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HYPOTHESES

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- Bowersox, Donald J., Closs, David J., (1996), "Logistical Management." Tata McGraw, Hill, New Delhi.
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# A STUDY ON MOBILE PAYMENT SYSTEMS AND SERVICES

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**ABSTRACT**

*Payment System is the backbone of advanced monetary economy. It is also one of the key areas in which technology has been driving force for innovation. Generally Payment systems in India have had a chequered history and traditional systems have been in vogue for many centuries, well mingling with the more recent electronic products. The initiatives of the Reserve Bank- all through a consultative process - have always aimed at the establishment of an integrated system that would benefit all the sectors of the economy, and at the same time reduce the overall risk in the system. In this paper we will study about the next generation cash less payment method using cell and its basic fundamentals architecture and other entities which take a vital to complete a particular task.*

**KEYWORDS**

M-Commerce, M-Payment, Architecture, Payment protocol.

## MOBILE COMMERCE – BEYOND E-COMMERCE

Mobile phone is a convenient technology for large scale adoption among urban as well as rural people crossing the barriers of language and last mile connectivity. More than 5 billion people are expected to own mobile phones in the globe by 2011-12. There are currently 300 million mobile phones in India and 100 million are added every year. In a few years more than 500 million people are expected to have mobile phones in India [1].

M-commerce is often defined as the buying and selling of goods and services using wireless handheld devices such as mobile telephones or personal data assistants (PDAs). In the last four years, growth in the number of mobile telephone users worldwide has exceeded fixed lines, expanding from 50 million to almost Three billion in 2009. This fast growth stems from the cost advantage of mobile infrastructure over fixed-line installation and from the fact that mobile network consumers can simply buy a handset. Mobile commerce is a natural successor to electronic commerce. Electronic commerce has been facilitated by automatic teller machines (ATMs) and shared banking networks, debit and credit card systems. Mobile payments are a natural evolution e-payment schemes that will facilitate mobile commerce. A mobile payment or m-payment may be defined, for our purposes, as any payment where a mobile device is used to initiate, authorize and confirm an exchange of financial value in return for goods and services.[3] The main difference between successful implementations of mobile payment services in the Asia Pacific region and failure in Europe and North America is primarily attributed to the 'payment culture' of the consumers that are country-specific.

## LITERATURE REVIEW

- "There is no denying that today the mobile is more accessible than portable water or education in many parts of the country. While this is also cause to lament how technology has taken precedence over other essentials in life, one company decided to use it to advantage. Foreseeing the future for mobile money, Bharti Telesoft came up with the concept of Mobiquity or the mobile money solution'." **- Hindu Business Line, India**
- "A global association of mobile operators announced Monday the launch of a pilot program, in co-operation with MasterCard, to allow the world's 200 million migrant workers, many of whom do not have bank accounts, to send money to their dependents via mobile phones. The global money transfer pilot, who has the involvement of 19 mobile operators with networks in over 100 countries, representing over 600 million customers, was unveiled at 3GSM, an annual industry trade fair in Barcelona that is expected to attract some 60,000 visitors this year." **- Red Herring The Business Technology**
- "Mobile phones are becoming an increasingly popular way to make all sorts of payments. In America fans of the Atlanta Hawks have been testing specially adapted Nokia handsets linked to their Visa cards to enter their local stadium and to buy refreshments. Elsewhere schemes are more advanced." **- Economist.com**

## NATURE OF SERVICES

The wide accessibility of the Internet makes any e-commerce service globally available. The Web enables search and delivery of rich information, and sophisticated electronic transaction processes can be integrated easily with backend enterprise information systems. In contrast, the delivery of m-commerce applications relies on private wireless communication carriers. These services are usually delivered to a specific region, and are rather simple, more personalized, location-specific and time-sensitive. Since a mobile device usually accompanies a person wherever he or she goes, mobile services can be delivered to a person anywhere and anytime rather than to a fixed office or home.

The major differences between m-commerce and e-commerce are summarized in **Table 1.1**

TABLE 1.1: E-COMMERCE Vs. M-COMMERCE

| | E-COMMERCE | M-COMMERCE |
|---|---|---|
| **ORIGIN** | | |
| Sponsorship | Government-sponsored Internet | Private mobile phone industry |
| Business entry cost | Low | High |
| Customer access cost | Free or low cost Internet access | High mobile service charge |
| Customer base | Highly educated computer users | Less educated cell phone customers |
| **TECHNOLOGY** | | |
| Message transmission | Packet-switched data transmission | Circuit switched for streamlined voice communication |
| Protocol | TCP/IP, HTTPML | GSM, TDMA, CDMA, 3G |
| Standardization | Highly standardized | Multiple incompatible standards |
| Connectivity | Global | Mainly regional |
| Bandwidth | High | Low |
| Identity | URL with IP and domain name | Phone number |
| Application development | General computer applications | Device-specific applications |
| Interface device | Personal computers | Cell phones and PDAs |
| Mobility | Fixed location | Mobile |
| Display | Big screen | Small screen |
| Main input mode | Keyboard for full text input | Voice with small key pad |
| Main output mode | Text and graphics | Voice with small text display |
| Local processing power | Powerful CPU with large memory and disk space | Limited processing power with small memory chip |
| Software and Programming | Support a variety of programming languages | Java or specific script languages |
| Trend | Towards sophistication | Towards minimization |
| **SERVICES** | | |
| Service range | Global | Regional |
| Delivery destination | PC in office connected to the Internet | Person accompanied by a mobile device |
| Transaction complexity | Complete and complex transactions | Simple transactions |
| Information provided | Rich information | Simple and short messages |
| Timing | Less time-critical | Time critical |
| Location-based service | No | Yes |
| Target mobility | Service to a fixed point | Service to a moving target |
| Backend business connection | Strong connection to backend business information systems | Weak connection to backend business information systems |
| Service classification | B2C (business to consumer) and B2B (business to business) | P2P (person to person) and P2S (person to system) |

## MOBILE PAYMENT CHARACTERISTICS

When you want to take services under such a Mobile Devices, following kinds of characteristic should be present in the system. [4]

**A) SIMPLICITY AND USABILITY**

The m-payment application must be user friendly with little or no learning curve to the customer. The customer must also be able to personalize the application to suit his or her convenience.

**B) UNIVERSALITY**

M-payments service must provide for transactions between one customer to another customer (C2C), or from a business to a customer (B2C) or between businesses (B2B). The coverage should include domestic, regional and global environments. Payments must be possible in terms of both low value micro-payments and high value macro-payments.

**C) INTEROPERABILITY**

Development should be based on standards and open technologies that allow one implemented system to interact with other systems.

**D) SECURITY, PRIVACY AND TRUST**

A customer must be able to trust a mobile payment application provider that his or her credit or debit card information may not be misused. Secondly, when these transactions become recorded customer privacy should not be lost in the sense that the credit histories and spending patterns of the customer should not be openly available for public scrutiny. Mobile payments have to be as anonymous as cash transactions. Third, the system should be foolproof, resistant to attacks from hackers and terrorists. This may be provided using public key infrastructure security, biometrics and passwords integrated into the mobile payment solution architectures.

**D) COST**

The m-payments should not be costlier than existing payment mechanisms to the extent possible. An m-payment solution should compete with other modes of payment in terms of cost and convenience.

**E) SPEED**

The speed at which m-payments are executed must be acceptable to customers and merchants.

**F) CROSS BORDER PAYMENTS**

To become widely accepted the m-payment application must be available globally, word-wide.

## MOBILE PAYMENT SOLUTIONS

Mobile payment solutions may be classified according to the type of payment effected, and based on the technology adopted to implement the solution. There are a variety of combinations of these frameworks – technology adopted and mode of payment, a survey of which would constitute a study in itself. There are three different models available for m-payment solutions on the basis of payment [7]

a) Bank account based

b) Credit card based

c) Telecommunication company billing based

**BANK ACCOUNT BASED**

Banks have several million customers and telecommunication operators also have several million customers. If they both collaborate to provide an m-payment solution it is a win-win situation for both industries. In this model, the bank account is linked to the mobile phone number of the customer. When the customer makes an m-payment transaction with a merchant, the bank account of the customer is debited and the value is credited to the merchant account.

**CREDIT CARD BASED**

In the credit card based m-payment model, the credit card number is linked to the mobile phone number of the customer. When the customer makes an m-payment transaction with a merchant, the credit card is charged and the value is credited to the merchant account. Credit card based solutions have the

limitation that it is heavily dependent on the level of penetration of credit cards in the country. In India, the number of credit card holders is 15 million. Only this small segment of the population will benefit in the credit card based model. Though limited in scope, there may be high demand within this segment for a payment solution with credit cards and also, may provide high volumes of transactions.

**TELECOMMUNICATION COMPANY BILLING**

Customers may make payment to merchants using his or her mobile phone and this may be charged to the mobile phone bills of the customer. The customer then settles the bill with the telecommunication company [11]. This may be further classified into pre-paid (debit) and post-paid (credit).

## TECHNOLOGIES FOR MOBILE PAYMENTS

The mobile technology landscape provides various possibilities for implementing m-payments. Essentially, a GSM mobile phone may send or receive information (mobile data service) through three possible channels [1] – SMS, USSD or WAP/GPRS. The choice of the channel influences the way m-payment schemes are implemented. Secondly, the m-payment client application may reside on the phone or else it may reside in the subscriber identity module (SIM). We briefly describe NFC technology as another possibility.

**SHORT MESSAGE SERVICE (SMS)**

This is a text message service that enables short messages (140-160 characters) that can be transmitted from a mobile phone. Short messages are stored and forwarded by SMS centers. SMS messages have a channel of access to phone different from the voice channel.[10] SMS can be used to provide information about the status of one's account with the bank (informational) or can be used to transmit payment instructions from the phone (transactional).

**UNSTRUCTURED SUPPLEMENTARY SERVICES DELIVERY (USSD)**

Unstructured Supplementary Service Data (USSD) is a technology unique to GSM. It is a capability built into the GSM standard for support of transmitting information over the signaling channels of the GSM network. USSD provides session-based communication, enabling a variety of applications. USSD is session oriented transaction-oriented technology while SMS is a store-and-forward technology. Turnaround response times for interactive applications are shorter for USSD than SMS.

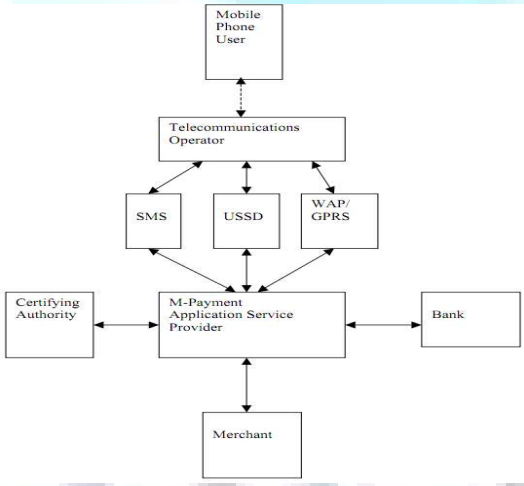
**WAP/GPRS**

General Packet Radio Service (GPRS) is a mobile data service available to GSM users. GPRS provides packet-switched data for GSM networks. GPRS enables services such as Wireless Application Protocol (WAP) access, Multimedia Messaging Service (MMS), and for Internet communication services such as email and World Wide Web access in mobile phones.

## A GENERIC ARCHITECTURE FOR M-PAYMENTS

This is a simple, illustrative conceptual model that describes the relationship between the major participants in an m-payment scenario (Fig. 1.0). There is the customer and the merchant who would like to use an m-payment service. The M-Payment Application Service Provider (MASP) provides the necessary technical infrastructure (hardware and software) to facilitate m-payments and acts as an intermediary between the financial institutions and mobile network operators. The MASP registers users who would like to avail of the m-payment service. The users (customers and merchants) have to be registered with the MASP prior to using the service. At the time of registration the MASP collects the bank account details (or credit card details) of the customer and merchant as well as their valid digital certificates. The mobile phone numbers of the customer and the merchant are mapped to their respective bank accounts and this mapping is maintained by the MASP.

**FIG. 1.0: ARCHITECTURE OF M-PAYMENT**




The users are provided with a client m-payment application (mobile wallet) that is either resident on their phones or else in the SIM card. This application may be provided over the air to the uers. The mobile wallet will normally interact with the MASP server.

A mobile phone user communicates with a merchant and makes an economic transaction (e.g., buying a ticket from an airline over the phone). The merchant obtains the phone number of the customer and initiates the m-payment transaction request stating the amount for which payment is required. The customer confirms the request and authorizes payment. The MASP receives the authorization and verifies the authenticity of the customer. The MASP then debits the customer account and credits the merchant account by interacting with the bank. Once the electronic funds transfer is successful a confirmation message is sent to the customer and the merchant advising them of the debit and credit respectively. The Certifying Authority also shown in Fig. 1.0 supplies digital certificates for the users in the system to provide security (see section below). This model can be extended to handle the interaction between the MASP and the financial system taking into account inter-bank payments and settlement.

**M-PAYMENT PROTOCOLS**

A sample protocol that describes the transaction between a customer and a merchant, each using his or her mobile phone and a m-payment application service provider as an intermediary is outlined in this section. It is assumed that customer and merchant are registered as users with the m-payment application service provider (with their respective bank account details) and both of them have valid digital certificates. The transactions are detailed below…

1. Service Request: Customer → Merchant

Customer makes a service request to the merchant

2. Product Options: Merchant → Customer:

Merchant sends his product options and his certificate

3. Product Selection: Customer → Merchant:

Customer selects a product; the selection is signed by the customer's private key

4. Payment Request: Merchant → M-payment Application Solution Provider (MASP) → Customer:
The payment request (containing the invoice amount) is signed using merchant's private key. Customer can verify that the merchant is genuine by using his certificate (sent earlier in step 2). The MASP also authenticates the merchant before passing the payment request to the customer.
5. Payment Authorization: Customer → MASP:
The customer authorizes the payment request by digitally signing the authorization using the customer's private key. The MASP transfers the money from the buyer's account to the seller's account by communicating to the bank(s).
6. Payment Confirmation: MASP → Customer:
MASP confirms payment made to merchant
7. Payment Confirmation: MASP→Merchant:
MASP informs merchant of successful payment
The customer and the merchant can verify their respective bank accounts as to whether payment has been made.
The Institute for Development and Research in Banking Technology (IDRBT) has an experimental, proof–of-concept project where PKI enabled m-payment applications have been demonstrated to be feasible.

## STAKEHOLDERS

There are many different stakeholders in the process of implementing mobile payments. They are [6]
a) Consumers
b) Merchants
c) Mobile Network operators
d) Mobile device manufacturers
e) Financial institutions and banks
f) Software and technology providers
g) Government
Each player has different incentives and strategies. Sometimes these interests and strategies between different players may be in conflict e.g., the telecommunications network provider would like to maximize revenues through each m-payment transaction whereas customers and merchants would like to minimize costs for each m-payment transaction. The expectations of each of the stakeholders are outlined below.

**CONSUMER EXPECTATIONS**

- Personalized service
- Minimal learning curve
- Trust, privacy and security
- Ubiquitous – anywhere, anytime and any currency
- Low or zero cost of usage
- Interoperability between different network operators, banks and devices
- Anonymity of payments like cash
- Person to person transfers

**MERCHANT**

- Faster transaction time
- Low or zero cost in using the system
- Integration with existing payment systems
- High security
- Being able to customize the service
- Real time status of the mobile payment service

**BANKS**

- Network operator independent solutions
- Payment applications designed by the bank
- Exceptional branding opportunities for banks
- Better volumes in banking – more card payments and less cash transactions
- Customer loyalty

**TELECOM NETWORK PROVIDERS**

- Generating new income by increase in traffic
- Increased Average Revenue Per User.
- Become an attractive partner to content providers

**MOBILE DEVICE MANUFACTURER**

- Large market adoption with embedded mobile payment application
- Low time to market
- Increase in Average Revenue Per User (ARPU)

**GOVERNMENT**

- Revenue through taxation of m-payments
- Standards

## CONCLUSION

The Mobile Payment Forum of India (MPFI) has been formed with Institute for Development and Research in Banking Technology (IDRBT) and Rural Technology Business Incubator (RTBI), IIT Madras taking the lead role. Lots of challenges are to be overcome for a successful implementation of mobile payments to be widely accepted as a mode of payment. Businesses, merchants and consumers have to come forward and make value-producing investments. A regulatory framework and widely accepted standards will be the pillars on which mobile payment applications will be built.
Research so far has outlined a diversity of thinking and innovation that exists in the m-payments arena. Numerous solutions have been tried and failed but the future is promising with potential new technology innovations [4].

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