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A Project for a Virtual Mathematical Library

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Abstract. We present a project for a Virtual Mathematical Library, which is intended as a cooperative, distributed, hybrid library. The project is applied for funding through the DFG in the frame of the Digital Library Initiative.

1. The context of the project

One of the main challenges of the today's libraries is to provide integrated access to mathematics both on classical library resources as well as on heterogeneous and distributed digital information systems.

The origin and the location of the project for a Virtual Mathematical Library is the State and University Library Göttingen, SUB Göttingen. It is the main subject library of Germany for Pure Mathematics as well as for a whole list of other basic sciences. The background is the special subject collections program of the German national research foundation (Deutsche Forschungsgemeinschaft – DFG), which has adopted a policy of shared subject specialized collection development whereby at least one copy of every scholarly publication is available in Germany either via inter-library loan or photocopy service. This successful system should be transposed into the digital age. The goal is to supplement the current system, traditionally oriented to paper-based documents, with access to electronic resources [1].

In the past, SUB Göttingen initiated and participated in several projects in the context of electronic publishing and retrospective digitization in mathematics. It is impossible to give a complete summary of all these projects. I only want to refer to the Jahrbuch project ERAM providing a digital archive of the most important mathematical publications of the period

1868–1942 and a database based on the "Jahrbuch über die Fortschritte der Mathematik"[1], the *EULER*-portal to mathematics publications[2] or the NSF/DFG Cornell-Michigan project for a distributed library of mathematical monographs[3] as outstanding examples. Altogether, all these projects have led to the current idea of the Virtual Mathematical Library.

Furthermore, at SUB Göttingen, there are already experiences in developing virtual subject libraries with emphasis on the special subject collections. With the support of the DFG, SUB Göttingen has established virtual subject libraries which provide access to electronic collections for Anglo-American Culture[4], for History[5], and for Earth Sciences[6]. Moreover there are the subject gateways MathGuide[7], GeoGuide[8], ForestryGuide[9], Anglo-American Literature Guide[10], and HistoryGuide[11], listing web-sites according to specific subjects for scholarly research.

To complete the round of virtual subject libraries in Göttingen two further virtual libraries are in preparation. These are the virtual library for information, documentation, book studies, and library sciences as well as the one for mathematics.

The project for a Virtual Mathematical Library will be a joint work with Günter Törner from Duisburg-Essen University. He has initiated the MATH-LIB-PAGE[12] project for a specialized access to university libraries, which is standardized for mathematicians. Moreover, there are project cooperations with Zentralblatt MATH, with the Bielefeld University Library, the Science and Technology as well as University Library (TIB/UB) Hannover, the Zuse Institute Berlin (ZIB), the Mathematics Faculty of the Göttingen University, and the IuK commission for information and communication in the sciences.

2. The goals of the project

The Virtual Mathematical Library is projected as a cooperative, distributed, hybrid library. That means it will offer a structured access to important electronic resources as well as to the extensive library resources of the special subject collections. Mathematics on digital systems include digitized mathematics, digitally represented mathematics, and formalized mathematics. These resources are widely spread over the web and occur in different formats from heterogeneous and distributed electronic and online content systems, what is in the nature of things. Moreover, there are different collections and projects working, partly independent, on the vision of a global Digital Mathematics Library [2]. The classical library sources are for instance books, journals, microfiche, CD-ROM collections, and databases. But also for

[1] http://jfm.sub.uni-goettingen.de/JFM/en/
[2] http://www.emis.de/projects/EULER/
[3] http://www.sub.uni-goettingen.de/projekte/en/cornellmichigan-ab_en.html
[4] http://www.sub.uni-goettingen.de/vlib/
[5] http://www.clio-online.de/
[6] http://www.sub.uni-goettingen.de/projekte/vfbgeo.html
[7] http://www.MathGuide.de/
[8] http://www.Geo-Guide.de/
[9] http://www.ForestryGuide.de/
[10] http://www.AnglistikGuide.de/
[11] http://www.HistoryGuide.de/
[12] http://www.math-lib.org/

the paper-based documents, there are several services to get the literature through electronic information networks. What is needed is some kind of centralized and integrated access.

It is the goal of the present project to make it possible for the user to work in a uniform information platform. The Virtual Mathematical Library is intended to become a central access to information and related services which are relevant for mathematicians. This will be realized in a web-based portal system. In the first instance, it emphasizes the features of a comprehensive mathematical subject guide and a search facility for mathematical information on the web. Furthermore, the classical library services of the mathematical subject collections will be provided. Additionally, this system will offer several further services, such as publication possibilities, long-term preservation, and a communication network. The concept of the Virtual Mathematical Library includes remote access both to the contents as well as to the services of the corresponding information sources. It will provide access to and delivery from global mathematical knowledge systems.

Finally, in respect of the fact, that generally the web is going to suffer from information overload, it is necessary to develop a far-reaching structure for meta-information about the included resources.

In order to keep the content of this Virtual Mathematical Library at a high quality level, the information made available will be permanently maintained and updated.

3. The structure of the system

In order to make it clear and easy to handle for the user, the platform is arranged as a composition of modules. The modules that will be offered are

- Subject Information Guide
- Special Subject Collections: Information & Services
- Mathematical Libraries
- Publication Possibilities
- Communication Network
- Study & Career
- Teaching: Information & Material
- Partners
- Opinions, Reviews, and Ideas.

In the following, these modules will be described more precisely.

Subject Information Guide. This module is a structured catalog of various information sources. It bases on existing distributed sources and should offer a collection of mathematical material as complete as possible. The subject information guide will include access to bibliographic data of library catalogs and subject data bases, digitized mathematical texts, and electronic full texts of preprint-servers and e-journals. That means all types of resources will be considered and integrated. Furthermore, sites of scientific organizations, unions and others will be linked since they offer competent and well-sorted information collections and other far-reaching resources.

As far as it is possible the access to the material will be free. But, integrating free as well as commercial resources, for some of the source one has to charge for and the user has to decide for which source he is willing to do so.

Moreover, the subject information guide contains an intellectual selection and an index concerning the contents. There will be short descriptions characterizing the contents and services of each resource and a description of printed and electronic information sources combined with access to the full text.

Textual, this guide will be sorted by subject as well as by resource type. The subdivision by subjects will base on the Mathematics Subject Classification MSC 2000. Whereas the arrangement by the types of the resources will be divided into several categories like library catalogs, conventional journals with document delivery, electronic journals, preprint servers, retro-digitized material, theses, web-sites of mathematical institutions and departments, societies, research projects, etc. Altogether, this allows a subject and resource type oriented browsing, respectively.

The subject information guide will be completed by databases which are relevant to mathematics, bibliographic databases as well as full text resources.

Special Subject Collections: Information & Services. This module addresses the special subject collections for the mathematical sciences, SUB Göttingen (Pure Mathematics) and TIB/UB Hannover (Applied Mathematics). Here, the background of the special subject collections program of the DFG will be presented and access to the associated services particularly the document delivery systems will be offered. These are web-based document delivery systems for searching and ordering in the complete stocks of the libraries. Further components are online contents, acquisition lists, and inter-library loan.

Mathematical Libraries. Here, we want to construct a specialized access to university libraries as well as to libraries of mathematical departments which is standardized for mathematicians. This will be achieved by integrating and follow-up the MATH-LIB-PAGE project[13].

Publication Possibilities. This module includes the TEX-Documentation-Center which will be developed in a joint project between Günter Törner (Duisburg-Essen University) and SUB Göttingen as a major part. Here, this Virtual Mathematical Library offers an open publication platform, the possibility of archiving tex-files and a set of associated services.

Further components are the WebDOC-server of the SUB Göttingen as well as the ProPrint-project. WebDOC is organized by the Pica foundation (Netherlands) and realizes a central document server at SUB Göttingen. ProPrint is a cooperation between SUB Göttingen and Humboldt University, Berlin, that has developed a print-on-demand service with a unified search-and-order system.

Communication Network. As a comprehensive information system for the mathematical community links to calendars of events such as conference calendars or data of exhibitions as well as certain scientific news, e.g. proofs of important conjectures or information on prizes, awards, and prize winners, will be collected.

[13] http://www.math-lib.org/

Experiences of other virtual subject libraries show that activities to establish and embed the portal into the mathematical community are very important. In order to propagate the progress of the project, mailing lists and newsletters are planned.

Study & Career. Here, mathematical problems and competitions for pupils and students will be linked. Examples are national and international mathematical olympiades. The intention for this is to build up early relations to prospective young mathematicians. Furthermore, professional perspectives and possibilities in mathematics, both academic and non-academic will be composed. Other components should be information for students, job markets for mathematicians, and programs for graduate students and postdocs.

Teaching: Information & Material. This module targets to collect the huge amount of different resources concerning teaching mathematics at universities. These are various textbook collections of university libraries and several online-resources for teaching material, such as collections of exercises, seminar papers, and lecture notes. Moreover, there are several video records of lectures on the web. Another useful thing would be a guide to specialized courses and programs, e.g. summer schools, for graduate students.

Partners. This module links all the cooperation partners of this project and provides further information concerning joint activities. To ensure the quality of the service also closed cooperations with mathematicians and mathematical societies are essential.

Opinions, Reviews, and Ideas. Since the project gives an user oriented occurrence the main priority, contacts to the doers of the system will be offered. In particular, we plan to ask the users to review the resources and the contents. Moreover, we want to motivate discussions and suggestions for further developments and prospects of the project.

4. The realization of the project

The whole offer will be presented in a web-portal where the navigation is organized as clear and transparent as possible. In order to get easy access and short page load times the web programming will base on some basic principles that have to be specified in detail.

The major part of the work that has to be done is the integration of existing sources. Before amassing anything that gets in one's way, a definition of useful and reasonable selection criteria will be formulated. Here, the ruling principle should be the relevance to mathematics, whereas the design and presentation is more secondary. Aside from these selection criteria the quality can only be ensured by closed cooperations with the scientists, committed individuals as well as associations and societies.

A further aspect of realizing the project and establishing the new services successfully is a strict marketing for the web-site right from start.

Finally, as an essential component the implementation of a meta search engine is planned. This search engine will offer a parallel cross-search on different data sources, e.g. central databases, bibliographic databases, content repositories, library catalogs, various internet resources, and other mathematically related search services. For practical reasons, we will make use of an existing search engine. Due to the rapid increase of mathematically relevant

content on the web, it is necessary to make this content accessible and searchable by content-based queries and integrated indexing.

The timeline for the first two years

The target date to start with the project is in spring 2005. Half a year later, a first and preliminary version of the portal, including the modules *subject information guide*, *special-subject collections*, and *mathematical libraries* is going to go online. The next period is devoted to the continuous integration of various information sources and service platforms. Moreover, a whole list of technical details has to be tackled. And two years later, with this Virtual Mathematical Library a rather completed approach towards integrated access to mathematics should be available.

References

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[2] Jackson, Allyn: *The Digital Mathematics Library.* Notices of the AMS **50**(8) (2003), 918–923.

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