Urban WLAN Solutions in Finnish Cities

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INTRODUCTION

Wireless urban networks can be approached from many perspectives. They are commonly studied on the basis of technology development (e.g. Chao, Uden, & Shih, 2005; Bijker et al., 2012), business and service support (e.g. Friday, Davies, Wallbank, Catterall, & Pink, 2004; Jenisch, Orlamünder, Köstring, & Brügge, 2005), urban marketing and city image promotion (e.g., Dobers, 2004; Inkinen, 2010) or societal use of technology (e.g. Palm & Wihlborg, 2006; Johnson & Wetmore, 2008).

This article gives a detailed outline of the provision and condition of public wireless local area networks (WLANs) in Finland. The cases of Oulu, Turku and Helsinki ("Arabianranta" residential area) are presented. These cities are relevant study locations, because they have actively participated to the creation processes of public city WLANs. They are also using wireless networks as promotion tools in their image marketing. In addition, Finland has been regarded as one of the top "network ready" nations in the world and was ranked as the world leader in the latest Networked Readiness Index by WEF (2013).

BACKGROUND

Several relevant studies on wireless networks have been conducted recently (e.g. Zhuang, Gan, Loh, & Chua, 2003; Harwit, 2005; Salkintzis, Pavlidou, Fitzek, & Varma, 2005). For example, Tang and Baker (2002) analysed metropolitan area wireless networks in three locations in the US, including the San Francisco Bay Area, Washington D.C. and Seattle. They provided an extensive quantified analysis of network loading, activity and mobility patterns of data signals.

There are variations in 1) technologies, 2) organisational arrangements and 3) usage preferences related to WLANs. There are several "city networks" that could be studied here. First, several technical solutions exist for different purposes. Private radio access networks (RANs) and cellular wide area networks (WANs) are often deployed by public authorities (e.g. emergency units, police, maintenance) for the purpose of sharing and delivering information from their daily field operations. WLANs are the third typical solution structure for providing a higher bandwidth in outdoor conditions. WLANs are based on standardised industry technologies. Three main standards are used to define the communication protocol between the access point and the client. They are all variants of the IEEE 802.11 standard (802.11a, 802.11b and 802.11g). The (a) and (g) standards provide 54 Mbps rates and the (b) standard, 11 Mbps. However, in practice, the rates are considerably lower because of protocol overheads and distance decay between the client and the access device (Cisco, 2013).

A variety of interest groups are needed to realise a WLAN that provides services to the public, such as residents, tourists and business visitors. These include infrastructure providers, Internet service providers (ISPs), hardware providers and clearinghouse operators. In general, provision of a WLAN can be characterised either as a top-down approach in which network operators charge access fees, or as a bottom-up approach in which end-users are offered a free access on a non-commercial basis (Rao & Parikh, 2003). Thus, the main relationships are business-to-customer (B2C), business-to-business (B2B), business-to-government (B2G) and customer-to-government (C2G). Publicly provided

DOI: 10.4018/978-1-4666-5888-2.ch623

non-commercial networks are often partly commercial, because their production and development usually requires outsourced services by collaborating partners. "Wireless city networks" are collections of networks under a same brand and they differ fundamentally from single actor networks (e.g. closed company network).

Second important issue of public and open access WLANs is information security and authentication (e.g. DeNardis, 2011). Commercial services always require an authentication procedure due to the need to charge for the service. From this viewpoint, non-commercial networks are more challenging because from the end user perspective, they can be either open access or ID-required networks. From the technical viewpoint, all connections have an "authentication" in the machine-to-machine interaction (requiring an IP address), but end user information is not included in open access networks.

Public organisations can provide two main elements for end-users: 1) the network access signal and 2) the access device. All other components and their provision are based on B2B or B2C arrangements. However, this is a generalised and spatially non-contextualised description of a WLAN provision. The issue becomes more complex when location-related specifics are included. For example, the physical attributes of the WLAN environment are important, because architecture (building heights and materials) and surface topology influence connection quality and speed.

The third, and perhaps the most problematic, field of WLAN analysis is human-to-computer interaction (see Davies, Cheverst, Friday & Mitchell, 2002; Dawley & Anthony, 2003; Inkinen, 2006). This refers to user preferences, needs, contents and services of the Internet used via the WLAN connections. These include issues of P2P networking and distribution of copyrighted materials. Misuse of information networks is an identified problem of open access networks. Therefore, in most cases non-commercial freely accessible networks have an authentication system to prevent unwanted network behaviour. This implicates issues of network security and related protocols, e.g. Wired Equivalency Privacy (WEP) that encrypts transmitted data. Also other security mechanisms, such as end-to-end encryption and virtual private networks (VPN) are tools that increase mobile workstation privacy and security.

WIRELESS NETWORKS IN FINLAND

General Overview

Finnish public WLANs can be divided into three categories. First, the largest players are national and international telephone operators, such as Sonera, Elisa and Finnet Group (DNA). These services are provided on a "hot spot" principle, referring to spatially limited locations within a city space. Commercial hot spots are commonly located in hotels, airports, shopping malls, conference centres, restaurants and other gathering places in which the customer segment is expected to need wireless data transfer. These services have a charge, and depending on the tariff system, access can be obtained for minutes to weeks. Hot spot WLANs are targeted to professionals and they mainly serve the needs of business.

Second, there are numerous other WISPs (Wireless Internet Service Providers). In addition to the largest players these include local actors such as electricity companies, smaller telephone operators or cable-television operators. The target of these services is households and small companies. Compared to "hot spot" networks, WISP connections are commonly less expensive for the end user.

Third, there are non-commercial WLANs providing Internet access in specific city locations. We use the term "city networks" mainly to refer to these non-commercial public WLANs provided or arranged by public sector. The extent of their network coverage varies, depending on the service provision arrangement. Commonly, non-commercial networks in Finland are developed and maintained by units of higher education, such as universities, or by public sector coalitions, including municipal organisations in co-operation with universities and local businesses. The triad co-operation between businesses, universities and government organisations is also called B-U-G co-operation (see terms and definitions). Generalised description of the available WLAN options is presented in the Figure 1.

In addition, it is possible to identify value-added WLAN services. They are private networks, but their provision is a complementary service (side product). Free-of-charge WLAN services in cafés, restaurants and hotels are examples of private non-commercial networks. In general, their provision is based on the consumption of another product (such as a beverage)