ISSN 2029-7564 (online)
SOCIALINĖS TECHNOLOGIJOS
SOCIAL TECHNOLOGIES
2011, 1(2), p. 217–235.

BUSINESS MODEL FOR FEMTOCELLS: FRANCHISING FOR ENERGY SAVING

Tiago Carvalho Moreira

Instituto de Telecomunicações, PT Inovação, Portugal,
tiago-c-moreira@ext.ptinovacao.pt

Michele Albano

Instituto de Telecomunicações, Portugal, michele@av.it.pt

Ayman Radwan

Instituto de Telecomunicações, Portugal, aradwan@av.it.pt

Jonathan Rodriguez

Instituto de Telecomunicações, Portugal, jonathan@av.it.pt

Alvaro Gomes

Instituto de Telecomunicações, PT Inovação, Portugal,
agomes@ptinovacao.pt

Abstract

Purpose—*The purpose of the paper is to analyze how business models are employed in mobile communications, in order to tune them to the Femtocell domain, in addition to studying other goals that can be achieved by looking at the business models in an alternative way.*

Design/methodology/approach—*By analyzing the technologies directly linked to a business model, it would be possible to produce a taxonomy of their usage. An analysis of the value chain is used to understand how to enhance current approaches to achieve new goals.*

Findings—*The article covers the perspective that mobile networks evolution and*

ISSN 2029-7564 (online)
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femtocell implementation in the mobile market can bring innovative services to the final user, by leveraging on alternative usage of business models.

***Research limitations/implications**—The acceptance of the usage of particular business models by mobile operators can bring benefits to the final users in the form of innovative services. An example of these services is the implementation of techniques to save energy on the terminal side.*

***Practical implications**—As soon as the targeted technologies become mature, it will be possible to provide novel services to the final user, while increasing the operational and business benefits of the mobile operators.*

***Originality/Value**—A novel view on the current application of the business model is developed, and new innovative goals are shown to be achievable by novel approaches, or by traditional approaches applied in an innovative way. In particular, we show a case study where a novel service called C2POWER applies franchising (re-selling of services) of broadband access, to save energy on the mobile terminal side.*

***Keywords**: Business models, cooperation, value chain, network sharing.*

***Research type**: research paper / viewpoint.*

1. Introduction

In the present day, to support the implementation of novel technologies in the cellular network market, it is necessary to have a good business model that shows the main benefits of this new architecture and the revenues associated. To build a good business model it is important to follow a line that defines how the entity attracts customers to pay for a service, how those services are delivered to the customer, how the entity converts customer payments into profits and finally how the entity is organized to be able to meet the customer needs.

Actually there are many successful business models (e.g. the internet business models [1] or the recycling business model [2]) that can be used as references to support the construction of innovative approaches. Consequently, we can consider that innovation can be achieved through novel business models or by altering already existing ones. An analysis of the value chain is important to understand where an innovation can be applied. For example, the book [3] and the work [4] discuss how to build and analyze a business model when applied to a particular scenario. Thus, besides the analysis of current approaches and the design of novel ones, a fundamental part of the innovation in the present work is related to the study of the exact position the approaches hold in the mobile value chain.

In the case of the telecommunication industry, one of the main topics analyzed is the role of different actors that appear in the overall value chain, and the impact that choosing different business models can have on them. In the current state-of-the-art it is possible to find business models related to mobile telecommunications, like for example

[5] which shows the role of several players in the mobile market, their objectives and possible different interactions between each other.

Femtocell is a novel technology devised to extend mobile network coverage to indoor environments by deploying small base stations at users' houses connected to the internet by broadband access. We consider how a user can act as Mobile Virtual Network Operator (MVNO) by providing connectivity to other mobile devices by sharing his/her broadband access by means of femtocell solution. Femtocell networks have been studied lately, as they can bring several benefits to mobile operators, while providing advantages to the final consumers. Femtocells are low cost, low power network solutions that can increase the quality of service for the final consumers, and in both [6] and [7] the authors show business model examples where femtocells benefit both the consumer and the wireless access providers.

C2POWER is a novel service, aimed at saving energy on the mobile terminal side, by applying a traditional business model (re-selling of services, or franchising [8]) in an alternative way.

2. Mobile operators and value chain

As technology evolves, it is used increasingly by companies and final consumers, with the goal of improving operations and subsequently translating it in either financial gains or strategic advantages. Opportunities for realizing these two types of benefits can be identified through an examination of the business value chain illustrated in Figure 1, which describes the case of a mobile network value chain. The figure shows the relationship aspect of the value chain, highlighting the relationship management between organizations and the resulting competitive advantage for the appropriate strategy value. Strategy value in this case is defined as "the art of positioning a company in the right place on the value chain"—the right business, the right products, the right market segments with the right value—adding activities. This strategy can be viewed as the value-creating system itself, in which members work together to create value. A key strategic task is the reconfiguration of the value chain roles and the relationships in order to mobilize the creation of value in new forms and by new players. The value is the relationship between the utility combination of benefits delivered to the customer and the total costs of acquiring the delivered benefits; in other words, the value is described as a preferred combination of benefits (value criteria) compared with the acquisition costs. Furthermore, in [9] "relative value" is defined as the perceived satisfaction obtained from alternative value offers. In Figure 1, it is possible to observe the entities which are part of the value chain and their positions, which correspond to characteristics and functions respectively. Identifying the characteristics of each player is useful to fully understand where, for example, an organization exploits new values; meaning that "characteristics" are defined as "an entity that can best exploit ways to create value" and function is considered the "specific activities that are responsible for creating characteristics". For example, by identifying the specific activities of a particular player in the value chain, it is possible to identify the competitive advantage [10], [11].

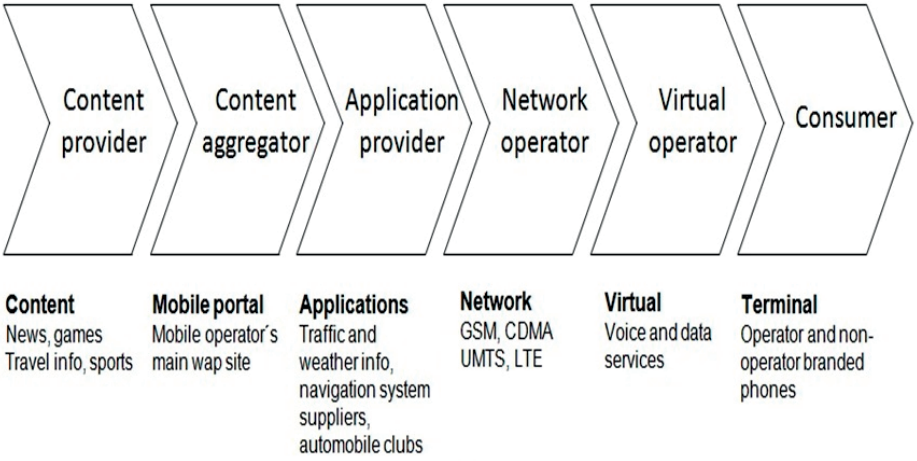

Figure 1. Mobile network value chain

With the support of Figure 1, we can observe that the mobile network operators are prevalent in the value chain, dominating content delivery and the user retail environment for purchasing content and applications in the shape of operator portals. Many operators are currently expanding their role into content aggregation, application stores, smart enabler services for developers and other parties. With this growing demand of wireless networks from users, mobile operators have the challenging task to exploit new locations to expand their own business. Actually divided by two types of evolution, developing and developed countries have an important role in the mobile market proliferation, where a mobile operator needs to analyze the market to further have a dominant position for future revenues. This domain is most visible in developing countries like China or India, because with the growth of network coverage there is an increased handset subsidy; moreover some operators chose the strategy to have handset exclusivity with some handset brands. In developed countries, this domain is much smaller, since mobile operators have to face competition in all of their activities; hence having to spend high values on subscriber acquisition, taking into account the saturation of the market or even by constantly analyzing the economic slowdown [12].

Mobile operator competitiveness is nowadays strongly dependent on providing new contents and services to the end user. Because mobile operators are unable to develop all these services and contents in-house without losing their focus on their main business, they resort to other companies, which have these services and contents as their main businesses and can offer innovative solutions to promote the mobile operator in its competitions with other mobile operators. However, to maintain their position, mobile operators have developed portals to ensure that content creators are kept away from end-customers. This practice is based on the traditional assumption of the value chain that development of strategies is led by operators.

2.1. Content providers

Initially, the purpose to have content providers came directly from the network operators, who contacted other companies for proposals to be content providers that could produce diverse contents for the end users. Such role was gladly accepted and the allocation of the majority of these content providers is now well established on top of companies (network operators), with the content providers having the challenge task of showing to the end-customers that the mobile operator's contents is a high quality service. However, this partnership between network operators and content providers brings some difficulties that must be balanced in terms of business. For instance, the network operator has to be convinced that the content providers would maintain a high standard for their contents, while at the same time have to feel secure about their own relationship with other content providers that could produce innovative and interesting contents that would be applied in the network operator.

When a company in the business market offers a wide range of content, they usually provide their own created content based on their own field of business. Resources, like the mobile internet, are used to provide contents to consumers without spending a lot of financial resources. Only a restricted group of people in the company needs to work on a website to further include content. This means that these companies are simultaneously content owners as well as content providers. With these arrangements, the company can create cheap contents and obtain large profits, if it can appeal to a large number of consumers. Companies in the category computer gaming are the best example of content owners and content providers.

Being an official content provider brings benefits, such as [13]:

- Billing system—one advantage is the possibility of using the operator's billing system for charging the users. The subscription fees are the main source of revenue for the majority of content providers.
- A place on the menu—being placed on the menu of the mobile service is the most effective way to reach users since most people look for content through the main menu.
- Free marketing—information brochures about mobile internet service mention different services, which get the users' attention.
- High quality stamp—the official content providers can thus, through the fact that they are official, assure users that their content is most probably superior. An unofficial content provider is subject to a quality testing by users and any failure that they find is a serious problem for content providers. For this reason, users normally choose an official site.

The role of content providers brings also some drawbacks, like:

- Limited flexibility—official content providers must have the permission to conduct more than minor changes to their sites. Consequently, it takes longer to adjust to new trends or to introduce new ideas.

- Prohibition against advertisement—official content providers have been prohibited from having advertisements on their sites. Having ads is still limited, but this restriction is slowly being removed.

2.2. Content aggregators

A content aggregator is an individual or organization that gathers Web content (and/or sometimes applications) from different online sources for reuse or resale. There are two kinds of content aggregators, depending on whether they

- simply gather material from various sources for their Web sites.
- gather and distribute content to suit their customer's needs. The latter process is called syndication.

For example Sapo [14] and Moreover [15] are among the increasing number of companies offering aggregated content for resale. Aggregators are companies created with the aim of reducing the time and effort needed to constantly analyze websites for updates. The main role of these companies is to collect updated information from several providers, group them in a unique space and then make them available for consumers (subscribers) in a single browser display or desktop application. Once subscribers are registered to a feed, an aggregator is able to check for new content at user-determined intervals and retrieve updates automatically. The way that content is provided to subscribers is nominated as "pushed". For example, when the subscriber receives an email, the content is "pushed" to him. Aggregator features are frequently seen in portal sites (such as Sapo, My Yahoo! and iGoogle) and email programs. Content aggregators are also mentioned as RSS readers, feed readers, feed aggregators, news readers or search aggregators.

2.3. Application service provider

Mobile operators and mobile service providers will have to take into consideration that they can suffer competition from MVNO's (Mobile Virtual Network Operators), and from the negative impact of new communication technologies (WiMax, WiFi, IP Multimedia Subsystem or IMS) and broadcast technologies. Today, internet access is still dominated by the fixed line or WiFi hotspots, but in the near future mobile devices that are connected to telecommunications networks are predicted to become the most important way to access the digital applications and services. Consequently, an application service provider (ASP) is a company that offers individuals or enterprises access over the Internet to applications and related services that would otherwise have to be located in their own personal or enterprise computers [16]. ASP services are expected to become an important alternative, not only for smaller companies with low budgets for information technology, but also for larger companies as a form of outsourcing for many services for individuals as well.

Applications in the center of the ASP include:

- Remote access facilities to users within an enterprise with a common file server.

- Special applications that would be expensive to install and maintain within your own company or on your own computer.

While ASPs are expected to provide applications and services to small enterprises and individuals on a pay-per-use basis, larger corporations use ASP services to mainly promote a centralized control with a special kind of application server that is architected to handle applications off personal computers [17].

2.4. Mobile virtual network operator (MVNO)

When there is a point of rupture in the traditional value chain, due to several factors (such as fractious relationship between manufacturing and marketing or too many islands of data that lead to delayed decision making [18]), a new business model can emerge to take advantage as an intermediate like MVNO (Mobile Virtual Network Operator). MVNOs provide mobile voice and data services without owning the access rights to the spectrum they use. Figure 2 below shows the potential areas where an MVNO can participate within the Value Chain to further extract values.

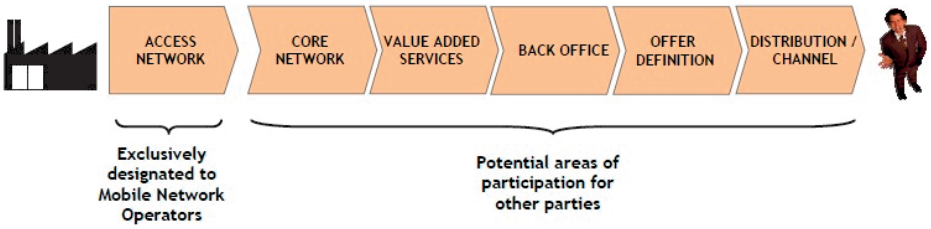

Figure 2. Potential areas of participation for MVNOs [19]

To provide services, MVNOs use the radio capacity obtained through commercial agreements with licensed mobile network operators, which have exclusivity of the access network, as the main purpose to exploit, for example, distribution channels, customer base in order to provide customized values (specific products) for customers, taking advantage of its brand awareness [19].

Typically there are three types of MVNOs [20]:

- Classic service providers—This kind of MVNO is usually seen as reseller. With the aim of reselling subscription to end users, MVNOs are dependent on MNO for every issue concerning service provision, billing and customer care.
- Hybrid MVNOs—This kind of MVNO acquires its own SIM card and usually controls several network elements. These MVNOs are closely linked with MNO, because they need to use network facilities and access to radio networks.
- Full MVNOs—A full MVNO owns network facilities and services like towers, mobile switching centers or mobile cellular services, with the exception of radio

network equipment. They have the ability to operate independently of the MNO and are also able to secure their own numbering ranges, design of services and tariff structures. To be a full MVNO, the MVNO normally needs to have an NFP (Network Facilities Provider) individual license for network facilities, an NSP (Network Service Provider) individual license for network services and an ASP (Application Service Provider) license to provide public cellular services.

In recent years, globalization and technology innovation changed the telecommunications industry and forced operators to renew and develop competencies to compete with mobile services. Today, for better efficiency, operators attempt to understand the preferences of customers and segment them, providing differentiating ion personalized offerings [21]. In Figure 3, we can see the changing of competencies, such as, core competence, where a monopoly operator is concerned about the installation of infrastructure, because it aims to maintain customers, while the major objective of the competitive operator is launching products to attract potential new customers and offer new services to existing ones.

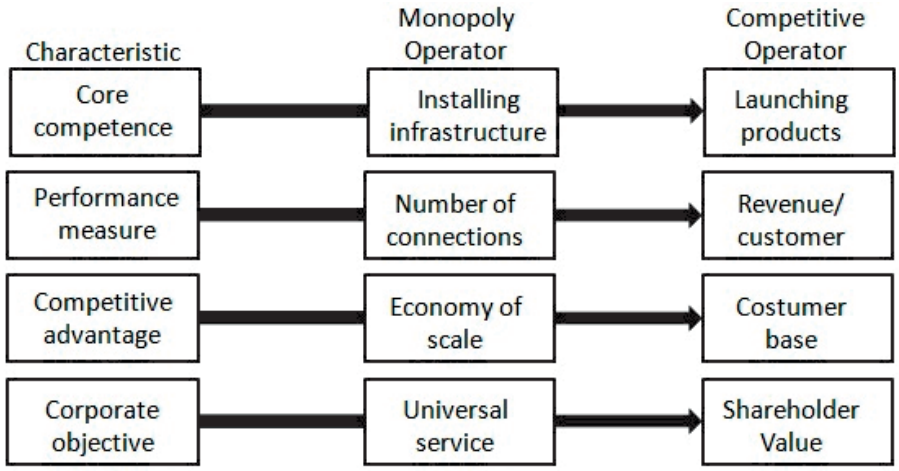

Figure 3. From monopoly to competition: challenges facing traditional telecom operators [21]

There is also a description for the measure of the performance of the operator. In a monopolist case, the measure of performance is verified by the number of connections, because it is important that the largest number of people become customers, increasing profits and at the same time preventing competitors from winning customers over. In a competitive case, the most important factor is the revenue per customer. It includes not only the revenues billed to the customer each month for usage, but also the revenue generated from incoming calls, payable within the regulatory interconnection regime. The monopolist operator looks to competitive advantage like an economy of scale, where it refers to the cost advantages that a business obtains due to their expansion. The

competitive operator is focused on the customer base, where the business serves a group of customers/consumers and tries to persuade them to become repeated consumers, resulting in a considerable slice of the profits. The monopolist operator provides a universal service as a corporate objective, while a competitive operator is based on a shareholder value where the company goal is to increase the potential of its shareholders by paying dividends.

2.5. Consumer

The network industry experts agree that final consumers have an important role in the value chain. Personalization, communication, positioning and immediacy are the focus of the mobile marketplace for consumers. They believe that to have success in the mobile world market, they have to continuously reinforce the need to think like the consumer and take the consumer needs into account. Today's mobile operators are able to develop the types and range of content and services that consumers will increasingly demand; meaning that they ultimately provide consumers the role to control the process of making new network services [21]. By understanding consumer needs, the operators are capable of adjusting final products or services to meet consumer preferences. With that approach, mobile network operators are able to exponentially increment profits in a certain product due to consumer satisfaction.

Consumers also have an important role in the development of a company with regards to innovation. If a company has a certain product without changes or innovation, in the long term, consumer choices will be driven away to updated products of other companies. So companies have to be aware of consumer choices and need to be in the frontline of innovation.

3. Femtocells as a player in the Value Chain

To understand the role of femtocell networks in the mobile value chain, it is important to analyse the main purpose of femtocell deployment in mobile market. The main goal of femtocell deployment is to provide access connectivity to subscribers that are within its range. Thus, it can be assumed that femtocell networks can position themselves as the Mobile Virtual Network Operator (MVNO) player in the mobile value chain, which is the infrastructure to access the Core Network. For this solution to be accepted by Network Operators, which control the mobile communications, we must assume that they continue this control by providing the femtocells at low cost to the customers. In exchange, the Network Operators will bill the subscribers using the solution. Users using the femtocell network get the role of the consumer player in the mobile value chain.

Business Case

Recently a new paradigm appeared in mobile networks, the femtocell approach. Femtocells are small base stations that provide standard network access and will revolutionize the concept of indoor network coverage. According to recent surveys, around 90% of data services and 2/3 of the phone calls take place in indoor environments. In some countries, like France or the United Kingdom, network operators have launched in the market the femtocell service for customers [22]. Orange France operator is offering a fully managed femtocell service and Vodafone UK became the first operator in Europe to launch a femtocell originally called Vodafone Access Gateway [23].

Besides higher bit rates, Qos and coverage, femtocell can also significantly decrease the energy consumption of mobile devices [24], when compared with macro cells. This fact seems to be the most favorable to broadly adopt femtocell equipment as indoor solution.

Currently, three different access models are defined for femtocell operation: the open model, closed model and hybrid model, which are differentiated as shown in Table 1.

Table 1. Femto cell access for UEs of any release [25]

	Access Mode		
	Open	Closed	Hybrid
UE allowed access to CSG	Access	Access	Preferential Access
UE not allowed access to CSG	Access	No Access	Access

For the sake of simplicity, the Open model can be assumed as public, where the femtocell equipment and transport connection owner belongs to the network operators. In this case, UEs have free access to the femtocell, because there is no differentiation in allowed and not allowed Closed Subscriber group (CSG). In the Hybrid model, the femtocell equipment is provided by a company for an individual owner. In this particular case, the UEs belonging to the CSG list have some privileges on the access to the femtocell; however customers not belonging to the CSG list can access the femtocell with restrictions. Finally, in the closed group, only UEs belonging to the CSG list can access the femtocell. Others are prohibited from accessing the Femtocell. These three types of access are described in more details below, showing the advantages and disadvantages of each one.

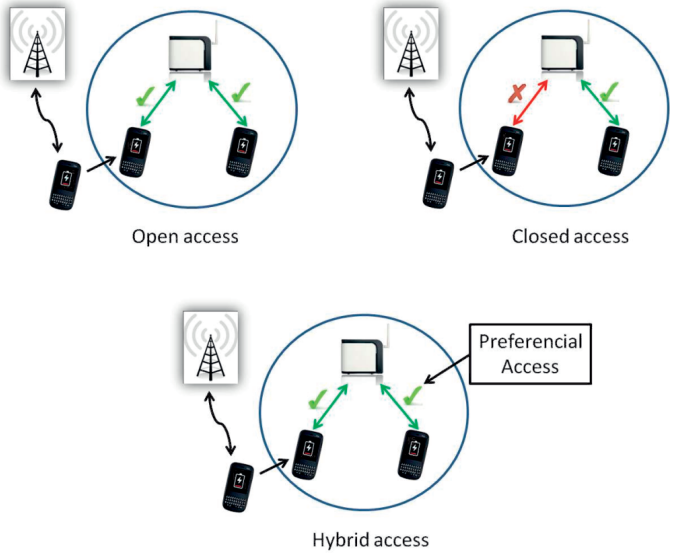

Figure 4. Access modes in femtocells

Femtocell Access Types

Open access

In this type of access, all users (CSG and non-CSG) are authorized to connect. The representation seen in Figure 4 shows a device connected to a macro cell, which enters within the femtocell coverage, and automatically updates its connection to the femtocell. The users are always connected to the strongest server (macro cell or femtocell) avoiding cross-tier interference, so the throughput of the network increases.

Inside homes or companies, this type of femtocells will be deployed in random locations. Being self-organization would be a good solution to minimize the negative impact of femtocells in other cells. On the other hand, when deployments are done by an operator, interference can be mitigated through the network planning and optimization. The location, power and frequencies assigned to each femtocell can in this case be planned in advance. However, open access has some drawbacks as well, the biggest of which is the reduction of the performance of the femtocell owner, due to the sharing of the femtocell resources with non-subscribers. Moreover, open access increases substantially the amount of handovers between cells due to the movement of outdoor users. A user moving into a residential area handovers from one femtocell to another, or to the macro cell. This will have a negative impact on the operator network because it increases the dropping probability of the call due to failure in the handover process. Different solutions have been proposed in which a centric sensing of the radio channel

is used as a mean to obtain parameters about the surrounding environment and to update the femtocell neighbouring list. Before open femtocells are widely deployed, research is required in order to support new algorithms to handle more neighbours and their different nature in a fast manner [26]. Nevertheless, open femtocells reduce the load of the macrocell network, and are advantageous for the network operators, who can either support new customers or save money in the macrocell operational costs, for instance by saving power.

Closed access

In closed access mode, only a subset of the users (CSG), which is defined by the femtocell owner, can connect to the femtocell. If a non-subscriber enters in the femtocell coverage (See Figure 4) the user cannot connect because the user does not have permission.

Nowadays, the closed model is the preferred model by customers for home femtocells. This decision is related to the full control of the femtocells and the list of authorized users. By law, femtocells must be able to perform emergency calls by everyone, even if not on the list of users of femtocell. This feature implies that some resources have to be released to non-subscribers, which is a minor drawback of this model.

The main problem of the closed method is the interference between femtocells. To reduce this problem, the power radiated by the femtocell must be auto configurable to ensure that coverage is sufficient for subscribers and minimizes interference with neighbouring femtocells and macrocells. This can be done through self-optimizing the femtocell radiated power, where each femtocell sets its power to a value that on average is equal to the received signal strength from the closest macrocell at a target femtocell radius. Another solution is the use of sector antennas in the FAPs (Femtocell Access Point) to minimize the overlapping of coverage areas [26]. The selection of an access control mechanism to femtocells has direct effects on the performance of the overall network, mainly due to its role on the definition of interference, so their features must be carefully studied. Both access methods (open and closed) suffer from advantages and disadvantages, which can be seen in Table 2.

Table 2. Closed vs. Open access [26]

Closed access femto cells	Open access femto cells
Higher Interference	More handovers
Lower network throughput	Higher outdoor throughput
Serves only indoor users	Increased outdoor capacity
Home market	SMEs, hotspots
Easier billing	Security needs

The impact that subscribers might feel that they are paying for a service that is exploited by others must be minimized in terms of performance or via economic advantages, like offer services or reducing costs [26].

Hybrid access

In this type of access, the femtocell provides not only authorization to CSG, but also to users who do not belong to CSG. Therefore, CSG members have special priority over other users. This means that users who belong to CSG have priority in connecting to femtocell and also have a guaranteed minimum QoS. On the other hand, users out of CSG have limited QoS and when services cannot be provided to CSG users, due an interruption of femtocell resources, it shall be possible to continue the communication in another cell. To minimize the impact of connections of users not belonging to CSG, it is possible for the network to reduce the data rate of established communications of non-CSG users [25].

As there are two different types of users, femtocells need to perform an identity request to obtain the UE's (User Equipment) IMSI (International Mobile Subscriber Identity) for access control and service level differentiation purposes [27].

There are many possible solutions to defining the hybrid model, i.e. to define how resources are shared between users of CSG and non-CSG. In Figure 5, three factors are illustrated that should be taken into account:

- **Use of the resources**: should all resources be shared equally among all users, or should a fixed amount be reserved for subscribers?
- **Treatment of non-subscribers**: should a finite amount of femtocell resources be allocated to all non-subscribers or to individual users?
- **Time dependency**: should the number of shared resources be changed over time?

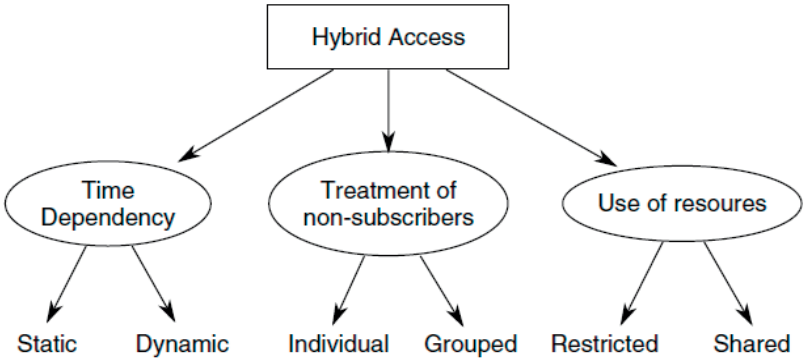

Figure 5. Factors defining the hybrid access algorithm [27]

For each particular mobile system (Wimax, UMTS, LTE), the average throughput and QoS per user can be increased deploying more small cells (or sectors, cell sectorisation) and optimizing the radio network, particularly minimizing the interference. However, small cells imply a high cost for the network operators (CAPEX and OPEX) that can jeopardize any expectation of future profits. For instance, the cost of site rent can be as high as 20% of the operator steady cost (OPEX).

One of the most attractive characteristics of the Hybrid access femtocells (assumed private) to the mobile operator is that it can provide a high quality of service at low expenses (no site rent). In fact, if the operator is also a fixed network operator, Hybrid access femtocells can increase its revenue providing xDSL connections that support the femtocells.

The main drawback of using open access (public) instead of closed access (private) is the high number of HO that may result to provide the continuity of the service to a user with high mobility. This fact implies a significant increase of signaling data in the network, higher call drop probability and lower QoS. Next section shows an alternative goal, which is saving energy on the mobile terminal side.

To understand the role of the femtocell solution as a player in the mobile value chain, it is necessary to analyze which function each player has. With this approach and by analyzing the whole value chain, the mobile virtual network operator seems to be the closest function related to the femtocell deployments. In fact, the femtocell solution cannot be seen as a content provider or content aggregator, because it does not provide any different content than actual macrocells to subscribers. On the other hand, it shall provide voice and data services, which is the main role of an MVNO. Finally, subscribers of femtocells have the role of consumers in the value chain, who only receive and use the service provided by femtocells.

Concluding, the femtocell offers a number of important benefits for both consumers and operators. In the near future with the transition to the LTE technology, the femtocells, beside improving the network coverage (better signal strength) at consumers homes, will enhance the performance of mobile data, while providing faster access to mobile services and multimedia content at the same time reducing the consumption of the terminal's battery due the proximity of the femtocell. These benefits come without requiring users to make changes in their mobile terminals, due to the fact that the network femtocell technology is the same as the macro cell. For mobile operators, the use of femtocells brings new ways to offer attractive services for femtocells users, and represents a high cost effective way of increasing both network coverage and capacity at consumer homes.

4. Use Cases—C2POWER

C2POWER [28] is a project funded by European Seventh Framework Programme (FP7), which is a funding program created by the European Union in order to support

and encourage research in the European Research Area. C2POWER aims at leveraging on two novel techniques (vertical handovers and cooperative relaying) to realize energy saving on the terminal side. In particular, it considers Femtocells as a new network access type, and integrates it into existing long-range RATs.

C2POWER proposes new architecture [29] based on the 3GPP SAE and context information that provides mechanisms to minimize the false HO and the ping pong effect between macro and femtocell. In the proposed architecture, a user re-sells his broadband access (franchising) by means of a C2POWER-enabled femtocell, to a visiting user having a C2POWER-enabled mobile terminal. The visiting mobile terminal will save energy, and both the Network Operator controlling the femtocell and the user who is sharing a broadband access will get revenues.

A business model for power efficiency in Horizontal/Vertical Handovers

Traditionally, the main goal for a business model is to explain how an enterprise will make money out of their business. However, in a few cases (e.g. business models linked to mobile telecommunications), it is possible to attain alternative goals. In this section we exemplify this alternative view by showing how a business model can be used to promote power efficiency on mobile equipments.

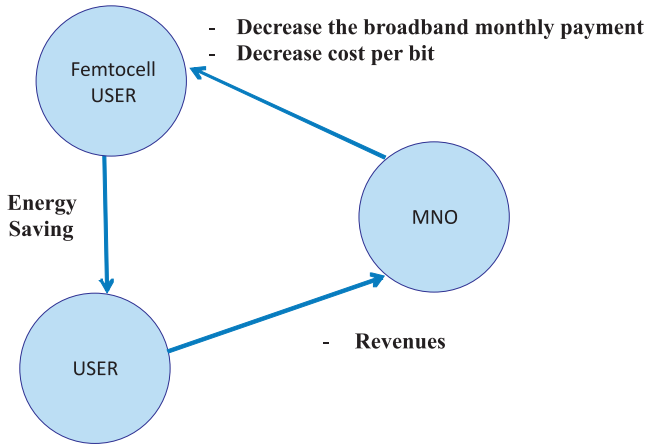

Figure 6. Relationship diagram for femtocell users

Use Case—Power efficiency on Horizontal/Vertical Handovers

With the purpose to sell femtocell solutions, a particular mobile operator offers new mobile services to consumers who purchase this type of equipment. John buys

a femtocell to enjoy the indoor coverage that femtocell provides. After deploying the femtocell equipment at home, John verifies that his femtocell provides coverage in the neighborhood of his house. Using the "hybrid femtocell" feature, John re-sells its broadband access (franchising) to all of his neighbors' mobile phones. The net result is that John's neighbors are able to access John's network and automatically save energy when in proximity of the femtocell.

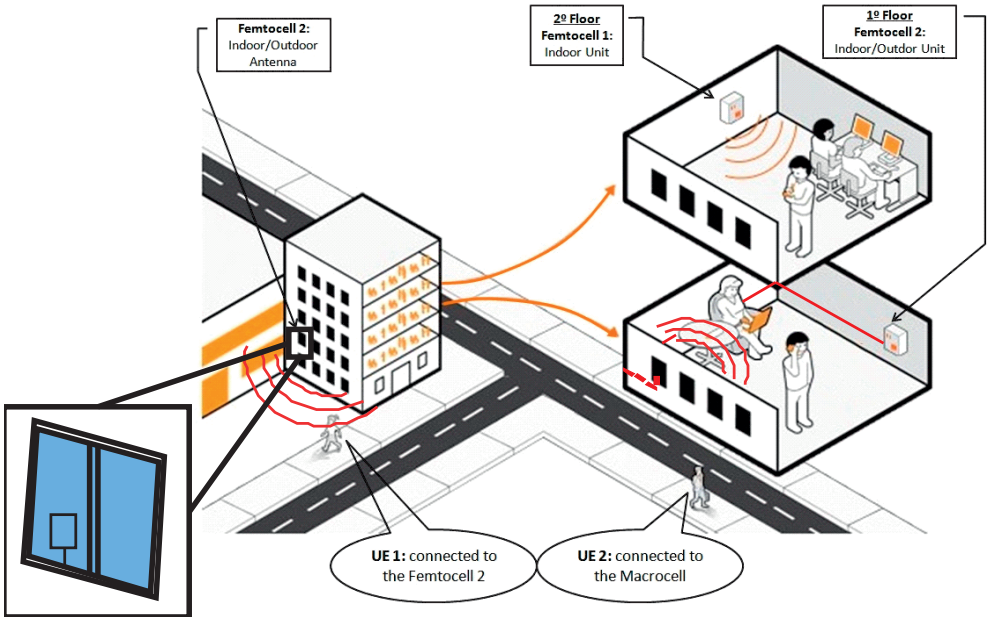

Figure 7. Indoor and Outdoor femtocell coverage

5. Conclusions

A good business model is needed to make a company prosper by attracting customers, and by converting customer payments into profits. This paper considers the telecommunication industry, and analyzes the role of the different actors in the overall value chain when proposing the introduction of femtocells into the scenario.

The paper then focuses on the role of Mobile Virtual Network Operator (MVNO), to be held by the user who decides to share his/her broadband access via a femtocell. A business model is provided, to show how both the network operator and the user can obtain benefit by the novel architecture.

Finally, the paper introduces C2POWER, which is a novel service, aimed at saving energy on the mobile terminal side. The role of a business model in C2POWER is both to encourage network operators and users to adopt the solution, and to implement an energy saving policy in the system.

Future work will provide further study on the C2POWER approach by means of simulations and of techno-economic analysis,

6. Acknowledgement

The research leading to these results has received funding from the European Community's Seventh Framework Programme [FP7/2007-2013] under grant agreement n°248577 [C2POWER].

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FEMTOCELIŲ VERSLO MODELIS: ENERGIJOS TAUPYMO FRANČIZĖ

Tiago Carvalho Moreira

Telekomunikacijų institutas, PT Inovacijos, Portugalija, tiago-c-moreira@ext.ptinovacao.pt

Michele Albano

Telekomunikacijų institutas, Portugalija, michele@av.it.pt

Ayman Radwan

Telekomunikacijų institutas, Portugalija, aradwan@av.it.pt

Jonathan Rodriguez

Telekomunikacijų institutas, Portugalija, jonathan@av.it.pt

Alvaro Gomes

Telekomunikacijų institutas, PT Inovacijos, Portugalija, agomes@ptinovacao.pt

Santrauka. *Verslo modelis yra pagrindinė priemonė siekiant, kad nauja technologija neštų pelną. Jos aprašymas gali būti naudojamas išryškinant naujos vartotojų naudojamos architektūros pranašumus. Turint tokį tikslą svarbu į verslo modelį pažvelgti kritiškai ir pasverti, į kurią vertės kūrimo grandinę konkreti technologija gali būti įtraukta. Aprašytame scenarijuje mes analizuojame judriojo ryšio pramonę ir viena iš pagrindinių analizuojamų temų yra skirtingų veikėjų, kurie atsiranda vertės grandinėje, vaidmuo ir poveikis, kurį*

jiems gali turėti pasirinktas modelis. Šiuo metu femtocelių tinklai pristato naują technologiją, sukurtą siekiant praplėsti judriojo ryšio veikimo zoną uždarose erdvėse. Vartotojo namuose išdėstomos mažos bazinės stotelės su plačiajuosčio interneto prieiga. Taikant šią technologiją judriojo ryšio operatoriai savo vartotojams gali teikti geresnės kokybės paslaugas uždaroje erdvėje. Pasirinkus šį technologinį sprendimą tinkamas verslo modelis turi parodyti, kaip judriojo telefono ryšio operatoriai pritaikę minėtą technologiją gali gauti pajamų. Verslo modelis gali padėti siekti skirtingų tikslų. Mes svarstome, kaip vartotojas gali veikti kaip mobiliojo virtualaus tinklo operatorius (*MVNO*) (*angl. Mobile Virtual Network Operator*) *suteikiant ryšį su kitu mobiliuoju įrenginiu, dalindamasis jo plačiajuosčio ryšio prieigos femtocelių sprendimu. Mes parodome verslo modelio C2POWER vaidmenį naujoje paslaugoje, skirtoje energijos taupymui.*

Raktažodžiai: *verslo modeliai, bendradarbiavimas, vertės grandinė, tinklo dalijimas.*