

Pervasive and Mobile Commerce

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COURSE ABSTRACT:

Due to the continuous performance improvement and cost reduction on the technology and networking infrastructure, there has been an explosive growth in the interests on developing Internet enabled pervasive devices which include PDAs (such as palm, Windows CE, psion), WAP phones, e-books, and various Internet appliances. These devices have just begun to trickle into our daily lives. According to an IDT study, it has been predicted that there will be around 80 million PDA devices and 900 millions WAP phones in just another two to three years in the world. Consequently, it is very likely that these devices will become one of the dominant Internet access mechanisms and supplement PC for Internet access in just a few years.

As opposed to the PCs, these pervasive devices have a wide variety of screen size, computing power, and network capabilities. These devices, such as palm, and Windows CE devices in general are much more mobile than a notebook. Instead of the traditional Internet access model where direct connection has to be established, the connectivity of many of these devices to Internet is occasional at best. As a result, these devices have to be able to do serious offline access of Internet. Many of these devices will have location awareness using GPS, wireless cell location, or a combination of both. These devices will include many WAP phones and those wireless-enabled palms and pocket PCs. Many of these devices may be attached to a home appliance such as the refrigerator, microwave oven, or even a toilet.

Since 1995, we have already begun to witness the emergence of Business-to-consumer (B2C) type of e-commerce such as Amazon. The pace of developing business-to-business e-commerce (B2B) applications, especially the establishment of electronic marketplace began to accelerate since 1998. It has become apparent that pervasive devices will definitely play an important role in the e-commerce applications. It is also expected that Business-to-Employee (B2E) , Peer-to-Peer (P2P, such as Napster), and Government-to-Citizen (G2C) will pick up steam in the near future. We have also begun to see that many traditional internet-only stores such as Gateway and E*Trade to have physical stores, while many brick-and-mortar stores have great success on their web-presence. These multi-channel business model is certainly going to become the norm as opposed to the exception.

The convergence of pervasive computing and electronic commerce certainly opens up many new challenges and opportunities for the research community in data management. In particular, we need to address the challenges arising from the evolution from a two-tier client-server model to a multi-tier computational model, an environment that the application server might roam at the edge of the network in order to provide better service for the pervasive devices, the need to anticipate location- and context-dependent queries, and the capability of delivering device- and bandwidth-neutral data and media content. Ultimately, the challenge is the capability of blending the real world and the virtual world in a seamless fashion so that the event in real world can be seamlessly translated into queries in the virtual world.

The purpose of this tutorial is to investigate the opportunities and challenges ahead for location-aware pervasive commerce. In particular, we will overview the current and immediate technology trends in the wireless area (WAP, 3G, etc.), the location service (GPS, TDOA, etc.) and bluetooth. We will also overview the current and future e-commerce frameworks and business models, including B2C, B2B, P2P, G2C, and B2E. Important infrastructure generalization that is needed to enable pervasive commerce is then investigated. A number of case studies of pervasive commerce scenarios are used to provide as a backdrop for this fast evolving direction.

OUTLINE:

- 1. Introduction & Motivation of Pervasive Commerce
- 2. Emerging pervasive technologies
 - Platforms
 - a. Palm
 - b. WinCE, Pocket PC
 - c. Symbian
 - Comparison of devices
 - a. power consumption
 - b. computational complexity
 - Communication
 - a. WAP/i-mode
 - b. 2.5G, 3G and beyond
 - c. bluetooth
 - Location-based technologies
 - a. LMP (Location Pattern Matching)
 - b. GPS (Global Position System)
 - c. TDOA (Time Difference of Arrival)
 - d. AOA (Angle of Arrival)
 - Transcoding: delivering data and multimedia content to variety of pervasive devices
 - a. HTML to WML
 - b. Multimedia transcoding: modality translation & summarization (Image, text, Video, speech)
 - c. Universal Media Access standard activities (MPEG-7)
 - d. Transcoding systems: IBM Websphere Transcoding Publisher, Oracle Portal-to-Go, Microsoft Mobile Information Server
 - Security:
 - a. digital signature/authentication - an overview
 - b. security measure for WAP 1.0 & 1.1 - Wireless Public-Key Infrastructure (WPKI)
 - c. security measure for WAP 1.2 & beyond - wireless identity module (WIM)
- 3. Emerging E-commerce frameworks
 - big picture: B2C, B2B, G2C, B2E, P2P
 - components: catalog, payment, order status
 - dynamic pricing: auction, reverse auction, exchange
 - multi-channel e-commerce
 - personalization, advertisement, and promotion
- 4. Infrastructure for supporting Pervasive Commerce
 - data model in the catalog
 - support for disconnected service
 - reconfigurable business process
- 5. Case studies: Using pervasive & location technologies to enable pervasive commerce
 - pervasive enablement of business processes in B2C & B2B
 - wireless wallet
 - new paradigm for advertisement and promotion
- 6. Summary and Looking forward

Biography of Chung-Sheng Li

Chung-Sheng Li received his B.S.E.E. degree from National Taiwan University, Taiwan, R.O.C. in 1984, and the M.S. and Ph.D. degree in electrical engineering and computer science from the University of California, Berkeley in 1989 and 1991, respectively. He has joined the computer science division of IBM T. J. Watson Research Center as a research staff member since Sept., 1991, manages the Image Information System Department from 1996 to 1999, and assumes the senior manager position for the E-commerce and Data Management Department since June 2000.

His research interests include (1) Broadband applications, which include digital library, knowledge discovery and data mining; (2) Broadband network and switching, which includes all-optical networks, storage area networks, and fiber channel; (3) Broadband technologies, which include optical chip interconnects, optoelectronics, and high-speed analog/digital VLSI circuit design. He has co-initiated several research activities in IBM on fast tunable receiver for all-optical networks and content-based retrieval in the compressed domain for large image/video databases. He is currently the principle investigator of a satellite image database project funded by NASA.

Dr. Li has received an Outstanding Innovation Award from IBM in 2000 for his leadership and major contribution to the IBM/NASA digital library project, and a Research Division award from IBM in 1995 for his major contribution to the tunable receiver design for WDMA, and numerous invention and patent application awards. He is currently an associate editor for the IEEE Transaction on Multimedia and Journal of Computer Vision and Image Understanding, the technical editor for the IEEE Communication Magazine. He has authored or coauthored more than 120 journal and conference papers and received one of the best paper awards from the IEEE International Conference on Computer Design in 1992. He is a senior member of the IEEE Circuit and System Society, the Laser Electro-Optic Society, the Communication Society, and the Computer Society.