



DELOS
Network of Excellence on Digital Libraries

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1 Introduction

The aim of this report is to provide a comprehensive view of the results obtained, and the methodologies and approaches employed by the DELOS Network of Excellence on Digital Libraries. The report also addresses the objectives of the Network as well as the degree to which these objectives have been reached.

1.1 Objectives

The main objectives of the DELOS Network of Excellence for Digital Libraries were to:

- Provide an appropriate context in which an international research agenda for future activities in the digital library domain can be developed and continuously updated with respect to research advances in this field;
- Contribute to the creation of a European digital library research community;
- Contribute towards improving the effectiveness of European research in this emerging area;
- Provide a forum where researchers, practitioners, and representatives of interested applications and industries can exchange ideas and experiences;
- Cooperate with on-going standardization activities in the relevant fields of the digital library domain;
- Facilitate take-up of digital library technologies in all interested application communities;
- Create a forum where results of EU funded digital library projects can be presented, common problems discussed, areas of co-operation identified;
- Promote co-operation between European and national digital library initiatives;
- Improve international co-operation in digital library research areas.

In short, the DELOS Network of Excellence aimed at providing a set of "services" for the European digital library community.

1.2 Activity organisation

The Network carried out a broad range of interrelated activities whose combined effect was the successful achievement of its objectives. These activities were organised into a set of Forums to stress an important feature of the Network, i.e., its openness.

Digital Library Research Forum.

The objective was to stimulate and co-ordinate actions that advance R&D in the digital library domain and to improve scientific collaboration between European research teams working in this domain.

Digital Library Evaluation Forum.

The objective was to accelerate and enhance research into digital libraries and to provide appropriate test-beds for evaluating research in the digital library domain.

Digital Library Standardisation Forum.

The objective was contribute to the definition of relevant standards and to follow standardisation activities in the digital library domain carried out by international bodies and working groups.

Digital Library Training and Technology Transfer Forum.

The objective was to train young researchers in digital library technologies and to undertake technology and knowledge transfer actions in order to demonstrate to European organisations the effectiveness and benefits of digital library technologies in an industrial/commercial environment and to encourage the take-up of such technologies.

Digital Library International Co-operation Forum.

The objective was to enhance the collaborative links between the European Union digital library research communities and to establish collaborative links with other non-EU digital library research communities.

1.3 NoE members

The DELOS Network of Excellence brought together a number of academic and industrial organizations interested in research and applications in the domain of Digital Libraries. In all, 68 institutions adhered to the DELOS Network. The membership list ordered by country is enclosed as Annex A.

1.4 DELOS Extension

The DELOS contract has been expanded with additional funding (extension of the DELOS main contract (July 2002 - June 2003)) to promote the achievements and activities of DELOS to the Central and Eastern European (CEE) countries. In order to be able to complete these activities the DELOS contract has been extended for a six months period time (until June 30 2003).

2 Results and Achievements

In this section we summarize the results and the achievements of DELOS, divided by activity Forum. Complete details of each activity can be found in the previous activity reports.

2.1 Digital Library Research Forum

2.1.1 Thematic Workshops

The objective of the thematic workshops was to give the opportunity to Europeans researchers coming from academia, industry and interested application communities to communicate requirements, problems, and solutions within different digital library areas; to exchange working experiences and give the different communities whose advancement is affected by the DL technologies the possibility to learn about the latest research developments in this field. Five workshops on topically relevant themes were organized. Research papers, invited papers, position papers, progress reports on on-going projects

and research activities, panels, and demos of running prototypes constituted the main form of communication at these workshops.

All the five workshops have been co-sponsored by the National Science Foundation (NSF-USA). Typically a workshop was co-chaired by two leading researchers in the field, one from Europe and one from the US. A number of speakers were invited at each workshop, with DELOS funding the participation of European speakers and NSF funding the participation of US speakers. The workshops were open to the participation of researchers from non-member organizations, and no registration fee (or a minimal fee to cover coffee breaks) was required for participation.

The workshop proceedings have been disseminated both in printed and electronic forms.

First Workshop on "Information Seeking, Searching, and Querying in Digital Libraries"

This workshop was held on 11-12 December 2000 in Zurich and attended by 55 participants. Prof. Hans-Jorg Schek (ETHZ) was the General Chairman. Prof. Bruce Croft (University of Massachusetts) was the US Programme Committee co-chairman and Prof. Klemens Boehm (ETHZ) was the European co-chairman. 42 papers were submitted (from Europe, North America, and Asia) and 23 were accepted. Seven invited talks were given.

Second Workshop on "Personalization and Recommender Systems in Digital Libraries"

This workshop was held on 18-20 June 2001 in Dublin and attended by 57 participants coming from fourteen countries. Prof. Alan Smeaton (Dublin City University) was the General Chairman. Prof. Jamie Callan (Carnegie Mellon University) was the US Programme Committee co-chairman, while Prof. Alan Smeaton was the European co-chairman. 25 papers were submitted and 16 were accepted. Three invited talks were given. Moderated discussion sessions at the end of each day provided an opportunity for participants to reflect on the day's talks and to address recurring themes and issues.

Third Workshop on "Interoperability and Mediation in Heterogeneous Digital Libraries"

This workshop was held on 8-9 September 2001 in Darmstadt and brought together 40 researchers and practitioners from fourteen countries. Prof. Erich Neuhold (FhG-IPSI) was the General Chairman. Dr Umeshwar Dayal (HP Labs, USA) was the US Programme Committee co-chairman, while Dr Matthias Hemmje (FhG-IPSI) was the European co-chairman. 27 papers were submitted and 13 were accepted. Two invited talks were given. Furthermore, a plenary discussion on Geo-referenced Information was organized.

Fourth Workshop on "Evaluation of DLs: Testbeds, Measurements and Metrics"

This workshop was held on 6-7 June 2002 in Budapest and brought together 28 researchers from Europe, USA and Japan. Dr Lazlo Kovacs (Hungarian Academy of Sciences) was the General Chairman. Prof. Christine Borgman (UCLA) was the US

Programme Committee co-chairperson, while Prof. Ingeborg Solvberg (NTNU) was the European co-chairperson. 16 papers were accepted. Seven invited talks were given. Four breakout sessions were organized on User Interfaces, Evaluation in Context, Metrics and Testbeds, and Strategies for funding future Evaluation Programmes.

Fifth Workshop on "Multimedia in Digital Libraries"

This workshop was held on 2-3 June 2003 in Crete and brought together about 45 participants from Europe and US. Prof. Stavros Christodoulakis (TUC, Greece) was the General Chairman. Prof. Ching-chih Chen (Simmons College, USA) was the US Programme Committee co-chairman, and Prof. Stavros Christodoulakis (TUC, Greece) was the European co-chairman. 23 papers were accepted, and 10 invited talks were given. The workshop included a panel to present and discuss the Report of the Joint NSF/EU Working Group on "Digital Imagery for Significant Cultural and Historical Material".

2.1.2 European Conference on Digital Libraries (ECDL)

The series of European Conference on Digital Libraries is intended to give researchers from universities, research centers, industry and government the opportunity to meet once a year to discuss evolving research issues and applications. ECDL attempts to meet the needs of a large and diverse constituency, which includes practitioners, researchers, educators, policy makers, and users. The focus of the conference is on providing a forum in which all the various aspects of digital libraries are addressed, in which all the various concerned communities are represented, and in which there is the opportunity for all of the participants and communities to learn from one another, and to apply that knowledge to an integrated programme of research, development, construction, and utilization in digital libraries.

This series of conferences is managed by a Steering Committee (SC), a Conference Committee (CC) and a Program Committee (PC). The purpose of the SC is to oversee the long-term planning and success of this conference. At each conference, the General Chair(s), the Program Chair(s), and explicitly identified other chairs (for example, Tutorial Chair, Panel Chair, etc.) form the Conference Committee for that conference and are in charge of the planning, running, and overseeing of that conference to ensure that it meets the objectives stated above. The General Chair(s) are responsible for the overall running of the conference and serve as the Chair(s) of the Conference Committee. The Program Chair(s) are responsible for planning the technical program of the conference.

ECDL2000

ECDL 2000 was held on September 18-20, 2000 in Lisbon, and was attended by over 300 participants. Prof. Josè Tribolet (IST/INESC) was the General Chairman. Dr Josè Borbinha (BN/IST/INESC) was the Programme Committee Chairman. The PC included members from seventeen countries.

The conference focused on alternative technologies, policies, and scenarios for global digital libraries. Twenty eight long and forty four short papers were presented. There were also five invited talks, three from EU and two from the US. In addition, three panel sessions were offered, and posters and demonstrators were presented. Finally, three high

level tutorials were held immediately preceding the conference and four workshops were held immediately following the conference. The conference was attended by more than 300 participants.

ECDL2001

ECDL 2001 was held on September 5-7, 2001 in Darmstadt, and was attended by about 300 participants. Prof. Eric Neuhold (GMD-IPSI) and Dr. Elisabeth Niggemann (Die Deutsche Bibliothek) were the General Chairpersons. Prof. Ingeborg Solvberg (NTNU) and Prof. Panos Constantopoulos (FORTH) were the PC Chairpersons. The PC included members from fourteen countries.

The conference focused on the possible convergence of libraries, museums, and archives in their capacity as carriers of collective memories, which will yield large digital information spaces, and will encourage future co-operation in information spaces. Twenty two long and seventeen short papers were presented. Besides the technical papers, the programme also featured three invited talks, three panels, and a poster and demonstration session. Moreover, tutorials and workshops conveniently arranged immediately before and after the conference extended the range of subjects and opportunities for exchange of knowledge and opinions offered by the conference.

ECDL2002

ECDL2002 was held on September 16-18, 2002 at the Gregoriana Pontifical University in Rome, and was attended by over 300 participants. Dr Costantino Thanos (CNR-ISTI) was the General Conference Chairman. Prof. Maristella Agosti (University of Padoua) was the PC Chairperson.

The focus of ECDL'02 was on underlying principles, methods, systems, and tools to build and make available effective digital libraries to end users. An international Programme Committee was set up composed of 61 members, with representatives from 25 countries. 145 paper submissions, 15 poster submissions and 18 proposals for demos were received. Each paper was evaluated by 3 referees and 42 full papers and 6 short papers of high quality were selected for presentation. Besides paper presentations, the programme also featured two invited talks, two panel discussions and a poster and demo session. Moreover, six tutorials and three workshops conveniently arranged immediately before and after the conference extended the range of subjects and opportunities for exchange of knowledge and opinions offered by the conference.

2.1.3 Brainstorming Workshops

The objective of this series of workshops was to define roadmap reports in the field of digital libraries and to provide valuable input for the definition of future research programmes both for the EC and national research funding agencies.

First Brainstorming Workshop on "Digital Libraries: Future Directions for a European Research Programme"

The workshop was held on 13-15 June 2001 in San Cassiano (Dolomites), Italy.

The objective of this workshop was to outline the main research directions of a future European research programme in the field of digital libraries. To this end, prominent members of the European research community were invited to participate in and contribute to the definition of a new vision of digital libraries, and translate it into concrete research actions. Some prominent members from the US research community were also invited, in collaboration with the National Science Foundation. 17 EU and 5 US high-level researchers attended. A report on the outcome of the workshop providing recommendations on the main research directions of a future European research programme was disseminated both in printed and electronic forms.

Second Brainstorming Workshop on "Digital Libraries: A Research Agenda"

This workshop was held on 6-7 December 2002 in Pisa (Italy).

The report of the first brainstorming workshop held in San Cassiano provided a high level framework for future research in digital libraries. It was decided to hold a second brainstorming workshop to define a more detailed research agendas in the identified major research topics. To this end, prominent members of the European DL research community were invited to participate in and contribute to the definition of a research agenda for the development of the next generation digital libraries. 16 EU high-level researchers attended. The outcome of the workshop constituted a valuable input for the definition of the research programme of a proposal for a Network of Excellence on Digital Libraries under the 6th Framework Programme.

2.1.4 Research Exchange Programme

A research exchange programme was implemented. This took the form of a fellowship programme between members of DELOS DL research teams. Financial support for this activity was sought from the "ERCIM" fellowship programme. The following exchange programme was implemented:

Dr Andreas Rauber from TU Wien to CNR	Sept. 2001 - May 2002
Dr Andreas Rauber from TU Wien to INRIA	June 2002 - Feb. 2003
Dr. Yann Loyer from Univ. Paris Sud to CNR	Sept. 2002 - Aug. 2003
Dr. Yannis Tzitzikas from FORTH to CNR	Oct. 2002 - June 2003

2.2 Digital Library Evaluation Forum

This forum has focused its activities on two main topics: the establishment of a Digital Library Test Suite and the evaluation of Cross-Language Retrieval.

2.2.1 Digital Library Test Suite

A Working Group was established, with the goal of promoting the creation, maintenance and operation of a Test Suite, in order to make test-beds available to other researchers. For this purpose, a generic classification and evaluation scheme for digital libraries was developed. The scheme is based upon the belief that evaluation of DLs should include a broad view of subject areas. The description scheme has four major dimensions:

data/collection, system/technology, users, and usage. For each of these dimensions the major attributes are defined.

In order to gather a first set of information about Digital library collections and test collections, a two-part questionnaire was designed. The Questionnaire A (available digital libraries and test collections) was concerned with the availability of existing digital libraries and test collections that could be used for research in the field of digital libraries. The Questionnaire B (desired digital library test collections) investigated future requirements of digital library test collections.

Based on the feedback to these questionnaires, it was decided to focus on the issue addressed in part A and go one step further by setting up a DL Meta-Library (see http://www.sztaki.hu/delos_wg21/metalib/). This is an extensible survey database, where each DL collection/test-bed can register and provide information about itself. Information provided here can be updated at any time by the original submitters after a password-based authentication. Questions are mapped on a hierarchy suggested by the proposed classification scheme. This scheme is also used for enhanced searching and browsing of the contents of the Meta-Library. Users can browse the hierarchy, get summaries or statistics of available solutions in selected area, or search for DLs having a certain solution with respect to specific attribute values. So far, 35 DL test beds have been registered.

The WG was also involved in the preparation of the fourth DELOS Thematic Workshop in Budapest (see section 2.1.1), where there was also a joint meeting with researchers from the US, with the aim of establishing a Joint NSF/EU Working Group on “Evaluation” (see section 2.5.3). Unfortunately, due to funding problems on the US side, there were no follow-up meetings of this joint group.

2.2.2 Cross-Language Evaluation Forum (CLEF)

The objectives of CLEF are to support digital library applications by (i) developing an infrastructure for the testing, tuning and evaluation of information retrieval systems operating on European languages in both monolingual and cross-language contexts, and (ii) creating test-suites of reusable data which can be employed by system developers for benchmarking purposes.

The first two evaluation campaigns of the Cross-Language Evaluation Forum (CLEF 2000 and CLEF 2001) were sponsored by DELOS. Seven European research groups collaborated in the coordination. The campaigns have been organized in cooperation with the Text Retrieval Conference series (TREC) and the US National Institute of Standards and Technology (NIST).

CLEF 2000

The first evaluation campaign was held from February to September 2000. Four evaluation tasks were prepared (for multilingual, bilingual, monolingual-non-English and domain-specific systems). The main test suite consisted of a newspaper and news agency document collections in 4 languages (French, German, English, Italian) and a query set in

8 languages (FR, DE, IT, EN, ES, NL, FI, SV). The GIRT database of German social science documents, with a controlled vocabulary in English, German and Russian, was used for the domain-specific task.

28 research groups (from academia and industry) participated in the campaign, and 20 groups actually submitted results (8 from North America and 12 from Europe). A total of 90 runs were received. The results were presented at a Workshop held in Lisbon, Portugal, on 21-22 September, immediately following ECDL 2000. There were approximately 35 participants. Working Notes containing reports on all the experiments were distributed at the Workshop.

CLEF 2001

The second evaluation campaign was held from January to September 2001. In addition to the four evaluation tasks offered in 2000, an experimental track testing interactive cross-language systems and focusing on the document selection task was also offered. The test-suite was considerably larger than that used in 2000, containing nearly one million documents in six languages instead of four – the new languages being Spanish and Dutch. The queries were created in the document languages and then additional queries sets were produced in Finnish, Swedish, Russian, Japanese, Chinese and Thai. More than 40 groups registered to participate in one or more of the main tasks. In the end, 31 groups actually submitted results (8 from North America, 19 from Europe and 4 from Asia). A total of 193 runs were received. The results were presented at a Workshop, held in Darmstadt, Germany, on 3-4 September 2001, immediately preceding ECDL 2001. The Workshop was attended by approx 50 researchers and system developers. Working Notes containing preliminary reports and statistics on the CLEF 2001 experiments were distributed.

The CLEF 2000 and 2001 Working Notes are publicly accessible on the CLEF website. Revised and expanded versions of the papers presented at the Workshops have been published by Springer in the Lecture Notes for Computer Science series (LNCS 2069, LNCS 2406).

In September 2001, CLEF obtained independent funding from the European Union IST programme, under contract No. IST-2000-31002. Under this contract, two other evaluation campaigns have been organized. However, CLEF has maintained close contacts with DELOS, and the Workshops have continued to be organized in conjunction with the ECDL conference series. In addition, in a collaboration between CLEF and DELOS, a feasibility study for cross-language spoken document retrieval was run within DELOS during 2002 and the results were presented at the CLEF Workshop in Rome, September 2002.

2.2.3 INEX Initiative

The widespread use of XML in digital libraries, product catalogues, scientific data repositories and across the Web prompted the development of appropriate searching and browsing methods for XML documents. As part of a large-scale effort to improve the efficiency of research in information retrieval and digital libraries, the INEX initiative

has initiated an international, coordinated effort to promote evaluation procedures for content-based XML retrieval. The initiative provides an opportunity for participants to evaluate their retrieval methods using uniform scoring procedures and a forum for participating organizations to compare their results.

The aim of this initiative was to provide means, in the form of a large test-bed (test collection) and appropriate scoring methods, for the evaluation of retrieval of XML documents. The test collection consists of XML documents, tasks/queries, and relevance judgments given by (potential) users with these tasks. Participating organizations contribute to the construction of this test collection in a collaborative effort to derive the tasks/queries and relevance judgments for a large collection of XML documents. The test collection also provides participants a means for future comparative and quantitative experiments. Due to copyright issues, only participating organizations have access to the constructed test collection.

In the first round of INEX, in 2002, a test collection of real world XML documents along with standard topics and respective relevance assessments was created. There were two types of tasks, content-only queries specifying only the desired content, and content-and-structure queries containing also conditions referring to the structure of the XML elements to be retrieved. 25 groups submitted retrieval results for these tasks. Relevance assessments were performed by the participating groups, each being responsible for one or two topics. In addition, there were 11 other groups doing assessment work. The evaluation results were discussed at a Workshop in Schloss Dagstuhl, Germany in December 2002, and the proceedings were published in the DELOS workshop series.

2.3 Digital Library Standardisation Forum

The goal of the Standardization Forum was to support the production by ad-hoc Working Groups of white papers describing and analyzing well-defined problems in the development and implementation of digital libraries from the standpoint of different existing or emerging standards. On the model of the Joint EU/NSF Working Groups from the first cycle of DELOS (1996-1999), the aim was to produce analyses understandable by non-experts yet up-to-date enough to constitute a significant contribution to the literature. Such working groups require the sustained effort of perhaps a dozen researchers and digital library practitioners from a variety of backgrounds, and not every group could follow through on its original intentions. Three groups produced white papers.

Registries

The DELOS Working Group on Registries, led by Thomas Baker (Fraunhofer-Gesellschaft, Germany), met twice and produced "Principles of Metadata Registries", which presents a layered model and normalized terminology for describing the landscape of metadata standards. Against this backdrop, the paper discusses emerging efforts to create "registries" of metadata vocabularies -- online dictionaries for helping users and information providers interpret or translate between different metadata languages. The

group members were Christophe Blanchi (CNRI, USA), Dan Brickley (World Wide Web Consortium, UK), Erik Duval (Katholieke Universiteit Leuven, Belgium), Rachel Heery and Pete Johnston (UKOLN, UK), Leonid Kalinichenko (Academy of Sciences, Russia), Heike Neuroth (SUB Goettingen, Germany), and Shigeo Sugimoto (University of Tsukuba, Japan).

Ontology Harmonization

The DELOS Working Group on Ontology Harmonization, led by Martin Doerr (FORTH, Greece), brought together researchers from a variety of perspectives on ontologies. Applying techniques for building and testing semantic links between different but overlapping hierarchies of concepts, the group succeeded in reconciling the CIDOC Conceptual Reference Model (an event-aware ontology for contextual knowledge about museum objects), with the ABC Harmony Model (a model for recasting metadata about Web objects into a framework of explicit events). Aside from presenting a methodology for harmonization, the paper "Building Core Ontologies" describes points of conceptual convergence in detail and lays the foundation for data merging between the two models. Members of the working group were Carl Lagoze and James Cheney (Cornell, USA), Jane Hunter (DSTC, Australia), Thomas Baker (Fraunhofer, Germany), Dan Brickley and Libby Miller (ILRT, UK), Donatella Castelli, Aldo Gangemi, Nicola Guarino, and Carlo Meghini (CNR, Italy), Nicholas Crofts (City of Geneva, Switzerland), Tony Gill (RLG, USA), Stephan Koernig and Wolfgang Meier (TU Darmstadt, Germany), and Nikolay A. Skvortsov (Academy of Sciences, Russia).

Project Metadata

The DELOS Working Group on Project Metadata, co-chaired by Stephan Koernig (TU Darmstadt, Germany) and Yuri Hohlov (Russian Development Gateway), sought to define a common basis for sharing various types of metadata about projects. Recognizing the importance of common denominators such as Dublin Core, the paper "Describing Projects" takes stock of recent developments in enabling technologies such as Semantic Web, Web services, and metadata harvesting to lay out the challenge of creating a clearinghouse for information about projects in a particular area such as "economic development". Members of the group were Thomas Baker (Fraunhofer-Gesellschaft, Germany), Jost Bohlen (Chemistry Information Centre, Berlin), Gregory Crane (Tufts University, Boston), Kafkas Caprazli, Stephen Katz, Johannes Keizer and Gauri Salokhe (FAO, Rome), Mark Roantree (Centre for Digital Video Processing, Dublin), Gerd Stumme (University of Karlsruhe, Germany), Sudhakar Kaveeshwar and Virginia Yee (World Bank, USA), and Anna Vezhnevets (Academy of Sciences, Russia).

2.4 Digital Library Training and Technology Transfer Forum

The activities of this Forum have followed three main lines: (i) training of young researchers in the field of Digital Libraries, through the organization of Summer Schools; (ii) dissemination of research results and exchange of practical experiences with user communities, through the organization of Tutorials and Joint Workshops; (iii) raising the awareness of Digital Libraries technologies, through the organization of National Events

2.4.1 International Summer School on Digital Libraries (ISDL)

The main objective of ISDL was to provide a high level course on the emerging domain of digital libraries and its underlying technologies. Moreover, it offered a unique opportunity for a complete update on all aspects of digital libraries and encouraged contacts between participants, lecturers, and interested parties. The School was directed towards members of the DL research community (in the wide sense): primarily graduate students, but also young researchers and professionals involved in R&D in digital library related areas.

This series of schools is managed by a Steering Committee (SC). The purpose of the SC is to oversee the long-term planning and success of this School. At each School a director is appointed. The director of the School is responsible for planning and running the technical program of the ISDL. The School was of a one-week duration and organized annually. The number of participants was limited to 50 in order to allow interaction between the students and the teachers. At the end of each School, a questionnaire was distributed to the participants in order to assist in evaluating the organization, the facilities, the programme and lecturers.

ISDL 2001

The first DELOS Summer School was held in Pisa, Italy, from 9-13 July 2001, under the direction of Prof. Maristella Agosti (University of Padoua, Italy). It had a broad programme covering most of the fundamental issues underlying the multidisciplinary domain of digital libraries. The programme was organized in nine half-day lectures, having as invited lecturers leading researchers in the digital library domain, both from the US and Europe. Each lecture was devoted to a fundamental topic of digital libraries, addressing both the methodological aspects and the presentation of the results of some of the most innovative and significant DL projects.

The School was attended by 52 students, from 16 different countries. 36 students were from universities and research institutions, and the remaining 16 were from libraries and archives. The School lectures were disseminated both in printed and electronic forms.

ISDL 2002

The second DELOS Summer School was held in Pisa, Italy, from 8-12 July 2001, under the direction of Dr. Vittore Casarosa (CNR-ISTI). Being the second Summer School, it was decided to focus on specific issues related to digital library applications, i.e., the exploitation of digital library technologies in several applications domains. The programme was organized in nine half-day lectures, having as invited lecturers leading researchers in the digital library domain, both from the US and Europe. Each lecture was devoted to a presentation of a digital library application in a specific application domain.

The School was attended by 47 students, from 14 different countries. 30 students were from universities and research institutions, and the remaining 17 were from libraries and archives. The School lectures were disseminated both in printed and electronic forms.

2.4.2 Training and Technology Transfer Events

The objective of these events was to undertake dissemination and technology transfer actions with the aim at convincing European organizations of the effectiveness and benefits of the employment of digital library technologies within industrial/commercial environments and to speed up the take up process of the new digital library technologies.

Tutorial on "Standards and Metadata"

This tutorial was held on 2 November 2000 in Moscow during the Conference EVA 2000, presented by Dr. Thomas Baker (Fraunhofer) and Dr Carl Lagoze (Cornell University). It was attended by about eighty participants, primarily from the eastern European museum, library, and research communities.

The tutorial traced the rise of a "metadata movement" on the Web, from the broadly scoped Dublin Core Metadata Initiative through the development of the related Resource Description Framework of the World Wide Web Consortium to today's diverse landscape of standardization efforts in multiple domains and applications. It summarized recent efforts to build a distributed Web infrastructure for managing interoperability among metadata vocabularies and presented ongoing research issues such as the conflicting requirements of fuzzy resource discovery and precise, event-based description. The practical approach of the Open Archives Initiative was described in detail as a guide for metadata implementers.

Tutorial on "Multilingual Access for Information Systems"

This tutorial was held on 23 August 2001 in Boston, during the Conference IFLA 2001, presented by Dr Carol Peters (CNR) and Paraic Sheridan (MNIS-TextWise Labs). It was attended by about forty participants.

The tutorial addressed the needs of the users of today's information networks and digital libraries who want to be able to find, retrieve and understand relevant information wherever and whatever language it may have been stored. The tutorial, thus, focused on tools and technologies for multilingual information access and cross-language information retrieval. The tutorial provided participants with an overview of the main issues of interest in both these sectors. Topics covered included: the specific requirements of particular languages and scripts, processing of multilingual document collections, multilingual metadata, techniques for cross-language retrieval, system evaluation.

FIAT/IFTA/DELOS Joint Workshop on "Audio-Visual Metadata Modeling"

This workshop, organized in cooperation with the International Federation for Television Archives, took place in London on 23 September 2001, in conjunction with the annual FIAT/IFTA Conference. It was attended by about 30 participants.

The workshop was divided into two sessions. In the first session, research results and on-going standardization activities were reported. In the second session, a panel of leading representatives from application domains (e.g. broadcasting, archives, and movie industry) presented and discussed real-life experiences with metadata models and editors, in order to stimulate a discussion and an exchange of opinions with the audience.

FIAT/IASA/DELOS Workshop on "Preservation"

This workshop, organized in cooperation with the International Federation for Television Archives and the International Association of Sound and Audiovisual Archives took place in Helsinki on 3 April 2003 in conjunction with the annual IFTA/IASA meeting. It was attended by about 60 participants.

The one-day workshop brought together researchers from the fields of preservation and digital libraries and end-users (of media digital libraries) from the IFTA/IASA community to present and discuss the hot topics (in research and practice) when dealing with digitization, preservation and access to digital libraries. The workshop was divided into two sessions. In the first session, research results and on-going activities in the field of preservation were reported. In the second session, the results of the joint DELOS/NSF Working Groups on "Preservation" and "Spoken Word Digital Audio Collections" were presented.

Dissemination International Workshop "Planning for a Digital Library", Torun, 23-29 October 2002

Dissemination International Workshop "Current Trends in Digitization: Meeting with the National Librarians", Torun, 3-4 February 2003

Dissemination International Workshop "From General Standard of Archival Description to Encoded Archival Description", Warsaw, 25-26 April 2003 ***Joint Workshop "Archives in Society: Meeting with the National Archivists", Elblag, 22-24 May 2003***

2.4.3 National Events

The objective of these events was to reach a wider audience than the traditional thematic workshops and thus improve the awareness and the involvement of the different national application communities in Digital Libraries technologies.

Italian National Workshop

A workshop dedicated to "Digital Libraries: Research and Development in Italy" was organized in Rome on 31 October 2001. It was attended by about 120 participants, mostly from the library community.

The main objectives of the workshop were: (i) to make a survey of Italian research and development activities in the field of digital libraries, (ii) to give researchers and representatives of interested application communities the opportunity to exchange ideas and experiences; and (iii) to promote collaboration between the Italian digital library research community and the Italian Cultural Heritage institutions. The workshop was divided into two sessions and was concluded by a panel discussion in which representatives of the research community, memory-based institutions and industry discussed possible modalities for collaboration.

Greek National Workshop

A workshop dedicated to "Developing Digital Libraries" was held in Corfu, Greece on 21 June 2002. It was attended by about 110 participants, mostly from the library community.

The goal of the workshop was to update all participants on the organization, the developing stages and the opportunities on the development of digital libraries in Greece. The presentations were addressed to personnel of Greek Libraries, and other organizations that manage content. They showed the nature and basic elements of the digital libraries, the digital objects and the metadata, they indicated how digital libraries can be organized, and demonstrated some successful digital libraries. They also gave emphasis to issues that concern most new digital library developers, such as digitization guidelines.

Latvia, "Metadata", Riga, 16 April 2003

Hungary, "Preservation of digital cultural heritage", Budapest, 6 May 2003

Slovak Republic, "Information Behaviour in Digital Libraries", Bratislava, 21-22 May 2003

Poland, "Creating Sustainable Digital Libraries", Warsaw, 13 June 2003

2.5 Digital Library International Collaboration Forum

2.5.1 International Cooperation Workshops

Digital libraries are inherently distributed and it is crucial to share aspects such as standards to ensure that the functions a digital library provides are useful in a global, multi-lingual and multi-cultural environment. DELOS has established collaborative actions with some other non-EU research communities (with the US, Russian, Central and Eastern European, non-EU Mediterranean Digital Library research communities).

DELOS/Russian DL Research Community Workshop

This workshop was held in Moscow on 7-9 June 2001, and was attended by about 20 participants.

The goal of the workshop was to evaluate possibilities for establishing collaborations between EC-funded groups and Russian partners in the field of digital libraries and to identify key issues for such collaborations. In addition, the UNESCO Institute for Information Technologies in Education in Moscow expressed its interest in supporting this workshop, and therefore a session was held on 9 June dealing mainly with "Digital Libraries in Education", with additional participants invited by UNESCO. The topics discussed helped to identify significant overlap in the interests of European and Russian DL researchers. After the presentations and discussions, the Workshop formulated and approved several recommendations for concrete actions, including: (i) improving and

intensifying the exchange of research results and development efforts in the area of DLs between existing European and Russian projects, and (ii) identifying joint activity areas that deserve to be generalized and extended to the level of DELOS Working Groups. The workshop proceedings were disseminated both in printed and electronic forms.

DELOS/non -EU Mediterranean DL Research Communities Workshop

A workshop on the "Design and Implementation of Digital Libraries" was held at the Al Akhawayn university in Ifrane, Morocco on 8-9 November 2001, and was attended by about 60 participants.

The aim of this workshop was to bring together digital libraries' researchers from both sides of the Mediterranean to present and discuss their experiences in designing, implementing, and maintaining digital libraries with respect to today's technological and economic environment. The programme of the workshop provided an overall introduction to some key areas in digital library research. A series of presentations was also included in the programme in order to provide an overview of on-going activities on both sides of the Mediterranean, and to identify areas of common interest. The final session of the workshop was directed towards identifying possibilities for co-operation and joint future actions. The workshop proceedings were disseminated both in printed and electronic forms.

DELOS-CEE Countries, Prague, 30 May 2003

2.5.2 Concertation Meetings

EC-IST, NSF and European national funding agencies are supporting substantial research concerned with digital libraries. DELOS organized a number of concertation meetings, which involved most of the projects funded by these organizations. The aim of such meetings was: to exchange working experiences, to share research results, to establish collaborative links between projects which share common objectives, to identify topics of common interest and establish joint working groups, to define joint research activities/projects, to jointly promote relevant standardization activities.

EU DL All Projects Meeting

A concertation meeting among the digital library projects funded by the European Union under the Fifth Framework Programme was held in Luxembourg on 7-8 February 2001, and was attended by about 60 participants.

The meeting brought together most of the projects funded by the EC IST Programme in the field of Digital Libraries, as well as representatives of other relevant initiatives in Europe and the US. The objectives of the meeting were to exchange information about the projects, to identify areas of synergy and possible co-operation, to jointly promote standardization and dissemination activities, and to provide the EC IST Programme an appreciation and a global view on the evolution of digital library technologies. 16 EC IST projects were presented. In addition, three presentations were given by representatives of DL initiatives in the US and Europe. The main research themes and challenges, which

emerged during the project presentations, were summarized and presented and discussed in a dedicated final session.

EU/NSF DL All Projects Meeting

A concertation meeting among the digital library projects funded by the European Union and the National Science Foundation (NSF), also including invited representatives of other relevant digital library initiatives in Europe, took place on 25-26 March 2002 in Rome. It was attended by about 130 participants.

The main idea behind this workshop was to bring together researchers from projects funded by the EC IST Programme and the NSF. By and large, scientist involved in the EC and NSF projects have not had the opportunity to meet regularly. A coordination effort can help avoid duplication of effort, prevent the development of fragmented digital systems, and encourage productive interchange of scientific knowledge and scholarly data around the world.

52 projects were presented: 22 EC projects, 10 European National Initiative projects from UK, Germany, Denmark, and Finland, and 20 US NSF projects. Each project presentation emphasized the results thus far achieved, allowing participating researchers to benefit from the experiences gained within similar projects to their own. On the afternoon of the second day, a plenary session was held, dedicated to the presentation and discussion of the DELOS report on "Future Directions for a European Research Programme on Digital Libraries". The Meeting presentations were disseminated both in printed and electronic forms.

Harmonization Meeting on "Digital Libraries National and EU Actions : The Need for Harmonization"

This meeting took place on 11 May 2001 in Brussels, bringing together representatives of EU national funding agencies and/or Digital Library national initiatives, and representatives of EU programmes. The meeting was by invitation only, and was attended by 16 participants.

The objective of the meeting was twofold. The first was to bring together representatives of important on-going or planned national DL initiatives for the purpose of exchanging information, discussing ways of co-operation, and identifying mechanisms which could lead to harmonization between these initiatives and future DL actions under the forthcoming FP6. The second objective was to collect suggestions and recommendations with regard to future DL actions in order to provide valuable input for the definition of appropriate actions in the DL field under the FP6.

The Meeting was organized into two sessions. In the first session each national representative gave a presentation on its current achievements and/or planned programmes. In the second session the crucial question of how to proceed was addressed. The central point, shared by all participants, was the identification of joint actions which was important to begin immediately, but which should be fully deployed under the forthcoming FP6.

2.5.3 DELOS/NSF Joint Working Groups

DELOS and the NSF agreed to set up seven joint Working Groups whose aim was to define a research agenda on a specific topic and identify areas and activities for co-operation between EU and US researchers. Each Working Group was co-chaired by a prominent member of the European and the US digital library research community, and consisted of approximately ten members, five from Europe and five from US. Each WG produced a white paper.

WG on "Spoken-Word Digital Audio Collections"

This WG addressed points of common interest in the creation and dissemination of spoken-word digital audio archives. A final white paper was produced describing the current state-of-the-art in the field and providing a series of recommendations with respect to those areas in which future research should be concentrated to ensure progress. In particular, significant issues were confronted in: identifying standards appropriate for digital preservation; creating open source, scalable architecture for storage and retrieval of audio; developing tools for audio structuring, browsing, and search; addressing language differences so that non-native speakers may access foreign-language spoken-word resources with relative ease; confronting intellectual property concerns.

WG on "Emerging Technologies and the Rediscovery of the Past"

The main objective of this WG was to document the directions that philological disciplines may take, in the light of the modern IP tools. The shift to an electronic environment is a challenge to rethink the basic infrastructure on which all scholarship and teaching rests. In particular, this WG explored the possibilities that emerging language technologies open up for teaching, learning, and research in the broad area of cultural heritage. While students of the past stand to gain powerful new tools that will affect every aspect of their work, developers of language technology also would benefit from exploring the needs of new audiences and new collections. A final white paper was produced which focused on mono-lingual technologies, such as information extraction, summarization, and other aspects of document understanding.

WG on "Digital Imagery for Significant Cultural and Historical Materials"

This WG addressed major problems and issues related to digital imaging, which are relevant to the creation, organization, and use of digital libraries, with specific emphasis on the aspects related to significant cultural and historical materials. Research on digital imagery for significant cultural and historical materials is imperative because of its potential impact on many related sciences and engineering, its relevance to education at all levels, and its role in promoting cultural understanding. A final white paper was produced which advocated an organized, continuing collaboration between subjects specialists and technologists in order to establish sustainable and enduring digital archives of the world's cultural heritage and to provide universal and ubiquitous online access for advanced research as well as for all levels of formal and informal public education.

WG on "Digital Archiving and Preservation"

The need for digital preservation touches all our lives, whether we are workers in commercial or public sector institutions, engage in e-commerce, participate in e-government, or use a digital camera. After examining existing and on-going research, and the changing technologies and their environment this WG produced a white paper, which identified research possibilities in the area of archiving and long-term preservation. A research agenda has been structured for digital archiving and preservation into three main areas: (i) emerging research domains, (ii) re-engineering preservation processes, and (iii) preservation systems and technology. This agenda will make possible new theoretical approaches, viable tools, and methodologies needed to respond to the array of challenges created by technology evolution. However, the WG felt that three research areas were likely to have the greatest impact: self-aware objects, metadata and the evolution of ontologies, and mechanisms for preservation of complex and dynamic objects.

WG on "Digital Library Information-Technology Infrastructures"

The WG advocated that there is a need for a move of digital library development from an art to a science and that it is time for generic digital library technology to be developed and incorporated into industrial-strength digital library management systems, offering advanced functionality through reliable and extensible services. Developing generic technology that can provide the necessary infrastructure to build effective Digital Library Management Systems (DLMS) is clearly of fundamental importance. It essentially, requires solutions to several "horizontal" problems that touch upon many aspects of a DLMS and its environment. Identifying the most critical of those and suggesting certain promising directions that the community could follow would be very useful in the overall effort to obtain applicable and interesting solutions and in pushing the field of DLs into the mainstream. The WG focused on the most central system issues so that some comprehensive suggestions were derived. These include issues related to system architecture, user-level functionality, and the overall operational environment.

WG on "Reference Models for Digital Libraries: Actors and Roles"

Actors in a digital library can be persons, organizations, automata or any kind of entity in general that play roles in the production, dissemination, management and use of digital information and services related with the digital library. This WG recommended that awareness must be raised around the problem of identifying and clarifying actors and roles in digital libraries. The problem should be addressed explicitly, and to make this happen, actions must be taken in three major directions by promoting: focused research in the development of formal and objective reference models for the description of actors and their roles in digital libraries; the relevance of clear identification and description of actors and their roles in digital library proposals and initiatives, especially those employing formal, objective reference models; the relevance of clear identification and analysis of actors and their roles in the evaluation frameworks and evaluation actions in digital libraries.

WG on "Personalisation and Recommender Systems in Digital Libraries"

This WG was organized to bring together specialists from differing backgrounds, who have vested interests in the future development of personalisation and recommender systems for digital libraries. The explicit goal of the WG was to identify the key research

challenges in this area and to develop a series of recommendations and research priorities. In the final white paper the introductory section provides some background on the scope of the WG, as well as the definition of what is meant by personalisation and recommender systems. The vision of the WG for the evolution of digital libraries is then presented, followed by a series of research challenges that the WG believes need to be met in order to realize the true potential of digital libraries. Finally, a series of specific recommendations and research priorities is presented.

3 Impact

In an attempt to quantify the DELOS impact, and following the indications provided at the DELOS reviews, we have quantified some parameters that may provide an indication of the effectiveness and the impact that the DELOS activities have had in the field of Digital Libraries. The main factors identified have been: (i) the number of researchers, students and professionals who were mobilized by the DELOS activities, divided in researchers funded by DELOS, and researchers funded by other sources; (ii) the number of person/days for each event, including the time spent for organization and publishing of the proceedings, when available, again divided in person/days funded by DELOS and person/days funded by other sources. The table below summarizes those figures.

Event	Researchers not DELOS funded.	Researchers DELOS funded.	Person/days Total	Person/days not DELOS funded	Person/days DELOS funded	Total
Thematic WS1	42	13	55	109	31	140
Thematic WS2	41	16	57	148	53	201
Thematic WS3	32	8	40	89	21	110
Thematic WS4	16	12	28	57	29	86
Thematic WS5	34	10	44	93	25	118
Total Thematic WS	165	59	224	496	159	655
ECDL 2000	340	13	353	1160	105	1265
ECDL 2001	300	7	307	1040	75	1115
ECDL 2002	320	2	322	1100	50	1150
Total ECDL	960	22	982	3300	230	3530
Brainst. WS1	5	17	22	30	54	84
Brainst. WS2	4	12	16	10	24	34

Event	Researchers not DELOS funded.	Researchers DELOS funded.	Person/days Total not DELOS funded	Person/days DELOS funded	Total
Total Brainst.	9	29	38	40	78
			0		0
Research Exch.	3	0	3	600	0
					600
Total WP1	1137	110	1247	4436	467
					4903
CLEF 2000	121	12	133	2454	106
CLEF 2001	165	20	185	3400	140
Total CLEF	286	32	318	5854	246
					6100
INEX	80	4	84	1390	58
Evaluation WG	0	10	10	35	96
Total Eval.	80	14	94	1425	154
					1579
Total WP2	366	46	412	7279	400
					7679
Registries WG	1	7	8	3	28
Ontology WG	4	11	15	12	40
Proj. MD WG	5	8	13	15	31
			0		0
Total WP3	10	26	36	30	99
					129
ISDL 2001	34	31	65	190	170
ISDL 2002	24	33	57	140	180
Total School	58	64	122	330	350
					680
Nat. Event Italy	120	0	120	130	2
Nat. Event Greece	99	11	110	109	13
Total Nat. Events	219	11	230	239	15
					254
Tutorial. EVA 2000	79	1	80	84	1
Tutorial. IFLA 2001	39	1	40	44	1
Total Tutorials	118	2	120	128	2
					130

Event	Researchers not DELOS funded.	Researchers DELOS funded.	Total	Person/days not DELOS funded	Person/days DELOS funded	Total
Joint WS IFTA	19	11	30	24	11	35
Joint WS IASA	53	7	60	58	7	65
Total Tech Transf.	72	18	90	82	18	100
Total WP4	467	95	562	779	385	1164
Int. Coop. Russia	12	8	20	41	24	65
Int. Coop. Medit.	38	22	60	81	50	131
Total Int. Coop	50	30	80	122	74	196
EU All Proj.	52	8	60	109	21	130
EU/NSF All Pr.	116	14	130	137	33	170
Harm. Mtng	0	16	16	0	21	21
Total Concert.	168	38	206	246	75	321
Joint WG s	42	45	87	168	145	313
Total WP5	260	113	373	536	294	830
Grand Total	2240	390	2630	13060	1645	14705

4 Final Remarks

The first objective of DELOS was to contribute towards the creation of a European Digital Library research community. Practically all the DELOS activities contributed to the achievement of this first objective: the series of thematic workshops, the series of the ECDL conferences, the international cooperation workshops, the building of evaluation infrastructures, the series of summer schools, the series of Digital Library All Projects workshops, the joint working groups and the research exchange programme. All these activities have been successful in bringing together a large number of researchers coming from very different research fields, as the Digital Library field is a multidisciplinary domain. Researchers from many fields like databases, information retrieval, user interfaces, knowledge representation, library science, multimedia, multilingual, architectures, semantic Web, etc. have become involved in the digital library field and

have created an important European digital library research community. In addition, the scientific level of all these activities has been in general very high, as testified also by the fact that almost all the DELOS activities were co-sponsored by other funding agencies (NSF), scientific institutions (Universities, Research Centers), and other international organizations (FAO, UNESCO). In conclusion, we believe that DELOS has fully achieved its first objective, i.e., to create a European digital library research community.

A second objective of DELOS was to define a research road map for digital libraries for the next years. The DELOS activities that contributed most to the achievement of this second objective were the thematic workshops, the series of brainstorming workshops and the DELOS/NSF joint Working Groups. Again, these activities have succeeded in involving top level European and US researchers who produced high quality "Future Research Directions" reports. Based on these reports a final "Road Map" report was also produced. All these reports constitute a valuable input for the funding agencies (EU, NSF) as well as for the whole digital library research community. These reports have constituted the backbone of a proposal for a Network of Excellence under the 6th Framework Programme (DELOS 2). Again, we feel that DELOS has fully achieved its second objective.

A third objective of DELOS was to establish collaborative links with the interested application communities (Libraries, Archives, Museums, Electronic Publishing, Broadcasting), and to disseminate the results of its activities to these communities. The DELOS activities that have contributed most to the achievement of this third objective were the series of workshops and tutorials jointly organized with those application communities, and the series of national technology transfer events. Although much work still has to be done in this area, these initial activities have allowed us to establish cooperative links between IT researchers and some application communities (IFLA, ICA, IFTA), which will survive the DELOS NoE.

A fourth objective of DELOS was to disseminate and extend the results of its activities to the Central and Eastern European countries. Thanks to the extension of the DELOS contract, in terms of funding and time, several dissemination activities have been possible in the last year of DELOS. These activities have succeeded in mobilizing a considerable number of researchers as well as representatives of application communities (mainly from libraries and archives) of these countries.

5 Appendix A – List of DELOS members

In the course of the DELOS life, new organizations have expressed interest in participating to the DELOS activities. Normally the addition of a new member to a Network of Excellence involves an amendment of the original contract. In order to eliminate the bureaucratic procedures involved in becoming a new member, in agreement with the IST Programme, we have established an “Associate Member” status. The organizations that are Associate Members can participate in all the activities of DELOS (workshops, working groups, management meetings, etc.) with the same benefits as full members. Here below is the final list of the DELOS members and associate members, divided by country. Additional details about each organization can be found on the DELOS web site.

Austria

OEAW	Austrian Academy of Sciences
TU	Technische Universität Wien

Czech Republic

MU	Masaryk Univerzity Brno
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Denmark

AUE	Aalborg University Esbjerg
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France

ERCIM	European Research Consortium for Informatics and Mathematics
INRIA	Institut National de Recherche en Informatique et en Automatique
LRI	Laboratoire de Recherche en Informatique - Université Paris Sud

Germany

FhG	Fraunhofer Gesellschaft
UniDo	University of Dortmund
FORWISS	Bavarian Research Centre for Knowledge-Based Systems
UNI MA	University of Mannheim
IZ	InformationsZentrum der Arbeitsgemeinschaft Sozialwissenschaftlicher Institute e V.
Springer	Springer-Verlag GmbH & Co. KG
telos	technology for electronic library organization and the semantic web
Tzi	Technologie-Zentrum Informatik - University of Bremen
UniDuisburg	University of Duisburg
SUB	Göttingen State and University Library

Greece

FORTH	Foundation for Research and Technology, Hellas
MUSIC/TUC	Laboratory of Distributed Multimedia Information Systems and Applications of Crete

UOA	University of Athens
ICOM	Intracom S.A., Hellenic Telecommunications & Electronics Industry
NDC	National Documentation Centre
UoC	University of Crete
IONIO	Ionian University
AUT	Aristotle University of Thessaloniki
Hungary	
MTA SZTAKI	Magyar Tudományos Akadémia – Számítástechnikai és Automatizálási Kutató Intézet
HLI	National Széchényi Library
Ireland	
DCU	Dublin City University
Israel	
eJewish.info	Developing Jewish Networking Infrastructures
Italy	
CNR	Consiglio Nazionale delle Ricerche
POLIMI	Politecnico di Milano
ICCU	Istituto Centrale per il Catalogo Unico delle Biblioteche Italiane e per le Informazioni Bibliografiche
MBAC	Ministero per i beni e le attività culturali
DIB	Università degli Studi di Bari
DEI	Università degli Studi di Padova
CiBit	Centro interuniversitario Biblioteca italiana telematica
ITC-irst	Istituto Trentino di Cultura - Centro per la Ricerca Scientifica e Tecnologica
DSI	Università degli Studi di Milano
MICC	Media Integration and Communication Center, University of Florence
CS	Department of Computer Science - University of Bologna
Latvia	
LU	University of Latvia
Norway	
NTNU	Norwegian University of Science and Technology
Poland	
NDAP	The General Office for State Archives
ICIMSS	The International Centre for Information Management Systems and Services
Portugal	
BN	Biblioteca Nacional

INESC Porto Instituto de Engenharia e Sistemas de Computadores do Porto

Russia

IPI RAS Russian Academy of Science

Slovakia

CU Comenius University

Spain

UNED Universidad Nacional de Educacion a Distancia

CAC Ciudad de las Artes y las Ciencias, S.A.

GRINBD Grupo de Recuperación de Información y Bibliotecas Digitales -
Universidad de Valladolid

dit-UPM Universidad Politécnica de Madrid

UOC Universitat Oberta de Catalunya

Ü Universidad Rey Juan Carlos

Cervantes Biblioteca Virtual Miguel de Cervantes

Sweden

SICS Swedish Institute of Computer Science AB

Switzerland

ETHZ Federal Institute of Technology

EIT Eurospider Information Technology AG

The Netherlands

CWI Centrum voor Wiskunde en Informatica

TNO-TPD Netherlands Organisation for Applied Scientific Research

UT/CTIT Universiteit Twente

ISIS Intelligent Sensory Information Systems - University of Amsterdam

United Kingdom

Elsevier Elsevier Science B.V.

AHDS Arts and Humanities Data Service

BBC British Broadcasting Corporation

Strathclyde University of Strathclyde

UKOLN UK Office for Library and Information Networking

Exeter University of Exeter