Mobile Commerce: Vision and Challenges
(Location and its Management)

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Mobile computing is distributed computing that involves elements whose location changes in the course of computation. Elements may be software components - such as mobile agents or moving objects -, data, hardware - such as palmtops and wireless phones -, or users. This being a very broad definition, the common underlying issue *is location and its management*.

The term mobile computing is very often used for wireless mobile computing - the use of portable devices capable of wireless networking. Wireless mobile computing faces additional constraints induced by the characteristics of wireless communications and the demand for portability. Mobile wireless computing enables access to data at any time and from any place towards the vision of ubiquitous or pervasive computing.

This realization of pervasive computing and the imminent maturity of e-commerce are giving, in reality, birth to mobile commerce. This "delivery" comes with new challenges and new opportunities. The opportunities are quite obvious; it is the ability to compute, *to commerce* and access information from anywhere and at any time.

limited wireless bandwidth. These are the fundamental (or if you like basic) parameters influencing the development of needed middleware and application models. We can view these characteristics in a hierarchical fashion where the basic elements influence higher more complicated systems.

Each on of these parameters affects in some degree the development of middleware and serious applications. The position here is that *"mobility" and "location"* has a more significant effect on the development of middleware, business models and services for the mobile user than the other parameters. Not to withstand of course the significance of these other parameters.

The current location of user defines the context of its operations and data of possible interest. This kind of information finds their way in most aspects of m-commerce, from B2B and B2C models, supply chain management, transaction processing, computational models, community systems, infotainment, services.

Locations management however, is not an easy task. We need the location and identity of users, the location and identity of information and the ability to effectively
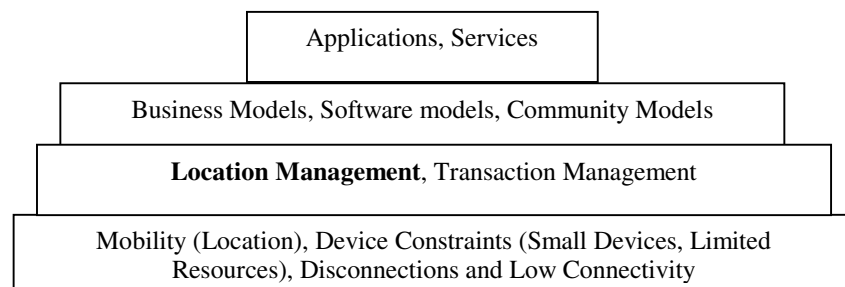

Figure 1: The Mobile Computing Stack

But what are the challenges? What are those new characteristics that on the one hand irrevocably handicapped the existing infrastructure in effectively supporting m-commerce and on the other hand open new avenues and opportunities for commerce? What is there that we must understand and achieve to literally materialize this vision?

It is understood and accepted that the new parameters in mobile computing [1,2,3] are (a) mobility of elements, (b) the screen size of the mobile/wireless units, (c) the limited resources of the mobile/wireless units and (d) the

associate them. This is very important and fundamental, indeed while we can find the location of the user as he moves what we currently lack is the ability, for example, to effectively associate his computations with the new location. In simple terms, the user moves around, his computations remains (and must remain) alive on the fixed network infrastructure, and the task is to associate the user with his computation and the local data. We need,

- To understand how the user is represented on the ireline infrastructure and in effect understand mobility and location of moving objects

- The collaboration of the telecom operators, who will give us the location of the user
- The identity and location of goods and data

Achieving this we can manage to introduce location characteristics into, (a) *Business models and supply chains*; In Business-to-Consumers (B2C) models location knowledge will allow suppliers to provide clients the best deal closest to his location. Similarly location knowledge will allow consumers to search for products only within close proximity. Likewise a supplier can design a responsive offering linked to the customer's location. Equally, in Business-to-Business (B2B) frameworks the location attributes enables various businesses to present their services and products in a location dependent fashion. The location attribute must find its way in the various structures of the B2B framework. (b) *Wireless services*; Location dependent services. Requests for the closest pharmacy, the closest fish restaurant, the closest hospital or hotel, etc, and directions to them are directly link to the users and data location and cannot be answered without that knowledge. In advance services that relate direction, time and location the location attribute is most important. Consider, for example, the request for the hotels that the user will find in 10 minutes going from his current location west. (c) *Community structures*; the location of friends, the location of family members, group meetings etc. are example of such communities that location is quite important. (d) *Transactional middleware*; will allow the move of distributed transactions to the safer and the closest site to the moving user.

Since the location of distributed components (or in our case clients) is not fixed, identifying their current location is necessary to contact, use, invoke, or commerce with them. Solutions to the problem of locating or tracking mobile objects vary depending on the application domain. In general, such solutions rely on a combination of storing some information about the location of the objects at selected sites and on performing some form of searching [4]. In m-commerce, however, we need two levels of location management. The first is the responsibility of the telecom operators and deals with the location of the moving client while the second level tracks the location of the client's surrogate, which roams the Internet to fulfill the tasks of its master. The moving characteristics of these two environments are quite different and thus different should be the location approaches. Indeed, this kind of m-commerce environment deals with users that are accessing the Internet via relatively slow moving mobile units of limited resources (e.g., palmtops, handheld devices, WAP-phones) and utilizing mobile surrogates (mobile agents or moving objects) that are moving "autonomously" and asynchronously around the Internet with small, medium and in many cases high moving frequency. Thus, for the second level we need a location middleware that is modular, simple, of low overhead, flexible and able to dynamically adjust to various location mechanisms.

The association of the m-commerce location attributes, namely the client's location, the good's and the surrogate's location is straight forward. The location of the client identifies the closest goods, the surrogate finds them and after it finds the client for the delivery of the needed info or confirmation.

Not to dismiss the importance and effect of the other parameters and to show that the notion of the surrogate applies and in other sectors of the same problem lets discuss their consequence. To deal with the characteristics of mobile computing (and of course for m-commerce), especially with wireless connectivity and small devices, various extensions of the client/server model have been proposed. Such extensions advocate the use of proxies or middleware components. Proxies of the mobile client residing at the fixed network, called server-*side* proxies, perform various optimizations to alleviate the effects of wireless connectivity such as message compression and re-ordering. Server-side proxies may also perform computations in lieu of their mobile client. Proxies at the mobile client undertake the part of the client protocol that relates to mobile computing thus providing transparent adaptation to mobility. They also support client caching and communication optimizations for the messages sent from the client to the fixed server. Finally, mobile agents [5] have been used with client/server models and their extensions. Such agents are initiated at the mobile client, launched at the fixed network to perform a specified task, and return to the mobile host with the results. Such function seems very appropriate for m-commerce and virtual enterprises.

References

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