A MEDIATOR FOR E-BUSINESS

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Abstract: Partner Relationship Management Systems are implemented in many companies to improve the relations to important partners along the value-chain. The goal is to differentiate themselves from competitors and their products. That leads to different types of relationships between customers, suppliers and other market-participants. Some of these types require a mediator, that connects the partners, if a direct connection is impossible. This article introduces the ideas of Partner Relationship Management within E-Business, and proposes a system called Mediator, which is able to tie together business partners in a distributed environment. This article presents the two parts of the mediator (communication system and information system) as well as their key technologies (an agent-based system based on a Peer-to-Peer network).

1 INTRODUCTION

In many lines of business, sales departments have been aimed at products and were assisted by mass-marketing activities. But the resulting impersonal contact to customers turned to be ineffective (Ritter, 2003). A reason for that was the customers' behavior, to change former accepted business connections quickly. It has been made easy by trends toward globalization and by increasing substitutability of products in mass-markets. This development is going to be stopped by differentiation in products and in personalizing the contact to customers.

Literature about Customer Relationship Management (CRM) and Supplier Relationship Management (SRM) proposes to utilize the Internet as one communication-channel in Relationship-Management. Doing so, the complete Customer-Buying-Cycle can be covered. In the sense of E-Business it means that the integration of both companies should be so uninterruptive in media-selection as possible. Hence a mediator is needed, which can reflect the relationship between both companies and can pick up and support the benefits of both ideas of Relationship-Management.

2 E-BUSINESS

E-Business means, the integrated execution of all business-processes in a company which can be automatized, with the help of information- and communication-technology (I&C-Technologies). This definition shows that E-Business on the one hand influences transaction-costs through integration of business-processes. On the other hand it affects the pass-through time and respectively the transmission-costs by the automated execution of business-processes with information- and communication-technology. Because of integration first takes place on the organizational site, which can, if technologically possible, be automated with the help of I&C-Technologies, a successfully realization of E-Business is bound on organizational adjustments, e.g., process-, task- and data-integration (Herden and Zwanziger, 2004). Therefore E-Business could in fact generate potentials of success, but they can only be implemented through restructuring organizational workflows (Thome, 2002). This is well-founded in the theory of informational added-values (Kuhlen, 1995).

A company has relations along the value-chain, from pre-suppliers, via direct suppliers, to distribution-partners, business-customers and end-

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customers. Additionally companies build up good relations to competitors too, because of changes and trends in markets, e.g., standards etc. (Riemer and Klein, 2002).

The choice of the appropriate business-partner and the exhaustion of potentials of success are realized by Partner Relationship Management (PRM). By that, steps in planning, realization and controlling of interorganizational relations to business-partners, with the aim to save and improve the competitiveness of a company are understood (Riemer and Klein, 2002).

2.1 Mediator

The mediator presented in this paper, is a technical system, which has to support the user, e.g. a company at E-Business. It should depict a market, on which market participants shall trade goods. Simon explains a market as an artifact (Simon, 1997; Sunder, 2004), a tool made by humans in social evolution or through construction, to trade goods. That market owns an inner and an outer environment. The rules and structures of the market lie inside. That includes a consistent language to exchange messages with other participants, a mechanism to define and implement the distribution of these messages, and rules that define messages, which are valid in each state of the market. The outer environment is made by the market participants, who are defined by their preferences, decision rules and their endowment.

Therefore, the mediator is made of participants (suppliers and customers), which maintain communication-connections, to cover the Customer Buying Cycle. It is split into a communication system (inner environment) and a set of information systems, which are doing information processing for each participant (outer environment).

The inner environment of the market is implemented as a Peer-to-Peer network. This architecture allows to distribute market participants on different computers over the network (e.g. the Internet). The outer environment of the market is based on agent-technology. Agents act on behalf of their users and shall support users in decision making (e.g. to select the right partner). Every user can communicate with her/his agent over different communication channels (e.g. mobile and stationary devices). Figure 1 shows a conceptional overview of the mediator system.

To participate in the market, the agent needs knowledge about the inner environment that is realized as an interface toward communication system. Analogous to humans' information processing, agent's behavior is also located in meta-cognition and is controlled by the Application Processor. Rules for decision making, preferences and endowment are located within this meta-cognition and form the outer environment of the market.

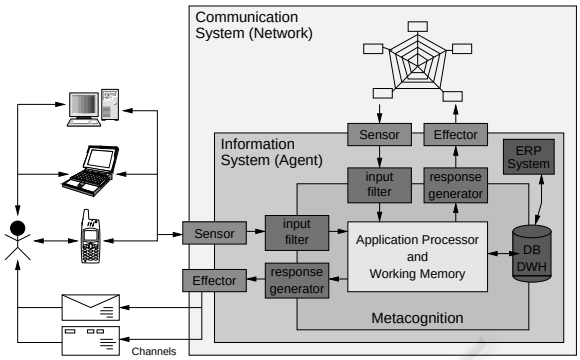

Figure 1: Mediator concept overview

As one can see in Figure 1, the knowledge is located in a database or data-warehouse, which is connected to a ERP-System. Therefore, the mediator can be integrated into current information systems. Doing so, the areas of analytical, operative and communicative PRM are covered, as well.

In the following sections the communication system and the information system are covered.

3 COMMUNICATION SYSTEM

As mentioned in Section 2.1 the communication system is realized as a Peer-to-Peer network. From the technical point of view a Peer-to-Peer network avoids a single point of failure. Therefore a Peer-to-Peer network inclines a higher reliability and scalability than centralized market places. If a centralized market place falls out, no market transactions are possible. If all market participants are distributed on different machines in a network, they can turn out without influencing other participants.

Moreover, there is an organizational reason to use a Peer-to-Peer network as communication infrastructure. A centralized system must be hosted by an organizational unit. This organization has the absolute monopoly to decide who could participate on the market and for which price. This monopoly may be used to charge higher fees from successful participants. In a fully decentralized Peer-to-Peer network all participants are having equal rights.

Beside the technical and organizational advantages of a Peer-to-Peer network, it must be possible for participants to find other participants who may be a possible partner. One basic system functionality is, that participants must be able to offer their products to others. In this mediator, each participant is able to offer the products through a service type definition. A service type is a description of a product, which can be published to other market participants. The service

type defines parameters and their values for the communication between market participants. Due to the requirement that this mediator cannot contain a centralized directory, the Peer-to-Peer network must enable this functionality.

Content-Addressable Networks (CANs) (Ratnasamy et al., 2001) address these issues and provide a fully decentralized and scalable infrastructure to distribute a directory. They are able to manage huge sets of (key,value)-pairs and cope with very high numbers of parallel transactions. CANs are using multi-dimensional vector spaces in which data objects can be stored.

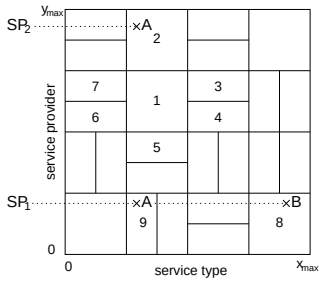

Figure 2: A two-dimensional CAN for discovering services and service providers

Figure 2 depicts a two-dimensional CAN for discovering services and service providers. Service provider SP_1 offers services for service type A and B. Service provider SP_2 offers only the service type A. Due to the same service type, the place of these services A in the directory of the CAN is on a vertical line. If a search for service type A is started, the routing through the directory follows this line. All peers which have an appropriate service type entry in their directories send back the provider and its address to the requesting peer.

In Section 2.1 we said, that another part of the communication system is to define rules and a consistent language for the participants. Figure 3 shows an UML activity diagram for the flow of messages between two communication partners (R is the requesting peer, P is the service provider).

The communication starts with a *Request* message of Peer R. The service provider can accept this request message or might decline the message with a *Reset* message. In the case that the provider accepts the requesting peer, it responses with a *Offer* message. If the offer satisfies the needs of R, it can send a *Booking* message to buy the product. Is the offer is not satisfying the needs of the requesting peer, it could either send a *Cancel* message to cease the communication or another *Request* message, which contains a new, and more detailed, request. If the booking message is successful, the provider sends back an *Ack* message.

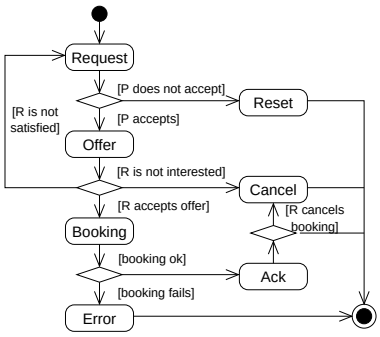

Figure 3: Message flow in the communication system

When the booking fails the provider sends an *Error* message.

This Section covered the network and the directory of the mediator. We have shown, how market participants communicate with each other. The next section describes, how agents are structured and which tasks the agents must fulfill.

4 INFORMATION SYSTEM

In Section 2.1 we mentioned, that the information system is implemented as an agent-based system. Agents act on the behalf of a user (Maes, 1994; Wooldridge and Jennings, 1994) and shall support users of the mediator in decision-making. In the mediator, agents play two roles: On the one hand, agents shall support the user in the role as buyer of a product. In this case they have to implement tasks in SRM. They must be able to search offers, to rate these offers and to order products. On the other hand, agents appear in the role of a seller and therefore have to realize tasks from the CRM. Here, they must be able to submit and to confirm an order. Moreover, they are able to analyze other agents, so that the offers are suitable to the requesting agent.

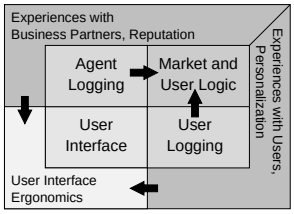

Figure 4: Agent functionality

These requirements lead to the schematic structure of an agent, which is shown in Figure 4. An agent logs its experiences with other agents and the user. These data are analyzed to evaluate the agent's environment.

The logged data from other agents are used to assess the trust in other agents. This can be accomplished by reputation mechanisms (Chavez and Maes, 1996; Padovan et al., 2001). The log data of the user can be used to refine the rating mechanisms for offers. This leads to a personalized analysis of incoming offers on client-side. All offers from different provider agents were rated by the requesting agent and displayed as sorted list. These mechanisms allow to evaluate the offers with user specific data, which were not part of the original request. Therefore sensitive data of the requesting agent will not be published for provider agents. Both logging variants influence the decisions made in the market and user logic, which is part of the Application Processor shown in Figure 1.

5 CONCLUSION

This paper revealed the concept of E-Business in the field of Partner Relation Management (PRM). The PRM of a company includes the relationship management to suppliers (SRM) and to customers (CRM). The SRM and CRM activities of a company can be seen as interfaces of a company to a market. To automate business processes in loosely coupled relations between organizations a mediator is needed.

The presented mediator is split in an inner environment (the communication system) and an outer environment (the information system). The communication system ties together distributed business partners and provides a decentralized service-oriented architecture based on a CAN. The information system is implemented as agent-based system. Each agent represents one company on the market and is able to perform business processes. The use of the mediator is domain independent, which means that different products can be offered and requested.

The concept of this mediator was successfully implemented in a case study in the tourist market. Different services (e.g. hotel reservation, restaurant searches and tourist information) were offered by different providers. Users are able to access the offered information over different devices and to customize their agent for their needs.

In future work we will investigate in the combination of different service types. The results of one service type shall be the input of another service type. For instance, a business trip by car includes an hotel reservation and information of petrol stations. The goal is, that the user only defines her/his destination and the necessary actions (routing, petrol station planning and hotel reservation) were done automatically by the user agent.

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