Mobile and Wireless Technologies:
Emerging Opportunities for Digital Government

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ABSTRACT

This paper overviews the rapid rise of mobile technologies, particular wireless communications devices. It outlines four emerging application areas where wireless technologies hold great potential for digital government efforts. It concludes by highlight the lack of research on wireless technologies in the social science, and the need to rapidly expand efforts in this area.

Keywords

Wireless communications, mobile technologies, digital government, cities.

1. THE RISE OF MOBILE TECHNOLOGIES

During the 1990s the American public was obsessed with the Internet, as experienced through the desktop PC and dialup modem. However, advances in mobile communications and computing technologies ("mobile technologies") actually outpaced the Internet and personal computer in terms of growth and diffusion. Until recently there was little notice of this trend in the media, and it remains largely unexplored by researchers.

Recent data highlight the spread of mobile technologies as a far larger and more important socioeconomic phenomenon than the spread of the Internet. According to industry analysts, by 1999 more mobile phones were being shipped annually than automobiles and personal computers combined. Fully 725 million of the world's 1.7 billion telephones are now mobile. [1,2] Sales of the PalmPilot, the leading personal digital assistant (PDA) surpassed 13 million units in 2001. These sales volumes will help mobile devices overtake desktop computers as the most popular devices for Internet access by 2003. [3,4]

In the United States there are more than 130 million mobile telephone subscribers, rivaling the estimated 100 million Internet users. [5,6] In developing countries, the use of cell phones is exploding while Internet use remains relatively limited by illiteracy and its high cost. Unlike the PC-based Internet, voice-driven information portals can serve the billions who cannot read or type.[1] In fact, mobiles phones are now appearing widely in the squatter communities that surround many third world cities; places where conventional wired phones have never existed.

The United States lags behind other nations in the civilian application of mobile technologies, despite the major role of American military contractors in developing many of the underlying technologies. Both cultural and regulatory differences are the most commonly cited reasons for this disparity. [7] Mobile phone use in Europe and Asia surged in the late 1990s as a combination of standardization around the Global System for Mobile Communications (GSM) technology and telecommunications deregulation helped consolidate consumer markets. Finland and Japan are the world's leaders in mass use of mobile telephony, with Sweden, Norway, Hong Kong and South Korea close behind. Mobile phone subscribership in the United States is around 40 percent, less than half that of the most "unwired" nations.

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[1] Services such as TellMe™ combine voice synthesis for the delivery of information on weather, traffic, and stocks via mobile telephone in response to spoken commands.

2. EMERGING OPPORTUNITES FOR DIGITAL GOVERNMENT

Mobile wireless technologies are creating new opportunities for efficiency and creativity in digital government in four main areas; *service delivery and urban management, economic development, urban design,* and *bridging the digital divide.*

2.1 Improving service delivery and urban management

The ability to deliver and/or receive information from citizens and public employees on the go presents numerous opportunities for digital government to improve service delivery and management of urban areas.

First, the ability to quickly and cheaply deliver information to mobile wireless users provides the possibility of micro-managing users of urban services in real-time. For instance, in Europe several cities have deployed a system which pages drivers with information about available spaces in various parking lots as they enter the central city. [8] This system can potentially greatly reduce traffic congestion caused by drivers manually searching for parking spaces.

Second, mobile users can become data providers to public service managers by acting as real-time probes or sensors about urban conditions. For example, if but a fraction of drivers (perhaps government vehicles) on the road were to allow urban managers to monitor location and speed, accurate real-time models of an entire region's road network and traffic flows could become a reality. Other applications that let concerned citizens report data on service outages or breakdowns could rapidly improve response times to resolve or repair such failures. Several commercial mobile information service providers such as LonelyPlanet and Vindigo rely heavily upon mobile user input to keep databases and content up-to-date.

2.2 Economic development

Connectivity has been a key precursor to economic development throughout history. Coastal cities prospered when the oceans were the dominant route for trade. Towns that were bypassed by the railroads or Interstate Highway System in the United States typically withered, cut off from the rest of the economy.

The present era is no different, but the critical connections (in addition to all those mentioned above) now are air transportation and digital telecommunications networks like the Internet backbone. [9,10]

Wireless technologies present a number of opportunities for improving connectivity.

- As a *primary connection* to global communications grids in isolated or underdeveloped regions. This is typically achieved using 2-way dedicated satellite service.

- As a *backup connection* in places that are connected to global networks but require additional redundancy in the case of an outage.

- As a way of *extending the utility of wired connections* away from desktops and buildings. Wireless data services such as CDPD, GPRS, and wireless LANs can create bubbles of bandwidth that carry the benefits of connectivity past a single location at the end of a wire. (Section 3 describes this in greater detail)

- As an *alternative local communications infrastructure*. The failure of many local communications grids in lower Manhattan on September 11, 2001 highlights the vulnerability of highly centralized wired telecommunications infrastructure. Wireless mesh networks can be easily and inexpensively deployed to be used as an alternative communications infrastructure during urban emergencies.

2.3 Better urban design: creating mediated spaces

Mobile wireless technologies provide the opportunity to augment traditional urban spaces with information spaces that can be accessed through mobile terminals or handsets. Primitive examples of such 'mediated places' exist in museums and exposition halls such as the Experience Music Project in Seattle, funded by Microsoft co-founded Paul Allen.

Traditionally, information about places has been archived, stored, and accessed far from the places it actually is about. Libraries, online databases, and the World Wide Web have all help disembody information from the place in which it is created. This has been a valuable service; yet it does somewhat rob places of their individuality.

As Ronald Abler, president of the Association of American Geographers has suggested, mobile wireless technologies offer us the opportunity to gather archived information about a specific place and make it accessible *in that place.* Doing so in many places will reinforce the identity of those places and people's desire to travel to them to learn about those places. Think of the tourist information signage common in many historical districts today amplified a million times.

Currently, most debate about these types of services and early development is taking place in the private sector. Given the traditional local control over street signage, the creation of mediated spaces needs to be conducted in a more open fashion with the aid of professional urban, architectural and information designers.

2.4 Bridging the Digital Divide

Perhaps the most exciting possibility presented by new wireless technologies is their ability to help overcome geographical constraints on access to broadband services.

Broadband carriers have been slow to deploy broadband services outside prime markets. The ensuing process of 'cherry picking' has only been amplified with the recent reduction in competition caused the recent failures of most competitive DSL vendors. The residential broadband market in the United States is now effectively a de facto duopoly in any given locality, consisting of the local incumbent carrier (the "baby Bell" companies) and the cable television franchisees.

As Figure 2 shows, the resulting pattern of broadband availability is highly selective. Rich neighborhoods like Manhattan's Upper East Side enjoy widespread DSL availability, while like the local infrastructure in poor and minority-dominated neighborhoods such as Lower East Side and Harlem has not been upgraded to support widespread deployment of broadband.
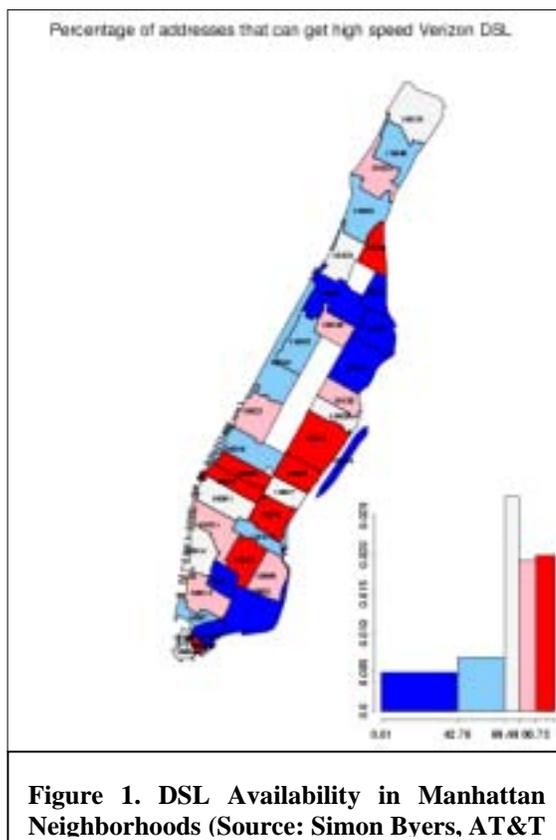

Figure 1. DSL Availability in Manhattan Neighborhoods (Source: Simon Byers, AT&T

3. THE FREE WIRELESS MOVMENT

Despite the slow speed with which the public sector (Section 2) and the research community (Section 4) has begun exploring the many possibilities of mobile and wireless communications for digital governance, activists around the world have seized upon new technologies for broadband wireless Local Area Networking to dramatically transform the nature of urban public spaces and last mile broadband services.[2]

Using an IEEE protocol for low-power wireless Ethernet on the unlicensed ISM (industrial, scientific, and medical) 2.4 Ghz spectrum, these activists have deployed off-the-shelf technology in busy urban locations, such as parks, transit stations, and university campuses and provided free wireless connections back into the high-speed Internet. As a result, these urban spaces are being radically transformed from disconnected "informational blackholes"[11] into broadband oases where boundaries between home, work, and the street are increasingly blurred.

This suggests that wireless connectivity can be thought of as an amenity, just like open space, light or air, which dramatically changes thinking about the deployment model. Until now, wireless connectivity has been thought of in the subscrivber-pays telco model. However, real estate owners are increasingly aware of the value wireless connectivity adds to their property.

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[2] In the interest of full disclosure, readers should be aware that the author is the co-founder of one such grassroots free wireless group, NYCwireless.
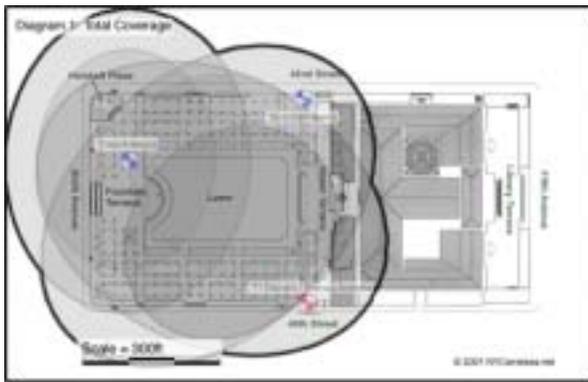
Figure 2. The NYCwireless network in Manhattan's Bryant Park, adjacent to the New

For example, NYCwireless (based in New York City), has partnered with the non-profit Bryant Park Restoration Corporation to build an always on, free public wireless LAN for Bryant Park – a park sometimes called "midtown Manhattan's living room". (Figure 2) As workers from nearby office buildings already tend to lunch and hold meetings in the park, staying in touch with their colleagues via mobile telephones, we strongly suspect the wireless LAN (which will permit VPN usage) will increase the amount and complexity of this activity, further erasing the line between workplace and public spaces.

4. THE LACK OF RESEARCH ON MOBILE TECHNOLOGIES

Unfortunately, the opportunities for using mobile technologies more widely in digital government are hindered by a lack of research on their social and economic implications.

4.1 Obstacles to Social Science Research on Mobile Technologies

Social science research on mobile communications and computing has suffered in the United States due to the comparatively slow rate of adoption. Yet even in Western Europe, where a mobile culture has developed rapidly, there have been few systematic studies on this topic. As Schemman [12] notes, "even though it seems obvious there must be social consequences… the telephone as well as the mobile telephone have aroused very little academic interest and have received hardly any criticism."

One explanation for the lack of scholarly interest in mobile technologies is that their evolution was incremental. Unlike the release of Netscape in 1994, which radically transformed the Internet, "cellular [telephony was] not so much a new technology as a new idea for organizing existing technology on a larger scale." [13] Vehicle-based mobile telephones have been available, if not affordable, in the United States since 1946 when AT&T deployed systems in 25 cities.[3] [14]

Difficulties in defining boundaries between various types of mobile technologies have also constrained social science research. Increasingly large amounts of computational power are integrated into the design of mobile communications devices, driving a convergence between mobile telephones and mobile computers. New products integrate the functionality of both a telephone and personal digital assistant (PDA). Combined with technologies such as Bluetooth, which will let mobile devices communicate through short range radio, it may not be long before a constellation of portable electronic devices are integrated into a personal "body net." [15] Such technologies are designed to augment our mental capabilities for the Information Age in the same way that steam power and machines augmented our physical capabilities at the onset of the Industrial Age.

Finally, dramatic differences between nations, gender, and generations create obstacles to research, as results are rarely generalizable beyond any single sub-group. Teenage mobile phone users are the most frequently studied population, because of their future role as tomorrow's consumers. However, the way technology is used by teens in single country is hardly indicative of the rest of the world. Regrettably, much of our present knowledge about mobile users is based on a few limited studies of young Scandinavians..

4.2 The Need for Research the Social and Economic Implications of Mobile Technologies

There is a compelling need to recognize, understand and even anticipate the social and economic impacts of mobile technologies and the communications services they are used to deliver. Furthermore, it is necessary to

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[3] Using a single radio transmitter for each metropolitan area, this system was not a "cellular" system. Because it could not reuse frequencies in different areas, capacity was very low. Even by the mid 1970's, the New York metropolitan system could only support about 450 subscribers.

understand the role of mobile technologies in the spatial and physical transformation of human settlements. The added value of mobile technologies over fixed-line and desktop technologies is in the freedom of movement it permits users. Yet most scholars have focused on the relationship between the user and the phone, not the user and the environment. [16] This represents a significant knowledge gap, both conceptually and methodologically.

The lack of research on the social and economic dimension of mobile technologies is a major gap in our capacity to understand how the 21st century urban region will develop. Mobile technologies and information services – such as the emerging field of location-based services - are re-emphasizing the importance of place in the information city. To study mobile communications and computing technologies, it is essential to draw upon the theories and methodological techniques of geography, anthropology, information and decision sciences, and urban planning and design. To overcome the lack of knowledge in this area, we will need to build a lasting inter-disciplinary research effort.

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