An Infrastructural Perspective on U-Commerce

Stephen Keegan
University College Dublin, Ireland

Caroline Byrne
Institute of Technology Carlow, Ireland

Peter O'Hare
University College Dublin, Ireland

Gregory M. P. O'Hare
University College Dublin, Ireland

INTRODUCTION

In modern mobile-equipped businesses, the scales of economics sway between increasing economic returns and flawlessly decreasing expenditures while providing a worthwhile service for their customer base. Early mobile computing adopters realized that the scales of economic solvency weighed in favor of businesses that seamlessly delivered and managed customer expectations. This is only feasible if all frontline staff are endowed with relevant technological advances and educated appropriately in their usage. Timely, adequate responses to customer requests results in retaining satisfied customers and an expanding customer base. Efficient use of mobile advances can reduce mundane office tasks by preventing replication of work through data transfer between mobile devices and workstations. These streamlined tasks can often tilt the scales favorably for a struggling company.

Mobile computing encourages technological advances at the company's cutting edge while supporting its employees' daily duties by optimizing tasks. This is achieved via various handheld devices, each operating daily as unique satellite data stations, wirelessly updating the central company computer system. Another recent phenomenon is that of astute consumers comparing and contrasting products and prices prior to purchase via the internet. Mobile computing allows us the luxury of comparison from our closest physical retail outlet. As we physically view the product desired, our mobile enabled handheld device can navigate the Internet for comparable products at more competitive prices, thus allowing us the power to purchase under the canopy of an informed choice.

We define u-commerce as "the use of ubiquitous networks to support personalized and uninterrupted communications and transactions between an organization and its various stakeholders to provide a level of value over, above, and beyond traditional commerce" (Junglas & Watson 2003). U-commerce encompasses concepts that are ubiquitous, universal, unique, and unison. We take this opportunity to explore each of these in some depth.

Ubiquitous

Computers are already ubiquitous in our society. With continually decreasing hardware costs, relentless miniaturization, and the adoption of high-speed networks, this trend is likely to continue. Modern automobiles already contain dozens of microprocessors, while the unabated popularity of third-generation mobile phones means that mobile computing is now within reach of people in their daily lives.

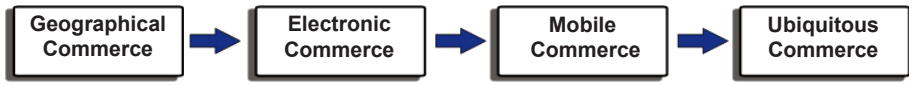
Universal

The utility factor of u-commerce-enabling accessories like laptops, mobile phones, and PDAs has been limited by the fact that they are often not universally usable. Perhaps the most well-known instance of this type of incompatibility lies within the domain of mobile phones. People traveling between Europe and the United States often find that their European (GSM) phones operating at the 900 MHz and/or 1800 MHz frequencies are incompatible with those in the United States (CDMA), which typically operate at a frequency of 1900 MHz.

Unique

Many current retail delivery systems fail to exploit the unique characteristics of each individual user. Within u-commerce we envisage a model whereby users interact with information and services based upon the context at that point in time. Here context can entail such factors as temporal informa-

Figure 1. The development of commerce



tion (e.g., What time of day is it?), user preferences (Does the user like ice-cream?), location data (e.g., How far is the user from our shop?), or user profile data (e.g., Is this user a female tourist?).

Unison

U-commerce relies on unison between all electronic data and equipment relevant in the user's life. Appropriate data such as profile information, product preferences, and financial data is securely shared in a distributed fashion and is readily retrievable at the appropriate time. Unison delivers the integration of various communication systems so there is a single interface or connection point.

BACKGROUND

Over the past decade the emergence of new electronic mobile and communications technologies has driven the way we conduct our business. Traditionally, commerce was geographic, with consumers seeking out and physically purchasing a product or service. The rapid deployment and ready accessibility of the Internet led to the dawn of *electronic commerce* (e-commerce). E-commerce enabled consumers to purchase products and service electronically via the Internet (http://www.ebay.com, http://www.amazon.com).

The development and widespread deployment of wireless technologies has ensured that mobile computing is spawning a dominant new culture (Rheingold, 2002). The mobile culture has gripped modern society with people regularly using their cellular phones, PDAs, MP3 players, and digital cameras. The development of new wireless hardware, software, and services is now occurring at an exponential rate. As a result m-commerce and u- commerce applications and services must be developed if they wish to evolve with the available technology.

M-commerce and u-commerce have significant differences from the geographical and electronic commerce which preceded them. Mobile devices impose a number of constraints upon business and service providers, including: smaller screen sizes, reduced interface interactivity, shorter battery life, and a restricted computational power. These restrictions have direct implications upon the mobile consumers, with users being less tolerant of irrelevant information and as a consequence having a shorter attention span. M-commerce and u-commerce business and service providers must address these restrictions and resolve them in creative and intelligent ways.

STATE OF THE ART

Shoppers today face a bewildering array of choices, whether they are shopping online or in the real world. To help shoppers cope with all of these choices, online merchants have deployed recommender systems that guide people toward products they are more likely to find interesting (Sarwar, Karypis, Konstan, & Reidl, 2001). Many of these online recommender systems operate by suggesting products that complement products you have purchased in the past. Others suggest products that complement those you have in your shopping cart at checkout time. If you have ever bought a book at Amazon.com or browsed musical listings at yahoo.com, you may have used a recommender system. Some of these systems, though ingenious, can prove to be of limited utility when applied to a mobile scenario. Dynamic pricing, mobile users, and limited hardware capabilities mean that new approaches are imperative.

Movielens Unplugged (Miller, Albert, Lam, Konstan, & Riedl, 2003) attempted to transpose the usability of the Movielens project to a selection of mobile devices. Particular emphasis was placed on developing a user interface that was capable of supporting multiple front ends and multiple devices. A set of generalized design principles was derived during a user trial. MobyRek (Ricci, Nguyen, & Cavada, 2004) is an on-tour recommendation system that becomes operational when a mobile traveler requests MobyRek to find some interesting travel products and ends when the traveler either selects a product or quits the session. It evolves in cycles, and in each cycle a set of recommended products is shown to the user. The recommendation process that it employs consists of four logical components: initialization, interaction, adaptation, and retainment.

Mobitip (Rudström, Svensson, Cöster, & Höök, 2004) is a mobile recommender system that allows people to create, rate, and share information using short-range Bluetooth communication, while occasionally synchronizing with a central server. It is argued that a real-time distribution schema of user profile data in impractical. The proposed solution involves storing a user's profile on the mobile device together, with a ranked list of predictions from a central server computed the