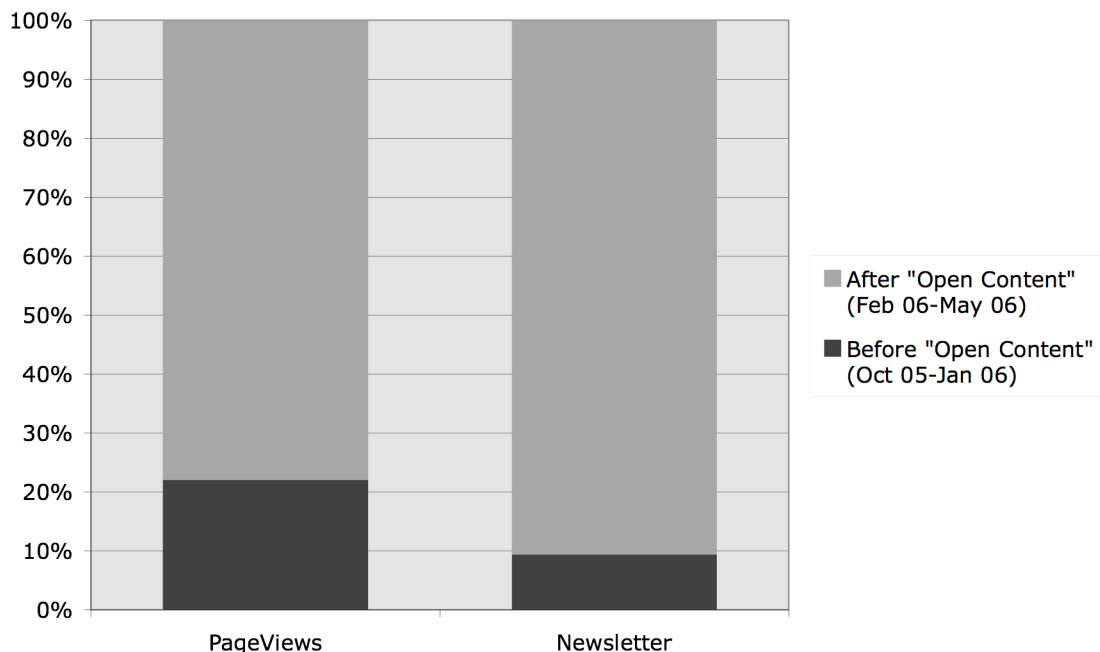

Figure 2: Comparison of page views and new subscribers to the GITTA newsletter in the four months period before and after the opening of the GITTA content in February 2006.

From a qualitative point of view there have already been some positive and promising offers:
- Translation offers from Eastern European partners into local languages (e.g. Bulgarian)
- A new lesson in development by a new partner from the French part of Switzerland
- Collaboration offers from Germany
- Possible integration of content into an open source GIS product

On the other hand there is no assurance that the new partners will comply with their promises and actually realize the planned tasks. The very nature of an open community is that the work is both voluntary and usually without binding legal agreements. Furthermore it remains to be seen whether updated or new lessons satisfy the quality standards set by the GITTA consortium. In certain cases (e.g. with a Bulgarian translation) it will not even be possible to check the content since none of the GITTA consortium members speak Bulgarian. In the worst case low-quality material could become incorporated in the GITTA course and harm the reputation of the course. Strict quality controls will be needed to guarantee the high standard claimed by the consortium.

It is important to understand that the open content strategy of GITTA does also include the release of the technology behind it as an open source project. Since the amount of projects using eLML are increasing and since the development of the framework is constantly improving, the decision of starting an open source project in 2004 seemed to be right. Furthermore the use of

eLML by the University of Zurich as a strategic platform had a very positive impact on the GITTA project when it comes to sustainability. As table 2 shows, a lot of services formerly carried out by the GITTA project are now offered by the central IT services department of the University of Zurich: The hosting of an XML server (Cocoon), maintaining a content repository (CVS), professional backups, implementing and testing new features etc. These services could only be centralized because today all projects are working with the same XML structure. Without the release of the original GITTA XML structure as an open source project this wouldn't have happened and each project would probably be working on their own technical solution. For GITTA the current state of the eLML project means savings of time and money in order to focus on the actual content of the lessons and project coordination.

Table 2: Comparison of tasks that were formerly carried out by the GITTA staff and are today – due to the university-wide used eLML standard – taken over by the University of Zurich (UZH).

	2001-2005:	Today:
Hosting:	GITTA Cocoon server	Hosted centrally by UZH
Content repository:	GITTA Groupware server	Hosted centrally by UZH
Backup & Security:	GITTA technical staff	IT team of the UZH
Updating XML structure	GITTA technical staff	eLML open source community and UZH
Browser compatibility tests:	GITTA team	All participating projects
Content creation:	Traditional XML editors	WYSIWYG Tool by UZH
User management:	Developed and maintained by GITTA technical staff	Not needed anymore as access is open

5   Conclusions

This paper has presented the Open Content strategy of GITTA (Geographic Information Technology Training Alliance – www.gitta.info). GITTA started out as a joint project of ten institutes at seven Swiss universities, funded by the Swiss Virtual Campus (SVC) program (www.virtualcampus.ch) between 2001 and 2006 to develop e-learning content in GIS. After having reviewed several options for sustaining a "life after SVC funding" the partners of the GITTA consortium opted for an Open Content strategy. It is felt by the GITTA consortium that this strategy has the best potential to allow a long life for GITTA materials, through the creation of a potentially worldwide "GITTA community" that extends far beyond the original consortium and hence ensures that the critical mass is reached necessary to sustain the momentum to continuously maintain and update the content and the technical infrastructure. The paper has reviewed the various options for publishing open content and why the Creative Commons licensing model was used. It has also discussed some of the problems encountered on this path, most notably the effort that has to be spent to clear all content for copyright issues, if content (e.g. pictures, geodata) of authors other than those of the consortium are used. And finally, we have also briefly reported on the Open Source strategy that is being pursued for the technical foundation of GITTA, that is, for the XML framework developed as part of GITTA that has been released as an open source project in 2004 under the name eLML (for more details, see Fisler and Bleisch 2006 as well as www.elml.ch).

As the analysis of the user and page view statistics as well as the interest shown by various external parties has shown, the open content strategy appears to have the potential to succeed in building a sustainable base for GITTA. Nevertheless, managing these open content (GITTA) and open source (eLML) projects in the future, with ceased external funding, will remain a formidable challenge. We hope to be able to add further positive chapters to this seeming success story at future EUGISES conferences. We keep our fingers crossed.

6   Acknowledgement

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