Mobile Telecommunications and M–Commerce Applications

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INTRODUCTION

This article presents an overview of prevailing trends and developments shaping mobile commerce (m-commerce) and the wireless economy. A review of wireless telecommunications infrastructure attempts to demystify the evolving technology landscape. Mobile Internet deployment and adoption demographics are highlighted, as are innovative wireless applications and current m-commerce issues.

BACKGROUND

The World Wide Web (WWW) and Web browser software brought mass market accessibility to the Internet. Riding on this ubiquity and reach is electronic commerce (e-commerce) in its many forms: inter-business dealing, intra-organization transactions and business-to-consumer trade, and so forth. E-commerce has witnessed impressive growth and continues to be a significant propellant of Internet progress. Participants have, however, hitherto been essentially tethered to fixed line connections. The development of novel wireless services and mobile adaptations of familiar applications (Ghini, 2000) is fueled by demand from increasingly nomadic users looking to access familiar online facilities, and the steady convergence of telecommunications and computing technologies (Messerschmitt, 1996).

Wireless telecommunications was conceived in the 1980s to carry voice, but has evolved to become data bearer, including Internet communications. The cellular telephone is now commonplace and more personal digital assistants (PDAs), hand-held computers and the like are sporting cellular radio connectivity. These devices form a sizable platform for deploying m-commerce applications. M-commerce refers to the ability to browse, interact with and make payment for goods and services directly from mobile terminals such as cell phones, PDAs and portable computers (Tan, 2002). Industry forecast statistics point to exponential growth in the sector:

- Worldwide shipment of Web-enabled wireless devices rose 796% in 2000 over 1999 and consumer transactions committed from such terminals will total US $1.8 trillion worldwide by 2005 (Source: Gartner Group).
- International wireless data market was expected to grow from 170 million to more than 1.3 billion subscribers between 2000–2004, equipping themselves with 1.5 billion wireless-capable handsets and other Internet appliances by end of 2004 (Source: Cahners In-Stat Group).
- Wireless Internet users in the Asia-Pacific region alone will rise 10-fold from 20 to 216.3 million between 2000–2007 (Source: Strategis Group).

As Internet and mobile communications converge, e-commerce evolves into m-commerce. The tremendous potential of "anytime" convenience and "anywhere" mobility in carrying out everyday online transactions will spur many unique mobile services yet.

TECHNOLOGY ROAD MAP

Early wireless telecommunications architecture in the late 1940s was modeled after television broadcasting. Tall, centralized transmitter towers provided radio coverage. Limitations like restricted user mobility and capacity, poor voice quality and high cost saw the introduction of new cellular technology in late 1970s—a superior architecture persisting to this day.

A cellular mobile communications system comprises a vast collective of low-power antenna subsystems, dispersed in small overlapping geographical units called cells. Individual cellular base stations provide local coverage and interconnect for a combined footprint that constitutes the wireless network. Modern implementations are typified by larger, sparse cells in rural areas and small, dense ones in metropolitan districts. The technology road map is demarcated by milestones corresponding to transmission bandwidth.

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First Generation—1G: Analogue radio transmission characterized 1G cellular systems. The one-time de facto standard throughout the Americas and the Asia-Pacific was the Advanced Mobile Phone Service (AMPS) introduced in the United States in 1983. Despite technical imperfections such as limited growth capacity, poor data transport and deficient transmission security, 1G systems maintained their popularity till the early 1990s. Improved derivatives of AMPS are still deployed in the remaining analogue cellular networks around the world today.

Second Generation—2G: Digital radio transmission heralded the 2G era. Information is digitized into a stream of computer binary coded data packets for transmission and reassembly at the receiving end. Two competing digitization schemes are Time Division Multiple Access (TDMA) and Code Division Multiple Access (CDMA). Better bandwidth utilization boosts network capacity, enhances coverage and improves voice quality. New service features such as data encryption, short text messaging, fax and data transmission can also be offered.

Launched commercially in 1991, the European developed, TDMA-based Global System for Mobile Communications (GSM) is the de facto international 2G standard today, with 863.6 million subscribers in 174 countries at end of May 2003 (Source: GSM Association, *http://www.gsmworld.com*). An American adaptation of GSM called PCS 1900 was launched in late 1995. CDMA-based networks began commercial operation in 1995 and are now the predominant standard in the Americas, Korea and Japan, with 164.1 million subscribers in 60 countries as at June 2003 (Source: CDMA Development Group, *http://www.cdg.org*).

Conventional fixed line Internet connectivity offers varying data rates:

- Up to 56 kbps (kilobits per second): Analog modem
- 64–128 kbps: Integrated Services Digital Network (ISDN)
- 256 kbps–1.5 Mbps (megabits per second): Optical fiber and Digital Subscriber Line (DSL)

In comparison, 2G data service provides 9.6–57.6 kbps throughput, with most network operators supporting only speeds no more than 14.4 kbps. This makes for poor overall user experience for consumers increasingly accustomed to higher-speed, broadband Internet access through fixed connections. Real-time multimedia applications such as live video are also impracticable on 2G architecture. Solutions better optimized for wireless data transmission are clearly needed to meet growing demand for quality mobile Internet access.

Second-and-a-Half Generation—2.5G: 2.5G systems extend 2G infrastructures for upgraded data throughput.

New handsets, however, are required to tap the improvements and other added functionalities. The enhancement to GSM is called the General Packet Radio Service (GPRS). Capable of a theoretical maximum 171.2 kbps transmission, the average is 40–80 kbps deployed in practice. Like the Internet, GPRS networks are also based on the Internet Protocol (IP) standard, so GPRS terminals function just like other wired Internet sub-nodes with seamless access to familiar applications such as the WWW, e-mail, Telnet and FTP (File Transfer Protocol), and so forth. The first commercial GPRS service was inaugurated in the United Kingdom in June 2000. 2.5G CDMA technology is known as the IS-95B standard and offers ISDN-like data rates. Its first commercial debut in Japan in early January 2000 beat GPRS to market by some 6 months, and the 64 kbps throughput was superior to prevailing 2G GSM offerings.

While data speed boost is useful in time-sensitive applications like online transactions and credit authorization, there remain technical idiosyncrasies and transmission latencies detrimental to time-critical multimedia functions such as video decoding and playback. Hence, 2.5G is still not the ideal platform for deploying high quality, real-time video conferencing.

"2.75G": When wireless data rates approach those of conventional fixed line broadband connectivity, user experience will improve significantly and truly mobile Internet access would be a reality. Some have termed this stage of the road map loosely as "2.75G".

The Enhanced Data rates for Global Evolution (EDGE) standard is engineered as an extension to GSM technology and leverages past investments in TDMA and GPRS. Throughput of 384–553.6 kbps is theoretically possible and early EDGE-compatible handsets support rates in excess of 100 kbps. The world's first commercial EDGE service was deployed in the United States in July 2003. The equivalent evolution in CDMA technology is the CDMA2000 standards, providing network speeds from 144–614 kbps. From the first commercial service in Korea in October 2000, CDMA2000 subscribers have grown to number 54.1 million by June 2003 (Source: CDMA Development Group).

Third Generation—3G: Wireless broadband connectivity and industry standards harmonization characterize 3G systems. New handsets are again necessary to exploit multimedia capabilities and applications enabled by high-performance wireless networking at unprecedented 384 kbps–2 Mbps speeds.

More importantly, the vision is for 3G devices to roam seamlessly on enabled networks within a country and across continents, creating truly borderless mobile services. To this end, the International Mobile Telecommunications 2000 (IMT-2000) recommendations were promulgated in late 1999 with international participation. IMT-2000 prescribes how mobile service providers should

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