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A Framework for Mobile Commerce

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Abstract

M-Commerce is concerned with using a handheld mobile terminal such as a PDA or a Smart phone, connecting with wireless networks and conducting transactions. Considering the fact that there are so many different M-Commerce services and products on the market, it is necessary to build a framework to organize them so that some conceptual structures can be discovered and new products and services may be compared meaningfully with existing ones along some uniform dimensions. In order to build such a framework, we propose three useful dimensions. This integrated three-dimensional framework will help us to better understand the development status of current mobile Commerce services and products and further help designers, developers, and researcher to strategize and effectively implement new mobile commerce applications (Upkar Varshney an Ron Vetter 2001). Furthermore, this framework will form the basis for a more comprehensive framework to be developed. We hope this framework will be useful in the investigation of related issues such as the impact and adoption of M-Commerce on organizations. The issue of what criteria will be used in choosing a good framework and its dimensions is also discussed in this paper.

Keywwords: Framework, mobile commerce, mobile commerce value chain, e-commerce, and telecom technologies.

Introduction

Electronic commerce and telecommunication technologies have impacted businesses enormously in the last few years. More and more people are beginning to enjoy the benefits of E-commerce and wireless telecommunication technologies. Researchers have pointed out in recent years that we can expect to do better if we combine the benefits of both e-commerce and telecommunications technologies in the form of M-Commerce products and services. These applications can collectively be termed " wireless e-commerce" or "mobile commerce" (Upkar Varshney and Ron Vetter 2001). Currently, millions of mobile phones and other mobile devices are in use worldwide. In the next few years, a more significant increase shall be seen.

In order to organize and structuralize various m-commerce products and services, here in this paper, we build an integrated framework for mobile commerce based on three proposed dimensions. These dimensions are: mobile commerce value chain; technical support infrastructures and characteristics of mobile commerce that add values. Criteria for choosing mobile commerce frameworks and dimensions are also discussed. The first dimension of the framework is built on a tentative mobile commerce value chain, examining where the revenue comes from and how mobile commerce products/services add values. In the second dimension, we have a discussion of how mobile commerce applications get support from environment and technology such as network infrastructures, platforms, handheld terminal infrastructure and so on. In the third one, we categorize various m-commerce applications according to their value added features. We believe that with the widespread acceptance of wireless telecom and further advance in mobile computing technologies, the mobile commerce will play a more and more important role in future e-commerce area.

Mobile Commerce

What does it mean when we refer to a term as M-Commerce? Generally speaking, M-Commerce is using a handheld mobile terminal such as a PDA or a Smart phone, connecting with wireless networks and conducting transactions. For example, we order and pay for a book using the Short Message Service.

Advantages of Mobile Commerce Applications

Compared with wire-connected PC, the key advantage of wireless device is the connecting ability from anywhere, any time- "ubiquitous interactivity". The second one is that the wireless device is distinctly personal and the usage can be tracked down to an individual rather than the household as in the case of a PC or other devices. Thirdly, wireless technology is "location aware"- that is, it is easy to track down where the user physically is as long as the wireless devices is on unless the user wouldn't want his now location revealed (Kannan, Chang, and Whinston 2001). The forth feature is its security. The mobile phone with its integrated SIM card is an ideal bearer for the private key digital signature of a PKI system. Thus, the mobile device can become a security tool, for example for secure payment in M-commerce. The Fifth is personalization. It refers to the feature that the users personal information will be available on the handheld terminal for personal identity and service customization (Durlacher 2000).

Disadvantages of Mobile Commerce Devices

Despite many advantages envisioned, if mobile commerce applications are ever to be widespread, several hurdles must be cleaned: First of all, given the constraints of its size for a handy usage, the user interface of a wireless device is quite limited and cannot display information-rich content in a useful way (This is also the marketing chance for technology vendors to solve this problem). Secondly, the present client devices have fairly limited capabilities for processing and storing information and data compare with PCs. (This will not be a big constrain in the future considering the explosive development of Chip technology. Thirdly and most importantly, the bandwidth of wireless devices would be a real big limitation to mobile commerce application (Kannan, Chang, and Whinston 2001).

There are also some non-technology aspects exist as obstacles such as trust between businesses and between businesses and consumers, security concerns and perceived usefulness. All of these aspects could limit the development of mobile commerce but they also provide opportunities for many businesses.

Existing Framework for Mobile Commerce

Because mobile commerce is a fairly new and still emerging phenomenon, there are very few established frameworks available. One of the most representative ones so far is by Upkar and Ron Vetter (2001). Their proposed framework for mobile commerce application shows a user plane with four levels and a developer-provider plane with three.

This framework defines several functional layers, simplifying the design and development so that different parties—vendors, providers, designers, and so on—can address individual layers. However, there are some shortcomings in this framework. For example, while it is obvious that there is a tight relationship between the user plane and the developer and provider plane, the authors failed to address it well in their framework. Another disadvantage is that the authors put all mobile commerce applications into some classes among the application layer without addressing any relationship among them. Because there are various products and services involved in this layer and many of them indeed have some different characteristics and internal relationships, we need a more detailed framework to address these differences.

Proposed Framework for Mobile Commerce

Criteria for Choosing a Framework

Before building a framework, it is necessary to discuss the criteria for choosing a framework in the context of mobile commerce. Because building a framework and choosing dimensions is a rather subjective work, it is hard to measure the goodness of the framework along with its dimensions. However, there are indeed some criteria for choosing a framework's dimensions. Hereby, I choose the following criteria in accessing the goodness of a framework.

One criterion is that the framework should be useful, which means that the framework will either helps the players in m-commerce arena to strategize and effectively implement mobile commerce applications, or it should be useful in research. Another one is that the framework should show sufficient consistency in categorizing a wide range of mobile commerce applications. That is to say, all those now existing and future possible mobile commerce applications that could be included in the framework should exhibit consistent logical relationships among the various categories of products and services. The third one should be the fitness of the framework, which means that the mobile products/services can be fit well into this framework.

Proposed Framework and Dimensions

Framework Structure

Above is the structure of our proposed framework for mobile commerce (figure 1). It has three planes all together: the value chain plane, technical support plan and applications plane. The advantage of using the mobile commerce chain as one dimension is that the players in the value chain theoretically provide all possible services and products for mobile applications and there is one obvious and consistent relationship among them, that is revenue flow gained by value their added applications. So each layer in this dimension refers both to the players and the products/services they provide. As to another dimension, the reasons why we propose it is because it is a hierarchical one and we can describe by it how various mobile commerce applications get support from technology and infrastructure. Although there is no tight or logical relationship between various layers in the third plan/dimension, they are categorized by their inbuilt value-adding characteristics of mobile commerce so that we can differentiate them more clearly.

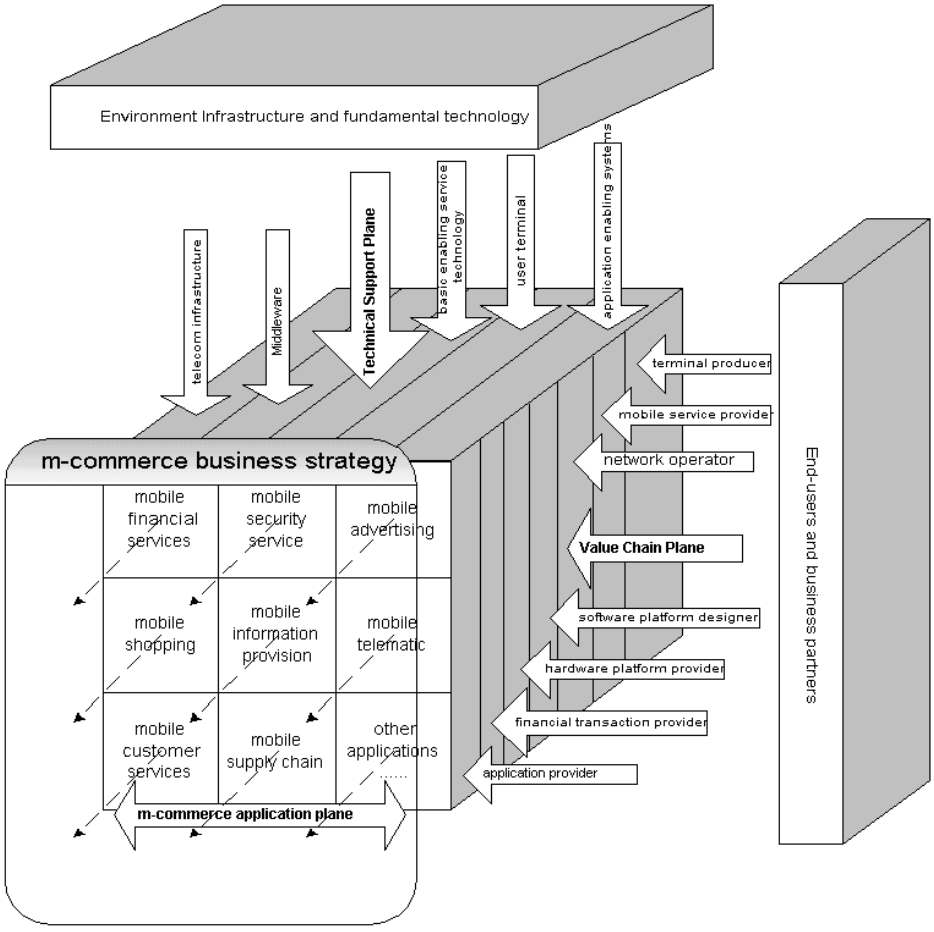

Figure 1. Framework for Mobile Commerce

Three Dimensions of the Framework

In this framework, the value chain plane is faced with or say gets support from an outside layer that stands for end-users and business partners (the business partners here refer to advertisers or other third parties that make use of mobile commerce services and products, they are not necessary to be the players in mobile commerce arena.). It is because the revenue source of mobile commerce mainly comes from end-users or business partners, and nearly all layers in this plane can get revenues directly from them.

The technical support plane is also support by an outside layer. This layer refers to the environment infrastructure and fundamental technology. It means that, despite not having been built well yet, environment infrastructure such as government regulation and fundamental technology like PKI (public key infrastructure) act as the cornerstone of mobile commerce and is the fundamental requirement to the development of mobile commerce.

The third plane, i.e. the mobile commerce application plane, can be also looked upon as one part in the mobile commerce value chain, that why we have positioned it where it now stands.

The mobile commerce business strategy is added because when those service and products provider companies are looking for further development in the long run or when some traditional companies want to reorganize their structures to fit in the intensive competition in m-commerce era, business strategy is need. The framework shows that the strategy layer gets support from various m-commerce applications in application plane.

Dimension One: Value Chain in Mobile Commerce

The following table (table 1) lists some of the players in mobile commerce value chain (end-users and business partners excluded).

Table 1. Players in Mobile Commerce Value Chain

Players in mobile commerce value chain	Description	Examples	Payer
Handheld terminal producers.	Produce handheld terminals	Nokia, Motorola, Simons and Ericcson	End-users
Basic mobile service provider	They act like a Internet service provider (AOL and Yahoo), who offers access for the user on the mobile network and provides other services, such as billing, helpdesk, etc.	Orange, Smartone, Sunday, etc (Hong Kong examples)	End-users
Network operator	Telecom Network Operators, who build and maintain the networks.	China Telecom, Hong Kong Telecom	Mobile service provider. (Most of network operators are also mobile service providers.)
Software platform designer	Organize a "soft" platform to integrate different communications and services for mobile commerce application	ExpressQ 3.0 by Nettech Systems	End-user, Advertiser and M-commerce service/product provider
Hardware platform provider	Provides Web/portal hosting and Internet accessibility	The mobile Internet platform by Air2Web	M-commerce service/product provider
Financial transaction provider	Handles the financial transactions	Banks, Qpass, and BEA WebLogic M-commerce Solutions	M-commerce products/services providers, Advertiser and End-users
M-commerce application products/services providers	The company, who offers products, information, transactions and entertainment service.	w-Store™, w-Travel™, w-News™ and w-Sports™ by w-Trade Technologies	End-users and Advertisers.

According to Els A.M. ven de Kar (2000), There are two main identified revenue sources for mobile commerce: the end-users and business partners. The end-user can be both consumers and businesses, the revenue flow they provided are as follows.

1. The money they paid for handheld terminals.
2. The money paid by per subscriber.
3. The money paid by end-users for connection services (either time based or byte based charging)
4. The money they paid for Information or services they paid for.
5. The profit margin gained by selling products to customers or commission fee paid by traders.

The business partners refer to the advertisers or other third parties that make use of mobile commerce application services and products to conduct their business. They provide revenue in somewhat different way, for example, advertisers pay commissions to identify their brand and attract customers.

Also each mobile commerce application provider can build its value-adding products and services using the functionalities provided by others.

Dimension 2: Technical Support of Mobile Commerce

The second dimension is partially adopted from Upkar and Ron's hierarchical framework (2001) but has many differences. Compared with the first dimension that focus on business application and value chain, this dimension is more concentrated in technology and infrastructure context. This new dimension has 5 levels in total and lower layers support each upper one directly or indirectly. It is also the feature of this dimension that we take into consideration of environment support and mobile commerce business strategy in the structure so that we can make it more compatible and comparable with existing infrastructure support framework of e-commerce (table 2).

Table 2. Technical Support Dimension

Layers in dimension	Descriptions and example
Mobile commerce application enabling systems	Mobile payment system, mobile supply chain systems, etc.
Wireless user terminals and their infrastructure	Wireless handheld devices and terminal that has WAP enabling explorer build inside, it provides the client side functions in mobile commerce applications.
Basic Mobile commerce enabling services technology and infrastructure	SMS, Cell Broadcast, SIM application Toolkit WAP, Mobile Chat Service.
Mobile commerce middleware	Mobile middleware is a layer of software that is used by application developers to connect their e-commerce applications with different mobile networks and operating systems without introducing mobility awareness in the applications
Telecommunication infrastructures and services	This layer includes physical networks (GSM, UMTS) and logical networks (Wireless LAN and Wireless Intranet or wireless Extranet). It also includes the wireless connection service.

The mobile commerce middleware act to band together the two layers of mobile commerce enabling infrastructures and fundamental mobile commerce enabling services. Wireless user terminal/infrastructure act as a link between those fundamental m-commerce enabling services and various m-commerce application services/products. M-commerce application services and products providers provide most of products and services to end-users and there are theoretically unlimited numbers of these services and products such as mobile financial applications, mobile advertising, mobile inventory management and mobile payment.

Dimension 3: Mobile Commerce Application Services and Products

Can we also divide them into different categories in this framework? Here we propose to use a third dimension to handle this question. The third possible dimension of this framework could be based on the unique characteristics of mobile commerce applications that combine the advantages of mobile communications with existing e-commerce services. And these characteristics can also be looked upon as the key drivers for the increasing expanded mobile commerce market. The following table (table 3) lists these categories and characteristics (or market drivers) in brief with examples. Furthermore, this layer could also be divided into several minor subsets according to different market segments: inter organizational, B2B, and B2C layer.

Because mobile commerce are often defined as mobile variance of e-commerce, most of these categories have their counterpart in wired world.

Table 3. Mobile Commerce Application Services and Products

Categories of mobile commerce application	Characteristics of mobile commerce applications that add values	Descriptions	Examples
Mobile Financial Services	Security, Ubiquitous intractability.	It offers wireless financial transactions and is a key driver for m-commerce market	Mobile banking; Mobile brokerage; Mobile cash and micro-payment;
Mobile security services	Security, personalization.	The wireless terminal can function as a security device for gaining access to buildings or for a transaction	Wireless PKI systems
Mobile Shopping	Security, Instant Connectivity, Convenience, personalization,	Mobile commerce extends your ability to make transactions across time and location and creates new transaction opportunities. It's only one button purchase.	Mobile Retailing; Mobile ticketing; Mobile Auctions; Mobile Reservations; Mobile Postcard.
Mobile Advertising	Ubiquitous intractability, personalization, localization.	It would allow one-to-one marketing, Pull or push model	Sunday in Hong Kong (it's subscribers can call a number and receive special offers by phone from shops in a particular shopping center.
Mobile Information Provisioning	Instant connectivity; Convenience; Personalization; Localization.	Information can be pushed or pull to the mobile terminals.	SMS based information services News services
Mobile Customer Services	Personalization; Localization.	It can be more economically by providing customer services in wireless way.	Visitor's mobile phone services provided by mobileshop.com.
Mobile Telematic	Localization	In-car navigation has been realized so far with GPS technology and CD-ROMs.	Smart Traffic Products by Nokia.
Mobile Supply Chain Integration	Convenience; instant connectivity; and	By integrating the mobile terminal into the supply chain, it will be possible for e.g. a sales representative to check whether a particular item is available in the warehouse.	3COM and Aether Technologies have joined forces to create OpenSky and to offer a service that gives smart phones and communicators mobile access to database applications.

Goodness of the Three Dimensions and Preliminary Result

From what we have discussed above, we can find that all of these three dimensions are good in the first two criteria. The dimensions seem consistent and useful. As to the criteria of fitness issue, we can test it by case studies of multiple examples of mobile commerce application services and products. The preliminary result shows that they fit well in these three dimensions. Although some mobile commerce solutions are aiming at a more comprehensive way to conduct mobile commerce, more products and services are only designed for one layer's capability and appear successful. Another interesting finding is that nearly all telecommunication companies such as network operators have entered or have planed to enter the mobile commerce area compared with at time when the concept of electronic commerce first emerge. It seems that they don't wish to miss another chance offered by telecommunication technologies any more. Contrary to the enthusiasm of telecommunication companies, the traditional companies and end users pay less attention to mobile commerce application products and services. It may suggest that the mobile commerce is only at its early stage of development and there is still a long way to go.

Further Development

Based on this framework, not only can we fit the products and services that we have already found into it, we can also find some blank space that is still waiting for fulfillment so that we may propose some possible products and services. For example, we propose the mobile commerce business strategy layer in our framework and envision a considerable market opportunities in this field.

By using this framework, we could also make analysis of market of those products and services for mobile commerce application and help to prevent the design and development of mobile commerce services and products in an ad hoc fashion. We also wish our work will be helpful in research of mobile commerce impact and adoption issues in the future.

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