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Abstract

Contracts play an important role in the every day life of many individuals. Contracts are often negotiated and drafted in an unstructured manner. In this paper we propose a more structured model driven approach to contracting. In particular, we focus on developing a risk and trust model for the transaction that is subsequently used to negotiate the contract. We show how rules can be applied to the risk and trust model of the contract in order to advice the contracting parties how the contract could be amended, e.g. by introducing control mechanisms, to make it more appropriate to their respective risk and trust assessments.

1.   Introduction

Electronic commerce is doing business via electronic networks. Paper-based trade documents such as, for example, request for quotation, purchase order or invoice are replaced by electronic messages, in particular *Electronic Data Interchange* (EDI) messages. These electronic messages are not only transmitted much faster than paper-based documents, but computers can also process them automatically. A

sophisticated type of automated processing of electronic messages is electronic contracting and negotiation where the actual trade contract is on-line negotiated and concluded via an electronic network. In principle this negotiation process could be done by autonomous software agents that are instructed by a human user how to negotiate for him. However, in most cases the electronic negotiation process will probably be semi-automated where the human user is also involved and takes the final decision. Also here automated processing can be very helpful, for example where the computer analyzes the content of the contract and provides what-if analyses to explain to the user what his liabilities and risks are if he agrees to a proposed contract.

The traditional process of negotiating and drafting a contract often adds significantly to the cost of the transaction. Making the drafting process more efficient and thereby reducing the transaction costs is thus an interesting value proposition.

Support for drafting all these contracts in often lacking or very limited (see [STT01] for an overview). There are CD-ROM collections of so-called 'boilerplate' contracts. You can select the boilerplate contract that you think fits your situation best. You can load the boilerplate contract into your word processor in order to complete the blanks or in order to remove, add or modify some clauses. There are special 'Write Your Own Will' kits that help people to write their testaments. Magazines for businessmen often publish articles about the things that you should check before signing a contract, such as "Which law governs the contract?" or these articles inform you about the pitfalls. For example, in the December 2001 issue of a Dutch magazine targeted at professional buyers they warn for the English phrase "time is of the essence" which at first appears to be harmless, but this phrase has a very far-reaching meaning in English law [G01]. The advice and support offered by these CD-ROM collections, special kits and magazines, however, is very generic. The boilerplate contracts and special kits only deal with frequently occurring situations such as labor contracts or rental contracts. Once you start deviating from the standard text of the boilerplate contract or if you need something that is just slightly out of the ordinary then you are on your own or you have to hire a legal expert.

In the late 1980s Ron Lee introduced the idea of 'electronic contracting' [L88]. Lee referred to "employment of technology for further standardization of certain classes of contracts in order to reduce the transaction costs and time of contracting" as electronic contracting. Lee focused mainly on the application of results coming from the field of Artificial Intelligence to the contract drafting process. In his CANDID work Lee showed how formal languages could be used to clearly and unambiguously represent the contents of certain classes of contracts [L80][L96]. In the late 1980s and early 1990s the state-of-the-art in communication technology represented a major limitation for the adoption of the 'electronic contracting' concept. At that time only very large organizations were using so called valued added networks (VANs) to exchange trade documents with their partners. These Electronic Data Interchange (EDI) systems were mainly used to exchange relatively

simple contracts such as call-off orders. The Interchange Agreement regulating the electronic exchange of the data and frame agreement regulating the exchange of the goods were negotiated and drafted off-line.

To a large extent the advent of the Internet in the mid 1990s removed the limitation that the communication technology was for electronic contracting. Suddenly, it was within the reach of almost every organization and individual to exchange data in an electronic way. It now seemed that everyone could reap the benefits of electronic contracting. As a result of this new situation many academic and commercial projects were initiated in order to advance the state-of-the-art in electronic contracting and to bring the benefits to even the smallest organizations.

This paper is devoted to a particularly important aspect of contracting, namely supporting contract drafting to include control mechanisms appropriate the parties' risk and trust profiles. Many things can go wrong before the parties have performed all the actions required to complete their transaction. The parties can make mistakes or they can behave opportunistically. Technical failures might affect the transaction. The weather might cause damage to the products or the weather might make it impossible to perform a service such as building a house. In order to cater for all these contingencies contracts often include many clauses that regulate the risks, costs, corrective actions and penalties associated with the situations in which something went wrong.

In section 2 we start by introducing our general approach to contracting, which we call 'contract engineering'. In section 3 we introduce the generic trust model that will be used to support the negotiators during the contract-drafting phase. In section 4 we demonstrate how the generic trust model can be used to make decisions about various scenarios. In section 5 we show how this decision making process can be formally implemented using what we call an Action Risk/Trust Matrix and a Rule Frame. In section 6 we present our conclusions and give an outline for further research.

2.   Contract Drafting

In this paper we use the following definition "contracts are promises that the law will enforce" [C01]. This definition appears to be very simple, but it does capture the essence of what contracts are very well. Given the definition, the law thus has to play an important role in any discussion about contracts and contract drafting. Many people, who have not enjoyed a legal education, are surprised though how little the law actually regulates if it comes to contracts. For example, the first article 1.1 of the UNIDROIT "Principles of International Commercial Contracts" states that "the parties are free to enter into a contract and determine its content" [U94]. The principles go on by stating that nothing requires a contract to be concluded in or evidenced by writing (article 1.2). The contract may be concluded either by the

acceptance of an offer or by conduct of the parties that is sufficient to show agreement (article 2.1).

This freedom seems to be reflected in the way in which many contracts are drafted. As there are no formal requirements about the structure and content of the contract everyone goes about drafting contracts in his own way. In other words, there is almost no systematic method used to guarantee the quality of the contract document. Of course, trained lawyers are usually hired to draft or verify the content of the contract. These lawyers are trained to spot missing clauses in the contract, to spot dangerous phrases in the contract and to advise their clients about possible unfavorable outcomes that the contract might have for the client. Lawyers can significantly improve the quality of the contract especially from a legal point of view. Also they play an important role in making the client aware of the risks he or she is running and which clauses to include in the contract to cope with the risk in an acceptable way. Lawyers, however, cannot really make sure that the contract adequately reflects the intentions, risk assessments, trust assessments and profit expectations of the contracting parties. In this paper we propose to use a structured approach to contract drafting. What makes our approach different from other existing contract drafting systems is that where most systems could be considered as advanced word processors for drafting, i.e. they are based on the idea of configuring a contract from template clause text blocks (see [STT01]), our approach is based on a principled analysis of the risk and trust issues that are relevant for a specific case. In addition, the system contains a library of heuristic rules to provide suggestions for controls that can be included in the contract for specific risks. The system contains a matching system that relates applicable rules to the risk and trust analysis of a specific case. For example, for a specific risk and trust analysis in international trade a letter of credit procedure could be suggested as a method to deal with these risks.

Below we list the various objects that we use to model contracts (see Table 1).

Object	Description
Actor	Any person or organization that performs an action defined in the contract or related to the contract
Role	A role is a meaningful cluster of activities, recognized by the business world ([B97], page 22)
Value Object	Contracts typically deal with the exchange of value objects, such as products, services and money, between the parties
Action	An activity performed by an Actor
Action Profile	The Action Profile contains the relationships among actions, the risk/trust assessments of the contracting party, and an analysis of the effects of events on the actions.
Event	An occurrence not performed by an Actor

Event Profile	The Event Profile specifies all events that might affect the performance of the contract and their likelihood.
Contract Clause	The terms and conditions of the contract document
Rule	A rule specifies how a contract should be amended given the Action and Event Profiles of the contracting parties.

The Action, Action Profile and Rule objects are discussed in more detail in the coming sections.

3.   Trust Model

In recent years the concept of 'Trust' has received a lot of attention from researchers and businesses (see for instance [AMR98]). The reason behind this sudden increase in attention is that most people agreed that in order for electronic commerce to really take of it is required that everyone has sufficient trust in the virtual environment. Trust, however, has proven to be a very elusive concept. Many definitions of trust exist. Distinctions have been made between the noun 'trust' that was taken to refer to the mental state and the verb 'to trust' that was taken to refer to the manifestation of trust in one's actions [CF98]. Trust has been studied by researchers from the fields of psychology and cognitive science, who treat trust as a mental state of an individual [CF98]. Trust has been studied as something that exists between two individuals [TT01]. And trust has been studied as something that exists in industrial districts or even nations [G02][F95]. Trust is sometimes seen as a static phenomenon that exists and that can be measured and can be used to explain things like the wealth of nations [F95] or the existence or emergence of institutions [Z86]. Other times, trust is seen as a dynamic phenomenon that can emerge, that can be built and that can cease to exist [RV92][RV94]. It has been argued that trust is needed only in risky situations [KK70]. The complementary or supplementary relationship between trust and control has been studied [DB98][GLF98][HL98][L79].

The fundamental principle that is important for this paper is that a party will engage in a transaction in case the potential gain outweighs the risk associated with the transaction. We conceive the potential gain as a subjective expected utility that can be broken down into [R01]:

- Perceived Direct Benefit – the subjective expected utility directly resulting from the exchange of value objects of the transaction

- Perceived Relationship Benefit – the subjective expected utility resulting from the relationship with the other party. This could, for instance, include the subjective expected utility of future transactions with the other party

- Perceived Strategic Benefit – the subjective expected utility resulting indirectly from the transaction or the relationship with the other party. For example, it can be good for once reputation to supply to the other party, which might lead to similar transactions with other organizations.

The risk associated with the transaction is a subjective expected utility loss calculation that factors in the party's risk propensity, the party's probability assessment and the party's expected utility loss of the unfavorable outcome. We distinguish between two types of risks, behavioral risk, which are the possible adverse outcomes directly resulting from behavior exhibited by the contracting parties, and environmental risk, which are adverse outcomes outside the influence of the contracting parties. The environmental risk component can be further broken down into:

- Technological Environment Risk, i.e. risk related to the technology used for the performance of the transaction, such as communication technology.

- Physical Environment Risk, i.e. risk related to the adverse effects of the weather.

- Political Environment Risk, i.e. risk related to political decisions made by governments, such as a trade embargo, raise in import/export duties, and war.

- Social Environment Risk, i.e. risk related to changing opinions of the society

In discussing the acceptance of electronic commerce by consumers and businesses the word 'trust' has been extensively used in relation to environment risk, especially technological environment risk. We do not consider trust to play a role in environmental risk. In other words, we do not want to say that "we trust that the weather will be good" or that "we trust that the integrity of the messages will be maintained by the communication system". In this paper we reserve the term 'trust' solely for the behavioral risk component. We use the term trust when we talk about the behavior we expect from the other parties involved in the contract, but we also use the term trust when we talk about the mechanisms that aim to control the behavior of the other parties. In other words, we talk about 'trust in the other party' and 'trust in the control mechanisms'. For more details about the separation between those two kinds of trust and related concepts such as 'communality trust' and 'understanding trust' we refer to reader to [TT00][TT02].

We measure the behavioral risk of the actions of the other party as the probability of the adverse behavior times the utility loss resulting from the behavior. The probability assessment consists of two components the 'Can Do' probability and the 'Will Do' probability. The 'Can Do' component measures the extent to which the adverse behavior is possible. The 'Will Do' component measures the likelihood that the other party will exhibit the adverse behavior, given that this behavior is possible. If we use terminology from transaction cost economics (TCE), then we could say that the 'Can Do' component measures the likelihood of the existence of an opportunity and the 'Will Do' measures the likelihood of opportunism, which in

TCE is defined as "self-interest seeking with guile" [W75][W85]. Behavioral risk of a certain action can thus be calculated as 'Can Do' times 'Will Do' times 'Utility Loss'.

We can further refine the analysis of behavioral risk by distinguishing between the various forms in which an undesirable outcome can be manifested. We distinguish between the following five possible outcomes of an action:

- *Performed as intended* (this is the intended outcome)

- *Not performed at all* (no attempt is made to perform the action)

- *Performed, but not as intended* (an attempt to perform the action is made, but the result is not as intended, e.g. quality of the delivered products is poor)

- *Performed, but too late* (the action is performed, but after the deadline)

- *Faked* (the action is not performed, but the party is made to belief that the other party has performed the action as intended)

The 'Can Do' and 'Will Do' assessments can now be made for each of these five possible outcomes. For example, one can assess the possibility that an action can be faked, this requires for instance that the outcome is not directly or immediately observable. And in case the possibility is greater than zero one can assess the probability that the other party will exploit this possibility and fake the action, which requires that there is a self interest for the other party to do so.

In the next section we demonstrate, with some informal examples, how we intend to use the risk and trust analysis during contract negotiation and drafting. In section 5 we present some of the details of our implementation.

4. Applying the Trust Model

In this section we discuss an action that is part of many contracts, namely 'to pay'. When we are negotiating a contract in which we are to deliver some goods or services in return for which the other party has to pay a certain amount of money, we have to consider the risk associated with the payment action. The analysis in the previous section shows that we have to assess the risks of non-payment, inadequate payment, late payment, and faked payments (e.g. using a bad check). For the example we limit ourselves to the risk of non-payment. We also ignore the environmental risk component.

Figure 1.A. shows the assumptions we make regarding the assessment made by the party of the potential gain of the transaction. We assume that the utility is measured in Euros and that the amount that the other party has to be pay is EUR 10,000 and that the party has a 20% direct profit for the transaction. The total Potential Gain is estimated at EUR 2,350.

Direct Benefit	2,000
Relationship Benefit	200
Strategic Benefit	150
Cost for controls	0
Total Potential Gain	2,350

Figure 1: *A Potential Gain analysis*

In Figure 1.B. the assessment of the non-payment risk is presented. The other party has all opportunity not to pay. The "Can do" probability bar measures from 0 tot 1, and is positioned at 1. There is no control mechanism that aims to reduce the opportunity for non-payment, so both the 'control effectiveness' as well as the 'trust in control' measures are set as at 0.
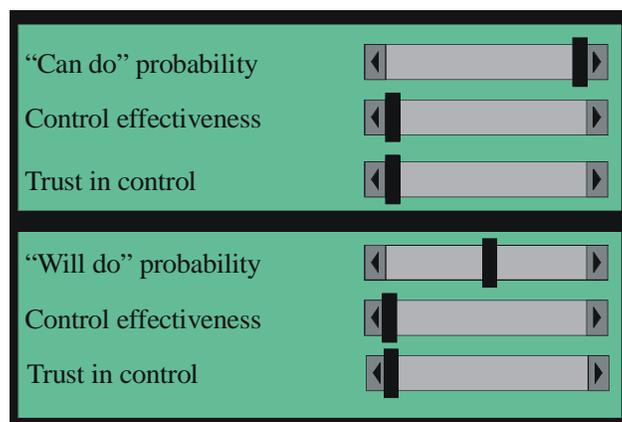

Figure 1.B: *Risk/Trust analysis non-payment risk*
(Note: the scrollbars range from 0 and 1)

In case the other party does not pay, then the whole amount EUR 10,000 is lost. The likelihood that the other party will exploit the opportunity by not paying is assessed as being 50%, or 0.5. The Behavioral risk is calculated as Can Do * Will Do * Utility Loss and is thus 1 * 0.5 * 10,000 = 5,000 (see Figure 1.C.). As the Behavioral Risk is greater than the Potential Gain it is printed in bold to indicate that the party will not engage in this transaction.
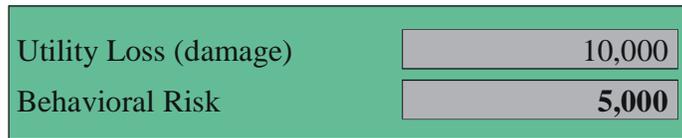
Utility Loss (damage)	10,000
Behavioral Risk	**5,000**

Figure 1.C: *Total behavioral risk*

Hence, in order for the party to engage in the transaction the risk has to be reduced. There are obviously two ways to do this. We can target the opportunity, the Can Do risk, or we can target the self-interest of the other party, the Will Do risk. Let's assume that we target the Can Do risk component by introducing a documentary credit procedure. In theory a documentary credit procedure reduces the risk of non-payment to zero, because the payment is guaranteed by an independent, reputable bank. The effectiveness of the control is thus 100%, or 1. However, we assume that the party knows about the many pitfalls that surround documentary credit procedures and therefore the party's trust in the documentary credit as a control mechanism is only 90% or, 0.9. Also, the trustworthiness of the bank involved plays a role in this assessment. Since the trust we have in the other party is no longer relevant (it has been replaced by the trust in the control mechanism and the bank) it has be greyed-out in Figure 2.
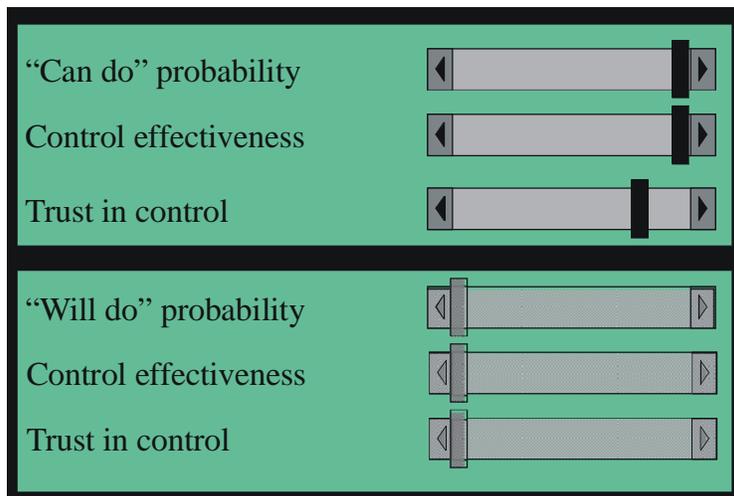

Figure 2: *Risk/Trust analysis non-payment risk with documentary credit*

The "Can Do" risk is now calculated as ('Can Do' probability – (Control Effectiveness * Trust in Control)) * Utility Loss = $(1 – (1 * 0.9)) * 10,000 = 1,000$. As this is less than the Potential Gain the party would engage in the transaction in case a documentary credit procedure is used. However, we have to take into account that control mechanisms are not free. The banks involved will charge a fee for the

documentary credit and one of the parties has to pay those fees. If the party has to pay the costs and they would be more than EUR 1,350, then the party would still not engage in the transaction.

Another approach to address to behavioral risk would be to require the other party to pay some of the money in advance. Let's assume we require the other party to pay 40% in advance. This does not affect the opportunity for the other party not to pay. However, the Utility Loss is reduced by 40% to EUR 6,000 and the resulting behavioral risk would thus be 1 * 0.5 * 6,000 = 3,000. This is more than the Potential Gain and would thus suggest that the party would not engage in the transaction. But, this assumes that the trust in the other party remained at 50%. However, if the other party accepts the 40% down payment, then the other party takes a risk and trusts us by putting up a significant portion of the money in advance. This observation causes the party to re-assess the trust in the other party and increase it to say 75% in this scenario. In the trust literature this is often referred to as 'reciprocal trust'. The calculation becomes 1 * 0.25 * 6,000 = EUR 1,500 and the party would thus engage in the transaction.
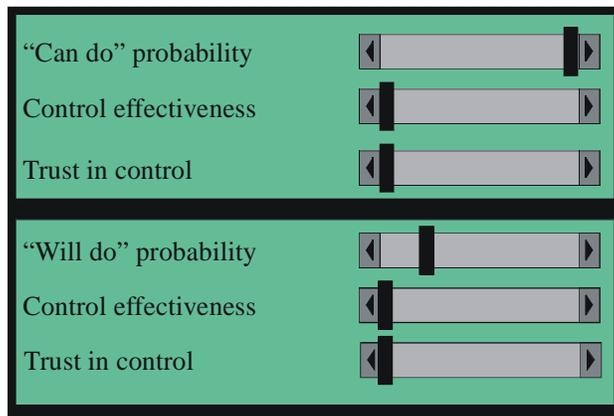

Figure 3: *Risk/Trust analysis non-payment risk with 40% down payment*

In this section we illustrated the idea of reasoning about trust and control mechanisms when negotiating and drafting contracts with examples. In the next section we show in more detail how we can model the various cost, risk and trust aspects related to the actions and how we can apply rules to the model that actually suggest the use of control mechanisms such as documentary credit procedures to the users of the system.

5.   Design of the System

The basic idea of the contract drafting based on risk/trust models is that the drafting is supported by a library of heuristic rules that are applicable to a specific risk/trust model. The user is supposed to give as input a specific setting of the rulers in the risk trust model, and the system contains rules that suggest control procedures to obtain the desired results. Hence, inside the system a kind of rule matching takes place that is based on heuristic rules to cope with all kind of risk and trust issues. In general the rules will be specific to a certain domain (e.g. a letter of credit procedure is specific for the domain of international sale of goods). However, the parameters of the rules are generic and they can be presented in a so-called rule frame. The rules that are applied in order to advice the user about possible risk reducing control mechanisms are structured according to the Rule Frame (Figure 4). A Rule Frame consists of a Context and a Rule. The Context is used to represent some general properties of the rule, such as the domain of application and the expert who created the rule in the system. The Rule component consists of three sub-components the Conditions of Application, Target and Implementation. The Conditions of Application describe to which action type the rule can be applied and under what conditions the rule could be applied. The Target component described what elements of the Action Risk / Trust matrix is being targeted by the rule. In other words, does the rule aim to reduce the Can Do probability or the Will Do probability. Or does the rule aim to reduce the Utility Loss without influencing the behavior of the other party, which for instance is the case with credit insurance. The Target component also describes to what degree the targeted element will be affected (in the opinion of the expert who created the rule). In the other words, this is the control effectiveness of the control proposed by the rule. The third component, Implementation, describes how the contract document and model of the contract/transaction have to be amended in case the rule in applied. The Implementation component might for instance specify that an actor and role have to be added the model when a third party credit insurer is used to reduce the risk of non-payment.

Figure 4: *Rule Frame*

In TextBox 1 a sample rule is shown as an XML representation of the Rule Frame. The rule is based on a International Chamber of Commerce model contract called the International Commercial Agency Agreement, in which a principal contracts an international agent to solicit orders from a foreign territory [ICC83]. The Conditions of Application indicate that the rule addresses the action 'to advertise' and that the Principal should apply it in case the Agent has to perform the action and that the Principal assesses that there is a chance greater than 20% that the Agent will not advertise in the way the Principal intends. The solution proposed by the rule in the Implementation component is to add a clause to the contract stipulating, "The contents of any advertising must be approved by the Principal." This also requires that an action be added to the model of the contract, as the Principal will now have to perform the action "approve the advertising contents".

6. Conclusions

In this paper we introduced a risk/trust model driven approach to contract drafting. We gave some examples to make the reader familiar with the idea of using a trust model to reason about contracts. We have also shown some of the implementation details of the system that we are currently developing. Several implementation details, such as the algorithm matching the action type descriptions in the rule with the action in the contract model, still have to be worked out. It is likely that several rules can be applied to the contract at any point during the negotiation, as we have shown with the documentary credit procedure and the down-payment control mechanisms. The system will have to support the user in choosing one of the rules. The system will of course also have to be tested by business users and experts to find out whether the approach feasible in practice. It is especially interesting to find out how much can be accomplished by only using generic rules that are not specific to a certain domain of application, such as 'international trade' or 'offshore software development'.

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TextBox 1: *A Sample Rule in XML Format*