Mobile Electronic Commerce and M-Payment Life cycle

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Abstract: Advances in wireless network technology and the continuously increasing number of users of hand held terminals make the latter an ideal channel for offering personalized services to mobile users and give pace to the rapid development of Mobile Electronic Commerce (MEC). In this paper, we discuss challenges in electronic commerce transactions including designing new business models, applications and services. Online transactions using mobile devices must ensure high security for user credentials.. M-Commerce is the electronic commerce performed using mobile devices. Since user credentials to be kept secret, a high level of security should be ensured.

Keywords: Mobile Computing, Electronic Commerce, Business Models, Transactions.

1 Introduction

As a mobile e-commerce transaction we define any type of transaction of an economic value that is conducted trough a mobile terminal that uses a wireless telecommunications network for communication with the e-commerce infrastructure. Mobile Electronic Commerce (MEC) refers to e-commerce activities relying solely or partially on mobile e-commerce transactions. MEC operates partially in a different environment than E-Commerce conducted in fixed Internet, due to the special characteristics and constraints of mobile terminals and wireless networks and the context, situations and circumstances in which people use their hand-held terminals. MEC has a number of business, technical and legal implications that are different from e-commerce in the fixed Internet setting. Most notably, location-based products and services is a completely new business, technical, and legal area that is typical of MEC[1].

Wireless Application Protocol (WAP) on one hand and TCP/IP+HTTP supporting mobile handsets like the Nokia 9000 Communicator on the other hand. WAP was developed by the Wap forum founded in 1997, aiming to develop the wireless Internet-like standards for digital wireless telecom networks. WAP can be understood as a kind of thin Web due to its simple Wireless Markup Language (WML) and simple browsers for the language, as well as a special protocol stack (WAP stack) that suits better to the wireless environment than the standard TCP/IP+HTTP stack.

WAP plays an important role in MEC by optimizing Internet standards for the constraints of the wireless environment and hand held terminals and thus bridging the gap between Internet and mobile world. Thus, it opens, at least in theory, also the existing e-commerce infrastructure in Internet for mobile handset users. Furthermore, WAP creates new business opportunities for players in the field, like device and infrastructure manufacturers, content and service providers, and for Mobile Network Operators. The latter can play a more active role and become more profitable and competitive while providing contents either solely in WML or both in HTML and WML[2].

2 Problem Formulation

2.1M-Commerce Architecture

The M-Commerce architecture is 3 tier architecture and mainly consists of following components as indicated in Fig 1.

1. Front end (client): The mobile device or the piece of software running on the mobile device.
2. Middleware (server): It is the software server running business logic of the system.
3. Back end (database): The back end mainly comprised of database servers.

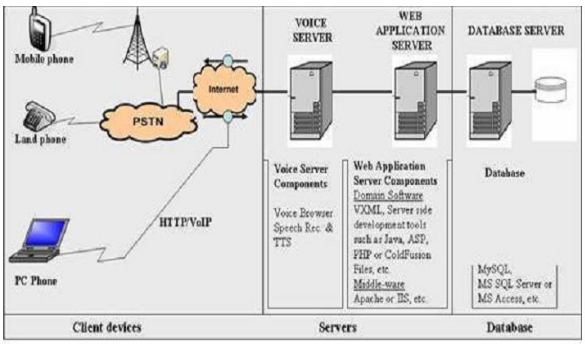

Fig 1: The M-Commerce Architecture

The M-Commerce architecture depicts different entities involved in 3 tiers and their functionalities. The cell phones are the client devices and used to access different services to the users. It provides the interface for the customers and serves as the front end for interaction. The base stations will route and forward the signal to intended destination. The SMS Gateway/WAP gateway supports either text or internet based communication.

2.2. Wireless Communications

The necessary networking infrastructure for wireless mobile computing in general combines various wireless networks including cellular, wireless LAN, private and public radio, satellite services, and paging. In wireless networks, digital signals are modulated into electro-magnetic carriers that propagate through space with about at the speed of light. The carriers used are radio waves or infrared light. In wireless telecom networks, the carrier frequencies used are around 900 MHz (European GSM), 1.8 GHz (GSM in America, DECT in Europe). 2.4 GHz and 5.8 GHz are also allocated for wireless networks .

As compared with wire line networks, wireless radio communications add new challenges:

C-autonomy. The handsets in the wireless radio networks are normally not always communicating with the network infrastructure, i.e. they are unreachable. There are numerous reasons for this behavior that can be described under Communication-autonomy

Bandwidth restrictions and network topology: In the case of many wireless networks, such as in cellular or satellite networks, communication channels have much less transfer capacity than wire line network. Further, the protocol overhead (headers) requires certain amount of the channel capacity, as in any network. Therefore, the available nominal transfer capacity of a channel is used rather inefficiently. E.g. GSM network offers typically 9.6 or 14.4 kbits/s transfer capacity for both downlink and uplink directions for the application data over CSD, although the nominal capacity of a logical channel used is ca 30 kbits/s.

The wireless IP network over GSM infrastructure, GPRS will offer basically a variable capacity up to 172 kbits/s. In practice, it is expected that the transfer capacity remains around 100 kbits/s. UMTS has the promise to provide 2 Mbits/s for both uplink and downlink in a connection. Wireless LANs offer then 1- 10 Mbits/s.

Variant bandwidth and bursty traffic: Currently, multi-network terminals are emerging that can use several networks to communicate. Typical forerunners are the dual-band devices that are able to use 900 MHz and 1.8 GHz GSM networks. Soon, there will be products that are able to also use WLANs and possibly Bluetooth, 2000), together with GSM, GPRS and soon also UMTS network infrastructure.

Variant Tariffs: For some networks (e.g., in cellular telephones), network access is charged per connection-time, while for others (e.g., in packet radio), it is charged per message (packet). In the WAP environment there is a larger variety of tariffs, e.g. session-based, transaction-based, connection time-based while in Mobile E-Commerce the range of tariffs is even wider[3].

2.3. Distinctive Features of MEC Applications and Services

MEC applications take advantage of mobile communications to offer to consumers and businesses additional benefits as opposed to traditional e-commerce applications.

Location-awareness. In mobile computing, knowledge of the physical location of a user at any particular moment is central to offering relevant services. The location of a mobile device is available to the mobile network operator but it can also be found using sensor

devices or technologies such as the Global Positioning System (GPS)[4].

Adaptivity: Mobile e-commerce applications should be adapted to the environment of their clients. Adaptability is possible along various dimensions including the type of the device in use, the currently available communication bandwidth as well as location and time.

Ubiquity: Mobile communications enhance electronic commerce by making electronic commerce services and applications available *anywhere and at anytime*. Through hand-held devices such as mobile phones, users can be reached at anytime, independent of their location.

Personalization: The information, services and applications available in the Internet today are enormous. It is thus important that the user receives information that is of relevance.

Broadcasting. Some wireless infrastructures, such as cellular architectures and satellite networks, support broadcasting of data to all mobile users inside a specific geographical region.

2.4. Business Modelsin Mobile E-Commerce.

There are many definitions of a business model. We use the definition by, where a business model is defined as:

- An architecture for Product, Service and Information Flows,
- A description of Business Actors and their Roles,
- A description of *Potential Benefits* of the various Business Actors,
- A description of the *Sources of Revenue*.

A business model by itself is not enough to provide an understanding of how the model contributes in realising the *business mission* and *objectives.*

The above definition can form the basis of a detailed analysis of the business models emerging in MEC. However, this is outside the scope of this paper, therefore we will concentrate on some of the above issues starting from a description of the main players in the Mobile Business Value chain who are:

- technology platform vendors that offer operating systems, e.g., Windows CE and Palm OS, as well as micro browsers, e.g., Phone.com,
- infrastructure and equipment vendors that provide the network infrastructure, e.g., Nokia, application platform vendors who offer middleware and standards,
- application developers,
- content providers and aggregators,
- mobile portal providers for application aggregation,
- mobile network operators,
- mobile service providers that offer added value services, and handset vendors and retailers.

A business should take into account its core competence before adopting a new business model. Thus, the *Mobile Network Operators* (MNO) have a competitive advantage over other players in the field as they already have a billing relationship with the customer, they maintain customer's personal data and they can easily identify the customer's geographic location. It is therefore natural for operators to adopt new business models that exploit these advantages and enter new markets and provide new services in order to increase their profits[5].

3 Problem Solution

3.1. M- Commerce: Risks, Security and Payment Methods.

A Mobile Payment is defined as a payment for product or services between two parties for which a mobile device plays a key role in the realization of payment. In an M-Payment activity a mobile phone is used by the payer in one or more steps during banking or financial transactions. The ubiquity of cell phones together with the convenience it offers suggests that mobile payments will constitute an increasing proportion of electronic payments.

Mobile applications can be either be mobile web or native. Security issues in mobile web applications closely resemble those of traditional web applications because of homogeneity in underlying development technologies and protocols [6]

3.2. Features of M-Commerce.

Following are some unique features of M-commerce.

a. *Ubiquity*: Here services are offered irrespective of users geographic location.

b. *Immediacy*: This feature is closely related to ubiquity where real time a ailment of

services is offered for genuine user.eg: stock market data.

c. *Localization:* Positioning technologies such as GPS offers goods and services specific to customer location.

d. *Instant Connectivity*: Constant online facility connected with the network avoiding dial up or boot up procedure.

e. *proactive functionality*: This feature ensures that the right information(relevant) at right time and place. Services like opt in advertising enables the user choices and preferences frequently.

3.3.M-Payment Life cycle.

Payment transaction in a mobile environment is very similar to a typical payment card transactions shown in Fig 2. It differs in the transport of payment detail involved i.e. wireless device using WAP/HTML based browser.

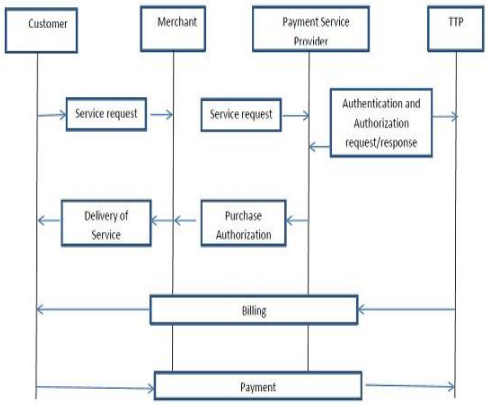

Fig 2: M-Payment life Cycle

Mobile payment lifecycle has the following main steps.

1. Registration: Customer opens an account with payment service provider for payment service through a particular payment method.

2. Transaction: Transaction mainly comprised of following four important steps.

a) The desire of a customer is generated using a SMS or pressing a mobile phone button.

b) The content provider forwards the request to the payment service provider.

c) Payment service provider then requests a trusted third party to authenticate and authorize the customer.

d) Payment service provider informs content provider about the status of the authentication and authorization. If successful authentication of the customer is performed, content provider will deliver the requested goods.

3. Payment settlement: This operation can take place during real time, prepaid or post-paid mode.

A real time payment involves the exchange of some form of electronic currency, for example payment settlement directly through a bank account. In prepaid type of settlement customers pay in advance using smart cards or electronic wallets. In post pay mode the payment service provider sends billing information to the trusted third party, which sends the bills to customers, receives money back, and then sends the revenue to payment service provider.

3.4. Wireless Public Key Infrastructure (WPKI) BasedD M-Commerce Security System

Public key cryptography technique is used as backbone for the WPKI to provide security in m-commerce. The entire certificate management life cycle activities starting from certification creation, generation, storing, distribution and revocation of public key certificate is supported by an WPKI architecture. [7].

WAP is the key entity in a wireless environment for connecting the internet. WTLS is the lighter version of TLS and it is suitable for wireless environment. For the secure connection and communication between service providers SSL is used. For high efficiency the system adopts enhanced certificate verification method which reduces the load of resource constrained devices.

Because of Mobile Computing or Mobile networks, M-Commerce has become reality today. The support of large number of cellular network service providers with competing speed made user to use his mobile device as a transacting module rather than simply using it for making calls. Following are some of the merits and demerits of M-commerce.

3.5. Advantages of M-Commerce .

1. Convenience: Just a few clicks on the device serve user purpose.
2. Flexible accessibility: User can be accessible through mobile devices and through various messengers.
3. Easy connectivity: As long as network is available the device can be in action.
4. Personalization: Since the device belongs to a specific user, it provides personalization to its user.
5. Time efficient: Critical transaction can be possible to execute with in a very short span of time.

Disadvantages of M-Commerce

1. Technological constraints of mobile devices may limit file size to be processed.
2. User interface may not be friendly to operate.
3. Limitation over the number of characters to be used on SMS.

4 Conclusion

Mobile E-Commerce is a challenging area as it creates opportunities for many players in the field, like Mobile Network Operators or Content and Service providers. MEC is a dynamically changing area and so are the applications and requirements due to the many interdependencies with user needs, wireless technology and legislation. It is thus essential that related business and legal issues are resolved and follow advances in technology. At the moment there is a small number of applications and content available, the WAP phones are not widely available and the call set-up time is too long.

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