

From Internet to Wireless Fidelity (Wi-Fi): A Study of Wi-Fi Public Hotspots Users.

Source: <http://www.tech-archive.net/Archive/PocketPC/microsoft.public.pocketpc/2006-08/msg00558.html>

- *From:* EsPUdeh@xxxxxxxxxx
 - *Date:* 31 Jul 2006 10:08:54 -0700
-

From Internet to Wireless Fidelity (Wi-Fi)

A Study of Wi-Fi Public Hotspots Users.
PATRICK UDEH, ABD, MBA.
espatfame@xxxxxxxx

New York City

April 18, 2006

To shed lights on the usage of Wi-Fi, we are currently collecting data for research study at www.WStudy.org click on [Wi-Fi Survey]. If you have used Wi-Fi Public Hotspot go to the site above and participate. There is a Dollar donation to charitable organization of your choice for completing the survey. For questions and information send an e-mail to pudeh@xxxxxxxxxx or admin@xxxxxxxxxx.

Introduction

Since its commercialization, the Internet has emerged from the confines of academia to become a mass-market service used by over 60 percent of the population (US Department of Commerce-NTIA, 2002). The Internet has also become a ubiquitous medium and a basic tool available to the general populace. Researchers suggest that advanced information technology and telecommunications infrastructures are requirements for active participation in today's global information economy (Kelly, 1998; Cairncross, 2001). One of the most important components in accelerating electronic-commerce, electronic government, and business development is high-speed broadband technology. The United States Department of Commerce (2002) noted,

"Broadband high-speed, always on Internet connectivity represents the next phase in the evolution of the Internet. Most experts predict broadband access will enable the creation of new applications and services that will transform economies and significantly impact the competitiveness of the businesses of the future".

According to Nielsen/Net Ratings data, as of March 2004, the United States broadband penetration of home connectivity was 45 percent, while at work penetration stood at 70 percent. Nearly three out of four U.S. households with a phone have access to the Internet, an overall penetration rate of 75 percent (Nielsen/Net Ratings, 2004). More

recently, wireless Internet access has entered the mainstream of the United States and industrialized countries. As a result, broadband access to the Internet has increased and become more available to the general population.

Wireless Revolution

The provision of wireless communications was not conceived until Bell Laboratories developed the cellular concept in the 1960s and 1970s. With the development of highly reliable, miniature, solid-state radio frequency hardware in the 1970s, the wireless communications era was born. Wireless local area network (WLAN) also dated back to early 70s when the University of Hawaii launched a research project, ALOHANET, which connected several computers on different islands via a radio network. It is not until the 80s did the Federal Communication Commission (FCC) authorized the use of the Industrial Scientific and Medical (ISM) band for public and commercial use. The ISM band spans 902 MHz to 5.85 GHz frequencies. The wireless fidelity (Wi-Fi) fits into this unlicensed band.

A wireless network is a network that uses radio waves as its carrier that can be used to establish network connections to the Internet for users within a coverage area. There are different types of wireless technologies available, for example, wireless fidelity (IEEE 802.11), Bluetooth (IEEE 802.15), and WiMax (IEEE 802.16), and 3G (WCDMA/CDMA2000) Internet accessing phones. Wireless technology provides new, low-cost and fast broadband connections to the Internet. Wireless communication allows consumers and businesses to transcend time and place, thus increasing accessibility and expanding both social and business networks (Palen, 2002). Wireless communication also promises to provide convenience, localization, and personalization of services (Clarke, 2001). Wireless Local Area Network shipments rose 65% from 2001 to 2002 with business shipments of 11.6 million units and home shipments of 6.8 million units, generating total market revenue of 2.2 billion dollars (Instat, 2002).

Wireless Fidelity (Wi-Fi)

One of the driving forces behind wireless technology growth was the creation of the IEEE 802.11 standard called wireless fidelity, popularly known as Wi-Fi. The IEEE 802.11 standard is the product of seven years of research that came to a head in 1997 (Champness, 1997). In addition to providing high performance and robust systems, the standard also promises multiple vendor interoperability. This means customers have the freedom to mix and match vendors to meet the requirement for each given application. As standards for wireless technology evolved, its speed increased and the prices of the wireless components decreased, making wireless technology pervasive and a commonplace part of the telecommunications infrastructure (Selander, 1999).

IEEE 802.11

The working group of the Institute of Electrical and Electronics Engineers (IEEE) in 1997 standardized 802.11 for wireless local area

network. The 802.11, popularly known as wireless fidelity (Wi-Fi) was designated a throughput of 2 Mbps over the 900 MHz ISM band. It was marred by interference since other products such as cordless phones operated on the same band. 802.11 also used two different encoding methods, Frequency Hopping Spread Spectrum (FHSS) and Direct Sequence Spread Spectrum (DSSS), which made many types of equipment incompatible.

IEEE 802.11b

In 1999, seeking to continue the invention of a speedy way to send data via unlicensed airwaves, engineers working on a standard for wireless local-area networks borrowed from existing technologies Ethernet's data packets, the Internet's routing protocols, and spread spectrum's use of many channels within a frequency band. The result is information delivered at speeds up to 11 Mbps in the 2.4-GHz band, and at a range of about 300 feet. IEEE 802.11b is the most successful WLAN technology to date. It offers only three available non-overlapping channels, meaning spectrum is scarce, and even with advanced modulation schemes, and interference is a problem.

IEEE 802.11a

802.11a provides up to 54 Mbps in the 5 GHz band. It was standardized in 1999 but its products started to appear in 2001. Its strength is high speed and lower risk of radio frequency interference than either 802.11b or 802.11g. This is because it is operating on a different band. In addition, the band gives it up to twelve non-operating channels instead of three available to 802.11b and 802.11g. The 802.11a also towers over the two in performance. The 802.11a uses a more advanced encoding scheme, orthogonal frequency division multiplexing (OFDM), which is the key to its faster speed. OFDM also utilizes bandwidth more efficiently while reducing interference. 802.11a got a boost in November 2003, when the FCC released an additional 255 MHz of spectrum in the 5.470–5.725 GHz band for unlicensed wireless devices, which increases the available spectrum by 80 percent.

IEEE 802.11g

802.11g promises complete interoperability with 802.11b and transmission rates up to five times (54 Mbps) on the same 2.4-GHz band. The drawback of 802.11g for a high-performance network is that it still resides in the crowded 2.4 GHz band and is therefore subject to the interference issues that plague 802.11b. It also has three non-overlapping channels.

Wireless Devices

Devices such as laptop computers, personal digital assistant (PDAs) and cellular phones enabled with Wi-Fi can send and receive information to and from the Internet, anywhere within range of an access point (AP).

Omni directional Wi-Fi access points are currently capable of transmitting signals up to 300 feet at up to 54 mega bits per second (mbps). Wireless fidelity Internet access promises relatively secure, high-speed Internet access from thousands of hotspots in restaurants, libraries, schools, bus terminals, airports, parks and other public places with access points (Couper, 2004). According to Langos (2003), Wi-Fi is fast becoming one of the dominant transmission delivery mechanisms because of its low cost and high bandwidth (Langos, 2003). As a result, wireless fidelity (802.11) has caught the attention of major technology companies.

Wireless Major Players

Apple kick-started the market in 1999 with the incorporation of Wi-Fi in its iBook portable for the low price of \$99.00 (Langos, 2003). The giant chipmaker, Intel also launched its wireless mobile computing technology "Centrino", which is designed to help manufacturers build notebooks that use less power, and promotes extended battery life along with wireless network capabilities (Spooner, 2003). Intel Centrino mobile technology includes a specialized mobile processor, related chipsets and 802.11 wireless network function that have been optimized, tested and validated to work together (Intel, 2003). The entry of these major players has increased the number of Wi-Fi enabled devices in the market.

A broadband Internet connection is seen as a facilitator to electronic commerce, e-government, online education, telemedicine, telecommuting and overall economic prosperity. Therefore, government and non-profit organizations have supported its development by promoting the establishment of free public "hotspots" for citizen use, while businesses have created commercial public hotspots for subscription fees.

EARLY WI-FI PUBLIC HOTSPOTS

The early free hotspots were championed by tech-enthusiasts, like Anthony Townsend of New York among others, who pioneered the early deployment of a free Wi-Fi public hotspot in Bryant Park, Manhattan-New York City. In 2001, Sky Dayton (founder of Earthlink Inc.) began Boingo Wireless Inc., which established early commercial Wi-Fi public hotspots that charge subscribers fees for service. Boingo provides Internet access via Wi-Fi to over 1300 hotspots around the US (Langos, 2003). Another major player is T-Mobile, a subsidiary of deutsche Telecom AG, which provides Wi-Fi wireless broadband Internet service in public hotspot locations such as Starbucks coffeehouses, Border Books and Music stores, FedEx Kinkos, the airline club of American, Delta, United and U.S. Airways.

In recent years, other players have joined the deployment of both commercial and free public hotspots, which resulted in the development of thousands of hotspots. There are about 5,000 free hotspots and 16,000 commercial hotspots worldwide (Langos, 2003). Researchers predict there will be around 180,000 hotspots worldwide enabled with Wi-Fi, the popular protocol for delivering high-speed Internet service,

From Internet to Wireless Fidelity (Wi-Fi): A Study of Wi-Fi Public Hotspots Users.

by 2007 (Biddlecombe, 2003).

Long Beach, California

As an example of use in practice, the economic development bureau of Long Beach, California is offering 8 mbps of free WI-FI access to create Internet broadband services along a four-block stretch of Pine Ave, a seaside strip running through the heart of downtown. The cost to the city is a modest \$4000 per year and they hope to stir activity in its business district through this modest investment (Gubbin 2003).

Pittsburgh, Pennsylvania

An interesting initiative is being undertaken in Pittsburgh, where a wireless hotspot has been organized by 3 Rivers Connect, a non-profit organization, which gets the majority of its funding from the State of Pennsylvania. It has teamed up with a local start-up "Grok Technology" to lease a wireless network for a pilot scheme covering a targeted area of the city and two parks (Raffray, 2002). The project, they hope, will be an economic development initiative with a net marginal return.

Bryant Park, NYC-Midtown Manhattan

In New York City, NYCwireless installed in 2002 wireless Internet broadband access in Bryant Park in midtown Manhattan. NYCwireless plan is to set up more than 100 very short range free wireless networks in parks, building lobbies, neighborhood centers and coffee shops. The Bryant Park wireless fidelity broadband Internet access attracts over 40 users per day.

NYC Lower Manhattan

New York City, with a focus in the Lower Manhattan, presents the requirements and uniqueness necessary to study the possibility of incorporating free consumer wireless fidelity broadband Internet access as a component of a multi-project economic development strategy. In May 2003, the Alliance for Downtown New York City launched the Lower Manhattan Wireless Network, a collection of free wireless hotspots in seven large and widely used locations throughout Lower Manhattan (downtownny.com, 2003).

The locations selected by the Alliance involve citizens' use in numbers that dwarf other wireless installations. These include high traffic areas such as Bowling Green Park; City Hall Park; Liberty Park Plaza; Rector Park; 60 Wall Street; the South Street Seaport and Vietnam Veterans Plaza. According to Shirley Jaffe, Vice President for Economic Development at The Downtown Alliance, the network should allow anyone in Lower Manhattan to walk to a free, wireless Internet connection within five minutes (downtownny.com, 2003).

The Downtown Alliance was motivated to act because of the economic devastation caused by the September 11th 2001 attack on the World Trade

Center. As an active participant in the rebuilding efforts, the Alliance is working hard to ensure that Lower Manhattan regains its past economic glory in view of the pain of 9/11. The attack is estimated at \$83 billion in damage to New York City's economy (NYC-Partnership, 2002). The service area includes three factors of great importance to the research.

First, it includes the area of the World Trade Center. The 9/11/01 disaster at the WTC is the prime factor in the governmental and private interest in promoting economic development in the area. Secondly, the area includes various technology incubators, including "Silicon Alley", implying a sophisticated tech-savvy population in the area. New York City even was selected as one of the intelligent communities in 2001, despite the 9/11 disasters by the Intelligent Community Forum, which is a special interest group within the World Teleport Association that focuses on the uses of broadband technology for economic development.

Intelligent communities are defined as: Communities whether within the political boundary or of a municipality or comprising a larger region, that view bandwidth as new essential utility, as vital to economic growth and public welfare as clean water and dependable electricity. They make conscious public policy choice to seize the control of the community's broadband destiny in order to ensure their businesses and citizens access to advanced information and communication services. Intelligent communities work to prosper in the Digital Age.

Rather than trying to prop up dying industries, they eagerly embrace the growth industries of tomorrow. They work to create advanced information and telecommunication infrastructure needed to gain a competitive edge in attracting and growing the leading-edge industries that create jobs in the economy of the 21st century. The introduction of widespread free consumer wireless fidelity broadband Internet access in Lower Manhattan is an attempt to extend this vision, one that could be replicated if it proves to be successful.

Finally, Lower Manhattan represents a daily work population estimated at 280,000, which thereby makes the Wi-Fi service potentially accessible by more people than anywhere else does in the nation. New York City has been on the forefront of information technology. New York City is rebuilding. Recognizing that widely accessible broadband Internet connection is a potential facilitator to economic growth and commerce, cities and economic development organizations are beginning to test the provision of broadband Internet service through sponsored wireless fidelity (WI-FI) hubs.

Wi-Fi Users

According to Gartner, an estimated 99 million people will be using Wi-Fi by 2006. The numbers are fast approaching a true mass-market level. Wi-Fi is cheap, powerful, and, most important, it works. Among the geeks, Wi-Fi has become a fascination, a glimpse of the future of the Internet. Like the Web, it is open, unregulated, and free. Anyone

can deploy it, and millions have. For many it is an epiphany – the unforgettable impact of being in the presence of something important and new. Wi-Fi technology is not limited to the office environment alone. With the proper broadcast technology, it can become an extensive wide area network, permitting an enterprise to link its staff together through a virtual private network across a corporate campus or across the country.

Conclusion

Even with the high number of wireless fidelity deployments worldwide, the usage at both commercial and free public hotspots is running below prediction for the technology (Bridlecomb, 2003). Research in the area of wireless fidelity– Internet access acceptance and adoption is sketchy; therefore, it has become imperative to understand the factors that affect the users' acceptance and adoption of wireless fidelity Internet access and the reasons for the lower than predicted number of users in both commercial and free Wi-Fi public hotspots.

The objective of this study is to better understand the adoption, user characteristics, and usage patterns of commercial and free wireless fidelity public hotspot users. In doing so, this study intends to draw upon several well-established initial acceptance models specifically: the technology acceptance model (TAM) (Davis, 1989) rooted in the theory of reasoned action (TRA), the theory of planned behavior, an extension of TRA, and the diffusion of innovation theory (DIT) by Rogers (1983, 1995, 2003). This study will further incorporate the concepts of disruptive technology (DT) presented by Christensen (1997) and to ascertain whether lower than anticipated rates of the usage of public wireless fidelity hotspots is affected by the disruptive effects of substitute products such as 3G Internet accessing cell phones with wireless application protocol.

This research will provide data to: (a) contrast wireless fidelity acceptance, adoption and use in commercial and free public hotspots; (b) inform as to whether the user characteristics and usage pattern data matches well with existing academic theories and models of earlier adopters' behavior; and (c) assess whether usage rates in both settings are affected by the disruptive technology characteristics of other substitute products, such as 3G Internet accessing cell phones. To shed lights on the usage of Wi-Fi, we are currently collecting data for this study at www.WStudy.org click on [Wi-Fi Survey]. If you have used Wi-Fi Public Hotspot go to the site above and participate. There is a Dollar donation to charitable organization of your choice for completing the survey. For questions and information send an e-mail to pudeh@xxxxxxxxxx or admin@xxxxxxxxxx .

Patrick Udeh, ABD . MBA, teaches at Touro University and Berkeley College, New York City. Current research study is titled; 'A comparison of User Characteristics and Usage Patterns of Commercial and Free Wireless Fidelity (Wi-Fi) Public Hotspots Users'.