An Architecture to Improve SME Participation in Electronic Commerce

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Abstract

It is a well-known problem that small and medium size enterprises (SMEs) have diffculty to participate in electronic commerce. In particular, the SME participation in business-to-business electronic commerce is seriously lagging behind compared to the very active participation of large companies. We discuss several barriers that could explain why SMEs have problems to participate in electronic commerce. Examples of such barriers range from lack of trust because of unclear status of electronic trade documents to specific SME problems in back office processing of electronic (EDI) messages. We also present a software architecture that is specifically dedicated to improve the participation by solving these barriers for SME participation.

Keywords: Electronic Commerce and SMEs, Architecture for Electronic Commerce, EDI, Electronic Payment Systems, Policy Recommendations on Electronic Commerce.

[1] This research was carried out as part of the activities of Working Group 1 of the Memorandum of Understanding *Open Acess to Electronic Commerce for European SMEs* of the European Commission. The Memorandum of Understanding is a consortium of European companies that advice the European Commission on policy measures to improve participation of European SMEs in electronic commerce.

1. Introduction

The architecture presented in this report indicates what is required from a software environment to give full support for electronic commerce with an emphasis on the needs of Small and Medium size Enterprises (SME).

The basic problem for any architecture for electronic commerce is the interoperability problem of standards and protocols. This interoperability occurs at different levels of electronic commerce. At the level of protocols for exchanging messages between different software applications for electronic commerce, between electronic payment protocols, between EDI messages and local SME software applications etc. In all these cases the fundamental question is whether to bridge the interoperability gap by more standardization, or to look for other types of solutions. Although standardization is very important, and substantial progress has been made (e.g. CORBA, JEPI, EDIFACT), there is a growing scepticism whether the interoperability problem can be solved by standardization alone. In addition to standardization other solutions should be looked for. One additional solution is to develop advanced translators that can translate different protocols or standards into each other. To develop advanced translators, it is necessary to base the translations on semantic models of business processes. Hence, we recommend the development of semantic translators that can help to solve the interoperability problem.

The special focus on the needs of SMEs is reflected in the architecture by the emphasis on, for example, legal advice on electronic contracting and negotiation, and EDI processing. Electronic contracting is not an issue for consumer-to-business electronic commerce. Private consumers

hardly ever negotiate about the contracts that are implicitly imposed on them by the companies from which they electronically buy goods. In contrast, electronic contracting is a serious problem for an SME that wants to start new cross-border business with a company in another country. Hence, on-line advice for electronic contracting is of vital importance for SME participation in electronic commerce. Another issue that is relevant for SMEs is EDI processing. Since most business-to-business electronic commerce is expected to be based on EDI like message exchange, SMEs face the difficult problem how to integrate this in their own IT environment. To facilitate this EDI integration we need to develop advanced semantic-based EDI translators that can adapt the EDI like messages to arbitrary protocols.

The architecture contains the following three layers

Business Process Layer

Services Layer

Technologies Layer

Each layer is enabled by the lower layer. The business process layer represents the business processes that are part of an electronic commerce trade transaction. The services layer contains the services that are needed to facilitate these business processes. The technologies layer contains the technologies that enable the services. For some services there are as yet very few technologies available. The development of the architecture in this paper was motivated by a comparison of some typical existing software environments for electronic commerce such as: CommerceNet IBM CommercePoint, Javacommerce, Microsoft Internet Commerce, SEMPER and Tradebase.

Taking into account results from research projects of the TEDIS Programme of the European Commission: BOLERO, EDIBoL, EDICON, MANDATE (see [4], [7], [8], [20], respectively) and other general reports on electronic commerce such as [15] and [10].

Architectures describe the constituting parts of certain topics and their relationships, seen from different points of view. It is impossible to show the total complexity in one single architecture. A trade-off had to be made between detail and overview. From the currently available architectures there are but a few in which an attempt is made to cover the complete picture of electronic commerce. For example, most existing software environments do not provide support to help SMEs with legal problems with electronic commerce. Another problem is the interoperability between these existing environments. Most existing software environments for electronic commerce have a building block architecture containing, for example, building blocks for different secure electronic payment systems and building blocks for creating directory services. However, there are no uniform protocols and standards to make building blocks from different environments communicate with each other.

At this moment most of the standards in Electronic Commerce are created de-facto. This means that the software with the largest market share dominates the market. When an infrastructure is in its infancy (like the current EC infrastructure) this method creates chaos and desinvestment. The user has to pay the price for this. Another way to create standards is to let a standardization body make specifications and negotiate with all the important parties to reach consensus. However, the representation of interest is mainly organised by country and industrial sector. This is due to the fact that governments took the lead in this process. The power of standardization bodies is based

on these national structures. Nowadays most governments prefer the market to regulate itself. The result of this is that most companies are not using standards and/or do not know which standards are available. Companies just use what they can buy.

One way to solve this problem is to quickly develop free software (instead of specifications). This development has to be controlled by a large well-balanced consortium of companies and other institutions. Free software creates often a de-facto standard (e.g. Netscape). A large consortium prevents the dominance of one party (e.g. Microsoft). Examples of this consortium approach are the World Wide Web Consortium (W3C) and CommerceNet (CN). W3C is more focused on the technical layers of software. CN is focused more on the business layer. Both W3C and CN are basically controlled from the United States. W3C has a focal point in Paris (INRIA).

2. Business Process Model of Electronic Commerce

In Figure 1 we first present the Business Process Model of electronic commerce, which is based on the business scenario between seller and buyer. The five phases in this scenario are

- *Marketing*: product information made available by the seller, and product information gathering by the buyer.

- *Contracting*: negotiating the terms of a contract between a seller and a buyer about the sale, delivery and payment of goods. Involves documents such as request for quotation, order (confirmation), invoice etc.

- *Transport*: delivery of the sold goods to the buyer. Usually carried out by a third party, that issues documents (Freight bill/Waybill) when taking over the goods from the seller.

- *Administration*: VAT report and Customs declaration concerning the sold goods.

- *Payment*: transfer of money from the buyer to the seller either via a bank, or via direct electronic payment.

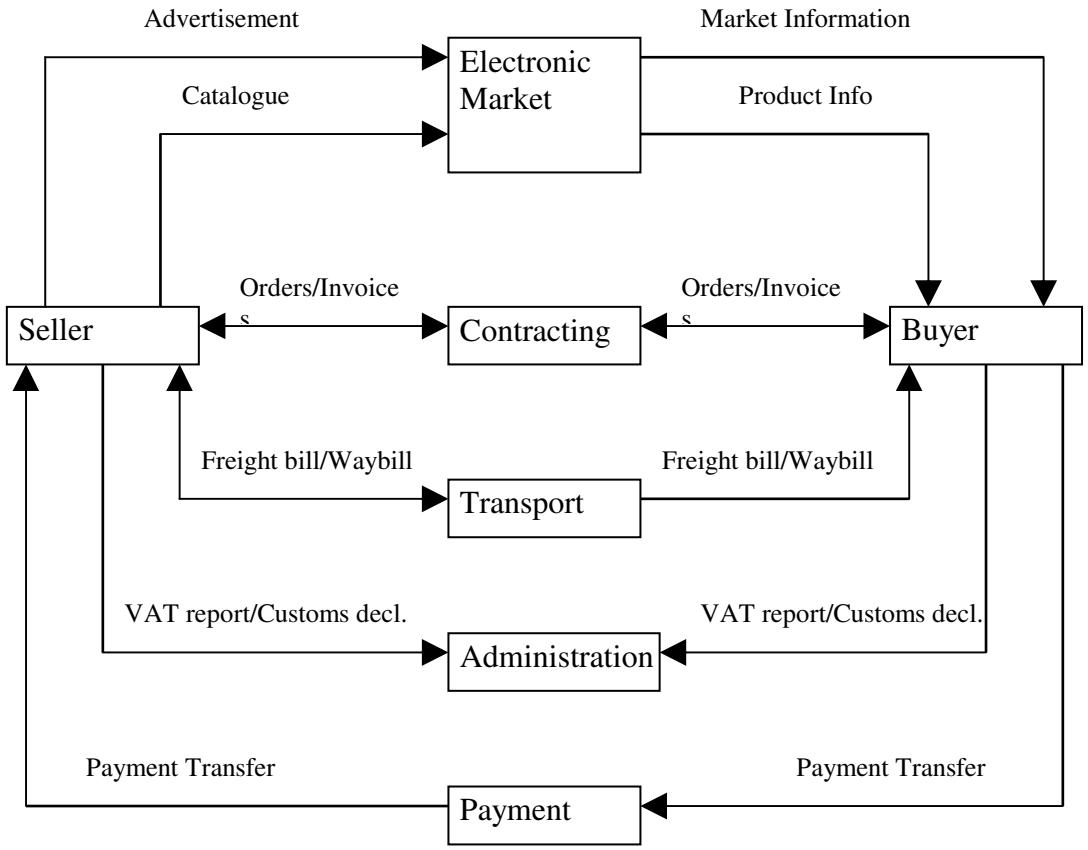

Fig. 1: Business Process Model of Electronic Commerce[2]

[2] This business model is adapted from the General Business to Business Model (Fig. 3.7) from the EWOS Technical Guide on Electronic Commerce (EWOS ETG 066, Sept. 1996).

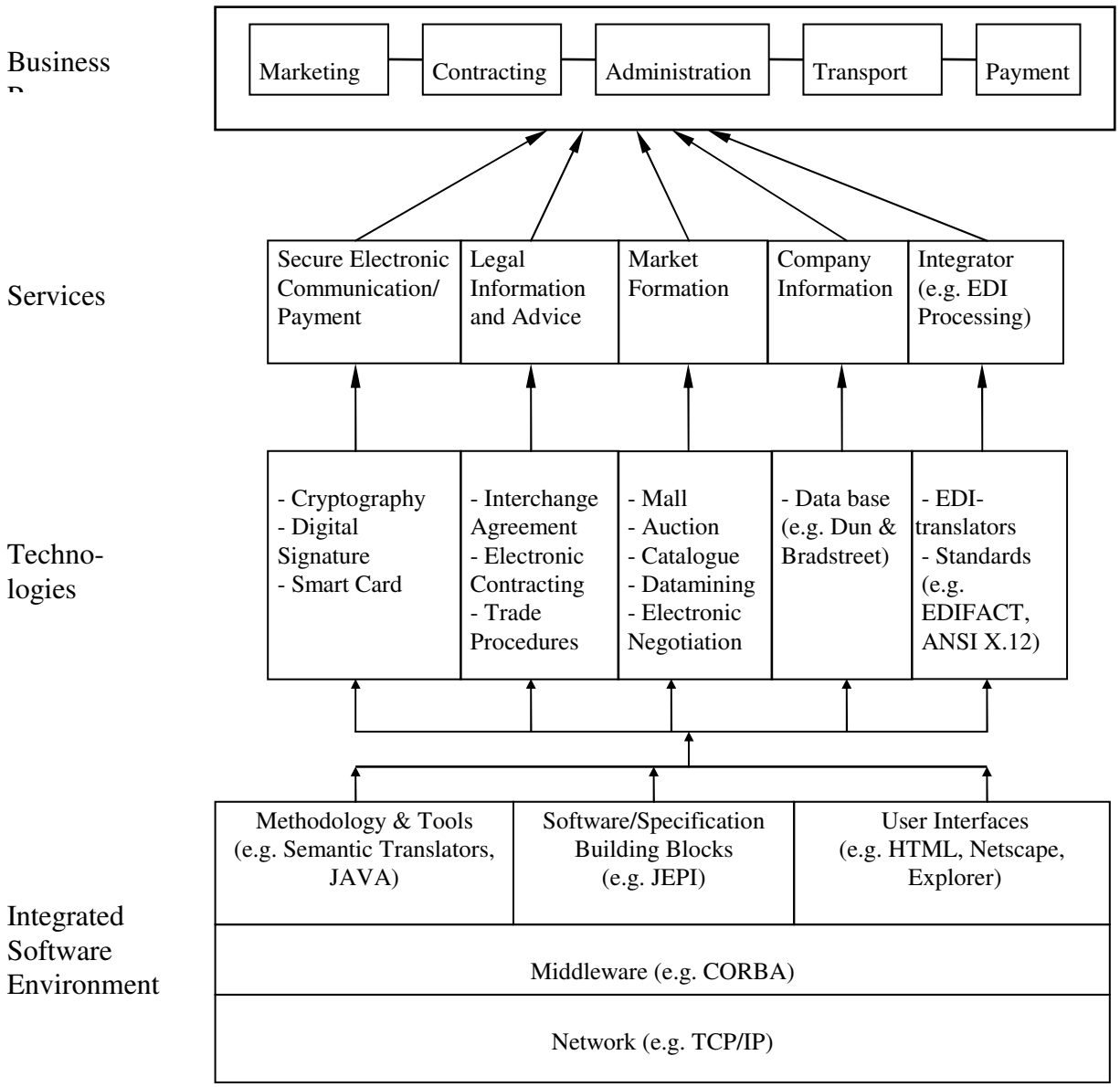

Fig. 2: Architecture for Software Environments for Electronic Commerce

The arrows in this figure indicate enabling relations. For example, cryptography and smart card are technologies that enable electronic payment services. In this architecture the representation of the business processes layer is somewhat simplified. The sequential order of business processes is not always a strict order. For example, contracting and administration often happen at the same time, and payment is often done before transport of the sold goods. All services at the services layer are relevant for every single business process (marketing, contracting, administration, transport and payment) at the business processes layer.

Integrated Software Environment.

The software environment is the most crucial part of Electronic Commerce. It is divided in a hardware/network oriented part (Middleware, Network), an application specific part (Building Blocks), a user oriented part (User Interface) and a developer oriented part (Methodology & Tools). At this moment the discussion about EC is dominated by the network protocol (TCP/IP, the Internet protocol) and the way the user interface is organised (the browser). Middleware is the glue that makes the network work together with the building blocks. An important development here is object orientation. The software that makes the building blocks (objects) work together is called a request broker. CORBA (Common Object Request Broker Architecture) is the architecture created by the Object Management Group (OMG) that tries to define standards on this level.

Methodology & Tools.

Methodology and tools to develop software building blocks are highly influenced by the developments in the middleware and the network. Object orientation is very difficult to learn, and tools change every year. Developers have to spend a lot of time in adapting themselves to the new situation. Software developers that are familiar with all the features of the new infrastructure are rare and therefore very expensive. This makes software development for SME virtually impossible. The only way to halt this development is to create simple tools. An important methodological issue is that we should not try to solve the current standardization problems by starting up more standardization initiatives, but by looking at other alternatives, in particular focus more on the development of advanced translator software based on semantic models of business processes. A Promising candidate for this translator software is the eCo System developed by CommerceNet (see [26]).

Software Specification and Building Blocks.

One way to simplify software development is to reuse software building blocks. These building blocks require interoperability in terms of functionality and interfaces. However, there are currently no uniform protocols and standards to make building blocks from different electronic commerce software environments communicate with each other. Because of the market force small collections of interoperable building blocks are currently developed. We recommend that essential parts of the infrastructure are selected that have to work together. The software for these parts can then be developed in pre-competitive research.

The choice for a suitable candidate for an integrated software environment for electronic commerce is a difficult one. The most promising candidate is the eCo System environment that is currently developed by CommerceNet (see [26]). The eCo System has several advantages. First, it has a building block architecture, which makes it relatively simple to implement the different services of our architecture. Secondly, the interoperability problem is avoided by an advanced type of protocol translation, which is based on a semantic analysis of business processes. The basic idea behind eCo System is not to wait till all standardisation problems will be solved, but improve the translation between the different standards and protocols. Thirdly, eCo System is a 'neutral' platform in the sense that it benefits from the input from most of the major companies involved in electronic commerce in the USA without one of these companies dominating it.

3. Services and Technologies

3.1. Secure Electronic Communication/Payment

By communication we mean the exchange of messages. The general security properties of electronic communication are:

- *Authentication*:

  that the sender or receiver of the document is indeed the agent he claims to be

- *Confidentiality*:

  that the content of the document cannot be read by a third party during electronic transfer

- *Non-Repudiation*:

  that the sender or receiver cannot falsely claim to have (not) received a document

- *Integrity*:

  that the content of the document is not modified during electronic transfer

Secure communication holds, in particular, for exchange of documents (contracts, requests for quotation, import- or export clearance documents, letters of credit, Freight bill/Way bill etc.)

Secure Electronic Payment is related to secure communication. For a good overview of the current state of electronic payment systems see [1], [18] and also [23].

Payment models

In a payment transaction different roles have to be distinguished; payer, payee, issuer (the payer's bank that sends the money), acquirer (the payee's bank that receives the money). Also different time points of payment have to be distinguished depending on, for example, whether the payment is before, during or after the delivery of the goods (pre-pay, pay-now, pay-later).

Security requirements

The security requirements for payment transactions are;

- Integrity, authorisation, confidentiality of the payment order
- availability and reliability of the underlying networking services and software and hardware components
- anonymity in certain cases

Classification of electronic payment systems

Payment systems are distinghuised in

- on-line systems (authorisation with each payment) versus off-line systems (no authorisation contact with a third party during payment).
- use of tamper-resistant hardware: none, smart card, electronic purse
- use of cryptography: crypto-less, shared-key, public-key.

Available Technologies:

Many technologies available. Most of them, but not all, are based on cryptography. Cryptography can be used also to obtain all security properties (Authentication, Confidentiality, Non-Repudiation, Integrity) of secure document exchange by applying digital signatures. In some cases cryptography is combined with smart card technology as carrier of keys. Below a slightly adapted version of the overview of electronic payment technologies from [1] is given.

ON-LINE Payment Systems:	OFF-LINE Payment systems:
1. Credit-card payment systems: - Proposal using no cryptography: First Virtual - Proposals using Cryptography: CyberCash, iKP - Proposed standard: SET 2. Micropayments: - Millicent, NetBill, Phone-Ticks, m-iKP, PayWord, MiniPay 3. Payment switches: - Globe ID(R) by GC Tech - OpenMarket payment switch - Anonymous "remailers" for change, e.g., NetCash, Anonymous credit-cards - Anonymous ("blind') signatures, e-cash	1. Electronic purses, using smart card - Shared key, e.g., Danmont/VISA, Proton - Public key, e.g., CLIP - Not known publicly: Mondex/Mastercard - Standardisation: CEN Intersector Electronic Purse, EMV Electronic Purse, ECBS Interoperable Financial Sector Electronic Purse. 2. Electronic cheques - FSTC Electronic Check Project - Anonymous ("blind") signatures, e.g., CAFE (European research project)

Figure 3. Proposed technologies for Internet payments

Two organisations are working on standardisation of electronic payment systems: the European Standardisation Organisation (CEN) and the Europay, Mastercard and VISA (EMV) consortium. SET is recently accepted by the European banks as de facto standard for credit card payments (decision by the ECBS TC4 meeting of 9/11/97). However, currently SET is only implemented for credit card transactions. Currently, a chip card based version of SET, the so-called C-SET is

under development. For debit card transactions there are still serious interoperability problems of cards as well as terminals, which will not be solved in the near future. Also credit card based electronic payment systems might be too complicated to be really useful for SMEs.

The choice for a particular payment system depends on the type of payment; micro payment (less than $1), low-value payment ($1-$300) and high-value payment. SET will be the standard for high-value electronic payments. Smart cards will be used as electronic wallets for micro and low-value electronic payments. Due to interoperability problems these smart-cards cannot be used for cross-border payments for a considerable period of time. The ECBS working group Interoperable Financial Sector Electronic Purse is working on a standard for an interoperable financial sector electronic purse, based on existing standardisation work within the Eurocard/Mastercard/Visa EMV (EMV'96 ICC Specifications), CEN (prEN1546), ECBS (TR103, DTR104), and the European Electronic Purse (EEP) Group. Another initiative on standardization in electronic commerce is the CEN/TC 224-ISO/TC 68/SC 6 Group for Standardization in Electronic Commerce (see [5]). Another issue is the use of electronic cash (e.g. Digicash). Currently, it is unclear which institutions have the right to issue electronic cash. This issue should be settled as soon as possible, preferably at a European level. There is a serious lack of standards in Europe on low-value electronic payment systems, in particular electronic purses, therefore standardization efforts on electronic purses should be intensified. Also regulation should be made about the use of electronic cash (e.g. which institution has the right to issue it?).

Payment Types

No.	Description	effective value range	electronic Standard	Contenders
1	micro-payment (simple, fast)	$0-1	none	?
2	e-cash / e-purse (simple, fast)	$0-300	none	ECBS / mondex / Proton
3	Debit card (pay-now) on-line	$1->	none	Chip ISO 8583
4	Credit card (pay-later) on-line or off-line	$10->	SET (non-chip)	C-SET(chip based) iKP (non-chip)
5	bank transfer instruction (bank to bank, no card company, low charges for national)	$2->	none	OFX / Integrion
6	cheque (bank to bank payment, no card company or %, low charges for international)	national: $5-> international: $25->	none	?
7	letter of credit + assc. Docs	$1000->	EDIFACT	Bolero
8	Bankers draft (large guaranteed payment)	$250->	none	?
9	purchase order, Invoice and payment	$0->	EDIFACT	OBI, OTP

Note 1: all can be based on smart cards or other technologies, this is separate from its function

Note 2: Interoperability is a problem specific to the individual technologies (hardware, protocols, formats)

Figure 4. Overview of Internet payment systems related to value

Business Payments

SET, credit cards and e-purse schemes for Internet commerce and payments are fine for merchants selling goods and services. But while perhaps the majority of the transactions in quantity will be made using these types of payment instruments, they do not cover the most important ones to most SMEs. The remaining percentage of payments that will constitute the largest total value of payments are the humble invoice and payment. This is the model used by most non consumer businesses.

Problem Statement

Most SMEs are not making or receiving payments with credit cards. Their payments are as cheques and bank transfer. The basic commercial documents used to support this are the invoice, reminder and payment instruction to their financial organisation. An optional purchase order, debit/credit note might also be used. Some SMEs would also use documents for factoring and official documents such as for VAT. The processing of these documents constitutes a considerable cost for SMEs, automated processing of these documents will bring benefits to the back office operation of SMEs.

Proposed solution

In addition to the well-known electronic payment systems (electronic credit-card based transactions, electronic purse or electronic cash) the possibility of simpler and probably cheaper solutions for SME should be investigated. For example, electronic processing of the existing purchase order-invoice-payment procedure that is currently the predominant way of payment in SME commerce. The proposed solution is not to introduce new types of documents or new

technologies but rather to replace these documents by electronic messages with an open and simple format with few rules. This would allow any accounting application to interface to both the SMEs clients and suppliers and their financial organisations. The standard would need to be formulated in such a way that it would allow for enhancements of the format of the messages and the message handling protocols to be integrated in a way that eased the implementation of enhancements and did not force all SMEs to upgrade versions concurrently. Some promising projects that are developed along these lines are *Open buying on the Internet* (OBI) and *Open Trading Protocol* (OTP).

SME Benefits

The SME would automate their order entry and accounting processes, expand their customer base and reduce costs. Automation would allow the SMEs to have a better cash flow management. Advantages over other payment systems are obvious. Payments are made by the SMEs own bank electronically to their supplier via the suppliers bank. The reverse is also true for payments form the SMEs clients to the SME. The whole process would be very simple, and perhaps most important, very similar to their current payment practice of SMEs. Another SME benefit would be that costs would be lower per transaction when compared to credit card (SET) transactions, where a percentage is charged.

Actions

- Identification of current message format specifications which could be used for definition of a new format. EDI format complexities are to be avoided.
- Identification of a security envelope to carry the messages safely and a security infrastructure to support the security mechanisms.
- Recognition of the messages by the authorities and courts as valid business documents. Support for the standard from accountancy firms, accountancy software vendors, financial organisations, government organisations, chambers of commerce and SMEs.

Requirements

To support this model some components need to be devised which do not exist to-day. Simple message formats are required, EDI or the Lite EDI might be suitable but complexity will cause delay. Payments via a bank should be available to anyone with a computer on the Internet. Integrion and OFX formats should play a part here. A mechanism which allows for trust of all parties must be foreseen, if the banks were to act as certificate authorities to create trust then this barrier would be reduced, X.509 standards could help.

Smart Cards

Smart cards are basically computers without a human interface (like a screen and keyboard). They are lightweight tamperproof devices. Cards are often used to identify a person. This functionality can be taken over by biometric security techniques such as a fingerprint, eye or face. The computer in a card has a small processor and low memory-capacity. These two are rapidly becoming more powerful. The processor will be able to communicate over a network with other computers. The price of these card(-computers) is high. At this moment every card manufacturer produces a huge variety of incompatible cards. The standards describing the functionality of cards are not specific enough. The result is that the functionality of a card depends on a particular infrastructure (e.g. Mastercard). There should be a more wide-spread use of multi-functional cards, i.e. cards that are independent from a specific software platform. Also the interoperability of applications for these cards must be improved.

Pricing structure of payment systems

The costs for electronic card-based payments is based on the costs a customer or a vendor has to pay to the card issuer. Below a certain value of payment the cost of payment is higher than the value paid. The vendor includes the price of the payment system in the price of his product. The customer pays another part of the cost of a payment system by accepting a lower credit interest rate. In the end the customer pays for it all. The cost of the different payment infrastructures imposes a high burden on the SME. We are not convinced that all the new variants of payment infrastructures are necessary. The introduction of another payment infrastructure creates a higher

level of complexity (interfaces) and adds costs. For example, although SET is a promising standard for credit-card based electronic payments it should be investigated whether credit-card based payment systems are suitable for SMEs, e.g. the costs might be too high for business-to-business electronic commerce between SMEs.

Trust versus security?

Another important issue is the role of security for the trust needed to participate in electronic payment. Currently, the assumption seems to be that the trust in an electronic payment system depends largely on the use of sophisticated security technologies. However, it is very questionable if this assumption is correct. Most likely the trust of private consumers is not created by disclosing all technicalities of cryptography to them, but instead it is important that a trusted third party, that performs the payment, is bearing the risks if something goes wrong with electronic payments. In other words, for the trust the most important thing is that the service provider simply bears all the risks of the electronic payment. And it is, so to say, an internal problem of this trusted third party if he wants to use secure payment systems, or not. It is not the technology that gives people trust, but the promise that another party is taking over the risks. This is of course comparable to the current situation with credit card payments that are trusted because credit card companies take all the risks, while at the same time it is widely known that the currently operational credit card payment systems are far from tamper-proof.

3.2. Legal Information and Advice

The problem with exchanging contracts or bills of lading in electronic format is that the legal status of these documents is often unclear (see e.g. [16], [27] and [17]). Even if the content of the electronic message is identical to a written contract, it is not guaranteed that it is accepted as a contract by a court, because the legal status of electronic messages is unclear. This might vary from country to country. Also it is legally often not clear when a contract becomes effective, if sent electronically. Does it become effective when sent by the seller's server, or when it is received by the buyer's server? Without a solution of these problems people do not trust electronic contracting. Special agreements, the so-called interchange agreements, have to be negotiated between trading partners to decide about legal status and procedures concerning electronic documents. Since this type of agreements are very complex and subtle, information and advice should be available on-line (see e.g. [22]). To complicate matters even further it is not only documents that count, but also procedures. A procedure is a fixed sequence of exchanges of documents. Often it happens that the legal status of a document depends on the position of this document in the complete trade procedure that consists of a particular sequence of document exchange between buyer and seller. Hence, also information about trade procedures is essential.

Available Technologies

Still in its infancy. An important prerequisite for developing on-line legal advice software is the development of (deontic) models for modelling and representing the legal content and implications (obligations, rights and permissions) of a contract (see for some first attempts [21], [11] and [25]). For on-line advice on trade procedures it could be useful to develop procedure modeling software that can be executed via web browsers (e.g. INTERPROCS, see [3]).

3.3. Market Formation

This service is meant to facilitate the formation of different types of electronic markets. The simplest type of electronic market is just matching supply and demand on the Internet. More complicated types of markets are different types of electronic malls or auctions. An electronic mall is a network infrastructure for a collection of electronic shops. There are a number of different types of auctions (e.g. bid/offer ratio, ascending bid sequence ('English auction') vs. descending bid sequence ('Dutch auction'), periodic vs. continuous auctions etc.). Recently, research has been started to investigate how economic theories on real auction mechanisms can be extrapolated to electronic markets. It appears that some auction mechanisms are more effective in an electronic environment than others. Another issue is the use of so-called datamining techniques (e.g. neural networks, genetic algorithms and other more traditional statistical techniques). To create niche marketing or mass customization it is essential to have very detailed consumer information. In marketing datamining techniques are applied more and more to obtain these consumer profiles from company databases. Datamining has an enormous potential for

electronic commerce, because in electronic environments consumer behaviour can be analysed directly instead of analysing a specific database.[3] The web itself is an enormous source of information. For example, searching webpages can yield information that is not contained in any company database. Much of the success of data mining techniques, however, depends on the privacy policy that will be adapted. In case of a very strict privacy policy data mining on the Internet could become virtually impossible. Another issue is the potential of electronic negotiation. The idea is that basic negotiation strategies could be implemented in electronic commerce software environments to support the contract negotiation between human agents.

Available Technologies

There are some on-going research projects on the formation of electronic malls (e.g. the Electronic Mall Bodensee project <http://www.emb.net/>). Research on auction mechanisms has been started recently (see e.g. [6], [13], [14]). Datamining techniques are well developed, and also its applications to traditional marketing, but the application to electronic marketing has just begun (for an overview see [9]). Also research on electronic negotiation has been started recently (see e.g. [28]). This research is based on results from game theory and the research on (formal) communication protocols in multi-agent environments.

[3] The potential of datamining for electronic commerce is emphasized in the Gartner report 'Electronic Marketplace strategies: Visions vs. Reality' [GB97].

3.4. Company Information

This service provides information about the economic position and organization of a company. This type of knowledge is essential to create the necessary trust relation between seller and buyer. In particular, if the goal is to establish a long-term trade relation. It is very unlikely that this electronic information gathering alone is sufficient for this type of trust building. Clearly, personal contacts are essential for this purpose. But before investing large sums in these personal contacts, the electronic company information should enable the user to get a first impression.

Available Technologies

Basically, this information can be provided by existing data bases with company information. An example of such a data base is Dun & Bradstreet. Important is that the information provider itself is a trustworthy content provider.

3.5. EDI Processing

Most of the business-to-business electronic commerce will eventually be build on top of Electronic Data Interchange (EDI) message communication. Currently, the predominant focus in electronic commerce is on increasing market reach rather than increasing efficiency on-line back office order processing. It is to be expected that in due course this latter focus will become equally important to the first one. In that case EDI processing will become more important too. The EDI processing service is a translator that translates EDI messages to a suitable data format

for existing applications. For an SME that has very little IT expertise this is an essential service, because it requires a huge effort to adapt its own IT infrastructure to existing EDI standards.

Available Technologies

EDI standardization is still going on at a slow pace. Existing standards such as UN/EDIFACT and ANSI X.12 are far from complete (see [2]). Mainly, because so many parties (e.g. EC, ISO, UN/SITPRO etc.) are involved in the negotiation. Proprietary standards with a small group of companies can be obtained, but to agree on uniform international world-wide standards is much more complicated. Instead of focusing on more EDI standardization one can also focus more on developing stronger translators that translate EDI messages into message formats of different software types. This requires very sophisticated translators based on semantic models of business processes. Fortunately, recently much research progress has been made on this issue. Another development to support SMEs with EDI processing is to develop a simplified type of EDI standards, the so-called Lite-EDI, that is easier to implement (see [19]).

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