DiLAS: a Distributed Service for the Management of Annotations

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This work reports on the status of advancement and development of the Digital Library Annotation Service (DiLAS) project which is aimed at designing and developing an architecture and a framework able to support and evaluate a decentralized annotation service. Specific attention is here given on the integration of the annotation service into DAFFODIL and BRICKS.

The mission of DiLAS is to foster change in users' interaction with Digital Library Management Systems (DLMS) and contribute to developing services for social infrastructure in Digital Libraries (DL). This mission is addressed through the provision of a new independent annotation service for interactive knowledge creation and sharing. The annotation service enriches the DL contents and usage, the users personalize the information in a new contextual learning opportunity, and they collaborate by sharing this new knowledge.

All the project participants have previous experience in developing a number of annotation systems targeted to different application domain users. Among those systems, there are (in alphabetical order): BRICKS (Building Resources for Integrated Cultural Knowledge Services), COLLATE (Collaboratory for Annotation Indexing and Retrieval of Digitized Historical Archive Material), DAFFODIL (Distributed Agents for User-Friendly Access of Digital Libraries), FAST (Flexible Annotation Service Tool), IPSA (Imaginum Patavinae Scientiae Archivum: Image Archive of the Paduan School), and MADCOW (Multimedia Annotation of Digital Content Over the Web).

Building on those previous experiences the project participants have identified the use cases the DiLAS annotation service needs to support and have decided to design and develop a generic annotation service, that is a service to be used into different DLMS. To this end, the architecture of the DiLAS system has been defined and it consists of three layers – the data, application and interface logic layers. This decomposition allows us to achieve a better modularity within DiLAS and to properly describe the behaviour of DiLAS by means of isolating specific functionalities at the proper layer.

The data logic layer manages the actual storage of the annotations and provides a persistence layer for storing the objects which represent the annotation and which are used by the upper layers of the architecture. In order to make it as flexible as possible, an abstract API for the functionalities of the storage has been defined. This API, in turn, allows for accessing different systems to perform the actual storage of the annotations. In the first prototype of the DiLAS system we use the MADCOW system as actual storage for the annotations, but for the final prototype we are going to integrate also the BRICKS system as storage provider.

The application logic layer provides advanced functionalities that make use of annotations, such as for example the search and retrieval of annotations described above. As in the case of the data logic layer, we defined a set of abstract API that make the access to the DiLAS service functionalities independent from the particular implementation provided.

The interface logic layer is devoted to manage the interaction with the end-user. It depends on the system into which DiLAS is going to be used and relies on the DiLAS Abstract Service API in order to provide the functionalities described above to the end user.

For the first prototype of DiLAS we use the DAFFODIL system in order to carry out some of the described user-level use cases, but in the final prototype the BRICKS system will be supported as well. Note that these two systems offer different kinds of functionalities based on annotations, but these functionalities are obtained as composition of the functionalities provided by the DiLAS Abstract Service API.

Note that both the application logic (Abstract Service API) and the upper part of the data logic (Abstract Storage API) correspond to the respective layers in the FAST system. Thus, FAST represents the architectural framework which makes it possible to integrate MADCOW, DAFFODIL, or BRICKS together. Indeed, FAST describes both these layers and the business objects exchanged among these layers by means of abstract interfaces. Those interfaces provide us with a general framework for describing the interaction and integration of the different layers without coupling it with a specific implementation. As a consequence, the integration of MADCOW, DAFFODIL, or BRICKS requires to provide a concrete subclass of the FAST layers and business objects, in order to fit them to the needs of the newly integrated systems.

The DiLAS annotation model derives from the FAST model. The current implementation of the DiLAS model provides a partial set of functionalities in order to fit into the MADCOW model.

With respect to the chosen architecture, a first prototype demonstrator of the DiLAS system has been developed at the "interface logic" layer. The objective of this demonstrator is to allow an easy access to the DiLAS functionalities, while showing the log of all the system activities, because this demonstrator is intended to be used by system developers for testing purposes more than by end users.

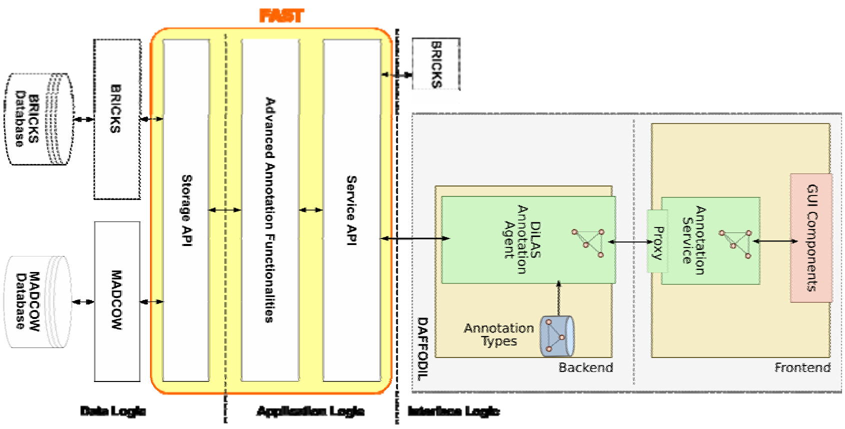

Figure 1: DiLAS/DAFFODIL architecture.

Figure 1 shows the architecture of DAFFODIL/DiLAS. DAFFODIL consists of two main parts: the backend running on a dedicated server, and the front-end executed on the user machine. A DiLAS annotation agent was implemented and is running in the DAFFODIL backend. This agent communicates with the FAST server.

On the DAFFODIL front-end, another annotation service is running which communicates with the DAFFODIL backend through a proxy. When the user creates a new annotation with the GUI components, the annotation service requests the annotation types in the ontology from the backend and creates a memory model of it. This memory model is used to dynamically set up the list of possible annotation types in the user interface. The newly created annotation, an instance of one of the annotation type classes, is sent to to backend annotation agent. The OWL code representing the annotation and its metadata is converted into a valid MADCOW format and sent to the FAST server. Similar for the other direction – if an annotation thread is requested for an object, the backend annotation agent queries the FAST server for all necessary annotations. These are transformed into instances of their corresponding annotation type class and the resulting OWL code (classes and instances) is sent via the proxy to the front-end annotation service in order to be displayed.

References

[1] Agosti M., Albrechtsen H., Ferro N., Frommholz I., Hansen P., Orio N., Panizzi E., Pejtersen A.M. and Thiel U. 2005. DiLAS: a digital library annotation service. In J.-F. Boujut (ed.), *Proceedings of Annotation for Collaboration - A Workshop on Annotation Models, Tools and Practices (IWAC 2005). Paris (France), 23-24 November 2005*. Paris: CNRS - Programme Société de l'Information. 91-101.

[2] Agosti M., Ferro N., Albrechtsen H., Frommholz I., Panizzi E. and Thiel U. 2005. Design, implementation and evaluation of the use of digital multimedia annotations in DL interaction and DL users collaboration. In C. Thanos (ed.), *DELOS Research Activities 2005*. DELOS Network of Excellence. 47-48.

[3] Agosti M., Ferro N., Frommholz I., Panizzi E., Putz W. and Thiel U. 2006. Integration of the DiLAS Annotation Service into Digital Library Infrastructures. In A. Blandford and J. Gow (eds.), *Proceedings of the. 1st International Workshop on Digital Libraries in the Context of Users' Broader Activities (DL-CUBA 2006). Chapel Hill (USA), 11-15 June 2006. 1-4*.

[4] Agosti M., Ferro N., Frommholz I. and Thiel U. 2004. Annotations in digital libraries and collaboratories – Facets, models and usage. In R. Heery and L. Lyon (eds.), *Research and Advanced Technology for Digital Libraries. Proceedings of the 8th European Conference (ECDL 2004). Bath (UK), 12-17 September 2004*. Lecture Notes in Computer Science 3232. Berlin-Berlin-Heidelberg: Springer. 244–255.

[5] Agosti M., Ferro N., Panizzi E. and Trinchese R. 2006. Annotation as a support to user interaction for content enhancement in digital libraries. In A. Celentano and P. Mussio (eds.), *Proceedings of the Working Conference on Advanced Visual Interfaces (AVI 2006). Venice (Italy), 23-26 May 2006*. New York: ACM Press. 151-154.