

# Towards Effective Negotiation Support in Electronic Marketplaces

Mareike Schoop and Christoph Quix  
Informatik V (Information Systems), RWTH Aachen, 52056 Aachen, Germany  
{schoop, quix}@informatik.rwth-aachen.de

## Abstract

Electronic marketplaces are an upcoming model for business-to-business electronic commerce. In electronic marketplaces, companies can offer their services and products. Other companies can search for products in the marketplace to find new business partners. Once contact between two business partners has been established, a negotiation starts in order to reach a formal agreement on their business relation. During the negotiation, documents and messages are exchanged. Systems for electronic markets support auctions and similar negotiation models rather than peer-to-peer negotiations. However, peer-to-peer negotiations are common in most business domains. In this paper, we propose a conceptual model to support electronic negotiations by extending the model of document management systems with communication models. The idea is based on the observation that the exchange of messages is closely related to the evolution of documents.

## 1 Introduction

Electronic commerce (EC) is turning from a vision into reality. There is a large number of EC approaches both from academic and industrial backgrounds [12]. Mostly, business-to-consumer EC is supported. When turning to the area of *business-to-business electronic commerce* (BtB EC), a number of specific issues can be observed. For example, the early stages of an EC process become very important as companies look for new suppliers and aim at distinguishing themselves from other competitors. Furthermore, trust plays an important role since the internet enables business connections with unknown companies that might not be trustworthy. In addition, electronic negotiations with specific characteristics for BtB EC must be made possible to allow structured and effective interactions between the business partners. Finally, integrated systems are required. The new components dealing with EC (i.e. starting from an intelligent search, supporting electronic negotiations, monitoring the fulfilment of contracts) need to be integrated with the existing business processes, e.g. logistic and management systems of the companies.

*Electronic marketplaces* (EMs) are an upcoming approach to support BtB EC. EMs enable companies to present their products and services in a uniform marketplace which can be searched by other companies looking for specific products and/or new business partners. Such solutions are for example realised by Ariba [1] and CommerceOne [2]. These systems support the first stage of an EC process, i.e. establishing new business contacts.

The second phase of an EC process is the negotiation. In this paper we will concentrate on the phase of *negotiation support* in an EM. In contrast to most approaches dealing with electronic negotiations, we will not consider the support of auctions or similar settings (as, e.g. [5, 14]) since we see them as less appropriate for peer-to-peer negotiations in BtB EC. The current status of electronic negotiations is that usually electronic forms of catalogues are presented to a customer which means that the customer can either decide to order for the price mentioned or to leave it altogether. No explicit support of interactions dealing with negotiation steps is offered. We argue that such support is required and, consequently, we will present our approach that provides the basis for effective negotiation management.

Conventional negotiations begin with a phase of request or offer followed by counter-offers and bargaining before finally reaching an agreement (or terminating the negotiation in case of severe disagreements). We propose similar structures for electronic negotiations and our approach is as follows. Problems observed to occur in negotiation processes have been classified according to a powerful framework based on communication theories [7, 8]. In this paper, we will specify the features of “ideal” systems that exploit the potential

of information technology whilst eliminating the problems of conventional forms of negotiation. The formalisation of the features (which will not be described in this paper) is based on formal logics introduced in [7, 15]. The classification of potential problems has been described in [8].

Negotiations usually involve the *exchange of documents* which are the basis of the discussion process. In addition, electronic negotiations involve the *exchange of structured messages* which form the medium of communication among the business partners. Traditional document management systems support the evolution of documents by keeping track of different versions [3]. However, such systems do not provide facilities to track the messages which are exchanged during the evolution of a document. We propose to link the messages to the documents, thereby combining document management and communication management. In this paper we will present a conceptual schema for extended document management in electronic negotiations that contains links between document, messages, and negotiations. It serves as the basis for systems effectively supporting electronic negotiations.

The approach described above will intuitively be motivated by a negotiation scenario in section 2. Requirements for negotiation support are derived which form the basis for a conceptual model for document management in electronic negotiations. The model will be discussed in section 3. The model enables traceability of negotiations including keeping track of documents and messages separately and combined (section 3.3). Concluding remarks and a discussion of the merits of our approach will be presented in section 4.

## 2 Motivation for Electronic Negotiations

In this section, we present a scenario of a negotiation process in BtB EC to motivate our approach. The scenario is used to identify patterns of negotiation processes and point out potential problems. Based on the analysis, we derive requirements for systems supporting electronic negotiations.

In this scenario, a company A wants to buy shoes with certain characteristics (leather sole, black colour). After finding a potential business partner in the electronic marketplace, company A starts the negotiation process with the other company, say company B. In traditional commerce, a buyer of company A will contact a sales person of company B by telephone, fax, or email. They might start a negotiation about the contract details and exchange messages with the following contents: (i) Company A requests a quotation for 100 pairs of shoes for \$20 each from Company B and asks for a possible delivery date. (ii) Company B responds that it can deliver the shoes until April 30, but only for a price of \$25. (iii) Company A does not accept this offer and makes a counter-offer where A proposes a price of \$21 for each pair of shoes. (iv) Company B responds now, that it can deliver the shoes until May 5, but the price is \$23. (v) Company A accepts this offer and the contract is signed by both companies.

As has been shown in the intuitive example, the companies exchange messages to define a contract for a business transaction. Each message changes one or more items of the contract. For example, the second message specifies the delivery date and the price. For later analysis or reuse of the negotiation it might be useful to know under which circumstances the delivery data and price were proposed. Today, the documents involved in a negotiation are put together in a traditional file for later evidences in case of legal conflicts.

Furthermore, a negotiation process follows a specific pattern. A negotiation can start either with a *request* for quotation as in the example or directly with an offer. After the first offer has been made, multiple *counter-offers* can be proposed alternately by the companies. During this phase, *assertions* can be made, e.g., clarifying business terms or delivery date. Finally, one of the companies will *accept* the offer of the other company and both companies will sign the contract. The other possibility is that the offer is finally *rejected* and no deal is struck. This observation implies that the negotiation steps cannot be done in a random order. Because of this, it is sometimes unclear in conventional negotiations which company has to react, and what kind of commitments the companies have already made during a negotiation.

Another problem are ambiguous statements during a traditional negotiation. On the one hand, the type of the message might be unclear. For example, a statement like “100 shoes for \$25” can be interpreted as a request for quotation or an offer. On the other hand, the content of the message might be misunderstood. In the example, the exact specification of the product or the quantity (100 shoes or 100 pairs of shoes?) might be problematic.

Based on our analysis of traditional negotiations and their shortcomings, the goal here is to facilitate

efficient electronic negotiation processes by using modern information technology for the management of documents and messages. We envision that such a negotiation system plays an important role in BtB marketplaces. A system to support electronic negotiations would need to consider certain *requirements* that can be derived from the analysis of today's negotiation processes and the facilities of document management and communication systems. Firstly, the system must be able to store messages with information about the sender, receiver, and the type of the message (e.g., request for quotation, accept, reject). Furthermore, documents (e.g., contract, terms of business) must be managed by the system. This includes versioning of a document as it evolves during the negotiation process.

The content of messages and documents needs to be specified to enable queries such as "Which goods do we need to deliver to company A?" or "What did company B offer?". On the other hand, systems that only offer predefined message and document contents appear too rigid and inflexible [13]. Therefore, a flexible system is desirable that is not restricted to a fixed message or document structure like most EDI systems [4]. In our approach, the contents of messages and documents is semi-structured.

In addition, the example above has shown that there is a strong relationship between the documents of a negotiation (e.g., the contract) and the messages exchanged. Therefore, messages and contracts need to be linked to see the context of a message and to have more information about the evolution of the contract.

Finally, the system should store all documents and messages in one context as it is done with a traditional file. By doing so, all information about the negotiation process is easy to access and not mixed with other (parallel) negotiations.

### 3 A Conceptual Model for Electronic Negotiations

In the previous section, we have discussed some requirements for systems supporting electronic negotiations. In this section, we will present a conceptual model for electronic negotiations that is based on these requirements. Firstly, the basic concepts will be introduced.

#### 3.1 Basic Concepts

Following the requirements, the conceptual model contains three basic concepts which will be discussed below: **Documents** and **messages** are stored in the context of a **negotiation**.

**Negotiations:** The context of the business interactions is a negotiation. Negotiations involve two or more parties and have a certain subject. During the negotiation, documents and messages are exchanged until the negotiation is concluded.

**Documents:** In electronic negotiations, documents play an important role. Negotiations are oriented towards reaching an agreement which is manifested in a contract. In our view, contracts evolve over time: each step in the negotiation process creates one version of the contract document. The business partners negotiate about the contents of these documents until either a final version of the document is created or the negotiation is terminated. Thus, documents are both the medium and the outcome of negotiations.

**Messages:** In traditional types of negotiation, face-to-face interactions as well as different media such as telephone, fax, letters, or emails are involved. In electronic negotiations, the emphasis is on message exchange via the internet. Thus, the concept of a message is of primary importance for our conceptual model.

Electronic message exchange in its simplest form would be sending email messages. However, to reflect the highly structured negotiation process in electronic commerce, a different form of electronic interaction is required. It must be clear to all partners involved:

- what is meant in a certain negotiation step (i.e. what the other partner talks about)
- what the subject of the negotiation is (e.g. whether the partners bargain about the price of certain products or whether they negotiate a frame contract as the basis for future deals)
- what phase of the negotiation they are in (e.g. in the opening phase of asking for a quotation or sending a quotation)
- what the obligations are for each partner.

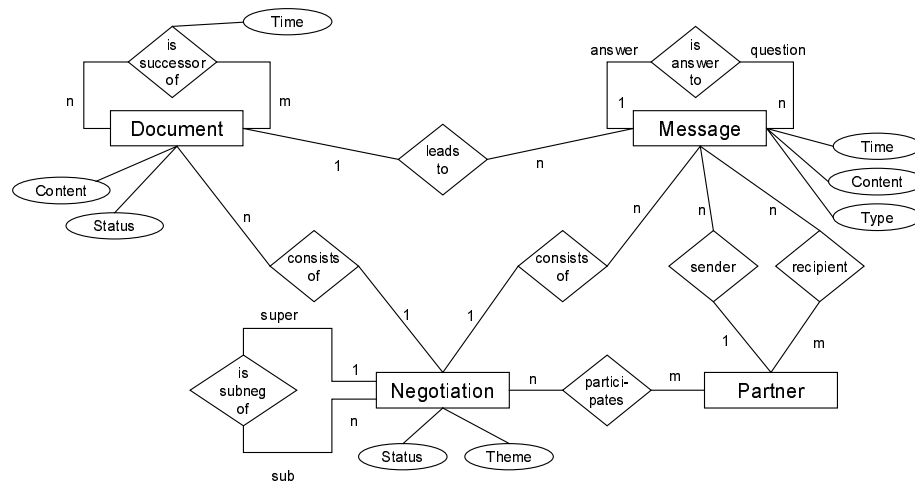


Figure 1: The conceptual model of electronic negotiations

Therefore, we propose a structured message exchange based on speech act theory [10] and formal logics [6]. Each message such as “Can you supply 100 pairs of shoes (code MM-48-1112) for \$20 each?” can be seen as a speech act in written form that consists of two components: the propositional content describes what the message is about (i.e. supply 100 pairs of shoes of code MM-48-1112 for \$20 each) whereas the illocutionary force describes the way the utterance is made (in this case as a request). Taken together, propositional content and illocutionary force form the speech act and both have to be known for the meaning of the utterance. Based on the type of message, there are certain possible answers. For example, a request made by partner A can be answered by a counter-offer, a rejection, or an acceptance made by partner B. The interested reader is referred to [9] where our work on communication management is presented in detail.

### 3.2 The Model

Having established the basic concepts of electronic negotiations, we can now present their features and relations. Figure 1 shows our conceptual model of document management in electronic negotiations in entity-relationship notation.

Each negotiation has a theme which describes the context of the business exchanges. Negotiations can be active or terminated which is represented by the attribute “status”. A negotiation contains documents as well as messages as discussed before. In addition, negotiations can contain subnegotiations. For example, a wholesaler might negotiate with a company about a special type of shoes; the wholesaler has not enough shoes of this type in store and therefore needs to negotiate with a third company about buying new supplies.

A message is sent by one of the business partners to the recipients. The message is sent at a certain time and has a (semi-structured) content. Furthermore, the type needs to be specified, e.g. whether it is a request, a counter-offer, an assertion etc. As messages are sent among the business partners involved in the negotiation, they are linked in a content-based sequence: When sending a message, the business partner answers a message sent by another partner. One message can of course have many answer messages. Imagine the situation where a request for products with a certain price and a due date is sent. The seller might send a message agreeing on the price whilst having to talk to the production manager about the due date. Later on, a new message is sent answering part of the original request which in this case would constitute a reply to the proposed due date.

A document has a status which specifies whether it is the final contract or an evolving version of the contract. The content of the document is the subject of the negotiation steps. Documents can be ordered in a tree-like structure. Thus, there is a many-to-many relationship called “is successor of” between documents. It is possible to turn back to a certain earlier document (say document version 5) during the negotiation process and to create a new version of the contract (i.e. a new successor of the document version 5, say document version 12) from there. Thus, it is necessary to keep track of the time of the relationship because document version 5 had only document version 6 as a successor before, at a later point in time, document

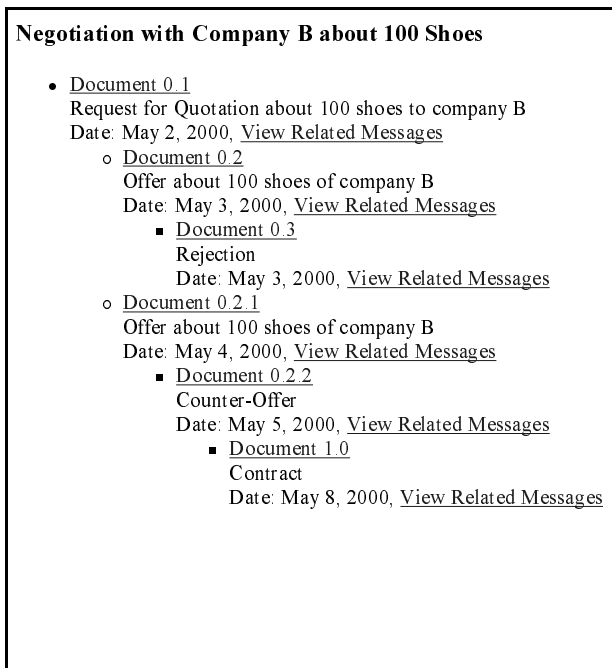


Figure 2: Document-oriented view

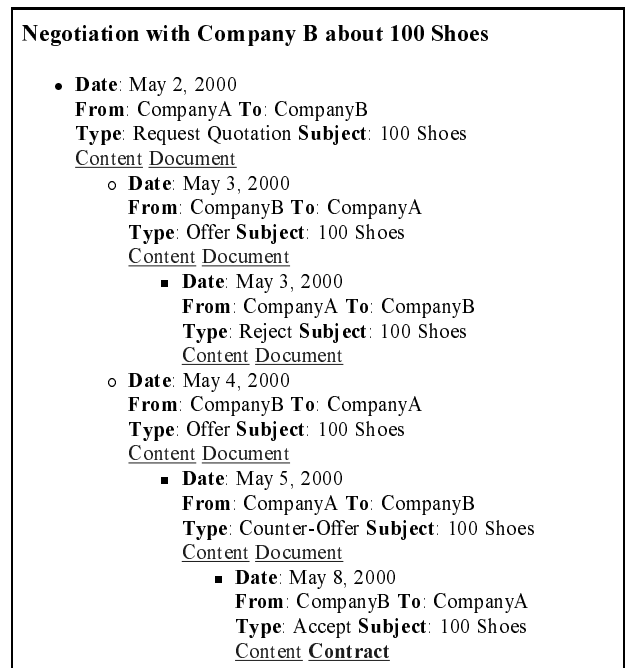


Figure 3: Message-oriented view

version 12 also became the successor. Thereby it is possible to keep the documents in a temporal sequence.

Messages and documents are linked because messages initiate new documents, i.e. new versions of the contract. For example, a request made by company A to company B of 100 pairs of shoes of code MM-48-1112 for \$20 each is a message that creates a document (i.e., a contract version) with the content of “B sends 100 pairs of shoes of code MM-48-1112 for \$20 each to company A”. This document then leads to further discussions through the medium of structured message exchange. We consider messages and documents as separate entities since their structures differ. Furthermore, the relationship among messages is of a different type than the relationship among documents (replies vs. versions).

### 3.3 Applications of the Model

The conceptual model forms the foundation of systems that effectively support electronic negotiations. Next we will discuss possible applications of the model which would improve the negotiation phase in EC.

On the one hand, the model improves the negotiation process directly as it facilitates a more structured communication. Messages can only be exchanged in a specific order. For example, an offer can only be answered by an accept, a counter offer, or a rejection. The message exchange system of a broker would only allow these possible answers for certain types of messages. Moreover, the type of each message is made explicit, thereby ensuring unambiguity. On the other hand, negotiations can be analysed afterwards in different ways. The trace of negotiation can be represented as a combination of the history of messages and of the history of documents where each message is linked to one document.

In a document-oriented view, the evolution steps of the contract are shown. For each step, the corresponding messages can be shown (see Fig. 2). In a message-oriented view, the message threads are represented and for each message, the related document can be shown (see Fig. 3). In addition, all stored messages and documents can be searched for information about offers, requests and contracts with certain companies, or about certain products.

Finally, the conceptual model can be used for a formalisation of negotiation processes. The formalisation provides the basis for reasoning mechanisms, e.g. about arising obligations. A language  $_{\text{coo}}\mathcal{L}$  (standing for cooperative language) has been developed and is presented in [7]. It is based on a combination of dynamic deontic logic [6] and illocutionary logic [11]. The language enables statements about speech acts concerning actions or propositions to be made by a author to a recipient; it enables the resulting effects such as beliefs

or obligations to be specified; and it allows deadlines for certain types of speech act to be made explicit. The language  $_{\text{coo}}\mathcal{L}$  allows the obligations to be checked at any point in time. It is possible to query the existing obligations, the ones that have already been fulfilled, and the unfulfilled obligations. In the present context, the language can be used to reason about the consequences of a negotiation, e.g., what obligations have to be fulfilled by each partner.

## 4 Conclusion

In business-to-business electronic commerce, negotiations can be conducted electronically. However, the current state of negotiation support offers only few useful features as most approaches concentrate on auction settings that are relevant for business-to-consumer contexts. An analysis of traditional forms of negotiation shows that documents are exchanged during the discussions. These documents can be seen as versions of the final contract. In addition, communication takes places in various forms about these documents, e.g. in face-to-face interactions, in written form such as letters or fax messages, in telephone conversations etc. In electronic marketplaces, most (or all) of the communication will be conducted through electronic exchanges. It then becomes vital to ensure unambiguity and to provide a certain structure so that the negotiation partners know what is talked about, whose turn it is to react, and what each partner's obligations are.

In this paper, we presented a conceptual model for electronic negotiations. We proposed a combination of document and communication management to capture all aspects of electronic negotiations. The document-oriented view shows the evolving contract documents whereas the message-oriented view represents the message threads and emphasises the communication steps. Both views are linked, thereby making it possible to see which message are related to a specific document and which document a certain message initiated. The conceptual model provides a powerful foundation for systems that effectively support electronic negotiations in business-to-business electronic commerce and that are a useful extension of electronic marketplaces. We are currently operationalising the conceptual model by means of a web-based prototype.

**Acknowledgements** The research is supported by the European ESPRIT Project "MEMO: Mediating and Monitoring Electronic Commerce", No. 26895 (<http://www.abnamro.com/memo/>). We would like to thank our project partners from CentER AR Tilburg for the useful discussions.

## References

- [1] Ariba, Inc. Homepage, <http://www.ariba.com/>
- [2] Commerce One, Inc. Homepage, <http://www.commerceone.com/>
- [3] J. Gulbins, M. Seyfried, H. Strack-Zimmermann. *Dokumenten-Management*. Springer, 1999.
- [4] R. Kalakota, A.B. Whinston. *Readings in Electronic Commerce*. Addison-Wesley, 1997.
- [5] S. Klein, C. Loebbecke. Signaling and Segmentation on Electronic Markets: Innovative Pricing Strategies for Improved Resource Allocation. In *Proc. 6th Research Symposium on Emerging Electronic Markets (RSEEM)*, Institut für Wirtschaftsinformatik, Arbeitsbericht Nr. 72, Universität Münster, Germany, pp. 127–142, 1999.
- [6] J.J.Ch. Meyer, R.J. Wieringa (eds). *Deontic Logic in Computer Science*. Wiley&Sons, Chichester, 1993.
- [7] M. Schoop. *Towards Effective Multidisciplinary Communication: A Language-Action Approach to Cooperative Documentation Systems*. PhD Thesis, The University of Manchester, UK, 1998.
- [8] M. Schoop. A Theoretical Framework for Speech Act Based Negotiation in Electronic Commerce. In *Proc. 6th Research Symposium on Emerging Electronic Markets (RSEEM)*, Institut für Wirtschaftsinformatik, Arbeitsbericht Nr. 72, Universität Münster, Germany, pp. 79–89, 1999.
- [9] M. Schoop, C. Quix. DOC.COM: Combining Document and Communication Management for Negotiation Support in Business-to-Business Electronic Commerce. To appear in *Proc. 34th Hawaii International Conference on System Sciences (HICSS 01)*, 2001.
- [10] J.R. Searle. *Speech Acts – An Essay in the Philosophy of Language*. Cambridge University Press, 1969.
- [11] J.R. Searle and D. Vanderveken. *Foundations of Illocutionary Logic*. Cambridge University Press, 1985.
- [12] M. Shaw, R. Blanning, T. Strader, A. Whinston (eds). *Handbook on Electronic Commerce*, Springer, 2000.
- [13] L. Suchman. *Plans and Situated Actions: The Problem of Human Machine Communication*. Cambridge University Press, 1987.
- [14] E. Van Heck, P. Ribbers. Experiences with Electronic Auctions in the Dutch Flower Industry. In: C. Westland, T. Clark (eds.), *Global Electronic Commerce: Theory and Case Studies*, MIT Press, pp. 355–366, 1999.
- [15] H. Weigand. Formal Models of Negotiation. *Proc. Workshop on Formal Models of Electronic Commerce (FMEC)*, Erasmus University Rotterdam, The Netherlands, June 1999.