Issues and Challenges in M-Commerce

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ABSTRACT

The emergence of mobile devices and wireless networks has created a new path in the field of e-commerce: “m-commerce”. The phenomenal growth in the use of cellular phones and more recently, also of wirelessly enabled Personal Digital Assistants (PDAs), is giving rise to yet another revolution in the business world. This revolution is focused on conducting business on the mobile commerce (M-Commerce). The technologies that support m-Commerce and in particular wireless networks, protocols and devices; the security and privacy levels when dealing with mobile commerce and what kind of issues are encountered when using mobile commerce systems and also evaluate the solutions on how m-commerce issues are avoided and how they are tackled by the technology evolution.

Keywords--- Mobile commerce, M-Commerce Technology, M-Commerce business applications, M-Commerce Value Network, M-Commerce Revenue Models.

I. INTRODUCTION

Less than a decade after the e-commerce revolution and its associated global impact on the business environment, it appears that another step has been taken in the evolution of networked computing. Transitioning from wired to wireless networks, the latest buzz in the industry is mobile commerce or m-Commerce.

Mobile commerce was born in 1997 when the first two mobile phone enabled Coca Cola vending machines were installed in Finland. They used short message service (SMS) to send the payment to the vending machines. In 1997, the first mobile phone based banking service was also launched in Finland using SMS.

M-Commerce could be viewed as a subset of e-Commerce. The name “m-Commerce” arises from the mobile nature of the wireless environment that supports mobile electronic business transactions. Devices including digital cellular phones, Personal Digital Assistants (PDAs), pagers, notebooks, and even automobiles, can already access the Internet wirelessly and utilize its various capabilities, such as e-mail and Web browsing.

II. M-COMMERCE TECHNOLOGY

Understanding how the m-Commerce environment has come to exist, as we know it today, as well as recognizing the strengths and weaknesses of the associated technologies in place, can provide the means through which the long-term direction of this industry could be assessed. Thus, the current state of wireless networks, wireless protocols and wireless devices is discussed below, highlighting important milestones.

III. WIRELESS NETWORKS

Wireless networks provide the backbone of m-Commerce activities. By utilizing these networks users can transmit data between mobile and other computing devices using wireless adapters without requiring a wired connection. Wireless networks were introduced as early as 1946, but a major milestone was the introduction of the Advanced Mobile Phone System (AMPS) that marked the arrival of cellular systems in 1983 in the United States. AMPS is an analog system used for voice communication. AMPS systems represented the first generation of cellular systems (hence it is commonly referred to as 1G).

The evolution of wireless networks continued with the second-generation (2G) systems that were introduced in the 1990s. Several of these systems (e.g. TDMA, CDMA, GSM) were also used primarily for voice applications, with the exception of the Short Message Service (SMS) capability offered by the GSM network. A recent upgrade of the 2G networks is referred to as 2.5G wireless networks (e.g. HSCSD, GPRS, EDGE) Being either circuit-switched or packet-switched, these networks are primarily intended to allow for increases in data transmission rates and in the case of packet-switched networks, an “always on” connection.
The hype surrounding wireless networks, however, revolves around the third-generation (3G) systems, expected to be deployed over the next few years, with certain regions already having access to them (e.g. Japan). These networks are commonly referred to as IMT-2000 on a global scale, and regional implementations are uniquely named (e.g. CDMA2000 in North America, W-CDMA/UMTS in Europe & Japan, CDMA One in Japan). Along with voice functionality, 3G networks support higher-speed transmissions for high-quality audio and video, as well as providing a global “always on” roaming capability.

IV. WIRELESS PROTOCOLS

While wireless networks evolved, the two main communication protocols, WAP and I-Mode, experienced their own evolution. Ericsson, Motorola and Nokia introduced WAP in 1997. WAP progressed from enabling basic functionality, such as WML and WML Script communications, in its first release, to supporting graphics, voice-enabled actions (i.e. wireless Web browsing), and video, as announced in the release of WAP 2.0, at the end of July of 2001. I-Mode, on the other hand, was introduced in 1999 by NTT DOCOMO and have grown in popularity to support 30 million users in less than three years. The capabilities of I-Mode were enhanced during 2001 through the introduction of I-appl, which incorporates JAVA and Secure Socket Layer (SSL) encryption capabilities, I-area, which provides location-specific information such as weather, local guide, maps and traffic, and I-motion, which enables viewing of video-clips.

It is unlikely that one of these protocols will prevail over the other on a global basis. The more likely scenario will be that wireless devices will evolve to support both protocols seamlessly.

V. WIRELESS DEVICES

Until recently, wireless devices could be placed in three distinct categories: mobile phones, wireless Personal Digital Assistants (PDAs), and wireless laptops. Recently, however, hybrid products have been introduced that combine features from two or all three categories with the intent of providing optimal capabilities to mobile users. Mobile phones have been around the longest and have experienced the greatest change since their inception. In the beginning, analog cellular phones were used exclusively for voice communications; next, digital phones were introduced, initially for voice communications but with added features (e.g. Call Display) and were later further enhanced with additional capabilities (e.g. Instant Messaging). PDAs experienced their own evolution, beginning as organizers for personal information with limited functions (e.g. “To Do” lists, Calendar). Currently, some PDAs have wireless transmission and Web browsing capabilities. The major operating systems for PDAs are Palm OS (e.g. Palm, IBM Workpad PC, Handspring Visor), EPOC (e.g. Ericsson R380, Nokia 9210 Communicator, Psion), and Windows CE (Compaq I Pac, HP Jornada, Casio E-125).

Wireless laptops include notebooks or portable PC browser clients that are wirelessly Web-enabled (e.g. IBM ThinkPad T20 connected with a GSM mobile phone through the infrared port). Although these devices are capable of supporting m-Commerce activities, they do not represent the main point of access for such activities due to their relatively larger sizes and heavier weights compared to other mobile devices.

The most recent development in mobile devices was the introduction of “smart phones”. These are mobile devices that are capable of tasks ranging from e-mail retrieval now to video and music streaming in the near future. “Smart Phones” are a combination of cell phones and PDAs (e.g. Kyocera QCPTM 6035 Smart Phone, Samsung SPH - I300). PDAs (e.g. Kyocera QCPTM 6035 Smart Phone, Samsung SPH - I300). This convergence trend is expected to continue in the foreseeable future to support consumer demands for mobile devices that can provide a wider range of capabilities.

VI. M-COMMERCE TODAY IN FIGURES

- In 2011, $350 billion was transferred between people across borders over mobile Devices. That is only across borders, not including mobile money transfers within countries.
- The global m-payments value reached $256 billion in 2012. That is only payments, not including people sending money to each other.
- The number of m-payment transactions will continue to grow by 58.5 percent annually to reach $8.9 billion transactions in 2014, according to industry expectations.
- By the end of 2013 the number of mobile money services had grown to 219 in 84 Countries and there were 203 million registered users worldwide in June 2013.
- There are two or more services available in 52 markets and 70 percent of service Providers plan to increase their mobile money investments in 2014.
- The number of mobile money agent outlets grew rapidly in 2013 with an increase of 71.5 percent.
- These record figures are evidence that m-commerce is on the rise. Interest is higher than ever and competition is increasing, especially in emerging markets.

VII. M-COMMERCE VALUE NETWORK

The M-Commerce value network introduced is made up of customers, network operators, service
providers, technology vendors, application developers, and content providers. Because of the multiple interdependencies among value network members, if any of these parties is underdeveloped (or absent), then the entire network could potentially break down. In addition, value network members may be made up of additional subsets of companies with more specific business objectives.

**Customers:** Customers may be the most important m-Commerce value network member, since in the absence of customer demand; there may be little, if any, need for any of the other players in the value network to be present. For example, if the wireless customer does not see the value in non-voice mobile services made available by content providers (e.g. weather information), then there is little point in network operators maintaining network service (e.g. GPRS), technology vendors manufacturing wireless products (e.g. handsets), service providers offering wireless products and services (e.g. wireless network access), or applications developed (e.g. wireless chat).

**Network Operators:** Arguably the second most significant party after the customer in the m-Commerce value network is the network operator. Network operators are crucial in the success of the m-Commerce industry, as they are responsible for a wide range of activities. Such activities include deciding if and when to invest in network infrastructure supporting non-voice services, educating customers about the availability and uses of these new services, and incurring additional expenses to support compatibility with networks of other operators. Such companies typically utilize a subscription fee business model with customers, as well as a transaction-based fee (e.g. per “hit”) business model with content providers.

**Service Providers:** Similar to the various Internet Service Providers (ISPs) for the wired Web, Mobile Service Providers (MSPs) emerged to provide an easy way for customers to gain access to wireless networks and available solutions. In addition to this function, some literature includes content providers and operators under this category, as they have come to expand their offerings into the area of servicing customers as well. Strictly speaking, however, MSPs sell products and services of others under their name to customers. The typical business models for this group are based on subscription fees as well as per-minute fees.

**Application Developers:** Application developers include software developers and system integrators that provide a wide range of services, such as hosting and transaction processing. Ultimately, these companies are responsible for delivering a practical solution to customers based on available technology. Thus, if they are successful in identifying and addressing customer needs, returns will be high for all involved in providing non-voice mobile services. Application developers may offer off-the-shelf products (e.g. chat programs), customized products developed specifically to meet one customer's requirements, or hybrid products based on generic products that are further customized with application-specific data. Typically, the business model adopted by these companies is based on software licensing fees, utility transaction costs, and subscription fees.

**Technology Vendors:** Technology vendors transform what is desired and theoretically designed to what is actually available. They supply the necessary hardware and some of the software to enable the convergence of telecommunications and IP networks, ranging from transmission towers to mobile handset receivers. Internally this group is made up of companies concentrating on different aspects of infrastructure.

**Content Providers:** The information a customer accesses when using the wireless Web may be made available through content providers (e.g. Reuters), content aggregators (e.g. digitallook.com), or portal providers (e.g. Yahoo!). For simplicity, these three types of companies are grouped here as “content
providers”. Content providers in the mobile industry currently tend to enter in exclusive agreements with network operators, giving rise to what is known as the “walled garden”, where subscribers to specific network carriers gain access to an exclusive set of content providers. This is a symptom that is being addressed in efforts to provide a truly ubiquitous wireless network that is not only technologically compatible, but also offers unrestricted access of content to all mobile users regardless of carrier selection. The typical business model is based on advertising and subscription fees.

VIII. M-COMMERCE REVENUE MODELS

There are a several revenue models that are found in the m-Commerce market place, some of which involve customers, while others do not. Typically, there are three revenue models that would involve payment by customers to any one or more of the value network members. These customer-initiated revenue models are access, subscription, and pay-per-use. Additional revenue models involve other members of the value network and are hence titled “non-customer initiated”. The non-customer initiated revenue models are advertising, transaction, payment clearing, hosting, and point-of-traffic. All eight revenue models are explained below:

Access: For customers to gain access and use a wireless network, an access fee is usually required. This fee is paid to the network operator directly or to the MSP (from which the network operator will eventually receive a portion, subject to the arrangement between the operator and the MSP). Access fees may be based on a flat rate, time-based, or volume-based. It should be noted that a “free access” model was introduced in the late 1990’s, but for the most part it has proven to be unsuccessful – the MSP sought to collect revenue from advertising instead in an attempt to lure customers by offering network access for free. Flat rate pricing is a more commonly adopted model in North America and allows mobile users to access the network without any constraints. Time-based (or per-minute or by-the-minute, as it is also known) provides users with network access that is billable by the total airtime used. Time-based is a more commonly adopted access revenue model in Europe. Finally, volume-based allows users to access the network for as long as they want, because they will be billed based on the total volume of information, or number of bits, used during the billing period. This model is available for packet-switched (as opposed to circuit-switched) networks and was introduced in sight of the newer network technologies that will be faster and “always on”.

Subscription: Content providers can earn revenue through user subscriptions. Similar to the access revenue model, the subscription model is threatened when free alternatives are presented to consumers. To maintain a competitive advantage, companies adopting this revenue model need to differentiate their product/service offering so as to recruit and maintain customers.

Pay-Per-Use: As an alternative to the subscription model, the pay-per-use model allows customers to purchase products/services/ without having to engage in a long-term commitment. Also, this model appeals to customers who do not want to pay for an entire product offering, but instead they might want to pay for a portion, such as a single song from an album rather than purchasing the entire album.

Advertising: To capitalize on the popularity of certain websites, companies may pay content providers in exchange for advertising space. This is a beneficial arrangement for both parties involved, as advertising revenue will subsidize the cost of providing the service, allowing either end-user prices to decrease or to enhance their offering. Still, there are downsides (e.g. customer frustration and attrition) that need to be considered prior to engaging in the advertising revenue model. Currently, mobile advertising is still in its early stages. A variant of this model is the sponsorship revenue model – in this case, features provided by other content providers are included on your site for a fee.

Transaction: Often content made available for purchase belongs to a particular supplier and not necessarily the distributor with whom the customer is interacting. Based on the total cost of the product/service, a commission is collected by the distributor. It is also possible to have the distributor purchase the product/service for resale; in this case, the total revenue is collected by the distributor, who in turn pays the supplier the original cost of the goods sold.

Payment Clearing: When a purchase is made wirelessly, a third party merchant collects a percentage of the total cost of purchase for processing the purchase made.

Hosting: Content providers may lack the necessary technology and/or the expertise to host their own content. In this case, they outsource hosting to companies that specialize in this area in exchange for a fee (e.g. monthly).

Point-of-traffic: To encourage content development, which in turn will yield an increase in the subscriber base, network operators may pay out a rate to content providers based on the generated traffic to their websites. This source of revenue for content providers helps alleviate content development costs.

IX. APPLICATION OF MOBILE COMMERCE IN VARIOUS SECTORS

Many more people have access to a mobile phone that to a computers and this means that m-commerce has the opportunity to connect not just big businesses but also small business and consumers on a massive scale. In this sense, mobile phones have the potential to bridge the digital divide and allow organizations and individuals to reach out to one another more easily than ever before. After the appearances of a new technology a remarkable growth occurs in it. This has been the same in mobile commerce. Mobile
Commerce has gained increasing acceptance amongst various sections society in last few years. The reasons for its growth can be traced back to technological and demographical developments that have influenced many aspects of the socio-cultural behavior in today’s world. Mobile services have registered impressive growth in preceding years and m-commerce is slowly but surely showing signs of a healthy growth. Several applications of M-Commerce are as follows:

**Travel and Ticketing:** By utilizing the B CODE technology or NFC1 technology we could use the mobile phone as a means receiving E-Tickets. B CODE tech consists of sending text SMS which is scan able from the mobile phone display screen through the related set. So by receiving the chosen SMS, the ticket is practically received and we could present the mobile phone to the scanning machine at the ticket receipt spot.

**Commerce:** Commerce is the exchange or buying and selling of commodities on a large scale involving transportation of goods from place to place. It is boosted by the convenience and ubiquity conveyed by mobile commerce technology. There are many examples showing how mobile commerce helps commerce. For example: consumers can buy products from a vending machine or pay a parking fee by using their cellular phones, and mobile users can check their bank accounts and perform account balance transfers without needing to go to a bank.

**Education:** Similar to other wired technologies, mobile wireless technologies have first been used in industry sectors such as business. The movement of mobile wireless technologies in education is a recent trend, and it is now becoming the hottest technology in higher education.

**Enterprise Resource Planning (ERP):** In the coming mobile commerce era, users will want to be able to have access to the right resources and work as efficiently as possible– whether they are traveling, seeing a customer or working at other remote locations– with their ERP systems. Many ERP vendors are currently researching for ways to provide mobility to ERP users. They attempt to connect employees to their work more effectively than ever before by enabling mobile phones and other wireless devices to become a new kind of tool to seamlessly exchange information, automate data entry and perform a range of transactions anytime, anywhere.

**Entertainment:** Entertainment has always played a crucial role in Internet applications and is probably the most popular application for the younger generation. Mobile commerce makes it possible to download game/image/music/video files at anytime and anywhere, and it also makes on-line games and gambling much easier to access and play. It is projected that by 2005, 80 percent of all mobile users in the United States and Western Europe will play mobile games at least occasionally.

**Health Care:** The cost of health care is high and mobile commerce can help to reduce it. By using the technology of mobile commerce, physicians and nurses can remotely access and update patient records immediately, a function which has often incurred a considerable delay in the past. This improves efficiency and productivity, reduces administrative overheads, and enhances overall service quality. Mobile technologies such as PDAs, Laptops or Tablet PCs can be of great value in hospitals and healthcare facilities by allowing better access to critical information – e.g. patient status, staff and patient location and facilities availability). Healthcare facilities that choose to adopt such technologies may be able to not only perform better but ultimately provide more efficient and better quality of care for patients.

**Inventory Tracking and Dispatching:** Just-in-time delivery is critical for the success of today’s businesses. Mobile commerce allows a business to keep track of its mobile inventory and make time-definite deliveries, thus improving customer service, reducing inventory, and enhancing a company’s competitive edge. Major delivery services such as UPS and FedEx have already applied these technologies to their business operations worldwide with great success.

**Traffic:** Traffic is the movement of vehicles through an area or along a route. The passengers in the vehicles and the pedestrians are all mobile objects, ideal clients of mobile commerce. Also, traffic control is usually a major headache for many metropolitan areas. Using the technology of mobile commerce can easily improve the flow of traffic in many ways. For example, a mobile handheld device can have the capabilities of a GPS, such as determining the driver’s exact position, giving directions, and advising on the current status of traffic in the area. A traffic control center could also monitor and control the traffic according to the signals sent from mobile devices in the vehicles.

**X. ISSUES THAT CONCERN M-COMMERCE IN TERMS OF SECURITY AND PRIVACY**

The most important element when we are dealing with m-commerce is security issues and how we can make it safe for customers to feel comfortable when using mobile phones, so in order to attract as many customers we need to insure the quality of the security level provided. However, it’s absolutely crucial to insure the safety of all kind of m-commerce transaction special those that involve money transactions, therefore there are three main areas:

**SECURITY ISSUES RELATED TO THE NETWORK TECHNOLOGIES**

The challenges that face the security network technologies issues GSM stand for Global System Mobile commerce, GSM’s are the most used and the most common in the world especially in Europe, they are also considered to be the most important element of mobile commerce now a days. GSM’s where first produced in the 1990s starting with a small market and very limited because it was not very handy back then, and also because it was very slow and above all that the device would not run without a computer which made it very inconvenient for customers to use it everywhere As
technology developed GSM and cell phones became more and more popular and more services were provided, such as SMS, wireless application protocols, HSCSD, and GPRS.

The Wireless Local Area Network, which is known as (WLAN), operates in the unlicensed 2.4GHz, and most mobile phones have this function and it is also becoming very popular. However during the default mode WLAN is not secured which makes the device easy to corrupt, so a certain level of security was needed and that is why the IEEE invented WEP (Wired Equivalent Privacy) in order to solve the following Problems:

1. Authentication to protect the association to an AP.
2. Integrity protection to MAC frames.
3. Confidentiality to MAC frames.

**Layer Security Transport**

Layer security transport gives more security to the wire logic, by this technology SMS and Packet data service was improved.

XI. **Solutions on How to Solve the Main Issues of Mobile Commerce**

**Security transaction over the web browser:** when a customer is using mobile transaction though a web browser the customer is protected by inactivity lock out, this technology logs out the user automatically when the connection is lost.

**USSD:** this technology will make sure that all kind of transaction been made does not fall on the wrong hands and it is very powerful mobile phone subscribers use their handsets for m-commerce activities.

XII. **Conclusion**

M-Commerce is a relatively new space; being proactive by exploring and learning the new perspectives of looking at customer’s preferences. It also helps business growing effectively, The opportunity to stay one step ahead from the competitors with the explosion of smart phones, 3G services and the adoption of unlimited data service plans. Although the discussions over the net neutrality is being at its edge, it is required to get assisted in the position of competitive advantage, what so ever the restrictions are put forth over coming it. Business owners now have the opportunity to easily connect with their customers in real time when ever and wherever they might be.

**References**


