

Flexible Services

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Mobile Financial Services MoFS
D1.1 State-of-the-art, part 1, version 1

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State-of-the-art:

A Review of International Situation of Mobile Financial Services

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1 Background: Overview of MoFS Project

Mobile Financial Services (MoFS) is a Flexible Services project that consists of research and development concerning the use of mobile phone for finance and trust related activities. Roughly, one could describe the goal of MoFS as studies and development that attempt to replace the wallet with the mobile phone - and augment it with supplemental functions and services.

MoFS is divided into thematic work packages that address different applications within mobile financial services. These work packages provide both a testbed for the implementation of the emerging services as well as the foundation for empirically-oriented research to study the requirements and effects of such applications. In practice, the aim in MoFS is to develop safe and flexible trust enablers, cost-efficient banking and payment tools for existing, new and innovative mobile services and to put these in practice by creating the critical technical and business enablers.

MoFS makes extensive use of the already existing state-of-the-art technology developed by the involved parties providing feedback, experiences, and requirements for further elaboration and successful implementation. Additionally, MoFS intends to offer already the developed

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prototype technology and application to other Flexible Services projects for trials and evaluative use.

Despite the strong technological basis and development in the project, the underlining philosophical approach towards technological development is "making the markets". During the last decade, there have been loads of trials and pilot tests e.g. in the area of mobile payments but only few have proven to be viable. The reasons for this development are studied and analyzed carefully in MoFS alongside the technical development that is carried out in the work packages of the project.

Alongside the application-specific research and development, MoFS aims at developing a living researcher and practitioner community. The aim is to gather together developers, students, doctoral candidates, researcher and regulative actors to discuss and develop the overall context that supports the practical implementation of mobile financial services. The development of the community is supported strongly by the participating universities and research groups to provide continuum for the thematic areas even outside the MoFS project itself. The participating universities include the themes and applications in their teaching and research activities together with industrial partners. This report aims at providing initial insights to the market situation and research activities.

As a deliverable D1.1 in MoFS, this document provides only part of the analysis of the market situation. There is an additional, separate document about "A Comparison of Mobile Payment Procedures in Finnish and Chinese Markets" by Junying Zhong (2009). That document is published as a conference paper in the 22nd Bled eConference "eEnablement: Facilitating an Open, Effective, and Representative eSociety and it is attached as the second part of the D1.1.

2 Review of Current Mobile Financial Services

The application domains in MoFS include mobile banking, payment, and ticketing. Additionally, authentication is a background service for payments, banking and ticketing, but also authentication services could be offered as stand-alone services. These application domains host the technological development, experiments, and trials.

Using money, opening locks or making phone calls are simple and intuitive things that even children can do. Despite this - or perhaps due to this - using a mobile phone to make payments or gaining access has not succeeded widely apart from few exceptions. One could say that so far there has been surprising little success in launching viable financial services. This can be seen to originate from devices which have kept consumers sceptic as well as service and business model complexities that have kept businesses sceptic. Easy and intuitive actions cannot be replaced with complex solutions.

Low level of usability has many reasons: small screen size, slow and unreliable Internet connection, technology driven product development to mention a few. The initial technological introduction of WAP introduced interactive services for the mobile phone. There was a great promise, but problems with WAP services were many: the appearance was limited because of small sized screens, the small screens did not offer much interaction possibilities, early-stage services resulted as not easy to use, and the usage of the services was too expensive for widespread adoption.

Customer and user viewpoint is a cornerstone in mobile financial services – as well as with any other service. Results and main findings on the US markets reflect the customer and user viewpoint. According to a KPMG survey (January 2009):

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- mobile banking important, but customers do not want to pay for it
- customers hesitant to use mobile devices for financial transactions and online banking
- 66% of US consumers do not feel comfortable using mobile devices for financial transactions.

Another survey study by Harris Interactive conducted in 2008 found that

- Security is the biggest obstacle for user acceptance
- 66% worried about using mobile phone to transmit sensitive financial info
- 63 % concerned about fraud and financial scams.
- 61% worry about losing a mobile phone containing personal financial information.

Javelin' Strategy and Research (2008) report about the usage of mobile phones in U.S. in their "US Mobile Banking Benchmark Study". The result is presented in Figure 1.

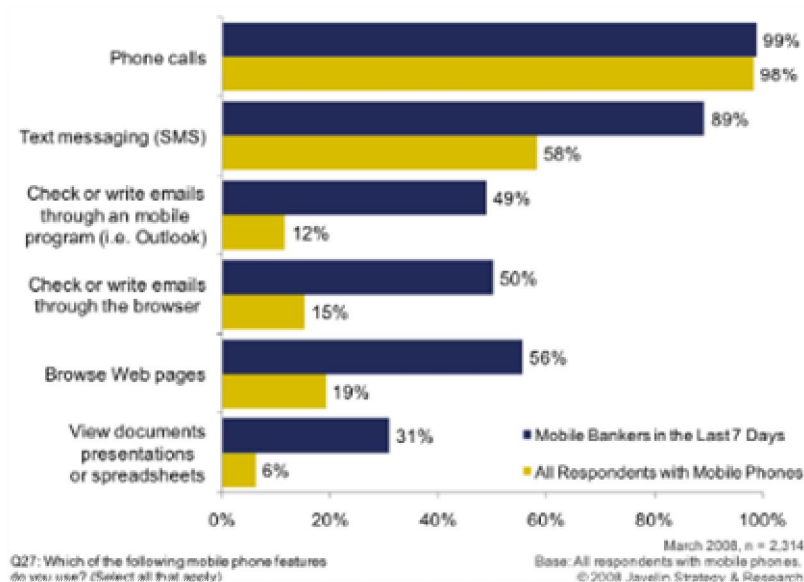


Figure 1. Usage of mobile phone functions by “mobile bankers” and all respondents. Source: Javelin Strategy and Research.

It is easy to see that the users of mobile banking are using their mobile phone in a more versatile ways than those users that do not use mobile banking. The figure does not, however, indicate what the reason is and what the conclusion is. Instead of interpreting the results just as “mobile bankers are using their mobile phones in a more advanced way” it might be interpreted also as “in order to use mobile banking, the user needs to be an advanced and skillful mobile phone user”. These two conclusions direct development work towards different solutions.

In addition to usage-centered and usability challenges, business models have appeared to be challenging as well. The co-operation of banks, mobile network operators (MNOs), credit card companies, merchants and handset manufacturers is a multi-faceted problem that has appeared to be difficult to solve. Among the challenges are revenues in a multi-actor network.

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3 User-Centred Approach to Mobile Financial Services

In mobile financial services, the most interesting questions that arise from user-centred point of view are related to the mobile context of use. Users acceptance and feel of security, situation, technology and culture are an essential part of the context of use and affect the success of mobile financial services' introduction and usage.

Mobile financial services, as any other payment services, have two users: customers and merchants. The successful introduction therefore needs acceptance of both parties and there are certain factors affecting the successful introduction of mobile payment systems. Hans van der Heijden (2005) states in his paper about the factors that: "In the area of consumer acceptance, these are their cost and their ease of use relative to other payment methods, and the perceived risk. In the area of merchant acceptance, transaction fees compared to debit and credit card systems are important, as is, to a significant extent, the ease of use for the merchant. Finally, both customer and merchant acceptance are highly interdependent as each influences the other, especially during the early stages."

Acceptance of mobile payment procedures

User's acceptance of a mobile payment can be seen as a two-step process. The first step is to full fill the essential conditions that enable the use, but do not provide motivation to use the service. Main approval criteria categories for essential conditions are costs, security, convenience, and special functionality issues, though cost and security are more important than convenience and special functionalities if categories go head to head with each other. The second step turns the intent to use into actual use if commensurate conditions are fulfilled, meaning that added-value is created for the consumer by using the service. Commensurate conditions are a combination of efficiency added-value, effectiveness added-value, aesthetic-emotional added-value, and flexible added-value. (Pousttchi, 2003)

Confidentiality of data, which is the most relevant essential condition, is affected by registration requirement and brand visibility. Brand visibility is connected to the idea of subjective security, meaning the feel of security the consumer has when using a product (Zmijewska et al, 2004). Subjective security is affected by experiences, discussion and beliefs about the product. There is no technical solution for it. Costs include costs from changing the phone, registration fees, and transaction costs. Speed is also relevant to mobile payments. The mobile payment should not any slower than ordinary payments. Mobile payments should also be widely accepted by merchants, mobile operators and be supported by a wide range of phones.

The ability to use a mobile phone for payment services provides not enough motivation for the user. Clearly, mobile phones should not be the only channel for payments (Mallat, 2006). In Japan, Sony Felica is offering financial services including payments, ticketing, access control, and membership cards. These services can be used with contactless IC chip cards but they require different card for every service. In the mobile version of these services, they can be bundled to a single mobile phone, thus preserving space and keeping everything in one place. (<http://www.sony.net/Products/felica/>)

Situation

Mobile banking and commerce are free of time and place dependence. They can be used in any place that has a mobile phone connection. Thus, the users goals are different from traditional Web context (Venkatesh et al., 2003). In fact, the ubiquitous use of mobile payments creates completely new use situations and the number of possible use situations grows significantly. If the number of use situations for a product is high then accommodating

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usability can be a challenge. Understanding the special requirements can lead to designing “mobile services that create value and generate revenues” (Venkatesh et al., 2003).

The choice of payment methods in the Internet are affected by the payment methods the user uses in the physical world (Böhle & Knud, 2001). As an analogy, the payment method used in mobile commerce should be affected by payment methods in the physical Point-of-Sale and in the Internet. The information is more important than the device itself. For money, there can be more suitable tools than a mobile phone in a certain situation. Mobile financial services should not be forced into contexts where they do not fit. Paying with a credit card or a mobile phone in a free market can be troublesome.

Technology and Investment Requirements

Mobile payment transaction technologies can be divided into cellular technologies (slow 2G and fast 2.5G and 3G), infrared, near field communication (NFC), and Bluetooth. Zmijewska (2005) has used ease of use, cost, usefulness, trust, mobility, and expressiveness as factors to analyze the suitability of these technologies for mobile payment systems.

Second generation mobile phone technologies GSM and CDMA offer great voice and messaging services. The mobile payment systems on GSM and CDMA depend on calling and messaging. The ease of use of these systems is challenging due to the limitations of using technology that has originally been designed for other purposes than payments. Perceived trust can be good because there is not a need to transfer credit card details. Mobility and cost can be an issue since calling and messaging do cost and mobile operators provide these payment services.

The 2.5G and 3G networks payment systems usually require a press of button and the PIN code. These solutions are, however, limited since the payment is easily applied only for digital content. Trust is perceived good since the amounts are relatively small and the PIN is used. Mobility is still an issue because mobile operators provide the services. Costs are low due to small data amounts and no cost for payment.

Infrared systems are also limited from the user's point of view: the beam works only in short range and it has to be directed correctly. As for usefulness, infrared on mobile phones has very low use-rate but the technology enables using the mobile phone as a wallet. Infrared's characteristics that make it hard to use make it also secure. In 2004 there were 150 million mobile phones with infrared so the technology is pretty widespread. However, current mobile phones might not support infrared as widely as five years ago. Using infrared is cheap because many phones support it already. There would be no additional costs for the user.

Near field communication can be considered as easy to use: It is used by waving the sending part in front of the reader. What comes to usefulness, NFC combined with application-specific functionality in the phone can be used to accommodate the needs of a mobile wallet that combines credit cards, loyalty cards, access cards, transit tickets etc. Perceived trust is high because NFC works only in short-range and validating purchases can require the use of a PIN code. From the investment viewpoint, many existing smart card systems understand NFC technology. The problem in mobility is that current mobile phones do not widely support NFC technology. Costs might be high at the moment because only few phone models have NFC. Currently, the technology is not yet widely integrated in mobile phones and its utilization requires that users invest into new technology.

Bluetooth is not as easy as NFC. The connection has to be manually set up. There are not any arguments supporting usefulness of Bluetooth in mobile payments. Bluetooth has a bad reputation in trust because it has been used to hijack a mobile phone. Bluetooth is widely available in mobile phones but the price of Bluetooth terminals is higher than for NFC terminals.

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4 Market Situation in US, Asia, and Europe

Few academic studies discuss the differences between the different mobile markets of US, Europe and Asia, but often these countries are discussed separately or only Europe and Asia are compared. The MoFS project has contributed to this work through a comparison between Finnish and Chinese mobile payment situation and solutions (see the paper by Zhong, 2009).

Zhan and Prybutok (2005) discuss the three large markets of Europe, US and Asia in 2005, however, much has happened since. At that time they discuss the US market as mainly used for spoken communication and sometimes text messages and very little web browsing. Currently the US' mobile market is adopting text messaging and web browsing rapidly.

Mobile phone penetration is expected to grow in 2009 to 92% (source Frost & Sullivan: Visions 2009: Paradigm shifts in mobile and wireless communications, December 2008). With the introduction of the smart phones like the Apple iPhone, Blackberry in the US, the market for wireless internet, SMS, email, video/mobile TV, music downloads and software application downloads has taken off. According to Vashney (2008), enterprises primarily uses m-commerce for location and tracking services, mobile financial services, shopping and advertisements, content, and telecommuting. Simple versions of m-commerce applications such as mobile games, payment systems, entertainment, and location sensitive content are gaining popularity throughout Europe, Asia, and the US.

Major US wireless companies are beginning to work with content and service providers to attract and retain mobile customers as well. Varshney (2008) mentions that wireless carriers' lack of experience in developing service content combined with the cost of building m-commerce infrastructure will require collaboration among multiple players, each using its own financial, technical, and developmental capabilities.

5 Mobile Banking

On-line banking solutions have been present nearly thirty years and have become widely used, at least in the western countries where the fixed Internet is widely spread than rest of the world. Almost any kind of banking activities from balance checking and simple money transfers to managing shares and loans can be done via a modern on-line banking solution.

Current Solutions for Mobile Banking

The mobile banking services range technologically from voice-based banking services and SMS-based account alerts to account balances and transactions ending in fully functional mobile banking solutions that can be used with a browser on a mobile phone. The mobile version of the Internet bank can have the same features as the Internet version that can be used with the computer and larger user interface.

In Nordic countries and Europe, Mobile banking solutions are being built based on fixed Internet banking solutions. For instance, the mobile banking solution offered by Nordea provides almost same services as their on-line bank. It can be used with mobile phones equipped with a web browser and a fairly sized display. According to Nordea, the mobile banking use will not challenge the traditional use through a fixed line but it will be a complementary channel that enhances the services offering. Another fact supporting this is the fact that payment infrastructure and methods are highly developed in Finland so there

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appears not to be urgent needs for mobile banking solutions for the Finnish market. This is a challenge for the development of such services.

Expectations are that in the developed markets, the mobile channel will not replace the fixed line channel in the short term. However, this is the case in the developed western countries; it is not the case in countries where fixed Internet connections are not yet properly built for widespread consumer use. Mobile will probably be the main channel to the Internet and, as well, to the on-line banking application.

SMS is currently the most popular platform for mobile banking in United States and it is currently the most popular platform for some time to come. In the US currently three platforms are applied for mobile payments/banking: SMS with around 60% adoption of users, WAP/browser based with 20% adoption and downloadable applications with 12% adoption. It is expected that the downloadable applications will increase since much more functionality is possible with these applications. Since the introduction of the smart phones in the US, the applications that can be downloaded and market for developing these apps has increased rapidly.

Almost all larger banks in U.S. offer a mobile payment solution. These include:

- Wells fargo (WAP technology and download apps for smart phones)
- Bank of America (BoFA): download mainly
- United (a regional bank)

Current mobile banking services in the US are:

- account alerts, security alers and reminders
- account balances, updates and history
- customer service via mobile
- branch or ATM location infomraiton
- electronic online payments and bills
- Fund transfers
- Transaction verification
- Mortgage alerts

Shahrokhi (2008) provides an overview of the status of e-finance and its challenges of 2007-2008. Mobile banking in 2007 in the US is most often performed via SMS or the mobile internet but can also use special programs downloaded to the mobile device. Mobile banking in the USA first appeared a before 2000, but it failed to catch on over the following few years. As an example, Wells Fargo shut its original mobile banking operations in 2002. It had only 2,500 users at the time. Wells is one of the first financial institutions to offer online banking and now is among the pioneers of mobile banking in the USA. Wells Fargo isn't just peddling "m-banking" to its customers; it also is providing small business and commercial "m-banking" services.

With the growth of the SMS market, the US is seen as an attractive market for mobile services as well as for mobile banking/payments. Currently all major US banks offer mobile banking solutions in some form and second-tier and regional banks are quickly catching up. The predominance of mobile banking is being SMS driven as opposed to WAP or embedded-application driven (Reuters, March 27, 2009 / J. Tilak). The rapid growth in mobile banking is, however, because of the current underpenetration of the market. Just over 3 percent of U.S. financial institutions will have mobile banking by the end of 2009.

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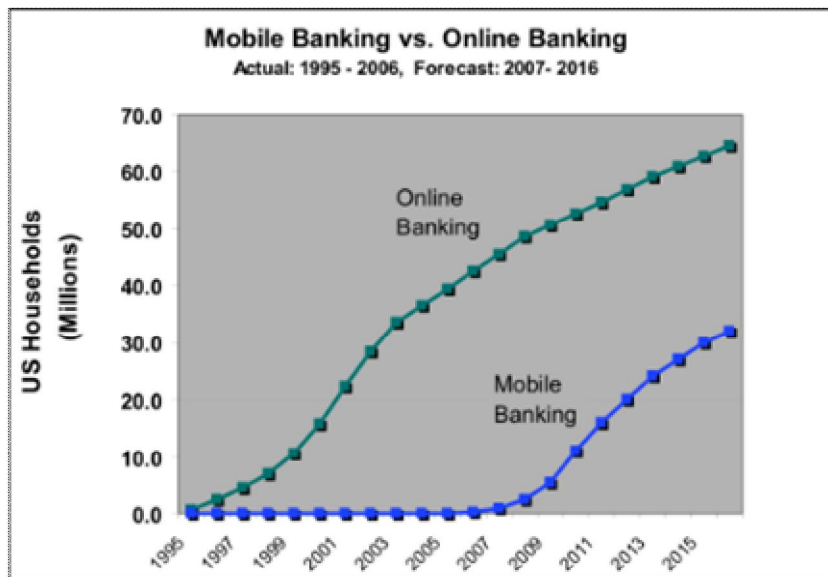


Figure 1: Mobile Banking vs. Online Banking Forecast: 1995 through 2016

U.S. households using a mobile device for banking*

Source: OnLine Banking Report, projections based on industry data, Feb 2007; accuracy estimated at +/- 25%

Figure 2. Estimate on the growth of mobile banking in United States. Source: <http://www.mmaglobal.com/mbankingoverview.pdf>

In addition to SMS-based services, Mobilemoneyventures (San Francisco, <http://www.mobilemoneyventures.net/>, MMV) is one of the leaders in providing mobile financial service solutions in U.S. MMV is a joint venture of Citi bank and South Korean SK telecom. MMV applies the DeviceAnywhere (San Mateo, California) services (<http://www.deviceanywhere.com/>). It is a service that offers end-to-end mobile application development solutions, to provide real-time remote testing and development services. MMV and DeviceAnywhere have partnered and have been able to consistently launch mobile financial services in global markets as Hong Kong with the fastest time to market and high standards in customer experience and interface design (March 31, 2009. Bank systems and technology).

Considering the role of banks, other type of development has taken place in Africa. In Kenya, Safaricom is running a mobile banking service M-Pesa that enables sending money using a mobile phone to another person with or without a mobile phone. The service is targeted to those consumers who do not have access to a bank or do not have sufficient income for a bank account. So the service is not provided by a bank but it works very much like a remittance service. The M-Pesa service has become very popular because it enables people to send money to their family members back home if a member of the family is working abroad. Reasons for the success of the service come from the lack of existing infrastructure: In Kenya, there are no banks in the countryside and some people can't open a bank account because of the high service costs. In summer of 2008, this service had 2.3 million registered users.

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6 Mobile Payments

Payments with a mobile device can be divided into proximity and remote payments. Proximity payments can be considered as a substitute that supersedes the traditional payment at the point-of-sales / cashier. Remote payments provide means for paying via mobile device, for instance through the use of a bank account. This payment type is a replacement for payments that may be done via web. Operator-driven mobile payments are billed usually by adding the payment to the monthly bill of the consumer's subscription.

In addition to proximity and remote payments, additional division relates to the amount of money in a single transaction. These are called micro and macro payments. The limit of such a payment is usually between 10 and 20 Euros.

	Remote	POS, manned	POS, unmanned
Micro-payment	Mobile content <ul style="list-style-type: none"> - ring tones - logos - information - games Parking	Small purchases in shops, kiosks and fast food restaurants	Vending, self-service <ul style="list-style-type: none"> - soda - tickets - cigarettes - instant photos - launderette Gas Toll
-10 €/ \$	Ticketing Person-to-person payments		
Macro-payment	Internet purchases <ul style="list-style-type: none"> - physical goods - digital content/ services - Prepaid card reloads 	Restaurants Retail shopping Taxi payments	Car wash

Figure 3. Classification of mobile payments (Mallat et al. 2004)

Proximity payments

Proximity payments, that is buying and paying at a store or other physical location, are the cornerstones of financial services. They were the first financial tools after barter trade and have evolved greatly over time. Payment methods in proximity retail are common and need to be easy and simple to use for the customer. Proximity payments are further divided into manned and unmanned Point-of-sales (PoS) (Mallat et al. 2004). Unmanned proximity micro payments include purchases from vending machines and self-service stations. Manned proximity micro payments consist of small purchases at kiosks, shops and fast food restaurants.

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Physical goods, digital content and prepaid card reloads are typical remote macro payments. Mobile proximity macro payments face bigger competition from established payment instruments: cash and cards. There are, however, integrating mobile credit card solutions. These include the GSMA's Pay-Buy-Mobile trial programme and the Sony Felica with Osafu-Keitai phones.

Mobile payments have not been around more than ten years. Mallat et al. state "At the same time, mobile payments must become faster, easier, and more convenient to use, and must have low transaction fees, wide availability, and standardised technologies in order to emerge as a mainstream payment solution" (Mallat et al. 2007). Currently, the number of successful mobile payment solutions for proximity payment is low but growing as ongoing trials transform into commercial products and services.

Current Proximity Payment Solutions

An example of a proximity payment system has been a solution called PayBox. It was a mobile payment solution that enabled customers to pay using a mobile phone in a retail store. The customer provided his telephone number to the merchant who entered it into the PayBox system. The system would call the customer who would authorise the payment with his PayBox PIN number. PayBox restructured itself in 2003 because of several reasons including slow development of the market and lack of system providers. After all, the system was not very cost-effective because communication was done via voice and SMS which kept the transaction costs higher than desired.

In MoFS project, current developments of proximity payments will be studied with the emerging implementation of NFC-enabled (near-field communication) mobile devices. The first NFC-enabled phones from Nokia are about to enter markets and they will provide a platform both for prototyping and for concept development and implementation. The GSM Pay-Buy-Mobile initiative is a trial programme applying handsets equipped with Near Field Technology (NFC) chips who can communicate with existing contactless payment systems.

Proximity payment is closely related to ticketing. Additional issues regarding that are dealt with in the ticketing section.

Remote Payments

Remote payments or payments at a virtual Point-of-Sale (PoS) mean paying or buying with a mobile device remotely i.e. content or some kind of service. Remote micro payments are usually "mobile content" i.e. ring-tones, logos and alike. Historically remote payments have included ring tones, logos and other kind of content that were suitable for the mobile phones of late 90s and early 2000. Additionally, remote micro payments include ticketing such as transit and parking. Currently the stores for mobile phones, i.e. Nokia Ovi and Apple's Appstore, are growing remote mobile payment markets as people have begun to download applications, music and other products to their mobile phones.

Modern mobile phones can do same kind of tasks as computers i.e. play video, send and receive email, open text files and presentations as well as browse the normal internet sites. The telecommunication connections have developed considerably during the last ten years from low speed GPRS to high speed 3G and WLAN technologies. The scale of services and content that can be bought and used with a mobile phone are expanding due to these changes.

Remote payments are closely related to mobile banking. Banks provide the possibilities to pay via bank accounts. This functionality is available for mobile devices as well. In MoFS, different prototype implementations have been discussed. Some rely on on-board credentials (ObC) whereas some may be used via specific bank-connected client applications.

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Although the US market seems to have been lagging behind in applying mobile phones and applications (text messages, SMSs, are now taking off in the US; VeriSign reports a 134 percent increase in year 2008 over 2007), a number of mobile payment solutions are under development. There is ongoing work on contracts between mobile phone providers, financial services and providers of mobile payment solutions.

One of the successful applications used worldwide is PayPal, owned by eBay (located in San Jose, California). PayPal is an e-commerce business allowing payments and money transfers to be made through the Internet. PayPal serves as an electronic alternative to traditional paper methods such as checks and money orders. A PayPal account can be funded with an electronic debit from a bank account or by a credit card. Currently PayPal is used for 12% of US internet payments (Business Week 8 March, 2009). PayPal has just signed a contract with Research in Motion, the developer of the BlackBerry devices in which PayPal will be an option for buying applications for the BlackBerry.

Obopay (Redwood city, California, www.obopay.com) is a mobile payment service that lets people send and receive money from any of the 200+ million mobile phones in the US. It offers a downloadable application for mobile phone to access account information. Sending money with Obopay costs 0.25 cents. The technology is based on SMS and WAP. Once registered, the Obopay works with registration and PIN code. Obopay has partnered with several mobile operators (Verizon, AT&T, Blackberry etc., financial providers, merchants and online partners). Currently, Obopay operates in the U.S. and India. If a person has a bank account, it is possible to link it to Obopay and use the mobile phone to make payments wherever Mastercard is accepted. Without a bank account, it is possible to load up your account using a prepaid model (TechCrunch, 27 March, 2009). Nokia invested 70 million dollar in Obopay in March 2009.

7 Mobile ticketing

Mobile ticketing means acquiring, buying, validating and ordering of a ticket using a mobile phone regardless of time and place. Mobile tickets can be used for example in mass transit, airline check-in, marketing and voucher distribution, and ticketing for performances, exhibitions and events. Mobile tickets can be purchased through different mobile channels i.e. SMS or a dedicated application, but mobile tickets can also be acquired through different channels.

In Finland, mobile ticketing has not been very widely used in general but mass transit, airline check-in and event ticketing and marketing have succeeded. In the capital area customers can buy mass transit tickets by mobile phone for metro, tram, and selected train and buss line services. The service is SMS based and in 2006 the total number of sold mobile tickets had exceeded 9 million in Helsinki. The service by Plusdial has also been sold to Stockholm Sweden and other European cities and they had sold 25 million tickets by the end of August 2008. In Sweden it became the most popular mobile service during only one year. In Helsinki, the Helsinki public transporting changed its service provider in June 2007.

Finnair was the first airline company to provide the ability to check-in to their flights by a text message. The service is provided by a Finnish company called Bookit. The service sends an SMS containing his flight information to the customer and the customer has to only reply with a message containing the letter 'A'. Using the SMS check-in service lowers the time the customer is in queue. 75 % of Finnair's frequent fliers who have the option for SMS check-in are using the service.

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In Japan Osafu-Keitai mobile phones have integrated contactless smart cards in them. The technology is standardised as ISO 18092 (NFC) and was a standard proposal for ISO 14443 (Contactless integrated circuit cards). These smart cards can host various payment applications that would normally mean multiple plastic cards for the consumer. There are at least four mass transit systems using Osafu-Keitai technology and more than half a dozen other ticketing applications. Its strengths are the ease of use (just place the phone next to a reader), convergence of services and it can recharge itself via Internet. Sony Felica that is the underlying technology is the de facto standard for contactless smart cards in Japan.

8 Authentication and Trust Services

Authentication is a baseline service that is required by almost all other services. In MoFS, authentication is covered both in a separate work package as well as an integrated part in other applications.

Authentication provides access to both virtual and real services. It may be used to open real doors or to provide access to electronic services with a passcode. Authentication is needed as a baseline. The nature of the service may indicate different levels of security and trust that needs to be applied. One aspect of research in MoFS is to study and understand these circumstances.

In MoFS, a prototype of a mobile authentication service is being developed in work package 2.

9 Literature on Mobile Financial Services

Following is a select list of literature and research papers regarding different thematic aspects of mobile financial services. The list is not all-inclusive and there may be overlaps due to the contents of each publication.

9.1 Business Models

1. Business Models (general): management perspective

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