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M-service and its framework

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Abstract

This paper presents M-commerce issues and a framework for M-commerce. The issues include mobile devices, trust and privacy, payment system, management and security and so on. The position and the importance of each topic in M-commerce are discussed extensively. Finally, a new framework for M-commerce is proposed. The framework has three dimensions which are software technology plane, hardware plane and M-commerce application plane. The criteria of a good framework are also indicated. With these criteria, it has been demonstrated that the framework is a natural framework and easy to understand. Furthermore, all issues in M-commerce can fit into the framework very well.

1 Introduction

The concept of M-commerce (or mobile electronic commerce) was introduced in the late 1990's. Mobile devices, involved in M-commerce, are becoming a large market. There were more than 350 million mobile devices worldwide in 1999 [3], this number may rise to 1 billion in the next few years [5]. Forty percent of consumer-to-business e-commerce would come from smart phones using the wireless application protocol (WAP) [6]. Based on a study by the Wireless Data and Computing Service, the annual mobile commerce market may rise to $200 billion by 2004 [12].

However, the mobile commerce industry is still in its infancy, and there are many problems that need to be addressed, for example: flexible business to consumer system, secure payments, M-commerce management and interoperability between networks and different devices, and so on. There are a number of papers that review various aspects of mobile e-commerce [13, 11]. Tarasewich, P., Nickerson, R., and Warkentin, M. [13] introduced different issues related to mobile client, communication infrastructure and mobile commerce application systems. These different issues represent an overview of the social, technical, and practical environment within M-commerce activities in the coming years and provide a foundational analysis research for further work and study within this domain. Muller-Veerse [11] published a mobile commerce report with the intention of providing operators, investors, mobile commerce service and equipment vendors, banks, and others, with a pragmatic view and analysis of the M-commerce market in Western Europe. It detailed analysis of the mobile commerce space with M-commerce enabling technologies, M-commerce enabling applications, consumer M-commerce Applications, business M-commerce applications, and so on. The author also indicated how these technologies and markets are evolved to provide growing momentum to the M-commerce applications market, how these applications shape over time and how the various players react to such developments by using mobile technologies (GSM, HSCSD, GPRS, EDGE, 3G / UMTS). These papers, however, as well as others cited in the remaining section of this paper, discussed what exists or is planned but do not discuss the issues of mobile commerce.

There are a few papers that have addressed various mobile commerce issues. Kannan et al. [9] discussed the characteristics of wireless technology and its usage, and viewed how wireless technology's contributions complement the capabilities brought about by the Internet based e-commerce. Based on the characteristics, the authors identified a series of propositions that were related to marketing and marketing research issues of mobile e-commerce. Varshney and Jain [14] presented several issues related to fourth generation wireless networks such as Multimode devices, Overlay network and Common access protocol, and so on. The differences between the first, second and third generation wireless networks were compared. The authors pointed out the possible problems of mobile commerce in the fourth generation wireless networks. Varshney and Vetter [15] envisioned new e-commerce applications that might be possible and significantly benefit from emerging wire-

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less and mobile networks. The authors attempted to identify several classes of applications such as mobile financial applications, mobile inventory management, proactive service management, product location and search, and wireless re-engineering and discussed how to successfully define, architect, and implement the necessary hardware/software infrastructure in support of mobile commerce. No paper that we are aware of, however, provides technological details of the issues.

2 Issues in M-Commerce

In this section, some issues with technological details on the way to M-commerce are reviewed. These issues are important to understanding M-commerce. The issues are:

1. Mobile devices;
2. Trust and privacy;
3. Management and implementation;
4. Security.

Mobile devices Early experiences with mobile electronic commerce in the banking industry can be used to learn of some potential dangers and issues to be taken into account. Customers can use Automated Teller Machines (ATM) and electronic home banking systems outside of traditional bank facilities for most of their usual transactions. This was consistent with the cost-savings strategy of most banks since electronic transactions were about seven times less costly compared to the manual handling of these transactions by a bank teller [1]. A mobile commerce provides new opportunities for customers and services and it is becoming a large market. The problem is knowing what kind of mobile devices the market will take.

One problem for mobile devices is knowing which protocols or systems for mobile client device communication will be accepted. Wireless devices, such as mobile phones and handheld computers, can access the Internet through the Wireless Application Protocol (WAP) [2]. However, whether WAP will become a globally accepted standard is still doubt. For instance, the NTT DoCoMo company in Japan invented a wildly popular i-mode that is a complete wireless system and includes its own protocol and services for its users. It is used for specifically designed Web sites and does not truly access the Internet. The protocols of I-mode are based on compact HTML (cHTML), a subset of standard HTML. Furthermore, the Wireless Markup Language (WML), based on XML, is not compatible with HTML and used as web sites description language within WAP [7]. Another example, Handheld Device Markup Language (HDML) is designed to view text portions of Web pages on wireless devices, however, is not based on XML. Whether WAP, i-mode, or some other protocols or systems will eventually dominate is a challenging problem [13].

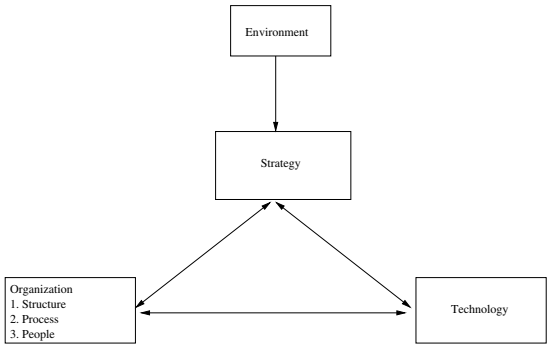

Figure 1. A simplified model of an organization

This should be a direction for design mobile devices which incorporate capabilities for customer usability and acceptability.

Trust and privacy Users are seriously concerned with privacy and trust, which may lead to a backlash against providers using such systems, or customers avoiding the use of these systems [4]. Some companies require customers to provide their information on their demographics information, buying patterns or product needs. Unfortunately, this data is critical in many cases since consumers do not know what will be done with their private data. There are two ways of handling these concerns, either customers can be made aware of the benefits of volunteering this data, or material incentives can be offered to customers to attract them.

Management and implementation We discuss management and implementation issues of M-commerce. Managerial activity implicates getting benefits of an electronic commerce system. Indeed, management revolves around the realization that technology alone do not solve issues or create advantages. This technology needs to be integrated by administrators, with the change access operations linked to people involved in a commerce system.

A summarized model of an organization is in Figure 1, and it shows the alignment between these different components as the main issue in establishing a sustained competitive advantage.

The issues of alignment relevant to electronic commerce systems are:

1. between strategy and technology;
2. between technology and the organizational processes;
3. between technology and people.

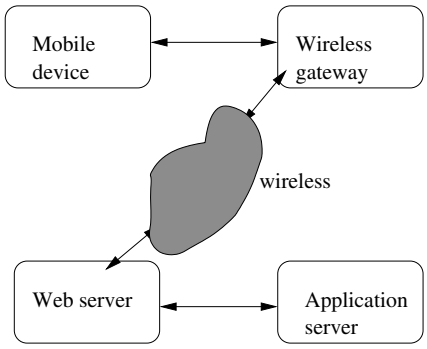

Figure 2. Users access service model

Security Security is a key enabling factor in M-commerce. With the industry moving toward a consensus on providing service on wireless commerce, the next major challenge for enterprises and service providers is securing resources from unauthorized access and preventing fraud. As companies allow customers to execute wireless transactions and business partners with wireless access to share information and resources via an Intranet or extranet, security becomes a chief concern. There are three levels for M-commerce security [10]. The following Figure 2 illustrates users access services in M-commerce. Three levels are involved in the figure. They are network connection level, management level, and transaction level.

3 A framework for M-commerce

We have explored issues in M-commerce and the new challenges it brings to strategy development. We now set up a framework that best illustrates how to learn and analyze commerce environment.

3.1 Criteria for Choosing a Framework

M-Commerce concerns with using a handheld terminal and mobile terminal such as a mobile phone, connecting with wired and wireless networks, and conducting transactions. Because there are many different kind of M-commerce Services (e-shop, e-bank, M-service, and so on), it is necessary to build a framework to organize them so that some conceptual structures can be discovered and new services may be compared meaningfully with existing ones along some uniform dimensions. In order to build such a framework, this section proposes three dimensions. This integrated three-dimensional framework helps users to understand the development status of current M-commerce services and further helps designers, developers, and researchers to strategize and effectively implement new M-commerce applications. The three dimensions are:

1. M-commerce hardware plane;
2. M-commerce software technology plane;
3. M-commerce application plane.

The first dimension of the framework is based on the hardware that is used within M-commerce such as communication server, computer terminal, mobile phone, lap computer, and so on. In the second dimension, we provide various kinds of software technologies in M-commerce such as financial transactions, e-payment, management, and so on. In the third dimension, we categorize different M-commerce applications according to their value added features.

M-commerce is a fairly new and still emerging phenomenon, there are very few established frameworks available [8, 16]. A framework for the field of M-commerce was introduced by Jeffrey F. etc [8]. There are four infrastructures in the framework; they are Technology, Capital, Media and Public Policy infrastructure. The authors specified the technology infrastructure is the foundation of a system. The hardware backbone of computers, routers, servers, modems, and other network technologies provides half of the technology issues. The other half includes the software and communication standards that run on the hardware, including the core protocol for the web. On the other hand, authors specified a Media infrastructure with communication technology. These two infrastructures are confusing by the communication technology. The main reason of this confused point is because the authors did not analyze the relationship between different infrastructures. Another framework proposed by Upkar and Ron Vetter [16], shows a user plane with four levels and a developer-provider plane with three. The framework has several functional layers. Consumers, providers, designers, and so on can find individual layers in the framework. However, there are some shortcomings in this framework. For instance, there is a tight relationship between the user plane and the developer and provider plane, the authors do not 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. Many services involved in this layer have different characteristics and relationships between them.

We discuss the criteria for choosing a framework in the context of M-commerce. A framework and its dimensions is a subjective work, there is no exact measure for the quality of a framework along with its dimensions. However, there are some criteria for choosing a framework's dimensions.

One criterion is that a framework should be natural, which means that the framework is easy to understand even to the novice. The next criterion is usefulness, which means that the framework either helps customers in M-commerce

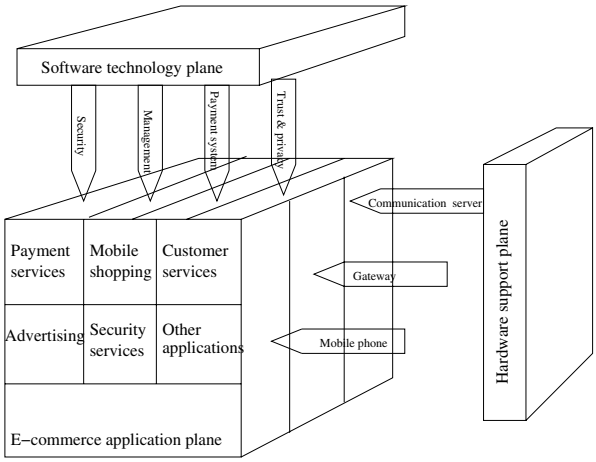

Figure 3. A framework of M-commerce

Software technologies	Description	Examples
Communication	It is used for connection between terminal users and servers	ray technology Secondary planet communication
E-service	It provides access for the user on the mobile network, such as billing, helpdesk,	Google, yahoo
Management	It offers how to manage a e-service system and who can access what information in the system	MAC, RBAC
Software platform	Organize a platform to integrate different communications and services for M-commerce	ExpressQ 3.0 by Nettech Systems
Financial transaction	Handles the financial transactions	Banks and BEA
Middleware	Middleware is a layer of software that is used by application developers to connect their E-applications with different networks and operating systems without introducing awareness in the applications	Snapshot in Aberdeen

Table 1. Software Technology in E-Commerce

Layers in dimension	Descriptions and example	Example
Terminals	mobile devices and terminal provides the client side functions in M-commerce applications.	Mobile phone Laptops
Computer server	It provides various information of service and users can choose what service they need	Nokia Mobile Server SDK 1.0, Yahoo Chat Service.
Gateway	It is used to connect from consumers to servers	InfoSync,

Table 2. Hardware in M-commerce

to strategize M-commerce applications, or provides a structure for researchers. The third criterion is that the framework should be sufficiently consistent in categorizing M-commerce applications. This means, all existing and possible future M-commerce applications can be included and fit well into the framework.

3.2 Framework and Dimensions

The framework proposed in Figure 3 has three plane: software technology plane, hardware plane and applications plane. The software technology plane theoretically provides all research work for M-commerce applications and there is one obvious electronic consistent relationship among them. The hardware plane includes all hardware used in M-commerce, such as various mobile devices and communication servers and so on. The application plane indicates different M-commerce applications such as mobile shopping, security service, and so on. M-commerce application is a combination of software technology and hardware technology. The software plane and the hardware plane have a tight relationship when an M-commerce application is built up. This is because software or hardware is not sufficient to set up a successful M-commerce service.

In this framework, the software technology plane is faced with an outside layer that supports end-users and other third parties who make use of M-commerce services. These parties are not necessary players in the M-commerce arena. This is because many people such as researchers and technology supporters are not involved in M-commerce.

The hardware plane is also supported by an outside layer. This layer refers to the hardware environment. Productions, for example, communication servers, mobile computers, gateway, and mobile firewalls and so on act as the cornerstone of M-commerce and are the basic requirements to implement an M-commerce.

The M-commerce application plane can be considered as an application of the first plane and the second plane. Therefore we have positioned it on another dimension.

Dimension 1: Software Technology in M-Commerce

There are many software technologies in M-commerce and new skills that are still being developed. Consumers and suppliers believe that good technologies can bring them benefit and can be used to build a trusted M-service. Therefore, the software plane includes the basic and important technology requirements such as payment system, management, and so on in M-commerce. This paper focuses on some topics on this dimension.

Table 1 provides some examples of software technologies.

Dimension 2: Hardware Support in M-Commerce

This dimension has several levels from the client side to the server side. We have various hardware productions in M-commerce. For example, mobile phones or handheld computers are used in consumer side while computer servers provide service context in service provider's side. Gateways, between terminals and servers, are used to connect to each other. Table 2 shows some hardware in M-commerce.

M-commerce application	Descriptions	Examples
e-shop	e-commerce extends ability to make transactions across time location and creates new, business opportunities.	Amazon.com Yahoo
Financial Services	It offers financial transactions and is a key issue in e-commerce environment	ebay e-pay
Security services	A terminal can function as a security device for gaining access to e-commerce	PKI systems Wireless PKI systems
Customer Services	It can be more economically to provide services	AvantGo, ebay
Advertising	It introduces production for companies and individuals	AdsOnWheel, AvantGo

Table 3. M-commerce application

Dimension 3: M-Commerce Application

This dimension is based on the unique characteristics of M-commerce that combine the advantages of electronic communications with existing M-commerce services. And these characteristics can also be looked upon as the key drivers for the increasing expanded M-commerce market [19]. Table 3 lists these categories and characteristics with examples. This layer can be divided into several minor subsets according to different market segments: C2C, B2B, and B2C layer, and so on.

M-commerce can be defined as mobile variance of e-commerce, most of these categories have their counterpart in a wireless world. From what we have discussed above, we can find that all of these three dimensions are good in the first criteria. The framework is natural and easy to understand. As to the criteria of consistency and fitness issues, we have shown that it can strategize M-commerce application and all existing and future applications are included in the framework and fit well in these three dimensions.

4 Conclusions

With the accelerating progress of content presentation standards and continuing advances in data transmission speeds, M-commerce is assured by both consumers and business. An overview of M-commerce has been presented in this paper. Various kinds of M-commerce issues such as mobile devices, e-payment, security and management, and so on are discussed. Finally, a new framework of M-commerce is also presented.

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