An Investigation of the Business Model in the Karlskrona Municipal Wireless Network in Sweden

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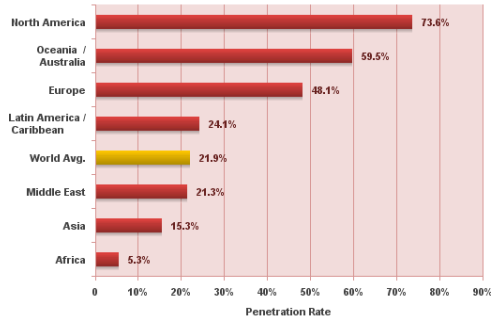
Abstract: In this paper, an investigation on an emerging operational "business model" for the municipal wireless network in the city of Karlskrona in Sweden is explored. We inquire into the association between of different actors involved in the business model implemented by Karlskrona municipality in our selected case study, and identify a number of key considerations in the business model and wireless city services for municipality when it is initializing and deploying the municipal wireless network as a business driven and public-utility driven service.

1. Introduction

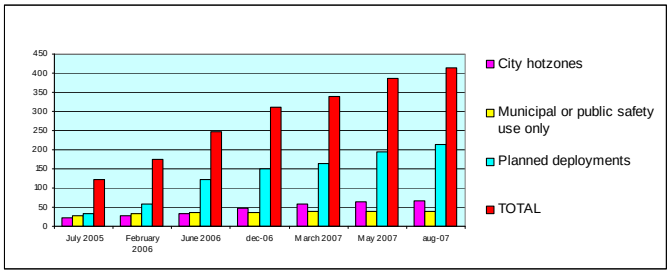
Municipal (Muni) wireless network is a recently established form of city-based wireless network, which provides mainly outdoor broadband wireless access to Internet for public usages. The wireless city is usually regarded as a public-utility service, which not only delivers well connected broadband services in the city at an affordable price but also promotes society interaction, bridges the digital divide and brings sustainable development to support municipalities, therefore the concept is attracting more and more attention from city authorities both in developed and developing countries. Graph 1 shows the current Internet usage worldwide. It can be seen that there is a distinctive penetration rate between developed and developing regions, which means there could be a high demand on Internet usage from developing regions.



Graph 1. Internet usage services worldwide by 2008[1]

There are hundreds of cities, which have deployed and have plans to build wireless broadband networks over their territories. Graph 2 shows a tendency of wireless internet services covered by city-wide network from the official web site of MuniWireless[2].

[1] Internet World Stats – www.internetworldststs.com/stats.htm



Graph 2. An illustration of tendency to have city wireless services

City authorities are closely involved in network initiatives and rolling out with various forms and scales at different stages, because it is often argued that inexpensive or even free of charge broadband access network are impossible, or at least time-consuming to be realized only depending on market forces. Generally, private network investors are cautions to protect investment, which could make the end goal of rolling out a full coverage area with an affordable price to be out of consideration. Therefore, employing a suitable business model of wireless city becomes an important choice regarding to the basis and design of wireless city networks.

In our paper, we select the wireless city of Kalrskrona, which is a Swedish city on the southeast coast of Sweden with wireless city services established in middle 2007, because its business model is potential among the other business models and is our main focus in our studies. This business model implemented by the Kalrskrona municipality has been achieved with low investments for external business partners involved, as well as open and fair access to wireless services within affordable price for local residents. These achievements are all significant challenges for a community and rural developing regions worldwide to successfully introduce Muni-wireless networks.

In this paper, we first investigate and summarize the existing business models of Muni-wireless networks implemented worldwide by distinguishing between ownerships of the network infrastructure and service provisioning. This step demonstrates the way to find appropriate rationale and system architecture of Muni-wireless network in our case study. To support our reasoning, we select the wireless city of Karlskrona for our case study and give a full analysis of its business model.

2. Existing Business Models of Municipal Wireless Network

Most of recent studies on Muni-wireless networks are rather vague to the various business models, which are conceivable and/or feasibly used in practice. A proposed classification is constituted by all potential combinations between two key roles (i.e. network ownership and network operation) that can each be taken up by common sorts of affiliation, such as: public, private and a combination of them(private and/or public) [1].

We follow the classification fit the considered case study. In order to have a convincing reason, we consider in parts both the network ownership and the service provisioning ownership. From the one side possession the physical assets and owning the users' relations on the other side, are the most major business roles that can be defined in these cases. Indeed, these business roles are often taken up by different actors. However operating the network infrastructure by itself is a less crucial role, and is usually either combined with network ownership or with service provisioning. Thus, knowing of what type of network ownership we can define as follows:

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[2] http://www.muniwireless.com

- **Private owner** - the network is operated on the basis of a contractual arrangement in form of a license and concession. Therefore, municipality can deliver the rights of access to city's sites (streetlights, traffic lights, municipal buildings and so on), existing backbones (fiber, wired backhauls), as well as financial support, and etc.
- **Public owner** – as the city authority that owns network and operates it by using municipality enterprise funds to cover infrastructure costs.
- **Open site owner** - the municipality provides open access to city's sites for the deployment of wireless network.

Then we define the different types of service provisioning as follows:

- **Private owner** – usually, a service provider, who supports and creates services to the network by gaining money from users' subscriptions and advertisements.
- **Public or Non-Profit owner –** a provider, who allows an access to network services by using municipality's funding or applying for state or philanthropic grants.
- **Wholesale** – can be consisted a group of private owners, who offer and provide services to end users.

The general scheme of the business model classifications can be obtained through the different variations of the network and service ownerships' relations, shown on the Fig. 1.

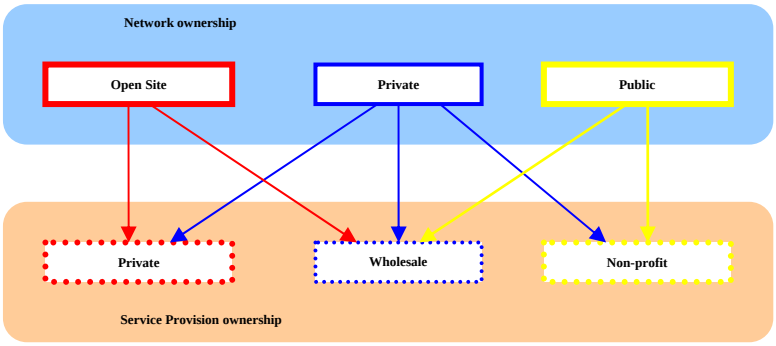

Fig 1. Business model for Muni municipal wireless network

- **Private-Private Model:** In this model the key roles, such as building of network, network operating and as well as service providing, are performed by the same private company. The influence from the municipality can be limited in terms of financial supports or exclusive rent access to city assets. In return the private actor would provide limited Internet access to residents with low or no cost.
- **Private-Wholesale model:** One of the most often used models in the US cities. The model is supported by deploying large mesh wireless clouds, whereby service is targeted towards the public usage. Public entity's prospects are that costs of deployment of Muni-wireless network are "nothing", though its profits are limited in rewarding from the network. Therefore, the public entity could retain a relative high level of influence, and take a less risk of claims to fairness among the different service providers.
- **Private-Public or Non-Profit model:** The private-public model is mostly used for large mesh wireless clouds, whereby the offered services for the public purposes. The positive gains for public authorities are that the financial inputs from the authorities remain insufficient and that there is unlikely unfair service providers' competition.
- **Public-Public or Non-Profit model:** The municipality builds and operates the network by itself in this model. All expenditures of network deployment and its operation are covered by the municipality, and service provision functions are run by the city municipality. However, it is obvious that it is not attractive model for long term run.

- **Public-Wholesale model:** The city builds and owns the Muni-wireless network. It signs an agreement with wholesale service providers, who would offer different contents with varied pricing subscriptions. Though this model is not commonly applied yet, for big cities like Boston, the US there has been planned to run theirs network based on it [1].
- **Open site – Wholesale model:** This model is almost similar to Public-Wholesale one. There is a difference that the access to build the network is granted to either for the open sites in order to provide the wireless access to the community (city's inhabitants) or for limited region of the city for a particular group of users (low-income families, or only for the public safety purpose). The service provision is run by a group of the ISPs (Internet service providers) by allowing customers to access to the limited services [2].

3. Case study – Wireless City of Karlskrona, Sweden

In middle 2007, Karlskrona, a city known as a historic naval and Telecom city on the southeast coast of Sweden, announced to have co-operations with *The Cloud*, the European wireless broadband network operator, to provide wireless city access in the city area. A fixed fiber network operator, *Affärsverken Karlskrona AB* which is fully owned by the Karlskrona commune, is on behalf of the municipality commune to cooperate with The Cloud to let the city be wireless.

Motivations of Karlskrona Municipality to build Wireless City

The motivations and benefits of building wireless city in Karlskrona have closely linked to the history and development strategies of the city. The municipality could enhance an already rich suite of social services, and improve innovative capacity via different services in the wireless city.

- Making the city more attractive to IT and telecom companies

A wireless city can be more attractive to new IT and telecoms companies, as well as facilitate business of companies in Karlskrona. Karlskrona, which was previously known as a 300-year-old fortress as well as old ship-building yard, has now successfully created a new type of city based on its strategy to support IT and telecom industries after 1990s. Wireless city gives companies a new approach to provide services as service providers. In addition, becoming a service partner of The Cloud can deliver their local services internationally without investing on the network infrastructures.

- Delivery of social municipal and tourist services

Wireless City gives local residences more freedom to acquire information through wireless broadband at anywhere in anytime. It is easy to access public internet resources, such as transportation, education, leisure services, and society activities. Additionally, wireless city can assist tourists to access the local websites in Karlskrona via different Wi-Fi enabled terminals.

- An natural expansion the city broadband network and increasing traffic

Wireless city can be naturally regarded as an expansion of the city fixed fiber network, which is owned and managed by *Affärsverken.* Since all the wireless network operators have to be the partner of *Affärsverken* in the business model, traffic passing through the fiber network is accordingly increasing, which brings more revenue to this municipal company.

Motivation of the Wireless Network operator-The Cloud

The main motivation for the wireless network operator *The Cloud* could be the predicted increasingly usage of wireless network by local companies and residents. The sustainable strategy of City attracts growingly attentions and investment on IT and telecom industries, and facilities internet connection of residents. For example, customers of *Telenor* can access

The Cloud's network for free, and therefore generate traffic passing through the network of *The Cloud*. It is also predicted that mobile broadband is going to replace the fixed broadband in the future, which creates a profitable market for wireless network operator. Fig 2 shows areas with wireless city service available in Karlskrona in 2007.

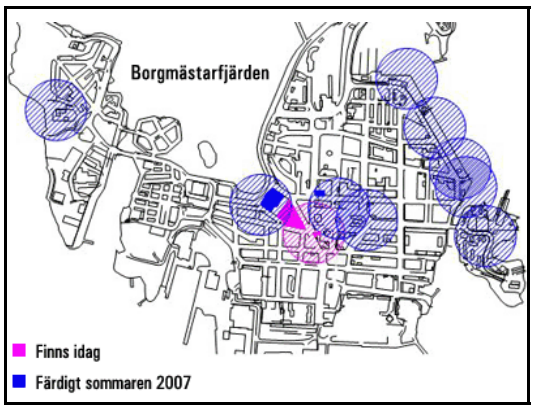

Fig. 2 Available areas in the city centre of Karlskrona in 2007[3]

Business Model Implementation in the Wireless City of Karlskrona

- Public-wholesale business model and its strength

The business model implemented in the wireless city of Karlskrona can be generally categorized as the Public-Wholesale model [3], where the local fixed network operator has established partnership with wireless network operator. Based on the co-operation with The Cloud, *Affärsverken* can accordingly extend its fixed fibre network to include wireless infrastructure at nearly zero cost, and subsequently achieve the goal of wireless city. It has to be noticed that the Karlskrona municipality has branded the network as "*Wireless City of Karlskrona*" and fully owned the brand. It indicates that the Municipality absolutely controls the wireless city network, and implements a neutral and open business model. New service providers and network operators can freely cooperate with *Affärsverken* and access to the business model.

In Karlskrona, *The Cloud* establishes the wireless network infrastructure and works actively with service providers, device and application partners to bring a range of experience into its sites [4]. Consequently, *Affärsverken* can share the revenue of The Cloud based on the traffic passing through its fiber network, and fully control activities of The Cloud to mainly keep a fair competition environment for different service providers and network operators.

Different roles of public and private actors involved in the business model are listed below.

- ***Local authority*** - The Karlskrona municipality initializes the wireless city and provides funding to *Affärsverken* on behalf of the municipality to act as a public force to build wireless city. The local authority also gives access to buildings and light poles for mounting access equipment [5].
- ***Fixed network operator*** - *Affärsverken* provides backbone and shares the revenue of the wireless network operator [6]. At the same time, it is a regulator, which takes control over the network on behalf of the Municipality.
- ***Wireless Network Operator*** - *The Cloud* mainly acts as a wireless network operator and brings services to end users. Being a network operator, it deploys and maintains the wireless network part in the wireless city. It could be also responsible for managing and outsourcing the network capacity for service providers, and shares revenue of service

[3] http://www.affarsverken.se/Privatkund/Stadsnat/Wireless-City/, 2006.

providers [5]. At the same time, *The Cloud* also provides an internet connection to the end user paying through the Credit Card Company or mobile operator by messages.

- ***Service Provide*** - It pays the network operator to let its customers to access the wireless network for free, or attracts new customers in the wireless city. In wireless city of Karlskrona, *The Cloud* has established partnership with various service partners, e.g. *Telenor, iPass, Spring PCS, Boingo, Trustive, Echovox SMS, AT&T*.
- ***Technology Partner*** - It manufactories and sells devices to network operators as well as end users.
- ***Credit Card Company or 3rd party*** - In wireless city of Karlskrona, it is responsible for charging and identifying end users, who don't have partner accounts of The Cloud in order to access the network. The payment module is widely used and gives a convenient way for users to subscribe services in the wireless city.

The model is shown in Fig. 3. By implementing the business model, Municipality can manage different actors in network rolling out, service provision and revenue sharing. Based on the collaborations with *The Cloud*, Municipality has low investment on the wireless city infrastructure and low administrative burden. It fully achieves the goal of owning and controlling the network, open access for any wireless network operators and service providers, and provides an affordable price for public access in the city.

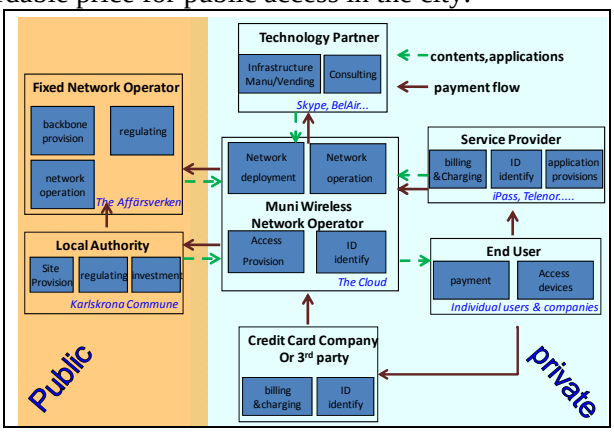

Fig. 3 Business model of wireless city in Karlskrona, Sweden

Weakness of the Business Model

- *The Cloud could not be a really open and fair network operator in the wireless city*
  Ideally, *The Cloud* should not involve in selling internet services to end users as network operator. A distinct weakness is due to the natural conflict of *The Cloud* acting as an ISP and network operator. As an ISP, *The Cloud* expects as many customers to buy service directly from it. However as a network provider, *The Cloud* has to sell access to other competitive ISPs. It can be hard for the ISP as well as the network operator not to discriminate against its competitors as well as customers. It is to some extend against the neutrality in the business model.

- *The Wireless City is collaborating with a potential competitor*
  Basically, there are no limitations to be accepted as a partner of the wireless city due to the revenue sharing module. Therefore *The Cloud* can establish partnerships with mobile network operator (MNOs) like *Telenor*, which can be regarded as the most potential competitors due to competitive 3G data technology and a stable customer resource. These partners could terminate collaborations with *The Cloud*, and provide mobile broadband services as competitors.

- *The partnership may be not stable if some service providers are going to collaborate in the same type of business with new network operators*
  Currently *Skype* is a major service provider of *The Cloud* and accordingly is a service provider in the wireless city. However customers now make *Skype* calls in some mobile handsets, which means it is possible to attract customers to use mobile broadband services from MNOs rather than wireless city.

Opportunities and Threats in terms of Subscriptions & Pricing Schemes

Easy subscriptions, reasonable price with no binding offerings are provided by the wireless city of Karlskrona compared with broadband services from fixed ISP and mobile network operators. Users have more freedom to choose the time and duration of subscribing the internet services in wireless city, and have four alternatives to subscribe the services. There advantages are giving opportunities for the wireless city to attract more customers.

- Paying to different service providers, e.g. *Telenor*, *iPass*.
- Buying airtime and making a payment through the Credit Card Company.
- Paying by sending a message via mobile operator network to acquire user name and password to log in.
- Buying the coupon valid for one-day or seven-day at coupon retailers in the city.

The price of accessing the wireless city network by paying through credit card for 30 minutes is SEK 40 and SEK 295 for 30 days. There is no binding and cancellation notice included in the offer. Compared with other ISPs in Karlskrona, e.g. the *Jacket Broadband AB*, *Tele2*, *Telia* and *Telenor*, the price offered by wireless city of Karlskrona is reasonable regarding to the broadband services available in most areas of the city. Users could also choose to be the customer of The Cloud's service partners, and therefore have free access to the wireless city network. This module is suitable for local IT and telecom companies to attract more customers by give them free access in the wireless city as a reward. Table 1 gives a comparison on subscription between wireless city and other fixed ISPs in Karlskrona.

Table 1. Subscription comparison among fixed ISP in Karlskrona[4]

Items/Provider	Wireless City	Jacket	Tele2	Telia	Telenor
Charge (Kr/Mon)	295[5]	298[6]	299[7]	279[8]	349[9]
Speed limit (Mpbs)	11 or 54	24	100	8	24
Connectivity	Wi-Fi	ADSL	LAN (ADSL)	ADSL	ADSL
Connection fee (Kr)[10]	0	495	0	495	0
Binding period (Mon)	0	12	12	18	12
Cancellation notice in advance (Mon)	0	3	3	3	3
Mobility	Yes	No	No	No	No

Since the wireless city service is not free, it is obvious to face a threat from mobile broadband services provided by MNOs. Table 2 shows a comparison on subscriptions between wireless

[4]Price information is available public websites of companies and checked on November 13, 2008.
[5]http://www.affarsverken.se/Privatkund/Produkter_och_tjanster/Stadsnat/Wireless-City/
[6]http://www.jacket.se
[7]http://www.tele2.se/via-stadsnat.html
[8]http://www.telia.se/privat/produkter_tjanster/internet/bredband-via-telejacket/
[9]http://www.bredbandsbolaget.se/wps/portal/privat/bredband?page=new&WCM_GLOBAL_CONTEXT=/wps/wcm/connect/b2/privat/bredband/bredband24
[10]Connection fee can be charged if the contract is less then the binding period, and it varies depending on companies. Generally, network installation and modems are free of charge if the contract is longer than one year.

city and MNOs in Karlskrona in terms of mobile broadband services. It can be seen that mobile broadband services from MNOs are more competitive in terms of mobility and coverage over the country. However, wireless city services can be more suitable for local residents and industries since speed and stable services are more important.

Table 2. Subscription fee comparison among fixed ISP in Karlskrona[11]

Items/Provider	Wireless City	3G	Tele2	Telia	Telenor
Charge (Kr/Mon)	295	199	189	229	199
Speed limit (Mpbs)	11 or 54	7.2	7.2	7.2	24
Connectivity	Wi-Fi	3G	3G	3G+WLAN	3G+WLAN
Connection fee (Kr)	0	250	0	0	250
Binding period (Mon)	0	12	12	18	0~24
Cancellation notice in advance (Mon)	0	3	3	3	3
Mobility	Yes	Yes	Yes	Yes	Yes

4. Conclusions

In this paper, we have given an overview of existing business models of wireless cities worldwide based on the different ownerships of the network infrastructure and service provisioning. Furthermore, we have taken the wireless city of Karlskrona in Sweden and made a case study on main drivers, business configurations, pricing and subscription schemes regarding its business model. Generally, the concept of Muni-wireless cities can not be treated as a pure business case since it has public and non-profit attributes. Based on our analysis of the case study, we come to the following conclusions:

1. Municipal initiative is essential. Wireless city can be regarded as a symbol of a city and facilitated local activities. In our case, the Karlskrona municipality plays an important role to take the decision of building Muni-wireless city based on local municipal profiles and development strategies.

2. Fair and open environment is more efficient for supporting competition among all parties involved. Moreover, transparent business interactions inside Muni-wireless are mostly expected from the municipality. Whether being forced or volunteered to open its network, the Muni-network operator needs to provide opportunities for any ISPs and wireless network operators to be fairly associated into the network. It could be regarded as an emerging intention compared with traditional concept of wireless city, where a single company monopoly occupies the most positions in the business model of the wireless city.

3. Wireless city services could be necessary to be free of charge, while people would inquire about certain information, e.g. public transportation timetable, based on its public-utility essence. A flexible and easy subscription plan, competitive pricing schemes and high-speed connection rates could make the wireless city to be the most promising alternative to displace traditional fixed broadband and succeed ubiquitous mobility as a bonus.

4. Low investments from a municipality could be achieved through the public-wholesale partnership business model. In Karlskrona, the municipality can be regarded as a lossless actor in the market. It doesn't need to put much investment funds to the wireless network

[11]Price information is available on the same websites accordingly in Table 1.

infrastructure, but it gains the privileges for its residents and local businesses. The investing of all the actors involved in the business model is economical compared with the traditional monopoly model.

Based on our investigations, the business model - public-wholesale based on partnership collaboration - is suitable solution for developing regions to deploy Muni-wireless network. Unlike the traditional business model, it could maximize user choices, create a fair competition environment, remain the municipality as a leading regulator and activate all parties in the business model.

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