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Abstract

Wireless Local Area Networks (WLAN) are receiving considerable attention in the industry and are perceived as a possible disruptive technology, capable of posing a credible threat to the dominance of mobile network operators and their 3G networks. In spite of this, the business aspects of public WLANs have been neglected by the research community. The objective of this paper is thus to investigate the use of WLAN to offer wireless services from a business point of view. The study is based on the example of current supply of WLAN services in Switzerland. By investigating different kinds of WLAN service providers and analyzing their business models through mini case studies, the paper provides a deeper insight into business aspects of public WLANs.

1.   Introduction

Public Wireless Local Area Network (WLANs) are receiving considerable attention in the industry. Hotspots offering wireless Internet access are emerging with high speed worldwide at many public places with a high frequency of people as airports, hotels, and cafes. As a result and due to the unexpected difficulties and delays of providing 3G networks, public WLANs got considerable attention as a possible thread to 3G networks in the press and literature (Zweig 2001), (Lehr and McKnight 2002). Since both technologies provide broadband data communication services, a significant share of 3G

revenues may be displaced from mobile operators towards WLAN providers (Laurent, Geraci et al. 2002).

Contrary to 3G, WLAN providers do not require a license to operate and can deploy their network with much smaller investment. Consequently, a plethora of different Wireless Internet Service Providers (WISPs) is currently trying to take advantage of this opportunity to enter the wireless market. These players include incumbent firms from the telecommunications industry (i.e. mobile network operators, wireline network operators, Internet Service Providers) as well as new players such as start-ups, technology enablers, venues and communities. This diversity is likely to result in fundamentally different strategic approaches and high competition.

In spite of the growing importance of WLANs, the business aspects of WLANs have been neglected by the research community. The main objective of this paper is to conduct an exploratory study of emerging WLAN business models on the example of the Swiss WLAN market, in order to identify the different types of WISPs, analyze their strategies and determine their key success factors (Herslow, Navarro et al. 2002). Based on this analysis, a classification framework for WLANs is proposed and a well-grounded insight into emerging WLAN business models and the future of WLAN networks will be presented.

The remainder of the paper is structured as follows. The next section describes our research methodology. Then section three provides an overview of the actual historical and technological context. Section four proposes a classification framework for WISPs, which are then illustrated in section five through case studies of selected Swiss organizations. Finally, section six exposes the principal results of the study and suggests further research directions.

2. Research Methodology

The research methodology used in this study follows a two steps process:

In the first theoretical research and preparatory step, secondary research material was gathered trough a literature review. Based on it, a new classification framework of the various types of WISPs is proposed in section 4. The classification framework provides an overview of the different strategic approaches used to offer WISP services and guided the subsequent selection of relevant WISPs for the empirical analysis. The major issues relevant to WLAN deployment are also identified in the first step and used as a base for structuring the interviews with these companies.

In order to illustrate the different emerging WISP strategies in the second research step, an empirical study was conducted based on the example of the Swiss WISP market by applying the case study research method. Foremost relevant companies for empirical research were chosen. In order to ensure the representativeness of the study, for each of the previously identified WISP types of the classification framework, a number of representative enterprises were chosen out of the active players on the Swiss WISP market. Then, primary research material was collected through interviews with representatives from these enterprises. The main results are presented through mini case studies in section 5. Finally, a cross-case analysis provides a snapshot of the current market situation and forms the base for extracting common and differing elements of the applied business models, giving insights into possible future WLAN developments.

3.   Underlying Technology and Its Development

3.1   Historical Background

WLANs are flexible communication systems transmitting data over electromagnetic waves, usually implemented as an extension to a wired LAN (Malladi and Agrawal 2002). Their origins go back to 1990 to the efforts of the IEEE 802.11 Working Group aiming at establishing a standard for wireless connectivity within a local area. Yet, consumer demand was stagnating, as adoption was actually hindered for the major reasons of high equipment prices, range limitations, performance problems, security and lack of interoperability (Ruber 1999).

Subsequent research led to the creation of the 802.11 standard in 1997 (providing 2Mbps in the 2.4GHz band), which unified an otherwise fragmented market that had previously relied on proprietary solutions. Growth in WLANs can actually be traced to the issue of the 802.11b standard in 1999 (providing 11Mbps in the 2.4GHz band), and to the interoperability certification service offered by the Wireless Ethernet Compatibility Alliance (Rao and Parikh 2002). Driven by an increasing use of portable devices to access network applications and thanks to improved performance, interoperable products and rapidly decreasing prices, WLANs rapidly started to be adopted by enterprises and residential consumers as an extension to or as a replacement of traditional LANs.

The widening diffusion of WLAN-enabled devices created an opportunity for WISPs to offer commercial WLAN access to nomad users in public locations. Recently, certain players expect to exploit this technology in order to create large-scale wireless broadband networks federating many WLAN hotspots in a common network. Two principal models are currently being used: a top-down approach, which requires a centralized entity who builds a network in a traditional way by planning, deploying and operating the network, and a bottom-up approach, which relies on a loose federation of enthusiasts willing to share their hotspots with each other (Rao and Parikh 2002). The former allows for guaranteed quality of service, support and scalability, but implies considerable initial investments. The latter benefits from organic growth and investment sharing among multiple participants, but is prone to scalability, quality of service, support and abusive use problems. As illustrated in section 4, both approaches are currently being pursued by different enterprises, some of which even try to pursue hybrid business models combining elements from the two approaches.

3.2   Technology Background - Competing Technologies

So far, we restricted our discussion to 802.11. Yet there are many competing WLAN technologies (see table 1 below). An early competitor to 802.11 is HomeRF, which offered similar technical specifications, but has been overshadowed in the marketplace by 802.11b, probably because the latter came first in the market and because of more aggressive marketing (ISP Planet 2002). Nowadays, 802.11b is by far the most commonly adopted standard, accounting for 71 percent of all wireless nodes shipped in 2001 (Griffith 2002). In the future, 802.11b might be overtaken by a new breed of standards such as 802.11a, 802.11g and HiperLan/2. Owing to this diversity, multimode chips supporting different technologies might become necessary.

	802.11	HomeRF 1.0	802.11b	HomeRF 2.0	802.11g	802.11a	HiperLAN 2
Release date	1997	1999	1999	2001	Future	1999	Future
Frequency of operation	2.4 GHz	2.4 GHz	2.4 GHz	2.4 GHz	2.4 GHz	5 GHz	5 GHz
Theoretical max. data rates	2 Mbps	1.6 Mbps	11 Mbps	10 Mbps	54 Mbps	54 Mbps	54 Mbps
Medium Access Layer	CSMA/CA	Hybrid CSMA-TDMA	CSMA/CA	Hybrid CSMA-TDMA	CSMA/CA	CSMA/CA	TDMA
Physical Layer (modulation)	FHSS or DSSS or Infrared	FHSS	DSSS	FHSS	OFDM	OFDM	OFDM

Table 1: Comparison of different WLAN technologies (Bakom 2002)

In addition to WLAN technologies, there are several other partially overlapping wireless technologies like Bluetooth, cellular networks (i.e. GSM, GPRS and UMTS) and different emerging technologies (Varshney and Vetter 2000). While all these technologies seek to satisfy telecommunication needs of mobile users, they differ in the scope of coverage, bandwidth and quality of service (see table 2 below). Bluetooth basically seeks to simplify connectivity in the PANs (Personal Area Networks), whereas cellular networks are built to provide ubiquitous coverage over a wide area.

	Bluetooth	**WLAN**	**GSM**	**UMTS**
Coverage	Personal area	Local Area	Wide Area	Wide Area
Frequency band	Unlicensed ISM 2.4GHz band	Unlicensed ISM 2.4GHz	Licensed GSM 900/1800/1900	Licensed IMT2000 1900/2100
Typical Range	10 m	100 m	up to 35 km	up to 8 km
Theoretical Max data rates	1 Mbps	54 Mbps	14.4 kbps	2Mbps
Typical data rates	721 kbps	30 Mbps	9.6 kbps	384 kbps
Applications	Data / (Voice)	Data / (Voice)	Voice / (Data)	Voice / Data

Table 2: Comparison of different wireless technologies

Though it is generally agreed that WLAN will have an impact on these technologies, there are many different opinions as to their competing or complementary nature (Laine 2002; Laurent, Geraci et al. 2002; Lehr and McKnight 2002). Compared to 3G, WLAN provides higher data rates with a much cheaper equipment and does not require licenses to operate. However, disadvantages of WLANs lie primarily 1) in missing components to the standard, which lacks proven security concepts, neglects quality of service, roaming and billing protocols; and 2) in the use of the unregulated 2.4GHz band, which makes WLAN networks susceptible to serious interferences (from ISM, Bluetooth and WLAN devices) and does not permit to avoid them trough centralized planning (i.e. by making neighboring base stations transmit on different channels or synchronizing emitters) (Dornan 2002; Redman 2002). Finally, WLANs are not suited to mobile use, owing to limited and discontinuous coverage, lack of handover between hotspots and lack of truly portable devices (Thorngren 2002).

4. A WISP Classification Framework

The business aspects of the WISP industry have already been investigated by a small number of authors trying to identify the different types of actors and their strategic approaches. Herslow, Navarro et al. (2002) suggest that WISPs can be distinguished by using pricing and coverage criteria, identifying Hot Spot WISPs, Facility Owners WISPs, Wide Area WISPs and Network Community WISPs. In addition they recognize other important players such as enablers (providers of technical solutions) and closed networks (private WLANs). Alvén and Farhang. (2002) focus on commercial WISPs, which are distinguished by their core business and the location covered. They identify single point WISPs, mobile carrier WISPs, ISP WISPs, plain WISPs, location specific WISPs, operator neutral WISPs, franchising WISPs and virtual WISPs. Sputnik (2002) claims that the future of 802.11 networks will take three directions: private networks, free public access networks (communities) and paid subscriber networks. Verma, Beckman et al. (2002) examine what strategic approaches may be employed by WISPs, differentiating between primary business models (which extend traditional ISP models offering WISP services paid for by monthly subscription fees), emerging business models (offering the occasional usage of WISP services using micro payments) and neighborhood area networks (NAN). NAN are non profit networks of end users who share their WLAN hotspots, either organized to cover an extensive area or a single location (Pozar 2001).

We propose to distinguish between the different classes of WISPs using two criteria: whether the service is a commercial offer (i.e. the aim is to gain a profit) and whether the coverage is extensive (i.e. if coverage targets a wide area or is restricted to a particular location). The former has profound implications on the technical requirements of quality of service, customer support, authentication systems and billing systems. The latter involves important technical concerns such as handover between hotspots and network planning. Constructing a matrix of these two criteria, we obtain four groups of players (see table 3 below):

	Selected locations coverage	**Extensive coverage**
Non commercial offer	Private WLAN	Community WISP
Commercial offer	Hotspot WISP	Wide Area WISP

Table 3: WISP classification

Private WLANs are closed membership, corporate or residential networks owned and operated by companies, institutions and households to provide network connectivity to their own members. The main reason for deploying private WLANs in business and institutions is to support user mobility within the company, thus benefiting from productivity, convenience and network flexibility advantages (Oake, Broxton et al. 1999; Herslow, Navarro et al. 2002). WLANs are especially expected to be successful in vertical sectors such as government, education, healthcare and hospitality (Lucero 2002). Residential wireless networks principally aim to support sharing of broadband Internet connections among multiple devices.

Community WISPs are free wide area networks created by clustering members' hotspots to provide public access together. They are mostly composed and operated by technology enthusiasts who get together in loose federations, motivated by an open source mentality and aiming at offering Internet access to the whole community (Herslow, Navarro et al. 2002). Nevertheless, commercial attempts trying to foster the community building process are appearing (e.g. providing a basic free service while earning money on a secure corporate version (Sputnik 2002)). Community networks usually provide the most

elementary service and do not treat issues beyond basic equipment and hotspots' location communication, such as security, billing or metering (Verma, Beckman et al. 2002), and are therefore particularly exposed to abusive Internet usage.

Hotspot WISPs are paid subscriber networks deployed inside specific public facilities such as airports, hotels, cafes, etc. to provide network access to their customers in their location. Venue owners might offer WLAN services themselves or in collaboration with specialized WISPs or technology enablers (Thorngren 2002). WLAN services are usually seen as a complementary offering intending to achieve a competitive edge over rival companies. Hotspot WISPs are expected to offer limited quality of service and run weak Authentication, Authorization and Accounting (AAA) systems (Alvén and Farhang 2002). To enable occasional usage micro-payment models are predicted (Verma, Beckman et al. 2002).

Wide Area WISPs are paid subscriber networks providing network access to customers in a wide area, such as a city or a country, offering coverage both inside and outside buildings (Herslow, Navarro et al. 2002). They usually offer guaranteed quality of service, technical support, operate strong AAA systems and other value-added services that free public networks cannot provide. Wide Area WLANs can be provided by incumbent firms such as traditional ISPs and MNOs extending their services towards WLAN, as well as start-ups, who may follow less integrated strategies such as franchising, virtual operator, operator neutral, location specific and roaming broker models (Alvén and Farhang 2002; Verma, Beckman et al. 2002).

As can be seen in table 4, the proposed classification can easily be compared with those mentioned above.

	Herslow, Navarro et al. 2002	Sputnik 2002	Alvén and Farhang 2002	Verma, Beckman et al. 2002
Private WLAN	Closed Networks (influencing actor)	Private networks		
Community WISP	Network community WISP	Public access networks		NAN
Hotspot WISP	Hot Spot WISP Facility owners WISP	Paid subscriber networks	Single point WISP Mobile carrier WISP ISP WISP Plain WISP	Emerging Model
Wide Area WISP	Wide Area WISP		Location specific WISP Operator neutral WISP Franchising WISP Virtual WISP	Primary Model

Table 4: Comparison of different WISP classifications

5. Case Studies

In this section the different emerging WLAN strategies are illustrated through case studies of Swiss WISPs. To motivate the selection of the analyzed companies first a short overview of the Swiss WISP market is provided.

5.1 Swiss WISP Market Overview

The provision of public WLAN services in Switzerland is a very recent phenomenon. In fact, the Swiss WISP pioneer firm Monzoon started its commercial service in August

2001. Since than numerous players entered the market. In April 2003, all together they operated more than 250 hotspots in Switzerland and plan additional 150 hotspots. An overview of the different types of hotspots is given in table 5 below[1].

	Active in May 2003	%	Planned in 2003	%
Hotels	133	53%	284	64%
Public venues	45	18%	69	16%
Residential Area	29	12%	31	7%
Schools	8	3%	13	3%
Airports + Railway stations	10	4%	12	3%
Others	27	11%	33	7%
Total	252		442	

Table 5: Hotspot survey (April 2003)

For the subsequent case study, the most representative WISPs of the active players on the Swiss market were chosen for each category of WISPs identified in the classification framework. Thereby the following criteria were applied: their position on the market, their existing experiences and the originality of their strategic approach. Below the reasoning behind the choices is explained in more detail:

The **Private WLAN** category currently includes a variety of organizations using WLAN to support their operations such as hospitals, universities and other private companies. The CHUV hospital case has been chosen because it deploys WLAN for strategic purposes and has the potential to open it to its patients in the future.

The **Hotspot WISP** category currently includes principally hotels, airports and cafés. The Zurich Airport case has been selected because it is one of the first WLAN-equipped venue and certainly has the greatest potential among venues.

The **Wide Area WISP** category currently includes MNOs and start-ups. These category presents the most variety of approaches, therefore the two leading network operators, Swisscom and Sunrise, and the leading start-ups have been selected – the WISP pioneer Monzoon and Netair.

Finally, **WLAN communities** are arising in numerous areas of Switzerland, including Lausanne (Myotis), Geneve (SFNet) and Bern (LuftNetz). The Myotis case has been selected because it has more experience and practical achievements than the others.

In order to illustrate the business models of the different actors in a consistent way, we base ourselves on the ontology for e-business models developed by (Osterwalder and Pigneur 2002), which is composed of four main elements: 1) the product innovation, that consists in the value proposition the firm delivers to its customers; 2) the customer relationship, defining the target customers, the distribution channels and the relationship strategy; 3) the infrastructure, containing the resources, the activities and the partnership network that are required to offer the value proposition; 4) the financial aspects, which ultimately determine the profitability of the organization. In addition, we illustrate the current experiences that enterprises are having in delivering WLAN services.

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[1] This table has been compiled in April 2003 using WISPs web sites (www.air2web.ch, www.monzoon.ch, www.swisscom-mobile.ch, wlan.thenet.ch, www.myotis.ch) and hotspot directories (e.g. www.hotspot-locations.com, www.swisshotspots.ch and www.802-11b.ch).

5.2   Private WLAN

Case study: CHUV (University Hospital Centre of the state of Vaud)[2]

The CHUV is a university hospital employing 5'000 people, serving 40'000 patients with a yearly budget of 400 millions €. In May 2002, they started a project of installing a WLAN covering the whole hospital during the next five years.

Value proposition. The WLAN offers access to a single strategic application allowing hospital's employees to consult and update all patient-related information stored in a central computerized file from anywhere in the hospital. The principal benefits sought are to increase the quality of medical treatment, patient's progress tracking, and productivity.

Customer relationship. Doctors use the system to access up-to-date patient information when prescribing medical acts, check the compatibility of different drugs and monitor patients' progress. Nurses retrieve doctors' prescriptions and update patients' files with the actual treatments dispensed. Moreover, this data can then be analyzed by pharmacy and administrative staff for various purposes. Currently CHUV does not plan to offer WLAN Internet access to patients.

Infrastructure management. The CHUV plans to extend its LAN (6000 nodes) with about 50 WLAN access points covering patient and staff rooms. Employees are given mobile internet devices (tablet PCs) to access the patient application. All activities related to infrastructure management as network planning, deployment, operation, maintenance, user education and support are performed in-house.

Financial model. The WLAN project involves a substantial investment, principally in personnel training, application development, equipment and service operation. There are no revenues, nevertheless, some cost reductions are expected in terms of productivity gains and a decrease in unnecessary drug administration and treatments.

Current experiences. Education of personnel is an important issue, as it takes time for the new technology to be accepted and to manage change. Security and privacy is also an important concern: communication is secured by using encryption technologies and hardware authentication mechanism (security cards), and devices do not store any information.

5.3   Hotspot WISP

Case Study: Zurich International Airport [3]

Zurich Airport operates a private WLAN since 1999 for airport operations (e.g. baggage tracing) and deploys a public WLAN service since mid 2002. Today, five access points have been installed mainly in lounges.

Value Proposition. Zurich Airport provides a public 802.11b WLAN service. Airport related information, e.g. timetables, is freely available, but internet access requires time-based subscriptions. Customers benefit from productive use of otherwise idle time and shortened perceived waiting times. Affiliate WISPs are offered access to a customer base of mainly business customers who stay an average of 1,5 hours at the airport.

Customer Relationship. Target customers are business travellers in the early adopter segment who possess and are familiar with WLAN equipment. Zurich Airport is not

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[2] Interview with Philippe Noth, person in charge for medical applications,www.chuv.ch

[3] Interview with Mathias Berger, currently responsible for WLAN at Zurich Airport

aiming at controlling the customer relationship itself but rather intends to offer customers a choice of WLAN service providers.

Infrastructure Management. Zurich Airport communicates individual access points, controls service providers and manages wired infrastructure. Today, service is only provided by Monzoon, but in the future Zurich Airport intends to manage the whole access point infrastructure and split traffic between multiple providers. Customer care, AAA and security services will be left to service providers or a relation managing company.

Financial Aspects. Zurich Airport gains revenue from service providers who in turn charge for user subscriptions: provider revenues are shared with the airport and in future providers may be additionally charged an initial fee to offer their services in the airport.

Current Experiences. Zurich Airport found that communication of individual access points and advertisements of the service are crucial for attracting users: business customers, using mostly email, currently prefer using their mobile phones' data transmission capabilities (existing billing relation) as a substitute to WLAN access. The split of responsibility between service providers and the venue slows down service adoption. Few problems with interferences or restrictions of hot spot positions were noted even in the airport environment. Skilled partners for WLAN service customer support were hard to find.

5.4   Wide Area WISP

Case Study: Swisscom Mobile[4]

Swisscom Mobile is Switzerland's major MNO with a market share of 66%. It has been doing research in the field of WLAN since 1999 and launched its service commercially in 2002. Nowadays, its network consists of 107 hotspots and is rapidly growing. WLAN services are positioned to complement cellular based services. Swisscom Mobile ascribes WLAN a massive importance for their future data services and has therefore invested substantially.

Value Proposition. Swisscom Mobile aims at achieving a competitive edge by providing high quality, innovative 802.11b WLAN services within a broad data and voice service portfolio. Venues are offered free set up and operation of WLAN at their sites and varying revenue sharing models. In addition, staff training, material and consulting for communication of hotspots are provided.

Customer Relationship. Swisscom targets business customers who need nomadic e-mail and corporate network access. Existing cellular customers can register for the service through SMS to receive access information, whereas others need to buy prepaid scratch cards. Furthermore, the former benefit from minute pricing and flat fee pricing schemas, while the latter are only offered an uninterrupted 2/24 hour pricing scheme. Existing infrastructure for customer support (hotline, Internet, branches) is also used for WLAN services. In order to develop the market Swisscom engages in broad marketing activities by providing WLAN coverage for international events such as the World Economic Forum in Davos.

Infrastructure Management. In order to achieve quality leadership, Swisscom provides an exclusive end-to-end solution, which includes network set up and operation, AAA and security services, customer care, on-site staff training, end-user education, service

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[4] Interview with Thomas Kern, Head of Product Management "Business"

marketing and communication of access points. Network integration and sale of prepaid cards is carried out together with partner companies.

Financial Aspects. WLAN is expected to be a profitable business on its own. Revenues are achieved by pre-paid and post-paid user subscriptions. A variety of revenue sharing models are proposed to venues depending on the location importance, but generally upfront investments must be covered to a specified extent before sharing revenues with venues. Venues also participate by selling prepaid cards.

Current Experiences. Business customers perceive public WLAN as a natural extension of cellular services. Services are mainly used to increase productivity and shorten waiting times. Although usage of installed hotspots is lower than expected, some usage picks could be observed in certain locations during specific periods of time (e.g. winter tourist centres hotspots during the winter holidays). On the other hand, site acquisition has proven easier for WLAN hotspots than for UMTS and little problems regarding interferences were experienced. Training of the venues' personnel, support in marketing of the service and special training of call centre personnel were crucial to assure high quality and adequate customer support.

Case Study: Sunrise, TDC Switzerland[5]

TDC is Switzerland's second largest MNO (18% market share) marketing cellular services under the brand Sunrise. WLAN services are not yet operational but planned for 2003. WLAN is seen as an important competitive weapon, penalizing operators without a WLAN service offering. Therefore, WLAN is planned to extend the existing business and increase customer loyalty.

Value Proposition. The service, based on 802.11b technology, will be provided as part of a comprehensive wireless service bundle. It will be initially restricted to wireless Internet access without value added or security services aside from recommendations. TDC will offer venues to enhance their attractiveness to end users through their brand and single point of contact for wide area WLAN access.

Customer Relationship. The service will be targeted at existing business customers and offered under the Sunrise brand. Customers will therefore have a single point of contact with the enterprise: WLAN services will be communicated using direct channels, customer support will use present Sunrise infrastructure and WLAN will be billed together with cellular services. In this context reliability of the service and its bandwidth as well as short reaction times will be a priority. In cases of exclusive hotspot coverage, prepaid and roaming services could also be offered.

Infrastructure Management. The customer relationships activities such as billing and customer care will be performed internally, whereas other activities like hotspot set up and operation may be performed by partners depending on the type of hotspot. TDC intends to make use of their experience in wholesaling to offer relationship management also for multi provider models to venues. A flexible business model without the restriction to end-to-end solutions is planned. The coverage of their service is to be selective based on the communication needs of existing customers.

Financial Aspects. Revenues are to be primarily achieved by postpaid subscriptions of existing Sunrise customers and shared with venues. Besides revenues from non Sunrise customers, no further revenue streams are expected in the initial stage.

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[5] Interview with Ezra Stein, Marketing of Broadband Services Sunrise Mobile

Case Study: Monzoon[6]

Monzoon is a neutral "greenfield" start-up company founded in the fall 2000, offering WLAN broadband Internet access and services. At present Monzoon operates about 25 hotspots in Switzerland. In the future Monzoon plans to provide additional value-adding services such as printing or location based services.

Value proposition. Monzoon's core offerings are the installation and operation of 802.11b-based WLANs at venues of corporate customers. Based on its innovative software solution, Monzoon is able to offer AAA services, facilitating commercial deployment of public WLANs and roaming with other WISPs. Monzoon also offers training to venues' staff and support for service marketing activities. A free encryption solution enabling secure data transmission is offered through Monzoon's web-site for download to end customers.

Customer Relationship. The main target customers are business customers, who are interested in providing WLAN services to their end customers. Monzoon has abandoned the idea to directly target end customers as this market segment is already occupied mainly by MNOs. However, Monzoon has organised several broad marketing events with the aim to develop the market (e.g Surf-am-See in summer 2001 and "Surftrophy" in summer 2002, where WLAN services were freely offered in the major cafes around the Zurich lake).

Infrastructure Management. The network is composed of autonomous hotspots connected to ISPs. Installation and operation of hotspots is performed in co-operation with a broad network of business partners. Technical partners are CISCO, IBM, and TOGEWAnet. Customer support is outsourced to professional call centres. Of strategic importance are roaming partners operating different kind of networks or providing enterprise-grade remote access services. Currently Monzoon has roaming agreements with five WLAN operators and with iPass, one of the leading provider of worldwide enterprise-grade remote access services. Further strategic partners are mobility providers like airlines.

Financial aspects. Revenues are achieved by prepaid scratchcards, postpaid subscriptions and yearly flat-fee subscription. The offered prices vary with respect to partners (e.g. customers of the partner Swiss airline receive special discounts). Revenues are currently shared with venues and in future it is planned to share them with content providers as well.

Current experiences. According to the experiences of Monzoon end customers use WLAN basically for e-mail and access to corporate VPN. The traffic volume varies at different hotspots. In average there are about 50 accesses per months, but most frequented hot spots achieve more than 100 accesses. Postpaid subscriptions are considered more convenient compared to scratchcards.

Case study: Netair[7]

NetAir is a very small start-up enterprise, currently in its creation stage, planning to offer WISP services on the Swiss Leman basin region. It tested its service during late 2002 in two hotspots and will make it commercially available in 2003.

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[6] Interview with Matthias Koch, CEO Monzoon Networks AG

[7] Interview with Patrick Winkler, founder of NetAir

Value proposition. NetAir provides a bare broadband wireless internet connection through the 802.11b technology. The basic service allows users to connect to a single hotspot and is positioned as a low-cost alternative to ADSL/cable connections. The premium version allows users to connect to the whole NetAir network. On the other hand there is limited support and quality of service guarantees except a 128 kbps minimal data rate and a maximum 24h interruption of service.

Customer relationship. NetAir targets the mainstream consumer market, with a particular attention towards early and late majority users, who are typically attracted by convenience and low prices (Moore 1999). In particular, the basic offering is directed to residential customers wanting a low cost Internet connection at home, while the premium service is directed to mobile users equipped with a WLAN enabled laptop.

Infrastructure management. The NetAir network is composed by autonomous hotspots, connected to the Internet by independent connections, sharing only the authentication and security software. The network covers different types of residential and public locations. Basically, the network is created using a hybrid approach: NetAir takes care of network planning, deployment, operation, maintenance, promotion and contract management, while involving users with an existing broadband connection in becoming part of the network, by sharing their existing broadband connections and hosting wireless equipment on their properties in exchange of revenue sharing possibilities. NetAir would also like to sign roaming agreements with other WISPs and roaming brokers in order to increase coverage and customer base. Other business partners are resellers (who promote the service for a commission), ISPs (who rent ADSL lines to connect the hotspots to the Internet) and equipment vendors.

Financial aspects. NetAir expects to gain revenue from monthly flat rate user subscriptions. Part of this revenue is shared with affiliate users depending on hotspot utilization. NetAir expects a two years payback period.

5.5   Community WISP

Case study: Myotis[8]

Myotis is a non profit association created in November 2002 aiming at creating an autonomous community WLAN covering Lausanne. The association already has a dozen members and operates a couple of hotspots, but hopes to reach fifty members and an adequate number of access points within 2003.

Value proposition. Myotis basically contributes to create a metropolitan community wireless network in Lausanne by helping members to deploy hotspots, federating them in a common network, coordinating their deployment (e.g. for avoiding interference) and collaborating with similar networks. Moreover, the association offers knowledge sharing and formation courses on different WLAN topics and allows experimenting with new wireless technologies and applications.

Customer Relationship. Myotis adopts a tiered customer relationship model. Members have full and unrestricted access to the community network and its services, while non members are offered restricted services (i.e. low bandwidth Web access). Commercial sale of its bandwidth might be considered to raise additional funding.

Infrastructure management. Initially, the network will be composed by autonomous hotspots set up by the association's members, linked to the Internet through independent

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[8] Interview with Jean-Christophe Heger, founder of the Myotis association

residential connections and sharing a common authentication system. Afterwards, a backbone network (copper lines and point-to-point wireless links) might connect the different hotspots, providing redundancy, load balancing and eventually sharing a common high speed Internet connection. Hotspots will be set up and maintained by single members, who are assisted by Myotis to select, install and configure the necessary equipment. The association also manages the authentication service and promotes the network.

Financial model. Members of the community are required to pay an initial and annual fees, which shall be used to extend the network and provide formation courses. They can also contribute on a voluntary basis with equipment, knowledge and work. Connection fees are, at least initally supported by single members providing access to their connections.

Current experiences. Currently, the major concerns are attracting new members and fostering their involvement. Additionally, Myotis is concerned in protecting itself against abusive usage of the community network.

6. Discussion

In this section the basic findings of the cross-case study will be discussed from two perspectives: 1) From the different aspects of business models following the previous structure and 2) from the point of view of the business models identified in the WISP classification framework.

Value proposition. Today, available WLAN technology is standardized and provides little opportunities for service differentiation based on bandwidth or quality of service. WLAN providers offer best effort with a maximum of 2 mbps. As a result providers have to seek differentiation opportunities in other spheres. Based on the interviews we can identify four differentiation opportunities: 1) Through leveraging strong existing customer relationships; 2) through fast establishment of partnerships and co-branding with companies having strong relationships to end customers; 3) through fast establishment of exclusive partnerships with attractive locations with a high frequency of end-customers in the early adopter business segment, e.g. airports, and 4) through the quality of added AAA services (for example is metered payment possible or not). Value-adding services as location-based or printing services might become an additional differentiation sphere in the future.

Players are not equally suited for taking advantage of these opportunities, due to their differing core competencies and resources. MNOs can leverage existing customer relationships and customer support infrastructure, and can offer integrated solutions with their cellular networks (e.g. see Laine 2002). In combination with fast occupation of locations, these core competencies provide the basis for a strong market position.

Start-ups targeting the business market as Monzoon, seek to balance out their lack of direct relationships to end-customers by early occupying attractive venues, by rapidly attracting early adopters, by establishing early relationships to potential multiplicators of their services as for example airlines, and by early roaming agreements. Another differentiation opportunity for start-ups in the future are development of competencies for offering value-adding services as for example printing services.

Alternatively, start-ups targeting the end-consumer market as NetAir, try to occupy particular market niches, e.g. by focusing on particular locations or geographical regions or by targeting particular customer segments (cf. Netair and Myotis). Venues and

companies also have an opportunity to enter the market by leveraging their location (cf. Zurich Airport and CHUV).

Customer relations.

The way that customer relationship are handled differs widely between the identified WISP categories. MNOs can leverage their existing customer care infrastructure, customer information, experience and billing systems to provide a more effective and efficient customer support. They can also rely on a well established brand and customer base to communicate and promote the service. As venues are not primarily interested in handling the customer relation regarding WLAN, clearly MNOs are positioned best taking care of customer relations. But, this holds only for domestic customers. Incoming foreign potential customers can only be addressed through co-branding and partnerships with international players as well as customer and brand owners. While WISPs targeting the business segment must provide impeccable customer support, other players deliberately rely on a minimal support to allow inexpensive offerings (cf. NetAir) or prefer outsourcing the customer relationship to other firms (cf. Zurich Airport).

In general, all interviewed parties highlighted the underdeveloped market for WLAN. This is due to several reasons: 1) Currently most companies do not have a strategy how to handle end-devices and WLAN usage; 2) customers are generally not aware of WLAN services and hotspot location, 3) WLAN-enabled end-devices are just starting to appear, 4) coverage is still limited and roaming agreements between WISP are not in place, and 5) security concerns are a serious burden for developing trust in WLAN services. In order to develop the market all players have to engage in broad marketing activities targeting end customers.

Infrastructure management.

All players relay on a broad network of partners to provide their services. But, one major difference is that MNOs generally have an established network and start-ups have to establish and develop it. To provide a reliable service, support and communication activities especially for business customers, the centralized top-down approach of building networks seems to prevail. First experiences show that initial investments in the installation of access points are low compared to costs for providing AAA and support infrastructure.

A crucial partner for all commercial WISPs are venues. Venues are ultimately interested at satisfying their customers but lack competencies in the area of WLAN. Therefore, training of the venue's personnel as well as support with marketing of the service is a key success factor for the service. However, the motivation of the venue to market the service will depend on the revenue-sharing model. Venues that are not offered a share of revenues resulting from usage of the installed WLAN are not interested in marketing the service.

Financial model.

Most commercial players use subscription models, basically using different variations of flat rate pricing schemes. Slight variations are also found in the payment means accepted, including prepaid cards, postpaid subscriptions paid by credit card or through an existing billing relationship. Here again MNOs have an advantage as they can leverage existing billing relationships. Metered payment has proven to be expensive to implement and only Swisscom Mobile aims at such a services. Volume based models are considered not feasible as users are not able to estimate transferred volumes of data. In the future, attractive revenue-sharing models will be necessary for the development of relationships to venues, content providers and providers of value-adding-services.

Experiences.

So far, interference with other networks related to installation or operation of access points has not shown to be a problem for any of the players. However, the actual usage of WLAN by customers has been below the expectations. Today in Switzerland, services are mainly used by business customers for e-mail and corporate access, even though with a lower intensity as expected. The mass market is largely unaware and uninterested in WLAN services. Although all players offer prepaid cards, they are perceived to be highly inconvenient, due to the fact that users can not simply start using a service when they detect it.

Based on the findings described above the following conclusions can be drawn for the business models of the different type of WISP described in the classification framework:

Private WISPs in many cases, have opportunities to leveraging their infrastructure by offering WISP services to customers. Entities like hospitals, universities, and households, might therefore evolve towards becoming hotspot WISPs or join a community WISPs. These entities might require to partner with a commercial WISP or technology enabler (e.g. a middleware software provider) to enhance the internal WLAN with AAA services and market the service.

The results of the survey show that **Hotspot WISP**s can further be classified in different subtypes. Venues basically differ in their attractiveness and potential to offer WISP services, due to the type of customers they normally have and the time and need that these may have to access network services. WISPs also differ in the competencies to operate a WLAN by themselves and to manage the customer relationship. These factors may strengthen the position of the venues in their negotiations with WLAN operators. For example venues which are attractive and have adequate network operation and customer relationship management such as the Zurich airport can obtain very favorable conditions and may host several WLAN providers. Such multi-operator hotspots are very much likely for similar venues and open the opportunity for new services enabling roaming and AAA services in a multi-operator environment.

Wide Area WISPs can also be divided in subcategories depending on the competencies and core business of the firm. While MNOs targeting quality leadership try to operate their own end-to-end solutions, others try to build on flexible business models offering start-ups the potential to sell to MNOs and ISPs as their wholesale customers. Wide Area WISPs have the potential to become the dominant WISP business model, but face the greatest risk and competitive pressure. At the current stage of the market development the most important race is for the attractive venues and roaming agreements with multiplicators. In the future the battle might be transferred in the area of value added services.

Community WISP is the most endangered type of WISPs. Obstacles to community WISPs might appear from different sides. Prevailing ISPs try to legally prevent a community usage of existing Internet connections: clauses prohibiting sharing of the connection have already been included in the contracts. In addition, communities may suffer from abusive usage problems, security concerns, scalability of self-organized solutions and the ability to create awareness and attract new members.

7.   Conclusion

This paper investigated the current situation of the Swiss WISP market. In order to ensure that the whole range of the current strategic approaches are investigated, a general

classification framework is proposed and used as a base for selecting the enterprises to interview. The case studies showed that the WLAN market is an emerging and highly dynamic market. From a business angle, WLAN seems to follow a complementary path to existing wireless and wired infrastructure based networks. But, at this point of time it is still open which business models will survive and further developments will very much depend on the speed of adoption of the technology by end customers.

In future, further research will be needed to verify the first results with a quantitative study and by comparing the results with surveys of other countries. As WLAN usage will pick up beyond the early adopter business segments, research on the application of diffusion models, disruptive technology or competitive strategy theories will lead to additional insights.

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