Web-Integrated Information Integration

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Information Integration via Web-based Publishing Workflows

One of the most fundamental subtasks of information integration which comes up very often in day-to-day business and research is the publishing of documents, e.g. project plans, business reports, presentation layers, product designs, idea sketches, announcements, telephone lists, reports, advertisements or research papers. Actually, over 90% of companies knowledge is - according to a study of the Gartner Group - stored in form of documents [Schneider (1995), p. 8].

INTERFYS, a project of the Institute for Information Systems, Münster (Germany), originates from working on innovative Online (Electronic, Internet) Publishing Concepts overcoming the severe disadvantages of print publishing. The broader intention of INTERFYS is to support editorial processes within a widespread net of knowledge holders (in the sense of Knowledge Management) and controllers who provide a customer oriented range of high quality documents, i.e. documents which can be used by recipients punctually, efficiently and profitably. The consolidation related to the production and publishing of corporate and research documents is usually connected with diverse review and revise processes. Managing collaboration within these processes causes problems: Due to awkward paper based information flows and lacking in control conventional editorial processes are often characterized by exceptionally lengthiness, spontaneous, unsystematic work, high error frequency and lack of transparency which results all in all in an insufficient quality. Hence, there is a lack of information integration.

Efficient information integration is first based on data integration. However, integrated systems do not only have to provide applications, data and documents for supporting single activities within editorial processes but need also to support the control of triggering activities concerning the quality assurance of information. A very popular information technology dedicated especially to the latter problem is *Workflow Management* [see also Bartholomew (1995)]. The analysis of editorial processes indicate a high potential benefit derivable from an automation using Workflow Management. Consequently, the INTERFYS project has not only been focused only on management and providing of hypermedia documents but on a workflow based dynamic process oriented support of distributed editorial work within an Intranet. Thus, INTERFYS shows an important additional potential of database based internet applications, which has been rarely regarded so far. The paper evaluates the conceptual and technical aspects of the System INTERFYS 2.0 which has just been realized.

In the first place, INTERFYS provides some core distributive functions which make up a comfortable user front-end for the reader, e. g. search functions, digest services, discussion forums. One difference is the dynamic content and versioning of documents. Once the draft-

status papers are published an author can submit updates to the system an therefore creates multiple versions of his documents enabling the reader only to look at the newest research results if he likes to, but also enables him to look at the hole history of research in one special field of interest. Table 1 comprises some distributive functions of INTERFYS which make up a comfortable user front-end for the reader.

Additionally, INTERFYS realizes a workflow from the first submission of documents to the final publication on the Web using modulized CFML statements as a Workflow Language. The system users, i.e. the authors, reviewers and arbitrators can dynamically request their individual worklists and can - if they have the rights - determine the state of an currently running or terminated workflow. In addition the system send E-Mail messages when process exceptions are raised, like an overdue review deadline. Currently, INTERFYS supports a double blind review with numerous loops for ensuring the quality and faithfulness to deadlines.

2 Conceptual and Technical Aspects of INTERFYS

The first stage of the project already resulted in a productive system (INTERFYS 1.0) which was presented on the CeBIT fair trade 1998 and as version 2.0 in 1999 in Hannover, Germany. For more Details on this System see [v. Uthmann, Speck 1998]. In 1999 the workflow functionality of INTERFYS 2.0 was separated in an own layer (MIDGARD). INTERFYS is currently in use as a platform for the review process of the 11th international Bled electronic commerce conference "Electronic Commerce in the Information Society", Bled, Slovenia and will be as well the platform for a pure electronic professional magazine for business information systems. The system can be visited under http://interfys.uni-muenster.de/.

The system is realized in an innovative way integrating Internet, Data Management and Workflow Management. This Integration is realized exclusively by standard WWW system components, i.e. without using dedicated Workflow Management systems. where the core of INTERFYS is formed by a gateway application implemented in Cold Fusion™ from Allaire [Allaire (1997), http://www.allaire.com/]. Consequently, for reviewing, administrating, submission and reading of documents the system can be accessed solely via Web browsers which are used as telework workplaces from all participants in editorial process. The software architecture of INTERFYS is realized by a three layer concept (see figure 1).

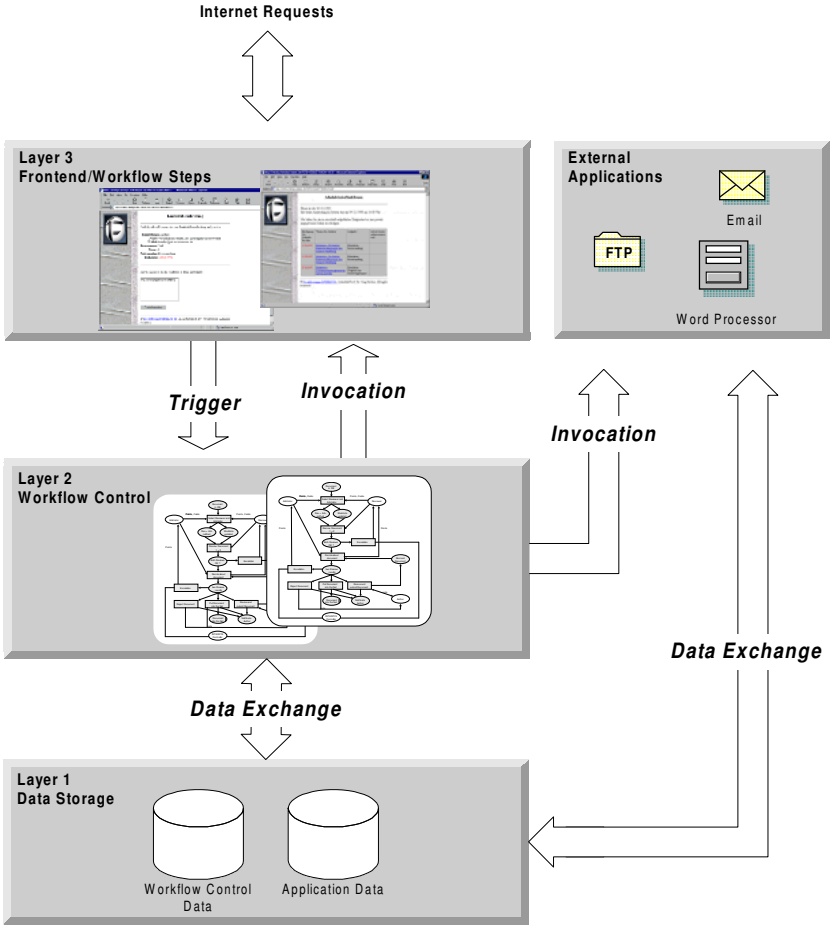

Fig. 1: Software architecture of INTERFYS

Layer one stores all data needed and created during the publication process. Additionally this layer encapsulates the storage of the supported process definitions. It is realized using standard database system with appropriate data models for workflow and application data.

The *second layer* (Midgard) encapsulates all workflow functionality, e.g. worklist managing and workflow step invocation. Different workflow types can easily be managed because the implementation of this layer is independent from specific process definitions. The adaptation effort needed for the implementation of new processes can significantly be reduced using this separation. The representation of the different workflow types is easily stored and maintained in the underlying database as well.

Although there is just used Internet technology the two constitutive criteria of Workflow Management are fulfilled here [see also Leymann, Roller (1997), pp. 102]: 1**.** There is an automation of process control realised executing core functions of Workflow Management, 2. There is a separation of task logic, i. e. of programs which support tasks referring to activities to be executed within workflows (individual text editors, FTP-Server, Web-Server, Mail-Server, Acrobat Writer™, Acrobat Reader™) and process logic, i.e. programs for automation of process control in the sense of the core functions of Workflow Management outlined. The knowledge, which activity follows another, is handed over to Midgard (this approach is regarded as transactional or production workflow by some authors [Sheth, Rusinkivicz (1993); Georgakopoulos, Hornick, Sheth (1995), p. 126]) and therefore acts as a controlling middleware.

Figure 2 shows exemplary how the first two workflow steps “Submit Document first time” and “Select Reviewer and Arbitrator” have been implemented using CFML. A workflow

activity “Submit Document first time” - and therefore a workflow instance - is triggered by authors in the way sketched above. It triggers the ftp-Upload and routes the relevant control data (date of submission, authors data, title, research domains etc.) to layer 3 of the INTERFYS system. The upper part of figure 3 shows how the generic SQL statements are dynamically build using CFML language performing the needed database inserts. As an excerpt of the hole CFML module it is shown how the submission database table an the authors/co-authors table is filled with the submitted data. Finally, the gateway program triggers the next activity “Select Reviewers and Arbitrator”.

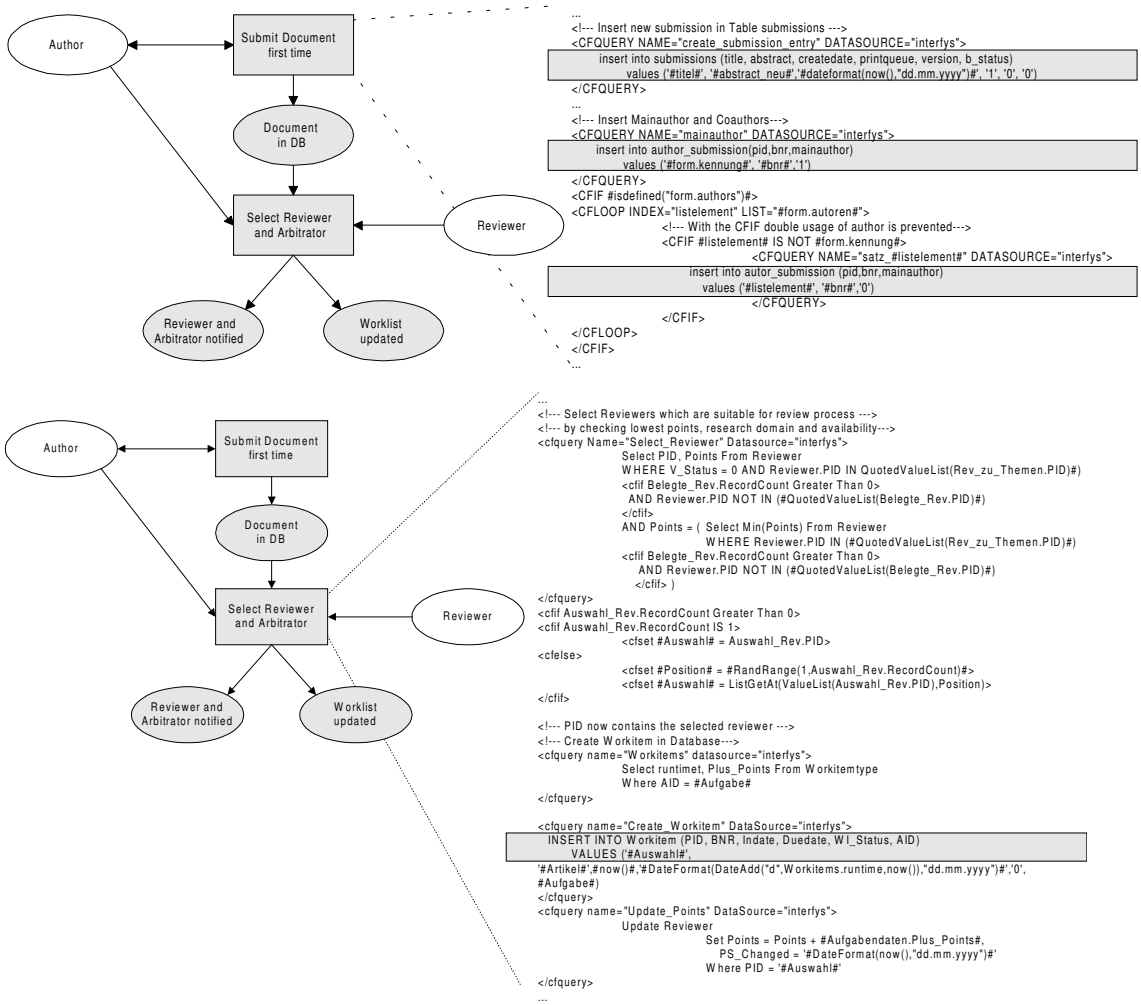

Fig. 4: CFML Implementation of workflow steps.

The *third layer* implements the process specific web front end and the single workflow steps, which are invoked by layer two's workflow engine. Therefore single web pages are build on demand by the web server and Cold Fusion as instances from web page templates. The implementation expense reduces significantly using this template technology and a common look-and-feel can be realized easily.

Single workflow steps can easily be reused in different workflow types. To support this separation of workflow steps and the coordination of these, the first and the second layer each have their own encapsulated database access. Conflict free access to workflow control data and application data can be ensured by this separation. When comparing this architecture to common workflow architectures, the workflow data of the first and second layer of INTERFYS can be seen as workflow engine. The third layer would referred to as the application layer.

4 Summary and Perspectives

INTERFYS supports information integration focussing on the most important corporate form of information, documents. Unlike prevailing online publishing systems it does not only support the widespread presentation of documents but also improves the management of editorial work processes with flexible IT support of process control. By increasing transparency and controllability of processes by systematic feedback control circuits, higher process and resource efficiency can be reached.

Currently, there are some workflow management system available which have the capability to work sufficiently in the context of the internet. But even in comparison to solutions based on such workflow management system, INTERFYS has three significant advantages [see also Lawrence (1997b)]:

A workflow management system would be an additional component which is itself costly (around US$ 30.000) and does not have the functionality for the interaction with participants via the web, especially readers services, so a gateway server would nevertheless be mandatory.

Editorial processes are relatively small sized and simple so that they would utilize only a minimum of the comprehensive functionality brought by workflow management system. Especially the central advantage of workflow management system, the relatively easy change of logical workflow structures through the use of dedicated graphical languages are rarely relevant because the structure of editorial workflows is not only relatively small sized and simple but are to a high degree persistent. Thus, a workflow management system would be functionally oversized so that the additional cost of installation, introduction and maintenance would not be justified.

On the other hand specific requirements occur which workflow management system often do not cope with just using their standard commands, like staff resolutions on the basis of a credit point system, graphical status view or the self-registration of authors as workflow participants during runtime. Moreover, Cold Fusion contains a number of standard commands to invoke internet applications while in workflow management system this often requires deeper knowledge about internet technology. Also the graphical status view could be easily realized using elementary Cold Fusion commands.

Against this background INTERFYS provides a very powerful and cost efficient concept of working environment within the general context of document publishing. Facing the rapidly growing usage of database based internet applications – for example Lotus enlarged its widely used groupware solution Notes™ by a web-server (Domino)- the concept will be even more relevant in the future.

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