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Contracting in the days of eBusiness

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Contracting in the Days of eBusiness

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Abstract. *Putting electronic business on a sound foundation – model theoretically as well as technologically – has to be seen as a central challenge for research as well as for commercial development. This paper concentrates on the discovery and the negotiation phase of concluding an agreement based on a contract. We present a methodology how to come seamlessly from a many-to-many relationship in the discovery phase to a one-to-one relationship in the contract negotiation phase. Making the content of the contracts persistent is achieved by reconstructing contract templates by means of mereologic (logic of the whole-part relation). Possibly nested sub-structures of the contract template are taken as a basis for negotiation in a dialogical way. For the negotiation itself the contract templates are extended by implications (logical) and sequences (topical).*

1 Introduction

The interest in electronic business has been a central topic in computer sciences for years, but it was the economic sciences that brought it to the core of computer sciences. Several kinds of eBusiness can be distinguished. Business-to-Consumer (B2C) concentrates on rebuilding classical trading with end customers in an electronic way. The most prominent example for this kind of business is the online bookshop Amazon (http://www.amazon.com). Most of the time fully configured goods are dealt with in this case, e.g. books or CDs. The only freedom of choice that is left to the customer is to press or not to press the "buy!" button in the web browser to accept the displayed offer or not. A special case of B2C is when the customer is the public authorities which is usually called business-to-administration (B2A). The most interesting category of eBusiness for our research is when companies are dealing with each other (B2B – business-to-business). This kind of trading is much more complex because configurable goods or contract components have to be dealt with. E.g. the price depends on the ordered quantity, or one can think of different options. Even though researching the B2B area has been done thoroughly, the existing approaches are still far from being perfect.

The worst point to be recognized is that at the moment the main effort is put on executing the business process. Discovery and negotiation are most of the time neglected (e.g. [8]). Negotiating the terms of business cooperation is usually still done outside the eBusiness system in some kind of a master policy. In the end only execution is done electronically, e.g. ordering according to previously made up rules. Contract negotiation – if necessary at all – is reduced to filling in parameters of the prearranged master policy.

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Generally speaking a complete business transaction goes through three different steps (e.g. [7]). While going through these the room to negotiate is more and more reducing (Figure 1). In the first discovery phase the product catalogues of the offerers are the central elements. It is the aim of an electronic marketplace to bring possible business partners together. These candidates go on to the second phase which is negotiation. This step is – if successful – concluded by a contract. The final phase is the execution of the business transaction.

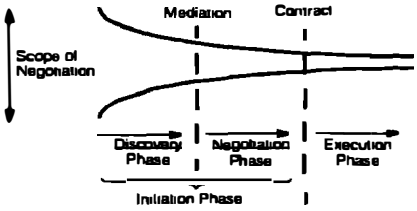

Fig. 1: Process oriented view of contract negotiations in eBusiness ([7])

It is the aim of this paper to offer a model for describing contracts, that can be used in the discovery phase as well as in the negotiation phase. We think that the content based combination of both phases is of fundamental importance for the whole B2B area. Dynamically finding new business partners and negotiation is especially important for creating virtual businesses, i.e. companies existing only for the duration of a given project. Also for B2C the aspects of "finding partners" and "negotiation" gain growing importance, as on the one hand the huge number of offers to be found in the internet cannot be surveyed any more. On the other hand the customer does not want to give up the opportunity to negotiate over things such as the price.

The following section gives an overview of the first two phases from a system technical point of view. The third section introduces extended mereological structures (whole-part-relation) for formulating the space of offers and demands set up by possible variants. Section 4 discusses the matching problem during initiation, which is the discovery and the negotiation phase put together. The following section continues the negotiation process by introducing two kinds of dialogues (meta dialogue and content dialogue). Before concluding this paper a brief XML grammar for formulating flexible contract offers and requests is provided.

2 An Overview of Discovery and Negotiation

As mentioned before the presented approach is particularly to support the first two phases of eBusiness. Still two different communication patterns are necessary: the discovery phase including its final mediation step is best organized by *publish/subscribe*. The following negotiation phase is by far better done in the *request/response* manner. From the point of view of the theory of reasoning three different levels, *rhetoric*, *topic* and *logic*, may be mapped to the single phase.

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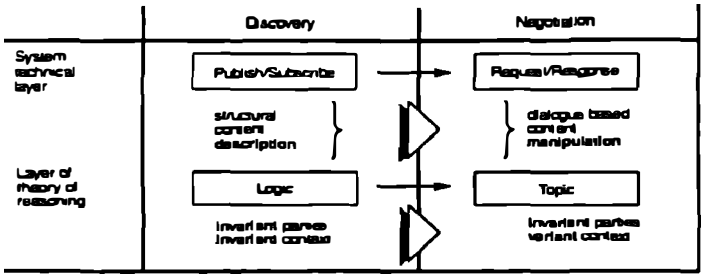

Fig. 2: Transitions in Contract Negotiation

2.1 Transitions in Contract Negotiation

It is the main goal of marketplaces to bring together producers with potential consumers for the sake of concluding a contract. Therefore all participants have to pronounce what they expect from one another or what they have to offer by presenting a contract schema. As an electronic representation one can think of digital versions of lost-and-found adverts as known from newspapers. But finding a matching pair of offer and request is rather difficult because of the unstructured nature of these adverts and because of the huge number of offers that have to be checked. Therefore a strict set of structural rules for describing offers and requests (section 3) as well as an appropriate system technical support is necessary to deal with complex and configurable goods or services. Furthermore we suggest to apply two different technologies to come on the one hand from pure structural content description in the discovery phase to dialogue based content manipulation in the negotiation phase on the other hand (figure 2). So the questions are how to find a matching business partner and how to seamlessly proceed from the first to the second phase.

2.2 'Publish/Subscribe' and 'Request/Response'

For the first phase, which is discovery, the communication and processing paradigm *publish/subscribe* is the best choice. In contrast to classical point-to-point communication based on *request/response* the subscriber (i.e. the interested party which might become the customer later on) pronounces his desires and is after that provided with matching offers by the mediating broker. The principle of publish/subscribe can for example be found in software engineering as the *observer pattern* ([2]), in message based communication in distributed systems (e.g. *Java Message Services*, [9], *Oracle Advanced Queuing*, [3]) or in subscription service applications ([5]).

Each offerer reaches many subscribers by a certain topic which leads in general to a many-to-many relationship. After completing the discovery phase this system reduces to possibly several one-to-one relationships (*point-to-point*) with the functional transport roles of *sender/receiver* according to the dialogue based roles of *request/response*.

Online shops or auctions as known today (e.g. ebay, www.ebay.com) can only be seen as "half" publish/subscribe systems: offers within an auction system for example can be understood as publications, but the interested party has no possibility to install a subscription. He usually has to go through the different offers manually which is called browsing.

Participants in publish/subscribe are always decoupled by a *broker/mediator* which on the one hand receives subscriptions (requests) and on the other hand publications (offers). The broker then has to find the matching pairs and forward the best looking offers to the appropriate subscribers. Matching and forwarding can be done in a *subject based* or a *content based* manner. In the *subject based* approach incoming publications are classified and distributed over a set of subjects (also known as *channels*). Subscriptions then refer to these channels. The more sophisticated *content based* approach allows the subscriber to formulate precisely his desires as a set of predicates that has to be applied to every incoming publication. Only those publications that fulfil the conditions of the given predicates are forwarded to the interested party. After successfully matching an interested party with an appropriate offerer the broker retires and the may-be-partners can proceed to the negotiation phase according to the request/response paradigm.

3 Structures of Offers and Requests

For both, matching offers with requests as well as for proceeding to the actual contract negotiation phase, offerers have to formulate their catalogue describing the single products or services they provide. In the same way the requestor also has to articulate his desires in an understandable and automatically processable way. Both descriptions have to be published to the marketplace system which embodies the broker of the loosely coupled publish/subscribe model. The problem is that for automatic processing and comparing offers and requests have to be specified according to a strict schema; on the other hand it is uncomfortable especially for the customer, if he has to go through myriads of details he perhaps has no idea of. For both parties the approach described here applies mereological structures (whole-part-relationship). Using this method especially configurable goods and services can be described in full detail. However it is also possible to describe non-configurable goods like books or CDs or rather "vague" requests by accordingly simpler structures. The following subsections apply mereologic both to the offerer side as well as to the requestor side. Furthermore pure mereologic is extended by introducing material implication. Two major assumptions have to be noticed:

- Contract schemas are *configurable*, i.e. they can be manipulated and edited by the possible partners in a dialogue based way.
- The *Closed World Assumption* holds, i.e. the partners reside in a closed system, to which nothing can be added during negotiation. A special dialogue is necessary for extending the schema of the contract.

3.1 Offers and Requests as Mereological Structures

As an example for modelling offers and requests as mereological structures the configuration of a personal computer is chosen. The example should be rather familiar and offers enough complexity to clarify the ideas of our paper. A producer specifies commercial data (prices, quantities, etc.) as well as detailed technical information (type of CPU, memory, special equipment, etc.) by formulating a configurable contract schema. This schema is easily reconstructible by means of mereologic.

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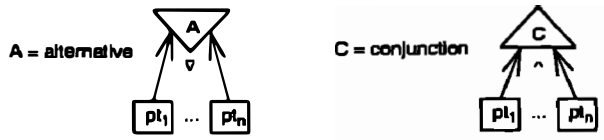


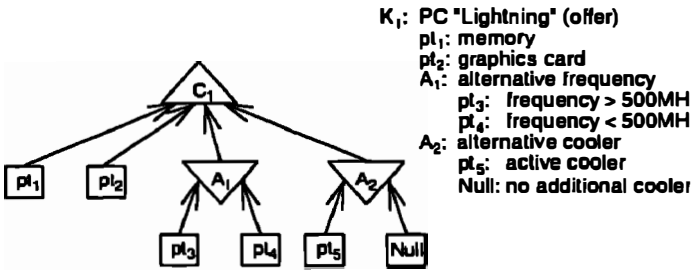
Fig. 3: Connectors for the Composition of Contracts

The building blocks of contract schemas are *pieces of text* (pt) symbolically represented by rectangles as seen in figure 3. They contain arbitrary content (e.g. text, pictures, multimedia files, ...) that are not further structured; these pieces of text are to be seen as terminal symbols. Single pieces of text can be combined by connectors (figure 3): *conjunctions* C (∧) and *alternatives* A (exclusive or, ∇).

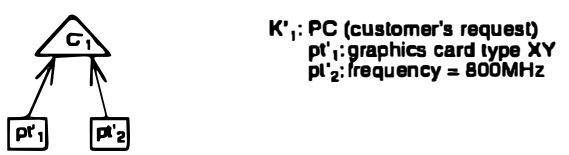
Alternatives can be further distinguished into *mandatory* and *optional alternatives*. For reconstructing an optional alternative, i.e. special equipment, an empty piece of text is necessary, the *null schema* Null. In figure 4a the alternative A_1 is an example for a mandatory alternative while A_2 depicts an optional one. Arrows leading to the connectors express the whole-part-relationship. Thus pt_1, ..., pt_n present sub schemas. The technical part of an offer by a PC vendor could look like that in figure 4a.

An offer is represented by a conjunction holding together the single parts of the offer like a bracket. A product catalogue again is a set of several offers. Depending on the marketplace the catalogue can be modelled as an alternative of single conjunctions (=offers) or as the conjunction of several optional alternatives each of which allows the interested party to take several offers into consideration at the same time (figure 5). For the following discussion this difference is of no importance and we restrict ourselves to a single offer, i.e. a conjunction.

Similar to an offerer's catalogue consumers can specify their requests in the same kind of structure. Especially the concept of alternatives and "leaving out" certain parts of the contract are well suited to express the rather vague ideas a customer frequently has. So in figure 4b an example of a (future) customer's request is presented in a very simple, unspecific way. In that case the consumer is looking for a PC containing a specific graphics card and a CPU with a frequency of 800MHz. It is obvious that the offer schema in figure 4a suits this request.

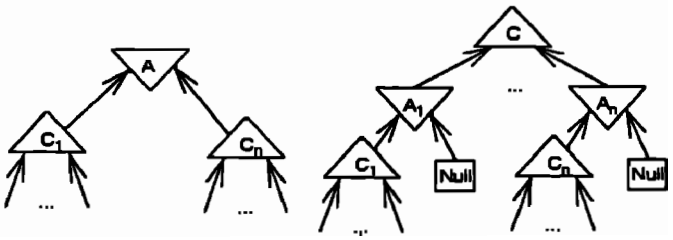


a. Offer of a configuration schema for a PC



b. Specification of a request for a PC

Fig. 4: Example of Part of a Contract Schema: Offer and Request



a. Catalogue as an alternative of single offers C_1, ..., C_n

b. Catalogue as conjunction of optional offers C_1, ..., C_n

Fig. 5: Mereological Reconstruction of a Product Catalogue

3.2 Extension by Implication

With the mereological structures introduced so far nearly every possible case – be it simple or complex – can be represented. Though one can think of certain situations when this reconstruction does not go far enough or is a little awkward. It is easily possible to extend the structures given so far by more sophisticated mechanisms for reasons of convenience. Still these handy shortcuts can again be replaced by – sometimes rather complex – combinations of conjunctions and alternatives. One interesting example for these extensions is the implication which will be covered in detail in this subsection. Further ideas are structures for defining default configurations in case the customer has no special requirements (e.g. certain juridical or delivery conditions).

It is quite probable that the terminal pieces of text might depend on one another. This is the case of a material *implication*, written '$a \prec b$'. Here a is called *antecedence* and b is called *consequence*. '$\prec$' is not an order relation but $a \prec b$ holds if the logical combination by subjunction ($\rightarrow$) is true, i.e. '$a \rightarrow b$' is true. In the sense of constructive logic ([6]) an ordered sequence comes up, as first the antecedence has to be dealt with successfully before the consequence can be taken care of[1]. It is interesting to notice that implications induce a logical sequence. When negotiating it does not make sense to talk about the consequence if the preconditions are not clear.

It is easy to understand that in the previously introduced structures implications are only reasonable over two alternatives, more specifically over two direct successors of the two alternatives. An implication between all other arbitrary elements has to be prohibited because it cannot be ensured if the necessary possibility of choice is given.

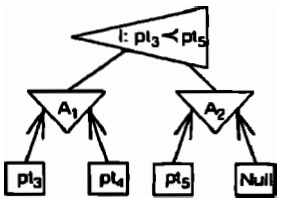


Fig. 6: Structural Extension by Implication

To present implications graphically the notation so far is extended according to figure 6. Here $pt_3 \prec pt_5$ holds, i.e. if in alternative A_1 the piece pt_3 is chosen the alternative A_2 is reduced to pt_5 which means that pt_5 is compulsory then. In our example that means: If the customer decides to buy a CPU with more than 500MHz he has to buy an additional cooler for technical reasons. Similar examples can be thought of when configuring cars, e.g. a diesel engine makes necessary an extra heating system.

1. Classical logic does not know the ordered sequence. It replaces '$a \rightarrow b$' by '$\neg a \vee b$' which is equivalent '$b \vee \neg a$'.

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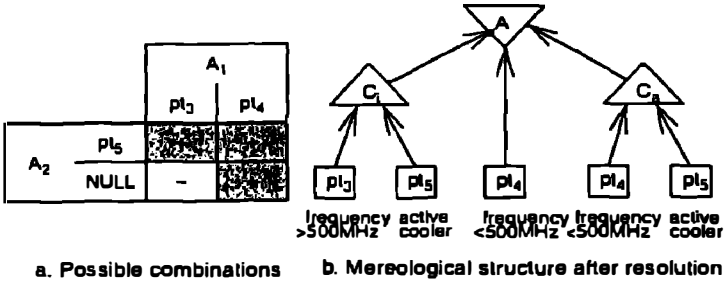
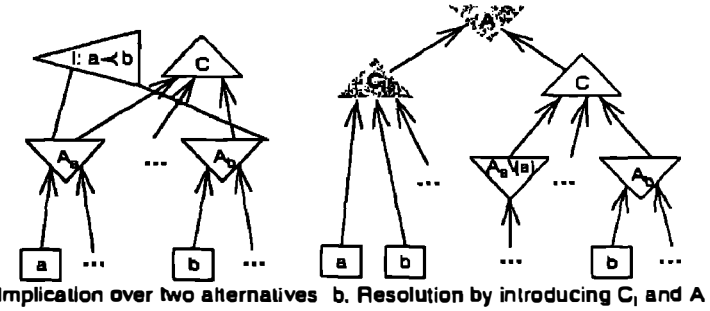


a. Possible combinations b. Mereological structure after resolution

Fig. 7: Resolving the Implication shown in figure 6



a. Implication over two alternatives b. Resolution by introducing C_I and A

Fig. 8: Conversion of Implication – General Case

4 Initiation of Contract Negotiations

The central goal of a marketplace applying the principle of publish/subscribe is bringing together offerers and requestors. For an electronic marketplace system the question arises how to accomplish this in an automatic fashion. We will deal with that question of how to match offer schemas and request schemas in the following subsections.

4.1 Similarity of Simple Mereological Structures

A marketplace on the one hand manages a set of offers on the other hand a set of requests of possible consumers. As in our case both offers and requests are expressed by means of mereological structures, the matching has to be performed by a structure based and a content based comparison. For the first thoughts on this matching process the concept of implication will be neglected.

A test on equality of structure and of the terminal elements has to be rejected because this approach does not take care of the basic idea of the mereological structure allowing a huge space of variants by using alternatives. Instead a test on some kind of similarity is needed to check if a given request is element of the space of variants constructed by the offer schemas. This relaxation from exact equality has to be supported by a configurable similarity relation allowing the issuer of the schema to specify to which degree he is ready to move away from his requirements. On the structural level this can be achieved by defining some parts of the schema as binding and some as optional. An alternative is to specify a threshold for similarity.

On the content level an order relation has to be defined for numerical values (e.g. frequency < 500 MHz); for textual values (e.g. graphics card) everything from exact matching to the application of regular expressions or dictionaries/thesauri is possible. Whatever technique is applied, offer and request must not differ in essential parts. What is "essential" has to be specified in advance as part of the schema.

4.2 Resolving Implications

Before advancing to the actual negotiation phase the marketplace system is able to further adjust offer and request to one another by resolving material implications as far as possible. This resolution is introduced by example in figure 6, but is possible in general. The implication $pl_3 \prec pl_5$ means: if the piece of text pl_3 is chosen, then the piece of text pl_5 has to be chosen in A_2. Under this condition the three cases depicted in figure 7a result; in mereological structures these cases correspond to the graphs shown in figure 7b. The original conjunction C_1 will therefore be replaced by a new alternative A allowing to choose between every valid combination of A_1 and A_2. In that graph C_I is exactly that conjunction that holds when the implication I (figure 6) has to be applied. The other branches represent the remaining cases (the combination (pl_4, NULL) can obviously be simplified).

The conversion of an implication into a set of basic mereological structures can in general be achieved in such a way that exactly one alternative and one conjunction has to be added to the original graph. This process is shown in figure 8: in part a of the figure an implication I over two alternatives A_a and A_b is given; part b presents the resolved equivalent presentation. The basic idea is to remove the piece of text a, the antecedence of I, from the original conjunction C, so that the implication cannot get activated. The newly introduced conjunction C_I has to take care of the case when a is chosen; according to I then the consequence b has to be taken. Finally the original conjunction C has to be combined with C_I introducing the new alternative A as top node. Obviously resolving the implication in this general case requires two conditional conjunctions, shaded in grey in figure 8.

Inducing implications that way allows the marketplace system to further specify the offer of interest. Some alternatives of the offer schema can already be decided by applying the customer's requests: In our running example the request pl'_2 (frequency = 800MHz) fulfils the antecedence of the implication I, i.e. pl_3 (frequency > 500MHz). Thus the alternative A_2 of the offer can automatically be resolved to pl_5 (additional active cooler) which yields the specialized offer displayed in figure 9. It is more specific in that sense that it meets offer and request of exactly the two involved partners.

If the specification of the offer is provided outside the eBusiness system (i.e. offline) it can happen that the customer requests an incompatible combination of pieces of text (e.g. a high frequency CPU without the necessary cooler). In that case the resolved, specialized offer is contradictory to the request and a special solution has to be found.

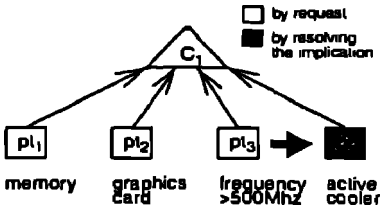


Fig. 9: Specialized offer after Resolving the Implication

A possible strategy is to transmit the resolved offer to the customer and to make clear that his request is apriori impossible. But this kind of conflict can be avoided in advance by delivering a suitable tool to the requestor that is aware of existing implications and resolves

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them while the consumer is constructing the request, i.e. if the antecedence of an implication is found the appropriate consequence is automatically added to the schema (online).

By producing the specialized schema of the offer the end of the discovery phase – and thus of the marketplace – is reached (figure 1) and offerer and requestor now have to proceed to the direct negotiation phase which is treated in the next section.

5 Realization of Contract Negotiations

While the discovery phase is best supported by the principle of *publish/subscribe* as described in section 2.2, the actual negotiation phase can only be realized by the more direct *request/response* pattern in a reasonable fashion. The *request* primitive on the one hand initiates a dialogue and thus creates a context; on the other hand the *response* primitive represents an answer to a request and thus takes over a supplied context. The central idea of our approach is besides the structured presentation of request and offer schemas (section 3), the structural organization of the actual negotiation process. When proceeding to the negotiation phase the participants are granted the roles of the *buyer* (before requestor, interested party) respectively the *vendor* (offerer, producer). Figure 10 shows a dialogue between these parties on C_1 (figure 4a). For demonstration reasons we go back to the original offer (including the alternatives) as shown in figure 4.

5.1 Determining the Order of Negotiation

When talking about the schema of negotiation dialogues determining the order of negotiation is of central interest. Though sequences are treated as a formal schematic problem, the contents (the materials) depend on the schema. Therefore it is only natural – similar to the distinction between the logical and the topical level – that two different categories of sequences exist. On the one hand the remaining alternatives have to be decided and the pieces of text have to be negotiated. Processing these elements is done in so called *content dialogues*. But before vendor and buyer can treat these components they have to agree on the sequence in which they want to conduct these content dialogues. This sequence is specified in a so-called *meta dialogue*, i.e. in a dialogue about the actual dialogue on the topical level.

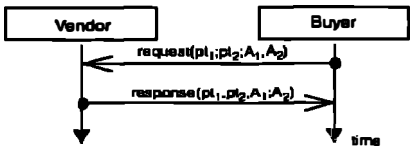

Fig. 10: Meta Dialogue for Fixing the Order of Negotiation

In topical contexts the question arises in which methodically reasonable sequence the single elements can be presented to support a quick understanding – similar to teaching and learning situations. In some cases proceeding from general to detail (top down) is preferable; in other situations the bottom up approach is more promising; another situation can only be solved in an ad hoc fashion. Therefore the possibility to initiate a meta dialogue is highly desirable, so the participants can agree if a;b or b;a is to be applied. The character ';' represents the order relation (reflexive, transitive, anti symmetrical) for the single steps. E.g. in a customer dominated market a unique meta rule exists: "In case of a conflict the customer has the right to decide on the further sequence." In different kinds of market models – e.g. a monopolistic market of

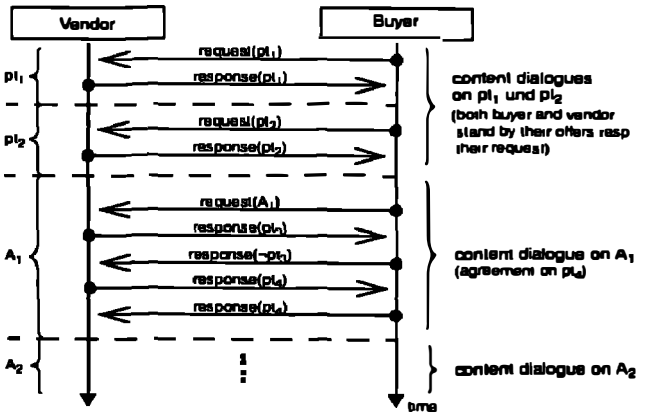

Fig. 11: Content Dialogue on C_1

offers – there may be other meta rules. Thus market models set the topical meta rules.

Let us assume that the vendor in our running example accepts the order $pt_1;pt_2;A_1;A_2$ suggested by the customer without objection in a single level dialogue (figure 10). A repetition of the request is to be understood as a positive answer.

The importance of talking about the agenda is not to be underestimated. By doing this the participating parties are enabled to let the appropriate specialist execute the negotiation process depending on the part of the contract, e.g. the juridical or the technical part.

5.2 Elimination of Alternatives

It is the main goal of the content dialogues to eliminate the remaining alternatives. Buyer and vendor take turns in the dialogue. A final contract can only be achieved if both participants come to mutual agreement on every terminal element (i.e. a piece of text). If for any reason one party does not agree on this part of an earlier offer or request any longer, the failure of the contract is unavoidable. According to the sequence defined in the meta dialogue for C_1 ($pt_1;pt_2;A_1;A_2$) the dialogues on pt_1 and pt_2 are rather simple (figure 11).

When negotiating the alternative A_1 in figure 11 the vendor suggests pt_3 what is objected by the buyer (*response*(¬pt_3)). By suggesting pt_4 the vendor finally succeeds in reaching an agreement on this alternative. The dialogue on A_2 is done the same way.

It is important to notice that fulfilling material implications is an essential precondition for any content dialogues: first of all the content of the antecedence of the implication has to be settled before according to the rules of dialogical logic ([6]) the consequence can be debated on.

6 Mapping Contract Schemas to XML

The mereological reconstruction of offers, catalogues and request presented in section 3 can be modelled in a natural way using the Extensible Markup Language (XML, [4]). In the following the major part of a simple Document Template Definition (DTD) is sketched allowing to formulate the offers like that depicted in figure 4:

```
<!ELEMENT PieceOfText ANY>
<!ATTLIST PieceOfText
    Name                    CDATA          #IMPLIED
    id                      ID             #REQUIRED>
```

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```
<!ELEMENT NullSchema EMPTY>
<!ATTLIST NullSchema
    Name                CDATA           #IMPLIED
    id                  ID              #REQUIRED>
<!ELEMENT Alternative
    ((PieceOfText|Alternative|Conjunction|NullSchema),
     (PieceOfText|Alternative|Conjunction)+)>
<!ATTLIST Alternative
    Name                CDATA           #IMPLIED>
<!ELEMENT Conjunction
    ((PieceOfText|Alternative|Conjunction),
     (PieceOfText|Alternative|Conjunction)+)>
<!ATTLIST Conjunction
    Name                CDATA           #IMPLIED>
<!ELEMENT Implication EMPTY>
<!ATTLIST Implication
    Name                CDATA           #IMPLIED
    Antecedence         IDREF           #REQUIRED
    Consequence         IDREF           #REQUIRED>
```

The single elements are written in bold font for readability and contain several attributes. PieceOfText elements have in addition to the optional standard attribute name a mandatory one called id which is required for constructing implications. At least two elements have to go into alternatives and conjunctions; further, alternatives may include up to one NullSchema. Implications are realized by two attributes, Antecedence and Consequence, referring to the IDs of pieces of text. Offers and requests specified according to this grammar can on the one hand be used as the object of the information phase and on the other hand by extension by sequences and implications for the actual negotiation process. E.g. the space of possible PC configurations shown in figure 4a is defined by the following piece of XML code:

```
<Conjunction Name="PC Offer">
    <PieceOfText Name="Memory" id="pt1"/>
    <PieceOfText Name="Graphics Card" id="pt2"/>
    <Alternative Name="Alternative frequency">
        <PieceOfText Name="frequency >500MHz" id="pt3"/>
        <PieceOfText Name="frequency <500MHz" id="pt4"/>
    </Alternative>
    <Alternative Name="Alternative cooler">
        <PieceOfText Name="active cooler" id="pt5"/>
        <NullSchema id="n1"/>
    </Alternative>
</Conjunction>
<Implication
    Antecedence="pt3"
    Consequence="pt5"/>
```

It is interesting to notice that this grammar is capable of expressing contract schemas that are far more complex. E.g. an arbitrary depth of nested conjunctions, alternatives or material implications is possible. Thus the meta schema presented here allows to model highly flexible and configurable contract schemas.

7 Related Work

Due to the limited space we can only briefly mention a few other approaches in this area. The basis for all electronic business certainly is the electronic data interchange format (EDI, [12]). EDI sets up rules for formatting business messages but is too expensive for small and medium enterprises. By the advent of XML several successors of EDI are entering the scene. On the one hand specifications are under development for formulating product catalogues (e.g. BMEcat [13]), opposed by frameworks concentrating on the business workflow (e.g. ebXML [11] or BizTalk [10]).

8 Summary and Conclusion

EBusiness is becoming more and more popular. Therefore it is of central importance to formalize the involved processes as far as possible to enable electronic support or in the best case automatic processing. The main aspects in that context are the specification of offers and requests as well as negotiating based on these structures for finally achieving a contract. For B2B as well as for B2C electronic business must be more than just pressing a "buy!" button in a webbrowser for buying a "primitive" good; but to achieve more, i.e. to deal with complex, configurable goods or services, a strict formal methodology is needed. We especially concentrate on the two phases of discovery and negotiation because these two are more difficult because of the wish for privacy but also because of the huge amount of offers provided by the internet and because these phases have been rather neglected so far.

It is the goal of the discovery phase to test a request against possibly all offers on similarity. If successful the remaining degrees of choice can in many cases be reduced by adapting offer and request to one another. To express the space of offers respectively requests we suggest to reconstruct both by applying mereological structures, thus allowing to use the same structural concept for both phases. Although from the processing point of view these phases have to be treated differently: discovery can be done in a natural way by the principle of *publish/subscribe* being well suited to handle the general many-to-many relationship between offerers and requestors. Furthermore the task of finding matching couples can be realized within the intermediating broker for reducing to a one-to-one relationship. From this point on a direct dialogue between the possible business partners is necessary, accomplished by following the *request/response* pattern and taking place on two different levels: in the *meta dialogue* both participants agree on the sequence of the actual debate on the real contract, which is done step by step within the *content dialogue*. For both phases this paper presents a universal XML grammar that can be easily adapted to the needs of special vertical domains.

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