

# Business Models for Personal Networks

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**Abstract - The aim of this paper is to define the concept of Personal Networks in a business model perspective and to discuss the business modelling aspects of personal networks. The paper suggests three generic business models for Personal Networks; a service oriented model, a self-organized model and a combination model. All three models are analysed and described at a generic level taking into account the most important business modelling aspects regarding the deployment of Personal Networks and Personal Area Networks. The paper is based on ongoing work within the MAGNET project (My personal Adaptive Global NET) WP1/task 4 on socio-economic impact and business models.**

**Index Terms - Generic business models, personal networks, personal area networks, service-oriented networks, self-organized networks**

## I. INTRODUCTION

The main strength of the Personal Network (PN) concept is that it emphasize the use of different network and information resources aiming at creating an electronic personal service environment, no matter, where the user is located. In the MAGNET project document, PNs are conceptualized in the following manner: ‘PNs are configured in an ad-hoc function, as the opportunity and demand arise to support personal applications. PNs consist of communicating clusters of personal and general digital devices shared with others and connected through various suitable interconnection agreements’ [2, p.6]. PNs thus comprise potentially ‘all of a person’s devices capable of network connection whether in his or her wireless vicinity, at home or in the office’ [2, p.6]. The implication is that the architectural aspects of networks and services and, therefore, also the business and business modelling aspects are at the centre of discussion.

The PN concept is closely related to, for instance, the Virtual Home Environment concept promoted in 3GPP and other similar concepts related to the use of heterogeneous networks for delivering personalized services to the end-users [3, 4, and 5]. However, the specificity of the MAGNET project on PNs is the focus on Personal Area Networks

(PANs) and peer-to-peer organized networks. The implication is that there is an emphasis on the self-organized aspects of networks and applications.

This has important consequences for business modelling. Generally, business modelling is a supply side exercise. User needs, targeted market segments and value propositions must be part of the modelling exercise. However, basically business modelling deals with the relationships between the players on the supply side in order to determine how they can service the needs on the demand side. In the case of PNs, the demand side has to be directly involved in the creation of business models. The reason is that user groups can set up parts of the network infrastructure and construct and deliver the services themselves, and will often only need to interconnect and work together with commercial network providers for parts of the network and service delivery assignments. PNs will, therefore, often consist of combinations of service delivery relations (i.e. from a business enterprise/operator to an end-user) and self-organized networks and applications (i.e. ad-hoc or peer-to-peer based). This does, however, not apply in all cases. A whole package of personal network resources and services may be delivered by commercial enterprises, but the possibility of user groups organizing parts of the communication processes and applications by themselves, makes the involvement of the demand side necessary in the development of business models.

## II. DIFFERENT APPROACHES

There is nothing very new in self-organized models even though telecommunication operators, before the liberalization of telecommunications, were seeking to push the ‘monopoly interface’ as deeply into the users’ entities as possible. The internal company networks and even the attached end-user equipment used to be owned by the monopoly providers. However, this has changed. Business users will mostly manage their own internal networks, but the borderline between self-organization and outsourcing is constantly shifting. Facilities management operations have existed for many years e.g. ASPs (Application Service Providers), offering their services to business users. Web services are the latest example in these kinds of arrangements.

A combination of self-organized structures and services delivery structures offered by commercial providers will therefore be a common situation – especially when different kinds of network resources are combined. A person having his

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or her own PAN may, communicate with another person's PAN by means of Bluetooth or other PAN technologies when they meet. When at the home base (i.e. residential or business), the communication devices of the users may connect through a WLAN, which is managed by the users themselves. Other WLANs, owned by network and service providers, may be used when located in a stationary manner outside the home base, and the services of commercial cellular mobile network providers may be used when on the move.

These kinds of combinations do not, in principle, present any major problems business-wise. When using the self-organized structures, the users do not pay for the applications and facilities they use. However, when using the services delivered by commercial providers, there will be a business relationship with payments to the service providers. Technologically, such combinations already exist. Files can be exchanged between two computers with PAN technology; local LANs are used when accessing the network at the home base; commercial WLAN services are used in public places such as hotels and airports; and cellular mobile networks are used when on the move or in a place with no WLAN coverage. However, in the future such combinations of different network facilities and business arrangements will become far more diverse and complex. The strength of the PN concept is that it is geared for fulfilling these diverse and complex situations.

Seen from the point of view of commercial network and service providers, users can be sub-divided into different market segments to which services must be adapted in order to win the market. Formerly, telecommunication operators would only offer a small range of products. Market segmentation for telephony would in its build-up phase relate to different social strata and their ability to pay for services. However, with the expansion of the variety of services offered, segmentations of the market have increasingly been seen as important. Different kinds of customers may demand different kinds of services, and customers in different situations may as well have different requirements. This is increasingly the exercise that network and service providers are performing – i.e. to sort out the extent to which different groups of customers can be serviced with specifically designed services without raising the costs of producing these specific services too much.

Seen from the viewpoint of different user groups, the primary aim is to get access to communications, applications and information in the most easy and low cost manner. In addition to this, there may also be an issue of information security and 'ownership' of information provided to the end-users. These considerations may lead user groups to build up and manage the network and information resources by themselves – in a self-organized manner. Perhaps the systems to be established build on existing internal information and network resources and can therefore be constructed and managed efficiently at relatively low costs. But in other cases

one or more external service and network providers can deliver parts of or the whole network and service package necessary for providing the users with the applications and facilities they need. In such cases, the establishment and management of the networks can be outsourced to commercial providers.

Often, a number of different players will be involved in providing PN services and applications. There can be different kinds of information and application providers, and the multitude of players involved in a PN can be a complicated patchwork. Some of these additional players may be commercial information providers and others may be non-commercial. Many different business models (or modes of organization) are possible. With respect to the overall question regarding the changes induced by PNs in business modelling in the wireless and mobile business areas, the general answer is, consequently, that PNs create the need for much more flexible business models of commercial network and service providers, as these commercial providers have to adapt to a far more diverse and heterogeneous environment. Market segmentation is absolutely necessary but not sufficient, as it is not only a question of designing specialized offers to different user communities but also of adapting to and combining different commercial offers with the self-organized parts of PNs. The business models must include a view on the shifting interfaces between the commercial service delivery parts of the networks and the self-organized parts.

### III. BUSINESS MODELS

The main emphasis regarding business models for PNs and PANs is related to the cooperation and relations between the different entities within the value chain, e.g. service providers, application providers, operators, content providers and content aggregators aiming at delivering the services and applications required or demanded by the end-users.

Overall the communication patterns and business models within PNs and PANs can be divided into three main categories: 1) service delivery models where a service provider delivers a specific set of services or applications; 2) self-organized or ad-hoc models where different individuals and entities create communities for exchanging information and files etc.; and 3) a combination of these two models.

This includes analyzing and explaining future business model possibilities within PNs and PANs and the interaction between these regarding both business models and technology aspects concerning the different actors in the wireless market space. Who will provide the network service; how will the business models develop; and what kind of standardization is needed to secure that the roaming vision between different networks and technologies becomes a reality from the business model point of view?

### A. Service oriented models

The service oriented models are closely related to the business models of the present mobile environment – where the end-users sign up to different services. Basically, the service oriented approach can be subdivided into two models: One where a network provider has the contact to the end-users and provides the different services and applications. Secondly, a model where the different subscriptions, services and applications are provided by some one else than the end-users' network provider, i.e. the network provider is merely used as a bit pipe to reach the services and applications required.

The model where the end-users' network provider is delivering all the different services and applications and is controlling the contact to the end-users, is a straightforward solution regarding business models. Here the operator is in charge and controls the value chain, by billing the end-user and dividing the revenue within the value chain, e.g. with service providers, application providers, content aggregators etc. (as seen in the i-mode model) is illustrated in figure 1.

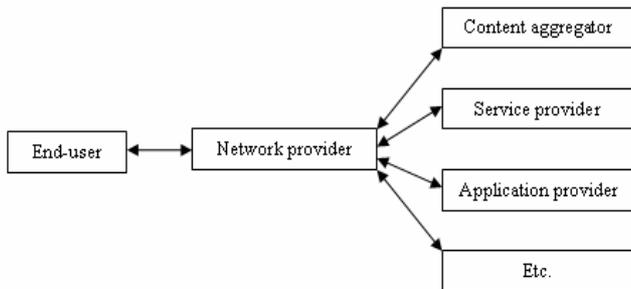


Fig. 1. Network provider business model

Turning to the second model, the picture is somewhat different. Here the end-user will use any network provider to connect to different content aggregators, service providers, application providers, etc. This business model is more complex, compared to the previous one, as the end-user and the content aggregator, service provider, application provider, etc. each have to establish a business relation, making it possible to bill the end-user (unless the service is free of charge). Furthermore, the end-user has to establish a relation to one or more network providers in order to get access to the subscribed services – as illustrated in figure 2.

The fact that there is no relation between the network providers and the different service providers could create a roaming problem. How will, for instance, the different services and applications, which the end-users have signed up for, be delivered, no matter, where they are and which access technology they use and what kind of access device they are connected from? These are some of the problems that need to be addressed together with authentication and authorization regarding deployment of PNs and PANs.

In principle, this business model is fairly straightforward, as the different content aggregators, service providers, application providers, etc. will establish a contract with the individual end-user and bill them according to terms and conditions. However, from an end-user perspective this set-up is, however, somewhat more complex: Besides, managing one or more network provider contracts (getting several bills, depending on the number of agreements with e.g., xDSL, mobile and WLAN providers), the end-users also have to manage and keep track of all the specific service agreements. As a consequence, the end-users will receive several bills, depending on the number of contracts.

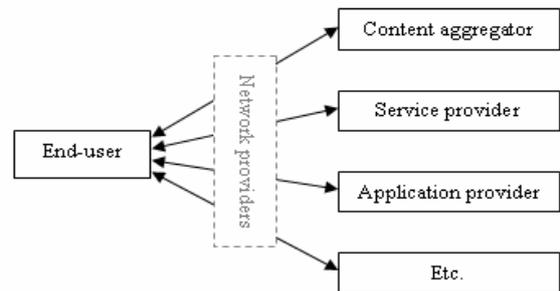


Fig. 2. End-user / provider business model

One solution regarding the billing situation could be to set up a billing aggregator to manage the end-users' different accounts and provide them with a single bill, whereby the billing aggregator will be 'owning' the end-user contacts.

### B. Self-organized models

The self-organized models, including ad-hoc and peer-to-peer models, cover a large area of possible interaction situations. Basically, the self-organized model could span from very local and simple ad-hoc cooperation between two or more entities to long distances, large scale and complex project cooperation including a multitude of persons, applications, services and network entities.

The self-organized scenarios focus on cooperative work and on what could be described as self-organized or ad-hoc cooperative contexts in relation to PNs. Within the self-organized context two scenarios are described to illustrate the potential involvement of PNs and how these can be supported by different business models - if any.

Starting with the simple model, the very simple illustration of a self-organized cooperative work situation consists of two or more persons who meet/team up and want to share or exchange documents, information, play a game etc. In this case, no network provider is required, as the involved entities will interconnect via their PANs, using ad-hoc network technologies, e.g. Bluetooth, as illustrated in figure 3.

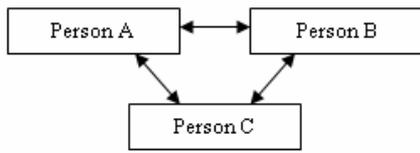


Fig. 3. Pure self-organized model

Essentially, this scenario is very self-organized and therefore no business model is actually needed for the communication or interaction taking place. On the other hand, the above case could also be extended and thereby require one or more network provider, application or service provider for the involved entities to connect and, possibly, use some kind of application or service for playing the game or getting access to the outside world, etc – implying that some kind of business model is required. In this situation, a third party might be needed as facilitator of infrastructure provision or access to specific applications and services. One assumption regarding this scenario could be that the specific person/entity would use whatever connection available and already signed up for.

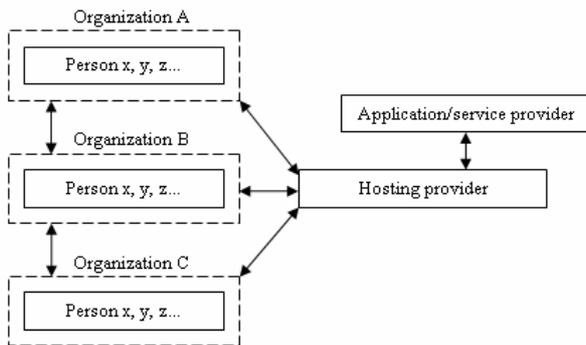


Fig. 4. Self-organized large scale project model

The more complex scenario regarding self-organized models could be a managed cooperative work scenario, where people team up in order to do a specific task or work on a joint project. In this organizational and project oriented context, the main difference compared to the ad-hoc scenario is the organized structure. However, knowledge sharing and the challenge of actually maintaining a community are also very important parameters.

Such a scenario could include three organizations with several persons from each organization, working together on a project where one of the organizations could be responsible for providing the virtual community (e.g. providing access to a shared server, the creation of a virtual community, etc). Alternatively, the shared medium could also be provided by a third party.

Basically, this set-up would probably use existing network connections (i.e. existing business models) for the main part of the communication, as most organizations already have a

fully functional infrastructure in place. Furthermore the amount of traffic could be high and consist of very demanding services and applications. However, when persons are outside the office or on the move and need to connect to the home base or be reached, some kind of wireless connection needs to be established.

### C. Combination models

Turning to the combination models which cover the wide range of combinations between the pure self-organized to the pure service oriented approach, the main feature here is that the end-user disposes over a mixture of services and self-organized models.

One example of a combination model could be related to an end-user (person A) participating in a project group, where people interconnecting through a self-organized network without needing a network provider, as the group uses ad-hoc based network technologies and only communicates within the group. Simultaneously, person A is using a service through a preferred mobile network provider, that has joined forces with different service and application providers in order to provide the end-user with a variety of options. Thirdly, person A is connected to a content aggregator via the company LAN or home xDSL connection to receive the preferred news services, which person A has signed up for. An example of this threefold combination model is shown in figure 5.

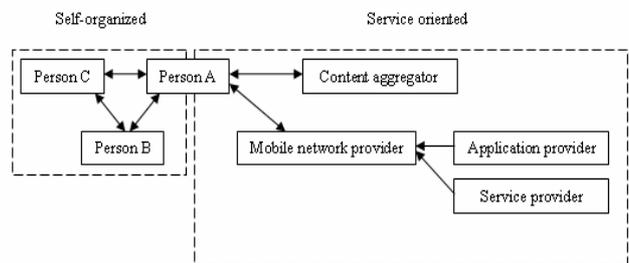


Fig. 5. First combination model

From a business model perspective, this set-up is more or less straightforward. The ad-hoc set-ups do not need a business model, as they are based on ad-hoc technologies and without any connection to the outside world. The two service oriented approaches need different business models. With respect to the mobile network provider, the end-user will receive one bill both for the access connection and the services and applications used – as the mobile network provider is delivering the different services and applications to the end-user.

The third model in play here is based on a network and service/application independent solution – meaning that there is no relation between the network providers and the actual service or application providers (in this case a content aggregator). Each of the involved entities will independently manage and control the end-user contact.

Another example of a combination model could be related to the mobility of the end-user, where the end-user connects to the home environment from wherever she/he is located and with whatever access technology and device available. In this example, the end-user is moving from an office environment to a hot-spot area and further on into an area covered by GPRS/3G access technologies and at the same time being in contact with the home environment – as illustrated in figure 6.

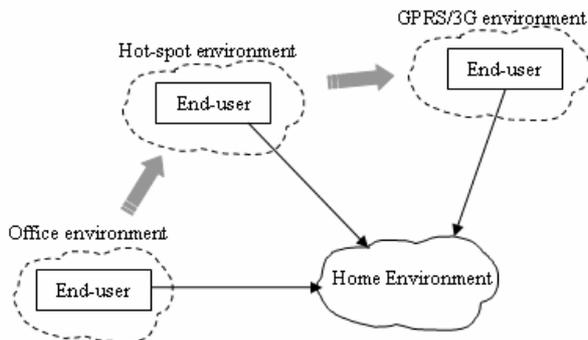


Fig. 6. Second combination model

From a business modelling perspective, this model is somewhat related to the model depicted in figure 2, where the end-user uses different network providers to connect to different services. Starting with the office scenario, the end-user simply uses the company LAN to connect to the home environment and, therefore, no specific business model is needed as the infrastructure is already in place and thereby also the business model for the infrastructure.

Moving to the hot-spot area, the situation changes somewhat. Here, the end-user needs to set up a business relation with the hot-spot provider in order to get connected (unless access is provided for free or in some kind of peer-to-peer relation). The business relation between the end-user and the service provider could be based on a subscription relation, if the end-user often uses the service or a simple pay-per-hour relation, if the end-user merely is passing by or in some kind of transit.

When the end-user leaves the hot-spot area and moves into the area covered by GPRS/3G access technologies, the situation changes again. Here, the end-user needs a subscription or, at least, the end-user's preferred mobile operator needs to have a roaming agreement in place with the current operator in order to get accepted and, thereby, connected to the available networks.

The three described business models all have some similarities and dissimilarities which have some influence on the business model and relation between the end-user and service providers. Starting with the roaming issue, it is important that the end-user is able to access and use the

services and applications signed up for, no matter which device and access technology (e.g. bit rate) is used to provide the connection – as these can vary significantly and thereby influence the service and application provisioning considerably.

From the end-user perspective, a second issue is the billing and pricing aspects. Travelling through these three scenarios, the billing as well as pricing conditions change radically from an end-user perspective: Starting with the free-of-charge office model; to the hot-spot area where either a subscription or by-the-hour payment model could be in place; to the mobile environment where some kind of subscription (roaming agreement) is needed. Looking at the cost in a pure bit rate perspective, the access costs to the home environment vary substantially, from nothing in the office environment, to a reasonable pricing in the hot-spot area, to an expensive pricing in the mobile network and an extremely expensive pricing model if it involves international roaming – making it very difficult for the end-user to actually know what the price is.

#### IV. CONCLUSION

The preliminary findings and descriptions in this paper have mainly been related to defining the PN concept in a business perspective and to discuss the different generic models of organization regarding PN and business models. Three different generic business models are proposed: a service delivery model, a self-organized model and a combination model. In contrast to the prevailing concepts on personalized services delivered on heterogeneous network platforms, the PN concept has a specific focus on the peering arrangements between PNs and PANs and the self-organized structures created around the establishment of many PNs and services.

The initial findings presented in this paper are based on ongoing work and research carried out within the MAGNET project. Further work and more in depth analysis of the business model aspects within PNs will be carried out, where a special focus will be on authentication, authorization, trust creation and more detailed value chain analysis.

#### REFERENCES

- [1] WP 1/task 4 of MAGNET project, *First Deliverable* (draft), September 2004
- [2] MAGNET, *Annex 1 – Description of Work*, 30 September 2003.
- [3] 3 GPP TR 22.121 v5.3.1. 2002, *Technical Specification Group Services and System Aspects, Service Aspects*, The Virtual Home Environment, (Release 5)
- [4] Suomalainen, J. *Service Provisioning in the Virtual Home Environment*. Helsinki University of Technology Telecommunications Software and Multimedia Laboratory. <http://www.tml.hut.fi/Studies/T110.551/2002/papers/May/jani.suomalainen.pdf>
- [5] UMTS World, Virtual Home Environment, <http://www.umtsworld.com/technology/vhe.htm>