M_Commerce Means Mobile Computing

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Abstract: *Many technologies and applications have appeared recently which are directed at mobile computing and the wireless Web. Wireless (or mobile) e-commerce is concerned with conducting transactions and other business activity with these new technologies and applications. This research looks at some of the relevant technologies, applications, and issues in wireless e-commerce. Mobile computing and mobile communications in order to provide a large number of advanced services to mobile users. The potentials of mobile e-commerce are enormous while related technical, business and legal issues become more complicated. The goal of this paper is to present and discuss problems associated with the trading and billing of tangible and intangible goods in an environment, where mobile handheld devices are used to conduct transactions and to identify requirements for these.*

Keywords: Mobile Computing, Wireless Application Protocol, Wireless Networks, wireless e-commerce.

1. Introduction

Wireless e-commerce (also called mobile commerce or m-commerce) is the promotion, buying, and selling of goods and services through electronic data communication networks that interface with wireless (or mobile) devices. Wireless e-commerce is a subset of wireless computing, which is the accessing of information systems by wireless means. Many of the issues that affect wireless computing in general also affect wireless e-commerce.

The concept of mobile computing is also still evolving; some people have coined the term ubiquitous computing to address the possibilities of anywhere, anytime computing. Mobility does not preclude mobile devices, but in our view the new possibilities and challenges for the EC are brought up via wireless portable terminals that are typically personal and hand-held.

Mobile e-commerce also includes the use of devices such handheld and laptop computers that interface with computing resources through wired synchronization. We do not consider this wired form of mobile e-commerce in this paper principally because it is likely to be replaced by wireless devices in the future. Our focus here is on the wireless forms of mobile commerce.

Definition - What does *Mobile E-Commerce (M-Commerce)* mean?

Mobile e-commerce (m-commerce) is a term that describes online sales transactions that use wireless electronic devices such as hand-held computers, mobile phones or laptops. These wireless devices interact with computer networks that have the ability to conduct online merchandise purchases. Any type of cash exchange is referred to as an e-commerce transaction. Mobile e-commerce is just one of the many subsets of electronic commerce. Mobile e-commerce may also be known as mobile commerce.

Mobile Electronic Commerce (MEC) has started recently to appear in the scene as a result of the continuously increasing number of hand-held devices, which makes them an ideal channel for offering a large number of advanced services to mobile users by exploiting the advantages of Internet, mobile computing and mobile communications. As MEC we define any type of economic activity that is considered as electronic commerce by legislation of some country or by business community *and* that is performed using a mobile wireless terminal by at least one party. In most cases the mobile terminal is used by a customer (not by merchant or bank) and the wireless network used is a wireless telecommunications network, although any other wireless network, such as wireless IP network could be used, too.

2. Literature Review

Our view is thus that MEC is a special case of EC, i.e. MEC has all the opportunities and problems that EC has, but it offers in addition some novel and very exciting possibilities - as well as new threats and challenges. Technical, business and legal issues become more complicated in MEC than in EC performed using stationary workstations and similar devices.

A number of MEC-specific novel applications and services, especially localised and personalised services have started to appear. We consider the location-based services now emerging in 2G+ and 3G telecommunication networks to fall under MEC in this context. At the same time, applications and services already offered in Internet for PC level fixed terminals are becoming available for mobile users. Thus, users can now buy various things, order goods and services, etc. using their mobile hand-held terminals instead of PCs. Although there are still differences between the quality and variety of services for different terminal types, they are becoming smaller, even vanishing.

The Wireless Application Protocol (WAP) [6] plays an important role in especially GSM-based MEC as it bridges the gap between the mobile world and the Internet world (TCP/IP networks) by optimizing standards for the unique constraints of the wireless environment. It also offers complicated enough security mechanisms and application

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platform for mobile electronic commerce applications to be developed.

The goal of this paper is to present and discuss problems associated with the trading and billing of tangible and intangible goods in a mobile computing environment and identify their transactional and other requirements. It is organized as follows: section 2 describes the steps and activities of the trading and billing process and the problems and critical issues associated with it.

3.1 Features

One of the features of m-commerce sites is the adaptation of websites to make them easier to use with smaller screen sizes. There are a number of adaptations that can be made including the removal of large graphics and the optimization of fonts for easier viewing and ergonomics.

3.2 Issues

A. Mobile Client Device Technologies and Issues

The interactivity devices or mobile client devices currently most important to wireless e-commerce are mobile telephones, handheld computers, laptop computers, and vehicle-mounted interfaces. Hybrid devices are now appearing, such as the crosses between mobile phones and handheld devices (sometimes called smartphones), but the question remains as to what form the devices will ultimately take, which is an important issue for mobile system developers.Electronic Commerce 436 2001 ó Seventh Americas Conference on Information Systems Usability will become more critical with handheld and phone devices, which differ from desktop and laptop computers in terms of their smaller screen sizes, less available memory, and limited input devices. Many handheld devices are limited to a few lines of text, and do not have traditional keyboards. One usability issue is the need for organizations to determine how people can best use applications and access information through different devices.

Wireless devices have forced developers to carefully revisit both operating systems and applications software on a variety of platforms. Operating systems such as Microsoft's Pocket PC and Palm's PalmOS have been developed for handheld devices.

Although this software meets some of the current needs, it has limited functionality. The creation of system software with increased functionality for devices with limited capabilities will be an ongoing challenge.

Another important building block for this emerging infrastructure landscape may be the Wireless Application Protocol (WAP), which enables wireless devices such as mobile phones to access the Internet. Many WAP-enabled devices have already appeared, although there is doubt as to whether WAP will become a globally accepted standard, especially with the popularity of Japan's i-mode. Developers ultimately face the issue of deciding which set of protocols to accept, or risk the potential problems of working with multiple standards and/or choosing to ignore some.

B. Communications Infrastructure Technologies and Issues:

The communications infrastructure necessary for the wireless Internet environment is quite complex. Wireless devices are likely to remain at a disadvantage over their wired counterparts in terms of bandwidth. Limited bandwidth is a significant problem that requires organizations to rethink how users interact through a wireless device with an information system. An important issue is how to create efficient applications that can realistically work with current technology.

- Local Area Network Technologies:
IEEE 802.11 and IEEE 802.11b are established wireless standards commonly used with laptops or personal computers for wireless local area networks. This technology provides speeds of 1 to 11 megabits per second (Mbps). Bluetooth is a relatively new, inexpensive short-range wireless standard that allows different devices (such as laptops and mobile phones) to communicate with each other. The maximum distance between devices is about 100 meters, and data exchange rates are 1 to 2 Mbps. HiperLAN is a set of wireless LAN standards, primarily used in Europe, which provides speeds up to 20 Mbps.

- Telecommunications Technology:
There are three basic "second-generation" (2G) digital wireless telephone technologies – time division multiple access, Global System for Mobile communication (GSM), and code-division multiple access. All these are circuit-switched services, where a user must dial-in and maintain a connection when data communications are desired. GSM is the most widely used of the three technologies, especially in Europe; its current speed is only 9.6 kilobits per second (Kbps). General Packet Radio Service (GPRS), based on GSM, is a continuous packet data service. Using this technology, network connections are "always-on", and mobile users need not dial into the Internet each time they need to access an application. GPRS promises data rates from 56 to 114 Kbps. GPRS communication channels are used on a shared basis, only sending or receiving packets as needed, rather than maintaining a continuous dedicated line as with circuit-switched services.

Many of the issues with telecommunications technologies are similar to those found with LANs. There are distinct bandwidth limitations with the older generation technologies, which make it difficult to develop efficient applications for all Standards vary from country to country, making it difficult for devices to interface to networks in different locations. An additional issue is the high initial cost of establishing a wireless network that uses these technologies.

C. Other Wireless Technology Issues

Security of wireless information is another important technical issue in m-commerce. Users and organizations will want assurance that their wireless communications and transactions are not intercepted. Organizations that set up wireless LANs must realize that there are no physical boundaries limiting their networks, and that people and devices outside the organization may have (inadvertent)

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access to their systems. Frequency hopping can make it more difficult to intercept data communications. Encryption technologies can also help, but will need to be made more efficient and more foolproof. The increased use of wireless devices for e-commerce makes the issue of positive identity verification even more important yet more difficult to ensure. One consequence of this need is the increasing importance of biometrics. Location technologies, especially the Global Positioning System (GPS), will also play a large part in wireless communications. However, privacy issues must be addressed, such as how personally-identifiable data and location data should be used.

3. Current Mobile Technologies

A. General Definitions

The term mobility refers to the ability of a user to change location. We view the issue of mobility from the point of view of a customer changing physical location (city, country, continent) together with his/her mobile hand-held terminal, as this will possibly cause complications for conducting trade. Note, that this differs from 'normal' Internet connection, that is - so far - assumed to take place between particular physical location (that is, the IP addresses involved can be mapped to a fixed physical location on earth). In general, merchants can also be mobile, but this does not actually make any difference, because, according to the proposed legislation they must have a physical 'place of establishment' and this is what matters in legal sense. Technically, however, a mobile merchant poses new challenges.

Another dimension of the access networks is the service capability. In the basic 2G network the services are voice, circuit switched data (CSD), and short messages (SMS). Especially short messages have been used to support financial services like banking and stock services. CSD can be used as the carrier in a TCP/IP network and it is possible now to do Internet banking using e.g., hand-held Communicators over CSD. Note that in some European countries e.g. balance inquiries can be made also over a voice interface by any GSM phone and the balance report can be either listened or received as a short message into the handset.

Bluetooth [2] is a new emerging technology that will evidently have impact on MEC. Using this technology it would be possible to conduct e-commerce transactions without a heavy network infrastructure. Thus, handheld devices could talk directly e.g. with cash registers. Currently integration of Bluetooth and WAP are under way.

B. Technologies

Wireless technologies for mobile commerce can be roughly categorized into mobile client devices for interactivity (or mcommerce terminals) and communications infrastructure.

4. Applications

Some of the applications of wireless technologies to e-commerce activities that have started to appear across the globe are summarized here. Many of these are currently constrained by technology limitations and issues described previously. Two fundamental application issues that researchers and developers must address are what tasks do users want to do without regard for temporal or spatial constraints and how to provide support for these tasks through wireless applications.

E-commerce payment systems can also benefit from wireless technology. One scenario involves a consumer not having to stand in line to make a purchase, but simply paying for an item though a wireless device. Final payments might even be billed to a telephone company. Bluetooth technology may enable a list of available services to be generated automatically on a device when a user walks close to a Bluetooth-equipped cash register. Wireless technology is well suited for bringing e-commerce to automobiles and other forms of transportation. Traffic advisory systems can warn of impending traffic jams. Cars will eventually be able to report potential problems to service centers themselves. The service center might even make minor adjustments to the car online. Car-mounted devices will eventually allow regular Internet access, although safety issues of "browsing while driving" must be addressed. While most initial mobile commerce applications seem to be aimed at the business-to-consumer market, business-to-business and intranet applications are also appearing. Service technicians can be dynamically assigned new tasks and sent problem information while they are traveling. Sales people can go literally anywhere in the field and access product information and customer accounts, although the applications right now are still subject to the constraints of current wireless devices. Organizations must address the issue of designing complex, robust applications that work well within these current (and any foreseeable) device limitations. Flexibility can be integrated into designs to enable future functionality.

Figure 1: Applications of mobile computing

Other applications of mobile computing:

4.1 For Estate Agents

Estate agents can work either at home or out in the field. With mobile computers they can be more productive. They can obtain current real estate information by accessing multiple listing services, which they can do from home, office or car when out with clients. They can provide clients with immediate feedback regarding specific homes or neighborhoods, and with faster loan approvals, since applications can be submitted on the spot. Therefore, mobile computers allow them to devote more time to clients.

4.2 Emergency Services

Ability to recieve information on the move is vital where the emergency services are involved. Information regarding the address, type and other details of an incident can be dispatched quickly, via a CDPD system using mobile computers, to one or several appropriate mobile units which are in the vicinity of the incident. Here the reliability and security implemented in the CDPD system would be of great advantage.
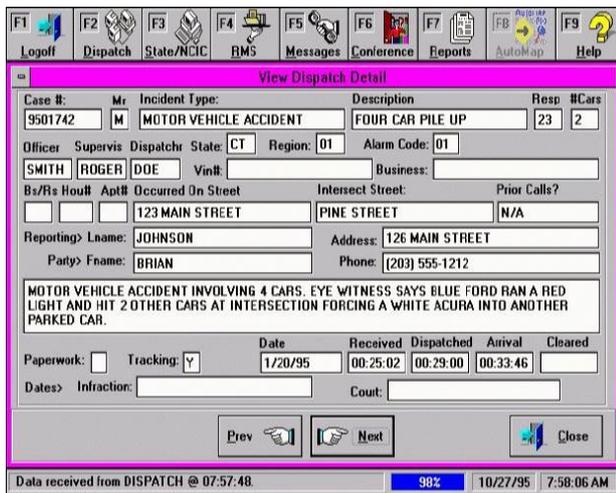
Figure 2: Police Incident Information Screen

4.3 In courts

Defense counsels can take mobile computers in court. When the opposing counsel references a case which they are not familiar, they can use the computer to get direct, real-time access to on-line legal database services, where they can gather information on the case and related precedents. Therefore mobile computers allow immediate access to a wealth of information, making people better informed and prepared.

4.4 In companies

Managers can use mobile computers in, say, critical presentations to major customers. They can access the latest market share information. At a small recess, they can revise the presentation to take advantage of this information. They can communicate with the office about possible new offers and call meetings for discussing responds to the new proposals. Therefore, mobile computers can leverage competitive advantages.

4.5 Stock Information Collation/Control

In environments where access to stock is very limited ie: factory warehouses. The use of small portable electronic databases accessed via a mobile computer would be ideal. Data collated could be directly written to a central database, via a CDPD network, which holds all stock information hence the need for transfer of data to the central computer at a later date is not necessary. This ensures that from the time that a stock count is completed, there is no inconsistency between the data input on the portable computers and the central database.

4.6 Credit Card Verification

At Point of Sale (POS) terminals in shops and supermarkets, when customers use credit cards for transactions, the intercommunication required between the bank central computer and the POS terminal, in order to effect verification of the card usage, can take place quickly and securely over cellular channels using a mobile computer unit. This can speed up the transaction process and relieve congestion at the POS terminals.

4.7 Taxi/Truck Dispatch

Using the idea of a centrally controlled dispatcher with several mobile units (taxis), mobile computing allows the taxis to be given full details of the dispatched job as well as allowing the taxis to communicate information about their whereabouts back to the central dispatch office. This system is also extremely useful in secure deliveries ie: Securicor. This allows a central computer to be able to track and recieve status information from all of its mobile secure delivery vans. Again, the security and reliabilty properties of the CDPD system shine through.
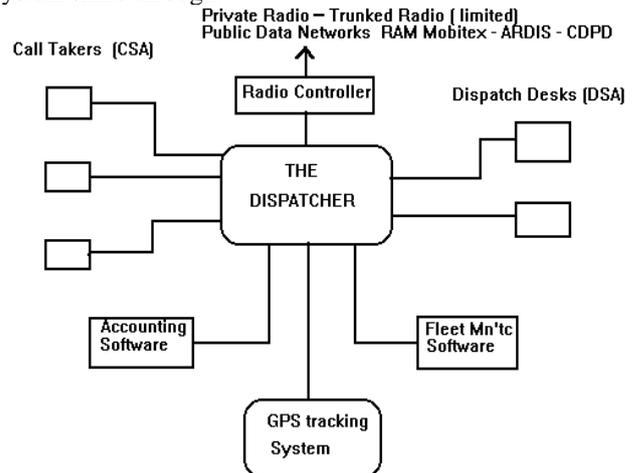

Figure 3: Taxi Dispatch Network

4.8 Electronic Mail/Paging

Usage of a mobile unit to send and read emails is a very useful asset for any business individual, as it allows him/her to keep in touch with any colleagues as well as any urgent developments that may affect their work. Access to the Internet, using mobile computing technology, allows the

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individual to have vast arrays of knowledge at his/her fingertips.

5. Advantages

5.1- Increase in Productivity- Mobile devices can be used out in the field of various companies, therefore reducing the time and cost for clients and themselves.

5.2- Entertainment- Mobile devices can be used for entertainment purposes, for personal and even for presentations to people and clients.

5.3- Portability- this would be one of the main advantages of mobile computing, you are not restricted to one location in order for you to get jobs done or even access email on the go

5.4. Cloud Computing- This service is available for saving documents on a online server and being able to access them anytime and anywhere when you have a connection to the internet and can access these files on several mobile devices or even PCs at home.

Figure 4: Advantages of mobile computing

5.5 The Benefits of Mobile Computing: 3 Key Benefits

a) Improved decision making
Mobile Computing lets you conduct business at the point of activity. The ability to collect, access and evaluate critical business information quickly and accurately means better decision making that can have a far-reaching effect on your company's ability to compete successfully.

b) Increased productivity and reduced costs:
Mobile computing can lead to increased individual productivity, increased sales per sales person, more service calls per repair person, less time spent by professionals on administrative work, and much more--all of which ultimately translates into higher sales at lower cost. And, on-the-spot invoice production in service vehicles can lead to shorter payment cycles and better cash flow.

c) Improved customer relations:
The success of a business can often be measured by its ability to satisfy customers. Mobile computers gives your field worker the ability to answer customer questions, check order

status and provide other services anytime their customers need them from wherever they happen to be.

Cost Effectiveness Paybacks for mobile computing investments can often be measured in months. For example, look at a typical service technician. With mobile computing it is very common to save an hour or more per day by simply eliminating the need to go to the office in the morning or return in the evening. Assuming that a technician bills out at $85 per hour you would be able to increase monthly revenues by approximately $1870 per month (22 days x $85 per hour).

- **Location flexibility**
This has enabled user to work from anywhere as long as there is a connection established. A user can work without being in a fixed position. Their mobility ensures that they are able to carry out numerous tasks at the same time perform their stated jobs.

- **Saves Time**
The time consumed or wasted by travelling from different locations or to the office and back, have been slashed. One can now access all the important documents and files over a secure channel or portal and work as if they were on their computer. It has enhanced telecommuting in many companies. This also reduces unnecessary expenses that might be incurred.

- **Enhanced Productivity**
Productive nature has been boosted by the fact that a worker can simply work efficiently and effectively from which ever location they see comfortable and suitable. Users are able to work with comfortable environments.

- **Ease of research**
Research has been made easier, since users will go to the field and search for facts and feed them back to the system. It has also made it easier for field officer and researchers to collect and feed data from wherever they without making unnecessary trip to and from the office to the field.

- **Entertainment**
Video and audio recordings can now be streamed on the go using mobile computing. It's easy to access a wide variety of movies, educational and informative material. With the improvement and availability of high speed data connections at considerable costs, one is able to get all the entertainment they want as they browser the internet for streamed data. One can be able to watch news, movies, and documentaries among other entertainment offers over the internet. This was not such before mobile computing dawned on the computing world.

- **Streamlining of Business Processes**
Business processes are now easily available through secured connections. Basing on the factor of security, adequate measures have been put in place to ensure authentication and authorization of the user accessing those services. Some business functions can be run over secure links and also the sharing of information between business partners. Also it's

worth noting that lengthy travelling has been reduced, since there is the use of voice and video conferencing. Meetings, seminars and other informative services can be conducted using the video and voice conferencing. This cuts down on travel time and expenditure.

6. Disadvantages

6.1 Quality of connectivity- as one of the disadvantages, mobile devices will need either Wi-Fi connectivity or mobile network connectivity such as GPRS, 3G and in some countries even 4G connectivity that is why this is a disadvantage because if you are not near any of these connections your access to the internet is very limited.

6.2 Security concerns- Mobile VPNs are unsafe to connect to, and also syncing devices might also lead to security concerns. Accessing a Wi-Fi network can also be risky because WPA and WEP security can be bypassed easily.

6.3 Power Consumption- due to the use of batteries in these devices, these do not tend to last long, if in a situation where there is no source of power for charging then that will certainly be a let down.

7. Conclusion

In this paper we investigated issues related with the b-to-c E-Commerce in an environment where a mobile customer initiates and concludes e-commerce transactions using his/her mobile hand-held terminal. This type of e-commerce is interesting from many points of view. The small displays and the scarce and expensive limited bandwidth may discourage the user to visit many sites and negotiate with different merchants; however, the use of mobile hand-held terminals opens a new business area in E-Commerce, the location based services, and new e-commerce scenarios seem to emerge. We consider mobile hand-held terminals as access technology to Internet. As such, some of their characteristics like their embedded payment facilities, the secure identification mechanism guaranteed by the operator (phone numbers) and protected by PIN, facilitate respective issues in E-commerce transactions. However, others characteristics, like their limited graphics capabilities, limited bandwidth, C-autonomy and their vulnerability result in a number of interesting implications from legislative, security, application and transactional point of view.

These are some of the issues need further investigation. And also defines applications, benefits, advantages as well as disadvantages for the work presented here depicts the results of our on going research in the area of mobile computing and electronic commerce.

8. Acknowledgement

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