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E-Commerce

E-Payment with global Micropayment Capability

E-commerce is an innovative way of doing business on the internet, and encapsulates concepts such as on-line banking and web-shopping. According to the forecasts, e-commerce can radically alter economical activities and the social enviroment surrounding them. The growth has been really impressive.

FRANK KOCSIS

Some main trends in the telecommunications are substantially influencing the way we live our lives and do business today:
- introduction of internet and internet-based services on a mass scale,
- a real explosion in the number of mobile phone users.

We are also observing the first phase of the commercialisation of convergence between mobile communication and the internet. The first mobile internet solutions and services are here, or will be introduced soon. It is expected that one of the most important applications will be electronic commerce (e-commerce).

An exploding development

Starting from a mere 725 million US-$ in 1995, total e-commerce is estimated to hit an average of 154 billion US-$ in February 2001 and 1 trillion US-$ in May 2003. A user can obtain practically anything over the internet today and the demand for easy access to more goods and services can only continue to spiral upwards. Customers would like to have easy access any time and anywhere. Today, there are approximately 210 million PC-terminals with internet access, and it is projected that the numbers will explode to approximately 350 million by 2005. Analysts also predict that by 2004 about 500 million mobile phones will have browsing capabilities. The mobile phone is serving its purpose as a medium to communicate very well. The next step is to develop a technology that not only allows the user to access the internet from a mobile phone terminal, but also to actually conduct commercial transactions over that same terminal. Using GPRS-technology, the capabilities of the widely deployed GSM-systems can be extended considerably providing substantially more bandwidth for mobile data services. The introduction of other wireless standards such as WAP (Wireless Application Protocol) enables the use of internet services from mobile terminals on a mass scale. WAP is the important first step for mobile portables. In that it allows users to retrieve relevant information irrespective of where they are. An added advantage of WAP is that it works seamlessly with all existing and future wireless network standards. WAP-enabled devices are already available on the market. WAP is an important enabler for the deployment of mobile internet on a mass scale.

Both users and service providers benefit from the introduction of mobile internet and WAP-technologies. Different classes of service providers (infrastructure providers selling air time, content providers selling content, etc.) can generate new revenue streams introducing new, WAP-based services. However, to charge for these new services, new means, procedures and tools are necessary. Different payment methods exist on the market, having different pros and cons. However, in most cases the transaction costs are simply too high, and in many cases even prohibitive. The market is waiting for a new e-payment system that offers the so-called global micropayment capability to handle even very low payments. Many content providers can make money first using an e-payment method with micropayments. E-commerce (also mobile e-commerce) also requires suitable e-payment methods to pay for the physical and digital goods sold through the internet.

Requirements of an advanced E-Payment System

In the new digital age, a more and more important and a more and more general need arises to be connected to anything, anywhere and at any time. Consumers would like to be able to purchase all kind of goods and services using the internet. This leads to new business opportunities, and new revenue streams are possible for content providers and merchants.

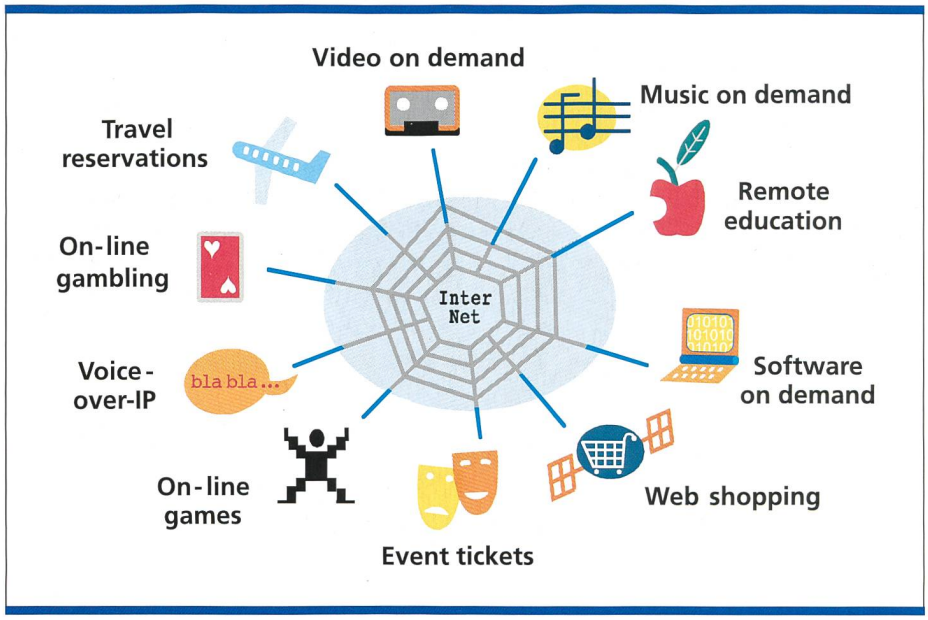

Fig. 1. Combined with the mobility provided by mobile technology, e-commerce can be very attractive for the consumers.

Combined with the mobility provided by mobile technology, e-commerce can be very attractive for the consumers. Figure 1 shows some application possibilities. Travel reservations, on-line gambling and on-line games, remote education, on-line distribution of software, video or music, etc. are existing applications, or the introduction of such services can be expected in the near future.
Advanced solutions should enable the purchasing from all types of terminals (mobile or fixed), purchasing (or selling) both digital goods (content, services, etc.) and physical goods. However, the consumers should pay and get invoiced for their purchases. So tools and methods are necessary to support all types and sizes of payments via the internet (fig. 2). One of the key issues in advanced e-commerce (using both wireline and wireless technology to access the consumers) is the development and introduction of a multi-purpose e-payment system. The key issues or requirements concerning such an advanced e-payment system will be discussed briefly in the following.

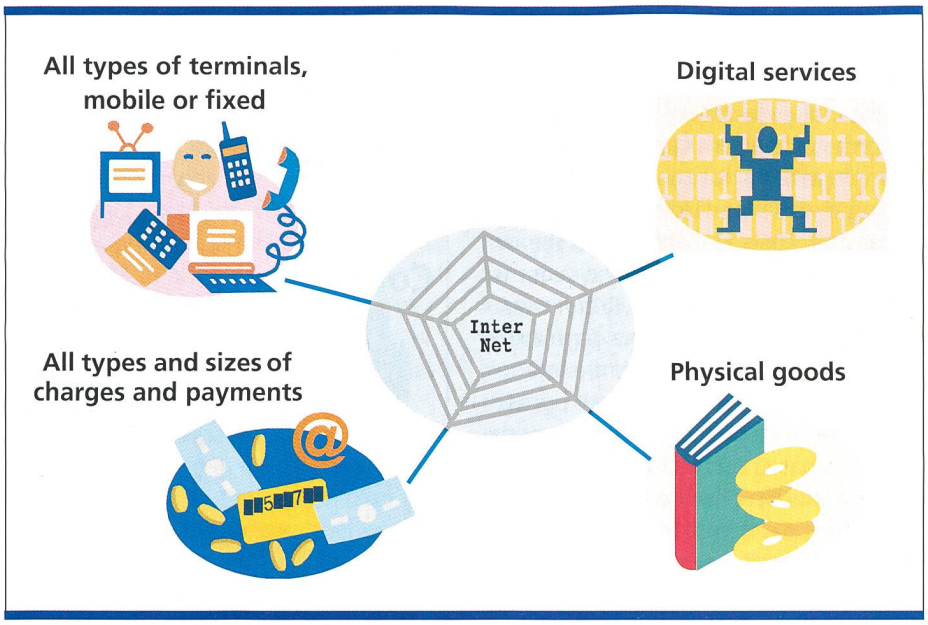

Fig. 2. Tools and methods are necessary to support all types and sizes of payments via the internet.

Easy to use

In the early days, the use of internet was rather complicated and it was mainly used by scientists and experts. As its use has become much simpler, the number of users has exploded. One of the main reasons for the popularity of the internet today is the feature "easy to use". Similarly, e-commerce can only be successful if the large masses of people can be addressed. However, this is only possible if the different elements in an e-commerce system are easy to use. So one of the most important requirements concerning an advanced e-payment system is that everybody can use it easily without any special expertise. If a PhD is necessary to use a mobile handset for payment, the success of the solution can be seriously questioned because the number of PhD's is usually rather low in the population. Easy to use means that simple steps are necessary to arrange a payment for a service or purchase via the internet, so even other people can use it very easily without any special training. High level graphical interfaces should be available, and the process itself should also be self-explainatory.

Security

As payment and money is involved, easy to use doesn't mean that security can be compromised. People are usually very sensitive concerning the security of their money, so an advanced e-payment solution should satisfy very strict security requirements. A high degree of security can be provided using secure user authentication such as digital signatures. In certain European countries, the use of digital signatures is mandatory even today, and there is an on-going standardization effort within the EU. It is expected that an agreed and widely accepted digital signature standard will be available within the EU shortly. After acceptance, the use of this standard will be mandatory in the member states of the EU. It is also expected that other European countries will follow the EU regulations. Similar standards or regulation are also expected in non-European countries. The proposed standard uses Public Key Infrastructure (PKI). Another aspect of security is to be in contact with a limited number of trusted payment providers. Using the current credit card based solutions, the consumer must reveal the very confidential credit card number in many cases to unknown content providers instead of communicating such sensitive information only to a trusted third party.

Minimal transaction Costs

To support all types of payments, the transaction costs should be minimal to be able to address the so-called small value economy. If the transaction costs are too high, it might be that the transaction itself costs more than the value of the transaction (the price for the purchase). In this case, it is not too very sensible to use an e-payment method, because the payment itself is too expensive. According to reports from different institutions, the small value economy is about 4 times larger than the large value economy, so an advanced e-payment method capable of addressing this segment could be very important for a large number of content or service providers. The requirement for minimal transaction costs leads to another very important feature called global micropayment capability.

Support for any Types of Charges

In e-commerce, in both wireline and mobile environments, different kinds of charges can appear. This is true for both the volume (size of the payments), and the type of charges, e.g. metered payments or reversed payments. The latter payment types can be very important for example in a usage-based charging environment (metering time or other measurement unit describing usage). The reverse payment option can be very important for example in a gaming environment awarding money (paying back) or additional games to a winner. Another possible application is to use reverse payment in loyalty programs similar to the frequent flyer programs of air companies. Other charging schemes are also possible, so a flexible business logic is necessary.

As to the size of the payments, one of the key issues is the global micropayment capability. Global micropayment means that even very small charges in the order of 0.1 cent can be charged. For example, a tiny price can be assigned for visiting a web page. However, if the transaction costs are higher than the value of the transaction, it is no sense to charge for that transaction. But in case of a micropayment capable e-payment system, the transaction costs are low enough to charge even very low prices. The importance of the micropayment capability is based on the fact that many content providers can earn money first using micropayments. For example, charging for visiting one web page, or charging a small amount of money for a piece of information (weather, stock exchange tip), for an MP3 song, a picture, etc. Although the price for a service can be very low, if consumers use it on a mass scale, the aggregated revenue can be considerable. From a consumer's point of view, the purchases (both large and small) will be aggregated on a virtual account, and the aggregated sums will be balanced at regular intervals. The account can be either post-paid or prepaid. Although the global micropayment capability is a key requirement, an advanced e-payment system should not be limited to micropayment.

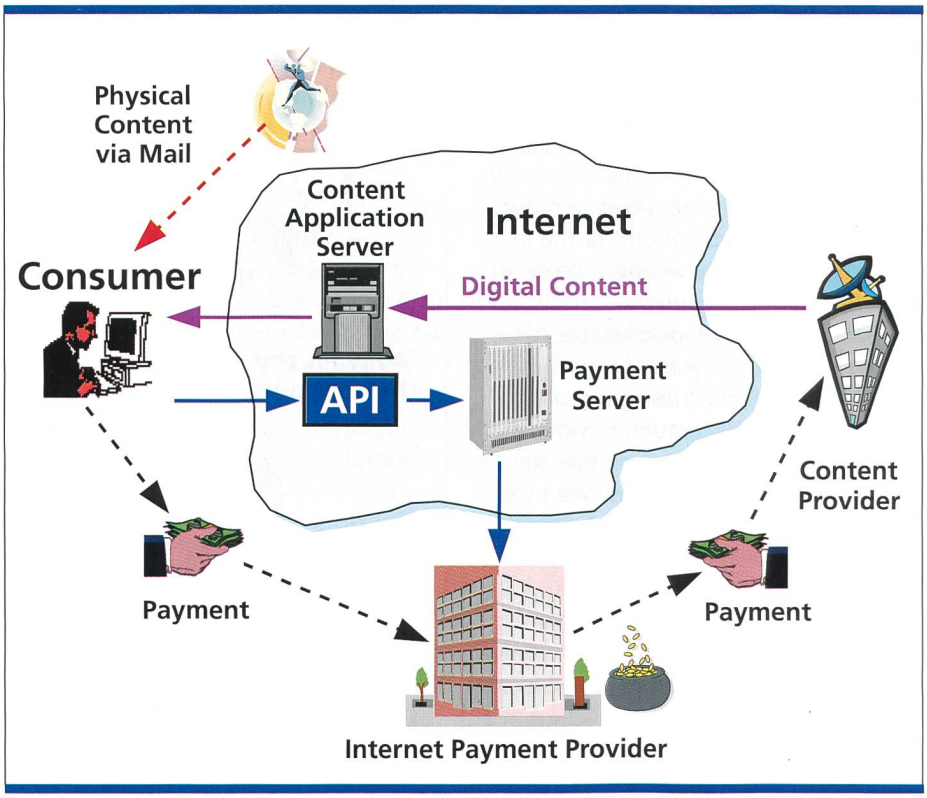

Fig. 3. The solution will be a multi-purpose payment system for the internet and its architecture will be based on the Jalda technology.

Support for both wireline and wireless Access

An advanced e-payment system should support both wireline and wireless access. It is expected that the traditional wireline internet-based e-commerce will be extended to mobile handset internet-based e-commerce (or m-commerce). Consumers would like to purchase everything, everywhere, and at any time. Providing access to e-commerce for mobile users is also a key issue for merchants. In this way, they can capitalize on the huge mobile customer base. According to the forecasts, the number of internet-capable mobile handsets will exceed the number of PC's connected to the internet in the very near future. However, the capabilities of the mobile handsets are different from the built in capabilities of PC's. The differences will be handled partly by WAP. However, there are other differences between a mobile and a wireline network. An advanced e-payment system should support special requirements related to wireless networks.

Global Roaming

A consumer might want to use his or her handset for e-commerce everywhere not only in the territory of his or her mobile internet provider, or to pay not only at his or her Internet Payment Provider (IPP). In these cases, the IPP involved will settle the payments with the home IPP. This is also a roaming situation similar to the roaming well known from mobile telephony. However, an advanced e-payment system should also provide support in such global roaming situations.

Speed

According to practical experiences, consumers are not very satisfied with e-payment solutions if the payment process is too slow and it takes too much time to finish a purchase. So an important requirement of a really good e-payment system is that it must be fast enough to facilitate a comfortable purchasing session.

API's for Content Providers

The provision of different kind of services to consumers will lead to the requirement to interface with different content-based applications. The life of a content provider will be so much easier if a well structured, open de facto industry Application Programming Interface (API) is available. On top of such an API, content providers can develop applications very easily, and they don't need to take care of the internal structure of the underlaying e-payment system.

Interface to Billing Systems

Of course, the consumers should also be billed for their purchases. Billing systems aggregate the payments from the individual customers and, at the end of the aggregation period (e.g., at the end of the month), invoices will be produced and sent to consumers. Telcom operators, merchants and other organizations on the selling side of the e-commerce value chain can have different kinds of billing systems in place. To aggregate the payments, an e-payment system should be interfaced with a billing system. To interface with a variety of different billing systems, an advanced e-payment system should be equipped with a very flexible and well structured billing interface.

A Solution based on the Jalda Technology

The Solution

In view of the challenges and requirements highlighted above, and the accep-

tance of the fact that the internet is, and will continue to be, an integral part of everyday life, it is clear that a de facto payment standard is necessary for open and secure e-commerce. This solution will be a multi-purpose payment system for the internet, with which users can pay for anything, anywhere, including payments made from mobile devices such as mobile phones and PDA's (Personal Digital Assistants); a system that works with on-line gaming, on-line retail, software providers, IP-operators, and other providers of practically any product or service over the internet. The architecture of such a solution – based on the Jalda technology – can be seen on figure 3.
The players are the consumers, content providers, and Internet Payment Providers (IPP's).

Consumer
The consumer is a customer of content providers and IPP's. In the virtual, digital world the consumer with internet access via a PC or mobile handset purchases digital goods (e.g. content) or physical goods (e.g. books) from a Web shopping application. The consumer will pay for the purchase to the content providers via IPP's. It is also possible that a content provider pays customers for their services, e.g. for answering questions in a market survey.

Content Providers
Content providers sell content which can be either digital or physical goods and/or services. However, the content providers don't directly bill the consumers. IPP's will directly bill the consumers (end users), and content providers will bill the IPP's. In this way, the content providers can obtain their money in a secure way from trusted third parties (IPP's). They don't need to invest in an expensive end user billing and collecting system (for example, dealing with delinquent customers), and small value purchases (micropayments) can be aggregated at IPP's before collecting. In this way, the transaction costs can be reduced significantly. Another issue is that content providers don't need a costly and complicated security infrastructure required for a payment system.

Internet Payment Providers (IPPs)
Internet Payment Providers (IPPs) collect the payment for the services and goods purchased by consumers from content providers. The content providers and the consumers have virtual accounts at IPP's. In this way, both the consumers and content providers are in contractual relationship with only a few IPP's (trusted third parties). The virtual accounts associated with consumers enable charging the consumers by whichever parameter the content provider desires. Charges can be incurred according to elapsed time, mouse clicks, searches, or other specified parameters and in any amount, that is, from fractions of a cent to tens or hundreds of dollars. The account set up by the user should include personal details, as well as credit or debit card details for payment purposes. These accounts are maintained and administered via an internet payment server operated by IPP's. The user is given a digital certificate which enables the "signing" of a digital signature on the purchasing contract through the internet. In other words, the mobile communication service becomes a "walking smart card".
On the other hand, IPP's also manage the account of content providers. The revenue from end users (consumers) or from other IPP's (for example, in the case of roaming) from the services or content of a content provider will be aggregated on the content provider's accounts. An IPP-cooperating with a content provider also stores a table defining the prices for the content provider's services. The price charged to a consumer will be calculated on the basis of this table. However, the prices in the table will be set up by the content providers. Content providers can also change this price table at their convenience.
The main function of the IPP-role is to provide a secure, trustworthy payment service for internet users, both consumers and e-commerce providers. It is very similar to a clearing-house functionality. The IPP could be a network operator, an ISP (Internet Service Provider), a payment card company, a bank or even a utility. Regarding the functionality, the IPP-role is very similar to that of a credit card company such as Visa or Mastercard, and therefore, issues of security are appropriately dealt with. For example, a bank or credit card company can effectively re-use the existing IT-infrastructure, and the brand name.
The IPP will invoice the consumer (end user) for all the services provided by the content providers having a contract with that IPP, or with content providers accepting the IPP collecting the money for them. The IPP can bill all services for its customers on one invoice periodically, for example on a monthly basis.
The main building blocks of the solution (fig. 3) are the Application Programming Interface (API), and the payment server. In case of mobile payments (fig. 4), a proxy server between the public wireline internet and the mobile network is necessary.

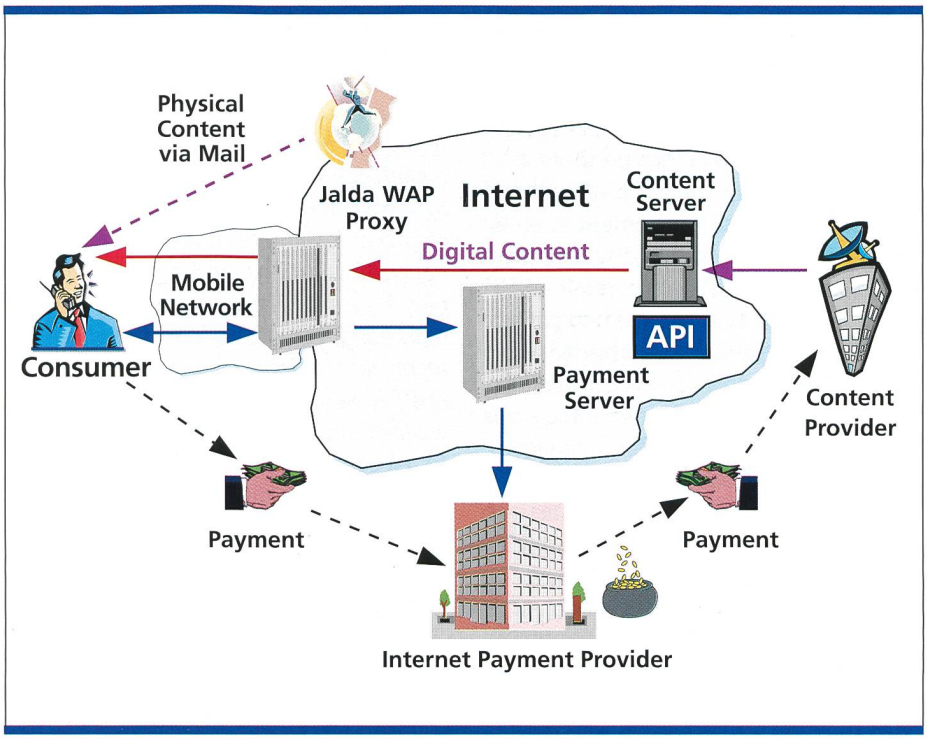

Fig. 4. The main steps of a purchase from a mobile handset.

The payment process

Based on the open API-concept, a content provider can create applications for two working modes. In the so-called local mode the API is located at the server of the content provider. In case of remote mode, the API will be located at the end user equipment (e.g. PC). A mobile payment system can be implemented as a local application running on a server accepting calls from mobile handsets.

As a first step, an account is opened for a consumer (end user) at an IPP. The account contains all the necessary data to administer the consumer. All payments made by the consumer will be aggregated on the account.

On the other side, another kind of account will be opened for a content provider at the IPP. The data stored in the account will reflect the contractual relationship between the IPP and the content provider. All payments from consumers for the services of the content provider will be aggregated on the account. Additionally, a pricing table will also be opened at the IPP, where the prices for the services of the content provider will be administered. The content provider can modify this table according to the contract with the IPP.

The payment transactions follow similar procedures both in case of local and remote applications. When a payment is initiated, the API will establish a secure connection between the user application and the payment server located at the IPP. This procedure protects sensitive data streams from tampering and eavesdropping. As needed, the API supplies an abstract value, called a tick, which will be registered by the payment server. Any financial value can be assigned to a tick. This financial value can even be a very small one, providing global micropayment capability. For example, the price for visiting a web site, or similar. When a tick is received by the server, an analysis process is started. On the basis of the data stored in the server, the following information will then be derived.

Who sent the tick?

- Which content provider and product the tick refers to?
- What is the price for the tick, and what discount scheme applies?
- Who will pay (not necessarily the person sending the tick)?
- How the consumer will be billed (pre- or post-paid, credit limit)?
- If the requested service allows purchases on credit

As a result, all data necessary to charge for a purchase will be available on the server. As the price information is stored on the payment server, the financial value assigned to a tick can be modified easily if the content provider decides to change the price.

The main steps of a purchase from a mobile handset are the following (fig. 4.):

- The customer will send a purchase order to the content provider. At the same time, the content provider will inform the IPP about the purchase request.
- The IPP first checks if the customer is a registered with a valid account. If yes, a contract will be assembled based on the information from the content provider and the price information stored at the IPP. The contract will be sent to the customer.
- If the customer agrees with the contract, he or she signs it, and the signed contract is sent back to the IPP.
- The IPP will again check the contract coming back from the customer (e.g. the signature will be checked), and the contract will be stored.
- If everything is OK, the IPP confirms the purchase at the content provider, and the purchased item (physical or digital good) will be delivered to the customer. At the same time, the charges for this purchase are sent to the account of the customer.

At the end of the billing period, the customer will be invoiced. Using this solution, the consumers (customers) are in contractual relationships with the IPP. The same applies to the content providers. This means that any sensitive information (e.g. account number, etc.) is only available at a trusted third party, at the IPP. On the content provider side, the content providers are in contractual relationships with the IPP or IPP's.

Security-related issues

To meet the needs of secure transactions over public networks, the proposed solution uses cryptographic technologies:

- to check the identity of IPP's and consumers (authentication)
- to establish secure connections between an IPP and consumers
- to provide confidentiality about sensitive (e.g. financial) data
- to use digital signatures to sign contracts

The system is based on the use of the RSA Public Key Infrastructure (PKI). Each consumer receives a pair of keys. One key is called public key, the other one is the private key. The public keys are published, while the the private keys are kept secret. All communication involves only public keys, and no private key is transmitted or shared. The public key cryptographic technology can also be used for authentication by digital signatures. Jalda technology uses digitally signed certificates for the authentication of the parties (consumers and IPP's) in the transaction processing. 7

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EHPT is an independent, world-class provider of application software and services to telecom operators and ISPs, and has installed over 500 OSS&BSS systems in 75 countries. Its success is based on thorough understanding of the convergence of telco and IT networks. Founded in 1993 as a joint-venture owned 60% by Ericsson and 40% by HP, EHPT has a global presence, with ist headquarters based in Stockholm, Sweden.

Zusammenfassung

E-Payment mit globaler Micropayment-Möglichkeit

Auf der Grundlage einer Zusammenstellung der wichtigsten Anforderungen an ein modernes E-Payment-system wurde eine neue E-Payment-methode mit globaler Micropayment-Möglichkeit (Zahlung von Kleinstbeträgen) präsentiert. Die Lösung kann sowohl im Festnetz und Mobilnetz als auch in Internetumgebungen eingesetzt werden. Die globale Micropayment-Funktion ermöglicht eine grosse Anzahl neuer, ertragssteigernder Applikationen, die auf der WAP-Technologie basieren. Als Schnittstelle für die Applikationen wurde ein gut strukturiertes API entwickelt. Dieses wird gratis verteilt und die Content Providers können darauf ihre eigenen Applikationen entwerfen. Das API kann von der Website www.jalda.com heruntergeladen werden. Die Sicherheit des Zahlungsvorgangs mittels Jalda-Technologie wird durch den Einsatz digitaler Zertifikate und durch PKI-basierte Verschlüsselungstechnik unterstützt.

TETRA

« Standard nears completion »

The European Telecommunications Standard Institute (ETSI) announces that the drafting of TETRA (Terrestrial Trunked Radio) standard Release 1 will be virtually completed by the end of 2000. Future developments for a new release are planned to commence as soon as possible.

TETRA is the ETSI standard designed for a new generation of digital land mobile radio communications. It is a modern digital Private Mobile Radio (PMR) and Public Access Mobile Radio (PAMR) technology aimed at meeting the needs of a broad range of demanding users. Main applications include shared systems for public and national safety, emergency and security services, public access systems for use by professional commercial users and private systems run by major organizations such as public transport operators.
TETRA uses Time Division Multiple Access (TDMA) technology with four user channels on one radio carrier and 25 kHz spacing between carriers. The unique features of TETRA which are addressing the critical needs of many different types of user include comprehensive group communication services and facilities, the capability for direct communication between radio terminals and, above all, sub-second call set-up time. Other services include circuit data and Internet Protocol (IP) compatible packet data, frequency economy and a comprehensive range of security features.
Brian Oliver, Chairman of ETSI Project TETRA, says: "The TETRA standard has now reached maturity with almost 95% of TETRA Release 1 finalized. However, like GSM, TETRA will continue to evolve and a significant effort is now going into the planning of the next generation of TETRA. This will maintain the unique characteristics of TETRA, including fast call set-up and group style communication, whilst adding new multi-media services and increasing data rates to ensure its compatibility with the 3G technologies."
ETSI Project TETRA currently involves over 150 representatives in its various technical working groups, with support from the TETRA MoU Association providing further expertise in specialist areas. ETSI Project TETRA has already produced 131 deliverables and there will be about 70 additional publications this year, 20 in the year 2001 and 5 in the year 2002.
Karl Heinz Rosenbrock, ETSI Director-General, comments: "ETSI Project TETRA is one of the most productive committees in ETSI. Out of the 130 or so standards published, half of them were published during the past year." He adds: "The ETSI TETRA standard is now becoming a clear commercial success, following in the footsteps of DECT and GSM, both being implemented globally."
The TETRA standard is now used throughout Europe and is already deployed or will be deployed soon in the Far East, the Middle East, Africa and South America. This rapid deployment in just a few years has signalled the success of TETRA, not only as a replacement technology in traditional mobile radio markets, but also as a technology suitable for new markets, such as the military. Phil Godfrey, Chairman of the TETRA MoU Association, comments: "TETRA already has well over 50 contracts and/or commitments from a wide variety of user organizations. The current TETRA market value is estimated to be in excess of US-$ 2 billion, with market projections for over US-$10 billion by 2004."

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