Technology as the catalyst of users’ acceptance in Electronic Commerce

TRADE

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SUMMARY
Trust is certainly going to be a key factor for Electronic Commerce (EC) to become universally accepted. It has always been the catalyst of any traditional commercial activity: without trust in their counter-parts neither consumers nor merchants will ever engage themselves in any transactions. Similarly, if trust and confidence in the new digital environment of EC cannot be provided, users will simply reject this new way of trading and retailing.

Usability is another key factor for the acceptance of EC services and applications. EC has in fact to do with humans, and not only computers (at a major difference from EDI). The introduction of any technological function (be it related to security, payment, or multimedia services) into an EC application has therefore to be measured against its overall usability by the categories of users it is intended for. Again, the net result of not doing so would simply be the dismissal of this service or application.

The issues of usability, trust and confidence in EC have to be addressed with a view to defining and experimenting with technical solutions which could be adopted, in the next generation of Internet-based EC services and applications, to create a familiar and trusted commercial environment in a digital setting.

Some of these issues have already been addressed by the on-going research project TRADE (Trials in the Domain of Electronic Commerce) within the ACTS Programme of the EU’s 4th Framework Programme. Based on the authors’ experience of deploying and running advanced trials of Electronic Commerce in TRADE, this chapter will attempt to outline a scenario of how the integration of different technologies could represent the catalyst for an effective uptake of interoperable EC services throughout Europe.

In consideration of the forthcoming new wave of European Research and Technology
Development activities in EC in the IST Programme within the 5th Framework Programme, the authors also try to point out the technological areas which, in their view, are more promising for providing support to the next generation of EC services and applications, and where research and development is still needed.

INTRODUCTION

Will Electronic Commerce (EC) fulfil its promise of heralding and leading the emerging evolutionary trend towards a European digital economy? This question needs to be posed and considered seriously in relation to some aspects of EC that make it special when compared to other cases of business process re-engineering. It all has to do with users, who will in the end trust or distrust Electronic Commerce, thus dictating whether or not it will become the cornerstone technology enabling the emergence of a myriad of workable and widely adopted applications.

Trust is certainly going to be a key factor for EC to become universally accepted [1][3]. It has always been the catalyst of any traditional commercial activity: without trust in their counter-parts neither consumers nor merchants will ever engage themselves in any transactions. Similarly enough, if trust and confidence in the new digital environment of EC cannot be provided, users will simply reject this new way of trading and retailing.

Usability is another key factor for the acceptance of EC services and applications [4][7][8]. EC has in fact to do with humans, and not only computers (at a major difference with EDI). The introduction of any technological function (be it related to security, payment, or multimedia services) into an EC application has therefore to be measured against its overall usability by the categories of users it is intended for. Again, the net result for not doing so would simply be the dismissal of this service or application.

The issues of usability, trust and confidence in EC have to be addressed with a view to defining and experimenting with technical solutions which could be adopted, in the next generation of Internet-based EC services and applications, to create a familiar and trusted commercial environment in a digital setting. The objectives of future RTD undertakings (in particular the IST Programme within the 5th Framework Programme) in the area of electronic commerce should therefore be to:

- suggest ways in which innovative video, voice, communication, security and payment technologies can be used in combination to build up a “trusted digital environment for EC” in a user-centric approach;
- understand how multimedia delivery over broadband Internet extensions can be combined with low-cost network access solutions, such as ADSL, and terminals (i.e. Set-Top-Box);
- highlight all topics related to the ergonomics of an EC user interface and define guidelines in different application areas, ranging from website design to Internet TV user interface design where ergonomics and user-friendliness are achieved by means of consolidated and new standards for 3D user interfaces (such as VRML).
Some of these issues have already been addressed by the on-going research project TRADE. Based on the authors’ experience of deploying and running advanced trials of Electronic Commerce in TRADE, the present chapter will attempt to outline a scenario of how the integration of different technologies could represent the catalyst for an effective uptake of interoperable EC services throughout Europe.

**Trust and Usability in Electronic Commerce**

The issue of trust is central for the uptake of EC services and applications. Trust permeates every aspect of traditional commerce and, in some cases, EC applications are nothing else than the replication in a digital setting of procedures and processes that are well established and accepted in a traditional commerce environment. This is specially true for business-to-consumer (B-C) EC scenarios where many of the applications tend to replicate concepts such as “shopping mall”, “shopping cart”, “store”, “shop”, “electronic box office”, etc., which have well-understood traditional equivalents and for which users’ expectations and requirements are rooted in everyday life.

The notion of trust in EC is therefore even more stringent and subject to psychological and cultural constraints than in other kinds of distributed applications, where traditional equivalents may not be readily identifiable or available. This also implies that, for real-world EC applications (and particularly those in B-C scenarios), trust cannot automatically be generated by the notion that security mechanisms and techniques are in place: additional functionality needs to be provided to users (be they consumers, merchants, or any kind of intermediaries) which relates to the satisfaction of at least some of the basic requirements derived by traditional commerce experiences.

Video, voice and multimedia technology can be of great help in providing services which resemble conventional commerce experiences and facilitate the transition to and the acceptance of EC applications by users. Audio-video services can be provided within the EC application user interface to allow conversation with a human shop-assistant or a help-desk operator for pre- or post-sales assistance in B-C scenarios, or human interaction between co-operating partners in business-to-business (B-B) scenarios.

Likewise, multimedia visualisation functionality allows a 3D representation of objects and environments (such as VRML) to emulate a traditional shopping experience and substitute for physical presence.

Even if not strictly necessary for completing either B-B or B-C business processes in some cases, it is believed that these services can facilitate acceptance and penetration of EC application and services among users and, specially, those with limited familiarity and experience of information technology services.

This raises another fundamental issue in EC which is related to applications and services usability. It is clear that even the most sophisticated and useful functionality cannot be accepted if, in the end, is not suited for use by the category of users it is intended for. So usability considerations have to come before of any others and dictate whether or not
technical features can satisfactorily be adopted in a specific EC service or application.

Compared with daily life shopping experiences it in fact appears that the existing EC tools on the Web often miss the mark in terms of ease of use. Consumers strongly request a straightforward path of purchase, with a very limited number of steps. This is vital for impulse shopping where delays in the order completion (e.g., in payment) can easily result in the consumer changing his mind and cancelling the operation [4].

Streamlined purchased operations might still conflict with the necessity, for companies to identify the consumer, for security (and marketing reasons). Registration forms, as an example, have often proved to be dissuasive for users.

Identification schemes should be explored in depth, so as to offer tools that are reliable for the merchants but very easy and transparent for the customers (while keeping high security standards).

In more general terms it appears obvious that, in order to reach a wide consumer diffusion, EC tools must be based on consumer-friendly technologies offering extreme ease of use, intuitive access to functionality, and zero-time training.

HOW CAN TECHNOLOGY HELP?

New opportunities for the multimedia market related to EC are represented by networking of firms and the interest of small and medium enterprises (SMEs) in EC. These activities are expected to provide companies with significant benefits in term of reduced costs (avoiding or limiting the product distribution chain) and wider business opportunities and models (including the setting up of virtual companies) [5].

The new opportunities create new business functions that tend to restructure the value chain, e.g., by squeezing out the old middle-men functions and introducing virtual middle-men who offer value-added services such as brokering, searching and referring. These new functions, in turn, create new markets shaped by electronic commerce using the new technologies in combinations of text, pictures and sound—i.e. multimedia.

Electronic Commerce includes both well-established and emerging technologies. Well-established technologies are mostly related to proprietary networks, whereas the emerging ones are mostly related to the Internet, but encompass other technologies as well including technological and organisational hybrid forms as CD-ROM/Internet and intranets (e.g., company network based on the Internet). The importance of the Internet in this relation lies in that it changes electronic commerce from being about transporting data into being economic activities on the Internet.

The new business opportunities are reflected in potential benefits for the end users, such as drastically enlarged choices in the emerging global marketplace and reduced costs of production and delivery. These new opportunities are, however, accompanied by new problems: these are related to access to the global marketplace, the new business models, and trust and security.

Successful development of Electronic Commerce requires a leading edge combination of
telecommunications infrastructures, technologies and services. Europe has a good starting point in a well-developed telecom infrastructure, but this position is threatened by very committed actions in both the US and Japan. The many actions currently undertaken in all of the three blocks to promote electronic commerce represent also a trend of developing incompatible standards—obviously a problem for an activity generally accepted as being global. Industry collaboration to counteract this is emerging and being supported by the Commission.

The business model related problems include profitability issues referred to above but, also, a new scenario where Internet is seen as the new market place, but it is not (yet ?) a market place in the traditional meaning with established and accepted rules and traditions for quality checks, choice, billing, payment etc. Such a scenario does not only involve security technologies but also transparency (‘how to locate’) and specific value creation. Some of these issues are beginning to be discussed as Open Service Provision (OSP).

Trust and security are often seen as technical issue and these are discussed in the following section. They also involve organisational aspects related to identification of the seller—who is he, and can he be trusted?—to redress—how to make a successful complaint on quality to a seller on the other side of the world?—to payment—can electronic payment be trusted and who holds the responsibility for possible failures? . These questions are not only important to consumers: failure to come up with answers creating confidence in the new products and functions will prevent the opportunities of EC from being realised.

**Security on the Internet**

The Internet still provides poor security, making customers reluctant to trust and use EC. Security and trust have many aspects and seem to be key issues for the provisioning of Electronic Commerce services. Functions in EC such as ordering, referral, delivery or payment typically require different kinds of security and, on the other hand, also users have different requirements (a public library has different needs from a bank).

Security services for EC have to address the main threats that the actors and the system implementing the business processes face. These threats are mainly related to authentication, authorisation, integrity, non-repudiation, availability, and confidentiality.

Technical solutions exist for many of the above issues: they are mainly related to firewalls, encryption, identification and user authentication methods and are increasingly related to World Wide Web (WWW) activities.

WWW transactions can be secured at three different levels: above HTTP, at the HTTP level, or below HTTP. Securing transactions above HTTP (CGI-PGP) involves the usage of HTTP as a transport mechanism for transferring data that will be decoded by external applications. At the HTTP level, the protocol can be enhanced to deal with encryption and authentication either in an ad-hoc way (SHTTP), or by adding security to the protocol using an extension protocol (PEP). Below HTTP a number of protocols (SSL, TLS, IPSEC, etc.) can be used to establish a secure and authenticated session on top of which the transactions can take place.
Even though security protocols like SSL (Secure Socket Layer), which is application-independent, and S-HTTP are already widely accepted on the Internet, additional security protocols are required in the specific context of EC applications either for a stronger protection or for better performances. One option is the SET (Secure Electronic Transaction) system developed for payments, but including features for encryption, identification and authentication.

Security protocols and implementations are presently evolving rapidly: security needs a standardisation of products overall for software vendors which have to integrate standardised EC functionality into standard software products in order to overcome barriers of technology present among SMEs. Further, standardisation should preferably be made on the market in co-ordination with institutions representing legal and regulatory aspects.

The security issue is perceived as important across regions, maybe somewhat less in the US, where new technologies such as SSL, SET etc. are being developed. Although export restrictions are being relaxed, strong encryption for most standard products is still only available in the US domestically.

Users have to have guarantees regarding transaction security. Users are not technicians and are usually not able to evaluate the quality of the proposed system on the basis of purely technical parameters. From this point of view, the compliance to a standard widely known as “secure” can contribute to increase user confidence in the system security.

However, other “less secure” tools could be exploited for transactions involving a very limited amount of money. Typical examples of such category of tools are represented by micro-payment systems.

Payment systems

Full realisation of the potential of Electronic Commerce applications over the Internet requires a payment system with a proper security environment in the sense that it ensures the trust of users and consumers.

However, another important issues is privacy that, in turn, can be split in two parts:

• anonymity: the buyer's identity is not used in payments;
• untraceability: the buyer cannot be identified and, in addition, two different payment transactions made by the same buyer cannot be linked.

There are a number of present and emerging payment systems, which can be classified into three main groups, according to the traditional payment model they resemble: the card, cheque, and cash models.

Card-based systems provide possibilities for secure use of the existing card authorisation infrastructure. In the traditional non-electronic structure the risk of the transaction is usually split between the merchant and the card issuer according to certain security rules for identification and authentication. Significant improvements to this model have been introduced, however, in some of the net-based electronic developments of this model. For instance, this is the case of the SET (Secure Electronic Transaction) protocol which provides
secure transaction, identification and authentication of both seller and buyer—or other parties in a transaction—based on a third party issued key-certificate. The SET system is very secure, but it is not anonymous and it is traceable. The bank involved knows the identities of the parties involved in a payment transaction and can link different transactions.

Cheque-based payment systems are the electronic counterpart of the paper check model and, as such, carry a reference to the issuer to prove their validity. Here digital signatures are used for signing and endorsing of the check and digital certificates for authenticating the payer. The security of these systems depends on the encryption chosen; it is not anonymous and it is traceable by the bank.

The cash model relies on electronic tokens, which may be authenticated independently of the issuer. To achieve this, self-authenticated tokens or tamper-proof hardware are usually adopted. This is the case of systems like Electronic Purses or Wallets consisting of a chip card which can be actually loaded with an amount of “electronic money” by means of an Automatic Teller Machine under control of the issuing bank. Here the cardholder bank account is debited during the process of loading the Electronic Wallet. These systems are typically less secure, but anonymous and non-traceable.

**Broadband platform for EC**

Basic requirements for an advanced EC platform are high quality of service for interactive and distributive multimedia applications and use of real video streaming such as MPEG1, MPEG2 or higher layer encoding. Compliance to standards (as for networking, security, multimedia, and payment services) and the availability of multilingual user interfaces are also perceived as important issues. But the requirements are under the constraint, especially for EC services targeted to residential users and SMEs, that the services need to provide low-cost access solutions or at least to provide what is considered as high value added [6].

An obvious solution is to allow customers’ access to broadband networking facilities via the low-cost ADSL access technology. The ADSL access appears to be the most promising technology in delivering high-speed data to residential users, both from a technological and an economical point of view considering a situation where twisted copper pairs are generally the only transport medium ubiquitously deployed. Modulation techniques for an intensive exploitation of the copper medium (CAP, DMT) are also quickly progressing.

ANSI has standardised the DMT-based solution for the transport of up to 8 Mbit/s to the customer. Other solutions, like the CAP-based ones, being more advanced in terms of industrialisation, represent alternative solutions to DMT, possibly better suited for other rates.

High quality videoconference is possible by using the duplex transport channel of up to 1 Mbit/s of the ADSL system, as well as video streaming via ATM-ADSL connection.

In this way, a subsequent upgrade of the access network with ADSL terminations will not require changes or modifications to other network elements (local node), nor will the use of additional or different equipment in the customer premises except for the ADSL modem.
The experience of TRADE

Project TRADE (TRiAIs in the Domain of Electronic commerce) aims to develop a new Electronic Commerce platform by integrating different kinds of multimedia interactive services in the context of different security solutions such as SSL, SET and OSK. [1]

Great importance is given in TRADE to security and payment issues and the project aims to adopt and evaluate different solutions in the context of EC pilot trials:

- integration of SSL (Secure Socket Layer) in the applications of the first phase of the project;
- integration of SET functionality in client and server to allow more secure payment transactions with banks, credit/debit card companies;
- integration of cheap smart card readers in the client (SOHO) terminal equipment as to enable advanced payment and authentication methods.

As for the platforms for the delivery of EC services, project TRADE plans to:

- evaluate different network transport technologies such as ATM, ISDN and their interoperability;
- demonstrate the benefits associated with ATM over ADSL to offer broadband access supporting multimedia services and high quality video streaming;
- improve the traditional Internet capabilities with real video streaming (MPEG coding) and videoconferencing at high bit rate (up to 1Mbit/s by ADSL);
- integrate a low-cost EC client platform architecture (in particular, a Set Top Box connected to a common TV set).

In the application domain, TRADE embraces three different areas of business encompassing B-C and B-B scenarios: ticketing services for entertainment, sales of fashion items and provision of legal and administrative consulting services. Within the context of these application areas, the major goals of TRADE are to:

- demonstrate the possibility of offering high quality multimedia services with sophisticated, but ergonomic and user-friendly interfaces;
- comply with the emerging multimedia standards, in particular VRML (Virtual Reality Markup Language), for interactive user interfaces and MPEG for video delivery;
- evaluate users’ satisfaction and acceptance of the applications allowing good services penetration.

The TRADE consortium is composed by the following partners: COSI, Italtel, FTI, McCann Erickson, Biglietto Elettronico, CARIDATA (I); Logic Control, Universitat Politecnica de Catalunya, Bufete Jaime Delgado Fernandez, Institut de Suport a l'Empresa (E); Université Catholique de Louvain (B); NCR Danmark (Dk); Thomson CSF Communications (F).

The project consists in two phases demonstration and two experimental and trial platforms located in Milano (I) and Barcelona (E), providing access to both residential and business users.

The Italian platform, as depicted in Figure 20, is based on ADSL access systems. Users are provided with a TV Set Top Box or a multimedia PC connected to the ADSL NT (Network
Termination) with an ATM 25 Mbit/s interface. The ADSL NT is connected via ATM over ADSL to the ADSL LT and the Access Adapter. The ATM node is connected (ATM 155 Mbit/s) to the Video Server which provides storage for all the MPEG video clips to be delivered during access to the different EC services.

Figure 20: The Italian EC platform

The TRADE server hosts all the applications and databases of the project. During the first trial phase of the project in the Italian trial island, the EC applications provided implement solutions capable to manage the whole cycle of the reservation and selling of tickets related to sport, cultural and entertainment events and requirements of highly specialised professional users (large and medium-sized tickets agencies) and semi-professional agencies (box offices). Figure 21 shows the overall arrangement of the EC scenario for the ticketing service application in Italy.

Figure 21: EC scenario of the ticketing service application in the Italian trial island
The applications of the second phase of project TRADE are developed in the Fashion domain (jewellery and furniture shops). They are characterised by 3D new user interfaces developed by the standard VRML and the real video streaming (in particular MPEG coding).

Similar arrangements of the EC trial platforms (without access to broadband networking) have been set up in Barcelona (E) to support EC applications in which legal and administrative consultants provide professional consulting services to both business and domestic users.

**Conclusions: what is next for EC? Hints for RTD in the IST Programme**

In the present world-wide transformation from an industrial society to the information society, new technologies are the catalyst of profound transformations in the way individuals and SMEs will live, work and do business in the next few years [2].

On one hand, the convergence of telecommunications, TV and traditional data networking technologies, and their ubiquitous availability at reasonable prices, will fertilise the growth of a myriad of “distributed applications” and “networked organisations” where physical separation between partners will no longer be a factor hindering the interaction between individuals and organisations.

On the other hand, advances in multimedia, security and digital video/audio processing technologies will allow the development of advanced services and innovative user interfaces satisfying the requirements of broader and diversified categories of users in working as well as spare time. Alongside the traditional “keyboard and display” user interfaces, satisfying the needs of “information workers” at the office and “leisure seekers” at home, keyboard-less and display-less user interfaces are expected to more and more frequently satisfy the needs of people “on the move”. Also, unobtrusive security and payment services will be able to provide the required data protection and high level of functionality without inhibiting users from accessing network-based applications because of either the fear of exposing sensitive data to malicious handling or the nuisance of undergoing complex security procedures.

Electronic Commerce is certainly one of the areas which will benefit most from the above technological advances and the enlargement of the user population having access to it. These advances will definitely contribute to the construction of that “trusted digital environment” for Electronic Commerce which is considered to be the single most important requirement to be achieved for a wide user acceptance of this new way of doing business in a digital setting.

Here, a number of phenomena are likely to occur in several technology areas which are of importance to electronic commerce:

- 3D and digital video technology (most likely MPEG-4) combined with voice-input/voice-output (mainly text-to-speech) will allow the construction of highly appealing and powerful user interfaces where animated, talking avatars can be used to provide virtual help-desk operators and shop assistants for EC applications in the B-C domain;
- advanced digital speech processing technologies, providing multi-speaker speech
recognition in adverse noise conditions and high quality text-to-speech voice output in
different languages, will offer access to EC applications in the B-B and B-C domains to the
fastest increasing European segment of telecommunication users: mobile GSM telephone
users;
• new security mechanisms will allow high level of data protection without relying on the
present weak “export grade” security made available by the US export regulations; at the
same time complex EC transactions involving several business partners, and very likely
mediated by software agents on behalf of the user, will need to be performed in a user-
friendly, yet highly effective way which, in addition could be deployed on a wide variety of
accesses to the EC application: Internet, STB, phone, mobile phone, etc.
• payment mechanisms suited to the different users’ requirements will eventually emerge;
as no “cure-all” payment system is likely to emerge. However, it is anticipated that micro-
payments methods will be mostly used for retail applications involving small transactions,
followed by more traditional smart-card based methods, such as SET and secure POS-
gateway transactions for card acquirers;
• as the variety of access methods to EC services will likely increase, together with the
different quality-of-service available over the different access connections, EC
applications need to be designed, as far as possible, independently of the access
platform, the QoS available, the kind of users accessing them (business users vs.
consumers). This calls for a unified way to design EC “meta-applications” which are de-
coupled from the above complexities via sophisticated user and application management
functions taking care to mask access, QoS, and user-interface diversities.
All the above areas need to be investigated in future RTD undertakings and, particularly,
those in the IST Programme focused on the next-generation of EC services and applications.
We firmly believe that both advances in the state-of-art of EC-related technologies and
demonstrations of how these advances can be used to support innovative EC applications in
different business sectors could really represent the catalyst for an effective uptake of
interoperable EC services throughout Europe.

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