Crossing the Boundaries: e-Invoicing / e-Procurement as native ERP features

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Abstract. Electronic Invoicing has attracted a lot of attention by being a cornerstone of the Digital Agenda for Europe, Europe's 2020 Strategy. This agenda mandates a "think small first" principle in order to enable e-invoicing for companies of any size. The electronic invoice should be exchanged between the ERP systems of business partners. Traditional approaches based on electronic data interchange failed to attract SMEs. Due to the high costs, they only use e-invoicing if forced by their larger business partners. In this paper, we present an alternative approach that is based on native ERP integration of most common e-invoice scenarios. This approach was successfully implemented in a research project resulting in a university spin-off.

Key words: Electronic Invoicing, Enterprise Resource Planning, Electronic Data Interchange, Inter-organizational Systems

1 Motivation

The Digital Agenda for Europe [1] is one of the seven flagship initiatives of the Europe 2020 Strategy . Its overall aim is to "deliver sustainable economic and social benefits from a digital single market based on fast and ultra-fast internet and interoperable applications". The communication of the European Commission on "Reaping the Benefits of Electronic Invoicing for Europe" [2] underpins the importance of e-Invoicing as part of the Digital Agenda. Accordingly, the European Commission wants to see e-Invoicing become the predominant method of invoicing by 2020 in Europe, because it is expected to save around EUR 240 billion over a six year period and to decrease CO_2 emissions of 1 million tons per year by reducing paper consumption and energy costs for transportation.

Nevertheless, e-Invoicing is a challenging goal since the communication also mentions that – according to a Eurostat Report on Enterprises Sending and/or Receiving e-Invoices [3] – the adoption rate of e-Invoicing is 42% by large companies and 22% by SMEs, leading to a rather low penetration rate of e-Invoices estimated at about 5% of all invoices. These low numbers are surprising, since e-Invoicing offers significant benefits compared to paper invoicing. Most of these benefits do not arise from savings in printing and postage costs (which are only

achieved by the sender), but rather from full process automation. In this context, one should note that invoices represent just a single step in an overall sales/procurement process. Thus, it is important to incorporate e-Invoicing in a series of business document exchanges resulting in the full electronic support of inter-organizational business processes. A straight-through processing of all business document exchanges will result in the following benefits: elimination of re-keying redundant data, fewer errors, faster transaction times, less inventory cost, shorter payment delays, less interest charges, better planning capabilities, etc.

Although these benefits are commonly known, the communication of the commission concludes that e-Invoicing is still too complex and costly, in particular for SMEs, which hampers its widespread adoption. Traditional Electronic Data Interchange Standards (EDI), such as UN/EDIFACT [4], which are used by many multinational companies are impractical for adoption by SMEs. With the appearance of XML new business document standards were introduced [5]. Although the markup-based XML document standards may provide advantages over a delimiter-based EDI syntax, the principal approach to develop business document standards did not change. As we outline in section 2, this approach results in significant drawbacks for SMEs. However, the Small Business Act [6] committed the EU to the "Think Small First" principle, or in other words, to focus in particular on the needs of SMEs. Thus, the EU communication on "Reaping the Benefits of Electronic Invoicing for Europe" [2] stresses the importance that e-Invoicing service providers develop services and solutions that require a low investment in infrastructure and skills for SMEs.

2 The failure of traditional approaches

Exchanging business documents, such as electronic invoices, between ERP systems is not new at all. In particular, large corporations have been implementing so-called electronic data interchange (EDI) [7, 8] solutions for more than 30 years. EDI leads to a cross-organizational business document exchange between ERP systems of two business partners without human intervention. Usually, EDI systems are based on business document standards. Still most common are solutions based on the delimiter-based UN/EDIFACT standard [4]. However, we recognize a move towards XML-based standards, such as UBL [9], even if this move takes place much slower than expected.

When referring to a "standard" one would expect that an enterprise that supports a certain standard, e.g. UN/EDIFACT, may send an invoice to any other enterprise that also supports this particular standard and that the receiving enterprise is able to process the invoice without any problems. However, this is not the case for the dominant business document standards (both UN/EDIFACT and XML ones). This is due to the fact that these business document standards are more or less designed as a reference document that has to be customized for partner-specific implementations. The "standard" covers the union of all elements that may be required by any enterprise in any industry in any geopolitical

region. This reference model of the "standard" is than restricted by a so-called message implementation guide (MIG) to the specific needs of a particular supply chain. This subset usually covers only 3 to 5% of the "standard" referenc model. By following this approach one may implement supply chains with a high performance, such as the just-in-time (JIT) implementations in the automotive industry. Large corporations use their economic power to enforce a particular MIG on their smaller partners along the supply chain. This results in a closed user group, i.e. an extranet, along the supply chain which supports a certain "dialect" of a standard.

Evidently, it is a prerequesite to implement a dedicated interface for a specific MIG in order to participate in an extranet. It is quite common that a new interface to the ERP system goes hand in hand with a customization of the ERP system itself. Accordingly, the implementation of a new MIG does not only require a lot of technical skills and know-how, but it is also quite cost-intensive. Thus, SMEs are rather reluctant in implementing EDI and are usually only willing to implement EDI when being forced by a more powerful business partner. This leads to the economic paradoxon that most commonly larger corporations can stick to a single MIG implementation, but smaller ones trading with multiple larger corporations have to suffer from the costs of multiple implementations. This is due to the fact that different dialects, i.e. different MIGs of different extranets are not compatible with each other. When participating in another extranet one has to bear the costs of another implementation of a MIG even if it is based on the same "standard".

3 An open e-Invoicing Platform

Already in 2005, we have proposed a theoretical framework for the types of systems that are used by companies of different size, which has been recognized by the e-Business W@tch of the European Commission [10]. The main idea can be outlined as follows: Only larger companies have in-house application developers or can afford hiring external consultants that are able to customize the interfaces to their ERP systems in order to participate in EDI/XML-based business document exchanges. Smaller companies prefer to buy commercial off-the-shelf (COTS) systems and are rather reluctant to spend plenty of money on external consultants to extend their systems, if not absolutely needed or not forced to by business partners. Thus, they have to rely on the functionality provided by these systems. According to the "Think Small First" principle, it follows that ERP vendors should implement common B2B scenarios in their products.

Following this basic EDI our group at the Vienna University of Technology joined forces with three Austrian software providers (BMD Business Software, Mesonic and Blue Monkeys) to conduct the research project ERPEL [11] to deliver a prototype implementation for the Austrian market. The results of the ERPEL project were convincing to start a university spin-off offering an open platform to conduct business document exchanges between ERP systems on the

fly. The main characteristics of the ERPEL platform are outlined in the following subsections.

3.1 Enabling B2B communication as a native feature of ERP systems

Today, the exchange of structured business documents is usually not a native feature of ERP systems. Such B2B communication is realized by external functionality, implementing enterprise application integration (EAI) features. Due to the high variability in document standards, message implementation guidelines and underlying communication protocols, these extensions require a high effort in customizing the solution to the individual needs. If not forced by larger business partners, SMEs are not willing to bear these costs. In contrary, ERPEL implements the B2B communication as a native feature of ERP systems. This results in a direct GUI integration eliminating the boundaries between ERP features and B2B communication. Thereby, sending a business document becomes as easy as printing a document. A document received via ERPEL is seamlessly "absorbed" by the ERP system without human interaction. In order to realize native ERPEL interfaces in ERP systems, we have special demands on the business document formats and the exchange protocol, detailed below.

3.2 Providing a document exchange protocol enabling full trace of exchanged documents

Usually, it is of interest to the sender of a business document to immediately know the status of the document, i.e., what happened to the document after transmission: Has the document been accepted by the platform? Was the document successfully delivered to the inbox of the recipient? Has the recipient picked up the document from the inbox? Was the recipient's system able to process the document? Am I still able to revoke the document (in case it has not yet been picked up)? Answers to these questions are given in the GUI of the ERP system, once the users opens up the corresponding business case. It follows that these requirements demand a business document exchange protocol on top of well-established network protocols, reflecting the status of the document delivery. The ERPEL document exchange protocol supports these requirements by means of business signals. Our protocol guarantees the necessary level of trust in electronic document exchange that conventional protocols (e.g., e-Mail/SMTP) are not able to provide.

3.3 Permitting business document exchanges without the need for prior technical agreements

Shortly after the first UN/EDIFACT implementations, the major roadblock for its widespread adoption became apparent. The initial high costs of establishing a partnership may be justified only for long term partnerships and between a limited number of partners. According to the Open-edi reference model [12],

these initial costs arise mainly due to the fact that business partners have to agree on a message implementation guideline (MIG), which requires a customized implementation for each of these partnerships. Open-edi suggests "introducing standard business scenarios and the necessary services to support them. Once a business scenario is agreed upon, and the implementations conform to the Open-edi standards, there is no need for prior agreement among trading partners other than the decision to engage in the Open-edi transaction in compliance with the business scenario". So far Open-edi remains a theoretical concept without any implementations. Nevertheless, we pick-up the Open-edi idea and provide a set of procurement business document types, whereby each of them is based on a core set of elements. A participant on the ERPEL platform may decide whether or not to support a specific document type. If a document is supported, the entire core set has to be understood. Thus, a simple lookup in the ERPEL registry ensures that a partner is capable of processing a certain business document type. This approach, which is in contrary to traditional ones, has been proven in Austria by the successful ebInterface initiative, which refers to invoices only.

3.4 Developing a simple extension mechanism for advanced business document requirements avoiding a proliferation of individual solutions

As mentioned before, the core business documents of ERPEL reflect the most important requirements requested by all business domains. In order to cope with the challenge of business domain-specific requirements that go beyond the core, ERPEL foresees a dedicated extension mechanism for the six core business documents. In order to avoid a proliferation of extensions caused by numerous bilateral agreements leading to an extension, the goal of ERPEL is to maintain a controlled set of extensions that have a well-defined hook in the core documents. ERPEL cooperates with the Austrian Economic Chamber on domain-specific extensions. Nevertheless, we still follow the Open-edi idea: If a company supports a specific extension, this information is declared in the ERPEL registry. Again, a simple lookup in the ERPEL registry ensures that a partner is capable of processing a certain document extension. This simple lookup replaces a complex technical agreement as used in traditional EDI systems.

3.5 Focusing on an open platform approach

Even if the concept of exchanging documents via a platform has been implemented before, these solutions are limited by a closed world approach. In other words, traditional platforms offer only the functionality, which has been implemented by the platform provider and third parties are hardly able to provide additional services on the platform. However, B2B interactions require a multitude of specialized and dedicated services, which are already offered by other service providers. In order to make use of these dedicated services, they should be seamlessly integrated into the document exchange platform. Consequently,

ERPEL follows an open platform approach. This means on the one hand that ERPEL provides the basic functionality of a document exchange and on the other hand that ERPEL provisions additional services, offered by third parties. Accordingly, ERPEL realizes the concept of a B2B app store for these additional services, which are further referred to as B2B apps. Third party providers may integrate their B2B apps on the platform and register them in the B2B app store. Users of these B2B apps are able to subscribe to them and utilize their functionality to meet their demands.

3.6 Additional B2B services leading to a fully-fledged B2B solution

As outlined above, companies may require additional services that go beyond the exchange of business documents. These services include for example digital signing of business documents and archiving of documents. Another type of offered service may cover business performance analysis by providing statistics on the document exchanges to the involved parties. Additionally, we also envision B2B apps realizing business functionality that is important for establishing new partnerships such as checks of creditworthiness, VAT numbers, and correct addresses. However, especially SMEs are unlikely to implement such solutions on their own or integrate different software packages to achieve the desired functionality. They want fully-fledged and out-of-the-box solutions involving no or only limited customization. ERPEL meets these needs by demands of its app store.

3.7 Lookup of customer and product information in the ERPEL registry

A central feature of the ERPEL infrastructure is a business registry. As mentioned above, the provision of registry functionality is key to enable the Open-edi vision of exchanging documents without prior technical agreements between the different partners. Accordingly, the registry covers the information which partner is capable of processing which documents and which extensions. In addition, the registry covers semantically enriched information about products and services offered by the ERPEL participants. Following the ERPEL approach, the product information is taken directly from the ERP systems of the business partners. Thereby, the ERPEL registry supports the information and selection phase of a business transaction enabling the search for potential business partners offering a desired product or service. Once a business partner has been found in the registry, the business transaction is conducted by exchanging business documents via ERPEL.

4 Conclusion

Following reports from the European Commission [2], it is envisoned that e-Invoicing is becoming the predominant way of issuing invoiced by 2020. In order

to reach a critical mass it is a necessity to deliver an inexpensive solution for SMEs that does not require any expert know-how. Traditional EDI standards and current XML-based standards fail in delivering such a solution for SMEs. Thus, we propose an integration of the business document exchange functionality in the ERP system itself. In the research project ERPEL we have implemented a prototype for the Austrian market in collaboration with three Austrian business solution providers. The ERPEL prototype is now extended by a university spin-off "ecosio" which offers a platform with the following characteristics:

– It is a *platform for exchanging business documents* of a procurment process, such as electronic invoices, without the need to prior agreements and partner-specific customizations.
– It is a solution that is *directly integrated into ERP systems* enabling ERP to ERP exchanges without any human intervention.
– It is a *ready-to-use* system where ERP vendors integrate a dedicated module into their ERP software.
– It comes *without any initial costs*, since the solution is part of the ERP system.
– It is *easy to use*, since the solution is integrated into the native user interface of the ERP system.
– It is a solution for companies of any size following the "Think Small First Principle" which does not require specific know-how nor high costs.
– It is *reliable*, since the business documents are exchanged as "registered letter". Users are able to fully trace the exchanges and are informed when the business document is delivered to the partner and when it is picked up by the partner.
– It is *secure* by building up on state-of-the-art authentication and authorization mechanisms.
– It is *inexpensive* and does not cost more than exchanging business documents by snail mail.
– It is fast since business docuements are transferred from one ERP system into the other within seconds.

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