Chapter 34
Mobile Location Based Services: Implications on Privacy

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ABSTRACT

Mobile Location Based Services (MLBS) have been in operation since the 1970s. Conceived initially for military use, the Global Positioning System technology was later released to the world for other applications. As usage of the technology increased, mobile network points, developed by mobile service operators, supplemented its usage in various applications of MLBS. This chapter charts the trajectory of MLBS applications in the mass market, afforded by the evolution of technology, digital, and mobility cultures. Assimilating various MLBS classifications, it then situates examples into four quadrants according to the measures of user-position or device-position focus, and alert-aware or active-aware applications. The privacy implications of MLBS are captured on the economic, social, and political fronts, and its future is discussed.

DEFINITION AND HISTORY OF MOBILE LOCATION BASED SERVICES

Location and positioning technology has been in operation since the 1970s. Conceived for the United States' (US) military, the Global Positioning System (GPS), a satellite-based technology, was used to locate people, places and objects via Cartesian coordinates (Brimicombe & Li, 2009; Chen, 2012; Crato, 2010; Giaglis, Kourouthanassis, & Tsamakos, 2003; Spiekermann, 2004). Eventually, in the 1980s, this technology was made available to the world by the US government. This meant that commercial and government entities were free to incorporate GPS technology into their existing infrastructures. Many proclaimed this development as the birth of Mobile Location Based Services (MLBS). However, MLBS was then at a nascent stage, as the GPS technology was typically found only in mobile devices with dedicated functions, and was not widely incorporated into mobile devices, such as mobile phones, together with other integrated technologies. Moreover, the GPS technology, which required mobile devices to be connected to at least three satellite stations in order to provide positional data, was rendered ineffective in built-up places or indoors due to poor connections with GPS satellites; signals are weakened

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upon passing through various media (e.g. atmosphere, walls, trees), or messed up when bouncing off buildings. In general, the technology was lacking in location accuracy and costly (Junglas & Watson, 2008). While this limitation did not greatly affect its usage in the maritime industry for tracking ships and cargo, due to their movements in open spaces, it has significant negative impact on the accuracy, timeliness of information and computing cost for mass consumer adoption (Rao & Minakakis, 2003). As such, its usage then was predominantly in the navigational systems of vehicles, such as cars, ships and planes, and for freight tracking.

In the mid 1990s, mobile operators, through their mobile network cell stations, enabled more reliable uses of MLBS. Emergency 911 services in the US first deployed this technology afforded by mobile operators to plug a life-threatening gap (Gow, 2005). There were many cases in which distressed callers were not able to verbally inform 911 service staff of their locations. As such, the US Federal Communications Commission established Wireless E9-1-1, a service concept requiring mobile phone operators to have systems in place to acquire location data of 911 callers, and route the information to the nearest emergency call station (Spiekermann, 2004). This demands that the "location accuracy must be within 50 to 100 meters for 67% of all calls and within 150 to 300 meters for 95% of all calls" (Junglas & Watson, 2008, p. 66).

Because the mobile phone industry was mandated to have accurate positioning technologies, it prompted them to venture into incorporating MLBS into their services for the masses. As a result, MLBS, defined as "services that integrates a mobile device's location or position with other information so as to provide added value to a user" (Spiekermann, 2004, p. 10), saw tremendous growth and adoption. This is broadly due to technological advancements that improved the accuracy, timeliness and reliability of the location information, and certain key factors, such as the formation of digital and mobility cultures, that promoted its mass adoption.

TECHNOLOGICAL ADVANCEMENTS

Technological advances in three distinct areas, namely Satellite-Based Technologies, Network-Based Technologies and Sensor-Based Technologies, have unlocked vast opportunities for MLBS. These developments afforded improved accuracy, reliability and timeliness of positioning information. Moreover, the integration of these technologies further enriched the location information. The following sections chart these developments.

Satellite-Based Technologies

Global Navigation Satellite Systems (GNSS) is a collective term referring to the many stand-alone satellite systems hovering above the earth. GPS is owned by the US and it is "the only one fully in operation and still in upgrading" (Chen, 2012, p. 203), with 31 satellites providing global coverage. The GPS system ensures that, at any one time, there are 5 to 8 satellites visible from any point on the earth for triangulation purposes (Brimicombe & Li, 2009). The Russians own GLObalnaja NAvigatsion-naja Sputnikovaja Sistema (GLONASS), which began development in 1976, but was only fully functional with total global coverage by its 24 satellites in 2011. The European Union's Galileo will be completed in 2018 and will boast over 30 satellites. The Chinese BeiDou Satellite Navigation System (BDS), currently meant for regional positioning purposes, will be expanded to a global COMPASS (or BeiDou-2)

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