

Towards the new-generation digital libraries: recommendations of the NSF/EU-DELOS working groups

Guest editor introduction

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Digital libraries represent new infrastructures and environments made possible by the implementation and integration of a number of IC technologies, the availability of digital content on a global scale, and a strong demand from the ever-increasing number of online users. They are destined to become an essential part of the information infrastructure of the 21st century.

Digital library research today is seen as grounded in computer science and engineering research, informed by domain research across disciplines, applicable to a broad set of scientific and nonscientific problem domains, and characterized by novel collaborative efforts focused on the creation, collection, organization, use, and preservation of large volumes of digital information in a rapidly changing, globally linked knowledge environment. The research environment for many disciplines in the sciences, arts, and humanities involves widespread creation, collection, organization, storage, synthesis, and sharing of huge volumes of digital information. As the world's store of online collections proliferates, the development of altogether new, analytical, comparative, and interpretive frameworks has emerged. Digital libraries are now viewed as essential to enhanced research environments. Recent planning reports funded by the National Science Foundation (NSF), including the *Report of the National Science Foundation Blue Ribbon Advisory Panel on Cyberinfrastructure* and, more recently, the *Report of the NSF Workshop on Research Directions for Digital Libraries: Knowledge Lost in Information*, make compelling cases for new investment in digital library research and infrastructure. The NSF/EU-DELOS working groups have effectively elucidated detailed research and infrastructure-building agendas and actions to be taken to ensure continuing progress.

However, digital libraries were not an explicit subject for research until the 1990s. The initiative that really established them as a distinct field came in 1994 when, in the United States, the NSF created the Digital Library

Initiative (DLI). Beyond and above the specific work that it funded, DLI also gave shape to an emerging discipline. Over the 10-year period from 1994 to 2004, the US Digital Libraries Initiatives and the International Digital Libraries Collaborative Research funded more than 50 projects totaling over \$70 million. The projects funded ranged in size and kind but were distinguished by broad collaboration and interdisciplinary research and testbeds. Information and links to the projects and other activities can be found at <http://www.dli2.nsf.gov/>.

In Europe, partly stimulated by the US activities, the digital libraries field started to emerge as a clearly identifiable area of research in the mid-1990s with the funding of some important national initiatives (for example, the eLib programme in the UK and the MeDoc project in Germany). The role played by the Commission of the European Union in the recognition of digital libraries as a research discipline was of great importance as the Commission has funded a large number of digital library projects. In particular, the Commission recognized the need to stimulate the creation of an integrated European digital library research community and for this reason has supported the DELOS Network of Excellence on Digital Libraries since its very beginnings.

DELOS was first funded in 1997–1999 as a working group by the ESPRIT Long Term Research Programme of the 4th Framework Programme (4FP) of the European Commission (EC). The objectives were to promote awareness in Europe of priority digital library research issues, to promote collaboration between European research teams active in the digital library domain, to encourage the launching of digital library projects both by the European Union and by national funding agencies, and to establish links between ongoing national and international projects in the digital library domain. In 2000 DELOS became a Network of Excellence on Digital Libraries funded by the 5th Framework

Programme of the EC. The mandate of the Network was to build on the initial efforts of the working group and thus contribute towards the creation of a strong and active European digital library research community by providing a forum where researchers, practitioners, and representatives of interested applications and industries could exchange ideas and experiences, and also by improving international cooperation. The success of the Network led to DELOS being again funded by the EC under the 6th Framework Programme. Its mission, now, is to integrate and coordinate the ongoing research activities of the major European research teams in the field of digital libraries with the aim of promoting the development of generic digital library technologies to be incorporated into industrial-strength digital library management systems (DLMS) offering advanced functionality through reliable and extensible services. For more information on the DELOS activities, see <http://www.delos.info/>.

International planning and coordination in the way digital libraries are developed and used is essential to create globally distributed information environments that offer users easy access and powerful tools for inquiry and research – regardless of geographical location, language, or data object formats. NSF and DELOS thus began to build collaborative links from very early on. The first formal collaboration concerning digital libraries between the two sides was in 1998 and consisted in the creation of five NSF/EU-DELOS working groups (on interoperability, metadata, intellectual property rights and economics, global resource discovery, and multilingual information access) that jointly explored digital-library-related technical, social, and economic issues, shared results, and made recommendations for the future. The results of these working groups were published in white papers and presented to national and international decision makers and funding agencies on both sides of the Atlantic. Other collaborative actions between DELOS and the NSF have included the sponsorship of DELOS thematic workshops by the NSF and the co-organization of the EU-NSF DL All Projects Workshop in Rome in March 2002.

As a result of discussions at the All Projects Workshop, DELOS and the NSF decided to set up another series of joint working groups with the mandate of defining research agendas for specific digital-library-related critical areas and identifying strategic topics and activities for cooperation between EU and US researchers. The ulti-

mate goal was to produce a set of recommendations leading to the efficient development of next-generation digital library management systems.

The chosen areas were: (i) DL Information Technology Infrastructures, (ii) Digital Imaging for Significant Cultural and Historical Material, (iii) Digital Archiving and Preservation, (iv) Personalization and Recommender Systems in Digital Libraries, (v) Actors in Digital Libraries, (vi) Spoken-word Digital Audio Collections and (vii) ePhilology: Emerging Language Technologies and Rediscovery of the Past. Each working group was cochaired by prominent members of the European and US digital library research communities and consisted of approximately ten European and US experts in the specific field covered. The groups met two or three times, in Europe and in the US.

This special issue of the *International Journal on Digital Libraries* contains eight papers presenting the collaborative activities in which DELOS and the NSF have been involved, with the main focus on the results of these seven working groups. The first article is an overview by Yannis Ioannidis that takes stock of the actual state of the art in the digital library domain, identifies some of the main problems to be solved, and proposes directions for future work. The paper provides a detailed analysis of the recommendations of the several activities carried out under the DELOS framework and within the NSF/EU-DELOS cooperation. It concludes with a proposal for a research roadmap based on the results of the working groups, which has the potential of transforming digital libraries into universal knowledge repositories and communication conduits. The other papers in this number have been derived from the reports produced by the seven working groups¹ and summarize their main findings. Each paper examines the principal research challenges in the area studied and recommends activities that would help to achieve not only the immediate research goals in that area but would also contribute to the achievement of significant progress in the digital library field as a whole and to the realization of the grand vision of universal knowledge infrastructures capable of rendering all kinds of information globally accessible, in a friendly, efficient, and effective way.

¹ These reports can be found on the DELOS website at http://delos-noe.iei.pi.cnr.it/activities/international_forum/Joint-WGs/joint-wgs.html.