

Paper submitted for the Global Mobility Roundtable,

Los Angeles, June 1-2 2007

Title:

**Customer relations and business role interaction
for
wireless access provisioning in local environments**

Jan Markendahl

Wireless@KTH

Royal Institute of Technology

Electrum 418

S-164 40 Kista

Sweden

jan.markendahl@radio.kth.se

phone: + 46 70 663 01 63

Östen Mäkitalo

Wireless@KTH

Royal Institute of Technology

Electrum 418

S-164 40 Kista

Sweden

Osten.makitalo@wireless.kth.se

phone: + 46 70 595 77 30

Customer relations and business role interaction for wireless access provisioning in local environments

Abstract

In this work we present results from the Swedish Tele-economic research project Novel Access Provisioning. We target business aspects for wireless access services in the local environment with focus on concepts that enable public access for anyone. Key characteristics are high data volumes and data rates combined with low cost, low price or access for free.

For fixed and mobile telephony and for Internet access services the traditional business model is based on a long term business agreement between the end-user and the provider, the subscription. Internet access now changes from mainly being a service consumed in own and fixed locations to be a service used at any location. The main topic in this paper is to address what kind of market actor that will be the most important for the provisioning of these public Internet access services - traditional operators or new market actors?

The research questions and methodology are related to business roles, market actors, customer relations, payment options and business mechanisms. The analysis is based on interviews with market actors within and outside the telecom sector that are candidates to take one or several business roles for access provisioning. Groups of business models, i.e. different ways to form the value constellation, were identified based on three groups of business roles; network operation & access provisioning, customer relation management & customer acquisition and establishment of trust & payment relations. Customer relations and payment options were analyzed and common characteristics of a SWOT analysis were summarized.

The main finding of the analysis is that local access provisioning to a large extent differ from the traditional operator business based on subscriptions. Low cost, high capacity public internet access is often a kind of “here and now” support of the daily life activities and are often based on temporary (“short term”) customer relations. The main conclusions are:

- 1) Actors from outside the telecom sector start to enter telecom business
- 2) The local access is closely related to other kind of services or part of a bundled offer
- 3) The main driver for new providers is to support the core business rather than to get revenues from an independent access provisioning business.

The most important company assets are the “short term” customer relations and the possibility to temporary have access to and to “control” the customers in the local environment, e.g. a hotel, a restaurant, an airport, a train or a bus.

1. Introduction

The usage of Internet services is currently changing from mainly being a service consumed in fixed and known locations like your home or at your work to be a service used at any location. In the Novel Access Provisioning (NAP) project [1][2] we study wireless access in the local environment with focus on concepts that enable public access for anyone [3]. Other characteristics are low cost, high data volumes and data rates [4][5][9].

One trend for voice services is that people tend to shift from fixed line phones and subscriptions to mobile phones and/or usage of voice over IP using broad band Internet access. Another trend is that wireless broad band access becomes available outside homes and offices. Two development paths are observed, see figure 1:

- Mobile network operators offering Internet access as a wide area coverage services
- Local market actors offering internet access in the local environment

For fixed and mobile telephony and for broadband connections the business model has been the same for many years. End-users have an agreement, a subscription, with an operator that provides the service. For mobile telephony the service is extended also to other countries, the user can use the same subscription when visiting foreign countries provided that roaming agreements are established between operators.

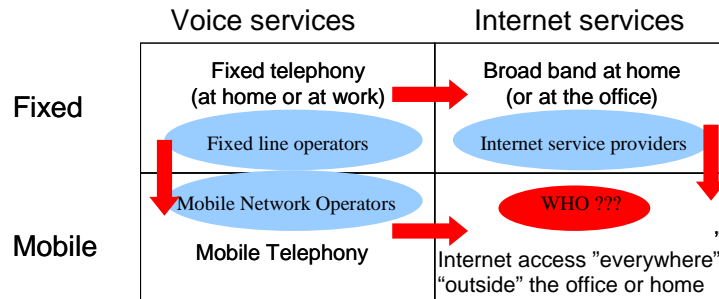


Figure 1 Fixed-Mobile, Voice-Internet Services Matrix

Now one question is obvious: what kind of market actors can provide services outside the home or office. Candidates are of course Mobile Network Operators (MNOs) and Internet Service Providers (ISP). However, it turns out that there are other types of market actors that can and already have started to offer, if not truly mobile at least wireless, broad band access services.

This paper will identify and describe some of these market actors, both within and outside the telecom sector. We will focus on cases where the local wireless access is provided "here and now" often as support to a non-telecom core business. The customer relation is often temporary and short term and the access service can be provided at low cost or for free. Based on a set of interviews we will also try to answer why market actors with established billing relations and/or long term customer relations show low degree of interest or have difficulties to enter this kind of market.

2. Problem background and research questions

The differences between fixed telephony and broad band connections compared to mobile telephony can be seen in both the technical and business domain of the different roles that need to be taken. For fixed telephony and broad band subscriptions you have your own dedicated resource, the fixed physical connection. This connection ends at a fixed location which is under the control of the subscriber, Hence, security and privacy is provided at a basic level you don't need to authorize yourself for every new call or session in this environment.

For mobile systems the situations is quite different, especially when the access is to be provided by different operators. Firstly, the users don't have dedicated communication resources; these are allocated dynamically according to the demand. Secondly, the user needs to provide identity information to every operator to which network the user wants access. Finally, the operator needs to have functions for access control. For the case where users may switch access provider for every session, the access control need to be active all the time.

For the different types of functionality mentioned above different roles can be identified;

- Provisioning of user identity,
- Checking of user identify,
- Access and admission control and
- Dynamic management of the communication resource.

In order to provide a full value proposition other types of business roles are also involved:

- Deployment, operation and maintenance of the network
- Development and provisioning of value added services
- Marketing and sales in order to attract customers
- Customer relation management and billing

The current cellular operators provide all of the roles listed above as part of a vertically integrated value chain. The main problem area deals with the situation where different providers are responsible for types of functionality and the related business roles.

We will discuss new forms of cooperation between market actors for provisioning of low cost, high capacity wireless access services in a local environment where a set of research questions can be identified:

1. Which business roles are identified for local access provisioning?
2. What kind of market actors can be observed?
3. What kind of customer relations and payment options are possible?
4. What kind of business relations and mechanisms need to be in place?

3. Methodology

Interviews and case studies

The case studies are based on more than 40 interviews with market actors, both within and outside the telecom sector [6]. The questions were focused on drivers for provisioning of wireless access, capabilities and partnerships. The results for the case studies are summarized in section 5.

Identification of business roles

From the analysis of the case studies seven basic business roles needed for local access provisioning were identified [1]. These are presented in section 4 in order to facilitate the description of the case studies to follow in section 5.

Grouping and analysis of value constellations

The next step was to analyze different types of value constellations observed in the case studies and to structure and group these into a value constellation map [7], see section 6. Five main groups of business models, i.e. types of interaction between market players, could be identified.

Analysis of types of customer relations

Next, the type of customer relations was analyzed together with payment options. Finally, a way to structure different kinds of customer relations and payment options were proposed and tested for the case studies and business models.

4. Business roles and company assets

From the analysis of the case studies we identified the following seven basic business roles for provisioning of local wireless [1]:

- *Site operation*. To provide (“operate”) the physical local environment where the access service is offered and consumed e.g. a restaurant, a hotel, a train or a public area.
- *Customer acquisition*. Actions that put attention to and attracts consumers to the access service. This can be direct marketing and sales of the access service as a stand alone feature or bundled with offers of the “core business” of the site owner, e.g. food or travels.
- *Identity and trust provisioning*. A business role that provides the identity of a potential consumer of the access service and/or a trust relationship with consumer that ensures that he or she can be trusted as a user.
- *Charging & Billing*, also called payment provisioning, includes two parts; the charging that is the collection of data use to calculate the usage fee for the case it is dependent on amount of usage and the end-user billing that includes presenting the bill to the customer and collecting the payment.
- *Access provisioning* both deals with how users are granted access to the network as well as how the network resources are controlled and shared between the users.
- *Network operation* includes operation, monitoring and maintenance of the physical infrastructure and support systems, often also network planning and deployment.
- *Provisioning of backbone capacity* is the business role that connects the access network with “the outside world”, technically it is a matter of transmission network resources

Companies have different types of capabilities and resources which determines what kind of business roles they can take [9][10]. The example in figure 2 illustrates what business roles different types of business entities can take, note that the responsibilities are overlapping.

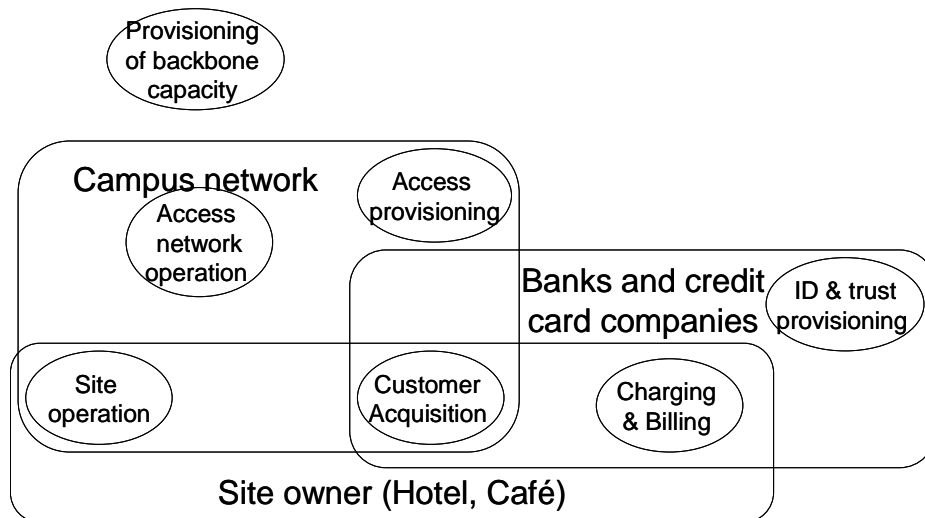


Figure 2: Examples of business roles and associated company assets

5. Case studies

Based on “state of art” analysis and on interviews with companies using new networking and business concepts for local wireless access a number of case studies are presented.

Public Access to cooperating private networks - The FON concept

FON¹ started in Spain late 2005 and during the spring 2006 launched operation in the US and many European countries. Currently (March 2007) FON has more than 360 000 hot spots world wide and more than 20 000 hot spots in Sweden. The FON concept is based on public access to private access points, where a FON member (a Fonero) with WLAN access point allows other “Foneros” to use the access. The usage is cheap or for free but economic incentives and revenue sharing between FON, the ISP and the Fonero providing the access point are part of the business model.

A Fonero gets a user name and the FON login and security procedures enable access to other networks belonging to the FON community. Users wishing to offer use of their access point to other FON members are provided with software that implements the relevant functionality at the WLAN access point required to allow the access. The users are divided into three classes: Those that allow public access to their WLAN access point in exchange for free use of other FON access are called “Linus” users. “Alien” users are those that pay a fee every time a connection to a FON WLAN network is made. Those that allow public access to their WLAN access point are called “Bill” users.

Glocalzone – a wireless city initiative

The Broadband operator Glocalnet, part of Swedish Telenor, offers wireless broad band access in 20 Swedish towns, a concept called Glocalzone². Trials have been performed in three towns during the summer of 2006 and the service is launched during 2007. This concept differs from the co-operation between the mobile network operator Telenor and the WLAN operator The Cloud which focuses on the business segment with indoor coverage in hotels, conference facilities etc. Glocalzone focuses on the consumer segment with both indoor and outdoor coverage in public environments like parks, cafes etc. Glocalnet is now looking for partners among different kind of “site owners” offering free installation of access points, free broad band and telephony for company use and also sharing of revenues from the paying users of the specific “Glocalzone”.

The wireless access is for free for all Glocalnet customers with fixed, mobile or broadband subscriptions. Note that this is valid in all “Glocalzones” in Sweden and not only in your “home town”. “This is an effort to support our core business as an ISP” one representative for Glocalnet says. For those that are not Glocalnet customers the access is possible for a fee ranging from 2 Euros per hour to 15 Euros per month.

¹ www.fon.com

² <http://www.glocalzone.se/>

Other examples of “Wireless cities”

Wireless city projects that were initiated a couple of years ago and driven by local organizations, e.g. in Austin³. Facility owners, shops etc could contribute to the wireless access and the local organization provided “some” support and also equipment, mainly in the deployment phase. A number of initiatives for larger metropolitan wireless networks have been reported⁴. In many cases, London, Philadelphia, San Francisco, Portland and Taipei, the local authorities had initiated the plans for such networks being a utility for the citizens.

As discussed in [8] another driver is that the cities own many type of infrastructure, e.g. traffic signals and street lights, which can be used for network deployment. Another interesting observation from the business case analysis is that access to city networks consisting of many, possibly small, networks is handled by overlays that offer login and authentication procedures for all users. This is similar to the FON concept.

WLAN operators with traditional business model

Public Internet access provided by access providers cooperating with site owners have existed for many years, e.g. Telia Homerun in Sweden. Most of the WLAN networks deployed by the telecom operators have traditionally been built with focus on the business traveler segment. These operators are generally using a traditional vertical telecom business model, i.e. trying to control the access network, the core network and the service platforms.

WLAN operators with open business model

WLAN access can be provided using an open business model which creates a number of opportunities for most players in the value chain. The network operator type of market actor is responsible for deployment and operation of the network and can focus on issues like dimensioning, assurance of quality and availability. One example is The Cloud⁵ which in Sweden operates networks at railway stations, in fast food restaurants and in airports. One representative for The Cloud says “we have been chosen mainly due to the fact that we offer solutions with open access...” The same person also foresees a large potential with this kind of cooperation with “an increased coverage in a broader range of site categories and an increased flexibility in differentiation of services due to cost and performance”, i.e. not only for business users. The site owner can be an active part and bundle the access offer component into their core business offer ensuring access for own customers or visitors. This is efficiently achieved by an agreement with one partner (the access provider) and using one infrastructure. New opportunities can be identified by revenue sharing and contribution to local marketing and sales. Traditional operators can also benefit from this business model and can focus on offering and bundling of services and on customer support. It is interesting to note cases where mobile operator subscriptions are used to “authenticate and bill” the “own” subscribers that use the open access⁶.

³ <http://www.austinwirelesscity.org/>

⁴ www.muniwireless.com

⁵ <http://www.thecloud.com/>

⁶ <http://www.ganag.com/>

Internet on trains - example of a closed business model

One example of a “closed” business model is train companies that offer Internet access onboard trains during the travel. The connectivity for the Internet access in trains is provided by a combination of 2G, 3G and satellite systems, also involving several cellular operators. The technical solution (with a high degree of novelty) is provided by a systems integrator⁷. The train operator provides the network, the site and the customers and hence represents a traditional operator business model. The access at the trains can be free (for business class travelers) or require a special fee (in economy class). In Sweden no plans exist at the moment to allow users with subscriptions with a telecom operator to be billed through the operator for the usage. One of the main drivers for “internet on trains” is to support the core business. The Swedish train company SJ wants to compete with the domestic airline companies.

From a UK train operator it is reported that the number of passengers in business class has increased after the introduction of “free” Internet access⁸.

Wireless broadband using WiMAX

Tests with WiMAX has been performed, e.g. by MobileCity in Skellefteå and by STOKAB in the Stockholm area. However, in these cases the service is “conventional” fixed access using a wireless link in areas where a fibre or DSL connection is not technically or economically feasible.

Broad band urban network providers and facility owners

Among local broad band network companies no or very low interest was noted for providing wireless access to the own customers. The possibility to use “wireless extensions” to the fixed broad band networks in order to provide open access “everywhere in the city” has not been considered. However, one town in Sweden, Karlskrona, has announced plans to deploy a wireless network with open access.

Facility owners have a large interest to provide broadband connections to the customers but showed low interest to provide wireless access within or outside the buildings. The following reasons were observed; i) the discussion on radiation from wireless systems, ii) the added values for end-users were considered as low, iii) the technology must be mature and proven to be reliable since “system failures causes bad will for us”.

⁷ www.icomera.se and www.sj.se

⁸ <http://www.sci-solutions.co.uk/news/press.html>

6. Analysis of business models

Based on how the value constellation is composed and on how different actors interact, the following groups of business models have been identified and selected for analysis [1]

Open access provided by the site owner

In this case a site owner makes a broadband connection available for public access using wireless technology. No service guarantees exist and the usage is open and for free and no functionality for identification, authorization or billing is used. The main driver is to support the core business of the site owner, e.g. a hotel or a coffee shop.

The site owner is responsible of all business roles except provisioning of backbone capacity. The network operation can be included in the maintenance of the site and the customer acquisition is integrated with the core business. Trust management, charging and billing are not present at all.

The strength of this concept is that support systems can be simple and cheap. Opportunities exist since customers will be attracted to the core business. Weaknesses are that the provider cannot reuse the customer relation since users are not identified and the risk for bad-will in case of overload or misuse. The main identified threat is that customers with high requirements will chose other sites and businesses.

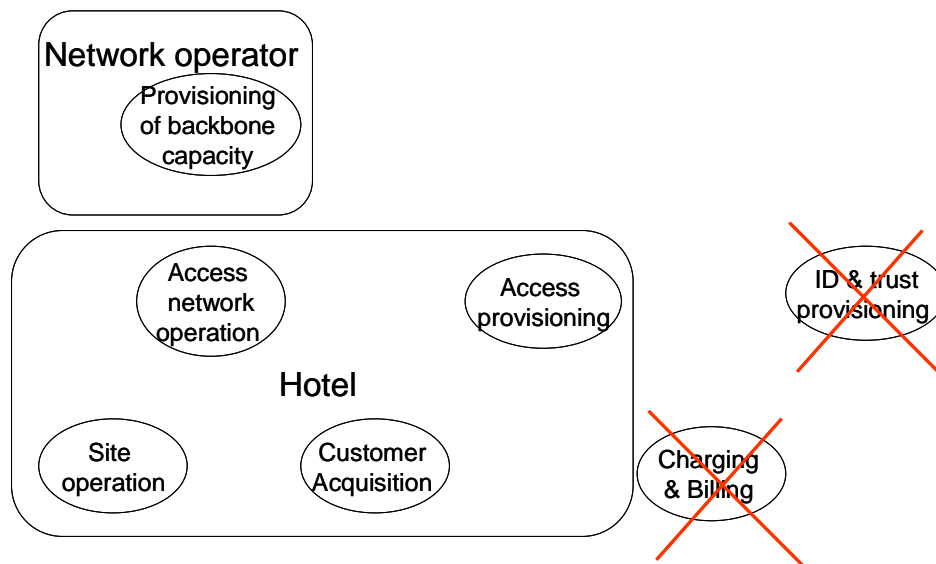


Figure 3: Value constellation map - "open access at a hotel"

The site owner takes most business roles

The main business relation with the customer is handled by the site owner who controls all business roles but multiple payment options (and providers) are possible. The usage is not for free and can be quite expensive e.g. 10-30 € for one to 24 hours. However, the site owner exploits the local monopoly of the access to the site and usually does not allow authentication, authorization or payment using subscriptions with other operators. The main driver is to support the core business with focus on increased customer satisfaction, e.g. the possibility of more efficient usage of the travel time can attract customers from the airline industry.

The site owner can be responsible of all business roles except provisioning of backbone capacity. Identification of users and charging & billing can be handled by the site owner or by a trusted 3rd party e.g. a credit card company. Identification, authorization, charging and billing are closely related, in the case of “single time usage” they are often handled simultaneously.

A strength and consequence of the local monopoly is that a “slightly” higher price can be tolerated. On the other hand a threat is that too high prices may lead to usage of other providers or use of other solutions, e.g. download elsewhere (wait) or to use other solutions (3G surf cards). To use other subscriptions for identification and payment may be an opportunity if allowed and a weakness if not allowed.

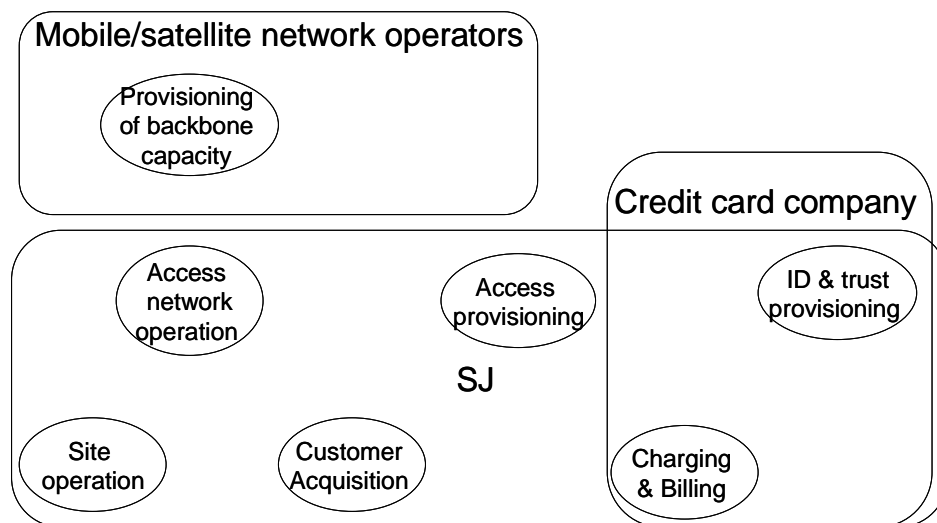


Figure 4: Value constellation map for the case “Internet on trains” where the train company is the site owner

Co-operation between site owner and network operator

The close co-operation between the site owner and the network operator is the key characteristic of this type of business model. The operator can be specialized in site survey and operation of local networks like e.g. The Cloud. The site owner can be of “any” type and the payment can be of different types; it could be included in payment for the core business or charged separately.

The main driver is to support the core business e.g. fast food or train travels. The network operator is responsible for network operations and the customer acquisition is handled by the site owner. Charging & billing can be handled by the site owner, the operator or by a trusted 3rd party e.g. a credit card company. Although the fee can be “free” in the meaning bundled with the fee for the core business service, login and authentication procedures are key features in this case. Hence, customer acquisition for “single time usage” is closely related to identification, authorization, charging and billing.

The strengths are that the site owner has “control” of users and that the open business model allows many actors to participate. This is related to the main identified opportunity where “roaming agreements” and revenue sharing may attract more customers and partners. The weaknesses are related to the one-time usage and the lack of national coverage which makes it difficult to exploit customer relations and loyalty. Threats are municipality and hot spots networks with free access and actors that offer nation wide networks.

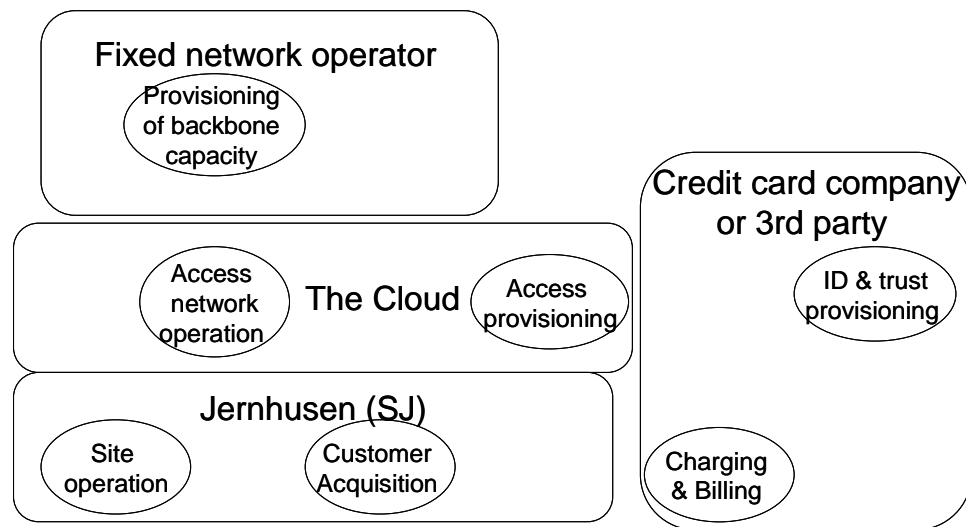


Figure 5: Value constellation for co-operating site owner and operator, example railway station

The network operator takes most business roles

In this business model TeliaHomerun and Glocalzone is the dominant actor as network operator and has the business relation with the customer through a subscription. For Telia the wireless access is included in the subscription fee. Glocalnet offers free access for own broadband customers. Other users can access the system for an extra fee.

The main driver is different for the two companies. Glocalnet has launched the wireless access in order to support the core business: broad band access to consumers. Telia has for many years offered access to business users in hotspots, recently the WLAN access is bundled with 3G.

The operator is responsible for all business roles except operation of the site. Customer acquisition is handled by the network operator or the site owner. Identification of users and charging & billing can be handled by the operator or by a trusted 3rd party e.g. a credit card company.

Common strengths are national coverage and strong brand. For Glocalnet no cost or low price clearly is a strength. An opportunity is to allow use other subscriptions which may enable revenue sharing. If this is not allowed customers may chose another operator. High prices may lead to use of other providers, to use free access or usage elsewhere.

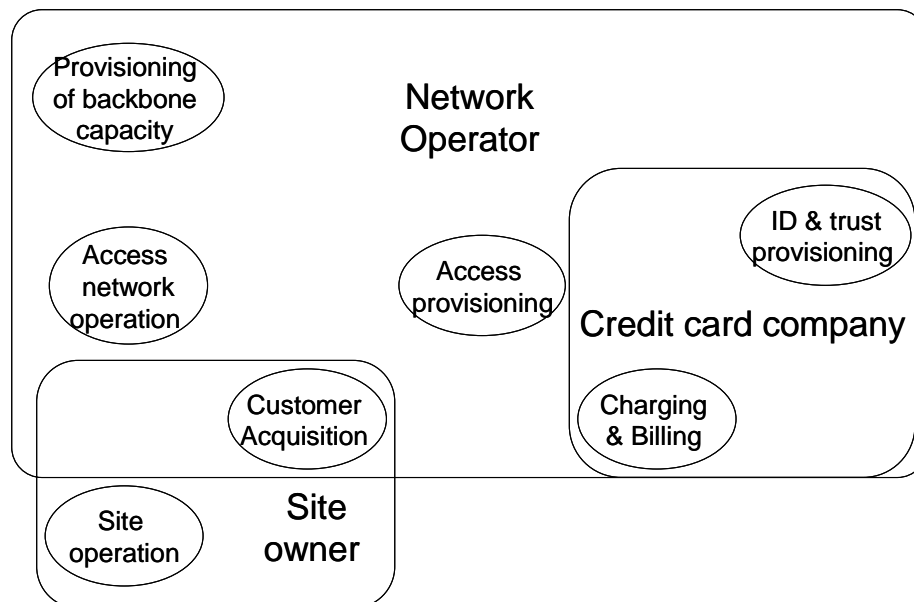


Figure 6: Value constellation map where the operator is the dominant actor

Co-operating private networks using overlays

For this group the general idea is that many “small” private networks are opened up for public access and linked together so that they act as “one large network”. This kind of “interconnection” is provided by some coordinator by use of a “business overlay”. Examples are private initiatives like FON and some forms of municipality networks where the local authority provides the business overlay [8].

The main driver in the mentioned cases is “the idea of cheap or free access to everybody without a traditional operator”. For municipality networks this is combined with the idea that wireless should be a public utility, for FON the sharing of resources is the drivers

The site owner, private persons or small companies, owns and operates the “small” networks consisting of wireless access points extending broad band connection provided by ISP’s. The interconnecting party is responsible for the customer relation and provides functionality that enables login procedures, authorization and sharing of revenues.

The identified strengths are the wide spread deployment with many access points and that the low cost characteristics offers low entry barriers. Opportunities are to offer “roaming”, to form partnerships and to bundle the access with offers to the consumer market. One weakness for FON with many “home networks” is the implicitly low coverage in hot spot locations; another one is the low degree of service guarantees and the potential risk with shared responsibility in case of problems. Identified threats are on one hand low economic incentives and on the other hand limited customer loyalty.

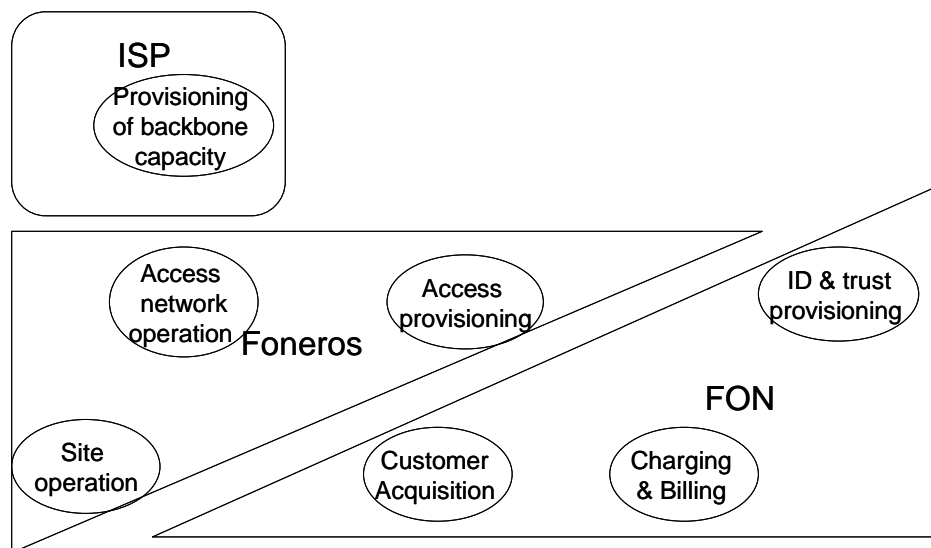


Figure 7: Value constellation map for the FON concept

7. Customer relations and payment options

We have chosen to classify the customer relations into two groups depending on the time frame and the duration of the business contact and how often it may be repeated and also how various payment options are related to identification and authorization for the network access.

Short term business relation, this includes both the “single time“, e.g. one hour wireless access at a hotel or at an airport and the hotel guest that stays a couple of days or week.

- Payment is critical for one-time subscriptions, the user ID is not important as such

Long term business relation (often a billing relation), which includes telecom subscriptions (mobile or fixed phone, cable TV or broad band access) and non-telecom billing relations dealing with consumption of water, electric power or the rent for flat or a house. Other cases are employment with a company or when you have a bank account or a credit card.

- Subscriptions of telecom services can be prepaid or postpaid, where the ID of the user is coupled to an account that is used for payment.
- For corporate users the user account is coupled to an ID, possibly with extra security for VPN clients etc, but no payment for the usage

Yet another way to structure the customer relations is how the payment for the usage of the wireless access is charged; it can be free with no charging for usage, it could be included in core business fee (e.g. train ticket or hamburger) or the usage of wireless access can be charged separately. In figure 5 different observed case are shown in a map with short/long term customer relations and payment strategy. It is interesting to note that companies that use the wireless to support the core business quite often offer usage for free or includes it in the fee for the core business.

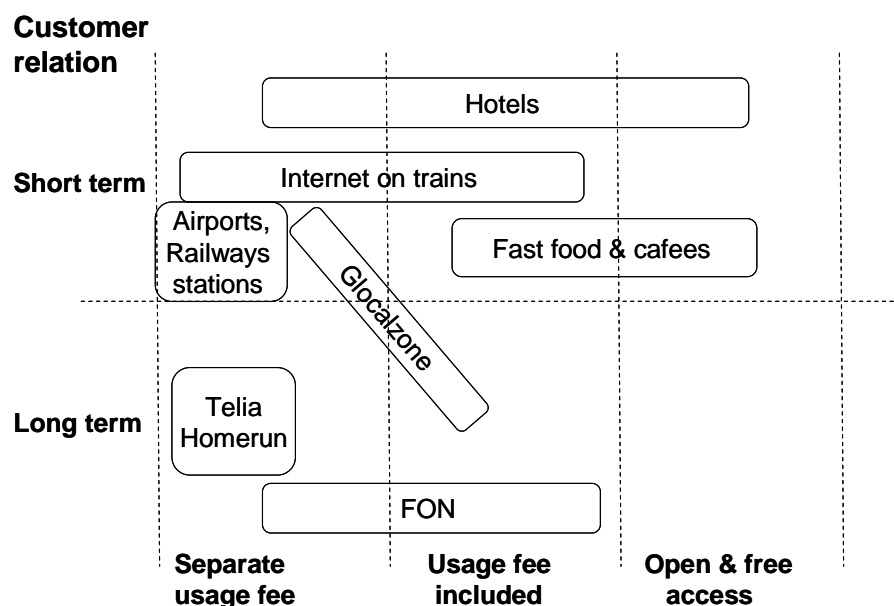


Figure 8: Business concepts mapped onto type of customer relations and payment strategy

8. Summary of analysis

Business roles

The following business roles were identified as essential components for the provisioning of access services in a local environment; site operation, customer acquisition, network operation and provisioning of backbone capacity. Some form of access control was observed in most also when the access is “for free”. Charging & billing and user identification were business roles that were observed in most cases.

Business mechanisms

For the cases where the network operation, payment, user identification and the customer relation are handled by more than two business actors it is of vital importance that the different parts of the value constellation works together smoothly and that the user can experience one bundled service. The five types of identified value constellations show that many different configurations of business roles are feasible.

Many types of payment options are possible; direct to the site owner, using a subscription with an operator or payment using a credit card. For “single time usage” the identification of users, authorization of access and payment is often handled at the same time.

Market actors

We have observed both mobile network and broad band network operators as well as specialized “network operators” operating network on behalf of other companies and without any own end-users. The most obvious trend is that non-telecom companies with some kind of control of a public or private environment start to act as access providers.

Drivers

We have identified the following types of drivers for provisioning of local wireless access:

- To make money on the access provisioning itself as a standalone business
- To support the core business whatever it may be; food, travel, hotel or telecommunication
- Open and free access; by sharing of private assets or as a public utility

In the observed cases on the Swedish market it seems like the first kind of driver, typical for the traditional operator business, is less successful. The incumbent (Telia) has offered hot spot access services to business users for many years. The prices have been high until now when competitors start to emerge. The main driver for local wireless access is to support the core business; hence payment is not that important but some kind access control is often included. We have not observed any cases where user ID is used for “tracking” of user behavior.

9. Conclusions

The analysis shows that provisioning of local wireless access services to a large extent differ from the traditional operator business associated with fixed and mobile telephony and fixed Internet access based on subscriptions. Low cost, high capacity public internet access can to a large extent be characterized as “here and now” support of the daily life activities and are often based on temporary customer relations. Two main conclusions can be made:

- Actors from outside the telecom sector start to enter telecom business
- The wireless access in local environments is not only a “here and now” service on its own, it is closely related to other kind of services and/or part of a bundled offer

The main driver for these new access providers is to support the core business rather than to get revenues from an independent access provisioning business. The key assets to exploit are the “short term” customer relations and the possibility to temporary “own” the customers in the local environment, e.g. a hotel, a restaurant, an airport, a train or a bus.

It can be noted that companies with “long term” customer relations and acting on local market (broad band companies, facility owners and banks) do not exploit this opportunity.

Acknowledgments

The contributions and support from our colleagues in the Novel Access Provisioning project, PhD Pablo Valiente and Professor Bertil Thorngren (Stockholm School of Economics), PhD Jan Werding and PhD students Johan Hultell and Mats Blomgren (Wireless@KTH) are highly appreciated.

This work has been co-funded by the Swedish Agency for Innovation Systems (VINNOVA).

Bibliography

- 1 Blomgren M, Hultell J, Markendahl J, Mäkitalo Ö, Thorngren B, Valiente P, Werding J, "Novel Access Provisioning – Final report" available at <http://www.wireless.kth.se/projects/NAP/publications.php> Stockholm, January , 2007
- 2 Markendahl J, Mäkitalo Ö, Werding J, "Novel Access Provisioning", *Proc. Helsinki Mobility Roundtable 2006*, June 2006,
- 3 O. Rietkerk, J. Markendahl, "Business roles enabling access for anyone to any network and service with Ambient Networks", *Proc. Helsinki Mobility Roundtable*, June 2006
- 4 Markendahl, J, Thorngren B, "Business models and business roles for use of low cost infrastructure solutions, *Proc. RVK 2005*, Linköping June 2005.
- 5 Markendahl J, Zander J, "Low Cost Broadband Wireless Access – Key Research Problems & Business Scenarios", *Proc. ISART04*, Boulder, March 2004.
- 6 Markendahl J, Werding J, Valiente P, "Local access provisioning driven by Supply-push or by Demand-pull? - Initial findings from interviews with market actors", *Proc ITS Europe 2006, Amsterdam August 2006*
- 7 Normann R, Ramirez R, "From Value Chain to Value Constellation: Designing Interactive Strategy", *Harvard Business Review*, Jul/Aug93, Vol. 71, Issue 4.
- 8 Bar F, Park N, "Municipal WiFi networks: The goals, practices and policy implications of the US case", *Communications and Strategies No 61*, 2006, pp. 107 – 125
- 9 Werding J, Markendahl J, Mäkitalo Ö, "Drivers Of Novel Access Provisioning – Re-Use Aspects And Operator Cooperation" *Proc. PIMRC 2006*, Helsinki, September 2006
- 10 Markendahl J, Mäkitalo Ö, Werding J, "Company asset analysis of candidates for novel access provisioning", *Proc. RVK 2005*, Linköping June 2005
- 11 K. Johansson, J. Lind, M. Berg, J. Hultell, N. Kviselius, J. Markendahl, and M. Prytz, "Integrating User Deployed Local Access Points in a Mobile Operator's Network" *Proc WWRP#12*, Toronto, Nov 2004.