DogitaLS1: the Dortmund digital library system

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This paper presents DogitaLS1, the Dortmund digital library system. DogitaLS1 uses Hyper-G, a second generation Internet Information system, as underlying WWW-server technology. The main emphasis is placed on two different goals that are important for digital libraries: structuring heterogeneous document collections and providing services for patrons and librarians. Concerning the structure of the document collection, the concepts provided by Hyper-G are exploited. Concerning the services, the tasks that both a patron and a librarian typically perform are examined. Then, we describe the services that have been implemented in DogitaLS1 to cover these different tasks. The paper also deals with how services can be embedded in the structure of a digital library if the digital library system is based on Hyper-G. Beyond this, this paper introduces services that do not have an analogue in conventional libraries but that have now become possible due to the technology used. Since DogitaLS1 is one of the few digital library systems based on Hyper-G, this paper might also be helpful to all who intend using Hyper-G as a substrate for implementing a digital library.

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1. Introduction

The Internet and World Wide Web (WWW) afford libraries new possibilities to disseminate information. For instance, many libraries are already offering a WWW-Z39.50 interface to allow patrons access from the WWW to their on-line public access catalogues (OPAC). Beyond this, public ftp sites, gopher sites, or repositories of Internet resources are also accessible (e.g. visit the home page of the Library of Congress [1]). In the near future, digital documents will belong to the document collection of a library as well. The significance of this new trend was recognized by the most important funding organizations in both the U.S. and Europe. As a result, NSF/APRA/NASA are funding the National Digital Library Initiative in the U.S. [2]. The European Community is funding about 70 different digital library projects in their programme ‘Telematic for Libraries’ [3].

Since these trends are changing the definition of what a conventional library is, the terms ‘digital library’ and ‘digital library system’ have come into use. In accordance with Gladney et al. [4], we view a digital library as extending the holdings of a conventional library into digital documents and Internet resources. An Internet resource is a link to other digital documents which are stored elsewhere on the Internet. Thus, only the link is under the control of the library, not the document to which the link points. Additionally, a digital library provides digital catalogues, containing meta-data about the holdings (i.e. digital documents, Internet resources, and physical documents like books, journals, etc.). According to Nürnberg et al. [5], a ‘digital library system’ consists of several components: client and server computing system and tools supporting
interaction among people and between people and client or sever software. A digital library system must accomplish, as far as possible, all necessary services of conventional libraries and must also exploit the advantages of the technology used.

This paper reports about the digital library system called DogitaLS1. DogitaLS1 is an acronym for ‘The Dortmund Digital Library System of LS1’ (LS1 is the name of the lab in the Computer Science Department at Dortmund University). DogitaLS1 is being developed at the LS1 of the Computer Science Department at Dortmund University, Germany. It is based on the widely adopted second generation Internet information system Hyper-G or HyperWave (the term ‘Hyper-G’ will be used throughout this paper). The remainder of the paper is structured as follows: After having given a brief introduction to Hyper-G in Section 2, Section 3 describes the structure of DogitaLS1. It also shows how the concepts of Hyper-G are exploited for organizing the holdings of DogitaLS1. In Section 4, the different services for patrons and librarians that are available in DogitaLS1 are described. General experiences in the project and with using Hyper-G are discussed in Section 5. As a conclusion, Section 6 addresses open issues in DogitaLS1 as well as ideas for future digital library systems. Sections 5 and 6 also relate the authors’ research of the existing literature.

2. Hyper-G at a glance

Hyper-G is a second generation Internet information system that is being developed under the leadership of Hermann Maurer and Frank Kappe at the Institute for Information Processing and Computer Supported New Media (IICM) at Graz University (Austria). Hyper-G server software is available for several different operating systems (e.g. SUN Sparc, IBM AIX). The client software runs under Microsoft Windows (Amadeus) and under UNIX (Harmony). All of the Hyper-G software (i.e. servers, clients, protocols, etc.) is compatible with the WWW.

The key features of Hyper-G include:

- collections allowing a set of documents to be organized hierarchically. A session manager (Fig. 1) is provided to work on and to display the collection hierarchy. Several document viewers (e.g. for Postscript, HTML, MPEG, VRML, etc.) exist to display the content of documents.
- an object-oriented database to store documents and meta-information about them.
- an integrated search engine for meta-information such as titles, keywords, and author as well as for full text. It is also possible that the result of a search query can be defined to be the search space for further queries.
- a link database in which all links are stored. Links are separated from documents and they are also bi-directional. This is exploited to guarantee link consistency in Hyper-G.
- a pre-defined set of attributes which can be defined for each Hyper-G object (e.g. the keyword attribute can be used to store meta-information about collections or documents).
- access control through user names, passwords and hierarchically structured user groups.

More information about Hyper-G can be found in the book ‘HyperWave—The Next Generation Web Solution’[6,7].
3. Structure of DogitaLS1

The aim of our research is to define organizational structures for digital libraries that provide a heterogeneous document collection. In the present case, such a heterogeneous collection comprises catalogues for (physical) books, digital documents including metadata, and Internet resources. Additionally, a special emphasis is placed on services supporting both patrons and librarians in their day-to-day work in a digital library. Unfortunately, for now, the issues related to services for publishers and authors have not been addressed (c.f. Section 6). A more detailed description of how the concepts offered by Hyper-G were exploited to organize the holdings in DogitaLS1 can be found in [8].

3.1 Structure of the holdings in DogitaLS1

To organize the holdings of DogitaLS1 three collections for documents were installed (‘Catalogues’, ‘Digital Documents’ and ‘Internet Resources’), one for services (‘Services’), one for private workspaces (‘Workspaces’), and one for an on-line help (‘Online Help’) (Fig. 1). Documents within collections are represented by a document icon followed by the title of the document (e.g. ‘Introduction to DogitaLS1’ in Fig. 1). Double-clicking on the icon brings up a document viewer to display the document’s content.

3.1.1 Catalogues. The collection ‘Catalogues’ includes an alphabetic catalogue in which meta-data about all books, journals, etc. of the research library are stored by means of Hyper-G documents. The title of such a document contains information
about authors, title and publication year of the document for which it provides metadata. Other useful information, such as keywords, are stored in the keyword attribute. As a result, a title search can be used to search for books by author’s name, title, or publication year. In addition, a keyword search can be used for searching for documents by means of keywords.

3.1.2 Digital documents. Digital documents (e.g. research reports, publications, etc. written by members of the research lab) are gathered in this collection. According to Kahn and Wilensky [9], the concept of ‘digital objects’ was used to store digital documents in DogitaLS1. In their notion, a digital object can be regarded as a content-independent package. The principal components are a unique identifier for the digital object and data. The data in a digital object may take multiple forms (e.g. Postscript, HTML, etc.). Since collections have a server-wide unique identifier and can also contain documents of different formats, they are used to model digital objects. In addition to the different formats of a document, each digital object (i.e. a collection) contains metadata about the document it represents (c.f. [8]). Note that the collections are exploited in two different ways: they are used to define the overall structure of the holdings in DogitaLS1 and to model digital objects. One might object that this is irritating from a conceptual perspective. The authors, however, have found no other way to represent digital objects in Hyper-G.

3.1.3 Internet resources. This collection contains links to interesting resources available on the Internet. Each link is represented as a Hyper-G document and, thus, is displayed in the same manner as a document. Another advantage is that a title or keyword search can be applied for links as well. Figure 2 shows the collection ‘Internet Resources’.
The documents are links which point to other resources on the Internet (e.g. the ‘D-Lib Magazine’ which is stored on a server in the U.S.).

3.2 Services and workspaces in DogitaLSI

This section shows how services were stored for different types of users and how they were made available. In DogitaLSI, a service is a CGI script which is connected to an HTML form. The services, themselves, are described in Section 4.

The basic ideas are to store all services at a central place in DogitaLSI and to provide only logical copies of the services users need. Therefore, two collections were set up called ‘Services’ and ‘Workspaces’. The collection ‘Services’ contains other collections for the different kinds of services DogitaLSI provides (Fig. 3). For example, in the collection ‘Librarian Services’ all services (i.e. HTML forms) for librarians are found (e.g. a service for cataloguing books, for consistency check of Internet resources, etc.). Public Services (i.e. services that are needed by all librarians or by all patrons) are accessible freely and, thus, they are not protected by a password. Other services that are only needed by a certain group of librarians, however, are stored in subcollections of the collection ‘Services’. These subcollections are protected by a password and, hence, they are hidden to users who are not eligible to use those services.

The collection ‘Workspaces’ contains workspaces (i.e. collections) for single librarians and for groups of librarians performing the same tasks. In these workspaces, logical copies of the required service from the collection ‘Services’ or from its subcollections
can be stored. For example, logical copies are useful if a librarian needs only one but not all services stored in a sub-collection of the collection 'Services'. In addition, the collection 'Workspace' also permits patrons or virtual working groups to have private space where they can store private documents (e.g. Internet resources). Privacy is maintained through using the access rights of Hyper-G.

4. Services in DogitaLS1

This section describes different types of services needed in digital libraries. In Section 4.1 we investigate how patrons typically use a traditional library. In addition, it is necessary to exploit the advantages of the technology used in the digital library; the latter lead to services for patrons that do not have an analogue in the traditional library. Section 4.2 briefly focuses on services for librarians needed for installing user accounts, supporting patrons, etc.

4.1 How do patrons work in a library?

Basically, two main activities are performed by patrons in libraries: browsing/searching and working (Fig. 4). Typically, patrons browse and search in a library if they are seeking less directed (browse) or more directed (search) literature needed for their research.

Since journals, books, etc. are available in libraries, patrons often prefer to work there rather than at home where only little literature is available. To support this, libraries normally provide desks and working rooms. It is important, however, to note that the two activities, browsing/searching and working, can not be separated completely from each other (this is indicated by the dotted line in Fig. 4). For example, often a patron starts working in the library but eventually ends up searching for documents that are required for continuing work.

Since libraries can also be considered as meeting places [10], one might argue that communicating is a main activity as well. As we see it, communicating, itself, is not characteristic of what patrons do in a library (e.g., a patron would probably not go to a library just for communicating) but communicating is certainly indispensable for performing the other two activities.

As Fig. 4 shows, there are different ways in which patrons browse/search and work in a library.
4.1.1 Browsing/searching. Browsing and searching are activities a patron can do without or with the support of librarians. Normally, patrons make use of the search possibilities (e.g. catalogues, OPACs) offered by the library with which they are familiar; thus, support is not required. Sometimes, however, patrons have to rely on the help and support of librarians. There appear to be two different ways (permanent/occasionally) in which patrons can ask for support. For example, in traditional libraries permanent support from the library can be found when a patron gets copies of the content of chosen journals on a regular base. By contrast, occasionally patrons want to search commercial on-line databases which comprise catalogues of holdings of other libraries and which often require special skills of librarians.

4.1.2 Working. Often, patrons prefer to work in a library rather than at home. Certainly, one reason is that most people are less distracted in a library than at home. Another reason is that most of the required literature is normally quickly accessible. Working in a library can take two different forms: alone, or in a group. For example, a patron works alone if he is writing his thesis. Group work is more likely if patrons have to collaborate with colleagues in a joint project. Since different ways of collaboration exist, we differentiate between a loosely connected and a tightly connected form of group working.

Normally, at universities advisors or instructors are only loosely connected to the different groups in their class. For example, this means that they can supervise the way a group pursues solving a given problem but they are not an active member of the group. The students involved in the group are tightly connected to it. They can discuss with other members of the group, they make suggestions and, thus, influence the direction of the group.

4.2 Services for patrons in DogitaLS1

One of our aims in DogitaLS1 is to provide different services covering the different forms of how patrons work in a library.

4.2.1 Browsing/searching without support. Patrons can browse the holdings of DogitaLS1 by using the alphabetic catalogue for physical books and journals. They can use a classification scheme for digital documents and Internet resources. Additionally they can use the search engine of Hyper-G for a more directed search (c.f. [8]).

4.2.2 Browsing/searching with permanent support. A service is being developed which permits patrons to define a personal profile. For example, whenever a new document (e.g. traditional book, Internet resource, or digital document) is catalogued, the profile service puts a message (i.e. an HTML document) in the patron’s private workspace if the profile matches some characteristics (Fig. 5) of the new document. The workspace is determined by the user’s login name. The advantage of this approach is that patrons do not need to have e-mail accounts. Still, optionally, it is also possible that a patron specifies an e-mail address to which an automatically generated e-mail is sent. Patrons can modify or delete their profiles at any time.

Figure 5 displays the profile form patrons use to get informed about new traditional books. It shows that a patron wants DogitaLS1 to inform him about new books (5)
that are published either by Springer or by Addison Wesley (2). The books should deal with hypermedia or multimedia (3) and should belong either to the category ‘Information Systems’ or ‘Software’ (4). Besides getting a document in his workspace, he also wants to get informed by an e-mail (6).

4.2.3 Browsing/searching with occasional support. For occasional support patrons fill in a form with information about what they are seeking. As a result, an automatically generated document is put in the workspace of the responsible librarian. After the librarians have performed the search, the results can either be sent as e-mail to the patron or can be put as HTML document in his workspace. The advantage of HTML documents is that the search result can be a collection of links to documents that matched the query. Thus, patrons can easily access the documents by following these links.

4.2.4 Working alone. The collection ‘Workspace’ permits patrons to have their private space (i.e. collections) where they can store private documents (e.g. Internet resources,
logical copy of digital documents, etc.). Privacy is maintained through using the access rights granted by Hyper-G.

4.2.5 **Collaborate tightly or loosely connected to a group.** Patrons are able to set up a virtual group which has a common workspace (i.e. a collection in DogitaLS1). The access rights to the group depend on whether a member is tightly or loosely connected to the group. Tightly connected members have read and write access while loosely connected members have read access only. We exploit Hyper-G’s ability to annotate documents or other annotations to share information about the same document among members of a virtual group. Finally, at any time, new members can join or quit the group.

An important issue in CSCW addresses possibilities of obtaining some idea of what colleagues have recently done. This issue is referred to as cooperation awareness. Since awareness is important for virtual groups, we are integrating corresponding features. To do this, we use a function of Hyper-G that determines which user created which documents during a certain period of time.

Notice boards are another form of supporting collaboration in a library. DogitaLS1 provides different notice boards for the different topics. Patrons can add new messages and also comment on existing messages. Hence, collaboration is possible. To avoid too many documents in a notice board, each document has an expiry date after which it and its comments are removed automatically. Unlike virtual groups where the members know each other, a patron is not aware of who reads the messages he attaches to a notice board. In contrast to this, he normally knows who commented on his message unless a message is attached anonymously to the notice board. Notice boards are represented as follows: for each notice and each comment, a new HTML document is created and stored elsewhere in DogitaLS1. When users access the notice board a HTML page is created dynamically. This dynamic HTML page (i.e. the notice board) contains only the headers of the original notices followed by the headers of corresponding comments including creation date and user name. To access an actual notice or an actual comment a link can be followed from its header to the corresponding HTML document.

4.3 **Support for librarians in DogitaLS1**

Certainly, librarians do much more in a digital library than can be covered in this paper. Therefore, we mainly focus on the services that they need to enable patrons to do their work as described in the prior section. It appears that the work of librarians can either concern the holdings of the library or the patrons (Fig. 6).
Concerning the holdings of a library, a librarian needs to catalogue and categorize the documents. Maintaining and re-organizing the holdings is a typical task performed by librarians as well. Since Internet resources belong to the holdings of DogitaLS1 it is also important that undefined links are avoided. To support patrons, librarians have to install private workspaces, grant or change access rights, provide required services, etc.

Librarians can perform many of their tasks by using the standard functionality of Hyper-G. For example, maintaining and re-organizing of the holdings normally affect both documents and collections. For either case, standard functions like copy document/collection, move document/collection, delete document/collection are provided in Hyper-G. Librarians can install new user accounts with an administration tool called haradmin. Using haradmin they can also grant access rights for the different collections in DogitaLS1.

Some of the services we implemented are described below.

- **Consistency check of Internet resources.** To avoid undefined Internet resources we implemented a service which allows librarians to check selected or all Internet resources for consistency. This service checks to see whether a document a link points to was moved or redirected to another place, if the document still exists, and if the server is still running.

- **Catalogue documents.** Librarians used forms to catalogue traditional documents (i.e. books, journals, and videos), Internet resources, and digital documents. The underlying CGI-scripts are connected to the profile services of DogitaLS1 (Fig. 5). As a result, the profile services can inform patrons immediately if a new document matches the patron's profile.

- **Install/remove virtual working groups.** Librarians are provided with a form to install/remove virtual working groups. The access rights are granted with respect to the way a patron is connected to the virtual group.

5. Experiences and discussion

In this section, some of the experiences with using Hyper-G as underlying server technology for DogitaLS1 are discussed along with the authors' research of the existing literature.

5.1 Re-organizing the collection hierarchy

Normally, the organizational structure of a digital library changes in time. Whenever a certain amount of new documents is added to the holdings, the organizational structure of the library is affected. This causes a re-organization in the digital library. At that time, documents have already been stored in the library. Links between documents have also already been established. Since re-organizing the document collection in a digital library means creating new collections or moving documents from one collection to another, links will probably be affected. By contrast to ‘traditional’ servers where a link denotes a path to a file on the server machine, in Hyper-G, links are objects separated from documents. The advantage of this is that in Hyper-G documents can be changed between collections without worrying about dangling links.
This is not only a useful feature for re-organizing the holdings of DogitaLS1 but has also proven to be beneficial for prototyping different collection hierarchies in early versions of DogitaLS1.

5.2 Services and workspaces

All services were distributed throughout the server in early prototypes of DogitaLS1. The disadvantage was that it was necessary to gather and copy the services from several already registered users whenever a new user received a new account on DogitaLS1. In the current version of DogitaLS1 all services are stored at a central place (i.e. the collection ‘Services’; c.f. Fig. 3). This is a big advantage when new librarians or patrons are to be added to or removed from the system. In order to add a new user, it is only necessary to create a new workspace and add copies of the services needed by the new user. For the removal of a user, their collection is merely deleted without worrying about the documents and services stored therein.

Another approach to sharing information and organizing people is known from the Grassroots system [11]. Grassroots provides a uniform framework to support collaboration among people by means of collectors (i.e. containers of information). Nevertheless, unlike workspaces, notice boards, etc. in DogitaLS1, Grassroots is a more general system which is not designed specifically to be used in digital libraries.

The idea of loose and tight connections to virtual working groups is similar to that used in SEPIA [12]. SEPIA is a hypermedia system in which loosely-coupled and tightly-coupled co-authoring is supported. To do this, SEPIA allows several authors to work on the same object (i.e. a hypermedia node) at the same time. For example, in an authoring session, all actions of an author are propagated immediately to the co-authors if the actions affect visible areas. In DogitaLS1, however, the emphasis is placed less on co-authoring than on collaborating in a digital library. Thus, we focused our research on how to provide work spaces in which information can be shared among people in different ways.

NYNEX Portholes [13] are another approach which enable individuals to maintain virtual work groups. In NYNEX Portholes, users can select with which members of a virtual group they want to collaborate. By contrast, all members of a virtual group work always together in DogitaLS1.

5.3 Profile service

At the moment each patron may only define one profile. This profile informs patrons about new documents from an area in which they are interested. As we see it, other forms of profiles might be useful. For example, the information broker Ariadne [14] allows patrons to specify a URL-profile. The profile service sends patrons an e-mail whenever a document changes to which a specified URL (i.e. a link) points. In contrast to DogitaLS1 where a profile can put its messages in a private workspace, Ariadne always requires an e-mail address. Certainly, profile services will play an important role in digital libraries in the near future.
5.4 Notice board

The main ideas of the notice board are borrowed from HyperNews [15]. The basic idea of HyperNews is to support structured and text-based discussions in the WWW. To do this, it allows readers to respond to any articles or responses they read in a HyperNews web. The articles support moderated organization of information, while the responses support unmoderated discussion about the information. Unfortunately, to our knowledge, HyperNews is not compatible with the Hyper-G server software. Therefore, we integrated the concept of commented notice boards in DogitaLS1. To begin with the authors wanted to use collection hierarchies to model commented notice boards. It quickly turned out, however, that this would have led to an overly complex user interface; patrons would have had to navigate through several collections before accessing a comment. The present implementation of a dynamically generated HTML page with links to the actual notices and comments is much more convenient to use.

5.5 Other digital library projects with Hyper-G

The Electronic Library for Mathematical Software (eLIB) [16] in Berlin, Germany, is also based on Hyper-G. eLIB offers on-line access to more than 10,000 mathematical algorithms and documents. It contains archives of test-data for various mathematical programming problems, software, discussion lists, mirrors of other network libraries, etc. In eLIB, the emphasis is placed on collecting material from all fields of scientific computing and providing it to a scientific community. LIBERATION [17] is another European project in which Hyper-G is being used in the context of digital libraries. The consortium of the project consists of publishers (e.g. Springer and Addison Wesley), libraries, and computer scientists. The basic idea of LIBERATION is to distribute already existing electronic information to libraries (e.g. via CD, local or wide area networks). Since this project has just begun at the time of writing this paper, first results are not available.

6. Open issues in DogitaLS1 and ideas for future systems

As a conclusion to this paper, this section discusses issues that have not yet satisfactorily been addressed in DogitaLS1. It is deemed necessary that the following list of items should be covered in future Internet information systems that intend to be used for digital library systems.

Concerns such as authoring aspects, billing services and copyright issues in DogitaLS1 were not addressed in detail. The reason is that DogitaLS1 is mainly used by a small number (≤ 30) of researchers in the laboratory at Dortmund University. Patrons do not have to pay for any documents and copyright is not a problem. Delivering copyright materials in electronic form to end-users, however, creates a number of interesting problems in the areas of protecting legal rights and document integrity. To address these issues, both legal and technical solutions must be developed [18]. For example, copyright aspects can be regulated through bilateral agreements between publishers and the libraries. Billing services not only have to handle authentication and charging of known registered users but also payment from unregistered users. For the latter, systems for the secure transfer and authentication of credit card details or a system for electronic money are needed [19].
Normally, different types of users have different access rights to the holdings of a digital library. This means that a kind of super-user has to define the access rights for each new user account. To ease this, we suggest introducing what we call a ‘sub-super-user’. In Hyper-G, a super-user has all access rights for the server software. This is more than a librarian requires to install user accounts. Thus, it could be regarded as a security problem since it might easily happen that too many rights are granted to a user (e.g. a patron gets access to collections of librarians). In contrast to a super-user, a ‘sub-super-user’ has only restricted access rights. These access rights could also be adapted to the types of users for whom a ‘sub-super-user’ is eligible to install accounts. To guarantee security, a ‘sub-super-user’ can only grant all or fewer of the access rights he has.

Off-line retrieval might become important for future systems. ‘Off-line retrieval’, is used to mean a possibility to submit a search query as a batch job from a command line to a certain digital library system. This would be helpful for digital libraries with huge amounts of documents or for digital libraries that are distributed among several servers at different places in the world. In such libraries searching can be very time-consuming and, thus, users may prefer an off-line search. The result can be delivered either to a user’s private workspace or it can be sent by e-mail.

Hyper-G presently lacks a Z39.50 interface. Z39.50 is a protocol for communication between computers for information retrieval. For example, we are currently preparing another project together with the library of the Dortmund University. On the basis of Z39.50, the meta-data collected in this project should also be made available and searchable in conjunction with other meta-data databases. Since Hyper-G does not support this protocol, we will have to store all the meta-data in an external database.

In the near future, the holdings of digital libraries will not only be based on one server but will be distributed among several servers. In four ways, Hyper-G already covers some aspects for distributed digital libraries: (1) In distributed digital libraries, a document is normally stored on one server only. However, it will probably be helpful to have logical copies of the documents on other servers of the digital library as well. With the copy document function, such a functionality is already available in Hyper-G. (2) Clients display all documents and collections in the same way regardless of whether they are logical copies, links to documents on other Hyper-G servers, or the physical document on the server to which the client is connected. Thus, users are not aware of where the documents are stored. As a result, a distributed digital library appears to the user in the same way as a digital library that is not distributed. (3) Link consistency is an important issue for distributed digital libraries since documents on the different servers will probably be interconnected densely. Fortunately, Hyper-G also guarantees link consistency for links that connect documents on different Hyper-G servers to one another. (4) Similar to the DIENST protocol [20,21], collections on different servers can be chosen to perform a parallel and distributed search.

Nevertheless, distributed libraries will have to serve much higher needs. For example, link consistency should also be guaranteed if different server software is used. (Note, that link consistency in Hyper-G is only guaranteed if the connected documents are stored in Hyper-G servers.) Further, patrons should be able to search in parallel, multiple physical databases which are heterogeneous in terms of access methods, record syntax, character set and even language. The results, however, should be presented as if a single logical database were being searched.
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* All URLs have been proven to be defined on August 1 1996. Changes of URLs, however, might cause undefined links at some point in the future.

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*Thomas Alders* and *Andreas Seifert* are graduate students at the Department of Computer Science at Dortmund University. In their diploma theses, they implemented both the structure and the services available in the digital library system *DogitaLS1*.