By Niina Mallat, Matti Rossi, and Virpi Kristiina Tuunainen

Mobile Banking Services

Adopting new and innovative mobile financial applications and service provisioning methods.

The rapid pace of adoption of next-generation mobile handsets in Asia and Europe has created opportunities for new and innovative mobile services. Some of the most promising, while still marginally adopted, are mobile financial services. Here, we investigate emerging mobile financial applications, including both mobile payments and banking services, showing how the new financial services can be deployed in mobile networks and identifying the main players in the emerging mobile financing value chain. We use examples from the European context to highlight the features of the new services as we explore the players' particular strengths and weaknesses in providing the services.

The wide penetration and personal nature of mobile phones, the overall stability of mobile communication technologies, and the positive experiences with m-commerce payments have made mobile solutions applicable for a variety of financial services. Current mobile financial applications include mobile banking and a variety of different micropayment solutions. Today, mobile payments are mainly used to pay for popular mobile content and services since there are few alternative payment solutions available. Other successful applications include ticketing and vending.

Mobile banking services are valued by users because of the inherent time and place independence, and the overall effort-saving qualities [7]. More generally, security and convenience have been suggested as the key drivers for the growth of mobile commerce [4, 8]. Personal mobile devices are effective in identifying the payer and confirming the transaction. Despite the claims of insecurity [3], the users seem to be willing to use quite simple mechanisms, for example MSISDN (the user's mobile telephone number) and PIN (personal identification number) for authorizing mobile micropayments. For proximity micropayments, technologies such as infrared, RFID, and Bluetooth have been applied. Macropayments and account transfers require higher security, and for these purposes wireless adaptations of PKI

and TLS/SSL (for example, the WAP 2.0 standard contains specifications of WPKI and WTLS) have been developed to enhance the security of mobile transactions (for more information, see [2]).

Mobile Payments

Mobile payments are expected to become one of the most important applications in m-commerce [9]. They are commonly categorized into micro- and macropayments with the distinction between the two occurring at approximately 10 euros or U.S. dollars, and are further subdivided into remote and proximity payments, depending on whether the purchase takes place at the point of sale (POS) or remotely via an electronic network (see Figure 1).

Micropayments. Remote mobile micropayments enable purchases of mobile content and services such as news, games, tickets, and location-based services. Mobile micropayments also provide a potential payment method for e-commerce (see the sidebar on micropayments).
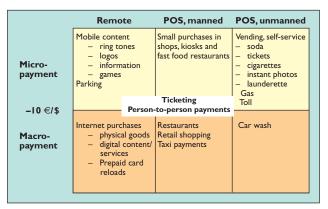
In Finland, Helsinki City Transport offers a mobile subway and tram ticket—an example of a successful mobile payment service. Customers can order a one-hour SMS ticket via their mobile phones by sending a SMS message to a service number. Approximately 55% of the tram tickets and nearly 10% of all individual tickets for Helsinki public transportation are currently purchased via a mobile phone. According to Helsinki City Transport, mobile ticket users have been satisfied with the new service, which has also reduced the problem of traveling without a ticket.

Mobile micropayments at unmanned POS include applications such as purchase of soft drinks or items from vending machines, and payments on self-service stations, for example paying for gas without cash at hand. Mobile micropayments at manned POS include small purchases at shops, kiosks, and fast food restaurants. While there are several pilot projects utilizing manned POS mobile payments, the use of these solutions has been marginal as the traditional payment methods are often more convenient in these purchase situations.

Macropayments. Mobile macropayments can be used to pay for larger purchases both electronically (e-commerce, mobile ticketing, gaming) and on manned and unmanned POS (restaurants, retail shopping, and so forth). Mobile macropayments face more competition from well-established traditional payment instruments. However, solutions developed for user authentication in macropayments provide possibilities

for a variety of different services such as passage control, digital signatures, and mobile government services.

The Finnish Population Register Centre together with Finnish telecom operators, is developing a mobile authentication service based on a WPKI solution. Mobile authentication can be used for m-government services and digital signatures both on Internet and

	Remote	POS, manned	POS, unmanned
Micro-payment	Mobile content – ring tones – logos – information – games Parking	Small purchases in shops, kiosks and fast food restaurants	Vending, self-service – soda – tickets – cigarettes – instant photos – launderette Gas Toll
~10 €/$		**Ticketing** **Person-to-person payments**	

Macro-payment	Internet purchases
	– physical goods
	– digital content/
	  services
	– Prepaid card
	  reloads
		Restaurants
		Retail shopping
		Taxi payments
			Car wash

Figure 1. Mobile payments framework with examples (adapted from [5]).

mobile networks and is expected to be available for users later this year.

Billing solutions for mobile payments. Currently, a common way to charge mobile payments is to add them to a monthly mobile phone bill. The advantages of operator billing are that it is widely available to customers and requires no additional service enrollment. In Great Britain, Vodafone m-pay is a special example of operator billing-based mobile payment, which can be used to pay for purchases on the Internet or at WAP sites. When a consumer visits a merchant's Internet site and wants to make a purchase using m-pay, he or she logs in to the payment service by user name and password. In the service, the consumer checks the details and accepts payment. The payment is then authorized and charged to the mobile phone bill or, for prepaid customers, deducted from the airtime credit (see www.vodafone.com).

In a credit card billing scheme, mobile payments are included in the consumer's credit card bill. The Mobile Payment Forum is working on standards for this area (see www.mobilepaymentforum.org). Another billing solution is to provide customers with a separate account for mobile payments. Separate accounts reduce credit risk but administering them may be inconvenient for customers. In a direct debit solution, the customer's bank account is immediately debited with the mobile payments. This solution is convenient for users because it utilizes the current bank account and requires no

additional administration from the customer.

The Dutch company Moxmo offers an example of a mobile payment solution based on direct debit to a bank account. When making a purchase via Moxmo mobile payment service, the consumer gives the merchant his or her mobile phone number. Moxmo IVR then calls the consumer and asks for a PIN, which the consumer enters via the mobile telephone keys to confirm the purchase and the payment is debited to the consumer's mobile wallet. Similarly, the consumer can charge or decharge his or her mobile wallet against a settlement bank account, or pay to another mobile phone directly. Retailers can integrate these types of payment functionality using Moxmo's Web services interface (see www.moxmo.com).

Mobile Banking

In their simplest form, mobile banking services enable users to receive information on their account balances via SMS. The new WAP- and Java-enabled mobile phones using GPRS support a wider variety of banking services such as fund transfers between accounts, stock trading, and confirmation of direct payments via the phone's microbrowser. Several European banks have

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Micropayments: A Technology with a Promising but Uncertain Future
By David Hinds

In the context of e-commerce, micropayments are Web-enabled financial transactions in which consumers can purchase online content or services for small amounts, typically defined as purchases of less than $1. Since the mid-1990s, various micropayment providers have attempted to achieve this goal by developing payment processing technologies. To be economically viable, a technology for handling payments of less than $1 must have related transaction costs in the range of 10 cents or less. Because minimum credit card transaction costs are typically 25 to 35 cents, credit card processing is not a viable option for such payments.

Micropayments provide a payment model in which content can be unbundled and sold using a pay-per-view concept. In terms of business needs, micropayments provide a means for merchants and individuals to obtain at least some revenue for content they are presently providing at no charge. To some extent, they also provide an alternative to digital piracy.

The overall business challenge for micropayment providers is to achieve a critical mass of both consumers and merchants. Merchants may be skeptical of their ability to begin charging for previously free content and they may also be concerned with losing revenue by unbundling their products. Consumers may have an inherent preference for flat-rate pricing (bundled or subscription models) over metered pricing (micropayments model), and some may merely believe that Web content should be free [2].

Earlier micropayment developers, such as Digicash, attempted to bypass the credit card system, using the concept of digital cash. These initiatives were unsuccessful and subsequent efforts recognized credit cards as part of the system and were focused on reducing the effective cost per transaction through the use of techniques such as aggregation and prepayment.

Recent successes in Europe and Japan with the sale of ring tones and other wireless services and products indicate that consumers are willing to make small value purchases of digital content. Furthermore, Apple's decision in April 2003 to offer 99¢ MP3 downloads may have signaled the beginning of a new era for micropayments. Beginning in 2003, a new generation of micropayment providers was launched (for example, Peppercoin, BitPass, Paystone Technologies) [1]. These companies claim to be able to support payments as low as one cent by offering creative techniques such as Peppercoin's statistical sampling method, which lowers effective transaction costs by a factor of a hundred.

In the future, micropayment providers will be challenged by the mobile payment systems, which have inherent advantages that could allow them to achieve low transaction costs. Additionally, it is possible that traditional credit card companies will adapt to handling micropayments as their efficiency continues to improve and as the competitive threat from other payment systems continues to increase. Will one or more of the new micropayment providers achieve critical mass? Are micropayments really ready to take off or will they merely continue to simmer? As with any emerging technology, only further experience and time will tell. **c**

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DAVID HINDS (dhh123@bellsouth.net) is a strategic management consultant and Ph.D. student in the Department of Decision Sciences and Information Systems at Florida International University.

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introduced successful mobile financial services for these smart phones, whereas some U.S. banks have recently closed their mobile banks due to lack of users. The mobile services are typically modified versions of the Internet banking services of the particular bank and the architectures are backed by several banking industry consortiums, such as Mobey forum and ECBS, for example.

Scandinavian Nordea bank provides users with a wireless banking application, which is built using the same back-office infrastructure as its Internet bank. Customers can use WAP over GPRS to track their account and credit card transactions (see Figure 2) and transfer funds between accounts. Furthermore, they can pay bills and trade equities using a menu-based interface. There is also a connection to the Solo Market, a virtual marketplace, where users can make payments by using the WAP service. The service uses changing passwords and WTLS for securing the transactions; see www.nordea.fi/eng/hen/solo/wap.asp?navi=puhelin&item=wap.

Region	Awareness	Current Usage	Intent To Use
Worldwide	40%	2%	44%
Japan	49%	2%	50%
Europe	44%	1%	46%
U.S.	22%	0%	38%
Rest of Asia	38%	4%	43%

Source: AT Kearney, February 2002

Worldwide awareness, usage, and intent to use mobile currency.

Figure 2. Screen display for a Nordea WAP bank account.

Key Players

The applications and solutions presented here seem to form an overly complex and mismatching set of possibilities. This complex structure of the mobile commerce business environment is caused by multiple players: traditional phone operators, Internet companies, content providers, and new m-commerce start-up companies, the various players having different backgrounds, agendas, and motivating interests [6]. Delivery of m-commerce applications and services requires the network, m-commerce technologies, contents, the user interface, and an efficient billing system. Each player has different strengths and weaknesses in providing these services and applications.

From the perspective of mobile financial services, the key players include banks and other financial institutions, such as credit card companies, the telecommunication operators, and retailers. Also, equipment manufacturers—of both handheld devices such as mobile phones and PDAs, as well as of POS registers and software vendors enabling the services—are incremental in creating the infrastructure.

Banks want to preserve their position as a central payment and banking services provider in the financial market. They are interested in participating in different pilot projects to see whether mobile technology has potential as a platform for financial services, and to protect their interests in the market. Banks are also interested in supporting their smart card standards (EMV) in the mobile environment. Credit card companies are interested in promoting mobile payment services especially in those countries and among those user groups where credit card penetration is low [1].

Mobile operators need more traffic and larger markets for mobile content services and applications. Efficient mobile payment solutions facilitate the sales of mobile content and also generate more traffic for mobile networks.

Technology providers hope to create standards, on which the more advanced applications could be build. For example, the Mobile Payment Forum provides an open framework for standardized mobile payments based on payment cards. PayCircle is a more technically oriented forum that proposes standard APIs for defining m-commerce applications.

Each of these players has different core competencies. Banks' strength lies in managing account-based payments, macropayments, and in mediation of payments. Telecom operators are good at handling small payments, collecting payment information, and billing. Operators also own the location info, which is based on their network services. Retailers' core competencies are in the actual commerce regardless of the channel. Technology providers and software houses are needed to deploy the terminals, telecom switch features, and application infrastructure.

The roles of these key players are not, however, necessarily apparent: in addition to their core strengths, both banks and telecom operators have a role as content creators and providers. Sometimes telecom operators also attempt to serve as financial institutions by granting credit for micropayments. Furthermore, the roles and functions these players perform today are not necessarily sustainable. Retailers, for instance, are introducing services that bypass both operators and banks. For example, a Finnish gas station chain allows the customers to pay for gasoline on the spot by sending a SMS message directly to the chain.

The ST1 gas station chain is conducting a pilot test in Finland of a mobile solution in which customers can order a security code to their mobile phone and pay at

the station with the code instead of using a credit card. To use the service, the customer first registers and announces the mobile phone number(s) and credit card number(s) to be included in the service. The customer can order the code to his or her phone in advance. When making the payment, the customer keys in the code to the gas ATM and the payment is debited from the credit card account. Telecom operators provide ST1 with an enhanced telephone number authentication service but are not involved in the payment solution as such. ST1 intends to launch the service for the general public during 2004. The company estimates the service is especially valuable for small- and medium-sized enterprises, for example taxi companies, which do not want to keep company credit cards in cars for security reasons.

Conclusion

While there is currently a whole range of mobile financial services available, most of these services are in an early phase of development and have not reached critical mass. The current full-fledged financial applications need technologies that are not yet widely used, such as GPRS and Java. However, when we move toward true 2.5G and 3G mobile networks and the applications and devices mature, we can expect quite a rapid increase in the number of users of these services. At the same time, mobile payments must become faster, easier, and more convenient to use, and must have low transaction fees, wide availability, and standardized technologies in order to emerge as a mainstream payment solution.

On the payment solution provision side we expect that, as illustrated by the mobile payments framework, different solutions will be developed for different services, depending on the size of the payment (micro or macro) and location (remote or local, manned or unmanned). There are several possible trends where different services are offered by different key players, mainly still by banks, the mobile operators, and credit card companies.

First, financial institutions and operators can cooperate and provide mobile payments together, dividing the responsibilities according to their core competencies. In this trend, mobile operators aggregate the payment data in mobile networks and banks are responsible for the actual financial transactions. A second possible trend is that operators act alone and develop solutions such as separate accounts or their own clearinghouse or credit institution where banks are not involved. This trend is most plausible for m-commerce micropayments and is possible if different players cannot find a way to cooperate. Third, it is possible that banks develop payment solutions where operators

are not involved. Bank-based solutions may emerge especially in POS and Internet payments and when the mobile network is used as a data carrier only.

The roles and tasks we have discussed are not, however, necessarily fixed, but subject to change and evolution. Currently the only successful and widely adopted payment applications have been based on the operator's billing and service infrastructure, but the emerging macropayment applications could be the domain of the incumbents—banks and credit card companies.

We believe each of the trends described is plausible, and that they are likely to coexist. Within all of them, applications will range from single-purpose applications to full-service suites. Operators' single-purpose micropayment solutions, for example, can be used for small purchases and could also easily be integrated into other applications, such as microbrowser-based m-commerce. Full financial applications combine these individual applications into full-fledged suites applicable for all types of financial services and transactions. While application developers choose which services to offer to the customers, the final decision to adopt one or several of these rests with the end customer who initiates transactions and pays for the chosen services. **C**

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NIINA MALLAT (niina.mallat@hkkk.fi) is a researcher in the Department of Information Systems Science at the Helsinki School of Economics in Finland.
MATTI ROSSI (mrossi@hkkk.fi) is a professor in the Department of Information Systems Science at the Helsinki School of Economics in Finland.
VIRPI KRISTIINA TUUNAINEN (tuunaine@hkkk.fi) is a professor in the Department of Information Systems Science at the Helsinki School of Economics in Finland.