Chapter XXII
Mapping the MIT Campus in Real Time Using WiFi

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ABSTRACT

This chapter presents the iSPOTS project, which collects and maps data of WiFi usage on the Massachusetts Institute of Technology campus in Cambridge, Boston. Instead of simply mapping the locations of WiFi availability, the project is possibly the first to use and analyze log files from the Institute's Internet service provider and to produce spatial visualizations of the observed activity in real time. The aim is to create a better understanding of the daily working and living patterns of the MIT academic community, which changes due to the emergence of WiFi itself. The MIT wireless IEEE 802.11 network, consisting of 3,000 access points (one of the largest of its kind) offers a privileged environment for this research and, in perspective, can provide a test bed for entire cities.

INTRODUCTION

Recent years have witnessed a great increase in wireless Internet access points (WiFi hotspots) in cities around the world. As of the end of 2007, there were over 67,000 public hotspots already available in the U.S. (JWire, 2007), roughly doubling every year. Several forward-looking cities like Boston, MA, San Francisco, CA, and Philadelphia, PA, have launched projects to provide city-wide wireless Internet access for all citizens (cf. Forlano in this volume), WiFi is becoming as common in urban areas as traditional public utilities, such as electricity and land-line phones. The popularity of WiFi is further enhanced by its capacity to communicate multiple types of media over the same protocol: text, voice, images and video can all be streamed over wireless networks instantaneously and globally. As ubiquitous WiFi coverage might be appearing in many cities[1], we see an urgent need to explore the spatial impact of this powerful new communication network from the point of view of an urban planner or architect.

A number of studies have been done to describe WiFi signal availability and intensity in geographic context (see for instance Skyhook, http://www.skyhookwireless.com/). A culture of so-called WiFi 'sniffing' has developed in recent years, which is often related to the mapping of public wireless networks on web pages (e.g., JWire, 2007, the global hotspots finder) 'wardriving' (mapping wireless networks by driving in a car equipped with a sniffer device) and 'warchalking': the drawing of symbols in public places to advertise open wireless Internet networks. Several computer science and engineering studies have used wireless log information to analyze and quantify network traffic to answer questions about network optimization, load balance, and the like (Kotz & Essien 2005). However, there have been few attempts to analyze spatial patterns of traffic on large WiFi networks through log information from Internet Service Providers (ISPs). The lack of such studies can possibly be attributed to the difficulties of accessing raw Internet traffic data and combining it with geo-spatial databases. In the iSPOTS project, carried out by the SENSEable City Laboratory at MIT in collaboration with MIT Information Services and Technology (IS&T), we have had the opportunity to access such data and to provide on-line visualizations of its spatial distribution to the public. A real-time system was set up to gather, process, and visualize the data on the campus map, allowing the MIT community to view and act upon the information instantaneously. A description of the project, including its architecture and preliminary results, is presented below.

The remainder of this chapter is structured as follows. Section 2 provides the background and some key pieces of work related to our project. Section 3 provides background on the MIT campus and network environment. Section 4 describes the data infrastructure, and Section 5 describes our data processing methods. We discuss the weaknesses of our current setup and prescribe directions for future work in Section 6 before concluding.

CONTEXT

A series of campus-wide WiFi studies during early 2000 has paralleled the ongoing transition from fixed wire accessibility to ubiquitous WiFi environment. Some of the most comprehensive of these studies were done in Dartmouth College (Henderson, Kotz & Abyzov 2004, Kotz & Essien 2002, Kotz & Essien 2005). Within the past years the usage of campus WiFi has increased as more people have adopted WiFi-enabled laptops, as well as other WiFi clients such as PDAs and VoIP devices. However, the proportion of WiFi users at popular buildings, in libraries and classrooms appeared to be consistent from the years 2001 to 2004. A similar pattern of preferred WiFi location usage was observed at the University of Saskatchewan in Canada (Schwab & Bunt 2004).