

# Document exchange as a basis for business-to-business co-operation

Hans-Jürgen HOFFMANN and Daniela HANDL  
Darmstadt University of Technology, Dept. of Computer Science,  
Chair on Programming Languages and Compilers,  
Alexanderstr. 10, D-64283 Darmstadt, Germany  
Tel: +49 6151 163410; Fax: +49 6151 166648;  
Email: {Hoffmann, Handl}@pu.informatik.tu-darmstadt.de

**Abstract.** Written documents are, since centuries, commonly used in co-operations between businessmen; they are exchanged, e.g., by letter or fax, they are drafted, copied and/or archived. Traditional data processing added computer-supported preparation of documents, may be by fill-in-a-form, before exchange. - Internet allows to exchange documents in form of E-mail, files, and WWW-pages. Database queries and Web searches are possible. Multimedia effects are state-of-the-art. Hyperlinks can be established. - Many facets of Electronic Commerce are realized by exchanging documents. E.g., building up a business contract; clarification of contract conditions and/or specifications; preparing and checking a contract in traditional bilateral business relations and/or in a group of businessmen, in following up business progress. Documents may have attached powerful extensions allowing planning and simulation, controlling document flow, access right restrictions and the like. - The paper develops requirements of document functionality and shows approaches for realization in an Internet-based, peer-to-peer system for document exchange, MALL2000.

## 1. Introduction

Important concepts reported here in preparing and exchanging a document with business partners (the „*correspondents*“) going beyond traditional paper form and its replacement in the Internet by a simple HTML-based Web site are, to start with:

- Document preparation and composition by (hierarchically) instantiating a *document structure* in the document composition framework HotDoc [1] (a previous research project supervised by the first author, see section 4), designed and implemented in a Smalltalk environment. The framework allows specialization of document entities, *HotDoc parts*, by subclassing. The framework classes and, possibly, their subclasses (finally what we call *part classes*, non-abstract classes at the bottom of the class hierarchy) provide a general document handling functionality, especially prepared for document presentation on the computer display screen and for interactive, direct manipulation with the instantiated parts by a user (i.e., a businessman).
- The *contents of a document part* is *typed* by the characteristics of the part class and may vary from plain text to a wide variety of multimedia features (see section 2) with attached functionality going beyond simple presentation and/or recorded playing. An outstanding example is the HotSimple [2] part class architected as an advanced spreadsheet-based, document-integrated simulation and planning tool (see section 4.3).
- A document together with its instantiated parts is a cluster of Smalltalk objects each one with a *state* recording what kind of information (text, multimedia material, results of a simulation/planning task, etc.) has been filled into parts by the user forming their

*contents*. The (time-varying) state of all document parts (following user manipulations) is the (time-varying) state of the document as a whole. The *document* (more precise, its state) can be viewed, stored, exchanged with business partners.

These concepts are a first step going beyond traditional paper form and are only possible in a computerized environment. They are the achievements of the HotDoc (and HotSimple) research contributions referenced above. End of 1997 the first author developed a vision to offer a document exchange system applying the concepts to an Electronic Commerce, business-to-business environment, MALL2000+ [3]. A project proposal was formulated leading to what is now the EU sponsored MALL2000 project *MALL FOR ONLINE BUSINESS BEYOND THE YEAR 2000* (see section 9 for the acknowledgement).

The paper at hand reports on continuing work by the authors in advancing HotDoc/HotSimple to a powerful, flexible, Internet-based system (the MALL2000 system<sup>1</sup>) for business-to-business applications (*extranets*, [4]). More concepts for advancements in preparing and exchanging documents have to be considered. First, section 2 discusses the term *multimedia* from a different, unusual viewpoint. A conception for document handling is developed in section 3. Next, section 4 is devoted to the HotDoc framework, the underlying approach. Now, concepts applied in the MALL2000 architecture going beyond those introduced in section 1 can be considered, section 5. The software interface architecture at the site of a businessman, the main topic of the paper and under design and implementation in the scope of the MALL2000 project, is presented in section 6. Section 7 sketches a scenario demonstrating the usability of the developed concepts. Remarks on industrial significance and benefits are given in section 8. Conclusions are in section 9.

## 2. „Multimedia“ in documents, a viewpoint

What is the exact meaning of the term *multimedia*?

In the scope of our considerations one may initially think of *text* with inclusion of some *diagrams*, *graphs*, *pictures*. There may be some rules for formatting the text, e.g., simply by blank spots, and/or structuring features, section numbering and the like. *Electronic documents* (see section 3) may show *animations*; recorded *videos* and/or *acoustic signals* may appear and may become activated. What else?

Emphasizing document exchange by electronic means you may ask for standardized *communication formats and/or protocols*. All what can be electronically exchanged in an appropriate format/protocol is covered by the term *multimedia*.

A very pragmatic definition would be what is *presentable by Web browsers*.

Under our vision we want to extend all these orthogonal viewpoints by demanding an *attached functionality* going beyond just text presentation in the document, attached to resp. document parts, going beyond communication activities, Web presentation. Characteristic examples of what we mean by *attached functionality* are:

- Is any document part prepared for an interaction changing its content, i.e., is it *active/inactive*?
- Is the document part *visible*, is it an *invisible substitute* with black-box functionality?
- Have parts („cells“) *constraint relations* to other parts in the same document, as we observe them in the well known spreadsheets?
- Are there links/hyperlinks *in* the document with attached functionality (e.g., shortcuts for rapid reading, modification highlighting).
- Are *access rights* controlled, is a *workflow* provided?

---

<sup>1</sup> For further details see <http://www-it.fmi.uni-sofia.bg/mall2000/home.html> and/or [http://www.pu.informatik.tu-darmstadt.de/Projekte/Mall2000/index\\_e.html](http://www.pu.informatik.tu-darmstadt.de/Projekte/Mall2000/index_e.html).

Characteristics may change or may be changed from time to time introducing a *dynamic behaviour* to the document. This viewpoint certainly goes beyond the traditional definitions. Documents and their parts become what we call *self-active*.

### 3. The underlying conception; document-centred business-to-business co-operation

In many Electronic Commerce (EC) applications designers concentrate on packaged modules (e.g., for product selection, desktop like information presentation, data base access, encryption, basket handling) and associated tools. There are no extra provisions to support handling of the „*documents*“ which one finds all over to be exchanged in EC applications.

In the MALL2000 project the underlying conception is a *document-centred approach* (DC) which we think is more appropriate in business-to-business co-operation because, in its essentials, it corresponds to the day-to-day experience of businessmen. DC covers working with all kinds of documents, memos, specifications, manuals, catalogues, orders, bills, business contracts, tax forms etc. Documents are used for *exchange in „space“* (i.e., to a business correspondent, in a group of businessmen) and „*time*“ (e.g., for recording, archiving). We already introduced the term *document part* and mentioned need for flexible *hierarchical structuring* of parts (leading to what we call *subparts*). Placement of parts (e.g., for supporting information extraction by a reader, just aesthetics to manifest corporate identity, to adhere to regulations for form letters) may be (optionally) handled by what we call a *Gestalter* (i.e., a layout policy control object). Relying on our *viewpoint of multimedia*, parts are considered to be *self-active*, giving (e.g.) control of document processing, at least to some extent, to a document itself in following a workflow attached to it; giving a simulation and planning functionality as known from spreadsheet application to allow a business correspondent to negotiate and individualize a proposed business contract to his individual needs (section 7 gives a correlated scenario).

Document composition, presentation and manipulation at the site of a businessmen requires flexible *editing facilities* (especially taking into account the multimedia viewpoint introduced above). The document composition framework HotDoc (see section 4) together with the Smalltalk environment in which it is realized provides a powerful technical basis to realize these DC- facilities.

Application of DC also implies special *provisions for document exchange* between correspondents. A document is no more a static entity as (e.g.) a letter send by mail, the processing state of all its parts has to be transferred including the resp. state of the attached functionality. Again, HotDoc and the object-oriented Smalltalk environment in which it is embedded (a so-called *virtual image*) are most important for appropriate realization.

### 4. HotDoc-Framework

Sections 2 and 3 identified the challenging characteristics of document handling and exchanging for business-to-business co-operation. The MALL2000 project applies, in one of its user service interfacing approaches (there is another one, more traditional without relying to CD described here), results of our previous *HotDoc* research ([1], [2]). The framework already covers most of the characteristics mentioned above. For application in the MALL2000 project for EC some streamlining has still to be done. In the following we will highlight interesting details of some part classes. Their design and implementation (*part class programming*) is done by appropriate subclassing of the available framework classes; message exchange and group co-operation of correspondents (via Internet and in Web browser integrated) will require revision in the framework itself.

#### 4.1 *HotSimple (already implemented, highlighted detail)*

*HotSimple* ([2], [5]) is a spreadsheet-based solution integrated into HotDoc to support simulation and planning tasks of businessmen. It involves bi-directional constraint handling, navigation and visualization facilities in the constraint solution space, advanced error control by unit specification, to mention some of the extraordinary features.

#### 4.2 *HotFlow (under implementation)*

Documents and their processing by a group of co-operating business correspondents will be controlled by the new part class *HotFlow*. A *HotFlow* document part is attached as a tag; it provides a script to control document workflow between involved correspondents. There will be some predefined workflow strategies (including conditionals) ready for attachment; and there will be provisions for individually specifying ones when working with a document covering non-routine document processing steps. In so far the *HotFlow* part class has to consider separation of document processing tasks as *delegation to agents* (see *HotAgent*, section 4.3) and processing *in persona*, interactive treatment by a businessman himself.

It cannot be foreseen in advance, *statically* how we call it, how a document should be treated. Provisions for *dynamic adaption* of a document workflow to newly upcoming needs have to be provided. An appropriate adaptation tool, visually supported [6], has to be architected and realized.

The attached functionality which we see in a *HotFlow* part of a document contains autonomous, self-active control of a processing schedule and synchronization of parallel work-flow steps.

#### 4.3 *HotAgent (under implementation)*

A MALL2000 correspondent will offer document-centred services to other correspondents in two categories:

- *In persona*, he himself will initiate and handle the service. This category is the main subject of the interactive provisions for document structuring, part instantiation, and editing as introduced.
- By delegating routine activities to an *agent* (e.g., related to database access and information searching). Embedding an agent demand into a workflow (conditional) helps a correspondent to concentrate his work to tasks which need personal interaction.

Realization under an (invisible) document part instantiated from the *HotAgent* part class and extracted from a correspondent's "agent library" if needed (under the conditions involved). A *HotAgent* part in a document activated from a *HotFlow* part tagged to the document is a script performing actions (including condition checking, filtering and matching with descriptions of possible routine activities, rule based) influencing the document at hand as a substitute for the human interactor (i.e., the businessman himself).

### 5. MALL2000 systems

Now, we may continue in the discussion of important concepts in preparing and exchanging a document going beyond traditional paper form as started in section 1. These are outstanding features of MALL2000 systems compared to present EC solutions for business-to-business co-operation.

- Applying CD throughout as the underlying conception for (system design and) an integrated, uniform and user-friendly system usage in a flexible, peer-to-peer, equally

entitling architecture for all the correspondents involved in a business contract reduces the *threshold for laymen* in information technology (what businessmen usually are).

- An important contribution is the advanced viewpoint of what is considered to be *multi-media*. It's a *functionality oriented attachment* to mere presenting/viewing a document as only a passive collection of document parts. The *simulation and planning capability* (HotSimple) as well as the *workflow control capability* (HotFlow) provided or under development, resp., bring in combination a level of self-activity to a document not known before. In database querying and information searching (HotData/HotSearch) combined with the delegation properties offered for routine work (HotAgent) the self-active functionality attachments demonstrate *improved support to businessmen*.
- Agent processing per se (HotAgent) as a *self-active treatment of routine activities* of correspondents are applicable (under workflow control) for recording the (intermediate and/or final) state of a business contract, for cc-ing, for archiving, to mention some outstanding possibilities, *without human interaction*.

## 6. Software interface architecture at the sites of businessmen

One main responsibility of the authors in the scope of the MALL2000 project is architecturing the Service Interface (SI) at the sites of businessmen and supervising its implementation. Implementation in the MALL2000 system will be as a Smalltalk applet in standard browser technology. To enhance software quality design patterns will be scrutinized. Besides improving the available HotDoc framework (including HotSimple) to realize the DC conception technical challenges are mainly in integration of workflow and agent concepts.

## 7. A sample scenario

A business enterprise wants to buy a company car for a physically handicapped employee. The car will have common extras (e.g., air-conditioning) as well as uncommon extras (e.g., special replacements for the pedals). This scenario describes a successful negotiation which leads to the conclusion of a contract. It serves as an example for documents as a basis for negotiations. (Mechanisms for breaking off a negotiation or transaction at miscellaneous points with the respective possibly resulting obligations should be provided as well; additional services like translation support, information on export restrictions, taxes etc. are not considered here.)

A MALL2000 user can get in touch with potential business partners by querying the MALL2000 database or by posting a note on the MALL2000 bulletin board (services not expounded here). When a contact is established, a negotiation document (ND) is created on the MALL2000 server - one document for each contact, if necessary -. Multiple partners can be involved in one document. In our example these might be:

- The manufacturer for the special replacements of the pedals,
- The motor-car dealer who installs the replacements of the pedals,
- The purchasing department of the enterprise which wants to buy the car,
- The handicapped employee himself.

As in most countries modifications on cars must be certified, partners might decide to give access rights to the respective safety standards authority (MOT, TÜV, ...) or to integrate certification into the workflow of the negotiation procedure.

All involved partners read and write parts of the ND. They specify demands, prices, terms of delivery etc. until they come to the point of entering into a contract. A document can consist of several hierarchically structured (sub)parts, depending on the preferences of partners and the branching of the actually discussed alternatives. In our example there

might be one part for each car model. Subparts thereof might consist of a picture, the choice of the common extras, the price and a description of the special replacements which would be possible or necessary in the respective car model. Subparts can have some functionality, e.g., if one special car model is available for no longer but a short period, the potential buyer has to decide within a certain time limit. If he doesn't react (due to illness, having forgotten it or whatever), a HotFlow part attached to the subpart remembers the partner involved automatically (e.g., by some form of a screen tag or an e-mail).

When partners decide in favour of one model with certain common or uncommon extras, the subparts for all other alternatives are closed. The contract is built up by all partners on the basis of the part of the ND with the description of the favoured alternative. Here much of the contract-relevant information is already available. Court of jurisdiction and other necessary details have to be added. MALL2000 offers draft agreements which can be modified. Articles of the contract can be filled in those agreements, but partners may also start with just a selection of them or even a blank sheet as well.

Execution of the contract (delivery of the car, modalities of payment etc.) might be guarded by further active parts of the document if partners request it.

Scenarios as the one described here, e.g., [7] (for curiosity, again in the context of the automobile industry), will open a new view on business processes. Legal requirements (in Germany) for *virtual business contracts* are discussed in [8].

## 8. Industrial significance and benefits

Traditionally, business-to-business co-operation by *circular letters*, the most equivalent form of our concepts in „non-electronic“, non-computerized offices, are time-consuming, difficult to control, especially with needs for synchronized parallel processing, requiring manual handling with costs for secretaries and messengers, are not able to compose a set of document parts under a controlled structure and to integrate different media without stapling paper sheets, to mention only some well-known aggravating circumstances. Many of them can be and are avoided in modern, computerized offices. But there is still room for improvement by involving the professional expert himself in „working with the document“, integrating all aspects of the business relation in one document (replacing, e.g., folders with a high risk of loss of sheets or taking them out of order), automating communication for exchange of the document, which becomes *self-active* (see section 2), with the correspondent(s), combining the document with its processing workflow.

## 9. Conclusions

The DC conception has proven, already in the early HotDoc and HotSimple research, to be a powerful basis for design of useful applications for document composition and (in general) for document processing. It provides, in our *wider viewpoint of multimedia* (section 2), by attached functionality to the variety of document parts provided (or under development, resp.) a level of self-activeness opening new and powerful, user-friendly solutions in business-to-business EC. We see further application areas (e.g., *Elektronische Laufmappen* [9], *Circular Letters* in governmental/administrative institutions; handling of patient data in hospitals for co-operating doctors; for document-centred group work in preparing project proposals; in writing technical specifications; in authoring self-active multimedia textbooks for distant, computer-based teaching and learning). And we envision, on the long range, a further transition from a *document-centred conception* to a *self-active, information-centred conception* [10] even in EC applications where a MALL2000-like system may find its role.

*Electronic Commerce* (EC), at the time being, is a buzzword with a lot of diverging facettes. It needs better conceptual understanding. Our work, based on what we call *document-centred* (DC), should - where applicable - help to strengthen the requirements, the understanding, and the realisation of, as we think, an important part of EC. It is a challenge to introduce it in business offices as soon as the project work is finished. For the correspondents involved it gives higher security in handling complex business relations.

The MALL2000 project started October 1998 and is planned for continuation till fall 2001. The authors are (among other things) responsible for the realization of the concepts mentioned following the DC conception exemplified in the HotDoc-based SI.

We recommend to consider *Document-centred Electronic Commerce* as an independent area of R&D, an independent status as already seen and accepted for Electronic Banking, Electronic Security, Electronic Mail Exchange, Web surfing for information collection.

Using standard software (Smalltalk kernels) with applicability on most computer platforms actually used in EC applications (PCs and/or UNIX-based) and standard Web browsers MALL2000 and its SI will give a flexible, easily usable path for businessmen to cooperate by document exchange with their correspondents, Europe-wide and even globally.

## 10. Project Acknowledgement

Work reported here is based upon the HotDoc and HotSimple research (1995 – 1998) by staff of the Chair on Programming Languages and Compilers (PÜ) of Darmstadt University of Technology, Dr. J. Buchner & Mr. T. Kunstmann et al., under supervision of the first author and is continued since 1998 in the scope of the INCO Copernicus project

MALL FOR ONLINE BUSINESS BEYOND THE YEAR 2000 (MALL2000) (EU sponsored, # 977041). We acknowledge continuing discussions and support with all members of the project consortium.

The work reported here covers workpackage 4 of the project performed under supervision of the first author. All opinions expressed in the paper are the opinion of the authors.

## References

- [1] J. Buchner, HotDoc – Ein flexibles System für den kooperativen Aufbau zusammengesetzter Dokumentstrukturen. Doctoral dissertation, Darmstadt University of Technology, 1998.
- [2] H.-J. Hoffmann, MALL2000+, a vision for a virtual marketplace for businessmen. In J.-Y. Roger et al. (Eds.), *Advances in Information Technologies: The Business Challenge*. ISBN 90-5199-385-4. IOS Press, Amsterdam, 1998, pp. 247 – 254.
- [3] T. Kunstmann, Rechnergestützte Simulation und Planung auf der Grundlage von Tabellenkalkulation. Unpublished manuscript, Darmstadt University of Technology, Chair PÜ, 1999.
- [4] F. J. Riggins, H.-S. Rhee, Toward a unified view of Electronic Commerce, *Comm ACM* **41** (1998) 88 – 95.
- [5] T. Kunstmann et al., HotSimple – Eine prototypische Benutzungsschnittstelle für das Simulations- und Planungswerkzeug Simple. G. Szwillus, Tagungsband PB'97: Prototypen für Benutzungsschnittstellen – Grundlagen, Techniken, Erfahrungen –. ISSN 0175-2863, Paderborn, 1997, pp. 89 – 93.
- [6] H.-J. Hoffmann, Daniela Handl, HotFlow – A visual language for workflow applications in E-commerce. Manuscript submitted to a conference, 1999.
- [7] NN (Andersen Consulting technology professionals), Avalanche: Automotive information services, [http://www.ac.com/services/cstar/cstar\\_child/eCavalanche\\_cn.htm](http://www.ac.com/services/cstar/cstar_child/eCavalanche_cn.htm), Jan. 8, 1999.  
S. J. Johnson, E. M. Schreck, Electronic Commerce, Seizing opportunity in the third wave. [http://www.ac.com/overview/Outlook/over\\_1apr97.html](http://www.ac.com/overview/Outlook/over_1apr97.html), 1997.
- [8] W. Reiners, Der „virtuelle“ Kaufvertrag – Zustandekommen von Kaufverträgen im Internet. In H. Popp, P. Mertens (Hrsg.), *Beiträge zum 4. FORWISS-Workshop „Elektronischer Verkäufer“*, 1997.
- [9] NN (Staff of Projekt POLITEAM), Entwicklung von Kooperationswerkzeugen zur Unterstützung der Regierungsfunktion in Berlin und Bonn, <http://orgwis.gmd.de/projects/POLITEAM/POLIKOM/politeam.htm>, 1997/98.
- [10] M. Baker, From document design to information design. *Conf. Proc. Crossroads in Communication, SIGDOC 97, ACM SIGDOC*, 1997, pp. 7 – 10.