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1. Introduction

The EuDML project aims to design and build a collaborative digital library service that will collate the mathematical content brought by 11 of its partners and make it accessible from a single platform, tightly integrated with relevant infrastructures such as the Zentralblatt MATH. As such, it is the first attempt toward a large-scale implementation of a Digital Mathematics Library (DML), and is expected to pave the way towards a truly inclusive and global DML.

An important part the project is proper testing, assessment and evaluation against the initial proposal and the completing environment. The evaluation in EuDML will support the process of decision about future sustainability, the process of benchmarking during the development and also during the design the requirement for clear interfaces for adding new content repository in the future. In this sense we will evaluate mainly EuDML and its providers and also eventual competitors.

For this purpose, it will be considered organization facet (i.e. organizational context and sustainability), services facet (i.e. the technical and functional characteristics of the services) and the content facet (its quantity and quality).

High level quality services for resource discovery in the EuDML project is a base priority. Therefore, the testing and validating of offered services or components are carried out according to a detailed plan. That plan comprises several runs, including at least two global evaluations held in the second and third year of the project.

This deliverable is the first outcome of this work and is based on a comparative study of existing services and a survey of the systems' presentation that partners contracted to provide to the EuDML project.

The purpose of this document is to give a much more detailed picture of existing services and content providers in EuDML project. To support that, we performed an evaluation and analysis process, which results highlights those services characteristics and system features that are most relevant to the project. These results will facilitate the design decisions and recommendations for EuDML system features and its functionality.

2. Executive summary

This deliverable reports on a comparative study of existing digital mathematics library services, surveying especially those services already offered by the content providers among the EuDML partners. This report aims to support the development of concepts, criteria and methods for the continuous evaluation of both existing and new relevant services.

The comparison focuses both on criteria specific to the content provided and the functionality supporting a user searching this content. Firstly the survey concentrates on the classification of relevant services in order to specify common evaluating criteria. Thereby the classification scheme follows frequently used services in digital libraries, archives, publishing systems and other content management systems. Each partner system has then been examined with respect to services provided for readers, authors, administrators as well as with respect to interoperability services.

In a next step information on maintenance of these and similar services will be collected.

3. Methodology

The goal of the comparative study was to give a comparative description of the contents and presentation of capabilities in order to be able to give suggestions based on already existing functionality for the EuDML project, providing also examples. Additional sites outside EuDML to broaden the view were incorporated, as well.

3.1. Classification of existing services

The services, provided in the EuDML partners systems can be grouped in the following common structure:

Readers services (with or without required user registration/account)

- **User interface** (content presentation, content classification scheme, content retrieval, browse, navigation, simple/advanced search)
- **Web feeds** (RSS, Atom)
- **Cross reference** (citation linking mechanisms, link resolvers)
- **Web 2.0 services** (tagging, comments, ratings, reviews, bookmarks, share this, other Web 2.0)
- **Statistical reporting** (size, diversity, self-counting, count of total items, top downloads, top cited, collection/repository growth over time, etc.)
- **User account** (roles, groups)
- **Email-alert**
- **Online subscriptions** (free access/non-free paid, license model)

Authors' services

- **User interface** (content presentation, content classification scheme, content retrieval, browse, navigation, simple/advanced search)
- **Web feeds** (RSS, Atom)
- **Cross reference** (citation linking mechanisms, link resolvers)
- **Web 2.0 services** (tagging, comments, ratings, reviews, bookmarks, share this, other Web 2.0)
- **Statistical reporting** (size, diversity, self-counting, count of total items, top downloads, top cited, collection/repository growth over time, etc.)
- **User account** (roles, groups)
- **Email-alert**
- **Online subscriptions** (free access/non-free paid, license model)
- **Online submissions** (license model, copyright, ownership, terms of use, etc.)

Administrators' services

- Users, groups, roles management
- Metadata curation
- Customisable workflow
- Bulk import metadata
- Bulk export metadata

Interoperability services (machine-to-machine interoperability services and protocols)

- OAI-PMH
- OAI-ORE
- SWORD

- Harvesting
- Persistent identifiers
- Other...

The survey is based on the frequently used services in digital libraries, archives, repositories and publishing systems. The purpose is to give us a clearer picture of existing services and content providers in EuDML project.

The main scopes of the survey are services related to readers, authors, administrators and interoperability services (interoperability services and protocols). Readers services cover all those related to web user interface navigation web feeds, cross references, Web 2.0 services (tagging, comments, ratings, reviews, bookmarks, share this), statistical reporting, email-alert and online subscriptions. Authors' services are considered that they have all readers' services and according functionalities, but with difference that authors can submit articles, track citations, etc. Services for administrators include all those related to system maintenance like the most general tasks as management of users, groups and roles, metadata curation etc. Interoperability services are considered to the ways in which digital repositories and libraries work with other systems using common standards and protocols. Sometimes these interfaces are used directly by people (e.g. web user interfaces, web search engines or web feeds like RSS feeds) and sometimes they are used by machine-to-machine. For example OAI-PMH service has been built to interact with different repository implementations used to harvest (or collect) the metadata descriptions of the records in an archive so that services can be built using metadata from many archives.

The outcomes of the survey will facilitate the design decisions and recommendations for the EuDML final services and EuDML partners.

3.1.1.Descriptive tables of classified services

The following description tables give more detailed information about each group of services.

Readers services	
User interface services	
Content presentation:	<p>Content presentation includes:</p> <ul style="list-style-type: none"> - File types of stored items (html, mathml, tex, ps, pdf, doc, images, etc.). - Service for online document format conversion – possibility for user to choose in which format to download a document. - Thumbnail (quick preview) - user can view content as a thumbnail (quick preview) in a web browser. - Option to view full article through a web browser without the need to download as a file, etc.
Content classification scheme:	<p>Classification schemes have a role in aiding information retrieval in a network environment, especially for providing browsing structures for subject-based information gateways on the Internet. Advantages of using classification schemes include improved subject browsing facilities, potential multi-lingual access and improved interoperability with other services. A list of classification schemes and controlled vocabularies used in existing Internet services.</p> <p>Examples of classification schemes Mathematics Subject Classification (MSC), DDC, UDC, Other</p>

Content retrieval	Export document in multiple formats and/or extract parts of a document (for example, extraction of only citations, references or figures from a particular article).
Browse and navigation:	Browsing by author, subjects, year, title, collections, type of item (article, proceeding, book, etc.) and other. Content filtering (new, recent, key words, subject, similar, sort results), service for personalized seeking of similar articles/documents.
Simple search:	Searching by keywords, phrases; predefined search only on metadata field/s (title, abstract, etc.).
Advanced search:	User can choose different scopes of search. Advanced search also provides any combination of searching at the same time by multiple selected scopes of search linked with conditional logical operators AND, OR, NOT. Advanced search may provide autocompleting of search terms; make suggestions with relevant keywords, phrases associated to the user search request.
Web feeds: (RSS, Atom)	Web feeds are used to publish frequently updated works such as blog entries, news headlines, etc. in a standardized format. An example of web feed format is RSS document (which is called a "web feed", or "channel") that includes full or summarized text, plus metadata such as publishing dates and authorship. Web feeds benefit publishers by letting them syndicate content automatically. They benefit readers who want to subscribe to timely updates from favoured websites or to aggregate feeds from many sites into one place. RSS feeds can be read using software called an "RSS reader", "feed reader", or "aggregator", which can be web-based, desktop-based, or mobile-device-based. A standardized XML file format allows the information to be published once and viewed by many different programs. The user subscribes to a feed by entering the feed's URI into the reader or by clicking a feed icon in a web browser that initiates the subscription process. The RSS reader checks the user's subscribed feeds regularly for new work, downloads any updates that it finds, and provides a user interface to monitor and read the feeds.
Cross reference:	(linking mechanisms, link resolvers) Services related to citation management. Some examples are Open URL linking, Link resolvers, Electronic resource integration, DOI, CrossRef, Handle.Net
Web 2.0 services:	<ul style="list-style-type: none"> • tagging • comments • ratings • reviews • bookmarks • share this • other
Statistical reporting:	<ul style="list-style-type: none"> • size • diversity • self-counting • count of total items • top downloads • top cited • collection growth over time, etc.
User account: (roles, groups)	Here any predefined users' roles and groups and the specific services for each of them should be listed and described.

Email-alert:	Services related to the notification via e-mail
Online subscriptions (free access/ non-free paid, license model)	Terms and conditions. Definitions of offered services, access and use, policy, copyright, etc.

Authors services	
User interface, web feeds, cross references, Web 2.0 services, statistical reporting, user account, Email-alert and online subscriptions are same as readers' services.	
Online submissions (License model, copyright, ownership, terms of use, etc.)	Terms and Conditions, Definitions, services offered, access and use

Administrators services	
Users, groups, roles management	Describe existing types of users and roles.
Metadata curation	Describe existing metadata curation system. How is it implemented? The goal of the curation system is to provide a simple, extensible, way to manage routine content operations on a repository. Some examples: <ul style="list-style-type: none"> • ensure a given set of metadata fields are present in every item, or even that they have particular values • profile a collection based on format types - good for identifying format migrations • network service to enhance/replace/normalize an item's metadata or content • ensure all items are readable and agree with the ingest values
Customizable workflow	A workflow consists of a sequence of connected steps. It is a depiction of a sequence of operations, declared as work of a person, a group of persons, an organization of staff, or one or more simple or complex mechanisms. Workflow may be seen as any abstraction of real work. For example the workflow may consist of maintaining publications by importing metadata from other sources, and attaching full text where available. This minimises the amount of manual form-filling needed. The interaction with the repository is limited to selecting which collection (if any) they want their work archived.
Bulk import metadata	It's often more efficient to import and export at once large amount of data. Is it possible for example to export at once all collection, all content of repository software?
Bulk export metadata	

Interoperability services (machine-to-machine interoperability services and protocols)	
OAI-PMH	Open Archives Initiative Protocol for Metadata Harvesting is a protocol developed by the Open Archives Initiative. It is used to harvest (or collect) the metadata descriptions of the records in an archive so that services can be built using metadata from many archives. An implementation of OAI-PMH must support

	representing metadata in Dublin Core, but may also support additional representations.
OAI-ORE	Open Archives Initiative Object Reuse and Exchange (OAI-ORE) defines standards for the description and exchange of aggregations of Web resources. The OAI-ORE specification implements the ORE Model which introduces the Resource Map (ReM) that makes it possible to associate an identity with aggregations of resources and make assertions about their structure and semantics.
SWORD	SWORD (Simple Web-service Offering Repository Deposit) is an interoperability standard that allows digital repositories to accept the deposit of content from multiple sources in different formats (such as XML documents) via a standardized protocol. In the same way that the HTTP protocol allows any web browser to talk to any web server, so SWORD allows clients to talk to repository servers.
Harvesting	Other mechanisms for harvesting metadata.
Persistent identifiers	The Handle System is a technology specification for assigning, managing, and resolving persistent identifiers for digital objects and other resources on the Internet. The protocols specified enable a distributed computer system to store identifiers (names, or handles), of digital resources and resolve those handles into the information necessary to locate, access, and otherwise make use of the resources. That information can be changed as needed to reflect the current state and/or location of the identified resource without changing the handle.
Others	Other machine-to-machine services and protocols.

It's not obligatory and not expected for each content provider to have all of these services. For each partner system, we survey groups of services for readers, authors, administrators and interoperability. It will be collected data about maintenance of these services or similar. This survey will give a detail picture of the existing services during the first evaluation run. The outcomes of the survey are included in Section 5.

The outcomes of the survey will facilitate the design decisions and recommendations for EuDML system features and its functionality. Moreover, it could support the following groups of services with base priority for EuDML project:

- **Services concerning to Interoperability and Integration** - describe the ways in which repositories work with other systems using common standards and protocols. Sometimes these interfaces are used directly by people (e.g. web user interfaces or RSS feeds) and sometimes they are used by machines (e.g. OAI-PMH and SWORD). Interfaces used by machines are sometimes referred to as m2m (machine-to-machine) interfaces.
- **Services supporting linking mechanism** - for effective use of distributed electronic resources in libraries. Some examples are Open URL linking, Link resolvers, Electronic resource integration, DOI, CrossRef, Handle.Net. Linking mechanism makes possible to build global digital libraries services and portals, because it provides unique item identifiers, persistent identifiers are used for citation management, etc.
- **Storage and long term preservation of digital information** – it concerns using well-known standards for metadata, storage data formats, etc. with provided support for a long time. Policies according to systems and software management, physical security, data security, data backups, disaster recovery, redundancy of data (multiple data duplication, digital archives, global web portals, providing content aggregation from various sources distributed over the Internet), etc.

3.2. Survey methodology

Generalized classification scheme covers the services for readers, authors, administrators and interoperability services and is built on the base of modern content management systems with advanced, developed and rich functionalities that are presented in the following list:

- **arXiv.org** is an archive for electronic preprints of scientific papers
- **ACM Digital Library** - Full text of every article ever published by ACM and bibliographic citations from major publishers in computing.
- **Springer Science** or Springer is a global publishing company which publishes books, e-books and peer-reviewed journals in science. Springer also hosts a number of scientific databases, including SpringerLink, SpringerProtocols, and SpringerImages.
- **The Public Library of Science (PLOS)** - is a non-profit organization of scientists and physicians committed to making the world's scientific and medical literature a public resource.
- **PLOS ONE** (accelerating the publication of peer-reviewed science) - An interactive open-access journal for the communication of all peer-reviewed scientific and medical research.

Readers services cover all related to web user interface navigation web feeds, cross references, Web 2.0 services (tagging, comments, ratings, reviews, bookmarks, share this), statistical reporting, email-alert and online subscriptions. Web 2.0 services, especially web feeds, could provide very useful additional mechanism for aggregating data. It gives the possibility for users to personalize and subscribe for multiple feeds channels listed on centralized web portal. Other Web 2.0 service – social bookmarks can be integrated in EuDML concerning to bookshelves and collecting favorite links by users.

Authors' services are considered having all readers' services and relevant functionalities, but with the difference that authors can submit articles, track citations, etc. These services are included because the most of observed systems have online manuscript submission system and other related services. Authors' services in EuDML should be considered only for new digital born articles and for digital publishers.

Statistical reporting is useful not only for authors and readers, ratings, popularity and etc., but it can be useful in system interoperability for optimizing performance. For example metadata/content aggregators consume a lot of systems computation performance and network bandwidth when they retrieve content from large digital repositories. With statistical reporting can be determined and planned time schedules for aggregators when they should be used and how often. Time schedule for aggregators can be adaptive if there are monitoring services based on statistical reporting from content providers.

Services for administrators include all those related to system maintenance like the most general tasks as management of users, groups and roles, metadata curation, etc.

The last group of services concerns interoperability and integration. The interoperability and metadata aggregation have primary priority according to EuDML project. It takes more effort to get support for machine-to-machine interfaces from all EuDML partners, because most of them have no OAI-PMH or other protocol.

The collected data for this survey also includes technical specifications for content provider system software platforms, operating system, database, programming languages, additional functionalities, etc. The outcome from technical part of the survey could give general information based on used technologies for software sustainability, scalability and development.

4. Comparative study

This section presents a comparative description of the contents and presentation of capabilities in order to be able to give suggestions based on already existing functionality for the EuDML project providing also examples. Also, additional sites outside EuDML were incorporated to broaden the view.

The attention is focused here on functionality/criteria connected with the provided contents and the user looking for that content. Apparently, not all the criteria used are purely of that nature. Some of them are also intertwined.

First, the general information about the studied sites and the therein provided contents is given. The second topic is that of typical tasks when accessing information/content, i.e., search, browse. Thirdly, the provided information is surveyed information and how this information is presented. Connectedness and relations between contents, also relations to external contents are presented finally.

The final subsection comprises suggestions.

4.1. Studied sites

- CEDRAM – Centre de diffusion de revues acadOmiques math0matiques
 - <http://www.cedram.org/>
- NUMDAM – Numerisation de documents anciens math0matiques
 - <http://www.numdam.org/>
- DMLE – Biblioteca Digital Española de Matem8ticas (Spanish Digital Mathematics Library)
 - <http://dmle.cindoc.csic.es/>
- ELIB – eLibrary of Mathematical Institute of the Serbian Academy of Sciences and Arts
 - <http://elib.mi.sanu.ac.rs/>
- PVLS – Polska Biblioteka Wirtualna Nauki – Kolekcja Matematyczna; (Polish Virtual Library of Science – Mathematical Collection)
 - <http://matwbn.icm.edu.pl/>; new version: <http://yadda.icm.edu.pl/mathbwn/>
- DMLCZ – Czech Digital Mathematics Library (DML-CZ)
 - <http://dml.cz/>
- DZ – DigiZeitschriften
 - <http://www.digizeitschriften.de/>
- GDZ – Göttinger Digitalisierungszentrum (Center for Retrospective Digitization, Göttingen)
 - <http://gdz.sub.uni-goettingen.de/>
- DSPACE – Digital Repository at IMI-BAS (Institute of Mathematics and Informatics at Bulgarian Academy of Science)
 - <http://sci-gems.math.bas.bg:8080/jspui/handle/10525/2>
- ZBMATH – Zentralblatt MATH Database
 - <http://www.zentralblatt-math.org/zbmath/>
- EMIS – ELibM – Electronic Library of Mathematics
 - <http://www.emis.de/>

- Arxiv -- arXiv.org
 - <http://www.arxiv.org/>
- Google – Google scholar
 - <http://scholar.google.com/>
- Euclid – Project Euclid
 - <http://projecteuclid.org/>
- Springer – Springerlink
 - <http://www.springerlink.com/>

4.2. Comparison of existing capabilities

4.2.1. General

Website languages

All sites offer at least an English version. Some are multi-lingual at least at the top level (ZBMATH). CEDRAM offers an over-all English and French version even regarding titles and abstracts though not throughout consistently.

Contents

All except Springer, DZ, GDZ, Arxiv, Google are purely dedicated to mathematical and related contents though all but Google (just in a very broad sense together with computer science and engineering) allow for a restriction to mathematical contents.

In general, the term mathematics is seen in a broader sense including computer science/informatics (DSPACE) or physical contents (more or less all of them).

Preprints

Springer has the category Online-First, CEDRAM explicitly provides a list of preprints (articles to appear within periodicals). Arxiv has originally been a preprint server. Google harvests all content independent of its publication status.

Consistent layout/style of the sites

(With a focus on browse within periodicals) At EMIS, the layout varies (sometimes significantly) depending on the periodical. There are differences at CEDRAM as well. The rest offers a consistent layout (e.g., links are consistently located at the same screen positions throughout the contents) and consistent style (e.g., NUMDAM, Euclid, DMLE).

In general, two types are encountered; either individual pages for periodicals/book series and individual search-option (as well as global), e.g., CEDRAM, EMIS, Euclid, or a more library-like presentation with a global search and one layout giving just tables of contents and short information, e.g., NUMDAM, PVLS.

ZBMATH, Google, Arxiv, due to their nature, do not fall into these categories.

Formula display

Mostly, the type of formula display depends on the publication/periodicals itself and differs within sites, even within periodicals (except ZBMATH which uses MathML/TeX). This is especially the case for Arxiv. In general, TeX is displayed but also html-formatting is used

or special characters or nothing at all. Seldom, images are used. CEDRAM uses MathML, Euclid MathJax, to some degree (seemingly depending on the publication).

Type/Number of publications

CEDRAM	5 journals, 5 proceedings/seminars
NUMDAM	32 journals, 29 Journals
DMLE	22 journals, 2 books
ELIB	9 journals
PVLS	10 journals, 4 book series
DMLCZ	12 Journals, 6 proceedings, 3 book collections (ca. 47 books)
DZ	39 journals
GDZ	6094 volumes (3551 complete volumes of journals, 1635 monographs, etc.)
DSPACE	6 journals, 1 proceedings, 3 book series
EMIS	91 journals
ZBMATH	>3 million reviews
Euclid	64 journals, 1 proceedings, 6 book series
Springer	202 journals, 2 book series, 4783 books (and 10 reference works)
Arxiv	total 666,321 e-prints
Google	n/a

Retro-digitized

PVLS, NUMDAM, DMLCZ, CEDRAM, DMLE, ELIB, DSPACE, DZ, Google, Euclid, GDZ

Born digital

PVLS, NUMDAM, DMLCZ, CEDRAM, DMLE, ELIB, DSPACE, DZ, Google, Euclid, Arxiv, Springer, EMIS

For the last three points, see also the EuDML WP3 survey on Content, metadata, interoperability and harvest.

4.2.2. Access to full texts

Completely free access is provided by PVLS, ELIB, DSPACE, GDZ, Arxiv. DMLE, DMLCZ, CEDRAM, NUMDAM, EMIS are partially under a moving wall policy. For Springer (except for some), DZ (partially), Euclid (depending on the journal), a subscription is needed.

Formats of full texts

Full texts are available in PDF. Some delivery additionally in DVI, DJVU, postscript, and others.

Format of URLs

Some services have verbose URLs (i.e., intuitive ones, e.g., browsing in CEDRAM, http://aif.cedram.org/cgi-bin/browse?id=AIF_2005__55_7, where AIF stands for the journal name, Annales de l'Institut Fourier, 2005 for the year of publication, 55 for the volume number and 7 for the issue).

Persistent (permanent) links for documents are provided by all except EMIS, ELIB, DMLE, CEDRAM (though the URLs are very clear) using sometimes internal identifier GDZ, DZ, Arxiv, ZBMATH, DSPACE (uses URI identifier (hdl.handle.net)).

The names for downloadable full texts are, at least, decipherable for some (e.g., DSPACE, PVLS, CEDRAM http://aif.cedram.org/cedram-bin/article/AIF_2005__55_7_2209_0.pdf, again journal name, year, volume, issue, first page of the article), Springer names all downloads “fulltext”.

Help/hints/information on site

All but ELIB, EMIS (no help/hints), DMLCZ (and PVLS -- not working) provide help/hints and information.

Remarkable features/problems

A functioning English version (the provided link only works on the upper level) of DMLE is available under http://161.111.200.139/matematicas/en/portada_en.php.

PVLS jumps back to Polish version from time to time (still in development).

4.2.3. Access to/retrieval of contents

The typical tasks are browsing and searching:

Browse

All except GDZ and Google provide at least browsing within periodicals/collections (refined within volumes/issues/chapters, DMLE within years of publication, DSPACE via issue date, author or title after restriction to certain periodicals/collections).

Additionally, at a global level, some other categories are offered by PVLS (author, publisher, year of publication), DSPACE (author, title, subject, year of publication) and DMLCZ (author, title, subject). The latter also provides browsing by title or author within periodicals.

Arxiv, due to its different overall structure, provides only browsing by subjects (general fields mathematics, physics, etc. and disciplines as subcategories to these fields) and, therein, by submission dates/years.

As browsing options, Springer offers types of documents (books, journals, etc.), also the collections (see Contents above) and the subjects therein. Both can be combined in order to refine the domain to browse in.

ZBMATH has author, journal and MSC2010 (classification/subject) databases which do not comprise a browsing function like on the other sites insofar that a journal name, author name or subject has to be provided. Contrary to that, the other sites present list of contents (authors, subjects, journals, etc.) to browse within.

Refinement/sorting

Within collections, DMLCZ provides browsing by authors or titles. In DSPACE, each of the browsing categories can be sorted by title, issue and submit date in ascending or descending order. Springer permits refinements depending on the level as well as further refinement regarding subjects or collections (see the preceding paragraph). Within collections/subjects, results are sortable by title or date (depending on the level).

GDZ, DZ allow for refinement regarding categories (i.e., types of publications) and for sorting by author, title, year of publication/ date of import (in ascending/descending order).

Remarkable features/problems

GDZ allows only browsing within the complete list of mathematical publications available (except for some filtering, see Refinement/sorting).

Euclid presents differently sorted list of journals (subject, publisher, name).

Search

All, except ELIB (only within periodicals) and PVLS (only within advanced search), provide a simple search at the global level.

GDZ does not have an advanced search (not yet). Springer, Arxiv, Euclid, DZ, DMLE and ELIB provide a simple search within certain fields. For the latter three, this is the only search option.

Advanced search

The search is by default global with the exception of ELIB, where no global search is implemented. CEDRAM, Euclid and ELIB allow for a search function within the collections/periodicals presented there (including an advanced search). Most of the others offer an option to restrict to periodicals/collections/subjects.

The search mask is comprised in most cases of boxes to which a search field can be assigned to. These boxes are combinable by Boolean operators (except, e.g., EMIS and CEDRAM where the boxes are combined by AND).

Options/functionalities

All, but at least author and title as options.

TeX is included in the search at ZBMATH, Arxiv, DMLCZ, Springer, Google.

Search in references is provided by PVLS, NUMDAM, CEDRAM.

All provide at least one of the following options or allow some kind of restriction to them: publisher, source, type of publication.

The same applies for subjects (internal ones, e.g., Arxiv, or very broad ones, e.g., DSPACE), keywords (e.g., PVLS, Euclid) and MSC2010 classifications (e.g., ZBMATH, Arxiv).

A search function anywhere is provided by all either via an extra option or simple search (e.g., DSPACE). Full texts are included (e.g., PVLS, Google, EMIS (as far as the respective web pages allow for)) or not (e.g., DMLE, Euclid).

A full text search is included (sometimes though experimental) except for (DMLE, ELIB, ZBMATH) or can be excluded (e.g., CEDRAM).

Search for phrases and wildcards (" ", *) are working for all except for DMLE (both not working) and PVLS (phrases not working). Springer automatically wildcards, DMLCZ as well their search is very insensitive (see remarks).

Boolean operators are allowed by all. The default is either OR (ELIB, DSPACE, Arxiv, DMLCZ, Springer) or AND (the rest).

Search for documents in a particular language is supported by DSPACE, DMLCZ, ZBMATH, PVLS and Google.

Help/Hints are available except for EMIS, ELIB, DMLCZ (not working at PVLS). Arxiv, ZBMATH give help/hints on the search pages.

Refinement/sorting

To refine search results, in ZBMATH, NUMDAM (modified search), DSPACE, DMLCZ, EMIS and Google, the current search query can be extended. A filtering is offered at DMLCZ.

In GDZ, DZ and Springer, refinement into subcategories is possible (see also Browsing above for sorting options).

CEDRAM and Euclid allow for sorting of results as an option in the search mask.

DSPACE, NUMDAM, DMLCZ, DZ, GDZ, Springer, and PVLS present sorting options.

Remarkable features/problems

DMLCZ has a very insensitive search, e.g., a search for “reduction” also leads to results with “reductive”. This also seems to be the case for DSPACE.

NUMDAM crashes when searching for TeX.

Google includes citations (optional). Also, a query field for AND, OR, NOT and an exact phrase.

ZBMATH and Arxiv allow for a search using their internal identifiers.

4.2.4.Provided information

Information/overview on collections/publications

Naturally, no information in this regard is given by Google and Arxiv.

Some features provided, though not by all, are alternative names, publishers, ISSN, ISBN, links to web sites and related publications. The completeness of the information varies very significantly between the studied sites, sometimes even within one site.

Information on documents

All but ELIB (and Google) provide a detailed view for the documents.

More or less detailed sources (except Arxiv for obvious reasons and DSPACE giving only a partial one) are provided. English titles for non-English contents (though not always complete) are given except by NUMDAM, Arxiv, PVLS, DSPACE, Google and EMIS.

All but GDZ, DZ (and Google) offer (apparently) abstracts, Euclid and CEDRAM (at least partially) additionally in English if the contents is non-English, ELIB completely.

MSC2010 classifications are partially given on Springer and NUMDAM, not at DMLE, PVLS and Google. Otherwise, they are provided, though, in most cases, also inconsistently. At least partially, keywords and/or subjects are available.

BiBTeX and/or otherwise formatted metadata of the documents are offered by ZBMATH, GDZ, DZ, PVLS (BiBTeX without page numbers) and Springer.

The existence of translations or the original documents are remarked at ZBMATH and Springer.

References are provided by PVLS (very few), DMLCZ, CEDRAM, NUMDAM (not complete), Euclid (very few), Google and Springer (for subscribers).

Some also provide links to reviewing databases (MR/ZBMATH). Persistent links to the documents in form of internal identifiers, DOI numbers, and other external identifier or just as an URL are given except by EMIS, ELIB, DMLE, CEDRAM (and Google).

Remarks

GDZ, DZ provide Meta data for various levels (periodicals/volumes/issues/documents, METS-download) and transliterated titles, etc..

ZBMATH delivers reviews in XML, text, PDF, AMS-TeX, BibTeX.

ZBMATH provides an author index and author profiles (statistics about the author in connection with ZBMATH, different spellings of names).

4.2.5.Relation between/connectedness of contents

References

References are provided, although not complete for all available documents, by PVLS, DMLCZ, CEDRAM, NUMDAM, Euclid and Springer. These references are comprised of the bibliography of the respective document. ZBMATH provides references in connection with their reviews/abstracts.

CEDRAM, NUMDAM, DMLCZ, Springer and Euclid provide links to reviewing databases (MR/ZBMATH) and links within their domain.

Additionally, NUMDAM, CEDRAM, Euclid and Springer offer in some cases links to other services (DOIs, Arxiv, JSTOR, MathDoc, etc.). ZBMATH links occasionally to Arxiv or provides a DOI-link.

Related documents

Some, e.g., ZBMATH, CEDRAM, provide information and links to documents the present document is cited in. If in the domain (sometimes even outside), links to errata, predecessor/successor of a document are given or there is at least a remark. This is done by ZBMATH, Euclid, CEDRAM, NUMDAM, DMLCZ and partially by Arxiv, Springer.

Some also give links to related contents of other services and/or to publishers/abstracts.

4.3.Conclusions/Recommendations

Keep it simple! A clear and intuitive structure (less is more!) and consistent layouts for periodicals, browsing (e.g., like in NUMDAM) should be. The main focus should be on the results/contents.

Formula should be display in MathML or TeX.

Search

Simple (e.g., ZBMATH), advanced search comprised of boxes with assignable fields with combinable by selectable conjunctions (not too many categories, e.g., Euclid, author, title, anywhere, full text, subjects (short list, e.g., Springer)). Also, phrase search and wildcards

should be supported, a short help and/or hints should be provided on the same page as the search mask. Sorting of results (year, title, author) would be preferable.

Browse

Do not use too many categories. By author, or in periodicals by subjects¹. Within categories, as a refinement or alternative, browsing by title, author, subject could be given. Sorting for result lists could be provided by title, year, author.

Browse by title or an over-extensive list of subjects on a global level is clearly overkill (e.g., DSPACE, DMLCZ).

Provided information

For documents, again, keep it short and clear!

The following information should be provided: abstracts (preferably at least in English) with (if no references are provided) readable references therein, titles (original and in English), links to predecessor/successor, errata, other related documents and cited in (e.g., ZBMATH, NUMDAM (citations in NUMDAM) http://www.numdam.org/numdam-bin/item?id=ASNSP_1972_3_26_4_747_0}).

MSC2010 classifications should be provided (also a possibility to clarify the meaning of them).

References should be included (authors, title, source in short, inside/outside link to document if available (Arxiv, DOI), ZBMATH, MSC2010).

For authors, a short information, number of papers in EuDML, etc., for periodicals, ISSN, ISBN, publisher, existing volumes in EuDML, a link to gain access to publications of the periodicals not in EuDML (external home page, publisher's page), related publications (continuation of another periodical, etc.) should be provided. Preferably, when browsing, a short description on the periodical could be given at the top of each page. Further information should be provided as a link to a separate page or an outside page or the publisher.

Export of citations (BibTeX, etc.) should be offered.

Connectedness/relations

Browse combined with search as search within certain categories (like within a periodical or within authors) would be preferable.

Browse lists/ search results should not have too many entries per page by default; a possibility to change the number of entries could be provided. The amount of information should be restricted and be dependent on the type of list (search, browse and different types therein). Links should be intuitive and clear (e.g., not two leading to the same result). The title could lead to the detailed view (abstracts, etc.), the author name to a list of papers by the author. A full text link (e.g., Euclid, ZBMATH) could also be provided.

Format of URLs

Persistent links, verbose URLs, also for full text downloads would be preferable (see above under Format of URLs).

¹ Not too fine, e.g., Springer <http://www.springerlink.de/mathematics-and-statistics/> the frame at the left (browse) vs. DSPACE <http://sci-gems.math.bas.bg:8080/jspui/browse?type=subject>

5. Survey of EuDML Content Providers

5.1. EuDML partners

Acronym	Name	Collections	Country	Website
CMD	Cellule MathDoc (UJF/CNRS)	NUMDAM CEDRAM	FR	http://www.mathdoc.fr/
CSIC	Instituto de Estudios Documentales sobre Ciencia y Tecnología — IEDCYT	DML-E	ES	http://www.cindoc.csic.es/
EDPS	EDP Sciences	Math. journals	FR	http://publications.edpsciences.org/
FIZ	Fachinformations- zentrum Karlsruhe, Zentralblatt MATH	ELibM Zentralblatt MATH	DE	http://www.zentralblatt-math.org/
IMAS	Matematický ústav AV ČR, v.v.i.	DML-CZ	CZ	http://www.math.cas.cz/
IMI-BAS	Institute of Mathematics and Informatics – Bulgarian Academy of Sciences	BulDML	BG	http://www.math.bas.bg/
IU	Ionian University: Department of Informatics	HDML	GR	http://www.ionio.gr/depts/cs/

5.2. Content providers through an EuDML partner

In this section for each EuDML partner service description tables are presented. The data for these tables should be collected by questionnaire or data collection sheet. Tables are based on classification scheme of existing services, frequently used in digital libraries/archives/publishing systems and other content management systems (see Preliminaries and 3.1). It's not obligatory and not expected for each content provider to have all of these services. For each system, we survey groups of services for readers, authors, administrators and interoperability.

The outcomes of survey will identify the most used services by the content providers and therefore it facilitates choosing relevant services for EuDML project.

Filled-in data in forms with “No*” means without answer and assumed as no confirmation of service availability.

Acronym	Name	Collections	Partne r	Website
BNF	Bibliothèque nationale de France	Gallica-MATH Gallica-MATH/JMPA Gallica-MATH/OEUVRES	CMD	http://gallica.bnf.fr/ http://portail.mathdoc.fr/JMPA/ http://portail.mathdoc.fr/OEUVRES/
BNP	Biblioteca Nacional de Portugal	Digitized Portugaliae Mathematica	IST	http://www.bnp.pt/ http://purl.pt/index/pmath/PT/index.html

5.3. BNF: Gallica-Math (JMPA)

Bibliothèque nationale de France

Gallica-Math: Journal de Mathématiques Pures et Appliquées

Collection URL address: <http://portail.mathdoc.fr/JMPA/>

Readers services							
User interface							
Content presentation	html, pdf						
Content classification scheme	No*						
Content retrieval	pdf						
Browse and navigation	Browse issue, year						
Simple search	Yes (mini-DML)						
Advanced search	Yes (mini-DML)						
Web feeds	RSS				Atom		
	No				No		
Cross reference	No*						
Web 2.0 services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No	No	No	No	No	No	No
Statistical reporting	No						
User account (roles, groups)	No						
Email-alert (services related to the notification via e-mail)	No						
Online subscriptions (free access/ non-free paid, license model)	No						

Authors services	
<not implemented> (not available)	
Authors services, user account, email-alert, online subscriptions, online submissions and other services similar to readers.	
Online submissions (License model, copyright, ownership, terms of use, etc.)	No

Administrators services	
Users, groups, roles management	Yes

Metadata curation	Yes, (Metadata editor, Web editor)
Customizable workflow	Yes
Bulk import metadata	No
Bulk export metadata	No

Interoperability services (machine-to-machine interoperability services and protocols)	
OAI-PMH	No
OAI-ORE	No
SWORD	No
Harvesting	No
Persistent identifiers	Yes
Others	No

5.4. BNF: Gallica-Math (OEUVRES)

Bibliothèque nationale de France

Gallica-Math: Œuvres complètes

Collection URL address: <http://portail.mathdoc.fr/OEUVRES/>

Readers services							
User interface							
Content presentation	html, pdf						
Content classification scheme	No*						
Content retrieval	pdf						
Browse and navigation	Browse author, volume, table of content.						
Simple search	No						
Advanced search	No						
Web feeds	RSS					Atom	
	No					No	
Cross reference	No*						
Web 2.0 services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No	No	No	No	No	No	No
Statistical reporting	No						
User account (roles, groups)	No						
Email-alert (services related to the notification via e-mail)	No						
Online subscriptions (free access/	No						

non-free paid, license model)	
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Authors services

<not implemented> (not available)

Authors services, user account, email-alert, online subscriptions, online submissions and other services similar to readers.

Online submissions (License model, copyright, ownership, terms of use, etc.)	No
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Administrators services

Users, groups, roles management	Yes
Metadata curation	Yes, (Metadata editor, Web editor)
Customizable workflow	Yes
Bulk import metadata	No
Bulk export metadata	No

Interoperability services (machine-to-machine interoperability services and protocols)

OAI-PMH	No
OAI-ORE	No
SWORD	No
Harvesting	No
Persistent identifiers	Yes
Others	No

5.5. BNP: Portugaliae Mathematica

Biblioteca Nacional de Portugal

Digitized Portugaliae Mathematica

Collection URL address: <http://purl.pt/index/pmath/PT/index.html>

Readers services

User interface	
Content presentation	Images (PNG/JPG), PDF, TXT. Thumbnails available in JPG files. It's possible to consult the work page by page or download the PDF file
Content classification scheme	MathSciNet and Zentralblatt MATH identifiers
Content retrieval	No*
Browse and navigation	Browsing by author, publication date, volumes, articles: http://purl.pt/index/pmath/PT/index.html

Simple search	No*						
Advanced search	No*						
Web feeds	RSS				Atom		
	No*				No*		
Cross reference	No*						
Web 2.0 services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No*	No*	No*	No*	No*	No*	No*
Statistical reporting	No*						
User account (roles, groups)	No*						
Email-alert (services related to the notification via e-mail)	No*						
Online subscriptions (free access/ non-free paid, license model)	No*						

Authors services

<not implemented> (not available)

Authors services, user account, email-alert, online subscriptions, online submissions and other services similar to readers.

Online submissions (License model, copyright, ownership, terms of use, etc.)	No*
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Administrators services

Users, groups, roles management	No*
Metadata curation	No*
Customizable workflow	No*
Bulk import metadata	No*
Bulk export metadata	No*

Interoperability services (machine-to-machine interoperability services and protocols)

OAI-PMH	http://oai.bn.pt (set: Portugal Matematica)
OAI-ORE	No*
SWORD	No*
Harvesting	No*
Persistent identifiers	Yes, locally managed PURL resolver
Others	http://oai.bn.pt (set: Portugal Matematica)

5.6. CMD: CEDRAM

Cellule MathDoc

Centre de diffusion de revues académiques mathématiques

Collection URL address: <http://www.cedram.org/>

Readers services							
User interface							
Content presentation	XHTML with TeX and MathML formulas (full record), pdf (full text)						
Content classification scheme	MSC						
Content retrieval	pdf						
Browse and navigation	Browse by journal, issue, author, and year. Sort by year and author						
Simple search	Yes						
Advanced search	Yes. Search on references						
Web feeds	RSS				Atom		
	No				No		
Cross reference	Yes: MathSciNet, Zentralblatt, internal references, references to cited articles through mini-DML						
Web 2.0 services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No	No	No	No	No	No	No
Statistical reporting	No						
User account (roles, groups)	No						
Email-alert (services related to the notification via e-mail)	No						
Online subscriptions (free access/ non-free paid, license model)	No						

Authors services	
<not implemented> (not available)	
Authors services, user account, email-alert, online subscriptions, online submissions and other services similar to readers.	
Online submissions	No

(License model, copyright, ownership, terms of use, etc.)	
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Administrators services	
Users, groups, roles management	Content generation, Web editor, Metadata transformations
Metadata curation	Yes
Customizable workflow	Yes
Bulk import metadata	No: metadata is generated from data. Bulk import data: Yes.
Bulk export metadata	Yes

Interoperability services (machine-to-machine interoperability services and protocols)	
OAI-PMH	Yes
OAI-ORE	No
SWORD	No
Harvesting	No
Persistent identifiers	Yes
Others	No

5.7. CMD: NUMDAM

Cellule MathDoc

Numérisation de documents anciens mathématiques

Collection URL address: <http://www.numdam.org/>

Readers services							
User interface							
Content presentation	HTML/TeX formulas (full record page with bibliographic ref., abstracts, bibliographies), pdf, djvu (full texts)						
Content classification scheme	MSC (not for every item)						
Content retrieval	pdf, djvu						
Browse and navigation	Browse by journal, issue, author, and year. Sort by year and author						
Simple search	Yes						
Advanced search	Yes. Search on references						
Web feeds	RSS				Atom		
	Yes				No		
Cross reference	Yes: MathSciNet, Zentralblatt, internal references, references to cited articles through mini-DML						
Web 2.0 services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No	No	No	No	No	No	No

Statistical reporting	Internally yes, no such data exported to third parties
User account (roles, groups)	No
Email-alert (services related to the notification via e-mail)	No
Online subscriptions (free access/ non-free paid, license model)	No

Authors services	
<not implemented> (not available) Authors services, user account, email-alert, online subscriptions, online submissions and other services similar to readers.	
Online submissions (License model, copyright, ownership, terms of use, etc.)	No

Administrators services	
Users, groups, roles management	Web editor, Metadata editor, End-user files generation
Metadata curation	Yes
Customizable workflow	Yes
Bulk import metadata	Yes
Bulk export metadata	Yes

Interoperability services (machine-to-machine interoperability services and protocols)	
OAI-PMH	Yes
OAI-ORE	No
SWORD	No
Harvesting	No
Persistent identifiers	Yes
Others	No

5.8. CSIC: DML-E

Consejo Superior de Investigaciones Científicas Biblioteca Digital Española de Matemáticas

Collection URL address: <http://dmle.cindoc.csic.es/>

Readers services							
User interface							
Content presentation	html, pdf						
Content classification scheme	CDU						
Content retrieval	pdf						
Browse and navigation	Yes						
Simple search	Yes						
Advanced search	Yes						
Web feeds	RSS				Atom		
	No				No		
Cross reference	No						
Web 2.0 services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No	No	No	No	No	No	No
Statistical reporting	No						
User account (roles, groups)	No						
Email-alert (services related to the notification via e-mail)	No						
Online subscriptions (free access/ non-free paid, license model)	No						

Authors services	
<not implemented> (not available)	
Authors services, user account, email-alert, online subscriptions, online submissions and other services similar to readers.	
Online submissions (License model, copyright, ownership, terms of use, etc.)	No

Administrators services	
Users, groups, roles management	Administrator, introducing data and users
Metadata curation	No
Customizable workflow	No
Bulk import metadata	Yes
Bulk export metadata	Yes

Interoperability services (machine-to-machine interoperability services and protocols)	
OAI-PMH	No
OAI-ORE	No
SWORD	No
Harvesting	No
Persistent identifiers	No
Others	No

5.9. FIZ: ElibM

Fachinformations-Zentrum Karlsruhe

The Electronic Library of Mathematics (ELibM)

Collection URL address: <http://www.emis.de/ELibM.html>

Readers services							
User interface							
Content presentation	HTML, PostScript, PDF						
Content classification scheme	MSC						
Content retrieval	Multiple formats						
Browse and navigation	Browsing by journal						
Simple search	Yes						
Advanced search	No						
Web feeds	RSS				Atom		
	No				No		
Cross reference	Linking from and to Zentralblatt MATH						
Web 2.0 services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No	No	No	No	No	No	No
Statistical reporting	Yes, (Only internal, not publicly available)						
User account (roles, groups)	No						
Email-alert (services related to the notification via e-mail)	No						
Online subscriptions	Depending on journal.						

Authors services	
<not implemented> (not available)	
Authors services, user account, email-alert, online subscriptions, online submissions and other services similar to readers.	
Online submissions (License model, copyright, ownership, terms of use,	No

etc.)	
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Administrators services	
Users, groups, roles management	No
Metadata curation	Only via interoperability with ZBMATH
Customizable workflow	Available for: journal production, mirroring, metadata import, metadata export
Bulk import metadata	No
Bulk export metadata	Yes

Interoperability services (machine-to-machine interoperability services and protocols)	
OAI-PMH	No
OAI-ORE	No
SWORD	No
Harvesting	Yes (proprietary methods based on analysis of HTML)
Persistent identifiers	Yes (ZBMATH number)
Others	Mirroring procedures (import: journals, export: whole site)

5.10. IMAS: DML-CZ

Institute of Mathematics of the Academy of Sciences of the Czech Republic Czech Digital Mathematics Library

Collection URL address: <http://dml.cz/>

Readers services		
User interface		
Content presentation	File types of stored items for presentation: PDF (web optimized by ghostscript for fast web view – linearization; created from internally collected html, MathML, TeX, ps, pdf, tiff, png).	
Content classification scheme	MSC	
Content retrieval	Optimized for Googlebot – every publication, even behind moving wall, has landing page in valid HTML with all metadata. All paper landing pages have metadata also in non-visible meta tags in format negotiated with Google for Google Scholar. References in journal articles presented as part of metadata in landing pages..	
Browse and navigation	Browsing by author, subjects, title, collections, type of item (journals, proceedings, monographs, etc.) and by semantic similarity computed from full texts of DML-CZ and NUMDAM. Content filtering (new, recent, key words, subject, similar, sort results), service for personalized seeking of similar articles/documents.	
Simple search	Searching in full texts and metadata by character sequences (utf8 strings).	
Advanced search	Advanced search in metadata by character sequences providing any combination of searching at the same time by multiple selected scopes of search (collection, title, author, language, MSC, year, ZBMATH identifier, MR identifier), linked with conditional logical operators AND, OR, NOT.	
Web feeds	RSS	Atom

	Not [yet]			Not [yet]			
Cross reference	Paper cross references are handled and exposed as metadata. Linking against ZMATH, MR and DML-CZ itself.						
Web 2.0 services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No	No	No	No	No	No	No
Statistical reporting	Only limited (e.g. in MSC browsing – article counts). Rich statistics generated internally (in Metadata Editor) only without their on-the-fly exposition. DML-CZ usage statistics generated by Google Analytics.						
User account (roles, groups)	No						
Email-alert (services related to the notification via e-mail)	No, only for administration purposes (feedback form, admin trigger events).						
Online subscriptions	Free access according to the moving wall policy of publishers (vast majority of content freely available)						

Authors services							
User interface							
Content presentation	Same as readers						
Content classification scheme	Same as readers						
Content retrieval	Same as readers						
Browse and navigation	Same as readers						
Simple Search	Same as readers						
Advanced Search	Same as readers						
Web feeds	RSS				Atom		
	No				No		
Cross Reference	Paper cross references are handled and exposed as metadata. Linking against ZMATH, MR and DML-CZ itself.						
Web 2.0 Services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No	No	No	No	No	No	No
Statistical reporting	Count/listing of author's items in DML-CZ						
User account (roles, groups)	No						
Email-alert	No						
Online subscriptions (free access/ non-free paid, license model)	Nothing special for authors						
Online submissions (License model, copyright,	Online submissions of new born-digital content are set up with journal publishers on the basis of individual contracts. The publishers remain owners of the digital content and grant the library operator a license to provide free access to the digital content for non-commercial personal use. Every document in the digital library is provided with a flyleaf containing an information about						

ownership, terms of use, etc.)	copyright and terms of use.
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Administrators services	
Users, groups, roles management	User can be any interested subject, there is no role management.
Metadata curation	Yes, we do a lot of metadata enhancements (title translations to English, reference editing, IdMR/IdZBMATH lookup, continuation/related articles interlinking, computation of similar articles, etc.)
Customizable workflow	Workflow in data production phase is very customisable via Metadata Editor (ME) - web application allowing hand and semiautomated procedures for input data editing, filtering, validation and conversion. The journal publishers are provided with special software procedures which enable them to produce inputs (new journal issue) for the digital library as by products of their typesetting process. Validating procedures enable them to check the formal correctness and completeness of data to be imported into DML-CZ digital library..
Bulk import metadata	Journal issues are being imported in one bulk from publishers
Bulk export metadata	Yes (for some publishers, goglebot)

Interoperability services (machine-to-machine interoperability services and protocols)	
OAI-PMH	Yes, in different schemas (tagged DC currently available, NLM under development)
OAI-ORE	No
SWORD	No
Harvesting	Yes
Persistent identifiers	Yes, the Handle System is used.
Others	No

5.11. IMI-BAS: BulDML

Institute of Mathematics and Informatics at Bulgarian Academy of Sciences Bulgarian Digital Mathematics Library

Collection URL address: <http://sci-gems.math.bas.bg>

Readers services	
User interface	
Content presentation	File types of stored items for presentation: pdf
Content classification scheme	No
Content retrieval	pdf, txt, every publication has exportable DC metadata
Browse and navigation	Browse by community, collection, title, author, issue, year,
Simple search	Yes
Advanced search	Advanced search in metadata by any combination of searching at the same time by multiple selected scopes of search (collection, title, author, language, year, identifier),

	with conditional logical operators AND, OR, NOT.						
Web feeds	RSS				Atom		
	Yes [but disabled]				No		
Cross reference	Article itself referencing are handled by prefixes assigned and resolved by Hadle.NET system.						
Web 2.0 services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No	No	No	No	No	No	No
Statistical reporting	No						
User account (roles, groups)	Yes, defined user groups: submitters, administrator						
Email-alert	Yes						
Online subscriptions	Free access according to the policy of publishers. (all available content with free open access)						

Authors services	
Nothing special for authors	
Online submissions	Online submission is available for authors according to the policy of publishers. Every document in the digital repository is provided with a flyleaf containing information about copyright and terms of use.

Administrators services	
Users, groups, roles management	Yes, management for users and groups
Metadata curation	Yes, (As of release 1.7, DSpace supports Curation System and can running curation tasks)
Customizable workflow	Yes
Bulk import metadata	Yes
Bulk export metadata	Yes

Interoperability services (machine-to-machine interoperability services and protocols)	
OAI-PMH	Yes
OAI-ORE	No
SWORD	Yes
Harvesting	No
Persistent identifiers	Yes (prefixes assigned and resolved by Handle.NET System)
Others	No

5.12. IU: HDML

Ionian University: Department of Informatics
Hellenic Digital Mathematics Library

Collection URL address: <http://sci-gems.math.bas.bg>

Readers services							
User interface							
Content presentation	html, pdf						
Content classification scheme	No*						
Content retrieval	pdf						
Browse and navigation	Yes						
Simple search	Yes						
Advanced search	Yes						
Web feeds	RSS				Atom		
	No				No		
Cross reference	No*						
Web 2.0 services	Tagging	Comments	Ratings	Reviews	Bookmarks	Share this	Other
	No	No	No	No	No	No	No
Statistical reporting	No						
User account (roles, groups)	No						
Email-alert	No						
Online subscriptions	No						

Authors services	
<not implemented> (not available)	
Authors services, user account, email-alert, online subscriptions, online submissions and other services similar to readers.	
Online submissions	No

Administrators services	
Users, groups, roles management	Administrator (edit data and users) Browsing user (browse content)
Metadata curation	No
Customizable workflow	No
Bulk import metadata	Yes
Bulk export metadata	Yes

Interoperability services (machine-to-machine interoperability services and protocols)	
OAI-PMH	No
OAI-ORE	No
SWORD	No
Harvesting	No
Persistent identifiers	No
Others	No

6. Generalized tables for content providers

Supported content file types (content storage, description and presentation)										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
Documents format (pdf, ps, ...):	pdf	pdf	pdf	pdf	pdf			pdf	pdf	pdf
Images format (jpeg, gif, png,...):								tiff, png		
Other:	html	html	html		djvu			html, MathML, TeX, ps, pdf,	DSpace can hold any file format	
Supported metadata formats										
<i>Dublin Core:</i>	No	No	No	No	No	-	-	Yes	Yes	No
<i>Qualified DC:</i>	No	No	No	No	No	-	-	Yes	Yes	No
<i>METS:</i>	No	No	No	No	No	-	-	-	Yes	No
<i>MARC:</i>	No	No	No	No	No	-	-	-	No	No
<i>Other:</i>	mini-DML and/or NLM archiving	mini-DML and/or NLM archiving	BNP Schema	NLM Journal archiving	NLM Journal archiving	To be decided	To be decided	To be decided	No	GAF DTD

Simple searching										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
Default domain or scope of search (titles, abstracts, inside documents)	Yes (minidml)	No	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Sorting options:	No	No	No	Yes	Yes	not checked	not checked	Yes	Yes	not checked

Advanced searching										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
Field-specific:	Yes	No	No	Yes	Yes	Yes	No	Yes	Yes	Yes
Boolean logic:	No	No	No	No	No	not checked	No	Yes	Yes	not checked
Sorting options:	Yes	No	No	Yes	Yes	not checked	No	Yes	Yes	not checked

Content classification services (default subject classes)										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
Mathematics Subject Classification (MSC)	No*	No*	No*	Yes	Yes (not for every item)	No	Yes	Yes	No	No
DDC:	No*	No*	No*	No*	No	No	No	No	No	No
UDC:	No*	No*	No*	No*	No	No	No	No	No	No
Other:	No*	No*	No*	No*	No	Yes, (CDU)	No	No	No / but DSpace is completely Configurable (Administrator defined Controlled vocabularies)	No

Web feeds and syndication										
<i>RSS:</i>	No	No	No	No	Yes	No	No	Not [yet]	Yes [but disabled]	No
<i>Atom:</i>	No	No	No	No	No	No	No	Not [yet]	No	No

Web 2.0 services										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
<i>Tagging</i>	No	No	No	No	No	No	No	No	Not [yet]	No
<i>Comments</i>	No	No	No	No	No	No	No	No	Not [yet]	No
<i>Ratings</i>	No	No	No	No	No	No	No	No	Not [yet]	No
<i>Reviews</i>	No	No	No	No	No	No	No	No	Not [yet]	No
<i>Bookmarks</i>	No	No	No	No	No	No	No	No	Not [yet]	No
<i>Share this</i>	No	No	No	No	No	No	No	No	Not [yet]	No
<i>Other Web 2.0</i>										
Statistical reporting										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
<i>size</i>	No	No	No	No	No	No	-	-	No	No
<i>diversity</i>	No	No	No	No	No	No	-	-	No	No
<i>self-counting</i>	No	No	No	No	No	No	-	-	Yes	No
<i>count of total items</i>	No	No	No	No	No	No	-	-	No	No
<i>top downloads</i>	No	No	No	No	No	No	-	-	No	No
<i>top cited</i>	No	No	No	No	No	No	-	-	No	No
<i>collection growth over time</i>	No	No	No	No	No	No	-	-	Yes	No
<i>other</i>	No	No	No	No	No	Yes	Yes	Yes	Yes	No

Administrators' functions										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
<i>Users, groups, roles management</i>	Yes	Yes	No*	Yes	Yes	Yes	No	Yes	Yes	Yes
<i>Metadata curation</i>	Yes	Yes	No*	Yes	Yes	No	Yes	Yes	Yes	No
<i>Customizable workflow</i>	Yes	Yes	No*	Yes	Yes	No	Yes	Yes	Yes	No
<i>Bulk import metadata</i>	No	No	No*	Yes (data)	Yes	Yes	No	Yes	Yes	Yes
<i>Bulk export metadata</i>	No	No	No*	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Machine-to-machine interoperability services and protocols										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
<i>OAI-PMH:</i>	No	No	No*	Yes	Yes	No	No	Yes	Yes	No
<i>OAI-ORE:</i>	No	No	No*	No	No	No	No	No	No	No
<i>SWORD:</i>	No	No	No*	No	No	No	No	No	Yes	No
<i>SWAP:</i>	No	No	No*	No	No	No	No	No	No	No
<i>RDF:</i>	No	No	No*	No	No	No	No	No	No	No
<i>RoMEO Integration:</i>	No	No	No*	No	No	No	No	No	No	No
<i>Other:</i>	No	No	No*	No	No	No	Yes	No	No	No

Technical specifications of content providers systems

Software platforms										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
Software name	Unknown	Unknown	Unknown	<i>SPI / EDBM 2</i>	<i>SPI / EDBM 2</i>	Unknown	Unknown	DSPACE <i>(with proprietary extensions and customization)</i>	DSPACE	Unknown
License / open source free commercial	Unknown	Unknown	Unknown	Free	Free	Unknown	Unknown	Open source Free	Open source Free	Unknown
Software project URL if available to download and use	N/A	N/A	N/A	N/A	N/A	N/A	N/A	http://www.dspace.org/	http://www.dspace.org/	N/A

Software platforms and dependencies										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
Operating systems										
<i>LINUX:</i>	Yes	Yes		Yes	Yes			Yes	Yes	Yes
<i>UNIX:</i>										
<i>SOLARIS:</i>										
<i>Windows:</i>						Yes				
<i>Mac OS X:</i>										
<i>Other:</i>										
Databases										
<i>MySQL:</i>	Yes	Yes		Yes	Yes	Yes		Yes		Yes
<i>Oracle:</i>										
<i>PostgreSQL:</i>								Yes	Yes	

Microsoft SQL Server:										
Cloud Storage:										
Other:										
Scripting languages										
Java:					Yes			Yes	Yes	
PERL:		Yes		Yes	Yes			Yes	Yes	
PHP:	Yes	Yes		Yes	Yes	Yes				Yes
JavaScript:								Yes	Yes	Yes
AJAX:		Python		Python	Python			Yes		Yes
Other:	Python							Ruby, bash, and many others (in data preparation)		

Services for training users and consultancy										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML- E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
Training:	-	-	-	-	-	-	-	No, trying to design self-explanatory system	Provided training resources by developer of DSpace software	-
Consultancy:	-	-	-	-	-	-	-	Feedback form	Feedback form	-
Other:	-	-	-	-	-	-	-	Consultancy to publishers	-	-

User validation										
Content provider/ collection	BNF/ Gallica-Math (JMPA)	BNF/ Gallica-Math (OEUVRES)	BNP/ Port. Mat.	CMD/ CEDRAM	CMD/ NUMDAM	CSIC/ DML-E	FIZ/ ElibM	IMAS/ DML-CZ	IMI-BAS/ BulDML	IU/ HDML
Registration Required:	-	-	-	-	-	-	-	No	Yes	-
LDAP Authentication:	-	-	-	-	-	-	-	No	Yes	-
Other:	-	-	-	-	-	-	-	Registered users only in metadata editor web application	No	-