A Negotiation Support System Integrating Document-Oriented Model and Communication-Oriented Model

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Abstract

Negotiation is the key stage of e-business. Negotiation Support System (NSS) are designed to assist negotiators in reaching satisfactory decisions by providing a means of communication through analysis of available information. There are two kinds of NSS: the communication-oriented NSS and the document-oriented NSS. Each of them has its own advantages and disadvantages. This paper proposes a new integrated model of NSS which combines their merits and overcomes their shortcuts. It embeds the approach of standard document exchange into the way of flexible communication. This NSS exhibits well in the course of usage.

Keywords: Negotiation support system (NSS), Integrating NSS model, Document-oriented model, Communication-oriented model

1. Introduction

Negotiation is the key sector of e-business. Negotiation Support System (NSS) are designed to assist negotiators in reaching mutually satisfactory decisions by providing a means of communication through analysis of available information. (Sandholm 1999) Many researchers in the field of economics, game theory and behavioral science studied negotiation and many NSS had been developed. They can be classified into two categories: the communication-oriented NSS and the document-oriented NSS.

The communication-oriented NSS focuses on the communication among negotiators. The WebNS system is the representation of the NSS of this kind. It provides different types of communication for the negotiators. The problem of the NSS of this kind is that its content is unstructured and it doesn’t provide support for business documents which play an important role in negotiations.(Schoop et al. 2003)

And the document-oriented NSS focuses on document exchanging and contract storing.

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INSPIRE, the well-known negotiation support system, is this kind of NSS. It provides several of forms to support the negotiation. The result of the negotiation is stored in contract. The problem of the document-oriented NSS is that important information about the negotiation is lost (Schoop et al. 2003).

We set up an integrative NSS which combines the two kinds of NSS mentioned above to overcome their shortcut and meet several of sophisticated requests of negotiation.

2. System Architecture

Generally, Integrative Negotiation Support System is a web-based NSS with the browser-server architecture, implemented in J2EE.(Li 2001)

At the client side, user employs browser or NSS-Tool integrating browser to connect the user interface of NSS, submits his request and displays the result from NSS. NSS run at server side. The system has a three-tier architecture consisting of a user Layer, a business layer and a data layer. The system architecture is shown in Fig 1.

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2.1 User Layer

User layer is the communication interface between negotiators and NSS. It provides a series of HTML pages which can be displayed in negotiators’ browsers. So Negotiators can use it to register and log into the NSS, publish and search information, submit their suggestions or receive suggestions from system. User layer provides a view of the list of negotiations which the negotiator attends and the status of each negotiation. This layer also provides a view of list of messages from system or other negotiators. At the same time, it provides the view of
the list of contracts.

2.2 Business Layer
Business layer is the core layer where the logical process of the negotiation is implemented in NSS. It receives the requests from the user layer, transacts these requests and sends the results to negotiator through the user layer.

This layer is composed of five components discussed carefully later. They are: Information management component is responsible for publishing, searching and storing information submitted by negotiators.

Message management component supports message exchange between system and negotiators or between a negotiator and another negotiator. It also support communication between negotiators. Document and contract management component is used mainly for storing documents and contracts, making contracts and supporting document exchange between negotiators. Negotiation process support component provides solution support and process support of negotiation. Negotiation management component is responsible for initializing, starting, processing, pausing and ending a negotiation.

2.3 Data Layer
Data layer uses relation database to store all information which is required in system. Those data include negotiators’ information, information published by negotiators, information of negotiation, message from system or negotiators and so on. This layer also stores contract which is expressed in XML by business layer.

3. Function Structure
The function structure is primarily composed of five parts shown in Fig2.

3.1 Information Management
Information management component is responsible for publishing, searching and storing
information submitted by negotiators. It is the entrance of NSS and is a basic part of system. The functions of this part are listed:

1. Information publishing supports negotiators to publish information about what they hope to buy or sell by the way of submitting a series of pages provided by system.
2. Information store. This part stores information received from negotiators according to their types. Then it will connect the information to the negotiator who published it, interrelated negotiation information, contract and its information. That means this part should organizes those information mentioned above indexed by business information which is submitted by negotiator. As a result, negotiators can search this interrelated information easily.
3. Information search. This part provides well-organized information and many styles of search, so that negotiators can get the information which they want easily.

3.2 Message Management
Message management component supports message exchange between system and negotiators or between a negotiator and another negotiator. It also supports communication between negotiators.

According to the source, message can be divided into user message and system message. This part provides three styles of user message exchange to meet different communication needs.

1. Private chat. Negotiators can exchange message by word in this way.
2. Communication by means of Video and Audio. NSS provides a tool which integrates browser, video meeting and contract alteration functions so that negotiator can communicate with other negotiator visually.
3. White Board. Negotiators can draw graph on it.

System message is the message exchanging between negotiators and system. It can be separated into informing message and inquiring message. Informing message mainly inform negotiators about status of negotiation or other negotiator. For example, when a negotiation finishes, NSS will send a system message to negotiator indicates that the negotiation is over. When a negotiator exits negotiation, NSS will send a system message to the other negotiators announces that a negotiator has been exited negotiation. Negotiator need not to reply message of this kind.

The usage of inquiring message is to inquire negotiator about process of negotiation. For example, NSS will inquire negotiator whether he would like to accept a new negotiation when a new negotiator wants to join in negotiation. Negotiator has to reply message of this kind, otherwise the procedure of negotiation would pause until he replies to this message.

3.3 Document and contract management
Document and contract management component is vital to store documents or contracts make contracts and support document exchange between negotiators. This part implements three functions.

1. System manages the documents related to business information, such as photos of
products, or technology standard. It receives documents of this kind uploaded by negotiators, stores and organizes them so that negotiators can find and download them.

(2) In negotiation process, this part provides the ability to support document exchange among negotiators.

(3) When one negotiation completes, this part will make contract in XML according to the result of this negotiation. Besides, stores the information of that contract. And negotiator can find and download it.

### 3.4 Negotiation process support

Negotiation process support is the core of NSS. It can be divided into solution driven support and process driven support according to the mode of driving negotiation process support.

Solution driven support uses mathematic models to provide abilities of complicated negotiation computation and quantitative negotiation analysis to NSS. It takes advantage of the abilities of computation and quantitative analysis of computer, so it can provide solution support for negotiator. Solution driven support set up negotiation according to the negotiation items which are submitted by negotiators. In each round of negotiation, negotiators submit their suggestions to system. Then system will employ negotiation support algorithm to compute system solution of this round according to these suggestions. NSS provides more chances to make the negotiation succeed in this way.

At present, the design of negotiation support algorithm focus on search of effective solution based on the rules of negotiation and user tendency. (Ayman 1998) NSS have two methods to implement the search of effective solution. One is multi-object planning model and the other is the negotiation decision support model based genetic algorithm. The multi-object planning model is suitable for handling the negotiation where there are less negotiation items. While the genetic algorithm model provides good for solving the problem of supporting complicated negotiation. NSS choose the two models according to particular negotiation. While process driven support does not provide any solutions of negotiation, it supports the whole process from the ready stage to end stage of negotiation. It provides active support for all stages based on logistic rules.

Process driven support set negotiation template according to the negotiation items defined by negotiators. In negotiation process, negotiators change the value of each item until they agree on it. When all negotiators agree on all items, the negotiation reaches success. These two kinds of support modes are useful in negotiation support practice. So NSS should combine them together to meet various negotiation requests.

### 3.5 Negotiation Management

Negotiation management component is responsible for controlling the negotiation procedure. Its tasks are listed:

1. **Set up negotiation.** It initializes the procedure and context of negotiation according to the negotiation items defined by negotiators.
2. **Start or resume negotiation.** It can start a new negotiation. And sometime the procedure
of negotiation is paused, it will resume it.

(3) Pause negotiation. Sometime system or negotiators have to pause the procedure of negotiation, this function can help it. It stores the context of procedure for resuming later.

(4) End negotiation. When one negotiation is over, it can stop this negotiation procedure, store the final result of this negotiation and release the context of this negotiation.

4. Negotiation Flow
NSS provides integrated support for negotiation following the sequence of before, in and after negotiation. The negotiation flow is shown as Fig3.

5. Performance and Usage
NSS centralizes the advantages of the communication-oriented NSS and the document-oriented NSS and provides the integrated support for the whole procedure of negotiation. NSS can overcome subjective cognitive limitation or prejudice of the negotiator, mood factor of negotiators so that it improves the quality and stability of the final result of negotiation. We once did an experiment. We let 926 couples of MBA students negotiate on the practical case with each other. At the first time each couple negotiated without NSS. We found only 26.9% negotiations reached agreements. And then those couples of students negotiated on the same case again. We found 42% negotiations reached agreements. That
implies NSS can improve the efficiency of negotiation. We have implemented one NSS based on the model mentioned above. This NSS runs on a network consisting of more than 60 enterprises in Heilongjiang province in China. This NSS mainly supports the negotiation in the trade of redundant material among these enterprises. This NSS promotes the transformation of redundant material of enterprises. According to estimation, this system will reduce one third of the cost of transaction.

6. Conclusion
We set up a whole NSS which integrates the advantages of the communication-oriented NSS and the document-oriented NSS. It embeds the approach of standard document exchange into the way of flexible communication so that it set up a new approach of negotiation. Before negotiation negotiators can publish and search business information under the support of information management in NSS. In negotiation process, it provides two modes of process support, solution driven support and process driven support for negotiation to meet various requests of negotiation. At the same time, the system provides two negotiation support model for solution driven support so that it can solve more kinds of problems of negotiation solution support. After negotiation the system makes contract for the successful negotiation according to its result so that the whole procedure of e-business is connected.

Well-structured Negotiation Support System is good so that it can improve the efficiency of negotiation. In the course of using, the NSS reduces the cost of trade by its good performance.

References
Negoisst a negotiation support system for electronic business-to-business negotiations in e-commerce Mareike Schoop, Aida Jertila, Thomas List Informatik V (Information Systems), RWTH Aachen, Ahornstr. 55, Aachen 52056 Germany 26-2-2003

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