The 4W Framework for B2B E-Contracting

Colophon

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Author(s) :	S. Angelov, P. Grefen

Synopsis:

Contracts are fundamental for the engagement of companies in commerce relations. B2B electronic contracting aims at improving the efficiency and effectiveness of the contracting process and at providing new opportunities to the contracting parties. Virtual enterprises, for example, can be dynamically formed on the basis of e-contracts. For the implementation of e-contracting in practice, an integral understanding of the contracting field must be established. In this paper, we propose a conceptual framework for business-to-business e-contracting support. The framework provides a complete view of the e-contracting concepts. The framework is the basis for specifying requirements to contracting systems. We use it to position research efforts in the e-contracting domain and to analyse them. Based on the framework, we discuss future research issues in e-contracting.

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1   Introduction

Since the very beginning of human history, the problem exists of lack of trust when people exchange values. Contracts between the exchanging sides have been adopted as a solution that specifies the rights and obligations of the participants and thus increases mutual trust. In business-to-business relationships "all economic production and exchange processes are organized through contracts. Contracts are the instruments and the means for the organization of exchange relations" [34]. Nowadays, contracting parties require establishment of contracts at lower costs, in a shorter time and without geographical restrictions. Electronic contracting aims at using information technologies for improving the efficiency and effectiveness of paper contracting and at extending the opportunities to the contracting parties. A number of new opportunities are revealed by the introduction of electronic contracting. Micro-contracting [23], [8], for example, can be introduced, analogously to micro-payments and micro-transactions [11]. In standard paper contracting, costs and time are too high to allow contractual relationships for small business transactions to exist. E-contracting decreases costs and time to reasonable values and allows micro-contracting to take place. Another example is the just-in-time contracting paradigm [23], [8], which introduces the possibility for contract establishment to take place at the latest possible moment. Just-in-time contracting allows parties to react to temporal market dynamics.

In this paper, we present a contracting framework that provides a general view over the contracting field. In our framework, we aim at identifying the concepts that describe the electronic contract and its environment and defining the relations between these concepts. Most other approaches in this direction deal with specific aspects or are based on specific contexts. This framework allows to observe basic requirements on contracting systems, analyse existing approaches for electronic contracting, and define new research issues in this field. Being a conceptual framework, it can be mapped to any project in this domain and used for its analysis.

Contracts aim at increasing the trust between companies by specifying the rights and obligations of the contracting parties. Additionally, e-contracts serve as a specification of the activities to be executed during the contract enactment by the parties. Thus, e-contracts contain concepts that are related to the mutual protection of the parties and to the contract enactment. Concepts related to the contract environment (e.g., concepts related to the business context of a contract or the creation of a contract) are usually not part of the contract content (see Figure 1). Consequently, contract models do not contain concepts from the contract environment.
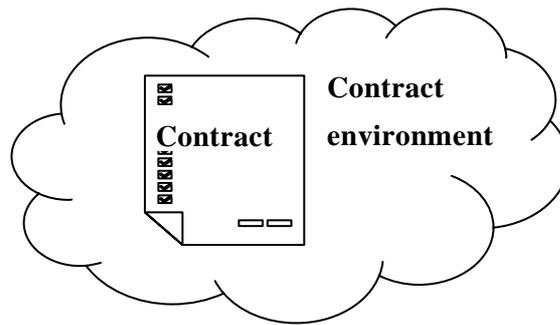
Figure 1: Contract and its environment

In the framework that we propose, we aim at a complete description of the concepts related to e-contracts to a level of abstraction sufficient to show the different aspects of e-contracting. That is why we describe the concepts involved not only in the contract content specification but in the contracting process in general. A contract model will contain a subset of the concepts in the e-contracting framework. Furthermore, depending on the context, the subset of concepts that are included into e-contracts can vary. In the elaboration of the e-contracting framework, we briefly explain which of these concepts are required for an e-contract, and if optional, under what conditions they can be included in the contract content.

Contract legislation has been elaborated and improved over the years to provide legal support for contracts. However, the new requirements set by e-contracting require changes and extensions of the supporting legislation in order to position e-contracting in a proper legal framework. That is why we discuss legal issues in e-contracting and explain the relation between them and the presented framework.

To illustrate the application of the framework, we describe two projects in this domain and we position them in the framework. The framework helps us identifying the context of each of these projects, their goals and issues related to the projects. We also use the framework to identify future research issues in the e-contracting domain and to provide a clear description of our future research goals. The structuring and description of the contracting concepts in the framework gives a possibility for establishing a common terminology and improving the mutual understanding among domain researchers.

This paper is organised as follows. In Section 2, the general view of the proposed framework is presented. Section 3 provides a second level of detail of the framework, explaining the identified e-contracting concepts at this level. Section 4 examines closely the process concept and its related concepts, which are part of the third level of detail of the framework. Section 5 discusses the legal aspects of e-contracting and existing problems in this respect. In Sections 6, related work is described. In Section 7, other research efforts from the e-contracting domain are analysed from the framework perspective. We end with conclusions and a discussion on future research issues.

This paper broadens and improves the research results presented in [5].

2 The 4W framework

In this section, we present the general view of the **4W** framework. First, we identify the groups of concepts related to the e-contracting. Next, we briefly explain the relations between these groups of concepts. Finally, we discuss the content of e-contracts from the perspective of the proposed framework.

2.1 The groups of concepts

The central concept in the framework we propose is the contract concept. There are many definitions for contracts, e.g., [14], and [27]. In this paper we use the following definition: *"A contract is a legally enforceable agreement in which two or more parties commit to certain obligations in return for certain rights"* [30].

This definition gives us an idea for four groups of contracting concepts that can be modelled. The participation of "two or more parties" leads us to a "who" concept. An agreement that is "legally enforceable" shows that there is a context for every contract i.e. a "where" concept. The "obligations in return for certain rights" relates to a "what" concept. And finally, the parties' commitment relates to a "how" concept. In this way, we can define the following four groups of contracting concepts:

Who Concepts that model the **actors** that participate in the contract establishment and enactment.
Where Concepts that model the **context** of the contract.
What Concepts that model the **exchanged values** and their exchange.
HoW Concepts related to the **means** and **processes** for contract establishment.

The **W**ho, **W**here, **W**hat and Ho**W** groups of concept form the general view of the **4W** framework. The approach that we take for the construction of our framework is similar to the approach in the Zachman Framework for Enterprise Architecture [37], [32]. The Zachman Framework is a classification scheme for enterprises. It outlines six focuses of the enterprise architecture, depicted from six perspectives. The six focuses are named by the six primitive interrogatives Who, Where, What, How, When, and Why and are listed in six columns, intersecting with the six perspectives. In the Who column of the Zachman Framework, *organizations* important to the business are listed. The Where column contains the *locations* in which the enterprise operates. The What column lists *data* important to the enterprise. The How column is dedicated to the *processes* that the enterprise performs. The When and Why columns are related to the business events and to the business strategies and goals of an enterprise respectively. The structure of the Zachman Framework with its six focuses underpins the choices made in the construction of the **4W** e-contracting framework, based on the **W**ho, **W**here, **W**hat and Ho**W** questions. The Why question is not of interest for our framework, as it does not add new e-contracting concepts relevant for the goals framework. Also, the When question is not relevant at the high level of description of e-contracting. However, at lower levels of detail, different aspect of the When question require attention (e.g., timing issues). We address shortly the time concept in the lower levels of detail of the framework (see Section 4).

2.2   Relations between the groups of concepts

Certain relations between the **Who**, **Where**, **W**hat and Ho**W** groups of concepts of the **4W** e-contracting framework exist. We have depicted the four groups of concepts and the relation between them in an ER diagram (see Figure 2). As we have already mentioned, the contract concept is central for our framework and is related to the four groups of concepts. A contract has actors that are involved in its creation and execution, context, etc. The involved actors play a role in the contract establishment, supplement to the contract context, and can have rights and obligations during the value exchange. The contract context can affect any of the contracting groups of concepts. Finally, the value exchange concepts make use of the concept related to the contract establishment. These relations show the tight coupling between the e-contracting concepts and the complexity of the contracting relations. Contracting models and subsequent software solutions for electronic contracting should take into consideration these relations and the consequences that follow from them.

Figure 2: The 4W framework

2.3   Concepts in the contract content

Concepts from each of the four groups can be included in an e-contract. A concept from the 4W framework that is included in the contract content is included in the form of one or more contract provisions. Contract provisions describe the different conditions, situations, stipulations, etc. that are included in the contract. Provision can, for example, specify conditions and stipulations for the value exchange, describe different terms and properties, and so forth. According to [15], provisions might be descriptive, prescriptive, procedural, algebraic, etc. A contract concept can be included in the contract content through one or more of the different types of provisions. For example, the party concept (see Section 3.1) is included in the contract content through the descriptive type of provision. One provision might involve in its description more than one contracting concept.

The next section provides a description of the details of each of the four groups of concepts and their "internal relations" i.e. relations between concepts within one group. We briefly discuss which concepts can be included in the contract content in the form of different provisions.

3 The 4W framework in detail

In this section, the four groups of concepts that we have identified in the previous section are elaborated. To simplify the complex structures, most of the relations between the four groups of concepts outlined in Figure 2are not repeated at the detail level.

3.1   The Who group of concepts

The "Who" concepts describe the actors that participate in the contracting processes. We identify the party, mediator and auxiliary implementor concepts as specializations of the actor concept (see Figure 3).

Figure 3: Detail view of Who

In business-to-business relations, two or more companies that want to exchange values create a contract, describing their mutual rights and obligations. The companies that participate in the established contract and exchange values are called parties. Every contract must have at least two parties. The parties can be a value provider, a value consumer or both. Throughout the contract life cycle (see Section 3.4), a party can use other actors (mediators or auxiliary implementors) that will facilitate the contract establishment or enactment.

A mediator is a company or a public institution that facilitates the contract establishment and contract enactment. As the lack of trust is a major problem in business-to-business relationships, Trusted Third Parties (TTP) performing trust management, are mediators of high importance [28]. Market places and brokers are examples for mediators in the information phase (see Section 3.4). Contract enactment mediators can be included in the contract content, if the specific context requires this.

During contract execution, parties perform processes in accordance with the negotiated contract terms. It is often the case that a party outsources part of the processes to be executed to an auxiliary implementor [21]. The entity created by the outsourcing of processes from one of the parties to another auxiliary implementor is often referred to as a virtual enterprise. A party that establishes a contract with a virtual enterprise sees the

virtual enterprise as one counter contracting party. Auxiliary implementors usually are not included in a contract.

3.2 The Where group of concepts

Every contract is established and enacted in a certain context. As shown in Figure 2, the contract context affects the contracting actors, the exchange of values, and the means and processes for contract establishment. However, as we have already discussed in Section 1, only part of the contract context is reflected in the contract content.

In this paper we depict three context dimensions, i.e., legal, geographical and business (see Figure 4), which we consider as basic. Many other context dimensions (e.g. social, political) can be present during the contracting process. For reasons of brevity, we do not discuss them.
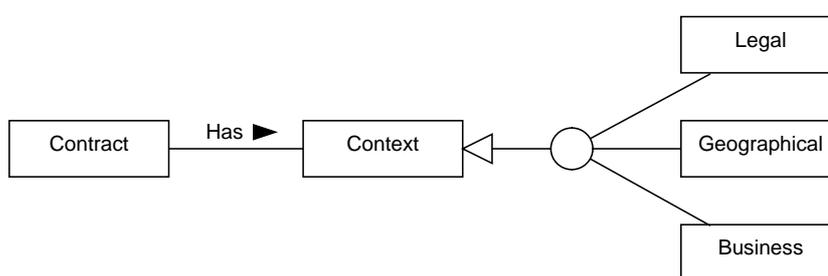
Figure 4: Detail view of Where

In cross-border business-to-business contracting, parties can choose the law that will govern their contract [26]. Parties can also specify in the contract the jurisdiction that will handle the situation in case of dispute. These and other legal issues position every contract in a certain legal context.

Geographical aspects are an important factor for contracting as well. Specific provisions driven by the geographical situation of one or both parties can be included in the contract. Further on, each country has its own national specifics that can affect the contracting process. Even for national contracts the geographical situation is important. The geographical context of contracts can affect the contract content, its representation, contracting processes, etc.

The business context has a central role in the contracting processes and contract content. For example, contracting between SMEs and between large companies can differ substantially. Parties can have many contract relations. It is often the case that one contract depends on the existence and execution of another [4], i.e., one contract is the business context for another. This is another example how the business context can influence the contracting processes and content. A contract management system should be able to support the different business contexts and the consequences following from them.

3.3 The What group of concepts

The "What" concepts describe the exchanged values and the processes and conditions related to their exchange. The exchanged values and their description are the core of a

contract. This core part is accompanied by a set of provisions related to the value exchange (see Figure 5).
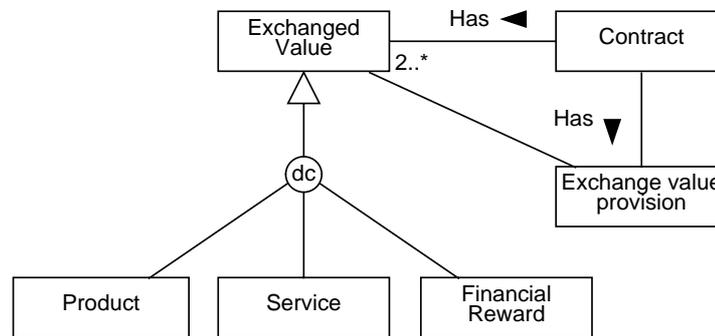

Figure 5: Detail view of What

The exchanged value between the parties can be a product, a service, and in the case of non-barter contracts a financial reward. When a product is the exchanged value, a product specification including the product properties is required. In this paper, we do not pay attention to the description of products. This topic has already been addressed in standards like EDI [33] and HS [36]. If the exchanged value is a service, the contract contains a service description and the processes that will be performed by the service provider (see Section 4). Thus, the contract contains a specification of one or more process descriptions.

Exchange value provisions describe additional processes and conditions related to the successful value exchange. Both, the exchanged value and the accompanying provisions are an indispensable part of the contract content. However, parties sometimes omit some of the exchange value provisions unintentionally (e.g., because of lack of knowledge) or intentionally (e.g., because a provision is well-known and needles to be specified, or due to opportunistic behaviour). In this way, some of the value exchange provisions can be left out of the contract content. The choice whether a provision should be included or not in the contract content depends on the contracting parties and the contracting context.

3.4   The HoW group of concepts

Concepts related to the "HoW" and "What" aspects of contracting (see Figure 6) are most challenging for researchers. They provide possibilities for automation of the contracting process, and thus for increasing its efficiency and effectiveness [23], [8]. Next, we briefly describe the "HoW" concepts and relations. We start with the contract representation and standards in this domain, proceed with contracting phases, and end with the contract structure.
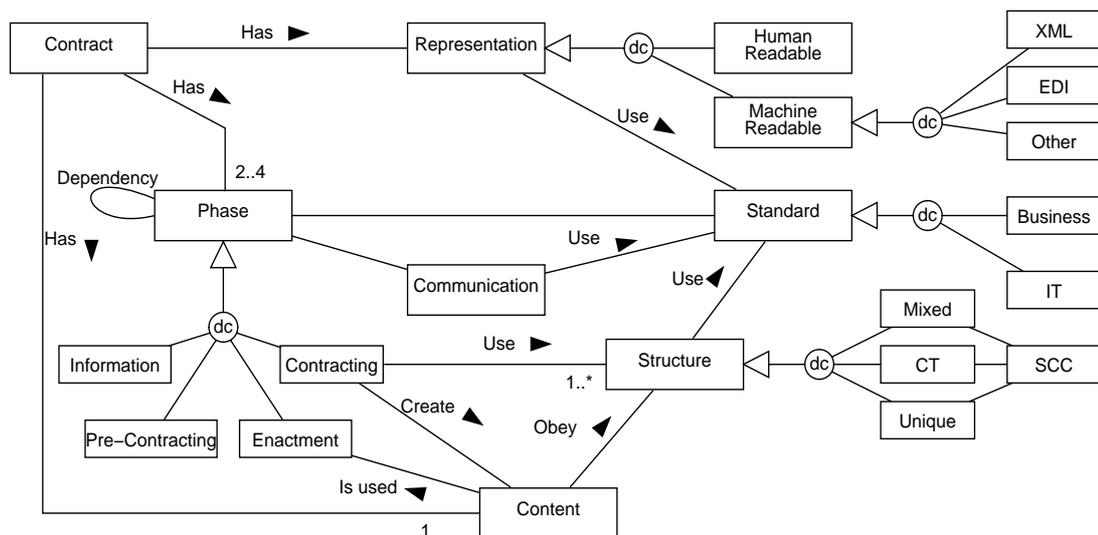
Figure 6: Detail view of HoW

The research in the electronic contracting domain has shown that besides the human-readable representation of contracts, a machine-readable representation is also necessary. This representation structures the document and allows its automated processing. Depending on the used technology, there can be different machine-readable representations, e.g. XML or EDI based.

To achieve interoperability between the parties and processes efficiency to be increased, standards are set. Standards for paper contracts [18] aim at facilitating the contract creation, especially in international context. The use of information technologies in contracting requires standardization in new areas. IT standards (e.g., [16], [31]) allow interoperability between parties to be achieved. Standards can be applied to the contract representation, contract content, communication between parties, etc.

Usually, the contracting process consists of four phases. i.e., information, pre-contracting, contracting, and enactment phase (see Figure 6). The business context, however, can change the contracting process, e.g., if there were previous contracting relations or the level of trust is high, the information and pre-contracting phases can be skipped or sped up [10], [6]. Details on each of these phases are provided in [10] and [7]. Usually a contract will contain information only about the enactment phase. However, in certain situations information about the execution of the other phases and the means for it can be included in a contract as well [22].

As the contracting process involves several parties, who agree on one common goal and its subsequent achievement, communication between parties plays an important role in all contract phases. For this reason, contracts can contain information about the communication means between parties (see e.g. [16]). Contract content results from the contracting phase and is used in the enactment phase. For the creation of a contract offer, a party can use a partially or completely predefined contract structure, i.e., Contract Template (CT). Parties can also start contracting by using a template that is further on elaborated and extended for the specific situation or by using a unique contract structure. In all scenarios, parties can use Standard Contract Clauses (SCC) that speed up contract creation.

4 The processes concept

In this section, we investigate the "What" and "HoW" groups of concepts at a lower level of detail and we concentrate on the *service* and *exchange value provisions* concepts from the "What" and the *contracting phase* and *communication* concept from the "HoW" group of concepts. At this lower level, we identify the process concept that is common for the "What" and "HoW" groups of concepts (in Figure 7 the concepts already identified in Section 3 are shown in bold).
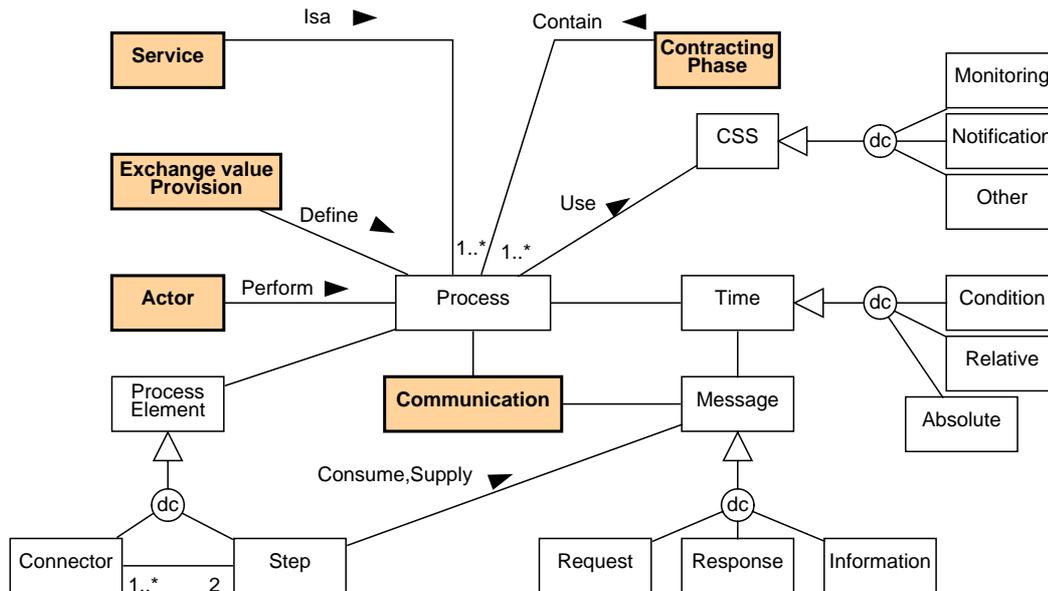
Figure 7: Processes in e-contracting

Contract phases comprise processes that support the establishment and enactment of a contract. Contracting processes can vary depending on the specific context [10], [7]. The order of execution of these processes can also change. As we have already mentioned, the contracting phase concept specifies the processes for the contract establishment. In the contract content, usually, only processes regarding the value exchange and activities related to it (e.g., activities that protect parties in cases of contract breach) are specified. The contract establishment processes are part of the contract environment (see Figure 1). In certain business situations, processes for the contract establishment can be included in the contract content [22].

As we have already discussed (see Section 3.3), in the case when the exchanged value is a service, the contract content contains a description of the processes to be performed for the service delivery. Value exchange provisions can define also processes to be executed or procedures to be followed. During contract enactment, these processes are performed by the contracting parties or by an auxiliary implementor. Usually, many processes are executed during the contract enactment phase. From the contracting perspective, however, only an external view of the processes performed by a contract actor is manifested [22]. This external view is a projection of all processes that are executed by a party, revealing only the processes required for the successful contract enactment and cooperation between the parties. The level of detail of the external process specification depends on the context and the contracting parties.

E-contracting systems and the participating actors can use cooperation support services (CSS), e.g., contract monitoring, notification, for the advanced execution of the processes. These services introduce possibilities for improved contract enactment and for decreased contract management efforts. CSS that facilitate the contract enactment can be specified in the contract in the form of provisions [29].

Each process is a collection of process elements, i.e., a step and a connector between two steps [35]. Processes start and end in a certain time point. The time point can be fixed (absolute or relative) or condition dependent (conditional). Throughout the process execution, requests, corresponding responses/reactions, and informational messages are exchanged. As messages serve process elements to exchange information, they are bound also to time constraints.

As e-contracting is performed between two or more parties, the processes performed by a party have to be in coherence with the processes performed by the other contracting parties. This requires a more detailed description of the e-contracting processes [10]. Furthermore, in order to exchange messages during the performance of these processes, communication patterns that guarantee coherence of the message exchange are required. An elaborate description on the contracting process, i.e., the activities that it comprises and the communication patterns required for the message exchange between parties is presented in [10].

In Section 5, we discuss legal issues relevant for the e-contracting domain. Section 6 presents related work in this domain. In Section 7, we use the proposed framework to analyse other research and standardization projects in the e-contracting field.

5 Legal issues of e-contracting

Business-to-business contracting, also in its electronic form, has legal objectives. Thus, the described 4W framework for e-contracting has to be compliant with the legal requirements for e-contract establishment and enactment that are set by law. For this reason, we pay specific attention to the legal aspects of the e-contracting process and the e-contract content and relate them to the 4W framework. We outline some problems in e-contracting from the legal point of view. This section, however, provides only a brief introduction to the topic. Several projects, e.g., the European projects eLegal [19] and ALIVE [1], have investigated the legal aspects of e-contracting in depth and have delivered a thorough description of this subject. The eLegal project has researched contracting supported by information technology in general, whilst the ALIVE project has concentrated on legal issues in the creation and operation of Virtual Enterprises (VE), the contracting relations between organizations from a VE and contract relations of the VE with companies external to the VE.

Initially, it was assumed that legal issues in e-contracting are identical with legal issues in traditional paper contracting. However, the electronic representation of contracts and the involved information technology in e-contracting set new requirements for the legal support of the contracting process. For example, the global nature of internet reveals new or easier possibilities for violations like hacking and copyright infringements. The new legal requirements for the electronic contracting caused special attention to be paid at government level. The European e-commerce directive 2000/31/EC of the European Parliament and the Council was elaborated, in order to give definition and to provide clarification on certain legal aspects of information society services. Next, we briefly outline legal issues concerning the e-contract content and e-contracting process addressed in the EU directives and other publications. We relate the legal issues to the 4W framework, indicating which groups of concepts are affected by it.

5.1 Contract content

In business-to-business contracting, parties have the freedom to create contracts with an arbitrary content not being limited in any aspect by law. The contract content depends entirely on the parties preferences. This, however, has changed with the introduction of e-contracting. The European e-commerce directive specifies fields that become an obligatory part of the business-to-business e-contract (e.g., name, geographical address, contact information, trade registration number, prices that indicate if tax and delivery costs are included, etc). Specification of contract obligatory data aims at protecting business parties that become more vulnerable in the new contracting conditions. The indicated obligatory fields in the directive relate to the Who, What, and HoW groups of concepts, and more specifically to the *party, mediator*, *exchanged value, exchange value provision,* and *content* concepts (e.g., the name and geographical address fields are related to the *party* and *content* concepts).

5.2 Digital signatures

Signatures that certify the consent of parties to the contracting terms are replaced in e-contracting by digital signatures. The directive 1999/93/EC of the European Parliament and of the Council on a Community framework for electronic

signatures provides clarification on the use of digital signatures. However, not all problems on digital signing have been resolved. Digital signatures are used to certify that the original document content has not been changed and that the document was sent from the genuine person. This means that digital signatures are used also during the exchange of non-legally binding documents between parties. As a result, legally binding digital signatures have to be differentiated from legally non-binding digital signatures. A possible solution to this problem is provided in the ebXML standard [17]. Another issue on digital signatures is that a signature has to be connected to a human being. Legal persons are not allowed to sign digitally (as stated in directive 1999/93/EC for electronic signatures). Digital signatures relate to the Who and HoW groups of concepts of the 4W framework i.e., the party, content, and communication concepts (see Figure 8).
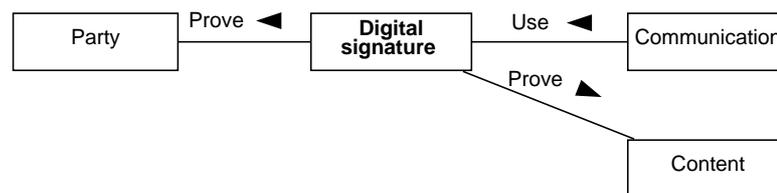

Figure 8: Relation of digital signatures to the 4W framework

5.3   Data privacy

Data protection and privacy issues during contracting and contract enactment also require special attention in e-contracting. Protection of the exchanged data between parties is guaranteed through data encryption. The issue of privacy and data protection becomes substantial especially when data has to be exchanged or even stored at a third party participating in the contracting process. Additional problem is the different legislation support in the different countries. For example, in the U.S. legislation, no clear legal remedies for breaches of data privacy exist [3]. Data protection and privacy issues are relevant for the Where and HoW group of concepts, e.g., the *business context* and *communication* concepts (see Figure 9).

Figure 9: Relation of data privacy to the 4W framework

5.4   E-contracting process

Business-to-business e-contracting process can vary significantly depending on the business, legal, etc. context. From legal perspective (as stated in the European e-commerce directive), companies have to provide a series of information before placing of an order by the consumer takes place (unless parties agree otherwise) [2]. This information concerns technical steps to be followed for the contract establishment, technical means available to users of the system for input errors corrections prior to the placing of the order, contract filing, etc. Another required e-contracting activity is the signing of the agreed upon contract. E-contracting processes are related to the HoW group of concepts in the framework (the *phase* concept).

5.5   Concluding remarks

In this section, we have shown that legal aspects in e-contracting require special attention. Legal issues relate to all four groups of concepts of the 4W framework and have to be considered together with the proposed framework. Specific legislation for e-commerce and in particular for e-contracting is being developed. However, there is still legal uncertainty in the domain of e-contracting, caused by ambiguities in the created legislative measures and by the differences in the national legislations addressing this topic.

6 Related work

The area of e-contracting has been researched in several projects. However, driven by the project requirements, these projects provide context specific and thus incomplete models of electronic contracting. Next, we discuss two projects, which are well-known in the domain of e-contracting.

6.1   The SeCo project

The project "Secure Electronic Contracts" (SeCo) at St. Gallen University has researched the requirements for secure electronic contracting and its possible applications. In the SeCo project, a contracting container is described [24]. The SeCo container consists of three layers, i.e., logic, information and communication layers (see Figure 10).

The logic layer contains information about the workflow logic of the contracting process and supports the management and execution of the process. This layer covers partially the "HoW" group of concepts in our framework, and more specifically the phase concept and the processes that this concept comprise (see Section 4). Other concepts of the "HoW" group are covered by the communication layer, explained below. In SeCo, the logic layer is not part of the e-contract but of the supporting information system.

The Information layer contains the contract information. In the structured part of the Information layer, four blocks are distinguished, i.e., who, what, condition, and legal. The *Who block* describes the involved contract parties and thus covers the party concept from the "Who" group of concepts in our framework. The *What block* describes the services or products that are exchanged. The *Condition block* contains the conditions for the value exchange. The *What block* can be compared to the exchanged value concept in our framework, and the *Condition block* to the exchange value provision concept (both from the "What" group of concepts). The Legal block represents the legal context provisions derived from the legal context concept in our framework. The unstructured part of the Information layer contains documents that are not part of the contract but still related to it (e.g., receipts).

The Communication layer contains the protocols that are required for the communication between parties. This layer covers the communication and standard concepts from the "HoW" group in our framework.
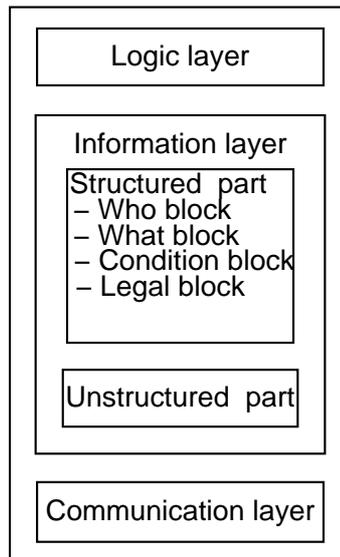
Figure 10: SeCo contract container

In this short comparison of the two models, we have shown that the SeCo contract container contains only a subset of the concepts from our framework. Concepts like business and geographical context, representation, mediators and auxiliary implementors are missing in the SeCo container. The reason for this is that in the SeCo container only the contract and a very limited part of its environment are described. This is due to the design objectives of the SeCo container, which has to cover only those concepts that are directly related to the e-contract creation and enactment. As a result, the SeCo container cannot provide all features that are required in more complex business relations, influenced by and dependent on the specific context. In our framework, we aim at a broader description of the contract environment, which allows us to analyse e-contracting in all of its aspects.

6.2   The COSMOS project

The COSMOS project has aimed at developing an internet based platform for business transactions. In the COSMOS project, a contract object model is presented [25]. As we have already discussed in Section 1, a contract model contains only a subset of the concepts identified in our framework. The COSMOS contract object model is an illustration to this. We have chosen it among the other existing contract models, as the COSMOS contract object model aims at achieving completeness to a low level of detail.

The model contains four basic objects, i.e., *Who*, *Legal*, *What*, and *How*. Figure 11 depicts only a general view of the contract model, as our goal is to give only a general comparison of the COSMOS contract model and the 4W framework. The *Who object*, similarly to the *Who block* in the SeCo container, represents the participating in the contract parties. The *Who object* is comparable with the party concept in the 4W framework. The *What object* represents the subject of the contract and is equivalent to the exchanged value concept in our framework. The *How object* contains the different provisions related to the value exchange. In this way the *What* and the *How object* together are equivalent to the "What" group of concepts in the 4W framework. The *Legal object* is comparable to the legal context provisions resulting from the legal context concept in our framework.
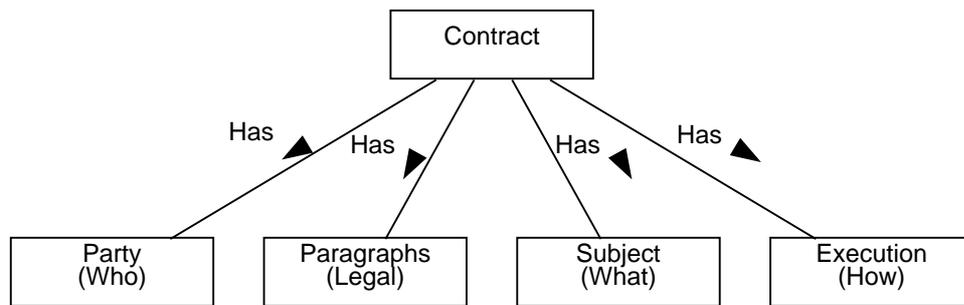
Figure 11: COSMOS contract model

The Information layer in the SeCo contract container and the COSMOS contract model are to a great extent similar. Compared to our framework, the COSMOS contract model specifies only the legal context and is missing the other contracting contexts. However, provisions driven by the geographical, business, etc. context sometimes need to be included in a contract as well. The "HoW" group of concepts in our framework is not considered in the COSMOS contract model at all. As we have explained in Sections 3.4 and 4, concepts from the "HoW" group are usually not included in the contract content. For this reason, they are omitted in the COSMOS contract model as well. Apart of the contract model, the COSMOS platform defines some of the "Who" concepts (e.g., brokers and online catalogues mediators), the "Where" concepts (e.g., business context of contracts), and the "HoW" concepts (e.g., contract templates). However, these concepts are not part of the COSMOS contract model.

7 Positioning other research efforts in the contracting framework

The work on the transformation from paper contracting to the electronic form of contracting is based on newly emerging and quickly developing information technologies. Information technologies can be used for the support of the "What" and "HoW" concepts in contracting. That is why research efforts concentrate on them. Advanced research projects, however, should pay attention not only to the "What" and "HoW" concepts, but should take into consideration the whole contracting framework, with its full complexity and the abundance of relations between the concepts.

In this section, a research and a standardization project are analysed from the perspective of the described framework. They are examined according to the four general concepts discussed in Section 2. The selected projects have already established results and with their completeness and richness allow the 4W framework to be used in its full potential. Other projects on e-contracting are for example performed at Queensland University [20] and Hong Kong University [12]. More information on research projects and standardization processes in the e-contracting domain is provided in [9].

7.1 CrossFlow project

CrossFlow is an ESPRIT project [13] addressing support for cross-organizational workflow management in virtual enterprises [21]. It was successfully completed in the end of 2000.

Who. In the CrossFlow project, service outsourcing within a service consumer/supplier paradigm is considered. A brokering mediator facilitates the matching of offers and requests.

Where. The business context is contracting and enactment of standard services in vertical markets. CrossFlow allows Partially Filled Contracts (PFCs) to be used in specific business contexts. PFCs are previously negotiated incomplete contracts and are used as a base for the final contract specification. The use of PFCs is part of the business context envisaged in CrossFlow. No other legal and geographical dimensions are regarded.

What. In the contract content, the exchanged service and the exchange value provisions are specified. CrossFlow concentrates on the exchanged service and does not closely inspect the corresponding remuneration. Additionally, in CrossFlow, CSS clauses are used and included in the contract content (remuneration in CrossFlow can be specified also through CSS clauses). Other provisions can be optionally specified, but they have no machine-readable representation [29]. In other words, the project focuses on the functional description of the relationship between the two organizations and more specifically on the service delivery aspects.

HoW. In CrossFlow, three of the contract phases are considered, i.e., information, contracting and enactment. The pre-contracting phase is not referred to explicitly. The project concentrates on the contract enactment phase. The contract is created on the base of a contract template. This results from the vertical market paradigm implied in the

project. The contract representation is XML-based and is thus machine-readable. Optionally, the contract can contain a human-readable section as well. CrossFlow is one of the few projects that focus on the processes description and performance and the cooperation support services that contribute to the contract enactment (e.g., contract monitoring).

Positioned in the framework, we can observe that the project does not pay attention to the legal and geographical contract context. The delivery of the second exchange value (presumably a financial reward) is not investigated as well. From the different contract provisions, only part of the exchange value provisions is taken into consideration. The legal and geographical contract context and the second exchange value are omitted for reasons of simplicity. The main goal in the CrossFlow project has been to provide support for contracting parties using workflow technology for advanced service delivery. The CrossFlow project has researched mainly the "What" and "HoW" groups of concepts and more specifically the process concept in them.

7.2   ebXML standardization effort

Among the many standardization initiatives, ebXML [16] has gained attention from many businesses and IT researchers and developers. It has strong industry supporters and globally recognized sponsors. Further on, it is a successor of Open-EDI and EDI, which is the currently used solution for exchange of electronic data among companies.

Who and Where. The goal of ebXML is broad - to provide a global solution for every company to perform business transactions in an electronic way. The ebXML standard considers all possible actors and contexts.

What. The electronic contract in ebXML defines the capabilities and requirements of a party in the e-commerce process. Thus it defines the exchange value and exchange value provision concepts.

HoW. ebXML supports all phases (see Figure 6) of the contracting cycle [16]. In the information phase in ebXML, the parties produce the contract offer, called Collaboration Protocol Profile (CPP). The electronic contract in ebXML is called Collaboration Protocol Agreement (CPA) and is derived from the intersection of the CPPs of the parties. In ebXML, a repository facilitates the information and contracting phases by storing the parties' profiles, and data and process definitions to be used by the parties for the offer and contract creation. The repository can serve also for storing contract templates. Special attention is paid to the specification of the business processes to be performed. A Business Process Specification Schema (BPSS) is provided for the support of business process specifications, aiming to achieve interoperability between different parties. It gives an elaborate description of the process and communication concepts from our framework. A more detail discussion on the description of parties' business processes and the communication between parties in ebXML is provided in [10] and [7]. ebXML requires the business processes description to be both human-readable and machine-readable. The machine-readable representation should be expressible in a XML syntax.

From the perspective of our framework, we can see that ebXML is a large standardization framework that aims to develop a standard supporting all aspects of e-business, including in this respect e-contracting. ebXML provides standards for many of the "HoW" concepts in the 4W framework (e.g., communication, phase, structure), considering all possible actors, contexts and values to be exchanged. ebXML aims at

achieving high level of interoperability between parties and at improving the efficiency and effectiveness of the contracting process. ebXML shows the role and importance of the standard concept from our 4W framework for the e-contracting process.

8 Conclusions

In this paper, we have described the 4W framework for business-to-business e-contracting and have used it for some basic reasoning on the requirements on contracting systems. The framework is presented in two levels of detail. Additionally, we have introduced the process concept which belongs to the third level of detail, showing that the framework can be further on elaborated. We have discussed legal issues related to e-contracting, explaining their close relation with the 4W e-contracting framework.

We have used the 4W framework to analyse a research and a standardization project from the e-contracting domain. From the perspective of the framework, the goals of these projects, their strong and weak points were discussed.

The framework allows new research topics in the e-contracting domain to be identified and be situated in the overall picture of the contracting process. It helps to identify what aspects of contracting can be improved and what new opportunities can be introduced to the contracting parties. An important role for e-contracting plays the structuring of the contract content and its machine interpretability, which allows automation of the contract enactment to be achieved. Machine interpretability of the contract provisions and primarily of the exchange value provisions provides opportunities for the elaboration of cooperation support services (CSS) that introduce new possibilities for improvement of the efficiency and effectiveness of the contract enactment. Contract screening and tracking are examples of such services [10]. These services are still to be investigated and specified. Their requirements over the contracting process and the contracting content must be also researched. We have already performed initial research on the e-contracting processes. Further on, a detailed e-contract model and an e-contract language are required to allow the definition of structured and machine interpretable e-contracts. Also, mappings between the external and the internal company process specifications must be investigated. The thorough investigation on the e-contracting processes and e-contract content is the starting point towards the goal of our future research i.e. the construction of detailed e-contracting reference architecture with flexible cooperation support services.

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