

# DEPLOYMENT OF e-INVOICE IN CROATIA

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Abstract: Deployment of e-Invoice infrastructure promises great savings in business transactions costs. But, due to slow transition from socialist economy, Croatia has just begun planning deployment of e-Invoice infrastructure in accordance with recently released national strategy for development of e-Business. Unfortunately, existence of globally competing standards makes decision making much harder. Technical sophistication of ebXML standard hasn't prevailed in struggle for global dominance with much broadly implemented technology of web services. Some compromise will therefore be necessary. Paper presents overview of different standards considered as candidates for deployment of e-Invoice infrastructure in Croatia, as well as details regarding particularities of Croatia's legal and business environment.

## 1 INTRODUCTION

Landscape for doing business has changed dramatically in the last decade, thanks to advances in information technology, coupled with big expansion of available network bandwidth. Although EDI (*Electronic Data Interchange*) systems have been around for decades (Hayes, 2002), gains from their introduction were realized mostly by large enterprises because of the economies of scale EDI required in order to get return on investment. EDI was introduced over value-added networks (VANs), which served as the common communication method but were expensive, with an initial cost of about US\$ 250,000 for a mainframe installation and subsequent fees as high as US\$ 0.70 per transaction (Albrecht *et al*, 2005).

Because of this high demand on ICT investments, small and medium-sized enterprises (SMEs) that form the backbone of developed world economies have hesitated with adoption of EDI (Banerjee and Golhar, 1994), but explosive growth of Internet as cheap and widely available information exchange platform has given them affordable alternative.

Emergence of XML and Web Services standards and their fast global adoption has certainly helped in

that regard. From Clipper and dBase to Java and .NET, software development industry has come a long way. Ease of developing simple business applications with the use of modern integrated development environments (Microsoft Visual Studio, Eclipse, IBM WebSphere) has put e-Commerce definitively within reach for SMEs.

Unfortunately, fundamental problem has remained the same – how to enable secure and semantically meaningful communication between different information systems. XML as a standard certainly defines „how“ to construct a valid XML document, but it doesn't say (nor it is its purpose) „what“ to put in XML schema that will represent some business information. Problem is similar with the set of specifications related to the technology of Web Services. They define basic infrastructure for message exchange, but there are multitude of issues regarding security and service discovery that have to be agreed between parties before message exchange can take place.

E-Invoice, as the most used electronic document (dubbed as „queen of commercial documents“) provides a case in point. There are literally hundreds of different definitions for XML schema representing e-Invoice in the world today and this was, and still is, one of the major stumbling blocks

for wider adoption and implementation of e-Procurement. Fortunately, at least there is widespread agreement that XML must be the underlying format for the message (Nurmilaakso, 2008).

Situation is much worse regarding standardization of infrastructure for message exchange, usually called “interoperability framework”. Efforts at standardization by UNCEFACT/OASIS alliance which started in 1999 and resulted in ebXML standard didn’t lead to wider adoption, mostly due to technical complexity of implementation and lack of support from major software vendors. Prevalence of web services as message-exchange “standard” on the Internet hasn’t gone unnoticed by ebXML committees and in its most recent version 3.0, ebXML turns to Web Services technologies, using WS-Security and WS-Reliability as standards for security and reliable transport.

In the following sections we will first give an overview of efforts at e-Invoice standardization in Europe and then proceed with the review of basic technologies relevant for deployment of e-Invoice. Situation in Croatia regarding e-Invoice is described in the final part of the paper.

## 2 e-INVOICE IN EUROPE

Realization of electronic invoicing has potential to reduce supply chain transaction cost in corporate and public sector by 243 billion Euros annually (Bryant and Liezenberg, 2008). Although such projections must always be taken with the grain of salt, it is clear that electronic invoicing is the way of the future.

The European Commission has made the development of e-Invoicing an objective in both the 2002 and the 2005 eEurope Action Plans and recently launched European Commission Expert Group with the objective of developing a European Electronic Invoicing Framework (EEI) in the timeframe 2008-2009. EEI has the scope and objective to „provide the basis to achieve interoperability of e-Invoicing solutions in the public and private sector” and to “help strengthen the positive commercial incentives for electronic trade as a replacement to manual paper-based processes” (European Commission Informal Task Force on e-Invoicing, 2007).

Considering the national differences in EU regarding status of e-Business development, it is not

at all surprising that some countries didn’t wait for EU-wide initiative and had started work on e-Invoice on their own. Northern European countries in particular are leaders in this area. Probably the most cited example is Denmark with reported savings of 100+ million Euros after their “big-bang” implementation of e-Invoice in 2005 (Brun, 2007). After initially introducing e-Invoice based on traditional EDI Value Added Network combined with OIOXML and UBL 0.7, Denmark is currently in the progress of introducing service-oriented e-Commerce network based on UBL 2.0, SOAP 1.1 (1.2), UDDI 3.0 and WS-\* standards.

Finland is another example. Its implementation, Finvoice, uses custom XML format for representing invoice, enclosed in an electronic envelope with the additional use of ePI (*Electronic Payment Initiator*) standard (Cimander and Kubicek, 2006). In Croatia’s neighborhood, Italy is in the process of deploying CBI as a variant of interbanking VAN where banks act as portals and intermediaries for e-Invoice users. Slovenia has ambitiously started e-Slog project, trying first with direct translation of EDIFACT (EANCOM) norms to XML but recently there are signs of a preference for a switch to GSI BMS.

Obviously, this proliferation of national initiatives in deployment of e-Invoice infrastructure creates many problems when it comes to cross-border interoperability. Problem is especially hard for small countries like Croatia that currently aren’t at the forefront of e-Invoice development, and, in Croatia’s case, not even in the EU yet. Of course, there is a readily available possibility of „wait-and-see“ approach with all the usual benefits for late adopter, but e-Business is too important as an engine for growth and innovation for this scenario to be realistic. Notwithstanding problems created by different standards available, some basic requirements for e-Invoice infrastructure are clear:

- secure message transport
- existence of common interoperability framework
- standardized format for message

Next three sections give an overview of current situation in these areas.

## 3 SECURITY OF ELECTRONIC EXCHANGE

Security considerations are paramount whenever there is an electronic exchange of sensitive

information over public network. There are five security criteria that must be satisfied in such communication: trust, authenticity, non-repudiation, integrity and confidentiality. Solution exists in the form of *public key infrastructure* (PKI) where *certificate authority* guarantees binding of user identities with public keys, thus solving the biggest problem of public key cryptography - proving that a public key is authentic, and has not been tampered with or replaced by a malicious third party.

Although technical aspects are relatively clear, there are problems in implementation and deployment of such systems, mostly related to the distribution of keys, and especially their revocation: privilege of key revocation, distribution of a new key, spreading the revocation and recovery of a leaked key.

Another issue is cross-border interoperability and standardization. Internet is becoming global marketplace, and EU started efforts at standardization in 1999, when European Commission in its Directive 1999/93/EC adopted legislation regarding advanced electronic signature. Of importance for digitally signing e-Invoice is also Directive 2001/115/EC and provisions of this law have been transferred to new EU VAT Directive 2006/112/EC.

In 2005, Croatia's government adopted legislation concerning electronic signature (Narodne novine, 2002) and electronic document (Narodne novine, 2005) that are in compliance with EU legislation. FINA (*Financial Agency*) was given central role as national certificate authority and since then some 10.000 digital certificates were issued.

Croatia's banks, mostly in foreign ownership, didn't wait for government legislation, and started development of e-Banking on their own. With more than 80.000 certificates issued so far banks are at the forefront of e-Business development in Croatia. Unfortunately, although these certificates certainly satisfy technical requirements for secure message transport, they weren't issued in formal accordance to the law and use of these certificates within e-Invoice infrastructure would require legislative changes.

Although there are issues that need further addressing, mainly in regard with cross-border (i.e. EU) interoperability of national PKI infrastructures, current development in the area of electronic security is sufficiently advanced for the purposes of e-Invoice.

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## 4 INTEROPERABILITY FRAMEWORK

Interoperability framework (IF) is a crucial component for deployment of e-Business infrastructure and all its aspects, including e-Invoice. IF can be described as a set of policies, technical standards and guidelines which enable solving interoperability issues between different IT systems. Some interoperability issues arise from the differences in the meaning of terms and modes of operations and some are related to the fact that different informational systems cannot share information easily. Within interoperability framework communication is done using a predetermined framework based on open international standards. As Croatia is a country where most companies are small and medium in size and EDI infrastructure is not so widely used, legacy considerations can be put aside.

Interoperability can be analyzed and implemented on three main layers: technical, semantic and process layer. Technical layer of interoperability encapsulates standards and norms for binding different systems and it forms a basis for enabling communication between them. It also specifies the envelope to package the content of business document with necessary headers as well as security and transportation standards.

Semantic level of interoperability deals with the meaning of data and ensures that data will be interpreted the same at both communication ends. Semantic layer also defines structures and elements of the business documents as well as the meanings of the terms used in these documents.

On the process layer, main concern is reconciliation of business processes. This layer defines roles of business partners, order of business documents exchange and how to respond to information in business documents with appropriate actions within defined business process. To take advantage of new technology business processes should be reexamined and reengineered and this issue goes to the heart of e-Business infrastructure.

Today, there are several competing standards on each layer and following sections give overview of different standards considered as candidates for deployment of e-Invoice infrastructure in Croatia. There are several XML frameworks that handle interoperability issues on different levels of interoperability, with twelve of them listed and compared in (Nurmilaakso, 2006).

On technical layer our candidates are:

- ebXML - a modular suite of specifications for conducting business using Internet, that puts at enterprise disposal standardized methods for business message exchange, data communication, definition and registration of business processes
- Web Services – based on a collection of XML technologies with the core consisting of three standards: SOAP (Simple Object Access Protocol) for transport, UDDI (Universal Description, Discovery and Integration) for discovery and WSDL (Web Services Definition Language) for description. Additional standards extend these basic standards and implement different capabilities such as security and reliable messaging.

#### 4.1 ebXML

ebXML, in development since 1999 and now in its version 3.0, provides solutions on all three layers. It encompasses following set of standards, most of them accepted as ISO 15000 standards:

- ebMS (ebXML Messaging Services, accepted as ISO 15000-2) - standard for exchanging messages reliably and securely. It also provides means to route a payload to the appropriate internal application once an organization has received it.
- ebRIM (Registry Information Model, ISO 15000-3) and ebRS (Registry Service, ISO 15000-4) - standards for publishing and discovery
- ebCPP (Collaboration Protocol Profile and Agreement, ISO 15000-1) - standard for specifying the details of how an organization is able to conduct business electronically. It specifies such items as how to locate contact and other information about the organization, the types of network and file transport protocols it uses, network addresses and security implementations.
- ebCCTS (ebXML Core Components Technical Specification, ISO 15000-5) - standard for defining business documents semantics
- BPSS (Business Process Specification Schema) - standard for describing business processes

One of the primary strengths of the ebXML infrastructure lies in its modularity. With a few exceptions listed standards may be used somewhat independently as they are only loosely related. The elements of the ebXML infrastructure may interact with each other, but in most cases are not required to.

ebMS operates on technical level of interoperability framework and its version 2.0 is the most implemented ebXML specification with many successful implementations. ebMS is complete solution which provides ways to pack data and transport them reliably and securely. On the other hand, ebMS is technically complicated standard and for some features implemented in version 2.0, such as security and reliability, more advanced implementations appeared. Weakness of ebMS version 2.0 was recognized and new ebMS specification version 3.0 carries significant changes and it is turning up to Web services technologies. ebMS 3.0 still relies on SOAP and SOAP with Attachments, but it uses WS-Security and WS-Reliability or WS-ReliableMessaging for security and reliable transport respectively.

#### 4.2 Web Services

Web Services core standards, SOAP, WSDL and UDDI, are not sufficient to handle successfully all aspect of e-Business infrastructure. A couple years ago lack of standardization concerning service discovery and business semantics significantly impeded usefulness of Web Services (Albrecht et al, 2005). In the meantime situation has improved and is still changing rapidly with many standards concerning e-Business in the process of formalization by relevant standardization bodies. The most important standards for e-Business are the following:

- WS-Security – this part of WS-\* specification is meant to provide a flexible set of mechanisms that can be used to construct a range of security protocols. The main goal is to accomplish end-to-end message content security and not just transport-level security. Message integrity is provided by XML Signature. Message confidentiality leverages XML Encryption in conjunction with security tokens to keep portions of a SOAP message confidential.
- WS-Reliability/WS-ReliableMessaging – this standard is intended to provide quality of service in the reliable delivery of messages.
- WS-Addressing – purpose of this standard is to provide transport-neutral mechanisms for addressing Web services and messages. Standard defines XML elements to identify Web service endpoints and to secure end-to-end endpoint identification in messages.

Two of the greatest strengths of Web Services are support from major software vendors and support for its core standards in many different languages from

very beginning. Implementation libraries exist in languages such as Java, .NET, Perl, Python, Visual Basic etc. and this was probably the major factor in their fast acceptance. Web services standards are also modular in nature and they do not depend on each other with the exception that all of them use SOAP as base protocol.

### 4.3 ebXML/WS Final Remarks

Existence of two competing standards confuses users and puts them in uncomfortable situation. There are not many complete ebXML implementations around, and only ebMS is well accepted and implemented. On the other side Web Services technology is still evolving and WS specifications are not yet mature nor do they have significant reference implementations. Denmark's experience after it completes its transition to UBL 2.0 and WS-\* will provide valuable and eagerly awaited input.

First step in resolving such situation was made recently by ebMS technical committee when it put development direction of ebMS version 3.0 towards Web Services technologies. This move resulted in lack of backwards compatibility with ebMS version 2.0 and ramifications of this are yet to be seen in practice. On the other hand, new version has introduced new features such as different processing modes, message pulling and message partition channels which are step ahead comparing to Web Services technology.

Some authors say that the ebXML organization views the ebXML standard not as an alternative to Web services, but as the standard for "Business" Web services. "Business" Web services are based on a peer-to-peer collaborative business process model, while the basic Web services are based on a client-server, RPC style model. ebXML provides a modular suite of specifications that is designed to enable standards-based, peer-to-peer, collaborative, business communication between enterprises. ebXML is complementary to basic Web services and builds upon them to enable "Business" Web services (Endrei *et al*, 2004).

## 5 MESSAGE STRUCTURE

After resolving issues regarding technical layer of the interoperability framework and establishment of message exchange protocols, there is one more question that needs to be addressed – agreeing on a format for the message. As has already been stated

in the introduction, today XML is the first, and for all practical purposes the only solution for sharing structured data across different IT systems.

But, porting flexibility of a paper invoice to the digital domain proved difficult to achieve. Even though defining XML schema for exchange of data in specific situation and between parties that know each other business well is fairly easy task, interoperability becomes important sooner or later. How to represent date in such communication is the simplest example of interoperability problems (is it DD-MM-YYYY or MM-DD-YYYY?) and situation is similar regarding different conventions for use of decimal point in North America and Europe.

Bottom-up approach, without agreement on interoperable standards, resulted in a whole array of different XML schemas for e-Invoice in use today. Most of them were defined *ad hoc* as an extension of ERP systems currently in use or for some specific industry or market segment (large customers, for example).

To realize maximum benefits and savings from implementation of e-Invoice infrastructure, integration with ERP (*Enterprise Resource Planning*) and SCM (*Supply-Chain Management*) systems is essential and this requires adoption of standards for semantic and process layer of interoperability framework. Unfortunately, as is the case with the technical layer, there are three globally competing standards in existence today:

- UBL (*Universal Business Language*) – currently in version 2.0.
- GS1 BMS (Business Message Standard)
- UN/CEFACT CII (Cross Industry Invoice) – awaiting formal acceptance, work has already started on version 2.0

There is multitude of criteria that can be used for deciding this question, and authority of UN/CEFACT standards body weighs heavily here with UN/TDED norm (ISO 7372) and its follow up ebCCTS (ISO 15000-5) norm. ebCCTS serves as foundation for both UBL and CII, and GS1 BMS committee has announced its intention to follow similar path in next versions of BMS. Delay in formal acceptance of CII standard gives an edge to UBL, but question is far from settled.

Additionally, there is a question of integration with product catalogs and the role of e-Invoice in the wider e-Procurement picture. GS1 BMS standard requires existence of GLN and GTIN catalogs, while UBL can work even without them. CII on this account has the advantage because it can work with catalogs across different industries. Successful resolution of this problem hinges heavily on the

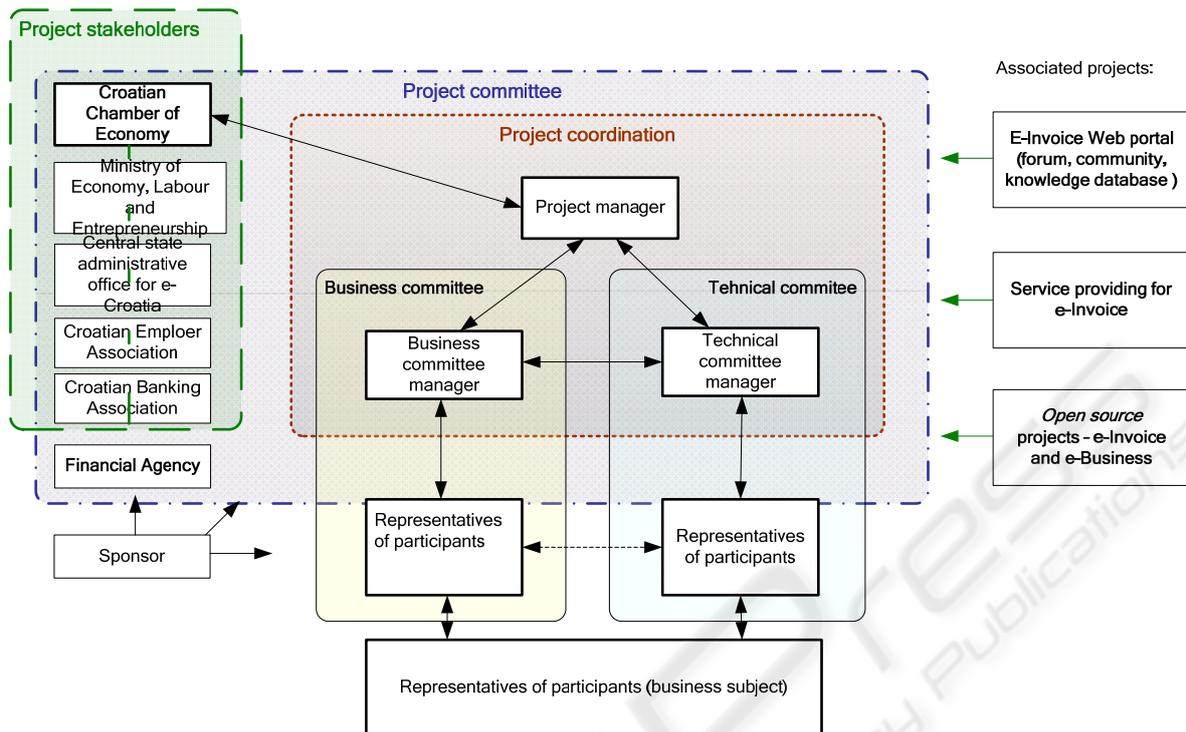


Figure 1: Croatian e-Invoice project organizational framework.

involvement of business subjects, but also on ERP vendors and their willingness to support adopted standards.

## 6 e-INVOICE IN CROATIA

Development of e-Business in Croatia was slow and progressed in piecemeal steps. Although there is visible improvement in providing basic electronic services for dealing with government, for example enabling submission over Internet of social security and tax forms (but only for firms and not for individuals), National strategy for development of e-Business was adopted only recently, at the end of 2007. Main goal is to increase economic competitiveness and to enable wider adoption of e-Commerce. e-Invoice and e-Procurement are among its most important projects.

The main obstacles in e-Invoice adoption are Croatian legislation, especially VAT legislation, and absence of interoperability framework. Our legislation is currently being adjusted as a result of negotiation with EU legislation and it is expected that this obstacle will soon be removed.

There are many open questions in adoption of an interoperability framework in Croatia. Starting

points in building our interoperability framework are use of common standards and compatibility with EU directives. The first step is initiation of a pilot project with the intention of providing answers to business and technical dilemmas. Proposed organizational framework for e-Invoice pilot project is shown in Figure 1.

Taking into consideration reluctance of firms and their software vendors to change and adapt their IT systems to newly defined format, one possibility is for service providers to assume responsibility for converting exchanged messages to appropriate format. Exchanges of e-Invoices with international systems are encouraged to go through service providers.

Basic roles of service providers, as defined by Croatian legislation, are receiving, sending, archiving and securing of electronic documents in the name of contracted users (Narodne novine, 2005). We are planning to take into account directives from European Committee for Standardization that additionally defines roles such as conversions between different formats, authentications and digital signing.

## 7 CONCLUSIONS

Croatia has started deployment of e-Invoice as first of several planned e-projects in accordance to recently adopted National strategy for e-Business. First task is to define common ICT infrastructure that will serve as foundation for further development of e-Business. There is a common agreement that it should be based on XML family of standards, and as much as possible in compliance with EU directives and practice.

Croatian Government and several public and private institutions are in the process of starting a pilot project with the primary goal of choosing appropriate standards for defining secure and reliable communication, business documents description and business process description. There are several competing standards in each area and choosing between them is not a trivial task.

Beside technology characteristics other issues should be taken into account such as future direction of technology development and progress of situation in European Union. At the moment we are leaning towards Web services as technology for enabling secure and reliable communication although we are closely monitoring ebXML suite of standards. There are still open questions about standards for describing business documents and standards for registry implementations. Our hope is that pilot project will provide us with further insights necessary for successful implementation and deployment of e-Invoice infrastructure.

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