

AUTOMATED BUSINESS PROCESS INTEGRATION WITH OPENXCHANGE

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ABSTRACT

In order to meet the requirement of a broad support of inter-organisational business processes, a smooth integration into existing business applications is necessary. Standardisation initiatives such as ebXML promise to provide a framework for flexible process and data interoperability among businesses. This is used as the basis for the development of the openXchange reference architecture described in this paper. It is designed to accomplish smooth business process integration based on ebXML and standardised e-business transactions and reference processes for significant business areas.

OpenXchange will provide an extended framework for demonstration and validation of e-procurement applications within several business domains. The mapping of the ebXML framework on the openXchange Architecture shows the gaps that need to be closed before companies can perform standardised e-business transactions. The components of the openXchange Architecture will be piloted in specific business domains within pilot applications in Germany and The Netherlands.

KEYWORDS

e-Business Integration, E-Collaboration, Business Processes, ebXML, Standardisation, e-Procurement.

1. INTRODUCTION

By the manifold means of e-business the way information is exchanged both within an organisation and across organisations' boundaries is subject to constant change. The Internet enables organisations to easily exchange data, but more important the Internet offers a technology to improve inter-organisational processes.

In order to provide organisations with efficient electronic connectedness, a smooth integration into existing business applications is necessary. Formerly, this problem was solved using transaction formats of the Electronic Data Interchange (EDI) standard with their known limitations. With the pervasiveness of the Internet the XML standard came up promising to overcome the limitations of EDI. The ebXML (e-business XML) initiative promises to provide a basis for flexible process and data interoperability among businesses.

The openXchange concept is a new progressive standardisation idea to smoothen inter-organisational processes. The development of the openXchange concept is undertaken by a European consortium

(consisting of Fraunhofer and TNO among others) within the research and development project openXchange funded by the European Commission (IST-2000-28548). With regard to its implementation the openXchange concept is focusing on the ebXML initiative and the application of existing standards as far as available. In addition the project is dedicated to collaborate with standardisation bodies in order to contribute to their further development.

In section 2 of this paper, e-business is introduced with its basic concepts relevant for the work described here. Because the ebXML framework is of great importance for the developments, its concepts are clarified in a short overview in the third section. The openXchange Reference Architecture is introduced in section 4. The last section contains the conclusion and outlook of the openXchange project and further developments.

2. E-BUSINESS AND BUSINESS PROCESS INTEGRATION

e-business activities mainly aim on realising cost reduction and efficiency effects. Information systems of different organisations and companies need to be connected in order to reduce business process lead times, the failure frequency when processing external information, and the number of communication channels. In former times companies used Electronic Data Interchange (EDI) to achieve these goals. But in the long run EDI applications turned out to be very complex and expensive with the result that only major companies can afford using EDI while small and medium-sized companies are not able to participate in EDI-based communication. Moreover, EDI is not flexible enough to cope with business relationships that change frequently (Stefansson, 2002). The pervasiveness and availability of the Internet promises to overcome these obstacles. However, in order to achieve end-to-end business process integration across company boundaries standards are needed for a common understanding which information must be exchanged between business partners.

In the field of inter-organisational business process integration two areas of standardisation can be identified. Document standards specify sets of documents that are necessary for a business process. Within a procurement process, for example, purchase orders, order acknowledgements, dispatch notifications and invoices are exchanged between a buying and a supplying party. Examples for document standards are xCBL, cXML, RosettaNet Partner Interface Processes (PIPs), and openTRANS (Frank, 2001; Kelkar et al, 2002). Document standards are applications of the Extensible Markup Language (XML) specification. The standard itself is encoded in Document Type Definitions (DTD) or XML schemes. Besides document standards, there are business process frameworks that define the overlying business process that participating companies follow when exchanging business documents. Some of them emphasise the organisational aspect of a business process (e.g. UDDI; Ehnebuske, 2001) while others are clearly process oriented (e.g. BizTalk by Microsoft Corporation (2001), eCo by Adkins, J. et al (2001), and ebXML described by Kotok and Webber (2001)).

ebXML is the most comprehensive business process framework since it does not only cover multiple layers of the communication and information interchange stack but also provides mechanisms for the automation of the integration process itself (Otto, 2001). Therefore, the openXchange architecture is mainly based on ebXML specifications as described as follows.

3. EBXML OVERVIEW

ebXML is a framework standard for the electronic exchange of company data and messages needed for business transactions. It is not limited to a certain industry like many other initiatives. This implies some possible overlap with other initiatives (e.g. Biztalk), however, none of them is as broadly conceptualised.

The project ebXML, started in 1999, is led by the organisations UN/CEFACT and OASIS. Company consortiums, branch organisations, standardising agencies, consultants and world-wide users worked on the creation of a set of specifications and papers first presented in spring 2001 (Kotok and Webber, 2001).

ebXML is positioned as a framework, not as a fixed package. An advantage of a framework is that certain parts can be individually chosen according to the specific needs of a company or consortium. It focuses on interoperability on more than one level, including the messaging level. However, the definition of actual message standards is left to the individual organisations or industry associations.

Within its framework several related facilities are presented for realising an operational cross-company e-business agreement and relationship and for the development of the actual message standard. Although the support of the developments of ebXML are evolving quickly, it is definitely not yet finalised. A lot of work has to be done on the specifications of the parts of the framework. However, independent of ebXML, there is a real need of organisations to standardise and harmonise their business processes and transactions for further processing by IT-systems.

Four activities before business transactions can take place are identified and supported by ebXML (Oude Luttighuis and van Blommestein, 2002). These activities will also be described in more detail in the following sections. The four activities are:

1. Standardising of messaging and processes
2. Recording of company profiles
3. Arranging an e-business agreement
4. Run-time of e-business process

However ebXML also provides input for another period which is supposed to address the implementation of business processes into IT-systems. This aspect is not described in more detail since this idea would impede an automated integration and support of the processes.

The ebXML approach that various industrial consortiums and branch organisations arrange agreements about, first, the operational process for doing e-business and, second, the exchange of messages within this process. Accordingly, these processes should be modelled in UML using the UMM method. Next, the models are translated into the XML-format to make it possible to store them in the so-called repository. An important role within this repository play the so-called core components. These are basic elements of messages that are context-free. This means they can be used in many branches and companies, like address data of a company, unlike the operational business processes that can be context-specific. With the core components and the operational processes in the repository, the aim is to standardise the processes and messaging exchanges as far as possible. The outcome of this first activity are the standardised business processes modelled against the Business Process Specification Schema (BPSS) and stored in the repository.

Besides, individual companies have to define their capabilities with regard to preferred communication channels and interfaces by means of a profile. This profile contains information about the way (processes and messages) they are able to do business and gives a description of the technological aspects of the business processes. This company profile (Collaboration Partner Profile, CPP) is set up in the second and stored in the registry.

Based on the CPP, matching takes place to identify potential collaborative partners. The outcome of this process is a collective agreement (Collaboration Partner Agreement, CPA) about how the identified companies want to do e-business transactions. In an ideal situation, this matching process is a completely automated process. Based on this agreement e-business transactions can actually start and can be executed by serving the related business service interfaces. For this run-time environment ebXML offers some facilities, e.g. an envelope to exchange messages based on SOAP. The agreement finally defines the way in which two (or more) companies actually will perform e-business transactions as a two-party (or multi-party) collaboration.

4. THE OPENXCHANGE REFERENCE ARCHITECTURE

The openXchange project aims on the development of a reference architecture for software applications that support the automation of inter-organisational business processes. These applications are to be seen as instances of the reference. In pilot user sites the applications will be implemented and evaluated. Within the reference a method is developed which is supposed to allow a company the participation in this created environment. The openXchange approach is based on the following premises:

1. Deployment of state-of-the-art e-business standards
2. Combination of the model view and the implementation view of business processes
3. Integration of modelling and transaction time

Therefore, the openXchange project scope is twofold. On the one hand, openXchange specifies business process components for certain industries, and on the other hand, it provides the openXchange Architecture to conduct e-business in an automated manner. In order to accomplish the development task, the overall openXchange Architecture is split into the following 'times' (in accordance with the four basic ebXML activities; see also **Erro! A origem da referência não foi encontrada.:**

1. Modelling Time
2. Profiling Time
3. Agreement Time
4. Transaction Time

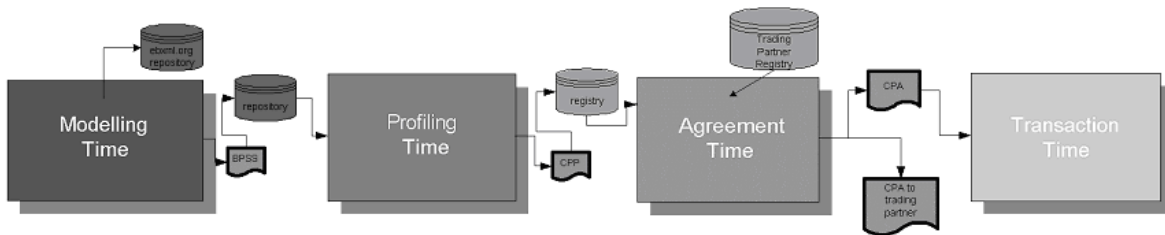


Figure 1. openXchange Reference Architecture

The following sections contain a description and an introduction of the related openXchange Architecture for these four different phases of business process integration.

4.1 The openXchange Modelling Time

The Modelling Time specifies the business process for a certain industry or domain. Due to the fact that a general standardisation of business processes is hardly possible to achieve and, moreover, not desirable, openXchange specifies sectoral sets of business process components. One sector, for example, is 'Catalogue Based Procurement' as it is used for indirect procurement by companies independent of their size, industry or location.

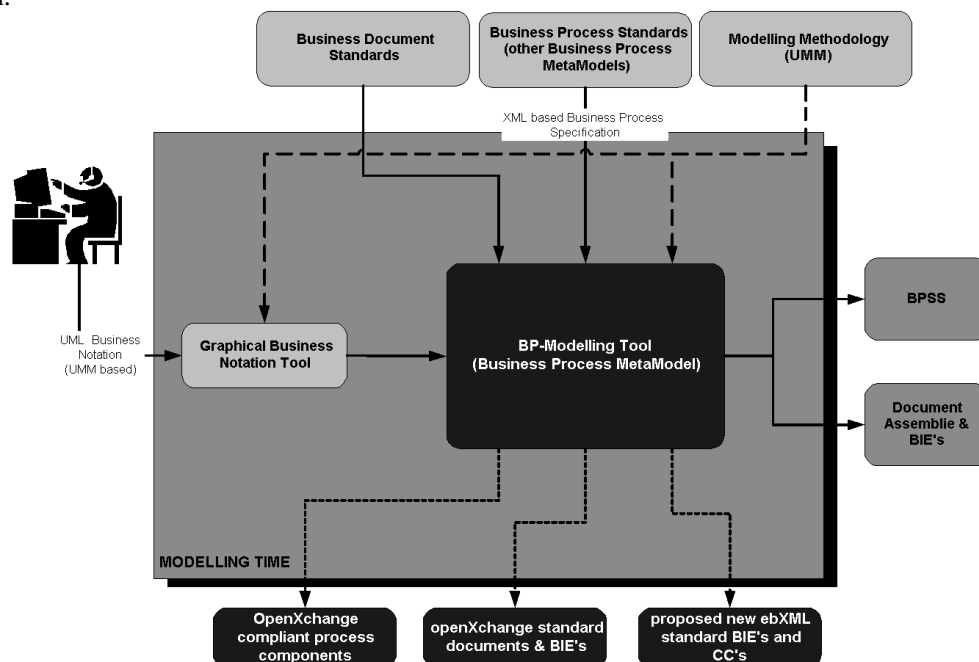


Figure 2. openXchange Modelling Time

The sets of business processes are identified and specified within the user requirements analysis of the openXchange project. The result is then modelled in UML (see Figure 2). The only component necessary for the Modelling Time is the openXchange Process Modeller. However, in this case the openXchange project makes use of existing business process modelling tools. The input for the Modelling Time is graphical, formal, or verbal information about business processes of certain industries or domains. The Modelling Time provides harmonised business process components that serve as an input for the following Profiling Time.

4.2 The openXchange Profiling Time

The main objective of the Profiling Time is the creation of a technical and business related profile of a business partner. Due to the premise that the integration process itself must be automated, i.e. be supported by information systems, the profile must be interpretable by a machine.

The result of the Profiling Time is a machine-readable partner profile (see Figure 3) that contains the following types of information:

1. Technical information about the interfaces and transport protocols the business partner uses to do e-business; this information is defined in an ebXML CPP.
2. Business process information about the number of different variants (out of the set of variants defined during the Modelling Time) the business partner supports and the specific roles of the participants; this information is stored in an 'enhanced' ebXML BPSS.

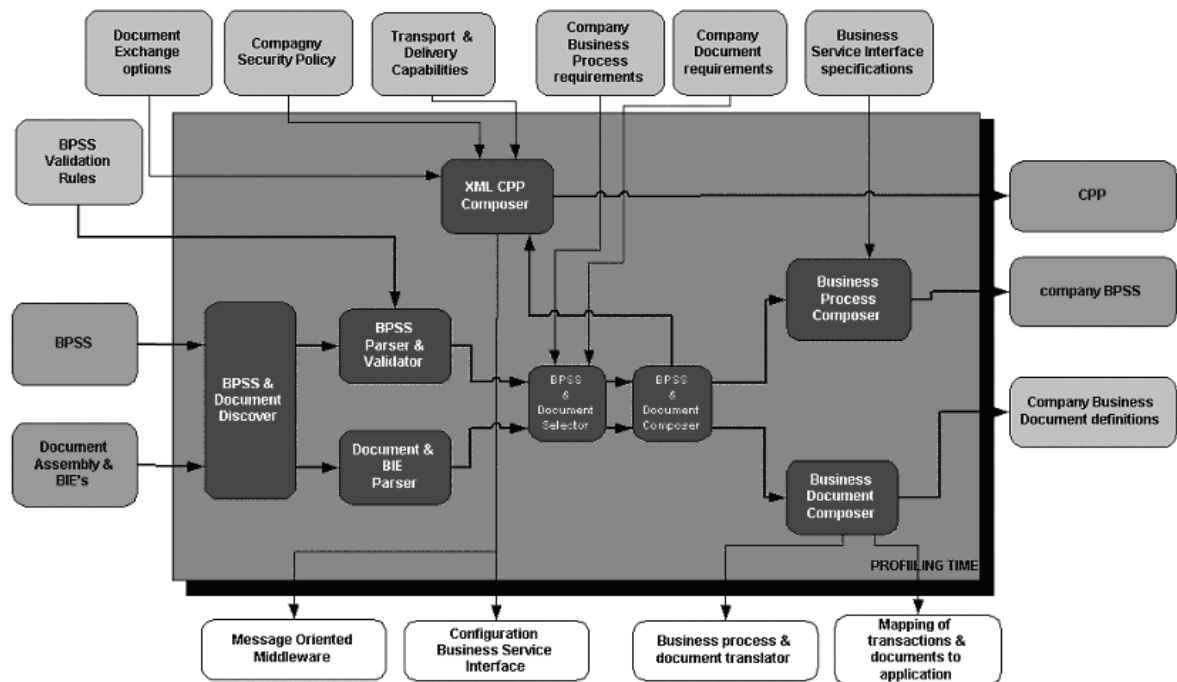


Figure 3. openXchange Profiling Time

These pieces of information take into account, for example, which is the correct HTTPS port to access a company's ERP system, which document standard is used to exchange business information, and in which sequence business documents have to be exchanged. The aim is the creation of XML documents that are in accordance with the partner profile. The system is equipped with a graphical user interface to model the specific process using predefined process components. Moreover, it allows the edition of documents to store technical information that exceeds the business process view.

The partner profile (the specific CPP and 'enhanced' BPSS) forms the basis for the following Agreement Time.

4.3 The openXchange Agreement Time

The objective of the Agreement Time is to match the profiles of two business partners and create an agreement document that describes the common business process and the circumstances under that both partners will follow the process. It is important to notice that the process of matching two profiles is carried out by an information system with a minimised proportion of manual activities. The result of the Agreement Time is a file that contains both an ebXML CPA and a common 'enhanced' ebXML BPSS. In case the two profiles do not allow a successful matching, a log file is produced that contains information about matching details, e.g. statements such as 'transport protocol incompatible'. The Agreement Time architecture, as depicted in Figure 4, consists of three main openXchange components, which are:

MergeValidator & Matchmaker

1. Evaluator & Negotiator
2. CPA Generator

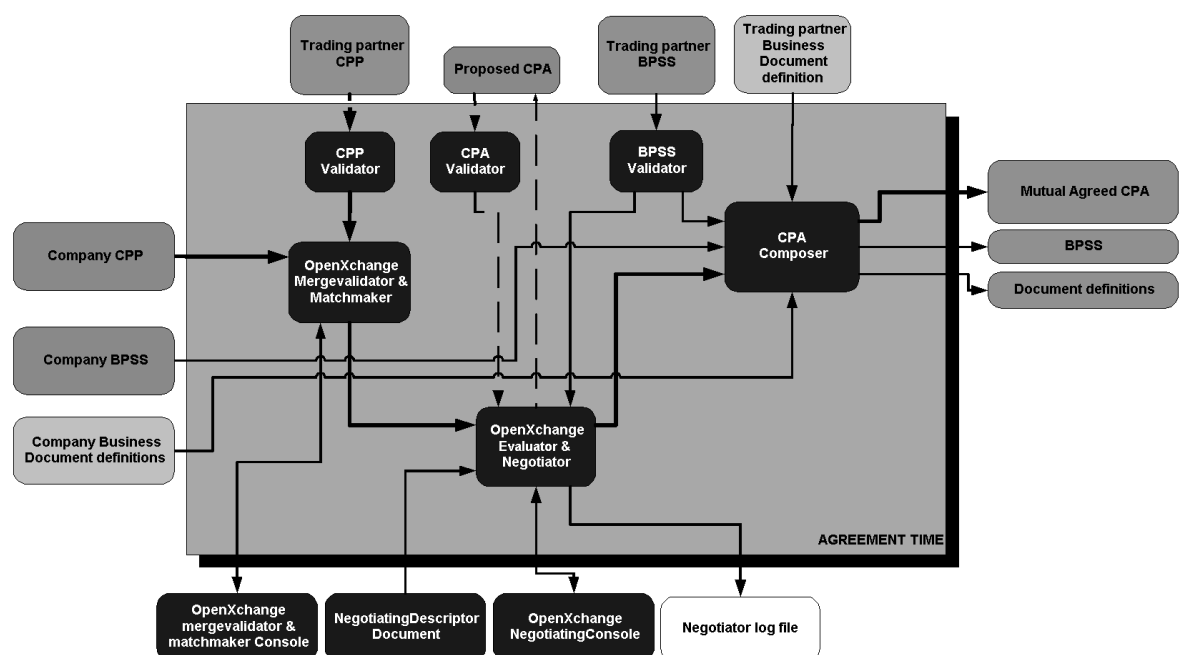


Figure 4. The openXchange Architecture at Agreement Time

After an agreement has been created successfully the information systems of both partners refer to that agreement during transaction time, i.e. when conducting e-business. In case the process was not successful the log file helps to identify the gaps between the two affected companies and therefore enables a strongly reduced customisations of the referenced IT-systems. The openXchange procedure then starts all over again from Modelling Time but then with a great chance of a successful creation of a CPA. By this means, although seen as a side effect, the openXchange Reference Architecture can be of great benefit in future cross-company business process integration projects.

4.4 The openXchange Transaction Time

During Transaction Time actual business is carried out. A triggering event (e.g. the initiation of the output determination of an ERP system) causes the instantiation of a certain business process. Business documents are then exchanged according to the business process specified in the common 'enhanced' BPSS and under the technical restrictions specified in the CPA.

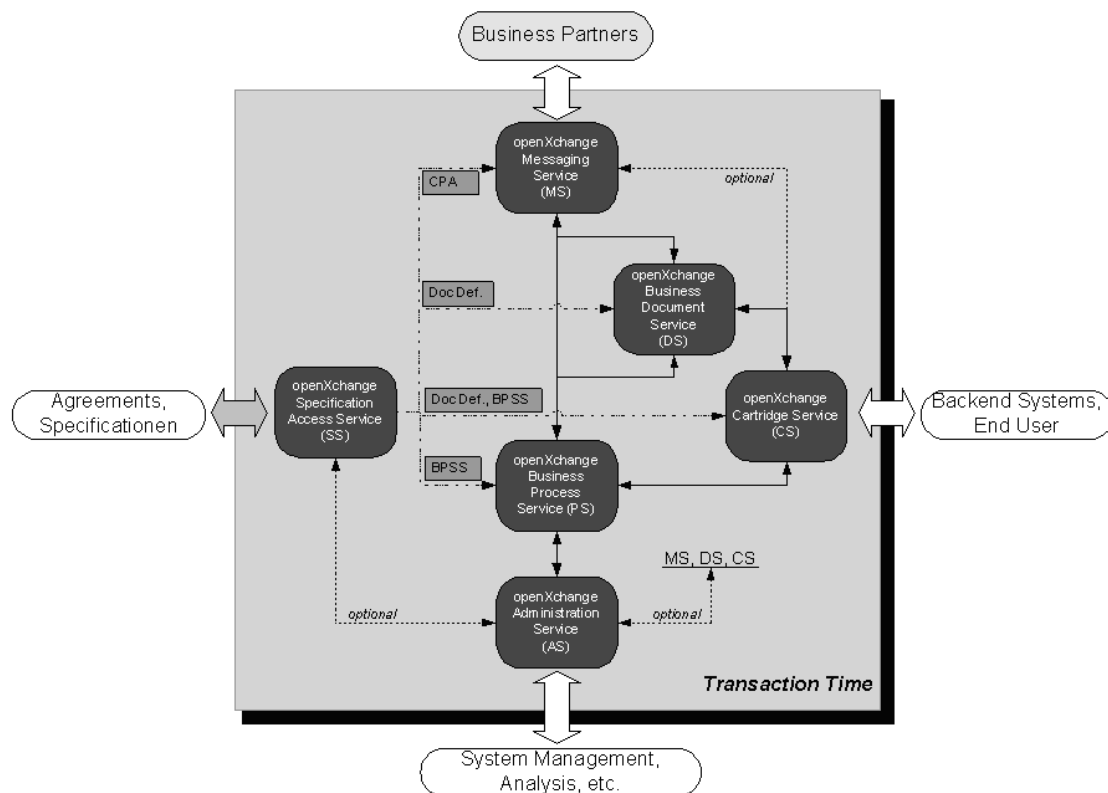


Figure 5. The openXchange Architecture at Transaction Time

At Transaction Time the architecture consists of six main openXchange components (see Figure 5):

1. 'Business Document Service' to validate single documents against specified restrictions
2. 'Business Process Service' to log and control the process execution
3. 'Messaging Service' to send and receive openXchange compliant messages
4. 'Cartridge Service' to provide the connection to existing information systems (e.g. ERP systems)
5. 'Specification Access Services' to provide access to the relevant XML documents
6. 'Administration Service' to allow administration of the environment

In this environment a business process instance is triggered by a certain event, e.g. the receipt of a purchase order in a specified XML based format, by the openXchange Messaging Service. After receipt the openXchange Document Service checks the transmitted information on feasibility and also checks whether the receipt of a purchase order is in line with the commonly agreed process. If so, the data gets posted into the underlying ERP system, which creates a response using the openXchange Cartridge Service again. The response is then formatted according to the specified formats and sent out to the business partner where the business process is continued. Therefore, an instance of the openXchange Architecture is necessary on both sides of the process to make sure that the agreed process is being followed.

5. BUSINESS APPLICATION AND IMPACT

The openXchange reference architecture is being applied at several pilot sites addressing different business areas and partial aspects of the reference in order to show proof of the overall concept. One pilot is located in the catalogue buying domain. It is designed for a flexible integration of business relationships with small and medium enterprises (SME) buying at the site of a manufacturer of electronic equipment. This pilot enables companies to serve business document standards, here e.g. openTrans for requests for quotations, orders,

etc., by on the one hand using a generic web interface to the environment or on the other hand by matching their back-end profiles to the supplier's profile and then executing the processes in an integrated environment.

The architecture allows thereby to create a 'win-win' situation for both buyer and supplier. The main advantage is envisaged to be the ability to easily adapt the profile also for newly business relationships. This will allow to cut down integration and implementation cost. In addition SMEs are enabled to use even complex XML document standards without having to implement all required back-end infrastructure by using web front-ends to the openXchange environment.

6. CONCLUSION

The openXchange project addresses one of the most important aspects of e-business, namely the integration of business processes and underlying systems. Current e-business activities often fail to provide reasonable implementation times and costs. High costs and long realisation times are mainly caused by problems of integration. openXchange provides an architecture that allows the automation of the integration process, thereby helping to reduce costs of ebusiness projects. The automation of the integration process can be achieved by providing not only a solution for the transaction time but also for the preceding phases (modelling, profiling and agreement time). In order to reduce the enormous complexity of the entire approach the openXchange approach does not support totally generic business processes but those that consist of a limited number of business process components for a certain industry or a certain domain. The modelling of the latter is based on the results of previous work of the participating project partners, e.g. the EP.NL project in the Netherlands or the E-START project in Germany. The openXchange Architecture is fully based on the utilisation of business standards such as ebXML as a process framework and document standards such as openTRANS. Continuous work on analysis, modelling and standardisation is necessary in order to meet the requirements of business processes in various other business areas for a later automated execution.

From the business perspective the most positive impact will arise only when the framework ebXML becomes widely accepted in the economy. Only when more and more companies provide their profiles and business processes complying to ebXML specifications a flexible integration of new relationships can take place. A first step into that direction is being taken by the developments of openXchange.

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