Looking forward EuDML — The European Digital Mathematics Library

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The present article intends to give some information about EuDML project, an European project that aims to "deliver a truly open, sustainable and innovative framework for access and exploitation of Europe's rich heritage of mathematics", and stress the importance of building an emerging PtDML (Portuguese Digital Mathematics Library) in this context of change [1]. EuDML is funded by the ICT Policy support Programme of the European Commission, coordinated by a research team of the Computer Science Department of IST (Instituto Superior Técnico) at the Technical University of Lisbon, led by José Luís Borbinha, the project scientific coordinator.

1. A Dream of a Unified Digital Mathematics Library

"Les mathématiciens se content de mettre leur production à la dispositon de tous comme sur des etagères où l´on peut venir se servir."

—Jean-Pierre Serre

The Digital Era, the emergence of the internet, the webmail, the new ways of communicate and the new channels of communication, changed the ways that researchers and scientists produce, publish and disseminate their scientific work. The birth of the electronic communication at the end of the 20th century has opened new opportunities for easier, faster dissemination, and more powerful discovery of scientific new results [2].

Mathematics is a basic science for a wide range of other branches of human knowledge, which needs quantitative though, with a huge variety of applications in all other sciences and technologies. So, building a central data service of mathematical knowledge has not only importance for the mathematical community, but also for all users of that knowledge. The main goal of a DML (Digital Mathematics Library) is to provide all the possible mathematical literature online and easily available through a central service or repository to anyone who has an internet connection in an electronic device, such as computer, cell phone of new generations or other type of machines [3]. The dream and vision were scripted long time ago [4]:

"In light of mathematicians' reliance on their discipline's rich published heritage and the key role of mathematics in enabling other scientific disciplines, the Digital Mathematics Library strives to make the entirety of past mathematics scholarship available online, at reasonable cost, in the form of an authoritative and enduring digital collection, developed and curated by a network of institutions."

—NSF DML project, Cornell 2002, CEIC 2004, IMU 2006

The benefits of building EuDML as part of a whole DML are unquestionable. EuDML is going to make the European heritage easily available from everywhere, since the laboratory of a mathematician is composed almost by its library and its richness is weighted by the availability of the mathematical knowledge required by its owner. This was previously emphasized by several workshops [5].

2. Previous work

A lot of work has already been done to transfer the past and current mathematical content into digital files (retro digitization process). Much of the current literature born in a digital way, i.e., created electronically and available online since its publication. Mathematics scope and the dimension of its scientific cor-

pus are huge with all of its branches and interlinked areas in theoretical and applied subjects, so following all the mathematics is impossible for a single individual. Mathematicians find themselves navigating the literature, moving from one article or book to another, pursuing results and proofs and relying on references in order to link to the next item. The linking process has become more important with the literature growth and it is one of the reasons why electronic publication has great potential benefit for mathematical research. The stress nowadays should be on integrating this dispersed content into one distributed electronically virtual library of mathematics.

Before the beginning of the EuDML project, several individual and satellite projects built their "mini-DML's" and central repositories or central data services, such as (see [6])

- NUMDAM (NUMérisation des Documents Anciens Mathematiques) [7],[8];
- Project Euclid [9];
- EMIS (European Mathematical Information Service) [10];
- CZ-DML (Czech DML) [11];
- E-DML (Biblioteca Digital Española de Matématicas) [12];
- Ulf Rehmann´s Collection (Bielefeld University) [13];
- JSTOR [14];

But alone, these single projects don't have the global scope or the empowered efforts that EuDML can achieve.

3. Presenting EuDML [1]

"The EuDML strives to make the significant corpus of mathematics scholarships published in Europe available online, in the form of an authorative and enduring digital collection, whether a researcher needs to follow a subtle pyramid of reasoning through a chain of related articles, an engineer needs to find results related to a particular concept, or a scholar project studies the history of a specific mathematical issue, there is a common need for an integrated interconnected gateway to the body of preserved mathematical literature."

— EuDML Document of Work [15]

The project, partially funded with the EC funds, through its "Competitiveness and Innovation Programme", started on 1 February 2010, and will last for three years, until 31 January 2013 and intends to
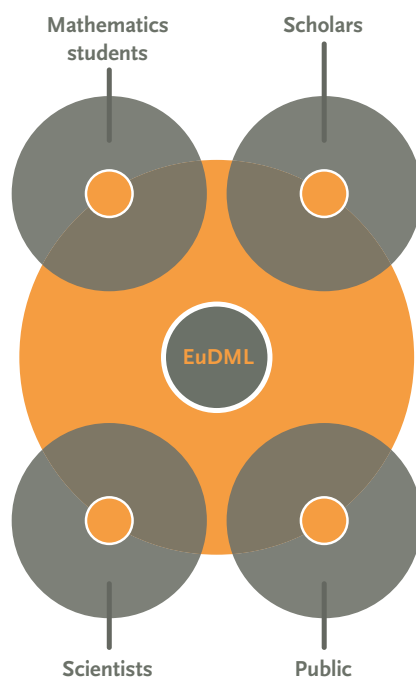

Figure 1

design and build a collaborative digital library service, through a network of academic libraries, aggregating a central metadata repository and endowing each item and a pointer to the associated full text and bibliographical databases [15]. EuDML will help the long term preservation of digital mathematical literature and will put the European Mathematical Community at the leading edge of the global drive towards a World Digital Mathematics Library, helping to maintain Europe's foremost position in mathematical research. Bringing together the dispersed heritage of digital mathematical literature, EuDML will provide explicit support, using the latest technologies for visually impaired users as well as automatic language translation support, in order to overcome language barriers, using the multilingual mathematical knowledge already developed by the institutional partners.

Targets

The foremost target (see Fig. 1) users are students and scholars, whose studies depend on the validity and the availability of previous and original mathematical literature. Working mathematicians have a prominent place among the target, since their production and the validation of their knowledge and of new results depends often on pre-existing literature. But not only mathematicians are part of the target users. Since mathematics has ramifications and interconnections with all other scientific disciplines, all the users of quantitative methods and logic-deductive reasoning are among this group of possible users.

1	Pt DML
2	DML-E
3	EDP Sciences
4	NUMDAM/CEDRAM
5	GDZ Mathematica/ERAM
6	Zentralblatt/ELibM
7	DML-CZ
8	DML-CZ
9	HDML
10	BulDML
11	RusDML

Figure 2

EuDML Body

Responsible for achieving sustainability and success in the end of the project, the EuDML consortium, is composed by 14 institutional partners, which include mathematicians, librarians, digital library experts, publishers, professional information service and document engineering specialists, and computer scientists, under the supervision of an external multidisciplinary scientific advisory board, formed under the auspices of the EMS (European Mathematical Society). The partners of the Consortium are:

- IST/UTL(Instituto Superior Técnico): Computer Science and Engineering Department (Portugal)
- UJF/CMD Université Joseph Fourier, Grenoble 1 (France)
- UB University of Birmingham (United Kingdom)
- FIZ Fachinformationszentrum (FIZ) Karlsruhe (Germany)
- MU Masarykova Univerzita (Czech Republic)
- ICM University of Warsaw, ICM (Poland)
- CSIC Consejo Superior de Investigaciones Cientificas ES (Spain)
- EDPS Edition Diffusion Presse Sciences (France)
- USC Universidade de Santiago de Compostela: Instituto de Matemáticas ES (Spain)

- IMI-BAS Institute of Mathematics and Informatics, BAS BG (Bulgaria)
- IMAS Matematický ústav AV ČR, v. v. i. (Czech Republic)
- IU Ionian University (Greece)
- MML Made Media (United Kingdom)
- CNRS/CMD Centre National de la Recherche Scientifique (France)

Content providers

EuDML is designed to eventually integrate all of the DML projects from every country in Europe, encouraging additional countries to embrace the project, creating a global DML in the future, and pursuing European publishers to cooperate with the library, with policies of cooperation designed properly (open-access, moving wall…). In the lifetime of the project there will be organized some workshops in order to introduce EuDML to the community of data providers that could be interested in the project.

Actually the group of the content providers is spatially configured in the European territory such as the picture shows (see Fig. 2).

Website [1]

At this moment there is not yet much information in the website, but at the time the project evolves there will be available more information, such as public deliverables and documents of the project and information concerning activities, such as workshops and public demo services (Fig. 3).

Workshop with content providers (Prague 15 October 2010)

EuDML is alive and is evolving and making itself known by the community. In the October 15, 2010, the partners UJF/CMD and IMAS organized a workshop with content providers, held at the Institute of Mathematics of the Academy of Sciences of the Czech Republic, in Prague. Besides project partners, it was attended by representatives of content providers, Ulf Rehman from IMU (International Mathematical Union),Ari Laptev, president of EMS (European Mathematical Society), publishers and further stakeholders, by librarians, such as Springer Services+Business Media representatives, mathematicians, the London Mathematical Society representatives, and public authorities.

The goals of the workshop (see [16]) were the presentation of the project and its purposes, a brief summary of the policies regarding content selection, archiving and access; plans for system architecture and releases schedule and the promotion of the dialogue between the participants, ending with an open panel discussion.

The program committee was formed by some partners of the project:

- Thierry Bouche (UJF/CMD chair)
- Jiri Räkosnik (IMAS/ local organizer)
- Enrique Macias Virgós (USC)
- Marie Louise Chaix (EDPS)

Representatives of the IMU (Ulf Rehman), the EMS (Ari Laptev), Universitäts Bibliothek Göttingen, and the Serbian Academy of Sciences presented their views and contributions to the global DML effort, and more specifically their suggestions to the EuDML project.

The final discussion was conducted by the questions of publishing and the power in the future of EuDML project in the definition of commercial policies of publishing of big companies, such as Springer or Elsevier, defining policies and agreements of open access, moving wall or some kind of individual users contributions, stressing not only the importance of contacting the important commercial publishers, but also how the EuDML objectives could help the strengthen of small and medium publishers, democratizing therefore the access to the mathematical publications.

Another EuDML workshop with data providers will be scheduled in next July, presenting EuDML to a broader audience and showing the goals achieved at the time.

4. It's time for the Portuguese DML (PtDML)

Meanwhile EuDML is growing and preparing its place as the main delivery service of a "truly open, sustainable and innovative framework for access and exploitation of Europe's rich heritage of mathematics" ([17], [18]) , it was formed a Portuguese Committee on Electronic Information and Communication (CEIC-Pt) in a previous meeting in the University of Minho (April 9, 2010), composed by Eugénio Rocha (Universidade de Aveiro), José Luís Borbinha (IST/UTLisboa), José Francisco Rodrigues (CMAF/ Universidade de Lisboa), Pedro J. Freitas (ULisboa and SPM-Portuguese Mathematical Society), Pedro Quaresma (Universidade de Coimbra) and Pedro Patricio (Universidade do Minho) with the mission to develop a portal that may congregate all the Portuguese mathematical heritage and all the publications of all the Portuguese mathematicians, linking it with EuDMl in the future. This is an important issue not only to study of the History of Portuguese Mathematics, but also to the current Portuguese mathematicians, which works will be accessible through a single and central place, in order to facilitate the search and the access.

There are several important publications and works of the past that are not yet collected digitally and it will be important to give access in a reference site such as PtDML may be in the future. For example, the Pedro Nunes works , the "História das Matemáticas em Portugal", of Francisco Gomes Teixeira (available in a personal website [19]), the mathematical works of José Anastácio da Cunha, Daniel da Silva, Gomes Teixeira, J. Vicente Gonçalves, Mira Fernandes, Ruy Luís Gomes and J. Sebastião e Silva, among others, which are dispersed by the several libraries, such as the National Library, the libraries of the University of Coimbra, Lisbon and Porto, the Library of the Academy of Sciences of Lisbon and several private collections. The electronic availability of these works is very important to the divulgation of the Portuguese mathematical heritage. One important source of interesting works of the mathematicians of the Portuguese past is the "Memoirs" ([20], [21]) of Academy of Sciences of Lisbon. The histor-

Figure 3
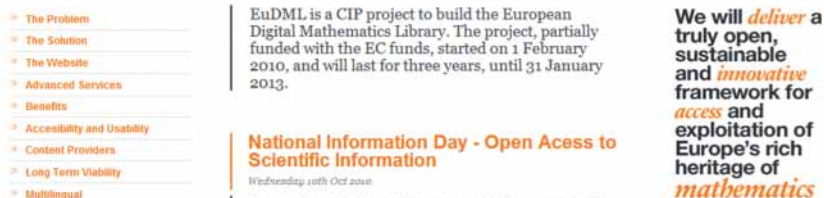
ical interest of the "Memoirs" is important since it contains a few important texts of Portuguese mathematicians.

But not only should the past be the focus of attention. It is important to have easy access to the currents publications of the Portuguese mathematical community. Articles, papers, books, chapters in proceedings are different types of written mathematical data and content, but should not be the only one to be considered. In the Digital Era, the multimedia content shouldn't be neglected; for instance it is relevant to make better known the Pedro Nunes Lectures held by the initiative of CIM (accessible through [22]). In what concerns journals and periodicals, the first journal digitized and currently available in the webpage of the SPM (Portuguese Mathematical Society) is "Portugaliae Mathematica" [23], the research journal of this society. But other periodicals should also be accessible in digital format, like the "Boletim" [24] and the "Gazeta da Matemática" [25], both of the SPM, or the "Boletim" [26] of the SPE (Statistical Portuguese Society).

At this time the initiative is still in a first stage, collecting data for cataloging and planning what and how to congregate the information, but it aims to construct a website that hopefully with collect and connect all the available content [27].

References

[1] EuDML website http://www.eudml.eu/

[2] J. Borbinha, Digital Libraries and the Rebirth of Printed Journals, in pp 97–110, of [28].

[3] John Ewing, Twenty Centuries of Mathematics: Digitizing and Disseminating the Past Mathematical Literature, Notices of the AMS, August 2000, volume 49, 771–779

[4] The Digital Mathematics Library, Notices of the AMS, volume 50, number 8, 918-923

[5] European Science Foundation Workshop on the European Virtual Library in Mathematics: http://www.usc.es/~esfmaths

[6] World Digital Mathematics Library: http://www.mathunion.org/WDML/

[7] The mini-DML: http://www.numdam.org/minidml/

[8] NUMDAM: http://www.numdam.org

[9] Project Euclid: http://projecteuclid.org

[10] The European Mathematical Information Service (EMIS): http://www.emis.de/

[11] Czech DML: http://dml.cz/

[12] "Biblioteca Digital Española de Matematicas": http://dmle.cindoc.csic.es/

[13] Ulf Rehmann's Collection: http://www.math.uni-bielefeld.de/~rehmann/DML/dml_links.html

[14] JSTOR: http://www.jstor.org/

[15] EuDML technical documents and Document of work

[16] Deliverable 3.3. EuDML , Thierry Bouche; Jiri Rákosník (soon available in EuDML website)

[17] E.M. Rocha, J.F. Rodrigues, Disseminating and Preserving Mathematical Knowledge, Communicating Mathematics in Digital Era, in 3–23, [28] and also in Bol. Soc. Port. Mat. 53 (2005), 1–21.

[18] T. Bouche, Towards a Digital Mathematical Library, Communicating Mathematics in Digital Era, in 47–74, [28]

[19] http://www.mac.uc.pt/~jaimecs/livrogt/livrogt.html

[20] F. Gomes Teixeira, História das Matemáticas em Portugal, Academia das Ciências, Lisboa, 1934.

[21] J.F.Rodrigues, Portuguese Mathematical Journals. Some aspects of (almost) periodical research publications, in pp. 601–627, The Practice of Mathematics in Portugal. Acta Universitatis Conimbrigensis Coimbra,(2004); (Eds. Luís Saraiva, Henrique Leitão) and also in Bol. Soc. Port. Mat. 50 (2004).

[22] CIM website: http://www.cim.pt

[23] Portugaliae Mathematica at the Portuguese National Library http://purl.pt/index/pmath/vol/PT/index.html

[24] Bulletim of the Portuguese Mathematical Society: http://nautilus.fis.uc.pt/bspm/

[25] Gazeta of the Portuguese Mathematical Society: http://www.mat.uc.pt/~gazeta/GazetaOnline/online.php

[26] SPE webpage: http://www.spestastistica.pt

[27] Assis Azevedo, J.L. Borbinha, Pedro J. Freitas, Eugénio Rocha, The Challenges of the Pt-DML, pp. 2–5, CIM Bulletin #27, January 2010

[28] J. Borwein, E.M. Rocha, J.F. Rodrigues (Eds.) Communicating Mathematics in Digital Era, A K Peters,Wellesley MA, 2008.