Wireless Technologies to Enable Electronic Business

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Richi Nayak
Queensland University of Technology, Australia

INTRODUCTION

Research and practices in electronic business (e-business) have witnessed an exponential growth in the last few years (Liautand & Hammond, 2001). Wireless technology has also evolved from simple analog products designed for business use to emerging radioactive, signal-based wireless communications (Shafi, 2001). The tremendous potential of mobile computing and e-business has created a new concept of mobile e-business or e-business over wireless devices (m-business).

BACKGROUND

M-business can be defined as the use of mobile technology in exchange of goods, services, information, and knowledge. M-commerce is the execution of transactions done on mobile equipment via mobile networks, which may be wireless or switched public networks. M-business includes the range of online business activities, business-to-business and business-to-consumer, for products and services through wireless devices such as mobile phones with display screens, personal digital assistance (PDA), two-way pagers, and low-end or reduced-size laptops.

Example applications are mobile ticketing and receipting, banking, gaming, e-mail communication, weather forecast, sport scores access, movie database access, stock exchange information, ordering of books, and other daily needs such as food and groceries. With new emerging mobile applications, users only receive selective and real-time information personalized to their interests (Ratsimor, Korolev, Joshi & Finin, 2001). For example by using a positioning system, the advertising information of local services and entertainment can be sent whenever a user is passing by a shopping mall. Another application is "inventory management" that tracks the location of goods, services, and people to determine delivery times. Multiple trucks carry large amounts of inventory that companies could access for just-in-time delivery (Varshney & Vetter, 2002).

Significant benefits of m-business to consumers are convenience, portability, safety, integrating existing mobile phones with mobile computing technology, verifiable receipts, and transaction records that can be made available instantly and permanently on a smartcard. Significant advantages of m-business to service providers and content providers include driving additional revenue and decreasing consumer attrition by offering new m-business services to specific groups of customers.

WIRELESS TECHNOLOGIES TO ENABLE M-BUSINESS

Many wireless technologies exist to enables m-business services (Tsalgatidou, Veijalainen, Markkula, Katasonov & Hadjiefthymiades, 2003). All technologies try to achieve benefits such as being powerful, simple, economical, and secure. Some examples of these techniques follow.

Wireless Application Protocol technology links wireless devices to the Internet by optimizing Internet information so it can be displayed on the small screen of a portable device.[1] Web pages accessed by WAP-enabled mobile portals during m-business transactions must be written in WML.[2] It is not sure how well WAP will be able to proliferate (Tsalgatidou et al., 2000). Developments such as third-generation (3G) mobile communications and XYPOINT WebWirelessNow applications (Wen, 2001) already allow mobile phone consumers to experience the Web services without WAP.

Wireless Internet connecting technologies that offer textual interface such as WAP significantly suffer from the constraints of wireless communication such as having a small display screen. An alternative solution is providing voice access to users. Advances in speech recognition and text-to-speech technologies have made voice-based communication possible between computers and users over the phone.

VoxML[3] technology, based on the W3C XML standard, enables the application interface to be in the form of dialogues. However, there is an extra overhead for content providers to offer the same Web service through different channels, for example, providing a voice-enabled browser for their wireless customers along with the HTML/XML/WML browser. Another overhead is the processing power that speech recognition requires. Also this type of data transfer mode is not appropriate for applications with confidential data where one could be overheard. Overall, the success of this technology depends on public acceptance of mobile

phones as data-delivering tools and the type of applications best suited to their use.

The *Bluetooth* technology further enhances the sphere of mobility by conducting m-business without a heavy network infrastructure unlike WAP and VoxML technologies.[4] The Bluetooth technology is designed to allow low-cost, short-range data (asynchronous) and voice (synchronous) radio link (2.4 GHz, 1 Mb/sec) to facilitate protected connections for stationary (homes, buildings, shopping centers, restaurants, cars, etc.) and mobile (phones, PDAs) computing environments. A simple example of a Bluetooth application is to automatically update mobile phone contents such as phone list, e-mails, and memos without any user involvement when the phone comes within the range of the home/office PC. Currently, the Bluetooth networks providing m-business services are limited to 10 meters only. Also, it has too many flaws in terms of security for the services to be trusted. A promising future of Bluetooth technology is its integration with WAP or VoxML.

Based on infrared technology, the *IrDA (Infrared Data Association)* easy-to-use technology provides low-cost, short-range, point-to-point connectivity between devices, interoperable/cross-platform at a wide range of speeds (115.2kb/s to 4Mb/s) with a physical range of 1 meter. IrDA technology is embedded into 40 million new devices each year such as personal computers, laptops, mobile phones, PDAs, digital cameras, pagers, and so forth.[5] The keyword of IrDA advantages is simplicity for ad-hoc, point-to-point exchange. However, the requirement of direct line of sight for devices to communicate is surely a disadvantage for conducting m-business.

IEEE802.11 (Wi-Fi) technology provides a high data rate over different ranges (54Mbps using the 2.4 and 5 GHz ISM band, 11Mbps using the 2.4 GHz ISM band).[6] The single Media Access Control protocol helps to keep the cost down, but interoperability is a problem. The data transmission rate has to be defined before the transmission between devices can start. In terms of the transmission itself, it is based on the well-known TCP/IP protocol. The availability of unlicensed spectrum is a significant enabler for broad acceptance of this technology. However, the technology has some security flaws. Because of the large physical range (100+ meters) and "always-on" connection model, this technology consumes a lot of power, limiting its use in PDAs, phones, and other lightweight mobile devices. The greatest advantage of this technology for conducting m-commerce is its speed.

HiperLAN, a specification substandard of IEEE802.11, is a short-range technology (from 10 to 100 meters) adapted to 3G networks with low power requirements.[7] HiperLAN provides flexible services such as mobility management and quality of service at low cost. The technology has a potential for conducting m-commerce in terms of supporting both ad hoc and client/server networks.

Ultra Wideband technology is a recent RF technology with advantages like large bandwidth, high data transfer rates, and immunity to interference.[8] Still, the technology is in its early stage of development, and there are not many products using this technology yet. However, in the future this network technology may be a very good alternative for conducting m-commerce.

Mobile Agent technology offers a new computing paradigm in which a program, in the form of software agents, is initiated at the host, can suspend its execution on a host computer, launch itself to another agent-enabled host on the network, resume execution on the new host, and return back to its host with the result (Hayzelden & Bigham, 1999). This type of paradigm advocates the client/server model where the client is a mobile portal and the server is a fixed network. The mobile agent performs various optimizations on the server in lieu of its mobile portal to reduce the problems such as C-autonomy, limited bandwidth, and limited computational power. The fixed network offers its services to the agent such as access to local resources and applications, the local exchange of information between agents via message passing, basic security services, creation of new agents, and so froth. Many research papers emphasize that one of the most promising approaches for developing e-business applications is mobile agent technology (Dikaiakos & Samaras, 2001; Tsalgatidou et al., 2000).

Figure 1. A typical platform enabling m-business services
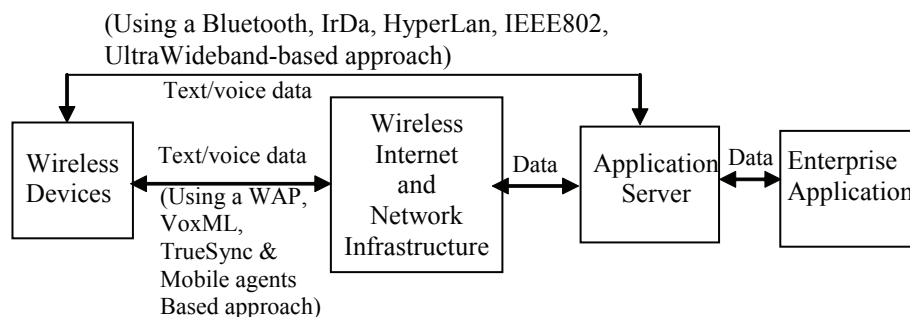
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