13. Business Model and Internet Broker Concept for Efficient Electronic Bidding and Procurement in the Tile Industry

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Abstract

This chapter outlines different generic e-broker models and describes the requirements and necessary concepts for establishing a broker service for tiles and related products in the supply chain of the tile industry. The objective of the service is to introduce innovation into the bidding and procurement processes between tile manufacturers, wholesalers and building contractors. The actors, relations and goods of the supply chain are presented, and the architecture chosen for the electronic marketplace and the support tools are described. The core functionality of the broker service, e.g. data exchange, repository access and negotiation, is outlined by means of UML use cases.

13.1 Introduction

The bid preparation and procurement processes of small and medium enterprises (SMEs) are still predominantly based on traditional approaches, tools and communication channels [15]. Additionally, the reuse of bidding data in subsequent procurement and order-processing tasks is usually badly supported. Although the adoption of Internet and Web-based technologies is currently weak, the general attitude of SMEs towards their use is positive [8]. Case studies confirm the potential of e-commerce in procurement [7, 9]. The companies benefit from time and cost savings, increased flexibility, improved inter-organizational information sharing and access to new markets. Major obstacles to e-commerce for SMEs are the investment costs, lack of adequate tools, difficulties in changing the traditional organizational systems, a lack of standards for the value chain and security objections [5, 15]. However, in order to face the pressure of international competition, SMEs need to take advantage of the potential of integrating bid preparation and procurement activities, as well as of applying e-commerce technologies within these processes.

The e.bip project is aimed at introducing innovation into the bidding and procurement processes of tile layers by establishing a new broker service in the supply chain of the tile industry based on existing solutions and standards. The broker

service represents a mediation system that increases the availability of product information, supports cooperation between tile manufacturers, wholesalers and tile layers, and provides a virtual marketplace in which to carry out electronic negotiation, ordering and invoicing.

This chapter presents the results of an analysis of the state of the art for business models in electronic commerce. The objective of this activity was to find the best e-business concept meeting the requirements of today's value chain in the tile construction sector. On the basis of the findings, the e.bip business model and its requirements have been defined, and the e.bip system has been designed from an architectural, functional and technical perspective.

13.2 State of the Art

E-commerce and e-business strategies are revolutionizing the traditional market and business structures. New players are in the market and are offering new kinds of services. The main characteristic of the electronic markets is independence of time and location. In this section, the basic aspects and concepts of the new electronic markets and business models are briefly summarized.

13.2.1 Participants

Following [13], the participants of electronic markets can be divided into five roles: sellers, buyers, business intermediaries, information intermediaries, and network and access providers, all of which can be either individuals or organizations.

Sellers own a value that can be transferred to a potential buyer under certain conditions. A seller can be an individual customer, a company or organization, or a virtual enterprise. Buyers are interested in the "value" of a potential seller and are willing to accept the conditions associated with the value. Business intermediaries alter the value of any business transactions between buyers and sellers. Information intermediaries mediate in the product, service or merchant selection process. Information intermediaries are not part of the business transaction itself but support the business transactions between buyers, sellers and business intermediaries by providing information services. Network and access providers offer the necessary technology means such as resources, applications or services, for carrying out the transactions over an open network and may be network operators, Internet or application service providers (ASP), etc.

13.2.2 Relations

With regard to the direction of the transaction, three types of market relations can be distinguished: business-to-business (b-2-b), business-to-consumer (b-2-c) and consumer-to-consumer (c-2-c). Another possible way to differentiate the relations

is by distinguishing between the numbers of players in a market for a certain good at a specific time, as described in [16] and [6], resulting in 1:1 relations, 1:*n* relations and *n*:*m* relations.

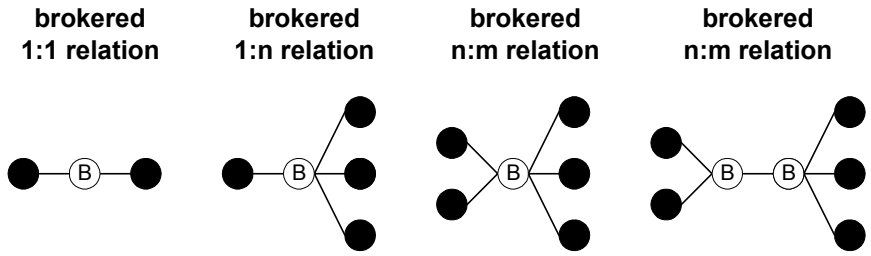

Fig. 13.1. Brokered market relations

The 1:1 relation represents the an individual negotiation between one seller and one buyer. It is the simplest of the models, but reflects many business transactions carried out daily, e.g. in online shops.

In a 1:*n* relation, one seller meets *n* buyers or *n* sellers meet one buyer. This scenario is used to maximize the return for the single player. Auctions, where the seller is the single player, and invitations to tender, where the buyer is the single player, are the prime examples of this model.

In an *n*:*m* relation *n* sellers meet *m* buyers. In this situation of multiple buyers and multiple sellers, transactions are executed in parallel with other transactions, some of which may be in competition for resources while others may be complementary. The prime examples of *n*:*m* relations are stock markets.

All of the above relations may go through a brokering process, resulting in brokered 1:1, 1:*n* and *n*:*m* scenarios (Fig. 13.1). In this case, the intermediary or broker collects orders for instance, from his/her customers and tries to fulfill those orders on the market. The broker can play the role of an information intermediary or a business intermediary. Common e-business concepts that can be applied in direct and brokered market relations are outlined in Sect. 13.2.4.

13.2.3 Goods

Goods with low prices are better suited to automated markets. The overheads created by sales staff, for example, can be reduced significantly if the goods can be purchased by an agent system. For goods that are more expensive, buyers often hesitate to send out an automated agent with a large amount of money for purchasing. In addition, goods that need special marketing strategies, such as unique or rare products or products whose value cannot be determined by objective means, are difficult to sell or buy with agents [16].

Marketplaces can be categorized into horizontal and vertical marketplaces, according to the spectrum of the products traded [11]. Horizontal marketplaces address a specific link and may cover several value chains. The products traded on horizontal marketplaces are usually MRO (maintenance, repair and operations)

goods. In contrast, in vertical marketplaces the procurement of goods directly relevant to a product (e.g. raw materials) is carried out within a specific value chain.

13.2.4 E-Business Concepts

According to [1, 7] different market models can be distinguished when one examines the purchase of products online: sell-side solutions, buy-side solutions and electronic marketplaces/intermediary solutions.

Sell-side solutions are single-seller, multiple-buyer market hierarchies. The seller sets up and controls the sell-side content and maintains the product catalogue.

Buy-side solutions are set up by a buyer to support the purchasing processes. In these systems, the buying organization is in control of the catalogue content and requests data from selected sellers/suppliers. An agent-based variant of a buy-side solution is described in [10]: the buying company does not maintain a local database, but uses agents to dynamically obtain the product data from suppliers or to search for new potential suppliers.

However, these solutions offer nonstandard interfaces, which cause problems concerning integration into back-office systems. In sell-side solutions, the buying organizations may have to integrate their systems with several different solutions if they deal with multiple sellers. In buy-side solutions, sellers wanting to participate in multiple buy-side solutions may have to deliver their data in multiple several formats.

Electronic-marketplace concepts can relieve sellers and buyers from the administration of the catalogue's content, as well as facilitate integration and market transparency through product data harmonization. In [13], the following e-broker models have been distinguished.

In virtual malls, third parties act as business intermediaries (see Sect. 13.2.1) between producers and customers and provide added value to the selling process by taking care of logistics, payment transactions, online catalogues, etc. Matchmakers, i.e. information intermediaries, provide customers with links or information about where to purchase the desired products or services online or in conventional ways. Marketplaces are run by third parties, i.e. information or business intermediaries, to provide an online means for buyers and sellers to establish business transactions. In virtual enterprises, different companies join forces and share resources and policies or even IT systems and business processes. In intercollaboration models, two or more parties belonging to different organizations collaborate to achieve a specific goal, such as creating a product or service. Unlike the case of a virtual enterprise, the degree of trust, integration and cooperation is rather low. The same applies to intracollaboration models, where the parties are members of the same legal entity.

Sell-side and buy-side solutions are mainly applied in direct 1:1 relations, while virtual malls, matchmakers and marketplaces represent the common forms of brokered e-commerce that aim to mediate between the buyers and sellers. Virtual enterprises and the inter-/intracollaboration models represent special broker con-

cepts, which are focused on the cooperation aspects rather than on commercial mediation between buyers and sellers.

13.3 A Business Model for Electronic Procurement in the Tile Industry

This section applies the above-mentioned generic findings to the specific requirements of the tile industry. In addition, the architecture of the e.bip broker network is outlined.

13.3.1 Participants

The value chain in the tile industry consists of various different players, namely manufacturers, stone traders, retailers, wholesalers, building contractors and customers. Their roles are defined as follows.

Manufacturers are producers of ceramic or natural stone tiles and act as sellers only. *Stone traders* sell complete solutions to their customers. The material needed is either bought from manufacturers or produced by the stone traders themselves. *Retailers* sell the products obtained from wholesalers to customers or tile layers. *Wholesalers* act as business intermediaries between manufacturers/stone traders and building contractors/ceramic retailers. The main added value provided by the wholesalers is the provision of logistics. *Building contractors* buy tiles from the wholesalers and retailers, and sell them and the contractors' additional services to customers. The building contractors comprise tile layers, architects, building companies and engineering companies. *Customers* are the final consumers of tiles or tile products.

Companies that play all above-mentioned roles – with the exception of customers – are present in the e.bip consortium. The Consorzio per la Zona Industriale Apuana (CZIA) is a consortium of stone traders and manufacturers of ceramic and natural stone tiles in the Massa and Carrara regions of Tuscany, Italy. TIBA is a Portuguese wholesaler and retailer of products and materials for the construction sector. Beinkofer is one of Austria's leading wholesalers and retailers of building material, tiles and do-it-yourself-supplies. Baldauf (based in Austria) deals in tiles and stones, and has its own purchasing department and an independent workforce of stone layers; thus it acts as a tile layer and building contractor.

13.3.2 Relations

The current relations between the members of the tile value chain have been outlined in the previous section. The e.bip network addresses the business-to-business relations between manufacturers, stone traders wholesalers/retailers and building contractors. As tiles are mainly purchased by color and texture and most customers need, in addition to the tiles, a tile laying service, it is unlikely that the custom-

ers will buy tiles via the Internet. Thus, the e.bip broker services will not cover the business-to-consumer aspects.

The relations between the members of the value chain are typically 1:1 relations (e.g. a wholesaler buys tiles from a manufacturer) or *n*:1 relations (e.g. a building contractor sends an invitation to tender to some wholesalers). When the e.bip electronic marketplace is established in the tile value chain, those business transactions which are carried out by applying the e.bip tools will turn into brokered 1:1 and brokered *n*:1 relations. The operator of the e.bip marketplace will act as a business intermediary, providing its users with additional services and business opportunities. Auctions (1:*n* relations) and stock market scenarios (*n*:*m* relations) are unusual in the tile value chain and thus will not be supported by the e.bip solution.

13.3.3 Goods and their Characteristics

e.bip creates a vertical marketplace in the supply chain of the tile industry (see Sect. 13.3.1). However, the envisaged prototype of the e.bip network will be focused on ceramic and natural stone tiles, although it will be open to other tile products and materials.

In the tile industry, many different types of tiles can be distinguished. The important characteristics of ceramic and natural stone tiles can be summarized as follows:

- The specific value (price per unit weight) of the product justifies long transport routes across several borders.
- Tiles are fashionable articles with short life cycles. This forces companies to either hold a very small stock (leaving little choice for consumers) or to run the risk of devaluation of merchandise owing to it going out of fashion.
- Tile production processes cannot be standardized. Both the varying quality of the raw material (for stone and marble tiles) and the details of the firing processes (for ceramic tiles) lead to variations in color, dimensions and quality, making it impossible to guarantee a large quantity of an exactly similar product.
- Different product identifiers for similar or identical items and the lack of standardization of the characteristics of construction materials in Europe often lead to communication problems within the supply chain.

13.3.4 Requirements on the e.bip Solution

The heterogeneous data structure within the construction business and the absence of common product identifiers impede access to up-to-date product information (about product characteristics) and therefore efficient cooperation within the tile supply chain.

In particular, the members of the e.bip value chain requested the services shown in Table 13.1.

Table 13.1. Requirements on the e.bip broker service

	Manufacturers	**Wholesalers/ Retailers**	**Building contractors**
Need identification	• Product marketing through online product catalogues	• Online catalogue with product data • Synchronization of product data with local repository	• Access to up-to-date product catalogues • Synchronization of product data with local repository
Brokering	• Capturing of advanced product data, including color and texture information	• Advanced search mechanisms • Mapping mechanism for product numbers • Access to advanced product characteristics • Price comparisons • Comparisons of other conditions	• Advanced search mechanisms • Mapping mechanism for product numbers • Access to advanced product characteristics • Price comparisons • Comparisons of other conditions
Negotiation	• Electronic negotiation mechanisms	• Electronic negotiation mechanisms	• Electronic negotiation mechanisms • Negotiation supporting invitations to tender
Purchase / delivery	• Online selling/ invoicing	• Online selling/ invoicing • Online ordering	• Online ordering

13.4 e.bip System Architecture

The e.bip system architecture, as shown in Fig. 13.2, consists of three main components:

- The master broker system: This is the central component of the e.bip architecture and represents a central, stand-alone online broker service.
- Seller and buyer client modules: These connect the master broker system with existing back-office solutions.
- A local application for bidding and procurement (e.bid/e.bip application).

A more detailed overview of the functionality is provided in the sections below.

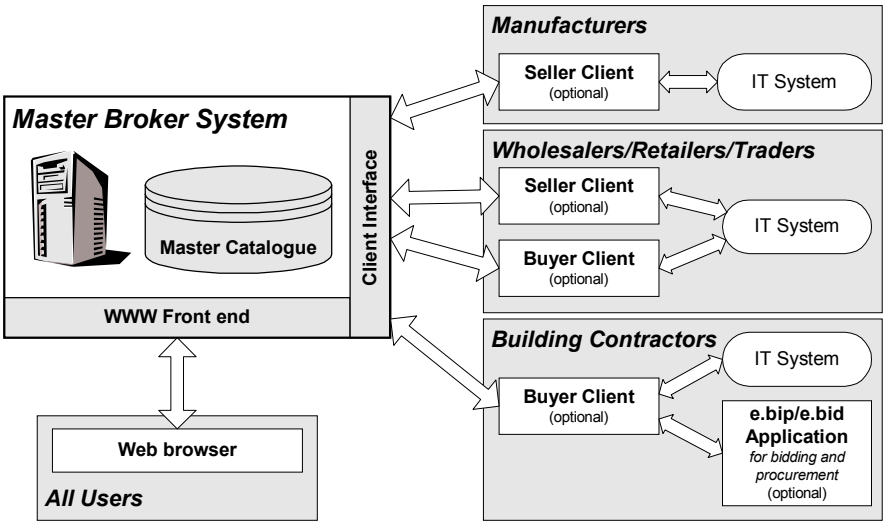

Fig.13.2. e.bip system architecture

13.4.1 Master Broker System

The master broker is as a virtual business-to-business spot marketplace for commodity items and will be run as an ASP (application service provider) service maintained by one or more of the e.bip partners. It may, additionally, be sold to interested third-party operators.

The e.bip broker service primarily covers stone and ceramic tiles, but is dynamically extendable to other products and materials. The provider of the master broker will control and administer the product classification scheme as well as the product definitions and attributes. However, to handle the continuously changing and developing products and product classes, all users of the master broker system will be able to make proposals, e.g. to introduce new product categories.

One of the main tasks of the master broker system is to unify the product information by providing a mapping mechanism to handle the problem of managing several product identifiers for similar articles. Also, advanced search features for tiles are offered, including color-matching mechanisms for finding tiles in a certain color or color range.

For distributing new or updated product information, special offers, invitations to tender, bids, etc. among the manufacturers, wholesalers/retailers and building contractors connected to the system, the potential buyers/sellers can use the notification services of the virtual marketplace. Negotiations between buyers and sellers are supported by providing negotiation agents. After the conditions and negotiation margins of a bid or request have been specified, the broker agents can autonomously negotiate the best price and thus considerably accelerate the overall negotiation process.

Ordering, invoicing and payment transactions will not be addressed by the first prototype of the master broker developed within the e.bip project, but will be supported by the client modules, as well as by the bidding/procurement application, and will be added as an option during the commercialisation phase.

Interested manufacturers, wholesalers/traders and building contractors can subscribe to the virtual marketplace and use it by accessing the Web front end through a normal Web browser without installing local software.

However, in order to interface the broker system with existing back-office solutions (ERP, accounting, etc.), a seller client and a buyer client application will be offered.

13.4.2 Seller and Buyer Client Modules

The client modules have been introduced into the e.bip architecture to provide a means of integration between the master broker system and the IT systems that already exist at the building contractors, retailers, stone traders or wholesalers. The seller client provides functions to transfer product information generated and stored at the seller's IT system to the master broker system. The buyer client can be used to integrate product or bidding/procurement data retrieved from the master broker system into existing IT systems or the e.bip/e.bid application (see Sect. 13.4.3). Additionally, both modules offer functions for retrieving supplier/customer data, and archiving services.

13.4.3 Local Application for Bidding and Procurement

For the more complex bidding/procurement process of building contractors, the bidding application "e.bid" developed in the CSCCM project [17, 18] will be extended. This application currently includes the generation of decomposed project calculations that take account of services and material. In e.bip, procurement and invoicing functionality, as well as an interconnection with the master broker, will be added to take full advantage of the new broker service. This will increase access to a greater quantity of product information and number of suppliers, and more up-to-date product information. The integrated e.bid/e.bip application will provide features such as:

- Synchronization and extension of a local product data repository with up-to-date information obtained from the master broker system.
- Semiautomatic generation of price/material inquiries for submission to the master broker system by means of the buyer client. The responses received (i.e. supplier bids) can be incorporated directly into the corresponding bid for the contractor's customer.
- Reuse of bidding data for procurement, order processing and invoicing processes. The application will support the information and workflow for all bidding and procurement activities by substituting for paper documents, interfacing with the master broker system and integrating electronic communication methods such as email.

13.5 Core Functionality of the Master Broker System

In the following section, the core functions of the e.bip marketplace will be outlined by using the use-case methodology that is part of the Unified Modeling Language (UML, [3]). A use case is a description of a limited task or process occurring in an everyday situation. A use case diagram depicts the relationships between use cases and actors, actors being the people, organizations or systems involved [12].

Figure 13.3 illustrates the core use cases of the master broker system and their context, by emphasizing the actors that surround the master broker system. Buyers and sellers can either directly access the master broker system through a standard Web browser or use the buyer/seller client application to communicate with the system (see Sect. 13.4.2). Stone traders, wholesalers and retailers act as both buyers and sellers, while manufacturers act as sellers and building contractors act as buyers only (see Sect. 13.2.1). Finally, the operator of the master broker has to interact with the system.

The following sections briefly describe the core use cases.

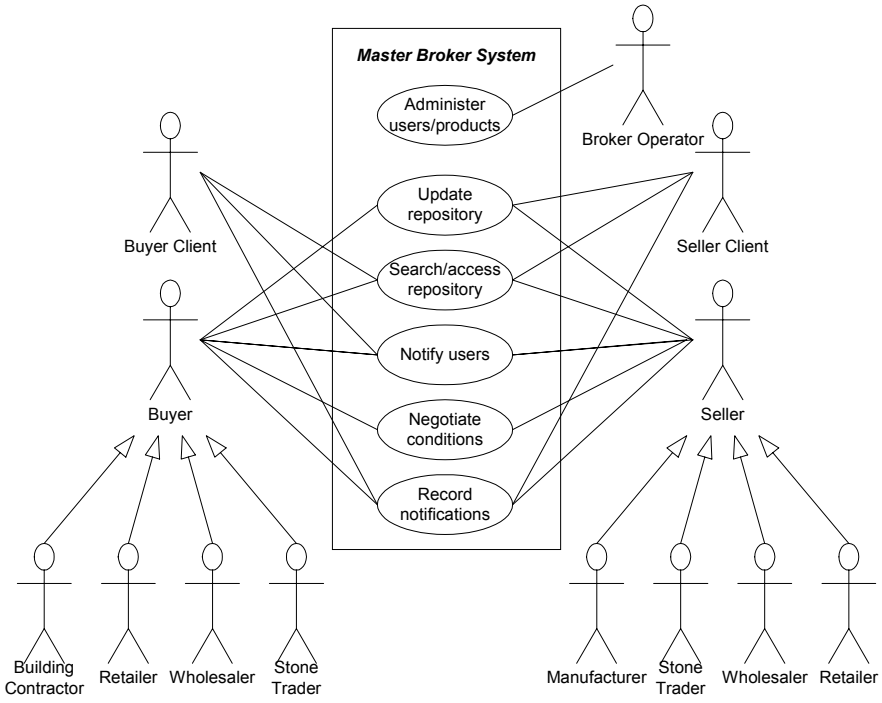

Fig. 13.3. Use Cases of the master broker system

13.5.1 Administer Users/Products

In order to administer the master broker system, the broker operator is enabled to accept or reject new users (i.e. sellers and buyers) who have registered themselves to the broker service. Additionally, the master broker will provide functions for managing the product classification scheme and for (re-)arranging product data within the scheme. By providing statistics about the transactions and repository status (e.g. number of users, search requests and products) the master broker enables the operator to retrieve the information required for controlling and managing the brokerage service.

13.5.2 Update Repository

The buyers and sellers can register as new users or change their existing registration data (i.e. company and user data). Additionally, the sellers can manually enter or update their product data. By use of the seller client application (see Sect. 13.4.2), new or changed product data can automatically be transferred to the master broker. The master broker authenticates the user (i.e. seller, buyer or user of the client application) by a user-id/password pair, and captures and updates the company, user or product data.

13.5.3 Search/Access Repository

Buyers can start search requests to get result lists about matching products or sellers. Sellers can look for the company information of potential buyers. By use of the buyer client (see Sect. 13.4.2), selected product data or seller information can be downloaded from the master repository to be further transferred into the local IT system, the e.bid/e.bip application (see Sect. 13.4.3) or the seller repository. The seller client can be used to download the company data of buyers for the buyer repository

13.5.4 Notify Users

Buyers can subscribe themselves to selected sellers, product categories or products so that they can be informed by the master broker when new products become available or existing product attributes (e.g. quality or price) change. A buyer can also use the notification services to distribute invitations to tender, inquiries, status messages about products received, payment transactions, etc. to subscribed or selected sellers. Alternatively, the buyer client can be used to transfer inquiries to the master broker.

Sellers can subscribe themselves to selected buyers so that they can be informed by the master broker if new invitations to tender or inquiries are provided by the buyers. Additionally, sellers can send information about bids, orders and

shipment to a buyer. The distribution of the notifications/information and the handling of the subscription lists are performed by the master broker.

13.5.5 Negotiate Conditions

Authenticated buyers and sellers can enter their bids and inquiries for products and services. In this case, the master broker uses the notification functions to distribute the messages or information. Optionally, the buyers and sellers can define negotiation parameters (e.g. optimal price, and time and price limits) through a negotiation agent to automatically negotiate the conditions for an order with the corresponding negotiation agent of the buyer(s). The master broker controls the agents and informs the negotiating parties about the status and results of the negotiations.

13.5.6 Record Notifications

The seller/buyer client applications transfer notifications relevant to procurement, such as shipment data or payment confirmations (from the local ERP or accounting systems connected to the system), to the master broker in order to allow order tracking for internal and external use. The buyer client is able to access answers to inquiries or bids received.

The broker records and lists messages and information received (e.g. bids) for the buyers and sellers and allows the users to structure the messages by putting them into user defined project folders. Thus, the broker enables the users to gain an overview of the current status and also to document the history of their bidding activities. By using the buyer or seller client, a user can also download the content of the project folders and locally archive the information. The master broker handles the notification lists of the users and allows the users to add/rename/remove user-defined subfolders.

13.6 Technical Overview

The master broker system will reside on a server so that users can access e.bip services on the Internet, either by a Java client application, such as a client module, or through a standard browser. The Web layer provides the interface to the master broker system. Owing to its dynamic model, the Web interface will be provided using JSP (Java Server Pages) technology, accessing the Java components residing on the master broker system server.

XML will be used for the data exchange between the master broker system and the client modules. The catalogue information will be exchanged on the basis of the Electronic Catalog XML (eCX) data type definition (DTD), as this provides a method for obtaining electronic catalogue interoperability. The transfer of the XML files will be accomplished using the Simple Object Access Protocol (SOAP), a light HTTP-based protocol.

The buyer and seller modules will reside on the client computers to support the communication between the e.bip master broker system and the existing IT systems of the client. In order to use the client modules, users will be able to download the application (seller module and/or buyer module), install it on their computer and configure the wrapper for their existing IT system. To provide the most flexible and platform-independent solution, Java will be used for the implementation of these modules.

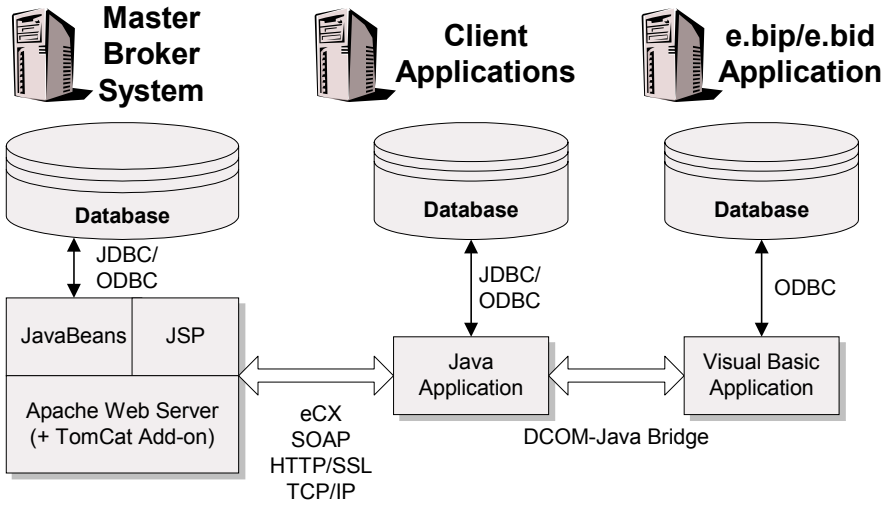

Fig. 13.4. e.bip technical realization

The procurement module will be an extension to the existing e.bid software system and will be implemented using Visual Basic and Microsoft SQLServer. The communication between the buyer module (Java) and the procurement module (DCOM) will be done using DCOM–Java bridge software such as J-Integra (from Linar Ltd.) or JCom (open source).

Figure 13.4 shows the main technical decisions regarding the e.bip architecture.

13.7 Conclusions

This chapter has presented the e.bip approach to introduce innovation into the bidding and procurement processes in the tile industry's supply chain, by establishing a new broker service in the supply chain of the tile industry. The basic concepts of electronic business models have been outlined, and the architecture developed for the e.bip marketplace, as well as the means of support for using the broker network, have been described.

Owing to the generic nature of the architecture, it is expected that the e.bip solution can also be applied to other branches of the building industry and other sec-

tors that are characterized by a similar supply chain management. Since the tile business is a very dynamic area in the construction business with respect to the life cycle of product information, a successful implementation of the broker service in this sector will represent an excellent test bed for the broker concept that will be able to prove its transferability to other sectors. It is expected that the e.bip solution will lead to a higher acceptance of electronic brokerage systems by emphasizing integration with existing systems and workflow support, without neglecting the usual "internet way" of doing business on an online marketplace.

At the time of writing, the project has finished the specification of the software components described in Sects. 13.4, 13.5 and 13.6 and has started the implementation of the system. Following the implementation phase, pilot projects will be established, for all roles in the tile supply chain (see Sect. 13.3.1), for evaluation, testing and refinement of the software system in early 2002. The e.bip consortium is also in contact with standardization authorities such as ASCER [2] and the C-ECOM project [4] to facilitate the establishment of a standard for the formal description of tile attributes and tile identification.

Future findings and results will be made available on the e.bip homepage on the World Wide Web [14].

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