On Deep e-Contracting

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Abstract

The use of electronic contracts is emerging as a way to improve the efficiency of contracting processes. Electronic contracts are, however, often used as a direct replacement for traditional paper contracts – which we call shallow e-contracting. Consequently, business processes in general and contracting processes in particular do not change much through the use of electronic contracts. New business scenarios caused by e-business developments, however, do require new contracting paradigms in which the use of electronic contracts becomes an essential element to obtain a radical paradigm shift in contractual business relations – which we call deep e-contracting. In this position paper, we explore these new paradigms. We link the paradigms to exchanged values described in e-contracts to obtain a mapping from business requirements. We next map the paradigms to contracting activities. Finally, we map the activities to information technology required for their automated support. Based on the paradigms and mappings, this paper provides a concise framework for the exploration of deep e-contracting.

1 Introduction

Contracts are the basis for establishing formal business relationships between autonomous organizations. Traditionally, contracts are physical paper documents. In the development of electronic means for communication and collaboration between organizations, electronic contracts have emerged as a digital alternative for physical documents [An01a]. Electronic contracts are, however, often used as a direct replacement for traditional paper contracts. Consequently, business processes in general and contracting processes in particular do not change much as a consequence of the use of electronic contracts. As this form of e-contracting does not penetrate the way of doing business, we call his *shallow e-contracting*.

New business settings have emerged in recent years, e.g., as a consequence of the fast development of electronic commerce. The new business settings do require new contracting paradigms in which the use of electronic contracts becomes an essential element to obtain a radical paradigm shift in contractual business relations. We call this *deep e-contracting*. Various research efforts have investigated specific aspects, e.g., the Cosmos project [Gri98], the CrossFlow project [Gre00, Koe00, Hof01], research at the University of Queensland [Goo00], at the University of St. Gallen [Gis00], at IBM research [Sac99] and at King's College [Das00]. A concise framework of the spectrum of e-contracting paradigms in both their business and technological contexts does not yet exist, however. Providing a first step towards such a framework is the goal of this paper. In doing so, we take some short turns and do not try to be complete – painting the overall picture is taken to be more important.

To achieve this, we systematically explore the use of electronic contracting in new business settings. In Section 2, we first discuss the contracting paradigms that are typical for the use of deep e-contracting in e-commerce scenario's. These paradigms are linked to specific contract types, which we type τ-, μ-, π-, and ε-contracts. In Section 3, we link the paradigms to types of exchanged values (goods and services) described in e-contracts. Doing so, we obtain a mapping between business contracting requirements and contract types. In Section 4, we link paradigms and contract types to contracting processes and the activities these are composed of. This results in a mapping of contract types to requirements to automated contracting support systems. In Section 5, we map these requirements to information technology addressing these requirements. The three mappings together provide a first approach to a complete framework for mapping business requirements to support system characteristics in the field of electronic contracting. We end this paper with conclusions and outlook in Section 5.

2 Paradigms for e-contracting

In this section, we present the paradigms for deep e-contracting. We base our selection of paradigms on dimensions of contracting processes that are affected by the use of information technology.

2.1 Dimensions of e-contracting

Automation of business processes takes place because automated systems are fast and cheap in their operation and are not subject to typical human mistakes. So automated systems can contribute to the time, cost and quality dimensions of business processes. This obviously also holds for contracting support systems, so we have the following three general dimensions in which automated support can improve contracting processes:

- contracting speed,
- contracting cost,
- contracting quality.

For contracting, there is an important fourth dimension. Contracting is basically a process the goal of which is to specify another process: the contractual exchange of values (see also Section 3.1). These business processes are generally called contract enactment or contract fulfillment. In e-business settings, these processes usually have automated support as well. Support for 'seamless' connection between contracting and contract enactment is essential for an effective and efficient end-to-end solution. Hence, we distinguish a fourth dimension for automated support for e-contracting:

- enactment connection

Together, we now have four dimensions that can be addresses to achieve deep e-contracting – either in isolation or in a combined fashion.

2.2 E-contracting paradigms

Based on the four dimensions discussed above, we distinguish the following four business-to-business electronic contracting paradigms, each of which is tailored to support contracting in one of the dimensions:

Just-in-time contracting is establishing a business relationship at the latest possible moment in a business process to be able to react to temporal market dynamics. As this is a time-critical form in contracting, we call this τ-contracting. E-contracting is required in this paradigm to meet speed requirements.

Micro-contracting is the form of contracting in which many small contractual business relationships are established to support a high level of selectivity and specialization in business collaboration. We call this paradigm μ-contracting. E-contracting is required to meet cost requirements with respect to establishing contracts.

Precision contracting is establishing contracts in which a large number of parameters is to be agreed upon. We call this π-contracting. E-contracting is required for quality (or effectiveness in a more general sense) reasons in contract establishment, for example error reduction.

Enactment contracting is establishing contracts such that they can be directly enacted by automated systems. Contract contents are to be automatically interpreted,

so electronic contracts are required. As this contracting form addresses the enactment connection dimension, we call this paradigm ε-contracting.

We label the contracts used in a certain paradigm the same way as the paradigms, e.g. in τ-contracting, τ-contracts are used.

2.3 Hybrid forms

Clearly, multiple dimensions as described above can be of importance in a specific business scenario. Therefore, hybrid forms of the above four contracting paradigms exist, e.g., just-in-time micro-contracting – which we call τμ-contracting – or precision enactment contracting – which we call πε-contracting. An example of the latter is the situation where the automatic enactment of a complex business process with many parameters is contractually outsourced from one organization to another.

3 Contract contents and paradigms

The contracting paradigms introduced in the previous section are applicable to specific kinds of collaborations between business organizations. In this section, we classify these collaboration kinds on the basis of the contract contents. In doing so, we focus on the type of the exchanged values specified in the contract [An01b, Ang02].

3.1 Exchanged value types

A contract in general describes an exchange of values between two (or more) parties. We distinguish between the following main exchanged value types:

Money: the exchanged value has a monetary character. Money can be physical or have an electronic form that is easier to transfer.

Product: the exchanged value has a predominant material (physical) character; it has to be produced before it can be delivered.

Service: the exchanged value has a predominant non-material character; it is usually generated during the delivery. A service can be a physical service or an e-service [Cas01].

Combined: the exchanged value has a balanced combination of material and non-material character, or in other words, is a combination of product and service.

The exchange of money is not too interesting in the context of this paper. For the other three types, we make a distinction between standard values, which are produced irrespective of consumer specifications, and custom values, which are produced to specific consumer requirements. Note that standard values may be parameterized to allow some flexibility and that custom values may be based on specific standards – hence the standard-custom dimension is actually a continuum. For reasons of clarity, however, we treat it in a binary form in this paper.

Contracting Paradigm	Product		Service		Combined	
	Standard	Custom	Standard	Custom	Standard	Custom
τ	X		X		X	
μ	X		X		X	
π		X		X		X
ε			X	X	X	X

Table 1: contract types versus exchanged value types

3.2 Value types and contracting paradigms

The resulting categories are related to the contracting paradigms in Table 1. In this table, we have indicated which paradigms are typical applicable for what types of exchanged values – in a highly simplified binary form for reasons of clarity. The time-critical character of τ-contracting fits best with standard exchanged values – as there is no time for customization. The cost-critical character of μ-contracting is also best applicable to standard exchanged values – as customization would be too expensive. In π-contracting, many details have to be automatically checked, which is most applicable to custom exchanged values. The link to automation of ε-contracting is usable for exchanged values with a service aspect – as pure products do not require much of an automatic process.
From the table, we can observe what hybrid contracting paradigms can be used for specific classes of exchanged values to profit most from e-business support. In other words, the table shows which aspects of deep e-contracting are relevant in specific business settings. For example, the most radical e-business approach to standard service contracting is by using a τμε-paradigm.

4 Contracting paradigms and processes

In the previous section, we have introduced four basic e-contracting paradigms and associated contract types. In this section, we link these paradigms to elements in contracting processes. This results in a mapping between contracting paradigms and affected contracting activities.

4.1 Contracting processes

A contracting process is composed of a number of phases that each covers specific activities in setting up and enacting a business relation. We distinguish the following main phases [Gis00, An01b]:

Information phase: information about possible business relationships is exchanged through market mechanisms (brokers, traders). Consequently, contact between parties is mostly indirect. Activities are information advertising (push mode by provider) and information gathering (pull mode by consumer).

Phase	Activity	τ	μ	π	ε
Information	Advertise Information	X		X	
	Gather Information	X		X	
Precontrac-tual	Exchange Information	X		X	
	Customize Offer	X		X	
Establish-ment	Negotiate Offer	X	X	X	X
	Validate Contract	X	X	X	X
	Sign Contract	X	X		
Enactment	Exchange Value				X
	Monitor & Control		X		X
	Evaluate Contract		X	X	

Table 2: contracting phases and activities versus contracting paradigms

Precontractual phase: in the precontractual phase, parties engage in direct contact with specific business intentions, but do not yet have a formal and legal relationship. Information regarding offers is directly exchanged between parties and details of offers are set (referred to as offer customization).

Establishment phase: in the establishment phase, the contract is actually established, resulting in a formal and legal business relationship. Activities are negotiation with respect to an offer, formal validation of a contract (internally and through trusted third parties), and signing a contract.

Enactment phase: in the enactment (or execution) phase, the values defined in the contract are exchanged. The enactment process can be complex, requiring various forms of monitor and control activities. During or after the exchange, the performance of parties is evaluated to obtain strategic information.

These phases and the activities they contain are listed in the first two columns of Table 2.

4.2 Contracting paradigms and contracting activities

We use the above four phases and the activities per phase as the basis for our mapping from contracting paradigms to contracting activities. The result is summarized in Table 2. Here, we show which activities require specific automated support for what contracting paradigms – again in a simplified binary form.

We see that for τ-contracting, automated support in the first three phases is critical in order to meet speed requirements. In the information phase, both consumers and providers of products and services need to be able to react fast with respect to changes in the market environment. This implies that efficient automated support must be available to deal with electronic market places. In the precontractual and establishment phase, a contract must be made fast – preferably in a completely automated fashion.
For μ-contracting, we see that establishing a contract requires specific automated support to meet the strict cost requirements. If monitoring and control of services are employed during enactment, this also requires cheap, automated mechanisms. The same holds for evaluation of delivered values.
For π-contracting, dedicated automated support is required in the phases until contract validation to handle the complexity of π-contracts. The same holds for the evaluation of π-contracts.
The automatic enactment associated with ε-contracting clearly places an emphasis on support for the exchange of values (the execution of the service) and monitoring and control of the exchange process. In the negotiation and validation activities of the establishment phase, support must be available for guaranteeing the executability of contracts that are to be established.
From the table, we can observe what requirements to automated support exist with respect to hybrid contracting paradigms by 'adding' multiple columns. In our example of τμε-paradigm, we see that the emphasis of automated support is on the first two activities of the establishment phase.

5 Contracting activities and support

In this section, we pay attention to automated support for activities in deep e-contracting processes. It is certainly not our intention to be complete here, but to provide a first step as an illustration of our framework. In doing so, we distinguish the following four classes of information technology:

- document management,
- process management,
- document transfer and authentication,
- negotiation support.

Our observations with respect to the mapping of contracting activities and information technology classes are summarized in Table 3.

5.1 Document management

As electronic contracts are in fact electronic documents, document or content management is an important technology class. This is obviously the case in the information phase activities in which advertisements are stored and exchanged, but also in the precontractual phase activities in which offers are modified. As XML is the de facto

standard for document like contracts, XML database technology (e.g. XML query languages like XML-QL [Deu98]) is of importance here.
Contract evaluation can pertain to either the evaluation of individual contracts or to the evaluation of sets of contracts. Rule systems can be used for the evaluation of individual contracts, e.g. to check whether all contract conditions are met upon completion of the contractual processes. This is certainly applicable in the context of π-contracting, where many conditions exist. Data warehousing and data mining techniques can be used to analyze the characteristics of large numbers of contracts to provide input for strategic decisions with respect to the choice of business partners. This is essential in the domain of μ-contracting, where the choice of business partners is made dynamically on the basis of context information.

5.2 Process management

General business process support is of relevance for most of the e-contracting processes as a whole to achieve the required levels of efficiency. Workflow management technology [Ley00] is clearly applicable here to provide an infrastructure for integrated process management across the individual contracting activities. This is most notably the case in the last three main phases, as these usually contain complex, structured processes.
Cross-organizational workflow technology [Gre00, Hof01] has the added value of the ability to integrate business processes of contractual partners, thereby contributing to speed requirements as dictated by τ-contracting.

5.3 Document transfer and authentication

Technology for transfer of XML documents is relevant in most activities – as structured information has to be exchanged between contracting parties. The SOAP protocol is an example of a popular standard for information exchange here [W300].
Digital signature systems [Nor01] are clearly of indispensable use in the sign contract activity. Digital signatures are for example included in the approach to contract structures of [Gis00]. Note that some form of signing all documents transferred in e-contracting processes is required to authenticate these documents.

5.4 Negotiation support

Negotiation support, e.g. [Su00], is a relevant technology class in the customize offer and negotiate offer activities. Automated negotiation can contribute to speed, cost and precision in these activities, so is applicable to most of our contracting paradigms.
Agent technology can be applied in the context of negotiation support or even broader context. For example, an agent society model for implementing contract environments is advocated in [Wei01].

Contracting Activity / Technology Class	Advertise Information	Gather Information	Exchange Information	Customize Offer	Negotiate Offer	Validate Contract	Sign Contract	Exchange Value	Monitor & Control	Evaluate Contract
XML Databases	**X**	**X**	**X**	**X**						
Data Warehous-ing										**X**
Workflow Technology			**X**	**X**	**X**	**X**	**X**	**X**	**X**	
XML Transfer	**X**	**X**	**X**	**X**	**X**		**X**	**X**	**X**	
Digital Signatures							**X**			
Negotiation Support				**X**	**X**					
Agent Technology		**X**	**X**	**X**	**X**					

Table 3: example information technology versus contracting activities

6 Conclusions

This paper presents a general framework to map contracting business characteristics through contracting paradigms and contracting activities to information system technology – this in the context of paradigms that are specific to e-commerce settings, which we call deep e-contracting. Business characteristics are stated in terms of the values exchanged in contractual relationships. Contracting paradigms are chosen such that they cover the typical benefits that automated solutions can bring to B2B contracting. We have called the paradigms τ-, μ-, π-, and ε-contracting to reflect the dimension on which each focuses with respect to contracting processes. Contracting activities are related to a general contract lifecycle model. The framework provides a first step towards a concise basis for the analysis of advanced e-contracting scenarios covering the spectrum from business requirements to technological solutions.

The framework presented in this paper can be extended in a number of directions. Firstly, the business characteristics can be extended to cover other dimensions than the exchanged value dimension, e.g. an organization type dimension. The analysis of combinations of contracting paradigms requires further attention with respect to consistence of requirements in complex scenarios. The simple binary character of the presented mappings can be considerably refined. Finally, the mapping to information system support clearly requires extension to provide a broader coverage of information technology categories on the one hand and e-business standards on the other hand.

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