

B2B or not 2B – What do you mean by B2B E-Commerce?

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When A Min was a young guy in the mid-forties a new buzzword appeared: B2B e-commerce. During the first hype it was expected that B2B ability will become a knock-out criteria for selecting business partners. Now, A Min is celebrating his 50th birthday with glamour - but the first glamour of B2B is gone. B2B is back to reality, where it was at A Min's 40th anniversary. At that time A Min already recognized that communications between enterprises will become more and more important. He advised his student to concentrate on this topic. Here, the student reports about his work on B2B. We take a look at the history of B2B which started around the time when A Min was born. The history was mainly dominated by business document standardization efforts. The shortcomings of this approach are analyzed. If projects towards integrating small & medium enterprises continue this path, B2B will never take off. Therefore, a paradigm shift for B2B is proposed and an initiative called ebXML following this paradigm is presented. When we meet again to celebrate A Min's 60th birthday, I hope to report that the paradigm shift has happened and the phrase "B2B or not 2B" is reality.

1. Introduction

In the 1990ies, the commercial success of the World Wide Web (WWW) resulted in a new buzzword: Electronic Commerce, or short e-Commerce. New types of businesses appeared in the so-called New Economy. Doing business on-line did not only affect industry but also the academic world. A lot of research was directed towards business models, e.g. [14], as well as IT infrastructure for e-Commerce [12]. In the beginning, industry as well as the academic world viewed the WWW as a new marketing and sales platform [15]. These are the types of application the 'original' WWW - defined more or less as an hypertext service over the Internet - was able to support. In a next step, companies started to use the Internet as an effective medium to support all business services. Interest shifted to the support of inter-organizational communication processes. This area became known as Business-to-Business e-Commerce, or short B2B.

According to Stuart Feldman, director of the IBM Institute for Advanced Commerce, B2B e-Commerce transactions are dominated by high business value, long-term relationships, complex business processes, and inter-computer communications [2]. From an IT point of view, businesses

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as opposed to consumers are characterized by running software applications in order to support their business operations. Thus, efficient communication has to integrate these applications instead of running a Browser-based communication platform and off-line applications separately. In an ideal case, applications of different business partners will interact with each other to perform a business transaction and human interventions are only necessary in unpredictable error conditions. Accordingly, real B2B e-Commerce is characterized by Application-to-Application (A2A) interactions.

Nevertheless, A2A interaction in a B2B environment was neither a new concept nor a new practice, because it has existed for over two decades before the commercial success of the Internet. It started all by the concepts of Electronic Data Interchange (EDI). But EDI was for a long time in an embryonic, innovative phase, although a number of factors, including drastically reduced costs of computing hardware, software and telecommunications combined with the lifting of trade barriers should have let into a phase of exponential global growth much earlier. In the academic world not much attention was given to the concepts of EDI at that time. Most of the rare publications were focused towards the impact of EDI on organizational aspects. The computer science community more or less ignored the research area centred on EDI.

In 1993 - the Web was just born and EDI was still in a deep sleep - a university professor gave advice to one of his Ph.D. students to concentrate his work on the topics of EDI and inter-organizational systems. The professor argued that the sleeping beauty will awake soon by advancements in the communication technology. In the beginning - the Web was based on a rather static hypertext system - the immediate take-off of B2B did not seem to happen. Contributions of the Ph.D. student were more or less exotic to most of the conferences. Usually, he found himself in sessions with contributions on totally different topics. However, with the appearance of XML as lingua franca for data interchanges on the Web everything changed immediately. The professor's advice became reality and the student had a headstart into B2B which has become a hot topic both for industry and research communities. This paper represents an overview of the student's experience in B2B gained as a vice chair of the Techniques and Methodologies Working Group (TMWG) of the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT). It is a contribution of the student to say thanks to his professor for setting him on the right track.

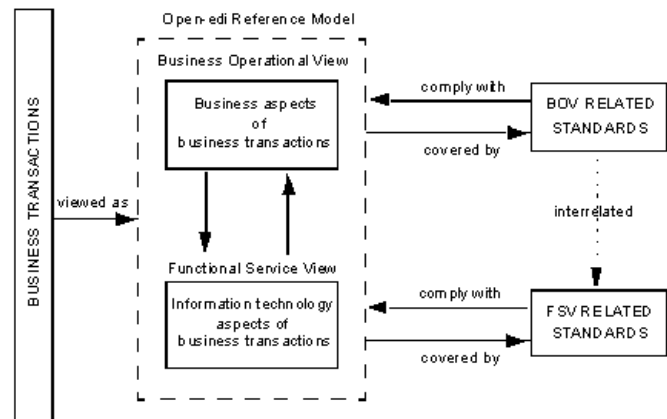
The remainder of the paper is structured as follows. Section 2 gives an overview of the most important initiative in B2B history. This history was dominated by approaches to standardize business document structures. In Section 3 we illustrate the problems of the current approach to standardize business documents. This approach - common to both traditional EDI and XML-based document standards - hampered the overall success of B2B so far. Consequently, Section 4 defines a necessary paradigm shift for future B2B initiatives. An initiative to support this paradigm shift is ebXML which is presented in Section 5. A short summary in Section 6 concludes the paper.

2. B2B History

The concept of a paper-less exchange of business documents was already created during the Berlin Airlift in 1948 [13]. However, it took some time until the first proprietary solutions of large corporations were developed. Recognizing the disadvantages of a closed user group led to the development of vertical standards, e.g. in the US Transport Data Coordinating Committee (TDCC) in 1968. Since business relationships commonly span over multiple sectors, the branch-independent standards ANSI X12 were developed in the US in 1983 and GTDI in Europe at around the same time. Owing to the globalization of trade, the UN/ECE/WP.4 (a predecessor of UN/CEFACT) started in the mid-1980ies an initiative leading to the UN/EDIFACT standards. The UN/EDIFACT syntax became an ISO standard in 1987 (IS 9735), whereas the first message type directory was published by the UN in 1990.

The literature in the 1990ies mostly reported success stories about EDI. Starting with the appearance of XML this rapidly changed and traditional EDI became one of the most criticized techniques. One might think that the EDI community was not conscious of the limitations of their approach before. However, the EDI community was aware of the drawback of bilateral agreements on subsets of ‘standard’ messages (see also Section 3). In the late 1980ies ISO created a working group

with the goal to specify a framework that allows business partners to exchange data without any prior communication agreements. This work resulted in the Open-edi reference model, which became an ISO standard in 1997 (IS 14662). Although the Open-edi reference model is on a rather high level of abstraction and does not go into any implementation details, its major contribution is the distinction between an Business Operational View (BOV) and a Functional Service View (FSV), which is depicted in Figure 1. The BOV is a perspective of business transactions limited to those aspects regarding the making of business decisions and commitments among organizations. The FSV is a perspective of business transactions limited to those information technology interoperability aspects of IT systems that are needed to support the execution of Open-edi transactions. The BOV related standards are employed by business users understanding the operating aspects of a business domain. The FSV related standards are used by the IT-experts [8].



UN/ECE/WP.4 itself was involved in the development of the Open-edi reference model and created in 1995 an ad-hoc committee AC.1 to research on technologies to support the Open-edi reference model. These technologies should lead to the next generation of edi standards. Note, that “edi” is intentionally written in lower case signifying alternative approaches to traditional EDI. AC.1 reported that business process modeling and object-oriented technology should help to describe the

real world of inter-organizational e-business. AC.1 proposed that next generation edi standards should be business process models for a particular business goal, including multiple possible scenarios. Trading partners will support one, more or all scenarios. In order for two trading partners to do business with each other they have to share at least one common scenario. It is envisioned that software providers will create applications that implement the most popular scenarios of business process models.

When UN/ECE/WP.4 reorganized itself to UN/CEFACT, the Techniques and Methodologies Working Group (TMWG) became the successor of AC.1. In 1998 TMWG recommended to use the Unified Modeling Language (UML) for modeling inter-organizational e-business scenarios to create BOV standards. At this time TMWG started to develop a methodology for inter-organizational business process modeling in order to ensure unambiguous definitions of business process models or BOV standards, respectively. The work resulted in UN/CEFACT's Modeling Methodology (UMM) [6, 16], which is a customization of the Rational Unified Process (RUP) [10]. The definition of BOV standards by applying UMM became known as object-oriented edi (OO-edi).

The development of XML started in 1996 and resulted in a W3C standard in 1998. XML provided a fast and non-bureaucratic way of defining electronic document types to be exchanged between business partners [17]. Within a short period of time a lot of XML-based business vocabularies were developed (cf. [9]). First success stories, like that of RosettaNet, underpin the strengths of XML in EDI. Similarly to the EDI history the proliferation of proprietary vocabularies was soon detected, and organizations started to develop solutions for certain verticals or user groups. Popular examples of such solutions include RosettaNet (<http://www.rosettanel.org>), Open Applications Group (OAG - <http://www.openapplications.org>), Open Financial Exchange (OFX - <http://www.ofx.net>), Open Travel Alliance (OTA - <http://www.opentravel.com>) and the Internet Open Trading Protocol (IOTP - <http://www.ietf.org/html.charters/trade-charter.html>). XML vocabularies shared by a large user group are certainly a step into the right direction. However, they ignore each other and have therefore incompatible implementations for the same semantic concepts, e.g. date (from a data-oriented point of view) or invoicing (from a process-oriented point of view). A comparison of several XML-based vocabularies and their concepts is contributed by Li [11].

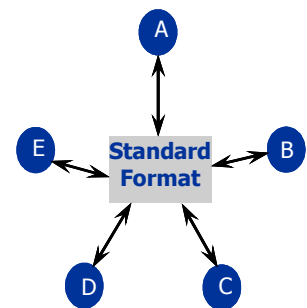
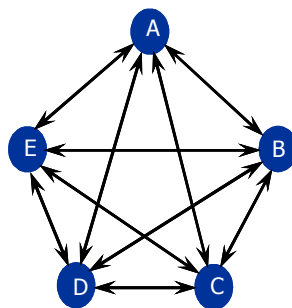
The above mentioned comparison includes also cXML (<http://www.cxml.org>) and xCBL (<http://www.xcbl.org>) the languages of the e-marketplaces of Ariba and Commerce One, respectively. Especially xCBL, which was influenced by the work of the eCo-Framework project [3], has a larger scope than today's e-marketplaces. The eCo workgroup on semantic recommendations initially wanted to create a full set of semantics for business documents expressed in an XML schema language. They recognized that the vast majority of interoperable e-commerce semantics has been defined in the area of EDI. Furthermore, they also concluded that the most significant problem in EDI is that of overloaded message types as described in Section 2. Given the short period of time the workgroup was only able to highlight critical design approaches and to produce a set of recommendations. These recommendations were illustrated by some samples of

business semantics using xCBL 2.0. xCBL was considered to be moving in the right direction in the use of SIMPL-edi a simplified subset of the UN/EDIFACT message standard. SIMPL-edi provides more focused EDI messages based on simple, standard international data elements and well structured master files using only about 20% of comparable UN/EDIFACT messages. However, SIMPL-edi was developed under the umbrella of UN/CEFACT in its ad-hoc group on SIMPLE-edi and forms & web based EDI (SIMAC). Accordingly, xCBL has started more or less as a reverse engineered subset of UN/EDIFACT message types expressed in an XML schema language. (Note, that reverse engineered does not mean automatic transformation by an algorithm). xCBL can be regarded as the first “joint effort” between the EDI and the XML community, although no co-operation did happen and no official link was created.

Owing to the growing popularity of XML and above mentioned vocabularies as ‘UN/EDIFACT replacements’, many UN/EDIFACT users asked in 1998 UN/CEFACT to look for an XML solution which should be compatible with existing UN/EDIFACT to protect their investments. TMWG was responsible for doing a feasibility study on using XML for B2B information transfer. The TMWG report on this subject rejected the idea of creating ‘Yet Another XML Solution’ by converting UN/EDIFACT to XML. This decision was mainly based on the fact that a syntactical transformation would hardly save any EDI problem, but would just add another e-business vocabulary to the XML world. Instead the recommendation was to built up on the Open-edi reference model by using business process modeling to create BOV standards and by using XML as key concept in the FSV layer. Additionally, TMWG suggested cooperating in the development of the solution with the IT-industry to combine UN/CEFACT’s business know-how with the experience of leading XML experts. The steering committee of UN/CEFACT accepted the TMWG recommendation and found an IT-Partner in the Organization for the Advancement of Structured Information Standards (OASIS) that shares the goal of open and inter-operable standards. This was the starting point for the ebXML (<http://www.ebxml.org>) initiative, which started in November 1999. The ebXML initiative will be described in more detail in Section 5.

3. Problems of Document Standards

The concept of a business document standard seems to be pretty straightforward. Instead of bilateral agreements between business partners, all business partners agree on a common format to be supported by all of them (see Figure 2). Each business partner involved must be able to map between in-house structures and the standard format for both incoming

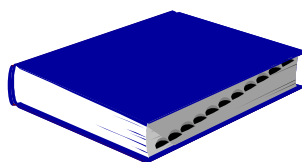


and outgoing business documents. This approach works very well on the syntactical level. It is easy to agree on a certain syntax, like that of UN/EDIFACT or XML.

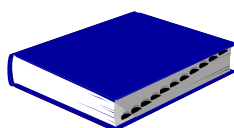
The crux is the content of the business document, which is independent of the syntax used. The resulting problems become even more obvious by considering a standardization effort for paper documents. Note, that the arising problems will be the same for electronic and paper-based documents. In order to standardize a paper document form, the concerned business partners have to agree on the structure of the document and the terminology used to identify the form fields. Usually, each partner will have a different opinion on the layout (= structure) of the document and the labels (= terminology) of the form's elements. After some discussions it is very likely that they come to an agreement on structure and terminology. The discussions necessary might be referred to as a "long and cumbersome" standardization process. Similarly, current standardization efforts of document standards are time consuming in order to define the semantics of elements as basic building blocks of documents as well as the structure of electronic documents.

The even more critical part concerning document standards is the question on which elements to include in a document standard. In a bilateral partnership it is easy to define the elements needed in a business document to perform a certain business function. If more and more partners join a partnership, all of them need their element requirements be represented in a document structure. It follows that some requirements of different partners are overlapping, but many elements are required by one or only a few partners and are not of interest to others. The solution to this problem seems to be straightforward. The business partners agree that elements not required by all partners become optional elements.

It is exactly the approach described above that leads to the most significant problems in B2B document standards. Document standards should be shared by as many partners as possible – ideally by all companies and organizations independent of their geographical location and type of industry. A globally valid standard document has to include all elements that are required by any company or organization around the world. This results in a very large number of optional elements. In terms of paper based systems this means that a standard document will be represented by a very large book. Nobody will ever present the whole “standard book” of a standardized purchase order to his customers and asks them to complete all (optional) elements within this book. Instead he will direct his customers to complete only certain elements and notify them about some rules to consider (e.g. a certain element must be completed only if another one is of a certain value).



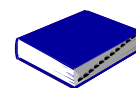
Standard



MIG
User Group



MIG
Company



MIG
Partner-specific

The same situation applies to standard business documents in the electronic world. For example, in UN/EDIFACT a “flattened” purchase order consists of about 1200 data elements, most of them are optional. So-called message implementation guidelines (MIGs) are used in order to adopt the overloaded standard documents to the business needs. A MIG is a well defined subset of elements associated with some rules to complete these elements. Usually, user groups (representing business partners in a certain industry and region) define MIGs for their respective members. E.g. the European Article Number Association (EAN) defines a MIG for a purchase order, including about 400 elements that seem to be useful for their members. Nevertheless, the EAN MIG is still overloaded. Most likely, no information system of any member will ever be able to handle all the 400 elements. Thus, big players usually define MIGs that exactly fit their needs and their information systems capabilities. In case of a purchase order, a company-specific MIG covers usually about 25 elements, which is only about 2% of the standard document. Unfortunately, the big players use different MIGs or in other words different elements. It is quite common that a big player dictates his MIG to all his smaller business partners. Only if big players not dictating the business relationship have to communicate with each other, they must harmonize their MIGs.

It follows, that big players are in a lucky situation. They have to deal with only one or at least a small number of different MIGs. Smaller business partners face the problem that they have to support multiple MIGs, if they have to communicate with multiple partners. For each MIG a business partner has to implement a mapping between in-house data structures and the exchange document format – either by means of a converter tool or by hard coding. Implementing various MIGs makes B2B expensive. Small companies cannot effort this.

Business document standards are able to standardize the syntax as well as elements and their overloaded structure. However, there is still a need for bilateral agreements on the level of the MIG. Implementing bilateral agreements hampers the overall success of B2B document standards. One might argue that these are failures of traditional EDI. Nevertheless, the generalization & specialization dilemma—specifying a general structure in order to reflect the requirements of a large user base and to specialize this structure for the requirements of certain business relationships—is independent of the syntax [5]. Therefore, following a similar approach in an XML environment in which database structures of individual organizations are harmonized would lead to the same problems [7]. By flattening Commerce One’s XML Common Business Library (xCBL) purchase order type one will count about 16000 data elements². Unfortunately, the average of instantiated data element types is not known, but it should be only a limited fraction.

Business documents standard have another major problem. They offer a pure data centric view. Business processes which drove the specification are not documented. However, business processes drive business data to be exchanged. Furthermore, business processes drive the choreography

² Note that xCBL only uses about 20% of the semantics of UN/EDIFACT. The misleading absolute number of 16.000 xCBL and 1200 UN/EDIFACT data elements is a result of having more specific elements in xCBL and more generic ones in UN/EDIFACT. The difference gets even worse by the flattening effect.

according to which business data is exchanged. Hence, lost business process information must be reconstructed by human intervention. For each business partnership this has to be done over and over again.

4. A Paradigm Shift for B2B

As mentioned in the previous section an approach focusing only on business document standardization is not best suited for B2B. It was mentioned that especially smaller enterprises face difficulties in this approach. Thus, an approach that fits the needs of these enterprises is required. As a first step it is necessary to analyze the characteristics of these enterprises and their specific needs. Usually, enterprises are classified into the following categories: large, medium, small, and micro enterprises. The European Union (EU) uses the number of employees, the turnover and the balance sheet total as parameters to classify enterprises:

Table 1. EU Classification of Enterprises

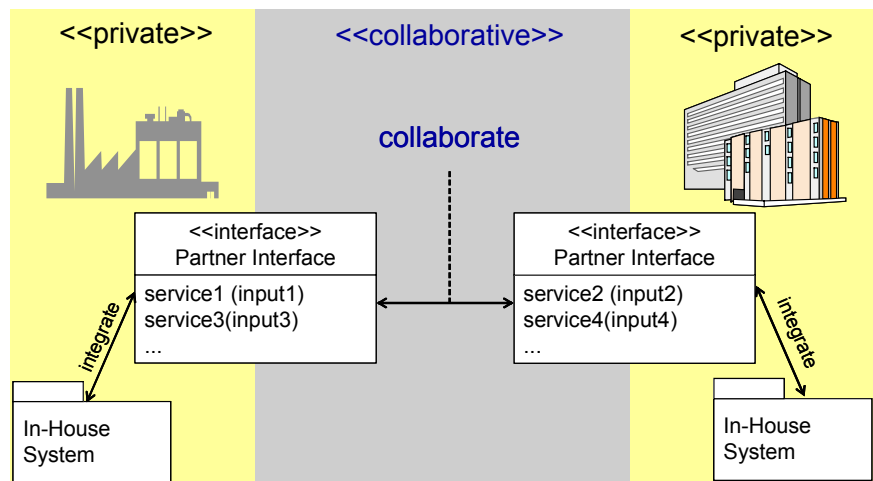
	Medium	Small	Micro
Employees	< 250	< 50	< 10
Turnover	< 40 Mio €	< 7 Mio €	-
Balance sheet total	< 27 Mio €	< 5 Mio €	-

The EU classification does not seem to be appropriate to classify enterprises according to their B2B capabilities. In regard to the classification for B2B capabilities we will differentiate between large enterprises, small & medium enterprises, and micro enterprises. Both large and small & medium enterprises (SMEs) use IT applications to run their business, e.g. a purchase order handling package. Micro enterprises commonly do not make use of IT applications. There is nothing to integrate with in order to realize A2A exchanges for B2B. Inasmuch, Micro enterprises behave rather similar to consumers. Browser-based web forms are appropriate for their needs. Thus, Micro enterprises will not be considered any further.

Accordingly, large and small & medium enterprises are candidates for B2B e-commerce. Today, large enterprises are the ones who already run B2B partnerships. SMEs only participate if they are forced to. Large enterprises either code their own software or they customize ERP-packages (e.g. SAP) to their own needs. Either way it is done, they have control over the interfaces to their applications. This means that they are able to implement a mapping between a B2B document format and their own in-house system. It might be expensive, but it works for large enterprises. SMEs usually buy software packages that fulfil certain business functions, install and run it. They do not have any control over the interfaces of their applications. This means that they are not able to perform any mapping. This is the reason why a mapping-based approach will never work for SMEs.

As a consequence, SMEs will only be able to participate in B2B e-commerce if they are able to buy corresponding software packages. Such a software package must provide both the business functions needed (e.g. purchase order handling) and the B2B functionality (e.g. ordering goods from a business partner). Only if these functions go hand in hand together in low cost commercial off-the-shelf software (COTS), we will see B2B e-commerce to take off. However, this requires a paradigm shift for producing B2B standard specifications. These specifications must unambiguously describe inter-organizational business processes with respect to their choreography and the involved document structures. Only unambiguous definitions allow software vendors to integrate these processes into their software products.

Today, the object-oriented approach is the preferred choice for designing and implementing in-house systems. An application is built by collaborating objects. When designing the applications, different designers will not develop their classes in isolation. Otherwise the objects would not collaborate. Designers clearly define how one object

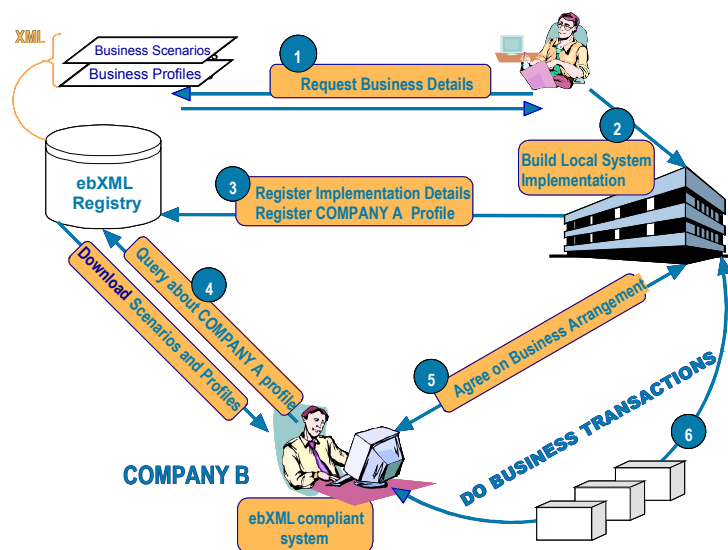


invokes the other. A similar approach is necessary for a B2B system (see Figure 4). A B2B system consists of the private areas on each partner's side and a collaborative space in-between. The B2B functionality of each participating partner must be realized by a partner interface class sitting at the border of the private and the collaborative space. An inter-organizational system or so-called business collaboration must be built by collaborating partner interface classes. When designing the business collaboration, designers of different partners must not develop their partner interface classes in isolation. Otherwise the interface classes would not collaborate. This is what is currently happening in most approaches using web services. B2B standard specifications must unambiguously define the collaborative space of a business collaboration, or in other words define the collaboration of partner interface classes. They must not consider the private space. Software vendors will use the unambiguous partner interface class definitions to integrate them into their products supporting a corresponding role in a business collaboration.

5. ebXML

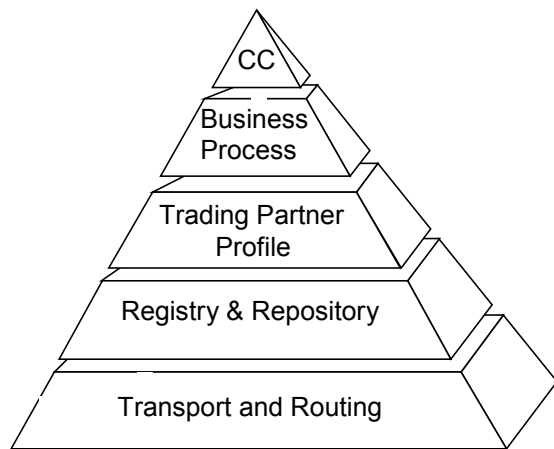
An initiative that follows the paradigm shift presented in the previous section is ebXML [4]. In 1999, the industry leaders UN/CEFACT and OASIS (Organisation for Advancement of Structured Information Standards) started this joint project. The vision of ebXML is to create a single global electronic marketplace, where businesses can find each other, agree to become trading partners and conduct business. All these operations will be performed automatically by exchanging XML documents. In order to support the needs of SMEs, ebXML envisions that software industries will deliver commercial off-the-shelf software (COTS) for B2B scenarios to the SMEs. This goal is expressed in the following, typical ebXML scenario between a large corporation (Company A) and a SME (Company B) as illustrated in Figure 5. This scenario is described in the ebXML technical architecture specification [1].

Company A requests business details from the ebXML registry (step 1) and decides to build its own ebXML-compliant application. Company A submits its own business profile information to the ebXML registry. The business profile submitted to the ebXML registry describes the company's ebXML capabilities and constraints, as well as its supported business scenarios. Company B, which uses an ebXML-compliant shrink-wrapped application, discovers the business scenarios supported by Company A in the registry (step 4). Company B



sends a request to Company A stating that they would like to engage in a business scenario (step 5). Before engaging in the scenario, company B submits a proposed business arrangement directly to Company A's ebXML-compliant software interface. The proposed business arrangement outlines the mutually agreed upon business scenarios and specific agreements. Company A then accepts the business agreement. Company A and B are now ready to engage in e-business by ebXML (step 6).

For this purpose ebXML offers a modular suite of specifications. These specifications provide a standard method to exchange business messages, conduct trading relationships, communicate data in common terms and define and register business processes. In contrary to other initiatives, ebXML addresses all aspects of B2B e-commerce. Thus, ebXML provides the most complete framework definition for B2B e-commerce. However, it is important to note that ebXML is not an "all or nothing" approach. Each of the modular specifications is consistent by itself. Thus, ebXML implementations might also make use of non-ebXML modules for certain functions when appropriate.



To support the ebXML scenario described above the ebXML specifications describe a way to define business processes and business documents that are exchanged to support these processes. Accordingly defined business processes and documents may be made public in a registry. ebXML specifies a mechanism to register and discover processes and documents. The total set of registered business processes in a registry defines the possibilities in an e-business world. Each organization participating in the e-business world may define its capabilities (IT capabilities, communication protocols, security requirements, supported business processes) as a

subset of what is possible. These company profiles called collaboration protocol profiles may be stored in a registry as well. This allows companies to query possible business partners and the way to conduct business with them. Before business partners can actually do business with each other they should build a trading partner agreement. This collaboration protocol agreement corresponds to an intersection of their profiles and includes additional results of negotiating variable parameters. In addition, ebXML defines a transport and routing layer to move the actual XML business documents between trading partners.

Accordingly, ebXML is structurally based on subsequent layers as shown in Figure 6. On top there are core components (CC), which will be assembled into business documents. The definition of business processes on the next layer will refer to business documents / core components supporting a single step in the choreography of a business process. The trading partner definitions on the next layer include a collaboration protocol profile that refers to the business processes and the roles therein a certain company is capable of. Furthermore, the layer includes collaboration protocol agreements that are formed by the intersection of individual collaboration protocol profiles. The registry and repository on the next layer must be able to register core components, business documents, the choreography of business processes, and collaboration protocol profiles. Each of the registry and repository must be assigned with a unique identification in order to allow a referencing mechanism as described above. The bottom layer of transport and routing has to ensure the messaging services needed for exchanging business documents at runtime.

6. Summary

The idea of B2B exists for about 50 years. Many efforts were on the way to allow seamless communication between different enterprises' applications. Most initiatives were centred on the standardization of business document types. The approach taken is to create overloaded business document types that are able to capture the requirements of any user of the document. This means that the document types fit the needs of everyone, but are not perfect to anyone. Thus, the

overloaded document types have to be customized for a business partnership by a bilateral agreement. According to this bilateral agreement a mapping between in-house structures and document types must be created. This makes the approach rather expensive.

When people started to recognize the drawbacks of bilateral agreements, XML entered the market. XML was announced to solve the problems of B2B, even for SMEs. However, following the same path as traditional EDI did before, does not solve any problem. SMEs will never be able to receive a message and import it into their application. Neither they have neither the power to do so, nor do their applications offer open interfaces. Consequently, we need to develop software that provides the business function and the B2B function in one single package. This requires unambiguous definitions for business collaborations to allow software vendors to integrate corresponding interfaces into their products.

An initiative that follows this approach is ebXML. Hence, ebXML is a world-wide initiative that tries to address the drawbacks of existing standards and approaches. It has the potential to successfully deliver solutions to these problems. ebXML defines unambiguous inter-organizational business processes. Documents exchanged within a process are built by reusable core components. Business process choreography and referenced documents are stored in a registry. Furthermore, the registry covers profiles of companies that express a company's ability to play a certain role in a business process. This allows companies to find each other and to agree to do business according to a well-defined business process. In addition to that ebXML specifies a SOAP-based messaging to realize the communications between business partners

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