Telecom perspective on Scenarios and Business in Home Services

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Abstract

The home network can be thought of as an extension of the telecommunications network reaching the customer wherever she is standing, sitting, lying or moving around in her home. According to this vision, there is a huge potential for service providers to offer their services into home networks. Early adopters have already home networks installed and there is a good variety of home networking products on the market. The current state is however far from a mass-market acceptance. In this paper a view on near-future home services scenarios is given. The services are classified into four main groups, entertainment, social inclusion, personal enrichment and home automation. This classification is based on previous work in national and international projects as well as the current research on next generation networks (NGN) and future services. Furthermore, this was supported by a questionnaire devised by the OSIAN project and submitted to a group of early adopters.

Nearly all over Europe telecommunications networks support the introduction of advanced new services, however without an integrated multi-services approach supported by a common platform. The main goal of the Eurescom project OSIAN is to define scenarios that utilise the already available customer premises equipment for new innovative home services. Technology is in place, but has only reached the early adopters. In order to reach the mass market, telecom operators (Telcos) have to take the role as service enabler. This includes the guarantee to provide services, which "work first time and ever", and which provide "value for money" for the customers.

OSIAN has identified a home infrastructure to meet the customer and operator demands. The infrastructure is based on a split gateway, with a public access to the Internet and a bridged mode, which connects to the operators' service infrastructure. The paper identifies the most promising services in the four domains and presents the principle infrastructure.

1. Introduction

This paper provides a view on future home services scenarios and business aspects, as seen from telecommunication operators. Operators from Hungary, Iceland, Israel, Norway, Portugal and Switzerland have discussed their view in the P1401 OSIAN project on "how to make future home services happen". To achieve this objective a generic comprehension of the research done on the future telecommunication networks was performed, and Home Services solutions were analysed.

Technologies and devices for homes are entering the market, and Nerds[1] have them already at home. From here it is however a long way to have successful home services for the common user. Satisfying the needs of different users in alternative homes will not happen through a "one size fits all" infrastructure. Having compared the user needs with technology offers, the OSIAN view concentrated on four service groups. The service groups are "Entertainment", "Social Inclusion", "Home Automation" and "Personal Enrichment". A more detailed description of these service group's characteristics is given in the following section.

To enable these services the current infrastructure, both at home and in the operator's networks will need modifications. Alternatives are discussed, addressing both the size of the residential gateway (RG) and the degree of control of the RG.

[1] We have extended the user characterisation "Nerd" to include Early Adopters.

The business cases for these new Home Services will be discussed in the last section before the conclusions. The Telecom Operators' perspective on the new Home Services will be clarified in the conclusions section where a summary with the main results is given.

2. The OSIAN vision, based on user requirements

The vision of future service scenarios was developed through a user group requirements and a market analysis, Figure 1. While most of the future scenarios either address "the vision of the future", our approach focuses on the near future. This vision is based on analysis of the existing infrastructure, which we established from interviews of early adopters. Roughly 80% of them had two or more PCs in the home, and 63% had installed a data network. The majority (80%) of people who had a data network had built it using wireless technology. Addressing the problems with today's infrastructure, 78% would like to exchange data between PC, TV, and audio equipment, but more than half (55%) had substantial problems in transferring content around.

Results from the questionnaire were not representative, but provided answers on where to focus in each of the scenarios. They were completed by an analysis of the market developments and social trends. The market drivers/trends in the home for 2005 are Flat screen and High-definition TV (HD-TV), broadband recording either on DVD or on hard-disk recorders, and the transformation from analogue to digital video and photography. Interconnectivity is however the most important aspect. This is established through the use of Media-PCs, socalled Mediacentres or simply by transporting iPod-like device around. The home broadband connection (e.g. ADSL) supports always online and enables on-demand services. Residential gateways are getting more mature, cheap, and offer innovative services in addition to communication. The social drives of a broadband, always-on connection are on-demand video, and multimedia social connectivity. We see a demand for enriched communication in the social context, where "participation in life" is easier. Broadband also allows for virtual groups based on your interests. The home portal becomes the centre for communication, making people's content available in and outside the home and allowing for the control of the home infrastructure. Users are aware of the potential services, but the "how to do?" limits the service adoption.

Preliminary work in the Eurescom P1206 project had provided a good overview over home infrastructure [1], thus OSIAN could concentrate on the specific infrastructure for service provision. Essential in the discussion is the question "how to make it happen", which again points to the question on "what to install". Experiences from ADSL installation show that the conventional household gets advice from early adopters on what to install. However, this advice is critical for the operation of the infrastructure. Early adopters like to play and want to have full control over the infrastructure whereas most people expect things to work easily from the outset.

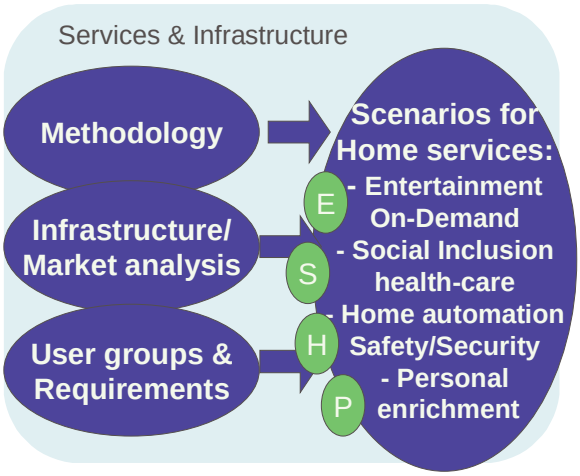

Figure 1 - Methodology used to establish scenarios for Home Services

The vision of an open network architecture, where the home is no longer an isolated place, but fully integrated in the access and service world, was first launched back in 2001 in the Eurescom P1118 project [5]. The vision, further developed in the P1206 project [1], found its way into the EU FP6 projects OBAN [3] and ePerSpace [4]. This idea of an open network architecture is the main objective of the current Home Networking research, It will enable the provisioning of services to the users in their home and in

nomadic situations. This activity must be seen interconnected with the overall Next Generation Networks (NGN) research.

The current research on NGN indicates that the next generation in-home networking should be based on a standardised approach for in-home intelligent device technologies. The home residential gateway must support management, connectivity, addressing and QoS for the various in-house applications. This ensures reliable delivery of services from the service provider, through the access network, to the end devices within the home-network.

The NGN characterisation may be summarised by the following objectives:

- A multi-service multi-protocol, multi-access, IP based network - secure, reliable and trusted
- An enabler for Service Providers, both real and non real-time, in p2p or client-server configuration
- Mobility / Nomadicity of both users and devices, and on intra and inter-Network Domains, between Fixed and Mobile networks
- Interactive "My communications services" anywhere, on any terminal, and at any time

On the current NGN research visions the Residential Gateway (RG) acts as a service platform for the end user, connecting a multi-service home network. The RG embeds the Home Agent (HA) that allows remote management of the home network by the service operator. It will have a powerful, networked management tool, located for example in an ISP or ASP premises and will inter-work with the HA. It will offer the remote access in a secure way to the home resources via mobile phones, personal digital assistants (PDAs), laptops or workstations.

It is clear that the introduction of eEurope 2005 Initiative (European Commission) acknowledges the interdependencies of "services, applications and content" on one hand and "broadband infrastructure and security matters" on the other, with each requiring the establishment of the other in order to provide a secure business environment. In fact, the specification of functionalities, methodologies, recommended standards and working practices that ensure convergence, interoperability and interactivity of multiple (and competing) products, applications and services in-home and to the home, must be defined in order to deliver standardised rules for all actors, systems, networks, protocols, applications and services involved in this business.

Figure 2 - The Residential Gateway question: Thick, thin or ultra thin?

Following the NGN vision, the RG will become a rather complex and therefore expensive unit. To install such a unit at the customer premises might go beyond the user's "willingness to pay" and the operator's "willingness to invest". OSIAN has analysed potential gateway configurations, Figure 2, their capabilities to provide services, acceptance of the users, and required management support from the operator.

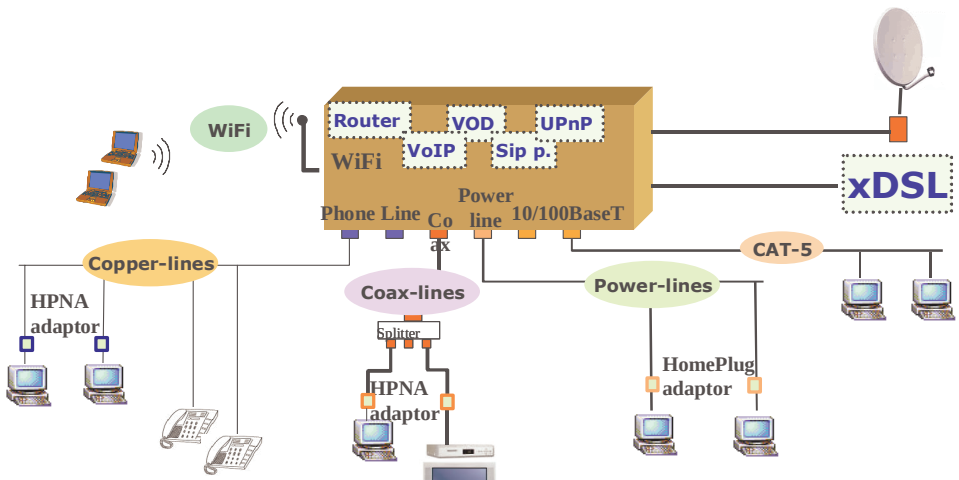

Figure 3 – Potential components of a residential gateway (RG)

Figure 3 addresses potential components of a residential gateway. Most customers will get their content from a cable network, an xDSL access or a terrestrial/satellite connection. The RG will have to have the potential to route all types of traffic, support VoIP (e.g. through the Session Initiation Protocol - SIP) and Video on demand (VoD) type of services, route multimedia communications (e.g. MPEG) and interconnect various devices in the home (e.g. through Universal Plug and Play - UPnP).

As most users would not like to lay out new cables in the house, wireless (WiFi) or reuse of existing power-lines or telephony lines (HomePNA) will be the preferred way of distributing the content.

Before addressing the proposed OSIAN solution, let us revisit the customer expectations to operator services. Services shall work the first time and every time you use them. They should work like the phone does, and not the PC, which requires "continuous" maintenance. Services shall be easy to handle, they have to work, and they have to be affordable for the customer. Nobody will buy a "residential gateway", unless it becomes a part of an infrastructure providing a specific service. Thus, an operator has to help the customer to the very end; he can't afford services, which are not working. In addition, he has to ensure that services will make money. These requirements limit the number of selected configurations and support an easy customer care.

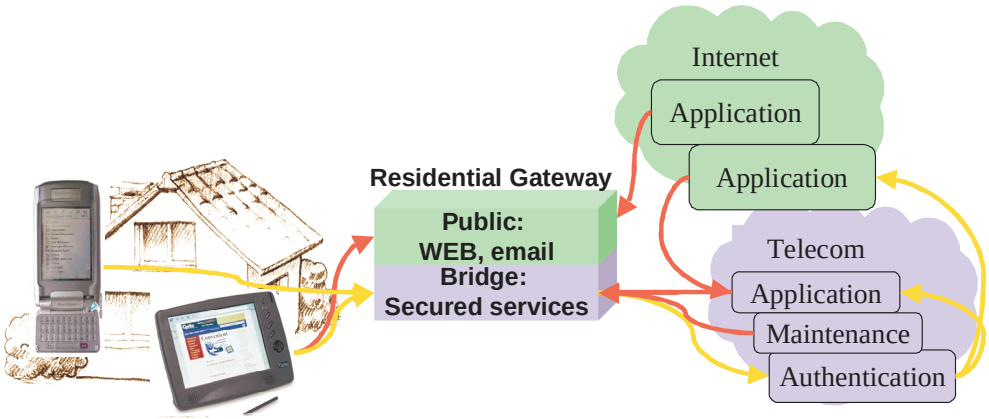

Figure 4 – Split RG functionality with 'public' and 'bridge' mode

In transferring the customer expectations to an infrastructure, we propose a thin gateway with split functionality, Figure 4. A thin gateway, which basically acts as an advanced router, will meet the price target of "below 100 €". The split functionality allows both "non supervised" Internet access and bridged access to the Telecom's service infrastructure. The public access gives the customer the possibility to be free to select, while the bridge mode allows advanced services with authentication, QoS and remote maintenance, based on functionality in the network.

The bridge mode allows "Plug & Play" applications, as the service components are kept in the network, and home services to communicate directly with the centralised service. For the customer, it means just to select a new application, and use it. Bridge mode functionality allows the operator to keep control of the service, as the application is kept in the network, and the QoS parameters of the home access are controlled from the operator. The advantages are illustrated using video on demand provision. Currently customers select a certain access bandwidth, typically in the range 500 kbit/s to 1.5 Mbit/s. This bandwidth is sufficient for fast Internet access, but only provides limited quality for VoD. By moving VoD to the bridge mode of the RG, we allow application-based bandwidth, e.g. 2-3 Mbit/s for the video streaming, independent of the limited public access. More examples are provided in the selected service scenarios in section 4.

3. Operators' view on service scenarios

OSIAN has identified four main service groups, Figure 5: Entertainment, Home automation, Personal Enrichment and Social Inclusion. Following the discussion from section 2, the operator has the need to restrict to a limited set of services, in order to make the customer care centre capable of handling the support requests. This section identifies the most promising services in the selected areas, identifies where and how to help the customer, while section 4 will concentrate on the detailed service scenarios.

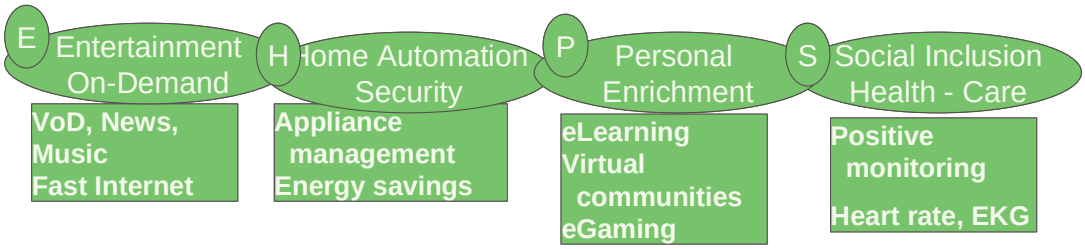

Figure 5 - Future Home Service groups (OSIAN view)

The characteristics of the services are as follows:

1) Entertainment and On-demand services

Characteristic of this type of services is the entertainment aspect, providing users with the information/entertainment exactly when they require it.

The *video on demand* (VoD) example might be extended to all on-demand services, and is selected due to the stringent requirements. "Killer application on TV is TV", thus a VoD service has to ensure that video can be enjoyed on the TV. This might be accomplished either by a dedicated set-top box (STB) to stream the video to the TV or by a PC and a media centre. We expect that flat-screens and HD-TV will drive the demand for this service.

The ***access to home content*** is the second service scenario in the entertainment area. Even though network storage is available, customers tend to keep their pictures/music/videos at home. But, access to the data shall be enabled, regardless if people are at home or on the move. Such a home network storage device eliminates also the need for having a PC up and running all the time, provides home content access (public and/or private content by distinct permissions configuration) from the home and might act as a gateway to the home automation infrastructure.

2) Home automation and security services, including remote access to data at home

The obvious example is energy control, but intrusion or water leakage alarms are also getting popular. ***Security surveillance*** systems had an increase in sales of more than 30% in Norway in 2004. Today these systems are "closed", with little customer interaction. Customers prefer to see "what is going on at home", including the "baby watch" functionality. This can be enabled by opening access rights to either mobile phones or remote broadband lines. ***Home automation*** is already a market for early adopters, but has not reached the mass market. Despite energy saving, we expect it to become interesting in the social context, to perform a positive surveillance of "which devices are switched on" in my parents' home.

This service group includes also the ***access to data stored in the home*** network, answering the needs of people equipped with digital entertainment and imaging equipment, which is already discussed in the entertainment section.

3) Personal enrichment/e-learning services

Broadband connections and always-on capabilities allow a much better connectivity to your groups of interest, addressed in the personal enrichment service group. This group covers the membership in virtual (interest based) communities, as well as e-Learning. We have selected two areas, ***dancing*** and support from ***hardware storage*** in order to demonstrate the potential.

What is common is that most people want to learn something new. But they don't want to appear to be stupid or get blamed, thus prefer to perform the first steps anonymously. Dancing lessons might start in your home, and after you feel more confident you will open to meet others with similar interests.

The second example carries the trends in hardware stores further. Currently hardware stores offer courses on different subjects, e.g. lay a wooden floor. Customers prefer "on demand help", based on a general overview "what does this work involve" or on specific problems during execution of the work. Interactive communications would enable the student at home to seek assistance or confirmation from the tutor. The dancing student would thus be able to receive a dedicated help on how he should improve his steps and the wooden floor worker could have the tutor's confirmation that she is indeed using the correct workmanship.

The e-learning services not only enable people to enrich their skills but can also be a significant contribution for a better social inclusion of e.g. handicapped or elderly people. This is further discussed below.

4) Social inclusion and health services

Social inclusion will become a pressing issue for the Western World. Physical distances put a barrier to the exchange, while broadband communication opens for participation in the life of "my grandchildren". In fact, due to longer life expectancy, new exclusion problems appear. New Telco services enabling elderly people to set-up or join virtual communities amongst themselves and/or social assistants (e.g. using video-telephony over IP) nurture their social life and hinder exclusion. This enables people to prolong their living in their own homes/environment and contributes to a higher quality of life.

A typical example is the usage of video telephony, which allows the easy distribution of pictures and videos. A service scenario called ***sending pictures*** in this area might include a dedicated channel on the home TV to show incoming multimedia.

Health services have the imminent need for cost reduction. Enabling remote surveillance of pre-operation or post-operation patients at home reduces costs down to 20 % compared to a stay in the hospital. Elderly centres face similar challenges regarding cost reductions, Here, mobile surveillance units are needed to allow wireless monitoring of health conditions or the localisation of old persons (e.g. having Alzheimer's disease). We indicate this scenario with ***home support***.

We expect the above-mentioned services as being the most suitable ones for a mass-market adoption. The following section will provide a short overview of the potential infrastructure for these services.

4. To achieve successful services

To achieve successful services is not only a question of answering technology and service challenges, it is also a question of how to bring the necessary infrastructure into the customer's home. The telecom operators have probably the "natural" role of integrating services and bringing the infrastructure into the homes. However, current "return on investment" requirements for operators prevent them from rolling-out complex and thus expensive infrastructure. The way OSIAN has approached the issue is by asking the customers which services they need first.

Such a question for the Entertainment service group might provide customer wishes such as:

- Hassle-free interconnectivity between music centre, TV, STB, PC, PDA and Mobile Phone
- Access to family photos from any home device
- Access to TV programs and music from any home device
- Remote access to family pictures on home PC

Based on the results of these questions, OSIAN has put together an infrastructure to enable service delivery, based on the split RG gateway architecture of section 2. Focus was on simple infrastructure, which to our expectation will increase the "willingness to pay", as well as the capability to upgrades for addressing service scenarios.

For the entertainment segment, we identified ***video on demand*** as one of the promising service concepts. The actors, TV broadcast companies, moviemakers like "Disney" and film archives have an interest on a high quality delivery of their products.

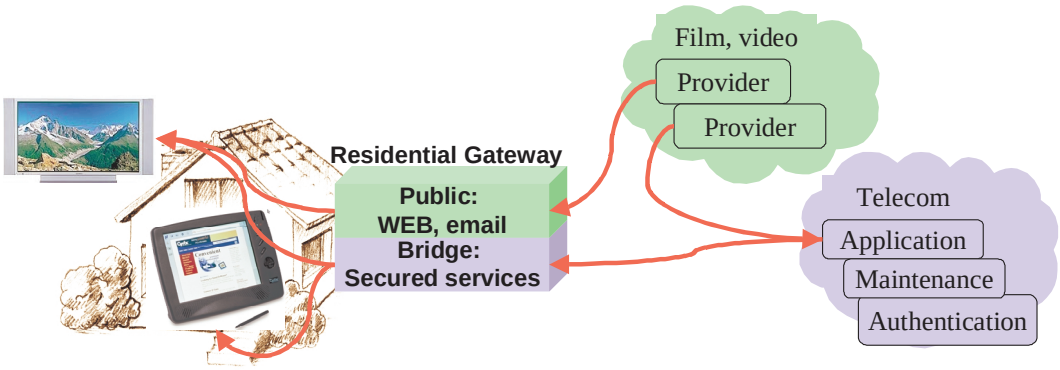

Figure 6 – Video on demand infrastructure

Figure 6 indicates the different ways in providing the service, either through the public access or through a dedicated bridged link. In the public area, the customer typically has limited bandwidth (e.g. 700 kbit/s), which allows for VHS quality video. As the link is based on shared bandwidth, QoS cannot be guaranteed, which might leave the opinion at the customer that the service is not satisfactory. Using the bridge mode, the Telecom operator has the opportunity to secure the required bandwidth (2-3 Mbit/s), and allow QoS control of each application. Taking into account the potential for application based billing, this service offer guarantees the video/film provider to deliver a good product, and the customer to just pay for the public bandwidth he needs.

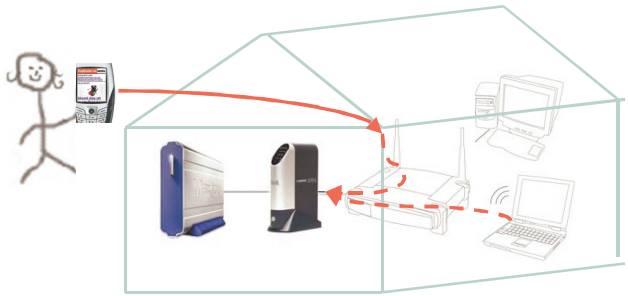

Figure 7 – Home network storage, example from Linksys [www.linksys.com]

Access to ***home content*** was identified as the other potential service example. Customers have more and more content in a digital form, and they want to ensure that the content is at home, not somewhere on the Web. They also want to have access to the data from all PCs, Laptops and the Mediacenter. In principle this can be achieved through a PC running e.g. Windows Media. However, power consumption, update requirements and remote maintenance capabilities favour dedicated home network storage as e.g. the Linksys NSLU2 of Figure 7. The network storage enables the disk access to all PCs in the home and remote access with http, ftp and streaming of data. With some extensions, it might also function as a gateway to the home automation network.

This *access to home content* example demonstrates the value for the customer. It is not the gateway functionality you buy, but the services: network storage and remote access.

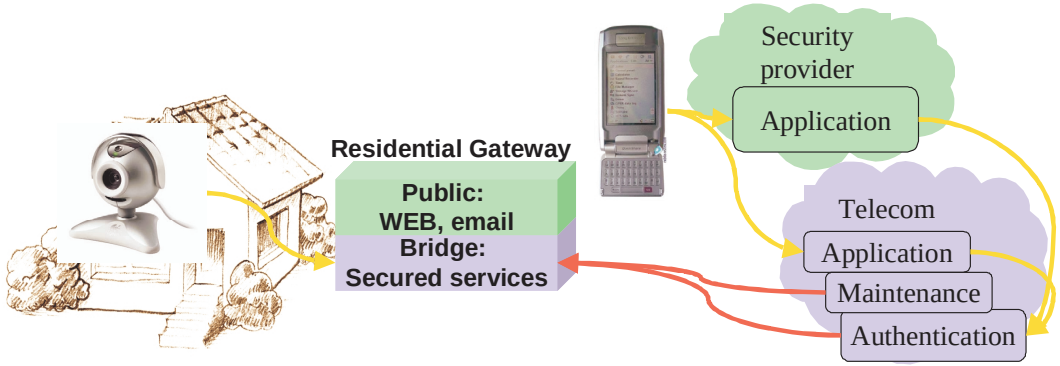

Figure 8 – Security/Home surveillance infrastructure

Figure 8 illustrates the service architecture for home security and surveillance. Current systems focus on wireless access, making the access quite expensive for audio/video transmission. A fixed-based system, just connected to the Internet, will face the problem of line monitoring. At each time the line into the customer's house has to be monitored a security company would have problems in monitoring the whole system. When transferring the transmission to the bridge mode, the line monitoring would be just one parameter in the existing TelCo infrastructure (similar to VoD provision, see Figure 6). Extra services such as remote access can easily be added; it would mean an addition to the authentication application in the operator's service infrastructure.

The three examples mentioned above just demonstrate the capabilities of split functionality in the residential gateway. An infrastructure, which basically acts as an advanced router, will meet the price target of "below 100 €" and allows both "non supervised" Internet access and bridged access to the

Telecom's service infrastructure. The public access gives the customer the possibility to be free to select, and the bridge mode allows advanced services with authentication, QoS and remote maintenance, based on functionality in the operator's network.

This section provided three service examples. The infrastructure for all identified services of section 3 may be found at the OSIAN homepage [2].

5. Business perspectives from telecom operators

There are two main reasons for the telecom operator's investment in Home Services: the client maintenance and the increase of the revenue per physical connection.

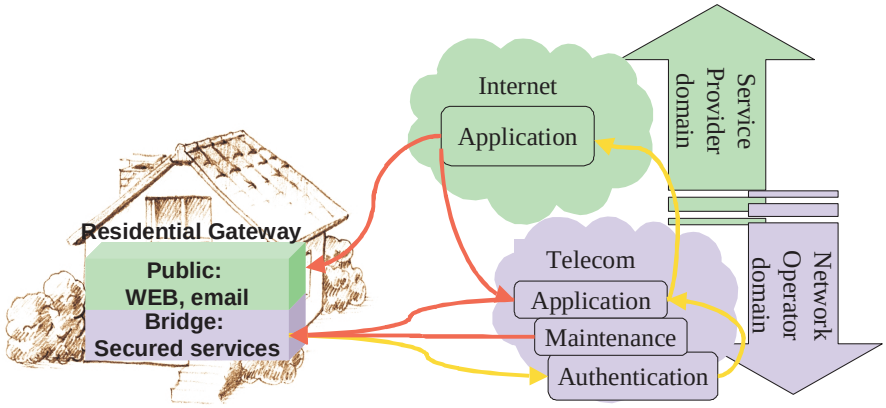

Figure 9 – Partnership in providing services to the mass-market

Due to the liberalisation of telecommunication services the market became unstable. New operators offer high concurrency services to the end-users and the incumbents must prepare their networks (sometimes using old technologies) for these challenges. The old fixed voice business is one of the most problematic due to the mobile technology concurrency. The xDSL technologies, namely ADSL, add a new type of services to the twisted copper pair, however new "Telco dependent" services must be added to these and also to the old POTS and ISDN interfaces to prevent the client disconnection.

Our approach is to provide an open, but authorised access to the xDSL network through the split RG functionality Figure 9. Customers don't want to be kept in a wallet garden, they want help in getting services running. With the split functionality it is up to the customer and the service provider to decide how the service should be provided. Without any QoS control through the shared, public access, like it is common today for all households, or through the bridge mode. Voice over IP (VoIP) might be used as an example. It is possible to phone over the public Internet (e.g. Skype), and in most of the cases the service might be regarded as being sufficient. However, speech quality can only be guaranteed if the VoIP operator has control of the line. Thus, delivering the VoIP service through the bridge mode allows for full QoS control, regardless of simultaneous Internet or streaming activities.

Following the success of GSM roaming, we also suggest a personalised access to the service world. Seamless authorisation opens for the provision of personalised services, and enables billing. It can be achieved by an authentication mechanism, which checks first if the device is registered to the residential gateway. If not, the authentication request is forwarded through the bridge mode to the authentication service of the operator, who then can provide access to the service world, without comprising the access functionality of the home services. Integration happens through a common multi-service platform, which gives to the operator the facility of adding easily new services over the same infrastructure. These services are added to the operator's service platform (see figure 9), instead of having to update each RG. The network management also will be simpler due to the decrease of different technologies.

6. Conclusions

Having addressed user needs in future homes, the operators involved in the P1401 OSIAN study have identified four successful scenarios for home services. For each of the service scenarios, the paper presents the most pressing requests and analyses the technology best to implement at the customers' premises. The project submitted a questionnaire to early adopters, which helped to build the project's vision. A further cornerstone for this vision is the recent research on next generation networks (NGN), which sets the objectives for future home networking. Those objectives denote that next generation in-

home networking will be based on a standardised approach for in-home intelligent device technologies. The home residential gateway must support management, connectivity, addressing and QoS for the various in-house applications. This ensures reliable delivery of services from the service provider to the end devices of the home-network. The four service categories studied in the paper are:

- Entertainment including on-demand services, especially video on demand and access to home content
- Home automation and security services including remote access to data at home
- Personal enrichment/e-learning services, illustrated through the example of dancing and of do-it-yourself support
- Social inclusion, illustrated by sending pictures/video to the home TV and health services, addressing the home care examples

The paper provides infrastructure examples, based on a thin gateway with split functionality. A thin gateway, which basically acts as an advanced router, will meet the price target of "below 100 €". The split functionality allows both "non supervised" Internet access and bridged access to the Telecom's service infrastructure. The public access gives the customer the possibility to be free to select, and while the bridge mode allows advanced services with authentication, QoS and remote maintenance, based on functionality in the network. The bridge mode allows keeping services in the operator's service platform, avoiding the need to update all residential gateways when a new service comes up. It also enables easy maintenance of the RG, as the RG is basically an intelligent router. Finally, the bridge mode opens for a personalised xDSL access and roaming, allowing customers to use any available wireless home connection, not just their own one.

The rollout of new services is expensive and does not necessarily fit today's strict return on investment demands. Therefore the focus has to be on service delivery through simple solutions covering only a limited number of infrastructures.

Acknowledgements

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