

# Contract Modelling for Digital Business Ecosystems

Jason Finnegan, TSSG, Paul Malone, TSSG, M<sup>a</sup> Alicia Espinosa Marañón, Pedro Bueso Guillén, UZA

Jason Finnegan, Paul Malone, Telecommunications Software & Systems Group, Waterford Institute of Technology  
Waterford, Ireland, e-mail : {jfinnegan, pmalone}@tssg.org

M<sup>a</sup> Alicia Espinosa Marañón, Pedro Bueso Guillén, School of Law (University of Zaragoza), Zaragoza, Spain  
e-mail: {aliciaes, pbueso}@unizar.es

**Abstract—** The aim of this paper is to discuss the legal and technical issues of creating legally binding contracts in a digital ecosystem and to present the solution created for the DBE (Digital Business Ecosystem) project[1]. We investigate the legal implications of electronic contracts and digital signatures, and also take a brief look at the types of clauses that make up a contract. The DBE contract model for creating contracts and contract templates is presented, along with the tools created for editing these contracts as part of the DBE project.

## I. INTRODUCTION

Digital Business Ecosystems are based on the concept of peer to peer business partnerships where new business deals are created so simply as to be possibly without direct human input. For this type of autonomous business relationships to be established it is vital to have electronic contracts specifying each partners rights and responsibilities.

The legal issues involved with using electronic contracts are broad, and largely untested as technology advances faster than legislation. Much legislation still exists that specifically requires or expects the use of paper based contracts, while E-commerce Directive 2000/31/EC [2] among others, specify that electronic contracts are as valid as paper contracts.

The technical issues involved with creating a standard for modelling contracts are greater than for most document types, as the possible types and structures of contracts can vary widely. This makes creating a rigid contract format virtually impossible, and requires us to look at a flexible approach, making as few presumptions as possible.

Existing contract models have been designed for traditional centralised business models, with standardised contract forms specified by the dominant party. The DBE contract model has been designed to be as flexible as possible, reusable in any jurisdiction and any business scenario where a legal binding contract is formed.

In order to create a flexible contract schema, the most important factor in this model has been to separate the legal elements and the technical semantics of the contract. This method allows for a single way to interpret the legal content (natural language) of the contract, while allowing automated contract enforcement based on any machine interpretable language.

The work presented here is funded through the EU

Digital Business Ecosystems Integrated Project[1].

## II. MOTIVATION FOR CONTRACTS IN DIGITAL ECOSYSTEMS

Contracts are present in all forms of business, either written, oral or implied, with the contract format depending on the levels of trust between the participants and the size of liabilities involved. In a digital ecosystem each participant is free to interact with all other participants; there is no central authority or guarantor. This brings benefits of increased competition and flexibility but raises problems of trust, as we may find ourselves in business with an unknown entity or consortium of entities. A neutral contract schema and tools can help to increase the level of trust between partners when starting a new business partnership.

For a new technology such as electronics contract to be accepted by small businesses it needs to be affordable. An open source solution can be provided free of cost to all users and therefore provides the best chance to become a widely accepted standard. The DBE contract schema and all associated tools (and source code) are freely available under the creative commons licence and OSI certified open source software licenses.

## III. LEGAL ISSUES OF ELECTRONIC CONTRACTING

Information technology advances are affecting the traditional way of doing business which is rapidly changing and developing from the legal point of view (from the exchange of paper to the exchange of electronic data). In that sense, the Internet is a new economic environment and it has a great potential. But if its infrastructure and commercial relationship mechanisms are not the appropriate ones, its potential will be lost. One of the biggest problems is that disruptive Internet based technologies develop faster than the policy- and rule makers can do.

It is a certainty that where there are contracts, there is litigation because there are two or more parties with opposing interests. Thus, the legal research into the DBE has always analysed the different kinds of transactions, in order to discover the common legal risks. This analysis provides the opportunity to design structures of contracts (as a result of that, there have been shaped General Terms and Conditions) that allows the parties to negotiate from common base of legal clauses, maximize the legal security, improve efficien-

cies and streamline their operations.

But several legal issues arise, many of which are the same as in traditional contracts. Although, the way to treat these issues is different, the Internet has not changed the basic rules of contracting, or contract law. However, as it has been said there are some legal issues which must be dealt with. These are discussed below:

#### *Electronic signed contracts*

From article 9 of the E-commerce Directive 2000/31/EC, e-contracts can be defined as those that are concluded by electronic means[1]. This Directive and the implementations of it through national laws have made e-contract and "paper contract" have the same legal force. So, drawing a distinction between paper-based written and electronic agreements should have no substantive effect. Nevertheless the question is not unreasonable, taking into account the fact that contracts based on certain subject matter can require a physical form. For certain subject matters a paper-based written contract may be compulsory, which may exclude the possibility of an electronic contract.

So, if all electronic contracts are necessarily written and have been considered equal to the paper contracts, the risk for this kind of contract becoming not legally binding due to its form, will be unlikely. However, in some cases a national law may require a certain form that, currently, is not possible to produce by electronic means (e.g. notary deeds). But for the DBE's commercial relationships it is not so important because these kind of public instruments will not be necessary. Thus, the problem will not be the existence of the contract, but its validity.

#### *Digital signatures*

Traditional paper based contracts offer face-to-face contracting and the possibility of knowing who is signing. This is an aspect which disappears in e-commerce. So, what is the best legal instrument that can make business people feel secure in an on-line transaction? The answer is the digital signature. But, what is a digital signature?

"It is an electronic signature (e-signature) that can be used to authenticate the identity of the sender of a message or the signer of a document, and possibly to ensure that the original content of the message or document that has been sent is unchanged. Digital signatures are easily transportable, cannot be imitated by someone else, and can be automatically time-stamped. The ability to ensure that the original signed message arrived means that the sender cannot easily repudiate it later.

A digital signature can be used with any kind of message, whether it is encrypted or not, simply so that receiver can be sure of the sender's identity and that the message arrived intact. A digital certificate contains the digital signature of the certificate-issuing authority so that anyone can verify that the certificate is real." [3]

Thus, the electronic document signed with an e-signature guarantees its authenticity (which is concerned with the origin of the message or document) and its integrity (which is concerned with the accuracy and completeness of the message or document). As it has been said in the definition, it also involves that the sender cannot deny having sent the message or document.

#### *Security, confidentiality and data protection*

If there is something that business people are afraid of, it is the security in their transactions. Data protection is concerned with preventing illegal use of collected data. The European Union (EU, hereafter) published the "Data Protection Directive 95/46/EC" which has provided a harmonized data protection standard at European level and in all participant states [4].

Nevertheless, there is no problem related to the electronic data exchanged itself from the legal point of view, but the point at issue is the confidentiality. The real question regarding data protection is how find the balance in an open marketplace like the DBE and, at the same time, being able to avoid competitors gaining access to commercially valuable data.

#### **IV. ELECTRONIC CONTRACTS STATE OF THE ART**

Legal Contracts are usually written by people with expertise in contract law, or the business domain. These contract writers are not usually technical experts and therefore technical contract writing tools have not been widely accepted. The majority of contracts that are publicly accessible online are written in plain text or HTML. There have been several attempts to create an XML based contract standard e.g. LegalXML[5], lXML[6]. These have attempted to either create or extend a schema describing business functions that would make up a business contract. This approach will lead to the creation of contract where both the natural language and semantics have the same meaning. However the major problem with this approach is that no programming language can ever be as expressive as a natural language. While a programming language may be unambiguous about how it is interpreted by a machine, its legal interpretation may not be the same as its machine interpretation.

#### *Digital Signature technologies*

For digital signing XML documents XML Advanced Electronic Signatures (XAdES)[8] represents the state of the art in terms of non-repudiation. XAdES is designed to provide the maximum level of long term security of a digital signature. This extra security comes at the cost of requiring external time-stamping services and certificate revocation lists. No open source implementation of the XAdES schema is currently mature enough for use, however implementations of the XMLDSIG[7] schema upon which XAdES expands are available. The DBE Contract schema is signature independent, so as to allow for future compatibility with XAdES or any other XML based Digital Signature system.

The goal of the OASIS Legal XML eContracts TC[5] is to create an XML specification that allows “the efficient creation, maintenance, management, exchange and publication of contract documents and contract terms”.

The TC was formed several years ago and produced its technical requirements document in May 2005[9]. This document [9] identifies the business problems relating to the preparation and management of various kinds of contracts, the persons affected by those problems and the business requirements of those persons to overcome those problems. Within that framework, it defines the functional characteristics an XML application must have to meet those needs. The document evaluates the various advantages that could be achieved from XML contracts such as automatic dispute resolution and easier creation of new contracts. The eContracts schema is derived from an instance of BNML[10], which was created by Elkera. BNML [Business Narrative Markup Language] is a general purpose schema allowing structured markup of narrative documents such as contracts. A comparison of the LegalXML eContracts schema and the DBE Contract schema is given in section VIII.

### V. THE DBE CONTRACT SCHEMA

The DBE contract schema is a data model, the primary aim of which is to provide a standard format for storing, presenting and communicating legally binding contracts.

The approach taken in creating this schema has been to use the minimum number of mandatory elements, simplifying the process of creating new contracts. A discussion of the main elements of the contract schema follow and the schema itself can be downloaded at [11].

#### Contract

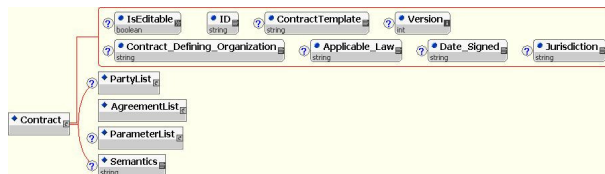


Figure 1: Contract

This top level element represents the contract at its most basic level. The Contract element[Figure 1: Contract] comprises an attribute set and sub-elements representing a list of participant legal entities (*PartyList*), a list of commitments those parties agree to (*AgreementList*), a set of parameters to which the *AgreementList* may refer (*ParameterList*) (for example, price, quantity, start date, end date, etc.) and finally a Semantics section. The semantics section simply allows other languages be used to define the contract in a machine readable language if available.

#### Jurisdiction and Applicable law

Two common features of virtually all contracts are jurisdiction and applicable law. ‘*Applicable\_Law*’ represent the

laws or rules under which the contract will be interpreted and *Jurisdiction* represents the judge or arbitrator if a dispute arises.

The DBE contract schema was designed with the concept of contract templates as being central to how contracts will be created. A contract template is a contract written for a common business scenario, which is then completed or customized by the end users.

The *ContractTemplate* attribute denotes the name of a reusable contract such as “INTERNATIONAL SALE OF GOODS CONTRACT” [12][12]. *ContractTemplate* also functions as the title for the contract, for cases of a unique contract.

#### PartyList

The *PartyList* element provides a set of participating legal entities (as defined by the jurisdiction of the *Contract*). The number of parties involved can range from zero (in the case of a generic reusable 'Term and Conditions' document) to multiple partners involved a joint agreement.

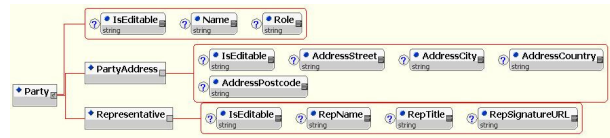


Figure 2: Party

Each participant of the contract is represented by a *Party* element [Error! Reference source not found.], which could be a person or company. In the case of a company a named representative may be included. However it must be noted that the legal validity of the contract is linked to the identity to the certificate used to sign the digital contract. Therefore the *Party* element’s main focus is to parallel the information about the participant that is usually included in a paper contract.

#### AgreementList

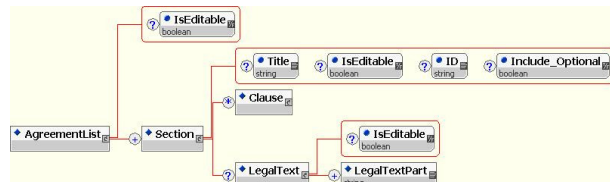


Figure 3: Agreementlist

The *AgreementList* [Figure 3: Agreementlist] represents the set of agreements or commitments that the participating parties (via *PartyList*). *AgreementList* contains one or more *Section* elements.

#### Section

A *Section* is representative of a sub-section of a contract and is itself made of a number of *Clause* elements and *LegalText* elements which refer to the *Section* itself.

A *Clause* element is equivalent to a section, and it can

also contain further clauses. The distinction between sections and clauses is mainly for easier presentation of complex contracts.

Both *Section* and *Clause* elements contain the attribute *Include\_Optional*, which is used primarily in contract templates to signify clauses that the user may or may not wish to include in the agreed contract. *Clause* types and their legal implication are discussed in more detail in Section VI.

### LegalText

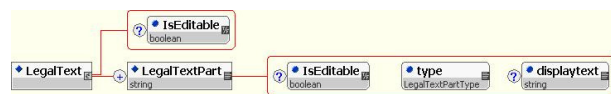


Figure 4: LegalText

The *LegalText* element [Figure 4: LegalText] is a represents a section of text (which may be made up from a number of parts) which has a legal meaning as interpreted by the jurisdiction of the contract. It comprises a number of *LegalTextPart* elements which make up the natural language content of a clause or section.

A *LegalTextPart* can be one of several types; *Text*, *ParameterReference*, *InternalReference*, *ExternalReference* or *RegulatoryReference*

The majority of *LegalTextPart* will be of type *Text*, interspersed with reference types

A *ParameterReference* is used to refer to an editable or customised field in a standardized contract. This field could be the name of the goods or services being traded, prices, dates or other transaction specific information. All Contract Parameters are stored in the *ParameterList*, so that the may be easily referenced from any point of the contract.

An *InternalReference* is used to reference any point of the contract via XPath, this can be used to reference other clauses, sections or attributes.

*ExternalReferences* are for referencing URL's, and *RegulatoryReferences* are for references to specific laws or conventions. Future development of semantic databases of legal regulations would allow for analysis of effects of regulatory changes on previously written contracts. The technology to do this has been researched in the DBE project but the effort involved in filling and maintaining a semantic regulatory database is currently unfeasible.

The *displaytext* attribute can be used for all references where the user does not wish for the target of the reference to appear in the legal text (i.e. to operate like a hyperlink, if supported by the contract editing tools).

### ParameterList

The *ParameterList* [Figure 5: ParameterList] holds a number of *Parameter* elements

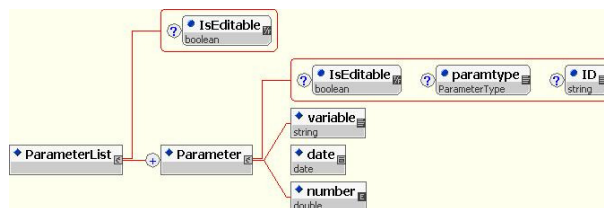


Figure 5: ParameterList

A *Parameter* is a key-value pair denoting a contract wide static reference. For example to represent a unit price in a contract the *id* might be “Unit-Price” and the contents might be a number of value “35” (the attribute *paramtype* would be set to “number”). The currency for this could be represented by another *Parameter* where the *Key* would be “Unit-Price-Currency” and the *Value* would be “Euro” (the attribute *paramtype* would be set to 'String').

### 1) Semantics

The optional *Semantics* section of the contract allows the DBE contract model to include extra XML based contract specifications. The *Semantics* section will contain machine readable instructions detailing the various obligations of the parties to the contract. The *Semantics* section of the contract will need to be created in parallel with the rest of the contract, as no machine translation between natural language contract and machine readable is currently possible.

It may be possible for the elements of the *Semantics* section to reference the parameters stored in the *Contract/parameterList*. This would allow certain contract templates to be editable while ensuring both natural language and *Semantics* sections of the contract have the same meaning.

The semantic sections can contain SBVR[13] or any other XML compatible language, it will not be necessary for Contract Editors and tools to understand the *Semantics* section of the Contract.

The natural language Section of the contract (*ClauseList* and *parameterList*) will be taken to express the true meaning of the contract, the *Semantics* section is a non-binding translation of this agreement into some form of machine readable language.

## VI. CREATING A CONTRACT OR CONTRACT TEMPLATE USING THE DBE CONTRACT SCHEMA

This section tries to show that frequently parties do not clearly define the contract terms or clauses. Some of them are missing; others are unclear, etc.. The DBE project has tried to avoid this problem through the creation of a contract schema, as follows:

First of all, there is a distinction between two type of clauses:

- Particular Clauses, and
- General Clauses, this type can also be:
  - Binding, or
  - Optional

The Particular Clauses group includes all these clauses which are the closest to the subject of the contract (e.g. in a Tourist Contract: the number, types and distribution of the rooms and their characteristics) and allow some negotiation (e.g. prices and extras).

The Binding General Clauses which do not depend on the subject of the contract are: Legal Capacity, Data Protection, Web's Intellectual Property, E-commerce Agreement, Dispatch and Receipt and Confidentiality Clause. And there can be others depending on the subject (e.g. Tourist Contract: Cancellations, No Shows and so on).

The common Optional General Clauses are: *Applicable Law, Jurisdiction and Arbitration and Alternative Dispute Resolutions (ADR)*. And there can also be more clauses which better suit the contact's subject matter (e.g. Tourist Contract: *Period of Release, Requests out of Release (On Request)* etc.).

Obviously, regarding legal issues, giving a complete solution is impossible because the business world, the technology and relationships are constantly changing. Thus, if this approach fails, there are the general rules of contract law and they follow a hierarchy of evidence when determining the terms of a vague or incomplete contract:

1. - Compulsory terms implied by law;
2. - The terms stated in the discussions and writings exchanged by the parties that are not in conflict;
3. - Non-compulsory terms implied by law;
4. - Terms implied by the current and past conduct of the parties; and
5. - Terms implied by industry custom and practice.

## VII. CONTRACT TOOLS

Several tools have been created as part of the DBE project to create and edit contracts, complete contract templates, sign and validate signed contracts. These tools are released as part of the DBEStudio project[15].

### *Contract Creator*

The Contract Creator is an Eclipse[14] based editor created using the DBE Contract Schema. It allows complete control over the creation of new contracts or editing of existing contracts. Completed contracts can be digitally signed using the XMLDSIG standard, with either a user supplied certificate or a certificate supplied by the DBE's Identity Management system.

### *Contract Editor*

The Contract Editor is designed to be an easy to use tool for customizing existing contract templates, by allowing the user to fill in certain specific information. The user editable fields should be parameters which are then referenced in the text of the contract.

Both the contract creator and contract editor can be deployed as eclipse plug-ins, as part of the DBEStudio project [15].

### *Contract Validator*

The Contract Validator checks that the digital signature of a signed contract is valid. It shows the user information about the certificate used to sign the contract, such as the company's name and address, and information on the certificate issuing authority.

### *Contract Rendering*

All of the tools to edit, view and validate DBE Contracts also have the facility to render the contract to PDF. This provides an easy way to present either a draft or signed contract to users in widely accepted format. The PDF format also provides a simple solution in cases where electronic signatures are not available or acceptable, simply print and sign the contract as done with traditional paper contracts.

## VIII. COMPARISON WITH RELATED WORK

In comparison with other digital contract systems the main advantages of the DBE Contract schema and tools are its flexibility, simplicity and openness.

If we compare the DBE Contract schema to another emerging standard, the OASIS eContracts specification, we can see a number of differences.

The target users of the DBE Contract schema are not expected to have a high level of technical expertise, therefore creating a model as simple as possible is required. The LegalXML eContracts TC has concluded that legal experts will not use their schema in the foreseeable future, but instead will remain using unstructured word processing tools[16]. The DBE contract Schema has attempted to address this issue by allowing the user to complete or customize contract templates. This gives the benefits of a structured contract system, while avoiding the need for a fully featured XML editor. The use of contract templates form a key part of the tools used create, edit and sign Digital Contracts in the DBE project.

Another unique feature of the DBE Contract Schema is the inclusion of a *semantics* section, which can describe some of the contents of the contract in a machine readable language.

By allowing the inclusion of other xml documents in the *semantics* section, the DBE contract Schema allows a contract to integrate with existing XML based systems such as accounting or authorization mechanisms. The LegalXML eContracts draft 1.0 specification[16], allows for attachments, however they must have a specific format.

The DBE Contract Schema was created to help SMEs address the legal issues of doing business between European countries. The problems of jurisdiction, language, and local regulations greatly increase the need for some tools to support the drafting of Contracts. The LegalXML eContracts Schema focuses on the "Anglo-American legal domain" [17].

## IX. CONCLUSION

This paper has presented a solution to creating electronic contracts in Digital Ecosystems, using open source technology and a flexible approach to writing contracts. The DBE Contract schema and tools are available to download from the DBEStudio project website[15][18].

Most of the legal issues addressed above (authentication, confidentiality, dispute resolution etc.) are issues related to *Governance* in the DBE Project, with how the business ecosystem operates.

What should be borne in mind with regard to contracts is the Antitrust Law. If the contract templates were inflexible, such a hard standardisation will restrict the competition and it will violate Articles 81 and 82 of the EC Treaty. Flexibility in modelling contracts provides the means to avoid this problem; and it is achieved by allowing the parties to include their own clauses. For this reason real contract templates that have been created can be edited to create a custom contract if required. However may then require legal advice for both parties as to the possible effects of these changes to the standard format.

Future work that would make use of the DBE contract schema could involve tools supporting the negotiation of contracts, or assisting a user to verify the legal validity of a contract.

## X. REFERENCES

- [1] Digital Business Ecosystem, EU FP6 integrated project number IST-2003-50793, [Online], Available: <http://www.digital-ecosystem.org> [2006, June 06].
- [2] Directive 2000/31/EC of the European Parliament and of the Council of 8 June 2000 on certain legal aspects of information society, in particular electronic commerce in the Internal Market (Directive on electronic commerce) (*OJ L 178, 17.7.2000, p. 1–16*).
- [3] Digital\_Signatures [http://searchsecurity.techtarget.com/sDefinition/0,,sid14\\_gci211953,00.html](http://searchsecurity.techtarget.com/sDefinition/0,,sid14_gci211953,00.html) (checked 25 September 2006)
- [4] Directive 95/46/EC of the European Parliament and of the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data (*OJ L 281, 23.11.1995, p. 31–50*).
- [5] OASIS LegalXML eContracts TC, [http://www.oasis-open.org/committees/tc\\_home.php?wg\\_abbrev=legalxml-econtracts](http://www.oasis-open.org/committees/tc_home.php?wg_abbrev=legalxml-econtracts) (Checked September 25<sup>th</sup>, 2006)
- [6] LEXML, <http://www.lexml.de> (Checked September 25<sup>th</sup>, 2006)
- [7] XMLDSIG, XML-Signature Syntax and Processing <http://www.w3.org/TR/xmlsig-core/> (Checked September 25<sup>th</sup>, 2006)
- [8] XADES, XML Advanced Electronic Signatures, <http://www.w3.org/TR/XAdES/> (Checked 25<sup>th</sup> September 2006)
- [9] Requirements for technical specification <http://www.oasis-open.org/committees/download.php/12799/econtracts.pdf> (Checked September 25<sup>th</sup>, 2006)
- [10] Elkera® Business Narrative Markup Language (BNML™) Schema [http://www.elkera.com/cms/products/bnml\\_schema/](http://www.elkera.com/cms/products/bnml_schema/) (Checked September 25<sup>th</sup>, 2006)
- [11] DBE Contract Schema, version 1.0, [http://dbestudio.sourceforge.net/schemas/contract/dbeContract\\_1.0.xsd](http://dbestudio.sourceforge.net/schemas/contract/dbeContract_1.0.xsd)
- [12] The ICC Model International Sale Contract (Manufactured Goods intended for resale), Comité Español de la Cámara de Comercio Internacional, Barcelona, 1999.
- [13] Semantics of Business Vocabulary and Business Rules (SBVR) [www.omg.org/docs/bei/05-08-01.pdf](http://www.omg.org/docs/bei/05-08-01.pdf) (Checked 25<sup>th</sup> September 2006)
- [14] The Eclipse Project <http://www.eclipse.org/> (Checked 25<sup>th</sup> September 2006)
- [15] The DBE Studio project <http://dbestudio.sourceforge.net/> (Checked 25<sup>th</sup> September 2006)
- [16] LegalXML eContracts Technical Committee, eContracts specification version 1.0(Draft) <http://www.oasis-open.org/committees/download.php/21492/spec.xml.pdf> (Checked 12<sup>th</sup> December 2006)
- [17] OASIS LegalXML eContracts TC charter <http://www.oasis-open.org/committees/legalxml-econtracts/charter.php> (Checked 12<sup>th</sup> December 2006)
- [18] The DBE Contract Schema, available at sourceforge [http://dbestudio.sourceforge.net/schemas/contract/dbeContract\\_1.0.xsd](http://dbestudio.sourceforge.net/schemas/contract/dbeContract_1.0.xsd) (Checked 12<sup>th</sup> December 2006)