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e-HUBs (URL1) is an ongoing research project partly funded by the European Commission, aiming to develop a web hosted e-engineering service (or "e-Hub") which is able to facilitate the outsourcing of engineering services. A key issue for the success of the e-Hub is how to build a secured and reliable On-line Contracting System" (OCS). To build such an OCS, this paper studies several important aspects related to the legal and contractual issues in e-Hubs, which include: 1) how legal and contractual issues are addressed in general business e-hubs; 2) what are the requirements for the design of e-engineering OCS; and importantly 3) what could be learned from the OCS developed in the eLEGAL project.

1. INTRODUCTION

The emergence of e-Hubs is expected to change the traditional approach towards marketing, business transaction and collaboration among clients and engineering providers. To ensure the success of transactions, e-Hubs must make devote considerable efforts to contracting services, legal supports and system security so that users are confident about the new approach of working which could lead to more trust and hence improved business relationships. To build OCSs, a deep analysis of specific contents of current contracts is required as well as an analysis of the procedures that are used to generate them. Conditions in contracts related to the use of e-Hubs, a conceptual framework for contract practice, the specific contents and subject of the contract, the contracting environment and supporting legal systems need to be carefully studied in order to select a suitable and effective conceptual representation.

As a dedicated service within the larger Business to Business (B2B) arena, the e-engineering Hub is designed to facilitate the outsourcing of engineering services. Its services cover not only partner finding, portfolio and profile tracking, business transaction fulfilment, collaboration management, but also collaborative project definition and planning. An important element with the latter contract negotiation is

based on the collaborative work plan. The contractual issues involved in the engineering outsourcing process are much more complex than those involved in general business services. The design of an e-engineering OCS has to deal with all the engineering issues that may create a liability. This is particularly true in the construction industry where contractual practices still follow the traditional methods to achieve legal admissibility of business contracts. This paper presents part of the research work for the development of e-engineering OCS for the e-HUBs project.

2. LEGAL AND CONTRACTUAL ISSUES IN E-HUBS

e-Hubs are neutral Internet-based intermediaries that focus on specific industry verticals or specific business processes, host electronic marketplaces, and use various market-making mechanisms to mediate any-to-any transactions among businesses. e-Hubs create value by aggregating buyers and sellers, creating marketplace liquidity, and reducing transaction costs (Kaplan and Sawhney, 1999). Three closely-related issues (i.e. system security, legal system and contractual issues) are crucial to secure the above services. The solution to these issues is a balance of legal, contract, management and supporting technology.

2.1 Legal Systems

Most e-Hubs will point users to the legal system adopted for the service and force them to knowingly accept it, particularly those important clauses, when they register in the system. Normally the terms and conditions of use also specify the contractual conditions, responsibilities and relationships between users, and users with e-Hubs. The Legal system is expressed either in the form of general terms and conditions or particular legal statements. Below are two examples:

SESAMi (URL2), as a typical business e-Hub, offers two kinds of service: e-procurement and e-auction. The legal system is explained in the SESAMi General Terms and Conditions including: definitions, trade rules, venue for trading, acceptance of terms and conditions, software licence, services scope, fees and charges, compliance with laws, warranties, limited warranty and disclaimer, limitation and exclusion of liability, indemnification, termination, copyright, trademarks, confidentiality, data protection, registration information, delay or force majeure, disputes, assignment, and notices. These clauses basically address users' right and responsibility and rules conducting business in the e-Hub based on the related law systems.

Covisint (URL3) is another e-Hub which provides some more general business services such as collaboration, procurement, supply chain, quality assurance, and portal. Besides the general legal terms and privacy statements, Covisint particularly develops Antitrust Compliance Policies and enforces it to its users. As it is not always easy to draw sharp lines between what is and what is not an antitrust violation, these policies contain practical instructions that are more rigorous than the requirements of general Antitrust Acts (e.g. Sherman Act, Clayton Act, Robinson-Patman Act, Federal Trade Commission Act). Based on the services provided, these policies address the contract legal problems in two different situations (URL4):

- Agreements among competitors: The policies are developed to minimize the risk that an entirely legal conduct will, however unintentionally, veer into a dangerous area or later appear to have done so. Some unlawful contracting approaches among competitors (e.g. price fixing, market allocation, and group boycotts) are illustrated to address the serious antitrust issues which could arise. Particular guidelines are given to prevent these unlawful agreements.
- Agreements with suppliers and customers (“Vertical” Agreements): Unlike agreements among competitors, “vertical” agreements with suppliers and customers usually are legal unless some anticompetitive effect can be demonstrated. They are also far more likely to be embodied in specific contracts, rather than inferred from discussions, so there is less risk that ambiguous conduct will be misunderstood. Some of the “vertical” agreements which can raise legal questions are addressed in the policy such as exclusive dealing, requirement contracts, preferential treatment, tying arrangements, or resale price restrictions.

In legal issues, both “substance” and “form” are important. Ultimately, what is most crucial is the substance of the contract. For example, one cannot avoid the antitrust laws by announcing that the negotiation purpose is to discuss a legitimate item when the substance of the conversation deals with an unlawful exchange of information. Similarly, depending on the circumstances, an agreement that on its face states that it is “non-exclusive” could be viewed as an exclusive arrangement if in fact the parties have reached an understanding, notwithstanding the written document, to deal with each other on an exclusive basis. “Form” and “semantics” also are important, however. On-line discussion, memoranda, e-mail and modified contract often contain information that is carelessly written and may create erroneous impressions about the conduct of the parties, their intentions, or their ability to achieve certain goals. Such documents may raise legal problems later.

2.3 Contracts

Two kinds of contracts are generally signed through e-Hubs: contracts built through tendering between or among competitors, and contracts signed through negotiation between or among providers and customers.

The first kind of contract is normally built through auction or tendering, the contracts built in such cases contain two major components: 1) the general contract clauses which are clearly explained before users start tendering. This section forms the essential conditions and requirements of the contract. Users have to accept them as a condition of tender; and 2) the item to be auctioned. This section includes the detailed descriptions of the bidding items including product model, features, description, photo, the final price bid by the buyer, and payment and delivery approach agreed by both parties.

A typical e-Hub which adopts such kind of contracting system is eBay. As the most popular business e-Hub, eBay provides a three-step shopping approach: 1) find the right item; 2) check the related information and bid it; and 3) pay the winning item. eBay provides a serial of standard contract clauses, it is the users’ responsibility to understand the legal and contractual terms before they make a bid. Once a buyer wins an item, s/he is naturally bounded with the seller by the contract based on: 1) the pre-contract conditions stated by eBay, 2) all the information listed by the seller to describe the item, 3) the winning price, and 4) the payment and

delivery approach negotiated and agreed by both parties. To secure the fulfillment of the contract, eBay also provides some additional services such as reliable payment and delivery approaches, third party Dispute Resolution services, dedicated Trust and Safety Team, or Buyer Protection Programme.

The second kind of contract is normally formed through negotiations between or among providers and customers in complex situations such as outsourcing of services, procurement of large goods or collaboration among partners in a virtual enterprise. Users in this case are normally enterprises rather than individuals. Negotiation is the key of this approach. It starts with initial contract templates provided by e-Hubs or recommended by users. Based on the contract templates, customers and providers negotiate the details of the contract, which normally covers the details of services or goods and the contract clauses. Depending on the content of services or goods to be purchased, most of the B2B e-Hubs only allow users to negotiate a few key items of contract while others following the standard clauses required by e-Hubs.

Unlike contracting among competitors, this approach requires a much clearer expression about contract clauses and responsibilities due to the complex contracting issues involved (e.g. the OCS in the e-engineering Hub); it also requires the users to have good control of the contract content, format, authority and security. Given its importance for industries, this contracting approach has been a research focus in recent years. One example is the eLEGAL project (URL5), which develops such an OCSs with great potential to be used in engineering outsourcing fields.

3. THE E-ENGINEERING HUB

The e-HUBs project aims to develop a universal e-engineering Hub, which provides an innovative approach to facilitating collaboration between different users by offering transparent templates that enable the collaborative generation of a complete set of “project work statements”. It extends the capabilities of its business clients with extended engineering resources by providing brokerage of complementary engineering services delivered by engineering service providers (ESP).

3.1 Functional Architecture

A particular functional architecture has been developed for the e-engineering Hub, on which users can define and negotiate project work statements and contract. The functional architecture can be summarized as follows:

- Essentially, the e-Hub workspace will be a generic negotiation platform allowing users to define, plan and negotiate various engineering and contractual issues during project preparation stage.
- To facilitate project planning, a meta workflow, developed based on the generic project planning process, is embedded in the e-Hub workspace as a generic project planning template. This workflow will guide users to define project plan details. At a high level, it specifies project definition process as briefing project charter, clarifying scope statement, and defining execution plan (PMBOK, 2000). Various essential project planning issues are covered in the execution plan workflow such as

project schedule, quality plan, risk plan, communication protocol, change management protocol, and resource plan; each guided by a sub-workflow.

- Besides the generic PPP workflow, various document templates for each of the project planning issues are also developed and embedded in the e-Hub. These templates cover all the key elements which every project plan should cover; these are also the basis for the development of the sub-workflows.
- Guided by the PPP workflow, various collaborative work statements will be defined through the e-Hub. Depending on each particular project, the work plan could be project deliverables or a meta workflow. If users are concerned about the details of project report, design, technical specifications or prototype, the plan will be work statements about these project deliverables. In other cases, if project execution process is the top concern, the work plan will be best presented by a meta workflow which addresses project activities, relationship, attributes, and schedule.

3.2 Contracting in the e-Hub

Based on the defined work plan, the e-Hub further facilitates the contract negotiation between the Client and the ESP. To facilitate contract negotiation, the e-Hub contains various contract templates covering different situations which users may encounter. Users can negotiate and specify the details of the contract and legal issues. All the related project planning diagrams and reports can be linked or integrated into the Conditions of Contract. The e-Hub platform will also ensure the security of the contract negotiation platform and the contract signed by users. The contract negotiation is mainly concerned with two aspects:

- *Negotiate agreement:* The agreement covers the key features of the contract to be signed between the Client and the ESP including the general work description, activities to perform, expected outcome, overall contract value, project schedule and milestones, payment terms and applicable laws. The e-Hub provides a number of agreement templates to suit different application situations.
- *Negotiate Conditions of Contract:* The Conditions of Contract further specify the contract, particularly the complex details. The Conditions of Contract include issues such as general responsibilities and authorities, legal framework, claims and dispute resolution, collaboration supports, quality planning, risk management, and technical specification. Similarly, the e-Hub provides several standard Conditions of Contract commonly adopted in industries. Users can select and modify the clauses in the standard Conditions of Contract according to the particular project requirements, or they can create new clauses for this contract.

Many issues need to be addressed to design such an OCS for the e-engineering Hub, such as the expression of contract content (which determines the generic contract templates), data control and storage, security, general legal issues, contract execution and technology used to develop the OCS.

4 SOLUTIONS PROVIDED BY THE ELEGAL'S OCS

The eLEGAL project explores the contractual and legal issues for the use of ICT in the construction industry. Based on the investigation, this project develops an OCS for the use of ICT in project based businesses to reap significant benefits for the

industry, both in pure financial terms and the access, control and quality of information. The architecture and technology adopted by the OCS could be referred for the development of the e-engineering Hub contracting system.

4.1 Contracts Representation in eLEGAL

Contractual practice concerns the definition of contractual elements and the consequences. Building OCSs requires a good analysis on both aspects. In order to confer an added value to OCSs, an integration of definitions concerning contractual elements with the consequences has to be merged into a common contract model. This model needs to be specified then by an appropriate meta-language such as XML (Extensible Markup Language) or by one of its business oriented 'dialect' such as ebXML (Electronic Business using eXtensible Markup Language). This leads to the problem of data and knowledge representation that should be orthogonal to the logic layering of OCS software. In fact, concurrency control (low layer), collaborative editing (intermediate layer) and validation of contracts (high layer) should be implemented regardless the way in which a contract and its elements are modelled.

Typical contractual elements in the construction industry (as well as in the e-engineering Hub) are clauses i.e. requirements that define the general conditions of business and the contractual context. They may also contain specific agreements between contracting parties that refer to the current contracting situation and subject. Figure 1 shows a possible XML formalization of clauses, which can be composed of several internal or external clauses. In the same way, each internal clause can include sub clauses, general related elements or raw text data, the optional XML attribute e-Clause_ previously specified, and so forth. It is desirable and likely that tools for supporting collaborative editing would be realized without anchoring users to a single definition of clauses, but offering them a wide range of available templates for clauses and, in general, for each contractual element.

Other recurrent elements are obligations that support the definition of the contract subject. They are supposed to provide a type system for obligations. Obligations are referenced by the contracting parties (who..._) and the workflow

4.2 Transactional Storage for Contracts

Besides the data and knowledge representation of contracts discussed above, this section further addresses the technological support for contracts basing the discussion on most promising ICT transactional technologies exposed in Merz et al. (2001a) and on the conceptual analysis proposed in Ingrassia et al. (2001).

First, OCSs should ensure the possibility of managing more than one version for the same contract. Such requirement arises, for example, when there are more than one user and the whole business contract must not be fully accessible to each user. Typically, in OCSs a user can be a contracting leader (responsible for setting new contract compounds, choosing contracting parties, submitting new contract versions, etc.), or a contracting party (able to access only a part of the whole contract, to change his preferences or public personal data, etc.), or an administrator (responsible for rendering new contract templates, configuring user permissions, registering new users, etc.). This leads to an overall system architecture in which there are several

client applications, each one logging a type of user belonging to the three ones earlier defined, and one logical server offering several types of services as negotiation, information and administration services. Such server is only logically one, meaning that there could be several physical servers in order to perform data reliability, load balancing and so forth.

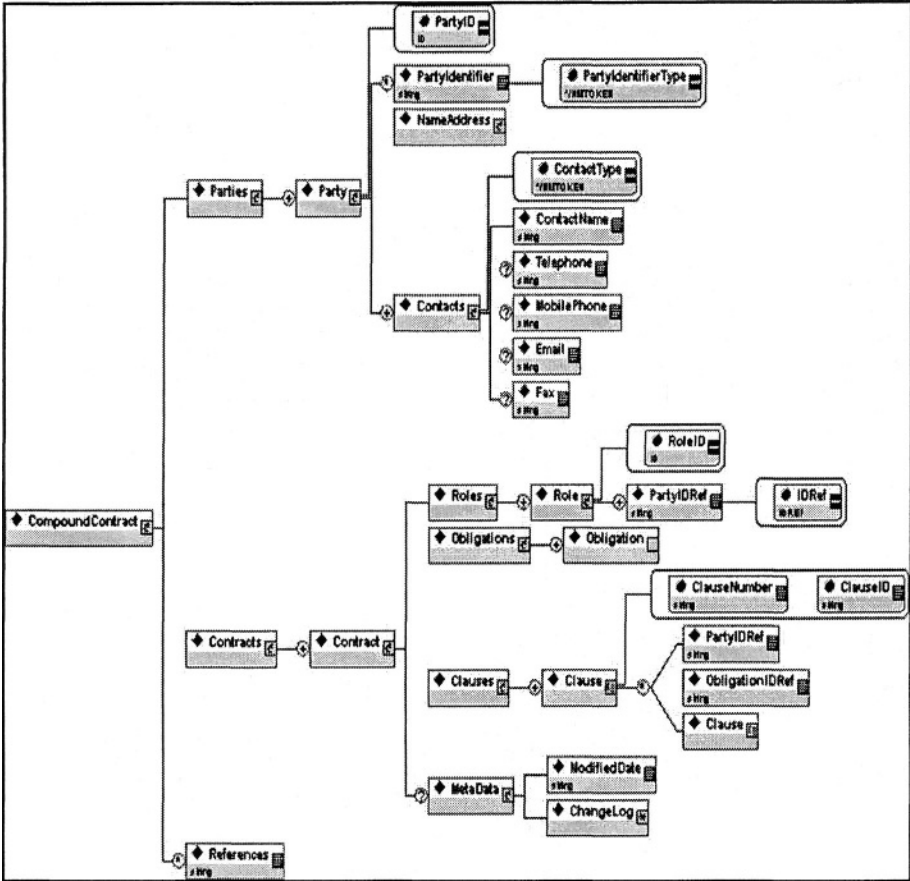


Figure 1 Possible definition of the XML ELEMENT Clauses

On the Client side, the final user should be able to log in with a specified set of permissions, to manipulate and, in case, sign contracts. Performing a login the user is actually selecting one of the available roles (each one enabling a different set of permissions) as contracting leader or contracting party, predefined by the administrator. After login, the final user should read and modify contracts by using a contract editor. Typically, the contract editor runs locally downloading or uploading contract versions from the negotiation server.

On the server side, three basic services should be offered. The business information service is required to support businesses evaluating potential contractors. In this regard, the European business register, a network for exchanging business information based on the concept of service broker system, is already

operative. The negotiation service should perform sub services as: submitting new versions from contracting leaders, decreeing the final agreement or disagreement, storing and retrieving contracts.

A feasible solution may use the Java 2 Enterprise Edition platform and its components in order to store and retrieve contracts and their parties, to implement high-level transaction management and to ensure interoperability with sophisticated transaction resources. All these components are included into the web server as extensions. For instance, the current status of a contract may be embodied by an appropriate EJB Entity Bean. The XML version of the contract would be obtained as explicit output of the bean or as a native format of the data source itself. The latter solution would be feasible if an appropriate database technology with XML native support is used. A proper set of EJB Session Bean interfaces could be used as general entry point for submitting changes and additions to the contract model or to perform element retrieving operations on the contract itself (Merz et al., 2001b).

Finally, the administrative service is concerned with the set of operations the final user is enabled to perform in any context, new user registrations and user profile management. Role management is one of the features supported by J2EE compliant web application servers, although it is not a standardized but server specific capability.

5. DISCUSSION AND FURTHER WORK

The e-engineering Hub provides users with a unique workspace to conduct project planning and contract negotiation. Guided by generic project planning processes users are able to plan the details of the outsourced project collaboratively in the e-Hub platform. Based on the resulting project details, users may choose to proceed to negotiate the contract and conditions of contract in the e-Hub platform. This raises the need for an on-line contracting system which can deal with the complex issues in engineering outsourcing partnerships.

By reviewing the related security, legal and contractual issues in general business e-hubs and studying the architecture and supporting technologies of the eLEGAL OCS, some of the major findings could be summarised as follows:

- Security, legal and contractual issues are vital for the success of e-Hubs. Various security procedures, legal systems and on-line contracting systems have been developed to ensure the smooth transaction conducted in B2B e-Hubs. These systems provide general references for the development of e-engineering OCS such as contracting procedures, trust building approaches, legal background and focuses, as well as general security procedure. However, even most of the matured OCSs in B2B Hubs are only designed to deal with product auction or tendering rather than complex engineering services. These OCSs are unable to cope with engineering services which often involve particular industrial problems and strong domain knowledge.
- The eLEGAL project defines a framework for specifying legal conditions and contracts to enable a legally admissible use of ICT in construction. Based on their investigation, this project develops a particular OCS for project based business. The study of eLEGAL has addressed the following issues: industrial requirements for

legal support for ICTs in projects; the legal basis for contracts on ICT use; and tools for contract negotiation and authoring. This OCS is particularly meaningful for the e-engineering OCS in terms of the contract representation, control, collaborative edition, storage and security. In e-HUBs these aspects are being adapted to suit the e-engineering environment.

Although the eLEGAL project provides a useful architecture and supporting technologies for the development of e-engineering OCS, there are a number of important issues to be further addressed:

Contract content: the eLEGAL project was initiated to deal with the legal and contractual issues for the use of ICT in construction. The contract clauses/templates stored in the eLEGAL OCS are particularly designed for the ICT legal and contractual issues. On the other hand, construction contracts defined and negotiated in the e-Hub are dealing with engineering outsourcing issues which are much more complex than the ICT contractual issues. A simple contract may involve a number of documents such as agreement, conditions of contract, general specifications, particular specifications and drawings. To fully address these documents, the OCS should not only provide comprehensive engineering service contract templates, but also provide more functions in tracking and highlighting changes, difficulties and disagreements.

Negotiation process: construction projects are characterized as complex and dynamic. Although most of construction contracts are negotiated and signed through face to face meeting, ambiguous contract clauses are still one of the major contributors to construction claims. Despite the great benefits brought by the e-engineering Hub, the on-line contract negotiation also brings drawbacks for the construction contract negotiation. Extra noise will unavoidably appear during the on-line contract negotiation process. Problems which could be solved otherwise through face to face negotiation such as different understanding of the contract terms and clauses caused by different language, culture, expertise and background could be worse. Risks are particularly high if unclear or uncertain technical items are involved in the work plan. The responsibility for the unclear contract clauses signed through the e-Hub would lead to disputes during the project execution project. Therefore, the OCS needs to particularly address this point.

Legal supports: Although construction documents are very commonly exchanged using ICT, this practice is very seldom regulated by contractual clauses. Legal document validity and responsibility is entirely attributed to the signed paper copy. A survey performed in the eLEGAL partner's countries revealed that although ICT document exchange has become part of the normal daily activity for most engineering companies, its legal and contractual regulation is not yet common practice. No comprehensive provision for ICT-based communication or contracting methods are addressed in construction. This requires the addition of various legal support procedures for the successful application of the OCS. For example, following the potential claims caused by the OCS, disputes might be generated. The e-Hub should provide certain mediation approaches such as independent trusted third-party get involved to resolve the dispute. Unless the industrial users are confident on these issues, it would be a major hurdle for the application of the e-engineering OCS.

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