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Report on the Third Workshop on Foundations of Digital Libraries

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The 3rd Workshop on Foundations of Digital Libraries was held in Århus, Denmark, on September 18, 2008, in conjunction with the [12th European Conference on Research and Advanced Technologies on Digital Libraries \(ECDL2008\)](#). Like the two previous workshops in the series, it was dedicated to discussing several fundamental issues of Digital Libraries (DLs) related to modelling the key concepts that characterise the field. In particular, it focused on problems related to *interoperability in large federated Digital Libraries*. Experts participating in prominent DL projects were invited to present the main interoperability problems identified in their domain, the solutions applied, and the main open issues. [The DELOS Reference Model for Digital Libraries](#) was suggested as the conceptual tool to be used as a formal basis for understanding and discussing the full spectrum of *interoperability* issues.

Donatella Castelli (ISTI-CNR) set the scene for the workshop by presenting how it could contribute to identifying and prioritising interoperability issues. In the past, the

workshop has been a forum for discussing the DELOS Reference Model, providing researchers with an organised framework for systematically investigating interoperability issues. In the future, it will be incorporated into the activities of the soon-to-be-launched DL.org project, an EC-funded Coordination Action that will focus on promoting interoperability between current and future DL initiatives.

Dagobert Soergel (University of Maryland) discussed the role of the Reference Model as a lingua franca for Digital Libraries. In particular, he illustrated how this model can promote interoperability at various levels, ranging from effective discovery of existing software and literature to organising and structuring discussions, courses and lesson plans, to investigating and comparing existing systems or parts of them in order for them to interoperate.

Yannis Ioannidis (University of Athens) gave a high-level review of current interoperability approaches and highlighted how these have focused on just part of this multifaceted issue. He classified interoperability issues into three levels of different complexity (superficial, syntactic, and semantic). He used the DELOS Reference Model as a basis and provided concrete examples to argue that interoperability is a broad issue touching on all six main concepts of the Model, including the not-so-common ones in interoperability discussions: User, Policy, and Quality, next to the usual: Content, Functionality, and Architecture.

Carlo Meghini (ISTI-CNR) presented data modelling issues that arise in a large federated Digital Library, such as [Europeana](#). In particular, he focused on modelling Europeana as an '*information integration system*' whose interoperability problems can be solved through a set of *mappings* between *local schemas* and the *global schema*, and through diffusing awareness of applicability of existing solutions borrowed from other domains (namely, the database domain). He also briefly reviewed ontology matching, ontology mapping, and ontology evolution results.

Stefan Gradman (Humboldt University) discussed the most challenging issues encountered when making [Europeana](#) interoperable. Such issues range from the *object model* used to properly represent compound objects, to *authentication services*, *semantic mappings*, *multilingualism*, and *data quality*. He concluded by saying that the *Reference Architecture*, a key concept in the DELOS Reference Model that is still under development, is expected to play a fundamental role in solving the issues identified in a pragmatic and informed manner.

Georg Eckes (Deutsches Filminstitut) presented various experiences in making film archives interoperable. In particular, he introduced the recently launched [European Film Gateway](#) project that, within the next 3 years, is called to federate and make interoperable various film archives and museums, holding moving images, books, pictures, posters, and sound recordings. He presented the main lessons learned from his past experiences, such as the need for a common basis of understanding, and he discussed how various levels of interoperability could be obtained by reconciling data at different levels of granularity.

Wolfram Horstmann (Bielefeld University) introduced the [DRIVER](#) project and the interoperability issues faced in that context. He illustrated how DRIVER can easily be conceived as an instantiation of (parts of) the Reference Model, e.g., how the model can capture the various notions of 'system' coexisting in DRIVER. He also presented the

experience of DRIVER in dealing with extreme diversity among multiple sources of information and the solutions put in place to mitigate it. He concluded by highlighting that diversity is a natural consequence of resource distribution and that interoperability is a cross-domain critical topic.

Paul Polydoros (University of Athens) presented the [D4Science](#) project and discussed the various interoperability issues faced when building an e-Infrastructure where computing and storage resources as well as collections and services – potentially offered by different providers – are made available for dynamically building *Virtual Research Environments*. He presented the conceptual framework underlying the design of the system and the corresponding technology developed for interoperability management, ranging from resource abstraction to data-agnostic transport mechanisms and metadata mapping.

Joan Lippincott ([Coalition for Networked Information](#)) reported on the priorities driving the activities of her institution, i.e., development of a user-centered view of digital libraries, interoperability of any form of digital objects, and management of author identities across different systems. She stressed how the first aspect is a prerequisite for understanding interoperability priorities and illustrated the multidisciplinary nature and needs of today's DL users with examples involving interoperability of several datasets and tools.

Seamus Ross (University of Glasgow) presented the key interoperability issues addressed in the context of the [Digital Preservation Europe](#) project and highlighted the connection between interoperability and preservation. The issues discussed ranged from *processes* (what the boundaries between static content, representations, and linkages are) and *change over time* (the creation of 'dynamic interoperability' frameworks) to *policy*, *legality*, and *preservation* (how to preserve 'interoperability potentiality'). He concluded by introducing various aspects to be considered at the intersection of interoperability and preservation, from bit stream to content, to context, to experience.

The above presentations initiated several exciting discussions. The fact that each presenter gave a different definition of interoperability reminded everyone that reality might be viewed differently depending on one's perspective. Interoperability is not a new problem. Nevertheless, contemporary Digital Library requirements have intensified the need for proper solutions, standards (either *de facto* or *de jure*), concrete development initiatives, and specialised efforts to find effective answers to the large number of questions associated with it. The workshop recognised the importance of developing interoperability-enabling technologies and, as prerequisites, the need for (i) *a unifying framework* for systematically describing and investigating all relevant issues and (ii) an *open forum* for discussing emerging approaches and promoting proper solutions. We expect that the DL.org initiative will contribute to both of them.

More information about the workshop and the work presented there is available from <http://www.delos.info/DLFoundations2008>.

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