

## USING XML AND DIGITAL SIGNATURES FOR ELECTRONIC INVOICES

**Alexander Grigorov<sup>1,2</sup>, Petko Bukov<sup>1</sup>, Anton Angelov<sup>3</sup>,  
Ekaterina Detcheva<sup>2</sup>**

<sup>1</sup> Faculty of Mathematics and Informatics, St. Kl. Ohridski  
University of Sofia

<sup>2</sup> Institute of Mathematics and Informatics, Bulgarian  
Academy of Sciences

<sup>3</sup> CMC Bulgaria Ltd.

[alexander\\_grigorov@fmi.uni-sofia.bg](mailto:alexander_grigorov@fmi.uni-sofia.bg),  
[bukov techno@yahoo.com](mailto:bukov techno@yahoo.com), [anton.angelov@cmc.bg](mailto:anton.angelov@cmc.bg),  
[detcheva@math.bas.bg](mailto:detcheva@math.bas.bg)

### ***Abstract***

*Electronic invoicing has many advantages and benefits. It has become very important as Bulgaria joined the European Union and the Bulgarian laws and regulations concerning invoicing had been harmonized with the European Directives. Our approach to electronic invoicing is based on XML. We have developed a detailed XML specification and a XML Schema that describes formally the structure of the XML invoice document. This schema is published in Internet and can be used for automatic software verification of electronic XML invoices. This will encourage other software developers and companies to create products for electronic invoices or to easily extend existing accounting or ERP products with import/export functions for e-invoice.*

*We have also developed an XML Invoice Viewer - a software product that will be distributed free of charge. The viewer allows electronic XML invoices to be viewed on screen or printed as if they are ordinary (paper) invoices.*

*Another important aspect of using XML for electronic invoices is that XML documents can be digitally signed using XML Signature - a W3C recommendation that defines an XML syntax for digital signatures. According to current Bulgarian legal regulations an electronic document signed with a valid Universal Electronic Signature is a legal valid document and can be used or accepted anywhere in Bulgaria. So we have extended our XML Invoice Viewer with functionalities for processing digitally signed XML invoices. We hope that the proposed XML specification will contribute to the further development of e-commerce and e-government services in Bulgaria.*

**Keywords:** *H.1 MODELS AND PRINCIPLES, H.4 INFORMATION SYSTEMS APPLICATIONS, J.1 ADMINISTRATIVE DATA PROCESSING, I.7 DOCUMENT AND TEXT PROCESSING*

## **Introduction**

Electronic invoicing (e-invoicing) is the conduct of invoicing and related processes through electronic channels and is perceived as the solution for eliminating the drawbacks of the paper invoicing process.

A definition of e-invoicing is provided in the EU Council Directive 2001/115/EC of 20 December 2001 which aims at simplifying, modernising and harmonising the conditions for invoicing in respect of value added tax, and includes rules on e-invoicing and archiving:

“The sending of invoices ‘by electronic means’, i.e. transmission or making available to the receiver and storage using electronic equipment for processing (including digital compression) and storage of data, and employing wires, radio transmission, optical technologies and other electromagnetic means□. By definition no paper document is involved.”

Electronic invoice is often referred to as an e-invoice. The most obvious way an electronic invoice differs from the traditional invoice is that it has an electronic form. Another difference is the technology used with electronic invoicing. The integrity of data and authenticity of the origin are main security issues related to electronic invoicing. The content of an electronic invoice has various message formats.

One major problem with electronic invoicing is that currently there is no international standard. Invoice applications use formats like EDI [4, 5], XML [6, 7, 8] and ebXML [9], Visa Global Invoice Specification [10], etc.

Invoice users are the senders and receivers of e-invoices. The number of users of e-invoicing is growing fast in EC. Reported growth rates in the B2B segment is 50% in 2009, but also the B2C segment shows significant growth (22% in 2009). The total number of registered businesses in Europe is at least 20 million<sup>15</sup> with some estimates up to 23 million.

**E-faktura** is the first bulgarian Electronic Invoice Presentment (EIP) system - called *eFaktura*, was created by BORICA - BANKSERVICE AD. The system is operated by a third party, called Consolidator. Bankservice manages and guarantees the relations between suppliers and buyers.

Bankservice realized the first in Bulgarian service Electronic Invoice – Presentation (EIP) through a consolidator under the title of eFaktura.bg.

### **XML Schema for e-invoice**

Our approach to electronic invoicing is based on XML. In [1] we have proposed a structure of an electronic invoice as an XML document by describing the major elements and subelements according to our vision. We have investigated the European directives and Bulgarian laws and legal regulations concerning invoicing. We have also reviewed various software products and paper invoices in order to make the XML invoice specification as general as possible.

The structure of a XML invoice document is as follows [1]:

The root element of the XML invoice document is the **Invoice** element. Below the root element, there are three top-level sections: **InvoiceHeader**, **InvoiceDetails**, and **InvoiceSummary**.

**InvoiceHeader** contains sub elements that hold all the data associated with the invoice as a whole that is not classed as summary information.

**InvoiceDetails** contain sub elements that hold all the invoice line-level data. There is one instance of **InvoiceDetails** for each invoice line.

**InvoiceSummary** contains sub elements that hold all the invoice summary details.

The following example shows the main structure of the XML invoice document:

```
<?xml version="1.0" encoding="utf-8"?>
<Invoice>
  <InvoiceHeader>
    : :
  </InvoiceHeader>
  <InvoiceDetails>
    : :
  </InvoiceDetails>
  <InvoiceSummary>
    : :
  </InvoiceSummary>
</Invoice>
```

We have also developed a XML Schema [11] that describes formally the structure of the XML invoice document.

Below is part of the XML Schema:

```
<?xml version="1.0" encoding="UTF-8"?>
<xsd:schema xmlns:xsd="http://www.w3.org/2001/XMLSchema"
elementFormDefault="qualified" version="1.0">
  <xsd:element name="Invoice">
    <xsd:complexType>
      <xsd:sequence>
        <xsd:element ref="InvoiceHeader"/>
        <xsd:element ref="InvoiceDetails"/>
        <xsd:element ref="InvoiceSummary"/>
      </xsd:sequence>
    </xsd:complexType>
  </xsd:element>
  ...
```

This schema has been published in Internet and can be used for automatic software verification of electronic XML invoices.

This will encourage other software developers and companies to create products for electronic invoices or to easily extend existing accounting or ERP products with import/export functions for e-invoice.

### **XML Invoice Viewer**

We have also developed an XML Invoice Viewer - a software product that will be distributed free of charge. The viewer allows electronic XML invoices to be viewed on screen or printed as if they are ordinary (paper) invoices.

The viewer is realized as a stand-alone application and as XSLT transformations to be viewed in a browser. Fig. 1 shows a screenshot of the standalone viewer.

**ФАКТУРА**  
**№:** 0000000002 / 1/30/2009  
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Fig. 1. Standalone XML Invoice Viewer

Fig. 2 shows a screenshot of the XML Invoice Viewer realized as XSLT transformations. The invoice is viewed in a browser.

### E-signing of XML invoice

Another important aspect of using XML for electronic invoices is that XML documents can be digitally signed using XML Signature - a W3C recommendation that defines an XML syntax for digital signatures [12].

According to current Bulgarian legal regulations an electronic document signed with a valid Universal Electronic Signature is a legal valid document and can be used or accepted anywhere in Bulgaria.

We have extended our XML Invoice Viewer with functionalities for processing digitally signed XML invoices.

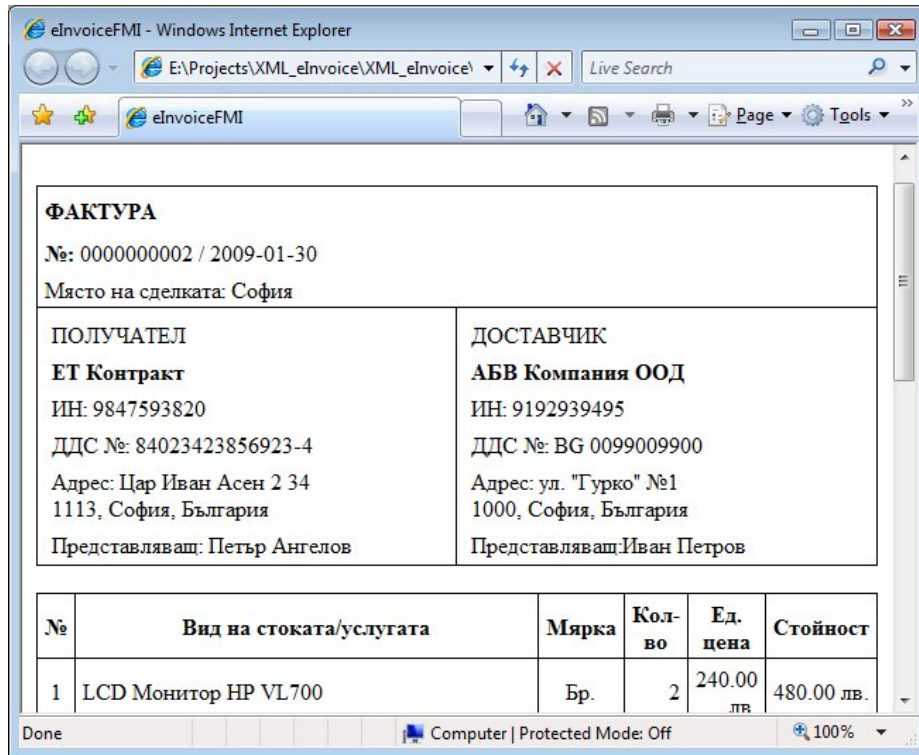


Fig. 2. XML Invoice Viewer using XSLT

Fig. 3 shows the process of digitally signing of an invoice document, while Fig. 4. shows the user interface of the program for signing a XML invoice.

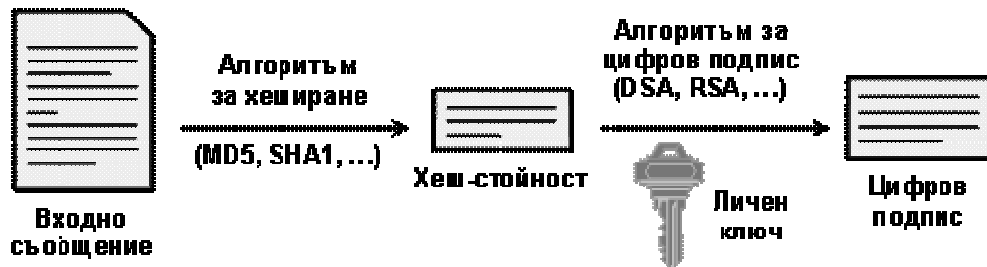


Fig. 3. Signing an invoice document

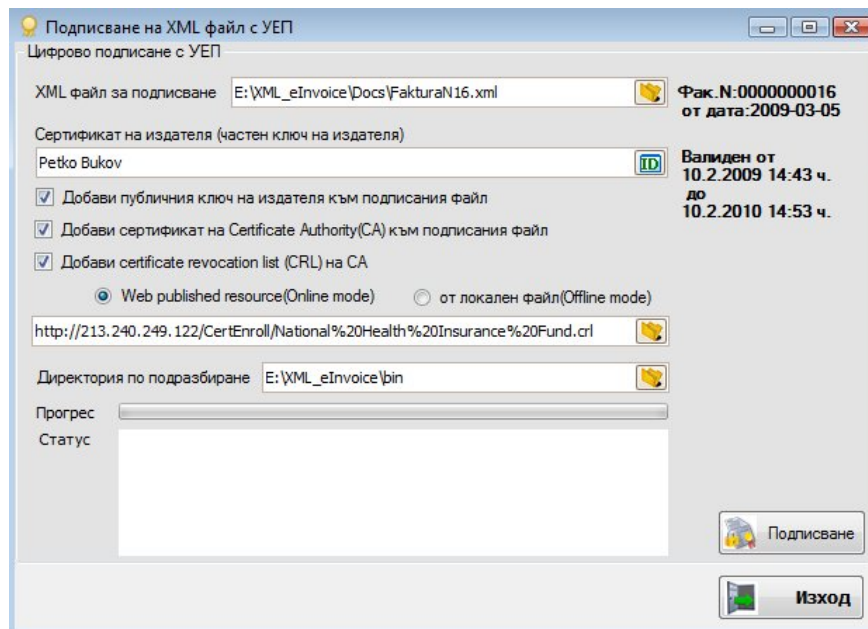


Fig. 4. User interface for signing an invoice document

We have also extended our application for verification of digitally signed XML invoices. Fig. 5 shows the process of verification.

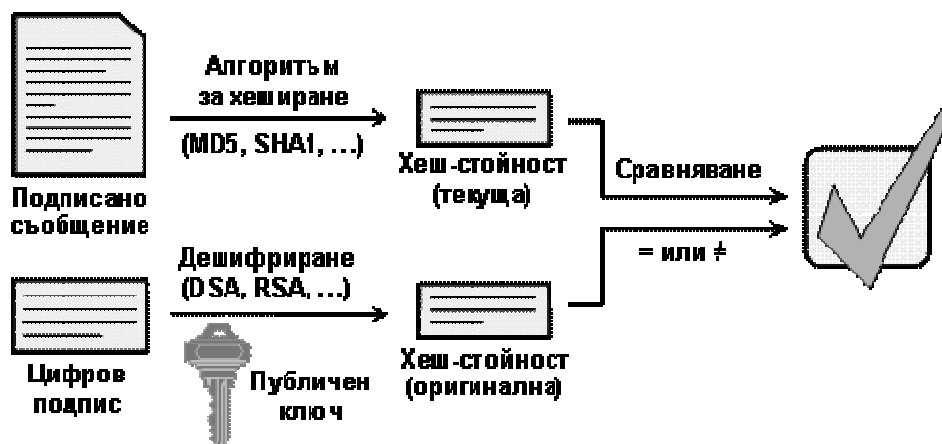


Fig. 5. Verification of digitally signed XML invoices

## Conclusion

We have developed a detailed XML specification and a XML Schema that describes formally the structure of the XML invoice document. Also we

have implemented a XML Invoice Viewer that has functionalities for processing digitally signed XML invoices.

We are planning also to build web services and applications for processing and delivering digitally signed XML invoices.

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