

Change of Business Models for Wireless Internet Access

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Abstract

Rapid wireless technology development, increasing dynamics of market and regulatory changes are forcing incumbent telecom operator to search for new, more dynamic business models. Same time the development enables new business opportunities for emerging new companies. This paper looks into drivers of the change and discusses on types of new business models that might develop as a result.

Keywords: wireless access, business models

1 Introduction

Today people are able to access the Internet and multimedia services with variety of different wireless devices. These devices may utilize broad range of different wireless access technologies including 2G and 3G cellular access, Wireless LAN (WLAN), WiMAX and Flash-OFDM. Some devices are multi-radio capable and can support two or more access technologies simultaneously. The capabilities of mobile devices and laptop PCs seem to further developing with still growing speed.

Different access networks, utilizing different access technologies, are controlled by different parties. Person who wants to utilize multi-radio capabilities of her or his device is required to have agreements with multiple companies, each having different authentication and charging mechanisms. Also moving seamlessly between different accesses is by no means a simple task at the moment. The ability to combine different, formerly separated, access technologies in order to reach new and attracting user experiences will be the key factor for future business models of wireless Internet access providers.

It should be noted that when discussing on business model in this paper, it is considered to be the way how business creates and captures value from new services or products. [1] A business model describes the way a company or network of companies aims to make money and create customer value. [2]

This paper discusses on possible changes of business models due the dynamics in the wireless Internet access

market. In section 2, existing business models are introduced. In section 3, drivers of the change are discussed. In section 4, a short overview to technology is given. In section 5, possible new emerging business models are illustrated, and in section 6 final conclusions are drawn.

2 Existing Business Models

Existing business models of mobile telecom operators can be characterized as network operator centric models, where the subscriber has tight linkage with the mobile operator. The mobile operator controls user's subscription and billing. It also provides value added services to customer in addition to basic voice, messaging and the Internet access services. The business models are based on the tightly coupling of a subscriber to the operator's network and services. [1]

Where as mobile telecom operators offer a set of services to their customer, current WLAN access providers have still mainly a single offer to their customers – the Internet access. The main business model for WLAN access providers is to offer broadband Internet access to their subscribers. The target customer segment has already started to broaden from business customers, who utilize the WLAN connection for their work, to WLAN broadband connectivity for consumers. In the Table 1 are listed the main existing wireless Internet access providers. Some of them offer wireless local hotspots as others are providing larger coverage area broadband wireless connections. Third existing WLAN business model is to provide wireless Ethernet connectivity for companies inside their own offices. This enables extended mobility for company's employees. Clearly there is also potential to introduce new business models such as Voice over IP among WLAN access providers. [3]

Table 1: Existing wireless Internet access providers

Type / Owner	Roaming	Centralized	Binding	Charged	Closed	Hotspot	Size
Telecom operators	yes	yes	high	yes	no	no	global
Virtual operators	yes	yes	high	yes	no	no	national
Local telecommunication	yes	yes	high	yes	yes	no	city
Restaurants / Cafes	no	no	low	both	both	yes	building
Hotels	no	no	low	yes	yes	yes	building
Libraries	no	no	low	no	no	yes	building
Airports	no	yes	low	yes	both	yes	area
Educational institutes	yes	yes	low	no	no	no	area
Municipal networks	yes	yes	medium	yes	yes	no	city
Energy companies	yes	yes	medium	yes	yes	no	city
Local companies	no	yes	medium	yes	yes	yes	building
Private user networks	no	yes	low	no	yes	yes	building
User P2P communities	yes	no	low	both	no	yes	global

As a part of the current agreements with mobile operator, a subscriber is used to receive a single bill that includes the charge of all the services that she or he has used during a certain time period. Furthermore, the operator has sophisticated and complex mechanisms to hide possible network access changes, mainly between 2G and 3G, from the subscriber. From a user perspective these requirements will remain same also in the future; any network access transition should be invisible as well the billing should be as simple as possible from subscriber point of view. In addition, the subscribers should be constantly aware of the possible charges of an each service they use. [4]

3 Drivers of the Change

There are three main external drivers of a change in business models; dynamics of technology, market and regulatory. Each of these drivers have different role in each phase of maturity of the business. Technology guides the most strongly dynamics of a business model in early development phase of a new business. Regulatory has the greatest role in implementation and rollout phase and the market development guides the most when business model is set for established market. [5] [6] When considering the wireless Internet access business today, it is seen to be moving from a development phase to a more mature market phase. Still, it seems that the main source of change in business models is the technology, but also the market competition is taking a more active role. In addition to above three main factors also other drivers have effect on business models. As an example of these is the standardization. Standards tend to define the technology selection, especially in the telecom business. Delay in standards can also delay the change in business models, e.g. due the delay of an interoperability that is further needed to reach the mass market.

From the technical perspective, new wireless access technologies, including WLAN, WiMAX and Flash-OFDM, are the main driver towards the change and increase of dynamics in wireless network business models. Same time more and more multi-radio terminals supporting simultaneously several access technologies are emerging into the market. Today, one can access the Internet via several access technologies with both mobile handsets and laptops PCs, among other end user devices like PDAs (Personal Digital Assistants). It seems that the scale of technical solutions is widening with increasing speed and that is challenging for both the access providers as well as the end-users.

From the market perspective, new players on the wireless Internet access provider market are emerging. Role of Internet Service Providers (ISPs) is changing and totally new players are entering to business. For example in Finland, several energy companies have offered the

wireless Internet access. Companies include e.g. Haminan Energia (Haminetti) [7], Mäntsälän Sähkö (MSOYNET) [8] and Porvoon Energia [9]. If existing mobile operators do not utilize the potential of new access technologies, they risk on losing their market share to these new wireless access providers. Due the fact that WLAN spectrum is unlicensed, companies that gain the best access over the most important locations such as airports and hotels early are in the best competition situation in the market later. [10]

From the regulation perspective, issues considering fair competition, telecommunication regulation, intellectual property rights and privacy can assist a change on business models. The Voice over IP (VoIP) regulation is the current topic, due companies like Skype. It should be noted that regulation can also trigger opportunities for a development of new products and services as well as underlying business models. [6] One interesting topic from regulation point of view might be the possibility to share WLAN hotspot access between end-users. It also seems that the regulation is always coming late and it can slow down or fasten the change of business models for wireless Internet access.

Considering the speed of change in the wireless Internet access business models, it can be noted to be depending on the speed a new innovation and technology is adopted by markets. At first, only a small number of people, the innovators itself, will adopt the new technology and the speed of adaptation is still slow. Next the early adopters join in and the speed on adaptation rises, leading also increase of the speed in business model change. When the majority has found the new technology or service, the change in business model needs to take place also. [5] As a result, the speed of change of the business models is connected to the development and adoption time of new technology or service. [6]

4 Technology Overview

Emergence of new wireless access technologies has led the industry to face the challenge of seamless interworking between these technologies. This challenge has further developed a set of new research and standardization activities to find out a feasible solution for seamless roaming between radio access technologies. These activities and technologies are discussed shortly in following to understand the possibilities they offer for new business models.

4.1 Mobile Internet Protocol

Mobile IP is specified by the Internet Engineering Task Force (IETF) in Request For Comments (RFC) 3344 [11] and enhanced by several other RFCs by IETF. The generic problem with IP mobility is that when an IP node moves to a new access network, it has to change its IP address to reflect the new point of attachment. Mobile IP

allows mobile device users to move from one network to another while maintaining their IP address information. When in visited network, the Mobile Node (MN) receives a new IP address from a Foreign Agent (FA), which is in practice router in roamed network. The Mobile Node informs its Home Agent (HA), which resides at home network that it is now reachable via a Care-of-Address provided by the Foreign Agent. The Home Agent will then tunnel packets from other nodes, called Corresponding Nodes (CN), to the Mobile Node at its current point of attachment by this new IP address information. [11]

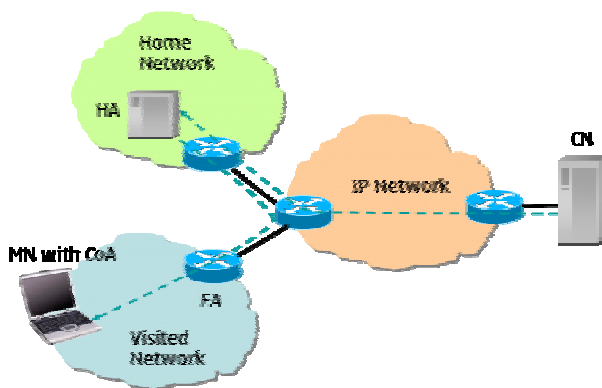


Figure 1: Mobile IP functionality

Mobile IP is essentially an IETF protocol, which alone is not a solution to the challenges the wireless Internet access providers are facing. It is a tool that can be used to reach the architecture required. As an example in the 3G Universal Mobile Telecommunication System (UMTS) access scenario, the Foreign Agent and the Home Agent need to be implemented into network as separate entities. In the 3G Code Division Multiple Access (CDMA) network the Foreign Agent is already implemented within the PDSN (Packet Data Service Node). [12]

4.2 Third Generation Partnership Project

The Third Generation Partnership Project (3GPP) is a standardization forum that was established to work on technical specifications over 3G mobile systems. Since then the work has widened to include the maintenance and development of the well-known Global System for Mobile communication (GSM) including evolved radio access technologies (e.g. General Packet Radio Service (GPRS) and Enhanced Data rates for GSM Evolution (EDGE)). [13]

In the 3GPP Release 6 new work item has been included to study the interworking of existing mobile network and WLAN network access. The work has been continued in the Release 7 and it has been divided into six scenarios that consider centralized roaming, service continuity, billing, charging, authentication and security

capabilities of these two access methods. Goal of the 3GPP is to re-use existing mobile operator control mechanism for WLAN environment as far as possible. This means that e.g. the authentication of WLAN subscriber could be based on Subscriber Identity Module (SIM). [14]

In addition to the specific 3GPP-WLAN interworking work item, the 3GPP has worked on IP Multimedia Subsystem (IMS) architecture since the Release 5. This architecture has been specified as access agnostic and should this way be capable to utilize any IP based access network to provide connectivity between end points. The IMS architecture is based on Session Initiation Protocol (SIP) specified by the IETF. [15] The IMS, as 3GPP work in general, is a telecom industry originated initiative to solve the challenge of controlling multiple access methods in a centralized way.

4.3 Unlicensed Mobile Access Technology

The Unlicensed Mobile Access (UMA) effort was initiated by a number of operators and vendors in January 2004. The goal of this work was to develop and publish an open set of technical specifications for extending mobile voice and data GSM/GPRS services over unlicensed spectrum technologies including Bluetooth and WLAN. The participating companies published the initial UMA technology specifications on 2004 and started to contribute the specifications to the 3GPP organization and finally agreed to discontinue operating as independent group. [16]

UMA technology provides alternative access to GSM and GPRS core network services via IP-based connections. In order to deliver a seamless user experience, the specifications define a new network element called UMA Network Controller (UNC) and associated protocols that provide the transport of GSM/GPRS signaling and user plane traffic over IP. The UNC interfaces into the core network via existing 3GPP specified A/Gb interfaces. [16] Also the terminal needs to be UMA enabled to support the technology.

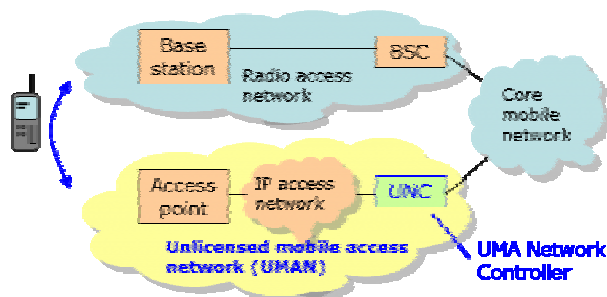


Figure 2: Unlicensed Mobile Access architecture [16]

The UMA technology is telecom oriented and is clear development to existing mobile operators to reach new business opportunities by utilizing WLAN and other

unlicensed radio access technologies. In the US market the driver for the UMA was mainly the limited cellular access indoor coverage. Operators saw WLAN as a solution to improve the coverage. In the EU, the UMA technology has lately been utilized by operators to offer lower voice call charges to their customers when call by using their WLAN router at home. This way operator can move voice traffic from the more expensive cellular radio network to their fixed broadband connections.

4.4 Ambient Networks Research Project

The Ambient Networks is an integrated research project led by the European Commission under the Information Society Technology (IST) priority. Partners of Ambient Networks constitute a consortium of the operators, vendors and research organizations. Ambient Networks target to an architecture providing users to access any available network without barriers. An ambient network can be defined as a collection of nodes and devices, which share a common network control plane. Project defines interfaces between ambient networks, to services layers and connectivity resources through which different cooperation levels in resource usage can be reached. The Ambient Networks concept drives for providing a synergistic cooperation among diverse radio access technologies belonging to the same or different operators. [17]

Ambient Networks research project is not targeted to specify details for dynamic access network usage, but more to introduce higher level framework and increase the discussion on ambient networks. Results of Ambient Networks research project are most likely reflected to 3GPP, IETF and related standardization forums. [18]

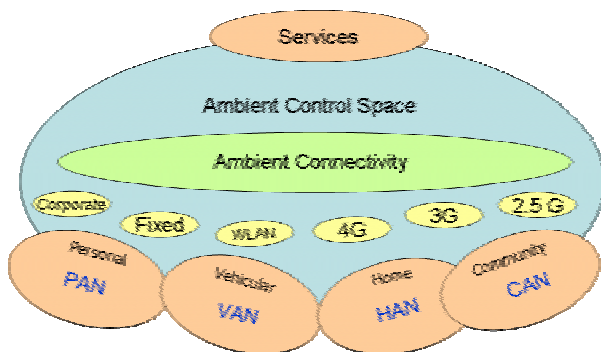


Figure 3: Ambient Networks architecture [18]

5 Emerging business models

It is seen that to be able to respond to the challenge the widening selection of access technologies offer, new types of cooperation between mobile network operators and wireless access providers are needed. It follows that new types of business relations and agreements have to be developed. Furthermore, it is seen that the value

networks of emerging wireless access services are more dynamic and complex than the old, rather static telecom centric value chains for mobile telecom like voice communication: current telecom value chains are slowly deconstructing and transforming towards a more complex value network with the entrance of new players and stakeholders. It is expected that more and more flexible value networks will arise and replace the current, more traditional, static and linear value chains. [19]

One new business model in resulting environment is the *Access Aggregator* role. [20] This role can most clearly be enabled in intra-operator environment. Already today, operators are providing several access technologies but subscribers are still required to authenticate themselves separately to each access network. *Access Aggregator* can provide more seamless movement between these access networks for subscriber. In the best case, the change of an access technology is fully transparent for the subscriber.

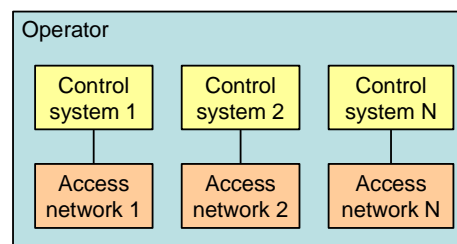


Figure 4: Current model of access networks control

The Figure 4 illustrates the current model of how access network authentication and charging is controlled in mobile operators' networks. In the worst case, each access network has own authentication, provisioning, charging and even billing mechanisms. This is highly inefficient from operator point of view and also confusing and frustrating for subscribers, as they may receive several bills from the operator and are needed to authenticate separately to each access network.

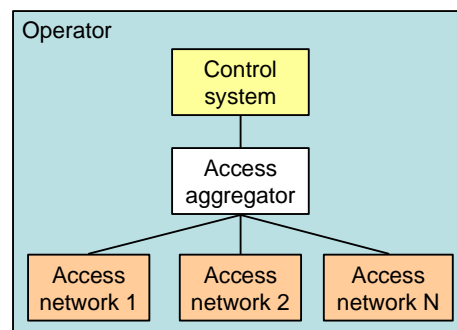


Figure 5: Access Aggregator in operator network

In the Figure 5 is illustrated the role of *Access Aggregator* for operator. Now the single backend control system can be utilized for several access networks inside

operator domain via aggregating provided by the *Access Aggregator*. This brings efficiency to access networks management and can provide new services and improvements also from subscriber point of view. In best case, even the seamless handover between access technologies can be provided with correct technological solution.

When looking inter-operator environment, similar business model as the *Access Aggregator* in intra-operator case can be found. The *Access Broker* role in inter-operator environment enables different access network owners to share their access networks and provide wider combined network coverage for their subscribers. *Access Broker* can handle the seamless movement between the access networks, similarly as the *Access Aggregator* inside operator domain. In addition, the *Access Broker* needs to control payments between access network owners based on the measured usage of the shared access networks. [20]

Where as the *Access Aggregator* is clearly a new intra-operator business model, the *Access Broker* can have different models on how it emerges. The *Access Broker* business mode can be brought in to market by an existing player, e.g. mobile operator. In this scenario, one of the existing operators needs to reach a new position in the market. Most likely this can be done with the help of non-cellular access providers, like energy companies that are offering WLAN connectivity to their customer. Through obtaining initial market position via agreements with these local WLAN access network owners, other mobile cellular operators may need to recognize the role of this new *Access Broker* and allow brokering of their access networks also. The Figure 6 illustrates the business model where an operator runs the *Access Aggregator* business model inside its own network and the *Access Broke* business model for other access providers.

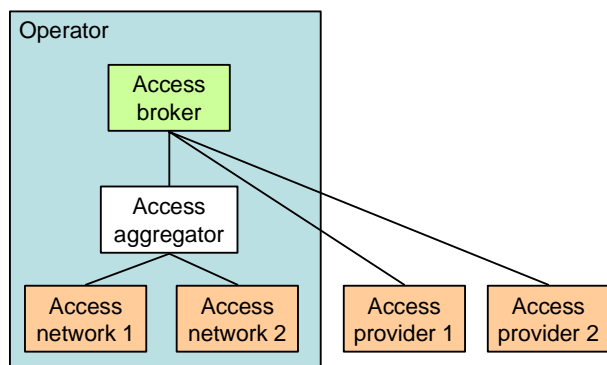


Figure 6: Operator acting as Access Broker

However, more likely way to reach the *Access Broker* role is by a new player in the market – a trusted 3rd party. The benefits of this option are quite clear. If the existing operator starts running the *Access Broker* business

model, there is a clear limitations what kind of information other access network providers are willing to give to such an entity, especially considering sensitive information e.g. authentication data. Trusted 3rd party has the privilege of being objective, especially if it does not have own access network and is not a competitor on that role in the market. This type 3rd party can act as a controller and even take a role as providing authentication, charging and billing services for access providers. This is more likely if access providers using *Access Broker's* services are not telecom operators but e.g. energy companies that are offering WLAN access to their customers. The Figure 7 illustrates the 3rd party *Access Broker* business model.

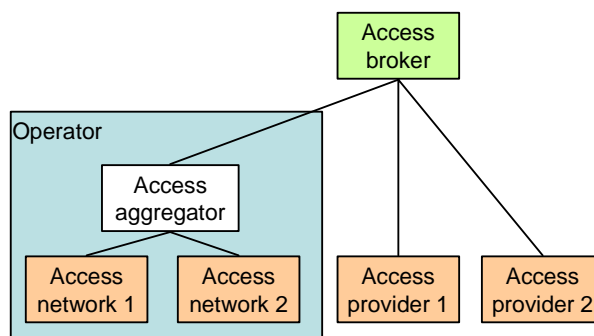


Figure 7: 3rd party Access Broker

It should also be considered that an *Access Broker* business may be set up as agreement of multiple access providers based on alternative wireless access technologies. This model is supported by the fact that the use of unlicensed frequency bands limits the number of access providers per a site. As only one WLAN network can be deployed per area, it is feasible for access network providers to merge their networks through creating common *Access Broker* business. This gives larger coverage for their network and access to a larger subscriber base, but still access network owners can continue as own companies and share the revenue based on agreements made. This further means that the new business model is efficiently a competitor to existing telecom operators, at least on some level depending on the access network coverage it can achieve. In the Figure 8 is illustrated *Access Broker* role for regional or local access providers.

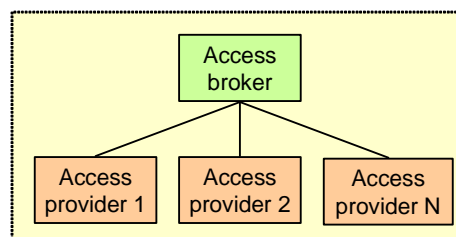


Figure 8: Access Broker for regional access providers

When considering the role of any of discussed new business models and actors in them, it can be noted that these new actors are in critical role. They clearly have a role in access selection and may also have a strong role in authentication, charging and billing of end users. It is also clear that mobile operators or other wireless access providers today are not willing to give any of these roles to new players. After all, these roles are clear control points towards subscribers and existing players want to keep their powerful positions. Despite of this fact, it seems that opportunities will emerge to create new business models based on some of these roles.

New business models discussed above are found when looking the change from existing telecom operators' point of view. However, the Internet is not based on telecom operators but individual users. There are no service charges or subscriptions in the pure Internet model. This change of view point gives totally new possibilities for business models to emerge. Already today we have seen wireless networks that individual users have setup by allowing other users to utilize their WLAN routers. As a return of the favor these users can then utilize WLAN routers of other users to access the Internet. [21] Examples of this type of communities include OpenSpark [22] and FON [23]. In this kind of community there are no real centralized control points and end-users cannot be considered as subscribers but more as members.

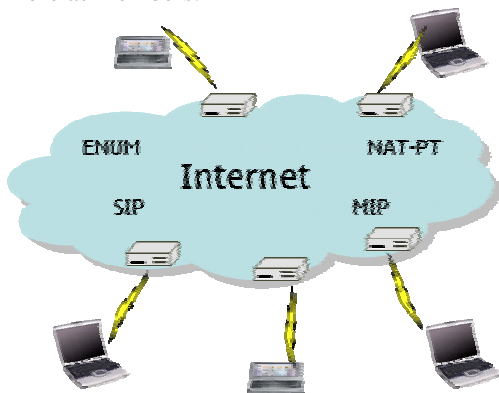


Figure 9: Internet WLAN community

Business models can be identified also for the Internet originated WLAN communities. Both OpenSpark and FON sell WLAN access point routers for their members. [21] This is a very simple business model and provides revenue only for the administrator of the community. In FON community members can also sell WLAN access for visitors and share the revenue with other members in the community. [21] This is already a more sophisticated business model and shows that the Internet WLAN communities can even offer a business model to compete with telecom operators and their WLAN offerings. It will be interesting to see what kind of challenge these more or less de-centralized WLAN communities will set

to existing telecom operators and other wireless Internet access providers.

6 Conclusions

New wireless access technologies are emerging and mobile devices are combining several radio technologies inside a single device cover. Still, the handover between these access technologies is limited and not even close to be a seamless experience for the end-user. By enabling more seamless movement between these access networks user would achieve better coverage for the Internet and multimedia service access.

Access network providers may own several networks, which are utilizing different radio technologies that are further based on different authentication and charging models. As the operation of these networks is not centralized, business models are also inefficient today. It can be expected that more centralized models for both intra- and inter-operator access network management and handovers will emerge.

Furthermore, the business models for the wireless Internet access are expected to face changes in mid term future. These changes in the business models are expected to enable utilization of multiple devices, multiple networks, and multiple access technologies in a more integrated fashion than models today. This challenge is not easily controllable or manageable with today's technologies or business models. As a result new business models are expected to emerge into market.

Another interesting aspect of the wireless Internet access business model evolution will be the challenge of the pure Internet model based WLAN communities. How these more or less de-centralized communities can challenge WLAN offerings of telecom operators and other market players? What are the business models that emerge from the Internet? These are questions that we need to wait for a bit before we can give the answers.

This paper presented the current and emerging business models of the wireless Internet access; it illustrated the drivers of change with few new business models that may emerge as a result.

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